

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DISH NETWORK LLC, DISH NETWORK SERVICE LLC, DISH NETWORK
CORPORATION, AND DISH NETWORK CALIFORNIA SERVICE
CORPORATION,

Petitioner,

v.

ENTROPIC COMMUNICATIONS, LLC,

Patent Owner.

CASE: IPR2024-00393

U.S. PATENT NO. 7,295,518

Declaration of Mr. Albert Garrett (Ex. 2002)

TABLE OF CONTENTS

I.	Qualifications and Background Information.....	6
II.	Legal Standards	9
A.	Claims	9
B.	Specification.....	10
C.	Prosecution History.....	10
D.	Preponderance of the Evidence.....	11
E.	Anticipation.....	11
F.	Obviousness	13
i.	Reasonable Expectation of Success.....	13
ii.	Motivation to Combine.....	14
iii.	Hindsight.....	16
iv.	Analogous Art.....	17
III.	Level of Ordinary Skill in the Art	18
IV.	Summary of the '518 Patent.....	20
V.	Summary of Opinions	27
VI.	Opinions	28
A.	Isaksson is not from the same field of endeavor as the '518 Patent.....	28
B.	Isaksson is not reasonably pertinent to the problems that the '518 Patent addresses	36
VII.	GROUND 2.....	41
A.	Dr. Williams' "RF challenges" would not have motivated a	

POSITA to combine Amit and Jacobsen	42
i. Amit solves reflections within its network.....	43
ii. Jacobsen’s multi-carrier modulation would not solve Amit’s hidden node problem	44
iii. Amit’s “high reflection” is not a problem that needs to be solved	46
B. Jacobsen’s multi-carrier modulation contradicts Amit’s goals	47
i. Amit’s goal is to provide a simple, cost-effect home network.....	48
ii. Jacobsen’s multi-carrier modulation contradicts Amit’s goal	51
C. A POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson.....	53
i. A POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson	54
A. Isaksson’s base sync frames would not function on Amit’s shared medium.....	54
B. Isaksson does not extend to coaxial cables ...	56
ii. Jacobsen already provides synchronized bit-loading	61
VIII. GROUND 1	64
A. Kliger already identifies and solves each issue that Dr. Williams uses as a motivation to combine.....	65
i. Kliger identifies and solves reflections at the splitter	66
ii. Kliger addresses its dynamic network conditions	68
iii. Kliger identifies and solves signal impairments.....	70
B. Isaksson’s base sync frames would not be used on Kliger’s network	72

i.	Isaksson’s base sync frames would not determine channel characteristics on Kliger’s network	73
A.	Isaksson’s base sync frames are not designed to function on a Kliger’s shared medium.....	74
B.	Isaksson’s base sync frames are not designed to function over an intermediary device.....	75
ii.	Isaksson’s base sync frames would alter the operation of Kliger	78
IX.	Reservation of Rights	80

I, Albert Garrett, declare as follows:

1. I am over eighteen years of age, and I am competent to testify regarding the matters set forth in this declaration if called upon to do so.

2. I have been retained in this matter on behalf of the Patent Owner, Entropic Communications, LLC (“Entropic”).

3. I submit this declaration at the request of K&L Gates, counsel for Patent Owner in this proceeding.

4. I have been asked to provide an opinion in response to DISH Network L.L.C., Dish Network Service L.L.C., DISH Network Corporation, and Dish Network California Service Corporation (collectively, “Petitioner”) and its expert, Dr. Williams, papers in this proceeding regarding whether the Petition and Dr. Williams have establish whether claims 1 and 3 of U.S. Patent No. 7,295,518 (“the ’518 patent”) are unpatentable under the United States Patent and Trademark Office’s inter partes review standard of a preponderance of the evidence.

5. In the preparation of this declaration, I have analyzed the ’518 Patent (Ex. 1001), its file history (Ex. 1002), the Declaration of Declaration of Tim A. Williams (Ex. 1004), four prior art references: Kliger (Ex. 1007), Isaksson (Ex. 1013), Amit (Ex. 1014), and Jacobsen (Ex. 1016). I also have considered the other documents or references cited in this declaration.

6. In forming the opinions expressed below, I have considered the documents listed above, the relevant legal standards as provided to me by counsel, and my own knowledge and experience.

7. I understand Dr. Williams has already provided his opinions in Ex. 1004; however, if he is permitted to offer additional opinions, I reserve my right to respond to those should I be asked.

I. Qualifications and Background Information

8. A summary of my experience, qualifications, and current employment are included in my CV, which is attached as Appendix A. The following is a brief summary of my relevant qualifications and professional experience.

9. I received a Bachelor of Science in Electrical Engineering from Auburn University in 1996. Subsequently, I received a Master of Science in Electrical Engineering from Clemson University in 1998, where I studied wireless digital communication. Course work focused on communication systems, mathematics, and probability and information theory. We developed a top-down understanding of systems to have detailed knowledge of performance limits, system parameters, and their implication on underlying statistics and their performances. System limits such as Shannon's Capacity theorem, which states that the maximum rate in bits per second at which information can be reliably relayed on a channel is proportional to the channel bandwidth and the log of the signal-to-noise ratio. The study further

included reviews and discussion of various error correction codes and their decoding methods. Probability studies found their application in understanding characteristics of various channels of communication, such as additive white Gaussian noise (AWGN), multipath models, and noise models. These concepts were often married into systems of spread-spectrum technology as was the typical application at the time for communication that was designed for secrecy and or to address specular multipath environments. As such, we often applied the concepts of code-division multiple-access (“CDMA”) to communication systems. Many of these concepts were integrated into my thesis work, which studied the packet error rate performance of a system where optimum performance is achieved by conjoint optimization of acquisition and payload decoding in a Direct Sequence Spread Spectrum system. My thesis work was titled “Multipath Acquisition for Rake Reception in DS Packet-Radio systems.”

10. After earning my Master of Science, I joined Harris Communications as a staff engineer for the research and development department. Afterwards, I joined Intersil, where I designed and implemented receiver algorithms for 802.11b/g/a/n (also known as Wi-Fi). My work focused on radio impairment compensation algorithms, acquisition algorithms, and tracking algorithms. As a system engineer at Intersil, I was responsible for building system budgets for attenuation, frequency offset and jitter, dynamic range of mixed-signal components.

11. After eight years of working in Wi-Fi and being promoted to Director of Communication Systems, I began to work in the field of in-home networks and MoCA. My experience spans both large corporations and start-ups, including Conexant, Cisco, and ComplexIQ. My responsibilities included system specification and design, algorithm design, bit-true simulation in C/C++, laboratory verification, and interoperability.

12. As a Principal Engineer and Co-Founder of Complex IQ, I advised executive management in corporate strategy, new product research and development, technical marketing, customer interaction, and engineering management. Complex IQ served as a resource to companies, such as Verizon, Comcast, Cox, Intel, and Cisco through contributing to the Board of MoCA, chairing MoCA Certification Working Group, and contributing to MoCA Specification Working Group for 10Gbps standard. In this work, I represented a third semiconductor/algorithm designer in critical conversations to help navigate proposed system solutions for 1gbps, 2.5gbps, 5gbps and 10gbps proposals. These conversations enabled Service Providers to ascertain the reasonableness of various proposals in addition to assessing the service providers wishes and demands for the technologies.

13. I am being compensated for my work associated with this case at an hourly rate plus reimbursement of reasonable expenses. My compensation is not

contingent on my opinions or the outcome of the case, and I have no other interest in this case or the parties thereto.

II. Legal Standards

14. Although I am not a lawyer, I have been advised on the relevant legal principles by Entropic's counsel and have used them as a basis for my opinions.

A. Claims

15. I have also been informed and understand that terms in the patent claims must be read as they would have been understood by a "person of ordinary skill in the art" ("POSITA") at the time of the claimed invention.

16. I understand that a POSITA is a person to which the claimed subject matter pertains with the capability of understanding the scientific and engineering principles applicable to the pertinent art. I understand that the following factors may be considered in determining the level of ordinary skill: the type of problems encountered in the art; prior art solutions to those problems; the speed with which innovations are made; the sophistication of the technology; and the educational level of active workers in the field. I also understand that not every factor may be present and that one or more factors may predominate.

17. I understand that the claims within a patent set forth what the inventors have presented as their inventions. I understand that claims can be independent or

in dependent form, meaning that they depend from the identified independent claims and add requirements to those claims.

B. Specification

18. I understand that there are other parts of a patent, including the abstract, the figures of a patent, the background of the invention, the summary of the invention, and the detailed description of the invention. I understand that these portions often are collectively referred to as the “specification” of a patent. I understand that technically, the claims are part of the specification, but that referring to the “specification” typically means referring to the written description of the inventions rather than the claims. I understand that the specification informs the understanding of the claims by, for example, describing the claimed invention and providing preferred examples of the claimed invention.

19. I have also been informed and understand that terms of a claim should be understood in the context of the claim as a whole. I also understand that the specification of the patent is relevant to the meaning of a claim term. I further understand that the claims must be read in light of the specification.

C. Prosecution History

20. I understand that the correspondence back and forth between the representative of the applicant, and the U.S. Patent and Trademark Office, leading up to the issuance of a patent is called the “file history” or “prosecution history.” It

has been explained to me that, in the process of obtaining a claim of a patent, the inventors and the examiner may make statements explaining their understanding of the scope of their claimed invention. It has also been explained to me that for a statement by the inventors to narrow the scope of a claimed invention, the statement must clearly and unambiguously limit the scope of an invention. I understand this is called “prosecution disclaimer” or “prosecution disavowal.” I understand that the claim language, specification, and file history are referred to as “intrinsic evidence” or “the intrinsic record.”

D. Preponderance of the Evidence

21. I understand that, unlike at the district court, patents subject to inter partes review, such as this proceeding, are not presumed to be valid, such that a lower burden of proof is used to judge the patentability of challenged claims. Unlike the district court’s “clear and convincing” burden, here a “preponderance of the evidence” burden exists.

E. Anticipation

22. I understand that a patent claim is invalid as “anticipated” by a single “prior art” reference if the reference discloses every single element of the claim with sufficient precision and detail to establish that the subject matter of the claim existed in the prior art. In particular, I understand that it is not sufficient to establish that all of the elements are collectively disclosed within the four corners of a particular

document. Instead, the operative question is whether a person of ordinary skill would have understood the elements as being arranged as in the claim itself. I also understand that a prior art reference cannot “anticipate” a patent claim unless that reference enables one of ordinary skill in the art to make and use what is disclosed without undue experimentation. Thus, if the reference does not enable one of ordinary skill to make or use each and every claim limitation, then the claim cannot be “anticipated” by the reference.¹

23. I understand that a prior art reference can disclose a given claim element actually or inherently.

24. In the case of actual disclosure, I understand that a person of ordinary skill would need to have understood that the disclosure corresponds to the claim element in question. I also understand that such disclosure may be implicit rather than explicit. For example, prior art need not use the same words as the claimed invention. However, I understand that ambiguous references do not anticipate.

25. In the case of alleged “inherent” anticipation, I understand that the claim element in question must necessarily be present when practicing the described

¹ I understand that the Petition and Dr. Williams are not advancing any anticipation-based theories of unpatentability.

technology even though the prior art reference itself contains no express description of the element in question. In particular, I understand that “possibilities or probabilities” are not sufficient to establish inherency. The mere fact that a certain thing may result from a given set of circumstances is not sufficient. Instead, the essence of inherency is that one of ordinary skill in the art would recognize that a reference unavoidably teaches the property in question.

F. Obviousness

26. I understand that a patent claim may describe an invention that was new (i.e., not anticipated by any prior art reference), but nevertheless be invalid for “obviousness” if the differences between the patented subject matter and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time of the invention was made.²

i. Reasonable Expectation of Success

27. I understand that an invention is not rendered obvious simply on the basis of two or more different disclosures that collectively disclose all of the claimed elements. In other words, an invention is not obvious just because all of the elements that comprise the invention may have been known in the prior art. Instead, a person

² I understand that the Petition and Dr. Williams are advancing two “obviousness” theories, one in Ground 1 and one in Ground 2.

of ordinary skill in the art must have had a reasonable expectation of success in pursuing the possibility that turns out to succeed and is claimed. In particular, I understand that knowledge of a goal does not itself render achievement of that goal obvious.

28. I also understand that determining whether or not a claimed invention would have been obvious requires assessing facts related to (1) the scope and content of the prior art, (2) the differences between the prior art and the claimed invention, (3) the level of ordinary skill in the art, and (4) any objective evidence (“secondary considerations”) of non-obviousness. I understand that this is known as consideration of the “Graham Factors.”

ii. Motivation to Combine

29. I further understand that an invention is not obvious just by demonstrating that each of its elements was, independently, known in the prior art. To prove that an invention is obvious, I understand that it can be important to point to a reason or reasons, such as a teaching, suggestion, or motivation, that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed invention does. I understand that this is because inventions in most (if not all) instances rely upon building blocks already known, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known, therefore it can be important to point to such a reason or reasons. I

understand that in identifying such a reason, the analysis need not require precise teachings in the prior art directed to the specific subject matter of the challenged claim.

30. I understand that it will often be necessary for a court to look to interrelated teachings of multiple patents and the background knowledge possessed by a person having ordinary skill in the art in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. I understand that any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed. I understand that when a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, either in the same field or a different one. I understand that the combination of familiar elements according to known methods may be obvious when it does no more than yield predictable results.

31. I also understand that a claim is not invalid as obvious if it is more than the predictable use of prior art elements according to their established functions.

32. Further, I understand that while predictability is a touchstone of obviousness, the concept of a “predictable result” under the law refers not only to the expectation that prior art elements are capable of being physically combined, but also that the combination would have worked for its intended purpose.

33. I also understand that if the prior art “teaches away” from combining known elements in the manner claimed by the invention at issue, discovering a successful way to combine them is less likely to be obvious. In particular, I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant, or would understand based on the reference that the line of development flowing from the reference’s disclosure is unlikely to be productive of the result sought by the applicant. Likewise, I understand that similar subject matter may not be sufficient motivation for a person of skill in the art to combine references if the references have conflicting elements.

34. Further, I understand that even if a reference does not necessarily “teach away,” the reference’s statements regarding preferences are relevant to a finding regarding whether a person of ordinary skill would have had reason to combine that reference with another reference

iii. Hindsight

35. I also understand that one must be cautious and resist the temptation to rely on hindsight reasoning when attempting to combine references to suggest that a claim may be obvious. It is important to analyze validity based on the perspective of one of skilled in the art at the time of the invention, which for this case I have

been asked to assume is August 30, 2001, and which I understand is the date Dr. Williams and the Petition use as the priority date of the '518 Patent. I understand that objective indicia (or “secondary considerations”) of non-obviousness or obviousness may be particularly probative and helpful in avoiding hindsight. I am not analyzing any secondary considerations as part of this declaration.

iv. Analogous Art

36. I understand that to be eligible as prior art in an obviousness analysis, the reference must be analogous art to the challenged patent. I also understand that it is Petitioner’s burden to prove that their references are analogous art to the challenged patent (i.e., the '518 Patent). I understand that to determine whether a reference is analogous art to the '518 Patent, a two-part test is applied: (1) if the reference is from the same field of endeavor as the challenged patent, the reference is analogous art, and (2) if the reference is reasonably pertinent to the particular problem with which the inventor of the challenged patent is involved, the reference is analogous art. If either of (1) or (2) is satisfied, the reference is considered analogous art. I understand that to determine the field of endeavor, courts have looked to the specifications of the patent and the alleged prior art reference and particularly to the “Background of Invention” and/or “Field of the Invention” sections.¶¶

III. Level of Ordinary Skill in the Art

37. In my opinion, a person of ordinary skill in the art (“POSITA”) with respect to the ’518 Patent would have had at least a bachelor’s degree in electrical engineering, computer engineering, or an equivalent field with at least two years of experience with coaxial cables. I based my opinion on the disclosure of the ’518 Patent, including the title, the abstract, and the specification.

38. The ’518 Patent is titled, “Broadband network for coaxial cable using multi-carrier modulation.” Ex. 1001 (’518 Patent), Cover. The Abstract aligns with the title and describes a “broadband local area data network uses coaxial cable wiring for interconnection of terminal devices.” Ex. 1001 (’518 Patent), Abstract. Further, the ’518 Patent defines the technical field as related to coaxial cables: “[t]his invention relates to broadband communication networks and *specifically* to communications using coaxial cable building wiring.”). Ex. 1001 (’518 Patent), 1:27-29. The summary of the invention also specifies coaxial cables because it states that the “present invention uses a form of multi-carrier modulation, orthogonal frequency division multiplex (OFDM), to transmit digital data signals through the coaxial cable wiring installed in homes.” Ex. 1001 (’518 Patent), 4:36-40. Finally, the detailed description and claims also concern coaxial cabling. Ex. 1001 (’518 Patent), 5:14-16 (“FIG. 3 shows a representative frequency allocation between network services and other services on a coaxial wiring system, including the use by

two different networks.”), Fig. 3, claim 1 (reciting “cable wiring comprising a splitter with a common port and a plurality of tap ports, and a plurality of segments of coaxial cable connecting between the splitter tap ports and the network devices).

39. My analysis and opinions below are given from the perspective of a POSITA in this technological field in the relevant time frame, unless stated otherwise.

40. I satisfied the definition of a POSITA before the filing date of the application leading to the '518 Patent. I now consider myself an expert in the relevant field of technology for the '518 Patent.

41. In forming my opinions for this declaration, I have used the perspective of one of ordinary skill in the art as defined above. My opinions, however, would not be affected if a POSITA is defined as someone who has slightly more or slightly less experience than described above.

42. For example, I understand that Dr. Williams opines that a POSITA would be an individual with a degree in electrical engineering, computer engineering, or a related field and experience working in signal processing and/or communication systems/networks. I understand that Dr. Williams has further opined that a person with additional education but less professional experience, and vice versa, may qualify as a POSITA. For instance, he believes a POSITA would also

include someone with a bachelor's and three or more years of experience or someone with a master's degree in electrical engineering and 1 year experience.

43. While I agree that more education experience could be substituted for less professional experience, I disagree that a POSITA would not need at least a year of coaxial-specific experience, experience I obtained through my work with the MoCA standard. MoCA specific experience is not necessary, but it is my opinion that coaxial work-experience is.

IV. Summary of the '518 Patent

44. The '518 Patent provides a broadband local area network using existing coaxial cable wiring for device communication. Ex. 1001 ('518 Patent), Abstract. To optimize communication, the '518 Patent transmits probe messages from one device to another. Ex. 1001 ('518 Patent), Abstract. The probe messages characterize and determine optimum multi-carrier bit loading for each channel of the coaxial local area data network. Ex. 1001 ('518 Patent), Abstract.

45. Figure 1 shows a traditional on-premises coaxial signal distribution plan, which includes signal splitters and network devices. Ex. 1001 ('518 Patent), 5:10-11 ("FIG. 1 is a diagram showing a prior art coaxial signal distribution plan."). The signal splitters distribute downstream signals from the point-of-entry to the network devices. Ex. 1001 ('518 Patent), 1:40-45 ("Signal splitters are used to distribute downstream signals from the point of entry (POE) to the various terminals

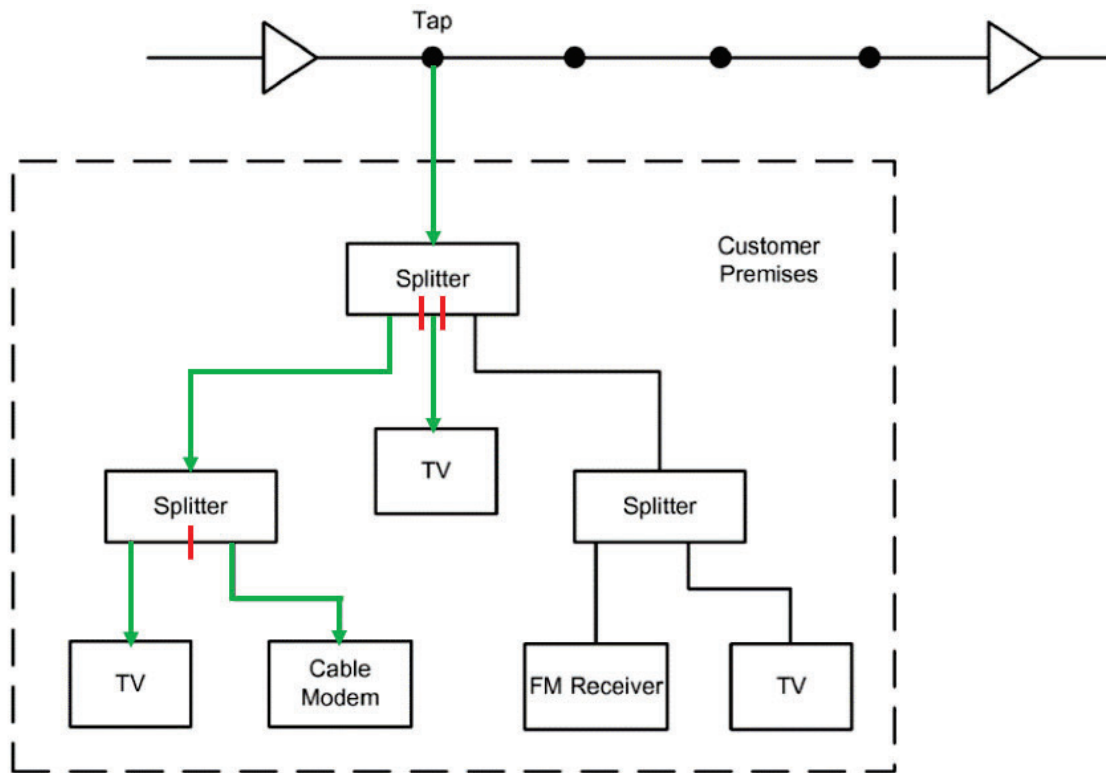
in the home.”), Fig. 1 (annotated below). A signal splitter (“splitter”) receives a signal at the input port and splits the power equally between two output ports. Ex. 1001 (’518 Patent), 1:53-56 (“Signal splitters are commonly used in home and other building type coaxial cable wiring. They have an input port and multiple output ports.”), 61-65 (“A typical two-way splitter splits the power equally between the two output ports if each port is terminated equally.”).

46. Splitters can also include a power-dividing ratio to divide the signal unequally between the two tap ports. Ex. 1001 (’518 Patent), 2:17-27 (“Splitters can be designed with power dividing ratios that are not equal.”). These splitters can balance signal power between terminal devices when the coaxial cable wiring includes multiple levels of splitters. Ex. 1001 (’518 Patent), 2:20-27 (“This type of splitter could be used to balance signal power at all terminal devices when there are multiple levels of signal splitters. A branch that terminates directly to a terminal device would be connected to a higher loss tap port.”). Splitters are typically bi-directional, and thus can also function as signal combiners. Ex. 1001 (’518 Patent), 2:5-10 (“Splitters are generally bi-directional; they can also function as signal combiners, which sum the power from multiple ports into a single output.”). When combining signals, the tap ports become input ports and the common port becomes an output port. Ex. 1001 (’518 Patent), 2:5-10 (“Splitters are generally bi-directional; they can also function as signal combiners, which sum the power from

multiple ports into a single output.”). As a result, the splitter provides a return path for terminal devices to transmit signals back to the cable head end. Ex. 1001 (’518 Patent), 2:11-16 (“The N-way splitter also combines the signals from each room, providing a return path for devices such as cable modems to transmit back to the cable head-end.”). While splitters are required for the network to function, they can also present obstacles for device-to-device communication. Ex. 1001 (’518 Patent), 2:35-38 (“In a conventional cable TV or cable modem use, this isolation is desirable because terminal devices do not communicate with each other, they only communicate through the POE with the cable head-end.”).

47. First, a splitter’s tap ports are isolated from each other, which causes signal attenuation when devices communicate through the tap ports. Ex. 1001 (’518 Patent), 2:27-34 (“Another characteristic of interest in signal splitters is the isolation between output ports.”); Fig. 1 (annotated below). While this inter-port isolation may be desirable in a conventional cable TV configuration where devices did not communicate over the splitters, the ’518 Patent requires devices to communicate with over tap ports. Ex. 1001 (’518 Patent), 2:28-41 (“In a LAN system, terminal devices must communicate directly with each other, therefore attenuation between tap ports in the signal splitters results in an undesirable signal loss.”). Thus, signal loss caused by this isolation is an undesirable byproduct of the existing design. Ex. 1001 (’518 Patent), 2:28-41 (“In a LAN system, terminal devices must communicate

directly with each other, therefore attenuation between tap ports in the signal splitters results in an undesirable signal loss.”).



Ex. 1001, Fig. 1 (annotated) (illustrating a traditional channel path of signal distribution (green) and isolated channel path between devices (red)).

48. Second, on-premises broadband coaxial networks provide different signal paths, leading to variable signal attenuation. Ex. 1001 ('518 Patent), 2:41-48 (“Presenting a further problem to terminal to terminal communications is the variation in attenuation in different branches of the building wiring.”). In other words, the signal path between each terminal device is unique, which results in varying levels of signal loss based on a varied number of splitters/combiners, various connected and nearby devices, and channel length. Ex. 1001 ('518 Patent), 2:41-48.

Signal loss may be overcome by replacing the main splitter at a building point-of-entry with a symmetric splitter/combiner, but a bi-directional power amplifier would have to be installed to boost the signal, and power (which is generally not available at the main splitter) would have to be provided to the amplifier. Ex. 1001 ('518 Patent), 2:54-3:1 ("Another approach to overcoming the splitter inter-port isolation is to replace the main splitter at the building POE with a symmetric power splitter/combiner."); 3:1-4 ("Another disadvantage of this approach is that power must be available for the amplifier, which is not generally present in the area a typical main splitter is located.").

49. Third, imperfect connection points create micro reflections, which may combine with the dominant main signal to produce a multipath signal. Ex. 1001 ('518 Patent), 3:5-10 ("Imperfect terminations at connections create micro reflections within the cable wiring."), 5:26 ("FIG. 8 shows a multipath signal created by a splitter."), Fig. 8. Multipath signals can create inter-symbol interference ("ISI"). Ex. 1001 ('518 Patent), 3:7-10 ("A reflection anywhere in the wiring produces a multipath signal in some or all wiring branches that creates inter-symbol interference (ISI)."). ISI is undesirable because it degrades the bit error rate ("BER") performance of a channel and impairs the ability to achieve high data rates. Ex. 1001 ('518 Patent), 3:15-16 ("ISI will degrade the bit error rate (BER) performance of the

communication channel.”), 4:23-25 (“The multipath environment impairs the ability to achieve high data rates in a communication network.”).

50. The '518 Patent communication network addresses each of these impairments to on-premises broadband networks over coaxial cable. Ex. 1001 ('518 Patent), 4:36-47 (“The present invention uses a form of multi-carrier modulation, orthogonal frequency division multiplex (OFDM), to transmit digital data signals through the coaxial cable wiring installed in homes.”). To address these impairments, the '518 Patent uses variable multi-carrier modulation over its coaxial network, which optimizes the network using probe messages to gather information regarding each signal path. Ex. 1001 ('518 Patent), 4:36-62 (“Based on the estimate of the channel, bit loading is applied to increase the modulation order at carriers with high signal to noise ratio and lower the modulation order at carriers with low signal to noise ratio.”). This information is then used to select the bit loading scheme for multi-carrier modulation. Ex. 1001 ('518 Patent), 4:36-62 (“Based on the estimate of the channel, bit loading is applied to increase the modulation order at carriers with high signal to noise ratio and lower the modulation order at carriers with low signal to noise ratio.”).

51. The channel probe messages, can be formed using a predetermined bit sequence and length, are transmitted between terminal devices to estimate channel characteristics. Ex. 1001 ('518 Patent), 4:48-52 (“Channel probing messages

formed using a predetermined bit sequence and length are transmitted between network devices to estimate the channel characteristics, including the multipath characteristics and a profile of the signal to noise ratio over the frequency band of interest.”). These channel characteristics can include (1) multipath characteristics and (2) the signal-to-noise (“SNR”) profile over the frequency band of interest. Ex. 1001 (’518 Patent), 4:48-52 (“Channel probing messages formed using a predetermined bit sequence and length are transmitted between network devices to estimate the channel characteristics, including the multipath characteristics and a profile of the signal to noise ratio over the frequency band of interest.”). The channel probe message is then analyzed by the receiving device to determine the channel impairment at each carrier frequency. Ex. 1001 (’518 Patent), 4:57-59 (“The receiving device processes the probe messages as received and determines the impairment present at each carrier frequency.”). Based on this channel estimation, the bit loading scheme can be adjusted to increase or decrease the modulation order corresponding to the determined SNR. Ex. 1001 (’518 Patent), 4:59-62 (“Based on the estimate of the channel, bit loading is applied to increase the modulation order at carriers with high signal to noise ratio and lower the modulation order at carriers with low signal to noise ratio.”).

V. Summary of Opinions

52. It is my opinion that Isaksson is not from the same field of endeavor as the '518 Patent. *See* ¶¶ 56-69. I agree with Dr. Williams that the '518 Patent's field of endeavor is "wired networking systems using coaxial cables." *See* ¶¶ 56-58; Ex. 1004 (Williams Declaration) ¶ 184 ("[E]ach of Amit, Isaksson, and Jacobsen are in the same field of endeavor as the '518 patent (i.e., wired networking systems using coaxial cables)."). It is my opinion that Isaksson is specific to twisted pair and thus its field of endeavor is not "wired networking systems using coaxial cables." *See* ¶¶ 59-69.

53. It is my opinion that Isaksson is not reasonably pertinent to the particular problem at issue in the '518 patent. *See* ¶¶ 70-79. A POSITA would have understood that the '518 Patent solves the problem of impairments that restricted high bandwidth communication between devices in a mesh network over existing on-premises coaxial cabling. *See* ¶¶ 70-73. Isaksson seeks to address the highly variable and non-stationary environment of a terrestrial, twisted-pair, point-to-point network. *See* ¶¶ 73-79.

54. It is my opinion that a POSITA would not have been motivated to combine Amit, Jacobsen, and Isaksson. *See*, ¶¶ 80-123. **First**, a POSITA would not have been motivated to combine Amit and Jacobsen in view of any "issue" that Dr. Williams identifies as a motivation to combine Amit and Jacobsen. *See*, ¶¶ 82-94.

Second, a POSITA would not have been motivated to combine Amit and Jacobsen because Jacobsen’s multi-carrier modulation contradicts Amit’s clear goals of providing a simple, cost-effective home network. *See*, ¶¶ 95-102. **Third**, a POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson because a POSITA would not have looked to Isaksson’s fundamentally different full duplex point-to-point system having a dedicated control channel. *See*, ¶¶ 103-123.

55. It is my opinion that a POSITA would not have been motivated to combine Kliger and Isaksson. *See*, ¶¶ 124 -157. **First**, Kliger already identifies and solves each “issue” that Dr. Williams uses to support a motivation to combine. *See*, ¶¶ 126-142. **Second**, a POSITA would have understood that Isaksson’s base sync frames would not function on Kliger’s network. *See*, ¶¶ 143-157. For at least these reasons, a POSITA would not have been motivated to combine Kliger and Isaksson.

VI. Opinions

A. Isaksson is not from the same field of endeavor as the ’518 Patent

56. I agree with Dr. Williams that the ’518 Patent’s field of endeavor is “wired networking systems using coaxial cables.” Ex. 1004 (Williams Declaration), ¶ 184 (“**First**, each of Amit, Isaksson, and Jacobsen are in the same field of endeavor as the ’518 patent (i.e., wired networking systems using coaxial cables).”). I understand the “field of endeavor” to be relevant to whether a reference can be used in an obviousness combination. I further understand that the “field of endeavor” is

the field to which the reference (prior art or patent) is directed to. This field of endeavor is supported by the background of invention, the field of the invention, and the claims and title of the '518 Patent, which I understand are appropriate places to look to ascertain the field of endeavor of a reference or patent. *See*, ¶ 37.

57. First, the '518 Patent is titled, “Broadband network for coaxial cable using multi-carrier modulation.” Ex. 1001 ('518 Patent), Cover. Second, the abstract describes a wired networking system over coaxial cabling. Ex. 1001 ('518 Patent), Abstract. (“A broadband local area data network uses coaxial cable wiring for interconnection of terminal devices.”). Third, the “technical field” of the '518 Patent states that this “invention relates to broadband communication networks and specifically to communications using coaxial cable building wiring.” Ex. 1001 ('518 Patent), 1:27-29 (“This invention relates to broadband communication networks and specifically to communications using coaxial cable building wiring.”). Fourth, the background focuses on coaxial networks and the issues present in such networks. *See* Ex. 1001 ('518 Patent), 1:33-4:33. The '518 Patent’s background also distinguishes between on-premises networks with out-of-home systems. *See* Ex. 1001 ('518 Patent), 1:33-4:33. Fifth, the claims require a data network implemented over coaxial cables. *See* Ex. 1001 ('518 Patent), claim 1.

58. In addition to this evidence, a POSITA would have recognized the '518 Patent’s field of endeavor as “wired networking systems using coaxial cables” based

on the references to coaxial cabling. Ex. 1001 ('518 Patent), 4:37-40 (“The present invention uses a form of multi-carrier modulation, orthogonal frequency division multiplex (OFDM), to transmit digital data signals **through the coaxial cable wiring** installed in homes.”), 6:29-32 (“**In a coaxial cable environment** signal-to-noise ratio (SNR) is generally high. To be useful the SNR is preferably in the range of 8 to greater than 30 dB.”), 5:14-16 (“FIG. 3 shows a representative frequency allocation between network services and other services **on a coaxial wiring system**, including the use by two different networks.”), Claim 3 (“A network device for communicating data to other network devices over **a coaxial wiring system ...**”).

59. It is my opinion that Isaksson’s field of endeavor is not “wired networking systems using coaxial cables.” Of the 125-pages that make up Isaksson, “coaxial” is mentioned once as background information of a different specification only. Ex. 1013 (Isaksson), 3:13-15 (“[T]he DAVIC specification reverses this order to enable premises distribution of VDSL signals over coaxial cable systems.”). Unlike the field of endeavor of the '518 Patent, Isaksson’s field of endeavor is multi-carrier signaling over **twisted pair**.

60. Isaksson provides a system for “synchronizing the updating of parameters relating to bit-loading” on a two-node, point-to-point, full-duplex, twisted pair network. Ex. 1013 (Isaksson), 1:3-7. Isaksson repeatedly asserts that its system is specific to twisted pair while naming its system: Multi-carrier System

for the Installed Copper network (“MUSIC”). Ex. 1013 (Isaksson), 26:8-13 (“MUSIC is intended to provide high-speed communication *on telephone copper wire pairs* for supporting broadband multimedia services.”), 24:14-19 (“The MUSIC system, described in this, and the cross referenced patent specifications ... offers a cost-effective robust customer implementation in silicon, providing 26:2 or 13:2 Mbps asymmetric **transmission over copper cables** (<1300 metres) for use on existing local telephony networks.”), 25:28-31 (“This is illustrated in Figure 2, which shows two transceivers each of which has a receiver, Rx, and a transmitter, Tx, **connected to a twisted copper pair.**”), 34:24-29 (“TA is a parameter measured during system start-up at the NU side and used for compensation of propagation delay on the copper wire. This has to be done in order to maintain the orthogonality, over the copper wire, for the sampled periods, on both the uplink and the downlink.”), 60:5-8 (“As shown in Figure 22, in a modem connection, using modems herein described, the two data paths work independently of each other on the same physical copper cable.”).

61. Dr. Williams includes a single sentence related to Isaksson’s field of endeavor but fails to appreciate the difference between the shared medium of coaxial cable and the point-to-point twisted pair system. Ex. 1004 (Williams Declaration), ¶ 184 (“**First**, each of Amit, Isaksson, and Jacobsen are in the same field of endeavor as the ’518 patent (i.e., wired networking systems using coaxial cables).”). A

POSITA would have understood that coaxial cabling and twisted pair mediums are fundamentally different mediums.

62. First, a POSITA would have understood that coaxial cabling and twisted pair have a different physical structure, resulting in different properties. Namely, coaxial cable is shielded with precisely controlled geometries at manufacturing. *See* Ex. 2006 (Signal-Integrity), 82 (“The term ‘coaxial’ refers to the fact that it has a small center conductor surrounded by a cylinder of insulating material, which is in turn surrounded by a cylindrically shaped conductor. The two conductors are coaxial (get it?) and so they make a capacitor.”). Because of this shielding, coaxial cables can support large bandwidths and high-frequency signals (e.g., 900 MHz to 6 GHz). Ex. 2007 (Coaxial-Products) (coaxial cable “is designed to carry high-frequency signals, 900 MHz to 6GHz, and to protect those signals against electromagnetic interference (EMI) from external sources.”).

63. Unlike coaxial cable, twisted pair is unshielded to save manufacturing costs. *See* Ex. 2006 (Signal-Integrity), 121 (“This is what Ethernet uses – unshielded twisted pair (UTP). This is important because, as one might guess, the unshielded cable is cheaper than shielded.”). As a result of the lack of shielding, twisted pair suffers from a loss of signal energy over distance and also lossy signal propagation. Ex. 2006 (Signal-Integrity), 107, 112-115. Twisted pair, therefore, behaves as a low-pass filter by causing higher frequency signals to be filtered out while successfully

transmitting low frequency signals. As an example, CAT5 cable has a specified passband of 100MHz over a 100m cable.

64. These constraints are shown in Isaksson. Namely, Isaksson explains that bandwidth constraints in twisted pair led to the development of various transmission schemes, including ADSL and VDSL. Ex. 1013 (Isaksson), 1:8-18 (“The demand for provision of multi-media and other bandwidth services over telecommunications networks has created a need to transmit high bit rate traffic over copper pairs. This requirement has led to the development of a number of different transmission schemes, such as, ADSL and VDSL.”).

65. Despite these efficiency improvements, bandwidth of twisted pair is still much smaller than coaxial cable. For example, Isaksson’s bandwidth is 10 MHz. Ex. 1013 (Isaksson), 26:6-8 (“In the MUSIC system, the available 10 MHz bandwidth is divided into 1024 carriers each of which is 9.77 kHz wide.”), 32:23-25 (“Using 1024 carriers over 10 MHz gives each carrier a bandwidth of 9.77 kHz.”), 83, Table 1 (listing “Cable Bandwidth” as “10 Mhz” and “Access technology” as “VDSL”). In contrast, the bandwidth of coaxial cabling can reach 900 MHz-6GHz. Ex. 2007 (Coaxial-Products), (coaxial cable “is designed to carry high-frequency signals, 900 MHz to 6GHz, and to protect those signals against electromagnetic interference (EMI) from external sources.”). Because of these bandwidth and signal integrity differences, different solutions are common on each medium. For example,

systems common on coaxial cabling leverage its excess bandwidths in a shared medium to reduce the cabling required, i.e cable TV with multiple 6MHz channels. Systems are commonly branched (sharing cables) and differentiate services by means of frequency division across many channels and end-points. Alternatively, systems operating on twisted pair medium tend to be point-to-point systems, including DSL, using dedicated wires between end-points and sharing the wire via frequency-division for upstream and downstream signaling, as the provided passband is not adequate for sharing more than two links when high bandwidth is required, as reflected in Isaksson's system.

66. In addition to bandwidth differences, coaxial cable and twisted pair have dramatically different frequencies and therefore wavelengths. Ex. 2006 (Signal-Integrity), 82 ("The term 'coaxial' refers to the fact that it has a small center conductor surrounded by a cylinder of insulating material, which is in turn surrounded by a cylindrically shaped conductor. The two conductors are coaxial (get it?) and so they make a capacitor.")). For example, a 1 MHz signal has a wavelength of roughly 300m. Lower frequencies on twisted pair have even longer wavelengths. A cable signal at (e.g., at 900 MHz) has a wavelength of 0.33m.

67. The difference in wavelength is physically significant as transmission-line effects, such as reflections, cause the frequency response of coaxial cable to be much more chaotic than telephone lines. Ex. 2006 (Signal-Integrity) 94-96, 99-101.

Signals transmitted at high frequencies over twisted pair results in higher losses and drops in signal strength while signals transmitted over coaxial cables at high frequencies are known to be chaotic, with sharp increases in attenuation at very specific frequencies. Furthermore, these transmission-line effects appear over much shorter cable lengths, such as those found inside homes, than telephone lines. Inside a home, it is clear that propagation over telephone lines is lumped, not distributed, and transmission-line effects such as reflections disappear. Based on these differences, a POSITA would have understood that twisted pair is fundamentally different from coaxial cable.

68. Besides the physical medium itself, the network topology of the '518 Patent is also fundamentally different than Isaksson's point-to-point network. For example, the '518 Patent's network is a branched topology that includes splitters that route signals from one input to multiple destinations. *See* Ex. 1001 ('518 Patent), 1:40-45 ("Signal splitters are used to distribute downstream signals from the point of entry (POE) to the various terminals in the home."), 1:53-56 ("Signal splitters are commonly used in home and other building type coaxial cable wiring. They have an input port and multiple output ports."). The '518 Patent communicates across splitter tap ports, which causes signal attenuation based on inter-tap isolation. Ex. 1001 ('518 Patent), 2:27-34 ("Another characteristic of interest in signal splitters is

the isolation between output ports. The isolation is typically between 10 dB and 40 dB. This isolation attenuates signals communicating between tap ports.”).

69. Isaksson’s system is a point-to-point network. Ex. 1013 (Isaksson), 4:21-25 (“It is an object of the present invention to provide a method, for use in a multi-carrier transmission system, of maintaining synchronism between two transceivers during dynamic system reconfiguration of bit-loading factors.”). Isaksson does not communicate across splitter tap ports and does not include the branch topology like that of the ’518 Patent. *See generally* Ex. 1013 (Isaksson). Further, Isaksson’s point-to-point network shares the telephone plant with POTS and ISDN device but does not provide communication for more than two devices. Neither does it provide a channel access method for additional devices to be added because Isaksson’s network is a single hop over twisted pair. Ex. 1013 (Isaksson), 32:14-20 (“One way is to allow POTS and ISDN systems to exist below the MUSIC frequency bands.”). In view of these fundamental differences, a POSITA would have understood that Isaksson does not share the same field of endeavor as the ’518 Patent.

B. Isaksson is not reasonably pertinent to the problems that the ’518 Patent addresses

70. Dr. Williams contends that a POSITA would have understood that Isaksson is analogous art to the ’518 Patent because “they are reasonably pertinent to the particular problem at issue in the ’518 patent.” Ex. 1004 (Williams

Declaration), ¶ 78. Dr. Williams contends that the '518 Patent and Isaksson are reasonably pertinent to the problem of “wired network signal impairment issues.” Ex. 1004 (Williams Declaration), ¶¶ 78-80. I disagree with Dr. Williams.

71. A POSITA would have understood that the '518 Patent solves the problem of impairments that restricted high bandwidth communication between devices over existing on-premises coaxial cabling. Ex. 1001 ('518 Patent), 4:36-47 (“The present invention uses a form of multi-carrier modulation, orthogonal frequency division multiplex (OFDM), to transmit digital data signals *through the coaxial cable wiring installed in homes.*”). A POSITA would have understood that the '518 Patent solves problems specific to communication between devices over **existing on-premises coaxial cabling** because the '518 Patent states that the prior art already solves impairments outside of the home. Ex. 1001 ('518 Patent), 4:28-33 (“The prior art references address communicating between a cable head end and in-home units but do not address the impairments present in the home wiring that restricts high bandwidth communication between devices within the home.”).

72. These impairments include (1) inter-port isolation from communicating across splitters, (2) variable signal attenuation caused by different channel paths, and (3) imperfect connection points at splitters, which cause micro reflections. Ex. 1001 ('518 Patent), 2:27-34 (“The signal reflections and tap port isolation of splitters existing in a typical cable TV wiring configuration presents a problem to shared

usage of the cable for a LAN system.”), 2:41-48 (“Communication is achieved through splitters and signal impairments caused by reflections and attenuation are overcome. Bit loading, along with power loading, adaptive power control, and frequency coordination can be used individually or in combination to implement a network that overcomes the problem of multipath and high attenuation in building cable wiring that would restrict the ability of terminal devices to communicate with each other.”), 3:5-16 (“Imperfect terminations at connections create micro reflections within the cable wiring.”), 4:23-25 (“The multipath environment impairs the ability to achieve high data rates in a communication network.”).

73. A POSITA would have understood that the impairments are the result of using a preexisting coaxial network for device communication. For example, coaxial networks include splitters to distribute signals downstream. Ex. 1001 (’518 Patent), 2:27-34 (“The signal reflections and tap port isolation of splitters existing in a typical cable TV wiring configuration presents a problem to shared usage of the cable for a LAN system.”). But splitter ports are isolated and include imperfect connections, leading to the inter-port isolation and reflections. Ex. 1001 (’518 Patent), 2:27-34, 3:5-16 (“A reflection anywhere in the wiring produces a multipath signal in some or all wiring branches that creates inter-symbol interference (ISI).”). Further, signal paths vary in a coaxial network based the branch topology, causing

variable signal attenuation. Ex. 1001 ('518 Patent), 2:35-48, Fig. 1. These issues are particular to components of an existing on-premises coaxial cable network.

74. A POSITA would not have viewed Isaksson as pertinent to these problems because Isaksson is not related to communication between devices over existing on-premises coaxial cabling and thus does not suffer from impairments that the '518 Patent identifies and solves. First, Isaksson does not communicate over tap ports of any splitters. Isaksson does not suffer from inter-port isolation or imperfect connection points at splitters. Second, there is no variation of cable lengths within a single network in Isaksson. Isaksson provides a point-to-point architecture that does not suffer from variable attenuation for transmissions directed to different devices in the network.

75. A POSITA would have understood that Isaksson's system does not include coaxial cables or communicate over splitters. Accordingly, a POSITA would not conclude that Isaksson is reasonably pertinent to the problems that the '518 Patent identifies and addresses.

76. A POSITA would have understood that Isaksson is directed to bit-loading techniques for any given hop in a twisted pair network, which effect the total bandwidth of a system. Ex. 1013 (Isaksson), 3:24-29. "This variation in bandwidth leads to an absolute system requirement for synchronous configuration of the transmitter and the receiver." Ex. 1013 (Isaksson), 3:29-32. Isaksson's "invention

relates to a method that, by means of a particular algorithm, ensures the synchronism of the system during configuration changes.” Ex. 1013 (Isaksson), 4:17-20 (“The present invention relates to a method that, by means of a particular algorithm, ensures the synchronism of the system during configuration changes.”). Isaksson’s synchronization problem and solution is not pertinent to the ’518 Patent’s problems or solutions.

77. Dr. Williams instead concludes that “Isaksson also addresses signal impairments on wired networks.” Ex. 1004 (Williams Declaration), ¶ 80. Dr. Williams states that Isaksson is concerned with the “need to transmit high bit rate traffic over copper pairs” and “inter pair interference in copper pair cables” as signal impairments affecting wired networks. Ex. 1004 (Williams Declaration), ¶ 80. However, Dr. Williams then concludes, without any support that “Isaksson provides solutions that address these impairments.” Ex. 1004 (Williams Declaration), ¶ 80.

78. Dr. Williams fails to cite to any disclosure in Isaksson that “address[es] these impairments” because Isaksson does not and is not concerned with these “signal impairments.” Ex. 1004 (Williams Declaration), ¶ 80. Isaksson “relates to a method that, by means of a particular algorithm, ensures the synchronism of the system during configuration changes.” Ex. 1013 (Isaksson), 4:17-20.

79. And even if Isaksson and ’518 Patent are reasonably pertinent to Dr. Williams broad problem of “wired network signal impairment issues,” a POSITA

would recognize that the signal impairments are fundamentally different between the '518 Patent and Isaksson. *See*, ¶¶ 62-67. Thus, the problem and solution of overcoming signal impairments in the '518 Patent is not reasonably pertinent to problem and solution of overcoming signal impairments in Isaksson.

VII. GROUND 2

80. Dr. Williams contends that a POSITA would have been motivated to combine Amit, Jacobsen, and Isaksson. *See, e.g.*, Ex. 1004 (Williams Declaration), ¶ 170 (“A POSITA would have been motivated to combine the teachings of Amit, Isaksson, and Jacobsen because they each deal with developing coaxial networks for digital communications and overcoming potential signal impairments that could impede that goal.”). I disagree with Dr. Williams that a POSITA would have been motivated to combine Amit, Jacobsen, and Isaksson.

81. First, a POSITA would not have been motivated to combine Amit and Jacobsen in view of any of the “issue” that Dr. Williams identifies as a motivation to combine Amit and Jacobsen. *See*, ¶¶ 82-94. Second, a POSITA would not have been motivated to combine Amit and Jacobsen because Jacobsen’s multi-carrier modulation contradicts Amit’s clear goals of providing a simple, cost-effective home network. *See*, ¶¶ 95-102. Third, a POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson because a POSITA would not have looked to Isaksson’s fundamentally different full duplex system. *See*, ¶¶ 103-123.

A. Dr. Williams’ “RF challenges” would not have motivated a POSITA to combine Amit and Jacobsen

82. Dr. Williams identifies “RF challenges” in Amit, including (1) “a problem with reflection”; (2) the “hidden nodes problem”; and (3) “high reflection.” Ex. 1004 (Williams Declaration), ¶ 165. Dr. Williams contends that a POSITA would have been motivated to combine Amit and Jacobsen to solve these “RF challenges.” Ex. 1004 (Williams Declaration), ¶ 169. Specifically, Dr. Williams contends that a POSITA would have been motivated to solve Amit’s “RF challenges” and improve Amit by using “Jacobsen’s teachings of multi-carrier modulation.” Ex. 1004 (Williams Declaration), ¶ 169.

83. I disagree with Dr. Williams. A POSITA would not have been motivated to combine Amit and Jacobsen based on any of the “RF challenges” that Dr. Williams identifies. *See*, ¶¶ 84-94. First, Amit’s “problem with reflection” would not have motivated a POSITA to combine Amit and Jacobsen because Amit already solves reflections within its network. *See*, ¶¶ 84-86. Second, Amit’s “hidden nodes problem” would not have motivated a POSITA to combine Amit and Jacobsen because Jacobsen’s multi-carrier modulation would not solve Amit’s hidden node problem. *See*, ¶¶ 87-91. Third, Amit’s “high reflection” would not have motivated a POSITA to combine Amit and Jacobsen because Amit’s network uses “high reflection” to communicate, and the “high reflection” is not an issue to be solved. *See*, ¶¶ 92-94.

i. Amit solves reflections within its network

84. Dr. Williams contends that Amit's "problem with reflection" would have motivated a POSITA to combine Amit and Jacobsen. Ex. 1004 (Williams Declaration), ¶ 173. I disagree with Dr. Williams. Amit's "reflections" would not have motivated a POSITA to combine Amit and Jacobsen because Amit already solves reflection within its network. Ex. 1014 (Amit), 20:15-43 ("Therefore this [transponder] module can be inserted in houses where there is a problem with reflection.").

85. Amit uses a transponder module to solve reflections within its network. Ex. 1014 (Amit), 20:42-43 ("Therefore this [transponder] module can be inserted in houses where there is a problem with reflection."). Amit explains that the transponder module "can be inserted in houses where there is a problem with reflection." Ex. 1014 (Amit), 20:42-43. The transponder module solves Amit's echo reflection problem by changing the frequency of upstream signals to a separate downstream frequency when transmitting the signal back to the receiving device. Ex. 1014 (Amit), 20:26-31 ("The transponder module changes the signal frequency from the US frequency to the DS frequency and transmits it to the home."). This way, a device can receive a signal with no echo. Ex. 1014 (Amit), 20:15-20 ("The two-frequency mode exists to eliminate the echo problem that exists in some of the

homes in the single frequency mode.’’), 20:26-31 (‘‘The HCNU-3 received this signal with no echo.’’).

86. A POSITA would have understood that Amit’s transponder module solves the problem with reflection. Ex. 1014 (Amit), 20:15-43. Because Amit solves the reflections within its network, a POSITA would not have been motivated to combine Amit and Jacobsen based on these reflections.

**ii. Jacobsen’s multi-carrier modulation would not solve
Amit’s hidden node problem**

87. Dr. Williams identifies Amit’s ‘‘hidden nodes problem’’ as a challenge within Amit’s network. Ex. 1004 (Williams Declaration), ¶ 165. Dr. Williams contends that Amit’s hidden nodes problem would have motivated a POSITA to combine Amit and Jacobsen. Ex. 1004 (Williams Declaration), ¶ 169. I disagree with Dr. Williams. Amit’s hidden nodes problem would not have motivated a POSITA to combine Amit and Jacobsen because Jacobsen’s multi-carrier signaling would not solve Amit’s ‘‘hidden nodes’’ problem.

88. Initially, Dr. Williams fails to explain how or why Jacobsen would fix the alleged ‘‘problem’’ of ‘‘hidden nodes’’ in Amit’s network. Ex. 1004 (Williams Declaration), ¶¶ 165-173. In other words, Dr. Williams relies on Amit’s ‘‘hidden nodes’’ as a motivation to add Jacobsen’s multi-carrier signaling (Williams Declaration, ¶ 173), but then fails to explain how multi-carrier signaling would

address a hidden node problem in the first instance. This is because a POSITA would have understood that multi-carrier signaling would not address Amit's hidden node problem.

89. “[H]idden nodes” exist “when the isolation difference between two different nodes is different than the isolation between other two nodes.” Ex. 1014 (Amit), 13:55-61. In an example, Amit states that “if there are some HCNU the attenuation between two of them might be low, and between each one of them to the 3rd might be high.” Ex. 1014 (Amit), 13:62-64. “This problem usually exist[s] in a home that contains some splitters [and] no notch filter.” Ex. 1014 (Amit), 13:59-60. Jacobsen provides no disclosure related to a “notch filter,” and Dr. Williams does not explain why a POSITA would add Jacobsen's multi-carrier modulation to address Amit's “hidden node problem,” which is specific to Amit's in-home network that does not include a notch filter. Ex. 1014 (Amit), 13:59-60 (“This problem usually exist[s] in a home that contains some splitters [and] no notch filter.”).

90. Instead, a POSITA would have understood that Jacobsen's multi-carrier modulation would not address isolation differences between nodes because Amit's isolation difference is caused by the structure of the physical network—not the type of signaling. Amit explains that its network components attenuate the signal: “The components that exists in the network (e.g. Amplifiers, splitters, and filters) supplies attenuation of the signal.” Ex. 1014 (Amit), 9:22-27. By knowing

the physical structure of the network, Amit calculates signal attenuation. Ex. 1014 (Amit), 10:21-25 (“The Attenuation/Isolation calculations can be done by adding the attenuation of each component and the attenuation of the wire in the required pass and in the required.”), Table I (listing “typical attenuation of the basic components”). To address this signal attenuation (which causes the hidden node problem), a POSITA would have increased the signal power delivered between nodes—not altered Amit’s modulation technique.

91. A POSITA would not have been motivated to add Jacobsen’s multi-carrier modulation to Amit’s in-home network to solve Amit’s hidden node problem because Jacobsen’s multi-carrier modulation would do nothing to solve Amit’s hidden node problem. Because Jacobsen’s multi-carrier modulation would not solve Amit’s hidden node problem, Amit’s hidden node problem would not have motivated a POSITA to combine Amit and Jacobsen as Dr. Williams contends.

iii. Amit’s “high reflection” is not a problem that needs to be solved

92. Dr. Williams identifies “[h]igh reflection” as “some RF challenges in designing the HomeCN components” in Amit’s network. Ex. 1004 (Williams Declaration), ¶ 165. Dr. Williams contends that the high reflection would have motivated a POSITA to combine Amit and Jacobsen. Ex. 1004 (Williams Declaration), ¶ 169. I disagree with Dr. Williams. The high reflections in Amit’s

network would not have motivated a POSITA to combine Amit and Jacobsen because the high reflection is not a challenge that needed to be solved.

93. A POSITA would have understood that Amit uses high reflection to achieve on-premises communication. Ex. 1014 (Amit), 14:1-6. Specifically, Amit explains that the “high reflection” is intentionally sought out and used in a beneficial manner in its home network. Ex. 1014 (Amit), 14:1-6 (“[T]he reflection from the notch filter is in the power of the signal or it might be higher. When this reflection is higher than the signal we can use this reflection as our main signal.”).

94. A POSITA would have understood that solving this issue would contradict Amit because Amit’s home network uses desires these “high reflection” to communicate. Without the high reflection, Amit would not function as intended. Because Amit’s high reflection is a property to be leveraged, not a problem to be solved, a POSITA would not have been motivated to combine Amit and Jacobsen based on these high reflections in Amit’s network.

B. Jacobsen’s multi-carrier modulation contradicts Amit’s goals

95. Dr. Willaims contends that a POSITA would have been motivated to “improve” Amit using Jacobsen’s multi-carrier modulation. Ex. 1004 (Williams Declaration), ¶ 169 (“Specifically, a POSITA would have been motivated to improve Amit-Isaksson’s coaxial HomeCN using Jacobsen’s teachings of multi-carrier modulation.”), ¶ 173 (“[A] POSITA would have been further motivated to use the

multi-carrier teachings of Jacobsen to modify Amit-Isaksson's HCN devices to use multi-carrier signaling.""). I disagree with Dr. Williams.

96. Initially, a POSITA would have identified Amit's goal as providing a simple, low-cost home networking solution. *See*, ¶¶ 97-98. A POSITA would not have been motivated to use Jacobsen's multi-carrier modulation on Amit's network because replacing Amit's single-carrier modulation with Jacobsen's multi-carrier modulation would frustrate Amit's goal. *See*, ¶¶ 99-102. Specifically, Jacobsen's multi-carrier modulation would (1) add unwanted complexity, (2) add hardware costs, and (3) add operational costs to Amit's network. *See*, ¶¶ 99-102. Therefore, a POSITA would not have been motivated to use Jacobsen's multi-carrier modulation over Amit's cost-effective home-networking solution.

i. Amit's goal is to provide a simple, cost-effect home network

97. A POSITA would have identified Amit's goal of providing a simple, low-cost home network because Amit states that its solution must be low cost and simple to install. *See* Ex. 1014, 2:53-55 (describing its invention as a system for "home networking over these coax cables, allowing for very high data rates and a low cost implementation."), 2:40-43 (The system allows "very high-speed digital and analog communications ... using low cost devices."), 18:33-34 (The home networking solution "[m]ust be low cost to allow the mass market to enjoy the

benefits of home networking.”), 1:67-2:3 (“The added cost of including this extra wiring is low and the benefits reaped can be great, because 100BaseT and other high-speed network types work well over this cable.”), 3:15-18 (“The present invention provides a low cost solution, which is very important to enable a solution for the mass market.”), 3:49-53 (“Parts of the device that are capable of connecting to a headend can be used for both home networking and for cable modem functionality, thus reducing the implementation cost of the home networking functionality.”), 4:1-8 (“[T]he home networking devices will be installed in various kinds of devices that employ general purpose computers (such as a laptop computer, a network computer, a TV, a DVD device, or even certain cellular phones), and use their general purpose processors to perform home networking functionality, thus reducing the implementation cost.”), 4:37-39 (“This passive filter provides a ‘single home’ operational mode that allows for low cost equipment and frequency re-use.”), 9:53-55 (“This mechanism of adding low cost filters at the entrance of a home/flat enables a single home/flat branch, and enables the Single Home operation mode.”), 10:8-9 (“The ‘branches’ method is very cost effective, and it increase the robustness of the home networking solution.”), 17:10-11 (“The present invention presents a low cost solution, which is very important to enable a solution to the mass market.”), 17:33-35 (“Since this is costly, multiple users are typically restricted to using the Internet one individual at a time.”), 19:46-48 (“Simple to install and to use. It can be low

cost to allow the mass market to enjoy the benefits of home networking.”), 21:44 (“The Bluetooth CM can be very simple, and cost effective.”).

98. A POSITA would have also understood that Amit’s design choices reflect its goal of providing a simple, low-cost home network. *See*, Ex. 1014 (Amit), 8:30-32 (“The modulation method is QPSK, QAM 16, QAM 64 or QAM 256 according to the channel conditions, and according to the equipment capabilities.”). For example, Amit installs its home networking devices in devices with general purposed computers. Ex. 1014 (Amit), 4:1-8 (“The home networking devices will be installed in various kinds of devices that employ general purpose computers ... and use their general purpose processors to perform home networking functionality, thus reducing the implementation cost of the home networking functionality.”). A POSITA would have understood that that this would save hardware costs because each of Amit’s home networking devices could use the processor of the other device thereby “reduc[ing] implementation costs.” Ex. 1014 (Amit), 4:1-8. In another example, Amit choses its modulation scheme “according to the equipment capabilities.” Ex. 1014 (Amit), 8:30-32. Amit’s home networking device use single-carrier modulation. Ex. 1014 (Amit), 8:30-37 (“[T]he home networking device ***must*** provide QPSK and QAM 16.”). With single-carrier modulation, Amit’s device would not require additional hardware required to implement multi-carrier

modulation. In view of these examples of Amit's disclosure, a POSITA would have identified Amit's goal as providing a simple, low-cost home network.

ii. Jacobsen's multi-carrier modulation contradicts

Amit's goal

99. A POSITA would not have been motivated to use Jacobsen's multi-carrier modulation on Amit's network because Jacobsen's multi-carrier modulation contradicts Amit's goals of a low-cost and low-complexity network by adding hardware costs, operational costs, and complexity to Amit's network.

100. First, implementing multi-carrier modulation would add hardware costs to Amit's network. Amit's home networking device use single-carrier modulation. Ex. 1014 (Amit), 8:30-37 ("[T]he home networking device *must* provide QPSK and QAM 16."), 15:26-28 ("Home Networking Channel. The Home Networking channel (**a single channel** that is used for sending and receiving information)."); see Ex. 1004 (Williams Declaration), ¶ 172 (A "POSITA would have understood that Amit's modulation schemes are single-carrier modulation schemes.") (citing Ex. 1014 (Amit), 15:26-28). Additional hardware would be necessary to implement multi-carrier modulation that is not currently include in Amit's devices. For example, a POSITA would have understood that each one of Amit's home networking devices would require several additional hardware components to implement multi-carrier modulation. These would include multiplexers and

demultiplexers, buffers, dedicated FFTs and inverse FFTs blocks, additional QAM constellation modulators and demodulators (1024-pt QAM), control blocks and memory for N (number of nodes) bit loading and gain-loading vectors. This additional hardware would increase the costs of each home networking device.

101. Second, implementing multi-carrier modulation would add operational costs to Amit's network through increased power consumption. To implement multi-carrier modulation, the amplifier in the transmitter would consume more power. For example, in a single-carrier QAM system a Power Amplifier designed to transmit a maximum power out of 0dBm or 1mW with a 15 dB gain would need a 1dB compression point of -16dBm input because the signal has a very low Peak to average power (0dB) [Target output power – PAPR – Gain – 1dB compression point = 3dBm]. However, to use the same amplifier in a multicarrier system such as MoCA with 512 point FFT would require the input operational point of [Target Output Power – Gain - PAPR – 1dB compression] = -28 dBm resulting in an output power of -16dBm. To achieve a 0dBm output power for the multicarrier system requires a PA capable of 16dBm output power. That implies a power consumption increase of 30 times that of a single carrier system, which further implies higher cost of implementation and operation.

102. Third, implementing multi-carrier modulation would add complexity to Amit's network. As introduced in paragraph 98, Amit uses single-carrier

modulation. Multi-carrier modulation is more complex because it would require, for example, each of Amit's devices to efficiently implement (1) an implementation of the fast Fourier transform that is sufficient to achieve required timelines, a redesign and implementation of preamble and acquisition algorithms to achieve sufficient system parameter estimation to enable reliable reception, an increase in the size of the DAC and the ADC to achieve sufficient dynamic range to accommodate the digital peak to average power (typically an additional 2 to 3 bits), implementation of RF hardware to accommodate the dynamic range, invention of compensation algorithms not required for single-carrier QAM to compensate for the RF components system errors (frequency, jitter, compression, gain and phase imbalance) to enable reliable reception of OFDM waveforms).

C. A POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson

103. Dr. Williams contends that a POSITA would have been motivated to combine Amit and Jacobsen with Isaksson. Ex. 1004 (Williams Declaration), ¶ 179. I disagree with Dr. Williams. First, a POSITA would not have looked to Isaksson's fundamentally different full duplex point-to-point twisted pair system having a dedicated control channel. *See*, ¶¶ 105-118. Second, Jacobsen already provides a synchronized bit-loading method, undermining Dr. Williams' reliance on Isaksson's synchronism as a motivation to combine Amit and Jacobsen with Isaksson. *See*, ¶¶ 119-123.

i. A POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson

104. A POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson because a POSITA would not have looked to Isaksson's fundamentally different full duplex, point-to-point, twisted pair system. *See*, ¶¶ 105-118. Instead, a POSITA would have understood that Isaksson's base sync frames would not function on the shared medium of Amit's coaxial cables. *See*, ¶¶ 105-118. A POSITA would have also understood that Isaksson does not extend to coaxial cables as a shared medium as used in Amit's network. *See*, ¶¶ 108-118.

A. Isaksson's base sync frames would not function on Amit's shared medium

105. Isaksson's base sync frames would not function on Amit's shared medium. Isaksson provides a two node, full-duplex system that utilizes multi-carrier modulation. Ex. 1013 (Isaksson), 1:27-2:1 ("Because inter pair interference in copper pair cables is higher where data is transmitted in both directions, i.e. symmetric duplex, a number of transmission schemes have proposed the use of asymmetric schemes in which high data rates are transmitted in one direction only."), 85, Table 1. Isaksson's control channel "will be a two-way connection since both the uplink transceiver and downlink transceiver contain a transmitter and a receiver." Ex. 1013 (Isaksson), 73:4-11. The control channel "is an absolute requirement." Ex. 1013 (Isaksson), 73:12-15.

106. Dr. Williams does not explain how Isaksson's base sync frame would function on Amit's network. Ex. 1004 (Williams Declaration), ¶ 180. Rather, Dr. Williams only provides a conclusory description that the Amit-Jacobsen-Isaksson HCN would transmit a base sync frame to other HCN devices, which would analyze the base sync frames to determine channel characteristics. Ex. 1004 (Williams Declaration), ¶ 180. A POSITA would have understood that Amit is a fundamentally different system, and Isaksson's base sync frames could not function on Amit's in-home coaxial system. Thus, a POSITA would not be motivated to implement Isaksson's base sync frames on Amit's network.

107. Amit provides a home network in a half-duplex, unsynchronized manner using CSMA protocol. *See, e.g.*, Ex. 1014 (Amit), 27:1-2 ("The data link protocol should be the IEEE 802.11 MAC layer CSMA/CA."). With this protocol, each network device is required to first check the coaxial network for a transmission (i.e., carrier sense) before transmitting (i.e., accessing) a waiting burst. Amit requires innovation to create a highly-reliable, guaranteed control channel that operates for a mesh network. CSMA, while providing very low-latency for networks with low utilization, suffers starvation to various nodes when the network experiences high-utilization. A control channel must have a guaranteed bandwidth rather than a best effort bandwidth. Amit's uncoordinated mesh network does not

provide any disclosure of a control channel, which is required by Isaksson to implement the base sync frames.

B. Isaksson does not extend to coaxial cables

108. Dr. Williams contends that Isaksson can extend to coaxial cables. Ex. 1004 (Williams Declaration), ¶ 180 (“A POSITA would have been motivated to combine the teachings of Amit, Isaksson, and Jacobsen because they each deal with developing coaxial networks for digital communications.”). I disagree with Dr. Williams. First, Dr. Williams’ evidence fails to show that Isaksson extends to coaxial cables. *See*, ¶¶ 109-118. Second, a POSITA would instead have understood that Isaksson applies to a point-to-point system implemented over twisted pair. *See*, ¶¶ 109-118. For these reasons, a POSITA would not have understood that Isaksson applies to coaxial cable systems and would not have been motivated to combine Amit-Jacobsen with Isaksson as Dr. Williams contends.

109. Dr. Williams contends that “Isaksson recognizes that its features can extend to coaxial networks.” Ex. 1004 (Williams Declaration), ¶ 181. To support his position, Dr. Williams cites two portions of Isaksson. Ex. 1004 (Williams Declaration), ¶ 181 (citing Ex. 1013 (Isaksson), 1:8-18, 3:4-15). Neither of these citations support Dr. Williams contention that Isaksson can extend to coaxial cables.

110. A POSITA would not have understood Dr. Williams’ first citation to Isaksson as “recogniz[ing] that its features can extend to coaxial networks.” Ex.

1004 (Williams Declaration), ¶ 181 (citing 1013, 1:8-18). Initially, Dr. Williams provides no explanation on why this disclosure supports his position. The disclosure (reproduced below) explains that various transmission schemes were developed to transmit high-rate traffic over *copper pairs*. Ex. 1013 (Isaksson), 1:8-18. A POSITA would not have read this disclosure as extending Isaksson's features to coaxial networks. Rather, Isaksson highlights the technological differences between Isaksson and Amit. As Isaksson is specific to transmission and modulation over copper pair, which is a bandwidth limited medium, transmission schemes were developed to transmit high bit rate traffic over copper pair. Ex. 1013 (Isaksson), 1:8-18. Amit provides an in-home network over coaxial cables, which does not suffer from the bandwidth limitations of copper pairs as a transmission medium.

The demand for provision of multi-media and other bandwidth services over telecommunications networks has created a need to transmit high bit rate traffic over copper pairs. This requirement has led to the development of a number of different transmission schemes, such as, ADSL and VDSL. One of the more likely modulation systems for all these transmission schemes is a line code known as DMT (discrete multi-tone), which bears some resemblance to orthogonal frequency division multiplex, and is a spread spectrum transmission technique.

Ex. 1013 (Isaksson), 1:8-18.

111. Dr. Williams' second citation (reproduced below) also does not support his conclusion that Isaksson's features can extend to coaxial networks. Ex. 1004 (Williams Declaration), ¶ 181 (citing 1013, 3:4-15).

Early versions of VDSL will use frequency division multiplexing to separate downstream from upstream channels and both of them from POTS and ISDN. Echo cancellation may be required for later generation systems featuring symmetric data rates. A rather substantial distance, in frequency, will be maintained between the lowest data channel and POTS to enable very simple and cost effective POTS splitters. Normal practice would locate the downstream channel above the upstream channel. However, the DAVIC specification reverses this order to enable premises distribution of VDSL signals over coaxial cable systems.

Ex. 1013 (Isaksson), 3:4-15.

112. Isaksson's disclosure describes VDSL. Specially, VDSL separates downstream and upstream channel and typically locates the downstream channel above the upstream channel. Ex. 1013 (Isaksson), 3:4-13. However, Isaksson states that "the DAVIC specification reverses this order to enable premises distribution of VDSL signals over coaxial cable systems." Ex. 1013 (Isaksson), 3:13-15.

113. Dr. Williams provides no explanation of why a POSITA would have understood this disclosure as demonstrating that Isaksson's features can extend to coaxial cabling. Page 3, lines 4 to 15, simply provides background on VDSL. This background is not tied to any features, including the base sync frames, of Isaksson.

114. Moreover, this sentence’s single reference to “coaxial cable systems” (which is the Isaksson’s only reference to coaxial) does not disturb the conclusion that Isaksson is entirely directed towards the distribution of signals to the home over twisted pair. *See e.g.*, ¶ 60. Neither does this disclosure suggest that the DAVIC specification is directed to distribution within the home. A POSITA would have understood that VDSL signal distribution is fundamentally different than in-home signal distribution. And even if it was assumed that VDSL related to in-home distribution, nothing in Isaksson teaches how that specification would handle such a shared medium for signal distribution. Further, even in the case of terrestrial distribution of coax, the DAVIC standard itself asserts that additional innovation is required on the shared medium of coaxial, making VDSL inadmissible in its existing form on coaxial cable, whether it is within the building or outside of the building. Accordingly, a POSITA would not view Isaksson’s features as extending to coaxial cables within the home.

115. A POSITA would have understood that Isaksson is specific to twisted pair and does not extend to coaxial cabling because Isaksson names its system Multi-carrier System for the Installed Copper network (“MUSIC”) and consistently reiterates that its system applies to twisted pair cabling. *See, e.g.*, Ex. 1013 (Isaksson), 24:8-10 (“MUSIC is intended to provide high-speed communication on telephone copper wire pairs for supporting broadband multimedia services.”), 24:14-

19 (“The MUSIC system, described in this, and the cross referenced patent specifications ... offers a cost-effective robust customer implementation in silicon, providing 26:2 or 13:2 Mbps asymmetric **transmission over copper cables** (<1300 metres) for use on existing local telephony networks.”), 25:28-31 (“This is illustrated in Figure 2, which shows two transceivers each of which has a receiver, Rx, and a transmitter, Tx, **connected to a twisted copper pair.**”), 34:24-29 (“TA is a parameter measured during system start-up at the NU side and used for compensation of propagation delay on the copper wire. This has to be done in order to maintain the orthogonality, over the copper wire, for the sampled periods, on both the uplink and the downlink.”), 60:5-8 (“As shown in Figure 22, in a modem connection, using modems herein described, the two data paths work independently of each other on the same physical copper cable.”), Figure 1, Figure 22.

116. Further, a POSITA would not have looked to Isaksson because Isaksson contains no teachings on sending or receiving signals over channels that traverse the tap ports of coaxial splitters, as in Amit. *See generally* Ex. 1013 (Isaksson). Isaksson does not mention or discuss any of the important aspects of this communication channel, including reflection, attenuation, and isolation. *See generally* Ex. 1013 (Isaksson).

117. Dr. Williams does not address any of these issues. Instead, Dr. Williams contends that Amit’s system “does not interfere with VDSL” and can

“connect to non-cable infrastructures,” which shows that Amit is related to VDSL. Ex. 1004 (Williams Declaration), ¶ 181 (citing Ex. 1014 (Isaksson), 2:24-30, 28:67). I disagree that this somehow shows Amit’s system is related to DSL. Amit’s network does not interfere with VDSL because it is isolated from VDSL by operating on coaxial cables instead of twisted pair. Thus, this would not motivate a POSITA to modify Amit’s network. Instead, it suggests that other network types would connect separately to Amit’s network via the networking interface rather than the physical medium and thus not result in a change of Amit’s system.

118. In view of this key distinction, a POSITA would not be motivated to combine Amit and Jacobsen with Isaksson because Isaksson is not pertinent to any of Amit’s potential issues caused by communicating over splitters. These fundamental technological differences between the references illustrate why Dr. Williams fails to provide a sufficient motivation to combine. Isaksson relates to point-to-point communication outside of a home over twisted pair while Amit provides an in-home network over coaxial cabling as a shared medium.

ii. Jacobsen already provides synchronized bit-loading

119. Dr. Williams contends that a POSITA would have been motivated to combine Amit and Jacobsen with Isaksson to achieve synchronized bit-loading and “prevent the connections between the Amit-Jacobsen-Isaksson HCN devices from failing due to one HCN device sending more/fewer bits per carrier than another HNC

device expects.” Ex. 1004 (Williams Declaration), ¶ 179 (“Thus, a POSITA would have been further motivated to implement Isaksson’s multi-carrier improvements to maintain connections between Amit-Jacobsen’s multi-carrier HCN devices using synchronized bit-loading in which the bit-loading parameters are based on channel characteristics.”) (citing Ex. 1014 (Isaksson), 3:24-34).

120. I disagree with Dr. Williams. A POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson to achieve synchronized bit-loading because Amit does not suffer from lack of synchronization. As Dr. Williams states, a “POSITA would have understood that Amit’s modulation schemes are single-carrier modulation schemes.” Ex. 1004 (Williams Declaration), ¶ 172 (citing Ex. 1014 (Amit), 15:26-28 (“Home Networking Channel. The Home Networking channel (a single channel that is used for sending and receiving information).”). A POSITA would have understood that single-carrier modulation schemes, like those of Amit, do not need to synchronize each sub-carrier as with multi-carrier modulation.

121. Dr. Williams instead contends that a POSITA would have been motivated to synchronize Jacobsen’s multi-carrier modulation. Ex. 1004 (Williams Declaration), ¶ 179. However, a POSITA would not have been motivated to combine Amit and Jacobsen with Isaksson to achieve synchronized bit-loading because Jacobsen does not suffer from lack of synchronization; Jacobsen already

provides a method of synchronized bit-loading. Ex. 1016 (Jacobsen), 10 (“Because the bit distribution is continuously updated during transmission as the receiver sends the required information to the transmitter on secure overhead channels, even severe and unpredictable interference like jam can be tolerated by a multicarrier system.”).

122. Jacobsen explains that “bit distribution is continuously updated during transmission as the receiver sends the required information to the transmitter on secure overhead channels.” Ex. 1016 (Jacobsen), 10. A POSITA would have understood that this “required information” to include the number of bits, allowing the transmitter to synchronize with the receiver. A POSITA would have understood that the “required information” includes the number of bits because if the “required information” did not include the number of bits, Jacobsen would not be able to maintain a connection. Isaksson also discloses this basic principle that a transmitter and receiver must communicate regarding the number of transmitted bits. When the number of transmitted bits change, the transmitter and receiver must be synchronized; “[i]f this requirement is not met, the system will be unable to maintain a connection.” Ex. 1013 (Isaksson), 3:29-34 (“This variation in bandwidth leads to an absolute system requirement for synchronous configuration of the transmitter and the receiver, in terms of the number of coded/decoded bits per symbol and carrier wave. If this requirement is not met, the system will be unable to maintain a

connection.”). Again, in view of this basic principle, a POSITA would have understood that Jacobsen discloses synchronized bit-loading.

123. Thus, I disagree with Dr. Williams that a POSITA would have been motivated to combine Amit and Jacobsen with Isaksson to achieve synchronized bit-loading because neither Amit nor Jacobsen suffer from a failing of providing synchronized bit loading. *See*, ¶¶ 119-122. A POSITA would not have been motivated to look to any reference for synchronization for bit-loading.

VIII. GROUND 1

124. Dr. Williams contends that a POSITA would have been motivated to combine Kliger and Isaksson. *See, e.g.*, Ex. 1004 (Williams Declaration), ¶ 68 (“It is my opinion that, in view of these concerns, a POSITA would have been motivated to improve Kliger’s multi-carrier signaling using Isaksson, which addresses the dynamic nature of multi-carrier signaling on wired networks.”).

125. I disagree with Dr. Williams that a POSITA would have been motivated to combine Kliger and Isaksson. First, Kliger already identifies and solves each “issue” that Dr. Williams uses to support a motivation to combine. *See*, ¶¶ 128-142. Second, a POSITA would have understood that Isaksson’s base sync frames would not function on Kliger’s network. *See*, ¶¶ 143-157. For at least these reasons, a POSITA would not have been motivated to combine Kliger and Isaksson.

A. Kliger already identifies and solves each issue that Dr. Williams uses as a motivation to combine

126. Dr. Williams identifies several “concerns” in Kliger’s network including (1) “[r]eflections [that] can occur at the splitter”; (2) Kliger’s dynamic network conditions; and (3) interference and noise. Ex. 1004 (Williams Declaration), ¶¶ 65-67. Dr. Williams contends that, “in view of these concerns,” a POSITA would have been motivated to combine Kliger and Isaksson. Ex. 1004 (Williams Declaration), ¶ 68. Specifically, Dr. Williams contends that “a POSITA would have been motivated to improve Kliger’s multi-carrier signaling using Isaksson.” Ex. 1004 (Williams Declaration), ¶ 68.

127. I disagree with Dr. Williams. First, reflections at the splitters would not motivate a POSITA to modify Kliger’s network because Kliger already solves reflections caused by the splitters. *See*, ¶¶ 128-133. Second, Kliger’s dynamic network conditions would not motivate a POSITA to combine Kliger and Isaksson because Kliger already includes features that address the dynamic network conditions. *See*, ¶¶ 134-137. Third, interference and noise would not motivate a POSITA to combine Kliger and Isaksson because Kliger already solves “signal impairments” and “external noise.” *See*, ¶¶ 138-142. Therefore, a POSITA would not have been motivated to combine Kliger and Isaksson based on any of the “concerns” that Dr. Williams identifies.

i. Kliger identifies and solves reflections at the splitter

128. Dr. Williams identifies “[r]eflections [that] can occur at the splitter” as a concern of Kliger’s network. Ex. 1004 (Williams Declaration), ¶ 65, 68. Dr. Williams contends that reflections at the splitter would have motivated a POSITA to combine Kliger and Isaksson. Ex. 1004 (Williams Declaration), ¶ 68 (“It is my opinion that, in view of these concerns, a POSITA would have been motivated to improve Kliger’s multi-carrier signaling using Isaksson, which addresses the dynamic nature of multi-carrier signaling on wired networks.”). I disagree with Dr. Williams. Kliger’s reflections at the splitters would not motivate a POSITA to combine Kliger and Isaksson because Kliger already solves these reflections.

129. Kliger explains that, while “[r]eflections can occur at the splitter,” Kliger’s “modem enables the home network 10 to coexist with pre-existing low quality splitters often found in cable networks.” Ex. 1007 (Kliger), ¶ [0073]. More specifically, Kliger’s modem “uses an efficient modulation scheme,” resulting in “higher data rates for a specific frequency band produces less cross talk between potentially interfering signals.” Ex. 1007 (Kliger), ¶ [0073]. This disclosure illustrates that Kliger addresses reflections at the splitters, and these reflections are not a “challenge” that needs to be solved. Ex. 1007 (Kliger), ¶ [0073].

130. A POSITA would have understood that Kliger solves the concern of splitter reflection. Ex. 1007 (Kliger), ¶ [0073]. Because Kliger solves splitter

reflections within its network, a POSITA would not have been motivated to combine Kliger and Isaksson based on these reflections.

131. To the extent that a POSITA would be motivated to alter Kliger's network in view of splitter reflection, which I disagree would be the case, a POSITA would not have looked to Isaksson. A POSITA would not have looked to Isaksson to solve splitter reflections because Isaksson is not related to reflection at splitters and thus does not solve splitter reflections. Because a POSITA would have understood that Isaksson does not solve splitter reflections, a POSITA would not have been motivated to combine Kliger and Isaksson based on Kliger's splitter reflections as Dr. Williams contends.

132. Moreover, a POSITA would not have looked to Isaksson to solve splitter reflections because Isaksson provides a network that communicates over a dedicated point-to-point architecture, unlike Kliger, which communicates on a shared medium over tap ports of splitters. *See, e.g.,* Ex. 1014 (Amit), Fig. 1. A POSITA would have viewed Isaksson's point-to-point architecture as fundamentally different than Kliger's branched topology that requires splitters. Based on these differences, signals would behave drastically different in Isaksson's system versus Kliger's network. Thus, to the extent Isaksson provided any solution to splitter reflections, which Isaksson does not, a POSITA would not have looked to Isaksson's

fundamentally different system that is unrelated to Kliger's network to solve splitter reflections.

133. A POSITA would also not have looked to Isaksson because Isaksson provides an installed copper network for data distribution outside of the home. Ex. 1013 (Isaksson), 24:8-28 ("The system, to which the present invention relates, is for convenience referred to as MUSIC - MUlti-carrier System for the Installed Copper network. MUSIC is intended to provide high-speed communication on telephone copper wire pairs for supporting broadband multimedia services."). In contrast, splitter reflections are relevant to an in-home network over coaxial cabling, such as Kliger. Dr. Williams uses two networks that have different interference, attenuation, carrier signals, and power considerations. Dr. Williams does not address these differences. Based on these differences, a POSITA would have viewed Isaksson as a fundamentally different system than Kliger and would not have looked to Isaksson to solve splitter reflections in Kliger's systems.

ii. Kliger addresses its dynamic network conditions

134. Dr. Williams identifies Kliger's dynamic network conditions, including the addition/removal of network devices and/or changing external conditions, as a concern of Kliger's network. Ex. 1004 (Williams Declaration), ¶¶ 67-68. Dr. Williams contends that Kliger's dynamic network conditions would have motivated a POSITA to combine Kliger and Isaksson. Ex. 1004 (Williams Declaration), ¶ 68

(“It is my opinion that, in view of these concerns, a POSITA would have been motivated to improve Kliger’s multi-carrier signaling using Isaksson, which addresses the dynamic nature of multi-carrier signaling on wired networks.”).

135. I disagree with Dr. Williams. Kliger’s dynamic network conditions would not motivate a POSITA to combine Kliger and Isaksson because Kliger already solves the addition/removal of network devices and changing external conditions.

136. Kliger solves adding and removing network device through its registration process. Ex. 1007 (Kliger), ¶¶ [0089], [0108]-[0112]. During the registration period, the master HNM indicates where the new HNM appears in the transmission order and “the amount of bandwidth that has been allocated to the HNM.” Ex. 1007 (Kliger), ¶ [0110]. When new HNMs are added to the network, the master HNM can change the amount of bandwidth allocated to each HNM to guarantee quality of service. Ex. 1007 (Kliger), ¶ [0103]. A POSITA would have understood that Kliger’s registration process allows Kliger’s network to dynamically adapts to the number of HNMs. And thus, adding or removing a network device would not cause a carrier to later become overwhelmed with interference as Dr. Williams contends. Ex. 1004 (Williams Declaration), ¶ 67 (“The dynamic nature of the network conditions means that the carriers used in the multi-carrier signaling are

subject to variable conditions. As a result, a carrier that was once clear of noise can later become severely affected by interference.”).

137. While Dr. Williams ignores the registration process, a POSITA would have understood that these features address the “concerns” that Dr. Williams relies on for his motivation. As such, Kliger’s dynamic network would not have motivated a POSITA to combine Kliger and Isaksson.

iii. Kliger identifies and solves signal impairments

138. Dr. Williams identifies “signal impairments, like interference and noise” as a concern of Kliger’s network. Ex. 1004 (Williams Declaration), ¶ 65, 68. Dr. Williams contends that these impairments would have motivated a POSITA to combine Kliger and Isaksson. Ex. 1004 (Williams Declaration), ¶ 68 (“It is my opinion that, in view of these concerns, a POSITA would have been motivated to improve Kliger’s multi-carrier signaling using Isaksson, which addresses the dynamic nature of multi-carrier signaling on wired networks.”). I disagree with Dr. Williams. Interference and noise would not motivate a POSITA to combine Kliger and Isaksson because Kliger already solves “signal impairments.”

139. Kliger’s network already address “signal impairments” through its registration process. Ex. 1007, ¶¶ [0108]-[0112] (“The registration period 232 is available for use by new HNMs.”). During the registration period, the master HNM determines where the new HNM will appear in the transmission order and “the

amount of bandwidth that has been allocated to the HNM.” Ex. 1007, ¶[0110]. If a new HNM is added to the network, the master HNM can change bandwidth allocation to each HNM to guarantee quality of service. Ex. 1007, ¶[0103] (“The master HNM 28 can change the amount of allocated bandwidth and the order of transmission, such as when a new HNM 28 registers for guaranteed quality of service.”). With this registration process, Kliger’s network can dynamically adapt to the number of HNMs and thus adding or removing a network device would not cause a carrier to be overwhelmed with interference.

140. A POSITA would have understood that Kliger solves the concern of signal impairments. Because Kliger solves impairments within its network, a POSITA would not have been motivated to combine Kliger and Isaksson based on these impairments as Dr. Williams contends. Ex. 1004 (Williams Declaration), ¶ 64 (“As I explain in more detail below, Isaksson’s techniques enable Kliger’s HNMs to overcome signal impairments that affect the inter-modem signaling on Kliger’s home network. Isaksson’s techniques also allow Kliger’s HNMs to determine carrier availability for the inter-modem signaling.”).

141. Even if Kliger did not already solve signal impairments in its network, a POSITA would not have looked to Isaksson to solve signal impairments in Kliger’s in-home network implemented over coaxial cabling. A POSITA would have understood that Isaksson’s point-to-point twisted pair system suffers from

completely different types of noise and interference than Kliger's coaxial cable network which are mitigated by using difference approaches. For example, twisted pair suffers from narrow-band impulse noise, which can be addressed through filtering, avoidance, or increasing the transmit power. In addition, twisted pair suffers from cross-talk which requires dedicated cancellation equipment. In contrast, coaxial cable suffers from interferences such as broadband signals, which can be addressed through avoiding corresponding frequencies. Thus, a POSITA would not have been motivated to look to Isaksson to solve signal impairments in Kliger's network.

142. Dr. Williams ignores features in Kliger's network that address each "issue" used as motivation to combine Kliger and Isaksson: (1) Kliger's modem addresses reflections cause by the splitter (§§ 128-133) and (2) Kliger's registration process addresses the dynamic nature and interference of its network (§§ 134-141). Accordingly, a POSITA would not have been motivated to combine Kliger with Isaksson for any of the "issues."

B. Isaksson's base sync frames would not be used on Kliger's network

143. Dr. Williams contends that "a POSITA would have been motivated to improve Kliger's multi-carrier signaling using Isaksson." Ex. 1004 (Williams Declaration), ¶ 68. Dr. Williams also contends that the resulting HNMs of Kliger "would transmit base sync frames having predetermined content to the other HNMs

over respective channels” and the other HNMs “would analyze the received base sync frames to determine channel characteristics of the respective channels.”. Ex. 1004 (Williams Declaration), ¶ 74. I disagree with Dr. Williams.

144. A POSITA would not have been motivated to implement Isaksson’s base sync frames on Kliger’s network. A POSITA would have understood that Isaksson’s base sync frames are designed for a full-duplex system implemented over twisted pair and would not function on Kilger’s half-duplex coaxial network. *See*, ¶¶ 145-157. Namely, a POSITA would have understood that (1) Isaksson’s base sync frames would not determine channel characteristics (¶¶ 145-154) and (2) Isaksson’s base sync frames would alter the intended operation of Kliger (¶¶ 155-157).

**i. Isaksson’s base sync frames would not determine
channel characteristics on Kliger’s network**

145. Dr. Williams contends that the combination of Kliger and Isaksson would use base sync frames to determine characteristics of a respective channel. Ex. 1004 (Williams Declaration), ¶ 74. Dr. Williams contends that each Kliger HNM “would transmit base sync frames” and the other HNMs “would analyze the received base sync frames to determine channel characteristics of the respective channels.” Ex. 1004 (Williams Declaration), ¶ 74. I disagree with Dr. Williams.

146. A POSITA would have understood that Isaksson's base sync frames would not be able to determine channel characteristics on Kliger's system. First, a POSITA would have understood that Isaksson's base sync frames would not function on Kliger's half-duplex system. *See*, ¶¶ 147-148 Second, a POSITA would have understood that Kliger's intermediary device would prevent Isaksson's base sync frames from functioning on Kliger's network. *See*, ¶¶ 149-154.

A. Isaksson's base sync frames are not designed to function on a Kliger's shared medium

147. First, a POSITA would have understood that Isaksson's base sync frames would not function on Kliger network because Isaksson's base sync frames are not designed to function on a shared medium like Kliger's coaxial cables. Instead, Isaksson's base sync frames are designed to function on Isaksson's point-to-point, full-duplex system. Specifically, Isaksson uses a control channel to provide "a two-way connection since both the uplink transceiver and downlink transceiver contain a transmitter and a receiver." Ex. 1013 (Isaksson), 73:4-11 ("The control channel is, in this case, a connection from the transmitter to the receiver. In a duplex system this connection will be a two-way connection since both the uplink transceiver and downlink transceiver contain a transmitter and a receiver."). This control channel "is an absolute requirement." Ex. 1013 (Isaksson), 73:12-15 ("The establishment of this channel is an absolute requirement as further configuration is impossible without a connection between the transmitter and the receiver.").

148. Dr. Williams fails to explain how the “absolute requirement” of Isaksson’s control channel can transmit base sync frames. This is unsurprising because a POSITA would readily understand that Kliger’s network is fundamentally different, and Isaksson’s base sync frames could not function in Kliger’s system. A POSITA would not be motivated to implement *Isaksson*’s base sync frames.

B. Isaksson’s base sync frames are not designed to function over an intermediary device

149. Dr. Williams contends that each Kliger HNM “would transmit base sync frames” and the other HNMs “would analyze the received base sync frames to determine channel characteristics of the respective channels.” Ex. 1004 (Williams Declaration), ¶ 74. However, Dr. Williams does not mention, or provide any explanation, of how Isaksson’s base sync frames would function over Kliger’s network, which uses intermediary device to communicate.

150. To communicate, Kliger’s HNMs transmit signals upstream on the upstream signal path to the HRU. Ex. 1007 (Kliger), ¶ [0055] (“The upstream signal is the signal coming from the backbone 20 to the HRU 44, and downstream signal is the signal returning from the HRU 44 to the backbone 20.”). The HRU (1) amplifies the signal’s power and (2) shifts the signal’s RF frequency before reflecting the signal downstream on the downstream signal path to the receiving HNM. Ex. 1007 (Kliger), ¶ [0056] (“The IF filter and amplifier unit 58 then amplifies and band pass filters the IF signal. The RF up-converter 56 shifts the

frequency of the IF signal up to the downstream frequency band. The amplifier 52 and BP filter 48 then amplify and filter the downstream signal.”). Kliger’s HNMs also use transmission power control, which allows the HRU to receive the upstream signal at a predefined power level. Ex. 1007 (Kliger), ¶ [0057] (“Each HNM 28 adjusts its transmission power to such a power level that when its transmitted signal arrives at the HRU 44, that signal has a predefined power level.”).

151. Unlike Kliger, Isaksson transmits the base sync frames over its point-to-point architecture **without** an intermediary device. Ex. 1013 (Isaksson), 24:8-28, Fig. 1. Once the base sync frame is received, a reference frame is used to determine characteristics of the point-to-point channel the frame just traversed. Ex. 1013 (Isaksson), 10:10-14. A POSITA would have understood that, to function on Kliger’s network, the base sync frame would need to determine characteristics of both the upstream channel to the HRU and the downstream channel to the receiving device.

152. Isaksson does not provide any disclosure regarding the process of determining channel characteristics via a signal that is transmitted along an upstream signal path, altered by an intermediary device, and transmitted downstream to a receiving device. And Dr. Williams fails to explain how Isaksson’s base sync frames would function over the intermediary device (i.e., the HRU) of Kliger, which changes the signals’ properties.

153. Even if the receiving HNM could somehow reconstruct the upstream signal before the properties of the upstream signal are altered by the HRU, the receiving HNM would still not be able to determine channel characteristics. Each HNM employs transmission power control to account for signal attenuation in the upstream path. Ex. 1007, ¶ [0057] (“Each HNM 28 adjusts its transmission power to such a power level that when its transmitted signal arrives at the HRU 44, that signal has a predefined power level.”). As a result, all upstream signals are received by the HRU at the same power level. Ex. 1007, ¶ [0057].

154. To the extent that the receiving HNM determines the properties of the unaltered upstream signal, the power level of the upstream signal would be the same regardless of the originating HNM (or the channel characteristics of the upstream path). Without being able to differentiate between upstream signals, the receiving HNM could not simply analyze the received base sync frames to determine two gain parameters and channel characteristics. Because a POSITA would recognize these issues, a POSITA would have understood that Isaksson’s base sync frames would not function over Kliger’s intermediary device. Thus, a POSITA would have understood that Isaksson’s base sync frames would not function over Kliger’s network.

**ii. Isaksson's base sync frames would alter the
operation of Kliger**

155. A POSITA would not have been motivated to implement Isaksson's base sync frames on Kliger's network because Isaksson's base sync frames would alter the intended operation of Kliger. Specifically, neither Isaksson nor Kliger discloses or suggests altering constellation size based on channel specific characteristics that function over splitters, which is addressed by the '518 Patent. Kliger focuses on in-home communication using its HNMs. Ex. 1007 (Kliger), ¶¶ [0040]-[0044]. Kliger requires its HNMs to transmit over the backbone using the same constellation size based on network characteristics rather than specific channel characteristics. Ex. 1007 (Kliger), ¶¶ [0091], [0099]. Kliger explains that "the constellation size is the same for each HNM 28 (when transmitting)." Ex. 1007 (Kliger), ¶¶ [0091], [0099]. All network communication is reduced to the lower signal to noise ratio of the home network. In an example, the channel (green) from the study to the living room may support 256-QAM. In contrast, the channel (red) from the family room to the bedroom may only be capable of supporting QPSK. Although the channel from the study to living room could support higher order constellation, *Kliger* requires both channels (i.e., the channels represented by the green and red arrows to implement the lower order constellation (*i.e.*, QPSK)).

channel with a higher SNR would corresponds to a higher the constellation size for transmission. This is made possible in Isaksson because its system analyzes a channel over a single point-to-point connection, which does not include splitters or intervening devices that divide the signal.

157. Replacing Kliger's method of transmitting using the same constellation size with Isaksson's base sync frames would require such a change to Kliger that a POSITA would not be motivated to look to Isaksson. Specifically, the combination of Kliger and Isaksson contradicts Kliger's transmission of bursts that use a fixed constellation size depending on the network characteristics. Ex. 1007 (Kliger), ¶ [0091]; [0099]. In view of this fundamental change, a POSITA would not have been motivated to implement Isaksson's base sync frames on Kliger's network.

IX. Reservation of Rights

158. I reserve the right to amend or supplement this declaration as this case proceeds and any additional information comes to light.

159. I understand that traditionally no live expert testimony is used at the PTAB, and I presently have no plans to testify, however should I be asked, I reserve my right to use exhibits to summarize or exemplify my opinions (including exhibits I have not yet created) if called to testify.

160. If it would be helpful to the Tribunal, I am willing and able to provide additional background.

161. I further reserve the right to respond to any opinions presented by any of Respondents' experts regarding the meaning of any claim term or limitation within the Asserted Claims. I also reserve the right to provide further opinions in this case, such as opinions regarding non-infringement and/or invalidity of the Asserted Patents, if requested to do so.

162. I declare under penalty of perjury that this declaration contains a true and correct statement of my opinions, based on the information available to me.

Dated: November 8, 2024

A digital signature block with a blue border. Inside, there is a handwritten signature in black ink. Above the signature, it says "Signed by:". Below the signature, there is a long alphanumeric string: "D269017F295E408...".

Mr. Albert Garrett

EXHIBIT A

Curriculum Vitae

Albert L Garrett

Systems Engineer * Principal Engineer * Director of Engineering

An expert in the development, optimization, productization, and standardization of signal processing for communications.

A collaborative leader in next-generation networking standards committees, working closely with industry leaders such as Cisco, Comcast, Verizon, Intel, and Broadcom.

An engineer with recognizable soft-skills as evidenced by advisor roles and board seat on non-profit organization.

SIGNAL PROCESSING COMPETENCIES

- System modelling/simulation
- Bit-true models
- C/C++/Python
- CDMA/OFDM/OFDMA
- FEC/RS/LDPC
- Impairment comp.
- Acquisition algos
- Analog/RF Specs
- AGC
- Algorithm design/optimization

AI COMPETENCIES

- Neural Networks
- Belief-propagation
- Probability Theory
- DNN, CNN, RNN,
- Bayes Networks
- Genetic Algorithm
- Deep Reinforcement Learning
- NLP
- Tensorflow
- Technical paper review and implementation

Experience

ComplexIQ Inc.

2011 – present

Principal Engineer / Co-founder / Manager

Supporting four major IC customers and deploying 10+ million devices in the field

Advised executive management in corporate strategy, new product R&D, technical marketing, customer interaction and engineering management. Trusted and influential resource among Fortune 100 companies such as Verizon, Comcast, Cox, Intel, and Cisco by:

- + contributing to Board of MoCA
- + chairing MoCA Certification Working Group
- + contributing to MoCA Specification Working Group for 10Gbps standard.

Researched and developed Convolutional/Deep Neural Network to allow remote diagnosis of problems parts with no prior knowledge of the home coax network configuration; from zero knowledge to fully implemented python/tensorflow CNN, allowing business discussion.

Researched and developed on-site diagnostics ios/android app to determine network problems with no prior knowledge of the home coax network configuration; from concept

to successful proof-of-concept, from zero knowledge to fully implemented Android/iOS app with Bayes algorithms for conversion of RF and MoCA measurements to UI/UX presentation.

Defined, implemented, specified fixed-point transmitter, receiver and algorithms for MoCA 2.0/2.5/3.0 system including LDPC belief-propagation / message passing, IQ on-line calibration, AGC convergence, time/freq acquisition and tracking. Bit-true models with system-level impairments.

Specified RF / analog requirements for transceiver front end (DAC/ADC), and baseband. Advised Analog Devices, Maxlinear, ST Micro, and MStar on development of compatible, proprietary MoCA radio designs.

Cisco Systems, Inc.	2008 – 2011
Staff Engineer	
<i>Member of small R&D team focused on IP development and supporting two major customers</i>	

Provided strategic leadership on behalf of Cisco in MoCA standard organization. Led direction for next generation MoCA solutions and MoCA 2.0 standards effort within the company. Chair of MoCA 2 Specification Working Group.

Coordinated and specified RF, AFE, and baseband for internal and external teams. Defined and modeled baseband algorithms to compensate for radio impairments.

Conexant Systems, Inc.	2007 – 2008
Multiple Roles	
<i>Member of small R&D team focused on MoCA development</i>	

Director of Engineering (Dec 2007 – Feb 2008)

Promoted to co-lead for international team located in LA and Bangalore to develop MoCA MAC/PHY/RF IC.

Served as representative member of entire team during M&A discussions between NXP and Conexant.

Staff Engineer (Oct 2006 – Dec 2007)

Led team of PHY designers in Bangalore India to implement MoCA specification in system model and RTL.

Defined analog specification with analog/mixed-signal team for MoCA transceiver for MoCA signaling and calibration support.

Older experiences available on request.

US Patents

	Conexant
6724834	Threshold detector for detecting synchronization signals at correlator output during packet acquisition

6748200	Automatic gain control system and method for a ZIF architecture
6973296	Soft decision gain compensation for receive filter attenuation
7174138	Power-based hardware diversity
7272109	Modified OFDM subcarrier profile (Definition of a half rate mode of operation for 802.11 OFDM)
Cisco	
8468223	Cooperation for consumer and Service Provider MoCA Networks
8804516B2	Opportunistic Transmissions within MoCA
9042823	Method, system, and apparatus for Extended Rate/Range communication over a communication network
9106435B2	Efficient Data Transmissions within MoCA
9998402	MoCA Packet Aggregation
ComplexIQ	
20170142030A1	Digital Coax Network Splitter (pending)

Education

Udacity AI Nanodegree, 2018	Artificial Intelligence, Machine Learning and Deep Neural Networks using Python and Tensorflow
Clemson University, 1998	Masters of Science Electrical Engineering - 4.0/4.0 GPA Digital Communications Theory Thesis on signal acquisition in DSSS technologies
Auburn University 1996	Bachelor of Science Electrical Engineering - 3.8/4.0 GPA Statistical/Mathematical Analysis Digital Communication/Information/Coding Theory Image processing; Comm Theory