

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DELL INC. and DELL TECHNOLOGIES INC.,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2021-01486
Patent 10,447,450 B2

Before CHARLES J. BOUDREAU, MICHELLE N. ANKENBRAND, and
MATTHEW S. MEYERS, *Administrative Patent Judges*.

BOUDREAU, *Administrative Patent Judge*.

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Dell Inc. and Dell Technologies Inc. (collectively, “Petitioner”) filed a Petition requesting *inter partes* review of claims 1–18 of U.S. Patent No. 10,447,450 (Ex. 1001, “the ’450 patent”). Paper 3 (“Pet.”). Neo Wireless LLC (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314(b) (2018); 37 C.F.R. § 42.4(a) (2020). We may not institute an *inter partes* review “unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314(a).

Upon consideration of the arguments and evidence presented, we determine that Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to any of the challenged claims. Accordingly, we deny institution of an *inter partes* review of the ’450 patent.

II. BACKGROUND

A. *Real Parties in Interest*

Petitioner and Patent Owner identify themselves as the real parties in interest. Pet. 89; Paper 5, 1 (Patent Owner’s Mandatory Notices).

B. *Related Matters*

The parties advise us that the ’450 patent is involved in district court litigation between the parties, captioned as *Neo Wireless LLC v. Dell Technologies Inc.*, No. 6:21-cv-00024 (W.D. Tex.). Pet. 89; Paper 5, 1. Patent Owner also advises us that the ’450 patent also was involved formerly in two other district court proceedings, captioned *Neo Wireless LLC v. LG Electronics, Inc.*, No. 6:21-cv-00025 (W.D. Tex.) and *Neo Wireless LLC v. Apple Inc.*, No. 6:21-cv-00026 (W.D. Tex.). Paper 5, 1

C. The '450 Patent

The '450 patent, titled “Method and System for Multi-carrier Packet Communication with Reduced Overhead,” issued October 15, 2019, from an application filed August 14, 2017, and claims priority through a series of continuation applications from a provisional application filed September 28, 2005. Ex. 1001, codes (22), (45), (54), (60), (63).¹

According to the '450 patent, bandwidth efficiency is one of the most important system performance factors for wireless communication systems. Ex. 1001, 1:33–34. In order to support the high degree of flexibility needed to accommodate different applications having different sized application payloads and different quality of service (“QoS”) requirements in packet-based data communication, however, wireless communication systems generally must provide a high degree of flexibility. *Id.* at 1:34–40. In wireless systems based on the IEEE 802.16 standard, for example, multiple packet streams are established for each mobile station to support different applications, and each packet stream is mapped into a wireless connection. *Id.* at 1:42–47. Special scheduling messages, DL-MAP and UL-MAP, are utilized to broadcast scheduling decisions to the mobile stations. *Id.* at 1:47–50. According to the '450 patent, the MAP scheduling method defined by the IEEE 802.16 standard involves significant control overhead, amounting altogether to 52 bits, representing as much as 32.5% of overall data communication for application such as voice-over-IP (“VoIP”) and resulting in a relatively low spectral efficiency. *Id.* at 1:51–2:13.

¹ Without conceding the validity of the priority claims, Petitioner identifies September 28, 2005, as the critical date. Pet. 1–2.

With the goal of improving spectral efficiency, the '450 patent describes a system and method for minimizing the control overhead in a multi-carrier wireless communication network by using a “time-frequency resource.” Ex. 1001, 2:13–16, 2:45–47. One or more zones in the time-frequency resource may be dedicated for particular applications, such as VoIP applications. *Id.* at code (57), 2:47–50. By grouping applications of a similar type together within a zone, a reduction can be achieved in the number of bits necessary for mapping a packet stream to a portion of the time-frequency resource. *Id.* at 2:50–54.

Figure 3 of the '450 patent is reproduced below.

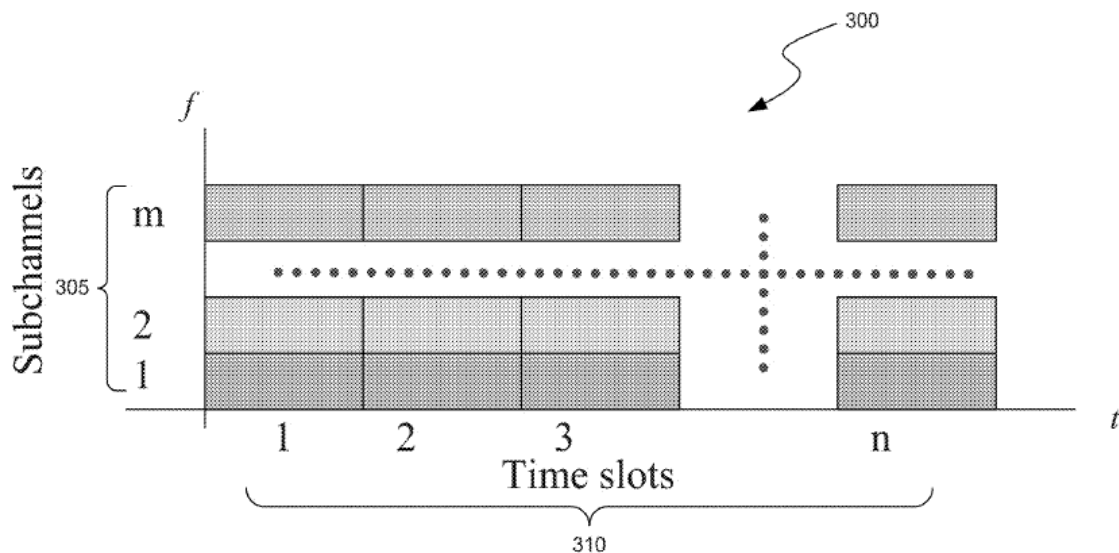


FIG. 3

Figure 3, above, is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, the frequency is divided into two or more subchannels 305, represented as subchannels 1, 2, . . . m; and time is divided into two or more time slots 310, represented as time slots 1, 2, . . . n. *Id.* at 4:18–22.

The '450 patent explains that “[t]he canonical division of the resource by both time and frequency provides a high degree of flexibility and fine granularity for resource sharing between multiple applications or multiple users of the resource.” *Id.* at 4:22–26.

Figure 6 of the '450 patent is reproduced below.

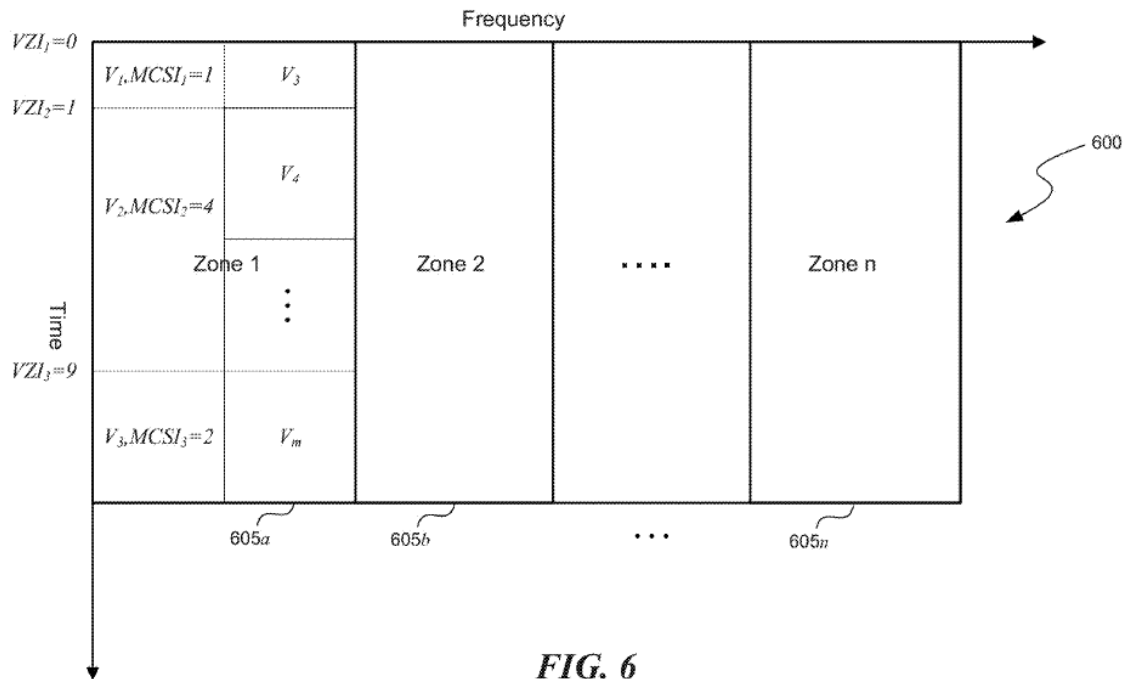


FIG. 6

Figure 6, above, is a block diagram of a frequency-time resource utilized by a wireless communication network. Ex. 1001, 2:32–33, 5:32–34. The '450 patent explains that Figure 6 depicts an alternative way of managing multiple packet streams in order to overcome the inefficiencies associated with the mapping of packet streams in typical wireless systems based on the IEEE 802.16 standard. *Id.* at 5:34–43. In Figure 6, time-frequency resource 600 is divided into zones 605a, 605b, . . . 605n, each of which is associated with a particular type of application (e.g., VoIP, video applications). *Id.* at 5:43–49. By grouping like applications together, the '450 patent explains, the amount of control overhead in MAC headers is

reduced. *Id.* at 5:49–51. More particularly, according to the '450 patent, when applications of a similar type are grouped together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a time-frequency segment can be achieved. *Id.* at 5:54–57. In some embodiments, the identification of the time-frequency segment associated with a particular packet stream can be indicated by the starting time-frequency coordinate and the ending time-frequency coordinate relative to the starting point of the zone. *Id.* at 5:57–61. If the time-frequency resource is divided into two or more zones, the amount of control information necessary to map to a location relative to the starting point of the zone may be significantly less than the amount of information necessary to map to an arbitrary starting and ending coordinate in the entire time-frequency resource. *Id.* at 5:64–6:2.

The '450 patent further explains that within each zone 605*a*, 605*b*, . . . 605*n*, the time-frequency resource may be further divided in accordance with certain rules to accommodate multiple packet streams $V_1, V_2, \dots V_m$. Ex. 1001, 6:3–6. For example, as depicted in Figure 6, zone 605*a* is divided into multiple columns, and the packet streams are arranged from top down in each column and from left to right across the columns. *Id.* at 6:6–9. The width of each column can be a certain number of subcarriers, and each packet stream $V_1, V_2, \dots V_m$ may be associated with an application. *Id.* at 6:9–11. For example, V_1 is the resource segment to be used for the first voice packet stream, V_2 is the resource segment to be used for the second voice packet stream, etc. *Id.* at 6:12–14. Further, according to the '450 patent, when the zones are further subdivided into time-frequency segments in accordance with certain rules, a mapping of packet streams to segments may be achieved using a one-dimensional offset with respect to the origin of

the zone rather than the two-dimensional (i.e., starting time-frequency coordinate and ending time-frequency coordinate relative to the starting point of the zone) mapping method discussed above. *Id.* at 6:22–29.

The '450 patent further describes use of a “basic resource unit,” which is the resource utilized by the highest available modulation coding scheme (“MCS”) associated with a particular packet stream, such that the resources used by other MCSs can be represented as integer multiples of the basic unit. *Id.* at 6:45–52. Once the MCS is selected for each packet stream contained in a particular zone, the offset to a segment representing a particular packet stream may be easily calculated, and the index for any selected packet stream is defined as the sum of all basic resource units associated with each packet stream preceding the selected packet stream, with an optional adjustment depending on the location where the division of the time-frequency resource is started. *Id.* at 7:7–18. The '450 patent explains that using basic resource units as the granularity of a location offset to the packet stream thus reduces the number of bits required to represent its location with the zone. *Id.* at 7:28–30.

D. Illustrative Claims

Claims 1, 7, and 13, reproduced below, are illustrative of the challenged claims:

1. An operating method for a wireless network comprising at least a base station and a mobile station, the wireless network employing a frame structure of multiple frames for transmission, each frame comprising a plurality of time intervals, each time interval comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, and each OFDM symbol containing a plurality of frequency subcarriers, the method comprising:

- assigning an identifier to the mobile station;

transmitting a signal containing information from the base station to the mobile station over a segment of time-frequency resource, the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a time interval, each unit containing a set of frequency subcarriers in a group of OFDM symbols, where $N=2, 4, \text{ or } 8$; and

receiving by the mobile station the transmitted signal; and

recovering by the mobile station the information from the received signal based on the starting time-frequency coordinate and N in conjunction with the identifier assigned to the mobile station.

7. A mobile device in a wireless packet system using a frame structure of multiple frames for transmission, each frame comprising a plurality of time intervals, each time interval comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, and each OFDM symbol containing a plurality of frequency subcarriers, the mobile device configured to:

receive an identifier from a base station in a cell in which the mobile device is operating; and

receive a signal containing information from the base station over a segment of time-frequency resource, the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a time interval, each unit containing a set of frequency subcarriers in a group of OFDM symbols, where $N=2, 4, \text{ or } 8$; and

recover the information from the received signal using the starting time-frequency coordinate and N in conjunction with the received identifier.

13. A base station in a wireless packet system using a frame structure of multiple frames for transmission, each frame comprising a plurality of time intervals, each time interval comprising a plurality of orthogonal frequency division multiplexing (OFDM) symbols, and each OFDM symbol

containing a plurality of frequency subcarriers, the base station configured to:

- provide an identifier to a mobile device in the cell;
- allocate a segment of time-frequency resource for carrying information to the mobile device, the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a time interval, each unit containing a set of frequency subcarriers in a group of OFDM symbols, where N=2, 4, or 8; and
- transmit a signal containing the information to the mobile device in a manner that allows the mobile device to recover the information using the starting time-frequency coordinate and N in conjunction with the provided identifier.

Ex. 1001, 12:47–67, 13:15–33, 14:7–26.

E. Evidence

Petitioner relies on the following prior art references:

Kim et al., US 2005/0157803 A1, published July 21, 2005 (Ex. 1005, “Kim”);

IEEE Std 802.16, 2004 Edition, *IEEE Standard for Local and metropolitan area networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems* (Oct. 1, 2004) (Ex. 1008, “IEEE802.16-2004”).

Petitioner also relies on a Declaration of Zhi Ding, Ph.D. (Ex. 1003).
Patent Owner relies on a Declaration of William P. Alberth, Jr. (Ex. 2001).

F. Asserted Ground

Petitioner asserts that claims 1–18 are unpatentable under 35 U.S.C. § 103(a) over the combination of Kim and IEEE802.16-2004. Pet. 10, 20–66.

III. ANALYSIS

A. Legal Standards

“In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify “with particularity . . . the evidence that supports the grounds for the challenge to each claim”)). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A patent claim is unpatentable for obviousness 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.” 35 U.S.C. § 103(a).²

The ultimate determination of obviousness is a question of law, but that determination is based on underlying factual findings. . . . The underlying factual findings include (1) “the scope and content of the prior art,” (2) “differences between the prior art and the claims at issue,” (3) “the level of ordinary skill in the pertinent art,” and (4) the presence of secondary considerations of nonobviousness such “as commercial success, long felt but unsolved needs, failure of others,” and unexpected results.

² The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103. Because the ’450 patent is alleged to have an effective filing date before the effective date of the applicable AIA amendments, we refer to the pre-AIA version of 35 U.S.C. § 103.

In re Nuvasive, Inc., 842 F.3d 1376, 1381 (Fed. Cir. 2016) (citing *inter alia* *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966)).

“To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.” *In re Magnum Oil Tools Int’l, Ltd.*, 829 F.3d 1364, 1380 (Fed. Cir. 2016). Furthermore, in assessing the prior art, the Board must consider whether a person of ordinary skill would have been motivated to combine the prior art to achieve the claimed invention. *Nuvasive*, 842 F.3d at 1381.

As the Supreme Court has held, “because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known,” “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418–19 (2007).

B. Level of Ordinary Skill in the Art

Petitioner alleges a person having ordinary skill in the art as of the critical date of the ’450 patent “would have had at least a Bachelor’s degree in an academic area emphasizing electrical engineering, computer engineering, or a similar discipline, and at least two years of experience in the field working with, teaching, or researching wireless communication networks.” Pet. 8–9 (citing Ex. 1003 ¶ 32). Petitioner further contends that “[s]uperior education could compensate for a deficiency in work experience, and vice-versa.” *Id.* at 9 (citing Ex. 1003 ¶ 32). Patent Owner does not provide its own assessment regarding the level of skill in the art, or

otherwise dispute Petitioner’s assertion. *See generally* Prelim. Resp.; *see also* Ex. 2001 ¶ 23 (Mr. Alberth stating that he “accept[s] Dr. Ding’s proposed qualifications” of a person of ordinary skill in the art for purposes of his Declaration).

Based on our review of the record at this stage, we find that Petitioner’s proposal is consistent with the level of skill reflected in the prior art references of record. *See Daiichi Sankyo Co. v. Apotex, Inc.*, 501 F.3d 1254, 1256 (Fed. Cir. 2007) (listing the type of problems encountered in the art, prior art solutions to those problems, and the sophistication of the technology as factors that may be considered in determining the level of ordinary skill in the art). *See also Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (explaining that specific findings regarding ordinary skill level are not required “where the prior art itself reflects an appropriate level and a need for testimony is not shown”).

Accordingly, for purposes of this decision, we adopt Petitioner’s definition of the person of ordinary skill in the art.

C. Claim Construction

In an *inter partes* review based on a petition filed on or after November 13, 2018, we interpret claim terms using “the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.” 37 C.F.R. § 42.100(b) (2021).

Petitioner argues that based on the evidence, the “striking similarities between the prior art’s description of the claimed elements and that found within the ’450 Patent specification, and the well-established principle that

‘claim terms need only be construed to the extent necessary to resolve the controversy,’ no formal claim constructions are necessary in this proceeding.” Pet. 8 (quoting *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011)).

Patent Owner responds that the Petition should be denied for failing to take a position on claim construction or to disclose or apply its claim construction positions from the parallel litigation between the parties in the Western District of Texas, in which, Patent Owner contends, Petitioner is asking the court for construction of the claim phrase “the segment having a starting time-frequency coordinate.” Prelim. Resp. 45–53 (citing, e.g., Ex. 2011, 17–20 (Defendants’ Opening Claim Construction Brief, Case No. 6:21-cv-00024); Ex. 2016, 14–15 (Defendants’ Reply Claim Construction Brief, Case No. 6:21-cv-00024)). Patent Owner further points out that, for its part, it contends in co-pending district court litigation that “the claim term ‘the segment having a starting time-frequency coordinate’ is entitled to its plain and ordinary meaning.” *Id.* at 2 (citing Ex. 2014, 25–26 (Plaintiff Neo Wireless LLC’s Responsive Claim Construction Brief, Case No. 6:21-cv-00024)).

On this record, we agree with Petitioner that no terms or phrases in the claims require express construction. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only 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))).

D. Obviousness of Claims 1–18 over Kim and IEEE802.16-2004

Petitioner alleges claims 1–18 would have been obvious over Kim and IEEE802.16-2004, relying in part on Dr. Ding’s Declaration. Pet. 9–83

(citing Ex. 1003 ¶¶ 63–116, 118–132, 134–142, 144–147, 149–182, 188, 189). Patent Owner responds, relying in part on Mr. Alberth’s Declaration. Prelim. Resp. 2–29 (citing Ex. 2001 ¶¶ 25–54). Neither party alleges or presents evidence of secondary considerations of obviousness or nonobviousness.

We begin our analysis with a brief overview of Kim and IEEE802.16-2004, and we then address the parties’ contentions with respect to the challenged claims.

1. Kim

Kim, titled “Modulating and Coding Apparatus and Method in a High-rate Wireless Data Communication System,” describes an apparatus and method for determining a modulation order of packet data to be transmitted through a subcarrier (i.e., an orthogonal frequency carrier used in orthogonal frequency-division multiplexing (“OFDM”), such as in an IEEE 802.16a system) in a transmission apparatus. Ex. 1005, codes (54), (57), ¶¶ 7–11, 14, 26–32. Kim describes a resource allocation scheme in which channel resources are allocated to multiple users. *Id.* ¶ 13.

Figure 12 of Kim is reproduced below.

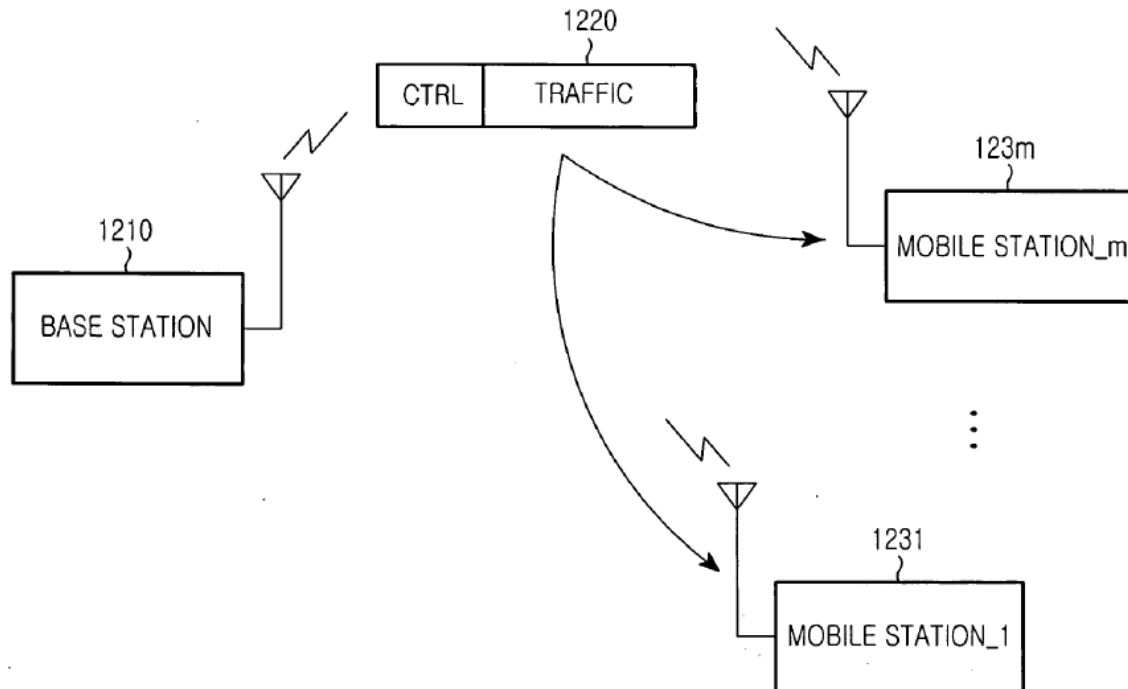


FIG.12

Figure 12, above, is “a block diagram illustrating an operation between a base station and mobile stations in accordance with an embodiment of [Kim’s] invention.” Ex. 1005 ¶ 49. With reference to Figure 12, base station 1210 communicates with mobile stations 1231–123m. *Id.* ¶ 85. According to Kim, base station 1210 transmits data in a “frame” (e.g., frame 1220 in Figure 12), where each frame includes multiple “slots.” *Id.* ¶ 85, Fig. 11. Kim explains that “the amount of channel resources allocated to one user is determined based on the number of subchannels . . . and the number of slots,” where a “subchannel” refers to a set of subcarriers, representing divisions of frequency bandwidth. *Id.* ¶¶ 11, 14, 52–54, 58. Each “channel resource” in Kim’s network includes a single subchannel spanning a single time slot, where “one slot comprises one or more OFDM symbols.” *Id.* ¶¶ 14, 53, 58.

In Kim's system, data is transmitted over one or more channel resources using an adaptive coding and modulation scheme corresponding to a Modulation order Product code Rate, which depends on the number of subchannels allocated to a user's data in a slot. Ex. 1005, code (57), ¶¶ 61–67. Figure 6 of Kim is reproduced below.

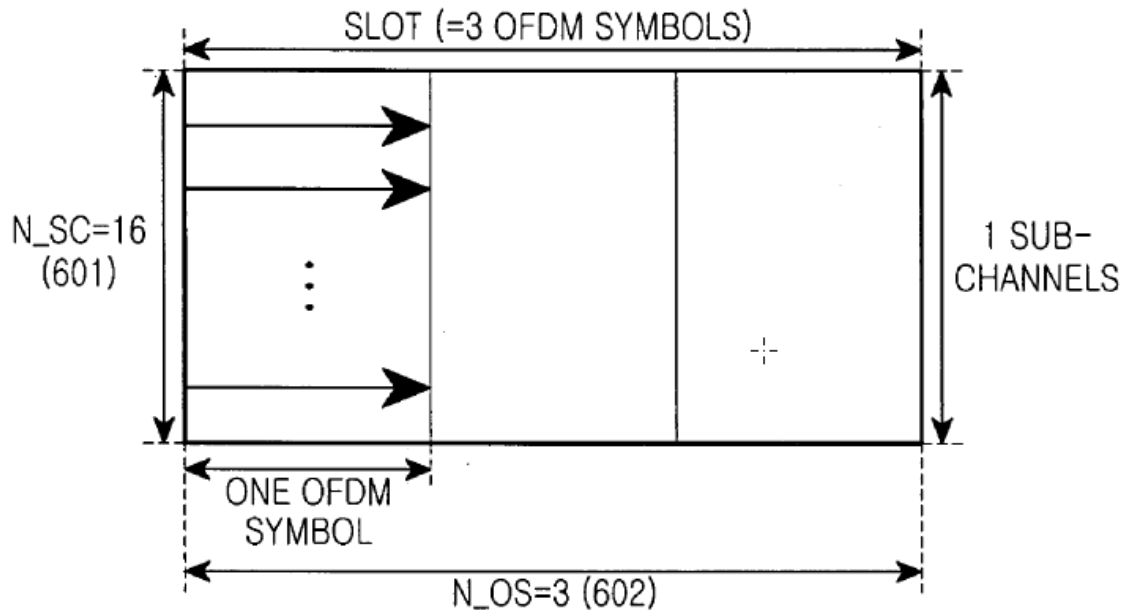


FIG.6

Figure 6, above, is “a diagram illustrating factors used for determining the number of modulation symbols allocated per slot according to an embodiment of [Kim's] invention in an [Orthogonal Frequency Division Multiple Access] system.” Ex. 1005 ¶ 43. In the embodiment shown in Figure 6, “three OFDM symbols are transmitted for one slot,” such that factor “N_OS” 602, representing “the number of OFDM symbols allocated per slot,” is shown to equal 3; whereas factor “N_SC 601,” representing “the number of subcarriers allocated per subchannel and OFDM symbol,” is

shown to equal 16. *Id.* ¶¶ 56, 57, 60. Whereas Figure 6 illustrates N_SC 601 as being equal to 16, Kim explains that “[t]he number of subcarriers allocated per subchannel is variable according to the number of OFDM symbols being transmitted.” *Id.* ¶ 60. According to Kim, “[b]ecause it is assumed in FIG. 6 that N_SC=16 and N_OS=3, the number of modulation symbols allocated to channel resources comprises one subchannel which is 48 (=16×3),” and “[w]hen expressed with the number of subcarriers rather than modulation symbols, N_MS [(i.e., the number of modulation symbols allocated to channel resource comprised of one slot and one subchannel)] represents 48 subcarriers.” *Id.* ¶¶ 58–60.

2. IEEE802.16-2004

IEEE802.16-2004 is a 2004 update to the IEEE 802.16 standard, revising and consolidating IEEE Std 802.16-2001, IEEE Std 802.16a-2003, and IEEE Std 802.16c-2002. Ex. 1008, 4, 37. “Th[e] revised standard specifies the air interface, including the medium access control layer and multiple physical layer specifications, of fixed [broadband wireless access] systems supporting multiple services.” *Id.* at 37.

3. Claim 1

a. Petitioner’s Contentions

Petitioner contends that claim 1 is unpatentable over Kim and IEEE802.16-2004. Pet. 31–64. First, Petitioner argues, to the extent that the preamble of claim 1 is deemed limiting,³ Kim discloses “wireless data communication networks” and an “operation between a base station and mobile stations,” which Petitioner alleges to be consistent with “fixed

³ We need not decide for purposes of this Decision whether the preambles of any of the challenged claims are limiting.

broadband wireless access systems” that include a “base station” communicating with a “subscriber station” in IEEE802.16-2004. *Id.* at 31–32 (citing Ex. 1003 ¶¶ 96–98; Ex. 1005 ¶¶ 5, 84, 86, Fig. 12; Ex. 1008, 1 (title), 43, 47). Thus, Petitioner contends, “the Kim-IEEE802.16-2004 network implements an ‘operating method for a wireless network comprising at least a base station and a mobile station,’” as recited in the preamble of claim 1. *Id.* at 33 (emphasis omitted) (citing Ex. 1003 ¶ 99). Petitioner further contends that Kim’s base station transmits “user data in a frame,” such that “user data is multiplexed every transmission frame,” and that IEEE802.16-2004 provides additional details of a “frame structure,” such that “the Kim-IEEE802.16-2004 network employs ‘a frame structure of multiple frames for transmission,’” as recited in the preamble of claim 1. *Id.* at 33–34 (emphases omitted) (citing Ex. 1003 ¶¶ 100–102; Ex. 1005 ¶¶ 14, 75, Fig. 11; Ex. 1008, 535, 536 (Fig. 218)).

Further, Petitioner contends, each frame in the Kim-IEEE802.16-2004 network consists of multiples time slots, which Petitioner maps to the recited “plurality of time intervals,” and both Kim and IEEE802.16-2004 disclose time slots that span multiple OFDM symbols. Pet. 34–37 (citing Ex. 1003 ¶¶ 103–110; Ex. 1005 ¶¶ 14, 57, Figs. 6, 11; Ex. 1008, 529, 532, 533, 534 (Fig. 216), 536 (Fig. 218)). Lastly with respect to the preamble of claim 1, Petitioner contends that “Kim discloses a ‘number of subcarriers allocated per subchannel and OFDM symbol,” while “IEEE802.16-2004 specifies an OFDMA symbol ‘is made up of subcarriers’ and defines a parameter ‘number of used subcarriers’ (‘N_{used}’) to ‘characterize the OFDMA symbol.’” *Id.* at 39–40 (emphases omitted) (citing Ex. 1003 ¶¶ 111, 112; Ex. 1005 ¶¶ 14, 56, 60, Fig. 2; Ex. 1008, 530, 531). Therefore, Petitioner argues, “the Kim-IEEE802.16-2004 network performs transmission using

OFDM symbols, with ‘each OFDM symbol containing a plurality of frequency subcarriers,’” as recited in the preamble of claim 1. *Id.* at 40 (emphasis omitted) (citing Ex. 1003 ¶ 113).

With respect to claim 1’s recitation of “assigning an identifier to the mobile station,” Petitioner argues that prior art knowledge of that step “is acknowledged in the Background of the ’450 patent itself, which acknowledges that the IEEE 802.16 standard specifies a 16-bit ‘connection ID (CID) . . . to identify the mobile station,’” and that “[s]uch prior art knowledge is further evidenced in Kim and IEEE802.16-2004.” Pet. 41 (emphasis omitted) (quoting Ex. 1001, 1:51–55) (citing Ex. 1003 ¶¶ 114–116; Ex. 1005 ¶¶ 72, 85; Ex. 1008, 43, 536 (Fig. 218), 557 (Table 275)).

With respect to claim 1’s recitation of “transmitting a signal containing information from the base station to the mobile station over a segment of time-frequency resource,” Petitioner argues that “Kim discloses that information for the user is transmitted over ‘channel resources’ consisting of multiple subchannels in frequency (e.g., a frequency resource) and one or more slots in time (e.g., a time resource),” and that “[t]he multiple subchannels in frequency and one or more slots in time collectively comprise a ‘time-frequency resource.’” Pet. 42 (emphases omitted) (citing Ex. 1003 ¶ 118; Ex. 1005 ¶ 58, Fig. 5). Pointing to an example in Kim in which one user is allocated all subchannels of one slot and some subcarriers of a second slot, while a second user is allocated the remaining subcarriers of the second slot, as well as a separate example in which a single user is allocated subchannels in two different slots, Petitioner contends that

[w]ith these assignments in both time (e.g., x-axis time slots) and frequency (e.g., y-axis subcarriers), Kim discloses that user A and user B are allocated “channel resources” (the claimed “segment of time-frequency resource”) consisting of multiple

subchannels in frequency and one or more slots in time, over which information is transmitted to the user.

Id. at 42–44 (emphasis omitted) (citing Ex. 1003 ¶¶ 119–121; Ex. 1005 ¶¶ 58, 61–67, Figs. 5, 7).

Petitioner further contends that “prior art knowledge of transmission of a ‘starting time-frequency coordinate’ for resource allocation is acknowledged in the Background Section of the ’450 patent itself,” which, Petitioner argues, “explains that, according to the existing IEEE 802.16 standard, ‘resource allocation is identified in the time domain scale with a start symbol offset (8 bits) . . . and in the frequency domain scale with a start logical subchannel offset (6 bits).” Pet. 44 (emphases omitted) (citing Ex. 1001, 1:60–66; Ex. 1003 ¶ 123). According to Petitioner, a person of ordinary skill in the art would have found transmission of a resource allocation using a starting time-frequency coordinate as being part of such person’s general knowledge, as evidenced by the Background section of the ’450 patent, Kim, and IEEE802.16-2004 and would have found the same to be an obvious solution and design choice based on such knowledge. *Id.* at 44–48 (citing Ex. 1003 ¶¶ 123–128; Ex. 1005 ¶¶ 73, 75, 81, 82; Ex. 1008, 532 (Fig. 215), 536 (Fig. 218), 558).

With regard to the limitation “the segment comprising N time-frequency resource units within a time interval,” Petitioner contends that “the Kim-IEEE802.16-2004 network allocates resources in multiples of a ‘subchannel’ in frequency and a ‘slot’ in time, which Kim refers to as a ‘channel resource’ and which IEEE802.16-2004 refers to as a ‘minimum possible data allocation unit’ (the claimed ‘resource unit’).” Pet. 48 (emphases omitted) (citing Ex. 1003 ¶ 130; Ex. 1005 ¶¶ 11, 53, 54, 58, Figs. 5, 7, 8; Ex. 1008, 530, 532). Petitioner contends, for example, that

Kim's Figures 6 and 7 depict an example resource allocation that includes a resource unit of one slot in time and one sub-channel in frequency. *Id.* at 48–49 (citing Ex. 1003 ¶ 130; Ex. 1005, Figs. 6, 7). Petitioner further contends, “Figure 5 . . . [of] Kim shows an example where ‘user A’ is allocated ‘a different number of subchannels for each slot’ . . . and user B ‘has the same number of subchannels for every slot,’” while “Figure 7 . . . [of] Kim shows an example where ‘user A transmits an OFDM symbol through 12 subchannels in a first slot SLOT(0) and an OFDM symbol through 8 subchannels in a second slot SLOT(1).”” *Id.* at 49–51 (emphasis omitted) (citing Ex. 1003 ¶¶ 131, 132; Ex. 1005 ¶¶ 62, 63, Figs. 5, 7). According to Petitioner, “because Kim discloses allocating resources (the claimed ‘segment’) that include an integer number (‘N’) of subchannels per slot (the claimed ‘resource units’), a [person of ordinary skill in the art] would have understood that the Kim-IEEE802.16-2004 network allocates a resource segment ‘comprising N time-frequency resource units within a time interval.”” *Id.* at 51 (emphasis omitted). Petitioner asserts that this is consistent with the ’450 patent, insofar as “neither the language of [the recited claim limitation] nor the written description of the ’450 patent requires that the claimed ‘segment’ must consist of **only** ‘N time-frequency resource units within a time interval,”” but instead use open-ended “comprising” claim language. *Id.* (emphasis omitted) (citing Ex. 1003 ¶ 134). Moreover, based on Kim’s description of Figure 7 as showing “user A transmits an OFDM symbol through 12 subchannels in a first slot SLOT(0) and an OFDM symbol through 8 subchannels in a second slot SLOT(1),” Petitioner contends that “the Kim-IEEE802.16-2004 network discloses allocating 8 subchannels within a time slot,” thereby satisfying the

claim language “where $N=2, 4, \text{ or } 8$.” *Id.* at 54–55 (emphases omitted) (citing Ex. 1003 ¶¶ 140–142; Ex. 1005 ¶ 63, Fig. 7).

With respect to the step of “receiving by the mobile station the transmitted signal,” Petitioner contends that Kim discloses operations performed by a “receiver” of a mobile station, citing disclosure in Kim that “[e]ach mobile station, or receiver, should first determine whether a signal transmitted by a base station is a signal transmitted to the mobile station itself” and “[t]he mobile station performs demodulation and decoding only on the signal transmitted to the mobile station itself, thereby restoring its user data.” Pet. 56–57 (alterations in original) (emphases omitted) (quoting Ex. 1005 ¶ 72) (citing Ex. 1003 ¶¶ 145–146; Ex. 1005 ¶¶ 71, 73, 78–83, Fig. 10).

Finally, with respect to the step of “recovering by the mobile station the information from the received signal based on the starting time-frequency coordinate and N in conjunction with the identifier assigned to the mobile station,” Petitioner contends that the IEEE802.16-2004 DL-MAP control message includes an “OFDMA symbol offset” and “subchannel offset” that collectively represent the claimed “starting time-frequency” and that the Kim-IEEE802.16-2004 combination network would utilize such symbol offset and subchannel offset to implement Kim’s “location information.” Pet. 57–58 (emphasis omitted) (citing Ex. 1003 ¶ 149; Ex. 1005 ¶¶ 73, 75, 81, 82; Ex. 1008, 557 (Table 275), 558). Petitioner further contends that “Kim discloses that the ‘control message’ in each frame also indicates ‘the number of subchannels’ allocated for the user data,” permitting Kim’s mobile station to “perform data demodulation and decoding” of user data, consistent with the specification in IEEE802.16-2004 that the DL-MAP message in each frame includes a parameter that

indicates the “number of subchannels with subsequent indexes, used to carry the burst.” *Id.* at 58 (emphasis omitted) (citing Ex. 1003 ¶ 150; Ex. 1005 ¶¶ 75, 76, 81, 82; Ex. 1008, 557 (Table 275), 558); *see also id.* at 58–60 (citing Ex. 1003 ¶¶ 151–153; Ex. 1005 ¶¶ 18, 58, 63, 81, 82, Fig. 10). Thus, Petitioner contends, “in the Kim-IEEE802.16-2004 combination, the mobile station recovers the information from the signal using both the starting time-frequency coordinate (e.g., the ‘OFDMA Symbol offset’ and ‘subchannel offset’ (as specified in IEEE802.16-2004)) and N (e.g., the number of subchannels (as specified by Kim)).” *Id.* at 60 (emphases omitted) (citing Ex. 1003 ¶ 154). Still further, Petitioner contends, “[r]ecovery of information in the Kim-IEEE802.16-2004 network occurs in conjunction with the identifier in at least two ways.” *Id.* at 61. First, Petitioner asserts, the identifier is used to determine whether data received in a frame is intended for the mobile station; and second, decryption of the data using a security association “identifier” is required for recovering information. *Id.* at 61–64 (citing Ex. 1003 ¶¶ 156–158, Ex. 1005 ¶¶ 72, 83; Ex. 1008, 46, 67, 71, 72, 73, 307, 308, 733).

b. Patent Owner’s Contentions

In response to Petitioner’s contentions, Patent Owner argues that the combination of Kim and IEEE802.16-2004 fails to teach a “segment of time-frequency resource,” “the segment having a starting time-frequency coordinate” and “comprising N time-frequency resource units within a time interval . . . where N=2, 4, or 8,” as recited in claim 1. Prelim. Resp. 11–29. Rather than teaching “a starting time-frequency coordinate,” Patent Owner contends, the Kim-IEEE802.16-2004 combination teaches only separate starting time and frequency coordinates, e.g., “a start symbol offset” in the

time dimension plus “a start logical subchannel offset” in the frequency dimension. *Id.* at 12–13.

Patent Owner argues that, as explained in the Background section of the ’450 patent, the IEEE 802.16 standard provides for multiple packet streams to be established for each mobile station to support different applications. Prelim. Resp. 3 (citing Ex. 1001, 1:42–45). Quoting the ’450 patent, Patent Owner argues, “[d]ue to the fact that different applications have different resource requirements, the allocated resource region is irregular from connection to connection,” and “[t]o accommodate this ‘irregular[ity]’ under the IEEE 802.16 standard, four parameters are used to allocate resources in the two independent dimensions of frequency and time.” *Id.* at 3–4 (first and third alterations in original) (emphasis omitted) (quoting Ex. 1001, 1:66–2:2) (citing Ex. 2001 ¶ 25). In particular, Patent Owner quotes, “[r]esource allocation is identified in the time domain scale with a start symbol offset (8 bits) and a symbol length (7 bits) and in the frequency domain scale with a start logical subchannel offset (6 bits) and a number of allocated subchannels (6 bits).” *Id.* at 4 (emphases omitted) (quoting Ex. 1001, 1:62–66). “Instead of spreading the various applications carried in packet streams throughout the available resource region[] per the IEEE 802.16 standard,” Patent Owner argues, “the inventors [of the ’450 patent] took a different approach: they ‘group[ed] like applications together,’” as illustrated in Figure 6 of the ’450 patent, “which in turn allowed the inventors to map the time-frequency resource by one-dimensional ‘time-frequency resource units’” and thereby reduce control overhead. *Id.* at 4–6 (third alteration in original) (quoting Ex. 1001, 5:43–53) (citing Ex. 1001, 2:48–49, 5:46–49, Fig. 6; Ex. 2001 ¶¶ 27–29).

According to Patent Owner, with support both from the '450 patent and from Mr. Alberth's Declaration,

[b]y effectively transforming the two independent dimensions of time and frequency into one time-frequency dimension measured by a basic resource unit having a fixed number of symbols in a fixed number of subcarriers that fits the resource requirements of a given application, the inventors achieved an advantageous reduction in the amount of data required to allocate resources.

Prelim. Resp. 8 (citing Ex. 1001, 7:28–30; Ex. 2001 ¶ 36). Moreover, Patent Owner argues, “[a] time-frequency resource unit is not an arbitrary combination of time and frequency units and is instead designed according to the application requirements of the application that is being grouped.” *Id.* at 9 (citing Ex. 2001 ¶ 38). In contrast, “no ‘time-frequency coordinate’ or ‘time-frequency resource unit’ is shown to be taught or suggested by the combination of Kim and IEEE802.16-2004.” *Id.* at 10. Rather,

[j]ust as in the IEEE 802.16 standard expressly distinguished in the background of the patent, these two references merely describe time units (symbols) and frequency units (subchannels) and suggest no “time-frequency” resource unit that transforms the time and frequency units into one combined dimension as disclosed and claimed by the '450 patent.

Id. Patent Owner further contends:

[B]y transforming time and frequency to a single dimension—time-frequency—measured in time-frequency resource units, the invention can use two parameters to map a packet stream: the starting time-frequency coordinate and N, the number of time-frequency resource units. Ex. 1001[,] 6:3–21, 7:7–39. Because there is no time-frequency dimension taught in Kim or IEEE802.16-2004, the combination lacks both innovative parameters. Instead, the combination of Kim and IEEE802.16-2004 uses an independent time dimension and an independent frequency dimension and requires four parameters to map a

packet stream, just like the prior art distinguished in the Background of the '450 patent.

Id. (citing Ex. 2001 ¶ 39).

c. Discussion

Having reviewed the parties' filings and evidence, we conclude that Petitioner has not shown a reasonable likelihood of prevailing in showing that claim 1 is unpatentable over the combination of Kim and IEEE802.16-2004. In particular, we agree with Patent Owner that the asserted combination fails to teach or suggest the recited "segment of time-frequency resource . . . having a starting time-frequency coordinate and . . . comprising N time-frequency resource units." Instead, as Patent Owner argues, we find in Kim and IEEE802.16-2004 teachings only of independent time and frequency coordinates and independent time and frequency units akin to those described in the Background section of the '450 patent and subsequently distinguished in the patent's Detailed Description section. We find no acknowledgement in Kim or IEEE802.16-2004 of the tradeoff described in the '450 patent between the flexibility afforded by the IEEE 802.16 standard to accommodate different applications having different size data payloads and different QoS requirements, on the one hand, and bandwidth efficiency and minimization of control overhead, on the other hand (*see, e.g.*, Ex. 1001, 1:33–52), let alone any teaching or suggestion of use of a combined time-frequency resource.

We acknowledge Petitioner's arguments that, for example, a person of ordinary skill in the art "would have understood that the Kim-IEEE802.16-2004 network transmits 'a signal containing information from the base station to the mobile station over a segment of time-frequency resource'" (Pet. 44 (emphasis omitted)), "would have found transmission of a resource

allocation using a starting time-frequency coordinate as being part of [such person's] general knowledge . . . and would have found transmission of a starting time-frequency coordinate to have been an obvious solution and design choice" (*id.* at 44–45), and "would have understood that, in the Kim-IEEE802.16-2004 network, a resource segment is transmitted with a 'starting time-frequency coordinate'" (*id.* at 47–48 (emphasis omitted)). Nevertheless, we find that such contentions are premised on Petitioner and its declarant's conclusory conflation of separate frequency subchannels and time slots as the recited singular "time-frequency resource" and separate starting time and frequency coordinates as the recited singular "starting time-frequency coordinate." *See, e.g., id.* at 42 ("The multiple subchannels in frequency and one or more slots in time collectively comprise a '**time-frequency resource**.'" (citing Ex. 1003 ¶ 118)), 44 (arguing that a person of ordinary skill in the art "would have understood prior art knowledge of transmission of a resource allocation that is identified in time by a **start symbol offset**, and is identified in frequency by a **start logical subchannel offset** (collectively, the claimed '**starting time-frequency coordinate**')") (citing Ex. 1003 ¶ 123)), 47 ("In the Kim-IEEE802.16-2004 network, a data region (the claimed 'segment') . . . is transmitted with (i) a '**starting time . . . coordinate**' . . . and (ii) a '**starting . . . frequency coordinate**' . . . (collectively, the claimed '**starting time-frequency coordinate**').") (citing Ex. 1003 ¶ 127)).⁴

⁴ Notably, Petitioner's declarant Dr. Ding's testimony with respect to the disputed claim limitations is substantively identical to the argument in the Petition and provides no additional basis to support Petitioner's conflation of separate time and frequency resources and coordinates as the recited time-frequency claim elements. *Compare, e.g.,* Ex. 1003 ¶¶ 118–144, *with* Pet. 42–55; *see* 37 C.F.R. § 42.65 ("Expert testimony that does not disclose

Therefore, based on the current record, we determine that Petitioner has not shown a reasonable likelihood of demonstrating that independent claim 1 would have been obvious over Kim and IEEE802.16-2004.

4. Claims 2–6

We have considered Petitioner’s arguments and evidence for claims 2–6, which depend directly or indirectly from claim 1. Pet. 65–78. Petitioner contentions for those claims do not remedy the deficiencies discussed in Section III.D.3 above with respect to claim 1. Accordingly, for the reasons discussed with respect to claim 1, we conclude that Petitioner has not demonstrated a reasonable likelihood that it would prevail in showing that claims 2–6 are unpatentable under 35 U.S.C. § 103(a) as obvious over Kim and IEEE802.16-2004.

5. Claims 7–18

Like claim 1, independent claims 7 and 13 each recite, *inter alia*, “a segment of time-frequency resource . . . having a starting time-frequency coordinate and . . . comprising N time-frequency resource units within a time interval, . . . where N=2, 4, or 8.” *See supra* Section II.D. We have considered Petitioner’s arguments and evidence for independent claims 7 and 13 and claims 8–12 and 14–18 dependent therefrom. Pet. 78–83. Petitioner contentions for those claims do not remedy the deficiencies discussed in Section III.D.3 above with respect to claim 1. Accordingly, for the reasons discussed with respect to claim 1, we conclude that Petitioner has not demonstrated a reasonable likelihood that it would prevail in

the underlying facts or data on which the opinion is based is entitled to little or no weight.”).

showing that claims 7–18 are unpatentable under 35 U.S.C. § 103(a) as obvious over Kim and IEEE802.16-2004.

6. Conclusion

Petitioner has not shown a reasonable likelihood that any of claims 1–18 would have been obvious over IEEE802.16-2004 and Kim.

E. Discretionary Denial Under 35 U.S.C. §§ 314(a) and 325(d)

Patent Owner contends the Board should exercise its discretion to deny institution under 35 U.S.C. § 314(a) in view of the parallel district court litigation between the parties and in light of the discretionary factors set forth in *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential). Prelim. Resp. 34–45. Patent Owner also contends the Board should exercise its discretion to deny institution under 35 U.S.C. § 325(d). *Id.* at 29–34.

Because we deny institution of *inter partes* review based on the merits of the Petition in this case, we need not and do not address these other contentions of Patent Owner.

IV. CONCLUSION

For the foregoing reasons, Petitioner has not demonstrated a reasonable likelihood of prevailing with respect to any of claims 1–18 of the ’450 patent on the asserted ground, and we deny institution of *inter partes* review.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that the Petition is *denied*, and no trial is instituted.

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Patent 10,447,450 B2

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