UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

NEXTGEN INNOVATIONS, LLC v. FUJITSU NETWORK COMMUNICATIONS, INC., et al.	§ § § § § §	CASE NO. 2:22-cv-00307-JRG-RSP (Lead Case)
NEXTGEN INNOVATIONS, LLC v. INFINERA CORPORATION	§ § § § §	CASE NO. 2:22-cv-00306-JRG-RSP (Member Case)
NEXTGEN INNOVATIONS, LLC v. AT&T SERVICES, INC., et al.	§ § § § §	CASE NO. 2:22-cv-00308-JRG-RSP (Member Case)
NEXTGEN INNOVATIONS, LLC v. NOKIA OF AMERICA CORPORATION, et al.	§ § § § § §	CASE NO. 2:22-cv-00309-JRG-RSP (Member Case)

OPENING EXPERT REPORT OF DR. PAUL PRUCNAL REGARDING
INVALIDITY OF U.S. PATENT NO. 8,238,754

Exhibit
PRUCNAL 002

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EXHIBIT LIST

Exhibit	Short Name	Description
Ex. A	'754 Patent	U.S. Patent No. 8,238,754; NEXTGEN_0000711
Ex. B	'754 File History	File History of U.S. Patent No. 8,238,754; NEXTGEN_0000746
Ex. C	'514 File History	File History of U.S. Patent Application No. 60/886,514; NOK00610472
Ex. D	Prucnal CV	*Curriculum Vitae* of Dr. Paul Prucnal
Ex. E	Shraga	U.S. Patent No. 6,697,374; PA_0003468
Ex. F	Togami	U.S. Patent No. 7,066,746; PA_0003611
Ex. G	Fujimori	U.S. Patent No. 7,206,366; PA_0003722
Ex. H	Liu	U.S. Patent No. 6,005,694; PA_0012198
Ex. I	Stiscia	U.S. Patent No. 7,385,995; PA_0003770
Ex. J	Gilliland	U.S. Patent No. 6,350,063; PA_0000098
Ex. K	Aboshi	U.S. Patent No. 8,412,041; PA_0014195
Ex. L	G.984.3 Standard Recommendation	ITU-T G.984.3 Standard Recommendation – Transmission Convergence Layer for Gigabit Passive Optical Networks; PA_0001401
Ex. M	G.984.3 Draft Recommendation	ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks; PA_0008213
Ex. N	Contribution 104	ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks; PA_0013992
Ex. O	OKI Article	*SFF & SFP Optical Transceivers*, OKI Technical Review Issue 190, Vol. 69, No. 2 (April 2002); PA_0002358
Ex. P	Ramaswami	Rajiv Ramaswami & Kumar Sivarajan, *Optical Networks, A Practical Perspective* (2d ed. 2002); PA_0002373
Ex. Q	Kramer IEEE	Glen Kramer & Gerry Pesavento, *Ethernet Passive Optical Network (EPON): Building a Next-Generation Optical Access Network*, IEEE Communications Magazine (February 2002); NOK00618099

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Exhibit	Short Name	Description
Ex. R	Kazi	Khurram Kazi, *Optical Networking Standards, A Comprehensive Guide for Professionals* (2006); NOK00618010
Ex. S	SFP MSA	SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001); PA_0005642
Ex. T	XFP MSA	10G small form factor pluggable, XFP Revision 4.5 (initial publication March 2002); NOK00615399
Ex. U	XENPAK MSA	INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002 (publicly announced March 12, 2001); NOK00615318
Ex. V	Kramer OSA	Glen Kramer, et al., *Supporting differentiated classes of service in Ethernet passive optical networks*, Journal of Optical Networking, Vol. 1, Nos. 8 & 9 (August & September 2002)
Ex. W	EC&M Article	Small Form Factor Connector Basics by Paul Rosenberg, EC&M.com (Sept. 1, 2001); NOK00618000
Ex. X	Going Serial Article	Going Serial in Gigabit Ethernet Designs by Martin Lund, EDN.com (June 20, 2002); NOK00618004
Ex. Y	G.983.1	ITU-T G.983.1 (10/98) Broadband optical access systems based on Passive Optical Networks (PON); PA_0000982
Ex. Z	G.983.2	ITU-T G.983.2 (04/00) ONT management and control interface specification for ATM PON; PA_0001101
Ex. AA	G.983.3	ITU-T G.983.3 (03/01) A broadband optical access system with increased service capability by wavelength allocation; PA_0001244
Ex. BB	G.983.4	ITU-T G.983.4 (11/01) A broadband optical access system with increased service capability using dynamic bandwidth assignment
Ex. CC	G.984.2	ITU-T G.984.2 (03/2003) Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer specification; PA_0001325
Ex. DD	G.984.1	ITU-T G.984.1 (03/2003) Gigabit-capable Passive Optical Networks (GPON): General Characteristics; PA_0001303
Ex. EE	ITU-T A.1	ITU-T A.1 (10/2000) Work methods for study groups of the ITU Telecommunication Standardization Sector (ITU-T); NOK00611000
Ex. FF	SG15 Contributions List	List of contributions from Oct. 2003 Geneva, Switzerland Meeting; NOK00610971

Exhibit	Short Name	Description
Ex. GG	SG15 TD-PLEN List	List of Plenary temporary documents from the Oct. 2003 Geneva, Switzerland Meeting; NOK00610973
Ex. HH	WP1 TD List	List of WP1 temporary documents from Oct. 2003 Geneva, Switzerland Meeting; NOK00610968
Ex. II	WP1 TD5	Report of Q.2/15 Rapporteur meeting, 13-14 August 2003, Santa Clara, USA; NOK00610994
Ex. JJ	TD-58GEN	List of participants at the Oct. 2003 Geneva, Switzerland; NOK00610976
Ex. KK	TD-7PLEN HTML	Webpage printout of The G.984.3 Draft Recommendation page; NOK00610993
Ex. LL	Contribution 104 HTML	Webpage printout of Contribution 104
Ex. MM	NextGen's Infringement Contentions	Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to Nokia Defendants
Ex. NN	NextGen's '754 Patent Infringement Chart	Plaintiff NextGen Innovations, LLC's Disclosure of Asserted Claims and Infringement Contentions to Nokia Defendants, Ex. N4: Nokia's GPON, XG-PON, and XGS-PON ONT/ONU Pluggables
Ex. OO	NextGen's ROG Responses	Plaintiff NextGen Innovations, LLC's Responses to Defendants' Second Set of Common Interrogatories (November 2, 2023)
Ex. PP	Tonguz Decl.	August 3, 2023, Declaration of Dr. Ozan Tonguz Regarding Claim Construction
Ex. QQ	Baker Decl.	August 3, 2023, Disclosure of R. Jacob Baker, Ph.D., P.E in Compliance with P.R. 4-3(B)
Ex. RR	Preliminary Claim Construction	November 14, 2023, Preliminary Constructions from Judge Roy S. Payne in Case No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (Lead Case)
Ex. SS	W. Soto Dep. Tr.	November 2, 2023, Deposition Transcript of Walter G. Soto
Ex. TT	A. Soto Dep. Tr.	November 3, 2023, Deposition Transcript of Alexander I. Soto
Ex. UU	F. Effenberger Dep. Tr.	November 21, 2023, Deposition Transcript of Frank Effenberger
Ex. VV	G.984.3 Article	"PON moves forward" by Claudia Bacco, NetworkWorld.com (Feb. 18, 2003); NOK00617118

I. INTRODUCTION

1. I, Dr. Paul R. Prucnal, have been asked to prepare this report on behalf of Defendants Nokia Corporation, Nokia Solutions and Networks Oy, and Nokia of America Corporation ("Nokia") in connection with Lead Case No. 2:22-cv-00307-JRG-RSP (the "Litigation"), pending before the U.S. District Court for the Eastern District of Texas, Marshall Division (the "Court"). I understand Lead Case No. 2:22-cv-00307-JRG-RSP is a consolidation of four related cases including Case No. 2:22-cv-00309-JRG-RSP filed by Plaintiff NextGen Innovations, LLC ("NextGen") against Nokia, Case No. 2:22-cv-00308-JRG-RSP filed by NextGen against AT&T Services, Inc. and AT&T Corporation, Case No. 2:22-cv-00306-JRG-RSP filed by NextGen against Infinera Corporation, and Case No. 2:22-cv-00307-JRG-RSP filed by NextGen against Fujitsu.

2. In this report, I provide opinions regarding the invalidity of U.S. Patent No. 8,238,754 (hereafter, "the '754 Patent"), which has been asserted by Plaintiff NextGen. I have been informed that NextGen has asserted Claims 1-16 and 18-30 of the '754 Patent against Nokia ("the Asserted Claims").

3. For my work on this matter, I am being compensated at my standard consulting rate of $725/hour. The outcome of this case has no bearing on my compensation. I expect to be available for deposition and to testify at trial in this Litigation.

4. Throughout this report, I cite non-exhaustive examples of certain documents or testimony that support my opinions. These citations do not signify that my opinion is limited to or based solely on those citations. Also, throughout this report, I may emphasize certain aspects of certain documents or testimony. Unless otherwise specified, that emphasis has been added.

5. This report is based on information currently available to me. I reserve the right to continue my investigation and study, which may include a review of documents and information that may be produced, and deposition testimony from depositions for which transcripts are not yet available or that have not yet been taken. Therefore, I expressly reserve the right to expand or modify my opinions in response to any additional information that becomes available to me, any matters raised by NextGen and/or opinions provided by NextGen's expert(s) or given any relevant Orders from the Court.

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II. SUMMARY OF CONCLUSIONS

6. In my opinion, based on my experience, knowledge of the art as of the '754 Patent's earliest alleged priority date, analysis of references, and consideration of the factual record, the Asserted Claims are invalid under 35 U.S.C. §§ 102 and 103 as anticipated or rendered obvious by one or more of the prior art references cited in this report and/or in view of a person of ordinary skill in the art's knowledge, as explained herein. The following chart summarizes my opinions. It is also my opinion that under NextGen's apparent theory of infringement, the Asserted Claims are invalid under 35 U.S.C. § 112 for failure to meet both the written description and the enablement requirements.

Grounds	Grounds for Invalidity	Statutory Basis
1a	Shraga + Togami	35 U.S.C. § 103
1b	Shraga + Togami + G.984.3 Draft Standard/Contribution 104	35 U.S.C. § 103
2	Fujimori + G.984.3 Draft Standard/Contribution 104	35 U.S.C. § 103
3	Stiscia + Gilliland	35 U.S.C. § 103
4a	Aboshi	35 U.S.C. § 102
4b	Aboshi + G.984.3 Standard Recommendation	35 U.S.C. § 103

7. As I intend to show in a forthcoming noninfringement report, the accused products do not practice any of the Asserted Claims. Based on NextGen's apparent theory of infringement as evidenced by its Final Infringement contentions, NextGen's allegations of infringement are extremely broad. For many claim limitations, none of the functionality accused by NextGen would infringe. In order to respond to such broad allegations, this Report frequently identifies how each of these noninfringing functionalities was known in the prior art. But identifying such functionalities should not be construed as an admission that such functionalities meet the requirements of the Asserted Claims. Further analysis will be provided in my forthcoming noninfringement report.

8. Besides the materials listed as exhibits, I have also considered the materials in Appendix A.

III. BACKGROUND AND QUALIFICATIONS

9. My education and experience are described more fully in Ex. D (*Curriculum Vitae* and Litigation Experience of Dr. Paul Prucnal). For ease of reference, I have highlighted certain information below.

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10. I have over 40 years of experience in communications and signal processing. I am currently a Professor of Electrical Engineering at Princeton University in Princeton, New Jersey. I graduated *summa cum laude* from Bowdoin College in 1974 with an A.B. in Mathematics and Physics. I then graduated from Columbia University in 1976 with an M.S. in Electrical Engineering. I went on to receive an M.Phil. from Columbia University in 1978 in Electrical Engineering and a Ph.D. from Columbia University in 1979 in Electrical Engineering. The title of my thesis was "Threshold Detection in Optical Communications and Psychophysics." My thesis investigated the quantum nature of light, the optimal detection of photons in optical communication systems, and the question of whether the human visual system, which I postulated could be modeled as a doubly stochastic Poisson point process, is capable of detecting a single photon.

11. Upon graduation from Columbia in 1979, I joined Columbia as an Assistant Professor of Electrical Engineering, and in 1984 I was promoted to Associate Professor.

12. In 1988, I joined the faculty of Princeton University as an Associate Professor of Electrical Engineering. My responsibilities there included teaching and research.

13. In 1989 and until 1991, I was a founding director of the New Jersey Advanced Technology Center for Photonics and Optoelectronic Materials. My responsibilities there included leading a $10 million research program involving approximately thirty faculty members.

14. In 1990, I was promoted to Professor of Electrical Engineering at Princeton University. My teaching responsibilities include courses in circuits, signal processing, quantum electronics, and fiber-optic communications.

15. While at Princeton University, I have received numerous awards and recognitions, including: (a) becoming a Fellow of the National Academy of Engineers, a Fellow of the IEEE, and a Fellow of the Optical Society of America; (b) receiving the Rudolf Kingslake Medal and Prize from the SPIE for the most noteworthy original paper in Optical Engineering; (c) receiving the Gold Medal Award from the Faculty of Mathematics, Physics, and Informatics at the Comenius University for leadership in the field of Optics; (d) receiving the Princeton University Graduate Mentoring Award; (e) receiving numerous Engineering Council Awards; (f) receiving the Walter Curtis Johnson Prize for Excellence in Teaching; (g) receiving the Princeton School of Engineering

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and Applied Science Distinguished Teacher Award; and (h) receiving The President's Award for Distinguished Teaching, Princeton University (2015).

16. In 1991, I was a visiting professor in the Research Center for Advanced Science and Technology at the University of Tokyo, where I held the NEC Chair. My responsibilities there included research on optical packet switching and giving lectures on fiber-optic networks.

17. In 1992, I was a visiting professor at the University of Parma. My responsibilities there included research on photonic switching and giving lectures on fiber-optic networks.

18. In addition to the activities, education, and professional experience listed above, I have been involved in several research projects that contribute to my expertise relating to fiber-optic communications.

19. In 1992-1995, I worked with Siemens Corporate Research on a project that involved research on ultrafast optical switching technology. My responsibilities included the investigation of optoelectronic technologies for high-speed multiplexing and switching.

20. In 1998-2001, I worked with Sun Microsystems on a project that involved research on optical backplanes and computer interconnects. My responsibilities included the design of a high-performance multiprocessor interconnection system.

21. In 1999-2000, I worked with SAIC on a project which involved research on fiber-optic network architectures. My responsibilities included the investigation of novel switching and multiplexing techniques.

22. In 2000-2002, I worked with Ultra Fast Optical Systems on a project that involved research and development on optical switching technology. My responsibilities included the design and testing of an all-optical switch.

23. In 2000-2003, I was a member of the advisory board on optical network technology for Alphion, Inc. My responsibilities included providing guidance on the development of technology in the optical networks space.

24. In 2003-2006, I worked with Kailight Inc. on a project that involved research and development on optical switching technology. My responsibilities included the design and testing

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of a digital optical repeater.

25. In 2004-2011, I worked with NEC Laboratories on a project that involved research on physical layer security in optical networks. My responsibilities included the design and analysis of techniques for optical steganography and data encryption using digital optical logic.

26. My research interests include fiber-optic communications systems and networks. I have extensive experience researching and teaching about optical signal processing and optical communications techniques such as multilevel modulation, equalization, and error-correcting codes. I also have experience with optical transceiver modules, including pluggable-type modules.

27. To date, I have published books on Optical CDMA and Neuromorphic Photonics, and 36 book chapters and reviews in the area of fiber-optic communications systems. In addition, I have published approximately 419 papers in conference proceedings and 329 peer-reviewed journal papers. I am also a named inventor on 28 patents relating to fiber-optic communications.

28. Through my work, I have earned the respect of the optical communication and electrical engineering community more broadly. I am a member of the advisory board on advanced computing and communications research for the Center for Computing Sciences. I have also chaired or served as a member on several dozen boards and committees related to electrical engineering.

IV. RELEVANT LEGAL PRINCIPLES

29. The following paragraphs detail legal standards and principles provided to me by counsel. These are not based upon my opinion or expertise but are instead merely the standards and doctrines that I have been told by counsel to use in my analysis. I have applied these principles to my analysis in the following sections of this Report.

A. Presumption of Validity

30. I understand that in deciding whether to issue a patent, the U.S. Patent and Trademark Office ("USPTO") examines the patent specification, its claims, and prior art references the Examiner finds or the applicant discloses to determine whether the patent application and its claims meet the requirements for patentability. I understand that each claim of a patent issued by the USPTO is presumed valid by law. This presumption of validity is overcome,

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however, if the party seeking to invalidate a claim proves invalidity by clear and convincing evidence, which I understand to mean evidence that convinces the finder of fact that it is highly probable that the particular proposition is true. I understand that the clear and convincing standard is a higher burden of proof than by a preponderance of the evidence, the latter of which is the standard used for infringement.

31. I understand the first step in determining whether or not a patent claim is valid is to properly construe the claims. I also understand that the claims must be construed the same way in determining validity/invalidity and infringement/non-infringement. I also understand that, as a general matter, a claim should not be limited to a preferred embodiment, but that in certain cases, the scope of the right to exclude may be limited by a narrow disclosure or by positions taken, such as by statements made during patent prosecution. I also understand the claims must be supported by the specification. I also understand that claims must be described within the specification.

32. I understand that the Court has issued a claim construction order (*see infra* Section VII.F), which I have applied in this report. For terms that have not been proposed for construction, I understand that they should be afforded their plain and ordinary meaning to one of the ordinary skill in the art.

B. Anticipation

33. I have been informed by counsel and understand that a claim is invalid on the basis of anticipation (under 35 U.S.C. § 102) if a single prior art reference discloses, either expressly or inherently, each and every limitation of the claimed invention. If the single prior art reference fails to disclose even one claim limitation, it does not anticipate the claim.

34. A single prior art reference may anticipate without disclosing a feature of the claimed invention if such feature is necessarily present, or inherent, in that reference.

35. Under the principles of inherency, if the prior art necessarily functions in accordance with or includes the claimed limitations, it anticipates. However, the prior art reference must necessarily include the non-disclosed limitation. Mere probabilistic inherency, or the presence of an unrecognized de minimis quantity of a claimed substance in the prior art, cannot anticipate a later patent or patent application.

36. A prior art reference alleged to be anticipatory must also enable one of ordinary skill in the art to make the claimed invention without undue experimentation. There exists a rebuttable presumption that prior art patents are enabled.

C. Obviousness

37. I further understand that a claimed invention is not patentable 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 the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Obviousness, as I understand it, is 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 indicia of obviousness to the extent they exist.

38. 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 person of ordinary skill in the art at the time of the alleged invention. A person of ordinary skill in the art is a hypothetical person who is presumed to be aware of all of the relevant art at the time of the invention. The person of ordinary skill is not an automaton and may be able to fit together the teachings of multiple patents employing ordinary creativity and the common sense that familiar items may have obvious uses in another context or beyond their primary purposes. I may refer to a person of ordinary skill in the art as a POSITA throughout this Report.

39. I understand that in order to combine prior art references to show obviousness, a person of ordinary skill in the art, without knowledge of the claimed invention, or without the use of hindsight, must have been motivated to combine the prior art by some suggestion or teaching in the prior art, the knowledge of one of skill in the art, or the nature of the problem to be solved.

40. An invention is obvious if a person of ordinary skill in the art, facing the wide range of needs created by developments in the field, would have seen an obvious benefit to the solutions tried by the 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 be obvious to a person of ordinary skill to try the known options. If a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique would have been obvious.

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41. I understand that hindsight may not be used when comparing the prior art to the invention for obviousness.

D. Motivations to Combine

42. I understand that in deciding obviousness, it is appropriate to consider whether some teaching, suggestion, or motivation would have led a person of ordinary skill in the art to combine the invalidating prior art references. I also understand that it is appropriate to look to a variety of factors when evaluating reasons to combine references in an obviousness analysis, and that it is important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the prior art elements in the manner claimed. I understand that it is still appropriate to use "teaching, suggestion, or motivation" as a factor in the obviousness analysis, but it is not appropriate to be overly rigid in applying any "teaching, suggestion, or motivation" test. I understand that a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was independently known in the prior art. I also understand that this is the case because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.

E. Objective Indicia

43. I understand that in evaluating whether patent claims are invalid as obvious, objective indicia of nonobviousness can be considered. Such objective indicia can include commercial success, long-felt but unsolved needs, copying, praise, unexpected results, industry acceptance, failure of others, and skepticism by experts.

F. Enablement and Written Description

44. I understand that a patent must contain an enabling disclosure. The specification must contain a written description of the invention, and of the manner and process of making and using it so as to enable a person skilled in the art to make and use the invention. Because patents are presumed valid, lack of enablement must be proven by clear and convincing evidence.

45. Enablement is not precluded where a reasonable amount of routine experimentation is required to practice a claimed invention, however, such experimentation must not be undue. Whether a disclosure requires undue experimentation is not a single, simple factual determination,

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but rather is a conclusion reached by weighing many factual considerations.

46. In determining whether a disclosure requires undue experimentation, I understand that the relevant considerations can include:

(1) the quantity of experimentation necessary,
(2) the amount of direction or guidance presented,
(3) the presence or absence of working examples,
(4) the nature of the invention,
(5) the state of the prior art,
(6) the relative skill of those in the art,
(7) the predictability of the art, and
(8) the breadth of the claims.

Not every one of these factors need be considered.

47. While the existence of a working example of the invention in the specification may be considered as one of many factors of sufficient enablement, working examples are, however, not required to satisfy the enablement requirement. Compliance with the enablement requirement does not turn on whether examples are disclosed in an application so long as the invention is otherwise disclosed in an enabling manner. Indeed, the importance of working examples may vary with the predictability of the art. Unlike in unpredictable arts, such as the biological, chemical, and pharmaceutical fields, the presence of a single embodiment may enable a broad claim when a more predictable art is in question, such as software design.

48. Limitations and examples in the specification do not generally limit what is covered by the claims. A specification need not enable a perfected, commercially viable embodiment absent a claim limitation to that effect.

49. The enablement requirement is separate and distinct from the description requirement.

50. I understand that a patent must comply with a written description requirement by conveying with reasonable clarity to those skilled in the art that, as of the priority date sought, the inventor was in possession of the alleged invention, namely that the inventor had invented each feature that is included as a claim limitation. I have been informed that I am not to look for verbatim descriptions of the claim limitations in the earlier-filed applications. Instead, I understand that the written description doctrine requires the disclosure of an application to adequately describe the

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invention so that a POSITA can recognize that the patentee actually invented what is claimed in the patent at the time of filing. In other words, the question is whether a POSITA would have understood the inventors to have possessed the invention being claimed based on what is described in the application when it is filed. The disclosure may be either express disclosure (i.e., constituting text, figures, and other descriptive materials) or inherent. A disclosure is inherent if a POSITA would have understood that the claimed subject matter is necessarily present in the material described in the application. I understand that the written description inquiry looks to the Figures and the originally filed claims in addition to the descriptive text of the application.

51. I also understand that the written description inquiry is not an inquiry into what would have been obvious over what is actually disclosed in the application. The question is not what a POSITA could have made based on the teachings of the application. Instead, the inquiry focuses on what was described and how a POSITA would have understood the disclosure.

V. PERSON OF ORDINARY SKILL IN THE ART

52. I have been informed that there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including the educational level of active workers in the field at the time of the invention, the sophistication of the technology, the type of problems encountered in the art, and the prior art solutions to those problems. I have been informed that the level of skill in the art can be evidenced by the prior art references.

53. I understand that Nokia alleges that a person of ordinary skill in the art ("POSITA") in reference to the '754 Patent would have had the equivalent of a four-year degree from an accredited institution (usually denoted as a B.S. degree) in electrical engineering, computer engineering, or similar discipline and at least two years of professional experience with optical communications and networks. Additional graduate education could substitute for professional experience, while significant experience in the field might substitute for formal education. Such a person would have had knowledge of design considerations known in the optical industry and would have been familiar with then-existing product solutions and would have understood how to search available literature for relevant publications.[1]

[1] Ex. PP at 10-11.

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54. I also understand NextGen alleges that a POSITA in reference to the '754 Patent would have had at least a bachelor's degree or equivalent in electrical engineering with optical engineering coursework, and two years of experience in optical transmission systems and associated components. More education can supplement practical experience and vice versa.[2]

55. I, myself, had these capabilities and qualified under both Nokia's and NextGen's definition of a POSITA prior to the earliest alleged priority date for the '754 Patent.

VI. GENERAL BACKGROUND RELATING TO PLUGGABLE OPTICAL TRANSCEIVER MODULES

56. Prior to the earliest alleged priority date of the '754 Patent, a POSITA would have been familiar with certain general background concepts. The '754 Patent generally relates to communications over passive optical networks. Specifically, the '754 Patent claims a pluggable optical transceiver module that, in addition to performing traditional optical transceiver module functions of opto-electrical conversion, embodies the role of a traditional ONT or ONU.[3] In this Section, I explain some general background concepts relevant to the '754 Patent.

A. Passive Optical Networks

57. A Passive Optical Network (PON) is a fiber-optic telecommunications network that provides broadcast connectivity from a main data source to endpoints. A fiber-optic network transmits information, in the form of modulated light, from one location to another. The modulated light, called signals, represent bits of data, such as voice, video, or computer data.[4]

58. In contrast to active optical networks, a PON distributes a single signal to multiple branches, point-to-multipoint, through unpowered optical beam splitters.[5] Instead of active devices, such as switches, in these locations, PONs generally use small passive optical splitters.[6]

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

[2] Ex. QQ at 4.

[3] Ex. 2 ('754 Patent) at 16:46-20:51.

[4] Ex. H (Liu) at 1:14-24.

[5] Ex. P at 603-604, Figure 11.7.

[6] Ex. Q at 68.

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 report.[7]

60. Figure 6-1 below shows the PON system configuration that consists of an OLT, ONUs, an optical splitter, and fibers. The optical fiber connected to the OLT branches at the optical splitter into fibers, and the branched fibers are connected to ONUs. Ex. M at 12; Ex. N at 11.[8]

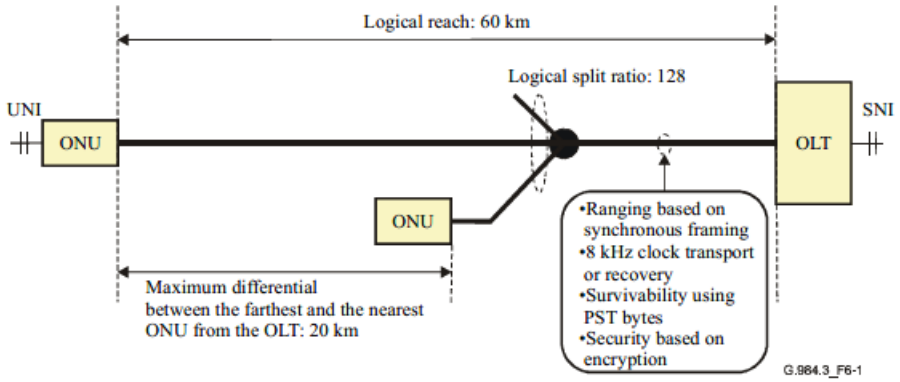


Figure 6-1/G.984.3 – G-PON system configuration

61. 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.[9] 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.[10]

62. 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

[7] Ex. M at 2-3, Fig. 6-1; Ex. N at 2-3, Fig. 6-1.

[8] Ex. M at 12; Ex. N at 11.

[9] Ex. H at 1:36-45.

[10] *Id.* at 24-30.

gruesome task of maintaining active curbside units and providing power to them.[11]

63. User devices, such as phones, computers, and televisions, use optical signals that traverse the fiber network. But these devices operate using electrical signals, which requires the fiber-optic network to have an optical-to-electrical interface that converts electrical signals to optical signals, and vice versa.[12]

64. According to the '754 Patent, it was known in the prior art, and to a POSITA, that optical modules are used in "applications requiring digital optical transmission such as SONET/SDH, 10 Gigabit Ethernet, Fibre Channel and DWDM running across metro access networks, wide area networks, access networks, storage area networks, and local area networks."[13]

B. Pluggable Optical Transceiver Modules

65. The optical-to-electrical interface is where electrical and fiber cables are connected to one another via an optical transceiver module. To allow the electrical and fiber cables to communicate with one another, the optical transceiver module converts signals between the optical and electrical domains.[14]

66. For example, the transceiver module includes a transmitter system and a receiver system. The transmitter receives digital electrical signals, which includes electronic data (information) typically in the form of binary voltages that drive the optical transmitter. The optical transmitter converts the electrical signals to optical signals, which are emitted onto an optical fiber. The receiver includes a light detecting device that receives optical signals and converts them to electrical signals. The transmitter and receiver, which together form the transceiver, thus send signals back and forth across the electrical-to-optical interface, allowing communication between the electrical components and optical fibers.[15]

67. Traditionally, optical transceiver modules were bulky and mounted in a relatively

[11] Ex. Q at 68.

[12] Ex. H at 4:11-14.

[13] Ex. A at 1:35-38.

[14] Ex. H at 4:11-14.

[15] *Id.*

fixed configuration, such as mounted on a circuit card located in a computer, peripheral device, or on a shelf in an equipment rack. But as optical networks garnered increased popularity, the market requirement to grow the capacity of network equipment required that the density of the network equipment improve.[16] This requirement manifested itself in a need to improve the density of optical interfaces at a faceplate, which led to the creation of a new type of transceiver: a Small Form Factor (SFF) device, shown below.[17]

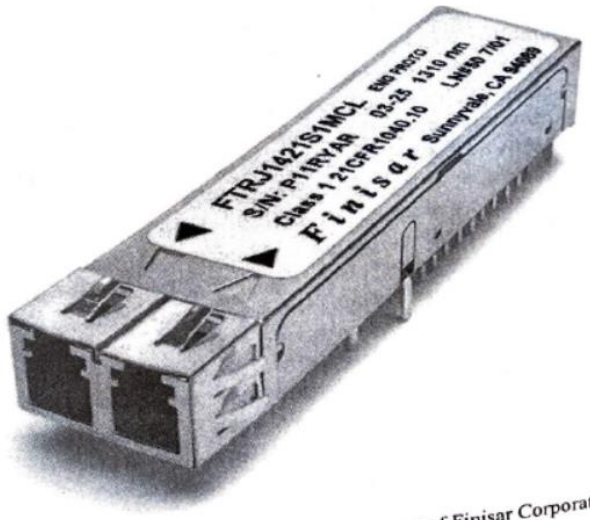


Figure 18-3. Example of SFF device (courtesy of Finisar Corporation)

68. The availability of SFF devices enabled high port densities in optical transmission systems. However, while solving the density problem, the SFF package had to be soldered down to the board, making replacement and repair a difficult process. In order to resolve the drawbacks of the SFF device, it was desirable to produce a smaller hot-pluggable optical transceiver that was easily removable.[18]

69. Thus, in the late 1990s and early 2000s, developers began to develop and design transceiver modules that could be inserted into and removed from a live circuit pack without disrupting service or impacting the performance of any other ports already in service.[19] The first

[16] Ex. R at 717.

[17] *Id.*

[18] *Id.* at 718.

[19] *Id.*

module to be developed was a GigaBit Interface Converter (GBIC), shown below.[20]

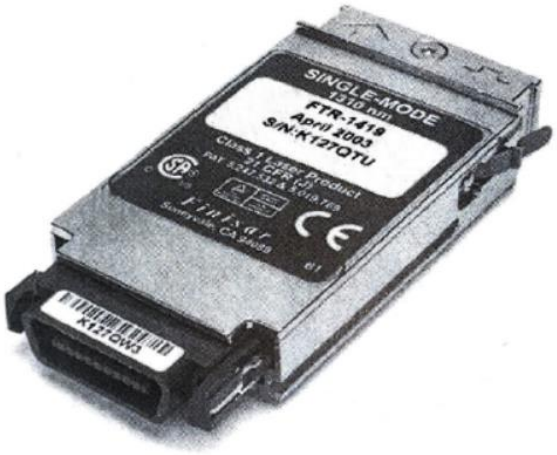


Figure 18-5: Example of GBIC device (courtesy of Finisar Corporation)

70. Shortly thereafter, Small Form-factor Pluggable (SFP) transceivers were developed (shown below).[21] The SFP modules were similar in size to the SFF devices, but were hot-pluggable, offering full flexibility and permitting a mix of various transceiver types on a single circuit pack and easing replacement in the case of transceiver failure.[22]

[20] *Id.* at 719-20.

[21] *Id.* at 718.

[22] *Id.*

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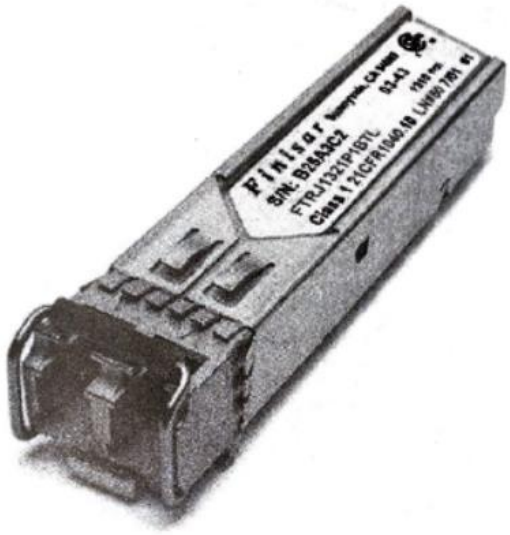


Figure 18-4. Example of SFP device (courtesy of Finisar Corporation)

71. Due to the need for 10 Gbps optical ports, for reasons such as Gigabit Ethernet applications, the XENPAK form factors was developed. XENPAK contains two SC (Subscriber Connector) optical connectors and required a cut-out on a printed circuit board in order to mate it with a PCB connector.[23]

72. Additionally, a hot-pluggable, small form-factor transceiver, called XFP, was developed to address the need for further size reduction in optical modules, anticipating a new generation of integrated circuits that could operate at 10 Gbps.[24] It could be used in a variety of applications, including SDH/SONET STM-64/IC-192, OTN G.709, 10Gbps Ethernet and Fibre Channel.[25]

73. In order to facilitate simple pluggable insertion and removal from the host device, these transceiver modules were constructed with a protective cage mounted at the front of the host device and an electrical interface realized through an electrical connector.[26] The electrical interface

[23] *Id.* at 725.

[24] *Id.* at 727.

[25] *Id.*

[26] *Id.* at 718-19.

provides all necessary input and output signals from the transceiver module to the host device.[27]

74. Further, in an effort to standardize the industry, system vendors supported Multi-Source Agreements ("MSA") between several component suppliers to define and specify all the physical and electrical requirements for specific pluggable form factors.[28] With MSAs in place, system vendors could concentrate on system architecture and not optical research and development. Several MSA optical module types were known by 2003, including but not limited to:

- Small form-factor pluggable (SFP) (*see* INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0, May 12, 2001).[29]
- 10G small form factor pluggable (XFP) (initial publication in March 2002; *see* 10 Gigabit Small Factor Pluggable Module, XFP Revision 4.5).[30]
- XENPAK (publicly announced March 12, 2001; *see* INF-8474i Specification for Xenpak 10 Gigabit Ethernet Transceiver, Rev. 3.0, September 18, 2002).[31]

I understand that Lucent, now Nokia, was involved in the development of these MSA standards.[32] These optical module form factors are also noted and discussed as prior art in the '754 Patent.[33]

75. The POSITA would have understood that the form factor used for the transceiver depends on the type of data, speed, and distance between communication devices. Different rules, called protocols, determine how the different kinds of data are transmitted.

C. Framing Protocols and Transmission of Data

76. The PON system provides a cost-effective solution for transmitting data in an optical network. In a typical PON architecture, downstream traffic is broadcast by a transmitter in

[27] *Id.*

[28] *Id.* at 712; Ex. S.

[29] Ex. S.

[30] Ex. T.

[31] Ex. U.

[32] *See* Ex. S at 1; *see also* Ex. T at 1; *see also* Ex. U at 1.

[33] Ex. A at Fig. 13, 2:11-20.

an OLT at the central office to all the ONTs/ONUs. Ex. P at 603. Each ONT/ONU processes the data destined to it by matching the address at the transmission protocol header. For the upstream channel, the ONTs/ONUs share a combined channel and use a media access control protocol, such as time division multiple access (TDMA) or some other multiaccess protocol, to communicate with the OLT at the head-end of the network. *Id.* An illustration of this data transmission process is depicted in Fig. 1, shown below. Ex. V at 281.

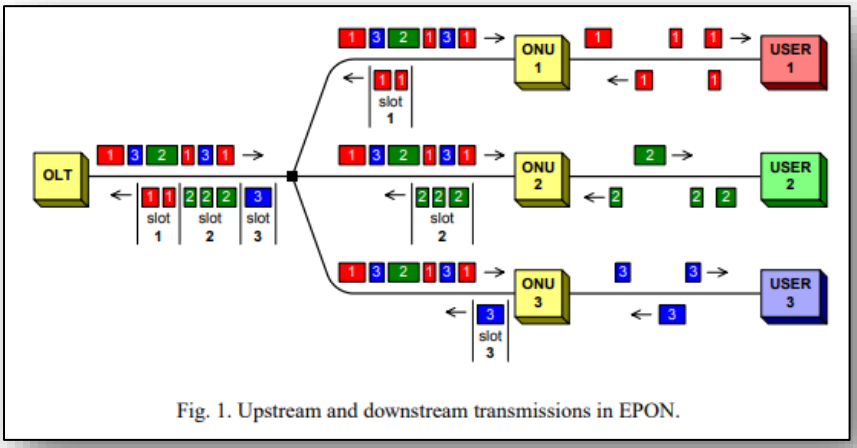


Fig. 1. Upstream and downstream transmissions in EPON.

77. Using the above approach, the PON system provides media access control for upstream traffic from the ONTs/ONUs to the OLT. The OLT transmits frames to the ONTs/ONUs, which indicate permitted time slots for the ONTs/ONUs to transmit data communications back to the OLT.[34]

78. The media access control concept is illustrated in Figure 7-4 below, derived from the G.984.3 Draft Recommendation[35]. The OLT sends pointers in the frame header, which indicate the time, or starting slot, at which each ONT/ONU may begin its upstream transmission. The OLT

[34] Ex. P at 604; Ex. Q at 70; Ex. M at 19; Ex. N at 18.

[35] As discussed *infra* Section IX.G., the G.984.3 Draft Recommendation is a draft recommendation proposal, submitted for approval as a standard, under the ITU-T. The Draft Recommendation discusses the architecture and functionalities of the PON to facilitate downstream and upstream transmissions in the network. It is my understanding that Walter Soto, one of the named inventors of the '754 Patent, attended the meetings where the G.984.3 Draft Recommendation and its contents were discussed and would have had access to the document and its predecessor documents, such as Contribution 104, also discussed *infra*. *See* Ex. II; Ex. JJ.

additionally conveys how long the ONT/ONU has available to transmit its data, or the frame that the ONT/ONU must cease transmission of its data. In this way, only one ONT/ONU can access the medium at any time, and there is no contention in normal operation.[36] The time slots are then synchronized so that transmissions from different ONTs/ONUs do not collide.[37]

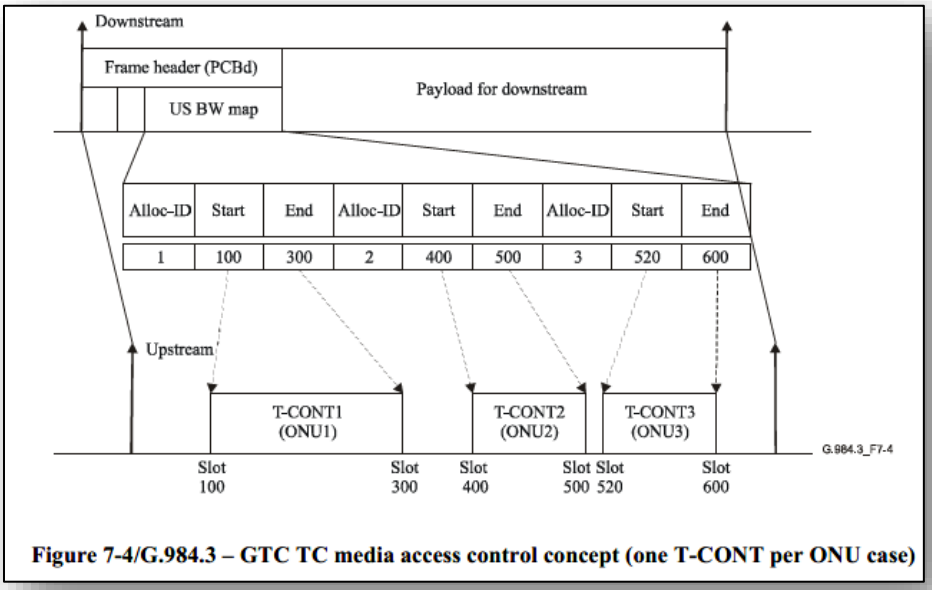


Figure 7-4/G.984.3 – GTC TC media access control concept (one T-CONT per ONU case)

D. Identification and Registration of ONTs/ONUs

79. As discussed above, an OLT in a passive optical network broadcasts its messages to all registered ONTs/ONUs on the network. For a message destined for a particular ONT/ONU to be received, it must contain the unique identification address of that ONT/ONU.

80. One such method of registering ONTs/ONUs is found in the ITU-T Standard Recommendation G.984.3 for gigabit passive optical networks (GPONs) which describes how an OLT assigns a unique address to identify each ONT/ONU.[38] It specifies that each ONT/ONU has a unique identification that is assigned by the OLT based on its serial number, which is registered

[36] *Id.* at 19; Ex. N at 18.

[37] *Id.*

[38] Ex. M at § 7.4.2; Ex. N at § 7.4.2.

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at the OLT during an "auto discovery" procedure.[39]

81. An OLT is permitted to send a request to an ONT/ONU to obtain its serial number while it is in the "Serial-Number" state. The OLT then assigns the ONT/ONU a unique address, called the "ONU-ID."[40] As part of the ranging process, described below, the OLT also verifies that the ONT/ONU's serial number matches its ID.

E. Ranging and Accounting for Delay

82. ITU-T G.984.3 Draft Recommendation further describes how upstream transmissions from ONUs in different locations, with different distances from the OLT, are synchronized to avoid interference. The ONTs/ONUs synchronize to a common clock through a process called ranging, where each ONT/ONU measures its delay from the head-end and adjusts its clock such that all the ONTs/ONUs are synchronized relative to the head-end. Ex. P at 604. Utilizing a method called Equalization-Delay, ONT/ONU transmissions to the OLT will appear as though they were transmitted from equal distance to the OLT.[41]

83. The process of determining the Equalization Delay is called "ranging." An OLT initiates a ranging process by sending a "Ranging Request" downstream to an ONT/ONU, which, in turn, responds with a transmission upstream. Based upon the round-trip delay time of that message, the OLT calculates the "Equalization Delay," which it sends back to that ONT/ONU. The Equalization Delay is used by the ONT/ONU to ensure that further upstream transmissions are synchronized with transmissions from the other ONTs/ONUs.[42]

84. The Equalization Delay (EqD) is an internal delay in an ONT/ONU that is controlled by the OLT, and it's set in such a way that all ONUs will have the same constant equalized round-trip delay (Teqd). When the constant equalized round-trip delay has been determined, and the round-trip delay of the nth ONT/ONU is measured, then the equalization delay

[39] *Id.*

[40] Ex. M at § 10.2.2.1; Ex. N at § 10.2.2.1.

[41] Ex. M at § 10.2.2.1; Ex. N at § 10.2.2.1.

[42] *Id.*

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of the nth ONT/ONU is calculated by: EqD(n) = Teqd – RTD(n).[43]

85. Once the ONT/ONU is supplied with its Equalization Delay factor, it is then synchronized to the beginning of the upstream frame. The upstream frame is delayed in relation to the beginning of the received downstream frame by the Equalization Delay factor, as illustrated below in Figure 10-3.[44]

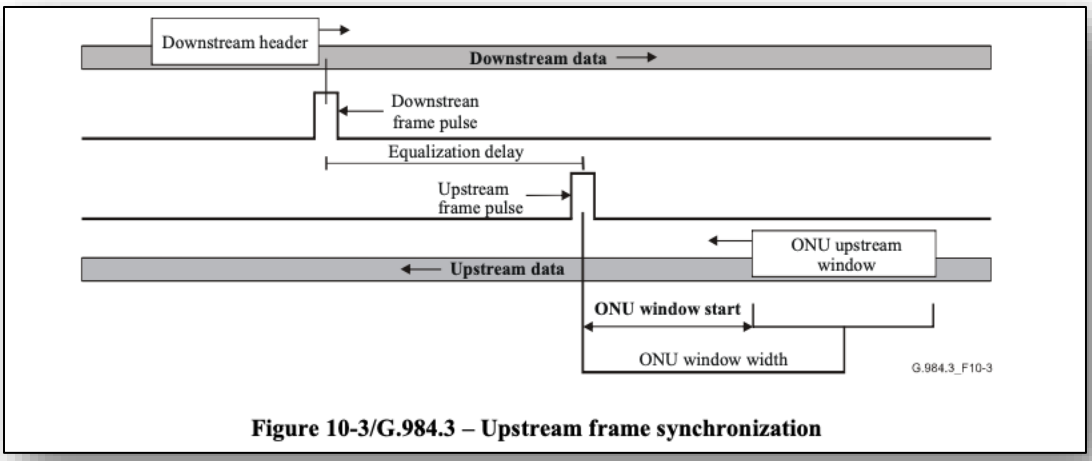


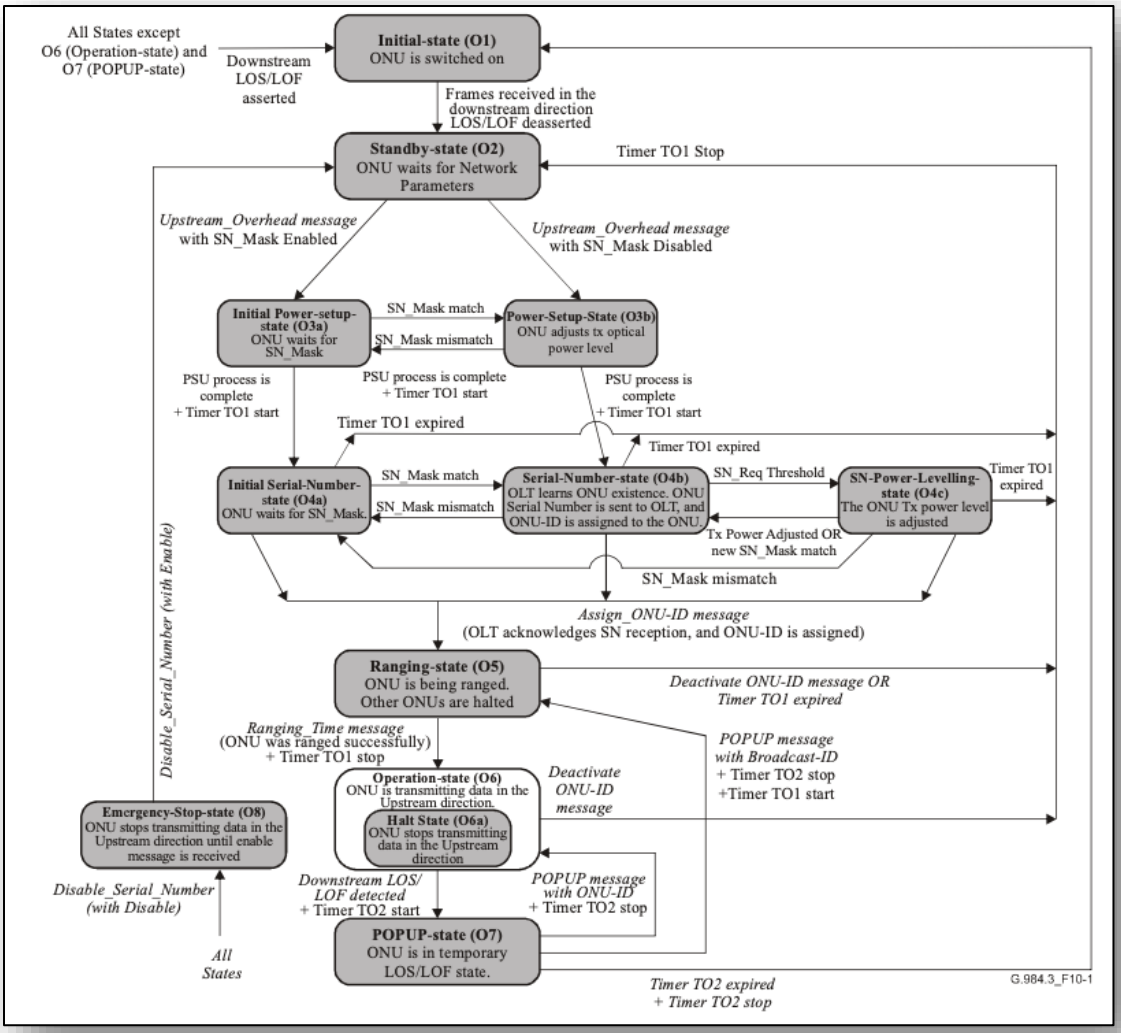
Figure 10-3/G.984.3 – Upstream frame synchronization

86. The overall state diagram of the ONT/ONU, which includes the states corresponding to ONU-ID assignment (state O4) and ranging (state O5), is shown below in Figure 10-1.[45]

[43] Ex. M at § 10.4.3; Ex. N at 78.

[44] Ex. M at § 10.4.4; Ex. N at § 10.4.3.

[45] Ex. M at § 10.2.2.2, Fig. 10-1; Ex. N at § 10.2.2.2, Fig. 10-1.

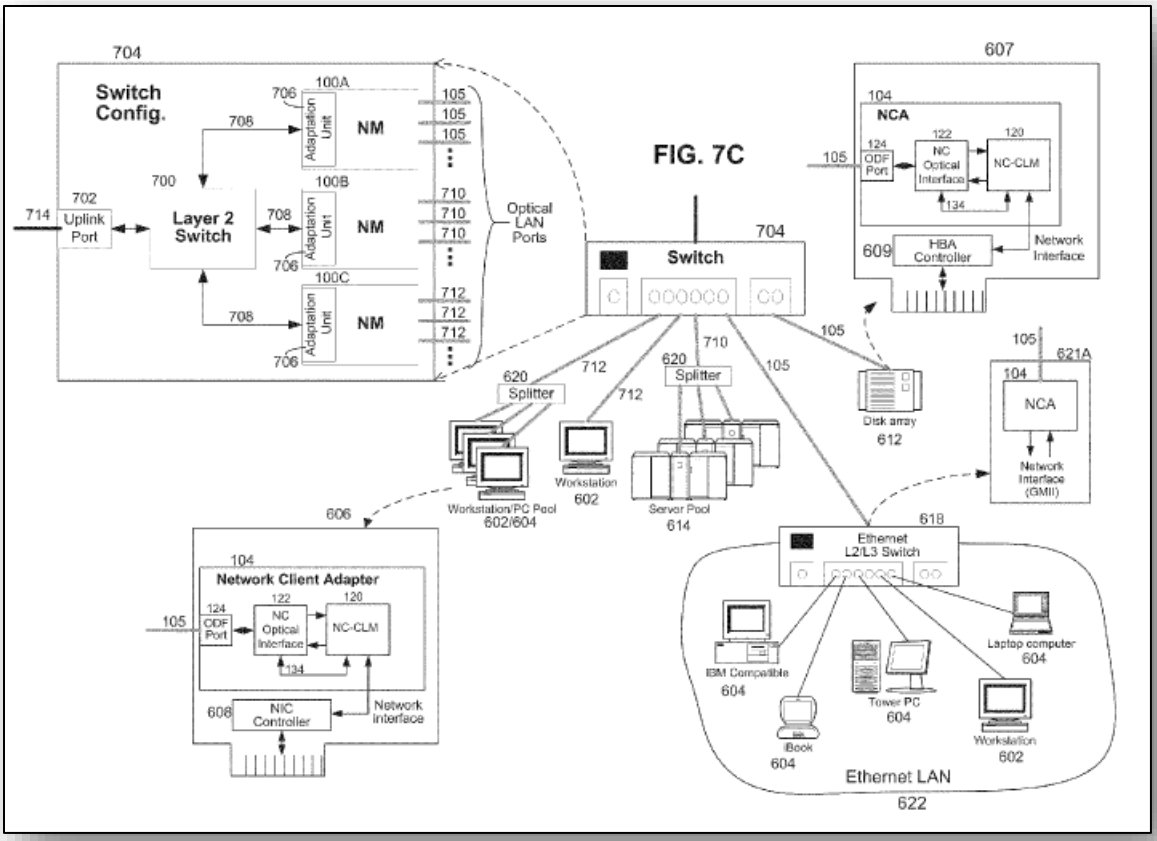


VII. THE '754 PATENT

A. Overview of the '754 Patent

87. The '754 Patent is generally directed towards communication over an optical network using pluggable optical transceiver modules, and in particular the optoelectrical interface. Specifically, the '754 Patent discloses a passive optical network interconnecting a plurality of nodes which includes a first node (the network head-end or network manager) and a plurality of remaining nodes (the network clients or optical network units (ONUs)).[46]

[46] Ex. A at Abstract, Fig. 7C.



88. The '754 Patent further discloses a network manager connected to the first node which controls the timing for each of the network clients to transmit signals over the passive optical network.[47] The control module of the network manager transmits control frame messages to each of the plurality of network clients on the PON for scheduling upstream transmission by the network clients.[48]

89. Figure 1 (shown below) is a schematic of a PON in the '754 Patent. The PON includes a head-end optical module 100 in communication with transceiver modules 104A-C via a passive optical distribution network 102.[49]

[47] Ex. A at Abstract.

[48] Ex. A at 8:60-9:18.

[49] Ex. A at 5:63-6:6.

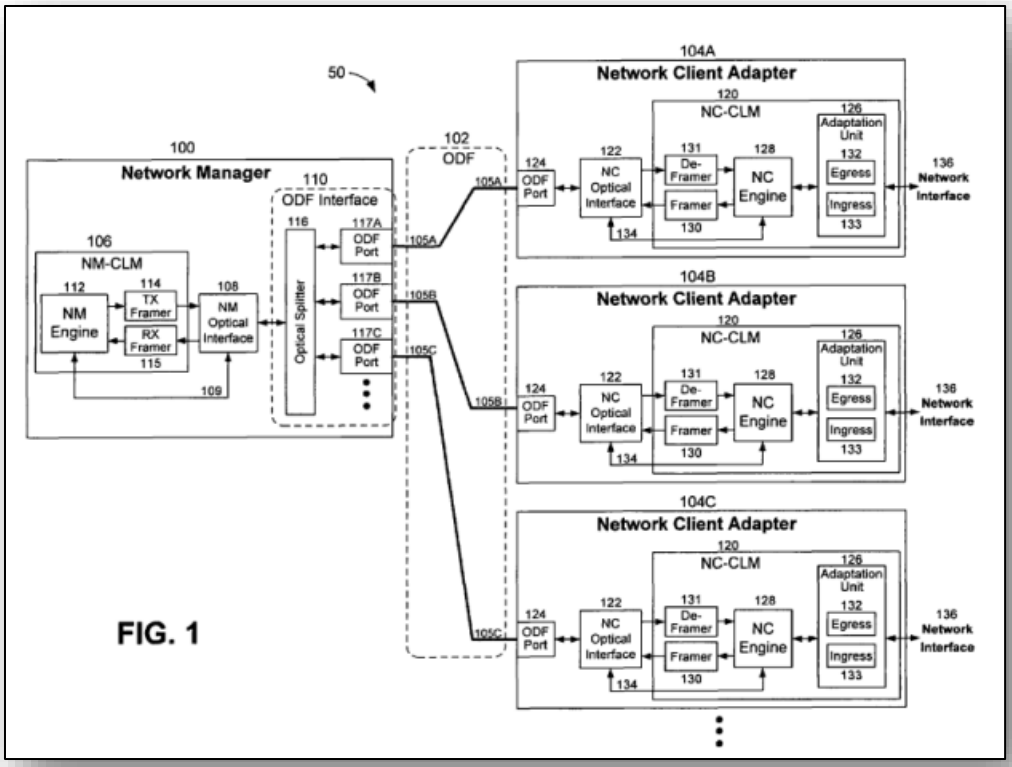


FIG. 1

90. The '754 Patent further discloses an optical transceiver module having a form factor and containing components capable of facilitating optical-to-electrical and electrical-to-optical conversion.[50]

91. The PON optical transceiver module is configured to process and transmit signals according to an OSI layer-2 or layer-3 protocol including Ethernet media access control (MAC).[51] With reference to the transceiver module 104A-C shown in Figure 1, each transceiver 104 receives an allocated time slot from the network manager at the head-end 100 that corresponds to a time period to transmit data upstream.[52] During the allocated time slot, the transceiver has a dedicated transmission interval to transmit data to the head-end without a collision resulting from another transceiver's data.[53] The head-end allocates a time slot to each transceiver by sending a network

[50] *Id.* at 2:31-42.

[51] *Id.*

[52] *Id.* at 8:60-9:10.

[53] *Id.* at 8:60-9:18.

communication that identifies the specific transceiver. *Id.*

B. The '754 Patent's Priority Date

92. I understand that in NextGen's Infringement Contentions, NextGen contended that "[t]he Asserted Claims of the '754 Patent are entitled to a priority date of October 30, 2003."[54] I also understand, as I will explain further infra § VII.E, that Defendants contest NextGen's alleged priority date and believe that the '754 Patent is entitled to a priority date no earlier than March 8, 2011, the date on which the applicants submitted the new matter that provided the alleged support for the asserted claims, or alternatively no earlier than July 6, 2004, the filing date of U.S. Patent Application No. 10/886,514 ("the '514 Application"), of which the '754 Patent claims to be a continuation. With that said, none of my opinions would change for Grounds 1-3 if the proper priority date were found to be October 30, 2003. My opinion for Ground 4 assumes that Defendants' theory is correct and the '754 Patent is entitled to a proper priority date of March 8, 2011.

C. The '754 Patent's Challenged Claims

93. I have been asked to evaluate Claims 1-16 and 18-30. I have reproduced these challenged claims below:

Claim	Recitation
[1.pre]	A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, the network client optical transceiver comprising:
[1.a]	an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters;

[54] Ex. MM at 6. The '754 Patent also claims priority to a second provisional application, U.S. Provisional App. No. 60/485,072, filed July 3, 2003. I understand that July 3, 2003, however, cannot be the priority date of the '754 Patent because material from the October 30, 2003 filed U.S. Provisional App. No. 60/515,836, to which the patent also purports to claim priority, is essential to adequately describe and enable the invention described in the claims of the '754 Patent under 35 U.S.C. § 112(a). Thus, it is my understanding that the priority date of the '754 Patent can be no earlier than October 30, 2003.

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[1.b]	a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion;
[1.c]	a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times; and
[1.d]	an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router; whereby
[1.e]	the network client optical transceiver module is configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network
[1.f]	and the network client optical transceiver module is configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.
2	The network client optical transceiver module of claim 1, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.
3	The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times.
4	The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times.
5	The network client optical transceiver module of claim 1, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers.

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6	The network client optical transceiver module of claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).
7	The network client optical transceiver module of claim 1, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: A serial interface; A parallel interface; and A XAUI interface.
8	The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network.
9	The network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module.
10	The network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.
11	The network client optical transceiver module of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module.
12	The network client optical transceiver module of claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.
13	The network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.
14	The network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.
15	The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes one or more of the following:

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	A laser; A laser driver; A photodiode; A transimpedance amplifier; and A limiting amplifier.
16	The network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: A media access controller (MAC) discrete chip; and A transmission convergence layer (TC-Layer) discrete chip.
[18.pre]	A network client optical transceiver module for a passive optical network: the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, and the network client optical transceiver module having an optical port to one or more optical fibers of the passive optical network, and the network client optical transceiver module having an optical interface block and for communicating with the head-end of the passive optical network, and the network client optical transceiver module having an electrical network interface port electrically coupled to the control module and for electrically communicating to the switch or router, a method of communicating with the head-end of a passive optical network from the network client optical transceiver module comprising the steps of:
[18.a]	(a) receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module;
[18.b]	(b) storing the received data inside the network client optical transceiver module;
[18.c]	(c) receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module;
[18.d]	(d) converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module;
[18.e]	(e) processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network;
[18.f]	(f) converting a portion of the stored received data to a second optical signal; and
[18.g]	(g) transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network; whereby
[18.h]	the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and the network client optical transceiver module electrically communicates with the switch or router.

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19	The method of claim 18, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.
20	The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more end times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) terminating the transmission of the second optical signal responsive to an end time for data transmissions to the head-end of the passive optical network.
21	The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more lengths of time respective to the start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) transmitting the second optical signal responsive to a length of time for data transmissions to the head-end of the passive optical network.
22	The method of claim 18, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers.
23	The network client optical transceiver module of claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: SC; LC; FC; ST; and MU.
24	The method of claim 18, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: A serial interface; A parallel interface; and A XAUI interface.
25	The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an assigned network identification address from the head-end of the passive optical network for addressing data to the network client optical transceiver module at the control module.
26	The method of claim 18, further comprising the steps of: (g1) adjusting the transmission of the second optical signal form the optical interface block through the optical port to account for the response delay of the optical transceiver module.

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27	The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an optical power level and adjusting the transmit optical power level of the network client optical transceiver module to the determined optical power level.
28	The method of claim 18, further comprising the steps of: (f1) encapsulating a portion of data received through the electrical network interface port into the payload section of a framing protocol for the passive optical network at the control module for conveyance to the optical interface block.
29	The method of claim 18, wherein the network client optical transceiver module includes one or more of the following: A laser; A laser driver; A photodiode; A transimpedance amplifier; and A limiting amplifier.
30	The method of claim 18, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: A MAC discrete chip; and A TC-Layer discrete chip.

D. Alleged Invention

94. I understand the alleged invention in the '754 Patent, based on the claim language, is a pluggable optical transceiver module that can perform functions associated with a traditional ONT/ONU, such as receiving transmission start and end times from the head end of the network and transmitting upstream responsive to said start and end times.[55]

E. Summary of Relevant Prosecution History

95. The '872 Application, which matured into the '754 Patent, was filed on December 30, 2010.[56] The Examiner made no prior art rejections and merely stated in the Notice of Allowability that the subject application was allowable over U.S. Patent Publication No. 2002/0163921 to Ethridge et al. ("Ethridge") for failing to disclose "an electrical network interface port electrically coupled to the control module and for coupling into the optical module port of the switch or router."[57] Ethridge claims a technique for multiplexing high speed computed data onto a

[55] Ex. A at cls. 1, 3.

[56] Ex. B.

[57] *Id*.

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fiber optic cable for transfer to a local head-end.[58]

96. The bulk of the prosecution history of the '754 Patent lies in the history of its parent application, "the '514 Application." The '514 Application was originally filed with 56 claims[59], which were cancelled and amended throughout the prosecution of the application.[60] The Examiner rejected the application six separate times, and on the ultimate Final Rejection, the applicant appealed the rejection to the Board.[61] The Board's Decision reversed the Examiner's decision to reject the claims of the '514 Application, stating that the passive optical network disclosed in the primary reference disclosed an optical wide area network (WAN), where the invention described in the '514 Application claimed an optical local area network (LAN).[62]

97. It is my understanding that none of the references used in the Grounds in Section X below were cited or considered during the original prosecution and are not cumulative of the art considered by the Examiner during prosecution. Because the '754 Patent was a first action allowance, specific references cited by the Examiner were discussed only in relation to the prosecution of the '514 Application. The '514 Application related to entirely different subject matter: the '514 Application's claims apply strictly to a LAN and no other access networks, where the claims of the '754 Patent apply to broadband access networks more generally. Applicants distinguished the cited references from the claims of the '514 Application at length in the prosecution history, emphasizing that the references related to WANs and access networks, where the '514 Application claims only related to LANs.[63] Moreover, I understand that the reasons Applicants articulated in distinguishing the '514 Application from the cited reference are the very reasons the '754 Patent and the '514 Application are materially different.

F. Claim Construction and Interpretation

98. I understand that NextGen and Nokia have put forth the following constructions

[58] *Id*.

[59] Ex. C at 4-33.

[60] *Id*. at 94-109, 134-144, 180-191, 237-248, 259-271, 322-333.

[61] *Id*. at 76-88, 119-129, 157-169, 202-217, 276-287, 303-315, 345-347.

[62] *Id*. at 468-475.

[63] *Id.* at 192-199, 295-300, 334-341.

regarding the '754 Patent and that the Court has not yet issued a final claim construction order. I also understand the Court has put forth the following preliminary constructions regarding the '754 Patent.[64]

Terms	Nokia's Proposal	NextGen's Proposal	Court's Preliminary Construction
"control module" '754 Patent, claims 1, 3-4, 8-14, 18, 20-21, 25-28	Subject to § 112, ¶ 6; indefinite for lack of corresponding structure.	Not subject to §112(6).	Not subject to §112(6).
"framing block" '754 Patent, claim 8	Subject to § 112, ¶ 6; indefinite for lack of corresponding structure.	Not subject to §112(6).	Not subject to §112(6).
"bi-directional optical interface block" / **"optical interface block"** '754 Patent, claims 1, 8, 18, 26, 28	Subject to § 112, ¶ 6; indefinite for lack of corresponding structure.	Not subject to §112(6).	Not subject to §112(6).

99. My analysis of the claims remains the same whether or not the Court applies NextGen's proposed construction or the Court's preliminary construction. As will be shown in my analysis below, the terms "control module," "framing block," and "bi-directional optical interface block"/"optical interface block" are invalid because of their associated function and their connection to certain other components, regardless of their comprising structure.

100. Unless a term was construed in a manner other than according to its plain and ordinary meaning, I have rendered my opinions regarding that term based on its plain and ordinary meaning to a POSITA at the time of the '754 Patent's earliest alleged priority date.

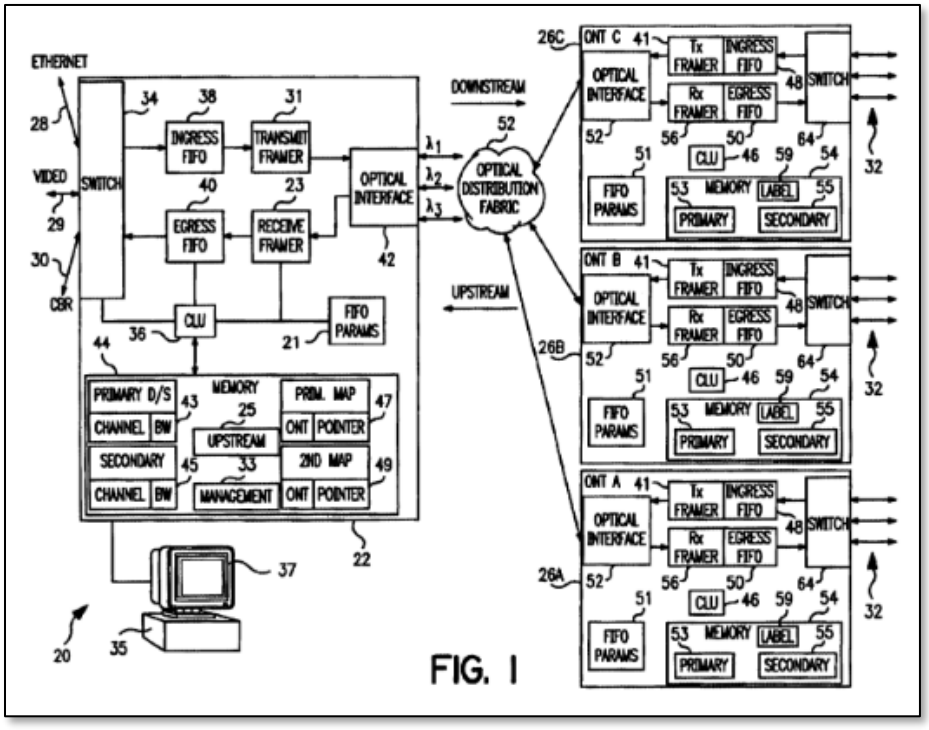
[64] Ex. RR.

VIII. OVERVIEW OF THE RELEVANT PRIOR ART

A. Shraga Overview

101. U.S. Patent No. 6,697,374 to Shraga et al. ("Shraga")[65], titled "Optical Network Communication System," was filed on December 5, 2001 and issued on February 24, 2004.

102. Shraga teaches a method for communication over a passive optical network from a central point to end points by time division multiplexing of a sequence of frames divided into multiple timeslots.[66] Specifically, as shown in Figure 1 below, Shraga discloses an optical line termination (OLT) which transmits optical signals downstream to a plurality of optical network terminations (ONTs), which are coupled via a passive optical distribution fabric, forming a PON.[67]



103. Shraga further discloses that the OLT acts as a controller of the downstream signals, and also of signals sent upstream by the ONTs and received by the OLT.[68] For example, Figure 2

[65] Ex. E

[66] Ex. E at Abstract.

[67] *Id.* at 2:32-36.

[68] *Id.* at 2:36-38.

of Shraga, shown below, illustrates a schematic showing the overall structure of a downstream frame and a virtual upstream frame transmitted in the network of Figure 1.

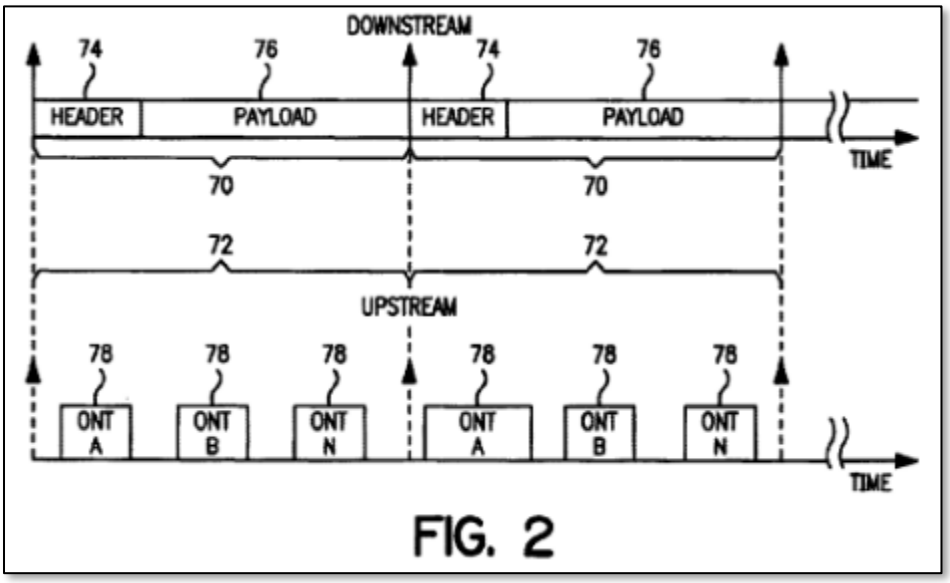


FIG. 2

104. Shraga explicitly teaches the process of transmitting upstream and downstream signals across the passive optical network. Specifically, Shraga discloses that downstream signals are sent in the form of frames having a constant period, and that each downstream frame comprises a number of "timeslots."[69] Each timeslot is a fixed number of bytes, and within each frame the OLT allocates timeslots directed to each of the ONTs, which transmit upstream signals according to time pointers.[70]

B. Togami Overview

105. U.S. Patent No. 7,066,746 to Togami et al. ("Togami")[71], titled "Electronic module having an integrated latching mechanism," was filed on March 14, 2003 and issued on June 27, 2006.

106. Togami teaches an opto-electronic transceiver module, used to interface an optical transmission cable to a host device, formed as a small form-factor pluggable ("SFP") device in

[69] *Id.* at 2:38-41.

[70] *Id.* at 2:41-54.

[71] Ex. F.

accordance with existing industry standards.[72] Specifically, Togami discloses that the module's size and shape may correspond to specifications defined by the hot-pluggable MSA standard.[73]

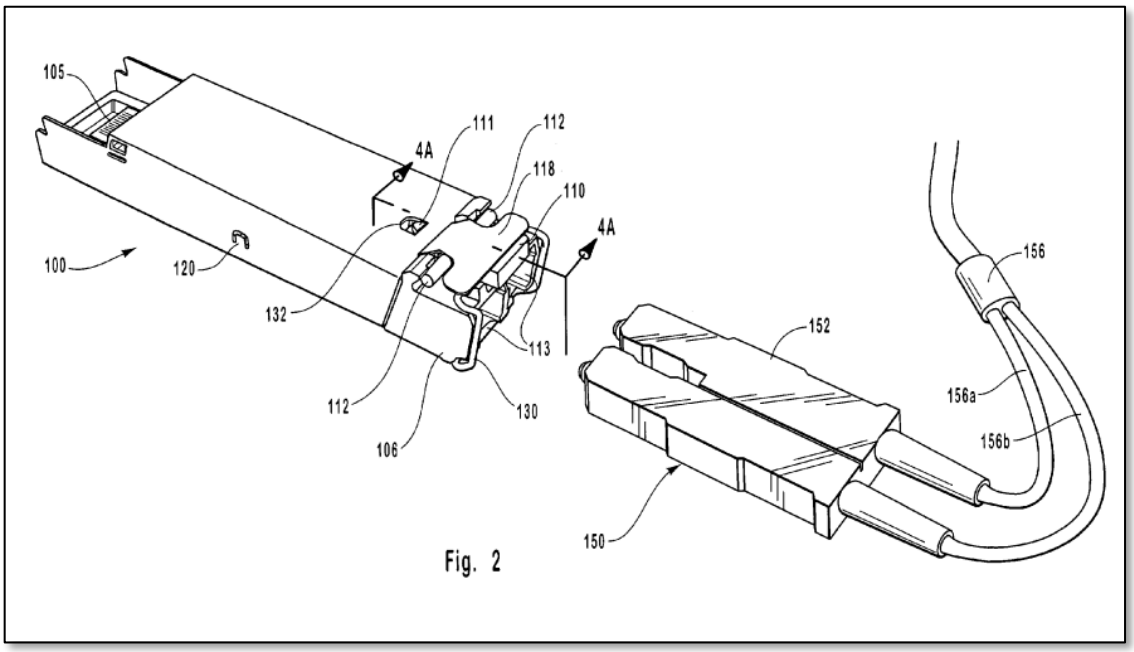


Fig. 2

107. Togami also discloses a module having at least one receptacle capable of physically receiving and interfacing with a corresponding optical fiber connector, which in turn is connected to a fiber optic cable.[74] Togami further discloses a module is capable of being operatively received within a compatible port provided by the host device, such as a network switch, hub, router, computer or the like.[75] Specifically, the module includes an edge connector formed at one end that is capable of electrically interfacing with the host device when the module is operatively received within the device port.[76]

108. Togami also discloses an opto-electronic transceiver module having transceiver electronics and optics to convert optical signals into electrical signals or electrical signals into optical signals and which employs a transmission protocol, such as the ANSI Fibre Channel (FC)

[72] Ex. F at 2:62-3:4.

[73] *Id.*

[74] *Id*. at 3:11-16.

[75] *Id.* at 2:62-3:4.

[76] *Id.* at 3:8-3:11.

protocol.[77]

C. Fujimori Overview

109. U.S. Patent No. 7,206,366 to Fujimori et al. ("Fujimori")[78], titled "System and Method for Programmably Adjusting Gain and Frequency Response in a 10-Gigabit Ethernet/Fibre Channel System," was filed on January 7, 2003 and issued on April 17, 2007.

110. Fujimori teaches an optical transceiver module for use in high-speed data communication networks over optical fibers (i.e., passive optical networks).[79] Fujimori states that the transceiver module "may be configured to communicate, namely transmit and receive," data between a computer system and an optical network, where the data transmitted and/or received may be formatted in accordance with a well-known OSI protocol standard.[80]

111. Fujimori teaches that the optical transceiver module may conform to MSA pluggable form factors, such as XENPAK or XFP.[81] Fujimori further confirms that the use of such pluggables was advantageous from a cost-savings prospective.[82]

112. Importantly, Fujimori states that its optical transceiver may include various "functional components" which may implement tasks such as "clock data recovery, clock multiplication, serialization/deserialization, encoding/decoding, electrical/optical conversion, descrambling, *media access control (MAC), controlling*, and data storage."[83] Thus, Fujimori makes clear that the invention contemplates placing a described MAC controller (shown in Fig. 1 below) on the optical transceiver module itself.[84]

[77] *Id.* at Claim 1, 1:46-54.

[78] Ex. G.

[79] *Id.* at 1:38-40, 2:11-41, 5:45-6:12.

[80] *Id.*

[81] *Id.* at 2:12-62.

[82] *Id.*

[83] *Id.*

[84] *Id.* at 5:45-6:29; Fig. 1.

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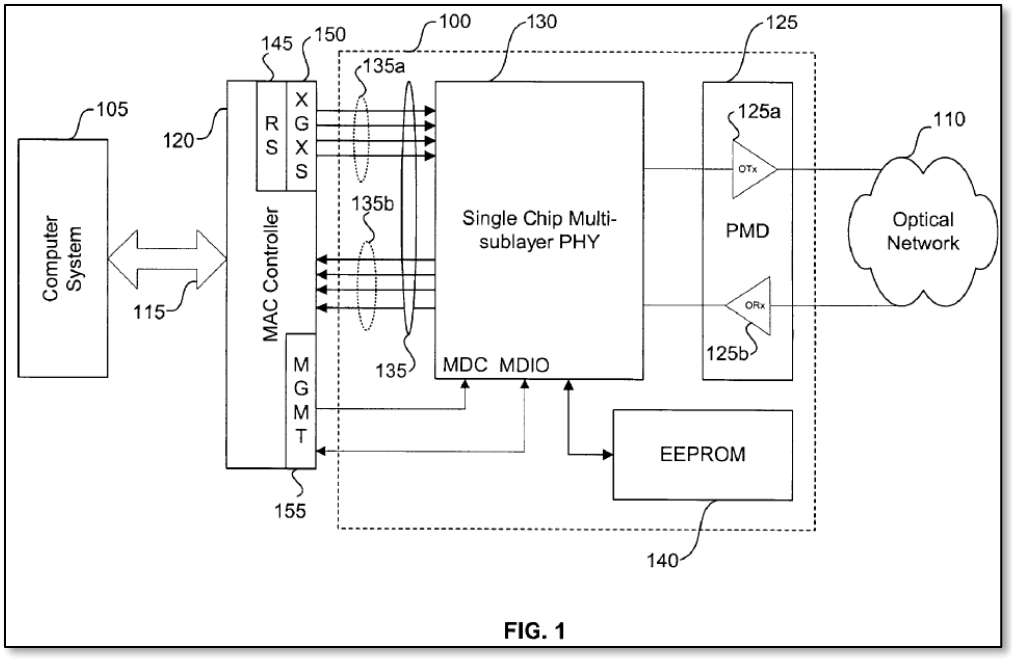


FIG. 1

D. Stiscia Overview

113. U.S. Patent No. 7,385,995 to Stiscia et al. ("Stiscia")[85], titled "System and Method for Dynamic Bandwidth Allocation on PONs," was filed on January 13, 2003 and issued on June 10, 2008.

114. Stiscia teaches an ONT in optical communication with an OLT via a passive optical network.[86] Stiscia's ONT contains an "integrated PON processor" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices . . . ."[87] The ONT is further configured to "receive and transmit upstream data from the one or more subscriber devices to the OLT via the passive optical network."[88] Stiscia's contemplated ONT is shown in Figures 2 and 3, below.

[85] Ex. I.

[86] *Id.* at 1:45-2:20.

[87] *Id.* at 8:38-47.

[88] *Id.*

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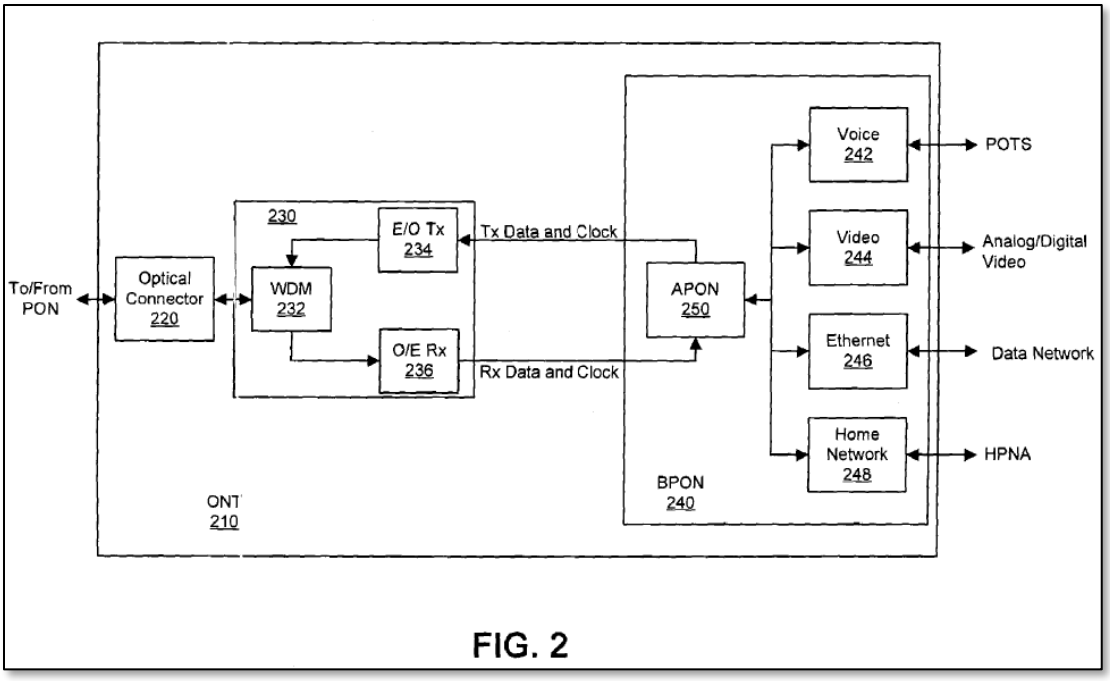


FIG. 2

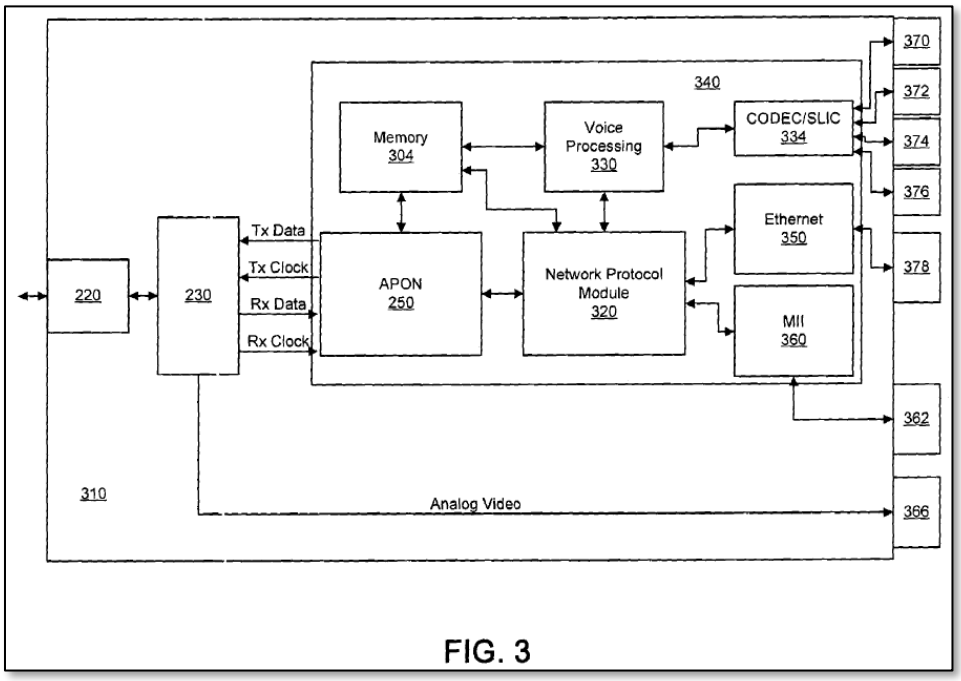


FIG. 3

115. Stiscia teaches that its ONT can be utilized with ITU-T recommendations covering physical layer requirements, trans-convergence (TC) layer, security, and a ranging protocol, along

with dynamic bandwidth allocation (DBA) and data protection mechanisms.[89]

E. Gilliland Overview

116. U.S. Patent No. 6,350,063 to Gilliland et al. ("Gilliland")[90], is titled "Pluggable Optical Transceiver Module Having a High Speed Serial Data Connector (HSSDC)." Gilliland was filed December 13, 1999 and issued on February 26, 2002.

117. Gilliland teaches a pluggable optical transceiver module containing "two opto-electronic devices mounted on a printed circuit board" capable of performing optical-to-electrical and electrical-to-optical signal conversion.[91] Gilliland's pluggable optical transceiver module interfaces with optical fibers of an optical network on one end and a port of a "host device" via the High Speed Serial Data Connector on the other end.[92] Gilliland's pluggable optical transceiver module is shown below in Figure 1.

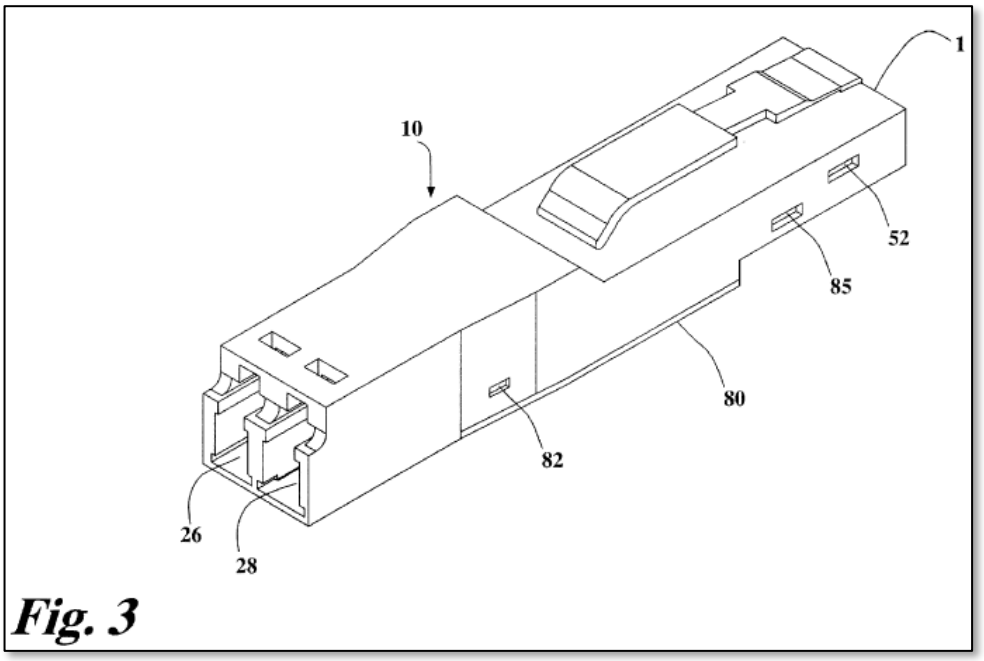


Fig. 3

118. Specifically, Gilliland teaches that its described pluggable optical transceiver

[89] *Id*. at 1:22-44.

[90] Ex. J.

[91] *Id.* at Abstract, 4:11-20, 6:38-65, Figs. 1-3.

[92] *Id.*

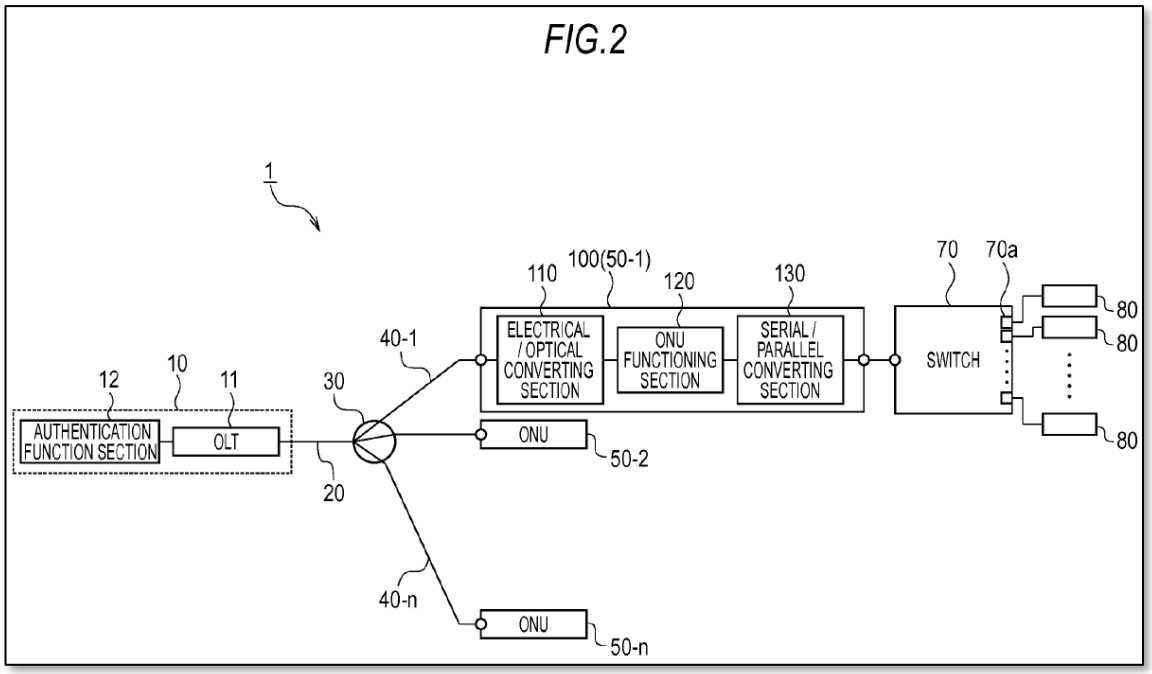
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module may correspond to a specification such as those prescribed by, for example, the Small Form Factor Committee.

F. Aboshi Overview

119. U.S. Patent No. 8,412,041 to Aboshi et al. ("Aboshi")[93], titled "Subscriber premises Side Optical Network unit and Optical Transmission System," was filed on April 24, 2009 and issued on April 2, 2013.

120. Aboshi teaches an MSA-compliant, pluggable ONU for use in a passive optical network.[94] Aboshi's ONU is designed to connect to the PON on one end and interface with a switch device on the other.[95] Aboshi's ONU contains an "ONU functioning section" that carries out a termination process and contains two MAC sections for establishing and performing communication with the OLT and managing signal output control, as shown in Figure 2 below.[96]



[93] Ex. K.

[94] *Id.* at 5:4-57.

[95] *Id.*; *Id.* at Fig. 2.

[96] *Id.* at 6:43-7:11.

G. The G.984.3 Standard Recommendation, G.984.3 Draft Recommendation, and Contribution 104 Overview

121. ITU-T Study Group 15, Temporary Document 7, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks ("The G.984.3 Draft Recommendation") was first published to the ITU-T server on October 17, 2003.[97] ITU-T Study Group 15, Contribution 104, Draft new Recommendation G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks ("Contribution 104") was first published to the ITU-T server August 25, 2003.[98] Both documents contain the same substantive material and will be referred to collectively as "the G.984.3 Draft Recommendation/Contribution 104" throughout this report, and I will provide citations for each document, respectively. Both documents were available as of the earliest alleged priority date: October 30, 2003.[99]

122. Both the G.984.3 Draft Recommendation and Contribution 104 matured into the official standard document for the G.984.3 – Transmission Convergence Layer for Gigabit Passive Optical Networks (the "G.984.3 Standard Recommendation").[100] The G.984.3 Standard Recommendation is the culmination of the different drafts published and discussed by Study Group 15 throughout the course of the 2001-2004 study period. The Draft Standard Recommendation was published as the official standard in February 2004.[101] For purposes of my analysis, all three G.984.3 documents contain substantially the same information and, specifically, identical disclosures cited *infra*. Any one document could be substituted substantively for another document and vice versa.

123. The G.984.3 Draft Recommendation/Contribution 104 and the G.984.3 Standard Recommendation describe the Transmission Convergence Layer for Gigabit-capable Passive Optical Networks, dealing with specifications for Gigabit PON Transmission Convergence (GTC) frame, message, ranging method, OAM functionality, and security.[102] Importantly, the G.984.3

[97] Ex. M; Ex. KK.

[98] Ex. N; Ex. LL.

[99] Ex. EE; Ex. FF; Ex. GG; Ex. HH.

[100] Ex. L.

[101] *Id.* at 1.

[102] Ex. L at 1; Ex. M at 1; Ex. N at 1.

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Draft Recommendation/Contribution 104 and the G.984.3 Standard Recommendation discuss the G-PON system configuration as well as the structure of data communications in a passive optical network.[103]

IX. INVALIDITY OF THE ASSERTED CLAIMS OF THE '754 PATENT

A. Ground 1A: The Shraga-Togami combination renders claims 1-16 and 18-30 obvious.

124. ***Motivation to combine.*** Both Shraga and Togami are directed towards data communications in an optical network.[104] Indeed, both Shraga and Togami teach devices that include an optical network interface port, an optical transmitter, an optical receiver, and an electrical network interface.[105]

125. As discussed *supra*, Shraga discloses a method for communication over a passive optical network between a head-end OLT and client-end ONTs. And as I discuss below, a POSITA would have understood that the ONT and optical network data communications system as taught in Shraga could, as one known option, have been implemented in a pluggable transceiver module as contemplated in Togami, and it would have yielded successful and beneficial results. Shraga's ONT/ONU has an optical interface that transmits and receives data to and from the optical distribution fabric, operating as a transceiver in a passive optical network.[106] Togami's pluggable transceiver module also "contains a laser transmitter circuit capable of converting electrical signals to optical signals and an optical receiver capable of converting received optical signals back into electrical signals."[107] It would have been obvious to a POSITA to combine the ONT capable of performing this function with the pluggable form factor housing performing the same function. A POSITA would have thus been motivated to combine the pluggable optical transceiver module of Togami with the ONT and optical network data communications system of Shraga to create a pluggable ONT for use in transmitting data communications over a passive optical

[103] *Id.*

[104] Ex. E at Abstract, 2:26-54.

[105] Ex. F at 1:5-2:7.

[106] Ex. E at 3:39-43, Fig. 1.

[107] Ex. F at 1:30-54.

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network.

126. A POSITA would have been motivated to combine Shraga and Togami for several reasons. First, utilizing the pluggable optical module having a small form factor in accordance with existing standards disclosed in Togami for data communications in a passive optical network, as taught in Shraga, was already well known and implemented in the art because of its numerous benefits, discussed in depth below.[108] For example, an article published in the OKI Technical Review in April 2002, entitled SFF & SFP Optical Transceivers ("OKI Article") expressly discloses a pluggable optical transceiver in conjunction with optical communications networks, such as GPON and EPON.[109] Specifically, the OKI Article discloses SFP optical transceiver products, which are compatible with "fiber channels, gigabit ethernets, or SONET applications have already been developed."[110] These applications are specifically discussed in the '754 Patent.[111] Fig. 1 of the OKI Article, produced below, explicitly shows the use of pluggable optical transceivers (shown in red) in these applications, along with others such as LANs:

[108] Ex. G; Ex. O; see also https://www.investor.agilent.com/news-and-events/news/news-details/2001/Agilent-Technologies-New-Fiber-Optic-Transceivers-Offer-Industrys-Lowest-EMI-Emissions/default.aspx (announcing "hot-pluggable" SFP fiber optic transceivers, which "allows greater flexibility in system configurations, and eliminates system downtime during upgrades and maintenance").

[109] Ex. O at 92, Fig. 1.

[110] *Id*. at 95.

[111] Ex. A at 1:34-37.

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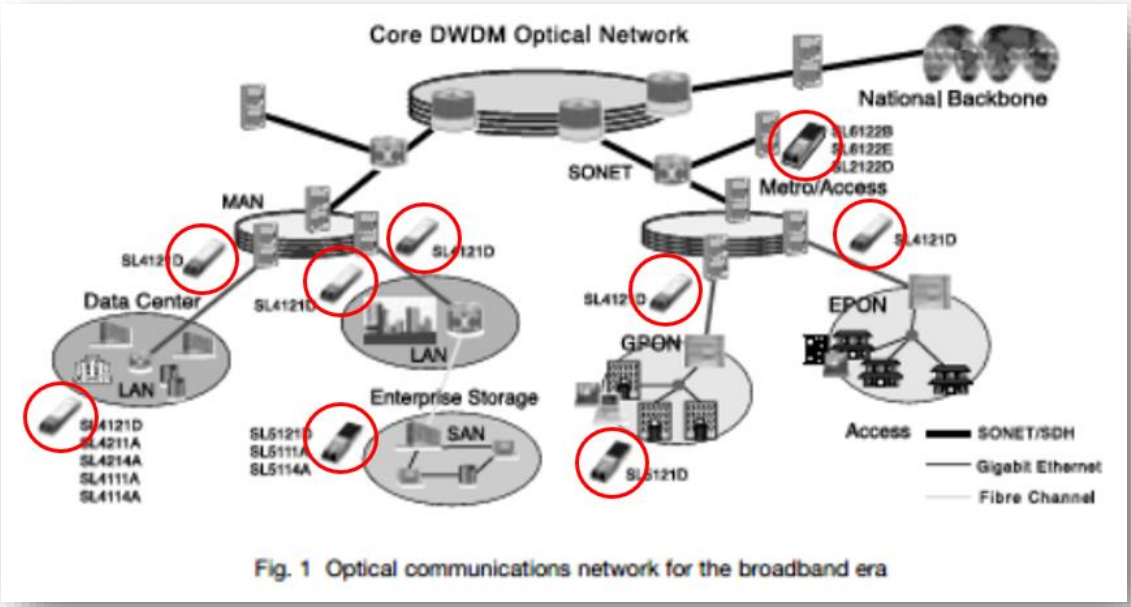


Fig. 1 Optical communications network for the broadband era

127. The OKI Article further emphasizes, as discussed in depth below, that the use of small form factor transceivers was advantageous because they were low-cost, highly versatile, and greatly simplified replacement and maintenance tasks by avoiding network interruption.[112]

128. Fujimori, as discussed above, also discloses the use of pluggable optical transceiver modules (specifically having form factors such as XFP and XENPAK) in high-speed data communication networks over optical fibers (i.e., passive optical networks).[113] The pluggable modules described in Fujimori "may be configured to communicate, namely transmit and receive, data between computer system and optical network," where the data transmitted and/or received may be formatted in accordance with the well-known OSI protocol standard.[114] Fujimori further confirms that the use of such pluggables was advantageous from a cost-savings prospective, as discussed further below.[115] Thus, a POSITA would have known about the use of pluggable optical transceiver modules, as in Togami, with ONTs employing optical network data communication

[112] *Id*. at 92, 94.

[113] Ex. G at 1:38-40, 2:11-41.

[114] *Id*. at 5:65-6:2.

[115] *Id*. at 2:42-47.

systems, as in Shraga, and therefore would have been motivated to combine the two references.

129. Second, a POSITA would have been motivated to combine Shraga and Togami because, as disclosed by the MSAs that had already standardized certain pluggable form factors, a pluggable ONT would be easier to install, repair, and/or replace than a traditional mounted component. This would decrease the chances for improper installation.[116] It would also decrease the likelihood that other components near the ONT could be damaged during servicing of the ONT because pluggables "can be individual accessed and removed from the host device without disturbing the adjacent modules and/or cable connections."[117]

130. A pluggable ONT would have also taken less time to install, repair, and/or replace because of its hot-pluggable, removable nature.[118] This, in turn, meant less down time for the fiber optic system during maintenance or servicing of the transceiver because the module "can be inserted and removed from the host system without removing electrical power."[119]

131. Third, a POSITA would have been motivated to combine Shraga and Togami because a pluggable ONT is more compact and takes up less room than other traditional ONTs. Because OLTs and ONTs/ONUs often have many additional components located in large racks, space is a limiting factor in many cases and smaller optical components are desirable. Decreasing the transceiver size was a goal of a POSITA in the optical network space during the early 2000s, as stated in the '754 Patent.[120] The benefit of decreasing transceiver size is discussed in Togami: "it is desirable to miniaturize the physical size of the transceiver module to increase the port density, i.e., and therefore accommodate a higher number of network connections within a physical space."[121] Thus, a POSITA would have been motivated to combine Shraga with Togami to create a smaller, pluggable module capable of performing the traditional data communications capabilities of an ONT.

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[116] *See* Ex. F at 2:1-8.

[117] *Id.*

[118] *Id*. at 1:49-60.

[119] *Id*.

[120] Ex. A at 2:14-16.

[121] Ex. F at 1:45-2:8.

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132. Fourth, a POSITA would have been motivated to combine Shraga and Togami to create a pluggable ONT for use in transmitting data communications over a passive optical network because a pluggable ONT is more cost effective. Decreasing costs was a goal of a POSITA in the optical network space during the early 2000s.[122] Specifically, utilizing already-standardized small form factor optical modules allows for system manufacturers to save costs by utilizing a larger number of ports for data communications.[123] Further, pluggables are easier to install, repair, and replace, which allows less skilled technicians to be able to service the communications system for a lower cost. Moreover, technicians do not have to repair and replace larger equipment, like a switch or router, when an opto-electrical component in a mounted transceiver fails.[124] Instead, the technician can simply replace the hot pluggable transceiver with a new transceiver.[125] As stated in the '754 Patent, manufacturing costs are also decreased when transceivers are produced separate from other opto-electrical equipment on printed circuit boards.[126] Further, the smaller size of the transceiver allows the optical equipment to take up less space, thus saving on rent and utilities.[127] And, importantly, where improvements are made in the space of pluggable optical transceivers to, for example, increase data throughput rates, it allows for the entire system to be upgraded by simply replacing the optical transceiver module.[128] This avoids costly replacement endeavors.[129]

133. Moreover, a POSITA would have had a reasonable expectation of success in combining the ONT and passive optical network data communications system in Shraga with the pluggable optical transceiver module in Togami 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 during the early 2000s.[130]

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[122] Ex. G at 2:42-47.

[123] *Id*.

[124] Ex. F at 1:49-2:8.

[125] *Id*.

[126] Ex. A at 1:39-55.

[127] Ex. G at 2:42-47.

[128] Ex. A at 1:48-55.

[129] *Id*.

[130] *See* e.g., Ex. F at 1:58-2:16; Ex. G at 2:42-47.

134. For at least these reasons, in reading Shraga, a POSITA thus would have been motivated to look to the pluggable optical transceiver module in Togami and would have had a reasonable expectation of success in doing so.

i. Claim 1

a. [1.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, the network client optical transceiver module comprising:

135. Under NextGen's apparent theory of infringement[131], to the extent the preamble is limiting, a POSITA would have understood the Shraga-Togami combination to disclose this limitation.

136. Shraga is clear in that it discloses a method for communication over a passive optical network from a central point to end points.[132] For example, in Figure 1 below, Shraga discloses a passive optical network composed of an OLT (shown in yellow in Figure 1 below) connected to three ONTs/ONUs (shown in red in Figure 1 below) via the optical distribution fabric (shown in blue in Figure 1 below). The OLT and ONTs/ONUs each contain transmitting (31, 41) and receiving (23, 56) components, an optical interface (42, 52) connecting each device to the optical distribution fabric and performing optical-to-electrical and electrical-to-optical conversion.

[131] Ex. NN at 1-8.

[132] Ex. E at Abstract.

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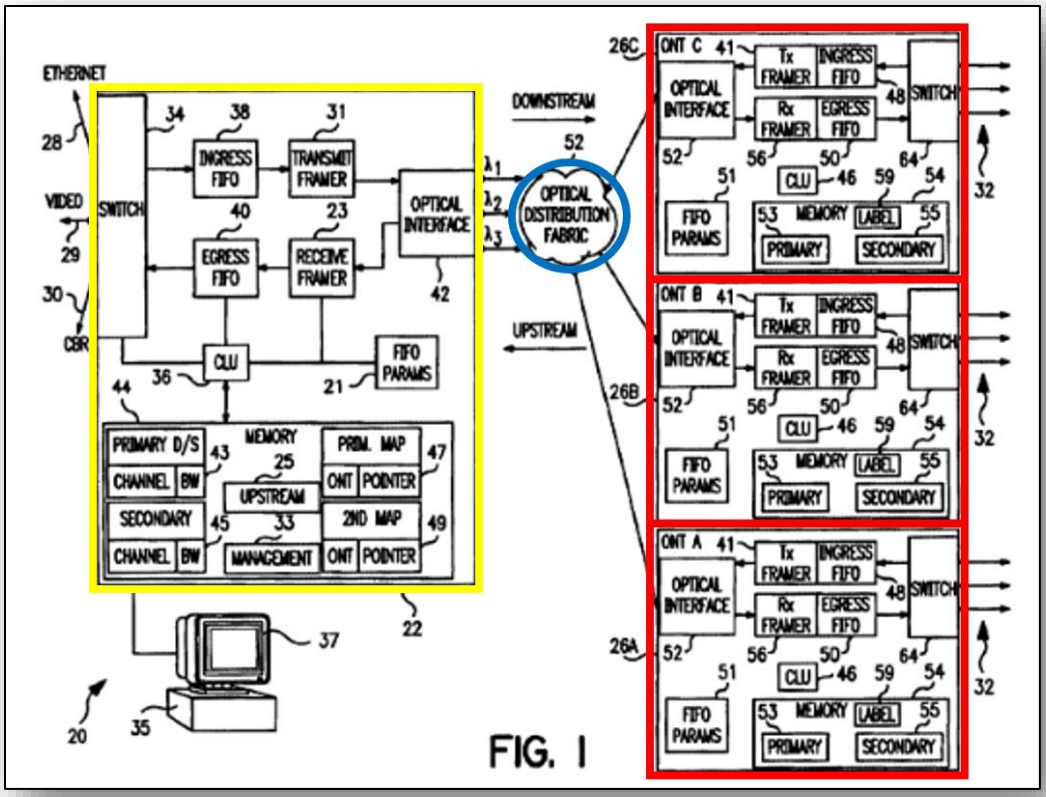


FIG. 1

137. Shraga further discloses that signals in the communication system of the passive optical network are transferred from the OLT to the ONTs/ONUs "via fiber optic cable and passive optical *splitters*, which comprise the physical optical distribution fabric (52) of the network."[133]

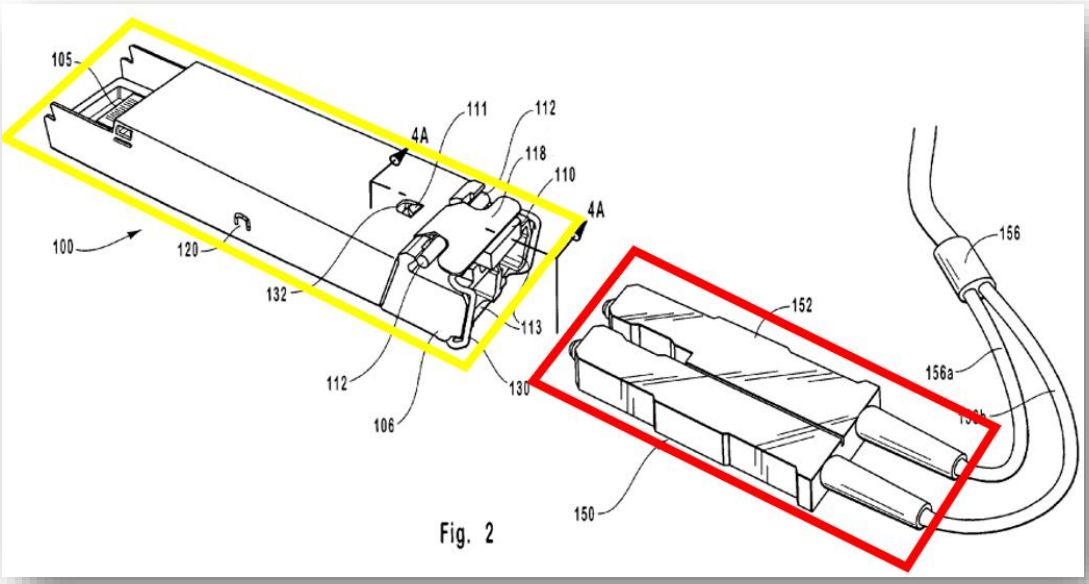
138. Togami discloses a pluggable optical transceiver module for use in fiber optic communications, where the module is a pluggable optical transceiver in a small form pluggable (shown in yellow below).[134] The pluggable taught in Togami is an opto-electronic transceiver module "typically used to interface an optical transmission cable medium" (shown in red below) to a "host device, such as a network switch, hub, router, computer or the like."[135] Such devices are capable of removably coupling to the host device, because they are capable of being inserted and

[133] *Id.* at 1:10-27.

[134] Ex. F at 2:54-3:4, 5:21-36, Fig. 2.

[135] *Id.* at 1:15-24, 2:54-3:4.

removed from the host device.[136]



139. Specifically, Togami discloses that the module's size and shape corresponds to specifications defined by the hot-pluggable MSA standard.[137] A POSITA would have combined Togami with Shraga for at least the reasons outlined in Section IX.A, above.

140. Therefore, it is my opinion that a POSITA would have understood that the Shraga-Togami combination discloses "a network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router."

141. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a PON having one or more splitters for coupling a network client optical transceiver module over one or more optical fibers to the head end of a PON was well known prior

[136] *Id.*

[137] *Id.* at 1:66-2:16, 4:64-5:12.

to the earliest alleged filing date of the '754 Patent.[138]

b. [1.a] an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters;

142. Under NextGen's apparent theory of infringement[139], a POSITA would have understood the Shraga-Togami combination discloses this limitation for the same reasons as discussed in the analysis of [1.pre].

143. As discussed above, Shraga teaches a passive optical network connecting a head-end OLT to multiple client-end ONTs/ONUs via fiber optic cables and passive optical splitters.[140] Shraga discloses that the ONTs/ONUs are "*coupled* to the [optical distribution] fabric."[141] As explained in [1.pre] above, the optical distribution fabric is made up of splitters and optical fibers.[142] When an ONT/ONU is "coupled" to the optical distribution fabric, it is connected to the fabric through the use of fiber optic cables.[143] In order to connect to an optical fiber, the ONT/ONU must contain a connection point (circled in red in Fig. 1 below) allowing the transfer of data between the ONT/ONU and the network. A POSITA would have understood that the ONT/ONU, in order to receive the fiber optic cables, would contain an optical port serving as the connection point for coupling to the optical fibers of the network.

[138] Ex. SS at 176:4-14.

[139] Ex. NN at 8-11.

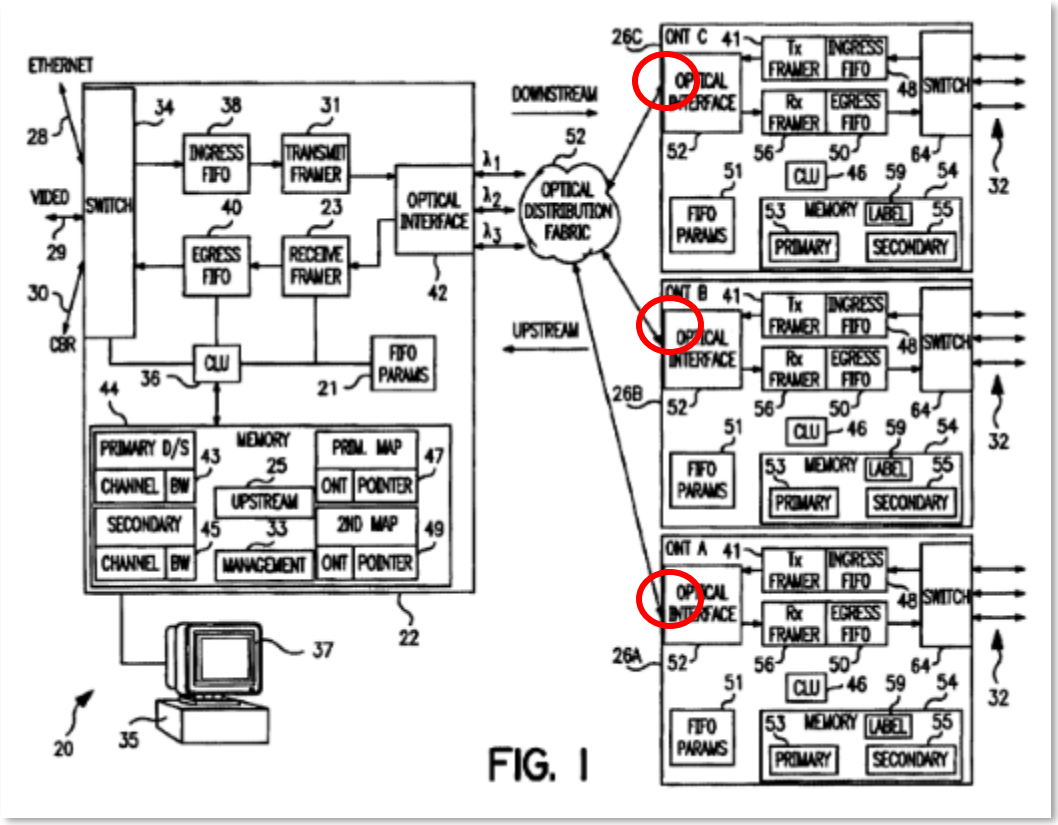
[140] Ex. E at 1:10-27.

[141] *Id.* at 4:38-41, 8:36-47, Fig. 1.

[142] *Id.* at 1:10-27.

[143] *Id.* at 4:38-41, 8:36-47, Fig. 1.

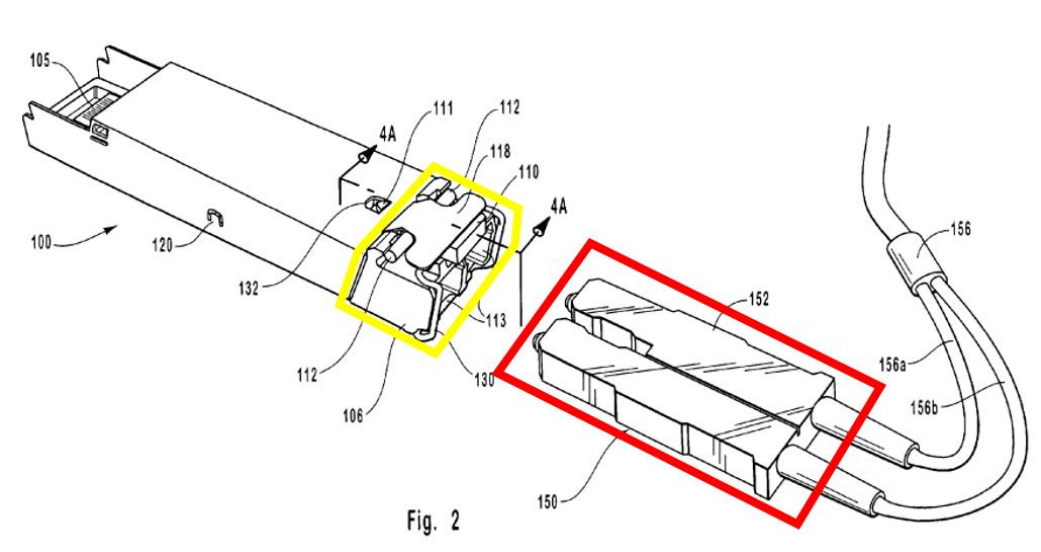
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144. Likewise, Togami has "at least one receptacle capable of physically receiving and interfacing with an optical fiber connector" which optically couples the transceiver module to a fiber optic cable.[144] Togami states that the module contains a "connector portion" (shown below in yellow) which possesses a "receptacle configuration" (i.e., optical port) that "operatively receives a corresponding modular fiber connector configuration, such as is typically used to interface with an optical fiber cable" (shown below in red).[145]

[144] Ex. F at 3:11-15.

[145] *Id.* at 5:38-48, Fig. 2.



145. Therefore, it is my opinion that a POSITA would have understood that the Shraga-Togami combination discloses "an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters."

146. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an optical port on a pluggable transceiver device was well known prior to the earliest alleged filing date of the '754 Patent.[146]

c. [1.b] a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion;

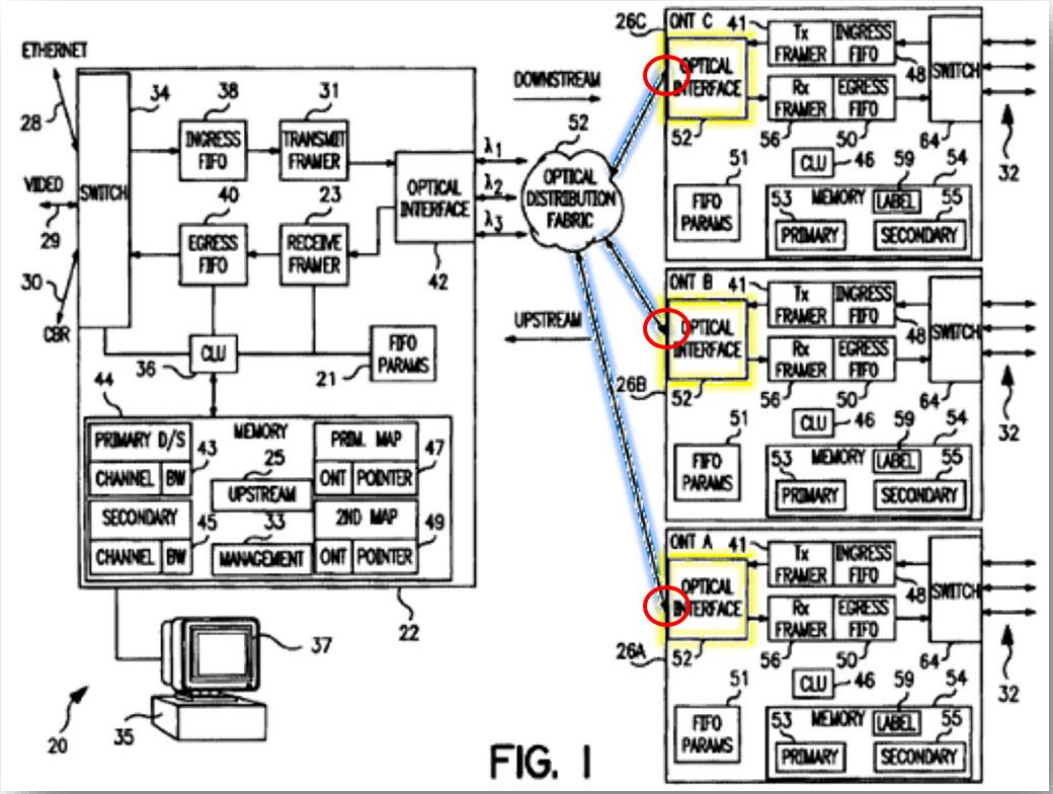
147. Under NextGen's apparent theory of infringement[147], in my opinion, the Shraga-Togami combination discloses a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion.

148. As discussed above, Shraga teaches an optical interface (shown below in yellow) connecting each of the ONTs/ONUs to the optical distribution fabric of the passive optical

[146] Ex. SS at 169:23-170:5, 170:18-22.

[147] Ex. NN at 11.

network.[148] It would have been obvious to a POSITA that this optical interface is bi-directional, as it is configured to receive incoming data communications from the optical distribution fabric and to transmit outgoing data communications to the optical distribution fabric, i.e., transport data communication signals bi-directionally.[149] Further, Figure 1 shows a bi-directional arrow (shown below in red) extending from the optical interface of the ONT/ONU to the optical distribution fabric, representing the bi-directional flow of data between the ONT/ONU and optical distribution fabric through optical fiber.[150] This arrow indicates that data is transferred both to and from the optical interface, making it bi-directional.[151]



149. As discussed above in the analysis of [1.a], a POSITA would have understood that

[148] *Id.* at 7:60-8:18, 8:36-47, Fig. 1.

[149] *Id.*

[150] *Id.* at Fig. 1.

[151] *Id.*

the ONT/ONU, in order to receive the fiber optic cable and because the optical fiber is shown transmitting data to and from the ONT/ONU, would contain an optical port for coupling to the optical fibers of the networks (circled in red in Fig. 1 above). This would allow the bi-directional data carried by optical fiber to and from the ONT/ONU to reach the optical interface block (shown above in yellow).[152] A POSITA would have understood that the optical interface, in order to transmit and receive data to and from the fiber optic cable, would thus be coupled to an optical port connected to the optical fibers of the network.

150. Further, Shraga discloses that this optical interface converts data from a "transmit framer," where it is an electrical signal, to an "optical format," which is an optical signal.[153] Also, the optical interface receives optical signals from the fabric and converts the signals to data, an electrical signal, which is then transferred to the receive framer.[154] Therefore, Shraga also teaches an optical interface block that converts signals from electrical-to-optical and optical-to-electrical.

151. Likewise, Togami discloses a transceiver module that "contains a laser transmitter circuit capable of converting electrical signals to optical signals and an optical receiver capable of converting received optical signals back into electrical signals."[155]

152. Following the optical interface disclosed in Shraga, as well as the opto-electrical conversion functionality disclosed in Togami, it is my opinion that a POSITA would have understood that the Shraga-Togami combination discloses "a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion."

153. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a "bi-directional optical interface" that performs electrical-to-optical and optical-to-electrical signal conversion was well known prior to the earliest alleged filing date of

[152] *Id.*

[153] *Id.* at 8:10-18, 8:36-43.

[154] *Id.*

[155] Ex. F at 1:39-54.

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the '754 Patent.[156]

d. [1.c] a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times; and

154. Under NextGen's apparent theory of infringement[157], in my opinion, the Shraga-Togami combination discloses a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times.

155. Shraga discloses that each OLT and ONT/ONU contains a control and logic unit (CLU) (shown below in yellow) which controls, via management software comprised in a memory, the overall operation of the individual elements of the ONT/ONU.[158] Specifically, Shraga teaches that the CLU is coupled to the optical interface.[159] A POSITA would have understood that the CLU would necessarily be "electrically coupled" to the optical interface, as the internal components of the ONT/ONU communicate via electrical signals.[160] The CLU controls the operation of data communications in the passive optical network, including data ingress (downstream from the head-end) and data egress (upstream to the head-end) found in the optical interface, as well as the transmit framer and receive framer, which in conjunction allow the ONT/ONU to transmit and receive optical data communications.[161]

[156] Ex. SS at 171:2-20.

[157] Ex. NN at 11-16.

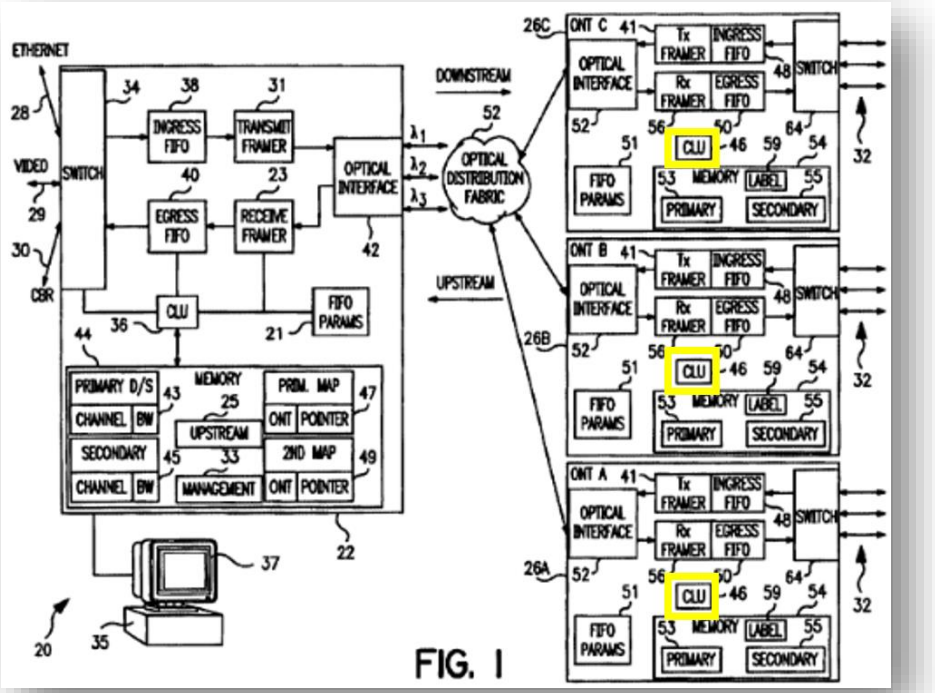
[158] Ex. E at 7:60-8:9, 8:36-43.

[159] *Id.*

[160] *Id.* at 8:10-18, 8:36-43.

[161] *Id.* at 7:60-8:9, 8:36-47.

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156. Further, Shraga discloses that downstream frames are transmitted from the OLT to the ONTs/ONUs and are comprised of a header (shown in yellow below), which begins with a frame alignment signal (identified as 84 below) that is used by the ONTs/ONUs as a reference point for syncing upstream transmissions, and further contains a series of overhead sections directed to specific ONTs/ONUs (shown in red below).[162] Each ONT/ONU overhead section includes an ONT identifier (shown in blue below) and an ONT pointers section (shown in green below).[163] Shraga teaches that each ONT pointers section includes a *start transmission time* (identified as 91 below) measured from the frame alignment signal, indicating when the ONT/ONU is to begin transmitting data within its window upstream, back to the head-end.[164]

[162] *Id.* at 9:66-10:13, 10:38-55, Fig. 2, Fig. 3.

[163] *Id.*; *Id.* at 10:56-11:6.

[164] *Id.*

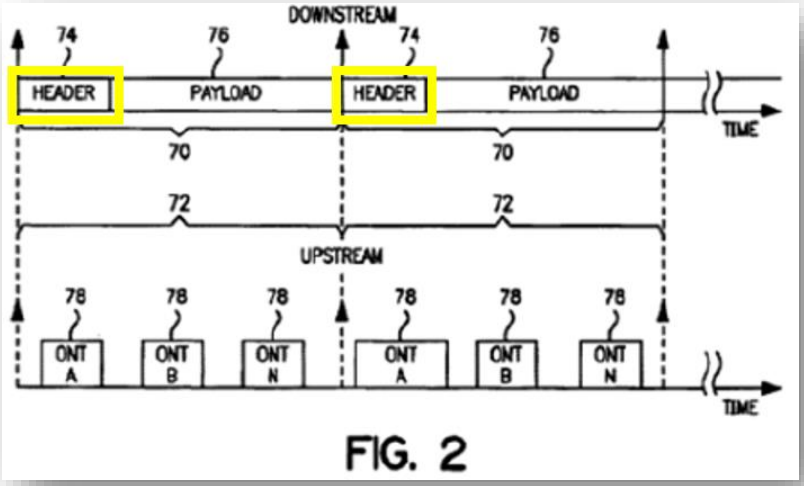


FIG. 2

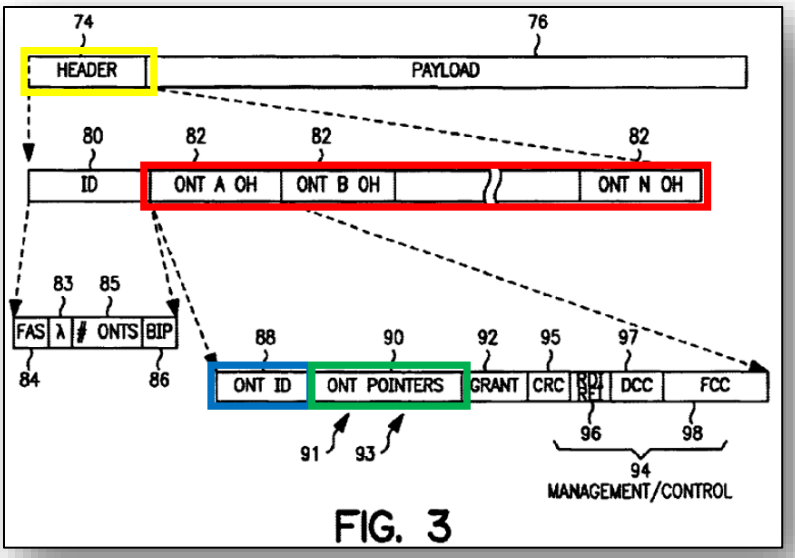


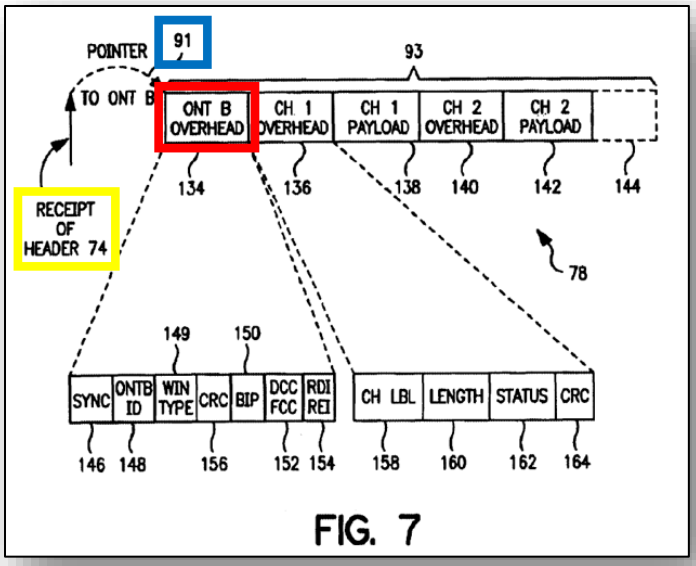
FIG. 3

157. Shraga further teaches that "[d]ata in the upstream window [] is generated and transmitted by [an] ONT []."[165] Figure 7, produced below, shows the details of an upstream window of the network created by each ONT/ONU for transmission to the OLT.[166] Once an ONT/ONU has received its start time from the OLT, which, as discussed above, is included in the header of the downstream transmission (shown in yellow in Fig. 7 below), the CLU of the

[165] *Id.* at 14:43-15:13, Fig. 7.

[166] *Id.*

ONT/ONU uses this information to construct the transmission window.[167] The ONT's/ONU's CLU generates the window in a way that will not cause its transmission to overlap with other upstream windows from other ONTs by aligning transmissions with the start time allocated by the OLT.[168] Figure 7, produced below, shows the details of an upstream window of the network created by each ONT/ONU's CLU for transmission to the OLT.[169]



158. The CLU constructs the transmission window beginning with the overhead section (shown in red above), which contains an identification field allowing the OLT to identify which ONT/ONU is sending the transmission.[170] As illustrated in Figure 7 above, the CLU of the ONT/ONU constructs the window in accordance with the start time (91) (shown in blue above) provided by the pointer of the downstream transmission.[171] After the window is fully constructed by the CLU, the ONT/ONU transmits the window upstream at the start time allocated to it.[172]

[167] *Id.* at 14:42-57, Fig. 7.

[168] *Id.*

[169] *Id.*

[170] *Id.*

[171] *Id.*

[172] *Id.*; *Id.* at 9:56-65.

Therefore, a POSITA would have understood that Shraga teaches a transceiver module "configured to transmit the data communications to the head-end of the passive optical network responsive to the start times" provided by the head-end OLT.

159. Thus, it is my opinion that a POSITA would have found the Shraga-Togami combination discloses "a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times."

160. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 1 was well known prior to the earliest alleged filing date of the '754 Patent.[173] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "start times," was well known prior to the earliest alleged filing date of the '754 Patent.[174]

e. [1.d] an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router; whereby

161. Under NextGen's apparent theory of infringement[175], in my opinion, the Shraga-Togami combination discloses an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router.

162. Specifically, Shraga teaches that the ONT/ONU contains an Ingress FIFO and Egress FIFO (shown in yellow in Fig. 1 below), which functionally contains the claimed electrical network interface port.[176] The claimed electrical network interface port is electrically connected to

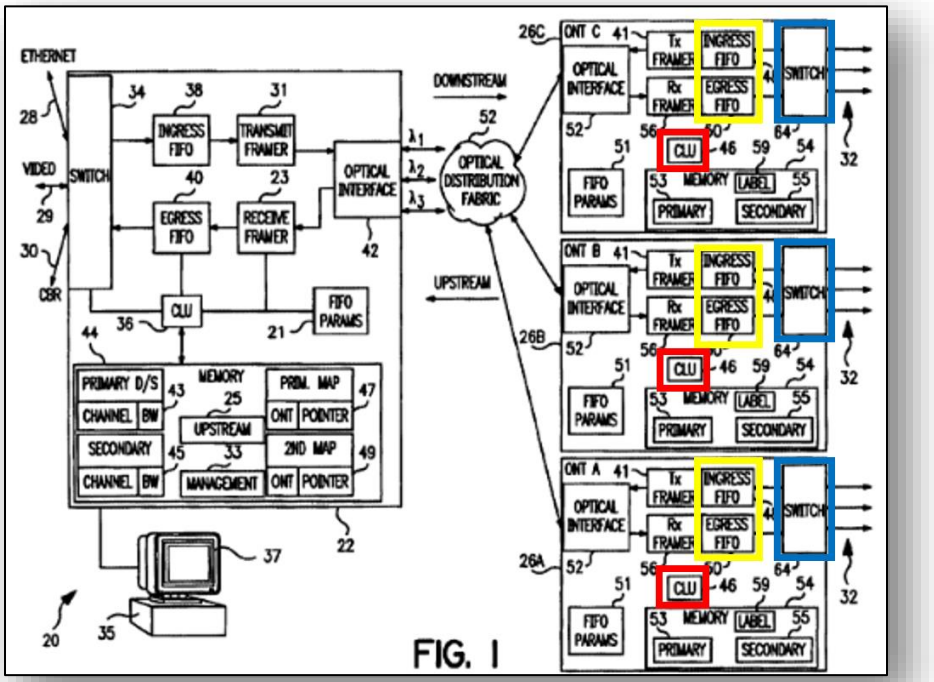
[173] Ex. SS at 182:16-24.

[174] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[175] Ex. NN at 17-20.

[176] Ex. E at 8:36-43.

the claimed control module because the Ingress FIFO and Egress FIFO taught in Shraga are electrically connected to the CLU (shown in red in Fig. 1 below). In particular, the CLU "controls the operation of a data ingress (downstream from the head-end) [and] a data egress (upstream to the head-end direction)."[177] Additionally, in each ONT/ONU, data "is transferred to transmit [the] framer [] from [the] FIFO [] by [the] CLU."[178] A POSITA would have understood that, for a CLU to cause data to be transferred to the framer, it must be electrically coupled to the framer in order to send control signals.



163. Additionally, Shraga teaches that the ingress and egress FIFOs are electrically coupled to the inputs and outputs on the left side of a switch (shown in blue in Fig. 1 above), which is illustrated explicitly in Figure 1.[179] Shraga also teaches that the switch operates according to "controlling signals received from [the] CLU."[180] A POSITA would have understood that, for the

[177] *Id.* at 8:2-5.

[178] *Id.* at 9:56-63.

[179] *Id.* at 8:36-42.

[180] *Id.* at 7:67-8:2.

switch in Shraga to operate according to controlling signals from the CLU, it must have been electrically coupled to the switch. A POSITA also would have understood that the inclusion of the switch within the ONT/ONU module itself, as shown in Shraga, is a design choice and that the switch could have been connected to the ONT/ONU internally or externally.

164. Further, Shraga discloses that the ONTs/ONUs operate as data modems and are coupled on their downstream sides to data lines which provide lower-rate services to the downstream clients of the passive optical network.[181] A POSITA would have understood that modems connect electrical users, such as PCs, to the network, and thus, for the same reasons discussed above, contain an electrical interface port. Additionally, as discussed above in Claim [1.C], because the process in Shraga converts optical signals to "data" signals, a POSITA would have known that the coupling between the ONT/ONU and the downstream data lines is through an electrical interface.[182]

165. Shraga also indirectly discloses that the host device, such as a switch or router, contains an optical module interface port. For the same reasons discussed above, the host device would contain a port for coupling to the ONT/ONU transceiver module in order to transfer data, in the form of electrical signals, between the transceiver module and host device. Specifically, in this case, the switch or router would contain an "optical module port" for interfacing with and coupling to the optical transceiver module. Thus, a POSITA would have understood that the host device, such as a switch or router, would have contained an optical module port for communicating with the ONT/ONU module.

166. In addition, Togami discloses that, typically, a pluggable transceiver module is electrically interfaced with a host device via a compatible connection port.[183] In particular, Togami teaches a pluggable optical transceiver module capable of being operatively received within a compatible port provided by the host device.[184] Host devices include, network switches, hubs,

[181] *Id.* at 7:29-35.

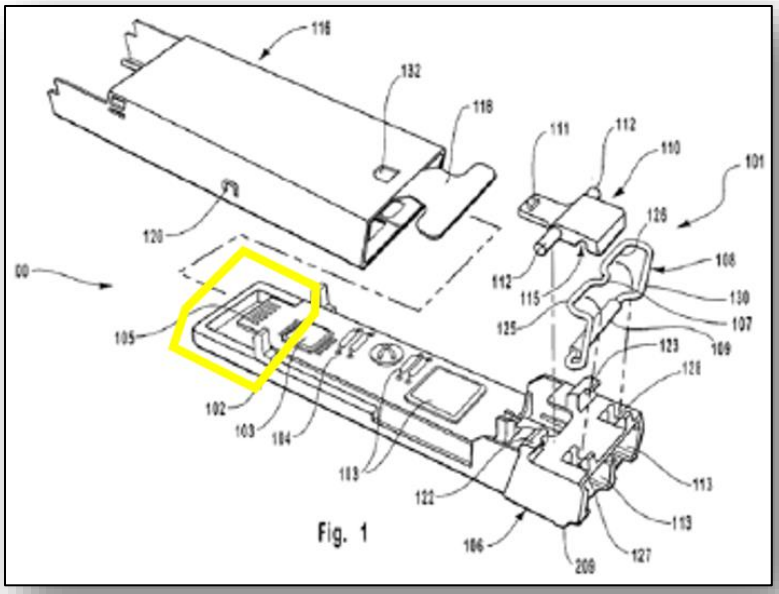
[182] *Id.* at 8:10-18.

[183] Ex. F at 1:55-58.

[184] *Id.* at 2:54-61.

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routers, computers, or any similar device.[185] Specifically, the module disclosed in Togami includes an edge connector that is capable of *electrically interfacing* with the host device when the module is plugged in to the device port.[186] Therefore, communications passed between the pluggable transceiver module and the host device would consist of electrical signals.[187] This electrical interface is shown below, in yellow, in Figure 1.[188]



167. Further, it would have been obvious to a POSITA that any pluggable form factor device, such as the device disclosed in Togami, would have included an electrical network interface port for electrically coupling into the optical module port of the host device. In particular, the Small Form-factor Pluggable MultiSource Agreement (MSA) describes the SFP electrical connector specifications, which outline the electrical network interface port (including dimensions, plating, and number of contacts) as well as other electrical specifications of the device.[189]

[185] *Id.*

[186] *Id.* at 3:5-22, 5:21-36.

[187] *Id.*

[188] *Id.* at Fig. 1.

[189] Ex. S at 14.

168. Thus, it is my opinion that a POSITA would have found the Shraga-Togami combination to disclose "an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router."

169. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an "electrical network interface port" on a pluggable optical transceiver module was well known prior to the earliest alleged filing date of the '754 Patent.[190]

f. [1.e] the network client optical transceiver module is configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and the network client optical transceiver module is configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

170. Under NextGen's apparent theory of infringement[191], for reasons discussed above in the analysis of [1.pre], [1.c], and [1.d], Shraga and Togami disclose a network client optical transceiver module configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

ii. Claim 2: The network client optical transceiver module of claim 1, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.

171. Under NextGen's apparent theory of infringement[192], it is my opinion that the Shraga-Togami combination discloses a network client optical transceiver module of claim 1, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-

[190] Ex. SS at 171:21-172:25.

[191] Ex. NN at 20.

[192] Ex. NN at 20-21.

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factor (XFP); XENPAK; X2; XPAK. For the device of Claim 1, *see supra*, Section IX.A.i.

172. Specifically, Togami teaches an opto-electronic transceiver module formed as a Small Form-factor Pluggable ("SFP") transceiver in accordance with the Multi Source Agreement (MSA), which defines the physical size and shape of transceiver modules and the corresponding host port in order to insure interoperability between different manufacturer's products.[193]

173. Togami further states that the optical transceiver module disclosed is not limited to an SFP form factor and can be utilized in many types of pluggable electronic module formats.[194] It would have been obvious to a POSITA that this would include other form factors, such as XFP, X2, XPAK, and XENPAK, which were all included in a well-known series of pluggables at the time of the '754 Patent's priority date because each of these form factors were the subject of multiple source agreement (MSA) standards, making them standard form factors in the optical communications industry.[195] In fact, the '754 Patent itself discloses these form factors as being in the prior art as related optical interface implementations, shown below.[196]

[193] Ex. F at 2:1-10, 2:54-3:4.

[194] *Id.* at 2:57-62.

[195] Ex. S; Ex. T; Ex. U.

[196] Ex. A at Fig. 13.

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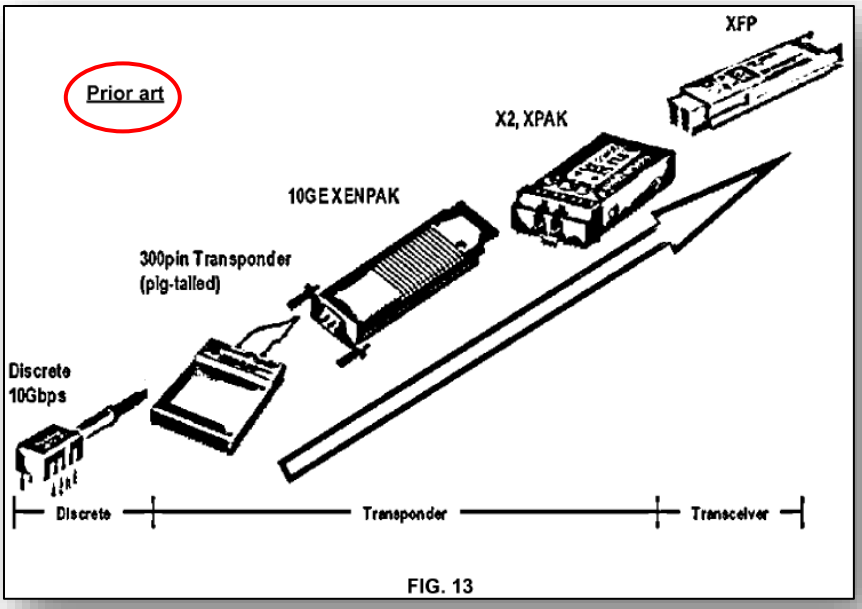


FIG. 13

174. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 2.

iii. Claim 3: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times.

175. Under NextGen's apparent theory of infringement[197], it is my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times. For the device of Claim 1, *see supra*, Section IX.A.i.

176. As previously discussed above in the analysis of [1.pre] and [1.c], Shraga and

[197] Ex. NN at 21.

Togami in combination disclose an optical transceiver module which is configured to receive downstream communications from the OLT in a passive optical network, allocating start times for each ONT/ONU to begin upstream data transmission, and each ONT/ONU is configured to transmit back to the OLT, in the upstream direction, data communications responsive to the start time allocated to it.

177. As discussed above in the analysis of [1.c], Shraga teaches that the CLU of each ONT/ONU constructs the transmission window in accordance with pointers contained in the header (shown in yellow in Fig. 3 below) sent in the down-stream frame from the OLT.[198] Shraga teaches that, in addition to containing the start transmission time, the ONT pointers section (shown in green in Fig. 3 below) includes a "maximum length" (identified as 93 below) that each ONT's/ONU's window is permitted to transmit within.[199] This length corresponds to the up-stream bandwidth that has been allocated to each individual ONT/ONU by the OLT and is based upon the total bandwidth requested by all the ONTs/ONUs.[200]

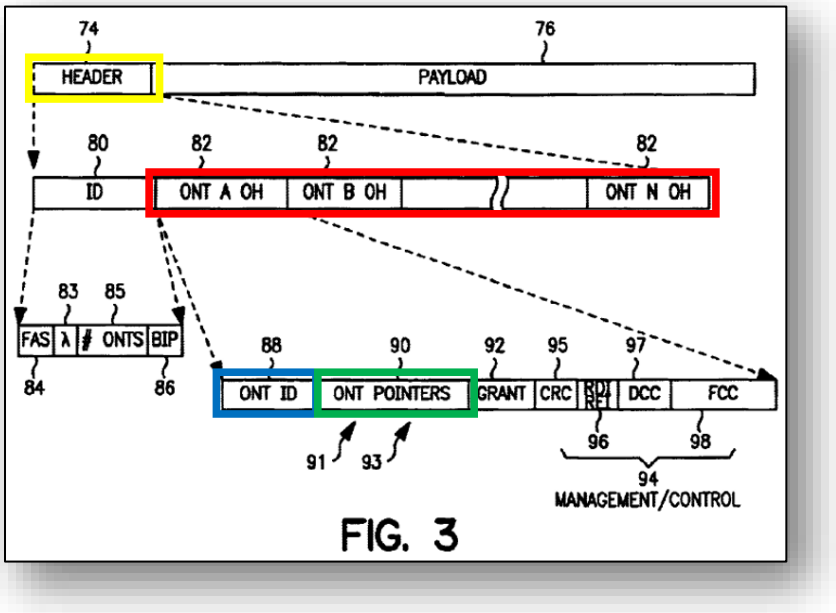


FIG. 3

178. As discussed above in the analysis of [1.c], once an ONT/ONU has received its

[198] Ex. E at 9:66-10:13, 10:38-11:6, Fig. 2, Fig. 3.

[199] *Id.* at 10:56-11:6.

[200] *Id.*

allocation from the OLT (shown in yellow in Fig. 7 below), the CLU of the ONT/ONU uses this information to construct the transmission window, beginning with the overhead section (shown in red below).[201] As illustrated in Figure 7 below, the CLU of the ONT/ONU constructs the window in accordance with the length (93) (shown in blue below) provided by the pointer of the downstream transmission.[202] The length of each channel payload section is determined by the CLU such that the length of the overall transmission window is less than or equal to the maximum window length allocated by the OLT.[203]

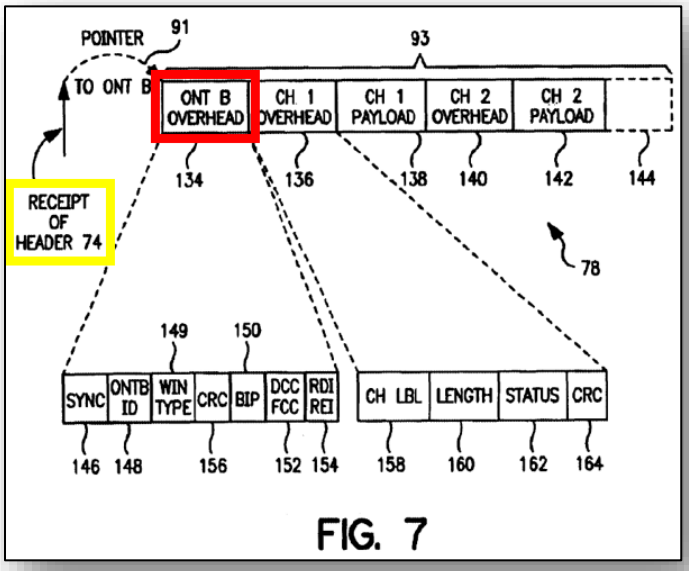


FIG. 7

179. After the window is fully constructed by the CLU, the ONT/ONU transmits the window upstream at the start time allocated to it.[204] Because each ONT/ONU receives an assigned transmission start time and transmission length time from the OLT, each ONT/ONU would thus know that its transmission must end at a certain time, possessing the equivalent knowledge of an assigned "end time." Therefore, a POSITA would have understood that Shraga teaches a transceiver module "configured to end transmissions to the head-end of the passive optical network

[201] *Id.* at 14:42-57, Fig. 7.

[202] *Id.* at 10:56-11:6, Fig. 7.

[203] *Id.* at 15:26-37, Fig. 7.

[204] *Id.*; *Id.* at 9:56-65.

response to the end times" provided by the head-end OLT.

180. A POSITA would have understood that, in describing a transmission system that allocates a certain number of times slots for transmission, Shraga would disclose a respective start time and end time for data communications from the ONTs/ONUs to the OLT. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 3.

181. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 3 was well known prior to the earliest alleged filing date of the '754 Patent.[205] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "end times," was well known prior to the earliest alleged filing date of the '754 Patent.[206]

iv. Claim 4: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times.

182. Under NextGen's apparent theory of infringement[207], it is my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times. For the system of Claim 1, *see supra*, § IX.A.i.

183. As previously discussed above in the analysis of [1.pre] and [1.c], Shraga and Togami in combination disclose a pluggable optical transceiver module which is configured to receive downstream communications from the OLT in a passive optical network, allocating start

[205] Ex. SS at 182:16-24.

[206] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[207] Ex. NN at 21-22.

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times for each ONT/ONU to begin upstream data transmission, and each ONT/ONU is configured to transmit back to the OLT, in the upstream direction, data communications responsive to the start time allocated to it.

184. As further discussed in Claim 3 above, Shraga explicitly teaches that the ONT pointers section (shown in green in Fig. 3 below) includes a "maximum *length*" (identified as 93 below) that each ONT's/ONU's window is permitted to transmit within.[208] This length corresponds to the upstream bandwidth that has been allocated to each individual ONT/ONU by the OLT and is based upon the total bandwidth requested by all the ONTs/ONUs.[209]

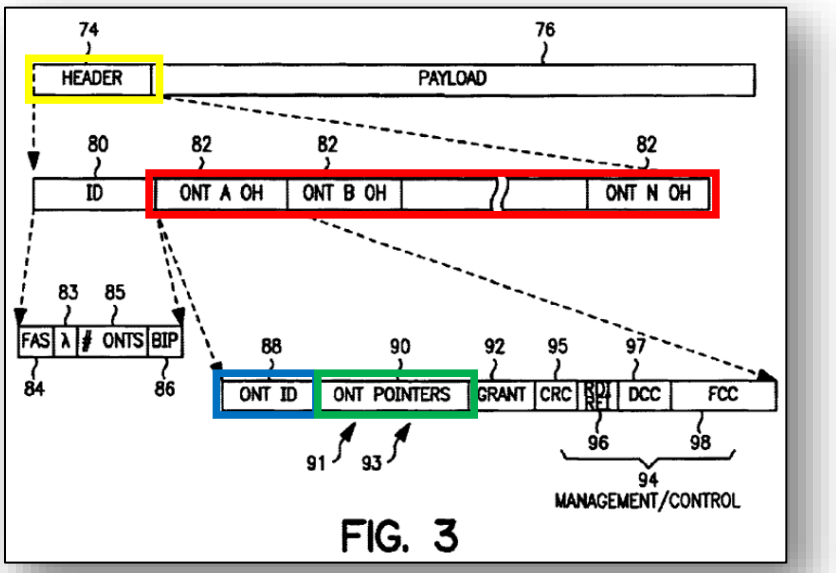


FIG. 3

185. As also discussed in Claim 3 above, Shraga explicitly teaches that each ONT/ONU is configured to transmit data back to the OLT with the same length allocation, as the CLU of the ONT/ONU constructs the upstream window in accordance with the length (93) (shown in blue below) provided by the pointer of the downstream transmission.[210] After the window is fully constructed by the CLU, the ONT/ONU transmits the window upstream at the start time allocated

[208] Ex. E at 10:56-11:6.

[209] *Id.*

[210] *Id.* at 10:56-11:6, 15:26-37, Fig. 7.

to it.[211]

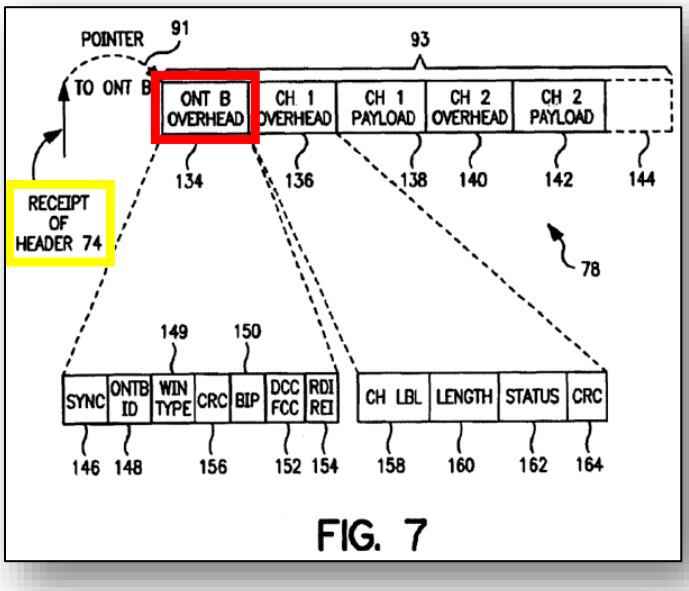


FIG. 7

186. A POSITA would have understood this limitation explicitly discloses communications representing lengths of time responsive to start times for transmitting data from the ONTs/ONUs to the OLT. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 4.

187. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 4 was well known prior to the earliest alleged filing date of the '754 Patent.[212] The inventors and patent owners also admit that TC-Layer functionality was well known prior to the earliest alleged filing date of the '754 Patent.[213]

[211] *Id.*; *Id.* at 9:56-65.

[212] Ex. SS at 182:16-24.

[213] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

v. Claim 5: The network client optical transceiver module of claim 1, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers.

188. Under NextGen's apparent theory of infringement[214], it is my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: multimode optical fibers; and single mode optical fibers. For the device of Claim 1, *see supra,* § IX.A.i.

189. A POSITA would have understood that the optical fibers discussed in Shraga would consist of either multimode optical fibers or single mode optical fibers, as these were well-known in the optical communications space during the early 2000's as the types of optical fibers used in passive optical network data communications.[215] In fact, a POSITA would have known that optical fibers must either be single-mode type or multi-mode type fibers—there are no other types of optical fibers.

190. Therefore, it is my opinion that the Shraga-Togami combination discloses a network client optical transceiver module "wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers."

vi. Claim 6: The network client optical transceiver module of claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

191. Under NextGen's apparent theory of infringement[216], it is my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of Claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC);

[214] Ex. NN at 22.

[215] Ex. P at 33-37.

[216] Ex. NN at 22-23.

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Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU). For the device of Claim 1, *see supra*, § IX.A.i.

192. Specifically, Togami discloses an opto-electronic transceiver module which contains a connector portion positioned at the front end of the base of the module (shown in yellow in Fig. 2 below).[217] The connector portion partially defines a cavity that forms a receptacle sized and shaped to operably interface with an optical fiber cable connector (shown in red in Fig. 2 below).[218]

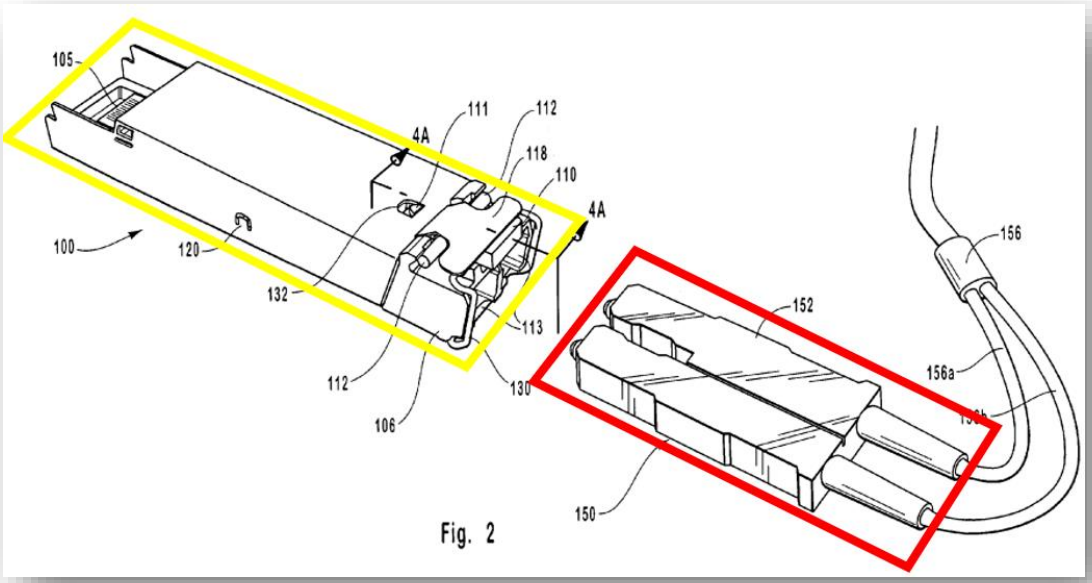


Fig. 2

193. Further, Togami explicitly states that this receptacle could be implemented so as to accommodate any one of a number of different connector configurations, depending on the particular application.[219] This includes but is not limited to, as Togami discloses, a Fiber Channel (FC) connector and an Infiniband connector.[220]

194. A POSITA would have understood the language of Togami to disclose other forms

[217] Ex. F at 5:38-48.

[218] *Id.*

[219] *Id.*

[220] *Id.*

of connector configurations, such as Subscriber Connector (SC), Lucent Connector (LC), Straight TP (ST), or Miniature Unit (MU), which were all well-known connectors in the early 2000's time frame.[221]

195. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 6.

vii. Claim 7: The network client optical transceiver module of claim 1, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

196. Under NextGen's apparent theory of infringement[222], it is my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface. For the device of Claim 1, *see supra*, ¶¶ IX.A.ii-vii.

197. As previously discussed above in the analysis of [1.pre] and [1.d], Togami discloses a pluggable optical transceiver module capable of being operatively received via an electrical interface within a compatible port provided by a host device.[223]

198. A POSITA would have understood that the electrical interface this limitation discloses would be selected from a group containing a serial interface, a parallel interface, or a XAUI interface, all of which were well known electrical interfaces in the optical communications space in the early 2000s.[224]

199. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 7.

[221] Ex. W.

[222] Ex. NN at 23.

[223] Ex. F at 2:54-3:22.

[224] Ex. X.

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viii. Claim 8: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network.

200. Under NextGen's apparent theory of infringement[225], it is my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network. For the device of Claim 1, *see supra*, § IX.A.i.

201. As previously discussed above in the analysis of [1.pre] and [1.b], Shraga discloses an optical interface connecting each of the ONTs/ONUs to the optical distribution fabric of the passive optical network, which a POSITA would have known was bi-directional based on its ability to receive incoming data communications and transmit outgoing data communications.[226]

202. Further, Shraga's Figure 1, shown below, illustrates a diagram of a set of ONTs/ONUs in a passive optical network, each containing an optical interface which connects directly to the framing block of the device, consisting of the Tx Framer (transmit framer) and Rx Framer (receive framer) (shown in yellow in Fig. 1 below). Additionally, each ONT/ONU contains a CLU (shown in red in Fig. 1 below), the control module of the device, which is electrically coupled to the components of the ONT, including the framing components as discussed above in the analysis of [1.c].[227] The CLU instructs the transmit framer, via electrical signals, to assemble data prior to transmission upstream.[228]

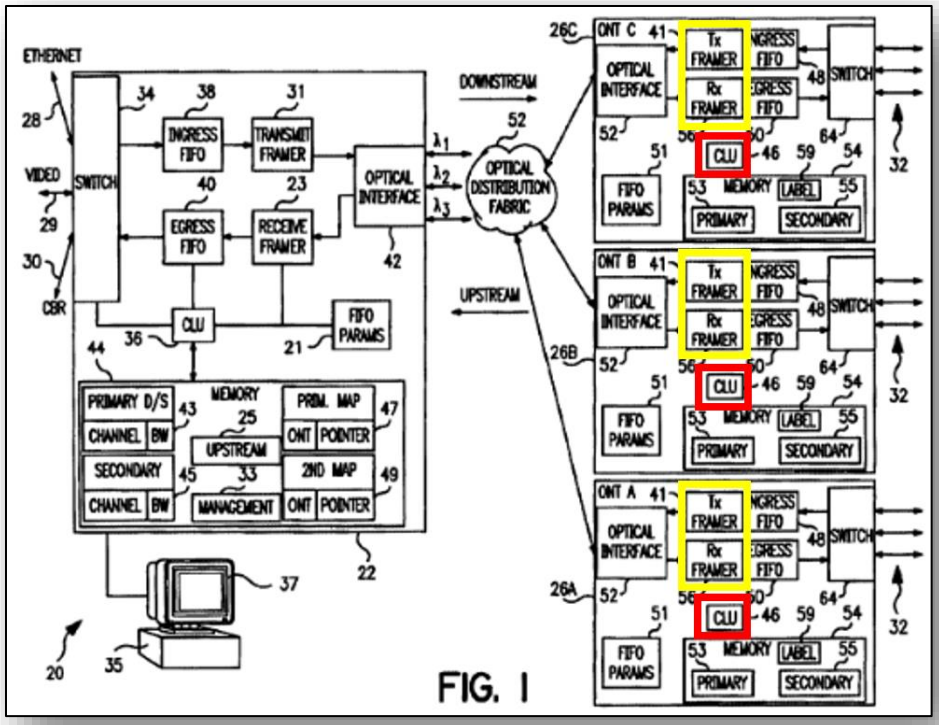
[225] Ex. NN at 23-24.

[226] Ex. E at 8:36-47, Fig. 1.

[227] *Id.* at 7:60-8:9, 8:36-43, Fig. 1.

[228] *Id.*; *Id.* at 9:48-55.

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203. Thus, the ONTs/ONUs disclosed in Shraga contain all the components for framing data communications in a passive optical network. A POSITA would have understood that these components would be configured to receive and transmit data communications in accordance with a framing protocol for the passive optical network, as Shraga discusses how the CLU coordinates framing data communications for transmission in accordance with the time slot allocation from the OLT.[229]

204. Specifically, Shraga teaches that the opto-electronic transceiver module disclosed transmits data according to a protocol of the passive optical network, though discusses explicitly that the data transferred is "not specific to any one protocol or service, and may be transmitted into and from the network according to substantially *any* protocol or service."[230]

205. Thus, a POSITA would have understood the Shraga-Togami combination to

[229] Ex. E at 15:26-36.

[230] *Id.* at 16:38-58.

disclose Claim 8.

ix. Claim 9: The network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module.

206. Under NextGen's apparent theory of infringement[231], in my opinion, a POSITA would have understood the Shraga-Togami combination to disclose the network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module. For the device of Claim 1, *see supra*, § IX.A.i.

207. Specifically, Shraga discloses a reference, U.S. Patent No. 5,528,592, which consists of a method for routing data in a passive optical network. The data includes a routing label determining an output port for the data packet, and an identifier that determines switching paths which connect the packet's source to a destination, such as a specific ONT/ONU.[232]

208. Further, Shraga discloses a similar method of data transmission, where the downstream transmission from an OLT to an ONT/ONU contains a downstream frame header (shown in yellow in Fig. 2 and 3 below), comprising a frame identification section (shown in red in Fig. 3 below), which directs each window of data to the correct destination ONT/ONU.[233] The number of header sections corresponds to the number of ONTs/ONUs with which the OLT communicates.[234]

[231] Ex. NN at 24.

[232] Ex. E at 1:56-67.

[233] *Id.* at 10:38-11:15, Fig. 2, Fig. 3.

[234] *Id.*

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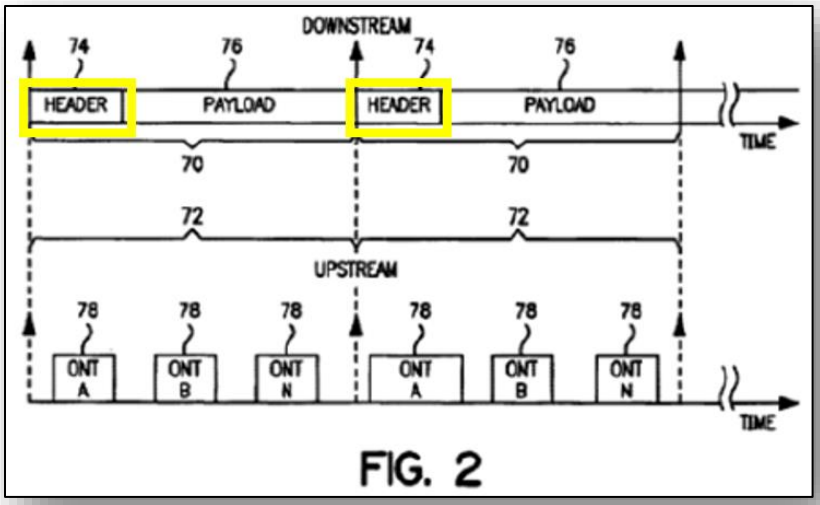


FIG. 2

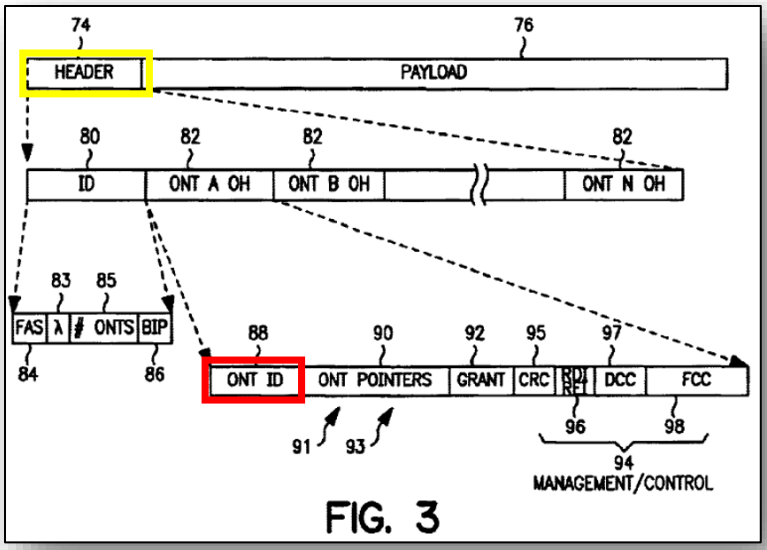


FIG. 3

209. A POSITA would have understood that this ONT ID section is an assignment of an identification address to each ONT/ONU in order to aid in data transmission over the passive optical network. In this way, the OLT can apportion data correctly to each ONT/ONU by assigning it an identification address for transmitting downstream communications and receiving upstream transmissions.

210. Additionally, A POSITA would have inherently had knowledge of the specifics of data communications in a passive optical network as described in various ITU-T standards

recommendation documents, such as the G.983.X Standard Recommendations and G.984.X Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module possessing the functionality of a traditional ONT/ONU would have contained a "control module" configured to receive an assigned network identification address from the head-end of the network and wherein the assigned network identification address can be used for receiving data addressed to the pluggable optical transceiver module.

211. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 9.

212. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[235] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 9, was well known prior to the earliest alleged filing date of the '754 Patent.[236]

x. Claim 10: The network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.

213. Under NextGen's apparent theory of infringement[237], in my opinion, a POSITA would have understood the Shraga-Togami combination to disclose the network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients. For the device of Claim 1, *see supra*, § IX.A.i.

214. As previously discussed above in Claims [1.pre] and 9, Shraga discloses a method for assigning and identifying ONTs/ONUs in a passive optical network. Shraga discloses the

[235] Ex. SS at 182:16-24.

[236] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8, 212:21-213:1.

[237] Ex. NN at 24-25.

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computation of a header by the OLT CLU through the process of determining how many ONTs/ONUs are active in the passive optical network, stating that "methods for performing such determinations" are well-known in the art."[238] This method is implemented by the CLU, which is configured to respond to the head-end identifying itself as a new client.[239] Shraga also states, as discussed above in Claim 8, that preferred embodiments of the present invention are "not specific to any one protocol or service" but may be implemented according to substantially any protocol or service."[240]

215. Additionally, A POSITA would have inherently had knowledge of the specifics of data communications in a passive optical network as described in various ITU-T standards recommendation documents, such as the G.983.X Standard Recommendations and G.984.X Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module possessing the functionality of a traditional ONT/ONU would have contained a "control module" configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.

216. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 10.

217. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 10 was well known prior to the earliest alleged filing date of the '754 Patent.[241] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 10, was well known prior to the earliest alleged filing date of the '754 Patent.[242]

[238] Ex. E at 11:48-60, Fig. 4.

[239] *Id.* at 11:49-61, 15:26-36, Fig. 4.

[240] *Id.* at 16:39-49.

[241] Ex. SS at 182:16-24.

[242] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

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xi. 12Claim 11: The network clients optical transceiver module of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module.

218. Under NextGen's apparent theory of infringement[243], in my opinion, a POSITA would have understood the Shraga-Togami combination to disclose the network client optical transceiver of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module. For the device of Claim 1, *see supra*, § IX.A.i.

219. Specifically, Shraga teaches that, because each ONT/ONU is some distance from the OLT, the distance causes a delay in signal transmission from the specific ONTs/ONUs to the OLT proportional to the distance.[244] Further, to compensate for this delay, a ranging time is added to each ONT/ONU's initial window start time determined by one of the ranging methods known in the passive optical network art, such as by sending a ranging signal from the OLT into the passive optical network and waiting for corresponding responses from active ONTs/ONUs.[245] The ranging signal responses are sent at the command of each ONT/ONU's CLU, which, as discussed above in the analysis of [1.c], controls the reception and transmission of signals for ONTs/ONUs on the passive optical network (i.e., the control module is configured to respond to a delay message from the head-end).[246] Once the ranging signal responses (i.e., the response delay messages) have been received from each ONT/ONU operating on the passive optical network, the OLT determines the ranging time to compensate for the delay by adding a ranging time to the initial start time allocated to each ONT/ONU in order to compensate for the delay in transmission.[247] A POSITA would have known that one such ranging method in the passive optical network art would have been that disclosed in the G.984.3 Draft Recommendation/Contribution 104.

[243] Ex. NN at 25-27.

[244] Ex. E at 12:34-60.

[245] *Id.*

[246] *Id.* at 12:40-60, 7:60-8:9, 8:36-47.

[247] *Id.* at 12:53-60.

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220. Additionally, A POSITA would have inherently had knowledge of the specifics of data communications in a passive optical network as described in various ITU-T standards recommendation documents, such as the G.983.X Standard Recommendations and G.984.X Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module possessing the functionality of a traditional ONT/ONU would have contained a "control module" configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the pluggable optical transceiver module to the head end of the network.

221. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 11.

222. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 11 was well known prior to the earliest alleged filing date of the '754 Patent.[248] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 11, was well known prior to the earliest alleged filing date of the '754 Patent.[249]

xii. Claim 12: The network client optical transceiver module of claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.

223. Under NextGen's apparent theory of infringement[250], in my opinion, the Shraga-Togami combination discloses the network client optical transceiver module of Claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process. For the device of Claim 1, *see supra*, § IX.A.i.

[248] Ex. SS at 182:16-24.

[249] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[250] Ex. NN at 28.

224. As discussed above in Claim 11, Shraga teaches that the distance between each ONT/ONU and the OLT causes a delay in the transmission of signals in the passive optical network.[251] To account for this transmission delay, the OLT initiates a response delay process, sending a ranging signal to each ONT/ONU requesting that the ONT/ONU respond with a ranging signal response, which the OLT then utilizes to determine how to allocate each ONT/ONU's transmission start time to compensate for the delay (i.e., the "response delay process").[252] The OLT factors this delay into the start time that it allocates to each ONT/ONU.[253] As discussed above in the analysis of [1.c], the ONT/ONU is configured to transmit, at the command of its CLU, data signals in response to the start time it is allocated by the OLT, which includes the ranging time compensation (i.e., "network period").[254] The upstream transmission from the ONT/ONU to the OLT is thus aligned to the network period in order to account for transmission delays.

225. Additionally, A POSITA would have inherently had knowledge of the specifics of data communications in a passive optical network as described in various ITU-T standards recommendation documents, such as the G.983.X Standard Recommendations and G.984.X Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module possessing the functionality of a traditional ONT/ONU would have contained a "control module" configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.

226. Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 12.

227. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 12 was well known prior to the earliest alleged filing date of the '754 Patent.[255]

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[251] *Id.*

[252] *Id.*

[253] *Id.* at 12:54-65.

[254] *Id.* at 7:60-8:9, 8:36-47, 12:40-60.

[255] Ex. SS at 182:16-24.

The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 12, was well known prior to the earliest alleged filing date of the '754 Patent.[256]

xiii. Claim 13: The network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.

228. Under NextGen's apparent theory of infringement[257], in my opinion, the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network. For the device of Claim 1, *see supra*, § IX.A.i.

229. Specifically, Shraga discusses communication between the OLT and an ONT in a passive optical network to adjust the operation parameters of the ONT, including ranging.[258] Shraga also discusses using lasers in optical transmitters in a passive optical network: "[i]nterface 42 converts data from transmit framer 31 to an optical format, most preferably by modulating a laser comprised in the interface and transmitting the laser output into fabric 24."[259] As discussed previously, because the control module of the ONT/ONU is configured to operate the transmitting and receiving functions of the optical transceiver module, a POSITA would have understood that the control module would have been configured to adjust the transmitting power level.[260] Shraga further refers to the "passive optical network art" that was known at the time of the patent.[261]

230. Additionally, a POSITA would have inherently had knowledge of the specifics of data communications in a passive optical network as described in various ITU-T standards recommendation documents, such as the G.983.X Standard Recommendations and G.984.X

[256] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[257] Ex. NN at 28.

[258] Ex. E at 12:41-53.

[259] *Id.* at 8:10-14, 8:36-42.

[260] *Id.*

[261] *Id.* at 12:41-43.

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Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module possessing the functionality of a traditional ONT/ONU would have contained a "control module" configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.

231. Accordingly, a POSITA would have understood the Shraga-Togami combination to disclose Claim 13.

232. Moreover, it is my understanding that the inventors and patent owners themselves assert that the concept of a controller (or "control module") capable of performing the functions described in Claim 13 was well known prior to the earliest alleged filing date of the '754 Patent.[262] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 13, was well known prior to the earliest alleged filing date of the '754 Patent.[263]

xiv. Claim 14: The network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.

233. Under NextGen's apparent theory of infringement[264], in my opinion, the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network. For the device of Claim 1, *see supra*, § IX.A.i.

234. Shraga discloses a payload section of a framing protocol in the transmission of data upstream from ONTs/ONUs to an OLT (shown in yellow in Fig. 7 below).[265] Shraga states that each upstream transmission contains channel payload sections that together have a length determined by the CLU of the ONT/ONU that is less than or equal to the maximum window length

[262] Ex. SS at 182:16-24.

[263] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[264] Ex. NN at 28-29.

[265] *Id.* at 14:43-15:13, Fig. 7.

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received in the pointers section of the downstream OLT transmission (identified as 93 below).[266]

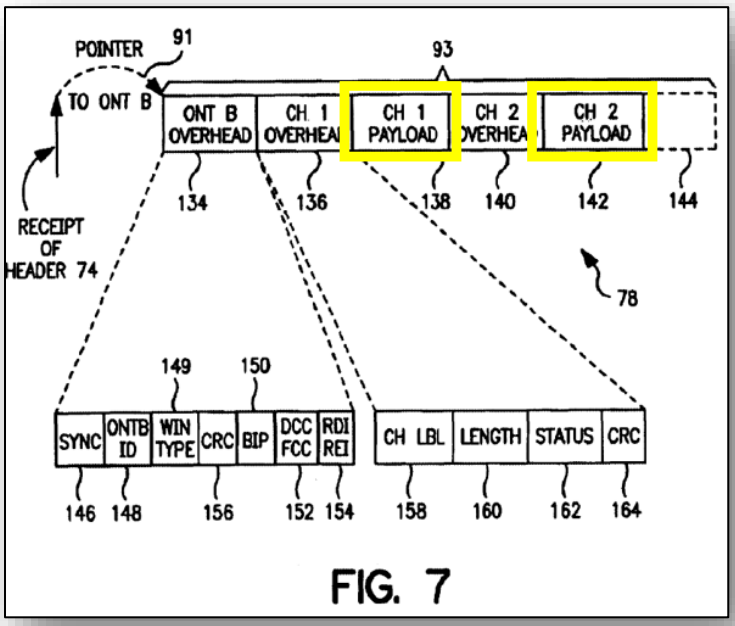


FIG. 7

235. Shraga describes the construction of the payload section, which consists of a process wherein the CLU reads data from ingress FIFO connected to the electrical interface, along with the FIFO parameters table and the allocated bandwidth of each channel, to construct the window, which is then transmitted upstream at a start transmission time after receipt of the header.[267] This process is depicted below in Figure 6, where the CLU checks the ingress FIFO for data to be incorporated into the payload section (shown in yellow below) before constructing the channel overhead section and channel payload section (shown in red below), which consists of the data read from the ingress FIFO.[268]

[266] *Id.* at 15:26-36.

[267] *Id.*

[268] *Id.* at 13:48-67, 9:56-57.

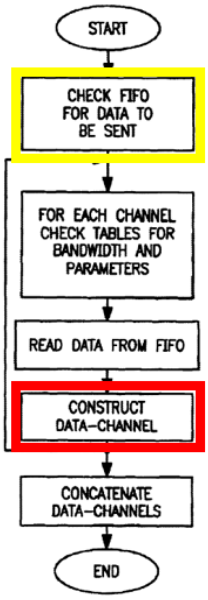


FIG. 6

236. Additionally, a POSITA would have inherently had knowledge of the specifics of data communications in a passive optical network as described in various ITU-T standards recommendation documents, such as the G.983.X Standard Recommendations and G.984.X Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module possessing the functionality of a traditional ONT/ONU would have contained a "control module" configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.

237. Thus, a POSITA would have understood the Shraga-Togami combination in view to disclose Claim 14.

238. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 14 was well known prior to the earliest alleged filing date of the '754 Patent.[269] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 14, was well known prior to the earliest alleged filing date of the '754

[269] Ex. SS at 182:16-24.

Patent.[270]

xv. Claim 15: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

239. Under NextGen's apparent theory of infringement[271], in my opinion that the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier. For the device of Claim 1, *see supra*, § IX.A.i.

240. Specifically, Shraga discloses an optical interface that converts data to an optical format by "modulating a laser comprised in the interface and transmitting the laser output" into the optical distribution fabric.[272] Likewise, Togami discloses that a transceiver module "typically contains a laser transmitter circuit" that is capable of opto-electrical conversion and the transmission and receipt of optical communications signals.[273]

241. Regardless, the components listed in Claim 15 are traditional components of a transceiver utilized in a data communications system of a passive optical network. The '754 Patent recognizes this: "[a] typical optical module is composed of a: laser []; laser driver (LD) []; photo detector (PD); transimpedance amplifier (TIA) []; limiting amplifier (LA) []."[274] In fact, the '754 Patent contains Figure 11 (shown below), which depicts a "typical optical module" and is labeled as prior art, contains the components claimed in Claim 15.

[270] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[271] Ex. NN at 29.

[272] Ex. E at 8:10-18, 8:36-43.

[273] Ex. F at 1:51-54.

[274] Ex. A at 1:56-62.

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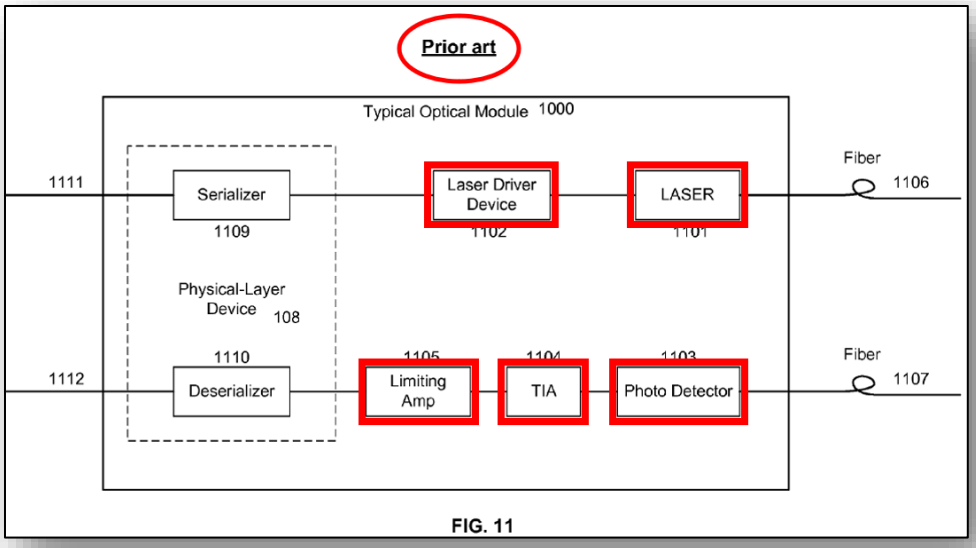


FIG. 11

242. It would have been obvious to any POSITA that these components would have been necessary to transmit optical data communications across a passive optical network.[275] Thus, a POSITA would have understood the Shraga-Togami combination to disclose Claim 15.

xvi. Claim 16: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

243. Under NextGen's apparent theory of infringement[276], in my opinion, the Shraga-Togami combination discloses the network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip. For the device of Claim 1, *see supra*, § IX.A.i.

244. As previously discussed above in the analysis of [1.pre], Shraga discloses an optical transceiver module that is an ONT. Additionally, a POSITA would have inherently had knowledge

[275] *Id.*; Ex. P at Fig. 11.7.

[276] Ex. NN at 29-30.

of the specifics of data communications in a passive optical network as described in various ITU-T standards recommendation documents, such as the G.983.X Standard Recommendations and G.984.X Standard Recommendations. In light of this knowledge, it would have been obvious to a POSITA that any pluggable optical transceiver module, acting as an ONT and possessing the functionality of a traditional ONT/ONU, would have contained a MAC discrete chip or a TC-Layer discrete chip. A POSITA would have understood that an optical transceiver performing data communications in a passive optical network would inherently contain a TC-Layer discrete chip as well as a MAC discrete chip, such as the MAC controller disclosed in Fujimori, in order to operate in accordance with standard network protocols.

245. Thus, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 16.

xvii. Claim 18

a. [18.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, and the network client optical transceiver module having an optical port to one or more optical fibers of the passive optical network, and the network client optical transceiver module having an optical interface block optically coupled to the optical port and for converting electrical signals to optical signals and for converting optical signals to electrical signals, and the network client optical transceiver module having an optical interface block and for communicating with the head-end of the passive optical network, and the network client optical transceiver module having an electrical network interface port electrically coupled to the control module and for electrically communicating to the switch or router, a method of communicating with the head-end of a passive optical network from the network client optical transceiver module comprising the steps of:

246. Under NextGen's apparent theory of infringement[277], to the extent the preamble is

[277] Ex. NN at 30-31.

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limiting, the Shraga-Togami combination discloses this claim for the same reasons as described in [1.pre] – [1.e].

b. [18.a] receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module;

247. Under NextGen's apparent theory of infringement[278], in my opinion, the Shraga-Togami combination discloses receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module.

248. Specifically, as discussed above in the analysis of [1.d], the Shraga-Togami combination discloses an electrical network interface port for communicating with the switch or router. Shraga teaches the coupling of ONTs to their downstream sides through an electrical interface, disclosing a switch explicitly.[279] Likewise, Togami discloses a pluggable transceiver electrically interfaced with a host device via a compatible connection port.[280] Host devices include network switches, hubs, routers, computers, or similar devices. *Id.* at 2:45-57. Specifically, the module disclosed in Togami includes an edge connector that electrically interfaces with the host device when the module is plugged in to the device port.[281]

249. Additionally, as discussed above in Claim 14, Shraga teaches that, in order for an ONT/ONU to construct the payload section of its upstream transmission, the CLU reads data from an ingress FIFO that is connected to the electrical interface.[282] Therefore, the optical transceiver module is configured to receive data communications via its electrical interface port, which would be connected to a switch or router. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module."

[278] Ex. NN at 31.

[279] Ex. E at 7:29-35, 8:10-18, Fig. 1.

[280] Ex. F at 1:55-58.

[281] *Id.* at 3:5-22, 5:21-36.

[282] Ex. E at 9:33-37, 9:56-57, 15:26-36.

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c. [18.b] storing the received data inside the network client optical transceiver module;

250. Under NextGen's apparent theory of infringement[283], in my opinion, the Shraga-Togami combination discloses storing the received data inside the network client optical transceiver module.

251. Shraga teaches an ONT/ONU that contains an ingress FIFO (first-in first-out logical memory) controlled by the CLU that acts as an initial buffer for upstream data (shown in yellow in Fig. 1 below).[284] Specifically, Shraga teaches that the ingress FIFO operates to store incoming data from the client device, such as a switch, prior to passing it on to the transmit framer for transmission onto the passive optical network.[285] After passing through the electrical interface port of the optical transceiver module, data received in the form of electrical signals from the client is transferred to the ingress FIFO where it is "written" to the FIFO.[286] Thus, the ingress FIFO stores received data temporarily until needed for transmission.

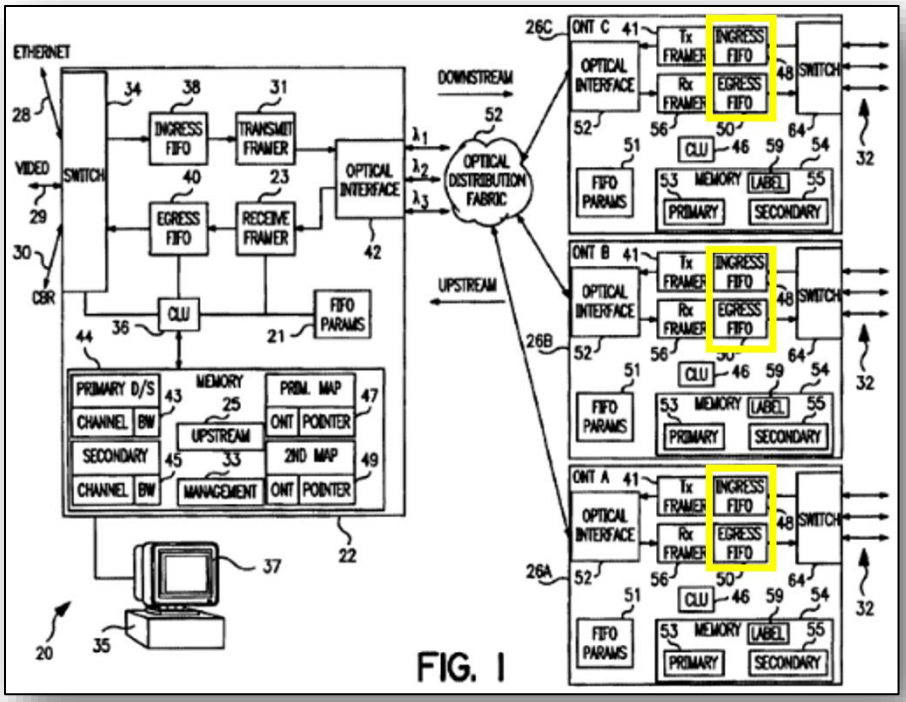
[283] Ex. NN at 31-32.

[284] Ex. E at Fig. 1, 8:2-9, 8:36-43, 9:33-37, 9:56-65.

[285] *Id*.

[286] *Id.*

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252. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "storing the received data inside the network client optical transceiver module."

d. [18.c] receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module;

253. Under NextGen's apparent theory of infringement[287], in my opinion, the Shraga-Togami combination discloses receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module.

254. As discussed above in the analysis of [1.c], the Shraga-Togami combination discloses a control module configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications. Specifically, Shraga teaches that downstream frames are transmitted from the OLT, comprised of a header containing a pointers section that includes a start transmission time as well as a maximum

[287] Ex. NN at 32.

window length, which is received by the ONTs/ONUs.[288]

255. Shraga further discloses that data communications from the OLT are received via the optical interface of each ONT/ONU.[289] The optical interface block is configured to receive incoming data communications from the optical distribution fabric and to transmit outgoing data communications to the optical distribution fabric.[290]

256. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module."

e. [18.d] converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module;

257. Under NextGen's apparent theory of infringement[291], in my opinion, the Shraga-Togami combination discloses converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module.

258. As discussed above in the analysis of [1.b], Shraga discloses an optical interface block configured to perform optical-to-electrical and electrical-to-optical signal conversion. Specifically, Shraga teaches an optical interface connecting each of the ONTs/ONUs to the optical distribution fabric.[292] Shraga further discloses that this optical interface converts data from a "transmit framer," which is an electrical signal, to an "optical format," which is an optical signal.[293] Additionally, the optical interface receives optical signals from the fabric and converts the signals

[288] Ex. E at 9:66-10:13, 10:38-11:6, Fig. 2, Fig. 3.

[289] *Id.* at 7:60-8:9, 8:36-47, Fig. 1.

[290] *Id.*; *id.* at 8:10-18, 8:36-43.

[291] Ex. NN at 32.

[292] Ex. E at 7:60-8:18, 8:36-47, Fig. 1.

[293] *Id.*

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to data, an electrical signal, which is then transferred to the receive framer.[294] Likewise, Togami discloses a transceiver module that "contains a laser transmitter circuit capable of converting electrical signals to optical signals and an optical receiver capable of converting received optical signals back into electrical signals."[295] Therefore, a POSITA would have understood that Shraga discloses converting the first optical signal received from the head-end to an electrical signal at the optical interface block.

259. As discussed above in the analysis of [1.c], Shraga discloses a control module that is configured to receive from the head-end of the passive optical network signals representing start times for transmitting data communications and is configured to transmit the data communications to the head-end responsive to the start times. Specifically, Shraga teaches that each ONT/ONU contains a CLU which controls the operation of data communications in the passive optical network, including data ingress (downstream from the head-end) and data egress (upstream to the head-end), as well as the transmit framer and receive framer, which allow the ONT/ONU to transmit and receive optical data communications.[296] The CLU of each ONT/ONU constructs an upstream transmission in accordance with start transmission time and maximum window length allocations from the head-end.[297] It would have been obvious to a POSITA that, in order to transmit data according to the start time allocation provided by the head-end, the optical signal representing the allocation would necessarily be conveyed to the CLU, which controls upstream transmission of the ONT/ONU once it was received by the optical interface and converted into an electrical signal.[298] Therefore, a POSITA would have understood that Shraga teaches conveying the electrical signal to the control module.

260. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver

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[294] *Id.*

[295] Ex. F at 1:39-54.

[296] Ex. E at 7:60-8:9, 8:36-47.

[297] *Id.* at 9:66-10:13, 10:38-11:6, 14:42-57, Fig. 2, Fig. 3, Fig. 7.

[298] *Id.*; *Id.* at 15:26-36, Fig. 7.

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module."

f. [18.e] processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network;

261. Under NextGen's apparent theory of infringement[299], in my opinion, the Shraga-Togami combination discloses processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network.

262. As discussed above in the analysis of [1.c], Shraga discloses a CLU (i.e., control module) that is configured to receive from the head-end of the passive optical network data communications representing start times for transmitting data communications and is configured to transmit the data communications to the head-end responsive to the start times and controls the operation of data communications in the passive optical network, including data ingress (downstream from the head-end) and data egress (upstream from the head-end), as well as the transmit framer and receive framer, which in conjunction allow the ONT/ONU to transmit and receive optical data communications.[300] As discussed previously, each ONT/ONU receives a start time allocation from the OLT, which indicates when each ONT/ONU is permitted to begin transmission of its data upstream.[301] This optical signal containing the start time is converted into an electrical signal which is used by the CLU to construct the data transmission in the upstream direction (i.e., "processing" the signal), consisting of an overhead section followed by a payload section in accordance with the constraints prescribed to it by the OLT, as discussed above in the analysis of [1.c]. [302]

263. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the

[299] Ex. NN at 33.

[300] Ex. E at 7:60-8:9, 8:36-47.

[301] *Id.* at 10:14-37, 13:24-46.

[302] *Id.* at 14:42-57, 15:26-36, Fig. 7.

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passive optical network."

g. [18.f] converting a portion of the stored received data to a second optical signal; and

264. Under NextGen's apparent theory of infringement[303], in my opinion, the Shraga-Togami combination discloses converting a portion of the stored received data to a second optical signal.

265. As discussed above in the analysis of [18.b], Shraga teaches an ingress FIFO within each ONT/ONU that operates to store incoming data from an external device prior to transmission onto the passive optical network.[304] When ready for transmission, the ONT/ONU constructs the overhead and payload sections in accordance with the start time and maximum window length allocation provided by the head-end, as discussed above in Claims [1.c], 3, and 4.[305] The ONT/ONU then, at the direction of the CLU, converts the stored data contained in the payload section of the upstream transmission window into an optical signal at the optical interface for transmission onto the passive optical network.[306]

266. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "converting a portion of the stored received data to a second optical signal."

h. [18.g] transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network; whereby

267. Under NextGen's apparent theory of infringement[307], in my opinion, the Shraga-Togami combination discloses transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network.

[303] Ex. NN at 33.

[304] Ex. E at 8:2-9, 8:36-43, 9:33-37, 9:56-65.

[305] *Id.* at 9:56-65, 14:42-57, 15:26-36, Fig. 7.

[306] *Id.*, *Id.* at 8:10-18, 8:36-43.

[307] Ex. NN at 33.

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268. As discussed above in the analysis of [1.c], the Shraga-Togami combination discloses a control module (CLU) within each ONT/ONU that constructs an upstream transmission window in accordance with start transmission times allocated to it from the OLT.[308]

269. Further, as discussed previously in [1.c], Shraga teaches an optical interface block, containing an optical interface port for connecting to optical fibers of the optical distribution network that is configured to receive incoming data communications from the network and to transmit outgoing data communications to the network.[309] Each ONT receives a start window transmission time and maximum length of window time, which the CLU utilizes to construct the upstream transmission window in the transmit framer, for transmission in accordance to its allocation from the head-end.[310] As discussed above in the analysis of [18.f], Shraga discloses that the upstream window is then transferred to the optical interface from the transmit framer where it is converted to an optical format by "modulating a laser comprised in the interface and transmitting the laser output into [the] fabric."[311]

270. Thus, a POSITA would have understood the Shraga-Togami combination to disclose "transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network."

i. [18.h] the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and the network client optical transceiver module electrically communicates with the switch or router.

271. Under NextGen's apparent theory of infringement[312], in my opinion, the Shraga-Togami combination discloses that the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data

[308] Ex. E at 14:42-57, 15:26-36, Fig. 2, Fig. 3, Fig. 7.

[309] *Id.* at 7:60-8:18, 8:36-47, Fig. 1.

[310] *Id.*; *Id.* at 9:56-65, 10:56-11:15.

[311] *Id.* at 8:10-18, 8:36-43.

[312] Ex. NN at 33-34.

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transmissions and the network client optical transceiver module electrically communicates with the switch or router.

272. As discussed above in the analysis of [1.c], and again in [18.e] and [18.g], the Shraga-Togami combination discloses a transceiver module configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications. Specifically, Shraga teaches that the OLT transmits downstream frames containing a pointer section that includes a start transmission time allocation for each ONT/ONU.[313] The ONTs/ONUs receive this allocation transmission and construct responsive communications accordingly before it transmits its data via the optical interface back to the OLT.[314] Therefore, the optical transceiver module disclosed by the Shraga-Togami combination is configured to communicate with the head-end of the network (i.e., the OLT) responsive to start times.

273. Further, as discussed above in the analysis of [1.d], the optical transceiver module disclosed in Shraga and Togami is configured to electrically communicate with a user device, including switches and routers. Specifically, Shraga discloses that the ONTs, upon receiving communications from the optical network, convert these optical signals to data signals.[315] The ONT/ONU then communicates these electrical signals to the downstream clients of the passive optical network.[316]

274. Additionally, also discussed in the analysis of [1.d], Togami teaches a pluggable transceiver module electrically interfaced with a host device via a compatible connection port.[317] The module disclosed in Togami includes an edge connector that is capable of *electrically interfacing* with the host device when the module is plugged in to the device port.[318] Therefore,

[313] Ex. E at 9:66-10:13, 10:56-11:6, Fig. 2, Fig. 3.

[314] *Id.* at 14:43-15:13, 15:26-36, Fig. 7.

[315] *Id.* at 8:10-18, 8:36-43.

[316] *Id.*; *id.* at 7:29-35.

[317] Ex. F at 1:55-58.

[318] *Id.* at 3:5-22, 5:21-37.

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the signals sent between the transceiver module and host device consist of electrical signals.[319] Specifically, Togami discloses that host devices can include network switches, hubs, routers, computers, or other similar devices.[320]

275. Thus, a POSITA would have understood the Shraga-Togami combination to disclose that "the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and the network client optical transceiver module electrically communicates with the switch or router."

xviii. Claim 19: The method of claim 18, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.[321]

276. Under NextGen's apparent theory of infringement[322], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 2. For the method of Claim 18, *see supra*, § IX.A.xvii.

xix. Claim 20: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more end times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) terminating the transmission of the second optical signal responsive to an end time for data transmissions to the head-end of the passive optical network.

277. Under NextGen's apparent theory of infringement[323], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 3. For the method of Claim 18, *see supra*, § IX.A.xvii.

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[319] *Id.*

[320] *Id.* at 2:62-3:4.

[321] Claims 19-30 are method claims analogous to device claims 2-16 I discuss *supra* Sections IX.A.ii-xvi. Thus, my discussion of the respective corresponding device claim is incorporated into and mirrored for the discussion of the parallel method claim.

[322] Ex. NN at 34.

[323] *Id.* at 34-35.

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xx. Claim 21: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more lengths of time respective to the start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) transmitting the second optical signal responsive to a length of time for data transmissions to the head-end of the passive optical network.

278. Under NextGen's apparent theory of infringement[324], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 4. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxi. Claim 22: The method of claim 18, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: multimode optical fibers; and single mode optical fibers.

279. Under NextGen's apparent theory of infringement[325], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 5. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxii. Claim 23: The method of claim 18, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

280. Under NextGen's apparent theory of infringement[326], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 6. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxiii. Claim 24: The method of claim 18, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

281. Under NextGen's apparent theory of infringement[327], the Shraga-Togami

[324] *Id.* at 35.

[325] *Id.* at 35-36.

[326] *Id.* at 36.

[327] *Id.* at 36.

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combination discloses this claim for the same reasons as described in Claim 7. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxiv. Claim 25: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an assigned network identification address from the head-end of the passive optical network for addressing data to the network client optical transceiver module at the control module.

282. Under NextGen's apparent theory of infringement[328], the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 discloses this claim for the same reasons as described in Claim 9. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxv. Claim 26: The method of claim 18, further comprising the steps of: (g1) adjusting the transmission of the second optical signal form the optical interface block through the optical port to account for the response delay of the optical transceiver module.

283. Under NextGen's apparent theory of infringement[329], the Shraga-Togami combination discloses this claim for the same reasons as described in Claims 11 and 12. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxvi. Claim 27: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an optical power level and adjusting the transmit optical power level of the network client optical transceiver module to the determined optical power level.

284. Under NextGen's apparent theory of infringement[330], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 13. For the method of Claim 18, *see supra*, § IX.A.xvii.

[328] *Id.* at 37.

[329] *Id.* at 37-39.

[330] *Id.* at 40.

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xxvii. Claim 28: The method of claim 18, further comprising the steps of: (f1) encapsulating a portion of data received through the electrical network interface port into the payload section of a framing protocol for the passive optical network at the control module for conveyance to the optical interface block.

285. Under NextGen's apparent theory of infringement[331], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 14. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxviii. Claim 29: The method of claim 18, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

286. Under NextGen's apparent theory of infringement[332], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxix. Claim 30: The method of claim 18, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

287. Under NextGen's apparent theory of infringement[333], the Shraga-Togami combination discloses this claim for the same reasons as described in Claim 16. For the method of Claim 18, *see supra*, § IX.A.xvii.

B. Ground 1B: The Shraga-Togami-G.984.3 Draft Recommendation/Contribution 104 Combination renders claims 9-14, 16, 25-28, and 30 obvious.

288. ***Motivation to combine.*** As previously discussed, both Shraga and Togami relate to data communications within a passive optical network. A POSITA would have been motivated to combine Shraga and Togami because of the obvious benefits of pluggable optical transceiver

[331] *Id.* at 40.

[332] *Id.* at 40-41.

[333] *Id.* at 41.

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modules with the functions entirely disclosed in the G.984.3 Draft Recommendation/Contribution 104.

289. The G.984.3 Draft Recommendation/Contribution 104, like Shraga and Togami, relates to data communications within an optical network. Specifically, the G.984.3 Draft Recommendation/Contribution 104 disclose a specification for a Gigabit-capable Passive Optical Network Transmission Convergence Layer.[334] Further, the G.984.3 Draft Recommendation/Contribution 104 discloses a gigabit passive optical network system configuration as well as the structure of data communications, such as framing structure and ranging.[335] There are several reasons a POSITA would have been motivated to combine the G.984.3 Draft Recommendation/Contribution 104 with Shraga and Togami.

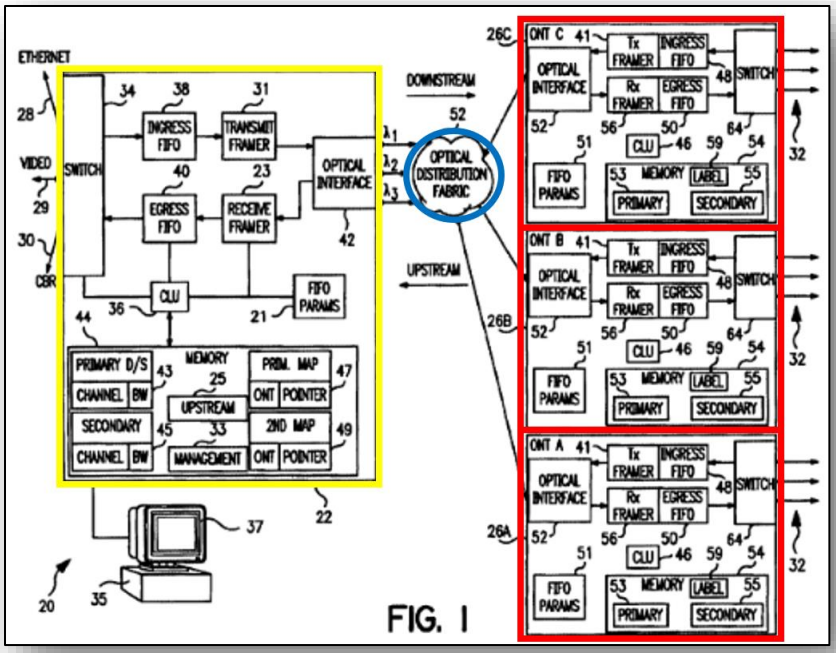
290. First, both Shraga and the G.984.3 Draft Recommendation/Contribution 104 describe the same passive optical network system architecture, wherein an OLT (shown in yellow in the figures below) is connected to multiple ONTs/ONUs (shown in red in the figures below) via a passive optical splitter and optical fibers.[336] Further, Shraga and the G.984.3 Draft Recommendation/Contribution 104 each disclose the components of ONTs/ONUs, as shown in the below figures.[337]

[334] Ex. M at 1; Ex. N at 1.

[335] *Id.* at Introduction.

[336] Ex. E at Fig. 1, 7:16-41, Ex. M at § 6.2; Ex. N at § 6.2.

[337] Ex. E at Fig. 1, 7:16-41.



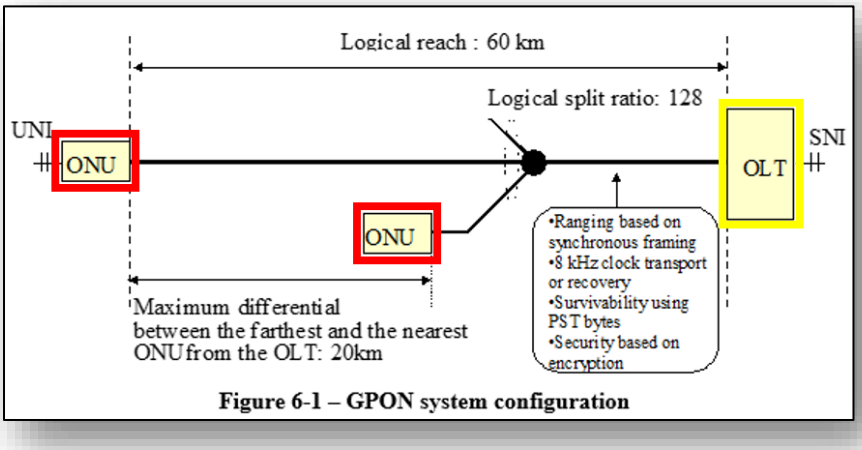


Figure 6-1 – GPON system configuration

291. Further, Shraga discloses several concepts involved in the operation of the passive optical network between an OLT and ONTs/ONUs, to which the G.984.3 Draft Recommendation/Contribution 104 provide additional disclosure. First, Shraga discloses ONTs/ONUs that contain a framing block and a CLU, which coordinates framing data

communications for transmission in accordance with the time slot allocation from the OLT.[338] A POSITA would have understood that the CLU and framing block would operate in accordance with a framing protocol, such as the framing protocol disclosed in the G.984.3 Draft Recommendation/Contribution 104. In fact, as discussed previously, Shraga discloses that data transferred in the network "may be transmitted into and from the network according to substantially *any* protocol or service."[339] A POSITA would have known that such a protocol would be found in a reference such as the G.984.3 Draft Recommendation/Contribution 104.

292. Second, Shraga teaches that the ONTs/ONUs are configured to respond to the OLT according to a network operating protocol for new clients (i.e., new ONTs/ONUs).[340] Specifically, Shraga discloses a flowchart in Figure 4 that teaches, as a first step, determining how many ONTs/ONUs are active in the passive optical network.[341] A POSITA would have understood that an ONT/ONU new to the network would operate in accordance with a protocol for new clients, such as the protocol disclosed in the G.984.3 Draft Recommendation/Contribution 104. Shraga further states that "methods for performing such determinations are known in the art" and, most preferably, "the method used includes processes for noting when a new ONT comes on-stream, as well as when an ONT goes off-stream."[342] It would have been obvious to a POSITA to look to the G.984.3 Draft Recommendation/Contribution 104 to teach a process for noting and registering new ONTs/ONUs on the network.

293. Third, Shraga teaches that, in order to compensate for the transmission delay caused by the physical distance between the OLT and each ONT/ONU, a "ranging time" (i.e., response delay) is added to the start time allocated by the OLT.[343] A POSITA would have understood that in order to compensate for a delay in network transmission, an ONT/ONU would have to operate in accordance with a protocol for determining a response delay, such as the process disclosed in the G.984.3 Draft Recommendation/Contribution 104. Further, as discussed previously, Shraga

[338] Ex. E at 15:26-36.

[339] *Id.* at 16:38-58.

[340] *Id.* at 11:48-60, 15:26-36, Fig. 4.

[341] *Id.*

[342] *Id.*

[343] *Id.* at 12:34-60.

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notes that transmission in the passive optical network can be conducted "according to substantially *any* protocol or service."[344]

294. Additionally, a POSITA would have naturally looked to the G.984.3 Draft Recommendation/Contribution 104, drafts to an ITU-T standard, to find techniques of data communication in a passive optical network, including time slot assignment to further aid in data transmission between a head-end and multiple ONTs/ONUs. A POSITA would have had knowledge of and would have understood the importance of the G.984.3 Draft Recommendation/Contribution 104 and their corresponding, eventual published standard, because adhering to it provided for the interoperability of equipment in an optical network from a variety of different vendors.[345]

295. For the reasons discussed above in Section IX.A, a POSITA would have been motivated to combine a passive optical network data communications system, like in Shraga, with a pluggable optical transceiver module, like in Togami and had a reasonable expectation of success in doing so. The same reasons above apply in relation to Togami and the G.984.3 Draft Recommendation/Contribution 104.

296. Both Shraga and the G.984.3 Draft Recommendation/Contribution 104 disclose data communication systems within an optical network. Shraga discloses a method for data communication from a central point (OLT) to multiple end points (ONTs) by frames divided into multiple time slots.[346] The OLT as described in Shraga acts as a controller of downstream signals to the ONTs and upstream signals from the ONTs, assigning specific time slots within which each ONT is allowed to transmit upstream.[347] The G.984.3 Draft Recommendation/Contribution 104 describe the framing structure by which an OLT communicates to multiple ONUs: downstream frames, from the OLT to the ONUs, indicating permitted locations for upstream traffic in upstream frames, from the ONUs to the OLT, synchronized with downstream frames.[348]

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[344] *Id.* at 16:38-58.

[345] *See, e.g.*, Ex. VV.

[346] Ex. E at Abstract.

[347] *Id.* at 2:36-41.

[348] Ex. M at § 7.4.1; Ex. N at § 7.4.1.

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297. Further, Shraga discloses several concepts involved in the operation of the passive optical network between an OLT and ONTs/ONUs, to which the G.984.3 Draft Recommendation/Contribution 104 provide a more in-depth disclosure. First, Shraga discloses ONTs/ONUs that contain a framing block and a CLU, which coordinates framing data communications for transmission in accordance with the time slot allocation from the OLT.[349] A POSITA would have understood that the CLU and framing block would operate in accordance with a framing protocol, such as the framing protocol disclosed in the G.984.3 Draft Recommendation/Contribution 104. In fact, as discussed previously, Shraga discloses that data transferred in the network "may be transmitted into and from the network according to substantially *any* protocol or service."[350] A POSITA would have known that such a protocol would be found in a reference such as the G.984.3 Draft Recommendation/Contribution 104.

298. Second, Shraga teaches that the ONTs/ONUs are configured to respond to the OLT according to a network operating protocol for new clients (i.e., new ONTs/ONUs).[351] Specifically, Shraga discloses a flowchart in Figure 4 that teaches, as a first step, determining how many ONTs/ONUs are active in the passive optical network.[352] A POSITA would have understood that an ONT/ONU new to the network would operate in accordance with a protocol for new clients, such as the protocol disclosed in the G.984.3 Draft Recommendation/Contribution 104. Shraga further states that "methods for performing such determinations are known in the art" and, most preferably, "the method used includes processes for noting when a new ONT comes on-stream, as well as when an ONT goes off-stream."[353] It would have been obvious to a POSITA to look to the G.984.3 Draft Recommendation/Contribution 104 to teach a process for noting and registering new ONTs/ONUs on the network.

299. Third, Shraga teaches that, in order to compensate for the transmission delay caused by the physical distance between the OLT and each ONT/ONU, a "ranging time" (i.e., response

[349] Ex. E at 15:26-36.

[350] *Id.* at 16:38-58.

[351] *Id.* at 11:48-60, 15:26-36, Fig. 4.

[352] *Id.*

[353] *Id.*

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delay) is added to the start time allocated by the OLT.[354] A POSITA would have understood that in order to compensate for a delay in network transmission, an ONT/ONU would have to operate in accordance with a protocol for determining a response delay, such as the process disclosed in the G.984.3 Draft Recommendation/Contribution 104. Further, as discussed previously, Shraga notes that transmission in the passive optical network can be conducted "according to substantially *any* protocol or service."[355]

300. Additionally, a POSITA would have naturally looked to the G.984.3 Draft Recommendation/Contribution 104, a draft to an ITU-T standard, to find techniques of data communication in a passive optical network, including time slot assignment to further aid in data transmission between a head-end and multiple ONTs/ONUs. A POSITA would have had knowledge of and would have understood the importance of the G.984.3 Draft Recommendation/Contribution 104 and their corresponding, eventual published standard, because adhering to it provided for the interoperability of equipment in an optical network from a variety of different vendors.

301. For the reasons discussed above in Section IX.A.i, a POSITA would have been motivated to combine a passive optical network data communications system, like in Shraga, with a pluggable optical transceiver module, like in Togami and had a reasonable expectation of success in doing so. The same reasons above apply in relation to Togami and the G.984.3 Draft Recommendation/Contribution 104.

xxx. Claim 9: The network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module.

302. Under NextGen's apparent theory of infringement[356], in my opinion, a POSITA would have understood Shraga and Togami in view of the G.984.3 Draft

[354] *Id.* at 12:34-60.

[355] *Id.* at 16:38-58.

[356] Ex. NN at 24.

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Recommendation/Contribution 104 to disclose the network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module. For the device of Claim 1, *see supra*, § IX.A.i.

303. Specifically, Shraga discloses a reference, U.S. Patent No. 5,528,592, which consists of a method for routing data in a passive optical network. The data includes a routing label determining an output port for the data packet, and an identifier that determines switching paths which connect the packet's source to a destination, such as a specific ONT/ONU.[357]

304. Further, Shraga discloses a similar method of data transmission, where the downstream transmission from an OLT to an ONT/ONU contains a downstream frame header (shown in yellow in Fig. 2 and 3 below), comprising a frame identification section (shown in red in Fig. 3 below), which directs each window of data to the correct destination ONT/ONU.[358] The number of header sections corresponds to the number of ONTs/ONUs with which the OLT communicates.[359]

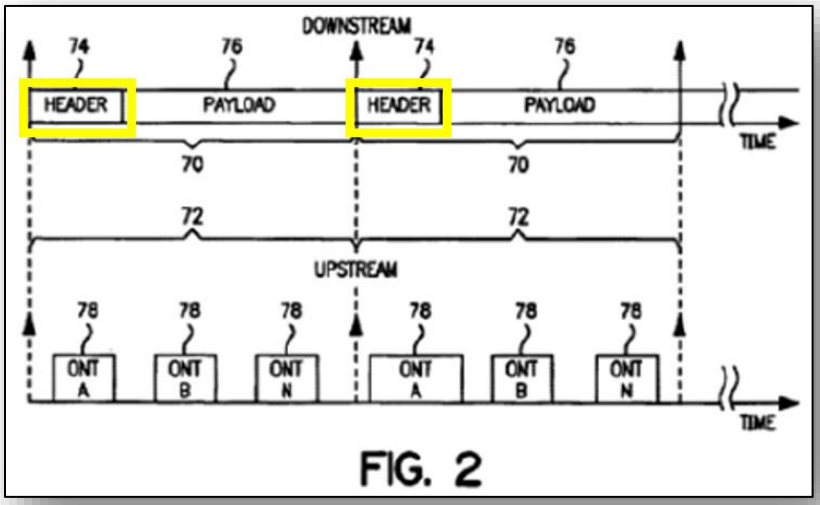


FIG. 2

[357] Ex. E at 1:56-67.

[358] *Id.* at 10:38-11:15, Fig. 2, Fig. 3.

[359] *Id.*

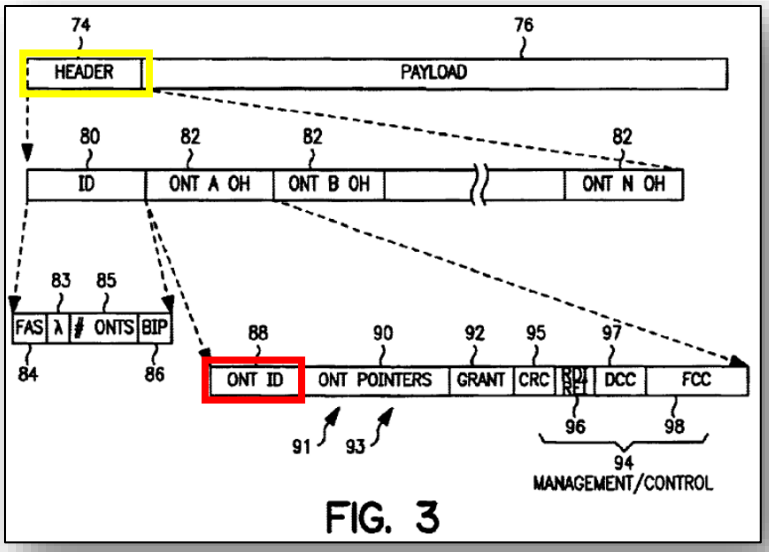


FIG. 3

305. A POSITA would have understood that this ONT ID section is an assignment of an identification address to each ONT/ONU in order to aid in data transmission over the passive optical network. In this way, the OLT can apportion data correctly to each ONT/ONU by assigning it an identification address for transmitting downstream communications and receiving upstream transmissions.

306. Additionally, the G.984.3 Draft Recommendation/Contribution 104 disclose an "ONU-ID Field" that indicates the particular ONT/ONU that is being granted time to transmit upstream on the passive optical network.[360] During the ranging process, in which new ONTs/ONUs entering the network become discoverable to the OLT, ONTs/ONUs are assigned an "ONU-ID" that is unique to each individual ONT/ONU, corresponding to the ONT/ONU's serial number.[361] This allows the OLT to direct messages to a specific ONT/ONU; each ONU-ID value is used to address the ONT/ONU directly. A POSITA would have understood that this method disclosed in the G.984.3 Draft Recommendation/Contribution 104 consists of the head-end of the network assigning an identification address in order to transmit to and receive data from the ONT/ONU.

[360] Ex. M at § 8.2.2.2; Ex. N at § 8.2.2.2.

[361] *Id.*

307. Thus, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 9.

308. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[362] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 9, was well known prior to the earliest alleged filing date of the '754 Patent.[363]

xxxi. Claim 10: The network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.

309. Under NextGen's apparent theory of infringement[364], in my opinion, a POSITA would have understood Shraga and Togami in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose the network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients. For the device of Claim 1, *see supra*, § IX.A.i.

310. As previously discussed above in Claims [1.pre] and 9, Shraga discloses a method for assigning and identifying ONTs/ONUs in a passive optical network. Shraga discloses the computation of a header by the OLT CLU through the process of determining how many ONTs/ONUs are active in the passive optical network, stating that "methods for performing such determinations" are well-known in the art."[365] This method is implemented by the CLU, which is configured to respond to the head-end identifying itself as a new client.[366] Shraga also states, as discussed above in Claim 8, that preferred embodiments of the present invention are "not specific

[362] Ex. SS at 182:16-24.

[363] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8, 212:21-213:1.

[364] Ex. NN at 24-25.

[365] Ex. E at 11:48-60, Fig. 4.

[366] *Id.* at 11:49-61, 15:26-36, Fig. 4.

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to any one protocol or service" but may be implemented according to substantially any protocol or service."[367]

311. A POSITA would have understood that such methods include the methods disclosed in the G.984.3 Draft Recommendation/Contribution 104, which discloses that ONTs/ONUs register to the management system of the OLT utilizing their serial number or through a ranging method.[368] Both methods are initiated by and performed under the control of the OLT. In the first method, a serial number of the ONT/ONU is registered in advance at the OLT.[369] In the second method, an OLT can periodically initiate the activation process of ranging to test and see if any new ONTs/ONUs have been connected to the network.[370] Specifically, the ONT/ONU "*responds* to messages, which are initiated in the OLT" identifying itself as a new client on the network.[371] Once an ONU is ranged, it is operational on the passive optical network.[372]

312. Thus, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 10.

313. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 10 was well known prior to the earliest alleged filing date of the '754 Patent.[373] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 10, was well known prior to the earliest alleged filing date of the '754 Patent.[374]

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[367] *Id.* at 16:39-49.

[368] Ex. M at § 7.4.2, 10; Ex. N at § 7.4.2, 10.

[369] *Id.* at § 10.

[370] *Id.*

[371] *Id.* at § 10.2.1.

[372] *Id.*

[373] Ex. SS at 182:16-24.

[374] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

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xxxii. Claim 11: The network clients optical transceiver module of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module.

314. Under NextGen's apparent theory of infringement[375], in my opinion, a POSITA would have understood Shraga and Togami in view of G.984.3 Draft Recommendation/Contribution 104 to disclose the network client optical transceiver of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module. For the device of Claim 1, *see supra*, § IX.A.i.

315. Specifically, Shraga teaches that, because each ONT/ONU is some distance from the OLT, the distance causes a delay in signal transmission from the specific ONTs/ONUs to the OLT proportional to the distance.[376] Further, to compensate for this delay, a ranging time is added to each ONT/ONU's initial window start time determined by one of the ranging methods known in the passive optical network art, such as by sending a ranging signal from the OLT into the passive optical network and waiting for corresponding responses from active ONTs/ONUs.[377] The ranging signal responses are sent at the command of each ONT/ONU's CLU, which, as discussed above in the analysis of [1.c], controls the reception and transmission of signals for ONTs/ONUs on the passive optical network (i.e., the control module is configured to respond to a delay message from the head-end).[378] Once the ranging signal responses (i.e., the response delay messages) have been received from each ONT/ONU operating on the passive optical network, the OLT determines the ranging time to compensate for the delay by adding a ranging time to the initial start time allocated to each ONT/ONU in order to compensate for the delay in transmission.[379] A POSITA

[375] Ex. NN at 25-27.

[376] Ex. E at 12:34-60.

[377] *Id.*

[378] *Id.* at 12:40-60, 7:60-8:9, 8:36-47.

[379] *Id.* at 12:53-60.

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would have known that one such ranging method in the passive optical network art would have been that disclosed in the G.984.3 Draft Recommendation/Contribution 104.

316. The G.984.3 Draft Recommendation/Contribution 104 discusses the presence of delay in transmission over a passive optical network due to the distances between each ONT/ONU and the OLT.[380] The delay between the OLT and each ONT/ONU is determined during the ranging process, discussed above in Claim 10. The OLT measures the arrival phase of the initial upstream transmission from the ONT/ONU during the ranging process.[381] Once determined, the OLT notifies the ONT/ONU of the delay and the ONT/ONU adjusts its transmission phase to the notified value.[382] This allows for all upstream frames to be properly synchronized together between all ONUs; the upstream transmissions will arrive separately, each one in its correct location within the frame, compensating for the delay caused by their distance from the OLT.[383] A POSITA would have understood that the ranging signal responses of Shraga, coupled with the ranging process of the G.984.3 Draft Recommendation/Contribution 104, discloses a control module configured to respond to a response delay message used to determine the delay in responses from the optical transceiver module.

317. Thus, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 11.

318. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 11 was well known prior to the earliest alleged filing date of the '754 Patent.[384] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 11, was well known prior to the earliest alleged filing date of the '754 Patent.[385]

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[380] Ex. M at § 10.1; Ex. N at § 10.1.

[381] *Id.*

[382] *Id.*

[383] *Id.* at § 10.2.2.1.

[384] Ex. SS at 182:16-24.

[385] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

xxxiii. Claim 12: The network client optical transceiver module of claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.

319. Under NextGen's apparent theory of infringement[386], in my opinion, Shraga and Togami in view of the G.984.3 Draft Recommendation/Contribution 104 disclose the network client optical transceiver module of Claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process. For the device of Claim 1, *see supra*, § IX.A.i.

320. As discussed above in Claim 11, Shraga teaches that the distance between each ONT/ONU and the OLT causes a delay in the transmission of signals in the passive optical network.[387] To account for this transmission delay, the OLT initiates a response delay process, sending a ranging signal to each ONT/ONU requesting that the ONT/ONU respond with a ranging signal response, which the OLT then utilizes to determine how to allocate each ONT/ONU's transmission start time to compensate for the delay (i.e., the "response delay process").[388] The OLT factors this delay into the start time that it allocates to each ONT/ONU.[389] As discussed above in the analysis of [1.c], the ONT/ONU is configured to transmit, at the command of its CLU, data signals in response to the start time it is allocated by the OLT, which includes the ranging time compensation (i.e., "network period").[390] The upstream transmission from the ONT/ONU to the OLT is thus aligned to the network period in order to account for transmission delays.

321. Thus, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 12.

322. Moreover, it is my understanding that the inventors and patent owners themselves

[386] Ex. NN at 28.

[387] Ex. E at 12:34-60.

[388] *Id.*

[389] *Id.* at 12:54-65.

[390] *Id.* at 7:60-8:9, 8:36-47, 12:40-60.

admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 12 was well known prior to the earliest alleged filing date of the '754 Patent.[391] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 12, was well known prior to the earliest alleged filing date of the '754 Patent.[392]

xxxiv. Claim 13: The network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.

323. Under NextGen's apparent theory of infringement[393], in my opinion, Shraga and Togami in view of the G.984.3 Draft Recommendation/Contribution 104 disclose the network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network. For the device of Claim 1, *see supra*, § IX.A.i.

324. Specifically, Shraga discusses communication between the OLT and an ONT in a passive optical network to adjust the operation parameters of the ONT, including ranging.[394] Shraga also discusses using lasers in optical transmitters in a passive optical network: "[i]nterface 42 converts data from transmit framer 31 to an optical format, most preferably by modulating a laser comprised in the interface and transmitting the laser output into fabric 24."[395] As discussed previously, because the control module of the ONT/ONU is configured to operate the transmitting and receiving functions of the optical transceiver module, a POSITA would have understood that the control module would have been configured to adjust the transmitting power level.[396] Shraga further refers to the "passive optical network art" that was known at the time of the patent.[397]

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[391] Ex. SS at 182:16-24.

[392] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[393] Ex. NN at 28.

[394] Ex. E at 12:41-53.

[395] *Id.* at 8:10-14, 8:36-42.

[396] *Id.*

[397] *Id.* at 12:41-43.

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325. Such passive optical network art known at the time of Shraga would have included the G.984.3 Draft Recommendation/Contribution 104. In addition to procedures for ranging, the G.984.3 Draft Recommendation/Contribution 104 discuss the procedure for optical power control in the ONT/ONU.[398] According to the G.984.3 Draft Recommendation/Contribution 104's description of the upstream Power Levelling state, power control measurements are made by the ONT/ONU to adjust the levels of optical power transmitted by the ONT/ONU to the OLT, shown in yellow in Figure 10-1 below.[399] This operation adjusts the power level of the transmitter in order to compensate for signal loss due to distance between the ONT/ONU and the OLT over which the transmitted optical signal must travel.[400]

[398] Ex. M at § 10.2.2; Ex. N at § 10.2.2.

[399] *Id.* at § 10.2.2.2.

[400] *Id.*

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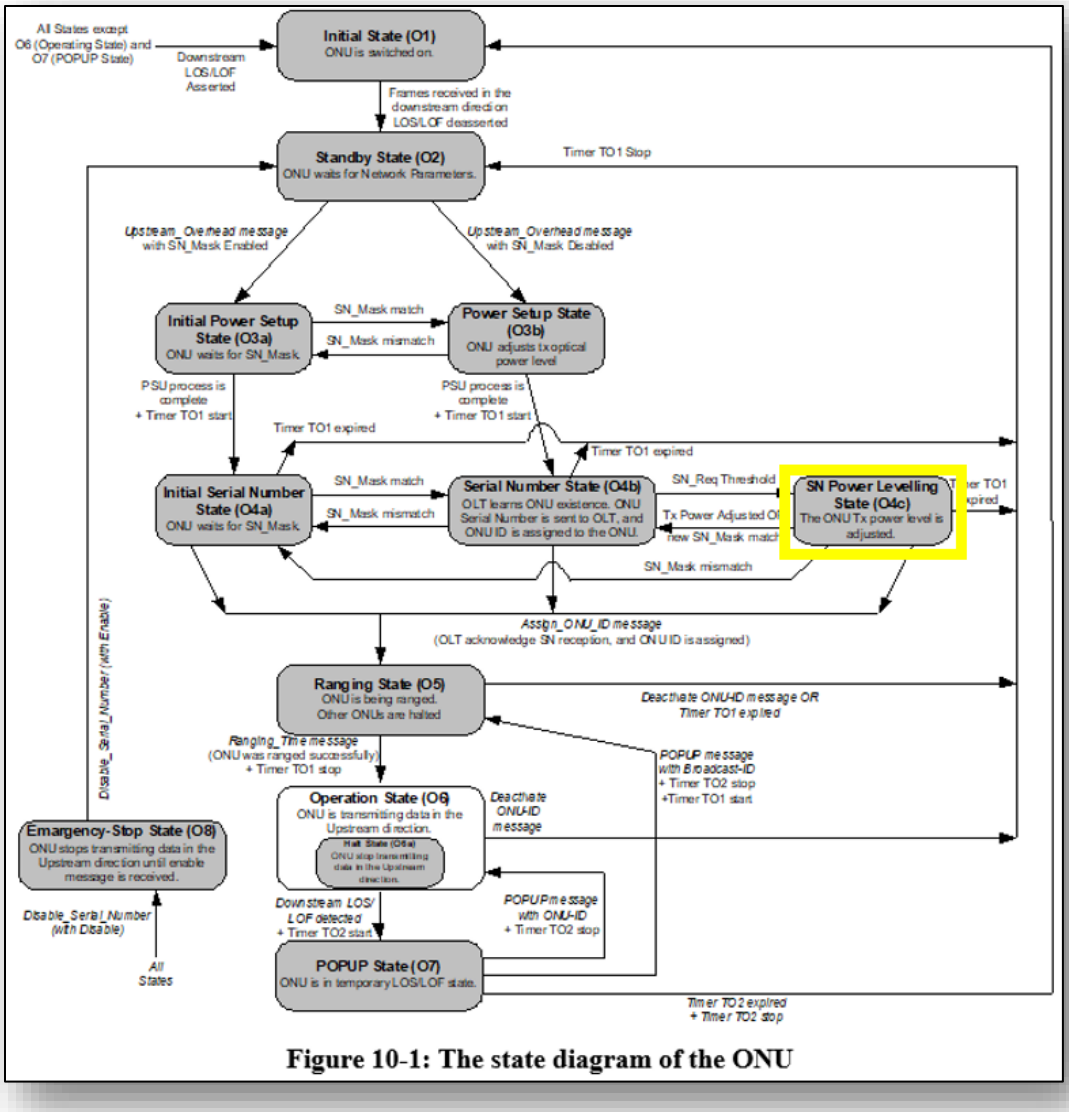


Figure 10-1: The state diagram of the ONU

326. A POSITA reading knowledgeable about lasers in optical transmitters in Shraga and changing the operating parameters of an ONT/ONU (including ranging), would have known to look to the G.984.3 Draft Recommendation/Contribution 104 for additional information on power control measurements and adjusting the laser power levels in the ONT/ONU. As discussed previously, because the control module of the optical transceiver module is configured to control the reception and transmission of signals, it would have been obvious to a POSITA that this adjustment to the transmitting optical power level would be conducted by the control module.

327. Accordingly, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 13.

328. Moreover, it is my understanding that the inventors and patent owners themselves assert that the concept of a controller (or "control module") capable of performing the functions described in Claim 13 was well known prior to the earliest alleged filing date of the '754 Patent.[401] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 13, was well known prior to the earliest alleged filing date of the '754 Patent.[402]

xxxv. Claim 14: The network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.

329. Under NextGen's apparent theory of infringement[403], in my opinion, Shraga and Togami in view of G.984.3 Draft Recommendation disclose the network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network. For the device of Claim 1, *see supra*, § IX.A.i.

330. Shraga discloses a payload section of a framing protocol in the transmission of data upstream from ONTs/ONUs to an OLT (shown in yellow in Fig. 7 below).[404] Shraga states that each upstream transmission contains channel payload sections that together have a length determined by the CLU of the ONT/ONU that is less than or equal to the maximum window length received in the pointers section of the downstream OLT transmission (identified as 93 below).[405]

[401] Ex. SS at 182:16-24.

[402] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[403] Ex. NN at 28-29.

[404] Ex. E at 14:43-15:13, Fig. 7.

[405] *Id.* at 15:26-36.

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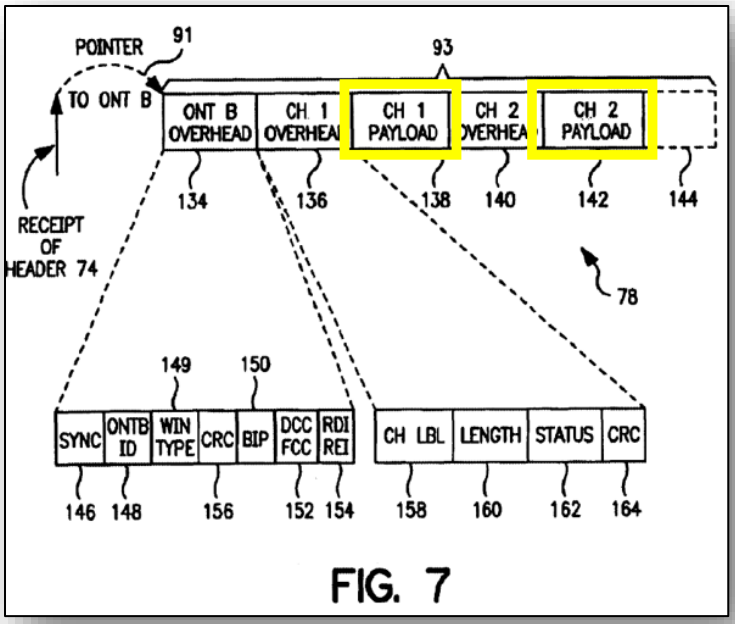


FIG. 7

331. Shraga describes the construction of the payload section, which consists of a process wherein the CLU reads data from ingress FIFO connected to the electrical interface, along with the FIFO parameters table and the allocated bandwidth of each channel, to construct the window, which is then transmitted upstream at a start transmission time after receipt of the header.[406] This process is depicted below in Figure 6, where the CLU checks the ingress FIFO for data to be incorporated into the payload section (shown in yellow below) before constructing the channel overhead section and channel payload section (shown in red below), which consists of the data read from the ingress FIFO.[407]

[406] *Id.*

[407] *Id.* at 13:48-67, 9:56-57.

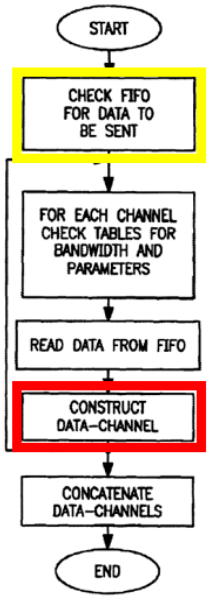


FIG. 6

332. In addition, the G.984.3 Draft Recommendation/Contribution 104 discloses an "Upstream payload section" contained within the upstream frame, similar to that described in Shraga.[408] This is shown below in Figure 8-9 and 8-10:

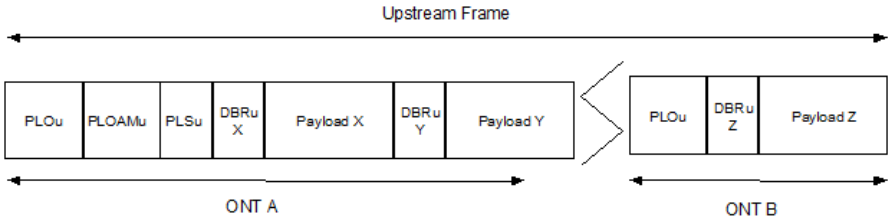


Figure 8-9 – GTC Upstream frame.

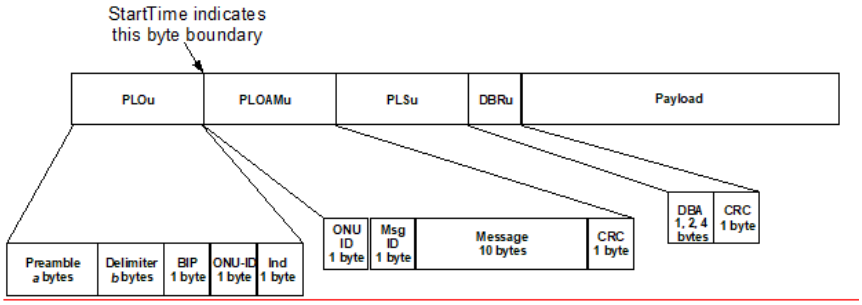


Figure 8-10 – GTC Upstream Overheads Detail.

[408] Ex. M at § 8.2.6; Ex. N at § 8.2.

333. Thus, a POSITA would have understood the Shraga-Togami combination in view to disclose Claim 14.

334. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 14 was well known prior to the earliest alleged filing date of the '754 Patent.[409] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 14, was well known prior to the earliest alleged filing date of the '754 Patent.[410]

xxxvi. Claim 16: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

335. Under NextGen's apparent theory of infringement[411], in my opinion, Shraga and Togami in view of the G.984.3 Draft Recommendation disclose the network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip. For the device of Claim 1, *see supra*, § IX.A.i.

336. As previously discussed above in the analysis of [1.pre], Shraga discloses an optical transceiver module that is an ONT. Additionally, a POSITA would have understood that an optical transceiver performing data communications in a passive optical network would inherently contain a TC-Layer discrete chip as well as a MAC discrete chip in order to operate in accordance with standard network protocols, such as the framing protocols and ranging protocols described in the G.984.3 Draft Recommendation/Contribution 104.[412]

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[409] Ex. SS at 182:16-24.

[410] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[411] Ex. NN at 29-30.

[412] Ex. M; Ex. N.

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337. Additionally, the G.984.3 Draft Recommendation/Contribution 104 are drafts for the ITU-T standard directed to "Transmission Convergence Layer for Gigabit Passive Optical Networks" (i.e., TC-Layer) and discusses media access control protocol throughout.[413] Specifically, the G.984.3 Draft Recommendation/Contribution 104 state that "PON TC function includes framing, *media access control*, OAM, DBA . . . ."[414] It would have therefore been obvious to a POSITA that any transceiver operating in accordance with the protocol described in the G.984.3 Draft Recommendation/Contribution 104 would necessarily contain a MAC discrete chip as well as a TC-Layer discrete chip in order to perform the MAC functionalities described in the TC-Layer function. Alternatively, a POSITA would have understood that the functionalities typically contained in a MAC discrete chip could also be integrated fully into the TC-Layer discrete chip, thus nullifying the need for a separate MAC discrete chip.

338. Thus, a POSITA would have understood the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose Claim 16.

xxxvii. Claim 25: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an assigned network identification address from the head-end of the passive optical network for addressing data to the network client optical transceiver module at the control module.

339. Under NextGen's apparent theory of infringement[415], the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 discloses this claim for the same reasons as described in Claim 9. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxxviii. Claim 26: The method of claim 18, further comprising the steps of: (g1) adjusting the transmission of the second optical signal form the optical interface block through the optical port to account for the response delay of the optical transceiver module.

340. Under NextGen's apparent theory of infringement[416], the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 discloses this claim

[413] *See, e.g.*, Ex. M at § 7.4.1; Ex. N at § 7.4.1.

[414] *Id.* at 14; *id.* at 13.

[415] Ex. NN at 37.

[416] *Id.* at 37-39.

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for the same reasons as described in Claims 11 and 12. For the method of Claim 18, *see supra*, § IX.A.xvii.

xxxix. Claim 27: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an optical power level and adjusting the transmit optical power level of the network client optical transceiver module to the determined optical power level.

341. Under NextGen's apparent theory of infringement[417], the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 discloses this claim for the same reasons as described in Claim 13. For the method of Claim 18, *see supra*, § IX.A.xvii.

xl. Claim 28: The method of claim 18, further comprising the steps of: (f1) encapsulating a portion of data received through the electrical network interface port into the payload section of a framing protocol for the passive optical network at the control module for conveyance to the optical interface block.

342. Under NextGen's apparent theory of infringement[418], the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 discloses this claim for the same reasons as described in Claim 14. For the method of Claim 18, *see supra*, § IX.A.xvii.

xli. Claim 30: The method of claim 18, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

343. Under NextGen's apparent theory of infringement[419], the Shraga-Togami combination in view of the G.984.3 Draft Recommendation/Contribution 104 discloses this claim for the same reasons as described in Claim 16. For the method of Claim 18, *see supra*, § IX.A.xvii.

C. Ground 2: The Fujimori-G.984.3 Draft Recommendation/Contribution 104 Combination renders claims 1-16 and 18-30 obvious.

344. ***Motivation to combine.*** Both Fujimori and G.984.3 Draft

[417] Ex. *Id.* at 40.

[418] Ex. *Id.* at 40.

[419] Ex. *Id.* at 41.

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Recommendation/Contribution 104 are directed towards data communications in an optical network.[420] Importantly, both Fujimori and G.984.3 Draft Recommendation/Contribution 104 discuss communication over an optical network in accordance with certain protocol, such as media access control (MAC).[421]

345. As discussed *supra*, Fujimori discloses a pluggable optical transceiver module for use in data communications over optical fibers, such as in passive optical networks.[422] Fujimori's optical transceiver module "may be configured to communicate, namely transmit and receive," data between a computer system and an optical network, where the data transmitted and/or received may be formatted in accordance with a well-known OSI protocol standard.[423] And functions associated with protocol performance associated with, for example, media access control include receiving from the head end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module. These functions are entirely disclosed in the G.984.3 Draft Recommendation/Contribution 104.

346. There are several reasons a POSITA would have been motivated to combine the G.984.3 Draft Recommendation/Contribution 104 with Fujimori.

347. First, both Fujimori and the G.984.3 Draft Recommendation/Contribution 104 describe an optical network communication system.[424] Further, Fujimori discusses several concepts involved in the operation of data communications in the network, such as compliance with OSI layers to include media access control and trans-convergence layers, both of which are described in-depth in the G.984.3 Draft Recommendation/Contribution 104.[425]

348. Additionally, a POSITA would have naturally looked to the G.984.3 Draft Recommendation/Contribution 104, drafts to an ITU-T standard, to find techniques of data

[420] Ex. G at 1:38-40, 5:65-6:2, Fig. 1; Ex. M at 1-2; Ex. N at 1-2.

[421] Ex. G at 5:65-6:12; Ex. M at 1-2; Ex. N at 1-2.

[422] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[423] *Id.*

[424] *Id.* at 1:34-49, 6:13-42, Fig. 1; Ex. M at §§ 5, 6; Ex. N at §§ 5, 6.

[425] Ex. G at 1:38-65; Ex. M at § 7.4; Ex. N at § 7.4.

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communication in a passive optical network, including time slot assignment to further aid in data transmission between a head-end and multiple ONTs/ONUs. A POSITA would have had knowledge of and would have understood the importance of the G.984.3 Draft Recommendation/Contribution 104 and their corresponding, eventual published standard, because adhering to it provided for the interoperability of equipment in an optical network from a variety of different vendors.

349. For at least these reasons, in reading Fujimori, a POSITA would have been motivated to look to the functional disclosures in the G.984.3 Draft Recommendation/Contribution 104 and would have had a reasonable expectation of success in doing so.

i. Claim 1

a. [1.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, the network client optical transceiver module comprising:

350. Under NextGen's apparent theory of infringement[426], to the extent the preamble is limiting, a POSITA would have understood Fujimori in view of the G.984.3 Draft Recommendation/Contribution 104 to disclose this limitation.

351. Fujimori discloses an optical transceiver module for use in a data communications network over optical fibers (i.e., a passive optical network).[427] A POSITA would have been extremely familiar with the concept of passive optical networks and understood that they comprise a head end, or OLT, connected via optical fibers and at least one passive optical splitter, to multiple subscribers, or ONTs/ONUs.

352. Further, the structure of a passive optical network is described in the G.984.3 Draft

[426] Ex. NN at 1-8.

[427] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

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Recommendation/Contribution 104.[428] As would have been common knowledge to a POSITA, the G.984.3 Draft Recommendation/Contribution 104 describe a Gigabit Passive Optical Network where an OLT (yellow) is connected to multiple ONUs (red) via optical fibers and a passive optical splitter, as shown below in Figure 6-1.[429]

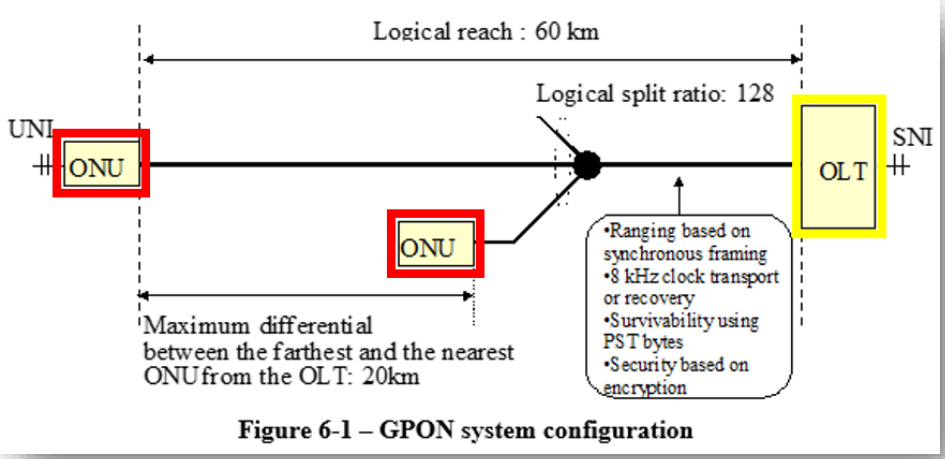


Figure 6-1 – GPON system configuration

353. Additionally, Fujimori teaches that the optical transceiver module described may conform to multi-source agreement (MSA) standardized optical module form factors, often referred to in the industry as "pluggables."[430] Fujimori explicitly discloses the use of XENPAK and XFP form factors, though a POSITA would have understood any MSA standardized form factor could be used to implement the teaching in Fujimori, such as the SFP form factor.

354. A POSITA would further understand that the purpose of such "pluggables" was to, as the name suggests, plug-in to or removably couple to another device, such as a switch or router. Fujimori teaches that the optical transceiver module described connects to and "may be configured to communicate, namely transmit and receive, data between computer system 105 and optical network 110."[431] This connection to computer system 105 (shown in yellow) is further illustrated

[428] Ex. M at Figure 6-1; Ex. N at Figure 6-1.

[429] *Id.*

[430] Ex. G at 2:11-62.

[431] *Id.* at 1:65-67.

below in Figure 1.

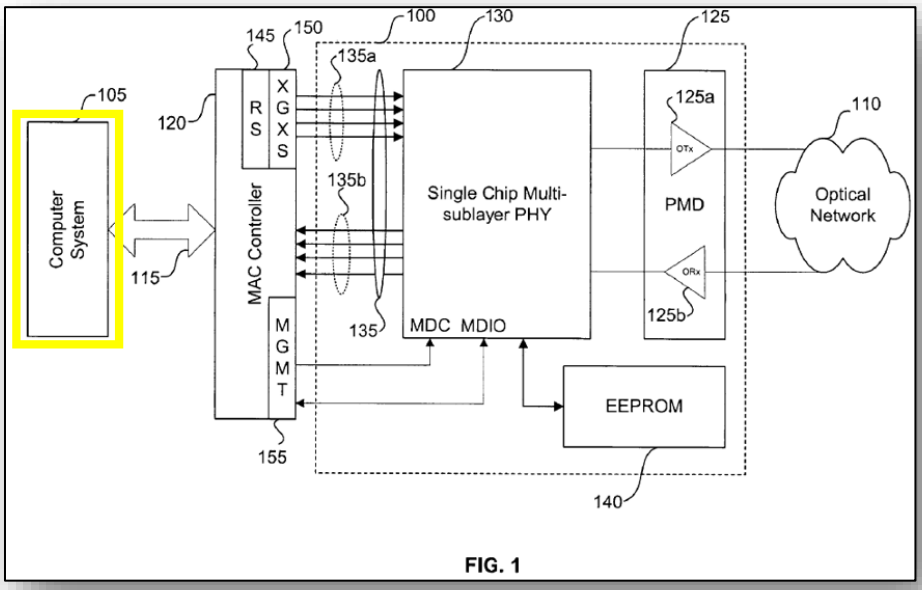


FIG. 1

A POSITA would have understood that a "computer system" as described in Fujimori would have consisted of a switch or router.

355. Therefore, it is my opinion that a POSITA would have understood the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination to disclose "a network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router."

356. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a PON having one or more splitters for coupling a network client optical transceiver module over one or more optical fibers to the head end of a PON was well known prior to the earliest alleged filing date of the '754 Patent.[432]

[432] Ex. SS at 176:4-14.

a. [1.a] an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters;

357. Under NextGen's apparent theory of infringement[433], in my opinion, a POSITA would have understood that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters for the same reasons as discussed in the analysis of [1.pre].

358. As discussed above, Fujimori teaches a pluggable optical transceiver module for use in a data communications network over optical fibers (i.e., a passive optical network).[434] As also discussed above and described in the G.984.3 Draft Recommendation/Contribution 104, a POSITA would have known a passive optical network to have one or more passive optical splitters, as passive splitters allow a passive optical network to take on its "passive" properties.

359. Further, as shown below in Figure 1, the optical transceiver module described in Fujimori couples directly to an optical network at the points highlighted in red below.[435] A POSITA would have understood that, in order to couple to the fibers of an optical network, a device such as the optical transceiver module described in Fujimori would have necessarily contained ports for coupling to and receiving optical fiber connectors (i.e., an "optical port").

[433] Ex. NN at 8-11.

[434] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[435] *Id.* at Fig. 1.

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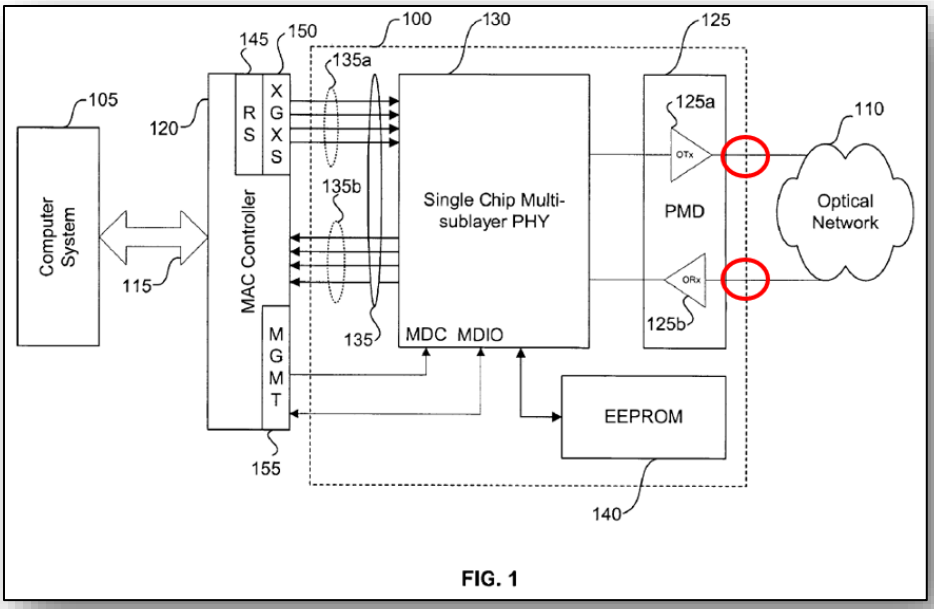


FIG. 1

360. Therefore, it is my opinion that a POSITA would have understood that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters."

361. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an optical port on a pluggable transceiver device was well known prior to the earliest alleged filing date of the '754 Patent.[436]

b. [1.b] a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion;

362. Under NextGen's apparent theory of infringement[437], in my opinion, a POSITA would have understood that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion.

[436] Ex. SS at 169:23-170:5, 170:18-22.

[437] Ex. NN at 11.

363. As discussed above, Fujimori teaches a pluggable optical transceiver module that contains "optical ports" for coupling to the optical fibers of an optical network.[438] Further, Fujimori teaches that the pluggable optical transceiver module contains a "PMD 125" (shown in yellow below) that is comprised of a PMD transmitter 125a to "transmit data originating from the computer system 105 over the optical network 110" and a PMD receiver 125b to "receive data desired for computer system 105 from the optical network 110."[439] These components are highlighted below in Fujimori's Figure 1.[440]

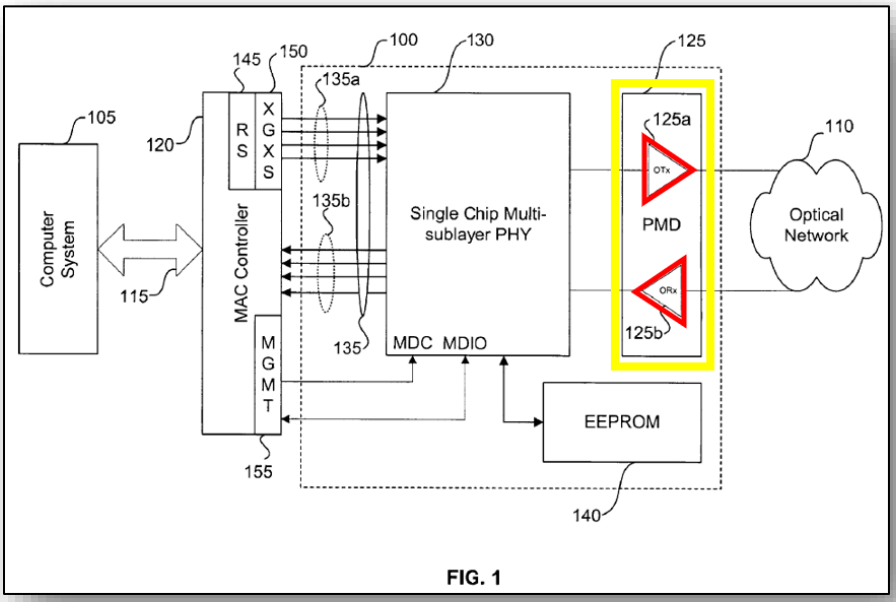


FIG. 1

364. Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" where "electrical signals may be received by PMD transmitter 125a and transmitted in a format such as optical signals over the optical network 110" and where "optical signals may be received by PMD receiver 125b and transmitted as electrical signals to the computer system."[441]

[438] Ex. G at Fig. 1.

[439] *Id.* at 7:25-43, Fig. 1.

[440] *Id.*

[441] *Id.*

365. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses an optical transceiver module containing a PMD 125 (i.e., "bi-directional optical interface block") "coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion" in accordance with [1.b].

366. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a "bi-directional optical interface" that performs electrical-to-optical and optical-to-electrical signal conversion was well known prior to the earliest alleged filing date of the '754 Patent.[442]

c. [1.c] a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times; and

367. Under NextGen's apparent theory of infringement[443], in my opinion, a POSITA would have understood that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times.

368. As discussed above, Fujimori teaches a pluggable optical transceiver module for use in a data communications network.[444] Fujimori discloses that optical transceivers, such as the one it teaches, "may include various function components which may implement tasks such as . . .

[442] Ex. SS at 171:2-20.

[443] Ex. NN at 11-16.

[444] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

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media access control (MAC) [and] *controlling* . . . ."[445] Fujimori is explicit that MAC controlling functionality may be included in the disclosed pluggable optical transceiver module.

369. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[446] The MAC controller 120 is indirectly coupled to the PMD 125 (i.e., "bidirectional optical interface block"). A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[447]

370. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[448] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

371. The G.984.3 Draft Recommendation/Contribution 104 explicitly discloses the use of "start times," that are assigned by the head end of the network, or OLT, and received by the subscriber ends of the network, or ONTs/ONUs, in order to align their upstream transmissions back to the head end.[449] The downstream frame contains a "StartTime field" that "indicates the starting time of the allocation."[450] Thus, it would have been obvious to a POSITA to combine the

[445] *Id.* at 2:36-41 (emphasis added).

[446] *Id.* at 5:45-6:12.

[447] *Id.*

[448] Ex. M at § 7.4.1, 8; Ex. N at 7.4.1, 8.

[449] *Id.* at § 8.1.3.

[450] *Id.*

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"start time" assignment, as was traditional for use in a PON communication system, with the MAC controller of the pluggable optical transceiver module discussed in Fujimori.

372. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times."

373. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 1 was well known prior to the earliest alleged filing date of the '754 Patent.[451] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "start times," was well known prior to the earliest alleged filing date of the '754 Patent.[452]

d. [1.d] an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router; whereby

374. Under NextGen's apparent theory of infringement[453], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router.

375. Fujimori teaches a pluggable optical transceiver module containing an "Ethernet attachment unit interface" or "XAUI" (i.e., the "electrical network interface port"), shown in yellow below in Figure 2.[454]

[451] Ex. SS at 182:16-24.

[452] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[453] Ex. NN at 17-20.

[454] Ex. G at 6:45-48.

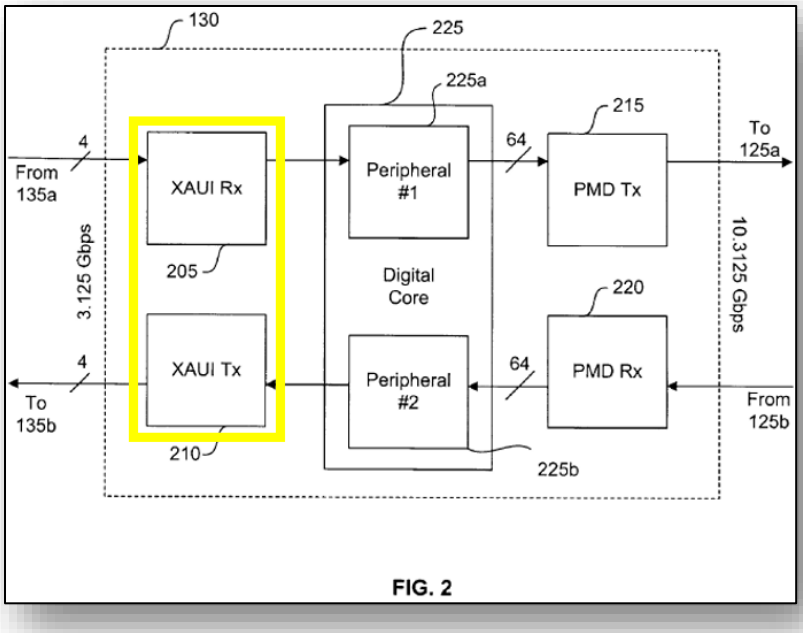


FIG. 2

376. As discussed above, Fujimori teaches that MAC controlling functionalities performed by the MAC controller 120 may be contained within the pluggable optical transceiver module itself.[455] A POSITA would have understood that, where the MAC controller 120 is physically located on the pluggable optical transceiver module, the XAUI interface is coupled to the MAC controller and a port of a switch or router (described in Fujimori as "computer system 105").[456] It would have been further obvious to a POSITA that any MSA-compliant pluggable optical module would necessarily contain an electrical network interface for coupling to a host device, such as a switch or router due to its pluggable and removable nature.

377. Therefore, it is my opinion that a POSITA would have found the Fujimori-G.984.3 Draft Recommendation/Contribution 104 to disclose "an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router."

378. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an "electrical network interface port" on a pluggable optical transceiver

[455] *Id.* at 2:36-41, 5:45-6:12.

[456] *Id.* at Fig. 1.

module was well known prior to the earliest alleged filing date of the '754 Patent.[457]

e. [1.e] the network client optical transceiver module is configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and the network client optical transceiver module is configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

379. Under NextGen's apparent theory of infringement[458], for reasons discussed above in the analysis of [1.pre], [1.c], and [1.d], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

ii. Claim 2: The network client optical transceiver module of claim 1, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.

380. Under NextGen's apparent theory of infringement[459], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK. For the module of Claim 1, *see supra*, § IX.C.i.

381. As discussed above in the analysis of Claim 1, Fujimori teaches that the optical transceiver module described can have a pluggable, MSA-compliant form factor. [460] Fujimori

[457] Ex. SS at 171:21-172:25.

[458] Ex. NN at 20.

[459] Ex. NN at 20-21.

[460] Ex. G at 2:11-62.

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explicitly discloses the use of XENPAK and XFP form factors, though a POSITA would have understood any MSA standardized form factor could be used to implement the teaching in Fujimori, such as the SFP, X2, or XPAK form factors. Each of these form factors had been standardized under MSAs and were well known to POSITAs in the industry at the time of the alleged priority date of the '754 Patent.

382. Therefore, it is my opinion that a POSITA would have understood the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination to disclose "a network client optical transceiver module [] wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK."

iii. Claim 3: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times.

383. Under NextGen's apparent theory of infringement[461], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times. For the module of Claim 1, *see supra*, § IX.C.i.

384. As discussed above in the analysis of Claim 1, Fujimori teaches a pluggable optical transceiver module for use in a data communications network.[462] Fujimori discloses that optical transceivers, such as the one it teaches, "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling* . . . ."[463] Fujimori is

[461] Ex. NN at 21.

[462] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[463] *Id.* at 2:36-41 (emphasis added).

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explicit that MAC controlling functionality, conducted in the disclosed MAC controller 120, may be included in the taught pluggable optical transceiver module. As also discussed above, a POSITA would have understood this MAC controller to perform functionality like that associated with the claimed "control module" of the '754 Patent. [464]

385. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

386. The G.984.3 Draft Recommendation/Contribution 104 not only explicitly discloses the use of "start times" assigned by the head end of the network, but also discloses the assignment of "end times."[465] The downstream frame, where information is transmitted from the head end to each of the subscriber ends, contains a "StopTime field" that "indicates the stopping time of the allocation."[466]

387. It would thus have been obvious to a POSITA to combine the "end time" assignment, as was traditional for use in a PON communication system, with the MAC controller of the pluggable optical transceiver module discussed in Fujimori.

388. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times."

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[464] *Id.*

[465] Ex. M at § 8.1.4; Ex. N at § 8.1.4.

[466] *Id.*

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389. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 3 was well known prior to the earliest alleged filing date of the '754 Patent.[467] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "end times," was well known prior to the earliest alleged filing date of the '754 Patent.[468]

iv. Claim 4: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times.

390. Under NextGen's apparent theory of infringement[469], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times. For the module of Claim 1, *see supra*, § IX.C.i.

391. As previously discussed above in the analysis of [1.pre] and [1.c], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a pluggable optical transceiver module for data communications in an optical network. Fujimori discuses a MAC controller (or "control module") that may be contained on the pluggable optical transceiver module itself.[470] A POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

[467] Ex. SS at 182:16-24.

[468] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[469] Ex. NN at 21-22.

[470] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

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392. As further discussed in Claim 3 above, the G.984.3 Draft Recommendation/Contribution 104 discloses the use of both "start times" and "end times" assigned by the head end of the network, but also discloses the assignment of "end times."[471] The downstream frame, where information is transmitted from the head end to each of the subscriber ends, contains a "StartTime field" that "indicates the starting time of the allocation" and a "StopTime field" that "indicates the stopping time of the allocation."[472]

393. A POSITA would have understood that allocations from the head end that assign a "start time" and "end time" for subscriber end transmissions onto the network effectively disclose a "length of time" for transmission. Because the beginning and end of the transmission allocation are defined, the allocated length of the transmission is also defined.

394. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times."

395. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 4 was well known prior to the earliest alleged filing date of the '754 Patent.[473] The inventors and patent owners also admit that TC-Layer functionality was well known prior to the earliest alleged filing date of the '754 Patent.[474]

[471] Ex. M at §§ 8.1.3-4; Ex. N at §§ 8.1.3-4.

[472] *Id.*

[473] Ex. SS at 182:16-24.

[474] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

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v. Claim 5: The network client optical transceiver module of claim 1, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers.

396. Under NextGen's apparent theory of infringement[475], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers. For the module of Claim 1, *see supra*, § IX.C.i.

397. A POSITA would have understood that the optical fibers discussed in Fujimori would consist of either multimode optical fibers or single mode optical fibers, as these were well-known in the optical communications space during the early 2000's as the types of optical fibers used in passive optical network data communications.[476] In fact, a POSITA would have known that optical fibers must either be single-mode type or multi-mode type fibers—there are no other types of optical fibers.

398. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers."

vi. Claim 6: The network client optical transceiver module of claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

399. Under NextGen's apparent theory of infringement[477], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the optical port includes one or more optical fiber connectors and the

[475] Ex. NN at 22.

[476] Ex. P at 33-37.

[477] Ex. NN at 22-23.

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optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU). For the module of Claim 1, *see supra*, § IX.C.i.

400. As discussed above in the discussion of [1.a], Fujimori teaches a pluggable optical transceiver module for use in a data communications network over optical fibers (i.e., a passive optical network).[478] Further, as shown below in Figure 1, the optical transceiver module described in Fujimori couples directly to an optical network at the points highlighted in red.[479] A POSITA would have understood that, in order to couple to the fibers of an optical network, a device such as the optical transceiver module described in Fujimori would have necessarily contained ports for coupling to and receiving optical fiber connectors (i.e., an "optical port").

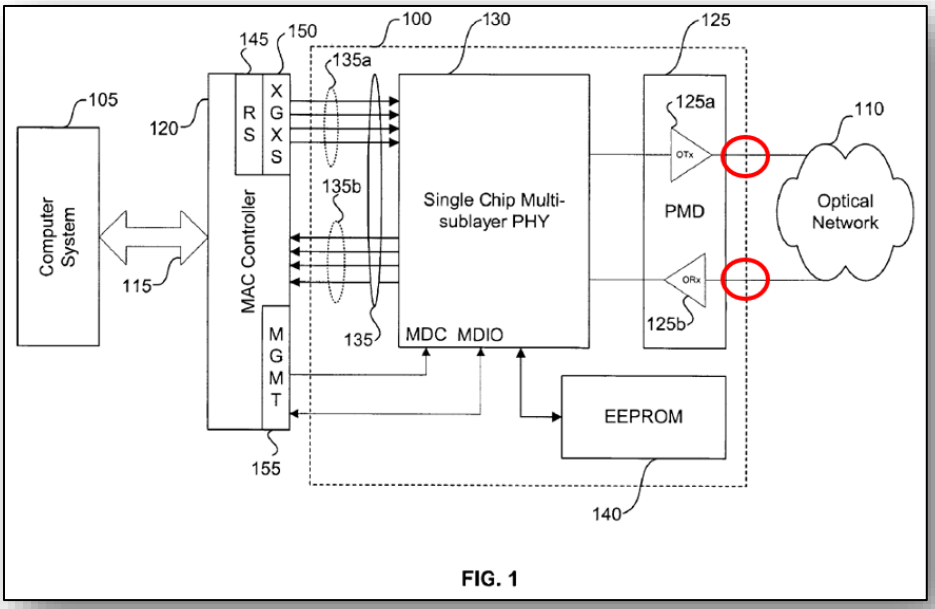


FIG. 1

401. Moreover, a POSITA would have understood that optical fibers interface with the optical port of a pluggable optical transceivers utilizing an optical fiber connector, which comprises the interlocking connection point of the fiber and the transceiver. As this would have been well known to a POSITA, it would have been understood that there were a limited number

[478] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[479] *Id.* at Fig. 1.

of different types of optical fiber connectors on the market at the time of the '754 Patent's alleged priority date, such as Subscriber Connector (SC), Lucent Connector (LC), Fiber Channel (FC), Straight TP (ST), and Miniature Unit (MU) connectors. [480] It would have been obvious to a POSITA to select an optical fiber connector from such a group.

402. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU)."

vii. Claim 7: The network client optical transceiver module of claim 1, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

403. Under NextGen's apparent theory of infringement[481], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface. For the module of Claim 1, *see supra*, § IX.C.i.

404. As discussed above in the analysis of [1.d], Fujimori teaches a pluggable optical transceiver module containing an "Ethernet attachment unit interface" or "XAUI" (i.e., the "electrical network interface port"), shown below in Figure 2.[482]

[480] Ex. W.

[481] Ex. NN at 23.

[482] Ex. G at 6:45-48.

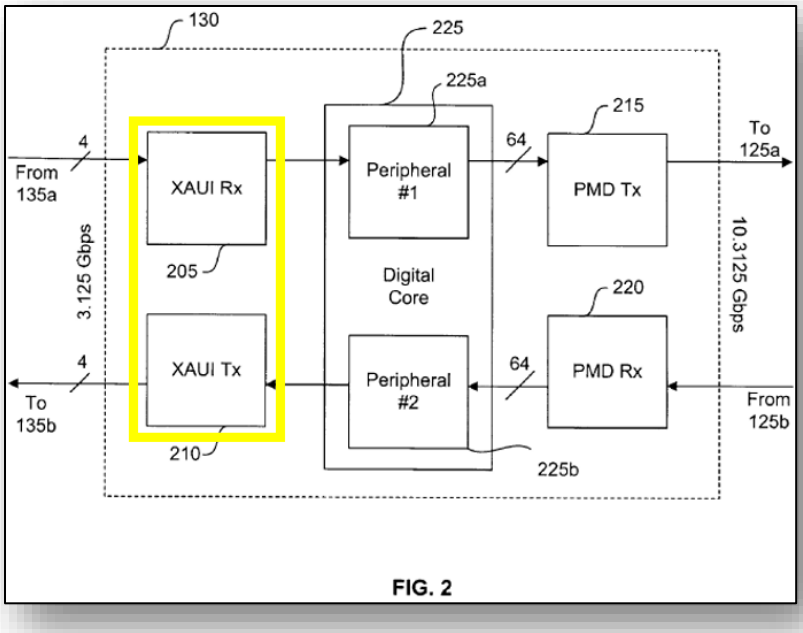


FIG. 2

405. As also discussed above, Fujimori teaches that MAC controlling functionalities performed by the MAC controller 120 may be contained within the pluggable optical transceiver module itself.[483] A POSITA would have understood that, where the MAC controller 120 is physically located on the pluggable optical transceiver module, the XAUI interface is coupled to the MAC controller and a port of a switch or router (described in Fujimori as "computer system 105").[484] It would have been further obvious to a POSITA that any MSA-compliant pluggable optical module would necessarily contain an electrical network interface for coupling to a host device, such as a switch or router due to its pluggable and removable nature.

406. Fujimori explicitly discloses the use of a XAUI interface, through a POSITA would have understood that the electrical interface this limitation discloses would be selected from a group containing a serial interface, a parallel interface, or a XAUI interface, all of which were well known electrical interfaces in the optical communications space in the early 2000s.[485]

407. Therefore, it is my opinion that the Fujimori-G.984.3 Draft

[483] *Id.* at 2:36-41, 5:45-6:12.

[484] *Id.* at Fig. 1.

[485] Ex. X.

Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface."

viii. Claim 8: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network.

408. Under NextGen's apparent theory of infringement[486], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network. For the module of Claim 1, *see supra*, § IX.C.i.

409. As previously discussed above in the analysis of [1.pre] and [1.b], Fujimori teaches a pluggable optical transceiver module that contains a "PMD 125" that is comprised of a PMD transmitter 125a and a PMD receiver 125b.[487] Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" (i.e., "bi-directional optical interface") where "electrical signals may be received by PMD transmitter 125a and transmitted in a format such as optical signals over the optical network 110" and where "optical signals may be received by PMD receiver 125b and transmitted as electrical signals to the computer system."[488] These components are highlighted below in Fujimori's Figure 1.[489]

[486] Ex. NN at 23-24.

[487] *Id.* at 7:25-43, Fig. 1.

[488] *Id.*

[489] *Id.*

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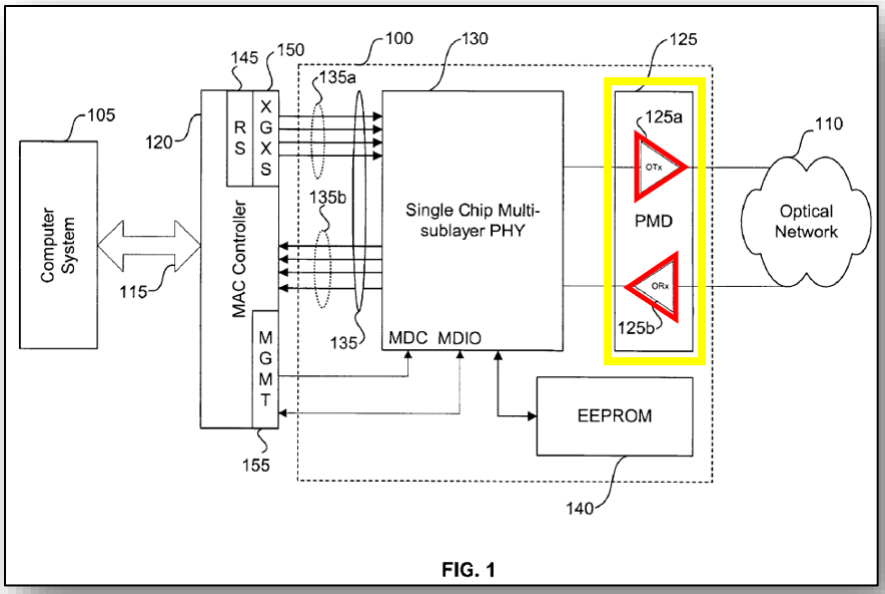


FIG. 1

410. As also discussed previously, Fujimori further teaches a MAC controller (or "control module") that may be contained on the pluggable optical transceiver module itself.[490] A POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. Framing structure and protocol are outlined extensively in the G.984.3 Draft Recommendation/Contribution 104.[491] Because the MAC controller implements the functionality described in the G.984.3 Draft Recommendation/Contribution 104, it would have been obvious to a POSITA that the framing block, as described in the claims, is located in the MAC controller, which executes all framing functions.

411. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a framer (i.e., "framing block") capable of performing the functions described in Claim 8 "can be part of a control module."[492]

[490] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[491] *See e.g.*, Ex. M at § 6.4.2 ("PON TC function specified in this recommendation . . . includes *framing* . . . .) (emphasis added); Ex. N at § 6.4.2.

[492] Ex. SS at 215:4-8.

412. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network."

ix. Claim 9: The network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module.

413. Under NextGen's apparent theory of infringement[493], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module. For the module of Claim 1, *see supra*, § IX.C.i.

414. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network that "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling* . . . ."[494] Fujimori is explicit that MAC controlling functionality may be included in the disclosed pluggable optical transceiver module.

415. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[495] A POSITA would understand the MAC controller 120 to perform functionality

[493] Ex. NN at 24.

[494] Ex. G at 1:38-40, 2:11-41, 5:45-6:12 (emphasis added).

[495] *Id.* at 5:45-6:12.

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like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[496]

416. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[497] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

417. One such recommendation is the assignment of identification addresses to subscriber ends by the head end. The G.984.3 Draft Recommendation/Contribution 104 disclose an "ONU-ID Field" of the downstream frame that indicates the particular ONT/ONU that is being granted time to transmit upstream on the passive optical network.[498] During the ranging process, in which new subscriber end ONTs/ONUs entering the network become discoverable to the head end OLT, ONTs/ONUs are assigned an "ONU-ID" that is unique to each individual ONT/ONU, corresponding to the ONT/ONU's serial number.[499] This allows the OLT to direct messages to a specific ONT/ONU; each ONU-ID value is used to address the ONT/ONU directly.

418. A POSITA would have understood that this method disclosed in the G.984.3 Draft Recommendation/Contribution 104 consists of the head-end of the network assigning an identification address in order to transmit to and receive data from the ONT/ONU. As discussed, a POSITA would have understood the MAC controller found in Fujimori's pluggable optical transceiver module to implement this functionality.

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[496] *Id.*

[497] Ex. M at § 8.2.2.2; Ex. N at § 8.2.2.2.

[498] *Id.*

[499] *Id.*

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419. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module."

420. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[500] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[501]

x. Claim 10: The network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.

421. Under NextGen's apparent theory of infringement[502], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients. For the module of Claim 1, *see supra*, § IX.C.i.

422. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network that "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling* . . . ."[503] Fujimori is explicit that MAC controlling functionality may be included in the disclosed

[500] Ex. SS at 182:16-24.

[501] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8, 212:21-213:1.

[502] Ex. NN at 24-25.

[503] Ex. G at 1:38-40, 2:11-41, 5:45-6:12 (emphasis added).

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pluggable optical transceiver module.

423. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[504] A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[505]

424. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[506] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

425. One such recommendation is the process of registering a new client or subscriber end unit on the network. The G.984.3 Draft Recommendation/Contribution 104 disclose that subscriber end ONTs/ONUs register to the management system of the OLT utilizing their serial number or through a ranging method.[507] Both methods are initiated by and performed under the control of the head end OLT. In the first method, a serial number of the ONT/ONU is registered in advance at the OLT.[508] In the second method, an OLT can periodically initiate the activation process of ranging to test and see if any new ONTs/ONUs have been connected to the network.[509]

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[504] *Id.* at 5:45-6:12.

[505] *Id.*

[506] Ex. M at §§ 7.4, 8; Ex. N at §§ 7.4, 8.

[507] Ex. M at §§ 7.4.2, 10; Ex. N at §§ 7.4.2, 10.

[508] *Id.* at 10.

[509] *Id.*

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Specifically, the ONT/ONU "*responds* to messages, which are initiated in the OLT" identifying itself as a new client on the network.[510] Once an ONU is ranged, it is operational on the passive optical network.[511]

426. A POSITA would have understood that this method disclosed in the G.984.3 Draft Recommendation/Contribution 104 consists of a new subscriber end ONT/ONU responding to a registration message from the head end OLT. As discussed, a POSITA would have understood the MAC controller found in Fujimori's pluggable optical transceiver module to implement this functionality.

427. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients."

428. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 10 was well known prior to the earliest alleged filing date of the '754 Patent.[512] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 10, was well known prior to the earliest alleged filing date of the '754 Patent.[513]

xi. Claim 11: The network clients optical transceiver module of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module.

429. Under NextGen's apparent theory of infringement[514], in my opinion, the Fujimori-

[510] *Id.* at § 10.2.1.

[511] *Id.*

[512] Ex. SS at 182:16-24.

[513] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[514] Ex. NN at 25-27.

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G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module. For the module of Claim 1, *see supra*, § IX.C.i.

430. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network that "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling* . . . ."[515] Fujimori is explicit that MAC controlling functionality may be included in the disclosed pluggable optical transceiver module.

431. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[516] A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[517]

432. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[518] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

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[515] Ex. G at 1:38-40, 2:11-41, 5:45-6:12 (emphasis added).

[516] *Id.* at 5:45-6:12.

[517] *Id.*

[518] Ex. M at §§ 7.4, 8; Ex. N at §§ 7.4, 8.

433. One such recommendation is utilizing a ranging process to determine the delay on a network. The G.984.3 Draft Recommendation/Contribution 104 discuss the presence of delay in transmission over a passive optical network due to the distances between each subscriber end ONT/ONU and the head end OLT.[519] The delay between the OLT and each ONT/ONU is determined during the ranging process, mentioned above in Claim 10. The OLT measures the arrival phase of the initial upstream transmission from the ONT/ONU during the ranging process.[520] Once determined, the OLT notifies the ONT/ONU of the delay and the ONT/ONU adjusts its transmission phase to the notified value.[521] This allows for all upstream frames to be properly synchronized together between all ONUs; the upstream transmissions will arrive separately, each one in its correct location within the frame, compensating for the delay caused by their distance from the OLT.[522]

434. A POSITA would have understood that this method disclosed in the G.984.3 Draft Recommendation/Contribution 104 consists of a subscriber end device responding to a delay message initiated by the head end of the network. As discussed, a POSITA would have understood the MAC controller found in Fujimori's pluggable optical transceiver module to implement this functionality.

435. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module."

436. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 11 was well known prior to the earliest alleged filing date of the '754 Patent.[523]

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[519] Ex. M at § 10.1; Ex. N at § 10.1.

[520] *Id*.

[521] *Id.*

[522] *Id.* at § 10.2.2.1.

[523] Ex. SS at 182:16-24.

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The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 11, was well known prior to the earliest alleged filing date of the '754 Patent.[524]

xii. Claim 12: The network client optical transceiver module of claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.

437. Under NextGen's apparent theory of infringement[525], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process. For the module of Claim 1, *see supra*, § IX.C.i.

438. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network that "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling* . . . ."[526] Fujimori is explicit that MAC controlling functionality may be included in the disclosed pluggable optical transceiver module.

439. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[527] A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[528]

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[524] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[525] Ex. NN at 28.

[526] Ex. G at 1:38-40, 2:11-41, 5:45-6:12 (emphasis added).

[527] *Id.* at 5:45-6:12.

[528] *Id.*

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440. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[529] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

441. One such recommendation is aligning upstream transmissions with the period of the network assigned to each subscriber end device in order to avoid collisions with other transmitting subscribers. As discussed above in Claim 11, the G.984.3 Draft Recommendation/Contribution 104 teaches a ranging process that is used to account for delay caused by the distance between the head end and subscriber ends of the network.[530] The head end OLT measures the arrival phase of the initial upstream transmission from the subscriber end ONT/ONU during the ranging process.[531] Once determined, the OLT notifies the ONT/ONU of the delay and the ONT/ONU adjusts its transmission phase to the notified value.[532] This allows for all upstream frames to be properly synchronized together between all ONUs; the upstream transmissions will arrive separately, each one in its correct location within the frame, compensating for the delay caused by their distance from the OLT.[533]

442. A POSITA would have understood that this method disclosed in the G.984.3 Draft Recommendation/Contribution 104 consists of aligning data communication transmissions with the network period of the optical network in order to compensate for network delay. As discussed, a POSITA would have understood the MAC controller found in Fujimori's pluggable optical transceiver module to implement this functionality.

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[529] Ex. M at §§ 7.4, 8; Ex. N at §§ 7.4, 8.

[530] Ex. M at § 10.1; Ex. N at § 10.1.

[531] *Id*.

[532] *Id.*

[533] *Id.* at § 10.2.2.1.

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443. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process."

444. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 12 was well known prior to the earliest alleged filing date of the '754 Patent.[534] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 12, was well known prior to the earliest alleged filing date of the '754 Patent.[535]

xiii. Claim 13: The network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.

445. Under NextGen's apparent theory of infringement[536], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network. For the module of Claim 1, *see supra*, § IX.C.i.

446. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network that "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling* . . . ."[537] Fujimori is explicit that MAC controlling functionality may be included in the disclosed pluggable optical transceiver module.

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[534] Ex. SS at 182:16-24.

[535] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[536] Ex. NN at 28.

[537] Ex. G at 1:38-40, 2:11-41, 5:45-6:12 (emphasis added).

447. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[538] A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[539]

448. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[540] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

449. One such recommendation is adjusting the optical power levels of a transmitting device to compensate for distance and delay between a subscriber end and the head end. In addition to procedures for ranging, the G.984.3 Draft Recommendation/Contribution 104 discuss the procedure for optical power control in the subscriber end ONT/ONU.[541] According to the G.984.3 Draft Recommendation/Contribution 104's description of the upstream Power Levelling state, power control measurements are made by the ONT/ONU to adjust the levels of optical power transmitted by the ONT/ONU to the OLT, shown in yellow in Figure 10-1 below.[542] This operation adjusts the power level of the transmitter in order to compensate for signal loss due to distance

[538] *Id.* at 5:45-6:12.

[539] *Id.*

[540] Ex. M at §§ 7.4, 8; Ex. N at §§ 7.4, 8.

[541] *Id.* at § 10.2.2.

[542] *Id.* at § 10.2.2.2.

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between the ONT/ONU and the OLT over which the transmitted optical signal must travel.[543]

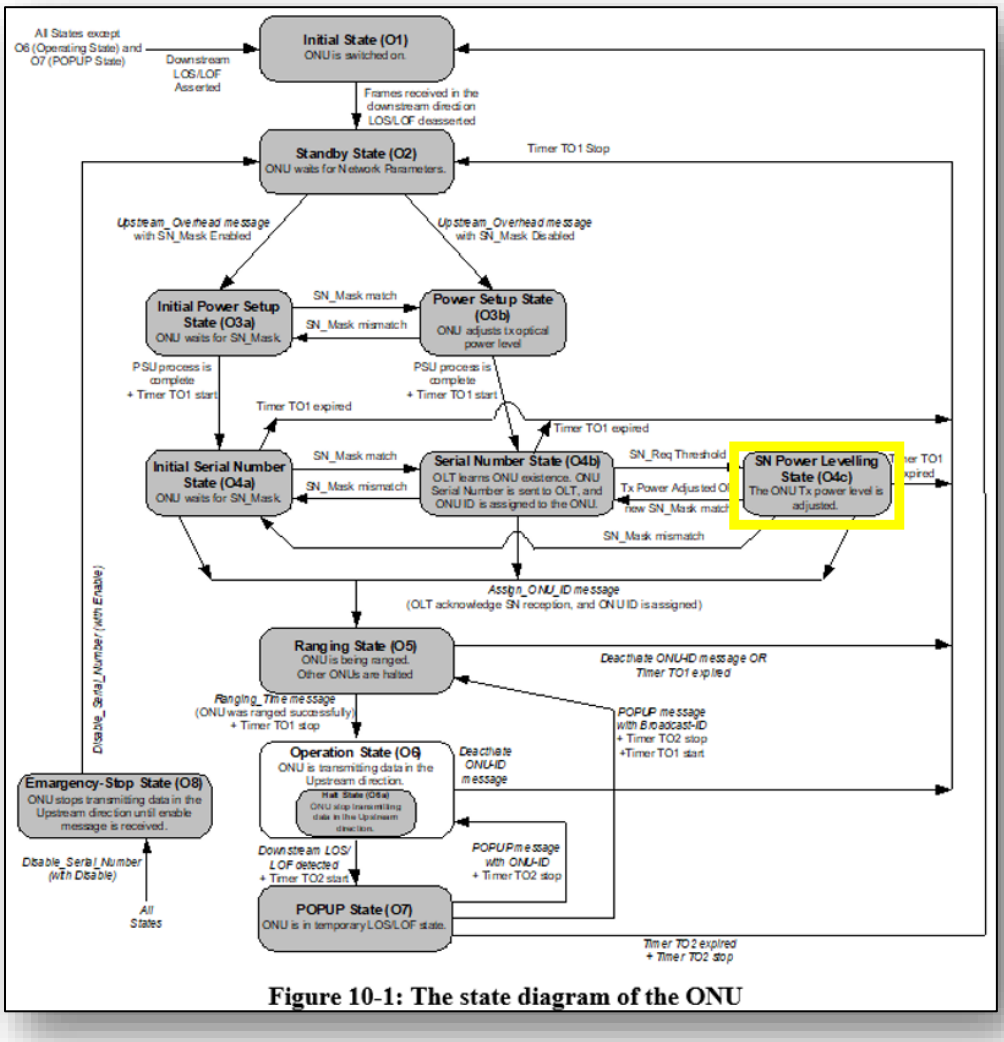


Figure 10-1: The state diagram of the ONU

450. A POSITA knowledgeable about the pluggable optical transceivers described in Fujimori, containing a transmitter subassembly, would have known to look to the G.984.3 Draft Recommendation/Contribution 104 for more information on power control measurements and adjusting the laser power levels in the subscriber end device.

451. As discussed previously, because the control module of the optical transceiver module is configured to control the reception and transmission of signals, it would have been

[543] *Id.*

obvious to a POSITA that this adjustment to the transmitting optical power level would be conducted by the control module. Moreover, a POSITA would have understood the MAC controller found in Fujimori's pluggable optical transceiver module to implement this functionality similarly to the "control module" of the '754 Patent.

452. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network."

453. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 13 was well known prior to the earliest alleged filing date of the '754 Patent.[544] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 13, was well known prior to the earliest alleged filing date of the '754 Patent.[545]

xiv. Claim 14: The network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.

454. Under NextGen's apparent theory of infringement[546], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network. For the module of Claim 1, *see supra*, § IX.C.i.

455. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network that "may include various function components which may implement tasks such as . . . *media access control* (MAC) [and] *controlling*

[544] Ex. SS at 182:16-24.

[545] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[546] Ex. NN at 28-29.

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. . . ."[547] Fujimori is explicit that MAC controlling functionality may be included in the disclosed pluggable optical transceiver module.

456. Further in the specification, Fujimori teaches a "medium access control (MAC) controller 120" that is configured to implement well-known OSI protocol standards for data transmission.[548] A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control module.[549]

457. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[550] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

458. One such recommendation is framing upstream data communications in accordance with a framing protocol for the network. The G.984.3 Draft Recommendation/Contribution 104 discuss the use of a framing structure at length and, in particular, the upstream frame structure relevant here and shown below in Figures 8-9 and 8-10.[551]

[547] Ex. G at 1:38-40, 2:11-41, 5:45-6:12 (emphasis added).

[548] *Id.* at 5:45-6:12.

[549] *Id.*

[550] Ex. M at §§ 7.4, 8; Ex. N at §§ 7.4, 8.

[551] *Id.* at § 8.2.

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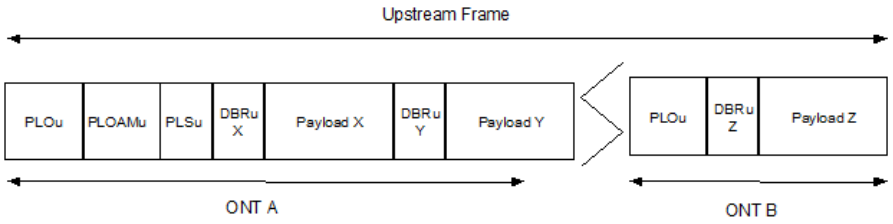


Figure 8-9 – GTC Upstream frame.

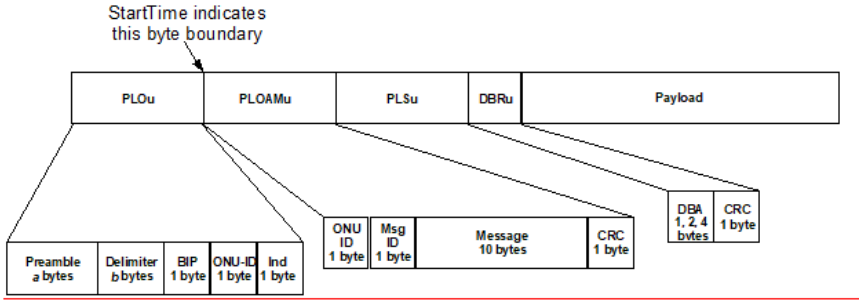


Figure 8-10 – GTC Upstream Overheads Detail.

459. As shown in the figures above, the G.984.3 Draft Recommendation/Contribution 104 disclose an "Upstream payload section" contained within the upstream frame.[552] As described, the upstream frame first transmits overhead data information followed by the communicated data contained in the payload section of the frame, which continues until the designated "stop time" or "end time."[553]

460. A POSITA would have understood that the data transmitted in the payload section would be received by the pluggable optical transceiver module from the host device, such as a switch or router or, as described in Fujimori, the "computer system." Because the pluggable optical transceiver module taught in Fujimori is connected to the host device via an electrical network interface port, as discussed in the analysis of [1.d], it would have been obvious to a POSITA that the data destined for the payload section of the frame would be received by the module via the electrical network interface port. Moreover, a POSITA would have understood the MAC controller found in Fujimori's pluggable optical transceiver module to implement this functionality similarly

[552] *Id.*

[553] *Id.*

to the "control module" of the '754 Patent.

461. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network."

462. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 14 was well known prior to the earliest alleged filing date of the '754 Patent.[554] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 14, was well known prior to the earliest alleged filing date of the '754 Patent.[555]

xv. Claim 15: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

463. Under NextGen's apparent theory of infringement[556], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier. For the module of Claim 1, *see supra*, § IX.C.i.

464. As discussed above in the analysis of [1.pre] and [1.b], Fujimori teaches a pluggable optical transceiver module that contains a "PMD 125" that is comprised of a PMD transmitter 125a and a PMD receiver 125b.[557] Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" (i.e., "bi-directional optical interface") where "electrical signals

[554] Ex. SS at 182:16-24.

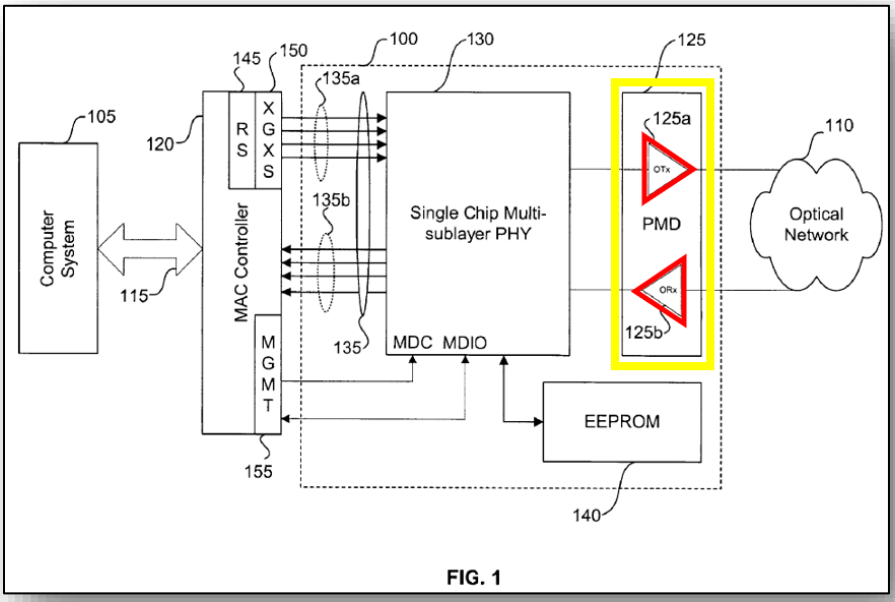
[555] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[556] Ex. NN at 29.

[557] *Id.* at 7:25-43, Fig. 1.

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may be received by PMD transmitter 125a and transmitted in a format such as optical signals over the optical network 110" and where "optical signals may be received by PMD receiver 125b and transmitted as electrical signals to the computer system."[558] These components are highlighted below in Fujimori's Figure 1.[559]



465. Regardless, the components listed in Claim 15 are traditional components of a transceiver utilized to transmit and receive signals in a data communications system of a passive optical network. The '754 Patent recognizes this: "[a] typical optical module is composed of a: laser []; laser driver (LD) []; photo detector (PD); transimpedance amplifier (TIA) []; limiting amplifier (LA) []."[560] In fact, the '754 Patent contains Figure 11 (shown below), which depicts a "typical optical module" and is labeled as prior art, highlighting the components described in Claim 15.

[558] *Id.*

[559] *Id.*

[560] Ex. A at 1:56-62.

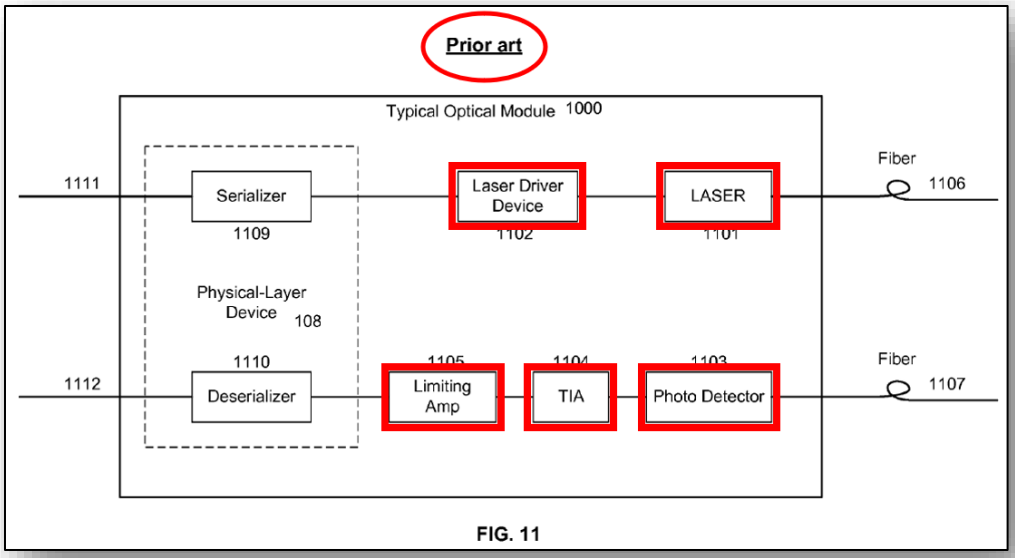


FIG. 11

466. It would have been obvious to any POSITA that these components would have been necessary to transmit optical data communications across a passive optical network.[561]

467. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module "wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier."

xvi. Claim 16: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

468. Under NextGen's apparent theory of infringement[562], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module wherein the network client optical transceiver module is an optical network

[561] *Id.*; Ex. P at Fig. 11.7.

[562] Ex. NN at 29-30.

terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip. For the module of Claim 1, *see supra*, § IX.C.i.

469. As discussed above in the analysis of Claim 1, Fujimori teaches a pluggable optical transceiver module for use in a data communications network over optical fibers (i.e., a passive optical network).[563]

470. Additionally, a POSITA would have understood that an optical transceiver performing data communications in a passive optical network would inherently contain a TC-Layer discrete chip as well as a MAC discrete chip, such as the MAC controller disclosed in Fujimori, in order to operate in accordance with standard network protocols, such as the framing protocols and ranging protocols described in the G.984.3 Draft Recommendation/Contribution 104 and discussed extensively above.[564]

471. Additionally, the G.984.3 Draft Recommendation/Contribution 104 are drafts for the ITU-T standard directed to "Transmission Convergence Layer for Gigabit Passive Optical Networks" (i.e., TC-Layer) and discusses media access control protocol throughout.[565] Specifically, the G.984.3 Draft Recommendation/Contribution 104 state that "PON TC function includes framing, *media access control*, OAM, DBA . . . ."[566] It would have therefore been obvious to a POSITA that any transceiver operating in accordance with the protocol described in the G.984.3 Draft Recommendation/Contribution 104 would necessarily contain a MAC discrete chip as well as a TC-Layer discrete chip in order to perform the MAC functionalities described in the TC-Layer function. Alternatively, a POSITA would have understood that the functionalities typically contained in a MAC discrete chip could also be integrated fully into the TC-Layer discrete chip, thus nullifying the need for a separate MAC discrete chip.

472. Therefore, it is my opinion that the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver

[563] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[564] Ex. M; Ex. N.

[565] *See, e.g.*, Ex. M at § 7.4.1; Ex. N at § 7.4.1.

[566] *Id.* at 14; *id.* at 13.

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module "wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip."

xvii. Claim 18

a. [18.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, and the network client optical transceiver module having an optical port to one or more optical fibers of the passive optical network, and the network client optical transceiver module having an optical interface block optically coupled to the optical port and for converting electrical signals to optical signals and for converting optical signals to electrical signals, and the network client optical transceiver module having an optical interface block and for communicating with the head-end of the passive optical network, and the network client optical transceiver module having an electrical network interface port electrically coupled to the control module and for electrically communicating to the switch or router, a method of communicating with the head-end of a passive optical network from the network client optical transceiver module comprising the steps of:

473. Under NextGen's apparent theory of infringement[567], to the extent the preamble is limiting, the combination of Fujimori and the G.984.3 Draft Standard/Contribution 104 discloses this claim for the same reasons as described in [1.pre] – [1.e].

b. [18.a] receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module;

474. Under NextGen's apparent theory of infringement[568], in my opinion, the Fujimori-

[567] Ex. NN at 30-31.

[568] Ex. NN at 31.

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G.984.3 Draft Recommendation/Contribution 104 combination discloses receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module.

475. As discussed above in the analysis of [1.d], the Fujimori-G.984.3 Draft Recommendation/Contribution discloses an electrical network interface port for communicating with the switch or router. Fujimori teaches a pluggable optical transceiver module containing an "Ethernet attachment unit interface" or "XAUI" (i.e., the "electrical network interface port"), shown below in Figure 2.[569] This interface connects the pluggable optical transceiver module to an external device, which a POSITA would have understood as a switch or router consistent with the "computer system" disclosed in Fujimori. [570]

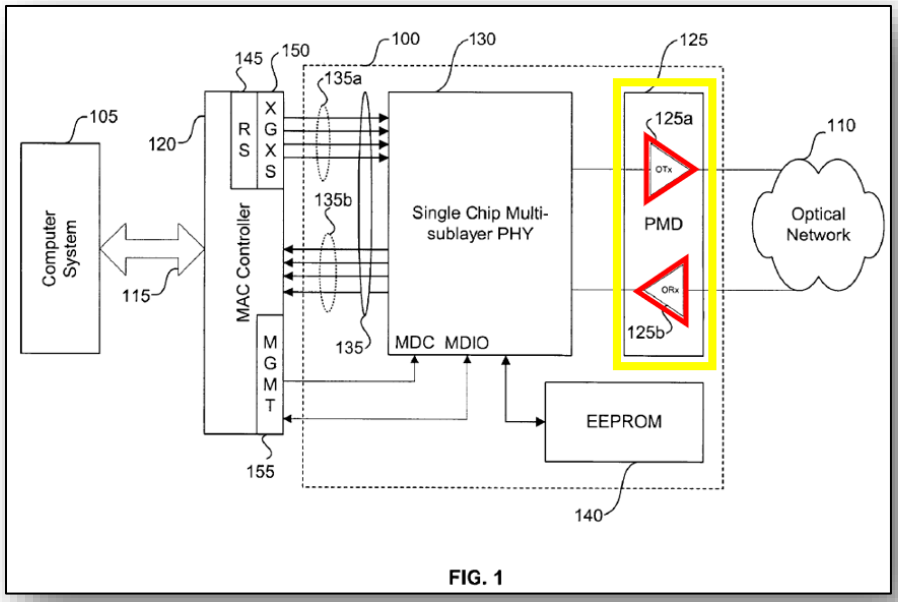


FIG. 1

476. As discussed above, Fujimori teaches that MAC controlling functionalities performed by the MAC controller 120 may be contained within the pluggable optical transceiver module itself.[571] A POSITA would have understood that, where the MAC controller 120 is

[569] Ex. G at 6:45-48, Fig. 2.

[570] *Id.* at Fig. 1.

[571] *Id.* at 2:36-41, 5:45-6:12.

physically located on the pluggable optical transceiver module, the XAUI interface is coupled to the MAC controller and a port of a switch or router (described in Fujimori as "computer system 105").[572] It would have been further obvious to a POSITA that any MSA-compliant pluggable optical module would necessarily contain an electrical network interface for coupling to a host device, such as a switch or router due to its pluggable and removable nature.

477. Further, as discussed above in Claim 14, a POSITA would have understood that, in order to transmit data communications upstream, an optical transceiver module (such as the one described in Fujimori) must receive data from the external host device to construct the payload section of the upstream transmission frame. The G.984.3 Draft Recommendation/Contribution 104 disclose an "Upstream payload section" contained within the upstream frame.[573] As described, the upstream frame first transmits overhead data information followed by the communicated data contained in the payload section of the frame, which continues until the designated "StopTime" or "end time."[574]

478. A POSITA would have understood that the data transmitted in the payload section would be received by the pluggable optical transceiver module from the host device, such as a switch or router or, as described in Fujimori, the "computer system." Because the pluggable optical transceiver module taught in Fujimori is connected to the host device via an electrical network interface port, as discussed in the analysis of [1.d], it would have been obvious to a POSITA that the data destined for the payload section of the frame would be received by the module via the electrical network interface port.

479. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module."

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[572] *Id.* at Fig. 1.

[573] *Id.*

[574] *Id.*

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c. [18.b] storing the received data inside the network client optical transceiver module;

480. Under NextGen's apparent theory of infringement[575], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses storing the received data inside the network client optical transceiver module.

481. As discussed above in the analysis of [18.a], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses receiving data from an external host device, such as a switch or router, via an electrical network interface port of the optical transceiver module. Fujimori discloses that optical transceivers, such as the one it teaches, "may include various function components which may implement tasks such as . . . media access control (MAC), controlling, and *data storage* . . . ."[576]

482. Further, Fujimori states that a function of its pluggable optical transceiver module is to transmit and receive data. It would have been obvious to a POSITA that data received for transmission would need to be stored on the device, even if only briefly, prior to transmission onto the network as Fujimori describes. Thus, a POSITA would have understood that the optical transceiver module contemplated in Fujimori contains components for storing data, such as the data received from the host device via the electrical network interface port.

483. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "storing the received data inside the network client optical transceiver module."

d. [18.c] receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module;

484. Under NextGen's apparent theory of infringement[577], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical

[575] Ex. NN at 31-32.

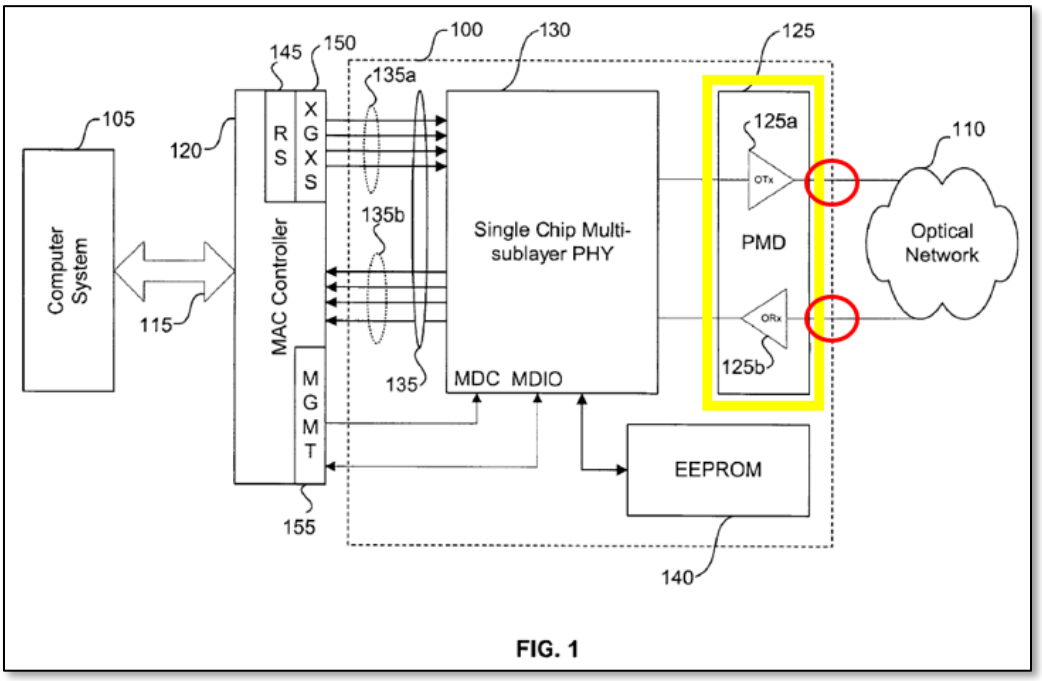
[576] Ex. G at 2:36-41 (emphasis added).

[577] Ex. NN at 32.

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interface block of the network client optical transceiver module.

485. As discussed above in the analysis of [1.a], the optical transceiver module described in Fujimori couples directly to an optical network at the points highlighted in red.[578] A POSITA would have understood that, in order to couple to the fibers of an optical network, a device such as the optical transceiver module described in Fujimori would have necessarily contained ports for coupling to and receiving optical fiber connectors (i.e., an "optical port").



486. As also discussed in the analysis of [1.b], Fujimori teaches that its pluggable optical transceiver module contains a "PMD 125" that is comprised of a PMD transmitter 125a and a PMD receiver 125b.[579] Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" (i.e., "bi-directional optical interface") where "optical signals *may be received* by PMD receiver 125b and transmitted as electrical signals to the computer system."[580] These components are also highlighted above in Fujimori's Figure 1.[581]

[578] *Id.* at Fig. 1.

[579] *Id.* at 7:25-43, Fig. 1.

[580] *Id.* (emphasis added).

[581] *Id.*

487. Because the optical port of the optical transceiver module is the physical connection point between the "optical interface block" (i.e., PMD) of the module and the optical fibers of the network, it would have been obvious to a POSITA that any downstream optical data would be received via the optical port at the optical interface.

488. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module."

e. [18.d] converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module;

489. Under NextGen's apparent theory of infringement[582], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module.

490. As discussed above in the analysis of [1.pre] and [1.b], Fujimori teaches a pluggable optical transceiver module that contains a "PMD 125" that is comprised of a PMD transmitter 125a and a PMD receiver 125b.[583] Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" (i.e., "bi-directional optical interface") where "electrical signals may be received by PMD transmitter 125a and transmitted in a format such as optical signals over the optical network 110" and where "optical signals may be received by PMD receiver 125b and transmitted as electrical signals to the computer system."[584]

491. As also discussed previously in the analysis of [1.c], Fujimori further teaches a MAC controller (or "control module") that may be contained on the pluggable optical transceiver

[582] Ex. NN at 32.

[583] Ex. G at 7:25-43, Fig. 1.

[584] *Id.*

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module itself.[585] It would have been obvious to a POSITA that an optical signal received and converted to an electrical signal at Fujimori's optical interface block, PMD 125, would necessarily subsequently be conveyed to the MAC controller, which determines certain data transmission allocation information from the received signal, as discussed above.

492. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module."

f. [18.e] processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network;

493. Under NextGen's apparent theory of infringement[586], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network.

494. As discussed above in the analysis of [1.c], Fujimori teaches a pluggable optical transceiver module for use in a data communications network containing a "MAC controller 120".[587] Further in the specification, Fujimori teaches a that the MAC controller 120 is configured to implement well-known OSI protocol standards for data transmission.[588] A POSITA would understand the MAC controller 120 to perform functionality like that associated with the claimed "control module" of the '754 Patent. For example, the MAC controller "provide[s] the necessary services . . . to ensure that packets are suitably formatted and communicated," a function analogous to the data transmission alignment functionalities associated with the '754 Patent's control

[585] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[586] Ex. NN at 33.

[587] Ex. G at 1:38-40, 2:11-41, 5:45-6:12.

[588] *Id.* at 5:45-6:12.

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module.[589]

495. Moreover, a POSITA would have understood that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104. The G.984.3 Draft Recommendation/Contribution 104 explicitly discusses the framing and transmission of data communications in accordance with a medium access control protocol.[590] A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

496. The G.984.3 Draft Recommendation/Contribution 104 explicitly discloses the use of "start times," that are assigned by the head end of the network, or OLT, and received by the subscriber ends of the network, or ONTs/ONUs, in order to align their upstream transmissions back to the head end.[591] The downstream frame contains a "StartTime field" that "indicates the starting time of the allocation."[592] Thus, it would have been obvious to a POSITA to combine the "start time" assignment, as was traditional for use in a PON communication system, with the MAC controller of the pluggable optical transceiver module discussed in Fujimori. It would have further been obvious to a POSITA that the pluggable optical transceiver module's MAC controller would necessarily process the received signal in order to determine such a "start time" allocation from the received signal, which, as discussed above, would have been converted to an electrical signal at PMD 125.

497. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network."

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[589] *Id.*

[590] Ex. M at §§ 7.4, 8; Ex. N at §§ 7.4, 8.

[591] *Id.* at § 8.1.3.

[592] *Id.*

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g. [18.f] converting a portion of the stored received data to a second optical signal; and

498. Under NextGen's apparent theory of infringement[593], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses converting a portion of the stored received data to a second optical signal.

499. As discussed above in the analysis of [18.b], Fujimori teaches that its pluggable optical transceiver module "may include various function components which may implement tasks such as . . . media access control (MAC), controlling, and *data storage* . . . ."[594] Moreover, Fujimori teaches that it's pluggable optical transceiver module is configured to transmit and receive data.[595] It would have been obvious to a POSITA that data received for transmission would need to be stored on the device, even if only briefly, prior to transmission onto the network as Fujimori describes. Thus, a POSITA would have understood that the optical transceiver module contemplated in Fujimori contains components for storing data, such as the data received from the host device via the electrical network interface port.

500. Further, as discussed above in the analysis of [1.b], Fujimori teaches that its pluggable optical transceiver module contains a "PMD 125" comprised of a PMD transmitter 125a and a PMD receiver 125b.[596] Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" (i.e., "bi-directional optical interface") where "electrical signals may be received by PMD transmitter 125a and transmitted in a format such as optical signals over the optical network 110."[597]

501. It would have been obvious to a POSITA that, in order to transmit the stored received data onto the optical network (the object of the optical transceiver module), the stored data would necessarily be converted from its electrical signal format to an optical signal format by PMD 125. Because signals transmitted across an optical network must be *optical signals*, it would

[593] Ex. NN at 33.

[594] *Id.* at 2:36-41 (emphasis added).

[595] *Id.* at 5:65-6:2.

[596] *Id.* at 7:25-43, Fig. 1.

[597] *Id.*

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have been obvious to a POSITA that any data transmission would first need to be converted to an optical format prior to transmission.

502. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "converting a portion of the stored received data to a second optical signal."

h. [18.g] transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network; whereby

503. Under NextGen's apparent theory of infringement[598], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network.

504. As discussed above in the analysis of Claim 1, Fujimori teaches a pluggable optical transceiver module that is configured to receive data communications from and transmit data communications onto an optical network.[599] The optical transceiver module described in Fujimori couples directly to an optical network at the points highlighted in red.[600] A POSITA would have understood that, in order to couple to the fibers of an optical network, a device such as the optical transceiver module described in Fujimori would have necessarily contained a port for coupling to and receiving optical fiber connectors (i.e., an "optical port").

[598] Ex. NN at 33.

[599] Ex. G at 5:65-6:2.

[600] *Id.* at Fig. 1.

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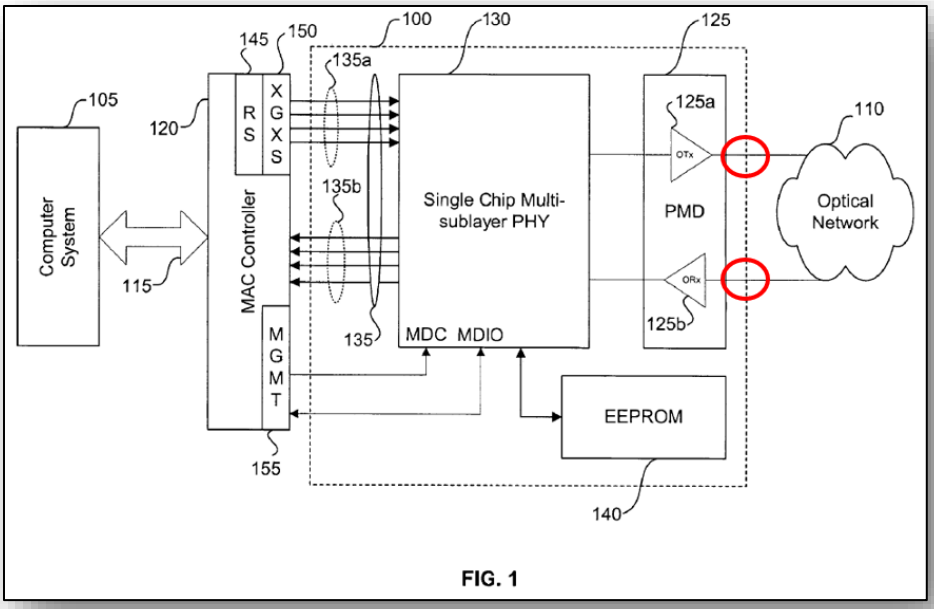


FIG. 1

505. As also discussed in the analysis of [1.b], Fujimori teaches that its pluggable optical transceiver module contains a "PMD 125" that is comprised of a PMD transmitter 125a and a PMD receiver 125b.[601] Fujimori states that PMD 125 "may also be configured to function as an electro-optical interface" (i.e., "bi-directional optical interface") where "electrical signals may be received by PMD transmitter 125a and *transmitted in a format such as optical signals* over the optical network 110."[602] These components are also highlighted above in Fujimori's Figure 1.[603]

506. Because the optical port of the optical transceiver module is the physical connection point between the "optical interface block" (i.e., PMD) of the module and the optical fibers of the network, it would have been obvious to a POSITA that any upstream optical transmission would be transmitted via the optical port at the optical interface.

507. Further, as discussed in the analysis of [1.c], Fujimori's pluggable optical transceiver module may contain a MAC controller that is configured to align data communications upstream to the head end of the network with certain transmission "start time" allocations received

[601] *Id.* at 7:25-43, Fig. 1.

[602] *Id.* (emphasis added).

[603] *Id.*

from the head end. A POSITA would have understood a pluggable optical transceiver containing the described MAC controller to implement the same functionalities and comply with the recommendations of the G.984.3 Draft Recommendation/Contribution 104 in order to be operable with the optical network.

508. The G.984.3 Draft Recommendation/Contribution 104 explicitly discloses the use of "start times," that are assigned by the head end of the network, or OLT, and received by the subscriber ends of the network, or ONTs/ONUs, in order to align their upstream transmissions back to the head end.[604] Thus, it would have been obvious to a POSITA any upstream optical signals transmitted from the pluggable optical module of Fujimori onto the network would have been in accordance with the "start times" allocated by the head end of the network.

509. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network."

i. [18.h] the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and the network client optical transceiver module electrically communicates with the switch or router.

510. Under NextGen's apparent theory of infringement[605], in my opinion, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses a network client optical transceiver module that optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and a network client optical transceiver module that electrically communicates with the switch or router.

511. As discussed above in the analysis of [1.c], and again in [18.e] and [18.g], Fujimori's pluggable optical transceiver module may contain a MAC controller that is configured to align data communications upstream to the head end of the network with certain transmission "start time" allocations received from the head end. Moreover, a POSITA would have understood

[604] *Id.* at § 8.1.3.

[605] Ex. NN at 33-34.

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that the MAC controller disclosed in Fujimori to be configured to implement the functionalities discussed in the G.984.3 Draft Recommendation/Contribution 104.

512. The G.984.3 Draft Recommendation/Contribution 104 explicitly discloses the use of "start times," that are assigned by the head end of the network, or OLT, and received by the subscriber ends of the network, or ONTs/ONUs, in order to align their upstream transmissions back to the head end.[606] The downstream frame contains a "StartTime field" that "indicates the starting time of the allocation."[607] Thus, it would have been obvious to a POSITA any upstream optical signals transmitted from the pluggable optical module of Fujimori onto the network would have been in accordance with the "start times" allocated by the head end of the network.

513. Additionally, as discussed above in the analysis of [1.d], the pluggable optical transceiver module disclosed in Fujimori is configured to electrically couple to and communicate with a host device or a "computer system," which a POSITA would have understood to include devices such as switches and routers. Fujimori's pluggable optical transceiver module contains an "Ethernet attachment unit interface" or "XAUI" (i.e., the "electrical network interface port"), shown below in Figure 2.[608]

[606] *Id.* at § 8.1.3.

[607] *Id.*

[608] Ex. G at 6:45-48.

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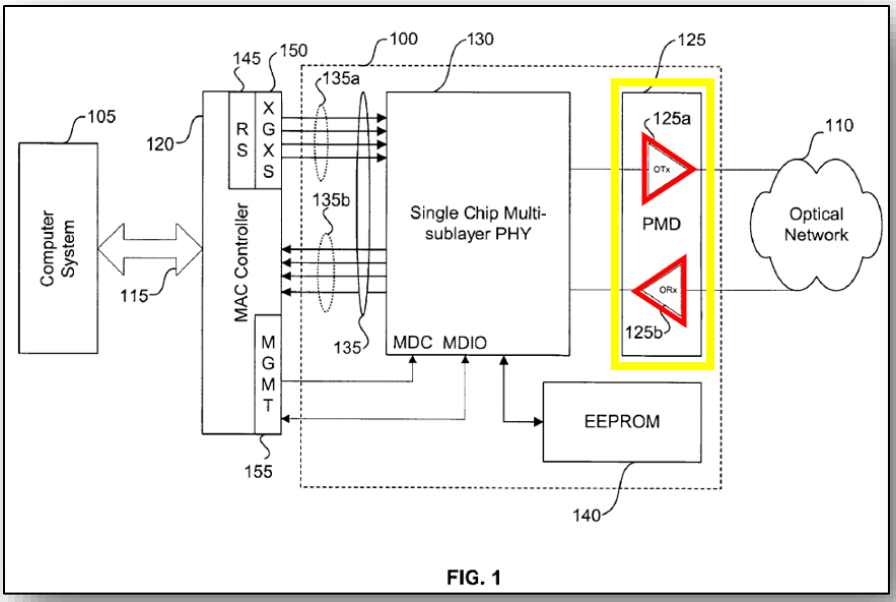


FIG. 1

514. A POSITA would have understood that, where the MAC controller 120 of Fujimori is physically located on the pluggable optical transceiver module as contemplated, the XAUI interface is coupled to the MAC controller on one end and a port of a switch or router (described in Fujimori as "computer system 105") on the other.[609] It would have been further obvious to a POSITA that any MSA-compliant pluggable optical module would necessarily communicate with a host device through electrical signals using an electrical network interface.

515. Therefore, the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses "a network client optical transceiver module [that] optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and [a] network client optical transceiver module [that] electrically communicates with the switch or router."

[609] *Id.* at Fig. 1.

xviii. Claim 19: The method of claim 18, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.[610]

516. Under NextGen's apparent theory of infringement[611], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 2. For the method of Claim 18, *see supra* § IX.C.xvii.

xix. Claim 20: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more end times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) terminating the transmission of the second optical signal responsive to an end time for data transmissions to the head-end of the passive optical network.

517. Under NextGen's apparent theory of infringement[612], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 3. For the method of Claim 18, *see supra*, § IX.C.xvii.

xx. Claim 21: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more lengths of time respective to the start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) transmitting the second optical signal responsive to a length of time for data transmissions to the head-end of the passive optical network.

518. Under NextGen's apparent theory of infringement[613], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as

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[610] Claims 19-30 are method claims analogous to device claims 2-16 I discuss *supra* Sections X.C.ii-ix. Thus, my discussion of the respective corresponding device claim is incorporated into and mirrored for the discussion of the parallel method claim.

[611] Ex. NN at 34.

[612] Ex. NN at 34-35.

[613] Ex. NN at 35.

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described in Claim 4. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxi. Claim 22: The method of claim 18, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: multimode optical fibers; and single mode optical fibers.

519. Under NextGen's apparent theory of infringement[614], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 5. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxii. Claim 23: The method of claim 18, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

520. Under NextGen's apparent theory of infringement[615], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 6. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxiii. Claim 24: The method of claim 18, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

521. Under NextGen's apparent theory of infringement[616], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 7. For the method of Claim 18, *see supra*, § IX.C.xvii.

[614] Ex. NN at 35-36.

[615] Ex. NN at 36.

[616] Ex. NN at 36.

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xxiv. Claim 25: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an assigned network identification address from the head-end of the passive optical network for addressing data to the network client optical transceiver module at the control module.

522. Under NextGen's apparent theory of infringement[617], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 9. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxv. Claim 26: The method of claim 18, further comprising the steps of: (g1) adjusting the transmission of the second optical signal form the optical interface block through the optical port to account for the response delay of the optical transceiver module.

523. Under NextGen's apparent theory of infringement[618], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claims 11 and 12. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxvi. Claim 27: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an optical power level and adjusting the transmit optical power level of the network client optical transceiver module to the determined optical power level.

524. Under NextGen's apparent theory of infringement[619], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 13. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxvii. Claim 28: The method of claim 18, further comprising the steps of: (f1) encapsulating a portion of data received through the electrical network interface port into the payload section of a framing protocol for the passive optical network at the control module for conveyance to the optical interface block.

525. Under NextGen's apparent theory of infringement[620], the Fujimori-G.984.3 Draft

[617] Ex. NN at 37.

[618] Ex. NN at 37-39.

[619] Ex. NN at 40.

[620] Ex. NN at 40.

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Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 14. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxviii. Claim 29: The method of claim 18, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

526. Under NextGen's apparent theory of infringement[621], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.C.xvii.

xxix. Claim 30: The method of claim 18, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

527. Under NextGen's apparent theory of infringement[622], the Fujimori-G.984.3 Draft Recommendation/Contribution 104 combination discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.C.xvii.

D. Ground 3: The Stiscia-Gilliland combination renders claims 1-16 and 18-30 obvious.

528. ***Motivation to combine.*** Both Stiscia and Gilliland are directed towards data communications in an optical network.[623] Indeed, both Stiscia and Gilliland teach devices that include an optical network interface port, an optical transmitter, an optical receiver, and an electrical network interface.[624]

529. As discussed *supra*, Stiscia discloses a method for communication over a passive optical network between a head-end OLT and subscriber-end ONTs. Specifically, Stiscia discloses an ONT capable of communicating with an OLT at the head-end. As I discuss below, a POSITA would have understood that the ONT disclosed in Stiscia could have been implemented in the

[621] Ex. NN at 40-41.

[622] Ex. NN at 41.

[623] Ex. I at Abstract, 1:12-50; Ex K at Abstract, 4:9-20.

[624] *See infra*, Sections X.D.i.

pluggable transceiver module as contemplated in Gilliland, and it would have yielded successful and beneficial results. Stiscia's ONT has an optical module that transmits and receives data to and from the optical distribution fabric operating as a transceiver in a passive optical network.[625] Gilliland's pluggable optical transceiver module would be successful at performing this function because it "converts optical signals into electrical signals" and converts "electrical signals . . . into optical signals."[626] A POSITA would have been motivated to combine the pluggable optical transceiver module of Gilliland with the ONT and PON communications method discussed in Stiscia to create a pluggable ONT for use in transmitting and receiving data communications over a passive optical network.

530. A POSITA would have been motivated to combine Stiscia and Gilliland for several reasons. First, as discussed in Gilliland, there was a need in the art to provide a link between an optical network, which is capable of transmitting signals at great distances, and a copper cable network, which is more suitable for transmitting signals at shorter distances.[627] Gilliland states that such a link would have been advantageous because it would have allowed individuals or business with existing copper cable communications structures to couple to large optical networks without the need for costly replacements of cable-based equipment, such as switches and routers. A pluggable ONT capable of connecting passive optical networks, transmitting optical signals across larger distances, on one end to copper cable networks, such as ethernet, for more local applications, on another end, would have been extremely beneficial in allowing existing cable infrastructure to couple to new, larger optical communications systems. Thus, a POSITA would have been motivated to combine the pluggable optical transceiver module of Gilliland with the ONT and passive optical network communication system of Stiscia in order to create a pluggable ONT capable of interfacing with the optical network on one end and a subscriber-based network on the other end.

531. Second, utilizing the pluggable optical module having a small form factor in accordance with existing standards disclosed in Gilliland for data communications in an ONT, as

[625] Ex J at 9:22-33, Fig. 2.

[626] Ex. J at 4:11-20.

[627] Ex. J at 1:41-2:10.

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taught in Stiscia, was already well known and implemented in the art because of its numerous benefits, discussed in depth below.[628] For example, an article published in the OKI Technical Review in April 2002, entitled SFF & SFP Optical Transceivers ("OKI Article") expressly discloses a pluggable optical transceiver in conjunction with optical communications networks, such as PONs.[629] Specifically, the OKI Article discloses that SFP optical transceiver products which are compatible with "fiber channels, gigabit ethernets, or SONET applications have already been developed."[630] These applications are specifically discussed in the '754 Patent.[631] Fig. 1 of the OKI Article, produced below, explicitly shows the use of pluggable optical transceivers (shown in red) in these applications, along with others such as LANs:

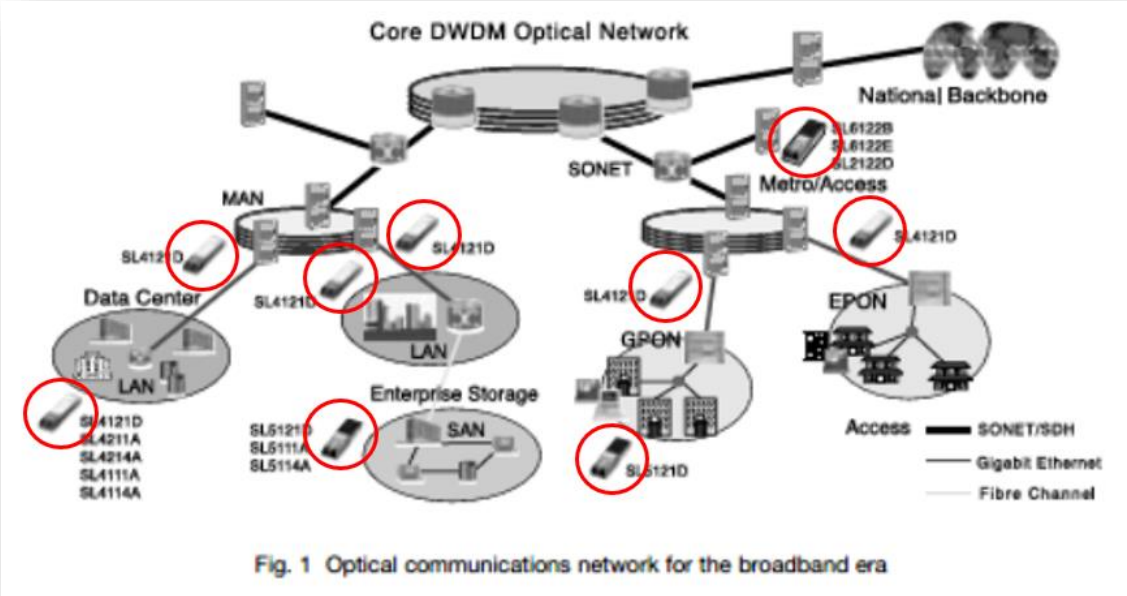


Fig. 1 Optical communications network for the broadband era

532. The OKI Article further emphasizes, as discussed in depth below, that the use of

[628] Ex. G; Ex. O; see also https://www.investor.agilent.com/news-and-events/news/news-details/2001/Agilent-Technologies-New-Fiber-Optic-Transceivers-Offer-Industrys-Lowest-EMI-Emissions/default.aspx (announcing "hot-pluggable" SFP fiber optic transceivers, which "allows greater flexibility in system configurations, and eliminates system downtime during upgrades and maintenance").

[629] Ex. O at 92, Fig. 1.

[630] *Id.* at 95.

[631] Ex. A at 1:34-37.

small form factor transceivers was advantageous because they were low-cost, highly versatile, and greatly simplified replacement and maintenance tasks by avoiding network interruption.[632]

533. Fujimori, as discussed above, also discloses the use of pluggable optical transceiver modules (specifically having form factors such as XFP and XENPAK) in high-speed data communication networks over optical fibers (i.e., passive optical networks).[633] The pluggable modules described in Fujimori "may be configured to communicate, namely transmit and receive, data between computer system and optical network," where the data transmitted and/or received may be formatted in accordance with the well-known OSI protocol standard.[634] Fujimori further confirms that the use of such pluggables was advantageous from a cost-savings prospective, as discussed further below.[635] Thus, a POSITA would have known about the use of ONTs and the optical network data communications systems they use, as in Stiscia, with the pluggable optical transceiver modules, as in Gilliland, and therefore would have been motivated to combine the two references.

534. Third, a POSITA would have been motivated to combine Stiscia and Gilliland because, as disclosed by the form factor committees and MSAs that had already standardized certain pluggable form factors, a pluggable optical transceiver module would be easier to install, repair, and/or replace than a traditional mounted transceiver. This would decrease the chances for improper installation.[636] It would also decrease the likelihood that other components near the transceiver could be damaged during servicing of the transceiver because "the transceiver modules can be individual accessed and removed from the host device without disturbing the adjacent modules and/or cable connections."[637]

535. A pluggable optical transceiver module also took less time to install, repair, and/or

[632] *Id*. at 92, 94.

[633] Ex. G at 1:38-40, 2:11-41.

[634] *Id*. at 5:65-6:2.

[635] *Id*. at 2:42-47.

[636] *See* Ex. F at 2:1-8.

[637] *Id*.

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replace because of its hot-pluggable, removable nature.[638] This, in turn, meant less down time for the fiber optic system during maintenance or servicing of the transceiver because the module "can be inserted and removed from the host system without removing electrical power."[639]

536. Fourth, a POSITA would have been motivated to combine Stiscia and Gilliland because a pluggable ONT is more compact and takes up less room than other traditional ONTs. Because OLTs and ONTs/ONUs are often contained in other devices having many components located in large racks, space is a limiting factor in many cases and smaller optical components are desirable. Decreasing the module size was a goal of a POSITA in the optical network space during the early 2000s, as stated in the '754 Patent.[640] Thus, a POSITA would have been motivated to combine Stiscia with Gilliland to create a smaller optical transceiver module capable of performing the traditional data communications capabilities of an ONT.

537. Fifth, a POSITA would have been motivated to combine Stiscia and Gilliland to create a pluggable optical transceiver module for use in transmitting data communications over a passive optical network because a pluggable optical transceiver is more cost effective. Decreasing costs was a goal of a POSITA in the optical network space during the early 2000s.[641] Specifically, utilizing already-standardized small form factor optical modules allows for system manufacturers to save costs by utilizing a larger number of ports for data communications.[642] Further, pluggables are easier to install, repair, and replace, which allows less skilled technicians to be able to service the communications system for a lower cost. Moreover, technicians do not have to repair and replace larger equipment, like a switch or router, when an opto-electrical component in a mounted transceiver fails.[643] Instead, the technician can simply replace the hot pluggable transceiver with a new transceiver.[644] As stated in the '754 Patent, manufacturing costs are also decreased when transceivers are produced separate from other opto-electrical equipment on printed circuit

[638] *Id*. at 1:49-60.

[639] *Id*.

[640] Ex. A at 2:14-16.

[641] Ex. G at 2:42-47.

[642] *Id*.

[643] Ex. F at 1:49-2:8.

[644] *Id*.

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boards.[645] Further, the smaller size of the modules allows the optical equipment to take up less space, thus saving on rent and utilities.[646] And, importantly, where improvements are made in the space of pluggable optical transceivers to, for example, increase data throughput rates, it allows for the entire system to be upgraded by simply replacing the optical transceiver module.[647] This avoids costly replacement endeavors.[648]

538. Moreover, a POSITA would have had a reasonable expectation of success in combining the ONT and passive optical network data communications system in Stiscia with the pluggable optical transceiver module in Gilliland 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 during the early 2000s.[649]

539. For at least these reasons, in reading Stiscia, a POSITA thus would have been motivated to look to the pluggable optical transceiver module in Gilliland and would have had a reasonable expectation of success in doing so.

i. Claim 1

a. [1.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, the network client optical transceiver module comprising:

540. Under NextGen's apparent theory of infringement[650], to the extent the preamble is limiting, a POSITA would have understood Stiscia in view of Gilliland to disclose this limitation.

541. Stiscia discloses a method for bandwidth allocation over a passive optical network

[645] Ex. A at 1:39-55.

[646] Ex. G at 2:42-47.

[647] Ex. A at 1:48-55.

[648] *Id*.

[649] *See* e.g., Ex. F at 1:49-2:8; Ex. G at 2:42-47.

[650] Ex. NN at 1-8.

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from a central office, or OLT, to multiple subscriber devices, or ONTs.[651] Stiscia states that the described PON conforms to specifications provided by the ITU, such as Recommendations G.983.1, G.983.2, G.983, etc. (collectively known as the ITU G.983.X Recommendations), which address physical layer and communication protocols between the central office, or head end, and subscriber devices, or network clients.[652] Stiscia states that its ONT "can be adapted to interface with any of a variety of PONs," such as ATM PON (APON) or Ethernet PON (EPON).[653] A POSITA would have understood that Stiscia's ONT could be utilized in additional PON networks, such as GPON or XGSPON.

542. Stiscia's Figure 1 reproduced below is an exemplary PON, illustrating the known PON system including a central office 104 having an OLT 110 (shown in yellow below) connected to a number of ONTs 130-134 (shown in red) via optical fibers of the PON 120 (shown in blue).[654] It would have been obvious to a POSITA, with knowledge of PONs and in reading Stiscia, that the optical fibers of the PON 120 would contain the passive optical component of a splitter.[655]

[651] Ex. I at 1:12-44; Fig. 1.

[652] *Id.*

[653] *Id.* at 8:57-61.

[654] *Id.*

[655] *Id.*; *Id.* at 24:11-12.

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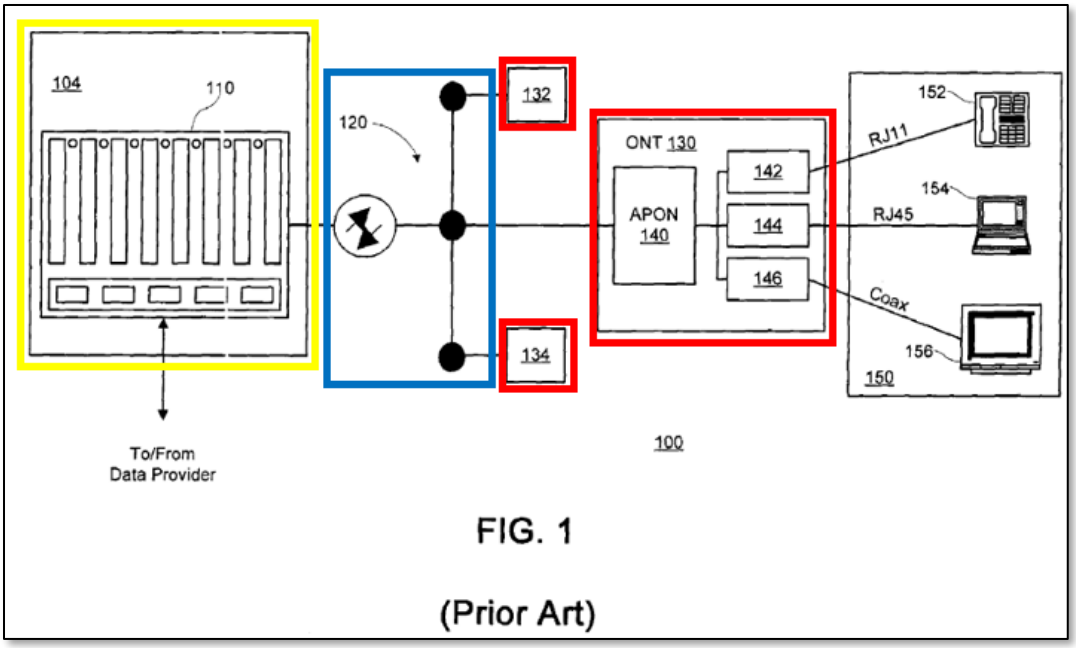


FIG. 1

(Prior Art)

543. Gilliland discloses a pluggable optical transceiver module for use in fiber optic communications, where the module is a pluggable optical transceiver in a small form factor pluggable (shown in Figure 3 below).[656] Specifically, Gilliland discloses that its pluggable optical transceiver module conforms to specifications defined by the Small Form Factor Committee.[657]

[656] Ex. J at 3:6-12, 4:9-10, Figs. 1-3.

[657] *Id.*

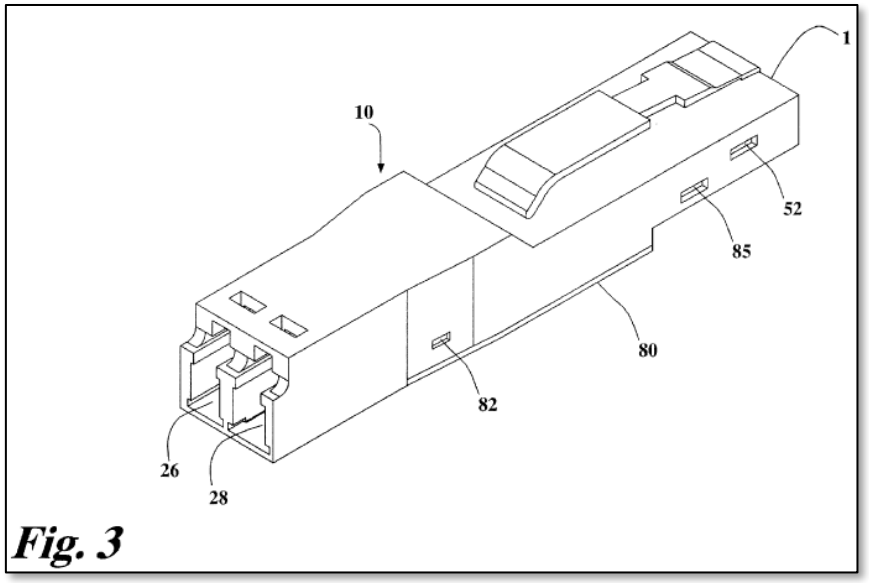


Fig. 3

544. Gilliland states that its optical transceiver module "converts optical signals into electrical signals and transfers such data" through a cable link style connector into a cable link connector receptacle of a node, accepts electrical signals from the cable link connector receptacle through the cable link style connector and then "converts such signals into optical signals.[658]

545. A POSITA would have been motivated to combine the passive optical network communications methods described in Stiscia with the pluggable optical transceiver module of Gilliland for the reasons outlined above in Section IX.D.

546. Therefore, it is my opinion that a POSITA would have understood that the Stiscia-Gilliland combination discloses "a network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router."

547. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a PON having one or more splitters for coupling a network client optical transceiver module over one or more optical fibers to the head end of a PON was well known prior

[658] *Id.* at 4:13-20.

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to the earliest alleged filing date of the '754 Patent.[659]

a. [1.a] an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters;

548. Under NextGen's apparent theory of infringement[660], a POSITA would have understood the Stiscia-Gilliland combination discloses this limitation for the same reasons as discussed in the analysis of [1.pre].

549. As discussed above, Stiscia teaches a passive optical network connecting a central office, or head end, OLT to multiple subscriber end ONTs via fiber optic cables and a passive optical splitter.[661] As shown in Figure 1, Stiscia's described ONT is coupled to fiber optic cables of the network.[662] As a POSITA would have understood, when an ONT is coupled to fiber optic cables of a network such as a PON, the ONTU must contain a connection point (circled in red below) allowing the transfer of data signals between the ONT and the network. A POSITA would have understood that the ONT, in order to receive and connect to the fiber optic cables, would contain an optical port serving as the connection point for coupling to the optical fibers of the network.

[659] Ex. SS at 176:4-14.

[660] Ex. NN at 8-11.

[661] Ex. I at 3:6-12, 4:9-10, Figs. 1-3.

[662] *Id.*

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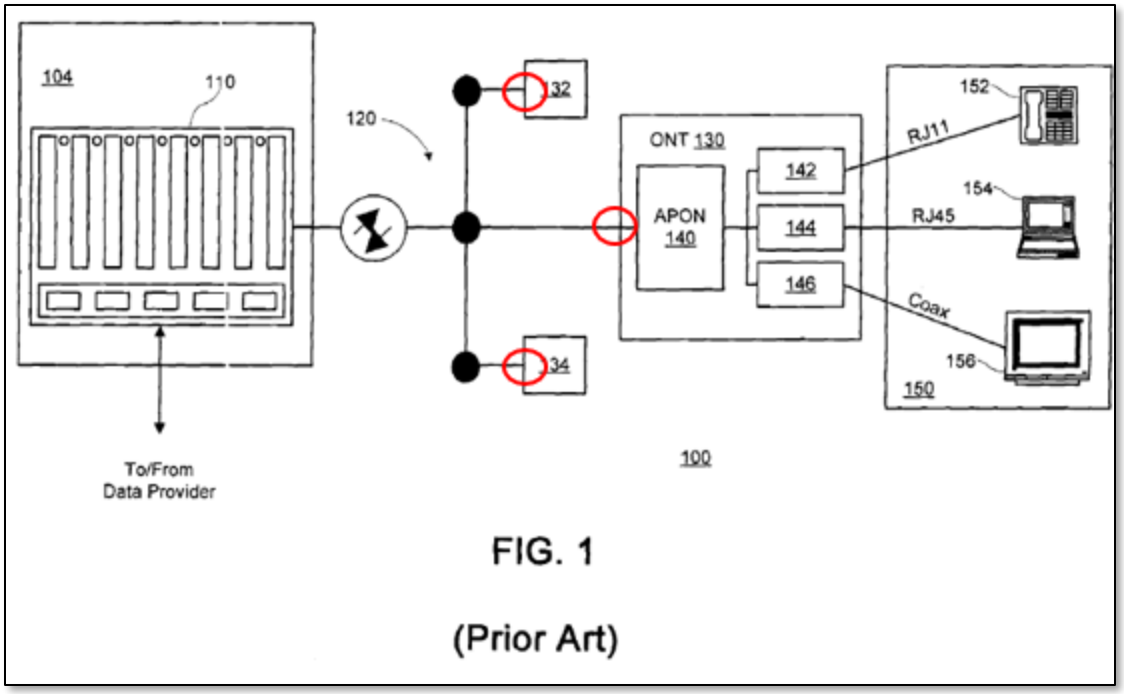


FIG. 1

(Prior Art)

550. Moreover, Stiscia states that its ONTs contain an "optical connector 220" that "serves a s a coupling device to the optical fiber of the PON 120."[663] Stiscia further states that the optical connector 220 (i.e., optical port), "provides the optical signals to [an] optical module 230" that performs optical-to-electrical and electrical-to-optical signal conversion.[664] Stiscia's optical connector is highlighted in yellow in Figure 2 below:

[663] *Id.* at 9:22-33, Fig. 2.

[664] *Id.*

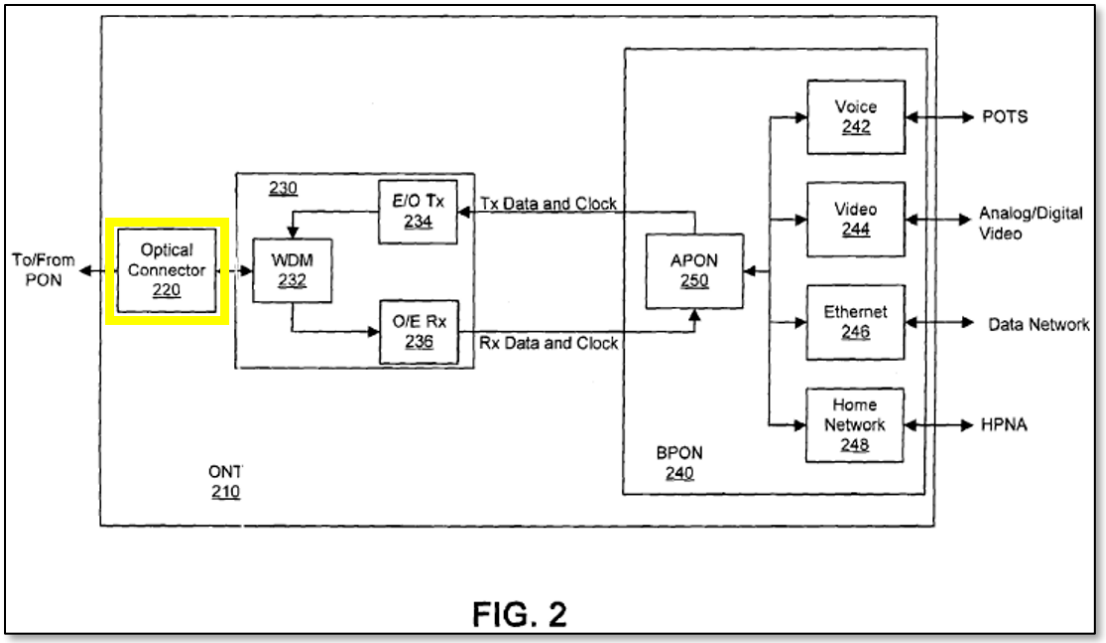


FIG. 2

551. Likewise, Gilliland describes that its pluggable optical transceiver module contains a "connector" that is designed to link the transceiver module to a cable link of the optical network.[665] Gilliland's pluggable optical transceiver receives signals from and transmits signals to the optical network via the described connector (i.e., "optical port").[666] These connectors are highlighted below in yellow in Gilliland's Figure 3:

[665] Ex. J at 4:11-20, 4:32-34, 6:38-65, 7:25-29, Fig. 3.

[666] *Id.*

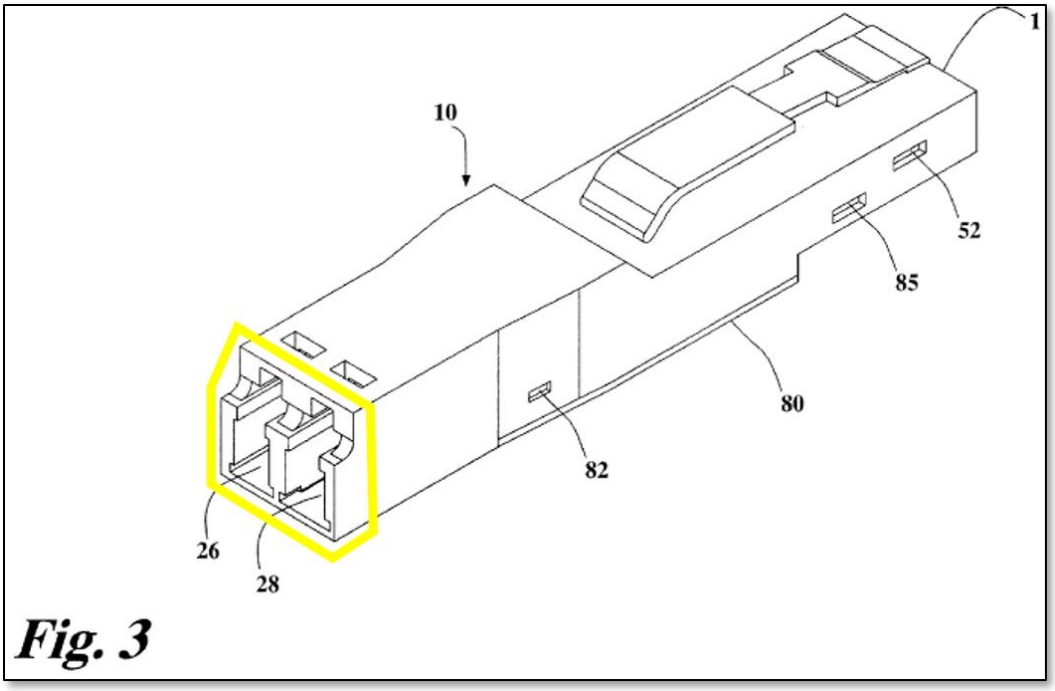


Fig. 3

552. Therefore, it is my opinion that a POSITA would have understood that the Stiscia-Gilliland combination discloses "an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters."

553. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an optical port on a pluggable transceiver device was well known prior to the earliest alleged filing date of the '754 Patent.[667]

b. [1.b] a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion;

554. Under NextGen's apparent theory of infringement[668], in my opinion, the Stiscia-Gilliland combination discloses a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion.

555. As discussed above in the analysis of [1.a], Stiscia teaches an optical connector 220

[667] Ex. SS at 169:23-170:5, 170:18-22.

[668] Ex. NN at 11.

(i.e., "optical port"), shown in yellow below, that couples to an optical module 230 (i.e., "bi-directional optical interface block"), shown in red below. [669] Moreover, Stiscia teaches that the optical module described comprises means for converting received optical signals to electrical signals and received electrical signals to optical signals.[670] In particular, the optical module 230 comprises a optical-to-electrical converter 236 and an electrical-to-optical converter 234, both shown below in blue. Thus, Stiscia's ONT contains a bi-directional optical interface block.

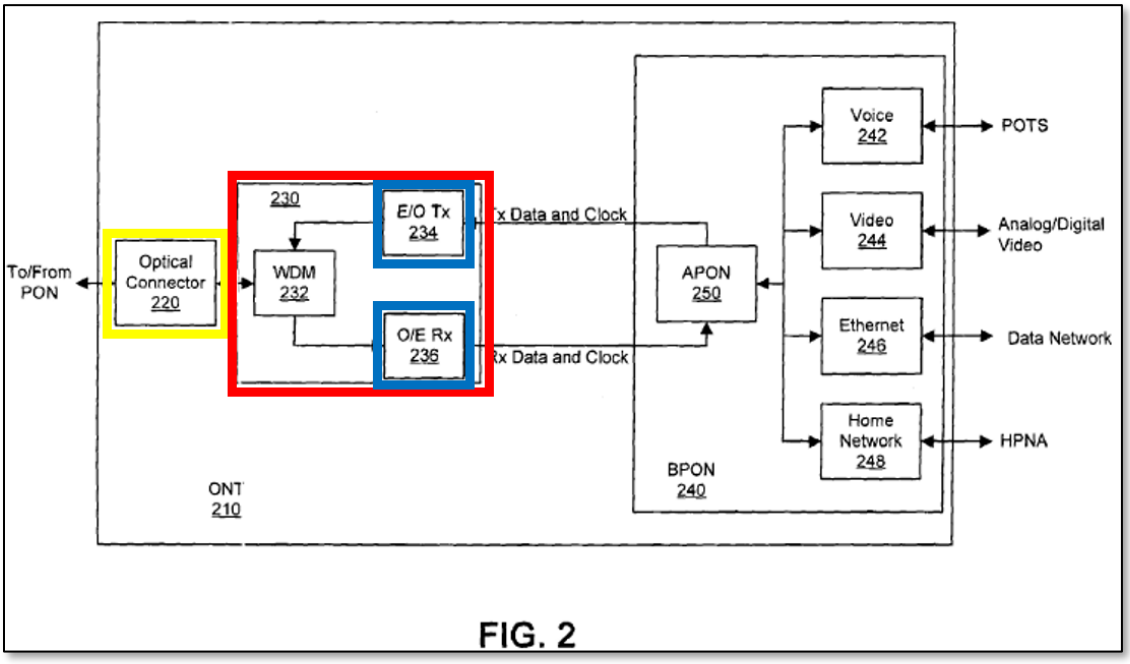


FIG. 2

556. Likewise, Gilliland teaches that its pluggable optical transceiver module "converts optical signals into electrical signals" and converts "electrical signals . . . into optical signals."[671] Thus, the optical transceiver module of Gilliland performs bi-directional optical and electrical signal conversion.

557. Therefore, it is my opinion that a POSITA would have understood that the Stiscia-Gilliland combination discloses "a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal

[669] Ex. I at 9:22-33, Fig. 2.

[670] *Id.*

[671] Ex. J at 4:11-20.

conversion."

558. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a "bi-directional optical interface" that performs electrical-to-optical and optical-to-electrical signal conversion was well known prior to the earliest alleged filing date of the '754 Patent.[672]

c. [1.c] a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times; and

559. Under NextGen's apparent theory of infringement[673], in my opinion, the Stiscia-Gilliland combination discloses a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times.

560. Stiscia teaches that its ONT contains "an integrated PON processor 240" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices."[674] Stiscia's PON processor 240 (i.e., control module) (highlighted in yellow) is coupled to the optical module 220 (i.e., bi-directional optical interface block) (highlighted in red), as shown below in Figure 2:

[672] Ex. SS at 171:2-20.

[673] Ex. NN at 11-16.

[674] Ex. I at 8:38-47.

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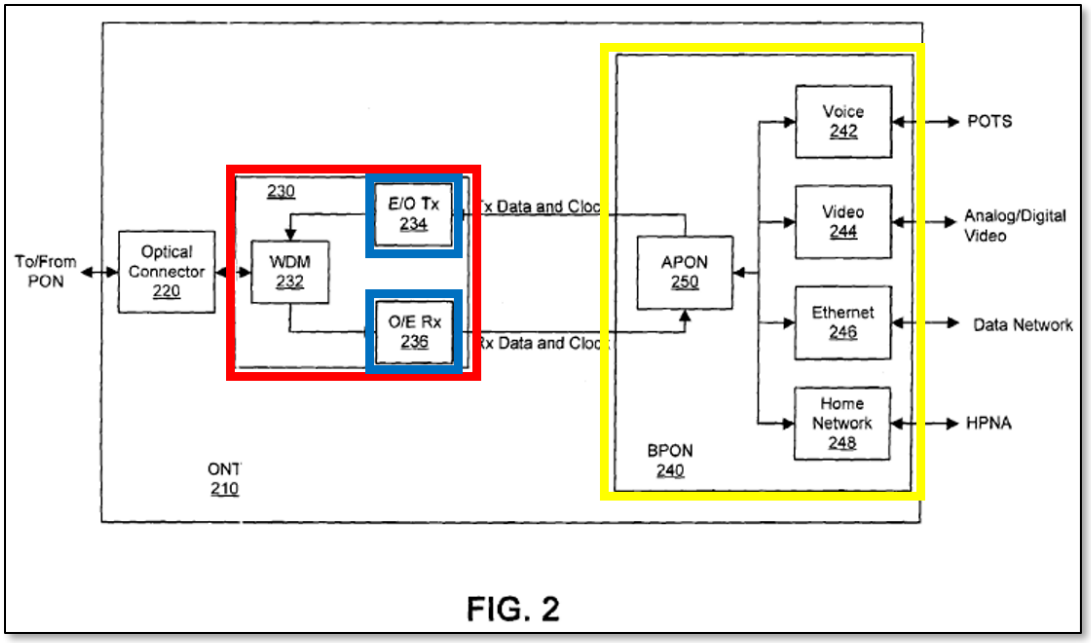


FIG. 2

561. Stiscia's PON processor 240 contains an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[675]

562. A POSITA would have understood that the downstream received and processed information related to controlling "the upstream transmission timing for ONTs on the PON" would include time slot or start time allocations from the OLT or head end of the network. For example, the G.983.X Recommendations, referenced directly in Stiscia, teach that the OLT assigns grants or "start minislots" to each of the ONTs or ONUs connected to the PON for allocation of bandwidth in the upstream frame.[676] Thus, the ONT of Stiscia is configured to receive "start times" from the OLT at the head end of the PON.

563. Further, Stiscia's ONT is "adapted to receive and transmit upstream data from the

[675] *Id.* at 12:1-15.

[676] Ex. Y at §§ 8.3, 8.3.5.1, 8.3.5.3.5;

one or more subscriber devices to the OLT via the passive optical network."[677] Stiscia describes the process in which the APON interface processes data to transmit upstream, including processing the data in accordance with one or more of the ITU G.983.X Recommendations (the details of which are discussed above), and providing the processed data to the electrical-to-optical converter 234, wherein the upstream data is converted from an electrical signal to an optical signal before being transmitted onto the PON to the upstream OLT.[678] A POSITA would have understood that such a transmission would align with the grant of a "start time" allocated to the ONT by the OLT at the head end of the of the PON.

564. Thus, it is my opinion that a POSITA would have found the Shraga-Togami combination discloses "a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times."

565. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 1 was well known prior to the earliest alleged filing date of the '754 Patent.[679] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "start times," was well known prior to the earliest alleged filing date of the '754 Patent.[680]

d. [1.d] an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router; whereby

566. Under NextGen's apparent theory of infringement[681], in my opinion, the Stiscia-Gilliland combination discloses an electrical network interface port electrically coupled to the

[677] Ex. I at 8:38-47.

[678] *Id.* at 11:5-17.

[679] Ex. SS at 182:16-24.

[680] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[681] Ex. NN at 17-20.

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control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router.

567. The ONT taught in Stiscia receives upstream data provided to the APON interface 250 of the PON processor 240 (or "control module") from one or more downstream subscriber devices.[682] Stiscia states that one such downstream subscriber device may consist of an Ethernet device, which a POSITA would have understood could be a switch or a router.[683] In this embodiment, Stiscia's ONT contains an "Ethernet interface 350" (shown below in yellow) that couples directly to the "Ethernet port 378" (shown below in red) of the Ethernet device (i.e., switch or router), as shown below in Figure 3.[684]

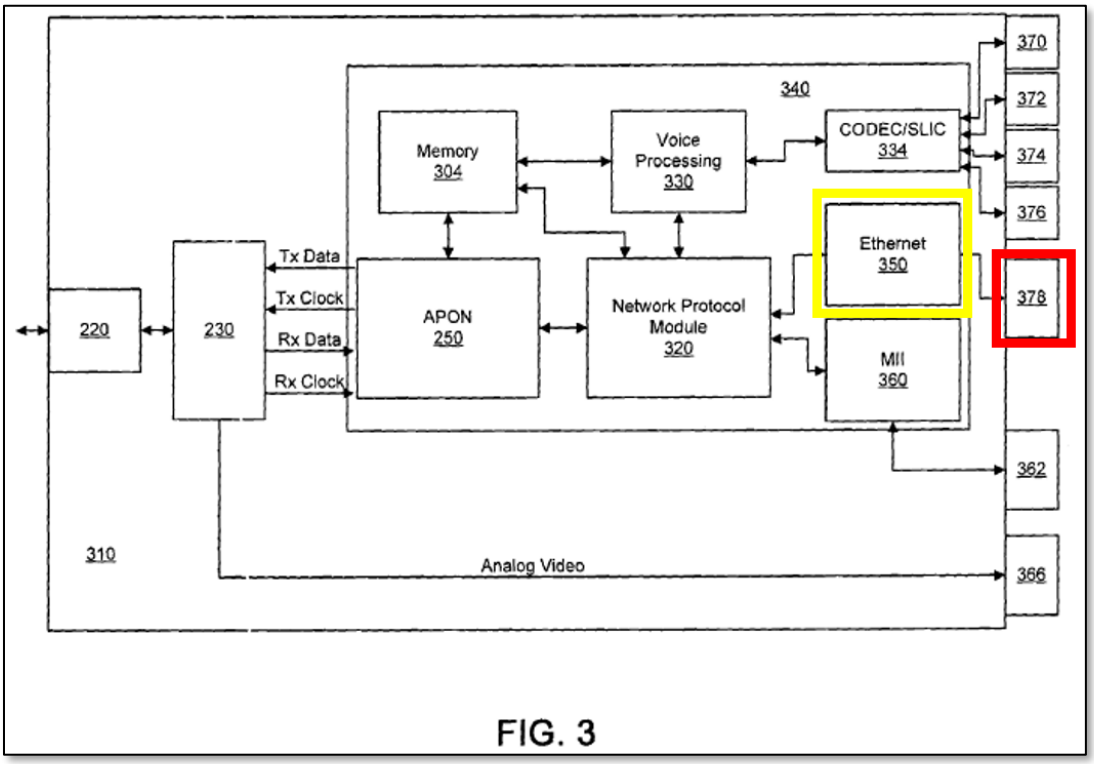


FIG. 3

568. A POSITA would have understood that signals transmitted between the Ethernet interface 350 (i.e., electrical network interface port) of the ONT and the Ethernet port 378 (i.e., optical module port) of the switch or router would consist of electrical signals, as Ethernet

[682] Ex. I at 13:11-29

[683] *Id.*

[684] *Id.*

communications are done utilizing electrical, not optical, signals.

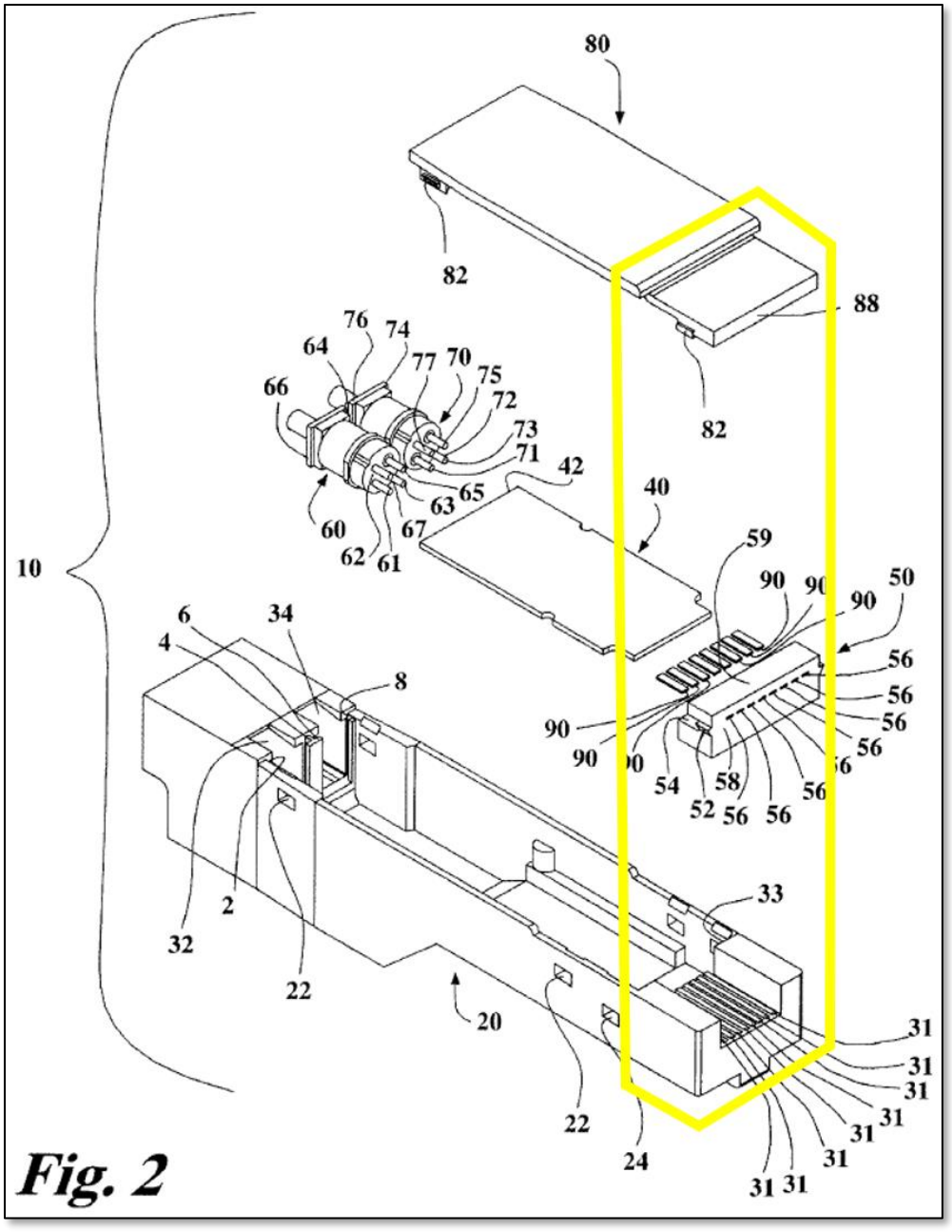
569. Likewise, Gilliland discloses a pluggable optical transceiver module that, on one end (as discussed above in the analysis of [1.a]) couples to the optical fibers or cables of an optical network and, on the other end, is capable of being received via a port of an external host device, which a POSITA would have understood could comprise a switch or router.[685] Specifically, Gilliland's optical transceiver module contains a "High Speed Serial Data Connector" for connecting to nodes or a host device "having ports."[686] Figure 2, reproduced below, shows the structure of the High Speed Serial Data Connector (i.e., electrical network interface port) on one end of the optical transceiver module, which couples directly to the described port (i.e., optical port) of the host device.[687]

[685] Ex. J at Figs. 1-3, 6:38-65.

[686] *Id.*

[687] *Id.*

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570. Thus, it is my opinion that a POSITA would have found the Stiscia-Gilliland combination to disclose "an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router."

571. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an "electrical network interface port" on a pluggable optical transceiver

module was well known prior to the earliest alleged filing date of the '754 Patent.[688]

e. [1.e] the network client optical transceiver module is configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and the network client optical transceiver module is configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

572. Under NextGen's apparent theory of infringement[689], for reasons discussed above in the analysis of [1.pre], [1.c], and [1.d], the Stiscia-Gilliland combination discloses a network client optical transceiver module configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

ii. Claim 2: The network client optical transceiver module of claim 1, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.

573. Under NextGen's apparent theory of infringement[690], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK. For the module of Claim 1, *see supra*, § IX.D.i.

574. Specifically, as discussed above in the analysis of Claim 1, Gilliland teaches a pluggable optical transceiver module that may conform to modules standardized by the Small Form Factor Committee, which a POSITA would have understood defines the physical size and shape of transceiver modules and the corresponding host port in order to insure interoperability

[688] Ex. SS at 171:21-172:25.

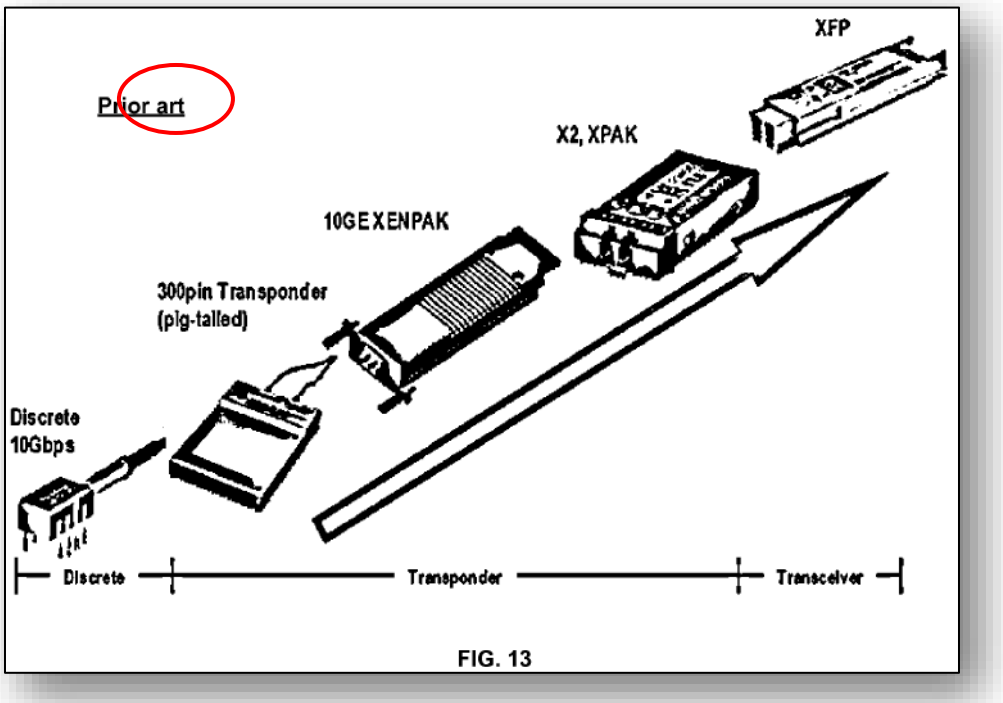
[689] Ex. NN at 20.

[690] Ex. NN at 20-21.

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between different manufacturer's products.[691]

575. It would have been obvious to a POSITA that such a description would include other form factors, such as SFP, XFP, X2, XPAK, and XENPAK, which were all included in a well-known series of pluggables at the time of the '754 Patent's priority date because each of these form factors were the subject of multiple source agreement (MSA) standards, making them standard form factors in the optical communications industry.[692] In fact, the '754 Patent itself discloses these form factors as being in the prior art as related optical interface implementations, shown below.[693]



576. Therefore, it is my opinion that a POSITA would have understood the Stiscia-Gilliland combination to disclose "a network client optical transceiver module [] wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor

[691] Ex. J at 3:6-11.

[692] Ex. S; Ex. T; Ex. U.

[693] Ex. A at Fig. 13.

(XFP); XENPAK; X2; XPAK."

iii. Claim 3: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times.

577. Under NextGen's apparent theory of infringement[694], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times. For the module of Claim 1, *see supra*, § IX.D.i.

578. As previously discussed above in the analysis of [1.pre] and [1.c], the Stiscia-Gilliland combination discloses a pluggable optical transceiver module which is configured to receive downstream communications from the OLT in a passive optical network, allocating start times for each ONT to begin upstream data transmission, and each ONT is configured to transmit back to the OLT, in the upstream direction, data communications responsive to the start time allocated to it.

579. As also discussed above in the analysis of [1.c], Stiscia teaches that its ONT contains "an integrated PON processor 240" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices."[695] Stiscia's PON processor 240 (i.e., control module) (highlighted in yellow) is coupled to the optical module 220 (i.e., bi-directional optical interface block) (highlighted in red), as shown below in Figure 2:

[694] Ex. NN at 21.

[695] Ex. I at 8:38-47.

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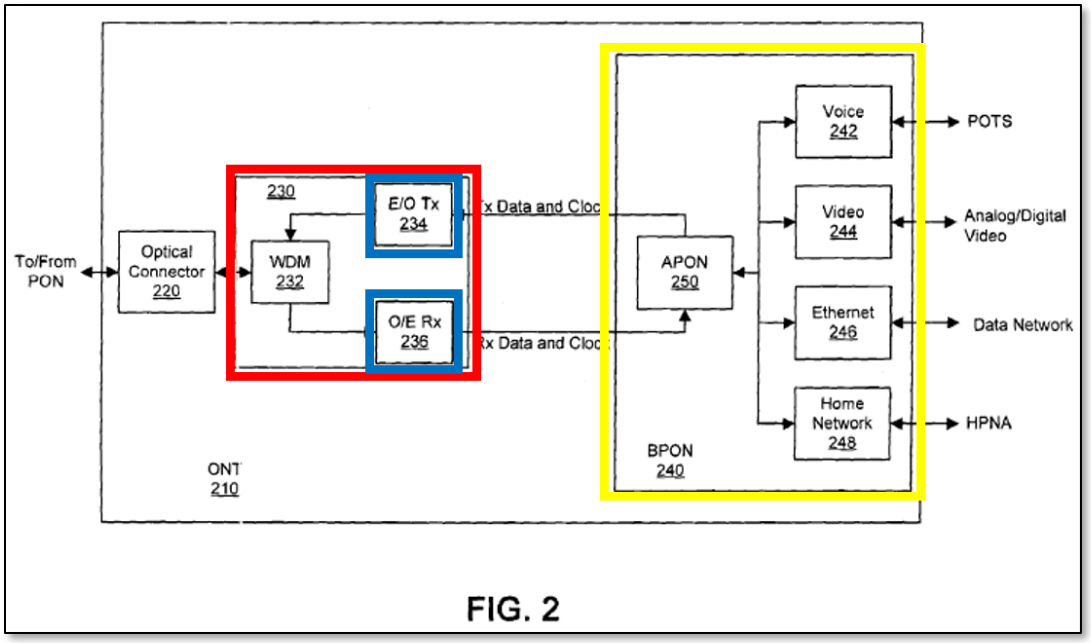


FIG. 2

580. Stiscia's PON processor 240 contains an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[696]

581. A POSITA would have understood that the downstream received and processed information related to controlling "the upstream transmission timing for ONTs on the PON" would include time slot or length of time allocations from the OLT or head end of the network. For example, the G.983.X Recommendations, referenced directly in Stiscia, teach that the OLT assigns grants or "start minislots" lengths to each of the ONTs or ONUs connected to the PON for allocation of bandwidth in the upstream frame.[697] The length of the grant corresponds to the "minislot" payload apportionment allocated to each of the ONTs on the network.[698] A POSITA would have understood that, in describing a transmission system that allocates a certain number of

[696] *Id.* at 12:1-15.

[697] Ex. Y at §§ 8.3, 8.3.5.1, 8.3.5.3.5;

[698] *Id.*

times slots for transmission, Stiscia would disclose a respective start time and end time for data communications from the ONTs to the OLT. Thus, the ONT of Stiscia is configured to receive "end times" from the OLT at the head end of the PON.

582. Further, as also discussed above in the analysis of [1.c], Stiscia's ONT is "adapted to receive and transmit upstream data from the one or more subscriber devices to the OLT via the passive optical network."[699] Stiscia describes the process in which the APON interface processes data to transmit upstream, including processing the data in accordance with one or more of the ITU G.983.X Recommendations (the details of which are discussed above), and providing the processed data to the electrical-to-optical converter 234, wherein the upstream data is converted from an electrical signal to an optical signal before being transmitted onto the PON to the upstream OLT.[700] A POSITA would have understood that such a transmission would align with the grant of an "end time" or "length" allocated to the ONT by the OLT at the head end of the of the PON.

583. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times."

584. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 3 was well known prior to the earliest alleged filing date of the '754 Patent.[701] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "end times," was well known prior to the earliest alleged filing date of the '754 Patent.[702]

[699] Ex. I at 8:38-47.

[700] *Id.* at 11:5-17.

[701] Ex. SS at 182:16-24.

[702] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

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iv. Claim 4: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times.

585. Under NextGen's apparent theory of infringement[703], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times. For the module of Claim 1, *see supra*, § IX.D.i.

586. As discussed above in the analysis of Claim 3, Stisica discloses an ONT that contains "an integrated PON processor 240" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices."[704] Stiscia's PON processor 240 (i.e., control module) (highlighted in yellow) is coupled to the optical module 220 (i.e., bi-directional optical interface block) (highlighted in red), as shown below in Figure 2:

[703] Ex. NN at 21-22.

[704] Ex. I at 8:38-47.

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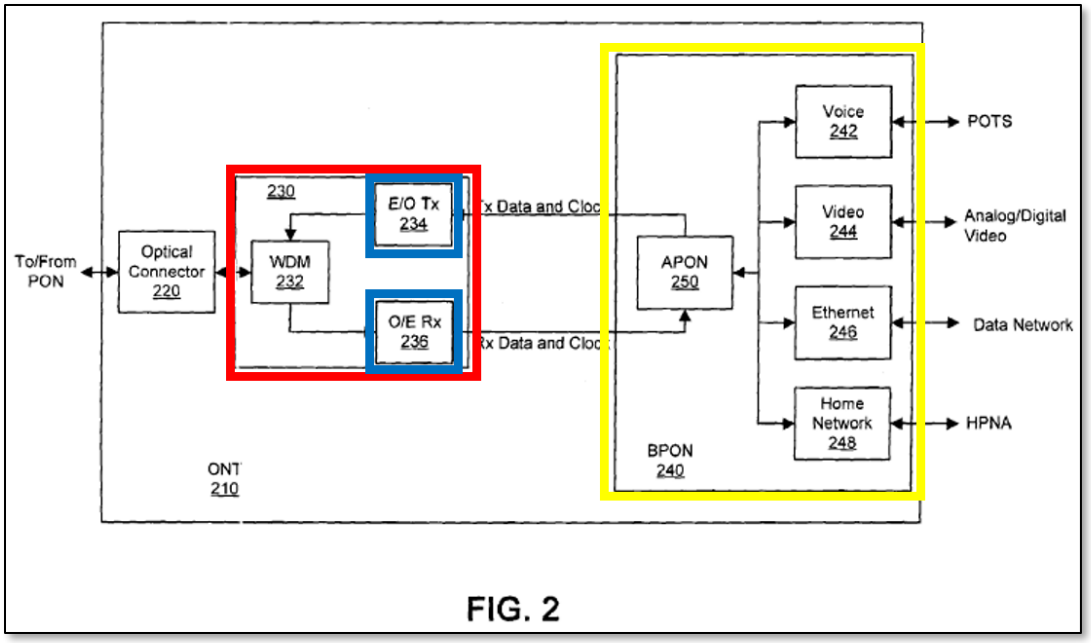


FIG. 2

587. Stiscia's PON processor 240 contains an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[705]

588. A POSITA would have understood that the downstream received and processed information related to controlling "the upstream transmission timing for ONTs on the PON" would include time slot or length of time allocations from the OLT or head end of the network. For example, the G.983.X Recommendations, referenced directly in Stiscia, teach that the OLT assigns grants or "start minislots" lengths to each of the ONTs or ONUs connected to the PON for allocation of bandwidth in the upstream frame.[706] The length of the grant corresponds to the "minislot" payload apportionment allocated to each of the ONTs on the network.[707] Thus, the ONT of Stiscia is configured to receive "lengths of time" from the OLT at the head end of the PON.

[705] *Id.* at 12:1-15.

[706] Ex. Y at §§ 8.3, 8.3.5.1, 8.3.5.3.5;

[707] *Id.*

589. Further, as also discussed above in the analysis of [1.c], Stiscia's ONT is "adapted to receive and transmit upstream data from the one or more subscriber devices to the OLT via the passive optical network."[708] Stiscia describes the process in which the APON interface processes data to transmit upstream, including processing the data in accordance with one or more of the ITU G.983.X Recommendations (the details of which are discussed above), and providing the processed data to the electrical-to-optical converter 234, wherein the upstream data is converted from an electrical signal to an optical signal before being transmitted onto the PON to the upstream OLT.[709] A POSITA would have understood that such a transmission would align with the grant of a "length" of the minislot allocated to the ONT by the OLT at the head end of the of the PON.

590. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times."

591. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 4 was well known prior to the earliest alleged filing date of the '754 Patent.[710] The inventors and patent owners also admit that TC-Layer functionality was well known prior to the earliest alleged filing date of the '754 Patent.[711]

v. Claim 5: The network client optical transceiver module of claim 1, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers.

592. Under NextGen's apparent theory of infringement[712], in my opinion, the Stiscia-

[708] Ex. I at 8:38-47.

[709] *Id.* at 11:5-17.

[710] Ex. SS at 182:16-24.

[711] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[712] Ex. NN at 22.

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Gilliland combination discloses a network client optical transceiver module wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers. For the module of Claim 1, *see supra*, § IX.D.i.

593. A POSITA would have understood that the optical fibers discussed in Stiscia and Gilliland would consist of either multimode optical fibers or single mode optical fibers, as these were well-known in the optical communications space during the early 2000's as the types of optical fibers used in passive optical network data communications.[713] In fact, a POSITA would have known that optical fibers must either be single-mode type or multi-mode type fibers—there are no other types of optical fibers.

594. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers."

vi. Claim 6: The network client optical transceiver module of claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

595. Under NextGen's apparent theory of infringement[714], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU). For the module of Claim 1, *see supra*, § IX.D.i.

596. As discussed above in the analysis of [1.pre] and [1.a], Stiscia discloses an ONT is coupled to fiber optic cables of the network. As a POSITA would have understood, when an ONT

[713] Ex. P at 33-37.

[714] Ex. NN at 22-23.

is coupled to fiber optic cables of a network such as a PON, the ONTU must contain a connection point (circled in red below) allowing the transfer of data signals between the ONT and the network. A POSITA would have understood that the ONT, in order to receive and connect to the fiber optic cables, would contain an optical port serving as the connection point for coupling to the optical fibers of the network.

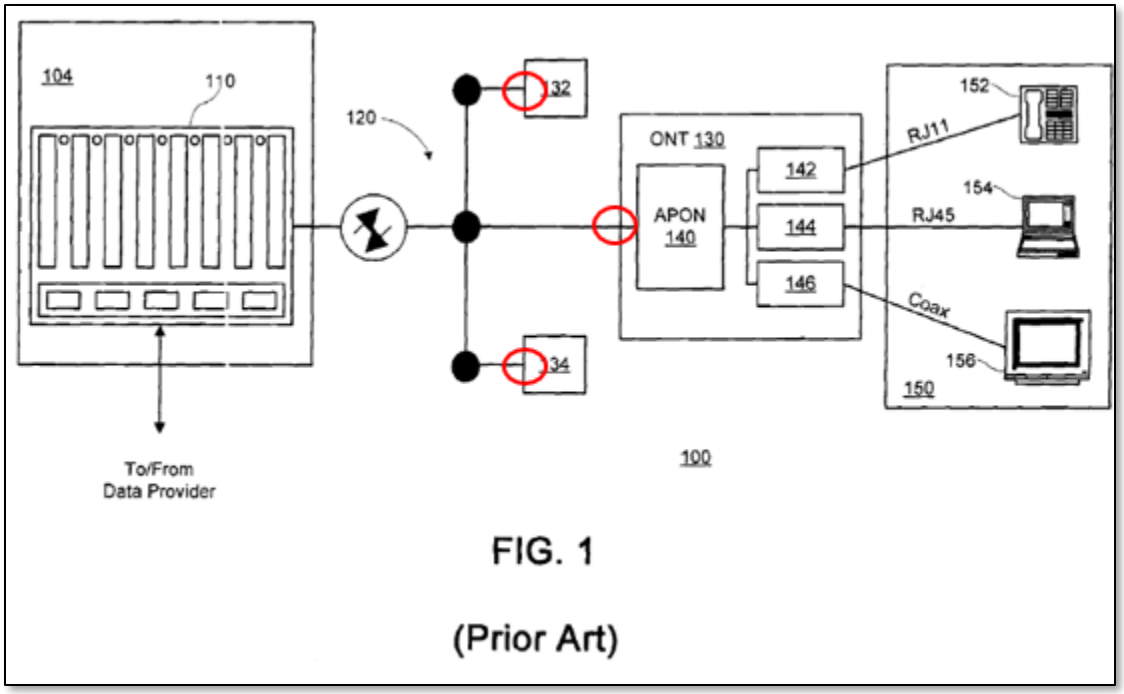


FIG. 1

(Prior Art)

597. Moreover, Stiscia states that its ONTs contain an "optical connector 220" that "serves a s a coupling device to the optical fiber of the PON 120."[715] Stiscia further states that the optical connector 220 (i.e., optical port), "provides the optical signals to [an] optical module 230" that performs optical-to-electrical and electrical-to-optical signal conversion.[716] Stiscia's optical connector is highlighted in yellow in Figure 2 below:

[715] Ex. I at 9:22-33, Fig. 2.

[716] *Id.*

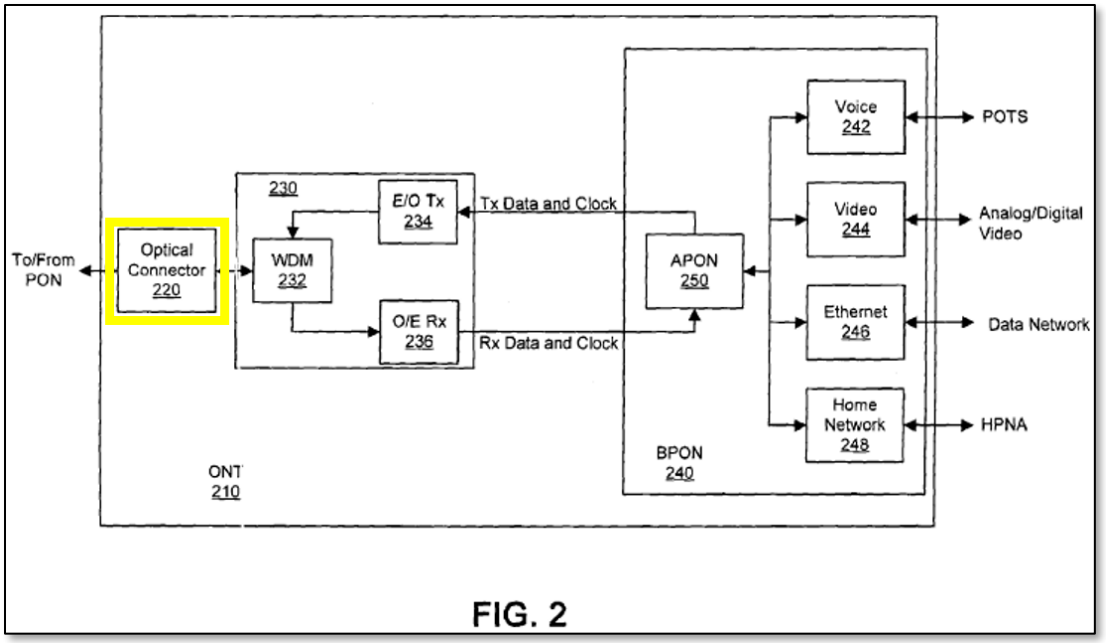


FIG. 2

598. Likewise, Gilliland describes that its pluggable optical transceiver module contains a "connector" that is designed to link the transceiver module to a cable link of the optical network.[717] Gilliland's pluggable optical transceiver receives signals from and transmits signals to the optical network via the described connector (i.e., "optical port").[718] These connectors are highlighted below in yellow in Gilliland's Figure 3:

[717] Ex. J at 4:11-20, 4:32-34, 6:38-65, 7:25-29, Fig. 3.

[718] *Id.*

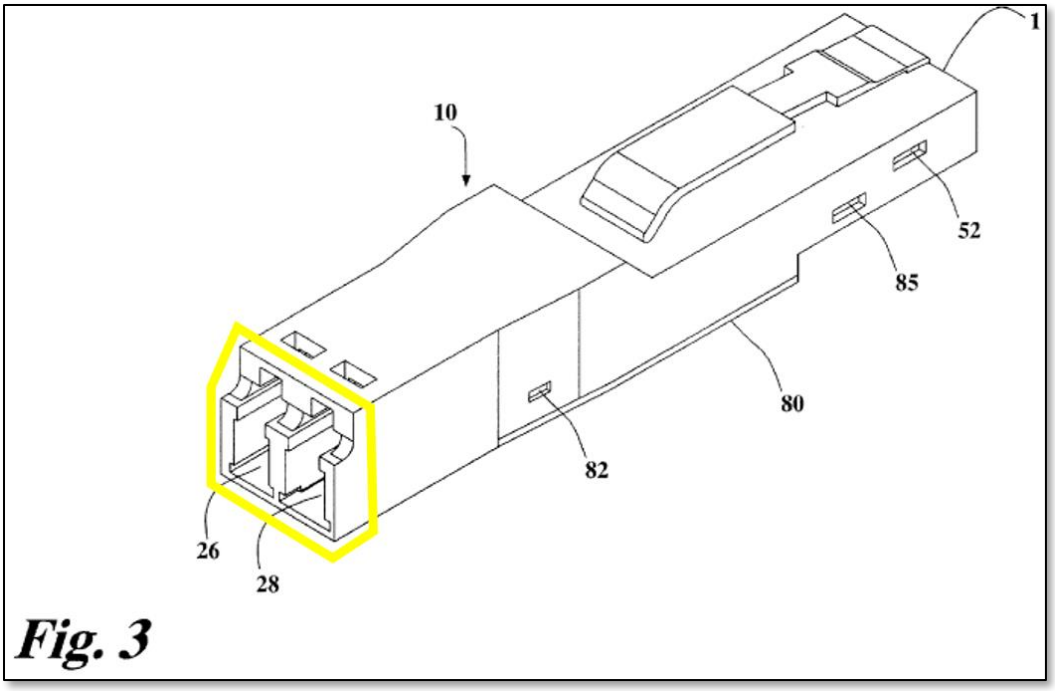


Fig. 3

599. Specifically, Gilliland discusses that its connector may comprise a Subscriber Connector (SC) or a Lucent Connector (LC), though Gilliland contemplates that other types of connectors can be used.[719] A POSITA would have understood the language of Gilliland to disclose other forms of connector configurations, such as Fiber Channel (FC), Straight TP (ST), or Miniature Unit (MU), which were all well-known connectors in the early 2000's time frame.[720]

600. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU)."

[719] Ex. J at 1:42-53, 3:49-4:6, 6:39-53.

[720] Ex. W.

vii. Claim 7: The network client optical transceiver module of claim 1, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

601. Under NextGen's apparent theory of infringement[721], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface. For the module of Claim 1, *see supra*, § IX.D.i.

602. As discussed above in the analysis of [1.pre] and [1.d], Stiscia's ONT receives upstream data provided to the APON interface 250 of the PON processor 240 (or "control module") from one or more downstream subscriber devices.[722] Stiscia states that one such downstream subscriber device may consist of an Ethernet device, which a POSITA would have understood could be a switch or a router.[723] In this embodiment, Stiscia's ONT contains an "Ethernet interface 350" (shown below in yellow) that couples directly to the "Ethernet port 378" (shown below in red) of the Ethernet device (i.e., switch or router), as shown below in Figure 3.[724]

[721] Ex. NN at 23.

[722] Ex. I at 13:11-29

[723] *Id.*

[724] *Id.*

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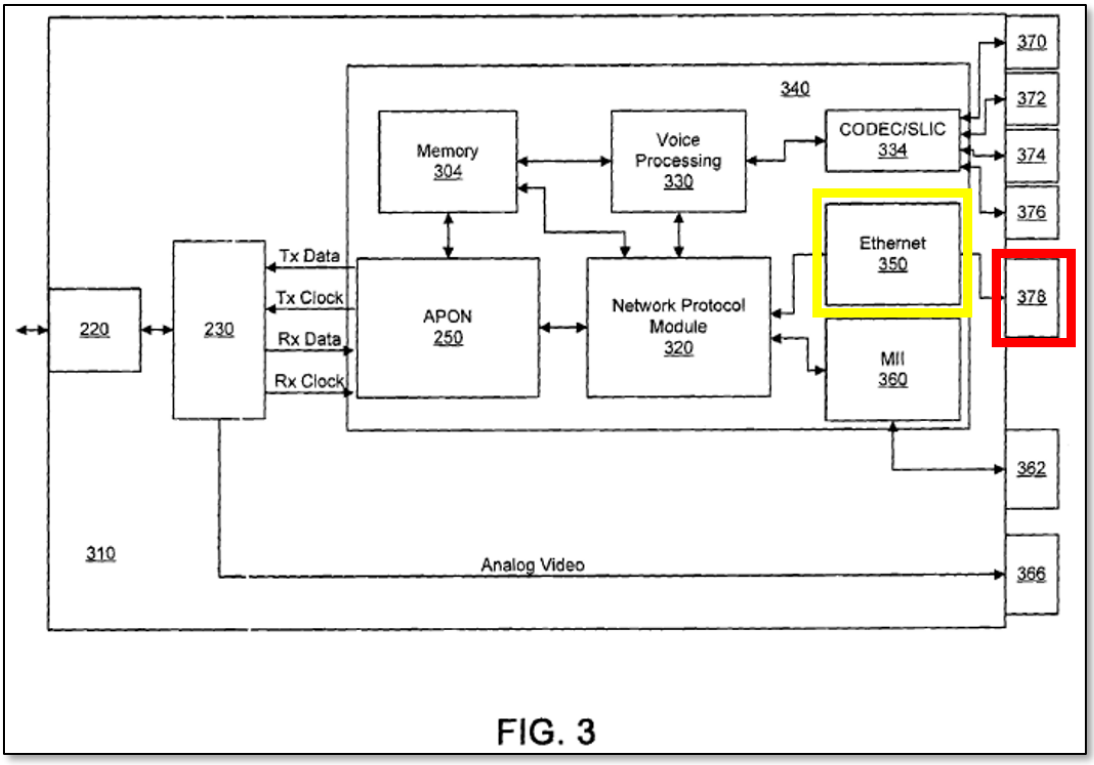
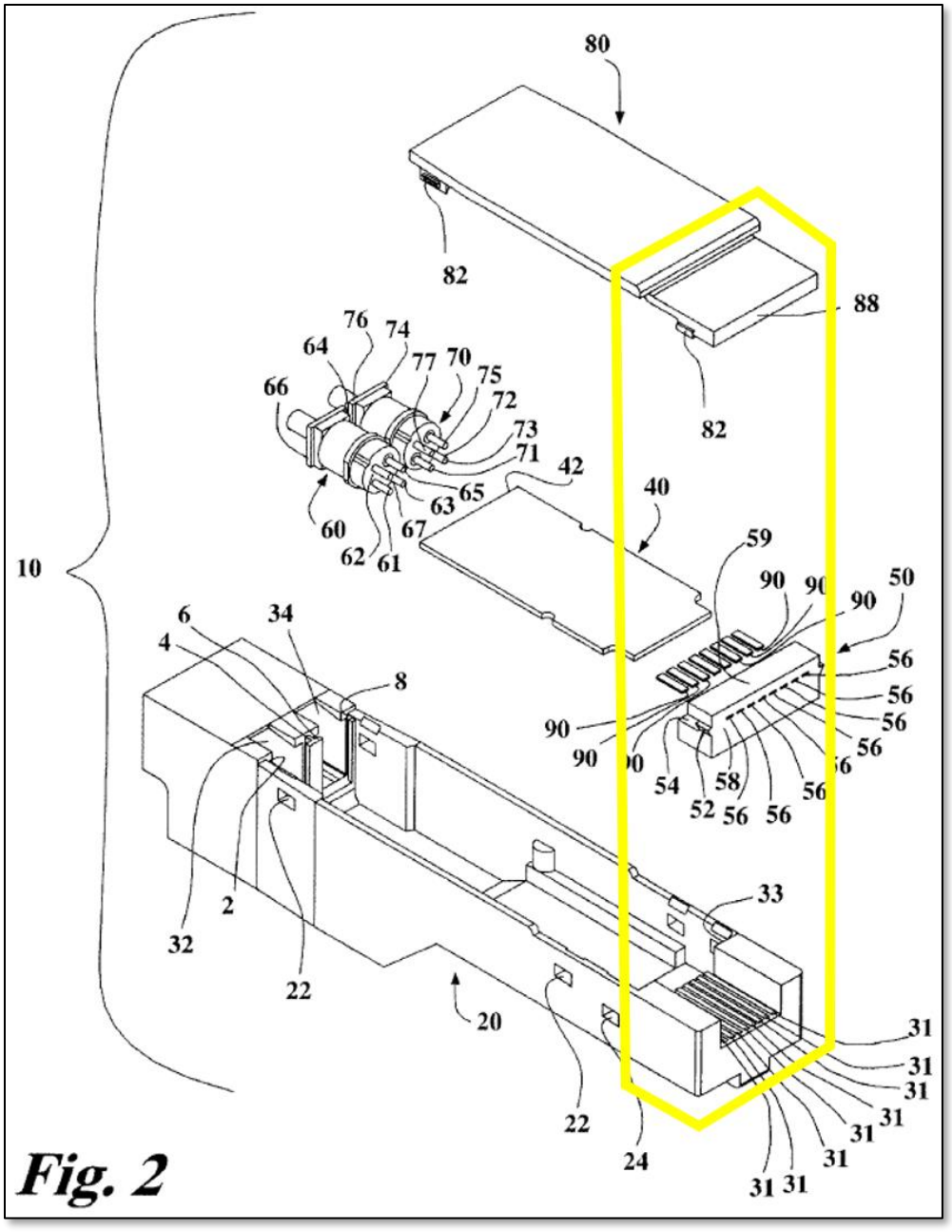


FIG. 3

603. As also discussed above, Gilliland discloses a pluggable optical transceiver module containing a "High Speed Serial Data Connector" (i.e., electrical network interface) for connecting to nodes or a host device "having ports."[725] Figure 2, reproduced below, shows the structure of the High Speed Serial Data Connector (i.e., electrical network interface port) on one end of the optical transceiver module, which couples directly to the described port (i.e., optical port) of the host device.[726]

[725] *Id.*

[726] *Id.*



604. A POSITA would have understood that the electrical interface this limitation discloses would be selected from a group containing a serial interface, a parallel interface, or a XAUI interface, all of which were well known electrical interfaces in the optical communications space in the early 2000s.[727]

[727] Ex. X.

605. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface."

viii. Claim 8: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network.

606. Under NextGen's apparent theory of infringement[728], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network. For the module of Claim 1, *see supra*, § IX.D.i.

607. As previously discussed above in the analysis of [1.pre] and [1.b], Stiscia discloses an optical module 230 (i.e., "bi-directional optical interface block"), shown below in red, capable of performing optical-to-electrical and electrical-to-optical signal conversion by the components shown in blue.[729] A POSITA would have known the optical module 230 was bi-directional based on its ability to receive incoming data communications and transmit outgoing data communications.

[728] Ex. NN at 23-24.

[729] Ex. I at 9:22-33, Fig. 2.

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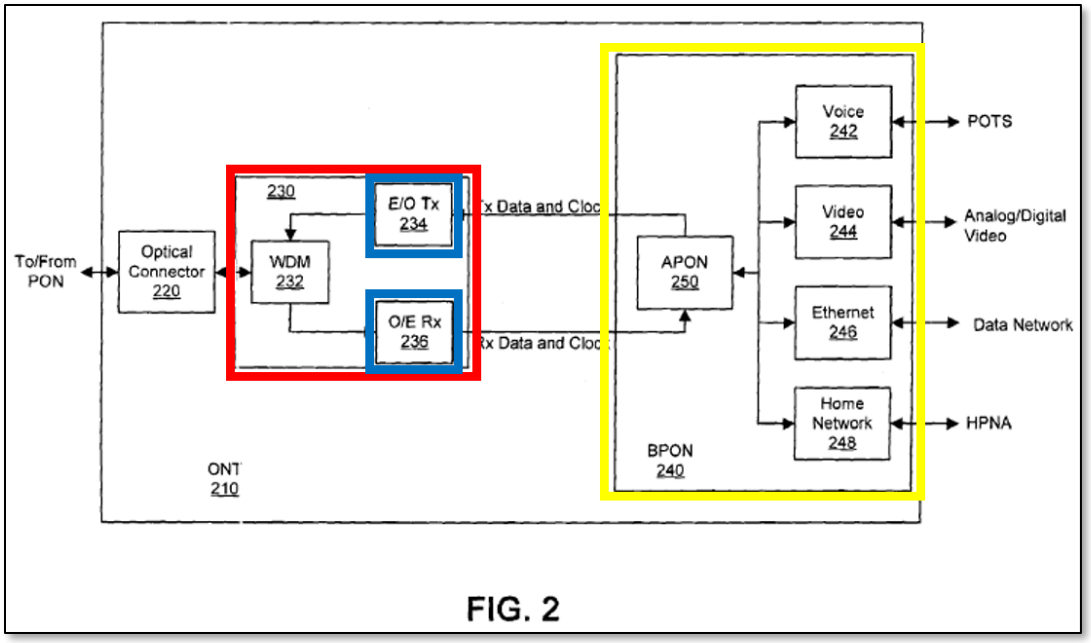


FIG. 2

608. As also discussed above in the analysis of [1.pre] and [1.c], Stiscia discloses a PON processor 240 (or "control module"), shown above in yellow, containing an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[730]

609. Further, Stiscia teaches that the APON interface 250 of its ONT device de-frames "[d]ownstream data received from the OLT" and frames "upstream data from subscriber devices" to the OLT at the central office or head end.[731] Specifically, Stiscia teaches that the APON interface 250 "scrambles and frames upstream ATM cells from the network protocol module 320, includes upstream PLOAM cells as appropriate, and provides the framed upstream data to the optical module 230 for transmission to an OLT over a PON to which the ONT 310 is connected."[732] Because Stisicia states that its ONT conforms to specifications in the ITU G.983.X

[730] *Id.* at 12:1-15.

[731] *Id.* at 2:29-50, 9:39-48, 11:5-17.

[732] *Id.* at 13:23-38.

Recommendations, a POSITA would have understood that the framing discussed in Stiscia would be done in accordance with a framing protocol, such as those found in the ITU G.983.X Recommendations. Thus, a POSITA would have understood that the ONT of Stiscia contains framing components that perform the same functionality associated with the "framing block" as described in the '754 Patent.

610. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a framer (i.e., "framing block") capable of performing the functions described in Claim 8 "can be part of a control module."[733]

611. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network."

ix. Claim 9: The network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module.

612. Under NextGen's apparent theory of infringement[734], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module. For the module of Claim 1, *see supra*, § IX.D.i.

613. As discussed above in the analysis of [1.pre] and [1.c], Stiscia discloses a PON processor 240 (or "control module") containing an "APON interface 250" that is configured to,

[733] Ex. SS at 215:4-8.

[734] Ex. NN at 24.

upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[735]

614. Further, Stiscia discusses that the ONT described maintains a PON ID for identification by OLT at the head end of the network.[736] The G.983.X Recommendations, referenced in Stiscia, as discussed above, discuss the assignment of a PON ID extensively. For example, G.983.1 describes the process in which an ONT/ONU receives its PON_ID, which is used to identify specific ONTs/ONUs on the PON.[737] In this process, the OLT at the head end of the network transmits an Assign_PON_ID message to the ONT and "[w]hen the serial number of the Assign_PON_ID message matches its own serial number, the [ONT/ONU] acquires its PON_ID."[738]

615. The G.983.1 Recommendation further describes that the PON_ID is used in transmission of downstream signals from the OLT to each of the ONTs/ONUs in order to identify what information contained in the transmission is meant for each ONT/ONU.[739] For example, the G.983.1 Recommendation describes, when a grant allocation message (as discussed in the analysis of [1.c]) is sent downstream, an ONU receives its individual message when the Grant_allocation message matches its own assigned PON_ID.[740]

616. Because the PON processor 240 (or "control module") is configured to operate and process signals in accordance with the ITU G.983.X Recommendations, it would have been obvious to a POSITA that the PON processor 240 would be configured to receive the PON_ID assignment from the head end.

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[735] *Id.* at 12:1-15.

[736] *Id.* at 17:31-39.

[737] Ex. Y at §§ 8.4, 8.4.4.

[738] *Id.*

[739] *Id.* at § 8.4.4.2.2.1.

[740] *Id.*

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617. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module."

618. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[741] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[742]

x. Claim 10: The network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.

619. Under NextGen's apparent theory of infringement[743], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients. For the module of Claim 1, *see supra*, § IX.D.i.

620. As discussed above in the analysis of [1.pre] and [1.c], Stiscia discloses a PON processor 240 (or "control module") containing an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and

[741] Ex. SS at 182:16-24.

[742] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8, 212:21-213:1.

[743] Ex. NN at 24-25.

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the like."[744]

621. The G.983.X Recommendations, referenced in Stiscia, discuss an installation method of new ONTs/ONUs on the network, describing two possible example methods to install a new ONT/ONU.[745] First, the network operator enables a ranging process to start when it knows that a new ONU has been connected.[746] Second, the OLT at the head end of the network periodically and automatically initiates the ranging process, testing to see if any new ONTs/ONUs have been connected.[747] In either method, the ONT/ONU responds to a message initiated by the OLT; thus, any new client ONT described in Stiscia would respond to a network operating protocol such as that described in G.983.1.

622. Because the PON processor 240 (or "control module") is configured to operate and process signals in accordance with the ITU G.983.X Recommendations, it would have been obvious to a POSITA that the PON processor 240 would be configured to respond in accordance with a network operating protocol for new clients.

623. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients."

624. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 10 was well known prior to the earliest alleged filing date of the '754 Patent.[748] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 10, was well known prior to the earliest alleged filing date of the '754

[744] Ex. I at 12:1-15.

[745] Ex. Y at §§ 8.4, 8.4.1.1.

[746] *Id.*

[747] *Id.*

[748] Ex. SS at 182:16-24.

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Patent.[749]

xi. Claim 11: The network clients optical transceiver module of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module.

625. Under NextGen's apparent theory of infringement[750], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module. For the module of Claim 1, *see supra*, § IX.D.i.

626. As discussed above in the analysis of [1.pre] and [1.c], Stiscia discloses a PON processor 240 (or "control module") containing an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[751]

627. As highlighted in the quote above, Stiscia discusses a process called "ranging" used to determine the transmission delay of each ONT. Similarly, the G.983.X Recommendations, referenced in Stiscia, as discussed above, discuss a process called "ranging" wherein the PON system measures the logical reach distances between each ONT/ONU and the OLT.[752] Described in detail in the G.983.1 Recommendation, the ranging process is initiated by the OLT, which sends a Ranging_time message to each ONT/ONU. Each of the ONTs/ONUs then send a responsive message back to the OLT at the head end of the network, which is used to determine the

[749] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[750] Ex. NN at 25-27.

[751] Ex. I at 12:1-15.

[752] Ex. Y at § 8.4.

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equalization delay that the OLT then factors into each time grant allocation.[753]

628. Because the PON processor 240 (or "control module") is configured to operate and process signals in accordance with the ITU G.983.X Recommendations, it would have been obvious to a POSITA that the PON processor 240 would be configured to respond to a response delay message from the head end of the network.

629. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module."

630. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 11 was well known prior to the earliest alleged filing date of the '754 Patent.[754] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 11, was well known prior to the earliest alleged filing date of the '754 Patent.[755]

xii. Claim 12: The network client optical transceiver module of claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.

631. Under NextGen's apparent theory of infringement[756], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process. For the

[753] *Id.*

[754] Ex. SS at 182:16-24.

[755] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[756] Ex. NN at 28.

module of Claim 1, *see supra*, § IX.D.i.

632. As discussed above in Claim 11, Stiscia and the ITU G.983.X Recommendations referenced in Stiscia teach that the distance between an OLT and each ONT/ONU causes a delay in the transmission of signals in the passive optical network.[757] To account for this transmission delay, the OLT at the head end of the network initiates a response delay process known as "ranging" by sending a ranging signal to each ONT/ONU requesting that the ONT/ONU respond with a ranging signal response, which the OLT then utilizes to determine how to allocate each ONT/ONU's transmission grant allocation to compensate for the delay (i.e., the "response delay process").[758]

633. As discussed above in the analysis of [1.c], the ONT device described in Stiscia is configured to transmit, via its PON processor 240 (or "control module") upstream data communications in accordance with the allocation (i.e., "start time") determined by the OLT, which includes the ranging time compensation (i.e., "network period").[759] The upstream transmissions from each ONT is thus aligned to the network period in order to account for transmission delays.

634. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process."

635. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 12 was well known prior to the earliest alleged filing date of the '754 Patent.[760] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 12, was well known prior to the earliest alleged filing date of the '754

[757] Ex. I at 12:1-15; Ex. Y at § 8.4.

[758] *Id.*

[759] *Id.*

[760] Ex. SS at 182:16-24.

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Patent.[761]

xiii. Claim 13: The network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.

636. Under NextGen's apparent theory of infringement[762], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network. For the module of Claim 1, *see supra*, § IX.D.i.

637. As discussed above in Claim 11, Stiscia and the ITU G.983.X Recommendations referenced in Stiscia teach that the distance between an OLT and each ONT/ONU causes a delay in the transmission of signals in the passive optical network.[763] In addition to procedures for ranging, the ITU G.983.X Recommendations discuss the procedure for optical power control of an ONT/ONU, described as "ONU optical power set-up."[764] A POSITA would have understood that the optical power set-up process discussed in the G.983.1 Recommendation is used to adjust the power level of the ONT/ONU's transmitter in order to compensate for signal loss due to the distance between the ONT/ONU and the OLT over which the transmitted optical signal must travel.

638. Because the PON processor 240 (or "control module") is configured to operate and process signals in accordance with the ITU G.983.X Recommendations, it would have been obvious to a POSITA that the PON processor 240 would be configured to adjust the transmitting optical power level to compensate for the distance between the ONT and the OLT at the head end of the network.

639. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a

[761] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[762] Ex. NN at 28.

[763] Ex. I at 12:1-15; Ex. Y at § 8.4.

[764] Ex. Y at § 8.4.

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network client optical transceiver module "wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network."

640. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 13 was well known prior to the earliest alleged filing date of the '754 Patent.[765] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 13, was well known prior to the earliest alleged filing date of the '754 Patent.[766]

xiv. Claim 14: The network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.

641. Under NextGen's apparent theory of infringement[767], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network. For the module of Claim 1, *see supra*, § IX.D.i.

642. As discussed above in the analysis of [1.d], Stiscia's ONT receives upstream data provided to the APON interface 250 of the PON processor 240 (or "control module") from one or more downstream subscriber devices.[768] Stiscia states that one such downstream subscriber device may consist of an Ethernet device, which a POSITA would have understood could be a switch or a router.[769] In this embodiment, Stiscia's ONT contains an "Ethernet interface 350" (i.e., "electrical network interface port") that couples directly to the "Ethernet port 378" of the Ethernet device

[765] Ex. SS at 182:16-24.

[766] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[767] Ex. NN at 28-29.

[768] Ex. I at 13:11-29

[769] *Id.*

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(i.e., switch or router).[770]

643. As also discussed above, Gilliland discloses a pluggable optical transceiver module containing a "High Speed Serial Data Connector" (i.e., electrical network interface port) for connecting to nodes or a host device "having ports."[771] Gilliland's Figure 2 shows the structure of the High Speed Serial Data Connector (i.e., electrical network interface port) on one end of the optical transceiver module, which couples directly to the described port (i.e., optical port) of the host device.[772]

644. Additionally, as analyzed in the discussion of [1.c], Stiscia discloses a PON processor 240 (or "control module") containing an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[773]

645. As discussed above in Claim 8, Stiscia teaches that the APON interface 250 of its ONT device de-frames "[d]ownstream data received from the OLT" and frames "upstream data from subscriber devices" to the OLT at the central office or head end.[774] Specifically, Stiscia teaches that the APON interface 250 "scrambles and frames upstream ATM cells from the network protocol module 320, includes upstream PLOAM cells as appropriate, and provides the framed upstream data to the optical module 230 for transmission to an OLT over a PON to which the ONT 310 is connected."[775] Because Stisicia states that its ONT conforms to specifications in the ITU G.983.X Recommendations, a POSITA would have understood that the framing discussed in Stiscia would be done in accordance with a framing protocol, such as those found in the ITU

[770] *Id.*

[771] Ex. J at Figs. 1-3, 6:38-65.

[772] *Id.*

[773] Ex. I at 12:1-15.

[774] *Id.* at 2:29-50, 9:39-48, 11:5-17.

[775] *Id.* at 13:23-38.

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G.983.X Recommendations.

646. The G.983.1 Recommendation discusses that each upstream frame contains a "payload" section.[776] Each ONT/ONU receives in its designated "minislot" assignment a specific "minislot payload" for transmitting upstream data communications back to the OLT, as shown below in Figure 18.[777] A POSITA would have understood that any data received for transmission would be encapsulated in the described payload section of the upstream frame.

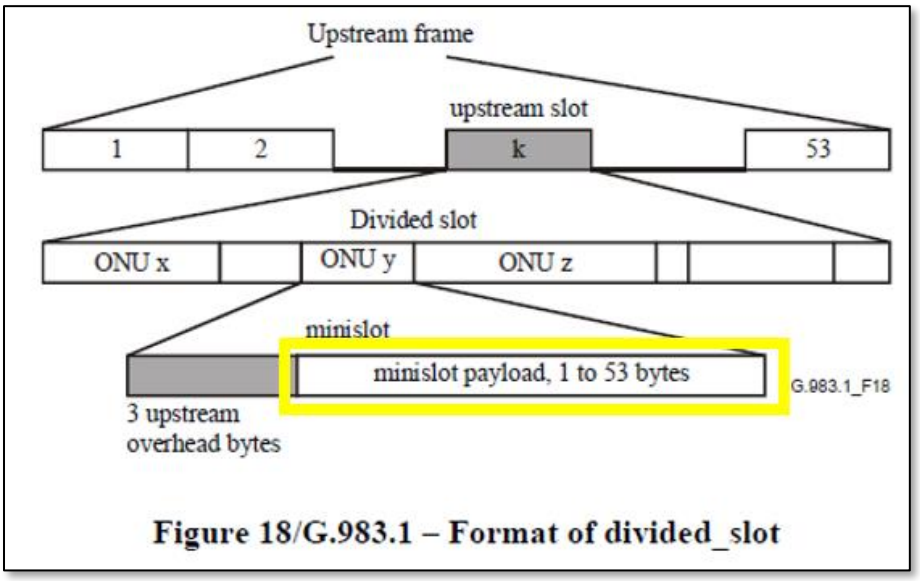


Figure 18/G.983.1 – Format of divided_slot

647. As can be seen below in Stiscia's Figure 3, data received at the Ethernet interface 350 (shown in yellow) passes through the PON processor 240 to the APON interface 250 (shown in red).[778]

[776] Ex. Y at § 8.3.5.

[777] *Id.*; *Id.* at Figure 18.

[778] Ex. I at Fig. 1.

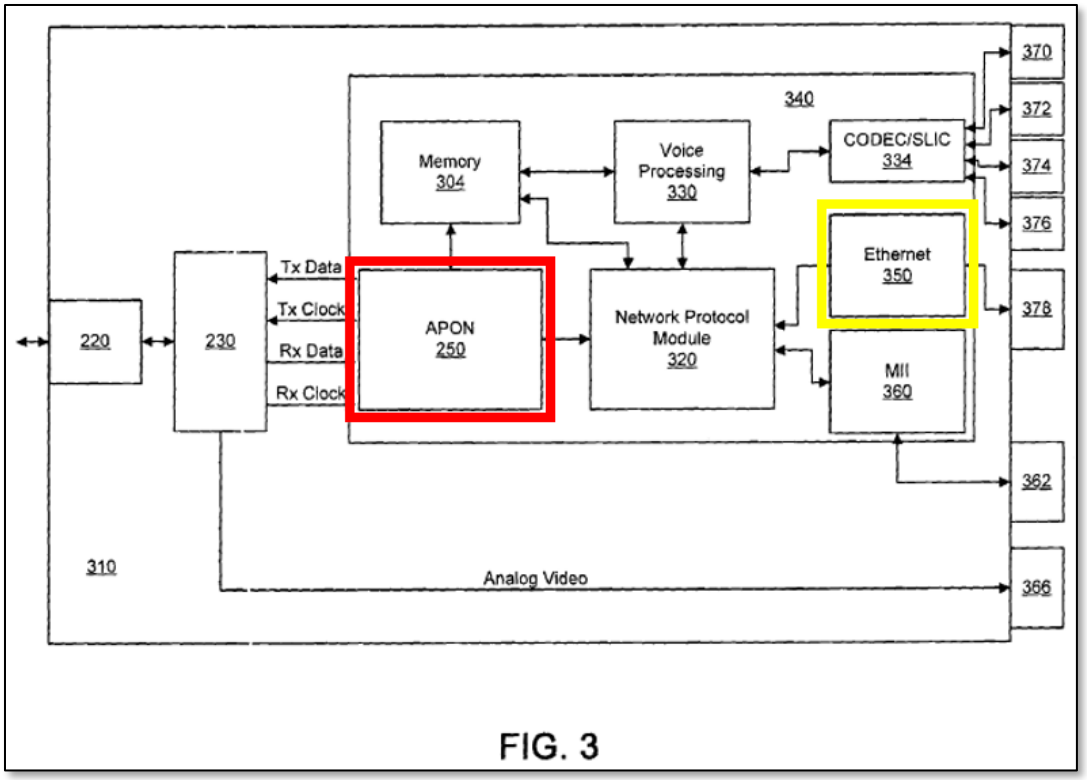


FIG. 3

648. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network."

649. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 14 was well known prior to the earliest alleged filing date of the '754 Patent.[779] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 14, was well known prior to the earliest alleged filing date of the '754 Patent.[780]

[779] Ex. SS at 182:16-24.

[780] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

xv. Claim 15: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

650. Under NextGen's apparent theory of infringement[781], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier. For the module of Claim 1, *see supra*, § IX.D.i.

651. As discussed above in the analysis of [1.b], both Stiscia and Gilliland teach that their respective devices contain a "bi-directional optical interface" capable of performing opto-electrical conversion in addition to transmitting and receiving optical signals to and from the PON. A POSITA would have understood that any device capable of performing such functionalities would contain the components of a laser, laser driver, photodiode, transimpedance amplifier, and a limiting amplifier.

652. Regardless, the components listed in Claim 15 are traditional components of a transceiver utilized in a data communications system of a passive optical network. The '754 Patent recognizes this: "[a] typical optical module is composed of a: laser []; laser driver (LD) []; photo detector (PD); transimpedance amplifier (TIA) []; limiting amplifier (LA) []."[782] In fact, the '754 Patent contains Figure 11 (shown below), which depicts a "typical optical module" and is labeled as prior art, contains the components claimed in Claim 15.

[781] Ex. NN at 29.

[782] Ex. A at 1:56-62.

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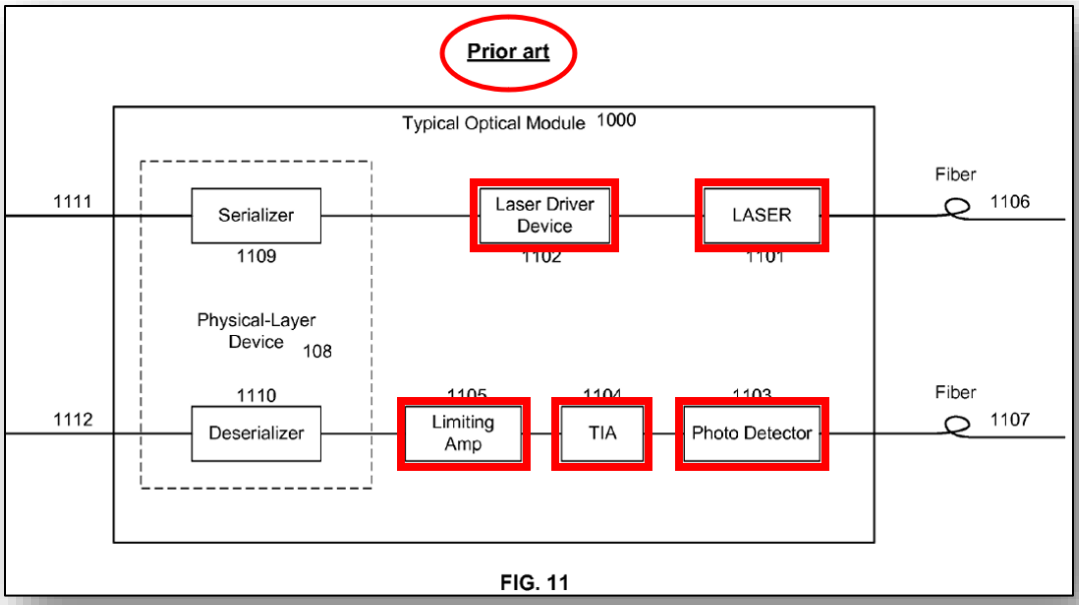


FIG. 11

653. It would have been obvious to any POSITA that these components would have been necessary to transmit optical data communications across a passive optical network.[783]

654. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a network client optical transceiver module "wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier."

xvi. Claim 16: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

655. Under NextGen's apparent theory of infringement[784], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip

[783] *Id.*; Ex. P at Fig. 11.7.

[784] Ex. NN at 29-30.

selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip. For the module of Claim 1, *see supra*, § IX.D.i.

656. As previously discussed above in the analysis of [1.pre], Stiscia discloses a method for bandwidth allocation over a passive optical network from a central office, or OLT, to multiple subscriber devices, or ONTs.[785] Stiscia states that the described PON conforms to specifications provided by the ITU, such as Recommendations G.983.1, G.983.2, G.983, etc. (collectively known as the ITU G.983.X Recommendations), which address physical layer and communication protocols between the central office, or head end, and subscriber devices, or network clients.[786] Stiscia states that its ONT "can be adapted to interface with any of a variety of PONs," such as ATM PON (APON) or Ethernet PON (EPON).[787] A POSITA would have understood that Stiscia's ONT could be utilized in additional PON networks, such as GPON or XGSPON.

657. As an example, G.983.1 Recommendation discusses "MAC protocol" for allocating upstream bandwidth on the PON among the ONTs/ONUs, where each ONT/ONU maps its upstream transmission into the minislot payload field of its minislot allocation.[788] The G.983.1 Recommendation also discusses "TC functions," such as frame structure, which a POSITA would have known are functions taking place at the TC-Layer in a network operating protocol.[789]

658. Thus, a POSITA would have understood that any optical transceiver performing data communications in a PON, and complying with the ITU G.983.X Recommendations, would inherently contain a TC-Layer discrete chip as well as a MAC discrete chip in order to operate in accordance with standard network protocols, such as the framing protocols and ranging protocols described in the ITU G.983.X Recommendations, as referenced in Stiscia.[790]

659. Therefore, it is my opinion that the Stiscia-Gilliland combination discloses a

[785] Ex. I at 1:12-44; Fig. 1.

[786] *Id.*

[787] *Id.* at 8:57-61.

[788] Ex. Y at § 8.3.5.

[789] *Id.*

[790] Ex. Y.

network client optical transceiver module "wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip."

xvii. Claim 18

a. [18.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, and the network client optical transceiver module having an optical port to one or more optical fibers of the passive optical network, and the network client optical transceiver module having an optical interface block optically coupled to the optical port and for converting electrical signals to optical signals and for converting optical signals to electrical signals, and the network client optical transceiver module having an optical interface block and for communicating with the head-end of the passive optical network, and the network client optical transceiver module having an electrical network interface port electrically coupled to the control module and for electrically communicating to the switch or router, a method of communicating with the head-end of a passive optical network from the network client optical transceiver module comprising the steps of:

660. Under NextGen's apparent theory of infringement[791], to the extent the preamble is limiting, the combination of Fujimori and the G.984.3 Draft Standard/Contribution 104 discloses this claim for the same reasons as described in [1.pre] – [1.e].

b. [18.a] receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module;

661. Under NextGen's apparent theory of infringement[792], in my opinion, the Stiscia-

[791] Ex. NN at 30-31.

[792] Ex. NN at 31.

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Gilliland combination discloses receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module.

662. As discussed above in the analysis of [1.d], the Stiscia-Gilliland combination discloses an electrical network interface port for communicating with a switch or router. The ONT taught in Stiscia receives upstream data provided to the APON interface 250 of the PON processor 240 (or "control module") from one or more downstream subscriber devices.[793] Stiscia states that one such downstream subscriber device may consist of an Ethernet device, which a POSITA would have understood could be a switch or a router.[794] In this embodiment, Stiscia's ONT contains an "Ethernet interface 350" (shown below in yellow) that couples directly to the "Ethernet port 378" (shown below in red) of the Ethernet device (i.e., switch or router), as shown below in Figure 3.[795]

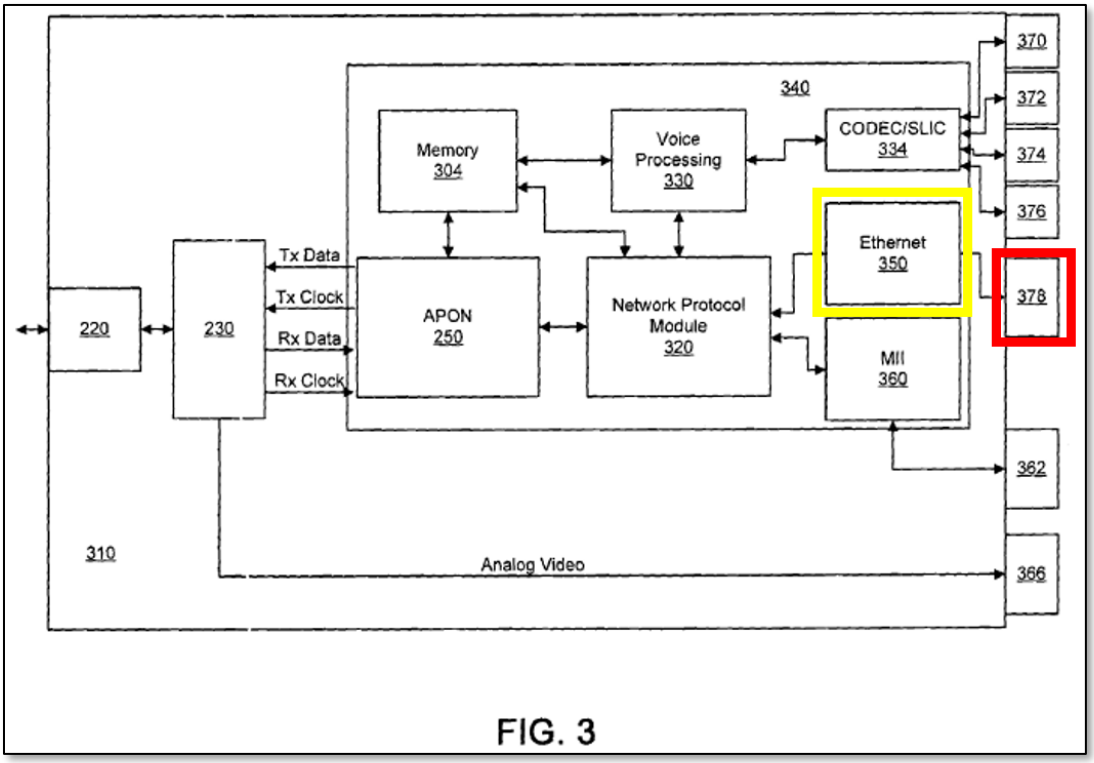


FIG. 3

663. A POSITA would have understood that signals transmitted between the Ethernet interface 350 (i.e., electrical network interface port) of the ONT and the Ethernet port 378 (i.e.,

[793] Ex. I at 13:11-29

[794] *Id.*

[795] *Id.*

optical module port) of the switch or router would consist of electrical signals, as Ethernet communications are done utilizing electrical, not optical, signals.

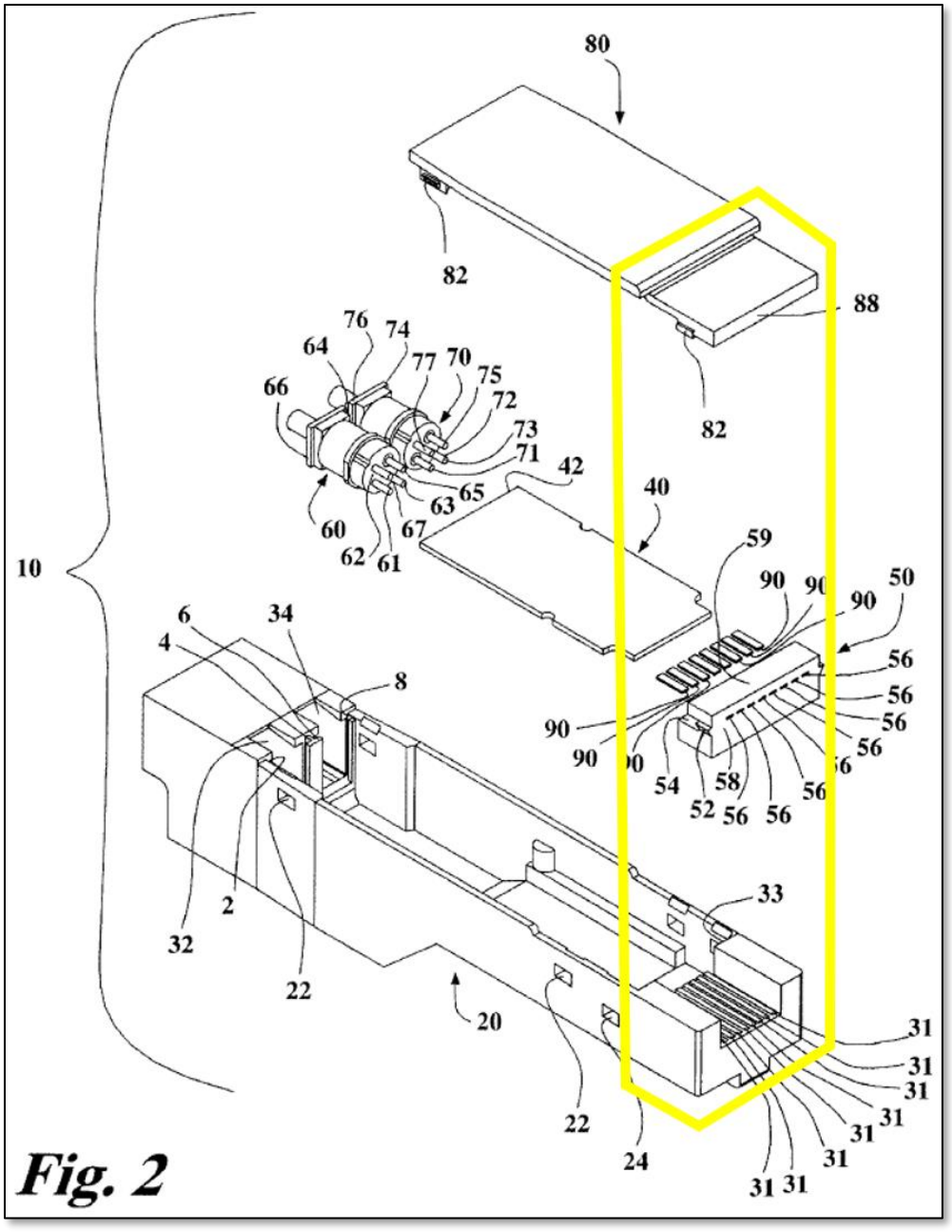
664. Likewise, Gilliland discloses a pluggable optical transceiver module that, on one end (as discussed above in the analysis of [1.a]) couples to the optical fibers or cables of an optical network and, on the other end, is capable of being received via a port of an external host device, which a POSITA would have understood could comprise a switch or router.[796] Specifically, Gilliland's optical transceiver module contains a "High Speed Serial Data Connector" for connecting to nodes or a host device "having ports."[797] Figure 2, reproduced below, shows the structure of the High Speed Serial Data Connector (i.e., electrical network interface port) on one end of the optical transceiver module, which couples directly to the described port (i.e., optical port) of the host device.[798]

[796] Ex. J at Figs. 1-3, 6:38-65.

[797] *Id.*

[798] *Id.*

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665. Further, as discussed above in Claim 14, a POSITA would have understood that, in order to transmit data communications upstream, an ONT (such as the one described in Stiscia) must receive data from the external host device to construct the payload section of the upstream transmission frame. A POSITA would have understood that the data transmitted in the payload section would be received by the ONT from the host device, such as a switch or router. Because the ONT taught in Stiscia and the pluggable optical transceiver module taught in Gilliland are connected to the host device via an electrical network interface port, as discussed in the analysis

of [1.d], it would have been obvious to a POSITA that the data destined for the payload section of the frame would be received by the device via the electrical network interface port.

666. Therefore, the Stiscia-Gilliland combination discloses "receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module."

c. [18.b] storing the received data inside the network client optical transceiver module;

667. Under NextGen's apparent theory of infringement[799], in my opinion, the Stiscia-Gilliland combination discloses storing the received data inside the network client optical transceiver module.

668. As discussed above in the analysis of [18.a], the Stiscia-Gilliland combination discloses receiving data from an external host device, such as a switch or router, via an electrical network interface port of the optical transceiver module. Stiscia also states that its described ONT contains memory for "temporary *data storage*."[800]

669. Further, as discussed extensively, a function of both the ONT described in Stiscia and the optical transceiver module described in Gilliland is to transmit and receive data. It would have been obvious to a POSITA that data received for transmission would need to be stored on the device, even if only briefly, prior to transmission onto the network as Fujimori describes. Thus, a POSITA would have understood that the optical transceiver module contemplated in Fujimori contains components for storing data, such as the data received from the host device via the electrical network interface port.

670. Therefore, the Stiscia-Gilliland combination discloses "storing the received data inside the network client optical transceiver module."

[799] Ex. NN at 31-32.

[800] Ex. I at 13:39-51.

d. [18.c] receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module;

671. Under NextGen's apparent theory of infringement[801], in my opinion, the Stiscia-Gilliland combination discloses receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module.

672. As discussed above in the analysis of [1.a], the Stiscia-Gilliland combination discloses a device that contains an optical port for coupling to the optical fibers of a PON. As also discussed in the analysis of [1.b], the Stiscia-Gilliland combination discloses a device that contains an optical interface block coupled to the optical port.

673. Stiscia teaches an optical connector 220 (i.e., "optical port"), shown in yellow below, that couples to an optical module 230 (i.e., "bi-directional optical interface block"), shown in red below. [802] Moreover, Stiscia teaches that the optical module described comprises means for converting received optical signals to electrical signals and received electrical signals to optical signals.[803] In particular, the optical module 230 comprises a optical-to-electrical converter 236 and an electrical-to-optical converter 234, both shown below in blue. Thus, Stiscia's ONT contains a bi-directional optical interface block.

[801] Ex. NN at 32.

[802] *Id.* at 9:22-33, Fig. 2.

[803] *Id.*

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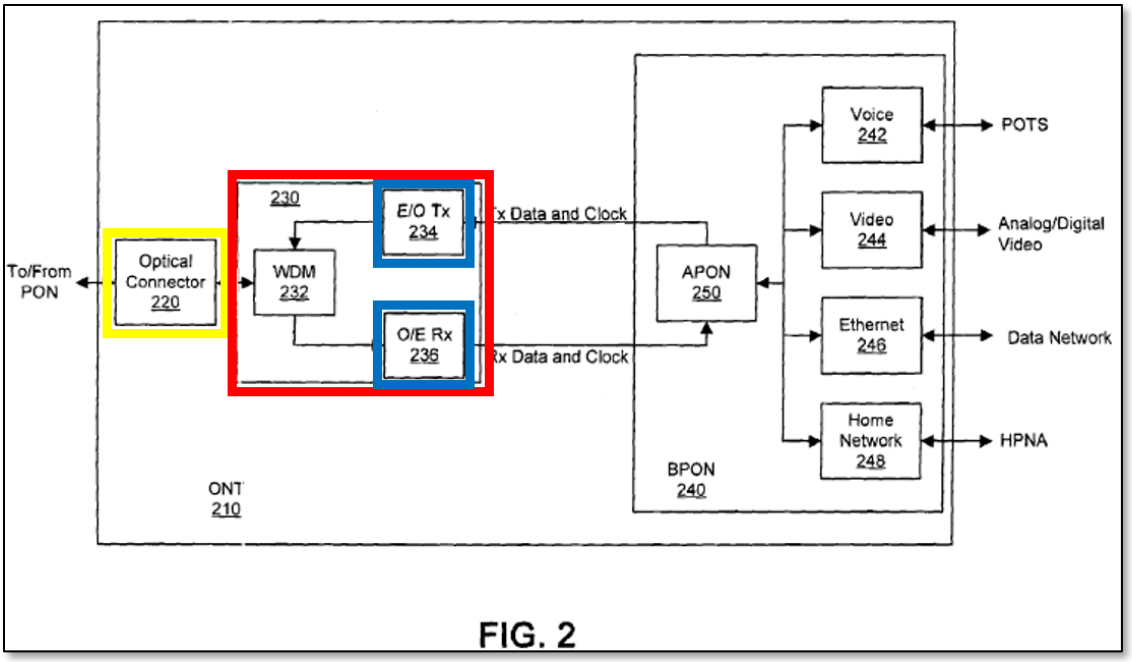


FIG. 2

674. Gilliland describes that its pluggable optical transceiver module contains a "connector" that is designed to link the transceiver module to a cable link of the optical network.[804] Gilliland's pluggable optical transceiver receives signals from and transmits signals to the optical network via the described connector (i.e., "optical port").[805] These connectors are highlighted below in yellow in Gilliland's Figure 3:

[804] Ex. J at 4:11-20, 4:32-34, 6:38-65, 7:25-29, Fig. 3.

[805] *Id.*

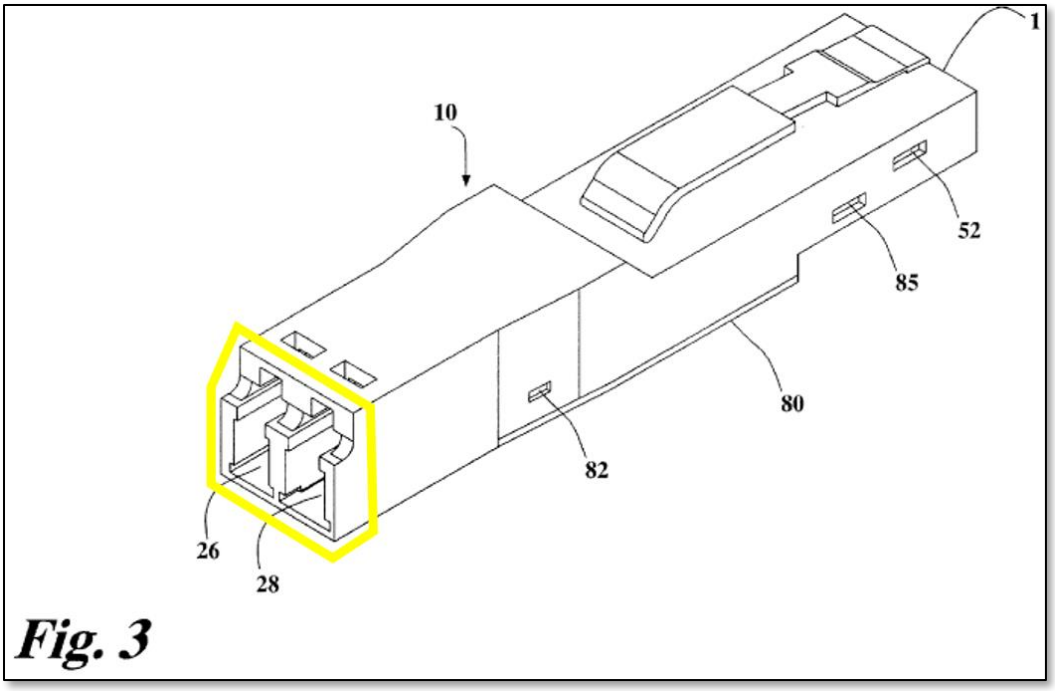


Fig. 3

675. Likewise, Gilliland teaches that its pluggable optical transceiver module "converts optical signals into electrical signals" and converts "electrical signals . . . into optical signals."[806] Thus, the optical transceiver module of Gilliland contains components for performing bi-directional optical and electrical signal conversion.

676. Because the optical port of the device described in the Stiscia-Gilliland combination is the physical connection point between the "optical interface block" of the module and the optical fibers of the network, it would have been obvious to a POSITA that any downstream optical data would be received by the device via the optical interface port at the optical interface.

677. Therefore, the Stiscia-Gilliland combination discloses "receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module."

[806] *Id.*

e. [18.d] converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module;

678. Under NextGen's apparent theory of infringement[807], in my opinion, the Stiscia-Gilliland combination discloses converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module.

679. As discussed in the analysis of [1.b], the Stiscia-Gilliland combination discloses a device that contains an optical interface block. Stiscia teaches an optical module 230 (i.e., "optical interface block"), shown in red below. [808] Moreover, Stiscia teaches that the optical module described comprises means for converting received optical signals to electrical signals and received electrical signals to optical signals.[809] In particular, the optical module 230 comprises a optical-to-electrical converter 236 and an electrical-to-optical converter 234, both shown below in blue. Thus, Stiscia's ONT contains an optical interface block.

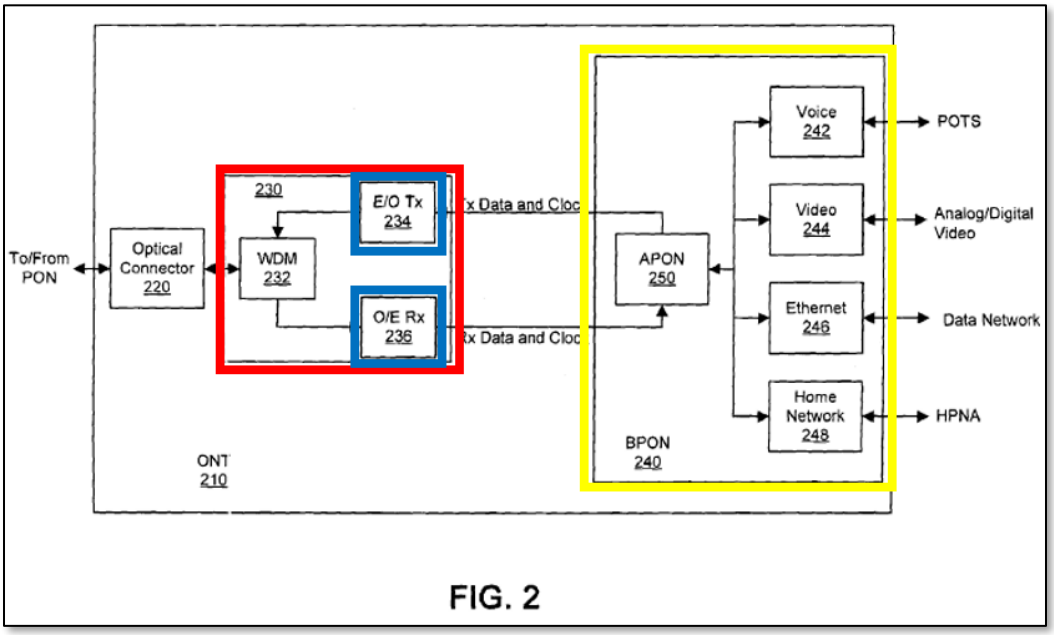


FIG. 2

[807] Ex. NN at 32.

[808] Ex. I at 9:22-33, Fig. 2.

[809] *Id.*

680. As also discussed previously in the analysis of [1.c], Stiscia teaches that its ONT device contains "an integrated PON processor 240" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices."[810] Stiscia's PON processor 240 (i.e., control module) (highlighted in yellow) is coupled to the optical module 220 (i.e., optical interface block).

681. It would have been obvious to a POSITA that an optical signal received and converted to an electrical signal at Stiscia's optical interface block, optical module 230, would necessarily subsequently be conveyed to Stiscia's control module, PON processor 240, which determines certain data transmission allocation information from the received signal, as discussed above.

682. Therefore, the Stiscia-Gilliland combination discloses "converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module."

f. [18.e] processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network;

683. Under NextGen's apparent theory of infringement[811], in my opinion, the Stiscia-Gilliland combination discloses processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network.

684. As discussed above in the analysis of [1.c], Stiscia teaches that its ONT contains "an integrated PON processor 240" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices."[812] Stiscia's PON processor 240 (i.e., control module) (highlighted in yellow) is coupled to the optical module 220 (i.e., optical interface block) (highlighted in red), as shown

[810] Ex. I at 8:38-47.

[811] Ex. NN at 33.

[812] Ex. I at 8:38-47.

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below in Figure 2:

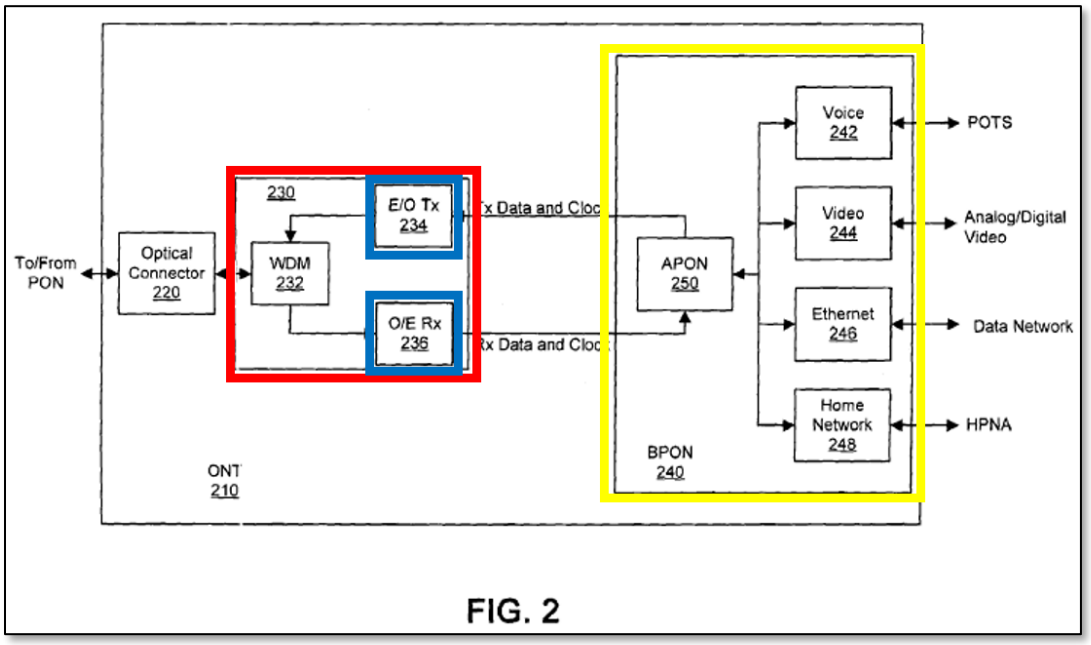


FIG. 2

685. Stiscia's PON processor 240 contains an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[813]

686. A POSITA would have understood that the downstream received and processed information related to controlling "the upstream transmission timing for ONTs on the PON" would include time slot or start time allocations from the OLT or head end of the network. For example, the G.983.X Recommendations, referenced directly in Stiscia, teach that the OLT assigns grants or "start minislots" to each of the ONTs or ONUs connected to the PON for allocation of bandwidth in the upstream frame.[814] Thus, the ONT of Stiscia is configured to receive "start times" from the OLT at the head end of the PON.

[813] *Id.* at 12:1-15.

[814] Ex. Y at §§ 8.3, 8.3.5.1, 8.3.5.3.5;

687. Thus, it would have been obvious to a POSITA to combine the "start time" assignment, as was traditional for use in a PON communication system, with the PON processor 240 of the ONT discussed in Stiscia. It would have further been obvious to a POSITA that the PON processor 240 would necessarily process the received signal in order to determine such a "start time" allocation from the received signal, which, as discussed above, would have been converted to an electrical signal at optical module 230.

688. Therefore, the Stiscia-Gilliland combination discloses "processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network."

g. [18.f] converting a portion of the stored received data to a second optical signal; and

689. Under NextGen's apparent theory of infringement[815], in my opinion, the Stiscia-Gilliland combination discloses converting a portion of the stored received data to a second optical signal.

690. As discussed above in the analysis of [18.b], Stiscia teaches that its ONT contains memory for "temporary *data storage*."[816] Further, as discussed extensively, a function of both the ONT described in Stiscia and the optical transceiver module described in Gilliland is to transmit and receive data. It would have been obvious to a POSITA that data received for transmission would need to be stored on the device, even if only briefly, prior to transmission onto the network as Fujimori describes. Thus, a POSITA would have understood that the optical transceiver module contemplated in Fujimori contains components for storing data, such as the data received from the host device via the electrical network interface port.

691. Further, as discussed above in the analysis of [1.b], both Stiscia and Gilliland teach that their devices contain means for converting electrical signals to optical signals. Stiscia teaches an optical connector 220 (i.e., "optical port"), shown in yellow below, that couples to an optical module 230 (i.e., "bi-directional optical interface block"), shown in red below. [817] Moreover,

[815] Ex. NN at 33.

[816] Ex. I at 13:39-51.

[817] *Id.* at 9:22-33, Fig. 2.

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Stiscia teaches that the optical module described comprises means for converting received electrical signals to optical signals.[818] In particular, the optical module 230 comprises an electrical-to-optical converter 234, shown below in blue.

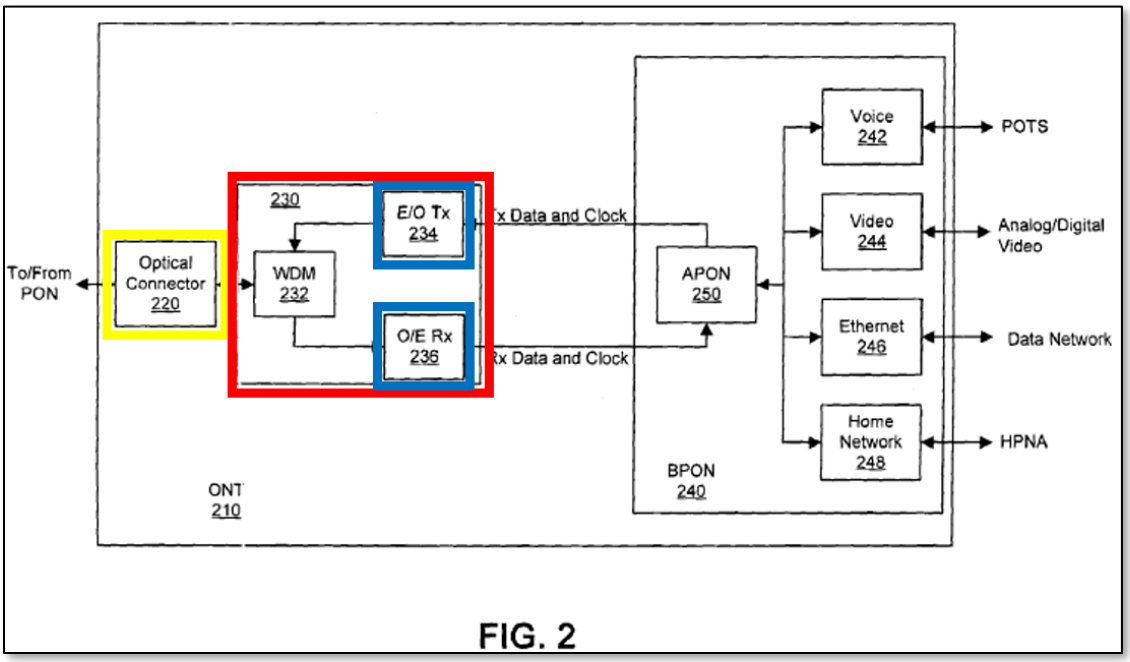


FIG. 2

692. Likewise, Gilliland teaches that its pluggable optical transceiver module "converts optical signals into electrical signals" and converts "electrical signals . . . into optical signals."[819]

693. It would have been obvious to a POSITA that, in order to transmit the stored received data onto the optical network (the object of a pluggable optical transceiver module), the stored data would necessarily be converted from its electrical signal format to an optical signal format by optical module 230. Because signals transmitted across an optical network must be *optical signals*, it would have been obvious to a POSITA that any data transmission would first need to be converted to an optical format prior to transmission.

694. Therefore, the Stiscia-Gilliland combination discloses "converting a portion of the stored received data to a second optical signal."

[818] *Id.*

[819] Ex. J at 4:11-20.

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h. [18.g] transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network; whereby

695. Under NextGen's apparent theory of infringement[820], in my opinion, the Stiscia-Gilliland combination discloses transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network.

696. As discussed above in the analysis of Claim 1, Stiscia teaches an optical connector 220 (i.e., "optical port"), shown in yellow below, that couples to an optical module 230 (i.e., "bi-directional optical interface block"), shown in red below. [821] Moreover, Stiscia teaches that the optical module described comprises means for converting received optical signals to electrical signals and received electrical signals to optical signals.[822] In particular, the optical module 230 comprises a optical-to-electrical converter 236 and an electrical-to-optical converter 234, both shown below in blue.

[820] Ex. NN at 33.

[821] *Id.* at 9:22-33, Fig. 2.

[822] *Id.*

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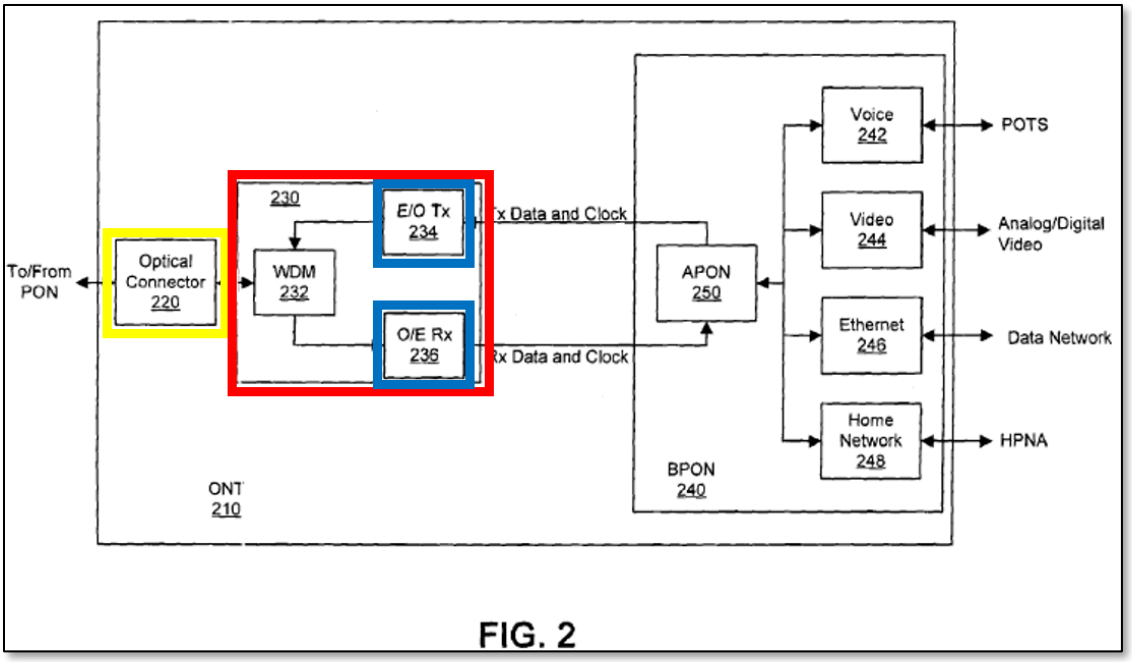


FIG. 2

697. Likewise, Gilliland describes that its pluggable optical transceiver module contains a "connector" that is designed to link the transceiver module to a cable link of the optical network.[823] Gilliland's pluggable optical transceiver receives signals from and transmits signals to the optical network via the described connector (i.e., "optical port").[824] These connectors are highlighted below in yellow in Gilliland's Figure 3:

[823] Ex. J at 4:11-20, 4:32-34, 6:38-65, 7:25-29, Fig. 3.

[824] *Id.*

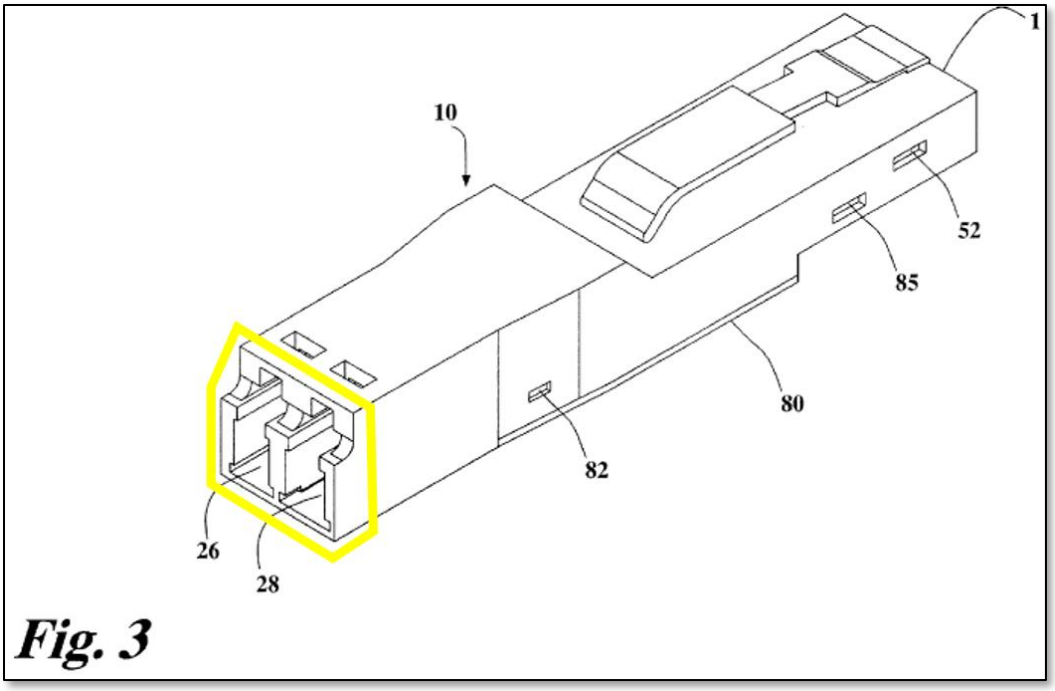


Fig. 3

698. Gilliland teaches that its pluggable optical transceiver module "converts optical signals into electrical signals" and converts "electrical signals . . . into optical signals."[825]

699. Because the optical port of the device described in the Stiscia-Gilliland combination is the physical connection point between the "optical interface block" of the device and the optical fibers of the network, it would have been obvious to a POSITA that any upstream optical transmission would be transmitted via the optical port at the optical interface.

700. Further, as discussed above in the analysis of [1.c], Stiscia teaches that its ONT contains "an integrated PON processor 240" that is "utilized to receive downstream data from an OLT via a passive optical network and provide the contents of the downstream data to one or more subscriber devices."[826] Stiscia's PON processor 240 (i.e., control module) (highlighted in yellow) is coupled to the optical module 220 (i.e., bi-directional optical interface block) (highlighted in red), as shown below in Figure 2:

[825] Ex. J at 4:11-20.

[826] Ex. I at 8:38-47.

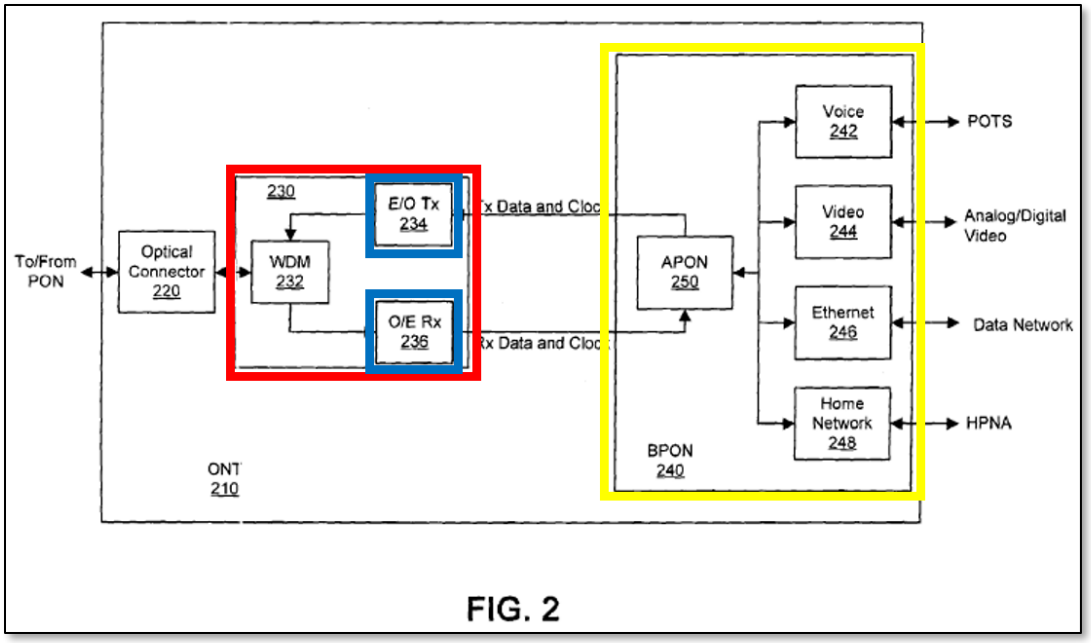


FIG. 2

701. Stiscia's PON processor 240 contains an "APON interface 250" that is configured to, upon receiving downstream data communication signals from the PON, process said signals "as defined by the ITU G.983.X Recommendation" to determine information such as that used to "control the upstream transmission timing for ONTs on [the] PON; perform ranging to determine the transmission delay and other relevant information; . . . miscellaneous control functions; and the like."[827]

702. A POSITA would have understood that the downstream received and processed information related to controlling "the upstream transmission timing for ONTs on the PON" would include time slot or start time allocations from the OLT or head end of the network. For example, the G.983.X Recommendations, referenced directly in Stiscia, teach that the OLT assigns grants or "start minislots" to each of the ONTs or ONUs connected to the PON for allocation of bandwidth in the upstream frame.[828] Thus, the ONT of Stiscia is configured to receive "start times" from the OLT at the head end of the PON.

703. Further, Stiscia's ONT is "adapted to receive and transmit upstream data from the

[827] *Id.* at 12:1-15.

[828] Ex. Y at §§ 8.3, 8.3.5.1, 8.3.5.3.5;

one or more subscriber devices to the OLT via the passive optical network."[829] Stiscia describes the process in which the APON interface processes data to transmit upstream, including processing the data in accordance with one or more of the ITU G.983.X Recommendations (the details of which are discussed above), and providing the processed data to the electrical-to-optical converter 234, wherein the upstream data is converted from an electrical signal to an optical signal before being transmitted onto the PON to the upstream OLT.[830] A POSITA would have understood that such a transmission would align with the grant of a "start time" allocated to the ONT by the OLT at the head end of the of the PON.

704. Therefore, the Stiscia-Gilliland combination discloses "transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network."

i. [18.h] the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and the network client optical transceiver module electrically communicates with the switch or router.

705. Under NextGen's apparent theory of infringement[831], in my opinion, the Stiscia-Gilliland combination discloses a network client optical transceiver module that optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and a network client optical transceiver module that electrically communicates with the switch or router.

706. As discussed above in the analysis of [1.c], and again in [18.e] and [18.g], the Stiscia-Gilliland combination discloses a device containing a "control module" that is configured to align upstream data communications to the head end of the network with certain transmission "start time" allocations received from the head end. Moreover, Stisicia states that its "control module" processes and transmits signals in accordance with ITU G.983.X Recommendations. [832]

[829] Ex. I at 8:38-47.

[830] *Id.* at 11:5-17.

[831] Ex. NN at 33-34.

[832] Ex. I at 12:1-15.

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707. Stiscia's ONT is "adapted to receive and transmit upstream data from the one or more subscriber devices to the OLT via the passive optical network."[833] Stiscia describes the process in which the APON interface processes data to transmit upstream, including processing the data in accordance with one or more of the ITU G.983.X Recommendations (the details of which are discussed above), and providing the processed data to the electrical-to-optical converter 234, wherein the upstream data is converted from an electrical signal to an optical signal before being transmitted onto the PON to the upstream OLT.[834] A POSITA would have understood that such a transmission would align with the grant of a "start time" allocated to the ONT by the OLT at the head end of the of the PON. Thus, the Stiscia-Gilliland combination discloses a device capable of optically communicating with the head end of the PON responsive to start times for data transmissions.

708. Additionally, as discussed above in the analysis of [1.d], the Stiscia-Gilliland combination teaches a device that is capable of electrically communicating with a switch or router. The ONT taught in Stiscia receives upstream data provided to the APON interface 250 of the PON processor 240 (or "control module") from one or more downstream subscriber devices.[835] Stiscia states that one such downstream subscriber device may consist of an Ethernet device, which a POSITA would have understood could be a switch or a router.[836] In this embodiment, Stiscia's ONT contains an "Ethernet interface 350" (shown below in yellow) that couples directly to the "Ethernet port 378" (shown below in red) of the Ethernet device (i.e., switch or router), as shown below in Figure 3.[837]

[833] Ex. I at 8:38-47.

[834] *Id.* at 11:5-17.

[835] *Id.* at 13:11-29

[836] *Id.*

[837] *Id.*

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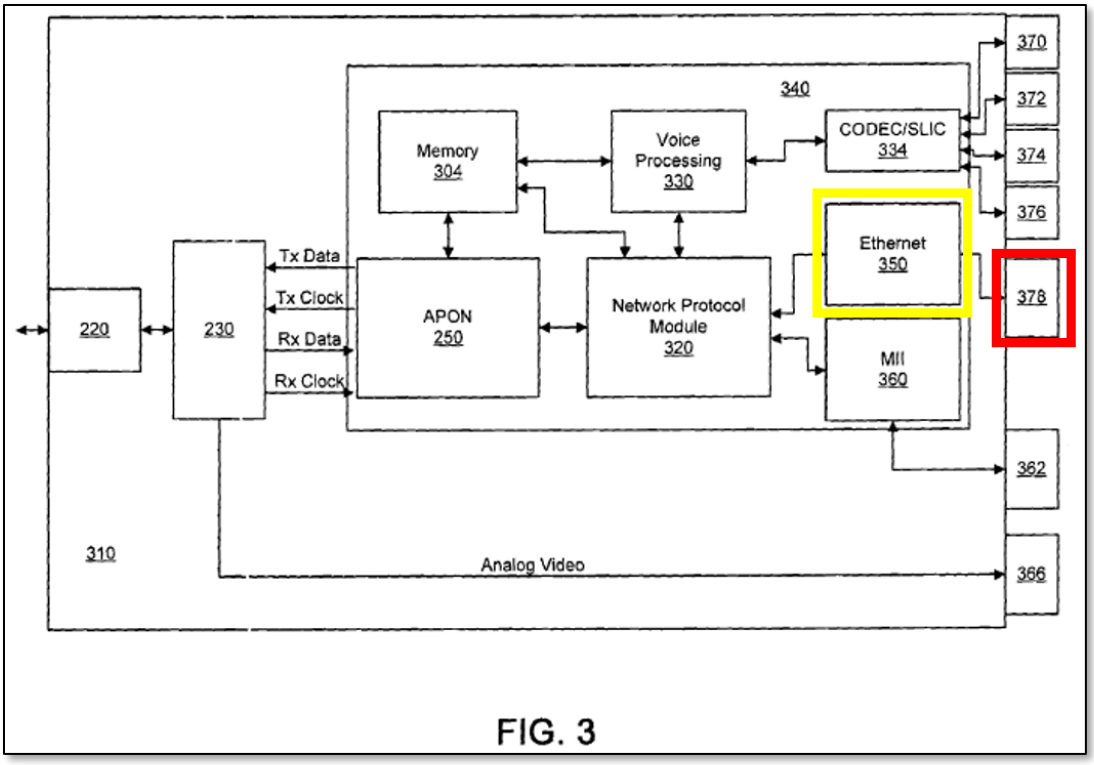


FIG. 3

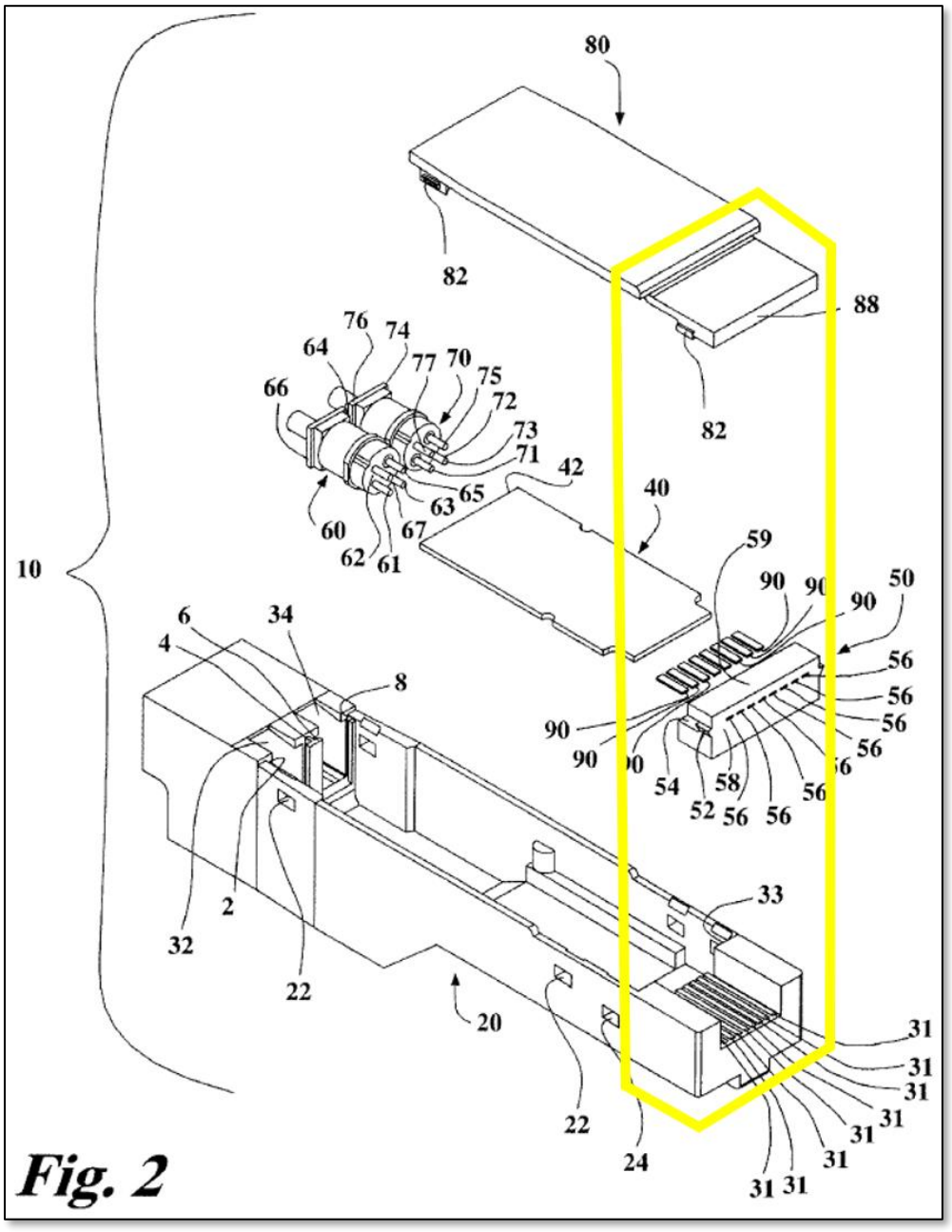
709. A POSITA would have understood that signals transmitted between the Ethernet interface 350 (i.e., electrical network interface port) of the ONT and the Ethernet port 378 (i.e., optical module port) of the switch or router would consist of electrical signals, as Ethernet communications are done utilizing electrical, not optical, signals.

710. Likewise, Gilliland discloses a pluggable optical transceiver module that, on one end (as discussed above in the analysis of [1.a]) couples to the optical fibers or cables of an optical network and, on the other end, is capable of being received via a port of an external host device, which a POSITA would have understood could comprise a switch or router.[838] Specifically, Gilliland's optical transceiver module contains a "High Speed Serial Data Connector" for connecting to nodes or a host device "having ports."[839] Figure 2, reproduced below, shows the structure of the High Speed Serial Data Connector (i.e., electrical network interface port) on one end of the optical transceiver module, which couples directly to the described port (i.e., optical

[838] Ex. J at Figs. 1-3, 6:38-65.

[839] *Id.*

port) of the host device.[840]



711. Thus, the Stiscia-Gilliland combination teaches a device that is capable of electrically communicating with a switch or router. Therefore, the Stiscia-Gilliland combination discloses "a network client optical transceiver module [that] optically communicates with the

[840] *Id.*

head-end of the passive optical network responsive to start times for data transmissions and [a] network client optical transceiver module [that] electrically communicates with the switch or router."

xviii. Claim 19: The method of claim 18, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.[841]

712. Under NextGen's apparent theory of infringement[842], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 2. For the method of Claim 18, *see supra* § IX.D.xvii.

xix. Claim 20: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more end times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) terminating the transmission of the second optical signal responsive to an end time for data transmissions to the head-end of the passive optical network.

713. Under NextGen's apparent theory of infringement[843], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 3. For the method of Claim 18, *see supra*, § IX.D.xvii.

[841] Claims 19-30 are method claims analogous to device claims 2-16 I discuss *supra* Sections X.D.ii-ix. Thus, my discussion of the respective corresponding device claim is incorporated into and mirrored for the discussion of the parallel method claim.

[842] Ex. NN at 34.

[843] Ex. NN at 34-35.

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xx. Claim 21: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more lengths of time respective to the start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) transmitting the second optical signal responsive to a length of time for data transmissions to the head-end of the passive optical network.

714. Under NextGen's apparent theory of infringement[844], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 4. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxi. Claim 22: The method of claim 18, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: multimode optical fibers; and single mode optical fibers.

715. Under NextGen's apparent theory of infringement[845], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 5. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxii. Claim 23: The method of claim 18, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

716. Under NextGen's apparent theory of infringement[846], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 6. For the method of Claim 18, *see supra*, § IX.D.xvii.

[844] Ex. NN at 35.

[845] Ex. NN at 35-36.

[846] Ex. NN at 36.

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xxiii. Claim 24: The method of claim 18, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

717. Under NextGen's apparent theory of infringement[847], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 7. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxiv. Claim 25: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an assigned network identification address from the head-end of the passive optical network for addressing data to the network client optical transceiver module at the control module.

718. Under NextGen's apparent theory of infringement[848], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 9. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxv. Claim 26: The method of claim 18, further comprising the steps of: (g1) adjusting the transmission of the second optical signal form the optical interface block through the optical port to account for the response delay of the optical transceiver module.

719. Under NextGen's apparent theory of infringement[849], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claims 11 and 12. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxvi. Claim 27: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an optical power level and adjusting the transmit optical power level of the network client optical transceiver module to the determined optical power level.

720. Under NextGen's apparent theory of infringement[850], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 13. For the method of

[847] Ex. NN at 36.

[848] Ex. NN at 37.

[849] Ex. NN at 37-39.

[850] Ex. NN at 40.

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Claim 18, *see supra*, § IX.D.xvii.

xxvii. Claim 28: The method of claim 18, further comprising the steps of: (f1) encapsulating a portion of data received through the electrical network interface port into the payload section of a framing protocol for the passive optical network at the control module for conveyance to the optical interface block.

721. Under NextGen's apparent theory of infringement[851], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 14. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxviii. Claim 29: The method of claim 18, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

722. Under NextGen's apparent theory of infringement[852], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.D.xvii.

xxix. Claim 30: The method of claim 18, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

723. Under NextGen's apparent theory of infringement[853], the Stiscia-Gilliland combination discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.D.xvii.

[851] Ex. NN at 40.

[852] Ex. NN at 40-41.

[853] Ex. NN at 41.

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E. Ground 4A: The Aboshi reference anticipates claims 1-2, 5-8, 15-16, 18-19, 22-24, and 29-30.

i. Claim 1

a. [1.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, the network client optical transceiver module comprising:

724. Under NextGen's apparent theory of infringement[854], to the extent the preamble is limiting, a POSITA would have understood Aboshi to disclose this limitation.

725. Aboshi describes a "passive optical network transmission system that branches an optical transmission path connected to a center by a passive optical splitter to lay the paths to a plurality of subscriber premises."[855] Moreover, Aboshi contains Figure 9 (reproduced below) illustrating a passive optical network such as the network described in [1.pre]. Figure 9 contains an OLT, i.e., head-end (shown in yellow), connected to a number of ONUs, i.e., subscriber or client ends (shown in red), via optical fibers branched at an optical splitter (shown in blue).[856] Aboshi also emphasizes that this configuration was well known, labeling it prior art.[857]

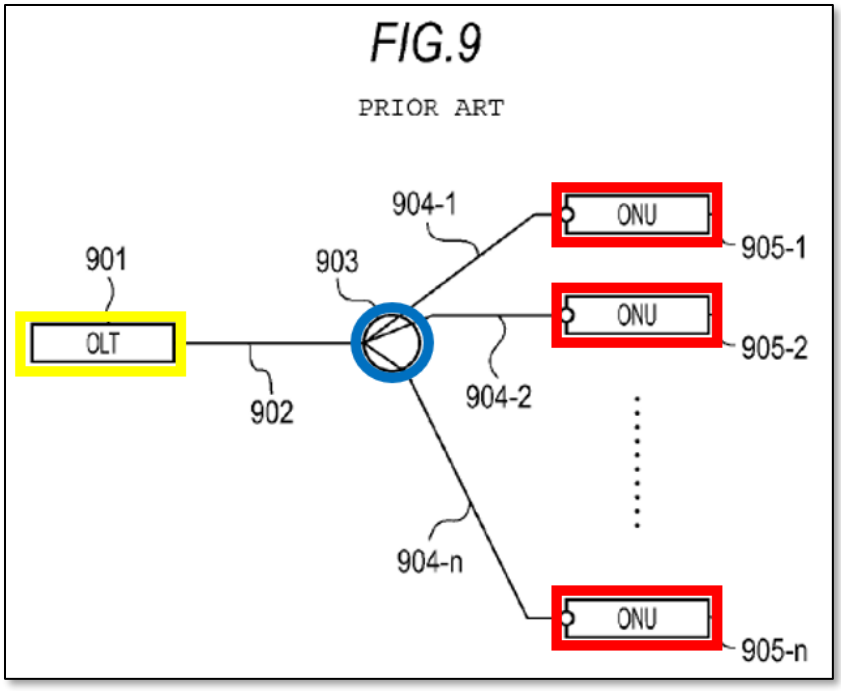
[854] Ex. NN at 1-8.

[855] Ex. K at 1:22-25.

[856] *Id.* at Fig. 9.

[857] *Id.*

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726. Further, Aboshi teaches a "subscriber premises side optical network unit" that contains a "multi-source agreement interface module," such as GBIC or SFP.[858] A POSITA would have understood that, in having an MSA-compliant interface for coupling to a host device, the optical network unit (ONU) configuration itself would have been contained in an MSA-compliant form factor, housings which were standardized in the industry and widely known. A POSITA would have understood that, in putting the ONU within an MSA form factor, the subscriber premises device would have been pluggable and configured to be easily couplable to or removable from a host device.

727. Aboshi describes such a host device (or "external node") as a switch having a plurality of ports.[859] Thus, a POSITA would have understood that Aboshi teaches a pluggable ONU that can removably couple to a switch or router.

728. Therefore, it is my opinion that a POSITA would have understood Aboshi to disclose "a network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical

[858] *Id.* at 2:62-65, 3:23-27.

[859] *Id.*

transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router."

729. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a PON having one or more splitters for coupling a network client optical transceiver module over one or more optical fibers to the head end of a PON was well known prior to the earliest alleged filing date of the '754 Patent.[860]

a. [1.a] an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters;

730. Under NextGen's apparent theory of infringement[861], in my opinion, a POSITA would have understood that Aboshi discloses an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters for the same reasons as discussed in the analysis of [1.pre].

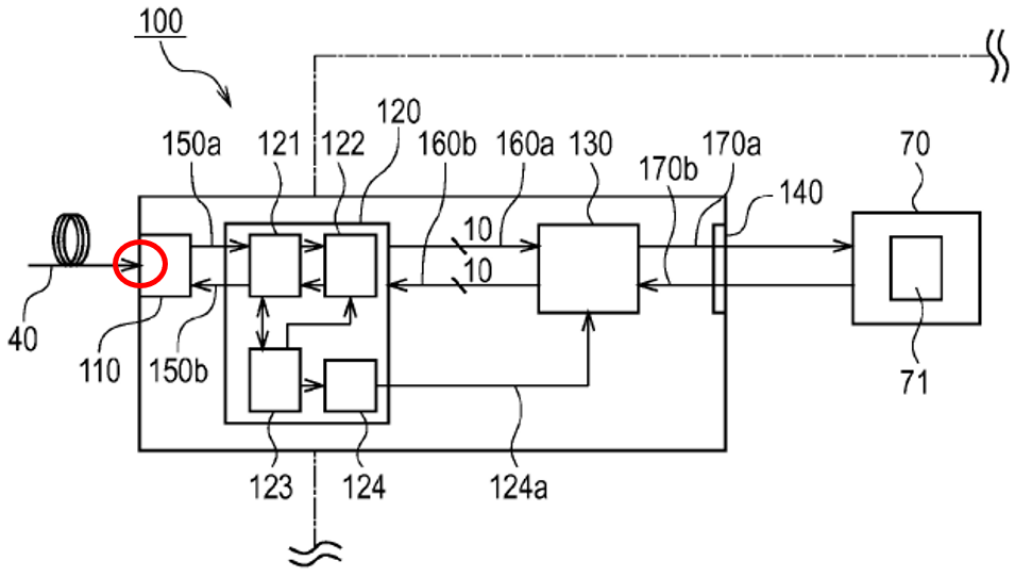
731. As discussed above, Aboshi teaches a pluggable ONU for a passive optical network. Aboshi further teaches that its pluggable ONU device, reproduced in Figure 1 below, contains "an electrical/optical converting section 110" that has an "optical input/output ends" (shown in red below) "to connect with the center side OLT 11 via an optical fiber 40."[862]

[860] Ex. SS at 176:4-14.

[861] Ex. NN at 8-11.

[862] Ex. K at 5:42-45, Fig. 1.

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732. These "optical input/output ends" directly interface with and couple to the optical fibers of the network.[863] Thus, a POSITA would have understood these "optical input/output ends" to be the same as the "optical port" described in [1.a].

733. Therefore, it is my opinion that a POSITA would have understood that Aboshi discloses "an optical port configured to optically couple to one or more optical fibers of the passive optical network having one or more passive optical splitters."

734. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an optical port on a pluggable transceiver device was well known prior to the earliest alleged filing date of the '754 Patent.[864]

b. [1.b] a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion;

735. Under NextGen's apparent theory of infringement[865], in my opinion, a POSITA would have understood that Aboshi discloses a bi-directional optical interface block optically coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical

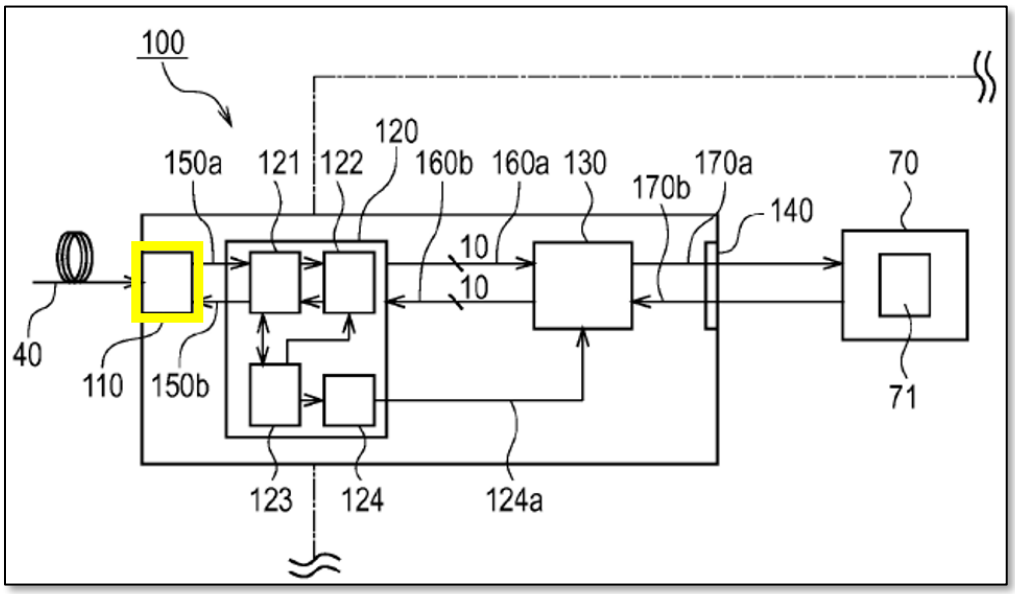
[863] *Id.*

[864] Ex. SS at 169:23-170:5, 170:18-22.

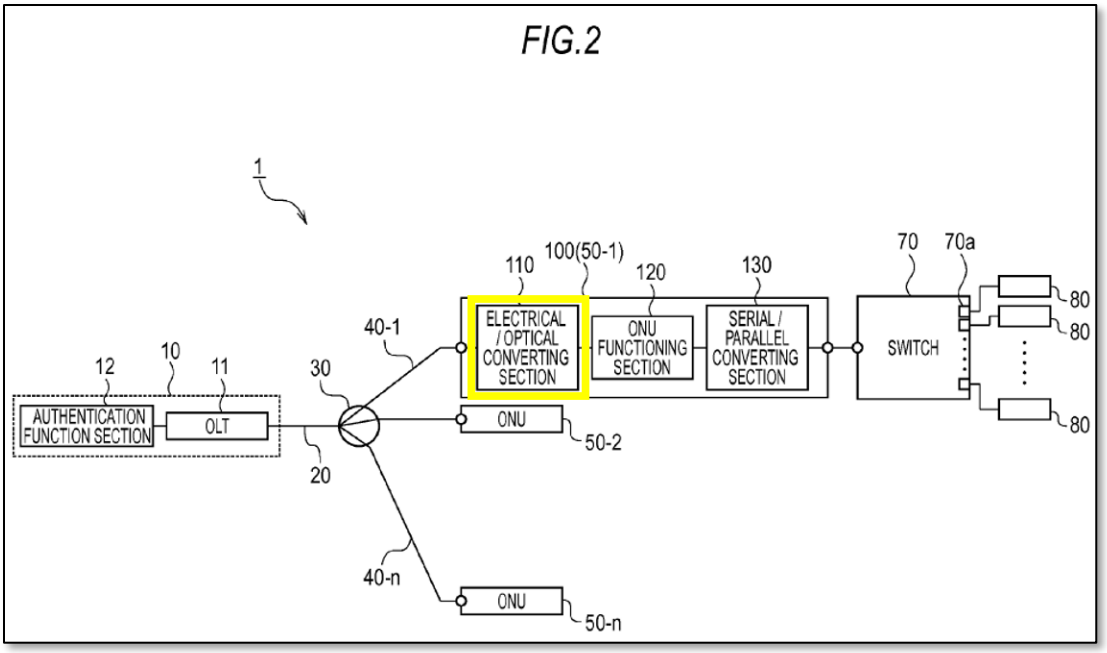
[865] Ex. NN at 11.

signal conversion.

736. As discussed above in the analysis of [1.a], the pluggable ONU taught in Aboshi contains an "electrical optical converting section 110," coupled to the optical input/output ends (i.e., optical port) that "converts optical signals transmitted from the OLT 11 of the center into electrical signals (photoelectric conversion)" and "also converts electrical signals . . . into optical signals (reverse photoelectric conversion) and transmits the optical signals to the OLT 11."[866] Aboshi's taught "electrical optical converting section 110" is shown below in yellow in a reproduction of Figures 1 and 2.



[866] *Id.* at 2:30-34, 3:31-36, 6:7-17, Fig. 1.



737. Therefore, it is my opinion that Aboshi discloses a pluggable ONU device containing an electrical/optical converting section (i.e., "bi-directional optical interface block") "coupled to the optical port and configured to perform optical-to-electrical and electrical-to-optical signal conversion" in accordance with [1.b].

738. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a "bi-directional optical interface" that performs electrical-to-optical and optical-to-electrical signal conversion was well known prior to the earliest alleged filing date of the '754 Patent.[867]

c. [1.c] a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times; and

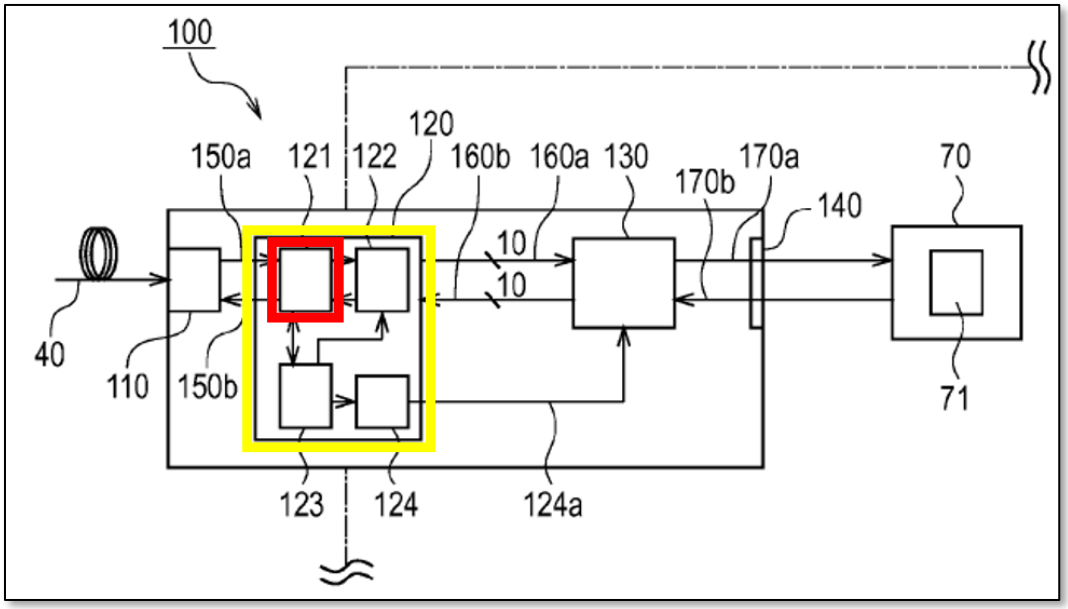
739. Under NextGen's apparent theory of infringement[868], in my opinion, a POSITA

[867] Ex. SS at 171:2-20.

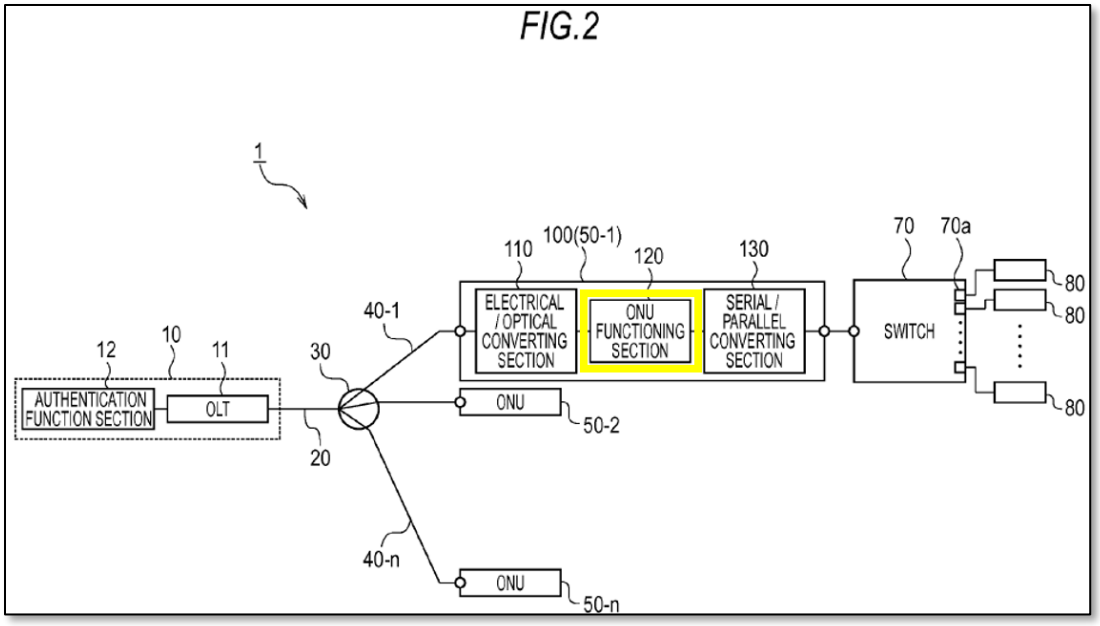
[868] Ex. NN at 11-16.

would have understood that Aboshi discloses a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to the start times.

740. Aboshi teaches that the pluggable ONU discussed above contains an "ONU functioning section 120" (shown below in yellow) containing MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[869] Figures 1 and 2, showing the structure of Aboshi's pluggable ONU, are reproduced below:



[869] *Id.* at 5:32-37, 6:43-49, 7:3-11, Fig. 1.



741. Aboshi further states that the ONU functioning section 120 contains a "first MAC section 121" (shown in red above) that "performs MAC processes related to the communication with the OLT 11 of the center" (i.e., head end).[870] A POSITA would have understood that, in performing MAC processes "related to communications" with the head end and because the described pluggable ONU performs MAC processes as described in the IEEE 802.3ah and ITU-T G.984.X standard recommendations, the ONU functioning section 120 is configured to receiving data communications from the head end representing start time allocations for transmission. Further, a POSITA would have understood that, in compliance with such standards, the ONU functioning section 120 is configured to transmit data communications back to the head end. A POSITA would have thus understood that the ONU functioning section 120 acts as the control module described in the '754 Patent.

742. Therefore, it is my opinion that Aboshi discloses "a control module electrically coupled to the bi-directional optical interface block and configured to receive from the head-end of the passive optical network data communications representing one or more start times for transmitting data communications to the head-end of the passive optical network and configured to transmit the data communications to the head-end of the passive optical network responsive to

[870] *Id.*

the start times."

743. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 1 was well known prior to the earliest alleged filing date of the '754 Patent.[871] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "start times," was well known prior to the earliest alleged filing date of the '754 Patent.[872]

d. [1.d] an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router; whereby

744. Under NextGen's apparent theory of infringement[873], in my opinion, Aboshi discloses an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router.

745. As discussed above in the analysis of [1.pre], the pluggable ONU taught in Aboshi contains an "interface module" that "is directly connected to an interface slot of the external node," which, as also discussed above, can comprise a switch or router.[874] This optical interface is highlighted below in Figure 2:

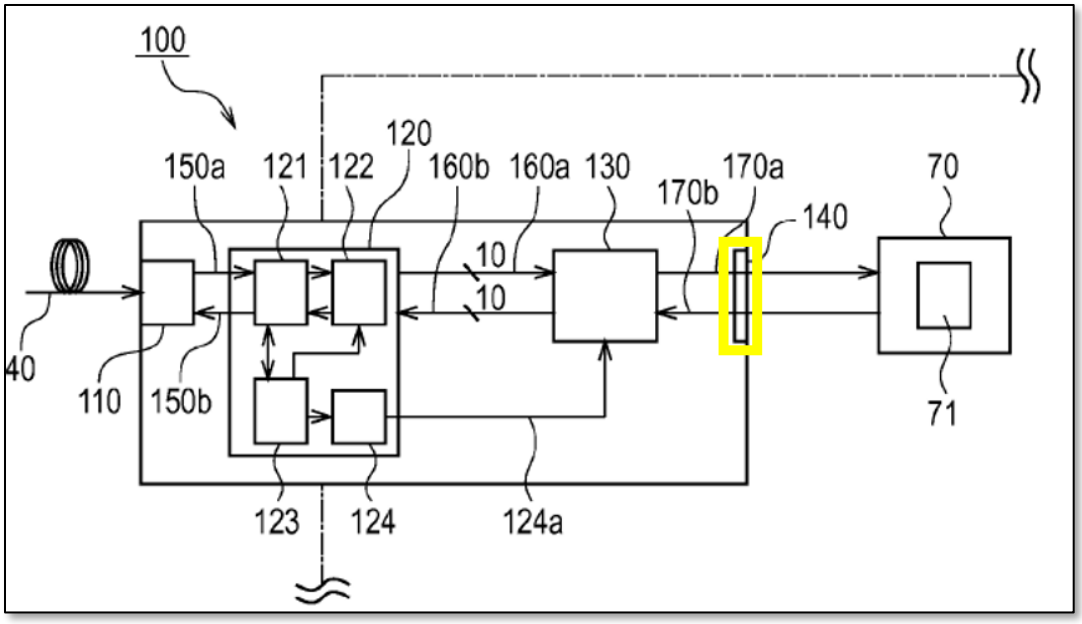
[871] Ex. SS at 182:16-24.

[872] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[873] Ex. NN at 17-20.

[874] *Id.* at 4:33-35, 5:25-31, cl. 8.

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746. A POSITA would have understood that the interface module couples the pluggable ONU to the switch disclosed. Further, Aboshi states that the interface module is connected to additional components of the pluggable ONU that transmit "electrical signals."[875] A POSITA would have thus understood that signals between the interface of the pluggable ONU and the switch would consist of electrical signals.

747. Therefore, it is my opinion that a POSITA would have found that Aboshi discloses "an electrical network interface port electrically coupled to the control module and for electrically coupling into the optical module port of the switch or router and for communicating with the switch or router."

748. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of an "electrical network interface port" on a pluggable optical transceiver module was well known prior to the earliest alleged filing date of the '754 Patent.[876]

[875] *Id.* at 6:2-6.

[876] Ex. SS at 171:21-172:25.

e. [1.e] the network client optical transceiver module is configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and the network client optical transceiver module is configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

749. Under NextGen's apparent theory of infringement[877], for reasons discussed above in the analysis of [1.pre], [1.c], and [1.d], Aboshi discloses a network client optical transceiver module configured to optically communicate with the head-end of the passive optical network responsive to start times for transmitting data communications to the head-end of the passive optical network and configured to removably couple to the optical module port of the switch or router and electrically communicate with the switch or router.

ii. Claim 2: The network client optical transceiver module of claim 1, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.

750. Under NextGen's apparent theory of infringement[878], in my opinion, Aboshi discloses a network client optical transceiver module wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK. For the module of Claim 1, *see supra*, § IX.E.i.

751. Specifically, as discussed above in the analysis of [1.pre], Aboshi teaches a "subscriber premises side optical network unit" that contains a "multi-source agreement interface module," such as GBIC or SFP.[879] A POSITA would have understood that, in having an MSA-compliant interface for coupling to a host device, the optical network unit (ONU) configuration itself would have been contained in an MSA-compliant form factor, housings which were standardized in the industry and widely known. A POSITA would have understood that, in putting

[877] Ex. NN at 20.

[878] Ex. NN at 20-21.

[879] *Id.* at 2:62-65, 3:23-27.

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the ONU within an MSA form factor, the subscriber premises device would have been pluggable and configured to be easily couplable to or removable from a host device.

752. Moreover, Aboshi contemplates that form factors other than GBIC and SFP may be used: "[t]here exist such modules as GBIC, SFP, *and others* as the MSA interface module."[880]

753. Further, as discussed throughout this report, a POSITA would have understood MSA-compliant form factors to include not only GBIC and SFP, but also XFP, XENPAK, X2, XPAK, and any other standardized, MSA-compliant form factor. Each of these form factors were included in a well-known series of pluggables at the time of the '754 Patent's earliest priority date because each of these form factors were the subject of MSA standards, making them standard form factors in the optical communications industry.[881] In fact, the '754 Patent itself discloses these form factors as being in the prior art as related optical interface implementations, shown below.[882]

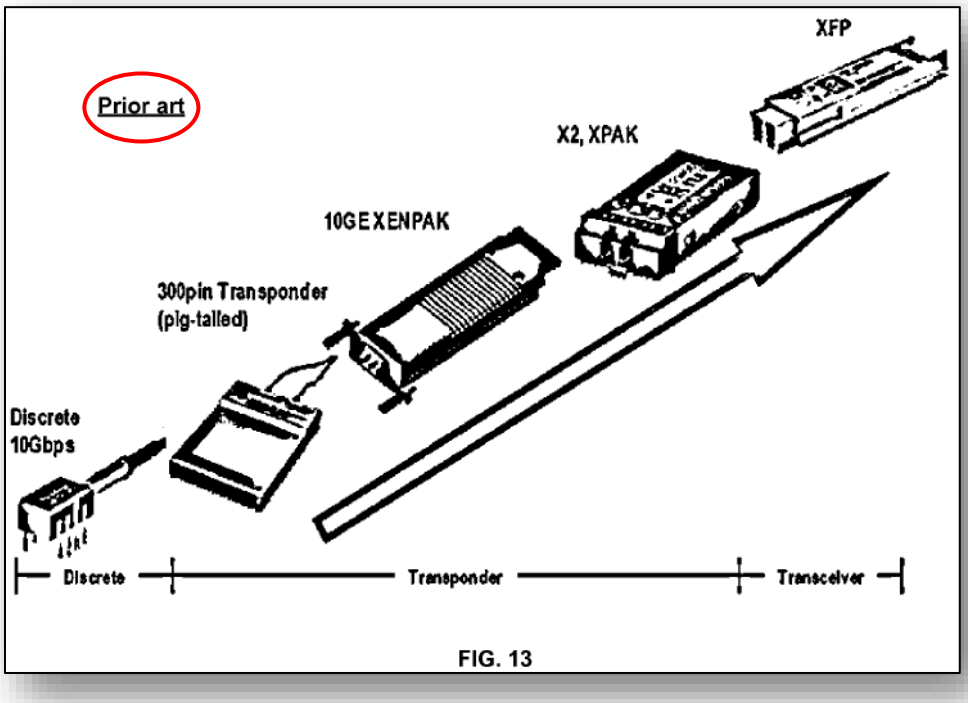


FIG. 13

[880] *Id.* at 5:49-57, 10:66-11:9.

[881] Ex. S; Ex. T; Ex. U.

[882] Ex. A at Fig. 13.

754. Therefore, it is my opinion that a POSITA would have understood Aboshi to disclose "a network client optical transceiver module [] wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK."

iii. Claim 5: The network client optical transceiver module of claim 1, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers.

755. Under NextGen's apparent theory of infringement[883], in my opinion, Aboshi discloses a network client optical transceiver module wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers. For the module of Claim 1, *see supra*, § IX.E.i.

756. A POSITA would have understood that the optical fibers discussed in Aboshi would consist of either multimode optical fibers or single mode optical fibers, as these were well-known in the optical communications space during the early 2000's as the types of optical fibers used in passive optical network data communications.[884] In fact, a POSITA would have known that optical fibers must either be single-mode type or multi-mode type fibers—there are no other types of optical fibers.

757. Therefore, it is my opinion that Aboshi discloses a network client optical transceiver module "wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: Multimode optical fibers; and Single mode optical fibers."

[883] Ex. NN at 22.

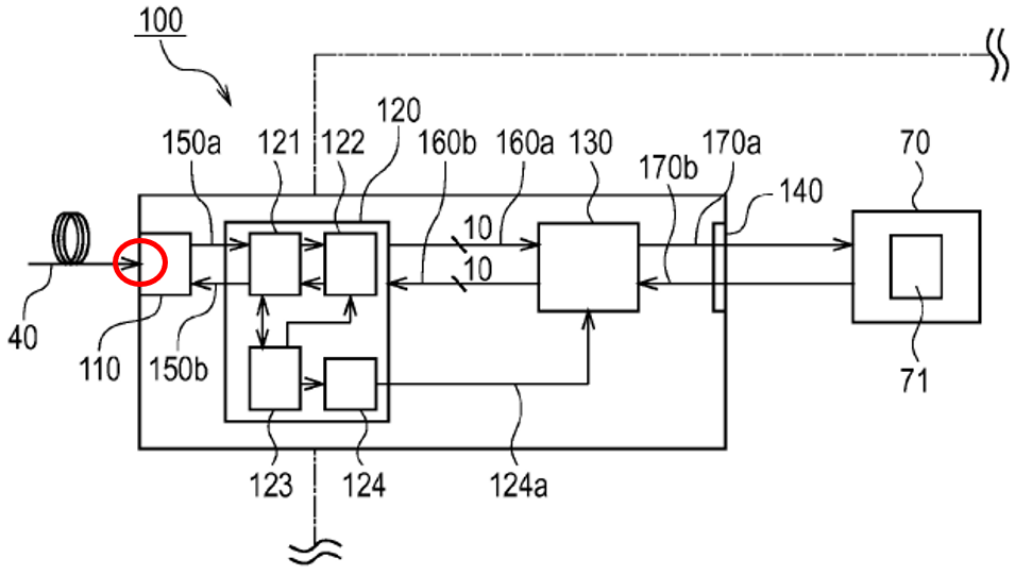
[884] Ex. P at 33-37.

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iv. Claim 6: The network client optical transceiver module of claim 1, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

758. Under NextGen's apparent theory of infringement[885], in my opinion, Aboshi discloses a network client optical transceiver module wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU). For the module of Claim 1, *see supra*, § IX.E.i.

759. As discussed above in the analysis of [1.a], Aboshi teaches a pluggable ONU for a passive optical network containing "an electrical/optical converting section 110" that has an "optical input/output ends" (shown in red below) "to connect with the center side OLT 11 via an optical fiber 40."[886]



760. These "optical input/output ends" directly interface with and couple to the optical

[885] Ex. NN at 22-23.

[886] Ex. K at 5:42-45, Fig. 1.

fibers of the network.[887] Specifically, Aboshi teaches that the pluggable ONUs disclosed are "connected respectively to the optical fibers" of the network.[888]

761. Further, a POSITA would have understood, with general knowledge and from the language of Aboshi, that the disclosed "optical input/output ends" (i.e., optical port) would comprise certain forms of connector configurations, such as Subscriber Connector (SC), Lucent Connector (LC), Straight TP (ST), Fiber Channel (FC) or Miniature Unit (MU), which were all well-known connectors in the early 2000's time frame.[889]

762. Therefore, it is my opinion that Aboshi discloses a network client optical transceiver module "wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU)."

v. Claim 7: The network client optical transceiver module of claim 1, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

763. Under NextGen's apparent theory of infringement[890], in my opinion, Aboshi discloses a network client optical transceiver module wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface. For the module of Claim 1, *see supra*, § IX.E.i.

764. As discussed previously in the analysis of [1.pre] and [1.d], Aboshi discloses a pluggable ONU capable of being received by an external node, which, as also discussed above, can comprise a switch or router.[891]The external node receives Aboshi's pluggable ONU via an electrical interface within a compatible port of the external node.[892]

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[887] *Id*. at 5:22-24.

[888] *Id.*

[889] Ex. W.

[890] Ex. NN at 23.

[891] Ex. K at 4:33-35, 5:25-31, cl. 8.

[892] *Id.*

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765. Aboshi also teaches that its pluggable ONU device contains a "serial/parallel converting section 130," connected to the external node via interface module 140, that converts inputted parallel signals into serial signals outputted to the external node.[893] Thus, it would have been obvious to a POSITA that the "interface module 140" (i.e., electrical network interface port) would include at least a serial interface.

766. Further, a POSITA would have understood that the electrical interface this limitation discloses would be selected from a group containing a serial interface, a parallel interface, or a XAUI interface, all of which were well known electrical interfaces in the optical communications space in the early 2000s.[894]

767. Therefore, it is my opinion that Aboshi discloses a network client optical transceiver module "wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface."

vi. Claim 8: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network.

768. Under NextGen's apparent theory of infringement[895], in my opinion, Aboshi discloses a network client optical transceiver module wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network. For the module of Claim 1, *see supra,* § IX.E.i.

769. As previously discussed above in the analysis of [1.pre] and [1.b], Aboshi discloses

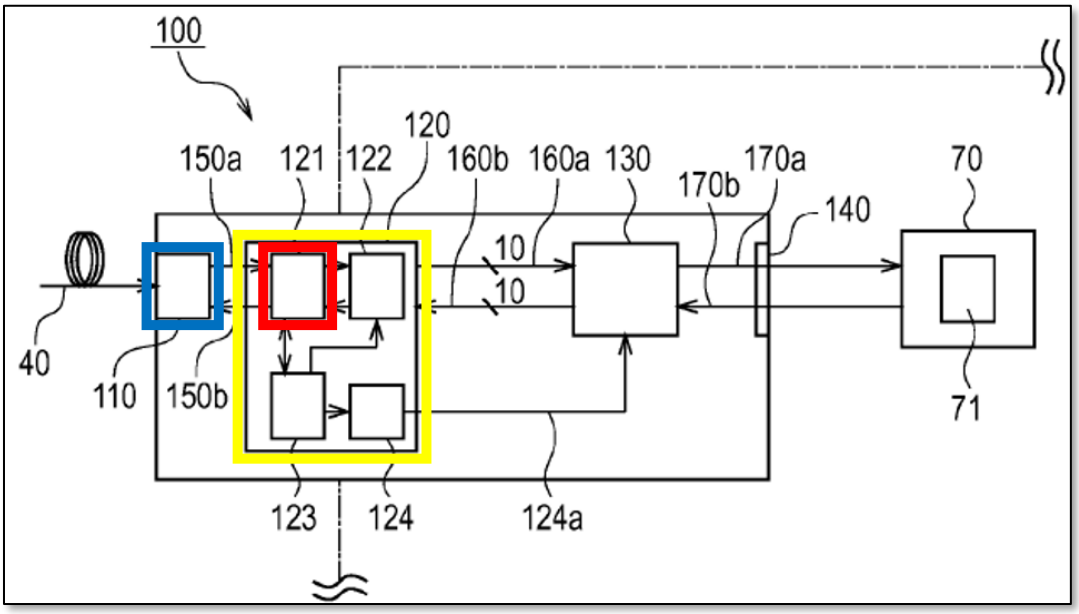
[893] *Id.* at 5:45-48, 6:33-42.

[894] Ex. X.

[895] Ex. NN at 23-24.

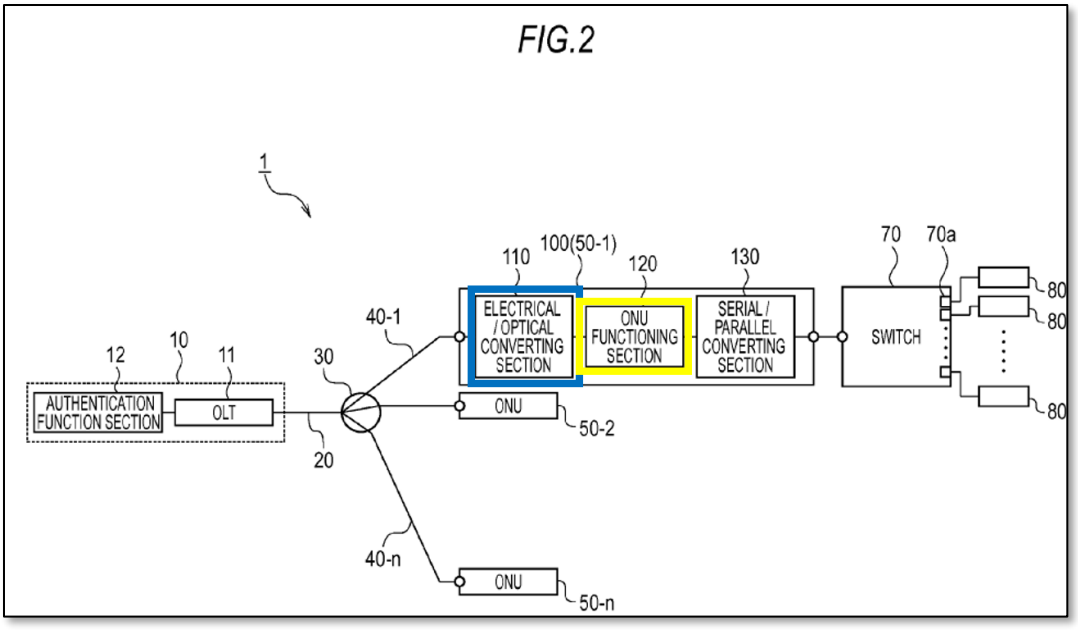
a pluggable ONU device that contains an "electrical optical converting section 110" (i.e., bi-directional optical interface), shown below in blue, coupled to the optical input/output ends (i.e., optical port) that performs electrical-to-optical and optical-to-electrical signal conversion.[896]

770. Further, Aboshi teaches that the pluggable ONU discussed above contains an "ONU functioning section 120" (shown below in yellow) containing MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[897] Figures 1 and 2, showing the structure of Aboshi's pluggable ONU, with the electrical optical converting section 110 connected to the ONU functioning section, are reproduced below:



[896] *Id.* at 2:30-34, 3:31-36, 6:7-17, Fig. 1.

[897] *Id.* at 5:32-37, 6:43-49, 7:3-11, Fig. 1.



771. Aboshi states that the ONU functioning section 120 contains two MAC sections: a first MAC section 121 and a second MAC section 122, which together "perform media access control conforming to IEEE 802.3ah" and, as a POSITA would have understood, ITU-T G.984.X standard recommendations.[898] Aboshi further states that the ONU functioning section 120 contains a "first MAC section 121" (shown in red above) that "performs MAC processes related to the communication with the OLT 11 of the center" (i.e., head end).[899] A POSITA would have understood that, in performing MAC processes "related to communications" with the head end and because the described pluggable ONU performs MAC processes as described in the IEEE 802.3ah and ITU-T G.984.X standard recommendations, the ONU functioning section 120 is configured to frame data communications in accordance with a framing protocol for the network (such as, for example, framing protocols described in the G.984.3 Standard Recommendation). A POSITA would have understood that the described ONU functioning section 120, in order to communicate with the head end, would transmit upstream data communications in the form of frames, necessarily requiring a framer or framing elements.

772. Moreover, it is my understanding that the inventors and patent owners themselves

[898] *Id.* at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[899] *Id.*

admit that the concept of a framer (i.e., "framing block") capable of performing the functions described in Claim 8 "can be part of a control module."[900]

773. Therefore, it is my opinion that Aboshi discloses a network client optical transceiver module "wherein the network client optical transceiver module includes a framing block electrically coupled to the bi-directional optical interface block and the control module is electrically coupled to the framing block and wherein the framing block is configured for framing data communications for transmission in accordance with a framing protocol for the passive optical network."

vii. Claim 15: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

774. Under NextGen's apparent theory of infringement[901], in my opinion, Aboshi discloses a network client optical transceiver module wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier. For the module of Claim 1, *see supra*, § IX.E.i.

775. Specifically, Aboshi discloses an "electrical optical converting section 110," coupled to the optical input/output ends (i.e., optical port) that "converts optical signals transmitted from the OLT 11 of the center into electrical signals (photoelectric conversion)" and "also converts electrical signals . . . into optical signals (reverse photoelectric conversion) and transmits the optical signals to the OLT 11."[902] A POSITA would have understood that, in containing elements that perform bi-directional optoelectrical conversion, the pluggable ONU described in Aboshi would necessarily contain components such as a laser, laser driver, photodiode, transimpedance amplifier, and limiting amplifier.

776. Regardless, the components listed in Claim 15 are traditional components of a transceiver utilized in a data communications system of a passive optical network. The '754 Patent

[900] Ex. SS at 215:4-8.

[901] Ex. NN at 29.

[902] Ex. K at 2:30-34, 3:31-36, 6:7-17, Fig. 1.

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recognizes this: "[a] typical optical module is composed of a: laser []; laser driver (LD) []; photo detector (PD); transimpedance amplifier (TIA) []; limiting amplifier (LA) []."[903] In fact, the '754 Patent contains Figure 11 (shown below), which depicts a "typical optical module" and is labeled as prior art, contains the components claimed in Claim 15.

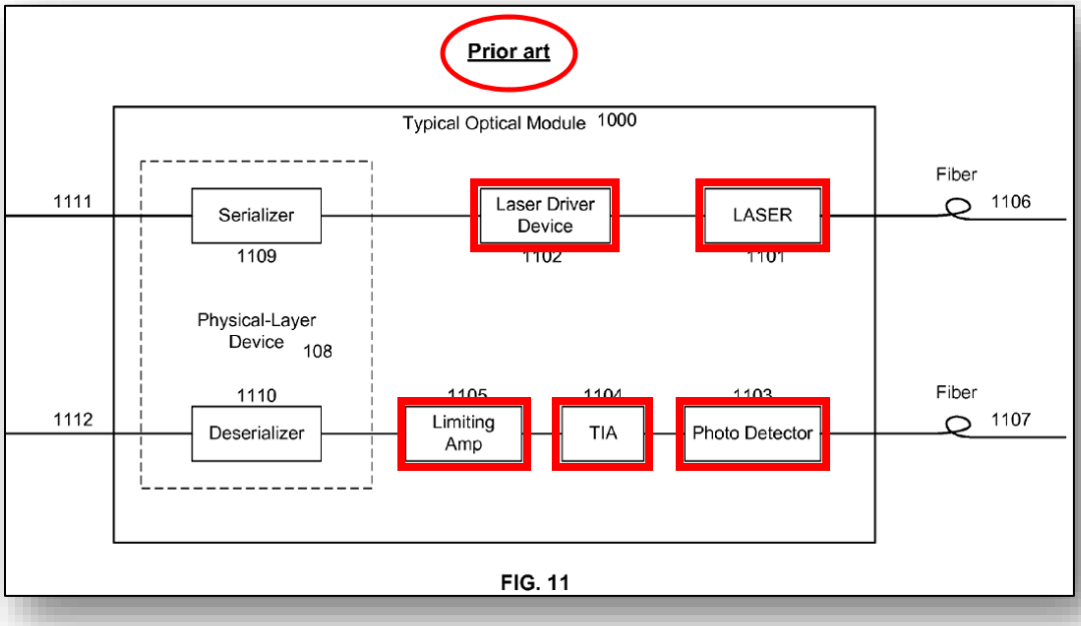


FIG. 11

777. It would have been obvious to any POSITA that these components would have been necessary to transmit and receive optical data communications across a passive optical network.[904]

778. Therefore, it is my opinion that Aboshi discloses a network client optical transceiver module "wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier."

[903] Ex. A at 1:56-62.

[904] *Id.*; Ex. P at Fig. 11.7.

viii. Claim 16: The network client optical transceiver module of claim 1, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

779. Under NextGen's apparent theory of infringement[905], in my opinion, Aboshi discloses a network client optical transceiver module wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip. For the module of Claim 1, *see supra*, § IX.E.i.

780. As discussed above in the analysis of Claim 1, Aboshi teaches a pluggable ONU device.[906] A POSITA would have understood that the terms ONT and ONU are used in the art interchangeably. Therefore, Aboshi discloses an optical transceiver module that is an ONT/ONU.

781. Further, the pluggable ONU device taught in Aboshi contains an "ONU functioning section 120" containing MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[907] A POSITA would have understood that these MAC components disclose the "MAC discrete chip" described in the claim. A POSITA would have also understood that, in order to perform the required functions of an ONU, and to implement IEEE 802.3ah and the ITU-T G.984.3 standard recommendations, such as G.984.3[908], Aboshi's ONU functioning section 120 would also possess the described "TC-layer discrete chip."

782. Additionally, a POSITA would have understood that an optical transceiver performing data communications in a passive optical network would inherently contain a TC-Layer discrete chip as well as a MAC discrete chip in order to operate in accordance with standard network protocols, such as the framing protocols and ranging protocols described in the G.984.3

[905] Ex. NN at 29-30.

[906] Ex. K at 2:62-65, 3:23-27.

[907] *Id.* at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[908] The G.984.3 Standard Recommendation is an ITU-T standard directed to "Transmission Convergence Layer for Gigabit Passive Optical Networks" (i.e., TC-Layer) and discusses media access control protocol throughout. *See, e.g.*, Ex. L at § 7.4.1.

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Standard Recommendation.[909] Alternatively, a POSITA would have understood that the functionalities typically contained in a MAC discrete chip could also be integrated fully into the TC-Layer discrete chip, thus nullifying the need for a separate MAC discrete chip.

783. Therefore, it is my opinion that Aboshi discloses a network client optical transceiver module "wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip."

ix. Claim 18

a. [18.pre] A network client optical transceiver module for a passive optical network, the passive optical network having one or more passive optical splitters for coupling the network client optical transceiver module over one or more optical fibers to the head-end of the passive optical network and the network client optical transceiver module having a pluggable form factor and configured to removably couple to an optical module port of a switch or router, and the network client optical transceiver module having an optical port to one or more optical fibers of the passive optical network, and the network client optical transceiver module having an optical interface block optically coupled to the optical port and for converting electrical signals to optical signals and for converting optical signals to electrical signals, and the network client optical transceiver module having an optical interface block and for communicating with the head-end of the passive optical network, and the network client optical transceiver module having an electrical network interface port electrically coupled to the control module and for electrically communicating to the switch or router, a method of communicating with the head-end of a passive optical network from the network client optical transceiver module comprising the steps of:

784. Under NextGen's apparent theory of infringement[910], to the extent the preamble is limiting, the combination of Aboshi and the G.984.3 Standard recommendation discloses this

[909] Ex. L at § 8.

[910] Ex. NN at 30-31.

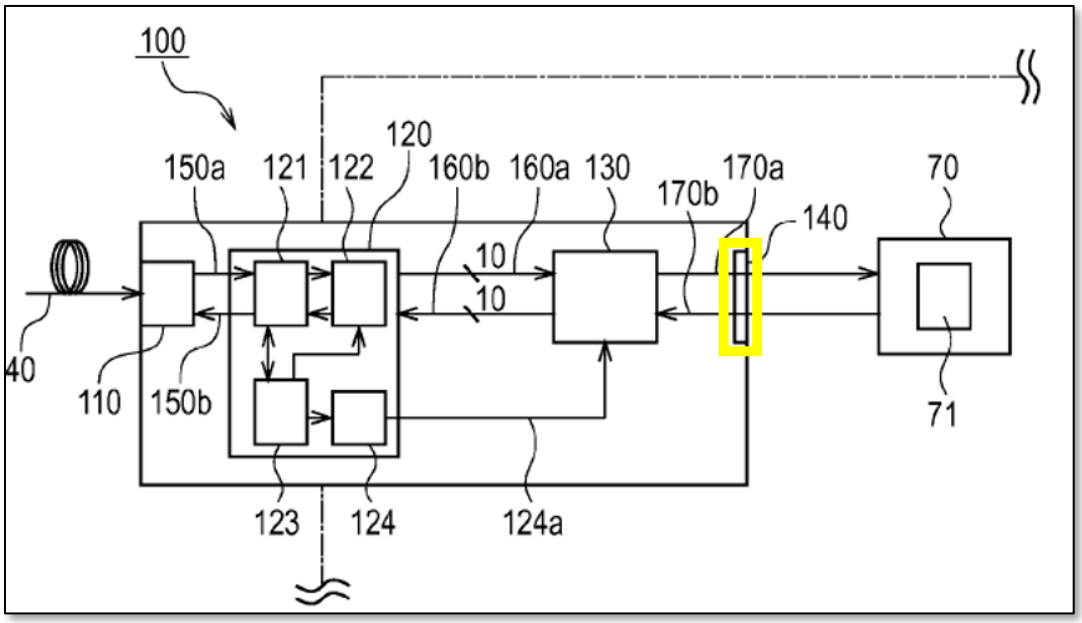
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claim for the same reasons as described in [1.pre] – [1.e].

a. [18.a] receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module;

785. Under NextGen's apparent theory of infringement[911], in my opinion, Aboshi discloses receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module.

786. As discussed in the analysis of [1.d], the pluggable ONU taught in Aboshi contains an "interface module" that "is directly connected to an interface slot of the external node," which, as also discussed above, can comprise a switch or router.[912] This optical interface is highlighted below in Figure 2:



787. As shown in Figure 2 above, and as a POSITA would have understood, the interface module couples the pluggable ONU to the switch disclosed.

788. Further, a POSITA would have understood that, in order to transmit data communications upstream, an ONU (such as the one described in Aboshi) must receive data from

[911] Ex. NN at 31.

[912] Ex. K at 4:33-35, 5:25-31, cl. 8.

an external host device to construct upstream data transmission frames. A POSITA would have understood that the data transmitted in the upstream frames would be received by the pluggable ONU from the external device, such as a switch or router or, as described in Aboshi. Because the pluggable ONU taught in Aboshi is connected to the external device via an electrical network interface port ("interface module 140"), as discussed in the analysis of [1.d], it would have been obvious to a POSITA that the data destined for transmission in the upstream frame would be received by the ONU via the electrical network interface port.

789. Therefore, Aboshi discloses "receiving data from the switch or router through the electrical network interface port of the network client optical transceiver module."

b. [18.b] storing the received data inside the network client optical transceiver module;

790. Under NextGen's apparent theory of infringement[913], in my opinion, Aboshi discloses storing the received data inside the network client optical transceiver module.

791. As discussed above in the analysis of [18.a], Aboshi discloses receiving data from an external device, such as a switch or router, via an electrical network interface port of the pluggable ONU. As also discussed above, Aboshi's pluggable ONU is configured to communicate with the head end (or OLT) of the network via upstream data transmissions.

792. Aboshi states that a function of its pluggable ONU device is to transmit data to and receive data from the network, as is typical in a passive optical network.[914] It would have been obvious to a POSITA that data received for transmission would need to be stored on the device, even if only briefly, prior to transmission onto the network as Aboshi describes. Thus, a POSITA would have understood that the optical transceiver module contemplated in Aboshi contains components for storing data, such as the data received from the external device via the "interface module 140" (i.e., electrical network interface port).

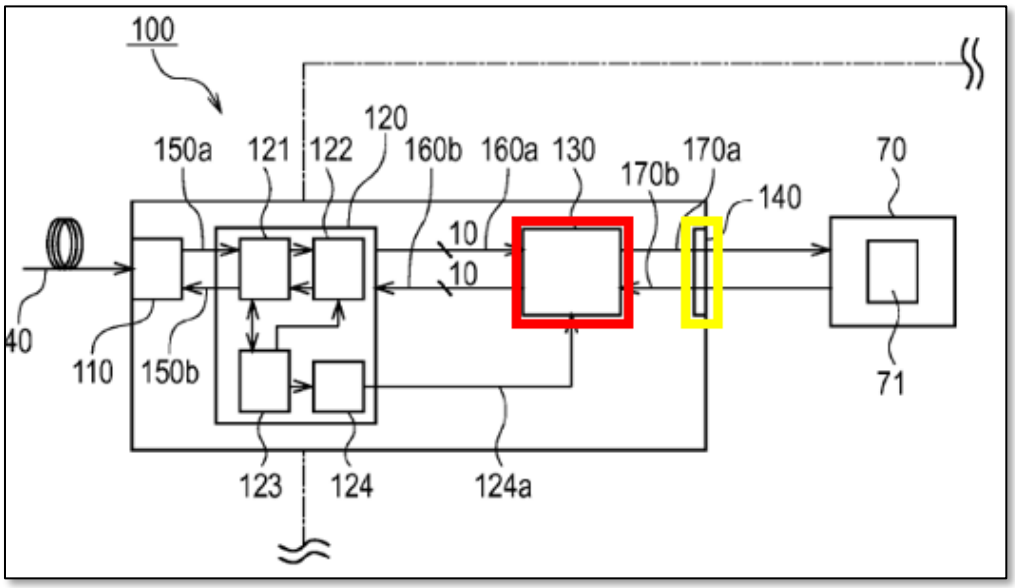
793. Moreover, Aboshi states that a function of its pluggable ONU device is to perform serial to parallel conversion at serial/parallel converting section 130 (shown in red below), which

[913] Ex. NN at 31-32.

[914] Ex. K at 5:4-6:6.

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is connected with the interface module 140 (i.e., "electrical network interface port," shown in yellow below):[915]



794. A POSITA would have understood that any device performing serial to parallel conversion (or, for that matter, parallel to serial conversion) inherently requires some form of storage. Prior to converting the signal from serial to parallel, or vice versa, the data is temporarily held in a storage means. Thus, prior to conversion at serial/parallel converting section 130, the electrical data signal received from the external node (i.e., switch) at interface module 140 would be temporarily stored.

795. Therefore, Aboshi discloses "storing the received data inside the network client optical transceiver module."

c. [18.c] receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module;

796. Under NextGen's apparent theory of infringement[916], in my opinion, Aboshi discloses receiving a first optical signal from the head-end of the passive optical network through

[915] *Id.*; *Id.* at Fig. 1.

[916] Ex. NN at 32.

the optical port at the optical interface block of the network client optical transceiver module.

797. As discussed above in the analysis of [1.a], the pluggable ONU described in Aboshi contains "an electrical/optical converting section 110" that has an "optical input/output ends" (shown in red below) "to connect with the center side OLT 11 via an optical fiber 40."[917] These "optical input/output ends" directly interface with and couple to the optical fibers of the network.[918] Thus, a POSITA would have understood these "optical input/output ends" to be the same as the "optical port" described in [18.c].

798. As also discussed in the analysis of [1.b], Aboshi's pluggable ONU contains an "electrical optical converting section 110," coupled to the optical input/output ends (i.e., optical port) that "converts optical signals transmitted from the OLT 11 of the center into electrical signals (photoelectric conversion)" and "also converts electrical signals . . . into optical signals (reverse photoelectric conversion) and transmits the optical signals to the OLT 11."[919]

799. Because the optical port of Aboshi's pluggable ONU is the physical connection point between the "optical interface block" (i.e., electrical optical converting section 110) of the module and the optical fibers of the network, it would have been obvious to a POSITA that any downstream optical data would be received via the optical port at the optical interface.

800. Therefore, Aboshi discloses "receiving a first optical signal from the head-end of the passive optical network through the optical port at the optical interface block of the network client optical transceiver module."

d. [18.d] converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module;

801. Under NextGen's apparent theory of infringement[920], in my opinion, Aboshi discloses converting the first optical signal to an electrical signal at the optical interface block and

[917] Ex. K at 5:42-45, Fig. 1.

[918] *Id.*

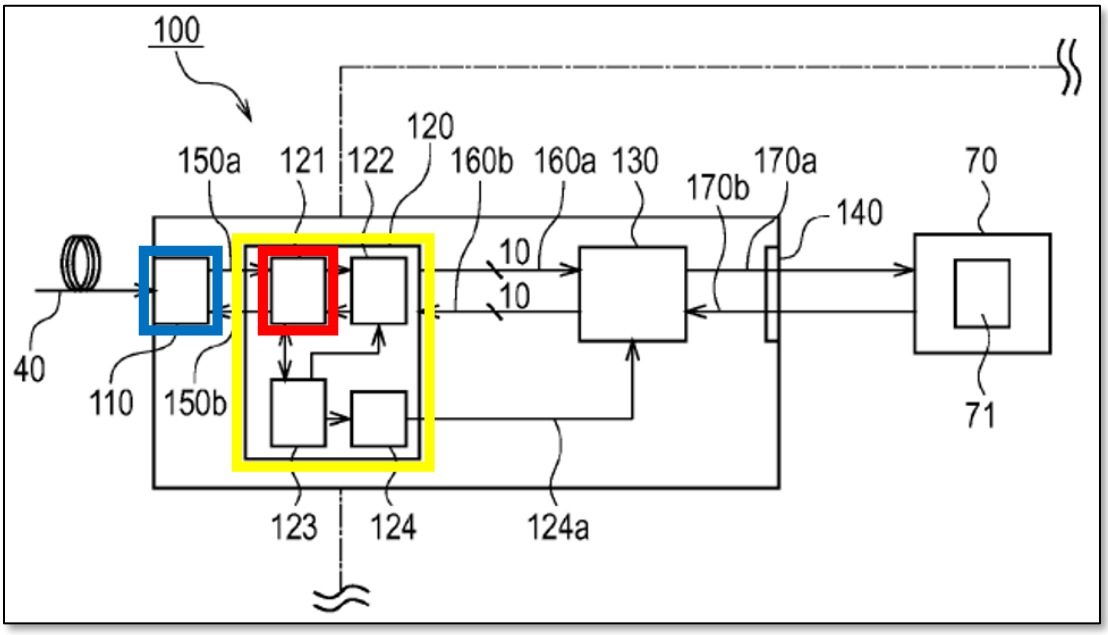
[919] *Id.* at 2:30-34, 3:31-36, 6:7-17, Fig. 1.

[920] Ex. NN at 32.

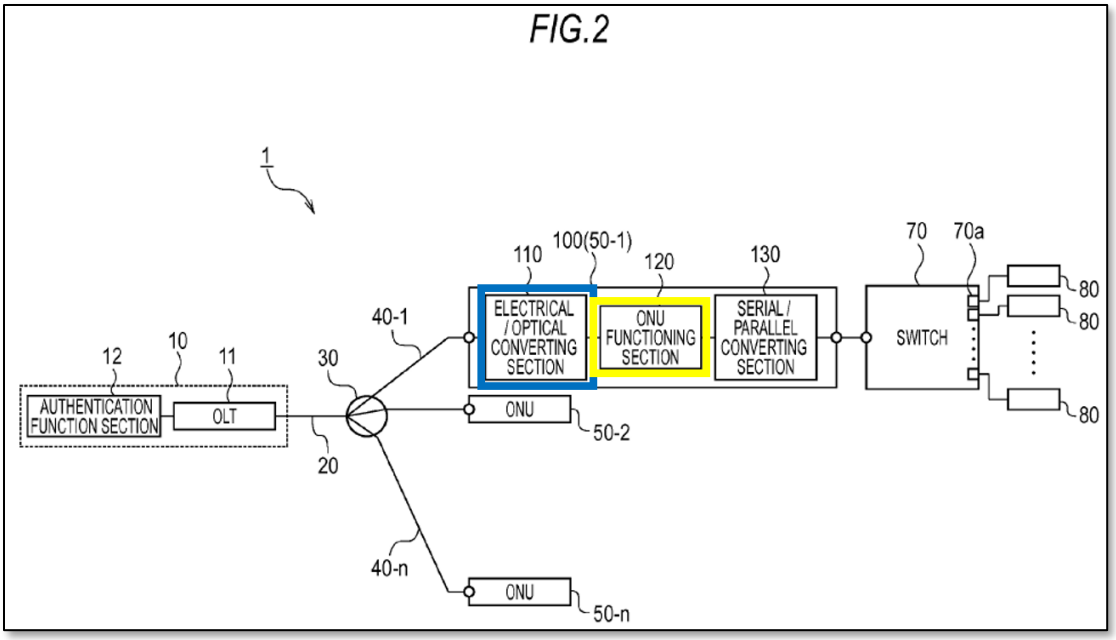
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conveying the electrical signal to the control module of the network client optical transceiver module.

802. As discussed above in the analysis of [1.pre] and [1.b], Aboshi teaches pluggable ONU taught in Aboshi contains an "electrical optical converting section 110," coupled to the optical input/output ends (i.e., optical port) that "converts optical signals transmitted from the OLT 11 of the center into electrical signals (photoelectric conversion)" and "also converts electrical signals . . . into optical signals (reverse photoelectric conversion) and transmits the optical signals to the OLT 11."[921] Aboshi's taught "electrical optical converting section 110" is shown below in blue in a reproduction of Figures 1 and 2.



[921] Ex. K at 2:30-34, 3:31-36, 6:7-17, Fig. 1.



803. As also discussed previously in the analysis of [1.c], Aboshi further teaches that the pluggable ONU discussed above contains an "ONU functioning section 120" (shown above in yellow) containing MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[922] It would have been obvious to a POSITA that an optical signal received and converted to an electrical signal at Aboshi's optical interface block, "electrical optical converting section 110," would necessarily subsequently be conveyed to the ONU functioning section 120, which determines certain data transmission allocation information from the received signal, as discussed above.

804. Therefore, Aboshi discloses "converting the first optical signal to an electrical signal at the optical interface block and conveying the electrical signal to the control module of the network client optical transceiver module."

[922] *Id.* at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

e. [18.e] processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network;

805. Under NextGen's apparent theory of infringement[923], in my opinion, Aboshi discloses processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network.

806. As discussed above in the analysis of [1.c], Aboshi teaches a pluggable ONU for use in a passive optical network containing an "ONU functioning section 120" comprised of MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[924] Aboshi further states that the ONU functioning section 120 contains a "first MAC section 121" that "performs MAC processes related to the communication with the OLT 11 of the center" (i.e., head end).[925] A POSITA would have understood that, in performing MAC processes "related to communications" with the head end and because the described pluggable ONU performs MAC processes as described in the IEEE 802.3ah and ITU-T G.984.X standard recommendations, the ONU functioning section 120 is configured to receiving data communications from the head end representing start time allocations for transmission.

807. Therefore, Aboshi discloses "processing the electrical signal at the control module to determine one or more start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network."

f. [18.f] converting a portion of the stored received data to a second optical signal; and

808. Under NextGen's apparent theory of infringement[926], in my opinion, Aboshi discloses converting a portion of the stored received data to a second optical signal.

[923] Ex. NN at 33.

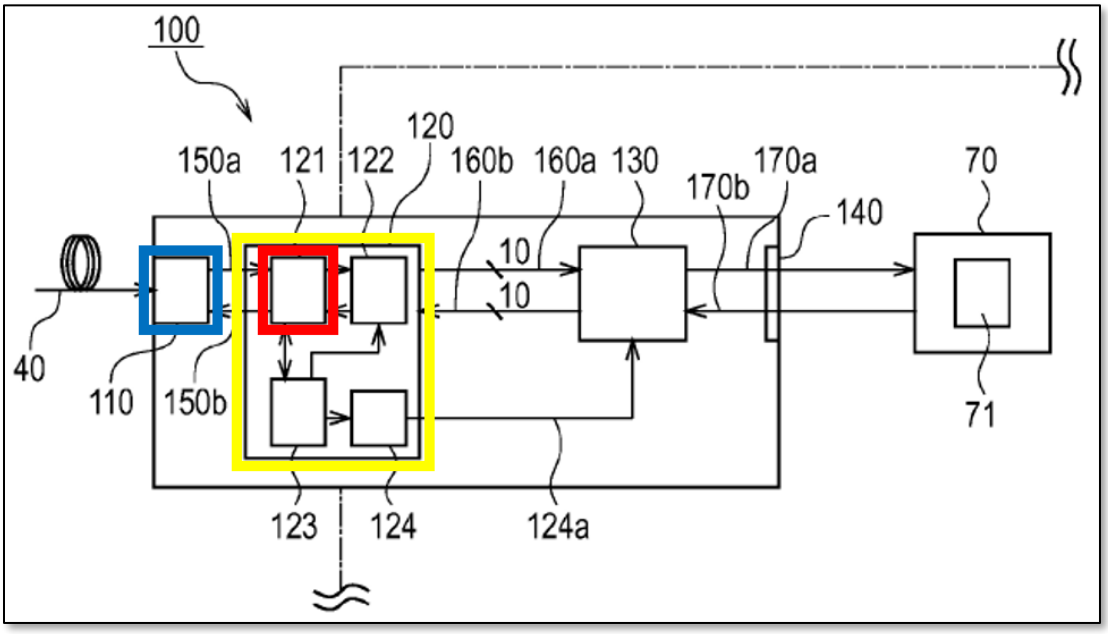
[924] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[925] *Id.*

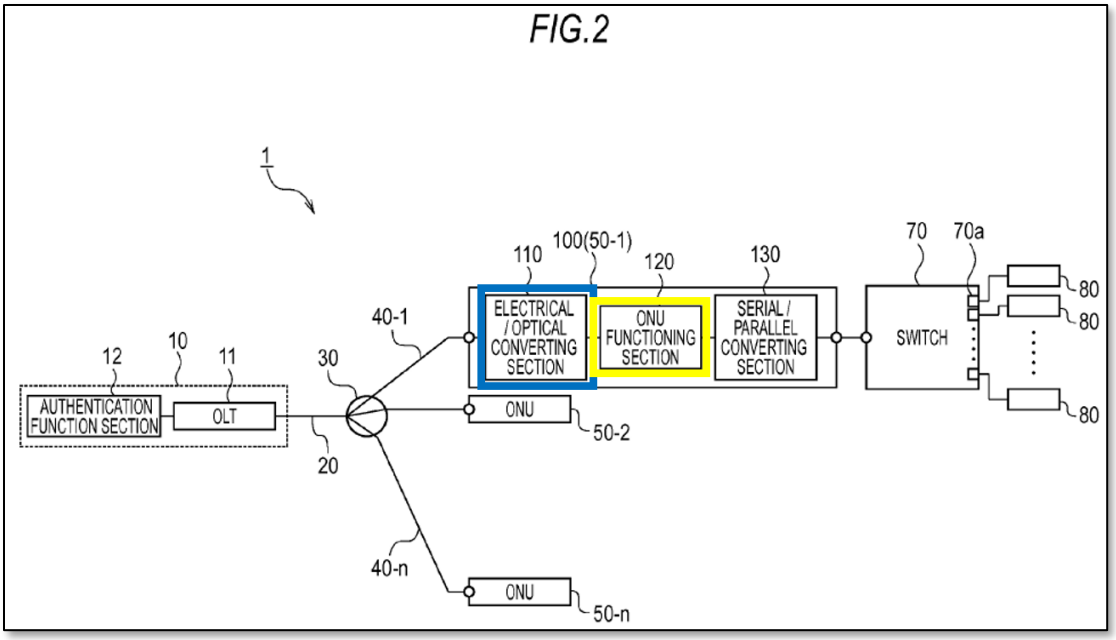
[926] Ex. NN at 33.

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809. As discussed above in the analysis of [1.pre] and [1.b], Aboshi teaches pluggable ONU taught in Aboshi contains an "electrical optical converting section 110," coupled to the optical input/output ends (i.e., optical port) that "converts optical signals transmitted from the OLT 11 of the center into electrical signals (photoelectric conversion)" and "also converts electrical signals . . . into optical signals (reverse photoelectric conversion) and transmits the optical signals to the OLT 11."[927] Aboshi's taught "electrical optical converting section 110" is shown below in blue in a reproduction of Figures 1 and 2.



[927] *Id.*



810. As discussed above in the analysis of [18.a], Aboshi discloses receiving data from an external device, such as a switch or router, via an electrical network interface port of the pluggable ONU. As also discussed above, Aboshi's pluggable ONU is configured to communicate with the head end (or OLT) of the network via upstream data transmissions.

811. Further, Aboshi states that a function of its pluggable ONU device is to transmit data to and receive data from the network, as is typical in a passive optical network. It would have been obvious to a POSITA that data received for transmission would need to be stored on the device, even if only briefly, prior to transmission onto the network as Aboshi describes. Thus, a POSITA would have understood that the optical transceiver module contemplated in Aboshi contains components for storing data, such as the data received from the external device via the "interface module 140" (i.e., electrical network interface port).

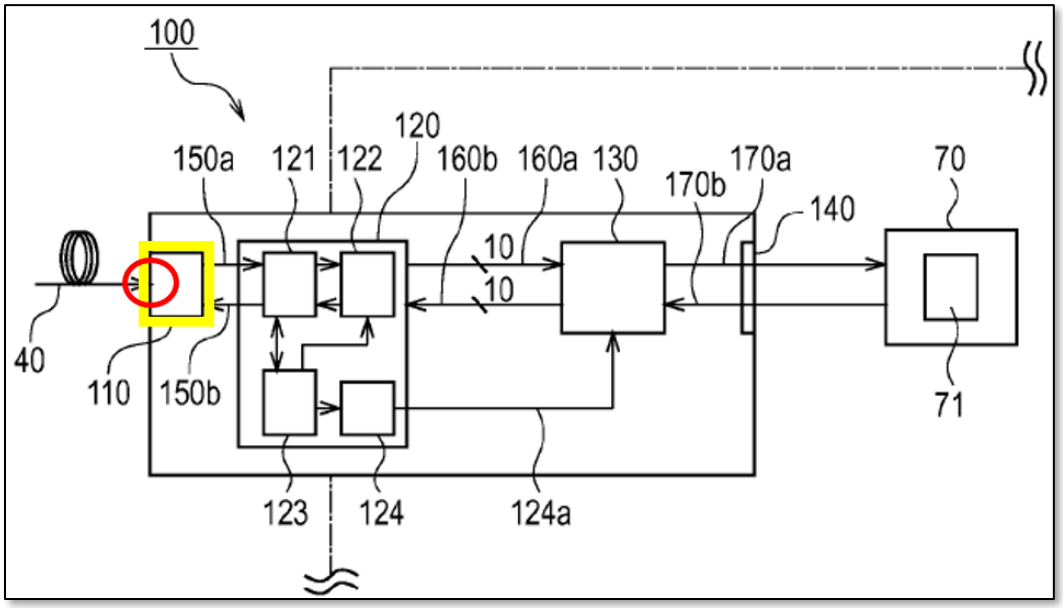
812. It would have been obvious to a POSITA that, in order to transmit the stored data onto the optical network (the object of the pluggable ONU), the stored data would necessarily be converted from its electrical signal format to an optical signal format by electrical optical converting section 110. Because signals transmitted across an optical network must be *optical signals*, it would have been obvious to a POSITA that any data transmissions from the pluggable ONU would first need to be converted to an optical format prior to transmission.

813. Therefore, Aboshi discloses "converting a portion of the stored received data to a second optical signal."

g. [18.g] transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network; whereby

814. Under NextGen's apparent theory of infringement[928], in my opinion, Aboshi discloses transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network.

815. As discussed above in the analysis of [1.a], teaches that its pluggable ONU device, reproduced in Figure 1 below, contains "an electrical/optical converting section 110" that has an "optical input/output ends" (shown in red below) "to connect with the center side OLT 11 via an optical fiber 40."[929]



816. These "optical input/output ends" directly interface with and couple to the optical

[928] Ex. NN at 33.

[929] Ex. K at 5:42-45, Fig. 1.

fibers of the network.[930] Thus, a POSITA would have understood these "optical input/output ends" to be the same as the "optical port" described in [1.a].

817. As also discussed in the analysis of [1.b], the pluggable ONU taught in Aboshi contains an "electrical optical converting section 110," coupled to the optical input/output ends (i.e., optical port) that "converts optical signals transmitted from the OLT 11 of the center into electrical signals (photoelectric conversion)" and "also converts electrical signals . . . into optical signals (reverse photoelectric conversion) and transmits the optical signals to the OLT 11."[931] Aboshi's taught "electrical optical converting section 110" is shown above in yellow.

818. Because the optical port of Aboshi's pluggable ONU is the physical connection point between the "optical interface block" (i.e., electrical optical converting section 110) of the module and the optical fibers of the network, it would have been obvious to a POSITA that any downstream optical data would be received via the optical port at the optical interface.

819. As further discussed above in the analysis of [1.c], Aboshi teaches a pluggable ONU for use in a passive optical network containing an "ONU functioning section 120" comprised of MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[932] Aboshi further states that the ONU functioning section 120 contains a "first MAC section 121" that "performs MAC processes related to the communication with the OLT 11 of the center" (i.e., head end).[933] A POSITA would have understood that, in performing MAC processes "related to communications" with the head end and because the described pluggable ONU performs MAC processes as described in the IEEE 802.3ah and ITU-T G.984.X standard recommendations, the ONU functioning section 120 is configured to receiving data communications from the head end representing start time allocations for transmission. Thus, it would have been obvious to a POSITA any upstream optical signals transmitted from the pluggable ONU of Aboshi onto the network would have been in accordance with the "start times" allocated by the head end of the network.

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[930] *Id*.

[931] *Id.* at 2:30-34, 3:31-36, 6:7-17, Fig. 1.

[932] *Id.* at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[933] *Id.*

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820. Therefore, Aboshi discloses "transmitting the second optical signal from the optical interface block through the optical port responsive to the one or more start times for data transmissions to the head-end of the passive optical network."

h. [18.h] the network client optical transceiver module optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and the network client optical transceiver module electrically communicates with the switch or router.

821. Under NextGen's apparent theory of infringement[934], in my opinion, Aboshi discloses a network client optical transceiver module that optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and a network client optical transceiver module that electrically communicates with the switch or router.

822. As discussed above in the analysis of [1.c], and again in [18.e] and [18.g], Aboshi's pluggable ONU contains an "ONU functioning section 120" comprised of MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.X standard recommendations.[935] Aboshi further states that the ONU functioning section 120 contains a "first MAC section 121" that "performs MAC processes related to the communication with the OLT 11 of the center" (i.e., head end).[936] A POSITA would have understood that, in performing MAC processes "related to communications" with the head end and because the described pluggable ONU performs MAC processes as described in the IEEE 802.3ah and ITU-T G.984.X standard recommendations, the ONU functioning section 120 is configured to transmit data communications to the head end in accordance with start time allocations for transmission.

823. Additionally, as discussed above in the analysis of [1.d], and again in [18.a], the pluggable ONU taught in Aboshi contains an "interface module" that "is directly connected to an interface slot of the external node," which, as also discussed above, can comprise a switch or router.[937] This optical interface is highlighted below in Figure 2:

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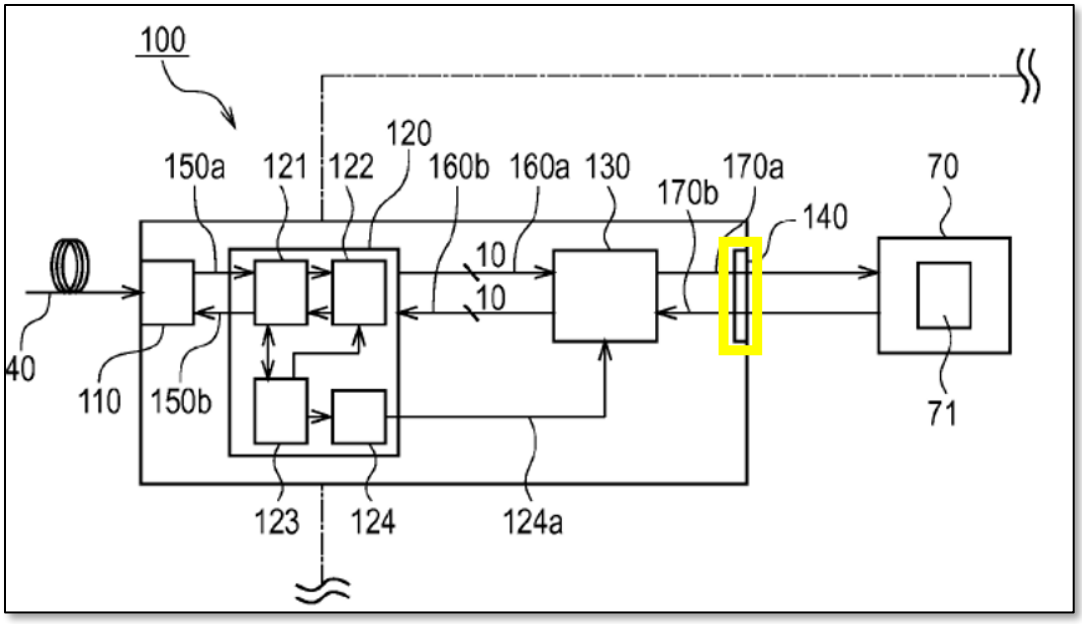
[934] Ex. NN at 33-34.

[935] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[936] *Id.*

[937] *Id.* at 4:33-35, 5:25-31, cl. 8.

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824. As shown in Figure 2 above, and as a POSITA would have understood, the interface module couples the pluggable ONU to the switch disclosed.

825. Further, a POSITA would have understood that, in order to transmit data communications upstream, an ONU (such as the one described in Aboshi) must receive data from an external host device to construct upstream data transmission frames. A POSITA would have understood that the data transmitted in the upstream frames would be received by the pluggable ONU from the external device, such as a switch or router or, as described in Aboshi. Because the pluggable ONU taught in Aboshi is connected to the external device via an electrical network interface port ("interface module 140"), as discussed in the analysis of [1.d], it would have been obvious to a POSITA that pluggable ONU communicates with the external device, a switch or router, via the electrical network interface port (i.e., interface module 140).

826. Therefore, Aboshi discloses "a network client optical transceiver module [that] optically communicates with the head-end of the passive optical network responsive to start times for data transmissions and [a] network client optical transceiver module [that] electrically communicates with the switch or router."

x. Claim 19: The method of claim 18, wherein the pluggable form factor of the network client optical transceiver module is selected from the group consisting essentially of: Small Form-factor Pluggable (SFP); 10 Gigabit Small Form-factor (XFP); XENPAK; X2; XPAK.[938]

827. Under NextGen's apparent theory of infringement[939], Aboshi discloses this claim for the same reasons as described in Claim 2. For the method of Claim 18, *see supra* § IX.E.ix.

xi. Claim 22: The method of claim 18, wherein the optical port is adapted to optically couple to one or more optical fibers selected from the group consisting of: multimode optical fibers; and single mode optical fibers.

828. Under NextGen's apparent theory of infringement[940], Aboshi discloses this claim for the same reasons as described in Claim 5. For the method of Claim 18, *see supra*, § IX.E.ix.

xii. Claim 23: The method of claim 18, wherein the optical port includes one or more optical fiber connectors and the optical fiber connectors are selected from the group consisting essentially of: Subscriber Connector (SC); Lucent Connector (LC); Fiber Channel (FC); Straight TP (ST); and Miniature Unit (MU).

829. Under NextGen's apparent theory of infringement[941], Aboshi discloses this claim for the same reasons as described in Claim 6. For the method of Claim 18, *see supra*, § IX.E.ix.

xiii. Claim 24: The method of claim 18, wherein the electrical network interface port includes an interface selected from the group consisting essentially of: a serial interface; a parallel interface; and a XAUI interface.

830. Under NextGen's apparent theory of infringement[942], Aboshi discloses this claim

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[938] Claims 19-30 are method claims analogous to device claims 2-16 I discuss *supra* Sections X.F.ii-ix. Thus, my discussion of the respective corresponding device claim is incorporated into and mirrored for the discussion of the parallel method claim.

[939] Ex. NN at 34.

[940] Ex. NN at 35-36.

[941] Ex. NN at 36.

[942] Ex. NN at 36.

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for the same reasons as described in Claim 7. For the method of Claim 18, *see supra*, § IX.E.ix.

xiv. Claim 29: The method of claim 18, wherein the network client optical transceiver module includes one or more of the following: a laser; a laser driver; a photodiode; a transimpedance amplifier; and a limiting amplifier.

831. Under NextGen's apparent theory of infringement[943], Aboshi combination discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.E.xvii.

xv. Claim 30: The method of claim 18, wherein the network client optical transceiver module is an optical network terminal (ONT) and includes a discrete chip selected from the group consisting essentially of: a media access controller (MAC) discrete chip; and a transmission convergence layer (TC-Layer) discrete chip.

832. Under NextGen's apparent theory of infringement[944], Aboshi discloses this claim for the same reasons as described in Claim 15. For the method of Claim 18, *see supra*, § IX.E.ix.

F. Ground 4B: The Aboshi-G.984.3 Standard Recommendation combination renders claims 3-4, 9-14, 20-21, and 25-28 obvious.

833. ***Motivation to combine.*** Both Aboshi and the G.984.3 Standard Recommendation are directed towards data communications in an optical network.[945]

834. As discussed *supra*, Aboshi teaches a pluggable ONU located at subscriber premises that communicates over a passive optical network with a head-end ONT.[946] Aboshi discloses the components of the describe pluggable ONU, and the G.984.3 Standard Recommendation discloses in detail certain functions associated with the MAC and TC-Layer performance described in the patent, such as time slot allocation from the head end.

835. The G.984.3 Standard Recommendation, like Aboshi, relates to data communications within an optical network. Specifically, the G.984.3 Standard Recommendation

[943] Ex. NN at 40-41.

[944] Ex. NN at 41.

[945] Ex. K at 1:22-25; Ex. L at 1-2.

[946] Ex. K at 1:22-25, 2:62-65, 3:23-27.

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discloses a specification for a Gigabit-capable Passive Optical Network Transmission Convergence Layer. Further, the G.984.3 Standard Recommendation discloses a gigabit passive optical network system configuration as well as the structure of data communications, such as framing structure and ranging. There are several reasons a POSITA would have been motivated to combine the G.984.3 Standard Recommendation with Aboshi.

836. First, and most importantly, Aboshi *explicitly* teaches that its pluggable optical module is compliant with not only IEEE 802.3ah, but also conforms to the standard recommendations of the G.984.x series of ITU Standards used for OLTs and ONUs.[947] Thus, it is obvious that a POSITA reading Aboshi would have looked to the G.984.3 Standard Recommendation for further insight as to the data communication structure of the described pluggable ONU with other devices on the network.

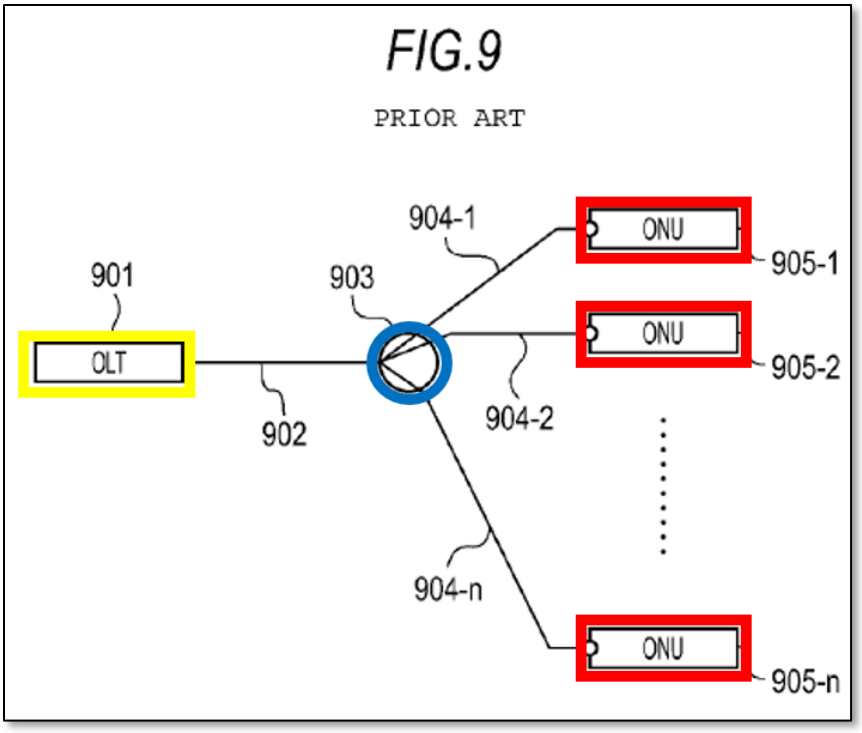
837. Second, both Aboshi and the G.984.3 Standard Recommendation describe the same passive optical network system architecture, wherein an OLT (shown in yellow in the figures below) is connected to multiple ONTs/ONUs (shown in red in the figures below) via a passive optical splitter and optical fibers.[948] Further, both Aboshi and the G.984.3 Standard Recommendation each disclose the components of ONTs/ONUs, as shown in the below figures.[949] Aboshi even describes this configuration as prior art.

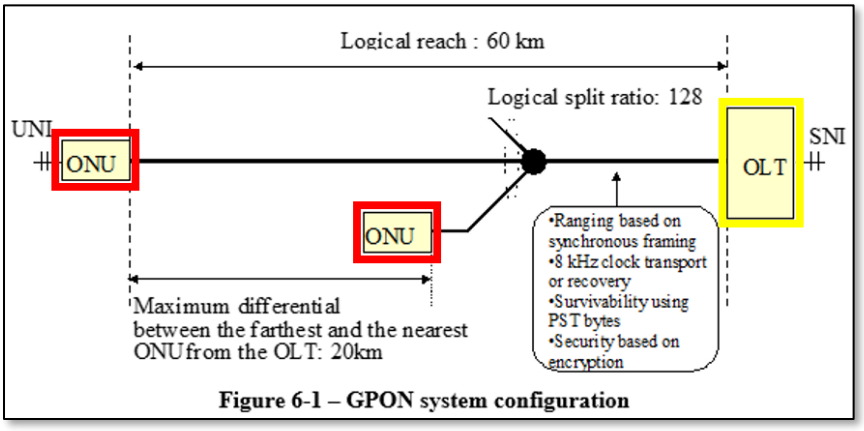
[947] *Id.* at 5:32-37.

[948] Ex. K at Fig. 9; Ex. L at § 6.2.

[949] *Id.*

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838. Further, Aboshi discloses several concepts involved in the operation of the passive optical network between an OLT and ONTs/ONUs, to which the G.984.3 Standard Recommendation provides a more in-depth disclosure. First, Aboshi discloses that its pluggable ONU contains an "ONU functioning section 120" containing MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[950] Further, Aboshi describes a process wherein the communication is enabled

[950] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

between the ONU and the OLT and where the OLT authenticates and establishes the identity of a specific ONU.[951] A POSITA would have known that the details of such functions would be found, with in-depth explanation for implementation, in a reference such as the G.984.3 Draft Standard.

839. Additionally, a POSITA would have naturally looked to the G.984.3 Standard Recommendation, an ITU-T standard, to find techniques of data communication in a passive optical network, including time slot assignment to further aid in data transmission between a head-end and multiple ONTs/ONUs. A POSITA would have had knowledge of and would have understood the importance of the G.984.3 Standard Recommendation because adhering to it provided for the interoperability of equipment in an optical network from a variety of different vendors.

840. For the reasons discussed above in Section IX.G, a POSITA would have been motivated to combine a passive optical network data communications system, like in the G.984.3 Standard Recommendation, with a pluggable ONU device, like in Aboshi and had a reasonable expectation of success in doing so.

i. Claim 3: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times.

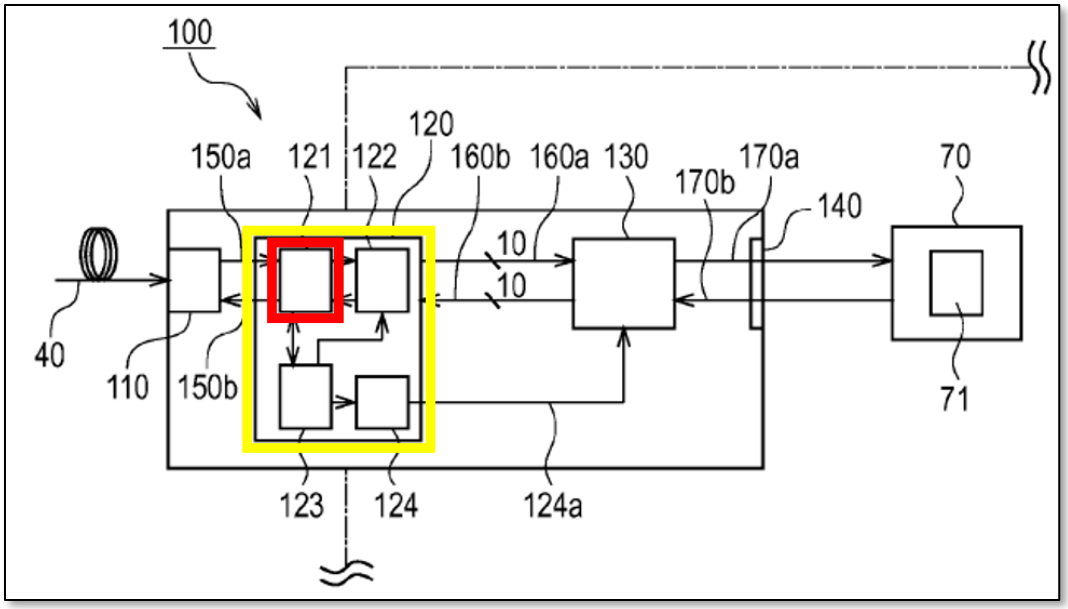
841. Under NextGen's apparent theory of infringement[952], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times. For the module of Claim 1, *see supra*, § IX.E.i.

[951] *Id*. at 8:39-48, 6:59-63.

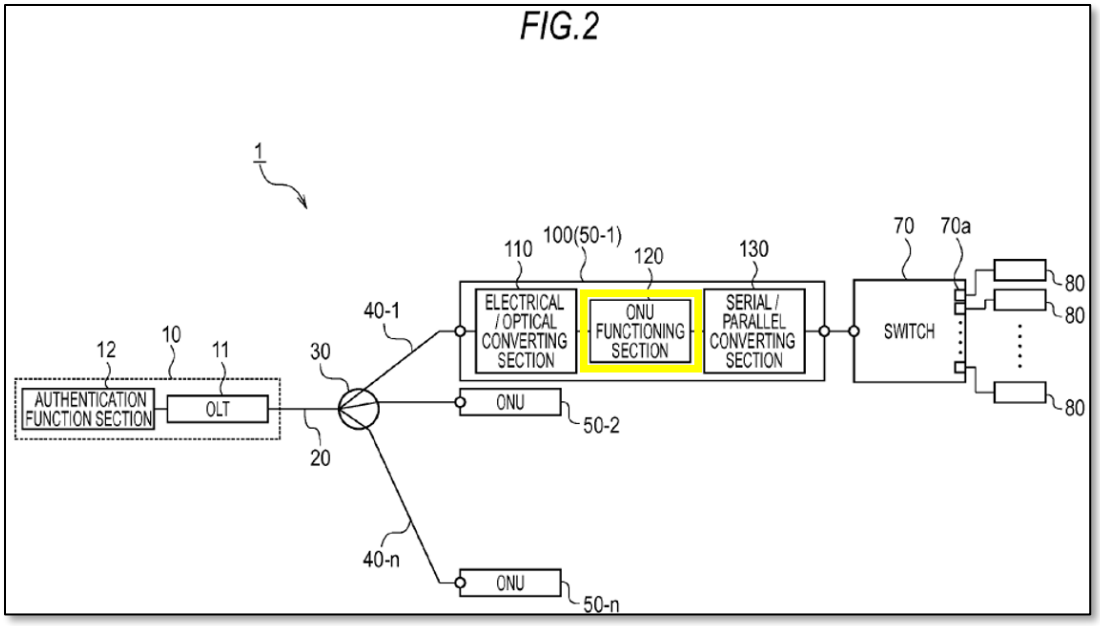
[952] Ex. NN at 21.

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842. As discussed above in the analysis of Claim 1, Aboshi teaches a pluggable ONU device that contains an "ONU functioning section 120" (shown below in yellow) containing MAC components that perform media access control conforming to IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[953] Figures 1 and 2, showing the structure of Aboshi's pluggable ONU, are reproduced below:



[953] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.



843. Aboshi further states that the ONU functioning section 120 contains a "first MAC section 121" (shown in red above) that "performs MAC processes related to the communication with the OLT 11 of the center" (i.e., head end).[954] A POSITA would have understood that, in performing MAC processes "related to communications" with the head end, the pluggable ONU described performs MAC processes as described in the IEEE 802.3ah and ITU-T G.984.X standard recommendations, such as the G.984.3 Standard Recommendation. Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

844. The G.984.3 Standard Recommendation not only explicitly discloses the use of "start times" assigned by the head end of the network as claimed in Claim 1, but also discloses the assignment of "end times." The downstream frame, where information is transmitted from the head end to each of the subscriber ends, contains a "StopTime field" that "indicates the stopping time of the allocation."[955] It would thus have been obvious to a POSITA to combine the "end time" assignment, as was traditional for use in a PON communication system, as described in the G.984.3

[954] *Id.*

[955] Ex. L at § 8.1.4.

Standard Recommendation, with the ONU functioning section 120 of Aboshi's pluggable ONU.

845. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more end times for transmitting data communications to the head-end of the passive optical network and the control module is configured to end transmissions to the head-end of the passive optical network response to the end times."

846. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 3 was well known prior to the earliest alleged filing date of the '754 Patent.[956] The inventors and patent owners also admit that TC-Layer functionality, including the concept of "end times," was well known prior to the earliest alleged filing date of the '754 Patent.[957]

ii. Claim 4: The network client optical transceiver module of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times.

847. Under NextGen's apparent theory of infringement[958], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times. For the module of Claim 1, *see supra*, § IX.E.i.

848. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses

[956] Ex. SS at 182:16-24.

[957] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[958] Ex. NN at 21-22.

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a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[959] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

849. As further discussed in Claim 3 above, the G.984.3 Standard Recommendation discloses the use of both "start times" and "end times" assigned by the head end of the network, but also discloses the assignment of "end times." The downstream frame, where information is transmitted from the head end to each of the subscriber ends, contains a "StartTime field" that "indicates the starting time of the allocation" and a "StopTime field" that "indicates the stopping time of the allocation."[960]

850. A POSITA would have understood that allocations from the head end that assign a "start time" and "end time" for subscriber end transmissions onto the network effectively disclose a "length of time" for transmission. Because the beginning and end of the transmission allocation are defined, the allocated length of the transmission is also defined.

851. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network data communications representing one or more lengths of times respectively to the start times for transmitting data communications to the head-end of the passive optical network and the control module is configured to transmit to the head-end of the passive optical network response to the lengths of times."

852. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 4 was well known prior to the earliest alleged filing date of the '754 Patent.[961]

[959] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[960] Ex. L at § 8.1.4.

[961] Ex. SS at 182:16-24.

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The inventors and patent owners also admit that TC-Layer functionality was well known prior to the earliest alleged filing date of the '754 Patent.[962]

iii. Claim 9: The network client optical transceiver of claim 1, wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module.

853. Under NextGen's apparent theory of infringement[963], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module. For the module of Claim 1, *see supra*, § IX.E.i.

854. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[964] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

855. One such recommendation is the assignment of identification addresses to subscriber ends by the head end. The G.984.3 Standard Recommendation discloses an "ONU-ID Field" of the downstream frame that indicates the particular ONT/ONU that is being granted time to transmit upstream on the passive optical network.[965] During the ranging process, in which new subscriber end ONTs/ONUs entering the network become discoverable to the head end OLT,

[962] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[963] Ex. NN at 24.

[964] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[965] Ex. L at §8.2.2.2.

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ONTs/ONUs are assigned an "ONU-ID" that is unique to each individual ONT/ONU, corresponding to the ONT/ONU's serial number. This allows the OLT to direct messages to a specific ONT/ONU; each ONU-ID value is used to address the ONT/ONU directly.

856. A POSITA would have understood that this method disclosed in the G.984.3 Standard Recommendation consists of the head-end of the network assigning an identification address in order to transmit to and receive data from the ONT/ONU. As discussed, a POSITA would have understood the ONU functioning section found in Aboshi's pluggable ONU device to implement this functionality.

857. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to receive from the head-end of the passive optical network an assigned network identification address and wherein the assigned network identification address can be used for receiving data addressed to the network client optical transceiver module."

858. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[966] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 9 was well known prior to the earliest alleged filing date of the '754 Patent.[967]

iv. Claim 10: The network client optical transceiver of claim 1, wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients.

859. Under NextGen's apparent theory of infringement[968], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to respond to the head-end of the passive optical

[966] Ex. SS at 182:16-24.

[967] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8, 212:21-213:1.

[968] Ex. NN at 24-25.

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network responsive to a network operating protocol for new clients. For the module of Claim 1, *see supra*, § IX.E.i.

860. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[969] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

861. One such recommendation is the process of registering a new client or subscriber end unit on the network. The G.984.3 Standard Recommendation discloses that subscriber end ONTs/ONUs register to the management system of the OLT utilizing their serial number or through a ranging method.[970] Both methods are initiated by and performed under the control of the head end OLT. In the first method, a serial number of the ONT/ONU is registered in advance at the OLT.[971] In the second method, an OLT can periodically initiate the activation process of ranging to test and see if any new ONTs/ONUs have been connected to the network.[972] Specifically, the ONT/ONU "*responds* to messages, which are initiated in the OLT" identifying itself as a new client on the network.[973] Once an ONU is ranged, it is operational on the passive optical network.[974]

862. A POSITA would have understood that this method disclosed in the G.984.3 Draft Standard Recommendation consists of a new subscriber end ONT/ONU responding to a registration message from the head end OLT. As discussed, a POSITA would have understood the ONU functioning section found in Aboshi's pluggable ONU device to implement this

[969] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[970] Ex. L at § 7.4.2, 10.

[971] *Id.* at § 10.

[972] *Id.*

[973] *Id.* at § 10.2.1.

[974] *Id.*

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functionality.

863. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to respond to the head-end of the passive optical network responsive to a network operating protocol for new clients."

864. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 10 was well known prior to the earliest alleged filing date of the '754 Patent.[975] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 10, was well known prior to the earliest alleged filing date of the '754 Patent.[976]

v. Claim 11: The network clients optical transceiver module of claim 1, wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module.

865. Under NextGen's apparent theory of infringement[977], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module. For the module of Claim 1, *see supra*, § IX.E.i.

866. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and

[975] Ex. SS at 182:16-24.

[976] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[977] Ex. NN at 25-27.

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standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[978] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

867. One such recommendation is utilizing a ranging process to determine the delay on a network. The G.984.3 Standard Recommendation discuss the presence of delay in transmission over a passive optical network due to the distances between each subscriber end ONT/ONU and the head end OLT.[979] The delay between the OLT and each ONT/ONU is determined during the ranging process, mentioned above in Claim 10. The OLT measures the arrival phase of the initial upstream transmission from the ONT/ONU during the ranging process.[980] Once determined, the OLT notifies the ONT/ONU of the delay and the ONT/ONU adjusts its transmission phase to the notified value.[981] This allows for all upstream frames to be properly synchronized together between all ONUs; the upstream transmissions will arrive separately, each one in its correct location within the frame, compensating for the delay caused by their distance from the OLT.[982]

868. A POSITA would have understood that this method disclosed in the G.984.3 Standard Recommendation consists of a subscriber end device responding to a delay message initiated by the head end of the network. As discussed, a POSITA would have understood the ONU functioning section found in Aboshi's pluggable ONU device to implement this functionality.

869. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to respond to a response delay message from the head-end of the passive optical network, wherein the response delay message is used to determine the delay in responses from the network client optical transceiver module."

870. Moreover, it is my understanding that the inventors and patent owners themselves

[978] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[979] Ex. L at § 10.1.

[980] *Id*.

[981] *Id.*

[982] *Id.* at § 10.2.2.1.

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admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 11 was well known prior to the earliest alleged filing date of the '754 Patent.[983] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 11, was well known prior to the earliest alleged filing date of the '754 Patent.[984]

vi. Claim 12: The network client optical transceiver module of claim 1, wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process.

871. Under NextGen's apparent theory of infringement[985], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process. For the module of Claim 1, *see supra*, § IX.E.i.

872. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[986] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

873. One such recommendation is aligning upstream transmissions with the period of the network assigned to each subscriber end device in order to avoid collisions with other transmitting subscribers. As discussed above in Claim 11, the G.984.3 Standard Recommendation teaches a ranging process that is used to account for delay caused by the distance between the head

[983] Ex. SS at 182:16-24.

[984] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[985] Ex. NN at 28.

[986] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

end and subscriber ends of the network.[987] The head end OLT measures the arrival phase of the initial upstream transmission from the subscriber end ONT/ONU during the ranging process.[988] Once determined, the OLT notifies the ONT/ONU of the delay and the ONT/ONU adjusts its transmission phase to the notified value.[989] This allows for all upstream frames to be properly synchronized together between all ONUs; the upstream transmissions will arrive separately, each one in its correct location within the frame, compensating for the delay caused by their distance from the OLT.[990]

874. A POSITA would have understood that this method disclosed in the G.984.3 Standard Recommendation consists of aligning data communication transmissions with the network period of the optical network in order to compensate for network delay. As discussed, a POSITA would have understood the ONU functioning section found in Aboshi's pluggable ONU device to implement this functionality.

875. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to align data communication transmissions with the network period of the optical network to account for transmission delays responsive to a response delay process."

876. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 12 was well known prior to the earliest alleged filing date of the '754 Patent.[991] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 12, was well known prior to the earliest alleged filing date of the '754 Patent.[992]

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[987] Ex. L at § 10.1.

[988] *Id.*

[989] *Id.*

[990] *Id.* at § 10.2.2.1.

[991] Ex. SS at 182:16-24.

[992] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

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vii. Claim 13: The network client optical transceiver module of claim 1, wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network.

877. Under NextGen's apparent theory of infringement[993], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network. For the module of Claim 1, *see supra*, § IX.E.i.

878. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[994] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

879. One such recommendation is adjusting the optical power levels of a transmitting device to compensate for distance and delay between a subscriber end and the head end. In addition to procedures for ranging, the G.984.3 Standard Recommendation discusses the procedure for optical power control in the subscriber end ONT/ONU.[995] According to the G.984.3 Standard Recommendation's description of the upstream Power Levelling state, power control measurements are made by the ONT/ONU to adjust the levels of optical power transmitted by the ONT/ONU to the OLT, shown in yellow in Figure 10-1 below.[996] This operation adjusts the power level of the transmitter in order to compensate for signal loss due to distance between the ONT/ONU and the OLT over which the transmitted optical signal must travel.[997]

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[993] Ex. NN at 28.

[994] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

[995] Ex. L at § 10.2.2.

[996] *Id.* at § 10.2.2.2.

[997] *Id.*

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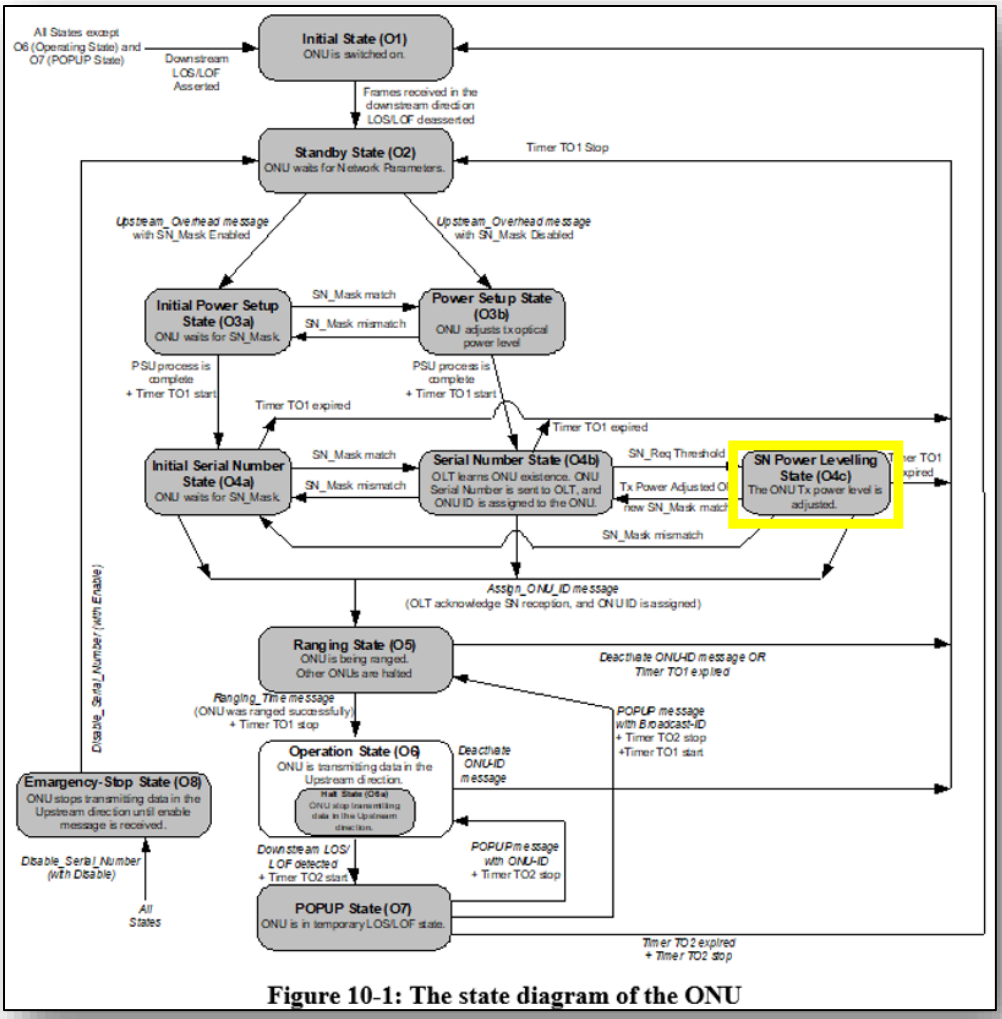


Figure 10-1: The state diagram of the ONU

880. A POSITA knowledgeable about the pluggable ONU described in Aboshi, containing a transmitter subassembly and referencing compliance with ITU-T G.984.x standard recommendations, would have known to look to the G.984.3 Standard Recommendation for more information on power control measurements and adjusting the laser power levels in the subscriber end device.

881. As discussed previously, because the control module of the optical transceiver module is configured to control the reception and transmission of signals, it would have been obvious to a POSITA that this adjustment to the transmitting optical power level would be conducted by the control module. Moreover, a POSITA would have understood the ONU functioning section 120 found in Aboshi's pluggable ONU device to implement this functionality

similarly to the "control module" of the '754 Patent

882. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to adjust the transmitting optical power level responsive to a message received from the head-end of the passive optical network."

883. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 13 was well known prior to the earliest alleged filing date of the '754 Patent.[998] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 13, was well known prior to the earliest alleged filing date of the '754 Patent.[999]

viii. Claim 14: The network client optical transceiver module of claim 1, wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network.

884. Under NextGen's apparent theory of infringement[1000], in my opinion, the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network. For the module of Claim 1, *see supra*, § IX.E.i.

885. As previously discussed above in the analysis of [1.pre] and [1.c], Aboshi discloses a pluggable ONU for data communications in an optical network. Aboshi's pluggable ONU contains an "ONU functioning section 120" for implementing the functionalities described and standardized in IEEE 802.3ah and the ITU-T G.984.x standard recommendations.[1001] Thus, a POSITA would have understood the ONU functioning section disclosed in Aboshi to be

[998] Ex. SS at 182:16-24.

[999] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

[1000] Ex. NN at 28-29.

[1001] Ex. K at 5:32-37, 6:43-49, 7:3-11, Fig. 1.

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configured to implement the functionalities discussed in the G.984.3 Standard Recommendation in order to be interoperable with the optical network.

886. One such recommendation is framing upstream data communications in accordance with a framing protocol for the network. The G.984.3 Standard Recommendation discuss the use of a framing structure at length and, in particular, the upstream frame structure relevant here and shown below in Figures 8-9 and 8-10.[1002]

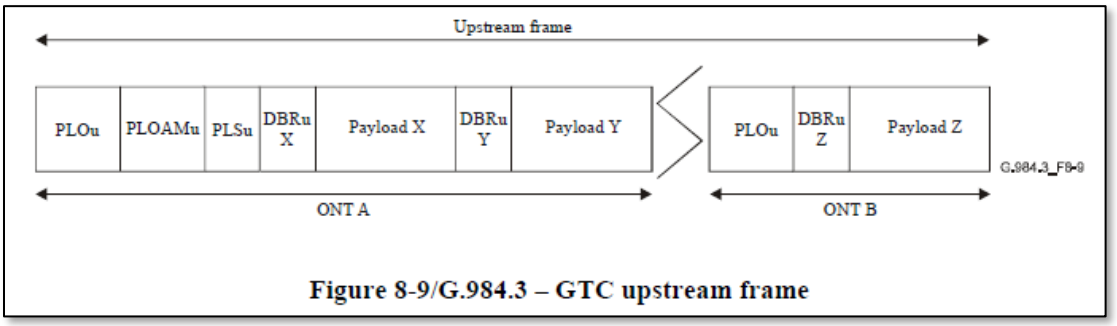


Figure 8-9/G.984.3 – GTC upstream frame

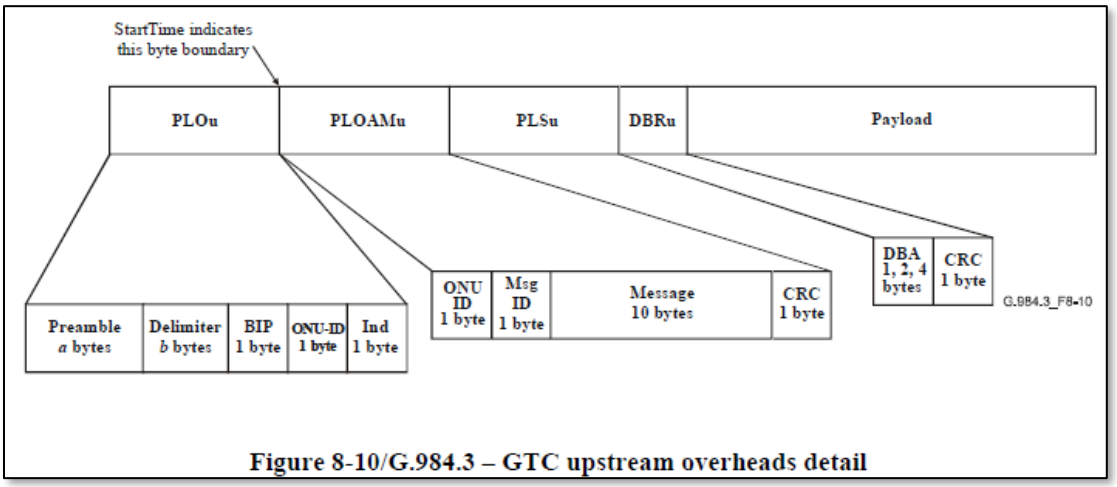


Figure 8-10/G.984.3 – GTC upstream overheads detail

887. As shown in the figures above, the G.984.3 Standard Recommendation discloses an "Upstream payload section" contained within the upstream frame.[1003] As described, the upstream frame first transmits overhead data information followed by the communicated data contained in the payload section of the frame, which continues until the designated "stop time" or

[1002] Ex. L at § 8.2.

[1003] *Id.*

"end time."[1004]

888. A POSITA would have understood that the data transmitted in the payload section would be received by the pluggable ONU from the external device, such as a switch or router, as described in Aboshi. Because the pluggable ONU device taught in Aboshi is connected to the external device via an electrical network interface port, as discussed in the analysis of [1.d], it would have been obvious to a POSITA that the data destined for the payload section of the frame would be received by the module via the electrical network interface port. Moreover, a POSITA would have understood the ONU functioning section found in Aboshi's pluggable ONU device to implement this functionality similarly to the "control module" of the '754 Patent.

889. Therefore, it is my opinion that the Aboshi-G.984.3 Standard Recommendation combination discloses a network client optical transceiver module "wherein the control module is configured to encapsulate at least a portion of the data received through the electrical network interface port into a payload section of a framing protocol for the passive optical network."

890. Moreover, it is my understanding that the inventors and patent owners themselves admit that the concept of a controller (or "control module") capable of performing the functions described in Claim 14 was well known prior to the earliest alleged filing date of the '754 Patent.[1005] The inventors and patent owners also admit that TC-Layer functionality, such as the functionality described in the Claim 14, was well known prior to the earliest alleged filing date of the '754 Patent.[1006]

[1004] *Id.*

[1005] Ex. SS at 182:16-24.

[1006] *Id.* at 167:20-169:8, 181:19-181:24, 192:15-193:8.

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ix. Claim 20: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more end times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) terminating the transmission of the second optical signal responsive to an end time for data transmissions to the head-end of the passive optical network.

891. Under NextGen's apparent theory of infringement[1007], the Aboshi-G.984.3 Standard Recommendation combination discloses this claim for the same reasons as described in Claim 3. For the method of Claim 18, *see supra*, § IX.E.ix.

x. Claim 21: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine one or more lengths of time respective to the start times for data transmissions from the network client optical transceiver module to the head-end of the passive optical network; and (g1) transmitting the second optical signal responsive to a length of time for data transmissions to the head-end of the passive optical network.

Under NextGen's apparent theory of infringement[1008], the Aboshi-G.984.3 Standard Recommendation combination discloses this claim for the same reasons as described in Claim 4. For the method of Claim 18, *see supra*, § IX.E.ix.

xi. Claim 25: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an assigned network identification address from the head-end of the passive optical network for addressing data to the network client optical transceiver module at the control module.

892. Under NextGen's apparent theory of infringement[1009], the Aboshi-G.984.3 Standard Recommendation combination discloses this claim for the same reasons as described in Claim 9. For the method of Claim 18, *see supra*, § IX.E.ix.

[1007] Ex. NN at 34-35.

[1008] Ex. NN at 35.

[1009] Ex. NN at 37.

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xii. Claim 26: The method of claim 18, further comprising the steps of: (g1) adjusting the transmission of the second optical signal form the optical interface block through the optical port to account for the response delay of the optical transceiver module.

893. Under NextGen's apparent theory of infringement[1010], the Aboshi-G.984.3 Standard Recommendation combination discloses this claim for the same reasons as described in Claims 11 and 12. For the method of Claim 18, *see supra*, § IX.E.ix.

xiii. Claim 27: The method of claim 18, further comprising the steps of: (e1) processing the electrical signal at the control module to determine an optical power level and adjusting the transmit optical power level of the network client optical transceiver module to the determined optical power level.

894. Under NextGen's apparent theory of infringement[1011], the Aboshi-G.984.3 Standard Recommendation combination discloses this claim for the same reasons as described in Claim 13. For the method of Claim 18, *see supra*, § IX.E.ix.

xiv. Claim 28: The method of claim 18, further comprising the steps of: (f1) encapsulating a portion of data received through the electrical network interface port into the payload section of a framing protocol for the passive optical network at the control module for conveyance to the optical interface block.

895. Under NextGen's apparent theory of infringement[1012], the Aboshi-G.984.3 Standard Recommendation combination discloses this claim for the same reasons as described in Claim 14. For the method of Claim 18, *see supra*, § IX.E.ix.

X. SECONDARY CONSIDERATIONS OF NON-OBVIOUSNESS

896. I have been informed that Defendants' Common Interrogatory No. 11 to NextGen sought "any secondary considerations of non-obviousness for each Asserted Claim" that NextGen intends to rely on.[1013] I have reviewed NextGen's response to Defendants' Common Interrogatory No. 11, and I have accounted for any secondary considerations of non-obviousness alleged therein.

[1010] Ex. NN at 37-39.

[1011] Ex. NN at 40.

[1012] Ex. NN at 40.

[1013] Ex. OO at 7-9.

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Below are my opinions with respect to specific secondary considerations.

897. ***Commercial success.*** In its response to Common Interrogatory No. 11, NextGen generally alleges Nokia's sales figures of the accused products are evidence of commercial success.[1014] But as will be shown in a forthcoming noninfringement report, the accused products do not practice any Asserted Claim. Regardless, NextGen fails to identify any evidence showing—or even alleging the existence of—any nexus between Nokia's accused products and the Asserted Claims. Consequently, NextGen has provided insufficient information for me to rebut this alleged secondary consideration. Moreover, each and every element in the Asserted Claims was disclosed in the prior art as shown in this report. And, as shown in Section XI below, the inventors were not in possession of the alleged invention as of 2003, and the '754 Patent lacks enablement and written description. Therefore, there can be no "commercial success" attributed to the Asserted Claims. Moreover, I understand that Nokia's sales of the products accused of infringement are far less than sales of pluggables that are used in a PON network that lack the control or TC-Layer on the pluggable.

898. ***Long-felt need and failure by others.*** In its response to Common Interrogatory No. 11, NextGen generally alleges that the claimed invention addresses a long-felt need "to create a full-featured pluggable optical transceiver."[1015] As proof, NextGen claims that "there were no products on the market at the time that implemented the claimed PON technology in a pluggable format," thus identifying a "need in the market in 2003."[1016] But, as shown in Section XII below, the inventors were not in possession of the alleged invention as of 2003, still are not to this day, and the '754 Patent lacks enablement and written description. Therefore, there was no "long-felt need" that was addressed by the Asserted Claims. Moreover, NextGen failed to show any nexus between any alleged "long-felt need" and any claimed features.

899. Further, it is my understanding that Walter Soto, an inventor and patent owner of the '754 Patent, admitted during deposition testimony that, when he and his company approached venture capitalists in hopes of funding to develop products related to the '754 Patent, these venture

[1014] *Id.* at 8.

[1015] *Id.* at 8-9.

[1016] *Id.* at 9.

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capitalists were not interested in funding their endeavors.[1017] Mr. Soto's deposition testimony directly contradicts NextGen's assertion that the '754 Patent addressed a long-felt need and thus would have been non-obvious.

900. ***Praise, award, and/or industry recognition.*** NextGen's response to Common Interrogatory No. 11 does not address whether the invention claimed in the '754 Patent received any praise, award, and/or industry recognition. It is my understanding, however, that Mr. Soto admitted during deposition testimony that neither his companies nor the '754 Patent itself have ever received any awards or industry praise.[1018] Moreover, based on his deposition testimony, it is my understanding that neither Mr. Soto nor his colleagues are aware of even a single article or peer reviewed resource discussing the '754 Patent or the Soto Brothers' companies.[1019]

901. ***Copying.*** In its response to Common Interrogatory No. 11, NextGen generally alleges that Nokia has "known about the patents-in-suit, or their parent families, since the mid-2000s." But, NextGen fails to offer specific evidence of copying, let alone any evidence supporting a nexus between any alleged copying and any claimed features.

* * *

902. It is my opinion that there are no objective indicia of non-obviousness evidencing the validity of any of the Asserted Claims. Further, to the extent any products allegedly practicing the claims have been successful, there is no nexus between the claimed inventions and the products' alleged success.

903. In its response to Common Interrogatory No. 11, NextGen did not allege or offer any specific evidence showing unsuccessful attempts, superior results, skepticism by others, or any other secondary considerations.

904. To the extent NextGen or its expert sets forth any evidence of any objective indicia of non-obviousness, I reserve the right to respond.

[1017] Ex. SS at 83:13-85:5.

[1018] Ex. SS at 224:11-225:5.

[1019] *Id.*; Ex. UU at 77:20-78:10.

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XI. INVALIDITY OF THE '754 PATENT BASED ON § 112

905. Under NextGen's apparent theory of infringement, the Asserted Claims are invalid under 35 U.S.C. § 112 for failure to meet the written description and/or enablement requirement.

906. As discussed throughout this Report, the Asserted Claims of the '754 Patent include the requirement that the claimed "control module" configured to perform certain functionality of a traditional ONT/ONU be located on a "pluggable optical transceiver module."[1020] The incorporation of these functionalities onto the pluggable, separating the invention from a traditional optical transceiver module, was an alleged point of novelty of the '754 Patent in light of the prior art. The inventors and patent owners of the '754 Patent admit, in the specification of the patent and in deposition testimony, that putting this kind of functionality within a pluggable optical transceiver module is "the basis of the invention" and that all other components described in the claims were already well know.[1021] This means a POSITA would not inherently know how to make the "control module" of the claimed optical transceiver pluggable. Nor would I expect a POSITA to know how to do this in the early 2000s.

907. At no point in the specification, claims, or drawings, however, does the patent teach a POSITA how to make or package the ONT/ONU functionality components capable of performing MAC and TC-Layer functionality within a small, pluggable optical transceiver module. Further, it is my understanding that the inventors of the '754 Patent, through their deposition testimony, emphasized that the "control module" of the claims was *not* similar to a controller found in a traditional ONT/ONU capable of performing the identical, claimed functionality.[1022] As an example, produced below is a section of the deposition transcript of Walter Soto, one of the two named inventors:[1023]

> Q: So you're basically—if I'm hearing you correctly, you're taking that [] functionality from a[] line card and putting it into a module?
>
> **A: Correct, that—the TC-Layer functionality and functionality to—to terminate.**

[1020] Ex. A at cl. 1.

[1021] *Id.* at 15:9-13; Ex. SS at 73:7-13; Ex. UU at 20:3-14.

[1022] *Id.* at 61:8-18, 74:11-75:5, 76:7-77:17.

[1023] *Id.*

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. . .

Q: Now going back to this intelligence-in-the-module concept, do you believe you were the first to invent the concept?

A: You're talking about intelligence in the module?

Q: Yes, sir.

A: Yes, absolutely.

908. Tellingly, the inventors and patent owners of the '754 Patent also admit that they did not, at any point before or after the filing of the applications that lead to the '754 Patent, develop a physical embodiment or prototype of the alleged invention.[1024] As an example, produced below is a section of the deposition transcripts of Alexander Soto, one of the two named inventors and the person responsible for prosecuting the '754 Patent:[1025]

Q: What's your role at NextGen?

A: It is still very similar to my previous roles. I still handle the patent prosecution and maintenance of our portfolio.

…

Q: Did you ever have any working prototypes of products that you were trying to bring to market?

A: We contemplated doing so, but it would require a lot of custom boards, and that was expensive to do, and again, why we were seeking funding.

Q: So you never made a functional product at UBI?

A: Correct.

…

Q: Did you ever have a working prototype of any products?

[1024] Ex. SS at 81:1-83:17, 93:2-97:6, 131:13-132:8, 223:13-224:3, 225:6-16; Ex. TT at 311:22-25, 285:6-14, 288:2-16 (highlighting added); Ex. UU at 20:15-25, 21:17-22:19.

[1025] *Id.*

> **A: Again, to get a working prototype, we tried at times to get a working prototype would have been expensive because again, what we were doing was -- would have been state of the art and would have required custom boards. And at some point we tried perhaps getting some off-the-shelf components for some parts that could have, you know, brought the overall cost to something that we could afford. But off-the-shelf stuff at the time would not have been able to do development required at speed that we were looking at. So again, it gets back to needing funding to be able to afford and build proper development –**

909. From reviewing the deposition testimony of both the inventors and their colleagues, I understand that the inventors were never able to reduce their alleged invention to practice, even through an elementary prototype. In fact, despite years of trying to profit off of their alleged invention and reduce it to practice (a process that began over three years after the claimed priority date), the inventors themselves were never able to create a single operational prototype. This was confirmed by Mr. Frank Effenberger, the Sotos' business partner and, now, rapporteur of Study Group 15 of the ITU.[1026] Despite stating that the claims of the '754 Patent would have required "state of the art . . . custom boards" that could not have been developed with "off-the-shelf stuff at the time," the '754 Patent is silent on what components should be used and how the claimed novel "control module" should be packaged within a pluggable optical transceiver to achieve the functionality claimed. Based on the inventors' testimony, coupled with the text of the '754 Patent, there is no evidence that the inventors were in possession of the claimed invention, even multiple years after the alleged priority date.

910. Therefore, because the patents are noticeably devoid of any description sufficient to teach a POSITA how to make the claimed functional components within the pluggable optical transceiver module, and because even the inventors themselves admittedly couldn't produce a working prototype, a POSITA would not have been able to utilize the alleged invention.

XII. DEMONSTRATIVES

911. I have not yet prepared any exhibits or demonstrative evidence for trial, but I intend to do so pursuant to the schedule set by the Court. I reserve the right to use animations, demonstratives, enlargements of real exhibits, and other devices to illustrate my opinions.

[1026] Ex. UU at 20:15-25; 21:17-22:19.

Alexander and Walter Soto, Ex. 2023
Nokia of America Corporation v. Alexander and Walter Soto, IPR2023-00960

XIII. SUPPLEMENTATION

912. I reserve the right to amend or supplement this report based on further discovery and preparation in this action, including my review of any expert report submitted on behalf of Plaintiff or any additional claim construction rulings. I specifically reserve the right to modify my report in response to any evidence provided by or expert report submitted on behalf of Plaintiff. I also reserve the right to rely on all other expert reports submitted in this litigation. For trial, I may prepare or help to create certain diagrams, charts, and demonstrations that illustrate the issues. I also have understood that I may be asked to give rebuttal testimony at trial on matters not covered in this report.

Alexander and Walter Soto, Ex. 2023
Nokia of America Corporation v. Alexander and Walter Soto, IPR2023-00960

XIV. CONCLUSION

For all of the reasons discussed in this report, it is my opinion that the Asserted Claims of the '754 Patent are invalid.

I declare under penalty of perjury that the foregoing opinions are true and correct.

Executed this 15th day of December, 2023.

By: 

Dr. Paul R. Prucnal

APPENDIX A: MATERIALS CONSIDERED

Besides the materials listed as exhibits to this Report and cited therein, I have also considered:

- Litigation Documents
  - Complaint for Patent Infringement Against Nokia (Case No. 2:22-cv-00309-JRG-RSP, Dkt. 1) (Aug. 9, 2022)
  - Nokia's Answer (Lead Case 2:22-cv-00307-JRG-RSP, Dkt. 42) (Nov. 10, 2022)
  - Nokia's First Amended Answer (Lead Case 2:22-cv-00307-JRG-RSP, Dkt. 163) (Aug. 23, 2023)
  - NextGen's November 3, 2022 Infringement Contentions and Exhibits attached thereto
  - Defendants' February 2, 2023 Invalidity Contentions and Exhibits attached thereto
  - Defendants' June 23, 2023 Supplemental and June 27, 2023 Corrected Supplemental Invalidity Contentions and Exhibits attached thereto
  - Defendants' August 28, 2023 Amended Invalidity Contentions and Exhibits attached thereto
  - The Parties Claim Construction Briefing and Exhibits attached thereto
  - *Inter Partes* Review No. IPR2023-009690 and Papers and Exhibits attached thereto
  - NextGen's Resp. to Second Set of Common ROGs (Nos. 10-15) (Nov. 2, 2023)
- Deposition Transcripts
  - O. Tonguz Depo. Tr. (Aug. 25, 2023)
  - R. Baker Depo. Tr. (Sept. 1, 2023)
  - R. Gitlin Depo. Tr. (Sept. 7, 2023)
  - A. Soto Tr. (Nov. 2-3, 2023)
  - W. Soto Tr. (Nov. 2-3, 2023)
  - S. Zsigmond (Nov. 2, 2023)
  - S. Meersman Tr. (Nov. 16, 2023)
  - F. Effenberger Tr. (Nov. 21, 2023)