

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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SAMSUNG ELECTRONICS CO., LTD.,  
Petitioner,

v.

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.,  
Patent Owner.

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IPR2025-00988  
Patent 10,687,281 B2

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Before KRISTEN L. DROESCH, TERRENCE W. McMILLIN, and  
JON M. JURGOVAN, *Administrative Patent Judges*.

McMILLIN, *Administrative Patent Judge*.

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

## I. INTRODUCTION

### A. *Background and Summary*

Samsung Electronics Co., Ltd., (“Petitioner”)<sup>1</sup> filed a Petition for *inter partes* review of claims 1–14 of U.S. Patent No. 10,687,281 B2 (Ex. 1001, “the ’281 patent”). Paper 2 (“Pet.”), 1. Wilus Institute of Standards and Technology Inc. (“Patent Owner”)<sup>2</sup> filed a Preliminary Response. Paper 10 (“Prelim. Resp.”).

We have authority to determine whether to institute an *inter partes* review. 35 U.S.C. § 314 (2018); 37 C.F.R. § 42.4(a) (2020) (“The Board institutes the trial on behalf of the Director.”). The standard for institution is set forth in 35 U.S.C. § 314(a), which provides that *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.” After considering the Petition and the Preliminary Response, as well as the evidence of record, we institute an *inter partes* review as to claims 1–14 of the ’281 patent.<sup>3</sup>

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<sup>1</sup> Petitioner identifies itself, Samsung Electronics Co., Ltd., as well as Samsung Electronics America, Inc., as the real parties-in-interest to this proceeding. Pet. 91.

<sup>2</sup> Patent Owner identifies itself, Wilus Institute of Standards and Technology Inc., as the real party-in-interest to this proceeding. Paper 7, 1.

<sup>3</sup> Prior to any decision on institution, Patent Owner requested (Paper 8) and Petitioner opposed (Paper 9) discretionary denial. An Order was entered that discretionary denial was not appropriate and the Petition was referred to the Board. Paper 11.

A Decision Denying Institution was entered. Paper 12. Petitioner requested rehearing. Paper 13. A Decision Granting [the] Request for Rehearing was entered that vacated the Decision Denying Institution (Paper 12) and provided “that a decision on whether to institute *inter partes* review

*B. Related Proceedings*

The parties identify the following district court matters related to the '281 patent: *Wilus Institute of Standards and Technology Inc. v. HP Inc.*, No. 2-24-cv-00752 (E.D. Tex.); and *Wilus Institute of Standards and Technology Inc. v. Samsung Electronics Co., Ltd.*, No. 2-24-cv-00746 (E.D. Tex.). Pet. 91; Paper 7, 1–2.

*C. The '281 Patent (Ex. 1001)*

The '281 patent is titled “Wireless Communication Method and Wireless Communication Terminal, Which Use Discontinuous Channel.” Ex. 1001, code (54). The '281 patent seeks to “provide high-efficiency/high-performance wireless LAN communication in a high-density environment” through the efficient signaling of non-contiguous channel allocation. *Id.* at 2:65–67, 5:7–9. In particular, “non-contiguous channel allocation refers to channel allocation in which a band occupied by the transmitted packet (i.e., PPDU [PLCP Protocol Data Unit]) includes at least one non-contiguous channel (or non-contiguous resource unit).” *Id.* at 33:41–46.

In operation, a transmitter may “transmit[] a packet through at least one channel which is idle based on the result of performing the CCA [clear channel assessment] of multiple channels.” Ex. 1001, 33:66–34:1. “[T]he transmitter signals non-contiguous channel allocation information via a non-legacy preamble of the packet,” such that a “receiver decodes the received packet based on the obtained non-contiguous channel allocation information.” *Id.* at 34:1–11. The “packet may be an HE MU [high-

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will be entered in due course.” Paper 14, 6. This is the decision on institution called for in Paper 14.

efficiency multi-user] PPDU,” in which a non-legacy preamble of the PPDU includes “a high efficiency signal A field (HE-SIG-A)” and “a high efficiency signal B field [HE-SIG-B].” *Id.* 34:11–13, 13:44–46, 13:53–59, Fig. 10(b). “[T]he non-contiguous channel allocation information may be signaled via a combination of subfield(s) of the HE-SIG-A and subfield(s) of the HE-SIG-B,” where “[t]he subfield(s) of the HE-SIG-A may signal at least a portion of the non-contiguous channel allocation information, and the subfield(s) of the HE-SIG-B may signal the remaining information.” *Id.* at 39:26–32.

Figure 15 of the '281 patent illustrates the configuration of an HE-SIG-B field, and is reproduced below, along with an enlarged selection showing only Figures 15(a) and 15(b).

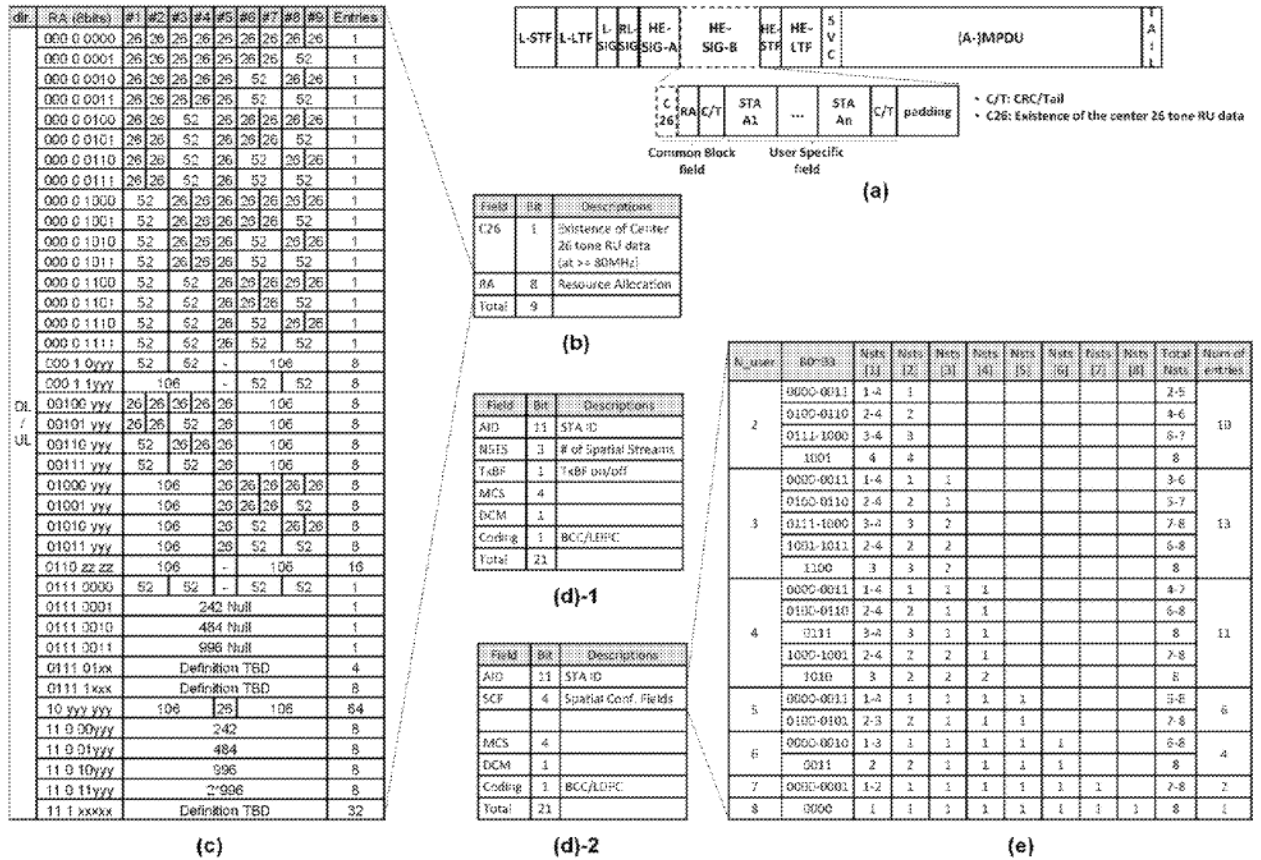
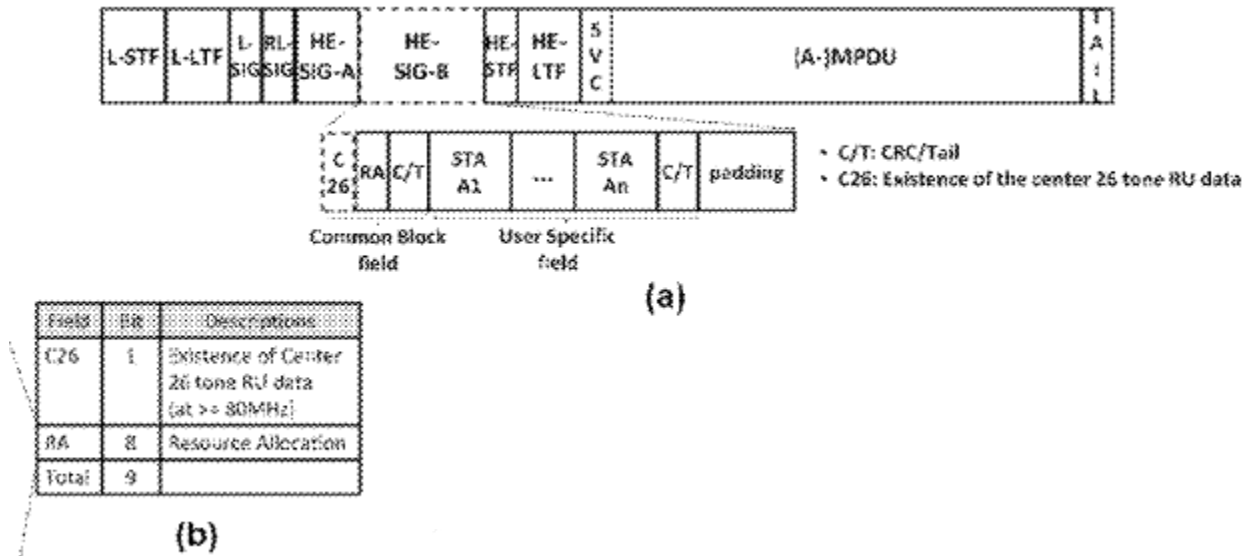


FIG. 15



Figures 15(a) and 15(b)

As shown in Figure 15(a), “the HE-SIG-B consists of a common block field and a user specified field.” Ex. 1001, 21:61–62. “[T]he common block field includes a resource unit allocation (RA) field,” which “contains information on resource unit allocation of a specific bandwidth (e.g., 20 MHz) in the frequency domain.” *Id.* at 21:64–22:3; *see id.* Fig. 15(b). In an embodiment, “in the channel configuration indicated by the bandwidth field of the HE-SIG-A, additional puncturing information may be indicated via the RA field of the HE-SIG-B.” *Id.* at 41:46–49. “Channels in which puncturing is indicated as described above are not assigned to the user.” *Id.* at 42:5–6.

#### *D. Challenged Claims*

Petitioner challenges claims 1–14 (all) of the ’281 patent. Pet. 1. Of the challenged claims, claims 1 and 8 are independent claims. Ex. 1001, 52:48–53:3; 53:40–54:12. Claim 8 recites:

- [8.pre] A wireless communication method of a wireless communication terminal, the method comprising:
- [8.1] receiving a wireless packet;
- [8.2] obtaining bandwidth information indicated via a bandwidth field of HE-SIG-A of the received packet;
- [8.3] obtaining information of an unassigned resource unit via at least one of the bandwidth field of the HE-SIG-A and a subfield of HE-SIG-B of the received packet; and
- [8.4] decoding the received packet based on the bandwidth information and the information of the unassigned resource unit,
- [8.5] wherein the information of the unassigned resource unit is indicated via a combination of the bandwidth field of the HE-SIG-A and a resource unit allocation field of the HE-SIG-B, and
- [8.6] wherein the bandwidth field of the HE-SIG-A indicates channel information to be punctured within the bandwidth,

and the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth.

Ex. 1001, 53:40–54:12.<sup>4</sup> Independent claim 1 is directed to “[a] wireless communication terminal,” and recites “a processor” (limitation [1.1]) and “a communication unit” (limitation [1.2]). Ex. 1001, 52:48–51; Pet. vii.

Limitation [1.3] recites “the processor is configured to” and limitations [1.4]–[1.9] correspond to limitations [8.1]–[8.6]. Ex. 1001, 52:48–54:46; Pet. vii–x. Dependent claims 2–7 depend, directly or indirectly, from claim 1 and dependent claims 9–14 depend, directly or indirectly, from claim 8.

*Id.* Limitations [1.4]–[1.9] and limitations [8.1]–[8.6] use almost the exact same language; and claims 2–7 and claims 9–14 use almost the exact same language.

#### *E. The Asserted Grounds*

Petitioner challenges claims 1–14 of the ’281 patent based on the grounds set forth in the table below.

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<sup>4</sup> We adopt the labelling of the claim limitations as shown in the “Listing of Challenged Claims” in the Petition. *See* Pet. vii–x.

| <b>Claims Challenged</b> | <b>35 U.S.C. §</b> | <b>Reference(s)</b>                      |
|--------------------------|--------------------|------------------------------------------|
| 1–5, 7–12, 14            | 103 <sup>5</sup>   | Josiam <sup>6</sup>                      |
| 1–7, 13                  | 103                | Josiam, Kim <sup>7</sup>                 |
| 1–3, 7–10, 14            | 103                | Bharadwaj <sup>8</sup> , Li <sup>9</sup> |
| 1–5, 7–12, 14            | 103                | Bharadwaj, Li, Chen <sup>10</sup>        |
| 6, 13                    | 103                | Bharadwaj, Li, Kim                       |
| 6, 13                    | 103                | Bharadwaj, Li, Chen, Kim                 |

Pet. 2. Petitioner supports its showing of unpatentability of the challenged claims of the '281 patent with the Declaration of R. Michael Buehrer, Ph.D. (Ex. 1003). Patent Owner has not filed a declaration of a technical expert in this proceeding.

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<sup>5</sup> The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. § 103, and was effective on March 16, 2013. The application for the '281 patent is U.S. Application No. 16/016,520, filed on June 22, 2018, which claims priority, through a PCT application, to a number of Korean applications, the earliest of which was filed on December 24, 2015. Ex. 1001, codes (21), (22), (30), (63), 1:9–28. Because the application for the '281 patent claims an earliest priority date after the effective date of the applicable AIA amendment, the post-AIA version of § 103 applies to the '281 patent.

<sup>6</sup> US 2017/0006608 A1, published Jan. 5, 2017, filed Jun. 24, 2016 (Ex. 1014).

<sup>7</sup> US 2018/0375632 A1, published Dec. 27, 2018, PCT filed Dec. 9, 2016 (Ex. 1018).

<sup>8</sup> US 2017/0181129 A1, published Jun. 22, 2017, filed Dec. 21, 2016 (Ex. 1021).

<sup>9</sup> US 2017/0041171 A1, published Feb. 9, 2017, filed Dec. 26, 2015 (Ex. 1023).

<sup>10</sup> US 2016/0330058 A1, published Nov. 10, 2016, filed Sep. 25, 2015 (Ex. 1025).

## II. OBVIOUSNESS ANALYSIS

### A. *Principles of Law*

Under 35 U.S.C. § 103, “[a] patent for a claimed invention may not be obtained . . . if the differences between the claimed invention and the prior art are such that the claimed invention 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 the claimed invention pertains.” *See KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007) (similar language). The question of obviousness involves resolving 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 when presented (4) objective evidence of non-obviousness (not presented here). *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Further, “there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *See KSR*, 550 U.S. at 418.

### B. *Level of Ordinary Skill in the Art*

Petitioner contends that

[A] person of ordinary skill in the art (“POSITA”) would have had a Bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and at least three years of experience in the research, design or development of wireless communication devices, systems, and/or networks, or the equivalent, as of the Critical Date (for Grounds 1A-1B and 2C-2D) or the Earliest Filing Date (for Grounds 2A-2B).

Pet. 4 (citing Ex. 1003 ¶ 27). Petitioner further contends that “[i]ncreased educational experience can make up for less work experience, and vice versa.” *Id.* “Patent Owner does not dispute this definition except for the

definition of the Critical Date, which Petitioner defined as May 14, 2016,” and “to the extent that Petitioner requires that the required experience and/or education level be acquired by the Critical Date,” “because it is not relevant or needed for someone to be a POSITA.” Prelim. Resp. 9–10.

Determining the level of ordinary skill in the art involves various factors, including the “type of problems encountered in the art; prior art solutions to those 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) (citation omitted). The prior art of record also reflects the level of ordinary skill in the art. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

For purposes of this institution decision, we adopt the assessment offered by Petitioner.<sup>11</sup> It is not materially disputed by the Patent Owner and is consistent with the ’281 patent and the asserted prior art.

### C. Claim Construction

In *inter partes* reviews, the Board construes claims using the same claim construction standard employed in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2023). The “words of a claim ‘are generally given their ordinary and customary meaning,’” as would have been understood by a person of ordinary skill in the art at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). “In determining the meaning of the disputed claim

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<sup>11</sup> No matter how designated in this decision, any determination (except our determination to institute trial) is preliminary and non-binding. We wish to have the full record as developed during trial before rendering any binding determination, finding, or conclusion.

limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–1317).

Petitioner asserts “that no formal claim constructions are necessary.” Pet. 3. “Patent Owner applies the plain and ordinary meaning of the challenged claims.” Prelim. Resp 11.

At this stage, no need exists to expressly construe any claim terms to resolve any dispute between the parties.<sup>12</sup> *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. Asserted Obviousness of Claims 1–5, 7–12, and 14 Based on Josiam*

Petitioner challenges claims 1–5, 7–12, and 14 as being obvious over Josiam. *See* Pet. 9–37. We start our analysis with a discussion of Josiam.

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<sup>12</sup> If either party contends that explicit claim construction is necessary in order to make a final determination whether or not any challenged claim is unpatentable based on the arguments and evidence presented, it should clearly explain why during trial and provide a clear and unambiguous construction with supporting evidence including specifically identifying the challenges, claims, and limitations to which the construction is necessary.

*I. Josiam (Ex. 1014)*

*a. Prior Art Status*

Petitioner contends that the '281 patent is not entitled to a priority date earlier than May 14, 2016.<sup>13</sup> Pet. 7 (“The '281 patent includes only two independent claims, 1 and 8. The subject matter of [1.9] and [8.6] is not supported by the pre-5/14/2016 applications.”). May 14, 2016, is the priority date of the '281 patent that is relied upon in the Petition. Pet. 2. April 27, 2016, is the priority date relied upon for Josiam in the Petition.<sup>14</sup> *Id.*

Petitioner contends that the last limitations of claims 1 and 8 (limitations 1.9 and 8.6) are not adequately disclosed in the Korean applications to which the '281 patent claims priority earlier than May 14, 2016. Pet. 7. The Petition asserts that “[a] POSITA reviewing these documents would not have reasonably concluded that they demonstrate possession of the last limitation of claims 1 and 8, which require that the bandwidth field of HE-SIG-A indicates channel puncturing information and the resource unit allocation field of HE-SIG-B indicates ***additional***

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<sup>13</sup> The '281 patent is based on an application that was filed on June 22, 2018, and published on October 18, 2018. Ex. 1001, codes (22), (65). The application for the '281 patent was a continuation of a PCT application filed on December 26, 2016. *Id.* at code (63). The '281 patent claims priority to eight (8) Korean applications that were filed from December 24, 2015, to July 1, 2016. *Id.* at code (30); *see also id.* at 1:9–28.

<sup>14</sup> Josiam was filed on June 24, 2016, and published on January 5, 2017. Ex. 1014, codes (22), (43). Josiam claims priority to six (6) provisional applications filed between July 1, 2015, and April 27, 2016.

puncturing information.” *Id.* (citing Ex. 1003 (Buehrer Decl.), ¶ 89). In support of this assertion, the Petition provides:

According to Dr. Buehrer, “none of these documents explicitly, implicitly, or inherently discloses using both the bandwidth field of the HE-SIG-A and the resource unit allocation field of the HE-SIG-B to indicate channel puncturing information as the claim elements require.” SAMSUNG-1003, [90]. At best, these documents discuss indicating unused channels using either HE-SIG-A or HE-SIGB fields—but not both. SAMSUNG-1003, [91] (discussing SAMSUNG-1010, [278], [288], which state that the “BW subfield of HE-SIG-A indicates *only the BW of the entire PPDU*”). The pre-5/14/2016 filings are similarly lacking for claims 6-7 and 13-14, which recite more specific requirements for the puncturing information (e.g., indicating which channel(s) is punctured) already unsupported by SAMSUNG-1006 to SAMSUNG-1010. *Id.*, [89], [90].

*Id.* 7–8. The issue of whether Josiam is prior art turns on whether a pre-May 14, 2016, Korean application adequately discloses “the bandwidth field of the HE-SIG-A indicates channel information to be punctured within the bandwidth, and the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth” as identically recited in limitations 1.9 and 8.6 of the ’281 patent.

Patent Owner argues that Petitioner is incorrect about the ’281 patent priority date and Josiam being prior art. Prelim. Resp. 12–15. The Preliminary Response states:

The ’281 Patent is supported by at least its earlier filed Korean application, **KR10-2016-0004471 (the “KR’447 Application”;** Ex. 1007), filed on January 13, 2016 **and KR10-2016-0026683 (the “KR’683 Application”;** Ex. 1009) filed on March 4, 2016. ’281 Patent at pg. 1. Both provisional

applications predate the purported priority dates of Josiam and Kim, on April 27, 2016 and March 23, 2016 respectively. Petition at 2 (Petitioner contends that Josiam and Kim are entitled to a priority date of April 27, 2016, and March 23, 2016, respectively).

*Id.* at 12–13 (emphasis added) (footnote omitted). Patent Owner argues:

Element 8.5<sup>[15]</sup> recites “wherein the bandwidth field of the HE-SIG-A indicates channel information to be punctured within the bandwidth, and the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth.” ’281 Patent, Claim 8. This element is at least supported by FIG. 17, paragraphs 159-164 of the KR ’447 Application (Ex. 1007). Ex. 1007 (KR ’447 Application) at FIG. 17, ¶¶ <159>-<164>; *see also id.* at ¶¶ <150>-<151>.

The KR ’447 Application discusses how to signal non-contiguous PPDU transmission throughout the specification. One example way of signaling through the bandwidth field in HE-SIG-A plus HE-SIG-B which further specifies where the unassigned resource is given the punctured channel. For example, the KR ’447 application discloses that “the BW bit field in HE-SIGA signals the bandwidth in the form of 20+S40, and HE-SIG-B, which contains the information for (A, C, D) bands.” **Ex. 1007 (KR ’447 Application)** at ¶<160>.

The KR’447 Application also discloses the resource allocation field in HE-SIG-B which is a field with 8 bits indicating “OFDMA frequency division allocation information for the corresponding bandwidth.” **Ex. 1007 (KR’447 Application)** at ¶ <96>. KR ’683 Application provides an example, where “[t]he Resource Allocation information may include an x-Null indicator, which signifies that a user is either not allocated in a particular frequency band or allocated but not

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<sup>15</sup> Patent Owner repeatedly refers to “element 8.5” in this section of the Preliminary Response. However, the quoted limitation is the last limitation of independent claim 8, limitation 8.6. The last limitation of independent claim 1, limitation 1.9, is identical to limitation 8.6.

transmitting user information over the SIG-B transmission channel. The x-Null indicator can have specific bandwidth-based indicators such as 242 Null (20MHz/242SC (subcarriers)), 484 Null (40MHz/484SC), and 996 Null (80MHz/996SC), or it may have a multi-purpose Null indicator.” **Ex. 1009 (KR ’683 Application)** at ¶ <93>.

*Id.* at 14–15 (emphasis added). The cited passages in Exhibits 1007 (KR’447 Application) and Exhibit 1009 (KR ’683 Application) do not support Patent Owner’s argument that any of the provisional applications from which the ’281 patent claims priority disclose all the elements of either limitation 1.9 or limitation 8.6.

Patent Owner contends that “[t]his element is at least supported by FIG. 17, paragraphs 159-164 of the KR ’447 Application (Ex. 1007). Ex. 1007 (KR ’447 Application) at FIG. 17, ¶¶ <159>-<164>; *see also id.* at ¶¶ <150>-<151>.” Prelim. Resp. 13–14. Cited Figure 17 is reproduced below.

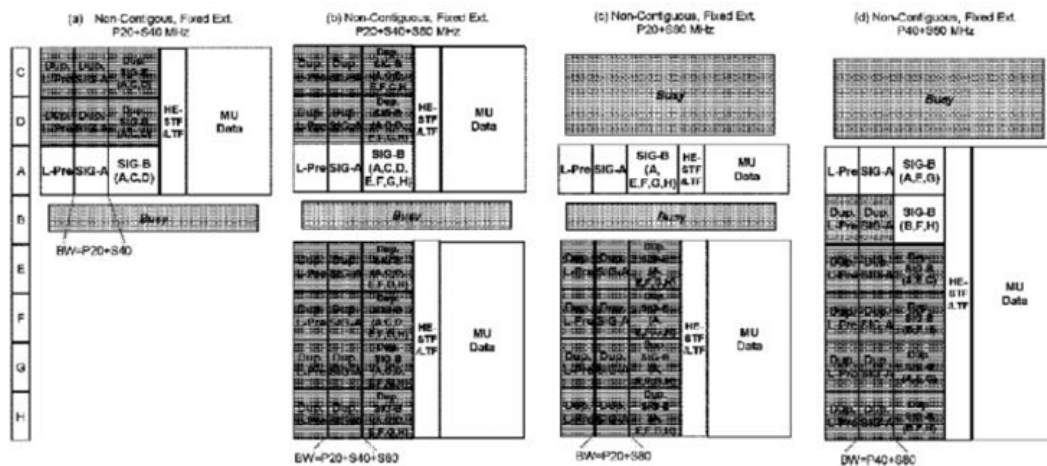


FIG. 17

Figure 17 depicts “methods for configuring HE-SIG-B when transmitting an HE PPDU using a Non-Contiguous, Fixed Extension scheme.” Ex. 1007, 11. The cited paragraphs 159–164 of Exhibit 1007 provide:

FIG. 17 illustrates methods for configuring HE-SIG-B when transmitting an HE PPDU using a Non-Contiguous, Fixed Extension scheme according to an embodiment of the present invention.

FIG. 17(a) depicts a scenario where an HE MU PPDU is transmitted over the entire 80MHz bandwidth while excluding the Secondary 20MHz band, utilizing only the Primary 20MHz and Secondary 40MHz channels. In this case, the BW bit field in HE-SIG-A signals the bandwidth in the form of P20+S40, and HE-SIG-B, which contains the information for (A, C, D) bands, is repeatedly transmitted over each available 20MHz channel. This approach reallocates the role of HE-SIG-B in the Secondary 20MHz band to the Primary 20MHz channel since the Secondary 20MHz channel is unavailable. FIG. 17(b) illustrates a scenario where an HE MU PPDU is transmitted over the entire 160MHz bandwidth while excluding the Secondary 20MHz band, utilizing only the Primary 20MHz, Secondary 40MHz, and Secondary 80MHz channels. In this case, the BW bit field in HE SIG-A signals the bandwidth in the form of P20+S40+S80, and HE-SIG-B (A, C, D, E, F, G, H), containing information for the (A, C, D, E, F, G, H) bands, is repeatedly transmitted over each available 20MHz channel. This approach reallocates the role of HE-SIG-B in the Secondary 20MHz band to the Primary 20MHz channel since the Secondary 20MHz channel is unavailable. FIG. 17(c) illustrates a scenario where an HE MU PPDU is transmitted over the entire 160MHz bandwidth while excluding both the Secondary 20MHz and Secondary 40MHz bands, utilizing only the Primary 20MHz and Secondary 80MHz channels. In this case, the BW bit field in HE-SIG-A signals the bandwidth in the form of P20+S80, and HE-SIG-B, containing information for the (A, E, F, G, H) bands, is repeatedly transmitted over each available 20MHz channel. This approach reallocates the role of HE-SIG-B in the Secondary 20MHz band to the Primary 20MHz channel since the Secondary 20MHz channel is unavailable.

FIG. 17(e) illustrates a scenario where an HE MU PPDU is transmitted over the entire 160MHz bandwidth while excluding the Secondary 40MHz band, utilizing only the

Primary 40MHz and Secondary 80MHz channels. In this case, the BW bit field in HE-SIG-A signals the bandwidth in the form of P40+S80, and HE-SIG-B contains information for the (A, E, G) bands and the (B, F, H) bands separately. These are transmitted alternately as HE-SIG-B (A, E, G) and HE-SIG-B (B, F, H) over each Primary 20MHz channel, each Secondary 20MHz channel, and every subsequent 20MHz channel in an alternating manner. Unlike FIGS. 17(a),(b), and(c), in this case, the Secondary 20MHz channel is available, so the role of HE-SIG-B is not reallocated to the Primary 20MHz channel.

Such variable configurations of HE-SIG-B can all be recognized through the BW field in HE-SIG-A. In this case, the BW field in HE-SIG-A signals one of the following configurations: P20, P40, P80, P160 (80+80), P20+S40, P20+S40+S80, P20+S80, or P40+S80.

Ex. 1007, 39–41. We can find no reference to the “resource unit allocation field of the HE-SIG-B” as recited in limitations 1.8 and limitations 8.5 in these passages. Patent Owner does not explain, and we do not discern, how or why these passages in Exhibit 1007 teach or suggest that “the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth” as recited in limitations 1.9 and 8.6.

With regard to the “resource unit allocation field of the HE-SIG-B” (and as also quoted above), Patent Owner argues:

**The KR’447 Application** also discloses the resource allocation field in HE-SIG-B which is a field with 8 bits indicating “OFDMA frequency division allocation information for the corresponding bandwidth.” **Ex. 1007 (KR’447 Application)** at ¶ <96>. **KR ’683 Application** provides an example, where “[t]he Resource Allocation information may include an x-Null indicator, which signifies that a user is either not allocated in a particular frequency band or allocated but not transmitting user information over the SIG-B transmission channel. The x-Null indicator can have specific bandwidth-

based indicators such as 242 Null (20MHz/242SC (subcarriers)), 484 Null (40MHz/484SC), and 996 Null (80MHz/996SC), or it may have a multi-purpose Null indicator.” **Ex. 1009 (KR ’683 Application) at ¶ <93>.**

Prelim. Resp. 14–15 (emphasis added). In an attempt to show that the “resource allocation unit” elements of limitations 1.9 and 8.6 are disclosed in the Korean applications, Patent Owner cites two different documents, Exhibit 1007 (KR’447 Application) and Exhibit 1009 (KR ’683 Application). *See id.* The cited paragraph 96 of Exhibit 2007 provides:

The HE-SIG-B may be present in an HE MU PPDU and contains information necessary for receiving a Multi-User PPDU. This information is classified into Common Info and User-Specific Info. The detailed configuration of HE-SIG-B is illustrated in FIG. 8(a). The RA (Resource Allocation) information, which contains the OFDMA frequency division allocation information for the corresponding bandwidth, is included, along with a CRC/Tail field to ensure integrity. The RA field is 8 bits in length and is structured as shown in FIG. 8(b). By analyzing the RA information, it is possible to determine how many STA-specific information elements are included. The STA specific information is transmitted in pairs along with the CRC/Tail field. If three STA-specific information elements are transmitted, the CRC/Tail field is separately appended to the first two STA information elements, while the third STA information element has its own CRC/Tail field. ***The STA-specific information is transmitted as a 21-bit field when the STA is an OFDMA STA, as illustrated in FIG. 8(c)-1, and when the STA is an MU-MIMO STA, the STA-specific information is also conveyed as a 21-bit field, as shown in FIG. 8(c)-2.***

Exhibit 2007, 27 (emphasis added). The cited paragraph 93 of Exhibit 1009 provides:

The HE-SIG-B may be present in an HE MU PPDU and contains information necessary for receiving a Multi-User

PPDU. This information is classified into Common Info and User-Specific Info. The detailed configuration of HE-SIG-B is illustrated in FIG. 8(a). The RA (Resource Allocation) information, which contains the OFDMA frequency division allocation information for the corresponding bandwidth, is included, along with a CRC/Tail field to ensure integrity. The RA field is 8 bits in length and is structured as shown in FIG. 8(b). By analyzing the RA information, it is possible to determine how many STA-specific information elements are included. The STA specific information is transmitted in pairs along with the CRC/Tail field. If three STA-specific information elements are transmitted, the CRC/Tail field is separately appended to the first two STA information elements, while the third STA information element has its own CRC/Tail field. ***The Resource Allocation information may include an x-Null indicator, which signifies that a user is either not allocated in a particular frequency band or allocated but not transmitting user information over the SIG-B transmission channel. The x-Null indicator can have specific bandwidth-based indicators such as 242 Null (20MHz/242SC (subcarriers)), 484 Null (40MHz/484SC), and 996 Null (80MHz/996SC), or it may have a multi-purpose Null indicator.***

Ex. 1009, 29 (emphasis added). As can be readily appreciated from these paragraphs, the material quoted by Patent Owner from Exhibit 1009 (Prelim. Resp. 14–15) to establish that “the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth” as recited in limitations 1.9 and 8.6 is disclosed does not appear in Exhibit 1007.

Patent Owner relies on citations to two separate documents (Exhibit 1007 and Exhibit 1009) to support its contention that all the elements of limitations 1.9 and 8.6 are disclosed. The necessity of relying on two documents to show the disclosure of these limitations belies a

contention that either of the cited documents alone discloses all the elements of these limitations. And, the disclosure relied on in Exhibit 1007 is not alleged to be found in Exhibit 1009 and vice-versa. Patent Owner has not shown that any of the pre-May 14, 2016, Korean applications from which the '281 claims priority includes disclosure of all the elements recited in limitations 1.9 and 8.6.

At least at this stage, we determine that Petitioner has sufficiently shown, for the purpose of institution that Josiam is prior art.<sup>16</sup> We credit the testimony of Dr. Buehrer cited in the Petition that none of the Korean applications to which the '281 patent claims priority filed earlier than May 14, 2016, “explicitly, implicitly, or inherently discloses using both the bandwidth field of the HE-SIG-A and the resource unit allocation field of the HE-SIG-B to indicate channel puncturing information as the claim elements require. . . . At best, these documents discuss indicating unused channels using either HE-SIG-A or HE-SIGB fields—but not both.” Pet. 7 (citing Ex. 1003 (Buehrer Decl.) ¶¶ 90–91). Dr. Buehrer’s testimony has not been shown by Patent Owner to be inaccurate.

*b. Summary*

Josiam is titled “Methods to Enable Efficient Wideband Operations in Local Area Networks Using OFDMA.” Ex. 1014, code (54). Josiam relates to “operating an access point (AP) in a wireless local area network (WLAN),” including “identifying a bandwidth of an orthogonal frequency

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<sup>16</sup> As Patent Owner relies on the same arguments in support of its contention that Kim is not prior art (*see* Prelim. Resp. 12), the same analysis and conclusion apply to Patent Owner’s argument regarding Kim. We determine that Petitioner has sufficiently shown for the purpose of institution that Kim is prior art.

division multiple access physical protocol data unit (OFDMA PPDU) by at least one of a primary channel or at least one secondary channel, and nulling a plurality of tones of OFDMA PPDU for the at least one secondary channel sensed busy.” *Id.* at code (57). In operation, Josiam’s AP

transmit[s], to a station (STA), a bandwidth signaling sub-field in high efficiency signal-A (HE-SIG-A) field included in a high efficiency multi-user PPDU (HE MU PPDU) indicating availability of at least one content channel, wherein the at least one content channel of high efficiency signal-B (HE-SIG-B) field on the downlink signal include[es] a primary channel and one or more secondary channels that comprise a plurality of OFDMA PPDU.

*Id.* ¶ 8.

Josiam discloses that “[i]n some embodiments, when a segment of the bandwidth is sensed busy, the RUs [(resource units)] spanning the channel sensed busy are unused and left empty.” Ex. 1014 ¶ 139. In such case, “[t]he channel sensed busy and nulled can be indicated in the physical layer convergence packet preamble,” where “[o]nce the unused channel is indicated, the RUs to be nulled are implicit as are RUs that are to be used in the transmission of the OFDMA PPDU.” *Id.* ¶ 151. For example, Figure 14 “illustrates an example PPDU transmission with a 60 MHz non-contiguous occupation in an 80 MHz PPDU,” and is reproduced below. *Id.* ¶ 152.

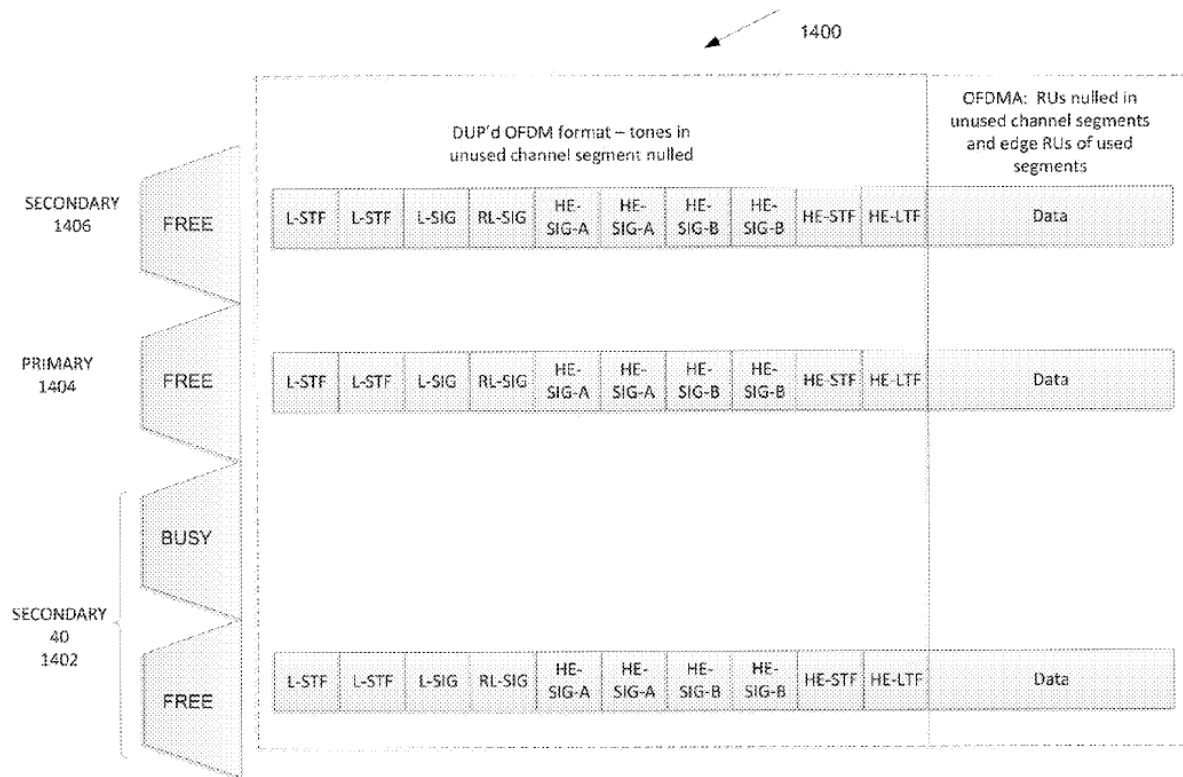


FIG. 14

As shown in Figure 14, “PPDU transmission 1400 comprises a secondary 40 channel 1402, a primary channel 1404, and a secondary channel 1406,” where “the secondary 40 channel 1402 comprises FREE and BUSY, and the primary channel 1404 and the secondary channel 1406 are FREE.” *Id.*

¶ 153. Because “[t]he bandwidth signaling in HE-SIG-A is constrained in bit width to indicate all combinations of used/unused 20 MHz segments in the PPDU bandwidth,” “[i]n some embodiments, the signaling between HE-SIG-A and HE-SIG-B may be split, specifically using the RU signaling field of the HE-SIG-B common field.” *Id.* ¶ 156.

In an example, “the bandwidth signaling sub-field in HE-SIG-A field of a HE-multi-user (MU) PPDU indicates both the PPDU bandwidth being used for OFDMA and availability of the HE-SIG-B content channels.” *Ex.*

1014 ¶ 163. In this example, “[t]he bandwidth and the content channel indication together tell the STA where the signaling for the OFDMA resource units is carried in the HE-SIG-B,” and “[t]he signaling for both used and unused portions is carried in the HE-SIG-B common portion.” *Id.* ¶ 164.

## 2. *Analysis of Independent Claims 1 and 8*

Petitioner provides a showing that independent claims 1 and 8 would have been obvious in view of Josiam. Pet. 9–37. Patent Owner argues that Josiam does not disclose the last limitation of claims 1 and 8 (limitations 1.9 and 8.6). Prelim. Resp. 15–18.

As shown above (Section I.D.), claim 1 is directed to a “wireless communication terminal” and claim 8 is directed to “a wireless communication method.” “[T]erminal” claim 1 has “processor” and “communication unit” limitations that are not recited in “method” claim 8. Other than these two limitations (“processor” and “communication unit”), the limitations in claims 1 and 8 are nearly identical and recite the same elements. As claim 8 has fewer limitations, we begin our analysis with claim 8.<sup>17</sup>

### *a. Independent Claim 8*

[8.pre] *A wireless communication method of a wireless communication terminal, the method comprising:*

Petitioner asserts “[t]o the extent the preamble is limiting, Josiam describes a method of ‘transmitting to a station (STA), a bandwidth signaling sub-field in high efficiency signal-A (HE-SIG-A) field included in a high efficiency multi-user PPDU (HE MUPPDU).’” Pet. 10–11 (citing Ex.

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<sup>17</sup> The Petition also discusses claim 8 (Pet. 10–25) prior to discussing claim 1 (*id.* at 35–37).

1003 (Buehrer Decl.) ¶ 159; Ex. 1014 (Josiam), code (57) (Abstract)).

Petitioner does not take a position as to whether the preamble is limiting.

*See id.*

Patent Owner does not dispute the showing as to the preamble or take a position as to whether the preamble is limiting. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that the preamble of claim 1 is taught by Josiam.

[8.1] *receiving a wireless packet;*

Petitioner contends:

Josiam teaches receiving a wireless packet (HE PPDU). SAMSUNG-1014, Abstract, [0006], [0264]-[0267], Fig. 38, claim 1; SAMSUNG-1003, [160]. For example, Josiam discloses “a station (STA) in a wireless local area network (WLAN) is provided. The STA includes a transceiver configured to receive, from an access point (AP), a bandwidth signaling sub-field in high efficiency signal-A (HE-SIG-A) field included in a high efficiency multi-user PPDU (HE MU PPDU) indicating availability of at least one content channel.” SAMSUNG-1014, [0006]. A POSITA would have understood that a PPDU is a wireless packet. SAMSUNG-1003, [160]; SAMSUNG-1023, [0015]; SAMSUNG-1046, 6:29-49; SAMSUNG-1001, 34:11-13 (“the received wireless packet may be an HE MU PPDU”).

Pet. 11. The contention that Josiam (Ex. 1014) teaches this limitation is well-supported.

Patent Owner does not dispute the showing for this limitation. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that this limitation is taught by Josiam.

[8.2] *obtaining bandwidth information indicated via a bandwidth field of HE-SIG-A of the received packet;*

Petitioner contends:

Josiam teaches obtaining bandwidth information (PPDU bandwidth) indicated via a bandwidth field of HE-SIG-A of the received packet (HE PPDU). SAMSUNG-1014, Abstract, [0006], [0154]-[0156], [0264]-[0267], Figs. 13, 38, Claim 1; SAMSUNG-1003, [161]-[162]. For example, Josiam teaches an HE MU PPDU including, among other fields, HE-SIG-A and HE-SIG-B fields. *Id.*

....

Josiam teaches that the HE-SIG-A includes a bandwidth field that indicates the PPDU bandwidth. SAMSUNG-1014, [0154]-[0155], [0161]-[0165]. For example, a station “may use the *indication in the bandwidth field signaled in the HE-SIG-A to decipher* both the *bandwidth of the PPDU* and the location of the content channel that it may decode in the HE-SIG-B.” SAMSUNG-1014, [0161].

Pet. 11–12. The contention that Josiam (Ex. 1014) teaches this limitation is well-supported.

Patent Owner does not dispute the showing for this limitation. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that this limitation is taught by Josiam.

[8.3] *obtaining information of an unassigned resource unit via at least one of the bandwidth field of the HE-SIG-A and a subfield of HE-SIG-B of the received packet; and*

The entire presentation in the Petition with regard to this limitation provides, “[f]or similar reasons to those discussed in [8.5], Josiam renders obvious that information of an unassigned resource unit is indicated via a combination of the bandwidth field of the HE-SIG-A and a resource unit

allocation field in the HESIG-B common field (“subfield of HE-SIG-B”).  
*See* [8.5].” Pet. 12 (emphasis added).

Patent Owner does not dispute the showing for this limitation or the showing for limitation 8.5. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that this limitation is rendered obvious by Josiam.

[8.4] *decoding the received packet based on the bandwidth information and the information of the unassigned resource unit,*

Petitioner argues, “Josiam renders obvious decoding the received packet based on the PPDU bandwidth (‘bandwidth information’) and the information of the unassigned resource unit.” Pet. 12 (citing Ex. 1003 (Buehrer Decl.) ¶¶ 164–175). With regard to “*decoding the received packet based on the bandwidth information,*” the Petition provides:

Josiam teaches decoding a received PPDU (“wireless packet”). SAMSUNG-1003, [165]; SAMSUNG-1014, [0161] (“STA may use the indication in the bandwidth field signaled in the HE-SIG-A to decipher both the bandwidth of the PPDU and the location of the content channel that it may decode in the HE-SIGB.”), [0164].

A POSITA would have understood that a received PPDU is decoded based on the PPDU bandwidth. SAMSUNG-1003, [166]-[171]; SAMSUNG-1014, [0161], [0164]. For example, Josiam teaches that the PPDU bandwidth is used to determine the length of the HE-SIG-B common field (specifically, the number of resource unit allocation fields) of the PPDU. SAMSUNG-1014, [0285]-[0287] (“***The number of RU allocation sub-fields in the HE-SIG-B common block field depends on the total PPDU bandwidth.***”). Additionally, Josiam teaches that the PPDU bandwidth indicates the overall OFDMA tone plan (e.g., possible RU arrangements, guard tone locations, DC tone locations) of the PPDU. SAMSUNG-1014, [0133]-[0150], [0249]-[0263], Figs. 9-13, 35-37 (illustrating different OFDMA tone plans for different PPDU bandwidths).

Additionally, a POSITA would have understood that the PPDU bandwidth informs a receiving station to which channels it should tune its receiver to receive the PPDU. SAMSUNG-1003, [167]-[168]; SAMSUNG-1023, [0027]; SAMSUNG-1031, 3-5; SAMSUNG-1034, 9; SAMSUNG-1040, 9. Based on Josiam's teachings relating to the use of the PPDU bandwidth of the PPDU, a POSITA would have understood that the PPDU is decoded based on the PPDU bandwidth—specifically, the information it provides (e.g., length of the HE-SIG-B common field, the overall OFDMA tone plan, which channels to use to receive the PPDU). SAMSUNG-1003, [171].

*Id.* at 13–14. This argument and the cited evidence support a determination that Josiam teaches, “*decoding the received packet based on the bandwidth information.*”

With regard to “*decoding the received packet based on . . . the information of the unassigned resource unit,*” the Petition provides:

Josiam also renders obvious that a received PPDU (“wireless packet”) is decoded based on the information of an unassigned RU (e.g., nulled RU). SAMSUNG-1003, [172]-[175]; *see* [8.5]. For example, a POSITA would have understood that a station decodes a received PPDU based on its RU assignment. SAMSUNG-1003, [172]-[173]; SAMSUNG-1025, [0101]-[0103], Fig. 17; SAMSUNG-1021, [0101]; SAMSUNG-1031, 4-5.

Specifically, Josiam teaches that a station determines its RU assignment by comparing the position of a user-field that matches its station ID to the RU arrangement indicated by the 8-bit RU allocation subfield. SAMSUNG-1014, [0279]-[0289]; *see* SAMSUNG-1025, [0090]-[0093], Figs. 12-14. In PPDUs larger than 40MHz, user fields are split between the HE-SIG-B content channels. SAMSUNG-1014, [0286]-[0287]. When a RU is nulled (unassigned), a POSITA would have recognized two options for adjusting the HE-SIG-B user-specific field in response to a nulled RU. SAMSUNG-1003, [174]-[175].

First, a POSITA would have understood that no user fields corresponding to the nulled RU may be transmitted.

SAMSUNG-1003, [174]; SAMSUNG-1014, [0294]-[0296]; SAMSUNG-1025, [0089]-[0093], Figs. 12-14; SAMSUNG-1028, 13 (“***no STA-specific information field assigned by the RU allocation subfield***”). In this case, a receiving station would adjust the alignment between its position in the user-specific field and the RU arrangement information based on the information of an unassigned RU as part of decoding a received PPDU. SAMSUNG-1003, [174]; SAMSUNG-1014, [0294]-[0296]; SAMSUNG-1025, [0089]-[0093], Figs. 12-14.

Second, a POSITA would have understood that a null or unassigned station ID may be included in the user field corresponding to the unassigned RU. SAMSUNG-1003, [175]; SAMSUNG-1014, [0304]-[0306]; SAMSUNG-1025, [0089]-[0093], Figs. 12-14; SAMSUNG-1032, 14; §III.A.5. Here, too, a POSITA would have understood that a receiving station uses the information of an unassigned RU to decode a received PPDU by skipping over the user field corresponding to the unassigned RU, and thus not attempt to decode the data in that RU. *Id.*

*Id.* at 13–14. This argument and the cited evidence support a determination that Josiam teaches, “*decoding the received packet based on . . . the information of the unassigned resource unit.*”

Patent Owner does not dispute the showing for this limitation. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that this limitation is rendered obvious by Josiam.

[8.5] *wherein the information of the unassigned resource unit is indicated via a combination of the bandwidth field of the HE-SIG-A and a resource unit allocation field of the HE-SIG-B, and*

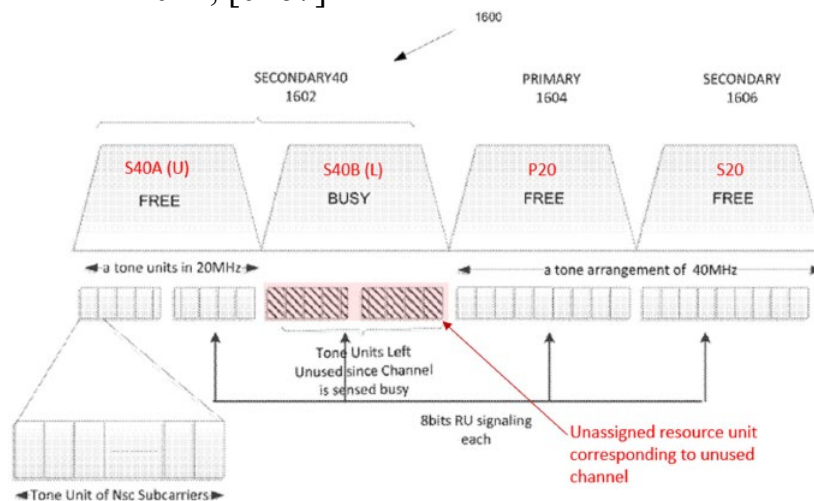
Petitioner contends that Josiam renders this limitation obvious.

Pet. 15–20 (citing Ex. 1003 (Buehrer Decl.) ¶¶ 176–183; Ex. 1014 (Josiam))

¶¶ 138–151, 154–168, 250–287, 304, Figs. 10–13, 16; Ex. 1017, 8; Ex. 1032, 11–15; Ex. 1045, 11–17). The Petition provides:

Josiam teaches indicating null channel information via the bandwidth field of HE-SIG-A and the RU signaling field in the HE-SIG-B common field. SAMSUNG-1003, [176]-[180]; SAMSUNG-1014, [0155]-[0168]; *see* [8.6]. Josiam teaches that information of a null channel indicates information of an unassigned RU corresponding to the nulled channel because the RUs that fall under the channel segment left unused are not assigned to any user (nulled). SAMSUNG-1003, [176]; SAMSUNG-1014, [0139], [0151], [0154]; SAMSUNG-1017, 8 (*“Resource units of OFDMA that full [sic] under the channel segment left unused are nulled. The nulling is always in units of resource units and not smaller.”*); *see* SAMSUNG-1032, 11-15; SAMSUNG-1045, 11-17.

For example, Dr. Buehrer explains that information of an unassigned RU may be indicated by the bandwidth field of HE-SIG-A indicating an 80MHz transmission and the number and location of the HE-SIG-B content channels. SAMSUNG-1003, [177]; SAMSUNG-1014, [0155]-[0168]; *see* [8.6]. In a RU allocation field corresponding to a punctured channel (e.g., S40B in the illustration below), the 8-bit RU signaling information may signal that the punctured channel is unoccupied *“by signaling an unused 242-tone RU.”* SAMSUNG-1014, [0167].



SAMSUNG-1014, Fig. 16 (annotated)

Josiam also renders obvious the information of an unassigned RU corresponding to a punctured channel is indicated via a combination of the bandwidth field of HE-SIG-A and the resource allocation field in the HE-SIG-B common field. SAMSUNG-1003, [178].

For example, Josiam teaches that a receiving station determines the number and arrangement of the RU allocation fields based on the total PPDU bandwidth (indicated by the bandwidth field), and a resource unit allocation field indicates a null 242-tone RU corresponding to a nulled channel within the PPDU bandwidth indicated by HE-SIG-A. SAMSUNG-1014, [0285]-[0287]. As another example, Josiam teaches that the bandwidth field of HE-SIG-A indicates the number, location, and length (number of resource unit allocation fields) of the HE-SIG-B content channels, which may contain a resource unit allocation field that indicates a null 242-tone RU corresponding to a nulled channel within the PPDU bandwidth indicated by HE-SIG-A. SAMSUNG-1014, [0155]-[0168], [0285]-[0287]; *see* [8.4], [8.6]. This mapping is consistent with Patent Owner's infringement contentions. SAMSUNG-1003, [179].

Moreover, Josiam teaches that, e.g., when S20 and/or S40B is punctured, the information of the punctured channel is indicated by *both* the bandwidth field of HE-SIG-A and the resource unit allocation field of HE-SIG-B. SAMSUNG-1014, [0167].

*Id.* at 15–18. The contention that Josiam teaches or renders obvious this limitation is well-supported.

Patent Owner does not dispute the showing for this limitation. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that this limitation is taught or rendered obvious by Josiam.

[8.6] wherein the bandwidth field of the HE-SIG-A indicates channel information to be punctured within the bandwidth, and the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth.

Petitioner contends Josiam teaches all the elements of this limitation. Pet. 21–25 (citing Ex. 1003 (Buehrer Decl.) ¶¶ 184–192; Ex. 1014 (Josiam) ¶¶ 134–139, 154–168, Figs. 14, 15, Table 1; Ex. 1017, 13–15, Ex. 1031, 4–5, Ex. 1045, 11–17). The Petition provides:

Josiam teaches a method for indicating whether one or more 20MHz channel segments that comprise an 80MHz or larger PPDU cannot be used because the channels are busy by nulling the RU corresponding to the busy channel. SAMSUNG-1014, [0134]-[0139]; SAMSUNG-1003, [184]-[192]. A POSITA would have understood that the channels indicated as unused within the PPDU bandwidth correspond to the claimed “channel information to be punctured” and “puncturing information.” SAMSUNG-1003, [184]; SAMSUNG-1001, 42:5-15; SAMSUNG-1030, 211; SAMSUNG-1031, 4-5; SAMSUNG-1045, 11-17.

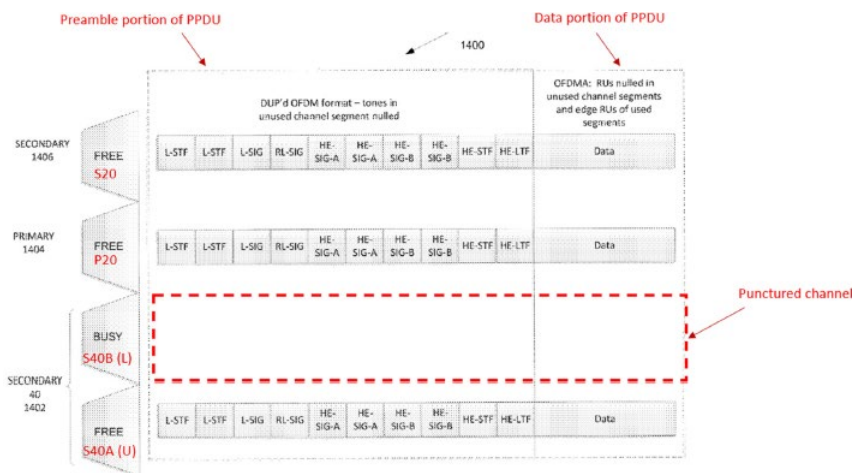


FIG. 14

SAMSUNG-1014, Fig. 14 (annotated)

*Id.* at 21. Petitioner contends that “puncturing” as used in limitation 8.6 would be understood by a skilled artisan to mean “that a certain channel within the PPDU bandwidth is not used, and thus the group of tones (resource unit) corresponding to the punctured channel is nulled (not transmitted nor assigned to any user).” *Id.* at 67 (citing Ex. 1003 (Buehrer Decl.) ¶ 235]; Ex. 1014 (Josiam) ¶¶ 0139, 154; Ex. 1021 ¶¶ 130–132, 138–142; Ex. 1023 ¶¶ 26, 34, 35, 51, 57, 71; Ex. 1030, 15; Ex. 1031, 4-5; Ex. 1032, 11-15; Ex. 1036, 13-15; Ex. 1045, 11-17).

Patent Owner disputes the showing for this limitation. Prelim. Resp. 15–18. The dispute between the parties relates to whether Josiam teaches, “*the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth*” as recited in the second part of limitation 8.6. Patent Owner argues, “Josiam fails to teach ‘the resource unit allocation field indicates additional puncturing information for the unassigned resource unit within the bandwidth’ in the independent claims.” *Id.* at 15–16. Patent Owner contends, “Specifically, Josiam uses the bandwidth field signaled in HE-SIG-A to decipher ‘both the bandwidth of the PPDU and the location of the content channel.’”<sup>18</sup> *Id.* at 16 (citing Ex. 1014 ¶ 161, Table 1). At least at this stage, we determine that this argument is not persuasive in view of passages cited in Josiam in the Petition. The Petition provides:

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<sup>18</sup> Patent Owner does not dispute that Josiam teaches “*the bandwidth field of the HE-SIG-A indicates channel information to be punctured within the bandwidth*” as recited in limitation 8.6. See Prelim. Resp. 15–18. Patent Owner acknowledges that “Josiam discloses using the bandwidth subfield to indicate whether a 20 MHz channel is not available.” *Id.* at 15 (citing Ex. 1014 (Josiam) ¶ 6).

Josiam explains that “[t]he bandwidth and content channel indication together tell the STA where the signaling for the OFDMA RUs is carried in the HE-SIG-B.” SAMSUNG-1014, [0164]-[0166]. For example, “[w]hen the bandwidth signaling field indicates 011 (e.g., the PPDU bandwidth is 80 MHz and the secondary 20 MHz channel is not used), HE-SIG-B content channel 2 is carried in the [L]2-20 MHz segment of the secondary 40.” *Id.* “Further information on the 20 MHz segment (e.g., [U]-20) used or unused [**additional puncturing information**] is carried in RU signaling of the HE-SIG-B common channel.” *Id.*

Josiam explains, the “8-bit RU signaling information [carried in the RU signaling field (‘resource unit allocation field’)] signals an unoccupied 20 MHz segment by signaling an **unused 242 tone RU**.” SAMSUNG-1014, [0167].

....

A POSITA would have understood Josiam’s method of splitting signaling between HE-SIG-A and HE-SIG-B as teaching this limitation. SAMSUNG-1003, [191]. Specifically, Josiam teaches that the bandwidth field indicates a PPDU bandwidth and whether some of the channels in the primary 80MHz bandwidth are not available (“channel information to be punctured within the bandwidth”). SAMSUNG-1003, [191]; SAMSUNG-1014, [0164]. Josiam further teaches that the RU signaling field (“resource unit allocation field”) may indicate additional unavailable 20MHz segments by signaling an unused 242-tone RU within the bandwidth of the PPDU (resource unit allocation field indicates additional puncturing information for the unassigned RU within the bandwidth). SAMSUNG-1003, [191]; SAMSUNG-1014, [0156], [0165]-[0167]. Additionally, where the unassigned RU is a nulled edge RU, a POSITA would have understood that the additional puncturing information is for the unassigned RU within the bandwidth (e.g., nulled edge RU is adjacent to the nulled (punctured) channel). SAMSUNG-1003, [192]; *see* [8.5].

Pet. 22–25 (alterations in original) (footnote omitted). The passages in Josiam cited in these passages in the Petition include the following:

In some embodiments, the signaling between HE-SIG-A and HE-SIG-B may be split, specifically using the RU signaling field of the HE-SIG-B common field. It may take advantage of the duplication structure in the HE-SIG-B to signal the unused 20 MHz segments in 80 MHz and 160 MHz PPDU.

....

The bandwidth and the content channel indication together tell the STA where the signaling for the OFDMA resource units is carried in the HE-SIG-B. The signaling for both used and unused portions is carried in the HE-SIG-B common portion. Some segments that are unused in the primary 80 MHz are indicated by the bandwidth signaling in HE-SIG-A. . . .

Further information on the 20 MHz segment (e.g., L-20) used or unused is carried in RU signaling of the HE-SIG-B common channel. When bandwidth signaling field indicates 100 (e.g., the PPDU bandwidth is 80 MHz, and the secondary 20 MHz and U-20 of the secondary 40 is not occupied), the HE-SIG-B content channel 2 is not transmitted; content channel one carries signaling for Primary and L-20 of the secondary 40 which are occupied. In this case, the contents of the HE-SIG-B common don't change (e.g., contains 28-bit resource indexing fields for the primary and L-20 of the secondary 40 along with a bit for the center 26 tone RU).

When 111 as shown in Table 1 is signaled, the PPDU is a 160 MHz (80+80) PPDU, where the secondary 20, secondary 40 are not used. All signaling for the primary and the secondary 80 is carried in HE-SIG-B content channel 1 (e.g., the contents of the HE-SIG-B common field change to accommodate signaling for the primary and the 20 MHz segments for the secondary 80 including the center 26 tones).

In some embodiments, the 8-bit RU signaling information signals an unoccupied 20 MHz segment by signaling an unused 242 tone RU. In cases where a specific content channel-2 is signaled empty, the corresponding RU signaling information for the RUs that occupied the same bandwidth as the content channel signaled empty is signaled as unoccupied by transmitting the 8-bit RU signaling information.

This information is redundant, but this ensures the signaling structure of the HE-SIG-B remains unaltered.

Ex. 1014 ¶¶ 156, 164–167. These passages in Josiam support Petitioner’s contention that Josiam discloses all the elements of this limitation and undermine Patent Owner’s contrary contention.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that this limitation is rendered obvious by Josiam.

*b. Independent Claim 1*

Petitioner relies heavily on its showing for claim 8 for claim 1. *See* Pet. 35–37. In addition, with regard to the additional limitations recited in “terminal” claim 1 that are not found in “method” claim 8, the Petition provides:

Josiam discloses “a station (STA) in a wireless local area network (WLAN).” SAMSUNG-1014, [0006]. Josiam further discloses that the station includes “a radio frequency (RF) transceiver 210” and “a controller/processor 240.” *Id.*, [0095]. The RF transceiver 210 is configured to receive a PPDU. SAMSUNG-1014, [0097]. The controller/processor 240 includes “processing circuitry configured to provide efficient wideband operations in WLANs.” SAMSUNG-1014, [0103].

*Id.* at 36. Patent Owner does not dispute that the additional limitations recited in claim 1, not found in claim 8, are taught or suggested by Josiam. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that the Petitioner will prevail in establishing that all the limitations of claim 1 are taught or suggested by Josiam and that claim 1 is rendered obvious by Josiam.

*c. Summary as to Independent Claims 1 and 8*

Petitioner has established a reasonable likelihood of establishing that Josiam teaches or suggests all the limitations of claims 1 and 8. We determine that there is a reasonable likelihood that Petitioner will prevail with respect to the unpatentability of claims 1 and 8 in view of Josiam.<sup>19</sup>

*3. Dependent Claims 2–5, 7, 9–12, and 14*

Petitioner also asserts that dependent claims 2–5, 7, 9–12, and 14 are obvious in view of Josiam. Pet. 25–37. The Petition provides a detailed and supported showing that the additional limitations recited in dependent claims 2–5, 7, 9–12, and 14 are taught by Josiam. *Id.* Patent Owner does not dispute the showing that the additional limitations recited in dependent claims 2–5, 7, 9–12, and 14 are taught by Josiam. *See* Prelim. Resp.

We determine that there is a reasonable likelihood that Petitioner will prevail with respect to the unpatentability of claims 2–5, 7, 9–12, and 14.

*E. Asserted Obviousness of Claims 1–7 and 13 Based on Josiam and Kim*

Petitioner challenges claims 1–7 and 13 as being obvious in view of Josiam and Kim. *See* Pet. 2, 37–51.

*1. Kim (Ex. 1018)*

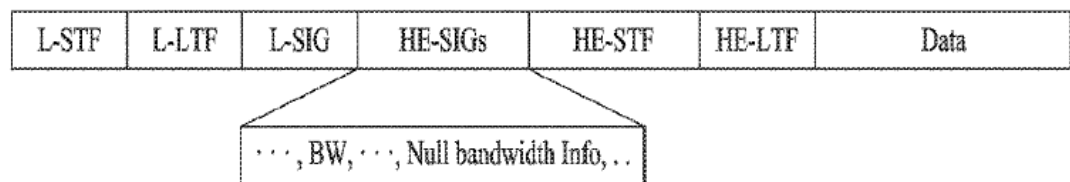
Kim is titled “Method for Supporting Flexible Resource Allocation in Wireless Communication System, and Device Therefor.” Ex. 1018, code

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<sup>19</sup> Thus, we determine that there is a reasonable likelihood that the Petitioner will prevail with respect to at least one of the claims challenged in the Petition pursuant to 35 U.S.C. § 314 and that *inter partes* review should be instituted. Accordingly, we institute as to all the challenged claims and all the challenges raised in the Petition. 37 C.F.R. § 42.108(a) (“When 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.”).

(54). Kim’s Figure 15, reproduced below, illustrates a transmitted frame that “can include information on an unused bandwidth and information on a null indicator (e.g., null bandwidth/channel/sub-channel information or non-contiguous bandwidth/channel/subchannel information) in a HE-SIG field.” *Id.* ¶ 87.

FIG. 15



Kim discloses that “an 11ax radio frame may include HE-SIG A and HE-SIG B as HE-SIG fields,” and that “[i]f total BW information and null indication information are transmitted,” either “both the total BW information and the null indication information may be included in HE-SIG-A,” or “the total BW information may be included in HE-SIG A, and the null indication information may be included in HE-SIG B.” *Id.* ¶¶ 92–93.

## 2. Analysis of Unpatentability Contentions Based on Josiam and Kim

Petitioner relies heavily on its showing based on Josiam alone (Ground 1A) in its showing for claims 1–7 and 13 based on the combination of Josiam and Kim (Ground 1B). *See* Pet. 37–51. With regard to “terminal” claims 1–7 and the combination of Josiam and Kim, the Petition provides:

Claims 1-7 require “[a] wireless communications terminal, the terminal comprising: a processor; and a communication unit, wherein the processor is configured to” perform steps corresponding to the methods of [8]-[14], respectively. To the extent [1]’s preamble is limiting, Kim discloses a “STA (station) operating in a wireless LAN

(WLAN).” SAMSUNG-1018, [0008]; SAMSUNG-1018, 2-3. Kim further discloses that the station (e.g. STA 150) includes “a processor 160, a memory 170, and a transceiver 180.” SAMSUNG-1018, [0161]. Transceiver 180 “may transmit/receive radio signals.” SAMSUNG-1018, [0162]. Processor 160 may be connected to transceiver 180 to “implement a physical layer and/or a MAC layer according to the IEEE 802 system.” *Id.*

A POSITA would have found it obvious for Josiam-Kim to include a processor (e.g., processor 160) and communications device (e.g., transceiver 180) to perform Josiam’s methods described in Ground 1A and Josiam-Kim’s methods described with respect to [6] and [13]. SAMSUNG-1003, [219]. A POSITA would have recognized the processor and transceiver, per Kim, as a suitable and predictable solution to implement Josiam and Josiam-Kim’s methods. *Id.* Such a combination would have yielded expected results and was within the skill of a POSITA. *Id.*

For similar reasons to those discussed in Ground 1A and [13], a POSITA would have understood Josiam-Kim as rendering obvious a wireless communication terminal (e.g., station) having a processor (e.g., processor 160), a communications unit (e.g., transceiver 180), wherein the processor is configured to perform the steps recited in the remaining limitations of [1]-[6]. SAMSUNG-1003, [220].

*Id.* at 50–51.

Petitioner also contends that the combination of Josiam and Kim teaches the additional limitations of dependent “method” claim 13. Pet. 47–50. (citing Ex. 1003 (Buehrer Decl.) ¶¶ 215–217; Ex. 1014 (Josiam) ¶¶ 155–168, Table 1; Ex. 1018 (Kim) ¶¶ 144, 145, Table 22). With regard to claim 13, the Petition provides:

As discussed in Ground 1A, Josiam teaches that the bandwidth field of HE-SIG-A indicates channel information to be punctured within the bandwidth and the RU signaling field

(resource unit allocation field) indicates additional puncturing information. SAMSUNG-1014, [0155]-[0168]; §III.A.2. In Josiam-Kim, a POSITA would have understood that, when the bandwidth field indicates a noncontiguous PPDU with a bandwidth of 80MHz (the bandwidth indication is set to “100”), the bandwidth field indicates puncturing of either S40A or S40B (per Kim). SAMSUNG-1018, [0144]-[0145], Table 22; SAMSUNG-1003, [215]. This is because, if neither S40A nor S40B is transmitted, a 40MHz PPDU (e.g., bandwidth indication “001”) would be indicated, and if both S40A and S40B are transmitted, a continuous 80MHz PPDU (e.g., bandwidth indication “010”) would be transmitted. *Id.*

*Id.* at 47–48.

Petitioner articulates reasons for combining the relevant teachings of Josiam and Kim as set forth in the Petition. *See* Pet. 40–47. The Petition provides:

Josiam’s method does not include bandwidth indications for full bandwidth (contiguous) 80 and 160MHz transmissions. SAMSUNG-1003, [113]; SAMSUNG-1014, [0155]-[0166], Table 1. A POSITA would have understood that one obvious solution would have been to include the four contiguous options from 802.11ac and use the remaining four options for non-contiguous operation, per Kim. SAMSUNG-1003, [113]; SAMSUNG-1018, [0144]-[0145], Table 22. Moreover, a POSITA would have understood that, by retaining the bandwidth signaling options from 802.11ac, implementation details for full bandwidth MU-MIMO may be reused from previously developed 802.11ac receivers. SAMSUNG-1003, [113]; SAMSUNG-1037, 15; SAMSUNG-1038, 12; SAMSUNG-1033, 259-261, 293-295; SAMSUNG-1029, 91-93, 131-132; SAMSUNG-1043, 8-9, 13.

A POSITA would have also been motivated to include separate indications for contiguous and non-contiguous bandwidth operation to the reduce physical layer design complexity and encoding/decoding complexity in less dense operating environments. SAMSUNG-1003, [114].

Specifically, a POSITA would have recognized that, when the probability of the channel being busy is low, the benefit of non-contiguous channel bonding can be small. SAMSUNG-1003, [114]; SAMSUNG-1039, 3-10.

....

A POSITA would have found Josiam-Kim obvious and predictable because the combination merely reflects the simple substitution of one set of indications of a 3-bit bandwidth field in HE-SIG-A for another set of indications of a 3-bit bandwidth field in HE-SIG-A, where both sets of indications include information of the total bandwidth of the PPDU and puncturing information for the S20 channel. SAMSUNG-1003, [117]; SAMSUNG-1014, [0154]-[0168]; SAMSUNG-1018, [0144]-[0145], Table 22.

Additionally, the Josiam-Kim bandwidth and content channel indication scheme for the bandwidth field of HE-SIG-A would have been obvious to try. SAMSUNG-1003, [118]. Indeed, a POSITA would have understood that there was a need to indicate which channels were used or unused in the preamble of an HE MU PPDU when non-contiguous PPDUs are transmitted and that there was insufficient space in the HE-SIG-A field to indicate all possible channel combinations. SAMSUNG-1003, [118]; SAMSUNG-1014, [0150]-[0156]; SAMSUNG-1023, [0028]-[0031]; SAMSUNG-1035, 5; SAMSUNG-1036, 13-15.

Pet. 43–46. Based on this showing (which, at least at this stage, is undisputed), we determine that a skilled artisan would have had a motivation to combine with a reasonable expectation of success the relevant teachings of Josiam and Kim as asserted in the Petition.

Patent Owner does not separately argue this ground. Prelim Resp. 18 (“Kim was asserted solely for purposes of the “processor” element. Petition at 50-51. Accordingly, the Josiam and Kim combination suffers from the deficiencies as discussed above in Ground 1A.”). Patent Owner’s statement is inaccurate. Kim was not asserted solely for purposes of the “processor”

element. *See* Pet. 40 (“In Josiam-Kim, a bandwidth and content channel indication scheme for the bandwidth field of HE-SIG-A, per Josiam, is modified to include four contiguous PPDU options and four non-contiguous PPDU options, per Kim. . . . In the combination, a 3-bit bandwidth index, per Josiam, includes four contiguous options and four non-contiguous options that indicate, for each bandwidth of 80 or 160 (or 80 + 80)MHz, whether the S20 channel is transmitted, per Kim.”); 48 (“In Josiam-Kim, a POSITA would have understood that, when the bandwidth field indicates a non-contiguous PPDU with a bandwidth of 80MHz (the bandwidth indication is set to ‘100’), the bandwidth field indicates puncturing of either S40A or S40B (per Kim).” Petitioner relies on Kim for disclosing the “communication unit” limitation of claims 1–7. *Id.* at 50–51. Petitioner also asserts the Josiam/Kim combination against dependent claim 13 (*id.* at 47–50) and “method” claim 13 which depends directly from “method” claim 8. *Id.* at 47–50. Neither claim 13 nor claim 8 include a “processor” element. Ex. 1001, 53:40–54:15 (claim 8), 54:31–38 (claim 13). Patent Owner fails to dispute, or even correctly acknowledge, the relevant teachings in Kim and Petitioner’s showing based on a combination of the relevant teachings of Josiam and Kim.

We determine that there is a reasonable likelihood that Petitioner will prevail with respect to the unpatentability of claims 1–7 and 13 in view of a combination of the relevant teachings and suggestions of Josiam and Kim.

*F. Asserted Obviousness of Claims 1–14 Based on Combinations Including Bharadwaj*

Petitioner challenges claims 1–14 as being obvious in view of four combinations including Bharadwaj. Pet. 2 (Ground 2A (claims 1–3, 7–10, and 14 challenged based on Bharadwaj and Li), Ground 2B (claims 1–5, 7–

12, and 14 challenged based on Bharadwaj, Li, and Chen), Ground 2C (claims 6 and 13 challenged based on Bharadwaj, Li, and Kim)), and Ground 2D (claims 6 and 13 challenged based on Bharadwaj, Li, Chen, and Kim)).

Petitioner contends that “Bharadwaj . . . qualif[ies] as prior art under AIA § 102 because the relied-upon subject matter is fully supported by provisional applications filed by the Critical Date (for Grounds . . . 2C-2D) or the Earliest Filing Date (for Grounds 2A-2B).” Pet. 2–3. Patent Owner argues “Bharadwaj is not prior art to the ’281 Patent because the Petitioner failed to establish that the relevant subject matter was disclosed [in] Bharadwaj’s provisional application (Ex. 1022).” Prelim. Resp. 19.<sup>20</sup> We determine that Petitioner has not shown that the relied-upon subject matter in Bharadwaj (Ex. 1021) was disclosed in the Bharadwaj provisional application (Ex. 1022).

Bharadwaj is a U.S. Patent Application Publication that was published on June 22, 2017. Ex. 1021, code (43). It is based on an application filed on December 21, 2016. *Id.* at code (22). For the grounds relying on Bharadwaj, Petitioner relies on December 24, 2015, (for Ground 2A (Bharadwaj and Li) and Ground 2B (Bharadwaj, Li, and Chen)) and on May 14, 2016, (for Ground 2C (Bharadwaj, Li, and Kim) and for Ground 2D (Bharadwaj, Li, Chen, and Kim)) as the priority date for the ’281 patent.

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<sup>20</sup> Patent Owner cites *In re Riggs*, 131 F.4th 1377, 1344 (Fed. Cir. 2025) for its holding that “(to claim priority to the provisional application used in a prior art rejection, ‘the provisional application must also provide written description support for the specific portions of the patent specification identified and relied on in the prior art rejection.’”). Prelim. Resp. 19. Petitioner has failed to show that Bharadwaj’s provisional application (Ex. 1022) provides written description support for the specific portions of Bharadwaj (Ex. 1021) cited in the Petition.

Pet. 2. Bharadwaj’s publication and filing date are after either date relied upon by Petitioner for the ’281 patent. Accordingly, Bharadwaj is not prior art for any of these grounds unless it is entitled to the benefit of the filing date of one or more of the provisional applications to which it claims priority. *Id.* at code (60), ¶ 1.

Bharadwaj claims priority to five (5) provisional applications. *Id.* The earliest of these provisional applications was filed on December 21, 2015. *Id.* It is the December 21, 2015 provisional application that Petitioner relies upon as establishing the priority date for Bharadwaj. *See* Pet. 2 (showing 12/21/2015 as the Bharadwaj priority date). The December 21, 2015 provisional application was submitted as Exhibit 1022 with the Petition and is described as the “Bharadwaj Provisional” in the Petition’s Exhibit List. *Id.* at iii. None of the other provisional applications referred to in Bharadwaj and from which Bharadwaj claims priority are in evidence in this proceeding.

There are no cites to the Bharadwaj provisional application (Ex. 1022) in the Petition. *See* Pet. 51–53, 55–90. The cites in the Petition are only to the Bharadwaj U.S. Patent Application Publication (Ex. 1021). *See id.* Thus, the Petition includes no reasoning or explanations as to how or why the Bharadwaj provisional application (Ex. 1022) discloses or teaches or suggests the subject matter of the challenged claims or any limitation in the challenged claims. Accordingly, we are not able to determine whether the Bharadwaj provisional application (Ex. 1022) supports the contentions for which Bharadwaj (Ex. 1021) is cited in the Petition by considering the Petition.

Petitioner states that “[p]arallel citations to . . . Bharadwaj . . .

provisional application[ ] are included in Dr. Buehrer's Declaration." Pet. 3. However, the cites to the Bharadwaj provisional application (Ex. 1022) in Dr. Buehrer's Declaration (Ex. 1003) are not accompanied by any reasoning as to how or why the Bharadwaj provisional application (Ex. 1022) discloses, teaches, or suggests the same subject matter as the cited matter in Bharadwaj (Ex. 1021).

Bharadwaj (Ex. 1021) and the Bharadwaj provisional application (Ex. 1022) are quite different. Bharadwaj (Ex. 1021) is 75 pages long and contains 234 numbered paragraphs in the specification and 55 figures. The Bharadwaj provisional application (Ex. 1022) is 44 pages long and contains 101 numbered paragraphs in the specification and 12 figures. In its discussion of the grounds based on Bharadwaj (Grounds 2A, 2B, 2C, and 2D), the Petition repeatedly cites for support paragraphs and figures not found in the Bharadwaj provisional application (Ex. 1022). *See* Pet. 51–53, 55–90. For example, with regard to limitation 8.6, for which Patent Owner disputes the showing in the Petition (Prelim. Resp. 20–23), the Petition cites paragraphs 111, 124, 130–132, and 138–142 of Bharadwaj (Ex. 1021). Pet. 69–71. The Bharadwaj provisional application (Ex. 1022) does not contain any paragraphs with these numbers.

Patent Owner argues:

Petitioner cited to Bharadwaj at [0132]-[0142], which discusses FIGS. 11A-D. But these figures were not in the Bharadwaj provisional application. In fact, aside from conclusory statements, Petitioner did not make any effort to establish that the subject matter of Bharadwaj is disclosed in its provisional application. *See* Petition at 2.

Prelim. Resp. 19–20. We agree with Patent Owner. Petitioner has not shown in the Petition that the Bharadwaj provisional application (Ex. 1022)

teaches or suggests any limitations of any challenged claim and is, thus, prior art.

We determine that it has not been established that there is a reasonable likelihood that the Petitioner will prevail on the grounds based on Bharadwaj (Grounds 2A, 2B, 2C, and 2D) as set forth in the Petition.

### III. CONCLUSION

As the Petitioner has established that there is a reasonable likelihood of showing that at least one claim of the '281 patent is unpatentable, we determine that trial should be instituted on claims 1–14 of the '281 patent on all the grounds set forth in the Petition. *See* 37 C.F.R. § 42.108(a).

### IV. ORDER

Upon consideration of the record before us, it is

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–14 of U.S. Patent No. 10,687,281 B2 is instituted with respect the grounds set forth in the Petition (*see* Pet. 2); and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of U.S. Patent No. 10,687,281 B2 shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2025-00988  
Patent 10,687,281 B2

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