UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDIT CORPORATION
Petitioner

v.

3SHAPE A/S
Patent Owner

Case No. IPR2023-01315
Patent 10,695,151

DECLARATION OF DR. ELI SABER, PH.D.

3SHAPE EXHIBIT 2008
Medit v. 3Shape
IPR2023-01315

TABLE OF CONTENTS

I. INTRODUCTION 1

II. BACKGROUND AND QUALIFICATIONS 2

III. INFORMATION CONSIDERED 7

IV. RELEVANT LEGAL STANDARDS 7

A. Claim Interpretation 8

B. Perspective of One of Ordinary Skill in the Art 8

C. Anticipation 9

D. Obviousness 9

V. THE ’151 PATENT 12

VI. CLAIM CONSTRUCTION 13

VII. PETITIONER FAILS TO DEMONSTRATE THAT KORTEN DISCLOSES EACH OF THE FEATURES OF THE CLAIMS CHALLENGED IN GROUND 1 14

A. Korten does not disclose [Claim 1b]: “determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shae values” 14

B. Korten does not disclose [Claim 1c]: “wherein the method comprises deriving a certainty score expressing the certainty of the determined tooth shade value.” 23

C. Korten does not disclose [Claim 14b]: “determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D

representation and on known texture values of one or more reference tooth shde values" 28

D. Korten does not disclose [Claim 14c]: "wherein obtaining the digital 3D representation of the tooth comprises recording a series of sub-scans of the tooth, where at least one of said sub-scans comprises both texture information and geometry information for said tooth, and generating the digital 3D representation of the tooth from the recorded series of sub-scans." 28

VIII. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 2 WOULD HAVE RENDERED CLAIMS 1, 2, 4, 5, 9, AND 12-16 OBVIOUS 33

A. Claims 1, 2, 4, 5, 9 and 12 would not have been obvious by the combination of Korten and Lehmann II 34

1. Lehman II does not disclose [Claim 1b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth hade value" 34

2. Lehmann II does not disclose [Claim 1c]: "wherein the method comprises deriving a certainty score expressing the certainty of the determined tooth shade value." 36

3. A POSITA would not be motivated to combine accuracy features in Lehmann II with the system disclosed in Korten with a reasonable expectation of success 37

B. Claim 13 would not have been rendered obvious by the combination of Korten and Lehmann II 41

1. Korten does not disclose [Claim 13b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shde values" 42

2. Korten does not disclose [Claim 13c]: "wherein the method comprises creating a shade profile for the tooth from shade values determined one or more points on the tooth" 42

3. A POSITA would not be motivated to combine the tooth-shade-determining and averaging feature for regions of a patient's tooth disclosed in Lehmann II with the system disclosed in Korten with a reasonable expectation of success 42

C. Claims 14-16 would not have been rendered obvious by the combination of Korten and Lehmann II 43

1. Korten in view of Lehman II does not disclose [Claim 14b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or moe reference tooth shade values" 43

2. Korten does not disclose [Claim 14c]: "wherein obtaining the digital 3D representation of the tooth comprises recording a series of sub-scans of the tooth, where at least one of said sub-scans comprises both texture information and geometry information for said tooth, and generating the digital 3D representation of the tooth from the recorded series of sub-scans." 43

3. A POSITA would not be motivated to combine the accuracy features in Lehmann II with the system disclosed in Korten with a reasonable expectation of success 44

IX. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 3 WOULD HAVE RENDERED CLAIMS 10, 16, AND 17 OBVIOUS 44

X. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 4 WOULD HAVE RENDERED CLAIMS 1, 2, 9, 12 AND 14-16 OBVIOUS 45

A. Claims 1, 2, 9 and 12 would not have been rendered obvious by the combination of Korten and Lehmann I 45

1. Korten in view of Lehman I does not disclose [Claim 1b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade value" 45

2. Korten in view of Lehmann I does not disclose [Claim 1c]: "wherein the method comprises deriving a certainty score expressing the certainty of the determined tooth shade value." 49

3. A POSITA would not be motivated to combine accuracy features in Lehmann I with the system disclosed in Korten.....50

B. Claims 14-16 would not have been rendered obvious by the combination of Korten and Lehmann I 51

1. Korten in view of Lehmann I does not disclose [Claim 14b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values".....51

2. Korten in view of Lehmann I does not disclose [Claim 14c]: "wherein obtaining the digital 3D representation of the tooth comprises recording a series of sub-scans of the tooth, where at least one of the sub-scans comprises both texture information and gemetry information for said tooth, and generating the digital 3D representation of the tooth from the recorded series of sub-scans".....51

3. A POSITA would not be motivated to combine the accuracy features in Lehmann I with the system disclosed in Korten with a reasonable expectation of success 52

XI. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 5 WOULD HAVE RENDERED CLAIM 13 OBVIOUS 52

A. Korten does not disclose [Claim 13b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shde values" 52

B. A POSITA would not be motivated to combine the tooth-shade-averaging features for regions of a patient's tooth disclosed in Pye with the system disclosed in Korten with a reasonable expectation of success. 53

XII. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 6 WOULD HAVE RENDERED CLAIMS 10, 16, AND 17 OBVIOUS.....57

XIII. CONCLUSION.....58

APPENDIX 1

EXHIBIT	DESCRIPTION
1001	U.S. Patent No. 10,695,151
1003	Claim Construction Order, *3Shape A/S v. Medit Corporation*, Case No. 6:22-cv-00443, Dkt. No. 76 (W.D. Tex. May 2, 2023)
1009	U.S. Patent No. 10,028,810 ("Korten")
1010	U.S. Patent No. 6,206,691 ("Lehmann I")
1011	U.S. Publication No. 2011/0188086 ("Lehmann II")
1012	U.S. Patent No. 7,341,450 ("Pye")
1013	U.S. Patent No. 7,698,068 ("Babayoff")
1014	Rade D. Paravina, "Performance assessment of dental shade guides," Journal of Dentistry (2009)
1015	Expert Declaration of Hassan Foroosh, Ph.D.
1016	Patent Owner's Preliminary Response, Dental Imaging Techs. Corp. v. 3Shape A/S, IPR2023-00400 (PTAB April 17, 2023)
2001	U.S. Patent No. 11,418,770, issued on August 16, 2022 to N. Babayoff
2002	U.S. Patent No. 10,363,118, issued on July 30, 2019 to Y. Moalem
2003	U.S. Patent Publication No. 2016/0067018, published on March 10, 2016 to M. Korten *et al.*
2005	U.S. Patent No. 8,208,704, issued on June 26, 2012, to V. Wong and J. Milch
2009	*Curriculum Vitae* of Eli Saber

I, Eli Saber, hereby state as follows:

I. INTRODUCTION

1. I have been retained by Buchanan Ingersoll & Rooney ("Counsel") on behalf of 3SHAPE A/S ("Patent Owner") as an independent expert consultant in this *inter partes* review ("IPR") proceeding before the United States Patent and Trademark Office ("PTO").

2. I have been informed by counsel that in this IPR, Medit Corporation ("Medit" or "Petitioner") has filed a Petition ("Pet.") asking that the Board find Claims 1, 13 and 14 of U.S. Patent No. 10,695,151 ("the '151 Patent") (Exhibit 1001) unpatentable for one or more reasons. Counsel has informed me that the '151 Patent is owned by 3Shape A/S ("3Shape" or "Patent Owner")

3. I am being compensated at my ordinary and customary consulting rate for my work, which is $500 per hour. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other financial interest in this proceeding.

4. This report is based on information currently available to me. I reserve the right to continue my investigation and analysis, which may include a review of documents and information not listed above. I also reserve the right to expand or

otherwise modify my opinions and conclusions as my investigation and study continues, and to supplement my opinions and conclusions in response to any additional information that becomes available to me.

II. BACKGROUND AND QUALIFICATIONS

5. All my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, researching, and teaching the technology referenced in this declaration.

6. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I understand that a copy of my current curriculum vitae, which details my education and professional and academic experience, is being submitted as EX2009. A list of the matters in which I have previously testified or consulted is attached in Appendix 1. The following provides a brief overview of some of my experience that is relevant to the matters set forth in this declaration.

7. I am a Professor in the Department of Electrical and Microelectronic Engineering (EME) and the Chester F. Carlson Center for Imaging Science at the Rochester Institute of Technology (RIT) in Rochester, New York. I also serve as the Director of the Image, Video and Computer Vision Laboratory. I joined RIT's

full-time faculty in 2004. I have over thirty-four (34) years of industry and academic experience, thirty (30) of which are in the fields of Computer Vision, Digital Image/Video Processing, Pattern Recognition, and Machine Learning.

8. I received a Ph.D. in Electrical Engineering from the University of Rochester in 1996. My concentration was in Signal/Image/Video Processing, Pattern Recognition, and Computer Vision. I received a Master of Science Degree in Electrical Engineering from the University of Rochester in 1992 in the same concentration as listed above, and I received a Bachelor of Science Degree in Electrical and Computer Engineering, Summa Cum Laude, from the State University of New York at Buffalo in 1988.

9. Before becoming a full-time professor, I worked for Xerox Corporation for 16 years, from 1988 to 2004. During my years at Xerox, I was responsible for delivering color management, image processing innovations, architectures, and algorithms; xerographic sub-systems for a variety of color products; and control systems for toner production facilities. One of several roles I held at Xerox was Advanced Development Scientist and Manager. In that capacity, I established the Advanced Design Laboratory—an Imaging/Xerographics lab—and provided technical and managerial leadership for the Electrical, Imaging and Xerographics Department. In another role, as Product Development Scientist and Manager, I led

the research and development of image quality metrics for various product platforms. I also led the Image Science, Analysis, and Evaluation area, with 12 to 15 direct reports and a budget of approximately $2 million.

10. From 1997 until 2004, I was an adjunct faculty member at the Electrical Engineering Department of the Rochester Institute of Technology and at the Electrical & Computer Engineering Department of the University of Rochester. I was responsible for teaching undergraduate and graduate coursework such as Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Detection and Estimation Theory and Communication Systems; and performing research in multimedia applications, pattern recognition, image understanding and color engineering.

11. Since joining RIT full time, I have been responsible for teaching several undergraduate and graduate courses in Digital Signal Processing, Digital Image Processing, Digital Video Processing, Pattern Recognition, Engineering Analysis, Random Signal & Noise, Advanced Engineering Mathematics, Matrix Methods, Communications, Modern Control Theory, and Linear Systems.

12. I proposed, developed and introduced the Digital Video Processing course and reestablished the Pattern Recognition course at the Electrical Engineering Department at RIT. These graduate courses were instrumental in providing MS/PhD

students with the proper foundation and knowledge in all aspects of the subject areas in order to perform in-depth research in the field and continue to advance the state of the art.

13. The Digital Video Processing course is designed to provide a thorough and comprehensive coverage of the field. Topics covered include the mathematical representation of digital video including motion and time-varying image formation models, spatio-temporal sampling/reconstruction, sampling structure conversions, motion estimation using optical flow, block-based, pel-recursive, Bayesian and point correspondence type methodologies, segmentation, motion tracking, filtering, restoration, super-resolution and compression.

14. The Pattern Recognition course, on the other hand, covers pertinent concepts in Bayes decision theory, linear and nonlinear classifiers, artificial neural networks, feature selection/generation/extraction and various methodologies of clustering.

15. I have recently developed a new graduate course titled: "Advanced Neural Networks and Deep Learning: Theory, Mathematics and Algorithms". The course is intended to provide an in-depth comprehensive study of the theory, mathematics and algorithms for advanced neural networks and their usage in deep learning. It is primarily targeted for upper graduate students that are planning to

pursue advanced studies/research in the field. The course provides a thorough study of shallow and deep neural networks architectures and algorithms, activation functions, backpropagation, initialization, optimization strategies, etc. It then progresses to convolutional and recurrent style neural networks and, if time permits, will provide an overview of attention mechanisms/transformers and deep reinforcement learning. The course was taught for the first time in Spring 2024.

16. My current research focuses on image/video processing for multimedia, military & biomedical applications; computer vision and three-dimensional scene reconstruction; and machine learning for object tracking/remote sensing applications. As a principal investigator (PI) or co-principal investigator, I have acquired research funding in excess of $5.8 million since joining RIT and have managed multiple government grants from the Department of Defense as well as several corporate grants from Hewlett-Packard, Lenel, and Data Physics. I am currently managing (as PI) a multiyear government grant from the Department of Defense title "Target Detection/Tracking and Activity Recognition from Multimodal Data." In this project, we propose to develop operational target detection/tracking techniques and activity recognition/understanding methods that can leverage multimodal data in a fusion framework using deep learning algorithms while providing accurate and near real-time performance.

17. In 2012, I was awarded the Prestigious Trustees Scholarship, the highest award at RIT with regard to research recognition.

18. I am the author or co-author of thirty-eight (38) peer-reviewed journal publications.

19. I have also authored or co-authored one hundred (100) conference and workshop publications and a book entitled Advanced Linear Algebra for Engineers with MATLAB, published by CRC Press in February 2009, and am a named inventor on multiple U.S. and foreign patents.

20. I am a senior member of the Institute of Electrical and Electronic Engineers and a member of the IEEE Signal Processing Society, the Electrical Engineering Honor Society, Eta Kappa Nu.

III. INFORMATION CONSIDERED

21. In preparing this declaration, I have reviewed the ’151 Patent and the exhibits and documents referenced herein. In addition, my opinions are further based on my education, training, experience, and knowledge in the relevant field.

IV. RELEVANT LEGAL STANDARDS

22. I am not an attorney and offer no legal opinions. For the purposes of this Declaration, I have been informed about certain aspects of the law that are relevant to my analysis, as summarized below.

A. Claim Interpretation

23. I have been informed that during an *inter partes* review proceeding, claims are to be construed in light of the specification as would be read by a person of ordinary skill in the relevant art at the time the application was filed. I have been informed that claim terms are given their ordinary and customary meaning as would be understood by a person of ordinary skill in the relevant art in the context of the entire disclosure. A claim term, however, will not receive its ordinary meaning if the patentee acted as his own lexicographer and clearly set forth a definition of the claim term in the specification. In that case, the claim term will receive the definition set forth in the patent.

B. Perspective of One of Ordinary Skill in the Art

24. I have been informed that a patent is to be understood from the perspective of a hypothetical "person of ordinary skill in the art" ("POSITA"). Such an individual is considered to possess normal skills and knowledge in a particular technical field (as opposed to being a genius). I have been informed that in considering what the claims of a patent require, what was known prior to that patent, what a prior art reference discloses, and whether an invention is obvious or not, one must use the perspective of such a POSITA.

C. Anticipation

25. I have been informed that a claim is not patentable if it is anticipated. I have been informed that anticipation of a claim requires that every element of a claim is disclosed expressly or inherently in a prior art reference, arranged as in the claim, when considered from the perspective of a person of ordinary skill in the relevant art. I have been informed that when the structure recited in a reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. I have been informed that extrinsic evidence may be used to explain but not expand the meaning of terms and phrases used in the reference relied upon as anticipatory of the claimed subject matter.

D. Obviousness

26. I have been informed that a patent claim is obvious under 35 U.S.C. § 103, and therefore invalid, if the claimed subject matter, as a whole, would have been obvious to a POSITA as of the priority date of the patent based on one or more prior art references and/or the knowledge of a POSITA.

27. I have been informed that an obviousness analysis must consider (1) the scope and content of the prior art, (2) the differences between the claims and the prior art, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations, if any, of non-obviousness (such as unexpected results, commercial

success, long- felt but unmet need, failure of others, copying by others, and skepticism of experts).

28. I have been informed that a prior art reference may be combined with other references to disclose each element of the invention under 35 U.S.C. § 103. I have been informed that a reference may also be combined with the knowledge of a POSITA, and that this knowledge may be used to combine multiple references. I have been informed that a POSITA is presumed to know the relevant prior art. I have been informed that the obviousness analysis may take into account the inferences and creative steps that a POSITA would employ.

29. In determining whether a prior art reference would have been combined with other prior art or other information known to a POSITA, I have been informed that the following principles may be considered:

- whether the references to be combined involve non-analogous art;
- whether the references to be combined are in different fields of endeavor than the alleged invention in the patent;
- whether the references to be combined are reasonably pertinent to the problems to which the inventions of the patent are directed;

- whether the combination is of familiar elements according to known methods that yields predictable results;
- whether a combination involves the substitution of one known element for another that yields predictable results;
- whether the combination involves the use of a known technique to improve similar items or methods in the same way that yields predictable results;
- whether the combination involves the application of a known technique to a prior art reference that is ready for improvement, to yield predictable results;
- whether the combination is "obvious to try";
- whether the combination involves the known work in one field of endeavor prompting variations of it for use in either the same field or a different one based on design incentives or other market forces, where the variations are predictable to a POSITA;
- whether there is some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill in the art to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention;

- whether the combination requires modifications that render the prior art unsatisfactory for its intended use;
- whether the combination requires modifications that change the principle of operation of the reference;
- whether the combination is reasonably expected to be a success; and
- whether the combination possesses the requisite degree of predictability at the time the invention was made.

30. I have been informed that in determining whether a combination of prior art references renders a claim obvious, it is helpful to consider whether there is some teaching, suggestion, or motivation to combine the references and a reasonable expectation of success in doing so. I have been informed, however, that a teaching, suggestion, or motivation to combine is not required.

V. THE ’151 PATENT

31. The ’151 Patent discloses a method, a user interface and a system for use in determining shade of a patient’s tooth, wherein a digital 3D representation including shape data and texture data for the tooth is obtained. EX1001, Abstract. A tooth shade value for at least one point on the tooth is determined based on the

texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values. EX1001, Abstract.

VI. CLAIM CONSTRUCTION

32. For purposes of my analysis in this IPR proceeding, I have been informed that terms that appear in the claims of the '151 Patent should be interpreted according to their plain and ordinary meaning under the *Phillips* standard. In determining the ordinary and customary meaning, I have been informed that the words of a claim are first given their plain meaning that those words would have had to a POSITA at the time of the alleged invention. I also have been informed that the claims, specification, and file history may be used to better construe a claim insofar as the plain meaning of the claims cannot be understood. I have been informed that even treatises and dictionaries may be used under limited circumstances to determine the meaning attributed by a POSITA to a claim term at the time of filing.

33. I note that the constructions of some claim terms are disputed in the Related Litigation. Petitioner asserted that the term "deriving a certainty score" recited in Claim 1 as adopted by the District Court in the parallel litigation. The District Court construed this term to mean "determining an accuracy value based on the tooth shade value, the texture data, and/or texture information." EX1003 at 3.

VII. PETITIONER FAILS TO DEMONSTRATE THAT KORTEN DISCLOSES EACH OF THE FEATURES OF THE CLAIMS CHALLENGED IN GROUND 1

34. Petitioner asserts under Ground 1 that Claims 1, 12, 14, and 15 are anticipated by Korten. Pet. at 23-29. I disagree. Korten does not disclose each of the features of independent Claims 1 and 14. Thus, none of Claims 1, 12, 14 or 15 are anticipated by Korten.

A. Korten does not disclose [Claim 1b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values"

35. Petitioner asserts that Korten discloses "matching at least the first color with a standard color from a standard color scheme." Pet. at 25. Petitioner further asserts that Korten describes that "[s]uch a standard color scheme may for example correspond to the widely used VITAPAN™ Classical tooth color scheme." Pet. at 25. These assertions are not a disclosure of the requirements on Claim 1b. Petitioner fails to explain how Korten discloses determining a tooth shade value for at least one point on the tooth <u>based on</u> the texture <u>data of the corresponding point of the digital 3D representation</u>. Korten does not utilize the digital 3d representation to determine color.

36. I understand that the panel indicates in the Institution Decision (ID) that "Patent Owner appears to argue that the recited 'texture data' is different from the color data collected in Korten's method." ID at 19. It appears that the panel apparently believes that Patent Owner's argument was that texture data requires more than just color data. ID at 19-20. The panel then concluded that "[t]o the extent Patent Owner implies a construction of the term 'texture data' to *require* something other than color data, Patent Owner does not provide any arguments or supporting evidence for such a construction." ID at 20. However, the missing features of Korten do not relate to whether the term "texture data" requires more than just color data. Instead, the missing feature is that Korten does not disclose determining a tooth shade value <u>based on data of the corresponding point of the digital 3D representation</u>.

37. The '151 Patent states that "[d]etermining [] the tooth shade value from a digital 3D representation comprising both shape data expressing the shape of the tooth and texture data expressing a texture profile of the tooth provides the advantage that [the] shade and geometry information are directly linked." EX1001, 2:46-50. By determining the tooth shade value from data in the 3D digital representation, one gains numerous additional advantages. For example, determining the tooth shade

value from data in the 3D representation allows the user to rely on multiple sub-scans of the same or different points or locations of the tooth.

38. "Deriving the texture data based on texture information from two or more sub-scan[s] can provide a more accurate measurement of the texture data" *Id*., 4:33-35. "The texture information [derived from] one sub-scan for a particular region of the tooth may be unreliable, e.g. due to the angle between the surface in this region and the scanner when this particular sub-scan was recorded." *Id*., 4:35-39. "The combination of texture information from several sub-scans can provide more reliable color." *Id.,* 4:39-40. "This approach has the advantage that the derived texture data of the digital 3D representation are not as sensitive to errors in the texture information of a single scan." *Id.*, 4:59-61. "Such errors can be caused by several factors. *Id*., 4:62. "One factor is the angle between the optical path of the probe light at the tooth surface and the tooth surface itself." *Id*., 4:62-64.

39. "When utilizing e.g. the focus scanning technique, the texture data for a point on the tooth is preferably derived from a number of sub-scans where at least some of the sub-scans are recorded at different orientations of the scanner relative to the teeth." *Id.*, 4:64-5:1. "The sections of the sub-scans relating to this point are hence acquired at different angles relative to the tooth surface in this point." *Id.,* 5:1-4. This cannot be accomplished when one independently measures the color of

a point on a tooth, compares that measured color with a tooth shade guide and thereafter correlates the tooth shade with a point in the 3D representation.

40. Korten makes no mention of determining a tooth shade value based on any data in a 3D representation. There is no disclosure of using texture data in a 3D representation for determining a tooth shade. There is no mention of using color data in a 3D representation for determining a tooth shade value.

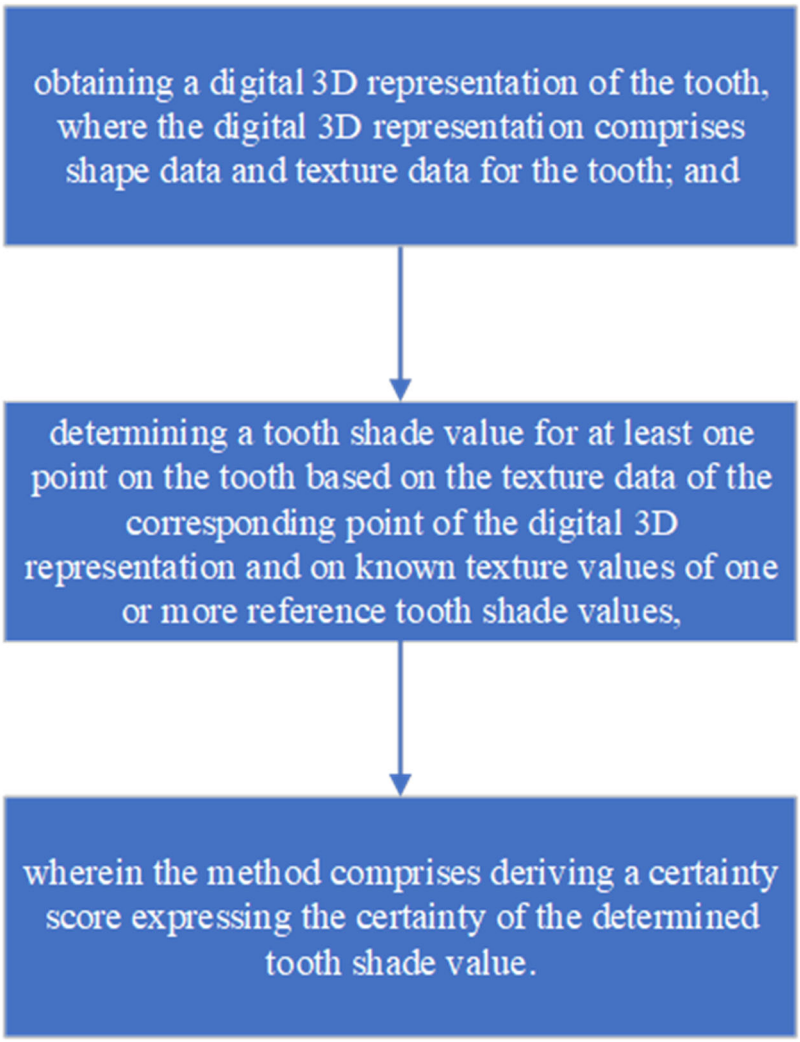
41. The ’151 Patent describes and claims a method for determining a shade value of a point on a patient’s tooth. A step in the process is obtaining a digital 3D representation of the tooth, where the digital 3D representation comprises both shape data and texture data for the tooth. EX1001, 2:5-15. I understand that the ’151 Patent states that texture information comprises at least one of tooth color or surface roughness. EX1001, 2:37-38. However, whether the texture data includes properties other than color is not relevant. What is relevant is that Claim 1 requires one to obtain a 3D representation having both shape and texture data (comprising at least one of color or surface roughness).

42. Another step in the process is determining a tooth shade value for at least one point on the tooth based on the texture data (comprising at least one of color and surface roughness) of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade

values. EX1001, 2:5-15. The 3D representation having both shape and texture data is obtained (not independently as in Korten) with an intra-oral scanner that obtains sub-scans of the scanned teeth from a plurality of 2D images. EX1001, 11:9-13. The generated digital 3D representation comprises shape data expressing the shape of the tooth and texture data (comprising at least one of color or surface roughness). EX1001, 11:57-59. The ’151 Patent describes and claims first obtaining a digital 3D representation having texture (comprising at least one of color and surface roughness) and then determining tooth shade values based on data in the digital 3D representation. EX1001, 2:46-50, Claim 1.

43. A diagram of the method claimed in the ‘151 Patent is provided below.

Figure 1



EX1001, Claim 1

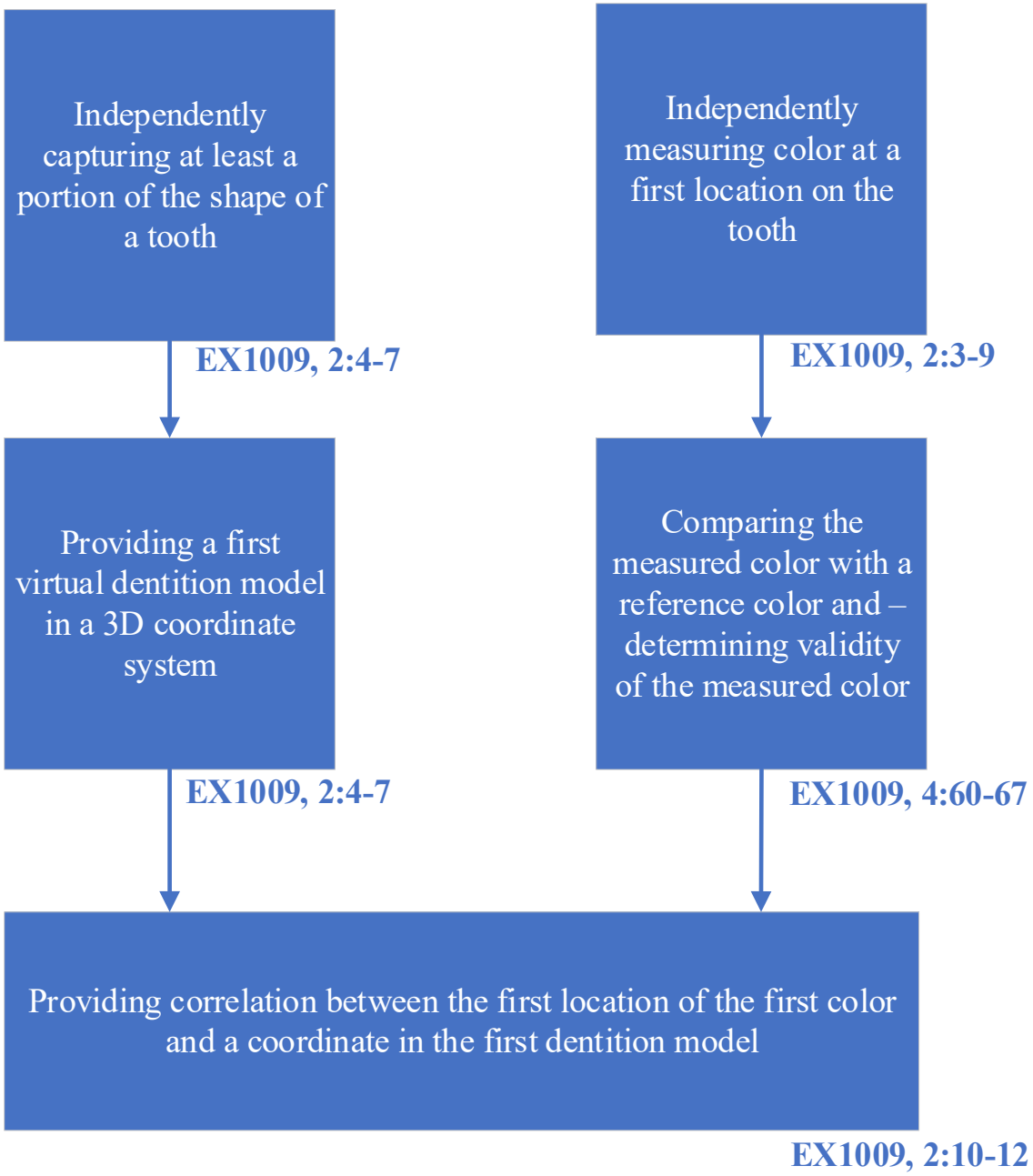
44. Petitioner fails to describe how Korten discloses first obtaining a 3D representation including shape and color data (or any other texture data), and then determining a tooth shade value based on the color data of the corresponding point of the digital 3D representation. Petitioner makes no mention of providing tooth shade based on the data of a point on a 3D representation. Instead, Korten discloses

comparing a directly measured tooth color with reference tooth shade values. *See, e.g.*, EX1009, 5:28-41.

45. Petitioner asserts that "Korten discloses that color data is captured on a point-by-point basis such that each captured XYZ location on the surface of the tooth will have color data that corresponds to that point on the tooth." Pet. at 25. According to Petitioner, Korten's reference to "the first color" corresponds to the color obtained for a location on the tooth. Pet. at 25-26. Petitioner explicitly states that this "relationship is even more explicit in the relevant disclosure in Korten because the reference to the 'first color' corresponds to the color obtained for the first location, or point, on the patient's tooth" Pet. at 26. However, obtaining color of a point on the tooth is not the same as providing tooth shade based on texture data of the corresponding point of a 3D digital representation having both shape data and texture data (comprising at least color or surface roughness).

46. A diagram of the method claimed in Korten is provided below to clearly illustrate the distinct differences between the '151 Patent and Korten.

Figure 2



47. As shown above in Figure 2, Korten obtains a dentition model without color. Korten measures color on a tooth and before placing the color into the

dentition model compares the measured tooth color with a reference color. Thereafter, Korten correlates color with a coordinate in its dentition model.

48. As shown above in Figure 1, Claim 1 of the ’151 Patent requires first creating a 3D representation including at least color or surface roughness. It then uses data from the 3D representation containing at least color or surface roughness and known values of one or more reference tooth shade values to determine tooth shade. In contrast, and as shown in Figure 2, Korten obtains a dentition model without color.

49. Korten provides no disclosure of using color data from a 3D representation to determine a shade value. Korten discloses comparing color with a reference shade before there is a correlation of the color and location of the dentition model.

50. Korten operates in this manner because it obtains the shape of a tooth using a first optical sensor while independently measuring the color at a location on the tooth using a second optical sensor (which Korten contemplates as preferably being part of a spectrometer). *See, e.g.*, Ex. 1009 at 2:64-4:40; 8:45-10:18; FIGs. 2-4. In particular, Korten specifically describes the separate optical arrangement that is used to independently obtain the shape of the tooth from measuring color. *See id.*

This allows Korten to compare the measured color with a reference color without any need to reference the 3D model. *See id.*

B. Korten does not disclose [Claim 1c]: "wherein the method comprises deriving a certainty score expressing the certainty of the determined tooth shade value."

51. Petitioner states that "[a] POSITA would understand that the technology in Korten calculates a 'certainty score' under this construction because it measures how accurately the standard color data for each standard tooth shade value matches the color data from the patient's tooth." Pet. at 27. Petitioner asserts that Korten discloses that the color data from the location on the patient's tooth may be compared to the standard color data from a standard color data scheme to find a matching standard color." Pet. at 26. Petitioner further asserts that "Korten describes that it is desirable to provide "precise color measuring," and that the technology it describes is directed towards "minimizing errors in color measurement." *Id.* According to Petitioner, a POSITA would understand the disclosure in Korten regarding "matching at least the first color with a standard color" to be referring to finding a standard color that closely matches the first color. *Id.* I disagree that these assertions amount to determining a certainty score as recited in the requirements of Claim 1c.

52. Petitioner fails to explain how any of these statements amount to deriving a certainty score expressing the certainty or accuracy <u>of the determined tooth shade value</u> as opposed to the measured tooth color. As explained above, the tooth shade value of Claim 1 is obtained from data in the 3D representation containing shape and texture data (comprising at least one of color or surface roughness). In contrast, Korten does not disclose obtaining a tooth shade value based on data in a 3D representation containing both shape and color data—it discloses comparing a tooth color with a reference color.

53. Korten explicitly states that "the method further comprises the step of comparing the measured first color with a reference color, and—depending on the degree of similarity or the match between the measured first color and the reference color –determining the validity of the measured first color." EX1009, 4:60-64. That is, Korten discloses determining similarity between a measured tooth color and a reference color. But, that is not what Claim 1 requires.

54. Claim 1 requires (1) determining a tooth shade value based on data of a corresponding point of the 3D representation and on known texture values of one or more reference tooth shade values and then (2) deriving a certainty score expressing the certainty of the determined tooth shade value. *See* Figure 1 above. The tooth shade value is based on data in the 3D representation instead of from a

tooth directly as disclosed in Korten. The certainty score in Claim 1 is of the tooth shade value of the 3D representation not the validity of the color measured from the tooth as in Korten. Again, Korten does not disclose obtaining a tooth shade value based on data in a 3D representation containing both shape and color data.

55. Korten's color matching of a tooth color with a reference color does not involve obtaining a certainty score of a tooth shade value that is based on data in a digital 3D representation. Korten discloses comparing color with a reference shade before there is a correlation of the color and location of the dentition model.

56. The '151 Patent describes using the certainty score to determine whether the "determined tooth shade value" in the 3D representation is acceptable. EX1001, 6:52-56. This may be based on the comparison of the derived certainty score and the range of acceptable certainty score values, *e.g.*, where it is decided that the determined tooth shade value is acceptable if the certainty score is within the range of acceptable values. *Id.* In some embodiments, if large variations are found in the texture information in the vicinity of the parts corresponding to the point for a substantial fraction of the sub-scans, the texture data derived therefrom may be unreliable and the tooth shade value derived for this point is accordingly not very reliable. EX1001, 7:9-13. In other embodiments, the certainty measure relates to

how close the texture data is to the known texture value of the determined tooth shade value. EX1001, 7:14-20.

57. Petitioner asserts that the system in Korten would need to compare the color data of the first color with each of the standard colors to find the closest match. Pet. at 26. Petitioner further asserts that Korten discloses "comparing the measured first color with a reference color, and—depending on the degree of similarity or the match between the measured first color and the reference color—determining the validity of the measured first color." Pet. at 26-27. According to Petitioner, Korten further discloses that "[a] mismatch between the measured first color and the reference color may trigger a further method step of issuing an error signal," and that the limits for finding an acceptable mismatch "may be adjustable." Pet. at 27. I disagree that these assertions amount to a disclosure of a certainty score as require by Claim 1c.

58. Korten's color matching of a tooth color with a reference color does not involve obtaining a certainty score of a tooth shade value that is based on data in a digital 3D representation. Korten describes independently obtaining shape and color and then correlating the color into an XYZ coordinate system.

59. Again, Korten operates in this manner because it obtains the shape of a tooth using a first optical sensor while independently measuring the color at a

location on the tooth using a second optical sensor (which Korten contemplates as preferably being part of a spectrometer). *See, e.g.*, Ex. 1009 at 2:64-4:40; 8:45-10:18; FIGs. 2-4.

60. In particular, Korten specifically describes the separate optical arrangement that is used to independently obtain the shape of the tooth from measuring color. *See id.*

61. This allows Korten to compare color with a reference shade before there is a correlation of the color and location of the dentition model. EX1009, 4:62-64.

62. Petitioner further asserts that Korten discloses "comparing the measured first color with a reference color, and—depending on the degree of similarity or the match between the measured first color and the reference color—determining the validity of the measured first color." *See* Pet. at 26-27; EX1009, 4:60–5:6; EX1015, ¶115. However, as stated above, measuring the validity of the measured first color of a tooth is not the same as "deriving a certainty score expressing the certainty of the determined tooth shade value." The measured first color in Korten is the color measurement of the tooth, whereas the determined tooth shade value in Claim 1 is based on data of a corresponding point on a digital 3D representation containing both shape and texture data (comprising at least one of

color and surface roughness). *See* Claim 1. Korten does not describe using data from a 3D representation to determine either tooth shade or a certainty score.

C. Korten does not disclose [Claim 14b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values"

63. Petitioner asserts that Korten discloses Element 14b. Pet. at 28. I disagree. For the same reasons Korten does not disclose or suggest [Claim 1b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values" Korten does not disclose or suggest the limitations of Claim 14b. *See* VII.A.

D. Korten does not disclose [Claim 14c]: "wherein obtaining the digital 3D representation of the tooth comprises recording a series of sub-scans of the tooth, where at least one of said sub-scans comprises both texture information and geometry information for said tooth, and generating the digital 3D representation of the tooth from the recorded series of sub-scans."

64. Petitioner asserts that Korten discloses Element 14c. Pet. at 28-29. I disagree. The Petition does not point to any disclosure in Korten of the features of Claim 14c. Petitioner's assertions fail to describe how Korten discloses "recording a series of sub-scans … where at least one of said sub-scans comprises both texture information [comprising at least one of color or surface roughness] and geometry

information for said tooth, and generating [a] digital 3D representation of the tooth from the recorded series of sub-scans," as recited in Claim 14c.

65. Korten discloses capturing data from a patient's dentition with the steps of capturing the shape of a tooth and independently measuring a color at a location on the tooth using separate sensors. EX1009, Abstract; *see also* Figure 2 above. There is no disclosure of a sub-scan containing both shape and color because Korten obtains shape and color independently.

66. Korten discloses capturing shape through the use of a scanner that "captures continuous 3D video images." EX1009, 4:24-36. Separately, Korten captures color using an optical sensor preferably a spectrometer which measures color at a point on the surface of a tooth. *Id.*, at 2:31-42. The method and system "allows for capturing shape and for measuring the color in independent steps" and thereafter "providing a correlation between the captured shape and the location at which the color is measured. *Id.*, at 1:9-12. That is, "independent from capturing the shape," Korten measures color at a point on the tooth. *Id.*, at 2:8-9. Thereafter, Korten provides "a correlation" between the color and "a coordinate in the dentition model." *Id.*, at 2:10-12.

67. Petitioner fails to demonstrate that Korten discloses a sub-scan comprising both texture (comprising at least color or surface roughness) information

and geometry information for a tooth or generating the digital 3D representation of the tooth from a recorded series of sub-scans.

68. The ’151 Patent discloses a system for determining shade of a patient’s tooth comprising a scanner capable of recording a digital 3D representation of the tooth where the digital representation comprises shape data and texture data (at least color or surface roughness) for the tooth. EX1001, 10:60-64. The 3D representation can be generated from the recorded sub-scans. *Id*., at 11:38-40. The sub-scans of the scanned teeth are reconstructed from a plurality of acquired 2D images. *Id.;* EX1001, 15:30-33 (“For instance a focus scanner can record series of 2D color images for the generation of sub-scans.”); 15:59-61 (“the individual sub-scans of the tooth are derived from a sequence of 2D images”). The generated digital 3D representation formed by such a procedure comprises shape data expressing the shape of the tooth. The texture information of the sub-scans can be used in various ways to provide that the generated digital 3D representation also comprises texture data (comprising at least one of color or surface roughness) expressing a texture profile of the tooth. *Id.*, 11:57-59.

69. Petitioner asserts that Korten discloses “measuring a second color at a second location on the same tooth or a further tooth in the patient’s dentition, the second location being different from the first location.” Pet. at 28. But measuring

color at a second point on a tooth or a further tooth is not a sub-scan let alone a sub-scan containing both texture information (comprising at least color or surface roughness) and geometry information.

70. Petitioner asserts that the "the first optical sensor may capture 'the shape of that further tooth and based thereon updating the first virtual dentition model by the shape of the further tooth.'" Pet. at 28. But Korten's first optical sensor only captures shape. It does not capture color. Further, providing a dentition model of a second tooth is not a sub-scan of a single tooth as required by Claim 14. Further, updating the first dentition model is not generating a digital 3D representation of the tooth from a recorded series of sub-scans. There is no mention of recording, Korten only states "updating." There is also no scan that provides color information used in generating a digital 3D representation. Korten discloses measuring color with a spectrometer at a point of a tooth and after the 3D dentition is prepared correlating the point of color to the 3D dentition.

71. Petitioner further argues that Korten discloses that "[t]he measured colors may be mapped relative to the first virtual dentition model at coordinates which correspond to the location at the dentition." Pet. at 29. However, mapping color to the virtual dentition is not a sub-scan containing texture information (comprising at least color or surface roughness) and geometry information. There is

no sub-scan containing both color and geometry. The recorded sub-scans in Claim 14 are not the 3D representation itself. Instead, the recorded sub-scans are used to generate the 3D representation.

72. Petitioner asserts that "[t]he capture of the first location corresponds to the first sub-scan in this claim limitation, and the capture of shape and color data associated with the second location correspond to the second sub-scan." Pet. at 29. According to Petitioner, "[b]y incorporating the shape and color data from the second subscan into the location coordinates determined for the first scan, the disclosed system in Korten generates the 3D representation using this series of sub-scans." *Id.* However, none of the scans described by Korten include capture of texture information (comprising at least color or surface roughness) and geometry information in a single sub-scan. Korten explicitly discloses capturing color and shape independently. EX1009, Abstract, 1:9-12, 2:1-12.

73. Further, while Petitioner describes "updating" the first virtual model, it does not explain where in Korten it describes recording a series of sub-scans and generating a digital 3D representation of a tooth from the recorded series of sub-scans. As indicated above, Korten explicitly discloses obtaining shape with a first sensor and independently obtaining color with a second sensor. Thereafter, there is

provided a correlation between the location of the color and a coordinate in the captured shape. EX1009, 2:10-13.

74. In the ID at page 29, the panel states that "the parties should develop whether limitation 14[c] requires the at least one ub-scan to collect shape and color data simultaneously." In fact, Claim 14 does not require collection of the shape and color data at the same instance within the sub-scanning period, but it does require a sub-scan to have collected shape and color data through the sub-scanning process and within the sub-scanning period. That is, it is the sub-scan process that collects both color and shape, not separate and independent data collection processes as in Korten. This is clear from the plain language of the claims.

75. Korten discloses scanning for shape. Korten does not collect color within that scanning process. Instead, Korten discloses measuring color on a point of the tooth and then correlating that data with the scanned shape data.

VIII. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 2 WOULD HAVE RENDERED CLAIMS 1, 2, 4, 5, 9, AND 12-16 OBVIOUS

76. Petitioner asserts that Claims 1, 2, 4, 5, 9, and 12-16 would have been obvious over Korten in view of Lehmann II. Pet. at 30. I disagree. Neither Korten nor Lehmann II independently or combined disclose each of the features of independent Claims 1, 13 and 14. Further, a POSITA would not have been

motivated to combine Korten with Lehmann II as Petitioner suggests. Thus, none of Claims 1, 2, 4, 5, 9, or 12-16 would have been obvious over the combination.

A. Claims 1, 2, 4, 5, 9 and 12 would not have been obvious by the combination of Korten and Lehmann II

77. Petitioner asserts that Claims 1, 2, 4, 5, 9, and 12 would have been obvious over Korten in view of Lehmann II. Pet. at 30. I disagree. Neither Korten nor Lehmann II alone or in combination disclose each of the features of independent Claim 1. Further, a POSITA would not have been motivated to combine Korten with Lehmann II as Petitioner suggests.

1. Lehman II does not disclose [Claim 1b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade value"

78. Petitioner asserts that Lehmann II discloses this limitation. Pet. at 30. I disagree. Petitioner fails to explain how Lehmann II determines a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of a 3D digital representation.

79. Petitioner first quotes Lehmann II as saying that "[t]he identification of tooth shade(s) is generally made by comparing the determined tooth color to a plurality of electronically stored tooth shades." Pet. at 30. According to Petitioner, the system in Lehmann II "associates one or more of the plurality of tooth shades

with at least one standardized shade" by comparing "the chromaticities and RGB representations" of the tooth color and the reference teeth. *Id.* Petitioner further asserts that Lehmann II discloses that "[t]he color information of the patient's tooth may be compared to the plurality of tooth shade guides on a pixel-by-pixel basis." *Id.* I disagree that these assertions amount to a disclosure of the features of Claim 1b.

80. Lehmann II discloses the use of a digital camera connected to a tooth shade analyzer subsystem. EX1010, Abstract. The "camera captures digital color images of the tooth, which are processed to form pseudo-pixels corresponding to areas of the tooth surface, and then compared to images of tooth shades relating to reference shade guides." EX1010, 3:27-30. Like Korten, Lehmann II makes no reference to determining a tooth shade value <u>based on</u> the texture (comprising at least one of color or surface roughness) <u>data of the corresponding point of a digital 3D representation</u>. In fact, Lehmann II makes no reference to a digital 3D representation containing shape and texture data at all.

2. Lehmann II does not disclose [Claim 1c]: "wherein the method comprises deriving a certainty score expressing the certainty of the determined tooth shade value."

81. Petitioner asserts that Lehmann II discloses this limitation. Pet. at 30-31. I disagree. Petitioner fails to explain how Lehmann II discloses deriving a certainty score expressing the certainty of the determined tooth shade value.

82. Petitioner asserts that Lehmann II relates to technology "for determining a patient's tooth shade." Pet. at 30. Petitioner further asserts that, "[t]he identification of tooth shade(s) is generally made by comparing the determined tooth color to a plurality of electronically stored tooth shades." Pet. at 30-31. According to Petitioner, "a comparison of the RGB values is made between the tooth image data 52 and the several shades to find a best fit or match." Pet. at 31. Once again, Petitioner fails to explain how any of these statements amount to deriving a certainty score or accuracy value expressing the certainty of the determined tooth shade value.

83. Lehmann II does not disclose obtaining a certainty score or accuracy value of the tooth shade based on data on the texture of a digital 3D representation continuing shape and texture data. Again, Lehmann II makes no reference to a digital 3D representation at all. Comparing colors or finding the best match is simply not the same as obtaining a certainty score or accuracy value let alone the expression of the certainty of the determined tooth shade value as recited in Claim 1.

84. Petitioner asserts that a POSITA would understand that finding the "best fit or match" necessarily involves determining accuracy values based on (i) the texture data (*e.g.*, color data) of the reference tooth shades and (ii) the texture data (*e.g.*, the color data) of the point on the patient's tooth because the "best fit or match" will correspond to the most accurate value. Pet. at 31. Petitioner cites to Dr. Foroosh (EX1015, ¶139) in support of this assertion. However, neither Petitioner nor Dr. Foroosh describe how Lehman II discloses reference to a shade value or a certainty score of the shade value based on data in a 3D representation containing shape and color data. Again, Lehmann II makes no reference to a digital 3D representation at all.

3. A POSITA would not be motivated to combine accuracy features in Lehmann II with the system disclosed in Korten with a reasonable expectation of success

85. Petitioner asserts that a POSITA would be motivated to include the "best fit" technology from Lehmann II into the shape and color measuring system from Korten. Pet. at 31. I disagree. A POSITA would not have been motivated to combine the "best fit" technology from Lehmann II into the shape and color measuring system from Korten.

86. Petitioner first asserts that both references disclose overlapping technology related to providing image, color, and tooth shade information. Pet. at

31. Petitioner next asserts that although Lehmann II is directed towards the analysis of 2D images, whereas Korten is directed towards rendering and displaying 3D models, this difference is immaterial as it relates to determining the certainty score of the selected tooth shade value. *Id.* I disagree with Petitioner that Korten and Lehmann II disclose overlapping technology that a POSITA would be motivated to combine.

87. The technology described in Korten is not overlapping with the technology described in Lehmann II as it relates to providing image, color, and tooth shade information. Korten describes using a spectrometer with a multiplicity of different color filters for measuring color. EX1009, 2:31-55. Lehmann II discloses the use of a solid state camera to capture tooth shade, and then compares the image to reference images also obtained from a camera. EX1010, 3:22-37; 5:5-11. Petitioner makes no attempt to explain how to combine these very different technologies.

88. A POSITA would have been well-aware of the issues associated with the combination of 2D images and 3D models. Korten discloses adding color for a point in the independently obtained 3D representation. Lehmann II discloses the use of a solid state camera to capture tooth shade, and then compares the image (as

opposed to a point) to reference images also obtained from a camera. EX1010, 3:22-37; 5:5-11.

89. Integrating color data for a point into a 3D representation is very different from associating an image with a 3D representation as required from the combination of Korten and Lehmann II. Imagine mapping a point to a 3D model as described in Korten to mapping an image (which requires extensive registration) to a 3D model as described in Lehmann II. Yet, there is no explanation in the petition as to how to integrate Lehmann II's 2D image containing color into Korten's 3D representation containing no color.

90. Lehmann II discloses the use of images, not points as disclosed in Korten. There is no explanation how a POSITA would have implemented the devices described in Lehmann II in the Korten system such that the 2D color image acquired in Lehmann II would be appropriately registered into the 3D representation of Korten. There is no explanation how one might associate a Z-coordinate of Korten with the 2D color data of the color image acquired by the Lehmann II camera. There is no explanation of how a POSITA would have Korten's processor register the 2D color image areas obtained by the Lehmann II camera with the 3D entity previously created by Korten, and then provide color values to the entity at the appropriately registered X-Y-Z points. There is no explanation of how one would

associate an existing shade guide acquired with a particular camera with the data gathered by Korten's imaging system.

91. A POSITA would have also been aware of the problems associated with using a spectrometer. Data "obtained using the spectrophotometric approach . . . has been found difficult to implement in practice." *See* U.S. Patent No. 8,208,704, issued on June 26, 2012, to Wong and Milch ("Wong") (EX2005, 3:54-58). "The use of a light scanning component for measuring different spectral components, generally employing a grating or filter wheel, tends to make the spectrophotometric system fairly bulky and complex." *Id.* at 3:58-61. "This makes it difficult to measure teeth toward the back of the mouth." *Id.* "Attempts to alleviate this problem have not shown great success." EX2005, 3:61-64. "To obtain a color mapping of an entire tooth surface requires numerous separate measurements with this approach." *Id.* at 4:4-6. "The image capture process is time-consuming and does not provide consistent results." *Id.* at 4:6-8. "Color mappings can be inaccurate using such an approach, since there can be considerable sensitivity to illumination and image capture angles and probe orientation during the imaging process." *Id.* at 4:8-12.

92. A POSITA would have also been well-aware of the problems with associating 2D color with 3D. Babayoff recognized that "[a]ssociating color information with three-dimensional objects is not straightforward, particularly when

the position information is obtained by using a three-dimensional scanning method, while the color information is obtained by using a two-dimensional scanning method." EX2001, 2:12-16; *see also* EX2002, 1:31-35. "The problem of conformally mapping the two-dimensional color information onto the three-dimensional surface model is difficult and it is common for mismatching of the color with three-dimensional points to occur." EX2001, 2:16-20. "Essentially, where two-dimensional color detectors are used for obtaining the color information, it is difficult to accurately associate color information from the detectors with the correct points on the three-dimensional surface model, particularly where relative movement between the object and the device occurs between the acquisition of the three-dimensional topological data and acquisition of the two-dimensional image data." EX2001, 2:20-27.

B. Claim 13 would not have been rendered obvious by the combination of Korten and Lehmann II

93. Petitioner asserts that Claim 13 would have been obvious based on Korten in view of Lehmann II. Pet. at 37. I disagree. Neither Korten nor Lehmann II discloses each of the features of Claim 13. Further, Petitioner is incorrect that a POSITA would have had the motivation to combine Korten with Lehmann II to arrive at the claimed invention with a reasonable expectation of success.

1. Korten does not disclose [Claim 13b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values"

94. Petitioner asserts that Korten discloses this feature of Claim 13. Pet. at 37. I disagree. *See supra* §VII.A.

2. Korten does not disclose [Claim 13c]: "wherein the method comprises creating a shade profile for the tooth from shade values determined one or more points on the tooth"

95. Petitioner asserts that Korten discloses this feature of Claim 13. Pet. at 37. I disagree for at least the same reasons Korten does not disclose Element 13b. *See supra* §VII.A.

3. A POSITA would not be motivated to combine the tooth-shade-determining and averaging feature for regions of a patient's tooth disclosed in Lehmann II with the system disclosed in Korten with a reasonable expectation of success

96. Petitioner asserts that Claim 13 would have been obvious based on Korten in view of Lehmann II. Pet. at 37. I disagree. A POSITA would not have been motivated to combine the tooth-shade-determining and averaging feature for regions of a patient's tooth disclosed in Lehmann II with the system disclosed in Korten. *See supra* §VIII.A.

C. Claims 14-16 would not have been rendered obvious by the combination of Korten and Lehmann II

97. Petitioner asserts that Claims 14-16 would have been obvious based on Korten in view of Lehmann II. Pet. at 42-44. I disagree for at least the following reasons. In my opinion, neither Korten nor Lehmann II discloses each of the features of Claim 14. Further, Petitioner is incorrect that a POSITA would have the motivation to combine Korten with Lehmann II to arrive at the claimed invention with a reasonable expectation of success. In my opinion, none of Claims 14-16 would have been obvious in view of the combination.

1. Korten in view of Lehman II does not disclose [Claim 14b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values"

98. Petitioner asserts that Korten in view of Lehman II discloses this element of Claim 14. Pet. at 42. I disagree. *See supra* §VIII.A.1.

2. Korten does not disclose [Claim 14c]: "wherein obtaining the digital 3D representation of the tooth comprises recording a series of sub-scans of the tooth, where at least one of said sub-scans comprises both texture information and geometry information for said tooth, and generating the digital 3D representation of the tooth from the recorded series of sub-scans."

99. Petitioner asserts that Korten discloses this element of Claim 14. Pet. at 42. I disagree. *See supra* §VII.D.

3. A POSITA would not be motivated to combine the accuracy features in Lehmann II with the system disclosed in Korten with a reasonable expectation of success

100. Petitioner asserts that the motivation to combine the accuracy feature in Lehmann II with the system disclosed in Korten overlaps with the motivation to combine described with respect to Claim 1. Pet. at 42. I disagree. *See supra*, §VIII.A.3.

IX. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 3 WOULD HAVE RENDERED CLAIMS 10, 16, AND 17 OBVIOUS

101. Petitioner asserts that Claims 10, 16, and 17 would have been obvious over Korten in view of Lehmann II and Babayoff. Pet. at 44-50. I disagree. I disagree. None of Korten, Lehmann II, or Babayoff either alone or in combination disclose each of the features of independent Claims 1 and 14. Petitioner asserts that the combination of Korten with Lehmann II discloses each of the limitations of Claims 1 and 14. Pet. at 45. I disagree. *See supra* §VIII. In my opinion, since Claims 1 and 14 would not have been obvious, Claims 10, 16, and 17 would not have been obvious.

X. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 4 WOULD HAVE RENDERED CLAIMS 1, 2, 9, 12 AND 14-16 OBVIOUS

102. Petitioner asserts that Claims 1, 2, 9, and 12-16 would have been obvious in view of Korten and Lehmann I. Pet. at 51. I disagree. In my opinion, neither Korten nor Lehmann I disclose each of the features of independent Claims 1and 14. Further, a POSITA would not have been motivated to combine Korten with Lehmann I as Petitioner suggests.

A. Claims 1, 2, 9 and 12 would not have been rendered obvious by the combination of Korten and Lehmann I

103. Petitioner asserts that Claims 1, 2, 4, 5, 9, and 12 would have been obvious over Korten in view of Lehmann I. Pet. at 51. I disagree. In my opinion, neither Korten nor Lehmann I alone or in combination disclose each of the features of independent Claim 1. Further, a POSITA would not have been motivated to combine Korten with Lehmann I as Petitioner suggests.

1. Korten in view of Lehman I does not disclose [Claim 1b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade value"

104. Petitioner asserts that Korten in view of Lehmann I discloses this limitation. Pet. at 51. I disagree. In my opinion, neither Korten nor Lehmann I disclose this feature of the claimed invention.

105. Here, Petitioner cites to Lehmann I as providing the requisite disclosures. *Id.* However, like Korten, Lehmann I does not provide a disclosure of determining a tooth shade value of a point on a tooth based on data of the corresponding point of a digital 3D representation containing both shape and color data. In fact, Lehmann I makes no reference to a 3D representation at all.

106. Petitioner asserts that in Lehmann I, a group of pixels covering a specific area of a tooth is identified, called a pseudo- pixel, and the intensity and color associated with the pseudo-pixel are computed by forming an average of the actual pixels. Pet. at 51. Petitioner further asserts that when this process is performed on a reference tooth, it results in a Reference Image, and when it is performed on a patient's tooth, it results in a Real Image. *Id.* According to Petitioner, the color for the "Real Image is compared (i.e., correlated) to each Reference Image in the database" using a correlation algorithm and, the correlation results in a composite match number ("CMN") that "indicat[es] how well the Real Image matches to that Reference Image. Petitioner further asserts that the composite match numbers are compared to one another and one of the Reference Images is selected as the 'best fit' match to the Real Image." *Id.*

107. Petitioner does not point to any use of a 3D representation to determine a shade value. In Lehmann I, a "camera captures digital color images of the tooth,

which are processed to form pseudo-pixels corresponding to areas of the tooth surface, and then compared to images of tooth shades relating to reference shade guides." EX1010, 3:27–31. "[T]he camera is equipped with a sleeve and illumination Subsystems that help reduce the variations in the color of digital images due to external factors." *Id.* at 3:33–36. After taking images of known reference teeth colors, and images of subject teeth, each image is processed into "pseudo-pixels," where "each pseudo-pixel 44 is made up of all or some of the real pixels within the area of the associated pseudo-pixel." *Id.* at 5:5–62. Then, "the intensity and color associated with a pseudo-pixel are computed or otherwise formed as an average (or other statistical measure) of the actual pixels forming the pseudo-pixel." *Id.* at 6:15–18. In a subsequent step:

> each pseudo pixel of the REAL IMAGE is compared to each pseudo-pixel of the REFERENCE IMAGE; and a composite match number ("CMN") is created indicating how well the REAL IMAGE matches to that REFERENCE IMAGE. The composite match numbers are compared to one another and one of the REFERENCE IMAGES is selected as the "best fit" match to the REAL IMAGE.

Id. at 9:35–42. Lehmann I does not disclose the use of a 3D representation to determine a shade value.

108. The ’151 Patent describes and claims a method for determining shade of a patient’s tooth including (1) obtaining a digital 3D representation of the tooth, where the digital 3D representation comprises both shape data and texture data (which includes color data) for the tooth and (2) determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values. EX1001, 2:5-15; *see also* Figure 1 above. The 3D representation having both shape and texture data (including color) is obtained together with an intra-oral scanner that obtains sub-scans of the scanned teeth are reconstructed from a plurality of 2D images. EX1001, 11:9-13. The generated digital 3D representation comprises shape data expressing the shape of the tooth and texture data (including color and/or surface roughness) expressing a texture profile of the tooth. EX1001, 11:57-59. Instead of determining tooth shade values from measurements on the tooth, the ’151 Patent describes and claims first obtaining a digital 3D representation having texture (including color and/or surface roughness) and then determining tooth shade values based on the digital 3D. EX1001, 2:46-50; Claim 1. *See* Figure 1 above.

109. Petitioner fails to describe how Lehmann I discloses determining a tooth shade value for at least one point on the tooth based on data of the

corresponding point of the digital 3D representation having both shape and color data. Lehmann I does not even disclose a process of making a 3D representation let alone a 3D representation containing both shape and color data. Thus, Lehmann I, like Korten, cannot disclose determining a tooth shade value based a point on a 3D representation and known texture values of one or more reference tooth shade values. There is no disclosure in either reference of first forming a 3D representation containing both shape and color data and then determining a tooth shade value based on the data of the 3D representation containing both shape and color data. Instead, both Korten and Lehmann I discloses comparing a measured tooth color with reference tooth shade.

2. Korten in view of Lehmann I does not disclose [Claim 1c]: "wherein the method comprises deriving a certainty score expressing the certainty of the determined tooth shade value."

110. Petitioner asserts that Korten in view of Lehmann I discloses this limitation. Pet. at 52. I disagree.

111. Petitioner asserts that Lehmann I relates to technology "for tooth shade determination using digital signal processing." Pet. at 52. Petitioner further asserts that, "color images of one or more teeth are analyzed and compared to known tooth shades for use in certain clinical or cosmetic procedures." Pet. at 52. Moreover, according to Petitioner, "Lehmann I discloses the use of a [] correlation algorithm

that results in a composite match number being determined that can be used to find a 'best fit.'" Pet. at 52. Once again, Petitioner fails to explain how any of these statements amount to deriving a certainty score or accuracy value expressing the certainty of the determined tooth shade value as required by Claim 1.

112. Lehmann I does not disclose obtaining a certainty score of the tooth shade value based on data on the data of the digital 3D representation. Lehmann I does not disclose expressing the certainty of the determined tooth shade value. Comparing colors or finding the best match is simply not the same as obtaining a certainty score or accuracy value let alone the expression of the certainty of the determined tooth shade value as recited in Claim 1.

3. A POSITA would not be motivated to combine accuracy features in Lehmann I with the system disclosed in Korten

113. Petitioner asserts that a POSITA would be motivated to include the "best fit" technology from Lehmann I into the shape and color measuring system from Korten. Pet. at 52-54. I disagree. For the same reasons that a POSITA would not have combined Lehmann II with Korten to arrive at the claimed invention, a POSITA would not have combined Lehmann I with Korten to arrive at the claimed invention. *See supra* §VIII.A.3.

B. Claims 14-16 would not have been rendered obvious by the combination of Korten and Lehmann I

114. Petition asserts that Claims 14-16 would have been obvious based on Korten in view of Lehmann I. Pet. at 56. I disagree for at least the following reasons. Neither Korten nor Lehmann I disclose each of the features of Claim 14. Further, Petitioner is incorrect that one skilled in the art would have the motivation to combine Korten with Lehmann I to arrive at the claimed invention with a reasonable expectation of success. .

1. Korten in view of Lehmann I does not disclose [Claim 14b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values"

115. Petitioner asserts that Korten in view of Lehmann I discloses this element of Claim 14. Pet. at 56. I disagree. *See supra* §X.A.1.

2. Korten in view of Lehmann I does not disclose [Claim 14c]: "wherein obtaining the digital 3D representation of the tooth comprises recording a series of sub-scans of the tooth, where at least one of the sub-scans comprises both texture information and geometry information for said tooth, and generating the digital 3D representation of the tooth from the recorded series of sub-scans"

116. Petitioner asserts that Korten discloses this feature of Claim 14. Pet. at 56. I disagree. *See supra* §VII.D.

3. A POSITA would not be motivated to combine the accuracy features in Lehmann I with the system disclosed in Korten with a reasonable expectation of success

117. Petitioner asserts that the motivation to combine the accuracy feature in Lehmann I with the system disclosed in Korten overlaps with the motivation to combine described with respect to Claim 1. I disagree. For the same reasons that a POSITA would not have combined Lehmann II with Korten to arrive at the claimed invention, a POSITA would not have combined Lehmann I with Korten to arrive at the claimed invention. *See supra* §VIII.A.3.

XI. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 5 WOULD HAVE RENDERED CLAIM 13 OBVIOUS

118. Petitioner asserts that Claim 13 would have been obvious over Korten in view of Pye. Pet. at 58. I disagree. Neither Korten nor Pye alone or in combination disclose each of the features of Claim 13. Further a POSITA would not have been motivated to combine the reference to arrive at the claimed invention.

A. Korten does not disclose [Claim 13b]: "determining a tooth shade value for at least one point on the tooth based on the texture data of the corresponding point of the digital 3D representation and on known texture values of one or more reference tooth shade values"

119. Petitioner asserts that Korten discloses this feature of Claim 13. Pet. at 58. I disagree. *See supra* §VII.A.

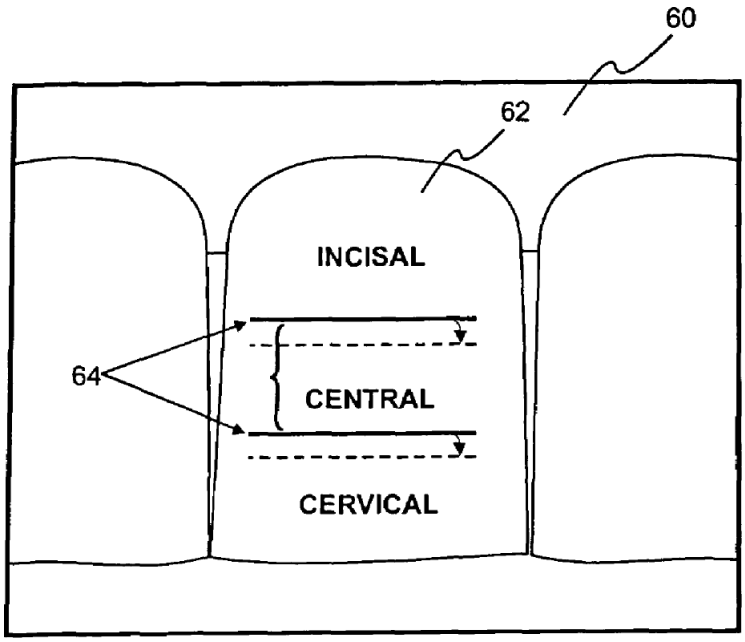
B. A POSITA would not be motivated to combine the tooth- shade-averaging features for regions of a patient's tooth disclosed in Pye with the system disclosed in Korten with a reasonable expectation of success.

120. Petitioner asserts that a POSITA would be motivated to use the tooth-shade-averaging feature for tooth regions described in Pye in the system described in Korten. Petitioner concludes that (1) a POSITA would be motivated to use the averaging technique for tooth regions described in Pye in the systems disclosed by Korten and (2) a POSITA would have a high expectation that such a combination would be successful. I disagree. A POSITA would not have been motivated to combine the tooth-shade-averaging feature for tooth regions described in Pye in the system described in Korten.

121. Pye relates to "tooth shade analysis tools." EX1012, 1:6–7. Pye describes that "known techniques do not appear to desirably address limitations that exist in processing, communications, storage, and/or other capabilities with respect to hardware or software equipment used in shade analyzing." *Id.* at 2:34–38. To improve on known techniques, Pye discloses "tooth shade scan systems and methods . . . in which shade information for a restorative product for a patient's tooth is obtained." *Id.* at 2:43–46. Pye's system "displays an image of the patient's tooth and displays dividers by which an operator can divide the tooth into regions of interest or into regions that correspond to major tooth regions (e.g., the incisal, central, etc.)."

Id. at 2:49–53. "Once regions of interest are identified, color characteristics for those regions are obtained." *Id.* at 3:1–2.

122. Figure 5, reproduced below, shows



123. Figure 5 shows a diagram of a user interface in a shade analyzing system, showing image 60 or a patient's mouth, with tooth 62, and lines 64 that divide the tooth into three regions: incisal, central, and cervical. EX1012, 7:51–61. Importantly, Pye discloses obtaining color characteristics of regions of interest. *Id.* at 3:1-9. Color characteristics such as values for red, green, blue, intensity, and other characteristics may be obtained. *Id.* Average values over an area, such as a major

tooth region, may be used for the color characteristics. *Id.* Thus, the color characteristics for several major regions of a tooth may be obtained. *Id.*

124. Korten describes that it associates color with at least one coordinate in the first dentition model based on the correlation between the location of the color and the coordinate in the first dentition model. EX1009, 4:41-45. Korten's color data is obtained and "stored in an appropriate format to define a unique position in a coordinate system, for example, in the format of X,Y, and Z coordinates based on an origin in a Cartesian coordinate system." *Id* at 4:45-52. The association of color and at least one coordinate may be provided data based, for example by a virtual array defining associated data fields for storing colors. *Id*.

125. Neither Petitioner nor its expert provide any explanation how one might associate the areas or regions described in Pye with a point based system requiring the use of an X, Y, and Z coordinate system. Further, without such coordinates, one skilled in the art would not be able to obtain a virtual array defining associated data fields for storing colors and their associated coordinates. This is so because areas and regions are not points in and X, Y, and Z coordinate system.

126. Neither Petitioner nor its expert explain how a POSITA could have successfully combined the 2D imaging systems of Pye and the 3D imaging system of Korten to arrive at the claimed shade averaging feature of Claim 13. There is no

explanation how a POSITA would have implemented the devices described in Pye in the Korten system such that the 2D color image in Pye would be placed into the 3D representation of Korten. There is no explanation how one might associate a Z-coordinate of Korten with the color data obtained by the Pye 2D color image obtained by the Pye camera. There is no explanation of how a POSITA would have Korten's processor align the 2D color image areas obtained by the Pye camera with the 3D entity previously created by Korten, and then provide color values to the entity at aligned X-Y-Z points. There is no explanation of how one would associate an existing shade guide useful with the Pye camera with the data gathered by Korten's imaging system.

127. As I mention above in paragraph 87 a POSITA was well-aware of the problems with associating 2D color with 3D representations from IPR2023-00400. *See* EX1016, pp. 35-36. Babayoff recognized that "[a]ssociating color information with three-dimensional objects is not straightforward, particularly when the position information is obtained by using a three-dimensional scanning method, while the color information is obtained by using a two-dimensional scanning method." EX2001, 2:12-16; *see also* EX2002, 1:31-35. "The problem of conformally mapping the two-dimensional color information onto the three-dimensional surface model is difficult and it is common for mismatching of the color with three-

dimensional points to occur." EX2001, 2:16-20. "Essentially, where two-dimensional color detectors are used for obtaining the color information, it is difficult to accurately associate color information from the detectors with the correct points on the three-dimensional surface model, particularly where relative movement between the object and the device occurs between the acquisition of the three-dimensional topological data and acquisition of the two-dimensional image data." EX2001, 2:20-27.

XII. PETITIONER FAILS TO DEMONSTRATE THAT THE ART ASSERTED IN GROUND 6 WOULD HAVE RENDERED CLAIMS 10, 16, AND 17 OBVIOUS

128. Petitioner asserts that Claims 10, 16, and 17 would have been obvious over Korten in view of Babayoff. Pet. at 61-63. I disagree. Petitioner does not discuss the limitations of independent Claims 1 and 14 under this ground. Apparently, Petitioner relies solely on Korten for the disclosure of the features of Claims 1 and 14. However, as discussed in §VII and §VIII, Korten does not disclose each of the limitations of Claims 1 and 14. Since Claims 1 and 14 would not have been obvious, dependent Claims 10, 16 and 17 would not have been obvious.

XIII. CONCLUSION

129. For the reasons set forth above, it is my opinion that Claims 1, 13 and 14 of the ’151 Patent would not have been anticipated or obvious over the prior art.

130. In signing this Declaration, I understand that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

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

Date: June 14th, 2024

Eli Saber

APPENDIX 1

I have previously testified and/or been consulted as an expert in the following matters:

3Shape A/S v. Dental Imaging Technologies & Carestream Dental
January 2024 - Present
US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan Ingersoll & Rooney PC
- Retained as an expert on behalf of 3Shape A/S (Petitioner)
- Provided expert opinions on proceedings involving US 10,076,391 (IPR2024-00548), US 11,234,798 (IPR2024-00549)

Amazon v. Nokia
January 2024 - Present
US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Perkins Coie
- Retained as an expert on behalf of Amazon (Petitioner)
- Provided expert opinions on proceeding involving US 7,724,818 (IPR2024-00572)

Autonomous Devices LLC v. Tesla, Inc.
October 2022 - Present
US District Court, District of Delaware

- Legal Firm: McKool-Smith
- Retained as an expert by the Barr Group on behalf of Autonomous Devices.
- Provided declarations in support of legal proceedings.
- Working on multiple IPRs (5X): IPR2023-01054, IPR2023-01055, IPR2023-01169, IPR2023-01172, IPR2023-01173

***RealD, LLC v. Microsoft Corp.*, No. 2:22-cv-00942-TL**
Feb. 2023 – June 2024

- Legal Firm: Michelman & Robinson
- Retained as an expert on behalf of RealD, LLC
- Provided expert opinions and a declaration in support of IPR2023-01046. Patent Owner Preliminary Response filed on 10/13/2023.

- Provide expert opinions and additional reports in support of Federal case.
- Provide algorithm support for software review

Meta Platforms, Inc.; Instaggram, Inc.; WhattsAPP LLC; Meta Platforms Technologies, LLC; and Giphy, Inc. v. VL Collective IP LLC
January 2024 – June 2024
Legal Firm: Reichman Jorgensen Lehman & Feldberg LLP

- Retained as an expert on behalf of VL Collective IP LLC.
- Provided expert opinions and a declaration in support of Patent Owner Response with regards to IPR2023-00924

Medit USA, Crown Jade Co. Ltd. (Petitioner) v. 3Shape A/S (Patent Owner)
Oct. 2023 – Present
US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan, Ingersoll and Rooney PC
- Retained as an expert on behalf of 3Shape A/S to provide expert opinions on proceedings involving U.S. Patent Nos. 9,629,551; 10,064,553; 10,695,151; 11,076,146; 11,368,667.
- Provide expert opinions in support of Patent Owner Response proceedings.

Facetec, Inc. v. iProov Ltd., Case No. 2:21-cv-02252-ART-BNW
October 2022 - Present
US District Court, District of Nevada

- Legal Firm: OneLLP
- Retained as an expert by Teklicon on behalf of FaceTec, Inc.
- Provided expert opinions as needed in support of legal proceedings

TVISION INSIGHTS v. The NIELSEN Company (US), LLC
August 2023 - Present
US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Erise Intellectual Property Law
- Retained as an expert on behalf of the Nielsen Company (US), LLC
- Provided expert opinions and a declaration in support of patent owner in IPR2023-01014.
- Documents were filed on 10/11/2023.
- PTAB decision to institute/not institute expected in January 2024.

Meta Platforms, Inc. f/k/a Facebook, Inc. v. Angel Technologies Group LLC
May 2023 – October 2023
US District Court, District of Nevada

- Legal Firm: McKool-Smith
- Retained as an expert by Alliance Technical Staffing on behalf of Angel Technologies Group LLC.
- Provide expert opinions and declarations in support of four IPR proceedings (IPR2023-00057, IPR2023-00058, IPR2023-00059, IPR2023-00060).
- Provided a Deposition on October 20th, 2023 for IPR2023-00057, IPR2023-00058, IPR2023-00059
- Provided a Deposition on October 23rd, 2023 for IPR2023-00060.

***In Re Lyft Rideshare* Litigation**
Dec. 2021 – Present
Superior Court of the State of California, Case No. CJC-20-005061

- Legal Firm: Williams & Connolly, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Lyft (Defendant)
- Provide reports and consulting services on the challenges of the use of Dashcam solutions in Vehicles
- Provided a Deposition on March 24th, 2023.

The first portion of the Case that requires my expertise has been settled.

***Alarm.com Incorporated v. Vivint, Inn*, No. 2:23-CV-00004-JRG-RSP**
March 2023 – Dec. 2023

- Legal Firm: Cravath, Swaine and Moore, LLP
- Retained as an expert on behalf of Alarm.com, Inc.
- Case has been settled

HL Holdings, Inc. v. LNHL, LLC, et al.
July 2023 – Dec. 2023

- Legal Firm: Nelson, Mullins, Riley and Scarborough LLP
- Retained as an expert by IMS Consulting and Expert Services on behalf of LNHL, LLC and Seek Now Inc. f/k/a Ladder Now LLC.
- Provided expert opinions and a report in support of legal proceedings.
- Provided a Deposition on November 29th, 2023
- Case has been settled.

Angel Group Co. Ltd. V. Sensen Networks Group Pty Ltd
July 2023 – Oct. 2023

- Legal Firm: Norton Rose Fulbright
- Retained as an expert on behalf of Angel Group Co. Ltd.
- Provide expert opinions in support of a potential IPR proceeding.
- Case has been settled.

United Services Automobile Association v. Truist Bank
March 2023 – Oct. 2023

- Case No. 2-22-CV-00291
- Legal Firm: Cravath, Swaine and Moore, LLP
- Retained as an expert on behalf of Truist Bank.
- Performed review of six patents.
- Case was settled.

Dental Imaging Technologies Corp. (Petitioner) v. 3Shape A/S (Patent Owner)
Feb. 2023 – July 2023
US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Buchanan, Ingersoll and Rooney PC
- Retained as an expert on behalf of 3Shape A/S.
- Provided consulting services in support of POPR for IPR2023-00387 (US 11,076,146).
- Provided consulting services in support of POPR for IPR2023-00400 (US 10,695,151).
- Provided consulting services in support of POPR for IPR2023-00411 (US 11,368,667).
- PTAB decision to NOT Institute on all three IPRs.

Nike v. Valmarc
January 2023 – Present

- Legal Firm: Hilgers Graben
- Retained as an expert on behalf of Valmarc Corporation
- Provided expert opinions in support of Patent Owner Preliminary Response on petitions IPR2022-01403 & IPR2022-01404
- PTAB granted institution but client opted not to pursue defending the patents.

Sensormatic Electronics, LLC v. Genetec, Inc. et al.
Oct. 2021 – Feb. 2023
US District Court, District of Delaware, Case 1:20-cv-00760-MN

- Legal Firm: Fish & Richardson, P.C.
- Retained as an expert by IMS Expert Services on behalf of Genetec, Inc. et al. (Defendant)
- Representing Genetec (USA) Inc. and Genetec Inc. (C. A. No. 20-760)
- Provided Opening, Rebuttal and Reply reports regarding invalidity & Non-infringement with regards to US 7,307,652.
- Sat in on a deposition of Plaintiff expert (April 29th, 2022) per counsel request.
- Provided a deposition on May 3rd, 2022
- Case is completed.

Roku, Inc. v. Flexiworld Technologies, Inc.
June 2022 – October 2022
US Patent and Trademark Office, Patent Trial and Appeal Board, Case No. IPR2022-01112
US Patent and Trademark Office, Patent Trial and Appeal Board, Case No. IPR2022-001269

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Roku (Petitioner).
- Provided a declaration in June 2022 in support of the IPR petition for US 10,140,073.
- Provided a declaration in July 2022 in support of the IPR petition for US 7,944,577.
- Case was settled in October 2022.

CareView Communications, Inc. v. Interactive Digital Solutions, Inc.
Jan. 2022 – April 2022

- Legal Firm: Mintz, Levin, Cohn, Ferris, Glovsky & Popeo, P. C.
- Retained as an expert by IMS Expert Services on behalf of Interactive Digital Solutions, LLC (Defendant) to provide declarations in support of 3 IPR proceedings
- Case was settled in April 2022.

Sovereign Peak Ventures, LLC v. Hisense Co., LTD
Nov. 2021 – Dec. 2021
US District Court, Eastern District of Texas, Case No. 21-cv-00209

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Hisense Co. (Defendant).
- Working to provide a declaration in support of the IPR petition for US 8,019,169.
- Case was settled in Early 2022.

Perfect Corporation v. Lennon Image Technologies, LLC
Sept. 2021 – June 2022
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2021-00124

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by WIT Legal, LLC on behalf of Perfect Corporation (Petitioner).
- Provided a declaration in support of the IPR petition for US 6,624,843.
- Petitioner filed a motion to dismiss its petition on April 5th, 2022.

Apple Inc. v. Corephotonics, LTD
Jan. 2021 – May 2021

- Legal Firm: Russ, August & Kabat,
- Retained as an expert by WIT Legal, LLC on behalf of Corephotonics in two IPR cases.
- Provided two declarations in support of IPR Petitions IPR2020-00487 & IPR2020-00860.
- Provided a deposition on 04/14/2021.

Davis Polk
Aug. 2020 – Nov. 2021

- Legal Firm: Davis Polk
- Retained as an expert by WIT Legal, LLC
- Provided expert and consulting services for video and point cloud type imagery.

Cravath, Swaine & Moore, LLP
Feb. 2020 – Mar. 2020 and Jan. 2021

- Legal Firm: Cravath, Swaine & Moore, LLP
- Retained as an expert by WIT Legal, LLC
- Evaluated computer vision technology for various clients.
- No reports, depositions or expert testimonies were provided.

Wells Fargo & Co. v. Lighthouse Consulting Group
Feb. 2020 – Sept. 2020
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00758 and IPR2020-00759

- Legal Firm: Winston & Strawn LLP
- Retained as an expert by DOAR on behalf of Petitioner Wells Fargo.
- Submitted two declarations in support of IPR Petitions IPR2020-00758 & IPR2020-00759 for US 8,590,940 and US RE44,274.

3Shape A/S v. Align Technology, Inc.
Jan. 2020 – April 2020
US District Court, District of Delaware, Case No. 18-cv-00886 (consolidated with 18-cv-00697)

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of plaintiff for US Patents-in-Suit Nos. 9,962,244 and 9,629,551 with regards to invalidity.
- Case was transferred to Troutman Pepper LLP very shortly after my engagement.

3Shape A/S et al v. Align Technology, Inc.
Oct. 2019 – Oct. 2020
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00222 and IPR2020-00223

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of Petitioner 3Shape A/S with respect to US 7,156,661
- Provided two declarations in support of IPR petitions (IPR2020-00223 and IPR2020-0222) for US 7,156,661. Both petitions were filed in December 2019.
- Provided a deposition on July 30th, 2020 in support of IPR2020-00223 that was instituted by PTAB and supporting materials for follow on responses.

***Uniloc 2017 LLC v. Netflix, Inc.* (Petitioner) (18-cv-2055)**
July 2019 – July 2020
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2020-00044

- Legal Firm: Perkins-Coie, LLP
- Retained as an expert by DOAR on behalf of Petitioner Netflix, Inc.
- Provided an expert declaration in support of IPR2020-00044 for US 6,584,229.
- Case was settled in July 2020.

Align Technology, Inc. v. 3Shape A/S et al
Feb. 2019 – Feb. 2022
US District Court, District of Delaware, Case No. 17-cv-01646 (LPS) (CJB)

- Legal Firm: Troutman Pepper LLP
- Retained as an expert by WIT Legal, LLC on behalf of Defendant 3Shape for US Patent-in-Suit No. 9,510,757 ('757 Patent).
- Served as expert for invalidity and non-Infringement for US 9,510,757
- Provided expert reports regarding Invalidity and non-infringement of '757
- Provided a deposition on 10 January 2020
- Case was settled in February 2022.

Certain Dental and Orthodontic Scanners and Software
Feb. 2019 – Oct. 2019
US International Trade Commission, Investigation No. 337-TA-1144 (3Shape v. Align)

- Legal Firm: Pepper Hamilton, PC
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S with respect to US Patent-in-Suit No. 9,299,192 ('192 Patent).
- Served as expert on invalidity, non-infringement and domestic industry.
- Provided expert opinions and rebuttal reports in support of the above proceedings.
- Provided a deposition (8/13/2019).
- Provided trial testimony on October 30th, 2019 (Trial was held Oct. 24-30, 2019) with regards to Invalidity, Non-infringement and Domestic Industry.

3Shape A/S et al v. Align Technology, Inc.
Oct. 2018 – Sept. 2019
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2019-00132 and IPR2019-00134 and IPR2019-00148

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S with respect to US 7,112,065, US 9,451,873 and US 9,299,192
- Represented 3Shape (Petitioner) in three IPR Petitions v. Align (Patent Owner).
- Provided three declarations in support of the IPR petitions for US 7,112,065, US 9,299,192 and US 9,451,873. All three petitions were filed in November 2018 and all three were instituted.
- Provided three depositions with regards to US 7,112,065 (8/16/2019), US 9,451,873 (09/18/2019) and US 9,299,192 (09/30/2019).

Blackberry Corp. et al v. Maxell, Ltd
Sept. 2018 – Oct. 2018
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2019-00087 and IPR2019-00095 and IPR2019-00097

- Legal Firm: Oblon, McClelland, Maier and Neustadt, LLP
- Retained as an expert on behalf of petitioner Blackberry Corp.
- Provided three declarations in support of the IPR petitions for US 9,100, 604 (Joinder), US 6,765, 616 and US 7,995,897.
- Case settled in May 2019.

Exocad GmbH et al v. 3Shape A/S
March 2018 – Sept. 2019
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2018-00788

- Legal Firm: Buchanan, Ingersoll and Rooney, PC
- Retained as an expert by DOAR on behalf of 3Shape A/S in defending an IPR filings of EXOCAD (Petitioner) v. 3Shape (Patent Owner). Case No. IPR 2018-00788
- Provided a declaration in support of the Patent Owner response for US 9,336,336.
- Provided a deposition on April 1st, 2019.

Certain Intraoral Scanners and Related Hardware and Software
February 2018 – Sept. 2018
US International Trade Commission, Investigation No. 337-TA-1090 & No. 337-TA-1091 (Align v. 3Shape)

- Legal Firm: Pepper Hamilton, LLP
- Retained as an expert by DOAR on behalf of respondent 3Shape A/S.
- Provided expert opinions regarding claim construction, noninfringement, and the domestic industry analysis.
- Attended a *Markman* hearing and provided a tutorial for the technology in suit.
- Provided a Deposition on July 16, 2018.
- Provided trial testimony as an expert on Sept. 20th, 2018 with regards to Non-infringement and Domestic Industry.

Nikon Corporation et al v. ASML Netherlands BV et al
July 2017 – Nov. 2017
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2018-00227

- Legal Firm: Morrison & Foerster
- Retained as an expert on behalf of petitioner Nikon Corporation.
- Provided an expert declaration in support of IPR petition for US 7,209,167.

Raster Printing Innovations, LLC v. Hewlett-Packard Company et al
April 2016 – May 2016
US District Court, Northern District of Illinois, Case No. 15-cv-03967

- Legal Firm: Morgan, Lewis & Bockius, LLP
- Retained as an expert by IMS Expert Services on behalf of defendant Hewlett Packard.
- Contributed to the development of initial invalidity contentions charts.
- Case settled very quickly after my engagement in June 2016.

Qomo Hitevission LLC v. Pathway Innovations and Technologies, Inc.
Nov. 2015 – Jan. 2016
US Patent and Trademark Office, Patent Trial and Appeal Board, IPR2016-00661

- Legal Firm: Mei & Mark, LLP
- Retained as an expert on behalf of petitioner Qomo Hitevission.
- Provided an expert declaration in support of petition for inter partes review.

Sony Corp of America. v. Image Processing Technologies, LLC
Aug. 2014 – Nov. 2014
US Patent and Trademark Office, Patent Trial and Appeal Board

- Legal Firm: Lerner, David, Littenberg, Krumholz & Mentlik LLP
- Retained as an expert on behalf of Sony.
- Provided an expert declaration in support of petition to institute inter partes review of US Patent No. 6,959,293.

Image Processing Technologies, LLC v. Canon Inc. et al
June 2011 – Dec. 2012
Case: US District Court, Eastern District of New York, Case No. 10-cv-03867

- Legal Firm: Fitzpatrick, Cella, Harper & Scinto
- Retained as an expert on behalf of defendant Canon Inc.
- Traveled to Japan twice to meet with Canon Technical & Engineering Teams
- Provided reports related to Invalidity, Non-Infringement, Rebuttals, and summary judgement.
- Provided a Deposition in April 2012.