

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

Case: IPR2025-01263

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

DECLARATION OF DR. IAIN RICHARDSON

Mail Stop “PATENT BOARD”
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

TABLE OF CONTENTS

I.	INTRODUCTION.....	1
II.	EDUCATIONAL BACKGROUND AND QUALIFICATIONS	2
III.	MATERIALS REVIEWED AND TIME OF INVENTION.....	5
IV.	LEGAL STANDARDS.....	6
	A. Overview	6
	B. Patent Claims	6
	C. Burden of Proof for Invalidity	8
	D. Claim Construction	8
	E. Person of Ordinary Skill in the Art	8
	F. Anticipation.....	9
	G. Obviousness	10
V.	PERSON OF ORDINARY SKILL IN THE ART (POSITA)	13
VI.	CLAIM CONSTRUCTION	13
VII.	BACKGROUND OF THE RELEVANT TECHNOLOGY	15
	A. Overview of Video Coding and Video Coding Standards.....	15
	B. Overview of Motion Prediction in Video Coding.....	18
	C. Technical Challenges in Motion Prediction.....	27
	D. Overview of the '714 Patent's Features Distinguishable from the Prior Art	29
	E. Overview of Rusert	34
	F. Overview of Nakamura.....	38
	G. Comparison of Rusert and Nakamura.....	40
	1. In Nakamura and Rusert, the Alleged Subsets are Determined Before the Alleged First Spatial Motion Vector Prediction Candidates are Known or Confirmed.....	41
VIII.	THE GROUNDS IN THE PETITION DO NOT ANTICIPATE OR RENDER OBVIOUS THE CHALLENGED CLAIMS	47
	A. Ground 1: Rusert in Combination with Karczewicz.....	47
	1. Rusert does not teach “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,” as required by the claims 47

B. Ground 2: Rusert in Combination with Karczewicz and Lin.....64

IX. CONCLUSION 65

I, Dr. Iain Richardson, declare as follows:

I. INTRODUCTION

1. I have been retained on behalf of Nokia Technologies OY and asked to provide opinions in respect of Inter Partes Review (IPR) proceeding IPR2025-01263 which relates to U.S. Patent No. 10,536,714, the '714 Patent. The Petition and the expert declaration in IPR2025-01263 appears to follow arguments from IPR proceedings IPR2024-00604, IPR2024-00605 and IPR2025-1153 in which I was also retained by Patent Owner. Petitioner's expert declaration used in this IPR petition is from the expert retained by petitioner in IPR proceedings IPR2024-00604 and -00605, Dr. Charles Creusere, to whose testimony I responded in the course of those prior IPR proceedings. I have previously provided five declarations regarding the validity of the '714 Patent: IPR2024-00604/605 PO Preliminary Response, IPR2024-00604/605 PO Response, IPR2025-01153 PO Preliminary Response, and two declarations subject to a protective order in the ITC investigation *Certain Video-Capable Laptop, Desktop Computers, Handheld Computers, Tablets, Televisions, Projectors, and Components and Modules Thereof*, Inv. No. 337-TA-1448. I have re-used and adapted text and illustrations from these previous declarations where I feel it is appropriate.

2. This declaration summarises the independent opinions that I have formed to date, based on the material currently available to me. I reserve the right to

modify my opinions, if necessary, based on further review and analysis of information that I receive after the filing of this Declaration, including in response to any positions taken by Petitioners or their experts that I have not yet been provided with.

3. My findings, as explained below, are based on my study, experience, knowledge and background in the fields discussed below. I am informed by my education and my extensive experience in the fields of video compression and multimedia coding and communications. I have also relied on my review and analysis of the prior art, information provided to me and information I have independently reviewed.

II. EDUCATIONAL BACKGROUND AND QUALIFICATIONS

4. Details of my professional qualifications and background are summarised below and are set out in detail in my Curriculum Vitae. *See* Ex-2011.

5. I am Director and co-founder of Vcodex BV.

6. I have over 30 years of experience related to video and image compression and coding. I am qualified by education and experience to testify as an expert with respect to subject matter in the fields of video, image, multimedia and general-purpose data encoding, decoding, compression, decompression, and transmission.

7. I received a Master of Engineering (M.Eng.) degree in Electronic and Electrical Engineering from Heriot-Watt University in Edinburgh, Scotland in 1990. I received a Doctor of Philosophy (Ph.D.) degree in Video Compression from Robert Gordon University in Aberdeen, Scotland in 1999. I worked as a Digital Signal Processing (“DSP”) Hardware Designer with GEC Avionics Ltd. from 1990 to 1993.

8. In 1993, I assumed a post as a Lecturer, then Reader and eventually a Full Professor in the field of image and video compression in the School of Engineering at Robert Gordon University. In 2009, I was awarded the position of Honorary Professor with Robert Gordon University.

9. At Robert Gordon University, I founded and ran an image communication technology research laboratory. I carried out original research in the field of data, image, and video compression, initiated and managed research projects, and supervised research students.

10. I am the author of five books and over 70 journal and conference papers on video and image coding and communication, including two widely cited books on the H.264 / MPEG-4 industry standards for video compression. In my 2002 book, *Video Codec Design*, I discussed in detail the efficient implementation of image and video compression on software and hardware platforms.

11. In 1995, during my employment at Robert Gordon University, I cofounded and became Technical Director, equivalent of Chief Technology Officer,

at 4i2i Communications Limited. I held this position until 2000. In my role at 4i2i, I was responsible for and engaged in the design of software and hardware modules for compression and communication systems. The designs included video processing algorithms in software and hardware for implementation on processing devices and the design of compression algorithms such as block-based transforms, run-length coding, and variable-length coding in software and hardware. A modified version of one of my video compression hardware designs was successfully used by NASA to stream video from the International Space Station.

12. In 2007, I founded Vcodex Limited (now Vcodex BV) and currently serve as the CEO, through which I provide technical and strategic advice to technology companies particularly relating to video, image, and data compression for streaming.

13. In 2009, I founded Onecodec Limited and served as CEO, leading the company's development of innovative video, image, and multimedia data compression and storage software and systems. Onecodec's technology and business activities were merged with Vcodex Limited in 2015.

14. I have previously prepared expert reports and testified in a number of cases concerning video and image compression, graphics compression, general purpose data compression, and multimedia streaming.

15. I am a named inventor on 11 patents or patent applications, including U.S. and non-US patents and applications.

16. Because of my background, training, and experience, I am qualified as an expert in the technical areas relevant to the '714 Patent.

17. My company Vcodex BV is being compensated for my independent analysis as an expert with respect to this inter partes review (IPR) proceeding. Neither my compensation nor Vcodex BV's compensation is contingent in any way on the content of my analysis or the outcome of this proceeding. I have no financial interest in Petitioner (Snap, Inc. and Hisense USA Corporation) or Patent Owner (Nokia Technologies Oy) and I have no financial interest in the challenged patent.

III. MATERIALS REVIEWED AND TIME OF INVENTION

18. The opinions contained in this Declaration are based on the documents that I have reviewed, including the Petition and all materials cited therein, the prior Institution Decision of IPR2024-00604/605, the deposition testimony of Dr. Creusere, my professional judgment, as well as my education, experience, and my knowledge regarding technologies related to the '714 Patent. I have also reviewed and considered Rusert, Karczewicz, Lin, and Nakamura, which I understand have been designated Exhibits Ex-1004 – Ex-1006, Ex-2008.

IV. LEGAL STANDARDS

A. Overview

19. I am not an attorney or a legal expert, and I do not opine on matters of law. All the legal standards, which are listed in this section and which I applied in reaching the conclusions expressed throughout this Declaration, were provided to me and explained to me by counsel. In preparing this Declaration, I have endeavored to faithfully apply these legal standards. I do not intend to offer opinions on the law. Below, I describe the legal standards that I applied in my analysis of the claims of the '714 Patent.

20. I have been informed by counsel and I understand that an issued patent is presumed valid and that the challenger of a patent's validity bears the burden of proving invalidity of the patent.

B. Patent Claims

21. I have been informed by counsel and I understand that a patent's claims describe the invention made by the inventors and describe what the patent owner owns and what the owner may prevent others from doing.

22. I have been informed by counsel that claims may describe products, such as machines or chemical compounds, or processes for making or using a product. Claims are usually divided into parts or steps called limitations.

23. I have been informed by counsel that there are two types of claims: independent claims and dependent claims. An independent claim sets forth all the requirements that must be met in order to be covered by that claim. Thus, it is not necessary to look at any other claim to determine what an independent claim covers. A dependent claim does not itself recite all of the requirements of the claim, but refers to another claim for some of its requirements. In this way, a dependent claim depends on another claim. The law considers a dependent claim to incorporate all of the requirements of the claims to which it refers.

24. I have been informed by counsel that a dependent claim then adds its own additional requirements. To determine what a dependent claim covers, it is necessary to look at both the dependent claim and any other claims to which it refers.

25. I have been informed by counsel that in a case where a dependent claim incorporates the limitations of an independent claim upon which it depends, if a reference fails to disclose any of the limitations of the independent claim, the claims which depend on that independent claim cannot be made invalid by such a reference. As a result, any of the references at issue in this proceeding that fail to disclose all of the limitations of an independent claim necessarily also fail to disclose all of the limitations of claims which depend on that independent claim.

C. Burden of Proof for Invalidity

26. I have been informed by counsel and I understand that the party challenging the validity of an issued U.S. patent in an IPR bears the burden of proving invalidity through facts supported by a preponderance of the evidence. I have been informed that a “preponderance of the evidence” means evidence sufficient to prove that a fact is more likely true than it is not.

D. Claim Construction

27. I have been informed by counsel and I understand that the first step in determining validity is to properly construe the claims. I have further been informed by counsel that, in this proceeding, the Board must determine the scope of the claims by using the same claim construction standard that United States District Courts use. Under this standard, the words of a claim are given their “ordinary” and “customary” meaning as would have been understood by a person of ordinary skill in the art at the time of the invention. I have been informed that such a person looks to the claims, specification, and file history in understanding the meaning of the claim terms. I have applied this understanding in this declaration.

E. Person of Ordinary Skill in the Art

28. I have been informed by counsel and I understand that a person having ordinary skill in the art may be defined by factors such as, when considered at the time of the alleged invention: (a) the levels of education and experience of the

inventor and other persons actively involved in the field; (b) the types of problems encountered in the field; (c) prior art solutions to those problems; (d) rapidity with which innovations are made; and (e) the sophistication of the technology.

F. Anticipation

29. I have been informed by counsel and I understand that a patent claim can be found invalid as anticipated if each and every element of the claim, as properly construed, is found either explicitly or inherently in a single prior art reference. If the single prior art reference does not disclose explicitly or inherently any one claim limitation, then that claim is not anticipated. I have further been informed that the single prior art reference cannot merely disclose each element; rather, it must disclose all of the elements as arranged in the claim. I have been informed that for a prior art reference to “inherently” disclose something, the reference must necessarily function in accordance with, or include the claimed limitations, to anticipate. The missing descriptive matter cannot merely probably or possibly include the claimed limitations. I have further been informed by counsel that, with respect to an anticipation analysis, it is improper to combine separate, distinct embodiments of a single prior art reference.

30. I have been informed that for a reference to be anticipatory, the reference must contain an enabling disclosure. I have been informed that merely

naming or describing the subject matter is insufficient if it cannot be produced without undue experimentation.

G. Obviousness

31. I have been informed by counsel and I understand that a patent claim can be found invalid as obvious if the differences between the claim and the prior art references would have been obvious to a person of ordinary skill in the art at the time of the invention, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any objective indicia of non-obviousness. I have further been informed by counsel that a claim can be found to be obvious in light of either a single prior art reference or multiple prior art references. I have been informed that references qualify as prior art for an obviousness determination only when they are analogous to the claimed invention. Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

32. I have been informed that to be obvious in light of a single prior art reference or multiple prior art references, there must be a reason either to modify the single prior art reference or to combine the two or more prior art references to

achieve the claimed invention. I have been informed by counsel that this reason may come from a teaching, suggestion, or motivation to combine which may come from the reference or references themselves, the knowledge or “common sense” of one skilled in the art, or from the nature of the problem to be solved, and may be explicit or implicit from the prior art as a whole.

33. I have been informed by counsel that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.

34. I have further been informed by counsel that there is no suggestion to combine, however, if a reference teaches away from its combination with another source. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the inventor, or if it suggests that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the inventor. If, when combined, the references would produce a seemingly inoperative device, then they teach away from their combination. I have been informed that it is improper to combine references where the references teach away from their combination.

35. I have been informed by counsel that the degree of teaching away will depend on the particular facts; in general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the inventor. I have been informed that a reference teaches away, for example, if the references leave the impression that the product would not have the property sought by the inventor.

36. I have been informed by counsel that if the teachings of a prior art reference would lead one skilled in the art to make a modification that would render another prior art device inoperable, then such a modification would generally not be obvious. I have been informed that if a proposed modification would render the prior art device unsatisfactory for its intended purpose, then the proposed modification would generally not be obvious.

37. I have been informed by counsel that it is improper to use hindsight in making the obviousness determination.

38. I have been informed by counsel that some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness must be made. I have been informed that, for example, there may be no rational underpinning to support the legal conclusion of obviousness where systems are already complete and the party challenging validity seeks to mix and match components, which each exist in the separate systems, from these complete systems.

V. PERSON OF ORDINARY SKILL IN THE ART (POSITA)

39. Based on my review of the '714 Patent, the types of problems encountered in the art at and prior to the time of the alleged invention, prior solutions to those problems, the pace with which innovations were made during the relevant time period, the sophistication of the technology, and the educational level of active professionals in the field, I apply Petitioner's definition of a POSITA for the sake of this Declaration, namely: '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'. (Petition, 14-15).

40. All my opinions in this Declaration are from the perspective of a person of ordinary skill in the art, as I have defined it above and during the relevant time frame (e.g., 2011). During that time frame, I possessed at least the qualifications of a POSITA, as defined above.

VI. CLAIM CONSTRUCTION

41. I understand that claim terms are typically given their ordinary and customary meaning, as would have been understood by a person of ordinary skill in the art at the time of the alleged invention. In considering the meaning of the claims,

I also understand that one must consider the claim language, specification, prosecution history, and the knowledge of a person of ordinary skill in the art at the relevant time.

42. In the previous IPRs, Nos. IPR2024-00604 and IPR 2024-00605, The Board interpreted the language “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*” to mean that a subset is determined based on the location of the block with which the first spatial motion vector prediction candidate is associated. (Ex-1007, IPR 2024-00604, IPR 2024-0605 Institution Decision, 16-18). In my opinion, this interpretation is correct, and a POSITA would readily understand this interpretation. For example, in Figure 9 of the '714 Patent, block “901” is associated with the first spatial motion vector prediction candidate “A0.”

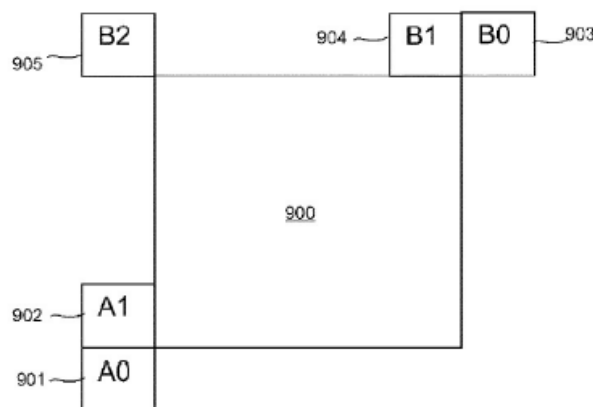


Fig. 9

(Ex-1001, Figure 9).

In this proceeding, Petitioners have stated that they agree with the Board's prior construction, in which the Board construed "the block" to mean "the block associated with the first spatial motion vector prediction candidate". (Petition, 16).

VII. BACKGROUND OF THE RELEVANT TECHNOLOGY

A. Overview of Video Coding and Video Coding Standards

43. Modern-day video coding and compression schemes involve a balance of competing concerns. On one hand, video technicians and consumers demand high fidelity and large resolution of the video images to make use of large high-definition displays and wider availability of high-speed Internet connections. However, the competing concern becomes the efficient use of storage space on hard drives and memory cards, as well as available bandwidth of Internet connections and computer processing demands. The use of modern video coding and compression schemes aims to represent the video images in a compressed form with as little data as possible, while maintaining as much quality of the original source images as possible after decoding, and ensuring that the video images can be decoded and displayed in real time. Present-day applications of video coding often involve a trade-off between computation, compression and video quality. Increasing the amount by which data is compressed can save storage space and transmission bandwidth but may result in degraded video quality to the point where the visual quality of decoded video is

unacceptably poor when viewed by the consumer. More compression for the same video quality, or better video quality for the same level of compression, may be achieved at the expense of increased computational processing and/or increased memory requirements. However, an increase in computational processing may require more sophisticated and perhaps more expensive processors and may lead to problems such as increased battery drain on mobile devices or reduced video frame rates.

Excerpt from Richardson 2010 book (Ex-2012¹) at page 69:

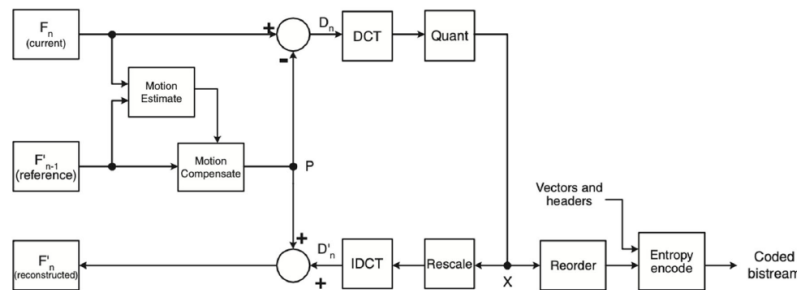


Figure 3.51 DPCM/DCT video encoder

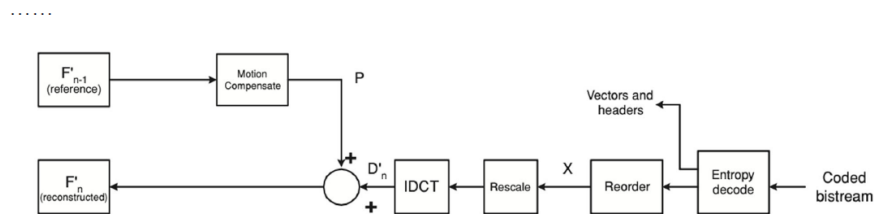


Figure 3.52 DPCM/DCT video decoder

¹ I refer here to Exhibit 2012 which contains excerpts from my 2010 book, “The H.264 Advanced Video Compression Standard.”

44. A video codec comprises a video encoder and a video decoder, which I illustrate in the above block diagrams from my 2010 book. A video encoder converts a sequence of input video frames (such as frame F_n in the above diagram, video encoder) into a coded bitstream, which is a compressed representation suitable for storage or transmission and a video decoder converts such a compressed representation into a series of decoded video frames (such as frames F'_n in the above diagram, video decoder). (Ex-2012, 69; Ex-1001, 1:32-39). As the '714 Patent explains, a video encoder forms a prediction for each block of pixels to be coded, labelled P in the above diagrams, using motion compensated prediction from an area in a previously coded video frame or spatial prediction from previously coded pixels in the same frame. The prediction is subtracted from the block of pixels to be coded to produce a residual or error, labelled D_n in the above encoder diagram. The residual or error is transformed, quantized and entropy encoded. (Ex-1001, 1:40-64). A video decoder entropy decodes the coded bitstream and rescales and inverse transforms block data to produce a decoded residual or error, labelled D'_n in the above decoder diagram. The decoder also decodes information that enables it to form the same prediction as the encoder, labelled P above, which it adds to the decoded residual to construct a decoded block of pixels and thus a decoded frame F'_n .

45. By 2011, a POSITA would have been familiar with video coding standards such as the ITU-T H.263 and H.264 standards discussed in the '714 Patent

(Ex-1001, 1:40-43). In common with other video coding standards, these standards each specify a format for a compressed bitstream and a method of decoding such a bitstream to produce a decoded video sequence but do not specify an encoding process.

B. Overview of Motion Prediction in Video Coding

46. Most video coding techniques exploit pixel redundancy in the spatial and temporal domains and involve finding ways to communicate new information in a bitstream by referencing similar, already communicated information. The references to already coded information are used to generate approximations (known as predictions) of each block of a video frame being encoded. At the decoder, predictions are combined with additional information (known as prediction error or residual information) to reproduce a reconstructed image. The encoder communicates to the decoder how to make predictions for each block as well as any residual information in a compressed form. The decoder creates the same prediction, decodes any residual information, and combines residual and prediction to reconstruct a block of video information (pixel values) from the coded block.

47. There are two main ways of exploiting redundancy in video coding to create such predictions, namely—intra coding and inter coding. In an intra-coded block in a frame of video, previously coded pixels in the same frame are used to create a prediction and to reduce the number of bits necessary to encode and

represent the current block. In an inter-coded block, a prediction block is constructed with reference to pixels in one or more previously coded frames, which may be frames in the past or the future in display order. The choice of one or more previously coded frames (known as reference pictures) and an offset (known as a motion vector, i.e., an offset indicating the location of a prediction source in another frame) identifying each similar region of pixels in a reference picture, are used to create a prediction block. The instructions for creating the prediction block, including the choice of reference picture and the motion vector, if present, are encoded along with any prediction error or residual, i.e., motion vector information is provided in the bitstream.

48. A widely used technique in video compression is the encoding of the source video through motion compensated prediction, such as inter prediction which I introduced in the previous paragraph. (Ex-2012, 28-38). This process can be carried out by dividing the individual picture elements (pixels) of a video frame into blocks of pixels. Motion compensated prediction attempts to find a prediction or match for a block of pixels in a current video frame, in a correspondingly sized region of a previously coded frame. Such a match may be found in the same position as the current block or in a shifted position in the previously coded frame. Such a shift in position may indicate, for example, that motion or other change is occurring in a particular area of the video scene. Motion compensated prediction has a very

significant contribution to compression performance, since encoding the motion compensated differences between video frames typically results in much less data than encoding each video frame without such motion compensated prediction.

49. In video coding, motion may be approximated as being block-wise constant, i.e., blocks of pixels in a frame are assumed to undergo translational motion represented by a motion vector with a horizontal and a vertical component. An example block size for prediction is 16x16 pixels, however modern video coding techniques allow for motion compensated blocks of various sizes, including blocks as small as 4x4 or as large as 64x64.

50. A strategy for reducing the amount of encoded data in the bitstream related to motion compensated prediction is to reduce the amount of data needed to represent the motion vectors themselves. Motion vector information can make up a substantial portion of a compressed video frame, particularly when small block sizes are used. However, the motion vectors of adjacent blocks (in space and time) are generally correlated, and this correlation or redundancy can be exploited through efficient encoding of motion vector information, e.g., by forming a prediction for the motion vector of a current block by taking into account the motion vectors of its neighbours.

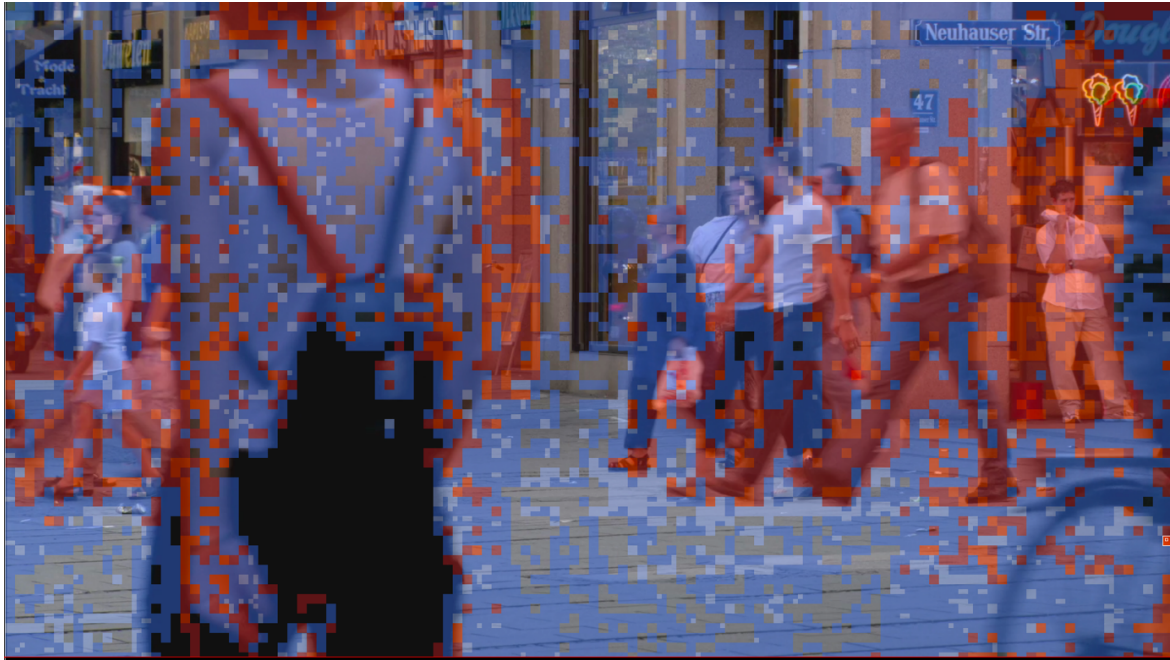
51. An H.264-complaint decoder can use the median value of three already-encoded spatially adjacent motion vectors to form a prediction for the current motion

vector. Any difference between the current motion vector and its prediction can be losslessly encoded in the bitstream and decoded by the decoder. Thus, an H.264-compliant decoder can predict a motion vector based on previously decoded motion vectors and add any motion vector difference to reconstruct the motion vector.

52. An H.264/Advanced Video Coding (AVC) inter-coded video frame (Ex-1004, ¶ 3), includes blocks (macroblocks) that may be coded in different ways, including: inter predicted with a non-zero motion vector, inter predicted without sending a motion vector (skipped/Direct mode), or intra predicted. Consider the following sample frame from a 1080p video sequence, ‘Pedestrian Area’. When encoded in an H.264-compliant format, the frame is processed in units of a macroblock, 16x16 pixels, shown as the larger-scale grid:

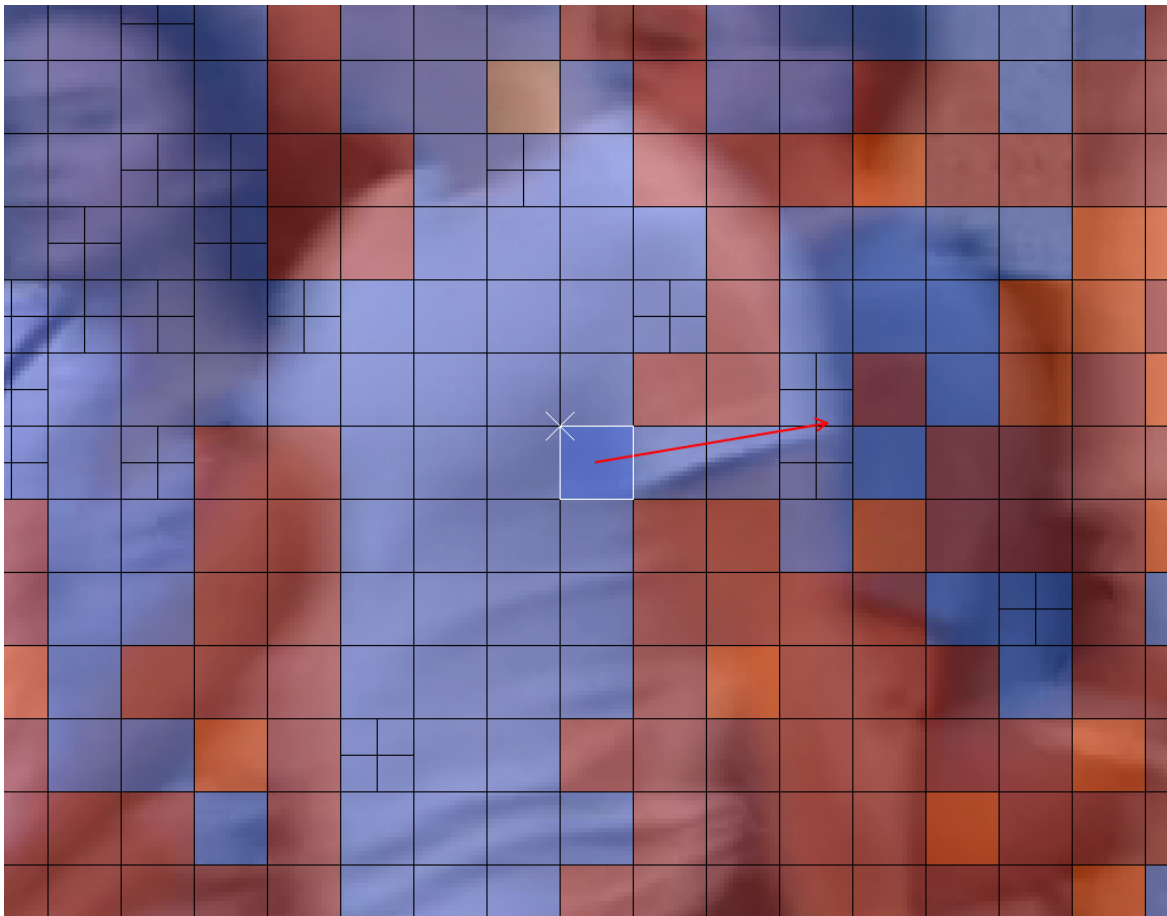


53. In an H.264 inter-coded frame, each macroblock is encoded using inter prediction with a non-zero motion vector (blue highlighting), inter prediction without sending a motion vector (for example, skipped) (no highlighting), or intra prediction (red highlighting)²:



54. Consider an inter-coded macroblock such as the one highlighted in the center of this close-up:

² Screenshots generated using video codec stream analysis tool, Elecard Streameye.



Some of the neighbouring macroblocks are inter-coded with motion vectors (blue highlighted macroblocks). Some of the neighbouring macroblocks, such as the upper-right macroblock in this example, are intra-coded (red highlighting). Intra-coded neighbours have no associated motion vector, since they do not use prediction from another frame.

55. H.265-compliant decoders can use more sophisticated ways of predicting motion vectors. Encoders that encode video into an H.265-compliant bitstream can thus reduce the number of bits necessary to encode motion vectors.

Two options in H.265 for signaling each motion vector are known as the Merge mode and the Advanced Motion Vector Prediction (AMVP) mode. The Merge mode allows spatio-temporally adjacent blocks to share the same motion vectors and other motion information. (Ex-2016, § 8.5.3.2.2). The AMVP mode provides an efficient way to predict the motion vector for the current block to be encoded from spatio-temporally adjacent blocks and to encode a difference or delta between the predicted motion vector and the actual motion vector (Ex-2016, § 8.5.3.2.5).

56. Nokia contributed to the Merge mode process specified in the H.265 Standard. The inventors of the '714 Patent proposed their solution in the JCTVC-G593 and JCTVC-H0252 contribution documents. (Ex-2014; *see also* Ex-2015). The topic of Merge mode was the subject of a “core experiment” by the JCTVC, and Nokia’s JCTVC-H0252 proposal was tested and ultimately adopted by the JCTVC, the committee responsible for developing the H.265 Standard.³ The '714 Patent corresponds with the inventors’ contributions.

³ The Report on the Merge mode core experiment is JCTVC-H0039, and the Meeting Report adopting Nokia’s contribution by way of JCTVC-H0039 is JCTVC-H1000. (Ex-2017; *see also* Ex-2018). Nokia’s approach was adopted at the eighth meeting of the JCTVC in February 2012.

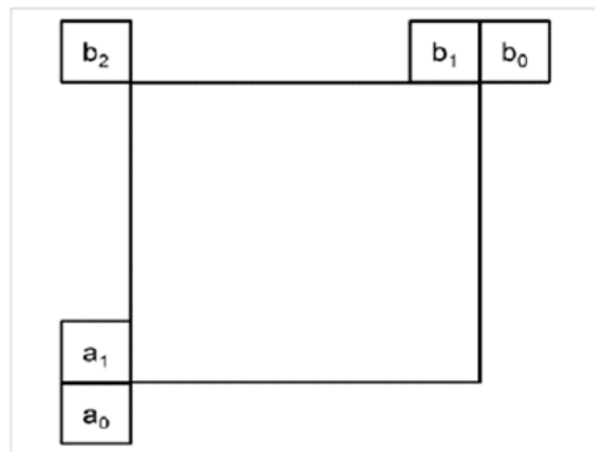
57. Merge mode exploits the property that motion vectors of neighboring blocks are often similar. In Merge mode, the encoder and decoder form lists of motion vector prediction candidates called merge lists, and then—through an indication in a bitstream—the encoder communicates to the decoder which candidate from the list to use.⁴ Merge mode can save bits by avoiding the need to send the motion vector explicitly and instead sending an index value to identify a motion vector prediction included in the merge list, but this potentially reduces prediction accuracy if the motion vectors available on the list do not produce accurate predictions since the decoder needs to form a merge list corresponding to that used at the encoder to correctly interpret the received index value. Further, if a transmission error occurs, selection from the candidate list at the decoder may be incorrect.

58. In Merge mode, upon completion of the merging process, the resulting merged region, i.e. the selected candidate block and the current block, share the same motion vector. The following Figure from Ex-2013 conceptually illustrates five

⁴ In Merge mode, a motion vector predictor is selected from a list of candidates, each of which is a motion vector of a previously coded block, and the index of the selected candidate in the list is encoded and sent to the decoder. The list can be constructed based on the five spatial neighbours, as well as a temporal candidate.

spatial neighbour blocks a_0 , a_1 , b_0 , b_1 , and b_2 that are spatially adjacent to the current block to be encoded. The availability of these blocks for merging is evaluated in the following order: a_1 , b_1 , b_0 , a_0 , b_2 . A temporal candidate for block merging at the same location in a reference frame, i.e. a previously coded frame that is not the current frame, is also evaluated for block merging. A candidate block is selected and the motion information for the current block is “inherited” from the candidate block, such that the motion information of the two blocks is merged.

Merge Mode Overview (Ex-2013, Figure 8):



59. It is frequently the case that two or more candidates have the same motion vector. It is beneficial to eliminate such duplicates to help create a shorter list and reduce the number of bits needed to specify the index in the list. Comparison of candidates for potential elimination can be a computationally costly process. As mentioned, the '714 Patent correlates with the inventors' Merge mode contribution

to the H.265 Standard development. One goal of the '714 Patent is to provide an enhanced Merge list process that “reduce[s] the complexity of the implementation [of Merge mode].” (Ex-1001, 4:19-30).

C. Technical Challenges in Motion Prediction

60. A computationally challenging part of motion-compensated prediction is identifying the motion vector to use for the prediction. This is typically done by sub-dividing the current frame into blocks and finding matching regions in previously coded reference frames to use to predict the blocks in the current frame. While the blocks in the current frame are generally formed based on some type of grid pattern, the best matching blocks in reference frames may not, and typically do not, align with the same grid. As a result, the search for a best matching block may involve many comparisons between the current block and many corresponding regions from reference frames, with differing motion vectors relative to the current block, to find the best available matching block. This search for a matching block is referred to as motion estimation.

61. The encoder may select a motion vector that points to an integer pixel offset value, which means that the corresponding block is a block of pixels already present in the reference frame. The encoder may also choose a motion vector that points to a sub-pixel location, i.e. a location between full pixel values in the reference frame. The advantage of using sub-pixel locations is greater accuracy of motion

prediction. However, the use of sub-pixel locations generally results in a greater number of calculations because pixel values must be generated for sub-pixel locations.

62. The encoder also encodes the instructions necessary to recreate the block prediction. These instructions may include motion vectors and whether they are to be used as part of a uni- or bi-prediction, and in some cases, an indication of one or more chosen reference pictures. Additionally, the encoder may compress and encode the difference (prediction error/residual) between the predicted values and the actual values, i.e. the original pixel values of the current from being encoded. The prediction error/residual data is typically compressed using a block transform such as the Discrete Cosine Transform, and the resulting transform coefficients representing the residual are subsequently quantized and entropy encoded, to limit the amount of data needed to represent the residual in the encoded video bitstream.

63. In inter prediction, a decoder uses the encoder's instructions including any motion vectors to recreate the prediction. The decoder then decodes any compressed prediction error to add it to the prediction to obtain the decoded video. As previously discussed, encode processes generally use as reference frames previously coded frames, so that the decoder can reconstruct a prediction for a current block using the prediction information communicated to, and already decoded at the decoder.

D. Overview of the '714 Patent's Features Distinguishable from the Prior Art

64. The '714 Patent correlates with the inventors' efforts to improve the Merge mode of the then-draft H.265 Standard. One goal of the '714 Patent is to provide an enhanced merge list process that “reduce[s] the complexity of the implementation [of Merge mode].” (Ex-1001, 4:19-30). One benefit of the '714 Patent's approach is a reduced number of comparisons between spatial motion vector prediction candidates. (*Id.*, 4:23-39).

65. Figure 5 of the '714 Patent illustrates an improved merge list construction embodiment developed by the inventors, where merge list candidates A0, A1, B0, B1, and B2 are part of a set of spatial motion vector prediction candidates and block 900 is a block of pixels. (Ex-1001, cl. 23; *see also id.*, 14:43-46, 17:5-13, Figures 9, 11a, and 11b (labelling the locations of merge list candidates relative to the current block)).



(Ex-1001, Figures 5a and 5b).

66. According to the '714 Patent, each motion vector prediction candidate A0, A1, B0, B1, and B2 (these labels represent the locations of the blocks with which the motion prediction candidates are associated)⁵ is subject to a limited set of comparisons and other conditions to determine whether it is to be included on the merge list. Further, a first spatial motion vector prediction candidate from the set of

⁵ A POSITA would understand that the labels can refer to both block locations and the motion vectors associated with the blocks at those locations. For example, “A0” can refer to the block location A0 in Figure 9 and—depending on the context—also refer to the motion vector associated with the block at location A0, which can be called candidate A0.

spatial motion vector prediction candidates is 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.” (Ex-1001, cl. 23). For instance, suppose candidate A0 is the “first spatial motion vector prediction candidate” of Claim 23. A subset of spatial motion vector candidates is determined based on the location of the block associated with the first spatial motion vector prediction candidate, i.e. A0. (*Id.*; *see also id.*, 14:64-15:18). As described in the ’714 Patent and depicted in Figures 5a and 5b, the processing of candidates can be done “independently in parallel.” *Id.* at 17:40-41. One reason the ’714 Patent enables a parallelizable process is that the subset of spatial motion vector candidates is determined based on the location of the block associated with the first spatial motion vector prediction candidate. The ability to carry out such processes in parallel enables faster processing times and is an important aspect of computationally efficient video encoding and decoding.

67. Using candidate A0 as the example first spatial motion vector prediction candidate and referring to Figures 5a and 5b of the ’714 Patent, it can be seen that the claimed “subset” associated with A0 is {A1}. The subset for A0 in the embodiment of Figure 5 does not include B1 or B0, even though A0/B1 and A0/B0 are possible candidate pairs. After the subset is determined based on a location of the block associated with the first spatial motion vector prediction candidate, Claim 23 requires the “motion information of the first spatial motion vector prediction

candidate” to be compared “with motion information of the spatial motion vector prediction candidate in the determined subset of spatial motion vector prediction candidates.” (Ex-1001, cl. 23). Again, using A0 as an example, A0 is compared to A1 based on the conditions described in Figures 5a and 5b. (*Id.*, 15:50-16:49). Since A0 is only being compared to A1 (i.e. A0 is not compared to B0, or B1), the remainder of the “comparing motion information” limitation is met—“without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates” (Ex-1001, cl. 23). This is because A0’s motion vector is only compared to A1’s motion vector. The determination of whether to include the first spatial motion vector candidate on the merge list, or whether to exclude it from the list, is based on the comparing step. (Ex-1001, cl. 23).

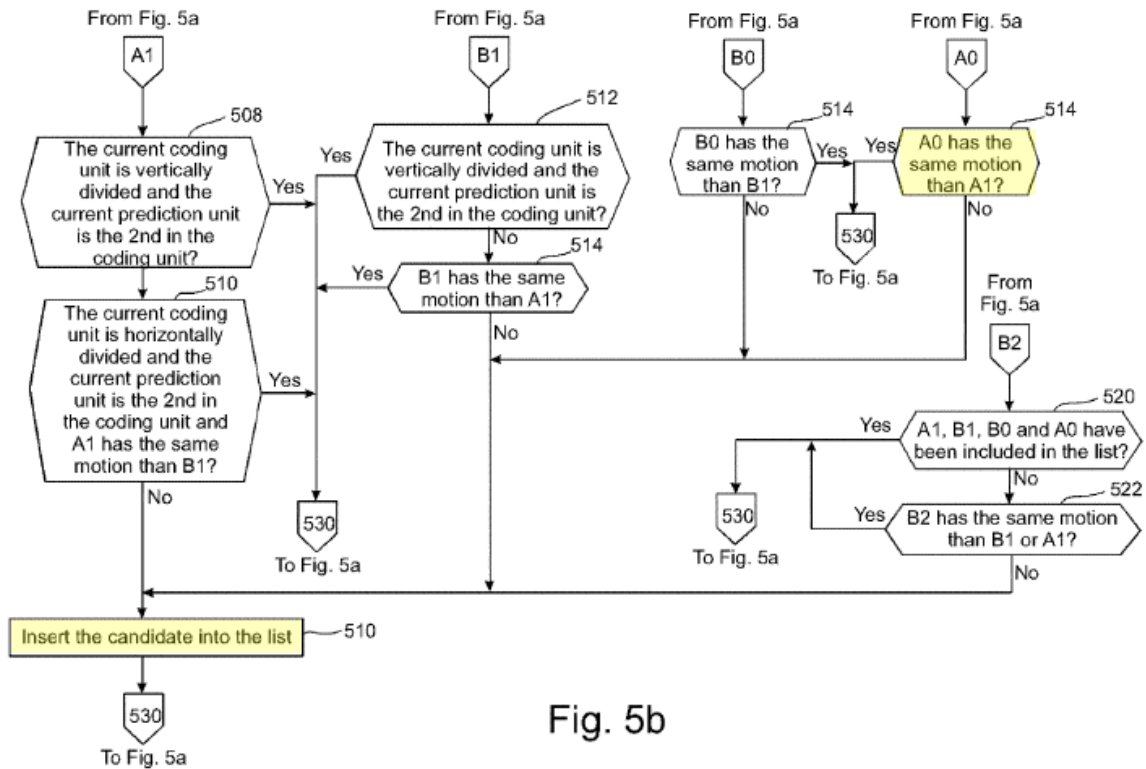


Fig. 5b

Ex-1001 at Figure 5b (annotating the example comparison)

If it is determined that A0 does not have the same motion as A1, then A0 is added to the motion vector prediction list based on the comparing step. The candidate pairs that are examined are described in the '714 Patent as shown in the below table.

First Spatial Motion Vector Prediction Candidate	Motion Vector Prediction Candidates in the Determined Subset of Spatial Motion Vector Prediction Candidates
A1	No subset. It is automatically included in the merge list if available.
A0	{A1}
B0	{B1}
B1	{A1}
B2	{A1, B1}

E. Overview of Rusert

68. Rusert discloses a method for generating a potential motion vector (“PMV”) candidate list, PMV_CANDS, for a current block of pixels that is being encoded or decoded. (Ex-1004, ¶¶ 11-12, 36-37). The PMV candidates can be obtained from previously coded neighboring blocks within an allowed distance from the current block. (*Id.*, ¶¶ 11, 40-44, 73). Dr. Creusere identifies the previously coded blocks within Rusert’s scan order as “spatial motion vector prediction candidates.” (Ex-2019, 72:11-76:19).

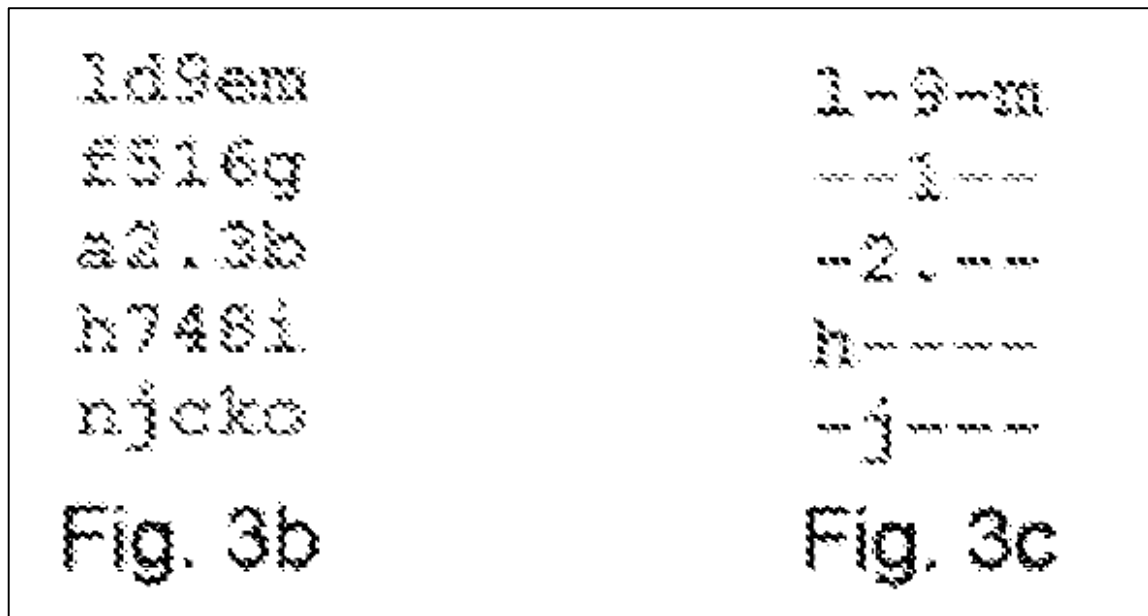
69. Rusert teaches search patterns for “an outwards going scan ... around the current block.” (Ex-1004, ¶¶ 44, 51-66; *see id.*, Figures 3a-3n (illustrating numerical scan order around the current block, labelled “.”, starting from block 1 and progressing outwards in a counterclockwise order)).



Fig. 3n

(*Id.*, Figure 3n (annotated by Dr. Creusere)). Using Figure 3n as an example, the list of PMV_CANDS can ultimately include the blocks that are available in the scan order, i.e., some or all of 1, 2, 3, ..., a, b, c, ... (Ex-2019, 75:6-76:1; *see also id.*, 72:11-76:19). In the case of Fig. 3n, the position of the current block is indicated by a dot ‘.’. The previously coded block immediately above the current block and labelled ‘1’ is evaluated first, if available. The block to the left of the current block labelled ‘2’ is evaluated next, if it is available, and so on.

70. Some of the numbered blocks in Rusert’s scan order may not be available, for example if the current block is along a frame boundary, or if some of the blocks have not yet been encoded when the current block is processed, or if the numbered block(s) do not have a motion vector present. Rusert describes exemplary scenarios of block unavailability, including for example blocks that have not yet been encoded, or blocks without a motion vector present, such as an intra-coded block. (Ex-1001, ¶ 54, Figure 3c). Rusert provides Figure 3c as an example where some blocks in the scan order of Figure 3b are unavailable, showing that only blocks 1, 2, 9, h, j, l and m are available for inclusion in PMV_CANDS.



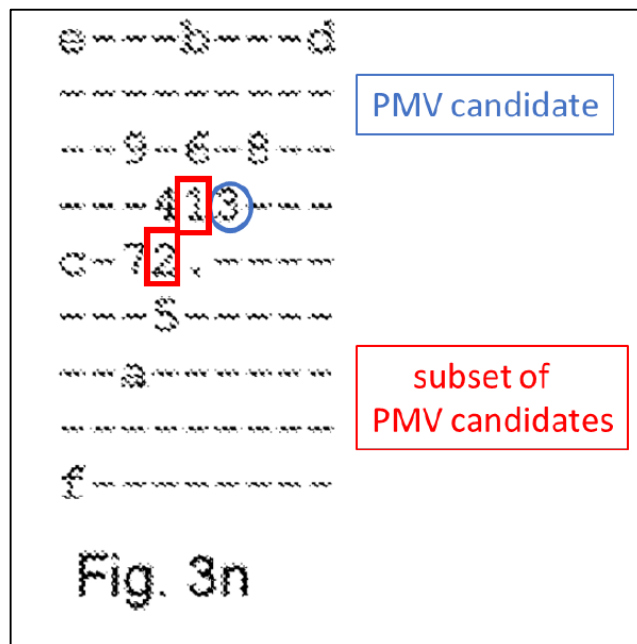
(*Id.*, Figures 3b and 3c).

71. As noted above, Rusert performs an outward scan of selected and available previously coded PMV candidates, starting from the current block and remaining within an allowed distance. (*Id.*, ¶¶ 4-5, 36-39, 43-44, 51-66).

72. As the scan expands outward, what Petitioner alleges is “the subset,” (Petition, 24-25), is determined based on which blocks have available candidates and whether those candidates satisfy comparisons with candidates already in PMV_CANDS (Ex-1004, ¶¶ 44, 51-66; *see also id.*, Figures 3a-3n).

73. For example, when the motion vector for the block with location 3 (“block 3”) is evaluated during Rusert’s scan sequence, the subset of candidates PMV_CANDS comprises candidates evaluated from earlier scan locations, which in this example may include blocks with locations 1 and 2, “block 1 and block 2”,

assuming those blocks were available and that block 2 is not sufficiently similar to block 1 to have been excluded. In other words, Rusert's subset PMV_CANDS is determined prior to knowing the location or value of the next spatial motion prediction candidate, which in this example is block 3 but ***need not be*** 3 (e.g., block 3 may be unavailable). Dr. Creusere has previously described that the "subset" (here, blocks 1 and/or 2) is determined based on the location of the block with location 3, which Petitioner alleges is the claimed "first spatial motion vector prediction candidate." (Petition, 29-30). As I will explain, I disagree.



(IPR2024-00604, -00605, Ex-1003, ¶ 130; annotated by Dr. Creusere)

74. The motion information of the block being evaluated, block 3 in this example, is then compared to the alleged subset, blocks 1 and 2 in this example, to

determine whether the block being evaluated will be included in PMV_CANDS. (Ex-1004, ¶¶ 62, 71). At the point at which Rusert evaluates block 3 in this example, Rusert compares all possible pairs of candidates.⁶

75. Dr. Creusere's description of Rusert has changed since his declaration in proceedings IPR2024-00604, -00605. In Dr Creusere's declaration in support of the current IPR, he has chosen to remove the above figures and has added newly annotated ones now relied upon by Petitioner. (Ex-1003, ¶ 119; Petition, 29-31). Petitioner cites Dr. Creusere's new opinions, absent from his previous declaration, to support an argument that misreads Rusert in new ways. (Ex-1003, ¶ 120; Petition, 31-32). However, this new framing does not change Rusert's teachings and does not resolve the faults in Petitioner's arguments, as I explain below.

F. Overview of Nakamura

76. Nakamura is a proposal to the H.265 development effort that attempted to provide methods for deriving candidates for Merge mode and the motion vector predictor (MVP). (Ex-2008, § 1). Nakamura suggested that the positions of the spatial neighbors eligible as merging candidates in Merge mode should be the same as those of the spatial MVP candidates, thereby unifying the location of the spatial neighbors for both Merge mode and MVP. (*Id.*) Additionally, the proposed

⁶ That is, comparisons are done with the pairs 1/3 and 2/3.

techniques sought to unify the derivation processes for Merge mode and MVP, as illustrated in Figure 1:

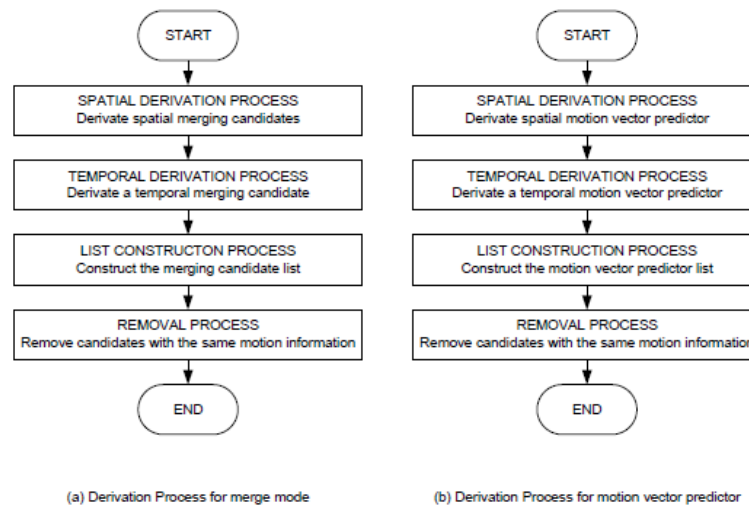


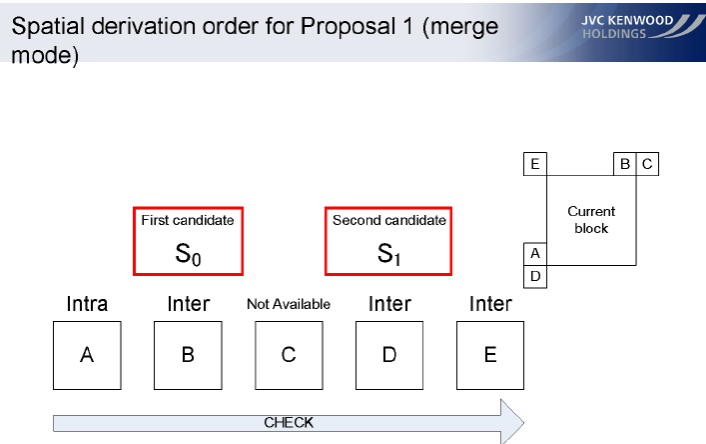
Figure 1 Derivation Process of merge mode and MVP in WD3

(*Id.*; see also *id.*, § 2.1).

77. For Merge mode, Nakamura teaches selecting two spatial motion vector prediction candidates (i.e. spatial candidates S0 and S1) for a merge list selected in a spatial derivation order from blocks A, B, C, D, and E (i.e. blocks in the current frame) relative to the current prediction unit.⁷ (Ex-2008, Abstract, § 1, § 2.2.1, Figures 1, 2(b), Tables 2-4). Following this spatial derivation order, Nakamura checks blocks A-E to identify the first available motion vector. When this motion vector is found it is denoted as spatial candidate S0. (Ex-2009, 8). Once S0 is

⁷ The JCTVC committee adopted Nokia's merge mode proposal over Nakamura's proposal as part of the draft HEVC/H.265 standard. (Ex-2019).

selected (i.e. S0 is assigned to the motion vector associated with one of the neighbouring block locations), S0 is automatically added to Nakamura's merge list. (*Id.*) Then Nakamura continues its availability check to identify a second candidate, denoted as S1 (i.e. to assign S1 to the motion vector of one of the neighbouring block locations), which, like S0, is added automatically to the merge list once identified. (*Id.*) In previous IPR proceedings, Nos. IPR2024-00604 and IPR 2024-00605, Dr. Creusere alleged that Nakamura's S0 is a "subset" according to the claims of the '714 Patent (IPR2024-00604, -00605, Exhibit 1003 ¶¶ 305-06).



7

(*Id.*, annotated by Dr. Creusere)

G. Comparison of Rusert and Nakamura

78. It should be noted that Rusert and Nakamura are similar in several important respects. One is that both Rusert and Nakamura determine what the Petitioner alleges to be the "subset of spatial motion vector candidates" *before* ever

determining or selecting what the Petitioner alleges to be the “first spatial motion vector prediction candidate.”

1. In Nakamura and Rusert, the Alleged Subsets are Determined Before the Alleged First Spatial Motion Vector Prediction Candidates are Known or Confirmed

79. Both Nakamura and Rusert determine what Petitioner alleges to be the “subset of spatial motion vector candidates” *before* determining or selecting what the Petitioner alleges to be the “first spatial motion vector prediction candidate.”⁸

Dr. Creusere agreed with this similarity in his deposition:

Q. I think I agree with you, that’s certainly true in Rusert, Doctor, that what will be the subset will be based on prior processing done at -- to the point where you reach the -- the first spatial motion vector prediction candidate.

And so to clarify with an example, by the time we reach the -- candidate 3 in Rusert using Figure 3N, we would have done some processing on 1 and 2.

And depending on 1 and 2 and whether they’re the same or sufficiently similar or available, that’s going to help us inform our choice of subset 3.

⁸ One consequence of this property of Nakamura and Rusert is that neither reference enable parallel processing decisions. Both Rusert and Nakamura must follow a sequential processing order, determining the alleged subset prior to evaluating the alleged first spatial motion vector prediction candidate, unlike the ’714 Patent in which such decisions can be taken in parallel (Ex-1001 at 17:40-41).

Do you agree with that?

A. Oh, for Rusert?

Q. Yes.

A. Yeah, I agree with that on -- with respect to Rusert.

Q. Okay. And to some extent -- now I'm going to refer to the Nakamura reference.

That's -- that's also true of the Nakamura reference, where we have S0 and S1; and if we're identifying S1 as the first spatial motion vector candidate, what exists in the subset of S0 will depend on some prior processing before we get to S1 in Nakamura's order.

A. I -- I believe it's accurate, yeah. S0 will be filled first, yeah, and then -- and then -- and we don't know what's going to be a priori, right?

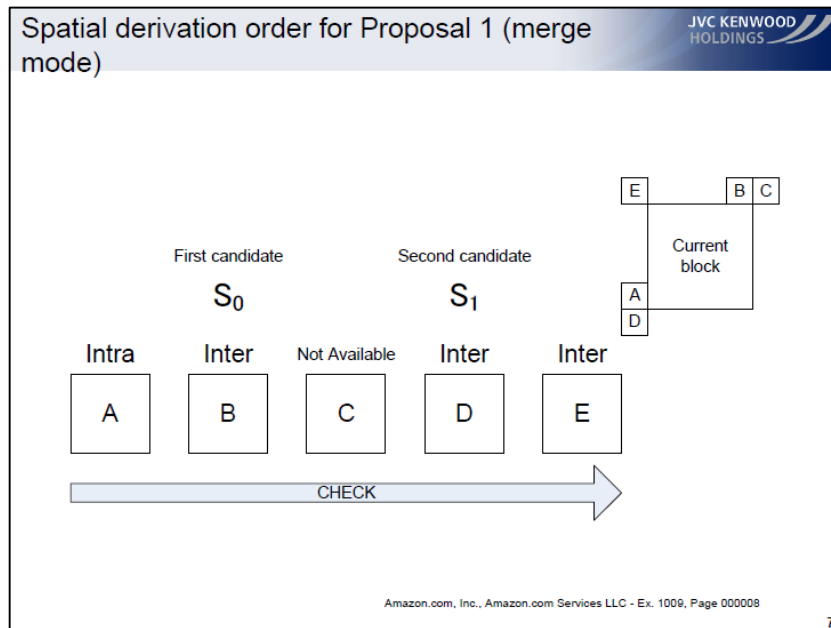
So then you'll -- you'll have -- you'll evaluate candidates for S1.

(Ex-2019, 103:20-105:9)

80. In my opinion, Dr. Creusere's statement is correct. In Rusert, the content of the alleged "subset" has already been determined before any selection, processing, or evaluation of what the Petitioner alleges is the "first spatial motion vector prediction candidate."

81. Considering Nakamura, Nakamura determines S0 (the alleged subset) first. Nakamura does this without knowledge or confirmation of what S1 will be. For

example, in the scenario shown below from Nakamura's proposal (Ex-2009, 8), the motion vector associated with neighboring block "B" is selected as the S0 value.⁹

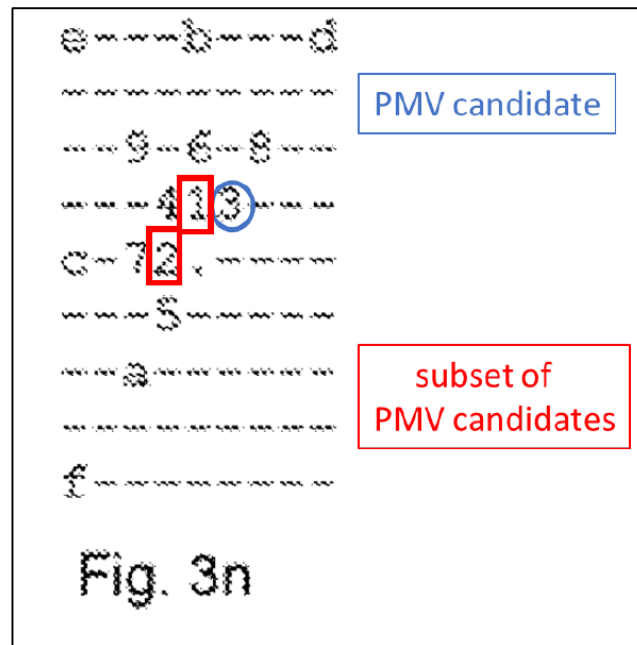


82. In this example from Nakamura, the selection of the motion vector of B as the value of S0 does not depend on the identity or block location of S1, which—at the time S0 is determined—could be any of C, D, E, or nothing, based on availability. This is true for any possible arrangement in Nakamura. In other words, Nakamura's alleged subset (the single value S0) is determined without knowledge of the alleged first spatial motion vector prediction candidate (the single value S1) or the location of the block associated with S1. Logically, a determination of the

⁹ The "check arrow" in Nakamura clearly shows the order in which A to E are considered.

subset (alleged to be S0) cannot be based on the location of the first spatial motion vector prediction candidate (alleged to be S1) if the first spatial motion vector prediction candidate (S1) is not known or confirmed at the time the determination of the subset (S0) is made. A POSITA would understand that the first spatial motion vector prediction candidate must be known and confirmed for any determination of a subset to be “based on” the location of the first spatial motion vector prediction candidate. The Board correctly noted this in its Institution Decision. (Institution Decision, 56 (“As Patent Owner notes, S0 is already selected regardless of what the selection of S1 thereafter might be. The subset S0 does not change depending on the later choice of S1.”)).

83. Considering Rusert, I have provided below an annotated version of Rusert’s Figure 3n from Paragraph 130 of Dr. Creusere’s -00604 declaration, which is identical to paragraph 127 of Dr. Creusere’s -00605 declaration. In Dr. Creusere’s example, blocks ‘1’ and ‘2’ are the alleged subset while ‘3’ is the alleged first spatial motion vector prediction candidate.

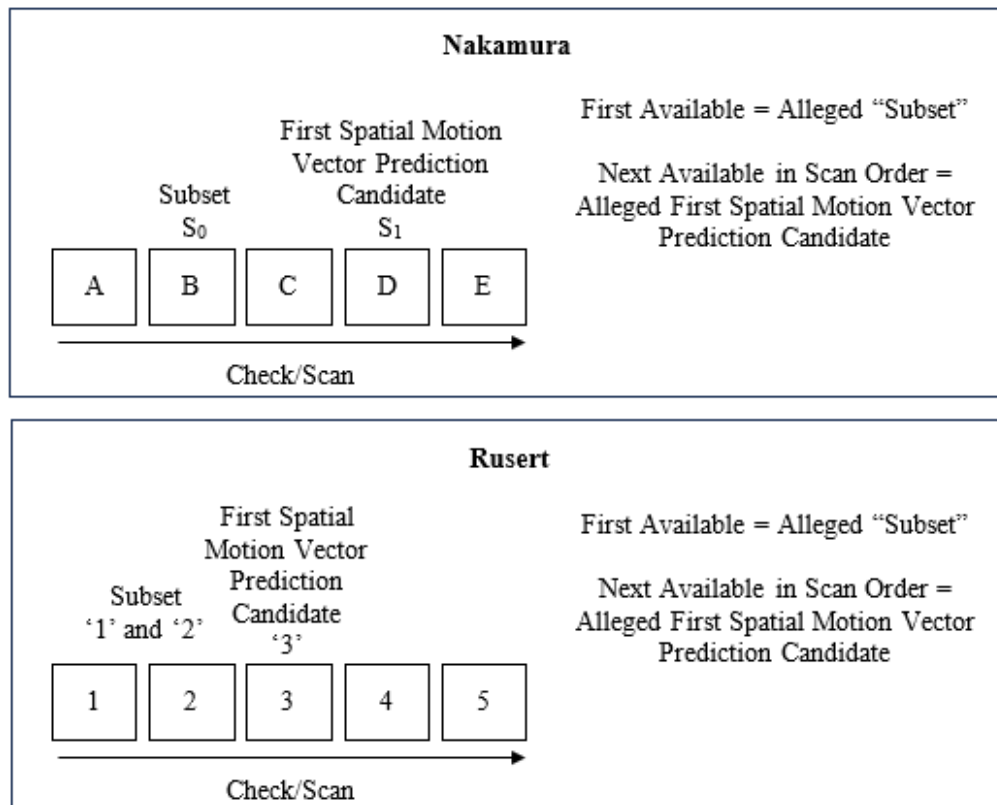


84. The content of Rusert's alleged subset depends on block availability. For example, if '1' is unavailable, (Ex-1004, ¶ 54 (giving exemplary scenarios where blocks are unavailable due to coding order or lack of motion vector); *see also supra* ¶ 72), the alleged subset will be just '2'. The alleged subset further depends on a comparison between the motion vectors of blocks '1' and '2', assuming both are available. If '1' and '2' are both available and their motion vectors are sufficiently similar or identical, the alleged subset will be just '1'.

85. By the time Rusert begins its processing to determine whether '3' is available and whether to add '3' to PMV_CANDS, the alleged subset has already been determined. Whether '3' is available is unknown to Rusert at the time the alleged subset is determined. If '3' is not available (for example, if block 3 is intra

coded), then—assuming both ‘1’ and ‘2’ are in the alleged subset—the next available candidate, which may be ‘4’, ‘5’ or a later block, will be compared to ‘1’ and ‘2’. Thus, in Rusert, the alleged subset (‘1’ or ‘1, 2’ in this example) has already been selected regardless of what the alleged first spatial motion vector prediction candidate (‘3’, ‘4’ or a later block depending on which blocks are available) thereafter might be. The alleged subset does not change depending on the later choice of candidate for evaluation and therefore does not change depending on the location of the alleged first spatial motion vector prediction candidate.

86. Furthermore, the Figure below illustrates that ***both*** Nakamura ***and*** Rusert’s alleged subsets are determined before the alleged first spatial motion vector prediction candidate is known or confirmed. In Nakamura, S0 is assigned the motion vector of block B, prior to determining a suitable motion vector for candidate S1. In Rusert, PMV_CANDS is determined to be ‘1’, ‘1, 2’ or ‘2’, prior to determining which is the next available block and whether to add the next available block motion vector to PMV_CANDS.



VIII. THE GROUNDS IN THE PETITION DO NOT ANTICIPATE OR RENDER OBVIOUS THE CHALLENGED CLAIMS

A. Ground 1: Rusert in Combination with Karczewicz

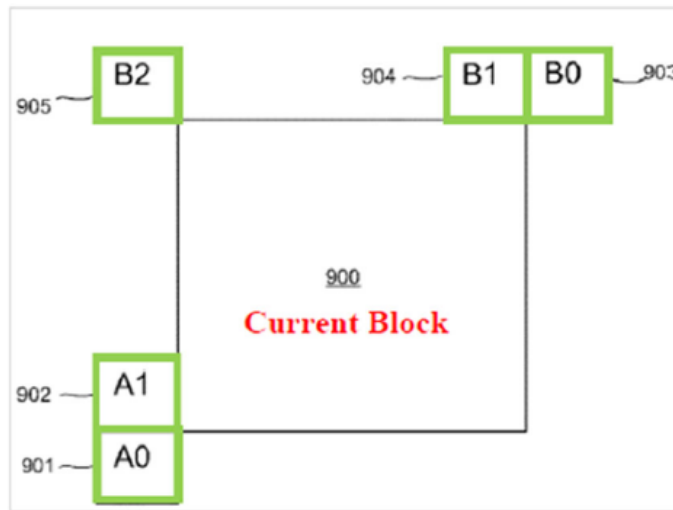
1. Rusert does not teach “determining a subset of spatial motion vector prediction candidates based on a location of the block associated with the first spatial motion vector prediction candidate,” as required by the claims

87. I understand that Petitioner is not relying on Karczewicz for this limitation. (Petition, 28-35).

88. As discussed above, Rusert’s subset of spatial motion vector candidates is not based on the location of the block associated with the alleged first spatial

motion vector candidate, nor is it in any way influenced by the alleged first spatial motion vector candidate.

89. The '714 Patent discloses that a set of spatial motion vector prediction candidates is obtained from neighboring blocks located around a current block of pixels being either encoded or decoded. (Ex-1001, 13:26-31). This relationship is illustrated in the following Figure. I have annotated the Figure to show the neighboring blocks from which the set of spatial motion vector prediction candidates is obtained.



Ex-1001, Figure 9 (annotated to show the set of motion vector prediction candidates A0, A1, B0, B1 and B2)

90. As a POSITA would understand, and as the '714 Patent makes clear, when generating the claimed motion vector prediction list, a spatial motion vector prediction candidate is selected for consideration and is subsequently compared with

a subset of the other spatial motion vector prediction candidates, by checking whether each member of the subset has the same motion information as the selected candidate. (Ex-1001, 15:50-16:55). The purpose of this comparison is to avoid adding a spatial motion vector prediction candidate to the motion vector prediction merge list if the new candidate would be redundant. (*Id.*, 4:19-26).

91. The subset that the '714 Patent describes is determined “based on the location of the block associated with the first spatial motion vector prediction candidate,” so that for each candidate in question, a subset is determined which is less than the full candidate set. Thus, instead of comparing a candidate with all the other four blocks (in the set of five candidates), the candidate is compared with a subset in order to avoid redundancy, while also reducing the computational work required to perform comparisons. (Ex-1001, 4:19-26) Columns 15-16 of the '714 Patent provide examples of comparing a candidate with a subset. Referencing the Figure above, for the candidate located above and to the right (B0), the '714 Patent teaches that a subset containing only B1 is used for comparison. (*Id.*, 16:24-31). Similarly, for the candidate located at the bottom left (A0), the '714 Patent teaches that the subset containing only A1 is used for comparison. (*Id.*, 16:32-39). In the embodiments of the '714 Patent, the location of a selected spatial motion vector prediction candidate must first be known in order to then determine a subset based on this location.

92. The Petition approaches the construction of a motion vector prediction list differently to the claimed technique of the '714 Patent. In Rusert, each spatial motion vector candidate is obtained from neighbouring blocks in a scanning order based on its distance from the current block. For each spatial motion vector candidate, Rusert determines whether, if available, it should be added to the list, and then moves on to the next PMV candidate in the scan order until the process is completed. (Ex-1004, ¶ 44). As I show above, Figure 3n of Rusert provides an exemplary depiction of this distance-based scanning method, with the closest PMV candidates being evaluated first and the farthest last (i.e., in the order 1, 2, 3 . . . 9, a, b . . . depending on availability), in a counter-clockwise spiral starting from the current block, i.e., ' '. (*Id.*, ¶ 58).

93. When determining whether to add a PMV candidate to the motion vector prediction (PMV_CANDS) list, Rusert compares the candidate to each previously added PMV candidate, i.e. to all members of PMV_CANDS at this point. For example, if candidate 1 has previously been added to the list, candidate 2 will be compared to candidate 1; if candidate 2 has also previously been added, then candidate 3 will be compared to candidates 1 and 2, and so on. (Ex-1004, ¶¶ 71-72). If the comparison determines that the candidate under consideration is too similar to one already added, then it can be excluded, i.e. not added to the PMV_CANDS list. (*Id.*)

94. In my opinion, Petitioner is incorrect in asserting that Rusert's alleged "subset" is determined based on the location of a selected spatial motion vector prediction candidate for at least two reasons. First, the content of PMV_CANDS at the time a PMV candidate is considered has already been determined without regard for the PMV candidate under consideration. Second, the content of the PMV_CANDS list is based on the availability and values of the previous candidates, not on the location of the current candidate under consideration. (Petition, 29).

95. Considering the first point, Rusert's PMV_CANDS list is constructed by scanning neighboring blocks in an order determined by their distance to the current block, where each motion vector block that is on the scan path is a PMV candidate.¹⁰ (Ex-1004, ¶ 61, Fig. 3n, reproduced below). Previously coded blocks

¹⁰ Rusert explains that if a block has no motion vector present (such as the red highlighted, intra coded macroblocks illustrated above in paragraphs 52-54), that block is not available as a motion vector candidate. In Rusert, only blocks with valid motion vectors may be added to the subset of motion vectors in PMV_CANDS. (Ex-1004, ¶ 54). Thus, a block that is unavailable, for example, because it does not have an associated motion vector, is not included in Rusert's scan order and is not evaluated for adding to PMV_CANDS.

that are outside of the allowed distance or are unavailable cannot be included in PMV_CANDS. (*Id.*, ¶ 54; Ex-2019 125:9-127:20).

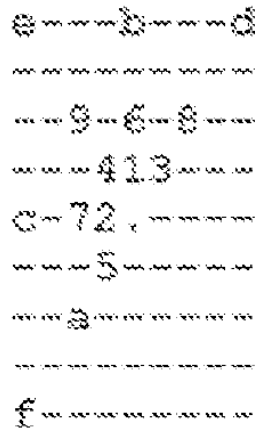
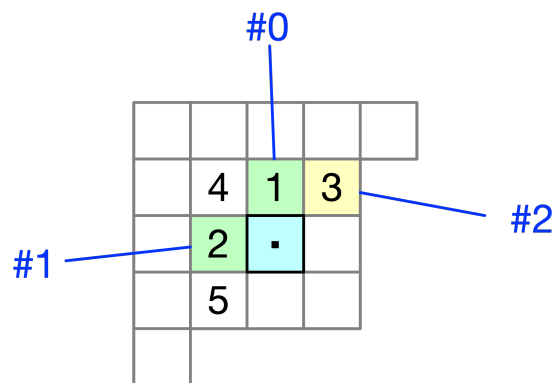


Fig. 3n

(Ex-1004, Figure 3n).

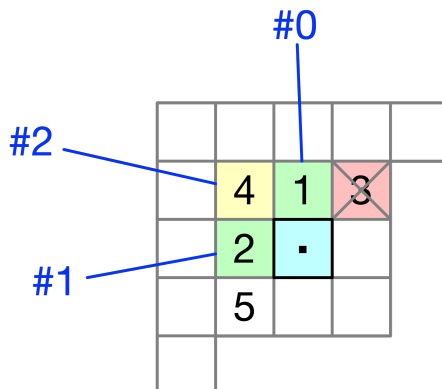
96. Petitioner argues that the subset is “based on” the current PMV block location, because for example if the current block being evaluated (which Petitioner describes as the first spatial motion vector prediction candidate) is 3, the subset is at most 1 and 2, i.e., according to Petitioner, the subset {1, 2} depends on the fact that block 3 is currently being evaluated. (Petition, 30-31). In my opinion, Petitioner is incorrect. Consider an example. At iteration 0 of Ruser’s scan, PMV_CANDS is empty and block 1 is evaluated, then added to PMV_CANDS. At iteration 1, PMV_CANDS contains {1} and block 2 is evaluated, then added to PMV_CANDS. At the next iteration 2, regardless of the location of the block being evaluated, PMV_CANDS (the alleged subset) can only contain (at most) blocks 1 and 2. The

location of the block being evaluated is not taken into account in any way when constructing the previous content of PMV_CANDS (the alleged subset). For example, if block 3 is available, then iteration number 2 (highlighted in yellow and labelled #2 in the Figure below) compares block 3 (assuming the scan order of Figure 3n above) with a subset (PMV_CANDS) containing 1 and 2.



Example 1: Block 3 is Available

97. If block 3 is not available, iteration number 2 would evaluate block 4 (which has a different position) with the same subset containing 1 and 2.



Example 2: Block 3 is Not Available

98. Thus, the subset does not depend on the location of the block currently being evaluated. It cannot, because the location of the block currently being evaluated (labelled 3 or 4 in the above examples) is not known at the point the alleged subset (1 and 2 in the above examples) has already been determined.

99. At the point at which Rusert has finished its comparison of neighboring block 2, the content of PMV_CANDS for the next block to be evaluated, is already known. PMV_CANDS will contain the set of candidates 1 and 2, assuming that 1 and 2 are both available and dissimilar. The location of, and information related to, block 3 (or block 4 or a later-numbered block, if block 3 is unavailable) has no effect on the contents of PMV_CANDS at the time block 3 is under consideration. PMV_CANDS is determined (i.e. all its members are assigned) prior to considering a next block position. This is very different to the method of the '714 Patent. In Rusert, no information about the next candidate (including the position of the next candidate) is taken into account when determining PMV_CANDS prior to evaluating the next candidate. Therefore, PMV_CANDS (the alleged “subset”) is not determined based on the location or any other aspect of the next candidate to be evaluated (the alleged “first spatial MVP candidate”). For example, assuming that blocks 1, 2, 3 and 4 are available and have dissimilar motion vectors, Rusert’s method proceeds as follows:

Iteration	PMV_CANDS before	Block being evaluated	PMV_CANDS after
0	{}	1	{1}
1	{1}	2	{1, 2}
2	{1, 2}	3	{1, 2, 3}
3	{1, 2, 3}	4	{1, 2, 3, 4}

100. Now assume that block 3 is not available, Rusert's method proceeds as follows:

Iteration	PMV_CANDS before	Block being evaluated	PMV_CANDS after
0	{}	1	{1}
1	{1}	2	{1, 2}
2	{1, 2}	4	{1, 2, 4}
3	{1, 2, 4}	5	{1, 2, 4, 5}

101. In the examples of these two tables, at iteration 2, PMV_CANDS always contains at most blocks 1 and 2. Depending on whether block 3 is available, the current block being evaluated may be block 3 or block 4, or a later-numbered block. Which block is being evaluated at iteration 2 (block 3, block 4, or a later block) has no bearing on the content of PMV_CANDS and therefore the location of the block being evaluated (the alleged “first spatial motion vector prediction candidate”) has no bearing on the content of PMV_CANDS (the alleged “subset”). The only things that determine the candidates in the PMV_CANDS list, at any iteration, are the availability and motion vector values of the blocks that are considered before the current block that is being evaluated.

102. As a further example, consider block 4. PMV_CANDS, prior to processing block 4, cannot depend on the location of block 4. The contents of PMV_CANDS depend only on the previously processed blocks in the scan order, i.e. on the values and processing of the motion vectors for blocks 1, 2, and 3 in this example. Block 4 in this example is the alleged “first spatial MVP candidate” and PMV_CANDS prior to evaluating block 4 is the alleged “subset of spatial MVP candidates,” according to Petitioner. Once again, PMV_CANDS is fully determined prior to the processing block 4, i.e. prior to selecting block 4 for processing. Consequently, the “determining a subset” (determining of PMV_CANDS prior to a comparison involving block 4) cannot be based on the location of block 4 or any other aspect of block 4.

103. Rather than being based on the location of a PMV candidate under consideration, the set of PMV candidates used for comparison in Rusert is determined based on the availability and value of each PMV candidate that has already been considered and added to the list. (Ex-1004 at ¶¶ 70-72). As I explain above, if candidate 3 is compared to candidates 1 and 2, this is not because candidate 3 is located at the top right, but because candidates 1 and 2 are available and dissimilar and thus both have previously been added to PMV_CANDS. (*Id.*, ¶¶ 70-72).

104. In reaching its institution decision in IPR2024-00604 and IPR2024-00605, the Board considered the following example: “if the first selected candidate is at the location of block 5, then the subset would be the four members 1, 2, 3, and 4, and if the first selected candidate is at the location of block 3, then the subset would be the two members 1 and 2.” (Institution Decision, Ex-1007, 35). In my opinion, this example is an incorrect characterization of Ruser. As I explained above, if the first selected candidate is at the location of block 5, then Ruser’s PMV_CANDS *may* consist of {1, 2, 3, 4} but may (and often will) consist of a smaller set such as {1, 2}, {1, 3} etc., depending on availability of blocks and similarity of motion vector values. If the first selected candidate is at the location of block 3, then PMV_CANDS *may* consist of {1, 2} but may alternatively consist of {1}, {2} or no entries at all, depending on availability and similarity as I explained above. Stated another way, the alleged subset PMV_CANDS may consist of {1, 2} for the first selected candidate at block 3, block 4, block 5 or any numbered block in Ruser’s scan, depending on availability of blocks. Thus, for this and the other reasons explained, I disagree with the Board’s conclusion that “The members of the determined subset [PMV_CANDS] depend on the location of the block associated with the first selected spatial motion vector prediction candidate.” (*Id.*).

105. I understand that Petitioners, relying on Dr. Creusere’s modified opinion, now contend that Ruser’s outward scan is ordered by increasing distance

from the current block and, therefore, that the subset of candidates used at a given iteration is “as close or closer” than the current PMV candidate, purportedly rendering the subset “based on the location of the block associated with the first spatial motion vector prediction candidate.” *See* Pet. at 29-32; Ex-1003 ¶¶ 117-120. In my opinion, a person of ordinary skill would not read Rusert this way, and this new framing does not satisfy limitation [1b] for at least the following technical and claim-construction reasons.

106. First, distance ordering in Rusert governs the time, or iteration, at which a neighbor location is visited; it does not transform the preexisting contents of PMV_CANDS into a subset that is determined “based on the location of the block associated with” that first candidate under evaluation. *See* Ex-1004 (Rusert) ¶¶ 11, 44, 53, 58, Fig. 3n; *see also supra* ¶¶ 93–94. In Rusert, the candidates in PMV_CANDS at an iteration (e.g., iteration k) are those already admitted from earlier locations relative to the current block based on availability and similarity comparisons. In other words, they are fixed before the k -th candidate is evaluated or even identified as the next available block. *See* Ex-1004 ¶¶ 70–73. Thus, the composition of PMV_CANDS at iteration k will be the same regardless of the location of the next available block associated with iteration k (i.e., the block from which that candidate’s motion vector is considered), as the contents of PMV_CANDS (the alleged ‘subset’) have been determined already during those

iterations before *k*. *See supra* ¶¶ 83–85. This is consistent with Rusert’s description of scanning and list-building, the distance constraints defined relative to the current block, and the duplicate removal that affects admission to the list. *See* Ex-1004 ¶¶ 11, 41, 70–73, Fig. 3n; *supra* ¶¶ 93–94. Therefore, Petitioner’s observation that different candidate locations along the Rusert scan order may have different PMV_CANDS is simply a result of progressing iterations of the scan pattern, not a subset determination based on a candidate’s location. *See* Pet. at 30. Petitioner is confusing correlation (e.g. the contents of PMV_CANDS when considering block 4, *may be* 1, 2 and 3) with causation (e.g. the contents of PMV_CANDS when considering block 4, are *caused by / based on* the location of block 4).

107. Second, under the Board’s construction in a prior proceeding that “the block” in [1b] is “the block associated with the first spatial motion vector prediction candidate,” Petitioners’ scan-distance theory still does not satisfy [1b]. *See* Ex-1007 (IPR2024-00604 Institution Decision) at 16–18; *supra* ¶¶ 42, 91. Petitioners and Dr. Creusere now argue that because Rusert orders its scan by increasing distance from the current block, the subset “ascertained” from PMV_CANDS at a given iteration contains candidates “as close or closer” than the current PMV candidate and is therefore “based on a location of the block associated with the first” candidate. Pet. at 32–35; Ex-1003 ¶¶ 120–123. That is not how Rusert works. Rusert’s distance rules are defined with respect to the current block and control only when a neighbor

is visited. Ex-1004 ¶¶ 53, 58–61. The contents of PMV_CANDS at iteration k are determined beforehand by availability and similarity checks on previously visited neighbors; admission or exclusion happens before the first candidate block is identified or evaluated, as explained above. Ex-1004 ¶¶ 71–73; *see also supra* ¶¶ 96–102. Petitioner admits this: ‘When [Rusert’s] block 3 is evaluated, the PMV_CANDS list would likely include the previously considered PMV candidates associated with blocks 1 and 2... The PMV for block 3 ... 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’. (Petition at 30-31, *emphasis added*). In other words, Petitioner agrees that the contents of PMV_CANDS at iteration k (‘the next iteration’) are completely determined before the alleged first candidate block (‘block 4’ in Petitioner’s example, which may be another block such as block 5 or block 6, depending on availability) is identified or evaluated.

108. Thus, the PMV_CANDS subset used when the candidate is evaluated cannot depend on the location of that candidate’s associated block. The ’714 patent, by contrast, ties the subset determination to the first candidate’s associated block (e.g., $B0 \rightarrow \{B1\}$; $A0 \rightarrow \{A1\}$). Ex-1001, 16:24–31, 16:32–39; Fig. 9; *see also supra* ¶ 91. Petitioners’ “as-close-or-closer” assertion merely reflects a current-block scan schedule; it does not show that the subset was determined “based

on the location of the block associated with the first” candidate, as [1b] requires under the Board’s construction. *See* Ex-1007 at 16–18; Pet. at 32–35; Ex-1004 ¶¶ 53, 61, 71–73.

109. Third, Petitioners’ “as-close-or-closer” theory is a scheduling artifact of a *current-block*-centric scan (i.e., the block of pixels from [1a]), not a *candidate*-location-based determination within the meaning of [1b]. It is trivially true that, at the moment a position at distance d is first visited, previously visited locations lie at distance $\leq d$ from the current block; but that truism does not establish that the alleged subset was determined based on the location of the block associated with the first candidate. *See* Ex-1004 ¶¶ 11, 44, 53, 58; Fig. 3n. As I explained, Petitioner confuses correlation (previously visited locations happen to be closer to the current block than to the current candidate position) with causation (candidates added to PMV_CANDS from previously visited locations cannot depend on the current candidate position, i.e. the location of the current candidate does not and cannot influence what has been added to PMV_CANDS). The alleged subset existed before the later candidate was identified; it would be the same subset for any later candidate at that moment in the scan order whose location is available. *See supra* ¶¶ 83–85, 93–94. Consider Petitioner’s example, where PMV_CANDS contains {1,2,3} (Petition, 31). If block 4 is available, PMV_CANDS when considering block 4 is {1,2,3}. However, if block 4 is not available, Rusert considers block 5 instead,

and PMV_CANDS when considering block 5 is {1,2,3}. The location of the block under consideration has changed (block 4 or block 5) but PMV_CANDS has not. A POSITA would therefore not understand Rusert to disclose 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,” as required by [1b], under the Board’s construction. *See* Ex-1007 at 16–18.

110. Petitioner states that Rusert’s PMV_CANDS list “cannot include a candidate that is *further away from the current block* than the current PMV candidate being evaluated” and that therefore the set of PMV candidates in the PMV_CANDS list is “based on [the] location of the block associated with the current PMV candidate”. Petition at 32, emphasis in original. However, as I have explained at length herein, in Rusert’s method, when the contents of PMV_CANDS for the current PMV candidate are determined and finalized, the location of the block associated with the current PMV candidate (the block under consideration) is not even known. In other words, the sequence of events in Rusert is as follows. First, PMV_CANDS is determined and finalized (e.g. PMV_CANDS = {1,2}). Then, the block associated with the current PMV candidate is determined based on availability and scan order (e.g. current PMV candidate block = 3, or 4, or 5, etc). In these examples, whether the current PMV candidate block is 3, 4 or 5, PMV_CANDS remains as {1,2}. The candidates in PMV_CANDS {1,2} happen to be closer to the

current block than any potential current PMV candidate (3, 4, 5, etc) but cannot depend on the location of the actual current PMV candidate.

111. This analysis aligns with the Board’s prior reasoning. In earlier proceedings, the Board determined that the “subset” must be based on the location of the block associated with the first candidate (rejecting a current-block reading of “the block”), and then further explained—when addressing a substantively analogous sequencing issue in *Nakamura*—that a subset selected before the later candidate is known cannot be “based on” that later candidate’s associated block. *See* Ex-1007 at 16–18, 56–57; *see also supra* ¶¶ 83–85. Those conclusions map directly onto Rusert’s process as Petitioners describe it here: PMV_CANDS is established by prior processing and remains independent of the later candidate’s associated block location, which in Rusert depends on the availability of that later candidate. *See* Ex-1004 ¶¶ 11, 41, 70–73, Fig. 3n. To the extent Petitioners rely on Dr. Creusere’s new “scan distance” framing to contend that [1b] is met because the subset is sometimes equal to the set of already-visited locations “as close or closer” than the current candidate, that argument conflates a *current*-block property (the scanning order based on distance) with the claim’s requirement of a *candidate*-location-based determination and fails under the Board’s construction and sequencing analysis. *See* Ex-1003 ¶¶ 57–58, 121–123; Ex-1007 at 16–18. The Board’s understanding of the sequencing issue in *Nakamura* is correct and applies

equally to Rusert, as Dr. Creusere admitted during deposition. *See* Ex-1007 ¶¶ 56–57; Ex-2019 103:20–105:9 (Creusere deposition in IPR2024-00604, -00605). In my opinion, a POSITA would therefore conclude that Rusert does not teach limitation [1b] as properly construed.

B. Ground 2: Rusert in Combination with Karczewicz and Lin

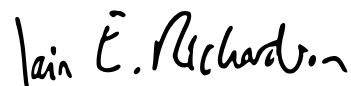
112. Petition includes a second ground (Rusert, Karczewicz, and Lin) where a third reference (Lin, Ex-1006) is used to address limitations in dependent claims 4, 11, 18, and 25. Lin is not used to address any limitations in the independent claims, and so cannot address the shortcomings of the Rusert / Karczewicz ground that I identify above.

IX. CONCLUSION

113. This Declaration represents the opinions that I have formed to date based on the material currently available to me. I reserve the right to revise, supplement, and/or amend my opinions stated in this Declaration based on new information that becomes available to me and on my continuing analysis of the materials available to me.

114. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine, imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: 5th November 2025



Dr. Iain Richardson