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Paper 11
Date: December 5, 2025

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

APEX BEAM TECHNOLOGIES LLC,
Patent Owner.

IPR2025-00903
Patent 11,546,110 B2

Before SCOTT A. DANIELS, KEVIN W. CHERRY, and SCOTT RAEVSKY, *Administrative Patent Judges*.

CHERRY, *Administrative Patent Judge*.

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

I. INTRODUCTION

Apple Inc. ("Petitioner") filed a petition to institute *inter partes* review of claims 1–20 of U.S. Patent No. 11,546,110 (Ex. 1001, "the '110 patent"). Paper 2 ("Pet."). Apex Beam Technologies LLC ("Patent Owner") filed a Preliminary Response. Paper 9 ("Prelim. Resp."). Patent Owner filed a request for discretionary denial. Paper 7 ("DD Request"). Petitioner responded in opposition to Patent Owner's request for discretionary denial. Paper 8 ("DD Opp."). Patent Owner's request for discretionary denial was denied and the petition was referred to the Board. Paper 10 ("DD Order").

We have authority under 35 U.S.C. § 314 to determine whether to institute an *inter partes* review. The standard for instituting an *inter partes* review is set forth in 35 U.S.C. § 314(a), which provides that an *inter partes* review may not be instituted unless "there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition." The Supreme Court has held that the Board, in a decision to institute under 35 U.S.C. § 314(b), may not institute review on less than all claims challenged in the petition. *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1355–56 (2018). Moreover, in accordance with our rules, "[w]hen instituting *inter partes* review, the Board will authorize the review to proceed on all of the challenged claims and on all grounds of unpatentability asserted for each claim." 37 C.F.R. § 42.108(a); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (interpreting the statute to require "a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition").

Applying those standards, and upon considering the Petition, the Preliminary Response, and the evidence of record, we determine the information presented demonstrates a reasonable likelihood that Petitioner would prevail in establishing the unpatentability of at least one of the challenged claims of the ’110 patent. Accordingly, we institute an *inter partes* review.

II. BACKGROUND

A. Related Matters

The parties identify the following district-court proceeding between the parties concerning the ’110 patent: *Apex Beam Technologies LLC v. Apple Inc.*, 6:24-cv-00223 (W.D. Tex.). Pet. 89; Paper 4, 2.

Petitioner also identifies the following district-court proceeding concerning the ’110 patent: *Apex Beam Technologies LLC v. Samsung Electronics Co., Ltd. et al.*, 2:24-cv-00203 (E.D. Tex.). Pet. 89.

B. Real Parties in Interest

Petitioner identifies Apple Inc. as its real party in interest. Pet. 89.

Patent Owner identifies Apex Beam Technologies LLC as its real party in interest. Paper 4, 2.

C. The ’110 Patent

The ’110 patent is titled “Method and Device for Multi-Antenna Transmission in User Equipment (UE) and Base Station.” Ex. 1001, Code (54). The ’110 patent relates to “multi-antenna transmission in user equipment (UE) and base station.” *Id.* at Code (57). The ’110 patent explains that, at the time of the invention, in a massive Multiple-Input Multiple-Output (MIMO) system, with “multiple antennas [that] can improve communication quality by forming narrower beams pointing to a specific direction through beamforming,” “the total throughput of a cell [could] be greatly increased by the number of massive antennas, so the number of single-cell users [could] be greatly increased." *Id.* at 1:28–30, 1:39–41. However, such "an increase in the number of cell users [may] lead to a large amount of signaling overhead of dynamic scheduling of wireless time-frequency resources." *Id.* at 1:42–44. Thus, it is one object of the '110 patent to "effectively reduce signaling overhead of wireless resource dynamic scheduling of a massive MIMO system." *Id.* at Code [57].

The '110 patent achieves its objective using multi-antenna transmission in a user equipment (UE), including transmitting and receiving a first radio signal and a first signaling, "wherein the first radio signal is transmitted by K antenna port groups" that "include a positive integer number of the antenna port(s)." *Id.* at 1:59–61. "[T]he first signaling is used to determine a first time resource pool" and "at least one of a first antenna virtualization vector and a second antenna virtualization vector is associated with the first antenna port group," and "K is a positive integer greater than 1." *Id.* at 1:62–2:4. As a result, "by associating the first time resource pool with the first antenna port group, the UE can quickly determine[] the location of the first time resource pool in the time domain by the index of the first antenna port group in the K antenna port groups" and "the UE can quickly determine the antenna virtualization vectors which [are] used for receiving radio signal[s] transmitted on the first time resource pool by the location of the first time resource pool in the time domain." *Id.* at 2:6–17. The first radio signal "includes one or more of Primary Synchronization Signal (PSS), Secondary Synchronization Signal (SSS), Master Information Block (MIB)/System Information Block (SIB), and Channel State Information Reference signal(s) (CSI-RS)." *Id.* at 2:32–36.

D. The Challenged Claims

Petitioner challenges claims 1–20 of the ’110 patent. Pet. 1. Of the challenged claims, claims 1, 6, 11, and 16 are independent; claim 1 is reproduced below with Petitioner’s identifiers for the claim limitations, as illustrative of the subject matter recited in the challenged claims.

> **[1.1]** A method for multi-antenna transmission in a user equipment, comprising:
>
> **[1.2]** receiving a first radio signal; and
>
> **[1.3]** receiving a first signaling;
>
> **[1.4]** wherein the first radio signal is transmitted by K antenna port groups; the antenna port group includes a positive integer number of antenna port(s);
>
> **[1.5]** a first antenna port group is one of the K antenna port groups;
>
> **[1.6]** the first signaling is used to determine a first time resource pool;
>
> **[1.7]** a second antenna virtualization vector is associated with the first antenna port group;
>
> **[1.8]** the second antenna virtualization vector is an antenna virtualization vector available to the user equipment in the first time resource pool; and
>
> **[1.9]** the K is a positive integer greater than 1;
>
> **[1.10]** the first radio signal includes one or more of PSS (Primary Synchronization Signal), SSS (Secondary Synchronization Signal), MIB (Master Information Block)/SIB (System Information Block) or CSI-RS (Channel State Information Reference signal);
>
> **[1.11]** the first signaling is a downlink signaling.

Ex. 1001, 29:7–26; Pet. iv.

E. Evidence

Petitioner submits the following evidence:

Evidence	Exhibit No.
Declaration of Narayan Mandayam, Ph.D.	1003
Kim et al., US 2013/0182594 A1 (published July 18, 2013, filed Jan. 16, 2013) ("Kim")	1004
Dahlman et al., *4G: LTE/LTE-Advanced for Mobile Broadband* (2d ed. 2014) ("Dahlman")	1007
Kim et al., US 2015/0162966 A1 (published June 11, 2015, filed July 2, 2013) ("Kim-966")	1008

F. Asserted Ground of Unpatentability

Petitioner asserts the following ground of unpatentability:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–20	103[1]	Kim, Dahlman, Kim-966

Pet. 1.

III. PATENTABILITY ANALYSIS

Petitioner contends that claims 1–20 of the ’110 patent are unpatentable under 35 U.S.C. § 103 over the combination of Kim, Dahlman, and Kim-966. Pet. 1, 15.

A patent 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 said 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;

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[1] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 103. The ’110 patent claims benefit of a December 3, 2016 foreign application priority date, which is after the effective date of the applicable AIA amendments. Ex. 1001, Code (30).

(3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness.[2] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

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

We organize our patentability analysis into four sections. First, we address the level of ordinary skill in the art. Second, we address claim construction. Third, we provide an overview of the asserted references. And fourth, taking account of the information presented, we consider whether the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a).

A. Level of Ordinary Skill in the Art

We consider the asserted grounds of unpatentability in view of the understanding of a person of ordinary skill in the art. In assessing the level of ordinary skill in the art, various factors may be considered, including the "type of problems encountered in the art; prior art solutions to those

[2] Patent Owner does not present arguments or evidence of secondary considerations in its Preliminary Response. Therefore, secondary considerations do not constitute part of our analysis herein.

problems; rapidity with which innovations are made; sophistication of the technology; and educational level of active workers in the field." *In re GPAC Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995) (quoting *Custom Accessories, Inc. v. Jeffrey-Allan Indus., Inc.*, 807 F.2d 955, 962 (Fed. Cir. 1986)). "[O]ne or more factors may predominate." *Id.*

Relying on the declaration testimony of Dr. Mandayam, Petitioner contends that an ordinarily skilled artisan for the '110 patent "would have a bachelor's degree in electrical engineering, computer engineering, computer science, or a similar field, along with two years of experience designing or developing wireless networks, including long-term evolution LTE/4G or 5G new radio (NR) cellular technology." Pet. 12. Petitioner additionally contends "[a]dditional education might substitute for some of the experience, and additional substantial experience might substitute for some of the educational background." *Id.*

Patent Owner "utilizes Petitioner's proposed level of skill in the art." Prelim. Resp. 2.

Based on this record, we adopt Petitioner's articulation of the level of ordinary skill in the art, which is consistent with the '110 patent and the asserted prior art, and we apply it in our obviousness evaluations below. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (the prior art, itself, can reflect appropriate level of ordinary skill in art). We note that our decision would be the same applying either party's definition of a person of ordinary skill in the art.

B. Claim Construction

Next, we turn to claim construction. In interpreting the claims of the '110 patent, we "us[e] the same claim construction standard that would be used to construe the claim[s] in a civil action under 35 U.S.C. [§] 282(b)." *See* 37 C.F.R. § 42.100(b) (2020). The claim construction standard includes construing claims in accordance with the ordinary and customary meaning of such claims as would have been understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. *See id.*; *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–14 (Fed. Cir. 2005) (en banc).

Petitioner contends that "[a]ll claim terms should be construed according to the *Phillips* standard," and that "no claim terms need be construed to resolve issues of controversy in the present Petition." Pet. 2. Patent Owner agrees "that claim construction is not required to resolve any issues." Prelim. Resp. 2.

Having considered the record, we determine that no express claim construction is necessary for any claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (holding that only claim terms in controversy need to be construed, and only to the extent necessary to resolve the controversy (citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

C. The Prior Art

Before turning to Petitioner's asserted grounds of unpatentability, we provide brief summaries of the asserted references.

1. Kim (Ex. 1004)

Kim is titled "Method and Apparatus for Transmitting and Receiving Reference Signal." Ex. 1004, Code (54). Kim relates to "effectively transmitting and receiving a Channel State Information-Reference Signal (CSI-RS) and measuring interference." *Id.* ¶ 3. Kim endeavors to fill a need "for a method and an apparatus for transmitting a reference signal for effective data transmission and reception, measuring interference, and generating channel state information in a MIMO transmission and reception." *Id.* ¶ 14. Kim provides "an effective transmission and reception method in a MIMO system having scores or more transmission antennas." *Id.* ¶ 17.

Kim describes a User Equipment (UE) "receiving a first reference signal from an eNB, generating channel state information based on the first reference signal, and transmitting the generated channel state information to the eNB." *Id.* ¶ 19. Kim also describes the UE "receiving a second reference signal from the eNB, generating channel state information based on the second reference signal, and transmitting the generated channel state information to the eNB." *Id.* The UE then "receiv[es] control information for data reception from the eNB." *Id.*

Kim explains that "scores or more transmission antennas [are] arranged in the eNB" and 'are used in transmitting a signal to one User Equipment (UE) or a plurality of UEs." *Id.* ¶ 51. A "UE can receive one or more spatial channels . . . depending on the number of reception antennas owned by the UE and the channel condition," and "in the case of simultaneous transmission to a plurality of UEs . . . signals transmitted to different UEs may cause interference (i.e., a multi-user MIMO interference) between them," weakening the signal receiving performance. *Id.* Kim provides for a UE to "precisely measure the channel state and the size of interference and transmit effective channel state information to an eNB by using the measured information," and for the eNB to "determine[] UEs to which it will make a downlink transmission, a data transmission speed for the transmission, and a precoding scheme to be applied." *Id.* ¶ 52. Kim "provides an effective Channel State Information-Reference Signal (CSI-RS) transmission and reception method in a massive MIMO system." *Id.* ¶ 53.

2. Dahlman (Ex. 1007)

Dahlman is a textbook entitled "4G: LTE/LTE-Advanced for Mobile Broadband." Ex. 1007, Title. Dahlman describes multiple antenna processing, such as "MIMO (Multiple-Input/Multiple-Output) antenna processing." *Id.* at 89. Dahlman explains that "[d]ownlink multi-antenna transmission is a key technology of LTE, and that "unknown *multi-antenna precoders* . . . will experience different 'radio channels' even if the set of antennas are located at the same site." *Id.* at 154. Dahlman explains that "[e]ach individual downlink transmission is carried out from a specific antenna port, the identity of which is known to the terminal," and that "each antenna port can, at least for the downlink, be seen as corresponding to a specific reference signal" and a "terminal receiver can then assume that this reference signal can be used to estimate the channel corresponding to the specific antenna port." *Id.* "The reference signals can also be used by the terminal to derive detailed channel-state information related to the antenna port." *Id.* Dahlman describes "*CSI reference signals* (CSI-RS)," that "are specifically intended to be used by terminals to acquire channel-state information (CSI), for example for channel-dependent scheduling, link adaptation, and transmission settings related to multi-antenna transmission." *Id.* at 185.

3. Kim-966 (Ex. 1008)

Kim-966 is titled "Method and Device for Reporting Channel State Information in Wireless Communication System." Ex.1008, Code [54]. Kim-966 discloses an "aperiodic transmission method for reducing overhead of transmission of a reference signal and a method and device for reporting relevant channel state information." *Id.* ¶ 3. Kim-966 provides "for reporting channel state information (CSI) by a user equipment (UE) having a plurality of CSI processes," including "measuring a channel based on a CSI-reference signal (CSI-RS) resource associated with one CSI process of the plurality of CSI processes" and "measuring an interference based on a CSI-interference measurement (CSI-IM) resource associated with the one CSI process," and "determining the CSI based on the measured channel and interference." *Id.* ¶ 5. Kim-966 explains that a "signal for a Multi User-Multi Input Multi output (MU-MIMO)-paired UE may be transmitted in a portion of subframes corresponding to the CSI-IM resource," and that the "signal for the MU-MIMO paired UE may be either a PDSCH for the MU-MIMO-paired UE or a dummy signal obtained by applying a precoding matrix associated with the MU-MIMO-paired UE." *Id.* ¶¶ 13–14.

D. Alleged Ground of Unpatentability Over Kim, Dahlman, and Kim-966

Petitioner contends that claims 1–20 of the '110 patent are unpatentable under 35 U.S.C. § 103 as obvious over Kim, Dahlman, and Kim-966. Pet. 38–87. Patent Owner argues that Kim does not teach or suggest limitation [1.6] that is required in all claims. Prelim. Resp. 5–6. Having considered the arguments and evidence before us, we determine that Petitioner demonstrates a reasonable likelihood that it would prevail on this asserted ground of unpatentability. We focus our analysis on claim limitation [1.6].

1. Claim 1

a) Limitation [1.6]

Limitation [1.6] requires that "the first signaling is used to determine a first time resource pool." Ex. 1001, 29:14–15.

Petitioner contends that the combination of Kim, Dahlman, and Kim-966 renders obvious this limitation. *See* Pet. 50–53. With respect to the "first signaling," Petitioner argues that the combination teaches "the UE [user equipment] ***receiving*** a 'system information block ('SIB') (***a first signaling***) which can include various types of information such as 'information about the allocation of subframes to uplink/downlink and configuration of the special subframe in the case of TDD [time division duplexing]." *Id.* at 43 (citing Ex. 1007, 358–62; Ex. 1004 ¶¶ 21, 65; Ex. 1003 ¶ 100).

Petitioner argues that "[b]ecause the SIB assigns time resources or an 'allocation of subframes for uplink/downlink,' an SIB would be understood to function as and render obvious as assigning the UE a collection of time intervals (e.g., subframes) or '***time resource pools***.'" *Id.* at 51 (citing Ex. 1007, 358–62; Ex. 1004 ¶¶ 60–61, 64–78, 84; Ex. 1003 ¶ 113). Petitioner contends that "a POSITA would have understood and found obvious that ***the first signaling*** (SIB) ***is used to determine*** an 'allocation of subframes to uplink/downlink' (***a first time resource pool***) through an assignment of a Time Division Duplexing (TDD) configuration." *Id.* (citing Ex. 1003 ¶ 113). Petitioner submits that "[t]he TDD configuration would identify a series of subframes available for uplink and downlink (***a first time***

resource pool)." *Id.* Petitioner provides an annotated version of Dahlman's Figure 9.7, reproduced below. *Id.* at 52.

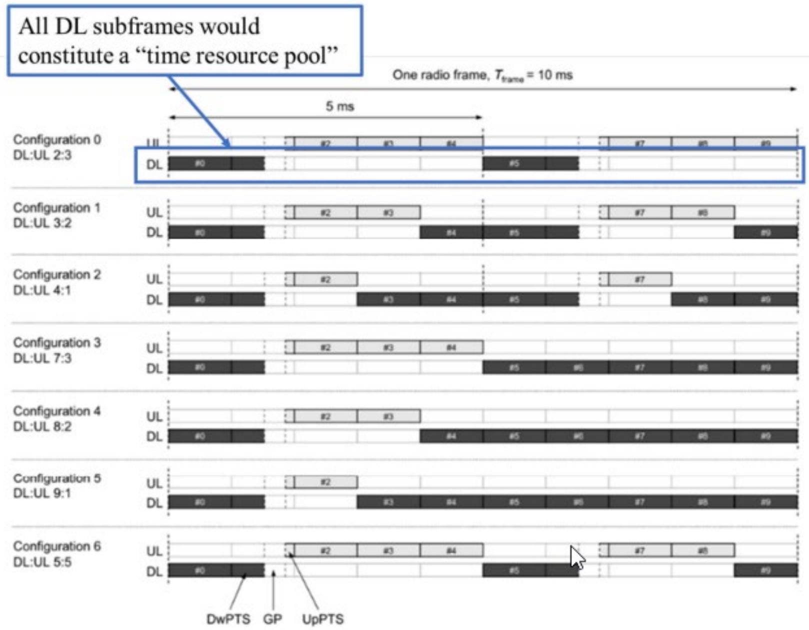

FIGURE 9.7
Different downlink/uplink configurations in case of TDD

Dahlman's Figure 9.7 shows different downlink/uplink configurations in the case of TDD, showing different subframe arrangements possible in a single radio timeframe. Petitioner submits that as shown in Dahlman's annotated figure 9.7, "a particular configuration for TDD would establish a 'pool' (Dahlman's 'allocation of subframes') of the downlink and uplink subframes (***time resources***) assigned to a UE." *Id.* at 51 (citing Ex. 1004 ¶¶ 61, 69; Ex. 1007, 358–62, FIG. 9.7; Ex. 1003 ¶ 113).

Petitioner contends that "a POSITA would have understood and found obvious that these uplink or downlink subframes represent time resources and thus the SIB ***is used to determine a first time resource pool***. *Id.* at 52 (citing Ex. 1003 ¶ 114). Petitioner notes that this is consistent with the disclosure of the '110 patent. *Id.* at 53 (citing Ex. 1001, 16:5–14 ("the subframe #3 and #7 in the first time resource pool {#1, #3, #5, #7} consists of the first time sub-pool"); FIG. 4–9. Petitioner further argues that "a POSITA would have understood that 'time resources' refers to periods or slots of time, such as a collection or pool of subframes." *Id.* (citing Ex. 1003 ¶ 115; Ex. 1006, 116). Thus, Petitioner contends that "a POSITA would have understood and found obvious that the SIB is the first signaling which is used to determine a first time resource pool consisting of the downlink or uplink subframes assigned to the UE through TDD configurations." *Id.* (citing Ex. 1003 ¶116).

Patent Owner argues the "special case" described in Dahlman—where "SIB 'includes information about the allocation of subframes to uplink/downlink and configuration of the special subframe in the case of TDD'"—"describes nothing related to the 'is used to determine' portion of the limitation." Prelim. Resp. 5. Patent Owner asserts that "Petitioner alleges POSITA knowledge in an attempt to interpret the disclosure of an SIB 'to function as and render obvious as assigning' and that 'a POSITA would have understood and found obvious that [SIB] is used to determine . . . .'" *Id.* Patent Owner contends that "Petitioner's allegation is conclusory and based on unsupported POSITA knowledge. The mere recitation of an SIB with nothing more cannot and does not teach the required '*is used to determine*' limitation." *Id.* at 5–6.

Patent Owner asserts that "Petitioner impermissibly relies on POSITA knowledge and expert testimony alone to account for missing elements which are not disclosed in the Dahlman reference," and "[b]ecause Petitioner has not shown that the SIB is used to determine the first time resource pool, Petitioner has failed to identify where the elements are disclosed in the prior art publication." *Id.* at 6.

We find that, on this record, Petitioner has shown sufficiently that the combination of Kim and Dahlman teaches limitation [1.6]. As an initial matter, we note that Patent Owner's characterization of TDD as a "special case," without any further explanation, does not persuade, because even if the combination only sometimes meets the claim element, it is sufficient to show obviousness. *See Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002 (Fed. Cir. 2016).

Here, Petitioner has shown sufficiently, on the current record, that Dahlman expressly discloses that SIB includes information about the allocation of subframes to uplink/downlink and configuration of the special subframe in the case of TDD. *See* Pet. 51. Dr. Mandayam explains, supported by Dahlman's Figure 9.7, that a person of ordinary skill in the art would understand that "a particular configuration for TDD would establish a 'pool' (Dahlman's 'allocation of subframes') of the downlink and uplink subframes (***time resources***) assigned to a UE." *Id.* (citing Ex. 1004 ¶¶ 61, 69; Ex. 1007, 358–62, FIG. 9.7; Ex. 1003 ¶ 113). On this record, we find that Petitioner is not relying solely on the testimony of Dr. Mandayam, but rather using his testimony to explain what a person of ordinary skill would understand from Dahlman's disclosure. Thus, we find that, on the current record, that Petitioner has shown sufficiently based on Dahlman's express disclosure and Dr. Mandayam's explanation that "***the first signaling*** (SIB) is used to determine an "allocation of subframes to uplink/downlink" (***a first time resource pool***) through an assignment of a Time Division Duplexing (TDD) configuration." *Id.* (citing Ex. 1003 ¶ 113). Overall, on this record, we find Petitioner's evidence, including the disclosure in Dahlman and Dr. Mandayam's testimony, persuasive as to limitation [1.6].

b) Undisputed Limitations

Petitioner asserts that the combination of Kim, Dahlman, and Kim-966 discloses the preamble and the remaining limitations of claim 1. Pet. 38–62. Petitioner identifies where the combination of Kim, Dahlman, and Kim-966 teaches these limitations, supported with testimony from Dr. Mandayam, which Patent Owner does not specifically rebut at this stage. We determine, on this record, that the combination of Kim, Dahlman, and Kim-966 discloses the preamble (whether or not limiting) and the remaining undisputed limitations of claim 1. *See LG Elecs., Inc. v. Conversant Wireless Licensing S.A.R.L.*, 759 F. App'x 917, 925 (Fed. Cir. 2019) (nonprecedential) ("The Board is 'not required to address undisputed matters' or arguments about limitations with which it was never presented.") (quoting *In re NuVasive, Inc.*, 841 F.3d 966, 974 (Fed. Cir. 2016)).

c) Summary as to Claim 1

Based on the preliminary record before us, Petitioner has shown a reasonable likelihood that claim 1 would have been obvious over the combination of Kim, Dahlman, and Kim-966.

2. Claims 2–20

Patent Owner does not raise any other separate arguments regarding claims 2–20 other than those we have considered above with respect to claim 1. *See* Prelim. Resp. 5. On the current record, we have reviewed Petitioner's contentions regarding claims 2–20 (Pet. 63–87), and determine that Petitioner shows a reasonable likelihood of prevailing with respect to the obviousness of claims 2–20 over Kim, Dahlman, and Kim-966.

IV. CONCLUSION

After considering the arguments presented in the Petition, the Preliminary Response, and the evidence of record, we determine that Petitioner demonstrates at least a reasonable likelihood of success in proving that at least one claim of the ’110 patent is unpatentable. Thus, we institute an *inter partes* review of all challenged claims (i.e., claims 1–20).

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–20 of the ’110 patent is hereby instituted on all grounds of unpatentability set forth in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial commencing on the entry date of this decision.

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