

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
Petitioner

v.

WILUS INSTITUTE OF STANDARDS AND TECHNOLOGY INC.,
Patent Owner

Case IPR2025-00934
U.S. Patent No. 11,159,210

**PETITIONER'S REPLY TO
PATENT OWNER'S RESPONSE TO PETITION**

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EXHIBITS

- SAMSUNG-1001 U.S. Patent No. 11,159,210 to Son, et al. (“the ’210 Patent”)
- SAMSUNG-1002 Excerpts from the Prosecution History of the ’210 Patent (“the Prosecution History”)
- SAMSUNG-1003 First Declaration and Curriculum Vitae of Dr. Christopher J. Hansen, Ph.D.
- SAMSUNG-1004 IEEE P802.11ax/D1.0 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for High Efficiency WLAN (November 2016) (“802.11ax_D1.0”)
- SAMSUNG-1005 IEEE P802.11ax/D0.5 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for High Efficiency WLAN (September 2016) (“802.11ax_D0.5”)
- SAMSUNG-1006 IEEE P802.11ax/D0.4 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for High Efficiency WLAN (August 2016) (“802.11ax_D0.4”)
- SAMSUNG-1007 IEEE P802.11ax/D0.3 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for High Efficiency WLAN

(August 2016) (“802.11ax_D0.3”)

SAMSUNG-1008 IEEE P802.11ax/D0.2 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for high efficiency in frequency bands between 1GHz and 6 GHz (June 2016) (“802.11ax_D0.2”)

SAMSUNG-1009 IEEE P802.11ax/D0.1 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Amendment 6: Enhancements for high efficiency in frequency bands between 1GHz and 6 GHz (March 2016) (“802.11ax_D0.1”)

SAMSUNG-1010 IEEE P802.11 Specification Framework for TGax, May 25, 2016 (“Stacey”)

SAMSUNG-1011 IEEE 802.11-16/0928r2 Proposed resolutions to comments on clause 26.3.9.8 (May 16, 2016)

SAMSUNG-1012 IEEE 802.11-16/0915r2 Bit field finalization of HE-SIG-A in HE PPDU formats (July 25, 2016)

SAMSUNG-1013 U.S. Pat. Pub. 2017/0181130 to Bharadwaj et al., filed on Dec. 21, 2016 (“Bharadwaj”)

SAMSUNG-1014 RESERVED

SAMSUNG-1015 U.S. Pat. Pub. 2016/0204912 to Sun, et al., filed January 8, 2016 (“Sun”)

SAMSUNG-1016 RESERVED

SAMSUNG-1017 Extended European Search Report

SAMSUNG-1018 IEEE802.11ax_D0.5 (Partial) (“802.11ax_D0.5_IDS”)

- SAMSUNG-1019 U.S. Provisional Application No. 62/270,562, filed on Dec. 21, 2015 (“Bharadwaj Provisional 1”)
- SAMSUNG-1020 U.S. Provisional Application No. 62/299,554, filed on Feb. 24, 2016 (“Bharadwaj Provisional 2”)
- SAMSUNG-1021 U.S. Provisional Application No. 62/328,602, filed on Apr. 27, 2016 (“Bharadwaj Provisional 3”)
- SAMSUNG-1022 U.S. Provisional Application No. 62/344,374, filed on Jun. 1, 2016 (“Bharadwaj Provisional 4”)
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- SAMSUNG-1025 Exhibit D (Infringement Chart for ’210 Patent), *Wilus Institute of Standards and Technology Inc., v. Samsung Electronics Co., LTD., et al.*, 2-24-cv-00746 (EDTX) filed September 11, 2024
- SAMSUNG-1026 Second Declaration and Curriculum Vitae of Dr. Christopher J. Hansen, Ph.D.
- SAMSUNG-1027 U.S. Pat. Pub. 2016/0380664 to Braun et al., filed on August 18, 2015, published on December 29, 2016 (“Braun”)
- SAMSUNG-1028 IEEE 802.11 Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 4: Enhancements for Very High Throughput of Operation in Bands below 6 GHz (“802.11ac-2013”)
- SAMSUNG-1029 Kim et al., IEEE 802.11-15/0821r2, HE-SIG-B Structure, 2015-07-11
- SAMSUNG-1030 Josiam, et al., IEEE 802.11-15/1066r0, HE-SIG-B Contents, 2015-09-13

- SAMSUNG-1031 Josiam, et al., IEEE 802.11-15/1315/r1, HE-SIG-B Mapping and Compression, 2015-11-09
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- SAMSUNG-1033 Noh et al., IEEE 802.11-16/0040r0, Issues with Compressed SIG-B Mode, 2016-01-18
- SAMSUNG-1034 Josiam, et al., IEEE 802.11-15/0349r1, HE-SIG-B Compression Mode, 2016-03-14
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- SAMSUNG-1037 *Fintiv* Stipulation
- SAMSUNG-1038 Supplemental Public Accessibility Declaration of Dr. Christopher J. Hansen, Ph.D.
- SAMSUNG-1039 IPR2025-00934 Email from Board Authorizing Petitioner's Motion to Submit Supplemental Information
- SAMSUNG-1040 Deposition Transcript of Dr. Todor v. Cooklev, Ph.D.
- SAMSUNG-1041 Reply Declaration of Christopher J. Hansen
- SAMSUNG-1042 Comments on TGax 802.11-16-0535r10 November 2016
- SAMSUNG-1043 Comment Resolutions on Clause 26.3.12 April 28, 2016
- SAMSUNG-1044 Comment Resolutions on Claus 26.3.9.8 May 16, 2016
- SAMSUNG-1045 IEEE P802.11ax/D2.0 Draft Standard for Information technology– Telecommunications and information exchange between systems Local and metropolitan area networks– Specific requirements. Part 11: Wireless LAN Medium Access

Control (MAC) and Physical Layer (PHY) Specifications.
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SAMSUNG-1046–1100 [Reserved]

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<https://www.uspto.gov/sites/default/files/documents/InterimProcesses-PTABWorkloadMgmt-20250326.pdf>

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SAMSUNG-1107 Order Granting Stay in *Cellspin Soft, Inc. v. Bytedance Ltd.*, No. 2:23-CV-00496-JRG-RSP (E.D. Tex. Jan. 26, 2025) (Payne, J.)

- SAMSUNG-1108 Motion Success for Stay Pending IPR (Post-Institution) (E.D. Tex.), DOCKETNAVIGATOR (last visited August 27, 2025)
- SAMSUNG-1109 LegalMetric, Individual Judge Report for Judge James Rodney Gilstrap Patent Cases December 2011 to January 2025
- SAMSUNG-1110 Complaint, *Wilus Inst. of Standards and Tech. Inc., v. Samsung Elecs. Co., Ltd., et al.*, No. 2-25-cv-00070 (E.D. Tex filed January 23, 2025)
- SAMSUNG-1111 U.S. District Court for the Eastern District of Texas Calendar Events Set for 6/1/2026 for Judge Rodney Gilstrap
- SAMSUNG-1112 [Reserved]
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- SAMSUNG-1114 [Reserved]
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- SAMSUNG-1116 Osama Aboul-Magd, *TGax January 2017 Meeting Agenda* (Dec. 10, 2016) IEEE 802.11-16/1587r5
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- SAMSUNG-1120 IEEE-SA Standards Board Bylaws, IEEE-SA Bd. Govs. (Nov. 2019)

SAMSUNG-1121 IEEE-SA Standards Board Operations Manual, IEEE-SA
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SAMSUNG-1122 U.S. District Court – Judicial Caseload Profile (E.D. Tex),
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I. INTRODUCTION

Patent Owner (PO)'s patentability arguments erroneously characterize 802.11ax/D1.0 in a manner inconsistent with whole sections of the reference not addressed in the Patent Owner Response (POR). These inconsistencies were revealed during the deposition of PO's own expert Dr. Cooklev, who conceded that these portions of the reference disclose multiple facts that can only be explained by 802.11ax/D1.0's support for HE-MU PPDU single-user transmissions in full-bandwidth mode. PO instead premised nearly its entire argument on a single comment from one IEEE member, Youhan Kim, submitted during the IEEE 802.11 working group's consideration of D1.0. But this comment was explicitly *rejected* by the working group. Moreover, the full record shows that Kim's comment, and those of other members, evidence that the claimed functionality would have been known and obvious to POSITAs before the earliest priority date of the '210 Patent.

II. GROUNDS 1A-B – 802.11AX/D1.0 TEACHES SINGLE-USER HE-MU PPDU TRANSMISSIONS IN FULL-BANDWIDTH MU-MIMO – [1.5], [1.7], [6.3], [6.5]

PO's central argument is that 802.11ax/D1.0 does not disclose or render obvious use of an HE-MU PPDU for a single user while the SIG-B Compression field indicates full-bandwidth mode. POR, 11. But this argument is simply not correct. The POR only arrives at its position through disregard of multiple portions

of 802.11ax/D1.0 that demonstrate the opposite of PO's position. For example, the POR cites Table 28-24 for an MU-MIMO allocation as alleged evidence that 802.11ax/D1.0 prohibited the single user case. POR, 12 (citing SAMSUNG-1004, 322-324). But the POR ignores that the same portions of 802.11ax/D1.0 teach that the HE-SIG-B user field of an HE-MU PPDU can include a non-MU-MIMO allocation for single-user (SU) transmissions. SAMSUNG-1004, 320-324 ("The HE-SIG-B user field for an SU allocation contain the subfields shown in Table 28-22 (Fields of the HE-SIG-B user field for an non-MU-MIMO allocation).")¹; Petition, 35-42 (contrasting Table 28-22 for non-MU-MIMO allocation and Tables 28-23–28-24 for MU-MIMO allocation). Importantly, the HE-SIG-B is only used in the HE-MU PPDU. SAMSUNG-1004, 267 (showing HE-SU PPDU without HE-SIG-B):

¹ All emphases added, unless otherwise indicated.

HE-SIG-B only present in HE-MU PPDU

The format of the HE SU PPDU is defined as in Figure 28-5 (HE SU PPDU format). This PPDU format is used for SU transmission and, in this format, the HE-SIG-A field is not repeated.



Figure 28-5—HE SU PPDU format

The format of the HE MU PPDU is defined as in Figure 28-6 (HE MU PPDU format). This format is used for transmission to one or more users that is not a response of a Trigger frame. The HE-SIG-B field is present in this format.

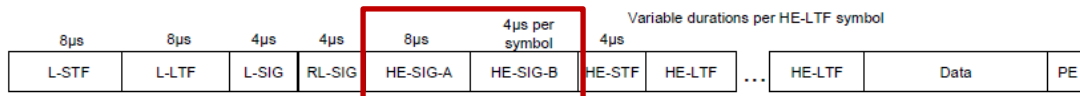


Figure 28-6—HE MU PPDU format

SAMSUNG-1004, Figures 28-5–6 (annotated)

See also, id., 278; Petition, 6; SAMSUNG-1003, ¶¶55-64; SAMSUNG-1041 ¶16.

The HE-MU PPDU, therefore, must support single-user transmissions using the user field for non-MU-MIMO allocations shown in Table 28-22. SAMSUNG-1041 ¶16.

Tellingly, however, the POR never mentions the user field for SU / non-MU-MIMO allocation of Table 28-22. 802.11ax/D1.0 teaches that, when the HE-MU PPDU is sent to more than one user, the HE-SIG-B uses the user field format for MU-MIMO allocations as shown in Table 28-23. Table 28-23 includes a spatial configuration subfield, and the spatial configuration subfield encoding is shown in

Table 28-24. But the spatial configuration subfield is not present in the non-MU-MIMO allocation format of Table 28-22. These differences discussed 802.11ax/D1.0 were not only highlighted in the Petition, but are also how the '210 patent itself differentiates between the MU-MIMO and non-MU-MIMO formats. *E.g.*, Petition, 12-13, 25-26, 36-38; SAMSUNG-1003 ¶¶69, 72-73, 89-90, 109-110; SAMSUNG-1001, 20:33-53, claims 2, 7.

The Petition explained how the disclosure in 802.11ax/D1.0 links the user field formats for single-user, non-MU-MIMO allocation to full-bandwidth transmissions, particularly when the SIGB Compression field of the HE-SIG-A is set to “1.” Petition, 34-39 (“802.11ax_D1.0 describes that the format of the user fields (shown in Tables 28-22 and 28-23 above) are identified based on the number of MU-MIMO users indicated by a subfield of the HE-SIG-A when operating in full bandwidth.”); SAMSUNG-1004, 264-265, 303 (Table 28-17), 320-324; SAMSUNG-1003, ¶¶107-115. The cited portions of 802.11ax/D1.0 differentiate between allocation signaling mechanisms, explaining that when the value of SIGB Compression field in HE-SIG-A is “0,” the number of users is indicated with the RU allocation as defined in Table 28-21 (RU allocation signaling: arrangement and number of MU-MIMO allocations).

54
55 **28.3.3.8.3 Resource indication and STA self-identification in an HE MU PPDU**
56
57 An AP that transmits an HE MU PPDU shall set the UL/DL field in the HE-SIG-A field to 0. A full
58 bandwidth MU-MIMO transmission using HE MU PPDU format has a value of 1 for the SIGB Compression
59 field in HE-SIG-A and the SIGB Common field is not present. If the value of SIGB Compression field in
60 HE-SIG-A is 0, the RU allocation signaling in the HE-SIG-B common field indicates the combination of
61 RUs in current PPDU bandwidth and the number of STAs on each RU for SU/MU-MIMO transmission. The
62 number of users in RU r for MU-MIMO transmission, $N_{user,r}$ is indicated together with the RU allocation as
63 defined in Table 28-21 (RU allocation signaling: arrangement and number of MU-MIMO allocations). If the
64
65

SAMSUNG-1004, 264 (annotated)

Thus, 802.11ax/D1.0 provides for RU signaling for the non-full-bandwidth scenario. SAMSUNG-1041 ¶¶13-15.

By contrast, when the SIGB Compression field in HE-SIG-A is 1 (indicating full-bandwidth), the number of stations in the MU-MIMO group is indicated in the “Number Of HE-SIG-B Symbols Or MU-MIMO Users” field in HE-SIG-A, where “the number of spatial streams, $N_{SS,r,u}$, is indicated by the NSTS field in user specific block defined in Table 28-22 (Fields of the HE-SIG-B user field for a non-MU-MIMO allocation) and Table 28-23 (Fields of the HE-SIG-B user field for an MU-MIMO allocation).” *Id.*, 265; *see also id.* (explaining that in $N_{SS,r,u}$, the number of users can include 1: “ $u = 1, \dots, N_{user,r}$ ”). Exemplary disclosure of 802.11ax/D1.0 is highlighted below:

65 defined in Table 28-21 (RU allocation signaling: arrangement and number of MU-MIMO allocations). If the
1 value of the SIG-B Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B
2 Common field and HE-SIG-B contains only User specific fields. The number of STAs in the MU-MIMO
3 group is indicated in the Number Of HE-SIG-B Symbols Or MU-MIMO Users field in HE-SIG-A. For
4 bandwidths larger than 20 MHz, the User block fields are split equitably between two SIG-B channels, i.e.,
5 for a k user MU-MIMO PPDU, 1, ..., $\text{ceil}(k/2)$ User block fields are carried in HE-SIG-B content channel 1
6 and $\text{ceil}(k/2) + 1, \dots, k$ User block fields in HE-SIG-B content channel 2. The number of spatial streams,
7 $N_{SS,r,u}$, is indicated by the NSTS field in user specific block as defined in Table 28-22 (Fields of the
8 HE-SIG-B user field for an non-MU-MIMO allocation) and Table 28-23 (Fields of the HE-SIG-B user field
9 for an MU-MIMO allocation). The allocated spatial streams for a designated MU-MIMO user and the total
10 number of spatial streams on the RU are indicated in spatial configuration field of user specific block
11 containing the STA ID of designated MU-MIMO STA as defined in Table 28-24 (Spatial Configuration
12 subfield encoding).
13
14 When processing the HE-SIG-B, a STA will look at information of each RU to find out its membership
15 status, i.e., if it belongs to a beamformee group in a certain RU. If $N_{user,r}$ STAs are scheduled in RU r , there
16 are $N_{user,r}$ user specific blocks for RU r . Each user specific block has an 11-bit field indicating the STA ID.
17 A STA identifies itself as a member in the beamformee group in the RU, if its STA ID matches one of the
18 STA IDs. The user position is indicated by the block index. From a multiplexing information lookup table
19 for $N_{user,r}$ the ordered number of spatial streams for all members in the beamformee group in RU r , $N_{SS,r,u}$
20 $u = 1, \dots, N_{user,r}$ is obtained. The spatial streams of different users are ordered in accordance to user position
21 values, i.e., the spatial streams for the user in user position 0 come first, followed by the spatial streams for
22 the user in position 1, followed by the spatial streams for the user in position 2, and followed by the spatial
23 streams for the user in position 3, and so on.
24
25
26
27
28
29

SAMSUNG-1004, 264-265 (annotated)

SAMSUNG-1041 ¶¶13-15.

Thus, in 802.11ax/D1.0, when in full-bandwidth, and the common block is omitted, Table 28-21 is not used as an allocation signaling mechanism. Instead, 802.11ax/D1.0 uses Table 28-22 (single user, non-MU-MIMO allocation) and Tables 28-23–24 (MU-MIMO allocation) when in full-bandwidth for allocation signaling. SAMSUNG-1041 ¶¶13-15, 18.

PO admits that Table 28-24 is used for MU-MIMO allocation in full-bandwidth. POR, 12-13. Table 28-24 provides the spatial configuration subfield

encoding for Table 28-23, which is also used for full-bandwidth transmissions.

802.11ax/D1.0, 265, 320-324:

B11-B14	<u>Spatial Configuration</u>	4	Indication for the number of spatial streams for a STA in an MU-MIMO allocation. <u>See Table 28-24 (Spatial Configuration subfield encoding).</u>
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Table 28-23—Fields of the HE-SIG-B user field for an MU-MIMO allocation

Bit	Field	Number of bits	Description
B0-B10	STA-ID	11	The STA-ID refers to the AID described in 9.4.1.8 (AID field). The 11 LSBs of the AID field are used to address STAs in this field.
B11-B14	Spatial Configuration	4	Indication for the number of spatial streams for a STA in an MU-MIMO allocation. See Table 28-24 (Spatial Configuration subfield encoding).
B15-B18	MCS	4	Modulation and coding scheme. Set to n for MCSn, where n = 0, 1, 2, ..., 11 Values 12 to 15 are reserved
B19	DCM	1	Indicates whether or not dual carrier modulation is used. Set to 1 to indicate that the payload of the HE MU PPDU is modulated with dual carrier modulation for the MCS. Set to 0 indicates that the payload of the PPDU is not modulated with dual carrier modulation for the MCS.
B20	Coding	1	Indicates whether BCC or LDPC is used. Set to 0 for BCC Set to 1 for LDPC

NOTE—Integer fields are transmitted in unsigned binary format, LSB first, where the LSB is in the lowest numbered bit position.

SAMSUNG-1004, Table 28-23 (highlighting SCF)

Petition, 37-38 (citing SAMSUNG-1004, Table 28-23)

SAMSUNG-1003, ¶¶107-115; SAMSUNG-1041 ¶17.

As explained in the Petition, Table 28-22 supports single-user (non-MU-MIMO) full-bandwidth transmissions, whereas Tables 28-23–28-24 support MU-MIMO transmissions. Petition, 27, 34-39; SAMSUNG-1003 ¶¶108-115; SAMSUNG-1004, 264-265, 320-324. Table 28-24 is not relevant to the single user format of Table 28-22, especially as Table 28-22 does not include a spatial configuration subfield. Petition, 27, 34-39; SAMSUNG-1003 ¶¶108-115;

SAMSUNG-1004, 264-265, 320-324. *See* §III.A, *infra*. *See also* SAMSUNG-1041 ¶18.

A. 802.11ax/D1.0 Supports Single-User HE-MU PPDU in Full-Bandwidth

Despite PO's arguments to the contrary, 802.11ax/D1.0 provides ample disclosure from which a POSITA would have understood that its HE-MU PPDU supports single-user transmissions in full-bandwidth. To start, 802.11ax/D1.0 explicitly discloses transmitting an HE-MU PPDU to just a single user. For example, 802.11ax/D1.0 defines the HE-MU PPDU format as carrying "one or more PSDUs to one or more users." SAMSUNG-1004, 239. PO's expert, Dr. Cooklev, confirmed that a PSDU is a PHY service data unit that carries data for a single user. SAMSUNG-1040, 35:12-36:17, 49:6-20. Indeed, a PSDU was incapable of carrying data for more than one user in 802.11ax, and thus an HE-MU PPDU containing just "one" PSDU would necessarily carry data for just "one" user." SAMSUNG-1041 ¶¶19-20. The HE-MU PPDU is defined as the format for transmitting to one or more users throughout 802.11ax/D1.0. *See also* SAMSUNG-1004, 188 ("HE-MU downlink "allows the AP to transmit simultaneously to one or more non-AP STAs" using DL MU-MIMO), 253 ("During transmission, a PSDU (in the SU case) or one or more PSDUs (in the MU case) are processed (i.e., scrambled and coded) and appended to the PHY preamble

to create the PPDU.”), 267 (HE-MU PPDU format used “for transmission to one or more users”), 312 (User Specific field of an HE-SIG-B (only in HE-MU PPDU) consists of one or more User Block Fields, where last block is for 1 or 2 users); SAMSUNG-1041 ¶¶19-20.

802.11ax/D1.0 further explains that in full bandwidth mode, the HE-MU PPDU is configured with a single resource unit (RU) that spans the entire channel bandwidth. Given 802.11ax/D1.0’s explicit disclosure that the HE-MU PPDU carries data in some instances to just “one” user (as discussed above), and that a user can be assigned to at most one RU, a POSITA would have understood that an HE-MU PPDU directed to “one” user employs a full bandwidth transmission consisting of a single RU. *E.g.*, 802.11ax/D.10, 189 (“Two STA-ID fields in HE-SIG-B shall not have the same value, unless the value is 2046, which is used to indicate an unallocated RU. If an AP sets one of the STA-ID field in the HE-SIG-B field to match the AID of a non-AP STA, then the non-AP STA may disregard any broadcast RU in the same HE MU PPDU.”); SAMSUNG-1041 ¶21 (explaining that in 802.11ax/D1.0, the STA-ID is the unique association identifier given to each STA by the AP when it associates with the AP. Each STA only has to receive and decode one RU.).

In another example, 802.11ax/D1.0 defines a full-bandwidth high-efficiency (HE) transmission in a 20 MHz channel as using a single, 242-tone resource unit (RU):

non-orthogonal frequency division multiple access (non-OFDMA): A full bandwidth HE transmission with 242-tone RU, 484-tone RU, 996-tone RU, 2×996-tone RU, or 2×996-tone RU allocated for 20 MHz, 40 MHz, 80 MHz, 160 MHz, or 80+80 MHz transmission, respectively.

SAMSUNG-1004, 39 (annotated)

In the case of a 20 MHz channel, a 242-tone RU indicates full bandwidth mode because the 20 MHz channel supports a maximum of 242 tones, leaving no bandwidth for additional RUs. SAMSUNG-1041 ¶¶23-24; *see also* SAMSUNG-1040, 54:17-56:7, 44:21-455 (“Whatever the format for single user, that transmission or that PPDU will use one resource unit.”). 802.11ax/D1.0 characterizes the maximum number of RUs for a 20 MHz channel width (CHW20) as equal to 1 for a 242-tone RU:

The maximum number of RUs in the 20 MHz, 40 MHz, 80 MHz, 160 MHz and 80+80 MHz HE PPDU formats are defined in Table 28-2 (Maximum number of RUs for each channel width)..

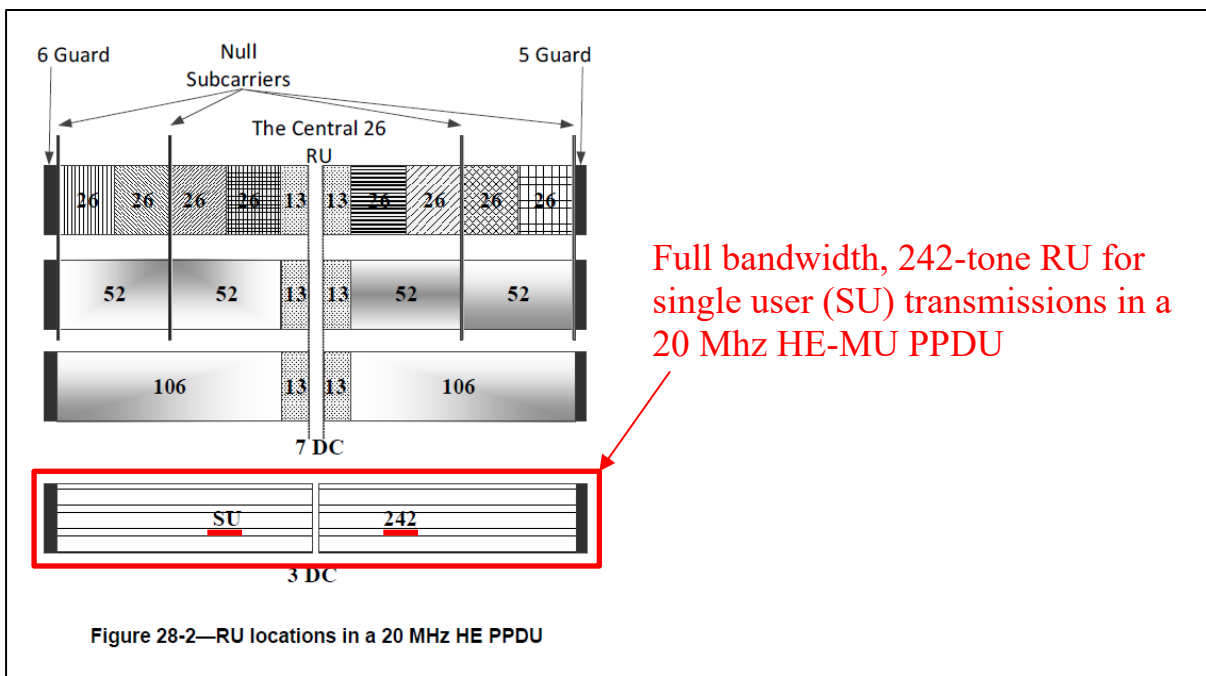
Table 28-2—Maximum number of RUs for each channel width

RU type	CBW20	CBW40	CBW80	CBW80+80 and CBW160
26-tone RU	9	18	37	74
52-tone RU	4	8	16	32
106-tone RU	2	4	8	16
242-tone RU	1	2	4	8
484-tone RU	N/A	1	2	4
996-tone RU	N/A	N/A	1	2
2×996 tone RU	N/A	N/A	N/A	1

SAMSUNG-1004, 255, Table 28-2, (annotated)

See also SAMSUNG-1040, 50:23-51:8; SAMSUNG-1004, 255; SAMSUNG-1041 ¶¶23-24.

In this context, it would have been apparent to a POSITA that 802.11ax/D1.0 supports full-bandwidth, single 242-tone RU for single user transmissions using an HE-MU PPDU. This is shown clearly by Figure 28-2:



SAMSUNG-1004, FIG. 28-2 (annotated)

See also SAMSUNG-1004, 257 (“Figure 28-2 ... for the 20 MHz ... **HE MU PPDU formats**”); SAMSUNG-1041 ¶¶25-26.

PO never addressed FIG. 28-2 in the POR, nor did Dr. Cooklev address it in his declaration. But when confronted with these disclosures in deposition, Dr.

Cooklev conceded that Figure 28-2 shows RU locations for a 20 MHz HE-MU PPDU. SAMSUNG-1040, 58:6-59:9; SAMSUNG-1004, 257. Likewise, Dr. Cooklev confirmed that Figure 28-2 shows that the HE-MU PPDU uses the full-bandwidth, single 242-tone RU for single user (SU) transmissions. SAMSUNG-1040, 59:6-60:5; SAMSUNG-1041 ¶¶25-26. .

PO and Dr. Cooklev also failed to address other portions of 802.11ax/D1.0 that contradict its position and further demonstrate support for full-bandwidth, single user transmissions using HE-MU PPDU. For example, 802.11ax/D1.0 teaches the following:

- A non-AP station (STA) can indicate support for “the reception of an HE MU PPDU payload **over full bandwidth**” in Table 9-262a–Subfields of the HE PHY Capabilities Information field. SAMSUNG-1004, 110.
- “An HE AP shall support ... [t]ransmission of an HE MU PPDU where none of the RUs utilize MU-MIMO (DL OFDMA).” SAMSUNG-1004, 237.
- “An HE AP shall support ... [t]ransmission of an HE MU PPDU consisting of a single RU spanning the entire PPDU bandwidth and utilizing MU-MIMO (DL MU-MIMO).” SAMSUNG-1004, 237.

- “An HE non-AP station shall support ... [r]eception of an HE MU PPDU consisting of a single RU spanning the entire PPDU bandwidth and utilizing MU-MIMO (DL MU-MIMO).” SAMSUNG-1004, 237.
- “An HE non-AP station may support ... [t]ransmission of an HE MU PPDU over partial PPDU bandwidth and full PPDU bandwidth.” SAMSUNG-1004, 238.
- Figure 28-13 depicts a “[t]ransmitter block diagram for the Data field of an **HE SU transmission** in a ... **242-tone RU** with BCC encoding,” and in particular “the transmitter blocks used to generate the Data field of a **single user HE transmission within a ... 242-tone RU** with BCC encoding for a single frequency segment when the number of spatial stream is less than or equal to 4.”² SAMSUNG-1004, 271-272.

² The disclosure in Figure 28-13 is not limited to HE SU PPDUs, but likewise applies to HE MU PPDUs that support OFDMA transmissions. SAMSUNG-1004, 271 (“This also includes the SU transmission in an RU that is part of a downlink or uplink OFDMA PPDU”); SAMSUNG-1041 ¶27, n1. Other transmitter diagrams in 802.11ax/D1.0 apply specifically to HE SU PPDUs. *See e.g.*, SAMSUNG-1004, 274, FIG. 28-16.

SAMSUNG-1041 ¶27.

B. PO's Expert Confirmed 802.11ax/D1.0 Teachings During Deposition

When presented with various portions of 802.11 inconsistent with PO's argument, Dr. Cooklev had no choice but to agree. SAMSUNG-1040, 38:18-39:1. For example, during his deposition, Dr. Cooklev conceded that 802.11ax/D1.0 teaches the following:

- HE-MU PPDU can carry one PSDU. SAMSUNG-1040, 37:20-23;
- HE-MU PPDU can be for one user. SAMSUNG-1040, 38:7-10;
- HE-MU PPDU includes a PSDU that carries data for just a single user.
SAMSUNG-1040, 49:13-15;
- HE-MU PPDU PSDU can be transmitted only within a single resource unit.
SAMSUNG-1040, 49:16-20;
- Data for one user is transmitted in a single resource unit. SAMSUNG-1040, 50:11-14;
- Full bandwidth does not use multiple resource units. SAMSUNG-1040: 52:9-53:3;
- A 20 MHz 242-tone RU is full-bandwidth. SAMSUNG-1040, 9-18, 67:17-20;

- The maximum number of resource units for a 20 MHz, 242-tone RU is 1. SAMSUNG-1040, 57:8-11;
- 802.11ax/D1.0 FIG. 28-2 shows a full bandwidth, 242-tone RU for a single user. SAMSUNG-1040, 59:18-60:5;
- Regarding $N_{SS,r,u}$, for a single-user transmission, $u = 1$. SAMSUNG-1040, 70:15-71:10.

Thus, as Dr. Cooklev was presented with portions of 802.11ax/D1.0 addressed nowhere in his declaration, he acknowledged a range of facts directly at odds with his original opinion that 802.11ax/D1.0 does not disclose or render obvious single-user transmissions using an HE-MU PPDU in full-bandwidth.

When pressed, the best evidence Dr. Cooklev could summon in support of his original opinion was 802.11ax/D1.0's disclosure in Table 28-24 and Kim's comments regarding the spatial configuration subfield. *E.g.*, SAMSUNG-1040, 63:9-13. But Table 28-24 is not relevant to the single-user (non-MU-MIMO) scenario for the reasons addressed in detail above and in the Petition. *See* SAMSUNG-1004, 322-324; Petition, 25-26 (citing SAMSUNG-1001, FIGS. 13(d)1-(d)2); *see also* SAMSUNG-1001, 20:33-54, cls. 2, 7. By contrast, Table 28-22 does not include a spatial configuration subfield; instead, Table 28-22

indicates the number of spatial streams $N_{SS,r,u}$ by the NSTS field.³ SAMSUNG-1004, 264-266, 320-324; Petition, 26-27, 35-41, 47; SAMSUNG-1001, 20:33-54, cls. 2 & 7; SAMSUNG-1041 ¶28. Accordingly, the fact that Table 28-24 does not identify a single user is irrelevant. 802.11ax/D1.0 provides an alternate table (Table 28-22) for that scenario.

As discussed in the Petition, and consistent with 802.11ax/D1.0 and the '210 patent, the user field format for single user, non-MU-MIMO allocation includes the NSTS field without a spatial configuration field, whereas the format for the MU-MIMO allocation includes a spatial configuration subfield. SAMSUNG-1004, 264-266, 320-324; Petition, 26-27, 35-41, 47; SAMSUNG-1001, 20:33-54, cls. 2 & 7. Thus, Dr. Cooklev's reliance on Kim's comment that "the Spatial Config subfield in HE-SIG-B has $N_{user} \geq 2$ " has nothing whatsoever to do with single-user transmissions because the spatial configuration subfield only applies to the user field format for MU-MIMO allocations in Tables 28-23–28-24. SAMSUNG-1041 ¶29.

³ 802.11ax/D1.0 expressly states that the number of users, u , can equal 1: $u = 1, \dots, N_{user,r}$. SAMSUNG-1004, 264-266, 398-399 (single user in HE MU PPDU, $N_{SS,r,u} = 1$ or 2). Dr. Cooklev agreed that $u = 1$ for single user. SAMSUNG-1040, 70:15-71:10.

Dr. Cooklev's interpretation of 802.11ax/D1.0 is also far less reliable than the express disclosures of 802.11ax/D1.0 itself or the various other evidence of record that contradicts his interpretation. Dr. Cooklev does not have first-hand experience with TGax—the group responsible for the 802.11ax/D1.0 draft. SAMSUNG-1041, 30:19-31:16 (“I was not part of that task group I’m not sure I had any involvement with the *ax* amendment.”). By contrast, Dr. Hansen was a voting member of TGax and was a contributor to 802.11ax/D1.0. SAMSUNG-1003 ¶51. Dr. Hansen explains that almost all comments produced during the letter ballot process, including John Son et al., *Discussions on Signaling for UL HE MU PPDU*, SAMSUNG-1115, involved making clarifications to disclosures and features that already existed in the draft, as opposed to introducing new technical features that a POSITA would not have perceived in D1.0. SAMSUNG-1041 ¶30. Thus, the edits made to 802.11ax/D1.0 were clarifications to concepts already enshrined within the draft. *Id.*

III. 802.11AX/D1.0 RENDERS [1.5], [1.7], [6.3], [6.7] OBVIOUS

Beyond the express teachings of 802.11ax/D1.0, Dr. Hansen provides a thorough explanation for why a POSITA would have found it obvious from 802.11ax/D1.0 that, when SIGB compression indicates full bandwidth, the format of the HE-SIG-B user field is identified based on the number of MU-MIMO users

indicated by the HE-SIG-A field. SAMSUNG-1003, ¶¶107-115; Petition 39-42.

The POR does not refute any of the several points Dr. Hansen made concerning obviousness. POR, 18-19. Indeed, PO and Dr. Cooklev cite to nothing in 802.11ax/D1.0 that prohibits full-bandwidth transmissions to a single user.

Instead, PO relies entirely on a single comment by Youhan Kim taken out of context and rejected by 802.11ax task group. As discussed below, Kim's comment does not mean or imply that full-bandwidth transmissions to single users were prohibited by 802.11ax/D1.0, and was rejected anyway. SAMSUNG-1041 ¶31.

A. Kim's Comment Was Rejected

PO's position is based on the erroneous premise that Youhan Kim's comment reflects the view of a POSITA that 802.11ax/D1.0's HE-MU PPDU did not allow a single user configuration in full bandwidth. *See, e.g.*, POR, 1 ("highly skilled professionals believed that such as scenario "cannot" occur in the prior art"). But Youhan Kim's comment was just one of thousands submitted for the 802.11ax/D1.0 draft, and, importantly, Kim's comment was rejected by the task group. SAMSUNG-1035. EX2021, 3; SAMSUNG-1041 ¶¶32-33. The comment and task group's response is reproduced below:

Jan 2017		doc.: IEEE 802.11-16/xxxxr0		
9770	277.20	Number of MU-MIMO users cannot be 1 (value 0x0) in HE-SIG-A of HE_MU PPDU because the Spatial Config subfield in HE-SIG-B has Nuser >= 2.	Make the value 0x0 reserved for the Number of HE-SIG-B Symbol Or MU-MIMO Users field of HE-SIG-A for HE_MU PPDU if the SIGB Compression field is 1.	Revised – Agree in principle with the comment, but one use case for setting the value 0 for the Number of HE-SIG-B Symbols Or MU-MIMO Users field of HE-SIG-A in HE MU PPDU is the UL HE MU PPDU case. For the full-BW UL HE MU PPDU, a non-AP STA transmitter may reduce HE-SIG-B overhead by setting SIGB Compression field to 1 while the number of MU-MIMO Users field is set to 0. Therefore, the value 0x0 should not be reserved. TGax editor to make the changes shown in 11-17/0173r0 under the heading that include CID 9770.
TGax rejected the proposal to reserve the 0x0 value in MU-MIMO Users field of HE-SIG-A for HE_MU PPDU if SIGB Compression field is 1				

EX2021, 3 (annotated)

The task group did not reserve the 0x0 value as Kim suggested, thus rejecting his proposal. Additionally, as part of their rejection, the task group pointed out that in 802.11ax/D1.0, the number of MU-MIMO users field can be set to 0 while in full bandwidth. EX2021, 3 (see highlighting above). As Dr. Hansen explains, the task group's rejection of Kim's comment is a strong indication that reserving the 0x0 value as Kim suggested was inconsistent with how a POSITA would have understood the original intent and disclosure of 802.11ax/D1.0. SAMSUNG-1041 ¶¶32-33.

The edits that the task group made further clarify that the 802.11ax/D1.0 does support single-user transmissions using HE-MU PPDU in full-bandwidth in

the downlink, pointing expressly to Table 28-22 for the non-MU-MIMO allocation.

Ex. 2021, 3:

28.3.10.8 HE SIG-B

28.3.10.8.1 Encoding and modulation

TGax Editor: *Modify the following paragraph in 28.3.10.8.1 in page 286 of D1.0 0 (#CID 5412, 6194, 7032, 7033)*

When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 1 (indicating full bandwidth MU-MIMO transmission), the Common Block field is not present and the content channel consists of only the User Specific field.

When the SIGB Compression field in the HE-SIG-A field of an HE MU PPDU is set to 1 (indicating full bandwidth MU-MIMO transmission) and the Number of HE-SIG-B Symbols or MU-MIMO Users field in the HE-SIG-A field of an HE MU PPDU is set to 0 (indicating 1 MU-MIMO user), the User Specific field in the HE-SIG-B field consists of the HE-SIG-B user field for a non-MU-MIMO allocation as shown in Table 28-22 (Fields of the HE-SIG-B user field for a non-MU-MIMO allocation). (#5412) (#6194) (#7032) (#9770)

The HE-SIG-B Symbols or MU-MIMO Users field in the HE-SIG-A field of an HE MU PPDU is set to 0 (indicating 1 MU-MIMO user), the User Specific field in the HE-SIG-B field consists of the HE-SIG-B user field for a non-MU-MIMO allocation as shown in Table 28-22 (Fields of the HE-SIG-B user field for a non-MU-MIMO allocation). (#5412) (#6194) (#7032) (#9770)

Ex. 2021, 3 (annotated)

SAMSUNG-1041 ¶¶34-36.

In this same document, to reject yet another Wilus comment, the task group pointed out that 802.11ax/D1.0 required the use of the non-MU-MIMO user field format for full-bandwidth single-user transmissions:

5412	285.55	An HE MU PPDU with the UL/DL field set to 1 is intended to one STA and the HE-SIG-B design is not efficient.	Please refine the HE-SIG-B design for the UL case to reduce the length of the HE-SIG-B field.	Revised – Agree in principle with the comment as discussed in 11-17/0110r0. For the full-BW UL HE MU PPDU, the Common Block field of HE-SIG-B is redundant. A transmitter may omit the field by setting SIGB Compression field in HE-SIG-A to 1. However, when SIGB Compression field is 1, MU-MIMO user field is sent where its Spatial Configuration subfield can only support NSTS indication for $N_{\text{user}} \geq 2$. Therefore, it is required that the User field in HE-SIG-B contains the non-MU-MIMO user field when the Num of MU-MIMO Users field in HE-SIG-A is set to 0. TGax editor to make the changes shown in 11-17/0173r0 under the heading that include CID 5412.
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EX2021, 2 (annotated).⁴

The task group rejected the comment, stating unequivocally that “when SIGB Compression field is 1 ... it is required that the User field in HE-SIG-B contains the non-MU-MIMO user field when the Num of MU-MIMO Users field in HE-SIG-A is set to 0.” EX2021, 2. This means that the task group recognized that 802.11ax/D1.0 supported (or suggested to a POSITA) single-user transmissions of HE-MU PPDU in full-bandwidth. SAMSUNG-1041 ¶¶34-36.

Thus, not only was it obvious to a POSITA that 802.11ax/D1.0 supported single-user transmissions in full-bandwidth, the task group understood that it was

⁴ Note that in 802.11ax/D0.2, the common block is not used for full-bandwidth operation. SAMSUNG-1008, 177; SAMSUNG-1042 (comment 2126 by Sriram Venkateswaran); SAMSUNG-1043, 2 (entering edits).

“required” to use the non-MU-MIMO user field (shown in Table 28-22) when the number of users in HE-SIG-A was set to 0 (indicating 1 user). *Id.*; SAMSUNG-1041 ¶¶34-37; *see also* Petition, 34-42 (discussing the user field format for single-user, non-MU-MIMO allocation in Table 28-22 for full-bandwidth transmissions of HE-MU PPDU).

Also, consistent with the Petition’s mappings, the edits made to §28.3.10.8 emphasize that the user field for a non-MU-MIMO allocation is shown in Table 28-22, a concept already disclosed and rendered obvious by 802.11ax/D1.0. EX2021, 3; SAMSUNG-1004, 320-324 (“The HE-SIG-B user field for an SU allocation contain the subfields shown in Table 28-22 (Fields of the HE-SIG-B user field for an non-MU-MIMO allocation).”), 277-278 (HE-SIG-B only for HE-MU PPDU); Petition, 26-27, 35-41, 47; SAMSUNG-1041 ¶38.

B. Dorothy Stanley’s Comments Show Obviousness

The Petition submitted Dorothy Stanley’s comments on 802.11ax/D1.0 as further evidence that a POSITA reading D1.0 would have understood that it was at least suggested single-user transmissions of HE-MU PPDU in full-bandwidth was supported. Petition, 46 n.6. Stanley’s comment asked:

Regarding “Each User Block field is made up of two user fields,” is it allowed to use the HE MU PPDU for a single user? If so, this statement is incorrect. Please clarify.

SAMSUNG-1036, 3.

In response, the task group agreed with Stanley, commenting that the text described that “the User Block field consists of 2 User field except the last user block field” and that “the HE-MU PPDU can be used for single user.”

SAMSUNG-1036, 3. PO’s attempt to spin Stanley’s comment in support of its position again misrepresents the facts and is not convincing. POR, n.3. Stanley’s comment recognized that the use of an HE-MU PPDU for a single-user was already permitted in 802.11ax/D1.0, and was requesting that the draft further emphasize that capability in the signaling tables. SAMSUNG-1035, 142; SAMSUNG-1036, 3; SAMSUNG-1041 ¶39. The task group agreed with her. SAMSUNG-1036, 3. SAMSUNG-1041 ¶39.

C. Wilus Applies the Wrong Standard for Obviousness

PO and Dr. Cooklev applied the wrong legal standard in rejecting the Petition’s obviousness analysis. This became evident from Dr. Cooklev’s deposition, where he repeatedly deflected evidence of HE-MU PPDUs being used for single-user transmissions in full-bandwidth mode by contending that such evidence was “not enough to conclude that D1.0 allows this.” SAMSUNG-1040, 47:10-15; *see also id.*, (“I agree that the sentence on page 39 [sic] says that, but like I said, that's not enough in my opinion.”), 46:25-19 (“insufficient to

conclude”). In other words, Dr. Cooklev discounted clear disclosures of the claimed features whenever he perceived potential ambiguities elsewhere in the document. But obviousness does turn on whether a standards document unambiguously supports the claimed features (even though 802.11ax/D1.0 does). It is enough that both options are suggested to render the claims obvious. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 405 (2007) (“Rigid preventative rules that deny recourse to common sense are neither necessary under, nor consistent with, this Court’s case law.”). Dr. Cooklev’s admissions in his deposition to the underlying technical facts demonstrating obviousness of the claimed features are far more informative. *E.g.*, SAMSUNG-1040, 37:20-23, 38:7-10, 49:13-15, 49:16-20, 50:11-14, 52:9-53:3, 9-18, 67:17-20, 57:8-11, 59:18-60:5, 70:15-71:10transmissionsEX2021, 2; *see also* Petition, 39-42; SAMSUNG-1003 ¶¶107-115.

Additionally, Dr. Cooklev’s excuse that 802.11ax/D1.0 was a first draft that did not yet support the claimed features is also a red herring. First, 802.11ax/D1.0 is not a “first draft,” as Dr. Cooklev states. SAMSUNG-1040, 38:7-19. As discussed in the Petition, 802.11ax/D1.0 is the culmination of at least five drafts, each of which were the product of technical contributions by task group and working group members over the course of a year. Petition, 8-16 (providing an overview of the development of 802.11ax from D0.1-D1.0). Second, in agreeing

that 802.11ax/D1.0 teaches that an HE MU PPDU can be sent to one or more users, Dr. Cooklev stated that there were certain inaccuracies and inconsistencies in 802.11ax/D1.0. But this same statement persists in later versions of 802.11ax. *E.g.*, SAMSUNG-1045, 33 (like 802.11ax/D1.0, 802.11ax/D2.0 defines HE-MU PPDU as “An HE PPDU transmitted with HE MU PPDU format that is capable of carrying one or more PHY service data units (PSDUs) for one or more users.”). Indeed, Dr. Cooklev could offer no specific examples of features that were inaccurate in 802.11ax/D1.0. Indeed, when asked, Dr. Cooklev admitted to having failed to read the entirety of 802.11ax/D1.0. SAMSUNG-1040, 38:18-23.

IV. GROUND 2 – BHARADWAJ CONTEMPLATES SINGLE USER MU-MIMO TRANSMISSIONS IN FULL-BANDWIDTH – CLAIMS [1.7], [6.5]

Bharadwaj contemplates full-bandwidth MU-PPDU transmissions to a single user. First, as discussed in the Petition, Bharadwaj teaches that in full-bandwidth, the number of MU-MIMO users is indicated by the “SIGB Number of Symbols/Number of MU-MIMO Users” field:

Two parts of HE-SIG-A	B18: B21	SIGB Number of Symbols/ Number of MU-MIMO Users	4	When SIGB compression field=0, indicates the number of HE-SIG-B symbols. Set to n for n+1 HE-SIG-B symbol, where n=0, 1, 2, ..., 15. When SIGB compression field=1, indicates the number of MU-MIMO users minus 1.
	HE-SIG-A1	SIGB Compression	1	Set to 1 for full BW MU-MIMO. Set to 0 otherwise.

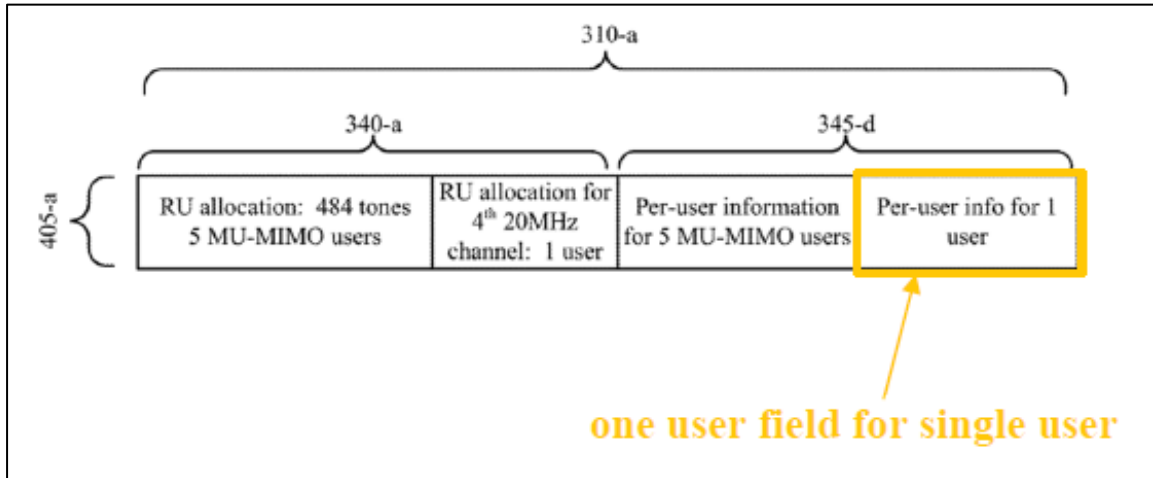
Petition, 70-71; SAMSUNG-1013, FIGS. 21A-B

Note that Bharadwaj does not restrict the number of MU-MIMO users indicated in the HE-SIG-A to be greater than 1, and PO identifies no such restriction.

SAMSUNG-1041 ¶¶40-41. Also in FIG. 21B, Bharadwaj provides a bitmap for encoding a cyclic prefix and long training field for a full bandwidth MU PPDU targeted to a single user. SAMSUNG-1013, FIG. 21B; SAMSUNG-1041 ¶¶40-41. Thus, a POSITA would have understood that Bharadwaj, when read as a whole, discloses and renders obvious that the number of MU-MIMO users indicates a single user in full-bandwidth. SAMSUNG-1041 ¶¶40-41.

The Petition links the single user transmissions to full-bandwidth operation. Specifically, the Petition explains that, in Bharadwaj, 1) **when SIGB compression is set to 1**, the “SIGB Number of Symbols/Number of MU-MIMO Users” field indicates **the number of MU-MIMO users**; and 2) when **the number of MU-MIMO users** indicates a single user, the HE-SIG-B field includes a user-specific field for non-MU-MIMO (SU) allocation for one user. Petition, 70-71, 73;

SAMSUNG-1013, FIGS. 21A-B, ¶[0097]. The Petition explained that Bharadwaj discloses a user block in an HE-SIG-B for a single user:



Petition, 73; SAMSUNG-1013 ¶[0085]-[0087], FIG. 5

SAMSUNG-1041 ¶42.

The POR points to Bharadwaj, FIG. 7, which is a table showing the spatial configuration encoding. Bharadwaj ¶[0093]. And as Bharadwaj explains, a “**user field for an MU-MIMO allocation**, e.g. in a HE-SIG-B field, may include a spatial configuration subfield.” *Id.* Thus, in Bharadwaj, like in 802.11ax/D1.0, the spatial configuration subfield is encoded only in user fields for MU-MIMO allocation, and FIG. 7 is not relevant to the non-MU-MIMO allocation.

SAMSUNG-1041 ¶43. In the combination, Sun teaches a user block field for a single-user transmission encoded into the HE-SIG-B (which is only for HE-MU PPDU). Petition, 74; SAMSUNG-1015 ¶¶[0072]-[0073], FIGS. 13A-B;

SAMSUNG-1003, ¶¶171-172. Sun teaches that for single user transmission, the

HE-SIG-B user field includes an NSTS encoding. *E.g.*, Petition, 75-76;
SAMSUNG-1015 ¶¶0084]; SAMSUNG-1003, ¶174. Thus, in the combination,
Bharadwaj teaches a user field format for MU-MIMO allocation that includes
spatial configuration subfield encoding, while Sun teaches a user field format for
non-MU-MIMO allocation that includes an NSTS subfield encoding. Therefore,
the Bharadwaj/Sun combination meets the limitations of the challenged claims.
SAMSUNG-1041 ¶43.

While 802.11ax/D1.0 omitted the common block from HE-SIG-B in full-
bandwidth, Bharadwaj is consistent with earlier versions of 802.11, evidenced by
802.11ax/D0.1 (March 2016):

801.11ax/D0.1 , 173 (SAMSUNG-1009)	Bharadwaj ¶¶0097] (SAMSUNG-1013)
If the value of SIGB Compression field in HE-SIG-A is 1, there is no RU allocation signaling in HE-SIG-B common field. The number of STAs in the MU MIMO group is indicated in the TBD field in HE-SIG-A.	The compressed mode may be used for MU-MIMO utilizing a full bandwidth. In such case, no RU signal information is transmitted in a HE_SIG-B [field]. ... In the compressed mode, a number of MU-MIMO users need to be indicated. To accomplish this, a field in

	the SIG-A field corresponding to the number of SIG-B symbols may be re-interpreted or repurposed, and the number of SIG-B symbols derived from the number of MU-MIMO users.
--	---

SAMSUNG-1041 ¶¶44-45. Additionally, contrary to the POR, Bharadwaj recognized that omitting the common block would reduce overhead. SAMSUNG-1013 ¶[0097] (describing that while the number of MU-MIMO users may be “indicated in a common portion of a HE-SIG-B field”, doing so “increases overhead”). The omission of the common field during full-bandwidth was introduced into 802.11ax in D0.2. SAMSUNG-1008, 177; SAMSUNG-1041 ¶¶44-45. Also note that the PO is asserting the Challenged Claims against a non-AP station, meaning that they are applying the claims to the downlink. *E.g.*, SAMSUNG-1025, 19-20 (mapping the receiving and decoding steps being performed at a mobile phone). Thus, the POR’s discussion of uplink signaling is irrelevant. SAMSUNG-1041 ¶¶44-45.

Importantly, also, none of the challenged claims require the omission of the common block while in full-bandwidth. Indeed, none of the claims mention the common block at all. Thus, the POR is placing a requirement onto Bharadwaj/Sun

that is absent from the claims. By contrast, the Bharadwaj-Sun combination teaches each and every aspect of the challenged claims, and in combination, renders them obvious. SAMSUNG-1041 ¶46.

V. GROUND 2 – BHARADWAJ AND SUN STAND ON THEIR OWN

The POR argues that “a POSITA would have interpreted Bharadwaj the same as D1.0.” POR, 24-25. As discussed above, PO’s conclusion that 801.11ax/D1.0 did not support single user HE-MU PPDU transmissions in full-bandwidth is incorrect. Therefore, PO’s attempt to color Bharadwaj-Sun as being likewise restricted falls flat. Additionally, PO’s attempt to link Bharadwaj/Sun to 802.11ax/D1.0 is a distraction and relies on the wrong legal standards. POR, 20, 26. PO’s attempt to tie Bharadwaj/Sun to 802.11ax/D1.0 fails for several reasons. First, Bharadwaj and Sun are prior art printed publications that render the Challenged Claims obvious in view of their own teachings and the knowledge of a POSITA at that time. *E.g., EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985) (explaining that a “reference must be considered for everything it *teaches* by way of technology” and on the issue of obviousness, “the combined teachings of the prior art as a whole must be considered”). SAMSUNG-1041 ¶¶47-49.

Second, the POR mischaracterizes Bharadwaj's discussion of 802.11. POR, 20. Bharadwaj is broadly applicable to wireless local area networks (WLAN) and never limits itself to compliance with 802.11ax. SAMSUNG-1013, [0005] (802.11 Wi-Fi is one example of a WLAN protocol), [0063]-[0064] (describing that stations and APs communicate according to direct wireless links, as well as 802.11 versions "including, but not limited to, 802.11b, 802.11g, 802.11a, 802.11n, 802.11ac, 802.11ad, 802.11ah, 802.11z, 802.11ax, etc."), [0143] (describing compatibility with different versions of 802.11). Additionally, to link Bharadwaj to 802.11ax/D1.0, the POR relies on Bharadwaj's December 21, 2016 filing date. But the POR ignores how Bharadwaj claims priority to a set of provisional applications filed as early as December 21, 2015. POR, 20; SAMSUNG-1013, face. SAMSUNG-1041 ¶¶47-49.

Given that Bharadwaj expressly intended broad applicability to Wi-Fi protocols and that Bharadwaj's priority predates 802.11ax/D1.0, PO's conclusion that a POSITA would have interpreted Bharadwaj the same as 802.11ax/D1.0 is incorrect. Indeed, Dr. Hansen testified that 802.11ax/D1.0 and Bharadwaj were different documents. EX2019, 9:9-11:2 ("I mean, they're different documents. One is a draft in a standard and the other one is a patent. So ... there could be differences between them."); SAMSUNG-1041 ¶¶47-49.

VI. 802.11AX/D1.0 WAS PUBLICLY ACCESSIBLE BEFORE THE CRITICAL DATE

The POR concedes the public accessibility of 802.11ax/D1.0 as of December 1, 2016. POR, 9. Rightfully so. Petitioner considers the question of public accessibility to be closed. Nonetheless, to assist the Board, and insofar as the Institution Decision invited further development of the evidentiary record pertaining to public accessibility, Petitioner provides the following brief discussion. ID, 14-15.

Following institution, Petitioner timely filed a Motion for Supplemental Information and a Supplemental Public Accessibility Declaration of Dr. Hansen pursuant to the Board's authorization. *See* Motion for Supplemental Information, Paper 16 (filed 12/09/2025) with SAMSUNG-1038. The Board granted the Motion, recognizing that 1) PO did not file an opposition, 2) the record would be "better developed" if Exhibit 1038 were entered into evidence, and 3) PO would have the ample opportunity to argue public accessibility in its response. Order Granting Motion for Supplemental Information, Paper 24, 5. PO cross-examined Dr. Hansen on both his initial (SAMSUNG-1026) and supplemental (SAMSUNG-1038) Public Accessibility Declarations. EX2019, 23:19-25:9 ("Would a POSITA have had access to publicly available 802.11 drafts as of the time they were made

publicly available? ...A: Yes.”). Now, in its POR, PO concedes public accessibility of 802.11ax/D.10. POR, 9.

Dr. Hansen, who was a Voting Member of TGax and actively involved in the development of 802.11ax Drafts between May 2014 and November 2020, explained with support from dozens of corroborating exhibits that 802.11ax/D1.0 was publicly accessible as of December 1, 2016. SAMSUNG-1026, ¶¶20-22, 24 (drafts submitting to larger “Working Group”), 26-27 (TGax meetings were open to the public and were publicly announced), 57-58 (agenda for November 2016 meeting publicly available and preparation of the 802.11ax/D1.0 draft announced), 59-60 (Draft D1.0 was initially made available to voting members of the IEEE 802.11 Working Group by December 1, 2016). Dr. Hansen clarifies how a member of the interested public could access 802.11ax/D1.0 on December 1, 2016. SAMSUNG-1038 ¶¶8-16.

Citing the 802.11 Operations Manual, Dr. Hansen explained that “all Active 802.11 participants were entitled access” to the private (online) area where drafts were provided. SAMSUNG-1038 ¶¶11-12. Any interested member of the public could become an Active 802.11 participant by attending a session. *Id.* ¶¶11-12, 14-15 (citing 802.11 Operations Manual §§7.1.1-7.1.2). Credentials for accessing the private area were provided to new Active 802.11 participants “immediately after attending their first session.” *Id.* And Active 802.11 participants were enrolled in

the STDS-802-11@LISTSERV.IEEE.ORG listserv to receive emails announcing release of drafts. Dr. Hansen noted that the term “private” did not imply that the drafts were closely held. SAMSUNG-1038 ¶¶11-12. Indeed, even interested persons outside of 802.11, such as members of the Internet Engineering Task Force (IETF), were provided credentials to the private area upon request. *Id.* ¶¶24-27 (describing various ways a member of IETF—not an Active 802.11 participant—could access the drafts kept in the private area). SAMSUNG-1026, ¶¶57-58; SAMSUNG-1038 ¶¶18-20.

VII. CONCLUSION

Petitioner has established that the Challenged Claims are unpatentable and respectfully requests that the Board find the same.

Respectfully submitted,

Dated: 06/22/2026

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CERTIFICATION UNDER 37 CFR §42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner's Reply to Patent Owner's Response totals 5,410 words, which is less than the 5,600 allowed under 37 CFR § 42.24(c)(4).

Dated: 06/22/2026

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e)(4), the undersigned certifies that on June 22, 2026, a complete and entire copy of this Petitioner's Reply to Patent Owner's Response to Petition and Accompanying Exhibits were provided by email to the Patent Owner by serving the email correspondence address of record as follows:

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