UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UNIFIED PATENTS, LLC,
Petitioner,

v.

GODO KAISHA IP BRIDGE 1,
Patent Owner.

IPR2020-00867
Patent 7,305,035 B2

Before JUSTIN T. ARBES, DAVID C. MCKONE,
and MELISSA A. HAAPALA, *Administrative Patent Judges*.

MCKONE, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background and Summary

Unified Patents, LLC ("Petitioner") filed a Petition (Paper 2, "Pet.") requesting *inter partes* review of claim 1 of U.S. Patent No. 7,305,035 B2 (Ex. 1001, "the '035 patent"). Pet. 2. Godo Kaisha IP Bridge 1 ("Patent Owner") filed a Preliminary Response (Paper 8, "Prelim. Resp.").

We have authority to determine whether to institute an *inter partes* review. *See* 35 U.S.C. § 314 (2016); 37 C.F.R. § 42.4(a) (2019). The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." For the reasons explained below, we decline to institute an *inter partes* review of the '035 patent.

B. Related Matters

The parties indicate that the '035 patent is not involved in any litigation or other judicial proceeding. Pet. 1; Paper 4, 1. Pending U.S. Patent Application No. 16/043,862 claims priority to the '035 Patent. Pet. 1.

C. The '035 Patent

The '035 patent describes a variable length coding technique for coding and decoding coefficients in blocks of moving picture data. Ex. 1001, 1:7–12. In coding a moving picture, compression of information volume is usually performed by using redundancies in the information. *Id.* at 1:16–22. Conventionally (e.g., in the MPEG-4 moving picture coding standard), such data undergo a transformation into the frequency domain, and blocks of the frequency information (e.g., 4X4 blocks of pixels) are quantized to generate coefficients. *Id.* at 1:19–28. The quantized blocks of coefficients are scanned in the order of low frequency components to high frequency components to generate pairs of values about each coefficient, each pair indicating (1) the number of zero coefficients subsequent to the current coefficient (a Run, or "R" value); and (2) the value (Level or "L" value) of the current coefficient. *Id.* at 1:29–35. Each (R, L) pair is transformed into a code number using a predetermined code table, and the code number, in turn, is encoded into a Variable Length Code ("VLC") using a VLC table. *Id.* at 1:35–47.

The '035 patent describes the following problem with this method:

> However, using the existing method engenders a decrease in coding efficiency since the code length gets longer as the number of consecutive zero coefficients R and a coefficient value L get larger. Usually, the decrease in coding efficiency is obvious when a low frequency component value is coded since the coefficient value L as a low frequency component value is large.
>
> Namely, as a result of assigning a single VLC table according to the occurrence probability and a single unique variable length code according to a pair of R and L, the coefficient value L indicating a large value is transformed into a variable length code having a very long code length. Even when coding L separately from R (one-dimensional coding of L) using a single VLC table, the same problem occurs as in the case of coding R and L as a pair.

Id. at 1:48–62.

In the solution described in the '035 patent, an RL sequence generation unit first converts the quantized frequency coefficients into a sequence of R and L pairs ("RL values"), as shown in Figures 3A, 3B, and 4A. Figures 3A and 3B are reproduced below:

Fig. 3A

-38	9	3	0
-5	-31	2	0
22	-12	-2	1
4	3	-1	0

Fig. 3B

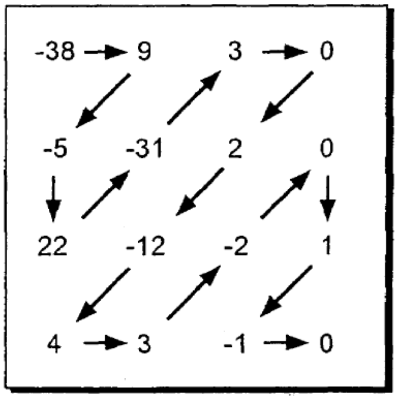
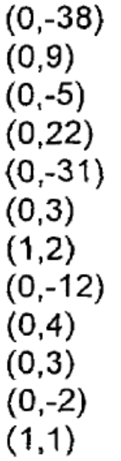


Figure 3A is a diagram showing quantized frequency coefficients in a block, with upper left frequency coefficients denoting low frequency components (e.g., direct-current components) and with frequency components becoming larger toward the lower right. *Id.* at 6:43–49. Figure 3B, using arrows, shows a progression (from low frequency to high frequency coefficients) of scanning the coefficients shown in Figure 3A. *Id.* at 6:49–54. Figure 4A is reproduced below:

Fig. 4A



(0,-38)
(0,9)
(0,-5)
(0,22)
(0,-31)
(0,3)
(1,2)
(0,-12)
(0,4)
(0,3)
(0,-2)
(1,1)
(0,-1)
EOB(End Of Block)

Figure 4A is a listing of RL values generated by the RL sequence generation unit, with EOB (End of Block) indicating that all subsequent coefficient values are zero. *Id.* at 6:55–61.

The sequence of RL values is then reordered (*id.* at 6:64–67), as shown in Figure 4B, reproduced below:

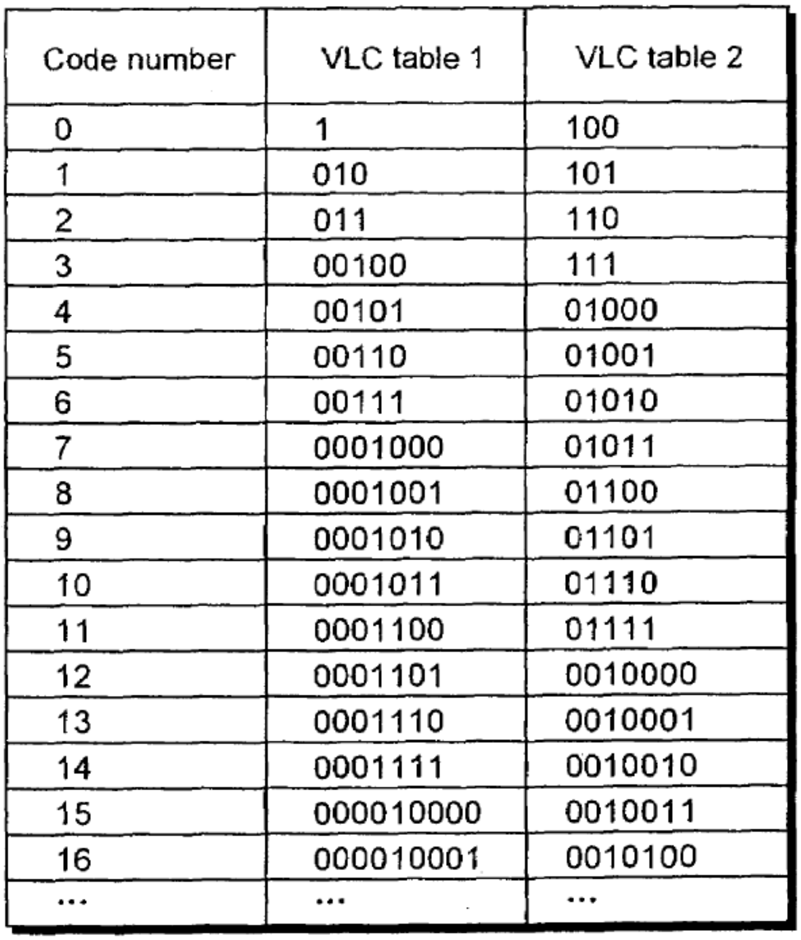
Fig. 4B

(0,-1)
(1,1)
(0,-2)
(0,3)
(0,4)
(0,-12)
(1,2)
(0,3)
(0,-31)
(0,22)
(0,-5)
(0,9)
(0,-38)
EOB(End Of Block)

Figure 4B is a listing of RL values reversed in order from that of Figure 4A, except the EOB value is not reordered. *Id.* at 6:66–67.

A code table correlates the RL values with code numbers. *Id.* at 7:4–6, Fig. 5. Multiple VLC tables correlate the code numbers with variable length codes. *Id.* at 7:6–8, Fig. 6. Figure 6 is reproduced below:

Fig. 6



Code number	VLC table 1	VLC table 2
0	1	100
1	010	101
2	011	110
3	00100	111
4	00101	01000
5	00110	01001
6	00111	01010
7	0001000	01011
8	0001001	01100
9	0001010	01101
10	0001011	01110
11	0001100	01111
12	0001101	0010000
13	0001110	0010001
14	0001111	0010010
15	000010000	0010011
16	000010001	0010100
...	...	...

Figure 6 is a diagram showing an example of a VLC table. *Id.* at 7:31. In this example,

> The VLC table 1 is used for the first RL value. In this case, the code number for the first RL value is "2," therefore, the variable length code is "011." The conversion of the code numbers into the variable length codes is performed subsequently, and when an absolute value of L exceeds a threshold value, the VLC table 2 is used for the following RL values. Assume that a threshold value of the absolute value of L is "2," the absolute value of L exceeds the threshold value at the fourth RL value (0, 3). Therefore, the VLC table 1 is used for the first through the fourth RL values and the VLC table 2 is used for the fifth RL value and thereafter.

Id. at 7:45–55. In this example, "[t]he RL values are converted into the variable length codes in an order reverse to the order for scanning." *Id.* at 8:33–35. According to the '035 patent,

> The absolute value of L usually becomes larger in the low-frequency domain, therefore, the absolute value of L become[s] larger when the RL values are converted into the variable length codes in an order reverse to the order in which the RL values are generated by scanning the coefficients from the low-frequency domain toward the high frequency domain.
>
> Therefore, when the absolute value of L gets larger after the absolute value of L has exceeded the threshold value, that is, by using the VLC table in which the variable length code becomes shorter as the code number gets larger, the total amount of code can be reduced. Namely, the total code amount for L can be reduced also by coding L and R separately, and also, by using plural VLC tables.

Id. at 8:47–60.

Claim 1, reproduced below, is the only challenged claim:

> 1. A decoding method for performing variable-length decoding on coded data obtained by performing variable-length coding on coefficients of a block which are obtained by performing frequency transformation on picture data of the block that has a predetermined sixe of pixels, the method comprising:
>
> performing variable-length decoding on coded data from a high frequency component toward a low frequency component to obtain decoded coefficients; and
>
> inverse scanning the decoded coefficients into two-dimensional coefficients of the block;
>
> wherein said performing variable-length decoding comprises:
>
> decoding a first coefficient using a first variable length code table of a plurality of variable length code tables;

> switching to a second variable length code table of the plurality of variable length code tables if an absolute value of the first coefficient exceeds a first threshold;
>
> decoding a second coefficient following the first coefficient using the second variable length code table;
>
> switching to a third variable length code table of the plurality of variable length code tables if an absolute value of the second coefficient exceeds a second threshold, the second threshold being greater than the first threshold; and
>
> decoding a third coefficient following the second coefficient using the third variable length code table.

D. Evidence

Petitioner relies on the references listed below.

Reference		**Date**	**Exhibit No.**
Luna	US 6,298,087 B1	Oct. 2, 2001	1004
Silva	E.A. da Silva & M. Ghanbari, *A DCT-Based Aliasing Cancellation Method in Subband Coding*, VOL. 3, NO. 5, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY 384–87	Oct. 1993	1005
VCEG-M51r1	M. Karczewicz, *Improved Intra coding*, VCEG-M51, ITU – TELECOMMUNICATIONS STANDARDIZATION SECTOR, STUDY GROUP 16 QUESTION 6, VIDEO CODING EXPERTS GROUP (VCEG)	Mar. 21, 2001	1006

Petitioner also relies on the Declaration of Lina J. Karam, Ph.D. (Ex. 1003).

E. The Asserted Ground of Unpatentability

Petitioner contends that claim 1 would have been obvious, under pre-AIA 35 U.S.C. § 103(a), over Luna, Silva, and VCEG-M51r1. Pet. 4.

II. ANALYSIS

A. 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), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent." 37 C.F.R. § 42.100(b) (2019); *see also Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc).

Petitioner contends that "first coefficient," "second coefficient following the first coefficient," and "third coefficient following the second coefficient," as recited in claim 1, "are used to distinguish different elements of the claim, and do not require the coefficients to be adjacent" in a sequence of decoded coefficients. Pet. 12. Patent Owner agrees with this construction "so far as the ordinal terms 'first,' 'second,' and 'third' should not be read to denote that the elements are *immediate* neighbors." Prelim. Resp. 19. We agree with Patent Owner, however, that none of these terms is a source of controversy in this proceeding. *Id.*

Patent Owner proposes construing "switching to a [second/third] variable length code table . . . if an absolute value of the [first/second] coefficient exceeds a [first/second] threshold," as recited in claim 1, to be necessary conditions for switching, and that the thresholds be predetermined values. Prelim. Resp. 21–25. Nevertheless, regardless of whether we accept this construction, we conclude that Petitioner is not reasonably likely to demonstrate the unpatentability of claim 1. Accordingly, it is not necessary to construe these terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (noting that "we need only construe terms 'that are in controversy, and only to the extent necessary to resolve the controversy'") (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Based on the record before us, we do not find it necessary to provide express claim constructions for any other terms.

B. *Obviousness of Claim 1 over Luna, Silva, and VCEG-M51r1*

Petitioner contends that claim 1 would have been obvious over Luna, Silva, and VCEG-M51r1. Pet. 29–71. For the reasons given below, Petitioner has not made a sufficient showing.

A 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 claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains." We resolve the question of obviousness 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 skill in the art; and

(4) objective evidence of nonobviousness, i.e., secondary considerations.[1] *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

1. Level of Skill in the Art

Petitioner, relying on the testimony of Dr. Karam, contends that a person of ordinary skill in the art "would have had a bachelor's degree in electrical or computer engineering, or a closely related scientific field such as physics or computer science, and two years of work experience with video compression." Pet. 10 (citing Ex. 1003 ¶¶ 38–42). Patent Owner "generally agrees with [Petitioner's] definition" of a skilled artisan. Prelim. Resp. 25. Petitioner's proposal is consistent with the technology described in the Specification and the cited prior art. For purposes of this Decision, we adopt Petitioner's proposed level of skill.

2. Scope and Content of the Prior Art

a) Overview of Luna

Luna relates to variable length decoding and decompression of a video signal. Ex. 1004, 1:6–9. In its challenge, Petitioner relies primarily on Luna's description of the background art. Pet. 29–34, 36, 44, 51 (citing Ex. 1004, 1:7–10, 1:32–33, 1:51–55, 1:66–2:13).

Luna's background discusses video compression in the context of the MPEG-2 standard. Ex. 1004, 1:32–44. In this example, video data are transformed, using a 2-dimensional discrete cosine transform (DCT) algorithm, into an 8×8 matrix of coefficients, which are then quantized,

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[1] The record does not include allegations or evidence of objective indicia of nonobviousness.

resulting in many higher frequency coefficients being set to zero. *Id.* at 1:50–62. The coefficients are then converted to a linear stream of run/level pairs (RL values), which are, in turn, coded using a VLC. *Id.* at 1:62–2:2.

Luna describes decoding such data as including "the steps of VLC decoding, inverse scanning to reconstruct the 8×8 2-dimensional quantised DCT coefficient matrix, inverse quantising to recover a truncated set of DCT coefficients, and inverse DCT." *Id.* at 2:3–7.

b) Overview of Silva

Silva is an "Express Letter" published in the journal IEEE Transactions on Circuits and Systems for Video Technology. Petitioner offers the testimony of Sylvia Hall-Ellis, Ph.D., an Adjunct Professor in the School of Information at San José State University in San José, California (Ex. 1008), as well as the testimony of Dr. Karam, as evidence that Silva was publicly accessible prior to the critical date of the '035 patent and, therefore, is prior art. Pet. 18–22. Patent Owner does not contest the prior art status of Silva at this stage of the proceeding. On the current record, we are persuaded that Petitioner has established a reasonable likelihood that Silva is prior art to the '035 patent.

Silva describes techniques for DCT-based subband coding of images. Ex. 1005, 384. In Silva's example, a transformed image is decomposed, or partitioned, into four subbands, as shown in Figure 2, reproduced below:

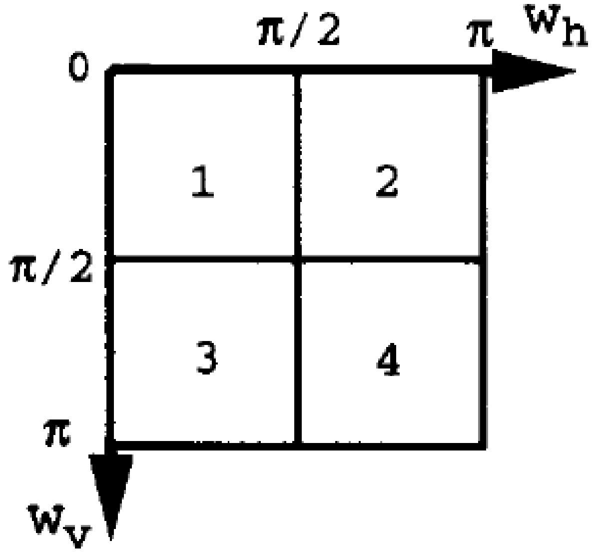


Fig. 2. Frequency partition used in the subband analysis.

Figure 2 is a diagram of a four-band subband decomposition, with partition 1 including the lowest frequency coefficients and partition 4 including the highest frequency coefficients. *Id.* According to Silva,

> The lowest band of a subband coded picture is similar to the original picture. However, due to subsampling, aliasing is introduced, causing some disturbances. If the components from the high bands that cancel the aliasing in the lowest band could be added to this band, a smooth low-pass version of the image would be obtained. Thus, when the subband decomposition is employed as part of an image coding scheme, it is desirable to identify those components from the high bands that cancel the aliasing components from the lowest band.

Id.

To minimize aliasing, Silva teaches concentrating scanning on the portions of the partitions that have the highest energy. This is shown in Figure 3, reproduced below.

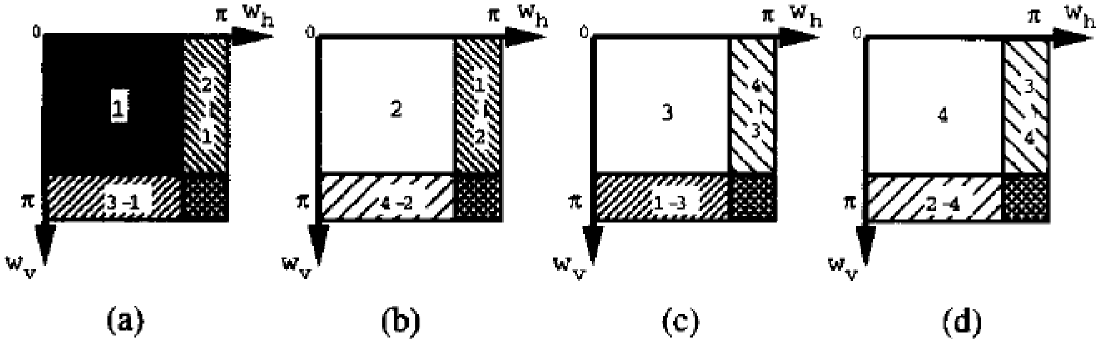


Fig. 3. Alias components of the subsampled bands: (a) band 1; (b) band 2; (c) band 3; (d) band 4.

Figure 3 is four pictures (a–d) representing partitions 1–4, respectively, of Figure 2. Silva explains that, to minimize aliasing, scanning of the partitions should focus on those areas of highest energy, which vary from partition to partition: "a smooth low-pass version of the image can be reconstructed with the dense shaded parts shown in Fig. 3, i.e., the whole of band 1, parts 1-2, 1-3, and the intersection of 2-4 and 3-4. In addition, these are the frequencies of each band with the highest energies." *Id.* at 384–85.

Silva teaches that, to concentrate on the coefficients of each partition with the highest energies, a different scanning direction should be used for each partition, as shown in Figure 4, reproduced below:

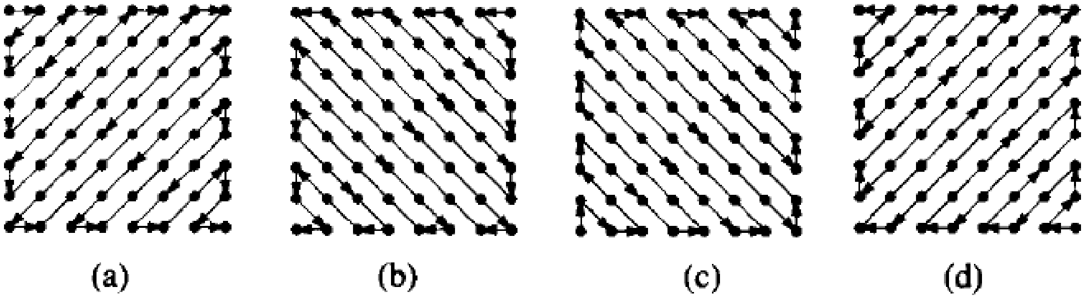


Fig. 4. Scanning directions of each band: (a) band 1; (b) band 2; (c) band 3; (d) band 4.

Figure 4 includes 4 pictures (a–d) of scanning directions for partitions 1–4 of Figure 2, respectively. According to Silva,

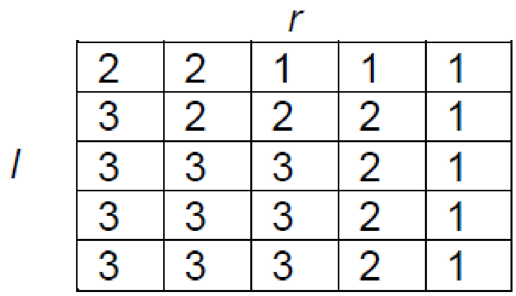
> if the scanning directions for the 8×8 DCT coefficients for each band are the ones shown in Fig. 4, the coefficients with the highest energy values will be, in general, scanned first. This will lead to shorter zero-runs and earlier end of block codes (EOB codes), and, as a consequence, lower bitrates than if the usual zigzag scanning is employed in all the bands.

Id. at 385 (endnote omitted).

c) *Overview of VCEG-M51r1*

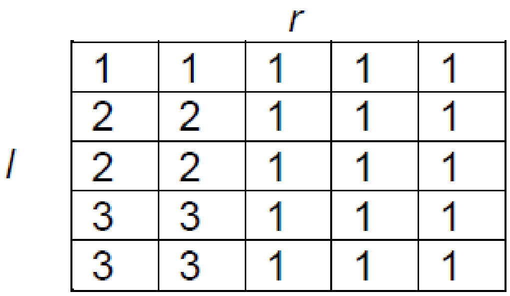
VCEG-M51r1 is a submission to a working group of a standard setting body. The parties dispute whether VCEG-M51r1 was publicly accessible as of the critical date of the ’035 patent and, thus, whether it is prior art to the ’035 patent. Pet. 23–29; Prelim. Resp. 45–48. Because Petitioner has not shown a reasonable likelihood of success, even if VCEG-M51r1 is prior art, we need not reach this issue.

VCEG-M51r1 proposes “using additional VLC tables derived from” a first VLC table (“UVLC”) to arrive at an improved method of encoding transform coefficients. Ex. 1006, 1. VCEG-M51r1 teaches calculating R and L indices “using the run (run_previous) and level (level_previous) information of the last decoded coefficient.” *Id.* at 2. These indices are used to access one of two table Ms (reproduced below), with an entry of the appropriate table M (M(l,r)) indicating which of multiple VLC tables should be used.



	r				
	2	2	1	1	1
	3	2	2	2	1
l	3	3	3	2	1
	3	3	3	2	1
	3	3	3	2	1

QP<24



	r				
	1	1	1	1	1
	2	2	1	1	1
l	2	2	1	1	1
	3	3	1	1	1
	3	3	1	1	1

QP>=24

The pictures above are two instances of Table M, the first showing table entries for indices r and l when QP[2] is less than 24, and the second showing table entries for indices r and l when QP is greater than or equal to 24. *Id.* The entries (1, 2, 3) in the table indicate which VLC table (UVLC, UVLC2, UVLC3) will be used. *Id.*

3. *Analysis of Claim 1*

Petitioner contends that Luna teaches the preamble of claim 1. Pet. 29–32. Specifically, Petitioner contends that Luna's description of decoding performed pursuant to section 7 of the MPEG-2 standard, along with the steps of VLC decoding, teaches a "decoding method for performing variable-length decoding," as recited in claim 1. *Id.* at 30 (citing Ex. 1004, 1:7–10, 2:3–13). Petitioner further argues that Luna's description of transforming video data into the frequency domain using a DCT algorithm, followed by quantisation and linearization, teaches that the decoding is on "coded data obtained by performing variable-length coding on coefficients of a block which are obtained by performing frequency transformation on picture data of the block," as recited in claim 1. *Id.* at 30–31 (citing Ex. 1004, 1:51–58, 1:66–2:2). Petitioner also argues that Luna's description of dividing an input picture into 8×8 pixel blocks teaches a block "that has a predetermined size of pixels," as recited in claim 1. *Id.* at 31–32 (citing

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[2] According to Dr. Karam, QP is a "quantization parameter" that is "set during the encoding process that influences the compression rate of the compressed video, thereby influencing the resulting bit rate of the video. In the H.263 and MPEG video compression standards, the quantization parameter can range from a value of 1 to 31." Ex. 1003 ¶ 125.

Ex. 1004, 1:32–33, 1:51–55). Patent Owner does not dispute these allegations.

The parties dispute whether the art teaches "performing variable-length decoding on coded data *from a high frequency component toward a low frequency component to obtain decoded coefficients*," as recited in claim 1 (emphasis added). Petitioner cites Luna for "performing variable-length decoding on coded data . . . to obtain decoded coefficients," but concedes that "Luna does not describe the order in which the coefficients are scanned for linearization."[3] Pet. 32–34 (citing Ex. 1004, 1:51–2:12).

Petitioner contends that Silva describes scanning in a zig-zag pattern from a bottom-right corner to a top-left corner (from a high frequency component toward a low frequency component), and that a skilled artisan would have recognized that this teaching could be applied to Luna's description of linearization of a quantized coefficient matrix. *Id.* at 35–36, 39–40 (citing Ex. 1005, Fig. 4(d)).

Petitioner contends that a skilled artisan would have combined the teachings of Luna and Silva because the references are analogous art, and because "a [person of ordinary skill in the art] would have recognized

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[3] Patent Owner argues that, in fact, Luna does describe the scanning order. Prelim. Resp. 28–32. As Patent Owner points out, Luna (Ex. 1004, 2:3–12) expressly describes performing video decoding according to Section 7 of the ISO/IEC 13818-2 MPEG-2 standard. *Id.* at 28–29. Patent Owner introduces evidence, by way of the ITU-T H.262 and H.263 Recommendations documents, that this standard decodes coefficients in the order of low frequency to high frequency. *Id.* at 29–30 (citing Ex. 2001, 18–19; Ex. 2002, 25–26; Ex. 2004, 10). The H.262 documents note that "[t]he identical text is also published as ISO/IEC International Standard 13818-2." Ex. 2001, 2; *see also* Ex. 2002, 4. Thus, through its reference to the standard, Luna appears to expressly describe a scanning order from low frequency to high frequency.

Silva's description of known scanning techniques that are shown to be 'efficient' as pertinent to the problem of improving coding efficiency." Pet. 41 (quoting Ex. 1005, 386; citing Ex. 1003 ¶ 92). According to Petitioner, Silva "explicitly provides a reason to incorporate its teachings to other video processing references like Luna" by stating that "if the scanning directions for the 8×8 DCT coefficients for each band are the ones shown in Fig. 4, the coefficients with the highest energy values will be, in general, scanned first. This will lead to shorter zero-runs and earlier end of block codes (EOB) codes), **and, as a consequence, lower bitrates than if the usual zigzag scanning is employed in all the bands**." *Id.* at 42 (quoting Ex. 1005, 385; citing Ex. 1003 ¶ 93). Further, citing to Dr. Karam's testimony, Petitioner argues that "researchers in the field of video coding were noting the benefits of ordering coefficients from a high frequency to a low frequency, specifically in the context of variable length coding techniques." *Id.* (citing Ex. 1003 ¶¶ 97–99). Petitioner argues that "Luna does not explicitly disclose the direction in which its blocks are scanned before the coding process occurs,"[4] but that a skilled artisan "would have recognized that [there existed] any number of options for scanning, including scanning from top-left to bottom-right, or the reverse, as in Silva." *Id.* at 42–43.

In response, Patent Owner argues that Petitioner has not shown that a skilled artisan would have combined the cited teachings of Luna and Silva. As noted above, we are persuaded by Patent Owner's argument that Luna teaches a scanning order from low frequency to high frequency. Prelim.

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[4] As noted above, we disagree with Petitioner that Luna does not disclose the direction in which its blocks are scanned, given Luna's express citation to Section 7 of the MPEG-2 standard.

Resp. 28–30. According to Patent Owner, the ’035 patent, the prior art, and textbooks describe good reasons for doing so. *Id.* at 31–32 (citing Ex. 1001, 6:61–64 (“[B]y performing scanning starting at the low-frequency domain toward the high frequency domain, it is possible to reduce the amount of information included in the RL sequence.”); Ex. 1004, 1:60–62 (“As most of the higher frequency coefficients are set to zero, linearization produces long runs of zeros.”); Ex. 1005, 385 (“[I]f the scanning directions for the 8×8 DCT coefficients for each band are the ones shown in Fig. 4, the coefficients with the highest energy values will be, in general, scanned first. This will lead to shorter zero-runs and earlier end of block codes (EOB codes), and, as a consequence, lower bitrates than if the usual zigzag scanning is employed in all the bands.”); Ex. 2006,[5] 199 (“For natural images, the low-frequency DCT coefficients tend to have a lot of energy while the high frequency coefficients tend to be very small.”)).

Patent Owner further argues that “[t]he Petition . . . improperly divorces the Silva-cited scanning order from its specific subband context, and omits any explanation or evidence as to how or why it would have been obvious to implement this subband-specific scanning order in the standardized H.262 transform coefficient block of Luna.” Prelim. Resp. 27. Patent Owner argues that Silva’s reverse-scanning description is tied to a specific atypical scenario in which images are decomposed into four subbands and that the reverse scanning is limited to the highest frequency subband. *Id.* at 32–33 (citing Ex. 1005, 384–85, Figs. 2, 4). In this scenario, Silva explains, higher energy coefficients appear in the bottom right of the

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[5] L. Guan et al., MULTIMEDIA IMAGE AND VIDEO PROCESSING 197–202 (2d ed. 2012).

highest frequency subband. Ex. 1005, 385, Fig. 3(d); Prelim. Resp. 34. Patent Owner argues that "[t]his is the opposite of the standard coefficient block of Luna, where the highest energy coefficients are on the top-left and the low energy/zero-value coefficients are on the bottom-right." Prelim. Resp. 34 (citing Ex. 1004, 1:55–58). Patent Owner argues that Silva describes scanning in reverse order in subband 4 for the same reason Luna describes scanning from top left to bottom right, namely, to scan coefficients with the highest energy values first, leading to shorter zero-runs and EOB codes. *Id.* at 34–35 (citing Ex. 1004, 1:55–58, 1:60–62; Ex. 1005, 385).

As to Petitioner's alleged specific teaching in Silva (e.g., Pet. 41–42; Ex. 1005, 385 ("This will lead to shorter zero-runs and earlier end of block codes (EOB codes), and, as a consequence, lower bitrates than if the usual zigzag scanning is employed in all the bands.") (endnote omitted)), Patent Owner argues that this teaching would not provide such a benefit if used with Luna's technique. Prelim. Resp. 37–39. Instead, Patent Owner argues, "using Silva's bottom-right to top-left scanning order in Luna would scan 'the coefficients with the highest energy values' last, ***NOT*** first." *Id.* at 38 (citing Ex. 1004, 1:55–62). This is because Luna's coefficients are ordered, per the H.262 standard, from high energy (low frequency) to low energy (high frequency). Thus, reversing the scan order would result in low energy coefficients being scanned first, contrary to Silva's teaching. *Id.* at 39–40.

We agree with Patent Owner. Petitioner's proposed reasons to combine Luna and Silva are conclusory and contrary to the teachings of the references. Petitioner points to Silva's statements that its techniques improve efficiency and will lead to shorter zero-runs and earlier EOB codes. Pet. 41–42 (citing Ex. 1005, 386). But Petitioner ignores the context in which Silva describes achieving these benefits, namely an atypical situation in which a high frequency subband of an image has coefficients arranged from low energy to high energy, rather than the more typical high energy to low energy. Ex. 1005, 384–85. Dr. Karam's testimony largely repeats the arguments in the Petition and also fails to account sufficiently for these teachings of Silva. Ex. 1003 ¶¶ 92–96. Thus, this testimony lacks credibility and is entitled to little weight. Petitioner has not shown sufficiently that a skilled artisan would have had a reason, with rational underpinning, to combine Luna and Silva.[6]

The parties also dispute whether the prior art teaches

> switching to a second variable length code table of the plurality of variable length code tables if an absolute value of the first coefficient exceeds a first threshold
>
> . . . [and]
>
> switching to a third variable length code table of the plurality of variable length code tables if an absolute value of the second coefficient exceeds a second threshold, the second threshold being greater than the first threshold

as recited in claim 1. Petitioner concedes that Luna does not teach multiple VLC tables, but argues that a skilled artisan "would have had reason to

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[6] Petitioner further alleges that "researchers in the field of video coding were noting the benefits of ordering coefficients from a high frequency to a low frequency, specifically in the context of variable length coding techniques," citing to Dr. Karam's testimony, but does not otherwise explain its argument or discuss the evidence. *See* Pet. 42 (citing Ex. 1003 ¶¶ 97–99). This is an improper incorporation by reference of analysis presented in Dr. Karam's testimony on the relevance of four references not discussed in the Petition, Exhibits 1024–1027, and will not be considered. *See* 37 C.F.R. § 42.6(a)(3) ("Arguments must not be incorporated by reference from one document into another document."). In any case, Dr. Karam does not explain sufficiently why these additional teachings would have suggested that a skilled artisan would have had a reason to reorder the scanning in Luna.

implement alternative VLC table implementations, such as the VLC tables provided in VCEG-M51r1." Pet. 51. Essentially, Petitioner argues that, if QP is kept above 24 and a sequence of RL values is chosen such that R is 2 or less, then according to table M in VCEG-M51r1, when the absolute value of the previous value of L is 1, the VLC table will be switched from UVLC to UVLC2. *Id.* at 46–48, 51–63. Petitioner identifies L=1 as the "first threshold." *Id.* at 47–48. Petitioner makes a similar argument for switching from UVLC2 to UVLC3, with L=3 as the "second threshold." *Id.* at 48–49, 66–69.

Petitioner contends that "incorporating the teachings of VCEG-M51r1 with Luna's teachings would have been no more than the use of a known technique to improve a similar method in the same way," and that a skilled artisan "would have further recognized that VCEG-M51r1 discloses an improvement to [the] decoding techniques" of Luna. *Id.* at 57 (citing Ex. 1003 ¶ 133). Petitioner points to VCEG-M51r1's characterization of its technique as an "[i]mproved method of encoding transform coefficients" and providing "coding improvements." *Id.* (quoting Ex. 1006, 1, 3). Petitioner contends that "contemporaneous discussion of the VCEG-M51r1 proposal indicated that the proposed method resulted in" bit rate savings, and that a skilled artisan would have recognized bit rate savings as advantageous.[7]

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[7] As Patent Owner points out, Prelim. Resp. 18 n.3, the contemporaneous discussion cited by Petitioner characterizes any such advantages as "limited." Ex. 1011, 10. Nevertheless, we need not resolve whether the technique of VCEG-M51r1 actually would have provided improvements to Luna, as Petitioner argues, because Petitioner's overall proposed combination relies on the scanning order of Silva, rather than that of Luna, as discussed below.

Id. at 57–58 (citing Ex. 1011, 10[8]; Ex. 1003 ¶ 134). Petitioner argues that there would have been a reasonable expectation of success in incorporating VCEG-M51r1's teachings into the decoding method of Luna because a skilled artisan "would have recognized that incorporating the teachings of VCEG-M51r1 would have required no more than a modification of Luna's prior art decoding process with different VLC tables disclosed by VCEG-M51r1." *Id.* at 58 (citing Ex. 1003 ¶ 135). Dr. Karam's testimony, cited in support of these arguments, does little more than repeat the arguments in the Petition, without adding to them materially. Ex. 1003 ¶¶ 134–135.

In response, Patent Owner contends that Petitioner "fails to account for the disparate methods of the Luna-Silva combination and VCEG-M51r1," and that Petitioner's "obviousness analysis is with reference to Luna, and **not** Luna as modified by Silva." Prelim. Resp. 67. In particular, Patent Owner argues, Petitioner has failed to account for whether VCEG-M51r1's technique would have been an improvement to the Luna/Silva combination asserted by Petitioner in which the scanning and decoding order proceeds in reverse. *Id.* at 67–68. According to Patent Owner, VCEG-M51r1 achieves its improvements in the context of scanning that proceeds from low frequency coefficients to high frequency coefficients, "the VLC table determination and switching proposed by VCEG-M51r1 is explicitly dependent on the decoding order," and "[t]o apply the VLC table switching technique of VCEG-M51r1 to the reverse scanning order (as proposed by the Petition's combination of Luna and Silva) would fundamentally change the variable length coding of VCEG-M51r1." *Id.* at 68–69. Patent Owner argues that "the Petition attempts to apply the technique to a substantively

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[8] Here, we use the page numbering added by Petitioner to the exhibit.

different method and in a critically different way, *i.e.*, to an undisclosed sequence of increasing coefficient value order with different tables and bits used to code the same data," and that "[t]he bitrate results of using such a divergent variable length coding and ensuing bit sequence would not have been predictable, let alone predictably successful." *Id.* at 72.[9]

We agree with Patent Owner. Claim 1 recites switching to different VLC tables based on the values of coded coefficients. Those coefficients are coded, according to claim 1, "from a high frequency component toward a low frequency component." As detailed above, Petitioner's theory of obviousness is that a skilled artisan would have recognized VCEG-M51r1 as providing an improvement to Luna's technique, which codes coefficients from a low frequency component toward a high frequency component. Petitioner provides no persuasive evidence or explanation as to why VCEG-M51r1's teachings would have provided an improvement if the scanning order were reversed, as it would have been with Petitioner's combination of Luna and Silva. Accordingly, Petitioner has not articulated a reason, with rational underpinning, for combining the teachings of VCEG-M51r1 with those of Luna and Silva.

Because Petitioner does not advance reasons, with rational underpinning, for combining Luna, Silva, and VCEG-M51r1, Petitioner does not establish a reasonable likelihood that claim 1 would have been obvious over Luna, Silva, and VCEG-M51r1.

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[9] Patent Owner makes other arguments as to VCEG-M51r1. Prelim. Resp. 48–66. However, as we deny the Petition on other grounds, it is not necessary to address these additional arguments.

III. CONCLUSION

For the foregoing reasons, we determine that the information presented in the Petition does not establish a reasonable likelihood that Petitioner would prevail in showing that claim 1 of the ’035 patent is unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied* as to the challenged claim of the ’035 patent, and no *inter partes* review is instituted.

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