UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC., OCLARO, INC., and
NOKIA OF AMERICA CORPORATION
Petitioners

v.

OYSTER OPTICS, LLC
Patent Owner

Case IPR2017-02190[1]
Patent 6,476,952 B1

NOTICE OF APPEAL BY PETITIONER OCLARO, INC.

[1] Case IPR2018-00988 has been joined with Case IPR2017-02190.

Director of the United States Patent and Trademark Office
c/o Office of the General Counsel
United States Patent and Trademark Office
Madison Building East, Room 10B20
600 Dulany Street
Alexandria, VA 22314

Pursuant to 35 U.S.C. §§ 141–44 and 319, and 37 C.F.R. § 90.2–90.3, notice is hereby given that petitioner Oclaro, Inc. ("Petitioner") appeals to the United States Court of Appeals for the Federal Circuit from the Final Written Decision entered March 22, 2019 (Paper 30) in IPR2017-02190 (Exhibit A), and all prior decisions and rulings related thereto or subsumed therein.

Providing the Director with the information contemplated in 37 C.F.R. § 90.2(a)(3)(ii), Petitioner indicates that the issues on appeal may include, but are not limited to, whether, in view of the full trial record, the Patent Trial and Appeal Board erred in deciding that Petitioner has not shown that: Claims 1–3 and 5 of U.S. Patent No. 6,476,952 (the "'952 patent") are unpatentable under 35 U.S.C. § 103(a) considering Bauch and Schneider; claim 4 of the '952 patent is unpatentable under 35 U.S.C. § 103(a) considering Bauch Schneider, and Heflinger; and any finding or determination supporting or related to the foregoing issues, as well as all other issues decided adversely to Petitioner in the Final Written Decision and/or in any prior orders, decisions, rulings, and opinions.

This Notice of Appeal is being filed within 63 days after the date of the Final Written Decision and thus within the period in 37 C.F.R. § 90.3.

Pursuant to 35 U.S.C. § 142 and 37 C.F.R. § 90.2(a), a copy of this Notice of Appeal is being filed simultaneously with the Patent Trial and Appeal Board, the Clerk's Office for the United States Court of Appeals for the Federal Circuit (along with the required docketing fees), and the Director of the Patent and Trademark Office c/o the Office of the General Counsel at the above-identified address. In addition, pursuant to Fed. Cir. R. 15(a)(1), one paper copy of the notice is also being sent to the Clerk of the Federal Circuit.

Respectfully submitted,

May 23, 2019
Dated

/s/ Darren Donnelly

Darren Donnelly (Reg. No. 44,093)
POLSINELLI LLP
1661 Page Mill Road, Suite A
Palo Alto, California 94304
Tel: (650) 461-7735
Fax: (650) 461-7701
DDonnelly@polsinelli.com

ATTORNEY FOR PETITIONER

CERTIFICATE OF FILING AND SERVICE

I, Darren Donnelly, hereby certify that on this 23rd day of May, 2019, in addition to being filed electronically through the Patent Trial and Appeal Board's E2E electronic filing system, a true and correct copy of the foregoing NOTICE OF APPEAL BY PETITIONER OCLARO, INC. is being caused to be filed by hand with the Director of the United States Patent and Trademark Office, at the following address:

Director of the United States Patent and Trademark Office
c/o Office of the General Counsel, Room 10B20
Madison Building East
600 Dulany Street
Alexandria, VA 22134

I also hereby certify that on this 23rd day of May, 2019 a true and correct copy of the foregoing NOTICE OF APPEAL BY PETITIONER OCLARO, INC. is being filed electronically with the Clerk's Office of the United States Court of Appeals for the Federal Circuit, and the filing fee being paid electronically. In addition, pursuant to Fed. Cir. R. 15(a)(1), one paper copy of the notice is also being sent to the Clerk of the Federal Circuit.

I also hereby certify that on this 23rd day of May, 2019 a true and correct copy of the foregoing NOTICE OF APPEAL BY PETITIONER OCLARO, INC. is being served, by electronic mail on the following parties:

Wayne M. Helge (whelge@dbjg.com)
James T. Wilson (jwilson@dbjg.com)
Aldo Noto (anoto@dbjg.com)
DAVIDSON BERQUIST JACKSON & GOWDEY L.L.P.
8300 Greensboro Drive, Suite 500
McLean, VA 22102

Respectfully submitted,

May 23, 2019
Dated

/s/ Darren Donnelly
Darren Donnelly (Reg. No. 44,093)
POLSINELLI LLP
1661 Page Mill Road, Suite A
Palo Alto, California 94304
Tel: (650) 461-7735
Fax: (650) 461-7701
DDonnelly@polsinelli.com

ATTORNEY FOR PETITIONER

EXHIBIT A

Trials@uspto.gov
571-272-7822

Paper No. 30
Entered: March 22, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC., OCLARO, INC., and
NOKIA OF AMERICA CORPORATION
Petitioner,

v.

OYSTER OPTICS, LLC,
Patent Owner.

Case IPR2017-02190[1]
Patent 6,476,952 B1

Before PATRICK M. BOUCHER, JESSICA C. KAISER, and
JOHN R. KENNY, *Administrative Patent Judges*.

KAISER, *Administrative Patent Judge.*

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

[1] Case IPR2018-00988 has been joined with Case IPR2017-02190.

I. INTRODUCTION

Cisco Systems, Inc. and Oclaro, Inc. filed a Petition pursuant to 35 U.S.C. §§ 311–319 requesting an *inter partes* review of claims 1–5 of U.S. Patent No. 6,476,952 B1 (Ex. 1001, "the '952 patent"). Paper 1 ("Pet."). Oyster Optics, LLC ("Patent Owner") filed a Preliminary Response (Paper 8, "Prelim. Resp."). Taking into account the arguments presented in the Petition and Patent Owner's Preliminary Response, we determined the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail in challenging claims 1–5 of the '952 patent, and we instituted this *inter partes* review as to those claims. Paper 9 ("Dec. on Inst.").

On July 27, 2018, we granted Nokia of America Corporation's motion for joinder in IPR2018-00988 and ordered that Nokia of America Corporation is joined as a petitioner in this proceeding.[2] Paper 20. During the course of trial, Patent Owner filed a Patent Owner Response (Paper 13, "PO Resp."); Petitioner filed a Reply to the Patent Owner Response (Paper 18, "Pet. Reply"); and Patent Owner filed a Sur-Reply (Paper 24, "PO Sur-Reply"). An oral hearing was held on December 21, 2018, a transcript of which is included in the record. Paper 29 ("Tr.").

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims

[2] We refer to Cisco Systems, Inc., Oclaro, Inc., and Nokia of America Corporation collectively as "Petitioner." Petitioner also filed Updated Mandatory Notices identifying additional real parties in interest. Paper 28.

1–5 of the ’952 patent. For the reasons discussed below, we hold that Petitioner has not demonstrated by a preponderance of the evidence that claims 1–5 are unpatentable under § 103(a).

II. BACKGROUND

A. The ’952 Patent

The ’952 patent relates generally to telecommunications, and more particularly, to improving security and data transmission over fiber optic networks. Ex. 1001, 1:13–15. The ’952 patent describes that amplitude modulated optical signals are not secure because they are easily detectable by a photodiode through only a small amount of tapped energy during transmission. *Id.* at 1:33–42. The ’952 patent also recognizes that there were transmission systems using phase modulation of the input data stream, but states that they included a light source in the receiver, and required the light to travel over a loop, whether back and forth in a single fiber or over a long length looped fiber, thus increasing hardware. *Id.* at 1:52–2:7. The ’952 patent further describes preexisting phase modulation transmission systems that generated “return-to-zero” optical pulses as easily readable by a detector. *Id.* at 2:16–20. The ’952 patent describes preexisting systems that used “multiple phase-compensated optical signals,” wherein each transmitter included a plurality of phase modulators, as complex and expensive. *Id.* at 2:21–32. The ’952 patent states that its objects are (1) to provide an improved security optical transmission system and device, (2) to provide high bandwidth optical data transport via transmission and recovery of phase-modulated optical signals, and (3) to provide a "simple yet secure phase-modulated optical data transmission system." *Id.* at 2:55–62.

The '952 patent summarizes its invention as follows:

> The present invention provides a fiber optic data transmission system comprising a transmitter having a laser emitting a continuous wave light, the transmitter including a phase modulator phase modulating the continuous wave light as a function of an electronic input data stream, so as to create a phase-modulated optical signal, an optical fiber transmitting the phase-modulated optical signal, and a receiver. The receiver includes an interferometer for receiving the phase-modulated optical signal, the interferometer having a first arm and a second arm, the second arm being longer than the first arm.
>
> Preferably, a time delay created by the second arm with respect to the first arm matches an electronic delay imparted on the electrical input data stream. This electronic delay may be in the form of a delay in a feedback loop of an exclusive-or or exclusive-nor gate in a circuit controlling the phase-modulator.

Id. at 2:63–3:12.

The '952 patent explains:

> The phase difference imparted by the phase modulator may be matched to the interferometric phase difference in one of three ways or a combination thereof: (1) by manufacturing the interferometer to have a 180 degree phase difference, in which case the input electronic data is sent through an exclusive-or gate; (2) by placing an additional phase modulator in an arm of the interferometer and altering the phase difference provided by the interferometer to achieve a 180 degree phase-shift; or (3) by determining the phase difference of the interferometer and compensating for the phase-difference by supplementing the electronic input data stream with phase-compensation data.

Id. at 4:9–20.

Figure 1 of the ’952 patent is reproduced below:

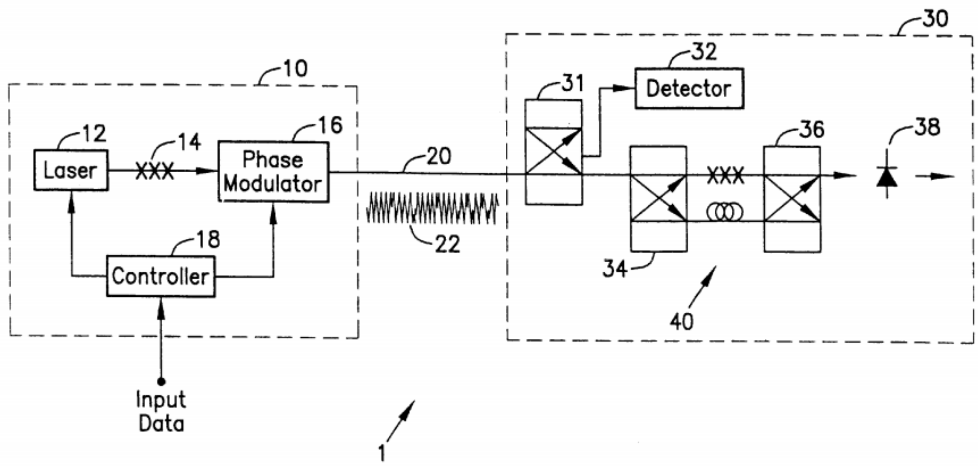


Fig. 1

Figure 1, reproduced above, is a schematic diagram of a preferred embodiment according to the ’952 patent. *Id.* at 4:48–49, 5:7–8. System 1 includes transmitter 10, optical fiber 20, and receiver 30. *Id.* at 5:8–10. Transmitter 10 includes continuous wave coherent laser 12, depolarizer 14, phase modulator 16, and electronic controller 18, and light from laser 12 is depolarized by depolarizer 14 prior to entering phase modulator 16. *Id.* at 5:10–18. Controller 18 controls phase modulator 16 as well as the power output emitted by laser 12. *Id.* at 5:18–21. An input data stream is fed to controller 18. *Id.* at Fig. 1. Phase modulator 16 phase modulates the input light from laser 12 based on electronic data stream OP outputted from controller 18. *Id.* at 5:24–30.

Figure 2 of the ’952 patent is reproduced below:

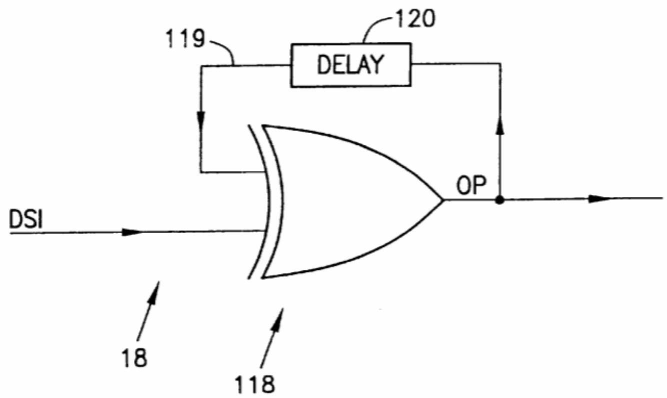


Fig. 2

Figure 2, reproduced above, shows a part of the circuitry of controller 18 of Figure 1. *Id.* at 4:50–51, 5:41–42. A first input of exclusive-or gate 118 comes from feedback loop 119, which feeds back the output of exclusive-or gate 118, and a second input of exclusive-or gate 118 comes from input data identified as DSI. *Id.* at 5:42–45. Electronic delay circuit 120 is provided within feedback loop 119, which causes output OP to arrive at the first input with a delay, for instance a delay time corresponding to that for receiving a certain number of input bits. *Id.* at 5:45–48.

Figure 3 of the ’952 patent is reproduced below:

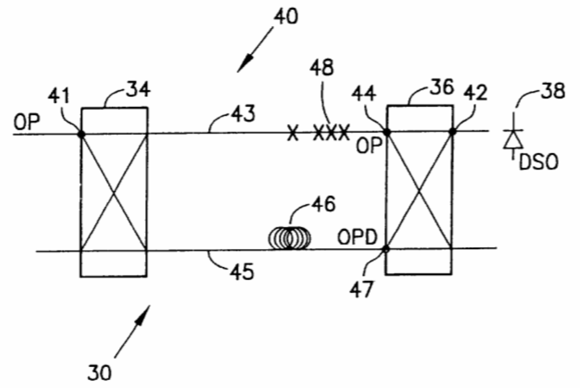


Fig. 3

Figure 3, reproduced above, shows in larger view interferometer 40 of Figure 1, which is located within receiver 30. *Id.* at 4:52–53. In receiver 30 of Figure 1, splitter 31 splits off a portion of the light to direct it to light monitoring detector 32 and sends the remainder to interferometer 40. *Id.* at 5:57–60. After passing splitter 31, optical signal 22 enters interferometer 40 at input 41 of splitter 34. *Id.* at 6:10–11. Splitter 34 splits the incoming light such that the input light travels over first fiber 43 and second fiber 45. *Id.* at 6:11–13. Second fiber 45 includes delay fiber 46, which may include a fiber loop of a desired length. *Id.* at 6:15–16. Delay fiber 46 then provides the light traveling within it to coupler 36, which recombines the delay signal with the non-delayed signal propagating through first fiber 43 and provides the recombined signal at output 42. *Id.* at 6:17–19.

The ’952 patent describes:

> The physical delay imposed by the interferometer 40 in the second light path through fiber 45, with its delay loop 46, with respect to light passing through the first light path through fiber 43 and depolarizer 48 is selected to match as closely as possible an electronic delay time ED imposed by electronic delay circuit

> 120 of the controller 18. If the first path in the interferometer 40 has a length L1 and the second path a length L2, the length L2 is selected, preferably by sizing loop 46, as a function of L1, the speed of light v in fibers 43 and 45, the light propagation delay through the depolarizer 48, DPD, and the electronic delay time ED.

Id. at 6:20–30 (emphasis omitted). If the input signal OP and the delayed signal OPD at inputs 44 and 47 are both zero or both one, then the two destructively interfere, and output detector 38 detects no light at output 42, in which case detector 38 provides a zero signal. *Id.* at 6:40–45. If, at inputs 44 and 47 of coupler 36, one of the inputs is a zero and the other is a one, then the light signals constructively interfere when combined at output 42, in which case detector 38 detects light and produces an electronic signal representing a one. *Id.* at 6:45–50. In that manner, interferometer 40 functions as an optical exclusive-or gate with one input leg delayed for signals arriving at input 41 of coupler 34. *Id.* at 6:55–59. As a whole, interferometer 40 optically and physically decodes the signal OP produced by the delayed-feedback exclusive-or gate 118 of Figure 2. *Id.* at 6:60–62.

Figure 6 of the ’952 patent is reproduced below:

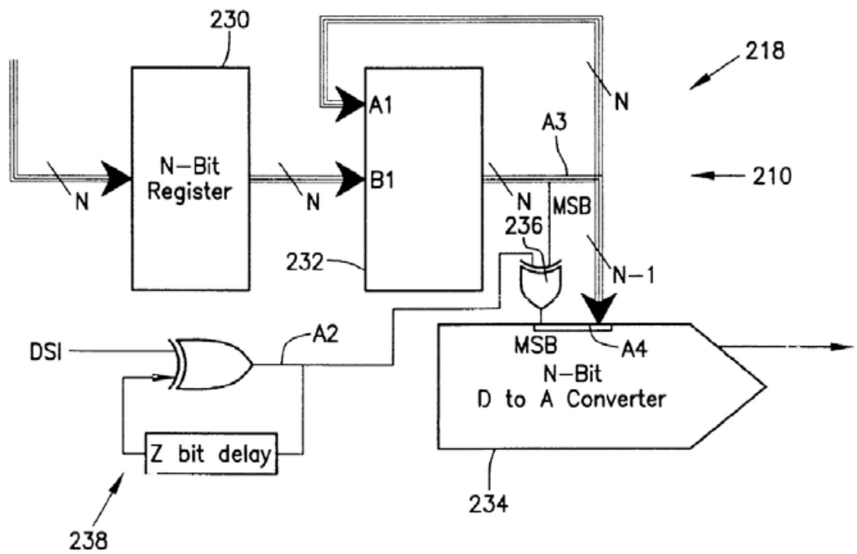


Figure 6, reproduced above, depicts details of an embodiment of the controller of Figure 1 with a phase-compensating circuit. *Id.* at 4:62–63. In particular, digital-to-analog ("D-A") converter 234 receives as its input A4, which is the combined output A3 of the arithmetic logic unit 232, with the most significant bit first passing through exclusive-or gate 236 and the other N−1 bits being fed directly. *Id.* at 8:24–30. D-A converter 234 then provides a voltage output corresponding to digital input A4, which then controls phase modulator 16 by shifting the optical signal by an amount proportional to the voltage applied over a full 360-degree range. *Id.* at 8:31–41.

Of the challenged claims, claim 1 is independent and is reproduced below:

> 1. A fiber optic data transmission system comprising:
>
> a transmitter having a laser emitting a continuous wave light, the transmitter including a phase modulator phase modulating the continuous wave light and a control circuit

> controlling the phase modulator as a function of an electronic input data stream having a time delay, so as to create a phase-modulated optical signal;
>
> an optical fiber transmitting the phase-modulated optical signal; and
>
> a receiver, the receiver including an interferometer for receiving the phase-modulated optical signal, the interferometer having a first arm and a second arm, the second arm being longer than the first arm, the interferometer having an interferometric delay corresponding to the time delay and a phase difference imparted by the first and second arms, the control circuit imparting a phase to represent a binary zero or one as a function of the phase difference, the control circuit including a digital-to-analog converter having an output for altering the phase of the phase modulator.

Ex. 1001, 10:9–29.

B. Related Matters

Both Petitioner and Patent Owner have identified multiple district court actions involving the ’952 patent. Pet. 1–2; Paper 6, 2–3; Paper 14. Petitioner has filed another *inter partes* review petition challenging claims of the ’952 patent in IPR2017-02189. Paper 6, 4. Patent Owner identifies additional *inter partes* review proceedings involving other patents, some filed by Petitioner, which may affect or be affected by a decision in this proceeding. Paper 7, 3–5.

C. Evidence Relied Upon by Petitioner

Petitioner relies on the following references[3]:

Reference		Date	Exhibit
Bauch	U.S. Pat. No. 6,826,371 B1	filed June 15, 2000	Ex. 1004
Schneider	U.S. Pat. No. 6,700,907 B2	filed June 29, 2001[4]	Ex. 1026
Heflinger	U.S. Pat. No. 6,396,605 B1	issued May 28, 2002; filed Jan. 26, 1999	Ex. 1025

Petitioner also relies on the Declaration of Daniel Blumenthal, Ph.D. (Ex. 1003) and the Declaration of Daniel Blumenthal, Ph.D. in Support of Petitioner's Reply (Ex. 1044).

D. Instituted Grounds of Unpatentability

We instituted a trial based on the asserted grounds of unpatentability ("grounds") set forth in the table below. Dec. on Inst. 31–32.

Claim(s) Challenged	Basis	References
1–3 and 5	§ 103(a)	Bauch and Schneider
4	§ 103(a)	Bauch, Schneider, and Heflinger

[3] The '952 patent was filed on November 26, 2001, and claims priority to two continuation-in-part applications filed on May 24, 2001, and January 17, 2001. Ex. 1001, at [22], [63].

[4] Schneider claims priority to a provisional application filed on November 20, 2000. Ex. 1027.

III. ANALYSIS

A. Patent Owner's Retroactivity Argument

In addition to the arguments discussed below, Patent Owner raises a constitutional argument based on the fact that "[a]t the time Patent Owner's patent issued, the express provisions of the Patent Act did not make patents revocable through *inter partes* review." PO Resp. 61. Patent Owner asserts: "Retroactively subjecting Patent Owner's vested patent rights to new qualifications—including possible cancelation by a newly constituted, non-Article III body operating under new statutes, rules, and procedures, including procedures contrary to 35 U.S.C. § 282(a)—presents a constitutional concern sufficient to preclude invalidation of the claims." *Id.* We decline to address this argument. *Califano v. Sanders*, 430 U.S. 99, 109 (1977); *Riggin v. Office of Senate Fair Employment Practices*, 61 F.3d 1563, 1569 (Fed. Cir. 1995).

B. Legal Principles

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) when in evidence, objective evidence of nonobviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). One seeking to establish obviousness based on more than one reference also must articulate sufficient reasoning with rational underpinning to combine teachings. *See KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

With regard to the level of ordinary skill in the art, we determine that no express finding is necessary, and that the level of ordinary skill in the art is reflected by the prior art of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001); *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995); *In re Oelrich*, 579 F.2d 86, 91 (CCPA 1978).

C. Claim Construction

In this *inter partes* review based on a petition filed before November 13, 2018, we construe claim terms according to their broadest reasonable interpretation in light of the specification of the patent in which they appear. *See* 37 C.F.R. § 42.100(b) (2017); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard). Under the broadest reasonable construction standard, claim terms are generally given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

During the institution phase, neither party proposed an express construction for any claim term. Pet. 35; Prelim. Resp. 14–15. And likewise, the parties did not propose any express constructions during the trial. *See* PO Resp.; Pet. Reply. We determine we need not explicitly construe any claim terms to resolve the issues before us. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed.

Cir. 2017) (noting that construction is needed only for terms that are in controversy, and only to the extent necessary to resolve the controversy).

D. Alleged Obviousness of Claims 1–3 and 5 over Bauch and Schneider

1. Bauch

Bauch discloses a variable rate differential phase shift keying (DPSK) system which includes a continuous transmitter and a multi-rate receiver with a single demodulator. Ex. 1004, 1:14–18. The DPSK modulation system of Bauch includes a transmitter having a carrier signal source, a phase modulator, and a DPSK encoder for modulating the carrier signal. *Id.* at 2:3–6. The signals are transmitted to a multi-rate receiver through a communication channel, for instance, free space. *Id.* at 2:8–10. The multi-rate receiver includes a single demodulator, for example, a single optical interferometer, used for multiple integer sub-harmonic data rates, which demodulates the modulated signal. *Id.* at 2:10–13. The demodulated signals are detected, for example, by photodiodes, and the detected signals are applied to a clock and data recovery circuit that is tuned as a function of the data rate. *Id.* at 2:13–18. Figure 2 of Bauch is reproduced below:

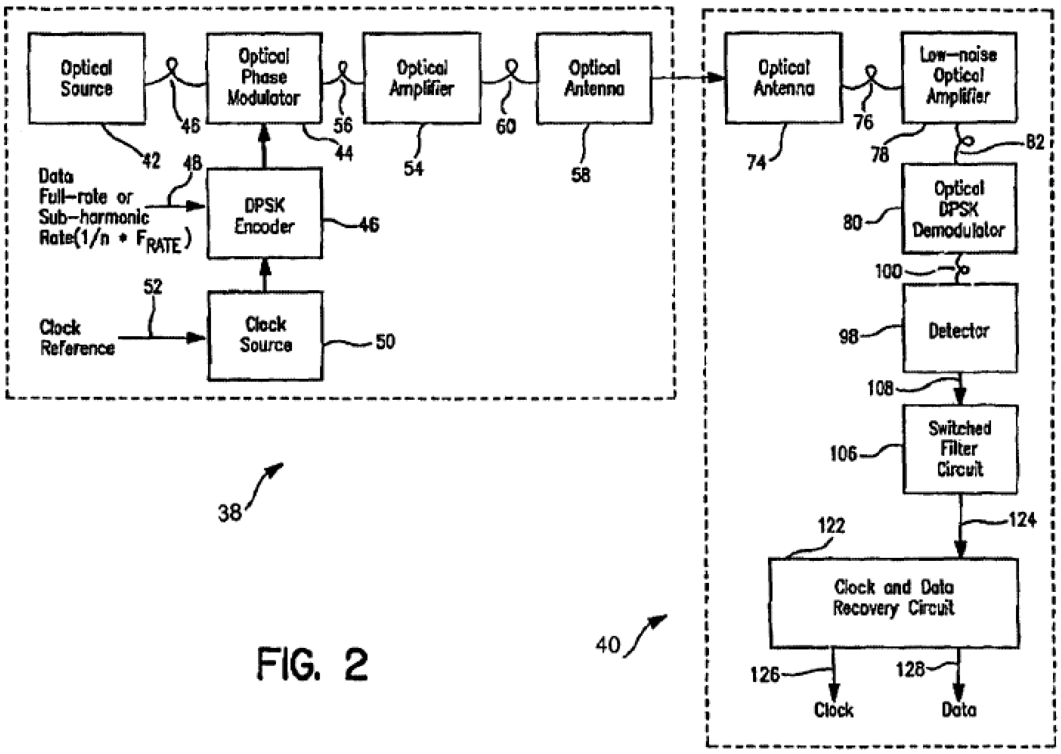


FIG. 2

Figure 2 illustrates an upper-level block diagram of Bauch's optical communication system, as generally described above. *Id.* at 2:34–35.

2. Schneider

Schneider describes its invention as follows:

> A microcontroller-based controller executes interleaved DC bias and gain control routines using monitored values of the monitored photocurrent output signal of a Mach-Zehnder laser modulator to derive a gain setting for the modulation drive signal and a bias level setting for the DC bias level, without tuning or adjustment. Subsequent to convergence of the gain and bias level settings, the control unit may repetitively interrupt and

> restart the DC bias and gain control routine at intervals that are staggered in a random time fashion, to achieve spectral dispersion of the gain and bias level settings, and provide insensitivity to periodic environmental noise.

Ex. 1026, Abstract. Figure 2 of Schneider, as annotated by Petitioner on page 32 of the Petition, is reproduced below:

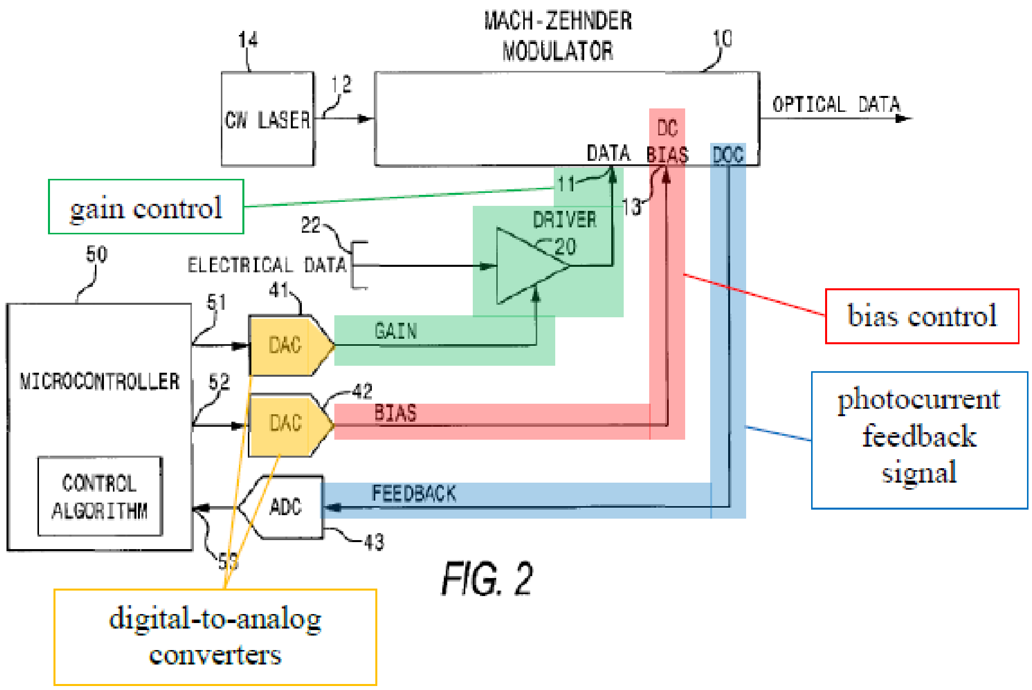


FIG. 2

Figure 2, reproduced above, is a block diagram of an architecture for performing closed loop bias and gain control according to Schneider. Ex. 1026, 3:50–54. Laser modulator 10 is arranged in output beam path 12 of continuous wave laser 14. *Id.* at 4:17–20. The gain control voltage is supplied from digital-to-analog converter (DAC) 41, and the DC bias voltage is supplied from DAC 42. *Id.* at 4:28–32. In addition, a feedback path to microcontroller 50, which includes analog-to-digital converter

(ADC) 43, monitors the output of modulator 10. *Id.* at 4:33–37. Schneider also describes a process for using its closed loop gain and bias control. *Id.* at 4:55–6:5, Fig. 3.

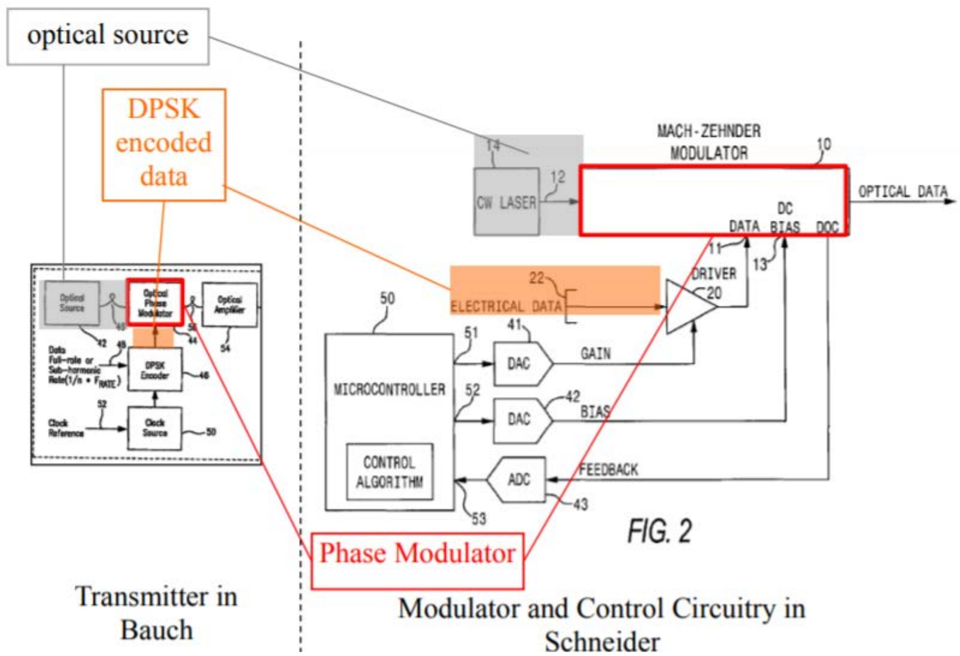
Schneider was filed on June 29, 2001, and Petitioner contends Schneider is prior art under 35 U.S.C. § 102(e) because either (1) the challenged claims of the ’952 patent are not entitled to a filing date earlier than November 26, 2001 or (2) Schneider is entitled to the effective filing date of its provisional application, November 20, 2000. Pet. 33. Regarding the effective filing date of the challenged claims, Petitioner contends the first disclosure of a “control circuit including a digital-to-analog converter having an output for altering the phase of the phase modulator,” as recited in independent claim 1, occurred in the application for the ’952 patent, and not in the earlier applications to which the ’952 patent claims priority. *Id.* at 14. Petitioner provides comparisons of the ’952 specification with each of the earlier applications that Petitioner contends show support for that limitation not being included in the earlier applications. *Id.* (citing Ex. 1032, 1, 7–20; Ex. 1033, 1, 8–23). Patent Owner does not address this assertion, or contend that the challenged claims are entitled to an earlier effective filing date. We find that Petitioner has sufficiently shown the challenged claims are not entitled to an effective filing date earlier than November 26, 2001, and we do not reach whether Petitioner has sufficiently shown Schneider is entitled to the date of its provisional application. Thus, we consider Schneider as § 102(e) prior art.

3. Claim 1

Claim 1 is the only challenged independent claim. Petitioner contends that claim 1 would have been obvious over Bauch and Schneider. Pet. 35–65. Based on the record developed during trial, we are not persuaded that Petitioner has demonstrated by a preponderance of the evidence that claim 1 would have been obvious over Bauch and Schneider.

Petitioner relies on Bauch as teaching most of the limitations of claim 1. *See* Pet. 41–65. Of relevance to our analysis here, Petitioner relies on Schneider as teaching the recited "control circuit" (in combination with Bauch's DPSK encoder 46). *Id.* at 49, 61–65. Petitioner also contends that it was known that conventional Mach-Zehnder ("MZ") modulators, such as the one used in Schneider, could be used to modulate phase, and Petitioner contends that a person of ordinary skill in the art "designing the DPSK communication system in Bauch would have been motivated to look to Schneider to implement phase modulator 44 using the MZ modulator and control circuitry in Schneider to control the optical phase imparted by the modulator." *Id.* at 39, 43, 48, 50, 58–61.

Petitioner acknowledges that Bauch "does not disclose a control circuit including 'a digital-to-analog converter having an output for altering the phase of the phase modulator,'" as recited in claim 1. *Id.* at 62. Petitioner, however, contends a person of ordinary skill in the art would have been motivated to look to the control circuitry in Schneider "to achieve the stability benefits taught in Schneider." *Id.* (citing Ex. 1003 ¶¶ 130–31). Petitioner contends that "[i]n the resulting transmitter, a [person of ordinary skill in the art] would have implemented the phase modulator in Bauch using the MZ modulator 10 and control circuitry of Schneider." *Id.* at 62–63 (citing Ex. 1026, 4:15–43, Fig. 2; Ex. 1003 ¶¶ 94–95, 131). Excerpts of Figure 2 of Bauch and Figure 2 of Schneider, as annotated by Petitioner on page 63 of the Petition, are reproduced below:



The combined figure above shows an embodiment of the transmitter of Bauch modified with the modulator and control circuitry of Schneider. When combining these teachings, Petitioner contends the resulting control circuit and modulator would integrate:

> (i) DPSK encoder 46 from Bauch, which would output the "electrical data" 22 shown in Figure 2 of Schneider and (ii) the gain and bias control circuitry of Schneider (analog-to-digital converter (ADC) 43 for reading the feedback current from the photodiode in the MZ modulator, microcontroller 50 for executing a control algorithm, and two digital-to-analog

> converters (DACs) 41 and 42 for gain and bias control of MZ modulator 10, and driver 20).

Id. at 63–64 (citing Ex. 1026, 4:15–43, Fig. 2; Ex. 1003 ¶ 131). In particular, Petitioner contends DAC 42 in Schneider teaches the recited "digital-to-analog" converter. *Id.* at 64.

Petitioner further contends it would have been obvious to use Schneider's DAC 42 to output a voltage (i.e., bias voltage) for altering the phase of MZ modulator 10. *Id.* at 64–65. Specifically, in Petitioner's combination, "MZ modulator 10 modulates an optical carrier signal to impart phase changes to represent data and alters its bias point based on the control algorithm in Schneider." *Id.* at 64. According to Petitioner, Schneider's "control algorithm uses prescribed increment and decrement values to set the appropriate bias voltage to compensate for environmental noise, temperature changes, and aging components," and a person of ordinary skill in the art would have understood that when used with an MZ modulator performing phase modulation, these "prescribed adjustments to the modulator bias at control port 52 alter the phase of the MZ modulator." *Id.* at 64–65.

Petitioner also provides reasoning for why Petitioner contends a person of ordinary skill in the art would have found it obvious to use Schneider's control circuit (and particularly its bias and gain control) with Bauch's transmitter. Pet. 35–41. Specifically, Petitioner contends "Schneider provides details about how to implement a modulator that Bauch is missing." *Id.* at 37. Petitioner further contends that a person of ordinary skill in the art "would have understood that a phase modulator would need bias and gain control to compensate and provide insensitivity for environmental noise, changes in temperature, and aging of components, and would have been motivated to utilize Schneider's control algorithms to achieve those benefits, as taught in Schneider." *Id.* at 38 (citing Ex. 1026, 1:41–52, 2:22–26, 3:28–30, 6:22–24; Ex. 1003 ¶¶ 99–103). Petitioner acknowledges that Schneider uses its modulator to modulate intensity, but argues a person of ordinary skill would have understood that Schneider's modulator could also be used to modulate phase. *Id.* at 39 (citing Ex. 1003 ¶¶ 94–102). Petitioner contends that at the relevant time, an MZ modulator was known to modulate either intensity or phase by adjusting the operating point along the modulator's transfer function (e.g., at the minimum point for phase modulation). *Id.* (citing Ex. 1003 ¶¶ 68–71, 94–99). Petitioner further contends that a person of ordinary skill "would have been motivated to combine Bauch and Schneider to add the gain and bias control mechanism of Schneider so that the modulator would be stable and otherwise able to operate in such 'real world' conditions" (i.e., environmental noise, changes in temperature, and aging of components). *Id.* at 41 (citing Ex. 1003 ¶¶ 90–103).

In its Response, Patent Owner argues that Petitioner's combination "is inconsistent with the design and principles of Schneider's closed-loop control circuit." PO Resp. 14. In particular, Patent Owner contends that "[t]he parameters for the DC bias voltage and drive voltage are different for a Mach-Zehnder modulator operating as an intensity modulator as compared to a Mach-Zehnder modulator operating as a phase modulator." *Id.* at 15 (citing Ex. 2031 ¶ 28); *see also id.* at 15–19 (For an ideal MZ modulator, DC bias voltage is set to Vπ/2 for operating as an intensity modulator and Vπ for operating as a phase modulator.).

Patent Owner contends, and Petitioner does not dispute (Pet. 39; Pet. Reply 3, 10), Schneider's MZ modulator operates to modulate intensity and not phase. PO Resp. 19. Patent Owner further contends that Schneider's control loop operates while its intensity modulator is modulating data. *Id.* at 27–28. Patent Owner points to Schneider's provisional application, which was incorporated into Schneider (Ex. 1026, 1:6–12), and states "[o]ne aspect of this invention is the algorithm for non-disruptively optimizing this bias point *in a system where there is normal data flow through the device*." PO Resp. 28 (quoting Ex. 1027, 1) (citing Ex. 2031 ¶ 49). According to Patent Owner (and again not disputed by Petitioner (Pet. Reply 3, 7)), Schneider's control algorithm calculates the bias point for intensity modulation, which is different than the bias point for phase modulation. PO Resp. 29–45.

Patent Owner contends that a person of ordinary skill in the art would not have looked to Schneider to operate a phase modulator. *Id.* at 45. Patent Owner acknowledges that Petitioner's declarant Dr. Blumenthal testified that a person of ordinary skill in the art would have used information about the modulator's transfer function derived by Schneider's control algorithm to control a phase modulator. *Id.* at 47 (citing Ex. 1003 ¶ 94). Nevertheless, Patent Owner contends that the Petition did not explain this theory, and a person of ordinary skill in the art would not have been motivated to operate Schneider in this way in any event. *Id.* at 47–51.

In its Reply, Petitioner contends that it explained in the Petition that "Schneider's algorithm is executed to derive information about the [MZ modulator's] transfer function, and then use that information to operate the [MZ modulator] as either an intensity modulator or a phase modulator, and specifically as a phase modulator when implemented in Bauch's system." Pet. Reply 3 (citing Pet. 39–41; Ex. 1003 ¶¶ 94–102). Petitioner contends that in its proposed combination, a person of ordinary skill in the art "would have executed Schneider's control algorithm and after execution is complete, a [person of ordinary skill in the art] would have operated the same [MZ modulator] to modulate phase in Bauch's system." *Id.* at 6–7 (citing Pet. 39–40; Ex. 1003 ¶¶ 100–102, 136–137). Specifically, Petitioner contends that Schneider's control algorithm settles on Vπ/2 (i.e., the bias point associated with intensity modulation), and then a person of ordinary skill in the art would "derive the peak of the transfer function (e.g., Vπ, which characterizes the transfer function)" (i.e., the bias point associated with phase modulation. *Id.* at 7.

Petitioner contends that in its proposed combination, "the control loop and algorithm are still the exact same as disclosed in Schneider." *Id.* at 11; *see* Tr. 17:12–21. Petitioner acknowledges that in the combination, the control algorithm would not run while transmitting data, but contends that running that algorithm when not transmitting data is consistent with Schneider's teachings and would not disrupt system operation. Pet. Reply

12–15. Petitioner points to Schneider's teaching that its control algorithm powers down for extended periods of time after it has settled to save power. *Id.* at 12 (citing Ex. 1026, 6:20–25, 6:36–38). Petitioner also contends that stopping data transmission to run Schneider's control algorithm would not disrupt system operation. *Id.* at 14. Instead, Petitioner contends a person of ordinary skill in the art "would have understood that Schneider's control routine would be used periodically in a system (e.g., like Bauch) that can stop data transmission (e.g., for maintenance)." *Id.* Petitioner points to a simulation run by Patent Owner's declarant Dr. Goossen as showing that Schneider's bias control routine can settle in as few as four iterations (*id.* at 15 (citing Ex. 2031 ¶ 77)), and also relies on Dr. Blumenthal's testimony that a person of ordinary skill in the art "would have recognized that Schneider's control algorithm could execute more quickly than the prior art bias control routines, limiting disruption" (*id.* (citing Ex. 1044 ¶ 9)). In support of the latter contention, Dr. Blumenthal cites a document titled "PSI0202 Modulator Bias Controller" that states it "[a]utomatically obtains bias point in < 50 milliseconds." Ex. 1044 ¶ 9 (citing Ex. 1049, 1–2). Dr. Blumenthal also states: "This time period is consistent with the acceptable link down time during network restoration under a link failure, and it was well known to a [person of ordinary skill in the art] via practice and standards such as SONET, that such events were accommodate [sic] for using data buffer storage." *Id.*

In its Sur-Reply, Patent Owner contends that Schneider's algorithm cannot function while its MZ modulator is transmitting phase-modulated data. PO Sur-Reply 1. Thus, Patent Owner contends that Petitioner failed to adequately show a person of ordinary skill in the art would have had a reason to make the combination as presented in the Petition. *Id.* at 1–2. Patent Owner further contends that Petitioner's reply arguments are improper because they are new and not set forth in the Petition. *Id.* at 2. And according to Patent Owner, Petitioner does not provide a sufficient motivation for making the modifications to Schneider's control algorithm as set forth in Petitioner's Reply in any event. *Id.* at 2–4.

We agree with Patent Owner that Petitioner did not clearly explain its combination in the Petition, and that even considering the combination as clarified in the Reply, Petitioner has not adequately shown a person of ordinary skill in the art would have been motivated to make the proposed modifications to operate Schneider's control algorithm with Bauch's phase modulation.

We begin by noting that several of the underlying facts on which we base our analysis do not appear to be disputed. Claim 1 relates to phase modulation, and the limitation on which we focus recites "the control circuit including a digital-to-analog converter having an output for altering the phase of the phase modulator." Ex. 1001, 10:25–29. The following facts appear to be undisputed: (1) Schneider discloses only intensity modulation using an MZ modulator and not phase modulation; (2) an MZ modulator could be used to modulate either intensity or phase; (3) an MZ modulator has the same transfer function regardless of whether it is modulating intensity or phase; (4) for an ideal MZ modulator, DC bias voltage would be set to Vπ/2 for operating as an intensity modulator and Vπ for operating as a phase modulator; (5) Schneider's control algorithm settles at Vπ/2, the bias point for operating as an intensity modulator; and (6) Schneider's control algorithm does not operate while transmitting phase modulated data. Pet. 39–40; Pet. Reply 3, 7, 13–14; Tr. 18:21–22; Ex. 2030, 117:4–17; PO Resp. 15–19, 40–45.

We agree with Patent Owner that the following accurately characterizes the operation of the combination Petitioner asserted in its Reply:

> (1) runs Schneider's control algorithm only while data is not transmitted,
>
> (2) settles on values specific for operation of the Mach-Zehnder modulator as an intensity modulator using feedback from a Mach-Zehnder modulator in that mode,
>
> (3) then turns off Schneider's control algorithm,
>
> (4) performs a conversion of the settled intensity-modulation values to produce converted values,
>
> (5) while Schneider's control algorithm remains off, operates the Mach-Zehnder modulator in a phase-modulation mode using the converted values and without any feedback from the Mach-Zehnder modulator operating in a phase-modulation mode.

PO Sur-Reply 3 (emphases omitted); *see* Pet. Reply 3–15.

We also agree with Patent Owner that these contentions were not clear in the Petition. In the Petition, when discussing using the digital-to-analog converter to output a voltage for altering the phase of the phase modulator, Petitioner pointed to Schneider's control algorithm using "prescribed increment and decrement values to set the appropriate bias voltage to compensate for environmental noise, temperature changes, and aging components." Pet. 64–65 (citing Ex. 1026, 1:41–46, 2:22–24, 3:28–30, 5:25–35, 6:22–24). Petitioner then contended that "[w]hen using these values in conjunction with an MZ modulator performing phase modulation, a [person of ordinary skill in the art] would have understood that prescribed adjustments to the modulator bias at control port 52 alter the phase of the MZ modulator." *Id.* at 65 (citing Ex. 1003 ¶ 132). In discussing the motivation to combine the teachings of Bauch and Schneider, Petitioner contends that at the relevant time, an MZ modulator was known to modulate either intensity or phase by adjusting the operating point along the modulator's transfer function (e.g., at the minimum point for phase modulation). *Id.* at 39 (citing Ex. 1003 ¶¶ 68–70). That contention, including how that operating point could be adjusted for phase modulation, was supported by the testimony of Petitioner's declarant Dr. Blumenthal. Ex. 1003 ¶¶ 68–71.

The Petition, however, was not clear that in the combination, Schneider's control algorithm would run only while data was not being transmitted. Instead, we agree with Patent Owner that Petitioner's contentions in the Petition suggest the opposite. PO Sur-Reply 1–2 (citing Pet. 60–62). In particular, we note the Petition strongly suggested it relied on the increment and decrement values of Schneider's control algorithm (and not an adjustment to the settled point from that algorithm) as corresponding to the "output for altering the phase of the phase modulator." *See* Pet. 64–65 ("When using these values [i.e., the prescribed increment and decrement values] in conjunction with an MZ modulator performing phase modulation, a POSITA would have understood that prescribed adjustments to the modulator bias at control port 52 alter the phase of the MZ modulator.”). This is also consistent with how Petitioner analyzed dependent claim 5 in the Petition. *See id.* at 68–71 (arguing that the prescribed increment and decrement values in Schneider’s control algorithm teach “rotating a phase imparted by the phase modulator by a predetermined amount,” as recited in claim 5). In other words, Petitioner appears to rely on intermediate changes to the bias voltage in Schneider (Pet. 64–65, 69–70 (citing Ex. 1026, Fig. 3)) as altering or rotating the phase of a phase modulator in the Petition, whereas in the Reply, Petitioner appears to rely on using information derived from the settled point of the control algorithm to alter the phase (Pet. Reply 13–14).

Petitioner contends that the arguments presented in the Reply are proper because they fairly respond to arguments raised in the Patent Owner Response. Tr. 23:24–25:14. But it is incumbent on Petitioner to explain the modifications to a reference on which it relies in its Petition. Specifically, a petition is required to include “[a] full statement of the reasons for the relief requested, including a detailed explanation of the significance of the evidence including material facts, and the governing law, rules, and precedent.” 37 C.F.R. § 42.22(a)(2). We disagree that Petitioner could not have anticipated that disruption of data flow would have been an issue in addressing the combination (Tr. 25:5–14). Schneider incorporates its provisional application by reference (Ex. 1026, 1:8–12), and that provisional application states: "Mach-Zehnder optical modulators require a bias adjustment, which place the static operating point of the modulator at quadrature [i.e., Vπ/2, the bias point for intensity modulation]. One aspect of this invention is the algorithm for non-disruptively optimizing this bias point *in a system where there is normal data flow through the device*." Ex. 1027, 1 (emphasis added). Because its proposed combination was inconsistent (or could reasonably be understood as inconsistent) with this teaching, Petitioner should have explained this aspect and the reasoning for why a person of ordinary skill in the art would have been motivated to make the proposed changes. Petitioner did not adequately do so in the Petition.

Even considering Petitioner's arguments and evidence presented in its Reply, we are not persuaded that Petitioner has sufficiently shown a person of ordinary skill in the art would have been motivated to use Schneider's control algorithm to modulate phase absent impermissible hindsight. *See In re Fritch*, 972 F.2d 1260, 1266 (Fed. Cir. 1992) ("It is impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious." (citation omitted)). Again, it is undisputed that Schneider discloses intensity, not phase, modulation, and that differences exist between the two in their bias adjustment, including the operating point for the bias voltage and whether Schneider's control algorithm would run during data transmission.

Petitioner contends that "Schneider is not limited to operating its control algorithm during data transmission. Rather, Schneider teaches a goal of avoiding disruption of the system." Pet. Reply 14. Even if Schneider is not limited expressly to operating its control algorithm during data transmission, its provisional application (as quoted above and incorporated into Schneider) identifies doing so as part of Schneider's invention. Ex. 1027, 1. Petitioner also characterizes any disruption from running Schneider's control algorithm when data is not being transmitted as "non-disruptive" and within "acceptable levels of operation." Pet. Reply 14 (citing Ex. 1044 ¶¶ 8–10; Ex. 2030, 58:3–62:2; Ex. 1026, 3:15–30, 4:44–54; Ex. 1027, 1).

We find Dr. Blumenthal's explanation on which Petitioner relies to support these characterizations insufficient. Petitioner has shown that a person of ordinary skill in the art *could* have modified Schneider's control algorithm to operate with Bauch's phase modulation (i.e., by running Schneider's control algorithm without transmitting data, taking the algorithm's settled point at Vπ/2, determining the bias point from that data, and then running the modulator as a phase modulator with the derived bias point). Petitioner, however, has not adequately shown a person of ordinary skill in the art would have been motivated to do so. *See Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015) ("[O]bviousness concerns whether a skilled artisan not only *could have made* but *would have been motivated to make* the combinations or modifications of prior art to arrive at the claimed invention.").

In particular, we are unpersuaded by Dr. Blumenthal's testimony that a person of ordinary skill in the art "would have recognized that Schneider's control algorithm would have executed more quickly than the prior art bias control routines that require manual adjustment." Ex. 1044 ¶ 9. In support, Dr. Blumenthal appears to compare Dr. Goossen's simulation of Schneider's algorithm (which allegedly settles in as little as 4 iterations) to a publication (Ex. 1049) that says a different system obtains the bias point in less than 50 ms. Ex. 1044 ¶ 9. Dr. Blumenthal, however, does not explain any comparison between the two, and we are left to speculate how long it would take Schneider's algorithm to both arrive at the information relevant to the transfer function and then convert that to information needed for phase modulation. In other words, Dr. Blumenthal provides us with an insufficient factual basis to support his testimony that Schneider's control algorithm would have executed more quickly than the prior art bias control routines that require manual adjustment. *See In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1368 (Fed. Cir. 2004) ("[T]he Board is entitled to weigh the declarations and conclude that the lack of factual corroboration warrants discounting the opinions expressed in the declarations."); *see also* 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight."). Thus, we find Petitioner has not sufficiently shown a person of ordinary skill in the art would have been motivated to modify Schneider in the way proposed.

We have also considered Dr. Blumenthal's testimony that the amount of time needed to run Schneider's algorithm would have been acceptable because the disruption in data transmission would have been akin to other acceptable disruptions such as those for maintenance or network restoration under a link failure. Ex. 1044 ¶ 9. Dr. Blumenthal, however, does not cite any support for this contention or provide analysis of what those disruptions would entail, other than relying on Dr. Goossen's simulation. *Id.* In addition, Dr. Blumenthal does not persuasively address why a person of ordinary skill in the art would have considered such disruptions acceptable when performing phase modulation of data. Again, it is not enough to say that a person of ordinary skill in the art could have made modifications to a reference. This is particularly true when the reference operates in a different way than the claims require (i.e., intensity instead of phase modulation). Based on the record before us, we find that Petitioner has not shown a person of ordinary skill in the art would have found the proposed modifications to Schneider's control algorithm obvious absent improper hindsight. *See Fritch*, 972 F.2d at 1266.

For the reasons discussed above, we conclude that Petitioner does not show, by a preponderance of the evidence, that claim 1 is unpatentable under 35 U.S.C. § 103(a) over Bauch and Schneider.

4. Claims 2, 3, and 5

Claims 2, 3, and 5 depend directly or indirectly from independent claim 1. Petitioner contends these dependent claims would have been obvious over Bauch and Schneider. Pet. 65–71. Petitioner's analysis of these claims, however, does not cure the deficiency with independent claim 1 discussed above. *Id.* Thus, we also conclude that Petitioner does not show, by a preponderance of the evidence, that claims 2, 3, and 5 are unpatentable under 35 U.S.C. § 103(a) over Bauch and Schneider.

E. Alleged Obviousness of Claims 4 over Bauch, Schneider, and Heflinger

Claim 4 depends indirectly from claim 1 and recites "wherein at least one of the first arm and the second arms includes an additional phase modulator." Ex. 1001, 10:35–37. Petitioner relies on Heflinger as allegedly teaching this additional limitation of claim 4. Pet. 75–78. Petitioner's analysis of claim 4, however, does not cure the deficiency with independent claim 1 discussed above. *Id.* Thus, we also conclude that Petitioner does not show, by a preponderance of the evidence, that claim 4 is unpatentable under 35 U.S.C. § 103(a) over Bauch, Schneider, and Heflinger.

IV. ORDER

It is

ORDERED that, based on a preponderance of the evidence, claims 1–5 of U.S. Patent No. 6,476,952 B1 have not been shown to be unpatentable; and

FURTHER ORDERED that, because this is a final written decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

PETITIONER:

Brian Oaks
Wayne Stacy
BAKER BOTTS LLP
brian.oaks@bakerbotts.com
wayne.stacy@bakerbotts.com

Darren Donnelly
POLSINELLI LLP
ddonnelly@polsinelli.com

PATENT OWNER:

Wayne Helge
James Wilson
Aldo Noto
DAVIDSON BERQUIST JACKSON & GOWDEY L.L.P.
whelge@dbjg.com
jwilson@dbjg.com
anoto@davidsonberquist.com