

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.

IPR2023-00426
Patent 8,467,366 B2

Before HYUN J. JUNG, JO-ANNE M. KOKOSKI, and
MATTHEW S. MEYERS, *Administrative Patent Judges*.

KOKOSKI, *Administrative Patent Judge*.

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

I. INTRODUCTION

Volkswagen Group of America, Inc. (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1–24 (the “challenged claims”) of U.S. Patent No. 8,467,366 B2 (Ex. 1001, “the ’366 patent”). Paper 2 (“Pet.”). Neo Wireless LLC (“Patent Owner”) filed a Preliminary Response. Paper 6 (“Prelim. Resp.”).

Institution of an *inter partes* review is authorized by statute when “the information presented in the petition . . . and any response . . . 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.” 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4 (2022). For the reasons discussed below, we deny the Petition and do not institute an *inter partes* review.

II. BACKGROUND

A. *Real Parties in Interest*

Each party identifies itself as the real party in interest. Pet.3; Paper 4, 1.

B. *Related Matters*

The parties identify roughly two dozen district court proceedings involving the ’366 patent. Pet. 3–5; Paper 4, 1–3. The parties also identify the following *inter partes* review previously before the Board that also challenged the ’366 patent: *Dell Inc., et al. v. Neo Wireless LLC*, IPR2021-01480 (denied institution Mar. 16, 2022) (“the 1480 IPR”). Pet. 5; Paper 4, 3. Petitioner additionally identifies five *inter partes* reviews of commonly-assigned patents. Pet. 5.

C. The '366 Patent

The '366 patent, titled “Methods and Apparatus for Random Access in Multi-Carrier Communication Systems,” describes a random access process that includes ranging:

In a wireless communication system, a mobile station first needs to perform a random access for establishing communication with a base station. The random access typically includes two steps: (1) Ranging and (2) Resource Request and Allocation. During Ranging, the mobile station sends a signal to the base station, so that the base station can identify the mobile station and measure the power and time delay of the mobile station, and inform the mobile station for power adjustment and time advance. During Resource Request and Allocation, the uplink and downlink resources for communication are requested and allocated. Ranging is a critical part of multi-carrier wireless communication system, and there are several important issues related to ranging:

1. The bandwidth efficiency of the ranging signals
2. The interference of ranging signal with other uplink signals
3. The detection performance and complexity at the base station receiver

The ranging process typically involves an exchange of messages between the base station and the mobile station by which the mobile station aligns itself with the start of each time slot after compensating for propagation delay and other factors.

Ex. 1001, 1:24–47. The '366 patent further explains that the ranging of many mobile stations may cause a problem because the mobile stations contend for access to the shared channel and it is difficult to complete ranging for any of the mobile stations. *Id.* at 1:47–53. This leads to excessive time to complete the ranging process and the waste of much bandwidth on the shared channel. *Id.* at 1:53–55.

The '366 patent describes “methods and apparatus for random access in a multi-carrier system” that use ranging signals that are designed to

improve receiving reliability, reduce interference with other uplink signals, and improve the detection performance at a base station receiver.

Id. at 2:40–44. The '366 patent explains that a multi-carrier signal is made up of subcarriers in the frequency domain, and data subcarriers can be arranged into groups called subchannels. *Id.* at 2:61–64, 3:5–6.

Figure 4 is reproduced below.

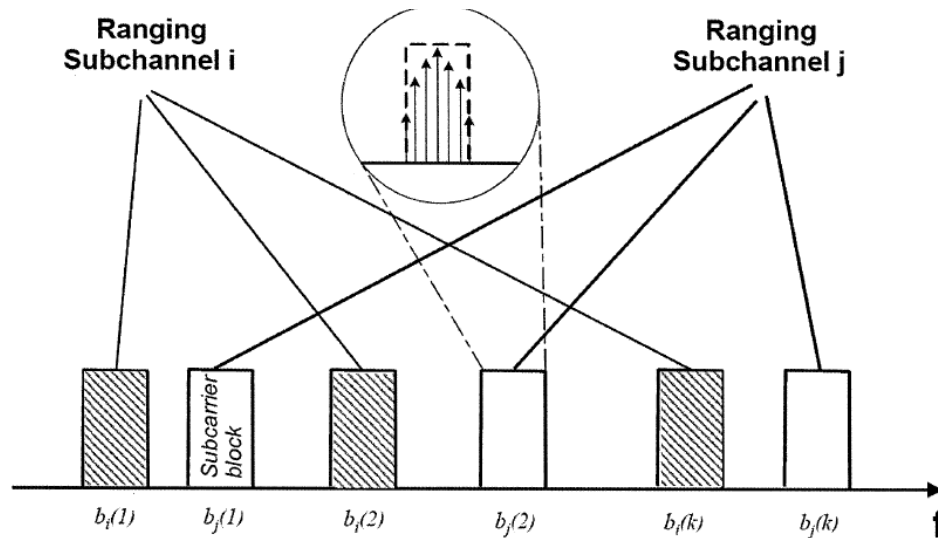


FIG. 4

Figure 4 shows two ranging subchannels composed of subcarrier blocks.

Id. at 1:66–67, 3:27–28. The '366 patent states:

FIG. 4 schematically shows that the signal power of the subcarriers towards the boundary (the lower ends and the higher ends in frequency) of a block is lower than that of the subcarriers towards the center of the block. (In a special case, the power levels of the two subcarriers at both ends of a block are set to zero.) Because different factors may cause possible overlap of two subcarrier blocks from two different transmitters, the attenuated boundary subcarriers will minimize the resulting interference.

Id. at 3:29–38.

The '366 patent further describes an embodiment in which “the ranging sequence is designed such that its corresponding time-domain signal exhibits relatively low peak-to-average power ratio.” *Id.* at 4:34–

37. According to the '366 patent, “[t]his improves the power efficiency of the mobile station transmission power amplifier.” *Id.* at 4:37–38.

D. Illustrative Claim

Petitioner challenges claims 1–24 of the '366 patent, of which claims 1, 9, 17, and 22 are independent. Pet. 1, 9. Claim 1 is illustrative of the claimed subject matter and is reproduced below.

1. [1P] In a multi-cell orthogonal frequency division multiple access (OFDMA) wireless communication system comprising a plurality of base stations and mobile stations, a mobile station configured to communicate with a serving base station in a cell via a communication channel, the mobile station comprising:

[1.1] an apparatus configured to transmit a data signal to the serving base station in the cell over a data subchannel, wherein the data subchannel comprises a plurality of adjacent or non-adjacent subcarriers within the communication channel; and

[1.2] an apparatus configured to transmit a ranging signal to the serving base station in the cell over a ranging subchannel for random access, wherein:

[1.3] the ranging signal is formed from a ranging sequence selected from a set of ranging sequences associated with the cell for identifying the mobile station;

[1.4] the ranging signal lasts over a period of one or multiple orthogonal frequency division multiplexing (OFDM) symbols and the ranging signal exhibits a

low peak-to-average power ratio in the time domain;
and

[1.5] the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero.

Ex. 1001, 7:2–26 (bracketed material added).

E. Asserted Grounds of Unpatentability

Petitioner asserts that claims 1–24 are unpatentable based on the following grounds:

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–4, 6–20, 22–24	103(a) ¹	Jeong, ² Suzuki, ³
2, 3, 5, 10, 11, 21	103(a)	Jeong, Suzuki, Gibson ⁴

¹ The Leahy-Smith America Invents Act (“AIA”), Pub. L. No. 112–29, 125 Stat. 284 (2011), revised 35 U.S.C. §§ 102 and 103 effective March 16, 2013. Because the parties agree that the ’366 patent has an effective filing date before March 16, 2013, we refer to the pre-AIA version of 35 U.S.C. §§ 102 and 103. See Pet. 6 (“The ’366 patent claims priority to March 9, 2004. Without conceding entitlement to this date, all applied references qualify as prior art as of March 9, 2004.”) (internal citation omitted); Prelim. Resp. 12 n. 5 (“Petitioner does not challenge the Patent’s priority date of March 9, 2004.”).

² Jeong, KR2003-00585589, published July 7, 2003 (Ex. 1008).

³ Suzuki, US 5,903,614, issued May 11, 1999 (Ex. 1009).

⁴ Jerry D. Gibson, “The Mobile Communications Handbook,” 2nd Edition, CRC Press LLC, 1999 (Ex. 1010).

Claim(s) Challenged	35 U.S.C. §	References/Basis
1, 4, 6–9, 12, 15–20, 22–24	103(a)	Koo, ⁵ 802.16ab, ⁶ Chayat, ⁷ Suzuki
2, 3, 5, 10, 11, 13, 14, 21	103(a)	Koo, 802.16ab, Chayat, Suzuki, Gibson

Pet. 9. Petitioner relies on the Declaration of Dr. Leonard J. Cimini (Ex. 1003) to support its contentions. *See generally* Pet. Patent Owner submits the Declaration of William P. Alberth, Jr. (Ex. 2001) with its Preliminary Response. *See generally* Prelim. Resp.

III. ANALYSIS

A. *Level of Ordinary Skill in the Art*

Petitioner contends that a person of ordinary skill in the art (“POSITA” or “POSA”) “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. 13 (citing Ex. 1003 ¶¶ 29–32, 42–43). In support of that contention, Dr. Cimini testifies that:

In my opinion, a person of ordinary skill in the art of the ’366 patent as of March 9, 2004, 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

⁵ Koo, US 2003/0198179 A1, published Oct. 23, 2003 (Ex. 1011).

⁶ Unapproved Working Document Standard Air Interface for Fixed Broadband Wireless Access Systems-Media Access Control Modifications and Additional Physical Layer for 2-11 GHz, Part 16, IEEE 802.16, July 2001 (Ex. 1012, “802.16ab”).

⁷ Chayat, WO 03/075500 A2, published Sept. 12, 2003 (Ex. 1013).

amount of education, e.g., a doctorate in electrical engineering, computer engineering, computer science, or an equivalent field would also qualify as a POSA for the '366 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 ¶ 42.

Patent Owner responds that Petitioner's proposed level of skill in the art "is unsupported by Petitioner's expert declaration, for it additionally requires or permits 'an advanced degree' on top of the required work experience." Prelim. Resp. 4–5 (citing Ex. 1003 ¶ 42). Patent Owner further asserts that, in the 1480 IPR that also challenged the '366 patent, "the Board found that the proper level of ordinary skill in the art is only a 'Bachelor's degree in an academic area emphasizing electrical engineering or a similar discipline,' and only 'two years of experience in the field working with, teaching, or researching wireless communication networks.'" *Id.* at 5–6 (citing IPR2021-01480, Paper 11 at 7). Patent Owner also asserts that "the Board recently rejected an **identically proposed** level of ordinary skill in the art by the same petitioner, and the same declarant Dr. Cimini in an IPR between the same parties and in connection with a patent in a similar field, finding that it was unsupported and inconsistent with the level of ordinary skill reflected in the prior art of record." *Id.* at 6–7 (citing *Volkswagen Gp. of Am., Inc. v. NEO Wireless, LLC*, IPR2023-00086, Paper 7 at 10–12 (PTAB June 16, 2023)).

Relying on the testimony of Mr. Alberth, Patent Owner argues that "the level of skill in the art already adopted by the Board in the [1480 IPR] (*i.e.*, bachelor degree with two years of experience) is substantially correct." Prelim. Resp. 7; Ex. 2001 ¶¶ 19–20. According to Mr. Alberth, "it was

uncommon for working professionals in the field to have doctorate degrees and such advanced education would be typical of someone with more than ordinary skill in the art.” *Id.* ¶ 19. In particular, Mr. Alberth testifies that

[a] POSITA in 2004 was typically involved in deploying and configuring wireless communication equipment to increase the reach of commercial wireless networks, increase their capacity to handle more users, and also allow for the deployment of new applications requiring more bandwidth. A POSITA would not have been required to design a wireless system from the ground up. This is because many important parameters and design choices had already been made by standards setting committees. Thus, a POSITA would have had enough knowledge of the technology to understand and deploy equipment adhering to these technical specifications, but would have a very limited ability to change the fundamental specifications of the network.

Id. ¶ 20.

Petitioner’s statement that “[a] person of ordinary skill in the art (‘POSA’) would have a bachelor’s degree in electrical engineering, computer engineering, computer science, or an equivalent field, or an advanced degree in those fields” indicates that the education for one of ordinary skill in the art would not merely be limited to a bachelor’s degree but could instead include an advanced degree such as a master’s degree or doctorate. Pet. 13. Petitioner’s statement is inconsistent with Dr. Cimini’s testimony on the level of ordinary skill in the art. As noted above, Dr. Cimini opines that one of ordinary skill in the art would have a bachelor’s degree and 3–5 years of academic or industry experience, although a greater amount of education could qualify someone as one of ordinary skill in the art. Ex. 1003 ¶ 42. As a result, the definition for one of ordinary skill in the art set forth in the Petition is unsupported by Dr. Cimini’s testimony.

Based on the current record, we credit Mr. Alberth's testimony discussed above, and we find that the level of skill in the art adopted in the 1480 IPR is consistent with the level of skill reflected in the prior art references of record. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (recognizing that the prior art itself may reflect an appropriate level of skill in the art). Accordingly, for purposes of this Decision, we apply the level of ordinary skill in the art adopted in the 1480 IPR, namely, "at least a Bachelor's degree in an academic area emphasizing electrical engineering or a similar discipline, and at least two years of experience in the field working with, teaching, or researching wireless communication networks" and "superior education could compensate for a deficiency in work experience, and *vice-versa*." IPR2021-01480, Paper 11 at 7.

B. Claim Construction

We construe each 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). Under this standard, claim terms are generally given their plain and ordinary meaning as would have been understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Realtime Data LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019).

Petitioner asserts "[n]o terms require express construction at this stage but Petitioner reserves the right to respond to any construction proposed by Patent Owner." Pet. 13 (citing EX1003 ¶¶ 44–45). At this stage of the proceeding, Patent Owner does not address claim construction. *See*

generally Prelim. Resp. We determine that it is not necessary to expressly construe any claim terms to resolve the parties’ dispute. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (claim terms need to be construed “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))).

C. Grounds 1 and 2: Obviousness Over Jeong and Suzuki (Ground 1) and Jeong, Suzuki, and Gibson (Ground 2)

Petitioner contends that the subject matter of claims 1–4, 6–20, and 22–24 would have been obvious over the combined teachings of Jeong and Suzuki, and that the subject matter of claims 2, 3, 5, 10, 11, and 21 would have been obvious over the combined teachings of Jeong, Suzuki, and Gibson. Pet. 13–46.

1. Jeong (Ex. 1008)

Jeong generally “relates to a method for ranging interval and ranging sub-channel allocation for initial ranging in a multi-user orthogonal frequency division multiple access (OFDMA) type wireless communication system in a point-to-multipoint broadband wireless access (BWA) system.” Ex. 1008, 2.⁸ In particular, Jeong describes “a ranging interval and ranging sub-channel allocation method for initial ranging of the multi-user OFDMA wireless communication system.” *Id.* at 2.

Jeong teaches that,

[i]n IEEE 802.16ab, OFDMA wireless communication system is defined such that data can be transmitted between a base station (“BS”) and a subscriber station (“SS”) using a microwave frequency band between 2 GHz and 11 GHz. Such

⁸ We refer to the page numbers added by Petitioner to the center-bottom of the page.

an OFDM wireless communication system can be defined as a two-dimensional access method that combines time division access and frequency division access technology, and each OFDMA symbol is carried on a subcarrier and bundled into a predetermined sub-channel. Ranging in the OFDM wireless communication system as described above periodically adjusts an accurate time offset between the base station and the subscriber station, and performs a power correction process.

Ex. 1008, 2. Jeong teaches that “the initial ranging uses a long ranging method in which an SS within the area of the BS is transmitted in two OFDM symbols when a new call is established with the BS” and “is performed in an initial state in which transmission power and time offset are not adjusted between the base station and the subscriber station.” *Id.* at 4.

Jeong describes a procedure for performing initial ranging wherein, when the BS transmits the system information necessary for initial ranging to the SS, the SS “randomly selects one ranging code with reference to the information” and transmits it to the BS. Ex. 1008, 4. After the BS detects the signal from the SS, it transmits time and power control information to the SS using a randomly selected code, and the SS performs time adjustment and power control with reference to that information. *Id.* Several sub-channels that are allocated as ranging sub-channels measure the data transmission time being transmitted from the SS as well as the power at that time. *Id.*

Jeong explains that a channel structure of a typical frequency division duplex (“FDD”) mode OFDMA wireless communication system “has a problem in that inter-channel interference (‘ICI’) occurs between the signal for ranging transmission and the signal for data transmission.” Ex. 1008, 3. Jeong then describes a channel structure of a typical time division duplex (“TDD”) mode OFDMA wireless communication system for solving the ICI

problem in the FDD mode, but notes that the “channel structure of the TDD mode of OFDMA wireless communication system has a problem in that ICI is generated between the ranging symbols when performing initial ranging in which transmission power and time offset are not adjusted between” the BS and the SS. *Id.* at 4.

Jeong seeks to solve these problems by “provid[ing] a ranging interval and ranging sub-channel allocation method for initial ranging in OFDMA wireless communication system capable of reducing the ICI between the ranging signals in the TDD mode OFDMA wireless communication system.” Ex. 1008, 4. In that regard, Jeong teaches that, “[t]o avoid [ICI] to the data channel due to the initial ranging, when the BS processes the data sub-channel, the BS should not receive any initial ranging signal.” *Id.* at 6. To achieve this, Jeong teaches that “a predetermined guard interval may be inserted into the carrier interval in order to prevent interference caused by using all carriers of a predetermined interval as ranging sub-channels as in the channel structure of the conventional TDD mode OFDMA wireless communication system.” *Id.* at 8. Jeong also describes insertion of a “guard interval between adjacent ranging sub-channels . . . to significantly reduce multiple access interference (‘MAI’) due to frequency offset and time offset from different ranging signals.” *Id.* at 10.

According to Jeong, the described method for initial ranging “not only prevents interference between a signal for initial ranging and a signal for data transmission,” it “also enables efficient management of resources, which reduces delay and overhead of the physical layer, thereby having the benefit of reducing overhead in MAC.” Ex. 1008, 11.

2. Suzuki (Ex. 1009)

Suzuki “relates to a communication method applicable to the orthogonal frequency division multiplex system (OFDM system) and a receiving apparatus for receiving a signal according to the communication method.” Ex. 1009, 1:6–10. Suzuki teaches that, in the OFDM system, “a plurality of subcarriers are successively arranged within a preallocated band. And a plurality of subcarriers within one transmission band are simultaneously utilized through one transmission path, and is further made to modulate collectively a plurality of subcarriers within one band in a band division.” *Id.* at 2:64–3:4.

Figure 1 is reproduced below.

FIG. 1

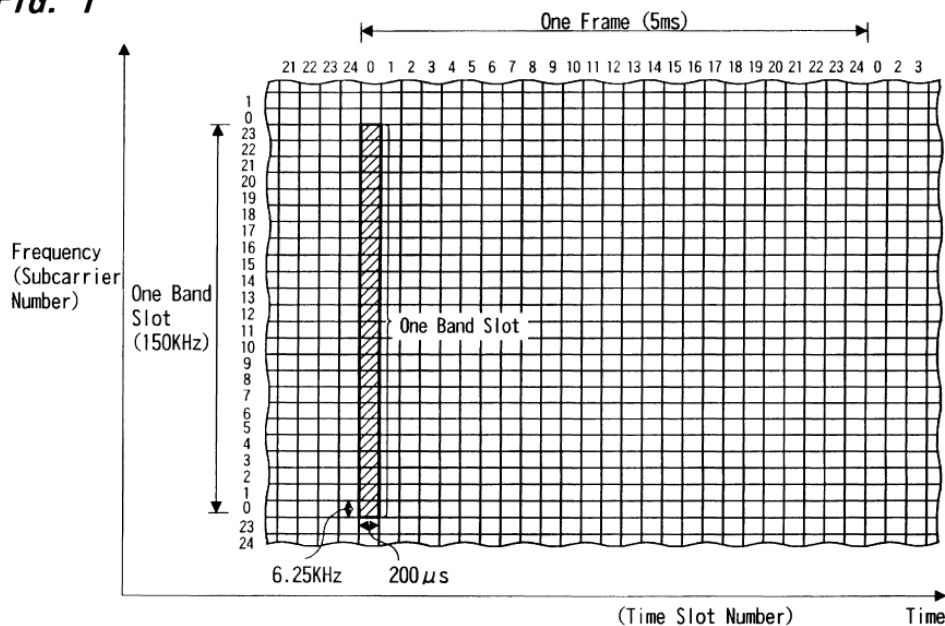


Figure 1 “is an explanatory diagram showing the structure of slots according to a communication method” described in Suzuki, and “shows how to construct slots of the transmitting signal.” Ex. 1009, 2:19–21, 3:5–6. The vertical axis represents frequency and the horizontal axis represents time. *Id.* at 3:7–8. One band slot consists of 24 subcarriers, numbered 0 to 23,

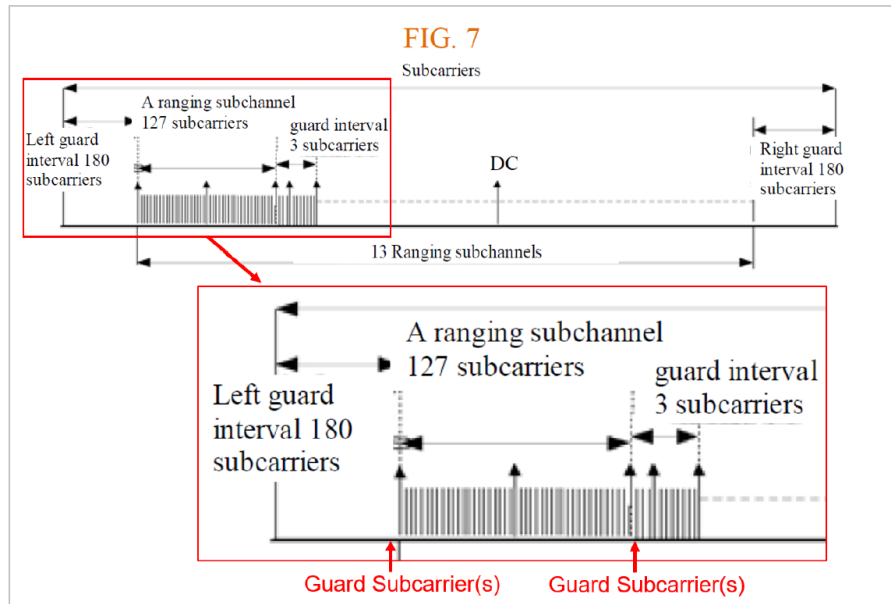
successively arranged at equal intervals. *Id.* at 3:12–15. Suzuki explains that subcarriers 1–22 are “really existing subcarriers” and “subcarrier numbers 0 and 23 at both ends within one band slot . . . are made guard band[s] in which no subcarrier is arranged and their powers are made zero.” *Id.* at 3:15–20.

3. *Analysis of Ground 1*

Petitioner contends that the combined teachings of Jeong and Suzuki teach or suggest all of the limitations of independent claim 1. Pet. 22–33. Patent Owner responds that Petitioner does not establish that the proposed combination discloses claim limitation 1.5, and also does not establish a sufficient reason to combine Jeong and Suzuki as proposed. Prelim. Resp. 9–40. We focus our discussion on limitation 1.5, as it is dispositive for purposes of this Decision.

Limitation 1.5 recites “the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero.” Ex. 1001, 7:23–26. Petitioner, therefore, must show that the combined teachings of Jeong and Suzuki disclose a block of subcarriers that includes the zero power subcarriers as part of the subcarrier block. We are not persuaded, based on the current record, that Petitioner carries its burden of doing so.

Petitioner contends that Jeong teaches “the ranging subchannel comprises at least one block of subcarriers within the communication channel” because “Jeong discloses a ‘ranging sub-channel consisting of 128 or 127 adjacent carriers.’” Pet. 31 (citing Ex. 1003 ¶ 87; Ex. 1008, 8, Fig. 7). Petitioner provides the following annotated version of Jeong’s Figure 7 to illustrate its contentions.



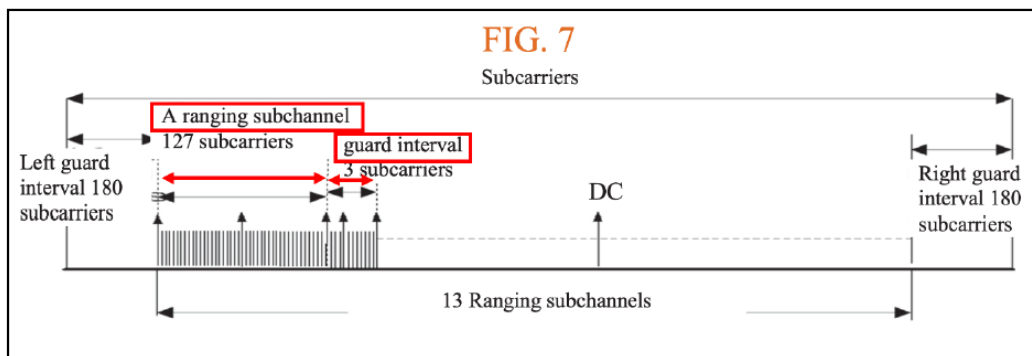
Annotated Figure 7 is an “exemplary diagram illustrating an initial ranging sub-channel allocation structure” described in Jeong. Ex. 1008, 2.

Petitioner’s annotations include a red box surrounding the left side of diagram, with a red call-out arrow pointing to an enlarged version of the box, to which Petitioner also adds red arrows that are labeled “Guard Subcarrier(s).” Pet. 32. Petitioner contends that “[t]he highlighted ranging sub-channel has 127 subcarriers used for signal transmission and is bounded, at both ends, by guard subcarriers.” *Id.* at 31 (citing Ex. 1008, 8; Ex. 1003 ¶ 88).

With respect to the “power levels of subcarriers at both ends of a block are set to zero” element of limitation 1.5, Petitioner asserts that “Jeong discloses guard subcarriers at both ends of the frequency band as well as guard subcarriers ‘between adjacent ranging sub-channels’” that “prevent interference caused by using all carriers of a predetermined interval as ranging sub-channels in the channel structure” but “does not describe the details of the guard subcarriers, which would have led a POSA to Suzuki’s zero-power subcarriers.” Pet. 32–33 (citing Ex. 1008, 8–9; Ex. 1003 ¶ 89).

In particular, Petitioner asserts that “Suzuki discloses ‘one transmission band’ or ‘band slot’ as having ‘twenty-four subcarriers,’” and “explains that only 22 of the subcarriers are available to carry information because ‘the subcarrier numbers 0 and 23 at both ends within one band slot, they are made guard bands in which no subcarrier is arranged and their powers are made zero.’” *Id.* at 33 (citing Ex. 1009, 3:5–20). Petitioner contends that “[i]t would have been obvious to a POSA to use zero-power subcarriers at both ends of a group of subcarriers, as described by Suzuki, in the guard intervals of the ranging sub-channel allocation methods disclosed by Jeong in order to reduce or prevent interference between ranging sub-channels” because the combination requires nothing more than the predictable use of Suzuki’s zero power subcarriers according to their established functions. *Id.* (citing Ex. 1003 ¶ 90; Pet. 22–23).

Patent Owner argues that “Jeong does not disclose zero-power subcarriers that are part of the ranging subchannel.”. Prelim. Resp. 26. Patent Owner argues that Jeong’s “guard intervals are provided **between** subchannels, and are not taught to be a part of the subchannel itself.” *Id.* at 26–27 (citing Ex. 1008, 8). Patent Owner provides its own annotated version of Jeong’s Figure 7, reproduced below, to illustrate its argument.



Annotated Figure 7 is an “exemplary diagram illustrating an initial ranging sub-channel allocation structure” described in Jeong. Ex. 1008, 2. Patent Owner’s annotations include a red box around the “A ranging subchannel” label, with a red arrow spanning the corresponding length of 127 subcarriers below it, and a red box around “guard interval” label, with a red arrow spanning the corresponding length of 3 subcarriers below it. Prelim.

Resp. 27. Patent Owner argues that Jeong “expressly confirm[s] that the sizes of both its subchannel and the ranging code are the same, at 127 subcarriers,” and points to Jeong’s statement that “[t]he ranging code used here is the gold code, and ***the length of the ranging code is 127, which is the length of one ranging subchannel.***” *Id.* (citing Ex. 1008, 9). According to Patent Owner, “[b]ecause the ranging code spans the entire size of the ranging subchannel, the subchannel does not and cannot include the zero-power guard subcarriers.” *Id.* (citing Ex. 2001 ¶¶ 57–59).

On this record, we agree with Patent Owner that Jeong describes the ranging subchannels as excluding the guard intervals. Jeong teaches that “a predetermined guard interval may be inserted into the carrier interval in order to prevent interference caused by using all carriers of a predetermined interval as ranging sub-channels as in the channel structure of the conventional TDD mode OFDMA wireless communication system.”

Ex. 1008, 8. For example, in describing Figure 7, Jeong states that

a ranging sub-channel consisting of 128 or 127 adjacent carriers . . . is configured, and a ranging sub-channel allocation method in which a guard interval is provided *between adjacent ranging sub-channels* is presented. At this time, the guard interval *between the ranging sub-channels* provides 2 subcarriers for a length of 128 ranging sub-channel and 3 subcarriers for a length of 127.

Ex. 1008, 8 (emphasis added). Jeong describes another “ranging sub-channel allocation method with a length of 128” where, “in the 2K mode, 1688 subcarriers can be used for ranging signal transmission, so 179 guard intervals are provided on the left and right sides, respectively.” *Id.* at 9. In yet another embodiment, “[t]he subcarriers in the 2K mode OFDMA wireless communication system are divided into 26 basic groups” wherein “each basic group is composed of adjacent carriers having a length of 64, and a guard interval of one subcarrier length is placed between each of these adjacent basic groups.” *Id.* Therefore, Jeong states, because “1689 subcarriers are used for ranging signal transmission, 179 guard intervals are provided on the left and right sides, respectively.” *Id.* Jeong explains that “since there is a guard interval between adjacent ranging sub-channels, it is possible to significantly reduce multiple access interference (‘MAI’) due to frequency offset and time offset from different ranging signals.” *Id.* at 10. Taken together, these disclosures in Jeong demonstrate that the guard intervals are not defined as part of the ranging subchannels.

Petitioner contends that a POSA would have used Suzuki’s zero-power subcarriers at both ends of Jeong’s block of subcarriers that comprises Jeong’s ranging subchannel “in the guard intervals of the ranging sub-channel allocation methods disclosed by Jeong.” Pet. 33. Because Jeong’s guard intervals are not defined as a part of the ranging subchannel that Petitioner identifies as the claimed “ranging subchannel compris[ing] at least one block of subcarriers within the communication subchannel,” Petitioner’s proposed substitution of Suzuki’s zero-power subcarriers for Jeong’s guard intervals results in the zero-power subcarriers being adjacent to Jeong’s ranging subchannel, not a part of the block of subcarriers that comprise the ranging subchannel as limitation 1.5 requires. And Petitioner does not

contend that a POSA would have modified Jeong's ranging subchannel to include Suzuki's zero-power carriers as part of Jeong's block of subcarriers. See Pet. 69–70.

Petitioner's alternative argument does not remedy these deficiencies. In particular, Petitioner argues, in the alternative, that “to the extent ‘*block of subcarriers*’ is interpreted to include the guard subcarriers at both ends, Jeong's 127 subcarrier ranging subchannel plus one or more guard subcarriers on each end is a ‘*block of subcarriers*.’” Pet. 31 (citing Ex. 1003 ¶ 88). Petitioner's argument, and Dr. Cimini's testimony in this regard, are both conclusory and fail to explain adequately how or why Jeong's guard intervals would be considered part of Jeong's ranging subchannel (and, thus, part of the claimed “block of subcarriers”) when Jeong specifically teaches that the guard intervals are not a part of Jeong's ranging subchannel.

For these reasons, we find that Petitioner does not sufficiently establish that the combined teachings of Jeong and Suzuki disclose “the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero” as required by claim 1. Accordingly, on the record before us, we determine that the Petition does not establish a reasonable likelihood that Petitioner would prevail in showing that the subject matter of claim 1, and claims 2–4 and 6–8 that depend therefrom, would have been obvious over the combined teachings of Jeong and Suzuki. Independent claims 9, 17, and 22 also contain “the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of the block are set to zero” limitations. Ex. 1001, 8:8–11, 8:56–59, 10:8–11. Petitioner relies on the same arguments with respect to these limitations as it does with respect to

limitation 1.5. *See* Pet. 33–34. Thus, for the same reasons as set forth with respect to limitation 1.5, we determine that Petitioner also fails to demonstrate a reasonable likelihood of prevailing with respect to independent claims 9, 17, and 22, and claims 10–16, 18–20, 23, and 24 that depend therefrom.

4. *Analysis of Ground 2*

Petitioner contends that the subject matter of claims 2, 3, 5, 10, 11, and 21 would have been obvious over the combined teachings of Jeong, Suzuki, and Gibson. Pet. 41–46. Claims 2, 3, and 5 depend from claim 1; claims 10 and 11 depend from claim 9, and claim 21 depends from claim 17. Petitioner does not rely on Gibson to remedy the deficiencies identified above with respect to the Petitioner’s contentions regarding independent claims 1, 9, and 17. *See id.* Accordingly, for the reasons set forth above with respect to Ground 1, we determine that Petitioner does not establish a reasonable likelihood of prevailing on its assertion that the subject matter of claims 2, 3, 5, 10, 11, and 21 would have been obvious over the combined teachings of Jeong, Suzuki, and Gibson.

D. Grounds 3 and 4: Obviousness over Koo, 802.16ab, Chayat, and Suzuki (Ground 3) and Koo, 802.16ab, Chayat, Suzuki, and Gibson (Ground 4)

Petitioner contends that the subject matter of claims 1, 4, 6–9, 12, 15–20, and 22–24 would have been obvious over the combined teachings of Koo, 802.16ab, Chayat, and Suzuki, and the subject matter of claims 2, 3, 5, 10, 11, 13, 14, and 21 would have been obvious over the combined teachings of Koo, 802.16ab, Chayat, Suzuki, and Gibson. Pet. 46–76.

1. *Koo (Ex. 1008)*

Koo “relates to a ranging method for a BWA (Broadband Wireless Access) system, and more particularly to a ranging method for a mobile

communication system using an [OFDMA] scheme.” Ex. 1011 ¶ 3. Koo teaches that the ranging method includes three processes: an initial ranging process, a bandwidth request ranging process, and a periodic ranging process. *Id.* at [57], ¶ 6. Koo explains that the objectives of each ranging process “have been defined in the IEEE (International Electrotechnical Commission) 802.16,” but “the standard document prescribed in the IEEE 802.16 does not define a method for allowing the [user equipment] to assign the [ranging code] to a variety of ranging processes having different usages and a message thereof.” *Id.* ¶¶ 8–9. Koo, therefore, “provide[s] a method for dynamically assigning different [ranging codes] to a [user equipment] according to the ranging objectives of the [user equipment] in a communication system using an OFDMA scheme.” *Id.* ¶ 18. In particular, Koo teaches

a method for classifying a ranging procedure between a transmission side and a reception sides into an initial ranging process, a bandwidth request ranging process, and a periodic ranging process, and allowing the transmission side to send [ranging codes] and their backoff values for use in each ranging process to the reception sides, the method including the steps of determining the number of initial [ranging codes] for the initial ranging process, the number of bandwidth requests [ranging codes] for the bandwidth request ranging process, and the number of periodic [ranging codes] for the periodic ranging process; determining a backoff value of the periodic [ranging codes] according to the number of periodic [ranging codes]; and sending the initial [ranging codes], the bandwidth request [ranging codes], the periodic [ranging codes], and the backoff value of the periodic [ranging codes] to the reception sides.

Id. ¶ 22.

2. 802.16ab (Ex. 1012)

802.16ab is a working document drafted to “potentially [form] the basis of an amendment to the IEEE 802.16 standard for medium-access and physical layer components that meet the functional requirements of a point-to-multipoint Broadband Wireless Access (BWA) system between 2 and 11 GHz as defined by the IEEE 802.16 Working Group.” Ex. 1012, 1.⁹

802.16ab presents “[d]etailed logical, electrical, and signal processing specifications . . . that enable the production of interoperable equipment.” *Id.*

802.16ab explains that “[a]n OFDM symbol is made up from carriers” of which there are several types: data carriers for data transmission, pilot carriers for different estimation purposes, and null carriers that do not transmit at all, for guard bands and DC carrier. Ex. 1012, 175. 802.16ab teaches that “[t]he purpose of the guard bands is to enable the signal to naturally decay and create the FFT ‘brick Wall’ shaping.” *Id.* 802.16ab further teaches that, “[a] set of carriers intended for one (group of) receiver(s) is termed a subchannel,” and “[t]he carriers forming one subchannel may, but need not be adjacent.” *Id.* 802.16ab explains that “[t]he symbol is divided into logical sub-channels to support scalability, multiple access, and advanced antenna array processing capabilities,” and “[t]he sub-channel structure will depend on the purpose for the sub-channelization.” *Id.*

802.16ab also describes OFDMA based ranging, in which “allocated sub-channels are grouped to a Ranging Sub-Channel and the modulated

⁹ We refer to the page numbers added by Petitioner to the bottom-center of the page.

codes are referenced as Ranging Codes.” Ex. 1012, 86. 802.16ab explains that the process begins with the SS randomly choosing a Ranging Slot as the time to perform the ranging and a Ranging Code (from the Initial Ranging domain) and sends it to the BS as a CDMA code. *Id.* at 88. Upon successfully receiving a Ranging Code, the BS sends a Ranging Response message that contains all the needed adjustments (such as time, power, and possibly frequency corrections) and a status notification to the SS. *Id.* The SS, upon receiving the Ranging Response message with a continue state, “continue[s] the ranging process as done on the first entry with ranging codes randomly chosen from the Secondary Ranging domain.” *Id.*

3. *Chayat (Ex. 1013)*

Chayat “relates to [OFDMA] systems, and in particular to construction of preambles for transmission of message bursts.” Ex. 1013, 1:8–10. In particular, Chayat describes a method “of implementing OFDMA systems with enhanced preamble properties” in which “[t]he transmit power is boosted during a preamble transmission, by utilizing preambles with a low Peak-to-Average Power Ratio (PAPR) property, as opposed to a higher PAPR during the data portion of the transmission.” *Id.* at 4:9–12.

4. *Analysis of Ground 3*

Petitioner contends that the combined teachings of Koo, 802.16ab, Chayat, and Suzuki teach or suggest all of the limitations of independent claim 1. Pet. 56–70. Patent Owner responds that Petitioner does not establish that the proposed combination discloses claim limitation 1.5, and does not establish a sufficient reason to modify 802.16ab as proposed. Prelim. Resp. 40–63. We focus our discussion on limitation 1.5, as it is dispositive for purposes of this Decision.

Limitation 1.5 recites “the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero.” Ex. 1001, 7:23–26.

Petitioner contends that 802.16ab teaches “the ranging subchannel comprises at least one block of subcarriers within the communication channel” because it “discloses that ‘subcarriers’ are ‘grouped into sub-channels’” and “further describes and shows ranging subchannels as including ‘ranging slots.’”

Pet. 69 (citing Ex. 1003 ¶ 173; Ex. 1012, 77, 86). Petitioner contends that “[a] POSA thus would have understood and found obvious that the ranging subchannel(s) disclosed by 802.16ab . . . include ‘*at least one block of subcarriers within the communication channel.*’” *Id.* (citing Ex. 1012, 86–90; Ex. 1003 ¶ 173).

Petitioner contends that, although 802.16ab teaches guard bands, it “does not expressly disclose that the ‘*power levels of subcarriers at both ends of a block are set to zero.*’” Pet. 69–70 (citing Ex. 1012, 175; Ex. 1003 ¶ 174). For this element of limitation 1.5, Petitioner points to Suzuki’s disclosure of a transmission band or band slot having 24 subcarriers wherein “only 22 of the subcarriers are available to carry information because ‘the subcarrier numbers 0 and 23 at both ends within one band slot, they are made guard bands in which no subcarrier is arranged and their powers are made zero.’” *Id.* at 70 (citing Ex. 1009, 3:5–20). Petitioner contends that “[a] POSA would have been motivated to combine Suzuki’s zero-power guard bands (zero-power subcarriers) at both ends of a block of subcarriers in 802.16ab’s ranging subchannel in order to reduce interference between adjacent blocks of subcarriers.” *Id.* (citing Ex. 1003 ¶ 177; Pet. 59–60).

Petitioner further contends that “802.16ab provides express teachings that would have motivated the combination, explaining that ‘[a]n OFDM

symbol is made up from carriers,’ which may include ‘[n]ull carriers’ that have ‘no transmission at all, for guard bands and DC carrier.’” Pet. 59 (citing Ex. 1012, 175). Petitioner also notes that “802.16ab further teaches that ‘guard bands . . . enable the signal to naturally decay and create the FFT ‘brick wall shaping.’” *Id.* (citing Ex. 1012, 175). Petitioner contends that “[t]hese teachings would have motivated a POSA to look to Suzuki, who discloses additional details of guard bands, such as where to place guard bands (e.g., both ends of one band slot) and their power level (e.g., zero).” *Id.* (citing Ex. 1009, 3:17–20. Petitioner additionally contends that “inserting guard bands between frequency bands was a well-known technique to reduce signal interference in cellular communication systems by 2004.” *Id.* (citing Ex. 1003 ¶ 151).

“[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007). “[I]t 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.” *Id.* An articulated reason to combine helps to avoid “the distortion caused by hindsight bias.” *Id.* at 421.

Petitioner does not show sufficiently, on this record, that the above-discussed disclosures of 802.16ab and Suzuki would have led a POSA to incorporate zero power subcarriers on both ends of 802.16ab’s block of subcarriers. Specifically, Petitioner’s analysis, and Dr. Cimini’s testimony in this regard, are conclusory and fail to explain adequately how or why a

POSA would have implemented Suzuki's zero power subcarriers into 802.16ab's block of subcarriers.¹⁰

As Patent Owner argues, and Mr. Alberth testifies, 802.16ab utilizes a Code Division Multiple Access ("CDMA") scheme "to allow multiple users to simultaneously use its ranging subchannels." Prelim. Resp. 44 (citing Ex. 2001 ¶¶ 74–77). Mr. Alberth explains that CDMA "is a method of allowing multiple users to access the bandwidth" that is "based on spreading technology" wherein, "instead of each user only utilizing an assigned portion of the frequency band, all users utilize the entire available frequency band." Ex. 2001 ¶ 74. Mr. Alberth further explains that, in the CDMA scheme, "[e]ach user is assigned a code (sometimes generated based on a pseudo-random number" and "[t]he user 'spreads' the information signal based on its assigned code to cover the entire available frequency bandwidth but with a lower power density." *Id.* ¶ 75. Mr. Alberth explains that, in 802.16ab, "the length of the Ranging Code is in multiples of 53 bits, and it depends on how many sub-channels are allocated for ranging," such that "the default for the 2K mode is 2 sub-channels' allocated for ranging, and, 'therefore the ranging code length is 106.'" *Id.* ¶ 81 (citing Ex. 1012, 204). Thus, Mr. Alberth testifies, 802.16ab "deliberately defines its ranging code to expand the entirety of the bandwidth of all ranging channels without any guard subcarriers in connection with the ranging subchannels." *Id.* ¶ 83 (citing Ex. 1012, 204). And, as Patent Owner notes, 802.16ab "explains that users 'are allowed to collide' on the ranging subchannels because the

¹⁰ Dr. Cimini's cited testimony mirrors the Petition, and Dr. Cimini does not provide additional explanation to support Petitioner's contentions.

‘colliding codes’ can be separated through the user’s randomly selected ranging code.” Prelim. Resp. 49 (citing Ex. 1012, 204; Ex. 2001 ¶ 84).

Mr. Alberth testifies “802.16ab standard’s teaching not to include guard frequency subcarriers in connection with ranging signal is due to the well-known fact that CDMA signals have a high tolerance to interference, as documented in various literature.” *Id.* ¶ 88. Patent Owner and Mr. Alberth then point to Gibson, which explains that “resistance to interference is an inherent property of spreading methods because the interference occurs after the signal is already spread, and its effect is greatly diminished after the original signal is despread.” Prelim. Resp. 52 (citing Ex. 1010, 184).

Petitioner’s proffered motivation to combine Suzuki’s zero power subcarriers with 802.16ab’s block of subcarriers is “to reduce interference between groups of subcarriers.” Pet. 59 (citing Ex. 1003 ¶¶ 150–151). Petitioner, however, does not address that 802.16ab deliberately chose¹¹ to not include guard subcarriers with ranging signals at least because the CDMA scheme described in 802.16ab has a high tolerance to interference. See Prelim. Resp. 44–53; Ex. 2001 ¶¶ 73–89; Ex. 1010, 184, 195. Absent more analysis in the Petition or Dr. Cimini’s declaration, we cannot say that Petitioner sufficiently shows that a POSA would have been motivated to modify 802.16ab’s CDMA scheme by adding Suzuki’s zero power subcarriers in order to reduce interference between subcarriers. Given 802.16ab’s CDMA scheme that already has a high tolerance to interference,

¹¹ Mr. Alberth identifies several instances in 802.16ab where “the standard does disclose guard bands in other situations where it deems them desirable,” indicating that “not allocating frequency guard subcarriers to or in connection with ranging subchannels was a deliberate design choice.” Ex. 2001 ¶¶ 85–87.

neither Petitioner nor Dr. Cimini sufficiently explains how or why a POSA would have been motivated to reduce interference between 802.16ab's subcarriers in the first instance, or that implementing Suzuki's zero power subcarriers in 802.16ab's system would have yielded predictable results. *See In re Nuvasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016) (stating that "conclusory statements" amount to an "insufficient articulation[] of motivation to combine"; "instead, the finding must be supported by a 'reasoned explanation'" (citation omitted)). For these reasons, we are not persuaded that Petitioner sufficiently establishes that an ordinarily skilled artisan would have been motivated to modify 802.16ab in light of Suzuki as Petitioner contends.

Accordingly, we determine that Petitioner fails to demonstrate a reasonable likelihood of prevailing in its assertion that the subject matter of claim 1, and claims 4 and 6–8 that depend therefrom, would have been obvious over the combined teachings of Koo, 802.16ab, Chayat, and Suzuki.¹² Independent claims 9, 17, and 22 also contain "the ranging subchannel comprises at least one block of subcarriers within the communication channel and power levels of subcarriers at both ends of a block are set to zero" limitations. Ex. 1001, 8:8–11, 8:56–59, 10:8–11. Petitioner relies on the same arguments with respect to these limitations as it does with respect to limitation 1.5. *See* Pet. 70–71. Thus, for the same reasons as set forth with respect to limitation 1.5, we determine that Petitioner also fails to demonstrate a reasonable likelihood of prevailing with

¹² Petitioner does not rely on Koo or Chayat with respect to limitation 1.5. *See* Pet. 69–70.

respect to independent claims 9, 17, and 22, and claims 12, 15, 16, 18–20, 23, and 24 that depend therefrom.

5. *Analysis of Ground 4*

Petitioner contends that the subject matter of claims 2, 3, 5, 10, 11, 13, 14, and 21 would have been obvious over the combined teachings of Koo, 802.16ab, Chayat, Suzuki, and Gibson. Pet. 74–76. Claims 2, 3, and 5 depend from claim 1; claims 10, 11, 13, and 14 depend from claim 9; and claim 21 depends from claim 17. Petitioner does not rely on Gibson to remedy the deficiencies identified above with respect to the Petitioner’s contentions regarding independent claims 1, 9, and 17. *See id.* Accordingly, for the reasons set forth above with respect to Ground 3, we determine that Petitioner does not establish a reasonable likelihood of prevailing on its assertion that the subject matter of claims 2, 3, 5, 10, 11, 13, 14, and 21 would have been obvious over the combined teachings of Koo, 802.16ab, Chayat, Suzuki, and Gibson.

IV. CONCLUSION

Based on the arguments in the Petition, the Preliminary Response, and the evidence of record, and for the reasons set forth above, we determine that Petitioner does not establish a reasonable likelihood of prevailing on its challenge that claims 1–24 of the ’366 patent are unpatentable.

V. ORDER

It is hereby

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

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