UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable MaryJoan McNamara
Administrative Law Judge

In the Matter of **CERTAIN VIDEO-CAPABLE LAPTOP, DESKTOP COMPUTERS, HANDHELD COMPUTERS, TABLETS, TELEVISIONS, PROJECTORS, AND COMPONENTS AND MODULES THEREOF**	**Investigation. No. 337-TA-1448**

COMPLAINANTS' OPENING CLAIM CONSTRUCTION BRIEF

ASUS-1018
ASUSTeK v. Nokia
IPR2025-01279

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MARKMAN **EXHIBITS LIST**

Exhibit No.	**Description**
JXM-0001	U.S. Patent No. 8,050,321
JXM-0002	'321 File History
JXM-0003	U.S. Patent No. 9,036,701
JXM-0004	'701 File History
JXM-0005	U.S. Patent No. 10,536,714
JXM-0006	'714 File History
JXM-0007	U.S. Patent No. 11,805,267
JXM-0008	'267 File History
JXM-0009C	Transcript of August 21, 2025 Deposition of J. Lainema
JXM-0010C	Transcript of August 26, 2025 Deposition of A. Hallapuro
JXM-0011C	Transcript of August 29, 2025 Deposition of M. Hannuksela
CXM-0001	Excerpt of Collins Cobuild Advanced Learner's English Dictionary, 4th Edition (2003)
CXM-0002	Excerpt of Merriam-Webster's Collegiate Dictionary, 10th Edition (2001)
CXM-0003	Hannuksela, *Simple Definition of GOP for Random Access*, Joint Collaborative Team (JVT) of ISO/IEC JTC1/SC29/WG11 and ITU-T SG16 Q.6, 2nd Meeting, Geneva, CH, Jan. 29 - Feb. 1, 2022, Document JVT-B041
CXM-0004	Excerpt of Sze, V. et al, *High Efficiency Video Coding (HEVC) Algorithms and Architectures*, Springer International Publishing (2014)
CXM-0005	Misra et al., *Entropy Slices for Parallel Entropy Coding*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 2nd Meeting, Geneva, CH, July 21-28, 2010, Document JCTVC-B111_r1
CXM-0006	Detlev, M. et al, *Novel entropy coding concept*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T

	SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 1st Meeting: Dresden, DE, April 15-23, 2010, Document JCTVC-A032
CXM-0007	Radha, H., *Signal Compression: Entropy Coding* (2008)
CXM-0008	U.S. Patent App. No. 61/555,703
CXM-0009	MPEP § 2111.03(I)
CXM-0010	Bici, O. et al, *Non-CE13: Simplification of merge mode*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 7th Meeting: Geneva, CH, Nov. 21-30, 2011, Document JCTVC-G593
CXM-0011	Bici, O. et al, *CE9: Results of SP experiments on simplification of merge process*, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 8th Meeting: San Jose, CA, USA, Feb. 1-10, 2012, Document JCTVC-H0252
CXM-0012	U.S. Patent App. No. 13/344,893 File History
CXM-0013	Excerpt of IEEE 100, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition (2000)
CXM-0014	Excerpt of Modern Dictionary of Electronics, 7th Edition (1999)
CXM-0015	Valvano, J. and Yerrabali, R., *Embedded Systems – Shape The World* (2020)
CXM-0016	Aamodt, T. and Chow, P., *Compile-Time and Instruction-Set Methods for Improving Floating- to Fixed-Point Conversion Accuracy*, ACM Transactions on Embedded Computing Systems, Vol. 7, No. 3, Article 26 (2008)
CXM-0017	Richardson, I., *Coding Video, A Practical Guide to HEVC and Beyond*, John Wiley & Sons Ltd (2024)

DECLARATIONS

Exhibit No.	**Description**
CXM-0018	Expert Declaration of Dr. Iain Richardson

I. INTRODUCTION

Per Order No. 16 (August 25, 2025), Complainants Nokia Technologies Oy and Nokia Corporation (collectively, "Nokia") provide their Markman Brief regarding the following claim terms: "reset/resetting" and "the identifier value" in U.S. Patent No. 8,050,321 (the "'321 Patent"); "entropy coding/code symbols" in U.S. Patent No. 9,036,701 (the "'701 Patent"); "first spatial motion vector prediction candidate" in U.S. Patent No. 10,536,714 (the "'714 Patent"); and "precision" in U.S. Patent No. 11,805,267 (the "'267 Patent") (collectively, the "Asserted Patents"). Nokia also provides the Expert Declaration of Dr. Iain Richardson (CXM-0018) addressing "entropy coding/code symbols" the '701 Patent and "precision" in the '267 Patent.

Nokia and the Commission Investigative Staff's (the "Staff") proposed constructions are consistent with the plain meanings of the disputed terms and both the intrinsic and extrinsic records. The ALJ should adopt Nokia and the Staff's proposed constructions for several reasons, including the following.

First, Respondents' proposed constructions for the terms "reset/resetting" and "the identifier value" improperly narrow the claims and disregard both the specification and ordinary usage. Respondents' proposed constructions would require a decoder to first decode an incorrect identifier value for the indicated first image frame of an independent sequence and then change that incorrect identifier value to a correct value. Nothing in the intrinsic record suggests a decoder would need to decode incorrect values or supports narrowing the claims in that way. Indeed, Respondents' proposed constructions read out the preferred embodiment of the '321 Patent.

Moreover, to the extent that Respondents raise an argument that "the identifier value for the indicated first image frame" must find antecedent basis in "identifier values for image frames according to a numbering scheme" or else be indefinite. That argument fails because a person of

ordinary skill in the art would not have any confusion about what "the identifier value for the indicated first image frame" refers to. The skilled artisan would appreciate that one property of a video sequence from a decoder's perspective that an identifier value is associated with each picture and that, consistent with the patent's preferred embodiment, to avoid issues with discontinuities in identifier values across frames upon a random-access request, "when activated at a random point, the decoder preferably sets the identifier of the first image frame…at zero," which restarts the numbering scheme. *Id*. at 11:37-40.

Second, Respondents improperly attempt to limit meaning of "entropy coding" to just "entropy encoding." However, like the way in which "video coding" can refer to video decoding and/or encoding as the context requires, "entropy coding" refers to entropy decoding and/or encoding. The use of the term in the '701 Patent's specification and the extrinsic evidence demonstrate the term "entropy coding" is often used to refer to entropy decoding, encoding, or both. Nothing in the '701 Patent specification clears the high bar required for a departure from this plain and ordinary meaning. Respondents' cherry-picked examples of extrinsic evidence using the term "coding" to refer solely to encoding are consistent with this Nokia and the Staff's position that "coding" or "entropy coding" can refer to decoding, encoding, or both. Respondents' examples fail to limit the plain meaning of "coding" or "entropy coding."

Third, Nokia and the Staff's proposed construction for "first spatial motion vector prediction candidate" is consistent with established law and the intrinsic and extrinsic records. Under longstanding claim drafting practice, words such as "first" are used to distinguish members of a set rather than used to show a serial or temporal order of members of a set. *See, e.g.*, CXM-0009 (Manual of Patent Examining Procedure) at § 2111.03(I). By contrast, Respondents' proposed construction, which appears intended to import a temporal order for the selection of the

"first spatial motion vector prediction candidate" into the claims. This attempted narrowing contradicts the intrinsic and extrinsic records, which make clear that "[t]he decisions for the candidates can be taken in any order of A1, B1, B0, A0 and B2 or independently in parallel." JXM-0005 ('714 Patent) at 17:40-41.

Fourth, Nokia's, or alternatively the Staff's, proposed construction for "precision" is consistent with the intrinsic record, the extrinsic evidence, and common sense. The specification, the file history, Dr. Iain Richardson, and the inventors of the '267 Patent all agree: Precision as used in the field of video coding, and in the '267 Patent in particular, is associated with how much information a value represents, not merely how that value is stored. The '267 Patent relates to the precision of predictions, which in turn correlates to smoother video with more accurate brightness and color values in pixels displayed to viewers. The dispute between the parties appears to be whether "precision" of a measurement or prediction can increase based merely on how one represents a that prediction or measurement rather than based on how much information that measure or prediction conveys, which is tied to the number of possible distinct alternatives a value can take. For example, under Respondents' apparent interpretation of their proposed construction, a coin flip represented using three bits (e.g., "000" for heads and "111" for tails) would have a higher precision than the same coin flip represented more efficiently using a single bit (e.g., "0" for heads and "1" for tails). But this is nonsensical: A coin flip has only two possible outcomes, so it is not possible to represent the result of a coin flip any more precisely by merely adding bits.

Accordingly, for the reasons described here, Nokia respectfully requests that the ALJ adopt Nokia's and the Staff's proposed constructions.

II. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art ("POSITA") for the '321,'701, '714, and '267 Patents, would have at least a bachelor's degree in electrical engineering, computer engineering, or a related field, with about two years of experience in video decoding or encoding technologies. More work or practical experience may qualify one not having the requisite education as a person with ordinary skill in the art while a higher level of education could offset less experience.

III. LEGAL STANDARDS

Claim construction is a matter of law. *Markman v. Westview Instruments, Inc.*, 52 F.3d 967, 970-71 (Fed. Cir. 1995) (*en banc*), *aff'd*, 517 U.S. 370 (1996). Claim terms are afforded their ordinary and customary meaning within the context of the entire patent in which the terms are used, i.e., the meaning that the term would have to a person of skill in the art at the time of the invention. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (*en banc*) (internal citation omitted). There are two exceptions to this general rule. First, "when a patentee sets out a definition and acts as his own lexicographer," and second, "when the patentee disavows the full scope of a claim term either in the specification or during prosecution." *Thorner v. Sony Comp. Entm't Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) (citing *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1580 (Fed. Cir. 1996)). The best evidence for construing claim terms is in the intrinsic record: the patent's claims, specification, and prosecution history. *Phillips*, 415 F.3d at 1314-18. However, extrinsic evidence, including expert testimony, dictionaries, and treatises, for example, may also inform claim construction. *Id*. at 1318.

A. Lexicography

Lexicography is where "a special definition [is] given to a claim term by the patentee that differs from the meaning it would otherwise possess." *Id.* at 1316 (citations omitted). The patent

specification "may act as a sort of dictionary, which explains the invention and may define terms used in the claims." *Markman*, 52 F.3d at 979. An inventor, through the specification of the patent, may act as its own lexicographer. *Schoenhaus v. Genesco, Inc.*, 440 F.3d 1354, 1358 (Fed. Cir. 2006) (citations omitted). However, the bar to depart from the customary and ordinary meaning of a claim term is high. *See Apple, Inc. v. Wi-LAN Inc.*, 25 F.4th 960, 967 (Fed. Cir. 2022). "To act as its own lexicographer, a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning and must clearly express an intent to redefine the term." *Id*. (quoting *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1371 (Fed. Cir. 2014)) (cleaned up).

B. Claim Differentiation

The doctrine of claim differentiation creates a presumption that each claim has a different scope. *Bradford Co. v. Conteyor NA, Inc.*, 603 F.3d 1262, 1271 (Fed. Cir. 2010) (citing *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1186 (Fed. Cir. 1998)) (internal quotations omitted). However, "[c]laim differentiation is a guide, not a rigid rule." *Laitram Corp. v. Rexnord, Inc.*, 939 F.2d 1533, 1538 (Fed. Cir. 1991) (citations omitted). The doctrine of claim differentiation "is not a rigid rule but rather is one of several claim construction tools." *ICU Medical, Inc. v. Alaris Medical Sys., Inc.*, 558 F.3d 1368, 1376 (Fed. Cir. 2009) (citations omitted).

IV. DISPUTED CLAIM TERMS

The parties dispute the constructions of the following claim terms from the Asserted Patents.

Claim Term	Nokia's Proposed Construction	Respondents' Proposed Construction	Staff's Proposed Construction
321: "reset/resetting"	Plain and ordinary meaning, which means	chang[e/ing] to a different value	Plain and ordinary meaning, which

Claims: 8, 10	set[ting] the identifier value for the first time or set[ting] the identifier value again to restart the numbering scheme.		means set[ting] the identifier value for the first time or set[ting] the identifier value again to restart the numbering scheme.
321: "the identifier value" Claims: 8, 10	Plain and ordinary meaning, which means an identifier value associated with the indicated first image frame of the independent sequence.	one of the decoded identifier values	An identifier value associated with the indicated first image frame of the independent sequence
701: "entropy coding/code symbols Claims: 1, 8	Plain and ordinary meaning, which means entropy encod[ing/e] or decod[ing/e] symbols.	entropy encod[ing/e] symbols	Entropy encod[ing/e] or decod[ing/e] symbols
714: "first spatial motion vector prediction candidate" Claims: 1, 9, 15, 23	Plain and ordinary meaning, which means one of the spatial motion vector prediction candidates selected for potential inclusion in the motion vector prediction list.	the spatial motion vector prediction candidate that is first for processing	One of the spatial motion vector prediction candidates selected for positional inclusion in the motion vector prediction list.
267: "precision" Claims: 1, 7, 19, 25	Plain and ordinary meaning, which means a measure of the number of distinct alternatives from which a value can be determined: for example, in binary representation, a number of bits required to represent each possible distinct alternative.	Plain and ordinary meaning, which is a number of bits needed to represent possible values	The number of bits (in binary representation) required to represent each possible distinct alternative.

V. ARGUMENT

A. '321 Patent

1. Technical Background to the '321 Patent

a. Frame Types, Frame Order, and Motion Compensated Predictions

The '321 Patent relates to encoding and decoding independent sequences of video frames. JXM-0001 ('321 Patent) at Abstract. Video files are made up of a series of video frames which are displayed rapidly in succession to create an impression of a moving image. *Id.* 1:55-58. The information included in consecutively displayed image frames typically includes a considerable amount of redundancy. *Id.* at 1:62-65. Video compression takes advantage of this redundancy to reduce the amount of data that needs to be stored in video files while maintaining video quality. *Id.* at 2:5-10. One of the ways that video compression takes advantage of redundancy is through motion-compensated temporal predication, where the contents of image frames in a video sequence are predicted from previously decoded image frames within the same video sequence. *Id.* at 2:16-23.

Frames are labeled differently based on whether they use motion compensated temporal prediction. Frames that do not use motion compensated temporal prediction and therefore do not refer to previously decoded frames with the video sequence to determine image information are called INTRA-frames or I-frames. *Id.* at 2:23-26. Conversely, "motion-compensated video sequence image frames that are predicted from previous image frames (known as reference frames) are called INTER-frames, or P-frames (Predicted)." *Id.* at 2:27-29. An independent video sequence can take the form of a group of pictures (GOP) made up of an I-frame and the P-frames which can only be determined based on the I-frame and the previously decoded P-frames of the GOP in question. *Id.* at 2:34-42. The '321 Patent's Figure 3a shows an I-frame followed by successive P-

frames. For example, the second frame of the sequence (P.0.1) is "used for predicting a third image frame 304 of the sub-sequence, i.e. a P-frame (P.0.2)." *Id*. at 12:22-24.

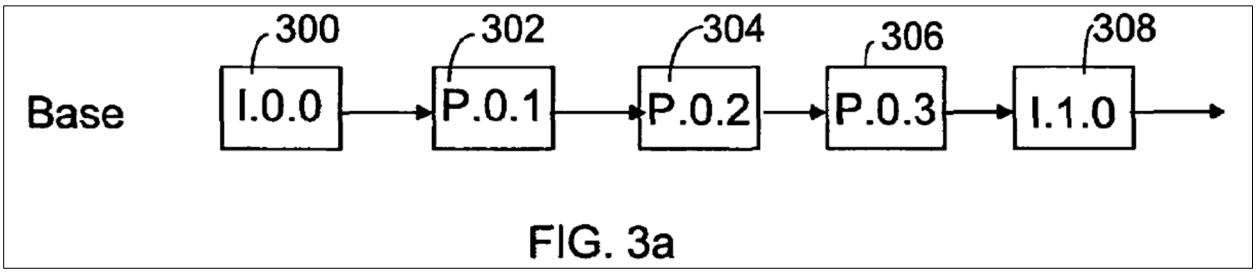


FIG. 3a

Figure 2 illustrates a scalable coding hierarchy with INTRA, base, and enhancement layers. The patent describes that, "[s]calability is typically implemented by grouping the image frames into a number of hierarchical layers" that allow "some elements or element groups of a video sequence [to] be removed without affecting the reconstruction of other parts of the video sequence." *Id.* at 3:4-8. When users stream video, "the streaming server may determine the number of scalability layers to be transmitted in a video stream, and thus the number of the scalability layers can be changed always when a new group of pictures GOP begins." *Id*. at 3:29-33.

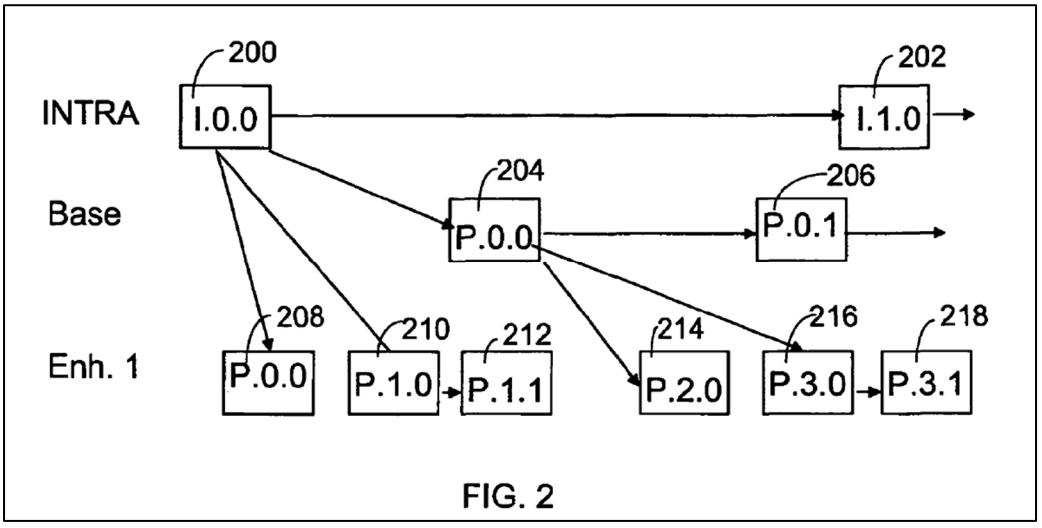


FIG. 2

In addition, bi-directionally predicted frames, or "B-frames" can be employed, which are predicted from two reference frames. *Id.* at 2:42-48. To further complicate matters, some video

coding systems permit the prediction of image frames from "temporally succeeding image frames." *Id*. at 15:10-15. In other words, a current image frame can be predicted from image frames that will be displayed by a decoder after the current image frame. This difference between decoding order and display order requires "that uncoded image frames be buffered for a sufficiently long period of time so that all image frames that are to be displayed can be coded and arranged into their order of presentation." *Id*. at 15:26-29.

To manage this complexity, identifier values are assigned to image frames through specific numbering schemes, where "within each sub-sequence, the video frames of the sub-sequence are given image numbers, using for example consecutive numbering that starts with the number 0 given the first video frame of the sub-sequence." *Id.* at 8:19-22. The numbering schemes enable a decoder to uniquely identify image frames. *See id*. at 10:54-66. If a frame within the independent sequence that is used in the motion-compensated prediction of another frame is lost or corrupted, the frames dependent on it can no longer be correctly decoded. *Id.* at 2:32-33.

b. Problems in the Art Prior to the '321 Patent

One of the problems discussed in the '321 Patent relates to determining appropriate access points for starting the decoding process. JXM-0001 ('321 Patent) at 3:62-63. For instance, this problem can arise when a user attempts to start browsing a video file from the middle, or at a particular point, of a video sequence. *Id.* at 3:63-66, 11:11-25. For example, a user may wish to skip a scene in a video. This situation could also arise when a video file contains errors that interrupt the playback or require the playback to be resumed from a point following the error. *Id.* at 11:13-20. If the decoder attempts to start the decoding process from a random point, then there is a chance that the decoder will attempt to decode an image frame without having previously decoded the earlier reference frames required to properly decode that image frame. There also may

be problems with the numbering of the image frames which causes the decoder to misinterpret skipped pictures as lost. *Id.* at 11:11-25. This can lead to undesirable delay or other performance degradations.

Another of the problems discussed in the '321 Patent relates to "reference picture selection," which in some video coding systems involving signaling a "selected reference image" in a bitstream to inform a decoder which reference picture should be used to predict "at least a part of a P-image." *Id*. at 3:42-52. With this scheme, it is possible to "select at least one image preceding an I-image that begins a group of pictures GOP as the reference image" such that "a group of pictures employing reference picture selection cannot necessarily be decoded independently." *Id*. at 3:52-56. Reference picture selection could lead to streaming difficulties because "the video sequence must be decoded, parsed and buffered for a long period of time to allow any dependencies between different image groups to be detected." *Id*. at 3:56-61.

c. The '321 Patent Solved Problems in the Art by Facilitating Random Access

The inventor of the '321 Patent addressed these problems by inventing a decoding technique in which a decoder receives an indication of a first image frame (in decoding order) of an independent sequence. This indication initiates a "reset" operation. All motion-compensated temporal prediction references in the independent sequence refer only to image frames within said independent sequence. The decoder resets the identifier value of the indicated first image frame with respect to the numbering scheme in use for the identifier values of decoded image frames. That is, the '321 Patent teaches that identifier values for pictures are decoded according to a numbering scheme, and "when activated at a random point, the decoder preferably sets the

identifier of the first image frame, preferably an I-frame, of the independently decodable sub-sequence at zero." JXM-0001 ('321 Patent) at 11:37-40.

Claim 10 is illustrative:

> 10. A video decoder comprising at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the at least one processor, cause the video decoder to decode a compressed video sequence, by causing the video decoder to at least:
>
> > decode from the video sequence an indication of at least one image frame, which is the first image frame, in decoding order, of an independent sequence, wherein all motion-compensated temporal prediction references of the independent sequence refer only to image frames within said independent sequence;
> >
> > start the decoding of the video sequence from said first image frame of the independent sequence, whereby the video sequence is decoded without prediction from any image frame decoded prior to said first image frame; and
> >
> > decode identifier values for image frames according to a numbering scheme; and
> >
> > reset the identifier value for the indicated first image frame of the independent sequence.

Id. at 24:13-32.

For example, a user may be playing a video—for example, with a television. The television decodes pictures in coding order, including decoding of the identifier values for image frames according to a numbering scheme. "According to a preferred embodiment of the invention, the image frames can be independently numbered using consecutive numbering in which successive reference image frames in the coding order are indicated with numbers incremented by one." *Id.* at 13:25-29. The user may then wish to skip a scene in the video. To do this, the user may attempt a "random-access" operation by selecting a playback position further along in the video. With the '321 Patent's invention, the user's television can receive an indication of a first image frame of an

independent sequence, corresponding to the next closest possible location to that requested, and reset the identifier value for the indicated first image frame of the independent sequence.

The '321 Patent describes several advantages of this approach. First, one "advantage of the procedure of the invention is that it enables [a decoder] to start browsing a video sequence from a random point, i.e. it provides the decoder with the information about the first picture of an independently decodable sequence. Thus, the decoder knows that by decoding this first picture, it is possible to continue the decoding process without any prediction from any prior picture." *Id*. at 4:48-54. Second, "a further advantage is that the decoder may discard any picture decoded prior to said initiation picture from its buffer memory since the prior pictures are no longer needed in the decoding process." *Id*. at 4:54-58. Third, another advantage is that the invention "allows a separate video sequence to [be] easily inserted into another video sequence." *Id*. at 4:58-60. Fourth, the invention also provides increased error resiliency capability: "A yet further advantage relates to detection of losses of image frames that start an independently decodable sub-sequence." *Id*. at 4:64-66. If the first image frame of an independent sequence is lost (for example, during transmission), it is unlikely that any error concealment method would result into a subjectively satisfactory image quality." *Id*. at 4:64-5:1. However, the invention provides "decoders [with] means to detect losses of image frames that start an independently decodable sub-sequence. Decoders may react to such a loss by requesting a retransmission or picture refresh." *Id*. at 5:1-6.

2. The ALJ Should Adopt Nokia and the Staff's Proposed Construction of "Reset/Resetting"

The claim limitation at issue is "reset[ting] the identifier value for the indicated first image frame of the independent sequence." JXM-0001 ('321 Patent) at cls. 8, 10. The "indicated first image frame" refers to a frame that can be, for example, a random-access point during video

playback. *See, e.g.*, *id*. at 11:26-40. Nokia and the Staff's proposed construction for "reset" and "resetting" as "set[ting] the identifier value for the first time or set[ting] the identifier value again to restart the numbering scheme" is consistent with the plain meaning of these terms and the intrinsic record.

The specification supports this construction by describing how "within each sub-sequence, the video frames of the sub-sequence are given image numbers, using for example consecutive numbering that starts with the number 0 given to the first video frame of the sub-sequence." 8:19-22. The '321 Patent further explains that when beginning decoding from a random access point, "the decoder preferably sets the identifier of the first image frame, preferably an I-frame, of the independently decodable sub-sequence at zero[,]" demonstrating that "resetting" may involve—consistent with the plain meaning of the term—setting the identifier value for the first time or again to restarting the number scheme as captured by Nokia and the Staff's proposed construction. *Id.* at 11:37-40.

By contrast, Respondents' proposed construction, "chang[e/ing] to a different value," improperly attempts to narrow the scope of "reset" and "resetting" to create an artificial requirement that the encoder first encode an identifier value for the first frame of an independent sequence (an incorrect one), which the decoder must then change to a different value (a correct one). This construction finds no support in the specification and contradicts both the intrinsic record and the plain meaning of "reset." Rather, the specification describes a process where "when activated at a random point, the decoder preferably sets the identifier of the first image frame, preferably an I-frame, of the independently decodable sub-sequence at zero[,]" without any suggestion that an incorrect value must first be decoded and then changed. *Id.* at 11:37-40. Moreover, this narrow construction effectively reads out the specification's only decoder

embodiment, which explains that the reset function allows proper numbering when "consecutive numbering that starts with the number 0 given to the first video frame of the sub-sequence" is implemented. *Id.* at 8:21-22. In plain English, "reset" encompasses both initial setting and re-setting operations, not merely changing from one predetermined value to another, making the "chang[e/ing] to a different value" construction both linguistically incomplete and technically unsupported by the '321 Patent's disclosure.

a. The Intrinsic Evidence Supports Nokia's and Staff's Proposed Construction

The intrinsic record, including the specification, claims, prosecution history, and any disclaimer made during prosecution, is the primary source for determining the meaning of claim terms. *See generally Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Courts must look first to the intrinsic evidence when construing claim terms, as "the specification is the single best guide to the meaning of a disputed term[.]" *Id.* at 1321 (internal citations omitted). Here, the specification's detailed disclosure of the reset operation, supported by specific embodiments, provides the authoritative guidance for interpreting "reset" and "resetting" in the context of the '321 Patent.

The specification explains that "within each sub-sequence, the video frames of the sub-sequence are given image numbers, using for example consecutive numbering that starts with the number 0 given to the first video frame of the sub-sequence." JXM-0001 ('321 Patent) at 8:19-22. The embodiments disclosed in the specification consistently describe that "when activated at a random point, the decoder preferably sets the identifier of the first image frame…at zero." *Id*. at 11:37-40. This language demonstrates that the specification describes the resetting of the identifier value for the first image frame as setting this identifier value (for example to zero) rather than

describing the resetting as "changing" the identifier value from one value to another. This supports the interpretation that "reset" encompasses restarting of the numbering scheme, as the specification describes that the decoder sets the identifier value at zero, which restarts the numbering scheme. As the specification describes, this may occur when, for example, a user wishes to access a video sequence at a random-access point. *Id*. at 11:37-40.

This interpretation makes technical sense in the context of the random-access embodiment. *See id*. at 11:26-40. As the patent describes, a problem may arise "when the user wishes to start browsing a video file in the middle of a video sequence." *Id*. at 11:11-13. Specifically, "[w]hen the browsing of a video file is resumed from a random point after previous browsing, discontinuity typically occurs in the image numbering. The decoder typically interprets this as unintentional loss of image frames and unnecessarily tries to reconstruct the image frames suspected as lost." *Id*. at 11:20-25.

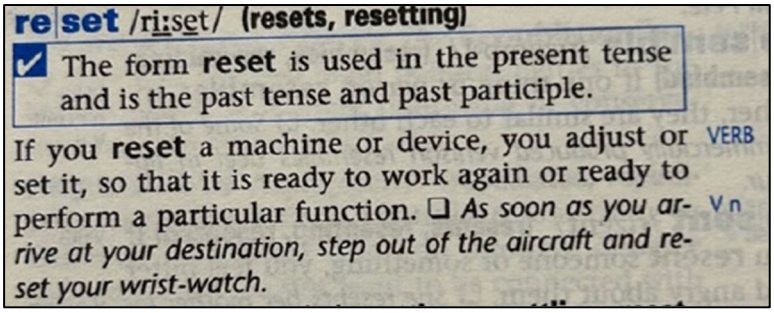
The invention avoids this problem. The patent's preferred embodiment explains that "an initiation image in an independently decodable Group of Pictures" is "activated at the random point of the video file." *Id*. at 11:26-30. Once a decoder receives an indication of this first image frame of an independent sequence, the specification's teaching demonstrates that the reset operation serves to establish proper numbering within independent sequences and avoids a decoder incorrectly interpreting a discontinuity of identifier values as an unintentional loss of frames. Nokia and the Staff's proposed construction is consistent with these teachings. That is, the setting of the identifier to *restart* the numbering scheme (e.g., by the decoder setting "the identifier of the first image frame…at zero" for the first time, *see id.* at 11:37-40) provides one benefit described in the patent—namely, that the decoder will not thereafter incorrectly interpret a discontinuity in image numbering caused by the random-access viewing as a loss of frames. *Id*. at 11:20-25.

By contrast, the specification does not suggest that an incorrect identifier value for the first image frame ("initiation image," see *id*. at 11:30-37) must first be decoded and then changed to a correct value. Indeed, the "discontinuity [that] typically occurs in the image numbering" is not a result of the decoder decoding an *incorrect* identifier value for an initiation, rather discontinuity results because "the browsing of a video file is resumed from a random point after previous browsing," which entails that (correct) identifier values will have discontinuities. The patent's invention avoids this concern with an indicated initiation image, for which the decoder can "reset" the associated identifier value as a matter of course without needing to decode its identifier value. Thus, the decoder need not consider any potential discontinuities with prior identifier values because the decoder knows this is a first image in decoding order of an independent sequence. *See id*. at 11:26-40

b. The Extrinsic Evidence Supports Nokia's and Staff's Proposed Construction

The extrinsic evidence further supports Nokia's and Staff's proposed construction of "reset[ting]" as "set[ting] the identifier value for the first time or set[ting] the identifier value again to restart the numbering scheme." Nokia and the Staff's proposed construction is consistent with the dictionary definition of "reset."

The Collins COBUILD dictionary defines "reset" as when "you adjust or set it, so that it is ready to work again or ready to perform a particular function." CXM-0001 (Excerpt of Collins COBUILD Advanced Learner's English Dictionary, 4th Edition (2003)).


re|set /ri:set/ (resets, resetting)

✔ The form **reset** is used in the present tense and is the past tense and past participle.

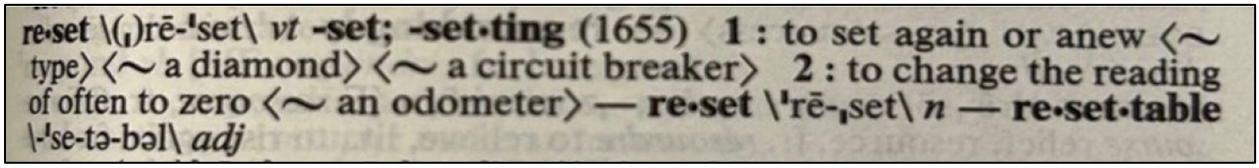
If you **reset** a machine or device, you adjust or set it, so that it is ready to work again or ready to perform a particular function. ❑ *As soon as you arrive at your destination, step out of the aircraft and reset your wrist-watch.*

VERB

V n

This definition encompasses both initial setting and subsequent adjustment or re-setting, which supports Nokia and the Staff's proposed construction that covers both setting the identifier value for the first time and setting it again. The dictionary's emphasis on making something "ready to work again" or "ready to perform a particular function" aligns with the concept of restarting a numbering scheme, where the identifier value is set (whether for the first time by a decoder or subsequently) to enable the proper functioning of the frame identification scheme without discontinuity issues caused by random-access.

The Merriam-Webster dictionary provides two definitions: "1: to set again or anew" and "2: to change the reading of often to zero." CXM-0002 (Excerpt of Merriam-Webster's Collegiate Dictionary, 10th Edition (2001)).


re•set \(ˌ)rē-ˈset\ *vt* **-set; -set•ting** (1655) **1 :** to set again or anew ⟨~ type⟩ ⟨~ a diamond⟩ ⟨~ a circuit breaker⟩ **2 :** to change the reading of often to zero ⟨~ an odometer⟩ — **re•set** \ˈrē-ˌset\ *n* — **re•set•table** \-ˈse-tə-bəl\ *adj*

The first definition covers the "setting again" aspect of the proposed construction, while the second definition supports the concept of restarting the numbering scheme by referencing changing readings "often to zero." This dual definition structure mirrors the proposed construction's coverage of both initial setting and subsequent setting to restart the numbering scheme. The reference to changing readings "to zero" is particularly relevant to the '321 Patent

context, where the preferred embodiment discusses that a decoder resets the identifier value for the indicated first image frame to zero to restart the numbering scheme for a given independent sequence. *See* JXM-0001 ('321 Patent) at 8:19-22, 11:37-40.

Additionally, the related JVT standard contributions submitted by inventor Miska Hannuksela reinforce that the decoder identifier resetting functionality includes random-access purposes. JVT-B041, titled "Simple Definition of GOP for Random Access," addresses the technical challenges of enabling "random access positions" in video streams. *See* CXM-0003 (JVT-B041).

Joint Video Team (JVT) of ISO/IEC MPEG & ITU-T VCEG (ISO/IEC JTC1/SC29/WG11 and ITU-T SG16 Q.6)
2nd Meeting: Geneva, CH, Jan. 29 - Feb. 1, 2002

Document: JVT-B041
Filename: JVT-B041.doc
Generated: 2002-01-23

Title: **Simple Definition of GOP for Random Access**

Status: Input Document to JVT

Purpose: Proposal

Author: Miska M. Hannuksela
Nokia Mobile Phones
P.O. Box 68
33721 Tampere
Finland

Tel: +358 40 5212845
Email: miska.hannuksela@nokia.com

Source: Nokia Corporation

2. NEEDS FOR RANDOM ACCESS

Random access property is needed at least in the following situations:

- A user seeks, winds, or rewinds a locally stored file.
- A streaming player requests a streaming server to play a file from an arbitrary position or to seek, wind, or rewind a file.
- A streaming player receives a packet or bit stream from an arbitrary position. Such a situation may result from tuning to a broadcast, for example. The player has to detect a stream position that provides a correctly reconstructed picture.
- A loss or corruption has been detected, and the displayed image is frozen, until a perfect recovery from the error is possible.

The former two situations are related to accessing a file from an arbitrary position, while the latter two situations require detecting of a random access position from a received bit-stream.

JVT-B041 clarifies that the purpose of the decoder's reset operation is to minimize the risk of an incorrect inference of a loss of pictures or corruption of data. *Id*. at 3 ("If the difference of the picture numbers of two consecutively received and stored pictures is not 1, the decoder should infer a loss of pictures or corruption of data."). JVT-B041 describes, consistent with the '321 Patent's specification that, "[B]ecause of file editing or when accessing a file or a bit-stream randomly, a discontinuity in picture numbers may occur naturally. Thus, we propose that the picture number *shall be reset to zero* in the first picture of an independently decodable GOP." *Id*. at 3 (emphasis added). The identifier resetting mechanism described in the '321 Patent serves this random-access objective by providing decoders with a clear signal that they can safely begin decoding from a particular point without concern for missing preceding frames. In other words, the reset mechanism serves as a preventive measure to avoid decoder confusion about missing or corrupted frames when beginning decoding from a random-access point. This extrinsic evidence of how the concept of "reset[ting]" was described by the inventor near in time to the invention further supports Nokia and the Staff's proposed construction.

By contrast, Respondents' construction of "reset" and "resetting" as "chang[e/ing] to a different value" only makes logical sense if one assumes the decoder receives and decodes an incorrect identifier value for the indicated first image frame but then chooses to change that identifier value to something else—a scenario that contradicts the purpose of the reset functionality as described in both the '321 Patent and the underlying JVT contributions. The reset functionality is not a protection against incorrect signaling of identifier values. That interpretation finds no support in the intrinsic record. Rather, the reset functionality addresses the issue that "when accessing a file or a bit-stream randomly, a discontinuity in picture numbers may occur naturally." CXM-0003 (JVT-B041) at 3; *see also* JXM-0001 ('321 Patent) at 11:20-25 ("When the browsing of a video file is resumed from a random point after previous browsing, discontinuity typically occurs in the image numbering. The decoder typically interprets this as unintentional loss of image frames and unnecessarily tries to reconstruct the image frames suspected as lost.").

c. Respondents' Proposed Construction is Inconsistent with the Intrinsic Evidence

Respondents' proposed construction is an attempt to import a narrowing limitation into the '321 Patent that a decoder must decode an incorrect identifier value for an indicated first image frame and then change that value to a new, different value. The intrinsic record provides no basis to import such a limitation into the claims. Respondents' construction is inconsistent with both the claim language itself and the specification.

"A construction which reads the preferred embodiment out of the scope of the claims would generally seem at odds with the intention of the patentee as expressed in the specification." *PPC Broadband, Inc. v. Corning Optical Communs. RF, LLC*, 815 F.3d 747, 755 (Fed. Cir. 2016); *see also Funai Elec. Co. v. Daewoo Elecs. Corp.*, 616 F.3d 1357, 1371 (Fed. Cir. 2010) (refusing to

read out preferred embodiment when patent-at-issue included only two embodiments). Here, the specification provides only one embodiment, the preferred embodiment, of decoder identifier resetting, and this embodiment is tied to random-access functionality. The specification explains that decoder identifier resetting occurs when "a problem in the numbering of image frames arises when the user wishes to start browsing a video file in the middle of a video sequence." JXM-0001 ('321 Patent) at 11:11-13. This problem manifests in specific random-access scenarios:

> [W]hen the user wishes to browse a locally stored video file backward or forward or to browse a streaming file at a particular point; when the user initiates the playback of a streaming file from a random point; or when a video file that is to be reproduced is detected to contain an error that interrupts the playback or requires the playback to be resumed from a point following the error.

Id. at 11:13-20.

The '321 Patent's solution addresses the discontinuity that typically occurs in the image numbering when "the browsing of a video file is resumed from a random point after previous browsing." *Id.* at 11:20-22. The specification states that "when activated at a random point, the decoder preferably sets the identifier of the first image frame, preferably an I-frame, of the independently decodable sub-sequence at zero." *Id.* at 11:37-40.

Considering this intrinsic record, Respondents' proposed construction fails for several reasons. First, the '321 Patent explicitly teaches that "when activated at a random point, the decoder preferably sets the identifier of the first image frame, preferably an I-frame, of the independently decodable sub-sequence at zero." *Id.* at 11:37-40. This language demonstrates that the decoder performs the resetting operation upon activation at the random point—not after first decoding some (incorrect) identifier value, as Respondents appear to contend. Moreover, the specification's description of discontinuity problems makes clear that the reset mechanism is designed to prevent the decoder from interpreting discontinuity in identifier values caused by

random-access "as unintentional loss of image frames and unnecessarily tr[ying] to reconstruct the image frames suspected as lost." *Id.* at 11:23-25. Respondents' proposed construction would improperly narrow the claims to a scenario where some intentional discontinuity occurs as a result of incorrect signaling and decoding of identifier values in a bitstream—a scenario never described in the patent.

d. Respondents' Proposed Construction is Inconsistent with the Extrinsic Evidence and Only Captures a Narrow Aspect of the Plain Meaning of "Reset"

Respondents' proposed construction of "reset[ting]" as "chang[e/ing] to a different value" only captures a limited scenario within the plain and ordinary meaning of "reset" where a decoder has an incorrect value and fixes that value. Respondents' proposed construction is inconsistent with the dictionary definitions of that term and the inventor's description of what "reset[ting]" entails around the time of the invention. For example, the Merriam-Webster dictionary defines "reset" as follows: "1: to set again or anew" and "2: to change the reading of often to zero." CXM-0002 (Excerpt of Merriam-Webster's Collegiate Dictionary, 10th Edition (2001)). The definition encompasses both scenarios where a value is being set for the first time with respect to a numbering scheme and where it is being re-established. Neither scenario requires that a reset value be different from a preceding value, if any. The second aspect of the definition's reference to changing readings "often to zero" is particularly relevant because it acknowledges that resetting frequently involves setting to a standard baseline value (zero), such as a decoder might do to restart a numbering scheme.

Consider the following hypothetical scenario. A group of people are in a circle formation doing push-ups together. The group decides to use a numbering scheme for their push-ups that increments by one with each successive push-up: 1, 2, 3, 4, and so on. The group's goal is to reach

10 push-ups together. However, to make the exercise session more unpleasant, the group decides that if any participant's knees hit the ground during the push-ups, the push-up count will reset to zero. The group proceeds with push-up and counts, "one, two, three…" and then one member of the group's knees hit the ground. As agreed, the group resets the count to zero. In this hypothetical, the count proceeds as 1, 2, 3 and then resets to 0. No value for a completed push-up was changed to zero from some other value. Rather, the count to apply to the next push-up (akin to the indicated first image frame) was reset.

Imagine now that the group successfully completes 10 repetitions, has a short break, and then decides to start a new set under the same conditions. In this case, the group's initial count will again be zero.

Reasonable observers will remark that the exercise group in fact "resets" the count with respect to their numbering scheme in both examples. This conclusion is consistent with the dictionary definitions of "reset." CXM-0002 (Excerpt of Merriam-Webster's Collegiate Dictionary, 10th Edition (2001)); CXM-0001 (Excerpt of Collins COBUILD Advanced Learner's English Dictionary, 4th Edition (2003)). However, Respondents' proposed construction would entail that what occurred is not a "reset" because there was no "chang[e/ing] to a different value" of the count of any particular completed push-up. Rather, in the scenario where the group reaches three push-ups but must reset, the value for the next push-up in line (akin to the indicated first image frame) is reset by the group with respect to the numbering scheme. The count for the next push-up would have been 4 according to the numbering scheme, but the count gets reset to 0, which starts the sequence of repetitions anew. Of course, the value of 4 is never reached (and subsequently changed to zero) as it must be under Respondents' construction. Because

Respondents' proposed construction excludes this plain meaning understanding of "reset," it is inconsistent with the extrinsic evidence (in addition to the intrinsic record).

3. The ALJ Should Adopt Nokia and the Staff's Construction of "The Identifier Value"

Nokia and the Staff's proposed construction is consistent with both the intrinsic record and the plain meaning of "the identifier value," which is "an identifier value associated with the indicated first image frame of the independent sequence."

The dispute between the parties appears to be whether the Asserted Claims of the '321 Patent are limited to a scenario where the identifier value for the indicated first image frame is decoded by a decoder and then reset by the decoder to a different value (per Respondents' proposed construction of "reset"). The narrow reading of the claims is inconsistent with the intrinsic record and the law on antecedent basis. Instead, the Asserted Claims cover scenarios in which a decoder decodes identifier values for some frames (e.g., non-initiation frames decoded during video playback prior to a random-access request) but later encounters an indicated first image frame for an independent sequence that resets the decoding process, including the identifier value numbering scheme (e.g., when a user requests a random-access point during video playback). Nokia and the Staff's proposed construction is consistent with this scenario, which matches the sole and preferred embodiment. Respondents' proposed construction would exclude this preferred embodiment.

The claims recite "decoding identifier values for image frames according to a numbering scheme," which by its plain language does not require that identifier values be decoded for all image frames. Rather, this phrasing naturally allows for decoding identifier values for any appropriate subset of image frames within the numbering scheme. JXM-0001 ('321 Patent) at 24:7-8. This is consistent with the concept of random-access described in the intrinsic record

whereby some image frames may be decoded prior to a user requesting a random-access position. *See id*. at 11:20-22 ("When the browsing of a video file is resumed from a random point after previous browsing, discontinuity typically occurs in the image numbering.").

a. The Law Supports Nokia's and Staff's Proposed Construction

Two claim limitations are relevant to this dispute. These limitations are provided from claim 10, below, as exemplary of the dispute:

> decode identifier values for image frames according to a numbering scheme; and
>
> reset the identifier value for the indicated first image frame of the independent sequence.

Respondents' apparent argument is that "the identifier value for the indicated first image frame" must be one of the "decoded identifier values for image frames" for the former to have proper antecedent basis. This argument fails. As a threshold matter, the plain language of the claims makes clear that "identifier values for image frames according to a numbering scheme" is not referring to the same thing as "the identifier value for the indicated first image frame of the independent sequence." That said, "inherent components of elements recited have antecedent basis in the recitation of the components themselves." *Bose Corp. v. JBL, Inc.*, 274 F.3d 1354, 1359 (Fed. Cir. 2001) (citing MPEP § 2173.05(e)).

There should be no dispute to a person of skill in the art of video coding that a decoder associates an identifier value with the indicated first image from of the independent sequence. In other words, it is an inherent component of the indicated first image frame that the decoder associates an identifier value with it in the context of the '321 Patent's invention. The Manual of Patent Examining Procedure provides the example that "the limitation 'the outer surface of said

sphere' would not require an antecedent recitation that the sphere has an outer surface" because having an outer surface is part of what makes a sphere a sphere. MPEP § 2173.05(e).

The '321 Patent describes "within each sub-sequence, the video frames of the sub-sequence are given image numbers, using for example consecutive numbering that starts with the number 0 given to the first video frame of the sub-sequence." JXM-0001 ('321 Patent) at 8:19-22. The patent further describes that a user may wish to resume "browsing of a video file … from a random point after previous browsing." *Id*. at 11:20-25. The skilled artisan who reads the claims in the context of the specification would understand that "decod[ing] identifier values for image frames" refers to a process of decoding identifier values for some image frames—for example, those image frames that were decoded by a user's device prior to a request to browse "at a random point." In the context of the '321 Patent, the skilled artisan would appreciate that one property of a video sequence from a decoder's perspective is that identifier values are associated with each picture.

The claims also require "reset[ting] the identifier value for the indicated first image frame of the independent sequence." The skilled artisan would appreciate that, to avoid issues with discontinuities in identifier values across frames upon a random-access request, "when activated at a random point, the decoder preferably sets the identifier of the first image frame…at zero[,]" which restarts the numbering scheme. *Id*. at 11:37-40. The skilled artisan would not have any confusion as to what "the identifier value for the indicated first image frame" refers to. Here, the phrase refers to an identifier value associated with the indicated first image frame of the independent sequence, which the specification explains may be a random-access point that resets the decoding process.

Thus, antecedent basis is not a problem for the '321 Patent. However, to the extent Respondents allege that under Nokia and the Staff's proposed construction "the identifier value

for the indicated first image frame of the independent sequence" lacks antecedent basis, explicit antecedent basis is not required. As "the *Manual of Patent Examining Procedure* states that "[o]bviously, however, the failure to provide explicit antecedent basis for terms does not always render a claim indefinite." *Energizer Holdings, Inc. v. Int'l Trade Comm'n*, 435 F.3d 1366, 1370 (Fed. Cir. 2006) (citing MPEP § 2173.05(e)). A claim is not indefinite for lack of antecedent basis if "the scope of a claim would be reasonably ascertainable by those skilled in the art." *Id*. at 1370-71 (quoting *Bose Corp. v. JBL, Inc.*, 274 F.3d 1354, 1359 (Fed. Cir. 2001)); see also *In re Moore*, 439 F.2d 1232, 1235 (CCPA 1971) ("[T]he definiteness of the language employed must be analyzed—not in a vacuum, but always in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art."); *Grace Instrument Indus., LLC v. Chandler Instruments Co., LLC*, 57 F.4th 1001, 1008 (Fed. Cir. 2023) ("[A]ny fact critical to a holding on indefiniteness … must be proven by the challenger by clear and convincing evidence.") (citation and internal quotation marks omitted). As explained, a skilled artisan would readily appreciate what "the identifier value for the indicated first image frame" refers to.

b. The Intrinsic Evidence Supports Nokia's and Staff's Proposed Construction

The intrinsic evidence supports construing "the identifier value" as having its plain and ordinary meaning of "an identifier value associated with the indicated first image frame of the independent sequence." The specification consistently describes the identifier being set to restart the numbering scheme, explaining that "when activated at a random point, the decoder preferably sets the identifier of the first image frame, preferably an I-frame, of the independently decodable sub-sequence at zero." JXM-0001 ('321 Patent) at 11:37-40. This language demonstrates that the

resetting operation targets a specific identifier value—namely, the one associated with the indicated first image frame—for the purpose of restarting the overall numbering scheme. This teaching also shows that the identifier value being reset is linked to the first image frame itself, not to some previously decoded value that must be modified.

This interpretation makes technical sense in the context of the random-access embodiment. *See id*. at 11:26-40. The random-access embodiment addresses a problem "when the user wishes to start browsing a video file in the middle of a video sequence." *Id*. at 11:11-13. Specifically, "[w]hen the browsing of a video file is resumed from a random point after previous browsing, discontinuity typically occurs in the image numbering. The decoder typically interprets this as unintentional loss of image frames and unnecessarily tries to reconstruct the image frames suspected as lost." *Id*. at 11:20-25.

The patent's preferred embodiment explains that "an initiation image in an independently decodable Group of Pictures" is "activated at the random point of the video file." *Id*. at 11:26-30. Once a decoder receives an indication of this first image frame of an independent sequence, the specification's teachings demonstrate that the reset operation, which sets the identifier value associated with the indicated first image frame, serves to establish proper numbering within independent sequences and to avoid a decoder incorrectly interpreting a discontinuity of identifier values as an unintentional loss of frames. Nokia and the Staff's proposed construction is consistent with these teachings. Respondents' proposed construction, by contrast, would exclude this preferred embodiment, as it would require (in conjunction with Respondents' "reset" proposed construction) the identifier value of the indicated first image frame to be decoded (as an incorrect value) and then changed to a different value. *See PPC Broadband, Inc. v. Corning Optical Communs. RF, LLC*, 815 F.3d 747, 755 (Fed. Cir. 2016) ("A construction which reads the preferred

embodiment out of the scope of the claims would generally seem at odds with the intention of the patentee as expressed in the specification.").

B. '701 Patent

1. Technical Background to the '701 Patent

a. Entropy Coding

Entropy coding is a term that describes processes for how video information is represented in a bitstream. In other words, entropy encoding "take[s] a set of data and based on the statistical properties of that data, represent[s] it in a compressed binary form using as few bits as possible, such that the original data can be recovered from the compressed binary form through entropy decoding. CXM-0018 (Richardson Dec.) at ¶ 56 (citing '701 Patent at 3:20-27, Figs. 6, 7). There are various forms of entropy coding, including Context Adaptive Variable Length Coding, which uses code-word look up tables to represent syntax element values, and Context Adaptive Binary Arithmetic Coding, which uses binary arithmetic coding to represent syntax element values.

Binary arithmetic coding represents a sequence of data symbols into a single fractional binary number required to represent each original symbol in a bitstream. Binary arithmetic encoding is performed by taking the original symbols and "binarizing" them to create bins, which are then represented as a binary fraction that lies within a range. Binary arithmetic decoding reverses this process. Each bin represents a bit in the binary fraction and has a probability associated with it that informs the encoder and decoders of the probability that a given bin is a 1 or a 0. This probability is known as the "context." The context must be known by both the encoder and decoder to accurately code original symbols. CXM-0018 (Richardson Dec.) at ¶ 61.

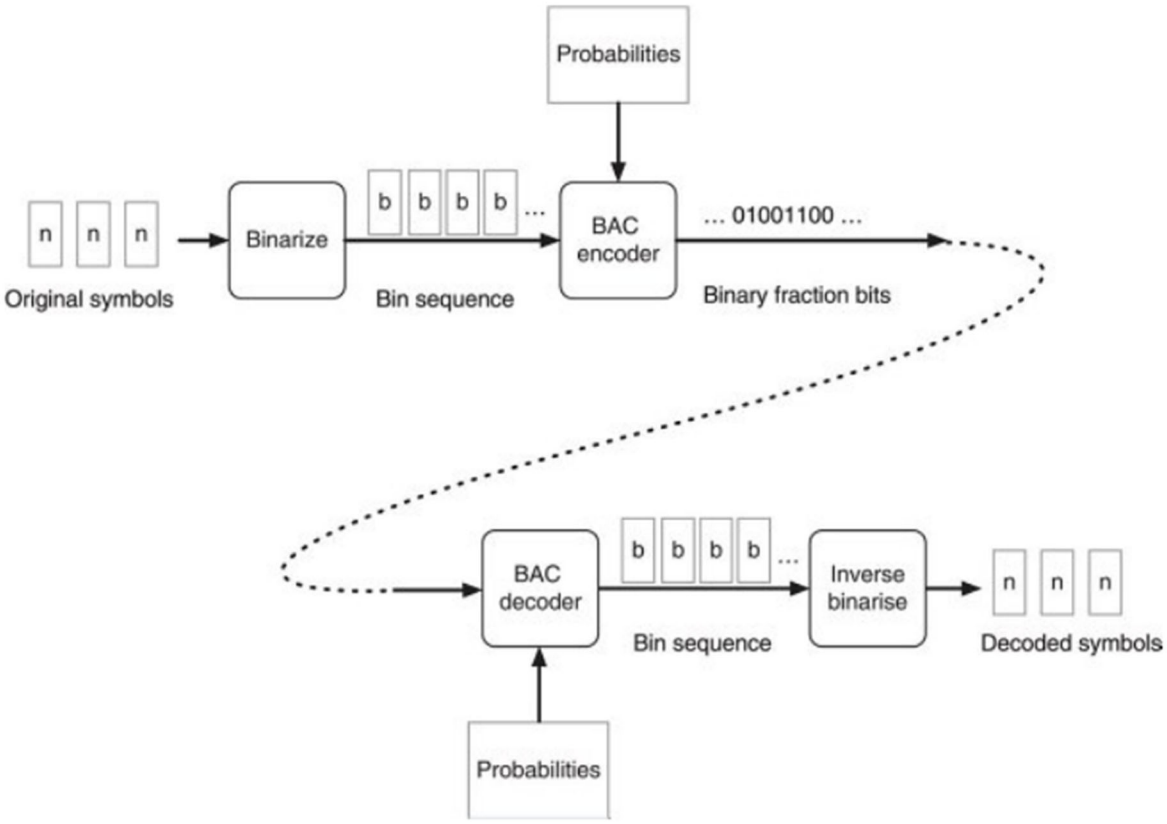


Figure 8.25 BAC encoding and decoding

CXM-0017 (Coding Video a Practical Guide to HEVC and Beyond) at 8.7.8. On the encoding side, after the bin sequence is formed, the probabilities (contexts) are used to convert the bins into a binary fraction sequence representing the range associated with the bin sequence. The decoder uses the probabilities (contexts) to convert the binary fraction sequence back into a bin and inverse binarize to arrive at the decoded symbols. An example arithmetic decoding process is provided below assuming equiprobable contexts for each bin:

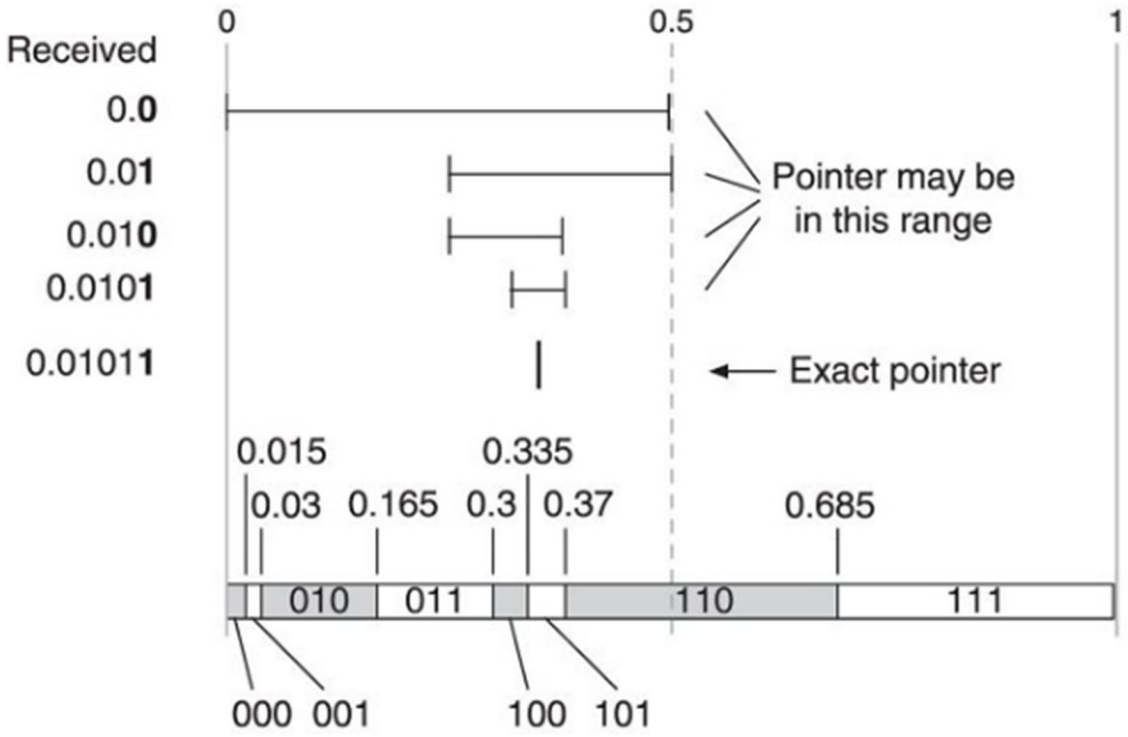


Figure 8.24 Receiving fractional bits, BAC decoder

CXM-0017 (Coding Video a Practical Guide to HEVC and Beyond) at 8.7.7. In this example, the first bin is a 0. This means that the binary fraction sequence falls within the range of (0, 0.5). The next bin is a 1, indicating that the binary fraction sequence falls within the range of (0.25, 0.5). This is followed by a 0, indicating a range of (0.25, 0.375). Followed by a 1, indicating a range of (0.3125, 0.375). Followed by another 1, indicating a range of (0.34375, 0.375). Using this method of binary fraction sequences allows entropy coding to achieve higher compression efficiency through prioritizing highly probably bins for more commonly coded values.

The "context adaptive" portion of these entropy coding engines refers to the ability to change the characteristics of the coding method based on previously coded data. For example, if multiple syntax elements have a value of "0" in a row, it may be more likely that the next syntax element will also have a value of "0." By updating contexts as coding progresses, more efficient

coding can take place to achieve higher compression. In the example above, bin0 may be adjusted to have a lower probability of 0, such as a 0.4 chance of being 0 and a 0.6 chance of being 1. This would allow the first bin to indicate a range of (0, 0.4) rather than (0, 0.5). Continuing through the bins in this manner could arrive at the desired range in less bits than an equiprobable model. CXM-0018 (Richardson Dec.) at ¶¶ 62-63.

b. Problems in the Art Prior to the '701 Patent

While context updating provides enhanced efficiency in video coding, it is also more computationally complex. Many devices with less powerful processors and battery constraints (such as mobile devices) struggle to keep up with the computational complexity of coding techniques such as CABAC when decoding or encoding video. As a result "significant usage of a mobile electronic device for the services [of video coding] typically consume battery power quickly and end up forcing the user to frequently recharge the battery or limit their usage." JXM-0003 ('701 Patent) at 1:37-50. Because of this, the H.264 decoding standard included two entropy coding engines. The "low complexity Context Adaptive Variable Length Coding" and "the Context Adaptive Binary Arithmetic Coding approach." JXM-0003 at 4:23-42. While this approach allowed encoders to choose the most appropriate method of encoding for its given use case (with lower end products opting for CAVLC and higher end products opting for CABAC), decoders were forced to use an entropy coding engine corresponding to the one selected by the encoder. This could result in products such as mobile devices and low-end computers struggling to keep up with the high-complexity CABAC entropy coding when decoding video. The use of CAVLC by certain encoders also resulted in decreased compression efficiency for bitstreams encoded using CAVLC.

c. The ’701 Patent Solved Problems in the Art by Balancing Complexity in Entropy Coding

The ’701 Patent solves this issue with a complexity balanced entropy coding engine. In other words, the ’701 Patent provides a system for capitalizing on the efficiency gains of CABAC while streamlining the computational process to alleviate strain on products performing the entropy coding. This is achieved through performing context updating on data most likely to benefit from the added compression efficiency and bypassing context updating for data that has less benefit from context updating. The ’701 Patent explains this in the context of Discrete Cosine Transform coefficients (DCTs):

> FIG. 4 illustrates an example of complexity versus bitrate for an example embodiment. The dashed line **90** may indicate a desired maximum level for a low complexity mode of operation. As indicated in FIG. 4, by employing an example embodiment that categorizes syntax elements and then encodes each category differently to reduce complexity, the computational complexity as indicated by the number of DCT coefficients, is kept below the desired maximum level by utilizing context adaptive arithmetic coding while bypassing probability estimation for DCT coefficient data for some symbols.

JXM-0003 (’701 Patent) at 11:23-40.

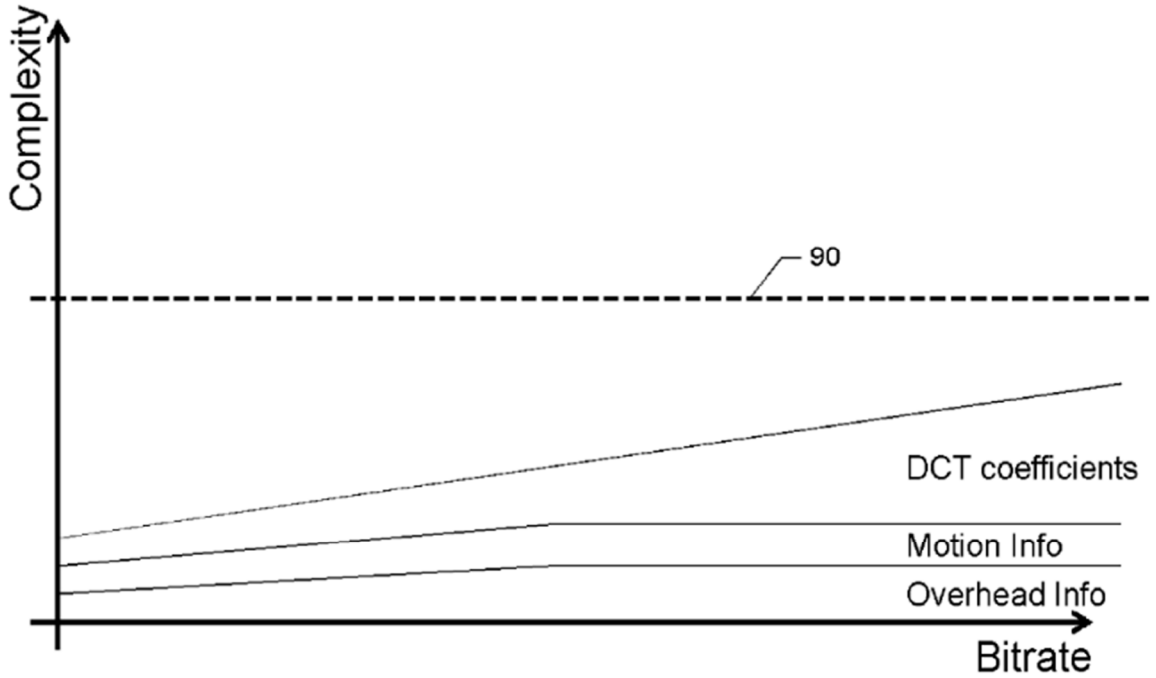


FIG. 4.

JXM-0003 (’701 Patent) at Fig. 4.

The ’701 Patent is especially effective in the context of DCT coefficients in a system wherein DCT coefficients are processed using a reverse diagonal scan order. CXM-0018 (Richardson Dec.) at ¶ 67. DCT coefficients represent a weighting factor applied to a given basis pattern based on the location of the DCT within a block. For example, a 4x4 transform block will have sixteen basis patterns as represented below:

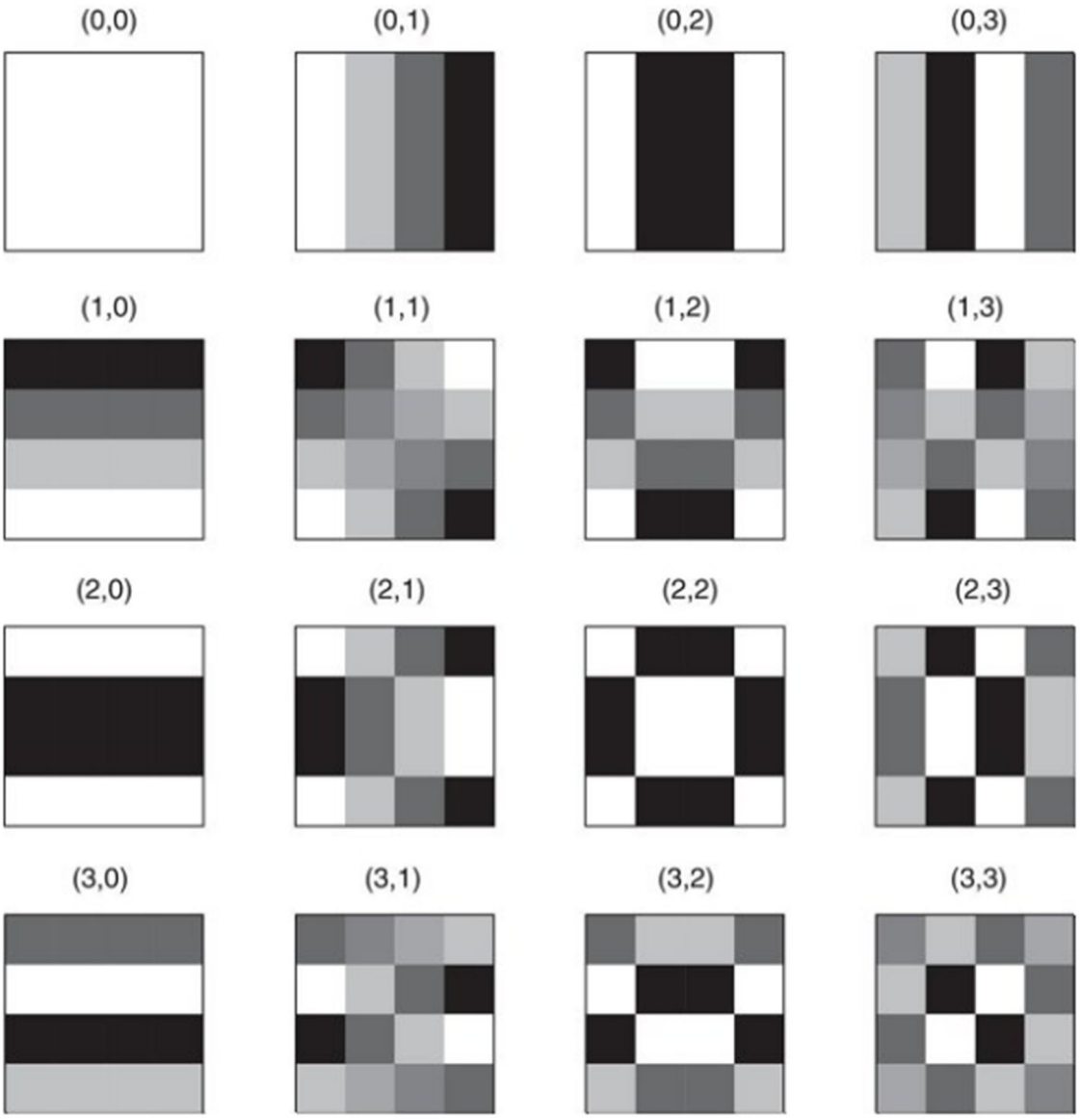


Figure 7.9 4 × 4 discrete cosine transform basis patterns

CXM-0017 (Coding Video a Practical Guide to HEVC and Beyond) at 7.3.2. The top left basis pattern is the average value for all residual blocks in the transform unit. Proceeding to the right increases the vertical frequency while proceeding down increases the horizontal frequency. Because of the characteristics of typical video images and because the human visual system is

more prone to notice details contained within lower frequency basis patterns, the basis patterns contained in the top left of the block are typically more important and thus have higher values. CXM-0017 at 7.3.1 When entropy coding DCT coefficients, certain systems proceed using a reverse diagonal scan order, meaning that the first coefficient to be processed is at the bottom right of the transform block. As the scan progresses to the top left of the block, it becomes less and less beneficial to perform context updating because it is more likely that a coefficient will be a large value requiring additional absolute level value signaling. As the inventors of the '701 Patent noticed, it can be beneficial to skip the context updating for these larger values to alleviate the computational requirements associated with context updating while maintaining the compression efficiencies for earlier values. CXM-0018 (Richardson Dec.) at ¶ 67.

Claim 8 is illustrative:

> 8. An apparatus comprising at least one processor and at least one memory including computer program code, the at least one memory and the computer program code configured to, with the processor, cause the apparatus to at least:
>
> > determine a frequency of occurrence threshold based on an expected frequency of occurrence of syntax elements in a bit stream;
> >
> > categorize a plurality of syntax elements of video content into first and second categories based on the frequency of occurrence threshold, wherein syntax elements which occur greater than the frequency of occurrence threshold are categorized into the second category and syntax elements which occur less than the frequency of occurrence are categorized into the first category;
> >
> > entropy code symbols that correspond to the first category of syntax elements and that have been subjected to a context update; and
> >
> > entropy code symbols that correspond to the second category of syntax elements and that have bypassed context updating.

2. The ALJ Should Adopt Nokia and the Staff's Proposed Construction of "Entropy Coding/Code Symbols"

The term "entropy coding symbols" should be construed according to its plain and ordinary meaning, which means entropy encoding or entropy decoding symbols. Nokia's and Staff's construction is supported by the intrinsic evidenced of the patent, extrinsic evidence in the field of video coding, and consistent with the parties' proposed exhibits. Respondents seek to limit the claims of the '701 Patent to solely entropy encoding. To do so would improperly limit the scope of the'701 Patent and disregard the intrinsic record, including embodiments disclosed in the '701 Patent's specification. Respondents appear to be making the argument that either: 1) the term "entropy coding" has a special meaning in the '701 Patent distinct from its commonplace use in the field of video coding as to exclude any possibility of covering "entropy decoding;" or 2) the term "entropy coding" as understood by a POSITA is used to refer exclusively to entropy encoding. Both arguments fail for the reasons set forth below.

a. The Intrinsic Evidence Supports Nokia's and Staff's Proposed Construction

Turning to Respondents' first potential argument, Respondents must show that the term "entropy coding" as described in the '701 Patent amounts to lexicography only covering the encoding process. There is a "'heavy presumption' that a claim term carries its ordinary and customary meaning" which is only overcome if i) "the patentee acted as his own lexicographer and clearly set forth a definition of the disputed claim term," ii) "the intrinsic evidence shows that the patentee distinguished that term from prior art," iii) the "ordinary meaning … so deprives the claim of clarity," or iv) in a means-plus-function format, the "claim term will cover nothing more than the corresponding structure or step disclosed in the specification." *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366-67 (Fed. Cir. 2002). The claims at issue are not means-

plus-function, so the fourth reasoning is not applicable. The claims have clear meaning covering both encoding and decoding under the plain and ordinary meaning of the term "entropy coding." Nothing in the prosecution history suggests that the term was distinguished from "entropy decoding" to overcome prior art. This leaves only the argument of lexicography. There are two main issues with this argument. First, lexicography is a high bar to show in claim construction, requiring that the patentee "'clearly set forth a definition of the disputed claim term' other than its plain and ordinary meaning." *Thorner v. Sony Computer Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012) (citation omitted). Further, "[i]t is not enough for a patentee to simply disclose a single embodiment or use a word in the same manner in all embodiments, the patentee must 'clearly express an intent' to redefine the term." *Id*. (quoting *Helmsderfer v. Bobrick Washroom Equip., Inc.*, 527 F.3d 1379, 1381 (Fed. Cir. 2008)). Second, adoption of Respondents' construction would narrow the scope of the claims to exclude embodiments disclosed in the patent specification. In claim construction, "there is a strong presumption against a claim construction that excludes a disclosed embodiment." *In re Katz Interactive Call Processing Pat. Litig.*, 639 F.3d 1303, 1324 (Fed. Cir. 2011) (citation omitted). The intrinsic evidence of the '701 Patent makes clear that the term "entropy coding" applies to both encoding and decoding.

The use of the term "entropy coding" within the '701 Patent does not amount to lexicography or any departure from the plain meaning of that term in the field of video coding. The '701 Patent explicitly discloses the use of "entropy coding" as being applied to both encoding and decoding, stating that "each of the syntax elements of a given bitstream may be encoded and decoded in accordance with complexity balanced entropy coding." JXM-0003 ('701 Patent) at 10:55-65. The '701 Patent clearly uses the term "entropy coding" to refer to both encoding and

decoding throughout the specification and provides various decoding embodiments. For example, the '701 provides the following embodiments that relate to decoding:

- "In some embodiments, the mobile terminal **10** may further include a video encoder/decoder." *Id*. at 6:34-39
- "For decoding, some example embodiments may process…" *Id*. at 10:25-36.
- "An instance of the categorizer **82** and the entropy coding engine **80** may be provided at the video encoder/decoder." *Id*. at 10:66-11:4.

The '701 Patent discloses decoding embodiments. To construe "entropy coding" as excluding these embodiments would be incorrect as a matter of claim construction law. *In re Katz Interactive Call Processing Pat. Litig.*, 639 F.3d 1303, 1324 (Fed. Cir. 2011). The '701 Patent fails to include any definition of "entropy coding" that would rise to lexicography or call for a construction other than its plain and ordinary meaning, which covers both entropy encoding and entropy decoding. As such, Respondents are incorrect that the term "entropy coding symbols" as contained within the '701 Patent should be construed as "entropy encoding symbols." Rather, the implicit evidence suggests that the correct construction of "entropy coding symbols" is "entropy encoding or decoding symbols."

If Respondents attempt to point to disclosures of the '701 Patent that use the phrase "video coding and decoding," this reliance is misguided and does not rise to the level of requiring the ALJ to depart from the plain and ordinary meaning of "entropy coding." First, as Dr. Richardson describes video "coding" is a generic term that can refer to encoding and/or decoding depending on the context. CXM-0018 (Richardson Dec.) at ¶ 34. Video coding covers the process of both

encoding and decoding video, used in tandem to achieve efficient compression and reduce computational complexity.

Second, even assuming that the use of the phrase "video coding" refers to encoding in some instances in the patent presents an inconsistency (rather than a particular use of a generic term), the consistent use of a term across embodiments within a patent is not enough to amount to lexicography overwriting the plain and ordinary meaning of a claim term, and inconsistent use certainly is not. *See Thorner v. Sony Computer Ent. Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2008) ("[i]t is not enough for a patentee to simply disclose a single embodiment or use a word in the same manner in all embodiments, the patentee must 'clearly express an intent' to redefine the term."). Even if the '701 Patent exclusively used the phrase "video coding and decoding," this would not be appropriate basis to limit the claims as Respondents propose. Moreover, the terms "video coding" and "entropy coding" are used distinctly within the '701 Patent. For example, the '701 Patent describes an "entropy coding engine" which is applied to both encoding and decoding:

> For decoding, some example embodiments may process first category symbols using procedures corresponding to the encoding mechanism employed. For example, if encoding is performed using CABAC or Pipe/V2V related approaches, the corresponding decoding approaches for each may be implemented for first category symbols. Meanwhile, syntax elements belonging to the second category may employ the same coding engine (e.g., the entropy coding engine **80**) as first category symbols except that static fifty percent bin probabilities may be employed in relation to decoding of these symbols (e.g., by employing a bypass coding mode of a CABAC engine).

JXM-0003 ('701 Patent at 10:25-36). The intrinsic evidence supports a construction of "entropy coding symbols" consistent with the plain and ordinary meaning of "entropy encoding or decoding symbols."

b. The Extrinsic Evidence Supports Nokia's and Staff's Proposed Construction

Extrinsic evidence shows that POSITAs in the field of video coding understand that "coding" and "entropy coding" apply to both encoding and decoding. CXM-0018 (Richardson Dec.) at ¶ 56. In his declaration, Dr. Richardson explains how people of skill in the art understand the terms "coding" and "entropy coding." Dr. Richardson points to several uses of these terms in the field of video coding consistent with Nokia and the Staff's proposed construction.

For example, as the '701 Specification points out, H.264 ("Advanced Video Coding") is a standardized specification for video decoding. H.264 also used an entropy coding engine known as "Context Adaptive Binary Arithmetic Coding (CABAC)." '701 Patent at 4:23-42. Dr. Richardson explains the same with regards to H.265 (High Efficiency Video Coding) which specifies a decoding process and "encoding process" is "a process not specified in [the H.265 Specification] that produces a *bitstream* conforming to this Specification." CXM-0018 (Richardson Dec.) at ¶ 42 (citing RXM-0060 (H.265, (04/2013)) (emphasis in original). That is, a standard document agreed upon by all the major parties in video coding used the term "arithmetic coding" rather than "arithmetic decoding" to refer to the entropy coding portion of the decoding standard. CXM-0018 at ¶ 41.

Likewise, Vivian Sze and Detlev Marpe describe "entropy coding" in the textbook *High Efficiency Video Coding (HEVC) Algorithms and Architectures* as follows: "Entropy coding is performed at the last stage of video encoding (and first stage of video decoding), after the video signal has been reduced to a series of syntax elements." CXM-0004 (High Efficiency Video Coding (HEVC) Algorithms and Architectures) at 7. Dr. Richardson notes that this description is "consistent with the skilled person's understanding that entropy coding includes entropy decoding

which is performed by decoders." CXM-0018 (Richardson Dec.) at ¶ 70. Dr. Richardson also explains that the editors and authors of this section of *High Efficiency Video Coding (HEVC) Algorithms and Architectures* were heavily involved in the standards setting effort and Detlev Marpe authored the first standards contributions on the development of CABAC. *Id*.

Members of the Joint Collaborative Team on Video Coding (JCTVC), the team responsible for developing the H.265 Standard, also used the term "entropy coding" to refer to both encoding and decoding. For example, in JCTVC-A032, titled "Novel entropy coding concept", Detlev Marpe, Heiko Schwarz, and Thomas Wiegand proposed a novel approach to entropy coding. "The basic idea of the presented entropy coding concept is the usage of multiple parallel binary encoders/decoders that operate at fixed probabilities." CXM-0006 (Novel Entropy Coding Concept) at 2. JCTVC-A032 was published at the first meeting of the JCTVC between April 15 and 23, 2010. As such, JCTVC-A032 is appropriate to show how a POSITA would have understood the term "entropy coding" at the time of the '701 Patent's provisional filing date of July 28, 2010.

Other JCTVC members held the same understanding. In July 2010, SHARP made a proposal to the JCTVC titled "Entropy Slices for Parallel Entropy Coding." SHARP's contribution focuses on entropy slices used in "entropy decoding and reconstruction loops." CXM-0005 (Entropy Slices for Parallel Entropy Coding) at 2. The bulk of SHARP's discussion of entropy slices for parallel entropy coding are centered on decoder functionality as illustrated by Figs. 1 and 2.

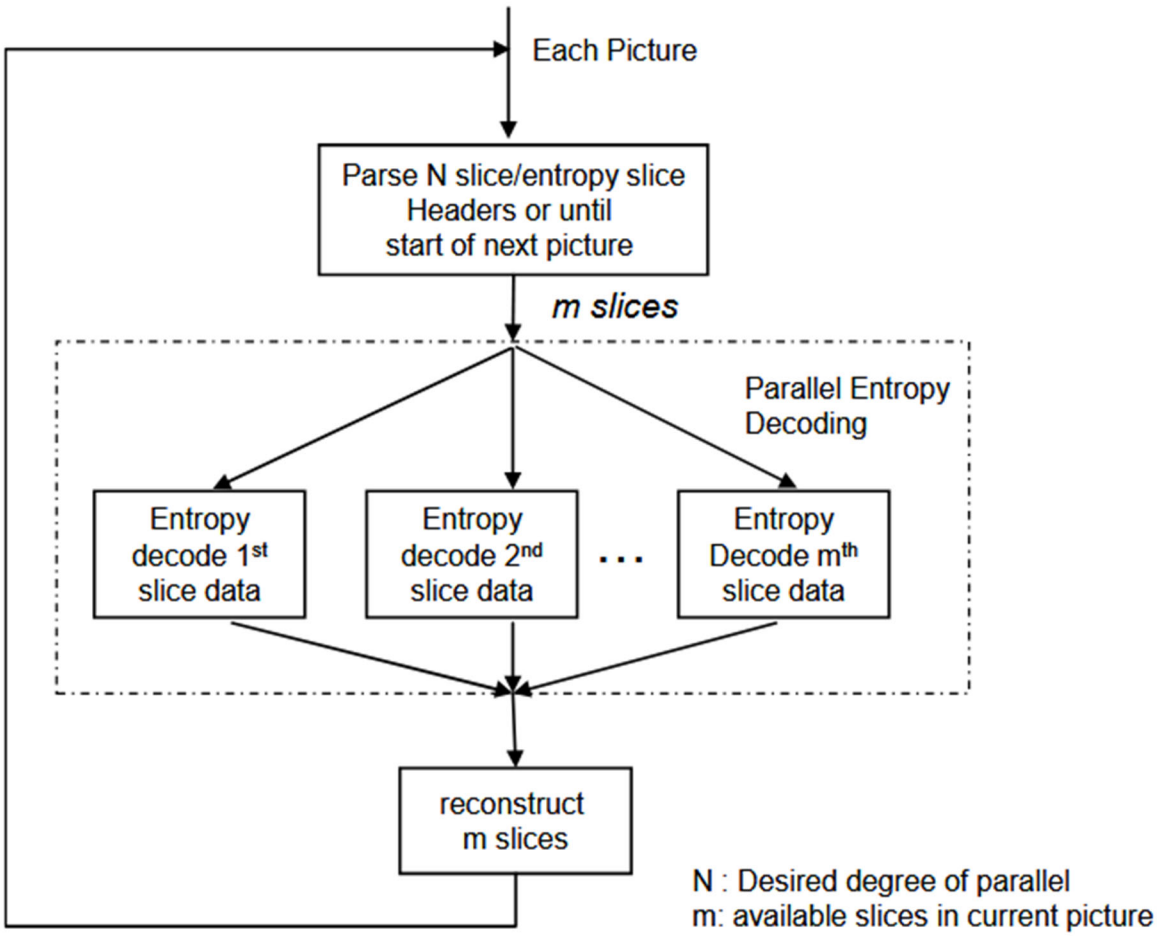


Fig. 1. Decoding process with parallel entropy decoding

CXM-0005 at 3.

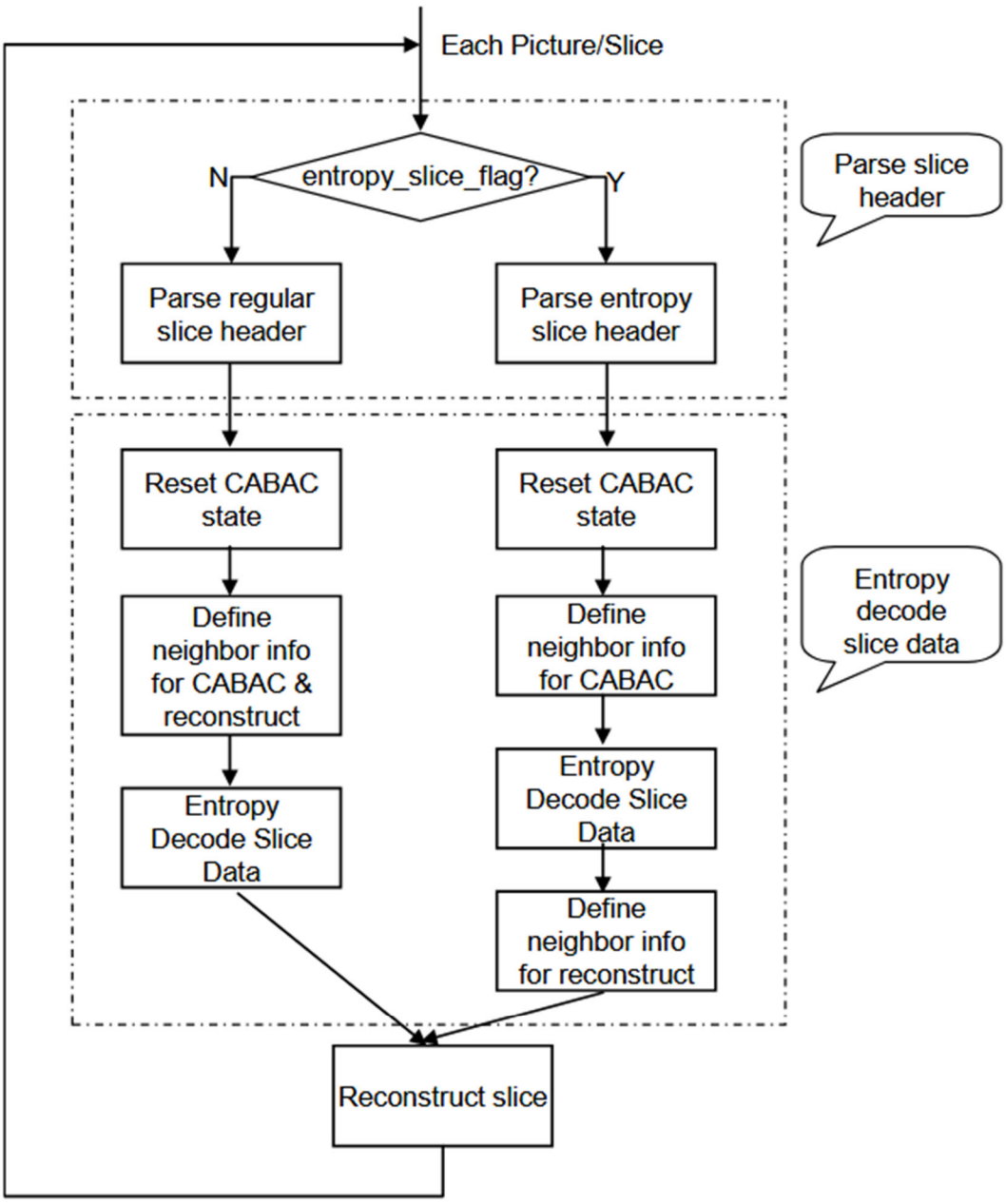


Figure 2: Decoding process of a slice and an entropy slice in sequential mode

CXM-0005 at 4. SHARP also discusses the purported improvements of entropy slices as seen by the decoder. *See* CXM-0005 at 4:

> Each of these entropy slices is restricted to include no more than a fixed number of bins, and thus, we assert they have a bounded **decoding**

> complexity. In this case, the 32 entropy slices may be processed by 32 **entropy decoders** in parallel, with each **entropy decoder** capable of processing a known number of bins, *N*, per frame. Similarly though, the bit-stream may be processed with 16 **entropy decoders** with each **entropy decoder** able to process *2*N* number of bins per frame. In this case, each **entropy decoder** would process two entropy slices serially. As we have previously discussed though, the serial processing does not add additional complexity. As yet another example, the bit-stream may be processed with 4 **entropy decoders**, each able to process *8*N* bins per frame. We suspect that it is clear to the reader that the system can be scaled to any target configuration, but we mention that the number of entropy slices does not need to be an integer factor of the number of **entropy decoders**. For example, the bit-stream may be processed with 6 **entropy decoder**, each able to process *6*N* bins per frame. In this case, not all **decoders** will process the same number of entropy slices.

JCTVC-A032 and JCTVC-B111 both provide insight as to how a POSITA would understand the term "entropy coding" at the time of the '701 Patent's invention. Both contributions discuss "entropy coding" in terms of being applied to both encoding and decoding, clearly placing decoding under the category of "entropy coding."

In addition to the evidence of how those working in the video coding field would have understood the term "entropy coding," the inventors of the '701 Patent described the term as covering both encoding and decoding. *See* JXM-0009C (Lainema Tr.) at 13 ("Q: What is 'entropy coding'? A: I believe that relates to encoding and decoding of syntax elements into and out of the bitstreams. Q: Can a decoder do entropy coding? A: Yes."); JXM-0010C (Hallapuro Tr.) at 9-10 ("Q: What does CABAC stand for? A: Context-adaptive binary arithmetic coding. Q: What is context-adaptive binary arithmetic coding? A: It's a form of entropy coding. Q: Can a decoder give entropy coding? A: Yes. Q: Can a decoder do CABAC? A: Yes."); *See also* CXM-0018 (Richardson Dec.) at ¶ 80 ("[Many other examples confirm the fact that POSITAs, including [Dr. Richardson], the co-chair of the H.264 and H.265 standardization efforts and at least two of the '701 Patent inventors, commonly use the term 'entropy coding' to refer to entropy encoding,

entropy decoding, or both."). Miska Hannuksela, another Nokia inventor, also provided testimony that the term "entropy coding" can be used to refer to either encoding or decoding depending on the context.

> Q: Do you understand entropy decoding could be performed by the decoder?
>
> A: Yes.
>
> Q: Do you understand entropy coding to be performed by the encoder?
>
> A: The encoder performs entropy encoding.
>
> Q: And entropy encoding is referred to as entropy coding in this paragraph, correct?
>
> A: Not the whole sentence, I think.

JXM-0011C (Hannuksela Tr.) at 122:19-123:6; *See also Id.* at 86:10-25. Here it can be seen that context is important when considering the term "entropy coding," one must specify whether they are referring to an encoder or decoder. Dr. Hannuksela was questioned about a distinct issued patent of his (RXM-0005, U.S. 10,154,274) with regards to encoding and decoding. Dr. Hannuksela noted that the patent in question describes both encoding and decoding using the term "entropy coding" and more detail would be required to delineate between where the patent discussed entropy encoding and entropy decoding. For example, the section in question states that "[c]ontext-based coding may for example be context adaptive binary arithmetic coding (CABAC) or context-based variable length coding (CAVLC) or any similar entropy coding." RXM-0005.

In summary, the inventors of the '701 Patent, members of the standards setting organizations at the time of the '701 Patent, textbooks, and, most importantly, the '701 Patent specification, all use the term "entropy coding" to refer to processes performed by both a decoder and an encoder. There is no reason that the term "entropy coding" should be limited to just one of the two in the claims of the '701 Patent.

c. Respondents' Proposed Construction is Inconsistent with the Intrinsic Evidence

As explained, Respondents' proposed construction disregards embodiments disclosed by the '701 Patent and attempts to limit the claims to entropy encoding. However, the '701 Patent repeatedly refers to entropy coding in both encoders and decoders. In fact, the '701 Patent only once uses a term other than "entropy coding" when referring to the processes of encoding and decoding. In describing Figure 5, the '701 Patent states that "[t]he method may further include signaling high efficiency or low complexity entropy encoding for syntax elements at a block, slice, picture or sequence level at operation." JXM-0003 ('701 Patent) at 12:54-13:15. The '701 Patent uses the term "entropy encoding" in this embodiment that includes "signaling" a type of entropy coding.

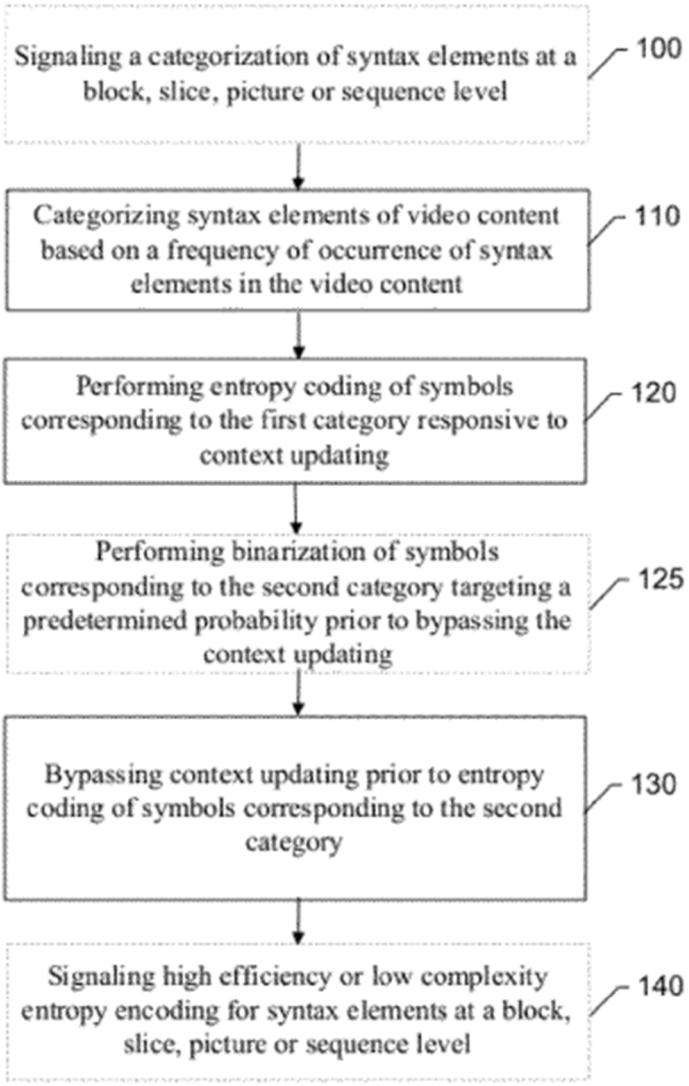

Signaling a categorization of syntax elements at a block, slice, picture or sequence level
100
Categorizing syntax elements of video content based on a frequency of occurrence of syntax elements in the video content
110
Performing entropy coding of symbols corresponding to the first category responsive to context updating
120
Performing binarization of symbols corresponding to the second category targeting a predetermined probability prior to bypassing the context updating
125
Bypassing context updating prior to entropy coding of symbols corresponding to the second category
130
Signaling high efficiency or low complexity entropy encoding for syntax elements at a block, slice, picture or sequence level
140

FIG. 5.

The ’701 Patent includes this term “entropy encoding” here to provide more limiting context for an embodiment whereas “entropy encoding” is not mentioned anywhere else. The inventors of the ’701 Patent understood how to use the terms “entropy coding” and “entropy encoding” and chose not to use the term “entropy encoding” in the claims of the ’701 Patent.

d. Respondents’ Proposed Construction is Inconsistent with the Extrinsic Evidence

Respondents’ exhibits fail to show that the term “entropy coding symbols” should be construed to include only “entropy encoding symbols.” Respondents cite to other patent applications, some by the same inventors as the ’701 Patent and some unrelated at all, to support their position. However, many or all these citations miss the point. Nokia and the Staff’s proposed construction of “entropy coding” includes entropy coding by both entropy encoders and entropy decoders. To the extent Respondents cherry pick examples of entropy coding being performed by entropy encoders, this does not contradict Nokia and the Staff’s proposed construction. Indeed, under Nokia and the Staff’s proposed construction, one could use the term “entropy coding” to refer to a class of actions taken by encoders, decoders, or both. As explained above, there is ample evidence that POSITAs in the field of video coding understand that the term “entropy coding” can be applied to both encoding and decoding and, in fact, use the term with that understanding.

Additionally, Respondents exhibits do not show that skilled artisans in the field of video limit the meaning of “entropy coding” to solely encoding. For example, RXM-0002 is the file history of IN458940, an Indian patent application related to the ’701 Patent. Notably, RXM-0002 uses the term “entropy coding” in the same manner as the ’701 Patent, referring to both encoding and decoding. *See* RXM-0002 at 16 (“Subject matter of claims discloses a method to enable the provision of efficient processing in the area of video coding and decoding by employing

complexity balanced entropy coding."), 37 (incorporating EP 2,599,315 B1) ("static fifty percent bin probabilities may be employed in relation to decoding of these symbols (e.g., by employing bypass coding mode of a CABAC engine.") Similarly, RXM-0003 uses the term "video coding" to refer to both encoding and decoding. RXM-0003 at [0003] ("The video devices may transmit, receive, encode, decode, and/or store digital video information more efficiently by implementing such video coding techniques"). Other patent applications fall for the same reasons. *See e.g.*, RXM-0004 at 1:20-28 ("A video coding system may comprise an encoder that transforms an input video into a compressed representation suited for storage/transmission and a decoder that can uncompress the compressed video representation back into viewable form"); RXM-0010 at [0120] "Alternatively, the bypass coding mode is chosen for selected bins in order to allow a speedup of the whole encoding (and decoding) process by means of a simplified coding engine"); RXM-0011 at [0003] ("Methods and apparatuses consistent with the present invention relate to video compression encoding and decoding, and more particularly, to entropy encoding and decoding of video data, in which different entropy coding methods are used for video compression"); RXM-0013 at [0114] ("the coding efficiency of a video coder can be further improved with the reduction of the decoding complexity").

Respondents also cite patents and patent publications that use the term "entropy coding" to refer to entropy encoding. However, these patent applications are clear to explain that "coding" is being used to refer to encoding, providing clear use of the term "entropy encoding." *See* RXM-0005 at 9:57-60 ("The entropy encoding…"); RXM-0006 at [208] ("entropy encoding is applied"), claims 8, 10, 18, 20, Figs. 15, 30; RXM-0007 at [0215] ("entropy encoding is applied"), Figs. 15, 30; RXM-0009 at [0030] ("there is provided an entropy encoder"), [0042] ("there is provided an

entropy decoder"), [0114]; RXM-0012 at [0005], ("the quantized transform coefficients are entropy encoded"), [0023].

Respondents also appear to rely on the deposition of Dr. Keith Botner in Investigation 337-TA-1380 to support its construction. Dr. Keith Botner is a survey expert who is not a POSITA in video coding under any conceivable definition. As Dr. Botner explained, he is not an expert in video coding but rather a survey expert. RXM-0023C (Botner Tr.) at 209:21-210:2 ("Q: And you are not an expert in video coding technology. Right? A: I am not an expert in video coding. I'm a survey expert.") As such, his use of the terms "coding," "encoding," and "decoding" have no bearing on how a POSITA would understand the terms. Dr. Botner's testimony was also unrelated to entropy coding. In any event, Dr. Botner repeatedly uses the term "coding" to refer to both encoding and decoding, while providing additional context to distinguish between the two when needed. *See e.g.* RXM-0023C at 63:10-22 ("H.264 is one of many codecs, so codec being shorthand for decoding and encoding algorithms"); 64:13-20 ("the survey asked about respondents' familiarity or understanding of video coding or video compression formats") 68:11-69:1 ("hardware accelerated encoding enabled"), 69:2-20 ("hardware-accelerated encoding, and then also there's hardware accelerated decoding").

Respondents also appear to rely on deposition transcripts from one inventor of the '701 Patent, Jani Lainema, and another Nokia engineer, Miska Hannuksela, from the 1380 Investigation. Both transcripts are unrelated to "entropy coding" and both inventors use the term "coding" to refer to both encoding and decoding, providing additional context where appropriate. *See* RXM-0025C (Lainema Tr. 1380) at 85:16-86:8 ("people are reporting run time impact, both on video encoding and video decoding"); RXM-0026C (Hannuksela Tr. 1380) at 317:11-20 ("all the video coding standards I'm aware of, they specify the decoding process").

Respondents point to several public filings made by Nokia in other litigations. Presumably the use of these filings is to show that Nokia has used the terms "entropy coder" and "entropy decoder" before. For example, in RXM-0027, Nokia refers to the output of an entropy decoder. RXM-0027 at 25. In RXM-0028, RXM-0029, RXM-0030, and RXM-0031, Nokia uses the term "entropy coding" when providing technical background to various patents. None of these statements are inconsistent with the fact that "entropy coding" can be used to refer to both encoding and decoding.

Respondents' exhibits relating to the use of the term "entropy coding" in the field of video coding also fail to aid their argument. For example, Respondents include JCTVC-A119, a proposal to the JCTVC first meeting in April 2010. In this proposal, submitted by Tandberg, Nokia, and Ericsson, section 2.6 is title "Entropy coding" and includes descriptions of both entropy encoding and entropy decoding processes, along with a figure showing how the two relate to one another. (VLC refers to variable length coding.)

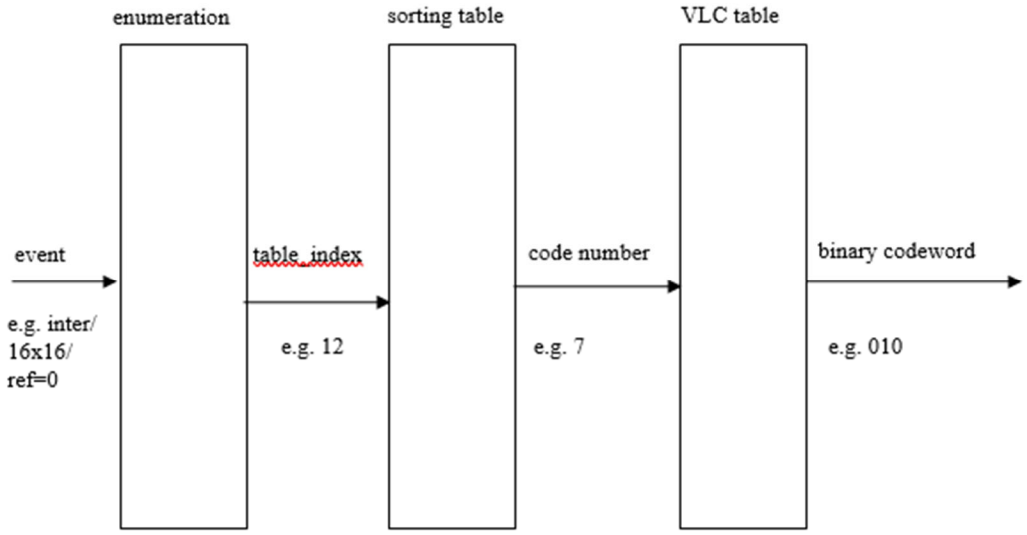


Figure 8 VLC encoding process

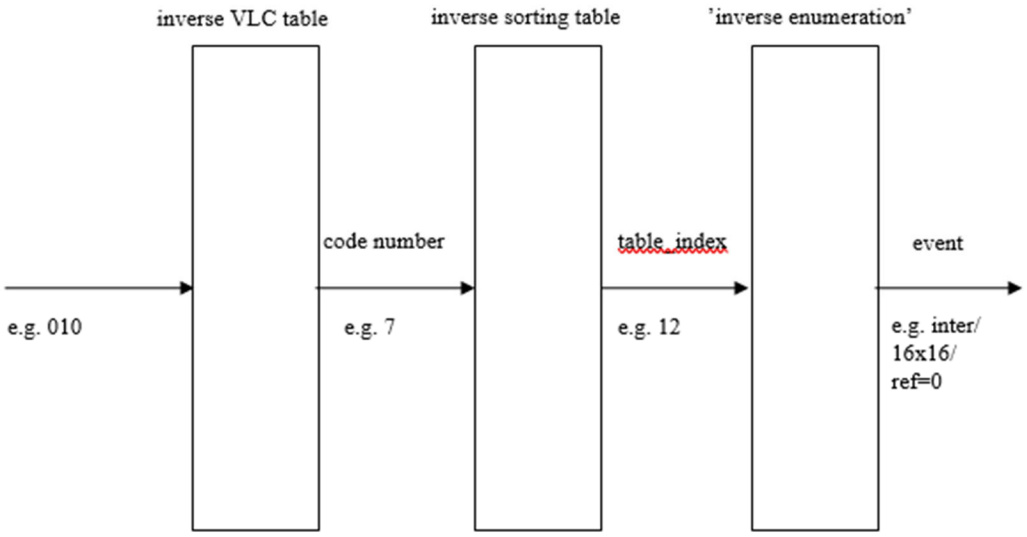


Figure 9 VLC decoding process

RXM-0032 (JVCT-A119) at 9-10. RXM-0033, which describes JVT-A119, takes a similar approach in discussing coding, encoding, and decoding, delineating or providing context when discussing encoding or decoding, such as in the complexity analysis section: "As mentioned earlier, the main motivation behind the TENTM proposal was to achieve low complexity operation, and to improve the coding efficiency over H.264/AVC, especially at high resolutions …

In order to test the encoding and decoding complexity of the proposed algorithm, the encoding and decoding time of the proposal was compared to the H.264/AVC reference software JM17.0" RXM-0033 (High Performance, Low Complexity Video Coding and the Emerging HEVC Standard) at 7-8. The same is true for RXM-0034. RXM-0034 (Low Complexity Video Coding and the Emerging HEVC Standard) at 4.

Respondents' reliance on dictionaries is also misguided. For example, the definition of "code" provided in RXM-0035 (A Dictionary of Computing) describes coding in the context of "encoding and its converse … decoding." RXM-0035 at 3. Further, the definition of "code" states "[t]he term 'an encoding' is *sometimes* used synonymously with 'a code.'" *Id*. (emphasis added). This definition refers to both encoding and decoding and makes clear that "an encoding" is only sometimes used synonymously with "a code," leaving open the understanding that decoding can be covered as well. RXM-0036 (Newton's Telecom Dictionary) specifically delineates "entropy encoding" in its definition of "entropy coding." RXM-0036 at 3. Further, these definitions are not specific to video coding. Rather, they are definitions of coding in a general sense. RXM-0037 is also consistent with Nokia and the Staff's proposed construction, defining "code" as "a technique for representing information in a form suitable for storage or transmission," "entropy coding" as "a term generally used as equivalent to lossless source coding. The name comes from the fact that lossless source coding can compress data at a rate arbitrarily close to the entropy of the source," and "video coding" in terms of both an "encoder" and a "decoder." RXM-0037 (Comprehensive Dictionary of Electrical Engineering) at 3-5. There is nothing to suggest that the term "coding" is restricted to only "encoding" and excludes "decoding" in any of these definitions.

The exhibits Respondents point to that use the term "entropy coding" to describe entropy encoding do not remedy the fact that "entropy coding" is also used to describe decoding. Nokia

does not contest that "entropy coding" can refer to entropy encoding. Indeed, that is part of Nokia and the Staff's proposed construction. However, Nokia and the Staff's proposed construction also accounts for the fact that "entropy coding" is also frequently used by skilled artisans to refer to both encoding and decoding (e.g., CXM-0004 (High Efficiency Video Coding) at 210 ("Entropy coding is performed at the last stage of video encoding (and first stage of video decoding")) or just decoding (e.g., in the H.264 and H.265 Standards). CXM-0018 (Richardson Dec.) at ¶¶ 72-73. Context is key when considering whether the term "entropy coding" is referring to encoding, decoding, or both in the art. Such context as provided by the '701 Patent's specification. As such, the ALJ should construe the term "entropy coding/code symbols" as the plain and ordinary meaning, which means "entropy encoding or entropy decoding symbols / entropy encode or entropy decode symbols."

C. '714 Patent

1. Technical Background to the '714 Patent

a. Merge Mode

A "video codec" system may include an encoder which transforms input video bitstreams into a compressed representation suitable for storage (or transmission) and a decoder which can uncompress the compressed representation into a viewable format. JXM-0005 ('714 Patent) at 1:32-36. To compress a video into a suitable representation, an encoder may discard some information in the original video sequence. *Id.* at 1:36-39. To rebuild the video into a watchable form, predictions are made based off previously decoded image blocks. *Id*. at 1:44-53. These predictions can be one of intra prediction or inter prediction. *Id*. 1:53-57.

Intra prediction is when predictions are made from the within the same frame, while inter prediction is when predictions are made from previously coded frames. *Id*. Inter prediction requires

transmitting or predicting motion vectors, which represent the displacement of blocks, between the current and reference frame. *Id*. Predicting motion vectors is "more efficient[]" than transmitting motion vectors because "motion vectors may be coded differentially with respect to block specific predicted motion vector." *Id*. at 2:65-67. The idea is that encoding and decoding only the difference between a predicted motion vector and its intended value, if any, is cheaper in terms of bits than coding the entire motion vector. A "spatial motion vector prediction" is a "prediction obtained only on the basis of information of one or more blocks of the [current] frame." *Id*. at 3:9-14. Conversely, a "temporal motion vector prediction" is one obtained based on "information of one or more blocks of a frame different than the current frame." *Id*. Together, these predictions are called "spatio-temporal motion vector predictions." *Id*. at 3:17-19. One category of coding mode used to predict motion vectors is called "merge" mode. *Id.* at 3:24-30. In traditional merge modes, motion vectors were predicted from motion vector candidates taken from neighboring blocks in the current frame. *Id*. at 3:24-38.

b. Problems in the Art Prior to the '714 Patent

Despite the advantages of prior art merge modes, earlier implementations faced serious limitations. *See* JXM-0005 ('714 Patent) at 3:60-4:15. Candidate lists often consisted of many redundant motion vectors because neighboring blocks frequently contained identical motion vectors. *See id.* at 3:64-4:3 The presence of duplicates not only wasted motion vector prediction list space but also forced additional signaling and processing with no gain in prediction quality. *Id.* at 4:7-15.

To combat this and reduce redundancies, some later merge modes employed an exhaustive comparison technique, which ensured that no duplicate candidate motion vectors were added to the motion vector prediction list. *Id*. at 3:64-4:3. This iteration, however, raised a set of different

issues. While this method reduced the file size of compressed bit streams, it did so at an enormous processing cost. *See id.* This approach was particularly problematic for mobile devices and embedded platforms, which operate with limited processing power and memory. *See id.* In addition, as more candidates were added to motion vector prediction lists, signaling overhead increased, which reduced compression efficiency and undermined one of the key motivations for merge mode in the first place. *Id.* at 4:7-15.

c. The '714 Patent Solved Problems in the Art by Inventing a New, Parallelizable Merge Mode

The '714 Patent introduces a new, efficient merge mode that addresses the problem of redundant candidates while enabling the possibility of faster, parallelizable processing of motion vector prediction candidates. When an encoded block of pixels is received, the video decoder determines a set of spatial motion vector prediction candidates ("SMVPCs"). JXM-0005 ('714 Patent) at 4:66-5:4. One of the SMVPCs from the set is selected for processing, and a subset of SMVPCs is identified based on the location of the selected SMVPC. *Id*. at 5:5-11. The motion information of the selected SMVPC is compared against the motion information of the SMVPC(s) in the determined subset to decide whether the selected SMVPC should be included in the motion vector prediction list. *Id*. at 5:12-21. If the motion information of the selected SMVPC is different from that of the motion information of the SMVPC(s) in the subset, then the selected SMVPC is included in the motion vector prediction list. *Id.* If the motion information of the SMVPC is redundant, then the selected SMVPC is excluded from the motion vector prediction list. *Id*.

For example, when the first SMVPC is B1, a subset of SMVPC(s) is determined to be A1 based on the location of the block at B1. JXM-0005 ('714 Patent) at 16:8-23. The motion information at B1 is compared to the motion information at A1 and if the motion information is

different, then B1 is added to the motion vector prediction list. *Id.* Through this approach, the motion vector prediction list contains minimal duplicate motion vectors.

Claim 23 is illustrative:

> 23. An apparatus comprising a processor and a memory including computer program code, the memory and the computer program code configured to, with the processor, cause the apparatus to:
>
> select a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for an encoded block of pixels as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list for a prediction unit of the encoded block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates;
>
> determine a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;
>
> compare motion information of the first spatial motion vector prediction candidate with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;
>
> determine to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on comparison of the motion information of the first spatial motion vector candidate with motion information of the spatial motion vector prediction candidate; and
>
> select a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels, wherein the spatial motion vector prediction candidate is selected from the motion vector prediction list using information that was received identifying a respective spatial motion vector prediction candidate from the motion vector prediction list constructed by an encoder.

The ’714 Patent’s new merge mode claims several advantages over the prior art. The ’714 Patent’s new merge mode teaches a parallelizable process, allowing the comparisons to take place simultaneously reducing the time it takes to encode or decode image blocks. *Id.* at 17:40-

41.Parallelization solved the problem in the prior art of a sequential process which could lead to slower rendering speeds among other unintended consequences.

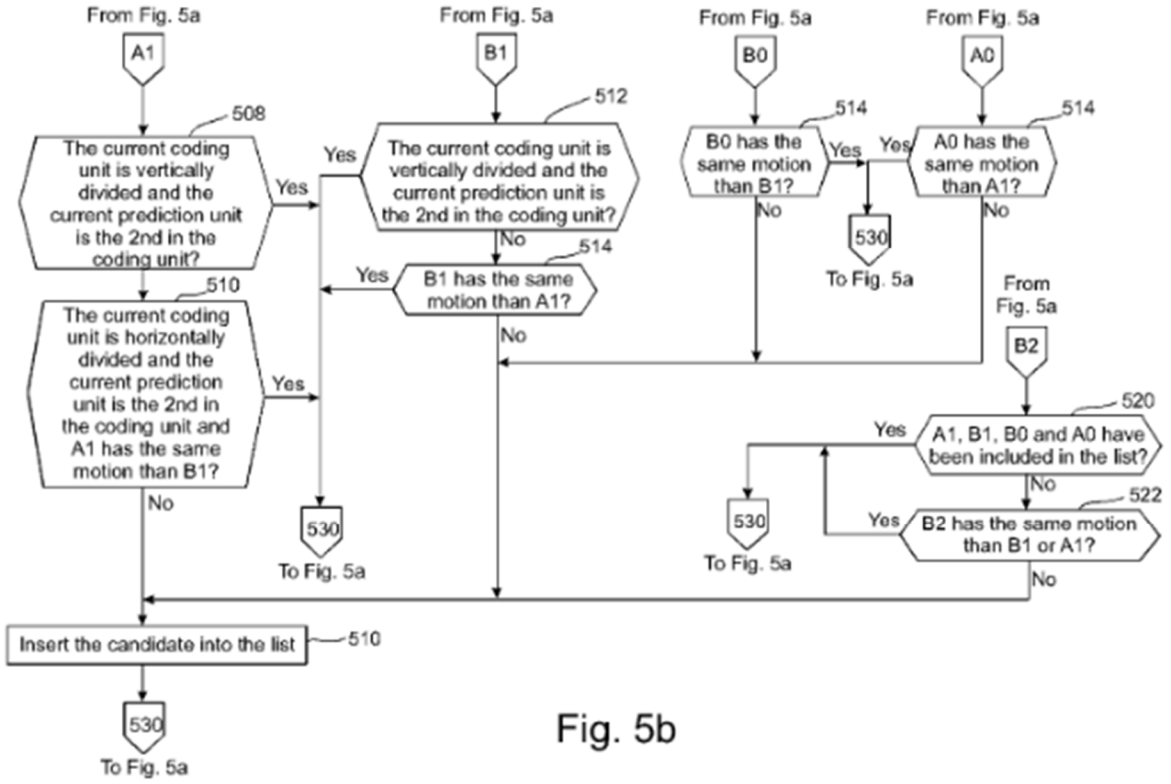


Fig. 5b

JXM-0005, Fig. 5b (showing that comparisons are not dependent on one another and can be performed in parallel).

The invention eliminates most duplicative entries into the motion vector prediction list avoiding a bloated motion vector prediction list. Further, by restricting comparisons to subsets, the claimed invention lowers computational complexity relative to the prior art exhaustive comparison methods. As a result of these advancements, coding efficiency is improved since fewer bits are needed to represent motion information while preserving prediction accuracy and reducing required processing power.

2. The ALJ Should Adopt Nokia and the Staff's Proposed Construction of "First Spatial Motion Vector Prediction Candidate"

The term "first spatial motion vector prediction candidate" should be construed according to its plain and ordinary meaning, which means one of the spatial motion vector prediction candidates selected for potential inclusion in the motion vector prediction list. Using the phrase "first [entity]" to distinguish members of a set is consistent with long settled law and patent claim drafting practice. CXM-0009 (MPEP) at § 2111.03(I) (citing *Gillette Co. v. Energizer Holdings Inc.*, 405 F.3d 1367, 1371-73 (Fed. Cir. 2005)). Nokia and the Staff's proposed construction is supported by the law, the intrinsic record, extrinsic evidence in the field of video coding, and the doctrine of claim differentiation. Based on the parties' claim construction meet and confer, it appears Respondents are attempting to read the word "first" as a limitation of first in time such that the Asserted Claims are limited to one specific spatial motion vector prediction candidate that is first in time for processing. Using Figure 5b of the patent as an example, Respondents appear to be arguing that only "A1" can be the "first spatial motion vector prediction candidate." This fails for several reasons. First, the law allows an inventor to use the modifier "first" to distinguish a member from a set without imposing narrowing temporal limitation into the claims. Second, even disregarding that long settled law, Respondents' proposed construction is inconsistent (or at best ambiguous) with respect to the "parallelizable" and "in any order" invention of the '714 Patent. Looking back to Figure 5b, for example A0, B0, and B1 can be processed at the same time as "A1." Yet Respondents appear to contend that only "A1" can be "first" under their construction and not any of the other candidates (even if the invention allows those to simultaneously be "first" in time). Third, Respondents' proposed construction improperly narrows the '714 Patent and disregards other intrinsic and extrinsic evidence.

a. Long Settled Law on Claim Drafting Provides that "First [Entity]" Can be Used to Distinguish Members of a Set Without Requiring an Inherent Order to the Members of the Set

It is long settled law and claim drafting practice that words such as "first" are used to distinguish members of a set rather than used to show a serial or temporal order of members of a set. *3M Innovative Properties Co. v. Avery Dennison Corp.*, 350 F.3d 1365, 1371 (Fed. Cir. 2003) ("The use of terms 'first' and 'second' is a common patent-law convention to distinguish between repeated instances of an element or limitation."). According to the Manual of Patent Examining Procedure, terms such as "first," "second," and "third" are used not "to show a serial or numerical limitation" but instead are "used to distinguish or identify the various members of the group." CXM-0009 at § 2111.03(I) (citing *Gillette Co. v. Energizer Holdings Inc.*, 405 F.3d 1367, 1371-73 (Fed. Cir. 2005)).

In *Gillette Co*., the patent at issue claimed a group of first, second, and third blades. 405 F.3d at 1372. The court held that the terms "first", "second", and "third" were "terms to distinguish different elements of the claim, not terms supplying a numerical limit." *Id*. at 1373. The court found that the claim did not follow a consecutive order and "thus clearly [is] not using the ordinals—first, second, third—to show a consecutive numerical limit but only to distinguish or identify the various members of the group." *Id*. This same reasoning applies to the claims of the '714 Patent because the '714 Patent claims do not follow a consecutive order in this regard.

In the '714 Patent, the term "first" is used to distinguish the spatial motion vector prediction candidate selected for potential inclusion in the motion vector prediction list for the other spatial motion vector prediction candidates. The "selecting a first spatial motion vector prediction candidate" step is practiced each time a spatial motion vector prediction candidate is chosen for potential inclusion in the motion vector prediction list. This means that the claim language must

distinguish between the different spatial motion vector prediction candidates. For example, when B0 is the spatial motion vector prediction candidate that is being considered for potential inclusion in the motion vector prediction list, B0 is the "first spatial motion vector prediction candidate." This is true for other spatial motion vector prediction candidates that are selected for potential inclusion in the motion vector prediction list. As stated, spatial motion vector prediction candidates can be selected for potential inclusion in the motion vector prediction list in parallel.

b. The Intrinsic Record Supports Nokia and the Staff's Construction

Nokia and the Staff's proposed construction is supported by the specification of the '714 Patent. The '714 Patent states that, "The decisions for the candidates can be taken in any order of A1, B1, B0, A0 and B2 or independently in parallel." JXM-0005 ('714 Patent) at 17:40-41. According to the '714 Patent's specification, the decisions for the spatial motion vector prediction candidates can be taken in parallel, or in other words, simultaneously in time as other spatial motion vector prediction candidates. *See id.* The fact that the spatial motion vector prediction candidates can be taken "independently in parallel" supports Nokia and the Staff's proposed construction of "first spatial motion vector prediction candidate."

The '714 Patent's specification discloses the process that occurs when each spatial motion vector prediction candidate is being considered for inclusion in the motion vector prediction list. *Id.* at 15:34-16:55. For example, when the spatial motion vector prediction candidate selected for potential inclusion in the merge list is located at block B1, the motion information for block B1 may be compared with the motion information located at block A1. *Id.* at 16:8-24. If the motion information of blocks B1 and A1 are different, then spatial motion vector prediction candidate B1 is added to the motion vector prediction list. *Id*. When the spatial motion vector prediction

candidate selected for potential inclusion in the motion vector prediction list is located at block B0, the motion information for block B0 may be compared with the motion information located at block B1. *Id*. at 16:24-31. If the motion information of blocks B0 and B1 are different, then spatial motion vector prediction candidate B0 is added to the motion vector prediction list. *Id*. When the spatial motion vector prediction candidate selected for potential inclusion in the motion vector prediction list is located at block A0, the motion information for block A0 may be compared with the motion information located at block A1. *Id*. at 16:32-35. If the motion information of blocks A0 and A1 are different, then spatial motion vector prediction candidate B0 is added to the motion vector prediction list. *Id.* at 16:35-39. When the spatial motion vector prediction candidate selected for potential inclusion in the motion vector prediction list is located at block B2, the motion information for block B2 may be compared with the motion information located at blocks B1 and A1. *Id*. at 16:45-49. If the motion information of block B2 is different from blocks B1 and A1, then spatial motion vector prediction candidate B2 is added to the motion vector prediction list. *Id.* The point is that the '714 Patent's specification discloses a range of "first spatial motion vector prediction candidate" possibilities and describes that "the decisions for the candidates can be taken in any order." *Id*. at 17:40-41.

Further, consistent with the intrinsic record, any predetermined order (such as in Claims 2 and 16) does not require a single spatial motion vector prediction candidate to be processed first in time. A predetermined order may be an order in which the spatial motion vector prediction candidates are processed in parallel. For example, Figure 5b in the '714 Patent shows that the invention is parallelizable:

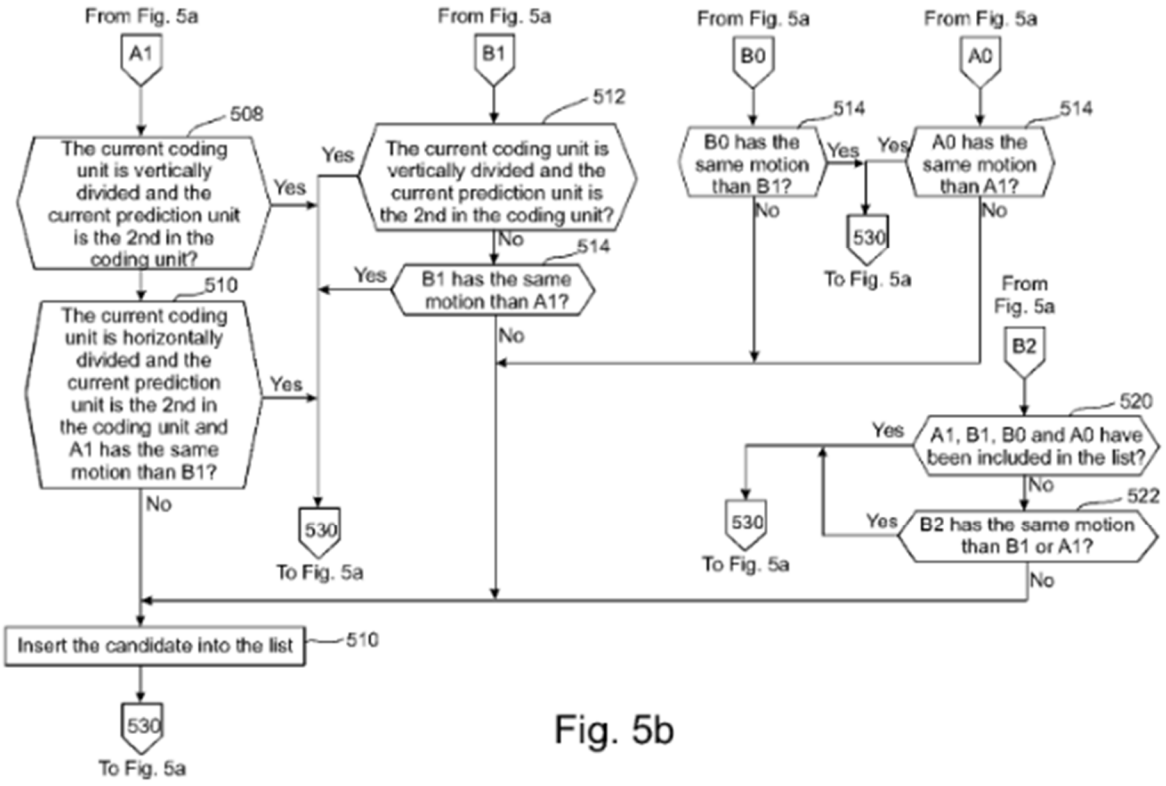


Fig. 5b

Id. at Fig. 5b. Any of A1, B1, B0, and A0 can be processed in parallel. Moreover, Figure 5b depicts operations according to an embodiment and is not limiting on the claims. The '714 Patent's specification and claims disclose any order or parallelization of the new merge mode invention.

Nokia and the Staff's proposed constructions align with the intrinsic record of the '714 Patent. The methods and apparatuses disclosed by the '714 Patent's intrinsic record are parallelizable, which in turn, support the construction that the "first spatial motion vector prediction candidate" refers to the spatial motion vector prediction candidate that has been selected for potential inclusion in the motion vector prediction list.

c. Respondents' Construction is Ambiguous

Respondents' proposed construction the spatial motion vector prediction candidate that is first for processing" introduces two ambiguities. One ambiguity involves what "first for

processing" means. Does this mean "first" at a given moment in time or the "first ever" spatial motion vector prediction candidate that a video coding product considers for a given block of pixels? The former interpretation might collapse into Nokia and the Staff's construction. However, assuming Respondents intend the latter interpretation (which seems to coincide with Respondents apparent intention that "A1" in Figure 5b of the patent be the "first spatial motion vector prediction candidate), then another ambiguity arises. How does Respondents' proposed construction apply to a parallelizable process in which there would be multiple "first spatial motion vector prediction candidates" selected for processing simultaneously? Respondents cannot argue that there can only be one "first" spatial motion vector prediction candidate, as such a response plainly contradicts the '714 Patent's teachings that, for its new merge mode, the "decisions for the candidates can be taken in any order … or independently in parallel." JXM-0005 ('714 Patent) at 17:40-41. Respondents may concede that there can be multiple "first" spatial motion vector prediction candidates given the patent's teachings on parallelizability. But then Respondents' proposed construction becomes essentially arbitrary under this interpretation. The interpretation would exclude from the scope of the Asserted Claims the selection of any given[1] spatial motion vector candidate insofar as that selection happened after a selection of a different spatial motion vector prediction candidate. However, the selection of the given spatial motion vector candidate would be included within the scope of the Asserted Claims according to Respondents if only it occurred at the same time as the selection of the different spatial motion vector prediction candidate. Nothing in the intrinsic record justifies that distinction.

[1] In patent claim drafting, one might refer to this given spatial motion vector prediction candidate as a "first" spatial motion vector prediction candidate to distinguish it from other candidates in the set. But given the parties' dispute over the word "first," Nokia will use the word "given" instead.

d. The Guidepost of Claim Differentiation Supports Nokia and the Staff's Construction

The doctrine of claim differentiation supports Nokia and the Staff's proposed construction. "The doctrine of claim differentiation create[s] a presumption that each claim in a patent has a different scope." *Bradford Co. v. Conteyor NA, Inc.*, 603 F.3d 1262, 1271 (Fed. Cir. 2010) (quoting *Comark Commc'ns, Inc. v. Harris Corp.*, 156 F.3d 1182, 1186 (Fed. Cir. 1998)) (internal quotations omitted).

Claims 2 and 16 of the '714 Patent undermine Respondents' position. Each states either that the method further comprises or that the apparatus is further caused to "select[ing] spatial motion vector prediction candidates from the set of spatial motion vector prediction candidates as the potential spatial motion vector prediction candidate in a predetermined order." *See* JXM-0005 at Cl. 2 and Cl. 16. The critical point here is that these dependent claims contemplate that *multiple* first candidates can be selected "as the potential spatial motion vector prediction candidate" according to the "selecting" step of the independent claims. Independent claims are broader than dependent claims. Thus, the relevant independent claims must include the possibility of multiple selections of (first) spatial motion vector prediction candidates or else the independent claims would be so narrow that Claims 2 and 16 would be rendered impossible to practice. Respondents' proposed construction would contradict this principle. *See Bradford Co.*, 603 F.3d at 1271 (the scope of an independent claim is "presumed to be broader" than a corresponding dependent claim). Moreover, selection in a "predetermined order" as in Claims 2 and 16 may be a parallelizable process. For example, Figure 5b of the '714 Patent shows a parallelizable process that is in a predetermined order: A0, A1, B0, and B1's selection can run in parallel, and this is predetermined. *Id.* at 17:41, Fig. 5b. That said, for the sake of argument, Nokia assumes Respondents will argue

that "predetermined order" requires that only one candidate can be "first" in time. Even if this were correct (which it is not), and even if one ignores that Claims 2 and 16 contemplate multiple first spatial motion vector prediction candidates in a predetermined order, Respondents' potential argument with respect to Claims 2 and 16 fails under claim differentiation because these dependent claims should have narrower scope than the independent claims. Since Claims 2 and 16 of the '714 Patent require the decisions for inclusion on the motion vector prediction list to be made in a predetermined order, the "first spatial motion vector prediction candidate" as claimed in the independent claims should be broader in scope. Claim differentiation, combined with the fact the specification informs a skilled artisan that the inventions are parallelizable, weighs against Respondents' proposed construction even if one assumes that a "predetermined order" cannot also be a parallelizable order (despite the patent giving precisely such an example in Figure 5b).

e. Respondent's Construction Contradicts the Intrinsic Record

Respondents' proposed construction contradicts the intrinsic record. Respondents' proposed construction requires one spatial motion vector prediction candidate to be "first for processing." Respondents' proposed construction contradicts the intrinsic record in two ways. First, Respondents' proposed construction implies that there must be an order in which the spatial motion vector prediction candidates are processed. Second, Respondents' proposed construction would preclude the parallelizability of the invention.

Respondents' proposed construction would preclude the disclosed parallelizability of the spatial motion vector prediction candidate processing. The '714 Patent's specification discloses that the decisions for spatial motion vector prediction candidates can be taken "independently in parallel." JXM-0005 ('714 Patent) at 17:41. If decisions, or processing, can occur independently in parallel, then either several of the spatial motion vector prediction candidates or none of the

spatial motion vector prediction candidates are "first." Respondents' proposed construction contradicts the parallelization of the invention and would not make sense considering the specification.

Respondents may point to an example embodiment of a dependent claim to support their proposed construction. The example in the '714 Patent's specification reads, "[t]hese spatial motion prediction candidates can be processed in a predetermined order, for example, A1, B1, B0, A0 and B2. The first spatial motion prediction candidate to be selected for further examination is thus A1." *Id*. at 15:15-18. Yet this is only an example, and "[t]he decisions for the candidates can be taken in any order of A1, B1, B0, A0 and B2 or independently in parallel." *Id*. at 17:40-41. "References to a preferred embodiment, such as those often present in a specification, are not claim limitations." *Laitram Corp. v. Cambridge Wire Cloth Co.*, 863 F.2d 855, 865 (Fed. Cir. 1988) (citing *SRI Int'l v. Matsushita Elec. Corp.*, 775 F.2d 1107, 1121 (Fed. Cir. 1985)); *see also Phillips v. AWH Corp.*, 415 F.3d 1303, 1323 (Fed. Cir. 2005) ("[A]lthough the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments.")

c. Extrinsic Evidence Supports Nokia and the Staff's Construction

Extrinsic evidence, including inventor testimony and corresponding standards contributions submitted by the inventors near in time to the inventions, supports Nokia and the Staff's proposed construction.

i. Inventor Testimony Confirms the Invention is Parallelizable

Inventor Jani Lainema testified that the invention is parallelizable. In his August 21, 2025, deposition, Mr. Lainema was asked about one of his standards contributions, JCTVC-H0252 (CXM-0011), which is related to JCTVC-G593 (CXM-0010) and inventions claimed in the '714

Patent. Mr. Lainema testified to the following with respect to the "Proposed Method" of the contribution:

> Q: And why are you making comparisons between motion information here?
>
> A: I believe that the motivation here is not to have many duplicate motion vector prediction candidates or merge candidates in the merge list.
>
> Q: So performing this process, what's the first step?
>
> A: Well, I don't think there's really an order of things here. This is more of a – it's a list of conditions.
>
> Q: And there's a series of comparisons that are going to be made, right?
>
> A: There is a set of comparisons that's being made here.
>
> **Q: And presumably, a program has to have some order in which it does those comparisons, right?**
>
> **A: Not necessarily**.
>
> **Q: Would these comparisons be done in parallel?**
>
> **A: I believe at least some of those can be done in parallel.**

JXM-0009C at 121:17-122:14 (emphasis added). Thus, inventor Jani Lainema's understanding coincides with Nokia and the Staff's proposed construction in two respects: First, there is no necessary order to the candidate selection and subsequent comparison steps. Second, the inventions are parallelizable. Both points support Nokia and the Staff's proposed construction, are consistent with the intrinsic record, and contradict Respondents' proposed construction.

ii. Corresponding Standards Contributions by the Inventors Support a Parallelizable Process

The '714 Patent's inventors' corresponding standards contributions, which were near in time to the inventions, also support Nokia and the Staff's construction. For example, JCTVC-G593 is an ITU-T standards contribution titled "Non-CE13: Simplification of merge mode." CXM-0010 at 1. In JCTVC-G593, the '714 Patent's inventors commented that "the proposed changes are more

suitable for parallel processing. . .” *Id*. at 5. As another example, JCTVC-H0252 titled “CE9: Results of SP experiments on simplification of merge process”, also supports a parallelizable process. According to JCTVC-H0252, one of the benefits of the invention is “[a]ll spatial and temporal MVP candidates can be derived independently in parallel.” CXM-0011 at 2. JCTVC-H0252 continues by noting “[t]his helps reducing either number of cycles or number of gates in a hardware implementation.” *Id*. According to JCTVC-H0252, the proposed method was intended to allow for reducing the number of motion comparisons in a “parallel-friendly way.” *Id*. at 1.

d. Respondents’ *Markman* Exhibits Fail to Support Their Proposed Construction

Respondents’ exhibit list includes Nokia’s initial infringement contentions for the ’714 Patent as evidence in support of their proposed construction. *See* RXM-0075C (Nokia’s Initial ’714 Infringement Contention Chart for Acer), RXM-0076C (Nokia’s Initial ’714 Infringement Contention Chart for ASUS), and RXM-0077C (Nokia’s Initial ’714 Infringement Contention Chart for Hisense). Nokia’s initial infringement contentions (to the extent relevant to this claim construction dispute)[2] are consistent with Nokia and the Staff’s proposed construction.

Nokia’s initial infringement contentions show that the available spatial motion vector prediction candidates are selected as the first spatial motion vector prediction candidate when determining whether to include the spatial motion vector prediction candidate in the motion vector prediction list. *See* RXM-0075C at 66-70. For example, Subclause 8.5.3.2.3 of the H.265 Standard, as disclosed in Nokia’s initial infringement contentions for decoding claims, shows that the spatial motion vector prediction candidates A0, A1, B0, B1, and B2 are processed.

[2] For the purposes of this argument, Nokia’s infringement contentions for Acer, ASUS, and Hisense are materially similar (other than that Hisense is only being accused of infringing decoding claims).

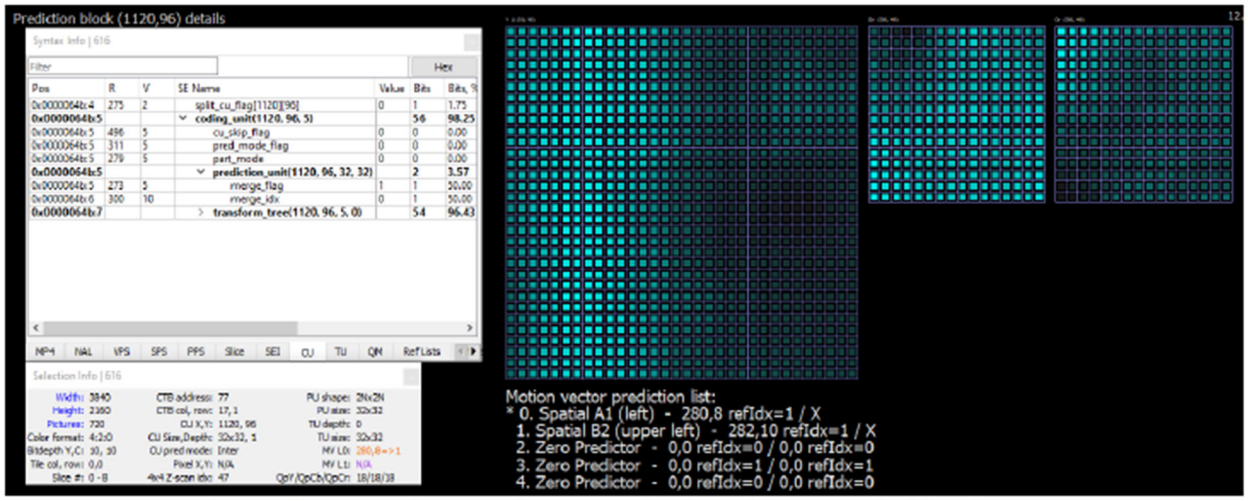
> As specified in Subclause 8.5.3.2.3 of the H.265 Standard, the spatial motion vector prediction candidates A0, A1, B0, B1, and B2 (see Figure 8-3) are processed. For each location A1, B1, B0, A0, and B2, the Accused Products check the availability of the block as specified in Subclause 6.4.2. If a block is coded in intra-coding or not available (e.g., the block is outside of the current slice or tile), its availability flag is set to FALSE, and it is not considered as a candidate for motion vector prediction and it is not added to the candidate list.

Id. at 67. For each of the locations, a first spatial motion vector prediction candidate is checked to see whether the block is available and, if so, the spatial motion vector prediction candidate is considered for processing to be added to the motion vector prediction list. *Id*. This is done so by noting the corresponding availableFlag as TRUE and then building the merge list once the values have been returned.

> For the derivation of $availableFlagB_0$, $refIdxLXB_0$, $predFlagLXB_0$ and $mvLXB_0$ the following applies:
>
> – The luma location ($xNbB_0$, $yNbB_0$) inside the neighbouring luma coding block is set equal to (xPb + nPbW, yPb − 1).
>
> – The availability derivation process for a prediction block as specified in clause 6.4.2 is invoked with the luma location (xCb, yCb), the current luma coding block size nCbS, the luma prediction block location (xPb, yPb), the luma prediction block width nPbW, the luma prediction block height nPbH, the luma location ($xNbB_0$, $yNbB_0$) and the partition index partIdx as inputs, and the output is assigned to the prediction block availability flag $availableB_0$.

Id. at 67-89 (B0 example). This is consistent with Nokia and the Staff's construction as a decoder operating according to H.265 Standard may consider first spatial motion vector prediction candidates independently in parallel or in several possible orders. *Id*.

Respondents' may argue that the screenshots provided in support of claim limitation 1[B] support their proposed construction. These arguments, however, would be incorrect. For example, on page 9 of Nokia's initial infringement contentions to Acer, the screenshot of VQ Analyzer shows a completed motion vector prediction list.



Source: Screenshots of VQ Analzyer software analyzing video encoded by the Acer Vero.

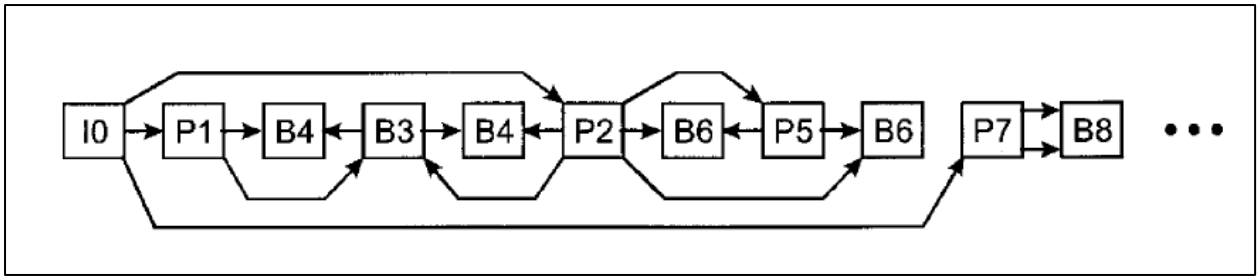
Id. at 9. Respondents' may argue that the ordering of the motion vector prediction list proves that there is an order to how spatial motion vector prediction candidates are processed. While the motion vector prediction list itself must be ordered so the merge index can be correctly positioned, this is not evidence that the spatial motion vector prediction candidates are processed in any specific order (not that any specific order is required) when generator such a motion vector prediction list. The spatial motion vector prediction candidates, as claimed by the '714 Patent's independent claims and supported by intrinsic and extrinsic evidence above, may be processed in parallel or in any order. The order of the final motion vector prediction list does not evidence that the spatial motion vector prediction candidates were processed in any certain order. All this shows is that, in the example above, spatial motion vector prediction candidates A1 and B2 were added to the merge list after the available spatial motion vector prediction candidates were processed.

D. ’267 Patent

1. Technical Background to the ’267 Patent

a. Bi-Directional Prediction

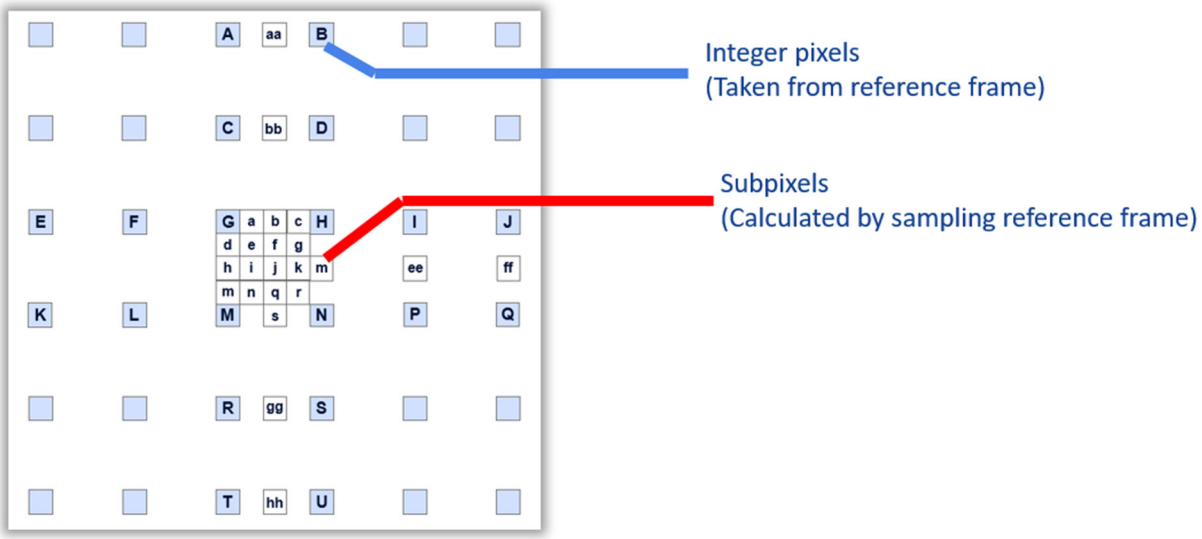
The ’267 Patent is directed to improvements in the error accumulation and coding efficiency of bi-directional motion compensated prediction (“bi-prediction”). Bi-prediction involves taking pixel values from two reference blocks to obtain separate predictions of a pixel value in a given frame, and combining them to reach a more accurate prediction. *See* CXM-0018 ¶ 53. An example of the interdependencies between a sequence of frames using the bi-prediction technique is reproduced below.



JXM-0007 (’267 Patent) at Fig. 8. Each block labeled “B” is a bi-predicted frame, utilizing references in the past and/or future to arrive at predictions for pixel values in the current frame.

b. Motion vectors

In traditional video coding, motion vectors are described with several degrees of precision. Some measurements use pixel precision: The smallest difference each motion vector can address is one pixel. Pixel precision motion vectors are represented in integers (e.g., the motion vector (1, 1)). Other measurements use subpixel precision: Motion vectors with subpixel precision can address differences measured by fractions of a pixel. An example arrangement of these coordinates provided by Dr. Iain Richardson is displayed below.



CXM-0018 (Richardson Dec.) at ¶ 53; *see also* JXM-0007 ('267 Patent) at Fig. 12 (depicting a substantially similar graphical representation). A system can choose to represent integer pixel and subpixel measurements with the same number of bits.

Advanced video coding technology measures predictions in subpixels when, for example, the prediction has been derived with the help of a P-tap filter. *See* JXM-0007 at 12:56-13:8; CXM-0018 ¶ 94. A P-tap filter uses the values of pixels in adjacent reference blocks, for example a 6-tap filter would select 6 pixels. *See id.* These pixels are selected because they have some correlation to the location of the interpolated result (as determined with the use of motion vectors). Using the values of pixels in adjacent blocks measured in whole pixels, the result of the filter will be of a subpixel precision, higher than the inputs. The purpose of using multiple correlated input values is to improve the accuracy of measurement and produce a more precise resulting value. The effect of subpixel interpolation can be seen in the frame below:

Figure 6.47 QCIF frame close-up, interpolated version, CIF version

CXM-00017 (*Coding Video*) at 358 (illustrating a sub-pixel interpolated reference frame).

Comparing the above frames, the left utilizes whole pixel encoding, while the center and right utilize subpixel interpolation at half pixels. This process is distinct from merely multiplying a location by a constant weight. The latter is not correlated with the result at all and cannot contribute to obtaining a more accurate measurement.

c. Registers

A register is memory where a sequence of bit values may be stored and accessed at high speed. *See* CXM-0015 at 24. This sequence may represent a numerical value or a memory address where a piece of data is stored. The number of bits of information which a register can store is determined by the architecture of the register. For example, the ARM CPU architecture provides 32-bit general-purpose registers. *See id.* at 27. ARM also provides instructions to only treat some of those 32 bits as meaningful to the calculation: LDRB/STRB. LDRH/STRH, and LDR/STR are instructions to load or store 8-bit bytes, 16-bit halfwords, and 32-bit words, respectively.

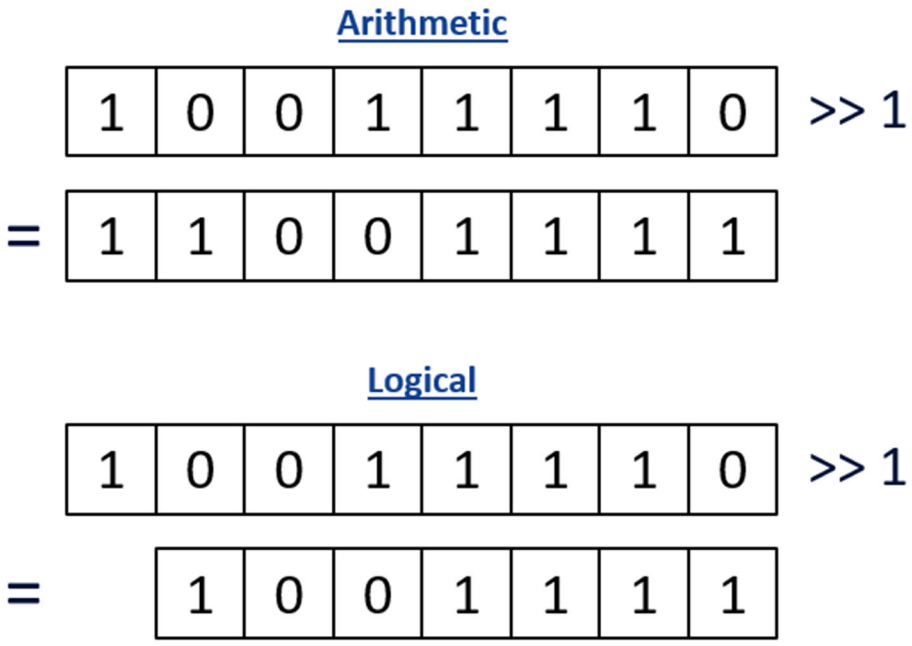
Loading a value less than 32 bits into a 32-bit register is known as "promotion." *See id.* For example, loading a signed 8-bit value sign-extends the value, *i.e.*, looks at the sign bit and fills

the upper 24 bits with that sign (0 for positive, 1 for negative). *Id.* This has the effect of preserving arithmetic operations involving negative numbers. Even though the number has been promoted to 32 bits in order for arithmetic operations to maintain correctness, the sign-extended bits of an 8-bit number in a 32-bit register will not change: they will not contribute to the precision with which one can represent numbers in the register at that time. The sign-extended bits will remain all zeroes or all ones until the register is repurposed. *See generally id.*

a. Bit Shifting

An arithmetic bit shift is a shift operation which preserves the sign bit of the sequence of bits. A shift operation merely moves values stored in a sequence of bits for a number of "places" in the direction specified, without any other behavior. An arithmetic shift, on the other hand, is used in video coding because of the prevalence of signed number representations. A signed number representation reserves the most significant bit[3] of a sequence of bits (represented throughout as the leftmost bit) to denote whether the number is positive or negative: if the sign bit is 0, the number is positive, and if the sign bit is 1, the number is negative. As such, arithmetic shifts and logical shifts are equivalent for positive numbers. The difference between an arithmetic right shift and a logical right shift of a sequence of bits with a sign bit suggesting that its value is negative is displayed below.

[3] The "most significant bit" of a sequence of bits refers to the bit of the highest "place" in the sequence. A sequence of bits can represent a number in base 2. For example, a 3-bit string has, from most significant to least significant, a 2^2's place, a 2^1's place, and a 2^0's place. The 2^2's place is the most significant bit because a 1 in that place corresponds to the decimal number 4, which is greater than all other places in the sequence of bits.



See CXM-0018 ¶¶ 94-95. In both shifts, the values stored in all bits move one "place" to the right. But in the arithmetic shift, the most significant bit (the sign bit) is preserved. In both shifts, the value of the least significant bit is lost as it is overwritten by the next-most-significant bit.

d. Problems in the Art Prior to the '267 Patent

A video encoded using bi-prediction inevitably accumulates rounding error over time, reducing the accuracy of the resulting signal. Techniques in the art to reduce accumulated error include, for example, applying a rounding offset to each prediction. *See* JXM-0007 ('267 Patent) at 3:56-65; CXM-0018 at ¶ 94. One possible solution discussed in the '267 Patent was signaling the direction that should be used for rounding (i.e., rounding up or down) to correct for rounding error by applying the signaled rounding in the decoder. JXM-0007 ('267 Patent) at 4:14-20. However, the '267 Patent noted that this solution increases the complexity of encoder and decoder implementations since two separate code branches would need to be written for performing bi-

prediction. *Id.* at 4:21-25. Additionally, adding another value to be signaled to the decoder increases the amount of data which must be included in a bitstream, reducing compression efficiency.

e. The ’267 Patent’s New Bi-Prediction Process Solved Problems in the Art

The ’267 Patent proposed a better solution. Instead of attempting to add additional code paths to conventional bi-prediction or inserting other signals into the bitstream, it changed bi-prediction itself to reduce the impact of rounding errors. The inventors of the ’267 Patent realized that during bi-prediction, prediction values are at a higher precision and thus that rounding errors have a smaller effect on the prediction signal. JXM-0007 (’267 Patent) at 13:51-55. By retaining this higher precision as the combination of prediction signals occurred and later reducing precision, rounding errors could be made negligible because they would occur in portions of the signal that would be lost after precision was reduced. *See id.* This solution allowed the rounding error problem to be solved without the need for additional signaling overhead or the addition of separate code branches. *See id.* 6:51-57.

f. The ’267 Patent Improves Accumulated Error Over the State of the Art

The inventors of the ’267 Patent recognized a need to further decrease accumulated error. By using subpixel interpolation, the claimed invention was able to reduce accumulated error. As the ’267 Patent explains, the claimed invention combines two prediction values a higher precision to form a bidirectional prediction P, to predict a current pixel with a certain precision and bit depth. JXM-0007 (’267 Patent) at 13:43-55. This approach allows reference frames to be stored at their original bit depth but uses high bit-depth operations for sub-pixel interpolation and bi-prediction to avoid loss of precision before a final bi-prediction was calculated. *Id.* at 12:41-14:27. With this

novel aspect, the resulting prediction P is more accurate and possesses decreased rounding error when it is transformed to the original bit depth. *Id.* at 4:29-35.

b. The Claimed Invention Improves Coding Efficiency Over the State of the Art

The inventors of the '267 Patent also observed that the accuracy of predictions relates to coding efficiency. *Id.* at 3:12-24; 3:49-51. Because the residual error resulting from a more accurate prediction will be smaller, that residual contributes fewer bits when quantized, entropy coded and included in the bitstream. *See* CXM-0018 (Richardson Dec.) at ¶ 92 (explaining that more accurate predictions result in improved compression efficiency).

Claim 25 is illustrative:

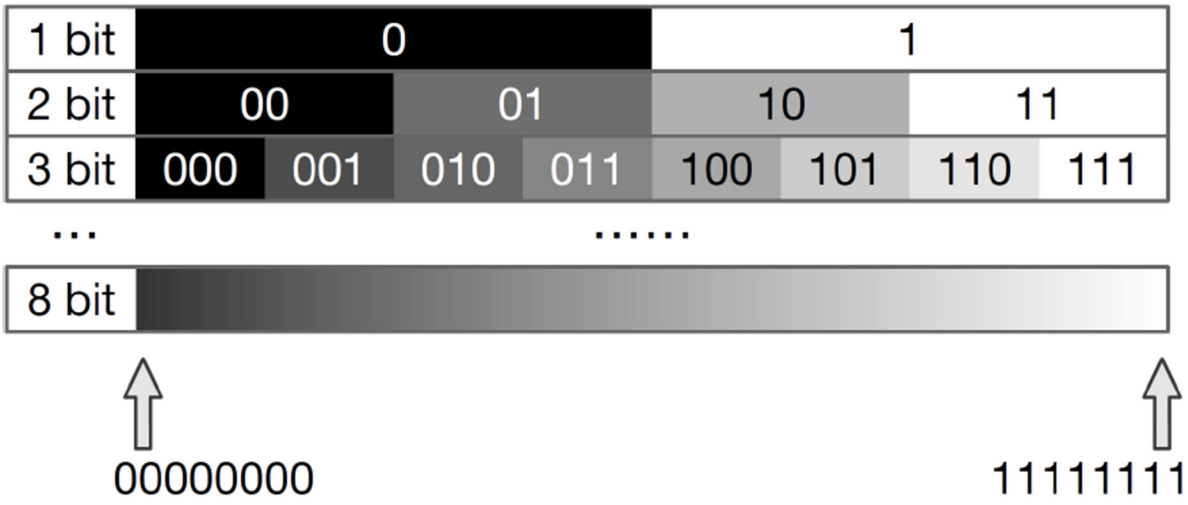
25. An apparatus for decoding a block of pixels, the apparatus comprising:

> at least one processor and at least one memory including computer program code, the at least one memory and computer program code configured to, with the at least one processor, cause the apparatus to:
>
> determine, for a current block, a first reference block based on a first motion vector and a second reference block based on a second motion vector, wherein the pixels of the current block, the first reference block, and the second reference block have values with a first precision;
>
> use said first reference block to obtain a first prediction, said first prediction having a second precision, which is higher than said first precision;
>
> use said second reference block to obtain a second prediction, said second prediction having the second precision;
>
> obtain a combined prediction based at least partly upon said first prediction and said second prediction;
>
> decrease a precision of said combined prediction by shifting bits of the combined prediction to the right; and
>
> reconstruct the block of pixels based on the combined prediction.

2. The ALJ Should Adopt Nokia's Proposed Construction of "Precision" or Alternatively the Staff's

The term "precision" should be construed according to its plain and ordinary meaning, which means a measure of the number of distinct alternatives from which a value can be determined: for example, in binary representation, a number of bits required to represent each possible distinct alternative. Alternatively, the ALJ should adopt the Staff's proposed construction, which includes the second half of Nokia's proposed construction: "a number of bits required to represent each possible distinct alternative."

As the intrinsic and extrinsic records show, the term "precision" refers to how many distinct alternatives of a value can be represented. The concept of precision is important in video coding because higher precision predictions will result in a smoother image and a more efficient coding. *See* CXM-0018 (Richardson Dec.) at ¶¶ 38-39 (showing different amounts of distinct alternative grayscale values for different precisions of luma), 92. For example, as Dr. Richardson's declaration in a previous engagement explains, the luma value of a pixel represents how bright or dark that pixel is. Representing a wider array of distinct alternatives requires representing luma with a higher precision and thus a larger number of bits.



CXM-0018 (Richardson Dec.) at ¶¶ 38-39; RXM-00046 (IPR2024-00626: Nokia Ex. 2015, Declaration of Iain Richardson) at 15. However, the number of bits used to represent a value is not the same as the value's precision—precision refers to the number of distinct alternatives that a value can take.

Nokia and the Staff's proposed constructions capture this plain meaning of "precision" and is supported by the record. The patent's specification consistently uses precision to refer to the number of distinct alternatives from which a value can be determined. Further, the prosecution history is consistent with this meaning—the distinction between number of bits and precision formed one basis on which the examiner allowed the claims. Further, Nokia and the Staff's proposed constructions are supported by the testimony of the inventors and video coding academic sources.

Respondents' proposed construction is rooted in a fundamental misunderstanding of precision because it ignores the number of distinct alternatives that a value can take and appears to only consider the number of bits being used. Stated simply: although higher precision values will require more bits to represent, the use of a higher number of bits is not sufficient to determine if a value is at a higher precision. Under Respondents' apparent interpretation of their proposed construction, a coin flip represented using three bits (e.g., "000" for heads and "111" for tails) would have a higher precision than the same coin flip represented more efficiently using a single bit (e.g., "0" for heads and "1" for tails). But a coin flip has only two possible outcomes, so it is not possible to represent the result of a coin flip any more precisely. The ALJ should reject Respondents' proposed construction because it suggests that a value could have arbitrarily high precision by representing it using a larger binary number, which is inconsistent with both the intrinsic and extrinsic records.

a. The Intrinsic Record Shows That Precision Entails Additional Information and Supports Nokia and Staff's Constructions

The '267 Patent uses the term precision to refer to the number of distinct alternatives from which a value can be determined. For example, the '267 Patent discusses the precision of prediction signals throughout its specification. *See, e.g.,* JXM-0007 at 4:32-35 ("according to some embodiments prediction signals are maintained in a higher precision . . . and the precision is reduced after"), 12:60-13:18 ("the precision M is higher than the precision of the expected prediction value"), 13:43-55 ("the result is then converted to a smaller precision . . . after this conversion the precision of the prediction signal corresponds with the precision of the input values").

Figure 11 of the '267 Patent illustrates a bi-prediction process according to one embodiment of the invention.

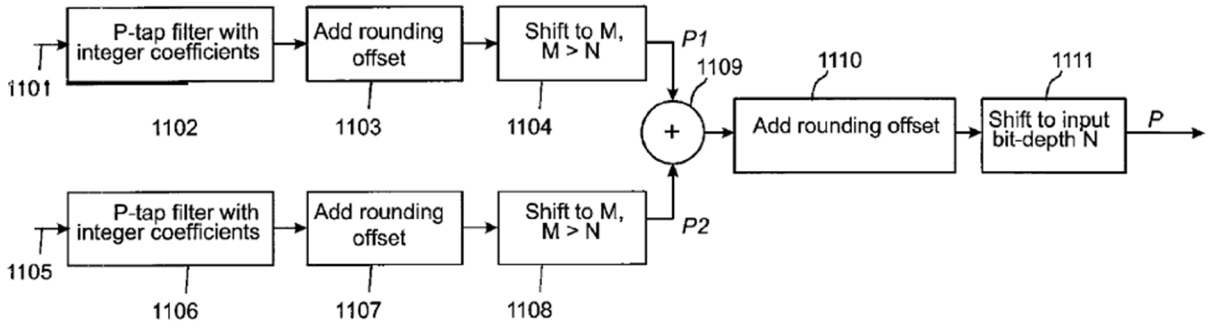


Fig. 11

JXM-0007 ('267 Patent) at Fig. 11.

As shown in Figure 11, the bi-prediction process of the '267 Patent starts by forming predictions using pixel values of reference blocks which have a bit-depth and precision of N bits. *Id*. at 12:52-13:8 (explaining how predictions are computed from pixels), 13:14-18 (explaining the bit depths used in reference to Figure 11). The patent discloses that a P-tap filter, one method

of forming predictions, results in an output with a higher precision than the input values because it involves combining multiple values (taken from pixels and sometimes subpixels near the a location in question) by weighting and summing them, increasing the number of distinct alternatives that the output prediction can have relative to its inputs.[4] *See id.* at 12:56-13:38 (explaining, in an example embodiment, the use of a P-tap filter to calculate the prediction value), 14:27-50 (explaining, in an example embodiment, weighting the inputs to a P-tap filter). As the '267 Patent explains, the output of a P-tap filter may have higher precision than is possible to represent in the registers available. *See id.* If the available registers can only hold M bits of precision, then the prediction can be right shifted down to M bits as shown in Steps 1104 and 1108. *See id.* at 13:12-14 (describing the first prediction being calculated at a higher precision), 13:40-42 (describing the second precision being calculated using the same method), 13:67-14:3 (describing shifting the higher precision intermediate calculation back to the input bit depth) 14:11-15 (describing rounding the higher precision intermediate calculations before combination to ensure the values fit within hardware registers). Although this intermediate reduction in precision may not be necessary for processors with sufficiently large registers, the precision of the prediction is reduced back to the expected bit-depth of N for display, as shown in Step 1111. *See id.* at 13:43-55, 13:63-67.

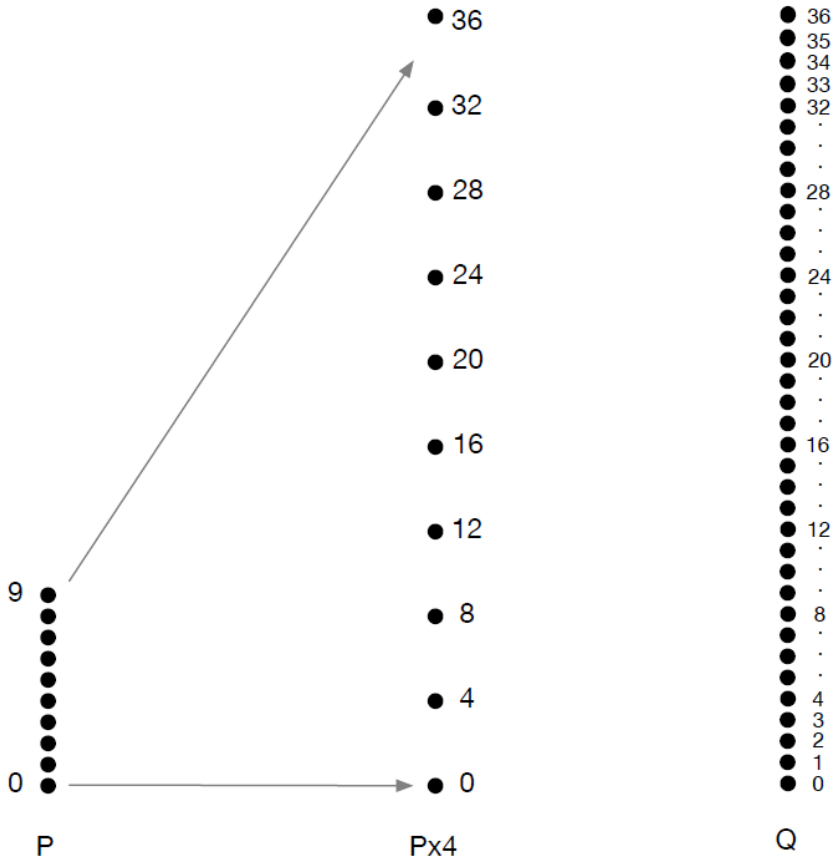
Each time the '267 Patent refers to precision, it refers to the number of distinct alternatives from which a value is determined. Even where the '267 Patent refers to "the precision of registers which store the filtering results," precision refers to the number of distinct alternatives for a value that a given register can be used to represent. *See id.* at 13:40-42, 14:11-15. This means that a

[4] Because P-tap filters combine multiple independent values, they are unlike other operations, such as multiplying by a weight, which do not increase precision.

register can be used to store values with the same or a lower precision than that of the register itself. CXM-0018 (Richardson Declaration) ¶ 100. An M-bit register can store 2^M distinct alternatives and thus can store a single coin flip, which requires only one bit of precision, or as many as M coin flips (with each bit representing whether the corresponding coin was heads or tails). *See id.*; *see also* CXM-0016 (*Compile-Time and Instruction-Set Methods for Improving Floating- to Fixed-Point Conversion Accuracy*) at 24. Even if a prediction is calculated with more than 2^M distinct alternatives, some of that precision must be lost to store it in an M bit register in the same way that the combined precision must eventually be reduced to N bits for display as part of an N bit output picture, for example, because a television is only capable of displaying 2N different brightnesses of pixel as shown in Dr. Richardson's diagram, above.

b. The Prosecution History Supports Nokia's and the Staff's Proposed Constructions

A P-tap filter combines multiple independent values and thus results in higher-precision predictions relative to its inputs. However, certain operations can result in an increased bit-depth despite causing no increase in precision. An example of an operation which does not increase precision is multiplication. Applying a multiplicative factor such as a weight to a value only maps it to a new range of values without changing the number of distinct values. *See* CXM-0018 (Richardson Dec.) at ¶¶ 104-107 (demonstrating that multiplying by a constant weight does not increase precision). For example, given an integer *P* between 0 and 9 inclusive, multiplying *P* by 4 does not change the number of distinct alternatives:



CXM-0018 at ¶ 104.

This distinction came up during the prosecution of one of '267 Patent's family members. In the file history of U.S. Application No. 13/344,893, the applicants distinguished the disclosure of the '267 Patent from prior art involving multiplication by weights. CXM-0012 (U.S. Patent App. No. 13/344,893 File History) at 22. The question was whether a reference which disclosed multiplication of a prediction P0(x,y) by a weight w had disclosed a prediction at an increased precision. The applicant made clear that it did not, stating that such a multiplication would "simply serve to change the range of values" in the same way as the coin flip example discussed above. *See id*; *see also* CXM-0018 (Richardson Dec.) ¶¶ 100, 104-105.

> independent claims. Although the Official Action on page 5 appears to take the position that Ye discloses such an increase in precision from the reference blocks to the first and second predictions and contends that $w \cdot P_0(x,y)$ increases the precision of $P_0(x,y)$ and that $(W-w) \cdot P_1(x,y)$ increases the precision of $P_1(x,y)$. As discussed during the interview, however, $w \cdot P_0(x,y)$ and $(W-w) \cdot P_1(x,y)$ do not have increase precision relative to $P_0(x,y)$ and $P_1(x,y)$, respectively, and, instead, simply serve to change the range of values, such as by increasing the range of values in instances in which $W>w>1$. Such an increase in the range of values as in Ye does not teach or suggest that the precision increases such that Ye fails to teach or suggest any increase in precision from the reference blocks to the first and second predictions.

CXM-0018 (Richardson Dec.) at ¶¶ 108 (discussing CXM-0012 (U.S. Patent App. No. 13/344,893 File History) at 126).

Moreover, in some embodiments, the input values to the predictions are left shifted before filtering to produce predictions. Claim 4 depends on Claim 2, which requires obtaining a prediction by interpolation based on a sub-pixel motion vector. JXM-0007 ('267 Patent) at 21:35-38. In the context of Claim 4 and analogous dependent claims, the prediction resulting from the application of an integer component of a motion vector to a second reference block has an increased precision. JXM-0007 ('267 Patent) at 21:44-47 (Claim 4). This is true for a prediction resulting from a motion vector with both an integer and a sub-pixel component (which will involve interpolation). Collectively, Claims 2 and 4 explain how the system obtains predictions from two different cases: sub-pixel motion vectors and motion vectors with an integer component. The precision of Claim 1 reflects that the first and second predictions are selected from an increased number of possible distinct alternatives.

c. The Extrinsic Record Supports Nokia's and the Staff's Proposed Constructions

As Mr. Hallapuro discussed in his explanation of why a left shift does not increase precision, the term "precision" is closely related to the amount of information represented by a value. JXM-0010C (Hallapuro Tr.) at 133:6-13; *see also* RXM-0046 (IPR2024-00626 Declaration of Iain Richardson) at 15 (relating the precision used for luma value with number of shades of gray that it can represent).

First, the testimony of the '267 Patent's inventors and Dr. Richardson's explanations are consistent with the general understanding of term "precision" in the fields of video coding and signal processing. In the IEEE Authoritative Dictionary of Standard Terms, precision is defined as "[t]he degree of exactness or discrimination with which a quantity is stated." CXM-0016 at 5. Likewise, the Modern Dictionary of Electronics defines precision as:

> 1. The quality of being sharply or exactly defined- I.e., the number of distinguishable alternatives from which a representation was selected. This is sometimes indicated by the number of significant digits the representation contains. ***See*** also accuracy.
>
> ***2.*** Also called reproducibility ***or*** repeatability. The degree with which repeated measurements of a given quantity agree when obtained by the same method and under the same conditions.

CXM-0017 at 7 (emphasis in original). Both definitions align with Nokia and the Staff's proposed constructions: Precision measures how many distinct alternatives a value can be determined from.

Additionally, a signal processing textbook, *Embedded Systems – Shape the World*, explains that precision is the number of distinct or different values for a measurement. CXM-0015 (Valvano, J. and Yerrabali, R., *Embedded Systems – Shape the World* (2020)) at § 2.1 ("precision is the number of distinct or different values."). As a later chapter of the same textbook explains, this definition of precision is important because it relates the number of distinct values a

measurement can be selected from to the smallest change in a signal that can be distinguished by a measurement. CXM-0015 at § 7.1 ("Amplitude resolution is the smallest change in input signal that can be distinguished . . . Amplitude precision is defined as the number of distinct values from which the measurement is selected."). This is the same definition which Dr. Richardson used during a prior deposition regarding the '267 Patent:

> Q: So how do you determine how many bits are needed to represent a number?
>
> A: So generally, in this field, the number of bits needed to represent a number -- or in this context, the number of bits needed to represent a variable, for example, depends on the number of values that variable can take.
>
> Q: And how many bits do you need to represent the number 1,000?
>
> A So to answer that question, I need to -- assuming that's it a value of a variable, I need to know how many possible values that variable has.

RXM-00061 (Deposition of Iain Richardson EX. 1024 (IPR2024-00627)) at 206:21-207:11. Dr. Richardson continued:

> Q: In your opinion, when two numbers with -- withdrawn. In your opinion, when two variables have the same number of possible values, those two variables always have the same precision, correct?
>
> A: If I consider a first variable and I consider the definition -- that I understand the petitioner, the patent owner, Dr. Freedman and myself all agree that the definition of precision is that a number of bits needed to represent possible values, then, yeah, if two variables each have the same number of possible values the number of bits needed to represent those two variables is going to be the same.

Id. 214:11-215:4 (emphasis added).

Accordingly, the number of bits used to represent a value is connected to the precision of that value because a value with M bits of precision must be represented using at least M bits, otherwise it would not be possible to distinguish between each alternative. However, the number of bits used is not the same thing as precision because it only serves as a lower bound on

precision—a one-bit measurement of a coin flip can be represented using more than one bit, but that coin flip can only ever have one bit of precision. *See also* RXM-0046 (IPR2024-00626 Declaration of Iain Richardson) at 30 ("It is ***false*** that the use of a higher number of bits determines or implies that a value is at a higher precision" (emphasis in original)); CXM-0018 (Richardson Dec.) ¶ 103 (reiterating Dr. Richardson's opinion that "whilst it is true that a higher precision value will require more bits to represent, it is false that the use of a higher number of bits determines or implies that a value is at a higher precision.").

Furthermore, just as with multiplication, left shifting a value alone also does not increase its precision. Rather, left shifting only maps values to a different range without changing the number of distinct alternatives the value can have. *See* CXM-0018 (Richardson Dec.) at ¶ 104. The '267 Patent explains that left shifting may be used to align the bit depth of values so that they can be used in filter operations (may involve subpixel values with higher precision). JXM-0007 at 14:4-10 ("the bit-depth of prediction samples with integer accuracy may be increased by shifting the samples to the left"). A left shift merely adds zeroes to the end of the value, which alone does not increase precision because it does not increase the number of distinct alternatives from which a value can be determined. Jani Lainema, one of the '267 Patent's inventors, testified to the following:

> Q: How do you increase or decrease the precision of a prediction?
>
> A: I think there are different ways of doing that. For example, to increase the precision, you can apply interpolation.
>
> Q: And might you do that by shifting bits?
>
> A: Sorry, can you repeat?
>
> Q: Can you do that by shifting bits; is that an operation you use?
>
> A: No.

. . .

Q: Shifting bits to the right is one way of decreasing precision, right?

A: I believe that is the case.

Q: And shifting bits to the left would increase the precision?

A: No.

Q: Why not?

A: It basically only multiplies the number by a certain amount. It doesn't affect the precision of the data, it only makes the data bigger.

JXM-0009C (Lainema Tr.) at 143:3-14, 144:10-20. Likewise, Mr. Hallapuro, another inventor of the '267 Patent, testified to the following:

Q: A shift to the left? Okay. And that's an increase in precision?

A: No.

Q: Why is that not an increase in precision?

A: It doesn't bring any new information to the result.

. . .

Q: Have you ever heard of a left shift that can increase precision?

A: Well, only if it's involved with something else that doesn't put only zeros to their -- those lower bits. But, yeah, **just shifting left does not increase precision**.

JXM-0010C (Hallapuro Tr.) at 133:6-13, 144:23-145:4 (emphasis added). Left shifting, which mathematically is multiplication, only makes the number bigger, but left shifting does not add any new information. In other words, a value that has been multiplied or left shifted still has the same number of distinct alternatives and has not increased in precision.

d. Respondents' Proposed Construction is Ambiguous, But to the Extent It is Inconsistent with Nokia and the Staff's Construction, Respondents' Proposed Construction Contradicts Both the Intrinsic and Extrinsic Records

Respondents' proposed construction is ambiguous and fails to properly capture the way "precision" is used both in the '267 Patent and by experts in the field of the invention. Under a generous interpretation, "a number of bits needed to represent possible values" could be understood to refer to the minimum number of bits necessary to account for each possible distinct alternative that a value could take (consistent with Nokia's and the Staff's proposals). However, based on the parties' meet and confer, Respondents appear to be interpreting their proposed construction differently. Respondents appear to interpret their construction as something akin to "a number of bits used to represent a given value" such that "precision" is divorced from the number of possible values or distinct alternatives a measurement can take. For Respondents, the upside appears to be that multiplying the result of a measurement or prediction could—under Respondents' theory—increase that measurement or precision's precision. For example, Nokia anticipates that Respondents will argue that a prior art reference that multiplies lower precision predictions by fixed values increases the precisions of those predictions even though no information about those predictions is gained.

In IPR Nos. IPR2024-00626 and IPR2024-00627, Petitioner Amazon appeared to take the position that "a number of bits ***needed*** to represent possible values" meant something akin to a number of bits used to represent a given value (even if those bits were not needed). RXM-0044 (IPR2024-00626 Institution Decision) at 8; RXM-0047 (IPR2024-00627 Institution Decision) at 8. As Dr. Richardson explained in his deposition during those engagements and in his declaration in this matter, such a misinterpretation would render the term "precision" meaningless because it

would allow any measurement or prediction to have any precision (potentially infinite precision) simply by multiplying that value or by changing the number of bits used to represent the measurement or prediction. RXM-00061 11 (IPR2024-00627 Deposition of Iain Richardson) at 206:21-207; CXM-0018 (Richardson Dec.) at ¶ 104. Increasing precision would be functionally equivalent to adding strings of 0's to a number without gaining any real information. But this understanding of precision directly contradicts the way the term is used in the specification and the positions taken by the applicants during prosecution. If the number of bits used to represent a value was equivalent to precision, then multiplying a prediction by a weight would result in a higher precision value, which is not the case and was an important point of distinction before the patent office. CXM-0012 (U.S. Patent App. No. 13/344,893 File History) at 126. Further still, this understanding contradicts the way that "precision" is used in related fields. CXM-0015 (Valvano, J. and Yerrabali, R., *Embedded Systems – Shape the World* (2020) at § 2.1 ("precision is the number of distinct or different values.").

Accordingly, Respondents' proposed construction should be rejected, particularly if Respondents' proposed construction is interpreted as "a number of bits used to represent a given value" in contrast to Nokia and the Staff's proposed constructions. In any event, Respondents' proposed construction invites confusion and future disputes as to its meaning between the parties and should further be rejected on that basis.

VI. CONCLUSION

For the foregoing reasons, the ALJ should adopt Nokia and Staff's proposed constructions for the '321, '701, and '714 Patent disputed terms, and the ALJ should adopt Nokia's proposed construction for the '267 Patent disputed term or, alternatively, Staff's proposed construction.

CERTIFICATE OF WORD COUNT COMPLIANCE

Pursuant to Ground Rule 1.7 the undersigned hereby certifies that the forgoing brief complies with the word-count limitation, and contains 23,518 words according to the word-processing program used to prepare this document (Microsoft Word). The word count includes footnotes. The word count does not include captions, table of contents, table of authorities, words in figures, the word count certificate, the signature block, or the certificate of service.

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Respectfully submitted,

/s/ Joshua J. Newcomer

Joshua J. Newcomer
jnewcomer@mckoolsmith.com
Veronica Manning
vmanning@mckoolsmith.com
MCKOOL SMITH P.C.
600 Travis St., Suite 7000
Houston, Texas 77002
Telephone: (713) 485-7300
Facsimile: (713) 485-7344

Warren Lipschitz
wlipschitz@mckoolsmith.com
Erik Fountain
efountain@ McKoolSmith.com
Alexandra Easley
aeasely@mckoolsmith.com
MCKOOL SMITH P.C.
300 Crescent Court, Suite 1500
Dallas, Texas 75201
Telephone: (214) 978-4000
Facsimile: (214) 978-4044

Joshua Budwin
jbudwin@mckoolsmith.com
R. Mitch Verboncoeur
mverboncoeur@mckoolsmith.com
MCKOOL SMITH P.C.
303 Colorado, Suite 2100
Austin, Texas 78701
Telephone: (512) 692-8700
Facsimile: (214) 978-4044

Jamie Levien
jlevien@mckoolsmith.com
MCKOOL SMITH P.C.
1717 K Street NW, Suite 1000
Washington, DC 20006
Telephone: (202) 370-8300
Facsimile: (202) 370-8344

Counsel for Complainants Nokia Technologies Oy and Nokia Corp.

CERTIFICATE OF SERVICE

I, Kim Jackson, hereby certify that on September 10, 2025, a true and correct copy of the foregoing document was served by the indicated means to the persons at the addresses below:

The Honorable Lisa R. Barton Secretary to the Commission **U.S. International Trade Commission** 500 E Street, SW, Room 112 Washington, DC 20436	☐ Via Hand Delivery ☐ Via Express Delivery ☐ Via First Class Mail ☒ Via EDIS
The Honorable MaryJoan McNamara Administrative Law Judge **U.S. International Trade Commission** 500 E Street, S.W. Room 317 Washington, D.C. 20436	☐ Via Hand Delivery ☐ Via Express Delivery ☐ Via First Class Mail ☒ Other: Email to McNamara337@usitc.gov
Marissa Ducca, Esq. Office of Unfair Import Investigations **U.S. International Trade Commission** 500 E Street, S.W., Room 401 Washington, D.C. 20436	☐ Via Hand Delivery ☐ Via Express Delivery ☐ Via First Class Mail ☒ Other: Email and Box to Marissa.Ducca@usitc.gov
Stephanie L. Roberts **Morgan, Lewis & Bockius LLP** 1111 Pennsylvania Ave, N.W. Washington, D.C. 20004-2541 Telephone: (202) 739-3000 Facsimile: (202) 739-3001 Craig Kaufman **TechKnowledge Law Group LLP** 20660 Stevens Creek Blvd. Suite 381 Cupertino CA 95014 Telephone: (650) 517.5200 Facsimile: (650) 226.3133 *Counsel for Respondents Acer Inc. and Acer America Corporation*	☐ Via Hand Delivery ☐ Via Express Delivery ☐ Via First Class Mail ☒ Other: Email to nokia-acergroup@morganlewis.com Acer-TKLGService-1448@tklg-llp.com
Joseph V. Colaianni, Jr. Linhong Zhang Jack Wilson, IV	☐ Via Hand Delivery ☐ Via Express Delivery ☐ Via First Class Mail

Damien Thomas **Fish & Richardson P.C.** 1000 Maine Ave., SW, Suite 1000 Washington, DC 20024 Telephone: (202) 783-5070 *Counsel for Respondents ASUSTeK Computer, Inc. and ASUS Computer International*	☒ Other: Email to serviceasusnokiaitc@fr.com
Bas de Blank **Orrick, Herrington & Sutcliffe LLP** 1000 Marsh Road Menlo Park, CA 94025-1015 Tel: (650) 614-7400 Fax: (650) 614-7401 *Counsel for Respondents Hisense Co., Ltd., Hisense USA Corporation, and Hisense Electronics Manufacturing Company of America Corporation*	☐ Via Hand Delivery ☐ Via Express Delivery ☐ Via First Class Mail ☒ Other: Email to Hisense-1448-Service@orrick.com

/s/ Kim Jackson
Kim Jackson
Senior Paralegal
McKool Smith