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Paper 30
Dated: September 11, 2024

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.

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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.

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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,

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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.

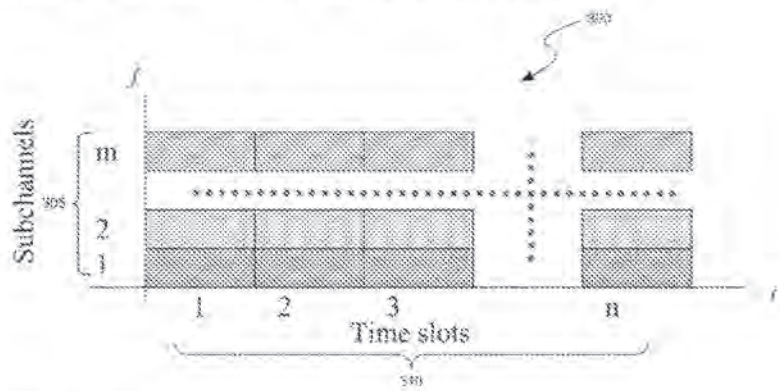

Figure 3 is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, "[t]he frequency is divided into two or more subchannels 305, represented as subchannels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

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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.

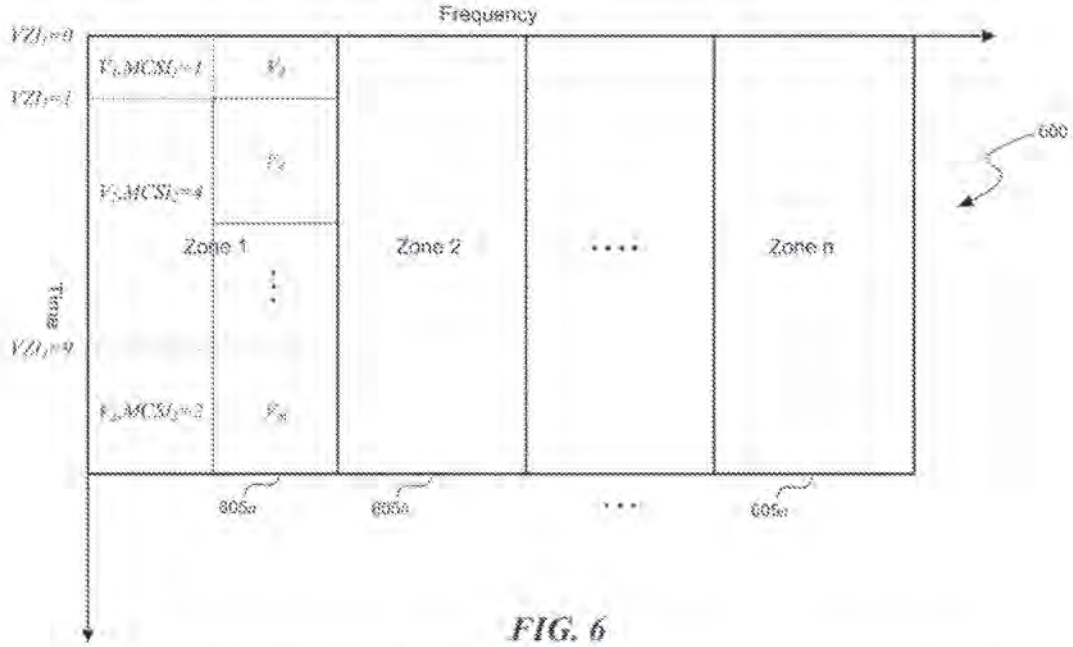

FIG. 6

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 605*a*, 605*b*, . . . 605*n*, 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

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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, . . . 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, . . . 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

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> 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:

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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).

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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.

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

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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:

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- 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).

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[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).

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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.

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Figure 1 of Park is reproduced below.

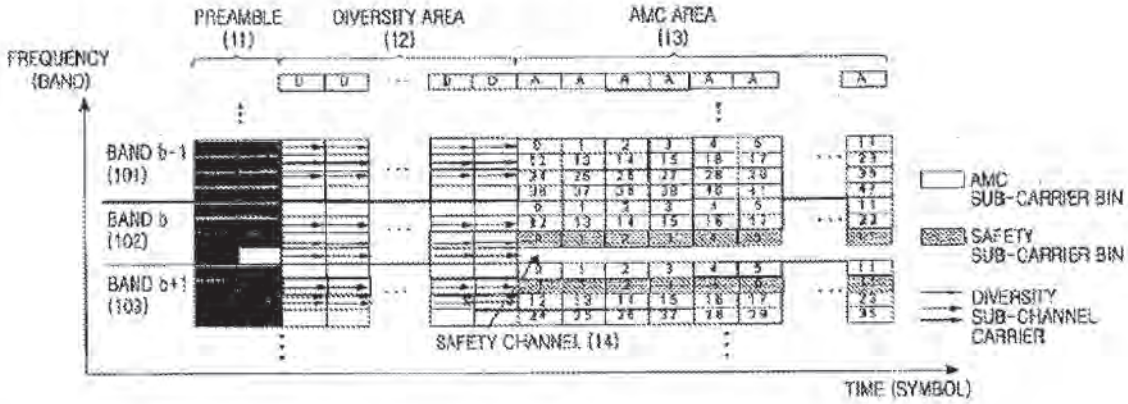

Figure 1 shows a frequency-time "view [of] a frame structure of a . . . Wireless Broadband (Wibro) system or an IEEE 802.16 system applied to an OFDMA system." Ex. 1005 ¶ 7.

> 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.

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

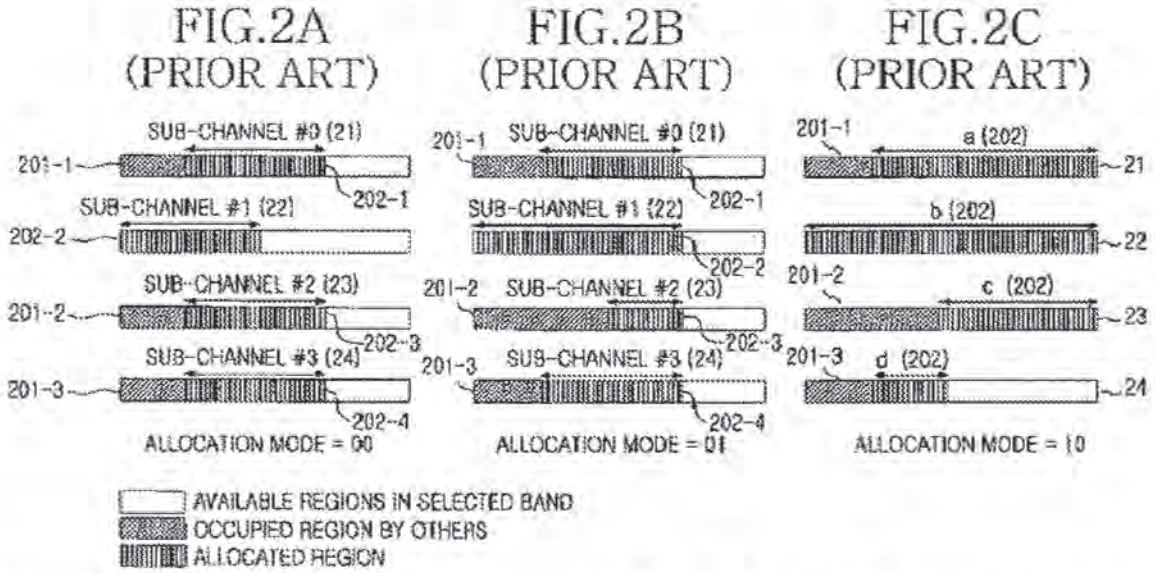

Figure 2 shows a frequency-time "view [of] sub-channel allocation modes defined in Table 95(/101) of the IEEE 802.16-2004 standard." Ex. 1005 ¶ 17. "According to the sub-channel allocation modes defined in Table 95(/101) of IEEE 802.16-2004, . . . the 'Allocation Mode' is assigned after selecting the 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.*

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

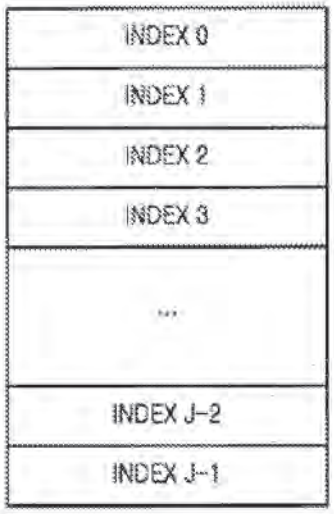

FIG.3A

FIG.3B

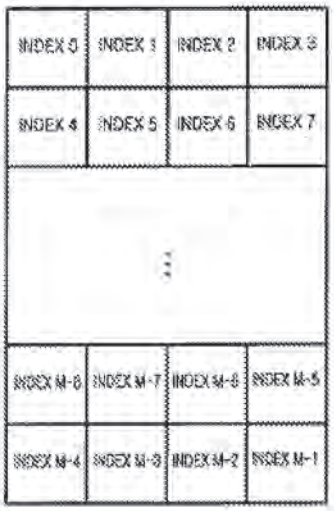

FIG.3C

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

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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.

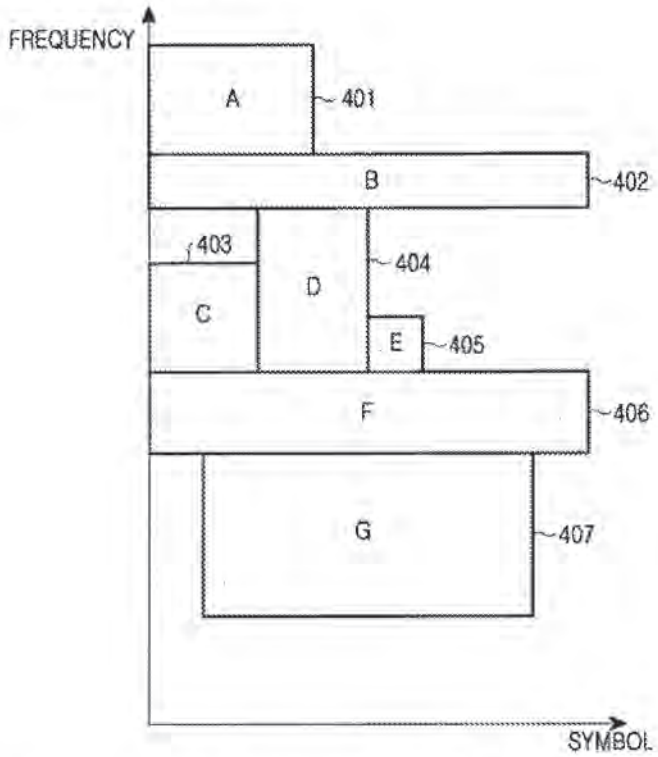

Figure 4 shows a frequency-time "view [of] allocation units having mutually different sizes and shapes, . . . allocated to the total resource region[,] and indexed according to an embodiment of the present invention." Ex. 1005 ¶ 45. "As shown in FIG. 4, resource allocation regions for plural subscribers 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

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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.

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

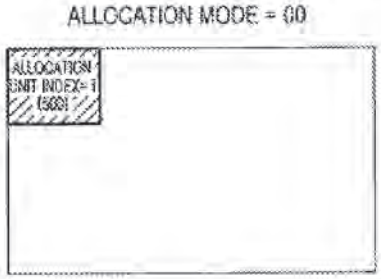

FIG.5A

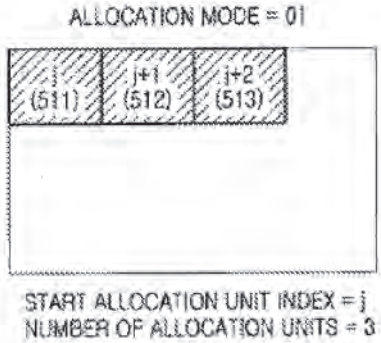

FIG.5B

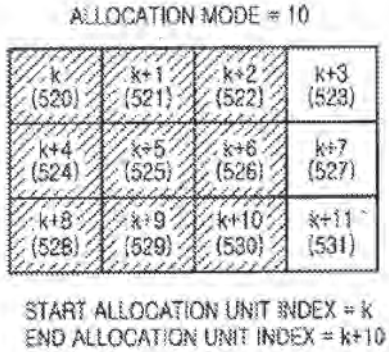

FIG.5C

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

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"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.

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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.

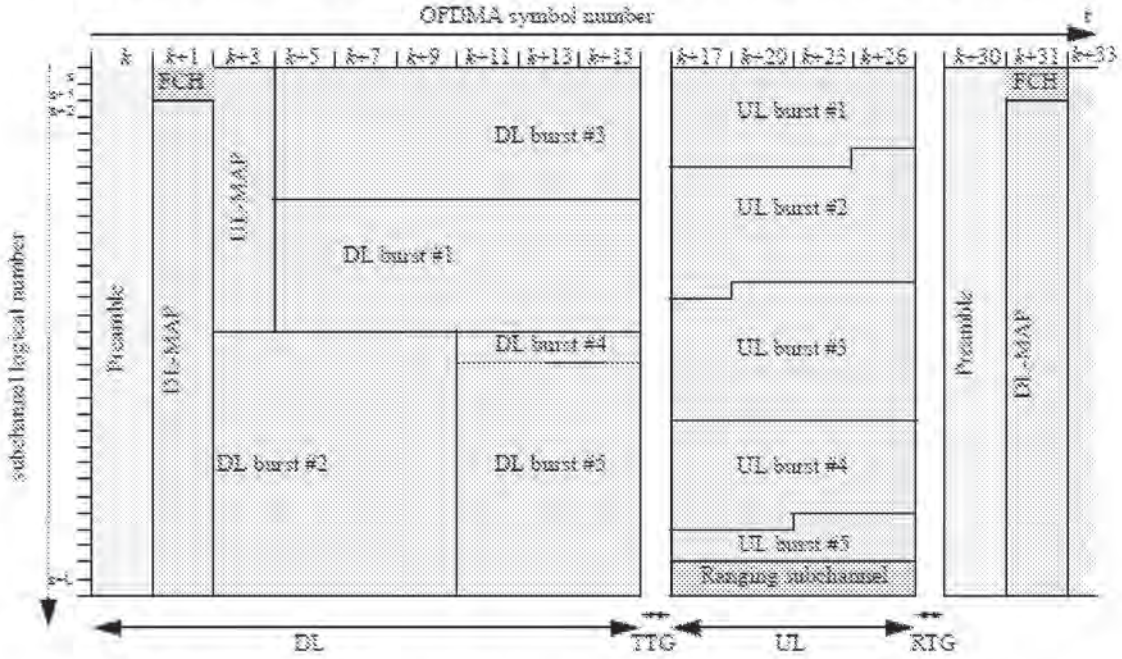

Figure 218—Time plan - one TDD time frame (with only mandatory zone)

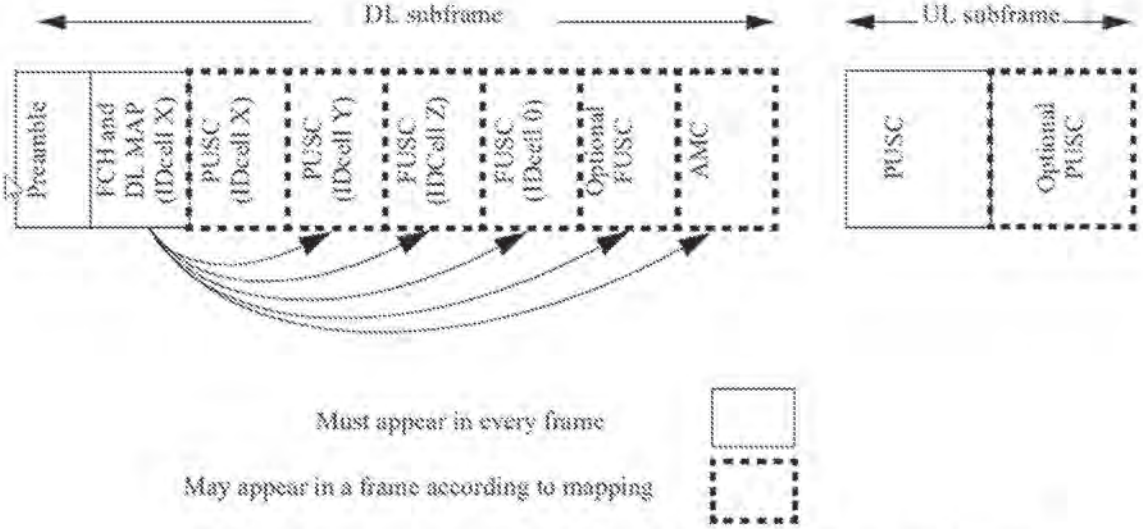

Figure 219—Illustration of OFDMA frame with multiple zones

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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.

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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, 267[7]). 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.

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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.

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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

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'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

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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

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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

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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

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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

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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.[1] 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

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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

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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, theDL-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

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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.

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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.

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Paper 11
Entered: December 6, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GENERAL MOTORS LLC AND NISSAN NORTH AMERICA, INC.,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2023-00962
Patent 10,447,450 B2

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

DROESCH, *Administrative Patent Judge.*

DECISION
Denying Institution of *Inter Partes* Review
35 U.S.C. § 314
Denying Motion for Joinder as Moot
35 U.S.C. § 315(c); 37 C.F.R. § 42.122

I. INTRODUCTION

General Motors LLC and Nissan North America Inc. (collectively "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 4 ("Pet."). Petitioner also filed a Motion for Joinder (Paper 3) with *Ford Motor Company v. Neo Wireless LLC*, IPR2023-00763 ("Ford IPR"). Paper 3 ("Mot."). Petitioner also filed a "Notice Ranking and Explaining Material Differences Between Petitions for *Inter Partes* Review of U.S. Patent No. 10,447,450."[1] Paper 2. Neo Wireless LLC ("Patent Owner") filed a Preliminary Response (Paper 10, "Prelim. Resp.") and a Response to Petitioner's Motion for Joinder (Paper 8). Petitioner filed a Reply in Support of Motion for Joinder. Paper 9.

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) (2022). 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).

We also have authority to consider Petitioner's Motion for Joinder. *See* 35 U.S.C. § 315(c); 37 C.F.R. § 42.122.

For the reasons explained below, we deny Petitioner's Motion for Joinder as moot.

Based on our consideration of 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*

[1] Petitioner ranks the petition filed in IPR2023-00963 ahead of this Petition.

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Plastic"), and expanded upon in *Valve Corp. v. Electronic Scripting Products, Inc.*, IPR2019-00062, Paper 11 (PTAB Apr. 2, 2019) (precedential) ("*Valve*"), we determine that the circumstances before us warrant the exercise of discretion under § 314(a) to deny institution of *inter partes* review of the '450 Patent.

II. BACKGROUND

A. Real Parties in Interest

Petitioner identifies General Motors LLC, Nissan North America, Inc. General Motors Company, LG Electronics, Inc., and Nissan Motor Acceptance Corporation a/k/a Nissan Motor Acceptance Company LLC as the real parties-in-interest. Pet. 54–55. Patent Owner identifies itself as the real party-in-interest. Paper 6, 1.

B. Related Matters

Petitioner lists numerous civil actions in which Patent Owner is the plaintiff and the '450 Patent is involved. Pet. 55–57. Patent Owner lists ten current district court proceedings involving the '450 Patent and fourteen proceedings that, according to Patent Owner, have been terminated. Paper 6, 1–4. The current district court proceedings include:

> *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.)

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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 Pet. 55–57; Paper 6, 1–2.

Both parties further identify IPR2021-01486 (institution denied, "Dell IPR"), IPR2022-01567 (instituted, "Volkswagen IPR"), IPR2023-00763 (institution denied), IPR2023-00793 (instituted, joined to IPR2022-01567), and IPR2023–00963 (concurrently filed) as proceedings before the Board. Pet. 58; Paper 6, 1, 4.

In addition, Petitioner also identifies several commonly-assigned U.S. patents that are the subject of IPR2022-01537, IPR2022-01539, IPR2023-00079, IPR2023-00764, IPR2023-00766, IPR2023-00791, IPR2023-00961, and IPR2023-00964. Pet. 58.

C. 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).

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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 "[a]t 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 of the 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.

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 designated 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

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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.

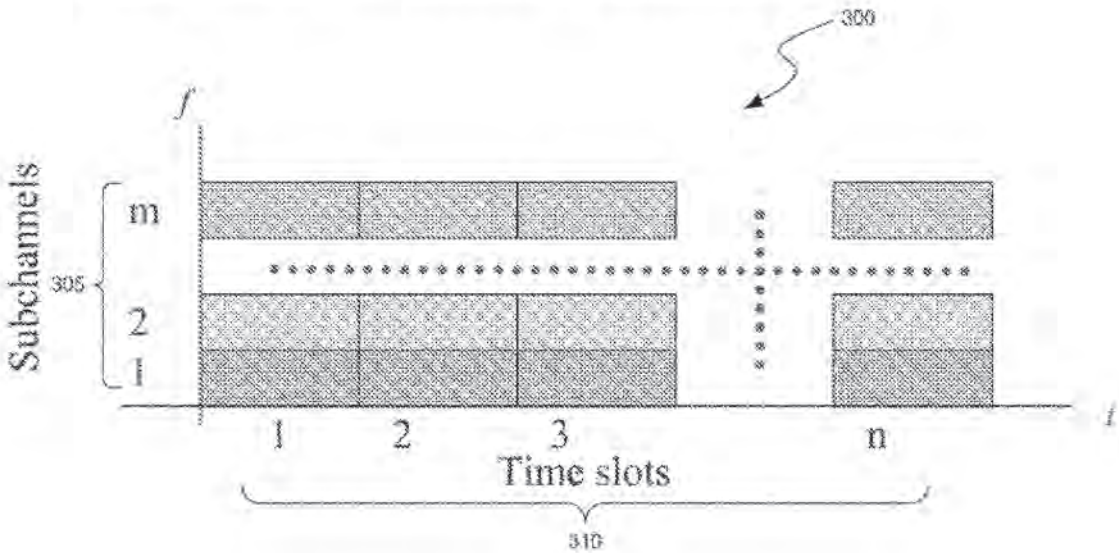

Figure 3 is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, "[t]he frequency is divided into two or more subchannels 305, represented as subchannels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

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Figure 6 of the '450 Patent is reproduced below.

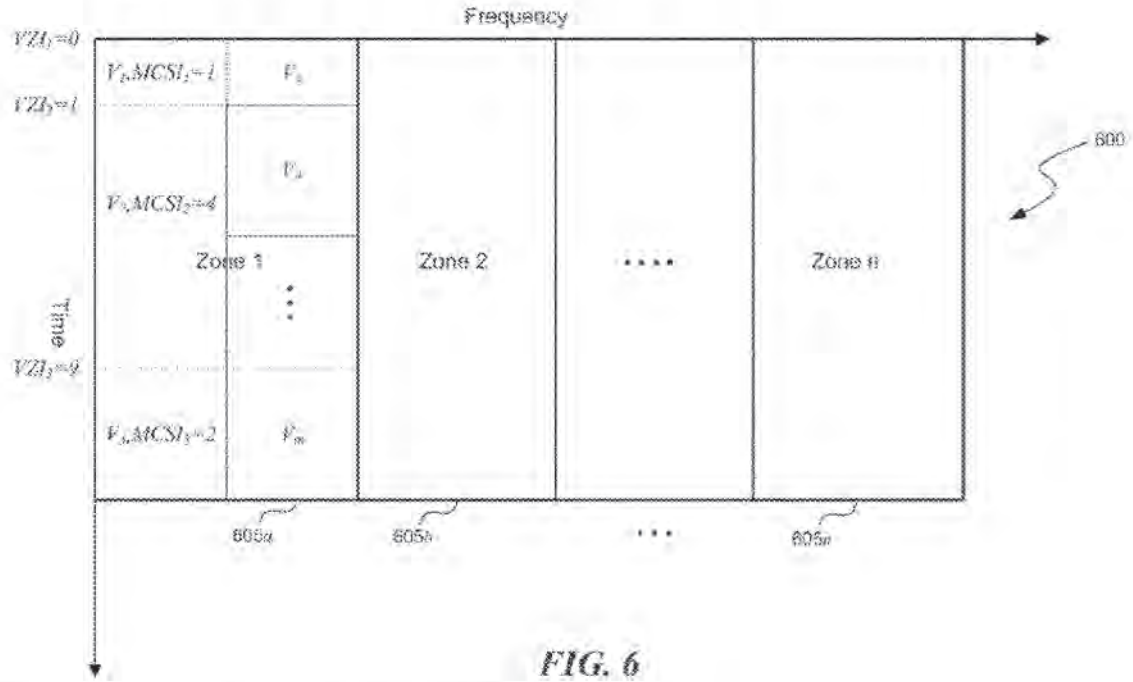

FIG. 6

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 605*a*, 605*b*, . . . 605*n*, 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 5:50–52. 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

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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, . . . 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, . . . 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, "[w]hen 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.

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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.

D. 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

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> 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.

E. Asserted Patentability Challenge and Asserted Prior Art

Petitioner asserts that claims 7 and 11 would have been unpatentable based on the following ground (Pet. 10–47):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
7, 11	103[2]	Park[3], IEEE802.16-2004[4]

Petitioner also relies on a Declaration of Todor Cooklev (Ex. 1003). Patent Owner relies on a Declaration of William P. Alberth, Jr. (Ex. 2001).

III. MOTION FOR JOINDER

Concurrent with the Petition, Petitioner filed a Motion for Joinder seeking joinder to *Ford Motor Co. v. Neo Wireless LLC*, IPR2023-00763. *See* Mot. 1. Petitioner acknowledges "[s]hould the Ford IPR be . . . not

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[2] 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 §§ 102 and 103.

[3] US 2006/0039274 A1, published Feb. 23, 2006 (Ex. 1005).

[4] *IEEE Standard for Local and Metropolitan Area Networks, Part 16: Air Interface for Fixed Broadband Wireless Access Systems* (Oct. 1, 2004) (Ex. 1006).

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instituted for any reason, Petitioners submit this motion for joinder would be moot, and requests the Board consider Petitioner's IPR petition on its own merits." Institution was denied in IPR2023-00763. *Ford Motor Co. v. Neo Wireless LLC*, IPR2023-00763, Paper 17 (PTAB Nov. 9, 2023). Accordingly, we deny Petitioner's Motion for Joinder as moot.

IV. ANALYSIS

35 U.S.C. § 314(a) provides:

> The Director may not authorize an inter partes review to be instituted unless the Director determines that the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.

The Supreme Court has explained that, because § 314 includes no mandate to institute review, "the agency's decision to deny a petition is a matter committed to the Patent Office's discretion." *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 273 (2016); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."). A decision whether to institute is within the Director's discretion, and that discretion has been delegated to the Board. 37 C.F.R. § 42.4(a); *see General Plastic*, Paper 19 at 19 (citing 35 U.S.C. § 314(a)); *Cuozzo*, 579 U.S. at 273.

As the Consolidated Trial Practice Guide[5] ("CTPG") notes, the AIA was "designed to establish a more efficient and streamlined patent system that will improve patent quality and limit unnecessary and counterproductive

[5] Available at https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf

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litigation costs." H.R. Rep. No. 112–98, pt. 1, at 40 (2011), 2011 U.S.C.C.A.N. 67, 69 (Post grant reviews were meant to be "quick and cost effective alternatives to litigation"); *see also* S. Rep. No. 110–259, at 20 (2008). The Board recognized these goals of the AIA, but also "recognize[d] the potential for abuse of the review process by repeated attacks on patents." *General Plastic*, Paper 19 at 16–17.

In *General Plastic*, the Board articulated a non-exhaustive list of factors to consider in evaluating whether to exercise discretion, under § 314(a), to deny institution of *inter partes* review based on a petition challenging the claims of a patent previously before the Board. Those factors include:

> 1. whether the same petitioner previously filed a petition directed to the same claims of the same patent;
>
> 2. whether at the time of filing of the first petition the petitioner knew of the prior art asserted in the second petition or should have known of it;
>
> 3. whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition;
>
> 4. the length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition;
>
> 5. whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent;
>
> 6. the finite resources of the Board; and
>
> 7. the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review.

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General Plastic, Paper 19 at 15–16.

We consider below all of the factors enumerated above.

A. First General Plastic Factor

The first *General Plastic* factor asks, "whether the same petitioner previously filed a petition directed to the same claims of the same patent." *General Plastic*, Paper 19 at 16. "[O]ur application of the *General Plastic* factors is not limited solely to instances when multiple petitions are filed by the same petitioner. Rather, when different petitioners challenge the same patent, we consider any relationship between those petitioners when weighing the *General Plastic* factors." *Valve*, Paper 11 at 2, 8–9.

First, we consider whether the "same claims" are being challenged. There is no apparent dispute that the challenged claims here were also challenged in the earlier-filed petitions in the Dell IPR and Volkswagen IPR. *See* Pet. 50–54; Prelim. Resp. 18–19. According to Patent Owner, "the fact that Petitioner challenges only a subset of the claims already before the Board for evaluation, further weighs against institution." Prelim. Resp. 19 (citing *Ericsson Inc. v. Uniloc 2017, LLC*, IPR2019-01550, Paper 8 at 11 (PTAB Mar. 17, 2020)).

Next, we consider "whether the same petitioner previously filed a petition," or "when different petitioners challenge the same patent, we consider any relationship between those petitioners." Petitioner contends that "*General Plastic* does not apply here because Petitioner has not previously challenged this patent and Petitioner and the Ford Petitioner are not similarly situated; for example, they are not accused in the litigation of infringing based on the same products as examined under Factors 1 and 3." Pet. 54 (citing *General Plastic*, Paper 19 at 15–19).

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In response, Patent Owner presents numerous considerations for the first factor. *See* Prelim. Resp. 13–20. Patent Owner summarizes those considerations as follows:

> Petitioner, Volkswagen (who filed the second, instituted petition), and Ford, who filed the third, targeted petition, are all co-defendants in the district court, and have been ordered by the Court to all ***jointly*** present their invalidity contentions to the district court—and in fact they have done so, including with respect to the same combination of the IEEE 802.16 and Park references asserted in this Petition. Furthermore, the district court judicial panel has found that both Petitioner and Volkswagen will have similar issues relating to claim construction and infringement as both are accused of infringement based on implementing the same LTE and/or 5G standards.

Id. at 13; *see id.* at 15–17 (reproducing Ex. 2019, 666; quoting Ex. 1010, 3; Ex. 1013, 1–2; citing Ex. 1010, 1, 3; Ex. 1027; Ex. 2019, 2 n.1, 16, 27). Patent Owner contends that Petitioner here has an even stronger relationship with petitioner Volkswagen and petitioner Ford than the relationship in *Valve* that the Board found sufficient to deny institution. *See id.* at 17; *see also id.* at 19 (pointing out that Petitioner did not present arguments why there is no "significant relationship."). Patent Owner further contends that, even absent a district court co-defendant relationship, the Board has found road mapping alone to be sufficient to deny institution. *See id.* at 17–18 (quoting *Ericsson*, Paper 8 at 12); *see also id.* at 19–20 (asserting that Petitioner does not mention *Ericsson* and not address the fact that it created an "implicit" relationship sufficient to deny institution).

Based on the current record, we are persuaded by Patent Owner's arguments that the relationship between Petitioner and Volkswagen falls within the purview of the type of "significant relationship" contemplated by

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Valve. *See Valve*, Paper 11 at 10. Although Petitioner and Volkswagen are not co-defendants in same the district court litigation where Patent Owner asserted the '450 Patent against Volkswagen nor the same district court litigation where Patent Owner asserted the '450 Patent against Petitioner, there is sufficient evidence indicating that Petitioner and Volkswagen have a significant relationship due to the filing of joint claim construction and invalidity contentions. *See* Exs. 2003–2005, 2019. Accordingly, due to the same claims being challenged in this Petition and in the petition filed in the Volkswagen IPR, and the significant relationship between Petitioner and Volkswagen, the first *General Plastic* factor weighs against institution.

B. Second, Fourth, and Fifth General Plastic Factors

Petitioner presents the second, fourth, and fifth *General Plastic* factors collectively. *See* Pet. 54. Accordingly, we also address these factors collectively. The second *General Plastic* factor asks the Board to consider, "whether at the time of filing of the first petition, the petitioner knew of the prior art asserted in the second petition or should have known of it." *General Plastic*, Paper 19 at 16. The fourth *General Plastic* factor asks the Board to consider "the length of time that elapsed between the time petitioner learned of the prior art asserted in the second petition and the filing of the second petition." *Id.* The fifth *General Plastic* factor asks, "whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent." *Id.*

According to Petitioner, "[a]s to timing under Factors 2, 4, and 5, while Petitioner became aware of the prior art references in the Ford IPR and the Dell IPR as of at least the time of their filing, Petitioner made no serial

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attack on the '450 patent and has filed this Petition within the one-month period under 37 C.F.R. § 42.122(b)." Pet. 54.

Patent Owner contends that, "at the time Volkswagen filed the second petition challenging the Patent in November, and certainly when Ford filed the third petition in March, Petitioner knew or should have known of the references it is now asserting in this sixth Petition." Prelim. Resp. 21. As to IEEE802.16-2004, Patent Owner asserts that this reference was one of two references that Dell relied upon in its petition filed on September 16, 2021. *See id.* (citing IPR2021-01486, Paper 2). According to Patent Owner, "Petitioner was undisputedly aware of the IEEE 802.16-2004 at the time Volkswagen filed its petition on September 27, 2022—a year after the *Dell Petition*." *Id.* (citing IPR2021-01567, Paper 2). As to Park, Patent Owner asserts that "Petitioner was either aware, or should have been aware, of its Park reference at the time Volkswagen filed the second petition against the Patent" because "Petitioner jointly with Volkswagen identified Park as a reference in its invalidity contentions shortly after the filing of the *Volkswagen Petition*" and "the *Volkswagen Petition* itself included the Park reference as an exhibit and discussed it." Prelim. Resp. 21–22 (citing Ex. 2019, 2 n.1, 16; IPR2022-01567, Ex. 1024). According to Patent Owner, "[t]here is simply no reason why Petitioner could not have filed a petition together with Volkswagen, filed a petition together with Ford, or even filed its separate Petition in November 2022 when it indisputably knew of its combination of IEEE 802.16-2004 and Park." Prelim. Resp. 27. Patent Owner further contends that Petitioner does not "present an 'adequate explanation' of the time lapse between the two petitions, just as it does not have an adequate explanation as to why there

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should be two instituted petitions against the same patent, which is strongly disfavored." *Id.* (citing *Valve*, Paper 11 at 14).

In consideration of the second *General Plastic* factor, we determine that Petitioner knew of, or should have known of the IEEE 802.16-2004 and Park references at the time Volkswagen filed its petition on September 27, 2022 to weigh against institution. We further determine that a substantial amount of time (i.e., at least eight months) elapsed between September 27, 2022, when Petitioner knew of, or should have known of both the IEEE 802.16-2004 and Park references and when the Petition was filed on June 5, 2023. Accordingly, we also determine that the considerations of the second and fourth *General Plastic* factors weigh against institution. As pointed out by Patent Owner, Petitioner does not offer any explanation for the time elapsed between the filings of the Volkswagen petition and this Petition directed to the same claims of the same patent. Accordingly, we also determine that the considerations of the fifth *General Plastic* factor weigh against institution.

C. Third General Plastic Factor

The third *General Plastic* factor asks the Board to consider "whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition." *General Plastic*, Paper 19 at 16. The Board explained the relevance of this factor in *General Plastic*:

> [F]actor 3 is directed to Petitioner's potential benefit from receiving and having the opportunity to study Patent Owner's Preliminary Response, as well as our institution decisions on the first-filed petitions, prior to its filing of follow-on petitions.

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> As discussed in our Decisions Denying Institution, we are concerned here by the shifts in the prior art asserted and the related arguments in follow-on petitions. Multiple, staggered petitions challenging the same patent and same claims raise the potential for abuse. The absence of any restrictions on follow-on petitions would allow petitioners the opportunity to strategically stage their prior art and arguments in multiple petitions, using our decisions as a roadmap, until a ground is found that results in the grant of review. All other factors aside, this is unfair to patent owners and is an inefficient use of the *inter partes* review process and other post-grant review processes.

Id. at 17–18 (internal citation and footnote omitted).

Petitioner does not directly address this factor. *See* Pet. 51–54.

Patent Owner contends:

> At the time Ford filed its Petition on March 29, 2023, Ford, and Petitioner, had already received the Patent Owner Preliminary Response in the *Volkswagen Petition*. Specifically, in the Volkswagen IPR, the Petition was filed on September 27, 2022, and the Patent Owner Preliminary Response was filed on February 8, 2023. Both dates are substantially prior to the filing date of the Petition in this matter, on March 29, 2023. In fact, the evidence suggests that Petitioner waited until the ***very last day*** of its statutory bar grace period to file its Petition on March 29, 2023, making sure it had received Patent Owner's Preliminary Response, and maximizing its road-mapping opportunity. *See* Ex. 2016 [Ford-POS] (service of complaint on Petitioner on March 29, 2022). Petitioner here waited even longer, until June 2023. . . .
>
> At the time it filed its Petition on March 29, 2023, Ford had also received Patent Owner's Preliminary Response (filed December 20, 2021) and the Board's decision denying institution (issued March 16, 2022) in the *Dell* IPR[.]

Prelim. Resp. 23–24.

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There is insufficient evidence that the preliminary response filed in the Volkswagen IPR or the preliminary response and institution decision in the Dell IPR was used as roadmap for this Petition or otherwise provided insight for filing this Petition. Accordingly, we determine that the considerations of the third *General Plastic* factor weigh neither for nor against institution.

D. Sixth and Seventh General Plastic Factors

In view of the parties addressing the sixth and seventh *General Plastic* factors collectively (*see* Pet. 54; Prelim. Resp. 28), we also address these factors collectively. The sixth and seventh factors ask the Board to take into consideration "the finite resources of the Board" and "the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review." *General Plastic*, Paper 19 at 16. The sixth and seventh factors are efficiency considerations. *See id.* at 16–17; *see also* CTPG at 56 (explaining that the Director's discretion under § 314(a) is informed by 35 U.S.C. § 316(b), which requires "the efficient administration of the Office, and the ability of the Office to timely complete proceedings instituted under this chapter"). As explained in *General Plastic*, "multiple, staggered petition filings, such as those here, are an inefficient use of the *inter partes* review process and the Board's resources." *Id.* at 21.

According to Petitioner, "[a]s to Factors 6 and 7, Petitioner seeks to join the Ford IPR and is not raising new arguments and will participate in an inactive/understudy role so that there should be no material impact on the Board's finite resources or its ability to issue a final determination within

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one year." Pet. 54 (citing *General Plastic* at 15–19; *Apple Inc. v. Uniloc 2017 LLC*, IPR2020-00224, Paper 10 at 4–5 (PTAB Apr. 6, 2020)).

In response, Patent Owner points out that it is generally inefficient and wasteful of resources to have multiple petitions challenging the same patent. *See* Prelim. Resp. 28 (quoting *Valve*, Paper 11 at 13). According to Patent Owner, "[a]s the sixth petition challenging this Patent, especially in light of at least one already instituted trial, these factors also strongly weigh against intuition." *Id.*

Under the circumstances before us, instituting *inter partes* review based on this Petition challenging the same claims as those challenged in the Volkswagen IPR would not be an efficient use of the finite resources of the Board. Although there may be some efficiency gains based on familiarity of the subject matter of the '450 Patent, those gains would be negated and surpassed by the inefficiencies of considering a second set of prior art challenges in this Petition. Moreover, the evaluation of the merits of the '450 Patent on the basis of only one petition should be sufficient, in most cases, to advance "the Board's mission is to improve patent quality and restore confidence in the presumption of validity that comes with issued patents." *Cuozzo*, 579 U.S. at 272; *see also* CTPG at 59 ("Based on the Board's experience, one petition should be sufficient to challenge the claims of a patent in most situations.").

Accordingly, we determine that the considerations of the sixth and seventh *General Plastic* factors weigh against institution.

E. Summary of Analysis

We have considered the circumstances and facts before us in view of the *General Plastic* factors. For the reasons identified above, we determine

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that a majority of the *General Plastic* factors weigh against institution of review, including the following facts: (1) this Petition challenges the same claims as those challenged in the petitions filed in the Dell IPR and Volkswagen IPR, (2) Petitioner has a significant relationship with Volkswagen based on the joint claim construction and infringement contentions in the district court with respect to Patent Owner's assertions of the '450 Patent; (3) Petitioner knew of, or should have known of the Park and IEEE802.16-2004 references at least eight months before filing the Petition; and (4) and the efficiency concerns implicated by instituting a second *inter partes* review challenging the same claims of the '540 Patent.

Based on these particular circumstances before us, we determine that it is appropriate to exercise discretion under § 314(a) to deny institution of *inter partes* review.

V. CONCLUSION

For the foregoing reasons, we deny Petitioner's Motion for Joinder as moot and exercise our discretion under § 314(a) to deny institution of *inter partes* review.

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner's Motion for Joinder (Paper 3) is *denied* as moot; and

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

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Paper No. 10
Entered: December 6, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

GENERAL MOTORS LLC, NISSAN NORTH AMERICA, INC., AND TESLA INC.,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2023-00963
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
Granting Motion for Joinder
35 U.S.C § 315(c); 37 C.F.R. § 42.122

I. INTRODUCTION

A. Background

General Motors LLC, Nissan North America, Inc., and Tesla Inc. (collectively "Petitioner") filed a Petition (Paper 4, "Pet.") requesting institution of an *inter partes* review of claims 1–18 of U.S. Patent No. 10,447,450 B2 (Ex. 1001, "the '450 Patent"). Concurrently, Petitioner filed a Motion for Joinder seeking to be joined as a party to *Volkswagen Group of America, Inc. v. Neo Wireless, LLC*, IPR2022-01567 ("Volkswagen IPR"). Paper 3 ("Motion" or "Mot."). Petitioner also filed a "Notice Ranking and Explaining Material Differences Between Petitions for *Inter Partes* Review of U.S. Patent No. 10,447,450."[1] Paper 2. A preliminary response was not filed. Neo Wireless LLC ("Patent Owner") filed a Response to Petitioner's Motion for Joinder (Paper 8, "Opp."). Petitioner subsequently filed a Reply in Support of its Motion for Joinder. Paper 9 ("Mot. Reply").

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) (2022). Under 35 U.S.C. § 314, an *inter partes* review may not be instituted "unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition."

We also have authority to consider Petitioner's Motion for Joinder. *See* 35 U.S.C. § 315(c); 37 C.F.R. § 42.122.

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[1] Petitioner ranks this Petition ahead of the petition filed in IPR2023-00962.

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For the reasons that follow, we determine that institution of *inter partes* review is warranted on the same grounds instituted in the Volkswagen IPR and grant Petitioner's Motion for Joinder.

B. Real Parties-in-Interest

Petitioner states that the real parties-in-interest are General Motors LLC, Nissan North America, Inc., Tesla, Inc., General Motors Company, LG Electronics, Inc., Nissan Motor Acceptance Corporation a/k/a Nissan Motor Acceptance Company LLC, and Quectel Wireless Solutions Co. Ltd. Pet. 3.

Patent Owner states that the real party-in-interest is Neo Wireless LLC. Paper 6, 1.

C. Related Matters

Petitioner lists numerous civil actions in which Patent Owner is the plaintiff and the '450 Patent is involved. Pet. 3–6; Mot. 1. Patent Owner lists ten current district court proceedings involving the '450 Patent and fourteen proceedings that, according to Patent Owner, have been terminated. Paper 6, 1–3. The current district court proceedings include:

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., No. 2:22-cv-11403 (E.D. Mich.);

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

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

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

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

Pet. 4–5; Paper 6, 1–2.

Both parties further identify IPR2021-01486 (institution denied), IPR2022-01567 (instituted), IPR2023-00763 (institution denied), IPR2023-00793 (instituted, joined to IPR2022-01567), and IPR2023–00962 (concurrently filed) as proceedings before the Board. Pet. 6–7; Paper 6, 1, 4.

In addition, Petitioner also identifies several commonly-assigned U.S. patents that are the subject of IPR2022-01573, IPR2022-01539, IPR2023-00079, IPR2023-00764, IPR2023-00766, IPR2023-00791, IPR2023-00961, and IPR2023-00964. Pet. 7.

D. The '450 Patent (Ex. 1001)

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 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

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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 "[a]t 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 of the 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.

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 designated 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.

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Figure 3 of the '450 Patent is reproduced below.

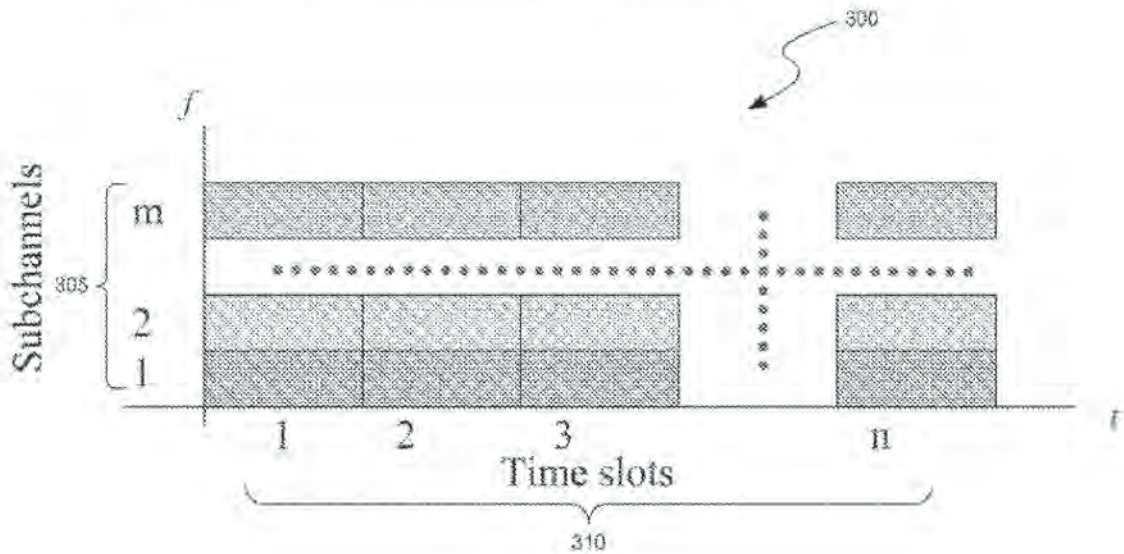

FIG. 3

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.

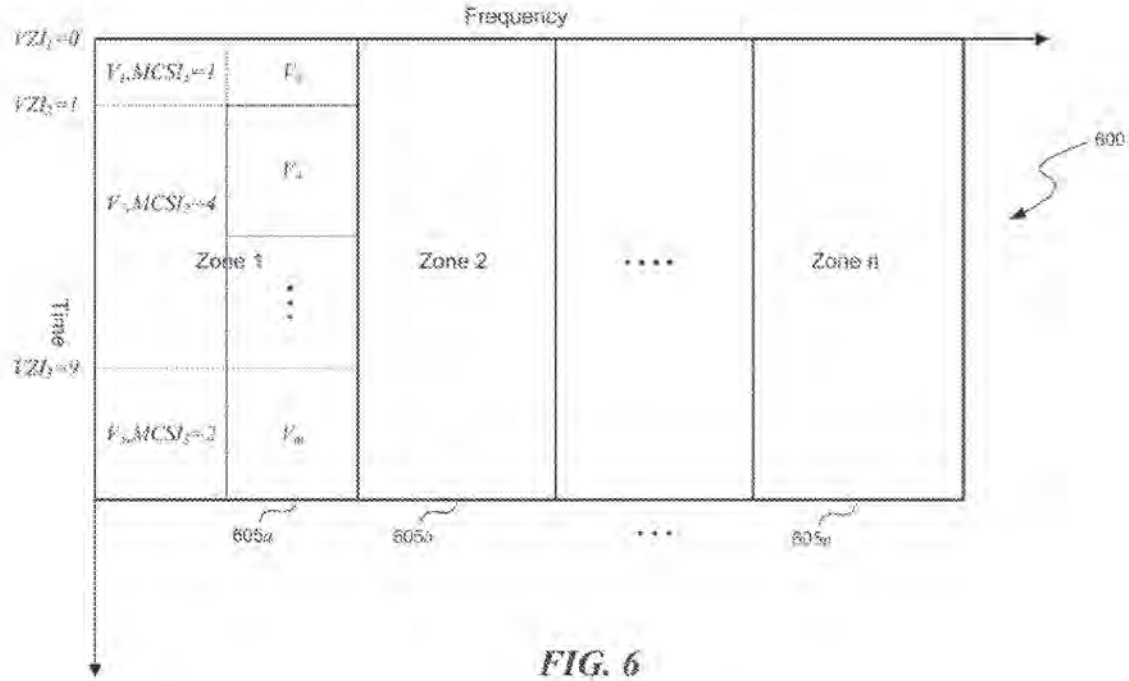

FIG. 6

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 605*a*, 605*b*, . . . 605*n*, 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 5:50–52. 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, . . . 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, . . . 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, "[w]hen 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. Illustrative Claim

Claims 1, 7, and 13 are independent, and claims 2–6, 8–12, and 14–18 depend therefrom, respectively. Claim 1, reproduced below, is 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;

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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, 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.

Ex. 1001, 12:47–67.

F. Evidence

Petitioner relies on the following prior art references in the asserted grounds of unpatentability (Pet. 10):

Name	Reference	Exhibit
Vijayan089	Vijayan et al., US 2005/0058089 A1, published March 17, 2005	1005
Wu	Wu et al., US 2005/0063345 A1, published March 24, 2005	1008
Vijayan475	Vijayan et al., US 2005/0141475 A1, published June 30, 2005	1006
Choi	Choi et al., US 2005/0243774 A1, published November 3, 2005	1009
Laroia	Laroia et al., US 2005/0277429 A1, published December 15, 2005	1007

Petitioner also relies on a Declaration of Matthew C. Valenti, Ph.D. Ex. 1048.

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G. Asserted Patentability Challenges

Petitioner asserts that claims 1–18 are unpatentable under 35 U.S.C. § 103(a) on the following grounds (Pet. 10):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–5, 7–11, 13–17	103[2]	Vijayan089, Laroia
1–5, 7–11, 13–17	103	Vijayan475, Wu
6, 12, 18	103	Vijayan089, Laroia, Choi
6, 12, 18	103	Vijayan475, Wu, Choi

II. ANALYSIS

Joinder for purposes of an *inter partes* review is governed by 35 U.S.C. § 315(c), which states:

> JOINDER.—If the Director institutes an inter partes review, the Director, in his or her discretion, may join as a party to that inter partes review any person who properly files a petition under section 311 that the Director, after receiving a preliminary response under section 313 or the expiration of the time for filing such a response, determines warrants the institution of an inter parties review under section 314.

"To join a party to an instituted [*inter partes* review (IPR)], the plain language of § 315(c) requires two different decisions." *Facebook, Inc. v. Windy City Innovations, LLC*, 973 F.3d 1321, 1332 (Fed. Cir. 2020). "First, the statute requires that the Director (or the Board acting through a delegation of authority) . . . determine whether the joinder applicant's petition for IPR 'warrants' institution under § 314." *Id.* "Second, to effect

[2] 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 §§ 102 and 103.

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joinder, § 315(c) requires the Director to exercise his discretion to decide whether to 'join as a party' the joinder applicant." *Id.*

A. Whether the Petition Warrants Institution

Petitioner states that its "Petition is substantively identical to the petition in the V[olkswagen] IPR." Mot. 4. Petitioner also states that its "expert declaration of Dr. Matthew C. Valenti is substantively identical to the declaration filed in the V[olkswagen] IPR petition." *Id.* at 9; *see id.* at 5 n.1. Petitioner further states that it "will not rely on expert testimony beyond that submitted by the V[olkswagen] IPR Petitioner unless the V[olkswagen] IPR Petitioner is terminated from the case prior to any necessary depositions." *Id.* at 8.

We instituted an *inter partes* review in the Volkswagen IPR. *See* IPR2022-01567, Paper 8 ("1567 Dec. on Inst."). We incorporate our previous analysis regarding the asserted grounds of unpatentability and conclude that Petitioner has demonstrated a reasonable likelihood of prevailing with respect to at least one claim of the '450 Patent challenged in the Petition for the same reasons. *See* 1567 Dec. on Inst. 10–73. Therefore, we determine that the Petition warrants institution of *inter partes* review on all claims and all grounds asserted in the Petition. 37 C.F.R. § 42.108(a) ("When instituting . . . review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim."); *see also SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018).

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B. Whether to Join Petitioner as a Party to the Volkswagen IPR

Joinder may be authorized when warranted, but the decision to grant joinder is discretionary. *See* 35 U.S.C. § 315(c); 37 C.F.R. § 42.122. We determine whether to grant joinder on a case-by-case basis, taking into account the particular facts of each case, substantive and procedural issues, and other considerations. When exercising that discretion, we are mindful that patent trial regulations, including the rules for joinder, must be construed to secure the just, speedy, and inexpensive resolution of every proceeding. *See* 35 U.S.C. § 316(b); 37 C.F.R. § 42.1(b). Any motion for joinder must be filed "no later than one month after the institution date of any *inter partes* review for which joinder is requested." 37 C.F.R. § 42.122(b). Petitioner filed its Petition and Motion for Joinder no later than one month after the institution decision in IPR2022-01567, and, thus, the Motion is timely.[3]

As the moving party, Petitioner has the burden of proof in establishing entitlement to the requested relief. 37 C.F.R. §§ 42.20(c), 42.122(b). A motion for joinder should: (1) set forth the reasons why joinder is appropriate; (2) identify any new grounds of unpatentability asserted in the petition; (3) explain what impact (if any) joinder would have on the trial schedule for the existing review; and (4) address specifically how briefing and discovery may be simplified. *See Kyocera Corp. v. SoftView LLC*, IPR2013-00004, Paper 15 at 4 (PTAB Apr. 24, 2013).

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[3] We instituted review in IPR2022-01567 on May 4, 2023. The Petition and Motion for Joinder were filed on June 5, 2023 (the Monday immediately following Sunday June 4, 2023).

1. Motion for Joinder

Petitioner argues that joinder is appropriate because it will promote an efficient determination of the patentability of the '450 Patent in a single proceeding without prejudice to any party. *See* Mot. 4–5. Petitioner contends that its Petition does not add additional complexity to the grounds in the Volkswagen IPR, because it "challenges the validity of the '450 patent on identical grounds to those in the V[olkswagen] IPR" and its "supporting materials—including its supporting expert declaration, exhibits, and exhibit numbering—are substantially identical to those presented in the V[olkswagen] IPR." *Id.* at 6 *see id.* at 6–7 (citing *Sony Corp. v. Memory Integrity, LLC*, IPR2015-01353, Paper 11 at 5–6 (PTAB Oct. 5, 2015)). According to Petitioner, although they use their own expert declarant, the expert's declaration agrees with and adopts the facts, analysis, and conclusions of the expert declaration in the V[olkswagen] IPR and does not contain any new opinions not included in the V[olkswagen] IPR expert declaration." *Id.* at 6 (citing *Everlight Elecs. Co. v. Document Security Sys., Inc.*, IPR2018-01260, Paper 12 at 6–7 (PTAB Nov. 14, 2018)). Petitioner contends that joinder will not affect the schedule in the Volkswagen IPR, and agrees to adhere to all applicable deadlines set forth in the Volkswagen IPR Scheduling Order. *See id.* at 7. Petitioner further asserts that joinder will simplify briefing and discovery because Petitioner has agreed to consolidated filings and an understudy role. *See id.* at 7–8. More specifically, in the understudy role, Petitioner agrees to the following conditions:

> (a) Petitioners shall not make any substantive filing and shall be bound by the filings of the V[olkswagen] IPR

> Petitioner, unless a filing concerns termination and settlement, or issues solely involving Petitioners;
>
> (b) Petitioners shall not present any argument or make any presentation at oral hearing unless an issue solely involves Petitioners, or when addressing Board-approved motions that do not affect the V[olkswagen] IPR Petitioner, or its respective position;
>
> (c) Petitioners shall not seek to cross-examine or defend the cross-examination of any witness, unless the topic of cross-examination concerns issues solely involving Petitioners;
>
> (d) Petitioners shall not seek discovery from Patent Owner on issues not solely involving Petitioners;
>
> (e) Petitioners will not rely on expert testimony beyond that submitted by the V[olkswagen] IPR Petitioner unless the V[olkswagen] IPR Petitioner is terminated from the case prior to any necessary depositions. If the V[olkswagen] IPR Petitioner is not terminated from the case prior to any necessary depositions, Petitioners agrees to rely entirely on, and be bound by, the expert declarations and depositions in the V[olkswagen] IPR. Petitioners's expert declaration of Dr. Matthew C. Valenti is substantively identical to the declaration filed in the V[olkswagen] IPR petition. *See, e.g., Noven Pharm., Inc. v. Novartis AG*, IPR2014-00550, Paper 38 at 5 (PTAB April 10, 2015). Unless and until the current petitioner in IPR2022-01567 ceases to participate in the instituted V[olkswagen] IPR, Petitioners will not assume an active role.

Mot. 7–8. In a footnote, Petitioner adds "should the V[olkswagen] IPR Petitioner's participation in the V[olkswagen] IPR terminate, Petitioners would take over primary responsibility for subsequent filings and discovery." *Id.* at 9 n.2.

2. Patent Owner's Response to Motion for Joinder

Patent Owner responds that joinder "should only be granted with additional conditions limiting [Petitioner]'s participation as joined understudy petitioner." Opp. 1. Patent Owner notes that Petitioner

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"concedes that measures limiting its joined participation are appropriate, and pre-emptively agrees to several such limits." *Id.* at 2 (citing Mot. 1–2, 7–10). Patent Owner, however, contends that Petitioner does not make clear what its "understudy" role entails. *See id.* at 2 (citing Mot. 1–2). In Patent Owner's view, the Board should make explicit that the "understudy" role means that Petitioner will not make any substantive filing, not make oral hearing presentations, not seek to take cross-examination testimony, and not seek other discovery. *See id.* at 2–3. "Unless the promised 'understudy role' is expressly clarified as discussed below, Patent Owner respectfully opposes granting the subject joinder request." *Id.* at 3.

Patent Owner argues that joinder should only be granted with the following additional conditions:

> (1) That [Petitioner] be denied any right to participate in the joined proceeding, including filing papers, engaging in discovery, or participate in depositions and oral argument, jointly or otherwise, without first obtaining authorization from the Board; and
> (2) That [Petitioner]'s exhibits, including its separate expert declaration (Ex. 1048), not be added to the record of this case, and that [Petitioner] have no right as understudy petitioner to submit any separate exhibits or other materials.

Opp. 3. Patent Owner also argues that joinder should only be granted if Petitioner "is given no right thereby to participate, as a joined party, without express prior Board authorization." *Id.* at 4; *see also id.* at 6–9 (similar arguments with citations to past Board proceedings).

Patent Owner also contends that Petitioner's conditions on its participation are vague and leave open a possibility that Petitioner can insert itself unilaterally, contrary to past Board conditions on joinder. *See*

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Opp. 4–7, 11–12 (citing Mot. 2, 7–10). Patent Owner asserts that Petitioner "has not promised not to submit its own separate evidence" and has done so already, including submitting separate witness testimony. Opp. 4; *see also id.* at 10–11 (citing Ex. 1048). Patent Owner also contends that allowing Petitioner to present its own separate, different evidence would hinder a "just, speedy, and inexpensive resolution" of the joined proceeding. *See id.* at 11–12.

Patent Owner further asserts that should joinder be granted, Dr. Valenti's Declaration should be withdrawn. *See* Opp. 11. According to Patent Owner, "[i]n other proceedings, the Board has granted joinder only on the simple, efficient condition that the joined petitioner use the witness declaration of the existing party, and indeed that, if it has filed a declaration, that the declaration be withdrawn." *Id.* at 12 (citing *Mylan Pharms. Inc. v. Janssen Oncology, Inc.*, IPR2016-01332, Paper 21 at 9–11 (PTAB Jan. 10, 2017); *Argentum Pharma. LLC v. Janssen Oncology, Inc.*, IPR2016-01317, Paper 9 (PTAB Sept. 19, 2016); *Sony Corp. of Am. v. Network-1 Security Sols., Inc.*, IPR2013-00386, Paper 16 at 7 (PTAB July 29, 2013)). Patent Owner further contends that Petitioner's exhibits should not become exhibits in the Volkswagen IPR. *See id.* at 12–13. Patent Owner notes that Petitioner's exhibits "appear identical to exhibits Volkswagen has previously filed" (*id.* at 12 (citing Exs. 1001–1047) and argues that our rules "generally deny parties the right to the filing of duplicative exhibits without express Board authorization." *Id.* at 12–13 (citing 37 C.F.R. § 42.6(d)).

3. Petitioner's Reply in Support of its Motion for Joinder

Petitioner replies that Patent Owner's additional condition that Petitioner be denied any right to participate in the joined proceeding,

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including filing papers, engaging in discovery, or participate in depositions and oral argument, jointly or otherwise, without first obtaining authorization from the Board is unnecessary because Petitioner's stipulated conditions are consistent with the Board's practice. *See* Mot. Reply 2–3 (quoting Mot. 7–9; citing *Sony v. Memory Integrity*, Paper 11 at 6–7; *Advanced Micro Devices, Inc. v. Monterey Research, LLC*, IPR2021-00776, Paper 13 at 22 (PTAB Oct. 13, 2021); *Taiwan Semiconductor Mfg. Co., Ltd. v. Arbor Global Strategies, LLC*, IPR2021-00736, Paper 9 at 8 (PTAB Jun. 11, 2021)). Petitioner also replies that Patent Owner's condition that Petitioner's exhibits, including its separate expert declaration (Ex. 1048) should be withdrawn if joinder is granted and that Petitioner has no right to submit any separate exhibits or other materials is inconsistent with the Board's practice. *See id.* at 3–5 (citing *Everlight*, Paper 12 at 6–7; *Splunk Inc. v. Sable Networks, Inc.*, IPR2022-00228, Paper 9 at 8 (PTAB Apr. 4, 2022); *MSN Labs. Private Ltd. v. Bausch Health Ireland Ltd.*, IPR2023-00016, Paper 12 at 3–4 (PTAB Nov. 29, 2022); *Mylan v. Janssen*, Paper 21 at 11; *Argentum v. Janssen*, Paper 9 at 5–6; *Sony v. Network-I Security Sols.*, Paper 16 at 7).

4. Determining that Joinder is Appropriate

Upon considering the parties' arguments and the evidence presented, we are persuaded that it is appropriate under these circumstances to join Petitioner to the Volkswagen IPR. Petitioner challenges the same claims that are challenged in the Volkswagen IPR on the same grounds using the same prior art and evidence. Petitioner explicitly agrees that it will take an "understudy role" in the Volkswagen IPR, and has shown that the trial schedule will not be affected at all by joinder. *See* Mot. 7–9; Mot. Reply 1;

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see also Opp. 2 (Petitioner "has said it 'will act as an understudy' until the target IPR petitioner is no longer a party in the proceeding.").

At this stage of the proceeding, we determine Patent Owner's additional conditions are not necessary. *See* Opp. 2–3. If Petitioner fails to abide by its own conditions, then Patent Owner should meet and confer with Petitioner and contact the Board, if the parties cannot come to an agreement.

For the reasons discussed above, we determine that joinder to the Volkswagen IPR would result in the just, speedy, and inexpensive resolution of Petitioner's challenge. *See* 37 C.F.R. § 42.1(b). Accordingly, we grant Petitioner's Motion for Joinder and join Petitioner as a party to the Volkswagen IPR.

III. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314, an *inter partes* review of claims 1–18 of the '450 Patent is instituted with respect to all grounds raised in the Petition;

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;

FURTHER ORDERED that Petitioner's Motion for Joinder (Paper 3) with IPR2022-01567 is *granted*, and Petitioner is hereby joined as a petitioner in IPR2022-01567;

FURTHER ORDERED that the asserted grounds of unpatentability on which the Board instituted *inter partes* review in IPR2022-01567 are

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unchanged, and no other grounds of unpatentability are added in IPR2022-01567;

FURTHER ORDERED that the Scheduling Order (Paper 9) entered in IPR2022-01567, and any modifications thereto, shall govern the schedule of the joined proceeding;

FURTHER ORDERED that Petitioner's role in IPR2022-01567 shall be limited as stated by Petitioner in the Motion for Joinder (Paper 2) unless and until Volkswagen is terminated from the proceeding in IPR2022-01567;

FURTHER ORDERED that the case caption in IPR2022-01567 shall be changed to reflect joinder of Petitioner as a petitioner in accordance with the attached example;

FURTHER ORDERED that a copy of this Decision shall be entered into the record of IPR2022-01567; and

FURTHER ORDERED that all further filings shall be made in IPR2022-01567.

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
AMERICAN HONDA MOTOR CO., INC., GENERAL MOTORS LLC,
NISSAN NORTH AMERICA, INC., AND TESLA, INC.,[4]
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2023-001567
Patent 10,447,450 B2

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[4] American Honda Motor Co. Inc. was joined as a petitioner to this proceeding based on a petition and motion for joinder filed in IPR2023-00793, which were granted. General Motors LLC, Nissan North America, Inc., and Tesla, Inc., were joined as a petitioner to this proceeding based on a petition and motion for joinder filed in IPR2023-00963, which were granted.

Trials@uspto.gov
571-272-7822

Paper 17
Entered: November 9, 2023

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

I. INTRODUCTION

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.").

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).

Based on our consideration of 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*"), we determine that the circumstances before us warrant the exercise of discretion under § 314(a) to deny *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. 63; Paper 6, 1.

B. Related Matters

The parties indicate that the '450 Patent was or is the subject of IPR2021-01486 ("Dell IPR") (institution denied) and IPR2022-01567

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("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 advises us that the '450 Patent was formerly 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.

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C. 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 application such as voice-over-IP ("VoIP") and resulting in a relatively low spectral efficiency. *Id.* at 1:51–2:13.

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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.

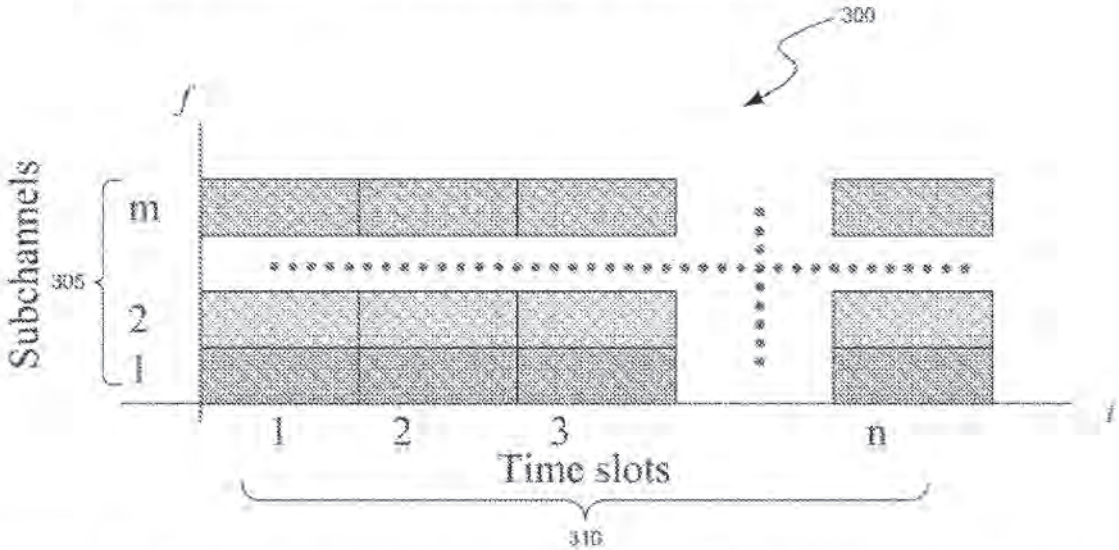

Figure 3 is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, "[t]he frequency is divided into two or more subchannels 305, represented as subchannels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

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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.

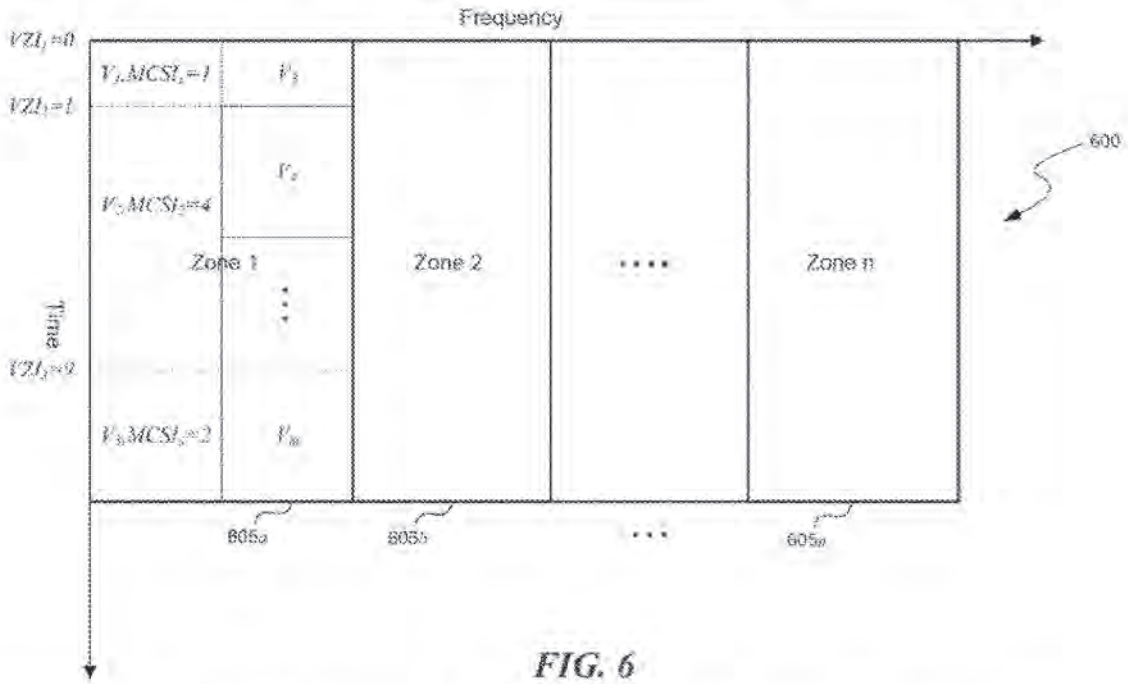

FIG. 6

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 605*a*, 605*b*, . . . 605*n*, 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

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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, . . . 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, . . . 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, "[w]hen 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.,

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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 "[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.

D. 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:

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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.

E. Asserted Patentability Challenge and Asserted Prior Art

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

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
7, 11	103[1]	Park[2], IEEE802.16-2004[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).

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[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 §§ 102 and 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).

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III. ANALYSIS

35 U.S.C. § 314(a) provides:

> The Director may not authorize an inter partes review to be instituted unless the Director determines that the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.

The Supreme Court has explained that, because § 314 includes no mandate to institute review, "the agency's decision to deny a petition is a matter committed to the Patent Office's discretion." *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 273 (2016); *see also Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) ("[T]he PTO is permitted, but never compelled, to institute an IPR proceeding."). A decision whether to institute is within the Director's discretion, and that discretion has been delegated to the Board. 37 C.F.R. § 42.4(a); *see General Plastic*, Paper 19 at 19 (citing 35 U.S.C. § 314(a)); *Cuozzo*, 579 U.S. at 273.

As the Consolidated Trial Practice Guide[4] ("CTPG") notes, the AIA was "designed to establish a more efficient and streamlined patent system that will improve patent quality and limit unnecessary and counterproductive litigation costs." H.R. Rep. No. 112–98, pt. 1, at 40 (2011), 2011 U.S.C.C.A.N. 67, 69 (Post grant reviews were meant to be "quick and cost effective alternatives to litigation"); *see also* S. Rep. No. 110–259, at 20 (2008). The Board recognized these goals of the AIA, but also

[4] Available at https://www.uspto.gov/sites/default/files/documents/tpgnov.pdf

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"recognize[d] the potential for abuse of the review process by repeated attacks on patents." *General Plastic*, Paper 19 at 16–17.

In *General Plastic*, the Board articulated a non-exhaustive list of factors to consider in evaluating whether to exercise discretion, under § 314(a), to deny institution of *inter partes* review based on a petition challenging the claims of a patent previously before the Board. Those factors include:

> 1. whether the same petitioner previously filed a petition directed to the same claims of the same patent;
>
> 2. whether at the time of filing of the first petition the petitioner knew of the prior art asserted in the second petition or should have known of it;
>
> 3. whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition;
>
> 4. the length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition;
>
> 5. whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent;
>
> 6. the finite resources of the Board; and
>
> 7. the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review.

General Plastic, Paper 19 at 15–16.

We consider below all of the factors enumerated above.

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A. First General Plastic Factor

The first *General Plastic* factor asks, "whether the same petitioner previously filed a petition directed to the same claims of the same patent." *General Plastic*, Paper 19 at 16. "[O]ur application of the *General Plastic* factors is not limited solely to instances when multiple petitions are filed by the same petitioner. Rather, when different petitioners challenge the same patent, we consider any relationship between those petitioners when weighing the *General Plastic* factors." *Valve*, Paper 11 at 2, 9.

First, we consider whether the "same claims" are being challenged. There is no apparent dispute that the challenged claims here were also challenged in the earlier-filed petitions in the Dell IPR and Volkswagen IPR. *See* Pet. 51–57; Prelim. Resp. 15. According to Patent Owner, "the fact that Petitioner challenges only a subset of claims already before the Board for evaluation, further weighs against institution." Prelim. Resp. 15 (citing *Ericsson Inc. v. Uniloc 2017, LLC*, IPR2019-01550, Paper 8 at 11 (PTAB Mar. 17, 2020)).

Next, we consider "whether the same petitioner previously filed a petition," or "when different petitioners challenge the same patent, we consider any relationship between those petitioners." Petitioner contends that the first factor weighs strongly in favor of institution. *See* Pet. 54, 57. Petitioner contends that in contrast to the relationship between the petitioners in *Valve*, there is no relevant relationship between Petitioner and Volkswagen as they are direct competitors, were not sued in the same court, and are only before the Board due to Patent Owner's strategy of filing seven infringement complaints against seven automobile manufacturers. *See* Pet. 54. Petitioner asserts that Volkswagen and Petitioner are not co-

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defendants because Patent Owner moved to transfer the seven different district court proceedings into a single multidistrict litigation for pretrial proceedings only. Pet. 55. According to Petitioner, even if Petitioner and Volkswagen could be considered co-defendants, "that would not be enough to establish the significant relationship required for this factor." Pet. 54–55 (citing *Facebook, Inc. v. Express Mobile, Inc.*, IPR2021-01455, Paper 11 at 11 (PTAB March 4, 2022) ("*Express Mobile*")). Similarly, Petitioner argues that, the fact that the seven parties submitted coordinated claim constructions and invalidity contentions, is not enough to establish the significant relationship required for this factor. *See* Pet. 56 (citing *Twitter, Inc. v. Palo Alto Rsch. Ctr. Inc.*, IPR2021-01458, Paper 11 at 31–33 (PTAB Apr. 6, 2022)).

Petitioner also distinguishes the relationship between Petitioner and Volkswagen, contending that unlike the circumstances in *Valve*, Petitioner did not incorporate Volkswagen's technology under license or receive technical assistance from Volkswagen. *See* Pet. 55. Petitioner further asserts that even if all seven accused defendants comply with the cellular LTE specification, it takes much more than that to establish the requisite significant relationship. *See id.* Petitioner contends that Petitioner and Volkswagen are even less related than the petitioners in *Express Mobile* where the Board found that the parties were not related despite the petitioners being sued in the same court on the same day. *See* Pet. 56. Petitioner further asserts that it had no involvement with or input into Volkswagen's *inter partes* review and vice versa. *See* Pet. 57

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In response, Patent Owner presents numerous considerations for the first factor. *See* Prelim. Resp. 10–17. Patent Owner summarizes those considerations as follows:

> Petitioner and Volkswagen (who filed the second petition) are co-defendants in the district court, and have been ordered by the Court to jointly present their invalidity contentions to the district court—and in fact they have jointly presented their invalidity contentions to the district court, including with respect to the same combination of the IEEE 802.16 and Park references asserted in this Petition. Furthermore, the judicial panel has found that both Petitioner and Volkswagen will have similar issues relating to claim construction and infringement as both are accused of infringement based on implementing the same LTE and/or 5G standards.

Prelim. Resp. 10; *see id.* at 11–13 (reproducing Ex. 2019, 666; citing Ex. 1013, 1–2; Ex. 1010, 1, 3; Ex. 1027; Ex. 2019, 2 n.1, 16, 27). Patent Owner contends that Petitioner here has an even stronger relationship with Volkswagen than the relationship in *Valve* that the Board found sufficient to deny institution. *Id.* at 14. Patent Owner further points out that, even absent a district court co-defendant relationship, the Board has found road mapping alone to be sufficient to deny institution. *See id.* (quoting *Ericsson*, Paper 8 at 12).

Patent Owner argues that Petitioner's series of arguments addressing why there is no significant relationship between it and Volkswagen fail because "Petitioner does not address the fact that it has created an 'implicit[]' relationship sufficient to deny institution by using the prior petitions as a road-map." Prelim. Resp. 15 (citing Pet. 53–57; *Ericsson*, Paper 8 at 12). Patent Owner also contends that Petitioner's argument that it is not a co-defendant with Volkswagen by choice, is true for most if not all co-defendants. *See id.* at 15–16.

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Patent Owner further contends that Petitioner's reliance on *Express Mobile* is misplaced because it is readily distinguishable from the circumstances here. *See* Prelim. Resp. 16. According to Patent Owner,

> both [Petitioner] and Volkswagen are accused of infringement based on implementing the same standards, and the judicial panel expressly found that "[All actions thus can be] expected to share factual questions concerning such matters as the technology underlying the patents, prior art, claim construction, and/or issues of infringement involving the patents."

Id. (citing Ex. 1013, 1–2). Patent Owner asserts that the district court has ordered defendants to jointly select and present a limited number of validity challenges, and they have done so, including with respect to the same combination of IEEE 802.16-2004 and Park presented in this Petition. *See id.* (citing Ex. 2019, 666).

Patent Owner further contends that it was Petitioner's choice to not be involved with Volkswagen's *inter partes* review. *See* Prelim. Resp. 17. Patent Owner contends that there is no reason why multiple defendants cannot be expected to cooperate in their IPR challenges when the defendants are forced into a single multi-district litigation because of strong overlap of issues, and are expected to make joint submissions regarding claim construction and infringement. *See id.*

Based on the current record, we are persuaded by Patent Owner's arguments that the relationship between Petitioner and Volkswagen falls within the purview of the type of "significant relationship" contemplated by *Valve*. *See Valve*, Paper 11 at 10. Although Petitioner and Volkswagen are not co-defendants in same the district court litigation where Patent Owner asserted the '450 Patent against Volkswagen nor the same district court case where Patent Owner asserted the '450 Patent against Petitioner, there is

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sufficient evidence indicating that Petitioner and Volkswagen have a significant relationship due to the filing of joint claim construction and invalidity contentions. *See* Exs. 2003–2005, 2019. Accordingly, due to the same claims being challenged in this Petition and Volkswagen's Petition and the significant relationship between Petitioner and Volkswagen, the first *General Plastic* factor weighs against institution.

B. Second, Fourth, and Fifth General Plastic Factors

Petitioner presents the second, fourth, and fifth *General Plastic* factors collectively (*see* Pet. 57–59). Accordingly, we also address these factors collectively. The second *General Plastic* factor asks the Board to consider, "whether at the time of filing of the first petition, the petitioner knew of the prior art asserted in the second petition or should have known of it." *General Plastic*, Paper 19 at 16. The fourth *General Plastic* factor asks the Board to consider "the length of time that elapsed between the time petitioner learned of the prior art asserted in the second petition and the filing of the second petition." *Id.* The fifth *General Plastic* factor asks, "whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent." *Id.*

Petitioner asserts that the second, fourth, and fifth *General Plastic* factors are less relevant when Petitioner is not the same party or significantly related to the earlier petitioner. *See* Pet. 57 (citing *Illumina Inc. v. Ravgen, Inc.*, IPR2021-01271, Paper 12 at 20 (PTAB Jan. 26, 2022); *Shenzhen v. Apaltek Co. v. Asatek Denmark A/S*, IPR2022-01318, Paper 7 at 11 (PTAB Feb. 6, 2023); *Express Mobile*, Paper 11 at 13; *Google LLC v. Parus Holdings, Inc.*, IPR2020-00846, Paper 9 at 24–26 (PTAB Oct. 21, 2020)).

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Petitioner contends that when a later filed petition relies on different prior art, this factor is especially less relevant. *See id.* (citing *Google LLC v. Neonode Smartphones LLC*, IPR2021-01041, Paper 19 at 12–14 (PTAB Jan. 13, 2022)).

Petitioner asserts that Volkswagen "independently chose to prepare and file its IPR relatively early in this slow-moving multidistrict litigation." Pet. 58. Petitioner acknowledges that it "knew of, or should have known of, the art in its IPR at the time VW hurriedly filed its IPR." *Id.* Petitioner further contends that even if these factors are to be given weight, Petitioner "was fully justified in waiting until [Patent Owner] reduced the number of asserted claims to just *two claims* and the parties agreed to certain claim constructions." *Id.*; *see* Pet. 58–59 (quoting *LG Elecs., Inc. v. Bell N. Rsch., LLC*, IPR2020-00319, Paper 15 at 13 (PTAB June 23, 2020); *Shenzhen AOTO Elecs. Co. v. Ultravision Techs., LLC*, IPR2021-00190, Paper 7 at 18–19 (PTAB June 9, 2021)). According to Petitioner, it

> conserved party and Board resources by waiting until [Patent Owner] reduced the number of asserted claims for all six asserted patents on November 28, 2022 down to just two claims for the ['450 Patent], and the parties agreed to several constructions in a joint statement submitted on January 18, 2023.

See Pet. 58 (citing Ex. 2009, 7; Ex. 1011, 12–13).

In response, Patent Owner contends that, "at the time Volkswagen filed the second petition challenging the Patent, Petitioner knew or should have known of the references it is now asserting in this third Petition." Prelim. Resp. 18. As to IEEE802.16-2004, Patent Owner asserts that this reference was one of two references that Dell relied upon in its petition filed on September 16, 2021. *See id.* (citing IPR2021-01486, Paper 2).

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According to Patent Owner, "Petitioner was undisputedly aware of the IEEE 802.16-2004 at the time Volkswagen filed its petition on September 27, 2022—a year after the *Dell Petition*." *Id.* (citing IPR2021-01486, Paper 2). As to Park, Patent Owner asserts that "Petitioner was either aware, or should have been aware, of its Park reference at the time Volkswagen filed the second petition against the Patent" because "Petitioner jointly with Volkswagen identified Park as a reference in its invalidity contentions shortly after the filing of the *Volkswagen Petition*" and "the *Volkswagen Petition* itself included the Park reference as an exhibit and discussed it." Prelim. Resp. 18–19 (citing Ex. 2019, 2 n.1, 16; IPR2022-01567, Ex. 1024).

According to Patent Owner, "[t]here is simply no reason why Petitioner could not have filed a petition together with Volkswagen, or even filed its separate Petition in November 2022 when it indisputably knew of its combination of IEEE 802.16-2004 and Park." Prelim. Resp. 24. Patent Owner further contends:

> Petitioner claims that the reason it waited until the last day of its statutory bar to file its Petition was that it was "conserv[ing] party and Board resources" by waiting to see if Patent Owner would drop district litigation claims. Pet., 58. But that *ex post facto* rationale is not credible for several reasons.
>
> First, Volkswagen's Petition has already challenged all claims of the Patent, and its trial is currently pending before the Board. It is not clear what "resources" would be preserved by Petitioner later challenging only a subset of the claims already being considered by the Board. *Compare Ericsson*, 11 (holding that "challenging a subset of previously challenged claims" did not favor institution). . . . .
>
> The fact that Petitioner did not file a joint Petition with Volkswagen, but instead chose to wait six months to file a

> separate Petition, has wasted, not preserved, the Board's resources. . . . .

Prelim. Resp. 24–25.

As explained above addressing the first *General Plastic* factor, we consider Petitioner and Volkswagen to have a significant relationship, and, therefore, contrary to Petitioner's assertion, the second, fourth, and fifth *General Plastic* factors remains relevant for the purpose of determining whether to institute review. Therefore, in consideration of the second *General Plastic* factor, we determine that Petitioner knew of, or should have known of the IEEE 802.16-2004 and Park references at the time Volkswagen filed its petition on September 27, 2022 to weigh against institution. We further determine that a substantial amount of time (i.e., at least seven months) elapsed between September 27, 2022, when Petitioner knew of, or should have known of both the IEEE 802.16-2004 and Park references and when the Petition was filed on March 29, 2023. Accordingly, we also determine that the considerations of the fourth *General Plastic* factor weigh against institution. Although Petitioner asserts that its delay in filing its Petition was reasonable and justified, and conserved Board and party resources by focusing the dispute to the reduced asserted claims in the district court proceedings, as explained below with respect to the sixth *General Plastic* factor, instituting *inter partes* review on the basis of this Petition challenging the same claims as those challenged in the instituted Volkswagen IPR will not conserve the finite resources of the Board. Accordingly, we also determine that the considerations of the fifth *General Plastic* factor weigh against institution.

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C. Third General Plastic Factor

The third *General Plastic* factor asks the Board to consider "whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition." *General Plastic*, Paper 19 at 16. The Board explained the relevance of this factor in *General Plastic*:

> [F]actor 3 is directed to Petitioner's potential benefit from receiving and having the opportunity to study Patent Owner's Preliminary Response, as well as our institution decisions on the first-filed petitions, prior to its filing of follow-on petitions. As discussed in our Decisions Denying Institution, we are concerned here by the shifts in the prior art asserted and the related arguments in follow-on petitions. Multiple, staggered petitions challenging the same patent and same claims raise the potential for abuse. The absence of any restrictions on follow-on petitions would allow petitioners the opportunity to strategically stage their prior art and arguments in multiple petitions, using our decisions as a roadmap, until a ground is found that results in the grant of review. All other factors aside, this is unfair to patent owners and is an inefficient use of the *inter partes* review process and other post-grant review processes.

Id. at 17–18 (internal citation and footnote omitted).

Petitioner asserts that "[t]his factor should receive little weight, and is neutral in any event." Pet. 59. Petitioner contends that road mapping concerns are minimized when, as here, Petitioner did not and could not refine its Petition in view of any lessons learned from later developments because the merits of the previous preliminary response have not been addressed by the Board. *See id.* (quoting *Code 200, UAB v. Bright Data Ltd.*, IPR2022-00861, Paper 18 at 5 (PTAB Aug. 23, 2022) (precedential);

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citing *Code 200*, Paper 14 at 25–70; *Siemens Gamesa Renewable Energy, Inc. v. General Elec. Co.*, IPR2022-01479, Paper 11 at 10–14 (PTAB Mar. 7, 2023). Petitioner further asserts that similar circumstances existed between different petitioners in *Express Mobile* where the Board found that Facebook received limited benefit from having been able to review the preliminary response. *See* Pet. 60 (citing *Express Mobile*, Paper 11 at 12–13).

Petitioner contends that it gained no unfair tactical advantage because the parties agreed in the district court to adopt the same construction of "time-frequency coordinate" that Patent Owner advanced in its preliminary responses filed in the Dell IPR and Volkswagen IPR. *See* Pet. 60. Petitioner asserts that it adopted the same construction in its Petition. *See id.* Petitioner also asserts that its prior art and arguments are completely different from the prior art and arguments advanced in the petitions filed by Volkswagen and Dell. *See id.* (citing *Shenzhen AOTO*, Paper 7 at 18; *Neonode*, Paper 19 at 13).

In response, Patent Owner contends:

> At the time [Petitioner filed its Petition on March 29, 2023, it had already received the Patent Owner Preliminary Response in the *Volkswagen Petition*. Specifically, in the Volkswagen IPR, the Petition was filed on September 27, 2022, and the Patent Owner Preliminary Response was filed on February 8, 2023. Both dates are substantially prior to the filing date of the Petition in this matter, on March 29, 2023. In fact, the evidence suggests that Petitioner waited until the ***very last day*** of its statutory bar grace period to file its Petition on March 29, 2023, making sure it had received Patent Owner's Preliminary Response, and maximizing its road-mapping opportunity. *See* Ex. 2016 [Ford-POS] (service of complaint on Petitioner on March 29, 2022). . . .

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> At the time it filed its Petition on March 29, 2023, Petitioner had also received Patent Owner's Preliminary Response (filed December 20, 2021) and the Board's decision denying institution (issued March 16, 2022) in the *Dell* IPR[.]

Prelim. Resp. 20–21.

We agree with Petitioner that the third *General Plastic* factor is neutral. There is insufficient evidence that the preliminary response filed in the Volkswagen IPR or the preliminary response and institution decision in the Dell IPR was used as roadmap for this Petition or otherwise provided insight for filing this Petition where "prior art and arguments are completely different than VW's (and Dell's)." Pet. 60. Accordingly, we determine that the considerations of the third *General Plastic* factor weigh neither for nor against institution.

D. Sixth and Seventh General Plastic Factors

In view of the parties addressing the sixth and seventh *General Plastic* factors collectively (*see* Pet. 61–62; Prelim. Resp. 26–27), we also address these factors collectively. The sixth and seventh factors ask the Board to take into consideration "the finite resources of the Board" and "the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review." *General Plastic*, Paper 19 at 16. The sixth and seventh factors are efficiency considerations. *See id.* at 16–17; *see also* CTPG at 56 (explaining that the Director's discretion under § 314(a) is informed by 35 U.S.C. § 316(b), which requires "the efficient administration of the Office, and the ability of the Office to timely complete proceedings instituted under this chapter"). As explained in *General Plastic*, "multiple, staggered petition

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filings, such as those here, are an inefficient use of the *inter partes* review process and the Board's resources." *Id.* at 21.

Petitioner asserts that the Board's mission is to improve patent quality and restore confidence in the presumption of validity that comes with issued patents. *See* Pet. 61 (quoting *Code 200*, Paper 18 at 6). Petitioner contends that it "should not be prejudiced by [Volkswagen]'s litigation strategy to rush out an IPR as soon as possible, without waiting to see which claims are at issue and disavowing the parties' agreed-upon constructions in the Joint Claim Construction Statement." *Id.* (citing Ex. 1011). Petitioner further asserts that its Petition is streamlined by challenging the only two claims at issue in the litigation and adopting the agreed-upon claim constructions. *See id.* Petitioner also contends the Board is now familiar due to Dell's and Volkswagen's previous petitions. *See id.* (quoting *Parus*, Paper 9 at 26; *Illumina*, Paper 12 at 25).

In response, Patent Owner points out that it is generally inefficient and wasteful of resources to have multiple petitions challenging the same patent. *See* Prelim. Resp. 26 (quoting *Valve*, Paper 11 at 13). According to Patent Owner, "[a]s the third petition challenging this Patent, especially in light of an already instituted trial, these factors also strongly weigh against intuition." *Id.* Patent Owner asserts:

> The fact that the second petition challenging the claims were instituted is an additional factor that weighs against institution. As noted above, the Board has also instituted trial in the Volkswagen Petition, with oral argument for that matter scheduled for February 1, 2024. Thus, instituting a second trial on the same claims of the same patent would present a double burden on both the Board and Patent Owner that would not have been present if Volkswagen's petition were also denied.

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Prelim. Resp. 26. According to Patent Owner, the '450 Patent "will be fully evaluated again on the merits based on the full record at the conclusion of the Volkswagen IPR." *Id.* at 27.

Under the circumstances before us, instituting *inter partes* review based on this second Petition challenging the same claims as those challenged in the Volkswagen IPR would not be an efficient use of the finite resources of the Board. Although there may be some efficiency gains based on familiarity of the subject matter of the '450 Patent, those gains would be negated and surpassed by the inefficiencies of considering a second set of prior art challenges in this Petition. Moreover, the evaluation of the merits of the '450 Patent on the basis of only one petition should be sufficient, in most cases, to advance "the Board's mission is to improve patent quality and restore confidence in the presumption of validity that comes with issued patents." *Cuozzo*, 579 U.S. at 272; *see also* CTPG at 59 ("Based on the Board's experience, one petition should be sufficient to challenge the claims of a patent in most situations.").

Accordingly, we determine that the considerations of the sixth and seventh *General Plastic* factors weigh against institution.

E. Summary of Analysis

We have considered the circumstances and facts before us in view of the *General Plastic* factors. For the reasons identified above, we determine that a majority of the *General Plastic* factors weigh against institution of review, including the following facts: (1) this Petition challenges the same claims as those challenged in the petitions filed in the Dell IPR and Volkswagen IPR, (2) Petitioner has a significant relationship with Volkswagen based on the joint claim construction and infringement

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contentions in the district court with respect to Patent Owner's assertions of the '450 Patent; (3) Petitioner knew of, or should have known of the Park and IEEE802.16-2004 references at least seven months before filing the Petition; and (4) and the efficiency concerns implicated by instituting a second *inter partes* review challenging the same claims of the '540 Patent.

Based on these particular circumstances before us, we determine that it is appropriate to exercise discretion under § 314(a) to deny institution of review.

IV. CONCLUSION

For the foregoing reasons, we exercise our discretion under § 314(a) to 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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Paper 8
Entered: May 4, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,
Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2022-01567
Patent 10,447,450 B2

Before HYUN J. JUNG, CHARLES J. BOUDREAU, and MATTHEW S. MEYERS, *Administrative Patent Judges.*

BOUDREAU, *Administrative Patent Judge.*

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

I. INTRODUCTION

Volkswagen Group of America, Inc. ("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 2 ("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 demonstrated a reasonable likelihood of prevailing with respect to at least one of the challenged claims. Accordingly, we institute *inter partes* review of claims 1–18 of the '450 patent on all asserted grounds. *See* 37 C.F.R. § 42.108(a) ("When instituting . . . review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim.").

II. BACKGROUND

A. Real Parties in Interest

Petitioner and Patent Owner identify themselves as the real parties in interest, and Petitioner identifies itself as a subsidiary of Volkswagen AG. Pet. 3; Paper 5, 1 (Patent Owner's Mandatory Notices).

B. Related Matters

The parties advise us that the '450 patent is or has been involved in at least 23 ongoing or terminated district court proceedings, including, among others, *Neo Wireless LLC v. Volkswagen Group of America, Inc.*, No. 1:22-

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cv-00076 (E.D. Tenn.), filed March 29, 2022, and terminated June 14, 2022; *In re Neo Wireless, LLC Patent Litigation*, 2:22-md-03034 (E.D. Mich.), filed June 23, 2022; and *Neo Wireless LLC v. Volkswagen Group of America, Inc.*, No. 2:22-cv-11404 (E.D. Mich.), filed June 28, 2022. Pet. 3–4; Paper 5, 1–3. The '450 patent also was the subject of a petition for *inter partes* review in *Dell Inc. v. Neo Wireless, LLC*, IPR2021-01486 (petition filed September 16, 2021, Paper 3; institution denied April 14, 2022, Paper 12). We additionally note that Ford Motor Company and American Honda Motor Co., Inc. ("Honda") also have filed petitions for review of the '450 patent. IPR2023-00763, Paper 1; IPR2023-00793, Paper 3. Honda's petition is substantially identical to the instant Petition and was accompanied by a motion for joinder as a petitioner in this proceeding. IPR2023-00793, Paper 2.

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).

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.

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.

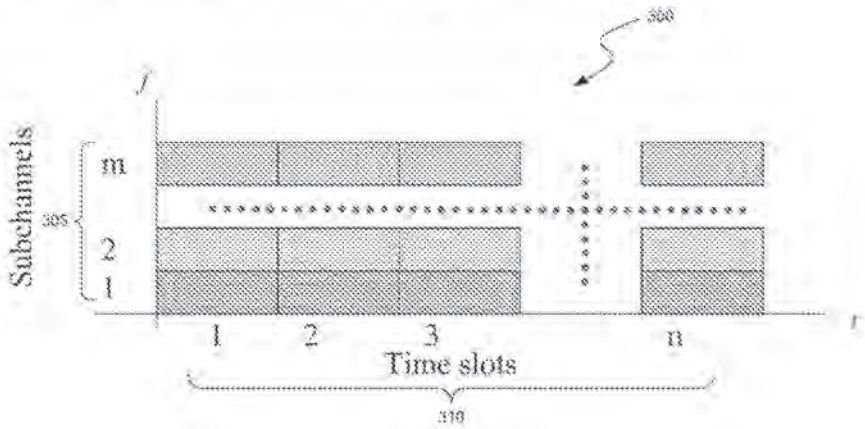

FIG. 3

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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.

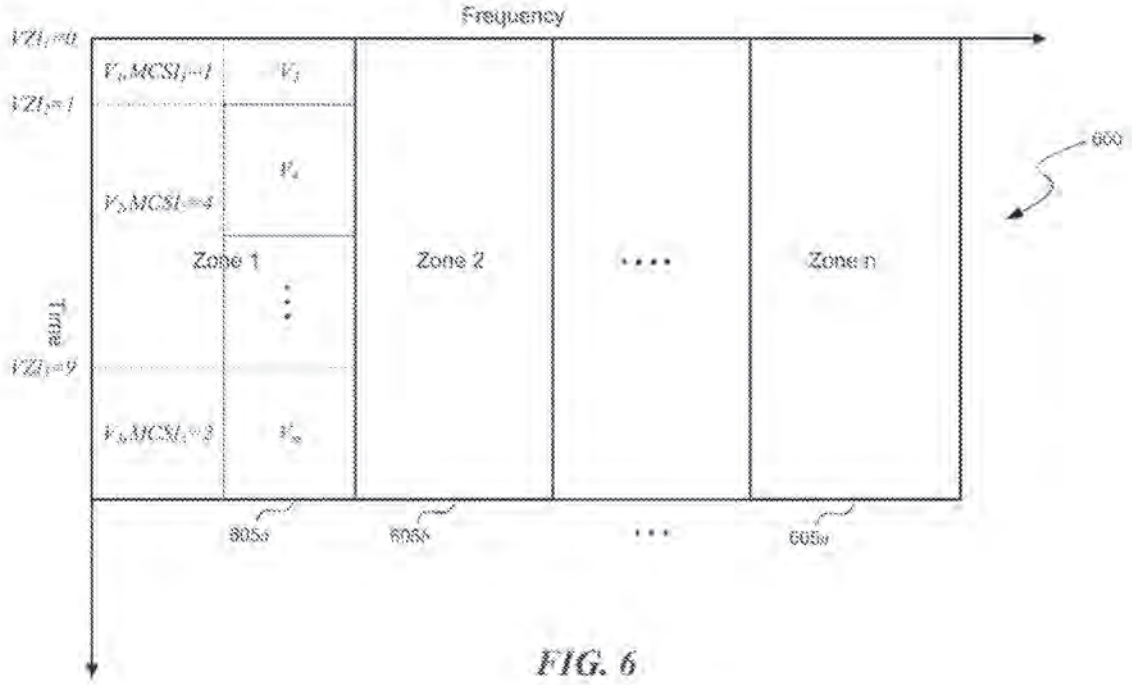

FIG. 6

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 605*a*, 605*b*, . . . 605*n*, 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, . . . 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, . . . 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 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 Claim

Among the challenged claims, claims 1, 7, and 13 are independent. Claim 1, reproduced below, is 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, 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.

Ex. 1001, 12:47–67.

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E. Evidence

Petitioner relies on the following prior art references in the asserted grounds of unpatentability:

Name	Reference	Exhibit
Vijayan089	Vijayan et al., US 2005/0058089 A1, published March 17, 2005	1005
Wu	Wu et al., US 2005/0063345 A1, published March 24, 2005	1008
Vijayan475	Vijayan et al., US 2005/0141475 A1, published June 30, 2005	1006
Choi	Choi et al., US 2005/0243774 A1, published November 3, 2005	1009
Laroia	Laroia et al., US 2005/0277429 A1, published December 15, 2005	1007

Pet. 6. Petitioner asserts that "all references relied upon qualify as prior art with respect to September 28, 2005," the filing date of the provisional application from which the '450 patent claims priority. *Id.* at 5. According to Petitioner, Vijayan089, Wu, Vijayan475, Choi, and Laroia all are prior art under at least pre-AIA 35 U.S.C. § 102(e); and Vijayan089, Vijayan475, and Wu additionally are prior art under pre-AIA 35 U.S.C. § 102(a).[1] *Id.*

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

[1] Because the application from which the '450 patent issued was one in a series of continuation applications of which the earliest was filed before March 16, 2013, the pre-AIA ("America Invents Act") versions of §§ 102 and 103 apply. Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011); *see* Ex. 1001, code (63).

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F. Asserted Grounds

Petitioner asserts that claims 1–18 are unpatentable under 35 U.S.C. § 103(a) on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–5, 7–11, 13–17	103(a)	Vijayan089, Laroia
1–5, 7–11, 13–17	103(a)	Vijayan475, Wu
6, 12, 18	103(a)	Vijayan089, Laroia, Choi
6, 12, 18	103(a)	Vijayan475, Wu, Choi

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." Pre-AIA 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.

[2] *See supra* note 1.

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> 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.

In re Nuvasive, Inc., 842 F.3d 1376, 1381 (Fed. Cir. 2016) (citation omitted) (quoting *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

Dr. Wilson opines in her Declaration that

> a person of ordinary skill in the art ("POSITA") in the context of the '450 patent as of September 28, 2005 (the earliest priority date of the '450 patent), would have a B.S. degree in electrical engineering, computer engineering, or computer science, or an equivalent field, as well as at least 3–5 years of academic or

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> industry experience in mobile wireless communications, or comparable industry experience. A greater amount of education, i.e., a doctorate in electrical engineering, computer engineering, computer science, or an equivalent field would also qualify as a POSITA for the '450 patent in lieu of a B.S. degree. Experience could take the place of some formal training, as domain knowledge may be learned on the job. This description is approximate, and a higher level of education or skill might make up for less experience and vice versa.

Ex. 1003 ¶ 52; *see also* Pet. 18 (citing Ex. 1003 ¶¶ 52–53). Patent Owner does not provide its own assessment regarding the level of skill in the art, or otherwise dispute Dr. Wilson's testimony. *See generally* Prelim. Resp.; *see also* Ex. 2001 ¶¶ 21–23 (Mr. Alberth acknowledging Dr. Wilson's assessment and testifying that he "accept[s] Dr. Wilson's proposed qualifications of a POSITA" for purposes of his Declaration).

Based on our review of the record at this stage, we find Dr. Wilson's assessment to be 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). Nonetheless, we further find that the qualifier "at least" before the number of years of academic or industry experience introduces unnecessary ambiguity into the assessment as it lacks any upper bound. Accordingly, we adopt Dr. Wilson's assessment, minus the qualifier "at least," for purposes of determining whether there is a reasonable likelihood that Petitioner would prevail with respect to at least one of the claims challenged in the Petition.

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C. Claim Construction

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 "[t]he '450 patent does not explicitly define any claim terms, and the claim terms recited in the challenged claims are sufficiently clear on their face." Pet. 18. Thus, Petitioner asserts, no terms require explicit construction. *Id.* Nonetheless, Petitioner contends that Patent Owner argued in a previous litigation that the term "configured to" (which we find to be recited in claims 7 and 13) should be construed such that "[a]n apparatus/element is 'configured to' perform a function if it includes hardware and/or software enabling the apparatus/element to perform the function." *Id.* at 18–19 (citing Ex. 1020, 4). Citing the testimony of Dr. Wilson, Petitioner argues that a person of ordinary skill in the art "would have understood this term to have its plain and ordinary meaning, but to the extent that this construction is adopted, the grounds of unpatentability presented [elsewhere in the Petition] still render this claim element obvious." *Id.* at 19 (citing Ex. 1003 ¶¶ 54–57).

Patent Owner responds that, while Petitioner proposes no construction beyond plain meaning in this proceeding, Petitioner is among nine defendants that submitted terms for construction in related district court litigation and participated in meet-and-confer negotiations with respect to those terms. Prelim. Resp. 4–5 (citing Ex. 2003, 1, 5–6 (Joint Claim

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Construction Statement from *In re Neo Wireless, LLC Patent Litigation*)). Patent Owner acknowledges that Petitioner added "footnotes suggesting that it 'do[es] not take a position on the constructions'" when the parties submitted the constructions to the court but contends that Petitioner later "stipulated in the District Court that it waives its rights to challenge those constructions, in that Court or in this proceeding, including on appeal." *Id.* at 5 (citing Ex. 2004, 1 n.1 (App'x A: Agreed Claim Terms from *In re Neo Wireless, LLC Patent Litigation*); Ex. 2005 1 n.1 (App'x B: Disputed Claim Terms from *In re Neo Wireless, LLC Patent Litigation*); Ex. 2006 (Notice of Stipulation Regarding Claim Construction from *In re Neo Wireless, LLC Patent Litigation*)). Against that backdrop, Patent Owner argues that "[a]ll the parties agree, and Petitioner agrees not to challenge, that 'time-frequency coordinate,' which applies to all claims, should be construed as 'one dimensional time-frequency coordinate'"; that "[t]he parties agree that, with respect to independent claim 7 and its dependent claims, the preamble is limiting and should be given its plain and ordinary meaning"; and that "the parties agree, with respect to dependent claim 11, that 'wherein modular coding is applied to the time-frequency resource units in the segment of time-frequency resource' should be construed as 'wherein a modular coding scheme is applied to the time-frequency resource units in the segment of time-frequency resource.'" *Id.* at 6 (citing Ex. 2004, 2, 5).

Further, Patent Owner argues, Patent Owner and the defendants in the district court litigation disagree as to the construction of the term "time-frequency resource unit," which appears in each of the challenged independent claims, with Patent Owner asserting that the term should be given its "[p]lain and ordinary meaning" and that "[n]o construction [is] necessary," while the litigation defendants propose to construe that term as

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"a combination of time and frequency units designed according to the application requirements of the application that is being grouped." Prelim. Resp. 6 (citing Ex. 2005, 3).

Having considered the parties' arguments, we agree with Petitioner that no terms or phrases in the claims require express construction at this stage of the proceeding. *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))). First, regardless of whether we adopt Patent Owner's construction of "time-frequency coordinate" as "one dimensional time-frequency coordinate," we find, as discussed in more detail below, that at least Vijayan089 teaches such a one-dimensional time-frequency coordinate. *See, e.g.*, *infra* § III.E.3.c. Second, we also conclude that we need not expressly construe the term "time-frequency resource unit." *See* Prelim. Resp. 6. Notwithstanding Patent Owner's contention that Petitioner's district court co-defendants proposed a construction for that term in co-pending litigation, Patent Owner itself points out that "Petitioner has made no attempt to apply Defendants' proposed litigation construction . . . for any of its grounds" in this proceeding. *Id.* at 6–7 (citing Pet. 44–48, 74–80). Accordingly, we preliminarily find that the parties appear to agree that plain and ordinary meaning of "time-frequency resource unit" should apply in this proceeding.

Nonetheless, we identify below a potential dispute with regard to the construction of the claim limitation "each unit containing a set of frequency subcarriers in a group of OFDM symbols" that is underdeveloped on the present record. *See infra* §§ III.E.3.c, III.F.3.c. The parties are advised to

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address the construction of that limitation in their briefing in the course of trial.

D. Discretionary Denial Under 35 U.S.C. § 314(a)

Patent Owner contends the Board should exercise its discretion to deny institution under 35 U.S.C. § 314(a), contending that the instant challenge should be denied as an improper serial petition in view of the Board's denial of institution in IPR2021-01486. Prelim. Resp. 45–53. Citing statements in the Petition that summarize the Board's reasons for denying institution of *inter partes* review in IPR2021-01486 and explain why the instantly presented references and arguments differ from those presented in that earlier proceeding, Patent Owner contends that the Petition raises "particularly significant" "road-mapping concerns." *Id.* at 46–48 (citing Pet. 17, 97–98; *Code200, UAB v. Bright Data Ltd.*, IPR2022-00861, Paper 18, 5 (Aug. 23, 2022) (precedential); *General Plastic Co. v. Canon Kabushiki Kaisha*, IPR2016-01357, Paper 19, 11, 16–17 (Sept. 6, 2017) (precedential); *Synaptics, Inc. v. Amkor Tech, Inc.*, IPR2017-00085, Paper 12, 10 (Apr. 18, 2017)).

1. Serial Petitioning

In *General Plastic*, the Board articulated a non-exhaustive list of factors to consider in evaluating whether to exercise discretion under § 314(a) to deny a petition that challenges a patent that was previously challenged before the Board. These factors are:

1. whether the same petitioner previously filed a petition directed to the same claims of the same patent;
2. whether at the time of filing of the first petition the petitioner knew of the prior art asserted in the second petition or should have known of it;

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3. whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition;
4. the length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition;
5. whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent;
6. the finite resources of the Board; and
7. the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review.

Gen. Plastic, Paper 19 at 9–10. These factors are "a non-exhaustive list" and "additional factors may arise in other cases for consideration, where appropriate." *Id.* at 16, 18.

a. Whether the same petitioner previously filed a petition directed to the same claims of the same patent

As Patent Owner points out, all claims of the '450 patent were challenged previously in IPR2021-01486, filed by Dell. Prelim. Resp. 1. The Board denied institution in that proceeding on April 14, 2022. IPR2021-01486 (Paper 12). While recognizing that Board decisions denying "follow-on" petitions have generally "concentrated upon the discretion to deny serial petitions by a single petitioner," Patent Owner argues that "these concerns also apply when the petitioners are not the same," citing *Valve Corp. v. Electronic Scripting Products, Inc.*, IPR2019-00062, Paper 11, 2, 15 (Apr. 2, 2019) (precedential) and *Ericsson Inc. v. Uniloc 2017, LLC*, IPR2019-01550, Paper 8, 12 (Mar. 17, 2020). Prelim. Resp. 48–50.

We have considered Patent Owner's arguments but determine that the first *General Plastic* factor weighs against exercising our discretion to deny institution. In *General Plastic*, the petitioner filed a set of five follow-on petitions after its own earlier petitions for *inter partes* review of the same two patents were denied on the merits. *Gen. Plastic*, Paper 19 at 2–3. Petitioner here, as Patent Owner admits, has not previously filed any petition directed to the '450 patent. Moreover, although *General Plastic* has not been limited to instances where multiple petitions are filed by the same petitioner (*see, e.g.*, *Valve*, Paper 11 at 9 (stating that "when different petitioners challenge the same patent, we consider any relationship between those petitioners when weighing the *General Plastic* factors")), we find no evidence of record in the present case that Petitioner shares any relationship with Dell. Unlike in *Valve*, in which the Board found a "substantial relationship" to exist between different petitioners where the earlier and later petitioners not only were co-defendants in district court litigation but the earlier petitioner's accused products in the litigation incorporated technology licensed from the later petitioner, we find no evidence in the record before us of any similar relationship between Petitioner and Dell. We are not persuaded that Petitioner's and Dell's both being defendants in district court litigation involving the '450 patent rises to the type of "significant relationship" described in *Valve*. *Cf. Valve*, Paper 11 at 10. This case also differs from *Ericsson*, where the Board found that a petitioner had "implicitly created" a relationship with earlier petitioners "by using the prior petitioners' work as a menu and picking and choosing from their work product." *Ericsson*, Paper 8 at 12. Notwithstanding Patent Owner's citation of *Ericsson* (Prelim. Resp. 49), Petitioner here does not rely on prior art "pick[ed] and cho[sen]" from any earlier petitions.

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b. Whether, at the time of filing of the first petition, the petitioner knew of the prior art asserted in the second petition or should have known of it

Patent Owner does not contend that Petitioner knew or should have known of the prior art asserted in the Petition at the time Dell filed the petition in IPR2021-01486. Indeed, it appears from the record that the '450 patent had not yet been asserted against Petitioner as of the time Dell filed its petition in September 2021. *See* Paper 5, 3; Pet. 3 (identifying March 29, 2022, as filing date of first district court proceeding against Petitioner involving the '450 patent). Unlike in *Ericsson*, where the petitioner picked and chose from among references previously cited in earlier petitions challenging claims of the same patent, the prior art asserted here by Petitioner was not cited in any prior petition for review of the '450 patent. *See Ericsson*, Paper 8 at 12–13. And again, we find no evidence in the record of any significant relationship between Petitioner and Dell. Thus, whether Petitioner knew of, or should have known of, the prior art relied upon in this Petition at the time Dell filed its petition is of no import under this factor. For this reason, we determine that the second *General Plastic* factor does not weigh in favor of exercising our discretion to deny institution.

c. Whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition

It is undisputed that Petitioner had received both Patent Owner's preliminary response and the Board's decision denying institution in IPR2021-01486 at the time of filing the Petition. *See* Pet. 17–18 (summarizing the proceedings in IPR2021-01486). Nonetheless, as noted

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above, the present Petition is the first petition filed by Petitioner with respect to the '450 patent, and we find the impact of this factor to be mitigated to some extent by Patent Owner's staggered assertions of the '450 patent in district court proceedings over more than a year. *See id.* at 3–4 (listing related matters and filing dates thereof); Paper 5 (listing related matters). At the time Patent Owner first asserted the '450 patent against Petitioner in the Eastern District of Tennessee in March 2022, more than a year after asserting the '450 patent against Dell in the Western District of Texas in January 2021, Patent Owner had already filed its preliminary response in IPR2021-01486, and the Board's decision denying institution in IPR2021-01486 issued only about two weeks later. Accordingly, we weigh this factor at most slightly in favor of exercising our discretion to deny institution.

> *d. The length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition; Whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent*

We do not find any evidence in the record with regard to when Petitioner learned of the asserted prior art, and accordingly, we have no basis to conclude that Petitioner delayed in filing the Petition. Moreover, the instant Petition is the first petition that Petitioner has filed directed to the '450 patent, and again, Patent Owner's arguments do not show any relationship between Petitioner and Dell, rendering the "time elapsed between the filings of multiple petitions" factor inapplicable to our analysis. Accordingly, we determine these factors do not weigh in favor of exercising our discretion to deny institution.

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e. The finite resources of the Board; The requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review

Having considered Patent Owner's arguments, we determine that the sixth and seventh *General Plastic* factors do not weigh in favor of exercising our discretion to deny institution. "[T]he intent of the [sixth] factor . . . is to conserve *Board* resources from repeat or multiple staggered petitions challenging the same claims of the same patent before the Board." *Samsung Elecs. Co. v. Immersion Corp.*, IPR2018-01499, Paper 11, 17 (PTAB Mar. 6, 2019). Unlike in *Ericsson*, this proceeding is not part of a series of repeat or multiple staggered proceedings, but rather is the only challenge to the '450 patent that Petitioner has filed, and no other challenges to the '450 patent have been instituted.

f. Weighing the factors

For the reasons stated above, we determine that only *General Plastic* factor 3 weighs to any extent in favor of exercising our discretion under 35 U.S.C. § 314(a) to deny institution. On balance, particularly in view of the lack of evidence of any relationship between Petitioner and prior petitioner Dell, we decline Patent Owner's request to deny the Petition under 35 U.S.C. § 314(a) for reason of serial petitions.

2. Other Arguments

Patent Owner further contends that, "[e]ven aside from the hindsight 'road-mapping' on which the Petition is based, . . . the 'different' alleged prior art raised in this petition is even less persuasive, for obviousness purposes, than the alleged prior art raised in the grounds already denied trial as meritless at the threshold" in IPR2021-01486. Prelim. Resp. 50. For example, Patent Owner alleges, citing to arguments earlier in the

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Preliminary Response, "Vijayan089 and Vijayan475 are worse than the obviousness combination in [the prior petition] in that their alleged 'time-frequency resource units' do not contain 'a group of OFDM symbols.'" *Id.* at 50–51 (citing *id.* at 29–45 (Prelim. Resp. § IV)).

As we explain in our discussion below of the merits of Petitioner's challenges, we are sufficiently persuaded at this stage of the proceeding that Petitioner has established a reasonable likelihood of prevailing in its asserted challenges, notwithstanding Patent Owner's arguments to the contrary. *See infra* §§ III.E–G. Accordingly, we are not persuaded by Patent Owner's argument that the challenge raised by the present Petition is less persuasive than that presented in IPR2021-01486.

Finally, referring again to IPR2021-01486, Patent Owner argues that "the denial of the prior challenge is entitled to weight" and that "failure of the prior challenge is evidence of nonobviousness." Prelim. Resp. 51–58 (title case and bold face omitted). More particularly, according to Patent Owner, "[a] denial of institution on the merits is entitled to significant weight in a later IPR against the same patent," as "[u]nlike a decision to institute, which is decided on a low threshold and is preliminary, a decision to ***deny*** institution is decided on the opposite threshold (***lack*** of reasonable likelihood), and is final." *Id.* at 53. Patent Owner further contends that failed obviousness challenges are "objective indicia of nonobviousness." *Id.* at 54. We disagree. We draw no inference from a prior denial of *inter partes* review where the prior petition was based on different prior art references. Although a decision on institution of *inter partes* review—whether granting or denying institution—is not appealable, it is not a final judgment on the merits giving rise to preclusive effect. *See In re MaxPower Semiconductor, Inc.*, 13 F.4th 1348, 1351–52 (Fed. Cir. 2021) (jurisdiction

under 28 U.S.C. § 1295(a)(4)(A) was unavailable because a decision on institution of *inter partes* review is not a final judgment). Further, although various "objective indicia of nonobviousness," or "secondary considerations," are, when in evidence, an essential part of our obviousness analysis, Patent Owner cites, and we are aware of, no precedent for a prior denial of a petition for *inter partes* review being recognized as objective evidence of non-obviousness. *See Graham*, 383 U.S. at 17–18 (identifying commercial success, long-felt but unsolved needs, and the failure of others as examples of secondary considerations); *see also* Andrew Blair-Stanek, Increased Market Power as a New Secondary Consideration in Patent Law, 58 Am. U. L. Rev. 707, 712–13 (2009) ("Courts to date have developed nine secondary considerations: (1) long-felt need; (2) failure of others; (3) commercial success; (4) commercial acquiescence via licensing; (5) professional approval; (6) copying by and praise from infringers; (7) progress through the PTO; (8) near-simultaneous invention; and (9) unexpected results."); *WBIP, LLC v. Kohler Co.*, 829 F.3d 1317, 1335 (Fed. Cir. 2016) ("Evidence of industry skepticism weighs in favor of non-obviousness.").

E. Obviousness of Claims 1–5, 7–11, and 13–17 over Vijayan089 and Laroia

Petitioner alleges claims 1–5, 7–11, and 13–17 would have been obvious over Vijayan089 and Laroia, relying in part on Dr. Wilson's Declaration. Pet. 30–60 (citing Ex. 1003 ¶¶ 106–189). Patent Owner responds, relying in part on Mr. Alberth's Declaration. Prelim. Resp. 1–2, 8–18, 29–41 (citing Ex. 2001 ¶¶ 30, 33, 38, 57–59, 68–72).

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We begin our analysis with an overview of Vijayan089 and Laroia, and we then address the parties' contentions with respect to the challenged claims.

1. Vijayan089

Vijayan089, titled "Multiplexing and Transmission of Multiple Data Streams in a Wireless Multi-carrier Communication System," describes transmission of multiple data streams in "super-frames," each having a predetermined time duration and divided into multiple frames. Ex. 1005, codes (54), (57). According to Vijayan089, data blocks for the data streams are encoded to generate corresponding code blocks that are each partitioned into multiple subblocks, and the multiple subblocks for each code block are transmitted in the multiple frames of the same super-frame, one subblock per frame. *Id.* at code (57), ¶ 10. Each data stream is allocated a number of transmission slots in each super-frame and assigned specific transmission units to achieve efficient packing, reduce transmission time, provide adequate time-diversity, and minimize signaling. *Id.* at code (57), ¶ 11. Vijayan089 discloses that a wireless device can select and receive individual data streams and that, because overhead signaling for various parameters of the data streams may be transmitted prior to each super-frame and may also be embedded within the data payload of each data stream, the wireless device can determine the time-frequency location of each desired data stream in the upcoming super-frame and minimize power consumption by powering on only when the desired data stream is transmitted. *Id.*

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Figure 1 of Vijayan089 is reproduced below.

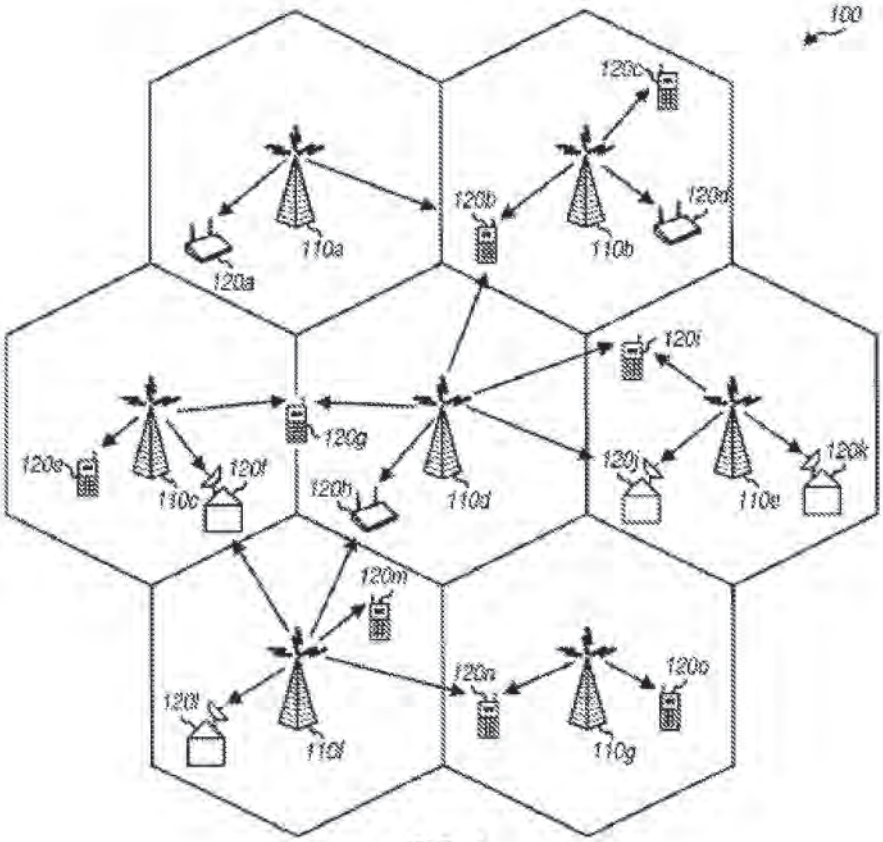

FIG. 1

Figure 1, above, is an illustration of a wireless multi-carrier system of Vijayan089. Ex. 1005 ¶ 14. With reference to Figure 1, system 100 includes base stations 110 (also called, e.g., access points or transmitters) distributed throughout the system, along with fixed or mobile wireless devices 120 (also called, e.g., user terminals, mobile stations, user equipment) located throughout the coverage area of the system. *Id.* ¶ 36. Each base station 110 may broadcast multiple data streams simultaneously to wireless devices 120 within its coverage area. *Id.* ¶ 37. Each data stream is sent on a separate physical layer channel (PLC) (also called, e.g., a data channel or traffic channel). *Id.*

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Figure 2 of Vijayan089 is reproduced below.

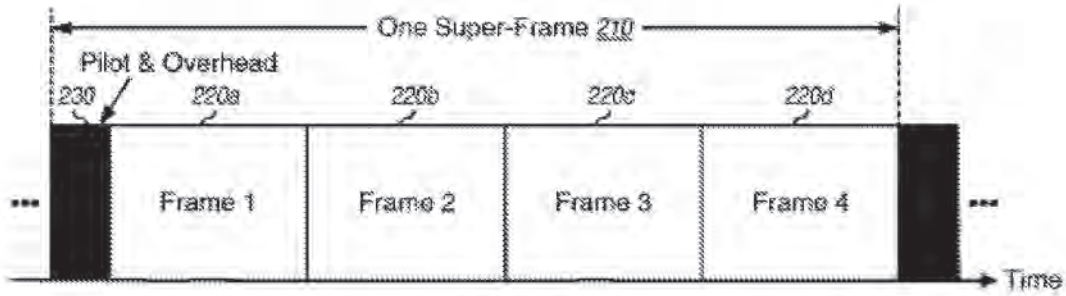

FIG. 2

Figure 2, above, shows an exemplary super-frame structure that may be used for broadcast system 100. Ex. 1005 ¶¶ 15, 38. Each super-frame 210 has a predetermined time duration, which, according to Vijayan089, may be selected based on various factors, and each super-frame is divided into multiple equal-sized frames 220. *Id.* ¶ 38. In the embodiment shown in Figure 2, each super-frame is divided into four frames. *Id.* Further, each super-frame 210 is preceded by pilot and overhead section 230, which in one embodiment includes one or more pilot OFDM symbols used by the wireless devices for, for example, frame synchronization, frequency acquisition, timing acquisition, or channel estimation; and one or more overhead OFDM symbols used to carry overhead signaling information for all PLCs of the associated (e.g., immediately following) super-frame. *Id.* ¶ 44. According to Vijayan089, the wireless devices may initially use the overhead OFDM symbols to determine the time-frequency location of each desired data stream and may subsequently power on only during the time that the desired data stream is transmitted using the embedded overhead signaling. *Id.* Vijayan089 explains that these signaling techniques may provide significant savings in power consumption. *Id.* Vijayan089 further discloses that, although Figure 2 depicts a specific super-frame structure, pilot and

overhead information may alternatively be sent in other manners, such as on dedicated subbands using frequency division multiplexing (FDM). *Id.* ¶ 45.

Figure 4 of Vijayan089 is reproduced below.

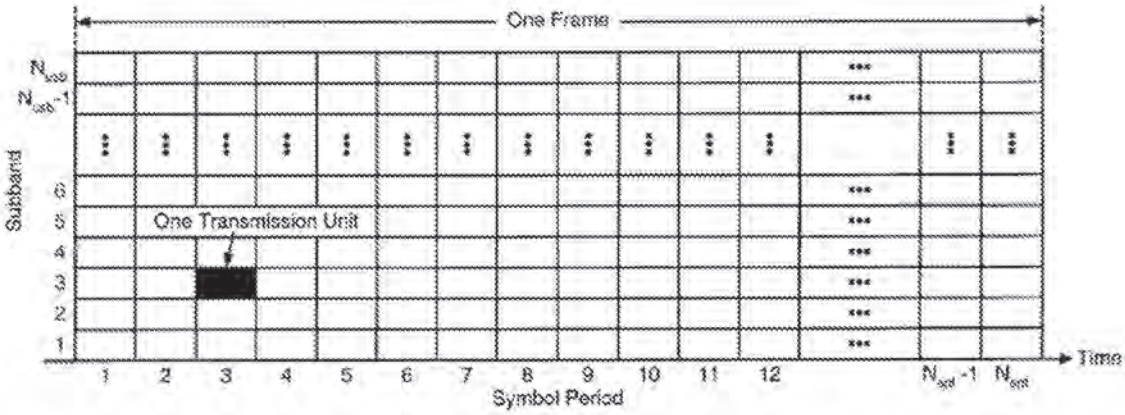

FIG. 4

Figure 4, above, depicts the structure of a single frame on a time-frequency plane, where the horizontal axis represents time, given in units of OFDM symbol periods, and the vertical axis represents frequency. Ex. 1005 ¶¶ 17, 46. According to Vijayan089:

> Each OFDM symbol period is the time duration to transmit one OFDM symbol . . . . The specific number of symbol periods per frame (N_{spf}) is determined by the frame duration and the symbol period duration, which in turn is determined by various parameters such as the overall system bandwidth, the total number of subbands (N_{tsb}), and the cyclic prefix length . . . . Each frame also covers the N_{tsb} total subbands, which are given indices of 1 through N_{tsb}.
>
> With OFDM, one modulation symbol may be sent on each subband in each symbol period, i.e., each transmission unit. . . . In each OFDM symbol period, N_{dsb} data symbols may be sent on the N_{dsb} data subbands, N_{psb} pilot symbols may be sent on the N_{psb} pilot subbands, and N_{gsb} guard symbols are sent on the N_{gsb} guard subbands. As used herein, a "data symbol" is a modulation symbol for data, a "pilot symbol" is a modulation symbol for pilot, and a "guard symbol" is a signal value of zero. The pilot symbols are known a priori by the wireless devices. The N_{dsb}

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> data symbols in each OFDM symbol may be for one or multiple PLCs.

Id. ¶¶ 46–47. Further, according to Vijayan089, the allocated resources from each active PLC may be given in units of "transmission slots," where each slot corresponds to a group of data subbands or modulation symbols in a symbol period, such that each active PLC is allocated at least one slot in a super-frame and is also assigned specific slots therein. *Id.* ¶¶ 59, 60. Vijayan089 explains that although allocation and assignment may be viewed separately for clarity, they "are typically performed jointly since allocation may be affected by assignment, and vice versa." *Id.* ¶ 60. A resource allocation/assignment scheme attempts to achieve a balance between conflicting goals and may allow for flexibility in the setting of priority. *Id.* ¶ 66. More particularly, each active PLC in a super-frame is allocated a certain number of slots based on the payload of the PLC, such that different PLCs may be allocated different numbers of slots, and the specific slots to assign to each active PLC may be determined in various manners. *Id.* ¶ 67.

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Three such manners are depicted in Figures 7A, 7B, and 7C of Vijayan089. *Id.* ¶¶ 67–79. Figure 7B is reproduced below.

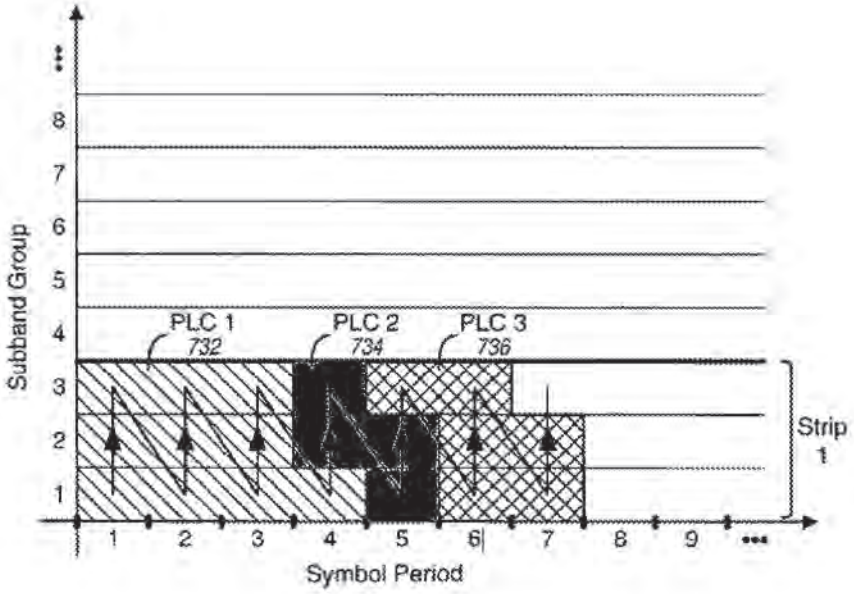

FIG. 7B

Figure 7B, above, shows assignment of slots to PLCs in "sinusoidal" or "zigzag" segments. Ex. 1005 ¶¶ 23, 72. With reference to Figure 7B, Vijayan089 explains that a frame may be divided into N_{st} strips, each covering at least one subband group and further spanning a contiguous number of symbol periods. *Id.* ¶ 72. Each active PLC is mapped to and assigned slots in one of the strips in a specific order, e.g., using a vertical zigzag pattern in which slots are selected from low to high subband group indices. *Id.* ¶¶ 72–73. In the example shown in Figure 7B, strip 1 includes subband groups 1 through 3. *Id.* ¶ 73. PLC 1 is assigned a segment 732 containing ten slots from subband group 1 in symbol period 1 through subband group 1 in symbol period 4; PLC 2 is assigned a segment 734 containing four slots from subband group 2 in symbol period 4 through subband group 2 in symbol period 5; and PLC 3 is assigned a segment 736 containing six slots from sub band group 3 in symbol period 5 through

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subband group 2 in symbol period 7. *Id.* The remaining slots in strip 1 may be assigned to other active PLCs mapped to this strip. *Id.*

Vijayan089 explains that the slot assignment scheme depicted in Figure 7B "effectively maps all of the slots in a two-dimensional (2-D) strip onto a one-dimensional (1-D) strip and then performs 2-D slot assignment using one dimension." Ex. 1005 ¶ 74. Vijayan089 further explains that "[e]ach active PLC is assigned a segment within the strip," where "[t]he assigned segment may be specified by two parameters: the start of the segment (which may be given by the starting subband and symbol period) and the length of the segment." *Id.* Also, "[a]n additional parameter is used to indicate the specific strip to which the PLC is mapped." *Id.* In general, according to Vijayan089, "the segment assigned to each active PLC may include any number of slots," but "less overhead signaling is required to identify the assigned segments if the segment sizes are constrained to be in multiple (e.g., 2 or 4) slots." *Id.* According to Vijayan089, the slot assignment scheme of Figure 7B "facilitate[s] efficient packing of PLCs in each frame" and "also reduce[s] the amount of overhead signaling needed to indicate the specific slots assigned to each active PLC." *Id.* ¶ 76.

2. Laroia

Laroia, titled "Efficient Paging in a Wireless Communication System," describes methods and apparatus for two-stage paging wireless communications systems, allowing for reduced wireless terminal power consumption requirements associated with paging. Ex. 1007, codes (54), (57), ¶ 21. In the described methods, wireless terminals are assigned to paging groups, and first paging signals are communicated from a base station to the terminals, causing the terminals to wake up and ascertain whether their paging group should expect a second paging signal or else go

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back to sleep. *Id.* at code (57), ¶¶ 22, 26. Laroia explains that the disclosed paging methods may be used in an OFDM wireless communications system. *Id.* ¶ 34.

Figure 2 of Laroia is reproduced below.

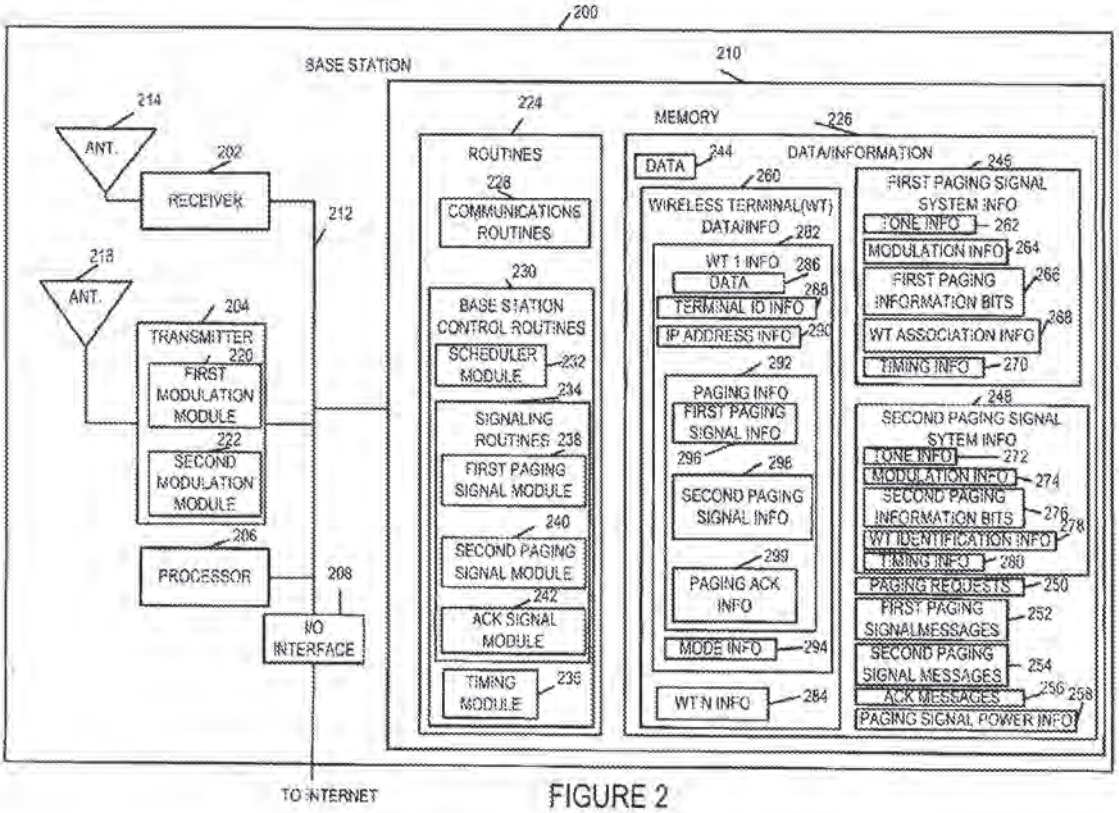

FIGURE 2

Figure 2 illustrates an exemplary base station implemented in accordance with Laroia's invention. Ex. 1007 ¶¶ 9, 35. With reference to Figure 2, base station 200 includes receiver 202, transmitter 204, processor 206, I/O interface 208, and memory 210, coupled together via bus 212 over which the various elements may interchange data and information. *Id.* ¶ 35. Memory 210 includes routines 224 and data/information 226, where data/information 226 is used by processor 206 to control base station 200, perform routine base station operations, and implement the paging methods of the invention. *Id.* ¶ 36. Data/information 226 includes, *inter alia*, first paging signal system information 246, second paging signal system

information 248, and wireless terminal (WT) data/information 260. *Id.* ¶ 37. WT data/information 260 includes, *inter alia*, "terminal identification (ID) information" 288, which may be a base station assigned ID for wireless terminal WT1. *Id.* ¶ 38. Second paging signal information system information 248 includes, *inter alia*, "WT identification information" 278, which in turn may include information allowing a wireless terminal receiving second paging information to identify that it is the specific intended recipient for a second paging signal message. *Id.* ¶ 40.

3. Independent Claim 1

a. Petitioner's Contentions

Petitioner contends that claim 1 is unpatentable over Vijayan089 and Laroia. Pet. 30–51. With reference to the asserted combination, Petitioner argues that "Vijayan089 expressly discloses using time-frequency 'transmission units' or 'transmission slots' to allocate resources and using a starting time-frequency coordinate and an N-value of transmission slots," while "Laroia expressly assigns an identifier to a wireless terminal so that it can discern its own messages intended for reception." *Id.* at 30. Petitioner further contends that a person of ordinary skill in the art "would have found it obvious and would have been motivated to combine Vijayan089 and Laroia to also provide [Laroia's] capability in Vijayan089's system." *Id.* (citing Ex. 1003 ¶¶ 107–116, 134–137).

i. Preamble

With respect specifically to the preamble of claim 1,[3] Petitioner contends that Vijayan089 describes the same operating method and wireless

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

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network recited in claim 1. Pet. 33 (citing Ex. 1003 ¶¶ 117–129). First, Petitioner alleges, Vijayan089 discloses "a wireless network comprising at least a base station and a mobile station," pointing to Vijayan089's "wireless multi-carrier broadcast system 100" that includes "base stations 110" and "wireless devices 120," noting that "Vijayan089 also states that the 'wireless device' may refer to a 'mobile station.'" *Id.* at 33–35 (citing Ex. 1003 ¶¶ 118–120; Ex. 1005 ¶¶ 36–37, Figs. 1, 11, 12). Second, Petitioner contends, Vijayan089 discloses "employing a frame structure of multiple frames for transmission," citing Vijayan089's "super-frame 210" that can be "divided into multiple . . . frames" that includes time and frequency components and use time-frequency "transmission units" for transmission of data. *Id.* at 35–36 (citing Ex. 1003 ¶¶ 121–124; Ex. 1005 ¶¶ 11, 38–49, 58–67, Figs 2, 4). Finally, Petitioner contends that Vijayan089 discloses "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," pointing to Figure 4 and corresponding text of Vijayan089, illustrating and describing frequency subbands (i.e., "frequency subcarriers," in the parlance of claim 1) and time intervals measured "in units of OFDM symbol periods," where "N_{dsb} data symbols may be sent on the N_{dsb} data subbands" within "each OFDM symbol period." *Id.* at 36–38 (quoting Ex. 1005 ¶¶ 46, 47) (citing Ex. 1003 ¶¶ 125–129; Ex. 1005, ¶¶ 5, 37, 46–47, 59–67, 70–77, Fig. 4).

ii. "assigning an identifier to the mobile station"

Petitioner argues that Vijayan089 renders obvious the step of "assigning an identifier to the mobile station," as recited in claim 1. Pet. 38–39. More particularly, Petitioner points out that "Vijayan089

allocates transmission units via a 'unicast transmission [that] is sent to a specific wireless device'" and "also allows a wireless device 'to recover each data stream independently, without having to process the other data streams being transmitted simultaneously.'" *Id.* at 38 (quoting Ex. 1005 ¶¶ 6, 9) (citing Ex. 1005 ¶¶ 6, 7, 9, 11, 44, 35, 106). According to Petitioner, "[t]o provide unicast transmissions and independent data stream recovery, a POSITA would have found it obvious for Vijayan089 to have assigned an identifier to each wireless device," because "[o]therwise, it would be more difficult for each wireless device to discern its own respective data stream for recovery." *Id.* at 38–39 (citing Ex. 1003 ¶ 130–133).

In the alternative, Petitioner contends that Laroia explicitly discloses the recited "assigning" step, citing Laroia's disclosures of "terminal identification (ID) information" as being "a base station assigned ID for [wireless terminal] WT 1" and of "'WT identification information' allow[ing] a wireless terminal to identify that it 'is the specific intended recipient' for a particular message." Pet. 39 (emphasis omitted) (quoting Ex. 1007 ¶¶ 38, 40) (citing Ex. 1003 ¶¶ 134–137; Ex. 1007 ¶¶ 38–40, 49, 53, 58, 63–65, Figs. 2, 3, 5).

Citing Dr. Wilson's testimony, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Vijayan089 and Laroia to implement Laroia's assignment of a wireless device identifier with Vijayan089's OFDM communication system for several reasons. Pet. 30–32 (citing Ex. 1003 ¶¶ 108–116). First, Petitioner contends, related to its argument discussed above that Vijayan089 itself renders the "assigning" step obvious, a person of ordinary skill in the art would have used an identifier to specifically identify a wireless device, in order to implement Vijayan089's disclosure of "unicast communications." *Id.*

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at 30–31 (citing Ex. 1003 ¶¶ 108–110; Ex. 1005 ¶¶ 6, 7, 35). While conceding that "Vijayan089 does not explicitly discuss types of identifiers or how to implement such identifiers," Petitioner argues that a person of ordinary skill in the art "would have therefore sought references that taught techniques for implementing wireless device identifiers," and that "Laroia is such a reference." *Id.* at 31 (citing Ex. 1003 ¶¶ 108–110; Ex. 1007 ¶¶ 38, 40, 53, 63).

Petitioner further contends, "[i]mplementing a wireless device identifier within Vijayan089's system would also further Vijayan089's goal of 'minimiz[ing] power consumption' and having a wireless device that powers on 'only when the desired data stream is transmitted'"—a goal that Petitioner contends is described by both Vijayan089 and Laroia. Pet. 31 (citing Ex. 1005 ¶¶ 7–9, 11, 44, 61; Ex. 1007 ¶¶ 3, 6, 63, 64, code (57)). Moreover, Petitioner contends, "[c]ombining Vijayan089 and Laroia would have amounted to combining well-known prior art elements to yield predictable results," as "[a]ssigning a wireless device identifier was a well-known technique in the prior art used to allow a mobile device to discern its own intended messages," and "[i]n view of this ubiquitous usage, a POSITA would have had a reasonable expectation of success in combining Vijayan089 and Laroia to facilitate wireless transmissions." *Id.* at 31–32 (citing Ex. 1003 ¶¶ 113–114; Ex. 1005, ¶¶ 5, 36, 37, 107–111, Figs. 1, 11, 12; Ex. 1007 ¶¶ 32–35, 38–42, Figs. 1–3). Finally, Petitioner contends, "[t]his combination would have been predictable and would have operated to perform its intended purposes in view of [the references'] common OFDM configuration." *Id.* at 32 (citing Ex. 1003 ¶¶ 113–116). According to Petitioner, "[i]n the combined system, the base station would have used the identifier to specify the resource allocation parameters for a particular

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wireless device," which "would have then used the identifier to discern its assigned transmission slots . . . and recover its respective data." *Id.* (citing Ex. 1003 ¶¶ 113–116; Ex. 1005 ¶¶ 11, 44, 74, 76, 106, 110).

iii. "transmitting a signal containing information from the base station to the mobile station over a segment of time-frequency resource"

Petitioner argues that Vijayan089 discloses transmitting a signal "from the base station to the mobile station over a segment of time-frequency resource," as recited in claim 1, citing disclosure in Vijayan089 that an "assigned segment may be specified by two parameters: the start of the segment (which may be given by the starting subband and symbol period) and the length of the segment." Pet. 41 (emphasis omitted) (quoting Ex. 1005 ¶ 74) (citing Ex. 1003 ¶¶ 138–154; Ex. 1005 ¶¶ 11, 59, 72–76, Fig. 4). Petitioner contends that Vijayan089 describes the same base station and mobile station configuration described in claim 1, with Vijayan089's base station transmitting OFDM "data streams to be individually recovered" by a wireless device over "transmission units" or "transmission slots" having time and frequency components that disclose the claimed "time-frequency resource." *Id.* at 41–42 (citing 1003 ¶ 139; Ex. 1005 ¶¶ 9, 11, 59, 72–76, 108–110, Fig. 4). Petitioner points in particular to Vijayan089's depiction of a transmission unit in Figure 4 and depictions of transmission slots grouped into PLC segments (i.e., "segment[s] of time-frequency resource," in the parlance of claim 1) in Figures 7A and 7B, along with corresponding description. *Id.* at 42–44 (citing Ex. 1003 ¶¶ 139–143; Ex. 1005 ¶¶ 9, 11, 37, 46, 59, 60, 68–76, Figs. 4, 7A, 7B).

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iv. "the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a time interval . . . where N=2, 4, or 8"

Quoting Vijayan089's disclosure that an "assigned segment may be specified by two parameters: the start of the segment (which may be given by the starting subband and symbol period) and the length of the segment" and that a PLC segment "may include any number of slots," where "less overhead signaling is required to identify the assigned segments if the segment sizes are construed to be in multiple (e.g., 2 or 4) slots," Petitioner contends that "[t]he 'start of the segment' parameter (e.g., the starting subband and symbol period) discloses the claimed 'starting time-frequency coordinate'" and that "Vijayan089 discloses . . . the 'length of the segment' being 2, 4, or 8 slots." Pet. 45 (emphasis omitted) (quoting Ex. 1005 ¶¶ 74) (citing Ex. 1003 ¶¶ 144–145). Further quoting Vijayan089's disclosure of "map[ping] all of the slots in a . . . 2-D slot assignment using one dimension," Petitioner contends that "[t]his single dimension of a number of slots discloses the claimed number of 'time-frequency resource units.'" *Id.* (emphasis omitted) (quoting Ex. 1005 ¶ 74) (citing Ex. 1003 ¶¶ 146–148). Petitioner points to segment 734 corresponding to "PLC 2" in Figure 7B of Vijayan089 as illustrative, arguing that "[s]egment 734 includes a starting time-frequency coordinate of: Symbol Period = 4, Subband Group = 2" and "also has four (i.e., N = 4) time-frequency resource units depicted as four transmission slots (colored in black)." *Id.* at 46–47 (citing Ex. 1003 ¶¶ 149–151; Ex. 1005, ¶¶ 9, 11, 59, 67–76, Fig. 7B).

v. "each unit containing a set of frequency subcarriers in a group of OFDM symbols"

Petitioner maps Vijayan089's "transmission slot" to the recited "unit" and maps the "subband group[s]" in each transmission slot to the recited "set of frequency subcarriers." Pet. 47 (citing Ex. 1003 ¶¶ 152–154; Ex. 1005 ¶¶ 56, 59 (disclosing that each transmission slot "corresponds to one group of (e.g., 500) data subbands"), 87, Fig. 7B). Petitioner contends "[e]ach group of subbands transmits OFDM symbols," quoting Vijayan089's disclosure that "[w]ith OFDM, one modulation symbol may be sent on each subband in each symbol period." *Id.* at 48 (quoting Ex. 1005 ¶ 47) (citing Ex. 1003 ¶¶ 152–154; Ex. 1005 ¶¶ 5, 59).

vi. "receiving by the mobile station the transmitted signal"

Petitioner contends that "Vijayan089 discloses a wireless device (*i.e.*, the claimed 'mobile station') receiving transmitted information signals from a base station." Pet. 48–49 (citing Ex. 1005 ¶¶ 109–111, Fig. 12). In particular, Petitioner cites Vijayan089's disclosure of "wireless device 120x" including, *inter alia*, "antenna 1212," "receiver unit 1214," and "OFDM demodulator 1220," where "antenna 1212 receives the modulated signal transmitted by base station 110x and provides a received signal to . . . receiver unit (RCVR) 1214," "[r]eceiver unit 1214 conditions, digitizes, and processes the received signal," and "OFDM demodulator 1220 . . . identifies the 'received data symbols and received overhead symbols.'" *Id.* at 49 (quoting Ex. 1005 ¶ 109). Thus, Petitioner argues, "these components receive the signal transmitted from the base station corresponding to the PLC segments with corresponding slot assignments." *Id.* (citing Ex. 1003 ¶¶ 155–157; Ex. 1005 ¶¶ 9, 11, 59, 67, 72–76, 108–10).

vii. "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 Vijayan089's wireless device using receiver unit 1214 and OFDM demodulator 1220 recovers data from the received OFDM signal based on the starting time-frequency coordinate and N time-frequency resource units. Pet. 50 (citing Ex. 1003 ¶¶ 158–161; Ex. 1005 ¶¶ 65, 109–11, Fig. 12). Further, Petitioner argues, "controller 1260" of Vijayan089's wireless device 120x "also uses 'overhead signaling' identifying the 'resource allocating and assignment for each selected PLC' to recover the OFDM data in 'one or more specific data streams/PLCs,'" and Vijayan089 discloses that the overhead signaling includes "two parameters: the start of the segment . . . and the length of the segment." *Id.* (emphasis omitted) (quoting Ex. 1005 ¶¶ 74, 110) (citing Ex. 1005 ¶¶ 9, 11, 44, 59, 72–74). With those parameters, Petitioner asserts, "the wireless device can 'determine the time-frequency location of each desired data stream,'" and "[t]he wireless device therefore recovers a 'given data stream of interest' using a starting time-frequency coordinate (the 'start of the segment' parameter) and N time-frequency resource units (the 'length of the segment'—including 2 or 4 transmission slots)." *Id.* (emphasis omitted) (quoting Ex. 1005 ¶ 11) (citing Ex. 1003 ¶¶ 158–161; Ex. 1005 ¶¶ 11, 44, 106).

Additionally, as in connection with the "assigning" step discussed above, Petitioner contends that "Vijayan089 suggests using an identifier corresponding to the wireless device when recovering the data during unicast transmissions" and that "Laroia confirms this understanding and explicitly uses identifiers to differentiate between multiple wireless

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terminals." Pet. 50–51; *see supra* § III.E.3.a.ii. Citing Dr. Wilson's testimony, Petitioner argues that a person of ordinary skill in the art "would have found it obvious and would have been motivated to implement the identifier described in Laroia with Vijayan089's system." *Id.* at 51 (citing Ex. 1003 ¶¶ 164–165). In Petitioner's view, "th[e] identifier would allow a wireless device to differentiate its own allocation parameters from others" and "would be transmitted with Vijayan089's overhead signaling, which includes the starting time-frequency coordinate and number of slots." *Id.* (citing Ex. 1003 ¶¶ 164–165; Ex. 1005 ¶¶ 11, 44, 74, 76; Ex. 1007 ¶¶ 40, 53, 63). Using the identifier and allocation parameters, Petitioner asserts, "Vijayan089's wireless device would recover signals from the slots corresponding to a PLC segment." *Id.* (citing Ex. 1003 ¶¶ 164–165; Ex. 1005 ¶¶ 109–111, Fig. 12).

b. Patent Owner's Contentions

i. "starting time-frequency coordinate"

In response to Petitioner's contentions, Patent Owner argues, first, that the combination of Vijayan089 and Laroia fails to teach or render obvious the "starting time-frequency coordinate" recited in each of the challenged independent claims. Prelim. Resp. 8. Rather, Patent Owner contends, "Vijayan089 . . . uses both 'a starting subband and symbol period,' which Petitioner improperly attempts to combine into a single parameter." *Id.*

According to Patent Owner, "[t]he '450 patent describes several innovations that together allow for a reduction in overhead when allocating time-frequency resources," and "[t]he use of a single 'starting time-frequency resource' is one of these innovations, required by all the claims and recited in each independent claim." Prelim. Resp. 9 (citing Ex. 1001, cls. 1, 7, 13). Patent Owner contends that the '450 patent distinguishes a

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prior art allocation scheme in which both a "start symbol offset" and a "start logical subchannel offset" were needed to specify the start of the time/frequency region. *Id.* (citing Ex. 1001, 1:62–66). Quoting the testimony of Mr. Alberth, Patent Owner argues that "a 'POSITA would have understood the claimed "starting time-frequency coordinate' to be different from and exclude the collective labeling of a starting time coordinate and a separately described starting frequency coordinate.'" *Id.* at 10 (quoting Ex. 2001 ¶ 57). Additionally citing the claim construction briefing from the parallel district court litigation, Patent Owner further contends that "[i]t is . . . undisputed that the 'starting time-frequency coordinate' must have a single dimension covering both time and frequency," and "[a]ny reference that uses both a starting time coordinate and a separate starting frequency coordinate does not have a one-dimensional coordinate in both time and frequency." *Id.* (emphasis omitted) (citing Ex. 2001 ¶ 57; Ex. 2004, 5; Ex. 2006, 2).

In light of these considerations, Patent Owner argues that "[m]uch like in the [IPR2021]-01486 Petition, this Petition in effect draws a box around two separate, one-dimensional coordinates in Vijayan089 and asserts that they 'collectively' constitute a single 'starting time-frequency coordinate.'" Prelim. Resp. 13. In particular, Patent Owner points to Petitioner's contentions that Vijayan089's "'start of the segment' parameter (e.g., the starting subband and symbol period) discloses the claimed 'starting time-frequency coordinate'" and that Vijayan089's "[s]egment 734 includes a starting time-frequency coordinate of: Symbol Period = 4, Subband Group = 2." *Id.* at 13–15 (quoting Pet. 45–47). In Patent Owner's view, notwithstanding Vijayan089's "refer[ence] to the starting subband and symbol period collectively as the 'start of segment' parameter," "[i]t is . . .

clear that the 'start of the segment' is composed of two individual sub-parameters," and "[t]hus, Vijayan089 is like the . . . reference in the '450 patent's background, in that it has both a starting time coordinate and a separate starting frequency coordinate." *Id.* at 13–14 (citing Ex. 1005 ¶¶ 73, 74; Ex. 2001 ¶ 58). In this regard, Patent Owner contends, "[t]he Petition's arguments with respect to Vijayan089 are materially similar to the arguments that were previously rejected in the [IPR2021]-01486 Petition," which "attempted to merge . . . 'OFDMA Symbol offset' and 'subchannel offset' collectively into the claimed 'time frequency-coordinate.'" *Id.* at 16–17 (citing IPR2021-01486, Paper 3, 47, 60 (Petition); IPR2021-01486, Paper 10, 27 (Decision Denying Institution)). Finally, Patent Owner contends that "Vijayan089's 'start of segment,' even if it were to be considered a single starting coordinate, is not a 'starting ***time-frequency coordinate***' because it does not satisfy the undisputed requirement that a 'time-frequency coordinate' be 'one dimensional.'" *Id.* at 18.

ii. "N time-frequency resource units . . . containing a set of frequency subcarriers in a group of OFDM symbols"

Patent Owner additionally argues that "Vijayan089 does not teach or render obvious 'time-frequency resource units . . . each unit . . . in a group of OFDM symbols," contending that Vijayan089's "transmission slots" that Petitioner maps to the recited "time-frequency resource units" cover only a single OFDM symbol, not a "group of OFDM symbols." Prelim. Resp. 29, 33. According to Patent Owner, the Petition "ignor[es] [Vijayan089's] explicit discussion of OFDM symbols and conflat[es] the claimed 'OFDM symbols' with modulation symbols." *Id.* at 29.

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In Patent Owner's view, "[o]ne of the key features of the [recited] time-frequency resource unit is that it has multiple symbols," allowing for a reduction in "the amount of control overhead but at the cost of flexibility." Prelim. Resp. 30–32 (citing Ex. 1001, 6:49–50, Table 1; Ex. 2001 ¶¶ 30, 68). Patent Owner contends that the Petition correctly identifies Vijayan089's "symbol periods" as the recited "OFDM symbols" when asserting that Viyanan089 has "time intervals . . . comprising a plurality of [OFDM] symbols," but that, "[w]hen attempting to establish that 'each unit containing a set of frequency subcarriers in a group of OFDM symbols,' . . . Petitioner changes its tune" and "switches to arguments based on modulation symbols" rather than "symbol periods as the alleged 'OFDM symbols.'" *Id.* at 33–34 (citing Pet. 37, 42, 48). According to Patent Owner, "[t]he reason for this switch is quite simple: each of Vijayan089's transmission slots covers only one symbol period, and thus the transmission slot is not 'in a group of OFDM symbols' as required by the claims." *Id.* at 34.

Further, Patent Owner contends, "Vijayan089 OFDM symbol period and modulation period are very different concepts, that are not interchangeable." Prelim. Resp. 34. In particular, Patent Owner argues, "Vijayan089's symbol period is simply a measure of time, as indicated by the fact that it is described as the unit in time axis," whereas "[b]y contrast the 'modulation symbol' is a unit or resource for transmitting different types of signals," and "[t]here can be multiple modulation symbols in a single symbol period " *Id.* at 34–36 (quoting Ex. 2001 ¶¶ 69, 70).

"Using the correct read of the 'OFDM symbol' onto Vijayan089," Patent Owner asserts, "its transmission slots do not satisfy the limitation of 'containing a set of frequency subcarriers in a group of OFDM symbols.'" Prelim. Resp. 37 (emphasis omitted). Patent Owner contends that this is

"most clearly evident from examining Figure 7B of Vijayan089 as annotated by Petitioner." *Id.* at 37–38 (citing Pet. 46). With reference to that figure, Patent Owner contends:

> Mr. Alberth explains how this figure and its annotations show "time-frequency resource units" containing a set of frequency subcarriers in a ***single*** "OFDM symbol" rather than the "***group*** of OFDM symbols" required by the claims:
>
> > Figure 7B of Dr. Wilson's annotation to this figure correctly states that "PLC 2 … includes four time-frequency resource units (N=4). Ex. 1003 [Wilson Decl.] ¶¶ 144; *see also* Pet., 46 (Ex. 1005 [Vijayan089] Fig. 7B with Petitioner's annotations). The "time-frequency resource units" clearly refers to the four blackened boxes resembling a tetris symbol S rotated clockwise onto its side labeled 734. Each of the four black boxes is a transmission slot. Ex. 1005 [Vijayan089] ¶ 59 ("The allocated resources for each active PLC may be given in units of 'transmission slots' (or simply, 'slots')."). From this figure it can easily be seen that each slot has a duration of only one symbol period. *See* Ex. 1005 [Vijayan089] Fig. 7B. Since the slot is the alleged "time-frequency transmission unit," and each symbol period is the duration of a single claimed "OFDM symbol," this shows that the "time-frequency transmission unit" does not contain subcarriers in "a group of OFDM symbols" as required by the claim. Rather, the slot only lasts one symbol period so the alleged "time-frequency transmission unit" at most contains a set of frequency subcarriers in a single OFDM symbol.

Prelim. Resp. 38–39 (quoting Ex. 2001 ¶ 71).

Finally, Patent Owner contends that, "[e]ven if, contrary to the evidence presented above, the modulation symbol could be considered the claimed 'OFDM symbol' and the 'group of OFDM symbols' limitation could be met, this read is inconsistent with Petitioner's earlier position that

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the claimed 'OFDM symbol' should be read on Vijayan089's symbol period," and "Petitioner's attempt to 'switch horse mid-race' should be rejected." Prelim. Resp. 40–41 (citing *Facebook, Inc. v. Uniloc USA, Inc.*, IPR2017-01524, Paper 7, 19 (Dec. 4, 2017); *Coherus Biosciences, Inc. v. Hoffman-La Roche Inc.*, IPR2017-02066, Paper 11, 14 (Mar. 9, 2018); *Denso Corp. v. Collision Avoidance Techs. Inc.*, IPR2017-01715, Paper 7, 55-57 (Jan. 23, 2018)).

c. Discussion

On the preliminary record before us, we are persuaded that Petitioner has articulated reasoning with rational underpinning to support combining the teachings of Vijayan089 and Laroia and has shown a reasonable likelihood that it will prevail in showing that claim 1 is unpatentable over the combination.

Despite Patent Owner's arguments that Vijayan089 fails to teach a "starting time-frequency coordinate" (Prelim. Resp. 1, 8–10, 13–18), Vijayan089 expressly discloses a slot assignment scheme that "effectively maps all of the slots in a two-dimensional (2-D) strip onto a one-dimensional (1-D) strip and then performs 2-D slot assignment using one dimension" (Ex. 1005 ¶ 74; *see also id.* at claim 52 (reciting "wherein transmission units in each 2-D strip are mapped to a one-dimensional (1-D) strip, and wherein each data stream mapped to the 2-D strip is assigned a segment of contiguous transmission units in the corresponding 1-D strip")). That disclosure is cited in the Petition (*see* Pet. 25) and by Dr. Wilson (Ex. 1003 ¶ 88) but is not addressed by Patent Owner. We understand from that disclosure that Vijayan089 thus teaches a one-dimensional time-frequency coordinate.

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As Patent Owner recognizes, Vijayan089 further discloses that "[t]he assigned segment may be specified by two parameters: the start of the segment (which may be given by the starting subband and symbol period) and the length of the segment" (Ex. 1005 ¶ 74). In view of the preceding disclosure in the same paragraph of Vijayan089 that the slots may be mapped "onto a one-dimensional (1-D) strip," we do not understand the identification of the start of the segment "by the starting subband and symbol period" as requiring "***both*** a starting time coordinate ***and*** a separate starting frequency coordinate," as Patent Owner contends. *See* Prelim. Resp. 14.

Indeed, dependent claims 2 and 3 of the '450 patent, discussed in Section III.E.5 below, separately contemplate that the starting time-frequency coordinate of claim 1 may indicate either "a starting OFDM symbol of the segment of time-frequency resource" (claim 2) or "a starting subcarrier of the segment of time-frequency resource (claim 3). *See* Ex. 1001, 13:1–6. If, as Patent Owner appears to suggest, the starting time-frequency coordinate cannot "be given by the starting subband and symbol period," it is unclear how the further limitations set forth in claims 2 and 3 are to be reconciled with such a prohibition. The parties are advised to address these considerations more fully in their trial briefing.

Notwithstanding Patent Owner's arguments that Vijayan089 does not teach or suggest the limitation of "each unit containing a set of frequency subcarriers in a group of OFDM symbols" (Prelim. Resp. 29–41), we also find Petitioner's contentions with respect to that limitation sufficient on the preliminary record.

Whereas Patent Owner appears to read the limitation not only to require each time-frequency resource unit to contain a set of frequency

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subcarriers in a group of OFDM symbols but also to require that each time-frequency resource unit must individually span multiple OFDM symbols, we find that to present an issue of claim construction that is underdeveloped on the preliminary record before us. The parties are accordingly advised to address the construction of that limitation in their briefing in the course of trial.

4. Independent Claims 7 and 13

Independent claim 7 is directed to a mobile device in a wireless packet system using a frame structure essentially as recited in the preamble of claim 1, where the mobile device is configured to receive an identifier and a signal, essentially as recited in the assigning and transmitting steps of claim 1, and to recover the information from the signal, again essentially as recited in claim 1. Ex. 1001, 13:15–33. Independent claim 13 is directed to a base station in a wireless packet system similarly using the frame structure as recited in the preamble of claim 1, where the base station is configured to provide an identifier to a mobile device in the cell, allocate a segment of time-frequency resource as recited in claim 1 to the mobile device, and transmit signal containing information to the mobile device in a manner that allows the mobile device to recover the information, essentially as in the "recovering" step of claim 1. *Id.* at 14:7–26.

Petitioner refers back to its arguments for claim 1 for all limitations of claims 7 and 13. Pet. 51–54. With respect to the recitations in claims 7 and 13 of the mobile device and base station, respectively, operating in a "wireless packet system," Petitioner further contends that Vijayan089 describes communications using "packets," citing disclosure in Vijayan089 that a "data stream for a PLC is partitioned into data packets" and Vijayan089's mapping "the number or slots needed to transmit one packet"

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based on the mode or modulation scheme used for transmission. *Id.* at 52 (citing Ex. 1003 ¶¶ 168–170; Ex. 1005, code (57), ¶¶ 83, 85–87, 114), 54 (citing Ex. 1003 ¶¶ 173–174; Ex. 1005, code (57), ¶¶ 83, 85–87, 114). Petitioner additionally contends that "Vijayan089 depicts base station cells in Figure 1 and a wireless device as a 'cellular phone,'" thus teaching that the mobile device operates within a cell serviced by a base station, as further recited in claims 7 and 13. *Id.* (citing Ex. 1005 ¶¶ 36–37, Fig. 1). Further, according to Petitioner, Laroia also describes the same cell-based configuration, as depicted in Figure 1 thereof. *Id.* at 53 (citing Ex. 1007, ¶¶ 32–34, Fig. 1).

Patent Owner relies on the same arguments for claims 7 and 13 as for claim 1. *See* Prelim. Resp. 8–18, 29–41. For the reasons discussed in Section III.E.3 above with respect to claim 1, and based on Petitioner's further arguments addressing the packet and cell-based limitations of claims 7 and 13, we conclude that Petitioner shows a reasonable likelihood of prevailing with respect to both claims.

5. Dependent Claims 2–5, 8–11, and 14–17

Claims 2, 8, and 14 depend from claims 1, 7, and 13, respectively, and each further recites "wherein the starting time-frequency coordinate indicates a starting OFDM symbol of the segment of time-frequency resource." Ex. 1001, 13:1–3, 34–36, 14:27–29. Claims 3, 9, and 15 depend from claims 1, 7, and 13, respectively, and each further recites "wherein the starting time-frequency coordinate indicates a starting subcarrier of the segment of time-frequency resource." *Id.* at 13:4–6, 13:37–39, 14:30–32. Claims 4, 10, and 16 depend from claims 1, 7, and 13, respectively, and each further recites "wherein the starting time-frequency coordinate indicates a starting group of subcarriers of the segment of time-frequency resource." *Id.*

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at 13:7–9, 13:40–42, 14:33–35. Claims 5, 11, and 17 depend from claims 1, 7, and 13, respectively, and each further recites "wherein modular coding is applied to the time-frequency resource units in the segment of time-frequency resource." *Id.* at 13:10–12, 14:1–3, 14:36–38.

For the dependent claims listed above, Petitioner argues with citations to Vijayan089 and Dr. Wilson's testimony that Vijayan089 teaches each of their additional limitations. Pet. 54–60. Patent Owner does not provide any arguments specifically for any of the challenged dependent claims, but relies only on the arguments presented for the independent claims. *See* Prelim. Resp. 8–18, 29–41.

Based on the arguments presented and the evidence cited in the Petition, Petitioner shows a reasonable likelihood of prevailing on each of claims 2–5, 7–11, and 13–17 in its challenge based on Vijayan089 and Laroia.

6. Conclusion

Petitioner has shown a reasonable likelihood that it will prevail in showing that claims 1–5, 7–11, and 13–17 would have been obvious over Vijayan089 and Laroia.

F. Obviousness of Claims 1–5, 7–11, and 13–17 over Vijayan475 and Wu

Petitioner alleges claims 1–5, 7–11, and 13–17 would have been obvious over Vijayan475 and Wu, relying in part on Dr. Wilson's Declaration. Pet. 60–91 (citing Ex. 1003 ¶¶ 190–274). Patent Owner responds, relying in part on Mr. Alberth's Declaration. Prelim. Resp. 1–2, 8–12, 18–32, 41–45 (citing Ex. 2001 ¶¶ 30, 38, 52, 57, 60–65, 68, 72).

We begin our analysis with an overview of Vijayan475 and Wu, and we then address the parties' contentions with respect to the challenged claims.

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1. Vijayan475

Vijayan475, titled "Transmission of Overhead Information for Reception of Multiple Data Streams," relates to "techniques for transmitting overhead information for reception of multiple data streams in a communication system." Ex. 1006, code (54), ¶ 3. Vijayan475 describes a super-frame structure for communications and is generally directed to OFDM communications. *Id.* ¶¶ 10–12, 25, 63–71.

Figure 1 of Vijayan475 is reproduced below.

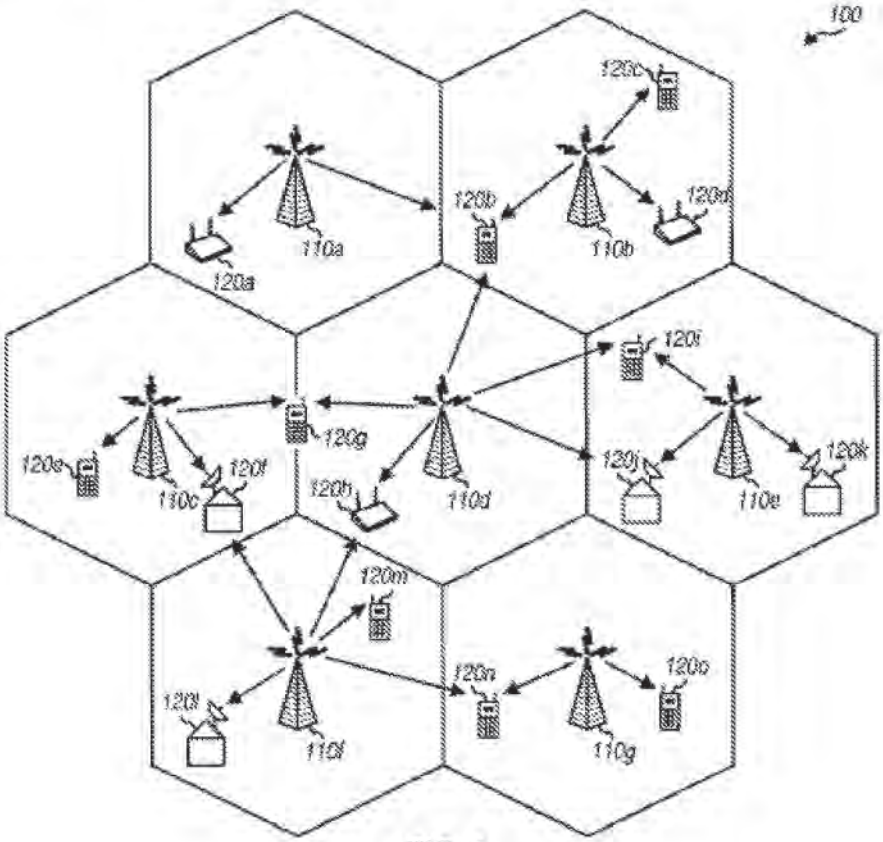

FIG. 1

Figure 1, above, is an illustration of a wireless multi-carrier system of Vijayan475. Ex. 1006 ¶ 15. With reference to Figure 1, system 100 includes base stations 110 (also called, e.g., access points or transmitters) distributed throughout the system, along with fixed or mobile wireless

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devices 120 (also called, e.g., user terminals, mobile stations, user equipment) located throughout the coverage area of the system. *Id.* ¶ 26. Each base station 110 may broadcast multiple data streams simultaneously to wireless devices 120 within its coverage area. *Id.* ¶ 27. The data streams are sent on data channels or multiplexed logic channels (MLCs). *Id.* In a specific embodiment that is described in detail, each MLC may carry up to three data streams (e.g., one for signaling and up to two for packet/traffic data), but Vijayan475 states that, in general, each MLC may carry any number of data streams. *Id.* ¶ 28.

Figure 2 of Vijayan475 is reproduced below.

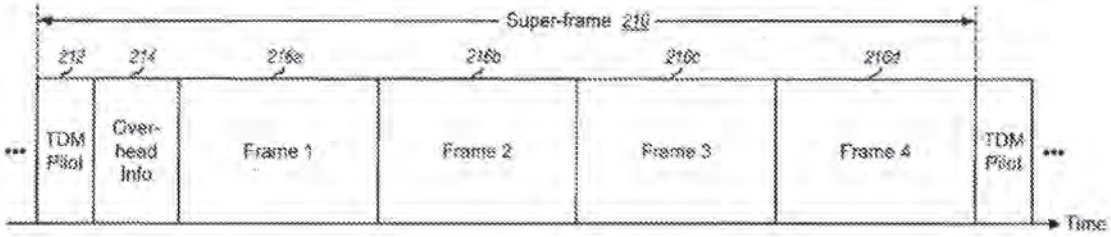

FIG. 2

Figure 2, above, shows an exemplary super-frame structure that may be used for system 100. Ex. 1006 ¶¶ 16, 29–32. With reference to Figure 2, data transmission occurs in units of super-frames 210 (also referred to as frames or time slots), each spanning a predetermined time duration that may be selected based on various factors. *Id.* ¶ 29. In Figure 2, each super-frame includes field 212 for a time division multiplexed (TDM) pilot, field 214 for overhead information, and four equal-sized frames 216a–216d. *Id.* ¶ 30. Data streams are multiplexed and sent in frames 216a–216d. *Id.*

Vijayan475 discloses that data may be transmitted in various manners in system 100. Ex. 1006 ¶ 36. In one embodiment, M slots are formed in each symbol period, where M≧1, and mapped to sets of subbands. *Id.* "For a given super-frame structure, a fixed number of slots is available for

transmission in each super-frame." *Id.* ¶ 37. "Each MLC may be 'allocated' a fixed or variable number of slots in each super-frame, depending on the MLCs payload, the availability of slots in the super-frame, and possibly other factors." *Id.* ¶ 38. "Each 'active' MLC, which is an MLC to be transmitted in a given super-frame, is allocated at least one slot," and "[e]ach active MLC is also 'assigned' specific slots within the super-frame," based on "an assignment scheme that attempts to (1) pack the slots for all active MLCs as efficiently as possible, (2) reduce the transmission time for each MLC, (3) provide adequate time-diversity for each MLC, and (4) minimize the amount of signaling needed to indicate the slots assigned to each MLC." *Id.*

Figure 4 of Vijayan475 is reproduced below.

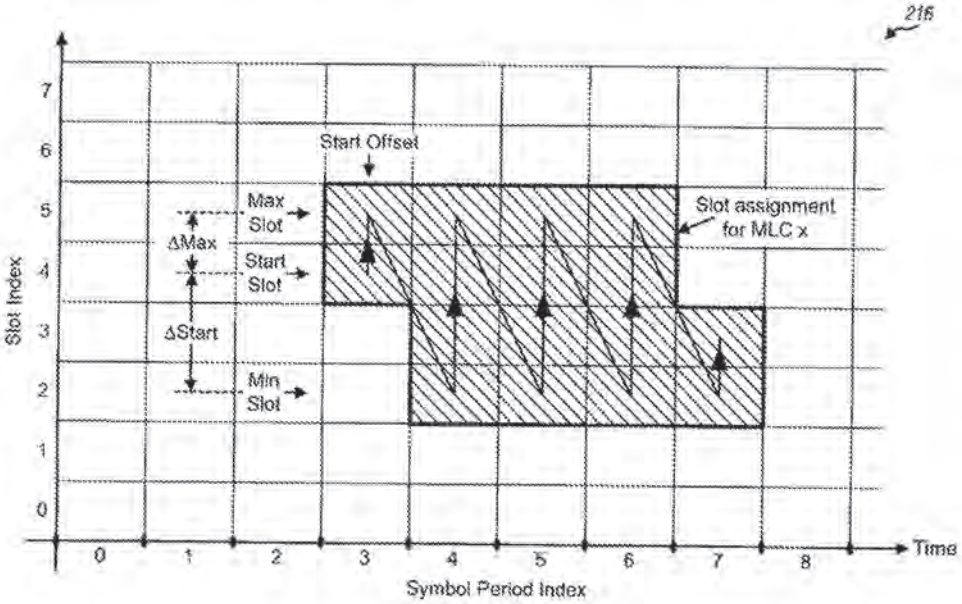

FIG. 4

Figure 4, above, shows an exemplary slot assignment scheme that assigns slots to MLCs using a "sinusoidal" or "zigzag" pattern. Ex. 1006 ¶¶ 18, 39. In the illustrated assignment scheme, "a frame is divided into one or more 'strips', and each strip spans at least one slot index and further spans a

contiguous number of (e.g., all) symbol periods in the frame." *Id.* ¶ 39. Each active MLC is mapped to one strip and is assigned slots in that strip. *Id.* For example, the slots in each strip may be assigned to the MLCs in a specific order using a vertical zigzag pattern that "selects slots from the lowest slot index for the strip to the highest slot index for the strip, one symbol period at a time, starting with the first symbol period for the strip." *Id.* Figure 4 also shows the assignment of slots to a given MLC x for one frame 216. *Id.* ¶ 40. In particular, Vijayan475 explains,

> MLC x is assigned slots starting from a start slot index (Start Slot) at a designated symbol period index (Start Offset) and going to a highest slot index (Max Slot), then starting from a lowest slot index (Min Slot) in the next symbol period index and going to the highest slot index, and so on, until the number of slots allocated to MLC x has been reached. For the example shown in FIG. 4, MLC x is assigned 16 slots starting at slot index 4 in symbol period index 3, zigzaging between the lowest slot index 2 and the highest slot index 5, and concluding at slot index 3 in symbol period index 7.

Id. Vijayan475 further explains that "slot information may be encoded to reduce the number of bits needed to convey th[e] information." *Id.* ¶ 46.

2. Wu

Wu, titled "System and Method for Embedding OFDM in CDMA Systems," relates to single and multi-carrier CDMA systems and methods and to methods of providing increased capacity to such systems and methods. Ex. 1008, code (54), ¶ 2. Wu describes, *inter alia*, a system comprising a transmitter in combination with a plurality of receivers, at least one of which is OFDM-capable. *Id.* ¶ 26. According to Wu, the transmitter may be adapted to transmit, for example, a downlink signal that may include an OFDM packet channel divided into OFDM slots and a control channel that that identifies to receivers which OFDM slots are for a given receiver to

use and "identifiers for each receiver scheduled during the slot and an indication of which sub-carriers are for which receiver." *Id.* ¶¶ 7, 20, 21, 33, 34. The user equipment (UE) receiver then demodulates the "OFDM slot only if scheduled during the slot." *Id.* ¶¶ 25, 50. To implement the disclosed features, Wu in certain embodiments describes transmitting a "supplementary high speed shared control channel" (HS-SCCH) that is used to transmit information that allow receivers to determine where their content has been transmitted in the downlink structure. *Id.* ¶ 94. Among other information, the supplementary HS-SCCH may include a UE identifier ("sixteen bit UE identifier 165") that "identifies which receiver is to receive the current [high speed data packet access] HSDPA content." *Id.* ¶¶ 94, 98, Fig. 4.

3. Independent Claim 1

a. Petitioner's Contentions

Petitioner contends that claim 1 is unpatentable over Vijayan475 and Wu. Pet. 63–83. With reference to the asserted combination, Petitioner argues that "Vijayan475 expressly discloses using time-frequency 'slots' to allocate resources as well as using a starting time-frequency coordinate and 'number of slots allocated' to inform a wireless device of an allocation," while "Wu discloses a user equipment (UE) identifier to specifically designate a wireless device to receive allocated transmissions." *Id.* at 60–61 (citing Ex. 1003 ¶¶ 190–191, Ex. 1006 ¶¶ 36–42; Ex. 1008 ¶¶ 33, 34, 92, 94, 98). Petitioner further contends that a person of ordinary skill in the art "would have found it obvious and would have been motivated to combine Vijayan475 and Wu to also provide [Wu's] capability" in Vijayan475's system. *Id.* at 61 (citing Ex. 1003 ¶¶ 192–199).

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i. Preamble

With respect specifically to the preamble of claim 1, Petitioner contends that Vijayan475 describes the same operating method and wireless network recited in claim 1. Pet. 63 (citing Ex. 1003 ¶¶ 200–214). First, Petitioner alleges, Vijayan475 discloses "a wireless network comprising at least a base station and a mobile station," pointing to Vijayan475's "wireless multi-carrier broadcast system 100" that includes "base stations 110" and "wireless devices 120." *Id.* at 64 (citing Ex. 1003 ¶¶ 201–203; Ex. 1006 ¶¶ 26–27). Petitioner cites Figures 8 and 9 of Vijayan475 as depicting a base station and wireless device, respectively, further noting that "Vijayan089 also states that the 'wireless device' may refer to a 'mobile station'" and that "Vijayan475's base stations and mobile stations communicate wirelessly to disclose the claimed 'wireless network' as depicted in Figure 1." *Id.* at 46–66 (citing Ex. 1003 ¶¶ 201–203; Ex. 1006 ¶¶ 26, 67–75, Figs. 8, 9).

Second, Petitioner contends, Vijayan475 discloses "employing a frame structure of multiple frames for transmission," citing Vijayan475's "super-frame 210" that "includes multiple frames for transmission of OFDM signals," such as the exemplary frame depicted in Figure 4. Pet. 66–67 (citing Ex. 1003 ¶¶ 204–208; Ex. 1006, code (57), ¶¶ 10, 12, 29–32, 37–42, 45, 56–59, Fig. 4). Petitioner contends Vijayan475 "also describes using time-frequency 'slots' within the super-frame structure to transmit data" and "describes allocating a 'fixed or variable number of slots in each super-frame' for a multiplexed logical channel (MLC) segment." *Id.* at 67 (citing Ex. 1006 ¶¶ 36–41, 45–49, 57).

Finally, Petitioner contends that Vijayan475 discloses "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," pointing to Figure 4 and corresponding text of Vijayan475, illustrating and describing "the assignment of slots to a given MLC x for one frame 216." Pet. 67–68 (citing Ex. 1003 ¶¶ 209–214; Ex. 1006, ¶¶ 39–42, Fig. 4). Petitioner argues Vijayan475 "discloses each time interval comprising a plurality of OFDM symbols" and "describes OFDM communications provided on the subbands within each slot." *Id.* at 69 (citing Ex. 1003 ¶¶ 211–213; Ex. 1006 ¶¶ 25, 69–71). Further, Petitioner contends, "[e]ach slot within the time interval has a duration of one OFDM 'symbol period' as seen in Figure 4," where "the time interval spanning Symbol Period Indices 3-7 includes five OFDM symbols." *Id.* (citing Ex. 1003 ¶¶ 211–213; Ex. 1006 ¶¶ 36, 39–42, Fig. 4). Thus, Petitioner asserts, "each time interval comprises a plurality of OFDM symbols." *Id.* Further, Petitioner argues, "Vijayan475 also discloses 'each OFDM symbol containing a plurality of frequency subcarriers' as claimed," as Vijayan475 states that "[m]ultiple carriers may be provided by orthogonal frequency division multiplexing (OFDM)" and that "OFDM effectively partitions the overall system bandwidth into multiple (N) orthogonal subbands" or "subcarriers." *Id.* (emphasis omitted) (quoting Ex. 1006 ¶ 25) (citing Ex. 1006 ¶¶ 25, 26).

ii. "assigning an identifier to the mobile station"

Petitioner argues that Vijayan475 renders obvious the step of "assigning an identifier to the mobile station," as recited in claim 1. Pet. 69–70 (citing Ex. 1003 ¶¶ 215–218; Ex. 1006 ¶¶ 5–9, 25, 26, 37–42, 44, 62). In support of this argument, Petitioner points out that "Vijayan475 allocates transmission units or 'slots' for a 'unicast transmission [that] is sent to a specific wireless device.'" *Id.* (citing Ex. 1006 ¶¶ 5, 25). Petitioner

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contends that a person of ordinary skill in the art "would have found it obvious to assign an identifier to the specific wireless device especially to provide unicast transmissions," and to "allow the wireless device to discern its own intended data streams and 'quickly find and extract' or recover 'individual data streams of interest.'" *Id.* at 70 (citing Ex. 1003 ¶ 215–218; Ex. 1006 ¶¶ 5–9, 25, 26, 37–42, 44, 62). Otherwise, Petitioner contends, "it would be more difficult for each wireless device to discern its own respective data stream for recovery." *Id.* (citing Ex. 1003 ¶ 215–218).

In the alternative, Petitioner contends that Wu explicitly discloses the recited "assigning" step, citing Wu's disclosure of a base station assigning a UE identifier to a mobile device via a control channel in an OFDM system. Pet. 70–72 (citing Ex. 1003 ¶¶ 219–222; Ex. 1008, code (57), ¶¶ 4, 20, 21, 25, 32–34, 50, 87, 92, 94, 98, 128–134, Fig. 2). Citing Dr. Wilson's testimony, Petitioner argues that a person of ordinary skill in the art would have been motivated to combine Vijayan475 and Wu to implement Wu's assignment of a UE identifier with Vijayan475's OFDM communication system for several reasons. Pet. 61–63 (citing Ex. 1003 ¶¶ 192–199). First, Petitioner contends, related to its argument discussed above that Vijayan475 itself renders the "assigning" step obvious, a person of ordinary skill in the art would have used an identifier to specifically identify a wireless device, in order to implement Vijayan475's disclosure of "unicast communications" or to communicate data to a specific wireless device. *Id.* at 61 (citing Ex. 1003 ¶¶ 192–199; Ex. 1006 ¶¶ 5, 25, 26). While conceding that "Vijayan475 does not explicitly discuss types of identifiers or how to implement such identifiers," Petitioner argues that a person of ordinary skill in the art "would have therefore sought references that taught techniques for implementing

wireless device identifiers," and that "Wu is such a reference." *Id.* at 62 (citing Ex. 1003 ¶¶ 192–199; Ex. 1008 ¶¶ 32–34, 87, 92, 94, 98).

Petitioner further contends that a person of ordinary skill in the art would have been motivated to combine Wu's UE identifier with Vijayan475 to allow its wireless devices to differentiate and identify its own slot allocation and respective messages for reception. Pet. 62 (citing Ex. 1006 ¶¶ 5, 25–26, 44; Ex. 1008 ¶¶ 33–34, 87, 92, 94, 98). Thus, Petitioner argues, "combining Wu with Vijayan475 would have improved the functionality of Vijayan475's wireless devices by providing a simple process for discerning resource allocation slots." *Id.* (citing Ex. 1003 ¶¶ 194–195). Moreover, Petitioner contends, "[c]ombining Vijayan475 and Wu would have amounted to combining well-known prior art elements to yield predictable results," as "[a]ssigning a wireless device identifier was a well-known technique in the prior art used to allow a mobile device to discern its own intended resource allocation," and "[i]n view of this ubiquitous usage, a POSITA would have had a reasonable expectation of success in combining Vijayan475 and Wu to facilitate wireless transmissions." *Id.* at 62–63 (citing Ex. 1003 ¶¶ 196–199; Ex. 1006 ¶¶ 25–27, 36, 39–42, 67–75, Figs. 1, 8, 9; Ex. 1008 ¶¶ 101, 134, 137, Fig. 6). Finally, Petitioner contends, "[t]his combination would have been predictable and would have operated to perform its intended purposes in view of [the references'] common OFDM configuration and assignment of OFDM slots." *Id.* at 63 (citing Ex. 1003 ¶¶ 196–199). According to Petitioner, "[t]he combined system would have used the UE identifier to specify the resource allocation parameters (e.g., Vijayan475's slot allocation parameters and/or stream lengths) for a particular wireless device," which Vijayan475 would have used to identify its assigned transmission slots to receive and recover the corresponding

data." *Id.* (citing Ex. 1003 ¶¶ 195–199; Ex. 1006 ¶¶ 9–12, 38, 42–55, 62, 64).

iii. "transmitting a signal containing information from the base station to the mobile station over a segment of time-frequency resource"

Petitioner argues that Vijayan475 discloses transmitting a signal "from the base station to the mobile station over a segment of time-frequency resource," as recited in claim 1, citing disclosure in Vijayan475 defining a "segment" using a "starting time-frequency coordinate" and N time-frequency resource units in the form of encoded starting "slot information" and "stream length" parameters. Pet. 72 (citing Ex. 1003 ¶¶ 223–241; Ex. 1006 ¶¶ 38–42, 45–55). Petitioner contends that Vijayan475 describes the same base station and mobile station configuration described in claim 1, with Vijayan475's base station transmitting "'multiple [OFDM] data streams on multiple data channels' which may be recovered by wireless devices," and Vijayan475's wireless device then "'receiv[ing] the modulated signal' and identif[ying] the transmitted OFDM symbols." *Id.* at 73 (citing Ex. 1003 ¶¶ 224–227; Ex. 1006, code (57), ¶¶ 9, 60, 69, 71–73). Petitioner further contends,

> Vijayan475's base station also transmits the OFDM symbol information "over a segment of time-frequency resources" as claimed. [Ex. 1006], FIG. 4, ¶¶36-42. Vijayan475 describes transmitting data over "slots," which disclose the claimed "time-frequency resource." *Id.* "M slots are formed in each symbol period and are mapped to M disjoint or non-overlapping sets of subbands, where M≧1." *Id.*, ¶36. Therefore, each slot is a resource having a time component (symbol period) and frequency component (subband). EX1003, ¶225.

Id. Petitioner maps "MLC x" in Vijayan475's Figure 4 to the recited "segment of time-frequency resource," citing Vijayan475's disclosure that

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the term MLC refers to a "multiplexed logical channel" segment that is assigned one or more slots to carry "one or more data streams." *Id.* at 73–74 (citing Ex. 1003 ¶ 225; Ex. 1006 ¶¶ 9, 27, 28, 40, 51, 52). Petitioner contends that "[t]his assignment of 'slots' in the time-frequency plane discloses the claimed 'segment of time-frequency resource[]." *Id.* at 74 (citing Ex. 1003 ¶¶ 226, 227; Ex. 1006 ¶¶ 27, 28, 36–42, 45).

iv. "the segment having a starting time-frequency coordinate and the segment comprising N time-frequency resource units within a time interval . . . where N=2, 4, or 8"

Citing Vijayan475's definition of a segment using a "Start Offset" and "Slot Info" parameters corresponding to the "Start Slot" and "the number of slots allocated to the MLC," Petitioner contends that "Vijayan475's 'Start Offset' and 'Slot Info' parameters collectively identify a starting time-frequency coordinate," while "Vijayan475's Stream Lengths parameter identifying the number of slots in the segment . . . discloses the claimed N time-frequency resource units." Pet. 75–77, 79 (citing Ex. 1003 ¶¶ 228–238; Ex. 1006 ¶¶ 36–42, 45 (Table 1), 45–49, 51, 52, 54–57, Fig. 4).

Petitioner further contends that "Vijayan475 also discloses a second way to convey [starting time-frequency coordinate] information to reduce overhead signaling," citing disclosure in Vijayan475 that "slot information may be encoded to reduce the number of bits needed to convey this information," using "ΔStart" and "ΔMax" parameters. Pet. 77 (quoting Ex. 1006 ¶ 46) (citing Ex. 1003 ¶¶ 231–234; Ex. 1006 ¶¶ 40, 42, 46–49). Petitioner argues that "Vijayan475 encodes these parameters as shown in Table 2," and "the simple 'Slot Info Code' transmitted by a base station conveys the Min Slot, ΔStart, and ΔMax parameters to the wireless device"

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for derivation of the starting time-frequency coordinate. *Id.* at 78 (citing Ex. 1003 ¶¶ 232–234; Ex. 1006 ¶¶ 45–49, 48 (Table 2), Fig. 4).

Lastly, Petitioner contends that "Vijayan475 also discloses or otherwise renders obvious a segment having N time-frequency resources units within a time interval where N=2, 4, or 8." Pet. 79 (citing Ex. 1003 ¶¶ 237, 238). For example, Petitioner argues, a person of ordinary skill in the art would have understood from Vijayan475's disclosure of each MLC being assigned "M slots . . . where M≧1" that M could equal 2, 4, or 8 slots and that using 2, 4, or 8 slots for a segment would beneficially utilize less overhead signaling." *Id.* (citing Ex. 1003 ¶¶ 237, 238; Ex. 1006 ¶¶ 36, 38). Moreover, Petitioner asserts, it would have been a simple design choice for a person of ordinary skill in the art to use any number of slots between one and sixteen (as assigned to MLC x in Figure 4 of Vijayan475) to convey an MLC segment. *Id.* at 79–80 (citing Ex. 1003 ¶¶ 237, 238; Ex. 1006, ¶¶ 36, 38, 40, Fig. 4).

v. "each unit containing a set of frequency subcarriers in a group of OFDM symbols"

Petitioner maps Vijayan475's "slot" to the recited "unit," as discussed above, and maps the "M disjoint or non-overlapping sets of subbands" in each symbol period to the recited "set of frequency subcarriers." Pet. 80 (citing Ex. 1003 ¶¶ 239–241; Ex. 1006 ¶¶ 25, 36). Petitioner further contends, "Vijayan475 conveys data using OFDM symbols, which also use sets of subcarriers," and "[w]hen transmitting OFDM symbols, multiple carriers or 'multiple [] orthogonal subbands' are used." *Id.* (citing Ex. 1006 ¶¶ 25, 36, 69–71, Fig. 4). Thus, Petitioner argues, "Vijayan475 discloses each slot including a set of frequency subcarriers in a group of OFDM

symbols." *Id.* (citing Ex. 1003 ¶¶ 239–241; Ex. 1006 ¶¶ 25, 36, 69–71, Fig. 4).

vi. "receiving by the mobile station the transmitted signal"

Petitioner contends that "Vijayan475 discloses a wireless device (*i.e.*, the claimed 'mobile station') receiving transmitted information signals from a base station." Pet. 80–81 (citing Ex. 1006 ¶¶ 71–73, Fig. 9). In particular, Petitioner cites Vijayan475's disclosure of "wireless device 120x" including, *inter alia*, "antenna 912," "receiver unit 914," and "OFDM demodulator 916," where "antenna 912 receives the modulated signal transmitted by base station 110x and provides a received signal to . . . receiver unit (RCVR) 914," "[r]eceiver unit 914 conditions, digitizes, and processes the received signal," and "OFDM demodulator 916 . . . extract[s] the data and overhead symbols." *Id.* at 81 (quoting Ex. 1006 ¶ 71). Thus, Petitioner argues, "these components receive the signal transmitted from the base station corresponding to the MLC segments with corresponding slot assignments." *Id.* (citing Ex. 1003 ¶¶ 242–244; Ex. 1006 ¶¶ 36, 38–55).

vii. "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 Vijayan475's wireless device using receiver unit 914 and OFDM demodulator 916 recovers data from the received OFDM signal based on the starting time-frequency coordinate and N time-frequency resource units. Pet. 82 (citing Ex. 1003 ¶¶ 245–247; Ex. 1006 ¶¶ 71–73, Fig. 9). Further, Petitioner argues, "controller 940" and "RX data processor 930" of Vijayan475's wireless device 120x "also recover the relevant information by identifying 'one or more MLCs' and the

corresponding 'slot assignment for each selected MLC,'" and "RX data processor 930 then 'processes each detected data symbol stream for each MLC of interest.'" *Id.* (citing Ex. 1006 ¶ 72). More particularly, according to Petitioner, "Vijayan475 recovers MLC segments using overhead signaling information" that "conveys a starting time-frequency coordinate and a number of slots ('N-value') using Start Offset, Slot Info, and Stream Length parameters." *Id.* (citing Ex. 1006 ¶¶ 40, 42, 44–47, 56). With these parameters, Petitioner contends, "the wireless device determines the 'time-frequency location of each MLC' and recovers the corresponding information." *Id.* (citing Ex. 1003 ¶¶ 245–248; Ex. 1006, code (57), ¶¶ 9, 10, 40, 42, 44–55, 60).

Still further, Petitioner argues that a person of ordinary skill in the art "would have also found it obvious and would have been motivated to implement the identifier described in Wu with Vijayan475's system." Pet. 82 (citing Ex. 1003 ¶¶ 248–251). As in connection with the "assigning" step discussed above, Petitioner contends that, in view of Vijayan475's "unicast transmissions," a person of ordinary skill in the art would have implemented Wu's UE identifier to allow a wireless device to identify its own allocation parameters from those intended for other wireless devices. *Id.* at 83 (citing Ex. 1006 ¶¶ 5, 25, 26; Ex. 1008, code (57), ¶¶ 32–34, 87, 94, 98). Petitioner contends that "[t]his identifier would have been provided to the particular wireless device to allow recovery of the MLC segment and therefore would have also corresponded to the wireless device's Start Offset, Slot Info, and Stream Length parameters." *Id.* at 82–83 (citing Ex. 1003 ¶¶ 248–251; Ex. 1006 ¶¶ 5, 25, 26, 42, 45–55; Ex. 1008 ¶¶ 33, 34, 87, 92, 94, 98). Using the identifier and these parameters, Petitioner asserts, "the receiver would determine whether to recover data from a transmitted OFDM

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signal based on 'whether or not the receiver is scheduled during the slot.'" *Id.* at 83 (citing Ex. 1003 ¶ 251; Ex. 1008 ¶¶ 25, 50, 100).

b. Patent Owner's Contentions

i. "starting time-frequency coordinate"

In response to Petitioner's contentions, Patent Owner argues, first, that the combination of Vijayan475 and Wu fails to teach or render obvious the "starting time-frequency coordinate" recited in each of the challenged independent claims. Prelim. Resp. 8. Rather, Patent Owner contends, "Vijayan475 specifies the start of its slot with two parameters – the start offset, which acts as a starting time coordinate, and the slot info, which specifies the starting frequency coordinate." *Id.*

As detailed above in the discussion of Patent Owner's contentions regarding the asserted Vijayan089-Laroia ground (*see supra* § III.E.3.b), Patent Owner contends that the '450 patent distinguishes a prior art allocation scheme in which both a "start symbol offset" and a "start logical subchannel offset" were needed to specify the start of the time/frequency region; that "[i]t is . . . undisputed that the 'starting time-frequency coordinate' must have a single dimension covering both time and frequency"; and that "[a]ny reference that uses both a starting time coordinate and a separate starting frequency coordinate does not have a one-dimensional coordinate in both time and frequency." Prelim. Resp. 9–10 (emphasis omitted) (citing Ex. 2001 ¶ 57; Ex. 2004, 5; Ex. 2006, 2).

Against this backdrop, Patent Owner argues that both Petitioner's reading of Vijayan475's "Start Offset" and "Slot Info" and its reading of Vijayan475's "ΔStart" and "ΔMax" parameters along with the Min Slot parameter as identifying the recited "starting time-frequency coordinate" are flawed. Prelim. Resp. 18–19 (citing Pet. 76–77). In Patent Owner's view,

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"[e]ach of these reads attempts to artificially combine multiple parameters in different dimensions into the single claimed 'starting time-frequency coordinate.'" *Id.* at 19. Patent Owner contends that "Vijayan475 does indeed identify multiple ways to assign its slots (the alleged 'time-frequency resource') to a given MLC," including a "rectangular slot pattern" and a "zigzag pattern," but that, as explained by Mr. Alberth, each uses separate parameters to convey where the MLC should start in the time domain (i.e., "slot symbol period" or "Start Offset") and where the MLC should begin in the frequency domain (i.e., "slot index" or "Slot Info"). *Id.* at 19–24 (citing Ex. 1006 ¶¶ 40, 42, 45 (Table 1), Fig. 4; Ex. 2001 ¶¶ 60–62). In this regard, Patent Owner argues, Vijayan475 "is therefore not materially different from [the prior art IEEE] 802.16 [standard described] in the '450 [patent]'s background, the 802.16-Kim combination rejected in the [IPR2021]-1486 IPR, and Vijayan089 above," as "[a]ll of these systems use one parameter for a starting time coordinate and a different parameter for a starting frequency coordinate" and "do not disclose or render obvious the claimed single 'starting time-frequency coordinate.'" *Id.* at 24.

Regarding Petitioner's contention that Vijayan475 also discloses a second way to convey starting time-frequency coordinate information, using encoding "to reduce the number of bits needed to convey this information," Patent Owner argues that such encoding "does not convert Vijayan475's starting time coordinate and separate string frequency coordinate into the claimed 'starting time-frequency coordinate,'" but rather "[i]t continues to use Start Offset as starting time coordinate" and uses different parameters in the frequency dimension." Prelim. Resp. 24–26 (citing Ex. 1006 ¶¶ 45 (Table 1), 46–54, 56, 58, Fig. 5; Ex. 2001 ¶¶ 63–65). Further, according to Patent Owner, although Vijayan475's encoding "reduces the number of bits

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that needs to be transmitted to convey the zigzag shape from nine to seven," "this is still more than the three bits that would have been needed to convey the starting frequency coordinate using 802.16." *Id.* (citing Ex. 1006 ¶ 49; Ex. 2001 ¶ 63). Still further, Patent Owner contends, Vijayan475's "Slot Info Code does not directly indicate the Start Slot, but it does allow Vijayan475's wireless device to determine the starting location of the MLC is the frequency dimension," and "[t]hus it 'is itself a starting frequency coordinate.'" *Id.* at 27 (quoting Ex. 2001 ¶ 65). Thus, Patent Owner concludes, "Vijayan475 never uses the claimed 'starting time-frequency coordinate' with only one dimension but rather consistently uses ***both*** a starting time coordinate ***and*** a starting frequency coordinate." *Id.*

ii. "N time-frequency resource units . . . containing a set of frequency subcarriers in a group of OFDM symbols"

Patent Owner additionally argues that "[t]he Petition's argument for Vijayan475 is even weaker" than its argument for Vijayan089 "as it does not even attempt to show that the alleged 'time-frequency resource unit' is in multiple OFDM symbols," and "[i]n fact, the alleged 'time-frequency resource unit' . . . covers only a ***single*** OFDM symbol." Prelim. Resp. 29.

As detailed above in the discussion of Patent Owner's contentions regarding the asserted Vijayan089-Laroia ground (*see supra* § III.E.3.b), Patent Owner contends that "[o]ne of the key features of the [recited] time-frequency resource unit is that it has multiple symbols," allowing for a reduction in "the amount of control overhead but at the cost of flexibility." Prelim. Resp. 30–32 (citing Ex. 1001, 6:49–50, Table 1; Ex. 2001 ¶¶ 30, 68). Patent Owner contends that, "[a]s with the Vijayan089, the Petition initially identified Vijayan475's 'symbol period' as the alleged 'OFDM symbol,'"

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but "in the section attempting to show that the alleged 'each unit containing a set of frequency subcarriers in a group of OFDM symbols' the Petition makes no attempt to show that the slot spans multiple of the symbol periods." *Id.* at 41–42 (citing Pet. 69, 80). According to Patent Owner, "[t]he Petition fails to explain how the fact that multiple slots of the MLC convey OFDM symbols has any bearing on whether each individual slot 'contain[s] a set of frequency subcarriers in a group of OFDM symbols,' as claimed." *Id.* at 42. In Patent Owner's view, "Vijayan475 is clear that, in the embodiment relied upon by the Petition, while each slot can cover multiple subcarriers, it is limited to one 'symbol period.'" *Id.* at 43. Focusing on the 16 slots corresponding to MLC x in Vijayan475's Figure 4, Patent Owner contends that "it is clear that every single one of these slots occupies ***only one*** symbol period." *Id.* at 44–45 (citing Ex. 1006, Fig. 4; Ex. 2001 ¶ 72). Thus, Patent Owner concludes, "it is clear that the embodiment relied upon by Petitioner in Vijayan475 does not teach or render obvious a 'time-frequency resource units . . . each unit . . . in ***a group*** of OFDM symbols' as required by the claims." *Id.* at 45.

c. Discussion

On the preliminary record before us, we are persuaded that Petitioner has articulated reasoning with rational underpinning to support combining the teachings of Vijayan475 and Wu and has shown a reasonable likelihood that it will prevail in showing that claim 1 is unpatentable over the combination.

Despite Patent Owner's arguments that Vijayan475 fails to teach a "starting time-frequency coordinate" (Prelim. Resp. 1, 8–10, 18–28), we are sufficiently persuaded on the preliminary record before us that at least Vijayan475's disclosure of encoding slot information to convey "ΔStart,"

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"ΔMax," and "Min Slot" parameters as a single "slot info code" teaches the recited "starting time-frequency coordinate" (*see* Pet. 77–79 (citing Ex. 1003 ¶¶ 232–234; Ex. 1006 ¶¶ 40, 42, 46–49, 48 (Table 2), 56). The fact that Vijayan475's wireless device *subsequently* may derive separate starting time and starting frequency coordinates from the slot info code does not negate the fact that the slot info code appears on the preliminary record to be a singular coordinate. *Cf.* Prelim. Resp. 25–27. Moreover, we are not persuaded otherwise by Patent Owner's contention that Vijayan475's slot info code would use "more . . . bits tha[n] would have been needed to convey the starting frequency coordinate" using the IEEE 802.16 prior art standard discussed in the Background section of the '450 patent. *Id.* at 24–25 (citing Ex. 2001 ¶ 46). First, we understand the slot info code to convey not only "the starting frequency coordinate," as in Patent Owner's comparison, but also the "starting time-frequency coordinate." Second, notwithstanding that a stated goal of the '450 patent is to reduce overhead signaling, the claims do not recite any specific number of bits that may be employed for such signaling.

Regarding Patent Owner's arguments that Vijayan475 does not teach or suggest the limitation of "each unit containing a set of frequency subcarriers in a group of OFDM symbols" (Prelim. Resp. 29–32, 41–45), we also find Petitioner's contentions with respect to that limitation sufficient on the preliminary record, for essentially the same reasons as set forth in the discussion of the asserted ground based on Vijayan089 and Laroia (*see supra* § III.E.3.c). In particular, Patent Owner's arguments appear to present an issue of claim construction that is underdeveloped on the preliminary record before us, and the parties are accordingly advised to address the

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proper construction of the relevant limitation in their briefing in the course of trial.

4. Independent Claims 7 and 13

Petitioner refers back to its arguments for claim 1 for all limitations of claims 7 and 13. Pet. 83–86. With respect to the recitations in claims 7 and 13 of the mobile device and base station, respectively, operating in a "wireless packet system," Petitioner further contends that Vijayan475 describes communications using "packets," citing disclosure in Vijayan475 that a "each MLC may carry up to three data streams, e.g., one data stream for signaling and up to two data streams for packet/traffic data" and Vijayan475's disclosure of the use of MAC packets to transmit data and definition of Stream Length based on the length of a "stream layer packet." *Id.* at 84 (citing Ex. 1006 ¶¶ 28, 32–35, 45, 50–54), 86 (same). Petitioner additionally contends that "Vijayan475 depicts base station cells in Figure 1 and a wireless device [as] a 'cellular phone,'" thus teaching that the mobile device operates within a cell serviced by a base station, as further recited in claims 7 and 13. *Id.* (citing Ex. 1006 ¶¶ 26–28, Fig. 1).

Patent Owner relies on the same arguments for claims 7 and 13 as for claim 1. *See* Prelim. Resp. 8–12, 18–32, 41–45. For the reasons discussed in Section III.F.3 above with respect to claim 1, and based on Petitioner's further arguments addressing the packet and cell-based limitations of claims 7 and 13, we conclude that Petitioner shows a reasonable likelihood of prevailing with respect to both claims.

5. Dependent Claims 2–5, 8–11, and 14–17

For dependent claims 2–5, 8–11, and 14–17, Petitioner argues with citations to Vijayan475 and Dr. Wilson's testimony that Vijayan475 teaches each of the claims' additional limitations. Pet. 86–91. Patent Owner does

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not provide any arguments specifically for any of the challenged dependent claims, but relies only on the arguments presented for the independent claims. *See* Prelim. Resp. 8–12, 18–32, 41–45.

Based on the arguments presented and the evidence cited in the Petition, Petitioner shows a reasonable likelihood of prevailing on each of claims 2–5, 7–11, and 13–17 in its challenge based on Vijayan475 and Wu.

6. Conclusion

Petitioner has shown a reasonable likelihood that it will prevail in showing that claims 1–5, 7–11, and 13–17 would have been obvious over Vijayan475 and Wu.

G. Obviousness of Claims 6, 12, and 18 over Vijayan089, Laroia, and Choi or over Vijayan475, Wu, and Choi

Petitioner alleges claims 6, 12, and 18 would have been obvious, either over Vijayan089, Laroia, and Choi or over Vijayan475, Wu, and Choi, relying in part on Dr. Wilson's Declaration. Pet. 91–94 (citing Ex. 1003 ¶¶ 275–291).

We begin our analysis with an overview of Choi, and we then address the parties' contentions with respect to the challenged claims.

1. Choi

Choi, titled "Repetition Coding for a Wireless System," relates generally to a data transmission scheme for a wireless communication system in which data transmission may be enhanced by "repetition encoding," including in the context of systems using OFDM. Ex. 1009, codes (54), (57), ¶¶ 1, 13. Choi explains:

> An OFDM symbol includes 48 values that are transmitted on different subchannels. To provide extended range, each value that is sent is repeated several times by the transmitter. In one embodiment, the bits are convolutionally encoded using the same

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> encoding scheme as the encoding scheme specified for the IEEE 802.11a/g standard. Each encoded value is repeated and transmitted. Preferably, the values are repeated in the frequency domain, but the values may also be repeated in the time domain. In some embodiments, the repetition coding is implemented before interleaving and a specially designed interleaver is used to handle repeated values. In addition, a pseudorandom code may be superimposed on the OFDM symbols to lower the peak to average ratio of the transmitted signal.

Id. ¶ 13. Choi further explains that "[f]or time domain repetition, the OFDM symbols in the time domain (after the IFFT operation) are repeated a desired number of times, depending on the data rate." *Id.* ¶ 16. According to Choi, "[t]his scheme has an advantage in efficiency since just one guard interval is required for r-repeated OFDM symbols in the time domain." *Id.* In contrast, Choi explains, repetition of OFDM symbols in the frequency domain requires insertion of a guard interval between every OFDM symbol in the time-domain, because OFDM symbols with frequency-domain repetition are not periodic. *Id.* ¶ 18. Nonetheless, Choi explains, "repetition in the frequency domain can achieve better multipath performance if the repetition pattern is configured in the frequency-domain to achieve frequency diversity." *Id.*

2. Dependent Claims 6, 12, and 18

Claims 6, 12, and 18 depend from claims 5, 11, and 17, respectively, and each recites "wherein a repetition coding is further applied to the time-frequence [sic] resource." Ex. 1001, 13:13–14, 14:4–6, 14:39–41. Petitioner argues that "[t]he '450 patent does not provide any special definition for 'repetition coding,' but states that '[t]hose skilled in the art will appreciate that coding and signal repetition can be combined to provide lower coding rates," and Petitioner contends that a person of ordinary skill in

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the art "would have therefore recognized 'repetition coding' as referring to a simple and well-known technique where information bits are repeated." Pet. 91–92 (emphasis omitted) (quoting Ex. 1001, 6:58–62) (citing Ex. 1003 ¶¶ 275–279). Petitioner further contends that "Choi confirms that it would have been obvious to apply repetition coding to time-frequency resource units." *Id.* at 92 (citing Ex. 1003 ¶¶ 280–281). In particular, Petitioner argues, "Choi describes 'enhancing the transmission of the data by further repetition encoding the data' to improve 'error correction' and provide a 'more robust data transmission scheme at reduced data rates'" and "applies this repetition coding to OFDM symbols" "in both the time and/or frequency domains." *Id.* (citing Ex. 1003 ¶¶ 280–281; Ex. 1009, code (57), ¶¶ 2, 13, 16–18, 51).

According to Petitioner, one of ordinary skill in the art would have been motivated to combine Choi with either Vijayan089 and Laroia or Vijayan475 and Wu to provide error correction and more robust data transmission, as taught by Choi. Pet. 92–93 (citing Ex. 1003 ¶¶ 182–284, 288–289; Ex. 1009, 2). Petitioner contends that Vijayan089 and Vijayan475 both acknowledge that repeating portions of signals was a well-known technique and both also explicitly use redundancy, either to provide "forward error correction coding," in Vijayan089, or to improve the reception of signals, in Vijayan475. *Id.* (citing Ex. 1005 ¶¶ 39, 83, 101, 114, 118; Ex. 1006 ¶ 64). Petitioner contends that Choi's repetition coding would have furthered these goals and would have alleviated errors in OFDM systems. *Id.* (citing Ex. 1003 ¶¶ 288–289; Ex. 1009 ¶¶ 16–18, 22–24, 45). A person of ordinary skill in the art would therefore have applied Choi's repetition coding to Vijayan089's time-frequency units or to Vijayan475's time-frequency slots and would have also had a reasonable expectation of

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success in doing so in view of their common OFDM usage. *Id.* at 92–94 (citing Ex. 1003 ¶¶ 282–284, 288–291; Ex. 1005 ¶ 39, 83, 101, 114, 118; Ex. 1006 ¶¶ 36–42, 45–49, 57; Ex. 1009 ¶¶ 16–18, 22–24, 45).

Patent Owner does not provide arguments specifically for claims 6, 12, and 18 but instead relies on its arguments for the independent claims from which they depend. *See* Prelim. Resp. 8–48.

Based on the arguments presented and the evidence cited in the Petition, we are persuaded that Petitioner has articulated reasoning with rational underpinning to support combining the teachings of Choi with either Vijayan089 and Laroia or Vijayan475 and Wu and has shown a reasonable likelihood that it will prevail in showing that each of claims 6, 12, and 18 in its challenges based on those combinations.

IV. CONCLUSION

For the foregoing reasons, Petitioner has demonstrated a reasonable likelihood that it will prevail in showing that claims 1–18 of the '450 patent are unpatentable, and we institute an *inter partes* review of the '450 patent on all asserted grounds. *See* 37 C.F.R. § 42.108(a).

V. ORDER

In consideration of the foregoing, it is hereby:

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

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

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AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 **Director of the U.S. Patent and Trademark Office** **P.O. Box 1450** **Alexandria, VA 22313-1450**	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Northern District of Ohio on the following

☑ Trademarks or ☐ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
3:22-cv-01252	7/15/2022	Northern District of Ohio

PLAINTIFF	DEFENDANT
Neo Wireless LLC	FCA US, LLC

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,467,366	6/18/2013	Neo Wireless LLC
2 10,075,941	9/11/2018	Neo Wireless LLC
3 10,447,450	10/15/2019	Neo Wireless LLC
4 10,771,302	9/8/2020	Neo Wireless LLC
5 10,833,908	4/17/2018	Neo Wireless LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
Conditional Transfer Order (CTO 1) by the Judicial Panel on Multidistrict Litigation. In re: MDL 3034 Neo Wireless, LLC, Patent Litigation. Case Transferred to Eastern District of Michigan and assigned to the Honorable Terrence G. Berg.

CLERK	(BY) DEPUTY CLERK	DATE
Sandy Opacich	/s/Natalie Wlotzko	8/15/2022

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
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