UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED,
Petitioner,

v.

BANDSPEED, INC.,
Patent Owner.

Case IPR2016-00620
Patent 8,873,500 B2


ARPIN, Administrative Patent Judge.

DECISION
Institution of Inter Partes Review
37 C.F.R. § 42.108

I. BACKGROUND

A. The ’500 Patent (Ex. 1001)

The ’500 patent is titled “Approach for Managing the Use of Communications Channels Based on Performance.” Ex. 1001, [54]; see id. at col. 1, ll. 1–3, 60–62. Figure 2 of the ’500 patent is reproduced below.

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1 Petitioner identifies Qualcomm Incorporated, Qualcomm Atheros, Inc., and Qualcomm Innovation Center, Inc., as real parties-in-interest. Pet. 2.

2 Patent Owner identifies only Bandspeed, Inc., as a real party-in interest. Paper 5, 2.
FIG. 2

Figure 2 depicts a communications network having communications devices or mechanisms labeled master 210, slave 220, and slave 230. *Id.* at col 9, l. 51–col. 10, l. 9; *see id.* at col. 2, ll. 5–18 (describing “participants” as “a device or mechanism that communicates with other devices or mechanisms,” including “a master participant” or “master” and “slave participants” or “slaves”). Each communication device or mechanism includes a memory, a processor that may execute instructions stored in memory, and a transceiver configured to transmit and receive communications with other devices of the communications network. *Id.* at col. 10, ll. 3–9.
To manage the communications channels, the methods and devices of the ’500 patent communicate between communication devices over a plurality of communication channels, test the plurality of communication channels, and select a first set of communications channels based on the results of the testing, e.g., “based on the performance of the communications channels and channel selection criteria.” See id. at col. 4, ll. 26–28. “For example, the selection criteria may be to select the good channels but not the bad channels.” Id. at col. 7, ll. 3–5; see id. at col. 4, ll. 4–12 (describing a “bad” channel as one that suffers from interference). The methods and devices may revert to the plurality of channels and thereafter may select a second set of communication channels. See id. at col. 4, ll. 28–31.

The ’500 patent describes various techniques for measuring performance of communications channels. See id. at col. 10, l. 33–col. 15, l. 7. For example, the methods and devices of the ’500 patent may measure performance by means of special test packets (id. at col. 10, l. 49–col. 12, l. 53), received signal strength indicators (“RSSI”) (id. at col. 12, l. 57–col. 13, l. 17), cyclic redundancy checks (“CRC”) (id. at col. 14, ll. 1–21), and forward error correction (“FEC”) (id. at col. 14, ll. 39–56). The methods and devices of the ’500 patent may classify a communication channel based on channel performance and one or more classification criteria. Id. at col. 15, ll. 14–42. “For example, a channel may be classified as ‘good’ or ‘bad’ based on the results of the channel performance testing by applying one or more performance measurements to specified performance criteria.” Id. at col. 15, ll. 16–19.
The methods and devices of the ’500 patent use a frequency hopping ("FH") protocol, such as defined by Bluetooth standards.\textsuperscript{3} \textit{Id.} at col. 8, ll. 19–23.

A frequency hopping (FH) protocol is an approach for wireless communications in a communications network that uses a frequency hopping signal transmission technique in which information or data is transmitted over a set of frequencies in a communications frequency band. . . . The order in which the communications network hops among the set of frequencies is known as the \textit{hopping sequence}. \textit{Id.} at col. 2, ll. 19–27 (emphasis added). For example, a method or a device using a FH protocol “transmits data on one channel, hops to the next channel in the hopping sequence to transmit more data, and continues by transmitting data on subsequent channels in the hopping sequence.” \textit{Id.} at col. 2, ll. 34–38. “When the FH communications system hops over part of the frequency band \textit{occupied} by an [non-frequency hopping ("NFH")]) communications system, there may be interference between the systems.” \textit{Id.} at col. 3, ll. 33–36 (emphasis added). “Interference results in data transmission errors, such as an increase in the bit error rate (BER) or the loss of data packets, resulting in reduced transmission quality and performance and the need to retransmit the data.” \textit{Id.} at col. 3, ll. 58–61. Thus, the use of an FH protocol may reduce problems with interference from other communications systems and other interference sources. \textit{Id.} at col. 2, ll. 39–41.

Figure 5B of the ’500 patent also is reproduced below.

\textsuperscript{3} The “Bluetooth” word mark and logos are registered trademarks owned by Bluetooth SIG, Inc.
Figure 5B depicts forming a modified hopping sequence through replacement of a bad channel, i.e., default channel 522b, in a default set of channels, e.g., in a default FH sequence, with a good channel, i.e., good channel 576a, in a channel register, i.e., register with default channels 520. *Id.* at col. 5, ll. 51–53; *see id.* at col. 20, ll. 13–16. For example, “whenever [the] selection kernel 510 addresses a channel classified as bad in [the] register with default channels 520, the bad channel is replaced with a good channel that is randomly selected from [the] table of good channels 570.” *Id.* at col. 20, l. 64–col. 21, l. 1. As a result, “only good channels are selected to form the hopping sequence.” *Id.* at col. 20, ll. 61–62.

The ‘500 patent also discloses switching from using the modified hopping sequence back to using the default channels. *Id.* at col. 24, ll. 15–16. The decision to switch back to default channels may be based on elapsed time or changed performance. *See id.* at col. 24, ll. 18–28.
B. Illustrative Claim

Claims 1, 14, 16, and 29 are independent claims. Claims 1 and 14 are method claims, and claims 16 and 29 are directed to devices which implement methods substantially similar to those recited in claims 1 and 14, respectively. Claim 1 is illustrative of the claims at issue and is reproduced below:

1. A method performed by a master device in a frequency hopping wireless communication system, the method comprising:

   - communicating with a slave device over a plurality of communication channels according to a default hopping sequence;
   - testing the plurality of communication channels;
   - selecting a subset of the plurality of communication channels based on results of the testing;
   - communicating with the slave device over the subset of communication channels according to an adapted hopping sequence;
   - monitoring the subset of communications channels;
   - based on results of the monitoring or after a specified period of time, reverting back to communicating with the slave device over the plurality of communication channels according to the default hopping sequence.

_Id._ at col. 27, ll. 11–27. Claims 2–13 depend directly or indirectly from claim 1; claim 15 depends from claim 14; claims 17–28 depend directly or indirectly from claim 16; and claims 30 and 31 depend directly from claim 29. Claims 17–28 recite limitations that parallel those of claims 2–13, and the limitations of claim 15 parallel those of claim 30. We determine, for purposes of our analysis, that the device
claims, although differing in format, do not require a separate analysis.

C. Related Proceedings


D. Applied References and Declaration

Petitioner relies on the following references and declaration in support of its asserted grounds of unpatentability:

[Interactively search this docket at https://libpatent.com/network/graph/ptabdocket/6756/IPR2016-00620]
Pet. i.

The ’500 patent issued from U.S. Patent Application No. 14/034,206, filed September 23, 2013. Ex. 1001, [21], [22]. The ’500 patent, however, claims priority to a string of patent applications as a division or a continuation; the earliest of these claims a filing date of September 6, 2001. Id. at [60]; see Pet. 4–5. Nevertheless, Petitioner notes that the ’500 patent claims priority to U.S. Provisional Patent Application No. 60/264,594, filed January 25, 2001. Ex. 1001, [60]; see Pet. 5. Petitioner asserts that the filing date of the provisional application is the “earliest effective filing date” to which the ’500 patent could claim priority, but argues that each of Dabak and Kockmann is prior art to the ’500 patent as of that date or the September 6, 2001, filing date of the earliest utility application from which the ’500 patent claims priority. Pet. 5.

Petitioner bears the initial burden of production that the applied references are prior art. See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc., 800 F.3d 1375, 1379–80 (Fed. Cir. 2015) (After the petitioner has satisfied the initial burden of production to show that the applied references are prior art, the burden of production shifts to the patent owner to show that the applied references are not prior art.). Here, Petitioner has met its initial burden of production to show that the applied references are prior art.

<table>
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<td>1002</td>
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<td>1010</td>
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E. Asserted Grounds of Unpatentability

Petitioner asserts the following grounds of unpatentability:

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Pet. 4.

II. ANALYSIS

A. Claim Construction

In an inter partes review, claim terms in an unexpired patent are construed according to their broadest reasonable interpretation in light of the specification of the patent in which they appear. See 37 C.F.R. § 42.100(b); Cuozzo Speed Techs. LLC v. Lee, 136 S.Ct. 2131, 2144–46 (2016). Under that standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. In re Translogic Tech., Inc., 504 F.3d 1249, 1257 (Fed. Cir. 2007).

1. “hopping sequence” (Claims 1, 14, 16, and 29 and others)

Each of challenged, independent claims 1, 14, 16, and 29 expressly recites a “hopping sequence.” Citing the Board’s decision to institute in IPR2015-00314 (Ex. 1003, 7; see supra Section I.C.), Petitioner argues that

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4 Petitioner argues that a person of ordinary skill in the relevant art “would have a B.S. degree in Electrical and/or Computer Engineering, or an equivalent field, as well as at least 3-5 years of academic or industry experience in the wireless communications field.” Pet. 11 (citing Ex. 1002 ¶¶ 10–13); see Ex. 1002 ¶ 14. For purposes of this Decision and to the extent necessary, we adopt this assessment of a person of ordinary skill in the relevant art.
“hopping sequence” means “the order in which the communications network hops among the set of frequencies.” Pet. 11–12; see Ex. 1001, col. 2, ll. 25–27 (“The order in which the communications network hops among the set of frequencies is known as the hopping sequence.”) (emphasis added)). Petitioner’s declarant, Dr. Zhi Ding, also testifies that the phrase “hopping sequence” is “a well-understood term of art” (Ex. 1002 ¶ 32 (citing Ex. 1013, 127–33)) and means “[t]he order in which the communications network hops among the set of frequencies” (id. ¶¶ 23, 32 (citing Ex. 1001, col. 2, ll. 25–27)). We credit Dr. Ding’s testimony that the phrase has a well-understood meaning and adopt Petitioner’s construction as the broadest reasonable interpretation of the phrase “hopping sequence,” in light of the specification of the patent in which it appears, for purposes of this Decision.

2. “clear” and “occupied” channel (Claims 4, 7, 19, and 22)

Petitioner asserts that

[t]he specification of the ’500 Patent does not use the terms “clear” or “occupied” to refer to channels. Instead, the ’500 Patent uses the terms “good” and “bad” channels. Ex. 1009 4:10, 6:58-63. A “good” channel is one that experiences a low interference level, whereas a “bad” channel experiences a high interference level. Id. A [person of ordinary skill in the art] reading the specification would equate a “good” channel to a “clear” channel and a “bad” channel to an “occupied” channel. Ex. 1002 ¶ 32.

Pet. 12. Consequently, Petitioner argues that the broadest reasonable interpretation for the term “clear” channel is a channel with “low interference,” and the broadest reasonable interpretation for the term “bad channel,” i.e., an “occupied” channel, is a channel with “high interference.” Id. (citing Ex. 1009, col. 4, l. 10, col. 6, ll. 58–63). We disagree.
Initially, we note that, contrary to Petitioner’s assertion, the Specification of the ’500 patent uses the term “occupied” to refer to channels. In particular, the Specification states that “[w]hen the FH communications system hops over part of the frequency band occupied by an NFH communications system, there may be interference between the systems.” Ex. 1001, col. 3, ll. 33–36 (emphases added). Because Petitioner failed to consider the use of the term “occupied” in the Specification, Petitioner incorrectly equated an “occupied channel” with a “bad channel.” Pet. 18. Further, Petitioner failed to consider the meaning of “clear” in light of the Specification’s use of the term “occupied.” We do not adopt this construction because we conclude it is not consistent with the specification of the ’620 patent.

An “occupied” channel may exhibit interference (see id. at col. 3, ll. 33–36), even “high interference,” and a “clear” channel may exhibit less interference, even “low interference.” The terms “occupied” and “clear,” however, are narrower terms than “bad” and “good,” respectively, and their meanings cannot properly be equated under the broadest reasonable interpretation standard. See Ex. 1011, 10 (“[T]he existence of NFH systems will give high RSSI in channels they occupy.”), 12 (“A channel which gives constant packet loss or high [number of error bits (“NEB”)] will be identified as occupied by NFH system, and classified as Occupied. Other channels will be classified as Clear, even though they occasionally give packet loss or high NEB, as this could be a clash by another FH system or local fading.”); see also Broadcom Corp. v. Qualcomm Inc., 543 F.3d 683, 689 (Fed. Cir. 2008) (“When the claim addresses only some of the features disclosed in the specification, it is improper to limit the claim to other,
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unclaimed features.” (quoting Ventana Med. Sys., Inc. v. Biogenex Labs., Inc., 473 F.3d 1173, 1181 (Fed. Cir. 2006)).

From the context of the Specification of the ’500 patent, we understand the term “occupied” to refer to a channel already in use by a NFH communication system. Id. at col. 3, ll. 27–33. As the Specification explains, “[i]n contrast to FH systems, a non-frequency hopping (NFH) system is simply a communications system whose carrier does not hop over a set of frequencies. A typical NFH system may occupy a portion of the communications frequency band corresponding to several frequencies used by an FH system.” Id. at col. 2, ll. 28–32 (emphasis added). Thus, in light of the Specification and for purposes of this Decision, we determine that the broadest reasonable interpretation of an “occupied” channel is “a channel that already is in use by a NFH communication system.”

Referring to claim 4, the claim recites that “the channel classifications for the plurality of communication channels comprise one of two values for each channel of the plurality of communication channels, one of the two values indicating the channel is occupied and the other of the two values indicating the channel is clear.” Id. at col. 27, ll. 45–50 (emphases added); see also id. at col. 27, l. 65–col. 28, l. 3 (claim 7), col. 29, ll. 24–29 (claim 19), 46–51 (claim 22). Thus, per the language of the challenged claims, a channel may be either “occupied” or “clear.” In this context and given the usage of “occupied” in claims 4, 7, 19, and 22, for purposes of this Decision, we determine that the broadest reasonable interpretation of a “clear” channel is “a channel that is not already in use by a non-frequency hopping communication system.”
3. “default hopping sequence” (Claims 1, 14, 16, and 29)

Petitioner argues that the term “default hopping sequence” at least encompasses “an original hopping sequence that does not change based on channel performance.” Pet. 13; see id. at 12 (citing Ex. 1002 ¶ 34). In particular, Petitioner argues that the Specification of the ’500 patent equates “default” and “original” when referring to the set of channels of the hopping sequences. Id. (citing Ex. 1001, col. 19, ll. 30–33 (“some participants may communicate . . . using the original or default set”)). We, however, do not read the Specification as equating these terms. The text of the ’500 patent relied upon by Petitioner merely indicates that, under certain circumstances, the words “default” and “original” may have overlapping meanings.

Further, relevant definitions of “default” are “a preset value that a computer system assumes or an action that it takes unless otherwise instructed” (RANDOM HOUSE WEBSTER’S COLLEGE DICTIONARY 347 (2d ed. 1999) (Ex. 3001)) and, in the field of computer science, “[a] value automatically used or an action automatically carried out unless another is specified” (MCGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS 501 (4th ed. 1989) (Ex. 3002)). See Ex. 1002 ¶ 34 (citing Ex. 1011, Fig. 11 (“After connection between master and slave is set-up, the default hopping sequence is the standard hopping sequence over the entire band.”) (emphases added)). Thus, in the context of the Specification of the ’500 patent, and on this record, we determine that an ordinary and customary meaning for “default” is “preset.”

Further, citing to the construction of a similar, but not identical, term in a related patent, U.S. Patent No. 7,027,418 B2, Petitioner notes that in an infringement litigation involving that patent, the district court construed “default set of two or more communication channels” (emphasis added) as
“an original set of communication channels” (emphasis added). *Id.* (citing *Bandspeed, Inc. v. Sony Elecs., Inc.*, 2011 WL 10947893, at *6 (W.D. Tex. Aug. 12, 2011) (reproduced in Ex. 1002, App. 2)). Although we generally are not bound by the constructions reached in district court litigation, we may consider them in our determination of the proper construction of this term. *See Power Integrations, Inc. v. Lee*, 797 F.3d 1318, 1326–27 (Fed. Cir. 2015) (Although under certain circumstances the Board may be obligated to evaluate the district court’s construction and to determine whether that construction is consistent with the broadest reasonable construction, “[t]here is no dispute that the board is not generally bound by a prior judicial construction of a claim term.”). Nevertheless, we are not persuaded that the Specification of the ’500 patent equates “default” and “original.”

Consequently, on this record, and for purposes of this Decision, we determine that the broadest reasonable interpretation of “default hopping sequence” is “a preset hopping sequence that does not change based on channel performance, including, but not limited to, an original hopping sequence.”

**4. Other Claim Terms**

For purposes of this Decision, we discern no other claim terms that require express interpretation. *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011) (explaining that “claim terms need only be construed ‘to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).
B. Asserted Obviousness over Dabak or Dabak and Kockmann

1. Overview

Petitioner argues that claims 1–3, 5, 8, 10–18, 20, 23, and 25–28 are unpatentable under 35 U.S.C. § 103(a) as obvious over Dabak and claims 1–31 are unpatentable under 35 U.S.C. § 103(a) as obvious over Dabak and Kockmann. See supra Section I.E. To support its arguments, Petitioner provides a detailed mapping of limitations of challenged claims to Dabak and to Dabak and Kockmann. Pet. 16–55. Petitioner also cites Dr. Ding’s Declaration for support. See Ex. 1002 ¶¶ 40–209.

A patent claim is unpatentable 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 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. Telesflex 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 skill in the art;5 and (4) objective evidence of nonobviousness, i.e., secondary considerations.6 Graham v. John Deere Co., 383 U.S. 1, 17–18 (1966). On this record and for the reasons set forth below, we are

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5 See supra Section II.A. (note 4).
persuaded that Petitioner demonstrates a reasonable likelihood of prevailing in this challenge to claims 1–5, 8–20, and 23–31 of the ’500 patent.

2. *Dabak* (Ex. 1009)

Dabak seeks to improve data throughput and to reduce packet error rates in FH systems. Ex. 1009, col. 4, ll. 33–38; *see* Ex. 1002 ¶ 35. Dabak teaches systems and methods for improvement of Bluetooth protocol frequency hopping. *Id.* at col. 2, ll. 26–30. The Bluetooth protocol allows master and slave devices to frequency hop among 79 1-MHz channels in the 2.4 GHz industrial, scientific, and medical (“ISM”) band up to 1,600 times per second. *Id.* at col. 1, ll. 38–40, 64–66. “Although the Bluetooth protocol employs frequency hopping to provide for frequency diversity and as a means for providing robustness against noise/interference, the frequency hopping of Bluetooth does not exploit the full frequency diversity of the wide Bluetooth transmission bandwidth, particularly for voice applications.” *Id.* at col. 2, ll. 13–18. To further address these issues, Dabak teaches the “use of solely good frequencies” to “significantly improve Bluetooth performance.” *Id.* at col. 5, ll. 65–67. In particular,

> [b]ased upon the Slave to Master transmission, the Master keeps a record of the best frequencies, i.e. those frequencies exhibiting good signal correlation characteristics, low numbers of retransmissions, low BER and the like. Signals generated at these frequencies will have the least path loss or least interference from other sources, like microwave ovens, etc. Then, at some point in time, the Master communicates to the

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7 Although the Examiner considered Dabak among numerous other references during the prosecution of the ’500 patent, the Examiner did not address Dabak directly during prosecution. In the absence of discussion of Dabak’s teachings during the prosecution of the ’500 patent, we decline to exercise our discretion and reject the Petition under 35 U.S.C. § 325(d).
Slave that after N packets, the Master and Slave should use the frequency $f_i$, in their communication for a time $T_i$ (instead of the normal Bluetooth hopping frequencies over time $T_i$). . . . After time $T_i$, the Master and Slave would return to the normal Bluetooth hopping frequencies. The foregoing procedure would then be continually repeated as long as the Master and Slave continue to communicate with one another.

_Id._ at col. 2, ll. 38–62 (emphasis added). Here, the “normal Bluetooth hopping frequencies” correspond to a default FH sequence.

Figures 3A and 3B of Dabak are reproduced below.

![Figure 3A](image1)

![Figure 3B](image2)

Figure 3A depicts Dabak’s use of a Master-Slave Dwelling (“MSD”) technique, in which a normal Bluetooth FH pattern is employed. _Id._ at col. 8, ll. 42–49. Figure 3B depicts the switch to the MSD technique for time $T_i$.

Specifically, Master (“M”) communicates with Slaves ($S_1$, $S_2$, and $S_3$) over 29 different channel frequencies ($f_1$, $f_2$, . . . $f_{29}$). _Id._ During this normal Bluetooth FH, “the Master performs measurements on all frequencies regarding path loss characteristics between the Master and the Slave to determine the channels with least interference from other sources, e.g. other Bluetooth links, microwave ovens and the like. The path loss characteristics are evaluated to determine if Master-Slave Dwelling should be implemented . . . .” _Id._ at col. 7, ll. 17–23. Based upon these measurements, the Master
“keeps a record of the best frequencies, i.e., frequencies with [the] least path loss or least interference from other sources.” Id. at col. 7, ll. 29–31. If the Master “determine[s] that one or more frequencies are not effectively providing error-free transmissions to the Slave(s),” the MSD technique is implemented. Id. at col. 7, ll. 24–28.

Referring to Figure 3B, during time $T_i$, communications between the Master and Slaves S₁ and S₂ continue to frequency hop, but communications between the Master and Slave S₃ dwell on a single frequency, frequency $f_{11}$. Id. at col. 8, ll. 49–57. Although communications with Slave S₃ dwell at frequency $f_{11}$, communications with Slaves S₁ and S₂ continue according to the normal Bluetooth FH protocol.

Normal Bluetooth hopping is again implemented at frequency $f_{25}$ which is the first hopping frequency used by the Master following the MSD. During the time $T_i$, it can be seen that all communications between the Master and Slaves 1 and 2 will continue using the normal Bluetooth hopping pattern, even though MSD is being used between the Master and Slave 3. Id. at col. 8, ll. 57–63 (emphasis added). At the end of period $T_i$, or if communications are adversely affected by a new source of interference, the Master and Slave S₃ resume normal Bluetooth FH. Id. at col. 7, ll. 44–51, 57–64.

3. **Kockmann (Ex. 1010)**

As with Dabak, Kockmann teaches apparatus and methods for improvement of FH protocol performance. See Ex. 1010, col. 2, ll. 49–53. In particular, Kockmann notes that:

Problems occur when the plurality of usable carrier frequencies is not temporally constant. This, for example, is the case when a carrier frequency recognized as disturbed is blocked during a certain time span and, thus, is not enabled for employment and,
for example, is enabled for re-employment after a certain time span. 

*Id.* at col. 2, ll. 24–32 (emphasis added). “A disturbed carrier frequency is thus a carrier frequency onto which a signal is modulated that exceeds a specific threshold.” *Id.* at col. 6, ll. 47–49. A disturbance may be “either a disturbance in the actual sense or an occupancy by some other transmitter is present.” *Id.* at col. 6, ll. 42–43 (emphasis added).

Kockmann teaches that a base station sends a message to mobile stations providing the list of disturbed frequencies. *Id.* at col. 4, ll. 33–40. The base station and mobile stations eliminate disturbed frequencies from their table of frequencies used for FH communication. *Id.* at col. 4, ll. 27–31, 40–44. Kockmann then forms a “modified sequence” replacing disturbed frequencies and comprising only undisturbed frequencies. *Id.* at col. 7, ll. 44–55. Once Kockmann detects that “the previously disturbed carrier frequency is now no longer disturbed,” or “when [the frequency] was inhibited for longer than a previously defined time,” that frequency no longer needs to be replaced in the table of frequencies used for communication. *Id.* at col. 7, ll. 53–63, col. 11, ll. 24–33, col. 8, ll. 39–49.

4. **Obviousness over Dabak**

Petitioner argues that Dabak teaches or suggests all of the limitations of claims 1–3, 5, 8, 10–18, 20, 23, and 25–28 of the ’500 patent. Pet. 16–38. In particular, Petitioner argues that Dabak teaches or suggests all of the limitations of each of independent claims 1, 14, and 16. Pet. 17–25 (claim 1), 31–32 (claim 14), 33–35 (claim 16). Although claims 1 and 14 are directed to methods and claim 16 is directed to a device, claim 16 merely describes a device comprising a memory, which stores instructions
corresponding substantially to the steps of the method recited in claim 1, and
a processor. See Pet. 33. With one notable exception, Petitioner provides,
on this record, a persuasive mapping of the teachings of Dabak onto the
limitations of each of the challenged claims.

Initially, independent claim 1 recites the steps of “communicating
with a slave device8 over a plurality of communication channels according
to a default hopping sequence; testing the plurality of communication
channels; [and] selecting a subset of the plurality of communication
channels based on results of the testing.” Ex. 1001, col. 27, ll. 14–19. In
view of Petitioner’s analysis, we are persuaded that Dabak teaches or
suggests each of these limitations. Each of the challenged independent
claims, however, recites the limitation “communicating with the slave device
over the subset of communication channels according to an adapted hopping
sequence.” Ex. 1001, col. 27, ll. 20–22 (claim 1), col. 28, ll. 42–44 (claim
14), 64–66 (claim 16). After reviewing Petitioner’s arguments and evidence,
including the supporting testimony of Dr. Ding, we are not persuaded that
Dabak teaches or suggests this limitation.

With regard to the use of “an adapted hopping sequence” to
communicate between the master device and the slave device over a subset
of the plurality of communication channels, Petitioner argues that this
limitation is taught by Dabak’s Figure 3B. Pet. 20–23. As discussed above,
Dabak describes switching from a normal Bluetooth FH protocol to a MSD

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8 Although claim 16 recites “[a] frequency hopping wireless communication
device” and “another frequency hopping wireless communication device,”
instead of “a master device” and “a slave device,” as recited in claims 1 and
14, we understand that the communication devices of claim 16 encompass
master and slave devices. See Ex. 1001, col. 2, ll. 5–18.
technique to avoid frequencies with path loss or interference from other sources. Ex. 1009, col. 2, ll. 38–48; see supra Section II.B.2. In particular, as depicted in Dabak’s Figure 3B, reproduced above, during time period $T_i$, when Dabak’s systems and methods employ the MSD technique, the Master $M$ communicates with the Slaves $S_1$ and $S_2$ using the normal, Bluetooth FH protocol and with Slave $S_3$ over a single frequency $f_{11}$. Ex. 1009, col. 8, ll. 57–63. Thus, Petitioner argues that “Dabak teaches the concept of device $M$ switching from a default hopping sequence to an adapted hopping sequence in order to avoid interference, then reverting back to the default hopping sequence.” Pet. 15 (citing Ex. 1002 ¶ 38). Although a single frequency may be a subset of a plurality, i.e., two or more, communication channels, as recited in claim 1, we are not persuaded that dwelling on a single frequency teaches an “adapted hopping sequence,” as we construed “hopping sequence” above. See supra Section II.A.1 (“hopping sequence” means “the order in which the communications network hops among the set of frequencies”); see Pet. 11–12.

Petitioner appears to acknowledge this deficiency in Dabak’s teaching with respect to Figure 3B. Pet. 21–23. Specifically, Petitioner states that:

To the extent it is argued that master $M$ communicating with slaves $S_1$ and $S_2$ using a normal hopping and adapting the hopping sequence to use a dwelling frequency $f_{11}$ with slave $S_3$ (as opposed to a plurality of frequencies) is insufficient to disclose “communicating with the slave device over the subset of communication channels according to an adapted hopping sequence,” Dabak suggests implementing the MSD technique therein by hopping over a subset, which includes a plurality of channels, with slave $S_3$.

Pet. 21–22. We are not persuaded by this argument.
First, Petitioner argues that Dabak teaches that its systems “alternate between a standard Bluetooth frequency channel hopping sequence and a modified Bluetooth hopping sequence.” Id. at 22 (citing Ex. 1009, col. 3, ll. 40–42). Petitioner argues that a person of ordinary skill in the art would understand the “modified Bluetooth hopping sequence” to refer to a plurality of frequencies. Id. (citing Ex. 1002 ¶ 46). The problem with this argument, however, is that Petitioner does not demonstrate what the “modified Bluetooth hopping sequence” is, so that we may determine whether it satisfies the other limitations of the challenged claims. Instead, Petitioner refers to various portions of Dabak and suggests that a person of ordinary skill in the art would have been able to achieve the recited limitation or that it would be obvious for such a person to try to do so. Id. at 22–23 (citing Ex. 1002 ¶ 46). Petitioner’s arguments lack support or sufficient explanation as to why a person of ordinary skill would have had reason to modify Dabak to achieve the recited limitation. Consequently, we find Petitioner’s arguments and Dr. Ding’s testimony to be conclusory, compromised by impermissible hindsight, and unpersuasive. See also InfoBionic, Inc. v. Braemar Manufacturing, LLC, Case IPR2015-01704, slip op. at 6 (PTAB Feb. 16, 2016) (Paper 11) (“We do not find the testimony of Petitioner’s expert to be persuasive or helpful as it repeats the Petitioner’s arguments and offers little or no elaboration as to how one of ordinary skill in the art would understand the term ‘subset.’ . . . See 37 C.F.R. § 42.65(a) (‘Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.’)”) (citations omitted).

Although we have highlighted specific evidence and arguments for emphasis, we have reviewed the entirety of Petitioner’s analysis for
independent claim 1, as well as the supporting testimony of Dr. Ding. Based on our review of the arguments and evidence, we conclude that Petitioner has failed to establish a reasonable likelihood of prevailing on its challenge to independent claim 1 as rendered obvious by Dabak. Moreover, because Petitioner’s arguments for the obviousness of independent claims 14 and 16 over Dabak, rely on the arguments and evidence presented with respect to independent claim 1, we also conclude that Petitioner has failed to establish a reasonable likelihood of prevailing on its challenge to independent claims 14 and 16 as rendered obvious by Dabak or on its challenge to claims 2, 3, 5, 8, 10–13, 15, 17, 18, 20, 23, and 25–28, which depend from claim 1, 14, or 16, as rendered obvious by Dabak.

5. Obviousness over Dabak and Kockmann
   a. Claims 1–3, 5, 8, 10–18, 20, 23, and 25–28

   As discussed above, although Petitioner provides a mapping of Dabak onto the limitations of each of claims 1–3, 5, 8, 10–18, 20, 23, and 25–28, we are not persuaded that Dabak teaches at least one limitation of each of independent claims 1, 14 and 16. See supra Section II.B.4. Petitioner argues, however, that Kockmann teaches this missing limitation of independent claims 1, 14, and 16 and that a person of ordinary skill in the art would have reason to combine the teachings of Dabak and Kockmann to achieve the methods and devices recited in those independent claims. Pet. 39–40 (claim 1), 47 (claim 14), 49 (claim 16). On this record and for the reasons set forth below, we agree.

   Petitioner argues that Kockmann teaches frequency hopping, monitoring interference and disturbances on each channel, eliminating disturbed channels from the hopping sequence, hopping over an adapted frequency hopping
sequence, and reintroducing the previously disturbed channels in the hopping sequence once disturbance has abated, i.e., reverting back to a default hopping sequence.

Pet. 16 (citing Ex. 1002 ¶ 39). In particular, Petitioner argues that Kockmann teaches that, if a particular frequency in a hopping sequence is determined to be “disturbed,” that frequency is removed from the hopping sequence. *Id.* at 39 (citing Ex. 1010, col. 7, ll. 25–44); see supra Section II.B.3. Petitioner further argues that the removal of the disturbed frequency from the hopping sequence creates a “modified sequence” that “comprises only undisturbed carrier frequencies.” [Ex. 1010] 7:44-47. Kockmann’s disclosure of “only undisturbed carrier frequencies” is a subset of communications channels; the “modified sequence” using only undisturbed frequencies is the adapted hopping sequence. Ex. 1002 ¶ 112. As such, Kockmann teaches communicating with a slave device over the subset of communications channels according to an adapted hopping sequence. *Id.*

Pet. 39. On this record, we find this argument persuasive, and, thus, we are persuaded that Kockmann teaches the limitation of independent claims 1, 14, and 16 that is missing from Dabak. Further, as noted above, we are persuaded that Dabak teaches the remaining limitations of independent claims 1, 14, and 16. *See* Pet. 29–31 (the remaining limitations of claim 1), 31–32 (the remaining limitations of claim 14), 33–35 (the remaining limitations of claim 16).

Petitioner also provides a persuasive rationale for combining the teachings of Dabak and Kockmann. *Id.* at 39–40. Petitioner asserts that they are both references directed to the same problem, namely, “to communication performance improvements through adapted frequency hopping to avoid channels disturbed by interference.” *Id.* at 40 (citing Ex.
In addition, according to Petitioner, a person of ordinary skill in the art would have had reason to modify the teachings of Dabak regarding the MSD technique in view of the teachings of Kockmann “to utilize multiple channels to communicate with the slave device over the subset of communication channels according to an adapted hopping sequence” in order to accomplish the shared goals of these references. *Id.* at 40 (citing Ex. 1002 ¶ 113). According to Petitioner, the combination of these teachings “is a simple use of known teachings to yield predictable results.” *Id.* (citing *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.”)).

Although we have highlighted specific evidence and arguments for emphasis, we have reviewed the entirety of Petitioner’s analysis for independent claim 1, as well as the teachings of Dabak and Kockmann and the supporting testimony of Dr. Ding and the mapping of the teachings of Dabak onto claims 2, 3, 5, 8, 10–18, 20, 23, and 25–28. Based on our review of the arguments and evidence, we conclude that Petitioner has established a reasonable likelihood of prevailing on its challenge to independent claim 1 as rendered obvious by Dabak and Kockmann. Moreover, because Petitioner’s arguments for the obviousness of independent claims 14 and 16 over Dabak and Kockmann rely on the arguments and evidence presented with respect to independent claim 1, we also conclude that Petitioner has established a reasonable likelihood of prevailing on its challenge to independent claims 14 and 16 as rendered
obvious by Dabak and Kockmann and on its challenge to claims 2, 3, 5, 8, 10–13, 15, 17, 18, 20, 23, and 25–28, which depend from claim 1, 14, or 16.

b. Claims 4 and 19

Claim 4 depends from claim 3 and recites that “the channel classifications for the plurality of communication channels comprise one of two values for each channel of the plurality of communication channels, one of the two values indicating the channel is occupied and the other of the two values indicating the channel is clear.” Ex. 1001, col. 27, ll. 45–50. Similarly, claim 19 depends from claim 18 and recites the identical limitations of claim 4. Id. at col. 29, ll. 24–29. Petitioner argues that Kockmann teaches that a channel frequency may be described as falling into one of two classifications: as disturbed frequency or as a non-disturbed frequency. Pet. 41; see Ex. 1010, col. 6, ll. 43–49. Further, Petitioner notes that “[d]isturbance thereby means that either a disturbance in the actual sense or an occupancy by some other transmitter is present.” Pet. 41 (quoting Ex. 1010, col 6, ll. 41–43). Thus, a disturbed frequency may be an occupied frequency. Similarly, both Dabak and Kockmann teach that a bad and disturbed frequency, respectively, may be determined by the level of interference measured on the frequency. See Ex. 1009, col. 2, ll. 42–44; Ex. 1010, col. 6, ll. 47–49. Thus, we are persuaded that Kockmann teaches the limitations of claims 4 and 19.

Because Dabak teaches the “classifications” of claim 3, from which claim 4 depends (Pet. 26–27; see also id. at 35–36 (claim 18)), Petitioner argues that a person of ordinary skill in the art “would recognize that Kockmann’s classification of carrier frequencies being disturbed discloses the value indicating an occupied channel, and Kockmann’s classification of
carrier frequencies being non-disturbed discloses the value indicating a clear channel” (id. at 41 (citing Ex. 1002 ¶ 124)). Thus, as recited in challenged claims 4 and 19, Kockmann teaches two values for channel classifications: one value indicating the channel is occupied and the other indicating the channel is clear. Id. at 42 (citing Ex. 1002 ¶ 123). The simple substitution of a known classification variation within the same field would have been obvious to a person of ordinary skill in the art. Ex. 1002 ¶ 124; see KSR, 550 U.S. at 417 (“[I]f a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.”).

Although we have highlighted specific evidence and arguments for emphasis, we have reviewed the entirety of Petitioner’s analysis for claims 4 and 19, as well as the teachings of Dabak and Kockmann and the supporting testimony of Dr. Ding and the mapping of the teachings of Dabak onto claims 3 and 18. Based on our review of the arguments and evidence, we conclude that Petitioner has established a reasonable likelihood of prevailing on its challenge to claims 4 and 19 as rendered obvious by Dabak and Kockmann.

c. Claims 6, 7, 21, and 22

Claim 6 depends from claim 5 and recites that the results of the monitoring comprise channel classifications for the subset of communication channels; and wherein reverting back to communicating with the slave device over the plurality of communication channels according to the default hopping sequence based on results of the monitoring comprises reverting back to communicating with the slave device over the plurality of communication channels according to the default
hopping sequence based on the channel classifications for the subset of communication channels.

Ex. 1001, col. 27, ll. 55–64 (emphasis added). Similarly, claim 21 depends from claim 20 and recites the identical limitations of claim 6. Id. at col. 29, ll. 36–45.

Petitioner argues that the limitations of claims 6 and 21 are taught by the teachings of Dabak and Kockmann as applied to independent claims 1 and 16 (see supra Section II.B.5.a) and Dabak as applied to claims 5 and 20 (Pet. 27–28, 36). See Pet. 42–43. In particular, with respect to the portion of claims 6 and 21 describing reverting back to the default hopping sequence on the basis of the results of monitoring, Petitioner argues that Kockmann teaches monitoring of those frequencies of the plurality of communication channels that previously have been identified as “disturbed.” Id. at 43. Specifically, Petitioner argues that

Kockmann further discloses reclassifying disturbed channels as non-disturbed. “This inhibit can be in turn canceled by the inhibit/enable unit 21 as soon as a renewed acquisition by the acquisition means 24 indicates that the previously disturbed carrier frequency is now no longer disturbed.” Ex. 1010 7:55-59. Once a previously disturbed frequency is reclassified as non-disturbed, that frequency is no longer inhibited and is thus used in the hopping sequence again: “When it is also found . . . that the carrier frequency value f3 is no longer disturbed, then the carrier frequency value f3 is [] reset to its original address 3, as shown in FIG. 11.” Id. 11:25-32; Ex. 1002 ¶ 129.

Pet. 43 (bolded italics in original; italics added).

On this record, we are persuaded that Kockmann teaches monitoring the condition of a frequency previously excluded from the subset. Claims 6 and 21, however, recite reverting to the default hopping sequence based on the classification of the frequencies within the subset of communication channels.
channels, not the classification of previously excluded channels of the plurality of communication channels. Referring to Kockmann, inhibit/enable unit 21 creates the subset of communication channels by inhibiting a channel that previously was part of the plurality of communication channels; thus, “a previously disturbed carrier frequency” is not part of the subset of communication channels. Ex. 1010, col. 7, ll. 55–59. Therefore, Petitioner misreads the claim language, and we are not persuaded that the portions of Dabak and Kockmann relied on by Petitioner teach the limitations of challenged claims 6 and 21.

Based on our review of the arguments and evidence, we conclude that Petitioner has failed to establish a reasonable likelihood of prevailing on its challenge to claims 6 and 21 as rendered obvious by Dabak and Kockmann. Moreover, because claims 7 and 22 depend from claims 6 and 21, respectively, we also conclude that Petitioner has failed to establish a reasonable likelihood of prevailing on its challenge to claims 7 and 22 as rendered obvious by Dabak and Kockmann.

d. Claims 9 and 24

Claim 9 depends from claim 8 and recites the step of reverting back to communicating with the slave device over the plurality of communication channels according to the default hopping sequence after a specified period of time comprises reverting back to communicating with the slave device over the plurality of communication channels according to the default hopping sequence after a clear channel usage timeout.

Ex. 1001, col. 28, ll. 8–14 (emphasis added). Similarly, claim 24 depends from claim 23 and recites the identical limitations of claim 9. Id. at col. 30, ll. 1–7.

The Specification of the ’500 patent explains that
implementation of a selected set of communications channels includes setting a good channel usage timeout (GCUT). Because interference may change over time, such as from other communications systems starting or stopping to be used or as a result of changes of location of the participants of the communications network or of interference sources, it may be useful to periodically change the set of channels being used.

Id. at col. 21, ll. 30–37 (emphases added).

Kockmann teaches that a frequency inhibit or blocking by inhibit/enable unit 21 may be cancelled “when the inhibited carrier frequency is again suitable for the transmission or, respectively, when it was inhibited for longer than a previously defined time.” Ex. 1010, col. 8, ll. 45–48 (emphasis added); see Pet. 46. Petitioner acknowledges that, although claims 9 and 24 refer to changing sets of “clear” channels after a set period of time, Kockmann teaches changing sets of “disturbed,” e.g., “occupied,” channels after a set period of time. Pet. 46. Nevertheless, Petitioner argues that “the ultimate concept and functionality of avoiding particular channels for a specified time (as opposed to using specified channels for the specified time) due to the knowledge that interference patterns change over time is fundamentally the same.” Id. (citing Ex. 1002 ¶ 138).

As we noted above, “occupied” and “clear” are alternative conditions for a channel. See supra Section II.A.2. In view of our construction of “occupied” and “clear” and Dr. Ding’s supporting testimony, we are persuaded, on this record, that Kockmann’s disclosure teaches or suggests the recited limitations of claims 9 and 24. Dr. Ding testifies that:

A person of ordinary skill in the art would find it obvious to implement expiration times on either type of channels as they are both utilizing specified times, due to known practical design
issues, to accomplish the same goals. Thus, Kockmann
discloses utilizing the original/default frequencies after the
expiration of a clear channel usage timeout.
Ex. 1002 ¶ 138. Based on our review of the arguments and evidence, we
conclude that Petitioner has established a reasonable likelihood of prevailing
on its challenge to claims 9 and 24 as rendered obvious by Dabak and
Kockmann.

e. Claims 29–31

Petitioner does not challenge independent claim 29 as rendered
obvious over Dabak alone. See supra Section II.E. Nevertheless, Petitioner
argues that, with the exception of the final limitation of independent claim
29, namely, “reverting back to communicating with the other device over the
plurality of communication channels according to the default hopping
sequence based on a clear channel usage timeout” (Ex. 1001, col. 30, ll. 42–45), all of the limitations of independent claim 29 are taught or suggested by
the teachings of Dabak and Kockmann as mapped by Petitioner with respect
to independent claims 1, 14, and 16 (Pet. 52–53). Petitioner further argues
that the final limitation of independent claim 29 is taught by the same
teachings of Kockmann that teach the limitations of claims 9 and 24 (id. at
44–46) and that a person of ordinary skill in the art would have combined
the teachings of Dabak and Kockmann to achieve the device of claim 29 for
the same reasons that such a person would have combined those teachings to
achieve the methods and devices of claims 9 and 24, respectively (id. at 47).
For the reasons set forth above, we agree. See supra Sections II.B.5.a. and
b.

Claim 30 depends from claim 29 and recites substantially the same
limitations as those recited in claim 15. Pet. 54. Petitioner argues that, as
described in claims 1 and 29, a person of ordinary skill in the art would have found it obvious to combine the teachings of Dabak and Kockmann and would have found the limitations of claim 30 obvious for at least the same reasons that such a person would have found the corresponding limitations of claim 15 obvious. See id. at 38–39, 48; Ex. 1002 ¶¶ 206, 207. Again, we agree. See supra Section II.B.5.a.

Finally, claim 31 depends directly from claim 29 and recites that “the device the device is a master device in a frequency hopping communication system and the other device is a slave device in the frequency hopping communication system.” Ex. 1001, col. 30, ll. 51–54. This dependent claim has no corresponding claim among the other dependent claims.

Nevertheless, Petitioner notes that:

In describing Figure 8, Dabak explains, “Piconet 200 can be seen to have a Master device 202 and a plurality of Slave devices 204, 206, 208. These devices communicate within the piconet 200 using standard Bluetooth hopping frequencies alone or in combination with modified Bluetooth hopping frequencies . . . .” Ex. 1009 11:2-6. Pet. 54–55. Thus, Petitioner argues that Dabak teaches the additional limitations of claim 31. Id. at 55 (citing Ex. 1002 ¶ 209). We agree and are persuaded that a person of ordinary skill in the art would have had reason to combine the teachings of Dabak and Kockmann to achieve the device recited in claim 31 for the same reasons set forth with respect to independent claims 1 and 29.

Although we have highlighted specific evidence and arguments for emphasis, we have reviewed the entirety of Petitioner’s analysis for claims 29–31, as well as the teachings of Dabak and Kockmann and the supporting testimony of Dr. Ding and the mapping of the teachings of Dabak onto claim
15. Based on our review of the arguments and evidence, we conclude that Petitioner has established a reasonable likelihood of prevailing on its challenge to claims 29–31 as rendered obvious by Dabak and Kockmann.

III. SUMMARY

We are not persuaded that Petitioner has demonstrated a reasonable likelihood of prevailing on its challenge to claims 1–3, 5, 8, 10–18, 20, 23, and 25–28 of the ’500 patent as obvious over Dabak. We are persuaded, however, that Petitioner has demonstrated a reasonable likelihood of prevailing on its challenge to claims 1–5, 8–20, and 23–31 of the ’500 patent as obvious over Dabak and Kockmann. We are not persuaded, however, that Petitioner has demonstrated a reasonable likelihood of prevailing on its challenge to claims 6, 7, 21, and 22 of the ’500 patent as obvious over Dabak and Kockmann. At this stage of the proceeding, we have not made a final determination as to the patentability of any of these challenged claims or the construction of any claim term.

IV. ORDER

It is, therefore,

ORDERED that, pursuant to 35 U.S.C. § 314(a), an inter partes review of the ’500 patent is instituted on the grounds of obviousness of claims 1–5, 8–20, and 23–31 over Dabak and Kockmann;

FURTHER ORDERED that inter partes review is not authorized based on any other proposed grounds of unpatentability; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial commencing on the entry date of this Decision.
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