

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SNAP INC. and HISENSE USA CORPORATION,

Petitioners

v.

NOKIA CORPORATION AND NOKIA TECHNOLOGIES OY,

Patent Owner.

Case: IPR2025-01439

IPR2025-01440

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

DECLARATION OF DR. MICHAEL ORCHARD

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	EDUCATIONAL BACKGROUND AND QUALIFICATIONS	2
III.	MATERIALS REVIEWED.....	6
IV.	LEGAL STANDARDS	6
A.	Overview	6
B.	Patent Claims.....	7
C.	Burden of Proof for Invalidity.....	8
D.	Claim Construction.....	8
E.	Person of Ordinary Skill in the Art	9
F.	Anticipation	9
G.	Obviousness.....	10
V.	PERSON OF ORDINARY SKILL IN THE ART (POSITA).....	13
VI.	CLAIM CONSTRUCTION.....	14
VII.	BACKGROUND OF THE RELEVANT TECHNOLOGY	17
A.	Motion Compensation in Video Coding	18
B.	Mode Selection in Video Coding	24
C.	Skip Mode Macroblocks	28
D.	Technical Contribution of the ‘808 Patent.....	30
VIII.	THE GROUNDS IN THE PETITION DO NOT ANTICIPATE OR RENDER OBVIOUS THE CHALLENGED CLAIMS	39
A.	Ground 1: Karczewicz	39
a.	Karczewicz Overview	39
b.	A POSITA would not have been motivated to combine two of Karczewicz’s mutually exclusive modes of operation.....	52
c.	Dependent Claims 23, 28-29, 34, 39-40.....	53
B.	Ground 2: MPEG-1 in combination with H.263	54
a.	MPEG-1 Overview	55

b.	H.263 Overview	55
c.	A POSITA would not be motivated to combine MPEG-1 and H.263	57
d.	The Combination of MPEG-1 and H.263 do not practice the Challenged Claims	64
IX.	SIGNATURE.....	66

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 on two Inter Partes Review (IPR) proceedings, IPR2025-01439 and IPR2025-01440. Both relate to U.S. Patent No. 7,532,808, which I will refer to as the '808 Patent. My compensation does not depend on the outcomes of these or any other proceedings.

3. This Declaration summarizes the independent opinions 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.

4. I testified at the evidentiary hearing in the International Trade Commission investigation 337-TA-1379. The 1379 case involved the '808 Patent. Amazon asserted the MPEG-1 and H.263 reference against the '808 Patent, and had previously asserted the Karczewicz reference against the '808 Patent but dropped the Karczewicz reference before the evidentiary hearing. Thus, I have familiarity with the Karczewicz and MPEG-1 and H.263 references from the ITC proceeding.

5. I testified at the ITC evidentiary hearing that Amazon's MPEG-1 and H.263 obviousness ground does not render the asserted claims of the '808 Patent

obvious. The administrative law judge issued a determination finding that the asserted claims of the '808 Patent were not obvious.

6. My opinions are based on the materials I considered and my study, experience, knowledge and background in the field of video coding. I am informed by my education and my extensive experience in the fields of video and multimedia coding and communications. I also relied on my review and analysis of the prior art, information provided to me, and information I have independently reviewed.

7. I am submitting the same declaration for both IPR2025-01439 and IPR2025-01440, 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 (-01439 IPR) and Claims 10-11, 15-16, 20-22, 44, 47-49, 51-54, 58-60, 62-64 (-01440 IPR) of the '808 Patent. My cites to the petition are to the page numbers in IPR2025-01439, but my opinions and analysis apply to the arguments made in both petitions.

II. EDUCATIONAL BACKGROUND AND QUALIFICATIONS

8. Details of my professional qualifications and background are summarized below and described in my Curriculum Vitae attached to this declaration.

9. I am a Professor of Electrical and Computer Engineering at Rice University in Houston, Texas.

10. 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.

11. My graduate studies were concentrated in 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.

12. 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.

13. 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”

14. I have served as an Associate Editor for the IEEE Transactions 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.

15. 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

16. The opinions contained in this Declaration are based on the documents that I have reviewed, including the petitions and all materials cited in the petitions, 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, MPEG-1, 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, including Karczewicz before Amazon dropped its arguments relating to that reference. I have also reviewed the declaration of Dr. Eli Saber.

IV. LEGAL STANDARDS

A. Overview

17. I am not an attorney or legal expert. 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 and explained to me by counsel. In preparing this Declaration, I 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.

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

B. Patent Claims

19. 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.

20. 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 elements called limitations.

21. I have been informed by counsel that there are independent claims and dependent claims. An independent claim sets forth all the requirements that must be met for the 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 the requirements of the claims to which it refers.

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

23. I have been informed by counsel that in a case where a dependent claim incorporates the limitations of an independent claim on 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 or grounds at issue in this proceeding that fail to disclose or render obvious all the limitations of an independent claim necessarily also fail to disclose or render obvious all the limitations of claims which depend on that independent claim.

C. Burden of Proof for Invalidity

24. I have been informed by counsel and I understand that the party challenging the validity of an issued U.S. patent in an IPR proceeding 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

25. 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

26. 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

27. 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 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.

28. 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

29. I have been informed by counsel and I understand that a patent claim can be found invalid as obvious if the differences between the claim and the prior art references would have been obvious to a person of ordinary skill in the art at the time of the invention, taking into account (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any objective indicia of non-obviousness. I have further been informed by counsel that a claim can be found to be obvious in light of either a single

prior art reference or multiple prior art references. I have been informed that references qualify as prior art for an obviousness determination only when they are analogous to the claimed invention. Two separate tests define the scope of analogous prior art: (1) whether the art is from the same field of endeavor, regardless of the problem addressed; and (2) if the reference is not within the field of the inventor's endeavor, whether the reference still is reasonably pertinent to the particular problem with which the inventor is involved.

30. 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.

31. 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.

32. 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 patent, 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.

33. 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.

34. 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.

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

36. 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)

37. 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.

38. 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.

VI. CLAIM CONSTRUCTION

39. 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.

40. I also understand that Petitioners and Patent Owner agree on the construction of the term “skip coding mode.” They construe “skip coding mode” as “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 construction is based on the inventor’s lexicography.

41. A POSITA would understand that, at a minimum, a “non-active” motion vector is one that is always assigned zero while an “active” motion vector is a predicted motion vector that is not necessarily zero.

42. The '808 Patent provides distinct processes for generating “non-active” and “active” motion vectors:

If it is found that the surrounding region exhibits a certain type of motion, a non-zero motion vector representative of that motion is generated and associated with the current macroblock. In particular, the continuity, velocity or deviation of motion in the surrounding macroblocks or sub-blocks can be analyzed. For example, if the motion in the surrounding region exhibits a certain level of continuity, a certain common velocity, or a particular form of divergence, a motion vector representative of that motion can be assigned to the current macroblock to be coded. On the other hand, if the region surrounding the current macroblock does not exhibit such continuity, common velocity or divergence and has an insignificant level of motion, the macroblock to be coded is assigned a zero motion vector, causing it to be copied directly from the reference frame, just as if it were a conventional SKIP mode macroblock.

Ex. 1001 at 14:23-51.

According to the invention, skip (or SKIP) mode macroblocks in a video coding system adapt to the motion of surrounding image segments. If active motion is detected around a macroblock to be coded/decoded, motion parameters conforming to the motion are generated and the macroblock is motion compensated. In this way, no additional information needs to be transmitted from the encoder to the decoder.

Ex. 1001 at 15:61-67; *See also e.g.*, Ex. 1001 at 18:51-19:10, 20:6-16, 24:61-25:3, Figure 8.

43. A POSITA would understand that the '808 Patent's skip coding mode is not simply a coding mode in which a skip mode macroblock may have a motion vector associated (be it zero or non-zero). Instead, the '808 Patent's skip coding mode covers the specific process for determining and associating a motion vector "... with each skipped macroblock ...". In non-active scenarios, the assigned motion vector is always zero valued, in the same manner as traditional skip mode. In active scenarios, motion vectors are predicted via motion vector prediction, the outcome of which will yield a motion vector of a certain value (which may have components of non-zero or zero value) depending on the prediction method and the motion vector values of blocks surrounding the skipped block.

VII. BACKGROUND OF THE RELEVANT TECHNOLOGY

44. 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.

45. Most video coding techniques exploit redundancies in the spatial and/or 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. There are two main ways of exploiting redundancy in video coding in order to create predictions of blocks of pixels—intra coding and inter coding. With intra coding, predictions are generated from already coded blocks in the same image frame. While inter coding predictions 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.”

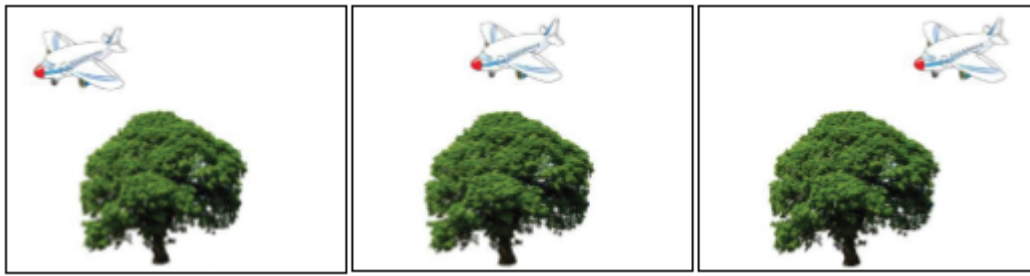
46. Motion compensated prediction is a technique wherein an encoder can signal a motion vector to instruct a decoder to copy a block of pixels from a particular region in a previously decoded frame. Because coding occurs in raster scan order (top left and across, then down), blocks above and to the left can serve as references to create the signaled motion vector, while blocks to the right and below are unavailable. 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.

A. Motion Compensation in Video Coding

47. 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. These benefits are important to many everyday applications for watching, storing, or sending videos, such as streaming videos over wireless networks, or any other network.

48. A moving object may travel across a stationary background, for instance when an airplane flies 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 illustrate 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 image of the plane itself contains no new information.



49. In the frames shown above, the tree may correspond to redundant or perceptually irrelevant data in a video sequence. 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.

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

51. "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.

52. 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). Positive and negative numbers are used to express opposite directions. As an example, Figure 9 of the '808 Patent depicts multiple non-zero vectors with the same direction and magnitude.

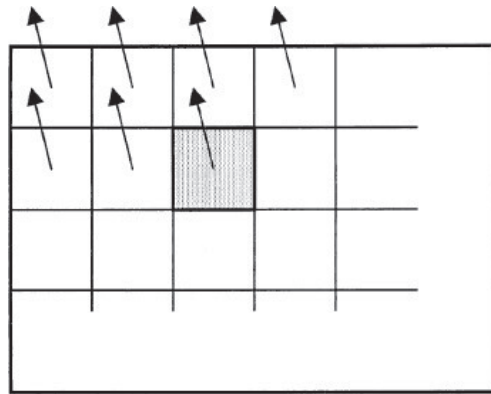


FIG. 9

'808 Patent, Figure 9 (Ex. 1001).

53. To manage the representation of motion within a frame, typical video coding systems divide each frame of a video sequence into “macroblocks,” which in a preferred embodiment are formed from regions of 16x16 image pixels. Each macroblock of a frame is encoded individually, and if motion compensation is used for coding a particular macroblock, motion vectors are associated with that macroblock to characterize its motion.

54. Video coding systems offer a variety of approaches, which may or may not involve motion compensation, for encoding the content of a macroblock. For a decoder to make any sense of the information it receives for a particular macroblock, it needs to know what approach was used by the encoder for coding the content of that macroblock. For that reason, an encoder selects a “coding mode” which it assigns to each macroblock and transmits it to the decoder. Knowing the encoding approach defined by the “coding mode” it receives for a particular macroblock, the decoder is prepared to decode, parse, and utilize whatever subsequent information it receives for that macroblock in a correct manner. The process used by the encoder to decide which “coding mode” to assign to each macroblock is referred to as “Mode Selection”, which I will describe in more detail in the subsequent paragraphs.

55. The '808 Patent describes various coding modes associated with a particular prior art video coding system, referred to as JM1 of the Joint Video Team (JVT) codec.¹ 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 in January 2002. JVT was a combined effort by the Motion

¹ JM1 also details a method for median motion vector prediction using three surrounding macroblocks to calculate a median motion vector. A POSITA would understand how to use JM1's motion vector prediction method.

Pictures Expert Group (MPEG) of ISO/IEC and the Video Coding Experts Group (VCEG) of ITU-T. Some of the coding modes of JM1 are shown in the table below, taken from the '808 Patent:

TABLE 3		
Macroblock Coding Modes of JM1		
Codeword Index	Mode	UVLC Codeword
—	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)

56. The coding modes shown in Table 3 above are those coding modes that use the motion compensation approaches supported by the JM1 codec for encoding a macroblock. The label, “UVLC Codeword”, in the right-most column refers to “Universal Variable Length Codes,” and they are the actual bits inserted into the video bitstream to direct the decoder to use the associated “coding mode” for a particular macroblock. Principles of information theory motivate using UVLC codewords having fewer bits for representing “coding modes” that are more likely to be used. However, it should be recognized that the bits shown in this table are merely the tip-of-the-iceberg in terms of the number of bits used for coding a particular macroblock using a particular “coding mode”. For all except the first entry on this list, one or more motion vectors, each having a horizontal and vertical component, need to be encoding and transmitted to the decoder. Also, with the

exception of the first entry, after performing motion compensated prediction using the associated motion vectors, prediction error (residual information) must be encoded and transmitted for the reconstruction of pixel values of image blocks.

57. The exact count of how many bits are required for each of these modes depends on the details of each mode, and the image content of the macroblock being encoded, but three facts are worth noting: first, for all except the first entry on the list, substantial numbers (from 10's to possibly 100's) of bits are needed to support the corresponding coding mode; second, for particular macroblocks, the more expensive (in terms of bits) coding modes may be capable of generating much more accurate approximations of the original macroblock than any other coding mode (that is why each is included in this state-of-the-art standard); and third, for any particular macroblock, there will be large discrepancies among the number of bits required by the various coding modes. All three of these facts are important considerations in devising the best approach for selecting a "coding mode" for any given macroblock.

B. Mode Selection in Video Coding

58. It may seem naively obvious that each macroblock should pick the coding mode that produces the most accurate approximation of the original macroblock being coded. However, since the earliest days of video coding standard

development, it has been recognized that such a naïve policy leads to very poor video coding quality.

59. It should be noted that, since “Mode Selection” is a process conducted completely at the encoder, it is not formally specified by any video coding standard, since standards only specify requirements on the video decoding process. However, for at least three decades the importance to video coding quality of performing optimal mode selection has been widely recognized, and issues relating to mode selection have strongly influenced the evolution of video coding algorithms and standards. Furthermore, the ‘808 Patent teaches principles of optimal mode selection both in its description of the prior art, and of the proposed invention.

60. For each macroblock of a video sequence, mode selection in video coding decides how many bits to invest in the coding of the macroblock and how much distortion (error) to accept in the approximation of the original macroblock contents. Given a targeted budget for how many bits are available for coding each unit time period (e.g. second, minute, etc.) of video, the problem of optimal mode selection can be recognized as analogous to optimal investment allocation for a financial portfolio. Summarizing the conclusion of the allocation problem, we can be confident that a particular allocation of funds is optimal if and only if a) every available dollar is invested somewhere, and b) the per-dollar return on each dollar

invested by the allocation is greater than the per-dollar return of any investment opportunity not included in the allocation.

61. Applying the portfolio allocation insights to video coding mode selection, a given collection of mode decisions is optimal if a) every bit available under the budget limit is applied to the encoding of some macroblock somewhere, and b) the per-bit reduction in distortion resulting from any bit invested in the selection of any mode for any macroblock is higher than the per-bit reduction in distortion that would have resulted from investing that same bit in the selection of any other mode for any other macroblock.

62. Though the previous paragraph describes how to recognize an optimal solution to the problem of mode selection, it doesn't describe how to reach this optimality condition. Mathematically, this problem is solved with Lagrangian optimization, which involves making mode selections based on a Lagrangian "cost function", rather than simple distortion costs. The '808 patent teaches to use a Lagrangian cost for mode selection in prior art coding systems:

After these operations, the mode that minimizes a certain cost function is selected for the macroblock. The cost function typically combines the prediction error with number of estimated bits needed to code the macroblock and thus measures the relative efficiency of each coding mode. [11:14-18]

63. Thus, for purposes of optimal mode selection, any “coding mode” is only partially defined by the approach taken for producing its approximation of a macroblock. A complete description of a “coding mode” also requires a characterization of the number of bits (or estimated number of bits) that will be required by the “coding mode”.

64. Any implementation of a “coding mode” requires the actual specification of codeword bits that will be uniquely decoded to inform a decoder both i) what further information, if any, is to be expected to support the operations of the mode, and ii) what specific operations to perform for that “coding mode”. A macroblock can only have one coding mode, else the decoder will not be able to ascertain the further expected information and operations to perform to properly decode the macroblock.

65. Karczewicz describes operations that can be used for reconstructing macroblocks that Petitioners allege have similarities to operations performed in the ‘808 invention. However, even if one accepts the alleged similarities between operations, Petitioners ignore the fact that Karczewicz fails to identify a valid “coding mode” that performs those operations, and any “coding mode” that Petitioners attempt to construct themselves bears no resemblance to the novel “skip coding mode” that is the contribution of the ‘808 Patent.

66. Specifically, in Karczewicz, the term “mode” appears very sparingly to refer generally to a way of doing motion compensation, without making any attempt to define what a POSITA would recognize as a “coding mode”, as understood in the context of the ‘808 specification and claims. The closest Petitioners come to pointing to bits that identify an alleged “coding mode” is the single MCI bit [Petition, 17–18], but Karczewicz does not teach the MCI bit to completely specify the operations of any “coding mode”. A POSITA would not understand this single bit to identify a “coding mode”.

C. Skip Mode Macroblocks

67. Skipped macroblocks were an important feature in the earliest video coding standards and played an essential role in managing bit rate allocation in video encoding. MPEG1 aimed to code video at sufficiently low bitrates that it could not afford the bits needed to code every macroblock using standard Inter- or Intra-prediction coding modes at reasonable precision. Instead, MPEG1 produced reasonable coding quality when it used its available bitrate to code some subset of the macroblocks in the video, and just “skip” all other macroblocks. Of course, the “skipped” macroblocks could not just be ignored, so the “skip mode” was born.

68. The most distinctive feature of the skip-mode macroblock in MPEG1 is that it uses NO bitrate. The approach defined for handling the reconstruction of a skipped macroblock was not new to MPEG1. In MPEG1, a skipped macroblock is

predicted using motion compensation with a motion vector of (0,0), and a residual of all “0”s is added to the motion compensated prediction. But MPEG1’s normal motion-compensated prediction mode already supports motion compensation with any motion vector (including (0,0)), and residual coding already supports adding a residual of all “0” values. Thus, in terms of the approach taken for representing the macroblock content, MPEG1’s skip coding mode is just a copy of an already existing coding mode. However, the distinctive feature of MPEG1’s Skip mode is that it uses far fewer bits than any other way of producing that result.

Whereas the macroblock address increment within a slice for I-pictures is restricted to one, it may be larger for P-pictures. Any macroblocks thus skipped over are called “skipped macroblocks”. ... Skipped macroblocks have no VLC code. Instead they are coded by having macroblock address increment code skip over them. [Ex. 1007 (MPEG1) p. 93]

69. MPEG1 uses the parameter “macroblock_address_increment” as a way of assigning long runs of macroblocks as “skipped macroblocks”, so that the total cost of using the skip coding mode (including the cost of choosing this mode) is often a small fraction of 1 bit per macroblock. Because macroblocks from stationary backgrounds of video scenes are reasonably well predicted by copying the macroblock in the same position of the previous frame, and typical video sequences have significant areas of stationary background, “skip coding mode” of video coding

standards in the past three decades (e.g. MPEG1, MPEG2, H.263, H.264, etc.) have been designed to apply motion compensation with a motion vector of (0,0).

70. The effectiveness of a skip coding mode can be assessed by how heavily it is used. Given its very low bit cost, optimal mode selection heavily favors selecting Skip mode, so unless skip mode reconstructions are very poor contenders for best reconstruction, the skip mode is used very often. As mentioned earlier in the discussion of Mode Selection, the high frequency use of the very low-cost “skip coding mode” typically saves substantial bit-rate in stationary background areas of a video scene, thus allowing the investment of the bulk of the budgeted bitrate on more sophisticated coding modes to handle more complex areas in the scene.

D. Technical Contribution of the ‘808 Patent

71. Certain types of video effects, such as panning or zooming, result in large regions of macroblocks requiring motion vectors that are closely related to each other. In these situations, it is expected that there should be a way to encode the motion field (i.e. collection of motion vectors) much more efficiently than if they were unrelated to each other. The motion corresponding to these types of effects is called “global motion” and at least two proposals for exploiting the properties of global motion were under consideration at the time of the invention of the ‘808 Patent. These proposals for efficiently coding motion were: “Global Motion Compensation” (or “GMC,” such as that used in H.263+) and “Global Motion

Vector Coding” (“GMVC”). In both approaches, the encoder was required to signal information in the bitstream that would describe motion applicable to an entire image frame. Ex. 1001 at 12:48-58. 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 as compared with conventional skip coding. GMVC was proposed to the JVT as a solution to global motion (VCEG-O20). (Ex. 1001, 13:31-33).

72. While the inventor of the '808 Patent was aware of these other efforts to exploit global motion, he also recognized another consequence of “global motion” that severely undermined coding efficiency. In light of the importance of mode selection to high-quality coding (as explained earlier in this declaration), he understood the value of having a very low bitrate coding mode available as an option in the mode selection process. While the “Skip” mode provided the very low bitrate option for videos containing regions of stationary background, videos containing global, non-zero motion never used that option:

A problem with the approach adopted in JM1 of the JVT codec is that the assumption that skip mode is always the most probable is not valid. If the video sequence contains global motion (panning, zooming, etc.), skip mode is actually never used. In these cases compression efficiency is seriously degraded, especially at lower bit-rates, since the codec is forced to use high overhead macroblock coding modes. [‘808, 12:41-47]

73. The ‘808 patent describes the technical problem it addresses as:

JM1 of the JVT codec, for example, has no special provision for taking account of global motion in video sequences. Therefore, when such motion is present it causes the video encoder to select macroblock coding modes that explicitly model the motion. This leads to a significant degradation in coding efficiency, as the global motion component is encoded in every INTER coding macroblock (or sub-block). [‘808, 13:51-58]

74. Due to these insights of the inventor, the invention of the ‘808 patent doesn’t really attempt to solve the same problem as GMC and GMVC. Though all proposals relating to “global motion” were considered by the same working group of the JVT development team, the fact that the ‘808 invention was adopted into the standard while others were not adopted is not necessarily evidence that it is a better solution to the same problem. Instead, it is evidence that the inventor of the ‘808

found a better problem to address: How can the low bit-cost option of “skip coding mode,” which is so beneficial in stationary background areas of video scenes, also be made available to areas of scenes that have global motion? The ‘808 Patent discloses a novel “skip coding mode” which, like previous “skip coding” modes, uses no bits besides the bits used to select the mode, and provides a low bit-cost option for scenes that include global motion, while retaining the benefit of existing “skip coding mode” for stationary background areas of video scenes.

75. The invention of the ‘808 Patent is described as a modification of the skip coding mode of the JM1 draft:

According to the invention, the coding modes used by encoder 600 correspond to those provided by JM1 of the JVT codec (shown in Table 3), with the exception that the SKIP mode is redefined to allow representation of global and regional motion. More specifically, the SKIP mode is modified in such a way that 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. In the following this type of motion vector will be referred to as a “skip mode motion vector.”

Ex. 1001 at 17:43-53.

76. The ‘808 Patent describes that the invented “skip coding mode” is just as inexpensive (in bitrate) as the JM1 skip coding mode, but improved in its ability to adapt to both active and non-active motion scenarios. The stated objective is that the modified “skip coding mode” will be selected in both active and non-active motion scenarios during “mode selection”, and thus it will be used more often than the original JM1 skip coding mode.

77. For a macroblock in the non-active motion scenario (stationary background areas of a scene), the ‘808’s novel “skip coding mode” assigns the macroblock:

“... a zero (non-active) motion vector, in which case it is treated in the same way as a conventional skip mode macroblock and copied directly from the reference frame, ...”

Ex. 1001 at 14:25-28. For a macroblock in the active motion scenario (including various forms of global motion), the ‘808’s novel “skip coding mode” assigns the macroblock “... a non-zero (active) motion vector.” Ex. 1001 at 14:28-29. The ‘808 novel “skip coding mode” adapts between these two options based on analysis of motion in neighboring the macroblock to be coded.

“The decision as to whether a macroblock should be associated with a zero or non-zero motion vector is made by analysing the motion of other macroblocks or sub-blocks in a region surrounding the macroblock to be

coded. If it is found that the surrounding region exhibits a certain type of motion, a non-zero motion vector representative of that motion is generated and associated with the current macroblock.”

Ex. 1001 at 14:29-35.

78. A POSITA understands from the '808 specification that non-active motion vectors are always zero while active motion vectors are generated (or predicted) according to some motion model, and thus, not necessarily zero. It is important to note that any mathematical formula used to generate a predicted active motion vector may sometimes produce the values (0.0,0.0). While the '808 specification doesn't explicitly address this technicality, a POSITA would understand from the '808 Patent's various discussions of predicting active motion vectors that such a vector would still be considered an “active” motion vector.

79. Figure 8 of the '808 Patent provides a diagram of the functional blocks of the improved skip coding mode. Block 802 analyzes the motion characteristics of previously coded image segments surrounding the macroblock in question. I'll note that under the agreed-upon construction, it is my opinion that the skip coding mode must look to “image segments” plural, meaning two or more surrounding image segments to perform this analysis. Upon considering the motion characteristics of previously coded image segments surrounding a skip coded macroblock, it is determined whether the skip coded macroblock should be

associated with active or non-active motion. After this decision reached, a motion vector is generated for the skip coded block in one of two ways. Either a zero (non-active) motion vector is generated by block 804, or active motion vector parameters are generated (for example, using the motion vector prediction method of JM1) by block 803.

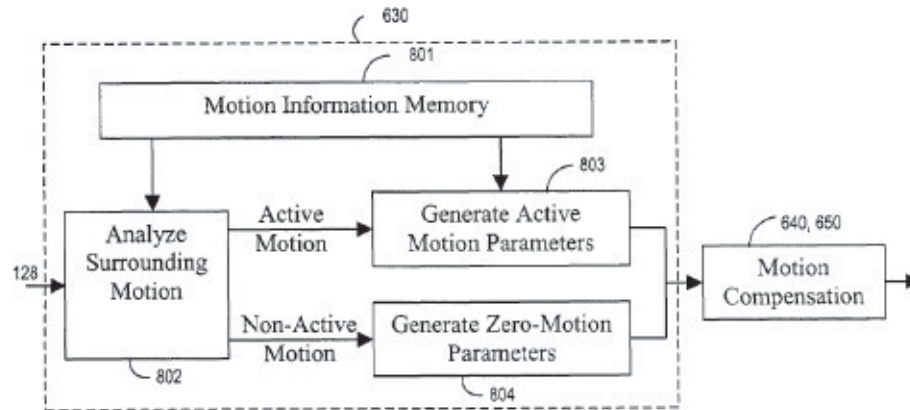


FIG. 8

808 Patent, Figure 8 (Ex.1001)

80. Because the '808 Patent's skip coding mode calculates the motion vector to use in motion compensation entirely based on previously coded neighboring motion, the '808's newly defined "skip coding mode" meets the constraints of a JM1 skip mode macroblock: namely, that the only bits required for the invented skip coding mode are the bits used by JM1 for coding the "RUN" parameter, identifying skip mode macroblocks, and no additional bits are required:

This approach enables the motion analysis of the surrounding region performed in the encoder to be

duplicated exactly in the decoder. This, in turn, means that according to the invention, no additional information must be sent to the decoder in order to model global or regional motion. [Ex. 1001, 14:60-64]

81. Also consistent with the unmodified features of the JM1 skip coding mode (as well as skip coding modes of all other video coding standards), the invented skip coding mode remains an extremely inexpensive coding option since it allocates no additional bits for representing either motion or residual error:

Depending on the coding mode, the compressed video data included in the bit-stream for an INTER-coded macroblock may comprise a combination of VLC encoded prediction error information for each block, motion vector information for the macroblock (or sub-blocks) and encoded control information including an indication of the coding mode used to encode the macroblock in question. If a macroblock is encoded in skip mode, no prediction error or motion vector information relating to the macroblock is included in the bit-stream. [Ex. 1001 at 20:43-55.]

82. While the objective of the '808 Patent was to introduce a skip coding mode that would be very frequently used in regions of videos having "global motion", the real challenge was to achieve this objective without interfering with the success of the original JM1 skip coding mode in being very frequently used in

regions of videos having stationary backgrounds. A novelty of the '808 invention lies in its success at offering a single, very inexpensive skip coding mode for both active and non-active scenarios while meeting the constraints of skip mode macroblocks, that no additional bits are required except, in the context of JM1, the small number of "RUN" parameter bits used to identify skip mode macroblocks.

83. The success of the '808 invention in achieving its objective is evidenced by the fact that it was adopted into the H.264 standard and is credited with at least a part of that standard's impressive coding efficiency. Additional commentary on the '808 invention's success in its objective of increasing the use of skip coding mode as a way of saving bitrate over a large number of macroblocks can be found in later reports. For example, a 2007 paper exploring additional improvements to the '808 contribution motivates its proposal with:

In general, H.264 SKIP mode macroblock has great impact on coding efficiency because about 30 – 70 % of macroblocks are set as skip mode. Ex. 2030 (Improvement of H.264 Skip Mode), Abstract.

84. A POSITA understands that these 30-70 % of macroblocks likely use an average of .15 - .25 bits for each macroblock, which is probably a negligible fraction of the bitrate available for coding each video frame. Thus, the remaining 30-70 % of macroblocks are able to be coded with perhaps twice as many bits as would have been available without the use of skip mode.

85. The prior art relied on by Petitioners for its Ground 1 and Ground 2 obviousness positions fail to disclose or render obvious a single coding mode that considers surrounding motion to determine whether an active or non-active motion vector should be associated with a skip mode macroblock. Petitioners put forth combinations of modes that it alleges do either active or non-active motion. The prior art coding modes cited by Petitioners either always address active motion or always address non-active motion, like prior video coding standards.

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

A. Ground 1: Karczewicz

86. 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.

a. Karczewicz Overview

87. 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 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 refinement coefficients in the case of affine motion field prediction), not novel coding modes.

88. Considering this context provided for Karczewicz, it is my opinion that Petitioners' 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.

89. Drawing this out, I understand that Petitioners assert that Karczewicz discloses five specific "coding modes." Pet., 12–16. In my opinion, none of the "coding modes" referenced by Petitioners 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. Petitioners point 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.

90. 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 Petitioners 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. 17. In this assertion, Petitioners ignore the function of the ’808 Patent’s skip coding mode and focus on the result of a zero or non-zero motion vector. In doing so, Petitioners disregard the determination between active and non-active motion 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. Petitioners also destroy 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.

91. Petitioners also ignore 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 "codeing modes" described could be represented by a single coding mode and single indication in the bitstream. It is not clear how a POSITA 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.

92. I understand that Petitioners also rely on Karczewicz's disclosure of "motion coefficient indication" bits to support their 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 Petitioners suggest, a "single indicator" where a "POSITA would have understood a zero MCI bit indicates that a segment is assigned a 'skip coding mode.'" Pet. 17. 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.² In other words, this refinement information is added to a predicted affine

² Petitioners separately argue that a hypothetical bit could be used to indicate a zero prediction error. Pet., 33. They claim such a bit does not constitute "motion vector information." A POSITA would understand that a bit indicating all-zero prediction

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.

93. Additionally, Karczewicz does not teach that “the decision to code a second segment with [zero motion vector] or [predicted non-zero motion vector] depends on the motion characteristics in the neighboring segment(s).” Pet. 19. Petitioners 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’

error is motion vector information, because it informs the decoder not to correct the results of the application of motion vectors.

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.

94. As noted above, Petitioners assert that Karczewicz discloses five “coding modes.” (Pet., 12–16). The first three “modes” are allegedly described on Ex. 1006, page 17. However, the authors make clear that these “modes” are not compatible with “skip coding” modes. First, the authors state:

The choice of which option to use is made in the encoder on the basis of the “rate-distortion” considerations ...” Ex. 1006, 17:2-4.

Since the choice is made at the encoder, based on information only available to the encoder, the choice itself needs to be transmitted to the decoder, in addition to any other information required by the coding “mode.” For “skip mode macroblocks” the only available bits are those that represent the skip mode, such as the “RUN” parameter. Second, the authors summarize the bit requirements of all 3 modes described on page 17:

Basically, there are two types of information that must be transmitted to the decoder in order to enable correct reconstruction of a given segment. These are: 1.) selection information, enabling the decoder to select the correct neighboring segment(s) to use in prediction; 2.) motion coefficient information. Whenever a segment is coded

using a prediction field, whether there is an associated refinement field or not, it is necessary to provide information about the neighboring segment(s) used in the prediction. Ex. 1006, 17:19-25.

As no bits are allowed to be transmitted to support “skip mode macroblock” reconstruction, these three “modes” do not qualify as processes that can be applied to skip mode macroblocks.

95. The other two “modes” cited by Petitioners are described on Ex. 1006, page 31, and correspond to INTRA coding mode, and the standard, prior-art skip mode of MPEG1, MPEG2, or JVT-B118. The fifth option identified by Petitioner (i.e. prior art skip coding mode) does qualify as a process that can be applied to skip mode macroblocks but bears no resemblance to the ‘808 skip coding mode, since it corresponds exactly to the prior art identified in the ‘808 specification. A key difference between the ‘808 invention and these “coding modes” from Karczewicz cited by Petitioners involves a choice made at the encoder based on information not available to the decoder, whereas the ‘808 invention involves a choice made at the decoder based on information already available at the decoder deciding between an “active” or “non-active” process to apply to reconstructing skip mode macroblocks.

96. Petitioners show persistent confusion between a statement that a value, field, or segment equals zero, and a statement that a value, field, or segment is not coded. For example, on various occasions Petitioners point out that the affine motion

fields described in Karczewicz might have a zero value. This zero value affine motion field is computed and influences a choice made by the encoder, but this needs to be used by the decoder, which means that the zero value must be coded and transmitted. This is distinct from the '808 Patent's process for choosing 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. The '808 offers an improved approach to reconstructing "skip mode macroblocks", while the Karczewicz teachings, even when they produce zero-valued results, are incompatible with processing "skip mode macroblocks". Karczewicz provides no disclosure of assigning a motion vector generated for a block based on an active/non-active classification made at the decoder through considering surrounding motion.

97. Even if we ignore any bitrate used by Karczewicz to represent prediction error (zero or non-zero), Petitioners are mistaken to suggest that a reconstruction consisting only of a prediction field does not require any bits to be transmitted. Karczewicz teaches the opposite:

Basically, there are two types of information that must be transmitted to the decoder in order to enable correct reconstruction of a given segment. These are: 1.) selection information, enabling the decoder to select the correct neighboring segment(s) to use in prediction; 2.) motion

coefficient information. Whenever a segment is coded using a prediction field, whether there is an associated refinement field or not, it is necessary to provide information about the neighboring segment(s) used in the prediction. Ex. 1006, 17:19-25.

Whenever a segment is represented by a prediction field calculated at the encoder using the teachings of Karczewicz, the encoder chooses how it uses neighboring segment information to produce the best prediction, and the encoder needs to send the choices it makes to the decoder for the prediction to be useful in reconstructing the segment. Thus, such an approach is incompatible with the reconstruction of skip mode macroblocks, which receive no information at all from the encoder other than an indication that the macroblock has been skipped.

98. I disagree with Petitioners' assertion 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. 17. First of all, one of the two "coding modes" that Petitioners refer to is the one discussed in the previous few paragraphs, which conclude that this "coding mode" is not even compatible with the reconstruction of any "skip mode macroblock". Secondly, Petitioners' assertion only refers at most to two of the at least three functionalities required of the '808 invention. In order for the '808 invention to be suitable for coding skip mode macroblocks (which have no possibility for information other than

the fact they are skipped), another consideration required by the invention is a consideration of surrounding motion to be performed *at the decoder* in order to classify the motion as either “active” or “non-active” motion. (An encoder would also need to perform this functionality as part of its mode selection process when evaluating the skip coding mode.) Petitioners fail to identify (and I am unable to find) any teachings in Karczewicz for providing this functionality.

99. It is important to emphasize that the difference between the various types of analyses that are disclosed in Karczewicz and the type required for the ‘808 invention is more significant than only the place where it is performed. The analysis performed at the encoder *uses* the segment (macroblock) being coded in the analysis it performs, for calculating all the cost functions that the encoder uses for making its choices. See, for example, Claim 61. The analysis performed at the decoder that is required by the ‘808 invention *cannot use* the segment being coded. A decoder is not capable of performing this type of analysis because 1) a decoder does not choose how to code a block, and 2) a decoder does not have the information necessary to perform this analysis (uncompressed or RAW data).

100. I understand that Petitioners also rely on Karczewicz’s disclosure of “motion coefficient indication” (MCI) bits to support their argument that Karczewicz invalidates the ’808 Patent. To begin with, Petitioners are incorrect in stating:

... a POSITA would have understood a zero MCI bit indicates that a segment is assigned a “skip coding mode.”
Pet. 17.

As explained multiple times in the paragraphs above: “Whenever a segment is coded using a prediction field, whether there is an associated refinement field or not, it is necessary to provide information about the neighboring segment(s) used in the prediction.” Ex. 1006, 17:22-25. A POSITA would understand the fact that any information at all is required for performing a coding mode makes it incompatible with the basic requirements of a “skip coding mode”.

101. But even if we ignore the fact that “modes” having a zero MCI are not even compatible with the requirements of skip mode macroblocks, any indicator, like MCI, that is active for multiple encoder choices for coding various “modes” is not suitable as an indicator of “skip coding mode”. This is because once a “skipped” macroblock is assigned to be skipped, it is not possible for any additional information to be associated with it. Without knowing the reason, among multiple possible reasons, the encoder had for skipping a particular macroblock, the decoder has no way of knowing which reconstruction process the encoder expects to be used to reconstruct the said skipped macroblock.

102. Signaling either one of the two proposed “modes” that allegedly constitute the ’808 Patent’s skip coding mode would require not only the MCI bit but also an additional indication in the bitstream to inform the decoder of the decoding

process to be used. In short, this proposed combination of “modes” is not a combination at all. It is two distinct modes that require explicit signaling of each “mode” in the bitstream. It is not clear how a POSITA would achieve a modification in which these two “modes” are combined, as the function of the suggested single coding mode would vary greatly from the function of any “mode” described in Karczewicz, much less an unclear combination of them. Petitioners’ suggested modification merely restates that the MCI bit is set to zero for both of Petitioners’ “modes”—Petitioners make no attempt to explain what changes are required to combine the two “modes.” Pet. 18–19.

103. Petitioners citing that “the decision to code a second segment with [zero motion vector] or predicted non-zero motion vector ... depends on the motion characteristics in the surrounding segment(s)” (Pet. 19) accurately characterizes Karczewicz’s disclosures relating to mode selection as performed by the encoder. However, the second “assigning” element of ‘808 Claim 1 does not merely require the assigning of a “[zero motion vector] or a predicted non-zero motion vector ...”, but also that the “assign(ed)” motion vector is “... for the skip coding mode for the first segment”. Regardless of what features the “assigning” process might have at the encoder, the fact that it is performed at the encoder, and that “skip mode macroblocks” receive no bits that might communicate the “assigned motion vector” to the decoder, make it clear that any “assigned” motion vector cited by Petitioners

is not “... for the skip coding mode for ...” any segment being decoded, and thus does not meet the second “assigning” limitation of ‘808’s Claim 1.

104. At least for the reasons stated above, 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. A POSITA would not have been motivated to combine two of Karczewicz’s mutually exclusive modes of operation

105. As discussed above, Karczewicz discloses an MCI bit that provides information regarding the presence of refinement motion coefficients for a given block. The MCI bit is set to zero when no refinement information is present and is set to one when refinement information is present. The sole function of the MCI bit is to instruct the decoder as to whether it should expect to receive refinement information. Ex. 1006, 37:5-13. The MCI bit is not an indication of a coding mode as it provides no information as to the coding mode selected for a macroblock or whether the block is to be represented by a motion prediction field. *Id.* 17:8-18, 31:22-25. Karczewicz discloses a separate signaling in the bitstream for the disclosed coding options. *See, e.g.*, Ex. 1006, Figure 2 (signaling both prediction motion vector field and refinement motion vector field information).

106. The MCI bit is set to zero in two scenarios: where a segment is coded using a zero-motion vector field and where a segment is represented as a prediction field only, when the segment can be adequately represented in terms of the motion

field of one or more of its previously coded neighbors. In the second scenario, it is indicated that the segment is assigned a predicted motion vector field. While the MCI bit is set to zero for both of these scenarios in Karczewicz, it does not delineate between the two situations. As discussed above, additional information is required to indicate how the segment has been encoded and is to be decoded.

107. In my opinion, it is unclear how a POSITA would have been able to combine the two modes. It is also unclear how a POSITA would have any expectation of success in doing so, particularly given that it is unclear what putting the “modes” together would look like. As stated above, a segment can only have one coding mode at a time. I have seen no suggestion of how this proposed combination of “modes” would function by Petitioners. As such, the MCI bit does not provide an indication of a skip coding mode as claimed by the '808 Patent and it is not clear how Karczewicz could be modified to do so.

c. Dependent Claims 23, 28-29, 34, 39-40

108. Dependent claims 23, 28-29, 34, and 39-40 all include a “derivation” step for the predicted non-zero motion vector. I understand that Petitioners assert the derivation step is akin to the assigning the skip coding mode. Pet. 29–31. In my opinion, the derivation step relates to process of deriving the predicted non-zero motion vector, using a motion vector prediction method such as is disclosed in JM1.

109. My opinion is based on the fact that the '808 Patent distinguishes between two steps in the video coding process. First, there is “assigning a skip coding mode,” as in claims 1 and 7, with either a zero (non-active) or non-zero (active) motion vector. Second, the process includes “deriving the predicted non-zero motion vector,” as in claims 23, 28-29, 34, 39-40. This step is performed when active motion is assigned. The first step (assigning a skip coding mode) includes determining whether the segment in question should treat the motion as active (non-zero) or non-active (zero) based on the motion information of a second segment neighboring the first segment. Ex. 1001, claims 1, 7. This decision between active and non-active determines whether and how the determining step proceeds. In the case of non-active motion, a zero motion vector is automatically generated and assigned to the skip coding mode and no determination step is required. For active motion, the determination step must then determine the non-zero motion vector using a process such as motion vector prediction.

110. As such, Karczewicz fails to disclose the determining step. This is because Karczewicz includes no means for distinguishing between active and non-active when a specific coding method is assigned to a given segment.

B. Ground 2: MPEG-1 in combination with H.263

111. In my opinion, MPEG-1 in combination with H.263 does not anticipate or render obvious the challenged claims of the '808 Patent.

a. MPEG-1 Overview

112. ISO/IEC 11172-2:1993, Information technology—Coding of moving pictures and associated audio for digital storage media at up to about 1,5 Mbit/s—Part 2: Video (MPEG-1) is a video coding standard developed by the Moving Picture Experts Group and was published in 1993. Ex. 1007. MPEG is a part of ISO/IEC (the International Organization for Standardization/the International Electrotechnical Commission).

113. MPEG-1 specifies two skip modes: a P-picture skip mode and a B-picture skip mode. A skipped macroblock using MPEG-1's P-picture skip mode uses a zero-motion vector, meaning the macroblock is copied from the reference frame with no motion. A skipped macroblock using the B-picture skip mode uses the macroblock type of the previous macroblock, meaning it copies the prior macroblock's motion vectors.

b. H.263 Overview

114. ITU-T Recommendation H.263 (February 1998) (H.263) is a video coding standard developed by ITUT VCEG (International Telecommunication Union Telecommunication Standardization Sector Video Coding Experts Group) and was first published in 1996. *See* Ex. 1001, 10:27-31; Ex. 1009.

115. The coding efficiency of the H.263 video coding standard was known to be much higher than that of MPEG-1, and more comparable to MPEG-2, the much

more advanced MPEG video coding standard that was released at about the same time as H.263, and which was being widely used in commercial products by 1998. Because of the far superior coding efficiencies of MPEG-2 and H.263, MPEG-1 was used very rarely by 1998, almost a decade after its first development.

116. The H.263 video coding standard targeted efficient coding of a slightly different class of video sequences than MPEG-2. While MPEG-2 targeted the coding of general video sources (e.g. broadcast television, DVD movies, etc.), H.263 was primarily targeted the efficient coding of video conference streams. Various differences in features of the two standards can be attributed to differences in their target applications. For example, MPEG-2 included features for handling interlaced video (e.g. broadcast TV), while H.263 did not. MPEG-2 provided buffering tools for managing significant delay in the display of decoded video, while H.263 did not (video used for video conferencing could not afford to be delayed). And H.263 placed higher priority on the efficient coding of stationary background areas of a video, since such areas are more frequently found in video conference sequences than in general video sources.

117. H.263 provides a coding mode equivalent to the “skip coding mode” of other standards, and it is controlled by the COD (coded macroblock indication) single bit flag sent with each macroblock.

COD: A bit which when set to “0” signals that the macroblock is coded. If set to “1”, no further information is transmitted for this macroblock; in that case the decoder shall treat the macroblock as an INTER macroblock with motion vector for the whole block equal to zero and with no coefficient data. Ex. 1009, p. 46.

118. H.263 also includes the use of bidirectionally predicted pictures and macroblocks (i.e. B-macroblocks). Section G.4 describes the calculations for the motion vectors used for B-macroblocks in H.263. Ex. 1009, p. 81-82. A POSITA would understand those calculations to result in setting all B-macroblock motion vectors to equal (0.0,0.0) whenever “skip coding mode” is used (i.e. COD = “1”).

119. Thus, like MPEG-1, H.263 also has an equivalent to “skip coding mode” for both P-macroblocks and B-macroblocks. Like MPEG-1, P-macroblocks use zero-valued motion vectors in “skip coding mode”, but unlike MPEG-1, zero-valued motion vectors are also used for B-macroblocks in “skip coding mode”.

c. A POSITA would not be motivated to combine MPEG-1 and H.263

120. Petitioners’ combination modifies MPEG-1’s B-picture skip mode to incorporate features of H.263’s approach to motion compensation that are unrelated to “skip coding mode” in H.263. It is my opinion that a POSITA would not be motivated to make the combination proposed by Petitioners without some other

source of teachings guiding the POSITA to pick out those particular unrelated features of H.263 to combine.

121. Firstly, at the time of the 1998 H.263 publication that Petitioners rely upon, H.263 was a state-of-the-art video coding standard incorporating the latest advancements in techniques for efficient video coding, while MPEG-1 was a nearly decade-old coding standard, far less efficient than all 1998 state-of-the-art coders, and used very rarely. To the extent that a POSITA might hope to find some benefit in combining the teaching of MPEG-1 and H.263, any improvement in coding efficiency due to such combination had no hope of increasing the coding efficiency of MPEG-1 to a level that would be competitive with state-of-the-art coders of 1998. But any improvement that might be achieved through such a combination could potentially yield significant performance improvements of H.263. Thus, a POSITA exploring such a combination might seek to modify H.263 in light of teachings of MPEG-1, but would not be motivated to modify MPEG-1 in light of teachings of H.263.

122. Secondly, even if one looked to modify some feature of MPEG-1 in light of the teachings of H.263, a POSITA would be motivated to base such modification on insights provided by H.263 about the feature being modified. I.e., if a POSITA hoped to find an improved method of B-skip mode processing, he/she

would look to combine MPEG-1 with teachings about H.263 B-skip mode processing, or at least skip-mode processing.

123. The feature of H.263 that Petitioner chooses to combine with MPEG-1 B-skip is the median predictor used to calculate candidate predictors in section 6.1.1. However, prior to H.263's description of this calculation, it directs:

When the corresponding macroblock was coded in INTRA mode ... or was not coded (COD=1), the candidate predictor is set to zero. Ex. 1009, p. 56

124. The subsequent description of calculations that Petitioners rely upon are explicitly intended to be applied for cases where the candidate predictor has not been set to zero. A POSITA would not be motivated to combine features that H.263 explicitly teaches NOT to apply to "skip coding mode" for the purpose of improving MPEG-1's B-skip coding mode.

125. Thirdly, even if one looked to combine some unrelated teaching of H.263 with MPEG-1 with hopes of improving MPEG-1, a POSITA would only be motivated to make such combination if H.263 offered some suggestion that an improvement would be possible.

126. The median calculations that Petitioners incorporate in their combination is used in H.263's motion compensation for INTER macroblocks. But H.263 specifies that "MVD is included for *all* INTER macroblocks ..." *Id.*, 38 (emphasis added). Motion compensated prediction can only occur for inter-picture

predicted macroblocks. *See id.*, 11. This means that MVD is always included for motion compensated predicted macroblocks in H.263. Thus, any suggestion that H.263 provides evidence of benefits of using median-calculated vector predictions would be understood by a POSITA to require the stipulation that such evidence is only found when the vector prediction is used with an MVD vector that is transmitted for this mode.

127. Furthermore, when sent, MVD always contains information. MVD “consists of a variable length codeword for the horizontal component followed by a variable length codeword for the vertical component.” Ex. 1009, 38. These variable length codes are given in Table 14:

Table 14/H.263 – VLC table for MVD

Index	Vector	Differences	Bit number	Codes
0	-16	16	13	0000 0000 0010 1
1	-15.5	16.5	13	0000 0000 0011 1
2	-15	17	12	0000 0000 0101
3	-14.5	17.5	12	0000 0000 0111
4	-14	18	12	0000 0000 1001
5	-13.5	18.5	12	0000 0000 1011
6	-13	19	12	0000 0000 1101
7	-12.5	19.5	12	0000 0000 1111
8	-12	20	11	0000 0001 001
9	-11.5	20.5	11	0000 0001 011
10	-11	21	11	0000 0001 101
11	-10.5	21.5	11	0000 0001 111
12	-10	22	11	0000 0010 001
13	-9.5	22.5	11	0000 0010 011
14	-9	23	11	0000 0010 101
15	-8.5	23.5	11	0000 0010 111
16	-8	24	11	0000 0011 001
17	-7.5	24.5	11	0000 0011 011
18	-7	25	11	0000 0011 101
19	-6.5	25.5	11	0000 0011 111
20	-6	26	11	0000 0100 001
21	-5.5	26.5	11	0000 0100 011
22	-5	27	10	0000 0100 11
23	-4.5	27.5	10	0000 0101 01
24	-4	28	10	0000 0101 11
25	-3.5	28.5	8	0000 0111
26	-3	29	8	0000 1001
27	-2.5	29.5	8	0000 1011
28	-2	30	7	0000 111
29	-1.5	30.5	5	0001 1
30	-1	31	4	0011
31	-0.5	31.5	3	011
32	0		1	1
33	0.5	-31.5	3	010
34	1	-31	4	0010
35	1.5	-30.5	5	0001 0
36	2	-30	7	0000 110
37	2.5	-29.5	8	0000 1010
38	3	-29	8	0000 1000
39	3.5	-28.5	8	0000 0110
40	4	-28	10	0000 0101 10
41	4.5	-27.5	10	0000 0101 00
42	5	-27	10	0000 0100 10
43	5.5	-26.5	11	0000 0100 010
44	6	-26	11	0000 0100 000
45	6.5	-25.5	11	0000 0011 110

Ex. 1009, 38–39. Table 14’s “Vector” column shows the horizontal and vertical component values that constitute MVD, and the “Codes” column shows how those values are represented in the bitstream. No matter the horizontal and vertical component value, each component is represented by some codeword—for example, a component value of 0 is represented in MVD as a single bit, “1.” *Id.*

128. In H.263’s motion compensated prediction, the median calculations Petitioners point to (termed “predictors” in the standard) are added to MVD to arrive at the motion vector for a macroblock. Ex. 1009, 44.

129. Petitioner does not mention a role for MVD in their proposed combination. If they intend their combination to include the MVD required by H.263’s motion vector reconstruction, then this combination does not qualify as a “skip coding mode”, since additional data is required. If they intend to omit MVD in the construction of their motion vector for B-skip, then they are incorrect in citing H.263 as providing any suggestion of the benefit of their approach. In fact, H.263 never uses this approach. At best, a POSITA would conclude that H.263 offers no evidence to suggest any advantages to this combination. At worst, a POSITA would infer that the fact that H.263 avoids ever using a motion vector constructed this way suggests that all explorations of approaches to using median predictions without MVD that were tested in the development of the H.263 standard failed to show any benefit.

130. For the reasons discussed above, a POSITA would lack motivation to combine MPEG-1 and H.263 as proposed by Petitioners, and would fail to understand why such a combination would even come under consideration. Modifying the 1991 MPEG-1 coding algorithm in light of 1998 state-of-the-art video coding technology would seem unlikely to produce something that could compete with 1998 technologies. A POSITA would also lack motivation to modify the MPEG-1 B-skip feature in a way that directly conflicts with H.263's successful treatment of B-skip or any of its skip coding modes. A POSITA further lack motivation to modify MPEG-1 B-skip by incorporating a median calculation taken from elsewhere in the H.263 standard, but using that median calculation in a way that is never used in H.263. The ad-hoc choices behind Petitioners' modification make it doubtful that the modified MPEG-1 would match the performance of either H.263 or unmodified MPEG-1 itself, and Petitioners offer no evidence that it would. History provides the only basis for assessing the proposed combination, and the fact that in the nearly 3 decades of video coding research and development since 1998, nothing at all resembling the proposed combination has ever been proposed, or adopted in later coding standards, points against Petitioners' contentions. A POSITA would reasonably conclude that the only reason for considering this combination at all is to attempt to mirror features of the teachings of the '808 patent as described in its claims.

d. The Combination of MPEG-1 and H.263 do not practice the Challenged Claims

131. Ignoring, for the moment, the lack of motivation to combine, Petitioners' combination does not include a "non-active" motion vector functionality, which is required by the accepted construction of "skip coding mode."

132. A POSITA would understand that the phrases "zero (non-active) motion vector" and "non-zero (active) motion vector" in the construction of skip coding mode describe two different processes: an active and a non-active process. A POSITA would further understand that the non-active process would always result in a motion vector of zero, and that the active process would not always result in a motion vector of zero. Ex. 1001, 14:23–28; 19:64–20:5. The active process can use a median of surrounding macroblocks, similar to the median prediction that is used along with MVD by H.263's motion compensated prediction. *Id.*, 19:64–20:5. A POSITA would further understand that the redefined skip coding mode would choose between these two processes. Observing a motion vector of zero, by itself, does not mean that the skip mode used the non-active process—the active process could potentially result in a motion vector of zero.

133. A POSITA would look to Figure 8 of the '808 Patent to help clarify the "active" and "non-active" terminology of the construction of "skip coding mode."

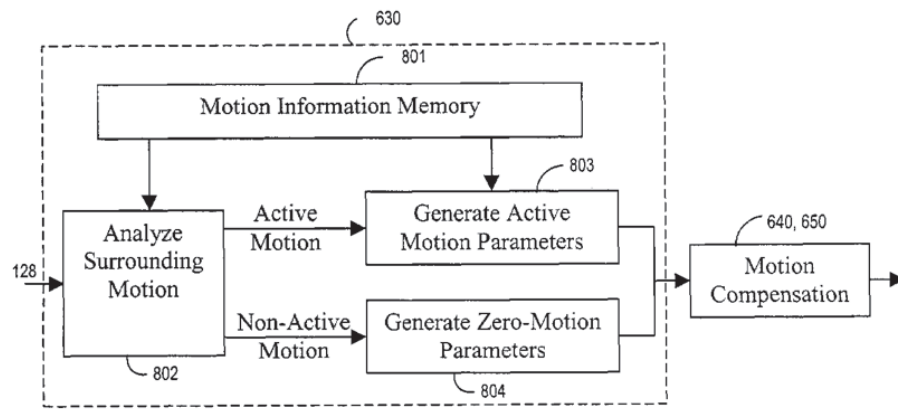


FIG. 8

Ex. 1001, Fig. 8. Figure 8 clarifies that there must be some choice between the active motion and non-active motion processes in the skip coding mode, which is made by an analysis of surrounding motion by the skip coding mode (block 802). A POSITA would understand that Figure 8 and the rest of the specification shed light on the meaning of “active” and “non-active,” showing that a choice between the two processes is required by the term skip coding mode. A POSITA would not understand an active process alone, such as median prediction, to satisfy the “non-active” process when that active process results in a zero-valued motion vector.

134. Petitioners’ understanding of H.263’s motion compensated prediction—which ignores the use of MVD—includes only the active process of the ’808 Patent’s redefined skip coding mode. A POSITA would understand the use of median prediction to always constitute an active process, even when the result of the median calculation results in a zero.

135. At least for the reasons stated above, MPEG-1 in combination with H.263 does not teach the claims of the '808 Patent, and a POSITA would not be motivated to combine these two technologies.

IX. SIGNATURE

This Declaration represents the opinions that I have formed up 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.

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

Dated: December 11, 2025

A handwritten signature in cursive script, reading "M. B. Orchard".

Dr. Michael Orchard