

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

EMERSON ELECTRIC CO.,
Petitioner,

v.

IPCO, LLC,
Patent Owner.

Case IPR2017-00008
Patent 8,233,471 B2

Before BRYAN F. MOORE, MICHAEL J. FITZPATRICK, and
ROBERT J. WEINSCHENK, *Administrative Patent Judges*.

WEINSCHENK, *Administrative Patent Judge*.

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

I. INTRODUCTION

Emerson Electric Co. (“Petitioner”) filed a Petition (Paper 1, “Pet.”) requesting an *inter partes* review of claims 17–22 and 31–36 (“the challenged claims”) of U.S. Patent No. 8,233,471 B2 (Ex. 1101, “the ’471 patent”). IPCO, LLC (“Patent Owner”) filed a Preliminary Response (Paper 7, “Prelim. Resp.”) to the Petition. On April 5, 2017, we instituted an *inter partes* review of the challenged claims of the ’471 patent on the following grounds:

Claims	Statutory Basis	Applied References
17, 18, 20, 21, 31, 32, 34, and 35	35 U.S.C. § 103(a) ¹	J. Burchfiel et al., <i>Functions and Structure of a Packet Radio Station</i> , 44 AFIPS Conference Proceedings, 245–51 (1975) (Ex. 1104, “Burchfiel”); and I. Gitman et al., <i>Routing in Packet-Switching Broadcast Radio Networks</i> , 24:8 IEEE Transactions on Communications, 926–30 (1976) (Ex. 1105, “Gitman”)
19, 22, 33, and 36	35 U.S.C. § 103(a)	Burchfiel; Gitman; and Robert E. Kahn, <i>The Organization of Computer Resources Into a Packet Radio Network</i> , 44 AFIPS Conference Proceedings, 177–86 (1975) (Ex. 1107, “Kahn”) ²

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, which was enacted on September 16, 2011, made amendments to 35 U.S.C. §§ 102, 103. AIA § 3(b), (c). Those amendments became effective eighteen months later on March 16, 2013. *Id.* § 3(n). Because the application from which the ’471 patent issued was filed before March 16, 2013, any citations herein to 35 U.S.C. §§ 102, 103 are to their pre-AIA versions.

² Petitioner refers to Kahn as Kahn75. Pet. 4–6.

Claims	Statutory Basis	Applied References
19, 22, 33, and 36	35 U.S.C. § 103(a)	Burchfiel; Gitman; Kahn; and Admitted Prior Art (“APA”) ³

Paper 12 (“Dec. on Inst.”), 19–20.

After institution, Patent Owner filed a Response (Paper 21, “PO Resp.”) to the Petition, and Petitioner filed a Reply (Paper 29, “Pet. Reply”) to the Response. An oral hearing was held on December 19, 2017, and a transcript of the hearing is included in the record. Paper 39 (“Tr.”).

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a). For the reasons set forth below, Petitioner has shown by a preponderance of the evidence that claims 17–22 and 31–36 of the ’471 patent are unpatentable.

A. *Related Proceedings*

The parties indicate that the ’471 patent is at issue in the following district court cases: *Emerson Electric Co. v. SIPCO, LLC*, No. 1:15-cv-00319 (N.D. Ga.)⁴; and *SIPCO, LLC v. Streeline, Inc.*, No. 1:16-cv-00830 (D. Del.). Pet. 3; Paper 3, 1–2; Paper 32, 2; Paper 36, 2. The parties also indicate that the following petitions for *inter partes* review are related to this case:

Case No.	Involved U.S. Patent No.
IPR2013-00482	U.S. Patent No. 6,044,062
IPR2014-00147	U.S. Patent No. 6,249,516

³ Petitioner cites to portions of the ’471 patent as evidence of APA. *See, e.g.*, Pet. 52–53 (citing Ex. 1101, 15:12–27). Patent Owner does not raise any issue with respect to Petitioner’s reliance on APA in this case.

⁴ *SIPCO, LLC v. Emerson Electric Co.*, No. 6:15-cv-00907 (E.D. Tex) was transferred to the Northern District of Georgia, opened as *SIPCO, LLC v. Emerson Electric Co.*, No. 1:16-cv-02690 (N.D. Ga.), and then consolidated with *Emerson Electric Co. v. SIPCO, LLC*, No. 1:15-cv-00319 (N.D. Ga.).

IPR2015-01901	U.S. Patent No. 8,000,314
IPR2016-01602	U.S. Patent No. 6,249,516
IPR2017-00007	U.S. Patent No. 8,233,471
IPR2017-00213	U.S. Patent No. 8,625,496
IPR2017-00252	U.S. Patent No. 8,000,314

Pet. 3; Paper 3, 2; Paper 32, 2; Paper 36, 2.

B. *The '471 Patent*

The '471 patent relates to a wireless network for transmitting digital data packets. Ex. 1101, 1:22–24. The '471 patent explains that prior wireless networks did not allow each client in the network to efficiently and effectively communicate with a multiplicity of other clients and servers in the network. *Id.* at 4:35–44. To improve on these prior wireless networks, the '471 patent describes a wireless network in which each client selects the path by which it transmits packets to a server. *Id.* at 5:18–23. The path can be either a direct path to the server or an indirect path through other clients. *Id.* at 5:23–26. According to the '471 patent, the client also searches for an improved path to the server and preferably chooses the best path, whether that is a direct path or an indirect path. *Id.* at 5:26–28, 5:40–43.

C. *Illustrative Claim*

Claims 17, 20, 31, and 34 are independent. Claim 17 is reproduced below.

17. A wireless network system comprising:

a first node including a first node controller and a first node radio modem, said first node controller implementing a first node process that includes controlling of said first node radio modem, said first node process including receiving and transmitting data packets via said first node radio modem;

a plurality of second nodes each including a second node controller implementing a second node process that includes controlling a second node radio modem, said second node

process including receiving and transmitting data packets via said second node radio modem, wherein said second node process of each of said second nodes includes initiating a radio transmission path to said first node that is a link to said first node through at least one of the remainder of said plurality of second nodes; and

wherein said first node process dynamically updates a second node link tree comprising second node link entries and dynamically modifies the second node link tree so that the data packet transmission from the first node is optimized.

Ex. 1101, 27:16–37.

II. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner argues that a person of ordinary skill in the art would have had “a minimum of a bachelor’s degree in Electrical Engineering and 2–3 years’ experience in the development and design, or technical marketing, of radio communications and computer network systems, or the equivalent (*e.g.*, education substituting for experience or vice-versa).” Pet. 10 (citing Ex. 1103 ¶¶ 9–11). Patent Owner’s declarant, Dr. Kevin C. Almeroth, testifies that a person of ordinary skill in the art would have had “the equivalent of a four-year degree from an accredited institution (usually denoted as a B.S. degree) in computer science, computer engineering or the equivalent and experience with, or exposure to, computer networks and routing” and “approximately two years of professional experience with computer networking, routing, and wireless networks.” Ex. 2002 ¶ 75. Dr. Almeroth notes that “[a]dditional graduate education could substitute for professional experience, while significant experience in the field might substitute for formal education.” *Id.*

Neither party identifies any specific instance in which the difference between the parties' respective definitions of the level of ordinary skill in the art impacts the analysis or conclusions of either party, or either party's declarant, in this case. Our findings and conclusions in this case would be the same under either party's definition of the level of ordinary skill in the art. To the extent necessary, though, we adopt Petitioner's definition, which is supported by the testimony of Petitioner's declarant, Mr. James T. Geier.⁵ Pet. 10; Ex. 1103 ¶¶ 9–11.

B. *Claim Construction*

The parties agree that the '471 patent has expired. Pet. 8; PO Resp. 8. As a result, we may construe the claims of the '471 patent pursuant to *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b); *see also In re Rambus, Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012) (holding, on appeal from a reexamination decision by the Board of Patent Appeals and Interferences, that “the Board’s review of the claims of an expired patent is similar to that of a district court’s review”). Under *Phillips*, we generally give claim terms their “ordinary and customary meaning” as understood by a person of ordinary skill in the art in question at the time of the invention. 415 F.3d at 1312–13. We consider the intrinsic evidence, namely, the claim language, the specification, and the prosecution history, if in evidence. *Id.* at 1314–17. We also can consider extrinsic evidence, but it is “less significant than the intrinsic record in determining ‘the legally operative meaning of claim language.’” *Id.* at 1317.

⁵ Dr. Almeroth notes that “I have considered Mr. Geier’s definition and it does not alter my opinions.” Ex. 2002 ¶ 80.

1. *Transmission Path / Link*

Petitioner proposes construing the term “selected link” to mean a path “established/observed/chosen by a second node, including the identification of each of the hops to be traversed by the data message packet en route to the first node.” Pet. 9. Petitioner cites to the specification of the ’471 patent as support for its proposed construction. *Id.* (citing Ex. 1101, 4:60–5:43, 11:18–28, 20:60–21:7). Patent Owner proposes construing the terms “transmission path” and “link” to mean “a description of the entire path from the second node to the first node.” PO Resp. 10. Patent Owner argues that its proposed construction is supported by the claim language and the specification of the ’471 patent. *Id.* at 9–12 (citing Ex. 1101, 4:56–59, 9:52–58).

In the Decision on Institution, we adopted Patent Owner’s proposed construction. Dec. on Inst. 6–7. Namely, we construed the terms “transmission path” and “link” to mean “a description of an entire path from a second node to a first node.” *Id.* at 7. We explained that our preliminary construction was supported by the claim language and the specification of the ’471 patent. *Id.* at 6–7. For example, claim 17 states that the second node initiates a radio transmission path “to said first node” (Ex. 1101, 27:28–32), and claim 20 states that the second node selects a link “to said first node” (*id.* at 27:64–28:4). Similarly, the specification of the ’471 patent explains that a path or link is “the entire path description from a given client to a given server.” *Id.* at 4:54–57, 4:64–67, 9:61–67.

Petitioner agrees with Patent Owner that the terms “transmission path” and “link” refer to a description of an entire path from a second node to a first node. Pet. Reply 4 (“For purposes of these proceedings, Petitioner

does not dispute that a ‘link’/’path’ provides ‘a description of the entire path from the client to the server.’”). Petitioner, nonetheless, takes issue with our preliminary construction, arguing that it includes “some circularity” because it still uses the term “path.” Pet. Reply 2–4; Tr. 4:9–17. Petitioner explains that its proposed construction provides further clarity by specifying that a path is the identification of each of the hops to be traversed by the data message packet en route to the first node. Pet. Reply 2–4; Tr. 4:18–21. Petitioner acknowledges, though, that its proposed clarification regarding the term “path” does not affect the outcome of this proceeding. Pet. Reply 2 (“The construction of this term does not affect the outcome of these proceedings.”); Tr. 5:7–12.

Therefore, consistent with the parties’ agreement in this case, we determine that the terms “transmission path” and “link” include a description of an entire path from a second node to a first node. We determine that further construction of the terms “transmission path” and “link” is not necessary to resolve the parties’ disputes regarding the asserted grounds of unpatentability in this case. *See infra* Sections II.C–II.D; *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and *only to the extent necessary to resolve the controversy.*”) (emphasis added).

2. Second Node Link Tree

Petitioner proposes construing the phrase “a second node link tree comprising second node link entries” to mean “a data structure for storing radio transmission paths/links where each second node has exactly one path/link to the first node.” Pet. Reply 5. Petitioner argues that its proposed construction is supported by the specification of the ’471 patent and certain

extrinsic evidence. *Id.* at 6–7 (citing Ex. 1101, 4:60–64, 15:28–16:48, Figs. 1a, 1b, 6b, 7, 9a; Ex. 1132 ¶¶ 46–47; Ex. 1137, 397; Ex. 2001, 84). Patent Owner proposes construing the phrase “a second node link tree comprising second node link entries” to mean “a data structure containing a representation of a plurality of transmission paths from a second node to a first node through other second nodes in the form of a graph with no cycles.” PO Resp. 13. Patent Owner argues that its proposed construction is consistent with “the well-known definition of the claim term ‘tree’ as ‘a connected undirected graph with no cycles.’” *Id.* at 13–14 (citing Ex. 2001, 68, 84).

Petitioner contends that Patent Owner’s proposed construction improperly requires that each second node must have a plurality of transmission paths to a first node, and that each path must be an indirect path through other second nodes. Pet. Reply 6–7; Tr. 7:15–8:4. At the oral hearing, Patent Owner agreed with Petitioner that each second node may have one path to a first node, and that each path may be a direct path or an indirect path. Tr. 29:2–9. Thus, the dispute between the parties focuses on Patent Owner’s position that a tree is a graph with no cycles. Pet. Reply 7–8; Tr. 8:5–22. Patent Owner’s proposed construction is based on a definition of the term “tree” in a book entitled “Introduction to Discrete Structures: For Computer Science and Engineering” by Franco P. Preparata and Raymond T. Yeh. PO Resp. 13 (citing Ex. 2001, 68, 84). Patent Owner, however, does not explain specifically why this particular definition of the term “tree” is consistent with how the ’471 patent uses the term “second node link tree” (see PO Resp. 13), and, therefore, we decline to incorporate that definition into the claims. Nonetheless, we note that, in this case, the asserted prior art

teaches a second node link tree even under Patent Owner’s definition of the term “tree.” *See infra* Section II.C.2.

Therefore, consistent with the parties’ agreement in this case, we determine that the phrase “a second node link tree comprising second node link entries” includes a data structure comprising entries in which each second node may have one path to a first node, and each path may be a direct path or an indirect path. We determine that further construction of the phrase “a second node link tree comprising second node link entries” is not necessary to resolve the parties’ disputes regarding the asserted grounds of unpatentability in this case. *See infra* Sections II.C–II.D; *Vivid Techs.*, 200 F.3d at 803 (“[O]nly those terms need be construed that are in controversy, and *only to the extent necessary to resolve the controversy.*”) (emphasis added).

3. *Selecting / Selected*

Petitioner indicates in the Petition that the terms “selecting” and “selected” refer to “selecting between available choices.” Pet. 9–10. In the Reply, Petitioner argues that those terms should be given their plain and ordinary meaning and that they “relate to the . . . concept of establishing a route to the server.” Pet. Reply 8 (citing Ex. 1132 ¶¶ 49–50). Patent Owner proposes construing the terms “selecting” and “selected” to mean “choose among alternatives.” PO Resp. 14. Patent Owner argues that its proposed construction is supported by the claim language and the specification of the ’471 patent. *Id.* at 14–16 (citing Ex. 1101, 4:56–59, 9:52–58).

At the oral hearing, Petitioner acknowledged that its interpretation of the terms “selecting” and “selected” in the Petition (i.e., selecting between available choices) is “synonymous” with Patent Owner’s interpretation of

those terms (i.e., choose among alternatives). Tr. 9:3–13. In fact, Petitioner agreed with Patent Owner’s proposed construction. *Id.* at 9:14–17.

Therefore, consistent with the parties’ agreement in this case, we determine that the terms “selecting” and “selected” include choosing among alternatives.⁶ We determine that further construction of the terms “selecting” and “selected” is not necessary to resolve the parties’ disputes regarding the asserted grounds of unpatentability in this case. *See infra* Sections II.C–II.D; *Vivid Techs.*, 200 F.3d at 803 (“[O]nly those terms need be construed that are in controversy, and *only to the extent necessary to resolve the controversy.*”) (emphasis added).

4. *Remaining Claim Terms and Phrases*

Petitioner proposes construing several other claim terms and phrases. Pet. 8–10. We determine that those claim terms and phrases do not require express construction to resolve the parties’ disputes regarding the asserted grounds of unpatentability in this case. *See infra* Sections II.C–II.D.

C. *Obviousness of Claims 17, 18, 20, 21, 31, 32, 34, and 35 Over Burchfiel and Gitman*

Petitioner argues that claims 17, 18, 20, 21, 31, 32, 34, and 35 would have been obvious over Burchfiel and Gitman. Pet. 5. A claim is unpatentable as obvious under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter

⁶ Patent Owner proposes the same construction for the terms “initiating” and “selecting,” but does not explain specifically why two different claim terms should be given the same construction. PO Resp. 14–16. Therefore, we decline to give the terms “initiating” and “selecting” the same construction, but we note that the asserted prior art nonetheless teaches “selecting.” *See infra* Section II.C.2.

as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) any objective indicia of non-obviousness. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

We have considered the parties’ arguments and supporting evidence, and we determine that Petitioner has shown by a preponderance of the evidence that claims 17, 18, 20, 21, 31, 32, 34, and 35 would have been obvious over Burchfiel and Gitman.

1. *Overview of Burchfiel and Gitman*

Burchfiel relates to a packet radio network. Ex. 1104, 245.⁷

Burchfiel explains that its packet radio network includes “fixed and mobile digital terminals which are sources and sinks of information, stations which provide centralized routing control and interconnections to other networks, and repeaters which provide area coverage for mobile terminals by performing a store-and-forward function.” *Id.* According to Burchfiel, a station configures the packet radio network by providing each element with a minimum distance route to the station. *Id.* at 247–248. The station stores the minimum distance routes in a connection table. *Id.* A repeater may change that route, though, by “specify[ing] an alternate address for the next

⁷ The parties cite to the original page numbers of Burchfiel, rather than the page numbers Petitioner added when it filed Burchfiel as Exhibit 1104 in this case. Thus, we also cite to the original page numbers of Burchfiel.

hop after some number of unsuccessful attempts to forward the packet along its specified route.” *Id.* at 247. When the station detects persistent alternate routing of packets, which indicates that an element has failed, the station updates the connection table by recomputing the minimum distance routes to the active elements. *Id.* at 247–248.

Gitman also relates to a packet radio network. Ex. 1105, 926.⁸ Gitman explains that a station provides each repeater with a label that defines the “complete path” between the repeater and the station. *Id.* at 928. According to Gitman, “[t]he routing is sufficiently flexible to allow departures from the first choice path and use of next shortest paths.” *Id.* For example, when a repeater transmitting a data packet encounters blocking in the original path, the repeater sends a search packet to other repeaters. *Id.* at 929. The searching repeater then substitutes an entire alternate path provided by a responding repeater for the original path and transmits the data packet using the alternate path. *Id.*

2. Claim 17

Claim 17 recites “[a] wireless network system.” Ex. 1101, 27:16. Burchfiel teaches a packet radio network. Pet. 16; Ex. 1104, 245, Fig. 1. Patent Owner does not dispute that the combination of Burchfiel and Gitman teaches the preamble of claim 17.

Claim 17 recites “a first node including a first node controller and a first node radio modem, said first node controller implementing a first node process that includes controlling of said first node radio modem, said first

⁸ The parties cite to the original page numbers of Gitman, rather than the page numbers Petitioner added when it filed Gitman as Exhibit 1105 in this case. Thus, we also cite to the original page numbers of Gitman.

node process including receiving and transmitting data packets via said first node radio modem.” Ex. 1101, 27:17–22. Burchfiel teaches a station (i.e., a first node) that includes a processor and a packet radio unit. Pet. 16–20; Ex. 1104, 249 (“PDP-11 processor interfaced to a packet radio unit”), Figs. 1, 4. Burchfiel teaches that the station’s processor controls the receipt and transmission of data packets via the packet radio unit. Pet. 16–20; Ex. 1104, 250 (“processes . . . which send and receive packets to and from the PRU device”), Figs. 1, 5. Patent Owner does not dispute that the combination of Burchfiel and Gitman teaches the above limitation of claim 17.

Claim 17 recites “a plurality of second nodes each including a second node controller implementing a second node process that includes controlling a second node radio modem, said second node process including receiving and transmitting data packets via said second node radio modem.” Ex. 1101, 27:23–27. Burchfiel teaches a plurality of terminals and repeaters (i.e., second nodes), each of which includes a processor and a packet radio unit. Pet. 20–22; Ex. 1104, 245 (“The programmable capability of the repeater is provided in its IMP-16 microprocessor . . . The set of functions which appear in common in a station, repeater, and terminal are identified in Figure 1 as a Packet Radio Unit”), Fig. 1. Burchfiel teaches that each terminal’s processor (or repeater’s processor) controls the receipt and transmission of data packets via the packet radio unit. Pet. 20–22; Ex. 1104, 245 (“The programs for providing interprocess connections within the PRN must be programmed into each terminal (data connection), [and] each repeater (control connection)”), Fig. 1. Patent Owner does not dispute that the combination of Burchfiel and Gitman teaches the above limitation of claim 17.

Claim 17 recites “wherein said second node process of each of said second nodes includes initiating a radio transmission path to said first node that is a link to said first node through at least one of the remainder of said plurality of second nodes.” Ex. 1101, 27:28–32. Gitman teaches that when a repeater transmitting a data packet encounters blocking in the original path, the repeater sends a search packet to other repeaters. Pet. 24–26; Ex. 1103 ¶¶ 109–111; Ex. 1105, 929 (“This generalization involves the search for an alternate repeater when encountering blocking. A ‘search’ protocol uses a search packet specifying the class of repeaters sought.”). Gitman also teaches that the searching repeater substitutes an entire alternate path provided by a responding repeater for the original path and then transmits the data packet using the alternate path. Pet. 24–26; Ex. 1103 ¶¶ 109–111; Ex. 1105, 929 (“A response by such a repeater contains the hierarchical label of the responding repeater. The searching repeater substitutes the label of the responding repeater into the original packet and transmits the packet.”).

Patent Owner responds that Gitman does not teach a second node process that *selects* a path to the first node.⁹ PO Resp. 35–40. Specifically, Patent Owner argues that, in Gitman, a repeater sends a search packet, receives a response from another repeater, and then substitutes the label of the responding repeater into the original packet and transmits the packet. *Id.* at 37–38 (citing Ex. 1105, 929). According to Patent Owner, “[t]here is no disclosure and no teaching in Gitman that a repeater has the choice of

⁹ Patent Owner also argues that Burchfiel does not teach a second node process that selects a path to the first node. PO Resp. 33–35. But Petitioner acknowledged at the oral hearing that it does not rely on Burchfiel for this limitation. Tr. 16:2–11.

leaving a label of a path that is known to be blocked in a packet after it receives [] a different label for another path from an alternate repeater.” PO Resp. 38–39. Patent Owner, therefore, concludes that “there is no selection of a link; the label given by the responding repeater is simply used.” *Id.* at 39 (citing Ex. 2002 ¶ 181).

Patent Owner’s argument is not persuasive. Even if a searching repeater in Gitman receives only a single response to a search packet, the searching repeater nonetheless chooses among alternative paths. Gitman teaches that “[t]he searching repeater substitutes the label of the responding repeater into the original packet and transmits the packet.” Ex. 1105, 929. When the searching repeater substitutes an entire alternate path provided by a responding repeater for the original path, the searching repeater chooses to transmit the data packet using the unblocked alternate path instead of the blocked original path.¹⁰ Ex. 1103 ¶ 110; Ex. 1105, 929; Ex. 1132 ¶¶ 56, 59, 64. Even if the searching repeater’s process always makes the same choice (i.e., to use the unblocked alternate path instead of the blocked original path), it nonetheless chooses among alternatives.

Moreover, we are not persuaded by Patent Owner’s argument that a searching repeater in Gitman receives only a single response to a search packet. Gitman teaches that “[a] ‘search’ protocol uses a search packet specifying the *class of repeaters* sought” and that “[a] response by *such a*

¹⁰ Patent Owner argues that the ’471 patent is not directed to routing around a failed node. Tr. 31:24–25. We disagree. For example, claim 20 recites “rerouting data packets around inactive or malfunctioning nodes.” Ex. 1101, 28:8–9. Similarly, the specification of the ’471 patent explains that “if the client 18A is lost due, for example, to a power or system failure, the data packets of client 18C can be routed through the client 18D.” *Id.* at 9:11–19.

repeater contains the hierarchical label of the responding repeater.” Ex. 1105, 929 (emphases added). As such, Gitman indicates that a search packet is sent to multiple repeaters, and, thus, multiple repeaters may respond to the search packet. Ex. 1103 ¶ 111; Ex. 1105, 929; Ex. 1132 ¶ 62. Gitman also teaches that its routing strategy, in general, “is sufficiently flexible to allow departures from the first choice path and use of next shortest paths.” Ex. 1105, 928. As a result, Gitman indicates that when a searching repeater receives multiple responses to a search packet, the searching repeater may choose the next shortest path from among the alternate paths provided.¹¹ Ex. 1103 ¶ 111; Ex. 1105, 928–929; Ex. 1132 ¶ 60.

Patent Owner argues that the challenged claims require each second node to select an *optimized* path to the first node. Tr. 32:2–3 (“Mr. Brownrigg’s hybrid approach was to get *more efficient* routing”) (emphasis added), 34:13–21 (“The idea of the 471 is this *continual optimization* . . . whenever this patent refers to *optimization*, it’s referring to *finding better paths*, searching for better paths, and choosing whether to use those paths”) (emphasis added). Neither the language of the challenged claims nor the specification of the ’471 patent supports Patent Owner’s argument.

For example, claim 17 states that the second node process “includes initiating a radio transmission path to said first node.” Ex. 1101, 27:28–30. In contrast, the first node process “dynamically modifies the second node link tree so that the data packet transmission from the first node is *optimized*.” *Id.* at 27:33–37 (emphasis added). The difference in the claim

¹¹ For example, Mr. Geier explains that a searching repeater may receive responses from different repeaters that are a different number of hops away from the station. Paper 34, 15; Ex. 2011, 67:6–68:1.

language used for the first node process and the second node process indicates that the second node process does not have to select an optimized path. Further, like the claim language, the specification distinguishes between simply initiating and/or selecting a path to the first node and determining an optimized path to the first node. For example, the specification states:

Preferably, the client process of each of the clients *initiates, selects, and maintains a radio transmission path* (“link”) to the server. As noted previously, this radio transmission path to the server is either a direct path to the server (1 hop) or an indirect path to the server (multi-hop) through one or more clients. *Preferably, the client process of a particular client also constantly searches for improved paths* to the server.

Id. at 5:21–28 (emphases added). Because the challenged claims only recite that the second node initiates and/or selects a path to the first node, we are not persuaded that the challenged claims require the second node to select an optimized path to the first node.

Nonetheless, Gitman teaches that its repeaters select an optimized path to the station. As discussed above, when a searching repeater in Gitman substitutes an entire alternate path provided by a responding repeater for the original path, the searching repeater chooses to transmit the data packet using the unblocked alternate path instead of the blocked original path. Ex. 1103 ¶ 110; Ex. 1105, 929; Ex. 1132 ¶¶ 56, 59, 64. By choosing the unblocked alternate path instead of the blocked original path, Gitman’s repeater chooses the better (i.e., optimized) path to the station. In addition, when a searching repeater receives multiple responses to a search packet, the searching repeater may choose the next shortest (i.e., optimized) path from

among the alternate paths provided. Ex. 1103 ¶ 111; Ex. 1105, 928–929; Ex. 1132 ¶ 60.

Claim 17 recites “wherein said first node process dynamically updates a second node link tree comprising second node link entries and dynamically modifies the second node link tree so that the data packet transmission from the first node is optimized.” Ex. 1101, 27:33–37. Burchfiel teaches that the station maintains a connection table with a minimum distance (i.e., optimized) route to each element. Pet. 26–29; Ex. 1103 ¶ 122; Ex. 1104, 247 (“each terminal is also given a connection to its controlling station, and this information is added to the station’s connection table”), 248 (“minimum distance routes”). Burchfiel teaches that the repeaters may specify an alternate next hop for a data packet when the original route is unsuccessful, and that the station detects persistent alternate routing of packets. Pet. 26–29; Ex. 1103 ¶ 118; Ex. 1104, 247–248 (“Dynamic routing changes . . . permitting a repeater to specify an alternate address for the next hop . . . A less dynamic but more global routing change is required when a repeater or station fails: persistent alternate routing of packets signals this failure, and the station detecting it must reconfigure the PRN to route all traffic around the failed element.”). Burchfiel also teaches that because persistent alternate routing of packets indicates that an element has failed, the station dynamically updates the connection table by recomputing the minimum distance (i.e., optimized) routes to the active elements. Pet. 26–29; Ex. 1103 ¶ 118; Ex. 1104, 247–248 (“The station performs this reconfiguration by updating the connectivity matrix to indicate that the failed element is incommunicado; by recomputing minimum distance routes to the elements

which are still active; and finally, by updating repeater routing parameters to route packets along these new routes.”).

Patent Owner responds that Burchfiel’s connection table does not teach a second node link tree comprising second node link entries.¹² PO Resp. 22–26. First, Patent Owner argues that the term “second node link tree” refers to a graph with no cycles, but Burchfiel “does not describe its connection table as a graph with no cycles.” *Id.* at 22 (citing Ex. 2002 ¶ 155). Patent Owner’s argument is not persuasive. As discussed above, we are not persuaded that the term “second node link tree” is limited to a graph with no cycles. *See supra* Section II.B.2.

Nonetheless, Burchfiel teaches that the connection table is a graph with no cycles. Patent Owner does not explain specifically what it means for a data structure to be a graph with no cycles (*see* PO Resp. 13, 22), but acknowledges that “[a] connected undirected graph is a graph in which there is a path for each pair of nodes” (*id.* at 13). Similarly, Petitioner explains that a graph with no cycles is a set of nodes and internode connections in which no paths start and end at the same node. Pet. Reply 16 (citing Ex. 1138, 162; Ex. 1141, 562; Ex. 1132 ¶¶ 94–95; Ex. 2001, 41, 68). Burchfiel teaches that the connection table includes a set of nodes (e.g., terminals, repeaters, and the station) and internode connections (e.g., hops) with one path between each terminal or repeater and the station. Ex. 1104, 247 (“Once the station has labelled all PRU’s and established connections to

¹² Patent Owner also argues that Burchfiel’s connectivity matrix does not teach a second node link tree. PO Resp. 25. Because Petitioner has shown sufficiently that Burchfiel’s connection table teaches a second node link tree, we do not address Patent Owner’s argument regarding the connectivity matrix.

them, the information for maintaining these connections is entered into the station's *connection table*.”); Ex. 1132 ¶¶ 94–95.

Second, Patent Owner argues that Burchfiel's connection table does not include routes from the terminals and repeaters (i.e., the second nodes) to the station (i.e., the first node). PO Resp. 23–26. According to Patent Owner, Burchfiel teaches that the connection table only includes routes from the station to the terminals and repeaters. *Id.* at 23–24 (citing Ex. 1104, 245, 247, 250; Ex. 2002 ¶¶ 156, 157, 160). Patent Owner further contends that the terminals and repeaters in Burchfiel use dynamic routing to transmit data packets to the station, rather than the routes stored in the connection table. PO Resp. 25–26 (citing Ex. 1104, 247).

Patent Owner's argument is not persuasive. Burchfiel teaches that “[a]s terminals come ‘on-line’ within the PRN, each terminal is also given a *connection to its controlling station*, and this information is added to the station's connection table.” Ex. 1104, 247 (emphasis added). This portion of Burchfiel indicates that the connection table includes routes from the terminals and repeaters to the station, not just from the station to the terminals and repeaters.¹³ *Id.*; Ex. 1132 ¶ 97. Further, contrary to Patent Owner's argument, Burchfiel teaches that the terminals and repeaters use the routes stored in the connection table to transmit data packets, and only perform dynamic routing “after some number of unsuccessful attempts to forward the packet along its specified route.” Ex. 1104, 247; Ex. 1132 ¶ 99.

¹³ In addition, Burchfiel teaches that the routes stored in the connection table are “bi-directional.” Ex. 1104, 246; Ex. 1132 ¶ 97.

3. *Claim 18*

Claim 18 depends from claim 17, and recites that “at least one of the second nodes is a mobile device.” Ex. 1101, 27:38–40. Burchfiel teaches that at least one of the terminals is a mobile digital terminal. Pet. 30; Ex. 1104, 245 (“fixed and mobile digital terminals”). Patent Owner does not dispute that the combination of Burchfiel and Gitman teaches the above limitation of claim 18.

Claim 18 recites that the first node process comprises “logic comparing a selected link from one of the plurality of said second nodes to said first node to a current second node link entry in said second node link tree.” Ex. 1101, 27:41–43. Burchfiel teaches that the station maintains a connection table with a minimum distance (i.e., optimized) route to each element. Pet. 26–29; Ex. 1103 ¶ 122; Ex. 1104, 247 (“each terminal is also given a connection to its controlling station, and this information is added to the station’s connection table”), 248 (“minimum distance routes”). Burchfiel also teaches that the station receives the route used for each data packet in the header of the data packet. Pet. 30–32; Ex. 1103 ¶¶ 141, 145; Ex. 1104, Fig. 3 (“ROUTE”). Thus, in Burchfiel, when a repeater selects an alternate next hop for a data packet, the station receives an alternate route in the header of the data packet.¹⁴ Pet. 30–32; Ex. 1103 ¶¶ 141, 145; Ex. 1104,

¹⁴ As discussed above, Gitman’s repeaters substitute an entire alternate path to the station for the original path in the data packet. Ex. 1103 ¶ 110; Ex. 1105, 929; Ex. 1132 ¶¶ 56, 59, 64. Thus, in Petitioner’s proposed combination, when one of Gitman’s repeaters selects an entire alternate path for a data packet, Burchfiel’s station receives the entire alternate path in the data packet. Pet. 32; Ex. 1103 ¶ 149.

247 (“permitting a repeater to specify an alternate address for the next hop”), Fig. 3 (“ROUTE”).

Burchfiel teaches that the station detects persistent alternate routing of packets. Pet. 30–32; Ex. 1104, 247–248 (“A less dynamic but more global routing change is required when a repeater or station fails: persistent alternate routing of packets signals this failure, and the station detecting it must reconfigure the PRN to route all traffic around the failed element.”). A person of ordinary skill in the art reading Burchfiel would have known that the station can detect persistent alternate routing of packets by comparing the routes in the headers of the data packets to the entries in the connection table. Pet. 30–32; Ex. 1103 ¶¶ 141, 145; Ex. 1104, 247–248. A person of ordinary skill in the art also would have recognized that doing so would have been advantageous because it would have allowed the station to detect persistent alternate routing of packets by using information already in the station’s possession, rather than requiring additional communication over the network. Pet. 30–32; Ex. 1103 ¶¶ 141, 145; Ex. 1104, 247–248. Thus, Burchfiel’s teachings, together with the background knowledge and perspective of a person of ordinary skill in the art, demonstrate that it would have been obvious to detect persistent alternate routing of packets by comparing the routes in the headers of the data packets to the entries in the connection table. Pet. 30–32; Ex. 1103 ¶¶ 141, 145; Ex. 1104, 247–248; *see In re Simon*, 461 F.2d 1387, 1390 (CCPA 1972) (“the question in a section 103 case is not only what the references expressly teach, but what they would collectively suggest to one of ordinary skill in the art”).

Claim 18 recites that the first node process comprises “logic dynamically updating said second node link tree when said comparison

meets predetermined conditions.” Ex. 1101, 27:44–45. Burchfiel teaches that because persistent alternate routing of packets (i.e., predetermined conditions) indicates that an element has failed, the station updates the connection table by recomputing the minimum distance (i.e., optimized) routes to the active elements. Pet. 32–34; Ex. 1103 ¶ 154; Ex. 1104, 247–248 (“The station performs this reconfiguration by updating the connectivity matrix to indicate that the failed element is incommunicado; by recomputing minimum distance routes to the elements which are still active; and finally, by updating repeater routing parameters to route packets along these new routes.”).

Patent Owner reiterates its previous argument that Burchfiel does not teach a second node link tree because Burchfiel’s connection table: 1) does not include routes from the terminals and repeaters to the station; and 2) is not a graph with no cycles. PO Resp. 27–28. For the same reasons discussed above, Patent Owner’s argument is not persuasive. *See supra* Section II.C.2.

Patent Owner also responds that Burchfiel does not teach comparing a selected link to a current second node link entry in the second node link tree. PO Resp. 28–31. Specifically, Patent Owner argues that Burchfiel’s station becomes aware of persistent alternate routing of packets via an initialization algorithm or control connection messages. *Id.* at 30–31 (citing Ex. 1104, 247, 250). Thus, according to Patent Owner, “Burchfiel’s station does not perform any comparison of the ‘route’ field in packet header with entries in its connection table, but obtains sufficient information to identify network topology changes that it would proceed directly to update the connectivity

matrix and re-compute minimum distance routes.” PO Resp. 31 (citing Ex. 2002 ¶ 170).

Patent Owner’s argument is not persuasive. Burchfiel teaches that the detection of persistent alternate routing of packets is one of several *different* ways to identify a component failure in the network. For example, Burchfiel teaches that the initialization algorithm “provide[s] a continuous monitor on connectedness to identify component failures,” but Burchfiel does not indicate that the initialization algorithm monitors persistent alternate routing of packets. Ex. 1104, 247; Ex. 1132 ¶ 104. Burchfiel also teaches that a repeater transmits a control connection message to identify “failure of some previously established route,” but Burchfiel does not indicate that a repeater transmits a control connection message to identify persistent alternate routing of packets. Ex. 1104, 250; Ex. 1132 ¶ 105. Burchfiel separately teaches that the repeaters may “specify an alternate address for the next hop,” and that the station (not the repeaters) independently “detect[s]” whether there is “persistent alternate routing of packets,” and, thus, whether an element has failed. Ex. 1104, 247–248; Ex. 1132 ¶ 106. In other words, Burchfiel indicates that the initialization algorithm and control connection messages identified by Patent Owner are separate from the detection of persistent alternate routing of packets relied on by Petitioner.

4. *Claims 20, 31, and 34*

Claims 20, 31, and 34 recite limitations similar to those discussed above for claim 17. Petitioner identifies evidence showing that the combination of Burchfiel and Gitman teaches the limitations of claims 20, 31, and 34. Pet. 36–45. Our analysis of the limitations of claim 17 applies to the similar limitations of claims 20, 31, and 34. Patent Owner raises the

same arguments for claims 20, 31, and 34 that we discussed above for claim 17.¹⁵ PO Resp. 22 (“As Recited In Independent Claim 20 And As Similarly Recited In The Other Independent Claims”), 32 (“As Recited In Independent Claim 20 and As Similarly Recited In Independent Claims 17, 31, and 34”). For the same reasons discussed above, Patent Owner’s arguments are not persuasive. *See supra* Section II.C.2.

5. *Claims 21, 32, and 35*

Claims 21, 32, and 35 depend from claims 20, 31, and 34, respectively, and recite limitations similar to those discussed above for claim 18. Petitioner identifies evidence showing that the combination of Burchfiel and Gitman teaches the limitations of claims 21, 32, and 35. Pet. 45. Our analysis of the limitations of claim 18 applies to the similar limitations of claims 21, 32, and 35. Patent Owner raises the same arguments for claims 21, 32, and 35 that we discussed above for claim 18. PO Resp. 26 (“As Recited In Dependent Claim 18, And As Similarly Recited In Dependent Claims 21, 32 and 35”). For the same reasons discussed above, Patent Owner’s arguments are not persuasive. *See supra* Section II.C.3.

6. *Reasons for Combining Burchfiel and Gitman*

Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the cited teachings of Burchfiel and Gitman. Pet.

¹⁵ At the oral hearing, Patent Owner argued that the method claims differ in scope from the system claims because the method claims require *each* second node to perform the step of selecting a path, whereas the system claims may only require *each* second node to have the capability of selecting a path. Tr. 36:20–37:6. In IPR2017-00007, Patent Owner disputes whether *each* repeater in Gitman selects a path to the server. Patent Owner does not present a similar argument in this case.

10–14 (citing Ex. 1103 ¶¶ 56–67). We agree with and adopt Petitioner’s reasoning. Specifically, Burchfiel and Gitman relate to the same field of endeavor as the ’471 patent, that is, a wireless network for transmitting data packets between clients and servers. Pet. 10–13; Ex. 1101, Abstract, 1:22–24; Ex. 1103 ¶¶ 57, 62; Ex. 1104, 246 (“One of the basic facilities required in the PRN is support of interprocess connections which provide reliable delivery of data from a PRN source to a PRN destination”); Ex. 1105, 928 (“A major use of the radio network will be local collection and distribution of traffic. This traffic primarily flows from repeaters to stations and from stations to repeaters.”). It would have been obvious to a person of ordinary skill in the art to combine Burchfiel and Gitman because Gitman’s search protocol would have improved Burchfiel’s network by increasing the likelihood of successfully transmitting a data packet to its intended destination. Pet. 13, 26; Ex. 1103 ¶¶ 65, 111. In addition, a person of ordinary skill in the art reasonably would have expected the combination to work. Pet. 14; Ex. 1103 ¶ 66.

It also would have been obvious to a person of ordinary skill in the art to combine Burchfiel and Gitman based on their interrelated teachings. Pet. 13; Ex. 1103 ¶ 65; *see KSR*, 550 U.S. at 418 (“Often, it will be necessary for a court to look to interrelated teachings of multiple patents.”). For example, Burchfiel and Gitman both teach repeaters that implement an alternate routing process when blocking is encountered in the original path to a station. Pet. 11–13; Ex. 1104, 247 (“permitting a repeater to specify an alternate address for the next hop after some number of unsuccessful attempts to forward the packet along its specified route.”); Ex. 1105, 929 (“This generalization involves the search for an alternate repeater when

encountering blocking.”). Thus, combining Gitman’s search protocol with Burchfiel’s network would have been the predictable use of prior art elements according to their established functions. Pet. 13–14; Ex. 1103 ¶¶ 65, 66, 111; see *KSR*, 550 U.S. at 416 (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”).

Patent Owner responds that Petitioner has not shown sufficiently that it would have been obvious to combine the cited teachings of Burchfiel and Gitman. PO Resp. 39–47. In particular, Patent Owner argues that Petitioner’s proposed combination of Burchfiel and Gitman is based on impermissible hindsight. *Id.* at 41 (citing Ex. 2002 ¶ 184). According to Patent Owner, “Petitioner did not explain why a POSA would modify Burchfiel’s centralized method of constructing a connectivity matrix and a connection table at the network server to use Gitman’s decentralized method of searching for paths from the repeaters.” PO Resp. 41 (citing Pet. 18–21).

Patent Owner’s argument is not persuasive. Petitioner identifies a specific reason why a person of ordinary skill in the art would have combined Gitman’s search protocol with Burchfiel’s network. As discussed above, a person of ordinary skill in the art would have combined Burchfiel and Gitman because it would have increased the likelihood of successfully transmitting a data packet to its intended destination and because it would have been the predictable use of prior art elements according to their established functions. Pet. 13–14, 26; Ex. 1103 ¶¶ 65, 66, 111. Further, we are not persuaded that Burchfiel teaches only a centralized method and Gitman teaches only a decentralized method. As discussed above, Burchfiel and Gitman each have centralized features because the station assigns a

route to the repeaters (Ex. 1104, 247 (“loading each repeater with routing parameters”); Ex. 1105, 928 (“assign, during initialization, routing information to repeaters”)), as well as decentralized features because the repeaters may implement an alternate routing process (Ex. 1104, 247 (“permitting a repeater to specify an alternate address for the next hop”); Ex. 1105, 929 (“involves the search for an alternate repeater”)).

Patent Owner also argues that Burchfiel and Gitman teach “fundamentally different approaches to routing.” PO Resp. 42 (citing Ex. 2002 ¶ 187). According to Patent Owner, “Burchfiel’s repeaters take a passive role in its search protocol and perform functions which are simple and require low processing power,” such as retrieving a next hop address from stored routing parameters. PO Resp. 42 (citing Ex. 1104, 247; Ex. 2002 ¶¶ 188–189). Patent Owner contends that “[o]n the other hand, Gitman’s algorithm is a decentralized routing algorithm where the repeater executing a search protocol is required to immediately seek alternate repeater(s) to get an alternate route in order to resolve blocking,” and, thus, would have required additional processing power and memory. PO Resp. 43–44 (citing Ex. 1105, 929; Ex. 2002 ¶¶ 190–191).

Patent Owner’s argument is not persuasive. Patent Owner does not identify specific evidence indicating how much processing power and memory would have been available to Burchfiel’s repeaters or how much processing power and memory would have been required to execute Gitman’s search protocol. See PO Resp. 39–47. Patent Owner instead compares the functions performed by Burchfiel’s repeaters and Gitman’s repeaters. *Id.* at 42–44. However, Patent Owner’s assertion that the functions performed by Burchfiel’s repeaters and Gitman’s repeaters are

fundamentally different is not supported by the evidence of record. For example, Burchfiel teaches that its repeaters “send ‘search’ packets,” “get local repeaters to bounce back search packets,” and perform “[d]ynamic routing changes . . . [by] specify[ing] an alternate address for the next hop after some number of unsuccessful attempts to forward the packet along its specified route.” Ex. 1104, 247. Gitman similarly teaches that its repeaters send search packets and select an alternate path from a responding repeater. Ex. 1105, 929. In other words, Burchfiel’s repeaters and Gitman’s repeaters perform similar functions. Ex. 1104, 247; Ex. 1105, 929; Ex. 1132 ¶ 68. Thus, the evidence of record indicates that Gitman’s search protocol would have been within the capabilities of Burchfiel’s repeaters. Ex. 1103 ¶ 66; Ex. 1132 ¶ 68.

Moreover, even if Burchfiel’s repeaters required additional processing power and/or memory to execute Gitman’s search protocol, it would have been obvious to a person of ordinary skill in the art to provide Burchfiel’s repeaters with the necessary processing power and/or memory. Ex. 1132 ¶ 69. Specifically, it would have been obvious to do so in order to achieve the benefit of Gitman’s search protocol discussed above, namely, to improve Burchfiel’s network by increasing the likelihood of successfully transmitting a data packet to its intended destination. Ex. 1103 ¶ 65; Ex. 1132 ¶ 69. A person of ordinary skill in the art would have balanced any additional complexity against the enhanced network capabilities provided by Gitman’s search protocol and would have been motivated to make the combination. Ex. 1132 ¶ 71.

Patent Owner argues that Burchfiel and Gitman teach away from Petitioner’s proposed combination. PO Resp. 39–40, 44–46. Patent Owner

points out (*id.* at 39, 45–46) that Burchfiel’s repeaters are “required to operate unattended in relatively remote areas for long periods of time,” and “must therefore be [] simple, low-powered component[s]” that are “not designed to support complex dynamic routing algorithms” (Ex. 1104, 245). Patent Owner also points out (PO Resp. 39, 46) that Gitman’s search protocol “must be implemented within the repeater, which requires additional memory” (Ex. 1105, 929).

Patent Owner’s argument is not persuasive. As discussed above, the evidence of record indicates that Gitman’s search protocol would have been within the capabilities of Burchfiel’s repeaters, and, thus, Burchfiel’s repeaters would not have required additional processing power or memory to implement Gitman’s search protocol. Ex. 1104, 247; Ex. 1105, 929; Ex. 1132 ¶ 68. Further, even if Gitman’s search protocol required additional processing power and/or memory, the evidence of record indicates that it would not have affected the ability of Burchfiel’s repeaters to operate unattended in relatively remote areas for long periods of time. Specifically, like Burchfiel, Gitman teaches that the repeaters in its radio packet network are suitable to be “located in remote or hostile locations where hardwire connections are uneconomical or not feasible.” Ex. 1105, 926.

Patent Owner argues that because Burchfiel’s routing algorithm and Gitman’s routing algorithm are substantially different, a person of ordinary skill in the art would not have been able to combine Burchfiel and Gitman as

proposed by Petitioner.¹⁶ PO Resp. 46. Patent Owner’s argument is not persuasive. As discussed above, Burchfiel’s repeaters and Gitman’s repeaters perform similar functions. Ex. 1104, 247; Ex. 1105, 929; Ex. 1132 ¶ 68. Thus, combining Gitman’s search protocol with Burchfiel’s network would have been the predictable use of prior art elements according to their established functions. Pet. 13–14; Ex. 1103 ¶¶ 65, 66, 111; *see KSR*, 550 U.S. at 416 (“The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results.”).

7. *Objective Indicia of Non-Obviousness*

Patent Owner argues that certain objective indicia, including a long-felt but unmet need and unexpected results, demonstrate non-obviousness of the challenged claims. PO Resp. 53–62.

a. *Long-Felt but Unmet Need*

Patent Owner argues that, prior to the ’471 patent, the majority of wireless networks were distributed networks in which each client dynamically tracked the topography of the network. PO Resp. 54–55 (citing Ex. 2002 ¶ 206). According to Patent Owner, this placed a significant overhead burden on the network and limited the number of clients that the network could support. PO Resp. 55 (citing Ex. 2002 ¶ 211). Patent Owner points to prior art systems that allegedly suffered from such overhead

¹⁶ Patent Owner also contends that Petitioner’s proposed combination “would result in both the station and the PRs attempting to calculate the same routing paths.” PO Resp. 44 (citing Ex. 2002 ¶ 193). We disagree. In the proposed combination, a repeater selects an unblocked alternate path for itself (Ex. 1105, 929), and the station determines optimized paths to all active elements (Ex. 1104, 248).

burden. PO Resp. 54–57 (citing Ex. 1105, 23; Ex. 1106; Ex. 1112; Ex. 2002 ¶¶ 206, 210, 211, 213, 215; Ex. 2005).

Patent Owner argues that the '471 patent satisfied the aforementioned long-felt need by increasing efficiency and reducing the overhead burden on a wireless network. PO Resp. 57. Patent Owner relies on: 1) the 37 C.F.R. § 1.132 Declaration of one of the named inventors of the '471 patent, Dr. Edwin B. Brownrigg, that was submitted during prosecution of the application that issued as the '471 patent; and 2) the Declaration of Dr. Almeroth that was prepared for this proceeding. PO Resp. 57–62 (citing Ex. 2002 ¶¶ 216–223). Dr. Brownrigg's Declaration describes a simulation he performed on his "wireless network invention." Ex. 2006 ¶¶ 24–25. According to Dr. Brownrigg, the simulation demonstrates that his wireless network invention "not only alleviated the problems of conventional wireless networks regarding a decrease in total bandwidth as more nodes are added, but . . . actually increased the network bandwidth as nodes were added to a wireless network already containing a substantial number of nodes." *Id.* ¶ 26. Dr. Almeroth's Declaration relies on Dr. Brownrigg's Declaration, but does not identify any other evidence indicating that the '471 patent increased efficiency and reduced the overhead burden on a wireless network. Ex. 2002 ¶¶ 219–223.

Patent Owner argues that there is a nexus between the evidence of a long-felt but unmet need and the challenged claims. PO Resp. 60–62. In particular, Patent Owner contends that "the '471 patent solved this long felt need . . . by employing both centralized and decentralized features in which a server maintains a tree with paths (centralized) and clients select paths to the server independently (decentralized)." *Id.* at 61 (citing Ex. 2002 ¶¶ 216–

223). According to Patent Owner, this centralized/decentralized approach is recited in the challenged claims. PO Resp. 61–62.

Based on the evidence of record, we determine that the nexus between Patent Owner’s evidence of a long-felt but unmet need and the challenged claims is weak. Dr. Brownrigg states generally in his Declaration that he performed a simulation on his “wireless network invention.” Ex. 2006 ¶¶ 24–25. But Patent Owner, Dr. Brownrigg, and Dr. Almeroth do not compare the system on which Dr. Brownrigg performed the simulation with the system or method recited in the challenged claims. See PO Resp. 57–62; Ex. 2002 ¶¶ 219–223; Ex. 2006 ¶¶ 24–27; Tr. 47:8–48:13.

Further, Dr. Brownrigg’s Declaration indicates that the simulated system increased efficiency and reduced overhead burden because of a feature that is *not* recited in the challenged claims. Specifically, Dr. Brownrigg states in his Declaration:

The tree sort algorithm, upon which my novel wireless network invention was based, enabled the wireless network to actually perform more efficiently with an increase of a certain number of nodes in the network, as these nodes were enabled to eavesdrop on each other to learn routing information from the server without having to broadcast on the wireless network.

Ex. 2006 ¶ 27. In other words, Dr. Brownrigg attributes the increased efficiency and reduced overhead burden to the tree sort algorithm that enabled nodes to eavesdrop on each other and learn routing information from the server without having to broadcast on the wireless network. *Id.* Similarly, Dr. Almeroth states in his Declaration:

Thus, the overhead routing information in the ’471 Patent is the communication of a client link tree from the server to the clients. The remainder of information necessary to make routing decisions can be gathered from regular network traffic,

without requiring additional routing overhead. . . . On the other hand, in conventional distributed wireless networks, each node continually transmitted network routing information to other nodes in the network. This significantly increased the routing overhead of the network. . . . In the '471 Patent, however, only minimal overhead results from adding each additional node, regardless of the previous number of nodes in the network. Further, by adding additional nodes, the ability of nodes to “eavesdrop” on transmission of neighbors and make routing selections without the use of additional routing overhead increases.

Ex. 2002 ¶¶ 221–223. Thus, Dr. Almeroth also attributes the increased efficiency and reduced overhead burden to the clients’ ability to eavesdrop on each other and use information gathered from regular network traffic to make routing decisions. *Id.*

Although this eavesdropping feature may be included in an embodiment described in the specification of the '471 patent (*see, e.g.*, Ex. 1101, 8:53–58, 9:53–60), Patent Owner does not identify where that feature is recited in the challenged claims (*see* PO Resp. 57–62; Ex. 2002 ¶¶ 219–223; Ex. 2006 ¶¶ 24–27; Tr. 47:8–48:13). As discussed above (*see supra* Section II.C.2), the challenged claims recite generally that each second node includes a process for initiating and/or selecting a path to the first node (Ex. 1101, 27:28–30, 27:65–28:1, 30:18–22, 30:56–60). But the challenged claims do not recite specifically how the second nodes select a path, and, thus, do not require that the second nodes eavesdrop on each other and use routing information gathered from regular network traffic to select a path. *See id.*; Ex. 1146, 102:24–103:14. Therefore, we determine that the nexus between Patent Owner’s evidence of a long-felt but unmet need and the challenged claims is weak.

b. *Unexpected Results*

Patent Owner argues that the system and method described in the '471 patent produced unexpected results. PO Resp. 57–60. Specifically, Patent Owner contends that, prior to the '471 patent, it was well known that the overhead burden for a wireless network increases as the number of nodes in the network increases. *Id.* at 57–58 (citing Ex. 2002 ¶¶ 217–218; Ex. 2005, 2, 9; Ex. 2007). According to Patent Owner, the aforementioned simulation performed by Dr. Brownrigg demonstrates the unexpected result that the overhead burden for the simulated wireless network decreases as the number of nodes in the network increases. PO Resp. 58–60 (citing Ex. 2002 ¶¶ 221–223).

Patent Owner relies on the same arguments and evidence discussed above to show that there is a nexus between the evidence of unexpected results and the challenged claims. PO Resp. 60–62 (citing Ex. 2002 ¶¶ 216–223). For the same reasons discussed above, we determine that the nexus between Patent Owner's evidence of unexpected results and the challenged claims is weak. *See supra* Section II.C.7.a.

8. *Totality of the Evidence*

For the reasons discussed above in Section II.C.1 through Section II.C.6, the evidence presented by Petitioner strongly indicates that claims 17, 18, 20, 21, 31, 32, 34, and 35 would have been obvious over the cited prior art. For the reasons discussed above in Section II.C.7, Patent Owner's evidence of long-felt but unmet need and unexpected results is weak. When considering all of the *Graham* factors, Patent Owner's weak evidence of long-felt but unmet need and unexpected results is substantially outweighed by Petitioner's strong evidence of obviousness. Thus, when considering all

the evidence of obviousness and non-obviousness together, *see In re Cyclobenzaprine Hydrochloride Extended-Release Capsule Patent Litigation*, 676 F.3d 1063, 1079 (Fed. Cir. 2012), we determine that Petitioner has shown by a preponderance of the evidence that claims 17, 18, 20, 21, 31, 32, 34, and 35 of the '471 patent are unpatentable as obvious.

D. *Obviousness of Claims 19, 22, 33, and 36 Over Burchfiel, Gitman, and Kahn, and Over Burchfiel, Gitman, Kahn, and APA*

Petitioner argues that claims 19, 22, 33, and 36 would have been obvious over Burchfiel, Gitman, and Kahn, and over Burchfiel, Gitman, Kahn, and APA. Pet. 5. We have considered the parties' arguments and supporting evidence, and we determine that Petitioner has shown by a preponderance of the evidence that claims 19, 22, 33, and 36 would have been obvious over Burchfiel, Gitman, and Kahn, and over Burchfiel, Gitman, Kahn, and APA.

1. *Claim 19*

Claim 19 depends from claim 18, and recites that the first node process comprises "logic determining if one of the plurality of said second nodes is authentic." Ex. 1101, 27:46–49. Kahn teaches "verify[ing] the authenticity" of repeaters and terminals. Pet. 52, 63; Ex. 1107, 183.¹⁷ APA teaches authentication techniques using one-way seeds. Pet. 52–53, 63; Ex. 1101, 15:12–27.

Claim 19 recites that the first node process comprises "logic determining if one of the plurality of said second nodes is already in said

¹⁷ The parties cite to the original page numbers of Kahn, rather than the page numbers Petitioner added when it filed Kahn as Exhibit 1107 in this case. Thus, we also cite to the original page numbers of Kahn.

second node link tree if one of the plurality of said second nodes is determined to be authentic.” Ex. 1101, 27:50–53. Burchfiel teaches that the station detects persistent alternate routing of packets. Pet. 55–56, 58–59, 63–66; Ex. 1104, 247–248 (“A less dynamic but more global routing change is required when a repeater or station fails: persistent alternate routing of packets signals this failure, and the station detecting it must reconfigure the PRN to route all traffic around the failed element.”). A person of ordinary skill in the art reading Burchfiel would have known that the station can detect persistent alternate routing of packets by comparing the routes in the headers of the data packets to the entries in the connection table. Pet. 55–56, 58–59, 63–66; Ex. 1103 ¶ 280; Ex. 1104, 247–248. A person of ordinary skill in the art also would have recognized that doing so would have been advantageous because it would have allowed the station to detect persistent alternate routing of packets by using information already in the station’s possession, rather than requiring additional communication over the network. Pet. 55–56, 58–59, 63–66; Ex. 1103 ¶¶ 141, 145, 280; Ex. 1104, 247–248. As such, Burchfiel’s teachings, together with the background knowledge and perspective of a person of ordinary skill in the art, demonstrate that it would have been obvious to detect persistent alternate routing of packets by comparing the routes in the headers of the data packets to the entries in the connection table, and, thus, to determine that a repeater or terminal already has an entry in the connection table. Pet. 55–56, 58–59, 63–66; Ex. 1103 ¶¶ 141, 145, 280; Ex. 1104, 247–248; *see Simon*, 461 F.2d at 1390.

Claim 19 recites that the first node process comprises “logic inserting one of the plurality of said second nodes in said second node link tree if one

of the plurality of said second nodes is authentic and is not already in said second node link tree.” Ex. 1101, 27:54–57. Burchfiel teaches that when the station detects persistent alternate routing of packets, the station updates the connection table by recomputing the minimum distance routes to the active elements, and, thus, deletes the original entry for a repeater and inserts a new entry. Pet. 55–56, 58–59, 63–66; Ex. 1103 ¶ 280; Ex. 1104, 247–248 (“The station performs this reconfiguration . . . by recomputing minimum distance routes to the elements which are still active; and finally, by updating repeater routing parameters to route packets along these new routes.”).

Patent Owner responds that Burchfiel does not teach determining if an authentic terminal or repeater already is in the connection table. PO Resp. 48–52. Specifically, Patent Owner argues that Burchfiel’s station creates a connectivity matrix based on search packets that the station receives from repeaters. *Id.* at 49 (citing Ex. 1104, 247; Ex. 2002 ¶ 198). Further, according to Patent Owner, the station provides any unlabeled repeaters with routing parameters, and then creates a connection table from the connectivity matrix. PO Resp. 49–50 (citing Ex. 1104, 247, 250). Patent Owner concludes that “[u]nlabeled devices have no ability to function on the network, so any packets received by the station at all after the connection table is established must necessarily be from clients that are in the connection table,” and, thus, “[t]here is no need to determine if the client is already in the connection table.” PO Resp. 50–51 (citing Ex. 2002 ¶ 200).

Patent Owner’s argument is not persuasive. Burchfiel teaches that its network “permit[s] any element to enter the net at any time on its own initiative.” Ex. 1104, 247. As such, additional repeaters may join the

network even after the station creates the connection table. Burchfiel also teaches that “[a]ll repeaters send ‘search packets,’” and that the station uses the search packets it receives from unlabeled repeaters to “relabel . . . the net” after the initial configuration. *Id.* Thus, even after the station creates the connection table, it still receives packets from unlabeled repeaters that are not already in the connection table. Ex. 1132 ¶ 114.

In addition, Patent Owner’s argument focuses on Burchfiel’s teachings regarding the initial configuration of the network, but does not specifically address Burchfiel’s teachings regarding the subsequent detection of persistent alternate routing. See PO Resp. 48–52. As discussed above, it would have been obvious that Burchfiel’s station detects persistent alternate routing of packets by comparing the routes in the headers of the data packets to the entries in the connection table. Ex. 1103 ¶ 280; Ex. 1104, 247–248; Ex. 1132 ¶ 113. By performing that comparison, Burchfiel’s station determines that a repeater that sent a data packet already has an entry in the connection table. Ex. 1103 ¶ 280; Ex. 1104, 247–248; Ex. 1132 ¶ 113. Further, when Burchfiel’s station detects persistent alternate routing of packets, it updates the connection table by recomputing the minimum distance routes to the active elements, and, thus, deletes the original entry for a repeater and inserts a new entry. Ex. 1103 ¶ 280; Ex. 1104, 247–248; Ex. 1132 ¶ 113.

2. *Claims 22, 33, and 36*

Claims 22, 33, and 36 depend from claims 21, 32, and 34, respectively, and recite limitations similar to those discussed above for claim 19. Petitioner identifies evidence showing that the combination of Burchfiel, Gitman, and Kahn, and the combination of Burchfiel, Gitman,

Kahn, and APA teach the limitations of claims 22, 33, and 36. Pet. 51–67. Our analysis of the limitations of claim 19 applies to the similar limitations of claims 22, 33, and 36. We note that claim 22 further recites that the first node process comprises “logic deleting one of the plurality of said second nodes from said second node link tree if one of the plurality of said second nodes is already in said second node link tree.” Ex. 1101, 28:26–29. As discussed above for claim 19, Burchfiel teaches that when the station detects persistent alternate routing of packets, the station updates the connection table by recomputing the minimum distance routes to the active elements, and, thus, deletes the original entry for a repeater and inserts a new entry. Pet. 55–56, 58–59, 63–66; Ex. 1103 ¶ 280; Ex. 1104, 247–248 (“The station performs this reconfiguration . . . by recomputing minimum distance routes to the elements which are still active; and finally, by updating repeater routing parameters to route packets along these new routes.”).

Patent Owner raises the same arguments for claims 22, 33, and 36 that we discussed above for claim 19. PO Resp. 48 (“The Challenged Dependent Claims 19, 22, 33, and 36 Are Not Obvious”). For the same reasons discussed above, Patent Owner’s arguments are not persuasive. *See supra* Section II.D.1.

3. *Reasons for Combining Burchfiel, Gitman, Kahn, and APA*

Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the cited teachings of Burchfiel and Kahn. Pet. 46–47 (citing Ex. 1103 ¶ 245). We agree with and adopt Petitioner’s reasoning. Like Burchfiel and Gitman, Kahn relates to the same field of endeavor as the ’471 patent, that is, a wireless network for transmitting data packets between clients and servers. Pet. 46; Ex. 1101, Abstract, 1:22–24; Ex. 1107, 179

(“The system consists of terminals and stations linked together by line of sight radio repeaters.”). It would have been obvious to a person of ordinary skill in the art to combine Burchfiel and Kahn so that Burchfiel’s station implements Kahn’s authentication technique to advantageously prevent unauthorized access. Pet. 47; Ex. 1103 ¶ 245; Ex. 1107, 183. In addition, a person of ordinary skill in the art reasonably would have expected the combination to work. Pet. 47; Ex. 1103 ¶ 245.

Petitioner argues that a person of ordinary skill in the art would have had a reason to combine the cited teachings of Burchfiel, Kahn, and APA. Pet. 47–48 (citing Ex. 1103 ¶ 246). We agree with and adopt Petitioner’s reasoning. Specifically, it would have been obvious to a person of ordinary skill in the art to implement Kahn’s authentication technique using APA’s authentication algorithm to advantageously add a layer of security. Pet. 47–48; Ex. 1103 ¶ 246. In addition, a person of ordinary skill in the art reasonably would have expected the combination to work. Pet. 48; Ex. 1103 ¶ 246.

4. *Objective Indicia of Non-Obviousness*

Patent Owner relies on the same objective indicia of non-obviousness discussed above with respect to claims 17, 18, 20, 21, 31, 32, 34, and 35. PO Resp. 53–62. Therefore, for the same reasons discussed above, we determine that the nexus between Patent Owner’s evidence of objective indicia of non-obviousness and the challenged claims is weak. *See supra* Section II.C.7.

5. *Totality of the Evidence*

For the reasons discussed above in Section II.D.1 through Section II.D.3, the evidence presented by Petitioner strongly indicates that claims 19,

22, 33, and 36 would have been obvious over the cited prior art. For the reasons discussed above in Section II.D.4, Patent Owner's evidence of long-felt but unmet need and unexpected results is weak. When considering all of the *Graham* factors, Patent Owner's weak evidence of long-felt but unmet need and unexpected results is substantially outweighed by Petitioner's strong evidence of obviousness. Thus, when considering all the evidence of obviousness and non-obviousness together, see *In re Cyclobenzaprine*, 676 F.3d at 1079, we determine that Petitioner has shown by a preponderance of the evidence that claims 19, 22, 33, and 36 of the '471 patent are unpatentable as obvious.

E. *Patent Owner's Observations*

Patent Owner filed Observations on the cross examination of Mr. Geier (Paper 34), to which Petitioner filed a Response (Paper 38). We have considered Patent Owner's observations and Petitioner's responses, and we determine that Patent Owner's observations do not demonstrate any issues with respect to the credibility of Mr. Geier's testimony. We also have considered Patent Owner's observations in connection with the arguments and evidence discussed above, and we have given Mr. Geier's testimony the appropriate weight in making our determination in this case.

F. *Constitutionality of Inter Partes Review*

Patent Owner argues that "[t]his IPR should be terminated and the petition dismissed because the IPR system is unconstitutional." PO Resp. 62–63. We decline to consider the constitutional challenge as, generally, "administrative agencies do not have jurisdiction to decide the constitutionality of congressional enactments" where consideration of the constitutional question would "require the agency to question its own

statutory authority or to disregard any instructions Congress has given it.” *Riggin v. Office of Senate Fair Emp’t Practices*, 61 F.3d 1563, 1569–70 (Fed. Cir. 1995). Nonetheless, we note that our reviewing court has upheld the constitutionality of *inter partes* review proceedings. *See MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1288–93 (Fed. Cir. 2015).

III. CONCLUSION

Petitioner has shown by a preponderance of the evidence that claims 17–22 and 31–36 of the ’471 patent are unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 17–22 and 31–36 of the ’471 patent are shown 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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