

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NOKIA OF AMERICA CORPORATION,

Petitioner

v.

ALEXANDER SOTO AND WALTER SOTO,

Patent Owner

Case: IPR2023-00682

U.S. Patent No. 10,771,181

PETITION FOR *INTER PARTES* REVIEW
UNDER 35 U.S.C. §312 AND 37 C.F.R. §42.104

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LIST OF EXHIBITS

Exhibit	Short Name	Description
Ex. 1001	'181 Patent	U.S. Patent No. 10,771,181
Ex. 1002	'181 File History	File History of U.S. Patent No. 10,771,181
Ex. 1003	Prucnal Declaration	Declaration of Dr. Paul Prucnal
Ex. 1004	Prucnal CV	<i>Curriculum Vitae</i> of Dr. Paul Prucnal
Ex. 1005	Agazzi '640	U.S. Patent No. 6,879,640
Ex. 1006	Wei	U.S. Patent No. 6,873,800
Ex. 1007		[Reserved]
Ex. 1008		[Reserved]
Ex. 1009	Agazzi '341	U.S. Patent No. 7,933,341
Ex. 1010	Jiang	U.S. Patent No. 6,665,498
Ex. 1011	Liu	U.S. Patent No. 6,005,694
Ex. 1012	Poplawski	U.S. Patent No. 5,879,173
Ex. 1013	Lavoie	Renaud Lavoie, <i>The Evolution of the Pluggable Module</i> , Broadcast Engineering (2012)
Ex. 1014	SFP MSA	SFF Committee, INF-8074i Specification for SFP (Small Formfactor Pluggable) Transceiver, Rev. 1.0 (May 12, 2001)
Ex. 1015	Leon-Garcia	Alberto Leon-Garcia & Indra Widjaja, <i>Communication Networks Fundamental Concepts and Key Architectures</i> (2000)

Exhibit	Short Name	Description
Ex. 1016	Ramaswami	Rajiv Ramaswami & Kumar Sivarajan, <i>Optical Networks: A Practical Perspective</i> (2d ed. 2002)
Ex. 1017	Senior	John Senior, <i>Optical Fiber Communications: Principles and Practice</i> (1985)
Ex. 1018	Papadias	C. B. Papadias & D. T. M. Slock, <i>On the Decision-Directed Equalization of Constant Modulus Signals</i> , Proceedings of 1994 28th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, USA, pp. 1423-1427, Vol. 2 (1994)
Ex. 1019	Feldman	U.S. Patent No. 6,295,272
Ex. 1020	Martin	Martin P. Clark, <i>Wireless Access Networks: Fixed Wireless Access and WLL Networks—Design and Operation</i> (2000)
Ex. 1021		[Reserved]
Ex. 1022		[Reserved]
Ex. 1023	'795 Patent	U.S. Patent No. 9,887,795
Ex. 1024	'795 File History	File History of U.S. Patent No. 9,887,795
Ex. 1025	'723 Patent	U.S. Patent No. 10,263,723
Ex. 1026	'723 File History	File History of U.S. Patent No. 10,263,723
Ex. 1027	DCO	Doc. No. 58, Docket Control Order, <i>NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.</i> , No. 2:22-cv-00307-JRG-RSP (E.D. Tex.) (consolidated cases)
Ex. 1028	Feuerstraeter	U.S. Patent No. 7,286,557

Exhibit	Short Name	Description
Ex. 1029		[Reserved]
Ex. 1030	Caseload	U.S. District Court – Judicial Caseload Profile (Sept. 2022)
Ex. 1031	181 Patent Infringement Contentions	NextGen’s Infringement Contentions Against Petitioner for the ’181 Patent in <i>NextGen Innovations, LLC v. Nokia of America Corporation et al.</i> , No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)
Ex. 1032	488 Spec	U.S. Provisional Application No. 60/480,488
Ex. 1033	Samueli	Henry Samueli, Jeffrey Putnam, Mehdi Hatamian, <i>QAM-Based Transceiver Solutions for Full-Duplex Gigabit Ethernet Over 4 Pairs of UTP-5 Cable</i> , Broadcom Corporation Presentation (Nov. 1996)

Nokia of America Corporation (“Petitioner”) seeks IPR under 35 U.S.C. §§311–319 and 37 C.F.R. §42 of Claims 1-3, 5-6, 8, 10-17, and 22-23 (“the Challenged Claims”) of U.S. Patent No. 10,771,181 (“the ’181 Patent”). Petitioner requests cancellation of the Challenged Claims.

I. STANDING UNDER 37 C.F.R. §42.104(a)

Petitioner certifies the ’181 Patent is available for IPR, and Petitioner is not barred or estopped from requesting IPR.

II. PAYMENT OF FEES

Petitioner authorizes Account No. 16-0605 to be charged.

III. OVERVIEW OF CHALLENGES AND RELIEF REQUESTED

Pursuant to 42.22(a)(1) and 42.104(b)(1)–(2), Petitioner requests cancellation of the Challenged Claims pursuant to the grounds below. Additional support is provided in the Declaration of Dr. Paul Prucnal (Ex. 1003).

Ground 1: Claims 1-3, 5-6, 8, 10-14, 17, and 22 are unpatentable under pre-AIA 35 U.S.C. §103(a) over Agazzi ’640 in view of Wei.

Ground 2: Claims 15-16 and 23 are unpatentable under pre-AIA 35 U.S.C. §103(a) over Agazzi ’640 in view of Wei and Agazzi ’341.

Ground 3: Claims 1-3, 8, 10-17, and 22-23 are unpatentable under pre-AIA 35 U.S.C. §103(a) over Agazzi ’341 in view of Wei.

Ground 4: Claims 5-6 are unpatentable under pre-AIA 35 U.S.C. §103(a) over Agazzi '341 in view of Wei and Agazzi '640.

IV. BACKGROUND

A. '181 Patent Overview

The '181 Patent describes and claims processing optical and electrical signals according to existing m-ary modulation techniques in a pluggable transceiver module. Ex. 1001, Abstract, 2:30-54. The '181 Patent utilizes these traditional modulation techniques to “convert electrical data input signals into modulated light signals for transmission over the [optical] fiber.” *Id.*, 7:1-5.

The '181 Patent fails to add anything to the then-existing state of the art, and instead merely describes standard electrical-to-optical signal processing components and techniques contained within well-known pluggable form factors. Ex. 1003, ¶45. The Board should thus institute review and find each of the Challenged Claims unpatentable.

B. Technical Background

1. Optical Network

Fiber-optic networks transmit information in the form of modulated light signals over optical fibers. Ex. 1011, 1:14-45. User devices like phones and computers utilize optical signals to transmit information over long distances. Ex. 1010, 1:17-46. But, because user devices operate using electrical signals, they

require electrical-to-optical interfaces to convert between electrical and optical signals to utilize the optical network. *Id.*

2. Pluggable Form Factors

Optical transceiver modules are an interface between electrical and optical cables and convert signals between the optical and electrical domains. Ex. 1006, 1:24-59. Optical transceivers include a transmitter system, which receives electrical signals and converts them to optical signals, and a receiver system, which receives optical signals and converts them to electrical signals. Ex. 1003, ¶50. Such modules were originally bulky and mounted in a relatively fixed position. Ex. 1012, 2:25-30; Ex. 1003, ¶51. To make replacement and maintenance easier, smaller hot-pluggable optical transceivers were developed and form factors like the small form pluggable (“SFP”) were standardized across the industry. Ex. 1006, 1:66-2:11; Ex. 1014.

3. M-ary Modulation

M-ary modulation is a process whereby two or more bits of information are transmitted simultaneously on a signal. Ex. 1015, 125-30; Ex. 1003, ¶55. Compared to traditional binary modulation, where only one bit of information is transmitted at a time, m-ary modulation allows for higher data throughput. Ex. 1001, 10:11-19. The ’181 Patent identifies traditional m-ary modulation techniques, including QAM, PAM, and QPSK. Ex. 1001, 10:22-28.

4. Signal Processing

One type of signal processing, called equalization, involves removing signal distortion. Ex. 1016, 266-67; Ex. 1017, 412-14. There are two general types of equalization: blind and non-blind. Ex. 1003, ¶61. Non-blind equalization uses a known training sequence of symbols with channel information to determine appropriate coefficients whereas blind equalization estimates the coefficients without any initial knowledge of the channel statistics. *Id.*, ¶62.

Another type of signal processing, called error-correction, accounts for and corrects received errors, which can be caused by noise, interference, channel distortion, and decoding issues. *Id.*, ¶63. Forward error correction (“FEC”) involves transmitting redundant data to allow the receiving system to reconstruct the transmitted data and correct errors. Ex. 1020, 353-58. There are two general types of FECs: block codes and convolutional codes. Ex. 1016, 267-72; Ex. 1003, ¶66. Reed-Solomon and low-density parity-check (“LDPC”) codes are examples of block codes (Ex. 1016, 270-71; Ex. 1015, 131) and trellis codes are an example of convolution codes (*id.*). Each of the aforementioned codes was well known in the art at the time. Ex. 1003, ¶67.

C. ’181 Patent Prosecution History

U.S. Patent Application No. 16/297,610, which matured into the ’181 Patent, was filed on March 9, 2019. Ex. 1001. The Examiner solely rejected the claims of

the '181 Patent application for nonstatutory double patenting over U.S. Patent 10,263,723 (“’723 Patent”), which is the immediate parent of the '181 Patent. Ex. 1002, 76, 124. Applicants filed a terminal disclaimer to overcome the rejection. *Id.*, 64.

U.S. Patent Application No. 15/884,351, which matured into the '723 Patent, was filed on January 30, 2018. Ex. 1025. There were no rejections for this application. *See generally* Ex. 1026. The '723 patent is a continuation of U.S. Patent No. 9,887,795 (“the '795 Patent”), which is the immediate parent of the '723 Patent. Ex. 1025.

U.S. Patent Application No. 15/095,137, which matured into the '795 Patent, was filed on April 10, 2016, and was rejected twice by the Office. Ex. 1023; Ex. 1024. The '795 Patent application was filed with five original claims. Ex. 1024, 240-41. Independent claim 1 disclosed a method for m-ary modulation by an optical transceiver module that performed a number of signal processing steps and the dependent claims disclosed specific (and already-known) form factors and signal processing techniques. *Id.* None of the original claims included a “pluggable” limitation. *Id.*

In a first rejection, claims 1 and 3-5 were rejected as anticipated by Brede (U.S. Patent No. 6,603,822). *Id.*, 174-78. Claim 2 was rejected as obvious over

Brede in view of Aronson (U.S. Pub. No. 2007/0031153) as Aronson disclosed the form factors. *Id.*

In response, Applicants added claims 6-21 and amended claims 1-5 to include the “pluggable” limitation, arguing that Brede disclosed an optical line terminal (“OLT”), not a pluggable transceiver. *Id.*, 174-78, 151-52.

In a second rejection, claims 1, 3-7, and 10-21 were rejected as anticipated by, or obvious over, Brede. *Id.*, 121-28. Claims 2, 8, and 9, which relate to form factors, were rejected as obvious over Brede in view of Sheth (U.S. Patent No. 7,729,617) as Sheth taught pluggable form factors. *Id.*

In response, Applicants reasserted their previous argument—the OLT disclosed in Brede was not a pluggable transceiver. *Id.*, 69-74. The Examiner then allowed the claims without any explanation of the decision. *Id.*, 56-60.

D. Priority Date

The '181 Patent claims priority to U.S. Provisional Application No. 60/477,845, filed on June 10, 2003. Petitioner assumes (without determining) that the patent is entitled to this priority date. If Patent Owner disputes the prior art status of any of Petitioner's cited references, Petitioner reserves the right to challenge the priority date.

E. Prior Decisions

The '181 Patent was previously considered in *NextGen Innovations, LLC v. II-VI, Inc. et al.*, No. 4:20-cv-00854-SDJ (E.D. Tex.). The case was transferred to the Northern District of California (styled as *NextGen Innovations, LLC v. II-VI, Inc. et al.*, No. 4:21-cv-07477-YGR (N.D. Cal.)). And it was voluntarily dismissed before dispositive judgments or claim construction.

The '181 Patent is currently asserted in four pending district court cases in *NextGen Innovations, LLC v. Infinera Corporation*, No. 2:22-cv-00306-JRG-RSP (E.D. Tex.); *NextGen Innovations, LLC v. Fujitsu Network Communications, Inc. et al.*, No. 2:22-cv-00307-JRG-RSP (E.D. Tex.); *NextGen Innovations, LLC v. AT&T Services, Inc. et al.*, No. 2:22-cv-00308-JRG-RSP (E.D. Tex.); *NextGen Innovations, LLC v. Nokia of America Corporation et al.*, No. 2:22-cv-00309-JRG-RSP (E.D. Tex.). The cases were consolidated into lead case No. 2:22-cv-00307-JRG-RSP. No dispositive judgments or claim construction orders have issued. A claim construction hearing is set for November 8, 2023; the dispositive motion deadline is set for January 29, 2024; and jury selection is set for May 6, 2024. Ex. 1027, 1-3.

The '181 Patent was previously considered by the Board during an IPR in *II-VI, Inc. v. NextGen Innovations, LLC*, IPR2021-01361. The Board denied institution under 35 U.S.C. §325(d). None of the prior art references used for invalidity in this

Petition were used in the prior IPR, nor do they share priority with any references used in the prior IPR.

F. Claim Construction (37 C.F.R. §42.104(b)(3))

The terms should receive their respective plain and ordinary meaning as understood by a person of ordinary skill in the art under *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005).

V. PRIOR ART REFERENCES

The following prior art references were not cited or considered during prosecution. Ex. 1003, ¶¶84-88.

A. Agazzi '640

U.S. Patent No. 6,879,640, which issued on April 12, 2005, derives from U.S. Patent Application No. 09/693,709, which was filed on October 20, 2000. Agazzi '640 qualifies as prior art under at least pre-AIA 35 U.S.C. §102(e).

B. Wei

U.S. Patent No. 6,873,800, which issued on March 29, 2005, derives from U.S. Patent Application No. 09/656,779, which was filed on September 7, 2000. Wei qualifies as prior art under at least pre-AIA 35 U.S.C. §102(e).

C. Agazzi '341

U.S. Patent No. 7,933,341, which issued on April 26, 2011, derives from U.S. Patent Application No. 09/797,428, which was filed on February 28, 2001. Agazzi

'341 thus qualifies as prior art under at least pre-AIA 35 U.S.C. §102(e). Agazzi '341 does not share priority with Agazzi '640.

VI. LEVEL OF ORDINARY SKILL IN THE ART

A person of ordinary skill in the art (“POSITA”) pertinent to the '181 Patent would have had at least a bachelor’s degree in electrical engineering, computer engineering, or similar discipline and had at least two years of optical communications, networking and signal processing experience. Ex. 1003, ¶30. Additional experience may compensate for less education. *Id.*

VII. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. Ground 1

1. Overview of Ground 1

i. Agazzi '640

Agazzi '640 discloses “an optical communications transceiver” (Ex. 1005, 12:20) with “modulation transmitters and receivers” that “can be integrated on a single integrated circuit” (*id.*, Abstract). The optical transceiver in Agazzi '640 converts signals between the optical and electrical domains and performs signal processing including m-ary modulation/demodulation, equalization, and error correcting. *Id.*, 3:12-49, 16:7-19; Ex. 1003, ¶85. A goal of Agazzi '640 is to use “bandwidth efficient modulation techniques to overcome the limitations of low quality optical channels [which] result[s] in higher transmission rates and reduced

system costs.” Ex. 1005, 1:44-48. To achieve this, Agazzi ’640 also teaches implementing “digital signal processing (DSP) and coding algorithms ... in a single monolithic chip.” *Id.*, 3:53-60.

ii. Wei

Wei discloses a “hot pluggable optical transceiver in a small form pluggable ... type package.” Ex. 1006, 3:29-32. Wei further discloses a “fiber optic transceiver module” that is in an “SFP” package. *Id.*, 2:1-17; Ex. 1003, ¶87. A goal of Wei is to create a pluggable optical transceiver module in an SFP package because “users desire a more compact, high throughput fiber optic transceiver” (Ex. 1006, 1:66-2:4) that “minimize[s] down time of fiber optic modules by allowing the hot replacement of fiber optic modules” (*id.*, 2:5-11). Ex. 1003, ¶87. To accomplish this, Wei teaches “vertically stacked receiver and transmitter printed circuit boards” allows packaging the functions of larger transceivers into smaller form factors. Ex. 1006, 2:28-35; Ex. 1003, ¶87.

iii. Motivation to Combine

Agazzi ’640 and Wei are directed to optical transceiver modules with integrated optoelectronics. Ex. 1005, Abstract, 12:20; Ex. 1006, 1:24-30; Ex. 1003, ¶90. Indeed, Agazzi ’640 and Wei both disclose a transceiver module with a system interface, an optical transmitter, an optical receiver, and an amplifier. Ex. 1005, Figs. 10, 12, 12:20; Ex. 1006, 1:24-45, 4:45-46; Ex. 1003, ¶90.

Specifically, Agazzi '640 discloses a transceiver module that performs signal processing including m-ary modulation/demodulation, equalization, and error-correction, which allows data to be transmitted at higher rates through existing fiber infrastructure. Ex. 1005, 2:66-3:55, 15:15-17; Ex. 1003, ¶92. Agazzi '640 further discloses that the “receivers and transmitters are integrated on a single integrated circuit.” Ex. 1005, Abstract. Agazzi '640 also discloses that “the electronics ... may be integrated into a single integrated circuit ... on a single chip.” *Id.*, 9:33-41. Agazzi '640 explains that “the system cost may be reduced [by] placing as much of the processing as possible within the integrated circuit.” *Id.*, 9:33-41. Agazzi '640 does not, however, expressly disclose a pluggable transceiver module as taught in Wei.

Wei discloses a “hot pluggable optical transceiver in a small form pluggable ... type package.” Ex. 1006, 1:66-2:4. Wei teaches how to package larger transceiver modules into a pluggable SFP package by vertically stacking the transmitter and receiver printed circuit boards. *Id.*, 2:28-35. Wei further teaches that a compact pluggable transceiver is easier to replace by technicians and it can be produced with reduced manufacturing costs. *Id.*, 1:53-2:11.

A POSITA would have understood the transceiver taught in Agazzi '640, with integrated optoelectronics on a single circuit, would have been implemented in the pluggable form factor taught in Wei. Ex. 1003, ¶93. And a POSITA would have

been motivated to combine the transceiver module of Agazzi '640 with the pluggable form factor of Wei for several reasons to include creating a cost-effective pluggable transceiver with greater data throughput that was easily removable.

First, market pressures were increasing the demand for compact pluggable transceivers with high data throughput rates in a standardized form factor. Ex. 1003, ¶94. “[U]sers desire[d] a more compact, high throughput fiber optic transceiver ... in a small form pluggable (SFP), LC package.” Ex. 1006, 1:66-2:4. As consumer demand was increasing, the fiber-optic industry standardized the pluggable SFP form factor to ensure compatibility across fiber-optic systems. Ex. 1014. Accordingly, because of consumer preferences and industry standards, a POSITA would have understood that higher throughput pluggable transceivers in an SFP form factor were needed. Ex. 1003, ¶94.

Second, pluggable transceivers were easier to install and replace compared to mounted transceivers. Ex. 1006, 2:5-11; Ex. 1003, ¶94. This allowed for faster servicing or replacement of damaged transceivers (*i.e.*, less down time during maintenance), decreased the chances of improper installation, and decreased the likelihood that components near the transceiver would be damaged during servicing. Ex. 1006, 2:5-11; Ex. 1003, ¶94.

Third, decreasing the size was a stated goal in both Agazzi '640 (Ex. 1005, 9:33-41) and Wei (Ex. 1006, 1:66-2:4), and pluggable transceivers in an SFP

package were smaller, more compact, and take up less room than other transceivers. Ex. 1003, ¶95. Indeed, Wei teaches vertically stacking components so as to enable a transceiver, such as the transceiver in Agazzi '640, to be integrated into a pluggable. Ex. 1006, 2:28-32. This was an important consideration because space is a limiting factor in many optical systems. Ex. 1003, ¶95.

Fourth, decreasing costs was a stated goal in Agazzi '640 (Ex. 1005, 1:45-49) and Wei (Ex. 1006, 1:54-56), and a pluggable transceiver that performs m-ary modulation was cost-effective. Ex. 1003, ¶96. Pluggable transceivers were easier to install, repair, and replace, and required less skilled technicians. Ex. 1006, 2:5-11; Ex. 1003, ¶96. Manufacturing costs were also decreased when manufacturing pluggable transceivers as taught in Wei. Ex. 1006, 1:45-60. Further, smaller, more compact pluggable transceivers take up less space which allowed the optical equipment that the pluggable transceivers interfaced with to take up less space, thus saving on rent and utilities. Ex. 1003, ¶96. Costs were also saved by m-ary modulation because it allowed for higher data speeds without the need to replace older fiber channels. Ex. 1005, 2:66-3:55.

Fifth, increasing data throughput was a stated goal in Agazzi '640 (Ex. 1005, 3:4-3:11) and Wei (Ex. 1006, 1:66-2:1), and an m-ary pluggable transceiver would have higher data throughput rates. Ex. 1003, ¶97. M-ary modulation also allowed

for cost savings because more data could be transferred in the same channel as compared to traditional binary modulation. *Id.*; Ex. 1001, 10:11-19.

Accordingly, a POSITA who wanted to maintain high data throughput rates as taught by Agazzi '640 would have looked to Wei when evaluating how to package a high throughput transceiver in a pluggable form because Wei also teaches high data throughput. Ex. 1003, ¶97. As Agazzi '640 and Wei share many stated goals, a POSITA would have had a reasonable expectation of success in combining the transceivers in Agazzi '640 and Wei to produce expected results, which were stated goals in the references. *Id.*, ¶98.

A POSITA would also have been motivated to combine a transceiver that performs m-ary modulation, like in Agazzi '640, with a pluggable transceiver, like in Wei, after reviewing the prior art. Ex. 1003, ¶99. For example, Jiang discloses that “it is easier to make the transceiver pluggable” (Ex. 1010, 5:34-41) and Feldman discloses a pluggable transceiver module that conveys m-ary modulated signals from a subcarrier channel to a high-speed channel (Ex. 1019, Abstract, 6:21-29, Fig. 13). Ex. 1003, ¶¶99-100.

2. Claim 1

i. [1.pre] A pluggable optical transceiver module comprising of:

To the extent the preamble is limiting, Wei discloses claim [1.pre]. Ex. 1003, ¶102. Wei discloses a “fiber optic transceiver module” that is “hot pluggable.” Ex.

1006, 2:17-20, 3:29-32. Specifically, Wei discloses a pluggable optical transceiver module “in a small form pluggable (SFP)” form factor. Ex. 1006, 2:1-2. The SFP form factor was an industry recognized pluggable form factor standard set out in a multisource agreement. *See, e.g.*, Ex. 1014; Ex. 1003, ¶102. Indeed, the ’181 Patent admits that pluggable optical modules like the SFP are standard. Ex. 1001, 11:34-37.

ii. [1.A] an electrical system interface for receiving a first electrical data signal and for transmitting a second electrical data signal;

Agazzi ’640 discloses claim [1.A]. Ex. 1003, ¶¶103-06. The ’181 Patent teaches that electrical “system interfaces ... can be selected from conventional interfaces including ... XGMII, SGMII, RGMII or XAUI.” Ex. 1001, 9:22-26; *see also* Claim 11 *infra*. The ’181 Patent also teaches that the transmitter system receives “electrical data input signals” and converts them “into modulated light signals” and the receiver system receives the light signals and converts them “into electrical signals” before transmission. *Id.*, 6:64-7:9.

Agazzi ’640 discloses an optical transceiver module that includes a transmitter system that receives electrical “digital data” signals through an “XGMII interface” (highlighted below). Ex. 1005, 2:54-55, 7:14-19, 8:36-44, Fig. 10; Ex. 1003, ¶103. The signals received through the XGMII interface, which the ’181 Patent admits is

an electrical system interface, are electrical signals because transmitters receive electrical signals. Ex. 1001, 6:64-7:9.

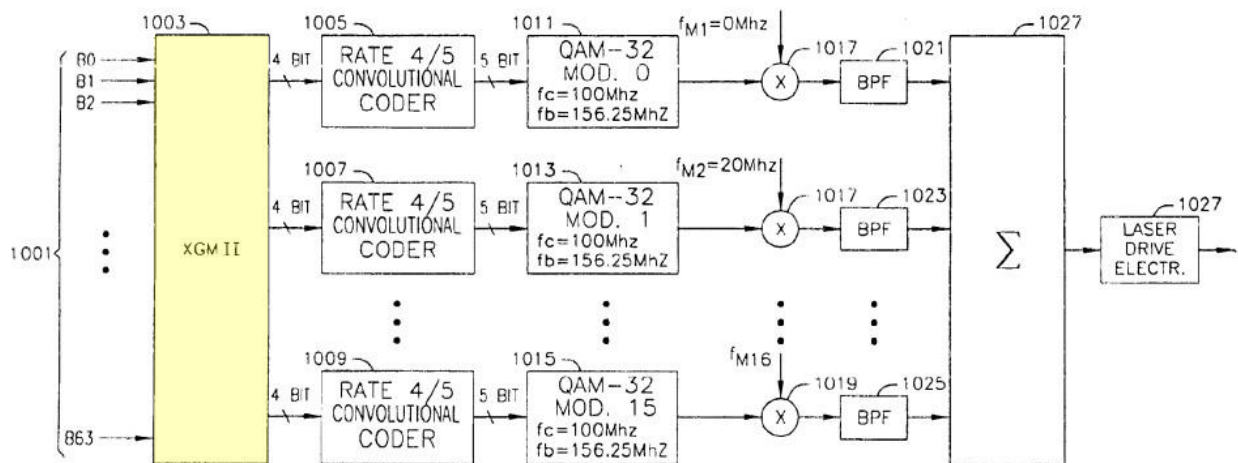


FIG. 10

Ex. 1005, Fig. 10 (annotated). The XGMII interface receives many electrical data signals through it, each one of which is an example of the claimed “first electrical data signal”¹ for at least the reasons explained above. Ex. 1003, ¶104.

Agazzi '640 also discloses an optical transceiver module that includes a receiver system which transmits electrical “digital data” signals through an “XGMII interface” (highlighted below). Ex. 1005, 2:59-60, 11:36-42, Fig. 12; Ex. 1003, ¶105. The signals transmitted through the XGMII interface (highlighted below),

¹ The “first” electrical data signal is an arbitrary name for a signal that is received through the electrical system interface. Ex. 1003, ¶104.

which the '181 Patent admits is an electrical system interface, are electrical signals because receivers transmit electrical signals. Ex. 1001, 6:64-7:9.

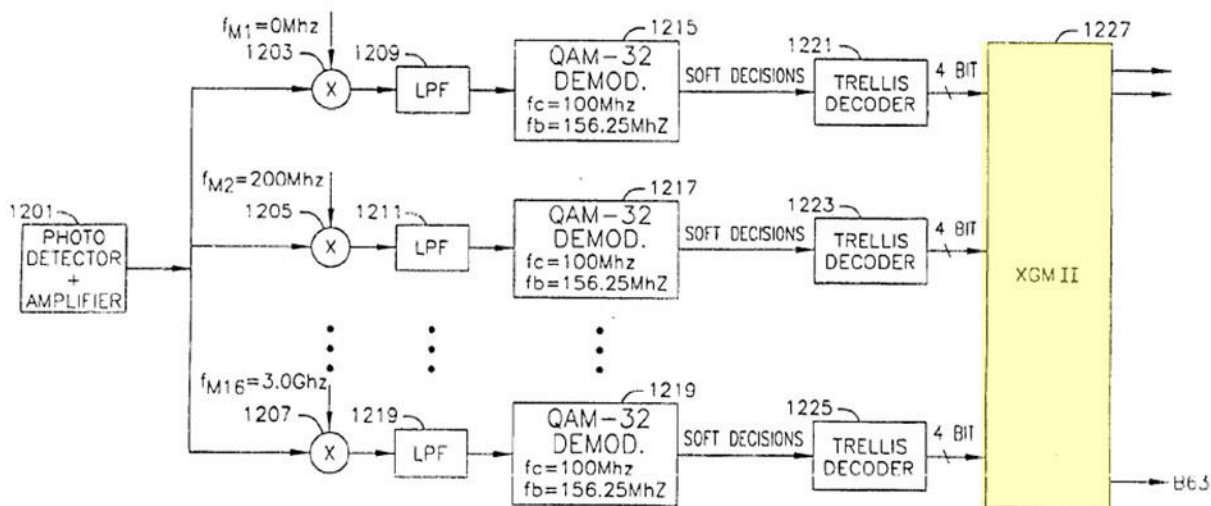


FIG. 12

Ex. 1005, Fig. 12 (annotated). The XGMII interface has many electrical data signals transmitted through it, each one of which is an example of the claimed “second electrical data signal”² for the reasons explained above. Ex. 1003, ¶106.

² The “second” electrical data signal is an arbitrary name for a signal that is transmitted through the electrical system interface. Ex. 1003, ¶106.

iii. [1.B] an m-ary modulator for increasing the number of bits per symbol in the first electrical data signal to produce a first m-ary modulation signal;

Agazzi '640 discloses claim [1.B]. Ex. 1003, ¶¶107-09. Agazzi '640 discloses performing “Quadrature Amplitude Modulation (QAM) to encode several bits per transmitted symbol.” Ex. 1005, 3:15-21. Agazzi '640 further discloses an optical transceiver module with a transmitter system that includes a QAM modulator (highlighted below), which the '181 Patent specifically identifies as a type of m-ary modulation. Ex. 1005, 12:5-9; Ex. 1001, 10:22-28.

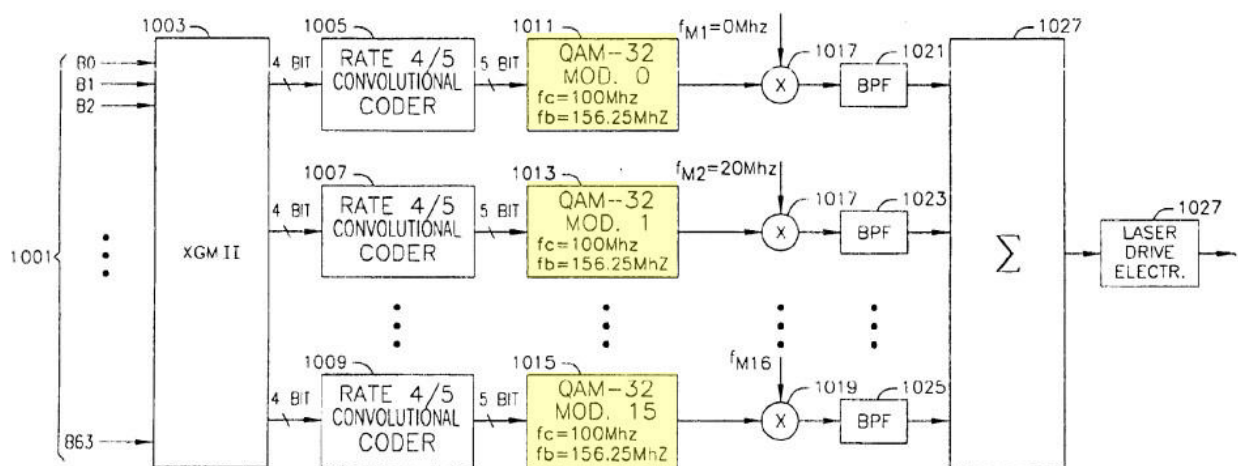
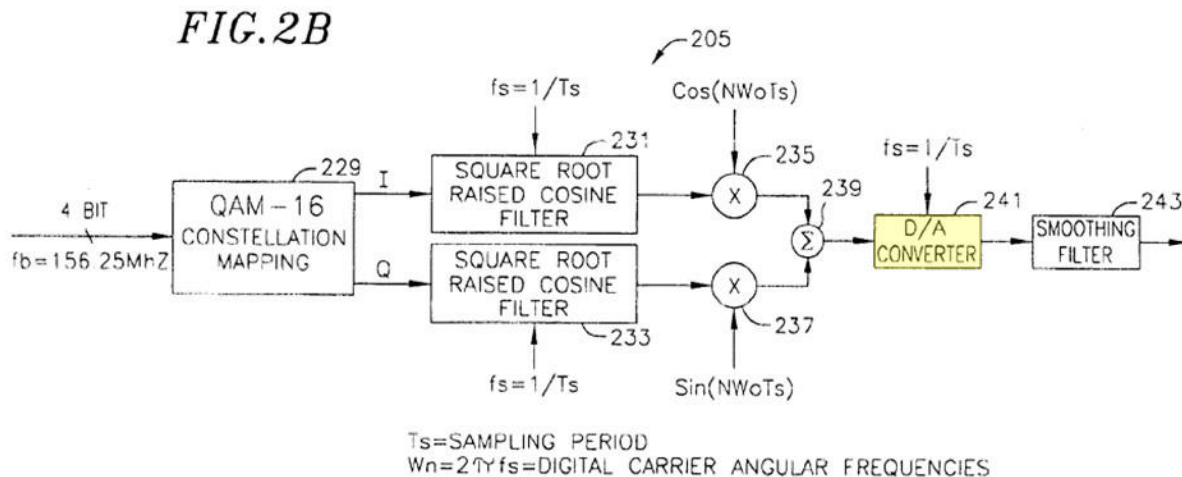


FIG. 10

Ex. 1005, Fig. 10 (annotated). As depicted in Figure 10, the QAM modulator (*i.e.*, m-ary modulator) modulates a received signal (*i.e.*, first electrical data signal received via the XGMII system interface) to produce a modulated signal (*i.e.*, first m-ary modulation signal) using QAM modulation (*i.e.*, m-ary modulation). Ex. 1003, ¶109.

iv. [1.C] a digital to analog converter for converting the first m-ary modulation signal to a first electrical m-ary analog modulation signal;

Agazzi '640 discloses claim [1.C]. Ex. 1003, ¶¶110-11. Agazzi '640 discloses a block diagram of a QAM modulator within a transmitter system with a “Digital to Analog converter 241” (highlighted below) that processes the signal after it passes through the QAM modulator. Ex. 1005, 2:28-29, 9:54-62. Figure 2B depicts the QAM modulator in Figure 2A. Ex. 1005, 2:28-29. Figure 10, which is previously referenced, is a specific “modification of the transmitter of Fig. 2A to incorporate trellis coding.” *Id.*, 54-55. The illustration of the modulator in Figure 2B thus depicts the modulator in Figure 10. Ex. 1003, ¶111.



Id., Fig. 2B (annotated). As depicted in Figure 2B, the digital to analog converter receives a modulated digital signal from the QAM modulator (*i.e.*, first m-ary modulation signal) and converts it to an analog signal (*i.e.*, first electrical m-ary analog modulation signal). Ex. 1003, ¶111.

v. [1.D] a driver for amplifying the first electrical m-ary analog modulation signal to an amplified first electrical m-ary analog modulation signal to drive an optical transmitter;

Agazzi '640 discloses claim [1.D]. Ex. 1003, ¶¶112-13. Agazzi '640 discloses an “optical transmitter” that includes a laser that “transmits the data across a fiber optic channel.” Ex. 1005, 7:18-19, 10:14-16; Ex. 1003, ¶112. Agazzi '640 further discloses “laser drive electronics” (highlighted below).

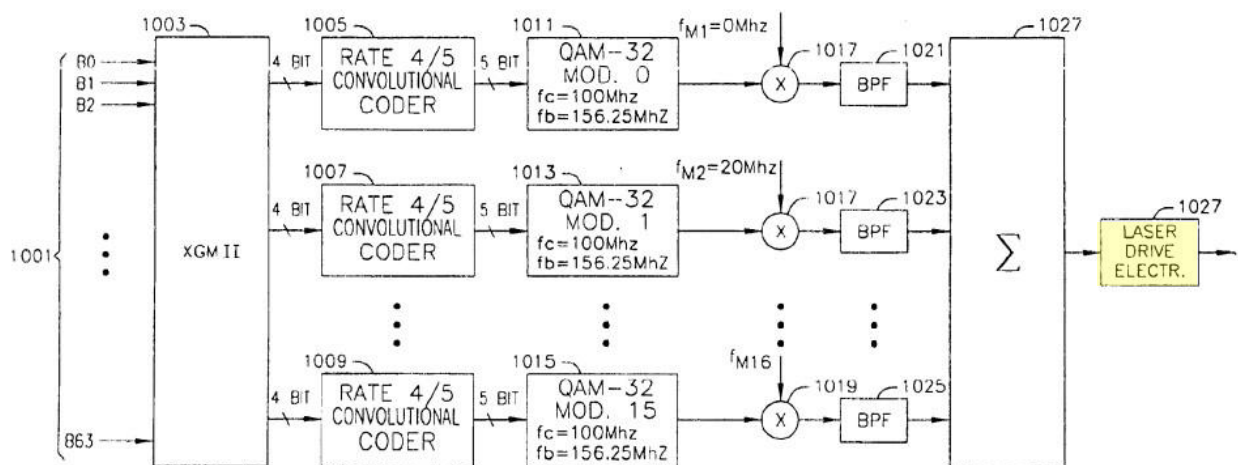


FIG. 10

Ex. 1005, Fig. 10 (annotated). Agazzi '640 explains the “signal from the laser drive electronics [] is provided to a laser” (*id.*, 10:14-16) where the “laser drive electronics [] intensity modulates the laser beam, which is then coupled into a fiber optic channel” (*id.*, 11:11-14).

A POSITA would have understood the modulated signals were necessarily amplified by the laser drive electronics to ensure they were sufficiently strong to drive the laser, which must emit optical signals that can traverse long distances over

optical fibers. Ex. 1003, ¶113. Indeed, a prior art textbook confirms what a POSITA would have understood and corroborates Dr. Prucnal's testimony, as it states a "laser drive circuit ... consists of two differential amplifiers ... The two differential amplifiers provide sufficient modulation current amplitude for the laser." Ex. 1017, 400. The laser driver electronics (*i.e.*, driver) thus amplifies a received signal (*i.e.*, the first electrical m-ary analog modulation signal) to produce an amplified signal (*i.e.*, amplified first electrical m-ary analog modulation signal) to drive the laser (*i.e.*, optical transmitter). *Id.*

vi. [1.E] the optical transmitter for emitting a first optical signal on a first wavelength responsive to and representative of the amplified first electrical m-ary analog modulation signal from the driver;

Agazzi '640 discloses claim [1.E]. Ex. 1003, ¶114. Agazzi '640 discloses an "optical transmitter" that includes a laser that "transmits the data across a fiber optic channel." Ex. 1005, 7:18-19, 10:14-16; Ex. 1003, ¶114. Agazzi '640 explains the "signal from the laser drive electronics [] is provided to a laser ... The output of the laser is coupled to a fiber optic channel." Ex. 1005, 10:14-16. Accordingly, the laser (*i.e.*, optical transmitter) in Agazzi '640 is driven by (*i.e.*, responds to) the electrical signal from the laser drive electronics (*i.e.*, amplified first electrical m-ary analog modulation signal), which the laser converts into a corresponding optical signal (*i.e.*, first optical signal on a first wavelength) that represents the received

electrical signal. Ex. 1003, ¶114. The laser then emits the optical signal onto an optical fiber. *Id.*

vii.[1.F] an optical detector for receiving a second optical signal on a second wavelength to produce an electrical analog signal;

Agazzi '640 discloses claim [1.F]. Ex. 1003, ¶115-16. Agazzi '640 discloses a “receiving apparatus comprises an input that receives a transmitted optical signal and converts it into an electrical signal.” Ex. 1005, 1:66-2:1. Specifically, Agazzi '640 teaches a photo detector (highlighted below) “receive[s] the multi-carrier modulated signal from the fiber optic and convert[s] it into an electrical signal.” *Id.*, 11:17-22.

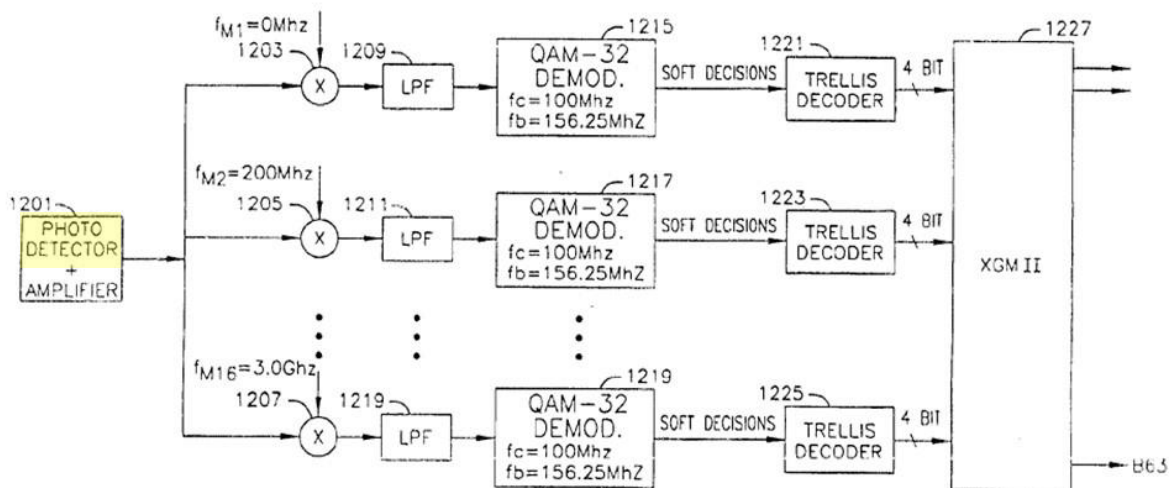


FIG. 12

Ex. 1005, Fig. 12 (annotated). Agazzi '640 explains that the “photodetector ... converts the optical signal into a voltage level.” *Id.*, 10:18-20. A POSITA would

have understood the voltage level corresponds to analog signals because Agazzi '640 teaches that analog to digital converting is performed on the signal after it is received by the photo detector. Ex. 1005, 11:16-29; Ex. 1003, ¶116. As depicted in Figure 12, the photo detector (*i.e.*, optical detector) receives an optical signal (*i.e.*, second optical signal on a second wavelength) from the optical fiber and produces a corresponding electrical analog signal. Ex. 1005, 7:19-24, Fig. 12; Ex. 1003, ¶¶115-16.

viii. [1.G] an amplifier for amplifying the electrical analog signal to an amplified electrical analog signal;

Agazzi '640 discloses claim [1.G]. Ex. 1003, ¶117-18. Agazzi '640 discloses “amplifiers.” Ex. 1005, 3:3-4. Specifically, Agazzi '640 discloses an amplifier (highlighted below) that amplifies an electrical analog signal from the photo detector to produce an amplified electrical analog signal. Ex. 1005, 10:14-23; Ex. 1003, ¶118.

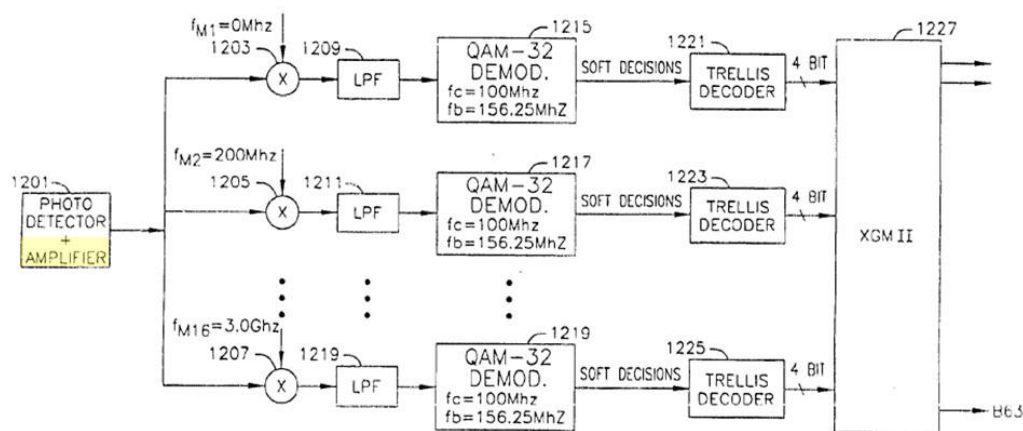


FIG. 12

Ex. 1005, Fig. 12 (annotated).

ix. [1.H] a clock data recovery unit for recovering clock and data information to produce a second m-ary modulation signal from the amplified electrical analog signal;

Agazzi '640 discloses claim [1.H]. Ex. 1003, ¶119. Agazzi '640 discloses “clock and data recovery circuits.” Ex. 1005, 2:66-3:4. For example, Agazzi '640 discloses a receiver system with a demodulation block that includes clock data information (highlighted below) on the signal. Ex. 1005, 13:20-22; Ex. 1003, ¶119. Specifically, the demodulation block shows the carrier frequency and bit rate, which is clock data information that was recovered from the signal. Ex. 1005, 13:20-22; Ex. 1003, ¶119.

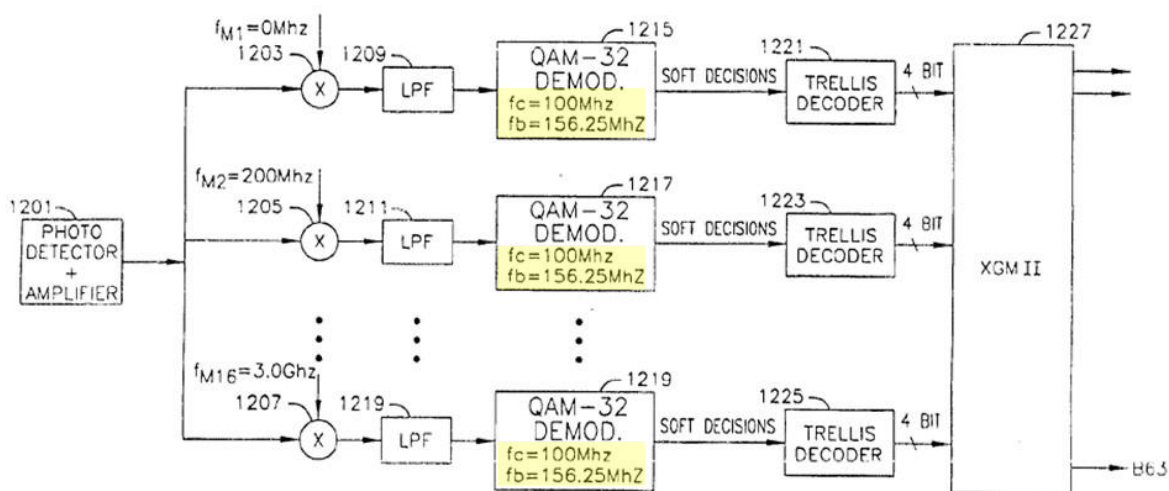


FIG. 12

Ex. 1005, Fig. 12. It was also well-known in the art at the time that clock data recovery was a routine part of signal processing that occurs in the receiver. Ex.

1003, ¶119. Indeed, a prior art textbook confirms what a POSITA would have understood and corroborates Dr. Prucnal’s testimony, as it states the “the clock must be extracted from the received signal.” Ex. 1016 at 265. And the ’181 Patent confirms what a POSITA would have known—clock data recovery occurs before demodulation. Ex. 1001, 10:47-11:7. The clock and data recovery circuit in Agazzi ’640 thus recovers clock data information from an input signal (*i.e.*, amplified electrical analog signal) to produce an output signal (*i.e.*, second m-ary modulation signal). Ex. 1003, ¶119.

x. [1.I] an equalizer for performing equalization on the second m-ary modulation signal to remove noise; and

Agazzi ’640 discloses claim [1.I]. Ex. 1003, ¶¶120-21. Agazzi ’640 discloses that the “present invention also describes ... equalization.” Ex. 1005, 4:55-59. Agazzi ’640 further discloses that “[i]t is desirable to replace optical equalization techniques by DSP-based equalization techniques” (*id.*, 4:5-8) which the ’181 Patent identifies is an undesired type of noise (Ex. 1001, 12:20-26). Agazzi ’640 teaches that equalizers “compensate pulse dispersion and the resulting inter-symbol interference ... and phase distortion.” Ex. 1005, 3:21-26. Agazzi ’640 also teaches that distortion is a problem at high data rates. *Id.*, 1:33-37. Figure 12 below depicts the digital processing in the receiver system. A POSITA would have understood the equalizer was necessarily present within the boxed area to compensate for distortion

as QAM modulation supports high data throughput which results in increased pulse dispersion and intersymbol interference on received signals. Ex. 1003, ¶¶120-21.

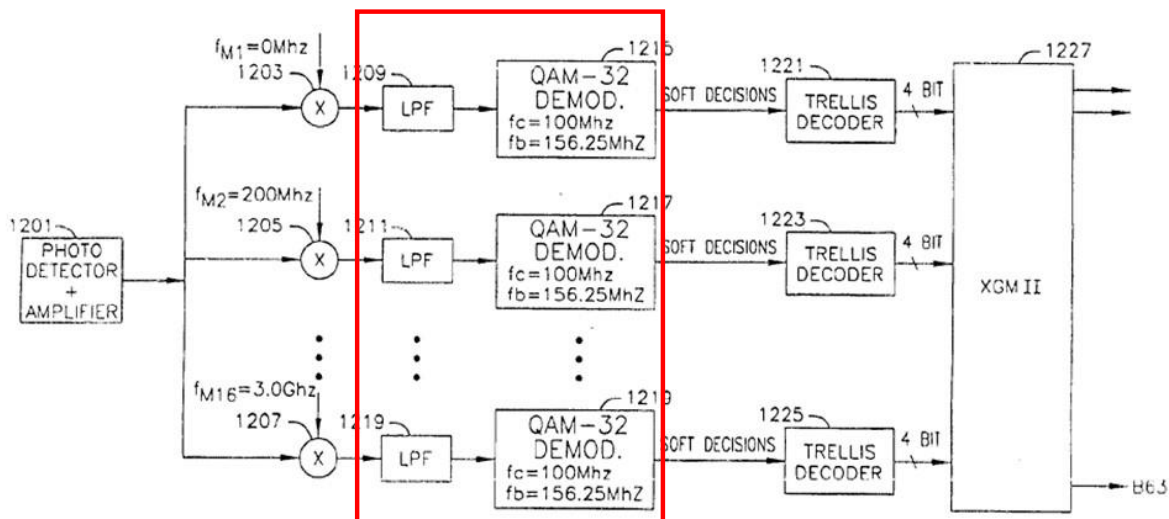


FIG. 12

Ex. 1005, Fig. 12 (annotated). Indeed, a prior art textbook and a Broadcom presentation confirms what a POSITA would have understood and corroborates Dr. Prucnal’s testimony, as the textbook states that equalization was needed “to cancel the effects of intersymbol interference due to pulse spreading” (Ex. 1016, 266) and the presentation illustrates that an equalizer was present in a QAM receiver before the decoder (Ex. 1033, 2). Moreover, the infringement contentions against Petitioner confirms what a POSITA would have known, that an equalizer was present in the receiver for an m-ary modulation system even if it was not explicitly illustrated in a block diagram of the receiver—“the equalizer, or its equivalent is contained within the ... DSP [digital signal processing].” Ex. 1031, 66.

The equalizer in Agazzi '640 thus receives a signal (i.e., second m-ary modulation signal) and removes noise from the signal to produce an equalized signal (i.e., equalized second m-ary modulation signal). *Id.*

xi. [1.J] an m-ary demodulator for decreasing the number of bits per symbol in the equalized second m-ary modulation signal to produce the second electrical data signal.

Agazzi '640 discloses claim [1.J]. Ex. 1003, ¶¶122-23. Agazzi '640 discloses “demodulators, which will demodulate the signal according to the modulation used by the transmit apparatus.” Ex. 1005, 2:1-11. Specifically, Agazzi '640 discloses a QAM demodulator (highlighted below), which the '181 Patent expressly discloses is an m-ary modulation scheme. Ex. 1001, 10:22-28.

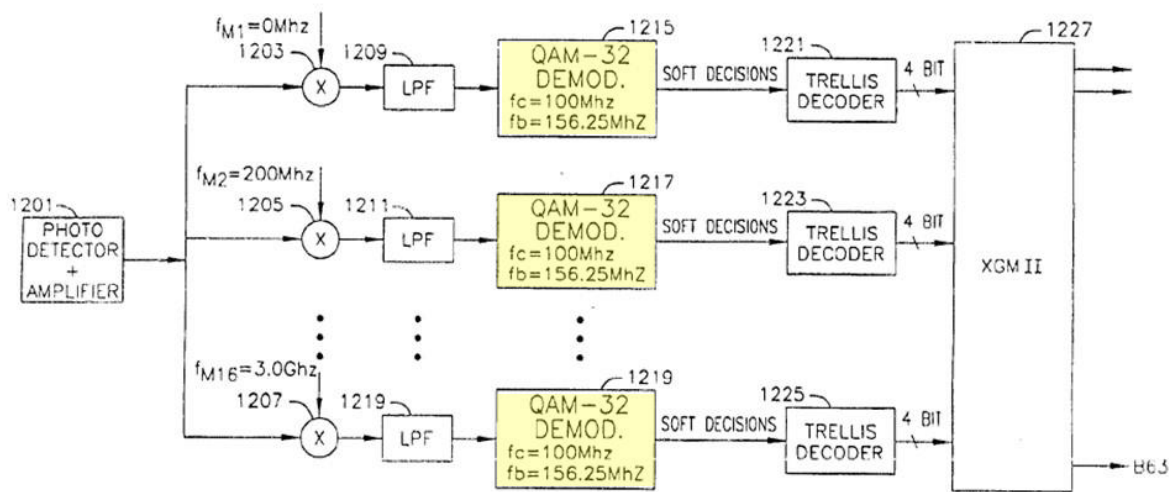


FIG. 12

Ex. 1005, Fig. 12 (annotated). The '181 Patent also teaches that m-ary demodulators decrease the number of bits per symbol. Ex. 1001, 15:31-33. The QAM

demodulator (i.e., m-ary demodulator) thus demodulates a received signal (i.e., equalized second m-ary modulation signal) by decreasing the number of bits per symbol to produce a demodulated signal (i.e., second electrical data signal). Ex. 1003, ¶123.

3. Claim 2: The pluggable optical transceiver module of claim 1, wherein the form factor of the pluggable optical transceiver module is a pluggable form factor standard.

Wei discloses claim 2 for the same reasons as described in claim [1.pre]. Specifically, Wei discloses an SFP pluggable form factor standard.

4. Claim 3: The pluggable optical transceiver module of claim 2, wherein the pluggable form factor standard of the pluggable optical transceiver module is a small form factor pluggable (SFP) or SFP+ form factor standard.

Wei discloses claim 3 for the same reasons as described in claim [1.pre]. Specifically, Wei discloses an SFP pluggable form factor standard.

5. Claim 5: The pluggable optical transceiver module of claim 1, wherein the m-ary modulator and the m-ary demodulator perform m-ary quadrature amplitude modulation and demodulation, respectively, that uses two or more bits per symbol.

The combination of Agazzi '640 and Wei discloses claim 5 for the same reasons as disclosed in claim [1.pre], [1.B], and [1.J]. Specifically, Wei discloses a pluggable optical transceiver module and Agazzi '640 discloses quadrature amplitude modulation.

6. Claim 6: The pluggable optical transceiver module of claim 1, wherein the m-ary modulator and the m-ary demodulator perform m-ary quadrature phase shift keying modulation and de-modulation, respectively, that uses two or more bits per symbol.

The combination of Agazzi '640 and Wei discloses claim 6. Ex. 1003, ¶¶129-31. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '640 discloses performing “quadrature phase shift keying (QPSK)” (Ex. 1005, 17:5-8), which the '181 Patent identifies as a type of m-ary modulation (Ex. 1001, 10:22-28). Agazzi '640 discloses the other limitations in claim 6 for the same reasons disclosed in claim [1.B] and [1.J].

7. Claim 8: The pluggable optical transceiver module of claim 1, wherein the electrical system interface includes parallel signals.

The combination of Agazzi '640 and Wei discloses claim 8. Ex. 1003, ¶132-33. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '640 discloses utilizing “parallel processing architectures” in order “to process the higher data rates available in optical fibers.” Ex. 1005, 4:18-21. For example, Agazzi '640 discloses a transmitter system that receives parallel electrical signals through the electrical system interface (highlighted below), one of which includes the first electrical data signal. Ex. 1003, ¶134. This is depicted in Figure 10 by the parallel arrows to the left of the electrical system interface. Figure 10 also

shows that the first electrical data signal, which is one of the arrows, is included with other electrical data signals in parallel.

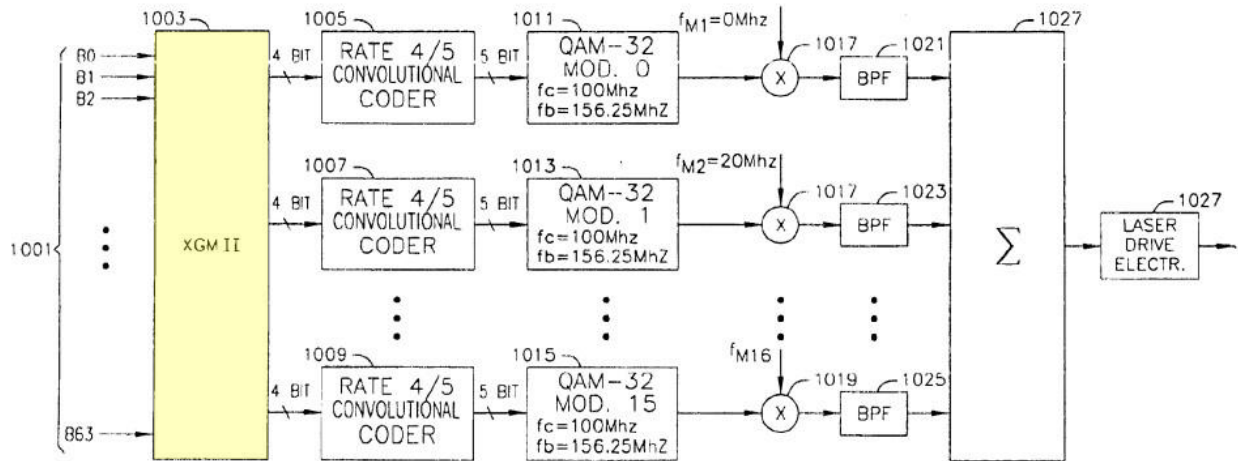


FIG. 10

Ex. 1005, Fig. 10 (annotated).

Agazzi '640 further discloses a receiver system that transmits parallel electrical signals through the electrical system interface (highlighted below), one of which includes the second electrical data signal. Ex. 1003, ¶134. This is depicted in Figure 12 by the parallel arrows to the right of the electrical system interface. Figure 12 also shows that the second electrical data signal, which is one of the arrows, is included with other electrical data signals in parallel.

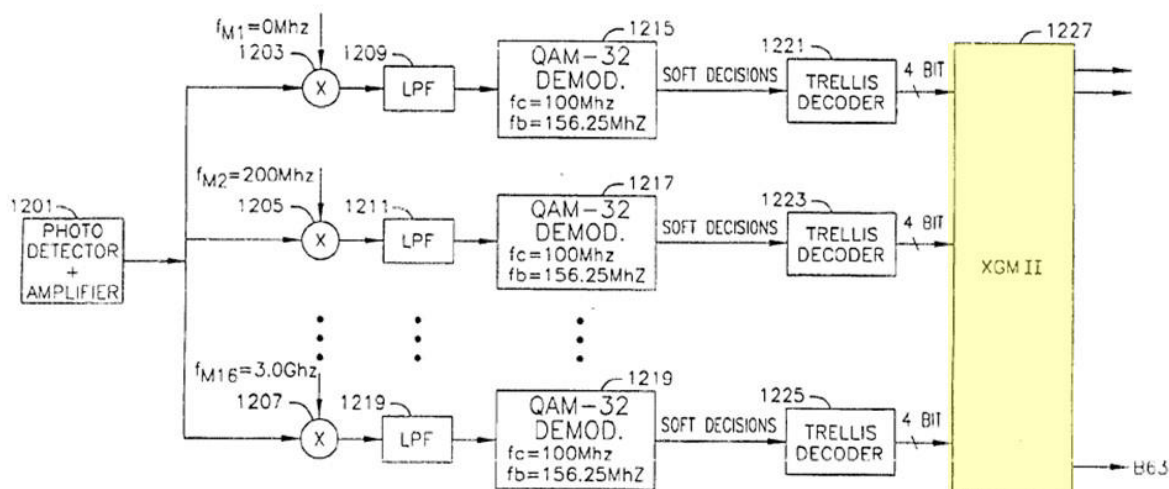


FIG. 12

Ex. 1005, Fig. 12 (annotated).

The electrical system interface thus includes parallel electrical signals that are received into and transmitted out of the electrical system interface. Ex. 1003, ¶¶132-34.

8. Claim 10: The pluggable optical transceiver module of claim 1, wherein the first electrical data signal and second electrical data signal includes parallel electrical data signals.

The combination of Agazzi '640 and Wei discloses claim 10 for the same reasons as described in claim 8.

9. Claim 11: The pluggable optical transceiver module of claim 1, wherein the electrical system interface includes an attachment unit interface (AUI) based interface.

The combination of Agazzi '640 and Wei discloses claim 11. Ex. 1003, ¶¶129-31. Wei discloses the preamble for the same reasons as described in claim

[1.pre]. Agazzi '640 discloses “the XAUI interface” as an alternative to the XGMII interface. Ex. 1005, 8:53-56. The XAUI interface is identified in the '181 Patent as a “conventional” system interface. Ex. 1001, 9:22-26. Moreover, prior art U.S. Patent No. 7,286,557 to Feuerstraeter explains that the XAUI interface stands for the “10Gb/s attachment unit interface (XAUI)” and is identified in the 802.3ae Ethernet standard. Ex. 1028, 1:39-45. A POSITA would have been familiar with the 10Gb/s attachment unit interface (XAUI) as it was in IEEE 802.3ae and would have understood the XAUI interface disclosed in Agazzi '640 was a type of electrical system interface that includes an attachment unit interface (AUI). Ex. 1003, ¶136.

10. Claim 12: The pluggable optical transceiver module of claim 1, wherein the first optical signal on a first wavelength is configured to emit into a first optical fiber and the second optical signal on a second wavelength is configured to be received from the first optical fiber.

The combination of Agazzi '640 and Wei renders claim 12 obvious. Ex. 1003, ¶138-40. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '640 discloses that the “optical transmitter 123 transmits the data across a fiber optic channel 125. The optical receiver 107 accepts the data from the fiber optic channel 125.” Ex. 1005, 7:14-24.

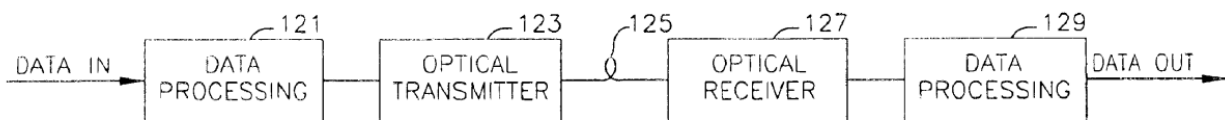


FIG. 1D

Id., Fig. 1D.

As depicted in Figure 1D, the optical transmitter transmits optical signals into the optical channel (where one of the transmitted signals is the first optical signal on a first wavelength) and the optical receiver receives optical signals from the optical channel (where one of the received signals is the second optical signal on a second wavelength). Ex. 1005, 7:14-24, 1D; Ex. 1003, ¶139. The optical channel that the signals traverse includes either a single or multiple optical fibers. Ex. 1003, ¶139. For example, U.S. Patent No. 6,005,694 teaches that “dozens of fibers may be included in a single cable.” Ex. 1011, 1:39-41. A POSITA would have understood that the optical channel includes either a single or multiple optical fibers and that the optical signals, including the first and second optical signals, traversed either the same (*i.e.*, first optical fiber) or different optical fibers (*i.e.*, first and second optical fibers), and that this was an obvious selection from a finite number of choices. Ex. 1003, ¶138-43.

11. Claim 13: The pluggable optical transceiver module of claim 1, wherein the first optical signal on a first wavelength is configured to emit into a first optical fiber and the second optical signal on a second wavelength is configured to be received from a second optical fiber.

The combination of Agazzi '640 and Wei renders claim 13 obvious for the same reasons as described in claim 12.

12. Claim 14: The pluggable optical transceiver module of claim 1, wherein the noise removed by the equalizer includes intersymbol interference (ISI).

The combination of Agazzi '640 and Wei discloses claim 14. Ex. 1003, ¶¶144-45. Wei discloses the preamble for the same reasons as described in claim [1.pre]. And, as explained in claim [1.I], Agazzi '640 discloses equalization to remove a type of noise called intersymbol interference.

13. Claim 17: The pluggable optical transceiver module of claim 1, wherein the digital to analog converter is configured to shape, condition, or emphasize the first electrical m-ary analog modulation signal for improved transmission performance.

The combination of Agazzi '640 and Wei discloses claim 17. Ex. 1003, ¶¶146-49. Wei discloses the preamble for the same reasons as described in claim [1.pre]. And, as explained in claim [1.C], Agazzi '640 discloses a digital to analog converter, and a POSITA would have understood that a digital to analog converter conditions signals from the digital to analog domain to assist with transmission as analog signals were required to drive the laser. Ex. 1003, ¶146-47.

14. Claim 22

Claim 22 is practically identical to Claim 1. The only difference is that claim 22 adds limitation [22.K], “wherein the m-ary modulator and the m-ary demodulator perform m-ary pulse amplitude modulation and de-modulation, respectively, that uses two or more bits per symbol.” The infringement contentions confirm that only

claim [22.K] is different as the contentions cite back to claim 1 for support for claim [22.pre]-[22.J]. Ex. 1031, 86-87.

The combination of Agazzi '640 and Wei discloses claim 22. Specifically, the combination of Agazzi '640 and Wei disclose claim [22.pre]-[22.J] for the same reasons described in claim [1.pre]-[1.J], and Agazzi '640 discloses claim [22.K]. Agazzi '640 discloses performing “Pulse Amplitude Modulation (PAM) ... to encode several bits per transmitted symbol” (Ex. 1005, 3:15-20), which the '181 Patent identifies as a type of m-ary modulation (Ex. 1001, 10:22-28). Agazzi '640 discloses the m-ary modulator and demodulator for the same reasons disclosed in claim [1.B] and [1.J].

B. Ground 2

1. Overview of Ground 2

i. Agazzi '640

See overview of Agazzi '640 in Ground 1.

ii. Wei

See overview of Wei in Ground 1.

iii. Agazzi '341

Agazzi '341 discloses “an optical transceiver module” that includes “digital signal processors that process signals to be transmitted and received over a channel.” Ex. 1009, 1:66-2:2, 3:34-36. The optical transceiver processes signals for an optical

channel using m-ary modulation, equalization, and forward-error-correcting codes. *Id.*, 2:8-29, 4:33-39; Ex. 1003, ¶89. Agazzi '341 further discloses “transmitter and receiver sections described herein are implemented as a transceiver integrated circuit constructed as a single chip.” Ex. 1009, 4:62-65. A goal of Agazzi '341 is “to achieve reliable data transmission at relatively high data transfer rates” in a cost-effective manner. Ex. 1009, 1:55-65; Ex. 1003, ¶89.

iv. Motivation to Combine

Agazzi '640 and Wei attempt to increase the data throughput rate in fiber-optic communications in a cost-effective manner. Ex. 1005, 1:23-49; Ex. 1006, 1:66-2:4; Ex. 1003, ¶163. Agazzi '640 discloses equalization as a technique to achieve this: “To make the most efficient use possible of the available channel bandwidth, channel equalization techniques may also be used.” Ex. 1005, 3:21-26. But, Agazzi '640 and Wei do not expressly disclose decision directed, or blind, equalization with coefficients.

Agazzi '341 relates to fiber-optic communications, like Agazzi '640 and Wei, and also discloses a “decision feedback equalizer” that uses “coefficients” to perform equalization in an optical transceiver. Ex. 1009, 10:11-22; Ex. 1003, ¶164-65. There were several reasons a POSITA would have been motivated to combine Agazzi '341 with Agazzi '640 and Wei.

First, decreasing the size of the transceiver was a stated goal Agazzi '640 (Ex. 1005, 9:33-41) and Wei (Ex. 1006, 1:66-2:4), and Agazzi '341 discloses packaging the transmitter and receiver sections of the transceiver together as an “integrated circuit constructed as a single chip.” Ex. 1009, 4:62-65. This was an important consideration because space is a limiting factor in many optical systems. Ex. 1003, ¶166.

Second, increasing data throughput was a stated goal in both Agazzi '640 (Ex. 1005, 3:4-3:11) and Wei (Ex. 1006, 1:66-2:1), and a transceiver with the equalization capabilities taught in Agazzi '341 more efficiently utilizes the available bandwidth which results in a higher data throughput rate. Ex. 1003, ¶167-68. Moreover, Agazzi '341 discloses m-ary modulation, like Agazzi '640. Ex. 1009, 4:33-35. Therefore, a POSITA would have understood the equalization methods from Agazzi '341 were particularly suited to systems that implement m-ary modulation, like the m-ary pluggable transceiver taught by the combination of Agazzi '640 and Wei. Ex. 1003, ¶167-68.

Third, implementing cost-effective methods was a stated goal in Agazzi '640 (Ex. 1005, 1:45-49) and Wei (Ex. 1006, 1:54-56), and the equalization techniques disclosed in Agazzi '341 were cost-effective ways to maintain data reliability while increasing data throughput because they did not require replacement of older fiber infrastructure, which can be costly. Ex. 1003, ¶169.

Accordingly, a POSITA would have looked to Agazzi '341—as it discloses a cost-effective technique for maintaining data reliability in m-ary systems at high throughput rates—and would have been motivated to implement its equalization techniques into the m-ary pluggable transceiver from Agazzi '640 and Wei to maintain reliable data at high rates. Ex. 1003, ¶¶169-70. Moreover, a POSITA would have had a reasonable expectation of success in adding the equalization capabilities to the m-ary pluggable transceiver to produce expected results, which were stated goals in the references. Ex. 1003, ¶170.

2. Claim 15: The pluggable optical transceiver module of claim 1, wherein the equalizer performs decision directed equalization on the second m-ary modulation signal to remove noise.

The combination of Agazzi '640, Wei, and Agazzi '341 discloses claim 15. Ex. 1003, ¶¶171-72. Agazzi '640 and Wei disclose the limitations in claim 1. Agazzi '341 discloses an equalizer that performs “decision feedback equalization” (i.e., decision directed equalization). Ex. 1009, 7:42-43; Ex. 1003, ¶171. Agazzi '341 further discloses that “channel information [is] generated ... in the decision feedback equalizer” in the form of coefficients. Ex. 1009, 10:14:25; Ex. 1003, ¶171. As decision directed equalization determines channel information based on received signals without a training sequence, the decision feedback equalization in Agazzi '341 covers decision directed equalization because it generates coefficients

representative of channel information inside the equalizer with no training sequence.

Ex. 1003, ¶171.

3. Claim 16: The pluggable optical transceiver module of claim 1, wherein the equalizer performs blind equalization on the second m-ary modulation signal to remove noise.

The combination of Agazzi '640, Wei, and Agazzi '341 discloses claim 16. Ex. 1003, ¶¶173-74. Agazzi '640 and Wei disclose the limitations in claim 1. As explained in claim 15 (*supra* claim 15), Agazzi '341 discloses decision directed equalization. Decision directed equalization is a well-known type of blind equalization. Ex. 1018, Abstract (“Decision-directed (DD) equalization is the most primitive blind equalization (BE) method.”); Ex. 1003, ¶173. Accordingly, the decision directed equalization disclosed in Agazzi '341 is a type of blind equalization. *Id.*, ¶173.

4. Claim 23

Claim 23 is practically identical to Claim 1. The only difference is that claim 23 adds limitation [23.K], “wherein the equalizer includes coefficients or weights configured to remove noise from the second m-ary modulation signal.” The infringement contentions confirm that only claim [23.K] is different as the contentions cite back to claim 1 for support for claim [23.pre]-[23.J]. Ex. 1031, 88-90.

The combination of Agazzi '640, Wei, and Agazzi '341 discloses claim 23. Specifically, the combination of Agazzi '640 and Wei disclose claim [23.pre]-[23.J] for the same reasons described in claim [1.pre]-[1.J], and Agazzi '341 discloses claim [23.K]. Agazzi '341 discloses “decision feedback equalizer coefficients.” Ex. 1009, 10:12-13. Agazzi '341 further discloses that the coefficients represent channel information: “[T]he channel information consists of coefficients generated by an adaptive equalization algorithm.” *Id.*, 10:36-37. A POSITA would have understood that equalizers remove noise by multiplying different versions of a received signal with coefficients based on channel characteristics, and then summing the weighted signals to form an equalized signal. Ex. 1003, ¶186. Accordingly, the “equalizer” in Agazzi '341 includes “coefficients” that represent “channel information,” which allows the equalizer to remove noise from received signals by adapting to the channel characteristics. *Id.*

C. Ground 3

1. Overview of Ground 3

i. Agazzi '341

See overview of Agazzi '341 in Ground 2.

ii. Wei

See overview of Wei in Ground 1.

iii. Motivation to Combine

Agazzi '341 and Wei are directed to optical transceiver modules with integrated optoelectronics. Ex. 1009, 4:62-65; Ex. 1006, 1:24-30; Ex. 1003, ¶188. Indeed, Agazzi '341 and Wei both disclose a transceiver module with a system interface, an optical transmitter, an optical receiver, and an amplifier. Ex. 1009, Figs. 5, 23, 1:66-2:7; Ex. 1006, 1:24-45, 4:45-46; Ex. 1003, ¶188.

Specifically, Agazzi '341 discloses a transceiver module that performs signal processing including m-ary modulation/demodulation, equalization, and error-correction, which allows data to be transmitted at higher rates through existing fiber infrastructure. Ex. 1009, 1:55-2:20, 4:33-35; Ex. 1003, ¶190. Agazzi '341 further discloses “transmitter and receiver sections described herein are implemented as a transceiver integrated circuit constructed as a single chip.” Ex. 1009, 4:62-65. Agazzi '341 does not, however, expressly disclose a pluggable transceiver module as taught in Wei.

Wei discloses a “hot pluggable optical transceiver in a small form pluggable ... type package.” Ex. 1006, 3:29-32. Ex. 1006, 1:66-2:4. Wei teaches how to package larger transceiver modules into a pluggable SFP package by vertically stacking the transmitter and receiver printed circuit boards. Ex. 1006, 2:28-35. Wei further teaches that a compact pluggable transceiver is easier to replace by

technicians and it can be produced with reduced manufacturing costs. Ex. 1006, 1:53-2:11.

A POSITA would have understood the transceiver as taught in Agazzi '341, with integrated optoelectronics on a single circuit, would have been implemented in a pluggable form factor as taught in Wei. Ex. 1003, ¶191. And a POSITA would have been motivated to combine the transceiver module of Agazzi '341 with the pluggable form factor of Wei for several reasons to create a cost-effective pluggable transceiver with greater data throughput that is easily removable. *Id.*

First, market pressures were increasing the demand for compact pluggable transceivers with high data throughput rates in a standardized form factor. Ex. 1003, ¶192. “[U]sers desire[d] a more compact, high throughput fiber optic transceiver ... in a small form pluggable (SFP), LC package.” Ex. 1006, 1:66-2:4. As consumer demand was increasing, the fiber-optic industry standardized the pluggable SFP form factor to ensure compatibility across fiber-optic systems. Ex. 1014. Accordingly, because of consumer preferences and industry standards, a POSITA would have understood that higher throughput pluggable transceivers in an SFP form factor were needed. Ex. 1003, ¶192.

Second, pluggable transceivers were easier to install and replace compared to mounted transceivers. Ex. 1006, 2:5-11; Ex. 1003, ¶192. This allowed for faster servicing or replacement of damaged transceivers (*i.e.*, less down time during

maintenance), decreased the chances of improper installation, and decreased the likelihood that components near the transceiver would be damaged during servicing. Ex. 1006, 2:5-11; Ex. 1003, ¶192.

Third, decreasing the size was a stated goal in Agazzi '341 (Ex. 1009, 4:62-65) and Wei (Ex. 1006, 1:66-2:4), and pluggable transceivers in an SFP form factor were smaller, more compact, and take up less room than other transceivers. Ex. 1003, ¶193. Indeed, Wei teaches vertically stacking components so as to enable a transceiver, such as the transceiver in Agazzi '341, to be integrated into a pluggable. Ex. 1006, 2:28-32. This was an important consideration because space is a limiting factor in many optical systems. *Id.*

Fourth, decreasing costs was a stated goal in both Agazzi '341 (Ex. 1009, 1:50-51) and Wei (Ex. 1006, 1:54-56), and a pluggable transceiver that performs m-ary modulation was cost-effective. Ex. 1003, ¶194. As pluggable transceivers were easier to install, repair, and replace, less skilled technicians were needed to service the communication system. Ex. 1006, 2:5-11; Ex. 1003, ¶194. Technicians also did not have to repair or replace larger mounted equipment when an optoelectrical component failed in a pluggable transceiver. Ex. 1003, ¶194. Instead, the technician simply replaced the hot pluggable transceiver with a new transceiver. *Id.* Manufacturing costs were also decreased when fabricating pluggable transceivers as taught in Wei. Ex. 1006, 1:45-60. Further, smaller, more compact pluggable

transceivers take up less space which allowed the optical equipment that the pluggable transceivers interfaced with to take up less space, thus saving on rent and utilities. Ex. 1003, ¶186. Costs were also saved by m-ary modulation because it allowed for higher data speeds without the need to replace older fiber channels. Ex. 1009, 1:55-59; Ex. 1003, ¶194.

Fifth, increasing data throughput was a stated goal in both Agazzi '341 (Ex. 1009, 1:46-51) and Wei (Ex. 1006, 1:66-2:1), and an m-ary pluggable transceiver would have higher data throughput rates as m-ary modulation allowed more data to be transferred in the same channel over the same amount of time as traditional binary modulation. Ex. 1001, 10:11-19; Ex. 1003, ¶195.

Accordingly, a POSITA who wanted to maintain high data throughput rates as taught by Agazzi '341 would have looked to Wei when evaluating how to package a high throughput transceiver in a pluggable form because Wei also teaches high data throughput. Ex. 1003, ¶196. As Agazzi '341 and Wei share many stated goals, a POSITA would have had a reasonable expectation of success in combining the transceivers in Agazzi '341 and Wei to produce expected results, which were stated goals in the references. *Id.*, ¶196.

A POSITA would also have been motivated to combine a transceiver that performs m-ary modulation, like in Agazzi '341, with a pluggable transceiver, like in Wei, after reviewing the prior art. *Id.*, ¶197. For example, U.S. Patent No.

6,665,498 to Jiang discloses that “it is easier to make the transceiver pluggable” (Ex. 1010, 5:34-41) and U.S. Patent No. 6,295,272 to Feldman discloses a pluggable transceiver module that conveys m-ary modulated signals from a subcarrier channel to a high-speed channel (Ex. 1019, Abstract, 6:21-29, Fig. 13). Ex. 1003, ¶¶197-98.

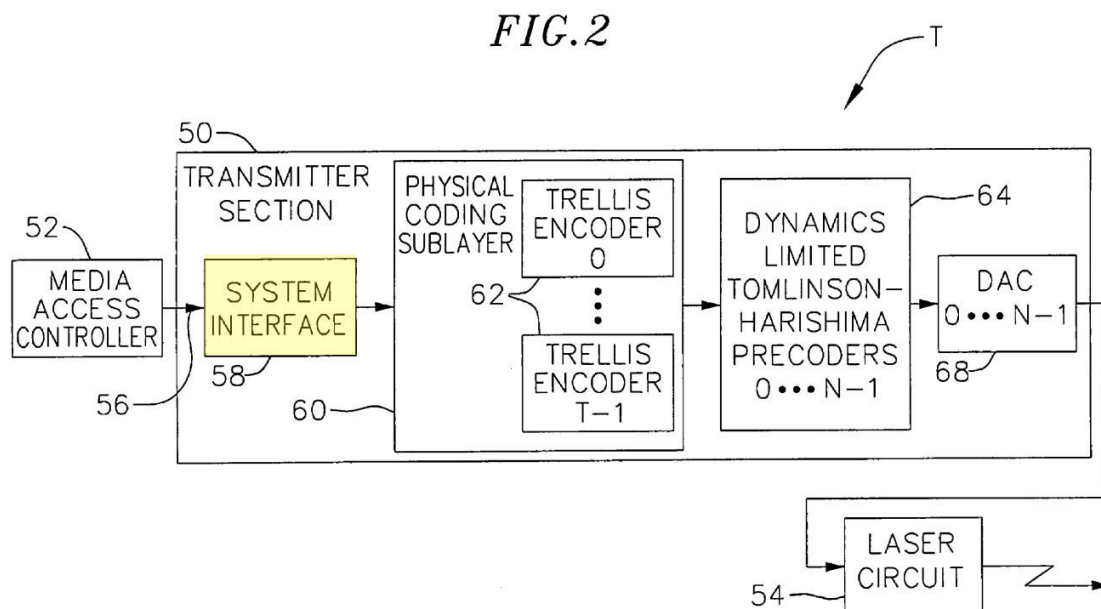
2. Claim 1

i. [1.pre]

To the extent the preamble is limiting, Wei discloses claim [1.pre] for the same reasons as described at Ground 1 in claim [1.pre].

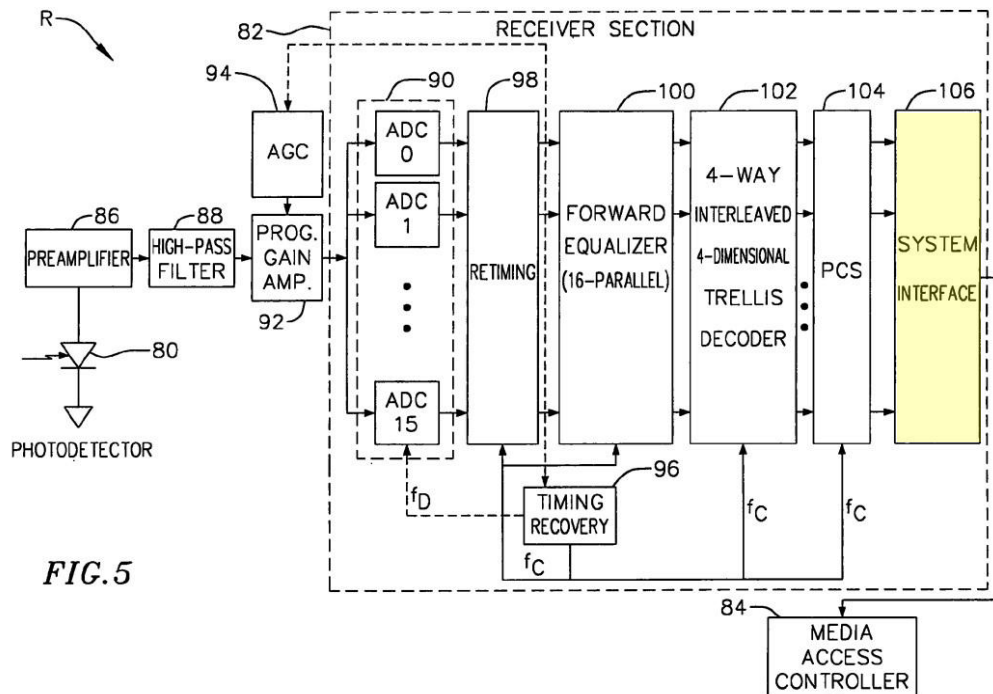
ii. [1.A]

Agazzi '341 discloses claim [1.A]. Ex. 1003, ¶¶201-04. Agazzi '341 discloses an optical transceiver module that includes a transmitter system that receives electrical “digital input signals” through the “system interface” (highlighted below). Ex. 1009, 1:15-18, 14:7-9, Fig. 2; Ex. 1003, ¶201; *see also* Claim 11 *infra*.



Ex. 1009, Fig. 2 (annotated). The electrical system interface receives many electrical data signals through it, each one of which is an example of the claimed “first electrical data signal.” *Id.*; Ex. 1003, ¶202.

Agazzi '341 also discloses an optical transceiver module that includes a receiver system with “symbol-by-symbol decoders [] to produce digital output signals” which are transmitted through a “system interface” (highlighted below). Ex. 1009, 14:19-24, Fig. 5; Ex. 1003, ¶203.



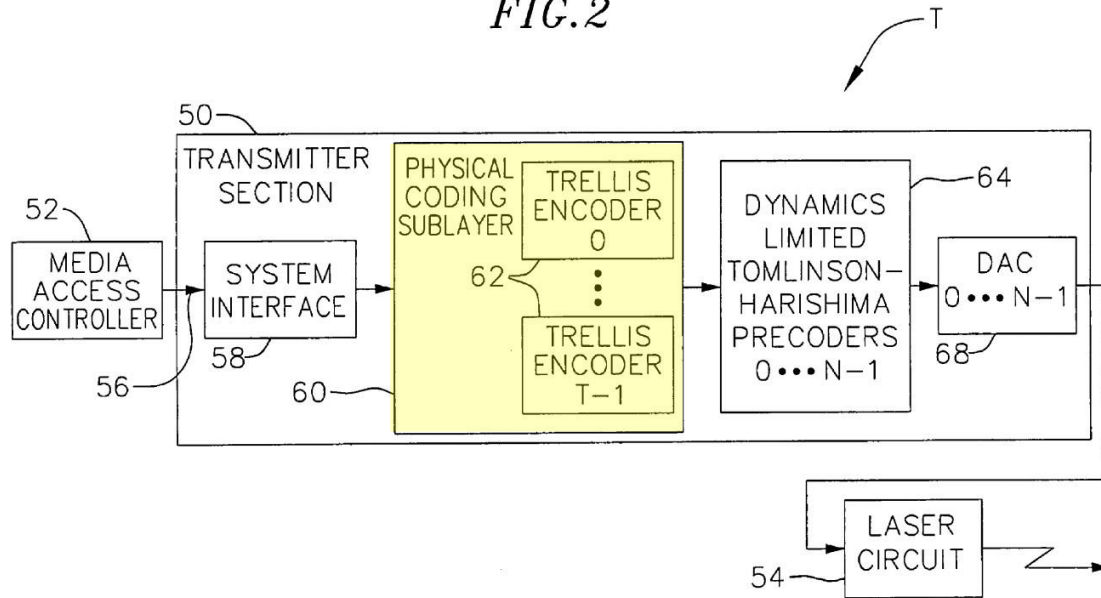
Ex. 1009, Fig. 5 (annotated). The electrical system interface has many electrical data signals transmitted through it, each one of which is an example of the claimed “second electrical data signal.” Ex. 1003, ¶204.

Agazzi '341 also teaches that the system interface can be an “XAUI interface” or “X-GMII interface” (Ex. 1009, 14:65-15:3; *see also* Claim 11 *infra*), which are both conventional types of interfaces identified by the '181 Patent. Ex. 1001, 9:25.

iii. [1.B]

Agazzi '341 discloses claim [1.B]. Ex. 1003, ¶¶205-06. Agazzi '341 discloses an optical transceiver module with a transmitter system that performs “five-level pulse amplitude modulation (PAM-5)” (Ex. 1009, 4:33-39), which the '181 Patent specifically identifies as a type of m-ary modulation (Ex. 1001, 10:22-28). Agazzi '341 also discloses trellis coding (highlighted below) in combination with a PAM-5 system. Ex. 1009, 4:54-57. Agazzi '341 discloses “simplified block diagrams of selected components” in Figure 2 below and illustrates a trellis encoder. Ex. 1009, 4:58-60. A POSITA would have understood the trellis coding also includes a modulator as modulators were necessary to perform PAM modulation. Ex. 1003, ¶205. Indeed, a prior art textbook confirms what a POSITA would have understood and corroborates Dr. Prucnal's testimony, as it states that trellis encoding systems “are more complex in that they combine error-correction with the modulation.” Ex. 1015, 121.

FIG. 2

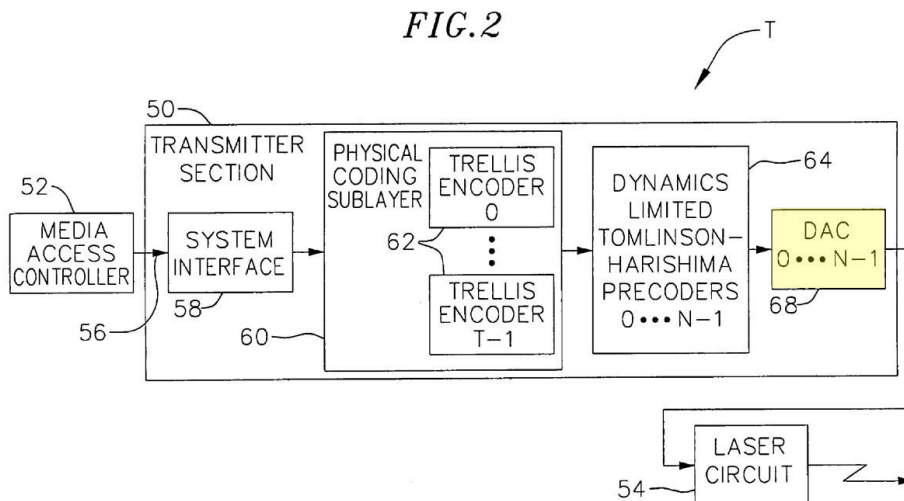


Ex. 1009, Fig. 2 (annotated). Moreover, infringement contentions against Petitioner in a pending case (No. 2:22-cv-00309-JRG-RSP (E.D. Tex.)) explain that an “m-ary modulator, or its equivalent” is present if m-ary modulation is occurring. Ex. 1031, 14. The transmitter system thus includes a PAM-5 modulator (*i.e.*, m-ary modulator) within the trellis encoder that converts a received signal (*i.e.*, first electrical encoded data signal) to a modulated signal (*i.e.*, first m-ary modulation signal) using PAM-5 modulation (*i.e.*, m-ary modulation). Ex. 1003, ¶¶206.

iv. [1.C]

Agazzi '341 discloses claim [1.C]. Ex. 1003, ¶¶207-08. Agazzi '341 discloses a transmitter system with “digital to analog converters (DACs).” Ex. 1009, 4:12-20. As shown in Figure 2, after passing through the processing elements, the

signals pass through a digital to analog converter (highlighted below). Ex. 1003, ¶201.



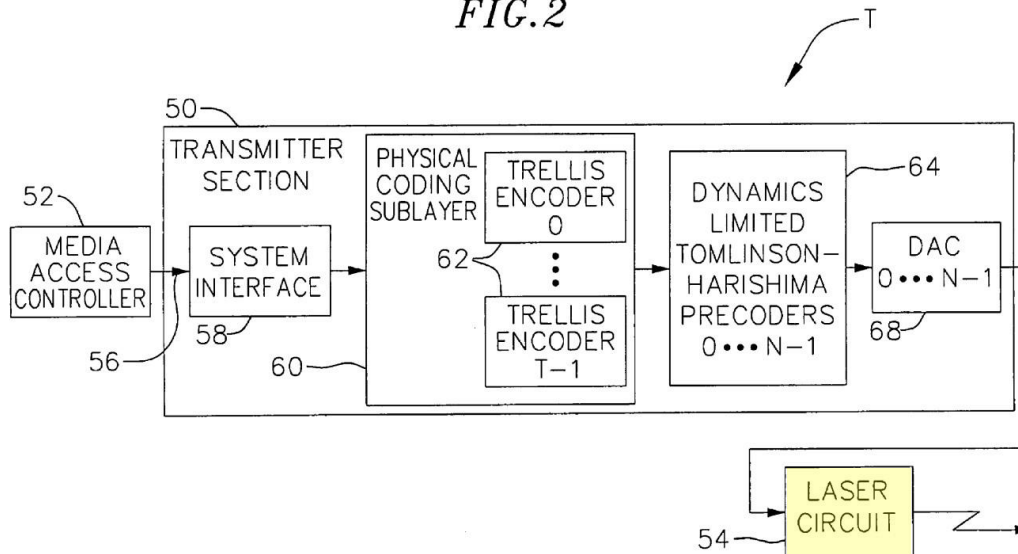
Ex. 1009, Fig. 2 (annotated). As depicted in Figure 2, the digital to analog converter receives a digital signal (*i.e.*, first m-ary modulation signal) and converts it to an analog signal (*i.e.*, first electrical m-ary analog modulation signal). Ex. 1003, ¶208.

v. [1.D]

Agazzi '341 discloses claim [1.D]. Ex. 1003, ¶¶209-10. Agazzi '341 discloses “a laser driver.” Ex. 1009, 13:14. Agazzi '341 also discloses a “laser circuit [that] generates optical signals that are sent over an optical channel.” *Id.*, 4:66-5:3. The laser circuit (highlighted below) includes the laser driver and laser, and Agazzi '341 teaches that the laser is an “optical transmitter.” Ex. 1009, 15:52-54; Ex. 1003, ¶209. A POSITA would have understood the laser driver amplifies the signals to ensure they were sufficiently strong to drive the laser, which must emit optical signals that can traverse long distances over optical fibers. Ex. 1003, ¶210.

Indeed, a prior art textbook confirms what a POSITA would have understood and corroborates Dr. Prucnal's testimony, as it states a "laser drive circuit ... consists of two differential amplifiers ... The two differential amplifiers provide sufficient modulation current amplitude for the laser." Ex. 1017, 400.

FIG. 2



Ex. 1009, Fig. 2 (annotated). The laser driver (*i.e.*, driver) in the laser circuit thus amplifies a received signal (*i.e.*, first electrical m-ary analog modulation signal) to produce an amplified signal (*i.e.*, amplified first electrical m-ary analog modulation signal) to drive the laser (*i.e.*, optical transmitter). Ex. 1003, ¶210.

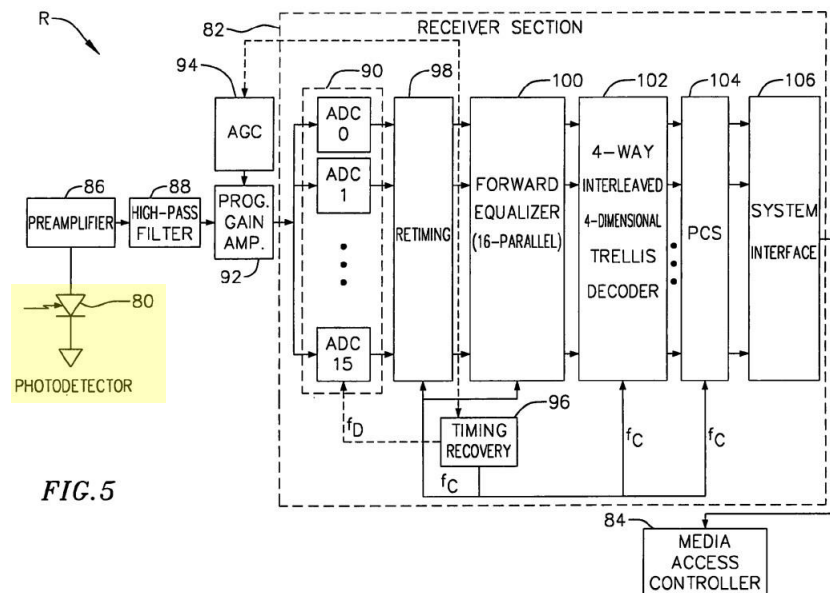
vi. [1.E]

Agazzi '341 discloses claim [1.E]. Ex. 1003, ¶211. As explained in claim [1.D], Agazzi '341 discloses a laser circuit with a laser driver that drives a laser, which Agazzi '341 teaches is an optical transmitter. Agazzi '341 also discloses that the "laser circuit 54 generates optical signals that are sent over an optical channel."

Ex. 1009, 4:66-5:3. The laser (i.e, optical transmitter) is driven by (i.e., is responsive to) an electrical signal (i.e., amplified first electrical m-ary analog modulation signal) from the laser driver and produces a corresponding (i.e. representative) optical signal (i.e., first optical signal on a first wavelength) that it emits onto an optical fiber. Ex. 1003, ¶211.

vii.[1.F]

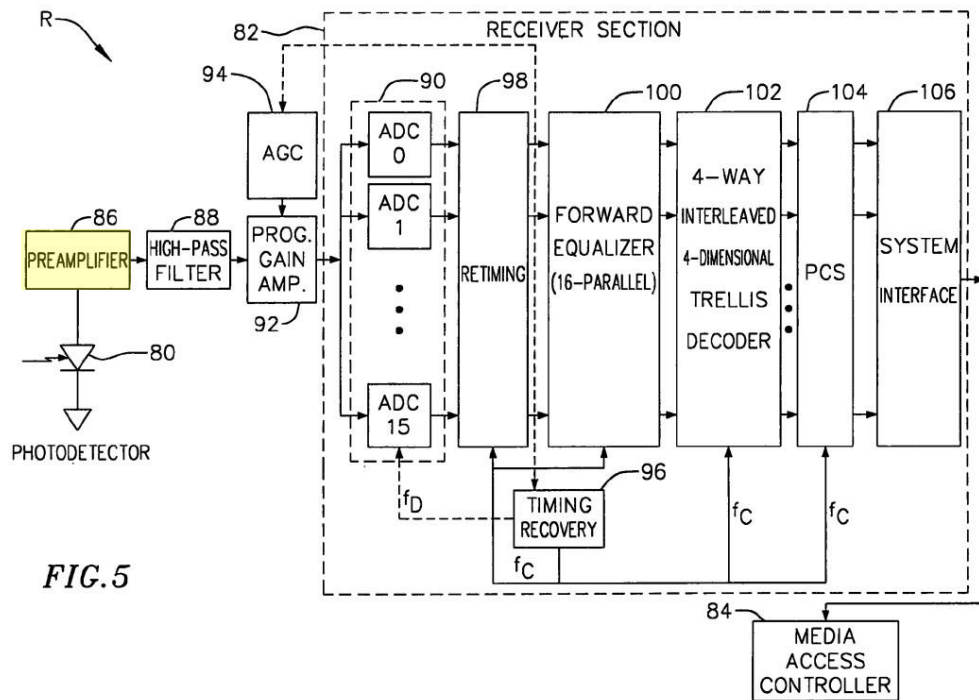
Agazzi '341 discloses claim [1.F]. Ex. 1003, ¶212-13. Agazzi '341 discloses a receiver system that includes a “photodetector 80 [that] receives optical signals from an optical channel ... to provide an encoded data stream to a receiver section 82.” Ex. 1009, 6:41-44. Agazzi '341 also discloses that the data stream produced by the photodetector (highlighted below) is an electrical analog signal because the signal later passes through analog to digital converters. *Id.*, 6:50-51, Fig. 5; Ex. 1003, ¶213.



Id., Fig. 5 (annotated). As depicted in Figure 5, the photo detector (*i.e.*, optical detector) receives an optical signal (*i.e.*, second optical signal on a second wavelength) from the optical fiber and produces a corresponding electrical analog signal. Ex. 1009, 6:41-44; Ex. 1003, ¶213.

viii. [1.G]

Agazzi '341 discloses claim [1.G]. Ex. 1003, ¶214-15. Agazzi '341 discloses “that output of a photodetector 80 is amplified by a preamplifier 86.” Ex. 1009, 6:46-48.



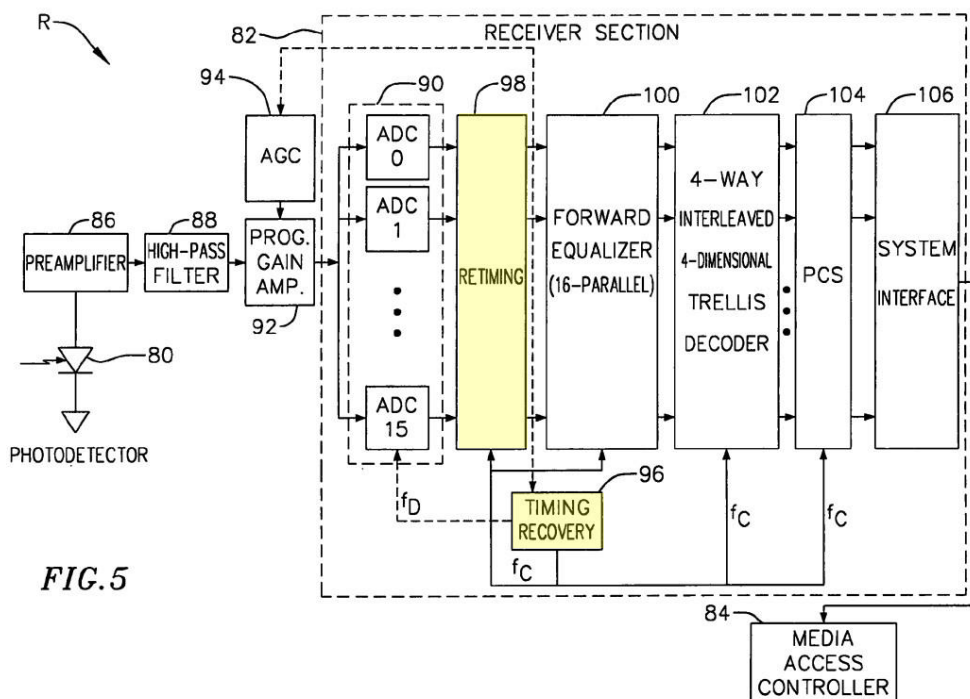
Ex. 1009, Fig. 5 (annotated). As depicted in Figure 5, the output signal from the photodetector (*i.e.*, electrical analog signal) is amplified by the preamplifier (*i.e.*,

amplifier) to produce an amplified signal (i.e, amplified electrical analog signal).

Ex. 1009, 6:46-48; Ex. 1003, ¶215.

ix. [1.H]

Agazzi '341 discloses claim [1.H]. Ex. 1003, ¶216-18. Agazzi '341 discloses that, after the electrical signals are amplified, they pass through “retiming ... to, in effect, align the signals ... during each clock cycle” and through a “timing recovery circuit” that “provides a number of clocks to the components of the receiver.” Ex. 1009, 7:14-17, 6:61, Fig. 5; Ex. 1003, ¶216. The retiming and timing recovery circuit (highlight in yellow) recovers clock and data information. Ex. 1003, ¶¶216-17.

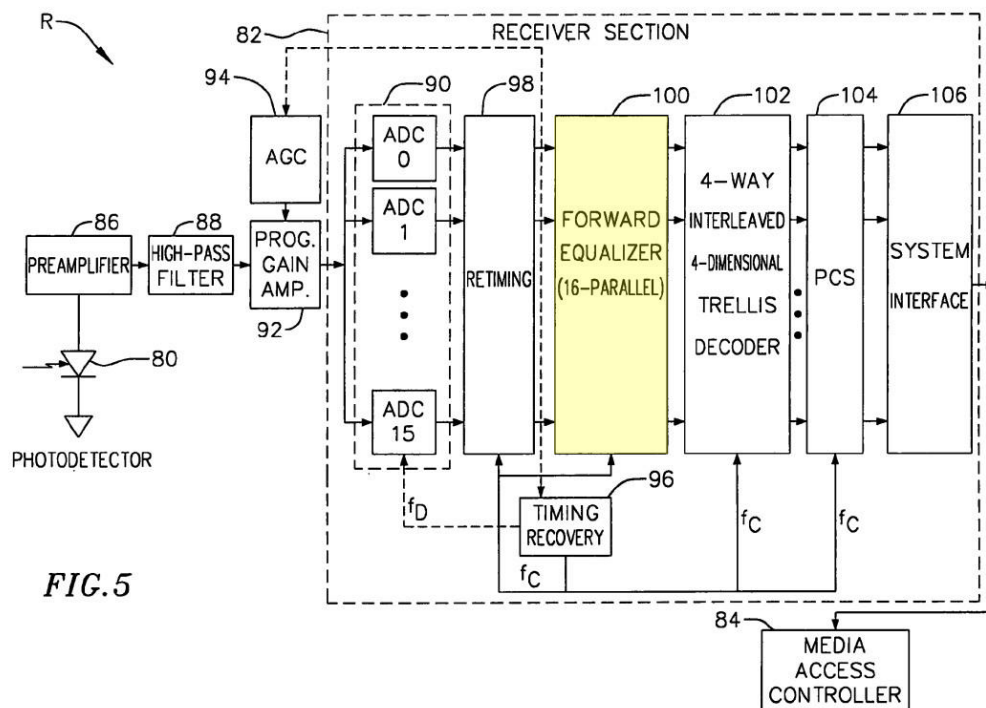


Ex. 1009, Fig. 9 (annotated).

Moreover, it was also well-known in the art at the time that clock and data recovery was a routine part of signal processing that occurs in the receiver. Ex. 1003, ¶218. As depicted in Figure 5, retiming and timing recovery circuit (*i.e.*, clock data recovery unit) receives an input signal (*i.e.*, amplified electrical analog signal), recovers clock and data information, and produces an output signal (*i.e.*, secondary modulation signal). Ex. 1003, ¶218.

x. [1.I]

Agazzi '341 discloses claim [1.I]. Ex. 1003, ¶¶219-20. Agazzi '341 discloses “a forward equalizer that may be used in the receiver of FIG. 5.” Ex. 1009, 2:57-58.

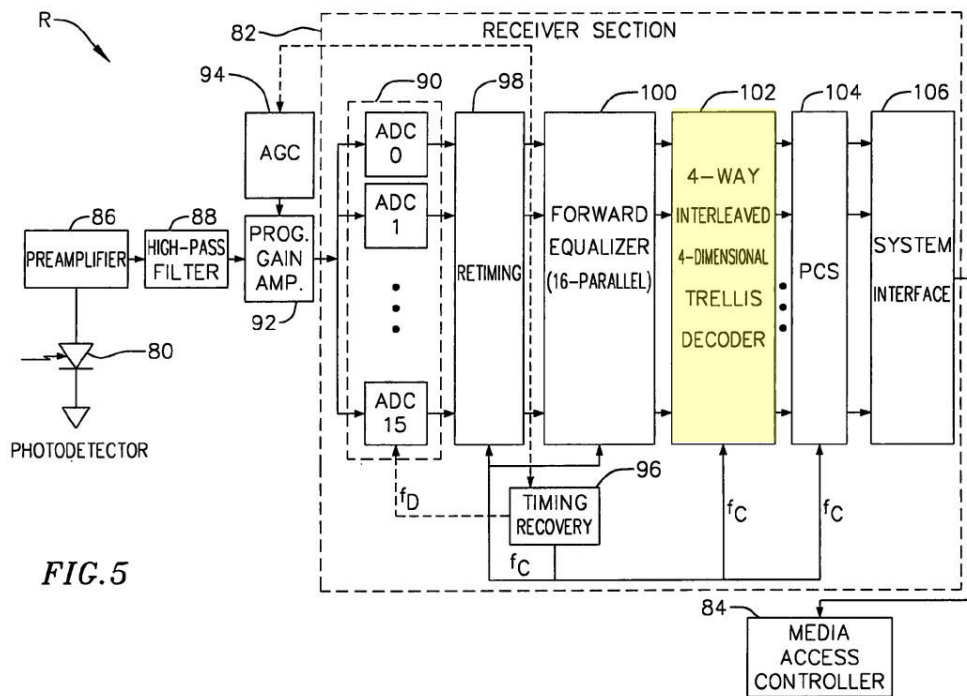


Id., Fig. 5 (annotated). Agazzi '341 also teaches incorporating “equalization for compensating for intersymbol interference introduced by the limited bandwidth of

the multimode fiber.” *Id.*, 4:40-49. The ’181 Patent specifically discloses that “equalization ... remove[s] undesired information (e.g. intersymbol interference (ISI)) or noise.” Ex. 1001, 12:20-26. Moreover, a POSITA would have understood that equalizers were implemented to reduce noise like intersymbol interference, as this was well known at the time. Ex. 1003, ¶220. The equalizer in Agazzi ’341 thus receives a signal (*i.e.*, second m-ary modulation signal) and removes noise from the signal to produce an equalized signal (*i.e.*, equalized second m-ary modulation signal). *Id.*

xi. [1.J]

Agazzi ’341 discloses claim [1.J]. Ex. 1003, ¶¶221-22. As discussed in claim [1.B], Agazzi ’341 utilizes “PAM-5” modulation, which the ’181 Patent specifically identifies as a type of m-ary modulation. Agazzi ’341 further discloses that the receiver system includes a “symbol-by-symbol decoder ... to determine, for example, the PAM level of the received signal.” Ex. 1009, 14:28-32. The decoder is highlighted in Figure 5 below.



Agazzi '341 also discloses that trellis coding and decoding is done in combination with a PAM-5 system, which requires modulation and demodulation. Ex. 1009, 4:54-57. Agazzi '341 discloses “simplified block diagrams of selected components” in Figure 5 above and illustrates a trellis decoder. Ex. 1009, 4:58-60. A POSITA would have understood that trellis decoding also included a demodulator as demodulators were necessary to perform PAM demodulation. Ex. 1003, ¶221-22. Indeed, a prior art textbook confirms what a POSITA would have understood and corroborates Dr. Prucnal’s testimony, as it states that trellis encoding systems “are more complex in that they combine error-correction with the modulation.” Ex. 1015, 121. Moreover, the infringement contentions against Petitioner state that an m-ary demodulator must be present: “If m-ary modulation is used, the receiving

functionality must include a m-ary-type demodulator.” Ex. 1031, 73. The trellis decoder thus includes a PAM-5 demodulator (*i.e.*, m-ary demodulator) to produce a demodulated signal (*i.e.*, second electrical encoded data signal) from the received signal (*i.e.*, equalized second m-ary modulation signal). Ex. 1003, ¶¶221-22. Moreover, the ’181 Patent teaches that m-ary demodulators decrease the number of bits per symbol. Ex. 1001, 15:31-33.

3. Claim 2

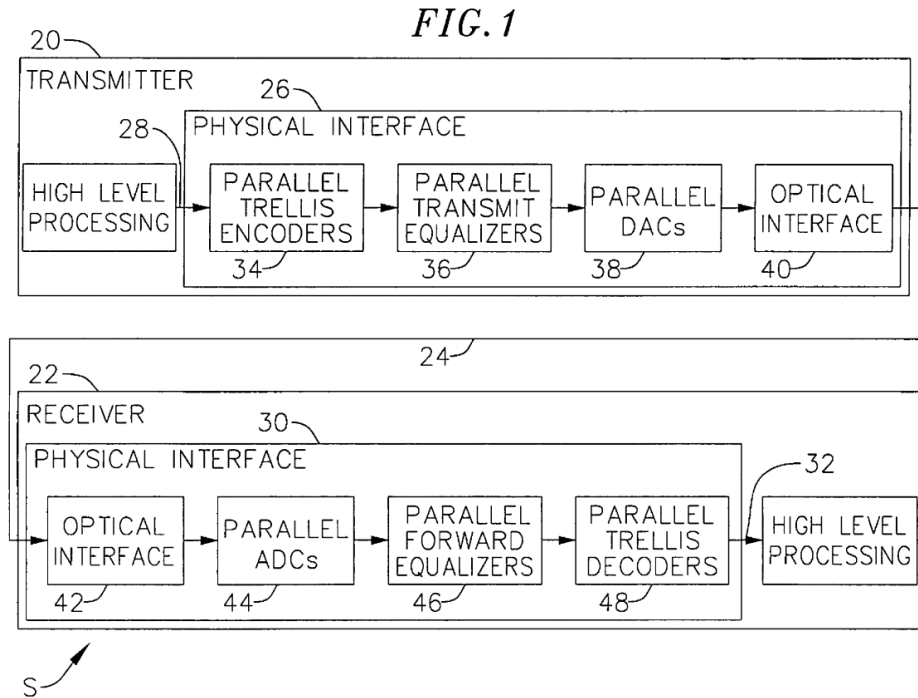
Wei discloses claim 2 for the same reasons as described in Ground 1 at claim 2.

4. Claim 3

Wei discloses claim 3 for the same reasons as described in Ground 1 at claim 3.

5. Claim 8

The combination of Agazzi ’341 and Wei discloses claim 8. Ex. 1003, ¶225-27. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi ’341 discloses “parallel processing in the transmitter, receiver and data converters.” Ex. 1009, 4:50-57. For example, Figure 1 depicts the parallel processing capabilities of the transceiver.



Id., Fig. 1. A POSITA would have understood based on the parallel processing capabilities that the electrical system interface (*supra* claim [1.A]) in the transceiver was configured to receive and transmit parallel electrical signals, and that there were multiple such signals (including the first and second electrical data signals). Ex. 1003, ¶225-229. As the first and second electrical data signals are each one of a number of signals that are transmitted and received in parallel, the first and second electrical data signals are parallel data signals and are included with other data signals that are likewise transmitted and received in parallel.

6. Claim 10

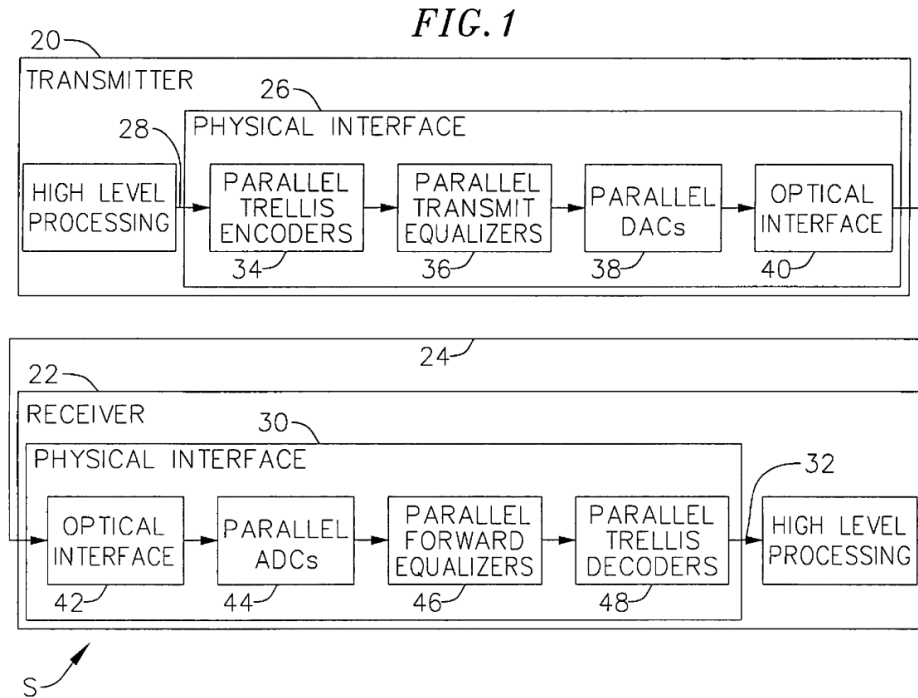
The combination of Agazzi '341 and Wei disclose claim 10 for the same reasons as described in claim 8.

7. Claim 11

The combination of Agazzi '341 and Wei discloses claim 11. Ex. 1003, ¶¶231-32. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '341 discloses the “XAUI interface” as an option for the system interface. Ex. 1009 at 15:1. The XAUI interface is identified in the '181 Patent as a “conventional” system interface. Ex. 1001, 9:22-26. Moreover, prior art U.S. Patent No. 7,286,557 to Feuerstraeter explains that the XAUI interface stands for the “10Gb/s attachment unit interface (XAUI)” and is identified in the 802.3ae Ethernet standard. Ex. 1028, 1:39-45. A POSITA would have been familiar with the 10Gb/s attachment unit interface (XAUI) as it was in IEEE 802.3ae and would have understood the XAUI interface disclosed in Agazzi '341 was a type of electrical system interface that includes an attachment unit interface (AUI). Ex. 1003, ¶231.

8. Claim 12

The combination of Agazzi '341 and Wei renders claim 12 obvious. Ex. 1003, ¶233-34. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '341 discloses that a “transmitter 20 sends data to a receiver 22 over an optical channel 24” (Ex. 1009, 3:52-53) where the “optical channel typically consists of a standard ... fiber optic cable.” (Ex. 1009, 4:33-35).



Id., Fig. 1.

The optical transmitter thus transmits optical signals into the optical channel (where one of the transmitted signals is the first optical signal on a first wavelength) and the optical receiver receives optical signals from the optical channel (where one of the received signals is the second optical signal on a second wavelength). Ex. 1009, 3:52-53, 4:33-35, Fig. 1; Ex. 1003, ¶234. The optical channel that the signals traverse, which Agazzi '341 teaches is a standard fiber optic cable, includes either a single or multiple optical fibers. Ex. 1003, ¶234. For example, U.S. Patent No. 6,005,694 teaches that “dozens of fibers may be included in a single cable.” Ex. 1011, 1:39-41. A POSITA would have understood that the optical channel includes either a single or multiple optical fibers and that the optical signals, including the first and second optical signals, traversed either the same (*i.e.*, first optical fiber) or

different optical fibers (*i.e.*, first and second optical fibers), and that this was an obvious selection from a finite number of choices. Ex. 1003, ¶234, 237.

9. Claim 13

The combination of Agazzi '341 and Wei renders claim 13 obvious for the same reasons as described in claim 12.

10. Claim 14

The combination of Agazzi '341 and Wei discloses claim 14 for the same reasons as in claim [1.pre] and [1.I]. Specifically, Wei discloses a pluggable optical transceiver module and Agazzi '640 discloses equalization to remove a type of noise called intersymbol interference.

11. Claim 15

The combination of Agazzi '341 and Wei discloses claim 15. Ex. 1003, ¶241-42. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '341 discloses the other limitations in claim 15 for the same reasons as in Ground 2 at claim 15.

12. Claim 16

The combination of Agazzi '341 and Wei discloses claim 16. Ex. 1003, ¶243-44. Wei discloses the preamble for the same reasons as described in claim [1.pre]. Agazzi '341 discloses the other limitations in claim 16 for the same reasons as in Ground 2 at claim 16.

13. Claim 17

The combination of Agazzi '341 and Wei discloses claim 17. Ex. 1003, ¶¶245. Wei discloses the preamble for the same reasons as described in claim [1.pre]. And, as explained in claim [1.C], Agazzi '341 discloses a digital to analog converter, and a POSITA would have understood that a digital to analog converter conditions signals from the digital to analog domain to assist with transmission as analog signals were required to drive the laser. Ex. 1003, ¶245-46.

14. Claim 22

Claim 22 is practically identical to Claim 1. The only difference is that claim 22 adds limitation [22.K], “wherein the m-ary modulator and the m-ary demodulator perform m-ary pulse amplitude modulation and de-modulation, respectively, that uses two or more bits per symbol.” The infringement contentions confirm that only claim [22.K] is different as the contentions cite back to claim 1 for support for claim [22.pre]-[22.J]. Ex. 1031, 86-87.

The combination of Agazzi '341 and Wei discloses claim 22. Specifically, the combination of Agazzi '341 and Wei disclose claim [22.pre]-[22.J] for the same reasons described in claim [1.pre]-[1.J], and Agazzi '341 discloses claim [22.K] for the same reasons described in claim [1.B] and [1.J]. Specifically, Agazzi '341 discloses pulse amplitude modulation.

15. Claim 23

Claim 23 is practically identical to Claim 1. The only difference is that claim 23 adds limitation [23.K], “wherein the equalizer includes coefficients or weights configured to remove noise from the second m-ary modulation signal.” The infringement contentions confirm that only claim [23.K] is different as the contentions cite back to claim 1 for support for claim [23.pre]-[23.J]. Ex. 1031, 88-90.

The combination of Agazzi ’341 and Wei discloses claim 23. Specifically, the combination of Agazzi ’341 and Wei disclose claim [23.pre]-[23.J] for the same reasons described in claim [1.pre]-[1.J], and Agazzi ’341 discloses claim [23.K] for the same reasons described in Ground 2 at claim [23.K]. Specifically, Agazzi ’341 discloses an equalizer with coefficients to remove noise.

D. Ground 4

1. Overview of Ground 4

i. Agazzi ’341

See overview of Agazzi ’341 in Ground 2.

ii. Wei

See overview of Wei in Ground 1.

iii. Agazzi ’640

See overview of Agazzi ’640 in Ground 1.

iv. Motivation to Combine

Agazzi '341 and Wei attempt to increase the data throughput rate in fiber-optic communications in a cost-effective manner. Ex. 1009, 1:46-51; Ex. 1006, 1:66-2:4; Ex. 1003, ¶¶274, 277-78. Specifically, Agazzi '341 performs PAM-5 modulation to increase the data throughput rate. Ex. 1009, 4:33-35. But, Agazzi '341 and Wei do not expressly disclose increasing data throughput rates using QAM or QPSK modulation. Ex. 1003, ¶274.

Agazzi '640 relates to fiber-optic communications, like Agazzi '341 and Wei, and also discloses performing QAM or QPSK modulation to increase data throughput rates. Ex. 1005, 3:15-20. There were several reasons a POSITA would have been motivated to combine Agazzi '640 with Agazzi '341 and Wei.

First, increasing the data throughput rate was a stated goal in Agazzi '640 as well as Agazzi '341 and Wei (Ex. 1005, 2:66-3:55; Ex. 1009, 1:46-51; Ex. 1006, 1:66-2:4), and performing QAM or QPSK modulation increased the data throughput rate over the modulation techniques disclosed in Agazzi '341 and Wei (Ex. 1003, ¶¶276-77).

Second, increasing data rates in a cost-effective manner was a stated goal in Agazzi '640 as well as Agazzi '341 and Wei (Ex. 1005, 1:45-49; Ex. 1009, 1:46-51; Ex. 1006, 1:50-69), and QAM and QPSK were cost-effective modulation schemes

to increase the data throughput rate because they did not requirement replacement of older fiber infrastructure (Ex. 1003, ¶278).

A POSITA would have been motivated to combine Agazzi '640 with Agazzi '341 and Wei to implement QAM or QPSK modulation in the m-ary pluggable transceiver taught by Agazzi '341 and Wei to further increase data transmission rates. *Id.* Moreover, a POSITA would have had a reasonable expectation of success in adding QAM or QPSK modulation to an m-ary pluggable transceiver to produce expected results, which were stated goals in the references. Ex. 1003, ¶279.

2. Claim 5

The combination of Agazzi '341, Wei, and Agazzi '640 discloses claim 5. Agazzi '341 and Wei disclose the limitations in claim 1. Agazzi '640 discloses the other limitations in claim 5 for the same reasons as in Ground 1 at claim 5.

3. Claim 6

The combination of Agazzi '341, Wei, and Agazzi '640 discloses claim 6. Agazzi '341 and Wei disclose the limitations in claim 1. Agazzi '640 discloses the other limitations in claim 6 for the same reasons as in Ground 1 at claim 6.

VIII. DISCRETIONARY ISSUES

A. The Petition Does Not Present the Same References Addressed in Prosecution

Institution should not be denied under §325(d). Under *Advanced Bionics*, the Board uses a two-part framework in determining whether to exercise its discretion under § 325(d), specifically:

- (1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and
- (2) if either condition of [the] first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of challenged claims.

Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH, IPR2019-01469, Paper 6 at 8 (PTAB Feb. 13, 2020) (precedential). The Board has held that the first prong of *Advanced Bionics* is not met where “neither [the combination references] nor similar prior art was before the examiner and ... the prosecution history does not include any overlapping arguments directed to this prior art.” *Godbersen-Smith Constr. Co. v. Guntert & Zimmerman Const. Div., Inc.* IPR2021-00050, Paper 24 at 19-21 (PTAB May 7, 2021).

This Petition does not include any prior art references that were cited during the original prosecution of the '181 Patent or the prosecution of the parent '723 Patent or grandparent '795 Patent; nor are the references cumulative of any of the art considered by the Examiner. Ex. 1003, ¶¶84-89, 74-82. Moreover, the prior art

references were not cited, nor are they cumulative, of prior art identified in IPR2021-01361. And, importantly, the primary prior art references used in this Petition disclose an optical transceiver module with integrated optoelectronics, as claimed by the '181 Patent, rather than an OLT device, as disclosed in the primary prior art reference used by the Examiner during prosecution of the grandparent '795 Patent application. Ex. 1003, ¶¶75-82. Accordingly, not only is the art different, but the arguments are also materially different.

For example, the primary reference used by the Examiner during prosecution to initially reject the grandparent '795 Patent application was Brede (U.S. Patent No. 6,603,822). Ex. 1024, 174-78. The Examiner noted that Brede disclosed all the independent claim limitations except for the “pluggable” limitation. *Id.*, 152-53. The Examiner also used Aronson and Sheth to reject the pluggable form factor limitations. *Id.*, 121-28, 174-78. To traverse the first rejection, Applicants distinguished Brede as an OLT with separate and distinct optical elements rather than an optical transceiver module with the optical elements packaged together within the module.

While Applicants' acknowledge that an OLT is a device that transmits and receives and thus can be considered a transceiver, however, the **Brede optical elements** (14, 16 of Fig. 3) **are described as distinct elements that transmit and receive separately and NOT as a transceiver as in Applicants' claims.** Additionally, these **optical elements** (14, 16) are **connected to the OLT 12 via a coaxial cable** interface (22, 28), again distinguished as distinct from the OLT 12 and

again NOT as a pluggable optical transceiver module as in the Applicants' claims.

Id., 153 (emphasis added). But, this argument was not successful, and the application was rejected a second time. *Id.*, 121-28. After the second rejection, Applicants further distinguished the OLT in Brede from an optical transceiver module, explaining:

[T]he HDT is a rack mounted unit that is securely mounted using eight screws to the metal frame of a shelf of a rack ... **Brede's optical transmitters 14 and optical receivers 16 are yet more rack mounted units** that connect to the HDT 12 via coaxial cables 22, 28 respectively, and importantly that **none of these references refer to [sic] this entirety of rack mounted units as a pluggable optical transceiver, nor even just an optical transceiver** as in the Examiner's interpretation, on the contrary these references teach away from this interpretation.

Id., 70 (emphasis added). After making this argument, the Examiner issued a notice of allowance. *Id.*, 56.

Unlike the OLT disclosed in Brede, with optical elements separate and outside the OLT device, the primary references in this Petition (Agazzi '640 and Agazzi '341) each discloses an optical transceiver module where the transmitter and receiver optoelectronics are integrated within the transceiver module (Ex. 1003, ¶81), which the Applicants explained was what was meant by the claimed "optical transceiver module" limitation. In particular, Agazzi '640 discloses an "optical communications transceiver" where "the receivers and transmitters are integrated on a single integrated circuit" (Ex. 1005, 16:9-14, Abstract) and Agazzi '341 discloses an

“optical transceiver module” where “the transmitter and receiver sections ... are implemented as a transceiver integrated circuit constructed as a single chip” (Ex. 1009, 3:34-36, 4:61-65). As such, Agazzi ’640 and Agazzi ’341 cannot be considered as cumulative of Brede.

Unlike the references in this Petition, the Examiner never had a primary reference with integrated optoelectronics. Ex. 1003, ¶81-82. This would have changed the motivation-to-combine analysis as the Applicants successfully traversed the rejections by arguing that the OLT of Brede was not akin to an optical transceiver module with integrated optoelectronics—an argument that cannot be used to overcome Agazzi ’341 and Agazzi ’640. *Id.*

Moreover, the Examiner never had a reference that disclosed how to efficiently package the optoelectronics, such as the optoelectronics in Agazzi ’341 and Agazzi ’640, to fit within a pluggable form factor. The Examiner used Aronson and Sheth to cover the pluggable limitation in rejections, but neither teach how to efficiently package the transceiver components within a pluggable form factor as disclosed in Wei. For example, Wei discloses “separate vertically stacked printed circuit boards allows packaging the functions of [larger modules] within an LC or other small form factor package” like the SFP. Ex. 1006, 2:1-2, 2:28-32. This would have changed the motivation to combine calculus as a POSITA would have better

understood how to package the functionality of modules like Agazzi '640 and Agazzi '341 into an SFP package. Ex. 1003, ¶¶95, 193.

Accordingly, the combination of references used in this Petition cannot be cumulative of the art and/or arguments raised during prosecution as there are material differences between the grounds herein and what was previously presented. *Tianma Microelectronics Co., v. Japan Display Inc.*, IPR2021-01058, Paper 16 at 31 (PTAB Jan. 5, 2022). Because the first prong is not met, the Board need not move to the second prong. *See id.* at 21; *Oticon Med. AB v. Cochlear Ltd.*, IPR2019-00975, Paper 15 at 20 (PTAB Oct. 16, 2019).

Regardless, under the second prong, the Examiner erred in a manner material to the patentability of the Challenged Claims. In the provisional application, Applicants disclosed well-known pluggable form factors in the Background section. Specifically, Applicants admitted that “System Vendors have sponsored and supported Multi-Source Agreements (MSA) ... that define and specify all the physical and electrical requirements for optical transponders and transceivers,” including the pluggable XFP transceiver. Ex. 1032, ¶3. But, in the application that led to the '181 Patent, Applicants moved this information from the background prior art section into the main portion of the specification with one exception. Ex. 1001, 11:24-26. Applicants failed to disclose that the pluggable form factors were set out in industry recognized multisource agreements. Ultimately, the claims were allowed

after Applicants added the pluggable limitation. Yet, Applicants never informed the Examiner that this information was originally in the background prior art section in the provisional, thus rendering it applicant admitted prior art, and that multisource agreements standardized the form factors for pluggable transceivers, nor is it clear the Examiner understood this fact. This error is material to the patentability of the Challenged Claims.

For at least these reasons, the Board should not deny institution under §325(d).

B. The Board Should Not Deny Institution Under *Fintiv*

The claims of the '181 Patent have never been tested in view of the most relevant prior art. In view of these strong challenges and the nascent nature of the current district court proceedings, institution should not be discretionarily denied under §314(a). See *NHK Spring Co. v. Intri-Plex Techs., Inc.*, IPR2018-00752, Paper 8 at 19-20 (PTAB Sept. 12, 2018) (precedential); *Apple v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 13-14 (PTAB Mar. 20, 2020) (precedential).

Factor 1—a potential stay of the district court litigation—is neutral because no party has requested a stay. *VMWare, Inc. v. Intellectual Ventures I LLC*, IPR2020-00470, Paper 13 at 17 (PTAB Aug. 18, 2020) (finding in the absence of a stay motion that this factor “does not weigh for or against discretionary denial”).

Factor 2—the district court trial date and the Board’s statutory deadline—should be considered neutral. The earliest estimated trial date for the four currently

pending consolidated cases is far in the future as jury selection is not set to begin until at least May 6, 2024. *See* Ex. 1027, 1. While trial in the district court case is set for May 2024, the Director directed the PTAB to consider “statistics on median time-to-trial for civil actions in the district court in which the parallel litigation resides.” Interim Procedure, 8-9. The median time to trial in the Eastern District of Texas is 21.0 months (Ex. 1030, 35), which also gives a trial date of no earlier than May 2024. Because much can change in fourteen months, the current trial date does not support denial. *See Dish Network v. Broadband iTV*, IPR2020-01280, Paper 17 at 16 (PTAB Feb. 4, 2021) (“We cannot ignore the fact that the currently scheduled trial date is more than nine months away and much can change during this time”).

Moreover, given the number of consolidated cases, the potential length of the trials, and post-trial motions, it is likely that the district court proceedings will not be complete before the final written decision in this matter. The Board has frequently held that this factor does not implicate the decision whether to institute “if the trial date is at or around the same time as the projected statutory deadline.” *Fintiv*, IPR2020-00019, Paper 11 at 6. Thus, this factor does not support discretionary denial.

Factor 3—investment in the district court proceedings—weighs heavily against discretionary denial. The district court case is in its early stages and the Court has not issued any substantive rulings with respect to the ’181 Patent.

Specifically, infringement contentions were served on November 3, 2022; invalidity contentions were served on February 2, 2023; and the claim construction hearing is not scheduled until November 8, 2023. Ex. 1027, 3. Moreover, it is unlikely that a claim construction order will issue, or claim construction briefing even begin, prior to the PTAB's projected September institution decision date. Accordingly, the district court will not invest significant resources or issue substantive orders related to the challenged patent prior to the issuance of an institution decision. *See Fintiv*, IPR2020-00019, Paper 11 at 9-12; *DISH Network L.L.C. v. Broadband iTV, Inc.*, IPR2020-01280, Paper 17 at 18-21 (PTAB Feb. 4, 2021). Regardless, Petitioner diligently prepared this Petition and filed well in advance of the statutory deadline, which weighs against denying institution.

Factor 4—overlap between this proceeding and the district court proceedings—favors institution. Instituting trial will allow issues to be narrowed in the district court because, if instituted, Petitioner stipulates that it will not pursue invalidity against the asserted claims in the district court using the specific combination of prior art references set forth in the grounds presented in this Petition for purposes of establishing obviousness. *See Sand Revolution II LLC v. Continental Intermodal Group-Trucking LLC*, IPR2019-01393, Paper 24 at 11-12 (PTAB June 16, 2020) (holding a similar stipulation weighs against discretionary denial). Given

the lack of overlap between the proceedings, this factor weighs against the Board exercising discretion to deny.

Factor 5—overlapping parties—is neutral as it is “far from an unusual circumstance that a petitioner in *inter partes* review and a defendant in a parallel district court proceeding are the same.” *Sand Revolution II, LLC v. Continental Intermodal Group*, IPR2019-01393, Paper 24 at 12-13 (Jun. 16, 2020).

The final *Fintiv* factor—other considerations—weighs against discretionary denial. As detailed herein, the merits of the Petition are strong, and the claims are invalid. For example, none of the grounds asserted herein were previously considered by either the Office or the district courts. *Cf. Comcast Cable Comm’n’s, LLC v. Rovi Guides, Inc.*, IPR2019-00231, Paper 14 at 11 (PTAB May 20, 2019) (obviousness challenges not “previously considered by the Office or any court” weigh in favor of not denying institution). Moreover, the ’181 Patent is currently asserted in four consolidated district court cases. Institution of this IPR provides the opportunity for narrowing and simplifying the litigations for the district court.

C. The Board Should Not Deny Institution Under *General Plastic*

The *General Plastic* factors do not apply for several reasons. First, this is the first and only *inter partes* review (“IPR”) petition filed by Petitioner with respect to the ’181 Patent. As noted in Section IV.E, the ’181 Patent was challenged in an IPR filed by II-VI, Inc. (IPR2021-01361), with which the Petitioner had no involvement

and which was not instituted. There is no overlap between the art relied on herein and the art relied upon in the prior IPR. Second, because the earlier IPR was discretionarily denied and the Board did not substantively address the merits of the prior petition, any concerns of serial petitions are largely outweighed by the benefits to the patent system of improving patent quality by reviewing the merits of the challenges raised in this petition, which have not been addressed to date. *Code200, UAB v. Bright Data, Ltd.*, IPR2022-00861, Paper 18 5-6 (P.T.A.B. Aug. 23, 2022) (precedential).

IX. CONCLUSION

Petitioner respectfully requests cancellation of the Challenged Claims.

X. MANDATORY NOTICES UNDER 37 C.F.R. §42.8

A. Real Party in Interest Under 37 C.F.R. §42.8(b)(1)

The real parties in interest are Nokia of America Corporation, Nokia Corporation, and Nokia Solutions and Networks OY. All entities are named defendants in the district court proceedings.³

B. Related Matters Under 37 C.F.R. §42.8(b)(2)

The '181 Patent is the subject of litigation pending against Petitioner filed on August 9, 2022, styled *NextGen Innovations, LLC v. Nokia of America Corporation et al.*, No. 2:22-cv-00309-JRG-RSP (E.D. Tex.). The '181 Patent is also the subject of the following additional litigations: *NextGen Innovations, LLC v. II-VI, Inc. et al.*, No. 4:20-cv-00854-SDJ (E.D. Tex.); *NextGen Innovations, LLC v. II-VI, Inc. et al.*, No. 4:21-cv-07477-YGR (N.D. Cal.); *NextGen Innovations, LLC v. Infinera Corporation*, No. 2:22-cv-00306-JRG-RSP (E.D. Tex.); *NextGen Innovations, LLC*

³ In the district court case pending against Petitioner, additional names are included as purported defendants with the three named real parties in interest. The additional names include “Nokia Networks”, “Nokia USA Inc.”, “Nokia Networks Inc.”, and “Nokia Solutions and Networks US LLC.” None of these names are actually present-day entities. As a result, they are not identified here as real parties in interest because they do not exist as present-day entities.

v. Fujitsu Network Communications, Inc. et al., No. 2:22-cv-00307-JRG-RSP (E.D. Tex.); *NextGen Innovations, LLC v. AT&T Services, Inc. et al.*, No. 2:22-cv-00308-JRG-RSP (E.D. Tex.); and *II-VI, Inc. v. NextGen Innovations, LLC*, IPR2021-01361.

Petitioner is not aware of any other judicial or administrative matter that would affect or be affected by a decision in this IPR.

C. Designation of Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioner provides the following designation of counsel.

Lead Counsel	Backup Counsel
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Pursuant to 37 C.F.R. § 42.8(b)(4), counsel agrees to service by mail as detailed above, and to electronic service by email at the following addresses: scott.stevens@alston.com; karlee.wroblewski@alston.com, and matt.welch@alston.com. Pursuant to 37 C.F.R §42.10(b), a Power of Attorney executed by Petitioner accompanies this Petition.

D. Service Information

Please address all correspondence and service to the addresses listed above.

Petitioner consents to electronic service directed to scott.stevens@alston.com;
karlee.wroblewski@alston.com, and matt.welch@alston.com.

Date: March 15, 2023

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CLAIMS APPENDIX

Claim	Recitation
[1.Pre]	A pluggable optical transceiver module comprising of:
[1.A]	an electrical system interface for receiving a first electrical data signal and for transmitting a second electrical data signal;
[1.B]	an m-ary modulator for increasing the number of bits per symbol in the first electrical data signal to produce a first m-ary modulation signal;
[1.C]	a digital to analog converter for converting the first m-ary modulation signal to a first electrical m-ary analog modulation signal;
[1.D]	a driver for amplifying the first electrical m-ary analog modulation signal to an amplified first electrical m-ary analog modulation signal to drive an optical transmitter;
[1.E]	the optical transmitter for emitting a first optical signal on a first wavelength responsive to and representative of the amplified first electrical m-ary analog modulation signal from the driver;
[1.F]	an optical detector for receiving a second optical signal on a second wavelength to produce an electrical analog signal;
[1.G]	an amplifier for amplifying the electrical analog signal to an amplified electrical analog signal;
[1.H]	a clock data recovery unit for recovering clock and data information to produce a second m-ary modulation signal from the amplified electrical analog signal;
[1.I]	an equalizer for performing equalization on the second m-ary modulation signal to remove noise; and
[1.J]	an m-ary demodulator for decreasing the number of bits per symbol in the equalized second m-ary modulation signal to produce the second electrical data signal.
2	The pluggable optical transceiver module of claim 1, wherein the form factor of the pluggable optical transceiver module is a pluggable form factor standard.
3	The pluggable optical transceiver module of claim 2, wherein the pluggable form factor standard of the pluggable optical transceiver

Claim	Recitation
	module is a small form factor pluggable (SFP) or SFP+ form factor standard.
5	The pluggable optical transceiver module of claim 1, wherein the m-ary modulator and the m-ary demodulator perform m-ary quadrature amplitude modulation and de-modulation, respectively, that uses two or more bits per symbol.
6	The pluggable optical transceiver module of claim 1, wherein the m-ary modulator and the m-ary demodulator perform m-ary quadrature phase shift keying modulation and de-modulation, respectively, that uses two or more bits per symbol.
8	The pluggable optical transceiver module of claim 1, wherein the electrical system interface includes parallel signals.
10	The pluggable optical transceiver module of claim 1, wherein the first electrical data signal and second electrical data signal includes parallel electrical data signals.
11	The pluggable optical transceiver module of claim 1, wherein the electrical system interface includes an attachment unit interface (AUI) based interface.
12	The pluggable optical transceiver module of claim 1, wherein the first optical signal on a first wavelength is configured to emit into a first optical fiber and the second optical signal on a second wavelength is configured to be received from the first optical fiber.
13	The pluggable optical transceiver module of claim 1, wherein the first optical signal on a first wavelength is configured to emit into a first optical fiber and the second optical signal on a second wavelength is configured to be received from a second optical fiber.
14	The pluggable optical transceiver module of claim 1, wherein the noise removed by the equalizer includes intersymbol interference (ISI).
15	The pluggable optical transceiver module of claim 1, wherein the equalizer performs decision directed equalization on the second m-ary modulation signal to remove noise.
16	The pluggable optical transceiver module of claim 1, wherein the equalizer performs blind equalization on the second m-ary modulation signal to remove noise.
17	The pluggable optical transceiver module of claim 1, wherein the digital to analog converter is configured to shape, condition, or

Claim	Recitation
	emphasize the first electrical m-ary analog modulation signal for improved transmission performance.
[22.Pre]	A pluggable optical transceiver module comprising of:
[22.A]	an electrical system interface for receiving a first electrical data signal and for transmitting a second electrical data signal;
[22.B]	an m-ary modulator for increasing the number of bits per symbol in the first electrical data signal to produce a first m-ary modulation signal;
[22.C]	a digital to analog converter for converting the first m-ary modulation signal to a first electrical m-ary analog modulation signal;
[22.D]	a driver for amplifying the first electrical m-ary analog modulation signal to an amplified first electrical m-ary analog modulation signal to drive an optical transmitter;
[22.E]	the optical transmitter for emitting a first optical signal on a first wavelength responsive to and representative of the amplified first electrical m-ary analog modulation signal from the driver;
[22.F]	an optical detector for receiving a second optical signal on a second wavelength to produce an electrical analog signal;
[22.G]	an amplifier for amplifying the electrical analog signal to an amplified electrical analog signal;
[22.H]	a clock data recovery unit for recovering clock and data information to produce a second m-ary modulation signal from the amplified electrical analog signal;
[22.I]	an equalizer for performing equalization on the second m-ary modulation signal to remove noise;
[22.J]	an m-ary demodulator for decreasing the number of bits per symbol in the equalized second m-ary modulation signal to produce the second electrical data signal; and
[22.K]	wherein the m-ary modulator and the m-ary demodulator perform m-ary pulse amplitude modulation and de-modulation, respectively, that uses two or more bits per symbol.
[23.Pre]	A pluggable optical transceiver module comprising of:

Claim	Recitation
[23.A]	an electrical system interface for receiving a first electrical data signal and for transmitting a second electrical data signal;
[23.B]	an m-ary modulator for increasing the number of bits per symbol in the first electrical data signal to produce a first m-ary modulation signal;
[23.C]	a digital to analog converter for converting the first m-ary modulation signal to a first electrical m-ary analog modulation signal;
[23.D]	a driver for amplifying the first electrical m-ary analog modulation signal to an amplified first electrical m-ary analog modulation signal to drive an optical transmitter;
[23.E]	the optical transmitter for emitting a first optical signal on a first wavelength responsive to and representative of the amplified first electrical m-ary analog modulation signal from the driver;
[23.F]	an optical detector for receiving a second optical signal on a second wavelength to produce an electrical analog signal;
[23.G]	an amplifier for amplifying the electrical analog signal to an amplified electrical analog signal;
[23.H]	a clock data recovery unit for recovering clock and data information to produce a second m-ary modulation signal from the amplified electrical analog signal;
[23.I]	an equalizer for performing equalization on the second m-ary modulation signal to remove noise;
[23.J]	an m-ary demodulator for decreasing the number of bits per symbol in the equalized second m-ary modulation signal to produce the second electrical data signal; and
[23.K]	wherein the equalizer includes coefficients or weights configured to remove noise from the second m-ary modulation signal.

CERTIFICATION UNDER 37 C.F.R. §42.24

Petitioner certifies that the word count in this Petition is 13,747 words, as counted by the word-processing program (Microsoft Word for Office 365) used to generate this Petition, where such word count excludes the table of contents, table of authorities, mandatory notices, certificate of service, appendix of exhibits, and this certificate of word count. This Petition is in compliance with the 14,000-word limit set in 37 C.F.R. § 42.24(a)(1)(i).

Date: March 15, 2023

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§42.6(e), 42.105, the undersigned hereby certifies that true and correct copies of the above-captioned PETITION FOR INTER PARTES REVIEW OF U.S. PATENT NO. 10,771,181, all associated exhibits, and Petitioner's Power of Attorney were served in their entireties on March 15, 2023, upon the Patent Owner at the correspondence address of record for the subject patent as listed on the USPTO's Patent Center via UPS Next Day Air®:

ALEXANDER SOTO
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Date: March 15, 2023

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