

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FORD MOTOR COMPANY,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2023-00763
Patent 10,447,450 B2

Before KRISTEN L. DROESCH, HYUN J. JUNG, and
STEPHEN E. BELISLE, *Administrative Patent Judges*.

DROESCH, *Administrative Patent Judge*.

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

I. INTRODUCTION

A. Background

Ford Motor Company (“Petitioner”) filed a Petition requesting *inter partes* review of claims 7 and 11 of U.S. Patent No. 10,447,450 B2 (Ex. 1001, “the ’450 Patent”). Paper 1 (“Pet.”). Neo Wireless LLC (“Patent Owner”) filed a Preliminary Response. Paper 12 (“Prelim. Resp.”).

On November 9, 2023, we denied institution under § 314(a), after considering the factors set forth in *General Plastic Industrial Co. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19 (PTAB Sept. 6, 2017) (precedential only as to Section II.B.4.i) (“*General Plastic*”), and expanded upon in *Valve Corp. v. Electronic Scripting Products, Inc.*, IPR2019-00062, Paper 11 (PTAB Apr. 2, 2019) (precedential) (“*Valve*”). Paper 17 (“Decision”). Petitioner requested Director Review of the Decision, which was granted. Papers 18, 19. On March 22, 2024, the Director issued a Decision Vacating the Decision as an improper extension of the “significant relationship,” as set forth in *General Plastic* and *Valve*, and remanding to the Board to issue a decision on institution that addresses the merits of the Petition. Paper 28 (“Director’s Decision”).

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).

For the reasons provided below and based on the record before us, we determine that Petitioner establishes a reasonable likelihood that it would prevail in showing at least one of the challenged claims is unpatentable.

B. Real Parties in-Interest

Petitioner and Patent Owner identify themselves as the real parties in-interest. Pet. 63; Paper 6, 1.

C. Related Matters

The parties indicate that the '450 Patent was or is the subject of IPR2021-01486 (institution denied), IPR2022-01567 ("Volkswagen IPR") (pending final written decision) and IPR2023-00793 (joined to Volkswagen IPR). See Pet. 6–7; Paper 6, 1.

Patent Owner indicates the '450 Patent is currently involved in the following district court proceedings between the parties:

In Re: Neo Wireless, LLC Patent Litigation, No. 2-22-md-03034 (E.D. Mich.)

Neo Wireless, LLC v. Ford Motor Co., No. 2-22-cv-11402 (E.D. Mich.)

Neo Wireless LLC v. American Honda Motor Co., Inc. et al., No. 2-22-cv-11403 (E.D. Mich.)

Neo Wireless, LLC v. Volkswagen Group of America, Inc. et al., No. 2-22-cv-11404 (E.D. Mich.)

Neo Wireless, LLC v. Nissan North America Inc et al., No. 2-22-cv-11405 (E.D. Mich.)

Neo Wireless LLC v. Toyota Motor North America, Inc. et al., No. 2-22-cv-11406 (E.D. Mich.)

Neo Wireless, LLC v. General Motors Co. et al., No. 2-22-cv-11407 (E.D. Mich.)

Neo Wireless, LLC v. Tesla Inc., No. 2-22-cv-11408 (E.D. Mich.)

Neo Wireless, LLC v. Mercedes-Benz USA, LLC, No. 2-22-cv-11769 (E.D. Mich.)

Neo Wireless v. FCA US LLC, No. 2-22-cv-11770 (E.D. Mich.)

See Paper 6, 1–2.

Patent Owner also indicates the '450 Patent was involved in fourteen other district court proceedings. *See* Paper 6, 2–4. In addition, Petitioner identifies a dozen U.S. patent applications and issued patents “related to the '450 Patent.” *See* Pet. 63.

D. The '450 Patent

The '450 Patent, titled “Method and System for Multi-Carrier Packet Communication with Reduced Overhead,” issued on October 15, 2019, from an application filed August 14, 2017, and claims the benefit of an earlier effective filing date through a series of continuation applications to a provisional application filed on September 28, 2005. Ex. 1001, codes (22), (45), (54), (60), (63).

According to the '450 Patent, “[b]andwidth 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 “at the medium access control (MAC) layer, 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 applications such as voice-over-IP (VoIP) and resulting in a relatively low spectral efficiency. *Id.* at 1:51–2:13.

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.

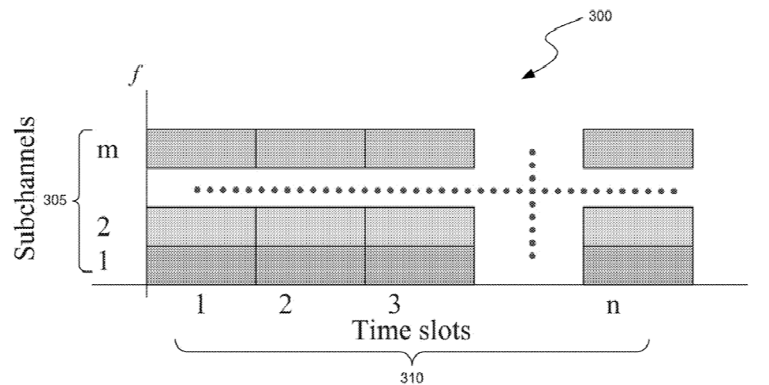


Figure 3 is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, “[t]he frequency is divided into two or more subchannels 305, represented as subchannels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

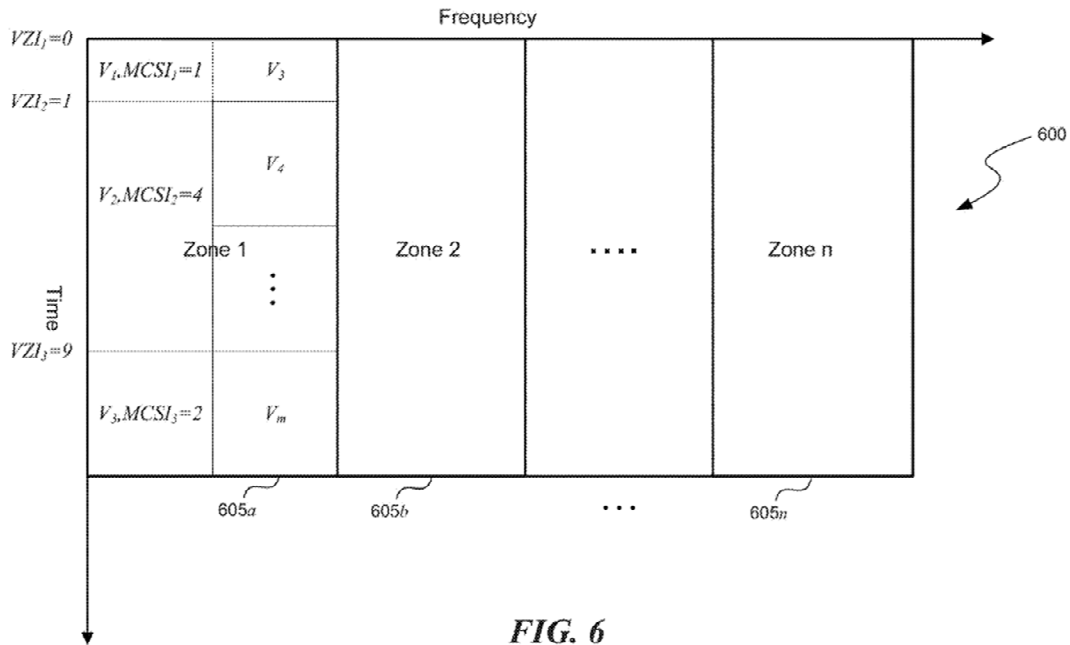


FIG. 6

Figure 6 is a block diagram of a frequency-time resource utilized by a wireless communication network. Ex. 1001, 2:32–33, 5:32–34. 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. “[B]y grouping like applications together[,] the amount of control overhead in MAC headers is reduced.” *Id.* at 5:49–51. More particularly, according to the ’450 Patent, “[w]hen 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 “[w]ithin 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. Ex. 1001, 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 “[u]sing basic resource units as the granularity of a location offset to the packet stream reduces the number of bits required to represent its location with the zone.” *Id.* at 7:28–30.

E. Challenged Claims

Claim 7 is independent and claim 11 depends therefrom. Claim 7 is representative and is reproduced below:

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, or 8; and

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

Ex. 1001, 13:15–33.

F. Asserted Patentability Challenge and Asserted Prior Art

Petitioner asserts that claims 7 and 11 would have been unpatentable based on the following ground and prior art (Pet. 1–2, 9–49):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
7, 11	103 ¹	Park ² , IEEE 802.16-2004 ³

Petitioner also relies on a Declaration of Todor Cooklev (Ex. 1003).

Patent Owner relies on a Declaration of William P. Alberth, Jr. (Ex. 2001).

¹ The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011), amended 35 U.S.C. §§ 102 and 103 effective March 16, 2013. Because the '450 Patent claims the benefit of an earlier effective filing date prior to the effective date of the applicable AIA amendment, we refer to the pre-AIA versions of § 103.

² US 2006/0039274 A1, published Feb. 23, 2006 (Ex. 1005).

³ *IEEE Standard for Local and metropolitan area networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems* (Oct. 1, 2004) (Ex. 1006).

II. ANALYSIS

A. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) if in evidence, so-called secondary considerations. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).⁴

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person having ordinary skill in the art as of the critical date of the ’450 patent “would have a bachelor’s degree in electrical engineering, computer engineering, computer science, or an equivalent field, or an advanced degree in those fields, as well as at least 3–5 years of academic or industry experience in mobile wireless communications, or comparable industry experience.” Pet. 7–8 (citing Ex. 1003 ¶¶ 36–38). Petitioner further contends that “[s]uperior education could compensate for a deficiency in work experience, and vice-versa.” Pet. 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.

⁴ At this stage of the proceeding, the parties do not present evidence or arguments regarding secondary considerations.

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

We interpret claim terms using “the same claim construction standard that would be used to construe the claims in a civil action under 35 U.S.C. 282(b).” 37 C.F.R. § 42.100(b). Under the principles set forth by our reviewing court, the “words of a claim ‘are generally given their ordinary and customary meaning,’” as would be understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

Petitioner argues that “[t]he prior art relied on in this Petition discloses the subject matter of the challenged claims under any reasonable construction, including their plain meaning.” Pet. 8. Petitioner also asserts, however, “the parties agreed on several claim constructions in district court” including:

- Preamble – the preamble is limiting
- “configured to” – “designed to”
- “time-frequency coordinate” – “one-dimensional time frequency coordinate”
- “wherein modular coding is applied...” – “wherein a modular coding scheme is applied...”⁵

Pet. 8–9 (citing Ex. 1011, 9, 12–13, 15) (emphasis omitted).

Petitioner asserts the parties disagreed, in district court, as to a construction for the claimed “time-frequency resource unit.” Pet. 9.

Petitioner explains and proposes:

In district court, [Patent Owner] proposes the plain meaning, arguing that incorporating any further limitation would be improper. Ex. 1011 (Joint Claim Construction Statement) at 017; Ex. 1019 ([Patent Owner] Opening Claim Construction Brief) at 21–24. Solely for the purposes of this IPR, [Petitioner] adopts [Patent Owner]’s plain meaning construction. [Patent Owner] cannot argue for a narrow construction to avoid the prior art, and then rely on a broader one for infringement.

In the alternative, [Petitioner] adopts the narrower construction the [joint defense group] proposed in district court, namely “a combination of time and frequency units *designed according to the application requirements of the application that is being grouped.*”

Pet. 9 (quoting Ex. 1011, 17).

⁵ These are original ellipses. We use, herein, “...” to represent original ellipses (i.e., quoting a party’s statement that includes ellipses). We use, herein, “. . .” to represent our insertion of ellipses to replace text (i.e., added ellipses).

Patent Owner does not provide its own claim constructions or otherwise dispute Petitioner’s assertions. *See generally* Prelim. Resp.; *id.* at 28 n.1 (agreeing that preamble is limiting)

On this record, we agree with Petitioner that no terms or phrases in the claims require express construction. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) (“The Board is required to construe ‘only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. Challenge to Claims 7 and 11 over Park and IEEE 802.16-2004

Petitioner asserts that claims 7 and 11 are unpatentable as obvious over Park and IEEE 802.16-2004. *See generally* Pet. We begin our analysis with a brief overview of Park and IEEE 802.16-2004, followed by an analysis of the parties’ contentions addressing the challenged claims.

1. Overview of Park (Ex. 1005)

Park is titled “Method for Discretely Indicating Resource Allocation Information and a Method for Reducing Load When Indicating a Resource Allocation Information.” Ex. 1005, code (54). Park “relates to an Orthogonal Frequency Division Multiple Access (OFDMA) wireless communication system” and, “[m]ore particularly, . . . [to] indicating resource allocation information in an OFDMA wireless communication system.” *Id.* ¶ 3.

Figure 1 of Park is reproduced below.

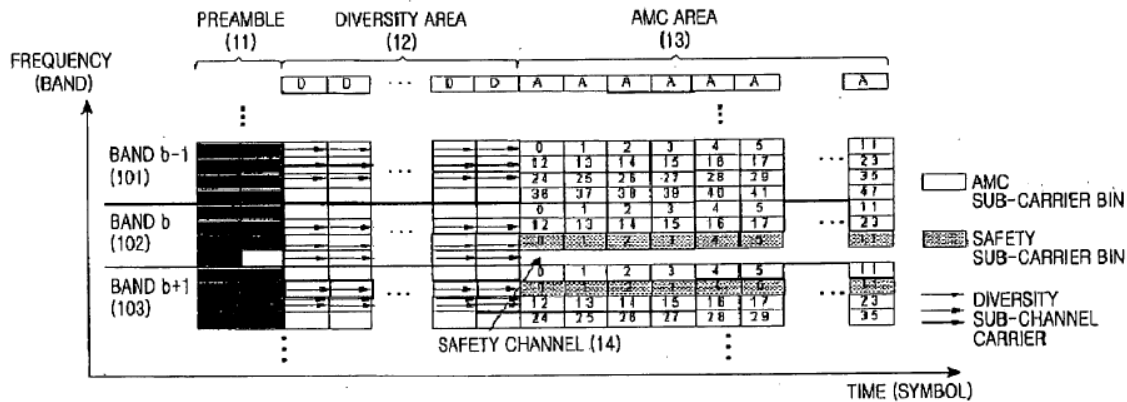


Figure 1 shows a frequency-time “view [of] a frame structure of a . . . Wireless Broadband (Wibro) system or an IEEE 802.16 system applied to an OFDMA system.” Ex. 1005 ¶ 7.

According to the OFDMA scheme, resources are allocated to subscribers through a plurality of sub-carriers (for example, 512 sub-carriers or 1024 sub-carriers) provided in a frequency domain and a plurality of time slots (for example, 20 to 30 time slots) provided in a time domain to transmit upstream and downstream data.

Id. ¶ 6. “As shown in FIG. 1, total frequency bands are divided into a plurality of bands 101, 102 and 103.” *Id.* ¶ 8. “[T]he time axis (symbols) is divided into a preamble area 11, a diversity area 12 and an adaptive modulation and coding (AMC) area 13.” *Id.* ¶ 10.

Figure 2 (composed of Figures 2A–C) is reproduced below.

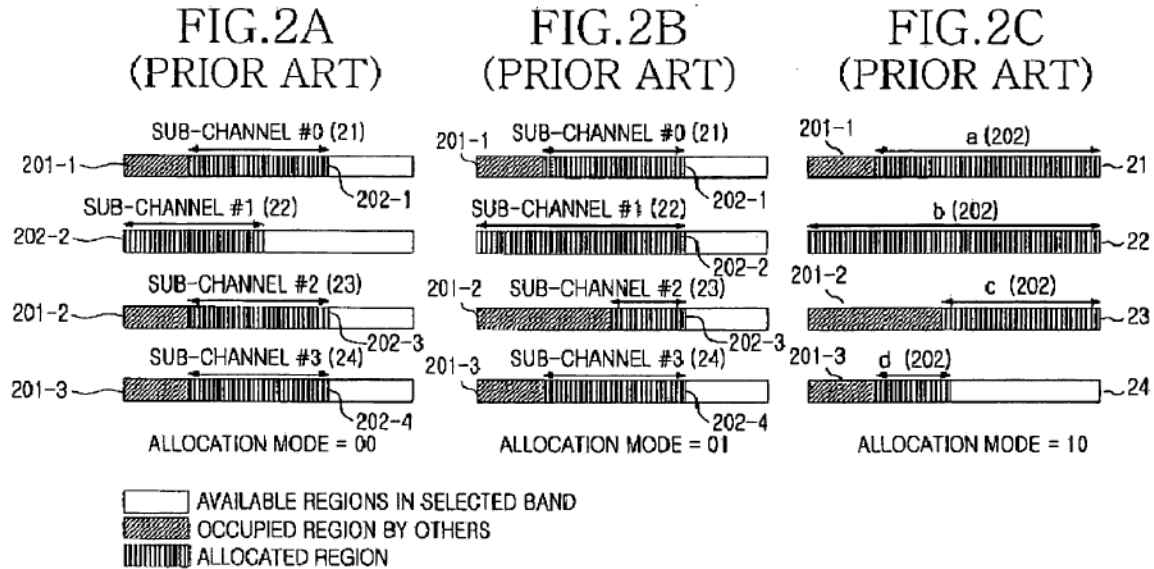


Figure 2 shows a frequency-time “view [of] sub-channel allocation modes defined in Table 95(/101) of the IEEE 802.16-2004 standard.” Ex. 1005

¶ 17. “According to the sub-channel allocation modes defined in Table 95(/101) of IEEE 802.16-2004, . . . the ‘Allocation Mode’ is assigned after selecting the Bands, thereby indicating resource allocation information.” *Id.* ¶ 18. “The Allocation Mode consists of 2 bits and defines three modes.” *Id.* ¶ 19. The modes are:

set to binary “00” when the same numbers of sub-channels are allocated in the selected Bands[;] set to binary ‘01’ when different numbers of sub-channels are allocated in selected Bands[;] and set to binary ‘10’ when the total number of the sub-channels allocated in the selected Bands is defined by the “Nep code” and “Nsch code”.

Id. ¶ 20.

As shown above in Figures 2A–C, “the Bands have sub-channel groups 21, 22, 23 and 24 including regions 201-1, 201-2 and 201-3 occupied by others.” Ex. 1005 ¶ 22. “FIG. 2A[] represent[s] the Allocation Mode

‘00’ . . . [whereby] the subchannel groups 21, 22, 23 and 24 have the same-sized allocated regions 202-1, 202-2, 202-3 and 202-4 . . . adjacent to the regions 201-1, 201-2 and 201-3.” *Id.* ¶¶ 22–23. “FIG. 2B[] represent[s] the Allocation Mode ‘01’ . . . [whereby] the subchannel groups 21, 22, 23 and 24 have the different-sized allocated regions 202-1, 202-2, 202-3 and 202-4 . . . adjacent to the regions 201-1, 201-2 and 201-3.” *Id.* ¶¶ 24–25. “FIG. 2C[] represent[s] the Allocation Mode ‘10’ . . . [whereby] the subchannel groups 21, 22, 23 and 24 have allocated regions a, b, c and d . . . determined by the ‘Nep code’ and ‘Nsch code’[; t]hat is, the allocated regions a, b, c and are formed while sequentially filling the available regions of the sub-channel groups 21, 22, 23 and 24.” *Id.* ¶¶ 26–27.

“[A]ccording to the above method for indicating resource allocation information, present resource allocation information may indicate a position sequenced to previous resource allocation information, so that it is impossible to ensure an interval when allocating resources to various subscribers, thereby degrading flexibility of resource allocation.”

Ex. 1005 ¶ 28. “In addition, since the position sequenced to previous resource allocation information is indicated, the present resource allocation information may depend on the previous resource allocation information, so that it is necessary to indicate the resource allocation information after fully recognizing the previous resource allocation information.” *Id.* ¶ 29.

Park’s “invention has been made to solve the above-mentioned problems.” Ex. 1005 ¶ 30. “[A]n object of the present invention is to provide a method for discretely indicating resource allocation information regardless of previous resource allocation information in an OFDMA wireless communication system.” *Id.*

Figure 3 (composed of Figures 3A–D) is reproduced below.

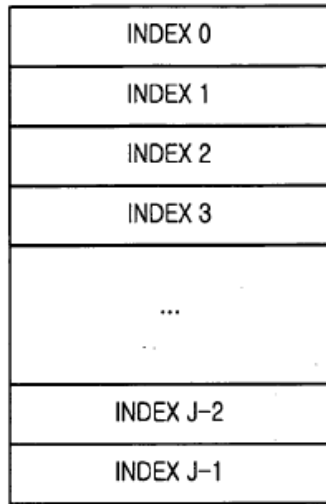


FIG.3A

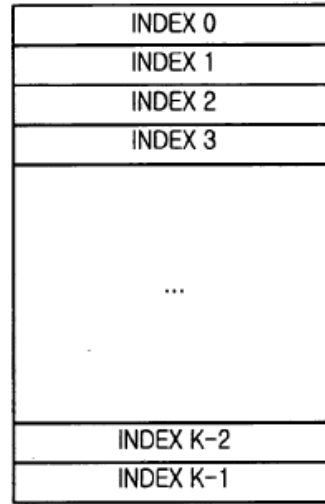


FIG.3B

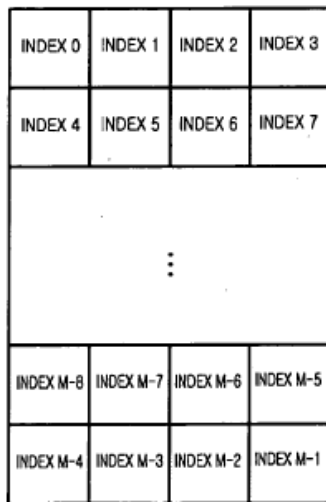


FIG.3C

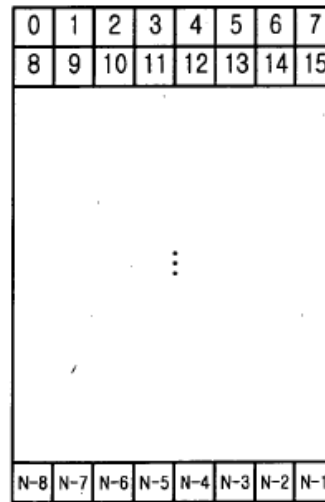


FIG.3D

Figure 3 shows a frequency-time “view [of] allocation units having mutually different sizes and shapes, . . . allocated to the total resource region[,] and indexed according to an embodiment of the present invention.”

Ex. 1005 ¶ 45. “The allocation units shown in FIGS. 3A to 3D . . . are represented as a, b, c, and d, respectively.” *Id.* ¶ 49. “[A]n index value of

the allocation unit a is in a range of $a(0)$ to $a(J-1)[.]$ ” *Id.* “[A]n index value of the allocation unit b is in a range of $b(0)$ to $b(K-1)[.]$ ” *Id.* “[A]n index value of the allocation unit c is in a range of $c(0)$ to $c(M-1)[.]$ ” *Id.* “[A]n index value of the allocation unit d is in a range of $d(0)$ to $d(N-1)$.” *Id.*

“The resource allocation regions shown in FIG. 4,” addressed next, “can be simply represented by using the allocation unit as shown in FIG. 3.”

Id. ¶ 52.

Figure 4 is reproduced below.

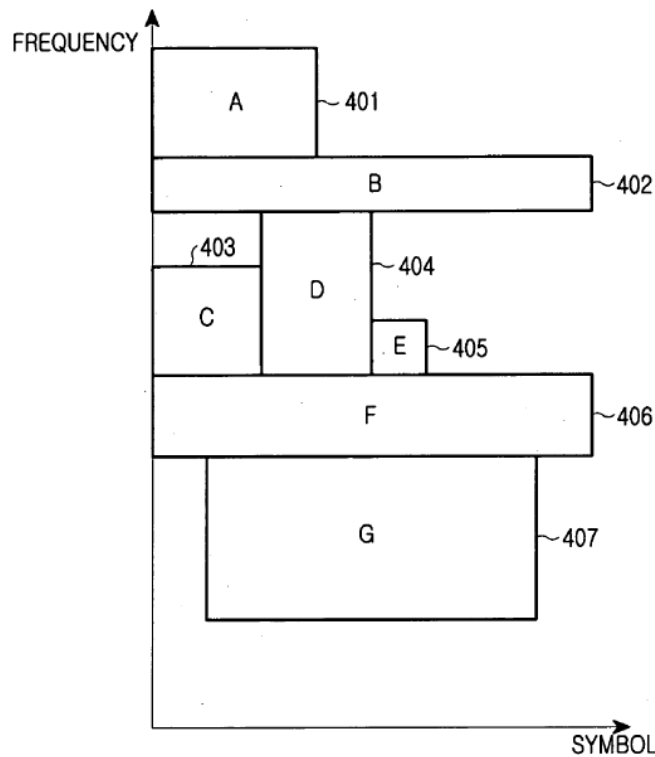


Figure 4 shows a frequency-time “view [of] allocation units having mutually different sizes and shapes, . . . allocated to the total resource region[,] and indexed according to an embodiment of the present invention.”

Ex. 1005 ¶ 45. “As shown in FIG. 4, resource allocation regions for plural subscribers include A 401, B 402, C 403, D 404, E 405, F 406 and G 407.”

Id. ¶ 51. “[U]sing the allocation unit as shown in FIG. 3 . . . , B 402 and

C 403 can be represented as b(0) and c(8), respectively.” *Id.* ¶ 52. “In addition, A 401 can be represented as c(0) and c(1)[; t]his means continuous resource allocation regions can be simply represented by assigning a start allocation unit index and a total number of the allocation units.” *Id.* ¶ 53. And, “D 404 can be represented as d(26), d(27), d(34), d(35), d(42) and d(43) [; t]his means a rectangular shaped resource allocation region can be simply represented by assigning a start allocation unit index and an end allocation unit index.” *Id.* ¶ 54.

“[As] will be described [next] with reference to FIG. 5,” the “allocation mode ‘00’ represents a signal allocation unit is allocated.” Ex. 1005 ¶ 64. “[A]llocation mode ‘01’ indicates that continuous allocation units are allocated.” *Id.* “[A]llocation mode ‘10’ indicates that allocation units are allocated in a rectangular pattern.” *Id.* “In the allocation mode ‘00’, the corresponding allocation region can be indicated by using the index value of the corresponding allocation unit.” *Id.* ¶ 65. “In the allocation mode ‘01’, the corresponding allocation region can be indicated by using the index value of the start allocation unit and the total number of allocation units.” *Id.* ¶ 66. “[I]n the allocation mode ‘10’, the corresponding allocation region can be indicated by using the index value of the start allocation unit and the index value of the end allocation unit.” *Id.* ¶ 67.

Figure 5 (composed of Figures 5A–C) is reproduced below.

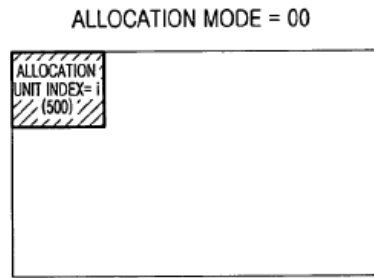


FIG.5A

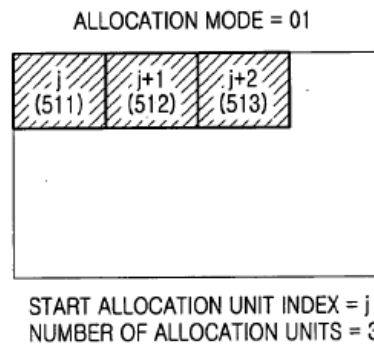


FIG.5B

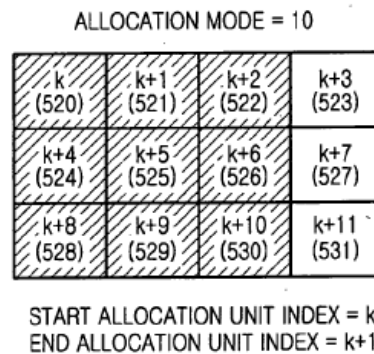


FIG.5C

Figure 5A represents allocation mode “00,” Figure 5B represents allocation mode “01,” and Figure 5C represents allocation mode “10.” Ex. 1005 ¶¶ 68–71. Allocation mode 00 in Figure 5A is “indicating that a single allocation unit is allocated in the allocation region.” *Id.* ¶ 69. “Thus, the allocation region is represented with ‘i’ which is an index value of the corresponding allocation unit 500.” *Id.* Allocation mode 01 in Figure 5B is

“indicating that continuous allocation units 511, 512 and 513 are allocated in the allocation region.” *Id.* ¶ 70. “To indicate the allocation region, ‘j’ which is an index value of a start allocation unit 511 and ‘3’ which is the total number of the allocation units are used.” *Id.* Allocation mode 10 in Figure 5C is “indicating that a plurality of allocation units are allocated in the rectangular pattern.” *Id.* ¶ 71. “To indicate the allocation region, ‘k’ which is an index value of a start allocation unit 520, and ‘k+10’ which is an index value of an end allocation unit[] 530[,] are used.” *Id.*

2. Overview of IEEE 802.16-2004 (Ex. 1006)

IEEE 802.16-2004 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. 1006, 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.

In a section describing “PMP frame structure,”⁶ the standard introduces the frame structure as follows:

When implementing a TDD system, the frame structure is built from BS and SS transmissions. Each frame in the downlink transmission begins with a preamble followed by a DL transmission period and an UL transmission period. In each frame, the TTG and RTG shall be inserted between the

⁶ The undefined acronyms of the IEEE 802.16-2004’s quotations herein are PMP (point-to-multipoint), TDD (time division duplex or duplexing), BS (base station), SS (subscriber station), DL (downlink), UL (uplink), TTG (transmit/receive transition gap), RTG (receive/transmit transition gap), FCH (frame control header), QPSK (quadrature phase-shift keying), and IE (information element). Ex. 1006, 49–52.

downlink and uplink and at the end of each frame, respectively, to allow the BS to turn around.

Ex. 1006, 535.

Figures 218 and 219 of IEEE 802.16-2004 are reproduced below.

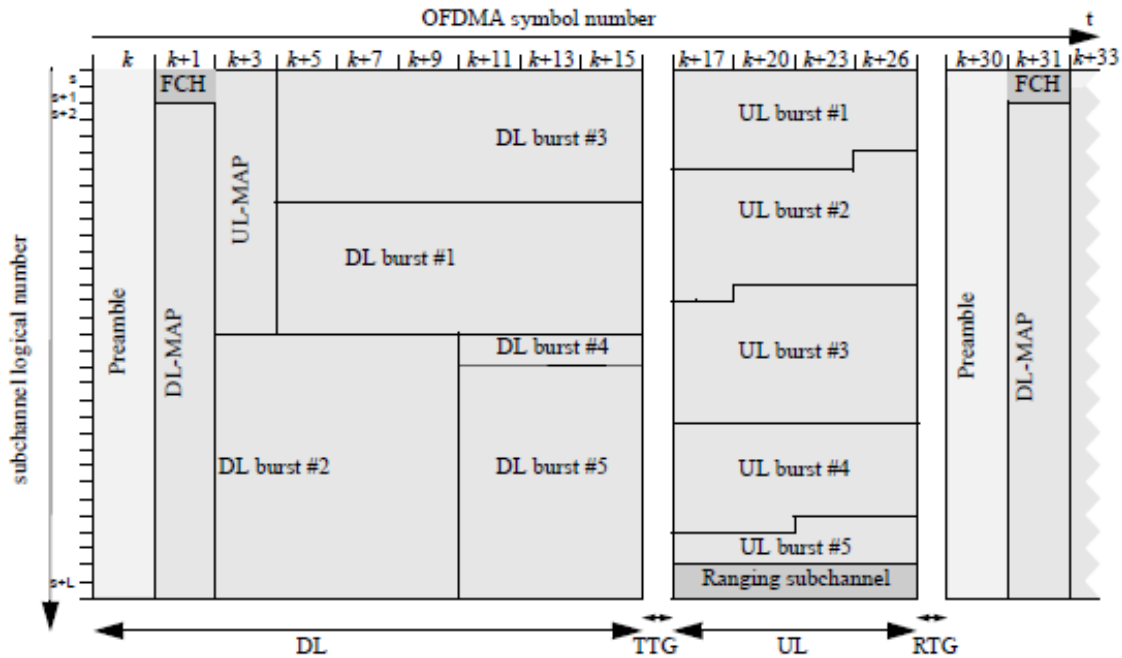


Figure 218—Time plan - one TDD time frame (with only mandatory zone)

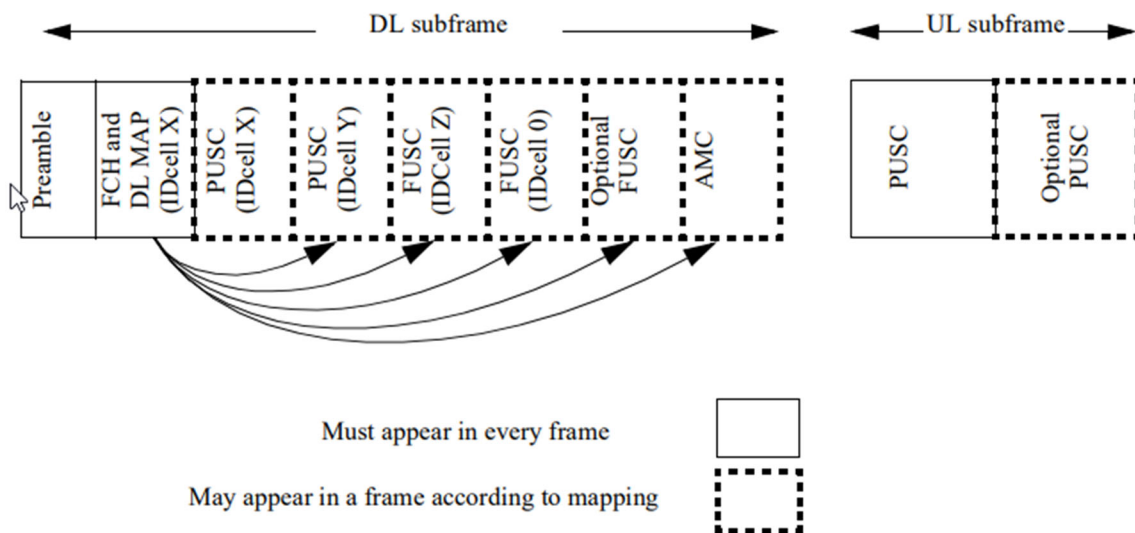


Figure 219—Illustration of OFDMA frame with multiple zones

Figures 218 and 219, respectively illustrate a “[t]ime plan – one TDD time frame (with only mandatory zone)” and “OFDMA frame with multiple zones.” Ex. 1006, 536–537. Figures 218 and 219 are described as follows:

Subchannel allocation in the downlink may be performed in the following ways: partial usage of subchannels (PUSC) where some of the subchannels are allocated to the transmitter, and full usage of the subchannels (FUSC) where all subchannels are allocated to the transmitter. The first two transmitted subchannels in the first data symbol of the downlink is called FCH. The FCH shall be transmitted using QPSK rate 1/2 with four repetitions using the mandatory coding scheme (e.g., the FCH information will be sent on four adjacent subchannels) in a PUSC zone. The FCH contains the DL_Frame Prefix as described in 8.4.4.3, and specifies the length of the DL-MAP message that immediately follows the DL_Frame_Prefix and the repetition coding used for the DL-MAP message.

The transitions between modulations and coding take place on OFDMA symbol boundaries in time domain and on subchannels within an OFDMA symbol in frequency domain.

The OFDMA frame may include multiple zones (such as PUSC, FUSC, PUSC with all subchannels, optional FUSC, AMC and optional FUSC with all subchannels), the transition between zones is indicated in the DL-Map by the Zoneswitch IE (*see* 8.4.5.3.4). No DL-MAP or UL-MAP allocations can span over multiple zones. Figure 219 depicts OFDMA frame with multiple zones.

Ex. 1006, 536.

3. Analysis for Independent Claim 7

- a. *[Preamble] 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:*

Petitioner adopts an earlier agreed-upon District Court claim construction position that the preamble of claim 7 is limiting. *See* Pet. 8 (citing Ex. 1011, 9, 12–13, 15). Patent Owner agrees that the preamble is limiting. *See* Prelim. Resp. 28 n.1.

Petitioner asserts that Park teaches the preamble of claim 7 based on Park’s disclosures of an OFDMA wireless network system. *See* Pet. 16–17 (citing Ex. 1001, 1:34–2:16; Ex. 1003 ¶¶ 48–49, 102–110; Ex. 1005, code (57), ¶¶ 3, 15, 31–33, 57, Tables 1, 2; Ex. 1006, 267⁷). Petitioner contends that the combination of Park and IEEE 802.16-2004 discloses the recited “mobile device in a wireless packet system,” based on Park’s disclosure of a “subscriber” or “terminal.” *See* Pet. 17–18 (citing Ex. 1005 ¶¶ 5–6, 31–33; Ex. 1006, 11), 20. According to Petitioner, “Park discloses improvements to existing 802.16-based systems that enabled the ‘[n]ext-generation *mobile* communication systems [to] transmit data with superior quality at a high transmission rate to provide subscribers with various improved multimedia services.’” Pet. 18 (quoting Ex. 1005 ¶ 5); *see* Pet. 14 (citing Ex. 1005 ¶ 5). Petitioner contends that “[t]o reduce overhead relative to IEEE 802.16-2004, Park describes its improvements to IEEE 802.16-2004

⁷ Petitioner references the document page numbers not the Exhibit page numbers.

by dividing its time-frequency resource into allocation units and regions.” Pet. 15 (citing Ex. 1005 ¶¶ 72–73). According to Petitioner, “Park explains that ‘[t]he present invention can be applied to the Wi[B]ro or IEEE 802.16 standards in various manners,’ including by adapting the IEEE 802.16-2004 DL(/UL)_MAP IE fields.” *Id.* (citing Ex. 1003 ¶¶ 54–65, 73–101; Ex. 1005 ¶¶ 75–79, 85). Petitioner asserts that “Park built upon existing 802.16-based systems/service, including the South Korean ‘WiBro’ *mobile* wireless system.” Pet. 18 (citing Ex. 1003 ¶¶ 54–101, 125–128; Ex. 1005 ¶¶ 7, 73–75; Pet. 10–14); *see* Pet. 14 (citing Ex. 1003 ¶¶ 54–65, 74–101; Ex. 1005 ¶¶ 31, 73–75, 75–79, 85).

Petitioner contends that a person of ordinary skill in the art would have been motivated to combine the teachings of Park and IEEE 802.16-2004, as proposed by Petitioner, because Park directs a person of ordinary skill in the art to implement its teachings in a system based on that standard to reduce overhead and improve flexibility. *See* Pet. 14 (citing Ex. 1003 ¶¶ 54–56, 74–101; Ex. 1005 ¶¶ 31, 73–79, 85); *see also* Pet. 16 (addressing Park’s teachings regarding improving flexibility and reduction in bits, citing Ex. 1003 ¶¶ 54–101; Ex. 1005 ¶¶ 31, 73–74), 17 (similar argument, citing Ex. 1005 ¶ 75). Petitioner asserts that Park describes its improvements to the IEEE 802.16-2004 allocation scheme to reduce overhead and explains that it can be applied to Wibro or IEEE 802.16 standards in various manners. *See* Pet. 15 (citing Ex. 1003 ¶¶ 54–65, 73–101; Ex. 1005 ¶¶ 72–79, 85). According to Petitioner, “[b]ecause Park improves and builds upon IEEE 802.16-2004 systems, a [person of ordinary skill in the art] at the relevant time would have looked to the teachings of 802.16-2004 to provide the underlying structure for Park’s disclosed improvements.” Pet. 15–16.

Petitioner also asserts that Park and 802.16-2004 both disclose using a frame structure of multiple frames for transmission and each frame comprising a plurality of time intervals and each time interval comprising a plurality of OFDMA symbols. *See* Pet. 20 (reproducing Ex. 1005 Fig. 1; Ex. 1006, Fig. 218 (with added annotations); citing Ex. 1003 ¶¶ 48–51, 104–124; Ex. 1005 ¶¶ 7, 36), 22–23 (citing Ex. 1003 ¶¶ 111–113, 121–124; Ex. 1005 ¶ 6; Ex. 1006, 496–498, 574–575, Fig. 218). Petitioner further contends that IEEE 802.16-2004 discloses that each OFDMA symbol is made up of frequency subcarriers and that the mobile device is “configured to:” *See* Pet. 23–25 (citing Ex. 1003 ¶¶ 129–133; Ex. 1005 ¶ 9, Fig. 1; Ex. 1006, 494–95, 574–575; Ex. 1025, 293–294).

Patent Owner argues that Park and IEEE 802.16-2004 do not teach a “mobile device.” *See* Prelim. Resp. 28–43. In support of its arguments, Patent Owner contends that it is well-established that the IEEE 802.16-2004 standard did not support mobile users, which is confirmed by various literature in the field. *See id.* at 29–36 (quoting Ex. 1025, 33–34; Ex. 2001 ¶¶ 36–45). Patent Owner asserts “[t]he word ‘mobile’ does not appear in the standard even once.” *Id.* at 30. According to Patent Owner, “‘802.16-based systems’ that were based on 802.16(e) could support mobile users . . . but ‘802-16 based systems’ that were based on Petitioner’s 802.16-2004 reference could not.” *Id.* at 36 (citing Ex. 1025, 363; Pet. 18).

Patent Owner further argues that Park does not disclose applying its method to mobile users and does not otherwise modify IEEE 802.16-2004 to make it mobile. *See id.* at 37–43. According to Patent Owner, “Park does not disclose mobile users. It only discloses ‘terminals.’” *Id.* at 37. Patent Owner contends that “[n]othing in [paragraph 5] of Park even hints at Park

‘enabling’ IEEE 802.16-2004 to become ‘mobile.’” *Id.* at 39 (citing Ex. 1005 ¶ 5). Patent Owner asserts that “this disclosure has nothing to do with whether Park discloses ‘mobile’ users, which it does not.” *Id.* Patent Owner further asserts that Petitioner’s expert testimony addresses Park’s proposed changes to the DL-MAP format which does not have any correlation with making IEEE 802.16-2004 mobile. *See id.* (citing Ex. 1003 ¶¶ 51, 97; Ex. 2001 ¶ 47). According to Patent Owner, Park “says nothing about applying it[’s method] to a mobile station that implements IEEE 802.16-2004. That is not surprising because . . . it was well known that [] IEEE 802.16-2004 w[as] not mobile.” *Id.* at 39–40.

We do not agree with Patent Owner’s arguments. Petitioner contends that Park would have been understood to disclose a “mobile device.” *See* Pet. 17–18. As Petitioner points out (*see* Pet. 10, 15, 18), Park expressly discloses “WiBro,” a “Wireless Broadcast (Wibro) system or an IEEE 802.16 system applied to an OFDMA system” and that its “invention can be applied to the Wibro or IEEE 802.16 standards in various manners.” Ex. 1005 ¶¶ 7, 75. Petitioner also relies on Dr. Cooklev’s Declaration testimony to support its contention that Park would have been understood to disclose a mobile device. *See e.g.*, Pet. 10 (citing Ex. 1003 ¶¶ 56–58; Ex. 1024), 15 (citing Ex. 1003 ¶¶ 54–65, 73–101; Ex. 1005 ¶¶ 75–79, 85), 18 (citing Ex. 1003 ¶¶ 54–101, 125–128). A portion of Dr. Cooklev’s Declaration testimony, cited in the Petition, states that “WiBro was a South Korean mobile wireless service designed to provide wireless broadband access to devices moving up to 60-70 kilometers per hour.” Ex. 1003 ¶ 56 (citing Ex. 1024). The article cited by Dr. Cooklev supports this testimony. *See* Ex. 1024, 1 (“Although the concept is still in its development stages, the

portable Internet, named by Korean officials as WiBro (wireless broadband), is designed to provide high-speed access of a maximum 1Mbps to receiver devices moving at speeds of 60 to 70 kilometers per hour.”). At this stage, Park’s express disclosure of WiBro and the supporting testimony that WiBro provides high-speed Internet access to moving devices sufficiently shows that one of ordinary skill in the art would have understood that Park discloses the “mobile device” recited in the preamble.

In addition, we note that many of Patent Owner’s supporting arguments are not commensurate in scope with the claim limitations or are misplaced. Claim 7 does not recite or otherwise require “mobile users,” support of “mobile users,” or the application of a method to “mobile users,” as argued by Patent Owner. *See* PO Resp. 29–36. Claim 7 merely recites a “mobile device.” Ex. 1001, 13:15–33. Petitioner also does not assert that IEEE 802.16-2004 discloses support of “mobile users,” and does not propose making IEEE 802.16-2004 mobile. *See* Pet. 12–20. To the extent Patent Owner’s arguments are premised on a specific meaning of “mobile device” limited to a device travelling at relatively high speed or a cell phone (e.g., a device for “mobile users”), we invite the parties in further briefing to offer respective proposed claim constructions for the term “mobile device.”

Patent Owner also contends that Petitioner’s assertion that Park discloses the claimed mobile device on the basis of the disclosure of a “subscriber” or “terminal” is refuted by Petitioner’s expert who testifies that Park does not expressly state the subscriber or terminal is a mobile device. *See* Prelim. Resp. 38 (citing Ex. 1003 ¶ 126). According to Patent Owner, “Park . . . never characterizes [terminals or subscribers] as ‘mobile.’” *Id.* Related to these arguments, Patent Owner asserts that Petitioner’s argument

that Park discloses improvements to existing IEEE 802.16-based systems that enabled the next generation mobile communication systems is refuted by Park’s disclosure. *See id.* at 38–39 (citing Ex. 1005 ¶ 5; Ex. 2001 ¶ 47; Pet. 18). Patent Owner asserts that Park’s paragraph 5 disclosure has nothing to do with mobile users. Patent Owner further contends that Petitioner’s argument is refuted by Petitioner’s expert testimony that explains that the changes Park proposes are limited to altering the format of the DL-MAP by adding a variable to the DL-MAP IE format. *See id.* at 39 (citing Ex. 1003 ¶¶ 51, 97). According to Patent Owner, “the DL-MAP IE is merely an information element for transmitting the resource allocation information to the user. . . . It is not shown to have any correlation with making the IEEE 802.16–2004 mobile.” *Id.* (citing Ex. 1003 ¶¶ 51, 90; Ex. 2001 ¶ 47).

We do not agree with Patent Owner’s arguments because, as explained above, Park’s express disclosure of WiBro and the supporting testimony that WiBro provides high-speed Internet access to moving devices sufficiently shows that one of ordinary skill in the art would have understood that Park discloses the “mobile device” recited in the preamble. In addition, we note that Patent Owner’s arguments mischaracterize and overlook certain arguments of Petitioner and overlook certain supporting citations to Park’s disclosures. Contrary to Patent Owner’s assertions, Petitioner does not propose to make the IEEE 802.16-2004 standard mobile by altering the format of the DL-MAP. *See* Pet 14–15; 17–18. Patent Owner overlooks that Petitioner’s argument relies on Park’s disclosure of “subscribers” and “terminals” as well as Park’s disclosures directing persons of ordinary skill in the art to implement Park’s improvements to existing IEEE 802.16-based

mobile wireless systems, including the WiBro mobile wireless system. *See* Pet. 17–18 (Ex. 1003 ¶¶ 54–101, 125–128; Ex. 1005, code (54), ¶¶ 5–7, 31–33, 73–79). Patent Owner’s arguments also focus on Park’s paragraph 5 disclosure and overlook Petitioner’s citations to Park’s paragraphs 7 and 73–79 explicitly addressing the application of Park’s invention to the Wibro (Wireless Broadband) or IEEE 802.16 standards. *See* Pet. 18 (citing Ex. 1005 ¶¶ 5, 7, 73–79)

For the purpose of institution and based on Petitioner’s supporting citations to Park, IEEE 802.16-2004, and Dr. Cooklev’s testimony (Ex. 1003), we are persuaded Petitioner sets forth sufficient articulated reasoning with rational underpinning to support the conclusion that a person ordinary skill in the art would have been motivated to combine the teachings of Park and IEEE 802.16-2004 as proposed by Petitioner because Park directs a person of ordinary skill in the art to implement its teachings in a mobile wireless system based on that standard to reduce overhead and improve flexibility. *See* Pet. 14 (citing Ex. 1003 ¶¶ 54–56, 74–101; Ex. 1005 ¶¶ 31, 73–79, 85); 18 (citing Ex. 1003 ¶¶ 54–101; Ex. 1005 ¶¶ 73–79); *see also* Pet. 14–19 (Petitioner’s reasons for combining Park and IEEE 802.16-2004).

Accordingly, at this stage of the proceeding, we determine Petitioner shows sufficiently that the combination of Park and IEEE 802.16-2004 discloses, teaches, or suggests the preamble of claim 7.

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

Petitioner asserts that the combination of Park and 802-16-2004 teaches this limitation based on the disclosure in IEEE 802.16-2004 of a

connection identifier (CID or RCID) in the DL-MAP message broadcast from the base station to subscribers. *See* Pet. 25–27 (citing Ex. 1003 ¶¶ 33–34, 58–59, 70–73, 134–145; Ex. 1005 ¶¶ 13–15 (Table 1), 55–57 (Table 2); Ex. 1006, 7–8, 46, 110–111 (Table 97)).

Patent Owner does not address Petitioner’s showing for this limitation of claim 7. *See* Prelim. Resp. 28–53. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). At this stage of the proceeding, we determine Petitioner shows sufficiently for the purpose of institution that the combination of Park and IEEE 802.16-2004 discloses, teaches, or suggests this limitation of claim 7.

c. 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, or 8;

Petitioner asserts that Park discloses these limitations based on Park’s teaching that “its mobile devices receive a signal containing information from a base station” (Pet. 27–28 (citing Ex. 1003 ¶¶ 146–149)), and Park’s disclosure of receiving this information over a resource allocation region having allocation units, and disclosure of an allocation region having an index value of the start allocation unit that identifies the start of the allocation region and the total number of allocation units (*see* Pet. 28–31 (reproducing Ex. 1001, Fig. 6; Ex. 1005, Fig. 4; citing Ex. 1001, 6:3–14; Ex. 1003 ¶¶ 74–101, 146–155; Ex. 1005 ¶¶ 39, 50–51, 73–83, Figs. 6A, 6B)). Petitioner contends that Park illustrates an example of its allocation mode 01 in Figure 5B where the allocation region starts at the allocation unit with

index j and has a total number of three allocation units which teaches N time-frequency resource units. *See* Pet. 31–34 (reproducing Ex. 1005, Fig. 5B (with annotations added); citing Ex. 1003 ¶¶ 45, 62–65, 156–173; Ex. 1005 ¶¶ 33, 38, 43–44, 46–47, 50, 66, 70, claim 4); *see also* Pet. 38 (addressing Park’s disclosure of the total number of the allocation units used to fill a particular allocation region, citing Ex. 1003 ¶¶ 168–182; citing Ex. 1005 ¶¶ 66, 70). Petitioner asserts that Park further teaches that each unit contains a set of frequency subcarriers in a group of OFDM symbols. *See* Pet. 41–43 (citing Ex. 1003 ¶¶ 157–159, 183–191; citing Ex. 1005 ¶¶ 44–47, 49, Figs. 3A–3D; Ex. 1008, 517, 575; Ex. 1025, 293–94)

Petitioner contends that Park discloses examples where $N=1$, $N=2$, and $N=8$. *See* Pet. 34–35 (reproducing a combination of Ex. 1005, Figs. 3, 4 (with added annotations); citing Ex. 1003 ¶¶ 171–175; Ex. 1005 ¶¶ 46–49, 51, 53), 39–40 (reproducing Ex. 1005, Fig. 3D (with added annotations); citing Ex. 1003 ¶¶ 176–182; Ex. 1005 ¶¶ 46–49, 51–54, 66, 70); *see also* Pet. 38–39 (Park’s mobile device is configured “for all reasonable N , which includes at least $N=1-8$ (and thus the claimed $N=2, 4$, or 8).”), 40 (“Park’s mobile device is configured to receive a signal with $N=2, 4$, and 8 , as well as other integers.”)

Patent Owner contends that Park and IEEE 802.16-2004 do not teach a segment comprising N resource units, where “ $N=2, 4$, or 8 ”. *See* Prelim. Resp. 43–53. According to Patent Owner, “the plain meaning of the claim and the specification require that the size of the segment be selected among the numbers 2, 4 or 8, and excluding the intervening integers $N=3, 5, 6$ or 7.” *See id.* at 48–52. Patent Owner further asserts that “the plain meaning of the claim suggests that it excludes intervening integers 3, 5, 6

or 7.[□] This is because the claim does not recite every integer N in the range of 2–8, but only N=2, 4, or 8.” *Id.* at 48 (citing *Insituform Techs., Inc. v. Cat Contr., Inc.*, 99 F.3d 1098, 1106 (Fed. Cir. 1996); *Free Motion Fitness, Inc. v. Cybex Int’l*, 423 F.3d 1343, 1350 (Fed. Cir. 2005)). Patent Owner further contends that “the specification makes clear that the choice of N=2, 4, or 8 excludes intervening integers.” *Id.* at 50 (citing *Chi. Bd. Options Exch., Inc. v. Int’l Sec. Exch., LLC*, 677 F.3d 1361 (Fed. Cir. 2012); *In re Abbott Diabetes Care Inc.*, 696 F.3d 1142 (Fed. Cir. 2012)). Patent Owner asserts that “the choice of N=2, 4, or 8 is not arbitrary; it was a deliberate selection that followed from the specific choice of time-frequency unit granularity that the inventors discovered had additional benefits.” *Id.* at 51–52 (citing *Pet. 44–47*; *Kinetic Concepts, Inc. v. Blue Sky Med. Grp., Inc.*, 554 F.3d 1010, 1018–19 (Fed. Cir. 2009); *Wisconsin Alumni Res. Found. v. Apple Inc.*, 905 F.3d 1341, 1351–52 (Fed. Cir. 2018); *Choon’s Design, LLC v. IdeaVillage Prods. Corp.*, 776 Fed. App’x 691, 695–96 (Fed. Cir. 2019)); *see also id.* at 44–47 (addressing the ’450 Patent disclosure). Patent Owner further contends that the claim should not be read so broadly so as to undo all the improvement over the prior art. *See Pet. 52–53* (citing *SciMed Life Sys. v. Advanced Cardiovascular Sys.*, 242 F.3d 1337, 1341 (Fed. Cir. 2001); *Ekchian v. Home Depot, Inc.*, 104 F.3d 1299, 1304 (Fed. Cir. 1997)); *see id.* at 52 (arguing the prior art created irregular resource allocation, had large control overhead, and limiting N offers solutions to both problems, citing *Pet. 44–48*, *Ex. 1001*, 2:1–4, 6:45–62).

We do not agree that the plain language of claim 7 excludes integers N=3, 5, 6, or 7. Claim 7 utilizes the open-ended term “comprising” in the recitation “the segment comprising N time-frequency resource units within a

time interval.” Due to the use of the term “comprising” in the recitation, the full scope of claim 7 may include additional N time-frequency resource units, such as N=3, 5, 6, 7, in addition to the claimed “N time-frequency resource units within a time interval, . . . where N=2, 4, or 8.”

We also do not agree with Patent Owner’s argument that the ’450 Patent Specification requires the exclusion of intervening integers N=3, 5, 6 or 7. The ’450 Patent does not disclose the exclusive use of N=2, 4, or 8, nor does it disclose the exclusion of other integers such as N=3, 5, 6, 7. *See* Ex. 1001, 6:22–7:6. In contrast to Patent Owner’s argument, the ’450 Patent Specification discloses Table 1 in exemplary and optional terms. In particular, the ’450 Patent discloses:

For *example*, Table 1 below sets forth *representative* modulation and forward-error correction (FEC) coding schemes (MCS) that *may* be used for voice packet streams under various channel conditions.

. . .

In *some embodiments*, the MCS *may* be selected to utilize modular resources. For *example*, as illustrated in Table 1, 80 raw modulation symbols are needed to transmit 160 information bits using 16QAM modulation and rate-1/2 coding, the highest available MCS in the table. The resource utilized by this highest MCS is called a basic resource unit (“Unit”), i.e., 80 raw symbols in this example. The resource utilized by other MCS is simply an integer multiple of the basic unit. For *example*, four units are required to transmit the same number of information bits using QPSK modulation with rate-1/4 coding.

Ex. 1001, 6:31–6:55 (emphasis added).

In summary, based on this preliminary record, we determine that the recitation of “where N=2, 4, or 8” does not exclude N= 3, 5, 6, or 7 from the full scope of claim 7. Accordingly, at this stage of the proceeding, we

determine Petitioner shows sufficiently that Park and IEEE 802.16-2004 discloses, teaches, or suggests this limitation of claim 7.

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

Petitioner asserts that Park and IEEE 802.16-2004 teach this limitation based on the combination of Park and IEEE 802.16-2004 “disclos[ing] a base station transmitting data to a mobile station.” Pet. 43 (citing Ex. 1003 ¶¶ 48–51, 75, 142–145, 192–195; Ex. 1005 ¶ 5; Ex. 1006, 316). According to Petitioner, a person of ordinary skill in the art “would have understood that a base station transmits data to the mobile station via an encoded signal and the mobile station decodes that signal to recover the data.” *Id.* (citing Ex. 1001, 4:12–13; Ex. 1003, 136–144, 192–195). Petitioner asserts that “OFDMA allows multiple mobile devices (and receivers), allocating subcarriers to a specific mobile device (and receiver). *Id.* (citing Ex. 1003 ¶¶ 49, 108, 136–144, 192–196; Ex. 1005 ¶ 13; Ex. 1006, 46, 152, 316). According to Petitioner, “[i]n other words, the DL-MAP provides the mobile station with the parameters it uses to extract/decode information from the base station’s encoded signal.” Pet. 45 (citing Ex. 1003 ¶¶ 136–144, 192–196). Petitioner asserts that Park discloses the DL-MAP IE includes a start allocation unit index, number of allocation units, and RCID_ID. *See* Pet. 45 (citing Ex. 1003 ¶¶ 78–96, 192–196; Ex. 1005 ¶¶ 55, 59, Table 2).

Patent Owner does not address Petitioner’s showing for this limitation of claim 7. *See* Prelim. Resp. 28–53. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. At this stage of the proceeding, we determine Petitioner shows sufficiently for the purpose of institution that the combination of Park

and IEEE 802.16-2004 discloses, teaches, or suggests this limitation of claim 7.

4. Analysis for Dependent Claim 11

Claim 11 recites: The mobile device of claim 7, wherein modular coding is applied to the time-frequency resource units in the segment of time-frequency resource. Petitioner asserts that Park and IEEE 802.16-2004 disclose the claimed modular coding scheme based on the DL-MAP IE format which uses a combination of the “Nep code” and “Nsch” code that indicates the number of allocated sub-channels and modulation schemes for the DL burst. *See* Pet. 46–48 (citing Ex. 1003 ¶¶ 135–145, 156–182, 180–181, 200–209; Ex. 1005 ¶¶ 13, 15, 33, 39, 43, 57, Tables 1, 2, 95; Ex. 1006, 110–111, 603–610, Table 97).

Patent Owner does not address Petitioner’s showing for claim 11. *See* Prelim. Resp. 28–53. Nonetheless, the burden remains on Petitioner to demonstrate unpatentability. *See Dynamic Drinkware*, 800 F.3d at 1378. At this stage of the proceeding, we determine Petitioner shows sufficiently for the purpose of institution that the combination of Park and IEEE 802.16-2004 discloses, teaches, or suggests the limitations of claim 11.

5. Summary

For all of the foregoing reasons and based on the record before us, we determine there is a reasonable likelihood Petitioner would prevail in showing that claims 7 and 11 are unpatentable under 35 U.S.C. § 103 over the combination of Park and IEEE 802.16-2004.

III. CONCLUSION

For the foregoing reasons, we determine there is a reasonable likelihood that Petitioner would prevail in showing at least one of the challenged claims of the '450 Patent is unpatentable.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 7 and 11 of the '450 Patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '450 Patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2023-00763
Patent 10,447,450 B2

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