

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

AMERICAN HONDA MOTOR CO. INC., GENERAL MOTORS LLC,
NISSAN NORTH AMERICA, INC., and TESLA, INC.,¹

Petitioner,

v.

NEO WIRELESS LLC,
Patent Owner.

IPR2022-01567
Patent 10,447,450 B2

Before KRISTEN L. DROESCH, HYUN J. JUNG, and
MATTHEW S. MEYERS, *Administrative Patent Judges*.

DROESCH, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining No Challenged Claims Unpatentable
35 U.S.C. § 318(a)

¹ 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. Volkswagen Group of America, Inc., has been terminated from this proceeding.

I. INTRODUCTION

We have authority to hear this *inter partes* review under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, Petitioner has not established by a preponderance of the evidence that claims 1–18 of U.S. Patent No. 10,447,450 (Ex. 1001, “the ’450 Patent”) are unpatentable.

A. Procedural History

Volkswagen Group of America, Inc. (“Volkswagen”) filed a Petition requesting *inter partes* review of claims 1–18 of the ’450 Patent. Paper 2 (“Pet.”). Neo Wireless LLC (“Patent Owner”) timely filed a Preliminary Response. Paper 7. Pursuant to 35 U.S.C. § 314, we instituted trial on May 4, 2023, as to all of the challenged claims and all of the grounds raised in the Petition. Paper 8 (“Institution Decision,” “Dec. on Inst.”).

After institution of trial, Patent Owner filed a Response. Paper 16 (“PO Resp.”). Also following institution of trial, American Honda Motor Co., Inc., (“Honda”) filed a Petition requesting *inter partes* review along with a Motion for Joinder. Pursuant to 35 U.S.C. §§ 314, 315(c), we instituted trial and granted the Motion for Joinder. Paper 24. Volkswagen and Honda filed a Reply to the Response. Paper 26 (“Pet. Reply”). General Motors LLC, Nissan North America, Inc. and Tesla Inc. filed a Petition requesting *inter partes* review along with a Motion for Joinder. Pursuant to 35 U.S.C. §§ 314, 315(c), we instituted trial and granted the Motion for Joinder. Paper 32.

Volkswagen and Patent Owner filed a Joint Motion to Terminate the proceeding as to Volkswagen. Paper 41. We granted the Motion and Volkswagen was terminated from the proceeding. Paper 43. Accordingly,

Honda, GM, Nissan, and Tesla (collectively, “Petitioner”) remain in this twice-joined proceeding.

Patent Owner filed a Sur-reply to the Reply (Paper 51, “PO Sur-reply”).

The Petition relies on a Declaration of Sarah Kate Wilson, Ph.D., (Ex. 1003) and the Reply relies on a second Declaration of Dr. Wilson (Ex. 1048). Patent Owner filed a Second Declaration of William P. Alberth, Jr. (Ex. 2010) to support its Response.

Dr. Wilson and Mr. Alberth were cross-examined during trial, and a transcript of Dr. Wilson’s deposition (Ex. 2007) and a transcript of Mr. Alberth’s deposition (Exs. 1049, 1050) are included in the record. A transcript of the deposition of Matthew C. Valenti, Ph.D.² is also included in the record. Ex. 2019.

Oral argument was held on March 29, 2024. A transcript of the oral argument is included in the record. Paper 57.

B. Real Parties in-Interest

American Honda Motor Co., Inc. and Honda Development & Manufacturing of America, LLC as well as General Motors LLC, Nissan North America Inc., and Tesla Inc. identify themselves as the real parties in-interest for Petitioner. IPR2023-00793, Paper 3; IPR2023-00963, Paper 3. Patent Owner identifies itself as the real party in-interest. Paper 5, 1 (Patent Owner’s Mandatory Notices).

² A Declaration of Matthew C. Valenti Ph.D. was filed in support of the petition filed in IPR2023-00963, in which Dr. Valenti adopted the testimony of Dr. Wilson. *See* IPR2023-00963, Ex. 1048.

C. 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-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 further note that Ford Motor Company and General Motors and Nissan North America filed petitions for review of the '450 patent. IPR2023-00763, Paper 1; IPR2023-00962, Paper 4. The petitions were granted and the proceedings joined in IPR2023-00763. IPR2023-00763, Papers 30, 33.

D. The '450 Patent

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

According to the '450 Patent, “[b]andwidth efficiency is one of the most important system performance factors for wireless communication systems.” Ex. 1001, 1:33–34. In order to support the high degree of

flexibility needed to accommodate different applications having different sized application payloads and different quality of service (“QoS”) requirements in packet-based data communication, however, wireless communication systems generally must provide a high degree of flexibility. *Id.* at 1:34–40. In wireless systems based on the IEEE 802.16 standard, for example, “multiple packet streams are established for each mobile station to support different applications,” and “at the medium access control (MAC) layer, each packet stream is mapped into a wireless connection.” *Id.* at 1:42–47. “Special scheduling messages, DL-MAP and UL-MAP, are utilized to broadcast scheduling decisions to the mobile stations.” *Id.* at 1:47–50. According to the ’450 Patent, the MAP scheduling method defined by the IEEE 802.16 standard involves significant control overhead, amounting altogether to 52 bits, representing as much as 32.5% of overall data communication for 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.

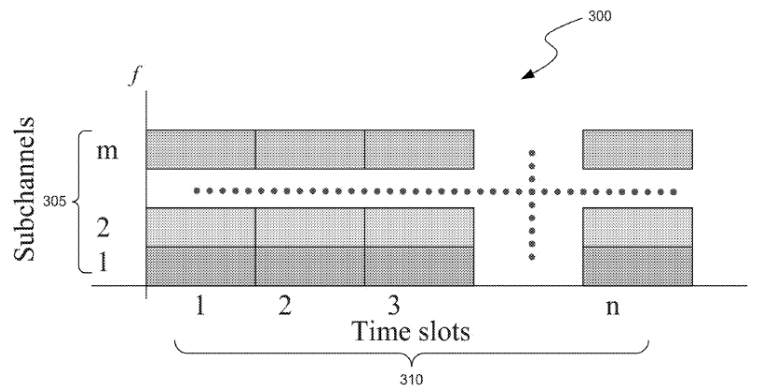


Figure 3 is a block diagram depicting a division of communication capacity in a physical media resource (e.g., radio or cable) into frequency and time domains. Ex. 1001, 2:25–26, 4:16–18. With reference to Figure 3, “[t]he frequency is divided into two or more subchannels 305, represented as subchannels 1, 2, . . . m ,” and “[t]ime is divided into two or more time slots 310, represented in the diagram as time slots 1, 2, . . . n .” *Id.* at 4:18–22. The '450 Patent explains that “[t]he canonical division of the resource by both time and frequency provides a high degree of flexibility and fine granularity for resource sharing between multiple applications or multiple users of the resource.” *Id.* at 4:22–26.

Figure 6 of the '450 Patent is reproduced below.

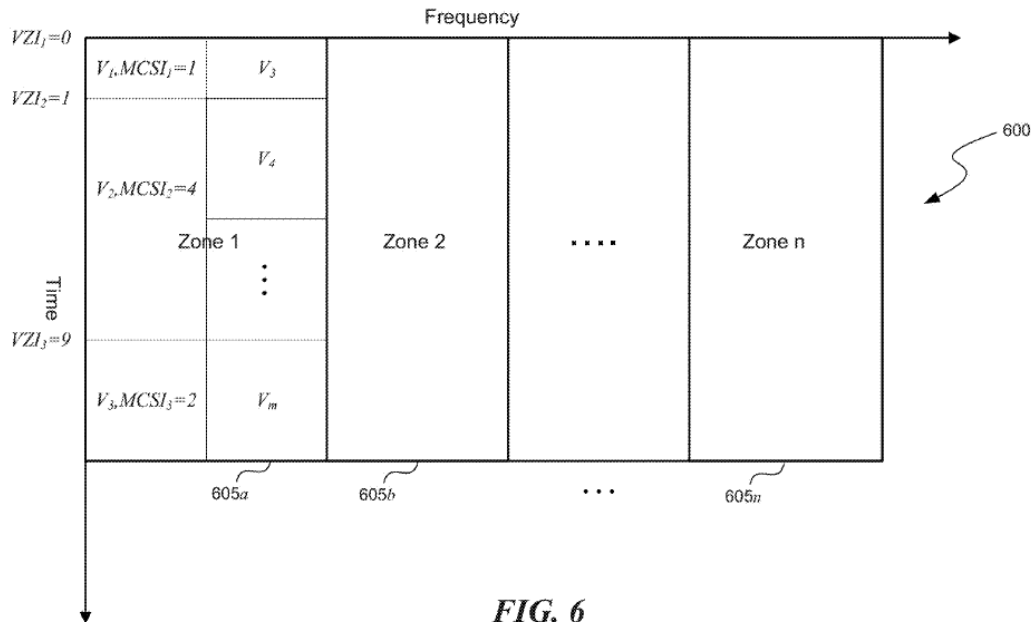


FIG. 6

Figure 6 is a block diagram of a frequency-time resource utilized by a wireless communication network. Ex. 1001, 2:32–33, 5:32–34. Figure 6 depicts an alternative way of managing multiple packet streams in order to overcome the inefficiencies associated with the mapping of packet streams in typical wireless systems based on the IEEE 802.16 standard. *Id.* at 5:34–43. In Figure 6, time-frequency resource 600 is divided into zones 605a, 605b, ... 605n, each of which is associated with a particular type of application (e.g., VoIP, video applications). *Id.* at 5:43–49. “[B]y grouping like applications together[,] the amount of control overhead in MAC headers is reduced.” *Id.* at 5:49–51. More particularly, according to the '450 Patent, “[w]hen applications of a similar type are grouped together within a zone, a reduction in the number of bits necessary for mapping a packet stream to a time-frequency segment can be achieved.” *Id.* at 5:54–57. “In some embodiments, the identification of the time-frequency segment associated with a particular packet stream can be indicated by the starting

time-frequency coordinate and the ending time-frequency coordinate relative to the starting point of the zone.” *Id.* at 5:57–61. According to the ’450 Patent,

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

When the zones are further subdivided into time-frequency segments in accordance with certain rules, a mapping of packet streams to segments may be achieved using a one-dimensional offset with respect to the origin of the zone rather than the two-dimensional (i.e., starting time-frequency coordinate and ending time-frequency coordinate relative to the starting point of the zone) mapping method discussed above.

Id. at 6:22–29.

The '450 Patent further describes use of a “basic resource unit,” which is the resource utilized by the highest available modulation coding scheme (MCS) associated with a particular packet stream, such that the resources used by other MCSs can be represented as integer multiples of the basic unit. Ex. 1001, 6:45–52. Once the MCS is selected for each packet stream contained in a particular zone, the offset to a segment representing a particular packet stream may be easily calculated, and the index for any selected packet stream is defined as the sum of all basic resource units associated with each packet stream preceding the selected packet stream, with an optional adjustment depending on the location where the division of the time-frequency resource is started. *Id.* at 7:7–18. The '450 Patent explains that “[u]sing basic resource units as the granularity of a location offset to the packet stream reduces the number of bits required to represent its location with the zone.” *Id.* at 7:28–30.

E. Illustrative Claim

Claims 1, 7, and 13 are independent and claims 2–6, 8–12, and 14–18 ultimately 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;

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. Instituted Patentability Challenges and Asserted Prior Art

Petitioner challenges claims 1–18 as unpatentable on the following grounds and prior art (Pet. 5–94):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–5, 7–11, 13–17	103(a) ³	Vijayan089 ⁴ , Laroia ⁵
1–5, 7–11, 13–17	103(a)	Vijayan475 ⁶ , Wu ⁷
6, 12, 18		Vijayan089, Laroia, Choi ⁸
6, 12, 18		Vijayan475, Wu, Choi

³ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112-29, 125 Stat. 284, 285–88 (2011), revised 35 U.S.C. § 103 effective March 16, 2013. The ’450 Patent issued from an application filed before that date, so we refer to the pre-AIA version of § 103, but our findings and analysis would be the same under the current version of the statute.

⁴ US 2005/0058089 A1, published March 17, 2005 (Ex. 1005, “Vijayan089”).

⁵ US 2005/0277429 A1, published December 15, 2005 (Ex. 1007, “Laroia”).

⁶ US 2005/0141475 A1, published June 30, 2005 (Ex. 1006, “Vijayan475”).

⁷ US 2005/0063345 A1, published March 24, 2005 (Ex. 1008, “Wu”).

⁸ US 2005/0243774 A1, published November 3, 2005 (Ex. 1009, “Choi”).

II. ANALYSIS

A. 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 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 asserts that Petitioner’s definition of a person of ordinary skill in the art is inconsistent with the Board’s prior findings in IPR2021-01486 and based on a significantly higher level of skill. *See* PO Resp. 5–6. According to Patent Owner, “Petitioner’s proposal additionally requires or permits ‘an advanced degree’ on top of the required work experience.” *Id.* (citing Ex. 1003 ¶ 52). Patent Owner asserts that Petitioner’s expert, Dr. Wilson, does not provide analysis or evidence to support Petitioner’s proposed significantly higher level of ordinary skill in the art as well as to support the departure from the Board’s previous findings. *See id.* at 7 (citing Ex. 2007, 21:13–22, 23:13–20). Patent Owner further contends that Dr. Wilson’s opinion espousing this higher level of ordinary skill in the art should be entitled to little weight. *See id.* at 7–8 (citing *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (PTAB

Aug. 24, 2022) (precedential); *Dionne v. Liotta*, Int. 104,333, Paper 119 at 5 (PTAB Oct. 31, 2001) (informative)).

Patent Owner asserts that, in a recent IPR, the Board rejected an identical proposed level of ordinary skill in the art proposed by Volkswagen finding that the proposed level of ordinary skill was unsupported and inconsistent with the level of ordinary skill reflected in the prior art of record. *See* PO Resp. 8 (citing *Volkswagen Grp. Of Am., Inc. v. NEO Wireless, LLC*, IPR2023-00086, Paper 7, 10–12 (June 16, 2023)). Patent Owner asserts that its expert, Mr. Alberth, explains that the level of ordinary skill in the art adopted by the Board in IPR2021-01486, comports with the state of the art at the time of the invention. *See* PO Resp. 9–10 (reproducing Ex. 2010 ¶¶ 19–20). In IPR2021-01486, the Board adopted the definition that, as of September 28, 2005, a person of ordinary skill in the art

would have had at least a Bachelor’s degree in an academic area emphasizing electrical engineering, computer engineering, or a similar discipline, and at least two years of experience in the field working with, teaching, or researching wireless communication networks. . . . Superior education could compensate for a deficiency in work experience, and vice-versa.

Ex. 1010, 8–9; *see* Ex. 1014, 11–12. In support of its arguments that the level of ordinary skill in the art adopted by the Board in IPR2021-01486 comports with the actual state of the art, Patent Owner directs attention to Mr. Alberth’s testimony discussing the professionals working in the wireless communications in 2004, and the type of work with which a POSITA was involved in 2005. *See* PO Resp. 9–10; Ex. 2010 ¶¶ 19–20.

In the Reply, Petitioner asserts “the Petition and Dr. Wilson’s [D]eclaration explain that a bachelor’s degree in electrical engineering, computer engineering, computer science, or an equivalent field along with at

least 3-5 years of academic or industry experience would be sufficient for a POSITA.” Pet. Reply 28 (citing Pet. 18; Ex. 1003 ¶ 52; Ex. 1048 ¶¶ 82–83). Petitioner asserts that advanced degrees may be used as alternatives to qualify as a POSITA. *See id.* at 28–29 (citing Pet. 18; Ex. 1003 ¶ 52). According to Petitioner, Patent Owner’s expert “Mr. Alberth has acknowledged that an advanced degree is optional.” *Id.* at 29 (citing Ex. 1050, 33:13–34:5, 42:11–44:3).

Based on our review of the record, we adopt Petitioner’s proposed definition of a person of ordinary skill in the art as it does not materially differ from Patent Owner’s proposed definition and is consistent with the level of skill reflected in the ’450 Patent Specification and the asserted prior art. In any event, our conclusions would be the same under Patent Owner’s definition.

B. Claim Construction

In an *inter partes* review proceeding, the Board applies the same claim construction standard as that applied in federal courts in a civil action under 35 U.S.C. § 282(b), which is generally referred to as the Phillips standard. *See* 37 C.F.R. § 42.100(b); *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). Under the *Phillips* standard, “words of a claim ‘are generally given their ordinary and customary meaning.’” *Phillips*, 415 F.3d at 1312. “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17). Extrinsic evidence may be useful, but it is unlikely to result in a reliable

interpretation of patent claim scope unless considered in the context of the intrinsic evidence. *Phillips*, 415 F.3d at 1317.

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. *See id.*

Patent Owner asserts that the claim term “a starting time-frequency coordinate” is not disclosed by separate time and frequency coordinates, as the Board correctly found in IPR2021-01486. *See* PO Resp. 11 (citing Ex. 1014, 26–27). More specifically, Patent Owner points out that, in the decision denying institution in IPR20021-01486, the Board held that the petitioner’s contentions were premised on a “conflation of . . . separate starting time and frequency coordinates as the recited singular ‘starting time-frequency coordinate.’” Ex. 1014, 27; *see* PO Resp 12–13. Patent Owner parenthetically points out that the Board also found that the applied prior art teachings only of independent time and frequency units were akin to the prior art described in the Background of the ’450 Patent and subsequently distinguished in the Detailed Description. *See* PO Resp. 13 (citing Ex. 1014, 13, 26).

Patent Owner argues that, despite having the burden to state how the challenged claims are to be construed, Petitioner has chosen not to traverse the Board’s prior construction in IPR2021–01486 of “a starting time-frequency coordinate.” *See* PO Resp. 13 (citing 37 C.F.R § 42.104(b)(3)). Patent Owner contends that it is black-letter law that the Board’s decision as to this claim term is part of the intrinsic evidence for the ’450 Patent. *See id.* at 14 (citing *Aylus Networks, Inc. v. Apple Inc.*, 856 F.3d 1353, 1360 (Fed. Cir. 2017)). Patent Owner asserts that, as a result, Petitioner has waived any

challenge to the Board’s prior construction. *See id.* at 13–14 (citing *Hulu LLC v. Sound View Innovations LLC*, IPR2018-01023, Paper 15 at 5–6 (PTAB Aug. 14, 2019); *Cisco Sys., Inc. v. Oyster Optics, LLC*, IPR2017-01719, Paper 31 at 23–25 (PTAB Jan. 24, 2019)).

Patent Owner further asserts that the Board’s prior construction of “a starting time-frequency coordinate” is correct on the merits. *See* PO Resp. 14, 21. Patent Owner asserts that the plain meaning of the claims in light of the ’450 Patent Specification and the disclosed embodiments support the Board’s prior construction. *See id.* at 14–19 (reproducing Ex. 1001, Fig. 6, Table 1; citing Ex. 2010 ¶¶ 39–46). Patent Owner contends that, in contrast to the Board’s preliminary finding in this proceeding that dependent claims 2 and 3 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 or a starting subcarrier of the segment of the time-frequency resource, Patent Owner’s position is supported by claims 2 and 3. *See id.* at 20 (citing Ex. 1014, 46). According to Patent Owner, if the starting time-frequency coordinate of claim 1 would mean a separate time coordinate and a separate frequency coordinate, then dependent claims 2 and 3 would be superfluous. *See id.* (citing Ex. 2010 ¶ 48). Patent Owner further contends that claims 2, 3, and 4 support Patent Owner’s construction by stating that the time and frequency starting positions at a given granularity must be reverse-determinable. *See id.* at 20–21 (citing Ex. 2010 ¶¶ 49–50).

In the Reply, Petitioner asserts that Patent Owner alleges that “a starting time-frequency coordinate” should be construed to require “a single index that combines the two time and frequency dimensions into a single time-frequency dimension,” or limited to a “single index that conveys the

location in both the time and the frequency dimensions.” *See* Pet. Reply 2 (citing PO Resp. 11, 14; Ex. 2010 ¶ 39). Petitioner asserts that Patent Owner’s reliance on statements from IPR2021-01486 and the ’450 Patent Specification’s description of a basic resource unit do not support this construction. *See id.* (citing PO Resp. 12–19; Ex. 1048 ¶¶ 10–22; Ex. 1049, 50:10–16).

More specifically, Petitioner contends that Patent Owner’s reliance on the decision denying institution in IPR2021-01486 is misplaced because it did not provide any construction for any term of the ’450 Patent and did not construe the starting time-frequency coordinate to be limited to only a single index value. *See* Pet. Reply 2–3 (citing Ex. 1014, 12–13). According to Petitioner, that decision was only a preliminary analysis of the claims and focused on the deficiencies of the applied references in that proceeding which are not at issue here. *See id.* at 3 (citing Ex. 1014, 26–28). Petitioner contends that the deficiencies in those references were addressed in the instant Petition and are not present in the Vijayan089 and Vijayan475 references. *See id.* (citing Pet. 17–18, 97–99). Petitioner contends that the Board already considered and rejected the same arguments in the Institution Decision of this proceeding. *See id.* (citing Dec. on Inst. 41–42, 45–46).

Petitioner asserts that the passages of the ’450 Patent Specification cited by Patent Owner to support its construction “merely discuss the ‘basic resource unit,’ an example depicted in Figure 6, and one particular goal of the patent—reducing overhead bits.” Pet. Reply 3. According to Petitioner, “[n]one of these passages suggest that the ‘starting time-frequency coordinate should be limited solely to a single index value.” *Id.* (citing Ex. 1048 ¶¶ 14–17). Petitioner further asserts that the ’450 Patent describes the opposite, where a single index is not used. *See id.* at 3–4 (citing

Ex. 1001, 7:50–54). Petitioner further contends that other disclosures of the '450 Patent refute Patent Owner's "single index" construction. *See id.* at 4 (citing Ex. 1001, 6:22–30; Ex. 1048 ¶¶ 18–20). Petitioner also asserts the '450 Patent also does not use the term "one-dimensional" to refer to the single index value or to limit what format the starting time-frequency coordinate can take. *See id.* at 5 (citing Ex. 1048 ¶¶ 18–20). Petitioner further contends that dependent claims 2 and 3 do not support Patent Owner's construction because the Board already determined that the "starting time frequency coordinate" is not limited to a single index value. *See id.* (citing Ex. 1014, 46; Ex. 1048 ¶¶ 21–22; PO Resp. 19–21). Petitioner asserts that dependent claims 2, 3, and 4 provide different granularities for the starting time-frequency coordinate indicating that claim 1 is not limited to a singular index. *See id.* at 5–6 (citing Ex. 1048 ¶¶ 21–22).

In the Sur-reply, Patent Owner contends the '450 Patent Specification and well-established law on the subject of disclaimer all confirm that "a starting time-frequency coordinate" cannot be disclosed by separate time and frequency coordinates. *See* PO Sur-reply 1 (citing Ex. 1001, 5:57–61, 8:15–18; Fig. 6; Ex. 2010 ¶¶ 39–44). Patent Owner asserts that Federal Circuit precedent removes any ambiguity about this distinction. Patent Owner reiterates that the Board denied institution in IPR2021-01486 challenging the '450 Patent, based on the determination, and Patent Owner's underlying argument, that separate time and frequency coordinates do not disclose the claimed time-frequency coordinate. *See id.* at 2 (citing PO Resp. 12–13; Ex. 1014, 27). In support of Patent Owner's argument that the decision denying institution in IPR2021-01486 establishes disclaimer, Patent Owner points to the Federal Circuit's holding in *Aylus* that "statements made

by a patent owner during an IPR proceeding can be . . . relied upon to support a finding of prosecution disclaimer.” *Id.* (citing *Aylus*, 856 F.3d at 1361). Patent Owner asserts that the effect of the prior decision in IPR2021-01486 on this proceeding is not a matter of Board discretion because a disclaimer in an IPR proceeding is binding in later proceedings. *See id.* (citing *Cupp Computing AS v. Trend Micro Inc.*, 53 F.4th 1376, 1383 (Fed. Cir. 2022)). Patent Owner contends that its arguments and the Board’s decision in the IPR2021-01486 distinguishing prior art that is materially identical to Vijayan089 and Vijayan475 on the basis that separate time and frequency coordinates do not disclose the claimed “time-frequency coordinate” is sufficient to create a disclaimer. *See id.* at 2–3 (citing *Ekchian v. Home Depot, Inc.*, 104 F.3d 1299, 1304 (Fed. Cir. 1997); *Ford Motor Co. v. TMC Fuel Injection Sys., LLC*, IPR 2014-00272/00273, Paper 36 at 19 (PTAB June 22, 2015); *Ford Motor Co. v. Vehicle Operation Techs., LLC*, IPR2014-00594, Paper 26 at 15–17 (PTAB Oct. 15, 2014); *Spectrum Int’l, Inc. v. Sterilite Corp.*, 164 F.3d 1372, 1378 (Fed. Cir. 1998) *Saffran v. Johnson & Johnson*, 712 F.3d 549, 559 (Fed. Cir. 2013)).

In the Sur-reply, Patent Owner asserts that the Reply fails to address prosecution disclaimer, including any legal precedent. *See* PO Sur-reply 3–4 (citing Pet. Reply 2–5; Ex. 2019, 111:5–15). Patent Owner further contends that the Reply also fails to refute the ’450 Patent Specification’s support for this construction and instead incorrectly argues that the Specification describes the exact opposite on the basis that it discloses that the VZI index can be omitted. *See id.* at 4 (citing PO Resp. 4; Ex. 1001, 7:40–54). According to Patent Owner, “[e]ven in the cited portion, where the VZI index is omitted, the starting time-frequency coordinate is still not identified by separate time and frequency coordinates, but by the MSCI index.” *See*

id. (citing Ex. 1001, 7:50–54). Patent Owner further contends that the Reply notes that dependent claims 2–4 define the granularities of the “time-frequency coordinate” of claim 1, which “confirms that the function of claims 2–4 is only to define the ‘granularity’ of the time-frequency coordinate—not to indicate whether claim 1’s ‘time-frequency coordinate’ can be specified through separate time and frequency coordinates.” *Id.*

After reviewing the parties’ respective positions and the intrinsic evidence cited by the parties, we agree with Patent Owner that the Board’s decision denying institution in IPR2021-01486, finding that “a starting time-frequency coordinate” is not disclosed by separate starting time and frequency coordinates, constitutes a disclaimer which is binding on these proceedings. *See* Ex. 1014, 27; *Aylus*, 856 F.3d at 1361; *Cupp Computing AS v. Trend Micro Inc.*, 53 F.4th 1376, 1383 (Fed. Cir. 2022); *see also* Ex. 1012, 12–13 (Patent Owner’s arguments that a time coordinate and a frequency coordinate is not the same as “a starting time-frequency coordinate.”). As such, we find that the ordinary and customary meaning of “a starting time frequency coordinate” excludes separate time and frequency coordinates. We further agree with Patent Owner that the ’450 Patent Specification is consistent with this construction because it discloses segments of time-frequency resource (e.g., $V_1, V_2, \dots V_m$) each having a starting time-frequency coordinate (e.g., index $VZ_1=0, VZ_2=1, VZ_3=9 \dots V_m$). *See* Ex. 1001, 6:3–14, 7:7–27, Fig. 6; PO Resp. 16–17. Finally, we agree that the recitations of dependent claims 2 and 3 are not inconsistent with “a starting time frequency coordinate” that does not encompass separate time and frequency coordinates. *See* PO Resp. 19–21.

Petitioner’s arguments premised on Patent Owner’s proposing a construction for “a starting time-frequency coordinate” limited to a single

index or one-dimension (*see* Pet. Reply 2–6) are misplaced because, although Patent Owner’s Response briefly mentions a single index (*see* PO Resp. 11, 14), the overall thrust of Patent Owner’s arguments is that “a starting time-frequency coordinate” cannot be disclosed by separate time and frequency coordinates. *See* PO Resp. 11–21.

In sum, based on the full record before us, we find that the ordinary and customary meaning of “a starting time frequency coordinate,” recited in claim 1 and independent claims 7 and 14, excludes separate time and frequency coordinates.

C. 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).⁹

⁹ The parties do not present evidence or arguments addressing secondary considerations.

*D. Patentability Challenge to Claims 1–5, 7–11, and 13–17 over
Vijayan089 and Laroia*

1. Overview of Vijayan089 (Ex. 1005)

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.*

Vijayan089 discloses a system that includes base stations (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. Ex. 1005 ¶¶ 14, 36. Each base station may broadcast multiple data

streams simultaneously to wireless devices 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.*

Figure 2 of Vijayan089 is reproduced below.

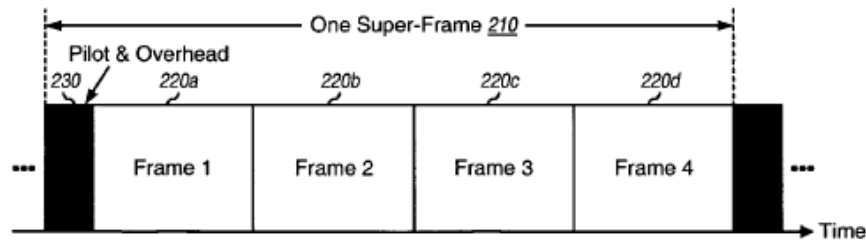


Figure 2, above, shows an exemplary super-frame structure that may be used for broadcast system 100. Ex. 1005 ¶¶ 15, 38. Each super-frame 210 has a predetermined time duration, which, according to Vijayan089, may be selected based on various factors, and each super-frame is divided into multiple equal-sized 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.

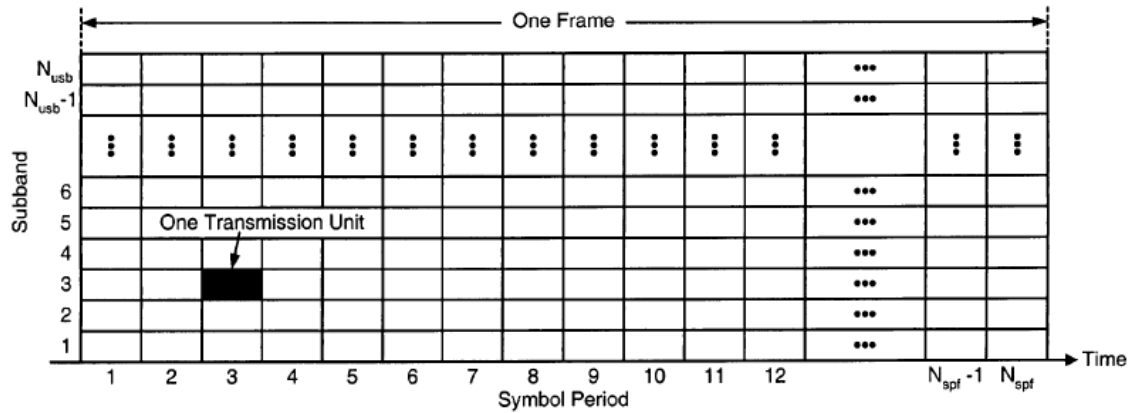


Figure 4, above, depicts the structure of a single frame on a time-frequency plane, where the horizontal axis represents time, given in units of OFDM symbol periods, and the vertical axis represents frequency. Ex. 1005 ¶¶ 17, 46. According to Vijayan089:

Each OFDM symbol period is the time duration to transmit one OFDM symbol The specific number of symbol periods per frame (N_{spt}) 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} 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. Three such manners are depicted in Figures 7A, 7B, and 7C of Vijayan089. *Id.* ¶¶ 67–79.

Figure 7B of Vijayan089 is reproduced below.

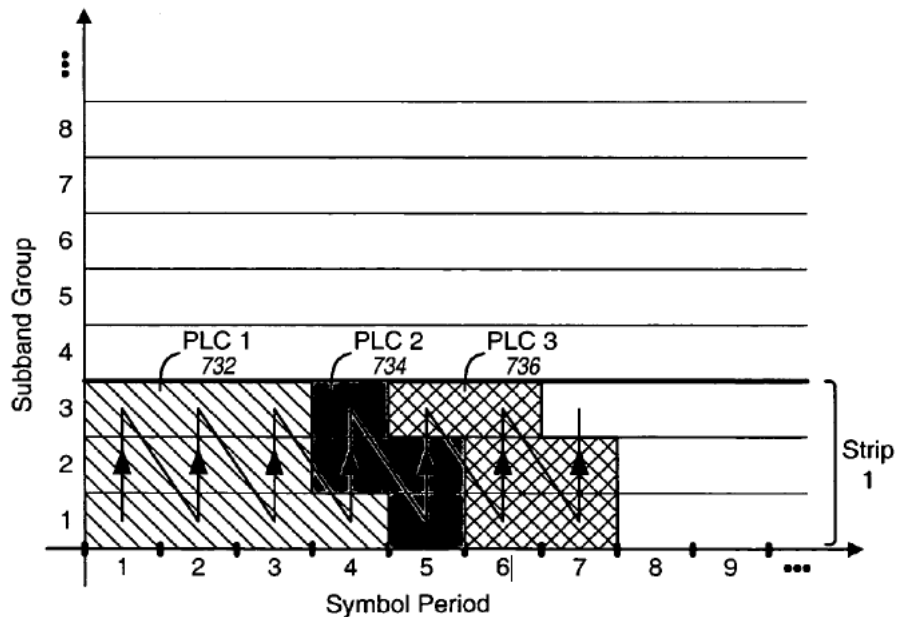


Figure 7B, above, shows assignment of slots to PLCs in “sinusoidal” or “zigzag” segments. Ex. 1005 ¶¶ 23, 72. With reference to Figure 7B, Vijayan089 explains that a frame may be divided into N_{st} strips, each covering at least one subband group and further spanning a contiguous number of symbol periods. *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 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. Overview of Laroia (Ex. 1007)

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 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.

Laroia discloses a base station that includes a receiver, a transmitter, a processor, an I/O interface, and a memory coupled together via a bus over which the various elements may interchange data and information. Ex. 1007 ¶ 35. The memory includes routines and data/information, where the data/information is used by the processor to control the base station, perform routine base station operations, and implement the paging methods of the invention. *Id.* ¶ 36. Data/information includes, *inter alia*, first paging signal system information, second paging signal system information, and wireless terminal (WT) data/information 260. *Id.* ¶ 37. WT data/information includes, *inter alia*, “terminal identification (ID) information,” which may be a base station assigned ID for wireless terminal WT1. *Id.* ¶ 38. Second paging signal information system information includes, *inter alia*, “WT identification information,” 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. Analysis of Claim 1

Petitioner asserts that the subject matter of claim 1 would have been obvious in view of the combined teachings of Vijayan089 and Laroia. *See* Pet. 30–60. We provide below a brief overview of several of Petitioner’s undisputed assertions addressing the preamble and some of the limitations of claim 1 as well as the reasons to combine the teachings of Vijayan089 and Laroia in order to provide background information, followed by a discussion and analysis of one of the specific disputed limitations of claim 1.

With respect to

[a]n 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,

recited in the preamble of claim 1, Petitioner asserts that Vijayan089 describes the same operating method and wireless network. *See* Pet. 33–38 (citing Ex. 1003 ¶¶ 117–129; Ex. 1005 ¶¶ 5, 11, 36–49, 58–67, 70–77, Figs. 1, 2, 4, 11, 12). Petitioner further asserts that Vijayan089 renders obvious the first limitation of “assigning an identifier to the mobile station,” as recited in claim 1. *See* Pet. 38–39 (citing Ex. 1003 ¶ 130–133; Ex. 1005 ¶¶ 6, 7, 9, 11, 44, 35, 106).

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) (citing Ex. 1003 ¶¶ 134–137; Ex. 1007 ¶¶ 38–40, 49, 53, 58, 63–65, Figs. 2, 3, 5); *see* Pet. 30 (citing Ex. 1003 ¶¶ 107–116, 134–137). Petitioner contends that 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 to specifically identify a wireless device, in order to implement Vijayan089’s disclosure of unicast communications and minimize power

consumption. *See* Pet. 30–32 (citing Ex. 1003 ¶¶ 107–116; Ex. 1005 ¶¶ 6, 7–9, 11, 35, 44, 64; Ex. 1007 ¶¶ 3, 6, 38, 40, 53, 63, 64 code (57)).

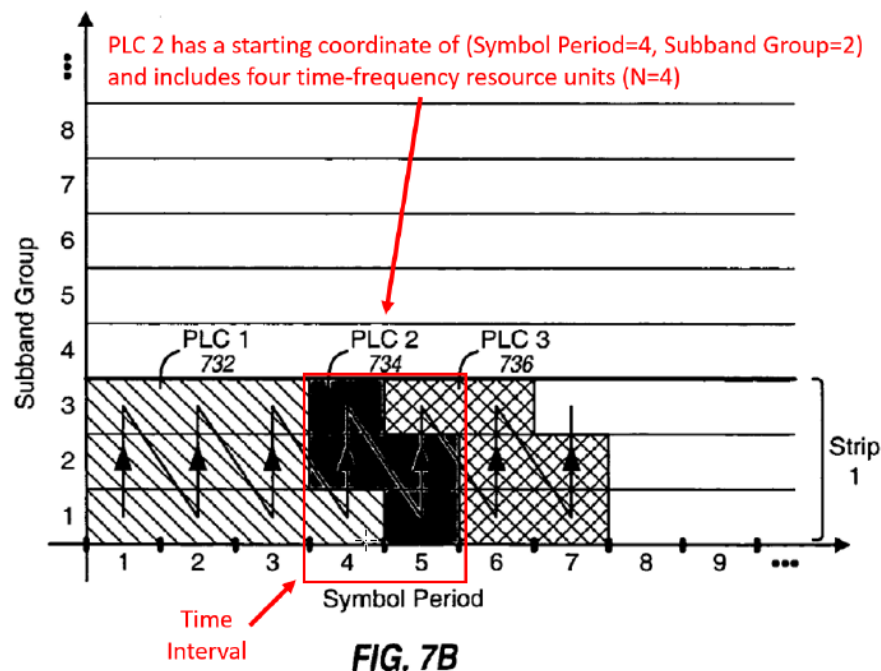
Petitioner further asserts that the combination would have been the combination of well-known prior art elements to yield predictable results, and a POSITA would have had a reasonable expectation of success in making the combination. *See* Pet. 31–32 (citing Ex. 1003 ¶¶ 113–114; Ex. 1005, ¶¶ 5, 11, 36, 37, 44, 74, 76, 106–111, Figs. 1, 11, 12; Ex. 1007 ¶¶ 32–35, 38–42, Figs. 1–3).

Petitioner contends that Vijayan089 teaches transmitting a signal “from the base station to the mobile station over a segment of time-frequency resource,” as recited in claim 1, citing 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.” Pet. 41 (emphasis omitted) (citing Ex. 1003 ¶¶ 138–154; Ex. 1005 ¶¶ 11, 59, 72–76, Fig. 4). Petitioner contends that Vijayan089 describes the base station transmitting OFDM “data streams to be individually recovered” by a wireless device over “transmission units” or “transmission slots.” *See* Pet. 41–42 (citing Ex. 1003 ¶ 139; Ex. 1005 ¶¶ 9, 11, 59, 72–76, 108–110, Fig. 4). According to Petitioner, “each transmission unit is a resource having a time component (symbol period) and frequency components (subband).” Pet. 42 (citing Ex. 1003 ¶ 140; Ex. 1005 ¶¶ 9, 46, 59–60, 67). In particular, Petitioner points to Vijayan089’s depiction of a transmission unit in Figure 4 and depictions of transmission slots grouped into PLC segments in Figures 7A and 7B, along with corresponding description, and asserts that the Vijayan089’s PLC segments teach segments of time-frequency resource. *See* Pet. 42–44 (reproducing Ex. 1005, Figs. 4, 7A, 7B (with Petitioner’s

annotations added); citing Ex. 1003 ¶¶ 139–143; Ex. 1005 ¶¶ 9, 11, 37, 46, 59, 60, 68–76).

Turning to the disputed limitation, Petitioner contends that Vijayan089 teaches “the segment having a starting time-frequency coordinate” based on Vijayan089’s “explicit[] state[ment] 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. 44–45 (quoting Ex. 1005 ¶ 74). According to Petitioner, “[t]he ‘start of the segment’ parameter (e.g., the starting subband and symbol period) discloses the claimed ‘starting time-frequency coordinate.” Pet. 45 (citing Ex. 1003 ¶¶ 144–145). In support of its argument Petitioner reproduces Figure 7B of Vijayan089 with added annotations.

Petitioner’s annotated Figure 7B of Vijayan 089 is reproduced below.



Petitioner’s annotated Figure 7B of Vijayan089 shows assignment of slots in “zigzag” segments including Petitioner’s added annotations of “Time

Interval” and “PLC2 has a starting coordinate of (Symbol Period=4, Subband Group=2) and includes four time-frequency resource units (N=4).” *See* Pet. 46; Ex. 1005 ¶ 72. Petitioner asserts, “[a]s an example, Vijayan089 discloses ‘segment 734’ corresponding to ‘PLC 2’ in Figure 7B, which discloses the claimed ‘segment of time-frequency resource.’” Pet. 46 (citing Ex. 1003 ¶¶ 149–151; Ex. 1005 ¶¶ 9, 11, 59, 67–76). According to Petitioner, “[s]egment 734 includes a starting time-frequency coordinate of: Symbol Period = 4, Subband Group = 2.” Pet. 47 (citing Ex. 1003 ¶¶ 149–151; Ex. 1005, Fig. 7B, ¶ 73).

Patent Owner contends that “Vijayan089’s ‘start of the segment’ parameter that is specified by a separate “starting subband” and a separate “symbol period” is *exactly*—and at the very least, *materially*—the type of prior art distinguished by the Patent and rejected by the Board in the -01486 IPR as failing to disclose the claimed ‘time-frequency coordinate.’” PO Resp. 22 (citing Ex. 1014, 27). Patent Owner further asserts that Petitioner’s expert, Dr. Wilson, admitted that Vijayan089’s start of the segment parameter consists of a separate time and separate frequency parameter. *See id.* (citing Ex. 2007, 149:6–12, 150:10–22, 152:22–153:5); *id.* at 30–31 (similar argument); PO Sur-reply 17 (similar argument). According to Patent Owner, “Vijayan089’s ‘starting subband’ describes the location of the start of the segment in the frequency domain. Thus it is a starting frequency coordinate. Similarly, the starting ‘symbol period’ describes where the segment begins in the time domain. It is thus a starting time coordinate.” PO Resp. 23 (reproducing Ex. 1005, Fig. 7B (with Patent Owner’s added annotations); citing Ex. 2010 ¶ 54). Patent Owner asserts that Vijayan089 discloses a similar strategy in identifying the starting coordinates in its other embodiments by specifying the starting subband group for the frequency

dimension and the starting symbol period for the time dimension of the rectangular pattern shown in the embodiment of Fig. 7A. *See id.* at 23–24 (citing Ex. 1005 ¶ 70; Ex. 2010 ¶ 55).

Patent Owner asserts that Petitioner emphasizes that Vijayan089 refers to the starting subband and symbol period collectively as the start of the segment parameter, but contends the Petitioner is making the same conflation of two separate parameters that the Board rejected in IPR2021-01486. *See* PO Resp. 26 (citing Pet. 45; Ex. 2007, 151:20–21; Ex. 1014, 27). According to Patent Owner, “Petitioner has not presented any argument as to why the POSITA, without the benefit of the ’450 inventors’ invention, would have modified Vijayan089’s disclosure to identify the start of the segment differently, or even an argument that it would have been allegedly obvious to do so.” *Id.* at 32.

In the Reply, Petitioner reiterates that “Vijayan089 explicitly states an ‘assigned segment may be specified by **two parameters: the start of the segment ... and the length of the segment.**’” Pet. Reply 6 (citing Ex. 1005; Pet. 45–47). According to Petitioner, “Vijayan089 therefore explicitly refers to the ‘start of the segment’ parameter as a single parameter, which discloses the claimed ‘starting time-frequency coordinate.’” *Id.* (citing Ex. 1048 ¶ 23). Petitioner further contends that Patent Owner fails to acknowledge that Vijayan089 explicitly refers to the start of the segment as a single parameter. *See* Pet. Reply 7 (citing PO Resp. 22–24; Ex. 1005 ¶ 74). Petitioner asserts that the “start of the segment” parameter discloses the “starting time-frequency coordinate” under its plain and ordinary meaning, and under a proposed construction of “a one-dimensional time-frequency coordinate.” *See id.* at 7 (citing Ex. 1048 ¶ 23).

Petitioner asserts that Patent Owner mischaracterizes Vijayan089's Figure 7B and Petitioner's annotations. According to Petitioner, "[r]ather than being limited to sending separate time and frequency coordinates, Figure 7B identifies the starting position for a segment and the number of units in that segment." Pet. Reply 7–8 (reproducing Ex. 1005 Fig. 7B (with Petitioner's annotations); citing Ex. 1048 ¶ 26; Pet. 45–47).

Petitioner asserts that "consistent with Figure 7B, Vijayan089 expressly discloses that the "the start of the segment"—symbol period 4 and subband group 2—is represented as a single parameter." Pet. Reply 8 (citing Ex. 1005 ¶ 74; Pet. 45–47; Ex. 2007, 151:12–152:6). According to Petitioner, "[u]sing this 'start of the segment' parameter, Vijayan089's mobile device would determine the independent time and frequency coordinates as indicated in [Petitioner's] annotations" of Figure 7B. *Id.* (citing Ex. 1048 ¶ 27).

In the Sur-reply Patent Owner contends that the Petition does not dispute that Vijayan089 discloses separate time and frequency coordinates. PO Sur-reply 17 (citing Pet. 45). Patent Owner points out that Dr. Wilson admitted that Vijayan089's start of the segment parameter "'**need[s]**' both a starting time and a starting frequency component." *Id.* (citing Ex. 2007, 149:6–12, 150:10–22, 152:22–153:5). Patent Owner further contends that Dr. Wilson in her Declaration stated "that Vijayan089's '**starting coordinate [is] specified by** symbol period = 4 and subband group = 4.'" *Id.* (citing Ex. 1003 ¶ 87). According to Patent Owner, "the fact that Vijayan089 used **nomenclature** referring to these separate starting time and frequency coordinates as a single parameter does not change its **disclosure**." *Id.*

We agree with Patent Owner that Petitioner's position set forth in the Petition is that Vijayan089 discloses a start of the segment parameter in

terms of separate time (e.g., symbol period) and frequency (e.g., subband) coordinates. *See* Pet. 44–47. Although Vijayan089 discloses that the assigned segment may be specified by two parameters—the start of the segment and the length of the segment, Vijayan089 further discloses the start of the segment parameter may be given by the starting subband and symbol period. *See* Ex. 1005 ¶ 74. Petitioner does not direct us to any disclosure in Vijayan089 describing this start of the segment parameter in any additional detail or describing this parameter in terms other than a starting symbol period (i.e., time coordinate) and subband (i.e., frequency coordinate). *See* Pet. 44–47. Indeed, Petitioner asserts that PLC2 or “Segment 734 includes a starting time-frequency coordinate of: Symbol Period =4, Subband Group =2.” Pet. 47; *see* Pet. 46 (Petitioner’s annotated Figure 7B of Vijayan089); Ex. 1003 ¶¶ 87, 150. We further agree that Dr. Wilson’s deposition testimony is consistent with Vijayan089’s description of the start of the segment in terms a starting symbol period (i.e., time coordinate) and subband (i.e., frequency coordinate). *See* Ex. 2007, 149:6–12, 150:10–22, 152:22–153:5.

As explained above in Section II.B., we find that separate time and frequency coordinates have been disclaimed from the ordinary and customary meaning of “a starting time-frequency coordinate.” Accordingly, Vijayan089’s disclosure of the start of the segment parameter given by the symbol period (i.e., time coordinate) and starting subband (i.e., frequency coordinate) does not disclose the claimed “a starting time-frequency coordinate” in accordance with its correct construction.

In the Reply and based on an incorrect assumption that Patent Owner proposes a “single index” as a construction for “a starting time-frequency coordinate,” Petitioner asserts that “Vijayan089 still discloses the ‘starting

time-frequency coordinate’ because Vijayan089’s single ‘start of the segment’ parameter suggests the use of an index value.” Pet. Reply 10 (citing Ex. 1048 ¶¶ 30–31). According to Petitioner, “a POSITA would have recognized that an index is an obvious way to convey a single parameter” and “would have recognized that this would further Vijayan089’s goal of overhead reduction and would have been obvious in view of Vijayan089 already using a single index value to convey the length of the segment.” *Id.* (reproducing Ex. 1024, Fig. 5B; citing Pet. 9–10; Ex. 1024 ¶¶ 53, 66, 70; Ex. 1048 ¶¶ 30–31).

Patent Owner asserts that the Reply advances new obviousness theories which are unsupported and untimely. *See* PO Sur-reply 16 (citing *DISH Network LLC v. Sound View Innovations LLC*, IPR2020-01276, Paper 40 at 32 (Feb. 8, 2022); Consolidated Trial Practice Guide (“CTPG”) 73 (Nov. 2019); *Wasica Fin. GmbH v. Cont’l Auto. Sys.*, 853 F.3d 1272, 1285-1286 (Fed. Cir. 2017); *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1369 (Fed. Cir. 2016)). Specifically, Patent Owner asserts that Petitioner proposes to modify Vijayan089 in view of Park (Ex. 1024). *See* PO Sur-reply 20 (citing Pet. Reply 10). Patent Owner contends that Petitioner’s newly proposed combination would, for the first time, modify Vijayan089 to assign index numbers to all slots and identify the starting coordinate of a segment through the slot index number. *See id.*

We agree with Patent Owner that these Reply arguments modifying Vijayan089 in view of Park are untimely. Contrary to Petitioner’s suggestion, Patent Owner does not explicitly propose construing “a starting time-frequency coordinate,” as limited to a “single index.” *See* PO Resp. 11–21; PO Sur-reply 1–5. A reply may only respond to arguments raised in a response or to address issues discussed in the institution decision.

See CTPG 73–74 (citing *SAS Institute Inc. v. Iancu*, 138 S.Ct. 1348, 1358 (2018); 37 C.F.R. § 42.23(b)). “‘Respond,’ in the context of 37 C.F.R. § 42.23(b), does not mean proceed in a new direction with a new approach as compared to the positions taken in” the petition. *Id.* at 74. A petitioner may not submit new arguments or evidence in a reply that it could have presented earlier, for example, to make out a prima facie case of unpatentability. *See id.* at 73. “[A] reply . . . that raises a new issue or belatedly presents evidence may not be considered.” *Id.*; *see also Axonics, Inc. v. Medtronic, Inc.*, 75 F.4th 1374, 1381 (Fed. Cir. 2023) (“We have held that a petitioner may not in reply rely on new prior art to teach a claim limitation.”). Accordingly, we decline to consider Petitioner’s belated Reply arguments that it would have been obvious to modify Vijayan089 to use an index.

Based on the entire record, we are not persuaded that Vijayan089 teaches or suggests “a starting time-frequency coordinate” in accordance with the correct ordinary and customary meaning disclaiming separate time and frequency coordinates. In sum, based on the entire record, Petitioner has not shown by a preponderance of the evidence that the subject matter of claim 1 would have been obvious over the combination of Vijayan089 and Laroia. Therefore, based on the entire record, Petitioner has not established by a preponderance of the evidence that claims 1 is unpatentable under 35 U.S.C. § 103(a) over Vijayan089 and Laroia.

*4. Analysis of Independent Claims 7 and 13 and
Dependent Claims 2–5, 8–11, and 14–17*

Independent claims 7 is directed to a mobile device and independent claim 13 is directed to a base station and each recite limitations similar to claim 1, including “the segment having a starting time-frequency

coordinate.” *See* Ex. 1001, 13:15–33, 14:7–26. Claims 2–5, 8–11, and 14–17 depend from claims 1, 7, and 13, respectively. *See* Ex. 1001, 13:1–12, 13:34–42, 14:1–3, 14:27–38. Petitioner relies on its arguments addressing claim 1 to address the limitations of claims 7 and 13. *See* Pet. 51–54.

For the reasons discussed above in Section II.D.3. addressing claim 1, based on the entire record, we are not persuaded that Vijayan089 teaches or suggests “a starting time-frequency coordinate,” as recited in claims 7 and 13, in accordance with the correct ordinary and customary meaning that disclaims separate time and frequency coordinates. In sum, based on the entire record, Petitioner has not shown by a preponderance of the evidence that the subject matter of claims 7 and 13, as well as the subject matter of dependent claims 2–5, 8–11, and 14–17 would have been obvious over the combination of Vijayan089 and Laroia. Therefore, based on the entire record, Petitioner has not established by a preponderance of the evidence that claims 2–5, 7–11, and 13–17 are unpatentable under 35 U.S.C. § 103(a) over Vijayan089 and Laroia.

*E. Patentability Challenge to Claims 1–5, 7–11, and 13–17 over
Vijayan475 and Wu*

1. Overview of Vijayan475 (Ex. 1006)

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.

Vijayan475 discloses a wireless multi-carrier system that includes. includes base stations 110 (also called, e.g., access points or transmitters) distributed throughout the system, along with fixed or mobile wireless devices (also called, e.g., user terminals, mobile stations, user equipment) located throughout the coverage area of the system. Ex. 1006 ¶¶ 15, 26. Each base station may broadcast multiple data streams simultaneously to wireless devices 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.

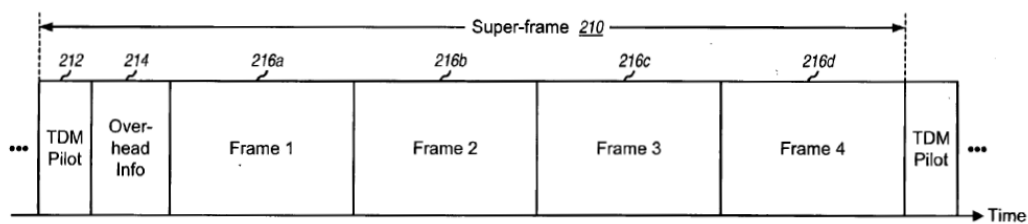


Figure 2, above, shows an exemplary super-frame structure that may be used for the system. Ex. 1006 ¶¶ 16, 29–32. With reference to Figure 2, data transmission occurs in units of super-frames 210 (also referred to as frames or time slots), each spanning a predetermined time duration that may be selected 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 the system. Ex. 1006 ¶ 36. In one embodiment, M slots are formed in

each symbol period, where $M \geq 1$, 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.

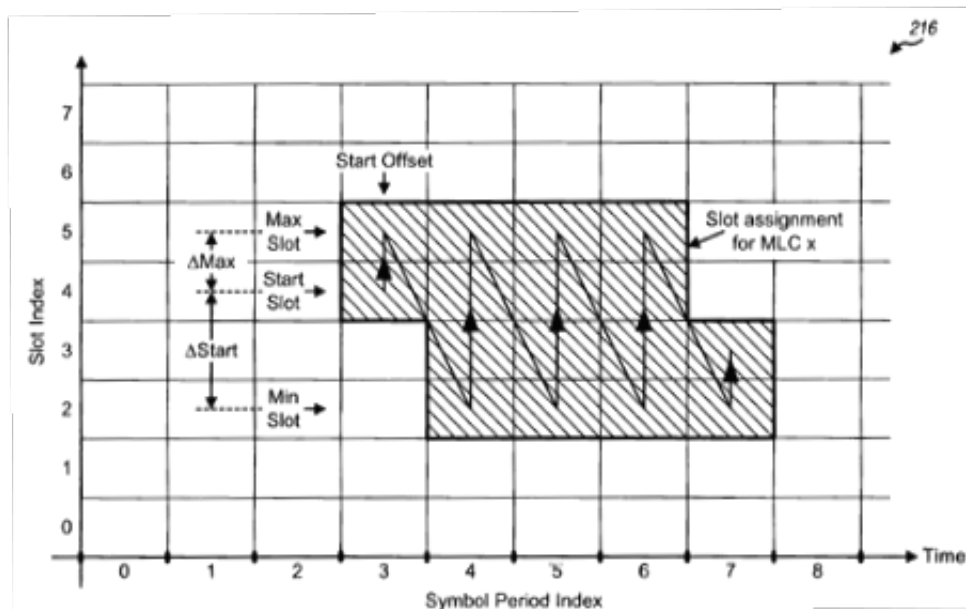


Figure 4, above, shows an exemplary slot assignment scheme that assigns slots to MLCs using a “sinusoidal” or “zigzag” pattern. Ex. 1006 ¶¶ 18, 39. In the illustrated assignment scheme, “a frame is divided into one or more

‘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, zigzagging 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 discloses a System Parameters Message used to carry location information for the MLCs. *See* Ex. 1006 ¶ 43. Location information for each MLC includes all parameters to describe the time-frequency location for the MLC. *See id.* The System Parameters Message includes one or more location records. *See id.* ¶¶ 43–44.

[T]he location record carries a Start Offset field, a Slot Info field, and a Stream Lengths field. The Start Offset field indicates the first or starting symbol period index for the slots assigned to the MLC. The Slot Info field contains slot information, which conveys all parameters used to describe

the assigned slots (e.g., the Min Slot, Start Slot, and Max Slot). The Stream Lengths field carries the length of each stream layer packet carried by the MLC in the current super-frame.

Id. ¶ 45. Vijayan⁴⁷⁵ further explains that “slot information may be encoded to reduce the number of bits needed to convey th[e] information.” *Id.* ¶ 46.

2. Overview of Wu (Ex. 1008)

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 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. Analysis of Claim 1

Petitioner asserts that the subject matter of claim 1 would have been obvious in view of the combined teachings of Vijayan475 and Wu. *See* Pet. 60–91. We provide below a brief overview of several of Petitioner’s undisputed assertions addressing the preamble and some of the limitations of claim 1 as well as the reasons to combine the teachings of Vijayan475 and Wu in order to provide background information, followed by a discussion and analysis of one of the specific disputed limitations of claim 1.

With respect to the preamble of claim 1, Petitioner contends that Vijayan475 describes the same operating method and wireless network as recited in claim 1. *See* Pet. 63–67 (citing Ex. 1003 ¶¶ 200–214; Ex. 1006, code (57), ¶¶ 10, 12, 26, 29–32, 36–42, 45–49, 56–59, 67–75, Figs. 4, 8, 9). Petitioner further asserts that Vijayan475 renders obvious the first limitation of “assigning an identifier to the mobile station,” as recited in claim 1. *See* Pet. 69–70 (citing Ex. 1003 ¶¶ 130–133; Ex. 1006 ¶¶ 5–9, 25, 26, 37–42, 44, 62).

In the alternative, Petitioner contends that Wu explicitly discloses the recited “assigning” step, citing Wu’s disclosures of a base station assigning a UE identifier to a mobile device via a control channel in an OFDM system. *See* 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). Petitioner contends that 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 to specifically identify a wireless device in order to implement unicast communications or communicate to a specific wireless device, to allow its wireless devices to differentiate and identify its own slot allocation and respective messages for

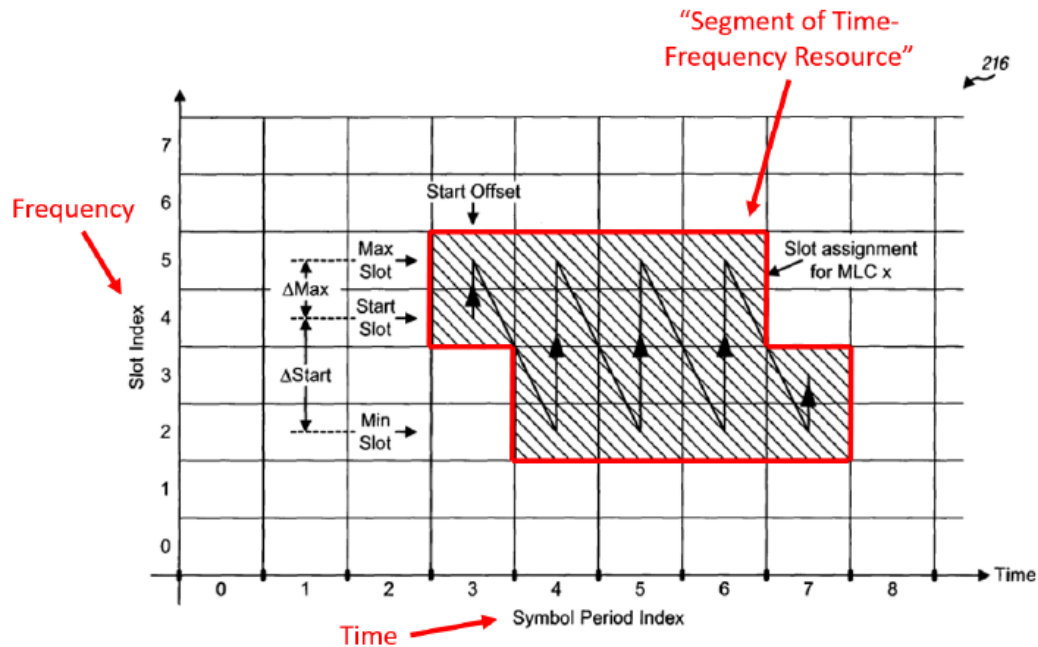
reception, and provide a simple process for discerning resource allocations slots. *See* Pet. 61–62 (citing Ex. 1003 ¶¶ 192–199; Ex. 1006 ¶¶ 5, 25, 26, 44; Ex. 1008 ¶¶ 32–34, 87, 92, 94, 98)). Petitioner further asserts that the combination would have been the combination of well-known prior art elements to yield predictable results, and a POSITA would have had a reasonable expectation of success in making the combination. *See* Pet. 62–63 (citing Ex. 1003 ¶¶ 196–199; Ex. 1006 ¶¶ 9–12, 25–27, 36, 38–55, 62, 64, 67–75, Figs. 1, 8, 9; Ex. 1008 ¶¶ 101, 134, 137, Fig. 6).

Petitioner contends that Vijayan475 teaches transmitting a signal “from the base station to the mobile station over a segment of time-frequency resource,” as recited in claim 1, citing Vijayan475’s disclosure of 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 transmitting multiple OFDM data streams on multiple data channels to wireless devices which receive the modulated signal and identify the transmitted OFDM symbols. *See* Pet. 73 (citing Ex. 1003 ¶¶ 224–227; Ex. 1006, code (57), ¶¶ 9, 60, 69, 71–73). According to Petitioner,

Vijayan475 describes transmitting data over “slots,” which disclose the claimed “time-frequency resource.” . . . “M slots are formed in each symbol period and are mapped to M disjoint or non-overlapping sets of subbands, where $M \geq 1$.” . . . Therefore, each slot is a resource having a time component (symbol period) and frequency component (subband).

Pet. 73 (citing Ex. 1003 ¶ 225; Ex. 1006 ¶¶ 36–42, Fig. 4). In support of its arguments, Petitioner reproduces Figure 4 of Vijayan475 with added annotations. *See* Pet. 74.

Petitioner’s annotated Figure 4 of Vijayan475 is reproduced below.



Petitioner’s annotated Figure 4 of Vijayan475 shows assignment of slots to an MLC using a “zigzag” pattern including Petitioner’s added annotations of “Frequency,” “Time” and “Segment of Time-Frequency Resource.” *See* Pet. 74; Ex. 1006 ¶ 18. As shown in Petitioner’s annotated Figure 4 of Vijayan475, Petitioner maps MLC x to the claimed “segment of time-frequency resource.” *See* Pet. 73–74 (citing Ex. 1003 ¶ 225; Ex. 1006 ¶ 38). Petitioner points out that the MLC refers to a “multiplexed logical channel” segment that is assigned one or more slots to carry “one or more data streams.” *See* Pet. 73 (citing Ex. 1006 ¶¶ 9, 38). Petitioner contends that each MLC may carry data streams to a wireless device and the “assignment of ‘slots’ in the time-frequency plane discloses the claimed ‘segment of

time-frequency resource[].” Pet. 74 (citing Ex. 1003 ¶¶ 226–227; Ex. 1006 ¶¶ 9, 27, 28, 36–42, 45, 51–52).

Turning to the disputed limitation, Petitioner contends that Vijayan475 teaches “the segment having a starting time-frequency coordinate” based on Vijayan475’s disclosure of defining a MLC segment “using ‘Start Offset’ and ‘Slot Info’ parameters corresponding to the ‘Start Slot.’” Pet. 75 (citing Ex. 1003 ¶¶ 228–238; Ex. 1006 ¶¶ 40, 42, 45–47, 56). According to Petitioner, “Vijayan475’s ‘Start Offset’ and ‘Slot Info’ parameters collectively identify a starting time-frequency coordinate.” Pet. 76 (reproducing Ex. 1006, Fig. 4 (with Petitioner’s annotations added); citing Ex. 1006 ¶¶ 40, 42, 45–49, 56); *see* Pet. Reply 11–13 (similar arguments; reproducing Ex. 1006, Fig. 4 (with Petitioner’s annotations), Table 1 (with Petitioner’s annotations); citing Pet. 75–77; Ex. 1006 ¶¶ 40, 42, 45–47, 56; Ex. 1014, 67–69; Ex. 1048 ¶¶ 34–36; Ex. 1049, 36:18–37:9, 38:12–40:8). Petitioner asserts “[t]he ‘Start Offset’ indicates the ‘starting symbol period index for the slots assigned to the MLC,’” and “[t]he ‘Slot Info’ parameter includes ‘Min Slot,’ **Start Slot**, and Max Slot’ parameters,” as shown in Figure 4 of Vijayan475. *See* Pet. 77 (citing Ex. 1003 ¶¶ 228–230; Ex. 1006 ¶¶ 40, 42, 46–49, Table 1, Fig. 4).

In Response, Patent Owner asserts that Vijayan475’s “starting coordinates of the first slot of the segment (the Start Slot) is identified by two separate coordinates: a ‘Start Offset’ coordinate (the time component), and a ‘Slot Info’ coordinate (the frequency component), both of which are necessary for the identification of the start of the segment coordinates.” PO Resp. 34. In support of its argument, Patent Owner relies on its expert, Mr. Alberth’s testimony to explain that Vijayan 475 discloses two sets of parameters for indicating the start slot, the start slot variable in the frequency

domain, and the start offset variable in the time domain. *See id.* at 34–37 (reproducing Ex. 1006, Fig. 4 (with Patent Owner’s annotations); citing Ex. 2010 ¶¶ 72–75). Patent Owner contends that “the combination of Vijayan475’s ‘Start Offset’ and ‘Slot Info’ [] fails to disclose the claimed ‘a starting time-frequency coordinate’ because “the ‘Start Offset’ is a time coordinate, and ‘Slot Info’ is a separate frequency coordinate, for the starting position.” *Id.* at 37; *see* PO Sur-reply 22 (“[S]eparate time and frequency coordinates do not ‘collectively’ disclose the claimed ‘time-frequency coordinate.’”).

In addition, Petitioner contends that “Vijayan475 also discloses a second way to convey this [slot] information to reduce overhead signaling” using “ Δ Start” and “ Δ Max” parameters. Pet. 77 (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, Δ Start, and Δ Max parameters to the wireless device” for derivation of the starting time-frequency coordinate. *Id.* at 78 (reproducing Ex. 1006, Table 2 (with Petitioner’s added annotations); citing Ex. 1003 ¶¶ 232–234; Ex. 1006 ¶¶ 45–49, Table 2, Fig. 4).

In Response, Patent Owner contends that Petitioner’s alternative argument as to how Vijayan475 discloses the claimed “a starting time-frequency coordinate” fails for similar reasons because the only difference is the way that the frequency parameters of the starting position are combined into a Slot Info Code. *See* PO Resp. 37. According to Patent Owner, “to identify the starting coordinates of the segment, there is still a need to separately identify a time coordinate (Start Offset) and a separate frequency coordinate (this time identified by the Slot Info Code).” *Id.*; *see also* PO

Sur-reply 22 (similar argument, citing PO Resp. 38–39). Patent Owner contends that “Petitioner admits that Vijayan475 would need both the ‘Slot Info Code’ (the frequency coordinate) and the ‘Start Offset’ (the time coordinate) to identify the starting coordinates of the segment.” PO Resp. 37–38 (citing Pet. 78). Patent Owner further asserts that “the introduction of the Slot Info Code in Vijayan475 does not make any fundamental changes to how Vijayan475 operates.” *Id.* at 38–39 (reproducing Ex. 1006, Fig. 5 and Table 2 (with Patent Owner’s annotations added); citing Ex. 2010 ¶¶ 78–80). Patent Owner contends that Petitioner’s expert, Dr. Wilson admitted that, in Vijayan475, one must also know the time coordinate in addition to the Slot Info Code. *See* PO Resp. 39–40 (citing Ex. 2007, 182:19–22); *see also* PO Sur-reply 22 (similar argument, citing Ex. 2007, 182:19–22; PO Resp. 39–40). According to Patent Owner, “Vijayan475 requires the time coordinate in addition to the slot info code in order to identify the starting position of the segment. This is because, as also discussed above, the Slot Info Code only combines the frequency components of the segment into a code, and does not otherwise incorporate or include any time element.” PO Resp. 40 (citing Ex. 2010 ¶ 81); *see* PO Sur-reply 22 (similar argument, citing PO Resp. 38–39).

In the Reply, and based on an assumption that Patent Owner proposes a “single index” as a construction for “a starting time-frequency coordinate,” Petitioner asserts that “even assuming that Vijayan475 uses two fields to convey the starting parameters, these parameters would still be conveyed using a single string of bits in practice, and would therefore still disclose a ‘starting time-frequency coordinate.’” Pet. Reply 13 (citing Ex. 1048 ¶ 37).

In the Sur-reply, Patent Owner asserts that “[t]he claimed ‘time-frequency coordinate’ does not depend on the happenstance of how separate

time and frequency coordinates may happen to be transmitted, such as consecutively in the same control message; rather, they depend on the characteristic of the coordinate itself.” PO Sur-reply 23. Patent Owner reasons, that if it wasn’t the case that the time-frequency coordinate was dependent on the characteristics of the coordinate itself, the prior art distinguished in the background of the ’450 Patent Specification could disclose the invention when the separate time and frequency parameters would be transmitted consecutively. *See id.* Patent Owner asserts that Petitioner’s proposed understanding would be inconsistent with the Office’s prosecution of the patent. *See id.* (citing Ex. 1001, 1:51–2:16; Ex. 2010 ¶¶ 45–46; Ex. 1014, 26–27).

We agree with Patent Owner that Petitioner’s position set forth in the Petition is that Vijayan475 discloses a starting time-frequency coordinate in terms of a separate time (e.g., “Start Offset,” “starting symbol period index”) and separate frequency coordinates (e.g., “Slot Info,” in terms of “Min Slot Start Slot, and Max Slot” or “Slot Info Code” in terms of “Min Slot, Δ Start, and Δ Max” parameters). *See* Pet. 75–78; Ex. 1006, Fig. 4. Petitioner does not dispute that Vijayan475 describes the “Slot Info,” or “Slot Info Code” in terms of frequency (i.e., subbands). *See* Pet. Reply 11–15. Indeed, the Petition includes arguments that Vijayan475 describes transmitting data over “slots,” that “M slots are formed in each symbol period and are mapped to M disjoint or non-overlapping sets of subbands, where $M \geq 1$,” and that “each slot is a resource having a time component (symbol period) and frequency component (subband).” Pet. 74 (citing Ex. 1003 ¶ 225; Ex. 1006 ¶ 36). As explained above in Section II.C., we find that separate time and frequency coordinates have been disclaimed from the ordinary and customary meaning of “a starting time-frequency coordinate.” We find Petitioner’s arguments

premised on a single index construction are misplaced because the ordinary and customary meaning of “a starting time-frequency coordinate” is not limited to a single index. In sum, Vijayan475’s disclosure of the start of an MLC segment defined by the “Start Offset” or “starting symbol period index” (i.e., a time component) and “Slot Info” or “Slot Info Code” (i.e., a frequency component) does not disclose the claimed “a starting time-frequency coordinate” in accordance with the ordinary and customary meaning in which separate time and frequency coordinates have been disclaimed.

In the Reply, and based on an incorrect assumption that Patent Owner proposes a “single index” as a construction for “a starting time-frequency coordinate,” Petitioner contends that “Vijayan475 would still render obvious the claimed ‘starting time-frequency coordinate’ under [Patent Owner]’s single index value construction, because Vijayan475 also discloses encoding the starting parameters.” Pet. Reply 13 (citing Ex. 1014, 67–68; Ex. 1048 ¶¶ 38–40). According to Petitioner, “[e]ncoding the starting slot information to generate a Slot Info Code and providing this together with the Start Offset information discloses a “starting time-frequency coordinate.” *Id.* at 13–14 (citing Pet. 75–80). Petitioner asserts that “Vijayan475’s ‘Slot Info Code’ uses a single index value that encodes multiple starting slot parameters (‘ Δ Start,’ ‘ Δ Max,’ and Min Slot)” and “a POSITA would have found it obvious to also include the ‘Start Offset’ parameter with the other Slot Info parameters during encoding.” *Id.* at 13–15 (reproducing Ex. 1006, Table 2; citing Pet. 75–80; Ex. 1003 ¶¶ 231–234; Ex. 1006 ¶¶ 40, 42, 45–49; Ex. 1048 ¶¶ 38–42). According to Petitioner, “a POSITA would have additionally found it obvious to encode a starting time and frequency

parameter into a single index.” *Id.* at 15 (citing Ex. 1048 ¶¶ 38–42; Ex. 1049, 47:4–8, 48:1–6, 49:18–22).

In the Sur-reply, Patent Owner asserts that Petitioner’s Reply arguments modifying the teachings of Vijayan475 so that the indexing of the frequency parameters also incorporates time parameters is a new argument and untimely. *See* PO Sur-reply 23.

We agree with Patent Owner that these Reply arguments are untimely. Contrary to Petitioner’s suggestion, Patent Owner does not explicitly propose construing “a starting time-frequency coordinate,” as limited to a “single index.” *See* PO Resp. 11–21; PO Sur-reply 1–5. As explained above, a reply may only respond to arguments raised in a response or to address issues discussed in the institution decision. *See* CTPG 73–74 (citing *SAS Institute*, 138 S.Ct. at 1358; 37 C.F.R. § 42.23(b)). “‘Respond,’ in the context of 37 C.F.R. § 42.23(b), does not mean proceed in a new direction with a new approach as compared to the positions taken in” the petition. *Id.* at 74. A petitioner may not submit new arguments or evidence in a reply that it could have presented earlier, for example, to make out a prima facie case of unpatentability. *See id.* at 73. “[A] reply . . . that raises a new issue or belatedly presents evidence may not be considered.” *Id.* Accordingly, we decline to consider Petitioner’s belated Reply arguments that it would have been obvious to modify Vijayan475’s encoded information to include the “Start Offset” (i.e., time component) together with “Slot Info” (i.e., frequency component) in the encoded information¹⁰.

¹⁰ Even if Petitioner’s new arguments were considered, we agree with Patent Owner that the record insufficiently supports Petitioner’s asserted reason for modifying Vijayan475. *See* PO Sur-reply 23–24; Ex. 2019, 161:17–20, 178:8–179:20, 180:9–13.

Based on the entire record, we are not persuaded that Vijayan⁴⁷⁵ teaches or suggests “a starting time-frequency coordinate” in accordance with the correct plain and ordinary meaning that disclaims separate time and frequency coordinates. In sum, based on the entire record, Petitioner has not shown by a preponderance of the evidence that the subject matter of claim 1 would have been obvious over the combination of Vijayan⁴⁷⁵ and Wu. Therefore, based on the entire record, Petitioner has not established by a preponderance of the evidence that claims 1 is unpatentable under 35 U.S.C. § 103(a) over Vijayan⁴⁷⁵ and Wu.

*4. Analysis of Independent Claims 7 and 13 and
Dependent Claims 2–5, 8–11, and 14–17*

Independent claims 7 is directed to a mobile device and independent claim 13 is directed to a base station and each recite limitations similar to claim 1, including “the segment having a starting time-frequency coordinate.” *See* Ex. 1001, 13:15–33, 14:7–26. Claims 2–5, 8–11, and 14–17 depend from claims 1, 7, and 13, respectively. *See* Ex. 1001, 13:1–12, 13:34–42, 14:1–3, 14:27–38. Petitioner relies on its arguments addressing claim 1 to address the limitations of claims 7 and 13. *See* Pet. 83–86.

For the reasons discussed above in Section II.E.3. addressing claim 1, based on the entire record, we are not persuaded that Vijayan⁴⁷⁵ teaches or suggests “a starting time-frequency coordinate,” as recited in claims 7 and 13, in accordance with the correct plain and ordinary meaning that disclaims separate time and frequency coordinates. In sum, based on the entire record, Petitioner has not shown by a preponderance of the evidence that the subject matter of claims 7 and 13, as well as the subject matter of dependent claims 2–5, 8–11, and 14–17 would have been obvious over the

combination of Vijayan475 and Wu. Therefore, based on the entire record, Petitioner has not established by a preponderance of the evidence that claims 2–5, 7–11, and 13–17 are unpatentable under 35 U.S.C. § 103(a) over Vijayan475 and Wu.

F. Patentability Challenges to Claims 6, 12, and 18 over Vijayan089, Laroia, and Choi, and over Vijayan475, Wu, and Choi

Claims 6, 12, and 18 depend ultimately from claims 1, 7, and 13. Ex. 1001, 13:13–14, 14:4–6, 14:39–41. Petitioner does not rely on the teachings of Choi to remedy the deficiencies of the teachings of Vijayan089 and Vijayan475 identified above with respect to “a starting time-frequency coordinate,” recited in claims 1, 7, and 13. *See* Pet. 91–94.

For the reasons discussed in Sections II.D.3 and II.E.3. above addressing claim 1, based on the entire record, Petitioner has not shown by a preponderance of the evidence that the subject matter of dependent claims 6, 12, and 18 would have been obvious over the combination of Vijayan089, Laroia, and Choi, and the combination Vijayan475, Wu, and Choi. Therefore, based on the entire record, Petitioner has not established by a preponderance of the evidence that claims 6, 12, and 18 are unpatentable under 35 U.S.C. § 103(a) over Vijayan089, Laroia, and Choi, and over Vijayan475, Wu, and Choi.

III. CONCLUSION

For the foregoing reasons, and after having analyzed the entire record and assigning appropriate weight to the cited supporting evidence, Petitioner has failed to establish by a preponderance of the evidence that claims 1–18 are unpatentable.

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–5, 7– 11, 13–17	103(a)	Vijayan089, Laroia		1–5, 7–11, 13–17
1–5, 7– 11, 13–17	103(a)	Vijayan475, Wu		1–5, 7–11, 13–17
6, 12, 18	103(a)	Vijayan089, Laroia, Choi		6, 12, 18
6, 12, 18		Vijayan475, Wu, Choi		6, 12, 18
Overall Outcome				1–18

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has not established by a preponderance of the evidence that claims 1–18 of the '450 Patent are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2022-01567
Patent 10,447,450 B2

FOR PETITIONER:

Thomas Rozylowicz
Jeffrey Mok
Won Yoon
John Johnson
Timothy Riffe
Usman Khan
FISH & RICHARDSON
tar@fr.com
jmok@fr.com
yoon@fr.com
jjohnson@fr.com

Timothy Riffe
Usman Khan
FISH & RICHARDSON
riffe@fr.com
khan@fr.com

Reginald Hill
Nicole Keenan
JENNER & BLOCK LLP
rhill@jenner.com
nkeen@jenner.com

FOR PATENT OWNER:

Kenneth Weatherwax
Edward Hsieh
Parham Hendifar
LOWENSTEIN & WEATHERWAX LLP
weatherwax@lowensteinweatherwax.com
hsieh@lowensteinweatherwax.com
hendifar@lowensteinweatherwax.com

Hamad Hamad
CALDWELL, CASSADY & CURRY P.C.
hhamad@caldwellcc.com