UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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AMAZON.COM, INC., AMAZON.COM SERVICES, LLC,
Petitioner

v.

NOKIA TECHNOLOGIES OY,
Patent Owner

_____

Case: IPR2024-00847
IPR2024-00848

U.S. Patent No. 7,532,808

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DECLARATION OF DR. MICHAEL ORCHARD

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1. I, Dr. Michael Orchard, declare as follows:

I. INTRODUCTION

2. I have been retained on behalf of Nokia Technologies OY and asked to provide opinions in respect of two Inter Partes Review (IPR) proceedings, IPR2024-00847 and IPR2024-00848, both of which relate to U.S. Patent No. 7,532,808, the '808 Patent.

3. This Declaration summarizes 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 subsequent to 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. I further understand that an institution decision is "all-or-nothing" and so I have focused my opinions on the independent claim at issue in this petition. Should the petition be instituted, I anticipate offering additional opinions regarding both the dependent and independent claims. I have also been asked to compare the art raised and applied in the petition to art that was before the PTO during the prosecution of the '808 Patent and its family members.

4. I testified at the evidentiary hearing in the International Trade Commission Matter 337-TA-1379. Petitioner Amazon.com, Inc. had previously asserted the Karczewicz and Frojdh references against the '808 Patent but dropped

these references in favor of another obviousness ground before the evidentiary hearing. I testified at the evidentiary hearing that Petitioner's remaining ground (based on MPEG-1) does not render the asserted claims of the '808 Patent obvious.

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

6. I am submitting the same declaration for both IPR2024-00847 and IPR2024-00848, as these petitions raise the same grounds for Claims 1-2, 6-7, 9, 23-25, 28-30, 32, 34, 36, 39-41, 43, and 65 (-00847) and Claims 10-11, 15-16, 20-22, 44, 47-49, 51-54, 58-60, 62-64 (-00848) in the same challenged patent, namely the '808 Patent. My cites to the petition herein are to the page numbers in IPR2024-00847.

II. EDUCATIONAL BACKGROUND AND QUALIFICATIONS

7. Details of my professional qualifications and background are summarized below and are set out in detail in my Curriculum Vitae, attached to this declaration.

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8. I am a Professor of Electrical and Computer Engineering at Rice University in Houston, Texas. This report reflects my analysis and opinions in connection with my role as an expert on behalf of Nokia in the above-referenced IPRs.

9. I received my Bachelor of Science in Electrical Engineering from San Diego State University in 1981. In 1986, I received a Master of Science in Electrical Engineering from San Diego State University. In 1988, I received a Master of Arts in Electrical Engineering from Princeton University. In 1990, I received a Ph.D. in Electrical Engineering from Princeton University.

10. My graduate studies were concentrated in the area of image and video processing algorithms, with my doctoral dissertation detailing a method for displaying digital images on video display monitors with limited palette size, and advanced methods for video compression. During my graduate studies, I also worked at AT&T Bell Laboratories in the Video Communications department. After I received my Ph.D. degree, I stayed on at AT&T Bell Laboratories as a consultant while I took a position as Assistant Professor in the Department of Electrical and Computer Engineering at the University of Illinois at Urbana-Champaign. During my time at the University of Illinois, I taught the fundamental undergraduate courses in digital signal processing and graduate courses in advanced digital signal processing and image processing. I continued my academic career as an Associate

Professor at Princeton University where I continued to teach classes in digital signal processing and image processing. Since 2001, I have been a Professor in the Department of Electrical and Computer Engineering at Rice University. In this position, I teach undergraduate courses on the analysis and modeling of randomness in engineering design, and on the design of digital signal and image processing systems, as well as a lab course in electronic system design. I also teach graduate level courses in digital signal processing and digital image processing. The subject matter of these courses cover the application of image and signal processing in consumer devices, including multimedia compression for transmission over general communications channels and networks. My research continues to explore image and video compression algorithms and applications thereof, including advanced techniques of image and video compression for use in digital cameras, cellular telephones, and general computer platforms and networks.

11. I have consulted extensively in the fields of digital signal processing and image and video processing, including through consulting positions with AT&T Bell Laboratories (and later AT&T Laboratories), NEC Research Institute, Flextronics Corporation, Schlumberger, and Interdigital. These engagements have involved investigation, development and simulation of software algorithms for efficient representation of image and video data for transmission over a variety of communications channels and networks.

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12. In the course of my academic and industrial career, I have published over 100 technical papers for journals and conferences on various aspects of my research, and I am named inventor on seven patents issued by the USPTO:

- U.S. Patent No. 5,047,842 – "Color image display with a limited palette size"
- U.S. Patent No. 6,556,624 – "Method and apparatus for accomplishing multiple description coding for video"
- U.S. Patent No. 6,628,845 – "Method for subpixel registration of images"
- U.S. Patent No. 6,823,018 – "Multiple description coding communication system"
- U.S. Patent No. 6,920,177 – "Method and apparatus for accomplishing multiple description coding for video"
- U.S. Patent No. 7,289,565 – "Multiple description coding communication system"
- U.S. Patent No. 8,594,205 – "Multiple description coding communication system"

13. I have served as an Associate Editor for the IEEE TransActons on Image Processing, and have been Co-General Chair of OSA's Digital Image Processing and Analysis Conference, and Technical Program Chair for the IEEE International Conference on Image Processing.

14. My research expertise has focused on image and video processing with a concentration in image and video compression. I have supervised 12 Ph.D. students in these research topics, with three currently tenured at research universities. My students and I have made significant contributions to the development of digital signal processing software algorithms for compressing image and video data, enabling the widespread transmission of multimedia data over communications channels and networks. My research contributions in these areas led me to be named an IEEE Fellow in 2000, "for contributions to the theory and development of image and video compression algorithms."

III. MATERIALS REVIEWED AND TIME OF INVENTION

15. The opinions contained in this Declaration are based on the documents that I have reviewed, including the Petition and all materials cited therein, my professional judgment, as well as my education, experience, and my knowledge regarding technologies related to the '808 Patent. I have also reviewed and considered Karczewicz, Frojdh, and H.263 which I understand have been designated Exhibits Ex-1006 – Ex-1009. As mentioned, I spent time analyzing these references in connection with 337-TA-1379 before Petitioner Amazon.com, Inc. dropped all validity grounds relating to these references before the evidentiary hearing.

IV. LEGAL STANDARDS

A. Overview

16. I am not an attorney or legal expert, and I do not opine on matters of law. All the legal standards, which are listed in this section and which I applied in reaching the conclusions expressed throughout this Declaration, were provided to me and explained to me by counsel. In preparing this Declaration, I have endeavored to faithfully apply these legal standards. I do not intend to offer opinions on the law. Below, I describe the legal standards that I applied in my analysis of the claims of the ’808 Patent.

17. I have been informed by counsel 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

18. I have been informed by counsel 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.

19. 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.

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

21. 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.

22. 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

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

D. Claim Construction

24. 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

25. 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

26. 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.

27. 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

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

29. 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.

30. 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.

31. 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 applicant, 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 applicant. 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.

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32. 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 applicant. I have been informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the applicant.

33. 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.

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

35. 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

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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)

36. Based on my review of the ’808 Patent, the types of problems encountered in the art at and prior to the time of the alleged invention, prior solutions to those problems, the pace with which innovations were made during the relevant time period, the sophistication of the technology, and the educational level of active professionals in the field, I believe that a person of ordinary skill in the art, at the time of the invention, would have had at least a Bachelor’s degree in electrical engineering, computer science, or computer engineering; familiarity with the relevant video coding standards as of this time; and at least two years of work experience in research, design, development, and/or testing of video coding hardware and/or software. More education could have substituted for less work experience and vice versa.

37. All of 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., March 2002). During that time frame, I possessed at least the qualifications of a POSITA, as defined above.

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VI. CLAIM CONSTRUCTION

38. 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.

39. I also understand that Petitioner and Patent owner propose claim constructions of the term "skip coding mode." I understand this term was disputed in the co-pending ITC investigation, 337-TA-1379, for which I also filed an expert declaration support Patent Owner's construction. In the 1379 Investigation, Patent Owner and Staff proposed a construction of "skip coding mode" of "a coding mode in which a zero (non-active) motion vector or a non-zero (active) motion vector is associated with each skip mode macroblock, depending on the characteristics of the motion in image segments surrounding the macroblock in question." This proposed construction was based on inventor's lexicography and was ultimately adopted by the ALJ. (Ex. 2007). Petitioner proposed a similar construction, keeping the lexicography designated in the '808 Patent, but adding the language "and residual information can be provided for each skip mode macroblock" to the end of the proposed construction. *Id*. In my opinion, the differences in proposed constructions

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between Petitioner and Patent Owner do not affect my ultimate opinion that the '808 Patent is valid over the references asserted by Petitioner.

VII. BACKGROUND OF THE RELEVANT TECHNOLOGY

40. Video playback involves sequences of frames displayed quickly one after the other to give the illusion of motion. Video coding systems may divide frames into smaller segments such as blocks. The blocks are comprised of groups of pixels. Pixels are tiny, addressable units that may vary in brightness and color. The increasingly large number of pixels in modern displays and the massive range of possible values across the pixels presents a significant technical obstacle to communicating video. A large amount of data would be necessary to communicate the video in uncompressed form. Video encoding and decoding depend on a variety of techniques to compress and decompress video data while maintaining high quality and ensuring error resiliency.

41. Most video coding techniques exploit redundancies in the spatial and temporal domains. Relying on these redundancies, video encoders may communicate new information in a bitstream to decoders by referencing information that has already been decoded. Motion compensated prediction is one such technique. An encoder can signal a motion vector to instruct a decoder to copy a block of pixels from a particular region in a frame. The decoder uses the signaled motion vector to generate a "prediction." Though, this prediction may not be an exact

duplicate of the image the user is intended to see. Therefore, the prediction may be combined with additional information, typically referred to as prediction error or residual information, to create a reconstructed image block that more closely aligns with the intended image block. The encoder communicates to the decoder how to make predictions for each block, as well as any residual information in a compressed form. Then, the decoder generates a prediction, decodes any residual information, and combines the prediction with any residual information to reconstruct a decoded image block.

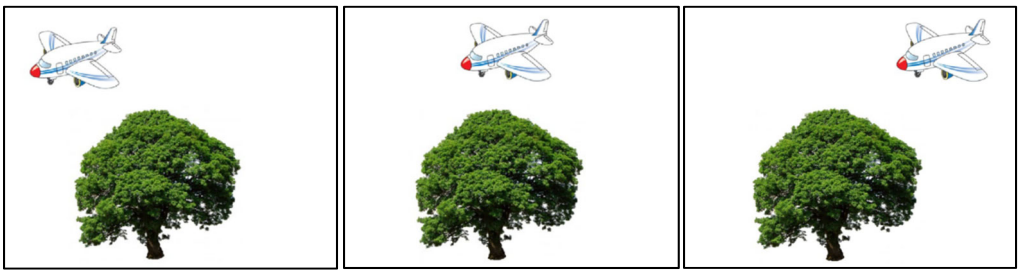
42. There are two main ways of exploiting redundancy in video coding in order to create such predictions—intra coding and inter coding. With intra coding, predications are generated from already coded blocks in the same image frame. While inter coding predications are generated from already coded blocks from different image frames known as reference pictures. Inter coding relies on motion vectors to instruct a decoder where, for a current image block, to copy a block of pixels from a previously decoded reference frame. Typically, techniques for predicting content in image frames from already coded frames are referred to as "motion compensation" or "motion compensated prediction."

A. Video Coding and Motion Compensation

43. Video coding makes storage, playback, and transmission of digital video content more efficient through, for example, decreasing the size of digital

video files—without noticeably degrading the picture quality—by reducing the redundant, or perceptually irrelevant, parts of a video sequence. Efficient video coding makes it easier to send high quality videos without the need for high transmission bandwidth and without degrading the quality of the picture. This benefit is valuable to anyone who watches, stores, or sends videos and is used in many everyday applications, such as streaming videos over wireless networks.

44. For instance, a moving object may travel across a stationary background, for instance when an airplane files over a stationary backdrop. As another example, a camera may pan across a scene such that stationary areas appear moving while moving objects may look either slower or faster depending on the direction of panning relative to the motion of the moving objects. The images below show three video frames and illustrates how the redundant or perceptually irrelevant data (*e.g.*, pixels constituting the background) may exist across multiple frames of a video sequence. For example, the tree in each picture does not move, and the image of the plane does not change but moves across the picture. Even though the plane has moved, the plane itself contains no new information.



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45. In the frames shown above, the tree may correspond to redundant or perceptually irrelevant data in a video file. In addition, the video data relating to the plane, which involves the motion of an object across the screen, includes a redundant image of the plane, but must account for the plane's motion. Redundancy here means "temporal redundancy," that the objects (*i.e.*, the tree and the plane) contain no new information across frames.

46. Temporal redundancy can be reduced by motion compensated prediction by allowing the image content of some frames in a digital video sequence to be "predicted" from one or more frames in the sequence. For instance, the encoder can provide motion information to the decoder that allows the decoder to predict where the plane should appear in the frame.

47. One way to do this entails different categories of frames when encoding a video. "Reference frames" (or "reference pictures") can serve as points of comparison from which the content of other frames can be predicted, for example, by tracking the motion of objects or regions between the reference frame and other frames using motion vectors.

48. Motion vectors convey both (1) direction and (2) magnitude. A "zero motion vector" will have a magnitude of zero. A non-zero motion vector will have a magnitude greater than zero and some direction. The direction of a vector can be expressed by multiple directional components (*e.g.*, horizontal or vertical

components). Negative numbers may be used to express certain directions. As an example, Figure 9 of the ’808 Patent depicts multiple non-zero vectors with the same direction and magnitude.

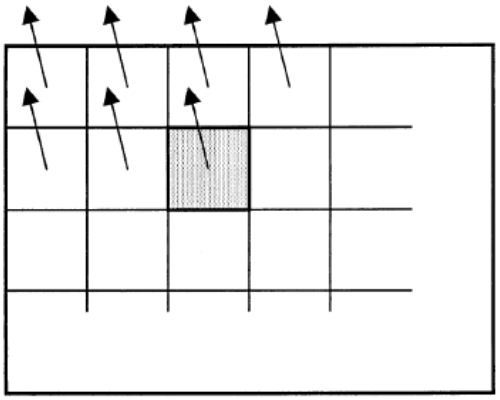

FIG. 9

’808 Patent, Figure 9 (Ex. 1001)

49. To better address motion within a frame, a video coding system may divide each frame of a video sequence into “macroblocks,” which in a preferred embodiment are formed from regions of 16x16 image pixels. Each smaller square frame of the entire rectangle divided into macroblocks is an individual macroblock.

50. Video pictures are divided into macroblocks and coded on a macroblock-by-macroblock basis in some video coding systems. Macroblocks can be allocated a “coding mode” by encoders based on the characteristics of the macroblock in question and according to the motion in the video sequence. The “coding mode” provides an indication to the decoder as to how to predict that macroblock.

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51. The ’808 Patent describes various coding modes associated with a particular prior art coded, referred to as JM1 of the Joint Video Team (JVT) coded. JM1 of the JVT codec, which would eventually become the H.264 video decoding standard, was the draft of the video coding recommendation under development by the JVT. JVT was a combined effort by the Motion Pictures Expert Group (MPEG) and the Video Coding Experts Group (VCEG). The coding modes of JM1 are shown in the table below.

TABLE 3

Macroblock Coding Modes of JM1

Codeword Index	Mode	UVLC Ccodeword
—	SKIP	Run-Length Coded
0	16 × 16	1
1	16 × 8	001
2	8 × 16	011
3	8 × 8	00001
4	8 × 4	00011
5	4 × 8	01001
6	4 × 4	01011

’808 Patent, Table 3 (Ex. 1001)

52. In Table 3 above, “UVLC Codeword” refers to “Universal Variable Length Codes” that represent data elements in a video bitstream. In JM1, like other video systems, the codewords indicating the coding modes were assigned in such a way that the shortest codeword is used to represent the coding mode that is statistically most likely to occur. JM1 assumed SKIP was the most likely coding mode. This was not a valid assumption.

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53. A person of ordinary skill in the art ("POSITA") would understand that the non-skip coding modes of JM1 in Table 3 use additional information called prediction error (residual information) for the reconstruction of pixel values of image blocks. By contrast, a POSITA would understand that the SKIP mode of JM1 skips this additional information and thus the pixel values of SKIP blocks are copied directly from the reference frame without residual information as part of the SKIP mode.

54. The encoder decides which coding mode will apply to a given macroblock through a process called motion estimation. For example, an encoder can perform motion estimation operations to determine the most efficient coding mode for a given macroblock. Because encoders can assign coding modes to each macroblock, a corresponding video decoder must be aware of these coding modes for it to properly decode received information relating to the macroblock in question. After selecting coding modes through the motion estimation process, encoders can provide an indication of the coding mode assigned to each macroblock in a video stream.

55. Depending on the coding mode in question, in the video bitstream this indication may accompany other information necessary for the decoder to correctly predict the macroblock (*e.g.*, "prediction error," which is a form of residual information). For instance, where motion-compensated prediction alone does not

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provide a sufficiently precise representation of image content, prediction error represents the difference between a decoded version of the INTER-coded frame and the image content of the frame to be coded. As explained, a POSITA would understand at the time of the invention that prediction error processes are used for inter prediction (or INTER) modes but are skipped for skip coding modes.

B. Skip Coding Modes in Video Coding

56. In video coding, SKIP (or skip) mode was traditionally used to indicate that the macroblock is to be copied from the reference video frame without the use of motion compensated prediction. Meaning, the macroblock in the frame being decoded is purely copied from a previous macroblock that was transmitted as part of the reference video frame. Hence, in scenarios involving objects exhibiting no motion across frames, use of SKIP mode provided considerable compression benefits. As a POSITA would have understood, JM1's skip coding mode does not involve any prediction error or residual information as part of that coding mode. (Ex. 1005, p. 37 (JM1 Subclause 3.4.1.)) An essential aspect of skip coding modes is that the coding, transmission, and decoding of residual information is "skipped" for the skip coding mode macroblocks.

57. A drawback with JM1 of the JVT codec was its inability to efficiently address specific types of motion in video sequences, such as panning or zooming. When certain motions were present, the older JM1 of the JVT coding system could

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not use skip mode and instead the codec was forced to use high overhead macroblock coding modes, which resulted in more data needing to be sent for a given video stream. As a result, one problem with the JM1 approach was the belief that skip mode is always the most probable was not valid.

C. Technical Challenges in Efficiently Coding Motion

58. Efficiently coding motion such as panning or zooming resulted in additional complexity. "Global Motion Compensation" (or "GMC," such as that used in H.263+) and "Global Motion Vector Coding" ("GMVC") were two attempts to address the problem of efficiently coding motion. In both approaches, the encoder was required to signal information in the bitstream that would describe motion applicable to an entire image frame. With GMC, a decoder would use that signaled information to warp a reference frame for use in motion compensated prediction. With GMVC, a decoder would rely on four signaled global motion vectors, one for each corner of a frame, and use a bilinear interpolation process based on the four global motion vectors to determine the motion of any given segment of a frame. Both GMC and GMVC required more complex motion estimation operations to be done by encoders and greater amounts of information to be included in encoded bitstreams.

59. The inventor of the '808 Patent recognized these limitations and set out to solve them by defining a new type of skip coding mode, referred to as the

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redefined skip coding mode. The redefined skip coding mode sought to provide improved coding efficiency with only a negligible increase in complexity based on a redefinition of the skip mode concept used in JM1 of the JVT codec.

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

A. Ground 1: Karczewicz

60. In my opinion, Intl. Pat. Pub. No. WO 01/11891 ("Karczewicz") does not anticipate or render obvious the challenged claims of the '808 Patent. Karczewicz is titled "Apparatus and method for compressing a motion vector field" and names Marta Karczewicz, Jani Lainema, and Bogdan-Paul Dobrin as inventors.

61. Karczewicz discloses a method and apparatus for coding a video sequence using affine motion vector fields. (Ex. 1006, 1:7-8). Karczewicz teaches various methods for coding and predicting motion vector fields with affine motion modeling. (*Id*., 1:9-10, 14:2-5, 31:14-25). Motion vector fields are three-dimensional space representations of motion projected onto an image. Karczewicz describes the use of motion coefficients to weight six basis functions common to the encoder and decoder for use with motion vector fields that represent different types of motion, such as rotation and skewing. Affine motion modeling is not a coding mode, but rather a method of modeling motion. This method of motion modeling was not implemented in any of the major video coding standards such as MPEG-1, H.263, or H.264. *See id*. at 9:7-11. Instead, H.263 and H.264 utilize translational motion

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vectors that represent straight line movement in the x and y directions. *Id*. A POSITA would understand that Karczewicz is directed to providing ways of coding affine motion coefficients (and residual coefficients in the case of affine motion field prediction), not novel coding modes.

62. Considering this context provided for Karczewicz, it is my opinion that Petitioner's Ground 1 fails to invalidate the '808 Patent. Petitioners assert that Karczewicz discloses different coding modes, however, as explained above, that is incorrect. Karczewicz does not discuss coding modes, but rather different methods for representing affine motion. Karczewicz states "there are several different ways in which a given segment can be coded." (Ex. 1006, 17:1-2). A POSITA would understand that Karczewicz is describing different methods of utilizing affine motion fields in coding a segment.

63. I understand that Petitioner asserts that Karczewicz discloses five "coding modes." (Pet., 18–19). In my opinion, none of the "coding modes" referenced by Petitioner would be understood by a POSITA to embody the "skip coding mode" as described by the '808 Patent. Karczewicz's "coding modes" describe the use of affine motion fields with a segment and disclose either sending motion field information or offset information to be used after predicting the affine motion fields. Petitioner points out that the affine motion fields described in Karczewicz could have a zero value, but this is distinct from the '808 Patent's

process for determining whether a zero (non-active) or non-zero (active) motion vector should be associated with a skip coded block based on motion characteristics of image segments surrounding a given skip mode macroblock. Karczewicz provides no disclosure that the way in which a motion vector is generated for a block should be determined based on an active/non-active classification after analysis of surrounding motion.

64. Petitioner also ignores the functionality of an encoder and decoder when stating that "Karczewicz does not discuss what happens if a prediction error of zero is calculated[, but a] POSITA would have found it obvious … to not send prediction error if the prediction error was calculated as zero." (Pet. 20). First, Karczewicz is talking about enhancing predictions of affine motion fields rather than predictions of blocks of pixels from reference frames based on motion vectors as discussed in the '808 Patent). (Ex. 1006, 10:10-17). A POSITA would understand that not sending any prediction error information at all for a block would disrupt the bitstream, as a decoder would be expecting to receive prediction error. A decoder would need to receive, at the very least, an indication that no residual error was to be included for the block.[1] Petitioner's assertion that "A POSITA would have

[1] A POSITA would know that, for coding modes with transformed prediction error (again, distinct from Karczewicz's enhancement information for predicted affine motion fields), "coded block patterns" or "CBP" is sent to inform a decoder which transform coefficients are present to represent prediction error.

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understood where prediction error is calculated to be zero, these standards would simply send the code signaling the end of a segment" ignores the fact that this indication would require additional bits to be sent, increasing the size of the bitstream. Petitioner is silent on whether its new alleged "coding mode" in Karczewicz would never have prediction error (again, a different type of prediction error than Karczewicz is concerned with) or would have some mechanism to inform a decoder whether prediction error is present. Petitioner is also silent on how this would relate to any surrounding motion analysis as required by all parties' proposed constructions. I am unaware of any assertion by Petitioner that Karczewicz would be modified to consider the motion characteristics in surrounding image segments to determine how to generate motion vectors (active or non-active).

65. Karczewicz also fails to disclose a single coding mode in which the segment is coded using either a zero (non-active) motion vector or a non-zero (active) motion vector depending on the characteristics of motion in image segments surrounding the macroblock in question. I disagree with Petitioner that a POSITA would have understood that two "separate coding modes" correspond to the alleged "two independent functionalities" of the '808 Patent's skip coding mode. (Pet. 22). In this assertion, Petitioner ignores the function of the '808 Patent's skip coding mode and focuses on the result of a zero or non-zero motion vector. In doing so, Petitioner disregards the determination between active and non-active motion

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described in the ’808 Patent, which a POSITA would understand cannot be achieved through merely combining two distinct coding modes that are capable of producing either a zero or non-zero motion vector. Petitioner also destroys the benefit of the ’808 Patent’s new skip mode. A POSITA would readily understand that it was possible to signal both zero-valued and non-zero valued motion vectors in the art; it was just more costly to do so. The benefits of video coding are not felt by *what* information can be sent (lots of information can be sent if one assumes enough bits to do so). Rather, the benefits relate to *how* information is sent because video coding techniques can be used to reduce the quantity of bits required to represent given information.

66. Petitioner also ignores the teachings of Karczewicz, wherein the encoder must signal the coefficients used for affine motion vector fields or tell the decoder a location to predict or copy those affine motion coefficients from. (Ex. 1006, 17:4-18). Even putting aside that Karczewicz is about affine motion models (and the ’808 Patent is not), the ’808 Patent avoids additional information through the use of a single coding mode indication that relies on information already sent for other blocks to inform the decision on how to generate a motion vector for a given block. It would not have been obvious to a POSITA to modify Karczewicz in such a way that the multiple “coding modes” described could be represented by a single coding mode and single indication in the bitstream. It is not clear how a POSITA

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would achieve this modification, as the function of the suggested single coding mode would vary greatly from the function of any described in Karczewicz, much less an unclear combination of them.

67. I understand that Petitioner also relies on Karczewicz's disclosure of "motion coefficient indication" bits to support its argument that Karczewicz invalidates the '808 Patent. However, this functionality is unrelated to the claims of the '808 Patent. The "motion coefficient indication" described in Karczewicz relates to a refinement field for the affine motion model coefficients and is intended to be used in affine motion vector field prediction. The '808 Patent requires no additional information to be transmitted in the bitstream relating to motion vector prediction. (Ex. 1001, 19:15-20). The MCI is not, as Petitioner suggests, a "single indicator" where a "POSITA would have understood a zero MCI bit indicates that a segment is assigned a 'skip coding mode.'" (Pet. 22). The MCI bit instead indicates whether additional refinement information is included in the bitstream, instructing the decoder to expect additional residual information related to a predicted affine motion field. In other words, this refinement information is added to a predicted affine motion field (consisting of a set of coefficients that, in weighted form, describe motion). This is not an indication of a coding mode, and a POSITA would not understand it to be one.

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68. Additionally, Karczewicz does not teach that "the decision to code a second segment with [zero motion vector] or [potential non-zero motion vector] depends on the motion characteristics in the neighboring segment(s)." (Pet. 23). Petitioner's mischaracterize Karczewicz. Karczewicz teaches "the encoder performs a comparison between the amount of data required a) to transmit motion coefficient data determined specifically for the second segment and b) that required if the second segment's motion vector field is determined from a projection of the motion model of the first segment plus some 'refinement' information." (Ex. 1006, 15:15-20). Here, Karczewicz does not disclose a choice between a zero or non-zero motion vector for a segment, but rather a choice between what motion vector fields to send to the decoder. A POSITA would not understand Karczewicz to teach the decision of a zero or non-zero motion vector is based on the motion characteristics of the neighboring segment (much less the motion characteristics of motion in image segments surrounding a macroblock in question, as required by all parties' constructions of "skip coding mode"). As such, Karczewicz does not teach a "skip coding mode" as described in the '808 Patent and does not invalidate the Challenged Claims of the '808 Patent.

B. Grounds 2A and 2B: Frojdh

69. U.S. Patent App. Pub. No. 2003/0123738 ("Frojdh") does not anticipate or render obvious the Challenged Claims of the '808 Patent. Frojdh is titled "Global

Motion Compensation for Video Pictures" and names Per Frojdh, Rickard Sjoberg, and Torbjorn Einarsson as inventors.

70. Frojdh is directed to a method for video compression that employs global motion compensation (GMC). (Ex. 1007, [0002]). Frojdh describes a method where macroblocks are grouped into slices and GMC information such as motion vectors are transmitted on a slice level. (*Id.*). Frojdh explains that when a GMC flag is enabled for a slice, the flag applies for all macroblocks in the slice. When the GMC flag is enabled, signaling that would otherwise represent a COPY mode is reinterpreted as a mode called Implicit Global Motion Compensation ("IGMC"), which lacks any transform coded residual information or explicitly signaled motion vector information. (*Id.*, [0022]).

71. It is my opinion that Frojdh is not entitled to the priority date of its provisional application because new subject matter was added to the publication that post-dates the '808 Patent. Specifically, paragraph 56 of Frojdh contains new subject matter not disclosed in the provisional application which Petitioner relies on to support its invalidity argument. The table below provides a comparison of paragraph 56 of Frojdh to the Petitioner's cited support in the provisional.

[0056] of Frojdh (Ex. 1007)	§ 6 of Frojdh Provisional cited by Petitioner (Ex. 1008)
As a further feature of the IGMC embodiment, a bitstream representing a coded image block can include a	6: SOLUTION

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[0056] of Frojdh (Ex. 1007)	§ 6 of Frojdh Provisional cited by Petitioner (Ex. 1008)
syntactic element which may be interpreted to indicate wither the IGMC mode or the COPY mode. A switch between the IGMC and COPY modes may be signalled implicitly, by means of other code elements. Alternatively, this switch may be signalled explicitly by a code word.	"The following is a list of implementation examples on how Global Motion Compensation (GMC) can be signaled: 1. Whether or not GMC should be used is signaled for each slice together with global motion information (vectors)." "The above examples can be combined with the different macroblock modes to take advantage of global motion compensation. Some, but not all, mode may use the (interpolated) global motion vectors. The following is a list of possible modes: 12. When GMC is enabled, a macroblock COPY mode signals that the encoder shall copy the macroblock from the (global) motion compensated reference picture. Hence, the displacements or motion vectors are given by the (interpolated) global motion vectors. No coefficients are coded." "15. When GMC is enabled, no explicit global motion vector is sent. We refer to this as Implicit Global Motion Compensation (IGMC), where the

[0056] of Frojdh (Ex. 1007)	§ 6 of Frojdh Provisional cited by Petitioner (Ex. 1008)
	macroblock COPY mode is reinterpreted an inter MB mode without coefficients. Just as for inter MB modes, the motion vectors for this mode are defined by the prediction from neighboring blocks. This mode can be used for macroblocks with only one motion vector (16x16 block)."

72. The IGMC feature described in paragraph 56 that allows for implicitly signaling a switch between COPY and IGMC mode is not disclosed in Petitioner's cited support for this paragraph.[2] The Frodjh provisional provides no discussion of this feature. As such, paragraph 56 of Frodjh is not prior art to the '808 Patent and fails to anticipate or disclose the Challenged Claims.

73. Frodjh proposes a different modification to the traditional skip, or COPY mode of the prior art. The '808 Patent defines a new skip mode that allows for the operation of traditional skip (copied from a collocated block in the reference frame) and active motion vector prediction to be accomplished with a single coding mode. (*See* Ex. 1001, 18:28-30, 18:62-19:10). The '808 Patent accomplishes this functionality with surrounding motion analysis to determine whether active or non-active motion vectors need be generated for a skip coded macroblock.

[2] It is also unclear what exactly Frojdh means by implicitly signaling a switch between COPY and IGMC and whether such switching is limited to the GMC flag on scenarios.

74. On the other hand, Frojdh discloses two distinct coding modes, COPY and IGMC, which must be explicitly signaled in the bitstream by both the GMC slice flag and other signaling. When the GMC slice flag is enabled, the decoder interprets signaling for the COPY mode as IGMC mode. When the GMC slice flag is disabled, the decoder interprets signaling for the COPY mode as COPY. IGMC mode always performs motion vector prediction. COPY never does. In other words, if one ignores the GMC aspects of Frojdh, Frojdh needs two separate coding modes to the '808 Patent's one redefined skip coding mode (not to mention the inflexibility Frojdh suffers by restricting the use of IGMC to scenarios in which the GMC flag is on, which presents constraints for other coding modes as well). Because Frojdh does not rely on surrounding motion analysis to make any determination between active or non-active motion vector generation, additional information must be included in the bitstream, such as the GMC flag.

75. Frojdh only discusses implicitly switching between IGMC and Copy mode in paragraph 56, which as discussed above is not supported by the Frojdh provisional application and is not prior art to the '808 Patent. Moreover, it is unclear what Frojdh means by such implicit switching. Petitioner does not clarify. In any event, Frojdh is silent on any surrounding motion analysis. Paragraph 56 of Frojdh fails to disclose a skip coding mode as claimed by the '808 Patent.

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76. Frojdh makes no distinction between "active" and "non-active" motion vector generation. Instead, Frojdh discloses the treatment of COPY to be traditional skip, wherein the motion vector is always zero, or IGMC, wherein a motion vector is predicted. Petitioner ignores this distinction in relying on the fact that a predicted motion vector may be predicted to be zero. (Pet. 41-42). Frojdh's IGMC mode must always perform a prediction and thus, always requires increased computation on the decoder side to arrive at a motion vector assignment for the IGMC coded macroblock. In the event that IGMC's prediction produced a zero motion vector, a POSITA would not understand this to be a zero (non-active) motion vector, but rather an active motion vector that was calculated to have the value zero. IGMC as described by Frojdh always performs in this manner, regardless of the characteristics of motion in surrounding image segments. A POSTIA would not understand this to function in the same manner as the skip coding mode claimed by the '808 Patent.

77. Petitioner also ignores basic concepts of coding hierarchy in asserting that Frojdh teaches or suggests a skip coding mode such as IGMC mode, or GMC with IGMC and COPY. (Pet. 44-45). To begin, GMC is not a coding mode for macroblocks. GMC is signaled at the slice level and applies to all macroblocks within a slice. GMC also governs whether COPY is interpreted as IGMC or COPY mode. Frojdh provides "a schematic diagram representing proposed global motion compensation in H.26L on picture and macroblock levels" in Figure 9:

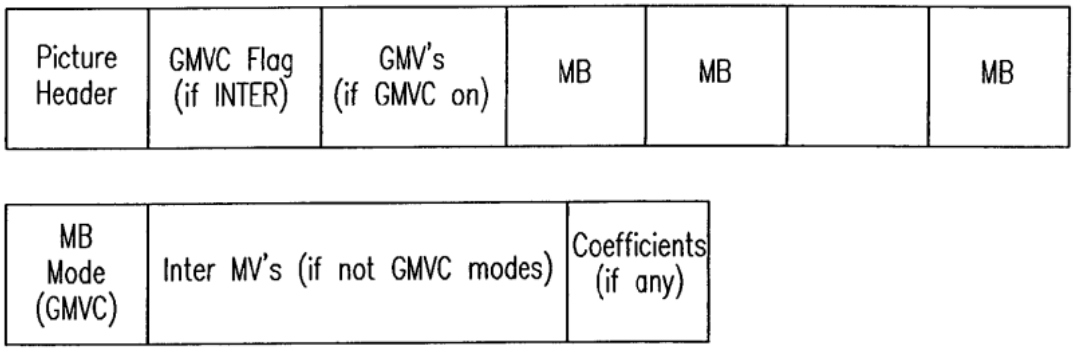

FIG. 9

Ex. 1007, [0034].

78. This schematic provides insight into the proposed syntax hierarchy present in Frojdh, with the GMC flag being signaled after the picture header and before the macroblock "MB" syntax. The macroblock mode "MB Mode" is signaled separately for each macroblock. Frojdh teaches that "IGMC mode can be used to replace the COPY mode in coding an image block." (Ex. 1007, [0055]). IGMC and COPY mode are not both available coding modes for a given block because the GMC flag dictates any assignment.

79. Petitioner's reliance on GMC is also flawed because GMC is signaled on the slice level, which is inconsistent with the "first segment" limitations in the claims. For example, limitation 1[b] requires a single motion vector be assigned to the first segment. Under Frojdh's GMC, this would require a motion vector be assigned to an entire slice, a scenario that is never contemplated in Frojdh. As another example, limitation 1[d] requires that an indication of the skip coding mode be included in the bitstream, wherein no further motion vector information for the

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first segment is coded in the encoded bitstream. Under Petitioner's interpretation of Frojdh, this indication would be the GMC flag for the slice, however, GMC mode requires additional motion vector information to be included in the bitstream:

> The method comprises … applying a signal to each encoded slice to indicate whether global motion compensation (GMC) is used in reconstructing its corresponding original slice, and if so, including GMC information with the encoded slice. (Ex. 1007, [0024])
>
> and
>
> … the GMC information contained in a given encoded slice comprises or represents a set of encoded global motion (GM) vectors. (*Id.*, [0025].)

80. I also understand that Petition raises the argument that "Frojdh further discloses how COPY mode (and the associated [zero motion vector]) 'is the cheapest mode to signal. In fact, run-length coding is used to signal a number of copied (skipped) macroblocks with one codeword.'" (Pet., 46 (citing Ex. 1007, [0047]; Ex. 1008, 8-9)). However, Petitioner ignores the fact that when in GMC mode, IGMC replaces the COPY mode. (Ex. 1007, [0055]). As such, IGMC and COPY mode use the same signal. Frojdh provides that "(IGMC) mode can be used as a tool in many coding scenarios which require a more useful MB mode than COPY mode, in order to minimize the total number of bits needed for motion vectors." (Ex. 1007, [0022]). A POSITA reading this and understanding that COPY and IGMC use the same signal, and therefore require the same amount of bits to signal, would not find it

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obvious to enable the use of both IGMC and COPY with GMC enabled. To enable such a use would require a modification of Frojdh to change the signals for IGMC and COPY such that both could be sent simultaneously. This would increase the cost of at least one of the signals in this hypothetical modification (where both COPY and IGMC could be signaled simultaneously). This would also frustrate the purpose of Frojdh, which focuses on representing motion in frames by widely applying global motion compensation techniques on the slice level. The use of COPY in GMC would indicate no motion and create additional information in the bitstream. In any event, this would still not disclose the skip coding mode of the '808 Patent, as this hypothetical additional signaling to distinguish between IGMC and COPY is distinct from the '808 Patent's surrounding motion analysis approach.

81. For the reasons stated above, it is my opinion that Frojdh does not anticipate or render obvious the Challenged Claims of the '808 Patent.

Dated: September 16, 2024

M. T. Orchard

Dr. Michael Orchard

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