

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Woojin Ahn, et al.	Attorney Docket No. 39843-0202IP1
U.S. Patent No.:	11,716,171	
Issue Date:	August 1, 2023	
Appl. Serial No.:	17/145,670	
Filing Date:	January 11, 2021	
Title:	WIRELESS COMMUNICATION TERMINAL AND WIRELESS COMMUNICATION METHOD FOR MULTI-USER CONCURRENT TRANSMISSION	

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES
PATENT NO. 11,716,171 PURSUANT TO 35 U.S.C. §§ 311–319,
37 C.F.R. § 42**

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EXHIBITS

- SAMSUNG-1001 U.S. Patent No. 11,716,171 to Ahn, et al. (“the ’171 Patent”)
- SAMSUNG-1002 Excerpts from the Prosecution History of the ’171 Patent (“the Prosecution History”)
- SAMSUNG-1003 Declaration and Curriculum Vitae of Dr. Zhi Ding
- SAMSUNG-1004 Complaint, *Wilus Institute of Standards and Technology Inc., v. Samsung Electronics Co., Ltd., et al.*, 2-25-cv-00070 (EDTX) filed January 23, 2025
- SAMSUNG-1005 Korean Application No. 10-2015-0030369
- SAMSUNG-1006 Translation and Certificate of Translation for SAMSUNG-1005
- SAMSUNG-1007 Korean Application No. 10-2015-0036754
- SAMSUNG-1008 Translation and Certificate of Translation for SAMSUNG-1007
- SAMSUNG-1009 Korean Application No. 10-2015-0066670
- SAMSUNG-1010 Translation and Certificate of Translation for SAMSUNG-1009
- SAMSUNG-1011 PCT Application No. PCT/KR2016/002199
- SAMSUNG-1012 Translation and Certificate of Translation for SAMSUNG-1011
- SAMSUNG-1013 U.S. Patent No. 10,305,638 (“Ahn”)
- SAMSUNG-1014 U.S. Patent No. 10,911,186 (“Ahn”)
- SAMSUNG-1015 U.S. Patent Publication No. 2019/0357256 (“Kim”)
- SAMSUNG-1016 U.S. Patent Publication No. 2015/0131517 (“Chu”)
- SAMSUNG-1017 U.S. Patent Publication No. 2015/0230244 (“Choi”)
- SAMSUNG-1018 *Fintiv* Stipulation
- SAMSUNG-1019 RESERVED
- SAMSUNG-1020 IEEE 802.11-2012

SAMSUNG-1021 IEEE 802.11-16/0368r0

SAMSUNG-1022 IEEE 802.11-16/0949r2

LISTING OF CHALLENGED CLAIMS

Claim 1	
[1Pre]	A wireless communication terminal, the terminal comprising:
[1.1]	a transceiver; and
[1.2]	a processor,
[1.3]	wherein the processor is configured to: receive a frame for allocating resource for uplink (UL) multi-user (MU) transmission to one or more terminals,
[1.4]	wherein the frame includes an association identifier (AID) field and a frame check sequence (FCS) field,
[1.5]	wherein the AID field is set to a value related to a first padding field, when the first padding field is included in the frame,
[1.6]	wherein the first padding field is used to adjust a length of the frame, and
[1.7]	wherein the first padding field is related to a preparation of a response frame for the frame, and
[1.8]	transmit the response frame in response to the frame.
Claim 2	
[2]	The wireless communication terminal of claim 1, wherein whether or not the first padding field is included in the frame is identified by the AID field.
Claim 3	
[3]	The wireless communication terminal of claim 2, wherein the first padding field consists of at least one bit, and wherein all of the at least one bit are set to '1'.
Claim 4	
[4]	The wireless communication terminal of claim 1, wherein the first padding field is located before the FCS field in the frame.
Claim 5	
[5]	The wireless communication terminal of claim 1, wherein the response frame includes a second padding field, when a specific condition is satisfied.

Claim 6	
[6]	The wireless communication terminal of claim 1, wherein the first padding field is used to extend the length of the frame.
Claim 7	
[7]	The wireless communication terminal of claim 1, wherein a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.
Claim 8	
[8]	The wireless communication terminal of claim 1, wherein the second padding field is used to set a same lengths of the response frames when two or more terminals transmit response frames in response to the trigger frame.
Claim 9	
[9Pre]	A wireless communication method of a wireless communication terminal, comprising:
[9.1]	receiving a frame for allocating resource for uplink (UL) multi-user (MU) transmission to one or more terminals,
[9.2]	wherein the frame includes an association identifier (AID) field and a frame check sequence (FCS) field,
[9.3]	wherein the AID field is set to a value related to a first padding field, when the first padding field is included in the frame,
[9.4]	wherein first padding field is used to adjust a length of the frame, and
[9.5]	wherein the first padding field is related to a preparation of a response frame for the frame; and
[9.6]	transmitting the response frame in response to the frame.
Claim 10	
[10]	The wireless communication method of claim 9, wherein whether or not the first padding field is included in the frame is identified by the AID field.
Claim 11	
[11]	The wireless communication method of claim 10, wherein the first padding field consists of at least one bit, and wherein all of the at least one bit are set to '1'.

Claim 12	
[12]	The wireless communication method of claim 9, wherein the first padding field is located before the FCS field in the frame.
Claim 13	
[13]	The wireless communication method of claim 9, wherein the response frame includes a second padding field, when a specific condition is satisfied.
Claim 14	
[14]	The wireless communication method of claim 9, wherein the first padding field is used to extend the length of the frame.
Claim 15	
[15]	The wireless communication method of claim 9, wherein a duration of the first padding field is set based on a time needed for the one or more terminals to process the frame.
Claim 16	
[16]	The wireless communication method of claim 9, wherein the second padding field is used to set a same lengths of the response frames when two or more terminals transmit response frames in response to the trigger frame.

Samsung Electronics Co., Ltd. (“Petitioner” or “Samsung”) petitions for *Inter Partes* Review (“IPR”) of claims 1-16 (“the Challenged Claims”) of U.S. Patent No. 11,716,171 (“the ’171 Patent”). Compelling evidence presented in this Petition demonstrates at least a reasonable likelihood that Samsung will prevail with respect to at least one of the Challenged Claims.

I. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the ’171 Patent is available for IPR. This petition is being filed within one year of service of a complaint against Samsung.

SAMSUNG-1004. Samsung is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

Samsung requests an IPR of the Challenged Claims on the grounds noted below. Dr. Zhi Ding provides supporting testimony in his Declaration.

SAMSUNG-1003, ¶¶4-203.

Ground	Claims	35 U.S.C. § 103
1	1-16	Kim
2	1-16	Chu-Choi

C. Claim Construction

Petitioner submits that no formal claim constructions are necessary because

“claim terms need only be construed to the extent necessary to resolve the controversy.” *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011). Petitioner reserves the right to respond to any constructions offered by Patent Owner or adopted by the Board. Petitioner is not conceding that each challenged claim satisfies all statutory requirements, nor is Petitioner waiving any arguments concerning claim scope or grounds that can only be raised in district court. For this petition, Petitioner applies prior art in a manner consistent with Patent Owner’s allegations of infringement before the district court.

D. Level of Ordinary Skill in the Art

For purposes of this IPR, 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 3 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. SAMSUNG-1003, ¶¶26-28. Increased educational experience can make up for less work experience, and vice versa. *Id.*

II. THE ’171 PATENT

A. Brief Description

The ’171 Patent is directed to “a wireless communication terminal” that enables simultaneous uplink transmissions by a plurality of terminals through the use of a trigger frame. SAMSUNG-1001, Abstract, 3:5-7, 3:50-52, 17:26-32, 20:1-

3, FIG. 20. In the example depicted in FIG. 20, the '171 Patent describes that “a trigger frame that triggers the multi-user simultaneous transmission may also be padded.” SAMSUNG-1001, 20:1-3, FIG. 20; SAMSUNG-1003, ¶58.

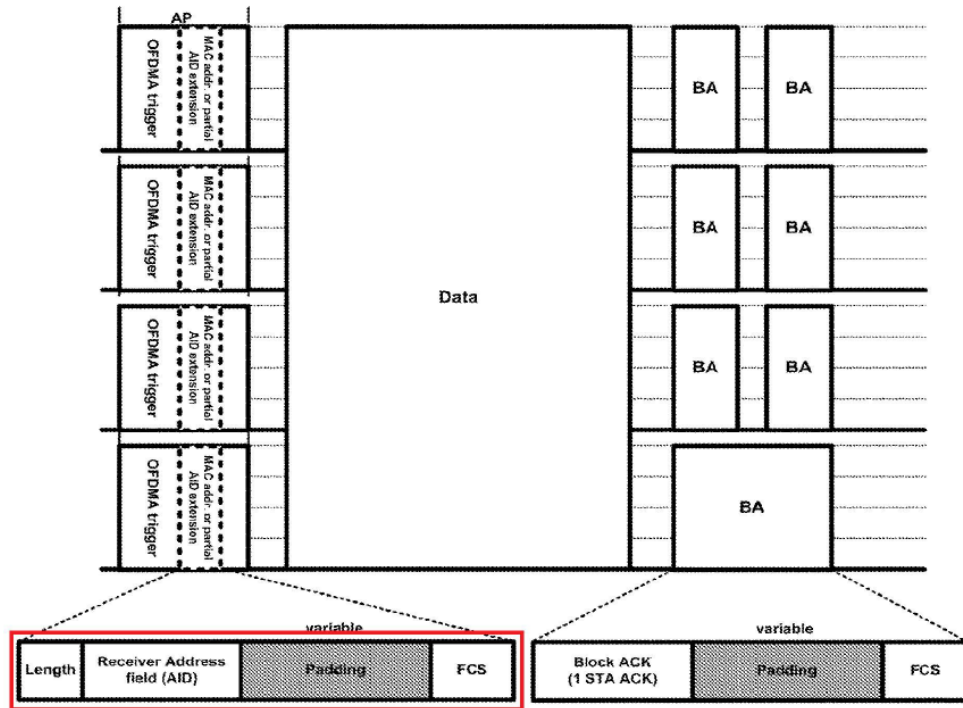


FIG. 20

SAMSUNG-1001, FIG. 20¹.

The '171 Patent further explains that “[t]he trigger frame may include AID information of the STA assigned to each channel” and “a predetermined padding may be performed before a Frame Check Sequence (FCS) field of the trigger frame” such that “the transmission of the trigger frame may be terminated at the

¹ Annotations to figures are shown in color.

same time in each channel through which the trigger frame is transmitted,”

allowing “the STAs [stations] to acquire additional processing time to participate in the multi-user simultaneous transmission in response to the trigger frame.”

SAMSUNG-1001, 20:6-18. Following transmission of the frame, the STAs simultaneously transmit uplink data to perform the multi-user uplink transmission.

SAMSUNG-1001, 17:29-32; SAMSUNG-1003, ¶59.

B. Prosecution History

Claims 13-26 (issued claims 1-7 and 9-15) were first introduced through a preliminary amendment filed on January 11, 2021, **without** accompanying discussion or identification of clear support in the corresponding portions of the specification or drawings. SAMSUNG-1002, 491-497.

The Examiner issued only one office action during the ’171 Patent’s prosecution, including prior art rejections of claims 13, 16-20, and 23-26 (issued claims 1, 4-7, 9, and 12-15) under §102 over Chu ’574 (US 2016/0165574). SAMSUNG-1002, 180-183. The Examiner also rejected claims on grounds of non-statutory double patenting, particularly claims 13, 16, 20, and 23 (issued claims 1, 4, 9, and 12) over claim 1 of U.S. Patent No. 10,305,638, and claims 13, 14, 16, 19-21, 23, and 26 (issued claims 1, 2, 4, 7, 9, 10, 12, and 15) over claims 1-3 of U.S. Patent No. 10,911,186. *Id.*, 176-180. The Examiner also indicated that claims 15 and 22 (issued claims 3 and 11) were allowable. *Id.*, 182.

In response, the applicant amended the claims and introduced new claims 27 and 28 (issued claims 8 and 16). SAMSUNG-1002, 159-170. Notably, the independent claims were amended to recite that “the AID field is set to a value related to a first padding field, when the first padding field is included in the frame.” *Id.*, 160-164. The applicant also filed a terminal disclaimer over U.S. Patent Nos. 10,305,638 and 10,911,186. *Id.*, 151-155. Following these amendments, the Examiner allowed all claims. *Id.*, 16-17.

However, as discussed below, the descriptions and drawings of the ’171 Patent—including its parent applications and foreign priority applications—do **not** provide adequate support for the features added during prosecution. Further, the prior art grounds presented in this Petition, which were not previously considered during prosecution, include references that disclose setting the AID field to a value related to a first padding field, when the first padding field is included in the frame—the feature that was identified as justifying allowance of the ’171 Patent. SAMSUNG-1003, ¶61.

C. Critical Date of the ’171 Patent

Petitioner submits that the Critical Date of the ’171 Patent is **no earlier than Jan. 11, 2021**—the filing date of the ’171 Patent—because the priority applications of the ’171 Patent fail to provide written description support for the claimed invention, as required by 35 U.S.C. §§ 112(a), 119(a), and 120.

As an initial matter, claim 1 of the '171 Patent recites a frame “for allocating resource for uplink (UL) multi-user (MU) transmission to one or more terminals.” SAMSUNG-1001, claim 1. The specification of the '171 Patent explains that the term “resource” may refer to “a channel or a sub-channel allocated to the STA,” and further states that the trigger frame “may indicate information on the channel or sub-channel allocated to each uplink transmission STA.” *Id.*, 11:56-58, 17:32-35. In view of this description, the claimed “frame” performs the functions of a trigger frame as understood in the context of multi-user uplink scheduling.

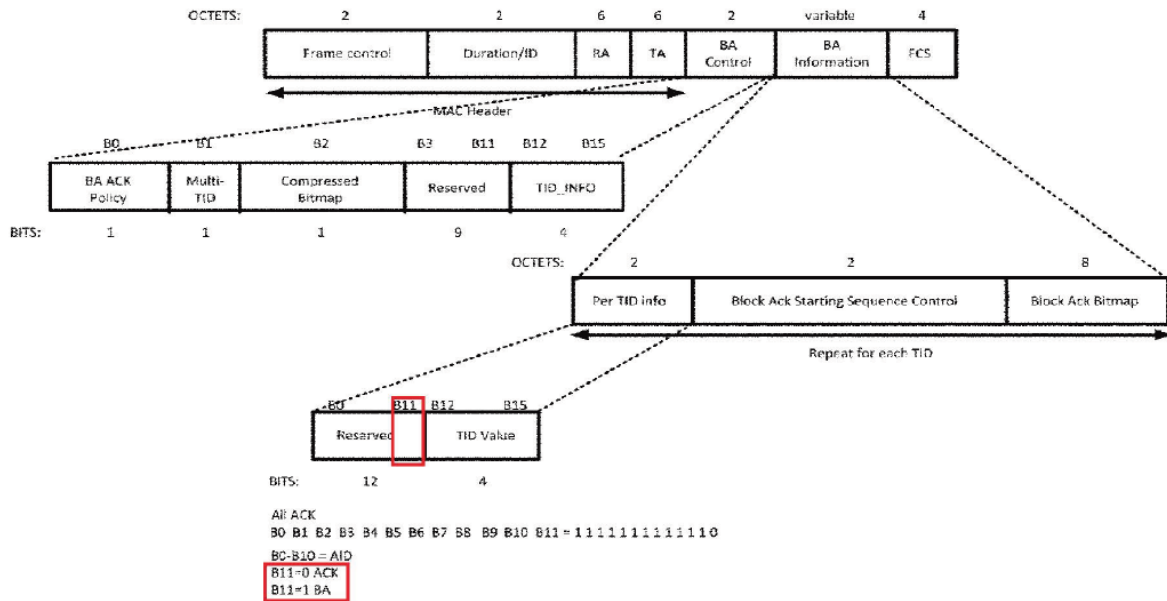
Under 35 U.S.C. § 119 and § 120, a U.S. patent may claim the benefit of an earlier application *only if* the earlier application includes a disclosure that satisfies the written description requirement of § 112. *See In re Gosteli*, 872 F.2d 1008, 1010-11 (Fed. Cir. 1989); *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1564, 1571-72 (Fed. Cir. 1997). The disclosure must demonstrate that the inventor had possession of the claimed invention as of the filing date. *Lizardtech, Inc. v. Earth Res. Mapping Inc.*, 424 F.3d 1336, 1345 (Fed. Cir. 2005). It is not sufficient that the invention would have been obvious in view of what is disclosed. *See In re Huston*, 308 F.3d 1267 (Fed. Cir. 2002); *In re Jones*, 10 F. App'x 822 (Fed. Cir. 2001). The requirement is not met if the disclosure merely points to a broad genus from which the specific claimed invention must be later extracted. *See Purdue Pharma v. Faulding*, 230 F.3d 1320, 1326–27 (Fed. Cir. 2000).

None of the Challenged Claims are supported by Korean Application Nos. 10-2015-0030369, 10-2015-0036754, or 10-2015-0066670, PCT Application No. PCT/KR2016/002199, U.S. Application No. 15/555,075, or U.S. Application No. 16/377,829 (collectively, “the pre-Jan. 11, 2021 applications”). SAMSUNG-1005-1014. In particular, independent claims 1 and 9 of the ’171 Patent recite that the “AID field is set to a value related to a first padding field, when the first padding field is included in the frame.” SAMSUNG-1001, claims 1 and 9. These features are absent from the pre-Jan. 11, 2021 applications. There is no disclosure establishing that the inventors were in possession of a frame structure in which the AID field is set to a value related to a first padding field, when the first padding field is included in the frame. SAMSUNG-1003, ¶62.

For example, Korean Application No. 10-2015-0036754 (“KR ’754”)—which is representative of the disclosure in the priority applications—discusses using a Block ACK (BA) format to implement a multiplexed group ACK. SAMSUNG-1007-1008, [0064], FIG. 9. It describes using bits B0-B10 for AID values and B11 as a flag to distinguish between a general ACK and a BA. *Id.* However, this pertains to uplink ACKs—not trigger frames—and B11 does not identify or relate to padding. Further, while KR ’754 notes that “[t]he padding method for length alignment of the AID field in the BA... can be similarly applied in the DL-OFDMA trigger process,” this only refers to inserting zero padding or

repeating AIDs in the **downlink** transmission. *Id.*, [0072]. It does **not** describe or enable an AID field within a trigger frame that is set to a value related to a padding field. SAMSUNG-1003, ¶¶63-64.

【도 9】



SAMSUNG-1007, FIG. 9

Likewise, the '171 Patent specification itself fails to describe the claimed functionality with the required clarity. It generally states that a trigger frame may be padded or may include duplicated AID information before the FCS field. SAMSUNG-1001, 20:1-12, 20:20-22, FIG. 20. However, it does not disclose setting the AID field to a value related to a first padding field, when the first padding field is included in the frame. These statements do not show possession of the specific claimed invention. SAMSUNG-1003, ¶¶65.

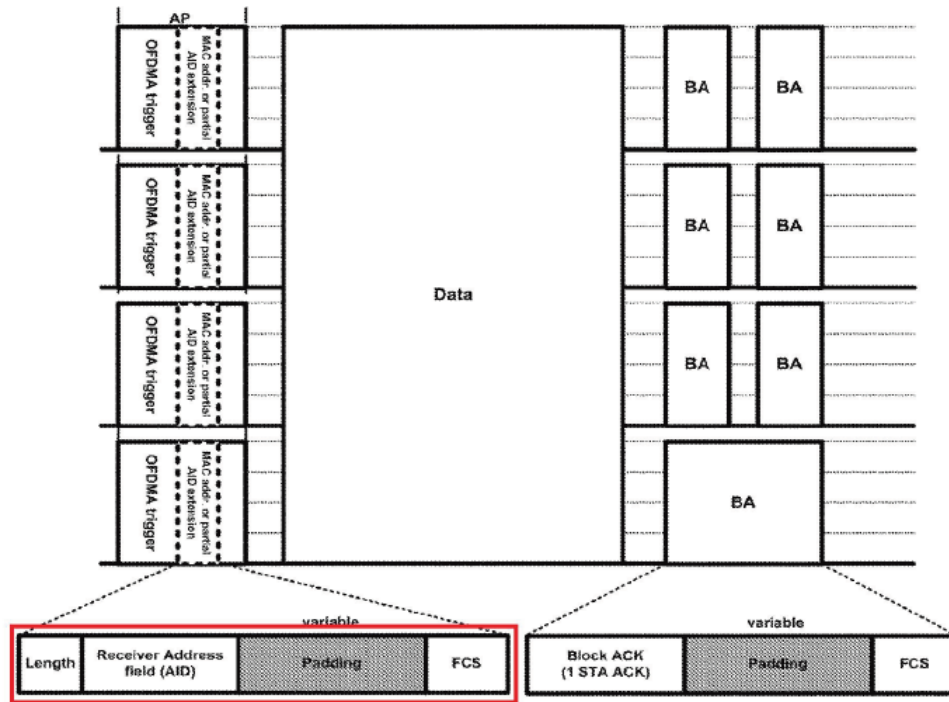


FIG. 20

SAMSUNG-1001, FIG. 20

Additionally, the dependent claims of the '171 Patent likewise lack written description support in the pre-Jan. 11, 2021 applications. For example, claim 2 (and corresponding claim 10) recites that “whether or not the first padding field is included in the frame is identified by the AID field.” SAMSUNG-1001, claims 2 and 10. As discussed above with respect to claim 1, the priority applications do not disclose that the AID field is set to a value related to the padding field. Nor do they describe any mechanism by which the AID field identifies the presence or absence of a padding field. There is no indication that the inventors were in possession of such functionality at the time of the pre-Jan. 11, 2021 filings.

SAMSUNG-1003, ¶66.

Claim 5 (and corresponding claim 13) likewise lacks written description support in the priority applications. Claim 5 recites that “the response frame includes a second padding field, when a specific condition is satisfied.”

SAMSUNG-1001, claim 5 and 13; SAMSUNG-1003, ¶67.

KR '754 does not disclose this functionality. Specifically, the only discussion of padding in the context of a trigger frame appears in the portion describing a downlink transmission scenario with respect to FIG. 12. KR '754 explains that, “in the DL-OFDMA trigger process, to align the length of the trigger when the AP notifies the AIDs of the terminals assigned to each channel, the same method as shown in FIG. 11 can be used—by inserting zero padding or repeating AIDs.” SAMSUNG-1007-1008, [0072]. This discussion is limited to padding applied to a downlink trigger frame issued by the AP and does not address any behavior or response of the terminals in preparing or padding their own uplink transmissions. SAMSUNG-1003, ¶68.

Accordingly, nowhere does KR '754 describe that a STA applies padding to an uplink packet (e.g., UL PPDU) in order to terminate its transmission at a designated time as recited in claim 5. Nor does the disclosure explain how the STA would determine such a designated termination time, much less how padding would be used to ensure alignment with that time. Absent such a teaching, a

POSITA would not understand that the inventors were in possession of the claimed behavior at the time of the pre-Jan. 11, 2021 filings. SAMSUNG-1003, ¶¶69.

Claim 7 (and corresponding claim 15) further recites that “a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.” SAMSUNG-1001, claims 7 and 15. Again, nothing in the pre-Jan. 11, 2021 applications discloses or enables such functionality. For example, while KR ’754 refers generally to the use of padding for alignment and notes that uplink data transmissions from multiple users may end at the same time due to scheduling and data padding, it does not describe or suggest padding whose duration is dynamically set based on processing time of one or more terminals. SAMSUNG-1007-1008, [0058], [0066], [0068], FIG. 12. The cited description relates only to matching ACK lengths or data alignment—not to terminal processing time. *Id.* Accordingly, the disclosure fails to show possession of the specific functionalities recited in dependent claims 2, 5, 7, 10, 13, and 15, and these claims are therefore not entitled to a priority date earlier than January 11, 2021. SAMSUNG-1003, ¶¶70-71.

Accordingly, the challenged claims are **not** entitled to a priority date earlier than January 11, 2021. Because every claim of the ’171 Patent depends on features that lack written description support in the pre-Jan. 11, 2021 applications, none are entitled to an earlier filing date. *Falko-Gunter Falkner v. Inglis*, 448 F.3d

1357 (Fed. Cir. 2006); SAMSUNG-1001, claims 1-16; SAMSUNG-1003, ¶¶72.

As shown in the table below, all references presented in this Petition pre-date January 11, 2021 and, thus, constitute prior art. In addition, both Chu and Choi pre-date the earliest claimed priority date of the '171 Patent, which is March 4, 2015, and constitute prior art regardless of the priority analysis set forth above.

Reference	Filing Date	Publication Date
US 2019/0357256 (Kim)	Jan. 8, 2018	Nov. 21, 2019
US 2015/0131517 (Chu)	Nov. 11, 2014	May 14, 2015
US 2015/0230244 (Choi)	Oct. 29, 2013	Aug. 13, 2015

III. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1] – Kim renders claims 1-16 obvious

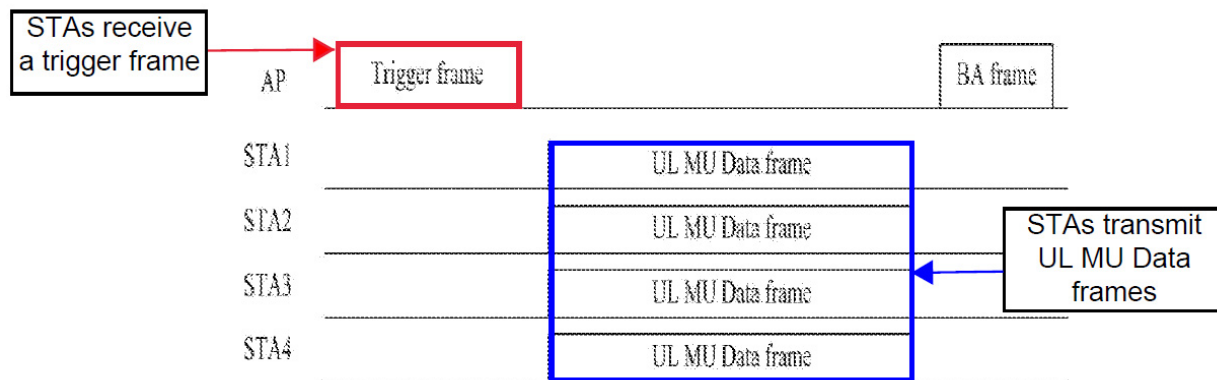
1. Overview of Kim

Kim discloses a process in which a plurality of stations (STA1 to STA4) receive, from the access point (AP), a trigger frame for uplink (UL) multi-user (MU) transmission. SAMSUNG-1015, [0131]-[0132], FIG. 16. The trigger frame includes (i) a User Information field, which in turn includes an **AID 12 subfield**, (ii) a **Padding** field, and (iii) a Frame Check Sequence (**FCS**) field. *Id.*, [0136], [0138], FIG. 17. The AID 12 subfield indicates the least significant 12 bits of the AID of the station that is to receive the corresponding User Information field. *Id.*, [0138]; SAMSUNG-1003, ¶¶73-76.

The AID 12 subfield in the User Information field identifies the least significant 12 bits of the AID of the STA that is assigned **uplink transmission resources**, while reserved values such as 0 or 2045 indicate allocation for random access, and a value of 4095 **signifies the start of a Padding field** in the trigger frame. SAMSUNG-1015, [0138], [0141]; SAMSUNG-1003, ¶¶73-76.

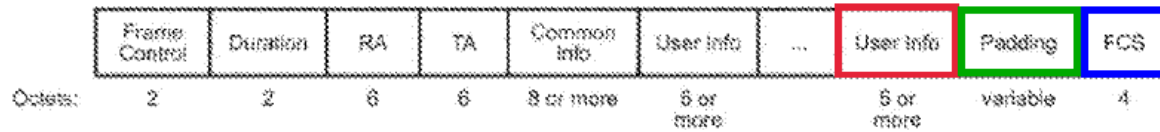
In response to the received trigger frame, “[t]he STAs may transmit a UL data frame using a HE trigger based PPDU format after SIFS from a PPDU including the trigger frame,” where “SIFS” refers to “Short Inter-Frame Space.” SAMSUNG-1015, [0100], [0133]; SAMSUNG-1003, ¶¶73-76.

FIG. 16

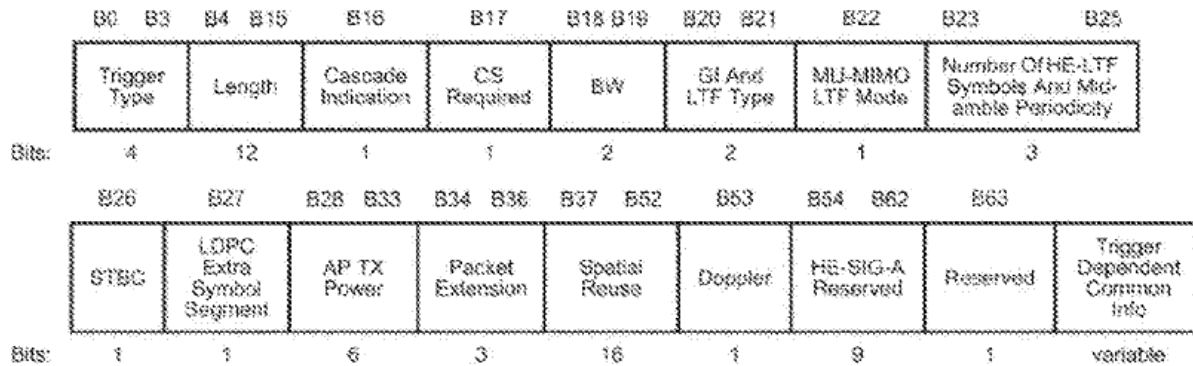


SAMSUNG-1015, FIG. 16

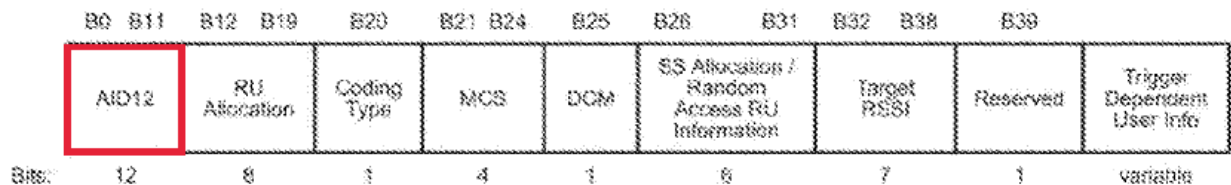
FIG. 17



(a) Trigger frame



(b) Common Info field of Trigger frame



(c) User Info field of Trigger frame

SAMSUNG-1015, FIG. 17

2. Analysis

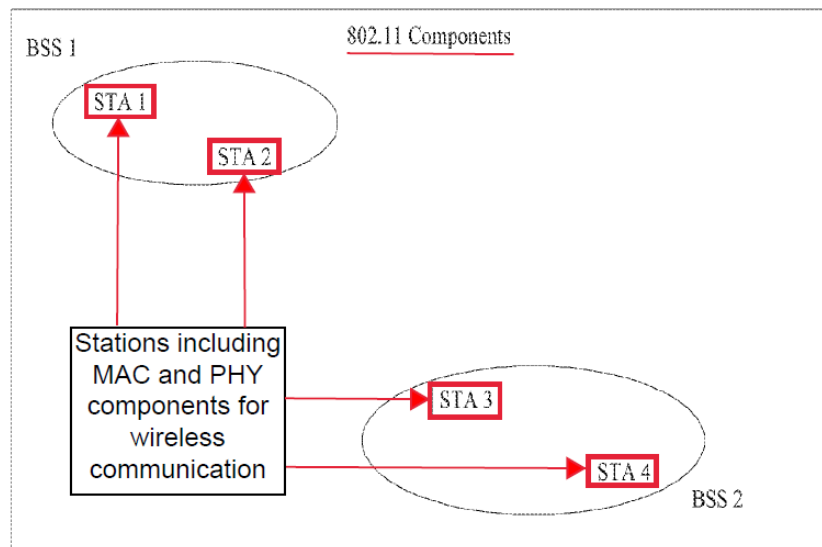
[1.pre] A wireless communication terminal, the terminal comprising:

As an initial matter, the '171 Patent does not define a “wireless communication terminal,” but instead describes a “station (STA) [that] is a predetermined device including **medium access control (MAC)** following a

regulation of an IEEE 802.11 standard and a **physical layer interface** for a wireless medium.” SAMSUNG-1001, 5:47-50².

To the extent the preamble is limiting, Kim’s STA meets this description. Specifically, Kim describes that “[a]n STA is a logical entity including a **physical layer interface** between a **Media Access Control (MAC) layer** and a wireless medium.” SAMSUNG-1015, [0044]; SAMSUNG-1003, ¶77. Thus, Kim’s STA satisfies the characteristics of a “wireless communication terminal” contemplated by the ’171 Patent, including the MAC and PHY components for wireless communication. SAMSUNG-1003, ¶77.

FIG. 1



SAMSUNG-1015, FIG. 1

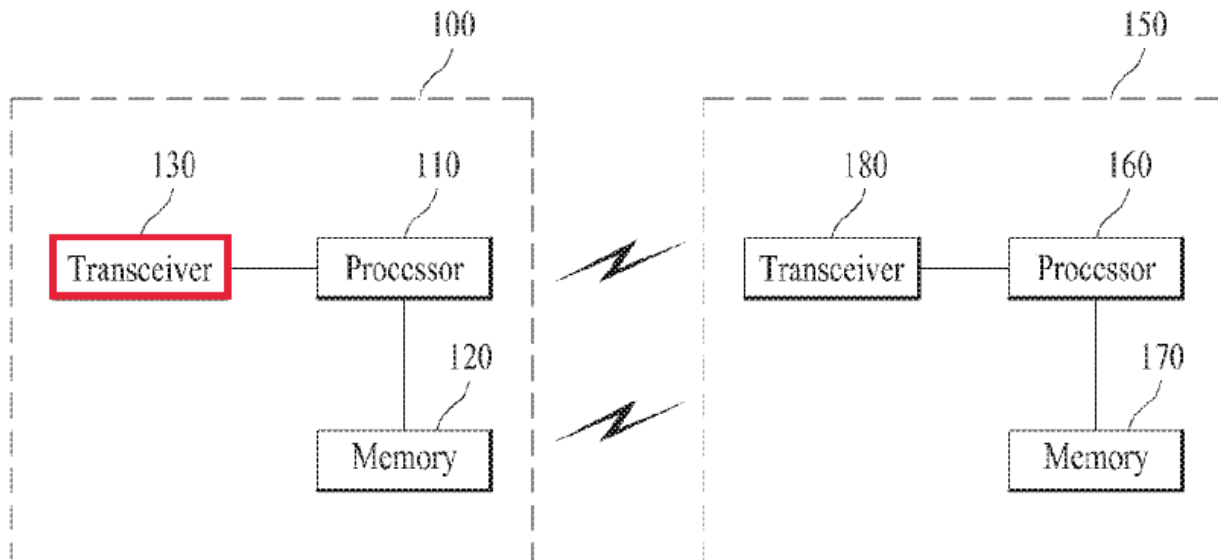
² All emphasis is added unless otherwise noted.

[1.1] a transceiver; and

The '171 Patent describes a transceiver that “transmits and receives a wireless signal such as a wireless LAN packet” and may include “transmit/receive modules having different frequency bands.” SAMSUNG-1001, 6:40-41, 6:45-47.

A POSITA would understand that Kim’s STA includes a similar transceiver structure. Specifically, Kim discloses that the STA includes a transceiver that can “transmit/receive a wireless signal and may be implemented in a physical layer of IEEE 802.11/3GPP.” SAMSUNG-1015, [0237], FIG. 26; SAMSUNG-1003, ¶78.

FIG. 26



SAMSUNG-1015, FIG. 26

[1.2] a processor, wherein the processor is configured to:

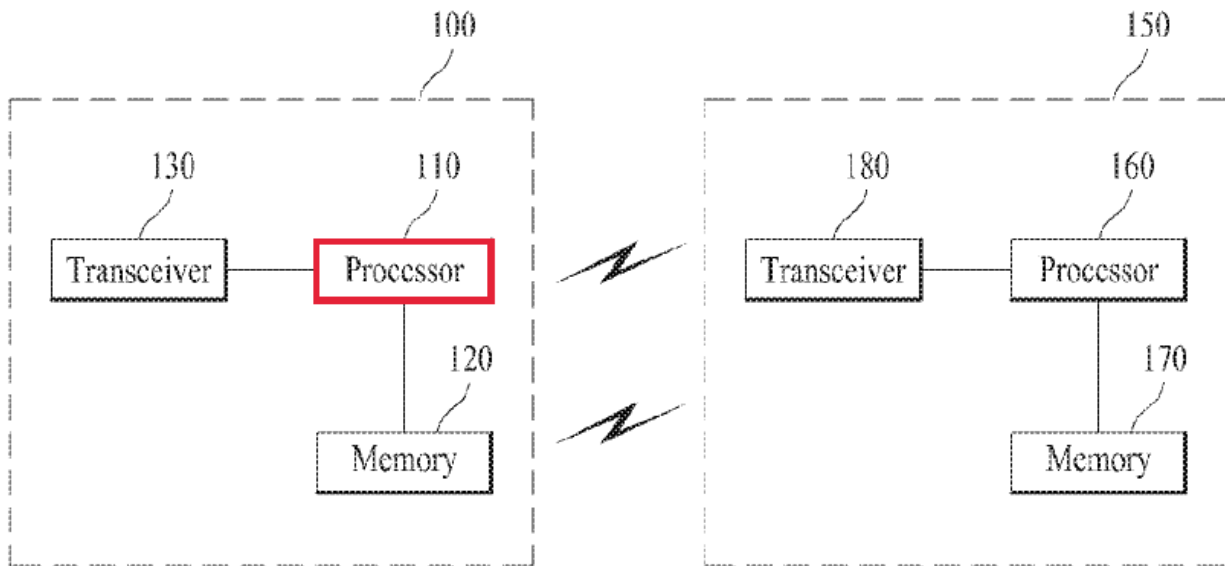
The '171 Patent describes a processor that “may process a frame received through the wireless network and besides, perform various processing for

controlling the station.” SAMSUNG-1001, 5:56-59. This description broadly encompasses functions such as MAC/PHY layer processing and coordinating responses to received frames, which are standard in wireless communication systems. SAMSUNG-1003, ¶79.

Kim discloses that the STA includes a processor implemented in a physical layer and/or a MAC layer and connected to a transceiver. SAMSUNG-1015, [0237], FIG. 26. Notably, Kim describes that the processor can “perform the above-described UL MU scheduling procedure,” which involves responding to a trigger frame for uplink multi-user transmission. *Id.*, [0131], [0133], [0237]. This UL MU procedure includes parsing and interpreting fields within the trigger frame (e.g., user-specific information including AID12, RU allocation, and MCS) and orchestrating uplink transmissions in response—activities that a POSITA would associate with MAC/PHY processing and station control. SAMSUNG-1003, ¶80.

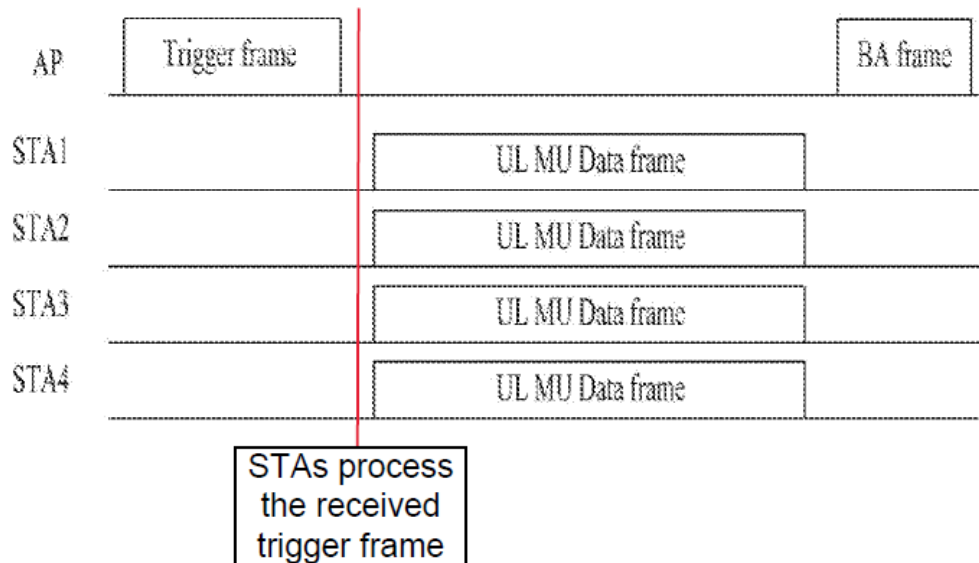
These are precisely the types of functionalities the ’171 Patent attributes to the claimed processor—namely, processing received frames and controlling the station. A POSITA would therefore understand that Kim’s disclosure of a processor, in combination with its integration into the MAC/PHY layers and participation in coordinated uplink procedures, is functionally equivalent to the processor described in the ’171 Patent and renders such a processor obvious. SAMSUNG-1003, ¶81.

FIG. 26



SAMSUNG-1015, FIG. 26

FIG. 16



SAMSUNG-1015, FIG. 16

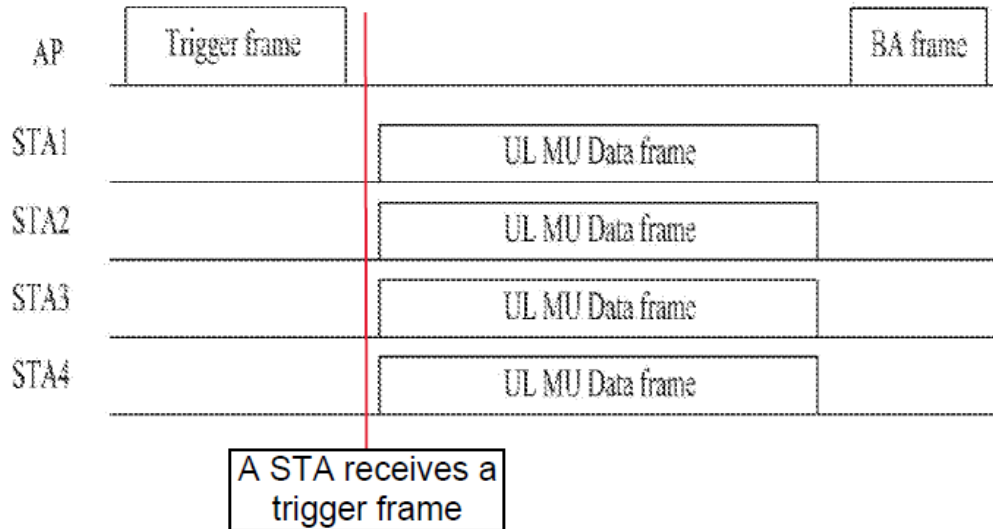
[1.3] receive a frame for allocating resource for uplink (UL) multi-user (MU) transmission to one or more terminals,

As described above, '171 Patent describes that the term “resource” may refer to “a channel or a sub-channel allocated to the STA,” and further states that the trigger frame “may indicate information on the channel or sub-channel allocated to each uplink transmission STA.” SAMSUNG-1001, 11:56-58, 17:32-35; *see supra*, §II.C; SAMSUNG-1003, ¶82.

Kim teaches a process in which a STA receives, from the AP, a trigger frame that includes UL MU allocation information, including “resource locations and sizes” as well as specific resource unit (RU) allocations in the User Information field. SAMSUNG-1015, [0132], [0138], FIGS. 17-18. In addition, Kim explains that “[t]he common field of the HE-SIG B includes information on all STAs configured to receive PPDU on a corresponding **bandwidth**. The common field can include **RU (resource unit) allocation information**.” *Id.*, [0127]. This indicates that RU allocation information is used to designate which sub-channels or bandwidth segments are assigned to each STA. A POSITA would recognize that Kim’s RU Allocation subfield corresponds to the channel or sub-channel allocation discussed in the '171 Patent. SAMSUNG-1003, ¶83. Accordingly, Kim’s trigger frame performs the same function as described in the '171 Patent—signaling resource allocations for UL MU transmissions to specific STAs—and therefore renders obvious receipt of a frame for allocating resource for

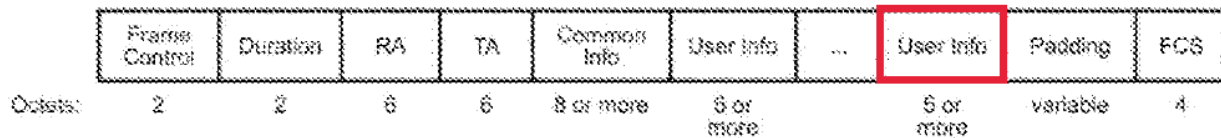
UL MU transmission to one or more terminals. SAMSUNG-1003, ¶84.

FIG. 16



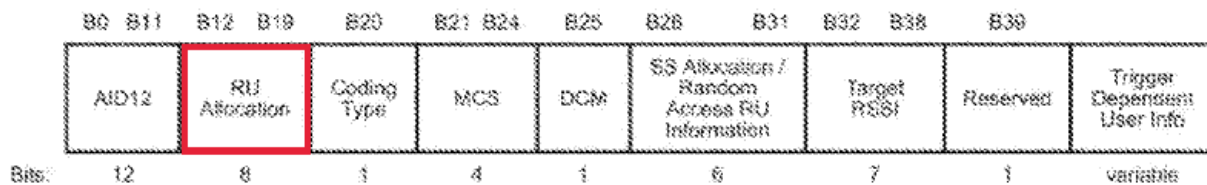
SAMSUNG-1015, FIG. 16

FIG. 17



(a) Trigger frame

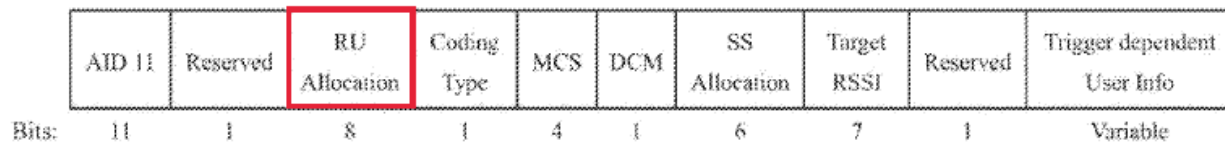
SAMSUNG-1015, FIG. 17(a)



(c) User Info field of Trigger frame

SAMSUNG-1015, FIG. 17(c)

FIG. 18

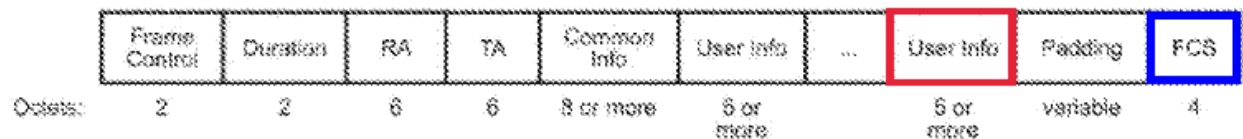


SAMSUNG-1015, FIG. 18

[1.4] wherein the frame includes an association identifier (AID) field and a frame check sequence (FCS) field,

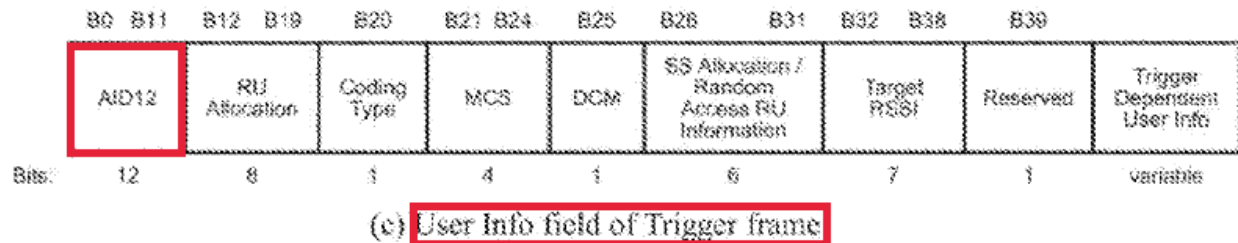
Kim teaches that “the trigger frame may include at least one of a Frame Control field, a Duration field, a Recipient STA Address (RA) field, a Transmitting STA Address (TA) field, a Common Information field, one or more Per User Information (Info) fields, a Padding field, and a Frame Check Sequence (FCS) field,” where “the User Information field may include at least one of an AID 12 subfield.” SAMSUNG-1015, [0136], [0138], FIG. 17. Accordingly, Kim teaches that the frame includes both an association identifier (AID) field and a frame check sequence (FCS) field. SAMSUNG-1003, ¶¶85-86.

FIG. 17



(a) Trigger frame

SAMSUNG-1015, FIG. 17(a)

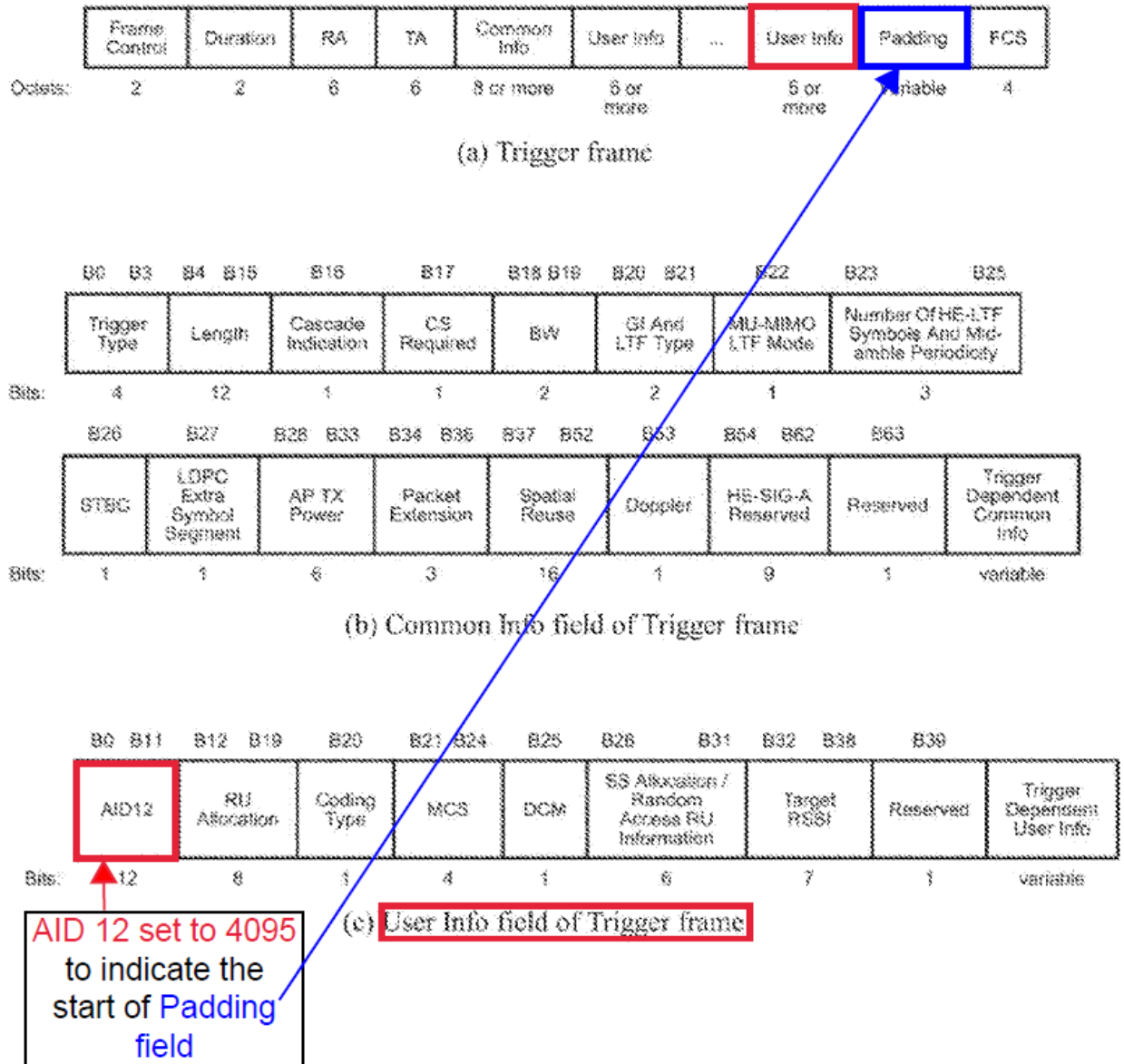


SAMSUNG-1015, FIG. 17(c)

[1.5] wherein the AID field is set to a value related to a first padding field, when the first padding field is included in the frame,

Kim teaches that, “[w]hen the **AID 12 subfield is 4095**, it may indicate that the **Padding field starts in the trigger frame.**” SAMSUNG-1015, [0138], [0139], [0143], FIG. 17. This teaches that the AID field (specifically, the AID 12 subfield) is set to a specific value—4095—when the trigger frame includes a padding field. Accordingly, Kim discloses that the AID field is set to a value related to the presence of a first padding field in the frame. SAMSUNG-1003, ¶¶87-89.

FIG. 17



SAMSUNG-1015, FIG. 17

[1.6] wherein the first padding field is used to adjust a length of the frame, and

Kim teaches that “[t]he Padding field **extends** the length of the trigger frame.” SAMSUNG-1015, [0139]. In addition, Kim describes that “[t]he padding

bits may be used to adjust the length of the data field to a predetermined unit.” *Id.*, [0108]. A POSITA would understand from this disclosure that padding is used not simply to determine a fixed frame length in advance, but to actively modify or align the frame length—specifically, to ensure that it meets a required granularity or transmission constraint (e.g., a predetermined unit size). SAMSUNG-1003, ¶88. This type of adjustment reflects an operational step that modifies the natural or initial length of the frame to comply with timing or protocol requirements. *Id.*, ¶¶88-89. Thus, Kim teaches the claimed feature that “the first padding field is used to adjust a length of the frame,” where the adjustment serves to conform the frame length to a specified alignment condition. *Id.*

[1.7] wherein the first padding field is related to a preparation of a response frame for the frame, and

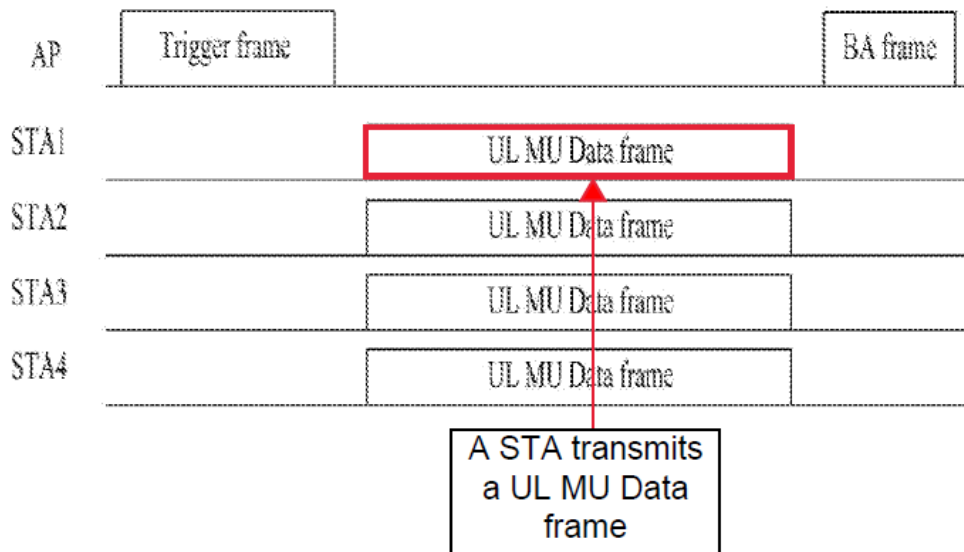
Kim teaches that “[t]he Padding field extends the length of the trigger frame so that a recipient STA may be allowed to **prepare for an SIFS response** after receipt of the trigger frame.” SAMSUNG-1015, [0139]. This teaches that the first padding field is related to the preparation of a response frame, as it provides the recipient STA sufficient time to prepare its SIFS response following the trigger frame. SAMSUNG-1003, ¶¶88-89.

[1.8] transmit the response frame in response to the frame.

Kim teaches that “[t]he STAs may **transmit a UL data frame** using a HE trigger based PPDU format after SIFS from a PPDU including the trigger frame,”

thereby describing a process in which receipt of a trigger frame causes a corresponding STA to transmit a UL data frame. SAMSUNG-1015, [0133], FIG. 16. Accordingly, the UL data frame is a response frame that is transmitted in response to the trigger frame, consistent with the claimed feature of “transmit the response frame in response to the frame.” SAMSUNG-1003, ¶¶90-94.

FIG. 16



SAMSUNG-1015, FIG. 16

[2] The wireless communication terminal of claim 1, wherein whether or not the first padding field is included in the frame is identified by the AID field.

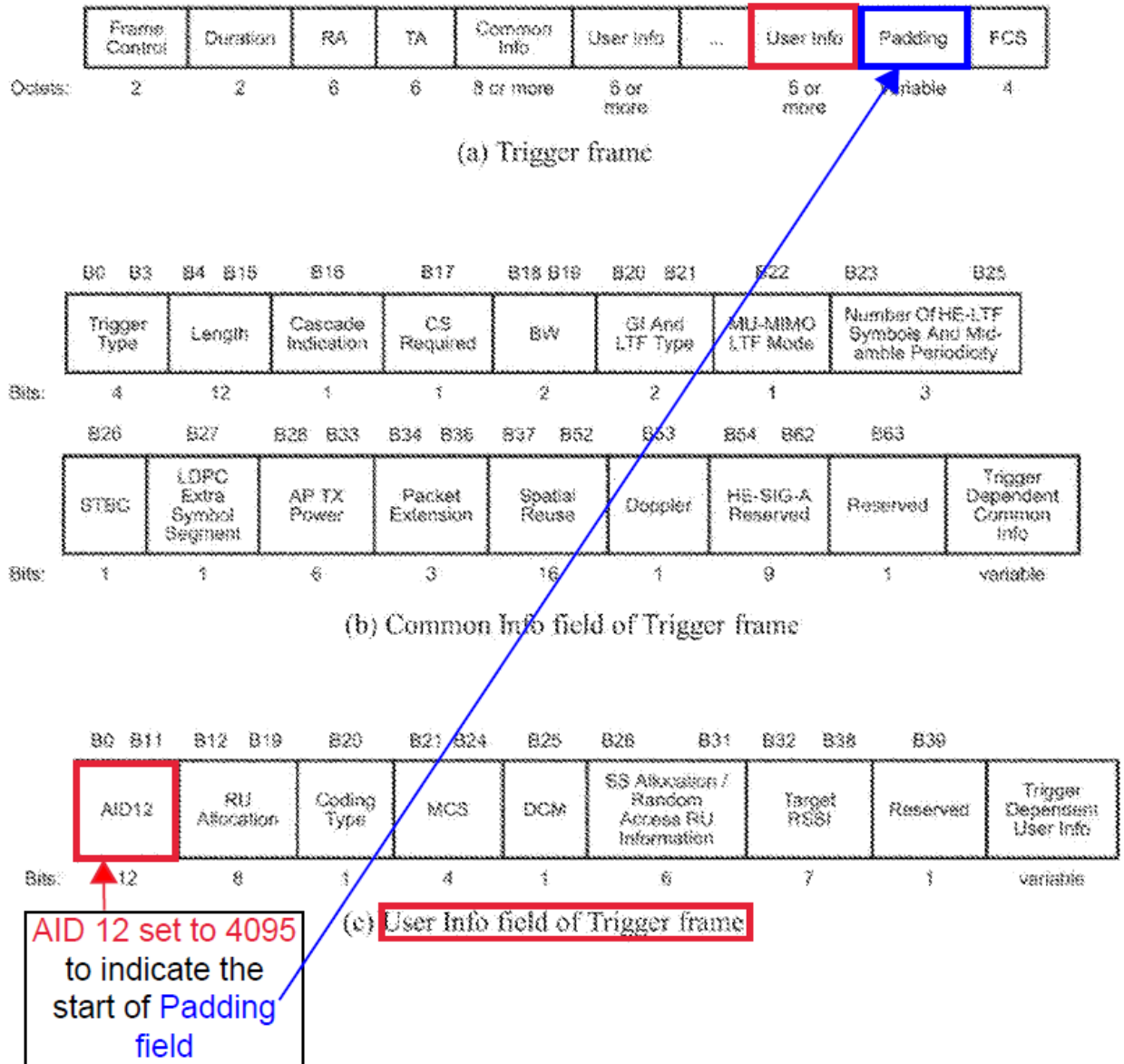
Kim teaches that the AID 12 subfield within the User Information field of the trigger frame conveys information beyond user identity. In particular, when the AID12 subfield is set to 4095, it indicates that a padding field starts in the frame. SAMSUNG-1015, [0138]. This teaches that the AID field can indicate the

presence of padding. SAMSUNG-1003, ¶100.

Although Kim does not state that other AID 12 values indicate the absence of padding, a POSITA would understand that if the special value (4095) is reserved to indicate the presence of padding, then values outside that range (i.e., any valid AID) indicate that padding is not present. SAMSUNG-1003, ¶101. Otherwise, the padding indicator would not be distinguishable. *Id.* Thus, in practice, the AID12 field provides a binary determination: (i) 4095 to indicate that padding is included or (ii) otherwise to indicate that padding is not included. *Id.* A POSITA would therefore consider that the AID field identifies whether or not the padding field is included. *Id.*

Even if Kim's disclosure is limited to identifying padding inclusion, it would have been obvious to a POSITA to implement the AID field as indicating padding absence when set to other values, particularly given the need for deterministic frame parsing and alignment with expected response timing. SAMSUNG-1003, ¶102. Accordingly, the claimed feature is either taught or would have been obvious in light of Kim.

FIG. 17



SAMSUNG-1015, FIG. 17

[3] The wireless communication terminal of claim 2, wherein the first padding field consists of at least one bit, and wherein all of the at least one bit are set to ‘1’.

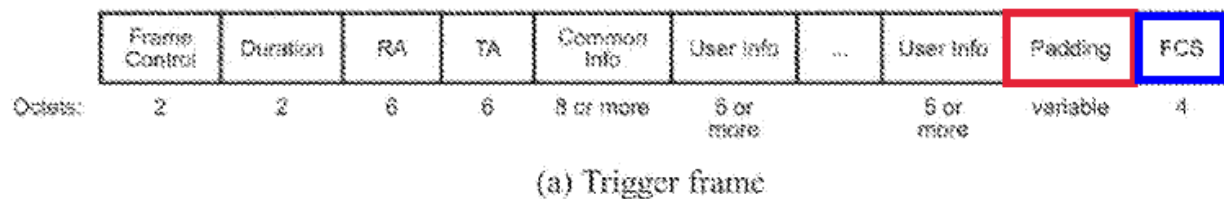
Kim teaches that “the Padding field has a length of two octets or longer which are set to all 1s.” SAMSUNG-1015, [0139], [0143], FIG. 17. This

discloses that the first padding field consists of at least one bit, and that all bits in the padding field are set to ‘1’. SAMSUNG-1003, ¶103.

[4] The wireless communication terminal of claim 1, wherein the first padding field is located before the FCS field in the frame.

Kim discloses that a **Padding field** is located before a **Frame Check Sequence (FCS) field** within the trigger frame. SAMSUNG-1015, [0109], [0136], FIGS. 10, 17; SAMSUNG-1003, ¶104.

FIG. 17



SAMSUNG-1015, FIG. 17

[5] The wireless communication terminal of claim 1, wherein the response frame includes a second padding field, when a specific condition is satisfied.

As an initial matter, the '171 Patent does not clearly define what constitutes “a specific condition.” In the absence of explicit guidance in the specification, Petitioner interprets this term to refer to the condition described in the '171 Patent’s diagram (e.g., FIG. 9), where uplink data transmissions from different STAs have varying durations. SAMSUNG-1001, FIG. 9; SAMSUNG-1003, ¶¶90-91.

Under this interpretation, the claim feature of “wherein the response frame includes a second padding field, when a specific condition is satisfied” is met when variable-length uplink data units are padded to ensure simultaneous termination. For example, the specific condition is the presence of unequal uplink transmission durations, and the second padding field is added to align the endpoints of these transmissions. SAMSUNG-1003, ¶91.

Moreover, claim 5 depends from claim 1, and thus the “response frame” recited in claim 5 refers to the same uplink data frame transmitted by the STA in response to the trigger frame (as described in limitation [1.8]). *See supra*, §III.A.4.[1.8]. As discussed with respect to claim 1, Kim discloses that after receiving a trigger frame, STAs transmit uplink data using a High Efficiency (HE) trigger-based PPDU format after a SIFS period. SAMSUNG-1015, [0133], FIG. 16; *see supra*, §III.A.4.[1.8]. Thus, the PPDU transmitted by the STA constitutes the “response frame” of claim 1 and forms the basis for the response frame in claim 5.

Kim further discloses that the trigger frame includes a Length subfield, which “indicates the L-SIG length of a HE trigger based PPDU (e.g., UL MU PPDU).” SAMSUNG-1015, [0137]. This length value is provided to all STAs scheduled for uplink transmission in the same trigger frame. A POSITA would understand that each STA uses this length value to determine the target

duration of its UL MU PPDU. SAMSUNG-1003, ¶92. As the payload sizes of different STAs may vary, some STAs must insert padding in their respective response frames to meet the required length and ensure that all uplink transmissions terminate simultaneously. *Id.*

This is corroborated by Kim’s discussion that the “data field [of the PPDU] may also include padding bits as necessary,” and that “[t]he padding bits may be used to adjust the length of the data field to a predetermined unit.” SAMSUNG-1015, [0108]. In this context, the “predetermined unit” is the common L-SIG length indicated in the trigger frame. *Id.*, [0137]. Accordingly, padding is applied within each STA’s response frame based on whether its unpadded transmission would fall short of the scheduled duration—i.e., when the “specific condition” of variable uplink duration exists. SAMSUNG-1003, ¶93.

Thus, to the extent the ’171 Patent requires the inclusion of a second padding field upon satisfaction of a condition (e.g., unequal transmission lengths), Kim teaches or at least renders this feature obvious. The second padding field is included in the same response frame transmitted in response to the trigger frame (i.e., the UL MU PPDU), and its inclusion is dictated by the need to conform to the length specified in the trigger frame. Kim’s discussion of frame length control and the use of padding for alignment satisfies the

claimed limitation. SAMSUNG-1003, ¶¶90-94.

[6] The wireless communication terminal of claim 1, wherein the first padding field is used to extend the length of the frame.

As explained above, Kim discloses that “[t]he Padding field **extends** the length of the trigger frame.” SAMSUNG-1015, [0139]; *see also* SAMSUNG-1015, [0108], *see supra*, [1.6]; SAMSUNG-1003, ¶¶88-89. The use of padding to extend the frame length is taught and forms the mechanism by which the frame length is adjusted to meet protocol constraints. SAMSUNG-1003, ¶¶88-89. Accordingly, Kim teaches the feature that “the first padding field is used to extend the length of the frame.” *Id.*

[7] The wireless communication terminal of claim 1, wherein a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.

Kim teaches that “[t]he Padding field extends the length of the trigger frame so that a recipient STA may be allowed to prepare for an SIFS response after receipt of the trigger frame.” SAMSUNG-1015, [0139]. This disclosure describes the claimed feature that “a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.” SAMSUNG-1003, ¶105.

A POSITA would understand that, in the context of uplink (UL) multi-user (MU) transmission, “preparation” for an SIFS response entails processing the received trigger frame. Kim describes that UL MU transmission begins

when an AP transmits a trigger frame to a plurality of STAs (e.g., STA1 to STA4). SAMSUNG-1015, [0131]. The trigger frame includes uplink allocation information—including resource locations, sizes, STA IDs, MCSs, and MU transmission types (e.g., MIMO or OFDMA)—which the receiving STAs must interpret to determine their transmission responsibilities. SAMSUNG-1015, [0132]; SAMSUNG-1003, ¶106.

First, upon receiving the trigger frame, each STA decodes the trigger frame to obtain its scheduling information. SAMSUNG-1015, [0131]-[0132]; SAMSUNG-1003, ¶107.

Second, each STA extracts its respective UL MU allocation information from the User Information field in the trigger frame. As Kim explains, the User Information field includes the AID12 subfield (identifying the receiving STA), the RU Allocation subfield, the MCS subfield, and other parameters necessary to configure the STA's transmission. SAMSUNG-1015, [0138]. This confirms that each STA extracts multiple configuration parameters to participate in the coordinated UL MU transmission. SAMSUNG-1003, ¶107.

Third, after extracting these parameters, each STA configures its own transmission accordingly. Kim teaches that each STA uses the HE trigger-based PPDU format for its response, which involves setting up its MAC and PHY layers based on the extracted information. SAMSUNG-1015, [0133];

SAMSUNG-1003, ¶108.

Fourth, Kim describes that each STA transmits its UL PPDU after a SIFS interval from the trigger frame, confirming that there is an expectation of immediate readiness to transmit. SAMSUNG-1015, [0133]. This timing requirement discloses that the STA completes all preparatory steps—including decoding, parameter extraction, and hardware configuration—within the short SIFS period. SAMSUNG-1003, ¶¶108-109.

Accordingly, Kim teaches each of the steps comprising “preparation” for UL MU response. A POSITA would understand that preparation includes decoding the trigger frame, extracting scheduling and transmission parameters, configuring the STA’s transmitter, and ensuring MAC and PHY readiness, all within the timing constraints of the UL MU protocol. These disclosures support the claimed relationship between processing the trigger frame and preparing for uplink response. SAMSUNG-1003, ¶¶109-110.

Thus, when Kim states that padding is included “so that a recipient STA may be allowed to prepare for an SIFS response,” this is, from a technical perspective, **equivalent** to allocating sufficient time for processing the received trigger frame. Moreover, Kim links the purpose of the padding field to the time required by the STA for this preparation. SAMSUNG-1015, [0139]. For example, (i) if less time were needed, less padding would suffice and, (ii) if

more time were needed, additional padding would be required. Accordingly, the duration of the padding field reflects the processing time needed by the STA. SAMSUNG-1003, ¶¶109-110.

While Kim describes the concept with reference to a single “recipient STA,” the trigger frame is broadcast to multiple STAs (e.g., STA1 to STA4) in the UL MU context, and the padding duration is set to accommodate the STA that requires the longest processing time. SAMSUNG-1014, [0131]-[0133], [0138], and [0139]. A POSITA would have understood that the padding field accounts for the time needed by all of the indicated STAs to process the trigger frame and prepare for a synchronized SIFS response. SAMSUNG-1003, ¶¶111-113. Therefore, the padding duration is based on the time needed by the one or more terminals addressed in the trigger frame. *Id.*

Therefore, Kim discloses the claimed feature of “wherein a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.” A POSITA would recognize that Kim’s padding field is functionally tied to the STA’s processing needs and is specifically included to ensure the STA is ready to respond after SIFS, rendering obvious the claimed limitation. SAMSUNG-1003, ¶114.

[8] The wireless communication terminal of claim 1, wherein the second padding field is used to set a same lengths of the response frames when two or more terminals transmit response frames in response to the trigger frame.

As described above, Kim teaches that uplink transmissions from multiple STAs are initiated in response to a trigger frame and are coordinated to end simultaneously. SAMSUNG-1015, [0133], FIG. 16; *see supra*, [5]. To enable this alignment, Kim discloses that each STA transmits a PPDU using a High Efficiency (HE) trigger-based format after a SIFS period, in response to the same trigger frame. SAMSUNG-1015, [0133], FIG. 16; SAMSUNG-1003, ¶95.

Kim further explains that the trigger frame includes a Length subfield, which “indicates the L-SIG length of a HE trigger based PPDU (e.g., UL MU PPDU).” SAMSUNG-1015, [0137]. A POSITA would understand that this Length subfield specifies the transmission duration for all STAs responding to the trigger frame, thereby ensuring temporal alignment across all uplink transmissions. SAMSUNG-1003, ¶96.

To comply with the prescribed length, Kim teaches that the data field of the PPDU “may also include padding bits as necessary,” and that such padding “may be used to adjust the length of the data field to a predetermined unit.” SAMSUNG-1015, [0108]. The use of padding thus ensures that each STA’s transmission occupies the full duration indicated by the Length subfield, even if

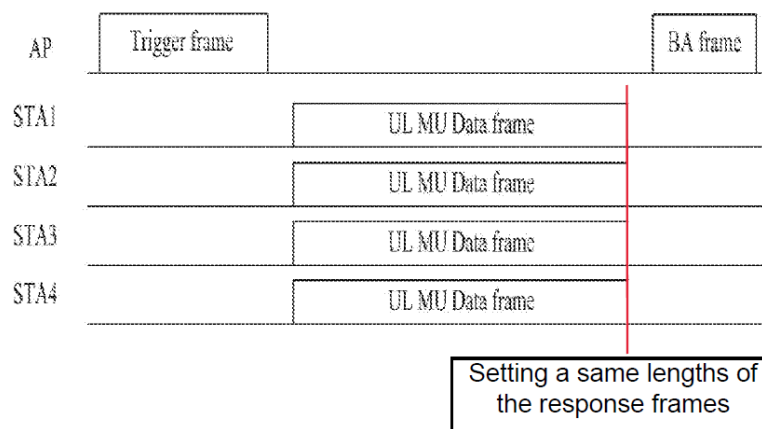
the STA's actual data payload is smaller. SAMSUNG-1003, ¶¶97.

By inserting a second padding into the data portion of its response frame (i.e., the PPDU), each STA ensures that the total frame length conforms to the specified transmission duration. SAMSUNG-1003, ¶¶98. This results in uniform frame lengths across all STAs responding to the same trigger frame.

Id. In doing so, the second padding field functions to “set a same lengths of the response frames” when two or more terminals respond to the same trigger frame. *Id.*

Thus, Kim teaches that a STA uses a second padding field—inserted into the data portion of the uplink PPDU—to match the frame length dictated by the trigger frame's Length subfield. SAMSUNG-1003, ¶¶95-99. This ensures that each response frame aligns temporally with those of other scheduled terminals. *Id.* As such, Kim teaches or at least renders this feature obvious. *Id.*

FIG. 16



SAMSUNG-1015, FIG. 16

Claims 9-16

The below claims are rendered obvious for similar reasons as discussed in the analysis for the corresponding claim listed in the table below.

Claim	Corresponding Claim
9Pre	1Pre
9.1	1.3
9.2	1.4
9.3	1.5
9.4	1.6
9.5	1.7
9.6	1.8
10	2
11	3
12	4
13	5
14	6
15	7
16	8

B. [GROUND 2] – Chu-Choi renders claims 1-16 obvious

1. Overview of Chu

Chu³ discloses a process in which a plurality of client stations 25 receive, from the access point (AP) 14, an uplink scheduling frame 902 including OFDMA uplink scheduling information to be used for transmission of an uplink OFDMA data unit. SAMSUNG-1016, [0090], FIGS. 9A, 9B, 10A, 10B. The uplink scheduling frame 902 includes an OFDMA uplink scheduling element 750 that includes a station identifier subfield 756 (AID). *Id.*, [0079], [0090], FIG. 7B. In response to the received uplink scheduling frame 902, “the plurality of client stations 25 transmit respective OFDM data unit 906 that collectively form an OFDMA data unit 904 to the AP 14.” *Id.*, [0093]. SAMSUNG-1003, ¶¶115-116.

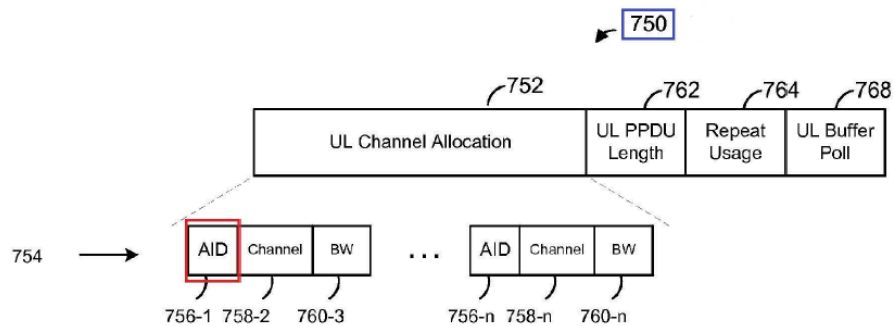


FIG. 7B

³ As used herein, Chu (or Chu '517) refers to U.S. Patent Application Publication No. 2015/0311517.

SAMSUNG-1016, FIG. 7B

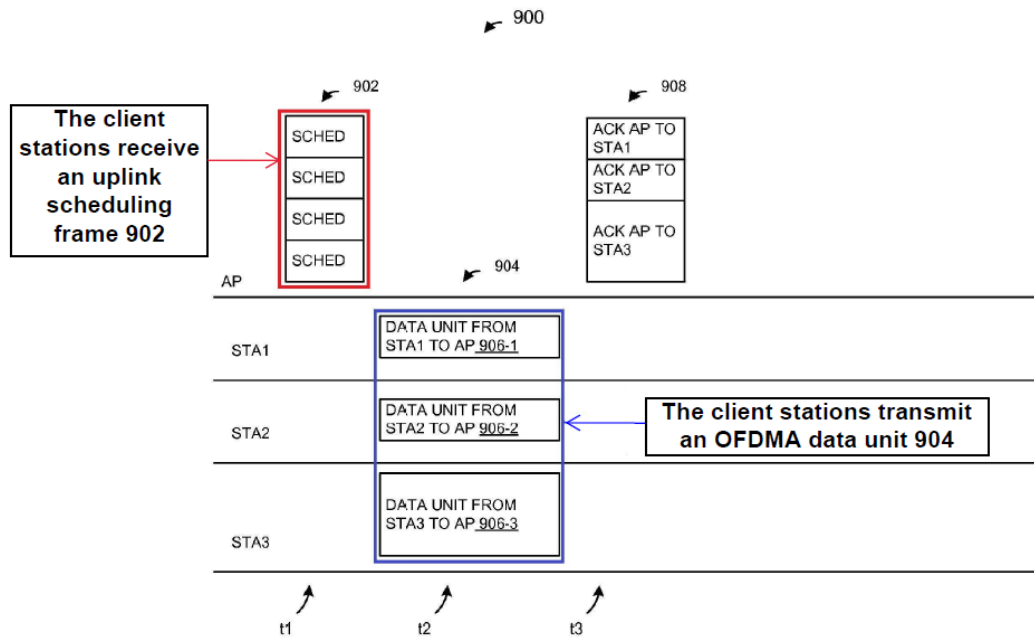


FIG. 9A

SAMSUNG-1016, FIG. 9A

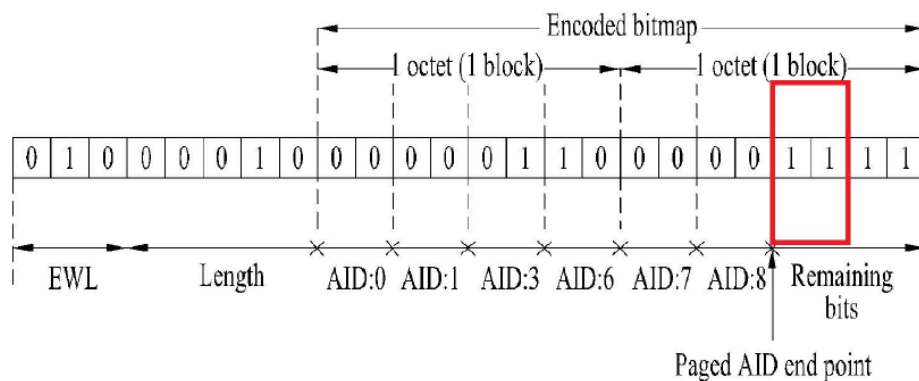
2. Overview of Choi

Choi discloses a method in which a station (STA) receives a frame from an access point (AP), where the frame includes a traffic indication map (TIM) element. SAMSUNG-1017, [0007]. The TIM element includes “one or more Association Identifier (Δ AID) Differential Value fields and a field following the one or more Δ AID fields indicates end of the one block.” *Id.* In particular, Choi teaches that a Δ AID field set to a **specific reserved value**—such as 11—functions as a delimiter or marker indicating a termination state. *Id.*, [0213]. This value is used to signal the beginning of padding that follows the actual Δ AID values within

the TIM element. *Id.*, [0214]. For example, Choi explains that, when the Δ AID field is set to 11, it identifies the start of padding bits, effectively distinguishing meaningful Δ AID data from appended non-data padding within the frame.

SAMSUNG-1017, [0213], [0214], FIG. 22; SAMSUNG-1003, ¶¶141-143.

FIG. 22



SAMSUNG-1017, FIG. 22

3. Combination

It would have been obvious to a POSITA to incorporate Choi's padding mechanism—specifically, the use of a specific value in the AID (or Δ AID) field to indicate the presence of padding—into the frame structure disclosed in Chu, in order to facilitate uplink transmission coordination in a multi-user environment.

Chu discloses the use of a frame to initiate uplink Orthogonal Frequency Division Multiple Access (OFDMA) transmissions from multiple client devices, whereby each device transmits data over a sub-channel allocated by the AP.

SAMSUNG-1016, [0042]. Chu describes that the frame “includes one or more

padding bits at the end of the scheduling frame 902 to provide sufficient time for the client stations 25 to prepare for uplink transmission based on the uplink scheduling information provided by the scheduling frame 902.” SAMSUNG-1016, [0093]; SAMSUNG-1003, ¶¶144-145.

While Chu mentions the presence of padding bits to allow for processing time, it does not describe how these padding bits are implemented or identified within the scheduling frame. In particular, Chu is silent as to any indication, flag, or marker that distinguishes the padding portion of the frame from other fields. It provides no detail on how the receiving client station would know which bits correspond to padding versus meaningful scheduling content.

This lack of specificity creates an implementation gap. In practical multi-user systems, where frame parsing is to be fast and accurate, the ability to distinguish padding from data or control information is essential for reliable operation. A POSITA, encountering this absence of guidance in Chu, would have recognized the need for additional implementation details to operationalize Chu’s contemplated padding feature in a robust manner. SAMSUNG-1003, ¶¶145-149.

Accordingly, the POSITA would have been motivated to consult other references that provide practical mechanisms for padding identification. Choi would have been an obvious choice for such purposes, as it addresses this issue. SAMSUNG-1003, ¶¶145-149.

Choi discloses using a specific value in the AID field (e.g., Δ AID) to signal the start of padding within a frame. SAMSUNG-1017, [0214]. For example, Choi teaches that, when the Δ AID field is set to a certain reserved value (e.g., 11), it serves as a marker that the subsequent bits are padding, used to fill out the remaining octets of the frame. *Id.*, [0007], [0213], [0214]. This allows the receiver to distinguish meaningful data from padding, simplifying frame parsing and ensuring proper interpretation. SAMSUNG-1003, ¶146.

Choi emphasizes the importance of such signaling for managing frame alignment and decoding, particularly in systems with variable-length fields. SAMSUNG-1017, [0005], [0024], [0231] [0239]; SAMSUNG-1003, ¶146.

Both Chu and Choi recognize the utility of padding to manage timing, synchronization and processing overhead. Chu uses padding to give client stations sufficient time to prepare for uplink transmission, while Choi highlights padding as a tool for maintaining octet alignment and supporting reliable decoding. SAMSUNG-1016, [0093]; SAMSUNG-1017, [0024], [0184]; SAMSUNG-1003, ¶147.

A POSITA would have had a reasonable expectation of success in incorporating Choi's padding signaling mechanism into Chu's scheduling frame. Both references are directed to similar systems—multi-user wireless uplink environments using scheduled transmissions—and share the common goal of

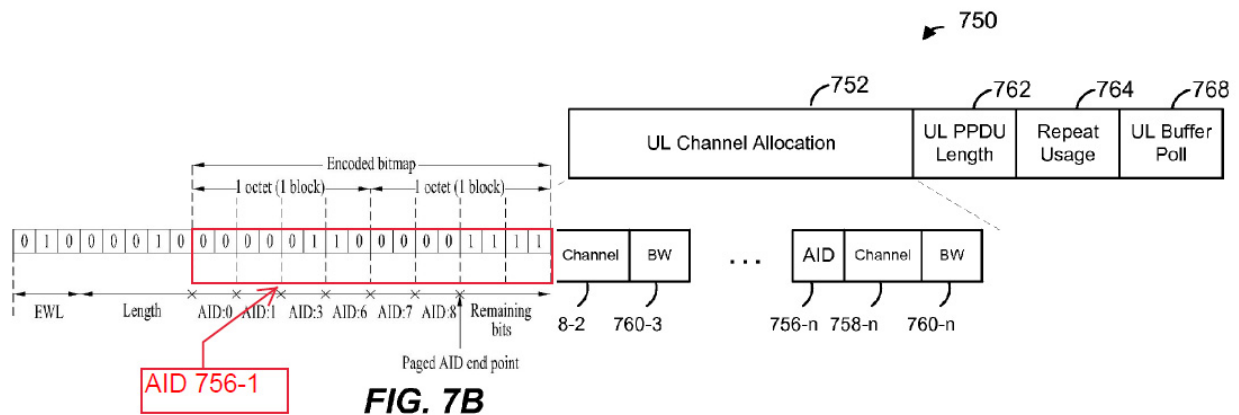
efficient and reliable coordination among client devices. SAMSUNG-1016, Abstract, [0002], [0042], [0090]-[0095]; SAMSUNG-1017, Abstract, [0001], [0003]-[0005], [0159]; SAMSUNG-1003, ¶¶146-152.

The mechanism disclosed in Choi is self-contained, using reserved values in existing fields (AID or Δ AID) to signal padding boundaries. SAMSUNG-1017, [0214]. This approach is modular and does not require fundamental changes to the underlying frame structure, making it easily portable to Chu's scheduling frame. Moreover, it provides the type of feature that Chu omits—an implementation detail that facilitates padding recognition and reliable decoding. SAMSUNG-1003, ¶¶146-152.

This combination would have resulted in predictable benefits such as (i) improved parsing efficiency, (ii) enhanced synchronization, and (iii) reduced likelihood of misinterpreting padding as data. Incorporating Choi's padding signaling technique into Chu's frame structure would have been an obvious design choice for a POSITA, as it applies a known solution (Choi's use of a specific field value to indicate padding) to address a known problem (Chu's lack of detail regarding padding implementation) in a related context (multi-user wireless scheduling). *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007); SAMSUNG-1003, ¶¶146-152.

In sum, Chu describes padding conceptually but fails to explain how to

implement or signal it. Choi provides that missing detail through its use of specific AID values to mark padding regions. A POSITA would have recognized this synergy and been motivated to combine these teachings to produce a more robust and reliable scheduling frame. SAMSUNG-1003, ¶¶144-152. The result would have been a predictable improvement in MU uplink scheduling, one well within the routine design capabilities of a POSITA. *Id.*



SAMSUNG-1016, FIG. 7B (as modified by Choi)

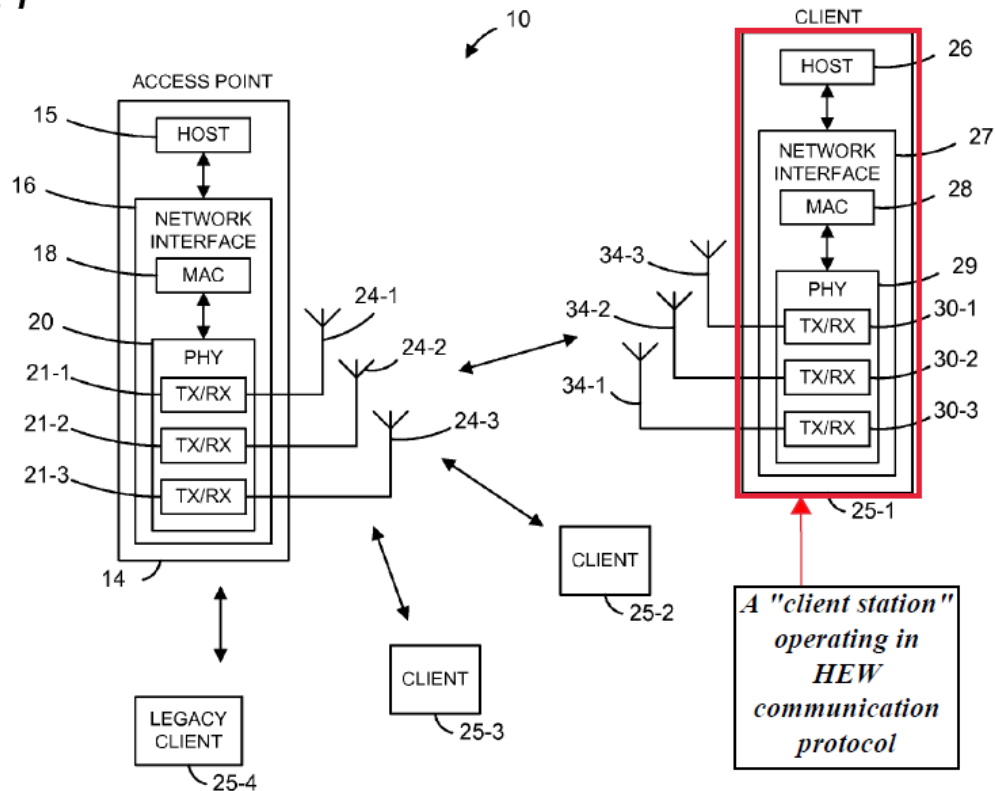
4. Analysis

[1.pre] A wireless communication terminal, the terminal comprising:

As an initial matter, the '171 Patent does not define a “wireless communication terminal,” but instead describes a “station (STA) [that] is a predetermined device including medium access control (MAC) following a regulation of **an IEEE 802.11 standard** and a physical layer interface for a wireless medium.” SAMSUNG-1001, 5:47-50.

To the extent the preamble is limiting, Chu discloses that its client stations meet this description. Specifically, Chu describes client stations configured to operate according to a “high efficiency WLAN” (HEW) communication protocol—i.e., the IEEE 802.11ax standard—which supports OFDMA-based communication and includes a MAC layer and a physical interface for wireless media. SAMSUNG-1016, [0043], [0044], FIG. 1. These client stations are configured to interact with an access point (AP) using HEW, and in some embodiments, also support legacy protocols such as IEEE 802.11a/n/ac. *Id.* Thus, Chu’s client stations satisfy the characteristics of a “wireless communication terminal” contemplated by the ’171 Patent, including compliance with IEEE 802.11 standards and the MAC and PHY components for wireless communication. SAMSUNG-1003, ¶117.

FIG. 1



SAMSUNG-1016, FIG. 1

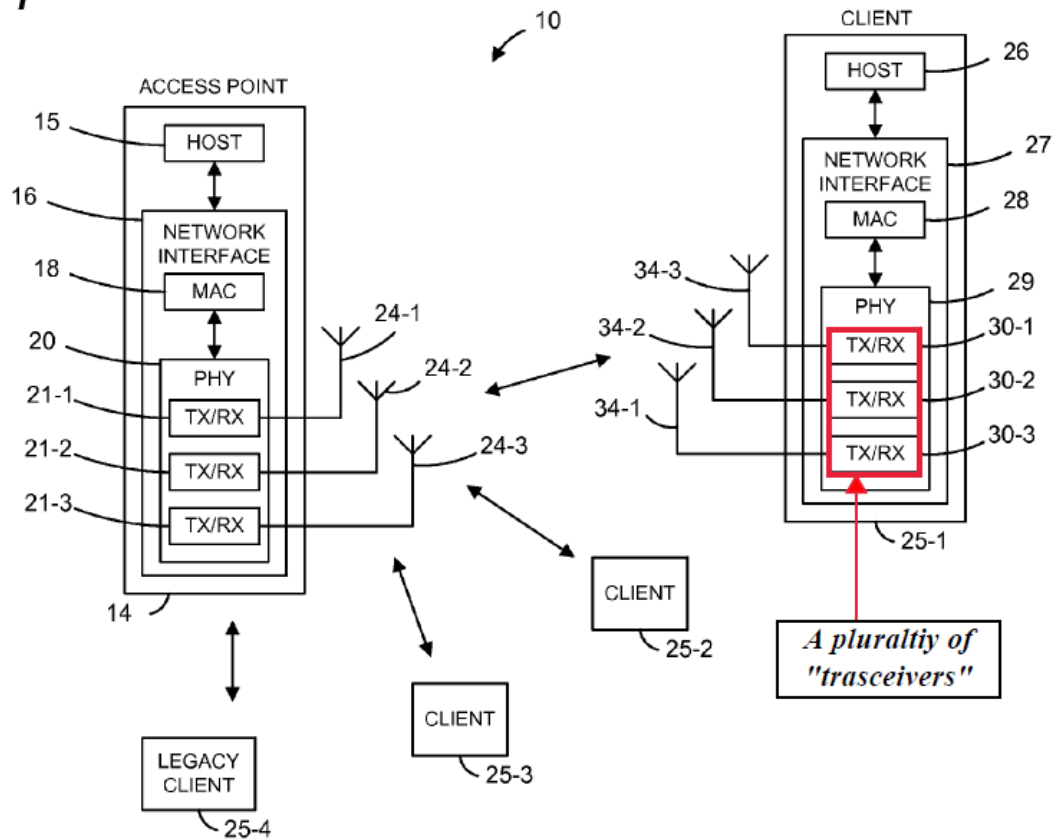
[1.1] a transceiver; and

The '171 Patent describes a transceiver that “transmits and receives a wireless signal such as a wireless LAN packet” and may include “transmit/receive modules having different frequency bands.” SAMSUNG-1001, 6:40-41, 6:45-47.

A POSITA would understand that Chu’s client stations include a similar transceiver structure. Specifically, Chu discloses that client station 25-1 includes a physical layer (PHY) processing unit 29 comprising a plurality of transceivers 30, which are coupled to antennas 34 and interface with a MAC processing unit and a host processor. SAMSUNG-1016, [0047], FIG. 1. The presence of multiple

transceivers in the PHY layer of the client station corresponds to the transceiver architecture described in the '171 Patent. SAMSUNG-1003, ¶118.

FIG. 1



SAMSUNG-1016, FIG. 1

[1.2] a processor, wherein the processor is configured to:

The '171 Patent describes a processor that “may process a frame received through the wireless network and besides, perform various processing for controlling the station.” SAMSUNG-1001, 5:56-59. This description broadly encompasses functions such as MAC/PHY layer processing and coordinating responses to received frames, which are standard in wireless communication

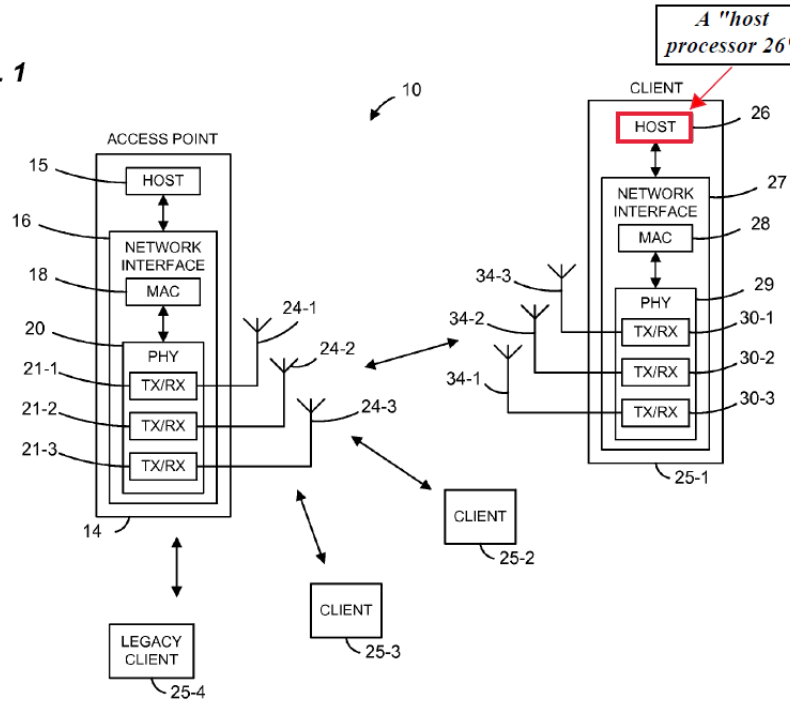
systems. SAMSUNG-1003, ¶119.

Chu discloses that client station 25-1 includes a host processor 26 that is coupled to a network interface 27. SAMSUNG-1016, [0047], FIG. 1. The network interface includes a MAC processing unit 28 and a PHY processing unit 29, which together enable the client station to receive and respond to control and data frames, including scheduling frames for OFDMA uplink transmissions. SAMSUNG-1016, [0047], FIG. 1; SAMSUNG-1003, ¶119.

Furthermore, Chu provides a detailed example in FIG. 9A and accompanying discussion, where a client station receives a scheduling frame and transmits data in response. SAMSUNG-1016, [0090]-[0094], FIG. 9A. These functionalities—receiving the scheduling frame, interpreting subchannel allocation, and triggering uplink transmission—are coordinated actions involving MAC/PHY operations and overall device control, which are performed by or under the direction of the host processor. SAMSUNG-1003, ¶120.

Thus, Chu's host processor 26 performs the same kind of frame processing and station control described as being performed by the '171 Patent's processor. A POSITA would recognize that Chu's disclosure of a host processor, MAC/PHY units, and corresponding operational context satisfies the claimed processor functionality in the '171 Patent and renders such a processor obvious. SAMSUNG-1003, ¶¶119-121.

FIG. 1



SAMSUNG-1016, FIG. 1

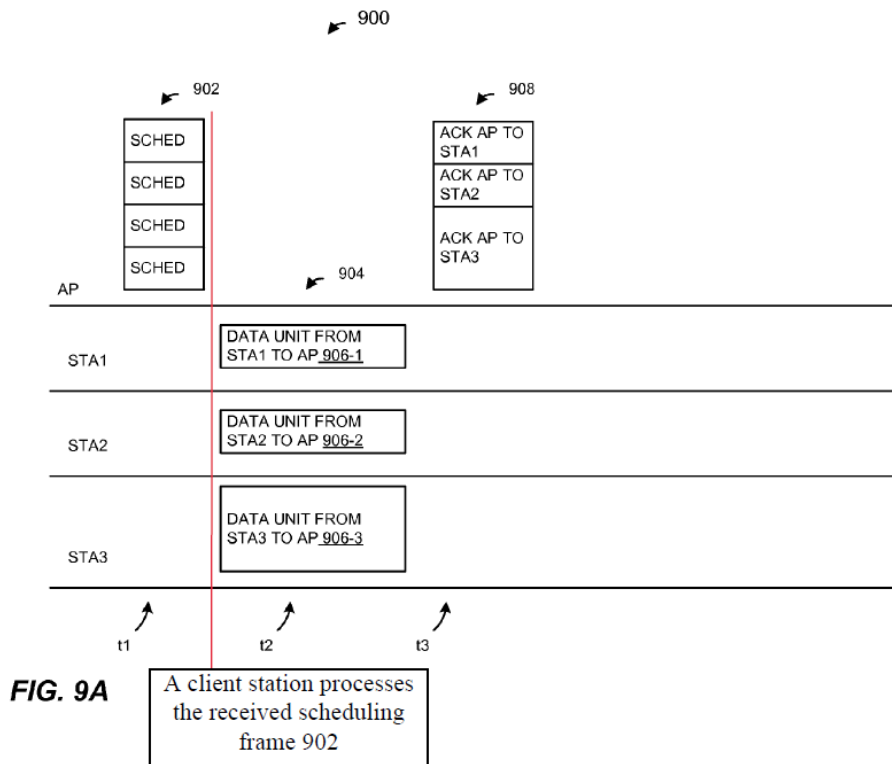


FIG. 9A

SAMSUNG-1016, FIG. 9A

[1.3] receive a frame for allocating resource for uplink (UL) multi-user (MU) transmission to one or more terminals,

As described above, the '171 Patent describes that the term “resource” may refer to “a channel or a sub-channel allocated to the STA,” and further states that the trigger frame “may indicate information on the channel or **sub-channel allocated to each uplink transmission STA.**” SAMSUNG-1001, 11:56-58, 17:32-35; *see supra*, §II.C; SAMSUNG-1003, ¶122.

Chu teaches a process in which a client station receives, from the AP, an uplink scheduling frame 902 including OFDMA uplink scheduling information to be used for transmission of an uplink OFDMA data unit. SAMSUNG-1016, [0090]. In particular, Chu teaches that “[t]he scheduling frame 902 indicates **respective sub-channels allocated for uplink OFDMA transmission** by three client stations STA1, STA2 and STA3.” *Id.*, [0092]. This teaches the allocation of distinct frequency-domain resources (sub-channels) to multiple client stations for use in a coordinate uplink transmission. SAMSUNG-1003, ¶123. Each of the client stations then “transmits its OFDM data unit 906 during the time t2 in a respective sub-channel, allocated to the client station 25, as indicated in the scheduling frame 902.” *Id.*, [0094]. These simultaneous, AP-coordinated transmissions by multiple stations over different sub-channels constitute an uplink multi-user transmission, as recited in the claim. SAMSUNG-1003, ¶124. Chu’s description aligns with the claim feature that the sub-channel is for uplink multi-

user transmission, and also with the '171 Patent's use of the term "resource" to refer to such allocated sub-channels. SAMSUNG-1003, ¶125.

[1.4] wherein the frame includes an association identifier (AID) field and a frame check sequence (FCS) field,

Chu teaches that the OFDMA uplink scheduling element 750, which is included in the uplink scheduling frame 902, includes a station identifier subfield (AID) 756. SAMSUNG-1016, [0079], [0090], FIG. 7B. In particular, Chu describes that "the station identifier subfields 756, a channel subfields 758 and a bandwidth subfields 760 are the same as or similar to the station identifier subfields 706," where "[t]he channel identifier subfield 706 includes an identifier, such as an AID or a partial AID, corresponding to a client station 25." SAMSUNG-1016, [0076], [0079]; SAMSUNG-1003, ¶126.

Moreover, Chu teaches that a control frame, which includes an uplink scheduling frame 902, includes a frame sequence check (FCS) sub-field 1352-12 within a control field 1350, showing that Chu's control frame structure incorporates error-detection functionality using an FCS field, a standard practice in MAC-layer frame design. SAMSUNG-1016, [0091], [0118], FIG. 13B; SAMSUNG-1003, ¶127.

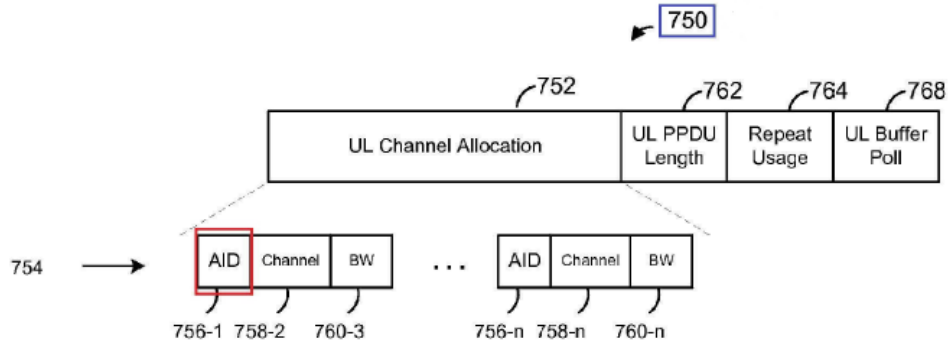


FIG. 7B

SAMSUNG-1016, FIG. 7B

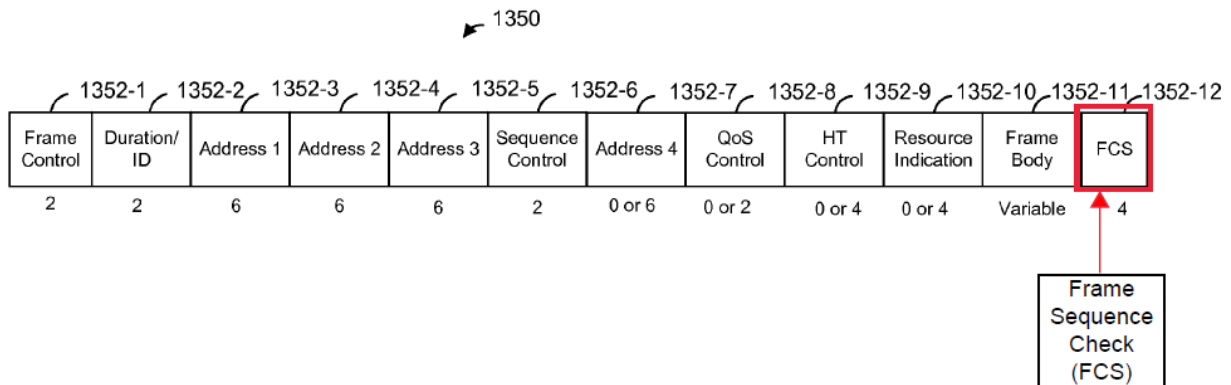


FIG. 13B

SAMSUNG-1016, FIG. 13B

[1.5] wherein the AID field is set to a value related to a first padding field, when the first padding field is included in the frame,

Chu discloses an uplink scheduling frame that enables multiple client stations to transmit uplink OFDMA data units in a coordinated manner, with each station using a sub-channel allocated by the AP. SAMSUNG-1016, [0042], [0090]. Chu further explains that padding may be included in the scheduling frame

to provide client stations sufficient time to decode the frame and prepare for uplink transmission. *Id.*, [0093]. However, while Chu discusses the use of padding, it does not teach which field within the frame is used to indicate the presence of that padding. *See supra*, §III.B.3; SAMSUNG-1003, ¶153.

Choi teaches a padding signaling mechanism that relies on a designated value within the AID field—specifically, a Δ AID field—to indicate the start of padding. SAMSUNG-1017, [0214], [0231]. Choi describes that, when the Δ AID field is set to a **particular termination value** (e.g., 11 in FIG. 22 or 00 in FIG. 23), it signals that all subsequent bits in the bitmap are padding. *Id.*, [0213]-[0214]. This value serves as a boundary marker, distinguishing meaningful AID entries from padding content. SAMSUNG-1003, ¶154.

While Choi refers to this field as a Δ AID field, it is functionally and structurally derived from the AID space and is interpreted by the receiving device as part of the overall AID processing logic. A POSITA would understand that this Δ AID field operates within a broader AID structure and, despite being encoded in a compressed format, it still constitutes a part of the AID field for signaling purposes. SAMSUNG-1003, ¶155.

Accordingly, Choi discloses that the setting of a specific value in the AID field (e.g., Δ AID = 11) signifies the inclusion of a padding field. For example, the frame includes padding because the AID field is set to a designated value—

satisfying the limitation that “the AID field is set to a value related to a first padding field, when the first padding field is included in the frame.” SAMSUNG-1003, ¶156.

A POSITA would have been motivated to incorporate Choi’s efficient, value-based signaling method into Chu’s scheduling frame to allow client stations to easily determine where valid user allocation data ends and padding begins. This would improve synchronization, reduce ambiguity, and enhance reliability in a multi-user uplink context—all of which are beneficial in the context of OFDMA-based scheduling, as in Chu. SAMSUNG-1003, ¶157.

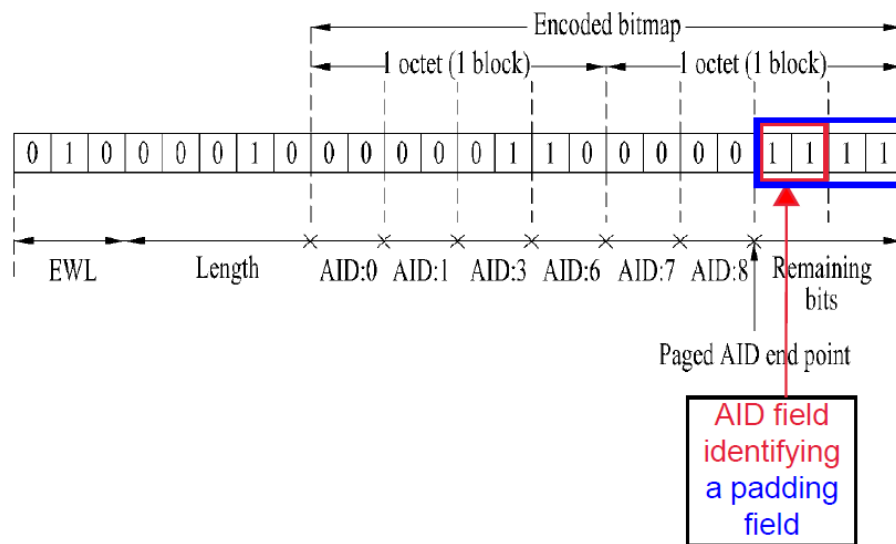
Moreover, incorporating Choi’s Δ AID-based signaling would not require additional fields or overhead. Because the Δ AID field is already parsed by the client stations as part of decoding user allocation information, using a reserved value to also indicate padding would be a lightweight yet effective enhancement. SAMSUNG-1003, ¶158. A POSITA would recognize that this approach allows flexible frame lengths while maintaining decoding simplicity and avoiding misinterpretation. *Id.*

Furthermore, even if the Δ AID field occupies only a portion of a byte (e.g., 2 bits), a POSITA would appreciate that it functions within the broader scope of the AID field structure. SAMSUNG-1003, ¶159. The presence of a specific subfield value (e.g., 11) that indicates padding is sufficient to meet the claimed condition.

Id. Whether the AID field is interpreted as the full octet or the subfield encoding (Δ AID), Choi teaches the use of a field value that is logically and structurally linked to the AID field, and that value is what signals the inclusion of padding. *Id.*

Thus, when Choi's Δ AID signaling technique is applied to Chu's uplink scheduling frame, the resulting structure satisfies the limitation of "the AID field is set to a value related to a first padding field, when the first padding field is included in the frame." The combination of Chu and Choi reflects the application of a known technique (AID field-based signaling of padding) to an analogous problem (uplink frame coordination), yielding predictable and beneficial results, in line with *KSR*. SAMSUNG-1003, ¶160.

FIG. 22



SAMSUNG-1017, FIG. 22

[1.6] wherein the first padding field is used to adjust a length of the frame, and

Chu teaches that padding bits are included at the end of the scheduling frame to adjust the overall frame length based on transmission requirements and client-side processing needs. SAMSUNG-1016, [0093].

In particular, Chu describes that “[t]he scheduling frame 902 includes one or more padding bits at the end of the scheduling frame 902 to provide sufficient time for the client stations 25 to prepare for uplink transmission based on the uplink scheduling information provided by the scheduling frame 902, in some embodiments.” SAMSUNG-1016, [0093]. This demonstrates that the padding bits are not merely placeholders, but are actively and functionally inserted to **alter the length of the frame** and achieve a specific timing objective of allowing client stations adequate preparation time for uplink transmission. SAMSUNG-1003, ¶161.

In addition, Chu explains that “a MAC header included in the scheduling frame 902 indicates a length of a valid payload, wherein the one or more padding bits follow the valid payload,” and “a signal field of a PHY preamble of the scheduling frame 902 includes an indication of the entire length of the scheduling frame 902, which includes the one or more padding bits at the end of the scheduling frame 902.” SAMSUNG-1016, [0093].

These disclosures confirm that padding bits are deliberately used to increase

and thereby modify the total length of the frame, and that this adjusted length is reflected in the PHY layer signaling. SAMSUNG-1003, ¶¶162-163. A POSITA would recognize this as a clear example of using a padding field to actively adjust the frame length. *Id.*

Notably, Chu’s disclosure aligns with the plain and ordinary meaning of “adjusting a length of the frame,” as the inclusion of padding is intended to control and extend the total frame duration. This adjustment is a purposeful mechanism to synchronize operations across multiple client stations in a multi-user uplink scheduling context. Therefore, Chu teaches that “the first padding field is used to adjust a length of the frame.” SAMSUNG-1003, ¶¶161-163.

In addition to Chu, Choi further teaches the claim limitation by describing the use of padding bits to adjust the length of the transmitted frame. For example, Choi describes that “[t]he Data field may include SERVICE field, a PLCP Service Data Unit (PSDU), and PPDU TAIL bits. When needed, the Data field may further include padding bits,” and that “the padding bits may be used to match the length of the Data field in units of a predetermined unit.” SAMSUNG-1017, [0125]. This demonstrates that padding bits are actively inserted as needed to change the Data field length (which encapsulates the MAC PDU) to satisfy PHY layer constraints. SAMSUNG-1003, ¶164. A POSITA would understand that this affects the total length of the physical layer frame, aligning with the claim

language that the padding field is used “to adjust a length of the frame.” *Id.*

Further, Choi provides an example involving the ΔAID fields, noting that “[t]he padding bits are used to match the encoded block information in octets,” and that “if the length of ΔAID_1 , ΔAID_2 , ..., ΔAID_m is less than a multiple of an octet, padding bits may be added to match the length of ΔAID_1 , ΔAID_2 , ..., ΔAID_m to the multiple of an octet.” SAMSUNG-1017, [0184]. In this context, the padding serves the functional purpose of aligning the data structure to specific transmission unit boundaries, which again reflects an intentional adjustment of the frame length for proper encoding and transmission. SAMSUNG-1003, ¶165.

Accordingly, a POSITA would recognize that Chu and Choi, either individually or in combination, teach the use of padding fields that are actively and functionally inserted to modify the overall length of the transmitted frame—whether to provide sufficient client preparation time (Chu) or to align transmission blocks to specific unit boundaries (Choi). Thus, the references disclose the claim limitation that “the first padding field is used to adjust a length of the frame.” SAMSUNG-1003, ¶166.

[1.7] wherein the first padding field is related to a preparation of a response frame for the frame, and

As described above, Chu describes that “[t]he scheduling frame 902 includes one or more padding bits at the end of the scheduling frame 902 to provide sufficient time for the client stations 25 to **prepare for uplink transmission** based

on the uplink scheduling information provided by the scheduling frame 902, in some embodiments.” SAMSUNG-1016, [0093]. Further, Chu teaches that, in response to the scheduling frame 902, “the plurality of client stations 25 transmit respective OFDM data unit 906 that collectively form an OFDMA data unit 904 to the AP 14.” *Id.* Thus, Chu links the inclusion of padding bits in the scheduling frame to providing sufficient preparation time for the client stations to transmit their respective OFDM data units in response to the scheduling frame. SAMSUNG-1003, ¶167.

A POSITA would readily understand that the OFDM data unit 906 transmitted by each client station constitutes the “response frame” to the scheduling frame, within the context of multi-user OFDMA systems. SAMSUNG-1003, ¶168. Specifically, the scheduling frame 902 allocates sub-channels and transmission parameters to each client station, and the OFDM data units are the respective transmission responses prepared and sent by the stations based on that scheduling information. SAMSUNG-1016, [0090], [0092], [0093]. As such, the preparation for transmitting the OFDM data unit 906 is preparation for transmitting a response frame corresponding to the scheduling frame 902. SAMSUNG-1003, ¶168.

Moreover, Chu further explains that “a MAC header included in the scheduling frame 902 indicates a length of a valid payload, wherein the one or

more padding bits follow the valid payload,” and that “a signal field of a PHY preamble of the scheduling frame 902 includes an indication of the entire length of the scheduling frame 902, which includes the one or more padding bits at the end.” SAMSUNG-1016, [0093]. These disclosures confirm that the padding is not arbitrary, rather, it modifies the total frame length in a deliberate manner to ensure accurate PHY-layer signaling and coordinated uplink behavior. SAMSUNG-1003, ¶169.

Thus, Chu’s disclosure teaches the claimed feature that “the first padding field is related to a preparation of a response frame for the frame.” The padding bits are inserted specifically to adjust the timing and structure of the scheduling frame so that client stations can adequately prepare and synchronize their response transmissions (i.e., the OFDM data unit). SAMSUNG-1003, ¶170.

Thus, Chu not only discloses the use of a padding field, but it also connects the purpose of that padding to the preparation of a response frame (i.e., the OFDM data unit 906) following the receipt of the original scheduling frame 902. This matches the claimed relationship between the first padding field and the preparation of a response frame. SAMSUNG-1003, ¶¶167-170.

In addition, Choi discloses this claim limitation. Choi explains that “[t]he padding bits are used to match the encoded block information in octets (i.e., to a length expressed as a plurality of octets). If the length of $\Delta AID1$, $\Delta AID2$, ...,

ΔAID_m , is less than a multiple of an octet, padding bits may be added to match the length ... to the multiple of an octet.” SAMSUNG-1017, [0184]. This padding operation ensures the response frame complies with format and alignment constraints required by the physical and MAC layers. SAMSUNG-1003, ¶171.

Accordingly, Chu and Choi, either individually or in combination, disclose the claimed feature that “the first padding field is related to a preparation of a response frame for the frame.” Chu provides padding to allow sufficient time for a station to prepare its transmission in response to a scheduling frame, while Choi adds padding to align the structure of the response frame itself to a transmission-compliant format. In both cases, the padding serves a preparatory function tied to enabling or structuring the response frame. Thus, the references teach that padding is not merely a mechanism for length adjustment, but rather plays a role in facilitating frame preparation and transmission in multi-user wireless communication systems. SAMSUNG-1003, ¶172.

[1.8] transmit the response frame in response to the frame.

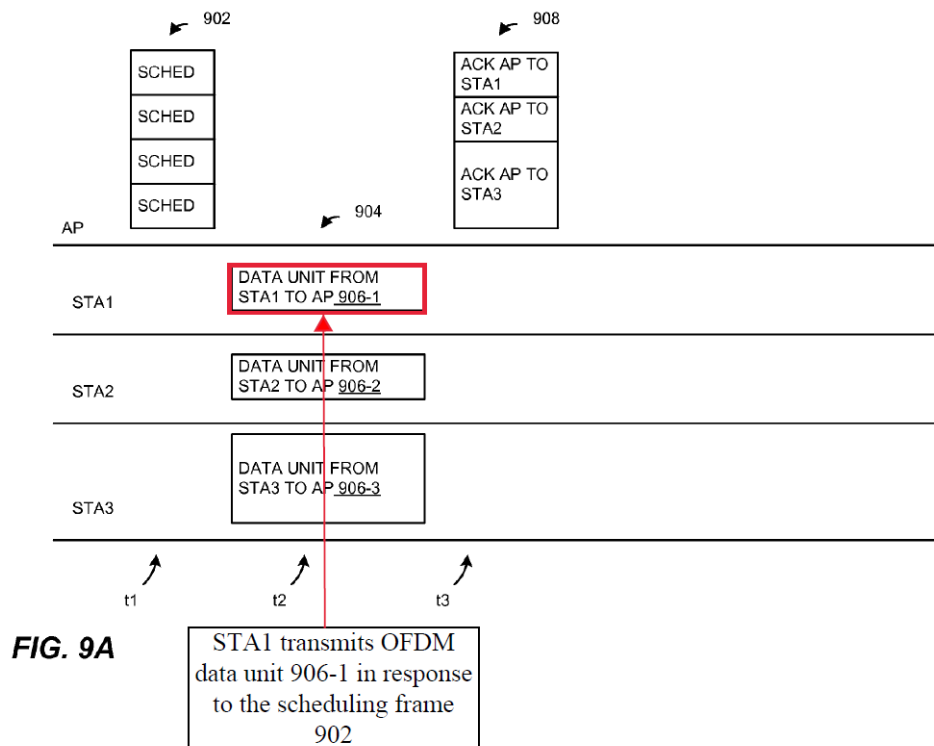
Chu teaches that the client station transmits the OFDM data unit 906 to the AP in response to an uplink scheduling frame 902. Specifically, Chu discloses that, “during a time t_1 , the AP 14 transmits an uplink scheduling frame 902 to a plurality of client stations 25,” where the scheduling frame includes OFDMA uplink scheduling information to coordinate the multi-user uplink transmission.

SAMSUNG-1016, [0090]; SAMSUNG-1003, ¶128.

In this regard, Chu describes the temporal behavior that follows the scheduling frame transmission. Specifically, Chu discloses that, “during a time t₂, the plurality of client stations 25 **transmit respective OFDM data unit 906 that collectively form an OFDMA data unit 904** to the AP 14.” SAMSUNG-1016, [0093]. Each STA begins its **transmission** at time t₂, which starts “upon expiration of a predetermined time interval, such as for example a time interval corresponding to a short inter-frame space (SIFS), after completion of reception of the scheduling frame 902.” *Id.* This structure—where client devices initiate uplink transmission after a known and fixed delay from receiving a frame containing scheduling and resource allocation information—is consistent with the claim feature that a wireless terminal transmits “the response frame in response to the frame.” SAMSUNG-1003, ¶129.

Chu further discusses mechanisms to ensure the client stations have adequate time to process the scheduling frame and prepare their transmissions. SAMSUNG-1003, ¶130. For example, Chu notes that “padding bits” may be included in the scheduling frame to provide this processing time, and that the PHY preamble indicates the total frame length (including padding), which further supports coordination and deterministic timing for the uplink transmission. SAMSUNG-1016, [0093].

Thus, Chu teaches that the client station (via its transceiver) transmits a response frame (i.e., the OFDM data unit 906) in response to the frame (i.e., the scheduling frame 902) that (i) includes sub-channel allocations, (ii) marks the start of a multi-user uplink transmission window, and (iii) is followed by client uplink transmissions after a known time interval (e.g., SIFS). Accordingly, a POSITA would have understood that Chu discloses the claimed feature of “transmit[ing] the response frame in response to the frame,” where the scheduling frame 902 in Chu operates as the frame described in the '171 Patent. SAMSUNG-1003, ¶¶128-133.



SAMSUNG-1016, FIG. 9A

[2] The wireless communication terminal of claim 1, wherein whether or not the first padding field is included in the frame is identified by the AID field.

As described above, Choi teaches that the STA, upon decoding the partial virtual bitmap, can identify a termination state—specifically through a particular Δ AID value—and thereby recognize that padding follows the valid Δ AID values. SAMSUNG-1017, [0214], [0231]; *see supra*, §III.C.4.[1.5]; SAMSUNG-1003, ¶¶173-176. While this suggests that the specific value in the Δ AID field may signal the start of a padding field, it does not convey the full binary determination of whether or not padding is included in the frame, as recited in claim 2. SAMSUNG-1003, ¶176.

In particular, Δ AID value may indicate when padding begins, but it does not indicate the absence of padding when such a field is not present or is set to a non-terminal value. SAMSUNG-1003, ¶176. For example, there is no signaling to confirm that the remainder of the frame is padding-free.

However, Choi does suggest that padding is not present unless and until a predetermined Δ AID value (e.g., 11) is detected. SAMSUNG-1017, [0211]-[0217]. That is, values other than the termination value—such as 00, 01, or 10—are interpreted as delta values and thus indicate the presence of valid AID data rather than padding. SAMSUNG-1003, ¶¶176-178. Accordingly, the absence of the termination value indicates the absence of padding.

However, even if this distinction is deemed a gap in Choi, a POSITA would have found it obvious to modify Choi to include such a mechanism. SAMSUNG-1003, ¶¶177-178. Given that padding affects frame parsing, alignment, and decoding, it would have been straightforward to implement a field or value in the AID (or a related bitmap structure) that indicates the absence of padding, particularly to improve parsing efficiency and avoid false detection or processing of unnecessary bits. *Id.* For example, a reserved Δ AID value could be used to signal the end of data and the absence of padding. *Id.*

Thus, a POSITA would have found it obvious to extend the existing AID-based signaling approach to include an indication of padding absence.

SAMSUNG-1003, ¶¶177-178.

[3] The wireless communication terminal of claim 2, wherein the first padding field consists of at least one bit, and wherein all of the at least one bit are set to ‘1’.

Choi teaches that the padding field is formed by repeating a specific bit pattern that signifies the start of padding. SAMSUNG-1017, FIG. 22; SAMSUNG-1003, ¶179. Specifically, Choi describes that when the Δ AID field is set to a specific reserved value—e.g., 11 in the 2-bit format shown in FIG. 22—it indicates a termination state, which signals the end of valid AID entries and the beginning of the padding field. *Id.*, [0214], FIG. 22.

Choi further explains that “[t]he Δ AID field set to the value indicating

the termination state (including following bits, if the following bits exist) corresponds to padding bits.” SAMSUNG-1017, [0214]. This indicates that not only the terminating Δ AID value (e.g., 11) signals the transition to padding, but that the subsequent padding bits themselves also carry the same value—that is, they duplicate the 11 bit pattern used to signal termination. SAMSUNG-1003, ¶179.

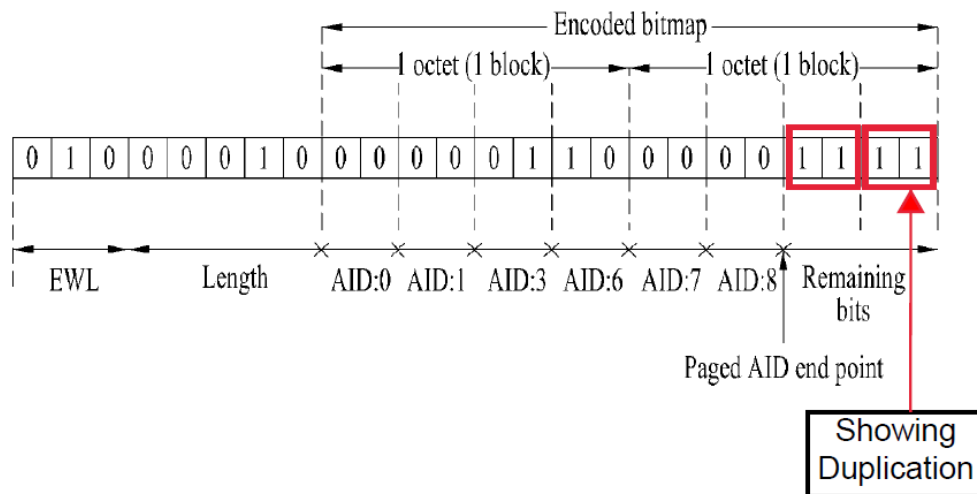
A POSITA would recognize that in the context of Choi’s encoding structure, the Δ AID values are implemented as 2-bit fields. SAMSUNG-1003, ¶179. Accordingly, the repeated padding bits—each being 11—are 2-bit values where both bits are set to 1. Therefore, each bit in the padding field is set to ‘1’, as recited in the claim. From a functional standpoint, this approach ensures that the padding field remains easily distinguishable from valid Δ AID values during frame parsing, while also preserving bitstream uniformity and decoding efficiency. SAMSUNG-1003, ¶180.

Moreover, this repeated use of the 11 bit pattern throughout the padding field serves not only as a structural filler but also reinforces the original termination signal, allowing robust identification of the boundary between valid AID content and padding. SAMSUNG-1003, ¶175.

Thus, Choi discloses that the padding field (i) consists of at least one bit (at least one 2-bit segment) and (ii) all bits within that field are set to ‘1’, due

to the repeated use of the 11 termination-indicating value. Accordingly, Choi teaches the claimed feature of “wherein the first padding field consists of at least one bit, and wherein all of the at least one bit are set to ‘1.’” SAMSUNG-1003, ¶¶173-181.

FIG. 22



SAMSUNG-1017, FIG. 22

[4] The wireless communication terminal of claim 1, wherein the first padding field is located before the FCS field in the frame.

Chu teaches that a control frame—which includes the uplink scheduling frame 902—contains a frame check sequence (FCS) sub-field 1352-12 within a control field 1350, illustrating that Chu’s frame structure implements MAC-layer error detection using a conventional FCS field. SAMSUNG-1016, [0091], [0118], FIG. 13B; SAMSUNG-1003, ¶182.

Similarly, Choi discloses a MAC frame format that includes a MAC

header, a frame body, and a Frame Check Sequence (FCS) field appended at the end of the frame. SAMSUNG-1017, [0121], [0126]. Choi explains that the MAC frame is transmitted or received as part of the PSDU in the PPDU frame format, confirming that this structure adheres to established physical-layer transmission protocols. SAMSUNG-1017, [0126]; SAMSUNG-1003, ¶183.

This arrangement is consistent with the IEEE 802.11 standard, which defines the MAC frame structure such that the FCS field is located at the end of the frame and used to verify the integrity of the entire MAC Protocol Data Unit (MPDU), including any padding that precedes it. *See* SAMSUNG-1020, Figure 8.1, Section 8.2.4.8; SAMSUNG-1003, ¶184.

A POSITA would recognize, consistent with both the standard and Dr. Ding's statement, that padding, when present, is positioned before the FCS to ensure it is included in the cyclic redundancy check(CRC). SAMSUNG-1003, ¶185. This placement is necessary because padding after the FCS would be excluded from error detection, potentially allowing undetected transmission errors. *Id.* Choi's frame structure confirms this ordering, showing padding precedes the FCS. SAMSUNG-1017, FIG. 9.

Accordingly, combining Chu's control frame structure (with embedded FCS and optional padding for timing alignment) with Choi's MAC frame format (which includes both padding and an FCS trailer), a POSITA would

have been motivated to structure the frame such that **the first padding field is located before the FCS field**, as recited in the claim. SAMSUNG-1003, ¶¶186-187. This placement reflects standard MAC-layer design practices, ensures that the padding bits are covered by the FCS integrity check, and preserve transmission reliability in multi-user uplink scenarios. *Id.*

Thus, the combination of Chu and Choi not only teaches the inclusion of both padding and FCS fields in a scheduling or trigger frame, but also supports the specific claimed arrangement—wherein the first padding field is **located before the FCS field**—based on well-established design practices known to a POSITA. SAMSUNG-1003, ¶188.

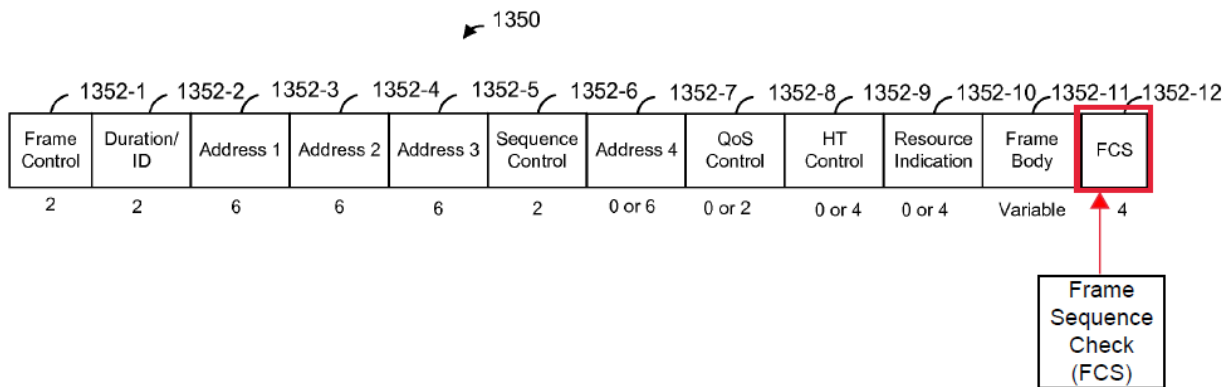
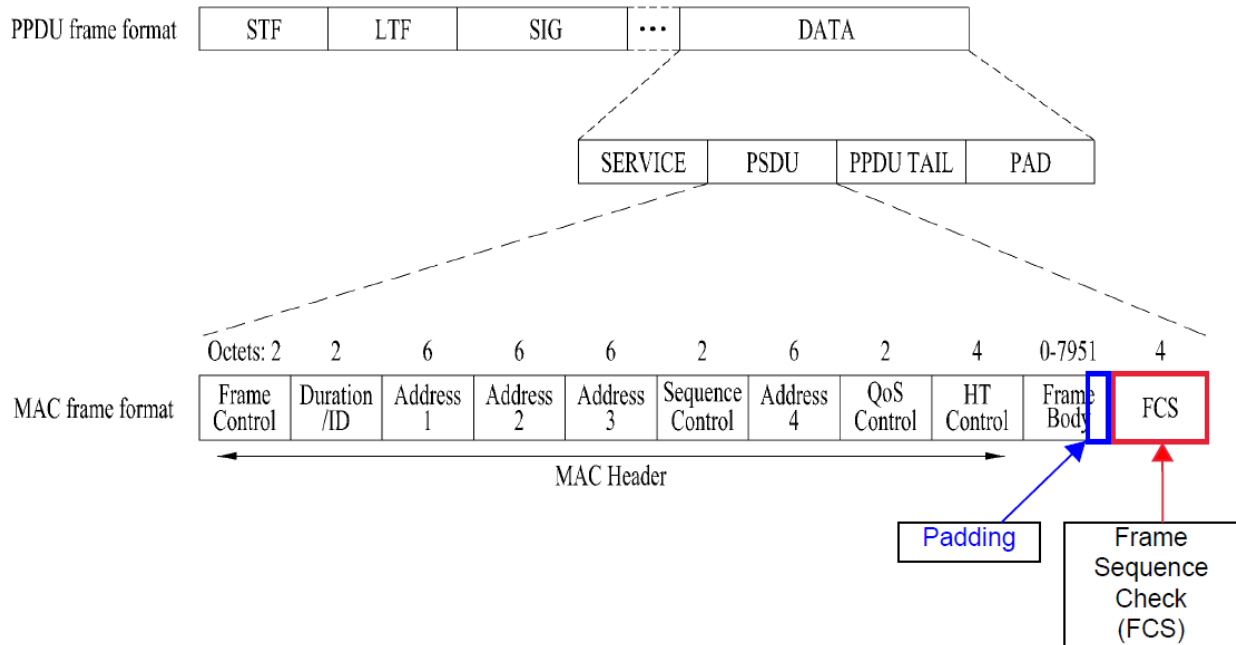


FIG. 13B

SAMSUNG-1016, FIG. 13B

FIG. 9



SAMSUNG-1017, FIG. 9

[5] The wireless communication terminal of claim 1, wherein the response frame includes a second padding field, when a specific condition is satisfied.

As an initial matter, the '171 Patent does not clearly define what constitutes “a specific condition.” In the absence of explicit guidance in the specification, Petitioner interprets this term to refer to the condition described in the '171 Patent’s flow diagram (e.g., FIG. 9), where uplink data transmissions from different STAs have varying durations. SAMSUNG-1001, FIG. 9. SAMSUNG-1003, ¶134.

Under this interpretation, the claim feature of “wherein the response frame includes a second padding field, when a specific condition is satisfied” is

met when variable-length uplink data units are padded to ensure simultaneous termination. SAMSUNG-1003, ¶134. For example, the specific condition is the presence of unequal uplink transmission durations, and the second padding field is added to align the endpoints of these transmissions. *Id.*

Chu discloses this concept. In particular, Chu teaches that “padding is used in one or more of the OFDM data units 302 to **equalize lengths** of the OFDM data units 302.” SAMSUNG-1016, [0057]. Chu explains that each OFDM data unit 302 is part of a larger OFDMA data unit, which includes transmissions from multiple STAs. *Id.* These transmissions are aligned in length to allow proper aggregation and processing. *Id.* This aligns with the concept of adding padding when the specific condition of unequal frame lengths is present. SAMSUNG-1003, ¶135.

While Chu refers to OFDM data units 302 in this context, a POSITA would understand that these are structurally and functionally equivalent to the OFDM data unit 906 described elsewhere in Chu. Both refer to uplink data transmitted by client stations over sub-channels allocated by the AP in a multi-user OFDMA setting. SAMSUNG-1016, [0054]-[0056], [0093]-[0094], FIGS. 3, 9A; SAMSUNG-1003, ¶132. Both data units serve as the **response frame** to an uplink scheduling frame (e.g., frame 902), and both conform to timing constraints imposed by the AP’s trigger. SAMSUNG-1003, ¶133.

In particular, Chu discloses that the scheduling frame 902 “indicates, to each of the client stations STA1, STA2, STA3, a length or duration (e.g., using the UL PPDU length field 762 of FIG. 7B) to be used for transmission of an uplink data unit during the TXOP.” SAMSUNG-1016, [0090]. Thus, each station is provided with a common transmission duration to use when sending its uplink data, regardless of the payload size. SAMSUNG-1003, ¶135.

A POSITA would readily understand that in such a multi-user uplink context, where a single TXOP and a shared length field are defined for all participating STAs, individual transmissions is padded to match the indicated duration. SAMSUNG-1003, ¶135. Otherwise, early termination by a STA would lead to asynchronous frame endings and potential interference or loss of synchronization. *Id.* Chu’s solution—explicitly equalizing the lengths of the OFDM data units by inserting padding—is a direct response to this issue. SAMSUNG-1016, [0057]; SAMSUNG-1003, ¶135.

Accordingly, Chu teaches or at least renders obvious the claimed feature of “wherein the response frame includes a second padding field, when a specific condition is satisfied.” The “specific condition” corresponds to the case where the STA’s native data does not fill the scheduled transmission time, and the “second padding field” is used to extend the uplink data frame (e.g., OFDM data unit 906) to the duration specified the UL PPDU length field.

Thus, Chu discloses or renders obvious the claimed feature of “wherein the response frame includes a second padding field, when a specific condition is satisfied.” SAMSUNG-1003, ¶¶134-136

[6] The wireless communication terminal of claim 1, wherein the first padding field is used to extend the length of the frame.

As described above, Chu teaches that padding bits are intentionally added to the scheduling frame 902. SAMSUNG-1016, [0093]; *see supra*, §III.B.4.[1.6]. Further, Chu describes that “a MAC header included in the scheduling frame 902 indicates a length of a valid payload, wherein the one or more padding bits follow the valid payload,” and “a signal field of a PHY preamble of the scheduling frame 902 includes an indication of the entire length of the scheduling frame 902, which includes the one or more padding bits at the end.” SAMSUNG-1016, [0093]. These disclosures show that the padding bits contribute to **extending** the total frame length, and that this extended length is both accounted for in control fields and signaled to receiving stations for timing alignment synchronization purposes. SAMSUNG-1003, ¶189.

A POSITA would understand that when padding bits are added after the valid payload and the total length field reflects those bits, the frame length has been extended. SAMSUNG-1003, ¶¶191-193, 195. The purpose (to ensure adequate preparation time for STAs) further reinforces that this is an

intentional, functional extension of the frame. *Id.*

Accordingly, Chu teaches or renders obvious the claimed feature of “wherein the first padding field is used to extend the length of the frame.”

In addition, Choi independently corroborates this claimed feature. Choi explains that “[t]he padding bits are used to match the encoded block information in octets (i.e., to a length expressed as a plurality of octets). If the length of ΔAID_1 , ΔAID_2 , ..., ΔAID_m , is less than a multiple of an octet, padding bits may be added to match the length of ΔAID_1 , ΔAID_2 , ..., ΔAID_m , to the multiple of an octet.” SAMSUNG-1017, [0184].

A POSITA would readily understand that this process of padding to the next octet boundary results in a definitive and quantifiable increase in the frame length—that is, the padding bits extend the length of the frame beyond what would be required for the actual content alone. SAMSUNG-1003, ¶¶190-192, 194-195. This extension is not incidental or irrelevant, rather, it serves to satisfy structural and encoding constraints of the frame format (e.g., byte-alignment), which are critical for ensuring reliable parsing and decoding of the transmission by receiving devices. *Id.*

Thus, Choi confirms that padding bits are added in a deliberate and structured way to extend the frame length to a compliant size (e.g., a multiple of 8 bits), consistent with the claimed language. SAMSUNG-1003, ¶¶190-192,

194-195.

Accordingly, Chu and Choi, either individually or in combination, disclose or render obvious the claimed feature that “the first padding field is used to extend the length of the frame.” Chu extends the scheduling frame to provide sufficient STA preparation time and includes the padding in the length fields of both the MAC header and PHY preamble. SAMSUNG-1016, [0093]. Choi extends the response frame to comply with octet-alignment rules necessary for proper interpretation at the receiving end. SAMSUNG-1017, [0184]. In both cases, the padding field modifies and increases the actual transmitted length of the frame in a purposeful and technically motivated manner, teaching the claim limitation. SAMSUNG-1003, ¶¶189-195.

[7] The wireless communication terminal of claim 1, wherein a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.

Chu teaches that “the scheduling frame 902 includes one or more padding bits at the end of the scheduling frame 902 to provide sufficient time for the client stations 25 to prepare for uplink transmission based on the uplink scheduling information provided by the scheduling frame 902.” SAMSUNG-1016, [0093]. This disclosure renders obvious the claimed feature that “a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.”

Chu provides context confirming that such “preparation” by client stations involves the processing of the received scheduling frame. In particular, Chu explains that the scheduling frame 902 includes OFDMA uplink scheduling information—such as sub-channel assignments and transmission durations (e.g., via the UL PPDU length field 762)—for a plurality of client stations. SAMSUNG-1016, [0090], [0092]. Chu further describes that each client station begins uplink transmission only after a predetermined delay (e.g., SIFS or a longer interval) following the reception of the scheduling frame. *Id.*, [0093]. This delay allows time “to decode the scheduling frame 902 and to prepare for uplink transmission based on the uplink scheduling information provided.” *Id.* Additionally, padding bits may be included at the end of the scheduling frame to provide this required preparation time. *Id.*

A POSITA would understand that this preparation encompasses multiple interrelated steps: (i) decoding the frame, (ii) extracting per-station uplink information (e.g., RU allocation, MCS, duration), (iii) configuring transmission parameters accordingly, and (iv) preparing the MAC and PHY layers for transmission. SAMSUNG-1003, ¶¶196-197. Chu’s disclosure supports each of these operations and clarifies that their completion is necessary before the client station can begin uplink transmission at time t2. SAMSUNG-1016, [0090]-[0093].

Each of these preparatory steps depends on the successful processing of the received scheduling frame. Thus, the “time to prepare for uplink transmission” described in Chu is, from a technical standpoint, **equivalent** to the “time needed to process the frame.” SAMSUNG-1003, ¶197.

Further, a POSITA would understand that the amount of padding is selected to accommodate the processing time of the one or more client stations indicated in the scheduling frame. SAMSUNG-1003, ¶198. For example, the duration of the padding field reflects the time required for each of the indicated client stations to complete its preparation, ensuring that all scheduled terminals are ready for uplink transmission after the predetermined interval. *Id.*

In addition, because Chu adds a padding field to provide this preparation time, a POSITA would understand that the padding duration is tied to the processing requirements of the terminal. SAMSUNG-1003, ¶199. For example, (i) if less time were needed, less padding would suffice and, (ii) if more time were needed, additional padding would be added. *Id.* In both cases, the padding duration is not arbitrary, and it is calculated to ensure sufficient time for client-side processing of the scheduling frame. *Id.*

Choi further reinforces this conclusion. SAMSUNG-1003, ¶200. Choi explains that “padding bits are used to match the encoded block information in octets (i.e., to a length expressed as a plurality of octets). If the length of

$\Delta AID_1, \Delta AID_2, \dots, \Delta AID_m$, is less than a multiple of an octet, padding bits may be added to match the length ... to the multiple of an octet.” SAMSUNG-1017, [0184]. This padding is introduced to finalize the formatting of the frame so it can be correctly parsed and transmitted according to protocol constraints. SAMSUNG-1003, ¶200.

A POSITA would understand that this formatting process—like Chu’s uplink preparation—entails terminal-side operations performed before transmission. SAMSUNG-1003, ¶200. Thus, the padding field compensates for processing time and structure alignment, confirming that its duration is a function of terminal processing requirements. *Id.*

Accordingly, both Chu and Choi, either individually or in combination, render obvious the claimed feature that “a duration of the first padding field is set based on a time needed for one or more terminals to process the frame.” Chu provides padding to allow time to process and act on scheduling information, while Choi provides padding to structure encoded control data. In each case, the padding field duration is defined by the terminal’s pre-transmission processing needs. SAMSUNG-1003, ¶201.

[8] The wireless communication terminal of claim 1, wherein the second padding field is used to set a same lengths of the response frames when two or more terminals transmit response frames in response to the trigger frame.

As described above, Chu teaches that “padding is used in one or more of

the OFDM data units 302 to **equalize lengths** of the OFDM data units 302.”

SAMSUNG-1016, [0057]; *see supra*, §III.B.4.[5]. Chu explains that each OFDM data unit 302 is part of a larger OFDMA data unit, which includes transmissions from multiple STAs. SAMSUNG-1016, [0057]. These transmissions are **aligned** in length to allow proper aggregation and processing. SAMSUNG-1016, [0057], SAMSUNG-1003, ¶95.

This alignment is further supported by Chu’s disclosure that the scheduling frame 902, which is transmitted by the AP to the client stations, indicates, for each client, a specific length or duration for the uplink data unit to be transmitted. SAMSUNG-1003, ¶96. In particular, Chu teaches that “the scheduling frame 902 further indicates, to each of the client stations STA1, STA2, STA3, a length or duration (e.g., using the UL PPDU length field 762 of FIG. 7B) to be used for transmission of an uplink data unit during the TXOP.” SAMSUNG-1016, [0090].

A POSITA would understand that this prescribed duration serves as a constraint that each client station meets—regardless of its individual payload size—to ensure synchronized completion of the uplink transmissions. SAMSUNG-1003, ¶¶96-98. Where a client’s actual data does not fill the allocated duration, padding is inserted into the OFDM data unit to match the required length. *Id.* Thus, the use of padding is not arbitrary but driven by the

need to conform to the duration provided in the scheduling frame. *Id.*

Accordingly, Chu discloses that padding is added to equalize the transmission lengths of multiple client stations responding to the same scheduling frame, and that this equalization is achieved with respect to a common, predetermined uplink duration conveyed in the UL PPDU length field. Thus Chu discloses or at least renders obvious the claimed feature of “wherein the second padding field is used to set a same lengths of the response frames when two or more terminals transmit response frames in response to the trigger frame.” SAMSUNG-1003, ¶¶95-99.

Claims 9-16

The below claims are rendered obvious for similar reasons as discussed in the analysis for the corresponding claim listed in the table below.

Claim	Corresponding Claim
9Pre	1Pre
9.1	1.3
9.2	1.4
9.3	1.5
9.4	1.6
9.5	1.7
9.6	1.8

Claim	Corresponding Claim
10	2
11	3
12	4
13	5
14	6
15	7
16	8

IV. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

Petitioner believes that discretionary denial is unwarranted, and yet, Petitioner intends to utilize the bifurcated briefing process contemplated by the March 26, 2025, Stewart Memorandum to rebut contentions if offered by Patent Owner to the contrary. SAMSUNG-1018.

V. CONCLUSION AND FEES

The Challenged Claims are unpatentable. Petitioner authorizes charge of fees to Deposit Account 06-1050.

VI. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(a)(1)

A. Real Party-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

(collectively, “Samsung”) are the real parties-in-interest.

B. Related Matters Under 37 C.F.R. § 42.8(b)(2)

The '171 Patent is the subject of civil action *Wilus Institute of Standards and Technology Inc., v. Samsung Electronics Co., Ltd., et al.*, 2-25-cv-00070 (EDTX) filed January 23, 2025; and *Wilus Institute of Standards and Technology Inc. v. HP Inc.*, 2-25-cv-00069 (EDTX) filed January 23, 2025. Petitioner is not aware of any disclaimers, reexamination certificates, or IPR petitions addressing the '171 Patent.

C. Lead And Back-Up Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner provides the following designation of counsel.

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D. Service Information

Please address all correspondence and service to the address listed above.

Petitioner consents to electronic service by email at IPR39843-0202IP1@fr.com

(referencing No. 39843-0202IP1 and cc'ing PTABInbound@fr.com).

Attorney Docket No. 39843-0202IP1

IPR of U.S. Patent No. 11,716,171

Respectfully submitted,

Dated June 9, 2025

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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 Petition for Inter Partes Review totals 13,801 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated June 9, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) et seq. and 42.105(b), the undersigned certifies that on June 9, 2025, a complete and entire copy of this Petition for Inter Partes Review and all supporting exhibits were provided by Express Mail, to the Patent Owner, by serving the correspondence address of record as follows:

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