

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

APEX BEAM TECHNOLOGIES LLC,
Patent Owner.

IPR2025-00905
Patent 11,917,581 B2

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

DANIELS, *Administrative Patent Judge*.

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

I. INTRODUCTION

Apple Inc., (“Apple” or “Petitioner”), filed a Petition requesting *inter partes* review (“IPR”) of claims 1–5, 7–11, 13–17, and 19–23 of U.S. Patent No. 11,917,581 B2 (Ex. 1001, “the ’581 patent”). Paper 2 (“Pet.”). Apex Beam Technologies LLC, (“Apex” or “Patent Owner”) filed a Request for Discretionary Denial. Paper 8 (“Request”). Petitioner filed an Opposition to Patent Owner’s Request. Paper 10. Patent Owner also filed a Preliminary Response to the Petition. Paper 11 (“Prelim. Resp.”). On September 19, 2025, the Acting Director of the United States Patent and Trademark Office issued a Decision denying Patent Owner’s Request, resolving the discretionary denial issues. Paper 12.

Under 35 U.S.C. § 314(a), 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.” Upon consideration of the arguments and evidence presented by Petitioner and Patent Owner, we are persuaded that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing the unpatentability of at least one of the challenged claims. *See* 35 U.S.C. § 314(a). Accordingly, we institute an *inter partes* review of the challenged claims.

A. *Real Parties in Interest*

Petitioner states that Apple Inc. is the petitioner and the real party in interest. Pet. 79. Patent Owner states that the real party in interest is Apex Beam Technologies LLC. Paper 6, 2.

B. *Related Matters*

The parties indicate that the ’581 patent is at issue in *Apex Beam Technologies LLC v. Apple Inc.*, Case No. 6:24-cv-00223 in the U.S. District Court for the Western District of Texas and *Apex Beam Technologies LLC v.*

Samsung Electronics Co., Ltd. et al., 2:24-cv-00203 in the Eastern District of Texas. Pet. 79; Paper 6, 2.

C. *The '581 Patent (Ex. 1001)*

The '581 patent, titled “Method and Device in UE and Base Station Used for Paging,” describes a 5G communication process for determining paging transmission opportunities, specifically, a system where User Equipment (“UE”), for example a cell phone, monitors at X time intervals for signaling from a base station, and if signaling is detected, wakes up to be in an active mode for receiving a paging message radio signal. Ex. 1001, Abstract. This wake up function is also known as a paging opportunity (“PO”). Figure 1 of the '581 patent is reproduced below.

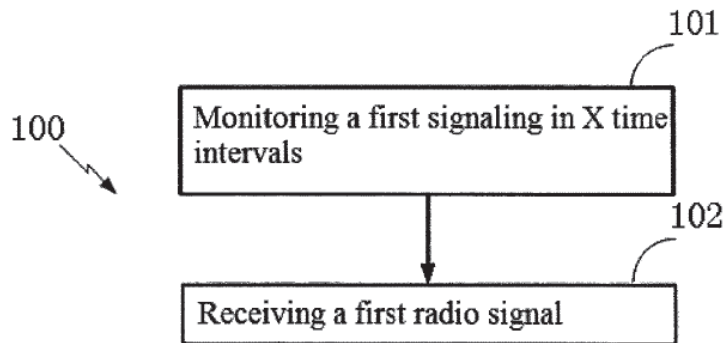


FIG. 1

Figure 1 “is a flowchart illustrating the transmission of a first signaling and a first radio signal.” *Id.* at 9:11–12. The '581 patent explains that in one embodiment X is a positive integer, and “[t]he first signaling is used for determining scheduling information for the first radio signal.” *Id.* at 9:65–67.

Figure 8 as annotated by the Board, reproduced below, shows how the first signaling determines scheduling information for the first radio signal. *Id.* at 19:65–20:9.

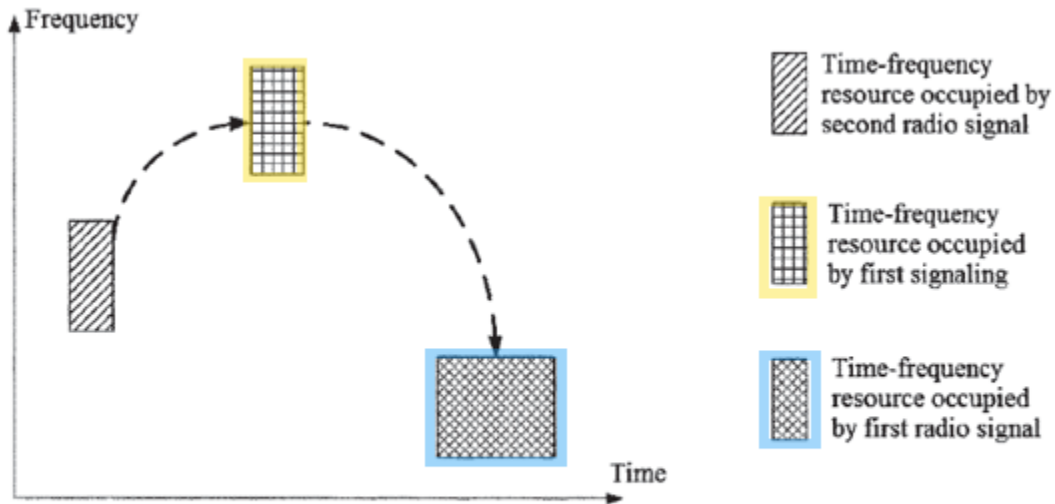


FIG. 8

Figure 8 illustrates a time-frequency resource block with cross-lines (yellow) occupied by first signaling, for instance downlink control (scheduling) information (“DCI”) in the time-frequency domain transmitted by physical downlink control channels (“PDCCH”). *Id.* The first signaling DCI enables the UE to locate and decode the subsequent first radio signal in the time-frequency resource with cross-oblique lines (blue), carrying the paging message transmitted by physical downlink shared channels (“PDSCHs”). *Id.* at 20:21–31.

In Figure 6, reproduced below, the ’581 patent also explains how UEs #1, #2, and #3 monitor the first signaling within X time intervals.

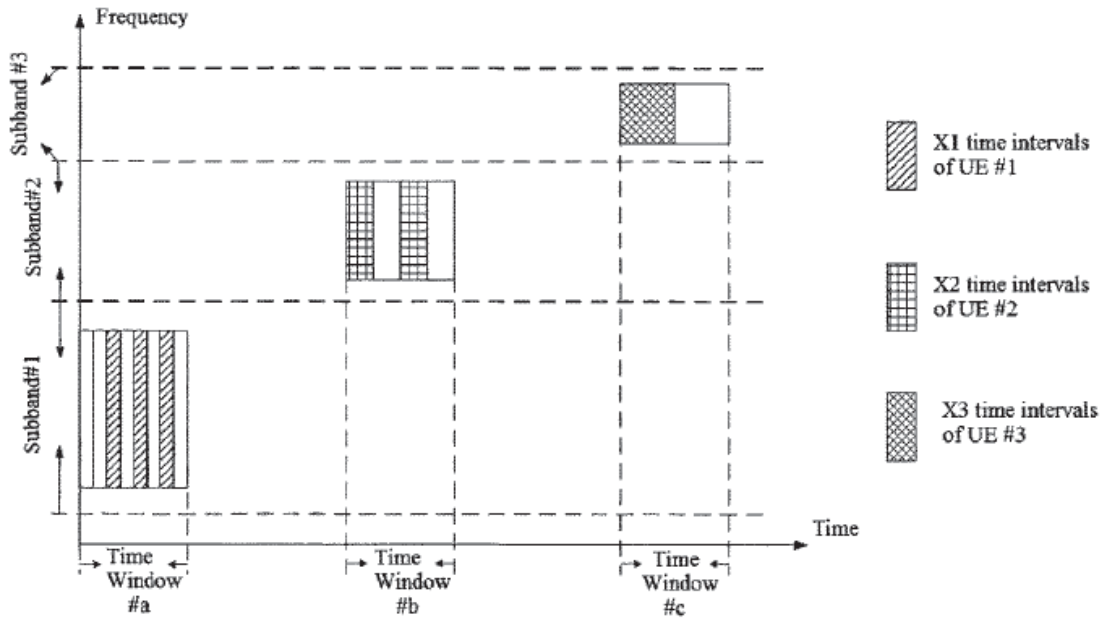


FIG. 6

Figure 6 illustrates, for example, that UE #2 monitors a first signaling in X2 time intervals within time window #b.

The '581 patent further describes that the length of each X time interval is dependent on the subcarrier spacing. Figure 7 of the '581 patent is reproduced below.

	Index of X=1 time interval in the first time window			
	Feature ID=a	Feature ID=b	Feature ID=c	Feature ID=d
Y=1	0	0	0	0
Y=2	0	1	0	1
Y=4	0	1	2	3
Y=8	1	3	5	7
Y=16	2	6	10	14

FIG. 7

Figure 7 is a table showing how subcarrier spacing determines the time-domain location as well as the duration of each X time interval with “Y

being a positive integer not smaller than X.” *Id.* at 19:8–9. For example, for UE with Feature ID=b, the X=1 paging occasion is at interval 3 of the time domain spanned by 8 intervals 0–7. The ’581 patent explains that “[t]he subcarrier spacing of subcarriers included in the first subband is used for determining Y. The feature ID of the UE is used for determining the X time intervals in the Y time intervals.” *Id.* at 19:9–12.

D. Illustrative Claim

Claims 1, 7, 13, and 19 are independent. Each of claims 2–5, 8–11, 14–17, and 20–23 ultimately depend from independent claims 1, 7, 13, and 19 respectively. Claim 1 illustrates the claimed subject matter and is reproduced below:

1. [1Pre]¹ A method in a User Equipment (UE) for paging, comprising:
 - [1a] monitoring a first signaling in X time intervals; and
 - [1b] receiving a first radio signal;
 - [1c] wherein X is a positive integer;
 - [1d] the first signaling is used for determining scheduling information for the first radio signal;
 - [1e] the scheduling information comprises occupied time-frequency resource, adopted Modulation Coding Scheme (MCS), and subcarrier spacing of subcarriers in occupied frequency domain resource;
 - [1f] the first radio signal carries a paging message;
 - [1g] the frequency domain resource used for transmitting the first signaling belongs to a first subband;
 - [1h] the first subband comprises a positive integer number of consecutive subcarriers in frequency domain; and

¹ The Board refers to Petitioner’s references [1Pre] – [1i] for certain claim limitations. Additional paragraph breaks are added for ease of reference.

[1i] location of the first subband in frequency domain is used for determining the X time intervals.

Ex. 1001, 23:13–29.

E. Prior Art and Asserted Grounds

Petitioner asserts that claims 1–20 would have been unpatentable based on the following grounds:²

Ground	Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1	1, 5, 7, 11, 13, 17, 19, and 23	103	Yeo ³ , TS36 ⁴
2	2–4, 8–10, 14–16, 20–22	103	Yeo, TS36, Mallick, ⁵

II. ANALYSIS

A. Legal Standards

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 before the effective filing date of the claimed invention to a person having ordinary skill in the art to which said subject matter pertains. 35 U.S.C. § 103; *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). “[W]hen a patent claims a structure already known in the prior art that is altered by the mere substitution of one element for another known in the field, the combination must do more than

² Petitioner supports its challenges with a Declaration of Zhi Ding, Ph.D. (Ex. 1003). *See infra*.

³ Ex. 1005, US Patent No. 10,491,447 (Nov. 26, 2019).

⁴ Ex. 1009, 3RD GENERATION PARTNERSHIP PROJECT; TECHNICAL SPECIFICATION GROUP RADIO ACCESS NETWORK; EVOLVED UNIVERSAL TERRESTRIAL RADIO ACCESS (E-UTRA); USER EQUIPMENT (UE) PROCEDURES IN IDLE MODE (Release 14) 3GPP TS 36.304 V14.2.0 (Mar. 2017) (copyright 2017) (“TS36”).

⁵ Ex. 1008, PCT Appl’n Pub. No. WO 2016/13613 A1 (Sept. 1, 2016).

yield a predictable result.” *KSR*, 550 U.S. at 416 (citing *United States v. Adams*, 383 U.S. 39, 50–51 (1966)). The question of obviousness is resolved based on 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 ordinary skill in the art; and (4) when in evidence, objective evidence of non-obviousness. *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 1889, 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 three sections. First, we address the level of ordinary skill in the art. Second, we address claim construction. And third, taking account of the information presented by both parties, we consider and determine for the reasons explained below why the Petition satisfies the threshold requirement for instituting an *inter partes* review under 35 U.S.C. § 314(a).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art at the time of the ’581 patent “would have had 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 and 5G new radio (NR) cellular technology.” Pet. 20 (citing Ex. 1003 ¶¶ 27–30). Petitioner also asserts that “[a]dditional years of experience could substitute for an advanced-level degree (and vice versa).” *Id.* at 21.

Patent Owner does not dispute Petitioner’s proposed level of ordinary skill in the art stating that “[f]or the purposes of this Preliminary Response only, Patent Owner utilizes Petitioner’s proposed level of skill in the art.” Prelim. Resp. 2.

On this record, Petitioner’s proposed level of ordinary skill in the art is not disputed and is consistent with our review and understanding of the technology and descriptions in the ’581 patent and the asserted prior art references. *Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001). For purposes of this Decision, we rely on Petitioner’s proposed level of ordinary skill in the art.

C. *Claim Construction*

Neither party proposes any claim constructions at this stage. Pet. 19–20; Prelim. Resp. 2. Where there is no dispute we conclude that no express interpretation of any claim term is necessary to determine whether to institute an *inter partes* review in this proceeding. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy.’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

D. *Ground 1: Claims 1, 5, 7, 11, 13, 17, 19, and 23 – Alleged Obviousness over Yeo (Ex. 1005), and TS36 (Ex. 1009)*

We have reviewed Petitioner’s cited evidence, including the prior art references and Dr. Ding’s declaration, and find that Petitioner has shown a

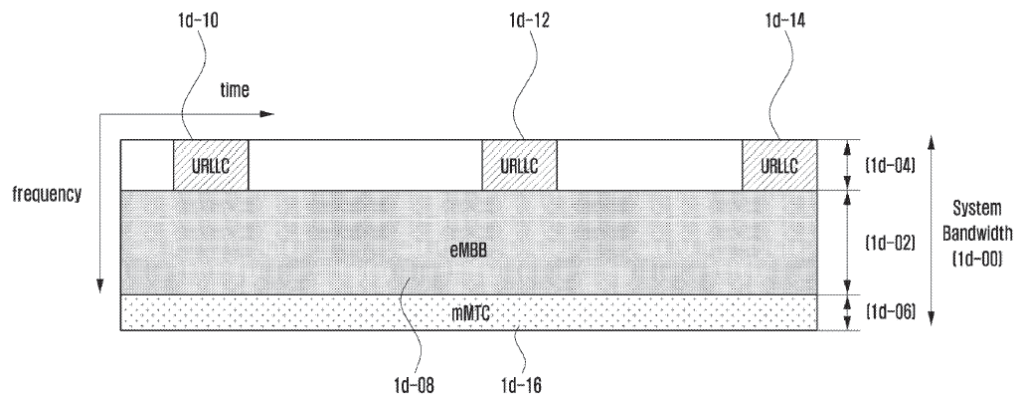
reasonable likelihood of prevailing on its challenge to claim 1 based on Yeo and TS36. Pet. 31–45. In its Preliminary Response, Patent Owner only disputes Petitioner’s arguments regarding limitations [1g] and [1h]. Prelim. Resp. 2–8. We, therefore, address specifically the parties’ arguments with respect to these claim limitations.

1. *Petitioner’s Arguments as to Limitations [1g] and [1h] and the Claimed “first subband”*
 - a) *Limitation [1g] – the frequency domain resource used for transmitting the first signaling belongs to a first subband*

Petitioner argues that Yeo’s PDCCH, configured as P-RNTI, discloses the claimed “first signaling.” Pet. 36. Petitioner contends that because Yeo teaches that the frequency domain identifiers of the PDCCH can be transmitted across the entire system transmission bandwidth, a person of ordinary skill in the art “would have readily understood from this disclosure that the bandwidth for transmitting the PDCCH constitutes or at least renders obvious ‘the frequency domain resource.’” *Id.* at 36–37 (citing Ex. 1003 ¶ 85; Ex. 1005, 13:64–67; Ex. 1006 ¶ 54).

By way of example, Petitioner argues that Yeo describes UEs that support massive machine type communication (mMTC) data transmission which facilitates mass communications among connected devices. *Id.* at 37 (citing Ex. 1005, 29:5–7; Ex. 1006 ¶ 211). According to Petitioner, Yeo’s Figure 1D, reproduced below, illustrates transmission of mMTC within subband (1d-06). *Id.* (citing Ex. 1005, 16:24–36; Ex. 1006 ¶ 168; Ex. 1003, ¶ 86).

FIG. 1D

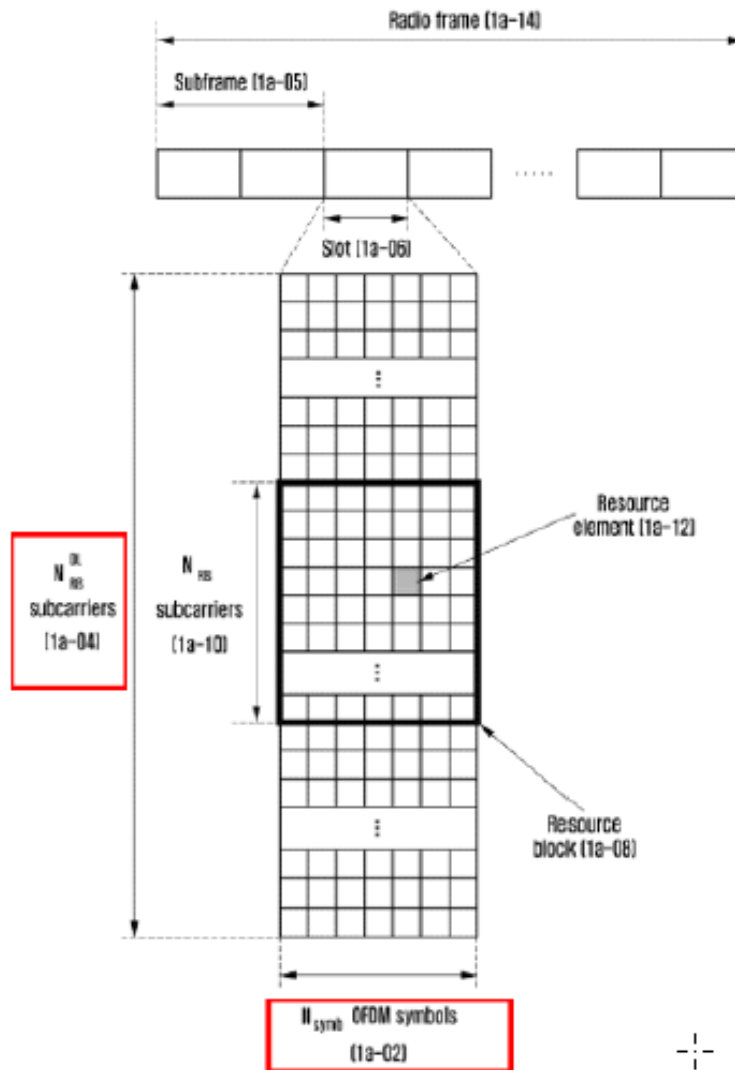


Yeo’s Figure 1D “illustrates a diagram of a state in which the data for eMBB, URLLC, and mMTC are allocated in the frequency-time resources in the communication system.” Ex. 1005, 6:31–33.

- b) *Limitation [1h] – the first subband comprises a positive integer number of consecutive subcarriers in the frequency domain*

Petitioner argues that “Yeo describes that information in a ‘data or a control channel is transmitted’ using ‘a basic structure of a time-frequency domain that is a radio resource region’ as shown in FIG. 1[A] (annotated below).” Pet. 40.

FIG. 1A



Yeo’s Figure 1A, as annotated by Petitioner, highlights the OFDM symbols within a slot of a subframe. *Id.* Petitioner argues that because “the PDCCH is transmitted in a service-specific subband (*see* discussion related to limitation [1g]), a POSITA would have readily understood that the service-specific subband would include the subcarriers associated with the corresponding OFDM symbols.” *Id.* Therefore, Petitioner concludes, “the subcarriers constitute[e] “a positive integer number of consecutive subcarriers in

frequency domain.” *Id.* (citing Ex. 1005, Fig. 1A, 12:35–41; Ex. 1006, Fig. 1a ¶ 60; Ex. 1003 ¶¶ 90–91).

2. *Patent Owner’s Arguments*

Patent Owner argues that the Petition fails to show how Yeo discloses or renders obvious limitations [1g] and [1h] in accordance with 37 C.F.R. § 42.104(b)(3)–(4). Prelim. Resp. 2–8. We address these arguments below.

a) *Whether Petitioner has shown a reasonable likelihood that Yeo discloses or renders obvious claim limitation [1g] “the frequency domain resource used for transmitting the first signaling belongs to a first subband*

Patent Owner argues that “Petitioner admits that Yeo discloses that the alleged frequency domain resource for the PDDCH does not ‘belong to a first subband,’ as required by the claims, and is instead spread over Yeo’s entire system transmission bandwidth.” Prelim. Resp. 7 (citing Pet. 36–37). However, read in context, we understand Petitioner’s argument to be that the specific frequency domain used by the PDCCH, i.e., the “frequency band resource,” is an allocated frequency band within the entire transmission bandwidth. Pet. 37–38 (citing Ex. 1005, 2:13–23, 9:60–10:21, 13:64–67, 16:24–36, 29:5–7; Ex. 1003 ¶¶ 86–88). To this end, Petitioner provides an example in Yeo where the frequency domain for mMTC is, as shown in Figure 1D, defined by subband 1d–06 within system bandwidth 1d–00. Pet. 38–39; *see also* Ex. 1003 ¶ 93 (Dr. Ding testifying that “Yeo also describes—with reference to its FIG. 1D (reproduced above)—dividing the system frequency bands into corresponding subbands for different services, with mMTC occupying subband 1d-06, for example.”) (citing Ex. 1005, 16:24–37).

Overall, we find Petitioner’s evidence, including the disclosure in Yeo and Dr. Ding’s testimony, persuasive as to limitation [1g] based on the evidence and facts before us at this early stage of the proceeding.

b) *Whether Petitioner has shown a reasonable likelihood that Yeo Discloses or Renders obvious Claim Limitation [1h] “the first subband comprises a positive integer number of consecutive subcarriers in the frequency domain”*

Patent Owner argues that “Petitioner relies on cascading levels of POSITA knowledge to allege disclosure of the elements of this limitation.” *Id.* at 5. Patent Owner argues, essentially, that Petitioner has impermissibly relied only on Dr. Ding’s testimony, and say-so, to show that Yeo’s “service-specific subband would include the subcarriers associated with the corresponding OFDM symbols—the subcarriers constituting a positive integer number of consecutive subcarriers in frequency domain.” *Id.* at 6 (quoting Pet. 40) (Patent Owner arguing that “Petitioner impermissibly relies on POSITA knowledge and expert testimony alone to account for missing elements which are not disclosed in the Yeo reference.”) This, however, is not the case.

Petitioner relies initially on the express disclosure of Yeo, namely Figure 1A, illustrating OFDM symbols in a subframe slot with consecutive subcarriers N_{RB} 1a–10 grouped together in the frequency-time domain as physical resource block (PRB) 1a–8. Pet. 40–41 (citing Ex. 1005, Fig. 1A, 12:35–41). In addition, Petitioner asserts that “Yeo describes that DCI is ‘transmitted through the PDCCH,’ . . . and the PDCCH is transmitted in a service-specific subband” as shown and disclosed by Figure 1D. *Id.* at 40 (citing Ex. 1005, 14:1–8). Dr. Ding, who’s testimony is at this early stage un rebutted, explains that a person of ordinary skill in the art “would have

readily understood that the service-specific subband would include the subcarriers associated with the corresponding OFDM symbols – the subcarriers constituting ‘a positive integer number of consecutive subcarriers in frequency domain.’” Ex. 1003 ¶ 90 (citing Ex. 1005, Fig. 1A, 12:35–41; Ex. 1006, Fig. 1a, ¶ 60).

Petitioner is not relying solely on the knowledge of Dr. Ding, but also on his testimony as to what a person of ordinary skill in the art would understand from Yeo’s disclosure. Overall, on this record, we find Petitioner’s evidence, including the disclosure in Yeo and Dr. Ding’s testimony, persuasive as to limitation [1h].

c) Conclusion as to Independent Claim 1

We have considered and find persuasive, at this stage, Petitioner’s arguments and supporting evidence as set forth at pages 31–45 of the Petition with respect to the remaining limitations [1pre]–[1f] and [1i]. Patent Owner does not contest Petitioner’s arguments as to these remaining limitations. Also, Dr. Ding’s testimony is currently un rebutted. Accordingly, we determine that Petitioner has shown a reasonable likelihood that Yeo alone, or the combined teachings of Yeo and TS36 render independent claim 1 obvious.

d) Claims 5, 7, 11, 13, 17, 19, and 23

Patent Owner does not raise any additional arguments specific to claims 5, 7, 11, 13, 17, 19, and 23. *See* Prelim. Resp. 2–8. On this record, we are persuaded that Petitioner has shown a reasonable likelihood of prevailing on its assertion that at least claim 1 is unpatentable over Yeo and TS36, and thus we need not determine at this time whether Petitioner also has shown a reasonable likelihood of prevailing as to any of the other challenged claims. *See supra*, Section II.E.1–2; 37 C.F.R. § 42.108(a).

E. Additional Obviousness Ground

Petitioner contends that claims 2–4, 8–10, 14–16, and 20–22 would have been unpatentable over Yeo, TS36, and Mallick under 35 U.S.C. § 103. Pet. 61–78. Patent Owner focuses its arguments only on limitations [1g] and [1h] in the first ground and does not address this additional ground. *See* Prelim. Resp. *generally*. Given our determination as to claim 1 based on Yeo and TS36 we need not determine at this stage whether Petitioner also has shown a reasonable likelihood of prevailing as to its other asserted grounds. *See* 37 C.F.R. § 42.108(a).

III. CONCLUSION

On this record, we are persuaded that Petitioner demonstrates a reasonable likelihood of prevailing on its challenge that Yeo and TS36 render obvious at least claim 1 of the '581 patent. That said, Petitioner's remaining obviousness challenge based on the Yeo, TS36, and Mallick is best left for trial after full development of the record. 37 C.F.R. § 42.108(c); *SAS Inst. v. Iancu*, 138 S. Ct. 1348, 1359–60 (2018); *see also PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (“Equal treatment of claims and grounds for institution purposes has pervasive support in *SAS*.”). We therefore institute trial on all claims and all challenges included in the Petition.

Our factual findings and determinations at this stage of the proceeding are preliminary, and based on the evidentiary record developed thus far. This is not a final decision as to the patentability of claims for which *inter partes* review is instituted. Our final decision will be based on the record as fully developed during trial.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that *inter partes* review of the '581 patent is hereby instituted as to claims 1–5, 7–11, 13–17, and 19–23 on the grounds set forth in the Petition; and

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

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