

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SNAP INC. and HISENSE USA CORPORATION,

Petitioners,

v.

NOKIA TECHNOLOGIES OY,

Patent Owner.

IPR2025-01263

U.S. Patent No. 10,536,714

PETITION FOR INTER PARTES REVIEW

OF U.S. PATENT NO. 10,536,714

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EXHIBIT LIST

Exhibit No.	Description
1001	U.S. Patent No. 10,536,714 to Bici, et al. (“the ’714 patent”)
1002	Prosecution File History for the ’714 patent (“Prosecution History”)
1003	Declaration of Charles Creusere (“Creusere Declaration”)
1004	U.S. Patent Application Publication No. 2011/0194609 to Rusert et al (“Rusert”)
1005	U.S. Patent Application Publication No. 2011/0249721 to Karczewicz et al (“Karczewicz”)
1006	U.S. Patent Application Publication No. 2014/0092981 to Lin et al (“Lin”)
1007	IPR2024-00604, Paper 11: Decision Granting Institution of Inter Partes Review
1008	IPR2024-00605, Paper 11: Decision Granting Institution of Inter Partes Review
1009	Sung Deuk Kim and Jong Beom Ra, An Efficient Motion Vector Coding Scheme Based on Minimum Bitrate Prediction, IEEE Transactions on Image Processing, Vol. 8, No. 8 (Aug. 1999)
1010	Ken McCann and Thomas Davies, Samsung and BBC Response to Call for Proposals on Video Compression Technology (2010)
1011	JCTVC-A124, Samsung’s Response to the Call for Proposals on Video Compression Technology, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11, 1 st Meeting, Dresden, DE, 15-23 April, 2010.
1012	U.S. Provisional Application 61/301,649 (“Rusert Provisional”)
1013	U.S. Provisional Application 61/500,903 (“Lin Provisional”)
1014	U.S. Patent Application Publication No. 2012/0128067 to Liu (“Liu”)
1015	Gary J. Sullivan, Recent Developments in Standardization of High Efficiency Video Coding (HEVC) (“Sullivan”)
1016	Frank Bossen, HEVC Complexity and Implementation Analysis (“Bossen”)
1017	Jian-Wei Chen et al, Introduction to H.264 advanced video coding. In: Proceedings of the 2006 Asia and South Pacific Design Automation Conference vol. 2006, PP. 736-741 (2006)

Exhibit No.	Description
1018	Won, Kwanghyun et al, Motion vector coding using decoder-side estimation of motion vector. In 2009 IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB). IEEE, 2009.
1019	Gary J. Sullivan et al, The H.264/AVC Advanced Video Coding Standard: Overview and Introduction to the Fidelity Range Extensions, SPIE Conference on Applications of Digital Image Processing XXVII, 2004.

The '714 patent purports to improve motion vector coding by comparing motion vector prediction candidates to subsets of other motion vector prediction candidates rather than comparing every possible pair of candidates. However, the Rusert prior art discussed herein had already disclosed the same alleged invention.

The Board previously instituted a pair of IPR petitions based on the same Rusert prior art but those cases were terminated prior to final written decision when Patent Owner settled with the prior petitioner. IPR2024-00604/605.¹

This Petition relies on the same prior art and presents substantially similar arguments to the prior IPR petitions. However, Petitioners here also address Patent Owner's main counterarguments from the prior IPR cases.

I. BACKGROUND

A. Inter Prediction and Candidate Motion Vectors

Since the 1990s, video-coding standards have applied “inter” or motion prediction to blocks (e.g., 8x8 pixel squares) in a video frame. Ex-1019, 000004, Figs. 1-2. This technique used motion vectors to describe the movement of blocks between frames. Ex-1017, 000002.²

¹ IPR2024-00604 involved the encoder-side claims whereas IPR2024-00605 involved the decoder-side claims.

² All emphasis/annotations added unless stated otherwise.

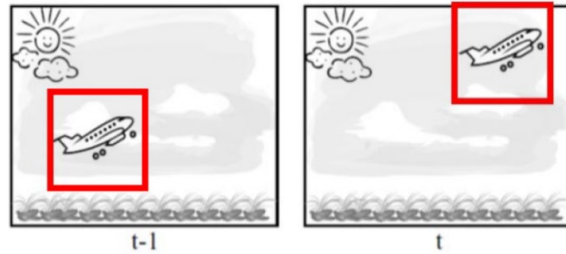
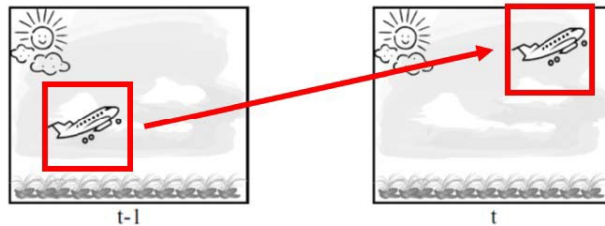


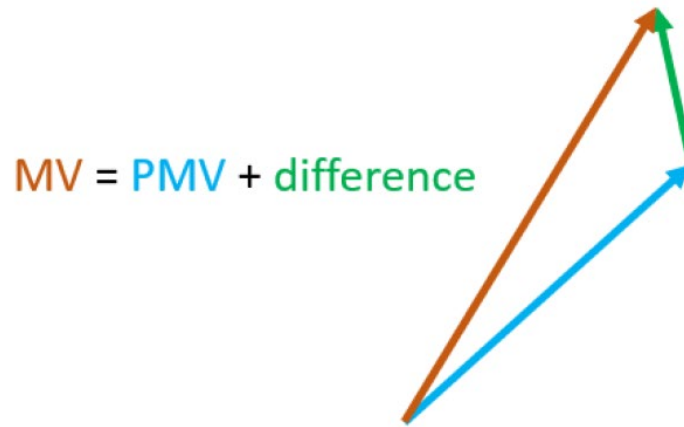
Fig. 3. Successive video frames

Instead of transmitting an entire block of pixels, an encoder signaled a motion vector, which the decoder used to locate the current block in a previously-coded frame (e.g., showing the airplane). The decoder then copied the pixels to the current block, thus eliminating the need for those pixels to be re-sent by the encoder. *Id.*, 000002-4; Ex-1018, 000001-3; Ex-1003, ¶¶4-8.



Many video-coding standards, including H.264, further reduced the size of video data by predicting the motion vectors themselves for a current block using motion vectors for prior blocks, and sending the difference between the predicted motion vector (“PMV”) or motion vector predictor (“MVP”) and the actual motion vector. This difference was typically much smaller than the full motion vector and thus required fewer bits. Since the encoder and decoder independently calculated the PMV, only the difference vector was transmitted, and the decoder calculated

the actual motion vector by adding the PMV to the difference vector. Ex-1018, 000001-2.



Ex-1003, ¶10.

By 2010, the idea of using neighboring blocks in the same frame to find PMV candidates was well-known. Ex-1003, ¶11. For example, this technique was described and applied in 1999 to MPEG-4:

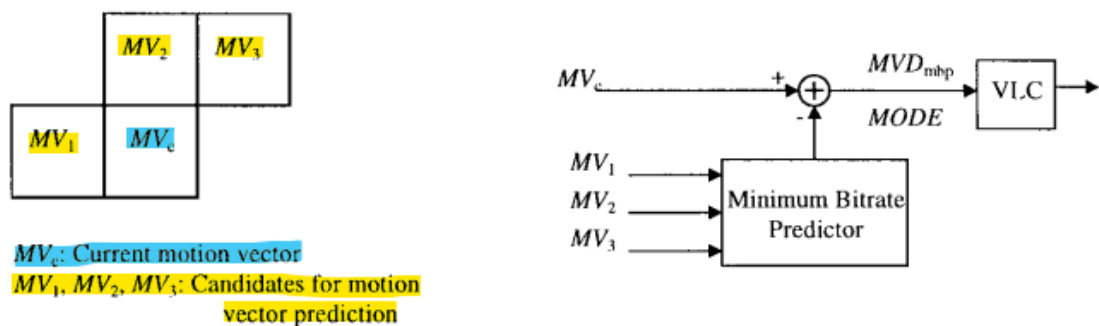


Fig. 1. Motion vector coding scheme.

Ex-1009, 1118. With this technique, neighboring candidates from the same frame were sometimes called *spatial* motion vector prediction candidates (as opposed to *temporal* motion vector prediction candidates taken from a different frame). Ex-

1018, 000001-3. Rusert described a similar approach for identifying PMV candidates and discusses application to H.264. Ex-1004, ¶¶2-3. Early drafts of the H.265 standard also obtained PMV candidates from neighboring blocks, which tended to share the same motion and were thus strong candidates for the current block. For example, Samsung's initial 2010 proposal referred to this technique as "Advanced Motion Vector Prediction (AMVP)":

Motion: **Advanced Motion Vector Prediction (AMVP)**

- Advanced Motion Vector Prediction (**AMVP**)
 - Extension of motion vector competition techniques
- Explicit motion vector predictor signaling
 - New candidate motion vectors
(motion vector candidates = {median(a' , b' , c'), a' , b' , c' , temporal predictor})
 - **Three spatial motion vectors (a' , b' , c')**
 - The first available one for each group (inter mode & same ref. idx)
 - Groups are the above group $\{a_0, a_1, \dots, a_{na}\}$, the left group $\{b_0, b_1, \dots, b_{nb}\}$ and the corner $\{c, d, e\}$
 - Median motion vector of three spatial motion vectors
 - Temporal motion predictor using one colocated motion vector
- **Signaling overhead is minimized**
 - Candidate order is adapted according to PU splitting
 - **Unnecessary or duplicated motion vectors are removed**

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Ex-1010, 12 (highlighting added); *see also* Ex-1011, 11-12 (discussing AMVP).

With these approaches, since the encoder and decoder independently generated the same candidate list (using the same information from neighboring

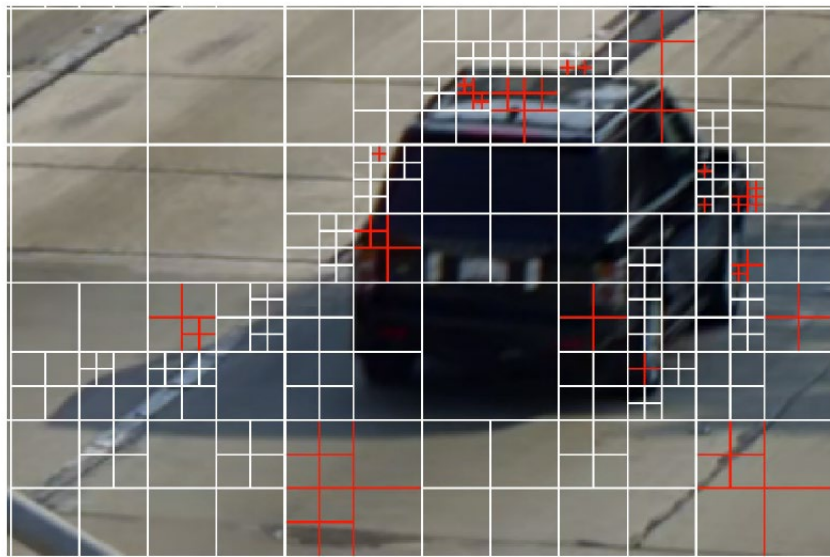
blocks), the encoder simply signaled to the decoder which candidate was chosen from the list, for example by sending an index value to signal a particular candidate from the list (*e.g.*, the *a'* candidate). *See, e.g.*, Ex-1009 at 1117-18 (discussing MODE bits for signaling the selected candidate from the set). These approaches reduced motion vector data because the encoder did not need to transmit the candidate list or even an entire motion vector; instead, the encoder transmitted a single, small number to signal as an index to signal which candidate in the set was ultimately chosen, and the decoder referred to its independently-constructed candidate list, which was identical to that of the encoder, to look up the selected candidate using the index. Ex-1004, ¶¶37; Ex-1003, ¶¶12-13.

A PMV candidate list with redundant candidates increased the list index size, requiring more bits. Thus, removing duplicates was known in the art (*e.g.*, Ex-1010 at 12 (“Unnecessary or duplicated motion vectors are removed”) (excerpted above)), and it was common to do so by comparing a subset of candidates, rather than every possible pair of candidates, to reduce computation. Ex-1003, ¶¶14-15. For example, Rusert taught “avoid[ing] duplicate[s]” by comparing new candidates to those already in the candidate list, which comprised a “subset” of candidates, rather than to the full set of previously-coded blocks. Ex-1004, ¶¶70-71.

B. H.264 to H.265

H.264 was published in 2003 and was widely adopted. In 2004, work began on improvements to H.264, and in 2010, the formal standardization process began for the successor standard H.265 (“HEVC”). H.265 used H.264 as a starting point; both shared the same architecture, with block-based motion prediction as explained above. Ex-1003, ¶¶16-17.

H.265 development introduced terminology for a type of block called a coding unit (“CU”), analogous to H.264 macroblocks and divisible into smaller CUs and prediction units (“PU”) to fit visual patterns in the frame. Ex-1015, 000005; Ex-1016, 000002 (showing blocks subdivided into smaller CUs and PUs):



Ex-1003, ¶18.

Motion vectors operated on PUs. In its simplest case, a CU was commensurate with a PU when the entire block had uniform motion, such as large

blocks of road in the above image. H.265 submissions included partition modes for dividing a CU into PUs when portions of the block had different motion. Ex-1014, ¶3, Fig. 2 (showing various partition modes):

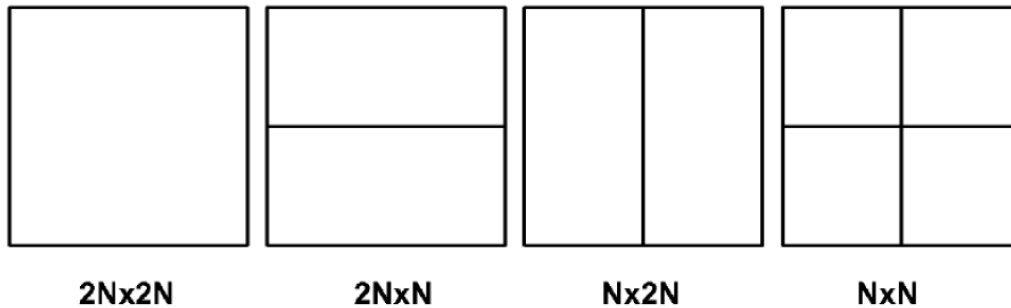


Fig. 2

See also, e.g., Ex-1010 (Samsung H.265 proposal) at 11. Ex-1003, ¶¶19-20.

II. THE '714 PATENT

A. Overview

The '714 patent purports to improve on H.264 and early H.265 drafts, which it admits pre-dated the patent. Ex-1001, 1:40-42, 2:21-25. The patent reduces the number of candidates in the MVP candidate list “by performing a limited number of motion information comparisons between candidate pairs to remove redundant candidates rather than comparing every available candidate pair.” Ex-1001, 4:18-27. In particular, the patent determines a “subset” of spatial candidates and compares a selected candidate with the subset, rather than the full set of candidates. Ex-1003, ¶¶21-23.

However, the prior art already included techniques for removing redundant MVP candidates without comparing each pair from the full set of candidates. Ex-1003, ¶24.

B. Priority Date

This Petition demonstrates invalidity as of November 4, 2011, the earliest priority cited on the face of the '714 patent.³ Ex-1003, ¶25.

III. IDENTIFICATION OF CHALLENGE

A. Statutory Grounds

Petitioners request *inter partes* review and cancelation of the challenged claims on the following grounds:

Grounds	Claims	Statutory Basis	Prior Art
1	1-3, 5-10, 12-17, 19-24, 26-30	§ 103	Rusert and Karczewicz
2	1-30	§ 103	Rusert, Karczewicz, and Lin

The Grounds render the challenged claims obvious because any differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to

³ Petitioners reserve the right to challenge the '714 patent's priority in other proceedings.

a person of ordinary skill in the art (“POSITA”) to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007).

B. Relied-Upon Prior Art⁴

1. Rusert (Ex-1004)

U.S. Patent Application Publication 2011/0194609 was filed February 7, 2011, published August 2011, and is prior art under §§ 102(a) and (e). Ex-1003, ¶¶30.

Rusert discloses a coding technique that constructs “a set of PMV [motion vector predictor] candidates, PMV_CANDS”⁵ and signals one of the candidates in the set as the predicted motion vector for the current block. Ex-1004, ¶4.

“Identifying a PMV [predicted motion vector] and signaling DMV [*i.e.*, the difference between the motion vector and the prediction] can take fewer bits than independently signaling the MV [*i.e.*, motion vector itself].” *Id.*; *see also id.* at ¶3 (explaining that $DMV = MV - PMV$ and DMV is transmitted). Ex-1003, ¶32.

⁴ Pre-AIA 35 U.S.C. §102 applies. MPEP §2159.02.

⁵ Rusert occasionally misspells this as “PMV_SANDS.” This is a clear typo.

“PMV_SANDS” and “PMV_CANDS” refer to the same list. *E.g.*, Ex-1004, ¶39, ¶¶42-44. Where Rusert refers to “PMV_SANDS,” the provisional correctly states “PMV_CANDS.” Ex-1004, ¶6; Ex-1012, 000009-10; Ex- 1003, ¶33.

Rusert discloses “an improved method and apparatus for selecting PMV candidates” that involves “selecting a set of PMV candidates as a *subset of the previously coded motion vectors* that were used for the previous blocks having an allowed distance from the current block.” Ex-1004, ¶¶7,11, 24. “Restricting the previous blocks that are considered reduces the number of previous motion vectors that must be considered meaning that less computation is needed, improving the processor efficiency of the coding.” *Id.*, ¶12.

Rusert discloses performing “an *outwards going scan* ... around the current block to obtain motion vectors to update PMV_[C]ANDS.” Ex-1004, ¶¶44, 58 (“spiral scan” wherein the “scan order spirals outwards”). Rusert discloses several “scan patterns” specifying the order in which PMV candidates in the vicinity of a current block are considered based on their distance (*i.e.*, Chebyshev and/or Euclidian distances) from the current block being encoded (or decoded). Ex-1004, ¶¶43-66. Various distance measurements and scan patterns are shown in Figures 3a to 3n. *Id.*, ¶30 (“FIGS. 3a to 3n illustrate possible scan patterns and distance measurements for a plurality of blocks surrounding a current block”). Ex-1003, ¶34.

To reduce the number of PMV candidates considered, the scan patterns may be restricted to blocks in “allowed positions” such as corner and middle block positions. Ex-1004, ¶¶15-16, 113. Fig. 3n, for example, depicts a scan pattern

where “all blocks other than the corner blocks and the blocks directly above and to the left of the current block are excluded.” Ex-1004, ¶65.

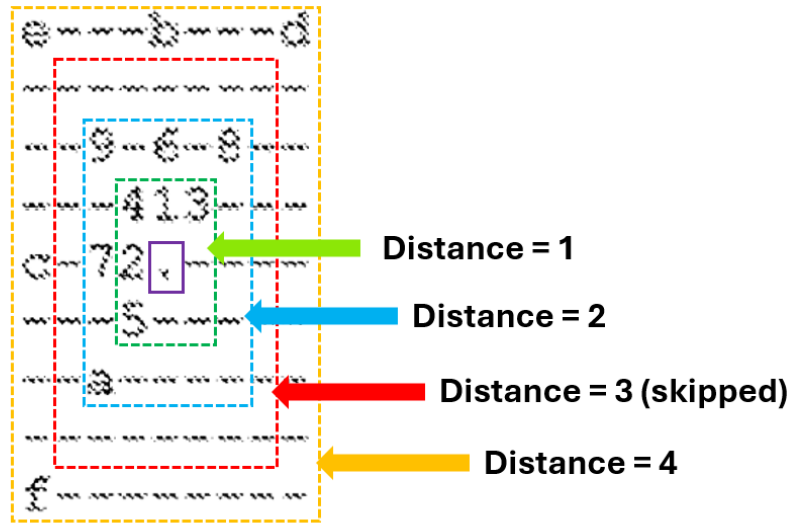


Fig. 3n

Id., Fig. 3n (color annotations added). The Fig. 3n scan pattern also skips all PMV candidates having a Chebyshev distance of 3 from the current block. *Id.*, ¶64 (scanning may be limited to candidates at distances that are powers of 2 from the current block); Fig. 3m. The numbers and letters in the pattern signify the order in which the blocks are evaluated from 1 through 9 and then a through f. *Id.*, ¶53. Rusert discloses “the search pattern shown in FIG. 3n has been found to combine good compression efficiency (i.e., finding good motion vectors) with good computation performance.” *Id.*, ¶66. Ex-1003, ¶35.

Because the scan starts with PMV candidates closest to the current block and progresses to candidates that are further away, the candidate list (PMV_CANDS)

is innately sorted by distance and no explicit sorting by distance needs to be performed. Ex-1004, ¶¶50, 53 (“closest ones first”), 73. Ex-1003, ¶36.

Rusert explains that “[l]imiting and/or reducing the number of candidates in PMV_CANDS can be helpful to reduce the overhead of signaling which PMV is used for motion vector prediction, since shorter lists require shorter code words.” Ex-1004, ¶84. To that end, a given PMV candidate in the scan pattern may be excluded from the candidate list (PMV_CANDS) if “the PMV candidate is a duplicate of another PMV candidate in the set; the PMV candidate is determined to be within a threshold distance of an existing PMV candidate; [or] the PMV candidate would never be used because at least one alternative PMV candidate will allow motion vectors to be coded using fewer bits.” *Id.*, ¶21. Additionally, a maximum size of the candidate list may be specified and such that scanning for additional PMV candidates is halted when the maximum allowed number of candidates has been reached. *Id.*, ¶¶73, 107 (exemplary limits of 4 and 7 PMV candidates). Ex-1003, ¶37.

Rusert is analogous art in the same field (video encoding/decoding, *infra* §IV). Rusert teaches “video encoding” and “decoding.” Ex-1004, ¶1, ¶¶23-25; Ex-1003, ¶38.

2. Karczewicz (Ex-1005)

U.S. Patent Application Publication No. 2011/0249721 was filed April 11, 2011, published October 2011, and is prior art under §§ 102(a) and (e). Ex-1003, ¶39.

Karczewicz teaches aspects of H.265 drafts including terminology for coding and prediction units. Ex-1005, ¶¶32-35. Karczewicz is analogous art in the same field (*infra* § IV). Karczewicz teaches techniques for “coding video data.” Ex-1005, Abstract; Ex-1003, ¶¶41-42.

3. Lin (Ex-1006)

U.S. Patent Application Publication No. 2014/0092981 claims priority to provisional 61/500,903, filed June 24, 2011, and is prior art under § 102(e). Lin is entitled to this priority date because the relied-upon subject matter is described in Lin’s provisional; also, claim 1 is supported by the provisional’s written description, which enables a POSITA to make/use Lin’s claimed invention.

Dynamic Drinkware, LLC v. Nat’l Graphics, Inc., 800 F.3d 1375, 1381 (Fed. Cir. 2015).

Lin’s Claim 1	Lin’s Provisional
1. A method of deriving a motion vector predictor (MVP) for a current block in an Inter, Merge, or Skip mode, the method comprising:	Ex-1013, 000007, 000009, 000012
determining neighboring blocks of the current block, wherein an MVP candidate set is derived from MVP candidates associated with the neighboring blocks;	Ex-1013, 000016 (Fig. 6)

determining at least one redundant MVP candidate according to a non-MV-value based criterion;	Ex-1013, 000009-11
removing said at least one redundant MVP candidate from the MVP candidate set; and	Ex-1013, 000009-11
providing a modified MVP candidate set, wherein the modified MVP candidate set corresponds to the MVP candidate set with said at least one redundant MVP candidate removed.	Ex-1013, 000008-11

Ex-1003, ¶¶43-44. Ground 2 below includes citations to Lin and Lin’s provisional.

Lin teaches removal of redundant MVPs for divided CUs, which is relevant to claim 11. Ex-1006, ¶25. Lin is analogous art in the same field (*infra* § IV). Lin teaches techniques “for motion vector coding.” Ex-1006, ¶2; Ex-1003, ¶¶46-47.

C. Standing

Petitioners certify that they are not barred or estopped from requesting this *inter partes* review, and the ’714 patent is eligible for it.

IV. FIELD AND LEVEL OF SKILL

The field of the ’714 patent is video encoding/decoding. Ex-1001, 1:40-42, 2:21-25. A POSITA at the time of the alleged invention of the ’714 patent would have had (1) a bachelor’s degree in electrical engineering, computer engineering, computer science, or a comparable field of study such as physics, and (2) approximately two to three years of practical experience with video

encoding/decoding. Additional experience can substitute for the level of education, and vice versa. Ex-1003, ¶¶48-50.

V. CLAIM CONSTRUCTION

Claims should be construed according to the ordinary and customary meaning as understood by a POSITA. 37 C.F.R. § 42.100(b).

A. “spatial motion vector prediction candidate”

A POSITA would have understood a “spatial motion vector prediction candidate” to mean a candidate motion vector obtained from one or more previously-coded blocks in the current frame. Ex-1003, ¶53.

The ’714 patent states “a spatial motion vector prediction is a prediction obtained only on the basis of information of one or more blocks of the same frame than the current frame.” Ex-1001, 3:9-14. A “candidate motion vector” uses “one or more neighbour blocks and/or other blocks of the current block in the same frame” and “represents the motion vector of one or more already encoded block.” Ex-1001, 12:51-59; Ex-1003, ¶54.

B. “temporal motion vector prediction candidate”

A POSITA would have understood a “temporal motion vector prediction candidate” to mean a candidate motion vector obtained from a previously-encoded frame. Ex-1003, ¶55.

The ’714 patent states that a “temporal motion vector *prediction* is a prediction obtained on the basis of one or more blocks of a frame different from

the current frame.” Ex-1001, 3:12-14. Furthermore, the patent states that “for temporal prediction... motion vectors of a co-located block or other blocks in a previously encoded frame can be selected as *candidate* predictors for the current block.” Ex-1001, 12:63-13:3; Ex-1003, ¶56.

C. “the block”

In the prior IPR cases, the Board construed “the block” to mean “the block associated with the first spatial motion vector prediction candidate.” Ex-1007, 16-18; Ex-1008, 15-17. Petitioners agree with this prior construction and apply it in this Petition. Ex-1003, ¶57.

D. “a subset of ... candidates”

Limitations [1b] and [9b] recite “a subset of ... candidates,” which means a subset of one or more candidates. The claims confirm that the subset may comprise one candidate. Limitations [1c] and [9c] compare motion information of a potential candidate with motion information of “candidates in the determined subset” of limitations [1b] and [9b]; dependent claims 3 and 10 further specify that the potential candidate is compared with “at most one other” candidate. The specification includes embodiments where the subset is a single candidate. Ex-1001, 15:50-16:39 (e.g., block A1 is compared with only block B1), Fig. 8b; Ex-1003, ¶58.

VI. CHALLENGED CLAIMS

A. Motivation to Combine and Reasonable Expectation of Success

Ground 1. Rusert teaches all limitations of the independent claims. Rusert uses H.264 terminology and teaches the blocks that serve as PUs in H.264. To the extent the claims require H.265 PUs, those were well-known and, for example, taught by Karczewicz. A POSITA would have been motivated to apply Rusert’s teachings to H.265 PUs and related concepts, as explained below. Ex-1003, ¶¶62-78.

Rusert does not itself use H.265 terminology. Nonetheless, Rusert explains that, while its examples were “given in the context of H.264/AVC, the principles disclosed herein can also be applied to ... other coding standard[s], and indeed any coding system which uses predicted motion vectors.” Ex-1004, ¶116. Karczewicz teaches the concept of PUs in H.265, which was emerging as the successor standard to H.264—both were drafted by ITU-T—sharing the same concepts of block-based video encoding with predicted motion vectors. Ex-1005, ¶32, ¶¶35-37, ¶66, ¶71; Ex-1006, ¶5. Karczewicz teaches H.265 concepts including PUs. Therefore, the art provides express motivation to apply Rusert’s teachings to other standards including H.265, as taught by Karczewicz. Ex-1003, ¶¶62-65.

This would have combined prior art elements according to known methods to yield predictable results, e.g., combining Rusert’s teachings for generating/de-duplicating MVP candidate lists with H.265 concepts, including PUs and related information for motion vectors. In Rusert’s H.264 examples, motion vectors and

motion prediction operate on blocks. Ex-1004, ¶¶2-5, ¶36, ¶43. As Karczewicz explains, for H.265 drafts, motion vectors and motion prediction operated on blocks called PUs. Ex-1005, ¶¶33-36, ¶¶64-66. Karczewicz also teaches types of information conveyed by motion vectors. Ex-1005, ¶35. A POSITA would have been motivated to apply Rusert's known techniques for selecting PMV candidates to PUs, to improve the similar draft H.265 standard in the same way that Rusert explained for H.264. This application would have been a simple substitution of Karczewicz's PU teachings for Rusert's block teachings, which would have yielded several advantages, including improved coding efficiency as taught by both references. Ex-1004, ¶7; Ex-1005, ¶6; Ex-1003, ¶¶66-70.

Additionally, a POSITA would have found motivation in the similarity of the references. Both are directed to ITU video-coding standards. Ex-1004, ¶116; Ex-1005, ¶¶32-33. Karczewicz explains that "[i]n general, a CU" of H.265 "has a similar purpose to a macroblock of H.264" and in its simplest case, a CU was a PU. Ex-1005, ¶33, ¶35; Ex-1003, ¶69.

A POSITA would have been motivated to combine teachings from Rusert's embodiments and background section regarding H.264 with each other. Rusert explains that its embodiments were provided in the context of H.264. Ex-1004, ¶¶3-4, ¶67, ¶77, ¶116; Ex-1003, ¶71.

Ground 1 relies on Rusert's teachings regarding PMV_CANDS, for which Rusert teaches two options: initializing and updating PMV_CANDS dynamically for each block, or using a sliding window. Ex-1004, ¶41. A POSITA would have been motivated to use the first option (for each block) because Rusert presents it as the first of a finite number of options (two). Ex-1003, ¶72.

Karczewicz discusses H.264 and H.265 and applies its teachings to both. Therefore, Karczewicz's teachings regarding additional H.265 features would not have dissuaded a POSITA from combining Karczewicz with Rusert. Ex-1005, ¶5, ¶38. H.265 does not prevent H.264 teachings from being applied, or vice-versa. Ex-1003, ¶73.

The combination would have had predictable results. Rusert already applies its teachings to block-based encoding/decoding. Ex-1004, ¶2, ¶11. A PU is a type of block. Ex-1005, ¶35. Rusert's concepts were readily applicable to PUs, and the combination would have had the predictable result of selecting PMV candidates (as Rusert teaches) for PUs (as Karczewicz teaches). Ex-1004, ¶116; Ex-1003, ¶74. Therefore, the combination would not have changed the principle of operation for Rusert or Karczewicz because it applies their teachings in the manner taught by each. Applying H.265 teachings to Rusert, and vice versa, was consistent with Rusert's statement that its principles are applicable to other standards. Ex-1004, ¶116; Ex-1003, ¶75.

A POSITA would have had a reasonable expectation of success when combining Rusert and Karczewicz. As explained above, the combination applies teachings according to their known purposes, in a conventional manner. The teachings are complementary aspects of block-based video encoding from H.264 and H.265. Ex-1004, ¶116. Karczewicz complements Rusert by teaching terminology and concepts from H.265. Ex-1005, ¶32. Ground 1 does not modify Rusert or Karczewicz in a way that would render either inoperative. To the contrary, their similar architectures would have given a POSITA a reasonable expectation of success in combining their teachings. Ex-1004, ¶11; Ex- 1005, ¶2; Ex-1003, ¶¶76-77.

A POSITA would have been capable of applying Karczewicz's teachings to Rusert and vice versa because they would simply apply Rusert's teachings from H.264 to H.265. Motion estimation had been widely used and well-understood since the 1990s; H.264 introduced motion vector prediction by the early-to-mid 2000s. These were basic aspects of video-coding a POSITA would have been knowledgeable about. *Supra* § IV; Ex-1003, ¶78.

The motivation to combine and reasonable expectation of success for Ground 2 is explained for Claim 4.

B. The '714 Patent's Encoder Claims

The '714 patent includes both encoder and decoder claims. The encoder and decoder claims are substantially similar and rendered obvious for largely the same reasons. Petitioners address the encoder claims first.

1. Claim 1*

[1pre] A method

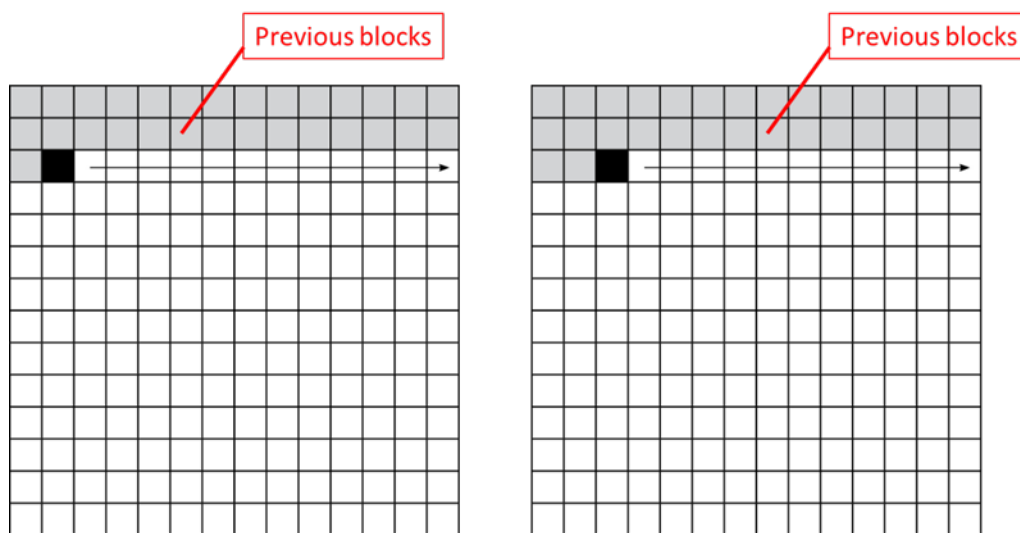
Ground 1 teaches [1pre], e.g., “a *method* of selecting PMV candidates” comprising elements explained below. Ex-1004, Abstract, ¶1, ¶11; *infra* §VI.B.1[1a]-[1e]; Ex-1003, ¶¶91-92.

[1a] selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a 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 block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;
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Ground 1 teaches [1a]. Ex-1003, ¶¶93-112.

Selecting a first spatial motion vector prediction candidate (PMV candidate) from a set of spatial motion vector prediction candidates (set of previously-coded motion vectors or set of PMV candidates in the scan pattern) **for a block of pixels**. Rusert teaches “selecting... PMV candidates” for a current block from a “*set of previously coded motion vectors that were used for previous*

blocks.” Ex-1004, ¶¶11-12, ¶15, ¶¶24-25, ¶39, ¶44, ¶¶51-66, ¶113, Fig. 6. As Rusert iterates through blocks of pixels in a frame, each block will have its own unique set of previously-coded motion vectors from which to select a PMV candidate because after a block is encoded/decoded, the set of previously-coded motion vectors increases, as illustrated below. Ex-1004, ¶2 (“pixel blocks”), ¶¶11-12, ¶36, ¶59, Fig. 3g; Ex-1003, ¶¶94-96:



In the alternative, the set of PMV candidates in the scan pattern is also “a set of spatial motion vector prediction candidates” from which a given PMV candidate (*i.e.*, the claimed “first spatial motion vector prediction candidate”) is selected for evaluation for possible inclusion in the candidate list. Ex-1004, ¶¶53-54, 58, 64-66; Ex-1003, ¶¶97-98.

Rusert’s PMV candidates (Ex-1004, ¶3) comprise spatial motion vector prediction candidates obtained from the set of previously-encoded blocks in the current frame and from the set of PMV candidates in the scan pattern. *Supra* §V.A.

They include “spatially neighboring motion vectors” (Ex- 1004, ¶¶6, ¶¶3-5) and are included in PMV_CANDS, which “comprise[s] *spatial ... neighbors* of the current block” in the current frame. Ex-1004, ¶¶67, ¶¶4-6; Ex- 1003, ¶¶95.

Selecting a first... candidate... as a potential spatial motion vector prediction candidate to be included in a motion vector prediction list

(PMV_CANDS). Rusert discloses selecting PMV candidates for evaluation “in an order that t[a]k[es] the closet ones first, with some tie-breaking rule for blocks at the same distance.” Ex-1004, ¶¶53 (“A possible order for the blocks shown in FIG. 3a is shown in FIG. 3b, where the order is shown according to: 1, 2, 3, ..., 9, a, b, ...”); *see also id.*, ¶¶59. Any given PMV candidate in the scan pattern could be the claimed “first spatial motion vector prediction candidate.” Ex-1003, ¶¶99-101.

As discussed, Rusert discloses search patterns for “an outwards going scan... around the current block.” Ex-1004, ¶¶44, ¶¶51-66, Figs. 3a-3n (showing numerical scan order around current block “.” from block 1 onwards, with directional annotation added for 3n):

1d9em
 #516g
 a2.3b
 h748i
 njcke

Fig. 3b

1-9-m
 --i--
 -2.-
 h-----
 -j-----

Fig. 3c



Fig. 3n

Ex-1003, ¶¶99-101.

The PMV candidates in the scan pattern are successively evaluated in order and either added to, or excluded from, the PMV_CANDS list. Ex-1004, ¶44, ¶¶51-66; *infra* §VI.B.1[1c]-[1d] (explaining evaluation for potential inclusion in PMV_CANDS); Ex-1003, ¶¶99, 101.

The PMV_CANDS list is a **motion vector prediction list for a prediction unit of the block of pixels**. It is a list of predicted motion vectors “used for coding a motion vector associated with a current... block.” Ex-1004, ¶41, ¶4, ¶¶39-42. PMV_CANDS is “dynamically generated specifically for the current... block[.]” Ex-1004, ¶41. “[B]efore a block is processed, a PMV_CANDS list is initialized and then updated with... motion vectors.” *Id.* When PMV_CANDS is updated, i.e., when “one or more motion vectors are added” (Ex-1004, ¶39), it comprises a subset of the set of previously-coded motion vectors that have been included in

PMV_CANDS to that point. Ex-1004, ¶¶4-5, ¶¶36-39, ¶¶43-44, ¶¶51-66. When PMV_CANDS is complete, a “predicted motion vector (PMV)” that “is used to predict a [motion vector]... is signaled” using an index “to select a particular PMV candidate... from PMV_CANDS[.]” Ex-1004, ¶36; Ex-1003, ¶102; *see also* Ex-1007 (IPR2024-00604 Institution Decision), 40 (“At the end of the list construction process, PMV_CANDS holds all members of the prediction list.”).

The prediction unit of Ruser’s block of pixels is the block itself because that is the unit for which a motion vector is assigned for motion prediction. Ex-1004, ¶¶2-4, ¶43. Ruser provides a motion vector for each “8x8 pixel block,” also called a “sub-block” because it is a portion of a “macroblock.” Ex-1004, ¶36. Ruser scans neighboring blocks because motion vectors are assigned based on blocks, which are the PUs in Ruser’s teachings. *See* Ex-1004, ¶¶50-67, Figs. 3a-3n; Ex-1003, ¶103.

Additionally, Ground 1 combines Ruser’s “block” teachings (following H.264 terminology) to PUs (in H.265 terminology). *Supra* §VI.A; Ex-1004, ¶116. As Karczewicz explains, H.265 introduced terminology for a type of block called “prediction unit[s.]” Ex-1005, ¶¶33-36; *supra* §I.B. “In general, a CU has a similar purpose to a macroblock of H.264” (Ex-1005, ¶33), which in its simplest case is commensurate with a PU but may also be divided into multiple PUs. Ex- 1005, ¶35. “[T]he PU may include data defining a motion vector for the PU” that is used

for “prediction using a PU[.]” Ex-1005, ¶¶35-36, ¶66; Ex-1003, ¶¶104-106. In short, Karczewicz explains that H.265 assigned motion vectors based on a type of block called a PU. Ex-1005, ¶¶33-36, ¶64. Rusert explained its teachings based on the blocks for which motion vectors were assigned (Ex-1004, ¶¶2-5, ¶36, ¶43). Therefore, it would have been obvious to apply Rusert’s teachings to PUs, with PMV_CANDS being a motion vector prediction list for a PU of the block of pixels. Ex-1005, ¶¶33-36, ¶66; Ex-1003, ¶¶104-106.

Where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates. PMV_CANDS is a “list of PMV candidates.” Ex-1004, ¶37. Each candidate is a motion vector (Ex-1004, ¶11, ¶¶24-25, ¶¶39-41) including “x and y components” (Ex-1004, ¶106, ¶36, ¶¶91-94, ¶100). Therefore, Rusert’s PMV_CANDS list includes motion information, including motion vectors and their x and y components, of the PMV candidates. Ex-1004, ¶¶2-3; Ex-1003, ¶107.

Additionally, Karczewicz teaches “the PU may include data defining a motion vector[.]” which includes “a horizontal component” (e.g., x-component), “a vertical component” (e.g., y-component), “a resolution..., a reference frame... and/or a reference list[.]” Ex-1005, ¶35. It was obvious to include this PU information in PMV_CANDS because the combination relies on Karczewicz’s PU teachings. *Supra* §VI.A; Ex-1003, ¶108.

PMV_CANDS is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit.⁶ Rusert uses an index to signal “a particular PMV candidate... from... PMV_CANDS” as the “predicted motion vector” for a block. Ex-1004, ¶¶35-37, ¶4 (“*signal a PMV to be used out of ... PMV_CANDS*”), ¶75, ¶88, Table 1. This index is transmitted to a decoder that uses this “transmitted index” to “determine the PMV... as used in the encoder” from PMV_CANDS to “reconstruct [a motion vector].” Ex-1004, ¶37, ¶¶88-102 (exemplary index codes). The index is transmitted as the motion information for the block. Ex-1004, ¶¶35-37; *infra* §VI.B.1[1e]; Ex-1003, ¶¶109-110. Ground 1 applies Rusert’s block-based teachings to PUs. *Supra* §VI.A; Ex-1003, ¶112.

Rusert Figs. 2a-2b show a PMV candidate 220 being signaled as the selected PMV for a block, using index 250. Ex-1004, ¶36. A decoder uses index 250 to identify PMV 220 as the PMV candidate to be used for the current block.

⁶ The ’714 patent admits this was known. Ex-1001, 3:60-66; Ex-1003, ¶109 n.2.

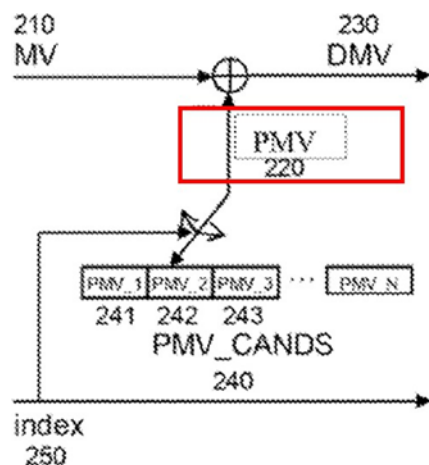


Fig. 2a

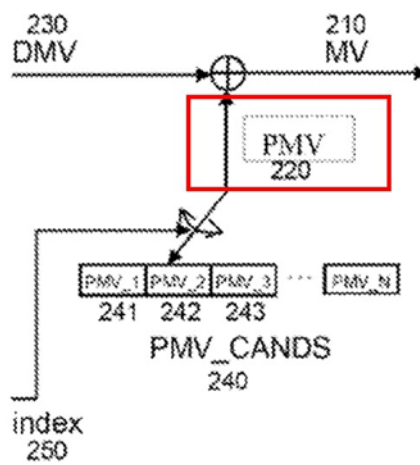


Fig. 2b

Ex-1003, ¶¶111.

[1b] determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate;

Ground 1 teaches [1b]. Ex-1003, ¶¶113-124.

Determining a subset of spatial motion vector prediction candidates.

Rusert teaches for each PMV candidate (“first spatial motion vector prediction candidate”) determining a subset of spatial motion vector prediction candidates. In particular, Rusert teaches that the evaluation of each PMV candidate includes a redundancy check whereby the PMV candidate is compared to the PMV candidates already in the PMV_CANDS list. Ex-1004, ¶71. Thus, Rusert teaches or suggests using the PMV_CANDS list to determine a subset of PMV candidates for comparing with the current PMV candidate. Ex-1003, ¶114; *see also* Ex-1007 (IPR2024-00604 Institution Decision), 39 (“During the list building process, PMV_CANDS holds those candidates which have been determined to be included,

thus far, in the prediction list, and those members constitute the subset with to which a selected candidate being evaluated for inclusion in the prediction list is compared.”).

The set of PMV candidates ascertained from the PMV_CANDS list is “a subset of spatial motion vector prediction candidates” as claimed. Ex-1004, ¶12 (“A PMV candidate list is created by selecting *a subset of the motion vectors previously used for previous blocks.*”) ⁷. As discussed *supra* §III.B.1, Rusert discloses using scan patterns to populate the PMV_CANDS list that exclude candidates at certain positions relative to the current block and at certain distances from the current block. *See also* Ex-1007 (IPR2024-00604 Institution Decision), 40 (“Prior to the end of the list construction process, PMV_CANDS holds the claimed subset.”); Ex-1003, ¶¶115-116.

A subset ... based on a location of the block associated with the first spatial motion vector prediction candidate. The subset of PMV candidates ascertained from the PMV_CANDS list is “based on a location of the block associated with the first spatial motion vector prediction candidate” as claimed. As

⁷ *See also id.* (“Restricting the previous blocks that are considered reduces the number of previous motion vectors that must be considered meaning that less computation is needed, improving the processor efficiency of the coding.”).

discussed *supra* §III.B.1, Rusert's scan patterns progress through a sequence of PMV candidates in patterns that spiral outward from the current block with each evaluated PMV candidate being added to the PMV_CANDS list unless it meets certain criteria for exclusion as unnecessary. In Rusert's approach, the subset of PMV candidates in the PMV_CANDS list grows as the scan progresses through the PMV candidates in the pattern. Ex-1003, ¶117. Using the below scan pattern in Fig. 3n as an example, the subset of PMV candidates in PMV_CANDS will be different when blocks 3 and 4 are evaluated.

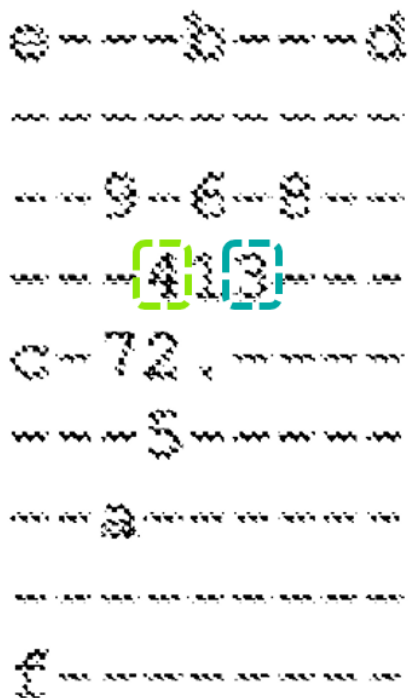


Fig. 3n

When block 3 is evaluated, the PMV_CANDS list would likely include the previously considered PMV candidates associated with blocks 1 and 2 (assuming

neither was excluded as unnecessary). The PMV for block 3, assuming its motion information differs from blocks 1 and 2, is then added to the PMV_CANDS list.

In the next iteration, the scan proceeds to block 4 and the PMV_CANDS list would then include blocks 1, 2, *and* 3. The figure below uses colored dots to show the different subsets of PMV candidates in the PMV_CANDS list when blocks 3 and 4 are evaluated, respectively:

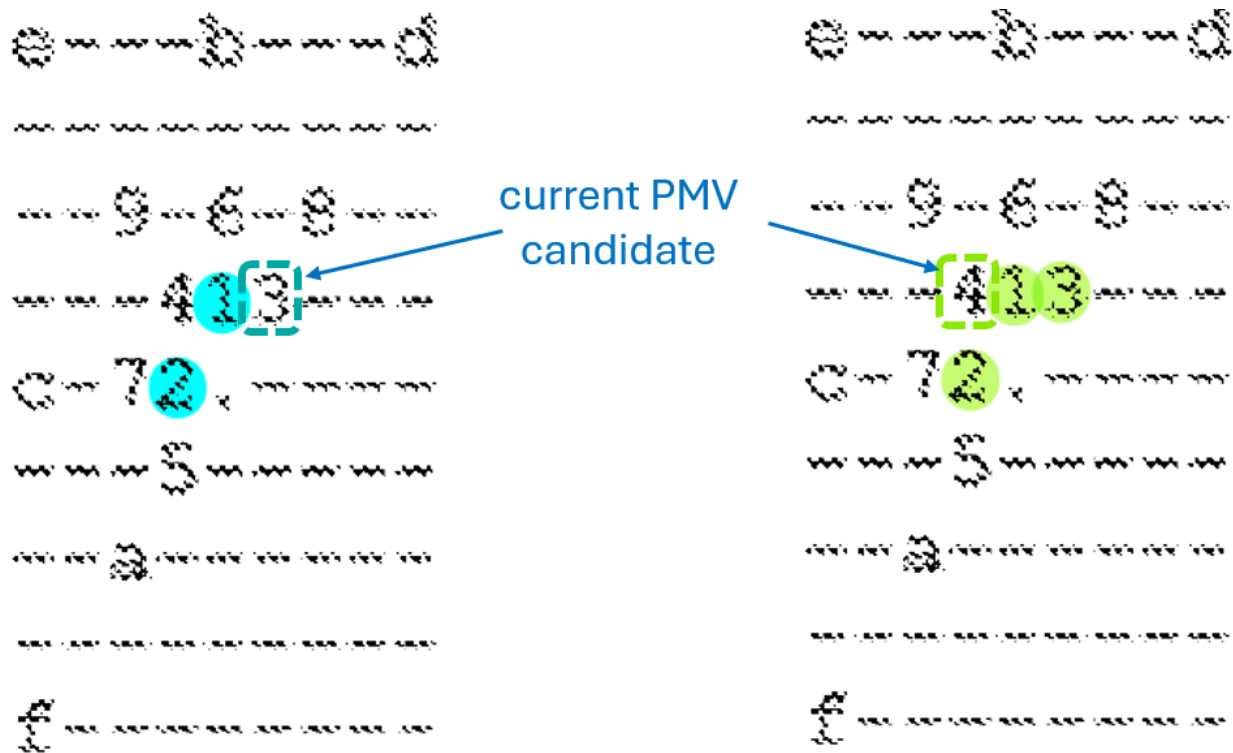


Fig. 3n

Fig. 3n

Ex-1001, Fig. 3n (annotations added); Ex-1003, ¶118-119.

As shown, the subset of PMV candidates in the PMV_CANDS list when a given PMV candidate is evaluated includes the previously considered PMV

candidates in the scan pattern that were not excluded as unnecessary. Ex-1003, ¶120. Moreover, because Rusert’s scan patterns are ordered based on increasing distance from the current block (*e.g.*, Ex-1004, ¶53), these subsets ascertained from the PMV_CANDS list only include PMV candidates that are *as close as or closer*⁸ to the block currently being encoded (*i.e.*, the ‘.’ block in Rusert’s Fig. 3 patterns). Ex-1003, ¶120. Conversely, the PMV_CANDS list cannot include a candidate that is *further away from the current block* than the current PMV candidate being evaluated. *Id.* Accordingly, the subset of PMV candidates determined from the PMV_CANDS list is “based on a location of the block associated with the” current PMV candidate (“first spatial motion vector prediction candidate”). *Id.* Additionally, as Dr. Creusere explains, the relative locations of the PMV candidates in the subset differ substantially based on the location of the current PMV candidate. *Id.*, ¶121.

In IPR2024-00604/605, Patent Owner argued that the PMV candidates in Rusert’s PMV_CANDS list are not determined based on the location of current PMV candidate because PMV_CANDS is already populated based on the

⁸ Successive PMV candidates in the scan order may have the same distance from the current block in which case a tie-breaking rule is used to determine the sequence as to these candidates. Ex-1004, ¶¶ 53, 59. Ex-1003, ¶120 n.4.

processing of the previous PMV candidates in the scan pattern. This argument should be rejected because nothing in the claim language precludes determining the claimed subset by referencing a list that already identifies a subset of PMV candidates based on the location of the current PMV candidate. Ex-1003, ¶122. By analogy, a cashier can “determine” a customer’s date of birth by reviewing the customer’s driver’s license. The ’714 patent neither expressly defines the non-technical term “determine” nor narrows its scope through disavowal. Indeed, the ’714 patent specification suggests an encoder can “determine” the maximum number of spatial motion prediction candidates by reading a stored value from memory.⁹

In IPR2024-00604/605, Patent Owner also tried to argue that the subset of PMV candidates in the PMV_CANDS list is not determined based on the location

¹⁰ Ex-1001, 14:53-59 (“A maximum number of spatial motion prediction candidates to be included in the merge list may be defined. This maximum number may have been stored, for example, to the memory 58 of the apparatus 50, or to another appropriate place. It is also possible to *determine* the maximum number by using other means, or it may be determined in the software of the encoder of the apparatus 50.”).

of the current PMV candidate because the makeup of the list is also impacted by other factors (*e.g.*, whether previous candidates in scan pattern are intra-coded and thus have no motion vector, whether previous candidates were themselves excluded as the same or too similar to other candidates in the list). This argument should also be rejected. First, the claim language—in particular the “based on ...” phrase— does not require the claimed subset to be based *only* on the location of the first spatial motion vector prediction candidate. The Federal Circuit has rejected similar arguments addressing claims with similar “based on ...” phrases.¹⁰ Second, a POSITA would have readily understood that in many instances—especially early in the scan pattern—none of the previously considered PMV candidates would have been excluded from the PMV_CANDS list and the list would include all the PMV candidates in the scan pattern that were previously

¹⁰ See, *e.g.*, *Centripetal Networks, LLC v. Palo Alto Networks, Inc.*, No. 2023-1654, 2024 WL 4639207, at *4 (Fed. Cir. Oct. 31, 2024) (“As a matter of ordinary and customary meaning, if an action is taken in reaction to the satisfaction of a rule with two criteria, then the action is taken ‘based on’ each of the two criteria.”); *see also id.* (“The asserted claims here do not include any limiting language, such as ‘only,’ as in ‘based only on one or more network-threat indicators,’ that would indicate that additional conditions cannot be considered.”) (*italics original*).

evaluated—all of which, as explained, are as close or closer to the current block than the current PMV candidate being evaluated. Ex-1003, ¶123. This is sufficient to show obviousness. *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016) (“[C]ombinations of prior art that sometimes meet the claim elements are sufficient to show obviousness.”) (citing *Hewlett–Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1326 (Fed. Cir. 2003)).

In summary, Rusert teaches determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate (*i.e.*, the current PMV candidate being considered). In Rusert, the subset is ascertained using the PMV_CANDS list which includes a subset of PMV candidates that are as close or closer than the current PMV candidate to the block currently being encoded. Ex-1003, ¶124.

[1c] comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates;
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Ground 1 teaches [1c]. Ex-1003, ¶¶125-136.

Comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates. Rusert teaches three comparisons for excluding

“unnecessary” candidates from the PMV_CANDS list; each satisfies [1c]. Ex-1004, ¶21, ¶¶71-72; *supra* §VI.B.1[1b]; Ex-1003, ¶126.

First, Rusert determines whether “the PMV candidate is a duplicate of *another* PMV candidate” in the subset of PMV candidates, which is stored as a list in PMV_CANDS. Ex-1004, ¶21, ¶71. “This ca[n] be done, when updating the list, by comparing the candidates already in the list with the new vector that could be added, and if a duplicate is found... [i]t is preferable to skip the new vector” thereby “reducing the number of candidates[.]” Ex-1004, ¶71, ¶62. A potential PMV candidate is selected and compared with each PMV candidate in the subset of preceding PMV candidates in Rusert’s scan sequence, which are the candidates already stored in PMV_CANDS. *Supra* §VI.B.1[1b]. If the x and y components of two motion vectors are the same, they are duplicates and the potential candidate is excluded. *Id.*; Ex-1003, ¶127.

Second, Rusert compares whether “the PMV candidate is... within a threshold distance of an existing PMV candidate” in the subset of candidates stored in PMV_CANDS, e.g., using “a similarity measure” such as Euclidean distance to calculate whether the difference between the x and y components of their motion vectors is “smaller than a pre-defined threshold”; if so, the potential candidate is removed/skipped. Ex- 1004, ¶21, ¶72, ¶87. The distance between duplicate PMV candidates is zero. Ex- 1003, ¶¶128, ¶128 n.5.

Third, Rusert compares whether “at least one alternative PMV candidate will allow motion vectors to be coded using fewer bits” (Ex-1004, ¶21) thereby “removing PMV candidates” that “will never be used” because another PMV candidate in the subset stored in PMV_CANDS facilitates “a bit sequence that is shorter or of the same length compared for all possible motion vectors.” Ex-1004, ¶¶90-94. When the x and y values of an existing candidate’s motion vector can be added to the x and y values of a difference motion vector (“DMV”)¹¹ to yield the x and y values of the selected candidate while using fewer overall bits, Rusert excludes the selected candidate. Ex-1004, ¶95 (teaching exemplary PMV/DMV combinations requiring fewer bits); Ex-1003, ¶129.

All three teachings compare a potential candidate with at least one other candidate from the subset of preceding candidates in Rusert’s scan sequence. Since preceding candidates have smaller index values, they would be signaled more efficiently than later duplicates, and Rusert improves efficiency by determining this subset and comparing potential new candidates to the subset. Ex-1004, ¶¶88-98; Ex-1003, ¶130.

All three teachings compare motion information of the PMV candidates, including the x and y components of their motion vectors. This is motion

¹¹ *Supra* §I.

information of the PMV candidates because they describe the “motion of pixel blocks across frames[.]” Ex-1004, ¶2. Motion vector coding includes an MVP combined with a DMV. Ex-1004, ¶3, ¶¶36-37; *supra* §VI.B.1[1a] (explaining motion information); Ex-1003, ¶130.

Rusert teaches or at least suggests performing three comparisons when evaluating whether to update PMV_CANDS with a PMV candidate. Ex-1004, ¶71, ¶75, ¶¶84-87, ¶90; Ex-1003, ¶131.

Comparing ... without making a comparison of each pair from the set of spatial motion vector prediction candidates. As discussed for [1a], the claimed “a set of spatial motion vector prediction candidates” could be (1) the set of motion vectors used for all previous coded blocks in the frame or (2) the set of motion vectors for the blocks in the scan pattern. Each of Rusert’s three teachings (explained above for [1c]) compares motion information of a selected PMV candidate with the subset of PMV candidates stored in PMV_CANDS, without making a comparison of each pair from the larger set of spatial motion vector prediction candidates under either mapping. Ex-1003, ¶132.

As to the first mapping, Rusert teaches that the subset of PMV candidates is itself a “*subset* of the motion vectors previously used for previous blocks.” Ex-1004, ¶¶11-12, ¶¶24-25. Since a given PMV candidate is only compared against the PMV candidates in the PMV_CANDS list and that list can only include PMV

candidates within the scan pattern; no PMV candidate in the scan pattern will be compared to spatial motion vector prediction candidates that fall outside the scan pattern. For example, in the Fig. 3n pattern, blocks with a Chebyshev distance of 3 from the current block are excluded. Ex-1004, ¶64; Fig. 3m; *see also id.*, ¶13 (discussing “allowed distance values”). Additionally, “all blocks other than the corner blocks and the blocks directly above and to the left of the current block are excluded.” *Id.*, ¶65; *see also id.*, ¶¶14-15 (discussing “allowed positions”). In the annotated figure below, the dotted orange blocks are excluded from the scan pattern because they are not in an “allowed position” and the dotted pink blocks are excluded based on their distance from the current block (*i.e.*, a Chebyshev distance of 3 which is not a power of 2).



Fig. 3n

Ex-1004, Fig. 3n (annotations added); Ex-1003, ¶133. Because these dotted orange and pink blocks are not within the scan pattern, they cannot contribute PMV candidates to the PMV_CANDS list, and no PMV candidate would be compared to the motion vectors for these blocks. Ex-1003, ¶133.

As to the second mapping, where the claimed “set of spatial motion vector prediction candidates” is the set of PMV candidates in Rusert’s scan patterns, Rusert discloses multiple reasons that would prevent every pair of candidates

within the scan pattern from being compared.¹² First, as discussed above for [1b], when a given PMV candidate in the scan pattern is considered, the PMV candidates in the PMV_CANDS list are limited to PMV candidates that are *as close or closer* to the current block being encoded. Using the scan pattern in Fig. 3n as an example, when block 3 is evaluated, it would be compared to blocks 1 and 2, but not to most of the other blocks in the pattern which are further away from the current block (*e.g.*, blocks 6 through 9 and a though f). Ex-1003, ¶134.

Second, Rusert teaches that a “scan may be terminated... as soon as a pre-defined number of unique PMV candidates have been found[.]” Ex-1004, ¶48. For example, Rusert teaches “us[ing] a maximum of four candidates in the [PMV_CANDS] list” or “us[ing] seven” as the maximum. Ex-1004, ¶107. Again, using the Fig. 3n pattern as an example, if PMV candidates 1, 2, 3, and 4 were all added and the list was limited to four PMV candidates, there would never be a comparison involving blocks 5 or 6 even though those blocks are within the scan pattern. Ex-1003, ¶134.

¹² While these examples are discussed *primarily* for purposes of the second mapping, these examples are also relevant to the first mapping as they provide further evidence that not every pair within the set of motion vectors used for all previous coded blocks in the frame is compared.

Therefore, Rusert discloses not comparing each possible pair of candidates from the set of all previously-coded blocks, or even each possible pair of blocks within the scan pattern. Rusert thus teaches Claim 1 with the recited “set” being either (a) the previously-coded motion vectors for that frame, or (b) the full set of candidates from Rusert’s scan order, because in both cases Rusert compares the selected candidate with a subset of candidates, without comparing each pair from the set of previously-coded motion vectors or the entire scan order. Ex-1003, ¶135.

[1d] determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

Ground 1 teaches [1d]. Ex-1003, ¶¶137-142.

As explained above, Rusert determines whether to include or exclude the selected first PMV candidate in PMV_CANDS, which stores the subset of PMV candidates, based on each of the three comparisons explained for [1c]. Rusert removes “unnecessary PMV candidates” to “ensure[] the length of the [PMV_CANDS] list is not unnecessarily long, which would reduce coding efficiency.” Ex-1004, ¶¶20-21. Rusert explains that “[a] PMV candidate *may be determined to be unnecessary*” and be therefore excluded if at least one of the three comparisons is fulfilled. Ex-1004, ¶21; *supra* §VI.B.1[1c]. “Unnecessary PMV candidates are removed ... because it may happen that some candidates in the list will never be used.” Ex-1004, ¶90. A shorter PMV_CANDS list “allows the

remaining PMV candidates to be signaled using shorter codes and so fewer bits[.]”

Ex-1004, ¶22, ¶90; Ex-1003, ¶¶138-139.

Rusert excludes unnecessary candidates when deciding whether to add a new candidate to the subset of PMV candidates stored in PMV_CANDS. Ex-1004, ¶21, ¶¶71-72; *supra* §VI.B.1[1c]. As part of the “update” process whereby new candidates are added, Rusert determines whether a selected PMV candidate should be included or skipped, meaning it is excluded based on any of the three comparisons from [1c]. Ex-1004, ¶¶71-72. Additionally, this would have been obvious because Rusert teaches the advantages of reducing the number of candidates in PMV_CANDS using the three comparisons from [1c] (Ex-1004, ¶12, ¶21, ¶70, ¶84, ¶90), and the natural time to perform the comparisons would have been when evaluating whether or not to add a candidate to the subset of PMV candidates stored in PMV_CANDS. As Rusert teaches, performing this check when PMV_CANDS is updated prevents “unnecessary” candidates from being added, “because it may happen that some candidates... will never be used[.]” Ex-1004, ¶90; Ex-1003, ¶¶140-141.

[1e] causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.
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Ground 1 teaches [1e]. Ex-1003, ¶¶143-149.

Rusert causes information (e.g., an index) identifying the one spatial motion vector prediction candidate from PMV_CANDS to be stored and transmitted to a decoder. For example, Rusert teaches an index “to select a particular PMV candidate... from... PMV_CANDS[.]” Ex-1004, ¶35. The index is stored in the video stream and transmitted “from the encoder... to the decoder[.]” Ex-1004, ¶150. The index identifies and signals one PMV candidate from PMV_CANDS. Ex-1004, ¶¶35-37, ¶75, ¶¶91-92, Figs. 2a-2b; *supra* §VI.B.1[1a].

In an encoded video stream, the “index... may be sent once together with each transmitted motion vector” and the decoder, “[u]sing the transmitted index, ... can determine the PMV... as used in the encoder[.]” Ex-1004, ¶¶35-37, Fig. 1:

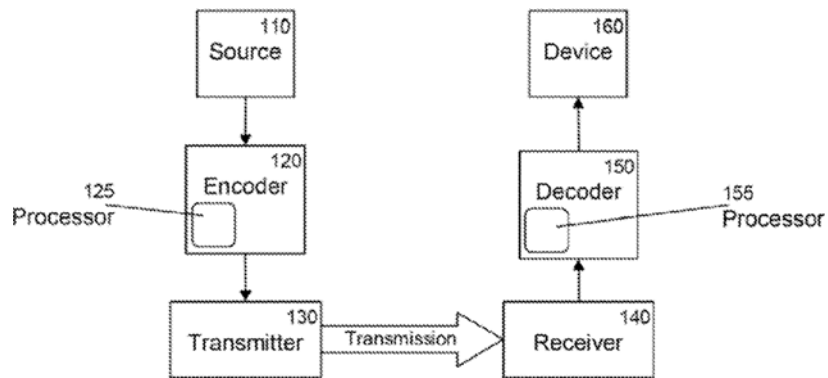


Fig. 1

Ex-1003, ¶¶144-145.

Rusert teaches exemplary binary codes for the index used for transmission and storage. Ex-1004, ¶¶88-102, Table 1 (annotation added):

Value	Index	Code
(-1,2)	0	1
(13, 4)	1	010
(12, 3)	2	011
(0, 2)	3	0010
(3, 4)	4	0011
(-4, 1)	5	0000
(4, 8)	6	0001

Ex-1003, ¶146.

Furthermore, Rusert teaches “the respective lists of PMV candidates” are “stored in the encoder and decoder[.]” Ex-1004, ¶35. Corresponding indices that identify candidates from those lists would have obviously been stored as well because the candidate lists serve no purpose without an index to identify a candidate, and Rusert teaches indices are used with the lists.¹³ Ex-1004, ¶35, ¶¶88-102. Ex-1003, ¶147. Ground 1 applies Rusert’s teachings from “blocks” to PUs. *Supra* §VI.A; Ex-1003, ¶148.

2. Claim 2

2. The method according to claim 1 further comprising selecting 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.

As explained above, Ground 1 teaches selecting a first spatial motion vector prediction candidate from the set of spatial motion vector prediction candidates as

¹³ For example, computers convert inputs of digits to binary code, then store and transmit the binary code. Ex-1003, ¶147 n.6.

a potential spatial motion vector prediction candidate (*supra* §VI.B.1[1a]) from “a plurality of blocks surrounding a current block.” Ex-1004, ¶30, ¶40, ¶¶51-66; Ex-1003, ¶¶152-155.

Rusert selects candidates in a predetermined order. Rusert teaches “a simple procedure to scan the candidates in order” (Ex-1004, ¶58) including ordered “scan patterns... for a plurality of blocks surrounding a current block[.]” Ex-1004, ¶30, ¶40, ¶¶51-66, Figs. 3a-3n.

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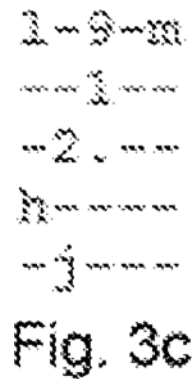
e---b---d
-----
---9-6-8---
---413---
c-72,-----
---5-----
---a-----
-----
f-----

```

Fig. 3n

Ex-1003, ¶153.

For example, Figs. 3b, 3c, 3e, 3l, 3m, and 3n scan blocks in ascending order from 1 onward, with letters representing ordering of 10 and above (“a” is 10, “b” is 11, etc.). In Fig. 3c, Rusert scans “blocks in the following order: 1, 2, 9, h, j, l, m.” Ex-1004, ¶¶53-54, Fig. 3c:



Ex-1003, ¶154.

Rusert discusses known benefits/tradeoffs associated with its exemplary scan patterns and highlights Fig. 3n for its balanced compression efficiency and computation performance. Ex-1004, ¶66. Rusert nonetheless teaches the use of each exemplary scan pattern because each example had its known applications where known benefits outweighed tradeoffs. Ex-1004, ¶¶51-65. Thus, each scan was known and used as a predetermined pattern. Ex-1004, ¶30; Ex-1003, ¶155.

3. Claim 3

3. The method according to claim 1, further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

Ground 1 teaches claim 3. Ex-1003, ¶¶157-161. As discussed, Rusert teaches three comparisons, each of which satisfies the comparing step in [1c]. *Supra* §VI.B.1[1c]; Ex-1004, ¶21. Rusert further teaches claim 3's additional limitation of comparing motion information for **at most one other** candidate of the

set. For Rusert’s scan sequences (*supra* §VI.B.1[1a]-[1b]; Ex-1004, ¶¶44, ¶¶51-66, Figs. 3a- 3n), the “PMV_CANDS list may be initialized e.g. as an empty list (zero entries)” and then “updated to include previously coded motion vectors[.]” Ex-1004, ¶39, ¶44, ¶71; *supra* §VI.B.1[1c]. When the scan moves to update PMV_CANDS with the second PMV candidate in the sequence (e.g., block ‘2’), that candidate is “compar[ed with] the candidates already in the list[.]” which is at most the first PMV candidate in the scan sequence. Ex-1004, ¶21, ¶¶38-40, ¶44, ¶71. Therefore, the motion information of the second candidate in the sequence is compared with at most one other PMV candidate (the first PMV candidate). Ex-1003, ¶¶159-160.

4. Claim 4

4. The method according to claim 1 further comprising examining whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

Rusert and Karczewicz teach the method according to claim 1. A POSITA would have been motivated to further apply Lin’s teachings, which satisfy claim 4. Ex-1003, ¶¶79-89, ¶¶162-169.

Examining whether the block of pixels is divided into a first prediction unit and a second prediction unit. Lin examines whether a block of pixels is divided. Lin teaches that, in H.265/HEVC, “[t]he basic unit for compression,

termed Coding Unit (CU), is a $2N \times 2N$ square block, and... [e]ach CU contains one or multiple Prediction Units (PUs)” with divisions “correspond[ing] to horizontal and vertical partition[s.]” Ex-1006, ¶4; Ex-1013, 000007, 000017. Horizontally-divided CUs have PUs of size $2N \times N$; vertically-divided CUs have $N \times 2N$ PUs. *Id.* Lin explains that a block of pixels can be divided into a first PU (“PU1”) and second PU (“PU2”). Ex-1006, ¶25, ¶44, Figs. 7A-7D (below); Ex-1013, 000007, 000010, 000017; Ex-1003, ¶163.

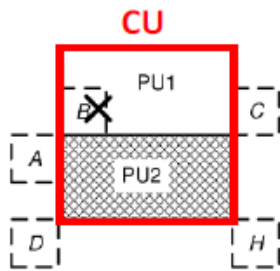


Fig. 7A

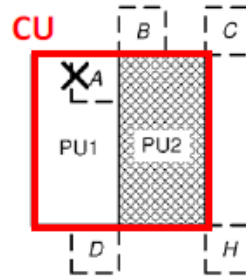


Fig. 7B

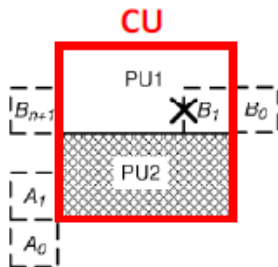


Fig. 7C

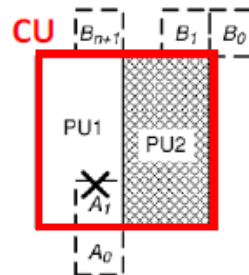


Fig. 7D

Lin examines whether the block is divided into two PUs horizontally (having $2N \times N$ PUs) or vertically ($N \times 2N$). Lin “identifies and removes redundant candidates” by examining the CU for “scenario[s] that... may cause the current PU to be... considered redundant and can be removed[,]” including where “for the second $2N \times N$,... $N \times 2N$... PU, one or more of the MVP candidates are redundant and removed if said one or more of the MVP candidates located within the previous (first) $2N \times N$,... $N \times 2N$... PU.” Ex-1006, ¶25, ¶44; Ex-1013, 000009-11, 000017; Ex-1003, ¶164.

And if so, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit. Lin examines whether (i) the current block is divided into two PUs and (ii) the spatial motion vector prediction candidate is from the other PU; if so, Lin excludes the candidate from the MVP list because it is redundant. Ex-1006, ¶44, ¶25, Figs. 7A-7D; Ex-1013, 000010, 000017.

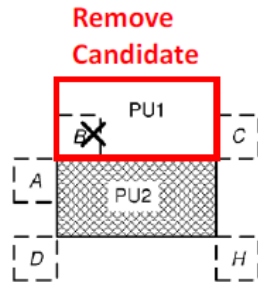


Fig. 7A

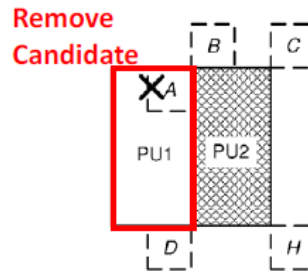


Fig. 7B

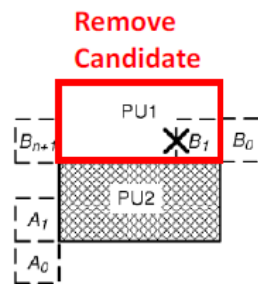


Fig. 7C

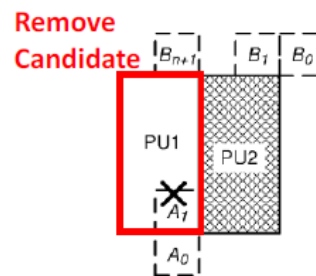


Fig. 7D

Ex-1003, ¶¶165-166.

Motivation to Combine Lin with Rusert/Karczewicz. Furthermore, this concept would have been obvious because a CU comprises one PU when it has uniform motion and is only divided if different parts are moving in different directions, as Karczewicz explains. *See* Ex-1006, ¶4; Ex-1013, 000007; Ex-1005, 35. Therefore, for a divided block, the motion vector for one PU is not a good predictor for the other. Lin teaches what Karczewicz suggests, that the motion vector from one half can be removed as a candidate for the other, thereby reducing the number of candidates. Ex-1006, ¶25, ¶44; Ex-1013, 000010; Ex-1003, ¶¶167-

168. This would have had the predictable result of excluding such candidates, consistent with the reason why a block was divided to begin with. Ex-1003, ¶85.

Accordingly, a POSITA would have been motivated to apply Lin's teachings to the Rusert/Karczewicz combination because Lin provides a straightforward teaching for reducing redundant candidates when blocks are divided. This would have furthered Rusert's goal of "reduc[ing] the number of previous motion vectors that must be considered[.]" Ex-1004, ¶12, ¶7; Ex-1003, ¶¶79-84. Ground 3 combines Lin's known technique to improve similar H.265 PU-based methods in the same way, which were ready for improvement to reduce the number of previous motion vectors that must be considered. Ex-1004, ¶12; Ex-1003, ¶¶79-84.

The combination would not have changed the principle of operation for any reference, in the manner taught by each reference. Ex-1006, ¶44; Ex-1013, 000010. Ground 2 simply applies Lin's exclusion of PUs in certain scenarios. Ex- 1003, ¶86.

Reasonable Expectation of Success. As with Ground 1, all references teach aspects of block-based video encoding for H.264/H.265 to reduce PMV candidates. Ex-1004, ¶25, ¶39, ¶¶42-44; Ex-1005, ¶3, ¶5, ¶38; Ex-1006, ¶4, ¶25; Ex-1013, 000009-11. The combination does not modify Rusert, Karczewicz, or Lin in a way that would render any reference inoperative. Indeed, many of the same reasons explained for Ground 1 likewise apply to Ground 2. Ex-1003, ¶¶87-89.

To the extent PO argues that Lin provides teachings in the context of merge mode (a mode of operation in H.265), that is irrelevant because the challenged claims do not require or exclude merge mode, and the underlying rationale for Lin’s teachings is broadly applicable to scenarios when a block has been divided. With or without merge mode, blocks are divided into multiple PUs to assign them different motion vectors. Ex-1005, ¶35; Ex-1006, ¶4; Ex-1013, 000007; Ex-1003, ¶84.

5. Claim 5

[5pre]. The method according to claim 1, further comprising
--

Ground 1 teaches [5pre]. *Supra* §VI.B.1[1pre]; Ex-1003, ¶171.

[5a]. determining a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and

Ground 1 teaches [5a]. Ex-1003, ¶¶172-176. As explained above, Ground 1 selects spatial motion vector prediction candidates (PMV candidates) as potential candidates to be included in a motion vector prediction list (PMV_CANDS).

Supra §VI.B.1[1a], §VI.B.2.

Rusert teaches “the number of candidates in PMV_CANDS *may be limited* to a pre-defined or dynamically obtained number” including one, four, or seven.

Ex-1004, ¶73, ¶77, ¶¶84-90, ¶107. By determining this maximum number, Rusert “reduce[s] the overhead of signaling which PMV is used for motion vector

prediction, since shorter lists require shorter code words” and balances the increased chance of a suitable match with the increased cost longer code words.

Ex-1004, ¶84, ¶13, ¶70, ¶107; Ex-1003, ¶¶173-174.

Additionally, Rusert teaches VLC index values that “depend on the maximum number of candidates in PMV__[C]ANDS” denoted as “Maximum list size C[.]” Ex-1004, ¶88. Therefore, Rusert determines a maximum number of candidates “C” which dictates index values. Ex-1003, ¶175.

[5b]. limiting the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

Ground 1 teaches [5b]. Ex-1003, ¶¶177-181. Rusert teaches “an outwards going scan... to obtain motion vectors to update PMV__[C]ANDS... may be terminated... as soon as a pre-defined number of unique PMV candidates have been found[.]” Ex-1004, ¶¶44-48. Furthermore, Rusert teaches “the candidate at the end of the PMV__{CANDS} list may be removed” to limit “the number of candidates in PMV__{CANDS}... to a pre-defined... number[.]” Ex-1004, ¶73. Thus, the number of PMV candidates in PMV__{CANDS} is limited to be smaller or equal to the pre-defined maximum number. Ex-1003, ¶¶178-179.

Additionally, Rusert teaches VLC examples based on the “Maximum list size C” of PMV__{CANDS} that limit the number of candidates in PMV__{CANDS} to be smaller or equal to the maximum number “C”. Ex-1004, ¶88; Ex-1003, ¶180.

6. Claim 6

[6pre]. The method according to claim 5 comprising:

Ground 1 teaches [6pre]. *Supra* §VI.B.5; Ex-1003, ¶183.

[6a]. examining, if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;

Ground 1 teaches [6a]. Ex-1003, ¶¶184-187. Rusert continues scanning for new candidates while their number is smaller than a pre-determined number; Rusert “terminat[es]” the scan for new candidates “as soon as a pre-defined number of unique PMV candidates have been found[.]” Ex-1004, ¶¶44-48, ¶13, ¶¶70-77, ¶¶84-90, ¶107; *supra* §VI.B.5. Additionally, Rusert teaches that “the candidate at the end of the PMV_CANDS list may be removed” to limit “the number of candidates in PMV_CANDS... to a pre-defined... number.” Ex-1004, ¶73; Ex-1003, ¶¶185-186.

[6b]. if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

Ground 1 teaches [6b]. Ex-1003, ¶¶188-196. Rusert obtains potential spatial motion vector prediction candidates from neighboring blocks. Ex-1004, ¶44, ¶¶51-66, Figs. 3a-3n; *supra* §VI.B.1[1a]. While scanning blocks for new candidates, Rusert examines whether the block to which a potential candidate belongs is available for motion prediction. First, Rusert teaches that blocks “coded after the

present block” “would never be available[.]” Ex-1004, ¶54. Second, blocks are “sometimes... available depending upon the traversal pattern used” to reach the current block, where some blocks would not be coded yet and would not have motion information for motion prediction. Ex-1004, ¶54. Third, Rusert examines whether blocks have “no motion vector present” or have “the same [motion vector] as a block earlier in the sequence” and are thus not available (since Rusert seeks to avoid duplication). Ex-1004, ¶54; Ex-1003, ¶¶189-193.

Rusert’s block is a PU because it is the unit for which a motion vector is assigned for motion prediction. Ex-1004, ¶¶2-5, ¶36, ¶43; *supra* §VI.B.1[1a] (explaining PUs). Ground 1 applies Rusert’s motion vector teachings to PUs, as explained above. *Supra* §VI.A, §VI.B.1[1a]; Ex-1004, ¶¶3-4, ¶36; Ex-1005, ¶¶33-36, ¶¶64-66. It would have been obvious to examine whether a PU, which Karczewicz teaches is the block for which motion vectors are assigned, is available for motion prediction because Rusert teaches three reasons why a motion vector might not be available for a block. Ex-1005, ¶¶33-36, ¶¶64-66; Ex-1003, ¶¶194-196.

[6c] if so, performing at least one of the following:

...

[6k] for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has

essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

Limitation [6c] is satisfied if [6k] is satisfied. Ex-1003, ¶198.

As explained above, Rusert's block is a PU, and Ground 1 applies Rusert's teachings, e.g. for scanning and analyzing motion vectors from blocks, to PUs.

Supra §VI.B.1[1a] (explaining Rusert's blocks), §VI.A (motivation to combine); Ex-1004, ¶¶2-5, ¶36, ¶43; Ex-1005, ¶¶33-36, ¶¶64-66; Ex-1003, ¶199.

If Rusert's scan continues (*supra* §VI.B.6[6a]), Ground 1 applies the below-explained teachings **for a potential spatial motion vector prediction candidate (from block 5), which is below the potential spatial motion vector prediction candidate on the left side (from block 2) of the prediction unit.** Rusert's scan pattern in Fig. 3n proceeds in numerical order. Ex-1004, ¶¶65-66. The PMV candidate for block 5 is below the candidate for block 2, which is on the left side of the current block (“.”) for which candidates are being evaluated. Ex-1004, ¶¶65-66, Fig. 3n:

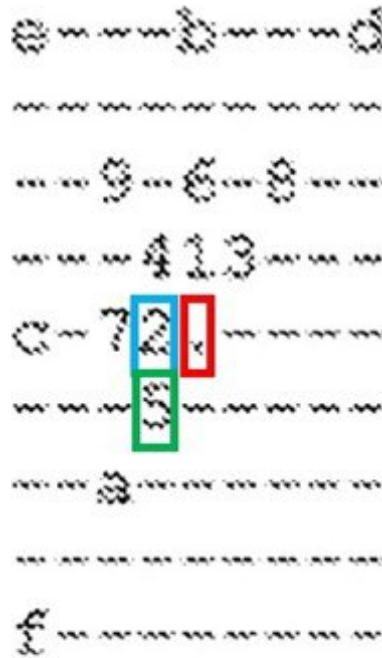


Fig. 3n

These blocks are PUs, and Ground 1 applies these teachings to PUs. Ex-1003, ¶¶200-201.

Excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit. When analyzing a potential PMV candidate, Rusert teaches “comparing the [PMV] candidates already in [PMV_CANDS] with the new [PMV candidate] that could be added, and if a duplicate is found ... skipping the new [PMV candidate].” Ex-1004, ¶¶71-72, ¶21, ¶62. Rusert excludes the potential spatial motion vector

prediction candidate from PMV_CANDS if “the PMV candidate is a duplicate of another PMV candidate” in PMV_CANDS or if it has essentially similar motion information, e.g., if “the PMV candidate is... within a threshold distance of an existing PMV candidate” in PMV_CANDS. Ex-1004, ¶21, ¶62, ¶¶71-72. In Fig. 3n, when Rusert evaluates whether to update PMV_CANDS with the candidate from block 5, Rusert compares it with candidates already in PMV_CANDS, e.g., from blocks 1, 2, 3, and 4. Ex-1004, ¶44, ¶¶65-66, ¶¶71-72, Fig. 3n. If the candidate from block 5 has essentially the same motion information compared with the candidate from block 2, then Rusert excludes the potential new candidate from block 5. *Id.*; Ex-1003, ¶¶202-203.

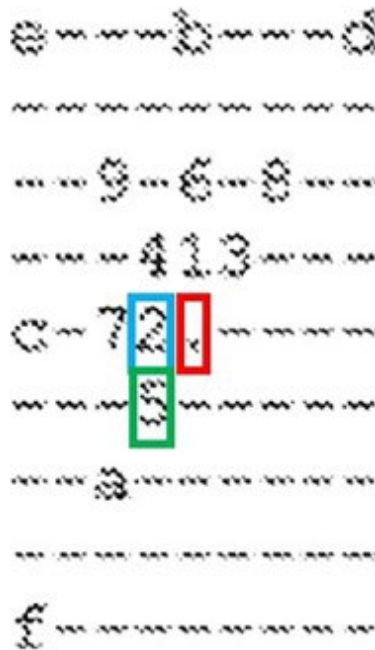


Fig. 3n

Rusert looks to whether the candidates are essentially similar by looking at whether they are duplicates or within a threshold distance. Ex-1004, ¶72 (excluding “new motion vectors... that are similar but not equal, such as pairs of motion vectors *that have a similarity measure* smaller than a pre-defined threshold...”); Ex-1003, ¶204.

7. Claim 7

7. The method according to claim 1 further comprising including a temporal motion prediction candidate into the motion vector prediction list.

Ground 1 teaches claim 7. Ex-1003, ¶¶206-209. “Motion vectors to be added to a PMV_CANDS list may comprise spatial or *temporal neighbors of the current block*, or combinations of spatial and/or temporal neighbors[.]” Ex-1004, ¶67. Temporal neighbors are “co-located blocks in neighboring frames.” Ex- 1004, ¶5. Therefore, Rusert includes a candidate motion vector obtained from a previously-encoded frame (a temporal motion prediction candidate). *Supra* §V.B; Ex-1003, ¶208.

8. Claim 8

8. The method according to claim 1 further comprising selecting one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the block of pixels.

Ground 1 teaches claim 8. Ex-1003, ¶¶210-214. Rusert teaches “signaling which PMV [candidate] is used for motion vector prediction[.]” Ex-1004, ¶84;

supra §VI.B.1[1a], [1e]. “[A] code ‘index’... is sent to *select* a particular PMV candidate... from... PMV_CANDS”; the particular PMV candidate represents the PMV used to “reconstruct $MV=DMV+PMV$ ” for the current block of pixels. Ex-1004, ¶36; Ex-1003, ¶212.

Additionally, Rusert teaches exemplary codes to signal the index of the selected candidate from PMV_CANDS. Ex-1004, ¶¶88-102; Ex-1003, ¶213.

9. Claims 15* and 29*

Beyond the preambles, claims 15 and 29 are nearly identical to claim 1, with limitations [15a]-[15e]/[29a]-[29e] having only minor differences from [1a]-[1e], respectively. Limitations [15c]/[29c] recite “each possible candidate pair” where [1c] recites “each pair” and is taught by Ground 1 because not comparing each pair satisfies not comparing each possible candidate pair. Ex-1003, ¶227, ¶249. Ground 1 teaches [15a]-[15e]/[29a]-[29e] for the same reasons provided for [1a]- [1e]. *Supra* §VI.B.1[1a]-[1e]; Ex-1003, ¶¶215-234, ¶¶242-251.

[15pre]. 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:

[29pre] A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

Ground 1 teaches [15pre] and [29pre]. Rusert teaches a video encoding/decoding “apparatus” (Ex-1004, ¶1, ¶¶24-27, ¶114, ¶116, claims 17-18)

comprising “a processor” and “a computer-readable medium, carrying instructions, which when executed[,]. . . causes [the processor] to carry out any of the methods disclosed herein.” Ex-1004, ¶¶24-26, ¶1; Ex-1003, ¶¶215-217, ¶¶242-244.

10. Claims 16-22

Other than the preambles, claims 16-22 are identical to claims 2-8. Ground 1 teaches the preambles (apparatus of claim 15). *Supra* §VI.B.9. Grounds 1 and 2 teach the rest of claims 16-22 for the reasons provided for claims 2-8, respectively. *Supra* §VI.B.2-8; Ex-1003, ¶¶235-241.

C. The ’714 Patent’s Decoder Claims

The decoder claims of the ’714 patent include substantially the same limitations as the encoder claims discussed above. Moreover, Rusert discloses that the decoder “follow[s] the same steps” as the encoder “for creating and modifying the set of PMV candidates” Ex-1004, ¶35. Karczewicz similarly teaches that the encoder and decoder use “reciprocal ... techniques.” Ex1005, ¶50.

Accordingly, the discussion of the decoder claims below references back to the detailed discussion above for the encoder claims. Ex-1003, ¶252.

1. Claim 9*

[9pre] A method comprising:

Ground 1 teaches [9pre], e.g., “a *method* of selecting PMV candidates” comprising elements explained below. Ex-1004, Abstract, ¶1, ¶11; *infra* §VI.C.1[9a]-[9e]; Ex-1003, ¶¶253-254.

[9a] selecting 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;

Ground 1 teaches [9a]. Ex-1003, ¶¶255-257.

Step [9a] is substantially similar to step [1a] except it omits the last portion of [1a] which recites that the motion vector prediction list is used to select the motion vector prediction candidate which gets signaled as the motion information for the prediction unit. As noted, Rusert teaches that the decoder “follow[s] the same steps” as the encoder “for creating and modifying the set of PMV candidates” Ex-1004, ¶¶35, 39 (“the decoder can derive the PMV_CANDS in the same way as the encoder”). Karczewicz similarly teaches that the encoder and decoder use “reciprocal ... techniques.” Ex1005, ¶50. Ex-1003, ¶256.

Because the decoder receives the encoded video data generated by the encoder and uses the signaled PMV candidate to *decode* a given block, a POSITA would have understood that, on the decoder side, the PMV candidates would be determined for “encoded block[s]” of pixels as claimed. Ex-1003, ¶257.

Accordingly, Rusert discloses decoding step [9a] for the same reasons it discloses substantially similar encoding step [1a]. *See supra* § VI.B.1[1a]; *see also* Ex-1003, ¶¶93-112.

[9b]	determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;
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Ground 1 teaches [9b]. Ex-1003, ¶¶258-259.

Step [9b] is substantially identical to step [1b]. As discussed, Rusert teaches that the decoder performs the same steps to derive the set of motion vector prediction candidates. Ex-1004, ¶¶35, 39. Accordingly, Rusert discloses decoding step [9b] for the same reasons it discloses substantially identical encoding step [1b]. *See supra* § VI.B.1[1b]; *see also* Ex-1003, ¶¶113-124.

[9c]	comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;
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Ground 1 teaches [9c]. Ex-1003, ¶¶260-264.

Step [9c] is substantially identical to step [1c] except that 9[c] requires (i) comparing the motion information of the first spatial motion vector prediction candidate with that of another spatial motion vector prediction candidate “of the set” (as opposed to “the determined subset”) and (ii) avoiding comparison of each “possible candidate” pair (as opposed to “each pair”) from the set. Ex-1003, ¶261.

As discussed, Rusert teaches that the decoder performs the same steps to derive the set of motion vector prediction candidates. Ex-1004, ¶¶35, 39. Accordingly, Rusert discloses decoding step [9c] for the same reasons it discloses

substantially similar encoding step [1c]. *See supra* §VI.B.1[1c]; *see also* Ex-1003, ¶¶262, 125-136.

Moreover, as discussed for [1c], Rusert’s method compares the motion information of the first spatial motion vector prediction candidate with the PMV candidates in the PMV_CANDS list. While the candidates in the PMV_CANDS list are the claimed “determined subset” (*supra* § VI.B.1[1b]), they are also a subset of the *broad*er claimed “set” of motion vector prediction candidates which, as discussed for [1a], can be either (1) the set of motion vectors used for all previous coded blocks in the frame or (2) the set of motion vectors for the blocks in the scan pattern. Accordingly, the comparisons to the candidates in the PMV_CANDS list discussed for [1c] satisfies the broader limitation of [9c] as well. Ex-1003, ¶263.

As discussed for [1c], Rusert’s method avoids comparing each candidate pair from the set of spatial motion vector prediction candidates. *See supra* § VI.B.1[1c]. For the same reasons, Rusert avoids “a comparison of each *possible candidate* pair from the set ...” as recited by [9c]. Ex-1003, ¶264.

[9d] determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and
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Ground 1 teaches [9d]. Ex-1003, ¶¶265-266.

Step [9d] is identical to step [1a]. As discussed, Rusert teaches that the decoder performs the same steps to derive the set of motion vector prediction candidates. Ex-1004, ¶¶35, 39. Accordingly, Rusert discloses decoding step [9d] for the same reasons it discloses substantially identical encoding step [1d]. *See supra* § VI.B.1[1d]; *see also* Ex-1003, ¶¶266, 137-142.

[9e] selecting 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.

Ground 1 teaches [9e]. Ex-1003, ¶¶267-273.

Selecting a spatial motion vector prediction candidate from the motion vector prediction list for use in decoding the encoded block of pixels. Rusert teaches “a code ‘index’... to select a particular PMV candidate... from... PMV_CANDS” and “[u]sing the transmitted index” to “determine the PMV” and reconstruct the motion vector. Ex-1004, ¶¶36-37. These techniques are “for video decoding... the current block[.]” Ex-1004, ¶23, ¶35. The current block is in an “encoded video stream” that is “passe[d] to a decoder... employed in decoding the encoded video stream.” Ex-1004, ¶34; Ex-1003, ¶268.

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. Rusert teaches “a particular PMV candidate” is selected “from a list of PMV candidates, PMV_CANDS[,]” using “a code ‘index’” sent “from the encoder” and received by the decoder. Ex-1004, ¶¶36-37, Fig. 1:

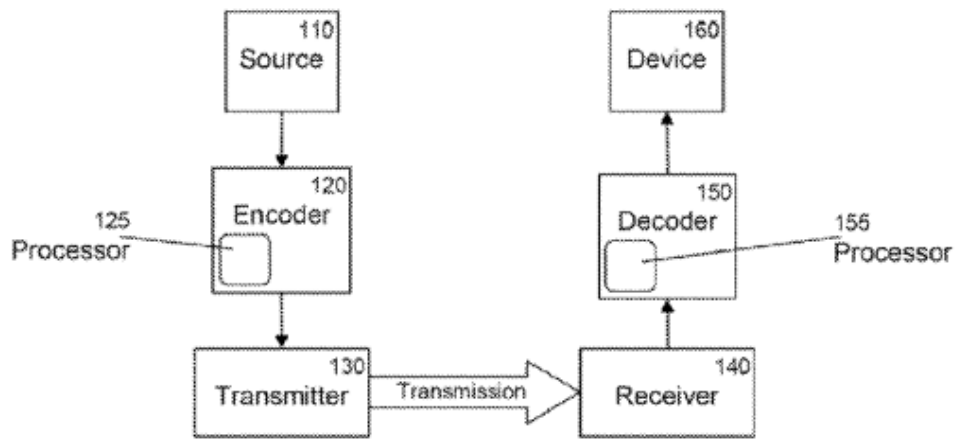
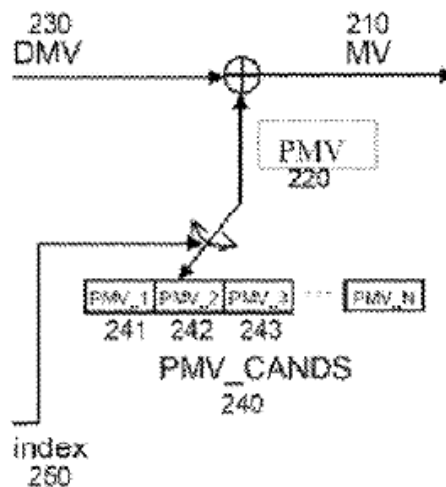
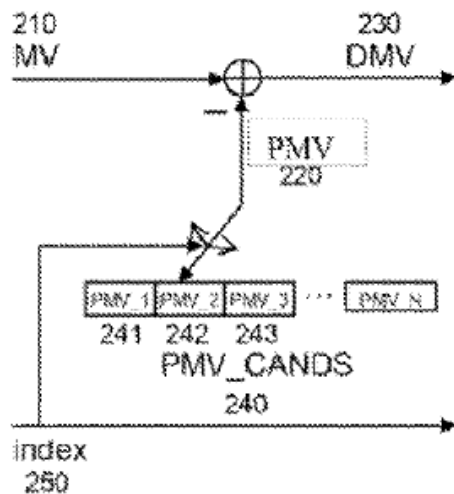


Fig. 1

The received index is information that identifies a respective PMV candidate from PMV_CANDS by pointing to a particular candidate based on its position in PMV_CANDS. In this way, it is an index into PMV_CANDS. Rusert teaches zero-based indexing examples, starting with zero for the first candidate and ending with n-1 for a list of n candidates. Ex-1004, ¶¶88-95; Ex-1003, ¶¶269-270.

PMV_CANDS is constructed by an encoder, and the decoder “mimics the encoder” to construct the same PMV_CANDS. Ex-1004, ¶¶35-39. From PMV_CANDS, the decoder uses the index “signaled from the encoder” to “select a particular PMV candidate[.]” Ex-1004, ¶36. “Using the transmitted index, the

decoder... can determine the PMV 220” to “reconstruct [the motion vector.]” Ex-1004, ¶27. Rusert illustrates this below. Ex-1004, Figs 2a-2b:



Ex-1003, ¶¶271-272.

2. Claim 10

10. The method according to claim 9 further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

Ground 1 teaches claim 10. Ex-1003, ¶¶274-275.

Claim 10 adds the same limitation as claim 3 and is rendered obvious for the same reasons. *Supra* § VI.B.3. Ex-1003, ¶¶275, 157-161.

3. Claim 11

11. The method according to claim 9 further comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the

potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

Claim 11 adds substantially the same limitation as claim 4 discussed above. As noted, Rusert teaches that the decoder “follow[s] the same steps” as the encoder “for creating and modifying the set of PMV candidates” Ex-1004, ¶¶35, 39 (“the decoder can derive the PMV_CANDS in the same way as the encoder”). Karczewicz similarly teaches that the encoder and decoder use “reciprocal ... techniques.” Ex1005, ¶50.

Accordingly, Rusert, Karczewicz, and Lin render obvious claim 11 for the same reasons discussed for claim 4. *See supra* § VI.B.4. *See also* Ex-1003, ¶¶277, 162-169.

4. Claim 12

[12pre] The method according to claim 9 further comprising
[12a] determining a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and
[12b] limiting the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

Ground 1 teaches claim 12. Ex-1003, ¶¶278-280.

Claim 12 adds the same limitations as claim 5 and is rendered obvious for the same reasons. *Supra* § VI.B.5. *See also* Ex-1003, ¶¶279-280, 170-181.

5. Claim 13

Claim 13 adds substantially the same limitations as claim 6 including the limitations below which are substantially identical to [6pre], [6a], [6b], [6c], and [6k].

[13pre]	The method according to claim 12 further comprising:
[13a]	examining, if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;
[13b]	if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;
[13c]	if so, performing at least one of the following: ...
[13k]	for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

Ground 1 renders obvious claim 13 for the same reasons discussed above for claim 6. *See supra* §VI.B.6. *See also* Ex-1003, ¶¶282-283, 182-205.

6. Claim 14

14.	The method according to claim 9 further comprising selecting one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the encoded block of pixels.
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Ground 1 teaches claim 14. Ex-1003, ¶¶284-289.

Rusert teaches “signaling which PMV [candidate] is used for motion vector prediction[.]” Ex-1004, ¶84; *supra* §VI.C.1[9a], [9e]. “[A] code ‘index’... is sent to *select* a particular PMV candidate... from a list of PMV candidates, PMV_CANDS”; the particular PMV candidate represents the PMV used to “reconstruct $MV=DMV+PMV$ ” for the current encoded block of pixels. Ex-1004, ¶36; Ex-1003, ¶286.

Additionally, Rusert teaches exemplary codes to signal the index of the selected candidate from PMV_CANDS. Ex-1004, ¶¶88-102. Rusert applies the above teachings to “video decoding, wherein the current block is the block being... decoded” (Ex-1004, ¶23, ¶35) and is part of an “encoded video stream” that is “passe[d] to a decoder[.]” Ex-1004, ¶¶34-36; *supra* §VI.C.1[9e]; Ex-1003, ¶¶287-288.

Given these teachings, a POSITA would have understood that the decoder uses the index to select the particular PMV candidate that provides the motion vector prediction for decoding the encoded block of pixels. EX-1003, ¶¶286-288.

7. Claims 23* and 30*

Beyond the preambles, claims 23 and 30 are nearly identical to claim 9, with limitations [23a]-[23e]/[30a]-[30e] having only minor differences with [9a]-[9e], respectively, and being satisfied for reasons explained above. *Supra* §VI.C.1[9a]-[9e]. Limitations [23c]/[30c] recite “the... candidate in the determined subset”

where [9c] recites “another... candidate of the set”; Rusert satisfies both by teaching a candidate in the subset (explained for [9b]), which is also another candidate in the larger claimed set. Ex-1003, ¶¶295-299, ¶¶320-321. Limitation [23d] repeats language from [23c], which Ground 1 teaches as explained for [23c] and [9c]. Ex-1003, ¶¶295-299, ¶¶260-264.

23[pre] 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: [30pre]. A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:
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Ground 1 teaches [23pre] and [30pre], e.g., with a video encoding/decoding “apparatus” comprising “a processor” and “computer-readable medium, carrying instructions, which when executed[,]. . . causes [the processor] to carry out any of the methods disclosed herein.” Ex-1004, ¶1, ¶¶24-27, ¶114, ¶116, claims 17-19; Ex-1003, ¶¶290-292, ¶¶313-317.

[30pre] recites “an encoder” with decoding functions. By the time of the alleged invention, a POSITA would have known that a PC with encoding capabilities could also decode compressed video. Ex-1003, ¶314. Karczewicz expressly references a “combined encoder/decoder (codec).” Ex-1005, ¶¶50, 129. Additionally, a POSITA would have been well-aware that encoders often included decoding capabilities so the encoders could use locally decoded image data during

the encoding process. Ex-1003, ¶314. Karczewicz discloses this as well. Ex-1005, ¶68. Accordingly, it would have been obvious to a POSITA for Rusert’s encoder to include program instructions for performing the claimed decoding steps. Ex-1004, ¶35 (“The methods disclosed herein are performed in the encoder during encoding, and also in the decoder during decoding.”); Ex-1003, ¶¶314, 316.

In IPR2024-00604, the petitioner argued that the reference to “an encoder” in [30pre] was a typo. If the reference to an encoder is treated as a typo, [30pre] is disclosed because Rusert discloses a video decoding “apparatus” comprising “a processor” and “computer-readable medium, carrying instructions, which when executed[,]... causes [the processor] to carry out any of the methods disclosed herein.” Ex-1004, ¶1, ¶¶24-27. Ex-1003, ¶¶315-316.

8. Claims 24-28

Beyond their preambles, claims 24-28 are identical to claims 10-14. Grounds 1 and 2 teach the preambles (apparatus of claim 23) (*supra* §VI.C.7) and the rest of claims 24-28 as explained for claims 10-14, respectively. *Supra* §§VI.C.2-6; Ex-1003, ¶¶306-312.

VII. MANDATORY NOTICES AND FEES

A. Real Party In Interest:

Petitioners identify themselves as real parties in interest. Out of an abundance of caution, Petitioner Hisense USA Corporation also identifies Hisense Co., Ltd., which entity was also sued by Nokia for alleged infringement of the '714 patent.

B. Related Matters:

To the best of Petitioners' knowledge, the '714 patent is presently or has been involved in the following related matters:

Case	Filing Date
<i>Certain Video-Capable Laptop, Desktop Computers, Handheld Computers, Tablets, Televisions, Projectors, and Components and Modules Thereof</i> Inv. No. 337-TA-3821 (ITC)	4/11/2025
<i>Nokia Technologies Oy v. Hisense Co. Ltd. et al</i> No. 1-25-cv-01871 (NDGA)	4/7/2025
<i>Nokia Technologies Oy v. ASUSTeK Computer Inc. et al</i> No. 2-25-cv-03053 (CDCA)	4/7/2025
<i>Nokia Technologies Oy v. Acer Inc. et al</i> No. 1-25-cv-00523 (WDTX)	4/7/2025
<i>Element Television Company, LLC et al v. Nokia Corporation a/k/a Nokia of America Corporation et al</i> No. 0-24-cv-04269 (DMN)	11/25/2024
<i>Certain Video Capable Electronic Devices, Including Computers, Streaming Devices, Televisions, and Components and Modules Thereof</i> Inv. No. 337-TA-1380 (ITC)	10/31/2023
<i>Nokia Corporation et al v. Amazon.com, Inc.</i> No. 1-23-cv-01232 (DDE)	10/27/2023

<i>Nokia Technologies Oy v. HP Inc. f/k/a Hewlett-Packard Company</i> No. 1-23-cv-01237 (DDE)	10/31/2023
<i>Nokia Technologies Oy v. Amazon.com, Inc. et al</i> No. 1-23-cv-01236 (DDE)	10/31/2023
<i>ASUSTeK Computer Inc. et al. v. Nokia Corporation and Nokia Technologies Oy</i> , IPR2025-01153 (PTAB)	6/16/2025
<i>Amazon.com, Inc. et al. v. Nokia Technologies Oy</i> , IPR2024-00604 (PTAB)	4/8/2024
<i>Amazon.com, Inc. et al. v. Nokia Technologies Oy</i> , IPR2024-00605 (PTAB)	4/8/2024

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Respectfully submitted,

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CLAIM APPENDIX

Encoder Claims

[1pre] 1. A method comprising:

[1a] selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a 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 block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

[1b] determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate;

[1c] comparing motion information of the first spatial motion vector prediction candidate with motion information of spatial motion vector prediction candidates in the determined subset of spatial motion vector prediction candidates without making a comparison of each pair from the set of spatial motion vector prediction candidates;

[1d] determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

[1e] causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

2. The method according to claim 1 further comprising selecting 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.

3. The method according to claim 1, further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

4. The method according to claim 1 further comprising examining whether the block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

[5pre]. The method according to claim 1, further comprising

[5a] determining a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and

[5b] limiting the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

[6pre] The method according to claim 5 comprising:

[6a] examining, if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;

[6b] if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

[6c] if so, performing at least one of the following:

[6d] for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[6e] the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;

[6f] the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially

similar motion information than a spatial motion vector prediction candidate above the prediction unit;

[6g] for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[6h] the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

[6i] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

[6j] for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[6k] for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of

the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

[6l] for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[6m] all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;

[6n] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[6o] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

7. The method according to claim 1 further comprising including a temporal motion prediction candidate into the motion vector prediction list.

8. The method according to claim 1 further comprising selecting one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the block of pixels.

[15pre] 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:

[15a] select a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a 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 block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

[15b] 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;

[15c] 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;

[15d] 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

[15e] cause information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

16. The apparatus according to claim 15 wherein the apparatus is further caused to select 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.

17. The apparatus according to claim 15, wherein the apparatus is further caused to compare motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

18. The apparatus according to claim 15 wherein the apparatus is further caused to examine whether the block of pixels is divided into a first prediction unit

and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

19. The apparatus according to claim 15, wherein the apparatus is further caused to:

determine a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and

limit the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

[20pre] The apparatus according to claim 19 wherein the apparatus is further caused to:

[20a] examine, if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;

[20b] if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

[20c] if so, perform at least one of the following:

[20d] for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction

candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[20e] the received block of pixels is vertically divided into a first prediction unit and a second prediction unit;

[20f] the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

[20g] for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[20h] the received block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

[20i] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

[20j] for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[20k] for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

[20l] for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[20m] all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;

[20n] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[20o] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

21. The apparatus according to claim 15 wherein the apparatus is further caused to include a temporal motion prediction candidate into the motion vector prediction list.

22. The apparatus according to claim 15 wherein the apparatus is further caused to select one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the block of pixels.

[29pre] A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

[29a] selecting a first spatial motion vector prediction candidate from a set of spatial motion vector prediction candidates for a 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 block of pixels, where the motion vector prediction list comprises motion information of the spatial motion vector

prediction candidates and is utilized to identify motion vector prediction candidates of which one spatial motion vector prediction candidate from the motion vector prediction list is signaled as the motion information for the prediction unit;

[29b] determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

[29c] comparing 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;

[29d] determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

[29e] causing information identifying the one spatial motion vector prediction candidate from the motion vector prediction list to be transmitted to a decoder or to be stored.

Decoder Claims

[9pre] A method comprising:

[9a] selecting 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;

[9b] determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

[9c] comparing motion information of the first spatial motion vector prediction candidate with motion information of another spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates;

[9d] determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing;
and

[9e] selecting 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.

10. The method according to claim 9 further comprising comparing motion information of the potential spatial motion vector prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

11. The method according to claim 9 further comprising examining whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

[12pre] The method according to claim 9 further comprising

[12a] determining a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and

[12b] limiting the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

[13pre]. The method according to claim 12 further comprising:

[13a] examining, if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;

[13b] if so, examining whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

[13c] if so, performing at least one of the following:

[13d] for a potential spatial motion vector prediction candidate on a left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[13e] the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;

[13f] the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

[13g] for a potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate

from the motion vector prediction list if any of the following conditions are fulfilled:

[13h] the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

[13i] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

[13j] for a potential spatial motion vector prediction candidate, which is on a right side of the potential spatial motion vector prediction candidate above the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[13k] for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the

spatial motion vector prediction candidate on the left side of the prediction unit;
and

[13l] for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, excluding the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[13m] all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;

[13n] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[13o] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

14. The method according to claim 9 further comprising selecting one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the encoded block of pixels.

[23pre]. 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:

[23b] 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;

[23c] 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;

[23d] 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

[23e] 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.

24. The apparatus according to claim 23 wherein the apparatus is further caused to compare motion information of the potential spatial motion vector

prediction candidate with motion information of at most one other spatial motion vector prediction candidate of the set of spatial motion vector prediction candidates.

25. The apparatus according to claim 23 wherein the apparatus is further caused to examine whether the received encoded block of pixels is divided into a first prediction unit and a second prediction unit; and if so, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the prediction unit is the second prediction unit.

[26pre] The apparatus according to claim 23 wherein the apparatus is further caused to:

[26a] determine a maximum number of spatial motion vector prediction candidates to be included in the motion vector prediction list; and

[26b] limit the number of spatial motion vector prediction candidates in the motion vector prediction list smaller or equal to the maximum number.

[27pre] The apparatus according to claim 26 wherein the apparatus is further caused to:

[27a] examine if the number of spatial motion vector prediction candidates in the motion vector prediction list smaller than the maximum number;

[27b] if so, examine whether the prediction unit to which the potential spatial motion vector prediction candidate belongs is available for motion prediction;

[27c] if so, perform at least one of the following:

[27d] for a potential spatial motion vector prediction candidate on a left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[27e] the received encoded block of pixels is vertically divided into a first prediction unit and a second prediction unit;

[27f] the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and if the prediction unit is the second prediction unit, and the potential spatial motion vector prediction candidate has essentially similar motion information than a spatial motion vector prediction candidate above the prediction unit;

[27g] for a potential spatial motion vector prediction candidate above the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[27h] the received encoded block of pixels is horizontally divided into a first prediction unit and a second prediction unit, and the prediction unit is the second prediction unit;

[27i] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit;

[27k] for a potential spatial motion vector prediction candidate, which is below the potential spatial motion vector prediction candidate on the left side of the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit; and

[27l] for a potential spatial motion vector prediction candidate cornerwise neighbouring the prediction unit, exclude the potential spatial motion vector prediction candidate from the motion vector prediction list if any of the following conditions are fulfilled:

[27m] all the other potential spatial motion vector prediction candidates have been included in the motion vector prediction list;

[27n] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate above the prediction unit;

[27o] the potential spatial motion vector prediction candidate has essentially similar motion information than the spatial motion vector prediction candidate on the left side of the prediction unit.

28. The apparatus according to claim 23 wherein the apparatus is further caused to select one motion vector prediction candidate from the motion vector prediction list to represent a motion vector prediction for the received encoded block of pixels.

[30pre] A non-transitory computer readable medium having stored thereon a computer executable program code for use by an encoder, said program codes comprising instructions for:

[30a] selecting 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;

[30b] determining a subset of spatial motion vector prediction candidates based on the location of the block associated with the first spatial motion vector prediction candidate;

[30c] comparing 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;

[30d] determining to include or exclude the first spatial motion vector prediction candidate in the motion vector prediction list based on the comparing; and

[30e] selecting 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.

CERTIFICATE OF SERVICE

The undersigned hereby certifies that on July 23, 2025, true and correct copies of the foregoing Petition for *Inter Partes* Review of U.S. Patent No. 10,536,714 and supporting materials (Exhibits 1001-1019 and Powers of Attorney) were served in entirety on the Patent Owner at the following addresses of record as listed on PAIR, via overnight delivery:

Nokia Corporation and Alston & Bird LLP
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The undersigned certifies that true and correct copies of the Petition for *Inter Partes* Review of U.S. Patent No. 10,536,714 and Exhibits 1001-1019 were also sent via electronic mail to the below attorneys of record for Plaintiff in the concurrent litigation matter(s):

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CERTIFICATE OF WORD COUNT UNDER 37 CFR §42.24(D)

Pursuant to 37 C.F.R. §42.24(a), Petitioners hereby certifies that portions of the above-captioned Petition for Inter Partes Review of U.S. Patent 10,536,714, in accordance with and reliance on the word count provided by the word-processing system used to prepare this Petition, that the number of words in this paper is 13,335. Pursuant to 37 C.F.R. §42.24(a), this word count is in compliance and excludes the table of contents, table of authorities, mandatory notices under §42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing. This word count was prepared using Microsoft Word.

Respectfully submitted,

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