UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MARVELL SEMICONDUCTOR, INC.,
Petitioner,

v.

CREDO TECHNOLOGY GROUP LTD.,
Patent Owner.

Case IPR2025-01219
U.S. Patent No. 11,012,252

DECLARATION OF TIM A. WILLIAMS

Mail Stop "Patent Board"
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

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I. ASSIGNMENT

1. I have been retained on behalf of Credo Technology Group., Ltd. ("Patent Owner" or "Credo") to offer technical opinions related to U.S. Patent No. 11,012,252 ("the '252 Patent") (EX-1001). I understand that Credo is requesting that the Patent Trial and Appeal Board ("PTAB" or "Board") find that Petitioner Marvell Semiconductor, Inc. ("Petitioner" or "Marvell") failed to prove that any claim of the '252 Patent is unpatentable in this *inter partes* review ("IPR") proceeding.

2. I have been asked to provide my independent analysis of the Petition regarding the '252 Patent.

3. I am not and never have been, an employee of Credo. I received no compensation for this declaration beyond my normal hourly compensation based on my time actually spent analyzing the '252 Patent, the Petition, the cited references in the Petition, and issues related thereto, and I will not receive any added compensation based on the outcome of any IPR or other proceeding involving the '252 Patent.

II. QUALIFICATIONS AND BACKGROUND INFORMATION

4. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment.

In formulating my opinions, I have relied upon my knowledge, training, and experience in the relevant art.

5. I am over 18 years of age, and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. Although my qualifications are stated more fully in my *curriculum vitae*, attached hereto as Appendix A, I provide below a brief summary of my qualifications.

6. I earned a Bachelor of Science degree in Electrical Engineering (BSEE) from Michigan Technological University in 1976. In 1982, I earned a Master's degree, also in Electrical Engineering (MSEE), from the University of Texas at Austin. I earned a Doctor of Philosophy (Ph.D.), also from the University of Texas at Austin, in 1985. My doctorate dissertation was "Digital Signal Processing Techniques for Acoustic Log Data." In 1991, I earned a Master of Business Administration degree from the University of Texas at Austin as well.

7. I have over 40 years of professional experience in wireless communications and telecom technology, including roles in large corporations as well as start-ups and consulting work.

8. For example, from 1979 through 1991, I held the positions of Senior Engineer, Senior Member of the Technical Staff, and Member of the Technical Staff at Motorola, Inc. My work at Motorola included serving as business manager,

project leader, and senior technical member for projects relating to the development of various cellular modems, transceivers, and transcoders.

9. As another example, in 1991, I co-founded Wireless Access, Inc., a start-up company focused on the Narrow Band PCS equipment market and which developed the over-the-air protocols, subscriber equipment, and integrated circuits to deploy 2-way paging services. I held the positions of Co-Founder, Chief Technical Officer, Vice President of Engineering, and Vice President of Business Strategy at Wireless Access until it was sold to Glenarye Electronics in 1998.

10. As another example, between 1998 and 2000, I was the Chief Technology Officer and Advisory Board Member of Picazo Communications, which built and sold software PBXs Telephony equipment using VoIP and Circuit Switched Technologies.

11. As another example, in 2004, I founded DoceoTech Inc., which provides training for engineers in Wireless, Networking, and Telephony technologies. Since 2004, I have served as DoceoTech's Chairman.

12. I hold over 25 United States patents in wireless and signal processing technology, as well as numerous patent applications in the same field. Additionally, I am a Patent Agent registered with the U.S. Patent and Trademark Office since January 2002. Further, I have served as a technical expert in multiple patent proceedings.

13. My *curriculum vitae*, included as an appendix to this declaration, includes a list of publications on which I am a named author. It contains further details regarding my experience, education, publications, and other qualifications to render an expert opinion in connection with this proceeding.

14. I have reviewed the '252 Patent, the Petition, the references cited in the Petition, and the references cited herein.

15. I have no financial interest in the outcome of this proceeding. I am being compensated for my work as an expert on an hourly basis. My compensation is not dependent on the outcome of these proceedings or the content of my opinions.

16. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the '252 Patent. Unless otherwise stated, my testimony below refers to the knowledge of one of ordinary skill in the art as of the priority date. Any figures that appear within this document have been prepared with the assistance of Counsel and reflect my understanding of the cited references in the Petition.

III. LEVEL OF ORDINARY SKILL IN THE ART

17. A person having ordinary skill in the art ("POSITA") as of August 28, 2018 would have had an undergraduate degree in electrical engineering or electrical and computer engineering, or equivalent knowledge, training, or

experience, with at least three years of experience working in high speed data communication. A higher level of education may substitute for less experience, and *vice versa*.

18. Petitioner asserts a similar level of ordinary skill in the art. Petition at 16. Under either definition, as of the Critical Date, I would have met the qualifications of a person of ordinary skill in the art.

IV. LEGAL STANDARDS

A. Terminology

19. I have been informed by Counsel and understand that the best indicator of claim meaning is its usage in the context of the patent specification as understood by one of ordinary skill. I further understand that the words of the claims should be given their plain meaning unless that meaning is inconsistent with the patent specification or the patent's history of examination before the Patent Office. Counsel has also informed me, and I understand that, the words of the claims should be interpreted as they would have been interpreted by one of ordinary skill at the time of the invention was made (not today). The '252 Patent was filed August 13, 2019 and claims priority to a foreign application filed on March 1, 2019, which I refer to as the "Critical Date" in this proceeding.

B. Legal Standards

20. I have been informed by Counsel and understand that documents and materials that qualify as prior art can render a patent claim unpatentable as being anticipated or obvious.

21. I am informed by Counsel and understand that all prior art references are to be looked at from the viewpoint of a person of ordinary skill in the art at the time of the invention, and that this viewpoint prevents one from using his or her own insight or hindsight in deciding whether a claim is anticipated or rendered obvious.

C. Anticipation

22. I understand that patents or printed publications that qualify as prior art can be used to invalidate a patent claim as anticipated or as obvious.

23. I understand that, once the claims of a patent have been properly construed, the second step in determining anticipation of a patent claim requires a comparison of the properly construed claim language to the prior art on a limitation-by-limitation basis.

24. I understand that a prior art reference "anticipates" an asserted claim, and thus renders the claim invalid, if all limitations of the claim are disclosed in that prior art reference, either explicitly or inherently (i.e., necessarily present).

D. Obviousness

25. I understand that even if a patent is not anticipated, it is still invalid if the differences between the claimed subject matter and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA.

26. I have been informed by Counsel and understand that a claim is unpatentable for obviousness and that obviousness may be based upon a combination of references. I am informed by Counsel and understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. However, I am informed by Counsel and understand that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.

27. I am informed by Counsel and understand that when a patented invention is a combination of known elements, a court determines whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue by considering the teachings of prior art references, the effects of demands known to people working in the field or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art.

28. I am informed by Counsel and understand that a patent claim composed of several limitations is not proved obvious merely by demonstrating that each of its limitations was independently known in the prior art. I am informed by Counsel and understand that identifying a reason those elements would be combined can be important because inventions in many instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known. I am informed by Counsel and understand that it is improper to use hindsight in an obviousness analysis, and that a patent's claims should not be used as a "roadmap."

29. I am informed by Counsel and understand that an obviousness inquiry requires consideration of the following factors: (1) the scope and content of the prior art, (2) the differences between the prior art and the claims, (3) the level of ordinary skill in the art, and (4) any so called "secondary considerations" of non-obviousness, which include: (i) ”long felt need” for the claimed invention, (ii) commercial success attributable to the claimed invention, (iii) unexpected results of the claimed invention, and (iv) ”copying” of the claimed invention by others.

30. I have been informed by Counsel and understand that an obviousness evaluation can be based on a single reference or a combination of multiple prior art references. I understand that the prior art references themselves may provide a

suggestion, motivation, or reason to combine, but that the nexus linking two or more prior art references is sometimes simple common sense. I have been informed by Counsel and understand that obviousness analysis recognizes that market demand, rather than scientific literature, often drives innovation, and that a motivation to combine references may be supplied by the direction of the marketplace.

31. I have been informed by Counsel and understand that if a technique has been used to improve one device, and a person of ordinary skill at the time of invention would have recognized that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.

32. I have been informed by Counsel and understand that practical and common sense considerations should guide a proper obviousness analysis, because familiar items may have obvious uses beyond their primary purposes. I have been informed by Counsel and understand that a person of ordinary skill looking to overcome a problem will often be able to fit together the teachings of multiple prior art references. I have been informed by Counsel and understand that obviousness analysis therefore takes into account the inferences and creative steps that a person of ordinary skill would have employed at the time of invention.

33. I have been informed by Counsel and understand that a proper obviousness analysis focuses on what was known or obvious to a person of ordinary skill at the time of invention. Accordingly, I understand that any need or problem known in the field of endeavor at the time of invention can provide a reason for combining the elements in the manner claimed.

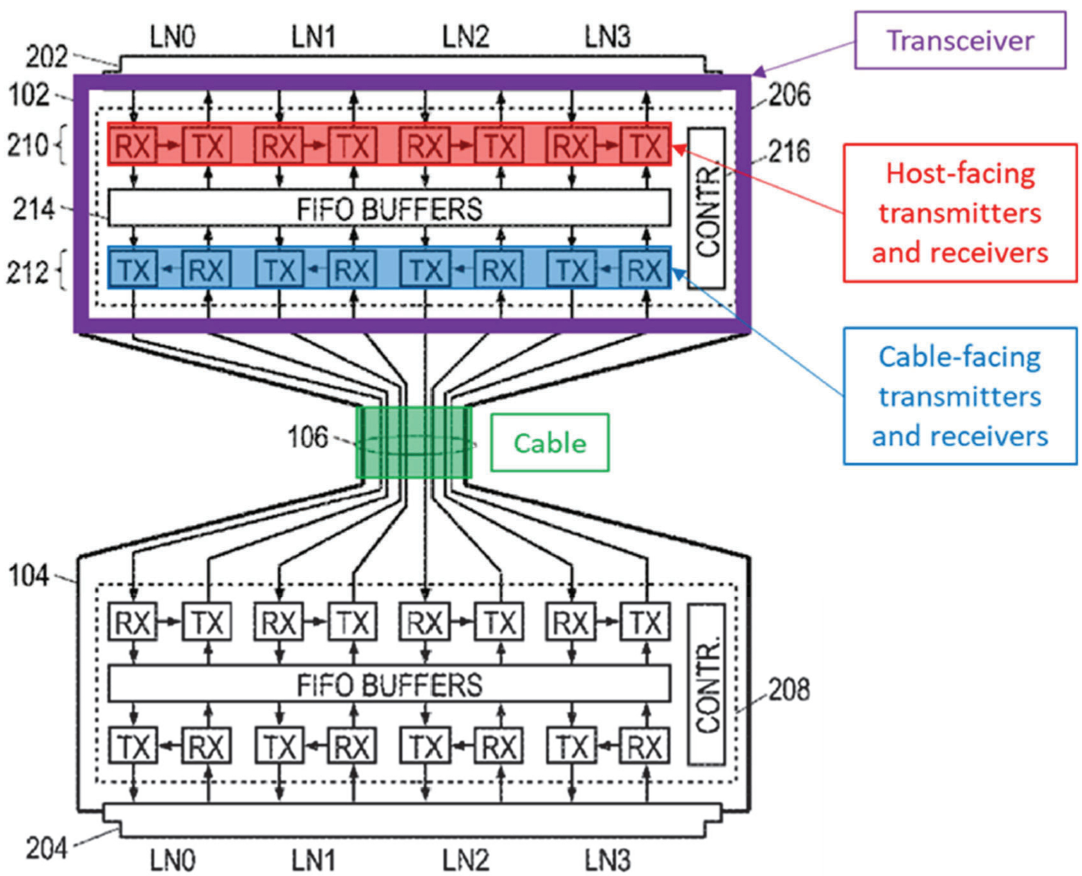
34. I have been informed by Counsel and understand that a claim can be obvious in light of a single reference, without the need to combine references, if the elements of the claim that are not found explicitly or inherently in the reference can be supplied by the common sense of one of skill in the art.

35. I have been informed by Counsel and understand that in an *inter partes* review, "the petitioner shall have the burden of proving a proposition of unpatentability," including a proposition of obviousness, "by a preponderance of the evidence." 35 U.S.C. §316(e).

V. SUMMARY OF THE '252 PATENT

36. The '252 Patent is directed to an active ethernet cable (AEC) that provides "a high-bandwidth communications link between devices in a routing network." EX-1001, Abstract, 3:44-46. The AEC of the '252 Patent includes connectors 102, 104 that each "include a powered transceiver that performs clock and data recovery (CDR) and re-modulation of data streams in each direction" thus providing "consistently robust data transfer over extended cable lengths … without

consideration of the electronics manufacturers of the network interfaces." *Id.*, 3:61-4:26, FIG. 2 (reproduced below). A "host-facing transmitter and receiver set 210 employ fixed equalization parameters that are cable-independent, i.e., they are not customized on a cable-by-cable basis." *Id.*, 4:60-5:5. These equalization parameters can include "filter coefficient values for pre-equalizer filters in the transmitters, and gain and filter coefficient values for the receivers." *Id.*



EX-1001 ('252 Patent), FIG. 2 (annotated)

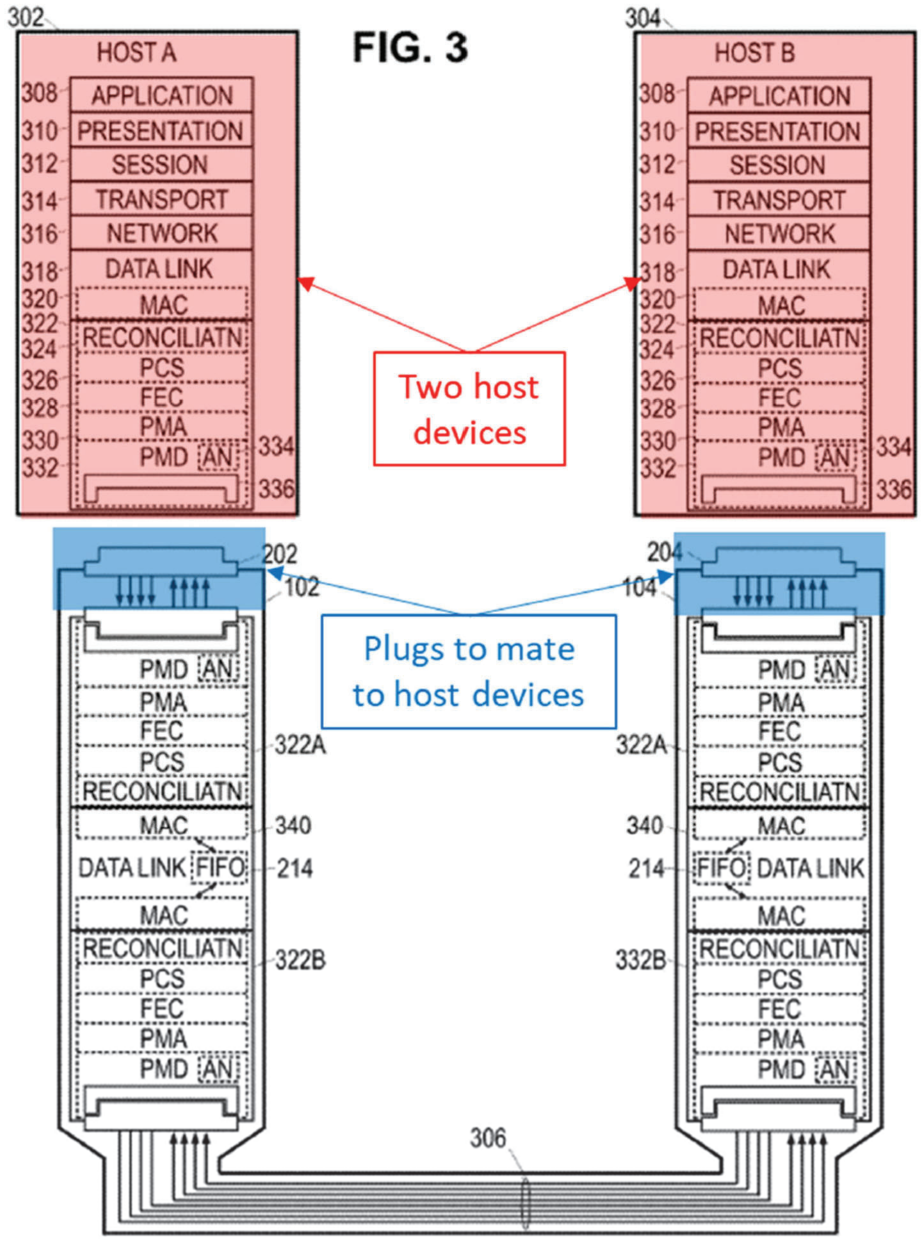
37. The transceiver sets 210 and 212 are described as follows:

> In at least some contemplated embodiments, the host-facing transmitter and receiver set 210 employ fixed equalization parameters that are

> cable-independent, i.e., they are not customized on a cable-by-cable basis. The center-facing transmitter and receiver set 212 preferably employ cable-dependent equalization parameters that are customized on a cable-by-cable basis. The cable-dependent equalization parameters may be adaptive or fixed, and initial values for these parameters may be determined during manufacturer tests of the cable. The equalization parameters may include filter coefficient values for pre-equalizer filters in the transmitters, and gain and filter coefficient values for the receivers.

EX-1001 ('252 Patent), 4:60-5:5.

38. The '252 Patent discloses that the cable illustrated in FIG. 2 forms "a point-to-point communications link between two host devices 302, 304," shown in FIG. 3. EX-1001, 5:6-6:54, FIG. 3. The cable connectors have "plugs 202, 204" that allow the cable to "mate with receptacles 336" of the two host devices. *Id.*



EX-1001 ('252 Patent), FIG. 3 (annotated)

VI. OVERVIEW OF THE CITED REFERENCES

A. Cornelius

39. Cornelius is directed to "[c]ircuits, methods, and apparatus that allow signals that are compliant with multiple standards to share a common connector on

an electronic device." EX-1006, Abstract. The reference addresses the problem of accommodating a legacy standard (DisplayPort) and newer standards (such as "HSIO" or "T29") on the same physical connector. EX-1006, 3:54-4:9, 5:33-39. Cornelius discloses active cables in Figures 5 and 6 that include "two active plugs…one on each end of cable," each with "dual clock and data recovery circuits for retiming data" and a cable microcontroller to configure those circuits. *Id.*, 6:6-24, Figs. 5-6.

40. The core teaching of Cornelius is a connector pinout arrangement and associated circuitry that enables signals from two different standards to share common connector pins without interfering with one another. EX-1006 at 2:20-26. Cornelius describes how pins for a newer high-speed standard may be arranged to reduce crosstalk and interference among themselves, and how additional circuitry—such as resistors, PiN diodes, multiplexers, coupling capacitors, and inductors—may be used to isolate the signal paths of the two standards from each other. *Id.*

B. Samaan

41. Samaan is a technical paper titled "High-speed Serial Bus Repeater Primer," authored by Samie B. Samaan, Dan Froelich, and Samuel Johnson of Intel Corporation. EX-1007, Title, Cover. The paper provides an overview of SerDes repeaters—specifically re-drivers and re-timers—describing their micro-

architecture, properties, applications, and limitations in the context of high-speed serial bus standards such as PCIe 3.0. EX-1007, ¶¶1-8.

42. Samaan is fundamentally a reference on adaptive equalization—not preset equalization. The central theme of Samaan is that equalization coefficients are determined dynamically through link training and adaptation protocols, where transmitters and receivers negotiate optimal TxEQ settings in real time. For PCIe 3.0, Samaan describes a four-phase TxEQ adaptation protocol in which both link partners exchange information about their supported equalization ranges (Phase 0), establish initial communication (Phase 1), and then iteratively request coefficient changes from each other until each receiver finds an optimal setting (Phases 2 and 3). EX-1007, ¶¶83-87. The "intent of adaptation is to allow both agents to adjust the link partner's TxEQ to an optimal value for their receiver, and for the specific channel and operating conditions at hand." EX-1007, ¶78.

C. Lugthart

43. Lugthart is directed to "[s]ystems and methods for high speed communications," including "transceiver architectures and techniques for retiming, multiplexing, de-multiplexing and transmitting data." EX-1004, Abstract. Specifically, Lugthart describes a transceiver system that interfaces between a host electronic device (e.g., electronic device 101a) and a line-side medium such as copper cable lines (e.g., cable conducting lines 111). *Id.*, FIGS. 1A, 2A, 4A, 4B.

44. Lugthart, FIG. 2A depicts a high-speed point-to-point communication system 100 that includes an active cable 110 connecting a first electronic device 101a and a second electronic device 101b. EX-1004, 14:9-11. The cable 110 has "first and second transceiver assemblies 105a, 105b," including first and second transceivers 107a, 107b, respectively, positioned at either end of conductive lines 111. *Id*., 14:31-34, 14:48-50.

45. To maintain signal integrity over the cable conducting lines 111, Lugthart specifically provides a transceiver structure (e.g., transceiver 107a) that compensates for signal degradation. EX-1004, 6:41-45 ("[t]he performance of communication systems is limited . . . by factors including intersymbol interference (ISI) and other characteristics . . . associated with the cable including loss, noise, dispersion and non-linear response"), 6:55-57 ("ISI can be reduced by ... designing the transceivers to compensate for or reduce the effects of ISI"), 15:5-10 ("[i]ntegrating transceivers into a cable can achieve a wide variety of advantages . . . an active cable [having integrated transceiver(s)] can permit communication over longer distance . . . with a thinner cable . . . using an active cable [having integrated transceiver(s)] can decrease jitter, noise, and/or ISI relative to a configuration using a passive cable.").

46. Lugthart focuses on compensating for loss in the cable conducting lines 111. EX-1004, 6:41-45, 6:55-57, 15:5-10; 9:10-12, 9:65-10:2, 23:59-24:2.

According to Lugthart, implementations of the transceivers include "adaptive and configurable signal conditioning features such as an integrated continuous time linear equalizer (CTLE), output pre-emphasis, self-adaptive digital equalization, by-passable forward error correction (FEC)." *Id.*, 29:21-28. Therefore, Lugthart explains that for purposes of establishing a high-speed communication link between two electronic devices, the operating parameters for the equalizers are adjusted during one or more training phases after a start-up phase. *Id.*, 47:53-64, 48:64-49:37.

47. During prosecution of the application that led to the '252 Patent, the Examiner considered the same disclosures of Lugthart when allowing the claims of the '252 Patent. The face of the '252 Patent identifies multiple references that the Examiner reviewed during prosecution, including U.S. Patent No. 9,337,993 to Lugthart *et al.* ("Lugthart-993"). EX-1001 at Page 000002. Lugthart-933 (EX-2021) is substantively identical to the Lugthart reference (the primary differences appearing in the face, background, and claims of the respective publications).

D. Aronson

48. Aronson (U.S. Patent No. 7,445,389), titled "Active Optical Cable with Integrated Eye Safety," is primarily directed to an active optical cable, which communicates over much of its length using optical fibers while presenting integrated electrical connectors at one or both ends. EX-1005, Abstract, 2:22–31.

Aronson's core innovation is enabling network nodes to use standard electrical ports (such as SFP, XFP, or X2) while benefiting from optical communication over the cable's length, along with integrated eye safety controls that disable or reduce optical power if the cable is severed. *Id.*, 2:22–31, 4:35-5:15, 12:33-45.

49. Aronson's primary architecture is an optical cable, and its equalization discussion is limited to a secondary copper patchcord variant designed for short (1–5 meter) connections between host equipment and patch panels. EX-1005, 2:22-31, 4:35-5:15, , 14:58-15:2. In Aronson's embodiments, signal integrity over the cable span is maintained by the optical medium itself—not by electrical equalization circuits within the cable. *Id.*, 6:8–35. Aronson's brief copper equalization teachings are ancillary to the patent's primary optical cable disclosure and directed to a fundamentally different signal transmission medium than conductive copper cables. *Id.*, Abstract, 2:22-31, 4:36-54.

50. As with Lugthart, the Aronson teachings upon which Petitioner relies were cited and considered by the Examiner during prosecution, and the Examiner allowed all challenged claims over those teachings. The face of the '252 Patent identifies two Aronson references as considered by the Examiner during prosecution: U.S. Patent No. 7,401,985 to Aronson ("Aronson-985") and U.S. Patent Publication No. 2007/0237464 to Aronson ("Aronson-464"). EX-1001 at Page 000002. Aronson-985 (EX-2022) and Aronson-464 (EX-2023) are

substantively identical to the Aronson reference (the primary differences appearing in the face, background, and claims of the respective publications).

VII. PETITIONER FAILS TO ESTABLISH THAT ANY CHALLENGED CLAIM IS UNPATENTABLE

A. Ground 1: Cornelius in view of Samaan (Claims 1-4, 6-9, 11-14)

51. Claim 1 of the ’252 Patent recites “[a]n active Ethernet cable” comprising, among other elements, electrical conductors connected between first and second connectors, each connector adapted to fit into an Ethernet port of a corresponding host device, each including a transceiver that performs clock and data recovery and re-modulation of inbound and transit data streams. EX-1001, 9:10–26. Claim 1 further requires “the respective transceivers each employing fixed, cable-independent, equalization parameters for each of: the remodulation of the transit data stream as the outbound data stream, and the clock and data recovery performed on the electrical input signal” *Id*. 9:27-36. Similar limitations appear in independent claims 6 and 11 *Id*. 9:53-10:26, 10:46-11:12.

1. Cornelius Does Not Teach an “Active Ethernet Cable”

52. Cornelius is directed to enabling “signals that are compliant with multiple standards to share a common connector on an electronic device,” specifically providing “a connector that provides signals compatible with a legacy standard in one mode and a newer standard in another mode.” EX-1006, Abstract.

In the embodiments described throughout the specification, the legacy standard is DisplayPort and the newer standard is identified as “HSIO” or “T29.” EX-1006, 3:65–4:9.

53. I have reviewed the Cornelius specification in its entirety. At no point does Cornelius describe, suggest, or contemplate using its active cable for Ethernet communications. The specification consistently refers to DisplayPort and HSIO standards, and at best includes passing references to other media standards such as DVI, USB, and PCIe. For example, Cornelius states: “In a specific embodiment of the present invention, legacy connection 115 is a Display Port connection.” EX-1006, 3:1-3. The pinouts described in Figure 3, the configurations described in Figure 4, the active cable embodiments of Figures 5 and 6, and the tethered cable embodiment of Figure 10 are all exclusively directed to DisplayPort/HSIO operations. EX-1006, Figs. 3–6, 10; 3:65-4:54, 4:65-5:39, 6:6–33, 10:33–11:43.

54. The Petition asserts that Cornelius “teaches or suggests using Ethernet with its active cable” because Cornelius “cites known standards including ‘Ethernet’” in its “Other Publications” section on the face of the patent. Pet., 22. I have examined this citation. It refers to a Wikipedia article about Ethernet printed from the internet, listed among dozens of other references. In my opinion, the mere listing of a Wikipedia page about Ethernet in a patent’s references cited section does not constitute a technical teaching or suggestion that the claimed active cable

should be configured for Ethernet use. Tellingly, other than this disparate citation, Cornelius does not mention Ethernet once in its entire disclosure. I understand that Dr. Chen also infers disclosure of Ethernet from the term "HSIO" in Cornelius. EX1003, ¶82. I disagree that such an inference is supported by the disclosure. The acronym HSIO is used to refer to "high-speed input-output," but its meaning is contextual. There is no single, universal definition of HSIO in the industry. To understand its meaning, one must look to the context in which it is used. In the context of Cornelius, a POSITA would not have understood HSIO to include Ethernet, particularly where the Cornelius disclosure itself does not mention Ethernet.

55. A POSITA reviewing Cornelius would understand that its active cable is specifically designed for what Cornelius describes as HSIO/DisplayPort connectivity. The connector pinouts described in Figure 3 of Cornelius are tailored to share pins between DisplayPort signals and HSIO signals—not Ethernet signals. EX-1006, 4:22–54, Fig. 3. The configuration detection methods described in Figure 4 rely on pull-up and pull-down resistors on DisplayPort configuration pins CFG1 and CFG2 to determine whether a connected device is a DisplayPort device or an HSIO device. *Id.*, 5:1–36, Fig. 4. None of this infrastructure has any relevance to Ethernet communications.

56. The Petition's motivation to combine Cornelius with Samaan for Ethernet functionality rests on the assertion that Cornelius is an Apple patent and Samaan is an Intel publication, and that Apple and Intel collaborated on Thunderbolt cables. Pet., 19–24. However, Thunderbolt is not Ethernet. Thunderbolt is a proprietary high-speed I/O protocol that can tunnel DisplayPort and PCIe signals—precisely the type of technology Cornelius addresses. EX-1006, 1:19–22, 4:1–9. In my opinion, a POSITA would not have been motivated to fundamentally redesign Cornelius's purpose-built HSIO/DisplayPort active cable into an Ethernet cable merely because a Wikipedia article about Ethernet was listed among the references cited during prosecution. Nor does Samaan's references to 10G-KR teach use of Ethernet cables. The 10G-KR standard is a form of "Backplane Ethernet" that does not use cables at all. Instead, Backplane Ethernet (including 10G-KR) involves communications over a single copper trace on the printed circuit board of a server backplane.

57. Dr. Chen's reliance on PCIe fares no better. *See* EX1003, ¶¶54–56. For example, EX1028 is an Intel marketing white paper from September 2005 titled "PCI Express Ethernet Networking." EX1028, p. 1. It discusses how PCI Express—as a host bus slot architecture on a motherboard—provides better I/O bandwidth for Ethernet network adapter cards than the older PCI and PCI-X parallel bus slots. *Id*., pp. 1–2. It then promotes specific Intel PRO/1000 network

adapter products that plug into PCIe slots to deliver Gigabit Ethernet connectivity. *Id*., pp. 4–5.

58. EX1028 at best shows that Ethernet NICs *sit in* PCIe slots—it does not show that PCIe *cables* should carry Ethernet traffic. EX1028, pp. 1, 4. Every type of I/O device sits in PCIe slots (graphics cards, NVMe drives, sound cards, RAID controllers). Under the this logic, the mere fact that a reference discusses PCIe would motivate combining it with *any* protocol that uses a PCIe host interface—which would encompass virtually every modern communication standard for devices like GPUs, storage controllers, or any other peripheral device. This renders the alleged "motivation to combine" meaningless.

59. To arrive at the "active Ethernet cable" of Claim 1, a POSITA would have needed to re-engineer the entirety of Cornelius's connector design—its pinouts, its configuration detection circuitry, its signaling rates, and its protocol-layer operations—to conform to the IEEE 802.3 Ethernet standard. The Petition identifies no teaching in Cornelius that would guide or motivate such a fundamental redesign, nor does it explain how this redesign would be accomplished. Pet. at 22–27.

2. Cornelius Does Not Teach Fixed Equalization Parameters That Remain Unchanged During Normal Cable Usage

60. Limitation [1e] of Claim 1 requires the equalization parameters to be "fixed." The '252 Patent specification explains that the host-facing transmitter and receiver sets "employ fixed equalization parameters that are cable-independent, i.e., they are not customized on a cable-by-cable basis." EX-1001, 4:60–63. The specification distinguishes these fixed parameters from "cable-dependent equalization parameters" that "may be adaptive or fixed." *Id.*, 4:63–5:2. In the context of the '252 Patent, "fixed" parameters are values that do not change during normal operation of the cable—they are established once and remain constant thereafter. *Id.*, 4:60–5:2.

61. The Petition asserts that Cornelius teaches "fixed" equalization parameters based on the following passage from column 11, lines 52–55 of Cornelius: "parameters for these circuits may be calibrated or otherwise determined by the manufacture[r] and stored as presets for loading during operation." EX-1006, 11:51–55. The Petition characterizes these manufacturer presets as "fixed at manufacturing" because they are "present[ed] as an alternative to parameters determined/trained when the cable is connected and operating." Pet. 44; EX-1003, ¶108.

62. I disagree that this passage teaches parameters that remain fixed and unchanging during normal cable operation. In the field of high-speed serial communications, the term "presets" typically refers to initial starting values that are loaded at the commencement of operation. The use of the word "loading" indicates that these values are loaded into operational registers when the cable begins operation—it does not suggest that they remain unchanged thereafter.

63. This interpretation is confirmed by the context in which this passage appears. Cornelius describes determining parameters "while the system is connected," which "may occur during power up, restart, or other periodical or event-based time." EX-1006, 11:55–59. A POSITA reading this approach would understand that this describes a dynamic adjustment process.

64. Moreover, Cornelius describes its calibration procedure in connection with Figure 11, which teaches a method involving placing the near end in loopback mode, transmitting and receiving a signal via the loopback path, and then "optimiz[ing] TX and RX parameters for near end circuits." EX-1006, Fig. 11, 11:62–12:10. Cornelius further states that "a host may put a near end of the cable in loopback mode, transmit data, and receive the data, and then adjust transmit and receive parameters accordingly." *Id.*, 11:64–66. These teachings indicate a dynamic optimization process. A POSITA would understand that even if manufacturer

presets are loaded initially, Cornelius contemplates subsequent adjustment of those parameters during the loopback calibration described in Figure 11.

65. Therefore, it is my opinion that Cornelius does not teach equalization parameters that are “fixed” in the sense required by Claim 1 of the ’252 Patent—i.e., parameters that are established and do not change during normal operation of the cable.

3. Samaan Teaches Away from Fixed, Cable-Independent Equalization Parameters

66. Even if a POSITA were to look to Samaan for guidance on how to implement equalization in Cornelius’s active cable, Samaan’s teachings would lead that POSITA away from using fixed, cable-independent parameters, not toward them. Samaan’s overarching focus is on the challenges of adaptive equalization training and the critical importance of adjustable, programmable equalization parameters in high-speed serial links.

67. Samaan repeatedly emphasizes that equalization parameters must be programmable. For retimer TxEQ (transmit equalization), Samaan explicitly states that “TxEQ…settings have to be programmable by the re-timer itself, in order to allow the device to participate in the PCIe 3.0 or KR TxEQ adaptation or training.” EX-1007, ¶225. This teaching makes clear that in Samaan’s architecture, TxEQ

parameters are not fixed—they must be dynamically settable by the retimer to support equalization training.

68. For the receiver side, Samaan teaches that a "Finite State Machine (FSM)" manages "adjusting the input Gain (AGC), CTLE, DFE settings, and other parameters, in such a way as to open the eye as widely as possible." EX-1007, ¶221. Samaan further teaches that the FSM may "continue to train [the equalization] throughout operation, depending on the sophistication of the design." *Id.*, ¶221. This passage confirms that in Samaan's retimer architecture, CTLE and DFE parameters are under active management by a state machine—not fixed at manufacturing.

69. Samaan devotes extensive discussion to the equalization training protocols used in PCIe 3.0 (Phases 0–3) and 10G-KR (Auto-Negotiation and Training). EX-1007, ¶¶78–91, ¶¶143–147. For PCIe 3.0, Samaan explains that the host and end device each request TxEQ adjustments from the other agent during Phases 2 and 3 of link equalization, with the "intent of adaptation" being "to allow both agents to adjust the link partner's TxEQ to an optimal value for their receiver, and for the specific channel and operating conditions at hand." *Id.*, ¶78. For 10G-KR, Samaan teaches that "[t]raining is conducted through use of a Training Frame" in which "the Rx sends to the other agent's Tx its request for a new coefficient

setting" and "the receiving Rx tries to detect the incoming pattern as it adapts its receiver's CTLE (and DFE, or any other resources)." EX-1007, ¶¶143–147.

70. Indeed, Samaan suggests that fixed equalization settings are suboptimal and unreliable. Samaan explains that "[s]emiconductor process, voltage, and temperature (PVT) variations cause a re-driver's equalization to vary part to part, and system to system" and that "such variations might range from approximately +/-0.5 to +/-1.5 dB." EX-1007, ¶¶62-63. Samaan concludes that these variations "render a re-driver's fixed settings suboptimal, eventually." *Id.*, ¶63. This teaching directly suggests that fixed equalization parameters are technically inferior and prone to failure over time.

71. In my opinion, if a POSITA were to look to Samaan for guidance on implementing equalization in an active cable's retimers, the POSITA would be led to implement programmable, adaptive equalization—not fixed, cable-independent parameters. Samaan teaches that equalization parameters in retimers are programmable and adapted through training protocols; that receiver-side equalization (CTLE, DFE) is managed by FSMs running proprietary adaptation algorithms; that even the simplest retimer form (Bit Re-timer) employs adaptive receiver equalization; and that fixed equalization settings are rendered suboptimal by PVT variations. EX-1007, ¶204-206, ¶221, ¶62. Samaan thus teaches away

from the "fixed, cable-independent, equalization parameters" required by Claim 1 of the '252 Patent.

4. Samaan Does not Teach How to Implement Retimer Technology in a Cable

72. Independent of the question of whether Samaan's equalization parameters are fixed or adaptive, Samaan does not teach a POSITA how to implement retimer technology—or any repeater technology—within a cable assembly. Samaan is a primer on SerDes repeater devices as discrete semiconductor components that reside on printed circuit boards (PCBs) within host systems, backplanes, or add-in cards. EX-1007, pp. 1–5. Samaan's entire discussion of re-drivers and re-timers is framed in the context of PCB-based signal integrity extension—extending the reach of traces on motherboards, backplanes, and across connectors—not in the context of embedding active electronics within a cable itself. *Id.*, ¶¶5–8, ¶¶153–162.

73. Samaan's sole reference to a "cable" in the context of retimer usage is a single parenthetical remark in Section 14.2, where Samaan states that information in training sets allows "a standard re-timer to be usable in a reversible cable (where either end can be plugged into the upstream or downstream component)." EX-1007, p. 58 (§14.2). This passing reference does nothing more than explain how a PCIe retimer determines its upstream/downstream orientation when placed in a

link that happens to use a reversible cable connector. It does not describe how a retimer would be physically integrated into a cable assembly, how equalization parameters should be configured for a cable-embedded retimer, what form factor the retimer silicon should take within a cable connector, or how power would be delivered to such a device.

74. A POSITA reviewing Samaan would not find any guidance on: (a) the physical integration of retimer circuitry into a cable connector housing; (b) the selection or configuration of equalization parameters for a retimer that is permanently embedded within a fixed-length cable (as opposed to one on a PCB that must accommodate varying channel lengths); (c) the thermal, power, or mechanical constraints of placing active silicon within a cable assembly; or (d) any design methodology for an "active cable" as that term is understood in the art. Samaan's brief mention of a "reversible cable" merely acknowledges that cables with reversible connectors exist in PCIe systems—it provides no teaching whatsoever about how to design or build such a cable with embedded retimer electronics.

75. Accordingly, to the extent the Petition relies on Samaan to supply the implementation details for Cornelius's cable—including how equalization parameters should be selected and configured for cable-embedded transceivers—Samaan does not provide the necessary teachings. A POSITA consulting Samaan

may at best learn about board-level retimer placement, PCB channel extension, and system-level link training, but would find no instruction on how to translate those teachings into an active cable product with transceivers embedded in its connectors.

B. Ground 2: Cornelius in view of Samaan and Lugthart (Claims 5, 10)

76. Claim 5 depends from Claim 4, which depends from Claim 2, which depends from Claim 1. Claim 5 adds the limitation: "wherein the inbound data stream and the outbound data stream each have a per-lane symbol rate in excess of 50 GBd." EX-1001, 9:50-52. Claim 10 recites the same per-lane symbol rate limitation in the context of the communication method of Claim 9. *Id.*, 10:43-45.

77. Lugthart (U.S. Patent No. 9,882,706) is a continuation of U.S. Application No. 14/581,934, filed December 23, 2014. EX-1004, p. 1 (Related U.S. Application Data). EX-1004, p. 1 The same application (No. 14/581,934) issued as U.S. Patent No. 9,571,308. *Id.*. Lugthart claims priority to three provisional applications: No. 61/921,360, filed December 27, 2013; No. 61/927,404, filed January 14, 2014; and No. 61/982,233, filed April 21, 2014. *Id.*

78. U.S. Patent No. 9,337,993 ("Lugthart-993", EX-2021) involves the same inventor team and the same assignee as Lugthart (9,882,706). EX-1004, p. 2 (listing U.S. Patent 9,337,993 B1, 5/2016, Lugthart et al., in the References Cited).

Lugthart-993 issued in May 2016 from the same patent family. The face of the Lugthart patent (EX-1004) itself lists Lugthart-993 among its U.S. Patent Documents in the References Cited, alongside U.S. Patent No. 9,379,878 (also to Lugthart et al., June 2016) and U.S. Patent No. 9,571,308 (also to Lugthart et al., February 2017)—confirming that these patents constitute a family of related applications sharing the same underlying disclosure. EX-1004, p. 2.

79. I reviewed the disclosures in the Lugthart-933 (EX-2021) reference and note that it appears to be substantively identical to the Lugthart reference (the primary differences appearing in the face, background, and claims of the respective publications). Lugthart (9,882,706) and Lugthart-993 share the same core technical disclosure: systems and methods for high-speed communications using innovative transceiver architectures and techniques for re-timing, multiplexing, de-multiplexing, and transmitting data. EX-1004, Abstract.

80. During prosecution of the ’252 Patent, the Examiner applied Lugthart-993 to reject the as-filed independent claims (which corresponded to limitations [1pre]–[1d]). EX-1002, 000547–558. In response to a rejection based on Lugthart-933, the applicant amended the claims to incorporate limitation [1e]—requiring fixed, cable-independent equalization parameters for both remodulation and CDR. EX-1002, 000629-38. After this amendment, the Examiner allowed the claims. EX-1002, 000672-74.

81. The fact that Lugthart-993 was specifically applied by the Examiner and found insufficient to address [1e] or [6k], as well as the additional features recited in dependent claims 2-5 or 7-10, means that the Examiner already appreciated the full scope of the Lugthart family's transceiver and equalization teachings, including their data rate disclosures. Adding the data rate teachings from Lugthart (9,882,706)—which are the same teachings present in Lugthart-993—to a combination that still lacks limitation [1e] does not render Claims 5 or 10 obvious.

C. Ground 3: Lugthart in view of Aronson (Claims 1-14)

1. Examiner Considered the Lugthart and Aronson Disclosures During Prosecution

82. As an initial matter, I note that the Examiner considered Lugthart and Aronson references during examination of the application that led to the '252 Patent, and those references contain the same disclosures that Petitioner and Dr. Chen now cite. The face of the '252 Patent identifies multiple references that the Examiner reviewed during prosecution, including U.S. Patent No. 9,337,993 to Lugthart *et al.* ("Lugthart-993"), U.S. Patent No. 7,401,985 to Aronson ("Aronson-985"), and U.S. Patent Publication No. 2007/0237464 to Aronson ("Aronson-464") and. EX-1001 at Page 000002. I reviewed the disclosures in Lugthart-933 (EX-2021), Aronson-985 (EX-2022), and Aronson-464 (EX-2023) and note that they appear to be substantively identical to the Lugthart and Aronson references,

respectively (the primary differences appearing in the face, background, and claims of the respective publications).

2. Lugthart Does Not Disclose Fixed, Cable-Independent Equalization Parameters

83. Lugthart teaches an active cable with transceivers at each end that perform CDR, equalization, and remodulation. EX-1004, 7:66–8:60, 14:29–15:27, 21:35–22:59, Figs. 1A, 2A, 4A. Critically, however, Lugthart does not teach that any equalization parameters are "fixed" and "cable-independent" in the sense required by the independent claims of the '252 Patent. To the contrary, Lugthart teaches a multi-phase channel negotiation process in which equalization parameters are dynamically adjusted. Specifically, Lugthart describes a three-phase startup sequence: (a) a start-up phase; (b) a full speed training phase; and (c) a full functional training phase. *Id.*, 47:53–65, Fig. 15.

84. During the full speed training phase, Lugthart teaches that "the parameters of the components in the transceivers connected to the first and second electronic devices are adjusted such that NRZ modulated signals at the full baud rate can be transmitted and received at an error rate that is below or equal to a threshold error value." EX-1004, 49:3–8 (block 902). Lugthart specifies that "[t]he parameters that are adjusted in this phase can include phase of the recovered clock, the shape of the transmitted pulse, levels for the thresholder/automatic gain

controller in the receiver, operating parameters for the equalizers, etc." *Id.*, 49:8–14.

85. Similarly, during the full functional training phase, Lugthart teaches that "the parameters of the components in the transceivers at the first and second electronic devices are further adjusted such that signals modulated using a multi-level modulation format at the full baud rate can be transmitted and received at an error rate that is below or equal to a threshold error value." EX-1004, 49:20–30 (block 903). Again, Lugthart specifies that "[t]he parameters that are adjusted in this phase can include phase of the recovered clock, the shape of the transmitted pulse, levels for the thresholder/automatic gain controller in the receiver, operating parameters for the equalizers, etc." *Id.*, 49:30–34.

86. These teachings are fundamentally inconsistent with "fixed, cable-independent" equalization parameters. Lugthart's channel negotiation process explicitly contemplates adjusting equalization parameters during the training phases to account for the specific channel conditions present at the time—including losses attributable to the particular cable connecting the transceivers. The parameters are determined adaptively each time a link is established, and they are tailored to the specific channel characteristics of the individual communication link. This the opposite of "fixed" parameters that do not change during normal

cable operation and “cable-independent” parameters that are not customized on a cable-by-cable basis.

87. The Petition acknowledges that Lugthart teaches “equalization to compensate for transmission line losses on the host side” and argues that because these parameters address host-side paths, they “do not depend on the characteristics of any particular connecting cable.” Pet. 81–83; EX-1003, ¶225. However, this argument conflates the physical location of a signal path with the independence of equalization parameters from cable characteristics. Lugthart’s training phases adjust “operating parameters for the equalizers”—the specification does not distinguish between host-side and cable-side equalization parameters in the context of its training procedure. EX-1004, 49:8–14, 49:30–34.

88. Furthermore, Lugthart teaches that its transceivers have “electronic device side interfaces that are capable of adaptive operation over high loss PCB channels permitting flexibility in board and connector design for low cost solutions.” EX-1004, 29:39–43. The phrase “adaptive operation” on the host side confirms that Lugthart contemplates dynamically adjusting host-side equalization to accommodate varying host channel conditions—not using fixed, cable-independent parameters.

89. Thus, Lugthart does not disclose “fixed, cable-independent, equalization parameters” as required by the independent claims of the ’252 Patent.

3. Aronson Does Not Cure Lugthart's Deficiency

90. The Petition relies on Aronson to supply the "fixed, cable-independent" aspect of limitation [1e]. Pet. 81–86; EX-1003, ¶¶226–237. Specifically, the Petition points to Aronson's teaching that the "first block in this IC would provide equalization to compensation for high frequency loss in the host board traces" and that "[s]uch equalization could be fixed." EX-1005, 13:49–56. For the receive direction, the Petition cites Aronson's teaching that "for driving the host PCB traces at this end of the cable, an output driver is provided with optional preemphasis" and that "[t]he preemphasis could be fixed." *Id.*, 14:50–57.

91. Aronson does not teach equalization parameters that are employed for both the remodulation of a transit data stream and the CDR performed on an electrical input signal. Aronson's Figure 12A describes a "Cable Driver IC" that provides equalization for the host-side input and preemphasis for the cable-side output. EX-1005, 13:49–14:5, Fig. 12A. Aronson's Figure 12B describes a "Cable Receiver IC" that provides equalization for the cable-side input and preemphasis for the host-side output. *Id.*, 14:22–57, Fig. 12B. These are separate ICs with separate functions—a driver IC and a receiver IC—not a single transceiver that performs both CDR on an input signal from the host and remodulation of a transit data stream for output to the host, as Claim 1 requires. Aronson does not teach a

single transceiver architecture in which "fixed, cable-independent" equalization parameters are employed for both of these functions simultaneously.

4. A POSITA Would Not Have Been Motivated to Combine Lugthart with Aronson

92. The Petition argues that a POSITA would have been motivated to combine Lugthart with Aronson because "Aronson teaches fixed equalization parameters," and "there are only two possibilities for setting those fixed parameters: (1) use the same parameters across different cables, or (2) customize the parameters on a cable-by-cable basis." Pet. 84-85; EX-1003, ¶229. In my opinion, this motivation is insufficient and is based on an improperly reductive framing of the design choices available to a POSITA.

93. As an initial matter, the Petition's framing ignores the third—and most prominent—option taught by both references: adaptive equalization. Lugthart's entire architecture is built around multi-phase channel negotiation with adaptive equalization training. EX-1004, 47:53–49:34, Fig. 15. Aronson likewise teaches "automatically adaptive" equalization as one of its options. EX-1005, 13:54–56. A POSITA starting from Lugthart's adaptive architecture would have had no reason to abandon Lugthart's sophisticated training approach in favor of Aronson's simpler "fixed" option—particularly for a high-speed active Ethernet cable

operating at data rates in excess of 50 GBd, where channel conditions vary significantly and adaptive equalization provides substantial performance benefits.

94. The Petition attempts to justify the combination by arguing that "[host-side parameters] do not vary between different connecting cables" and therefore "there was little justification for the extra complication or cost of customizing these parameters for properties of individual cables." Pet. 85; EX-1003, ¶229. However, this argument ignores that Lugthart's host-side equalization must account for variations in the host systems to which the cable is connected. Aronson itself acknowledges this reality: "[d]ifferent host systems may require different degrees of equalization and/or preemphasis because of the particular length or other nature of the electrical interconnect between the cable receptacle and the next IC elements." EX-1005, 11:41–45. If different host systems require different equalization settings—as Aronson teaches—then using the same fixed parameters across all connections is not a straightforward design choice. It requires a deliberate decision to sacrifice optimality for simplicity, which a POSITA working with Lugthart's already-sophisticated adaptive architecture would not have been motivated to make.

95. Furthermore, the combination would change the principle of operation of Lugthart. Lugthart's transceiver architecture is designed around its multi-phase channel negotiation process: the transceivers establish a start-up link, train at full

speed with NRZ, and then further train with multi-level modulation. EX-1004, 47:53–49:34, Fig. 15. This negotiation process adjusts all equalizer operating parameters—including host-side parameters—to achieve acceptable error rates for the specific link. EX-1004, 49:8–14, 49:30–34. Replacing Lugthart's adaptive host-side equalization with Aronson's fixed parameters would require fundamentally redesigning Lugthart's channel negotiation to skip or bypass host-side equalization training—a modification that would defeat the purpose of Lugthart's training architecture and could degrade link performance.

96. The Petition argues that "applying Aronson's calibration teachings to Lugthart simply fills in implementation details" and "would not change the principle of operation for either reference." Pet. at 86-87; EX-1003, ¶236. I disagree. Replacing adaptive, trainable equalization parameters with fixed, cable-independent parameters is not merely "filling in implementation details"—it is a fundamental change in how the transceiver operates. A transceiver with fixed host-side equalization parameters operates differently from one that adaptively trains those parameters during channel negotiation. The former cannot adjust to varying host conditions; the latter can. This is a change in the principle of operation, not a minor implementation detail.

97. Finally, Aronson's equalization teachings are directed to a fundamentally different cable architecture than that of Claim 1. Aronson is

primarily directed to an active optical cable with integrated electrical connectors. EX-1005, Abstract, 2:22–29. Indeed, Finisar Corporation, the assignee of Aronson, was also focused on optical cables, and announced an Active Optical Cable ("AOC") as early as 2008. EX-2024. Yet neither Finisar Corporation nor anyone else combined the teachings of Lugthart or Aronson to create a commercial Active Ethernet Cable—despite industry need for a less expensive option than AOCs.

98. Furthermore, as discussed above, the Examiner considered the substantive equivalent of both Aronson and Lugthart (i.e., Aronson-985, Aronson-464 and Lugthart-993) during prosecution of the '252 Patent application, yet did not base any rejection on the combination of the two references. *See generally*, EX-1002. To me, this further confirms that a POSITA would not have sought to combine these two references.

VIII. MATERIALS CONSIDERED

99. My analysis and conclusions set forth in this declaration are based on my educational background and experiences in the field (*see* Section II). Based on my knowledge and experience, I believe that I am considered to be an expert in the field. Also, based on my knowledge and experience, I understand and know of the capabilities of persons of ordinary skill in the field around the Critical Date.

100. My analysis and conclusions set forth in this declaration are based on the perspective of a POSITA.

IX. CONCLUSION

101. For all the reasons I have noted in the foregoing paragraphs, I am of the opinion that Petitioner has failed to show that any of the challenged claims are unpatentable.

102. I currently hold the opinions set expressed in this declaration. But my analysis may continue, and I may acquire additional information and/or attain supplemental insights that may result in added observations.

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

Date: May 8, 2026 By: Tim Arthur Williams
Tim A. Williams