

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NOKIA OF AMERICA CORPORATION *et al.*,

Petitioners

v.

IARNACH TECHNOLOGIES LIMITED,

Patent Owner

Case: IPR2024-00900

U.S. Patent No. 8,934,359

DECLARATION OF DR. ALEXANDER V. SERGIENKO

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3.	[1.B] the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and	48
4.	[1.C] the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal;	52
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3.	[2.B] the step of the optical line terminal detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical line terminal detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;	75
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5.	[3.D] the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.	86
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3.	[5.B]/[8.B]/[11.B] while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit; or, ...	100

4.	[5.C]/[8.C]/[11.C] while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical network unit notifying a hyper frame number to the optical line terminal; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time determined by the optical network unit itself comprises: after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit.....	105
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Exhibit	Short Name	Description
Ex. 1001	'359 Patent	U.S. Patent No. 8,934,359
Ex. 1002	'359 FH	File History of U.S. Patent No. 8,934,359
Ex. 1003	Sergienko Dec.	Declaration of Dr. Alexander V. Sergienko
Ex. 1004	Sergienko CV	<i>Curriculum Vitae</i> of Dr. Alexander V. Sergienko
Ex. 1005	G.984.3	ITU-T Recommendation G.984.3, Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification (Mar. 2008)
Ex. 1006	Lee	U.S. Patent App. Pub. No. 2005/0149822
Ex. 1007	Liu	U.S. Patent No. 6,005,694
Ex. 1008	Ramaswami	Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks, A Practical Perspective</i> (2d ed. 2002)
Ex. 1009	Kramer	Glen Kramer & Gerry Pesavento, <i>Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network</i> , IEEE Communications Magazine (February 2002)
Ex. 1010	Inf. Cont. Cover Pleading	Iarnach's Disclosure of Asserted Claims and Preliminary Infringement Contentions in <i>Iarnach Technologies Ltd. v. AT&T Inc., et al.</i> , 2:23-cv-231-JRG (E.D. Tex.)
Ex. 1011	'359 Patent Inf. Cont.	Iarnach's Infringement Contentions for the '359 Patent in <i>Iarnach Technologies Ltd. v. AT&T Inc., et al.</i> , 2:23-cv-231-JRG (E.D. Tex.)
Ex. 1012	Wijngaarden '381	U.S Patent App. Pub. No. 2010/0316381

Exhibit	Short Name	Description
Ex. 1013	Krimmel	U.S Patent App. Pub. No. 2006/0222362
Ex. 1014	Khermosh	U.S Patent App. Pub. No. 2008/0260378
Ex. 1015	Kanno	U.S Patent App. Pub. No. 2010/0021158
Ex. 1016	Wijngaarden '380	U.S Patent App. Pub. No. 2010/0316380
Ex. 1017	Hood	U.S. Patent No. 8,548,328
Ex. 1018	Effenberger II	Frank J. Effenberger, <i>et al.</i> , “Next-Generation PON—Part II: Candidate Systems for Next-Generation PON,” IEEE Comms. Mag., Vol. 47, Issue 11 (Nov. 3, 3009)
Ex. 1019	Effenberger III	Frank J. Effenberger, <i>et al.</i> , “Next-Generation PON—Part III: Candidate Systems for Next-Generation PON,” IEEE Comms. Mag., Vol. 47, Issue 11 (Nov. 3, 3009)
Ex. 1020	Chung	Hae Isni Chung & Young-Jin Kwon, Implementation of a High Speed GEM Frame Synchronization Circuit in the G-PON TC Sublayer Payload,” J. Korean Inst. of Comms. & Info. Sci., Vol. 34, Issue 5B (May 31, 2009)
Ex. 1021	Mohammadani	Khalid Mohammandani, <i>et al.</i> , “Highest Cost First-Based QoS Mapping Scheme for Fiber Wireless Architecture,” Photonics, Volume 7, Issue 4 (Nov. 22, 2020)
Ex. 1022	AT&T Case— DCO	Doc. No. 50, Docket Control Order, <i>Iarnach Technologies Ltd. v. AT&T Corp. et al.</i> , No. 2:23-cv-00231 (E.D. Tex.)

Exhibit	Short Name	Description
Ex. 1023	AT&T Case— Intervenor	Doc. No. 31, Order Granting Nokia’s Motion to Intervene, <i>Iarnach Technologies Ltd. v. AT&T Corp. et al.</i> , No. 2:23-cv-00231 (E.D. Tex.)
Ex. 1024	Caseload	U.S. District Courts – Judicial Caseload Profile (Dec. 2023)
Ex. 1025	Verizon Case— DCO	Doc. No. 45, Agreed Docket Control Order, <i>Iarnach Technologies Ltd. v. Verizon Communications, Inc. et al.</i> , No. 2:23-cv-00631 (E.D. Tex)
Ex. 1026	EPON v. GPON	<i>What is the Difference Between EPON and GPON?</i> , HITRON, https://us.hitrontech.com/learn/what-is-the-difference-between-epon-and-gpon/ (last accessed Apr. 21, 2024)
Ex. 1027	G.984.2	ITU-T Recommendation G.984.2, Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification (March 2003)
Ex. 1028	Hall-Ellis Dec.	Declaration of Dr. Sylvia D. Hall-Ellis
Ex. 1029	Hall-Ellis CV	<i>Curriculum Vitae</i> of Dr. Sylvia D. Hall-Ellis
Ex. 1030	Attachment 1A	Hall-Ellis Declaration Attachment 1A
Ex. 1031	Attachment 1B	Hall-Ellis Declaration Attachment 1B
Ex. 1032	Attachment 1C	Hall-Ellis Declaration Attachment 1C
Ex. 1033	Attachment 1D	Hall-Ellis Declaration Attachment 1D
Ex. 1034	G.9807.1	ITU-T Recommendation G.9807.1, 10-Gigabit-capable symmetric passive optical network (XGS-PON) (June 2016)

Exhibit	Short Name	Description
Ex. 1035	AT&T Complaint	Doc. No. 1, Complaint, <i>Iarnach Technologies Ltd. v. AT&T Corp. et al.</i> , No. 2:23-cv-00231 (E.D. Tex.)
Ex. 1036	Verizon Complaint	Doc. No. 1, Complaint, <i>Iarnach Technologies Ltd. v. Verizon Communications, Inc. et al.</i> , No. 2:23-cv-00631 (E.D. Tex.)

DECLARATION OF DR. ALEXANDER V. SERGIENKO

I, Dr. Alexander V. Sergienko, do hereby declare and say as follows:

I. Introduction

1. My name is Dr. Alexander V. Sergienko, and I have been retained as a technical expert by counsel for Petitioners to address certain issues regarding U.S. Patent No. 8,934,359 (“the ’359 Patent”).

2. I have personal knowledge of the facts contained in this Declaration, am of legal age, and am otherwise competent to testify.

3. Unless otherwise stated, the matters contained in this Declaration are of my own personal knowledge and, if called as a witness, I could and would testify completely and truthfully with regard to the matters set forth herein.

4. My opinions are based on my years of education, research, and experience, as well as my study of the relevant materials. A list of materials I considered is included at the beginning of this Declaration.

5. I reserve all available rights to supplement this Declaration if further information becomes available, or if I am asked to consider additional information. This Declaration represents only those opinions I have formed to date.

6. Further, I reserve all available rights to consider and comment on any additional expert statements or testimony of Patent Owner’s expert(s) in this matter.

7. I am being compensated at my usual consulting rate of \$500 per hour for my time spent working on issues in this matter. My compensation does not depend on the outcome of this matter or the opinions I express.

II. Qualifications

8. A true and correct copy of my curriculum vitae is attached as Ex. 1004 to this Declaration.

9. I received my Ph.D. in Quantum Radiophysics and Optics from Moscow State University in 1987 and my Master of Science Degree in Physics and Optics from Moscow State University in 1981.

10. I am currently a tenured full professor at Boston University where I hold joint appointments in the Photonics Center, the Department of Electrical and Computer Engineering, and the Department of Physics. My expertise and research interests include optics, photonics, secure communication, quantum physics, laser physics, nonlinear optics, and precise optical measurement in telecommunication and optical engineering.

11. I have experience and familiarity with the technical areas involved in this case. With over 30 years of research experience in the field of optics, I have studied and worked with optical networks such as those at issue in this case. For example, during my tenure as a Director of the Quantum Communication and Measurement Laboratory at the Boston University Photonics Center, I developed

quantum optical technologies for high-resolution characterization of optical device parameters (e.g., fibers, WDM switches, ROADM routers, and amplifiers) in telecommunication networks as well as technologies for secure communication (quantum cryptography).

12. My research areas of interest include, but are not limited to, lasers, optics, photonics devices, microscopy, nonlinear spectroscopy, and spectroscopic imaging; precise characterization of telecommunication networks and its elements including all-optical wavelength selective switches (WSS); liquid crystal spatial light modulators, MEMS-based optical switches, and DLP projecting displays; ultra-precise optical measurement in science and technology (quantum metrology), quantum sensors with attosecond (in time) and nanometer (in space) sensitivity based on quantum interferometry; OTDR with a mm spatial resolution; and secure quantum communication.

13. I have published 150 technical papers in major refereed research journals in the area of photonics, physics, and optical technology. Several of these research journals include: Nature Communications; Journal of the Optical Society of America; Physical Review Letters; and Physical Review A. These technical papers including a paper titled “Evaluation of Polarization Mode Dispersion in a Telecommunication Wavelength Selective Switch Using Quantum Interferometry” published in Optics Express; a paper titled “Precise evaluation of polarization mode

dispersion by separation of even- and odd-order effects in quantum interferometry” published in Optics Express; a paper titled “Odd- and Even-Order Dispersion Cancellation in Quantum Interferometry” published in Physical Review Letters; a paper titled “Dispersion and Fidelity in Quantum Interferometry” published in a Physical Review A; a paper titled “Photon-Counting Optical Coherence-Domain Reflectometry Using Superconducting Single-photon Detectors” published in Optics Express; a paper titled “Submicron axial resolution in an ultrabroadband two-photon interferometer using superconducting single-photon detectors” published in Optics Express; a paper titled “Simultaneous Measurement of Group and Phase Delay Between Two Photons” published in Physical Review A; a paper titled “Dispersion-Independent High-Visibility Quantum Interference in Ultrafast Parametric Down-Conversion” published in Physical Review Letters; a paper titled “Quantum Cryptography Using Femtosecond-Pulsed Parametric Down-Conversion” published in Physical Review A; a paper titled “Tests of a Two-photon Technique for Measuring Polarization Mode Dispersion with Subfemtosecond Precision” published in the Journal of Research of the National Institute of Standards and Technology; a paper titled “High Capacity Fibonacci Protocol for Quantum Communication” published in CLEO-Europe/QELS; a paper titled “High Capacity Fibonacci Protocol for Quantum Communication - Engineering Entangled States in High-Dimensional Hilbert Space” published in the First International Workshop for

Quantum Repeaters and Networks, Monterey, California; a paper titled “Development of Entangled-Coherent-State Quantum Key Distribution with Single-Photon Nonlinear Cross-Phase Modulation” published in QCrypt 2014, 4th international conference on quantum cryptography; a paper titled “High-resolution quantum measurement in modern telecommunication using broadband entanglement and fast single-photon detectors” published in the 2nd International Conference on Quantum Technology, Russian Quantum Center; a paper titled “High resolution optical time-domain reflectometry using superconducting single-photon detectors” published in ICONO/LAT: 2013; and a paper titled “Adaptive Optics Control of the Propagation of Biphoton Wavepacket” published in OSA Optics and Photonics Congress Imaging and Applied Optics.

14. I have presented more than 330 research papers at major international research conferences including multiple invited and plenary talks. I have contributed 7 book chapters on precise optical measurement and quantum optics. I have served as the sole editor of a book titled “Quantum Communications and Cryptography” and a co-author of a book “Quantum metrology, Imaging, and Communication” with two of my former postdocs.

15. I am an inventor on eight patents, including U.S. Patent No. 6,646,727, titled “Polarization Mode Dispersion Characterization Apparatus and Method,” and

U.S.S.R. Patent No. 51533534, titled “A Method for the Measurement of Time Parameters of Optical Processes and Photoelectric Devices.”

16. I have taught courses in optical measurement, quantum optics, photonics, electrical circuit theory, and analog electronics. I have also been an advisor to graduate students researching various subjects in physics, electrical engineering, and photonics.

17. I am a Fellow of the Optical Society of America (“OSA”) (<10% of total OSA members) and have been a lead of Quantum Computing and Communication Technical Group at OSA for several years. I am a member of the American Physical Society and a member of IEEE. I currently serve as an associate editor for two major physics and optics international research journals: Physical Review Letters and Journal of Optics.

18. From 1990 to 1996, I worked for the University of Maryland and the National Institute of Standards and Technology (“NIST”). While at NIST, I developed several novel optical measurement technologies that outperformed existing conventional approaches both in resolution and in accuracy. In 1996, I joined the Photonics Center and the Department of Electrical and Computer Engineering at Boston University. I since have been a member of the Boston University faculty.

19. While at NIST and Boston University I developed several new technologies allowing to evaluate several critical parameters of telecommunication networks and their elements, such as fibers, WDM switches, and ROADM routers. This involved the characterization of the fiber network quality based on single-photon optical time-domain reflectometry (OTDR) and measurement of polarization mode dispersion (PMD) and polarization-dependent loss (PDL) with superior resolution based on the use of quantum interferometry.

III. Scope of the Engagement

20. I have been retained by Alston & Bird LLP on behalf of Petitioners to provide various analyses and opinions. Among other tasks, I have been asked to address the technology claimed in the '359 Patent and to evaluate whether certain claims of the '359 Patent would have been obvious to a person of ordinary skill in the art.

21. All of the opinions I express in this Declaration have been made from the standpoint of a person of ordinary skill in the relevant art at the time of the invention of the '359 Patent, which I am informed is, for purposes of this matter, the earliest claimed priority date of November 4, 2009.

22. I have been asked to identify the level of skill in the art pertinent to the '359 Patent. It is my opinion that a person of ordinary skill in the art pertinent to the '359 Patent would have had at least a bachelor's degree in electrical engineering,

computer engineering, or similar discipline and had at least two years of experience with optical communications and networks. A person with a different degree but with additional relevant experience could still qualify if the additional experience compensates for the different educational background.

23. I consider myself a person of ordinary skill in the art as of no later than the earliest claimed priority date (November 4, 2009).

24. My opinions are based on my experience and knowledge and the information I have reviewed as of the date of this Declaration. In connection with my analysis, I have reviewed the exhibits listed in the above list of exhibits, as well as each of the items referenced herein. My opinions directed to the invalidity of the challenged claims are based, at least in part, on the following prior art publications:

- **“G.984.3”** (Ex. 1005), which is ITU-T Recommendation G.984.3 titled Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification, was published March 2008.
- **“Khermosh”** (Ex. 1014), which is U.S. Patent App. Pub. No. 2008/0260378, filed on December 16, 2003 and published October 23, 2008.

IV. Legal Standards

25. For purposes of this Declaration, counsel has instructed me to make the following assumptions:

26. Claims are construed from the perspective of a person of ordinary skill in the art (“POSITA”) as of the effective filing date of the patent application. Persons of ordinary skill in the art are deemed to read the claims in the context of the entire patent, including the specification and prosecution history. In other words, the terms are not considered in a vacuum.

27. It is my understanding that information that satisfies one of the categories of prior art set forth in 35 U.S.C. § 102 may be used in an invalidity analysis under §§ 102 or 103. If information is not properly classified as prior art under one of the subsections of § 102 of the Patent Act, then it may not form the basis of an anticipation or obviousness determination. It is also my understanding that, for *inter partes* review, applicable prior art is limited to patents and printed publications.

28. I am also informed and understand that a patent claim is invalid under 35 U.S.C. § 103 if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time of the invention to a POSITA to which the subject matter pertains. Obviousness, I am informed, is determined based on the scope and content of the prior art, the differences between the prior art and the claim, the level of ordinary skill in the art, and secondary indications of non-obviousness to the extent they exist.

29. I understand that whether there are any relevant differences between the prior art and the claimed invention is to be analyzed from the view of a POSITA at the time of the invention. A POSITA is a hypothetical person who is presumed to be aware of all of the relevant art at the time of the invention. The POSITA is not an automaton and may be able to fit together the teachings of multiple patents (or other printed publications) by employing ordinary creativity and the common sense that familiar items may have obvious uses in another context or beyond their primary purposes.

30. In analyzing the relevance of the differences between the claimed invention and the prior art, I understand that I must consider the impact, if any, of such differences on the obviousness or non-obviousness of the invention as a whole, not merely some portion of it. The person of ordinary skill faced with a problem is able to apply his or her experience and ability to solve the problem and also look to any available prior art to help solve the problem.

31. I understand that an invention would have been obvious if a POSITA, facing the wide range of needs created by developments in the field, would have seen an obvious benefit to the solutions tried by the patent applicant. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, it would have been obvious to a POSITA to try the known options. If a technique has been used to improve one device, and a POSITA

would recognize that it would improve similar devices in the same way, then using the technique would have been obvious.

32. I understand that I do not need to look for precise teachings in the prior art directed to the subject matter of the claimed invention. I understand that I may consider the inferences and creative steps that a POSITA would have employed in reviewing the prior art at the time of the invention. For example, if the claimed invention combines elements that were known in the prior art and if the combination yields results that were predictable to a POSITA at the time of the invention, then this would make it more likely that the claim was obvious. On the other hand, if the combination of known elements yields unexpected or unpredictable results, or if the prior art teaches away from combining the known elements, then this would make it more likely that the claim that successfully combined those elements was not obvious. I understand that hindsight must not be used when comparing the prior art to the invention during an obviousness analysis.

33. I understand that obviousness may be shown by demonstrating that it would have been obvious to modify what is taught in a single piece of prior art to create the patented invention. Obviousness may also be shown by demonstrating that it would have been obvious to combine the teachings of more than one item of prior art. I understand that a claimed invention may be obvious if some teaching, suggestion, or motivation exists that would have led a POSITA to combine the

invalidating references. I also understand that this suggestion or motivation may come from sources such as explicit statements in the prior art, or from the knowledge of a person having ordinary skill in the art. Alternatively, any need or problem known in the field at the time and addressed by the patent may provide a reason for combining elements of the prior art. I also understand that when there is a design need or market pressure, and there are a finite number of predictable solutions, persons of ordinary skill may be motivated to apply both their skill and common sense in trying to combine the known options in order to solve the problem.

34. I understand that absent evidence of an invention date prior to the filing date of a patent, the invention date of the patent is presumed to be its filing date. A prior invention requires a complete conception of the invention and a reduction to practice of that invention. The patent owner has the burden of establishing by clear and convincing evidence a date of conception earlier than the filing date of the patent.

V. Technical Background

35. In this technical background, I describe the pertinent technology as it existed as of November 2009, the assumed priority date of the '359 Patent.

36. The '359 Patent "relates to the field of optical communication technology, and more particularly, to a method for assigning and managing upstream burst overhead parameters used between an optical line terminal (OLT) and an

Optical Network Unit (ONU) in a passive optical network (PON) system.” Ex. 1001 (’359 Patent) at 1:7-12. Specifically, the ’359 Patent claims “[a] method for managing upstream burst overhead parameters” whereby the OLT or ONU determines suitable upstream burst overhead parameters based on the transmission quality of a downlink. *Id.* at cl. 1.

37. As I will describe, all these ideas were well known to a POSITA at the time of the alleged invention.

A. Passive Optical Networks

38. A Passive Optical Network (PON) is a fiber-optic telecommunications network that provides Ethernet connectivity from a main data source to endpoints. A fiber-optic network transmits information, in the form of pulses of light, from one location to another. The pulses of light, called signals, represent bits of data, such as voice, video, or computer data. Ex. 1007 (Liu) at 1:14-24.

39. In contrast to active optical networks, a PON distributes a single signal to multiple branches, point-to-multipoint, through unpowered optical beam splitters. Ex. 1008 (Ramaswami) at 603-604, Figure 11.7. Instead of active devices in these locations, PONs use small passive optical splitters. Ex. 1009 (Kramer) at 68.

40. PONs consist of a network-side interface at the main source, or head-end, and a client-side interface at the endpoints. Optical Line Termination (OLT) provides the network-side interface of the network while Optical Network

Terminations (ONTs), or Optical Network Units (ONUs), provide the client-side or user-side interface. ONTs and ONUs are virtually identical from a functionality point of view and will be referred to in unison throughout this Declaration. Ex. 1005 (G.984.3) at 3, 7.

41. PONs garnered popularity in the late 1990s and early 2000s because of their numerous benefits, such as their ability to convey significantly more information than conventional electrical cables. For example, an optical fiber operating at 10 Gb/s can carry data equivalent to over 128,000 voice calls. And dozens of fibers may be included in a single cable, thereby multiplying the amount of data that can be transmitted. Ex. 1007 (Liu) at 1:36-45. Because optical cables convey considerably more data than conventional electrical cables, fiber-optic networks are used to transmit large amounts of data across cities, states, and continents. *Id.* at 1:24-30.

42. Further, PONs allowed for long reach between central offices and customer premises, minimized fiber deployment, provided higher bandwidth, and eliminated the necessity to install active multiplexers at splitting locations, thus relieving network operators of the gruesome task of maintaining active curbside units and providing power to them. Ex. 1009 (Kramer) at 68.

43. To standardize communication networks and allow interoperability for equipment in PON networks, the ITU-T issued a series of recommendations. One

such recommendation was G.984.3, which describes “characteristics of a passive optical network (PON) with the capability of transporting various services between the user-network interface and the service node interface.” Ex. 1005 (G.984.3) at 1. Specifically, G.984.3 describes a gigabit-capable passive optical network (GPON), which is a “variant of the passive optical network (PON) access technology supporting transmission rates in excess of 1 Gbit/s and based on the G.984-series of ITU-T Recommendations.” *Id.* at 3.

44. G.984.3 further discloses components of the GPON network, including an optical line termination (OLT), an optical network unit (ONU), and an optical network termination (ONT). *Id.*

B. Link Quality

45. Determining the link or transmission quality between two points on an optical network can be done via myriad techniques. G.984.3 describes “performance monitoring” techniques that occur at the OLT and ONU, as shown below. *Id.* at 89.

11.2 Performance monitoring			
11.2.1 Items detected at OLT			
Type		Description	
		Detection conditions	Actions
ERR _i	BIP error of ONU _i	The received BIP-8 is compared with the calculated BIP-8 on the received stream. In case of a difference, ERR _i counter is incremented.	The number of differing bits is accumulated in ERR. SD _i and SF _i are declared upon BER crossing a defined threshold.
REI _i	Remote error indication of ONU _i	Once the ONU detects BIP errors, it sends upstream the number of errors inside the REI PLOAM message. When the received REI message is different than zero, REI _i counter is incremented.	REI _i counter is incremented accordingly.
11.2.2 Items detected at ONU			
Type		Description	
		Detection conditions	Actions
ERR	BIP errors	The received BIP-8 is compared with the calculated BIP-8 on the received stream. In case of a difference, ERR counter is incremented.	The number of differing bits is accumulated in ERR. SD and SF alarms are declared upon BER crossing a defined threshold.

46. I understand that Patent Owner, in the underlying district court litigation, contends that performance monitoring is synonymous with determining the link quality. Ex. 1011 ('359 Patent—Inf. Cont.) at 8-9.

47. G.984.3 also discloses specific performance monitoring relating to FEC that is performed in both the upstream (at OLT) and downstream (at ONU) directions. Ex. 1005 (G.984.3) at 93.

13.1.3 FEC statistics for performance monitoring

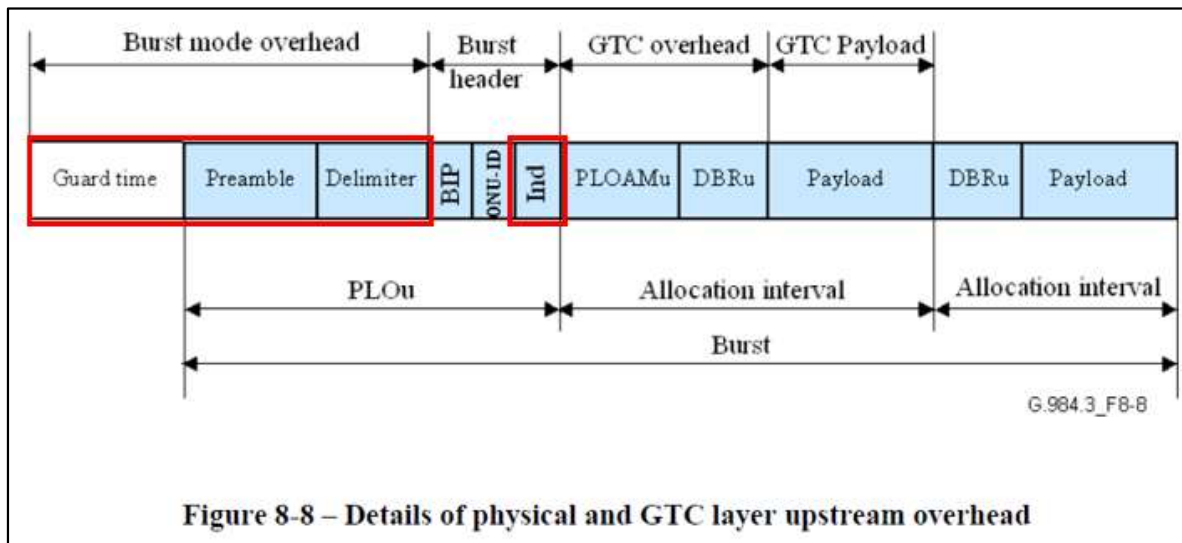
While FEC decoding is being executed, some statistic functionality should be supported both upstream and downstream in order to monitor the transmission performance between OLT and ONU.

These FEC statistic measurements should include counting the following items:

- Number of corrected bytes (i.e., bytes that have been corrected by FEC decoding).
- Number of corrected codewords (i.e., codewords that have been corrected by FEC decoding).
- Number of uncorrectable codewords (i.e., codewords that have not yet been successfully corrected by FEC decoding).
- Number of total received codewords (i.e., codewords that have been received and involved in the FEC decoding process).
- FEC seconds (i.e., the number of seconds during which an uncorrectable codeword was received).

C. Upstream Burst Overhead Parameters

48. Upstream burst overhead parameters define the parameters for upstream burst overhead. As shown in the below figure, guard time, preamble, and delimiter are examples of upstream burst parameters:



Ex. 1005 (G.984.3) at 37-38 (annotated). Another upstream burst parameter is the status of FEC. As shown in Figure 8-8 above, the “Ind” field in the burst header can contain an indication of FEC status—either FEC on or FEC off. *Id.* at 38-39.

D. Managing Upstream Burst Overhead Parameters based on Link Quality

49. As of the assumed priority date of the ’359 Patent, monitoring the link quality and adjusting upstream burst overhead parameters accordingly was well known in the prior art. While a POSITA would be aware of the abundant examples in the art, a few exemplary citations are provided below:

- Ex. 1012 (Wijngaarden ’381) at abs., [0022]: “[i]n a passive optical network, an upstream transmission rate from an ONT to an OLT can be optimized by matching a transmission scheme for a channel to the upstream transmission characteristics of the channel. An FEC coding can be made channel dependent so that channels with low error rates can use minimal protection ...;” “the BER can be monitored, either periodically or continuously, and updates made to the FEC scheme if necessary to either increase the strength of the FEC, thereby reducing the error rate, or decreasing the FEC thereby allowing a higher transmission rate.”
- Ex. 1013 (Krimmel) at [0007], [0035]-[0037]: “operating a passive optical network that is capable to consider changes of the transmission quality of a link.”
- Ex. 1014 (Khermosh) at [0012]: “a method of managing forward error correction in an ethernet passive optical network including ... monitoring communications quality from the optical line terminal, thereby determining a figure of merit of the communications” where “[p]referably, the figure of merit is one of (i) bit error rate ...”
- Ex. 1015 (Kanno) at [0015], [0060]: “counting, in each of the plurality of subscriber terminating units, an error count in a predetermined time range based on the number of corrections by an error correction function,

transmitting the error count from each of the plurality of subscriber terminating units to the office terminating unit, receiving, in the office terminating unit, the error count as a received error count, and determining, in the office terminal unit, based on the received error count, an error correction method or an error correction disuse which is used in each of the plurality of subscriber terminating units.”

- Ex. 1016 (Wijngaarden '380) at [0035]: “the FECs can effectively measure the BER and protect the channels adaptively. Other parameters, e.g., preamble length for upstream, delimiter length, delimiter sequence specification, header protection scheme, can be communicated in a similar fashion as for the FEC parameters.”
- Ex. 1006 (Lee) at [0029]-[0030]: “controlling effective FEC of an ONU and an OLT ... based on optical link quality.”

VI. The '359 Patent

50. The '359 Patent “relates to the field of optical communication technology, and more particularly, to a method for assigning and managing upstream burst overhead parameters used between an optical line terminal (OLT) and an Optical Network Unit (ONU) in a passive optical network (PON) system.” Ex. 1001 ('359 Patent) at 1:7-12. Specifically, the '359 Patent claims “[a] method for managing upstream burst overhead parameters” whereby the OLT or ONU determines suitable upstream burst overhead parameters based on the transmission quality of a downlink. Ex. 1001 ('359 Patent) at cl. 1.

51. I understand the filing date of Chinese application 200910212093, to which the '359 Patent claims priority, is November 4, 2009. Ex. 1001.

52. The claims of the '359 Patent that are being challenged, and that I have been asked to evaluate, are claims 1-11. I have reproduced the challenged claims below:

Claim	Recitation
[1.PRE]	A method for managing upstream burst overhead parameters, comprising:
[1.A]	an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit;
[1.B]	the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and
[1.C]	the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal;
[1.D]	wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:
[1.E]	the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and
[1.F]	the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,
[1.G]	the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.
[2.PRE]	The method of claim 1, wherein:

Claim	Recitation
[2.A]	after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state;
[2.B]	the step of the optical line terminal detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical line terminal detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;
[2.C]	the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.
[3.PRE]	The method of claim 1, wherein:
[3.A]	after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state;
[3.B]	the step of the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical network unit detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;
[3.C]	after the step of acquiring the quality information of the downlink, the method further comprises: the optical network unit notifying the quality information of the downlink to the optical line terminal;

Claim	Recitation
[3.D]	the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.
[4.PRE]	The method of claim 1, wherein:
[4.A]	after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state;
[4.B]	the step of the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical network unit detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;
[4.C]	The step of the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical network unit determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical line terminal via a unicast message or a broadcast message.
[5.PRE]	The method of claim 2, wherein:

Claim	Recitation
[5.A]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit, and sending the switching index value to the optical network unit via a downstream frame; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame; or,
[5.B]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit; or,

Claim	Recitation
[5.C]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical network unit notifying a hyper frame number to the optical line terminal; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time determined by the optical network unit itself comprises: after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit.
[6.PRE]	The method of claim 2, wherein:
[6.A]	the upstream burst overhead parameter set comprises: state of forward error correction, delimiter, preamble and guard band.
[7.PRE]	The method of claim 1, wherein:
[7.A]	in the step of the optical line terminal sending the parameter values or the identifications of more than one upstream burst overhead parameter set to the optical network unit, the optical line terminal sends the parameter values or the identifications of one or more upstream burst overhead parameter sets to all optical network units or one or more optical network units which communicate with the optical line terminal.
[8.PRE]	The method of claim 3, wherein:

Claim	Recitation
[8.A]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit, and sending the switching index value to the optical network unit via a downstream frame; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame; or,
[8.B]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit; or,

Claim	Recitation
[8.C]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical network unit notifying a hyper frame number to the optical line terminal; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time determined by the optical network unit itself comprises: after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit.
[9.PRE]	The method of claim 3, wherein:
[9.A]	the upstream burst overhead parameter set comprises: state of forward error correction, delimiter, preamble and guard band.
[10.PRE]	The method of claim 4, wherein:
[10.A]	the upstream burst overhead parameter set comprises: state of forward error correction, delimiter, preamble and guard band.
[11.PRE]	The method of claim 4, wherein:
[11.A]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit, and sending the switching index value to the optical network unit via a downstream frame; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame; or,

Claim	Recitation
[11.B]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit; or,
[11.C]	while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical network unit notifying a hyper frame number to the optical line terminal; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time determined by the optical network unit itself comprises: after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit.

VII. Prosecution History

53. U.S. Patent Application No. 13/257,621 (the “’621 Application”), which matured into the ’359 Patent, was filed on April 2, 2012. Ex. 1001.

54. The ’621 Application was filed with fourteen claims. Ex. 1002 (’359 FH) at 287-294. The originally filed independent claim 1 is shown below. *Id.* at 287.

1. A method for managing upstream burst overhead parameters, comprising:

an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit;

the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and

the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal.

55. The originally filed dependent claim 2 is shown below. *Id.* at 287.

2. The method of claim 1, wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:

the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and

the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,

the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.

56. On October 14, 2014, there was a telephonic interview. The Examiner stated that allowable subject matter existed in claim 2 as shown below. *Id.* at 36.

Examiner-Initiated Interview Summary	Application No. 13/257,621	Applicant(s) ZHANG ET AL.	
	Examiner PETER SOLINSKY JR	Art Unit 2463	

All participants (applicant, applicant's representative, PTO personnel):

(1) PETER SOLINSKY JR. (3) _____

(2) Ling Wu, applicant's representative. (4) _____

Date of Interview: 14 October 2014.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____

Issues Discussed ☐101 ☐112 ☒102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: 1 and 2.

Identification of prior art discussed: _____

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Explained that allowable subject matter existed in claim 2, 10, and 13 and claims could be allowable if independent claims were amended to include above claim language.

57. That same day, Applicant filed supplemental preliminary amendments incorporating the Examiner's suggestion from the interview, and the Examiner issued a Notice of Allowance with an Examiner's amendment that mirrored the Applicant's supplemental preliminary amendments. *Id.* at 16-50.

58. In the supplemental preliminary amendments, Applicant amended independent claim 1 by adding the limitations from dependent claim 2 into independent claim 1 as shown below. *Id.* at 39-40.

1. (Currently Amended) A method for managing upstream burst overhead parameters, comprising:

an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit;

the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and

the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal;

wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:

the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and

the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,

the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.

2. (Canceled) The method of claim 1, wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:

~~the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and~~

~~the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,~~

~~the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.~~

59. This mirrored the Examiner's amendment in the Notice of Allowance shown below. *Id.* at 21-22.

EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Ling Wu on October 14, 2012.

The application has been amended as follows:

What is claimed is:

1. (Currently Amended) A method for managing upstream burst overhead parameters, comprising:

an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit;

the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and

the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal;

wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:

the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and

the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,

the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.

2. (Canceled)

60. In the Notice of Allowance, the Examiner explained that independent claim 1, as amended, was not disclosed in ITU-T G.984.2. *Id.* at 34. This is shown below.

4. The following is an examiner's statement of reasons for allowance: The ITU standard ITU-T G.984.2 teaches the necessary signaling for a Gigabit-Passive Optical Network. The uplink data is transmitted in burst cycles. The standard states that uplink parameters stay the same as long as the optical network is operational. The invention is for setting up multiple sets of parameters to use in the uplink burst cycle in order to better use bandwidth based on the quality of the transmission channel.

61. The Examiner never issued an office action during prosecution. The Examiner also never addressed any prior art reference cited on the face of the '359 Patent during prosecution. For example, while ITU-T G.984.3 is cited on the face of

the patent, the Examiner never addressed this reference. The only reference the Examiner addressed was ITU-T G.984.2, and ITU-T G.984.2 is not cited on the face of the '359 Patent.

62. The '359 Patent has no related family members in the United States.

VIII. Claim Construction

63. Based on my review of the '359 Patent and its file history, a POSITA would have understood the claim terms in light of the specification, and interpreted them by using their plain and ordinary meaning in accordance with the then current state of the art.

IX. Prior Art References

A. G.984.3

64. ITU-T Recommendation G.984.3 ("G.984.3"), titled "Gigabit-capable Passive Optical Networks (G-PON): Transmission convergence layer specification," was publicly accessible at least as early as April 28, 2009. Ex. 1005 (G.984.3) at 1; Ex. 1028 (Hall-Ellis Dec.) at ¶¶47-53. G.984.3 was approved on March 29, 2008, and has 2009 copyright date and a 2009 print date. Ex. 1005 (G.984.3) at i-ii, 146. And Dr. Hall Ellis testified that "the ITU-G.984.3 technical standard document was publicly available on April 28, 2009, because by that date it had been approved by the ITU-T Study Group 15 and posted on the IUT website." Ex. 1028 (Hall-Ellis Dec.), ¶52, ¶¶47-53. While G.984.3 is cited by the '359 Patent, G.984.3 was never addressed by the Examiner during prosecution. *See generally*, Ex. 1002.

65. “Recommendation ITU-T G.984.3 describes the transmission convergence layer for gigabit-capable passive optical networks – a family of flexible access networks capable of providing a range of broadband and narrow-band services, operating at the rates of 2.48832 Gbit/s downstream, and 1.24416 or 2.48832 Gbit/s upstream.” Ex. 1005 (G.984.3) at i. The Recommendation includes the specifications for “upstream dynamic bandwidth assignment,” “ONU activation,” and “forward error correction,” among others. *Id.* “The Recommendation is intended to . . . Describe characteristics of a passive optical network (PON) with the capability of transporting various services between the user-network interface and the service node interface.” *Id.* at 1. G.984.3 is cited in patent publications, including Wijngaarden ’381, Wijngaarden ’380, and Hood. Ex. 1012 (Wijngaarden ’381) at [0003]; Ex. 1016 (Wijngaarden ’380) at [0003]; Ex. 1017 (Hood) at 1, 3:39. G.984.3 is also cited in printed publications, including Effenberger II, Effenburger III, Chung, and Mohammadani. Ex. 1018 (Effenberger II) at 57; Ex. 1019 (Effenberger III) at 64; Ex. 1020 (Chung) at 479; Ex. 1021 (Mohammadani) at 19.

66. G.984.3 (G-PON) is the predecessor to G.9807.1 (XGS-PON). As the two standards are related, and G.9807.1 evolved from G.984.3, G.9807.1 (the XGS-PON specification) contains very similar, if not identical, disclosures as G.984.3 (the

G-PON specification) as the XGS-PON specification developed from the G-PON specification.

B. Khhermosh

67. U.S. Patent Application Publication No. 2008/0260378 to Khhermosh (“Khhermosh”), titled “Method of Ethernet Frame Forward Error Correction Initialization and Auto-Negotiation,” published on October 23, 2008. Ex. 1014 (Khhermosh) at 1. Khhermosh was never addressed or considered by the Examiner during prosecution, nor was it disclosed in any IDS filed by the Applicant.

68. Khhermosh “relates to passive optical networks and, more particularly, to a method of performing forward error correction initialization and auto-negotiation in passive optical networks.” Ex. 1014 (Khhermosh) at [0002]. The method involves monitoring “[t]he communications quality from the ONU” and “if the communications quality is not sufficient,” results in the ONU using forward error corrected data. Ex. 1014 (Khhermosh) at abs. The communications quality is measured using “bit error rate.” Ex. 1014 (Khhermosh) at [0012].

X. Ground 1: The combination of G.984.3 and Khhermosh renders claims 1-11 obvious.

69. G.984.3 and Khhermosh are both directed to methods of managing upstream burst overhead parameters (*e.g.*, FEC) in PON systems. *See, e.g.*, Ex. 1005 (G.984.3) at i, 36-38, 92-93; Ex. 1014 (Khhermosh) at [0002]. For example, G.984.3 is a specification that describes “the transmission convergence layer for gigabit-

capable passive optical networks [GPON]” where the “[t]he upstream FEC function of the ONU can be activated/deactivated by the OpS system via the OLT.” *See, e.g.*, Ex. 1005 (G.984.3) at i, 36-38, 92-93, 99. And Khhermosh discloses a “method of managing forward error correction (FEC) initialization and auto-negotiation in ethernet passive optical networks [EPON].” Ex. 1014 (Khhermosh) at abs.

70. G.984.3 does not, however, expressly disclose where the upstream burst overhead parameters are determined based on the downlink quality. A POSITA would have been motivated to modify the method of G.984.3 to implement Khhermosh’s teaching where the upstream burst overhead parameters are determined by the OLT or ONU (*e.g.*, “performing forward error correction initialization and auto-negotiation in passive optical networks”) based on the downlink quality (*e.g.*, “bit error rate”). Ex. 1014 (Khhermosh) at abs., [0002], [0011]-[0012].

71. A POSITA would have been motivated to combine G.984.3 and Khhermosh for several reasons:

72. First, G.984.3 and Khhermosh disclose similar products, methods, and solutions; and both references are analogous art and in the same field of endeavor as each other. For example, both relate to optical network systems and include discussions of methods and processes for managing upstream burst overhead parameters in PON systems. Accordingly, a POSITA would have been aware of both

references and, as further discussed below, would have been motivated to combine the references.

73. Second, Khhermosh describes a problem of FEC management in traditional PON systems and provides usable solutions that a POSITA would have been motivated to add to G.984.3 to maximize bandwidth efficiency. Khhermosh explains that, while “FEC improves network performance when communications are limited by bit errors” and is thus “desirable to employ FEC when available and required,” “it is not desirable to employ FEC when not required because of the bit rate penalty.” Ex. 1014 (Khhermosh) at [0007]. Khhermosh explains that, due to this problem, there is “a widely recognized need for, and it would be highly advantageous to have a method of performing forward error correction initialization and auto-negotiation in passive optical networks.” Ex. 1014 (Khhermosh) at [0008]. This is consistent with my understanding of PON systems, which generally have static upstream burst overhead parameters after initialization, and which do not take into account adapting the upstream burst overhead parameters based on the link quality—as taught in Khhermosh.

74. Khhermosh then provides methods for addressing this problem. For example, in one method, Khhermosh discloses where the ONU detects the transmission quality of the downlink (“ONU 105 monitors the received data and determines a figure of merit for the communications from OLT 103”) and then

determines the upstream burst overhead parameters accordingly (“If the figure of merit is sufficient, then ONU 105 responds henceforth with non-FEC coded data (step 507). If the figure of merit is not sufficient, then ONU 105 responds henceforth with FEC coded data (step 505).”). Ex. 1014 (Khermosh) at [0027]. In another method, Khermosh discloses where the OLT detects the transmission quality of the downlink and then determines the upstream burst overhead parameters accordingly. *See, e.g.*, Ex. 1014 (Khermosh) at [0021], [0024], Fig. 2. A POSITA would thus have been motivated to implement Khermosh’s auto-negotiation method to solve the problem of unnecessary use of FEC, thereby maximizing the bandwidth efficiency.

75. Third, a POSITA would also have been motivated to combine G.984.3, which describes a method for managing upstream burst parameters, with Khermosh, which discloses automatically negotiating the use of FEC based on the bit error rate, after reviewing the prior art, which discloses additional methods for determining the upstream burst overhead parameters based on the downlink quality. As described above in Section V.D., managing upstream burst overhead parameters based on link quality was well known in the art. For example, Wijngaarden ’380, which demonstrates the knowledge of the POSITA, discloses that “the FECs can effectively measure the BER and protect the channels adaptively. Other parameters, e.g., preamble length for upstream, delimiter length, delimiter sequence specification, header protection scheme, can be communicated in a similar fashion as for the FEC

parameters.” Ex. 1016 (Wijngaarden ’380) at [0035]. Likewise, Wijngaarden ’381 discloses “[i]n a passive optical network, an upstream transmission rate from an ONT to an OLT can be optimized by matching a transmission scheme for a channel to the upstream transmission characteristics of the channel. An FEC coding can be made channel dependent so that channels with low error rates can use minimal protection ...” Ex. 1012 (Wijngaarden ’381) at abs., [0022]. And Lee discloses using FEC “only if necessary, thereby simplifying the managing of a link, and preventing an excessive 35% reduction of throughput caused by use of unnecessary FEC.” Ex. 1006 (Lee) at abs. Accordingly, a POSITA would have reasonably looked to that well-known art, like Khernosh, to improve the GPON network described in G.984.3.

76. Fourth, a POSITA would have had a reasonable expectation of success in combining G.984.3 with Khernosh’s teaching of automatic negotiation and enablement of FEC to produce expected results. In fact, many of the expected results of the combination were stated goals and benefits in the references and, more generally, goals of POSITAs in the optical communications space. *See, e.g.*, Ex. 1014 (Khernosh) at abs. (noting that “it is not desirable to employ FEC when not required because of the bit rate penalty.”).

77. While Khernosh specifically describes defects of traditional EPON systems, a POSITA would recognize that the differences between EPON (disclosed

in Khhermosh) and GPON (disclosed in G.984.3) systems are immaterial to the identified defects and would instead apply to all PON systems that did not adjust FEC based on BER. For example, EPON and GPON both cover PON technology, or Fiber to the Home (FTTH) networks. Ex. 1026 (EPON v. GPON) at 2. As such, “[b]oth EPON and GPON operate similarly since they are a type of PON.” *Id.* One difference, however, is the bandwidth. GPON is more efficient than EPON and offers greater bandwidth. *Id.* Notwithstanding, GPON systems, like EPON systems, need to make the most efficient usage of bandwidth as possible to maximize data transfer capabilities. Accordingly, a POSITA, when looking to maximize the available bandwidth in a GPON system as taught in G.984.3, would have looked to the similar EPON technology for methods of improving bandwidth. A POSITA, therefore, would have looked to Khhermosh as it teaches that bandwidth can be maximized by selectively enabling FEC based on the downlink quality.

A. Claim 1

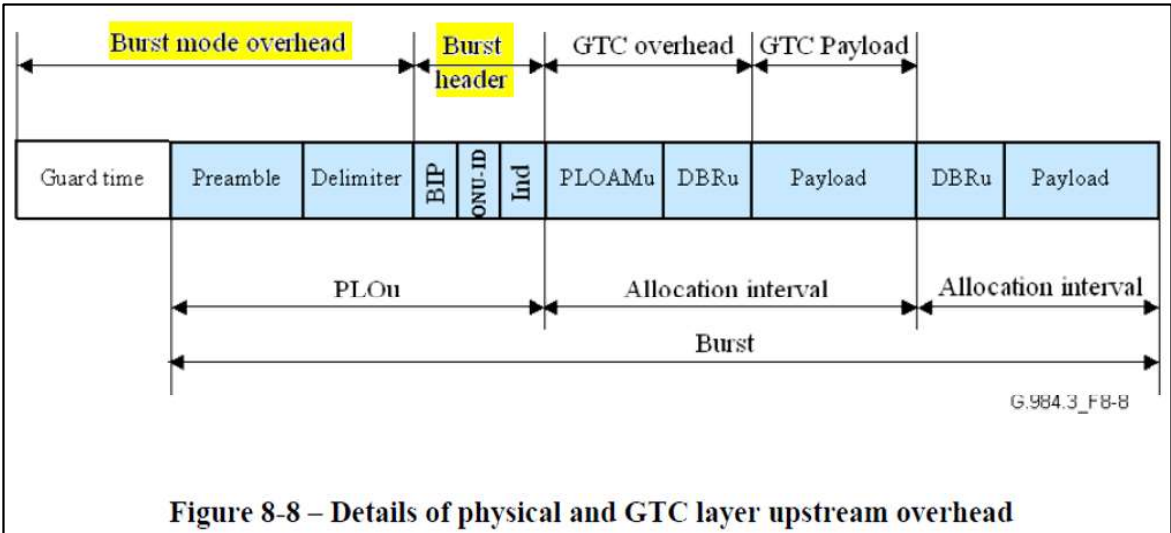
1. [1.PRE] A method for managing upstream burst overhead parameters, comprising:

78. To the extent the preamble is limiting, a POSITA would have understood the G.984.3-Khhermosh combination discloses this limitation.

79. The ’359 Patent discloses managing upstream burst overhead parameters in a PON system. Ex. 1001 (’359 Patent) at abs. The ’359 Patent provides examples of upstream burst overhead parameters, including the state of forward error

correction, delimiter, preamble, and guard band. *Id.* at 1:23-32. As I explain below, G.984.3 discloses managing the upstream burst overhead parameters disclosed by the '359 Patent.

80. For example, G.984.3 discloses how OLTs and ONUs communicate and, more specifically, how upstream burst overhead parameters are managed. *See, e.g.,* Ex. 1005 (G.984.3) at 13-14, 36-39, 124-131. ONUs communicate by sending burst messages in the upstream direction. *Id.* at 36-40. The upstream burst structure controls the format of the upstream messages. G.984.3 describes the upstream burst structure and explains that “[e]ach upstream transmission burst contains an upstream physical layer overhead (PLOu) section and one or more bandwidth allocation intervals associated with individual Alloc-IDs.” *Id.* at 36. This is shown in Figure 8-8 from G.984.3 below. *Id.* at 38. “The burst mode overhead is composed of guard time, preamble time and delimiter time.” *Id.* at 37.



81. Another upstream burst parameter is the status of FEC. As shown in Figure 8-8 above, the Ind field in the burst header can contain an indication of FEC status—either FEC on or FEC off. *Id.* at 38-39.

82. Moreover, during the O2 initialization state, G.984.3 discloses that “the ONU configures the overhead fields for the subsequent upstream transmissions using the Upstream_Overhead messages transmitted by the OLT. The following table shows the structure of the message, with ranges and typical values for the different fields.” *Id.* at 109-110. The upstream burst parameters, therefore, “are formed as dictated by the OLT.” *Id.* at 38.

Upstream_Overhead message			
Octet	Content	Description	Example value
1	11111111	Broadcast message to all ONUs.	
2	00000001	Message identification "Upstream_Overhead".	
3	gggggggg	Number of guard bits.	32 (G) (see Note 1)
4	xxxxxxx	Length of type 1 preamble bits.	8 (P1) (see Note 1)
5	yyyyyyyy	Length of type 2 preamble bits.	8 (P2) (see Note 1)
6	cccccccc	Pattern of type 3 preamble pattern.	AA
7	bbbbbbbb	Pattern of byte 1 of delimiter.	0xAB
8	bbbbbbbb	Pattern of byte 2 of delimiter.	0x59
9	bbbbbbbb	Pattern of byte 3 of delimiter.	0x83
10	xxemsspp	xx – Reserved e – Status of pre-equalization mechanism m – Status of SN_Mask mechanism ss – Max number of extra SN-transmissions	0 (See Note 2)
11	dddddddd	MSB of pre-assigned delay.	0 (See Note 2)
12	dddddddd	LSB of pre-assigned delay.	0 (See Note 2)
General note – The values in this message, except for P1 and P2, are selected according to OLT parameters and preferences. NOTE 1 – Given that the total length of the burst overhead is L (L maximum value is 128 bytes), the values for G, P1, P2, P3 (number of type 3 preamble bytes) and D (delimiter length) must satisfy $G+P1+P2+P3+D=L$. The Extended_Burst_Length message may pre-empt the value of L by modifying the value of P3 (for both pre-ranged and ranged states). It is the responsibility of the OLT to ensure that the total length of the burst overhead is an integer number of bytes. NOTE 2 – It is assumed that the pre-assigned delay is not used and that the SN value is transmitted once by the ONUs. Note also that since the Serial_Number_Mask message has been deprecated, the m bit should always be set to 0.			

Ex. 1005 (G.984.3) at 109-110.

83. G.984.3 also discloses managing the state of forward error correction, another upstream burst overhead parameter identified by the '359 Patent. For example, G.984.3 discloses that the "OLT sets the desired ONU FEC encoding status (on/off) using the Use_FEC bit in the Flags field. . . . An ONU that supports FEC encoding capability should respond to Use_FEC requests by encoding its

upstream data, adding the parity bytes at the end of each codeword, and providing FEC ON indication in the Ind field of an upstream burst header. If the Use_FEC bit is not set, such an ONU should transmit data bytes in place of parity bytes, and provide FEC OFF indication in the Ind field of the upstream burst header.” *Id.* at 93. G.984.3 further discloses that the “OLT sets the desired ONU FEC encoding status (on/off).” *Id.* at 99.

84. In addition, and similar to G.984.3, Khhermosh discloses managing upstream burst overhead parameters, including the state of FEC. For example, Khhermosh discloses “a method of managing forward error correction ... including the steps of ... monitoring communication quality from the optical line terminal, thereby determining a figure of merit of the communications” where the “figure of merit is one of (i) bit error rate ...” Ex. 1014 (Khhermosh) at [0012].

85. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khhermosh combination discloses: “*A method for managing upstream burst overhead parameters.*” See also 1[A] – 1[G].

2. [1.A] an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit;

86. A POSITA would have understood that the G.984.3-Khhermosh combination discloses this limitation.

87. G.984.3 discloses that OLTs and ONUs maintain a variety of alarms and performance monitoring indicators that can be used to detect the transmission quality of a downlink between the OLT and ONU. Ex. 1005 (G.984.3) at 83-89. For example, G.984.3 discloses that “[a]larms and performance monitoring encompasses mechanisms to detect link failure and monitor the health and performance of links.” *Id.* at 83. One example of alarm and performance monitoring indicators that are measured at the OLTs and ONUs is signal degradation, which is determined by measuring the bit error rate (BER). *Id.* at 85, 87. For the ONU, the downlink signal degradation is detected by measuring the BER of the downlink from the OLT as shown below. *Id.* at 87.

11.1.2 Items detected at ONU

Type		Description			
		Detection conditions	Actions	Cancellation conditions	Actions
LOS	Loss of signal	No valid signal is received in the downstream.	Switch off laser. Generate Loss_of_phy_layer notification. Change state according to clause 10.	Valid optical signal.	Move to Standby state.
LOF	Loss of frame	When 5 consecutive invalid PSync from OLT are received.	Switch off laser. Generate Loss_of_phy_layer notification. Change state according to clause 10.	When 2 consecutive frames have correct PSync.	Move to Standby state.
SF	Signal failed	When the downstream BER becomes $\geq 10^{-Y}$, this state is entered. Y is configurable in the range of 5 to 8.	—	Set inactive when the downstream BER is $< 10^{-(Y+1)}$.	—
SD	Signal degraded	When the downstream BER becomes $\geq 10^{-X}$, this state is entered. X is configurable in the range of 6 to 9, but must be higher than Y.	—	Set inactive when the downstream BER is $< 10^{-(X+1)}$.	—
LCDG	Loss of GEM channel delineation	When GEM fragment delineation is lost according to clause 8.3.2 state machine.	Generate Loss_of_phy_layer notification.	When GEM delineation is achieved.	—

88. The alarm and performance monitoring indicators used at the ONU (which are used to detect the downlink transmission quality) are sent to the OLT through an ONU management and control interface (OMCI) via the ONU management and control channel (OMCC), which is established once the ONU-ID is set during the serial number state. *Id.* at 10-11, 17-18, 100-112. This allows the ONU or OLT to detect transmission quality of the downlink based on the performance monitoring indicators from the ONU.

89. G.984.3 also discloses performance monitoring indicators for FEC. Specifically, G.984.3 teaches that, “while FEC decoding is being executed, some statistic functionality should be supported both upstream and downstream in order to monitor the transmission performance between OLT and ONU.” *Id.* at 93. Examples of performance monitoring indicators for FEC are shown below. *Id.*

13.1.3 FEC statistics for performance monitoring

While FEC decoding is being executed, some statistic functionality should be supported both upstream and downstream in order to monitor the transmission performance between OLT and ONU.

These FEC statistic measurements should include counting the following items:

- Number of corrected bytes (i.e., bytes that have been corrected by FEC decoding).
- Number of corrected codewords (i.e., codewords that have been corrected by FEC decoding).
- Number of uncorrectable codewords (i.e., codewords that have not yet been successfully corrected by FEC decoding).
- Number of total received codewords (i.e., codewords that have been received and involved in the FEC decoding process).
- FEC seconds (i.e., the number of seconds during which an uncorrectable codeword was received).

90. The alarms and performance monitoring indicators measured at the ONUs are used by the OLT or ONU to detect the transmission quality of the downlink.

91. In addition, Khermosh discloses an ONU detecting transmission quality of a downlink between the optical line terminal and the optical network unit. For example, Khermosh discloses monitoring the “communications quality” by measuring the BER. Ex. 1014 (Khermosh) at [0012]. Khermosh discloses the “ONU 105 receives data from OLT 103 (step 201) ... if the data received by ONU 105 is

FEC coded data (step 503), then ONU 105 monitors the received data and determines a figure of merit for the communications from OLT 103 ... If the figure of merit is not sufficient, then ONU 105 responds henceforth with FEC coded data (step 505).” Ex. 1014 (Khermosh) at [0027].

92. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*an optical line terminal or an optical network unit detecting transmission quality of a downlink between the optical line terminal and the optical network unit.*”

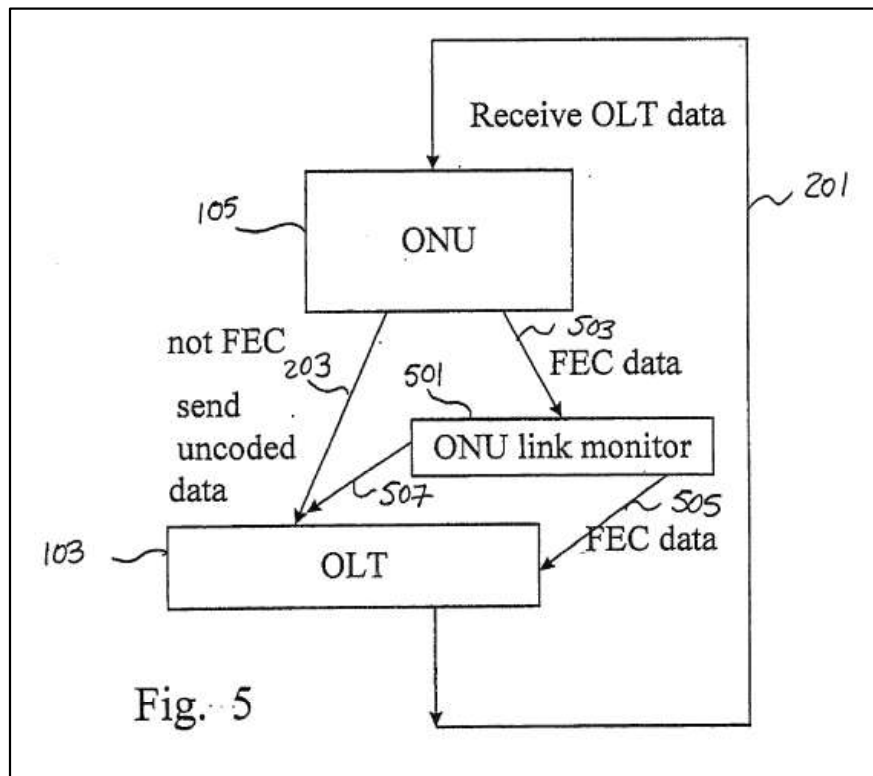
3. [1.B] the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality; and

93. A POSITA would have understood that the G.984.3-Khermosh combination discloses this limitation.

94. As I previously explained in limitations [1.PRE] and [1.A], G.984.3 and Khermosh disclose a method for managing upstream burst overhead parameters, including the state of FEC, and a means for detecting the transmission quality of a downlink by the OLT or ONU.

95. Khermosh discloses where the OLT or ONU determines the upstream burst overhead parameters, including the state of FEC, based on the detected transmission quality of a downlink.

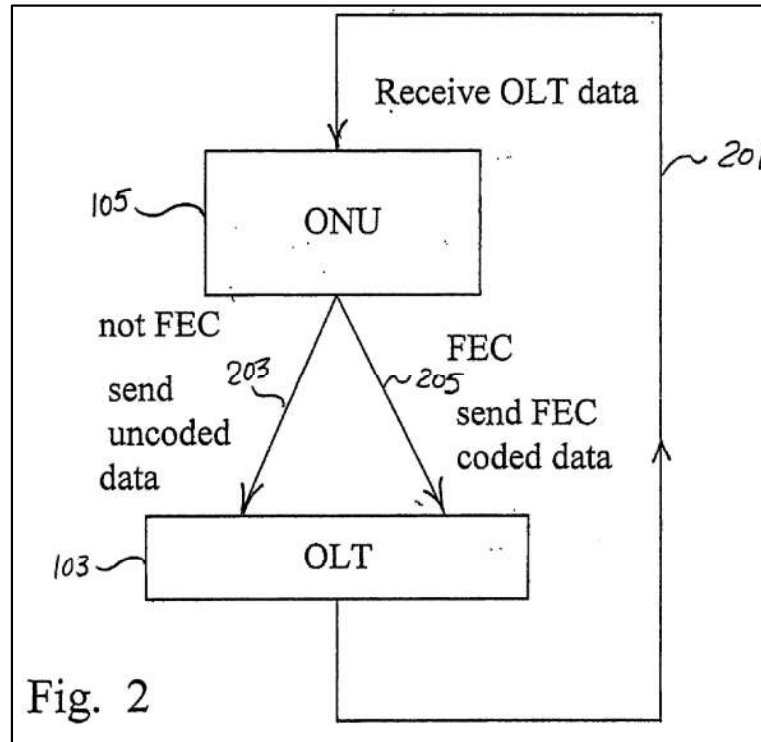
96. For example, Khermosh teaches where the ONU determines the upstream burst overhead parameters suitable for the ONU according to the transmission quality. Figure 5 of Khermosh discloses where ONU determines the upstream burst overhead parameters, including the state of FEC, based on the detected transmission quality of a downlink.



97. Specifically, Khermosh teaches that “FIG. 5 is a flow chart of an initialization and an auto-negotiation process, according to yet another embodiment of the present invention. ONU 105 receives data from OLT 103 (step 201). If the data received is non-FEC coded data, then ONU 105 responds with non-FEC coded data (step 203). However, if the data received by ONU 105 is FEC coded data (step

503), then ONU 105 monitors the received data and determines a figure of merit for the communications from OLT 103. If the figure of merit is sufficient, then ONU 105 responds henceforth with non-FEC coded data (step 507). If the figure of merit is not sufficient, then ONU 105 responds henceforth with FEC coded data (step 505).” *Id.* at [0027]. When the ONU receives FEC coded data and then monitors the received data to determine a figure of merit for the communications from the OLT (*i.e.*, detecting downstream transmission quality), and responds with FEC or non-FEC encoded data based on the figure of merit (*i.e.*, ONU determining upstream burst parameters based on the link quality), this limitation is satisfied.

98. As another example, Khhermosh teaches where the OLT determines the upstream burst overhead parameters suitable for the ONU according to the transmission quality. Khhermosh teaches that the PON network (which is controlled by the OLT) “automatically initializes each ONU and registers each ONU according to FEC coding capability of the ONU and the communications quality to and from the ONU. FEC coding is implemented when appropriate to improve the quality of the communications.” *Id.* at [0021]. Khhermosh, therefore, teaches that FEC should be implemented based on the transmission quality. Khhermosh also teaches where the OLT controls whether ONUs use FEC in the upstream direction, as shown in Figure 2.



99. “FIG. 2 is a flow chart of an initialization process, according to an embodiment of the present invention. ONU 105, capable of FEC coding, is added to an EPON 10. ONU 105 receives data from OLT 103 of EPON 10. If the data received from OLT 103 is FEC coded, then ONU 105 sends coded data (step 205) to OLT 103. If the data received from OLT 103 is not FEC coded, then ONU 105 sends uncoded data (step 203) to OLT 103.” *Id.* at [0024]. As Khernmash teaches that the system determines the transmission quality, that FEC is implemented based on the transmission quality, and that the OLT in Fig. 2 controls FEC in the upstream direction for an ONU, a POSITA would have understood that the OLT in Khernmash determines whether FEC should be implemented in the upstream direction based on the transmission quality.

100. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the optical line terminal or the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality.*”

4. **[1.C] the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal;**

101. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

102. G.984.3 discloses that “the ONU configures the overhead fields for the subsequent upstream transmissions using the Upstream_Overhead messages transmitted by the OLT.” Ex. 1005 (G.984.3) at 109-110. G.984.3, therefore, discloses where the OLT directs the ONU to use specific upstream burst overhead parameters and relays that information to the ONU via Upstream_Overhead messages. *Id.* The Upstream_Overhead message in G.984.3 includes information on the upstream burst overhead parameters including the guard band, preamble, and delimiter. *Id.* The Upstream_Overhead message also includes information on the pre-assigned delay. *Id.*

Upstream_Overhead message			
Octet	Content	Description	Example value
1	11111111	Broadcast message to all ONUs.	
2	00000001	Message identification "Upstream_Overhead".	
3	gggggggg	Number of guard bits.	32 (G) (see Note 1)
4	xxxxxxx	Length of type 1 preamble bits.	8 (P1) (see Note 1)
5	yyyyyyyy	Length of type 2 preamble bits.	8 (P2) (see Note 1)
6	ccccccc	Pattern of type 3 preamble pattern.	AA
7	bbbbbbb	Pattern of byte 1 of delimiter.	0xAB
8	bbbbbbb	Pattern of byte 2 of delimiter.	0x59
9	bbbbbbb	Pattern of byte 3 of delimiter.	0x83
10	xxemsspp	xx – Reserved e – Status of pre-equalization mechanism m – Status of SN_Mask mechanism ss – Max number of extra SN-transmissions	0 (See Note 2)
11	ddddddd	MSB of pre-assigned delay.	0 (See Note 2)
12	ddddddd	LSB of pre-assigned delay.	0 (See Note 2)
General note – The values in this message, except for P1 and P2, are selected according to OLT parameters and preferences. NOTE 1 – Given that the total length of the burst overhead is L (L maximum value is 128 bytes), the values for G, P1, P2, P3 (number of type 3 preamble bytes) and D (delimiter length) must satisfy $G+P1+P2+P3+D=L$. The Extended_Burst_Length message may pre-empt the value of L by modifying the value of P3 (for both pre-ranged and ranged states). It is the responsibility of the OLT to ensure that the total length of the burst overhead is an integer number of bytes. NOTE 2 – It is assumed that the pre-assigned delay is not used and that the SN value is transmitted once by the ONUs. Note also that since the Serial_Number_Mask message has been deprecated, the m bit should always be set to 0.			

103. G.984.3 also discloses that the message is transmitted three times by the OLT and that, “[u]pon receiving at least one of the messages, the ONU stores the received values and constructs the preamble and delimiter using the values received.” *Id.* at 110. G.984.3 further discloses that, after the ONU receives the upstream burst overhead parameters, the ONU configures its parameters, and waits for a minimum response time (*i.e.*, switching time), and then sends an upstream

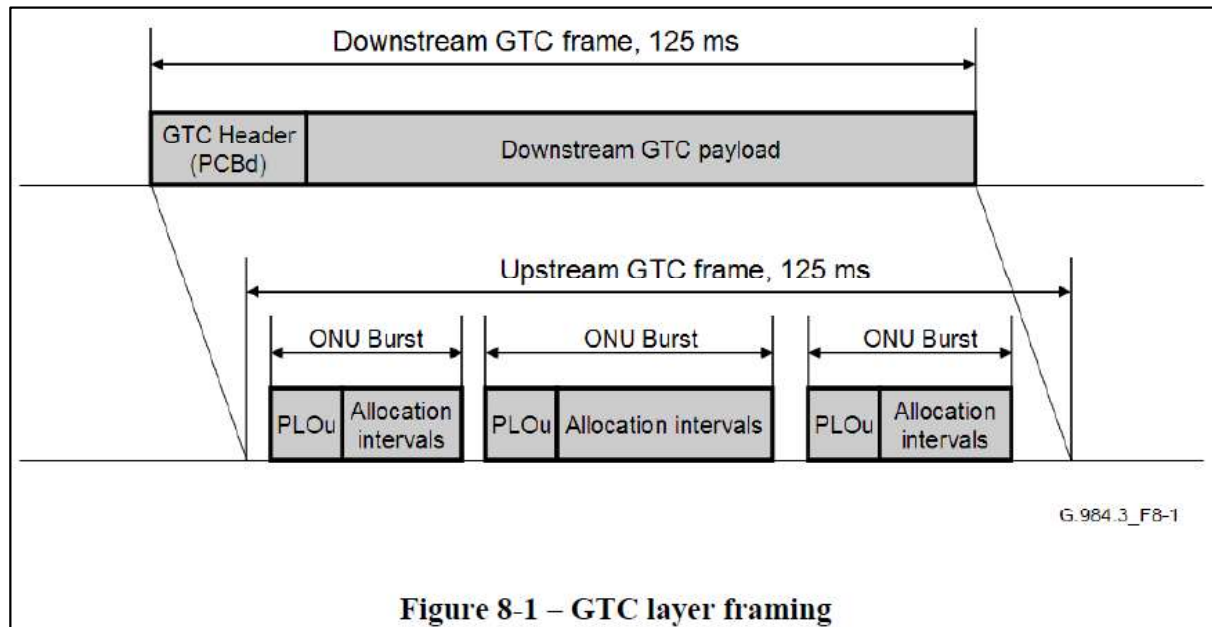
message. An example of the switching time is shown below. *Id.* at 69 (annotated and excerpted).

Table 10-1 – ONU activation states functional transitions							
Event	States of the ONU						
	Init (O1)	Standby (O2)	Serial Number (O3)	Ranging (O4)	Operation (O5)	POPUP (O6)	Emergency Stop (O7)
ONU power up was last operational state (before power-down) O7?: => O7 else: => O1	–	–	–	–	–	–	–
ONU achieves PSync synchronization	The ONU clears LOS and LOF, then: => O2	–	–	–	–	–	–
The ONU receives the upstream overhead parameters (PLOAMd = Upstream_Overhead)	–	The ONU configures its transmit parameters with the received values; starts timer TO1 then: => O3	–	–	–	–	–
The ONU receives the extended burst parameters (PLOAMd = Extended_Burst_Length)	–	–	If no serial number request has been received, the ONU configures its type 3 preamble length with the received values; otherwise, no action.	–	–	–	–
The ONU receives a serial number request (BW allocation structure with Alloc-ID = 254 PLOAMu = '1')	–	–	The ONU waits for minimum response time, plus pre-assigned delay, plus random delay before responding with a Serial_Number_ONU message.	–	–	–	–

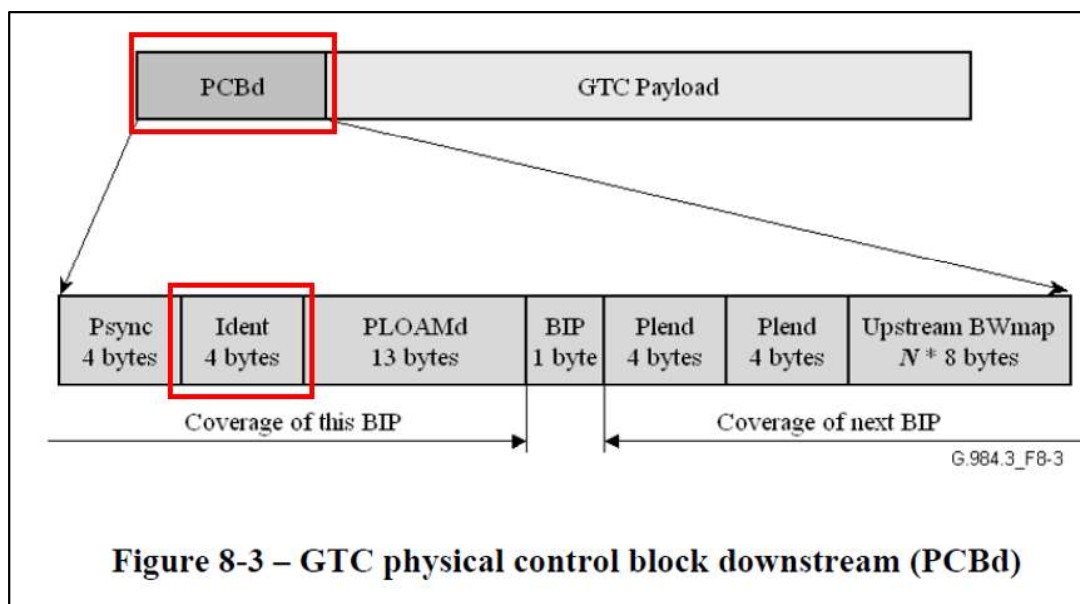
104. The switching time was well-known to a POSITA because ONUs must send their upstream messages in the correct time slot, otherwise the upstream messages from multiple ONUs would collide.

105. A POSITA would have readily understood that there must be a non-zero period of time between receipt by the ONU of the upstream parameters and use of the parameters in future transmissions (*i.e.*, switching time) to allow the ONU to (1) receive the message with the upstream burst overhead parameters, (2) interpret the message, (3) implement the new parameters, and (4) send an upstream transmission at the correct time.

106. Moreover, the '359 Patent explains, in one example, that the claimed “switching time” is indicated “to the ONU according to the following manner: notifying a hyper frame number to the ONU, so that the ONU starts to use the upstream burst overhead parameters after a frame indicate by the hyper frame number arrives.” Ex. 1001 ('359 Patent) at 6:41-46. G.984.3 discloses this embodiment. In G.984.3, the OLT sends a downstream frame with a GTC Header (PCBd) and GTC payload, as shown below. Ex. 1005 (G.984.3) at 30 (annotated). “The downstream GTC frame provides the common time reference for the PON and the common control signaling for the upstream.” Ex. 1005 (G.984.3), 30.

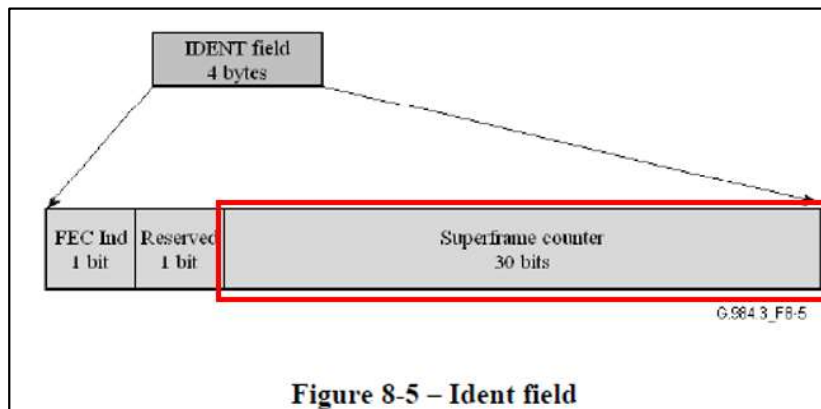


107. The physical control block downstream (PCBd) contains several fields for notifying ONUs how and when to send upstream burst messages. *Id.* at 31. “The OLT sends the PCBd in a broadcast manner, and every ONU receives the entire PCBd. The ONUs then act upon the relevant information contained therein.” *Id.*



Ex. 1005 (G.984.3) at 31 (annotated).

108. In order to synchronize the ONUs to ensure they send upstream messages at the correct time, the Ident field is used. The Ident field includes a “Superframe counter,” which the ONU compares to its own local superframe counter to ensure correct synchronization. *Id.* at 32-33.



Ex. 1005 (G.984.3) at 33 (annotated).

109. Because proper upstream communication is not possible until synchronization is confirmed, the ONU does not begin sending upstream communications using the upstream burst profile until after synchronization with the superframe counter. The superframe counter in G.984.3 is the hyper frame number described in the '359 Patent because it indicates to the ONU what frame to start using the upstream burst overhead parameters. G.984.3, therefore, discloses the claimed “switching time” because the '359 Patent explains that notifying a hyper frame number to the ONU, where the ONU begins using the upstream burst overhead

parameters after the frame indicated by the hyper from number, covers the “switching time” limitation. Ex. 1001 (’359 Patent) at 6:41-46.

110. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit after switching time determined by the optical network unit itself or indicated by the optical line terminal.*”

5. [1.D] wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit, the method further comprises:

111. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

112. Limitation [1.D] requires that limitations [1.E], [1.F], and [1.G] occur before limitation [1.A]. Limitation [1.D], therefore, is satisfied for the same reasons as previously explained in regard to limitation [1.A] and as will be explained in my analysis for limitations [1.E], [1.F], and [1.G]. Therefore, I incorporate by reference in its entirety my prior analysis for limitation [1.A] *supra* and my analysis for limitations [1.E], [1.F], and [1.G] *infra*.

113. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*wherein, before the step of the optical line terminal or the optical network unit detecting the transmission quality*

of the downlink between the optical line terminal and the optical network unit, the method further comprises.”

6. **[1.E] the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero; and**

114. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

115. G.984.3 discloses that the OLT determines and identifies N (one or more) kinds of upstream burst overhead parameter sets before claim limitation [1.A]. For example, the OLT communicates with ONUs and controls the upstream burst overhead parameters. Ex. 1005 (G.984.3) at 109-110. Specifically, “the ONU configures the overhead fields for the subsequent upstream transmissions using the Upstream_Overhead messages transmitted by the OLT. The following table shows the structure of the message, with ranges and typical values for the different fields.” *Id.* at 109-110.

Upstream_Overhead message			
Octet	Content	Description	Example value
1	11111111	Broadcast message to all ONUs.	
2	00000001	Message identification "Upstream_Overhead".	
3	gggggggg	Number of guard bits.	32 (G) (see Note 1)
4	xxxxxxx	Length of type 1 preamble bits.	8 (P1) (see Note 1)
5	yyyyyyyy	Length of type 2 preamble bits.	8 (P2) (see Note 1)
6	ccccccc	Pattern of type 3 preamble pattern.	AA
7	bbbbbbbb	Pattern of byte 1 of delimiter.	0xAB
8	bbbbbbbb	Pattern of byte 2 of delimiter.	0x59
9	bbbbbbbb	Pattern of byte 3 of delimiter.	0x83
10	xxemsspp	xx – Reserved e – Status of pre-equalization mechanism m – Status of SN_Mask mechanism ss – Max number of extra SN-transmissions	0 (See Note 2)
11	ddddddd	MSB of pre-assigned delay.	0 (See Note 2)
12	ddddddd	LSB of pre-assigned delay.	0 (See Note 2)
General note – The values in this message, except for P1 and P2, are selected according to OLT parameters and preferences. NOTE 1 – Given that the total length of the burst overhead is L (L maximum value is 128 bytes), the values for G, P1, P2, P3 (number of type 3 preamble bytes) and D (delimiter length) must satisfy $G+P1+P2+P3+D=L$. The Extended_Burst_Length message may pre-empt the value of L by modifying the value of P3 (for both pre-ranged and ranged states). It is the responsibility of the OLT to ensure that the total length of the burst overhead is an integer number of bytes. NOTE 2 – It is assumed that the pre-assigned delay is not used and that the SN value is transmitted once by the ONUs. Note also that since the Serial_Number_Mask message has been deprecated, the m bit should always be set to 0.			

116. The upstream burst overhead parameter sets include the state of FEC (on or off). Ex. 1005 (G.984.3) at 93. The parameter sets in the Upstream_Overhead message “are selected according to OLT parameters and preferences.” *Id.* at 110. This includes FEC. *Id.* at 92-93. The upstream burst overhead parameter sets, therefore, “are formed as dictated by the OLT.” *Id.* at 38. This occurs before the OLT sends the Upstream_Overhead message to the ONU. The OLT also determines and

identifies N kinds of upstream burst overhead parameter sets before claim limitation [1.A] because the Upstream_Overhead message is sent before the ONU sends any upstream communications, including upstream communications with information on the downlink quality.

Table 10-1 – ONU activation states functional transitions							
Event	States of the ONU						
	Init (O1)	Standby (O2)	Serial Number (O3)	Ranging (O4)	Operation (O5)	POPUP (O6)	Emergency Stop (O7)
ONU power up was last operational state (before power-down) O7?: => O7 else: => O1	–	–	–	–	–	–	–
ONU achieves PSync synchronization	The ONU clears LOS and LOF, then: => O2	–	–	–	–	–	–
The ONU receives the upstream overhead parameters (PLOAMd = Upstream_Overhead)	–	The ONU configures its transmit parameters with the received values; starts timer TO1 then: => O3	–	–	–	–	–
The ONU receives the extended burst parameters (PLOAMd = Extended_Burst_Length)	–	–	If no serial number request has been received, the ONU configures its type 3 preamble length with the received values; otherwise, no action.	–	–	–	–
The ONU receives a serial number request (BW allocation structure with Alloc-ID = 254 PLOAMu = '1')	–	–	The ONU waits for minimum response time, plus pre-assigned delay, plus random delay before responding with a Serial_Number_ONU message.	–	–	–	–

Ex. 1005 (G.984.3) at 69 (annotated).

117. Khhermosh also discloses where the OLT determines and identifies N (one or more) kinds of upstream burst overhead parameter sets before claim limitation [1.A]. Khhermosh, however, also teaches that the OLT determines and identifies N kinds of upstream burst overhead parameter sets according to different levels of link quality. For example, Khhermosh discloses that the OLT “automatically initializes each ONU and registers each ONU according to FEC coding capability of the ONU and the communications quality to and from the ONU. FEC coding is implemented when appropriate to improve the quality of the communications.” Ex. 1014 (Khhermosh) at [0021]. As taught in G.984.3 and as was well-known in the art at the time, during initialization, the OLT determines and identifies upstream burst overhead parameter sets and then sends the upstream burst overhead parameter sets to the ONU via the Upstream_Overhead message. Ex. 1005 (G.984.3) at 38, 92-93, 109-110. The upstream burst overhead parameter sets, as taught in Khhermosh, include FEC coding when link quality is low and non-FEC coding when link quality is high.

118. Khhermosh explains “If the figure of merit is sufficient, then ONU 105 responds henceforth with non-FEC coded data (step 507). If the figure of merit is not sufficient, then ONU 105 responds henceforth with FEC coded data (step 505).” Ex. 1014 (Khhermosh) at [0027]. As the OLT controls the upstream burst overhead parameter sets that are sent to the ONU during initialization, the OLT in Khhermosh

determines and identifies at least two upstream burst overhead parameter sets for the ONU, one set for FEC on and one set for FEC off, based on the link quality (high or low). Moreover, the OLT determines and identifies the upstream burst overhead parameter sets before claim limitation [1.A] because the upstream burst overhead parameter sets are sent before the ONU sends any upstream communications, including upstream communications with information on the downlink quality.

119. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the optical line terminal determining and identifying N kinds of upstream burst overhead parameter sets according to different levels of link quality, wherein N is an integer and is larger than zero.*”

7. **[1.F] the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set; or,**

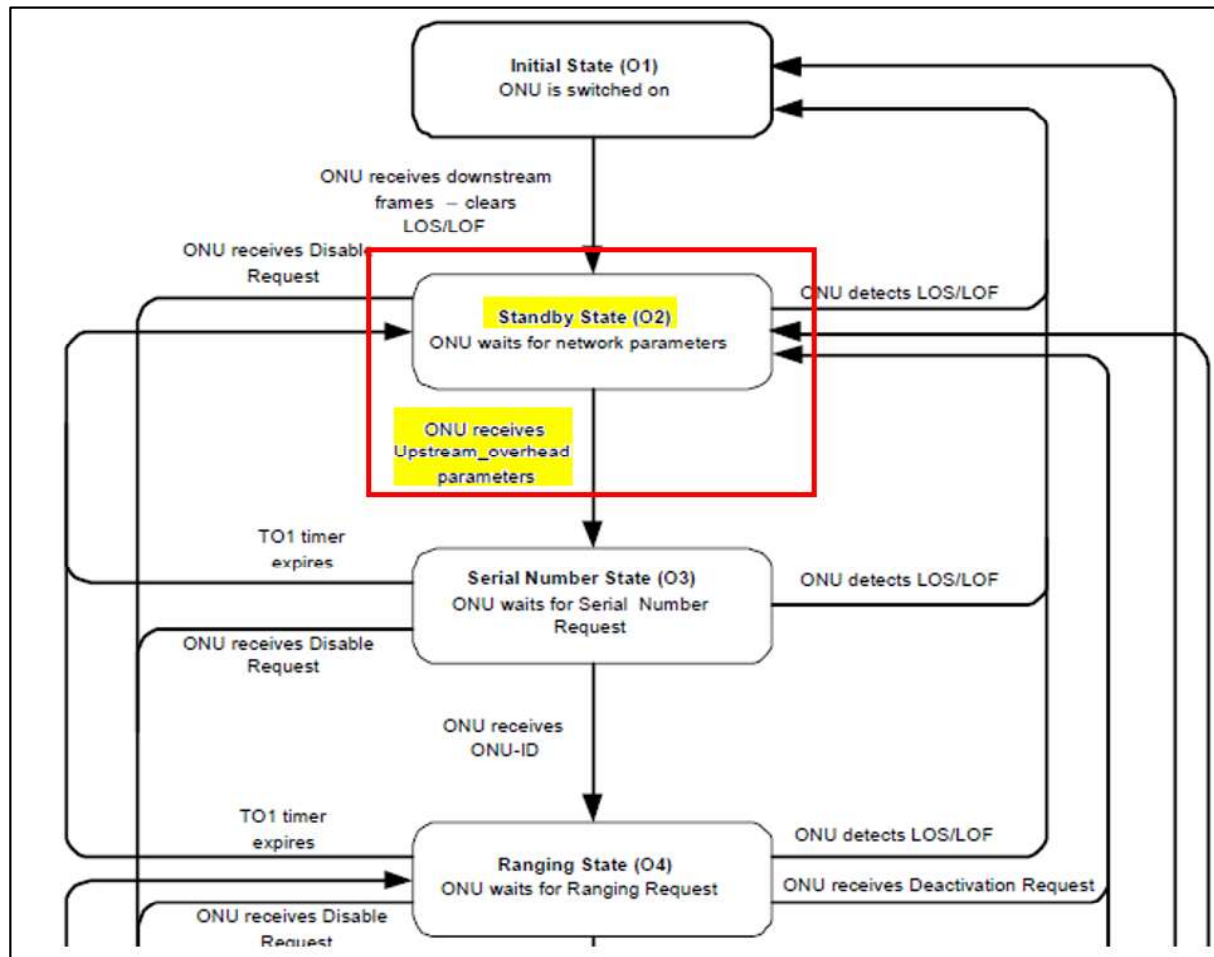
120. Claim limitation [1.F] is not a required limitation as only one of claim limitation [1.F] *or* [1.G] is required and, for the reasons discussed herein, the G.984.3-Khermosh combination discloses claim limitation [1.G]. Regardless, a POSITA would have understood the G.984.3-Khermosh combination also discloses claim limitation [1.F].

121. G.984.3 discloses that the Upstream_Overhead message is sent to the ONU from the OLT and includes parameter values or an identification of one default upstream burst overhead parameter set as it includes information on the upstream burst overhead parameters. Ex. 1005 (G.984.3) at 38. The following table shows “the structure of the message, with ranges and typical values for the different fields.” *Id.* at 109-110.

Upstream_Overhead message			
Octet	Content	Description	Example value
1	11111111	Broadcast message to all ONUs.	
2	00000001	Message identification "Upstream_Overhead".	
3	gggggggg	Number of guard bits.	32 (G) (see Note 1)
4	xxxxxxxx	Length of type 1 preamble bits.	8 (P1) (see Note 1)
5	yyyyyyyy	Length of type 2 preamble bits.	8 (P2) (see Note 1)
6	cccccccc	Pattern of type 3 preamble pattern.	AA
7	bbbbbbbb	Pattern of byte 1 of delimiter.	0xAB
8	bbbbbbbb	Pattern of byte 2 of delimiter.	0x59
9	bbbbbbbb	Pattern of byte 3 of delimiter.	0x83
10	xxemsspp	xx – Reserved e – Status of pre-equalization mechanism m – Status of SN_Mask mechanism ss – Max number of extra SN-transmissions	0 (See Note 2)
11	dddddddd	MSB of pre-assigned delay.	0 (See Note 2)
12	dddddddd	LSB of pre-assigned delay.	0 (See Note 2)
General note – The values in this message, except for P1 and P2, are selected according to OLT parameters and preferences. NOTE 1 – Given that the total length of the burst overhead is L (L maximum value is 128 bytes), the values for G, P1, P2, P3 (number of type 3 preamble bytes) and D (delimiter length) must satisfy $G+P1+P2+P3+D=L$. The Extended_Burst_Length message may pre-empt the value of L by modifying the value of P3 (for both pre-ranged and ranged states). It is the responsibility of the OLT to ensure that the total length of the burst overhead is an integer number of bytes. NOTE 2 – It is assumed that the pre-assigned delay is not used and that the SN value is transmitted once by the ONUs. Note also that since the Serial_Number_Mask message has been deprecated, the m bit should always be set to 0.			

122. The parameter values include the state of FEC (on or off). Ex. 1005 (G.984.3) at 93. G.984.3 also discloses that “[d]uring the parameter learning phase, the ONU, while remaining passive, acquires the operating parameters to be used in the upstream transmission.” Ex. 1005 (G.984.3) at 64. G.984.3 further discloses a “standby state (O2)” whereby “[d]ownstream traffic is received by the ONU. The ONU waits for global network parameters. Once the Upstream_Overhead message is received, the ONU configures these parameters (e.g., delimiter value, power level mode and pre-assigned delay) and moves to the Serial Number state (O3).” *Id.* at 66.

123. Moreover, G.984.3 teaches that the ONU receives the parameter values or an identification of one default upstream burst overhead parameter set in a standby state (*i.e.*, waiting state) and then uses the parameters. *Id.* at 66-68.



Ex. 1005 (G.984.3) at 68 (annotated).

124. The '359 Patent confirms the “Standby State (O2)” is the claimed “waiting state.” For example, the '359 Patent discloses that “the ONU receives the parameter value or the identification of the upstream burst overhead parameter set in *a waiting state (i.e., O2 state)*.” Ex. 1001 ('359 Patent), 7:49-52 (emphasis added).

125. G.984.3 further discloses that, after the “ONU receives the PON operating parameters (the lengths and patterns of the burst mode overhead components ...) through the Upstream_Overhead ... messages,” and the “ONU

announces its presence on the PON by responding to a broadcast serial number request periodically issued by the OLT” (*i.e.*, uses the upstream burst overhead parameter set). Ex. 1005 (G.984.3) at 65.

126. Moreover, the OLT sends a parameter value to the ONU and the ONU receives the parameter value in a waiting state and uses the upstream burst overhead parameter set before claim limitation [1.A] because the Upstream_Overhead message is received and used to respond to a serial number request message to set up the ONU-ID before the ONU sends upstream communications, via the OMCI, with information on the downlink quality. Ex. 1005 (G.984.3) at 10-11, 17-18, 100-112.

127. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the optical line terminal sending a parameter value or an identification of one default upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter value or the identification of the upstream burst overhead parameter set in a waiting state and using the upstream burst overhead parameter set.*”

8. **[1.G] the optical line terminal sending parameter values or identifications of more than one upstream burst overhead parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.**

128. Claim limitation [1.G] is not a required limitation as only one of claim limitation [1.F] *or* [1.G] is required and, for the reasons discussed herein, the G.984.3-Khermosh combination discloses claim limitation [1.F]. Regardless, a POSITA would have understood the G.984.3-Khermosh combination also discloses claim limitation [1.G].

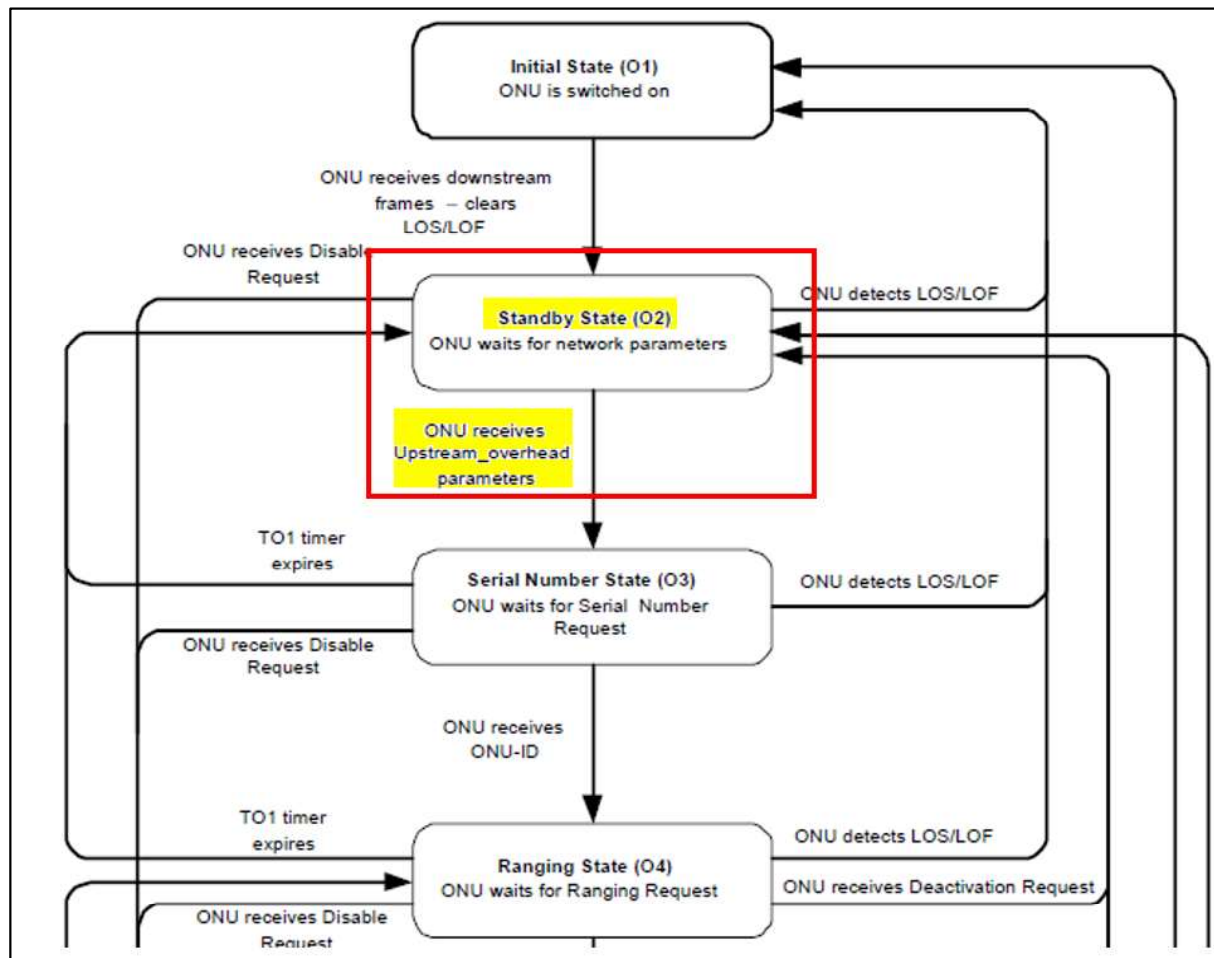
129. G.984.3 discloses that the Upstream_Overhead message is sent to the ONU from the OLT and includes parameter values or an identification of more than one upstream burst overhead parameter set as it includes information on the upstream burst overhead parameters. *Id.* at 38. The following table shows the structure of the message, with ranges and typical values for the different fields.” *Id.* at 109-110.

Upstream_Overhead message			
Octet	Content	Description	Example value
1	11111111	Broadcast message to all ONUs.	
2	00000001	Message identification "Upstream_Overhead".	
3	gggggggg	Number of guard bits.	32 (G) (see Note 1)
4	xxxxxxx	Length of type 1 preamble bits.	8 (P1) (see Note 1)
5	yyyyyyyy	Length of type 2 preamble bits.	8 (P2) (see Note 1)
6	ccccccc	Pattern of type 3 preamble pattern.	AA
7	bbbbbbbb	Pattern of byte 1 of delimiter.	0xAB
8	bbbbbbbb	Pattern of byte 2 of delimiter.	0x59
9	bbbbbbbb	Pattern of byte 3 of delimiter.	0x83
10	xxemsspp	xx – Reserved e – Status of pre-equalization mechanism m – Status of SN_Mask mechanism ss – Max number of extra SN-transmissions	0 (See Note 2)
11	ddddddd	MSB of pre-assigned delay.	0 (See Note 2)
12	ddddddd	LSB of pre-assigned delay.	0 (See Note 2)
General note – The values in this message, except for P1 and P2, are selected according to OLT parameters and preferences. NOTE 1 – Given that the total length of the burst overhead is L (L maximum value is 128 bytes), the values for G, P1, P2, P3 (number of type 3 preamble bytes) and D (delimiter length) must satisfy $G+P1+P2+P3+D=L$. The Extended_Burst_Length message may pre-empt the value of L by modifying the value of P3 (for both pre-ranged and ranged states). It is the responsibility of the OLT to ensure that the total length of the burst overhead is an integer number of bytes. NOTE 2 – It is assumed that the pre-assigned delay is not used and that the SN value is transmitted once by the ONUs. Note also that since the Serial_Number_Mask message has been deprecated, the m bit should always be set to 0.			

130. The parameter values include the state of FEC (on or off). Ex. 1005 (G.984.3) at 93. G.984.3 also discloses that “[d]uring the parameter learning phase, the ONU, while remaining passive, acquires the operating parameters to be used in the upstream transmission.” Ex. 1005 (G.984.3) at 64. G.984.3 further discloses a “standby state (O2)” whereby “[d]ownstream traffic is received by the ONU. The ONU waits for global network parameters. Once the Upstream_Overhead message

is received, the ONU configures these parameters (e.g., delimiter value, power level mode and pre-assigned delay) and moves to the Serial Number state (O3).” *Id.* at 66.

131. Moreover, G.984.3 teaches that the ONU receives the parameter values or an identification of more than one upstream burst overhead parameter set in a standby state (*i.e.*, waiting state) and then uses the parameters. *Id.* at 66-68.



Ex. 1005 (G.984.3) at 68 (annotated).

132. The '359 Patent confirms the “Standby State (O2)” is the claimed “waiting state.” For example, the '359 Patent discloses that “the ONU receives the

parameter value or the identification of the upstream burst overhead parameter set in *a waiting state (i.e., O2 state)*.” Ex. 1001 (’359 Patent) at 7:49-52 (emphasis added).

133. G.984.3 further discloses that, after the “ONU receives the PON operating parameters (the lengths and patterns of the burst mode overhead components ...) through the Upstream_Overhead ... messages,” the “ONU announces its presence on the PON by responding to a broadcast serial number request periodically issued by the OLT” (*i.e., uses the upstream burst overhead parameter set*). Ex. 1005 (G.984.3) at 65.

134. Moreover, the OLT sends parameter values or identification of more than one upstream burst overhead parameter set to the ONU and the ONU receives the parameter values or the indications of the upstream burst overhead parameter sets in a waiting state and uses one of the upstream burst overhead parameter sets before claim limitation [1.A] because the Upstream_Overhead message is received and used to respond to a serial number request message to set up the ONU-ID before the ONU sends upstream communications, via the OMCI, with information on the downlink quality. Ex. 1005 (G.984.3) at 10-11, 17-18, 100-112.

135. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the optical line terminal sending parameter values or identifications of more than one upstream burst overhead*

parameter set to the optical network unit; and the optical network unit receiving the parameter values or the identifications of the upstream burst overhead parameter sets in a waiting state and using one of the received upstream burst overhead parameter sets.”

B. Claim 2

1. [2.PRE] The method of claim 1, wherein:

136. The G.984.3-Khermosh combination discloses the preamble to claim 2 for the same reasons as described in claim 1.

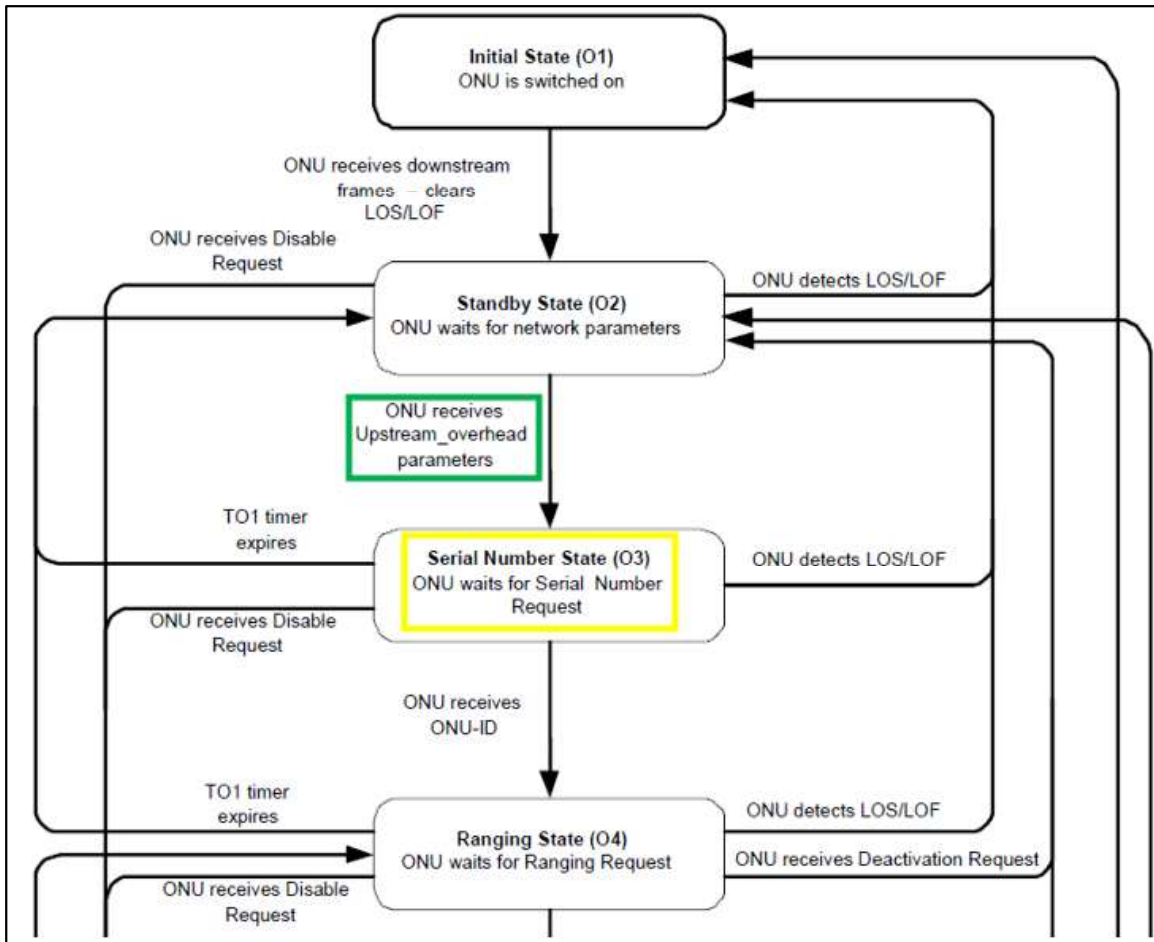
2. [2.A] after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state;

137. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

138. The G.984.3-Khermosh combination discloses “*the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s)*” for the same reasons as described in claim limitations [1.F] and [1.G], which I incorporate by reference in their entirety.

139. G.984.3 also discloses that *after* the ONU receives the Upstream_Overhead message with the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), “the ONU configures these parameters ... and moves to the Serial Number state (O3).” Ex. 1005 (G.984.3) at 66. The below

figures from G.984.3 show that the ONU enters the serial number state (yellow box) after it receives the upstream overhead parameters (green box). *Id.* at 68-69 (annotated and excerpted).



Event	States of the ONU						
	Init (O1)	Standby (O2)	Serial Number (O3)	Ranging (O4)	Operation (O5)	POPUP (O6)	Emergency Stop (O7)
ONU power up was last operational state (before power-down) O7?: => O7 else: => O1	–	–	–	–	–	–	–
ONU achieves PSync synchronization	The ONU clears LOS and LOF, then: => O2	–	–	–	–	–	–
The ONU receives the upstream overhead parameters (PLOAMd = Upstream_Overhead)	–	The ONU configures its transmit parameters with the received values; starts timer TO1 then: => O3	–	–	–	–	–
The ONU receives the extended burst parameters (PLOAMd = Extended_Burst_Length)	–	–	If no serial number request has been received, the ONU configures its type 3 preamble length with the received values; otherwise, no action.	–	–	–	–

140. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state.*”

3. **[2.B] the step of the optical line terminal detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical line terminal detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;**

141. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

142. The G.984.3-Khermosh combination discloses “*the step of the optical line terminal detecting the transmission quality of the downlink between the optical line terminal and the optical network unit*” for the same reasons as described in claim limitation [1.A], which I incorporate by reference in its entirety.

143. G.984.3 further discloses that, while in the serial number state (state O3), “there are four message types that are exchanged between the OLT and ONU.” Ex. 1005 (G.984.3) at 110. The first is the Extended_Burst_Length PLOAM message, which sends parameter values for the preamble that the ONU should use depending on whether the ONU is in the “pre-ranged states” (O3-O4)” or “ranged states (O5-O6).” *Id.* at 110-11. The second is the serial number request message. *Id.* at 111. The serial number request message is sent from the OLT to the ONU. *Id.* “Upon receiving the serial number request grant, the ONU responds with a Serial_Number_ONU message” in response to the serial number request message. *Id.* at 112. Upon receipt of the Serial_Number_ONU message, “the OLT associates

available ONU-ID values with the received serial numbers and assigns them to ONUs using the Assign_ONU-ID message.” *Id.* at 112. As a result, the ONU management and control interface (OMCI) is formed, and the ONU management and control channel (OMCC) is established once the ONU-ID is set during the serial number state. *Id.* at 10-11, 17-18, 100-112. This allows the ONU to communicate with the OLT and provide performance monitoring information (downlink transmission quality) to the OLT as explained in limitation [1.A]. Upon receipt of the performance monitoring information, the OLT detects the downlink transmission quality.

144. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the step of the optical line terminal detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical line terminal detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink.*”

4. **[2.C] the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.**

145. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

146. The G.984.3-Khermosh combination discloses “*the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink*” for the same reasons as described in claim limitation [1.B], which I incorporate by reference in its entirety.

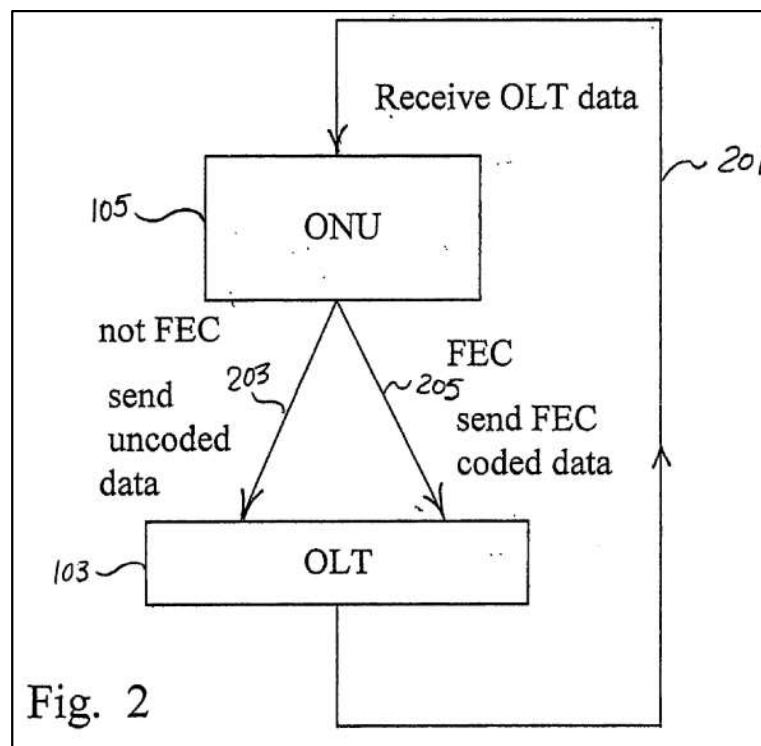
147. The G.984.3-Khermosh combination discloses where the OLT “*notif[ies] the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message*” for the same reasons as described in claim limitations [1.E], [1.F], [1.G] (which I incorporate by reference), and as explained below.

148. G.983.4 discloses where the OLT notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the ONU to the ONU via a unicast message or a broadcast message. For example, G.984.3 discloses where the “ONU receives the PON operating parameters (the lengths and patterns of the burst mode overhead components, value of the pre-assigned delay, and initial optical power level) through the Upstream_Overhead” message that is sent to the ONU by the OLT. Ex. 1005 (G.984.3) at 64-65. The Upstream_Overhead message, therefore, notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the ONU to the ONU. “The following table shows the structure of the message, with ranges and typical values for the different fields.” Ex. 1005 (G.984.3) at 109-110.

Upstream_Overhead message			
Octet	Content	Description	Example value
1	11111111	Broadcast message to all ONUs.	
2	00000001	Message identification "Upstream_Overhead".	
3	gggggggg	Number of guard bits.	32 (G) (see Note 1)
4	xxxxxxx	Length of type 1 preamble bits.	8 (P1) (see Note 1)
5	yyyyyyyy	Length of type 2 preamble bits.	8 (P2) (see Note 1)
6	ccccccc	Pattern of type 3 preamble pattern.	AA
7	bbbbbbb	Pattern of byte 1 of delimiter.	0xAB 0x59 0x83
8	bbbbbbb	Pattern of byte 2 of delimiter.	
9	bbbbbbb	Pattern of byte 3 of delimiter.	
10	xxemsspp	xx – Reserved e – Status of pre-equalization mechanism m – Status of SN_Mask mechanism ss – Max number of extra SN-transmissions	0 (See Note 2)
11	ddddddd	MSB of pre-assigned delay.	0 (See Note 2)
12	ddddddd	LSB of pre-assigned delay.	0 (See Note 2)

Ex. 1005 (G.984.3) at 109-110 (annotated). The Upstream_Overhead message is broadcast to all ONUs as highlighted above.

149. Khhermosh also discloses where the OLT notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the ONU to the ONU via a unicast message or a broadcast message. Khhermosh teaches that the OLT “automatically initializes each ONU and registers each ONU according to FEC coding capability of the ONU and the communications quality to and from the ONU. FEC coding is implemented when appropriate to improve the quality of the communications.” Ex. 1014 (Khhermosh) at [0021]. Khhermosh also teaches where the OLT notifies the ONU whether to use FEC in the upstream direction, as shown in Figure 2.



150. In describing Figure 2, Khhermosh explains that “FIG. 2 is a flow chart of an initialization process, according to an embodiment of the present invention. ONU 105, capable of FEC coding, is added to an EPON 10. ONU 105 receives data from OLT 103 of EPON 10. If the data received from OLT 103 is FEC coded, then ONU 105 sends coded data (step 205) to OLT 103. If the data received from OLT 103 is not FEC coded, then ONU 105 sends uncoded data (step 203) to OLT 103.” *Id.* at [0024]. Khhermosh also teaches that “FEC coding is implemented when appropriate to improve the quality of the communications.” Ex. 1014 (Khhermosh) at [0021]. Khhermosh, therefore, teaches that the OLT notifies the ONU whether to use FEC in the upstream direction based on the transmission quality (*OLT notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the ONU to the ONU*) by sending or not sending FEC encoded data. Khhermosh further discloses that downlink communications from OLTs are “broadcasts.” Ex. 1014 (Khhermosh) at [0023].

151. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khhermosh combination discloses “*the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and*

notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.”

C. Claim 3

1. [3.PRE] The method of claim 1, wherein:

152. The G.984.3-Khermosh combination discloses the preamble to claim 3 for the same reasons as described in claim 1.

2. [3.A] after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state;

153. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

154. Claim limitation [3.A] is identical to prior claim limitation [2.A]. I, therefore, incorporate by reference in its entirety my prior analysis for limitation [2.A], *supra*.

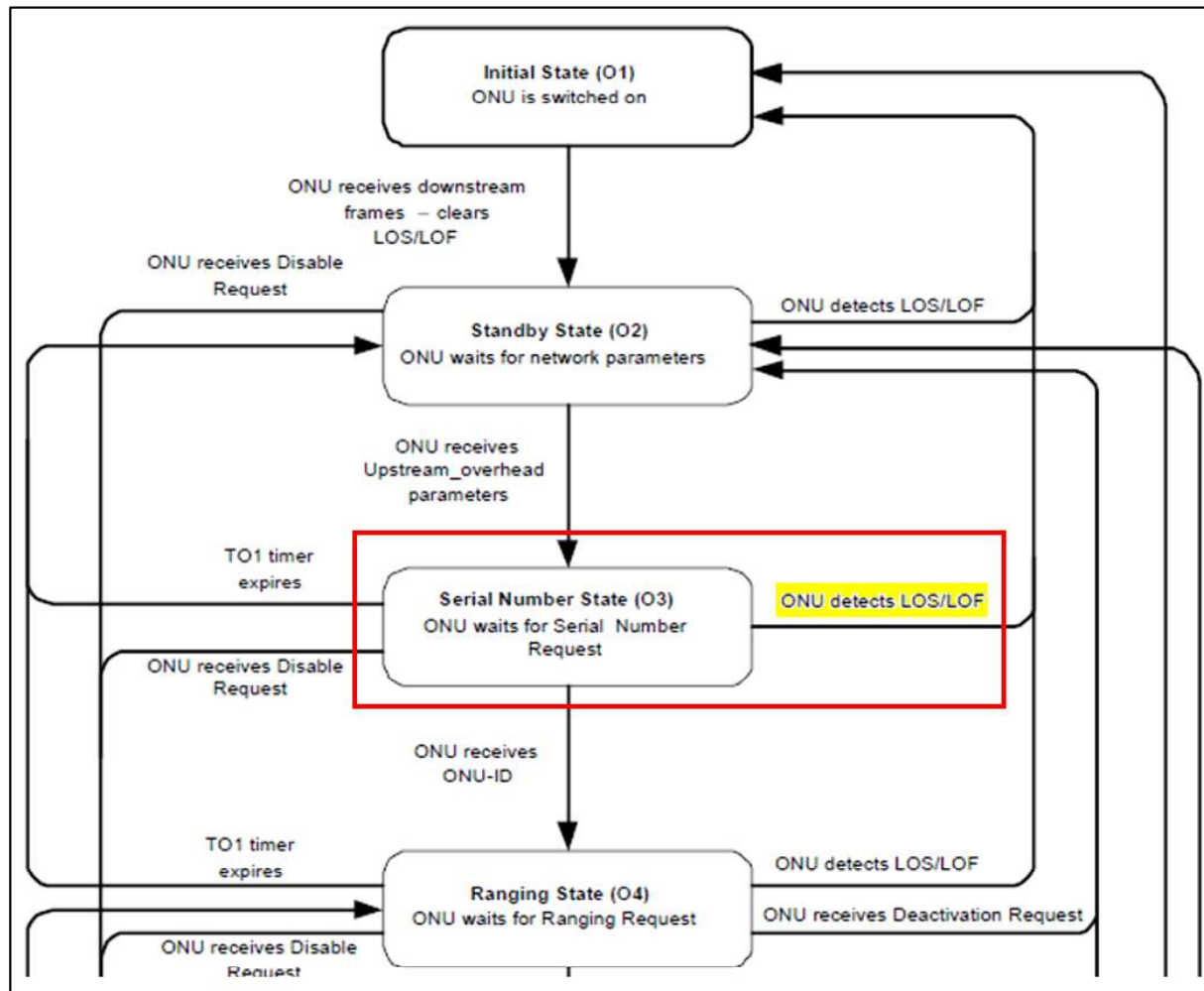
155. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state.*”

3. **[3.B] the step of the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical network unit detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;**

156. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

157. The G.984.3-Khermosh combination discloses this limitation for the same reasons as described in claim limitations [1.A] and [2.A] (which I incorporate by reference in their entirety), and for the reasons explained below. Specifically, claim limitation [1.A] discloses that the ONU detects the transmission quality of the downlink and claim limitation [2.A] discloses that the ONU enters into the serial number state.

158. G.984.3 discloses that the ONU detects the downlink between the ONU and the OLT to acquire quality information of the downlink in the serial number state. For example, the below figures from G.984.3 show that the “ONU detects LOS/LOF” in the serial number state. Ex. 1005 (G.984.3) at 68 (annotated and excerpted).



159. Detecting the LOS (loss of signal) or LOF (loss of frame) is at least one performance monitoring metric that is used by the ONU during the serial number state to detect the downlink quality. *Id.* at 5, 68-70, 83-87. Moreover, while only two performance monitors are specifically shown in the figure above, G.984.3 makes clear that there are many different types of performance monitors that the ONU can use to detect the downlink quality. A few examples are shown below.

11.1.2 Items detected at ONU

Type		Description			
		Detection conditions	Actions	Cancellation conditions	Actions
LOS	Loss of signal	No valid signal is received in the downstream.	Switch off laser. Generate Loss_of_phy_layer notification. Change state according to clause 10.	Valid optical signal.	Move to Standby state.
LOF	Loss of frame	When 5 consecutive invalid PSync from OLT are received.	Switch off laser. Generate Loss_of_phy_layer notification. Change state according to clause 10.	When 2 consecutive frames have correct PSync.	Move to Standby state.
SF	Signal failed	When the downstream BER becomes $\geq 10^{-Y}$, this state is entered. Y is configurable in the range of 5 to 8.	—	Set inactive when the downstream BER is $< 10^{-(Y+1)}$.	—
SD	Signal degraded	When the downstream BER becomes $\geq 10^{-X}$, this state is entered. X is configurable in the range of 6 to 9, but must be higher than Y.	—	Set inactive when the downstream BER is $< 10^{-(X+1)}$.	—

160. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the step of the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical network unit detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink.*”

4. **[3.C] after the step of acquiring the quality information of the downlink, the method further comprises: the optical network unit notifying the quality information of the downlink to the optical line terminal;**

161. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation. The G.984.3-Khermosh combination discloses this limitation for the same reasons as described in claim limitations [1.A] and [3.B] (which I incorporate by reference in its entirety), and for the reasons explained below.

162. G.984.3 discloses that, *after* the ONU detects the downlink between the ONU and the OLT to acquire quality information of the downlink in the serial number state (as explained in claim limitation [3.B]), the ONU notifies the quality information of the downlink to the OLT. For example, the ONU sends downlink quality information (e.g., downlink performance monitor information) via the optical network unit management and control channel (OMCC), which is established when the OLT assigns an ID to the ONU. *Id.* at 10-11, 48. Once the ONU-ID values are associated, the established OMCC allows the ONU to communicate with the OLT and provide performance monitoring information as explained in limitation [1.A].

163. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*after the step of acquiring the quality*

information of the downlink, the method further comprises: the optical network unit notifying the quality information of the downlink to the optical line terminal.”

5. **[3.D] the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.**

164. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

165. Claim limitation [3.D] is identical to prior claim limitation [2.C]. I, therefore, incorporate by reference in its entirety my prior analysis for limitation [2.C], *supra*.

166. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the step of the optical line terminal determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical line terminal determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst*

overhead parameter set(s) suitable for the optical network unit to the optical network unit via a unicast message or a broadcast message.”

D. Claim 4

1. [4.PRE] The method of claim 1, wherein:

167. The G.984.3-Khermosh combination discloses the preamble to claim 4 for the same reasons as described in claim 1.

2. [4.A] after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state;

168. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

169. Claim limitation [4.A] is identical to prior claim limitation [2.A]. I, therefore, incorporate by reference in its entirety my prior analysis for limitation [2.A], *supra*.

170. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*after the step of the optical network unit receiving the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s), the method further comprises: the optical network unit entering into a serial number state.*”

3. **[4.B] the step of the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical network unit detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink;**

171. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

172. Claim limitation [4.B] is identical to prior claim limitation [3.B]. I, therefore, incorporate by reference in its entirety my prior analysis for limitation [3.B], *supra*.

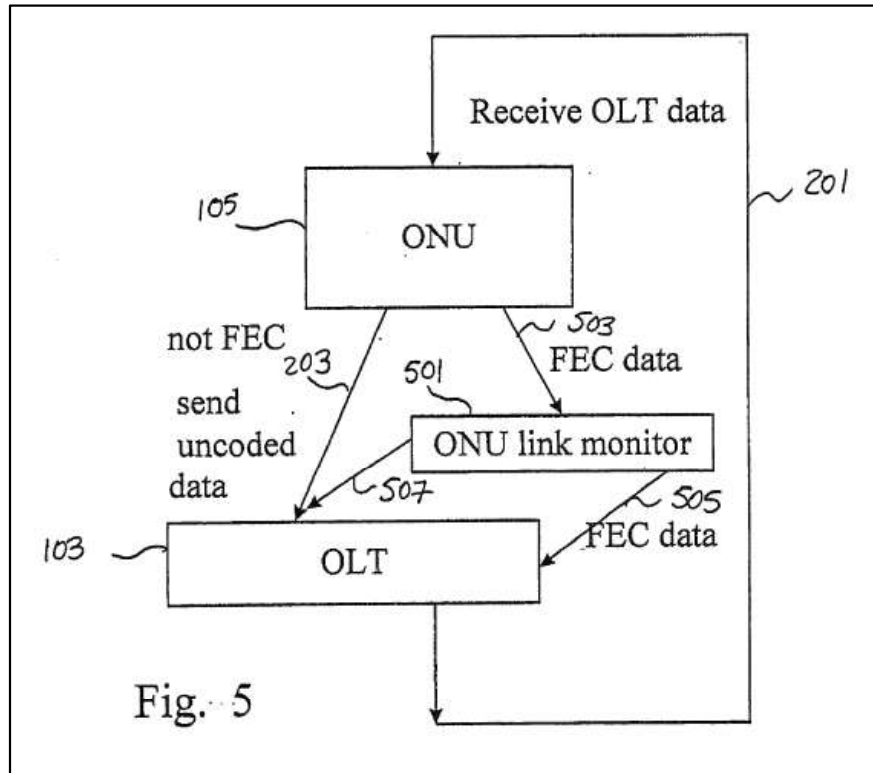
173. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the step of the optical network unit detecting the transmission quality of the downlink between the optical line terminal and the optical network unit comprises: in the serial number state of the optical network unit, the optical network unit detecting the downlink between the optical network unit and the optical line terminal to acquire quality information of the downlink.*”

4. **[4.C] The step of the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical network unit determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical line terminal via a unicast message or a broadcast message.**

174. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

175. The G.984.3-Khermosh combination discloses “*step of the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality*” for the same reasons as described in claim limitation [1.B] (which I incorporate by reference in its entirety), and for the reasons explained below.

176. Khermosh teaches where the ONU determines the upstream burst overhead parameter set suitable for the ONU according to the quality information of the downlink. Figure 5 of Khermosh discloses where ONU manages upstream burst overhead parameters, including the state of FEC, based on the detected transmission quality of a downlink.



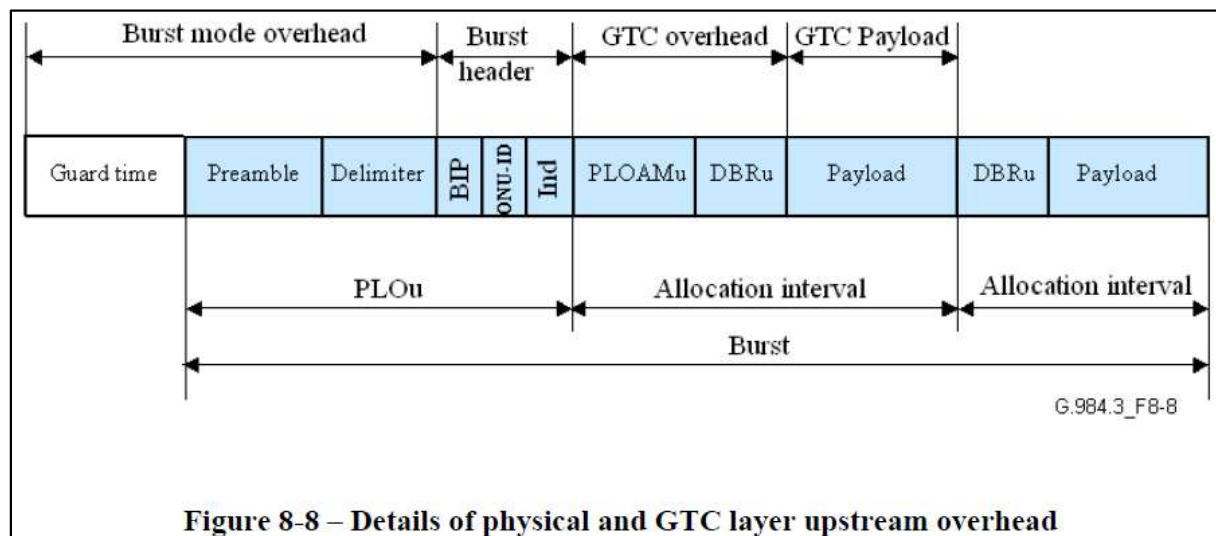
177. Specifically, Khermosh teaches that the “FIG. 5 is a flow chart of an initialization and an auto-negotiation process, according to yet another embodiment of the present invention. ONU 105 receives data from OLT 103 (step 201). If the data received is non-FEC coded data, then ONU 105 responds with non-FEC coded data (step 203). However, if the data received by ONU 105 is FEC coded data (step 503), then ONU 105 monitors the received data and determines a figure of merit for the communications from OLT 103. If the figure of merit is sufficient, then ONU 105 responds henceforth with non-FEC coded data (step 507). If the figure of merit is not sufficient, then ONU 105 responds henceforth with FEC coded data (step 505).” Ex. 1014 (Khermosh) at [0027].

178. When the ONU receives FEC coded data and then monitors the received data to determine a figure of merit for the communications from the OLT (*i.e.*, detecting downstream transmission quality), and responds with FEC or non-FEC encoded data based on the figure of merit (*i.e.*, ONU determining upstream burst parameter set based on the link quality), the ONU determines the upstream burst overhead parameter set suitable for the ONU according to the quality information of the downlink.

179. Khhermosh also discloses “*notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical line terminal.*” As explained above, the ONU responds to the OLT with FEC-coded or non-FEC coded data based on the downlink quality. When the ONU responds to the OLT, the ONU notifies the OLT of the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit. For example, when the ONU responds with FEC coded data, the ONU notifies the OLT that the upstream burst overhead parameter set includes FEC.

180. G.984.3 also discloses “*notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical line terminal.*” As disclosed in G.984.3, the upstream message includes information before the payload notifying the OLT of the

upstream burst overhead parameters which, as Khhermosh disclosed, can be determined by the ONU based on the downlink quality. As shown below, the upstream message notifies the OLT of the guard time, preamble, and delimiter via the burst mode overhead. Ex. 1005 (G.984.3) at 37-38. And the Ind field in the burst header contains an indication of FEC status—either FEC on or FEC off. *Id.* at 38-39.



181. The guard time, preamble, delimiter, and FEC status are all upstream burst overhead parameter values as described in the '359 Patent. Ex. 1001 ('359 Patent) at 1:15-33.

182. Khhermosh and G.984.3 also disclose where the upstream message is “*a unicast message.*” Due to the point-to-multipoint nature of a PON system, the upstream message from the ONU to the OLT is a unicast message. This is because, unlike in the downstream direction where the OLT can send a message to one ONU

(unicast) or all ONUs (broadcast), in the upstream direction the ONU can only send a unicast message to the OLT.

183. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*The step of the optical network unit determining the upstream burst overhead parameters suitable for the optical network unit according to the transmission quality comprises: the optical network unit determining the upstream burst overhead parameter set suitable for the optical network unit according to the quality information of the downlink, and notifying the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) suitable for the optical network unit to the optical line terminal via a unicast message or a broadcast message.*”

E. Claims 5, 8, and 11¹

1. [5.PRE]/[8.PRE]/[11.PRE] The method of claim [2/3/4], wherein:

184. The G.984.3-Khermosh combination discloses the preamble to claim 5, claim 8, and claim 11 for the same reasons as described in claim 2, claim 3, and claim 4.

¹ Claims 5, 8, and 11 contain verbatim language with the exception of the claim from which they depend. Accordingly, they are discussed together.

2. **[5.A]/[8.A]/[11.A] while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit, and sending the switching index value to the optical network unit via a downstream frame; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame; or,**

185. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation.

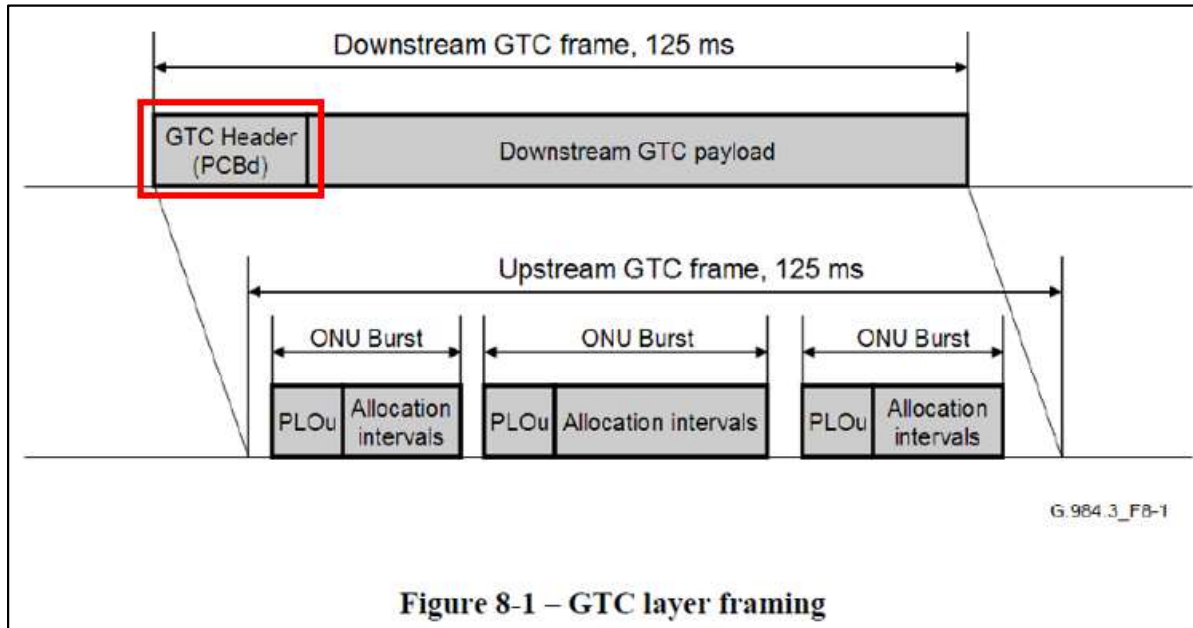
186. Claim limitations [5.A], [8.A], and [11.A] are not required limitations as only one of claim limitation [5.A]/[8.A]/[11.A], [5.B]/[8.B]/[11.B], or [5.C]/[8.C]/[11.C] are required and, for the reasons explained herein, the G.984.3-Khermosh combination discloses at least claim limitation [5.B]/[8.B]/[11.B]. Regardless, a POSITA would have understood the G.984.3-Khermosh combination also discloses this limitation.

187. The G.984.3-Khermosh combination discloses *“the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or ... the*

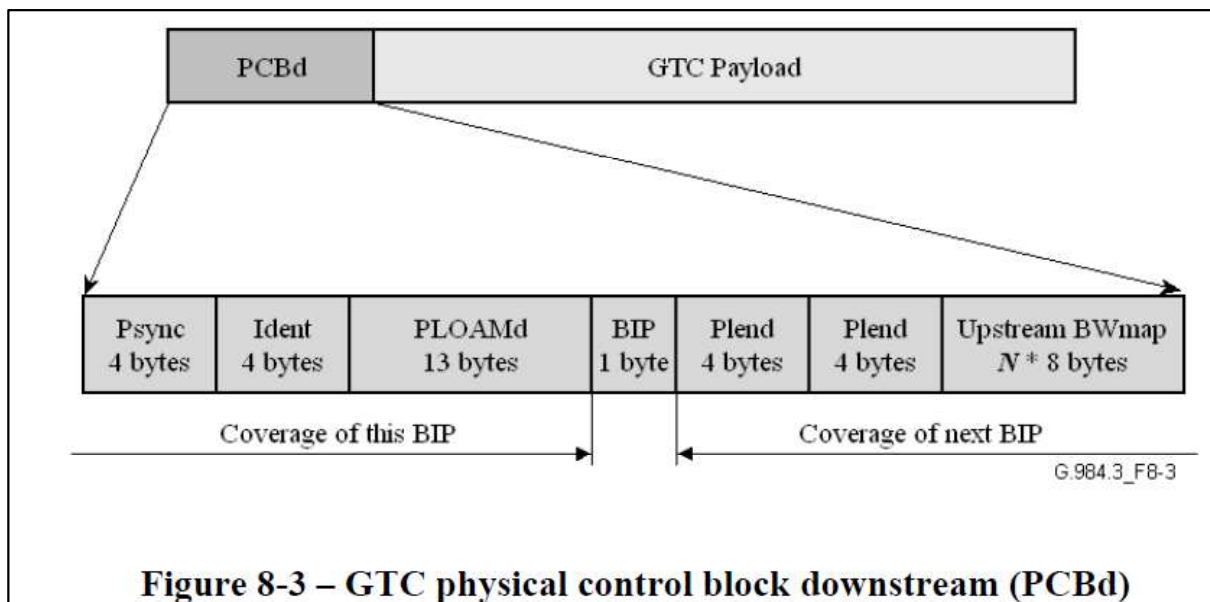
optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal” for the same reasons as described in claim limitation [2.C]/[3.D]/[4.C], which I incorporate by reference in its entirety.

188. G.984.3 discloses, while or after the OLT or ONU notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s), *“the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit, and sending the switching index value to the optical network unit via a downstream frame; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame.”*

189. For example, the OLT sends a downstream frame with a GTC Header (PCBd) and GTC payload, as shown below. Ex. 1005 (G.984.3) at 30. “The downstream GTC frame provides the common time reference for the PON and the common control signaling for the upstream.” Ex. 1005 (G.984.3) at 30 (annotated).

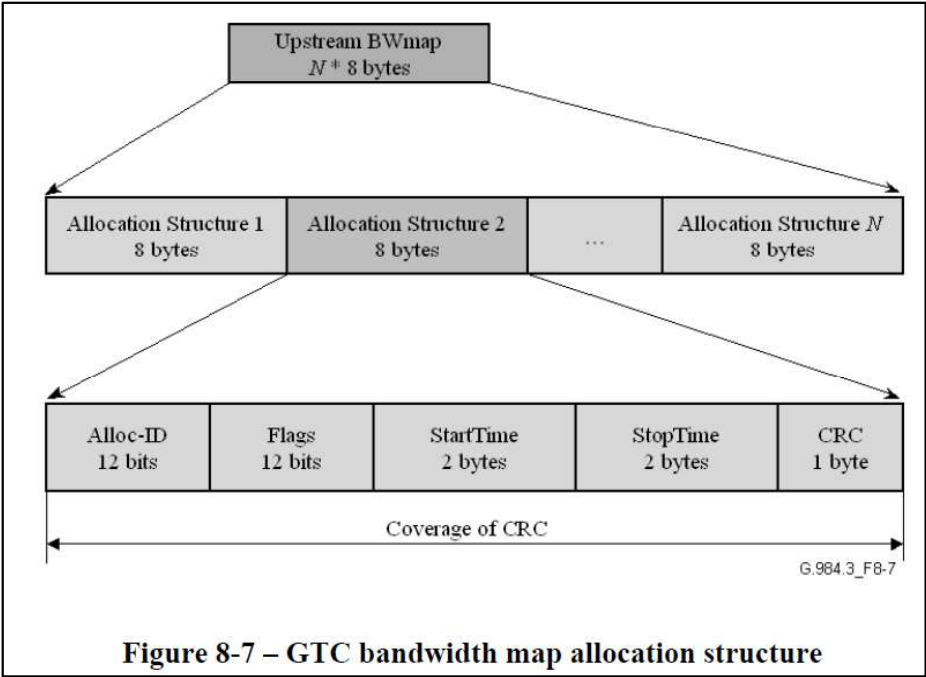


190. The physical control block downstream (PCBd) contains several fields for notifying ONUs how and when to send upstream burst messages. *Id.* at 31. “The OLT sends the PCBd in a broadcast manner, and every ONU receives the entire PCBd. The ONUs then act upon the relevant information contained therein.” *Id.*



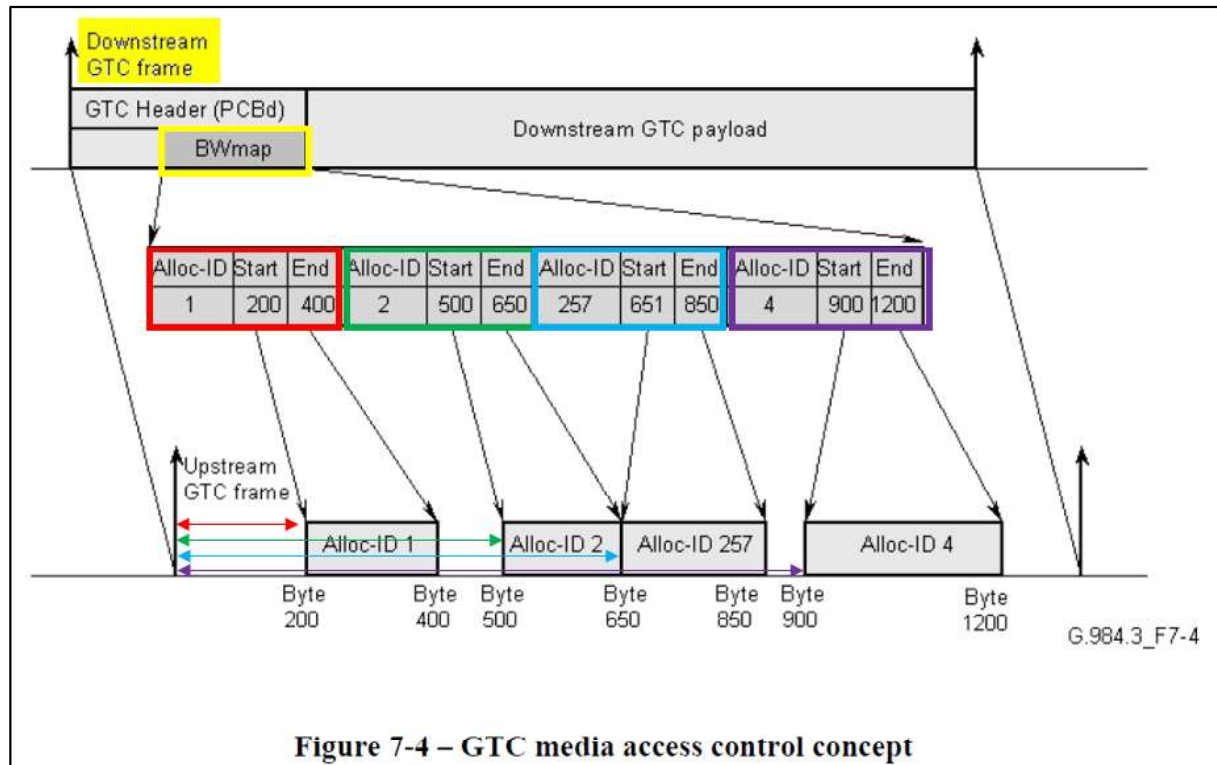
191. The PLOAMd field contains the PLOAM message. *Id.* at 33. The PLOAM message includes the upstream overhead parameters that the ONU should use. *Id.* at 54-55, 69.

192. The Upstream BWmap field includes the allocation structure for each ONU to send messages in the upstream direction, as shown in the following figures. *Id.* at 34; 19 (annotated).



193. The allocation structure in the bandwidth map includes the Alloc-ID field, which indicates the recipient (specific ONU) of the upstream bandwidth allocation. *Id.* at 34. The Flags field includes, among other things, an indication of whether the “ONU shall compute and insert FEC parity during this allocation.” *Id.* at 35. The StartTime and StopTime fields indicate starting and stopping times of the

upstream allocation of the specific ONU as measured in bytes. *Id.* The switching index value is shown by the colored arrows in the Figure below. *Id.* at 19 (annotated).



194. A POSITA would have understood that the time between when the upstream GTC frame begins and the assigned ONU start time is the claimed “switching index value.” This is because the ONU does not start to use the upstream burst overhead parameters suitable for the ONU until after the switching index value, as described and claimed in the ’359 Patent.

195. For example, ’359 Patent describes the “switching index value” (one of the colored arrows above) “in a tag field assigned for a bandwidth of the ONU” (yellow box above) “and sending the switching index value to the ONU via a

downstream frame” (yellow highlighting above) “so that after the ONU receives the switching index value, the ONU uses the upstream burst overhead parameters in a next frame” (colored boxes and corresponding colored arrows above). Ex. 1001 (’359 Patent) at 6:33-40; Ex. 1005 (G.984.3) at 19 (annotated). This mirrors the claim language: “*the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit*” (yellow box above); “*sending the switching index value to the optical network unit via a downstream frame*” (yellow highlighting above); and “*the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame*” (the ONU starts using the suitable upstream burst overhead parameters in the next frame after the switching time as shown by the colored arrows and corresponding colored boxes).

196. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s)*

of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal setting a switching index value of the upstream burst overhead parameters in a tag field assigned for a bandwidth of the optical network unit, and sending the switching index value to the optical network unit via a downstream frame; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the switching index value, the optical network unit using the upstream burst overhead parameters suitable for the optical network unit in a next frame; or,”

- 3. [5.B]/[8.B]/[11.B] while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit; or,**

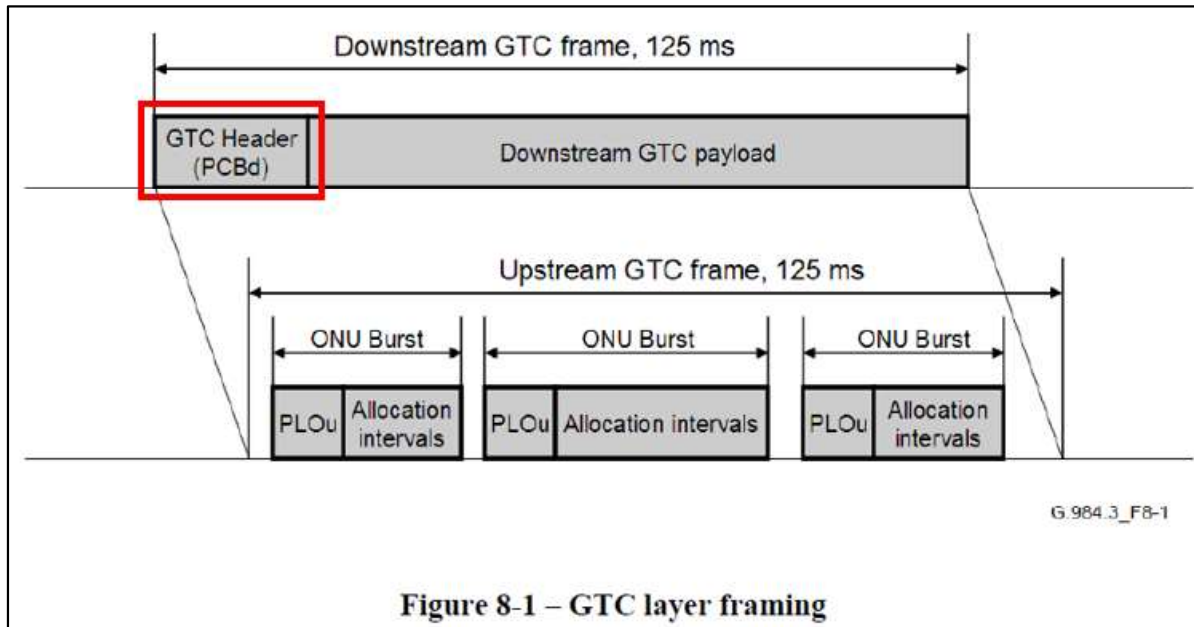
197. Claim limitations [5.B], [8.B], and [11.B] are not required limitations as only one of claim limitation [5.A]/[8.A]/[11.A], [5.B]/[8.B]/[11.B], *or* [5.C]/[8.C]/[11.C] is required and, for the reasons explained herein, the G.984.3-

Khermosh combination discloses claim limitation [5.A]/[8.A]/[11.A]. Regardless, a POSITA would have understood the G.984.3-Khermosh combination also discloses this limitation.

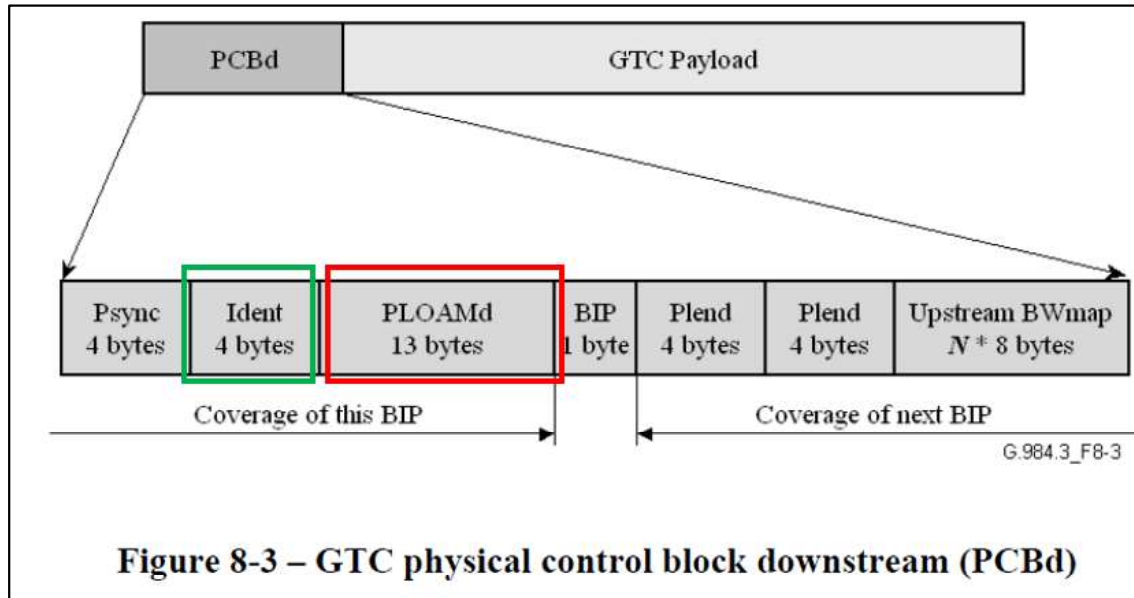
198. The G.984.3-Khermosh combination discloses “*the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or ... the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal*” for the same reasons as described in claim limitation [2.C]/[3.D]/[4.C], which I incorporate by reference in its entirety.

199. G.984.3 discloses, while or after the OLT or ONU notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s), “*the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit.*”

200. For example, the OLT sends a downstream frame with a GTC Header (PCBd) and GTC payload, as shown below. Ex. 1005 (G.984.3) at 30 (annotated). “The downstream GTC frame provides the common time reference for the PON and the common control signaling for the upstream.” Ex. 1005 (G.984.3) at 30.

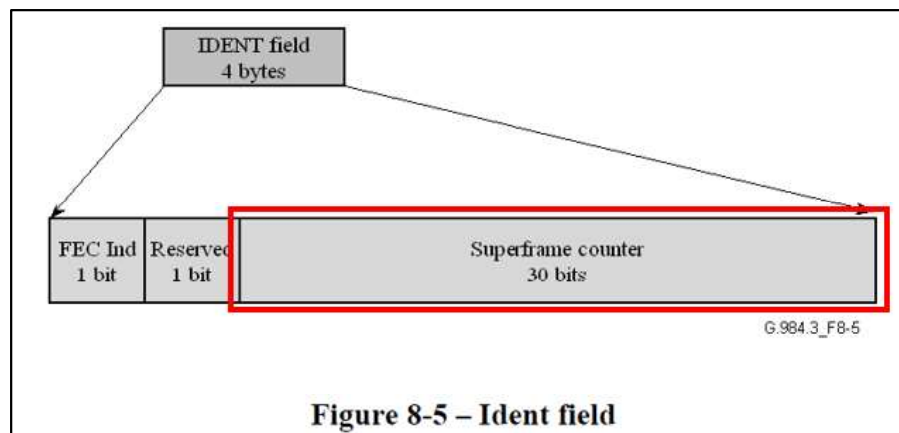


201. “The OLT sends the PCBd in a broadcast manner, and every ONU receives the entire PCBd. The ONUs then act upon the relevant information contained therein.” *Id.* at 31. The physical control block downstream (PCBd) contains several fields for notifying ONUs how and when to send upstream burst messages. *Id.* at 31. This includes the PLOAMd field (red box below) and Ident field (green box below).



Id. at 31 (annotated).

202. The PLOAMd field contains the PLOAM message. *Id.* at 33. The PLOAM message includes the upstream overhead parameters that the ONU should use. *Id.* at 54-55, 69. The Ident field includes a “Superframe counter” as shown below. *Id.* at 32-33.



203. The ONU compares to its own local superframe counter to the Superframe counter above to ensure correct synchronization. *Id.* at 32. Because

proper upstream communication is not possible until synchronization is confirmed, the ONU does not begin sending upstream communications using the upstream burst profile until after synchronization with the superframe counter (switching time).

204. The superframe counter in G.984.3 is the hyper frame number described in the '359 Patent because it indicates to the ONU what frame to start using the upstream burst overhead parameters. The '359 Patent explains that notifying that a hyper frame number tells the ONU to begin using the upstream burst overhead parameters after the frame indicated by the hyper frame number. Ex. 1001 ('359 Patent) at 6:41-46. A POSITA would, therefore, have understood that the claimed “hyper frame number” is the “superframe counter” because the ONU does not start to use the upstream burst overhead parameters suitable for the optical network until after a switching time as indicated by the superframe counter.

205. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses *“while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical line terminal notifying a hyper frame number to the optical network unit; the step of the optical network unit starting to use the*

upstream burst overhead parameters after the switching time indicated by the optical line terminal comprises: after the optical network unit receives the hyper frame number and after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit; or,”

- 4. [5.C]/[8.C]/[11.C] while or after the optical line terminal notifies the parameter value(s) or the identification(s) of the determined upstream burst overhead parameter set(s) to the optical network unit, or while or after the optical network unit notifies the parameter value(s) or the identification(s) of the upstream burst overhead parameter set(s) to the optical line terminal, the method further comprises: the optical network unit notifying a hyper frame number to the optical line terminal; the step of the optical network unit starting to use the upstream burst overhead parameters after the switching time determined by the optical network unit itself comprises: after a frame indicated by the hyper frame number arrives, the optical network unit starting to use the upstream burst overhead parameters suitable for the optical network unit.**

206. Claim limitations [5.C], [8.C], and [11.C] are not required limitations as only one of claim limitation [5.A]/[8.A]/[11.A], [5.B]/[8.B]/[11.B], *or* [5.C]/[8.C]/[11.C] is required and, for the reasons explained herein, the G.984.3-Khermosh combination discloses claim limitations [5.A]/[8.A]/[11.A] and [5.B]/[8.B]/[11.B].

F. Claims 6, 9, and 10²

1. [6.PRE]/[9.PRE]/[10.PRE] The method of claim [2/3/4], wherein:

207. The G.984.3-Khermosh combination discloses the preamble to claim 6, claim 9, and claim 10 for the same reasons as described in claim 2, claim 3, and claim 4.

2. [6.A]/[9.A]/[10.A] the upstream burst overhead parameter set comprises: state of forward error correction, delimiter, preamble and guard band.

208. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation for the same reasons as provided in claim limitation [1.PRE], which I incorporate by reference herein, and for the reasons explained below.

209. For example, G.984.3 discloses that the “[t]he burst mode overhead is composed of guard time, preamble time and delimiter time.” Ex. 1005 (G.984.3) at 37. Further, G.984.3 discloses “FEC status” as an additional upstream burst parameter. *Id.* at 38-39.

210. In addition, Khermosh discloses managing upstream burst overhead parameters, including the state of FEC. For example, Khermosh discloses “a method

² Claims 6, 9, and 10 contain verbatim language with the exception of the claim from which they depend. Accordingly, they are discussed together.

of managing forward error correction ... including the steps of ... monitoring communication quality from the optical line terminal, thereby determining a figure of merit of the communications” where the “figure of merit is one of (i) bit error rate ...” Ex. 1014 (Khermosh) at [0012].

211. I further incorporate by reference in its entirety my prior analysis for limitation [1.PRE], *supra*.

212. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khermosh combination discloses “*the upstream burst overhead parameter set comprises: state of forward error correction, delimiter, preamble and guard band.*”

G. Claim 7

1. [7.PRE] The method of claim 1, wherein:

213. The G.984.3-Khermosh combination discloses the preamble to claim 7 for the same reasons as described in claim 1.

2. [7.A] in the step of the optical line terminal sending the parameter values or the identifications of more than one upstream burst overhead parameter set to the optical network unit, the optical line terminal sends the parameter values or the identifications of one or more upstream burst overhead parameter sets to all optical network units or one or more optical network units which communicate with the optical line terminal.

214. A POSITA would have understood the G.984.3-Khermosh combination discloses this limitation. The G.984.3-Khermosh combination discloses

“in the step of the optical line terminal sending the parameter values or the identifications of more than one upstream burst overhead parameter set to the optical network unit” for the same reasons as explained in claim limitation [1.G], which I incorporate by reference in its entirety.

215. Khhermosh and G.984.3 also disclose where *“the optical line terminal sends the parameter values or the identifications of one or more upstream burst overhead parameter sets to all optical network units or one or more optical network units which communicate with the optical line terminal.”* For example, Khhermosh discloses that downlink communications from OLTs are “broadcasts.” Ex. 1014 (Khhermosh) at [0023]. Likewise, G.984.3 discloses that the Upstream_Overhead message (which includes the upstream burst overhead parameters) from the OLT is a “Broadcast message to all ONUs.” Ex. 1005 (G.984.3) at 109. Broadcast messages are sent to all optical network units.

216. Therefore, it is my opinion that a POSITA would have understood that the G.984.3-Khhermosh combination discloses *“in the step of the optical line terminal sending the parameter values or the identifications of more than one upstream burst overhead parameter set to the optical network unit, the optical line terminal sends the parameter values or the identifications of one or more upstream burst overhead parameter sets to all optical network units or one or more optical network units which communicate with the optical line terminal.”*

XI. Revision or Supplementation

217. In this declaration, I have presented my opinions regarding the invalidity of claims 1-11 of the '359 Patent based on the information available to me. My opinions are subject to change in view of opinions provided by the Patent Owner or its expert, or any additional information that I may receive. I reserve the right to supplement my opinions accordingly.

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

Executed May 23, 2024

A handwritten signature in blue ink that reads "Alex. Sergienko". The signature is written in a cursive style with a horizontal line underneath it.

Dr. Alexander V. Sergienko