

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

INFINERA CORPORATION,
Petitioner,

v.

ALEXANDER SOTO AND WALTER SOTO,
Patent Owner.

IPR2023-00834
Patent 9,887,795

Before THU A. DANG, PATRICK M. BOUCHER, and GARTH D. BAER,
Administrative Patent Judges.

DANG, *Administrative Patent Judge.*

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

I. INTRODUCTION

A. Background

Infinera Corporation (“Petitioner”) filed a Petition requesting an *inter partes* review (“IPR”) of claims 1–3, 5, 10–14, and 16–21 (“the challenged claims”) of U.S. Patent No. 9,887,795 (Ex. 1001, “the ’795 patent”). Paper 2 (“Pet.”), 1. 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. § 42.4. For the reasons set forth below, we deny the Petition and decline to institute an *inter partes* review.

B. Related Proceedings

The parties indicate that the ’795 patent is the subject of the following district court litigation: *NextGen Innovations, LLC v. Infinera Corporation*, No. 2:22-cv-00306 (E.D. Tex.). Pet. 67; Paper 7, 1. In addition, both parties identify the following as related district court matters in which the ’795 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. 67; Paper 7, 1. Petitioner additionally identifies the following matters as involving the ’795 patent: (1) *Nokia Innovations, LLC v. II-VI, Inc.*, 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. 67.

Both parties identify IPR2021-01358 and IPR2023-00680 (“the related IPRs”) as involving the ’795 patent. Pet. 68 (mistyped as “IPR2021-01359” and “IPR2023-00681”); Paper 7, 1. Patent Owner identifies several other *inter partes* reviews as involving a related patent, namely IPR2021-01359, IPR2021-01361, IPR2023-00681, IPR2023-00682, IPR2023-00835, IPR2023-00838, or IPR2023-00960. Paper 7, 1–2.

C. The ’795 Patent (Ex. 1001)

The ’795 patent, titled “System and Method for Performing High-Speed Communications Over Fiber Optical Networks,” is directed to “optical fiber communications generally, and more specifically to m-ary modulation in optical communication networks.” Ex. 1001, code (54), 1:26–28.

The ’795 patent describes several embodiments of optical transceiver modules. Ex. 1001, 8:65–11:11. One such embodiment is illustrated in Figure 3 of the ’795 patent, which is reproduced below.

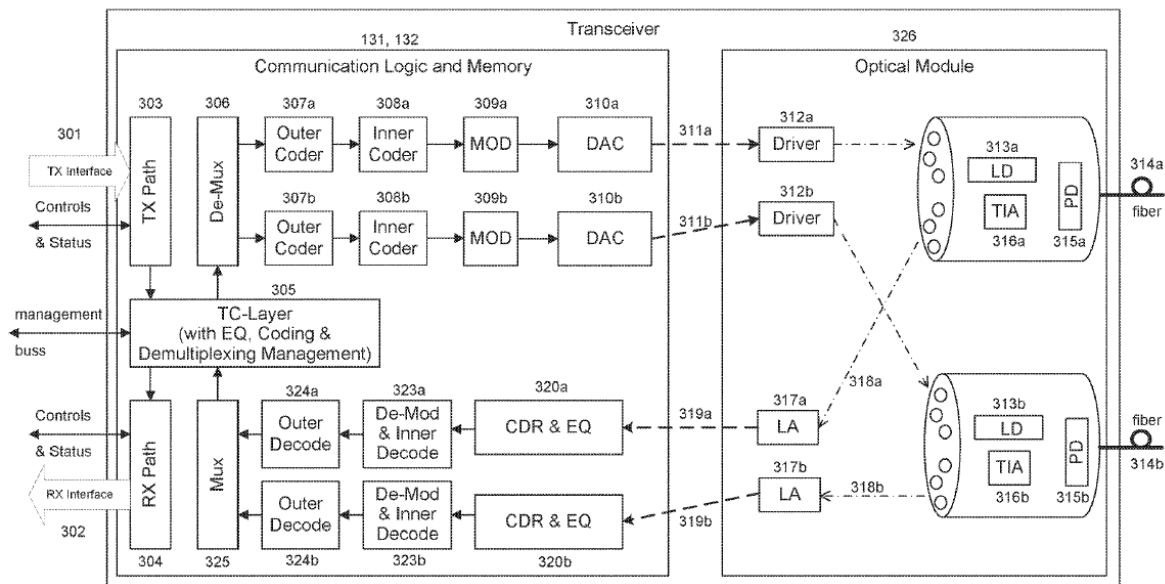


FIG. 3

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 8:65–66, 9:9–13. 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 9:9–36. 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 9:36–47.

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 9:52–61. Modulation block 309 performs any of a variety of m-ary modulation methods to increase the number of bits per symbol transmitted. *Id.* at 10:11–22. 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 10:27–37.

The receive side of the transceiver includes components that generally implement inverse functions of the transmit side. *See id.* at 10:38–11:11. 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 10:38–51. The electrical signal is processed by clock data recovery (“CDR”) and equalization (“EQ”) block 320 to recover clock

and data signals. *Id.* at 10:51–56. 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 10:56–11:4. 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 11:4–11.

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 10:27–51. Optical module 326 “can conform to a form factor of standard optical modules such as the 300pin, XENPAK, X2, XPAK, XFP or SPF and SPF+.” *Id.* at 11:25–27.

D. Illustrative Claim

Among the challenged claims, claim 1 is the only independent claim. Claim 1 is illustrative and is reproduced below:

1. A method for m-ary modulation communication by a pluggable optical transceiver module comprising of:

receiving a first electrical binary data signal through a system interface of the pluggable optical transceiver module;

converting the first electrical binary data signal in the pluggable optical transceiver module to a first electrical m-ary modulation signal;

amplifying the first electrical m-ary modulation signal to drive an optical transmitter in the pluggable optical transceiver module;

emitting a first optical signal on a first wavelength responsive to and representative of the amplified first electrical m-ary modulation signal from the optical transmitter in the pluggable optical transceiver module;

receiving a second optical signal on a second wavelength and producing an electrical signal from an optical detector in the pluggable optical transceiver module;

amplifying the electrical signal to facilitate clock and data recovery in the pluggable optical transceiver module;

recovering a clock data information from the amplified electrical signal to produce a second m-ary modulation signal in the pluggable optical transceiver module;

demodulating the second m-ary modulation signal to a second electrical binary data signal in the pluggable optical transceiver module; and

transmitting the second electrical binary data signal through the system interface of the pluggable optical transceiver module.

Ex. 1001, 14:60–15:22.

E. Prior Art Relied Upon

Petitioner relies upon the references listed below (Pet. 9):

Name	Reference	Date	Exhibit No.
Vrazel	US 2002/0167693 A1	Nov. 14, 2002	1006
Pang	US 2003/0020986 A1	Jan. 30, 2003	1007
Yee	US 7,146,103	Dec. 5, 2006	1030

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

Ex. 1003.

F. Asserted Grounds of Unpatentability

Petitioner challenges claims 1–3, 5, 10–14, and 16–21 on the following grounds. Pet. 1–2.

Claims Challenged	35 U.S.C. § ¹	References
1–3, 5, 10, 13, 14, 16–21	103(a)	Vrazel, Pang
11, 12	103(a)	Vrazel, Pang, Yee

II. ANALYSIS

A. Claim Construction

We construe each 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) (2020). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art (POSITA) at the time of the invention and in the context of the entire patent disclosure. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

On the record before us, we do not find it necessary to construe any term for purposes of this Decision. *See, e.g., Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent

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. Petitioner applies the pre-AIA version of 35 U.S.C. § 103(a), and Patent Owner does not contest that this is the applicable version. Pet. 1–2. On the record before us, we agree that the pre-AIA version of 35 U.S.C. § 103(a) applies.

necessary to resolve the controversy.” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that “only those terms need to be construed that are in controversy, and only to the extent necessary to resolve the controversy”)); *see also Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (applying *Vivid Techs.* in the context of an *inter partes* review).

B. Principles of Law

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)); *see also* 37 C.F.R. § 42.104(b) (requiring a petition for *inter partes* review to identify how the challenged claim is to be construed and where each element of the claim is found in the prior art patents or printed publications relied on). Petitioner cannot satisfy its burden of proving obviousness by employing “mere conclusory statements.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016).

A claim is unpatentable under 35 U.S.C. § 103 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 the 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 ordinary skill in the art; and (4) objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). In determining the level of ordinary skill, various factors may be considered, including the “type[s] of problems encountered in the art; prior art solutions to those problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field.” *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (citation omitted).

C. Level of Ordinary Skill in the Art

Petitioner asserts that a POSITA would have “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,” wherein “[m]ore experience can supplement less education and vice versa.” Pet. 6 (citing Ex. 1003 ¶ 38).

Patent Owner does not contest Petitioner’s proposal or offer an alternative. On this record, we are persuaded that Petitioner’s proposal is consistent with the technology described in the Specification and the cited prior art. For purposes of this Decision, we adopt Petitioner’s proposed level of skill.

D. Obviousness of Claims 1–3, 5, 10, 13, 14, 16–21

Petition contends that the combination of Pang in view of Vrazel renders obvious claims 1–3, 5, 10, 13, 14, and 16–21 of the ’795 patent. Pet. 10–56 (ground 1). Petitioner then contends that the combination of Pang and Vrazel in further view of Yee renders obvious dependent claims 11 and 12 of the ’795 patent. *Id.* at 57–60 (ground 2).

In response, with respect to ground 1, Patent Owner contends that Petitioner has failed to show that the combination of Pang and Vrazel teaches or renders obvious every limitation of the challenged claims. Prelim. Resp. 17–23. With respect to ground 2, Patent Owner contends that because Petitioner has failed to show that claim 1 is obvious, Petitioner similarly fails to show obviousness for claims 11 and 12 depending therefrom. *Id.* 24. We summarize the asserted prior art below.

1. *Pang (Ex. 1007)*

Pang, titled “Method and Apparatus for Pluggable Fiber Optic Modules,” relates to “[p]luggable fiber optic modules.” Ex. 1007, codes (54), (57). Figure 1 of Pang is reproduced below.

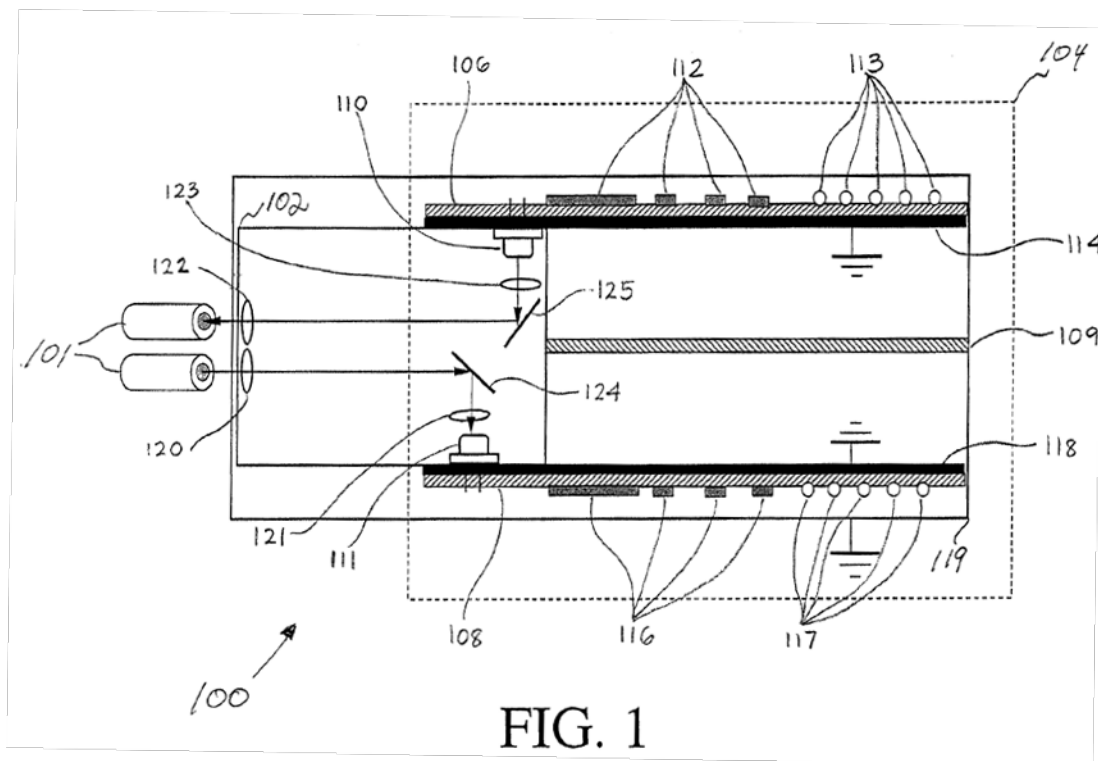


Figure 1 is a top cutaway view of fiber optic module 100, coupled to a pair of fiber optic cables 101. *Id.* ¶¶ 7, 66. Fiber optic module 100 includes optical block 102 and electrical element 104, which includes transmit printed

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 a “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 (Ex, 1006)*

Vrazel, titled “Increasing Data Throughput in Optical Fiber Transmission Systems,” relates to “increasing the throughput of data transmission over an optical fiber communication system through the use of multilevel modulation.” Ex. 1006, code (54), ¶ 2. Figure 2 of Vrazel is reproduced below.

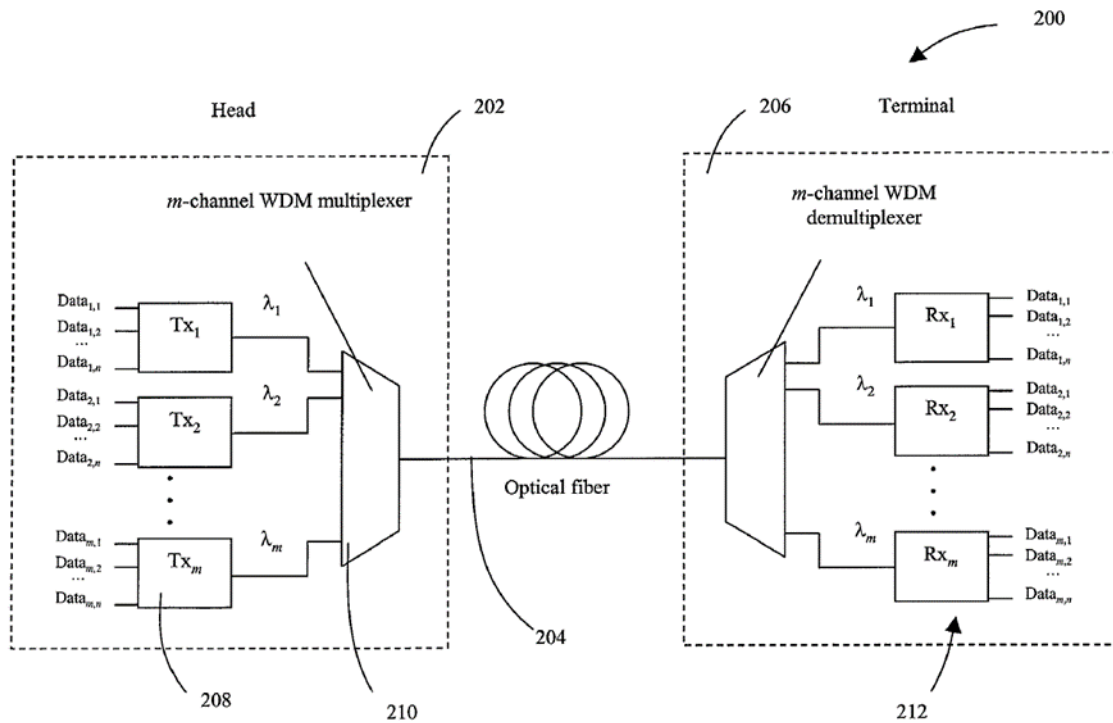


Fig. 2

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.

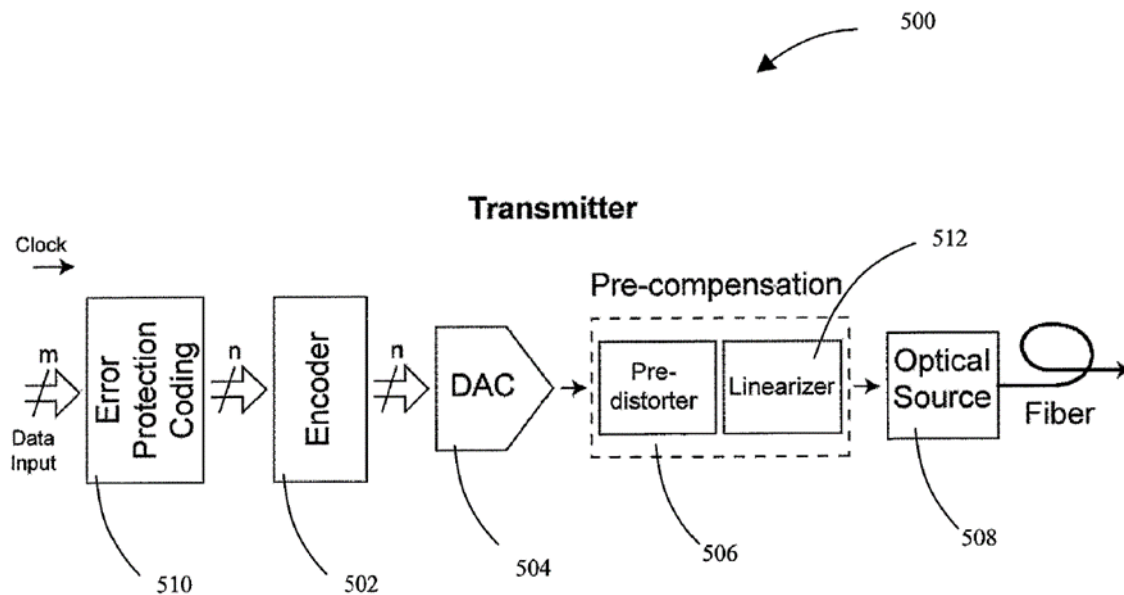


Figure 5 is a block diagram of exemplary transmitter 500, including error protection coding module 510, n-channel encoder 502, digital-to-analog converter 504, pre-compensation circuitry 506, and optical source 508. *Id.* ¶ 50. An m-bit word received at error protection coding module 510 is mapped “into 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.

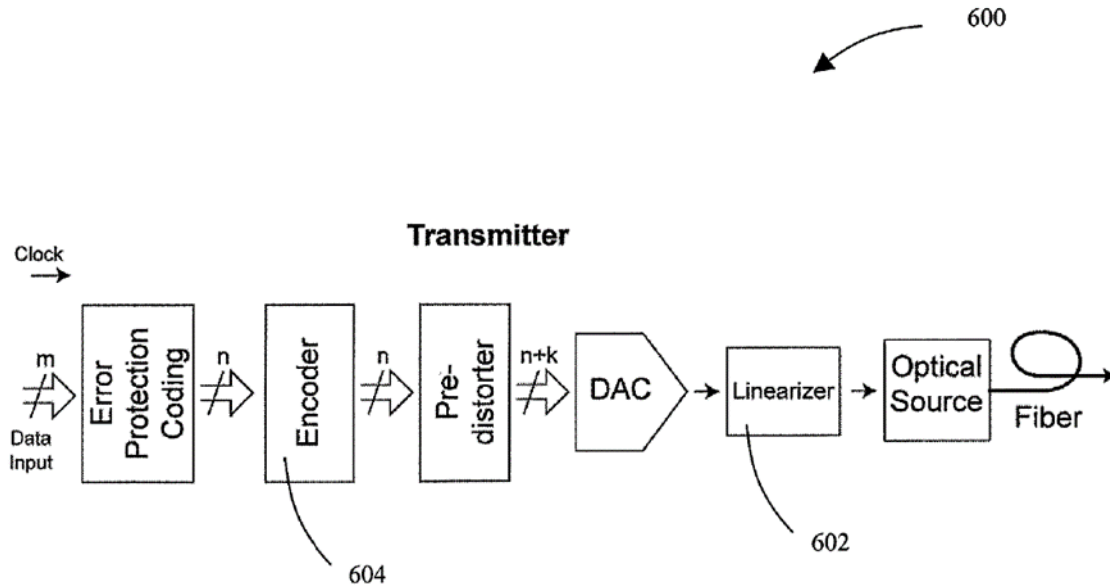


Figure 6 is a block diagram of alternative exemplary transmitter 600 in which the pre-distorter is positioned between n-channel encoder 604 and the digital-to-analog converter. *Id.* ¶¶ 19, 54. Like encoder 502 of Figure 5, encoder 604 receives encoded data and converts it to an n-channel Q-Gray code 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. Asserted Obviousness of Claims 1–3, 5, 10, 13, 14, and 16–21 over Pang and Vrazel (Ground 1).

Petitioner contends claims 1–3, 5, 10, 13, 14, and 16–21 would have been obvious over Pang and Vrazel, and provides an element-by-element analysis of Pang and Vrazel in relation to the challenged claims. Pet. 20–56, 59–60. 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 14–15 (citing Ex. 1003 ¶ 58). “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 15 (citing Ex. 1003 ¶ 58).

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.” Pet. 13. 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 ¶¶ 56–65; Ex. 1006 ¶¶ 11, 12).

Patent Owner contends the combination of Pang and Vrazel “lacks multiple claim elements,” wherein the Preliminary Response “focuses on [claim 1’s] ‘converting the first electrical binary data signal in the pluggable optical transceiver module to a first electrical m-ary modulation signal.’” Prelim. Resp. 17 (citing Ex. 1001, 14:65–67). Patent Owner contends “[t]he

Petition relies exclusively on Vrazel (not Pang) for this element, but fails to show disclosure of this element in Vrazel.” *Id.*

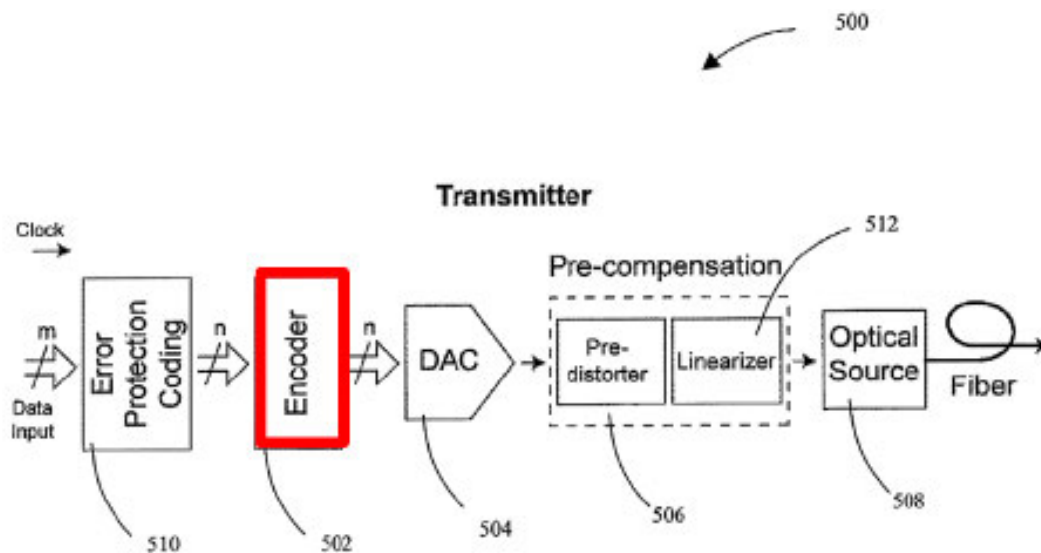
Because it is dispositive, we focus our analysis on independent claim 1’s recitation of “converting the first electrical binary data signal in the pluggable optical transceiver module to a first electrical m-ary modulation signal.” Ex. 1001, 14:65–67.

“converting the first electrical binary data signal in the pluggable optical transceiver module to a first electrical m-ary modulation signal”

In addressing this limitation, Petitioner relies solely on Vrazel, which Petitioner contends “discloses this limitation in at least two ways.” Pet. 27.

a. Encoder 502

First, Petitioner identifies Vrazel’s encoder 502, shown in the illustration of an exemplary transmitter in Vrazel’s Figure 5, as “an m-ary modulator.” Pet. 28–29. Annotated Figure 5 of Vrazel as shown in the Petition is reproduced below:



Annotated Figure 5 of Vrazel in the Petition shows transmitter 500 with n-channel encoder 502 highlighted in red. *Id.* at 28. According to Petitioner, encoder 502 receives the 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.” *Id.* Petitioner further contends that the “encoded signal is then 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.* at 29 (citing Ex. 1006 ¶¶ 43, 51, 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 encoded 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. (citing Ex. 1003 ¶ 84) (emphasis omitted).

We find persuasive Patent Owner’s challenge to this aspect of Petitioner’s analysis. In particular, Petitioner fails to show sufficiently that Vrazel’s encoder 502 is an “m-ary modulator” that converts an electrical binary data signal to an electrical “m-ary modulation” signal, as claimed. As Petitioner acknowledges, m-ary modulation was “‘known in the art’ to increase the number of bits per symbol transmitted.” Pet. 8 (citing Ex. 1001, 10:11–22; Ex. 1014, 876; Ex. 1003 ¶ 41). We are unpersuaded by

Petitioner's contention that Vrazel's encoder 502 receives the 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." Pet. 28. Here, we agree with Patent Owner that, although Petitioner relies on encoder 502 for m-ary modulation, "encoder 502 converts the protected n-bit work into a second 'error-resistant' n-bit word," which "does not increase the number of bits per symbol." See Prelim. Resp. 11–12 (citing Ex. 1006 ¶¶ 50–51). As Patent Owner points out, Vrazel's Table 1 makes clear that when an n-bit word is input (such as a 4-bit conventional binary word) to the encoder, an encoded n-bit word is output. *Id.* That is, the encoder keeps the bits-per-symbol constant at n (e.g., 4) bits. See Ex. 1006 ¶ 51 ("TABLE 1: Binary encoding schemes for 16 level transmission").

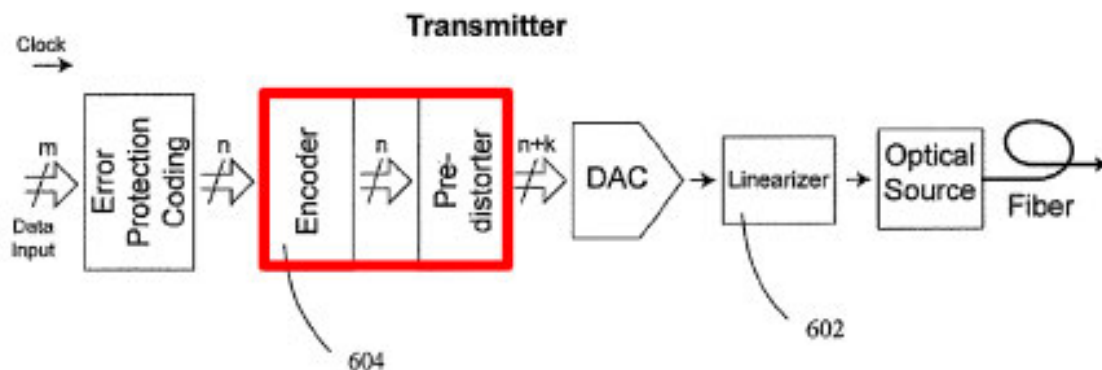
In advancing its argument, Petitioner appears to rely on Vrazel's statement in its "SUMMARY OF THE INVENTION," that "[t]he increase in system throughput is achieved by using advanced modulation techniques to encode greater amounts of data into the transmitted spectrum of a channel, thereby increasing the spectral efficiency of each channel." Ex. 1006 ¶ 10; see Pet. 22 (quoting Ex. 1006 ¶ 10). But Petitioner does not adequately explain how this summary disclosure specifically relates to m-ary modulation by Vrazel's encoder 502, and not another component in Vrazel's system, to achieve increasing the number of bits per symbol. Nor does Dr. Min provide any additional explanation for us to evaluate. See Ex. 1003 ¶¶ 80–82 (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).

In fact, Petitioner acknowledges that Vrazel’s encoder encodes an n -bit input into an n -bit output, wherein Vrazel’s DAC (and not the encoder) converts a n -bit output from the encoder into one of 2^n different amplitudes. Pet. 28–29 (“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.’”). We decline to speculate whether a mapping of Vrazel’s disclosure different from that presented by Petitioner might meet the limitation.

b. Encoder 604 and Pre-Distorter

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 “collectively, an m -ary modulator.” Pet. 29–31. Annotated Figure 6 of Vrazel as shown in the Petition is reproduced below:



Annotated Figure 6 of Vrazel in the Petition shows a transmitter with n -channel encoder 604 and pre-distorter highlighted in red. *Id.* at 30. 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, 43, 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 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 encoded 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 ¶ 87).

This identification suffers from similar deficiencies to Petitioner’s reliance on Vrazel’s Figure 5. That is, we agree with Patent Owner that Petitioner fails to show sufficiently that the combination of encoder 604 and pre-distorter converts to an electrical binary data signal to an m-ary modulation signal as the claim requires. *See* Prelim. Resp. 21–23. As Patent Owner points out, Vrazel’s pre-distortion is provided to “help compensate for non-ideal link frequency response and for some classes of link non-linearities, effectively reducing pattern-dependent errors in the transmitted data.” *Id.* at 21 (citing Ex. 1006 ¶ 54). Although Petitioner contends that “[t]he pre-distorter adds k bits to the input encoded signal and outputs an

n+k-bit Q-Gray code encoded signal,” Petitioner and its expert do not explain why the “+k” refers to the number of “bits” per symbol. Pet. 30.

Vrazel includes little discussion explaining the “+k” notation in Figure 6. Vrazel’s Figure 10 illustrates “an exemplary pre-distortion compensation circuit,” showing 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. *See* Ex. 1006 ¶¶ 23, 70–77. We thus we agree with Patent Owner that, according to Vrazel, the “+k” refers to a “predistortion amount” that is “added to the original signal as ‘n’” to counterbalance expected distortions (Prelim. Resp. 13 (citing Ex. 1006 ¶ 77)), and thus, is not related to the number of bits per symbol being transmitted.

Further, Patent Owner points out that Petitioner acknowledges that “some form of ‘modulation’ occurs after the DAC, well after the encoder or pre-distorter identified by Petitioner.” Prelim. Resp. 22 (citing Pet. 30, 33 (“Vrazel’s DAC outputs an electrical signal . . . that can be used to modulate the optical source” later)). Here, similar to its assertions regarding Figure 5, Petitioner acknowledges that, as shown in Figure 6, Vrazel’s DAC (rather than encoder 604 and pre-distorter) receives as input the n+k bit Q-Gray code encoded signal and generates one of 2^n different amplitudes. Pet. 30–31, (citing Ex. 1006 51, 53, 54 (“[t]he n+k-bit Q-Gray coded encoded signal is then input ot the DAC, which generates a 2^n -level electrical signal that can be used to modulate the optical source.”)).

We accordingly determine that Petitioner does not sufficiently show that Vrazel meets the requirements of the recited step of “converting the first electrical binary data signal in the pluggable optical transceiver module to a

first electrical m-ary modulation signal.” We therefore conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of independent claim 1 as unpatentable under 35 U.S.C. § 103(a) over Pang and Vrazel.

Each of claims 2, 3, 5, 10, 13, 14, and 16–21 depends directly or indirectly from independent claim 1, and Petitioner challenges these claims as unpatentable under 35 U.S.C. § 103(a) over Pang and Vrazel. Ex. 1001, 15:23–28, 32–35, 16:9–11, 16:18–25, 16:30–43; Pet. 46–56. 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 challenge of dependent claims 2, 3, 5, 10, 13, 14, and 16–21.

3. Asserted Obviousness of Claims 11 and 12 over Pang, Vrazel and Yee (Ground 2).

Claims 11 and 12 depend directly from claim 1. Petitioner does not rely on Yee to remedy the deficiencies discussed above concerning the “converting” to “m-ary modulation” signal step, but rather relies on its arguments associated with claim 1. *See* Pet. 59–60. We already addressed those arguments, and we find those arguments unavailing for the reasons stated above. We accordingly conclude that Petitioner does not demonstrate a reasonable likelihood of prevailing on its challenge of dependent claims 11 and 12.

III CONCLUSION

For the foregoing reasons, we deny institution of an *inter partes* review.²

IV, ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied*, and no trial is instituted.

² 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. 33–54.

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