

**UNITED STATES PATENT AND TRADEMARK OFFICE**

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**BEFORE THE PATENT TRIAL AND APPEAL BOARD**

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HISENSE USA CORPORATION; and  
HISENSE ELECTRONICA MEXICO S.A. de C.V.

Petitioner,

v.

VIDEOLABS, INC.,  
Patent Owner.

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U.S. Patent No. 7,769,238

Original Issue Date: August 3, 2010

Title: PICTURE CODING METHOD AND PICTURE DECODING METHOD

Case No. IPR2025-01329

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**PETITION FOR *INTER PARTES* REVIEW  
OF U.S. PATENT NO. 7,769,238  
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42 *et seq.***

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**LISTING OF EXHIBITS**

| <b>Exhibit</b> | <b>Description</b>                                                                                                                                     |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1001           | U.S. Patent No. 7,769,238 (the “’238 patent”)                                                                                                          |
| 1002           | Prosecution History of U.S. Patent No. 7,769,238                                                                                                       |
| 1003           | Declaration of Dr. Kannan Ramchandran                                                                                                                  |
| 1004           | International Publication No. WO03063501A1 (“Karczewicz”)                                                                                              |
| 1005           | Karczewicz Priority Application No. 10/054,610                                                                                                         |
| 1006           | Karczewicz Priority Provisional Application No. 60/369,500                                                                                             |
| 1007           | ITU-T Recommendation H.324 (“H.324”)                                                                                                                   |
| 1008           | ITU-T Recommendation H.263 (“H.263”)                                                                                                                   |
| 1009           | Chart Comparing disclosures from Karczewicz (Ex. 1004) and the corresponding disclosures from Karczewicz 60/369,500 Provisional Application (Ex. 1006) |
| 1010           | JVT-B045 (“Improved Low Complexity Entropy Coding for Transform Coefficients,” Bjontegaard, Gisle)                                                     |
| 1011           | U.S. Patent No. 7,099,387 (“Bjontegaard”)                                                                                                              |
| 1012           | IPR2018-00658, Paper 14                                                                                                                                |
| 1013           | IPR2022-00628, Paper 10                                                                                                                                |
| 1014           | IEEE Publication “Scene adaptive coder,” IEEE Transactions on Communications, 1984, W. Chen, C. H. Hsia, and W.K. Pratt                                |
| 1015           | IEEE Publication “Motion-compensation prediction with fractional-pel accuracy,” IEEE Transactions on Communications, April 1993, Bernd Girod           |

**CHALLENGED CLAIM LISTING**

| <b>Claim</b> | <b>Limitation No.</b> | <b>Limitation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1            | [1-PRE]               | A receiving apparatus which receives multiplexed data which is obtained by multiplexing coded audio data and coded picture data, said receiving apparatus comprising:                                                                                                                                                                                                                                                                                                                                                                                  |
|              | [1-A]                 | a demultiplexing unit configured to separate the multiplexed data into the coded audio data and the coded picture data;                                                                                                                                                                                                                                                                                                                                                                                                                                |
|              | [1-B]                 | an audio processing unit configured to decode the separated coded audio data; and                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|              | [1-C]                 | a picture decoding unit configured to decode the separated coded picture data,                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|              | [1-D]                 | wherein said picture decoding unit includes a block decoding unit configured to decode coded block data included in the coded picture data, the coded block data being obtained by dividing a picture signal into plural blocks, generating a residual block image from a block image of the respective blocks and a predictive block image obtained by intra-picture prediction or inter-picture prediction, and coding, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image |
|              | [1-E]                 | said block decoding unit includes: a coefficient number decoding unit configured to decode the coded block data to obtain the number of non-zero coefficients which are coefficients included in a current block to be decoded and having a value other than "0";                                                                                                                                                                                                                                                                                      |
|              | [1-F]                 | a unit configured to obtain coefficients corresponding to a residual block image of the current block by decoding the coded block data;                                                                                                                                                                                                                                                                                                                                                                                                                |
|              | [1-G]                 | a unit configured to obtain the residual block image of the current block by performing inverse quantization and inverse orthogonal transformation on the coefficients corresponding to the residual block image of the current block; and                                                                                                                                                                                                                                                                                                             |

| Claim | Limitation No. | Limitation                                                                                                                                                                                                                                                                                                |
|-------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | [1-H]          | a reproducing unit configured to reproduce a block image of the current block, from the obtained residual block image and a predictive block image obtained by intra-picture prediction or inter-picture prediction,                                                                                      |
|       | [1-I]          | said coefficient number decoding unit includes: a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a decoded block located on a periphery of the current block; |
|       | [1-J]          | a selecting unit configured to select a variable length code table based on the determined predictive value; and                                                                                                                                                                                          |
|       | [1-K]          | a variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table.                                                    |

**I. INTRODUCTION**

Pursuant to 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42, Petitioner respectfully requests *inter partes* review (“IPR”) of Claim 1 (“Challenged Claim”) of U.S. Patent No. 7,769,238 (the “’238 patent”).

The ’238 patent describes and claims a minor tweak to existing video coding techniques. To understand the ’238 patent’s purported invention, the undisputed context of ’238 patent is important. As explained in the ’238 patent’s Background, standard prior art video coding, such as MPEG-4 Part 2<sup>1</sup>, used block-based intra- and inter-frame prediction, followed by the discrete cosine transform of block pixel data to create coefficients, and the variable length coding (VLC) of those coefficients. Ex. 1001, 1:18-38. The Background asserts that the MPEG-2 system suffers from poor VLC coding efficiency because only one set of VLC codewords (“one VLC table”) is used. *Id.*, 1:39-44. The Background then explains that this problem is already addressed by using multiple VLC tables and selecting which table to use to code a particular block is based on the number of non-zero coefficients in the block (denoted as “ $N_c$ ” in this petition). *Id.*, 1:45-49. The ’238 patent then alleges a further improvement would be achieved by coding this  $N_c$  value with VLC, however, how to do so has not yet been established. *Id.*, 1:49-52.

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<sup>1</sup> ISO/IEC 14496-2:1999, is a standard document for MPEG-4 Part 2. Ex. 1003, ¶43.

The '238 patent purports to invent the details of a method for VLC coding this  $N_c$  value, which is claimed as a “coefficient number decoding unit.”

Everything else in the patent’s single claim is admittedly conventional, such as the “receiving apparatus,” “demultiplexing unit,” “audio processing unit,” and the “picture decoding unit” with its various sub-components to decode the video data.

Ex. 1001, 38:10-60 (Claim 1).

The '238 patent’s purportedly inventive method for encoding the  $N_c$  value is to use multiple VLC tables and select the specific VLC table used to code a particular block’s  $N_c$  value by predicting the number of non-zero coefficients in that block. This is because if the prediction is accurate, or close to accurate, a VLC table will be chosen that can efficiently encode the actual  $N_c$  value. The '238 patent claims a prediction method “based on” the  $N_c$  values of a “decoded block located on a periphery of the current block,” which, for example, is illustrated in Figures 4A and 4B.

Fig. 4A

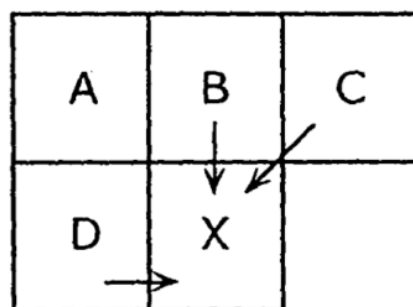
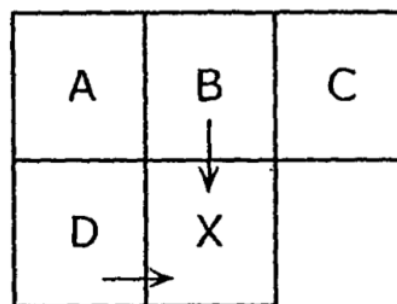


Fig. 4B



But it does not claim the details of how the peripheral block values are used to predict the  $N_c$  value for the block to be coded.

The '238 patent's purportedly novel  $N_c$  value encoding scheme is invalid because it was disclosed in International Publication No. WO 03/063501 ("Karczewicz"). Specifically, Karczewicz describes the same problem, in the same context, and provides the same solution. For example, Fig. 5 of Karczewicz illustrates the same relationship between peripheral blocks and the current block to be coded as Fig. 4 of the '238 patent:

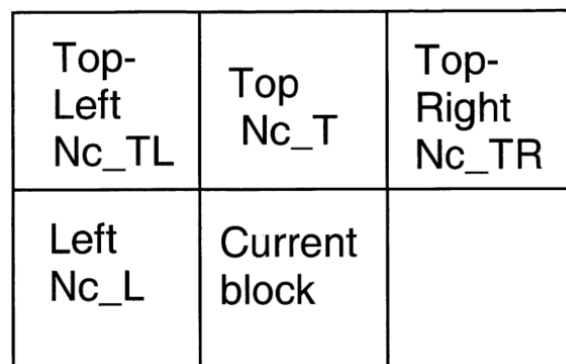


Fig. 5

While two prior petitions have been filed against the '238 patent by other petitioners, neither of the prior petitions presented Karczewicz or similar prior art. Specifically, IPR2018-00658 relied on prior art that predicted the VLC table to use for coding of the  $N_c$  value based on a temporally previous block (not a spatially neighboring block). See Ex. 1012 (IPR2018—00658, Paper 14) at pp. 16-19, 29-

32. And IPR2022-00628 presented art that was defeated when the Patent Owner demonstrated that it could rely on the foreign filing date of the '238 petition. *See* Ex. 1013. Neither of those issues are present in the current petition.

Accordingly, Petitioner requests that the PTAB institute trial and find the Challenged Claim unpatentable for the reasons set forth herein.

## **II. 37 C.F.R. § 42.8(B): MANDATORY NOTICES**

### **A. 37 C.F.R. § 42.8(b)(1): Notice of Real Parties-in-Interest**

Petitioners Hisense USA Corporation and Hisense Electronica Mexico S.A. de C.V, and Hisense Co. Ltd. and its other related entities including: Hisense Visual Technology Co. Ltd. f/k/a Qingdao Hisense Electric Co. Ltd.; Hisense International Co. Ltd.; Hisense International (Hong Kong) America Investments Co. Ltd.; Guiyang Hisense Electronics Co., Ltd.; Hisense International (HK) Co. Ltd.; Hisense Electronics Manufacturing Company of America Corporation; and Hisense Broadband Multimedia Technology Co., Ltd., are the real-parties in interest. No other parties exercised or could have exercised control over this Petition; no other parties funded or directed this Petition. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48759-60.

### **B. 37 C.F.R. § 42.8(b)(2): Notice of Related Matters**

To the best knowledge of Petitioner, the '238 patent has been involved in the following matters:

*Inter Partes* Review

United States Patent No. 7,769,238

| Case Name                                                                                                              | Filed            |
|------------------------------------------------------------------------------------------------------------------------|------------------|
| <i>VideoLabs, Inc. et al. v. Hisense Co. Ltd. et al.</i> , No. 2:24-cv-00904-JRG-RSP (EDTX)                            | November 6, 2024 |
| <i>VideoLabs, Inc. et al. v. Meta Platforms, Inc. et al.</i> , No. 1:22-cv-00680 (D. Del)                              | May 24, 2022     |
| <i>VideoLabs, Inc. v. HP Inc.</i> , No. 6:22-cv-01086 (WDTX) (settled)                                                 | Oct. 18, 2022    |
| <i>VideoLabs, Inc. v. ASUSTeK Computer Inc. et al.</i> , No. 6:22-cv-00720 (WDTX)                                      | June 30, 2022    |
| <i>VIDEOLABS, INC. v. TCL Technology Group Corporation et al.</i> , No. 2:25-cv-00161 (E.D. Tex)                       | Feb. 10, 2025    |
| <i>VideoLabs, Inc. et al. v. Roku, Inc.</i> , No. 1:23-cv-01136 (D. Del) (settled)                                     | Oct. 11, 2023    |
| <i>VideoLabs, Inc. v. Dell Techs. Inc.</i> , No. 6:21-cv-00456-ADA (WDTX) (settled)                                    | May 3, 2021      |
| <i>VideoLabs, Inc. v. Dell Technologies Inc.</i> , No. 1:23-cv-01366 (WDTX) (consolidated with 6:21-cv-00456, settled) | May 3, 2021      |
| <i>VideoLabs, Inc. v. Lenovo Group Limited et al.</i> , No. 6:22-cv-00721 (WDTX) (settled)                             | June 30, 2022    |
| <i>VideoLabs, Inc. v. Micro-Star International Co., Ltd. et al.</i> , No. 6:22-cv-00722 (WDTX) (settled)               | June 30, 2022    |
| <i>VideoLabs, Inc. v. Amazon.com, Inc.</i> , No. 6:22-cv-00079 (WDTX) (settled)                                        | Jan. 21, 2022    |
| <i>VideoLabs, Inc. v. Amazon.com Inc.</i> , No. 6:22-cv-01167 (WDTX) (settled)                                         | Nov. 14, 2022    |
| <i>VideoLabs, Inc. v. Amazon.com Inc.</i> , No. 2:22-cv-01451 (WD Wash.) (settled)                                     | Oct. 11, 2022    |

|                                                                                                                                                   |               |
|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <i>VideoLabs, Inc. v. Acer Inc. et al.</i> , No. 6:22-cv-00719 (WDTX) (settled)                                                                   | June 30, 2022 |
| <i>Optis Wireless Technology, LLC v. Huawei Technologies Co, Ltd.</i> , No. 2:17-cv-00123 (EDTX) (settled)                                        | Feb. 21, 2017 |
| <i>Certain Video Processing Devices and Products Containing the Same; Inv. No. 337-TA-1323 (Violation) ITC-337-TA-1323 (Terminated 4-25-2025)</i> | Aug. 8, 2022  |
| <i>Certain Video Processing Devices and Products Containing the Same; Inv. No. 337-TA-1341 (Violation) ITC-337-TA-1341 (Terminated 8-1-2023)</i>  | Nov. 29, 2022 |
| <i>Huawei Device Co., Ltd. v. Optis Wireless Tech., LLC</i> , IPR2018-00658                                                                       | Feb. 16, 2018 |
| <i>Dell Technologies Inc. v. VideoLabs, Inc.</i> , IPR2022-00628                                                                                  | Mar. 2, 2022  |

**C. 37 C.F.R. § 42.8(b)(3) and (4): Notice of Counsel and Service Information**

| <b>Petitioner's Lead Counsel</b>                                                                                                                                                                                                        | <b>Petitioner's Back-Up Counsel</b>                                                                                                                                                                         |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Richard F. Martinelli<br>Reg. No. 52,003<br>Orrick, Herrington & Sutcliffe LLP<br>51 West 52nd Street<br>New York, NY 10019-6142<br>Telephone: (212) 506-3702<br><a href="mailto:RFMPTABDocket@orrick.com">RFMPTABDocket@orrick.com</a> | Joseph A. Chern<br>Reg. No. 63,246<br>Orrick, Herrington & Sutcliffe LLP<br>2050 Main Street, Suite 1100<br>Irvine, CA 92614-8255<br><a href="mailto:2JAPTABDocket@orrick.com">2JAPTABDocket@orrick.com</a> |

Petitioner submits a Power of Attorney with this Petition. Please address all correspondence to lead counsel. Petitioner consents to service by email at the email addresses listed above.

**D. Fee for *Inter Partes* Review**

The USPTO is authorized to charge the filing fee and any other fees incurred by Petitioner to the deposit account of Orrick, Herrington, & Sutcliffe LLP: 15-0665.

**III. REQUIREMENTS FOR IPR**

This Petition complies with all requirements under 37 C.F.R. § 42.104 for IPR.

**A. § 42.104(a): Grounds for Standing**

The '238 patent is available for IPR. Petitioner is not barred or estopped from requesting IPR. This Petition is timely filed under 35 U.S.C. § 315(b).

**B. § 42.104(b): Identification of Challenge**

Under 37 C.F.R. §§ 42.104(b) and 42.22, Petitioner requests that the Board institute IPR on the Challenged Claim of the '238 patent and cancel those claims as unpatentable.

**1. § 42.104(b)(1): Challenged Claims**

Petitioner challenges Claim 1 of the '238 patent.

**2. § 42.104(b)(2): The Prior Art and Statutory Grounds**

The application for the '238 patent claims priority to foreign application JP 2002-112665, filed on April 15, 2002.

While Patent Owner has not shown its claims have support for the April 15,

2002 priority date, the references relied upon herein are prior art by that date as follows:

| <b>Patent/Publication</b>                                                 | <b>Filing / Priority Date</b>                                              | <b>Prior Art</b> | <b>Ex.</b>                                        |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------|------------------|---------------------------------------------------|
| International Publication No. WO 03/063501 (“Karczewicz” or “Nokia ’501”) | January 22, 2002 and April 2, 2002 (priority)<br>January 22, 2003 (filing) | 102(e)           | 1004<br>(Provisional Applications, Ex. 1005-1006) |
| ITU-T Recommendation H.324 (“H.324”)                                      | February 1998                                                              | 102(b)           | 1007                                              |
| ITU-T Recommendation H.263 (“H.263”)                                      | February 1998                                                              | 102(b)           | 1008                                              |

Although the Challenged Claim was filed prior to Karczewicz’ January 22, 2003 filing date, Karczewicz is entitled to claim priority to at least its April 2, 2002, provisional application. See Ex. 1004, (30). Specifically, at least provisional application No. 60/369,500 provides full support for Karczewicz claim 1 under *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1379-80 (Fed. Cir. 2015).

Petitioner provides limitation-by-limitation support for Karczewicz Claim 1 in at least the April 2, 2002, provisional application, below.

Karczewicz’ first priority claim, application No. 10/054,610, was filed on January 22, 2002. Ex. 1005; Ex. 1004, (30). Karczewicz’ second priority claim,

application No. 60/369,500, was filed on April 2, 2002.<sup>2</sup> Ex. 1006; Ex. 1004, (30).

As shown in the chart below, the April 2<sup>nd</sup> provisional provides full support for Claim 1 of Karczewicz (Ex. 1004) in the left column and the corresponding disclosures from the Karczewicz 60/399,500 Provisional Application (Ex. 1006) in the right column.<sup>3</sup> Ex. 1003, ¶¶76-87. Color coding and formatting between the claim language of Karczewicz (Ex. 1004) and the corresponding disclosures from the Karczewicz 60/399,500 Provisional Application (Ex. 1006) is provided for ease of reference and is not intended to be limiting.

| <b>Karczewicz Claim 1</b>                     | <b>Karczewicz 60/369,500 Provisional Application</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. A method of encoding a set of data symbols | See, e.g., Karczewicz 60/369,500, p. 1:12-14 (“The invention relates to a method, a system and a device for the coding of digital video. More specifically, the invention concerns the coding of quantised transform coefficients produced as a result of block-based transform coding in a video/image encoder/decoder using Variable Length Coding (VLC).”), 8:5-11 (“The invention relates to the variable length coding of the quantized transform coefficients produced as a result of block-based |

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<sup>2</sup> Presently, Petitioner only addresses the priority claim to the April 2, 2002, Provisional Application No. 60/369,500, which sufficiently predates the priority of the '238 patent. Karczewicz additionally claims priority to an earlier filed January 22, 2002, non-provisional, the subject matter relied on herein is fully supported by the Karczewicz 60/399,500 Provisional Application, which Petitioner reserves the right to rely on should Patent Owner claim an earlier priority date.

<sup>3</sup> This chart is not exhaustive and any absences from the chart should not be taken as indicative of any material difference between the references.

| Karczewicz Claim 1                                                                                                                                                                                                                                                                                                                                                         | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                            | <p>transform coding in a video encoder. The method according to the present invention seeks to address the aforementioned problems relating to improving the adaptability of variable length coding methods to the type and statistical properties of <u>the data symbols</u> to be coded while maintaining low computational complexity and good error resilience. One aim of the invention is to provide new and more efficient schemes for coding of (<i>run, level</i>) pairs representing non-zero-valued quantized transform coefficients.”); <i>see also</i> Ex. 1003, ¶79.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <p>comprising a certain first number of data symbols having a first value and a certain second number of data symbols having values other than said first value, in which a set of symbols to be variable-length encoded is formed from said <u>set of data symbols</u>, and variable-length encoding is applied to said set of symbols to be variable-length encoded,</p> | <p>“After a block of image pixels or prediction error values has been transform coded to form a two dimensional array of transform coefficient values and each of the coefficient values has been quantised, the transform coefficients for each block are ordered using a zig-zag scanning procedure. This operation converts the two-dimensional array of quantised transform coefficients into a one-dimensional array. Typical zig-zag scanning orders the coefficients approximately in ascending order of spatial frequency. This also tends to order the coefficients according to their values, such that coefficients positioned earlier in the one-dimensional array are more likely to have larger absolute values than coefficients positioned later in the array. This is because lower spatial frequencies tend to have higher amplitudes within the image blocks. Consequently, the last values in the one dimensional array of quantised transform coefficients are commonly zeros. <u>Typically, each non-zero quantised coefficient in the one dimensional array is represented by two values, referred to as level and run.</u> Level is the value of the quantised coefficient and run is the number of consecutive zero-valued coefficients preceding the</p> |

| Karczewicz Claim 1 | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
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|                    | <p>coefficient in question. A level value equal to zero is used to indicate that there are no more <b>non-zero coefficient values</b> in the block. This 0-level value is referred to as an EOB (end-of-block) symbol.”</p> <p>Karczewicz 60/369,500 Provisional Application, 1:20-2:5.</p> <p>“It has also been observed that there is strong correlation between the number of non-zero coefficients within a block and the (run, level) pairs possible in the same block. Notice that the number of non-zero coefficients in a block is bounded by the transform block size, e.g. by 16 for 4x4 transform. Likewise the value of <i>run</i> is bounded by the transform block size, again by 15 for 4x4 transform.</p> <p>...</p> <p>The codewords and the mappings between the (run, level) pairs and the codewords for each one of the tables are designed to provide optimum data compression when applied to a set of (run, level) pairs derived from an array of quantised transform coefficient values having <b>a specified number of non-zero-valued coefficients</b>.</p> <p>...</p> <p><b>A value, referred to as <math>N_C</math>, is assigned to that number and is used to signal explicitly the number of non-zero coefficient values in the array.”</b></p> <p>Karczewicz 60/369,500 Provisional Application, 7:1-28.</p> <p><b>“The invention proposes a method of VLC coding of the number of non-zero coefficients in the block. We also propose a method of VLC coding of (run,</b></p> |

| Karczewicz Claim 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>level) pair corresponding to the non-zero coefficients within the block.”</p> <p>Karczewicz 60/369,500 Provisional Application, 9:11-13</p> <p>Ex. 1003, ¶¶80-81.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <p>characterised in that at least one characteristic of the variable length encoding applied to the set of symbols to be variable-length encoded is adapted according to the number of the symbols to be variable-length encoded</p> <p>and that an indication of the number of variable-length encoded symbols is provided, said indication being a variable length codeword representative of said number of symbols to be variable length encoded selected from one of at least two alternative sets of variable length codewords according to said number of symbols to be variable length encoded.</p> | <p>“Another aim of the invention provides improved coding performance for encoding of non-zero quantised transform coefficients. The invention establishes a relationship between the number of non- zero-valued data symbols, the codewords used to represent the (run,level)pairs and the mappings between the (run,level)pairs and the codewords. The mapping between codewords and (run,level)is also dependent on the number of non-zero-valued data symbols and the previously encoded(run, level)pairs in the set of data symbols(the set of symbols could belong to a block or a macroblock in the video encoder/decoder).The mapping operation could be performed by means of an assignment table which defines the assignment of(run, level)pairs and codewords. Preferably, the mapping operation is performed by selecting one of a set of selectable assignment tables and assigning each of the (run, level) pairs to a codeword according to a mapping defined by the selected assignment table.”</p> <p>Karczewicz 60/369,500 Provisional Application, 8:25-34.</p> <p>“At least two sets of variable length codewords are provided for variable length coding the number of</p> |

| Karczewicz Claim 1 | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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|                    | <p data-bbox="646 327 1393 407">non-zero coefficients in the block, denoted by the <math>N_c</math> symbol.”</p> <p data-bbox="646 428 1370 508">Karczewicz 60/369,500 Provisional Application, 9:12-17.</p> <p data-bbox="646 583 1403 1008">“At least two sets of mappings are provided for relating the (run,level) pairs to the code numbers. Each (run,level) pair is first mapped to a code number using the mapping table selected from one of the at least two sets of mappings responsive to the value of max_run, defined to be the maximum value that a run can take. Max_run is initialized by considering the number of non-zero coefficients within the block and is updated after encoding of each (run,level) pair.”</p> <p data-bbox="646 1029 1370 1108">Karczewicz 60/369,500 Provisional Application, 9:19-23.</p> <p data-bbox="646 1184 1425 1860">“A second embodiment of the invention provides a method of coding of non-zero coefficients in the block. Notice that the number of non-zero coefficients in a block is bounded by the transform block size, e.g.by 16 for 4x4 transform. Likewise the value of <i>run</i> is bounded by the transform block size, again by 15 for 4x4 transform. When the number of nonzero coefficients is large, say close to the total size of the array, it is observed that (run,level) pairs with small value of run and high value of level have higher probability. For example, for 4x4 transform and with 15 non-zero coefficients, run can only take values in [0,1]. This simple example and further analysis of encoders on real-world images indicate that there might be a correlation between the number of non-zero</p> |

| Karczewicz Claim 1 | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |     |    |   |   |   |    |    |  |  |  |  |  |   |   |   |   |   |   |   |    |    |  |  |  |   |    |    |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
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|                    | <p>coefficients in a block and the run values of the block in question.</p> <p>Also note from the previous example that, as more and more run-level pairs are encoded from a block, possible number of run-level combinations start decreasing. Let us illustrate this with an example:</p> <p>Assume we have 5 non-zero coefficients in a block with run-level pairs (2,1),(3,2),(4,3),(2,3),(1,2).At the beginning of encoding of the block, since there are 5 non-zero coefficients and there can be at most 16 non-zero coefficients, run could take a value at most 11.Let us denote this maximum by max_run. After encoding the first pair, that is (2,1), max_run will decrease, precisely it will become 12, found by updating the previous max_run, by subtracting the current run value.More specifically, max_run is updated by:</p> <p>max_run=max_run-run;</p> <p>Where max_run is initialized by 16-Nc at the beginning of encoding of the block....</p> <p>In Table 6 and Table 7, an example of ordering of (run,level) pairs is presented according to the max_run value.</p> <div><div>level</div><table><tr><th colspan="12">Run</th></tr><tr><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>7</td><td>8</td><td>11</td><td>12</td><td></td><td></td><td></td></tr><tr><td>5</td><td>10</td><td>13</td><td>15</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>14</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table><div>11</div></div> | Run |    |   |   |   |    |    |  |  |  |  |  | 1 | 2 | 3 | 4 | 6 | 7 | 8 | 11 | 12 |  |  |  | 5 | 10 | 13 | 15 |  |  |  |  |  |  |  |  | 9 |  |  |  |  |  |  |  |  |  |  |  | 14 |  |  |  |  |  |  |  |  |  |  |  |
| Run                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |    |   |   |   |    |    |  |  |  |  |  |   |   |   |   |   |   |   |    |    |  |  |  |   |    |    |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| 1                  | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3   | 4  | 6 | 7 | 8 | 11 | 12 |  |  |  |  |  |   |   |   |   |   |   |   |    |    |  |  |  |   |    |    |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| 5                  | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 13  | 15 |   |   |   |    |    |  |  |  |  |  |   |   |   |   |   |   |   |    |    |  |  |  |   |    |    |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| 9                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |    |   |   |   |    |    |  |  |  |  |  |   |   |   |   |   |   |   |    |    |  |  |  |   |    |    |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |
| 14                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |     |    |   |   |   |    |    |  |  |  |  |  |   |   |   |   |   |   |   |    |    |  |  |  |   |    |    |    |  |  |  |  |  |  |  |  |   |  |  |  |  |  |  |  |  |  |  |  |    |  |  |  |  |  |  |  |  |  |  |  |

| Karczewicz Claim 1 | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---|--|--|---|---|---|---|---|---|----|--|---|----|--|--|---|----|--|--|---|--|--|--|----|--|--|--|----|--|--|--|----|--|--|--|
|                    | <div>Table 6 Max_run is 8.</div> <div><div>level</div><table><tr><th colspan="4">Run</th></tr><tr><td>1</td><td>3</td><td>5</td><td>9</td></tr><tr><td>2</td><td>7</td><td>12</td><td></td></tr><tr><td>4</td><td>10</td><td></td><td></td></tr><tr><td>6</td><td>14</td><td></td><td></td></tr><tr><td>8</td><td></td><td></td><td></td></tr><tr><td>11</td><td></td><td></td><td></td></tr><tr><td>13</td><td></td><td></td><td></td></tr><tr><td>15</td><td></td><td></td><td></td></tr></table></div> <div>Table 7 Max_run is 3.</div> <div>”</div> <div>Karczewicz 60/369,500 Provisional Application, 10:19-12:1.</div> <div>“Let us illustrate the encoding of Nc according to this embodiment of the invention with an example. Assume that the current Nc value to be encoded is 3, the neighboring Nc_L and Nc_T values are given by 4 and 2, respectively and Nc_map is given by Nc_map=[1 1 1 1 1 2 2 2 2] where VLC1 and VLC2 correspond to the codewords from Table 2 and Table 5, respectively. Using the equation (2), VLC_N becomes 2<sup>[4]</sup>. Then Nc=3 will be encoded as 0100 using Table 5 with VLC2.”</div> <div>Karczewicz 60/369,500 Provisional Application, 10:14-18.</div> <div>“The invention proposes a method of VLC coding of the number of non-zero coefficients in the block. We also propose a method of VLC coding of (run,level) pair corresponding to the non-zero coefficients within the block.</div> | Run |   |  |  | 1 | 3 | 5 | 9 | 2 | 7 | 12 |  | 4 | 10 |  |  | 6 | 14 |  |  | 8 |  |  |  | 11 |  |  |  | 13 |  |  |  | 15 |  |  |  |
| Run                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 1                  | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 5   | 9 |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 2                  | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 12  |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 4                  | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 6                  | 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 8                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 11                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 13                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |
| 15                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |     |   |  |  |   |   |   |   |   |   |    |  |   |    |  |  |   |    |  |  |   |  |  |  |    |  |  |  |    |  |  |  |    |  |  |  |

<sup>4</sup> Note, the value 2 is a clear clerical error. Applying equation (2):  $(4+2)/2 = 3$  and the 4<sup>th</sup> place (index=3) of Nc\_map is a value of 1, not 2. Ex. 1003, ¶84.

| Karczewicz Claim 1 | Karczewicz 60/369,500 Provisional Application                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    | <p>At least two sets of variable length codewords are provided for variable length coding the number of non-zero coefficients in the block, denoted by the Nc symbol. An Nc symbol is variable length coded using a codeword selected from one of the at least two sets of variable length codewords responsive to the values of previously coded Nc symbols. The previously coded Nc symbols that are used to assign VLC codewords could be advantageously chosen from the blocks that reside close to the block in question.”</p> <p>Karczewicz 60/369,500 Provisional Application, 9:10-18.</p> <p>Ex. 1003, ¶¶82-84.</p> |

In Section VII below, for every disclosure relied upon in this Petition from Karczewicz (Ex. 1004), Petitioner also cites to corresponding disclosures from the Karczewicz 60/369,500 Provisional Application (Ex. 1006). *See In re Riggs*, Case No. 2022-1945 (Fed. Cir. Mar. 24, 2025). For ease of reference, Petitioner also attached as Ex. 1009 a chart that compares the disclosures relied upon in the Petition from Karczewicz (Ex. 1004) in the left column and the corresponding disclosures from the Karczewicz 60/369,500 Provisional Application (Ex. 1006) in the right column. As the chart shows, the Karczewicz 60/369,500 Provisional Application discloses all of the concepts relied on in Karczewicz. Ex. 1003, ¶85. Again, this list is not exhaustive, and any absences from the chart should not be

taken as indicative of any material difference between the references. As shown above, the Karczewicz 60/369,500 Provisional fully supports Karczewicz’ disclosures and claims, (*i.e.* Karczewicz 60/369,500 Provisional supports both Claim 1 of Karczewicz and the concepts disclosed in Karczewicz relied on in this Petition). *Id.*, ¶86. Thus, Karczewicz is entitled to a priority date earlier than its January 22, 2003 filing date, namely an effective filing date of at least April 2, 2002. *Id.*

Below are the specific statutory grounds on which the claims are challenged:

| <b>Ground Number</b> | <b>Ground</b>                                                                                                     |
|----------------------|-------------------------------------------------------------------------------------------------------------------|
| 1                    | Claim 1 Is Obvious under 35 U.S.C. §103 (pre-AIA) (“Obvious”) Over Karczewicz In Combination with H.324 and H.263 |

None of the references on which these grounds are based were before the Examiner during prosecution of the ’238 patent.

### **3. Level of Ordinary Skill in the Art**

A POSITA in the technology described in the ’238 patent in 2002 would have had at least a Bachelor’s degree in computer science, computer engineering, electrical engineering, or a similar discipline, along with at least 2 years of experience with audio, image, and / or video coding. Ex. 1003, ¶31. Relevant experience can substitute for education and vice versa. *Id.*

**4. § 42.104(b)(5): Evidence Supporting Challenge**

The Declaration of Dr. Kannan Ramchandran (Ex. 1003) and other supporting evidence in the Exhibit List are filed herewith. Dr. Ramchandran's background and qualifications, and the information provided to him, are discussed in Exhibit 1003.

**IV. TECHNOLOGY BACKGROUND**

**A. Video Compression**

By April 2002, the field of video compression was well established and built upon the decades of understanding of video encoding principles. Ex. 1003, ¶35. The '238 patent explains that a video can be encoded by compressing each frame (picture) separately by leveraging redundancy within single frames and among sequential frames. *Id.* Specifically, the '238 patent teaches that a video encoder divides a picture into blocks and applies well-known block-based coding and compression techniques (*e.g.*, inter- or intra-picture prediction, orthogonal transformation, quantization, and so on) to each block. Ex. 1001, 1:19-27, Figs. 1, 4; Ex. 1003, ¶35. The '238 acknowledges that these techniques (described further below) were implemented in various video coding standards by the 1990s. *Id.*

**Blocks:** Video comprises a series of frames (pictures). An encoder subdivides each frame into blocks (*e.g.*, 16 x 16 pixels) that are processed individually. Ex. 1003, ¶36; Ex. 1008, Section 4.2.1.

**Prediction and Residual Block Image:** Prediction is used to achieve enhanced coding efficiency. Two types of common prediction are *inter*-picture prediction, which predicts the block based on a prior frame, and *intra*-picture prediction, which predicts the block based on neighboring blocks. Ex. 1008, Section 4.2.2. But prediction will not be perfect. Ex. 1003, ¶37. Encoders achieve significant compression while maintaining quality by transmitting only a “residual image,” which is the difference between the actual block and a *prediction* of what the actual block. *Id.*

**Transformation:** After creating a residual block, the encoder applies an “orthogonal transformation” (*e.g.*, a Discrete Cosine Transform) to transform the block’s spatial data to frequency data. Ex. 1008, Section 6.2.4, 48 (Annex A); Ex. 1003, ¶38. The result of the orthogonal transformation is a matrix of numbers, referred to as “coefficients.” *Id.*

**Quantization:** The encoder “quantizes” the data by dividing each element of the matrix by a predetermined value and rounding the result to the nearest integer to remove insignificant values. Ex. 1008, Sections 4.2.4, 6.2; Ex. 1003, ¶39. The output is a set of fewer coefficients than the transformed residual block image that are overall smaller in value. *Id.* This is a lossy form of compression that allows the coefficients to be represented by fewer bits. *Id.* But the more quantization the lower the quality of the encoded file.

***Entropy Coding / Variable Length Coding:*** The encoder finally applies “entropy coding” to convert the quantized coefficients into codewords (*i.e.*, bit representations). Ex. 1008, Section 4.2.1; Ex. 1003, ¶40. This process is lossless but still obtains a smaller file size. *Id.* For example, variable length coding (“VLC”) maps frequently occurring coefficients to shorter codewords and less frequently occurring coefficients to longer codewords to achieve compression. *Id.* For example, in a typical set quantized coefficient residual data, the values “0” and “1” often occur more frequently and, therefore, their values would be mapped to shorter binary codewords compared to other values. *Id.* These mappings from values to codewords are stored in a look-up-table.

## **B. Standards for Video Coding**

Before the filing of the '238 patent, video coding was largely driven by the activities of international standards organizations that sought to standardize multimedia coding techniques. Ex. 1003, ¶41. These standardization groups included International Standards Organization (ISO), the International Telecommunications Union (ITU), and the Joint Video Group. *Id.*

By the early 1990s, the Video Coding Expert Group (VCEG) of ITU-T had developed several standards (*e.g.*, H.324) that focused on videoconferencing over a network. *Id.*, ¶42. The ITU-T developed standards for video coding, including H.261 in 1990 and H.263 in 1996. *Id.* The H.263 standard included the well-

known steps of blocking, prediction, generating residuals, orthogonal transforms, quantization, and variable length coding. *Id.*

The ISO/IEC also develops standards and includes the Moving Pictures Expert Group (MPEG), which has promulgated several well-known standards for video coding. *Id.*, ¶43. For example, MPEG-1 was the standard in 1991 for storing movies on disk. *Id.* The MPEG-2 standard, released in 1996, further defined coding for broadcast and storing digital video on DVD. *Id.* And MPEG-4, released in 1999, defines standards that are still in use for Internet streaming, interactive video, and mobile video communications. *Id.*

In December 2001, the VCEG of ITU-T and MPEG of ISO/IEC joined to form the Joint Video Team (JVT) to work on a successor to H.263 and further enhancement to MPEG-4. During the early phases of development, the project was known as H.26L. *Id.*, ¶44. As the JVT finalized their work, it was promulgated as the H.264 standard and MPEG-4 Part 10 in May 2003. *Id.*

During JVT meetings in late 2001 and early 2002, several members submitted proposals for improved VLC entropy coding techniques, including the use of multiple VLC look-up-tables and prediction of how to know which table to use for encoding. *Id.*, ¶45. These proposals allowed the VLC to be better optimized to the content being encoded, such as the methods disclosed by Karczewicz. *Id.*

**V. THERE EXISTS A REASONABLE LIKELIHOOD THAT THE CHALLENGED CLAIMS ARE UNPATENTABLE**

The '238 patent states that the prior art commonly used a single variable length code (VLC) table to encode the values of each quantized coefficient in a current block. Ex. 1001, 1:28-44; Ex. 1003, ¶48. According to the '238, this technique was inefficient. *Id.*

To improve efficiency, the '238 patent proposes a system that encodes the total number of non-zero coefficients in a block (in addition to the values of the coefficients) using a VLC table that is selected from a plurality of VLC tables. Ex. 1001, 1:28-44; Ex. 1003, ¶49. The specific VLC table used to encode the number of non-zero coefficients is selected based on the number of non-zero coefficients in a block located on the periphery of the block being encoded. Ex. 1001, 1:45-62, 2:11-14, 37:53-57; Ex. 1003, ¶49. This is the same solution that was earlier described by Karczewicz as discussed above and in further detail below. *Id.*

**A. Problem Addressed by the '238 Patent and the Alleged Invention**

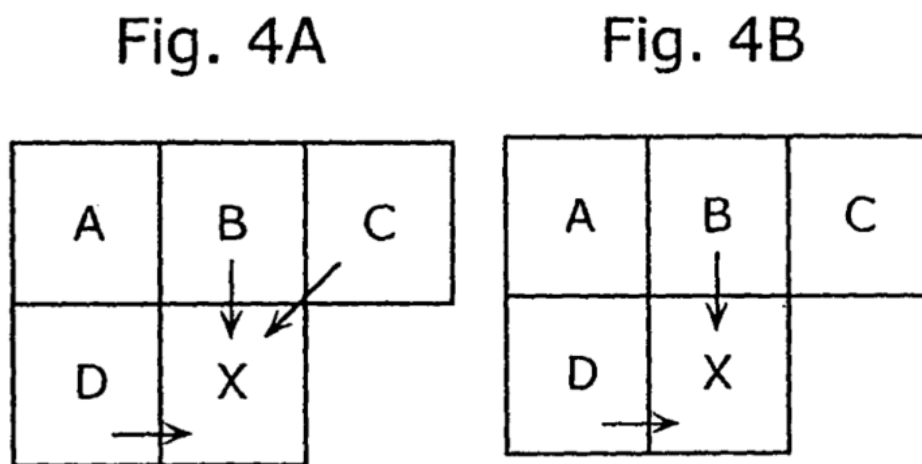
The '238 patent admits that fundamental video coding concepts recited in claim 1 were known in the art, including dividing a picture into blocks, creating a residual block image through inter- or intra-picture prediction, performing orthogonal transformation and quantization of the residual block image, and performing variable length coding (VLC) on the transformed, quantized

coefficients representing the residual block image. Ex. 1001, 1:19-27; Ex. 1003, ¶50.

To improve coding efficiency, because a single VLC table cannot be optimized for all blocks in a frame, the '238 patent proposes using multiple VLC tables for coding the ***coefficients***, which can be selected to suit different blocks. Ex. 1001, 1:42-52; Ex. 1003, ¶51. The VLC table used for a given block is selected based on the number of non-zero coefficients in that block. Ex. 1001, 11:25-40, Chart 5; Ex. 1003, ¶51. The number of non-zero coefficients for each block (referred to as " $N_C$ " in this petition) is expressly signaled by separately coding  $N_C$  and transmitting it with the block's coefficient data. Ex. 1001, 11:57-60; Ex. 1003, ¶51. The '238 patent proposes coding the  $N_C$  value itself with one of multiple VLC tables tailored for that purpose. Ex. 1001, 11:25-60; Ex. 1003, ¶51. This requires a mechanism to signal which VLC table was used to code each specific instance of  $N_C$ . Ex. 1001, 11:25-60; Ex. 1003, ¶51. Rather than providing the VLC table used expressly in the data stream, the '238 patent proposes picking the VLC table to use for coding based on a prediction of the number of non-zero coefficients in the block to be coded. Ex. 1001, 1:45-52, 3:25-29; Ex. 1003, ¶51. This prediction is based on the  $N_C$  value of one or more blocks located on the periphery of the current block to be coded. *Id.* This is a subtle point. The prediction of  $N_C$  for a block is only used to select the VLC table used to code the

actual  $N_C$  value for that block. Ex. 1003, ¶51. Also, for predicting  $N_C$ , the '238 patent discloses that its predictive value is calculated using an average value of the numbers of the coefficients other than 0 contained in the coded block similar to the  $fn$  defined by Karczewicz. Ex. 1001, 2:15-17; Ex. 1003, ¶52.

Figures 4A and B illustrate an exemplary embodiment of the relationship between the current block to be coded "X" and the blocks located on the periphery used for prediction ("A, B, C, D"):



Ex. 1003, ¶53. As shown, block "X" is the block currently being coded while blocks B, C, and D are reference blocks that have already been coded. Ex. 1001, 13:23-26; Ex. 1003, ¶54. The encoder predicts the number of non-zero coefficients that will be in block X by considering the number of non-zero coefficients in neighboring blocks B, C, and D (Figure 4A) or in neighboring blocks B, and D (Figure 4B). Ex. 1001, 13:23-51; Ex. 1003, ¶54. The predicted value is used to

select a particular VLC table from a plurality of VLC tables and used to code the **actual** number of non-zero coefficients for the block to be coded. Ex. 1001, 11:22-49; Ex. 1003, ¶54. Chart 5, below, shows an exemplary relationship between the predicted value and selected table. *Id.*

| CHART 5          |                 |
|------------------|-----------------|
| Predictive value | Reference table |
| 0~1              | VLC table 1     |
| 2~3              | VLC table 2     |
| 4~6              | VLC table 3     |
| 7~16             | VLC table 4     |

The selected VLC table is used to code the number of non-zero coefficients. Ex. 1001, 1:45-52; Ex. 1003, ¶55. In other words, once the actual number of non-zero coefficients in the block X is determined, that value is coded using the previously selected VLC table. Ex. 1001, 3:33-37; Ex. 1003, ¶55.

The only claim of the '238 patent recites a receiving apparatus configured to decode picture data using this technique. Ex. 1001, 38:47-60 (Claim 1); Ex. 1003, ¶56. Generally, the '238 patent describes the decoding process as reversing the steps performed by the encoder. Ex. 1001, 3:21-42, 22:43-58, 27:18-33; Ex. 1003, ¶56. The picture data is otherwise coded and decoded using well-known concepts (*e.g.*, block coding, orthogonal transformation, and quantization). Ex. 1001, 38:20-29; Ex. 1003, ¶56.

**B. Prosecution History**

The '238 patent, application No. 11/976,758, claims priority to foreign application JP 2002-112665.

The applicant added the single claim, as issued, via a September 29, 2008, preliminary amendment. Ex. 1002, 215-218. The '238 patent issued on August 3, 2010, without any substantive Office Action rejections or amendments to the claims. Ex. 1002, 496-504.

**C. Prior IPR Challenges**

The '238 patent was previously involved in two IPR challenges: IPR2018-00658 and IPR2022-00628.

The PTAB denied institution of IPR2018-00658 because the applied prior art (JVT-B045) did not disclose '238 patent element [1-I]. Ex. 1012 (IPR2018—00658, Paper 14), pp. 16-19, 29-32. The Board reasoned that “JVT-B045 determines the number of non-zero coefficients in the ‘*last* coded block,’ which is a temporal relationship,” whereas the claim “recites determining a predictive value based on a ‘spatial relationship’—the current block ‘located on a periphery of the current block’.” *Id.*, p. 17. This spatial relationship is shown in Figures 4A and B of the '238 patent.

The Patent Owner did not dispute that the proposed combination of H.324, H.263, and JVT-B045 taught all remaining claim elements of the '238 patent.

IPR2018—00658, Paper 14 at p. 10.

The PTAB rejected IPR2022-00628 because the Patent Owner successfully established the effective filing date of the '238 patent extended to the filing date of its foreign application, thereby antedating the asserted prior art necessary to the grounds in that petition. Ex. 1013 (IPR2022-00628, Paper 10), p. 2.

**D. Claim Construction**

The Board construes claims under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*) and its progeny. Under *Phillips*, claims are given their plain and ordinary meaning in light of the specification. 415 F.3d at 1315-17. The Board only construes claim terms when necessary to resolve the controversy. *See, e.g., Toyota Motor Corp. v. Cellport Sys., Inc.*, IPR2015-00633, Paper 11 at 16 (PTAB Aug. 14, 2015). Petitioner does not believe any claim construction is necessary here.

**VI. THE PRIOR ART**

**A. Karczewicz**

In International Publication No. WO 03/063501, Marta Karczewicz—who is a named inventor on nearly 700 patents in the video encoding space—describes conventional methods of VLC and recognizes that there is a continuing desire to improve data compression efficiency. Ex. 1004, 1:14-26:13, Ex.1003 ¶68.

Specifically, Karczewicz describes the benefits of new methods of VLC that are

adaptable to the statistical properties of the data to be coded, while maintaining low computational complexity, low memory requirements, and good error resilience. Ex. 1004, 26:13-17, 22-26, Ex.1003, ¶68.

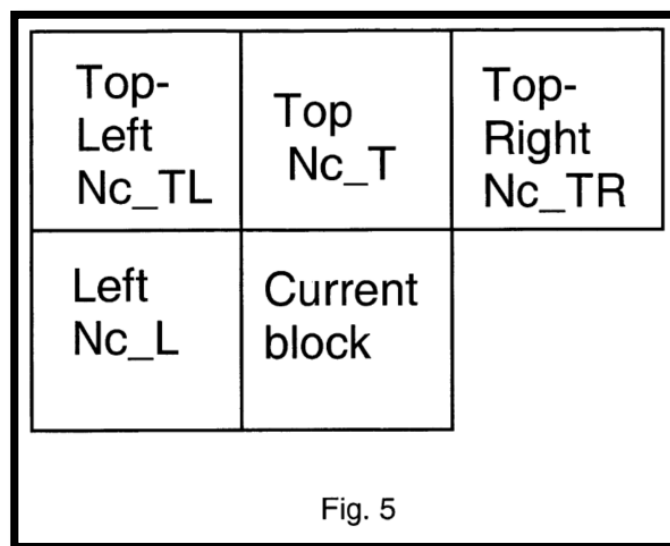
Karczewicz proposes a method of variable length coding of quantized transform coefficients produced from block-based transform coding in a video encoder. Ex. 1004, 26:28-30, Ex.1003, ¶69. Indeed, Karczewicz expressly identifies the ITU H.26L coder development as the background that the disclosed system is improving. Ex. 1004, 2:18-3:3, 19:9-20:29, 26:13-17, 22-26; *see also* Ex. 1006, p. 1:4-10, 2:21-3:23, 4:14-30, 7:1-28, Appendix 1 (ITU Question Q.15/SG16), Appendix 2 (JVT-B072), Appendix 3 (JVT-B118), p. 10.

Karczewicz recognized that the data in different blocks might have different statistical properties that would result in one VLC table being more efficient than another. Ex. 1003, ¶70. Thus, tailoring the VLC table to the data would gain coding efficiency. *Id.*

Karczewicz, thus, proposes a method of VLC coding using multiple VLC tables for coding. Ex. 1004, 33:29-34:9, Ex.1003, ¶71. The particular table used to code a block is based on the number of non-zero-value coefficients,  $N_c$ , in a block of quantized transform coefficients, which is signaled explicitly in the bit-stream transmitted to a corresponding decoder. Ex. 1004, 27:1-5, Ex.1003, ¶71. Karczewicz further teaches that  $N_c$  is itself VLC coded, which “provides a still

greater improvement in coding efficiency.” Ex. 1004, 27:7-10. The method involves the use of at least two sets of VLC codewords (*i.e.*, VLC tables) to encode  $N_c$  and defines rules for switching between the VLC tables based on the number of non-zero-valued coefficients in a block (or blocks) neighboring the block whose  $N_c$  value is to be coded. Ex. 1004, 27:12-16; Ex.1003, ¶71.

Figure 5 of Karczewicz shows a current image block to be coded and the  $N_c$  values for its immediately neighboring, previously encoded image blocks:



Ex. 1004, 31:28-29, 34: 11-14, Fig. 5; Ex.1003, ¶72. The terms  $N_{c\_L}$ ,  $N_{c\_TL}$ ,  $N_{c\_T}$ , and  $N_{c\_TR}$  denote respectively the number of non-zero quantized coefficients in the blocks to the left, top-left, top, and top-right of the current image block to be encoded. Ex. 1004, 34: 11-14, Fig. 5; Ex.1003, ¶72. The  $N_c$  value for the current image block is variable length encoded using a codeword from one of

the available sets of VLC codes, chosen by considering the already coded  $N_C$  value(s) of immediately neighboring block(s). Ex. 1004, 34: 11-14, Fig. 5; Ex.1003, ¶72.

Karczewicz describes an exemplary procedure for assigning a variable length code to an  $N_C$  value, taking into account the  $N_C$  values of the previously encoded neighboring blocks on the periphery of the current block:

$$\text{VLC\_N} = N_{c\_map}[fn(N_{c\_L}, N_{c\_TL}, N_{c\_T}, N_{c\_TR})] \quad (1)$$

Ex. 1004, 34:16-35:10; Ex.1003, ¶73. In the above expression,  $fn$  is a function that can be represented as:

$$\begin{array}{ccc} \text{VLC\_N} & = & N_{c\_map}[(N_{c\_L} + N_{c\_T}) / 2] \\ (2) & & \end{array}$$

*Id.*  $N_{c\_map}$  is an array that maps integer values to different available VLC codes and  $\text{VLC\_N}$  indicates the number of the table from which the codewords are to be selected. Examples of  $fn$  include “average” or “median.” *Id.*

Karczewicz represents one of several disclosures directed to the use of multiple VLC tables. Ex.1003, ¶74. For example, in the prior IPR challenges against the '238 Patent, both of JVT-B-45 (Ex. 1010) and U.S. Patent No.

7,099,387 (Ex. 1011) to Bjontegaard disclose the use of multiple VLC tables to encode values of coefficients in a current block. *Id.* Despite acknowledging that the use of multiple VLC tables was known, Patent Owner only distinguished Bjontegaard as teaching a predictive value (for selecting a particular VLC table) that was based on a temporal relationship (*e.g.*, determines prediction based on a last coded block) rather than the claimed spatial relationship (*i.e.*, “located on a periphery of the current block”). IPR2018—00658, Paper 14 at pp. 16-19, 29-32.

As discussed above in Sections V.B and V.C, the ’238 patent’s prosecution history and subsequent IPR challenges show the only concept claimed in the ’238 patent that the standards documents (discussed below) do not allegedly teach is the determination of a predictive value for the number of non-zero coefficients in a current block based on the number of non-zero coefficients included in decoded blocks located on a periphery of the current block. Ex.1003, ¶75. However, Karczewicz disclosed this predictive relationship before the ’238 patent.

## **B. Multimedia and Coding Standards**

Significant advancements in multimedia compression in the 1990s were driven by international standards organizations, who sought to standardize multimedia coding techniques. Ex.1003, ¶88. For example, the ITU-T developed each of H.323 and H.324 with a focus on videoconferencing over a network. *Id.* The ITU-T also developed the prior art H.261 and H.263 for video coding. *Id.*

Together, the H.324 and H.263 standards collectively define the basic elements of a multimedia coding system, including a demultiplexer, an audio codec, a video codec that implements block-based coding, prediction, transformation, quantization, and variable length coding. *Id.*

**1. H.324 (Ex. 1007)**

The ITU-T developed an international standard for videoconferencing over a General Switch Telephone Network (GSTN). Ex.1003, ¶89. As such, it includes features related to the coding of audio and networking. *Id.* This standard was presented in the initial publication of H.324 in March 1996, with a revision published in February 1998. Ex. 1007.

Terminal devices compatible with H.324 can process real-time voice, data, video, and combinations thereof. Ex. 1007, I (Summary); Ex.1003, ¶90. H.324 further specifies video and audio codecs to perform compression and decompression. *Id.* Figure 1 (annotated below) of H.324 shows a standard compliant multimedia videophone system:

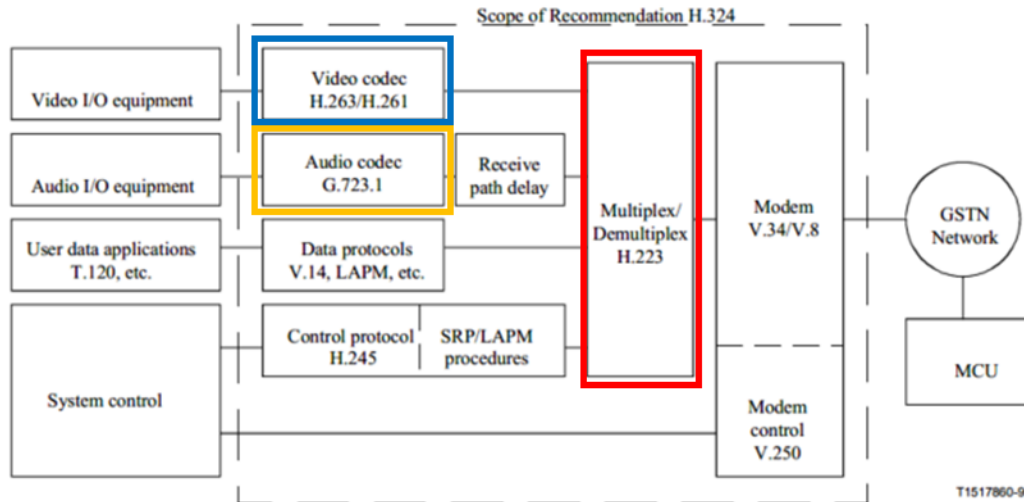


Figure 1/H.324 – Block diagram for H.324 multimedia system

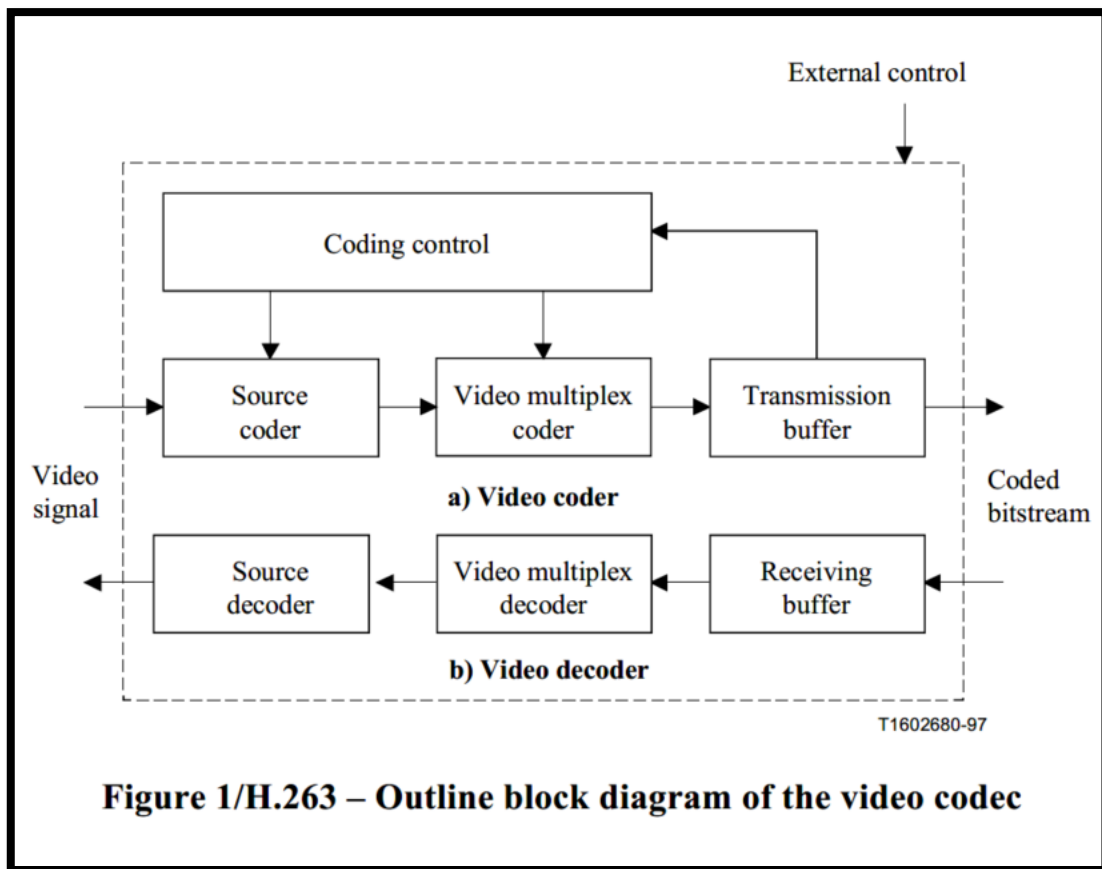
As shown, the system includes a video codec (blue rectangle) and audio codec (orange). The audio codec is described as a dual-rate audio and speech coder for multimedia communications and specifically recommends the use of H.263 as compatible video codecs. Ex. 1007, 2-3; Ex.1003, ¶90. The system also includes a multiplexer/demultiplexer (red) that, based on the H.223 standard, multiplexes transmitted video, audio, data, and control signals into a single bitstream and demultiplexes a received bitstream into its components parts. Ex. 1007, 2, 7; Ex.1003, ¶90.

## 2. H.263 (Ex. 1008)

The ITU-T developed and approved the H.263 standard in March 1996. Ex.1003, ¶91. H.263 specifies a video coding scheme for the compression of the moving picture element of audio-visual services at low bit rates. Ex. 1008, i.

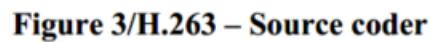
(Summary); Ex.1003, ¶91. A second version of the H.263 standard was released in February 1998, which is fully compatible with the first revision. Ex. 1008, 1; Ex.1003, ¶91.

H.263 discloses a block diagram of a video codec in Figure 1:



Ex.1003, ¶92. The video encoder provides a digital bitstream that may be combined with audio signals. Ex. 1008, 2; Ex.1003, ¶93. The video decoder performs the reverse process. *Id.*

A detailed diagram of the video encoder of Figure 1 is shown in Figure 3:



### C. Motivation to Combine Karczewicz and H.324 and H.263

A POSITA would have found it obvious to combine Karczewicz, H.324, and H.263 for many reasons. Ex. 1003, ¶¶95-99. Multimedia compression was a crowded art, based on concepts that were well understood, predictable, and routinely combined as needed to achieve a POSITA's design goals. Ex. 1003, ¶95.

First, the POSITA would have been motivated to combine H.324 with H.263. Ex. 1003, ¶96. Indeed, H.324 expressly mandates that all compliant

terminals offering video communication shall support H.263 video. Ex. 1007, p. 6 (Clause 6.1 Required Elements). Consistent with this, H.263 expressly references H.324 as a compatible standard. Ex. 1008, p. 2 (Clause 2 References); Ex. 1003, ¶96.

A POSITA would be further motivated to combine Karczewicz's coefficient number coder with the video coding systems and methods described in H.263 to predictably improve coding efficiency. Ex. 1003, ¶97. In 1999-2001 timeframe, POSITA's were actively looking for ways to improve on existing ITU and ISO standards. Indeed, the ITU and MPEG formed a joint taskforce, the JVT, expressly for that purpose, which was known as H.26L. Ex. 1003, ¶97. The express goal of these efforts was to build upon and improve the basic predictive and block coder framework of the H.263. Ex. 1003, ¶97. Indeed, the VLC coding disclosed by Karczewicz simply involves the non-lossy coding improvement of values included the H.263 standard, namely blocks with a certain number of non-zero coefficients. Ex. 1003, ¶97.

Consistent with this, Karczewicz expressly describes the need to improve methods of variable length coding in ITU-T standard coders, such as H.263 and its successor H.26L, to provide adaptability to the type and statistical properties of the data symbols to be coded, which improves compression while maintaining low computational complexity, low memory requirements, and good error resilience.

Ex. 1004, 2:18-3:3, 19:9-20:29, 26:13-17, 22-26; *see also* Ex. 1006, p. 1:4-10, 2:21-3:23, 4:14-30, 7:1-28, Appendix 1 (ITU Question Q.15/SG16), Appendix 2 (JVT-B072), Appendix 3 (JVT-B118), p. 10; Ex.1003, ¶98. Karczewicz further expressly confirms that its VLC coding scheme is H.263 compliant by expressly describing its use in the context of a multimedia system using H.263. Ex. 1004, Fig. 8, Ex.1003, ¶98. The combination of Karczewicz, H.324, and H.263 involves simply applying the Karczewicz coding technique to known standards (H.324 and H.263) as recommended by Karczewicz. Ex. 1003, ¶98.

Additional details regarding why a POSITA would have been motivated to combine Karczewicz, H.324, and H.263 with respect to the particular claims at issue are discussed in Section VII.A below.

## **VII. THE CHALLENGED '238 PATENT CLAIMS ARE UNPATENTABLE OVER THE PRIOR ART**

### **A. GROUND 1: Claim 1 Is Obvious Over Karczewicz In Combination With H.324/H.263**

#### **1. Independent Claim 1**

Karczewicz alone or in combination with H.324/H.263 renders Claim 1 obvious. Ex.1003, ¶¶100-186.

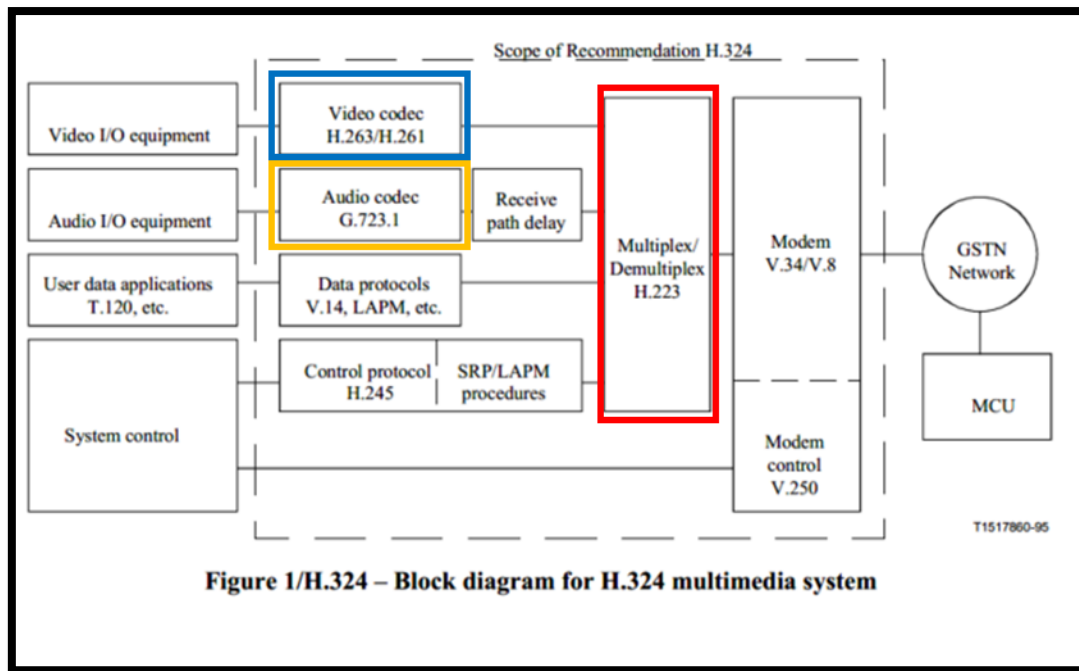
##### **a) [1-PRE]**

Karczewicz alone or in view of H.324 and H.263 discloses “[a] receiving apparatus which receives multiplexed data which is obtained by multiplexing

coded audio data and coded picture data.” Ex. 1003, ¶¶101-107.

As discussed above, this limitation recites basic coder features. Ex. 1003, ¶102. Both Karczewicz and the inventors of the ’238 patent were working on improving existing standards defined encoders, such as those encoders compliant with H.324/H.263. Ex. 1003, ¶102. In other words, both Karczewicz and the inventors of the ’238 patent recognized that this element was not only known in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶102. In fact, the Patent Owner—to support its earliest priority claim to a Japanese reference—argued that although the ’238 priority document did not expressly disclose an *audio* coding device, one of ordinary skill in the art would have known that the priority document was improving upon known standards (*e.g.*, H.26L and H.324) that coded both audio and video in multiplexing systems as required by claim 1’s preamble. Ex. 1013 (IPR2022-00628, Paper 10), pp. 11-22.

Consistent with Patent Owner’s admissions in prior IPR challenges, **H.324** discloses multimedia telephone terminals (Ex. 1007, 1), including Figure 1 that shows a generic multimedia videophone system:



The system includes a video codec (blue rectangle) and audio codec (orange). The audio codec is described as a dual-rate audio and speech coder for multimedia communications and the video codec uses H.263 or H.261 video coding schemes that share the same basic encoder/decoder structures. Ex. 1007, 2-3; Ex.1003, ¶¶103-104. The system also includes a multiplexer/demultiplexer (red) that, based on the H.223 standard, which demultiplexes a received bitstream into video, audio, data, and control signals. Ex. 1007, 2, 7; Ex.1003, ¶¶103-104.

Thus, **H.324** also teaches a receiving apparatus which receives multiplexed data which is obtained by multiplexing coded audio data and coded picture data. Ex. 1003, ¶105.

**Karczewicz** confirms that a multimedia terminal 80 that includes video

equipment 81, audio devices 82, and telematic devices 83 was well known. Ex. 1004, Fig.8 (shown below), p. 44:5-15, 17-27, 29-45:6; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶106. The video equipment 81 includes a monitor for displaying received video content and optional video processing equipment. Ex. 1004, p. 44:5-15; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶106. The audio equipment 82 typically includes a loudspeaker for reproducing received audio content. Ex. 1004, p. 44:5-15; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶106.

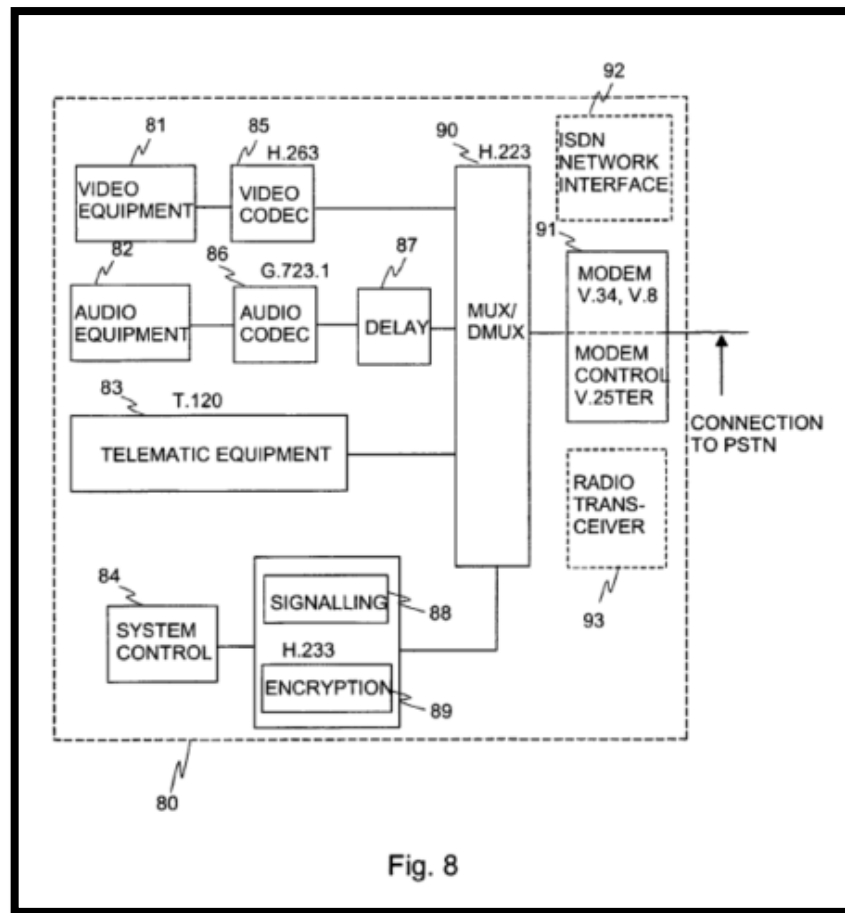


Fig. 8

When a multiplexed and possibly encrypted multimedia bit-stream is being received, MUX/DMUX unit 90 is responsible for decrypting the bit-stream, dividing it into its constituent multimedia components and passing those components to the appropriate codec(s) and/or terminal equipment for decoding and reproduction. Ex. 1004, p. 44:5-15; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶107.

### b) Element [1-A]

Karczewicz alone or in combination with H.324 and H.263 discloses “a

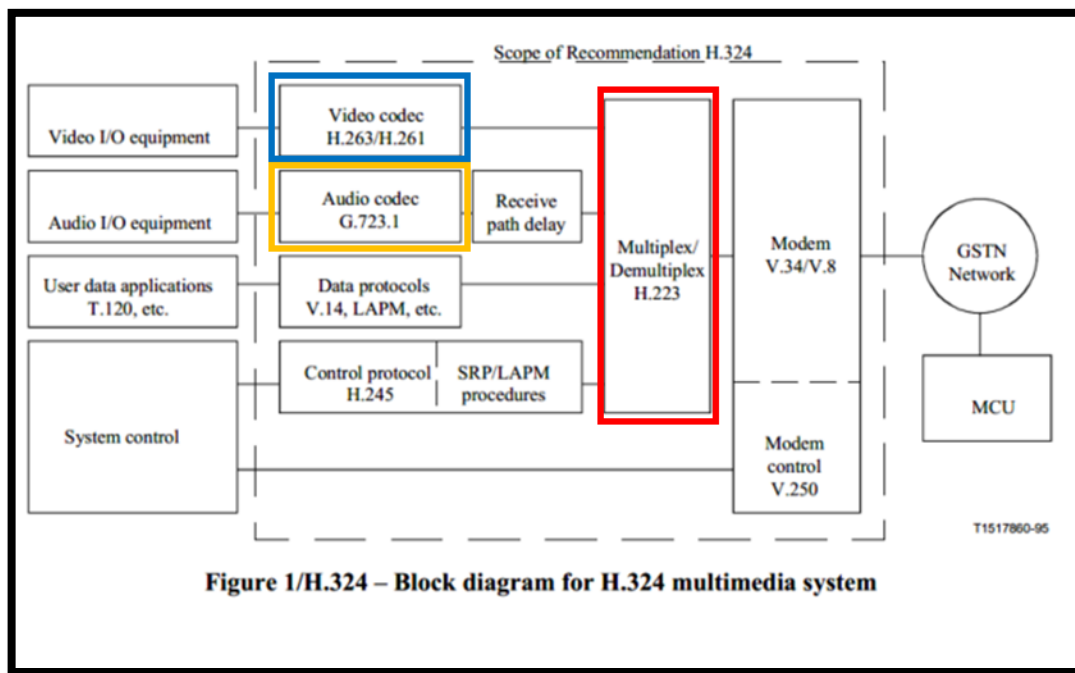
demultiplexing unit configured to separate the multiplexed data into the coded audio data and the coded picture data.” Ex. 1003, ¶108. The ’238 patent shows only a block-level functional description of a multiplexing/demultiplexing unit and assumes a POSITA would understand how to implement such a unit. Ex. 1001, 36:23-26; Fig. 29.

This limitation recites basic coder features. Ex. 1003, ¶109. Again, both Karczewicz and the inventors of the ’238 patent recognized that this element was not only known in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶109. To support its earliest priority claim to a Japanese reference, Patent Owner asserted the priority document was improving upon known standards (*e.g.*, H.26L and H.324) that coded both audio and video in multiplexing systems as required by claim 1’s element 1-A. Ex. 1013 (IPR2022-00628, Paper 10), pp. 11-22.

As with the preamble, Patent Owner argued **H.324** showed a demultiplexing unit configured to separate the multiplexed data into the coded audio data and the coded picture data. Ex. 1013 (IPR2022-00628, Paper 10), pp. 11-22; Ex. 1012 (IPR2018—00658, Paper 14), p. 10; Ex. 1003, ¶110.

For example, **H.324** requires a Multiplex Protocol (H.223), which specifies a demultiplexing unit that separates a received multimedia bit stream into video, audio, data, and control streams. Ex. 1007, 2, 6. The demultiplexing unit is shown

in Figure 1 in red. Ex. 1003, ¶111.



**Karczewicz** confirms that its system was compatible with this well-known process and teaches that when a multiplexed and possibly encrypted multimedia bit-stream is being received, the MUX/DMUX unit 90 is responsible for decrypting the bit-stream, dividing it into its constituent multimedia components and passing those components to the appropriate codec(s) and/or terminal equipment for decoding and reproduction. Ex. 1004, Fig. 8, p. 45: 19-28; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶112.

Karczewicz alone or in combination with H.324 and H.263 thus teaches a demultiplexing unit configured to separate the multiplexed data into the coded audio data and the coded picture data. Ex. 1003, ¶113.

**c) Element [1-B]**

Karczewicz in combination with H.324 and H.263 discloses “an audio processing unit configured to decode the separated coded audio data.” Ex. 1003, ¶114.

This limitation recites basic coder features. Ex. 1003, ¶115. Again, both Karczewicz and the inventors of the ’238 patent recognized that this element was not only known in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶115. To support its earliest priority claim to a Japanese reference, Patent Owner asserted the priority document was improving upon known standards (*e.g.*, H.26L and H.324) that coded both audio and video in multiplexing systems as required by claim 1’s element 1-B. Ex. 1013 (IPR2022-00628, Paper 10), pp. 11-22.

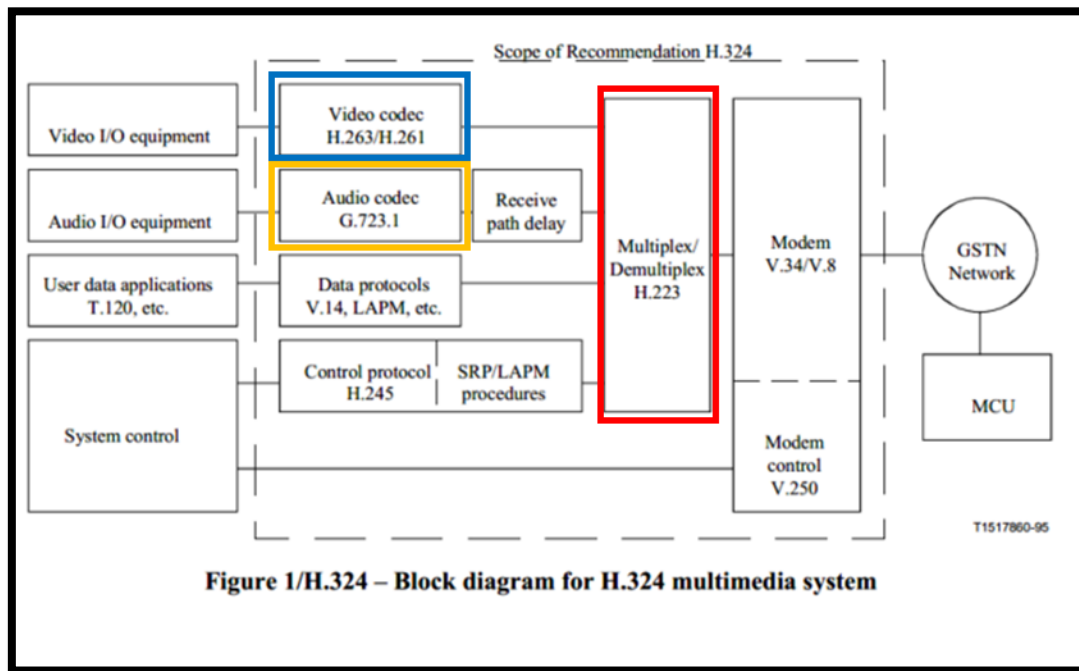
As with the preamble and element 1A, Patent Owner argued **H.324** showed an audio processing unit configured to decode the separated coded audio data. Ex. 1013 (IPR2022-00628, Paper 10), pp. 11-22; Ex. 1012 (IPR2018—00658, Paper 14), p. 10; Ex. 1003, ¶116.

For example, **H.324** requires an Audio Codec (G.273.1), which is an audio processing unit that decodes the audio stream separated from the bit stream by the demultiplexing unit. Ex. 1007, 2, 6; Ex. 1003, ¶117. Specifically, H.324 teaches that the Audio Codec “encodes the audio signal from the microphone for

transmission, and decodes the audio code which is output to the speaker.” *Id.*, 2;

Ex. 1003, ¶117. The audio processing unit is shown in Figure 1 in orange. Ex.

1003, ¶117.



**Karczewicz** confirms this was well known and discloses that its terminal's audio equipment is coupled to an audio codec 86. Ex. 1004, Fig. 8, p. 44: 29-45:6; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶118. Karczewicz discloses that “[l]ike the video codec, the audio codec comprises an encoder/decoder pair. It ... transforms encoded audio data received from the network back into a form suitable for reproduction, for example on the terminal's loudspeaker.” Ex. 1004, Fig. 8, p. 44: 29-45:6; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶118.

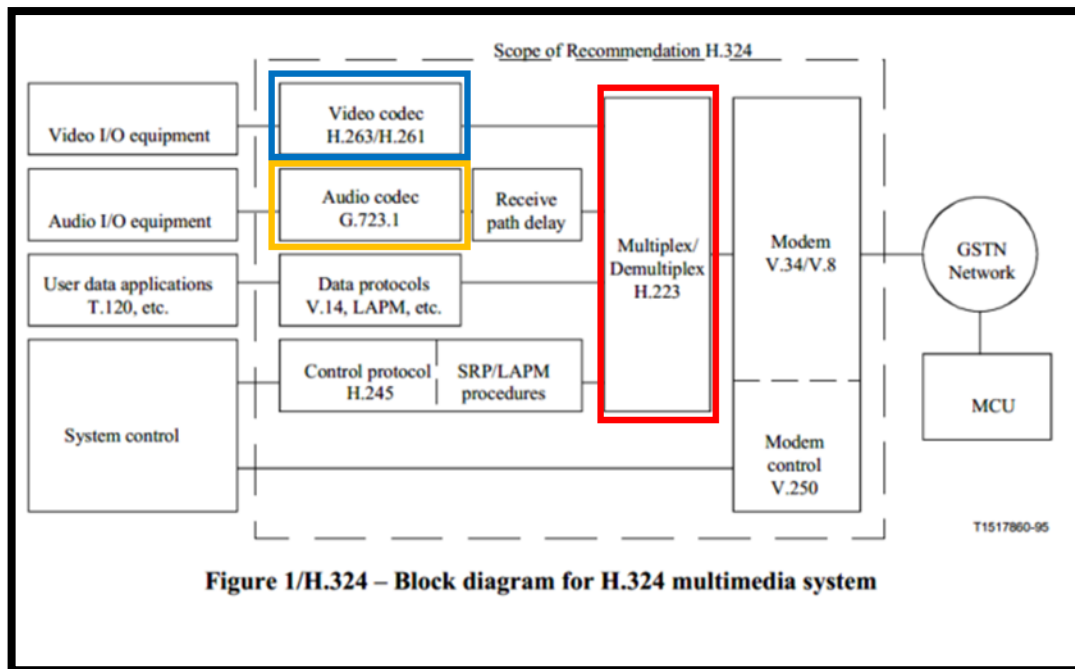
Karczewicz alone or in combination with H.324 and H.263 thus teaches an audio processing unit configured to decode the separated coded audio data. Ex. 1003, ¶119.

**d) Element [1-C]**

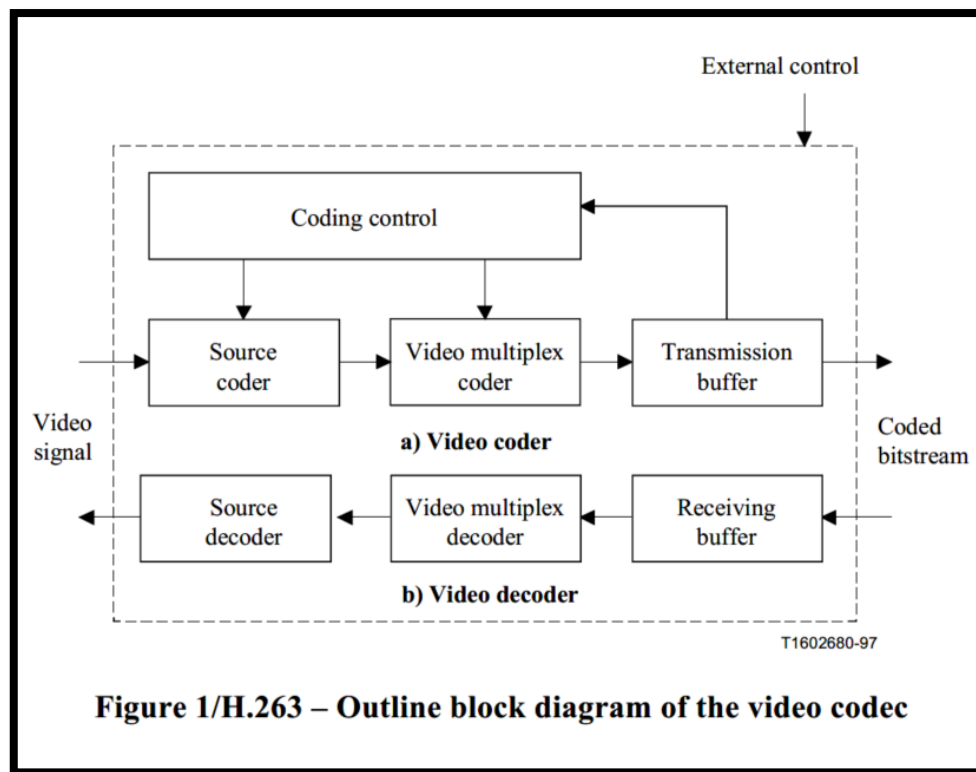
Karczewicz in combination with H.324 and H.263 discloses “a picture decoding unit configured to decode the separated coded picture data.” Ex. 1003, ¶¶120-125.

This limitation recites basic coder features. Ex. 1003, ¶121. Again, both Karczewicz and the inventors of the '238 patent recognized that a picture decoding unit configured to decode the separated coded picture data was not only known in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶121.

For example, **H.324** requires a Video Codec (H.263 and H.261), which is a picture decoding unit that decodes the video stream that has been separated by the demultiplexing unit. Ex. 1007, 2, 6; Ex. 1003, ¶122. The picture decoding unit is shown in the annotated Figure 1 in blue. Ex. 1003, ¶122.



**H.263**, which is incorporated by reference in H.324, details video codecs. Ex. 1008, 2; Ex. 1003, ¶123. For example, H.263 explains that the video coder provides a self-contained digital bitstream that can be combined with other signals (for example, as defined in Recommendation H.223). Ex. 1008, 2; Ex. 1003, ¶123. H.263 explains that the video decoder performs the reverse process. Ex. 1008, 2; Ex. 1003, ¶123. Figure 1 of the H.263 shows a video codec that includes a video decoder:



**Karczewicz** confirms this was well known and discloses that its video equipment 81 is coupled to a video codec 85, which video codec 85 includes a picture coding/decoding device similar to Fig. 15 of the '238 patent. Ex. 1004, Fig. 8, p. 44:17-27; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶124. Karczewicz describes that “[t]he video codec 85 comprises a video encoder and a corresponding video decoder both implemented according to the invention.... The video codec 85 is responsible for encoding captured video data in an appropriate form for further transmission over a communications link and decoding compressed video content received from the communications network. In the example illustrated in Figure 8, the video codec is

implemented according to ITU-T recommendation H.26L, with appropriate modifications to implement the adaptive variable length coding method according to the invention in both the encoder and the decoder of the video codec.” Ex. 1004, Fig. 8, p. 44:17-27; *see also* Ex. 1006, p. 1:16-18, 2:21-30, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶124.

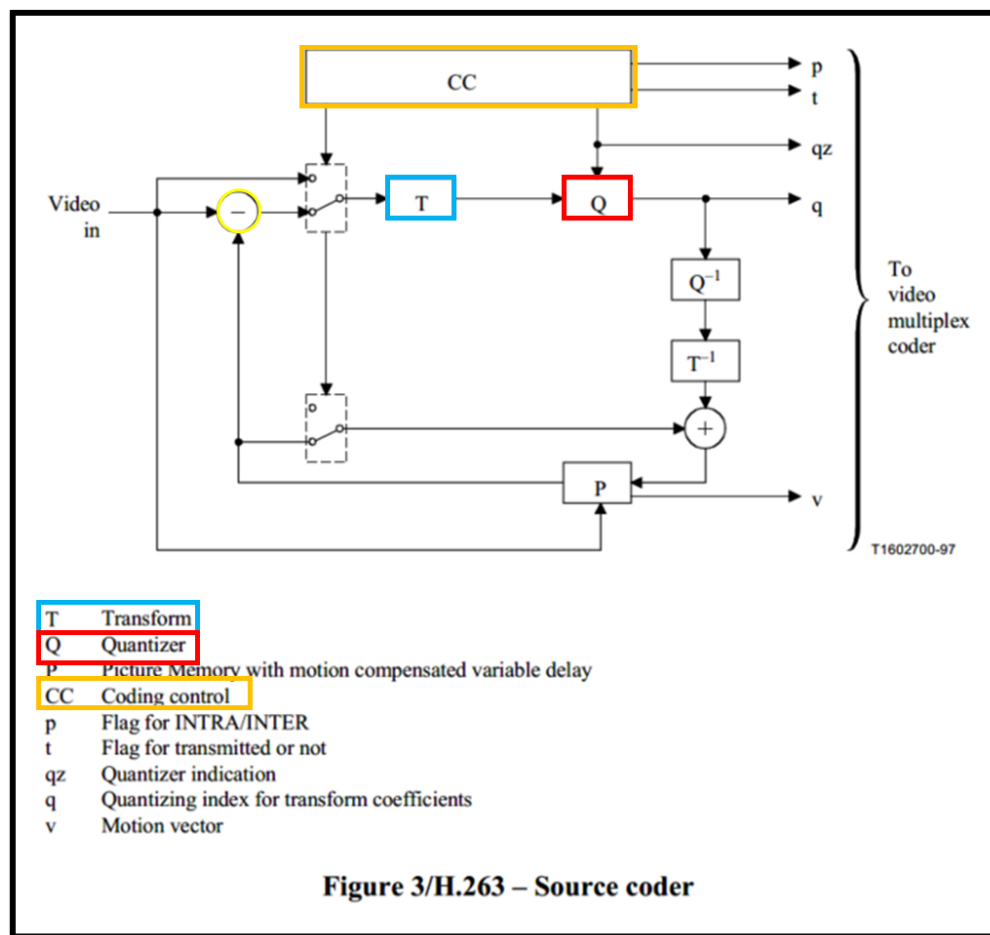
Karczewicz in combination with H.324 and H.263 thus teaches a picture decoding unit configured to decode the separated coded picture data. Ex. 1003, ¶125.

**e) Element [1-D]**

Karczewicz in combination with H.324 and H.263 discloses “wherein said picture decoding unit includes a block decoding unit configured to decode coded block data included in the coded picture data, the coded block data being obtained by dividing a picture signal into plural blocks, generating a residual block image from a block image of the respective blocks and a predictive block image obtained by intra-picture prediction or inter-picture prediction, and coding, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image.” Ex. 1003, ¶126.

This lengthy claim element generally recites the well-known steps of **block-based coding, prediction** (*i.e.*, inter- or intra-prediction), creating a **residual image**, orthogonal **transform, quantization**, and **coefficient encoding**. Ex. 1003,

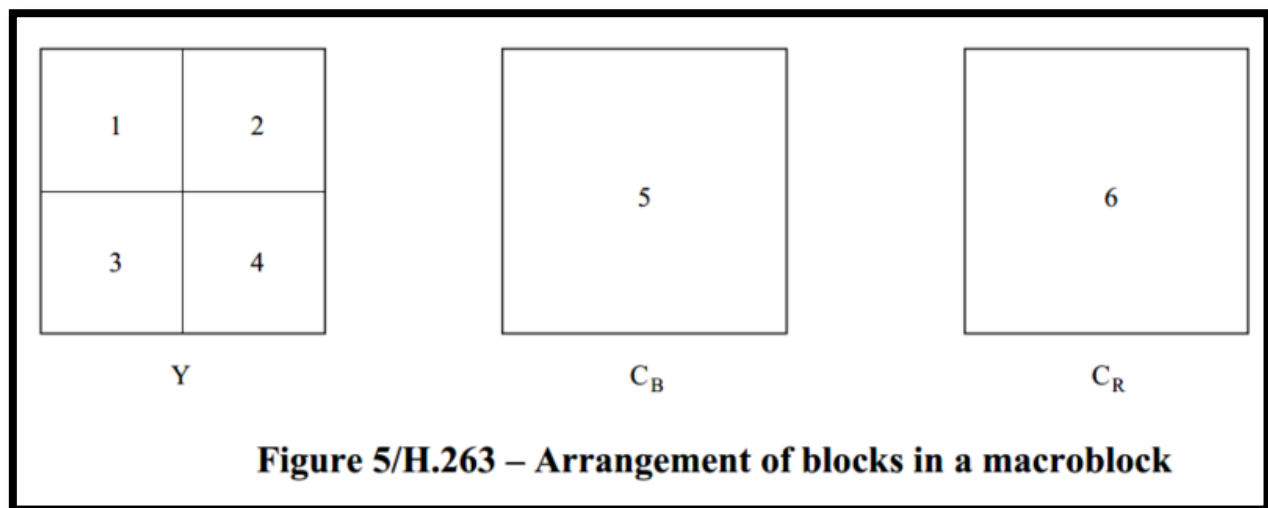
¶127. In fact, the majority of this claim merely recites that the exemplary data that the claimed decoder operates on is “being obtained” by conventional encoding steps. Ex. 1003, ¶127. The ’238 patent acknowledges that these steps are known in the background art. Ex. 1001, 1:19-38. And the Patent Owner did not dispute that **H.263** similarly taught this element. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶127. For example, **H.263** illustrates an encoder in Figure 3, which shows logical blocks for generating a residual image, transformation, and quantization that the claimed decoder operates on. Ex. 1008, Fig. 3; Ex. 1003, ¶127.



Nevertheless, these steps were known in the cited art. Ex. 1003, ¶128.

**Block-Based Coding** (“wherein said picture decoding unit includes a block decoding unit configured to decode coded block data included in the coded picture data, the coded block data being obtained by dividing a picture signal into plural blocks”)

**H.263** discloses dividing a moving picture into blocks. Ex. 1008, Section 4.2.1; Ex. 1003, ¶130. “Each picture is divided either into Groups of Blocks (GOBs) or into slices.” Ex. 1008, 9. Each GOB is then further divided into macroblocks. *Id.*, 10. Figure 5 of H.263 shows an exemplary macroblock that relates to 16 pixels by 16 lines of Y and the spatially corresponding 8 pixels by 8 lines of CB and CR. *Id.*, 11, Fig. 5 (below). H.263 describes that each macroblock consists of four luminance blocks and two spatially corresponding color difference blocks. Ex. 1008, 11; Ex. 1003, ¶130.



**Karczewicz** confirms this was well known and discloses that “each frame of a video sequence is divided into so-called 'macroblocks', which comprise luminance (Y) information and associated chrominance (U, V) information which is spatially sub-sampled.” Ex. 1004, p. 2:18-3:3, 5-16; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶131. Figure 3 illustrates one way in which macroblocks can be formed.

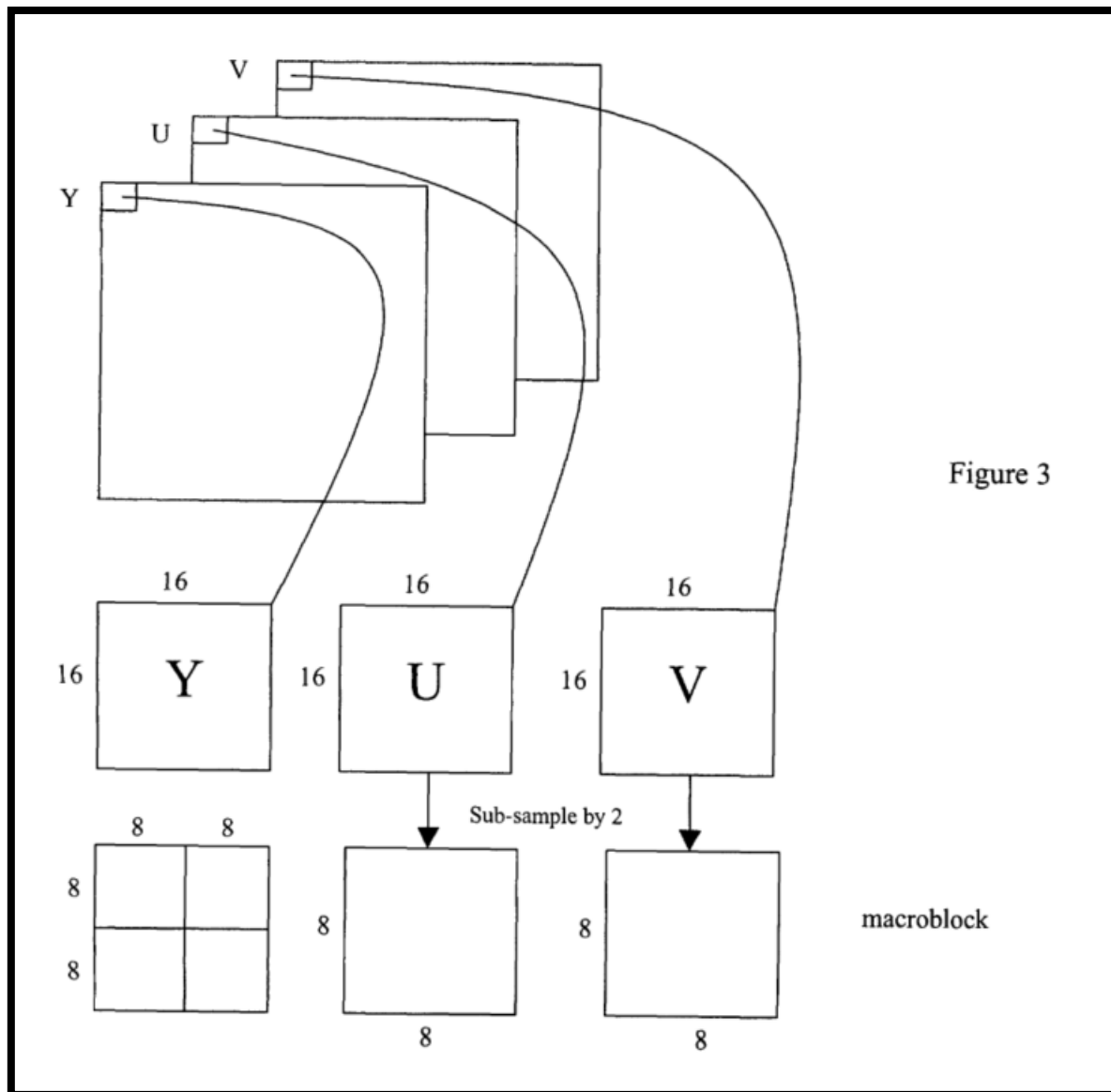


Figure 3

Figure 3 shows a frame of a video sequence represented using a YUV color model, each component having the same spatial resolution. Ex. 1004, Fig. 3, p. 2:18-3:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶132. Macroblocks are formed by representing a region of 16x16 image pixels in the original image as four blocks of luminance information, each

luminance block comprising an 8x8 array of luminance (Y) values and two spatially corresponding chrominance components (U and V) which are sub-sampled by a factor of two in the x and y directions to yield corresponding arrays of 8x8 chrominance (U, V) values. Ex. 1004, p. 2:18-3:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶132.

Karczewicz discloses that the International Telecommunications Union (ITU-T) recommendation H.26L defines the fundamental block size used within the macroblocks to be other than 8x8, for example 4x8 or 4x4. Ex. 1004, p. 2:18-3:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶132.

Karczewicz describes that its “decoder 200 comprises a video multiplex decoder 270, which receives an encoded video bit-stream 135 from the encoder 100 and demultiplexes it into its constituent parts, an inverse quantiser 210, an inverse DCT transformer 220, a motion compensated prediction block 240, a frame store 250, a combiner 230, a control manager 260, and an output 280.” Ex. 1004, p. 15:14-19; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶133.

**Prediction** (“*generating ... a predictive block image obtained by intra-picture prediction or inter-picture prediction*”)

**H.263** teaches the use of both intra- and inter-prediction. Ex. 1008, Section

4.2.2; Ex. 1003, ¶135. H.263 describes that a prediction of the block is formed based on previously-coded data, either from frames that have already been coded and transmitted (“inter-prediction”) or from the current frame (“intra-prediction”). Ex. 1008, 11-12; Ex. 1003, ¶135. In Figure 3 above, the Coding Control (“CC”) (shown in orange) block controls the modes of prediction. Ex. 1008, 9; Ex. 1003, ¶135.

**Karczewicz** also confirms the use of both intra- and inter-prediction. Ex. 1004, p. 5:5-23-6:5; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶136. For example, Karczewicz teaches that block-based transform coding can be applied to “[f]rames of a video sequence which are compressed using motion- compensated prediction are generally referred to as INTER-coded or P- frames.” Ex. 1004, p. 5:5-23-6:5, 12:9-13 (describing quantization in connection with operation of the encoder in INTRA-coding node); *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶136.

**Residual Block Image** (“*generating a residual block image from a block image of the respective blocks*”)

**H.263** teaches generating a residual block image to reduce the amount of transmitted data. Ex. 1008, 9; Ex. 1003, ¶138. The unit calculates a difference between the current block and the predicted block in the picture to create a

“residual picture.” Ex. 1008, 9; Ex. 1003, ¶138. In Figure 3 above, the circle with a negative sign (annotated in yellow) shows the unit for creating a residual picture. Ex. 1008, 9; Ex. 1003, ¶138.

**Karczewicz** discloses generating a “prediction error” (PE) frame, which is done on a block basis, since motion compensation prediction alone rarely provides a sufficiently precise representation of the image content. Ex. 1004, p. 5:5-23-6:5, 12:9-13, 15:1-12; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶139. The prediction error block is a residual block image from a respective block. Ex. 1008, p. 5:5-23-6:5; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶139. Karczewicz teaches, “[t]he prediction error information for each block of the macroblock is passed to DCT transformation block 104, which performs a two-dimensional discrete cosine transform on each block of prediction error values to produce a two-dimensional array of DCT transform coefficients for each block. DCT transformation block 104 produces an array of coefficient values for each prediction error block, the number of coefficient values depending on the nature of the blocks which make up the macroblock.” Ex. 1004, p. 11:29-12:7; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶139.

**Transform / Quantization** (“*coefficients obtained by performing orthogonal transformation and quantization on the residual block image*”)

**H.263** teaches “[a] hybrid of inter-picture prediction to utilize temporal redundancy and transform coding of the remaining signal to reduce spatial redundancy.” Ex. 1008, 2; Ex. 1003, ¶141. A POSITA would understand that, like the ’238 patent, transform coding includes orthogonal transformation techniques (*e.g.*, Discrete Cosine Transform (“DCT”)). Ex. 1001, 1:19-27 (confirming DCT or the like is an orthogonal transformation); Ex. 1003, ¶141. In Figure 3 above, the “Transform” block (“T”) (annotated in blue) shows the unit for transformation to reduce spatial redundancy. Ex. 1008, Fig. 3; Ex. 1003, ¶141. The output of the block T is a block of transform coefficients, which are subsequently quantized, such as by dividing each coefficient by an integer value and rounding to the nearest integer. Ex. 1008, Section 4.2.4 (Quantization); Ex. 1003, ¶141. In Figure 3 above, the “Quantizer” block (“Q”) (annotated in red) shows the unit for quantization. Ex. 1008, Fig. 3; Ex. 1003, ¶141.

**Karczewicz** discloses that “[t]he prediction error information for each block of the macroblock is passed to DCT transformation block 104, which performs a two-dimensional discrete cosine transform on each block of prediction error values to produce a two- dimensional array of DCT transform coefficients for each block. DCT transformation block 104 produces an array of coefficient values for each prediction error block, the number of coefficient values depending on the nature of the blocks which make up the macroblock.” Ex. 1004, p. 11:29-12:7; *see also* Ex.

1006, Appendix 3 (JVT-B118), pp. 10, 32; Ex. 1003, ¶142. Similarly, “[t]he transform coefficients for each prediction error block are passed to quantiser 106 where they are quantised using a quantisation parameter QP.” Ex. 1004, p. 12:9-13; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶142.

**Encoding Coefficients** (“*coding, on a block basis, coefficients*”)

**H.263** teaches that its quantized coefficients are then encoded on a block-by-block basis. Ex. 1008, 11; Ex. 1003, ¶144. “Data for the macroblocks is transmitted per macroblock in increasing macroblock number” and “[d]ata for the blocks is transmitted per block in increasing block number.” Ex. 1008, 11; Ex. 1003, ¶144. “Transmitted blocks are transformed and resulting coefficients are quantized and entropy coded.” Ex. 1008, 11; Ex. 1003, ¶144.

**Karczewicz** also discloses that the quantized coefficients are encoded on a block basis. Ex. 1004, p. 12:9-13, 11:29-12:7; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶145. For example, Karczewicz teaches that “[t]he prediction error information for each block of the macroblock is passed to DCT transformation block 104, which performs a two-dimensional discrete cosine transform on each block of prediction error values to produce a two-dimensional array of DCT transform coefficients for each block. DCT transformation block 104 produces an array of coefficient values for each

prediction error block, the number of coefficient values depending on the nature of the blocks which make up the macroblock.” Ex. 1004, p. 11:29-12:7; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶145.

Karczewicz in combination with H.324 and H.263 thus teaches that the picture decoding unit includes a block decoding unit configured to decode coded block data included in the coded picture data, the coded block data being obtained by dividing a picture signal into plural blocks, generating a residual block image from a block image of the respective blocks and a predictive block image obtained by intra-picture prediction or inter-picture prediction, and coding, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image. Ex. 1003, ¶146.

**f) Element [1-E]**

Karczewicz in combination with H.324 and H.263 discloses “said block decoding unit includes: a coefficient number decoding unit configured to decode the coded block data to obtain the number of non-zero coefficients which are coefficients included in a current block to be decoded and having a value other than ‘0’.” Ex. 1003, ¶147.

**Karczewicz** discloses a video decoder 700 that includes a variable length decoding unit. Ex. 1004, p. 39:8-19; *see also* Ex. 1006, p. 8:7-27, 9:13-22,

Appendix 3 (JVT-B118), pp. 10, 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶148.

Karczewicz teaches that “[i]n the decoder, the bit-stream is received and separated into its constituent parts by video multiplex decoder 770.... [T]he compressed video data extracted from the bit-stream is processed on a macroblock-by-macroblock basis. The compressed video data for an INTRA-coded macroblock comprises variable length codewords representing the VLC coded  $N_c$  value ... for each block of the macroblock, .... ” Ex. 1004, p. 39:21-40:4; *see also* Ex. 1006, p. 8:7-27, 9:13-22, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶148.

Karczewicz describes that when decoding VLC coded pairs for intra- or inter-coded image blocks, “video multiplex decoder 770 first **determines the number of non-zero-valued quantised transform coefficients in the block**. As previously explained, information relating to the number of non-zero-valued quantised transform coefficients,  $N_c$ , is inserted into bit- stream 635 by encoder 600. **Decoder 700 extracts this information from the received bit-stream.**

**According to the invention, the  $N_c$  value is itself VLC coded and therefore video multiplex decoder 770 performs an appropriate variable length decoding operation to recover the information relating to  $N_c$ .**” Ex. 1004, p. 40:11-41:8 (emphasis added); *see also* Ex. 1006, p. 8:7-27, 9:13-22, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶149.

Karczewicz in combination with H.324 and H.263 thus teaches that the

block decoding unit includes: a coefficient number decoding unit configured to decode the coded block data to obtain the number of non-zero coefficients which are coefficients included in a current block to be decoded and having a value other than '0'. Ex. 1003, ¶150.

**g) Element [1-F]**

Karczewicz in combination with H.324 and H.263 discloses “a unit configured to obtain coefficients corresponding to a residual block image of the current block by decoding the coded block data.” Ex. 1003, ¶151.

This limitation recites basic coder features. Ex. 1003, ¶152. Again, both Karczewicz and the inventors of the '238 patent recognized that a unit configured to obtain coefficients corresponding to a residual block image of the current block by decoding the coded block data was not only known in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶152.

For example, **H.263** teaches that its video decoder includes a unit that extracts quantized transformed coefficients from the coded bitstream. Ex. 1008, Section 6.2 (Coefficients Decoding); Ex. 1003, ¶153.

**Karczewicz** also discloses a DCT transformation block configured to obtain coefficients corresponding to prediction error information. Ex. 1004, p. 11:29-12:7; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 32; Ex. 1003, ¶154. Specifically, “[t]he prediction error information for each block of the macroblock

is passed to DCT transformation block 104, which performs a two-dimensional discrete cosine transform on each block of prediction error values to produce a two-dimensional array of DCT transform coefficients for each block. DCT transformation block 104 produces an array of coefficient values for each prediction error block, the number of coefficient values depending on the nature of the blocks which make up the macroblock.” Ex. 1004, p. 11:29-12:7; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 32; Ex. 1003, ¶154.

Karczewicz in combination with H.324 and H.263 thus teaches a unit configured to obtain coefficients corresponding to a residual block image of the current block by decoding the coded block data. Ex. 1003, ¶155.

**h) Element [1-G]**

Karczewicz in combination with H.324 and H.263 discloses “a unit configured to obtain the residual block image of the current block by performing inverse quantization and inverse orthogonal transformation on the coefficients corresponding to the residual block image of the current block.” Ex. 1003, ¶156.

This limitation recites basic coder features. Ex. 1003, ¶157. Again, both Karczewicz and the inventors of the ’238 patent recognized that a unit configured to obtain the residual block image of the current block by performing inverse quantization and inverse orthogonal transformation on the coefficients corresponding to the residual block image of the current block was not only known

in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶157.

For example, **H.263** teaches that its video decoder performs inverse quantization and inverse orthogonal transformation on the coefficients to obtain the residual block image of the current block. Ex. 1008, Section 6.2.1 (Inverse Quantization), Section 6.2.4 (Inverse Transform); Ex. 1003, ¶158. H.263 discloses that “[a]fter inverse quantization and zigzag of coefficients, the resulting 8 x 8 blocks are processed by a separable two-dimensional inverse discrete cosine transformation of size 8 by 8.” Ex. 1008, 47; Ex. 1003, ¶158.

**Karczewicz** also discloses that its video multiplex decoder 270 “reconstructs an array of quantised transform coefficient values for each prediction error block and passes them to inverse quantiser 210.” Ex. 1004, p. 17:7-18:4; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 32, 42-43; Ex. 1003, ¶159. The “[i]nverse quantiser 210 inverse quantises the quantised DCT coefficients representing the prediction error information for each block of the macroblock according to the control information and provides the now inverse quantised DCT coefficients to inverse DCT transformer 220. The inverse quantised DCT coefficients representing the prediction error information for each block are then inverse transformed in the inverse DCT transformer 220 to yield an array of reconstructed prediction error values for each block of the macroblock.” Ex. 1004, p. 17:7-18:4;

*see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 32, 42-43; Ex. 1003, ¶159.

Karczewicz in combination with H.324 and H.263 thus teaches a unit configured to obtain the residual block image of the current block by performing inverse quantization and inverse orthogonal transformation on the coefficients corresponding to the residual block image of the current block. Ex. 1003, ¶160.

**i) Element [1-H]**

Karczewicz in combination with H.324 and H.263 discloses “a reproducing unit configured to reproduce a block image of the current block, from the obtained residual block image and a predictive block image obtained by intra-picture prediction or inter-picture prediction.” Ex. 1003, ¶161.

This limitation recites basic coder features. Ex. 1003, ¶162. Both Karczewicz and the inventors of the '238 patent recognized that a reproducing unit configured to reproduce a block image of the current block, from the obtained residual block image and a predictive block image obtained by intra-picture prediction or inter-picture prediction was not only known in the art, but also defined in international standards. IPR2018—00658, Paper 14 at p. 10; Ex. 1003, ¶162.

For example, **H.263** teaches that for each macroblock, the decoder forms an identical prediction to the one created by the encoder. Ex. 1008, Section 6.3 (Reconstruction of Blocks); Ex. 1003, ¶163. H.263 discloses that “[a]fter motion

compensation and coefficients decoding (inverse transform included), a reconstruction is formed for each luminance and chrominance block.” Ex. 1008, 47; Ex. 1003, ¶163.

**Karczewicz** shows a video decoder 200 that includes a video multiplex decoder 270 (for receiving an encoded video bit-stream 135 from the encoder 100 and demultiplexes it into its constituent parts), an inverse quantiser 210, an inverse DCT transformer 220, a motion compensated prediction block 240, a frame store 250, a combiner 230, a control manager 260, and an output 280. Ex. 1004, p. 15:14-19; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 12, 16, 28, 32, 42-43, 69-70; Ex. 1003, ¶164.

Karczewicz then describes that the motion compensated prediction block 240 uses a reconstructed motion vector to identify the location of a region of reconstructed pixels in a prediction reference frame stored in frame store 250. Ex. 1004, p. 18:6-19:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 69-70; Ex. 1003, ¶165. Karczewicz teaches that the reference frame can be a previously decoded intra- or inter-coded frame. Ex. 1004, p. 18:6-19:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 69-70; Ex. 1003, ¶165. In either case, the region of pixels indicated by the reconstructed motion vector is used to form a prediction for the macroblock in question. Ex. 1004, p. 18:6-19:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 69-70; Ex. 1003, ¶165. “The prediction, that is

the blocks of pixel values derived from the reference frame, are passed from motion compensated prediction block 240 to combiner 230 where they are combined with the decoded prediction error information. In practice, the pixel values of each predicted block are added to corresponding reconstructed prediction error values output by inverse DCT transformer 220. In this way an array of reconstructed pixel values for each block of the macroblock is obtained. The reconstructed pixel values are passed to the video output 280 of the decoder and are also stored in frame store 250.” Ex. 1004, p. 18:6-19:3; *see also* Ex. 1006, Appendix 3 (JVT-B118), pp. 10, 69-70; Ex. 1003, ¶165

Karczewicz in combination with H.324 and H.263 thus teaches a reproducing unit configured to reproduce a block image of the current block, from the obtained residual block image and a predictive block image obtained by intra-picture prediction or inter-picture prediction. Ex. 1003, ¶166.

**j) Element [1-I]**

Karczewicz in combination with H.324 and H.263 discloses “said coefficient number decoding unit includes: a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a decoded block located on a periphery of the current block.” Ex. 1003, ¶167. In prior invalidity challenges against the ’238 patent, this is the only element that the Patent Owner

disputed to be taught by the prior art. IPR2018—00658, Paper 14 at p. 10; Ex.

1003, ¶167. However, Karczewicz—which has not been considered by the Office or the PTAB—discloses this exact element. Ex. 1003, ¶167.

**Karczewicz** expressly teaches that its video multiplex coder 670 determines the number of non-zero valued coefficients in a block of quantized transform coefficients by using at least two sets of variable length codewords:

When video multiplex coder 670 receives a block (two-dimensional array) of quantised transform coefficients, ***it determines the number of non-zero-valued coefficients in the array.*** According to the invention, this number, referred to as  $N_c$ , is variable length coded and transmitted to the decoder in bit-stream 635. ***At least two sets of variable length codewords are provided for variable length coding of the  $N_c$  value.*** In an embodiment of the invention, these are, for example, the VLC codewords defined respectively in Tables 2 and 5, previously described in the text. More specifically,  $N_c$  is variable length encoded using a codeword selected from one of the at least two sets of variable length codewords responsive to the values of previously coded  $N_c$  symbols. Advantageously, the previously coded  $N_c$  symbols used to ***assign the VLC codewords are chosen from blocks that reside close to the block being coded.***

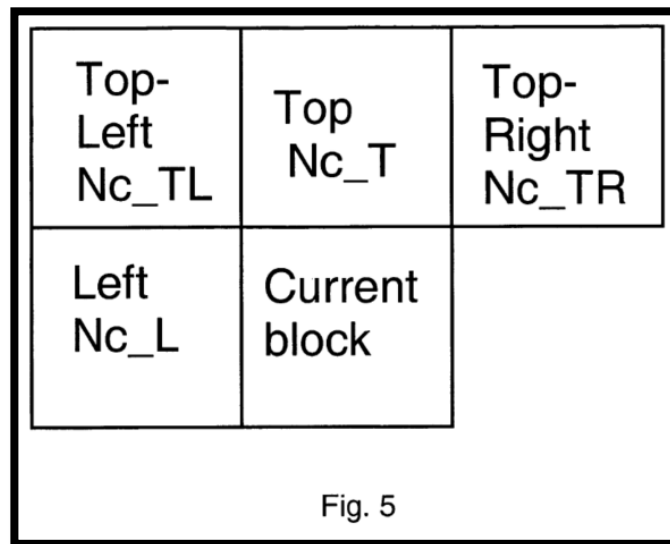
Ex. 1004, p. 33:29-34:9 (emphasis added), 39:8-19; *see also* Ex. 1006, Fig. 1, p.

8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10.

Figure 5 depicts an image block (nearly identical to Figure 4A and 4B of the '238 patent) to be VLC encoded and its neighboring blocks. Ex. 1004, Fig. 5, p.

34:11-14; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-

B118), p. 10; Ex. 1003, ¶169. The terms  $N_c\_L$ ,  $N_c\_TL$ ,  $N_c\_T$  and  $N_c\_TR$  denote respectively the number of non-zero quantized coefficients in blocks to the Left, Top-Left, Top and Top-Right of the current image block to be encoded:



The  $N_c$  value for the current image block is variable length encoded using a codeword from one of the available sets of VLC codes, chosen by considering the already coded  $N_c$  value(s) of immediately neighboring block(s). Ex. 1004, Fig. 5, p. 34:16-35:10; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶170.

Other than requiring the determination be based on the number of non-zero coefficients in at least one peripheral coded block, the Challenged Claim does not recite the algorithm used for the prediction. Ex. 1003, ¶171. Karczewicz meets this by describing an exemplary procedure for assigning a predicted  $N_c$  value,

VLC<sub>N</sub> in equation (1) below, taking into account the N<sub>C</sub> values of the previously encoded neighboring image blocks (N<sub>C\_L</sub>, N<sub>C\_TL</sub>, N<sub>C\_T</sub>, N<sub>C\_TR</sub>):

$$\text{VLC}_N = \text{N}_{C\_map}[fn(\text{N}_{C\_L}, \text{N}_{C\_TL}, \text{N}_{C\_T}, \text{N}_{C\_TR})] \text{ (Equation 1)}$$

Ex. 1004, 34:16-35:10; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10.

Karczewicz specifies that “when decoding the VLC coded (run, level) pairs for an INTRA- or INTER-coded image block, video multiplex decoder 770 first determines the number of non-zero-valued quantised transform coefficients in the block.... Decoder 700 extracts this information from the received bit-stream.

According to the invention, the N<sub>C</sub> value is itself VLC coded and therefore video multiplex decoder 770 performs an appropriate variable length decoding operation to recover the information relating to N<sub>C</sub>. As explained above, the VLC coding table used to encode the N<sub>C</sub> value for a particular image block is selected on the basis of the N<sub>C</sub> value(s) associated with a previously encoded image block or blocks.” Ex. 1004, 40:11-41:8; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶174. For example, in the case that N<sub>C</sub> values from blocks to the left, top-left, top and top- right are used to select the VLC table for coding subsequent N<sub>C</sub> values and the block scanning (coding) order is from the top-left of an image, row-by-row, Karczewicz explains that it is advantageous to encode N<sub>C</sub> values for blocks in the first row of the image, plus the

first block on the second row according to a predetermined scheme. Ex. 1004, 40:11-41:8; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶174. Then the  $N_C$  values for all subsequent image blocks can be encoded according to the rule described by equation (1) above and can be decoded at the decoder without any explicit indication of the VLC coding table used. Ex. 1004, 40:11-41:8; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶174.

Karczewicz in combination with H.324 and H.263 thus teaches that the coefficient number decoding unit includes: a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a decoded block located on a periphery of the current block. Ex. 1003, ¶175.

**k) Element [1-J]**

Karczewicz in combination with H.324 and H.263 discloses “a selecting unit configured to select a variable length code table based on the determined predictive value.” Ex. 1003, ¶176.

**Karczewicz** discloses a selecting unit configured to select a variable length code table based on the determined predictive value. Ex. 1003, ¶177. Table 2 of Karczewicz illustrates an exemplary set of VLC codewords:

| Codeword index | VLC Codeword |
|----------------|--------------|
| 0              | 1            |
| 1              | 010          |
| 2              | 011          |
| 3              | 00100        |
| 4              | 00101        |
| 5              | 00110        |
| 6              | 00111        |
| 7              | 0001000      |
| 8              | 0001001      |
| 9              | 0001010      |
| 10             | 000010000    |
| 11             | 000010001    |
| 12             | 000010010    |
| 13             | 000010011    |
| 14             | 000010100    |
| 15             | 000010101    |
| ....           | ....         |

Table 2: The First 16 UVLC Codewords of H.26L Generated According to the Scheme Presented in Table 1

Ex, 1004, p. 20:23-29, 21:Table 2; *see also* Ex. 1006, Fig. 1, Table 2, Table 5, p. 3:11-15, 8:14-30, 10:1-23; Ex. 1003, ¶177. Karczewicz recognizes that it can be advantageous to use more than one set of VLC codewords, such as a second set of VLC codewords (VLC2). Ex, 1004, p. 24:1-14; *see also* Ex. 1006, Fig. 1, Table 2, Table 5, p. 3:11-15, 8:14-30, 10:1-23; Ex. 1003, ¶177. Table 5 shows the first 16 codewords of VLC2.

| Codeword Index | VLC2 Codeword |
|----------------|---------------|
| 0              | 10            |
| 1              | 110           |
| 2              | 111           |
| 3              | 0100          |
| 4              | 0101          |
| 5              | 0110          |
| 6              | 0111          |
| 7              | 001000        |
| 8              | 001001        |
| 9              | 001010        |
| 10             | 001011        |
| 11             | 001100        |
| 12             | 001101        |
| 13             | 001110        |
| 14             | 001111        |
| 15             | 00010000      |

Table 5: The First 16 VLC2 Codewords of Q.15/SG16 Document Q15-K-30, Generated According to the Scheme Presented in Table 4

Ex. 1004, pp. 24-25, Table 5; *see also* Ex. 1006, Fig. 1, Table 2, Table 5, p. 3:11-15, 8:14-30, 10:1-23; Ex. 1003, ¶177. Karczewicz describes an exemplary procedure for assigning a variable length code to an  $N_C$  value, taking into account the  $N_C$  values of the previously encoded neighboring image blocks. Ex. 1004, 34:16-35:10; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶¶177-178. Examples of the  $fn$  include “average” or “median.” *Id.*

Karczewicz in combination with H.324 and H.263 thus teaches a selecting unit configured to select a variable length code table based on the determined predictive value. Ex. 1003, ¶179

**I) Element [1-K]**

Karczewicz in combination with H.324 and H.263 discloses “a variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table.” Ex. 1003, ¶180.

**Karczewicz** discloses that its variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table. Ex. 1004, p. 33:29-34:9, 39:8-19, 34:11-14, 16-35:10, 40:11-41:8, Fig. 5; *see also* Ex. 1006, Fig. 1, p. 8:7-27, 9:13-22, 10:1-23, Appendix 3 (JVT-B118), p. 10; Ex. 1003, ¶181.

Although **Karczewicz** expressly teaches a variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table, Patent Owner did not dispute that the prior art taught this element of the '238 patent. IPR2018—

00658, Paper 14 at p. 10; Ex. 1003, ¶182.

Karczewicz in combination with H.324 and H.263 thus teaches a variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table. Ex. 1003, ¶183.

#### **VIII. SECONDARY CONSIDERATIONS**

Petitioner is not aware of any secondary considerations that would overcome the strong showing of obviousness provided by the Petition. Ex. 1003, ¶184. Further, any attempt by Patent Owner to rely on alleged secondary considerations cannot overcome the showing of obviousness detailed above. *Tokai Corp. v. Easton Enters., Inc.*, 632 F.3d 1358, 1370 (Fed. Cir. 2011).

#### **IX. CONCLUSION**

For the foregoing reasons, Petitioner respectfully requests the Board institute review of the '238 patent and cancel the Challenged Claim.

*Inter Partes* Review

United States Patent No. 7,769,238

Date: July 25, 2025

Respectfully submitted,

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**CERTIFICATE OF WORD COUNT**

The undersigned certifies that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,769,238 PURSUANT TO 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42 complies with the type volume limitation in 37 C.F.R. § 42.24(a)(1). According to the utilized word-processing system's word count, the petition—excluding the caption, table of contents, a table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count, or listing of exhibits, and claim listing—contains 13,093 words.

Dated: July 25, 2025

By: /Richard F. Martinelli/

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*Counsel for Petitioner*

*Inter Partes* Review

United States Patent No. 7,769,238

**CERTIFICATE OF SERVICE**

The undersigned hereby confirms that the foregoing PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 7,769,238 PURSUANT TO 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42 and associated Exhibits 1001-1015 were caused to be served on via overnight courier upon the following counsel of record for Patent Owner:

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Re: VideoLabs, Inc.; U.S. Patent No. 7,769,238

Courtesy copies were also served via email on Patent Owner's counsel of record in a related district court litigation styled *VideoLabs, Inc. et al. v. Hisense Co. Ltd. et al.*, No. 2:24-cv-00904-JRG-RSP (E.D. Tex.):

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