UNITED STATES PATENT AND TRADEMARK OFFICE

_____

BEFORE THE PATENT TRIAL AND APPEAL BOARD

_____

ASUSTEK COMPUTER, INC and
ASUS COMPUTER INTERNATIONAL,
Petitioners

v.

NOKIA TECHNOLOGIES OY,
Patent Owner

_____

Case: IPR2025-01153

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 5
A. Overview 5
B. Patent Claims 6
C. Burden of Proof for Invalidity 7
D. Claim Construction 8
E. Person of Ordinary Skill in the Art 8
F. Anticipation 8
G. Obviousness 9
V. PERSON OF ORDINARY SKILL IN THE ART (POSITA) 12
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 28
D. Overview of the '714 Patent's Features Distinguishable from the Prior Art 30
E. Overview of Rusert 35
F. Overview of Nakamura 39
G. Comparison of Rusert and Nakamura 42
1. In Nakamura and Rusert, the Alleged Subsets are Determined Before the Alleged First Spatial Motion Vector Prediction Candidates are Known or Confirmed 42
VIII. THE GROUNDS IN THE PETITION DO NOT ANTICIPATE OR RENDER OBVIOUS THE CHALLENGED CLAIMS 50
A. Ground 1: Rusert in Combination with Karczewicz 50
1. Rusert does not teach "determining a subset of spatial motion vector prediction candidates based on a location

Nokia Exhibit 2022, p.2
ASUS v. Nokia
IPR2025-01153

of the block associated with the first spatial motion vector prediction candidate," as required by the claims 50

2. Rusert does not teach "comparing … without making a comparison of each pair from the set of spatial motion vector prediction candidates," as required by the claims 64

3. Rusert's scan order teaches away from combination with Karczewicz's variable-size prediction units, and a POSITA would not have had a reasonable expectation of success in combining the references 75

B. Ground 2: Rusert in Combination with Karczewicz and Lin 83

IX. CONCLUSION 85

Nokia Exhibit 2022, p.3
ASUS v. Nokia
IPR2025-01153

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 IPR2025-01153 which relates to U.S. Patent No. 10,536,714, the '714 Patent. The Petition and the expert declaration in IPR2025-01153 appears to copy heavily from IPR proceedings IPR2024-00604 and -00605, in which I was also retained by Patent Owner. The Expert declaration in IPR2025-01153 (ASUS-1003, the declaration of Joseph Havlicek) is principally made up of the declarations of Dr. Charles Creusere attached as appendices, which I addressed previously.

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

Nokia Exhibit 2022, p.4
ASUS v. Nokia
IPR2025-01153

analysis of the prior art, information provided to me and information I have independently reviewed.

4. I am submitting this declaration for IPR2025-01153. This IPR and its expert declaration copy and/or reproduce the arguments and expert declarations from two prior proceedings, IPR2024-00604 and IPR2024-00605. I have attempted to cite to the exhibit numbers used in the current proceeding, but as the expert declarations that actually address the merits use different exhibit numbers, I may use the exhibit numbers in Creusere declarations included as Appendices to Dr. Havlicek's declaration (ASUS-1003).

II. EDUCATIONAL BACKGROUND AND QUALIFICATIONS

5. Details of my professional qualifications and background are summarised below and are set out in detail in my Curriculum Vitae. *See* Ex-2002.

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

7. 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.

8. I received a Master of Engineering (M.Eng.) degree in Electronic and Electrical Engineering from Heriot-Watt University in Edinburgh, Scotland in 1990.

Nokia Exhibit 2022, p.5
ASUS v. Nokia
IPR2025-01153

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.

9. 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.

10. 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.

11. 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.

12. 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.

13. In 2007, I founded Vcodex Limited 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.

14. 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.

15. 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.

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

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

Nokia Exhibit 2022, p.7
ASUS v. Nokia
IPR2025-01153

18. 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 (ASUSTek Computer, Inc. and ASUS Computer International) or Patent Owner (Nokia Technologies Oy) and I have no financial interest in the challenged patent.

III. MATERIALS REVIEWED AND TIME OF INVENTION

19. 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, the deposition testimony of Dr. Havlicek and 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-1007.

IV. LEGAL STANDARDS

A. Overview

20. 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

Nokia Exhibit 2022, p.8
ASUS v. Nokia
IPR2025-01153

me and explained to me by counsel. In preparing this Declaration, I have endeavoured 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.

21. 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

22. 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.

23. 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.

24. 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

Nokia Exhibit 2022, p.9
ASUS v. Nokia
IPR2025-01153

depends on another claim. The law considers a dependent claim to incorporate all of the requirements of the claims to which it refers.

25. 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.

26. 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

27. 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.

Nokia Exhibit 2022, p.10
ASUS v. Nokia
IPR2025-01153

D. Claim Construction

28. 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

29. 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

30. 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.

31. 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

32. 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,

Nokia Exhibit 2022, p.12
ASUS v. Nokia
IPR2025-01153

(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 endeavour, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavour, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

33. 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.

Nokia Exhibit 2022, p.13
ASUS v. Nokia
IPR2025-01153

34. 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.

35. 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.

36. 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.

Nokia Exhibit 2022, p.14
ASUS v. Nokia
IPR2025-01153

37. 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.

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

39. 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)

40. 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

Nokia Exhibit 2022, p.15
ASUS v. Nokia
IPR2025-01153

professionals in the field, I apply Petitioner's definition of a POSITA for the sake of this Declaration. (Petition, 13-14).

41. 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

42. 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.

43. 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. (IPR 2024-00604, IPR 2024-0605 Institute 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."

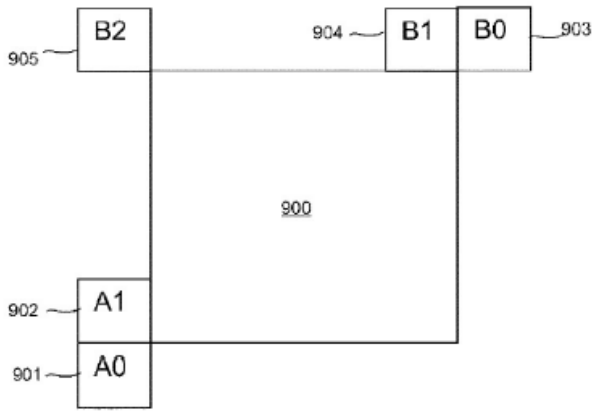


Fig. 9

(ASUS-1001, Figure 9).

44. Petitioner argues that "the block" recited in limitation [1b] could be interpreted to refer to either (a) the "block of pixels" introduced in [1a], or (b) the block from which the first spatial motion vector candidate is obtained. (Petition, 15). In other words, Petitioner believes that under their construction (a), the claim language "the block associated with the first spatial motion vector prediction candidate" should be interpreted to refer to block 900 in Figure 9 above rather than to one of the blocks that correspond to the spatial motion vector prediction candidates A0, A1, B0, B1, and B2.

45. In my opinion, Petitioner's proposed construction (a) is inconsistent with how POSITAs would understand the plain language of the claims. A POSITA would readily understand that "the block associated with the first spatial motion vector prediction candidate" refers to the blocks labelled 901 through 905 or A0 through B2 in Figure 9 above. Petitioner's Petition effectively erases "associated with the ***first spatial motion vector prediction candidate***" from the claim language, as the Board has previously recognized. (IPR 2024-00604, IPR 2024-0605 Institute Decision, 16-18).

VII. BACKGROUND OF THE RELEVANT TECHNOLOGY

A. Overview of Video Coding and Video Coding Standards

46. 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-2012[1]) at page 69:

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

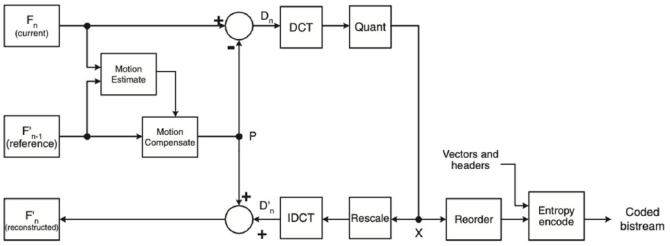


Figure 3.51 DPCM/DCT video encoder

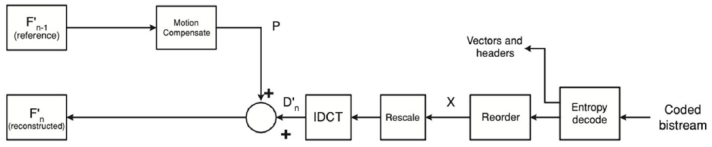


Figure 3.52 DPCM/DCT video decoder

47. 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; ASUS-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. (ASUS-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.

48. 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 (ASUS-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

49. 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.

50. 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.

51. 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.

52. 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.

53. 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.

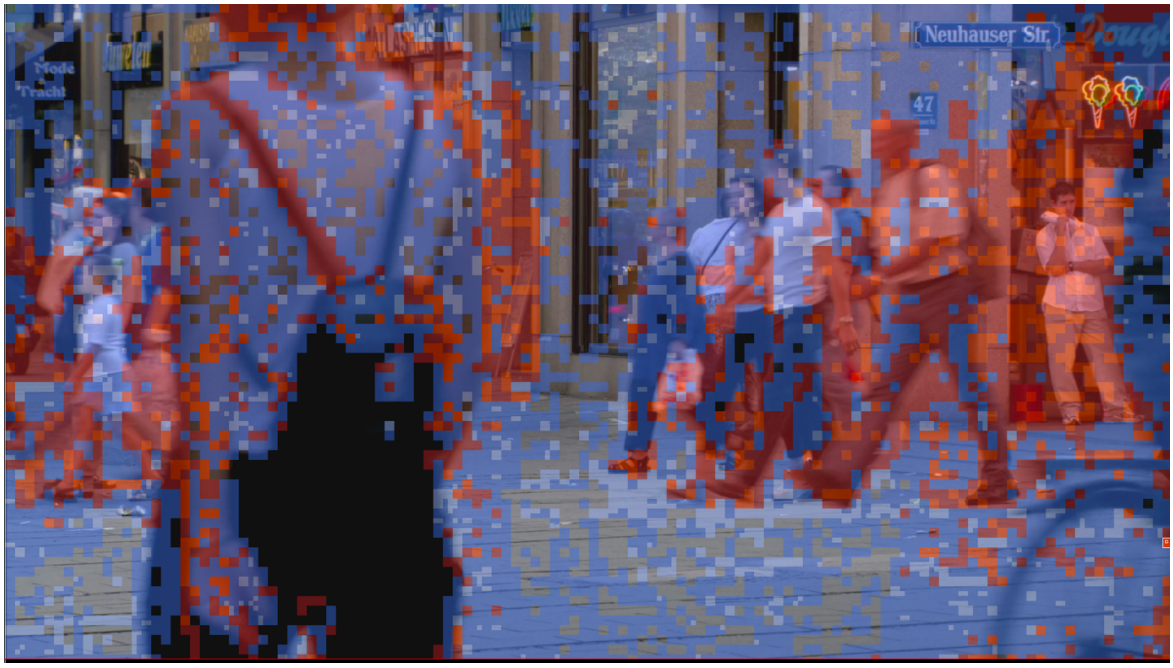
54. An H.264-compliant decoder can use the median value of three already-encoded spatially adjacent motion vectors to form a prediction for the current motion vector. Any difference between the current motion vector and its prediction can be losslessly encoded in the bitstream and decoded by the decoder. 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.

55. An H.264/Advanced Video Coding (AVC) inter-coded video frame (ASUS-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:

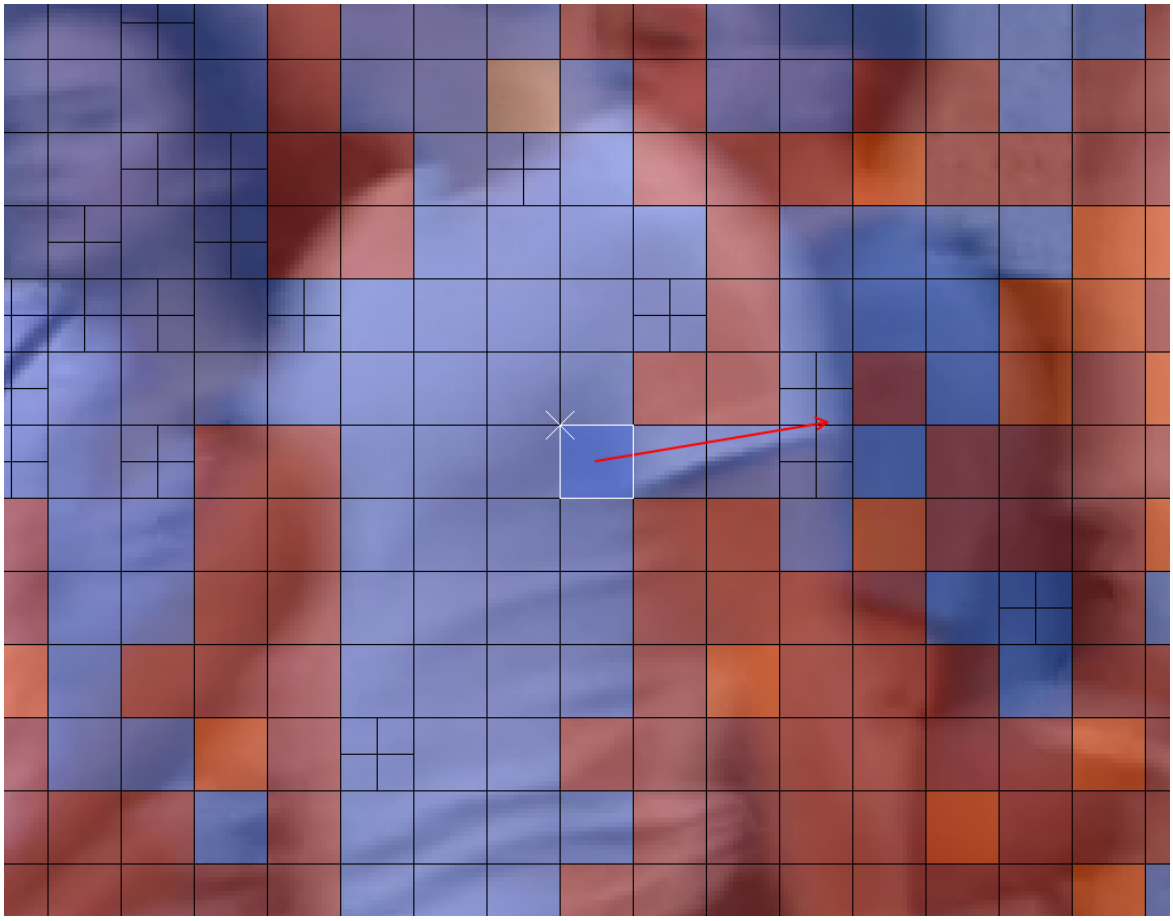


56. In an H.264 inter-coded frame, each macroblock is encoded using inter prediction with a non-zero motion vector (blue highlighting), inter prediction without sending a motion vector (for example, skipped) (no highlighting), or intra prediction (red highlighting)[2]:

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



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



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.

58. 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.

Nokia Exhibit 2022, p.27
ASUS v. Nokia
IPR2025-01153

Two options in H.265 for signalling 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).

59. Nokia contributed to developing 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.

Nokia Exhibit 2022, p.28
ASUS v. Nokia
IPR2025-01153

60. Merge mode exploits the property that motion vectors of neighbouring blocks are often similar. In Merge mode, the encoder and decoder form lists of motion vector prediction candidates for each block called merge lists, and then—through an indication in a bitstream—the encoder communicates to the decoder which candidate from the list to use for the block.[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.

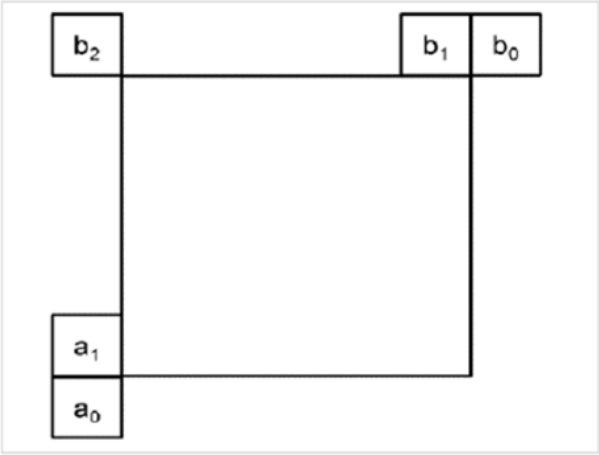
61. In Merge mode, upon completion of the merging process, the resulting merged region, i.e. the selected candidate block and the current block, share the same motion vector. The following Figure from Ex-2013 conceptually illustrates five

[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.

Nokia Exhibit 2022, p.29
ASUS v. Nokia
IPR2025-01153

spatial neighbour blocks a0, a1, b0, b1, and b2 that are spatially adjacent to the current block to be encoded. The motion vector prediction candidates from these blocks are then evaluated for availability and redundancy, and the remaining candidates are placed in the merge list in the following order, if available: a1, b1, b0, a0, b2. 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):



62. 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].” (ASUS-1001, 4:19-30).

C. Technical Challenges in Motion Prediction

63. A computationally challenging part of motion-compensated prediction is identifying the motion vector to use for the prediction. This is typically done by 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.

64. 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.

65. 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 block 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.

66. 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 previously coded frames as reference 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

67. 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]." (ASUS-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).

68. 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. (ASUS-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)).

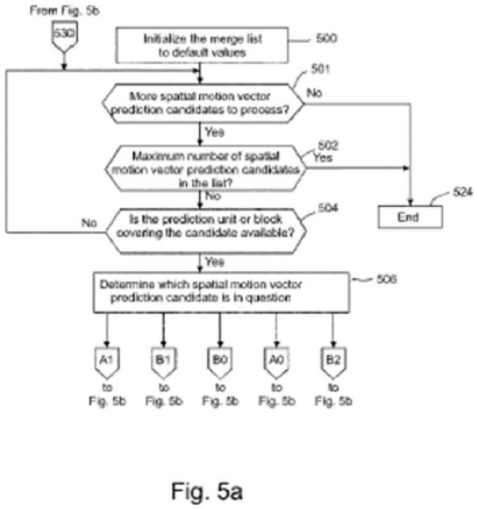


Fig. 5a

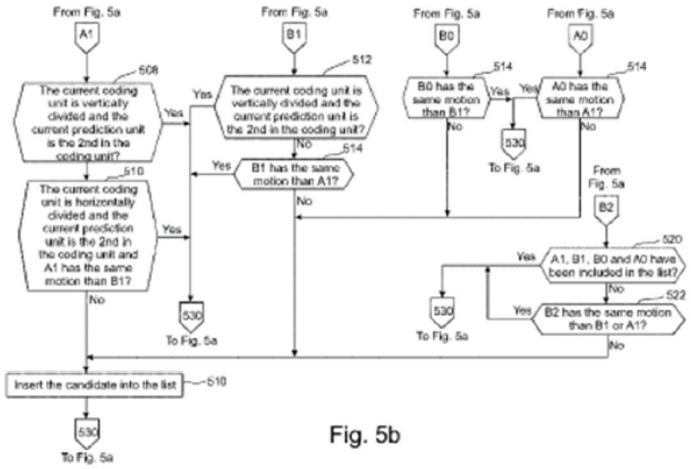


Fig. 5b

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

69. 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." (*Id.*, 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. As the inventors explained in their adopted contribution (JCTVC-H0252, Ex-2015), their solution was to remove the prior pruning process where all candidates were compared and, instead, "perform a smaller number of parallelizable motion information comparisons only between the spatial candidates." Ex-2015 at 1. In the inventors' contribution, as in the '714 Patent, each candidate is compared to only a small subset of other candidates based on the location of the block from which the candidate was obtained (Candidate from A1 inserted if available, candidate from B1 compared to candidate from A1, candidate from B0 compared to candidate from B1, candidate from A0 compared to candidate from A1, and candidate B2, if needed, compared to candidates from A1 and B1). Ex-2015 at 1-2; *see also* Ex-1001 ('714 Patent) at Figs. 5b, 8b (including at most a single comparison for the candidate from A1). In the patent and the inventors' contribution, only the process for determining

whether to include the candidate from B2 depends on whether candidates from other locations are included on the list. Candidates from A0, A1, B0 and B1 may be analysed in parallel. As Nokia's contribution explains, these independent candidate removal conditions permit an "early exit" from the merge process, and a corresponding reduction in decoding time. Ex-2015 at 2.

70. 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." (ASUS-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" (ASUS-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. (ASUS-1001, cl. 23).

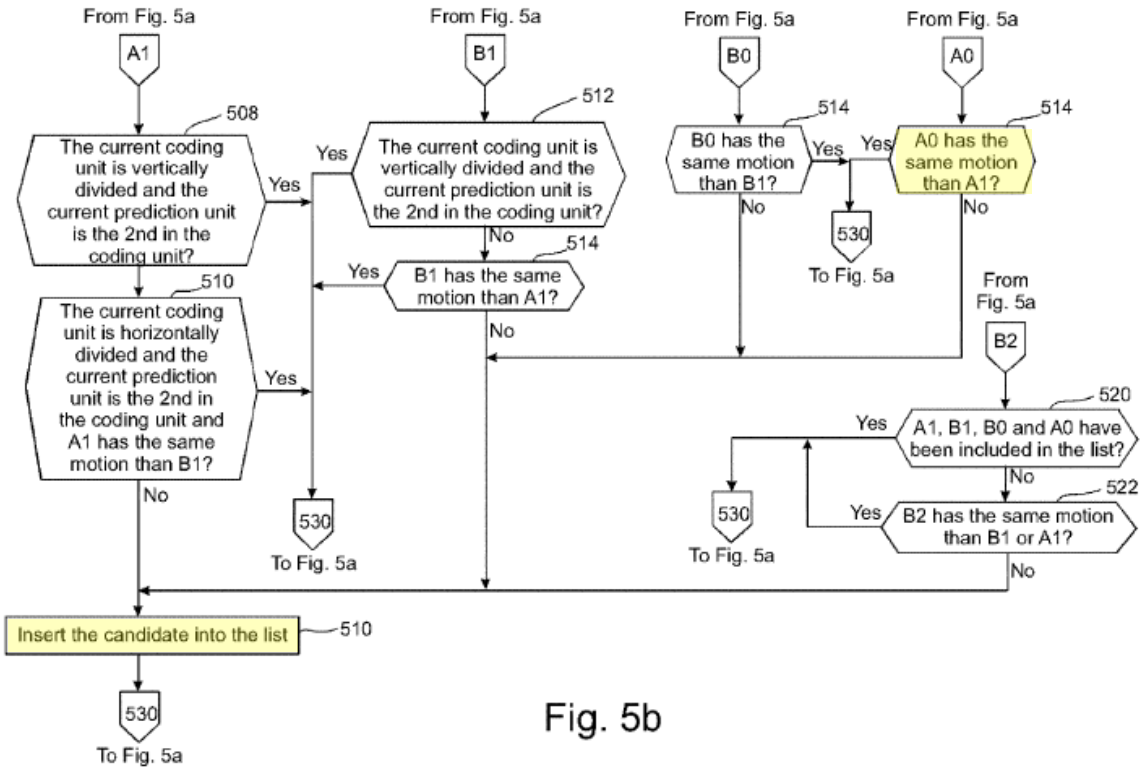


Fig. 5b

ASUS-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.

Nokia Exhibit 2022, p.37
ASUS v. Nokia
IPR2025-01153

A0	{A1}
B0	{B1}
B1	{A1}
B2	{A1, B1}

E. Overview of Rusert

71. 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. (ASUS-1004, ¶¶ 11-12, 36-37). The PMV candidates can be obtained from previously coded neighbouring 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-2020, 72:11-76:19).

72. Rusert teaches search patterns for "an outwards going scan … around the current block." (ASUS-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)).

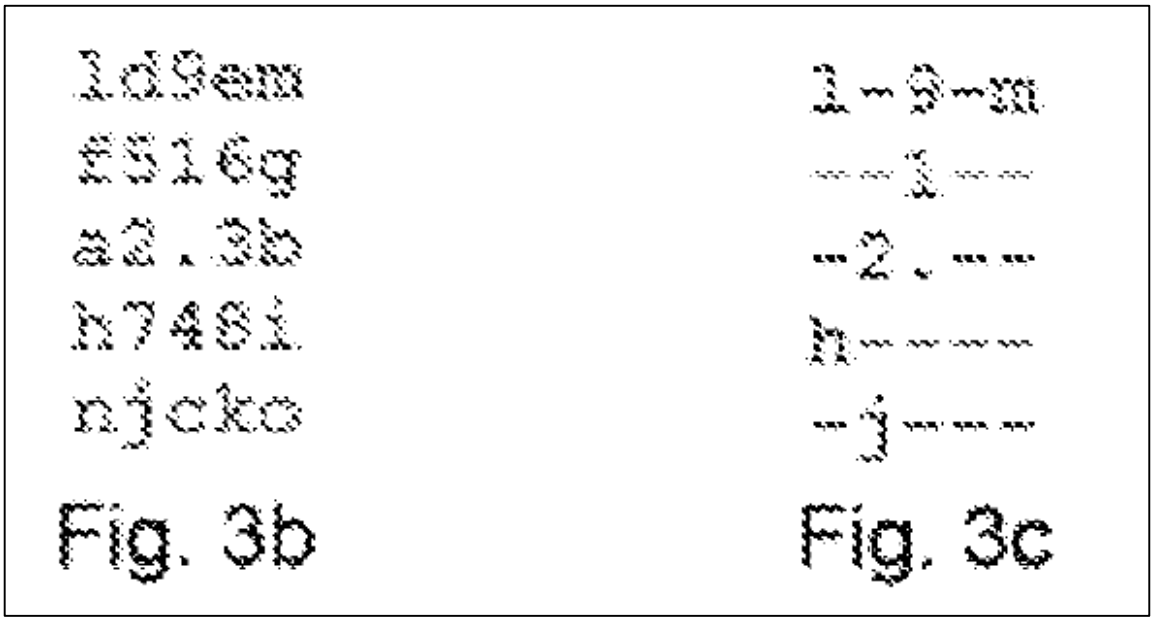


Fig. 3n

(*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-2020, 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.

73. 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. (ASUS-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.



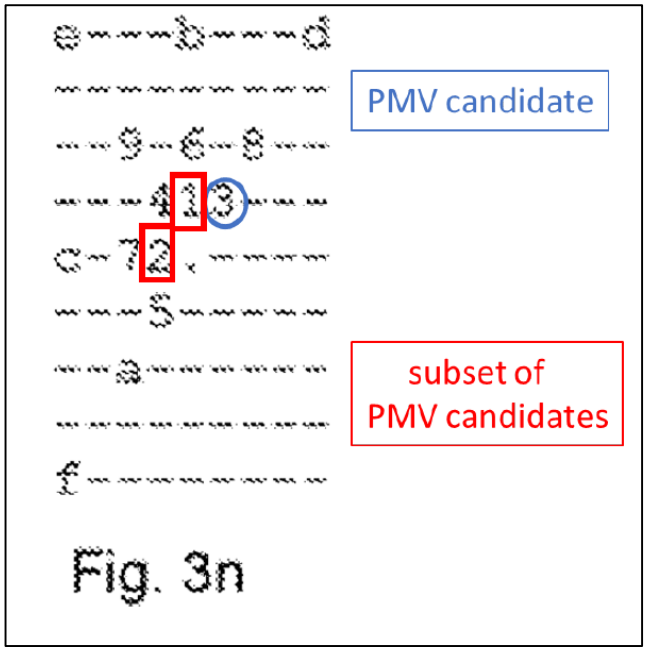
(*Id.*, Figures 3b and 3c).

74. 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).

75. As the scan expands outward, what Petitioner alleges is "the subset," (Petition, 28-29), is determined based on which blocks have available candidates and whether those candidates satisfy comparisons with candidates already in PMV_CANDS (ASUS-1004, ¶¶ 44, 51-66; *see also id.*, Figures 3a-3n).

76. 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). Petitioner argues 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, 28-29). As I will explain, I disagree.

Nokia Exhibit 2022, p.41
ASUS v. Nokia
IPR2025-01153



(ASUS-1003, app. A ¶ 130; annotated by Dr. Creusere)

77. 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. (ASUS-1004, ¶¶ 62, 71). At the point at which Rusert evaluates block 3 in this example, Rusert compares all possible pairs of candidates.[6]

F. Overview of Nakamura

78. 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). (ASUS-1007, § 1). Nakamura suggested that the positions of the

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

spatial neighbours 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 neighbours for both Merge mode and MVP. (*Id.*) Additionally, the proposed techniques sought to unify the derivation processes for Merge mode and MVP, as illustrated in Figure 1:

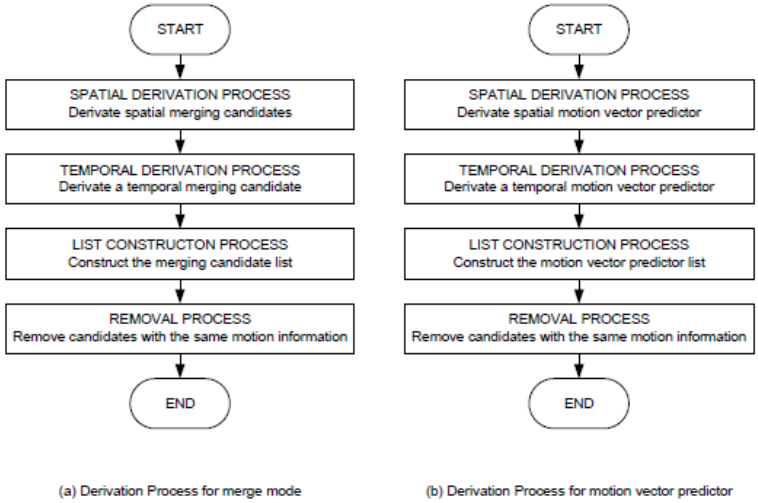


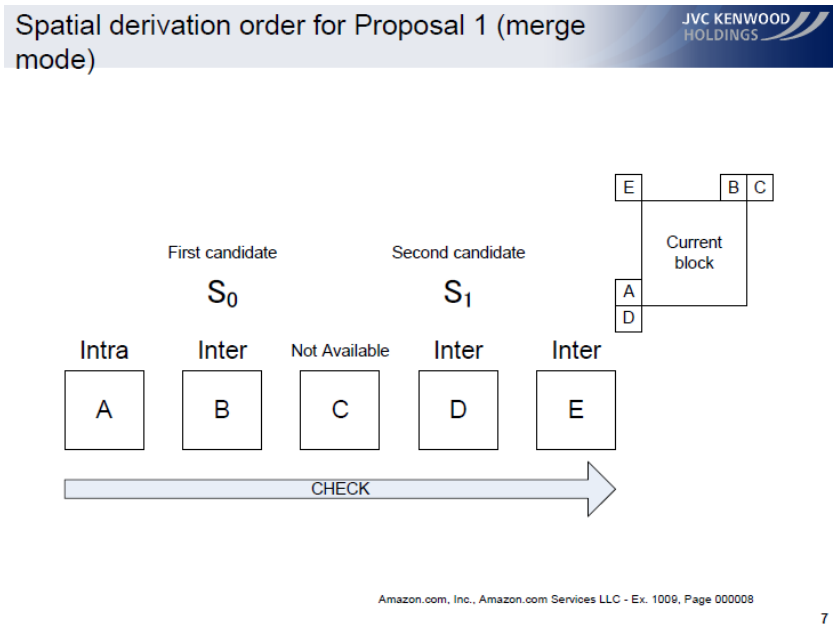
Figure 1 Derivation Process of merge mode and MVP in WD3

(*Id.*; *see also id.*, § 2.1).

79. 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] (*Id.*, Abstract, § 1, § 2.2.1, Figures 1,

[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).

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-2019, 8). Once S0 is 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 the previous IPR proceedings, Nos. IPR2024-00604 and IPR 2024-00605, Petitioner alleged that Nakamura's S0 is a "subset" according to the claims of the '714 Patent (Ex1003 Appendix A at paragraph 305).



(*Id.*)

G. Comparison of Rusert and Nakamura

80. 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

81. 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.

[8] One consequence of this property of Nakamura and Rusert is that neither reference enable parallel processing decisions. Both Rusert and Nakamura teach 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).

Nokia Exhibit 2022, p.45
ASUS v. Nokia
IPR2025-01153

> 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.
>
> 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-2020, 103:20-105:9)

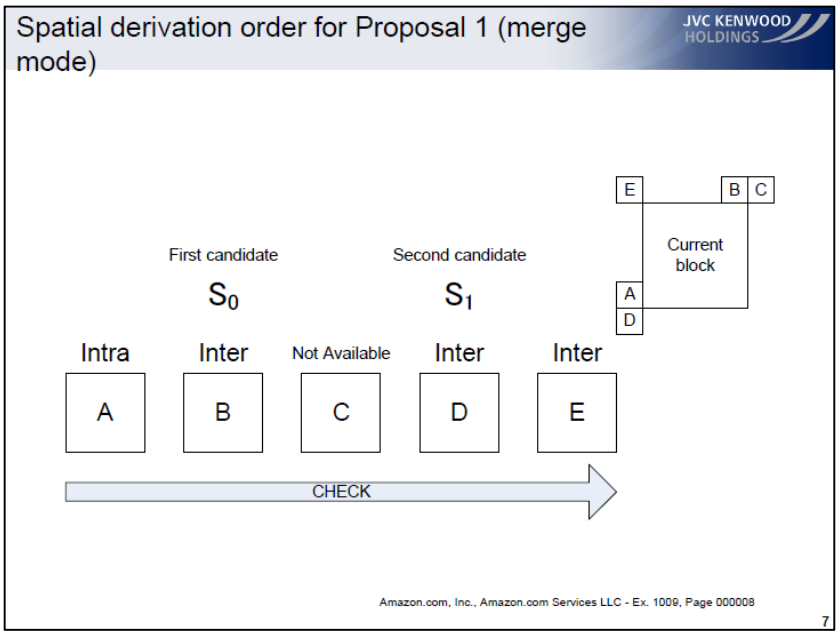
82. In my opinion, Dr. Creusere's statement is correct. In Rusert, the content of the alleged "subset" has already been determined before any selection, processing, or evaluation of what the Petitioner alleges is the "first spatial motion vector prediction candidate." Dr. Havlicek—Petitioner's expert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

independently confirmed the same sequential ordering during his deposition. Dr. Havlicek agreed that "Rusert's subset can only consist of motion vectors taken from blocks prior to the selected block in the scan order" and that this "is the way I believe a person of ordinary skill reads Rusert." (Ex-2021, Havlicek Dep. Tr. at 131:12–17). He further confirmed that when block 5 is selected, "it is not possible for any motion vector from the block marked 6 to be part of the subset" because Rusert "teaches that we follow a scan pattern that has an order to it" and the scan order "does not look at the motion vector associated with the block marked 6 until after the subset has been evaluated" with respect to block 5. (*Id.* at 130:8–131:6). Dr. Havlicek also acknowledged that you "must first visit a block before a motion vector, if any, is selected" and you "must first select a motion vector before that motion vector could be compared to anything, be it a subset or otherwise." (*Id.* at 91:5–91:19). These concessions confirm that in Rusert, the subset is fully determined before the next candidate in the scan order is ever visited, selected, or evaluated—exactly as Dr. Creusere previously agreed.

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

Nokia Exhibit 2022, p.47
ASUS v. Nokia
IPR2025-01153

example, in the scenario shown below from Nakamura's proposal (Ex-2019, 8), the motion vector associated with neighbouring block "B" is selected as the S0 value.[9]



84. 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.")).

85. 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.

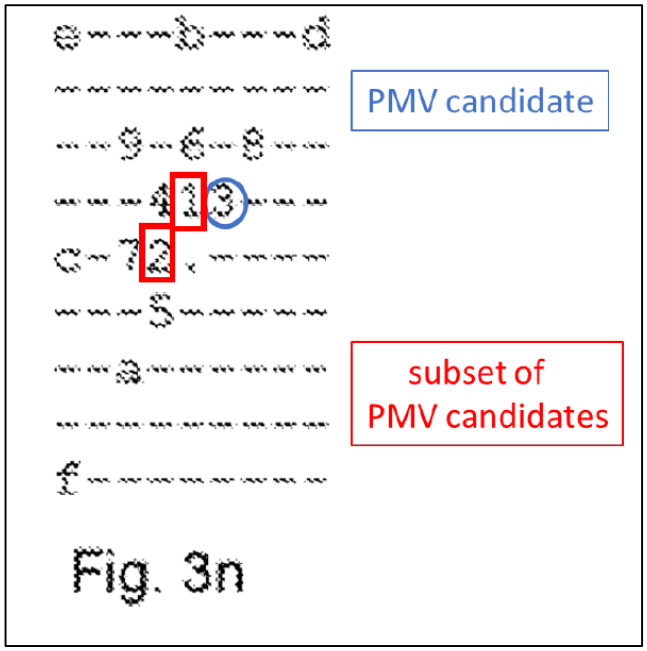


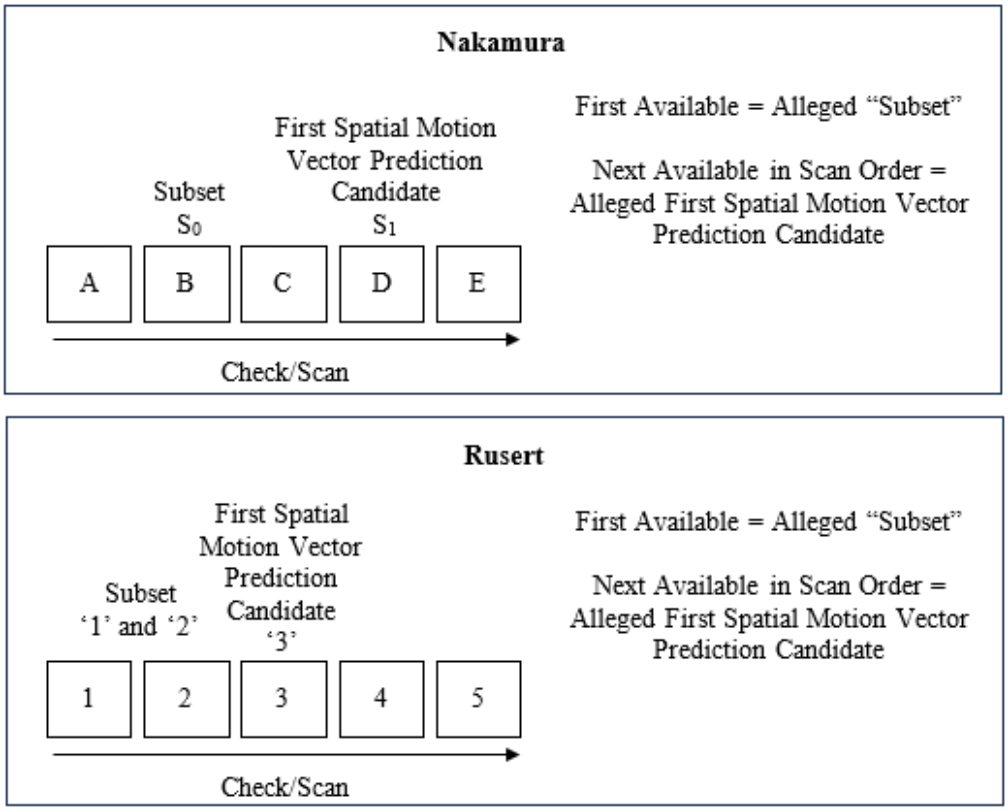
Fig. 3n

86. The content of Rusert's alleged subset depends on block availability. For example, if '1' is unavailable, (ASUS-1004, ¶ 54 (giving exemplary scenarios where blocks are unavailable due to coding order or lack of motion vector); *see also supra* ¶ 77), 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'.

87. 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. Dr. Havlicek confirmed this sequential reality in his deposition. When asked whether, once the update to the list has concluded, "we know the subset to which the next selected motion vector will be compared, but we do not yet know if the next visited block contains a motion vector," Dr. Havlicek answered: "It is true that we know the next block that will be visited. It is true that we do not know if that block has a motion vector." (Ex-2021, Havlicek Dep. Tr. at 135:17–136:2). Dr. Havlicek further acknowledged that the subset is "obviously evolving all the time as you process around the scan order" and that at certain times the subset "precisely coincides with PMV_CANDS." (*Id.* at 125:2–5). This testimony from Petitioner's own expert confirms that the alleged subset is fully established before Rusert even knows whether the next block in the scan order has a motion vector, let alone before any determination based on the location of that next block could occur.

88. 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

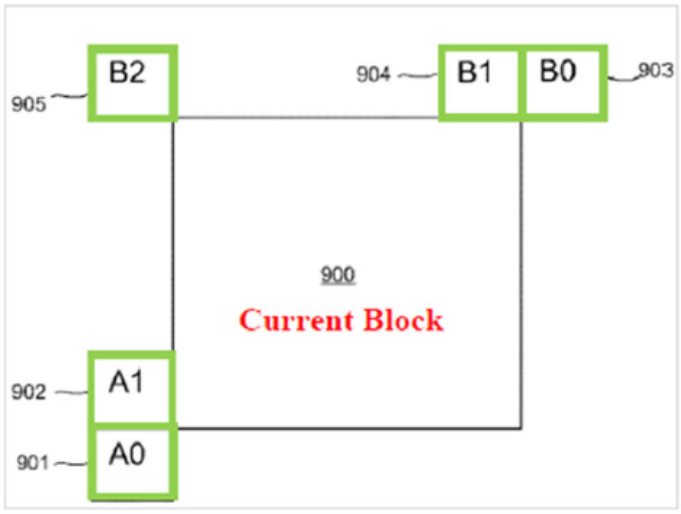
A. Ground 1: Rusert in Combination with Karczewicz

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

89. I understand that Petitioner is not relying on Karczewicz for this limitation. (Petition, 27-32).

90. 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.

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



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

92. 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. (ASUS-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).

93. 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. (*Id.*) 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. The fact that the location of a selected spatial motion vector prediction candidate (e.g., B0 or B2) is determinative of the members of the subset used for comparison (e.g., {B1} or {A1, B1}), in my opinion directly contradicts Petitioner's construction of "the block" in element 1[b]. (Petition, 23 (arguing that "the block" in element 1[b] means the "block of pixels" (i.e., the "current block" being encoded or decoded)); *see also supra* Section VI).

94. In its Institution Decision in IPR2024-00604 and IPR2024-00605, the Board disagreed with Petitioner's proposed construction of "the block" to mean "the block of pixels" in limitation 1[a]. (Institution Decision, 18). Instead, the Board

Nokia Exhibit 2022, p.55
ASUS v. Nokia
IPR2025-01153

agreed with Patent Owner that "the block" in limitation 1[b] means "the block associated with the first spatial motion vector prediction candidate," as limitation 1[b] states. (*Id.*) I agree with both Patent Owner and the Board.

95. 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. (ASUS-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).

96. 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. (*Id.*, ¶¶ 71-72). If the

Nokia Exhibit 2022, p.56
ASUS v. Nokia
IPR2025-01153

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.*)

97. In my opinion, Petitioner is incorrect in asserting that the 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, 39). Dr. Havlicek's own testimony underscores the inherently sequential, non-location-based nature of Rusert's subset determination. He described the list as being "in construction, under construction" as blocks are processed and acknowledged that the list "evolved" during the scan. (Ex-2021, Havlicek Dep. Tr. at 119:18–120:2). This evolving, sequential nature is fundamentally inconsistent with the '714 Patent's claims, where the subset for a given candidate is determined based on the location of the block associated with the spatial motion vector prediction candidate. In the '714 Patent, the subset for location A0 is always {A1}; the subset for location B0 is always {B1}. (ASUS-1001, 15:50–16:49).

98. Considering the first point, Rusert's PMV_CANDS list is constructed by scanning neighbouring 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] (ASUS-1004, ¶ 61, Fig. 3n, reproduced below). Previously coded blocks that are outside of the allowed distance or are unavailable cannot be included in PMV_CANDS. *(Id*., ¶ 54; Ex-2020 125:9-127:20).

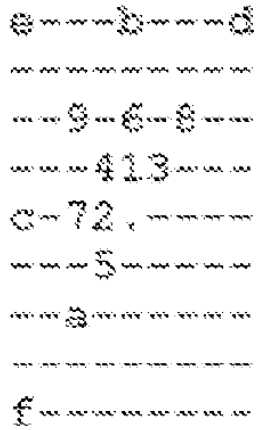
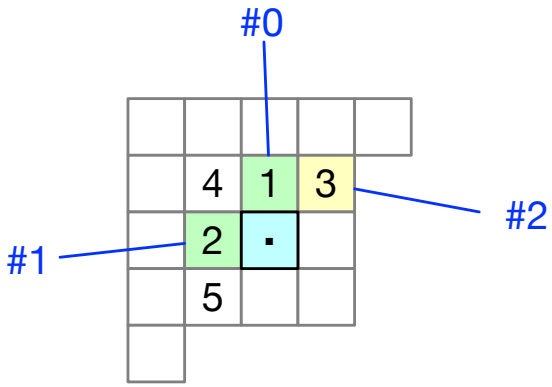


Fig. 3n

(ASUS-1004, Figure 3n).

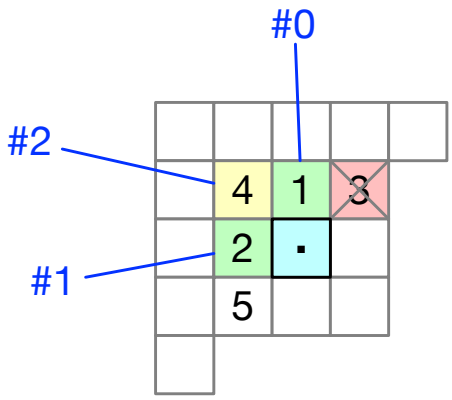
[10] Rusert explains that if a block has no motion vector present (such as the red highlighted, intra coded macroblocks illustrated above in paragraphs 59-61), that block is not available as a motion vector candidate. In Rusert, only blocks with valid motion vectors may be added to the subset of motion vectors in PMV_CANDS. (ASUS-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.

99. 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). In my opinion, Petitioner is incorrect. Consider an example. At iteration 0 of Rusert'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

100. 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

101. Thus, the subset does not depend on the location of the block currently being evaluated.

102. At the point at which Rusert has finished its comparison of neighbouring 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

Nokia Exhibit 2022, p.60
ASUS v. Nokia
IPR2025-01153

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}

103. 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}

104. 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.

105. 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.

106. Dr. Havlicek confirmed this sequence of Rusert. He testified that when Rusert visits a given block, paragraph 71 of Rusert explains that there is "an existing list" containing "candidates already in the list" which "will be compared with the new vector" from the block being visited, and that "[i]f it passes the test, yes, it will be added." (Ex-2021, Havlicek Dep. Tr. at 134:11–21). When asked whether, once the update to the list has concluded, "we know the subset to which the next selected motion vector will be compared, but we do not yet know if the next visited block contains a motion vector," Dr. Havlicek answered: "It is true that we know the next block that will be visited. It is true that we do not know if that block has a motion vector." (*Id.* at 135:17–136:2). This testimony confirms that the alleged subset (the list contents at any iteration) is fully established before Rusert reaches the next block, without any regard to the location of that next block.

107. 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. (ASUS-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).

108. Dr. Havlicek's testimony further confirms that Rusert's subset is not determined based on location. When asked how the subset is determined for a given candidate, Dr. Havlicek testified: "It's determined by the scan order." (Ex-2021, Havlicek Dep. Tr. at 128:18–129:2). This is a critical distinction. In the '714 Patent, knowing only the *location* of the first spatial motion vector prediction candidate is sufficient to determine the subset: if the first candidate is A0, the subset is {A1}; if the first candidate is B0, the subset is {B1}. (ASUS-1001, 15:50–16:49). The subset is a direct function of the candidate's spatial position. In Rusert, by contrast, knowing only the *location* of the next block in the scan order tells a POSITA nothing about the contents of PMV_CANDS. As Dr. Havlicek agreed, the subset "evolved" and is "in construction, under construction" as blocks are processed. (*Id.* at 119:18–120:2). Its contents depend entirely on the results of prior sequential processing; which earlier blocks had motion vectors, which of those motion vectors were unique, and which were excluded as duplicates.

109. Notably, Dr. Havlicek adopted Dr. Creusere's Nakamura analysis wholesale, stating in his declaration that he "agree[s] with the technical opinions and substance of Dr. Creusere's declarations" and "adopt[s] them as my own." (ASUS-

1003, ¶ 4). Yet Dr. Havlicek offers no independent opinions on Nakamura (Ex-2021, Havlicek Dep. Tr. at 32:1–2 ("My declaration submitted in this IPR proceeding offers no opinions on Nakamura.")). When asked at deposition whether there was "any particular aspect of Dr. Creusere's opinions on the grounds which you're opining on here that you take issue with and would not adopt," Dr. Havlicek answered: "Sitting here right now, I'm -- I'm not aware of any." (*Id.* at 26:2–8). Without opining on Nakamura, Dr. Havlicek independently made the very concessions about Rusert that defeated the Nakamura theory. The Nakamura theory failed because the subset was fully determined before the first candidate was identified, and the subset's contents did not depend on the first candidate's location. Dr. Havlicek confirmed both points: he agreed that after processing concludes for a given block, "it is true that we know the next block that will be visited. It is true that we do not know if that block has a motion vector" (*id.* at 135:17–136:2)—meaning the subset is fixed before the next candidate is even identified—and he agreed that what determines the subset is not the candidate's location but rather the scan order's sequential processing: "[i]t's determined by the scan order." (*Id.* at 128:18–129:2). These are the operative concessions that doomed the Nakamura theory in prior proceedings, and Dr. Havlicek has observed them with respect to Rusert.

110. In reaching its institution decision in IPR2024-00604 and IPR2024-00605, the Board considered the following example: “if the first selected candidate

Nokia Exhibit 2022, p.65
ASUS v. Nokia
IPR2025-01153

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, 35). In my opinion, this example is an incorrect characterization of Rusert. As I explained above, if the first selected candidate is at the location of block 5, then Rusert'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 Rusert's scan, depending on availability of blocks. Any correlation between position in the scan order and subset size is therefore incidental to sequential processing, not evidence of a causal location-based determination. 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." (Institution Decision, 35).

2. Rusert does not teach "comparing … without making a comparison of each pair from the set of spatial motion vector prediction candidates," as required by the claims

111. I understand that Petitioner is not relying on Karczewicz for this limitation. (Petition, 32-36).

112. I understand that the Petition asserts that Rusert teaches "comparing … without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates," as recited in the challenged claims. (Pet. at 34–36, 69–72). In my opinion, the Petition is incorrect. As I explain below, Rusert's method of building the PMV_CANDS list necessarily compares every possible candidate pair from the set of spatial motion vector prediction candidates, and therefore cannot satisfy this claim limitation.

113. Before explaining why Rusert fails to meet this limitation, I will first describe how the challenged claims operate with respect to the "set," the "subset," and the "comparing" step. As I discussed above in paragraphs 67–70, the '714 Patent discloses that a set of spatial motion vector prediction candidates is obtained from neighbouring blocks located around the current block of pixels being encoded or decoded. (ASUS-1001, 13:26–31). Claim 1 recites "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." (ASUS-1001, cl. 1). Claims 9, 15, 23, 29, and 30 include essentially the same limitation, reciting "without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates." (ASUS-1001, cls. 9, 15, 23, 29, 30). The '714 Patent achieves this by determining a subset that is less than the full set of spatial motion vector prediction candidates, and comparing the first spatial motion vector prediction candidate only to the members of that subset—not to every other member of the set of spatial motion vector prediction candidates. (ASUS-1001, 4:19–27, 14:21–16:55). For example, when candidate A0 is the first spatial motion vector prediction candidate, it is compared only to A1 (the subset); it is not compared to B0, B1, or B2 (the other members of the set of spatial motion vector prediction candidates). (ASUS-1001, 16:32–39). Candidate pairs such as A0/B0 and A0/B1 are never compared, even though B0 and B1 are members of the set of candidates. A POSITA would understand that is what it means to compare "without making a comparison of each possible candidate pair from the set", in the context of the ‘714 Patent.

114. In Rusert, by contrast, the method employed to build the PMV_CANDS list means that, to the extent a "set of spatial motion vector prediction candidates for the block of pixels" exists, it is created as the Rusert method moves through the scan order. (ASUS-1004, ¶¶ 44, 51–66). Petitioner's own expert, Dr. Havlicek, confirmed

this dynamic nature of the PMV_CANDS list, describing PMV_CANDS as being "in construction, under construction" as blocks are processed and acknowledging that the list "evolved" during the scan. (Ex-2021, Havlicek Dep. Tr. at 119:18–120:2). Dr. Havlicek further agreed that "Rusert's subset can only consist of motion vectors taken from blocks prior to the selected block in the scan order" and that this "is the way I believe a person of ordinary skill reads Rusert." (*Id.* at 131:12–131:17). He confirmed, for example, that when block 5 is selected in Rusert's method, "it is not possible for any motion vector from the block marked 6 to be part of the subset" because Rusert "teaches that we follow a scan pattern that has an order to it" and the scan order "does not look at the motion vector associated with the block marked 6 until after the subset has been evaluated" with respect to block 5. (*Id.* at 130:8–131:6). As a result, motion vectors corresponding to block locations at future positions in the scan order cannot be considered part of the "set" at the point in time when the "comparing" step occurs for a given candidate. Whether comparisons of these potential future set members are made is irrelevant to whether the claims are satisfied, because the claims require comparing "without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates," and future, unconsidered positions in the scan order are not yet part of the set at the relevant time. Motion vectors which are not part of the scan order for a block are never part of "[the] set of spatial motion vector prediction candidates for

[the] block of pixels" in Rusert's system. In short, Rusert's inability to compare motion vector candidates with motion vectors that are never in the set for the block at the time of the comparing step cannot satisfy the claimed "comparing … without making a comparison of each possible candidate pair from the set."

115. At each position in the Rusert scan order, if a motion vector is present, its motion information is compared to the motion information of every previously identified motion vector candidate that has been added to PMV_CANDS. (ASUS-1004, ¶¶ 71–72). Dr. Havlicek confirmed this, testifying that when a new candidate is considered, it "needs to be determined if it's equal to any of the ones that are currently on the list, if it's within a threshold of any of the ones that are currently on the list, and if it falls into a would never be used condition compared to the ones that are on the list." (Ex-2021, Havlicek Dep. Tr. at 154:14–22). When asked whether a candidate "will be compared to everything on the PMV candidate list at the time that it is processed," Dr. Havlicek answered: "Everything that's in the subset at that time, yes." (*Id.* at 156:6–11). For example, if candidates 1 and 2 have been added to PMV_CANDS, and candidate 3 is being evaluated, candidate 3 will be compared to both candidate 1 and candidate 2. (*see* ASUS-1004, ¶¶ 71–72). Candidates at previous positions in Rusert's scan order, which have motion information and where that motion information is unique, are included in the PMV_CANDS list. Each new candidate's motion information is compared directly with all candidates at previous

positions in Rusert's scan order, that have met the criteria to be included in the PMV_CANDS list. (*Id.*) Prior scan order candidates with redundant motion information that were excluded from PMV_CANDS based on a comparison of motion information, have the same motion information as candidates already on the PMV_CANDS list. (*Id.*, ¶¶ 62, 71). As a result, the motion information of each new candidate is effectively compared to the motion information of all previous candidates in the scan order—those with unique motion information are on the PMV_CANDS list and compared directly, and those that were excluded are excluded either because they do not have motion information (e.g. they are intra coded), and therefore are not available candidates, or because their motion information matched a candidate already on the PMV_CANDS list.

116. To illustrate, consider the scan order of Figure 3n and assume blocks 1, 2, 3, and 4 are available, i.e. they have motion information. (ASUS-1004, Fig. 3n). At iteration 0, block 1 is added to PMV_CANDS (the list is empty, so no comparison is needed). At iteration 1, candidate 2 is compared to candidate 1, which I will designate as the comparison pair {2, 1}. At iteration 2, candidate 3 is compared to candidates 1 and 2, designated as the pairs {3, 1} and {3, 2}. At iteration 3, candidate 4 is compared to all candidates in PMV_CANDS—which includes whichever of candidates 1, 2, and 3 were added—designated as the pairs {4, 1}, {4, 2}, and {4, 3} (assuming all were added). In total, the following pairs have been compared: {2, 1},

{3, 1}, {3, 2}, {4, 1}, {4, 2}, and {4, 3}. That is every possible candidate pair from the set of candidates 1 through 4.

117. The Petition argues that Rusert "avoids comparing each pair of candidates from the scan order" because "Rusert compares potential candidates with preceding candidates already in PMV_CANDS, which are a subset of the candidates in the scan order." (Pet. at 35; ASUS-1003, ¶¶ CA139, CB137). This argument conflates two distinct concepts: (i) the number of candidates in PMV_CANDS at a given iteration and (ii) whether all candidate pairs are compared. In Rusert, a candidate is excluded from PMV_CANDS only after it is compared to all current members of PMV_CANDS and found to be a duplicate or within a threshold distance, the so-called “deduplication” process. (ASUS-1004, ¶¶ 71–72). In this case, the excluded candidate's motion information has already been compared to every candidate in PMV_CANDS, and its motion information is the same as (or within a threshold distance of) an existing member of PMV_CANDS. (*Id.*) As a result, future candidates that are compared to the motion information of existing members of PMV_CANDS are compared to the motion information of the excluded candidate, because the excluded candidate shares the same (or substantially the same) motion information as the candidate that remains in PMV_CANDS. Thus, although a duplicate candidate may be removed from the PMV_CANDS list, the comparison of its motion information to all other candidates has already been

performed, and subsequent comparisons to the remaining list member carrying the same motion information serve as a comparison to the excluded candidate. In short, Rusert's "deduplication" process is itself the result of comparing all pairs of candidates that have been encountered.

118. Consider an example. Assume that candidates 1 and 2 are available and have identical motion information. After candidate 2 is compared to candidate 1 (pair {2, 1}), candidate 2 is excluded from PMV_CANDS as a duplicate. (ASUS-1004, ¶ 71). At this point, PMV_CANDS contains only {1}. When candidate 3 is evaluated, it is compared to candidate 1 (pair {3, 1}). But because candidate 2 has the same motion information as candidate 1, the comparison of candidate 3 to candidate 1 also comprises a comparison of candidate 3's motion information with candidate 2's motion information. In other words, every prior candidate's motion information has been effectively compared, whether or not that prior candidate remains in the PMV_CANDS list. Thus, all pairs have been compared: {2, 1}, {3, 1} (which also encompasses the comparison of 3 with the motion information of 2), and so on for every subsequent candidate.

119. This is fundamentally different from what the '714 Patent claims, and is the reason why Rusert fails to achieve the comparison-reduction benefit of the '714 Patent method. In the '714 Patent, when A0 is compared to A1, the comparison of A0's motion information with B0's motion information never occurs, because B0

Nokia Exhibit 2022, p.73
ASUS v. Nokia
IPR2025-01153

is not part of the subset. In other words, the pair A0/B0 is never compared, even indirectly or by proxy. (ASUS-1001, 15:50–16:7). There is no mechanism in the claimed method by which the comparison of A0 with A1 accounts for, or substitutes for, a comparison with B0. By contrast, in Rusert, every available candidate's motion information is compared—either directly or through a proxy of identical motion information—to every other available candidate's motion information.

120. The Petition further argues that Rusert does not compare each possible pair of candidates because "the scan may be terminated … as soon as a pre-defined number of unique PMV candidates have been found." (Pet. at 35 (citing ASUS-1004, ¶ 48). In other words, the Petition contends that Rusert's scan order may not traverse all potential blocks, and therefore Rusert avoids comparing some pairs. This argument fails because blocks at positions in the scan order that are never reached by the scan are not "candidates" in any meaningful sense.

121. The term "candidate" in the claims refers to a spatial motion vector prediction candidate for the block of pixels. A block position that Rusert's scan never reaches, because the scan terminates before getting there, is not a spatial motion vector prediction candidate for the current block. It was never identified, never selected, and never considered for inclusion in Rusert’s motion vector prediction list. A POSITA would understand that such a block cannot logically be part of "the set of spatial motion vector prediction candidates" at the time the comparing step occurs,

Nokia Exhibit 2022, p.74
ASUS v. Nokia
IPR2025-01153

because it was never a candidate in the first place. Petitioner's own expert agrees with this principle in relation to blocks that lack motion vectors. Dr. Havlicek testified that "the set of spatial motion vector prediction candidates cannot include a motion vector that came from a block which has no motion vector." (Ex-2021, Havlicek Dep. Tr. at 79:1–9). He further confirmed that if a block has a motion vector, "then can you consider it for inclusion on the list. If there's not one, well, then you can't." (*Id.* at 74:4–9). He also agreed that if a block is visited in the scan order but does not contain a motion vector, "no comparison will be performed because there is no motion vector to compare to any subset." (*Id.* at 136:20–137:2). The same logic applies to blocks that Rusert's scan never reaches at all. If we accept that blocks that are evaluated but lack motion vectors are not candidates, then blocks that are never evaluated—and whose motion vector status is never even evaluated—cannot be candidates.

122. The claim limitation requires comparing "without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates." (ASUS-1001, cls. 1, 9, 15, 23, 29, 30). Under Petitioner's interpretation, any process that does not scan every previously coded block in the entire frame would satisfy this limitation, because there would always exist some unconsidered block whose motion vector was never compared. This interpretation would render the "without making a comparison of each possible candidate pair" limitation

Nokia Exhibit 2022, p.75
ASUS v. Nokia
IPR2025-01153

meaningless. Under Petitioner's logic, virtually any comparison process, no matter how exhaustive within its defined scope, would satisfy the limitation simply because there exist blocks outside the scope of the comparison process that were never compared. That cannot be correct. A POSITA would understand that the "set of spatial motion vector prediction candidates" refers to the candidates that are actually identified and considered for the block being processed—not every previously coded block in the entire frame. (*See, e.g.*, ASUS-1004, ¶¶ 11–12 (describing the "set" as the candidates selected for a given block); *see also* IPR2024-00604 Ex-2020 at 72:11–76:19 (Dr. Creusere agreeing that the "candidates" are those in Rusert's scan order, not all previously coded blocks that are yet to be visited)).

123. Moreover, even Dr. Creusere, whose declarations the Petition incorporates wholesale, agreed in his deposition that the "candidates" in Rusert are those in Rusert's scan order, not all previously coded blocks. (IPR2024-00604 Ex-2020 at 72:11–76:19). A POSITA would understand that if the "set" is the candidates within the scan order, and the scan terminates after a pre-defined number of unique candidates have been found (ASUS-1004, ¶ 48), then the candidates that were never reached are simply not in the set. They are not "possible candidate pairs" because they are not candidates at all. Whether comparisons of these never-reached positions are made is irrelevant to the claim, because those positions do not form part of the "set of spatial motion vector prediction candidates" as that term is used in the claims.

Nokia Exhibit 2022, p.76
ASUS v. Nokia
IPR2025-01153

124. In summary, within Rusert's scan order, the "set of spatial motion vector prediction candidates" at any given point in the process consists of those candidates that have been reached and identified by the scan. As candidates from earlier scan order positions make up the entirety of the set at the time the comparison of a new candidate occurs, each new candidate has its motion information compared against the motion information of all candidates in the set, i.e. all candidates in earlier scan order positions. (ASUS-1004, ¶¶ 71–72). Because Rusert compares every possible candidate pair from within the defined set, Rusert cannot satisfy the "without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates" limitation of the challenged claims.

125. Additionally, I note that the Petitioner's own interpretation of the "set" across its arguments is inconsistent. When arguing that Rusert teaches "a set of spatial motion vector prediction candidates" in limitation [1a]/[9a], the Petition characterizes the "set" as "previously coded motion vectors that were used for previous blocks." (Pet. at 21 (citing ASUS-1004, ¶¶ 11–12)). But when arguing that Rusert teaches "without making a comparison of each possible candidate pair from the set," the Petition contends that candidates in PMV_CANDS are a "subset of the candidates in the scan order" and thus do not encompass all pairs "from the set." (Pet. at 35). These two characterizations are inconsistent, and the Petition does not reconcile them. If the "set" is as broad as all previously coded motion vectors, then

Nokia Exhibit 2022, p.77
ASUS v. Nokia
IPR2025-01153

the scan order itself is already a subset, and the "comparing" step necessarily does not involve all pairs from the larger "set" for a trivial reason—the majority of those motion vectors are not even candidates. If, on the other hand, the "set" comprises the scan order candidates (as Dr. Creusere agreed), then Rusert compares every pair within that set as I have explained above. In either case, the Petition's argument that Rusert satisfies the "without making a comparison" limitation fails.

126. For at least these reasons, it is my opinion that Rusert does not teach or suggest the "without making a comparison of each possible candidate pair from the set of spatial motion vector prediction candidates" limitation recited in the challenged claims of the '714 Patent. Because both Ground 1 and Ground 2 rely on Rusert for this limitation, and Rusert fails to teach it, both Grounds fail for this additional, independent reason.

3. Rusert's scan order teaches away from combination with Karczewicz's variable-size prediction units, and a POSITA would not have had a reasonable expectation of success in combining the references

127. I understand that the Petition proposes combining Rusert with Karczewicz to apply Rusert's block-based teachings to H.265 "prediction units" ("PUs") as taught by Karczewicz. (Pet. at 17–19; ASUS-1003, ¶¶ CA71–86). In my opinion, the Petition's proposed combination fails because Rusert's scan order is designed for, and only suited to, a uniform grid of equally sized blocks, and

Karczewicz teaches that H.265 introduces variable-size prediction units, including non-square, rectangular PUs that are fundamentally incompatible with Rusert's scan methodology. Rusert therefore teaches away from the proposed combination, and a POSITA would not have been motivated to combine the references or had a reasonable expectation of success in doing so.

128. Rusert's scan patterns are designed for a uniform grid of equally sized blocks. Rusert explains its teachings in the context of H.264, in which Rusert states that a motion vector is provided for each "8x8 pixel block," also called a "sub-block" because it is a portion of a "macroblock." (ASUS-1004, ¶ 36). Rusert's scan patterns, illustrated in Figures 3a through 3n, depict a regular grid in which each cell represents a block of the same size. (ASUS-1004, ¶¶ 51–66, Figs. 3a–3n). The current block, represented by ".", is surrounded by blocks of equal dimensions, and the scan order proceeds outward through this uniform grid. (*Id.*)

129. Rusert's scan order depends on distance calculations that presuppose a uniform block grid. Rusert teaches calculating distances between the current block and surrounding blocks using Euclidean distance, Chebyshev distance ("box distance"), and Manhattan distance. (ASUS-1004, ¶¶ 44, 51–59). For example, Rusert's Euclidean distance calculation assumes that each surrounding block occupies a fixed (x, y) position on a regular grid: "Assume for instance that the block we wanted to encode was in position x=3 y=5. Then we would rank the surrounding

blocks according to euclidian_dist = sqrt((xpos-3)^2 + (ypos-5)^2)." (ASUS-1004, ¶¶ 51–52). Similarly, the Chebyshev distance calculation—"Chebyshev_dist = max(|xpos-xcurrent|, |ypos-ycurrent|)"—assumes blocks at discrete grid positions with equal spacing. (ASUS-1004, ¶ 56). These distance calculations are only meaningful when each position on the grid represents a block of the same size. When blocks vary in size and shape, the concept of a single (x, y) position for a "block" and its "distance" from the current block becomes ambiguous.

130. Rusert's preferred scan pattern, Figure 3n, further confirms the uniform-block assumption. Figure 3n depicts the current block surrounded by blocks at positions labelled 1 through f, arranged in a pattern that includes only blocks "directly above and to the left of the current block" and "corner blocks." (ASUS-1004, ¶ 65, Fig. 3n). Rusert defines "corner" and "middle" positions relative to the current block as follows: "A previous block at a corner position is offset from a current block position by an equal distance in a horizontal direction and a vertical direction. A previous block at a middle position is either horizontally aligned or vertically aligned with a current block position." (ASUS-1004, ¶ 16). These definitions—corner blocks offset by "an equal distance" horizontally and vertically, and middle blocks "horizontally aligned or vertically aligned"—are coherent only when all blocks are uniform squares on a regular grid. Dr. Havlicek confirmed that

Figure 3n is the preferred scan pattern, describing it as "the apex of Rusert's sequential improvement." (Ex-2021, Havlicek Dep. Tr. at 95:22–96:5).

131. Karczewicz, by contrast, teaches that in H.265, coding units ("CUs") can be divided into prediction units ("PUs") of varying sizes, including non-square, rectangular shapes. Karczewicz explains that "[a] CU that is not split may include one or more prediction units (PUs)" and that "a PU represents all or a portion of the corresponding CU." (ASUS-1005, ¶ 35). In the simplest case, a CU comprises a single PU of the same size. But CUs can be divided into multiple PUs, with horizontal divisions creating 2NxN rectangular PUs and vertical divisions creating Nx2N rectangular PUs. (*See* ASUS-1005, ¶ 35; *see also* ASUS-1006, ¶ 4;). The Petition itself acknowledges these partition modes, explaining that "[w]hen a CU was split horizontally into two symmetric rectangular PUs, it was referred to as a 2NxN partition size" and "[a] vertically divided CU was referred to as an Nx2N partition size." (ASUS-1003, ¶ CA19; *see* Pet. at 5–6).

132. The Petition needs Karczewicz specifically for its H.265 PU terminology, to translate Rusert's "blocks" into "prediction units," but Karczewicz also introduces the very feature that undermines the combination: variable-size, non-square PUs. (*See* Pet. at 17–19; ASUS-1005, ¶¶ 33–36). The Petition cannot selectively adopt Karczewicz's "PU" terminology while ignoring the fact that PUs in H.265 can be rectangular, non-uniform in size, and arranged in patterns that do not

Nokia Exhibit 2022, p.81
ASUS v. Nokia
IPR2025-01153

conform to a regular grid. A POSITA reading Karczewicz would understand that the H.265 PU structure introduced block shapes and configurations that Rusert's scan order was never designed to handle.

133. Rusert's scan order breaks down when applied to non-uniform, rectangular PUs. Consider, for example, a coding unit that has been vertically divided into two Nx2N prediction units. The resulting PUs are tall, narrow rectangles, not squares. The blocks neighbouring such a PU on a given side may themselves be PUs of different sizes and shapes, depending on how their parent CUs were partitioned. In such a scenario, the spatial relationships that Rusert's scan order relies upon no longer hold (i.e., uniform grid positions, consistent distances between blocks, and predictable "corner" and "middle" positions). A rectangular PU may span multiple positions in what would otherwise be Rusert's uniform grid, or a single grid position may correspond to only a fraction of a larger PU. The distance from the current PU to a neighbouring PU becomes ambiguous because the neighbouring PU does not occupy a single (x, y) grid position but rather spans a range of positions. Importantly, this problem is not limited to cases where the current block itself is a non-square PU. Even when the current block's coding unit is undivided, yielding a single square PU, the neighbouring blocks surrounding it may be PUs from coding units that were partitioned differently, resulting in a mixture of square and rectangular neighbours of varying sizes. In H.265, the partitioning decision is made

independently for each coding unit (ASUS-1005, ¶¶ 33–35), so a POSITA would expect any given block to be surrounded by a heterogeneous mix of PU sizes and shapes. Rusert's distance calculations and corner/middle position definitions would therefore break down for the neighbouring blocks even if the current block happens to be square.

134. Dr. Havlicek himself acknowledged the complications that arise when attempting to apply Rusert's scan pattern to H.265's variable block structure. When asked how Rusert's scan would apply to surrounding blocks, Dr. Havlicek conceded: "Well, if it's H.265 and not H.264, then it's possible that all of those blocks were already processed because of division of a—of a coding unit, or maybe they weren't. So it might be that you can't consider the ones that are below the dot, you know." (Ex-2021, Havlicek Dep. Tr. at 102:16–103:1). This testimony confirms that even Petitioner's own expert recognizes that transitioning Rusert's scan order from H.264's uniform blocks to H.265's variable-size PU structure introduces significant uncertainty and complications that Rusert does not address.

135. Rusert teaches away from the proposed combination. Throughout its description of scan patterns, Rusert iteratively refines its approach to address problems inherent in scanning a grid of uniform blocks. Rusert notes that certain scan patterns are "quite hard to 'spiral outwards'" (ASUS-1004, ¶ 55), that some patterns "could require too many tests" (ASUS-1004, ¶ 65), and that the preferred

scan pattern of Figure 3n was selected because it "has been found to combine good compression efficiency (i.e., finding good motion vectors) with good computation performance" (ASUS-1004, ¶ 66). These refinements all assume and are optimized for a uniform grid of equally sized blocks. While Rusert states generally that its "principles . . . can also be applied to . . . other coding standard[s], and indeed any coding system which uses predicted motion vectors" (ASUS-1004, ¶ 116), a POSITA would understand this statement to refer to Rusert's general principle of selecting PMV candidates from spatially neighbouring blocks, and not to the specific scan methodology of Figure 3n, with its distance calculations, corner and middle position definitions, and uniform-grid assumptions. The portability of a general concept does not mean that the particular implementation Rusert discloses, and upon which the Petition relies, can function in a non-uniform block environment. Applying Rusert's scan to non-uniform, rectangular PUs would reintroduce and exacerbate the very problems Rusert worked to solve, because the foundational assumption of a uniform grid—upon which all of Rusert's distance calculations, scan orderings, and efficiency optimizations depend—would be violated.

136. A POSITA would not have been motivated to combine Rusert and Karczewicz for this additional reason. The Petition asserts that "Rusert's concepts were readily applicable to PUs" and that "the combination would have had the predictable result of selecting PMV candidates (as Rusert teaches) for PUs (as

Karczewicz teaches)." (Pet. at 19; ASUS-1003, ¶ CA83). But this assertion ignores the fundamental mismatch between Rusert's uniform-grid scan methodology and H.265's variable-size PU architecture, as explained above. A POSITA would have recognized that Rusert's scan patterns—particularly the preferred pattern of Figure 3n—were specifically designed for the uniform 8x8 sub-block grid of H.264, and that the introduction of variable-size, rectangular PUs as taught by Karczewicz would undermine the distance-based ordering and spatial assumptions upon which Rusert's entire scan methodology depends.

137. A POSITA would not have had a reasonable expectation of success in combining the references. The Petition claims that a POSITA would have had a reasonable expectation of success because "[t]he combination applies teachings according to their known purposes, in a conventional manner" and because "[t]he teachings are complementary aspects of block-based video encoding from H.264 and H.265." (Pet. at 19; ASUS-1003, ¶¶ CA85–86). But the teachings are not complementary with respect to the scan order. Rusert's scan order is a carefully calibrated system that depends on uniform block geometry, as explained above. Karczewicz's PU structure introduces non-uniform block geometry. A POSITA attempting to apply Rusert's Figure 3n scan pattern to a frame containing a mixture of 2Nx2N, 2NxN, and Nx2N prediction units of varying sizes would face fundamental design choices that Rusert does not address, including how to define

"distance" between non-uniform PUs, how to determine the scan order when neighbouring PUs span multiple grid positions, and how to identify "corner" and "middle" positions when the current block is itself a non-square rectangle. These are not trivial implementation details; they go to the core of Rusert's scan methodology. A POSITA would not have had a reasonable expectation that Rusert's scan order could be straightforwardly applied to variable-size PUs without substantial redesign of the scan methodology itself, and that neither Rusert nor Karczewicz provides.

138. For these reasons, it is my opinion that the Petition's proposed combination of Rusert and Karczewicz lacks both an adequate motivation to combine and a reasonable expectation of success. Rusert's scan order teaches away from application to non-uniform block shapes, and Karczewicz, the very reference the Petition relies upon for PU terminology, introduces the non-uniform, rectangular PU shapes that are incompatible with Rusert's scan methodology. This provides an additional, independent basis for finding that Petitioner has failed to demonstrate that the challenged claims are unpatentable under Ground 1.

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

139. Petition includes a second ground (Rusert, Karcewicz, and Lin) where a third reference (Lin, ASUS-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.

Nokia Exhibit 2022, p.87
ASUS v. Nokia
IPR2025-01153

IX. CONCLUSION

140. 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.

141. 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 wilful 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 March 2026

Iain E. Richardson

Dr. Iain Richardson

Nokia Exhibit 2022, p.88
ASUS v. Nokia
IPR2025-01153