

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NOKIA OF AMERICA CORPORATION and
AT&T SERVICES, INC.,

v.

IARNACH TECHNOLOGIES LIMITED,
Patent Owner.

IPR2024-00899
Patent 9,806,892 B2

Before KEVIN C. TROCK, KARA L. SZPONDOWSKI, and
CHRISTOPHER L. OGDEN, *Administrative Patent Judges*.

OGDEN, *Administrative Patent Judge*.

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

I. INTRODUCTION

Nokia of America Corporation and AT&T Services, Inc. (collectively, “Petitioner”) filed a corrected Petition (Paper 18, “Pet.”)¹ under 35 U.S.C. §§ 311–319 requesting *inter partes* review (“IPR”) of claims 1–5 and 10–15 of U.S. Patent No. 9,806,892 B2 (Ex. 1001, “the ’892 patent”). Iarnach Technologies Ltd. (“Patent Owner”) filed a Preliminary Response. Paper 10. After considering the arguments presented in the Preliminary Response, we determined that the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail with respect to challenging at least one of the challenged claims of the ’892 patent. We instituted this IPR under 35 U.S.C. § 314 on December 13, 2024, as to claims and all grounds raised in the Petition. Paper 19. Patent Owner filed a Response to the Petition (Paper 21, “PO Resp.”), Petitioner filed a Reply (Paper 28, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 32, “PO Sur-reply”).

We held an oral hearing on September 18, 2025, and the transcript is entered into the record. Paper 39 (“Tr.”).

This is a final written decision under 35 U.S.C. § 318(a) as to whether the claims challenged in the IPR are unpatentable. For the reasons below, we conclude that some of the challenged claims are shown to be unpatentable.

¹ See Order Granting Petitioner’s Unopposed Motion to File Corrected Petition, Paper 17 (Nov. 5, 2024).

II. BACKGROUND

A. THE '892 PATENT (EX. 1001)

The '892 patent “relates to systems, devices, and techniques for data communications in a passive optical network” and “to power saving in an optical network unit (ONU) of a passive optical network (PON).” Ex. 1001, 1:19–23. Figure 1 of the '892 patent, reproduced below, illustrates an example of a PON system. *Id.* at 2:12.

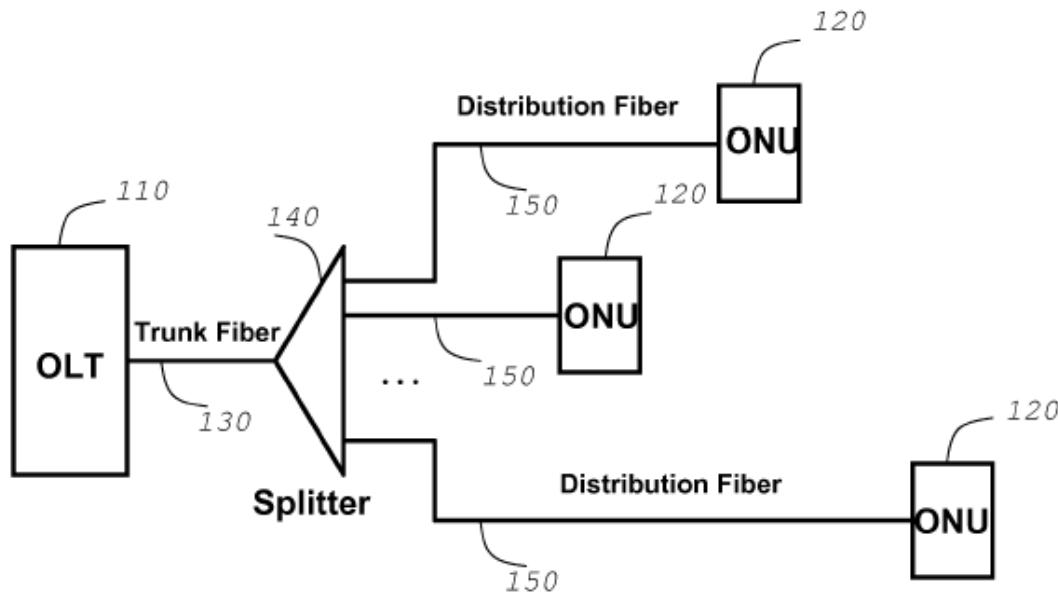


FIG. 1

The PON in Figure 1 includes optical line terminal (OLT) 110, a plurality of ONUs 120, and an optical distribution network (ODN) that includes optical feeder fiber or trunk fiber 130, splitter 140, and multiple distribution fibers 150. *Id.* at 3:41–44. ONUs 120 may be deployed at or near the users’ premises. *Id.* at 3:45–60.

The '892 patent explains that advanced PON systems (such as 10 Gigabit/sec EPON (10G-PON) and 10 Gigabit/sec PON (XG-PON)) use

protocol-based power-saving techniques based on signals sent between the OLT and the ONU. *Id.* at 4:8–16. These techniques define several power levels, and ONUs periodically switch between a full power level and one of the lower power levels. *Id.* But according to the '892 patent, these “[c]onventional ONUs . . . lack the technology of directly transitioning between two low power consumption states without having to go through an active state (e.g., a full powered state).” *Id.* at 4:34–40.

Thus, the '892 patent discloses (1) operating an ONU in a first state in which a transmitter of the ONU is turned off and a receiver of the ONU is turned on, (2) operating the ONU in a second state in which both the transmitter and the receiver are turned off, and (3) transitioning the ONU directly between the first state and the second state, based on a power management rule. *Id.* at code (57), 1:57–2:6. Figure 5 of the '892 patent, reproduced below, illustrates such an ONU:

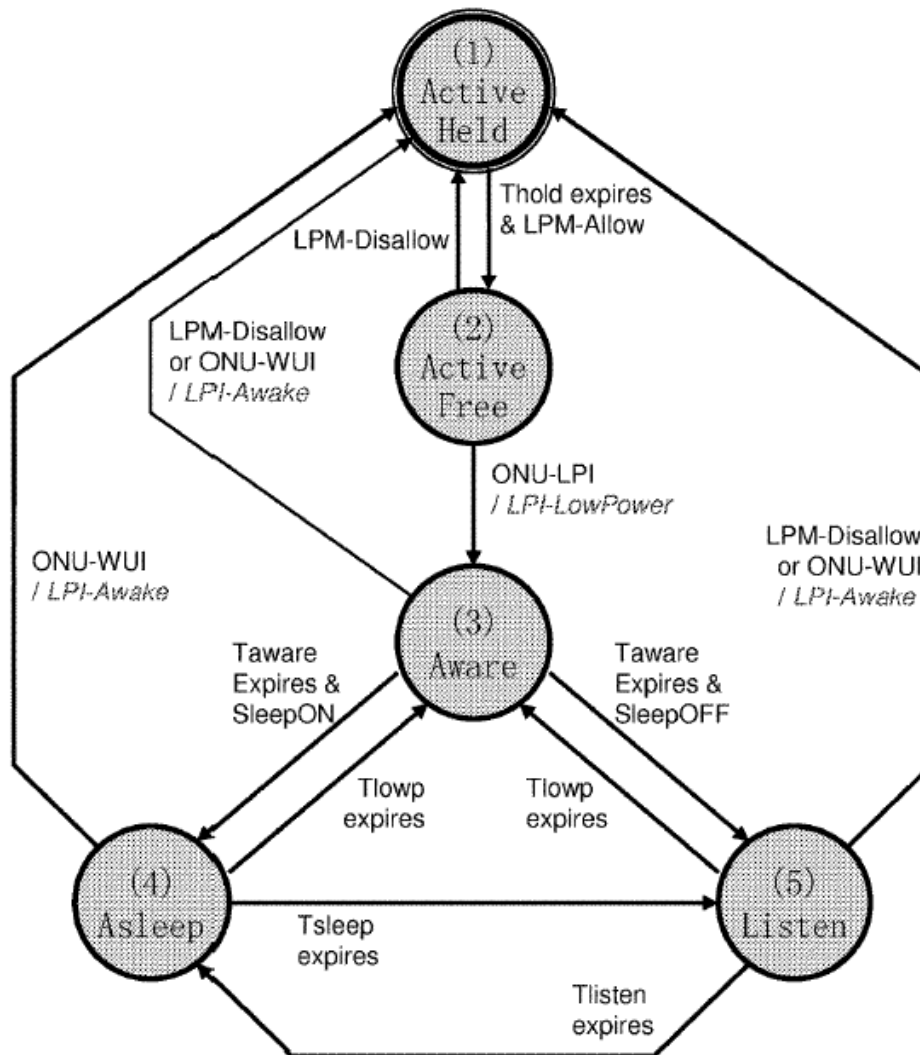


FIG. 5

As depicted in the state machine shown in Figure 5, the ONU has the following states: (1) ActiveHeld, in which the OLT mandates full power, (2) ActiveFree, in which full-power operation is at the ONU's discretion, (3) Aware, a low-power state in which the ONU's receiver and transmitter both remain on, (4) Asleep, a low-power state in which the ONU's receiver and transmitter are both turned off, and (5) Listen, a low-power state in which the ONU's transmitter is off but the receiver is on. Ex. 1001, 8:14–62.

Figure 5 includes two arrows depicting direct transitions in each direction between the Listen state (transmitter is off and receiver is on) and the Asleep state (both transmitter and receiver are off). According to the '892 patent, “[d]irect transition” between a first state and a second state “refers to changing the operational state of the ONU between the first and the second states without having to go through an intermediate third state in which the power utilized by the ONU increases.” Ex. 1001, 12:19–45.

B. CHALLENGED CLAIMS AND GROUNDS

Independent claim 1 is as follows:

- [1A] 1. A method of optical communication in a passive optical network, comprising:
- [1B] operating an optical network unit (ONU) in a first state in which a transmitter of the ONU is turned off and a receiver of the ONU is turned on;
- [1C] operating the ONU in a second state in which both the transmitter and the receiver are turned off;
- [1D] transitioning the ONU directly from the first state to the second state and transitioning the ONU directly from the second state to the first state, based on a power management rule;
- [1E] ensuring the ONU is fully powered up, synchronized, and capable of responding to both upstream and downstream traffic and control before exiting the first state or the second state; and
- [1F] receiving, by the receiver, a power management message from an optical line terminal (OLT); and
- [1G] changing the power management rule based on the received power management message.

Ex. 1001, 15:2–21 (Petitioner’s reference numbers added, omitting internal brackets); *accord* Pet. 75.

Petitioner argues two grounds for IPR, as summarized in the following table (*see* Pet. 1):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–5, 14, 15	103(a) ²	G.987.3, ³ Röger, ⁴ G.988 ⁵
10–13	103(a)	G.987.3, Röger, G.988, Ghazisaidi ⁶

C. DECLARATORY TESTIMONY

Petitioner submits a declaration by Dr. Alexander V. Sergienko. Ex. 1003; *see also* Ex. 1004 (Dr. Sergienko’s curriculum vitae). Patent Owner likewise submits a declaration by Dr. Kerry Litvin. Ex. 2007.

² 35 U.S.C. § 103 (2012), Leahy–Smith America Invents Act (“AIA”), Pub. L. No. 112-29 § 103, sec. (n)(1), 125 Stat. 284, 287, 293 (2011) (effective Mar. 16, 2013). The parties agree that this version of the statute applies. *See* Pet. 1; PO Resp. 4–5.

³ International Telecommunication Union Telecommunication Standardization Sector (ITU-T) Recommendation G.987.3, *10-Gigabit-Capable Passive Optical Networks (XG-PON): Transmission Convergence (TC) Layer Specification* (2011) (Ex. 1007). Petitioner contends G.987.3 qualifies as prior art under 35 U.S.C. § 102(a). Pet. 6–7.

⁴ M. Röger, et al. *Optically Powered Fiber Networks*, Optics Express, Vol. 16, No. 26 (Dec. 22, 2008) (Ex. 1006). Petitioner contends Röger qualifies as prior art under 35 U.S.C. §§ 102(a), (b). Pet. 6.

⁵ ITU-T Recommendation G.988, *ONU Management and Control Interface (OMCI) Specification* (2011) (Ex. 1008). Petitioner contends G.988 qualifies as prior art under 35 U.S.C. § 102(a). Pet. 7.

⁶ Ghazisaidi, WO 2013/014483 A1, published Jan. 31, 2013 (Ex. 1009). Petitioner contends Ghazisaidi qualifies as prior art under 35 U.S.C. § 102(e). Pet. 7–8.

D. RELATED PROCEEDINGS

As a related matter, the parties identify *Iarnach Techs. Ltd. v. Verizon Comm'ns, Inc.*, No. 2:23-cv-00631 (E.D. Tex.). Pet. 72; Paper 11, 2.⁷

III. ANALYSIS

A. LEVEL OF ORDINARY SKILL IN THE ART

The level of ordinary skill in the pertinent art at the time of the invention is a factor in how we construe patent claims. *See Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (en banc). It is also one of the factors we consider when determining whether a patent claim is obvious over the prior art. *See Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

To assess the level of ordinary skill, we construct a hypothetical “person of ordinary skill in the art,” from whose vantage point we assess obviousness and claim interpretation. *See In re Rouffet*, 149 F.3d 1350, 1357 (Fed. Cir. 1998). This legal construct “presumes that all prior art references in the field of the invention are available to this hypothetical skilled artisan.” *Id.* (citing *In re Carlson*, 983 F.2d 1032, 1038 (Fed. Cir. 1993)).

Petitioner argues that an ordinarily skilled artisan at the time of the claimed invention “would have had at least a bachelor’s degree in electrical engineering, computer engineering, or similar discipline and . . . at least two years of experience with optical communications and networks.” Pet. 3

⁷ Although the parties initially identified *Iarnarch Techs. Ltd. v. AT&T Corp.*, No. 2:23-cv-00231 (E.D. Tex.) as related, Patent Owner has informed us that the ’892 patent is no longer challenged in that proceeding. Paper 16, 34; Ex. 1035.

(citing Ex. 1003 ¶ 22). Patent Owner does not contest this proposed level of ordinary skill. PO Resp. 5. Also, neither party argues that the precise level of ordinary skill would be dispositive in this proceeding.

We adopt Petitioner’s proposed level of ordinary skill because it is undisputed, supported by testimonial evidence, and consistent with the asserted prior art and the types of problems and solutions in the ’892 patent. *See, e.g.*, Ex. 1001, 1:19–2:8.

B. CLAIM CONSTRUCTION

In an IPR, we construe a patent claim “using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). This generally includes “construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” *Id.* The ordinary and customary meaning of a claim term “is its meaning to the ordinary artisan after reading the entire patent” and “as of the effective filing date of the patent application.” *Phillips*, 415 F.3d at 1313, 1321.

There are only two circumstances in which a construction may depart from the ordinary and customary meaning: “1) when a patentee sets out a definition and acts as [their] own lexicographer, or 2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012). Any such special meaning of a term “must be sufficiently clear in the specification that any departure from common usage would be so understood by a person of experience in the field of the

invention.” *Multiform Desiccants Inc. v. Medzam Ltd.*, 133 F.3d 1473, 1477 (Fed. Cir. 1998).

Patent Owner argues that we should construe the phrase “transition . . . from . . . to” in claim 14⁸ to “require[] a direct transition from the first low power mode to the second low power mode and *vice versa*.” PO Resp. 6–7. In support of this, Patent Owner argues that the ’892 patent “pervasively advocates that *the invention* is direct transitions between low power states,” and this is also how the invention is described in the abstract. *Id.* at 7–8 (citing Ex. 1001, code (57), 1:58–63, 12:31–32, 12:53–54, 13:1–4, 13:14–22; *GPNE Corp. v. Apple Inc.*, 830 F.3d 1365, 1370 (Fed. Cir. 2016); *SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1341–42 (Fed. Cir. 2001)). According to Patent Owner, “there is not a single preferred embodiment that does not have direct transitions between a first and second state.” *Id.* at 9. Patent Owner also contends that the ’892 patent criticizes prior-art techniques that do not include direct transitions between the first and second power states. *Id.* at 8 (citing Ex. 1001, 4:32–40, Figs. 2, 3).

Further, according to Patent Owner, the applicant allegedly argued, in the context of what is now claim 14 which omits the word “directly,” that a prior-art reference failed to teach direct transitions. PO Resp. 8–9 (citing Ex. 1002, 26–27, 30, 33, 64, 67). Patent Owner also points to a change in both claim 1 and claim 14 in which the phrase “transitioning . . . between . . .

⁸ Although independent claim 12 contains a similar phrase (Ex. 1001, 16:42–45), Patent Owner relies on other arguments for claim 12 and does not argue that we need to interpret the phrase in the context of claim 12. PO Resp. 7 n.5.

and” was changed to “transitioning . . . from . . . to.” *Id.* at 9 (citing Ex. 1002, 30, 33, 64, 67). According to Patent Owner, this “suggest[s] that the applicant meant the ‘from’ and ‘to’ in the limitation to signify direct transitions from the first and second power modes, while the previously recited ‘between’ and ‘and,’ without ‘direct,’ language encompassed indirect transitions.” *Id.*; *see also* PO Sur-reply 2–3.

Patent Owner argues that the above evidence is sufficient to overcome any presumption arising from the doctrine of claim differentiation between claims 1 (which recites “transitioning . . . directly”) and claim 14 (which does not explicitly indicate that the transition is direct). PO Resp. 9–10 (citing *Anderson Corp. v. Fiber Composites, LLC*, 474 F.3d 1361, 1370 (Fed. Cir. 2007); *Multiform Desiccants, Inc. v. Medzam, Ltd.*, 133 F.3d 1473, 1480 (Fed. Cir. 1998)); *see also* PO Sur-reply 3.

In its Reply, Petitioner argues that the ’892 patent uses the word “transition” in some cases to refer to indirect transitions, so “the patentee appreciated the distinction between a ‘direct transition’ and the broader ‘transition.’” Pet. Reply 2–3 (citing Ex. 1001, 4:29–39, 5:61–63, 11:66–67, 12:33–37). According to Petitioner, Patent Owner is seeking to improperly import a limitation from the specification into the claims. *Id.* at 3.

Pointing to the prosecution history, Petitioner also argues that the fact the applicant amended certain claims to explicitly recite a direct transition, but not claim 14, is evidence that the applicant did not intend claim 14 to be narrowed like the other claims. Pet. Reply 3–4.

We agree with Petitioner. The evidence of record, including the '892 patent and its prosecution history,⁹ indicates that the ordinary and customary meaning of “transitioning . . . from . . . to” encompasses both direct and indirect transitions. Looking first to the claim language itself, the word “directly” appears in claims 1, 6, and 10, but not claim 14, presumptively suggesting that claim 14 was intended to more broadly capture systems with either direct or indirect transitions. *See CAE Screenplates Inc. v. Heinrich Fiedler GmbH*, 224 F.3d 1308, 1317 (Fed. Cir. 2000) (“In the absence of any evidence to the contrary, we must presume that the use of . . . different terms in the claims connotes different meanings.”). Holding otherwise would fail to give any effect to the word “direct” as it appears in claims 1, 6, and 10. *See Stumbo v. Eastman Outdoors, Inc.*, 508 F.3d 1358, 1362 (Fed. Cir. 2007) (denouncing claim constructions methodologies that render phrases in claims superfluous).

Moreover, Patent Owner’s proposed construction is inconsistent with the ordinary and customary meaning of “transitioning . . . from . . . to” from the perspective of a person of ordinary skill in the art reading the '892 patent specification. The specification uses the word “direct,” in at least some situations, to clarify that it is referring to direct transitions from one state to another state. *See, e.g.*, Ex. 1001, 13:2–5, 13:17–20, Figs. 10, 11. Although the '892 patent does not focus on examples in which the transition between the first and second states is indirect, it states that “[w]hile this patent

⁹ In its Response, Patent Owner does not rely on expert testimony or other extrinsic evidence for its proposed construction of “transitioning . . . to . . . from.” *See* PO Resp. 6–10.

document contains many specifics, these should not be construed as limitations on the scope of an invention that is claimed or what may be claimed, but rather as descriptions of features specific to particular embodiments.” Ex. 1001, 14:40–44. Thus, a person of ordinary skill in the art would have understood that the applicants did not intend to be bound solely to the specification’s direct-transition embodiments.

Nor has Patent Owner pointed to any credible evidence of clear disavowal or lexicography. We disagree with Patent Owner’s argument that a person of ordinary skill in the art would have understood the later-amended claim phrase “transitioning . . . between . . . and” to distinctively indicate an *indirect* transition. The ’892 patent specification undermines this argument by stating that a “[d]irect transition refers to [transitions] *between* the first *and* the second states without having to go through an intermediate third state.” Ex. 1001, 12:33–36 (emphasis added). In other passages, the ’892 patent uses the phrase “between . . . and” to refer to both direct transitions (*e.g.*, *id.* at 4:32–34, 12:31–33, 12:53–54) and indirect transitions (*e.g.*, *id.* at 11:66–67).

We also disagree with how Patent Owner characterizes the prosecution history. In an office action, the Examiner held that Pfeiffer (US 2009/0201840 A1) “teaches a method for transitioning directly between the first state and the second state.” Ex. 1002, 39. In response, the applicant amended claim 1 (which had already recited a direct transition) to explicitly recite a *bidirectional* direct transition between the first and second states. *Id.* at 30. The applicant argued that Pfeiffer’s direct transition was “one-directional, meaning that Pfeiffer teaches that the end node can enter [the second] state directly from the [first] state, but it cannot enter the [first] state

directly from the [second] state.” *Id.* at 26 (emphasis omitted). Claim 16, which ultimately became claim 14 on issuance, did not include the word “directly” and was not amended to include the word “directly.” *See id.* at 33. Thus, the disputed issue during prosecution was not whether Pfeiffer taught *direct* transitions, but whether Pfeiffer’s direct transitions were *bidirectional*.

For the above reasons, the evidence of record shows that the ordinary and customary meaning of “transitioning . . . from . . . to” in claim 14 encompasses either direct or indirect transitions. And there is no evidence to suggest a clear disclaimer or lexicography that would alter that meaning. Therefore, we decline to adopt Patent Owner’s proposed construction.

Petitioner raises three other claim-construction issues, but we do not need to resolve them in this proceeding. First, Petitioner argues that certain elements of claims 10 and 13 should be construed under 35 U.S.C. § 112(f). Pet. 4–5 (citing Ex. 1003 ¶¶ 51–53). Patent Owner concurs with Petitioner, but argues that “these terms do not need an explicit construction to resolve any of the issues in this trial.” PO Resp. 6.

Second, Petitioner proposes a construction for the phrase “power management message.” Pet. 26. However, Patent Owner argues that “this term is not germane to the contested issues presented to [the Board] and therefore requires no express definition.” PO Resp. 10. Petitioner does not contest this in its Reply.

Finally, Petitioner argues in its Reply that Dr. Litvin has relied on an erroneous interpretation of the claim 1 preamble, as evidenced in his deposition, which would limit the challenged claims to only high-bandwidth networks. Pet. Reply 16–17 & n.4 (citing Ex. 1036, 88:8–98:7). Patent Owner disputes Petitioner’s interpretation of Dr. Litvin’s testimony and does

not argue this claim interpretation. PO Sur-reply 17 & n.3 (“Patent Owner is not arguing that the ’892 Patent is patentable over the References due to the preambles.”).

Because these three claim-construction issues are not pertinent to any contested issues in this proceeding, we agree with Patent Owner that we need not resolve them as part of our decision. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (alteration in original) (quoting *Vivid Techs., Inc. v. Am. Sci & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. GROUND BASED ON G.987.3, RÖGER, AND G.988

Petitioner argues that claims 1–5, 14, and 15 are obvious over G.987.3, Röger, and G.988. Pet. 1, 8–54.

A claim is unpatentable as obvious under § 103 if the differences between the claimed subject matter and the prior art are “such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). When a ground in a petition is based on a combination of references, we consider “whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *Id.* at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

We base our obviousness inquiry on factors 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) any objective

indicia of obviousness or non-obviousness that may be in evidence. *See Graham*, 383 U.S. at 17–18.

Considering these factors, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–5, 14, and 15 are unpatentable as obvious for the reasons explained below.

1. *Overview of G.987.3*

G.987.3 is an international standards document describing a 10 Gigabit/sec XG-PON system. Ex. 1007, 1, 3, 9.¹⁰ Reproduced below is a state diagram for the XG-PON system's ONU:

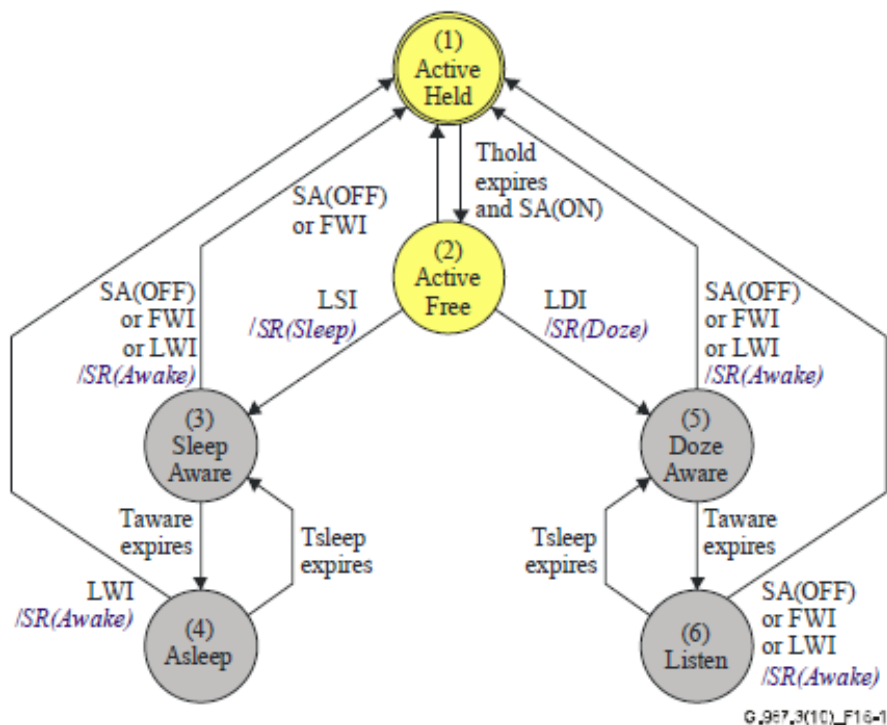


Figure 16-1 – ONU state transition diagram (initial state circled)

¹⁰ We refer to exhibit page number rather than internal page numbers.

Ex. 1007, 101. Figure 16-1 depicts a set of six states and transitions between them. The ONU power management states include (1) ActiveHeld, in which the ONU is fully responsive, forwarding downstream traffic and responding to all bandwidth allocations; (2) ActiveFree, similar to ActiveHeld except that the ONU can decide locally to transition to a low-power state; (3) SleepAware, in which both the ONU receiver and transmitter remain on for a particular duration; (4) Asleep, in which the ONU shuts down both its receiver and transmitter, retaining the ability to wake up on local stimulus; (5) DozeAware, similar to SleepAware, in which both the ONU receiver and transmitter remain on for a particular duration; and (6) Listen, in which the ONU receiver is on and the transmitter is off. Ex. 1007, 100–101.

In Figure 16-2, G.987.3 discloses a similar state diagram for the OLT:

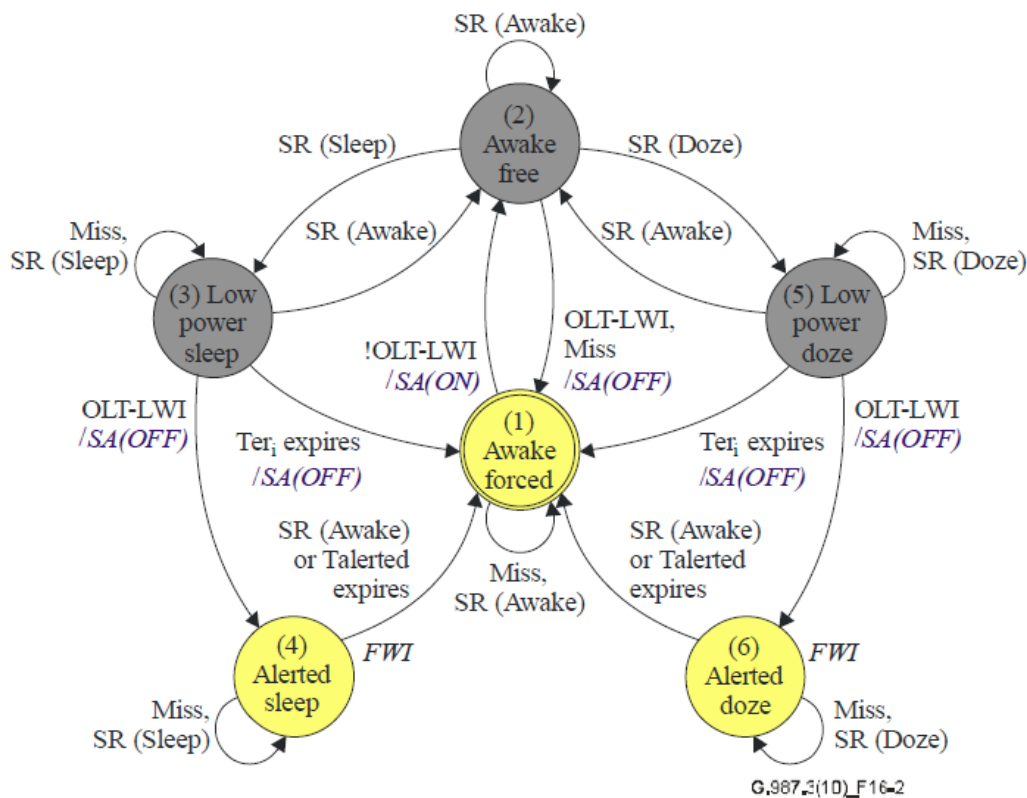


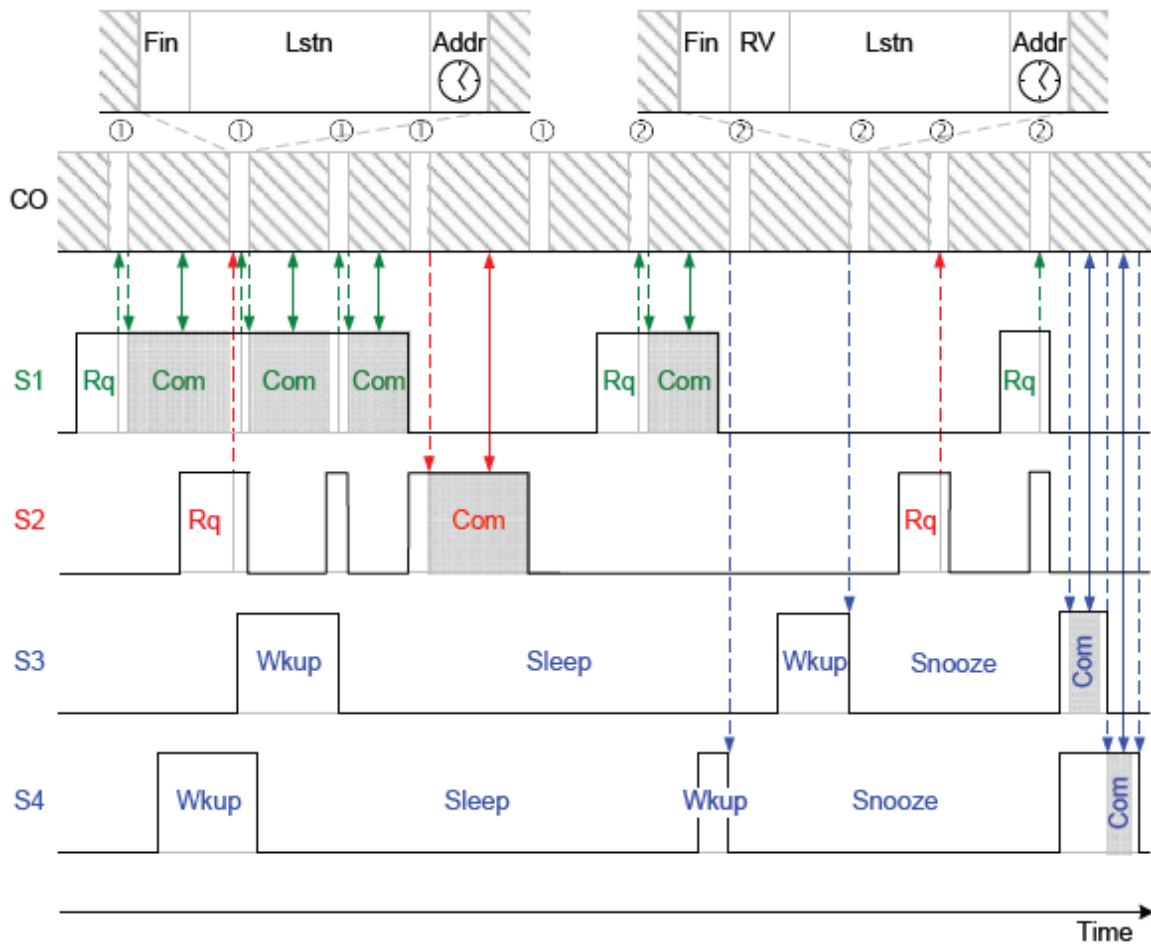
Figure 16-2 – OLT state transition diagram (initial state circled)

Ex. 1007, 104. As shown in Figure 16-2, the OLT has “[l]ow power sleep” (LowPowerSleep) and “[l]ow power doze” (LowPowerDoze) states. In both these states, “[t]he OLT provides normal allocations to the ONU but expects only intermittent responses from the ONU to bandwidth grants, as defined by various timers.” *Id.* at 104. A difference between the two states is that “[i]n the low power doze state, the OLT forwards downstream traffic; in the low power sleep state, the OLT may buffer downstream traffic.” *Id.* G.987.3 notes that “[d]irect transitions between [LowPower]Doze and [LowPower]Sleep mode are disallowed. When the OLT receives a request to execute such a transition, it attempts to regain state machine synchronization by waking up the ONU.” *Id.* at 105 (Tbl. 16-7 n.2).

2. *Overview of Röger*

Röger describes an “optically powered fiber network” that “connects and provides power to a multitude of subscribers, which are attached to a central office (CO) in a combined star and tree-like topology.” Ex. 1006, 3. Röger focuses optimizing energy use to enable “efficient use of the optically provided energy that is transmitted to each subscriber.” *Id.* In doing so, Röger implements (a) an “energy saving snooze mode” in which “[s]ubscribers maintain synchronism with CO,” and (b) a “minimum-energy sleep mode” in which “[s]ubscribers lose synchronism with CO” and “[a]ll communication circuitry [is] switched off.” *Id.* at 6.

Figure 2 of Röger is reproduced below:



Ex. 1006, 7. Figure 2 is a timing chart schematic showing communication between CO and four subscribers S1–4. *Id.* In particular, low-duty subscribers S3 and S4 “spend most of the time in a minimum-energy Sleep mode that is interrupted by nearly periodically appearing wake-up intervals Wkup, which are initiated autonomously by the subscribers.” *Id.* In Sleep mode, “only an inaccurate but ultra-low power clock is running for waking up the device, and so time synchronism with CO is lost.” *Id.* at 6. When periodically waking up, “subscribers S3 and S4 activate their basic receiver circuitry and listen for the CO’s polling.” *Id.* at 8. If, while the receiver is on, a subscriber receives a rendezvous signal (“RV”), it “extracts the time stamp

for the next rendezvous with CO, sets a high precision clock to the rendezvous time, and then goes to an energy-saving snooze mode” in which it maintains a precise quartz clock. *Id.* If, on the other hand, the subscriber does not receive an RV signal from CO during the wakeup period, the subscriber goes back to sleep. *Id.*

Thus, as shown in the Figure 2, subscriber S3 begins in Sleep mode and autonomously wakes up for an initial Wkup period. Sensing no RV signal from CO, S3 returns to sleep until it autonomously wakes again for a second Wkup period. This time, S3 receives an RV signal from CO (indicated by a dashed arrow), which sets a precise clock for a later rendezvous time. Ex. 1006, 7. Subscriber S3 then enters Snooze mode until the designated rendezvous time, upon which S3 “awake[s], listen[s] to be addressed, communicate[s] with CO, and go[es] again to Sleep mode.” *Id.* As shown in Figure 2, S3 communicates bidirectionally with CO during the rendezvous, as indicated by solid bidirectional arrows. *Id.*

3. *Claim 1*

According to Petitioner, “[t]here is no dispute that G.987.3 teaches each limitation of Claim 1, aside from limitation [1D].” Pet. Reply 9. Patent Owner does not contest this. *See* PO Sur-reply. Thus, we focus primarily on limitation 1D while briefly discussing the preamble and the other limitations.

(a) Preamble 1A and Limitations 1B and 1C

The preamble of claim 1 (1A) recites a “method of optical communication in a [PON],” and limitations 1B and 1C recite operating in a first state (transmitter turned off and receiver turned on) and a second state (both transmitter and receiver turned off). Ex. 1001, 15:1–8.

Petitioner argues that G.987.3 teaches communication between an ONU and an OLT in a PON and maps the recited first and second states to the “Listen” and “Asleep” states in G.987.3’s ONUs. Pet. 15–17. Patent Owner does not challenge these arguments. *See* PO Resp. 11–39. We find Petitioner’s arguments persuasive for the reasons given in the Petition, and we credit Dr. Sergienko’s supporting testimony. Pet. 15–18; Ex. 1003 ¶¶ 75–80. Thus, without determining whether the preamble is limiting, we find that G.987.3 discloses the preamble of claim 1 and limitations 1B and 1C.

(b) Limitation 1D

Limitation 1D recites “transitioning the ONU directly from the first state to the second state and transitioning the ONU directly from the second state to the first state, based on a power management rule.” Ex. 1001, 15:9–12.

(1) *Arguments in the Petition*

As noted above, Petitioner identifies the recited “first state” with the “Listen” state depicted in Figure 16-1 of G.987.3 and identifies the recited “second state” with the “Asleep” state. Pet 16, 18. According to Petitioner, G.987.3 discloses indirect transitions between these two states (via intermediate ActiveHeld and ActiveFree states). Pet. 19 (citing Ex. 1007, 100–102; Ex. 1003 ¶ 81).

Petitioner argues that a person of ordinary skill in the art would have modified G.987.3 to include direct transitions between Listen and Asleep “driven by a well-known problem in the field, reducing power consumption.” Pet. 11 (citing Ex. 1007, 97 (“[I]t is desirable to reduce the power consumed by an ONU as much as possible.”); Ex. 1003 ¶ 70); *see*

also Pet. Reply 5 (citing Ex. 1006, 2–3) (arguing that “G.987.3 discusses the importance of [reducing power consumption] for nearly an entire page”). According to Petitioner, direct transition between the states is one of a finite number of transitions between the six states of the ONU in G.987.3, and a person of ordinary skill in the art would have recognized that a direct transition would consume less power than an indirect transition. Pet. 11–12 (citing Ex. 1003 ¶ 70); *see also* Pet. Reply 9 (citing Ex. 2007 ¶¶ 108–110 (Patent Owner’s expert opining that “[w]ith so few realistic power saving options the ITU standard body undoubtedly considered all of them.”)).

Alternatively, or in addition to the above obvious-to-try argument,¹¹ Petitioner argues that Röger teaches direct, bidirectional transitions between its Sleep or Snooze states (which Petitioner alternatively equates to the recited “second state” because all communication circuitry is turned off) and the Wkup period (which Petitioner equates to the “first state” because the receiver is temporarily turned on). Pet. 20–22 & n.4 (citing Ex. 1006, 6–8, 10–13, Figs. 2, 6; Ex. 1003 ¶¶ 82–84). Separately, Petitioner argues that Röger’s system transitions between Snooze mode and the receiver-on “first state” before and after the rendezvous when the ONU is listening for subscriber data and potentially entering transmit mode. Pet. 22 n.4 (citing Ex. 1006, 12–13).

Petitioner also relies on Röger for teaching that transitions between first and second states are “based on a power management rule,” which in

¹¹ Petitioner clarifies in the Reply that its argument in the Petition is “that there would have been some modification to the base reference because it would have been obvious to try . . . *and/or* in view of the combination.” Pet. Reply 5 (emphasis added) (citing Pet. 12–15).

Röger corresponds to the rule that “subscriber stations should alternate back and forth between the sleep mode (‘second state’) and receive mode (‘first state’) until receiving a message to do otherwise.” Pet. 22–23 (citing Ex. 1006, 7; Ex. 1003 ¶ 85–86).

Petitioner argues that a person of ordinary skill in the art would have been motivated to implement Röger’s direct transitions into a G.987.3 PON because it was known in the art, before the priority date of the ’892 patent, that such direct transitions were more energy efficient, and the modification would have allowed an ONU to operate with “the least possible power consumption” and to “save both energy and communication bandwidth.” Pet. 12–14 (quoting Ex. 1006, 6–7) (citing Ex. 1003 ¶¶ 72–73); *see also* Pet. Reply 5. Also, according to Petitioner, such direct transitions were made more practical as of the priority date of the ’892 patent because of advancements in chip speed. Pet. 12–13 & n.1 (citing Ex. 1003 ¶ 72).

Patent Owner contests Petitioner’s obvious-to-try argument and the combination with Röger, and argues that the prior art teaches away from the proposed modifications to G.987.3. PO Resp. 11–40; PO Sur-reply 4–18. We address these contested issues below.

(2) *Obvious to Try and Combination with Röger*

Patent Owner argues that Petitioner’s obvious-to-try argument amounts to “an unspoken inherency argument,” and Patent Owner then proceeds to show that G.987.3 does not inherently disclose direct transitions between the ONU’s Listen and Asleep state. PO Resp. 12–14 (citing Ex. 2007 ¶¶ 68–78). In its Reply, Petitioner clarified that it is not arguing inherency. *See* Pet. Reply 5. We agree that Petitioner only argued in the Petition that G.987.3 discloses *indirect* transitions between the Listen state

(“first state”) and Asleep state (“second state”). Thus, we regard it as uncontested that G.987.3, alone, fails to disclose such direct transitions.

Regarding the combination of G.987.3 with Röger, Patent Owner argues that Petitioner has done no more than indicate that Röger discloses direct transitions¹² without adequately explaining why combining those transitions with G.987.3 would have been obvious. PO Resp. 32–33 (citing *Virtek Vision Int’l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882, 887 (Fed. Cir. 2024); *Personal Web Techs., LLC v. Apple, Inc.*, 848 F.3d 987, 993–994 (Fed. Cir. 2017); *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1375 (Fed. Cir. 2016)).

Patent Owner also argues that Röger’s system can only make direct transitions from its Sleep/Snooze states to a receive state “because Röger’s OLT does not expect the ONU to receive data traffic at any[]time in these states,” and only enters the wakeup state to listen for RV signals to set a precise rendezvous time. PO Resp. 34–35 (emphasis omitted) (citing Ex. 1006,¹³ 6, 11–12; Ex. 2007 ¶¶ 117–119). Thus, according to Patent Owner, Röger’s wakeup state is “fundamentally different” from G.987.3’s Listen state, during which the ONU can receive data traffic. *Id.* at 35 (citing Ex. 1007, 103, 106).

In addition, Patent Owner argues that the transitions before and after the rendezvous period are incompatible with G.987.3. PO Resp. 35–36.

¹² Patent Owner concedes that Röger teaches direct transitions from its Sleep/Snooze states to a receive state in which the receiver is turned on. *See* PO Resp. 32–34.

¹³ Patent Owner mistakenly cites Ex. 1005.

According to Patent Owner, the transition *into* the rendezvous period, in which the ONU's receiver is turned on, is incompatible because Röger synchronizes a precise time for the OLT–ONU rendezvous, whereas G.987.3 relies on a set of state messages between the OLT and ONU without trying to exactly synchronize the OLT and ONU. *Id.* at 37–38 (citing Ex. 1006, 7–8, 12, Fig. 2; Ex. 1007, 99). And according to Patent Owner, Petitioner has not “suggested that a [person of ordinary skill in the art] would or could modify G.987.3 so the OLT and ONU would agree upon a ‘precise rendezvous time’ like Röger, or explained how Röger’s fundamentally different rendezvous operation” would motivate a direct transition between G.987.3’s Listen and Asleep states. *Id.* at 39 (citing Ex. 1007, 102, 105 & n.2).

Patent Owner argues that Röger’s transition *out of* the rendezvous period, in which the receiver is turned off and the ONU is returned to Sleep mode, is also incompatible with G.987.3 because this transition is initiated by an End command from the OLT, but “G.987.3 is not designed for the OLT to command an ONU to go to sleep like Röger is.” *Id.* at 36 (citing Ex. 1006, Fig. 6). Patent Owner contends that in G.987.3, the OLT only ever grants the ONU *permission* to enter a low-power state, but never *commands* it to do so. *Id.* at 36–37 (citing Ex. 1007, 57, 100; Ex. 2007 ¶¶ 120–128). Thus, according to Patent Owner, this proposed modification would be incompatible with G.987.3’s basic design. *Id.* at 37 (citing Ex. 2007 ¶¶ 120–128).

In its Reply, Petitioner argues that it is irrelevant whether Röger’s rendezvous signals are the same as signals in G.987.3, as the challenged claims impose no signaling requirement other than a power-management

message in limitation 1F that Patent Owner does not contest is present in G.987.3. Pet. Reply 15–16. According to Petitioner, Röger teaches receiving power-management messages corresponding to the states of the receiver and transmitter, consistent with the challenged claims, during the ONU’s receive state and during the rendezvous periods. *Id.* at 16–18 (citing Ex. 1006, Fig. 2; Ex. 1036, 82:19–86:9; Ex. 1042).

In its Sur-reply, Patent Owner argues that Petitioner has failed to adequately explain “whether, why, and how in view of Röger a [person of ordinary skill in the art] would have modified G.987.3 as Petitioners contend.” PO Sur-reply 14. According to Patent Owner, its argument that Röger includes different signaling mechanisms is relevant to obviousness considerations, which need not be confined to the claimed features, and Petitioner has not explained why Röger’s teachings overcome Patent Owner’s teaching-away argument (discussed below). *Id.* at 15.

We find persuasive Petitioner’s arguments that it would have been a predictable and well-motivated variation of G.987.3, at the time of the claimed invention, to include a direct transition between the ONU’s two low-power states. *See KSR v. Teleflex*, 550 U.S. at 417 (“When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it, ... If a person of ordinary skill can implement a predictable variation, § 103 likely bars its patentability.”). We credit Dr. Sergienko’s testimony that a person of ordinary skill in the art would have been motivated to reduce power consumption and would have looked to ways of modifying G.987.3 to further that design goal. *See* Ex. 1003 ¶ 70; *see also* Ex. 1007, 97 (“For a variety of reasons, it is desirable to reduce the power consumed by an ONU as much as possible”).

We also credit Dr. Sergienko’s testimony that there were only a small number of ways to modify the state transitions in G.987.3’s ONU, and that it would have been obvious to consider those possibilities. Ex. 1003 ¶ 70. Patent Owner does not contest this. Dr. Litvin concedes, for Patent Owner, that “there is no conceivable way the [ITU] did not consider the proposed transition” between the ONU’s two low-power states when drafting G.987.3, although he contends the standards body prohibited such direct transitions as “a conscious and reasoned design choice.” Ex. 2007 ¶ 108; *see also id.* ¶ 109 (opining that there were only four possible choices for transitions in the ONU, and the ITU “undoubtedly considered all of them, including the direct transition from . . . Listen and . . . Asleep”); PO Resp 24 (conceding that “G.987 *explicitly considered* the very direct transitions that Petitioner say would be used”).

We also find persuasive Petitioner’s additional or alternative argument that Röger would have motivated modifying G.987.3 by allowing the ONU, while in sleep mode, to periodically turn on its receiver and check for messages from the OLT, which would have been direct transitions between “first” and “second” states as recited in claim 1. Pet. 20–22 & n.4; Ex. 1003 ¶¶ 82–84.

The evidence suggests that modifying G.987 as Petitioner proposes would have been within the abilities of a person of the ordinary skill in the art at the time of the claimed invention—either to add a direct transition between Listen and Asleep states or to allow the ONU, while in its sleep (both transmitter and receiver off) mode, to periodically turn on its receiver temporarily to listen for polling messages from the OLT, as Röger teaches. Pet. 11–12, 14–15, 19; Ex. 1003 ¶¶ 70, 74.

We also agree with Petitioner that there would have been motivation to make these modifications. Simply adding a direct transition to G.983.7's state diagram would have been one of only a finite number of choices, and doing so would have been expected to promote the design goal of consuming less power. Pet. 11–12; Pet. Reply 9; Ex. 1003 ¶ 70. A person of ordinary skill in the art would likewise have expected that adding a facility to periodically wake from G.987.3's sleep state by simply turning on the receiver without also turning on the transmitter, as Röger teaches, would increase energy efficiency. Pet. 12–14; Pet. Reply 5; Ex. 1003 ¶¶ 72–73; Ex. 1006, 6–7.

In making these determinations, we have also considered Patent Owner's teaching-away argument, which we discuss next.

(3) Teaching Away

Petitioner points out in the Petition that that G.987.3 includes a table of states for the OLT which states in a footnote (note 2) that “[d]irect transitions between Doze mode and Cyclic Sleep mode are disallowed.” Pet. 10 (alterations in original) (quoting Ex. 1007, 105). But according to Petitioner, “[t]his note is only applicable to the OLT, and there is no similar restriction or note in the ONU state transition and output table,” so the ONU has responsibility for its own transitions between low-power states, as further evidenced by G.987.3 and the ITU's later G.9807.1 XGS-PON standard. Pet. 10 (citing Ex. 1007, 106 (stating that the OLT must be able to deal with the possibility that the ONU unexpectedly fails to receive data or respond timely to messages); Ex. 1010, 235–238 (G.9807.1, which includes a similar note for the OLT but has a single, combined low-power state that can directly transition between receiver-off and receiver-on); Ex. 1003 ¶ 69).

In its Response, Patent Owner argues that note 2 in G.987.3 teaches away from direct transitions in the ONU. PO Resp. 14–29. According to Patent Owner, the G.987.3 drafters “explicitly considered the very direct transitions that Petitioners would say would be used, but G.987.3 still taught that direct ONU transitions from the Sleep to Doze states were not allowed.” PO Resp. 24 (emphasis omitted) (citing Ex. 1007, 105 (Tbl. 16–7, n.2)); *see also* PO Sur-reply 5.

Patent Owner disagrees with Petitioner that note 2 applies to the OLT, arguing instead that it applies only to the ONU. *Id.* at 14–16 (citing Ex. 2007 ¶¶ 79–104); *see also* Ex. 2007 ¶ 82–83 (opining that the disallowance in note 2 of the OLT state-transition table *only* applies to the ONU and not to the OLT); PO Sur-reply 4. According to Patent Owner, this is because if the OLT receives a request for a direct transition between low-power states, the OLT attempts to wake up the ONU. *Id.* at 16 (citing Ex. 1007, 105 (Tbl. 16–7 n.2)). Thus, such a request by the ONU would only occur if the OLT has become unsynchronized with the ONU, and the OLT would take corrective action to force the ONU into an awake state. *Id.* (citing Ex. 2007 ¶¶ 82–86); *see also id.* at 17–19 (citing Ex. 1001, 89, 98, 100, 103, 105; Ex. 2007 ¶¶ 86–93) (arguing that G.987.3’s Table 16–7 indicates that sleep request (“SR”) messages sent from the ONU to the OLT are disallowed if they are requesting a direct transition between low-power states).

Patent Owner also argues that the newer G9807.1 standard similarly disallows requests by the ONU to transition between low-power states, and like in G.987.3, the OLT’s state diagram includes no such direct transition. PO Resp. 19–22 (citing Ex. 1010, 229 (Fig. C.16.2), 238 (Tbl. 16.7); Ex. 2007 ¶¶ 101–104); *see also* PO Sur-reply 6.

Patent Owner also contends that G.987.3's teaching away of direct transitions between low-power states would not have been ameliorated by later advancements in chip speed, given that G.987.3 already discloses low-latency transitions between Asleep and SleepAware states, showing that the hardware for such transitions was sufficiently advanced at the time G.987.3 was drafted. PO Resp. 24–25 (citing Ex. 1007, 98 (Tbl. 16-1), 99, 101 (Fig. 16-1); Ex. 2007 ¶¶ 111–115).

In addition, Patent Owner argues that G.987.3 teaches away from adding a direct transition between the ONU's Listen and Asleep states because such a modification would have required a redesign that would fundamentally alter the operation of G.987.3. PO Resp. 26–29 & n.6. According to Patent Owner, G.987.3 requires the ONU to send messages to the OLT to notify of state transitions, since the OLT needs to know whether it can forward downstream traffic (if the ONU is in the Listen state) or buffer it (if the ONU is in the Asleep state). *Id.* at 27–29 (citing Ex. 1007, 101 (Fig. 16-1), 103 (Tbl. 16-5), 105 (Tbl. 16-7); Ex. 2007 ¶¶ 46–52, 107, 116–128). But if there were a direct transition between the ONU's Asleep and Listen states, no such message could be sent because the ONU's transmitter would be turned off in these modes. *Id.*

In its Reply, Petitioner argues that G.987.3's OLT and ONU state machines only “operate in partial state alignment,” and the OLT state machine is not the same as that of the ONU. Pet. Reply 6 (quoting Ex. 1007, 98) (citing Ex. 1007, 102–105). In any event, Petitioner argues, direct transitions between low-power modes were known in the art at the time of the claimed invention, and G.987.3 even acknowledges that the ONU could request the OLT to make such a transition and provides instructions for how

to handle such a request. *Id.* at 6–8 (citing Ex. 1007 ¶ 97; Ex. 1010, 238; Ex. 1036, 47:14–51:15; Ex. 2007 ¶¶ 108–110; Ex. 1003 ¶¶ 69–74).

Petitioner also argues that there is no architectural reason that would have prevented modifying G.987.3 from allowing direct transitions in the ONU, and in fact, such later modifications were incorporated in the standard in G.9807.1 and later editions of G.987.3. Pet. Reply 8 (citing Ex. 1036, 29:13–17, 36:8–37:14, 39:10–40:8, 45:9–46:22; Ex. 1037, 2–3); *id.* at 15 (citing Ex. 1003 ¶ 74). Petitioner also points to a 2013 ITU-T submission indicating a desire to simplify power-saving modes in G.987.3 in light of contemporary progress in transmitter driver technology, which allowed for faster enable/disable times. *Id.* at 8–9 (citing Ex. 1038, 1).

Petitioner also disagrees with Patent Owner that modifying G.987.3 as proposed would have made G.987.3 inoperable for its intended purpose. Petitioner disagrees that the proposed modification would require the ONU to send signals to the OLT requesting state transitions even though (impossibly) the ONU’s transmitter is off. Pet. Reply 10. According to Petitioner, there is no requirement in the claims that the ONU must send a message to the OLT for every state transition, and besides, the G.987.3 discloses that the OLT can buffer its downstream traffic if the ONU is in its Asleep state, so, like in Röger, the OLT does not need to be immediately informed every time the ONU turns its receiver on while in sleep mode. *Id.* at 10–11 (citing Ex. 1007, 103).

Petitioner argues that a person of ordinary skill in the art would have had the necessary background to successfully modify G.987.3 in an operable way. Pet. Reply 11–12 (citing Ex. 1003 ¶¶ 70–74, 81–86). As evidence of this, Petitioner argues that persons of ordinary skill in the art “*did in fact*

modify G.987.3 to implement direct transitions disclosed in Röger.” *Id.* at 12–13 (citing Ex. 1039, 102–112; Ex. 1036, 36:8–37:14, 39:10–40:8, 45:9–46:22). Petitioner points to 2013 proposals by Denis Khotimsky, one of the inventors of the ’892 patent, describing how to successfully modify G.987.3 by combining the ONU’s two low-power states into a single state that can directly transition between receiver-off and receiver-on. *Id.* at 13–15 (citing Ex. 1040, 10–12, Ex. 1041, 7; Ex. 1043, 1–13). According to Petitioner, G.987.3 ended up incorporating this idea in its 2014 version, and the same material was included in the G.9807.1 Recommendation (XGS-PON). *Id.* at 14–15 (citing Ex. 1039, 102–112; Ex. 1010, 230–239).

Petitioner disagrees that note 2 in G.987.3’s OLT state table was a result of a decision to reject the possibility that the ONU could turn its receiver on while in sleep mode. Pet. Reply 15. According to Petitioner, the G.987.3 standard came together as a compromise between two competing proposals, one for a “cyclic sleep” mode and one for “doze” mode, and the ITU simply combined the two proposals, noting that direct transitions between these two states in the OLT were not (yet) supported in the standard. *Id.* (citing Ex. 1037, 2–3).

In its Sur-reply, Patent Owner contends that it would have been impossible for the ONU to accidentally move directly between Asleep and Listen states, and the G.987.3 drafters included note 2 in the OLT state-transition table because the OLT could become unsynchronized by, for example, “missing ONU transitions” or receiving a corrupt message from the ONU. PO Sur-reply 5–6. And Patent Owner argues that the evidence of record confirms that in G.987.3 (before later modifications), doze mode and cyclic sleep mode had distinct behavior (buffering allowed in cyclic sleep

mode but data forwarded in doze mode), were mutually exclusive, and the OLT and ONU would negotiate at the start of each cycle whether the ONU would be in either doze or cyclic sleep mode. PO Sur-reply 7–8 (citing Ex. 1037, 2; Ex. 1041, 1; Ex. 2007 ¶¶ 50, 52, 116–120).

Patent Owner concedes that later modifications adopted in G.9807.1, which replace doze and cyclic sleep modes with a single “watchful sleep” mode, result in a system that is within the scope of claim 1. PO Sur-reply 8 (citing Ex. 1010, 31; Ex. 1036, 35:11–22). But according to Patent Owner, Petitioner did not argue that it would have been obvious to add a “watchful sleep” state to G.987.3, as in G.9807.1—only that a person of ordinary skill in the art “would have modified G.987.3 in light of Röger to allow direct transitions between G.987.3’s Listen (6) and Asleep (4) states, *which is not the same.*” *Id.* at 8–9 (citing Pet. 16, 18; Ex. 1010, 229, 238; Exs. 1037–1041, 1043). Patent Owner contends that the watchful sleep state “exists in parallel with the older mutually exclusive Listen and Asleep states,” and G.987.3 still teaches away from simply modifying the latter by keeping the separate Listen and Asleep states but adding a direct transition between them. *Id.* at 9–10 (citing Ex. 1010, 31; Ex. 1036, 36:8–37:14, 39:10–40:8, 40:5–18, 45:9–46:22, 101:2–9; Ex. 1043 (indicating a goal to add a watchful sleep mode while maintaining backward compatibility with the separate doze and cyclic sleep modes); Ex. 2007 ¶¶ 53, 81, 101).

Next, Patent Owner argues that the 2013 ITU-T submission, indicating a desire to simplify G.987.3’s power-saving modes since contemporary chips existed that had faster enable/disable times, did not propose to add a watchful sleep state, but to simply deprecate the doze state. PO Sur-reply 10–11 (citing Ex. 1038, 1–4, 13; Ex. 2007 ¶ 116). Thus,

according to Patent Owner, there is at least one restriction on the ONU's signaling mechanics that Petitioner's proposed modification to G.987.3 fails to account for, which is that the ONU "cannot turn on its transmitter to notify the OLT of the transition or the transition would not be direct." *Id.* at 12.¹⁴

Having considered the parties' evidence and arguments on both sides, we disagree with Patent Owner's argument that the prior art teaches away from Petitioner's proposed modifications to G.987.3. For a reference to teach away, it must "criticize, discredit, or otherwise discourage" investigation into the invention claimed." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 567 F.3d 1314, 1327 (Fed. Cir. 2009) (quoting *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004)); *Santarus, Inc. v. Par Pharm., Inc.*, 694 F.3d 1344, 1354 (Fed. Cir. 2012) ("A reference teaches away when it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the applicant." (quotation marks omitted) (quoting *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006))). We find nothing in G.987.3 that rises to the level of criticism or discrediting, and we find nothing that would

¹⁴ Patent Owner also argues that Petitioner improperly included a new theory in its Reply that a person of ordinary skill in the art would have had reason to "modify G.987.3 to stop an OLT from sending downstream traffic to an ONU after the OLT allowed the ONU to transition to a Doze/Listen state." PO Sur-reply 12–13 (citing Pet. Reply 11; Ex. 1038, 1–4; Ex. 1030, 5, 10, 12; Ex. 2007 ¶¶ 53, 114). We do not understand Petitioner to be making this argument. Petitioner only appears to be arguing that G.987.3 already allows the OLT to account for times when the ONU is in the Asleep state (receiver turned off) by buffering downstream data. Pet. Reply 11 (citing Ex. 1007, 103).

have discouraged a person of ordinary skill in the art from investigating ways to add a direct transition between the two states.

Although G.987.3 indicates that direct transitions between the OLT's doze and cyclic sleep modes are "disallowed" under the standard, this statement was in the context of the state transitions in the OLT. Ex. 1007, 105. Although the OLT and ONU have similar state machines, they are not identical and are only in "partial state alignment." *Id.* at 98. No such explicit disallowance appears in the context of the ONU's state machine that would explicitly disallow transitions between Listen and Asleep states. *See id.* at 102. Nor has Patent Owner pointed to anything in G.987.3 that would have prohibited the ONU from turning turn on its receiver, at least temporarily, while remaining in the Asleep state.

Patent Owner's teaching-away argument is also undermined by later documents suggesting that persons of ordinary skill in the art were not dissuaded by G.987.3's "disallowed" language from investigating ways to allow the ONU to turn on its receiver while remaining in a low-power sleep mode, as Röger teaches. *See* Exs. 1038–1041, 1043. This evidence is dated after the effective priority date of the '892 patent, so a person of ordinary skill in the art could not have considered these later developments at the time of the claimed invention. However, the documents weigh against Patent Owner's argument that Petitioner's proposed modifications to G.987.3 would have been inoperable or otherwise incompatible with G.987.3.¹⁵ We

¹⁵ As to Patent Owner's argument that the 2013 ITU-T submission did not propose to add a watchful sleep state, but to simply deprecate the doze state (PO Sur-reply 10–11), we note that this proposal stated that the ONU, while

find Petitioner’s arguments to the contrary more persuasive for the reasons outlined in Petitioner’s Reply. *See* Pet. Reply 12–18. Nevertheless, we would still disagree with Patent Owner’s teaching-away argument without this evidence of post-priority-date developments.

(c) Limitations 1E–1G

Limitations 1E–1G recite powering up and synchronizing the ONU, receiving a power-management message from an OLT, and changing the power-management rule based on that message. Ex. 1001, 15:14–21.

Petitioner sets forth how it contends that the combination of G.987.3, Röger, and G.988 teaches or suggests limitations 1E–1G. Pet. 23–35. Patent Owner does not challenge these arguments. *See* PO Resp. 11–39. We determine that Petitioner’s arguments are persuasive for the reasons given in the Petition, and we credit Dr. Sergienko’s supporting testimony. Pet. 23–35; Ex. 1003 ¶¶ 87–105. Thus, we find that the combination of G.987.3, Röger, and G.988 teaches limitations 1E–1G.

(d) Conclusion as to claim 1

For the above reasons, we determine that Petitioner has shown, by a preponderance of the evidence, that the combination of G.987.3, Röger, and G.988 teaches all the limitations of claim 1, and a person of ordinary skill in the art would have had reason to combine the references to implement the

in the simplified sleep mode, could “choose[] not to turn on its transmitter on every waking cycle” (i.e., remain in the low-power mode with only its receiver turned on) and “that will not be explicitly visible to the OTL.” Ex. 1038, 2. So it appears that the proposal did more than simply deprecate the doze state.

method of claim 1. We therefore determine that claim 1 is unpatentable under § 103(a) as obvious over G.987.3, Röger, and G.988.

4. *Claims 2, 3, 5, and 14*

Petitioner presents arguments addressing each of the limitations in dependent claims 2, 3, and 5, and independent claim 14, with support from the record and the testimony of Dr. Sergienko. *See* Pet. 36–42, 43–53. Patent Owner does not present distinct arguments for these claims. *See* PO Resp. 40–47. We agree with and adopt Petitioner’s uncontested analyses for each of these claims, and credit Dr. Sergienko’s supporting testimony.

As one example, claim 14 is like claim 1 but instead of reciting “transitioning . . . directly” from the first state to the second state and vice versa, claim 14 only requires a “transition” from the first state to the second state and vice versa. Ex. 1001, 17:1–4. Petitioner argues that G.987.3 discloses indirect transitions between the first state and the second state via intermediate states ActiveHeld, ActiveFree and SleepAware or DozeAware. Pet. 47–48.

As we discuss above, we disagree with Patent Owner’s proposal to construe the phrase “transition . . . from . . . to” in claim 14 to “require[] a direct transition from the first low power mode to the second low power mode and *vice versa*.” *See supra* Section III.B (quoting PO Resp. 6–7). Patent Owner does not contest that G.987.3 discloses an *indirect* transition as Petitioner argues. *See* PO Resp. 42. We find Petitioner’s argument that claim 14 would have been obvious over the asserted prior art persuasive.

5. *Claim 4*

Claim 4 depends from independent claim 1 and further recites “transmitting, to an optical line terminal, a message indicative of the transitioning between the first state and the second state.” Ex. 1001, 15:31–34.

Petitioner argues that claim 4 “seems to contradict [limitation 1D] since the transmitter would be turned on to transmit the message indicative of transitioning.” Pet. 42 (citing Ex. 1003 ¶ 116). Nevertheless, Petitioner argues that G.987.3 teaches that when the ONU exits either the Listen or Asleep states, it sends a SleepRequest (“SR”) message to the OLT. Pet. 42 (citing Ex. 1007, 52, 101, 103, Fig. 16-1; Ex. 1003 ¶ 117). According to Petitioner, “the ONU’s indirect transition performed when transmitting these messages would have been modified to the direct transition taught by Röger” as Petitioner explains in the context of limitation 1D. Pet. 43 (citing Ex. 1003 ¶ 118).

Patent Owner disagrees that Petitioner has shown a motivation for transmitting the message recited in claim 4. First, Patent Owner agrees with Petitioner that in the G.987.3 ONU’s Listen and Asleep states the “transmitter would be turned off” and thus the recited message could not have been sent when the ONU is in either of these states. PO Resp. 40–41 & n.7.

Patent Owner also argues that in G.987.3, SR messages are only sent when the ONU transitions between the subset of full-power states (ActiveHeld or Active Free) and the subset of low-power states (SleepAware, Asleep, DozeAware, or Listen). PO Resp. 41 (citing Ex. 1007, 98). Thus, according to Patent Owner, the ONU would not send an SR

message upon a transition from Listen to DozeAware, or a transition from Asleep to SleepAware, because those transitions are wholly within the low-power states. *Id.* at 41–42 (citing Ex. 1007, 100, Fig. 16-1); *see also* PO Sur-reply 21–22 (reiterating Patent Owner’s argument that note 2 of G.987.3 disallows the sending of messages indicating a direct transition between the low-power states).

In its Reply, Petitioner argues that because the indirect transition between Listen and Asleep must pass through ActiveHeld or ActiveFree, G.987.3 discloses that an SR will be sent at some point during that indirect transition. Pet. Reply 18–19 (citing Ex. 1007, 52; Ex. 1003 ¶ 117). Petitioner also argues that note 2 contemplates the sending of a message indicating a direct transition between Listen and Asleep. *Id.* (citing Ex. 1007, 105¹⁶).

We determine that Petitioner has not met its burden to show that a person of ordinary skill in the art would have modified G.987.3 to include the recited message indicating a direct transition between the first state and the second state. We disagree that there is necessarily a contradiction between claim 4 and limitation 1D. Although claim 4 recites a message indicating a transition that would occur while the transmitter is turned off, Petitioner has not pointed to anything in claim 4 or elsewhere in the ’892 patent requiring that the message must be sent at the same time as the transmission (as opposed to later after the transmitter is turned on).

Moreover, even though, as we determine above, it would have been obvious to include direct transitions between the ONU’s low-power states while the transmitter is turned off, Petitioner has not adequately explained

¹⁶ Petitioner incorrectly cites page 97.

why a person of ordinary skill in the art would have configured the G.987.3's ONU to send a message indicating such a direct transition. That G.987.3 would have sent an SR signal during an indirect transition that passes through ActiveHeld and ActiveFree is irrelevant because Petitioner is proposing to bypass ActiveHeld and ActiveFree. Thus, we determine that Petitioner has not met its burden to show that claim 4 would have been obvious over G.987.3, Röger, and G.988.

6. *Claim 15*

Claim 15 depends from independent claim 14 and further recites that the OLT is configured to transmit the control message that includes the power management rule that specifies a first time period for operation in the first low power state and a second time period for operation in the second low power state upon expiration of at least one of the first time period and the second time period.

Ex. 1001, 17:17–25.

Petitioner argues that G.987.3 discloses messages including an Isleep parameter (“the maximum time the ONU spends in its Asleep or Listen states” and an Iaware message (“the minimum time the ONU spends in its Aware state”). Pet. 53 (quoting Ex. 1007, 100) (citing Ex. 1003 ¶ 138). Petitioner cites similar teachings in G.988. *Id.* (citing Ex. 1008, 82; Ex. 1003 ¶ 138). According to Petitioner, Isleep corresponds to the recited “first time period” and Asleep corresponds to the recited “second time period,” and a person of ordinary skill in the art would have understood the parameters to be applicable for a direct transition between Asleep and Listen states in light of Röger. Pet. 53–54 (citing Ex. 1006, 6–8, 10–13; Ex. 1007, 98; Ex. 1003 ¶¶ 138–139).

In its Response, Patent Owner argues that Petitioner has pointed to two distinct messages in G.987.3 but has not shown that the prior-art references teach a *single* control message that includes a power-management rule specifying both the two time periods recited in claim 15. PO Resp. 43–47 & nn.8–9 (citing Ex. 1007, 98, 100–101, 106; Ex. 1008, 82). Patent Owner also contends that Petitioner has insufficiently explained why G.987.3’s Isleep and Asleep messages would have been applicable in the context of the combination with Röger. *Id.* at 47.

In its Reply, Petitioner argues that Patent Owner does not contest similar limitations in claims 3 and 11. Pet. Reply 20–21. Petitioner also contends that parent claim 14 refers to “a control message,” which, based on the indefinite article, does not exclude transmitting multiple control messages, each such message including one or the other of Isleep or Asleep messages. *Id.* at 21–23 (citing Ex. 1007, 98).

In addition, Petitioner argues that Röger teaches that the OLT transmits signals that specify the next rendezvous time, which effectively defines the amount of time the ONU remains in snooze mode (the recited “second low power mode”) prior to the rendezvous. Pet. Reply 23 (citing Ex. 1006, 12). Then, during the rendezvous, the ONU remains awake until it receives another command from the OLT to return to sleep mode, thus again controlling how long the ONU remains in the receive mode (the recited “first lower power mode”). *Id.* at 23–24 (citing Ex. 1006, 13).

In its Sur-reply, Patent Owner does not contest that claim 15 is consistent with multiple control messages, but argues that each such control message must specify both a first time period and a second time period. PO Sur-reply 23 & n.4.

We agree with Patent Owner. Although there could be multiple control messages, claim 15 plainly states that each control message includes a rule that specifies both “a first time period for operation in the first low power state *and* a second time period for operation in the second low power state.” Ex. 1001, 17:18–22 (emphasis added). Petitioner has not shown that the prior art teaches such a message. Thus, we determine that Petitioner has not met its burden to show that claim 15 would have been obvious over G.987.3, Röger, and G.988.

7. *Conclusion for Grounds Based on Goldenberg*

For the above reasons, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 1–3, 5, and 14 are unpatentable as obvious over G.987.3, Röger, and G.988, but has not made such a showing for claims 4 or 15.

D. GROUND S BASED ON OBVIOUS OVER G.987.3, RÖGER, G.988,
AND GHAZISAIDA

The remaining ground challenges claims 10–13 as obvious over G.987.3 in view of Röger, G.988, and Ghazisaida. Pet. 1.

1. *Claims 10 and 11*

Petitioner presents arguments addressing each of the limitations in independent claim 10 and dependent claim 11, with support from the record and the testimony of Dr. Sergienko, largely following its similar arguments for claims 1 and 3, respectively. *See* Pet. 54–59. Patent Owner does not present distinct arguments for these claims. *See* PO Resp. 48. We agree with and adopt Petitioner’s uncontested analyses for each of these claims, and credit Dr. Sergienko’s supporting testimony.

2. *Claims 12 and 13*

Independent claim 12 is directed to an OLT and is like claim 1 in that it includes limitations directed transitions between a “first low power state” and a “second low power state,” and the generation of control messages by the OLT for controlling these transitions. Ex. 1001, 16:38–49. It also recites “wherein the generated messages comprises [sic] a periodic consent message to allow the optical network unit to remain in either the first low power state or the second low power state.” *Id.* at 50–53.

Petitioner argues that G.987.3 teaches this last limitation because it teaches that the OLT sends “Sleep_Allow(ON)” messages that grant the ONU permission to remain in either Listen or Asleep states, at its discretion. Pet. 62–63 (citing Ex. 1007, 100, 103; Ex. 1003 ¶¶ 162–163). As to the requirement that consent messages be “periodic,” Petitioner argues that G.987.3 allows the OLT to send messages “at any time,” even if the sleeping ONU would not receive the transmission. *Id.* at 63 (citing Ex. 1007, 106; Ex. 1003 ¶ 163).

In response, Patent Owner argues that a Sleep_Allow(ON) only grants the ONU consent to *enter* a low-power state, and, G.987.3 does not teach the sending of any additional Sleep_Allow(ON) messages after that point, periodic or otherwise, which would allow the ONU to *remain* in either Listen or Asleep mode. PO Resp. 49–52 (citing Ex. 1007, 95, Fig. 16-2; Ex. 2007 ¶¶ 65, 129–135). According to Patent Owner, the ’892 patent includes an embodiment in which, “[u]pon transition to and periodically during the sojourn in [the low-power] state, the OLT sends an LPM-Allow message to the ONU,” suggesting that claim 12 requires periodic consent messages *while* the ONU remains in the low-power state. PO Resp. 50

(alteration in the original) (emphasis omitted) (quoting Ex. 1001, cols. 10–11, Table 6); PO Sur-reply 18.

In its Reply, Petitioner argues that claim 12 includes no express requirement “that the ONU *already* be in a low power state when it receives the claimed message,” only that remaining in the state is *allowed*, “which refers to future action by the ONU.” Pet. Reply 24. Petitioner contends that the ’892 patent, like Figure 16-1 in G.987.3, only depicts the OLT sending a Sleep_Allow(ON) signal to the ONU while the ONU is in the fully-awake ActiveHeld state, and never in Listen or Asleep modes (which in the latter case would be impossible because in Asleep mode the receiver is turned off). Pet. Reply 24–26 (citing Ex. 1001, Figs. 5, 7A, 7B, 7D, 7E; Ex. 1007, 101, Fig. 16-1).

Petitioner also argues that a person of ordinary skill in the art would have been “motivated to have an OLT send a Sleep_Allow(ON) message[] to an ONU in the Listen state before the Isleep timer expired such that the ONU would not have to exit the Listen state to a Doze Aware state.” Pet. Reply 26 (citing Ex. 1007, 51; Ex. 1003 ¶ 163). And according to Petitioner, “the message, which results in the ONUs remaining in a claimed low power state, can be sent each time the ONU is in Active Held, which happens periodically.” *Id.* at 26.

Finally, Petitioner argue that “Röger teaches that the OLT generates polling signals, which are the claimed ‘generated messages’ that are periodically sent to the ONUs,” and they “allow the ONUs to stay in” either the first or second low-power state. Pet. Reply 27 (citing Ex. 1006, 6–7, Fig. 2).

In its Sur-reply, Patent Owner argues that the ActiveHeld state, in which the ONU receives Sleep_Allow(ON) messages, “is not a low power state,” so the messages do not “(1) allow the ONU to *remain* in a low power state—just *enter* a low power state.” PO Sur-reply 18 (citing Ex. 1007, 95). Patent Owner also argues that once an ONU is in Listen state, it will need to transition to DozeAware, and then to ActiveHeld for reasons independent of OLT sleep permissions. *Id.* at 20 (citing Ex. 1007, Tables 16-1, 16-2).

Patent Owner also argues that Röger only ever teaches the sending of messages to wake up the ONU’s receiver at the rendezvous time, but never to allow the ONU to remain in a low-power mode. PO Sur-reply 20–21 (citing Ex. 1006, 7, Fig. 2).

We agree with Patent Owner that Petitioner has not sufficiently proven that G.987.3 or Röger teaches the sending of periodic messages allowing the ONU to remain in one of the two recited low-power states. As Patent Owner correctly notes, the Sleep_Allow(ON) message in G.987.3 reflects permission for the ONU to transition from ActiveHeld to ActiveFree modes. *See* Ex. 1007, 101–102. ActiveFree is not one of the low-power modes, although, while in ActiveFree, the ONU has permission “to exercise any power management mode and leave the selection of doze or cyclic sleep mode to the ONU’s discretion.” *Id.* at 100.

Thus, although the Sleep_Allow(ON) message appears to be associated with the potential of the ONU to *enter* Listen or Asleep modes at some future time, Petitioner has not persuasively shown that the message, itself, has anything to do, except in a purely circumstantial way, with the ONU *remaining* in one of those modes, once entered.

Also, although a Sleep_Allow(ON) message may, in some sense, “periodically” cause the ONU to transition from ActiveHeld to ActiveFree mode, this occurs while the ONU is awake. Petitioner has not shown that the OLT will send any such messages while the ONU is already in a low-power mode, and thus Petitioner has not clearly articulated how any repeated or “periodic” Sleep_Allow(ON) messages would have had any relation to the ONU *remaining* in a low-power mode once it gets there.

Petitioner’s new theory in the Reply that Röger also teaches periodic consent messages is untimely, as it does not respond to an argument in the Patent Owner Response. Pet. Reply 27. Instead, it simply presents an alternative obviousness theory, based on a different reference not used for that purpose in the Petition. *See* 37 CFR § 42.23(b).

Claim 13 depends from claim 12, and Petitioner relies on its arguments for other claims. Pet. 63 (citing Ex. 1003 ¶¶ 164–165). Thus, Petitioner does not present any arguments that would remedy the deficiency in its argument for claim 12, discussed above.

Thus, we determine that Petitioner has not shown, by a preponderance of the evidence, that claims 12 or 13 are unpatentable as obvious over G.987.3 in view of Röger, G.988, and Ghazisaida.

IV. CONCLUSION¹⁷

For the reasons above, Petitioner has shown by a preponderance of the evidence that claims 1–3, 5, 10, 11, and 14 of the '892 patent are unpatentable, but has not shown that claims 4, 12, 13, or 15 are unpatentable.

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–5, 14, 15	103	G.987.3, Röger, G.988	1–3, 5, 14	4, 15
10–13	103	G.987.3, Röger, G.988, Ghazisaidi	10, 11	12, 13
Overall Outcome			1–3, 5, 10, 11, 14	4, 12, 13, 15

V. ORDER

It is

ORDERED that claims 1–3, 5, 10, 11, and 14 of the '892 patent are unpatentable;

¹⁷ Should Patent Owner wish to pursue amendment of claims in a reissue or reexamination proceeding after this decision, we draw attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. § 42.8(a)(3), (b)(2).

FURTHER ORDERED that claims 4, 12, 13, and 15 of the '892 patent are not 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.

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Patent 9,806,892 B2

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