

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NEC CORPORATION, NOKIA CORPORATION, and
ALCATEL SUBMARINE NETWORKS,
Petitioner,

v.

NEPTUNE SUBSEA IP LIMITED,
Patent Owner.

IPR2018-01157
Patent 8,351,798 B2

Before BARBARA A. BENOIT, GREGG I. ANDERSON, and
JASON W. MELVIN, *Administrative Patent Judges*.

MELVIN, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

Petitioner, NEC Corporation, Nokia Corporation, and Alcatel Submarine Networks,¹ filed a Petition (Paper 4, “Pet.”) requesting *inter partes* review of claims 13–20 (“the challenged claims”) of U.S. Patent No. 8,351,798 B2 (Ex. 1001, “the ’798 patent”). Patent Owner, Neptune Subsea IP Limited,² timely filed a Preliminary Response. Paper 8. We instituted *inter partes* review of the challenged claims. Paper 10 (“Institution Decision” or “Inst.”). After institution, Patent Owner filed a Patent Owner Response (Paper 14, “PO Resp.”) and Petitioner filed a Reply (Paper 16, “Pet. Reply”). Neither party requested an oral hearing; none was held.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is entered pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed below, Petitioner has shown by a preponderance of the evidence that claims 13–20 of the ’798 patent are unpatentable.

A. RELATED MATTERS

As required by 37 C.F.R. § 42.8(b)(2), each party identifies various judicial or administrative matters that would affect or be affected by a decision in this proceeding. Pet. 82; Paper 7.

¹ NEC Networks & System Integration Corporation and NEC Corporation of America are additional real parties in interest. Pet. 82.

² Patent Owner is a wholly owned subsidiary of Neptune Subsea Holdings Ltd., which is a UK corporation and is a wholly owned subsidiary of Xtera Topco Ltd. f.k.a. Neptune Subsea Acquisitions Ltd., also a UK corporation. Paper 7.

B. THE '798 PATENT

The '798 patent relates to “fiber optic transmission technologies that allow[] Differential Phase Shift Keying (DPSK or 2 PSK) or even higher order phase shift keying to be performed at 20 gigabits per second per channel and higher bit rates in a [Wavelength Division Multiplexing] WDM (e.g., [Dense Wavelength Division Multiplexing] DWDM) wavelength multiplexed channeling environment.” Ex. 1001, 2:55–60. Long-distance transmission over optical fibers suffers from dispersion of the light waves, including chromatic dispersion, which “occurs because optics of different wavelengths tend to travel through the optical fiber at slightly different speeds.” *Id.* at 1:64–67. The '798 patent explains:

Some optical fibers are ‘positive dispersion’ fiber in which the longer wavelength (lower frequency) light travels through the fiber slightly slower than the shorter wavelength (higher frequency) light. Other optical fibers are ‘negative dispersion’ fiber in which the longer wavelength (lower frequency) light travels through the fiber slightly faster than the shorter wavelength (higher frequency) light. By mixing the use of negative dispersion and positive dispersion fibers, the dispersion can often be largely (but often not completely) cancelled out.

Id. at 2:3–12. Thus, the technology of the '798 patent uses pre-compensation applied at a transmitting terminal to affect the dispersion “such that each of most, if not all, channels have a minimum absolute accumulated dispersion that occurs somewhere within the length of the optical channel.” *Id.* at 2:60–64. In addition, post-compensation is applied “at the receiver to reduce or even potentially eliminate the chromatic dispersion.” *Id.* at 2:66–3:1.

Sometimes, a fiber causes unexpected asymmetries in the dispersion map and, to address such an occurrence, “the pre-compensation should be

more adaptive using perhaps a closed control loop to refine the pre-compensation (and post-compensation) through several iterations of bit error rate checking until an acceptable bit error rate is achieved.” *Id.* at 12:31–36. Thus, the ’798 patent describes including a “tunable channel compensation mechanism” to permit adjusting the dispersion compensation. *Id.* at 11:12–17, 14:13–24.

C. CHALLENGED CLAIMS

Challenged claim 13 is independent and claims 14–20 depend from claim 13. Claim 13 is reproduced below:

13. A method for configuring an optical system that includes at least in one direction a transmit terminal, a receive terminal, and an optical fiber link coupled there between to allow a transmit optical signal to be transmitted by the transmit terminal, through the optical fiber link, and to the receive terminal, the method comprising:
 - an act of adjusting a tunable pre-compensation mechanism at the transmit terminal such that at least a majority of a plurality of wavelength division multiplexed channels of the transmit optical signal at least initially reaches a minimum accumulated dispersion within a central distance of the length of the optical fiber link, wherein the act of adjusting is performed using a closed control loop that measures bit error rate at the receive terminal, and further adjusts the tunable pre-compensation mechanism until an acceptable bit error rate is achieved.

Ex. 1001, 16:25–40.

D. PRIOR ART AND ASSERTED GROUNDS

We consider the following grounds of unpatentability:

Claim(s) Challenged	35 U.S.C. §	References
13–20	103	Yamamoto ³ and Nishimoto ⁴
13	103	Chowdhury ⁵ and Webb ⁶
14–20	103	Chowdhury, Webb, and Tanaka ⁷

See Pet. 9–81.

E. LEGAL PRINCIPLES

An invention is not patentable “if the differences between the subject matter sought to be patented 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.” 35 U.S.C. § 103(a) (2006).⁸ 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) where in evidence, so-called secondary considerations, including commercial success, long-felt but unsolved needs, and failure of others. *Graham v. John Deere*

³ U.S. Pat. No. 6,021,235 (iss. Feb. 1, 2000) (Ex. 1005).

⁴ U.S. Pat. No. 6,871,024 B2 (iss. Mar. 22, 2005) (Ex. 1007).

⁵ U.S. Pat. Appl. Pub. No. 2004/0234272 A1 (pub. Nov. 25, 2004) (Ex. 1006).

⁶ U.K. Pat. Appl. Pub. No. GB 2423900 A (pub. Sept. 6, 2006) (Ex. 1009).

⁷ U.S. Pat. Appl. Pub. No. 2002/0012162 A1 (pub. Jan. 31, 2002) (Ex. 1010).

⁸ The America Invents Act included revisions to, *inter alia*, 35 U.S.C. § 103 effective on March 16, 2013. See Pub. L. No. 112-29, 125 Stat. 284, 287–88 (2011). Because the application resulting in the ’798 patent was filed before March 16, 2013 (see Ex. 1001, code (22)), the pre-AIA version of 35 U.S.C. § 103 applies.

Co., 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007) (citing *In re Kahn*, 441, F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of elements produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–17.

II. DISCUSSION

A. CLAIM CONSTRUCTION

In an *inter partes* review, the Board interprets claims of an unexpired patent using the broadest-reasonable construction in light of the specification of the patent. 37 C.F.R. § 42.100(b) (2017); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016); *see also* Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board, 83 Fed. Reg. 51,340 (Oct. 11, 2018) (codified at 37 C.F.R. pt. 42 (2019)) (final rule) (“This rule is effective on November 13, 2018 and applies to all IPR, PGR and CBM petitions filed on or after the effective date.”). Under that standard, we generally give a claim term its “ordinary and customary meaning,” which is “the meaning that the term would have to a person of ordinary skill in the art in question” at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

The parties submit and we agree that there is no need to construe any term to resolve the issues in this decision. *See* Pet. 7–9; PO Resp. 6; *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Ltd.*, 868 F.3d 1013,

1017 (Fed. Cir. 2017); *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

B. OBVIOUSNESS OVER YAMAMOTO AND NISHIMOTO
(CLAIMS 13–20)

1. Independent claim 13

Petitioner submits that Yamamoto teaches the general structure used in the method of claim 13, including a transmit terminal, a receive terminal, and an optical fiber link coupling the two. Pet. 9–12, 16–17. Yamamoto discloses a system for transmitting multiple wavelength bands, with each band having one of “chromatic dispersion compensators 41” before multiplexing and transmission over the link. Ex. 1005, Fig. 8, 6:66–7:16. Yamamoto’s Figure 8 is reproduced below:

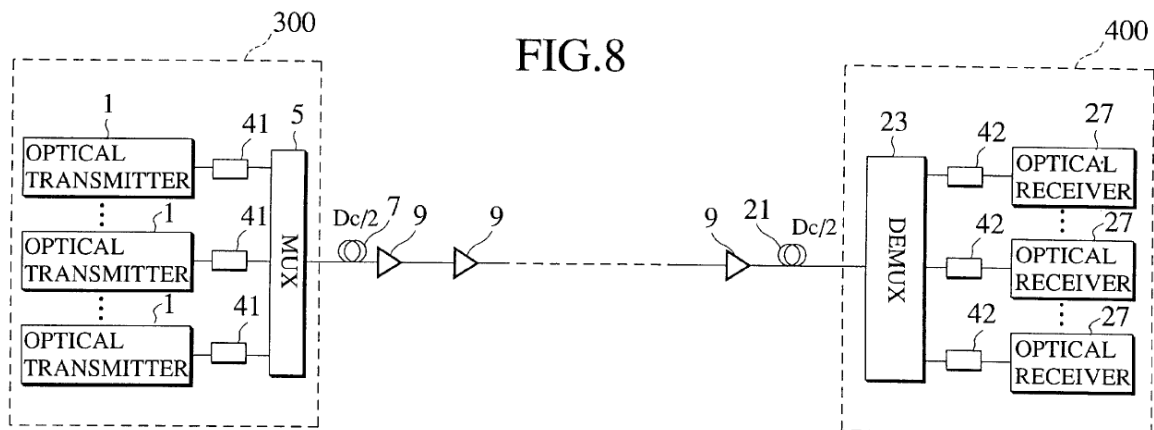


Figure 8 depicts that “chromatic dispersion compensating transmitter unit 300 has a plurality of optical transmitters 1, a multiplexer 5 combining (multiplexing) a plurality of different wavelength bands and a plurality of chromatic dispersion compensators 41” and that “chromatic dispersion compensating receiver unit 400 has a demultiplexer 23, a plurality of optical receiver 27 and a plurality of chromatic dispersion compensators 42.” *Id.*

at 7:4–11. Yamamoto discloses dispersion compensation fibers (DCOFs) as an example of the dispersion compensators and discloses adjusting the length of each DCOF to adjust pre-compensation applied to the fiber as needed for each wavelength. *Id.* at 3:27–33, 7:17–8:3, Figs. 9, 11; *see also* Pet. 10–12, 16–17, 18–19.

Yamamoto depicts the accumulated wavelength dispersion achieved when practicing its invention, showing that the dispersion is minimum in the center of the link. Ex. 1005, Fig. 12. Yamamoto’s Figure 12 is reproduced below:

FIG.12

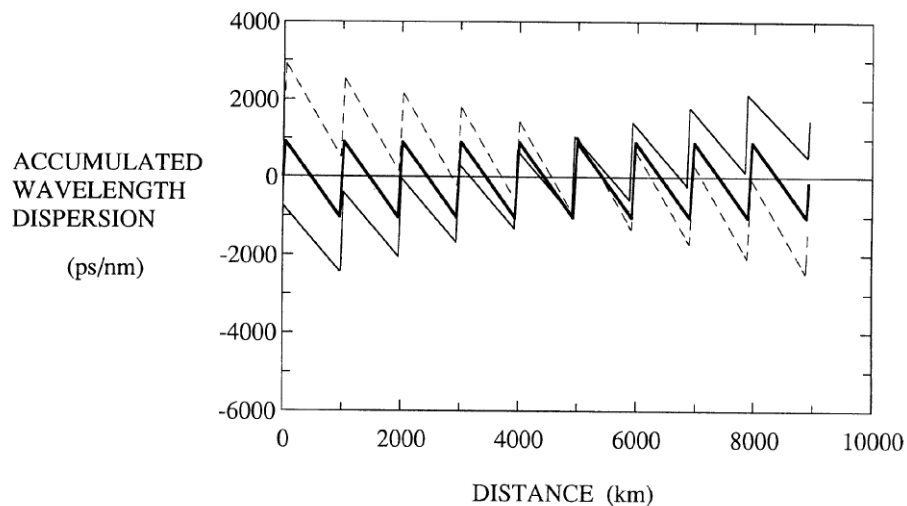


Figure 12 depicts “the accumulated wavelength dispersion according to the configuration shown in FIG. 11.” *Id.* at 8:4–5.

Petitioner submits that, in the same type of system as Yamamoto, Nishimoto teaches the use of variable dispersion compensators and feedback control based on the receiver’s bit error information. Pet. 13–15, 21–24. Nishimoto discloses that, for high-speed transmission, fixed compensation is

not adequate, requiring “a system for automatically compensating for wavelength dispersion and polarization mode dispersion.” Ex. 1007, 1:34–41. Petitioner points to Nishimoto’s disclosure that, by “making use of the variable dispersion compensator, it becomes possible to collectively compensate for the wavelength dispersion and polarization mode dispersion of the optical signal.” Pet. at 14–15 (quoting Ex. 1007, 3:49–60); *accord id.* at 22. Nishimoto discloses adjusting compensation “when the bit errors judged on the basis of the bit error information have exceeded a preset threshold, to thereby reset the compensation amount of the waveform degradation to a point where the bit errors become the minimum.” Ex. 1007, 4:3–15. In light of a desire for high-speed capability, submits Petitioner, a skilled artisan would have had reason to use Nishimoto’s variable dispersion compensator in place of Yamamoto’s DCOFs or chromatic dispersion compensators. Pet. 22–24. According to Petitioner, the combination “would yield an improved WDM system capable of automatic compensation for degradation of the optical signal waveform caused by both wavelength dispersion and polarization mode dispersion of the optical transmission path, resulting in further reduced size and cost.” Pet. 16.

Nishimoto discloses several embodiments. In one aspect, it employs multiple dispersion compensators for each of multiple channels in a multiplexed system. Ex. 1007, Fig. 17, 14:59–15:6, 15:47–59. Nishimoto’s Figure 17 is reproduced below:

FIG.17

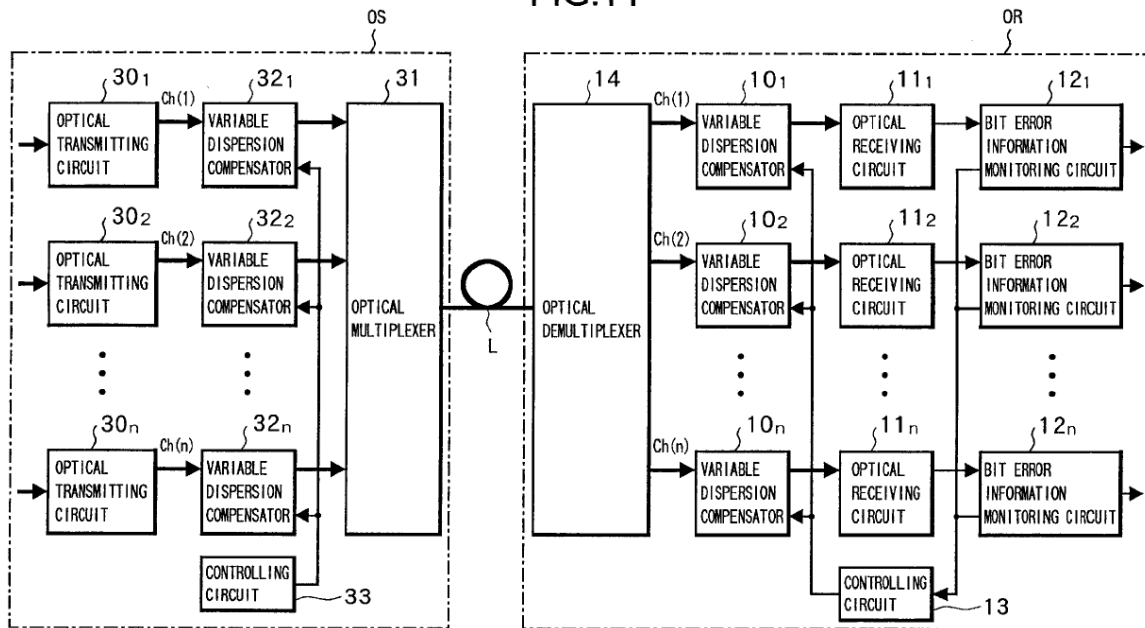


Figure 17 depicts a block diagram where “variable dispersion compensators $32_1, 32_2, \dots 32_n$ are provided at the optical sender OS side, so as to correspond to the channel lights Ch(1) to Ch(n) and a controlling circuit 33 is provided for controlling the wavelength dispersion values of the respective variable dispersion compensator 32_1 to 32_n .” *Id.* at 14:64–15:2. In that embodiment, Nishimoto discloses that the dispersion compensators at the transmit side may be “controlled corresponding to the dispersion compensating state at the receipt side.” *Id.* at 15:53–59. It also discloses an embodiment expressly showing that feedback from the receiver side may be sent to the transmitting side to automatically control the variable dispersion compensator at the transmitting side. *Id.* at Fig. 21, 17:49–66. Nishimoto’s Figure 21 is reproduced below:

FIG.21

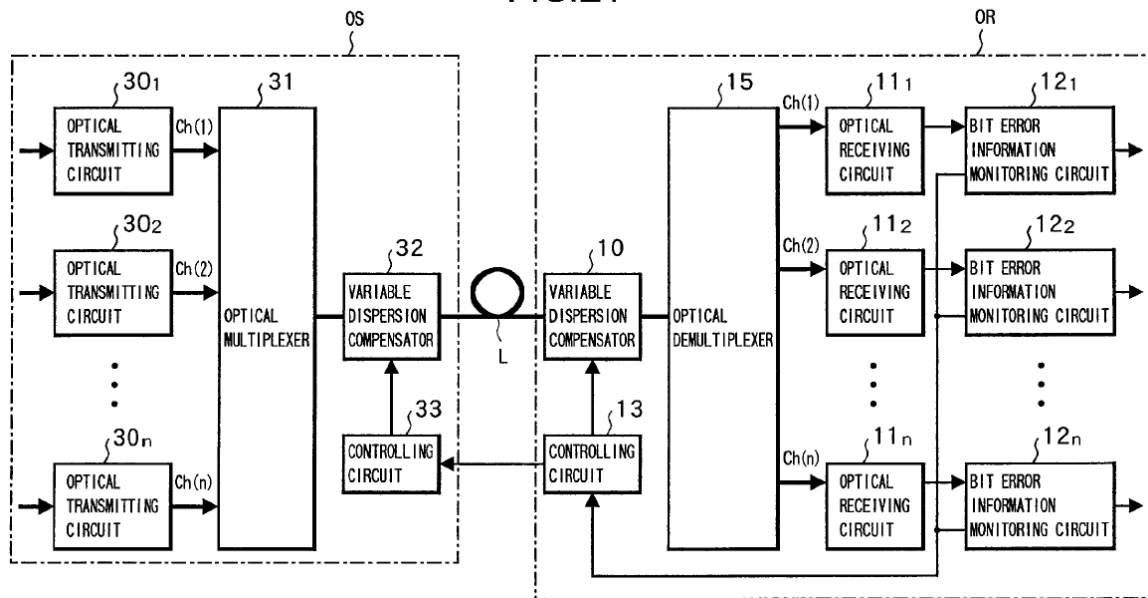


Figure 21 depicts Nishimoto’s closed-loop feedback control, where “dispersion compensator controlling information from the controlling circuit 13 at the optical receiver OR side to the controlling circuit 33 at the optical sender OS side, to thereby automatically control the variable dispersion compensator 32 at the transmitting side.” *Id.* 17:61–66. And in that example of feedback control, Nishimoto discloses that feedback control to the transmitting side may be performed “only when the bit error rate is not sufficiently reduced only by the optimizing control of the variable dispersion compensator 10 at the receipt side.” *Id.* at 17:66–18:6.

In light of Nishimoto’s multiple disclosures, Petitioner asserts that it teaches “a closed control loop that measures bit error rate at the receive terminal, and further adjusts the tunable pre-compensation mechanism until an acceptable bit error rate is achieved” as claimed. Pet. 24–31. Petitioner asserts that a person of skill would understand from Nishimoto’s disclosures to use the multiple individual dispersion compensators shown in Figure 17

with the feedback control shown in Figure 21 because doing so “would provide more fine-grained automatic control of the variable dispersion compensators 32₁ to 32_n at the transmitting side, as compared with a single collective dispersion compensators 32.” Pet. 29. Thus, reasons Petitioner, skilled artisans would have used that combined teaching from Nishimoto in further combination with Yamamoto’s system as described above. Pet. 29–31. The combination would use the bit error rate measurement from the receiver to perform feedback control of a variable dispersion compensator for each channel on the transmit side. *Id.* at 30–31.

Having considered Petitioner’s submissions and the evidence it relies on as well as Patent Owner’s arguments, which we address below, we conclude that Petitioner has shown by a preponderance of the evidence that the subject matter of claim 13 would have been obvious in light of Yamamoto and Nishimoto, and that a person of ordinary skill in the art at the time would have had reason to combine the relevant teachings as asserted to arrive at the claimed invention.

*a. “adjusting a tunable pre-compensation mechanism
at the transmit terminal”*

Patent Owner contends that Petitioner relies on Yamamoto alone as teaching “adjusting a . . . pre-compensation mechanism at the transmit terminal.” PO Resp. 6–12. In Patent Owner’s view, Yamamoto “does not disclose ‘adjusting’ the length of a DCOF in a given configuration.” *Id.* at 7.

Patent Owner’s argument has several problems. Patent Owner is correct that Yamamoto does not disclose adjusting the length of a DCOF “in a given configuration” but Petitioner does not assert otherwise. Indeed, claim 13 does not include any such requirement. As discussed above, Petitioner asserts that Yamamoto discloses adjusting the fiber length to

achieve certain system performance, at the time of system installation. *See* Pet. 18 (citing Ex. 1005, 6:16–7:43, 7:50–56, 11:15–46). Petitioner asserts further that Yamamoto encompasses wavelength-dependent length of the dispersion-compensation fibers. *Id.* (citing Ex. 1005, Figs. 1–3).

Further, the remainder of Petitioner’s assertions show that, although Petitioner relies on Yamamoto as teaching a symmetric dispersion target, the length of Yamamoto’s DCOFs is not the mechanism asserted in the combination for achieving that target. As discussed below, claim 13 requires that “the act of adjusting is performed using a closed control loop” and Petitioner asserts that skilled artisans would accomplish that using Nishimoto’s variable dispersion compensators. Pet. 24–31; *see also id.* at 22–23 (asserting a skilled artisan would have had reason to replace each of Yamamoto’s “chromatic dispersion compensators 41” in Figure 8 or “DCOFs 3” in Figure 11 with Nishimoto’s “variable dispersion compensator” (citing Ex. 1007, 2:1–8, 6:35–38, 20:55–63; Ex. 1003 ¶¶ 107, 108)).

At bottom, Patent Owner’s argument seeks to leverage Petitioner’s reliance on Yamamoto for one aspect of the claim and use that reliance to bind Petitioner to Yamamoto in ways Petitioner did not assert. As we explained in the Institution Decision, we do not read the Petition in the same way as Patent Owner. Inst. 8. Petitioner relies on Yamamoto’s teachings that pre-compensation may be used to control the dispersion map of each individual channel. Through that control (i.e., “adjusting”), Yamamoto teaches that “at least a majority of a plurality of wavelength division multiplexed channels of the transmit optical signal at least initially reaches a minimum accumulated dispersion within a central distance of the length of

the optical fiber link.” See Pet. 19–21 (citing Ex. 1005, 8:4–8, Figs. 10, 12, 16; Ex. 1003 ¶¶ 68, 69, 105–107). Thus, Petitioner’s reliance on Yamamoto’s DCOFs relates to Yamamoto’s teaching that a certain pre-compensation may be applied to each channel in order to achieve the claimed dispersion map for the channel.

Petitioner then further recognizes the benefits that would come from modifying Yamamoto’s system to use Nishimoto’s “dispersion compensating technique suitable for a long distance optical transmission system.” Pet. 21–24 (quoting Ex. 1007, 1:8–14). In the combined system, Petitioner asserts that Nishimoto’s techniques would provide dispersion-compensation components “that remain tunable after initial installation.” Pet. 23 (citing Ex. 1003 ¶ 107; Ex. 1007, 2:1–8, 6:35–38, 20:55–63). Accordingly, we do not agree with Patent Owner that the Petition is deficient as to the “adjusting” limitation. Rather, we find that the Yamamoto’s system, as modified to incorporate Nishimoto’s variable dispersion compensators in place of Yamamoto’s DCOFs, teaches the claimed adjusting.

b. “the act of adjusting is performed using a closed control loop that measures bit error rate at the receive terminal”

Patent Owner argues next that the Petition “fails to demonstrate how the alleged adjusting of the DCOF fiber length is performed using a closed control loop.” PO Resp. 12–16. This argument largely follows the prior one, in that Patent Owner views Petitioner as maintaining Yamamoto’s compensation mechanism—DCOF fiber length—rather than replacing it with Nishimoto’s tunable compensator. As discussed previously, Patent Owner’s reading of the Petition is not correct.

In addition to the incorrect focus on Yamamoto's DCOFs, Patent Owner also considers the Petition's assertion that, in the combination, those DCOFs are replaced "with variable dispersion compensators from Nishimoto." PO Resp. 15 (quoting Pet. 31). Here, Patent Owner argues that because the DCOFs do not exist in the combination, it is impossible to adjust their length to control dispersion with feedback control. *Id.* Petitioner does not propose such an arrangement but instead proposes performing feedback control with Nishimoto's variable dispersion compensators. Pet. 26–28. Patent Owner's argument misconstrues the Petition.

Patent Owner further argues that the Petition fails to show adjusting fiber length of DCOFs using a closed control loop (*id.* at 16–17). That argument similarly misconstrues the Petition for the same reasons just explained—namely, Petitioner relies on Nishimoto's variable dispersion compensators, not Yamamoto's DCOFs, in the asserted combination.

We have considered Petitioner's contentions regarding closed-loop control in the combined Yamamoto–Nishimoto system and conclude that Petitioner has made the required showing. Nishimoto discloses a control strategy where bit errors in the optical signal are measured at the receive terminal and used to control the variable dispersion compensators. Ex. 1007, 3:49–60, 14:67–15:2, Fig. 17. Thus, the combined system teaches "the act of adjusting is performed using a closed control loop that measures bit error rate at the receive terminal," as recited in claim 13.

c. *"closed loop control that . . . adjusts the tunable pre-compensation mechanism until an acceptable bit error rate is achieved"*

Patent Owner contends that neither Yamamoto nor Nishimoto discloses adjusting dispersion compensation "until an acceptable bit error rate is achieved." PO Resp. 17–21. Petitioner relies on Nishimoto for the

claimed feedback control. Pet. 24–31. Nishimoto discloses that the “compensation amount of the waveform degradation is feedback controlled based on the information concerning bit errors of the optical signal” and, more specifically,

vary[ing], during service operation, the compensation amount of the waveform degradation in a direction of reducing the bit errors at intervals of a preset step width when the bit errors judged on the basis of the bit error information have exceeded a preset threshold, to thereby reset the compensation amount of the waveform degradation to a point where the bit errors become the minimum.

Ex. 1007, 4:10–16. Nishimoto discloses using feedback to control compensators at the transmit terminal. *Id.* at Fig. 21, 17:49–18:11 (additionally disclosing a method to “control the wavelength dispersion value of the variable dispersion compensator 32 at the transmitting side only when the bit error rate is not sufficiently reduced” by controlling the receiver compensator). Petitioner submits that a skilled artisan would have had reason to apply such feedback to channel-specific compensators such as in Nishimoto’s Figure 17 because it “would provide more fine-grained automatic control of the variable dispersion compensators 31₁ to 32_n at the transmitting side, as compared with a single collective dispersion compensator 32.” Pet. 29 (citing Ex. 1003 ¶ 114).

Patent Owner argues that controlling “based on” the bit error rate is not the same as adjusting it “until” an acceptable bit error rate is achieved. PO Resp. 19. Patent Owner does not, however, explain the difference between Nishimoto’s disclosures and the claim language other than to point at the difference in wording. Patent Owner asserts that the difference “is critical because it is precisely the words of the claims . . . that define the

contours of the claimed invention.” *Id.* at 20. But Patent Owner’s explanation is that “[c]ontrolling something based on some parameter is plainly not the same as controlling that thing until a specific condition involving that parameter is achieved—in this instance, the temporal condition defined by ‘until an acceptable bit error rate is achieved.’” *Id.*

We noted in the Institution Decision that Patent Owner had not argued in the Preliminary Response that “until an acceptable bit error rate is achieved” requires that feedback control ceases once the error rate drops below a nonzero threshold. Inst. 10. While we remain unclear exactly what distinction Patent Owner makes between a parameter and controlling something until a specific condition involving the parameter is achieved, Nishimoto teaches feedback control to achieve an acceptable bit error rate. In particular, Nishimoto discloses operation to “control the wavelength dispersion value of the variable dispersion compensator 32 at the transmitting side only when the bit error rate is not sufficiently reduced” by the receiver compensator. Ex. 1007, 18:1–6. Based on that disclosure, we find that Nishimoto teaches a control strategy that depends on the bit error rate, and adjusts operation of the variable dispersion compensators until an acceptable bit error rate is achieved, thereby teaching this limitation of claim 13.

d. Reason to combine

Patent Owner argues that a skilled artisan would have had no reason to combine Yamamoto’s and Nishimoto’s teachings as asserted by Petitioner. PO Resp. 21–31. We address those arguments separately from the above-discussed limitations to mirror the structure of Patent Owner’s arguments.

(1) “tunable pre-compensation mechanism”

Patent Owner argues that Petitioner’s argument for using Nishimoto’s tunable compensators is a contingent argument, applicable only if one reads claim 13 to require a certain transmission rate. PO Resp. 21–25. We do not read Petitioner’s argument as so constrained. Rather, we understand Petitioner to argue that a desire for higher transmission speeds would drive skilled artisans to use solutions such as Nishimoto’s tunable compensators, particularly in light of Nishimoto’s guidance regarding the ability to achieve high speeds with the system. *See* Pet. 21–23. In that regard, we agree with Petitioner that the increase in transmission rates from Yamamoto’s to Nishimoto’s disclosures would have given skilled artisans reason to consider Nishimoto’s teachings. Pet. Reply 16–18 (citing Ex. 1005 8:9–11; Ex. 1007, 12:37–39). As Petitioner points out, Nishimoto specifically discloses that higher-speed transmissions were more sensitive to dispersion. Pet. Reply 17 n.9. Thus, we find the desire for higher transmission speeds and the need for techniques such as taught by Nishimoto would have given skilled artisans reasons to combine Nishimoto’s disclosure regarding dispersion compensation with Yamamoto’s system to achieve Yamamoto’s goals regarding the dispersion maps for multiple channels.

Further, Petitioner does not rest entirely on the desire for high-speed operation. Petitioner argues also that using Nishimoto’s adjustable compensators and feedback control would “yield an improved WDM system capable of automatic compensation for degradation of the optical signal waveform caused by both wavelength dispersion and polarization mode dispersion of the optical transmission path, resulting in further reduced size and cost.” Pet. 16 (citing Ex. 1003 ¶¶ 99, 101; Ex. 1007, 3:41–60, 4:3–58,

Figs. 17, 20, 21), 29–30 (quoting Ex. 1007, Abstract, 3:37–40, 6:56–64, 7:53–56, 11:41–46, 17:53–55, 17:59–60; citing Ex. 1003 ¶¶ 114–115); *accord id.* at 14 (quoting Ex. 1007, 3:19–25). Patent Owner recognizes that basis for the combination but argues that the record lacks evidence to support Petitioner’s claim of reduced size and cost. PO Resp. 25–26. Patent Owner does not contest that the modification would give Yamamoto’s system the ability to automatically compensate for signal degradation from dispersion. Nishimoto discloses that as transmission speeds increase, “changes in wavelength dispersion characteristics due to temperature changes of optical fiber; and the influence by polarization mode dispersion” both “can not be neglected,” therefore requiring a system for automatically compensating for wavelength dispersion and polarization mode dispersion,” as taught by Nishimoto. Ex. 1007, 1:34–41. We find that a skilled artisan would have had reason to make the combination because the system would gain capability for automatic compensation. Regarding reduced size and cost resulting from the combination, Patent Owner does not provide any contrary evidence and we conclude that Nishimoto’s statements regarding the benefit of its invention also would have motivated skilled artisans to make the combination. *See* Ex. 1007, 3:17–26 (“to thereby provide a dispersion compensating apparatus of reduced sizes at a reduced cost”).

(2) “closed control loop”

Patent Owner argues that Petitioner provides inadequate reason to modify Yamamoto to include the claimed closed control loop. PO Resp. 28–31. Patent Owner first asserts that Petitioner’s assertion the modification “would provide more fine-grained automatic control of the variable dispersion compensators” relates to modifying Nishimoto, not modifying

Yamamoto. *Id.* at 29–30. That is accurate, but it supports Petitioner’s contentions rather than undermining them. As explained above, Petitioner reasons why a skilled artisan would have configured Nishimoto’s feedback control in the manner claimed—using measurement of the bit error rate at the receive terminal to control individual pre-compensation mechanisms at the transmit terminal. *See supra* at 11; Pet. 24–31. Petitioner separately explains why the skilled artisan would have used such a feedback control with Yamamoto’s overall system. *See supra* at 9; Pet. 15–16, 19, 21–24. Petitioner’s explanation for using Nishimoto’s teachings in a particular manner does not cut against the additional reasons for using those teachings with Yamamoto.

As to using Nishimoto’s teachings in the claimed manner, Petitioner reasons that “[i]t would have been obvious to a [person of ordinary skill in the art] in view of this added closed control loop in Fig. 21 of Nishimoto that a similar closed control loop can likewise be added in Fig. 17 . . . such that bit error information (e.g., bit error rate measured at optical receiver (OR)) is sent to controlling circuit 33 at optical sender to adjust variable dispersion compensators 32₁ to 32_n.” Pet. 28–29 (Ex. 1003 ¶ 113). Petitioner further asserts that “such modification would provide more fine-grained automatic control of the variable dispersion compensators 32₁ to 32_n at the transmitting side, as compared with a single collective dispersion compensator 32.” Pet. 29 (citing Ex. 1003 ¶ 114). We find that Petitioner establishes reasons a skilled artisan would have applied feedback control to the individual compensators of Nishimoto’s Figure 17.

Petitioner separately argues that synergy between the goals of Yamamoto and Nishimoto would have led a skilled artisan to “incorporate

the teachings from Nishimoto into the system of Yamamoto.” Pet. 29–31 (citing Ex. 1007, Abstract; Ex. 1005, 3:37–40, 6:56–64, 7:53–56, 11:41–46, Fig. 11; Ex. 1003 ¶ 115). Moreover, we find that Petitioner adequately demonstrates why an ordinarily skilled artisan would have used Nishimoto’s teachings with Yamamoto—because doing so “would yield an improved WDM system capable of automatic compensation for degradation of the optical signal waveform caused by both wavelength dispersion and polarization mode dispersion of the optical transmission path.” See Pet. 16.

e. Summary

For the reasons described above, we find that a person of ordinary skill in the art at the time of invention would have had reason to combine Yamamoto’s and Nishimoto’s teachings as asserted by Petitioner and that the combination teaches all of claim 13’s limitations. Accordingly, Petitioner has shown by a preponderance of the evidence that the subject matter of claim 13 would have been obvious over Yamamoto and Nishimoto.

2. Dependent claims

Patent Owner argues that Petitioner inadequately addresses claims 14–20, each of which depend from claim 13. PO Resp. 31–34. According to Patent Owner, by relying on Yamamoto’s teaching of minimizing accumulated dispersion in the central region of an optical-fiber link, rather than addressing how the combined Yamamoto–Nishimoto system would perform, the Petition falls short of what is required. *Id.* at 32–33.

Petitioner asserts that Yamamoto’s teaching of minimizing accumulated dispersion in the central region of a link and Nishimoto’s teaching of “compensat[ing] for wavelength dispersion and polarization

mode dispersion,” would inspire a skilled artisan to configure the system as claimed. Pet. 32–34.

Although Patent Owner asserts that the Petition fails to address the precise claim language, we view the Petition’s reliance on Yamamoto’s Figure 12, showing accumulated wavelength dispersion of multiple wavelengths across specific distances of the link, as sufficient to demonstrate that “the central region is from 30 to 70 percent of the length” of the link recited in claim 13, as required by claim 14. *See* Pet. 32–33 (quoting Ex. 1005, Fig. 12, 2:32–34, 7:63–64; citing Ex. 1005, Fig. 16, 8:17, 8:62; Ex. 1003 ¶ 117). Petitioner asserts that Yamamoto’s Figure 12 shows exactly the claimed limitation. *Id.* (quoting and annotating Ex. 1005, Fig. 12). As explained above, Petitioner’s assertions against claim 13 include that the combined system (using Nishimoto’s variable dispersion compensators and feedback control) would be configured to achieve Yamamoto’s target as shown in Figure 12. *See supra* at 13. Patent Owner’s arguments about claim 14 misconstrue Petitioner’s arguments, which do not require a lengthy discourse. Petitioner has shown that the combination, by including feedback control of variable compensators, would allow Yamamoto’s system to achieve the targets that Yamamoto depicts in Figure 12. As Petitioner identifies, those targets satisfy the limitations of claim 14. Pet. 32–34.

As for claims 15–17, which depend from claim 13 and recite progressively narrowed definitions for claim 13’s “central region” expressed as percentages of the overall link, Petitioner shows that the same disclosure in Yamamoto’s Figure 12 satisfies those definitions because it depicts a dispersion map with a central region centered on the span of the optical fiber

link. Pet. 34–39. Moreover, claims 18–20 depend from claim 13 and recite progressively narrowed definitions for claim 13’s “central region” expressed as distances from the center. Petitioner annotates Yamamoto’s Figure 12 to show that its central region satisfies the limitations of claims 18–20. *Id.* at 40–45. We agree with Petitioner that Yamamoto’s Figure 12 shows the target dispersion map with minimum accumulated dispersion at the center of the span, satisfying the limitations of claims 15–20.

Patent Owner raises only the same objection to Petitioner’s showing for claims 15–20 as it raises against the showing for claim 14. PO Resp. 33. For the same reasons discussed above, we find Petitioner’s showing persuasive notwithstanding Patent Owner’s arguments. Accordingly, Petitioner has shown by a preponderance of the evidence that the subject matter of claims 14–20 would have been obvious in light of Yamamoto and Nishimoto.

C. OBVIOUSNESS OVER CHOWDHURY AND WEBB (CLAIM 13)

Chowdhury discloses an optical communication path comprising a series of links. Ex. 1006 ¶¶ 41–42, Fig. 3A. The path includes dispersion compensation at various points including before transmission, inline, and after transmission. *Id.* at ¶ 44. Chowdhury discloses configuring the dispersion pre-compensation “to optimally suppress nonlinear signal distortions over the length of the optical communication path.” Pet. 48 (quoting Ex. 1006 ¶ 45). Chowdhury incorporates Essiambre⁹ and relies on Essiambre for selecting the appropriate compensation. Ex. 1006 ¶ 45.

⁹ U.S. Patent Appl. Ser. No. 10/152,645, published as U.S. Pat. Appl. Pub. No. 2004/0208617 A1 (pub. Oct. 21, 2004) (Ex. 1008).

Essiambre illustrates pre-compensation selected such that the cumulative dispersion is minimized in the middle of a transmission distance. Ex. 1008, Fig. 2; Pet. 48–49.

Webb discloses “a method for estimating bit error rate (BER) performance of transmission system and its use in applying statistically consistent feedback via a high-level control loop.” Ex. 1009, 1:5–7. Webb discloses using feedback based on the BER to control “pre-dispersion applied by an adjustable dispersion element.” Ex. 1009, 4:17–26; *see also id.* at Fig. 3. It further states that its techniques “may be retrofitted to legacy systems without requiring a factory-based set up or calibration procedure.” *Id.* at 3:26–32.

Petitioner submits that a skilled artisan would have combined Webb’s closed control loop of adjustable compensation with Chowdhury’s overall communication system. Pet. 52–53. In particular, Petitioner submits that “dispersion compensator 32 of Chowdhury operates to perform a range of adjustment and hence is interchangeable with, for example, dispersion control 316 from Webb, which expressly includes suitable active elements such as ‘tuneable fibre-Bragg gratings and tuneable etalons.” Pet. 56 (quoting Ex. 1009, 10:7–8; citing Ex. 1006, Fig. 3A; Ex. 1003 ¶ 159).

Patent Owner contests several aspects of Petitioner’s assertions, one of which we find determinative of this unpatentability issue.

Claim 13 requires adjusting the tunable pre-compensation mechanism “such that at least a majority of a plurality of wavelength division multiplexed channels of the transmit optical signal at least initially reaches a minimum accumulated dispersion within a central distance of the length of the optical fiber link.” Petitioner asserts that the combination would follow

Chowdhury's method of adjusting pre-compensation to achieve symmetry in the cumulative dispersion. See Pet. 57–60. In Petitioner's view, symmetry in the cumulative dispersion equates to the claimed condition of minimum accumulated dispersion within a central distance of the link. Pet. 58–59. Chowdhury's Figure 6 is reproduced below:

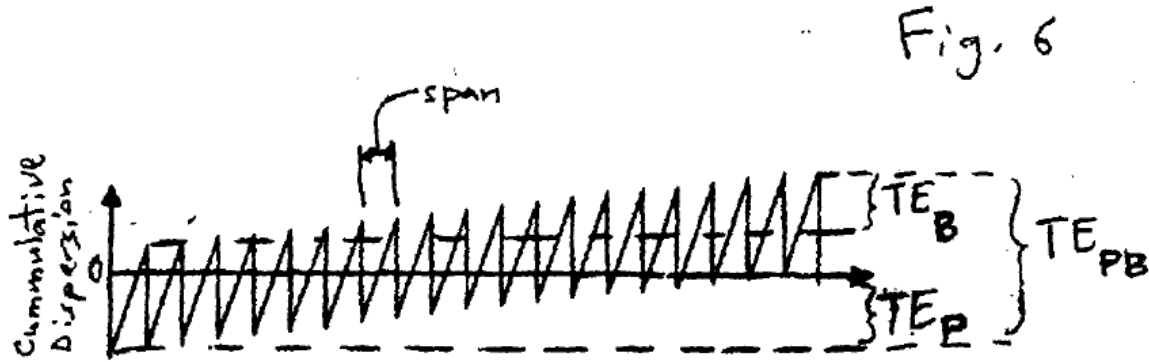


Figure 6 depicts an exemplary, singly periodic dispersion map for Chowdhury's system. Ex. 1006 ¶¶ 59–60. Petitioner submits further that, because Chowdhury performs aggregate pre-compensation, its Figure 6 is representative of dispersion maps from all channels of a particular optical link. *Id.* at 59 (citing Ex. 1003 ¶¶ 159, 162).

Patent Owner argues that Chowdhury's Figure 6 does not provide details regarding multiple channels and that Petitioner's expert provides insufficient explanation for why Figure 6 is representative of a plurality of channels, let alone a majority of channels. PO Resp. 39–43. Petitioner points out that Chowdhury's disclosure of minimum accumulated dispersion at the midpoint of a link resulting from a symmetric dispersion map applies to all wavelengths equally. Pet. Reply 24. Petitioner further points out that Chowdhury in some aspects distinguishes between single-channel operation and multiplexed operation. *Id.* at 24 n.11.

Petitioner's explanations fall short of meeting its burden. Although Chowdhury addresses wavelength-division multiplexed transmission, it does not speak to the dispersion maps of multiple channels. While its Figure 6 *could* be representative of dispersion maps for other channels, we cannot reach that conclusion simply by understanding that Chowdhury performs aggregate pre-compensation. See Ex. 1003 ¶ 162. Petitioner's declarant offers nothing further other than Chowdhury's overall approach of symmetry in the dispersion map. See *id.* ¶¶ 159, 162. Thus, we conclude the record is insufficient for us to conclude Chowdhury teaches adjusting pre-compensation such that a majority of the multiplexed channels have symmetry in their dispersion maps.

Accordingly, Petitioner has not shown by a preponderance of the evidence that claim 13 would have been obvious over Chowdhury and Webb.

D. OBVIOUSNESS OVER CHOWDHURY, WEBB, AND TANAKA¹⁶²
(CLAIMS 14–20)

In asserting that claims 14–20 would have been obvious over Chowdhury, Webb, and Tanaka¹⁶², Petitioner relies on its showing that Chowdhury and Webb render obvious claim 13, from which claims 14–20 depend. Accordingly, our conclusion for claim 13 also applies to claims 14–20. For the reason discussed above, we conclude Petitioner has not shown by a preponderance of the evidence that any of claims 14–20 would have been obvious over Chowdhury, Webb, and Tanaka¹⁶².

III. CONCLUSION

For the foregoing reasons, we determine Petitioner has shown by a preponderance of the evidence that each of claims 13–20 is unpatentable.

In summary:

Claim(s)	35 U.S.C. §	References	Claims Shown Unpatentable	Claims Not Shown Unpatentable
13–20	103	Yamamoto, Nishimoto	13–20	
13	103	Chowdhury, Webb		13
14–20	103	Chowdhury, Webb, Tanaka162		14–20
Overall Outcome			13–20	

IV. ORDER

Accordingly, it is:

ORDERED that claims 13–20 of the '798 patent are unpatentable; and

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

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