

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of: Junqing Sun & Haoli Qian Attorney Docket No. 59230-0004IP1
U.S. Patent No.: 11,032,111
Issue Date: June 8, 2021
Appl. Serial No.: 16/552,927
Filing Date: August 27, 2019
Title: SERDES PRE-EQUALIZER HAVING ADAPTABLE PRESET
COEFFICIENT REGISTERS

DECLARATION OF EXPERT

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: 12 Aug 2025

By: *Tim Arthur Williams*
Tim A. Williams

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I. ASSIGNMENT

1. I have been retained on behalf of Credo Technology Group., Ltd. (“Credo”) to offer technical opinions related to 11,032,111 (“the ‘111 patent”) (EX-1001). I understand that CREDO is requesting that the Patent Trial and Appeal Board (“PTAB” or “Board”) to deny institution of an *inter partes* review (“IPR”) proceeding of the ‘111 patent.

2. I have been asked to provide my independent analysis of the Petition regarding the ‘111 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 ‘111 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 ‘111 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 '111 patent, the Petition, and the cited references in the Petition.

15. I have also reviewed the following references:

- EX-2026 TI Glossary, Texas Instruments (Dec., 2013) (“TI Glossary”)

16. 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.

17. My opinions, as explained below, are based on my education, experience, and expertise in the fields relating to the '111 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

18. 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*.

19. Based on my experiences, I have a good understanding of the capabilities of a POSITA. Based on my knowledge, skill, and experience, I have an understanding of the capabilities of a POSITA. For example, from my industry experience, I am familiar with what a POSITA would have known and found predictable in the art.

IV. LEGAL STANDARDS

A. Terminology

20. 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 '111 patent was filed August 27, 2019, and claims priority to U.S. Provisional application No. 62/723,701 filed August 28, 2018, which I refer to as the "Critical Date" in this

proceeding.

B. Legal Standards

21. 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.

22. 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

23. 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.

24. 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.

25. 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

26. 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.

27. 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.

28. 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.

29. 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."

30. 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.

31. 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.

32. 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.

33. 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.

34. 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.

35. 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.

36. 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 '111 PATENT

37. The '111 Patent claims innovative, non-obvious improvements to serializer-deserializer (SerDes) communications, for example, using an “efficient adaptation interface for transmitter pre-equalizers” that enables “standards-suitable” data transmission over channels with varying “attenuation and dispersion.” EX-1001, 1:19-35; 1:39-2:16.

38. The '111 Patent explains that “as demand continues for ever-higher data rates [for data communications], extensions to the standard must account for

increased channel attenuation and dispersion even as the equalizers are forced to operate at faster symbol rates.” EX-1001, 1:19-35. Earlier techniques to address channel attenuation and dispersion “introduce[d] undesirable hardware complexity or cost.” EX1001, 1:31-35. To provide a low cost and effective solution to, in part, address channel attenuation and dispersion, the ’111 Patent discloses “SerDes pre-equalizer having adaptable preset coefficient registers.” EX-1001, title. The systems and methods described in the ’111 Patent provide, among other benefits, improvement in signal quality while also reducing or eliminating the need for receiver-side equalization, thereby enabling digital filtering with reduced bit width, and reducing power consumption in high-speed communications links, including chip-to-module (C2M) channels. EX-1001, 6:40-54, 5:24-30.

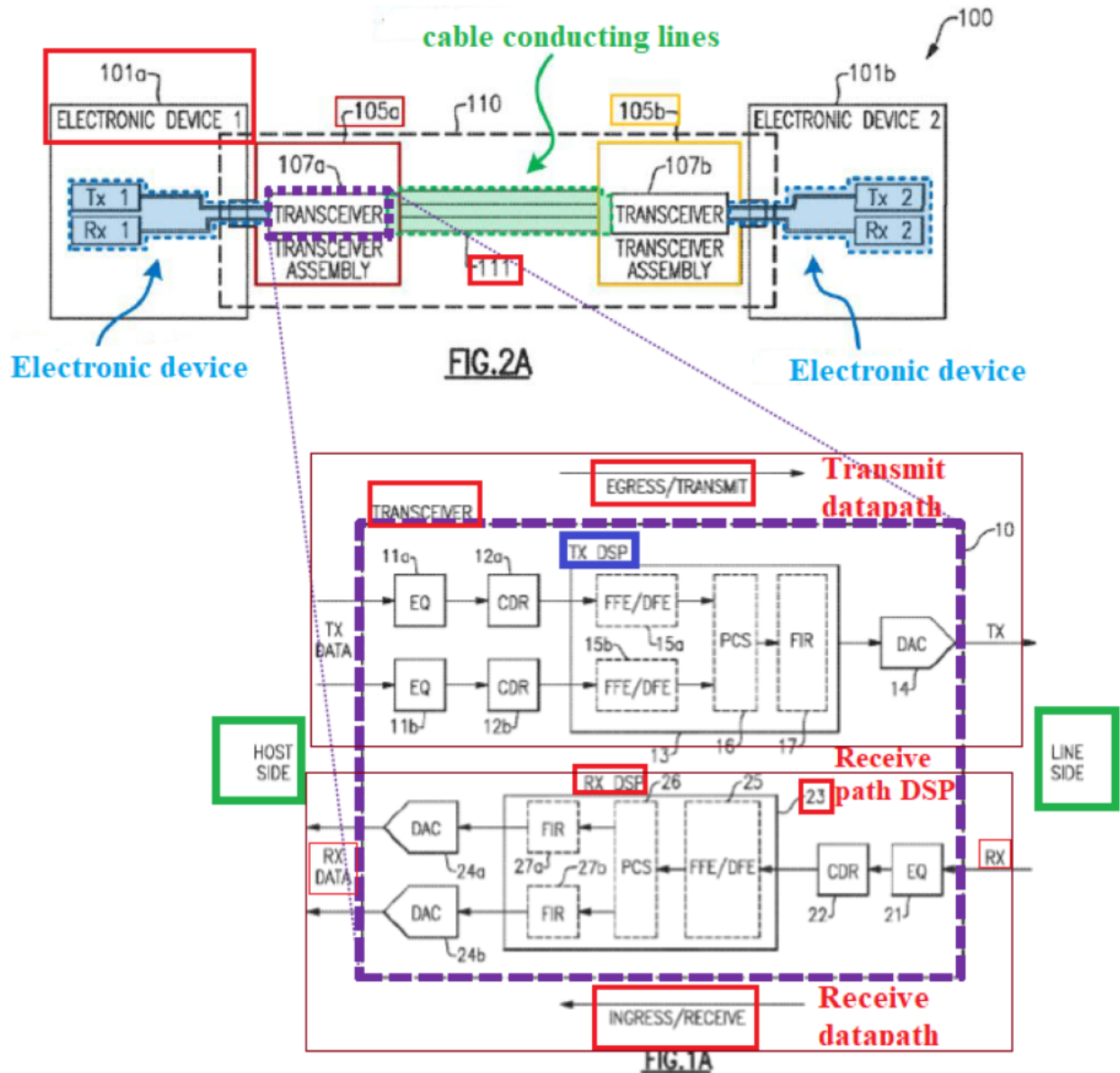
39. For instance, the inventors discovered that desirable performance characteristics, such as improved efficiency and signal integrity, could be achieved by (i) providing multiple registers in a transceiver controller, each storing a set of preset initial pre-equalizer coefficient values corresponding to different channel models, (ii) allowing for selection of optimal starting point set of coefficients, (iii) adaptive updating of such coefficients during a training phase, and (iv) application of the updated coefficients to pre-equalize transmitted data streams, while minimizing power consumption, hardware complexity, and noise enhancement. *See, e.g.*, EX-1001, 11:53-14:11; 14:12-15:3; 6:40-54.

40. Further, the above-described adaptive pre-equalization process can be implemented in a pluggable module transceiver. *See, e.g.*, EX-1001, Abstract, 1:49-57, claims 8, 11, 16. Such pre-equalization can be applied to counteract expected loss and dispersion, which “generally requires knowledge of the channel.” EX-1001, 6:40-54. In an example, the above-noted selection of optimal starting point set of coefficients requires communication between a transmitter and a receiver, since testing each set of preset coefficients involves (i) the transmitter transmitting signals to the receiver and (ii) the receiver demodulating the received signals to “estimate or measure error signals.” EX-1001, 14:12-38, FIG. 8. Once the optimal starting point is determined, (i) the transmitter can “program[] the pre-equalizer with the preset coefficients from the selected register and transmit[] a training pattern and/or data [to a receiver],” (ii) the receiver can “demodulate[] the receive signals, again obtaining error signals,” and (iii) a transceiver controller can “derive adaptation information” from the error signals and communicate remote adaptation information to the transmitter, e.g., via backchannel information fields. EX-1001, 14:36-67, FIG. 8. Such remote adaptation information can be used to adjust the transmit pre-equalizer. EX-1001, 14:57-15:3, FIG. 8.

VI. OVERVIEW OF THE CITED REFERENCES

A. Lugthart-706

41. Lugthart-706 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). EX-1005, FIGS. 1A, 2A (reproduced below, annotated), 16:9-20 (“electrical conducting lines 111 . . . can transport electrical signals between the first electronic device 101a and the second electronic device 101b . . . The conducting lines 111 can include metal (e.g., copper) conductors”).



EX-1005, FIGS. 1A, 2A (annotated).

42. To maintain signal integrity over the cable conducting lines 111, Lugthart-706 specifically provides a transceiver structure (e.g., transceiver 107a) that compensates for signal degradation. EX-1005, 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”), 15:5-20 ([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 . . . In such configurations, the conductive lines 111 may be formed”).

43. As shown above in FIGS. 1A and 2A, the transceiver architecture is divided into two directional paths—a transmit path (“EGRESS/TRANSMIT”) and a receive path (“INGRESS/RECEIVE”)—each of which includes respective components including equalizers (EQ), finite impulse response (FIR) filters, digital signal processors (DSPs), clock and data recovery (CDR) circuits. EX-1005, FIGS. 1A, 2A.

44. Lugthart-706’s EGRESS/TRANSMIT” and “INGRESS/RECEIVE” (e.g., in FIGS. 1A and 2A) indicate the direction of signal flow relative to the host device 101a and the cable conducting lines 111. EX-1005, FIGS. 1A, 2A. For example, a signal travels from a host device (e.g., 101a) through a transceiver module, and to the cable lines 111 on the EGRESS side, and a signal travels from the cable lines 111 through a transceiver module, and to a host device on the INGRESS side.

45. In Lugthart-706's transmit path, the EGRESS components of the transceiver 107a apply signal shaping techniques, including "digitally re-timing, conditioning, and multiplexing the differential signals," and "transmit[] the multiplexed signal as a multi-level modulated signal (e.g., PAM-4)" over the cable conducting lines 111. EX-1005, 6:41-45, 15:5-20, 15:64-16:3. Specifically, pre-equalization is applied to compensate for high-frequency loss and anticipated losses in the cable conducting lines 111 before the signal traverses the cable conducting lines 111. EX-1005, 6:41-45, 15:5-20.

46. In Lugthart-706's receive path, the INGRESS components receive signals from the cable conducting lines 111. These signals have undergone signal degradation in the cable conducting lines 111, which may be recovered, demultiplexed, and converted into a desired format before delivery to the host device 101a. EX-1005, 6:41-45 & 15:5-20 (describing the loss characteristics of the cable lines and attributing signal degradation primarily to those lines, and further describing how integration of transceivers into a cable can address such degradation), 9:10-12 ("The receive path equalizer 21 can be used to provide signal equalization to compensate for transmission line losses on the line side"), 9:65-10:2 ("[t]he receive path DSP 23 can be used to process (for example, filter or otherwise recover and condition) data recovered by the receive path CDR circuit

22, and to deserialize the data”); 22:60-23:6¹ (“The DSP 23 can . . . condition and de-multiplex the digital data signal to a plurality of de-multiplexed signal at a lower bit-rate . . . DSP 23 can . . . include one or more FIR filters and de-mapper to determine the signal components for the de-multiplexed data signal according to the desired modulation format”).

47. Therefore, the receive path applies post-equalization and processing—including EQ 21 and RX DSP 23—to correct distortion and convert the signal into the desired format after signal degradation has occurred during transmission over cable lines (conducting lines 111). EX-1005, 9:10-12, 9:65-10:2, 22:60-23:6.

48. Again, Lugthart-706 focuses on compensating for loss in the cable conducting lines 111. EX-1005, 6:41-45, 15:5-20. However, Lugthart-706 generally fails to provide details of signal processing for communications to and from the host device 101a, particularly on the INGRESS/receiver side. For instance, while Lugthart-706 focuses on compensating for loss in the cable conducting lines 111 (EX-1005, 6:41-45, 15:5-20), Lugthart-706 provides no description of any pre-equalization and adaptive equalization performed by the

¹ While I do not concede that the descriptions of FIGS. 4A and 4B are compatible with FIG. 2A, I have used those descriptions to the extent that the Petition has used them in support of its rationale.

receive-side DSP 23 (including FIR filters 27a-27b). Lugthart-706 also does not disclose that DSP 23 possesses channel information between the host device 101a and DSP 23. EX-1001, 6:40-54.

49. Similarly, per Petition's own description of adaptive equalization (Pet., 29 (18)), Lugthart-706 does not disclose adaptive equalization between the host device 101a and DSP 23 (or FIR filters 27a-27b therein). For example, Lugthart-706 is entirely silent on any communication between the host device 101a and DSP 23 that would enable the training and comparison of signals necessary for adapting equalization coefficients, as Petition's description requires. Pet., 29 (18). The Petition appears to acknowledge this as well. Pet., 32 (21).

B. Das Sharma

50. Das Sharma "provides a mechanism to reduce the time for link [peripheral component interconnect express (PCIe) link] training and equalization and increase its reliability." EX-1006, [0082]. "Specifically, a link training and equalization procedure . . . may utilize a software application which executes an algorithm which generates a set of coefficients for a transmission logic or receiver logic settings." EX-1006, [0082].

51. Das Sharma describes a PCIe link training and equalization process in which full swing (FS) and low frequency (LF) values associated with a PCIe

endpoint or root complex device are stored in configuration and status register, and subsequently read by a software application which uses those FS and LF values to generate a set of pre-equalization coefficients. EX-1006, [0082], [0083] (“The software application reads a full swing (FS) value and low frequency (LF) value associated with a device coupled to the bus interface link (e.g., root complex device or endpoint device) from a storage unit or element (e.g., configuration and status register) and inputs these values into an algorithm to generate a set of coefficients”).

52. Das Shama describes that the set of coefficients are stored within registers of the endpoint or root complex devices (e.g., devices 550, 560 of FIG. 5 (reproduced below, annotated)). In particular, “a set of default coefficients [are] located within registers of the transmitter or receiver components (e.g., provided by manufacturer) of the devices 550, 560.” EX-1006, [0078], FIG. 5 (reproduced below, annotated).

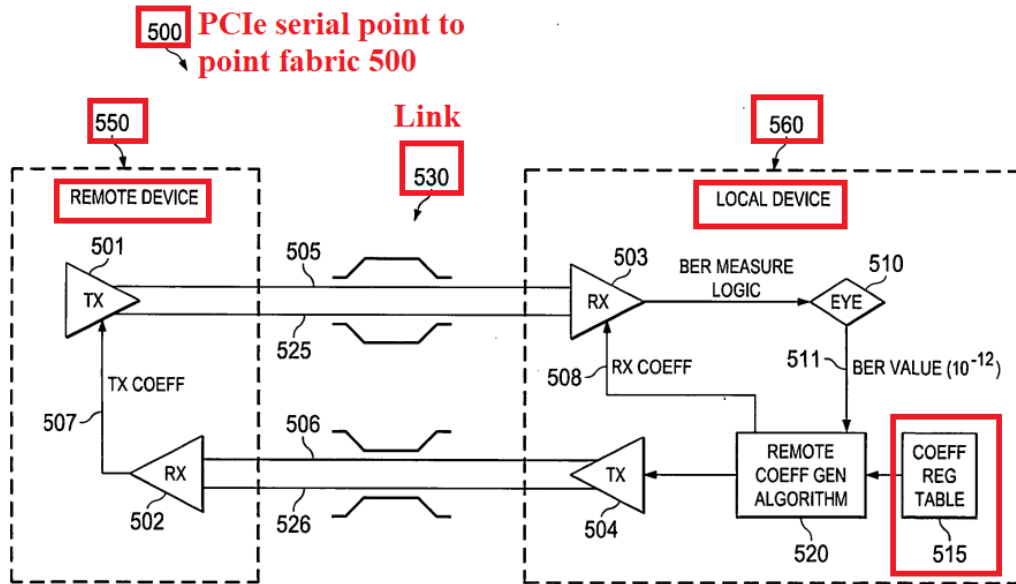


FIG. 5

EX-1006, FIG. 5 (annotated).

53. As seen above, Das Sharma's register-based coefficient storage is architecturally tied to PCIe endpoint or root complex devices. However, nothing in Das Sharma suggests that its register-based system and associated software would have been applied to any component outside the PCIe endpoint and root complex devices.

54. Moreover, Das Sharma fails to disclose or suggest (i) performing adaptive equalization techniques on a pluggable module transceiver over channel(s) between a host device and the pluggable module transceiver, and (ii) storing coefficients for adaptive pre-equalization within such pluggable module transceiver.

C. Mezer

55. Mezer describes a receiver-side equalization technique in which a pre-computed equalizer characteristic is selected based on a determined physical channel characteristic, such as cable length. EX-1007, FIG. 2A (reproduced below, annotated), 2:12-50.

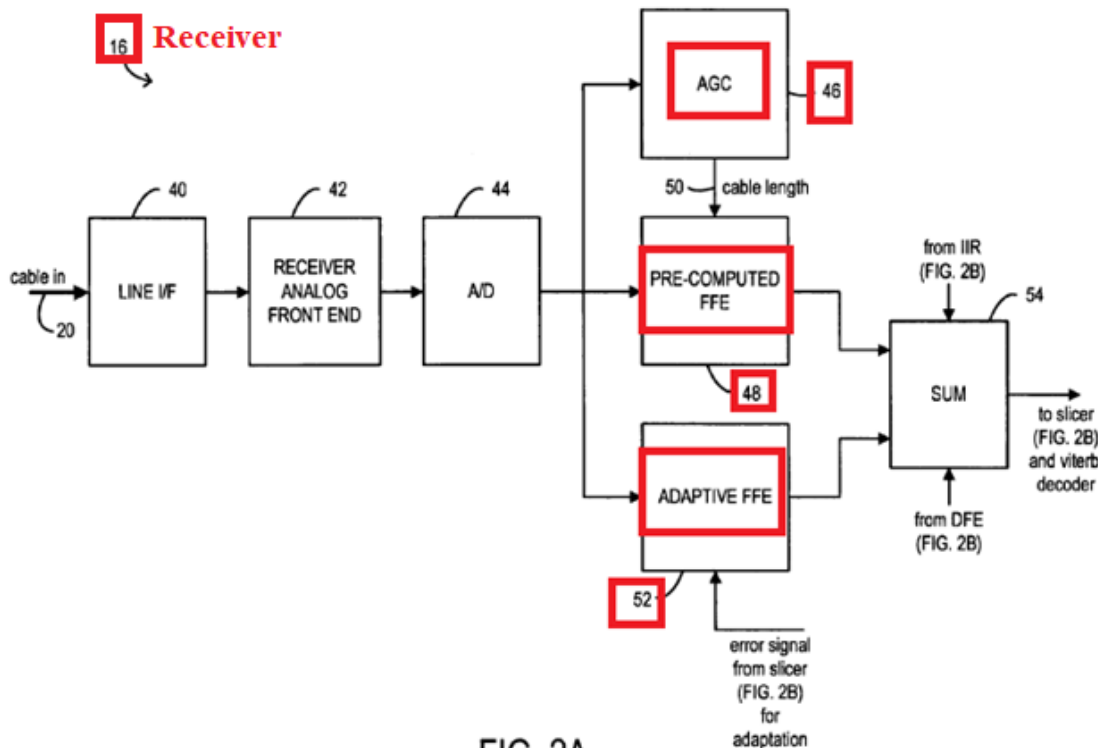


FIG. 2A

EX-1007, FIG. 2A (annotated).

56. The receiver 16 “includes an automatic gain control (AGC) circuit (or

block) 46 which is coupled to the analog-to-digital converter 44 to receive the stream of digital samples output by the analog-to-digital converter 44,” in which the AGC circuit 46 “may determine a characteristic of the communication channel 20 such as an approximate length of the cable which constitutes the communication channel 20.” EX-1007, 2:12-20. “Also included in the receiver 16 is a pre-computed feed forward equalizer (FFE) block 48. The pre-computed FFE block 48 is coupled to the analog-to-digital converter 44 to receive the stream of digital samples output by the analog-to-digital converter 44.” EX-1007, 2:21-25. “The adaptive FFE 52 may operate in accordance with conventional principles and may, together with the pre-computed FFE block 48 and other components described below, operate to equalize the incoming signals.” EX-1007, 2:47-50.

57. However, Mezer does not disclose or suggest transmitter-side pre-equalization or storing pre-equalizer coefficients for different channel models. Instead, Mezer’s disclosure is limited to receiver-side equalization.

VII. PETITIONER FAILS TO ESTABLISH A REASONABLE LIKELIHOOD OF PREVAILING ON ANY CHALLENGED CLAIM

58. As I explain below, Petition’s asserted references, considered individually or in the asserted combinations, do not render obvious: [1] pre-equalization and pre-equalizer coefficients; [2] multiple registers used in the transmitter, irrespective of channel models; and [3] registers that each corresponds

to a different channel model or stores coefficients used to determine a performance characteristic. EX1001, claims 1, 8, 11, 16. More specifically, the asserted references, considered individually or in the asserted combinations, do not render obvious the following features:

[1] pre-equalization and pre-equalizer coefficients (e.g., coefficients used for pre-equalization, including (i) “pre-equalizer coefficient values” that are being updated and that “convey a transmit data stream” for independent claim 1 and (ii) “initial coefficient values” for transmit filter(s) that “pre-equalize a corresponding serial symbol stream being transmitted to a port transceiver” for independent claims 8, 11, and 16);

[2] multiple registers themselves irrespective of different channel models;
and

[3] (i) each of multiple registers corresponding to a different channel model (for independent claim 1), (ii) each of multiple registers containing a set of initial coefficients values corresponding to a different channel model (for independent claims 8 and 16), and (iii) each register containing a set of pre-coefficient values for which the port transceiver determines a performance characteristic (for independent claim 11).

A. Lugthart-706-Das Sharma-Mezer fail to disclose or suggest “adaptive pre-equalization” and “pre-equalizer coefficients” associated with the adaptive pre-equalization

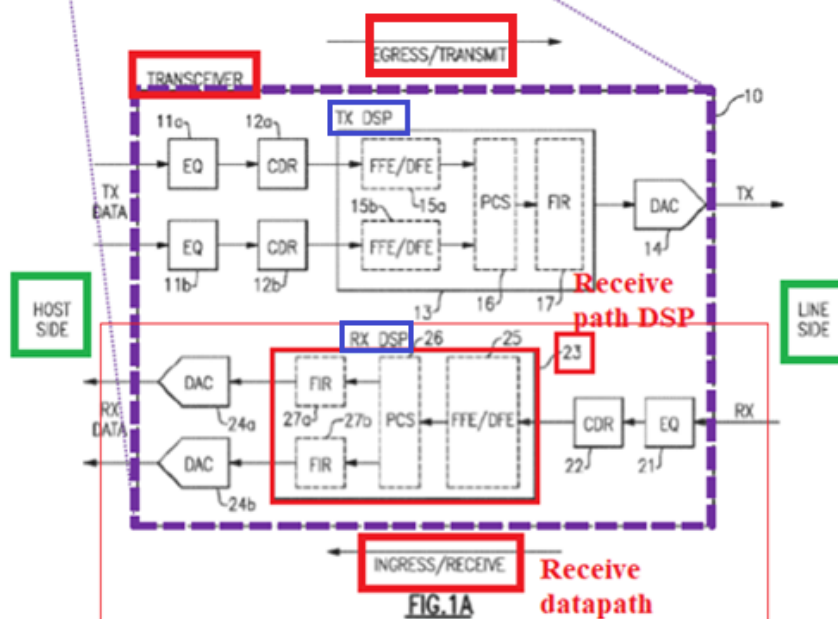
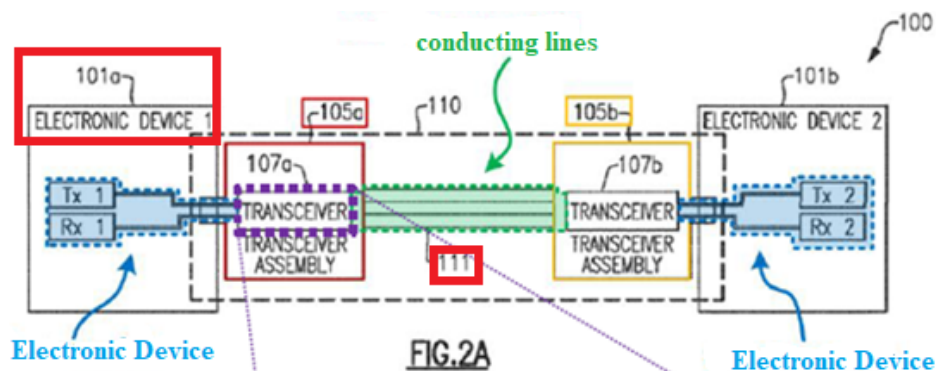
First, the Petition fails to show that Lugthart-706 discloses or suggests adaptive pre-equalization and associated pre-equalization coefficients.

59. First and foremost, Petition describes adaptive pre-equalization (pre-EQ) as follows:

“a well-known process whereby **(1) training signal(s) are transmitted** to the receiver from the transmitter, **(2) the receiver compares** the received signal(s) to the known good training signal(s) and determines an error, **(3) the equalization coefficients are adapted** (i.e., **modified**), in the receiver or the transmitter, **to reduce the error**, **(4) this continues iteratively until the received signal has an acceptable error** such as, e.g., a target bit error rate (‘BER’), and **(5) the adapted coefficients are adopted for use in equalizing signals** transmitted over the channel from the transmitter to the receiver.”

Pet., 29 (18).

60. Then the Petition asserts that **adaptive pre-EQ** is performed on a **receive datapath** of Lugthart-706’s transceiver 10, “**to compensate for transmission [line] losses . . . on the host side,**” referring to Figures 1A and 2A of Lugthart-706 below. Pet., 24-28 (13-17), 31 (20), 49 (38), 52-53 (41-42); EX-1005, FIGS. 1A, 2A (reproduced below, annotated).



EX-1005, FIGS. 1A, 2A.

61. More specifically, the Petition contends that “[a]lthough from the host’s perspective DSP 23 [digital signal processor] is on the ‘INGRESS/RECEIVE’ path . . . DSP 23—including FIR [finite impulse response] filters 27a/27b—provides pre-equalization for the signal (‘RX DATA’) that transceiver 10 transmits to the host transceiver” (Pet., 51 (40)), and contends that Lugthart-706’s transceiver performs “output pre-emphasis [Petition appears to equate ‘output pre-emphasis’ to pre-equalization]. . . to compensate for the

transmission [line] losses . . . on the host side.” Pet., 52-53 (41-42).

62. However, in direct contrast to the Petition’s assertions, Lugthart-706 explains that “[t]he receive path equalizer 21 [and RX DSP 23] can be used to provide signal equalization to **compensate for transmission line losses on the line side [as opposed to the host side, as the Petition alleges].**” EX-1005, 9:10-15, FIGS. 1A, 2A. Particularly, as I explained above with respect to overview of Lugthart-706, Lugthart-706’s equalization components are either TX (transmitter) components that perform pre-EQ to compensate for losses on the cable conducting lines 111 or RX (receiver) components that perform post-EQ to recover losses of the received data that has already undergone degradation due to channel effects at the conducting lines 111. *See supra* IV.A. As such, Lugthart-706 indicates that the **RX (receiver) DSP 23** performs post-equalization, operating on already degraded signals and serving to clean up those signals on the “INGRESS/RECEIVE” path, as opposed to performing *pre*-equalization, which requires equalization processing prior to, not after, transmission. *See supra* IV.A; *see also* EX-1005, 9:65-10:2 (“The **receive path DSP 23** can be used to **process (for example, filter or otherwise recover and condition) data recovered by the receive path CDR circuit 22, and to deserialize the data.**”).

63. Lugthart-706 says nothing about **(i) adaptive** equalization or **(ii)** adaptive **pre-equalization** on the **receive datapath DSP 23** (but rather describes

post-equalization process). However, in this regard, the Petition cherry-picks terms including [1] “**losses on the host-side**” (specific to “EGRESS/TRANSMIT,” but not “INGRESS/RECEIVE”) (EX-1005, 9:10-15) and [2] “**training phase**” (which is not tied to DSP 23/FIR filters 27a/27b) to suggest that Lugthart-706 discloses adaptive pre-EQ in an attempt to reach the claims. Pet., 51-54 (40-43); *see also id.*, 31 (20). The Petition is wrong for several reasons.

64. The first reason is that Lugthart-706 mentions “host-side losses” in the context of “EGRESS/TRANSMIT” signal path [but not INGRESS/RECEIVE signal path] where “the first and second transmit path equalizers 11a and 11b [on the EGRESS/TRANSMIT signal path] can be used to provide signal equalization to compensate for transmission line losses on the host side.” EX-1005, 9:10-15. As such, the Petition relies on the description of “host-side losses” on the EGRESS/TRANSMIT signal path but applies it to the INGRESS/RECEIVE signal path in an attempt to cure the lack of pertinent disclosure in Lugthart-706.

65. The second reason is that Lugthart-706 mentions “training phase” generally and says nothing about whether it’s applied to DSP 23/FIR filters 27a/27b on the alleged receive datapath. Specifically, the cited portions of Lugthart-706 (EX-1005, 48:64-49:19) that the Petition rely on to assert that “operating parameters for the equalizers” are “adjusted,” do not pertain to DSP 23/FIR filters 27a/27b. This “training phase” is generally directed to “establish[] a

high-speed communication link between a first electronic device [101a] and a second electronic device [101b].” EX-1005, 47:55-64. This disclosure simply does not associate training with DSP 23/FIR filters 27a/27b on the alleged receive datapath.

66. As described above in the overview Lugthart-706, Lugthart-706 provides very few details on communications with a host device. Specifically, there is no disclosure in Lugthart-706 of: (i) pre-equalization on “RX [receiver] DSP 23”; (ii) signal degradation in the signal pathway from the DSP 23 (including FIR filters 27a/27b) to the host side; (iii) adaptive pre-equalization between host “electronic device 101a” and “transceiver 107a”; and/or (iv) coefficient adaptation for use between host “electronic device 101a” and “transceiver 107a.”

67. Further, as noted above, I note that Petition itself describes adaptive pre-equalization, allegedly requiring “(2) the receiver compar[ing] the received signal(s) to the known good training signal(s) and determines an error” as a fundamental step. Pet., 29 (18). However, nowhere in Lugthart-706 describes such process involving “electronic device 101a” “compar[ing] the received signal(s) to the known good training signal(s) and determin[ing] an error,” on which the entire Petition is premised. Pet., 31-32 (20-21), 50-59 (39-48) (describing mappings for claim 1 elements based on the combination’s adaptive pre-equalization, citing to Petition’s combination section “VI.D”), 77-78 (66-67) (describing mappings for

claim 8 (e.g., [8b]) based on the combination's adaptive pre-equalization), 80-81 (69-70) (describing that mappings for features related to pre-equalization and associated coefficients of claim 11 are identical to those of claim 8), 85 (74) (describing that mappings for claim 16 are nearly identical to those of claim 8).

68. The Petition then makes unsupported conclusion: "Lugthart-706 describes training phases . . . [d]uring training . . . 'parameters' are 'adjusted,' including 'operating parameters for the equalizers' . . . POSA understood that this describes adaptive equalization," Pet., 31 (20), 51-54 (40-43).

69. As set forth above, the Petition fails to show that Lugthart-706 discloses or suggests performing adaptive pre-equalization and associated pre-equalization coefficients on Lugthart-706's receive datapath components, including (i) "pre-equalizer coefficient values" that are being updated and that "convey a transmit data stream" for independent claim 1 and (ii) "initial coefficient values" for transmit filter(s) that "pre-equalize a corresponding serial symbol stream being transmitted to a port transceiver" for independent claims 8, 11, and 16).

Second, the Petition's attempt to remedy Lugthart-706's deficiencies of adaptive pre-equalization and associated coefficients by using Das Sharma fails.

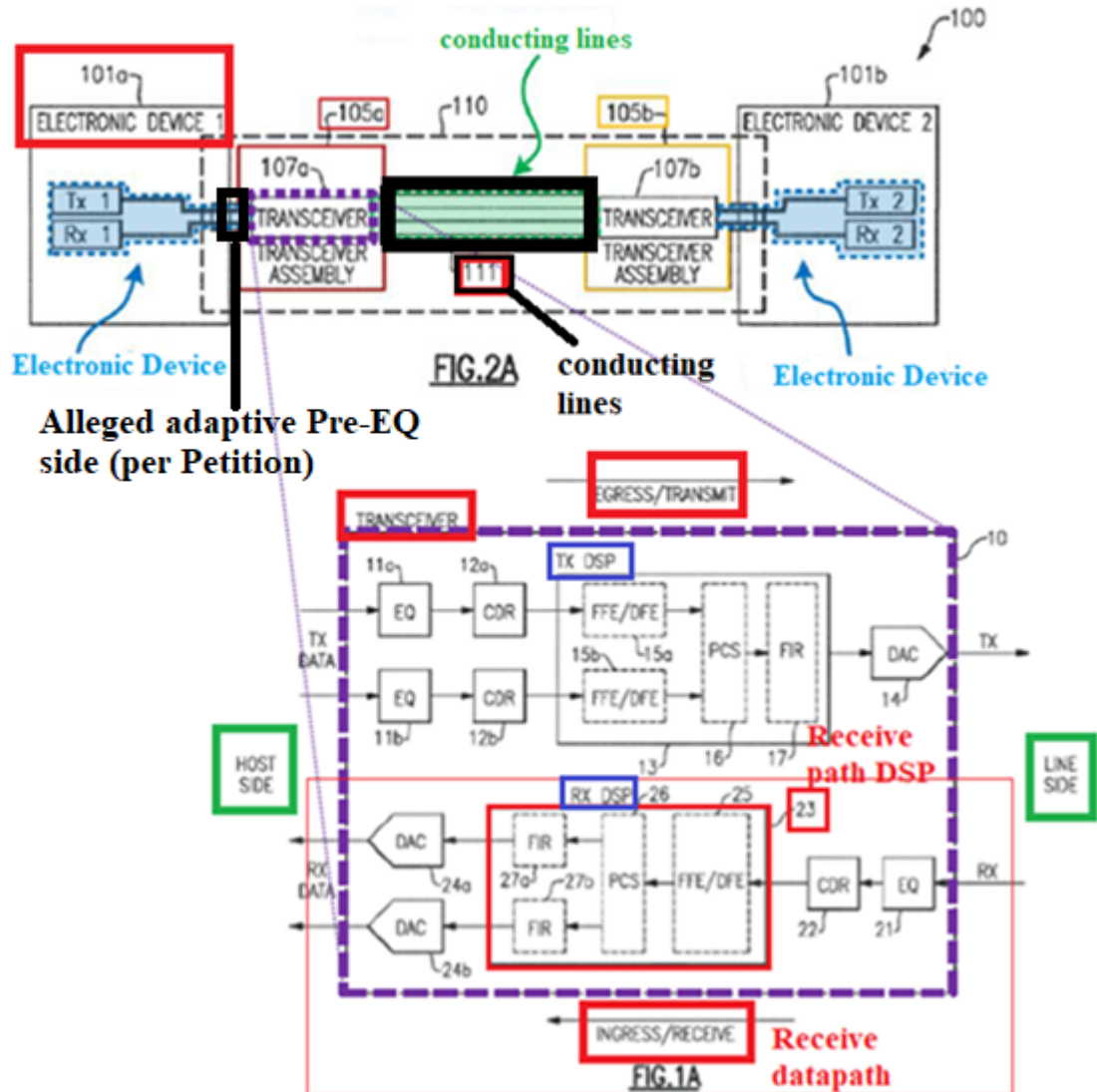
70. As an initial matter, the Petition asserts that, "to the extent Lugthart-706 is read to not expressly disclose using adaptive pre-equalization to adjust pre-

equalization coefficients for FIR filters 27a/27b of RX DSP 23 in Lugthart-706's transceiver assembly, Das Sharma would have motivated a POSA to have implemented Lugthart-706 in that manner." Pet., 32.

71. However, Petition's analysis fails due to [1] lack of connection between the Lugthart-706 and Das Sharma disclosures, [2] Lugthart-706's post-recovery focus (rather than adaptive pre-EQ) without feasible redesign explanation, and [3] hindsight bias using the '111 patent as guidance. Pet., 32; *see also supra* Section VI.A (describing that Lugthart-706 performs post-equalization on its receiver side).

72. First of all, the only link that the Petition establishes between Lugthart-706 and Das Sharma is the "PCI express protocol," mentioned once in 57 pages of Lugthart-706 and asserts that "Das Sharma teaches adaptive pre-equalization used in the same type of PCI Express protocol that Lugthart-706 describes." Pet., 32 (21). The Petition, however, overlooks that the single mention of "PCI Express protocol" in Lugthart-706 pertains solely to the conducting lines 111 (*see* EX-1005, FIG. 1A), and fails to explain how Das Sharma's alleged adaptive pre-equalization process is relevant to—or would be applied in—the receive datapath's DSP 23 (including FIR filters 27a/27b) or datapath located between electronic device 101a and transceiver 107a. EX-1005, 16:33-36, FIGS. 1A, 2A (reproduced below, annotated); Pet., 32 (21). For example, Lugthart-706's

only disclosure relating to PCI express corresponds to the following: “The **conducting lines 111** can include one or more sets of paired lines . . . [which] include one or more sets of paired micro coaxial cables. However, other types of **conducting lines 111** are possible. For example, shielded or unshielded twisted pair cables can be used in addition to any other appropriate type of cables, such as those that **can support different data and video protocols** (e.g., Serial ATA, Infiniband, **PCI Express**, DisplayPort I/O protocols, gigabit Ethernet, etc).” EX-1005, 16:33-36.



EX-1005, FIGS. 1A, 2A.

73. The Petition fails to explain how a disclosure related to a PCI Express protocol and any alleged adaptive pre-EQ being used over cable conducting lines 111 would apply to host-side communications that may not even involve similar cable conducting lines 111—particularly where, as Petition itself describes, “the pluggable module transceiver’s assembly is releasably plugged” into the electronic device 101a. Pet., 46 (35), 72 (61).

74. Second, even if one were to consider the combination of Lugthart-706 and Das Sharma, the Petition does not sufficiently explain how a POSITA would have combined the two references to arrive at the claimed features. For instance, while the Petition contends that “POSAs had multiple reasons to modify Lugthart-706 to make Lugthart-706’s pre-equalization process adaptive and to store the initial set of pre-equalization coefficients in a set of registers” and that “adaptive pre-equalization’s benefits for improving data transmission performance were well-known,” the Petition fails to explain how a POSITA/POSA would have modified Lugthart-706’s DSP 23 (including FIR filters 27a/27b) for adaptive equalization to communicate with a host device 101a. Pet., 33-34 (22-23).

75. Even if one were to consider the alleged benefits noted by the Petition, the Petition fails to acknowledge or account for differences between the cable-side and host-side communications, e.g., that the initial set of pre-equalization coefficients for cable-side communications would have been different from the initial set of post-equalization coefficients for host-side communications, to the extent equalization occurs between DSP 23 and the host device 101a as alleged by the Petitioner.

76. Accordingly, without using the ’111 patent as guidance, a POSITA would not have considered the use of adaptive pre-EQ in the proposed combination, and the Petition’s unpatentability rationale fails. Pet., 31-34 (20-23),

50-59 (39-48), 77-78 (66-67), 80-81 (69-70), 85 (74).

B. Lugthart-706-Das Sharma-Mezer fail to disclose or suggest “set of registers” and the Petition failed to explain why a POSITA would have been motivated to incorporate Das-Sharma’s registers into Lugthart-706’s system with a reasonable expectation of success

First, the Petition fails to provide sufficient motivation rationale in incorporating Das Sharma’s “set of registers” into Lugthart-706’s system.

77. Again, as described above, the only link that the Petition establishes between Lugthart-706 and Das Sharma is the “PCI express protocol,” which is mentioned once in 57 pages of Lugthart-706, and the Petition fails to explain how that specific PCI express protocol is related to the “set of registers” for allegedly storing coefficients associated with FIR filters 27a/27b.

78. To explain again, Lugthart-706’s only disclosure relating to PCI express corresponds to the following: “For example, shielded or unshielded twisted pair cables can be used in addition to any other appropriate type of cables, such as those that can support different data and video protocols (e.g., Serial ATA, Infiniband, PCI Express, DisplayPort I/O protocols, gigabit Ethernet, etc.)” EX-1005, 16:33-36.

79. The Petition does not explain why Lugthart-706’s tangential disclosure of the PCI Express protocol would inspire a POSITA to turn to Das Sharma’s “set of registers” for storing coefficients associated with FIR filters 27a/27b. Indeed, Lugthart-706’s disclosure teaches *using cables that support*

protocols such as the PCI Express protocol, but does not actually disclose using the PCI Express protocol in Lugthart-706's system. Indeed, the Petition does not explain why a POSITA would have implemented the PCI Express protocol in Lugthart-706, and why, in such a purported version of Lugthart-706's system (which is not described in the Petition and which is described in the context of cable-side communications), a POSITA would have incorporated Das Sharma's set of registers to support host-side communications.

80. Further, the Petition asserts that "on-chip registers were a well-known storage medium that POSAs understood were desirable for storing coefficients in a digital signal processor (DSP) because values can be retrieved from registers more quickly than from other types of storage, which may require the specific address locations for access." Petition, 23-24 (12-13)(citing Exp. Dec., Ex-1021, Ex-1022). However, [1] the fact that "on-chip registers were well-known storage medium," does not provide any motivation to a POSITA to combine Lugthart-706 and Das Sharma, and [2] the cited references (Ex-1021, Ex-1022) say nothing about storing coefficients and thus fail to show any association between (i) registers and (ii) coefficients in DSP; rather, they merely relate to generic efficiencies ("parallel and . . . immediate access" and "fewer clock cycles") related to having an additional storage medium.

81. In addition, as noted above, Das Sharma describes that the set of

coefficients are stored within registers of the endpoint or root complex devices, but not within a digital signal processor (DSP) of a transceiver that is not part of the endpoint or root complex devices. *See supra* Section VI.B.

82. Accordingly, without guidance of the '111 patent, a POSITA would not have come across the idea of incorporating Das Sharma's "set of registers" to Lugthart-706's FIR filters 27a/27b to store coefficients for performing the alleged (but non-existent) adaptive pre-EQ process in the receive datapath and using the "RX [receiver] DSP [23]." The Petition fails to show why a POSITA would have been motivated to make have been motivated to make the combinations or modifications of prior art to arrive at the claimed invention.

Second, the Petition failed to show reasonable expectation of success in incorporating Das-Sharma's alleged registers into Lugthart-706's system.

83. As an initial matter, the Petition merely states that "[a] POSA further knew how to store initial and updated pre-equalization coefficients in registers because Das Sharma taught this (EX-1006, [0075]-[0078]) and registers were a well-known storage medium for storing data in a digital signal processor like Lugthart-706's RX [receiver] DSP 23." Pet., 44 (33). However, the Petition never explains how to incorporate Das-Shama's "set of registers" into Lugthart-706's system.

84. Petition's argument for a reasonable expectation of success with respect to incorporating Das Sharma's "set of registers" into Lugthart-706 is

limited—if not entirely reduced—to the generic proposition that “registers were a well-known storage medium for storing data in a digital signal processor like Lugthart-706’s RX DSP 23.” Pet., 44 (33) (citing Ex-1021 (Peddle), Ex-1022 (Pickett)). This statement does not address the specific challenges or rationale for modifying Lugthart-706 to incorporate register-based coefficient storage. Simply asserting that “registers” were a “well-known storage medium” does not explain how such integration would occur and does not guide a POSITA on how to implement such register.

85. Moreover, the cited references Ex-1021, Ex-1022 allegedly disclose functionality of the register and generic features of the register, but does not relate in any aspect to Lugthart-706’s receive path DSP 23 (including FIR filters 27a/27b). Petition, 35 (24), 44 (33) (“registers permit ‘parallel and... immediate[]’ access and allow ‘data to be accessed, processed, and transferred more efficiently’ and ‘operations by a processor on data stored in ‘registers... within the microprocessor’ requires fewer clock cycles than operations on data stored in off-chip memory like DRAM”).

86. Importantly, while the Petition refers to Lugthart-706’s “transceiver 107a” as a SerDes module (e.g., “pluggable module transceiver 107a” (Pet., 23 (12))), the Petition does not explain how Das Sharma’s “configuration and status register”—which are implemented within PCIe “root complex device 901” or PCIe

“endpoint device 903,” and are not in pluggable SerDes modules—could be implemented in the alleged SerDes module in Lugthart-706 without substantial architectural redesign to incorporate such hardware registers and the associated software infrastructure. Petition 23 (12), 50 (39), 53-59 (42-48), 71-80 (60-69), 85(74); EX-1006, [0097], [0103]-[0106].

87. In addition, as described above with respect to the overview of Das Shrama, Das Sharma describes that the set of coefficients are stored within registers of the endpoint or root complex devices, but not within a digital signal processor (DSP) of a transceiver that is not part of the endpoint or root complex devices. *See supra* Section VI.B.

88. The Petition provides no explanation as to how Das Sharma’s registers could realistically be incorporated into Lugthart-706’s system, nor does Petition address the architectural redesign that such integration would require. With this omission, the Petition does not establish a reasonable expectation of success.

C. The Petition’s proposed combination fails to disclose or suggest that each of the multiple registers’ storing initial pre-equalization coefficient values corresponds to a different channel model.

While the Petition admits that Mezer’s coefficient is not tailored for pre-equalization, the Petition’s attempt to remedy this deficiency fails.

89. While admitting that Mezer’s equalization “is not pre-equalization,” the Petition relies on Dr. Min’s testimony that “the ‘equalizer characteristics’

(coefficients) in Mezer[’s receiver side] are analogous to coefficients used in an adaptive pre-equalization process [of the transmitter side],” because POSAs understood that a ‘feed-forward equalizer [of Mezer]’ was a type of equalizer that, like pre-equalization, improved communication by compensating for channel distortion.” Pet., 37 (26) & EX-1003, ¶115 (citing Raghavan (EX-1008), 17:4-14).

90. However, the cited portion of the cited reference for corroboration (Raghavan (EX-1008)) (i) does not disclose “improved communication” and (ii) merely describes that “Complex Equalizer 513 can be either a linear equalizer [e.g., feed-forward equalizer] . . . or a decision feed-back equalizer” with “adaptive” “coefficients of the equalizer transfer function”—**a receiver-side structure that says nothing about (i) pre-equalization or (ii) transmitter-side application.** EX-1008, 17:4-14. Although the naming convention appears to be opposite between Mezer’s *feed-forward* equalizer” and “decision *feedback* equalizer,” the “decision feedback equalizer” also refers to the receiver side structure. EX-2026, 18.

91. Moreover, the Petition further relies on Dr. Min’s testimony that “POSAs understood that Mezer’s teachings [“‘equalizer characteristics’ (coefficients)’] apply directly to Lugthart-706’s pre-equalization process” because: [1] “discussed **benefits Mezer describes of storing different initial equalization coefficients** for different channel types (**improved efficiency and/or using less**

hardware) apply equally to pre-equalization performed on the transmitter side [citing Mezer (EX-1007), 5:40-55]”; and [2] “**applying the same type of “lookup table” approach** for initial pre-equalizer coefficients on the transmitter side **was known** [citing Gotman, Buchardt, Zerbe-835, Das Sharma].” Pet., 38-39 (27-28) (citing EX-1003 ¶¶117-119, Mezer (EX-1007), 5:40-55 and other references (Gotman (EX-1014), Buchardt (EX-1015), Zerbe-835 (EX-1012), Das Sharma (EX-1006))).

92. However, neither point justifies the unsupported leap made by the Petition. Even assuming *arguendo* that Mezer describes benefits like improved efficiency and reduced hardware, those benefits arise solely in the context of receiver-side equalization. Mezer and references cited for corroboration say nothing that supports applying those alleged benefits to the alleged transmitter-side adaptive pre-EQ. Extending alleged benefits of receiver-side equalization to transmitter-side adaptive pre-equalization is irrelevant.

93. Similarly, the fact that transmitter-side “lookup tables” were merely “known” says nothing about applying Mezer’s receiver-side FFE at the alleged transmitter-side. The Petition simply stacks two unrelated facts and jumps to a conclusion without any technical or evidentiary bridge.

94. Finally the expert declaration arrives at unsupported conclusion: “For the foregoing reasons, it is my opinion that POSAs would have understood that

Mezer’s teachings are directly applicable to the pre-equalization process performed by Lugthart-706.” EX-1003, ¶119; *see also* Pet., 39 (28).

VIII. MATERIALS CONSIDERED

95. 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.

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

IX. CONCLUSION

97. For all the reasons I have noted in the foregoing paragraphs, the Board should deny institution of Ground 1 of the Petition, and thus decline to institute *inter partes* review of any claim of the ’111 Patent.

98. 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.

APPENDIX A

Tim Arthur Williams, Ph.D.
Curriculum Vitae

Dr. Williams has 45 years of professional experience in wireless communications, networking and telecom technology. He is an entrepreneur who has participated in the organization and operation of start up companies that brought wireless LAN, software VoIP PBX, and 2-way paging technology to the marketplace. Dr. Williams holds numerous patents in wireless and signal processing technology. He is an experienced litigation support consultant with experience in patent infringement matters. Dr. Williams is also a registered Patent Agent.

- Wireless LAN
 - Cellular and PCS Standards
 - Cellular Telephone Architecture
 - Digital Signal Processing
- Telecommunications Technology
 - VoIP Technology
 - Computer Networking
 - Wireless Networks & Protocols

Year	University	Degree
1991	University of Texas at Austin	MBA
1985	University of Texas at Austin	Ph.D., Dissertation: “Digital Signal Processing Techniques for Acoustic Log Data”
1982	University of Texas at Austin	MSEE, Thesis: “Cepstral Processing of Speech Signals”
1976	Michigan Technological University	BSEE

Professional Experience

From: 2008
To: 2010
Organization: Expressume, Inc / Montage Inc. – Milwaukee, WI
Title: Board Member
Summary: This company sells software for human resource recruiting. This company was sold in June 2019.

From: 2008
To: 2014
Organization: Faculte, Inc. – San Jose, CA
Title: Board Member
Summary: This company provided SaaS (Software as a Service) web video based communication products.

From: 2008
To: 2010
Organization: BitRail Networks Inc. – Miami, FL
Title: Founder, Board Member
Summary: This company sold computer networking solutions.

From: 2008
To: Present
Organization: Calumet Venture Management – Madison, WI
Title: Member
Summary: This company provides seed capital and management expertise to small companies.

From: 2006
To: 2015
Organization: BEEcube Inc. – Fremont, CA
Title: Founder, Board Member, Board Advisor
Summary: This company built high speed processing solutions. This company was sold to National Instruments, Inc. in Feb 2015.

Tim Arthur Williams, Ph.D.
Curriculum Vitae

From: 2006
To: 2015
Organization: Topaz Equity, LLC – Danville, CA
Title: Founder, Board Member
Summary: This is a private equity investment company. It owned AtomAMPD which develops, markets and sells software based network solutions.

From: 2004
To: Present
Organization: DoceoTech Inc. – Danville, CA
Title: Founder, Chairman
Summary: This was a training company that provides training for engineers in Wireless, Networking, and Telephony technologies. It is currently owned by Beach Technologies, LLC.

From: 2004
To: 2006
Organization: SiBEAM, Inc. – Sunnyvale, CA
Title: Founder, Chief Executive Officer
Summary: This is a fabless semiconductor company that develops high-speed wireless networking ICs. This company was sold to Silicon Image, Inc. in Apr 2011.

From: 2001
To: 2004
Organization: JetQue, Inc. – Danville, CA
Title: Founder, Chief Executive Officer
Summary: This company created messaging solutions for the mobile professional.

From: 1999
To: 2000
Organization: Atheros Communications, Palo Alto, CA
Title: Interim CEO, Advisory Board Member
Summary: This company builds wireless LAN ICs. Atheros became a public company in May 2004. (ATHR) This company was sold to QCOM in Jan 2011.

Tim Arthur Williams, Ph.D.
Curriculum Vitae

From: 1998
To: 2000
Organization: Picazo Communications, Inc. – San Jose, CA
Title: Chief Technology Officer, Advisory Board Member
Summary: This company built and sold software PBXs Telephony equipment using VoIP and Circuit Switched Technologies. The company was purchased by Intel.

From: 1996
To: Present
Organization: Beach Technologies, LLC – Danville, CA
Title: Chief Executive Officer
Summary: This is a consulting company that provides IP services. It owns DoceoTech LLC and Streaming Knowledge LLC, which perform the same services.

From: 1991
To: 1998
Organization: Wireless Access, Inc. – Santa Clara, CA
Title: Co-Founder, Chief Technical Officer, Vice President of Engineering, Vice President of Business Strategy
Summary: This was a startup company focusing on the Narrow Band PCS equipment market. The company developed the over the air protocols, the subscriber equipment and the ICs to deploy 2-way paging services. The company was sold to Glenarye Electronics.

From: 2014
To: 2021
Organization: Through Technology, LLC. – Chicago, IL
Title: Partner
Summary: This is a private equity investment company. It owns Through Technology Group, PTE LTD, which is registered in Singapore.

From: 1979
To: 1991
Organization: Motorola, Inc. – Austin, TX – Semiconductor Sector

Tim Arthur Williams, Ph.D.
Curriculum Vitae

Title: Sr. Engineer, Member Technical Staff, Sr. MTS
Summary: Business manager, project leader, and senior technical member of the teams which were responsible for product development of the following systems:

- ADPCM transcoder,
- ISDN U-reference point transceiver,
- CT-2 voice codec and channel modem,
- GSM voice codec and channel modem,
- TDMA voice codec and channel modem
- CDMA voice codec and channel modem, and
- Japanese Digital Cellular voice codec and channel modem.

From: 1976

To: 1979

Organization: Motorola Inc. - Chicago, IL - Communications Sector - Digital Voice Privacy Group

Title: Engineer

Summary: This group built the first commercial digitally encrypted two-way FM land mobile radio system.

Professional Certifications

- Patent Agent – U.S. Patent and Trademark Office #50,790 (Jan 2002)

Issued Patents

Patent	Date	Description
10,917,232	2021	Data Enciphering or Deciphering using a Hierarchical Assignment System
9,787,471	2017	Data Enciphering or Deciphering using a Hierarchical Assignment System
7,904,117	2011	Wireless Communication Device using Adaptive Beamforming
6,781,962	2004	Apparatus and Method for Stored Voice Message Control
6,600,481	2003	Data entry apparatus and method
6,088,457	2000	Method and apparatus for over the air programming a communication device
5,854,595	1998	Communications apparatus and method with a computer interchangeable integrated circuit card
5,557,642	1996	Direct conversion receiver for multiple protocols

Tim Arthur Williams, Ph.D.
Curriculum Vitae

5,428,638	1995	Method and apparatus for reducing power consumption in digital communications devices
5,345,406	1994	Bandpass sigma delta converter suitable for multiple protocols
5,101,344	1992	Data processor having split level control store
5,001,661	1991	Data processor with combined adaptive LMS and general multiplication functions
4,989,169	1991	Digital tone detector using a ratio of two demodulators of differing frequency
4,972,356	1990	Systolic IIR decimation filter
4,965,762	1990	Mixed size radix recoded multiplier
4,947,363	1990	Pipelined processor for implementing the least-mean-squares algorithm
4,876,542	1989	Multiple output oversampling A/D converter with each output containing data and noise
4,862,169	1989	Oversampled A/D converter using filtered, cascaded noise shaping modulators
4,843,585	1989	Pipelineable structure for efficient multiplication and accumulation operations
4,843,390	1989	Oversampled A/D converter having digital error correction
4,796,219	1989	Serial two's complement multiplier
4,737,925	1988	Method and apparatus for minimizing a memory table for use with nonlinear monotonic arithmetic functions
4,734,876	1988	Circuit for selecting one of a plurality of exponential values to a predetermined base to provide a maximum value
4,727,508	1988	Circuit for adding and/or subtracting numbers in logarithmic representation
4,722,067	1988	Method and apparatus for implementing modulo arithmetic calculations
4,682,302	1987	Logarithmic arithmetic logic unit
4,618,946	1986	Dual page memory system having storage elements which are selectively swapped between the pages
4,406,010	1983	Receiver for CVSD modulation with integral filtering
4,398,262	1983	Time multiplexed n-ordered digital filter

Patent Applications and Continuation Applications

Appl. Num.	Pub. Date	Description
20070037528	2007	Wireless Communication Device using Adaptive Beamforming
20040252679	2004	Stored Voice message Control Extensions

Tim Arthur Williams, Ph.D.
Curriculum Vitae

Published Papers

- 6 Sept 2016 Putnam, Jonathan D. and Williams, Tim A., The Smallest Salable Patent-Practicing Unit (SSPPU): Theory and Evidence.
Available at SSRN: <https://ssrn.com/abstract=2835617>
- 19 Sept 2022 Williams, Tim A, A Study of IPlytics Standard Essential Patent Tool.
Available at SSRN: <https://ssrn.com/abstract=4223782>

Litigation Experience

See attached.