

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INFINERA CORPORATION,
Petitioner,

v.

ALEXANDER SOTO AND WALTER SOTO,
Patent Owner.

IPR2023-00838
Patent 10,771,181 B2

Before PATRICK M. BOUCHER, GARTH D. BAER, and
KARA L. SZPONDOWSKI, *Administrative Patent Judges*.

BOUCHER, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314(a)

Infinera Corporation (“Petitioner”) filed a Petition pursuant to 35 U.S.C. §§ 311–319 to institute an *inter partes* review of claims 1–3, 5, 6, 8, 10–17, 22, and 23 of U.S. Patent No. 10,771,181 B2 (Ex. 1001, “the ’181 patent”). Paper 2 (“Pet.”). Alexander Soto and Walter Soto (collectively,

“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our authorization, Petitioner filed a Reply and Patent Owner filed a Sur-reply. Paper 9 (“Reply”); Paper 10 (“Sur-reply”).

We have jurisdiction under 35 U.S.C. § 314 and 37 C.F.R. § 42.3. Applying the standard set forth in 35 U.S.C. § 314(a), which requires demonstration of a reasonable likelihood that Petitioner would prevail with respect to at least one challenged claim, we deny the Petition and do not institute an *inter partes* review.

I. BACKGROUND

A. The '181 Patent

1. Overview

The '181 patent “relates to optical fiber communications,” and describes several embodiments of optical transceiver modules. Ex. 1001, 1:36–38, 9:7–11:20. One such embodiment is illustrated in Figure 3 of the '181 patent, which is reproduced below.

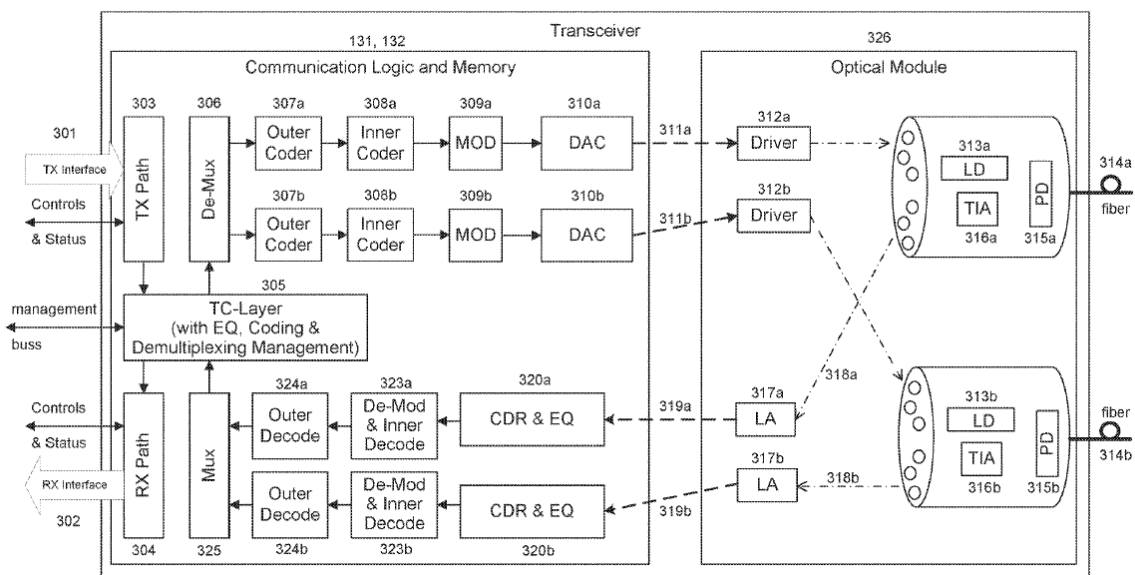


Figure 3 shows a system block diagram for an implementation of a transceiver with components for transmit-side processing generally in the upper half of the diagram and components for receive-side processing generally in the lower half. *Id.* at 9:7–8, 9:18–22. On the transmit side, signals are received from transmit (“TX”) interface 301 and prepared for data transmission by TX path block 303 and transmission convergence layer or media access control (“TC-Layer/MAC”) block 305. *Id.* at 9:18–45. Optionally, DeMux block 306 may split the transmitting data into a plurality of paths (two of which are shown in Figure 3), for demultiplexing data across multiple fibers. *Id.* at 9:45–56.

In a transmit path, transmit data may be provided to outer and inner coder blocks 307, 308 to perform error-correction coding, Reed-Solomon coding, trellis coding, and the like, as appropriate to the application. *Id.* at 9:61–10:9. Modulation block 309 performs any of a variety of m-ary modulation methods to increase the number of bits per symbol transmitted. *Id.* at 10:20–31. Digital-to-analog converter (“DAC”) 310 converts the m-ary modulated signal to an analog signal that is processed by laser driver 312, which drives an optical transmitter such as laser diode 313 to transmit an optical signal over fiber 314. *Id.* at 10:36–46.

The receive side of the transceiver includes components that generally implement inverse functions of the transmit side. *See id.* at 10:47–11:20. Photodiode (“PD”) 315 detects a received optical signal and converts it to an electrical signal that is amplified by transimpedance amplifier (“TIA”) 316 and linear amplifier (“LA”) 317, which may also perform signal conditioning. *Id.* at 10:47–60. The electrical signal is processed by clock data recovery (“CDR”) and equalization (“EQ”) block 320 to recover clock

and data signals. *Id.* at 10:60–65. De-Mod & inner decoder block 323 performs complementary demodulation to the m-ary modulation performed by modulation block 309, and, in combination with outer decoder block 324, decodes for error correction and other coding that may have been applied. *Id.* at 10:65–11:13. Optional multiplexer 325 may be applied to multiple signals on the receive side to provide a single signal that is output through receiver circuitry (“RX”) path 304 and RX interface 302. *Id.* at 11:13–20.

As illustrated in Figure 3, certain components that include laser driver 312 and linear amplifier 317, as well as laser diode 313, photodiode 315, and transimpedance amplifier 316 on both the transmit and receive side may be embodied in optical module 326. *See id.* at 10:36–60. Optical module 326 “can conform to a form factor of standard optical modules such as the 300 pin, XENPAK, X2, XPAK, XFP or SFP and SFP+.” *Id.* at 11:34–37.

2. Illustrative Claim

Independent claim 1 is illustrative of the challenged claims and is reproduced below.

1. A pluggable optical transceiver module comprising of:
 - an electrical system interface for receiving a first electrical data signal and for transmitting a second electrical data signal;
 - 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;
 - a digital to analog converter for converting the first m-ary modulation signal to a first electrical m-ary analog modulation signal;
 - 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;

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;

an optical detector for receiving a second optical signal on a second wavelength to produce an electrical analog signal;

an amplifier for amplifying the electrical analog signal to an amplified electrical analog signal;

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;

an equalizer for performing equalization on the second m-ary modulation signal to remove noise; and

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.

Ex. 1001, 15:2–33.

B. Evidence

Petitioner relies on the following references. Pet. 11–12.

Vrazel	US 2002/0167693 A1	Nov. 14, 2002	Ex. 1006
Pang	US 2003/0020986 A1	Jan. 30, 2003	Ex. 1007
Fujimori	US 7,206,366 B2	Apr. 17, 2007	Ex. 1028

In addition, Petitioner relies on a Declaration by Paul Min, Ph.D. Ex. 1003.

C. Asserted Grounds of Unpatentability

Petitioner challenges claims 1–3, 5, 6, 8, 10–17, 22, and 23 on the following grounds. Pet. 11.

Claim(s) Challenged	35 U.S.C. §¹	References
1–3, 5, 6, 8, 10, 12–17, 22, 23	103(a)	Pang, Vrazel
11	103(a)	Pang, Vrazel, Fujimori

D. Real Parties in Interest

In addition to itself, Petitioner identifies Cisco Systems, Inc. as a real party in interest. Pet. 78. Patent Owner identifies Alexander Soto and Walter Soto as real parties in interest, as well as NextGen Innovations, LLC, the exclusive licensee of the '181 patent. Paper 7, 1.

E. Related Matters

Both parties identify *NextGen Innovations, LLC v. Infinera Corporation*, No. 2:22-cv-00306 (E.D. Tex.) as a related district court matter in which the '181 patent is asserted against Petitioner. Pet. 78; Paper 7, 1. In addition, both parties identify the following as related district court matters in which the '181 patent is asserted against different defendants: (1) *NextGen Innovations, LLC v. Fujitsu Network Communications, Inc.*, No. 2:22-cv-00307 (E.D. Tex.); (2) *NextGen Innovations, LLC v. AT&T Services, Inc.*, No. 2:22-cv-00308 (E.D. Tex.); and (3) *NextGen Innovations, LLC v. Nokia of America Corporation*, No. 2:22-cv-00309 (E.D. Tex.). Pet. 78; Paper 7, 1. Petitioner additionally identifies the following matters as involving the '181 patent: (1) *NextGen Innovations, LLC v. II-VI, Inc.*,

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011), amended various provisions of 35 U.S.C. Based on the record before us, we apply the pre-AIA version of 35 U.S.C. § 103(a).

No. 4:20-cv-00854 (E.D. Tex.); and (2) *NextGen Innovations, LLC v. II-VI, Inc.*, No. 4:21-cv-07477 (N.D. Cal.). Pet. 74.

Patent Owner identifies IPR2021-01361 and IPR2023-00682 as involving the '181 patent.² Paper 7, 2. Patent Owner identifies several other *inter partes* reviews as involving the '181 patent or a related patent, namely IPR2021-01358, IPR2021-01359, IPR2023-00680, IPR2023-00681, IPR2023-00834, IPR2023-00835, and IPR2023-00960. Paper 7, 1–2.

II. ANALYSIS

A. Legal Principles

A claim is unpatentable for obviousness under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are “such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) when in evidence, objective indicia of nonobviousness, i.e., secondary considerations.³ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

² Petitioner’s identification of IPR2021-01359 and IPR2023-00681 appear to be incorrect since those proceedings involve related U.S. Patent No. 10,263,723 B2, at issue in IPR2023-00835. See Pet. 79.

³ The parties do not address objective indicia of nonobviousness, which accordingly do not form part of our analysis.

Additionally, the obviousness inquiry typically requires an analysis of “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring “articulated reasoning with some rational underpinning to support the legal conclusion of obviousness”)); see *In re Warsaw Orthopedic, Inc.*, 832 F.3d 1327, 1333 (Fed. Cir. 2016) (citing *DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1360 (Fed. Cir. 2006)).

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, we consider the level of ordinary skill in the pertinent art at the time of the invention. *Graham*, 383 U.S. at 17. “The importance of resolving the level of ordinary skill in the art lies in the necessity of maintaining objectivity in the obviousness inquiry.” *Ryko Mfg. Co. v. Nu-Star, Inc.*, 950 F.2d 714, 718 (Fed. Cir. 1991). The “person having ordinary skill in the art” is a hypothetical construct, from whose vantage point obviousness is assessed. *In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). “This legal construct is akin to the ‘reasonable person’ used as a reference in negligence determinations” and “also presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan.” *Id.* (citing *In re Carlson*, 983 F.2d 1032, 1038 (Fed. Cir. 1993)).

Petitioner proposes that a person of ordinary skill in the art “would have had at least a Bachelor’s degree in Computer Science, Computer Engineering, Electrical Engineering or a similar degree and at least two

years of professional experience with optical communications, networking, and signal processing.” Pet. 7. Petitioner adds that “[m]ore experience can supplement less education and vice versa,” and supports its proposal with testimony by Dr. Min. *Id.*; Ex. 1003 ¶ 38. Patent Owner does not specifically address the level of ordinary skill in its Preliminary Response.

Because we find Petitioner’s proposal reasonable, consistent with the level of skill reflected by the prior art, and supported by Dr. Min’s testimony, we adopt it for purposes of this Decision. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art may reflect an appropriate level of skill in the art).

C. Claim Construction

The Board uses “the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2019); *see Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). “Petitioner proposes that each claim term in the Challenged Claims be given its plain and ordinary meaning in this proceeding, and that no specific construction of any claim term is required.” Pet. 6. Patent Owner similarly does not propose any explicit construction of any claim term in its Preliminary Response.

On the record before us, we do not find it necessary to construe any term for this Decision. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe

terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Overview of Asserted Prior Art

1. Pang

Pang “relates to fiber optic modules.” Ex. 1007 ¶ 3. Figure 1 of Pang is reproduced below.

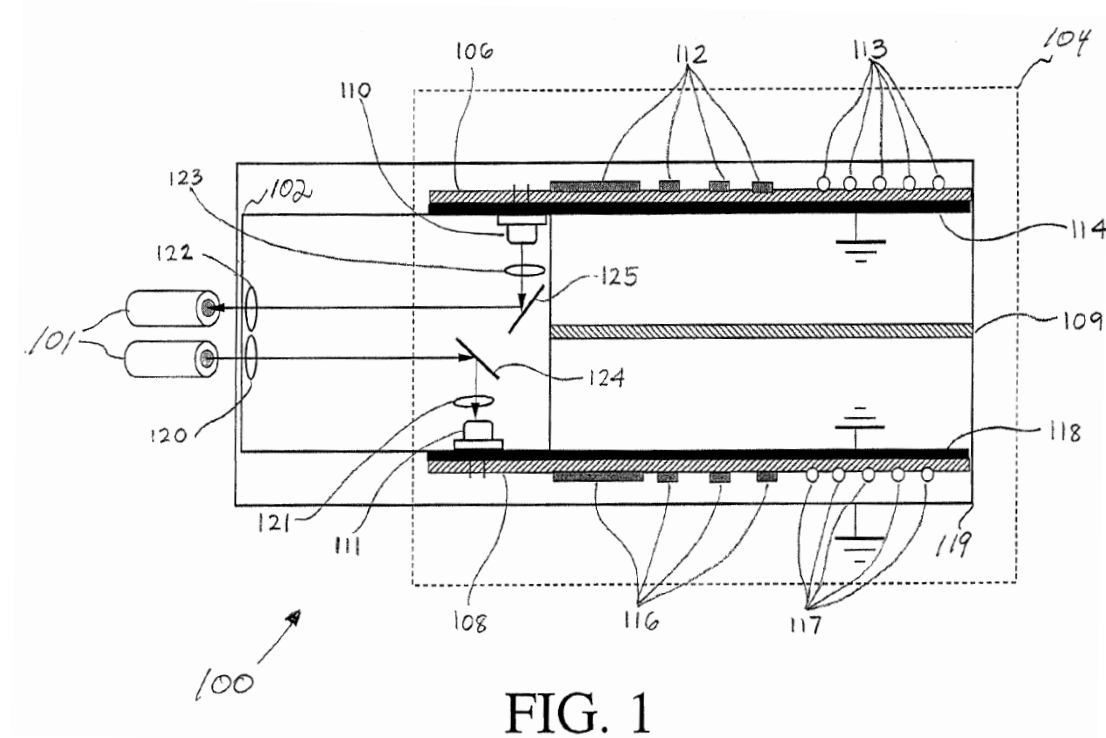


FIG. 1

Figure 1 is a top cutaway view of fiber optic module 100, coupled to a pair of fiber optic cables 101. *Id.* ¶¶ 7, 66. Fiber optic module 100 includes optical block 102 and electrical element 104, which includes transmit printed circuit board 106, receive printed circuit board 108, optional internal shield 109, light transmitter 110, light receiver 111, and shielded housing 119. *Id.* ¶ 66. Light transmitter 110 and light receiver 111 “are optoelectronic

devices for communicating with optical fibers,” with the patent describing an “optoelectronic device” as “a device which can convert or transduce light or photons into an electrical signal or an electrical signal into light or photons.” *Id.* Transmit printed circuit board 106 includes “electrical components 112 (transmitter integrated circuit (laser driver), resistors, capacitors and other passive or active electrical components),” and receive printed circuit board 108 includes “electrical components 116 (receiver integrated circuit (transimpedance amplifier and post amplifier), resistors, capacitors and other passive or active electrical components).” *Id.* ¶ 67.

Pang describes a configuration for a fiber optic module as “an MTRJ-SFP pluggable fiber optic module” having an “edge connection [that] may allow for the hot pluggability of the fiber optic module [] into a powered up host printed circuit board.” *Id.* ¶¶ 150, 155.

2. *Vrazel*

Vrazel “relates to optical fiber communications systems and more particularly relates to increasing the throughput of data transmission over an optical fiber communication system through the use of multilevel modulation.” Ex. 1006 ¶ 2. Figure 2 of Vrazel is reproduced below.

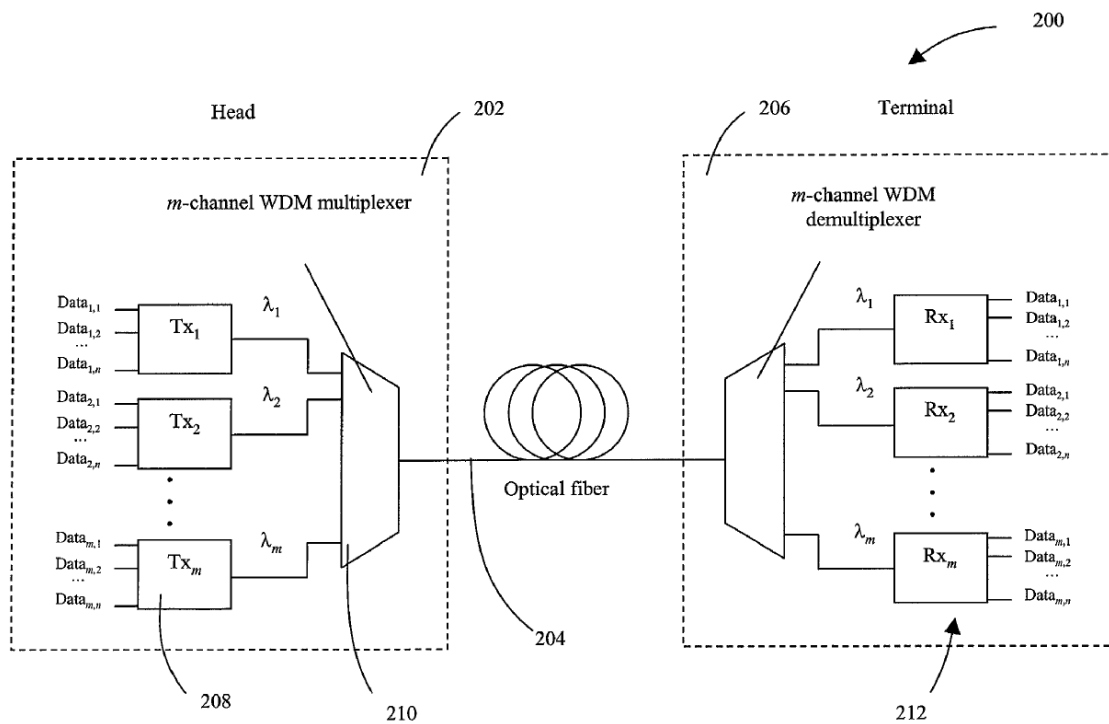


Fig. 2

Figure 2 is “a block diagram of an m-by-n channel WDM [i.e., wavelength division multiplexing] optical transmission system” that includes WDM transmission block 202 (the “Head”), optical fiber 204, and WDM reception block 206 (the “Terminal”). *Id.* ¶ 40. WDM transmission block 202 includes a number m of n -channel transmitters Tx 208, each of which “comprises an optical source and all circuitry necessary to modulate the source with the incoming data stream,” and includes m -channel WDM multiplexer 210. *Id.* WDM reception block 206 similarly includes an m -channel WDM demultiplexer and a number m of n -channel receivers Rx 212. *Id.*

Figure 5 of Vrazel is reproduced below.

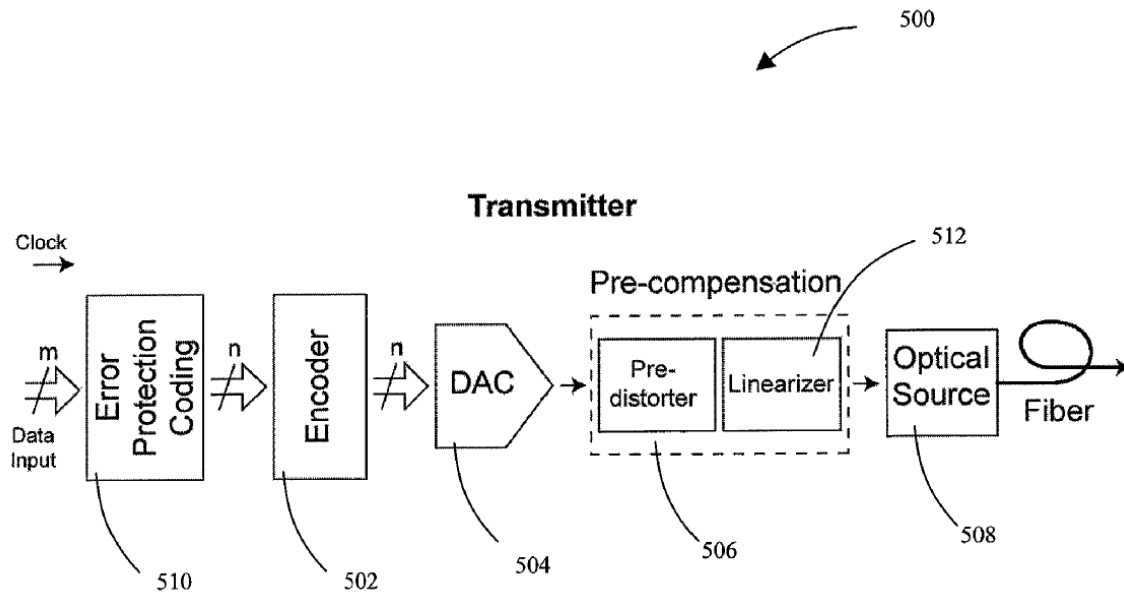


Figure 5 is a block diagram of exemplary transmitter 500, including error protection coding module 510, n -channel encoder 502, digital-to-analog converter 504, pre-compensation circuitry 506, and optical source 508. *Id.* ¶ 50. An m -bit word received at error protection coding module 510 is mapped “into an n -bit word where $n \geq m$.” *Id.* “For every clock cycle, the encoder 502 converts the protected n -bit word into a second ‘error-resistant’ n -bit word,” such as a Q-Gray code. *Id.* ¶ 51. “The encoded n -channels are input to [digital-to-analog converter] 504, which generates a 2^n -level electrical signal that can be used to modulate the optical source 508.” *Id.* Pre-compensation circuitry 506 includes a pre-distorter (which “can help compensate for non-ideal link frequency response and for some classes of link non-linearities”) and linearizer 512 (which “can linearize the optical source”). *Id.* ¶ 54.

Figure 6 of Vrazel is reproduced below.

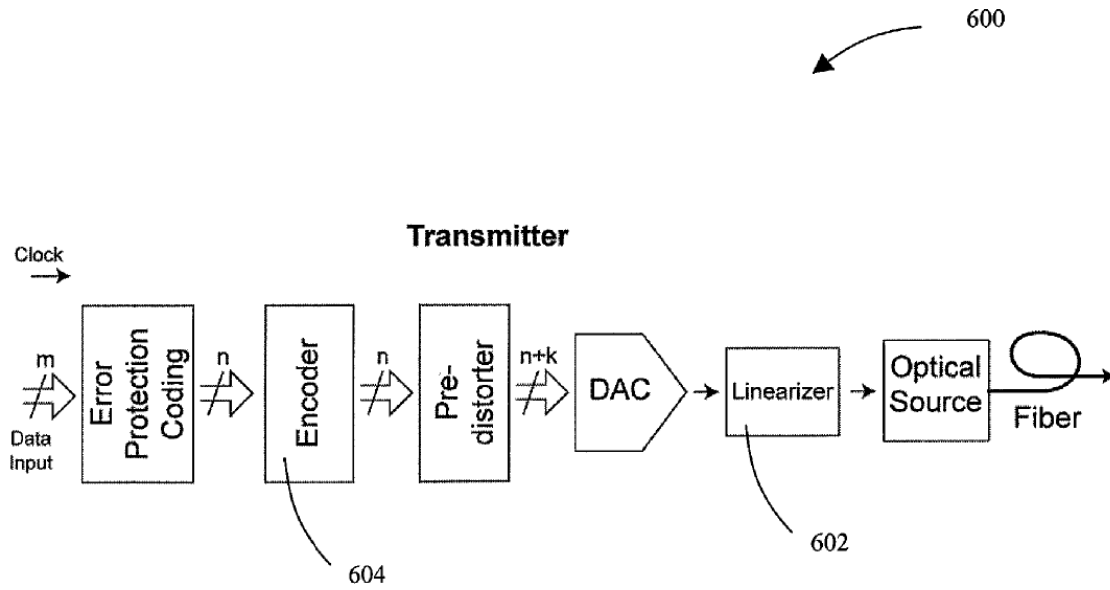


Figure 6 is a block diagram of alternative exemplary transmitter 600 in which the pre-distorter is positioned between n -channel encoder 604 and the digital-to-analog converter. *Id.* ¶¶ 19, 54. Like encoder 502 of Figure 5, encoder 604 receives encoded data and converts it to an n -channel Q-Gray code encoded signal. *See id.* ¶¶ 51, 53. This n -bit encoded signal is passed to the pre-distorter, which thereby operates in the digital domain in Figure 6 (as contrasted with operation in the analog domain in Figure 5). *Id.* ¶ 54.

Pre-distortion is implemented by tapping incoming electrical multilevel data and amplifying differences between tapped signals at different orders to generate polynomial $\mathfrak{R}$, which is summed with the symbol S_n to be transmitted in the data stream. *Id.* ¶¶ 73–77. The pre-distorter “will transmit the symbol $S'_n = \mathfrak{R} + S_n$ for each symbol in the data stream. In this way, the symbol S_n is predistorted by the amount $\mathfrak{R}$ to ensure that S_n is accurately received after transmission.” *Id.* ¶ 77.

3. Fujimori

Fujimori relates to “optical networking hardware, and more particularly to a system and method for performing on-chip synchronization of system signals.” Ex. 1028, 1:34–37. Fujimori describes interfacing a host system with a transceiver module through a 10 Gbps Ethernet attachment unit interface (“XAUI”). *Id.* at 6:43–46. “Notably, the XAUI [] may be configured as two, 4-bit interfaces, each with four serial lines, thereby achieving a throughput of about 10 Gbps.” *Id.* at 6:61–64.

E. Independent Claims

Petitioner challenges independent claims 1, 22, and 23 as unpatentable under 35 U.S.C. § 103(a) over Pang and Vrazel. Pet. 22–50, 63–68. In doing so, Petitioner characterizes Pang as relating “primarily to the physical arrangement of components in a pluggable optical transceiver,” but notes that Pang “does not provide a detailed description of the operation of the electrical components and techniques used in its transceiver.” *Id.* at 16 (citing Ex. 1003 ¶ 60). “In contrast,” Petitioner adds, “Vrazel provides a detailed description of the operation of electrical components and techniques suitable for use with Pang’s pluggable transceiver.” *Id.* at 16–17 (citing Ex. 1003 ¶ 60).

Petitioner accordingly proposes “to combine Pang’s teaching of a pluggable small form factor optical transceiver with Vrazel’s teaching of known modulation techniques for use with optical transceivers.” *Id.* at 15. According to Petitioner, a person of ordinary skill in the art would have had a reasonable expectation of success in effecting the combination “because Vrazel’s techniques enhance the transmission of optical signals over existing

fiber optics communications systems and add little or no complexity to their optical components.” *Id.* (citing Ex. 1003 ¶ 58; Ex. 1006 ¶¶ 11, 12).

Because it is dispositive, we focus our analysis on each independent claim’s recitation of “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.” Ex. 1001, 15:6–8 (claim 1), 17:13–15 (claim 22), 18:9–11 (claim 23). In addressing this limitation, Petitioner relies solely on Vrazel, which Petitioner contends “discloses this limitation in at least two ways.” Pet. 28 (addressing claim 1), 64 (addressing claim 22 by referring to analysis for claim 1), 66 (addressing claim 23 by referring to analysis for claim 1).

First, Petitioner identifies Vrazel’s encoder 502, shown in the illustration of an exemplary transmitter in Vrazel’s Figure 5, as corresponding to the recited “m-ary modulator.” *Id.* at 28–29. Petitioner asserts that encoder 502 “receives an encoded data signal from EPC module 510 and converts it to an n-channel ‘Q-Gray code’ encoded signal.” *Id.* at 29. Petitioner contends that this “increases the number of bits per symbol.” *Id.* (citing Ex. 1006 ¶¶ 10, 51, 53). Petitioner further observes that the “encoded signal is input to DAC 504, which ‘generates a 2^n -level electrical signal that can be used to modulate the optical source 508.’” *Id.* (quoting Ex. 1006 ¶ 51). In particular, Petitioner contends that “encoder 502 encod[es] data channels into a four-bit output that is then input to the DAC and ‘converted to one of 16 possible amplitude levels for a four times increase in data throughput.’” *Id.* (quoting Ex. 1006 ¶ 53). Petitioner summarizes:

A [person of ordinary skill in the art] understood that encoder 502 is an *m*-ary modulator because it takes an input encoded data signal (*first electrical data signal*) on the transmit side and converts it to a Q-Gray code encoded signal (*first m-ary modulation signal*) having multiple bits per symbol (*increasing the number of bits per symbol*), which is then input to the DAC to generate a 2^n -level electrical signal that is used to modulate the optical source.

Id. at 30 (citing Ex. 1003 ¶¶ 78–80).

Patent Owner disputes this aspect of Petitioner’s analysis for reasons that we find persuasive. In particular, we agree with Patent Owner that Petitioner fails to show sufficiently that Vrazel’s encoder 502 is an “m-ary modulator for increasing the number of bits per symbol” as the claim requires. *See* Prelim. Resp. 17–19. As Petitioner acknowledges, m-ary modulation was “‘known in the art’ to increase the number of bits per symbol transmitted.” Pet. 8–9 (citing Ex. 1001, 10:20–31; Ex. 1014, 876; Ex. 1003 ¶ 41). We are unpersuaded by Petitioner’s contention that Vrazel’s encoder 502 “receives an encoded data signal from EPC module 510 and converts it to an n-channel ‘Q-Gray code’ encoded signal, which increases the number of bits per symbol.” *See id.* at 29 (citing Ex. 1006 ¶¶ 10, 51, 53). Rather, we agree with Patent Owner that “encoder 502 converts the protected n-bit word into a second ‘error-resistant’ n-bit word,” which “does not increase the number of bits per symbol.” *See* Prelim. Resp. 11. As Patent Owner points out, “[b]oth Vrazel’s Table 1 and Table 2 make[] clear that when a 4-bit word (symbol) is input, an encoded 4-bit word (symbol) is output,” such that “the encoder keeps the bits-per-symbol constant at ‘n’ bits.” *Id.* at 23 (citing Ex. 1006 ¶¶ 51–53).

In advancing its argument, Petitioner appears to rely on Vrazel’s statement, made in its “SUMMARY OF THE INVENTION,” that “[t]he increase in system throughput is achieved by using advanced modulation techniques to encode greater amounts of data into the transmitted spectrum of a channel, thereby increasing the spectral efficiency of each channel.” Ex. 1006 ¶ 10; *see* Pet. 29 (quoting Ex. 1006 ¶ 10). But Petitioner does not adequately explain how this summary disclosure specifically relates to modulation by Vrazel’s *encoder* to achieve the recited “increasing the number of bits per symbol in the first electrical data signal.” *See* Prelim. Resp. 23. Nor does Dr. Min provide any additional explanation for us to evaluate. *See* Ex. 1003 ¶¶ 78–80 (repeating assertions made in the Petition); *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (PTAB 2022) (precedential) (holding declaration is entitled to little weight when it contains an exact restatement of a petition’s unsupported, conclusory assertions without additional supporting evidence or reasoning).

As Patent Owner observes, Petitioner “appears to admit that the encoder does not meet this limitation because Petitioner then argues that the DAC (not the encoder) converts a four-bit output from the encoder into one of 16 different amplitudes.” Prelim. Resp. 23 (citing Pet. 29). We decline to speculate whether a mapping of Vrazel’s disclosure different from that presented by Petitioner might meet the limitation.

Second, Petitioner identifies the combination of encoder 604 and the pre-distorter, shown in the illustration of the alternative exemplary transmitter in Vrazel’s Figure 6, as corresponding to the recited “m-ary modulator.” Pet. 30–31. For this alternative identification, Petitioner repeats its assertion, discussed above, that the encoder “receives encoded

data from EPC module 510 and converts it to an n -channel ‘Q-Gray code’ encoded signal, increasing the number of bits per symbol.” *Id.* (citing Ex. 1006 ¶¶ 10, 51, 53). Petitioner adds that “[t]he pre-distorter adds k bits to the input encoded signal and outputs an $n+k$ -bit Q-Gray code encoded signal,” which “is then input to the DAC, which generates a 2^n -level electrical signal that can be used to modulate the optical source.” *Id.* (citing Ex. 1006 ¶¶ 51, 53, 54). Similar to its analysis relying on Vrazel’s Figure 5, Petitioner summarizes:

A [person of ordinary skill in the art] understood that the encoder and pre-distorter in Vrazel’s Figure 6, collectively, is *an m -ary modulator* because it takes an input n -bit encoded data signal (*first electrical data signal*) and converts it to an $n+k$ -bit Q-Gray code encoded signal (*first m -ary modulation signal*) having an additional k bits per symbol (*increasing the number of bits per symbol*) that is then input to the DAC to generate a 2^n -level electrical signal that can be used to modulate the optical source.

Id. at 31 (citing Ex. 1003 ¶¶ 81–83).

This identification suffers from deficiencies similar to Petitioner’s reliance on Vrazel’s Figure 5 by failing sufficiently to show that the combination of encoder 604 and the pre-distorter is an “ m -ary modulator.” We also agree with Patent Owner that “Petitioner and its expert . . . do not explain why the ‘+ k ’ refers to ‘number of bits per symbol.’” Prelim. Resp. 24.

Vrazel includes little discussion explaining the “+ k ” notation in Figure 6, and Patent Owner offers an explanation that we find more compelling, particularly in light of the absence of any additional explanation to support Petitioner’s position by Dr. Min. *See Xerox*, IPR2022-00624,

Paper 9 at 15. Vrazel’s Figure 10 illustrates “an exemplary pre-distortion compensation circuit,” which Patent Owner explains as “show[ing] that the input data stream is modified by adding weighted, time-delayed preceding inputs, but there is no change shown to the number of bits per symbol being transmitted.” Ex. 1006 ¶¶ 23, 70–77; Prelim. Resp. 24–25. We thus agree with Patent Owner that, “according to Vrazel, ‘+k’ refers to a distinct aspect of the signal (a predistortion amount added to the original signal to counterbalance expected distortions) that has nothing to do with increasing the number of bits per symbol.” Prelim. Resp. 24 (citing Ex. 1006 ¶¶ 70, 77).

We accordingly determine that Petitioner does not sufficiently show that Vrazel meets the requirements of the recited “m-ary modulator” in any of the challenged independent claims. We therefore conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of independent claims 1, 22, or 23 as unpatentable under 35 U.S.C. § 103(a) over Pang and Vrazel.

F. Dependent Claims

Each of claims 2, 3, 5, 6, 8, 10, and 12–17 depends directly or indirectly from independent claim 1, and Petitioner challenges those claims as unpatentable under 35 U.S.C. § 103(a) over Pang and Vrazel. Ex. 1001, 15:34–16:28; Pet. 51–63. Claim 11 depends from independent claim 1, and Petitioner challenges that claim as unpatentable under 35 U.S.C. § 103(a) over Pang, Vrazel, and Fujimori. Ex. 1001, 16:1–3; Pet. 71–72. The deficiency in Petitioner’s analysis of independent claim 1 also applies to each of these dependent claims. We accordingly conclude that Petitioner

does not demonstrate a reasonable likelihood of prevailing on its challenges of dependent claims 2, 3, 5, 6, 8, 10, and 12–17.

III. CONCLUSION

For the foregoing reasons, we deny institution of an *inter partes* review.⁴

IV. ORDER

In consideration of the foregoing, it is
ORDERED that the Petition is *denied*, and no trial is instituted.

⁴ Because we deny the Petition on the merits, we do not reach Patent Owner’s request that we exercise our discretion to deny the Petition under *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 13–14 (PTAB Mar. 20, 2020) (precedential) or under 35 U.S.C. § 325(d). *See* Prelim. Resp. 36–57.

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