

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re Patent of: Woojin Ahn et al.  
U.S. Patent No.: 11,664,926 Attorney Docket No. 39843-0203IP1  
Issue Date: May 30, 2023  
Appl. Serial No.: 17/157,978  
Filing Date: January 25, 2021  
Title: AGGREGATED-MPDU, METHOD FOR TRANSMITTING  
RESPONSE FRAME THERETO, AND WIRELESS  
COMMUNICATION TERMINAL USING SAME

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**PETITION FOR *INTER PARTES* REVIEW OF UNITED STATES PATENT  
NO. 11,664,926 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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**EXHIBITS**

- SAMSUNG-1001 U.S. Patent No. 11,664,926 (“the ’926 Patent”)
- SAMSUNG-1002 Excerpts from Prosecution History of the ’926 Patent (“the Prosecution History”)
- SAMSUNG-1003 Declaration and Curriculum Vitae of Dr. Mark Mahon
- SAMSUNG-1004 U.S. Patent Pub. No. 2017/0111951 (“Chu”)
- SAMSUNG-1005 IEEE P802.11ax/D1.0, “Draft Standard for Information technology - Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 6: Enhancements for High Efficiency WLAN,” 802.11 Working Group of the LAN/MAN Standards Committee of the IEEE Computer Society (December 1, 2016) (“IEEE-D1”)
- SAMSUNG-1006 Liwen Chu, IEEE 802.11-16/1185r2 “IEEE P802.11 Wireless LANs 5.10.3 A-MPDU comment resolution,” IEEE Standards Ass’n (September 14, 2016) (“IEEE-D2”)
- SAMSUNG-1007 RESERVED
- SAMSUNG-1008 M. Shahwaiz Afaqui et al., “IEEE 802.11ax: Challenges and requirements for future high efficiency Wi-Fi,” (December 20, 2016)(“Afaqui”)

- SAMSUNG-1009 IEEE St 802.11 - 2016, “IEEE Standard for Information technology - Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications,” IEEE Computer Society (December 14, 2016) (“IEEE-D3”)
- SAMSUNG-1010 Boris Bellalta, “IEEE 802.11ax: High-Efficiency WLANs,” IEEE Wireless Communications (December 2015) (“Bellalta”)
- SAMSUNG-1011 RESERVED
- SAMSUNG-1012 Liwen Chu, IEEE 802.11-16/1186r0 “HE Variant HT Control – A-MPDU Content,” IEEE Standards Ass’n (September 12, 2016) (“IEEE-D4”)
- SAMSUNG-1013 Robert Stacey et al., IEEE 802.11-16/0024r1 “Proposed TGax draft specification,” IEEE Standards Ass’n (March 2, 2016) (“IEEE-D5”)
- SAMSUNG-1014 RESERVED
- SAMSUNG-1015 IEEE St 802.11 - 2012, “IEEE Standard for Information technology - Telecommunications and information exchange between systems Local and metropolitan area networks – Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications,” IEEE Computer Society (March 29, 2012) (“IEEE-D6”)
- SAMSUNG-1016 U.S. Patent Pub. No. 2015/0139214 (“Noh”)

SAMSUNG-1017 U.S. Patent Pub. No. 2012/0230448 (“Kang”)

SAMSUNG-1018 IEEE P802.11ax/D0.5, “Draft Standard for Information  
technology - Telecommunications and information exchange  
between systems Local and metropolitan area networks –  
Specific requirements, Part 11: Wireless LAN Medium Access  
Control (MAC) and Physical Layer (PHY) Specifications  
Amendment 6: Enhancements for High Efficiency  
WLAN(#1121),” 802.11 Working Group of the LAN/MAN  
Standards Committee of the IEEE Computer Society  
(September 2016) (“IEEE-D7”)

SAMSUNG-1019 RESERVED

SAMSUNG-1020 IEEE St 802.11ac - 2013, “IEEE Standard for Information  
technology - Telecommunications and information exchange  
between systems Local and metropolitan area networks –  
Specific requirements, Part 11: Wireless LAN Medium Access  
Control (MAC) and Physical Layer (PHY) Specifications,”  
IEEE Computer Society (December 18, 2013) (“IEEE-D8”)

SAMSUNG-1021 Liwen Chu et al., IEEE 802.11-16/0069r0 “Multi-TID A-  
MPDU in MU Transmission,” IEEE Standards Ass’n (January  
18, 2016) (“IEEE-D9”)

SAMSUNG-1022-1026 RESERVED

SAMSUNG-1027 Declaration of June Ann Munford

SAMSUNG-1028 Complaint, *Wilus Institute of Standards and Technology Inc., v.*

*Samsung Electronics Co., Ltd.*, 2:25-cv-00070 (E.D. TX Jan  
2025)

SAMSUNG-1029 Declaration of Dr. Christopher Hansen

SAMSUNG-1030 *Fintiv* Stipulation

## CLAIM LISTING

| Claim 1 |                                                                                                                                                                                                                        |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [1pre]  | A wireless communication terminal, the terminal comprising:                                                                                                                                                            |
| [1a]    | a processor; and                                                                                                                                                                                                       |
| [1b]    | a communication unit,                                                                                                                                                                                                  |
| [1c]    | wherein the processor is configured to: receive a PPDU (physical layer protocol data unit) including an A-MPDU (Aggregate-MAC Protocol Data Unit) in which one or more MPDUs (MAC Protocol Data Units) are aggregated, |
| [1d]    | wherein the A-MPDU includes Ack policy information related to a block Ack for the one or more MPDUs, and one or more subframes,                                                                                        |
| [1e]    | wherein each of the one or more subframes includes MPDU identifier information and an MPDU of the one or more MPDUs, and                                                                                               |
| [1f]    | wherein the MPDU identifier information includes an end of frame (EOF) field and a length field, and                                                                                                                   |
| [1g]    | transmit a response frame in response to the PPDU,                                                                                                                                                                     |

|                |                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [1h]           | wherein a type of the response frame is determined as one of an Ack frame, a compressed BlockAck frame, and a multi-STA BlockAck frame according to a combination of a type of the MPDU determined by the EOF field and the length field, and the Ack policy information, and |
| [1i]           | wherein the compressed BlockAck frame is used to transmit a response to the one or more MPDUs corresponding to one TID, when the one or more MPDUs correspond to the one TID among an one or more TIDs (traffic IDs).                                                         |
| <b>Claim 2</b> |                                                                                                                                                                                                                                                                               |
| [2]            | The wireless communication terminal of claim 1, wherein the A-MPDU further includes the one or more TIDs corresponding to the one or more MPDUs.                                                                                                                              |
| <b>Claim 3</b> |                                                                                                                                                                                                                                                                               |
| [3]            | The wireless communication terminal of claim 2, wherein the type of the response frame is determined by further considering a number of TIDs indicating an immediate response among the one or more TIDs.                                                                     |

| Claim 4 |                                                                                                                                                                                                                                                                                        |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [4]     | The wireless communication terminal of claim 3, wherein the type of the response frame is the Ack frame when the A-MPDU includes only one TID indicating the immediate response and the Ack policy information indicates a normal Ack.                                                 |
| Claim 5 |                                                                                                                                                                                                                                                                                        |
| [5]     | The wireless communication terminal of claim 3, wherein the type of the response frame is the compressed BlockAck frame when a number of the TIDs indicating the immediate response is one or more and the one or more TIDs are the same.                                              |
| Claim 6 |                                                                                                                                                                                                                                                                                        |
| [6]     | The wireless communication terminal of claim 3, wherein the MPDU delimiter information is first MPDU delimiter information in which a value of the EOF field is 1 and a value of the length field is non-zero, or second MPDU delimiter information in which the EOF field value is 0. |

| Claim 7 |                                                                                                                                                                                                                                                                                                                            |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [7]     | The wireless communication terminal of claim 6, wherein the type of the response frame is determined by further considering whether the A-MPDU includes a subframe including the first MPDU delimiter information, and whether the A-MPDU includes at least one subframe including the second MPDU identifier information. |
| Claim 8 |                                                                                                                                                                                                                                                                                                                            |
| [8pre]  | A wireless communication method of a wireless communication terminal, the method comprising:                                                                                                                                                                                                                               |
| [8a]    | receiving a PPDU (physical layer protocol data unit) including an A-MPDU (Aggregate-MAC Protocol Data Unit) in which one or more MPDUs (MAC Protocol Data Units) are aggregated,                                                                                                                                           |
| [8b]    | wherein the A-MPDU includes Ack policy information related to a block Ack for the one or more MPDUs, and one or more subframes,                                                                                                                                                                                            |
| [8c]    | wherein each of the one or more subframes includes MPDU identifier information and an MPDU of the one or more MPDUs, and                                                                                                                                                                                                   |

|                |                                                                                                                                                                                                                                                                               |
|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [8d]           | wherein the MPDU identifier information includes an end of frame (EOF) field and a length field; and                                                                                                                                                                          |
| [8e]           | transmitting a response frame in response to the PPDU,                                                                                                                                                                                                                        |
| [8f]           | wherein a type of the response frame is determined as one of an Ack frame, a compressed BlockAck frame, and a multi-STA BlockAck frame according to a combination of a type of the MPDU determined by the EOF field and the length field, and the Ack policy information, and |
| [8g]           | wherein the compressed BlockAck frame is used to transmit a response to the one or more MPDUs corresponding to one TID, when the one or more MPDUs correspond to the one TID among an one or more TIDs (traffic IDs).                                                         |
| <b>Claim 9</b> |                                                                                                                                                                                                                                                                               |
| [9]            | The wireless communication method of claim 8, wherein the A-MPDU further includes the one or more TIDs corresponding to the one or more MPDUs.                                                                                                                                |

| Claim 10 |                                                                                                                                                                                                                                          |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [10]     | The wireless communication method of claim 9, wherein the type of the response frame is determined by further considering a number of TIDs indicating an immediate response among the one or more TIDs.                                  |
| Claim 11 |                                                                                                                                                                                                                                          |
| [11]     | The wireless communication method of claim 10, wherein the type of the response frame is the Ack frame when the A-MPDU includes only one TID indicating the immediate response and the Ack policy information indicates a normal Ack.    |
| Claim 12 |                                                                                                                                                                                                                                          |
| [12]     | The wireless communication method of claim 10, wherein the type of the response frame is the compressed BlockAck frame when a number of the TIDs indicating the immediate response is one or more and the one or more TIDs are the same. |

| Claim 13 |                                                                                                                                                                                                                                                                                                                           |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [13]     | The wireless communication method of claim 8, wherein the MPDU delimiter information is first MPDU delimiter information in which a value of the EOF field is 1 and a value of the length field is non-zero, or second MPDU delimiter information in which the EOF field value is 0.                                      |
| Claim 14 |                                                                                                                                                                                                                                                                                                                           |
| [14]     | The wireless communication method of claim 13, wherein the type of the response frame is determined by further considering whether the A-MPDU includes a subframe including the first MPDU delimiter information, and whether the A-MPDU includes at least one subframe including the second MPDU identifier information. |

Samsung Electronics Co., Ltd. (“**Petitioner**” or “Samsung”) petitions for *inter partes* review (IPR) of claims 1-14 (“**Challenged Claims**”) of U.S. Patent No. 11,664,926 (“**the ’926 Patent**”). Compelling evidence presented in this Petition demonstrates at least a reasonable likelihood that Petitioner will prevail with respect to at least one of the Challenged Claims.

## **I. REQUIREMENTS FOR IPR**

### **A. Grounds for Standing**

Petitioner certifies that the ’926 Patent is available for IPR. Petitioner is not barred or estopped from requesting this review. SAMSUNG-1028, 42.

### **B. Challenge and Relief Requested**

Petitioner requests IPR of the Challenged Claims on the below grounds. SAMSUNG-1003, ¶¶31-192.

| <b>Ground</b> | <b>Claims</b> | <b>Basis for Rejection</b> |
|---------------|---------------|----------------------------|
| 1A            | 1-14          | §103: Chu and IEEE-D1      |
| 1B            | 1-14          | §103: Chu and IEEE-D2      |
| 2             | 1, 8          | §103: IEEE-D3              |

The ’926 Patent issued from U.S. Application No. 17/157,978, which was filed on January 25, 2021, and claims priority as early as December 21, 2016, the filing date of a parent Korean Patent Application No. 10-2016-0175999.

While Petitioner does not concede or necessarily agree that the '926 Patent should be entitled to the priority date of December 21, 2016, for purposes of this

IPR, Petitioner has used December 21, 2016 (“**Critical Date**”) as the earliest possible priority date.

As seen below, each applied reference predates the Critical Date and qualify as prior art.

| Reference | Date                                        | Section   |
|-----------|---------------------------------------------|-----------|
| Chu       | 10/20/2016 (filed)<br>4/20/2017 (published) | 102(a)(2) |
| IEEE-D1   | 12/1/2016 (published)                       | 102(a)(1) |
| IEEE-D2   | 9/14/2016 (published)                       | 102(a)(1) |
| IEEE-D3   | 12/14/2016 (published)                      | 102(a)(1) |

### 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 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. Increased educational experience can make up for less work experience, and *vice versa*. SAMSUNG-1003, ¶¶33-35.

**II. SUMMARY OF THE ’926 PATENT**

**A. Description**

The ’926 Patent is directed to “a wireless communication method and a wireless communication terminal for setting various formats of [an] aggregate MPDU [MAC protocol data unit] and the response frame thereto.”<sup>1</sup> SAMSUNG-1001, Abstract; SAMSUNG-1003, ¶68.

The ’926 Patent describes a wireless LAN system in which wireless communication terminals—such as non-access point stations (non-AP STAs) and access points (APs)—exchange aggregated MAC data units (A-MPDUs). As

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<sup>1</sup> A list of abbreviations can be found in Appendix C of the Declaration of Dr. Mark Mahon. *See* SAMSUNG-1003, Appendix C.

illustrated in FIG. 1, each basic service set (BSS) includes STAs (e.g., STA1-STA5, outlined in red) and access points (PCP/AP-1 and PCP/AP-2, outlined in green) connected by a distribution system (DS). SAMSUNG-1001, 6:56-67; 7:1-2; FIG. 1; SAMSUNG-1003, ¶69.

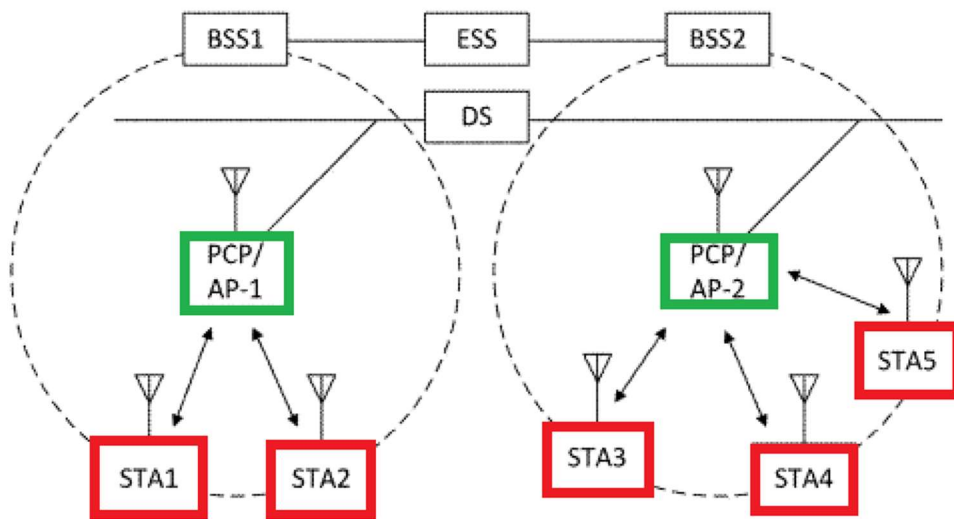


**FIG. 1**

SAMSUNG-1001, FIG. 1.<sup>2</sup>

The '926 Patent explains that the “term ‘terminal’ may be used to refer to a non-AP STA, or an AP, or to both terms,” and describes multiple scenarios: one in which a non-AP STA acts as the receiving terminal for receiving an A-MPDU and another in which an AP acts as the receiving terminal for receiving the same.

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<sup>2</sup> Annotations to the figures throughout this Petition are shown in color.

SAMSUNG-1001, 7:8-9, 16:37-41, 42-56, 17:5-7, 45-47, 18:14-16, 19:14-15, 38-40, 20:1-4, 17-19, 55-57; 21:40-44, 40-53, 22:1-4. In each case, the receiving terminal processes the received A-MPDU to determine a type of acknowledgment response. *Id.*; SAMSUNG-1003, ¶70.

The '926 Patent classifies the received A-MPDUs into the following three categories based on MPDU identifiers (e.g., MPDU delimiters) and traffic identifier (TID) information:

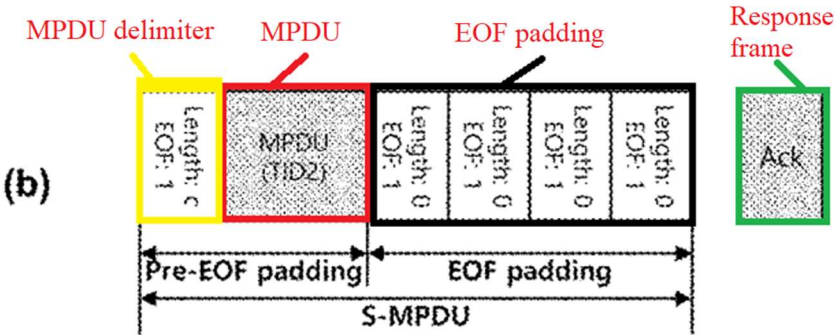
- (i) Single MPDU (S-MPDU);
- (ii) Single-TID A-MPDU; and
- (iii) Multi-TID A-MPDU.

*See generally* SAMSUNG-1001; *see also id.*, FIG. 10(a)-(c) (summarized below in Table 1); SAMSUNG-1003, ¶71.

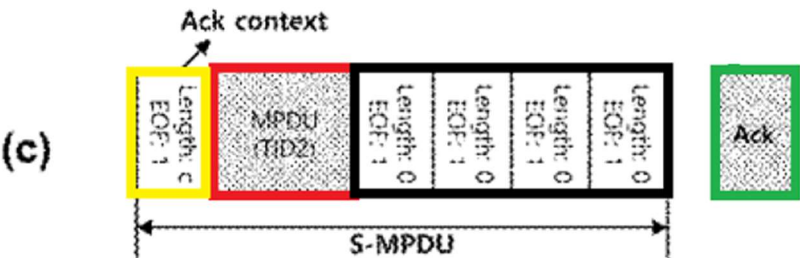
*Overview of the Received A-MPDU Types and Response Frame Determination*

As described in Table 1 below and explained by Dr. Mahon, the '926 Patent categorizes three different types of A-MPDUs that may be received by the recipient terminal, along with the corresponding response frames that the recipient terminal transmits. SAMSUNG-1003, ¶¶72-73.

| Type of<br>A-MPDU | A-MPDU Structure and Corresponding Response Frame                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S-MPDU            | <p>S-MPDU is a single MPDU having an MPDU delimiter with “the value of the EOF [(end of frame)] field [] set to 1 and the value of the MPDU length field [] set to a non-zero value.” SAMSUNG-1001, 11:27-33; 15:61-62. According to the ’926 Patent, the S-MPDU is an A-MPDU containing only one MPDU. SAMSUNG-1001, 15:54-67 (explaining that the MPDU format includes an “A-MPDU containing a single MPDU (embodiment of FIG. 10(c)).”), FIG. 10(c).</p> <p>“When an S-MPDU is received, the recipient [terminal] may respond with a normal Ack.” SAMSUNG-1001, 11:17-36, FIGS. 6(b) and 10(c). For example, as illustrated below, FIGS. 6(b) and 10(c) disclose the S-MPDU structure and corresponding response frame being an Ack frame. SAMSUNG-1001, FIGS. 6(b), 7(c), 10(c); 15:53-16:27; 12:43-13:33.</p> |



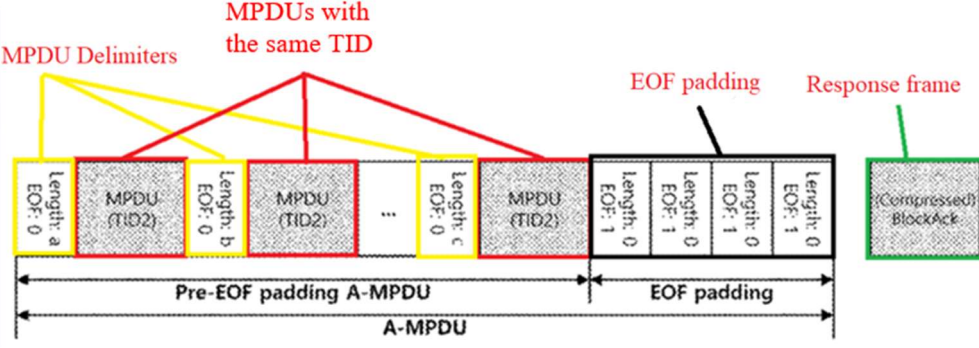
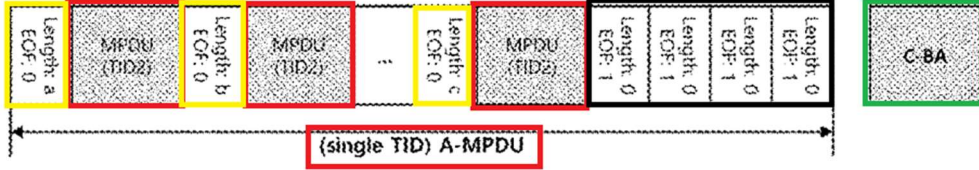
SAMSUNG-1001, FIG. 6(b).



SAMSUNG-1001, FIG. 10(c).

Single-TID  
A-MPDU

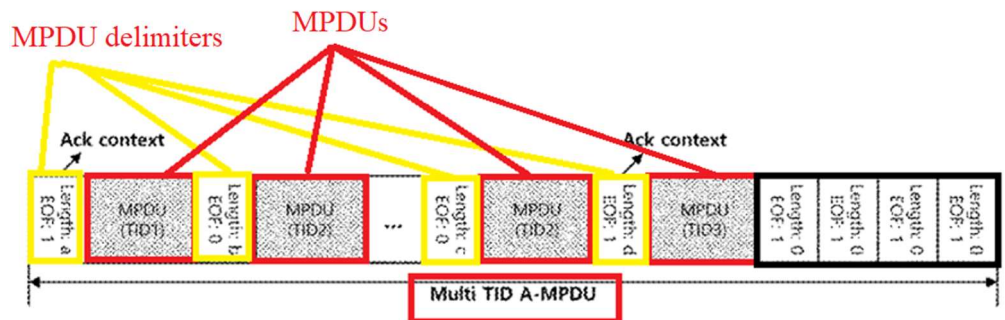
A single-TID A-MPDU refers to an A-MPDU where multiple MPDUs all belong to the same TID and have MPDU delimiters with EOF=0 and length≠0 in the pre-EOF padding portion of the A-MPDU. SAMSUNG-1001, 11:1-16; 15:59-61. For example, FIGS. 6(a) and 10(b) (reproduced below) disclose the single-TID A-MPDU structure and corresponding response frame being a Compressed BlockAck (C-BA) frame. SAMSUNG-1001, FIGS. 6(a), 10(b); 11:1-16; 16:5-15.

|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |  <p style="text-align: center;">SAMSUNG-1001, FIG. 6(a).</p>  <p style="text-align: center;">SAMSUNG-1001, FIG. 10(b).</p>                                                                                                                                                                                                                                                                                           |
| <p>Multi-TID A-MPDU</p> | <p>Multi-TID A-MPDU generally refers to an A-MPDU that includes MPDUs belonging to different TIDs. SAMSUNG-1001, 11:59-67; 15:57-59; 16:16-27. The '926 Patent describes two multi-TID A-MPDU example implementations:</p> <p><b>(1) 1<sup>st</sup> Implementation:</b> includes mixed EOF=0, length≠0 and EOF=1, length≠0 MPDU delimiters (e.g., each MPDU delimiter being followed by a respective MPDU) within the same A-MPDU. SAMSUNG-1001, 13:34-56, 12:43-59, 15:54-67, FIGS. 7(a), 10(a); <i>see generally id.</i>, 11:59-67, 12:1-59. Notably, FIG. 7(a) shows multi-TID A-</p> |

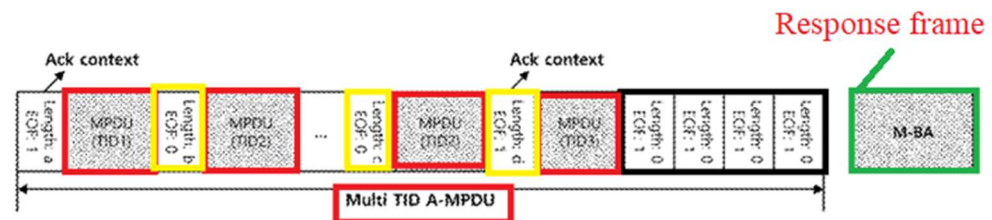
MPDU that includes both (i) the MPDU delimiters having EOF=1 preceding single MPDUs of distinct TIDs (e.g., TID1 and TID3) and (ii) the MPDU delimiters having EOF=0 for block of MPDUs of same TID (e.g., TID 2).

SAMSUNG-1001, FIGS. 7(a). FIG. 10(a) discloses another example of this 1<sup>st</sup> Implementation of multi-TID A-MPDU structure and corresponding response frame being a Multi-STA BlockAck (M-BA) frame.

SAMSUNG-1001, FIG 10(a); 16:16-27.



SAMSUNG-1001, FIG. 7(a).



SAMSUNG-1001, FIG. 10(a).

|  |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>(2) 2<sup>nd</sup> Implementation:</b> includes only MPDU delimiters having EOF=1, length≠0 (e.g., each MPDU delimiter indicating that a respective MPDU following that MPDU delimiter is a standalone MPDU for each TID).</p> <p>SAMSUNG-1001, 11:65-67; 12:22-67; 13:1-32.</p> <p>In both implementations, the receiving terminal may respond with an M-BA frame. SAMSUNG-1001, 12:22-31; 16:16-17; FIG.10(a).</p> |
|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

SAMSUNG-1003, Table 1.

The '926 Patent also describes uplink multi-user transmission, where the AP receives A-MPDUs from one or more STAs and generates a corresponding response frame—such as an Ack, C-BA, or M-BA—for each STA, as well as policy information, where “first [policy] value” may govern immediate response transmissions for all three response types. SAMSUNG-1001, 21:40-67, FIG. 13(a); SAMSUNG-1003, ¶¶74-77.

The '926 Patent issued after only one office action was issued during prosecution. SAMSUNG-1002, 187, 207, 209, 213; SAMSUNG-1003, ¶78.

### **III. THE CHALLENGED CLAIMS ARE UNPATENTABLE**

#### **A. [GROUNDS 1A/1B] – CLAIMS 1-14 ARE OBVIOUS OVER CHU AND IEEE-D1 or CHU AND IEEE-D2**

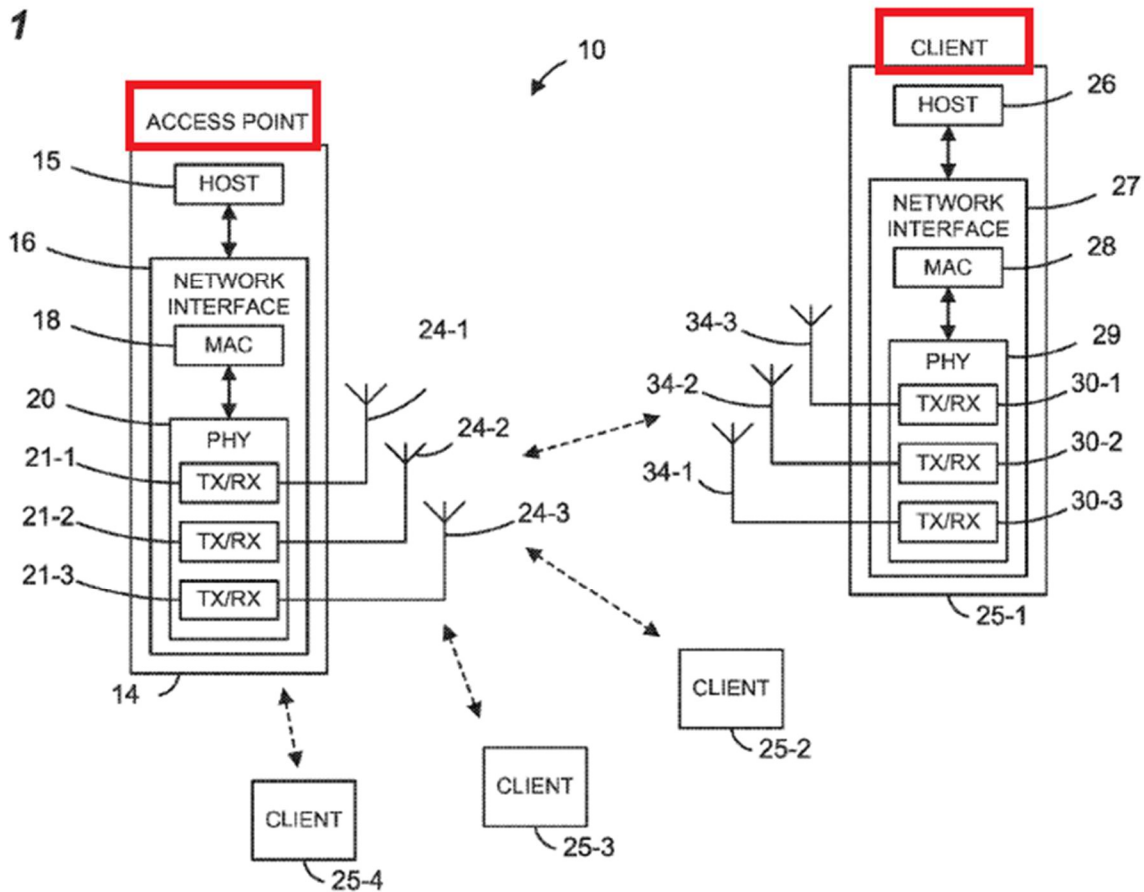
##### **1. Overview of Chu<sup>3</sup>**

Chu describes systems and methods for: (1) generating aggregate MAC Protocol Data Units (A-MPDUs) that include data units (e.g., MPDUs) associated with one or more TIDs and policy information, and (2) communicating acknowledgement response after receiving the A-MPDUs. SAMSUNG-1004, SAMSUNG-1004, [0007], [0010], [0032]-[0033], [0121]-[0141], claims 1, 12, 17, 20, 21, [0121]-[0142]; SAMSUNG-1003, ¶80.

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<sup>3</sup> General descriptions provided for the references and combinations discussed in this Section are incorporated into each subsection applying those references to the Challenged Claims.

**FIG. 1**



SAMSUNG-1004, FIG. 1.

Chu explains that each of the *access points (APs) and client stations* is capable of (1) generating and receiving A-MPDUs and (2) generating acknowledgment response frames (e.g., response MPDU) upon receipt of the A-MPDUs. SAMSUNG-1004, FIG. 1 (reproduced above), [0055], [0057], [0060], [0081], [0087], [0121], [0126], [0129], [0134]; SAMSUNG-1003, ¶81.

Referring to Chu's FIGS. 5A-5C (reproduced below), an A-MPDU 500 includes several subframes 502, 504, 506, 508, and each subframe (520) includes an MPDU (524) and MPDU delimiter (522). SAMSUNG-1004, [0058], [0059],

[0070]-[0076], [0129]-[0133], [0157]-[0161], FIGS. 5A-5C. Each MPDU

delimiter 522 (530) includes an EOF field and a length field that, along with the acknowledgment policy information (e.g., “acknowledgment policy bits of the QoS control field 314” of MPDU), determine the policy and the appropriate response frame. SAMSUNG-1004, [0058]-[0059], [0070]-[0076], [0157]-[0161], FIGS. 5A-5C; SAMSUNG-1003, ¶¶89-95.



**FIG. 5A**

520 = Example of one or more  
A-MPDU subframes 502, 504, 506

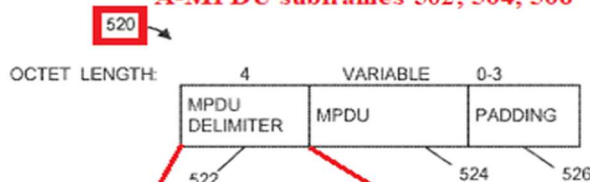


**FIG. 5B**

530 = Example of  
MPDU delimiter 522

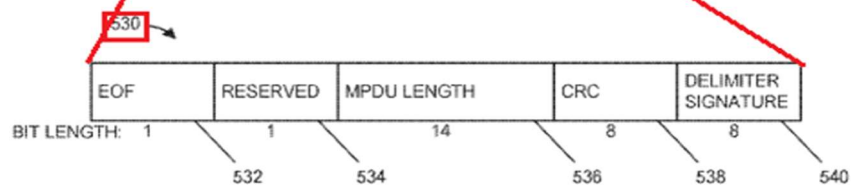


**FIG. 5C**

SAMSUNG-1004, FIGS. 5A-5C.

Chu further discloses that the response type acknowledging an A-MPDU can include the following:

[1] “Ack” for a “single VHT [Very High Throughput] MPDU”;

[2] “BlockAck after a SIFS [short interframe space] period”

(e.g., C-BA response) for a single TID A-MPDU (e.g., multiple MPDUs having the same TID); and

[3] “[M]ulti-TID block acknowledgment” (e.g., M-BA response) for a multi-TID A-MPDU (e.g., multiple MPDUs having different TIDs).

SAMSUNG-1003 ¶¶99-107, 108-114, 115-123 (*citing* SAMSUNG-1004, 1005, 1006, 1009, 1012, 1013, 1015, 1020).

Moreover, Chu discloses that acknowledgement responses can be determined based on each MPDU’s delimiter information and policy information. SAMSUNG-1004, [0073]-[0075], [0159], claims 12, 15; *see infra* Section III.A.6.(i).[1h]. In particular, Chu explains that the same policy bits (e.g., “00” or a value indicating “immediate Ack/BA”) can represent an immediate acknowledgment policy (e.g., the response is transmitted after a SIFS). SAMSUNG-1004, [0073]-[0075], claim 15. Within the immediate acknowledgment policy, a single MPDU with EOF=1 and nonzero MPDU length results in an Ack response message, and multiple MPDUs with EOF=0 and the same TID results in a BlockAck response message. *Id.* Accordingly, Chu’s response types can be determined using policy bits, the EOF field, and the MPDU length field of a received A-MPDU. SAMSUNG-1004, [0073]-[0075], [0159], claims 12, 15; SAMSUNG-1003, ¶¶91-123.

Petitioner's expert, Dr. Mahon, has provided a Table 2 (reproduced below)

based on Chu's teachings that summarizes the types of response frames and corresponding A-MPDU features. SAMSUNG-1003, ¶123.

| Response type<br>A-MPDU<br>Feature | "Ack" response <sup>4</sup>                                                                | "BlockAck"<br>response "after a<br>SIFS period"<br>(e.g., C-BA<br>response) <sup>5</sup> | Multi-TID block<br>acknowledgment<br>response<br>(e.g., M-BA<br>response) <sup>6</sup> |
|------------------------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| A-MPDU Type                        | VHT Single-MPDU                                                                            | Single TID A-MPDU<br>(Multiple MPDUs<br>associated with the<br>same TID)                 | Multi-TID A-MPDU<br>(Multiple MPDUs,<br>each associated with<br>a different TID)       |
| Policy                             | Single-MPDU having<br>"normal<br>acknowledgment"<br>policy ("e.g., which<br>asks for Ack") | MPDUs having<br>"implicit block<br>acknowledgment"<br>policy                             | MPDUs having<br>"normal<br>acknowledgment"<br>policy ("e.g., which<br>asks for Ack")   |

<sup>4</sup> SAMSUNG-1003, ¶¶99-107.

<sup>5</sup> SAMSUNG-1003, ¶¶108-114.

<sup>6</sup> SAMSUNG-1003, ¶¶115-123.

|                                                 |                                                    |                                                                                                    |                                                                            |
|-------------------------------------------------|----------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| <b>Delimiter<br/>information of<br/>MPDU(s)</b> | Single MPDU having<br>EOF=1, length≠0 <sup>7</sup> | MPDUs having<br>EOF=0, length≠0,<br>indicating a sequence<br>of MPDUs that<br>belong to single TID | MPDUs having<br>EOF=1, length≠0,<br>with each MPDU<br>having different TID |
|-------------------------------------------------|----------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|

SAMSUNG-1003, Table 2.

Finally, Chu's system is compatible with the IEEE 802.11 ecosystem, and particularly for IEEE 802.11ax standard. SAMSUNG-1004, [0035]-[0036], [0004]; SAMSUNG-1003, ¶¶83, 152.

## 2. Overview of IEEE-D1

The IEEE 802.11ax D1.0 ("**IEEE-D1**") describes optimization of data transmission and acknowledgment processes, particularly through the use of A-MPDUs. SAMSUNG-1005, 135 (109)<sup>8</sup>, 131-137 (105-111), 144-149 (118-123), 160-163 (134-137), 183-193 (157-167), 218-221 (192-195); SAMSUNG-1003, ¶138.

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<sup>7</sup> When the Declaration and Petition describe that an MPDU has a certain EOF and length, it refers to the MPDU delimiters having those values.

<sup>8</sup> For purposes of clarification, the number without the parenthesis refers to the pdf page number of the exhibit, and the number with the parenthesis refers to the page number at the bottom of the document.

IEEE-D1 describes the structure of multi-TID A-MPDUs, including the use of MPDU delimiter formats, examples of receiving multi-TID A-MPDUs, and mechanisms for acknowledging the receipt of multi-TID A-MPDUs with corresponding responses (e.g., Multi-STA BlockAck frame). SAMSUNG-1005, 219-220 (193-194). SAMSUNG-1003, ¶139.

For example, IEEE-D1 explains that a “multi-TID A-MPDU may contain multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 1, one for each TID that solicits Ack **and/or** multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 0, one for each TID that solicits BlockAck.” SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1003, ¶140.

Moreover, IEEE-D1 describes that a device (such as a High Efficiency Station (HE STA)) “that receives a multi-TID A-MPDU shall respond with a Multi-STA BlockAck frame that contains”: 1) a “One Per STA Info field indicating an Ack for each successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 1 (TID value equals that of the QoS Data/QoS Null frame or 15 for the Action frame)”; and 2) a “One Per STA Info field indicating a BlockAck for each TID of a successfully received MPDU that solicits a response that is preceded by a nonzero length MPDU delimiter whose EOF is 0 (TID value equals that of the QoS Data frame).”

SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1018, 179-180 (155-156);

SAMSUNG-1003, ¶141. Based on the IEEE-D1 disclosure, Dr. Mahon has provided a summary of the multi-TID A-MPDU structures and corresponding response types in IEEE-D1 in Table 3 below. SAMSUNG-1003, ¶142.

| Response type<br>A-MPDU<br>Feature              | “Multi-STA block”<br>acknowledgment response –<br>1 <sup>st</sup> instance <sup>9</sup> | “Multi-STA block”<br>acknowledgment response –<br>2 <sup>nd</sup> instance <sup>10</sup>                                                                            |
|-------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A-MPDU Type</b>                              | Multi-TID A-MPDU                                                                        | Multi-TID A-MPDU                                                                                                                                                    |
| <b>Policy</b>                                   | MPDUs having normal<br>acknowledgment policy (“that<br>solicits Ack”)                   | MPDU(s) having normal<br>acknowledgment policy (“that<br>solicits Ack”) co-exists with<br>MPDUs having block<br>acknowledgment policy (“that<br>solicits BlockAck”) |
| <b>Delimiter<br/>information of<br/>MPDU(s)</b> | MPDUs having EOF=1,<br>length≠0 with each MPDU<br>having different TID                  | MPDU(s) having EOF=1,<br>length≠0 co-exists with<br>MPDUs having EOF=0,<br>length≠0                                                                                 |

SAMSUNG-1003, Table 3

<sup>9</sup> SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5.

<sup>10</sup> SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5.

As noted in Table 3, IEEE-D1 **further** discloses a **second instance**: when the combination (nonzero length delimiters with differing EOF values (e.g., EOFs of 1 and 0) and corresponding policies (e.g., Ack and BlockAck)) is present within an A-MPDU, such an A-MPDU can correspond to a multi-TID A-MPDU and can trigger a Multi-STA block acknowledgment response. SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1018, 179-180 (155-156); SAMSUNG-1003, ¶143.

The additional multi-TID A-MPDU structure disclosed in IEEE-D1 supports more flexible aggregation formats by allowing nonzero length MPDU delimiters with differing EOF values to coexist within a single A-MPDU. SAMSUNG-1003, ¶144. This added flexibility enables a wider range of A-MPDU types to be transmitted and received, while also allowing the receiving terminal to distinguish between acknowledgment types (e.g., BlockAck (e.g., C-BA), Multi-STA BlockAck). SAMSUNG-1003, ¶144. For instance, a BlockAck can be used when the received A-MPDU contains multiple nonzero length MPDUs with the same TID and EOF=0, while a Multi-STA BlockAck can be used when the received A-MPDU contains multiple nonzero length MPDUs from different TIDs with mixed EOF values (EOF=0 and EOF=1) or all EOF=1. SAMSUNG-1003, ¶144.

In addition to the above, IEEE-D1 is prior art under 35 U.S.C. § 102(a)(1) (and as noted in Section I.A) because it was publicly accessible to the interested public before the Critical Date of December 21, 2016. SAMSUNG-1029, ¶¶17-36, 49-70. IEEE-D1 was published on December 1, 2016, and posted to the IEEE 802.11 Working Group website. *Id.* ¶¶52-56. The IEEE-D1 was made available online to approximately 600 members of the IEEE 802.11 Working Group. *Id.* ¶¶52-55, 66. On December 1, 2016, at least 251 members who participated in the draft review and voting were notified by email of the IEEE-D1's availability. *Id.*

Any interested person—including POSITAs—could have gained access to IEEE-D1 by becoming a voting member through publicly available procedures, or simply by obtaining a copy from a voting member, which was common practice. *Id.*, ¶¶17-36, 56-70. There was no expectation of confidentiality, and members frequently shared drafts like IEEE-D1 with colleagues in academia and industry. *Id.*, ¶¶17-36, 56-70. At least these facts, among others, as evidenced and corroborated in the expert declaration, establish that the IEEE-D1 was accessible to the relevant public and thus qualifies as a printed publication. *Id.*, ¶¶17-36, 49-70.

### **3. Overview of IEEE-D2**

The 802.11-16/1185r2 (“**IEEE-D2**”) discloses the same or similar subject matter found in IEEE-D1. SAMSUNG-1006, 4-5; SAMSUNG-1005, 219-220 (193-194). For example, both IEEE-D1 and IEEE-D2 contain the same or similar content under the “A-MPDU with multiple TIDs” section, where the multi-TID A-MPDU structure and the corresponding response message—namely, the Multi-STA BlockAck—are described, as previously noted with respect to IEEE-D1 and reflected in Table 3. SAMSUNG-1006, 4, 5; SAMSUNG-1005, 219-220 (193-194); *see supra* Table 3. Such content will not be repeated here. SAMSUNG-1003, ¶145.

Lastly, IEEE-D2 is prior art under 35 U.S.C. § 102(a)(1). SAMSUNG-1029, ¶¶17-45. For example, as explained in the Declaration of Dr. Christopher Hansen, the IEEE-D2 was published and publicly accessible via the IEEE Mentor website as of September 14, 2016, through keyword searches, direct navigation, and links available on IEEE’s websites and other publicly available resources. SAMSUNG-1029, ¶¶17-45.

### **4. Reasons for Combing Chu with either of IEEE-D1 or IEEE-D2**

A POSITA would have been motivated and found it obvious to combine Chu with either IEEE-D1 or IEEE-D2 as doing so would have merely involved combining prior art elements according to known methods to yield predictable

results, as explained in more detail below. In particular, a POSITA would have been motivated to combine the protocol for transmitting and receiving a multi-TID A-MPDU (as described in each of IEEE-D1 and IEEE-D2) containing MPDUs with nonzero delimiters having differing EOF values and corresponding response mechanisms (e.g., Multi-STA BlockAck) into Chu's system, and would have found the combinations predictable with a reasonable expectation of success. SAMSUNG-1003, ¶150.

First, adopting IEEE-D1 or IEEE-D2 enhances alignment and interoperability of Chu's system with the evolving IEEE 802.11ax standards. SAMSUNG-1003, ¶151. Chu explicitly discloses that its system incorporates by reference various IEEE 802.11 standards and explicitly discloses its processors as communicating according to the IEEE 802.11ax communication protocol.

SAMSUNG-1004, [0035]-[0036], [0004]. Thus, it would have been obvious and predictable for a POSITA to modify or update Chu's disclosed system based on features described in the 802.11ax specifications, including those relating to A-MPDU and acknowledgment mechanisms, as described in IEEE-D1 and IEEE-D2. SAMSUNG-1004, [0035]-[0036], [0004]; SAMSUNG-1005, 135, 137 (109, 111), 131-137 (105-111), 144-149 (118-123), 154-155 (128-129), 160-163 (134-137), 183-193 (157-167), 218-221 (192-195); SAMSUNG-1006, 4-5; SAMSUNG-1013, 15-17, 26-28, 49-50; SAMSUNG-1003, ¶151.

Further, a POSITA would have found the combinations predictable not only because Chu operates according to the 802.11 ax protocol, but also because the other 802.11 protocols in Chu are compatible with the 802.11 ax protocol. SAMSUNG-1004, [0004], [0035]-[0036]; SAMSUNG-1003, ¶152. For example, the 802.11 ax protocol builds upon and maintains backward compatibility with earlier 802.11 protocols, allowing 802.11-based systems to be extended or adapted to newer features. SAMSUNG-1003, ¶152 ; SAMSUNG-1008, 2 , 4; SAMSUNG-1010, 6.

Second, incorporating the IEEE 802.11 ax protocol enables more flexible and efficient multi-TID A-MPDU aggregation. SAMSUNG-1003, ¶153. While Chu supports multi-TID A-MPDU, with MPDUs having EOF value of 1 and each soliciting an Ack response, IEEE-D1 and IEEE-D2 describe an enhanced multi-TID A-MPDU format that allows utilization of different types of MPDUs with EOF values of 1 and 0 and that solicit both Ack and BlockAck responses within a single A-MPDU. SAMSUNG-1004, [0069], [0074], SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5. Specifically, the multi-TID A-MPDU in IEEE-D1 or IEEE-D2 aggregates MPDUs including (1) sequences of MPDUs that have EOF values of 0 and solicit BlockAck, and (2) standalone MPDUs that have EOF values of 1 and solicit Ack, all within a single A-MPDU. *Id.* As explained by Dr. Mahon, this new and enhanced format of multi-TID A-MPDU improves efficiency

by allowing diverse traffic types—one or more MPDU(s) requiring Ack, other MPDUs requiring Block Ack—within a single multi-TID A-MPDU, thereby reducing the number of data units (e.g., A-MPDUs and PPDUs) that need to be constructed and transmitted. SAMSUNG-1003, ¶153. *See infra* Table 4.

Moreover, a POSITA would have found the combinations predictable based on instructions provided in IEEE-D1 and IEEE-D2, which Chu incorporates “fully by reference.” SAMSUNG-1004, [0004]. IEEE-D1 and IEEE-D2 provide instructions based on the mix of EOF values for determining when to use a Multi-STA BlockAck response. SAMSUNG-1003, ¶154. Specifically, when MPDUs with nonzero length delimiters having differing EOF values (EOF=1 and EOF=0) are aggregated, IEEE-D1 or IEEE-D2 teaches that a Multi-STA BlockAck is triggered. SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5. In addition, IEEE-D1 and IEEE-D2 further disclose instructions for responding with a Multi-STA BlockAck frame, including the use of “One Per STA Info field,” for example, to indicate an Ack for nonzero length MPDU (with EOF=1) and BlockAck for nonzero length MPDU (with EOF=0), which are compatible with Chu’s multi-TID block acknowledgment frame structure featuring per-TID information and acknowledgment type subfields. SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5; SAMSUNG-1003 ¶154. These rules build upon the existing A-MPDU acknowledgment mechanism already disclosed in Chu, in

which EOF and length fields are used to distinguish acknowledgment policy and response types. *See*, SAMSUNG-1003, ¶¶154, 91-95, 99-123, Tables 2-4; SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5; SAMSUNG-1004, [0073]-[0076].

Third, IEEE-D1 and IEEE-D2 disclose an additional determination point for response frame determination. Particularly, Chu uses EOF and length fields to distinguish Ack from BlockAck, but does not distinguish Multi-STA BlockAck context if MPDUs having different EOFs (e.g., EOF=0 and EOF=1) are present. IEEE-D1 or IEEE-D2 cures this by disclosing an additional rule that makes such a distinction and provides a different type of response when MPDUs having EOF values are present. *See infra* Table 4; SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5; SAMSUNG-1004, [0073]-[0076], SAMSUNG-1003, ¶155.

Fourth, a POSITA would have found the combinations obvious and predictable because the response frames disclosed in the 802.11ax framework are the same as, or similar to, those in Chu, which builds upon the established A-MPDU format and associated acknowledgment frame types, including Ack response, immediate BlockAck response (e.g., compressed BlockAck response), and multi-TID block acknowledgment response (e.g., Multi-STA BlockAck response). SAMSUNG-1003, ¶¶99-107, 108-114, 115-223, 156; *see* Tables 2-4. Accordingly, this compatibility would have allowed Chu to readily incorporate the

acknowledgment mechanisms defined in IEEE-D1 or IEEE-D2 without requiring a system redesign. SAMSUNG-1003, ¶156.

Fifth, the combinations would have been obvious and predictable because Chu, IEEE-D1, and IEEE-D2 utilize similar systems and component. SAMSUNG-1003, ¶157. Because all three references adopt a high-efficiency (HE) wireless framework, using technologies such as Orthogonal Frequency Division Multiplexing (OFDM), Orthogonal Frequency Division Multiple Access (OFDMA), Multiple Input Multiple Output (MIMO), and Very High Throughput (VHT), incorporating the teachings of IEEE-D1 or IEEE-D2 into Chu would have been obvious and predictable and only involve routine skill of one in the art. SAMSUNG-1004, [0004], [0035], [0045]-[0053]; SAMSUNG-1006, 3-5; SAMSUNG-1008, 4, 6; *see e.g.*, SAMSUNG-1005, 35 (9), 171 (145), 235-239 (209-213). SAMSUNG-1003, ¶157.

Sixth, a POSITA would have pursued the combinations because doing so would have merely involved the application of known techniques (e.g., identifying a multi-TID A-MPDU based on EOF, length, policy information, and/or number of TIDs) to a known structure (e.g., (1) the A-MPDU described in Chu, configured to further include nonzero MPDU delimiters with differing EOF values along with existing policy framework (e.g., Ack/BlockAck), and (2) Chu's receiving terminal (AP or client station) configured to receive the A-MPDU, process the A-MPDU,

and determine response frames based on the received A-MPDU) to yield predictable results (e.g., determining a multi-STA block acknowledgment response frame). SAMSUNG-1003, ¶158; *see KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417 (2007).

### **5. The Chu-IEEE-D1 or Chu-IEEE-D2 combinations**

Chu describes a system for efficient transmission and acknowledgment of data units in wireless environments, utilizing A-MPDUs that include MPDUs, policy information, and delimiters with EOF and length fields. SAMSUNG-1004, [0058], [0059], [0070]-[0076], [0157]-[0161], FIGS. 5A-5C, 18. Chu's system supports normal acknowledgment, block acknowledgment (e.g., C-BA), and multi-TID acknowledgment (e.g., M-BA) responses. *See supra* Table 2; SAMSUNG-1003, ¶146.

Each of IEEE-D1 and IEEE-D2 describes the use of mixed EOF values (e.g., EOF=0 and EOF=1) and mixed policies (e.g., normal acknowledgment policy and block acknowledgment policy) within an A-MPDU, thereby introducing a new and enhanced format of multi-TID A-MPDU, as well as a second instance of M-BA response context. *See supra* Table 3; SAMSUNG-1006, 4-5; SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1003, ¶146.

The Chu-IEEE-D1 or Chu-IEEE-D2 combination would have enabled support for more flexible aggregation formats by allowing nonzero length MPDU

delimiters with differing EOF values to coexist within a single A-MPDU. This allows an A-MPDU to include a sequence of MPDUs that solicit BlockAck and one or more single MPDUs (e.g., standalone MPDUs) that solicit Ack at the same time. This added flexibility allows the receiving terminal to distinguish between acknowledgment types—such as BlockAck after SIFS (e.g., C-BA) and Multi-STA BlockAck—by utilizing MPDU delimiter information (e.g., EOF and length fields) and/or TID context. SAMSUNG-1003, ¶¶146-147.

As explained by Dr. Mahon, an example of the types of response frames and corresponding determination criteria based on Chu, incorporating the teachings of IEEE-D1 or IEEE-D2, is illustrated in Table 4 below. Dr. Mahon explains that Table 4 has been prepared by combining Tables 2 and 3. SAMSUNG-1003, ¶148.

| Response type<br>A-MPDU Structure | Ack response    | “BlockAck” response “after a SIFS period” (e.g., C-BA response) | Multi-TID block acknowledgment response (e.g., M-BA response) | M-BA response - 2 <sup>nd</sup> instance <b>(newly added based on IEEE D-1 or IEEE D-2)</b> <sup>11</sup> |
|-----------------------------------|-----------------|-----------------------------------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| A-MPDU Type                       | VHT Single-MPDU | Single TID A-MPDU                                               | Multi-TID A-MPDU                                              | Multi-TID A-MPDU                                                                                          |

<sup>11</sup> This 2<sup>nd</sup> instance of Multi-STA BlockAck context has been added from Table 3.

*See supra* Table 3.

|                                         |                                                 |                                                                                                         |                                                                                    |                                                                                                                      |
|-----------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|
| <b>Policy</b>                           | Single MPDU having normal acknowledgment policy | MPDUs within having block acknowledgment policy                                                         | MPDUs having normal acknowledgment policy                                          | MPDU(s) having normal acknowledgment policy co-exists with MPDUs having block acknowledgment policy within an A-MPDU |
| <b>Delimiter information of MPDU(s)</b> | Single MPDU having EOF=1, length≠0              | MPDUs having EOF=0, length≠0, indicating a sequence of MPDUs that belong to single TID within an A-MPDU | MPDUs having EOF=1, length≠0, with each MPDU having different TID within an A-MPDU | MPDU(s) having EOF=1, length≠0 co-exists with MPDUs having EOF=0, length≠0 within an A-MPDU                          |

SAMSUNG-1003, Table 4.

## 6. Analysis

### (i) Claim 1

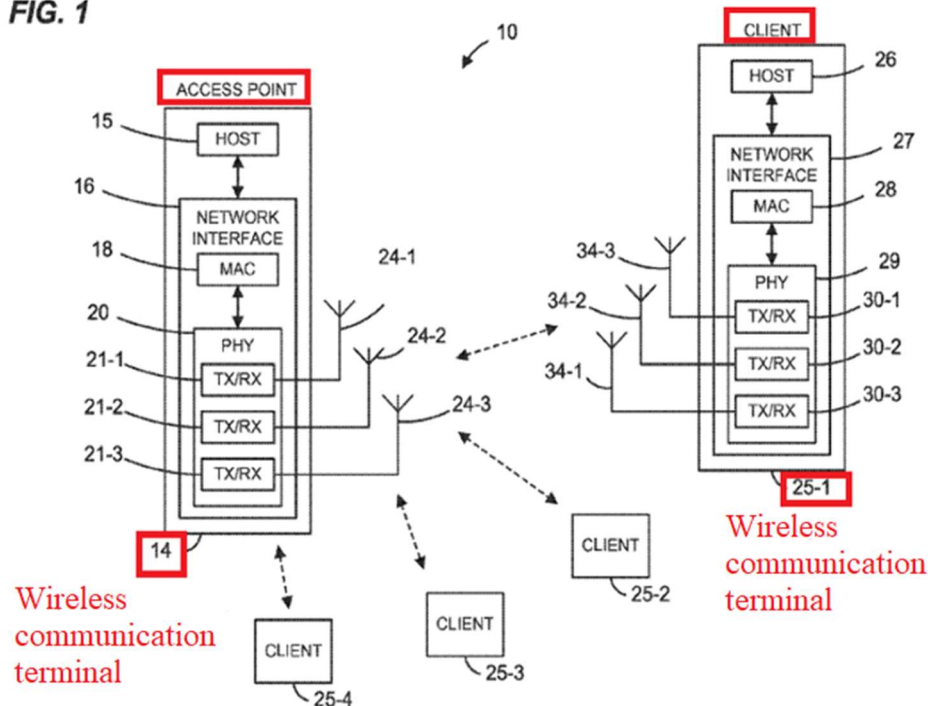
[1pre]

Even if the preamble is limiting, Chu in view of IEEE-D1 or IEEE-D2 renders [1pre] obvious. SAMSUNG-1003, ¶82.

For context, the '926 Patent explains that “terminal” can refer to a non-access point station (non-AP STA), an access point (AP), or both. SAMSUNG-1001, 7:8-9, 16:37-41, 42-56, 17:5-7, 45-47, 18:14-16, 19:14-15, 38-40, 20:1-4, 17-19, 55-57; 21:40-44, 40-53, 22:1-4.

Consistent with the '926 Patent, Chu discloses a “**wireless communication terminal**” in the form of either an Access Point (AP) under a first mapping or a client station under a second mapping. SAMSUNG-1003, ¶82. In particular, Chu’s FIG. 1 (reproduced below) “is a block diagram of an example *wireless local area network* (WLAN) 10.” SAMSUNG-1004, [0034], FIG. 1. This wireless network includes an AP 14 wirelessly communicating with one or more client stations 25 (e.g., 25-1, 25-2, 25-3). SAMSUNG-1004, [0034]-[0039]. For example, Chu describes that “one or both of the AP 14 and the client station 25 are configured to receive multiple uplink data units simultaneously transmitted by multiple second communication devices” and that “AP 14 or client station 25 generates an acknowledgment data unit to acknowledge receipt of the multiple data units.” SAMSUNG-1004, [0044]. Moreover, for example, Chu describes both (1) uplink transmission from a single station or multiple stations to an AP and (2) downlink transmission from an AP to a single station or multiple stations. SAMSUNG-1004, [0055]. At least because both the AP 14 and the client station 25-1 in Chu are communicating with each other wirelessly over a wireless local area network, a POSITA would have understood that each of Chu’s AP 14 and the client station 25-1 is a “**wireless communication terminal**.” SAMSUNG-1003, ¶82.

**FIG. 1**

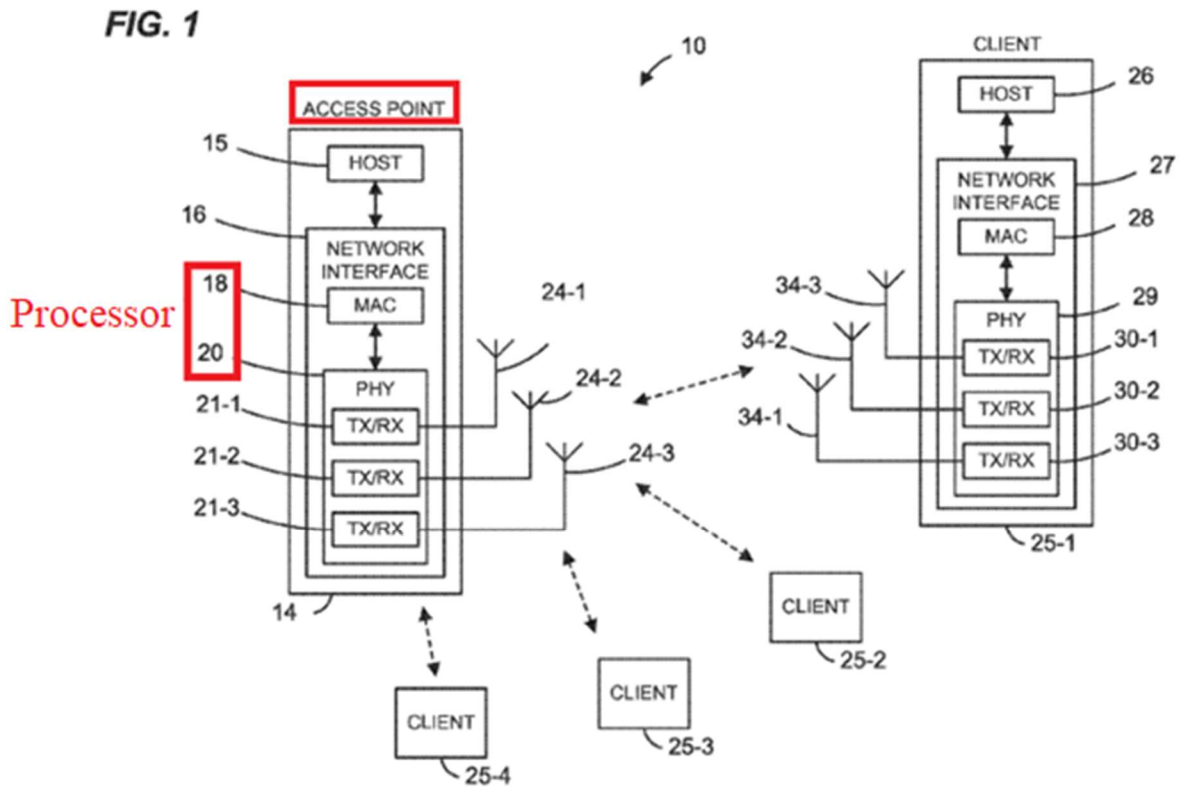


SAMSUNG-1004, FIG. 1.

[1a]

First Mapping

As shown in Chu’s FIG. 1 below, **the AP** includes a MAC processor 18 and PHY processor 20 (collectively the claimed “*processor*”). SAMSUNG-1004, [0034], [0040], FIG. 1. “[T]he MAC processor 18 and the PHY processor 20 are configured to operate according to” several different protocols, including, e.g., the **IEEE 802.11ax (High Efficiency protocol)**, IEEE 802.11ac, IEEE 802.11a, and/or IEEE 802.11n standards. SAMSUNG-1004, [0035]; SAMSUNG-1003, ¶83.



SAMSUNG-1004, FIG. 1.

### Second Mapping

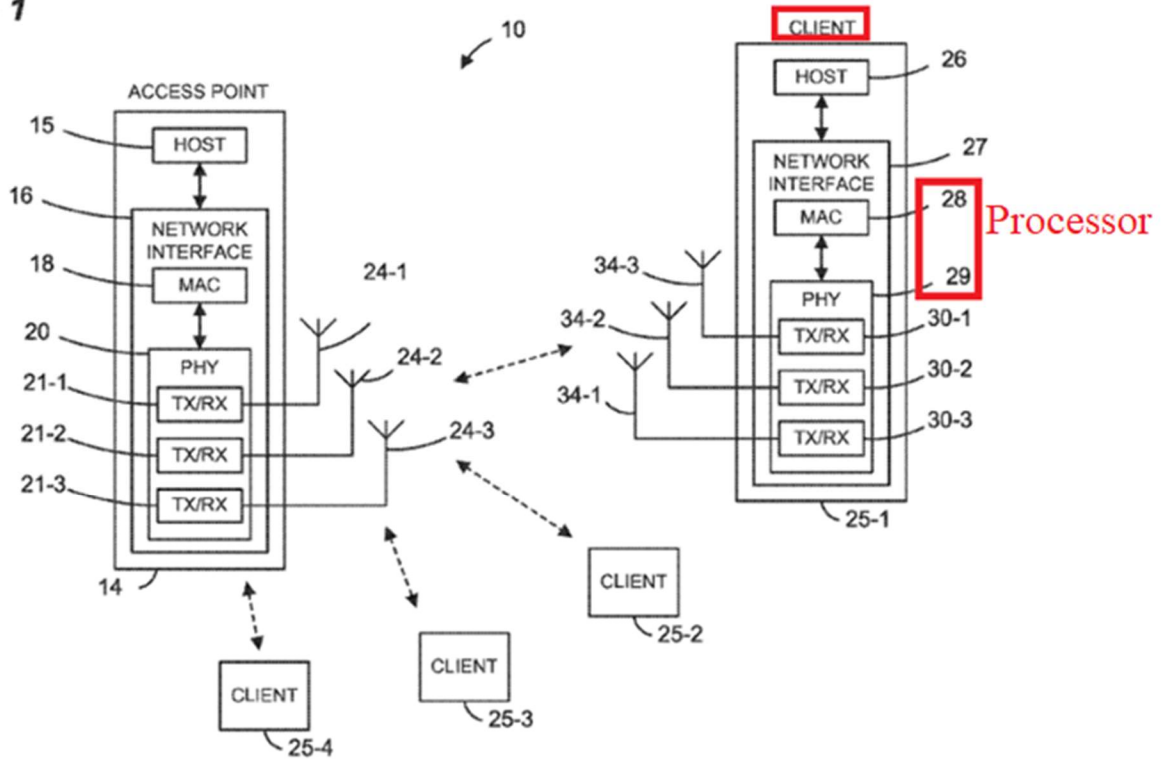
As shown in Chu's FIG. 1 below, **the client terminal 25-1** includes a MAC processor 28 and PHY processor 29 (collectively the claimed "**processor**").

SAMSUNG-1004, [0037], [0042], FIG. 1. The MAC processor 28 and PHY processor 29 can be implemented on a single IC. SAMSUNG-1004, [0037].

Among various operations, "[t]he MAC processor 28 and the PHY processor 29 of the client station 25-1 are configured to process received data units conforming to the first communication protocol" (the IEEE 802.11ax (High Efficiency protocol))

and other various protocols. SAMSUNG-1004, [0043], [0036]-[0037], [0042];  
SAMSUNG-1003, ¶83.

**FIG. 1**



SAMSUNG-1004, FIG. 1.

Under both mappings, Chu's PHY processor alone or both the MAC processor and the PHY processor may correspond to the claimed "*processor*." SAMSUNG-1004, [0040], [0042]. Indeed, it would have been obvious to a POSITA that the operations performed by the PHY and MAC processors can be performed in one combined processor or separate processors as a matter of design choice. SAMSUNG-1003, ¶84. Moreover, Chu discloses that, in some examples, the PHY and MAC processors are implemented on a "single IC" further indicating

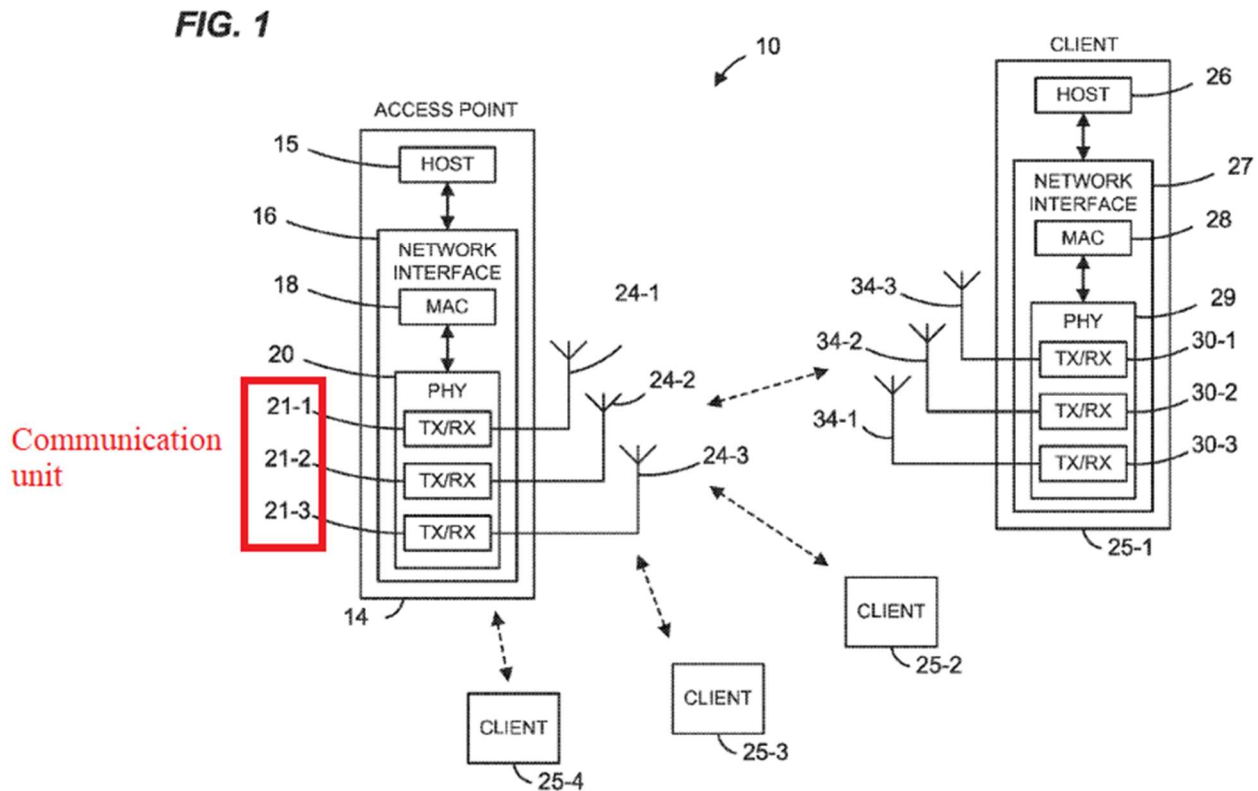
that both processors would have been combined into a single processor.

SAMSUNG-1004, [0034]-[0042]. SAMSUNG-1003, ¶84. As demonstrated below, Chu's "processor" implements the features recited in the claims under both mappings.

**[1b]**

*First Mapping*

Under the first mapping, Chu discloses that "[t]he PHY processor 20 includes a plurality of transceivers 21, and the transceivers 21 are coupled to a plurality of antennas 24." SAMSUNG-1004, [0034]. "The transceiver(s) 21 is/are configured to transmit the generated data units via the antenna(s) 24" over the WLAN network 10 and "to receive data units via the antenna(s) 24," and the data units may include PPDU's, A-MPDU's, and/or MPDU's. SAMSUNG-1004, [0041], [0053]. As illustrated in FIG. 1 (reproduced below), the transceiver(s) 21 are located within the same network interface 16, and connected to the MAC processor 18 and PHY processor 20 that "are configured to process . . . data units" received from the transceiver(s) 21. SAMSUNG-1004, [0041], FIG. 1. Thus, the transceivers 21, individually or collectively, are a "*communication unit*." SAMSUNG-1003, ¶85.



SAMSUNG-1004, FIG. 1.

### Second Mapping

Under the second mapping, Chu discloses that “[t]he PHY processor 29 includes a plurality of transceivers 30, and the transceivers 30 are coupled to a plurality of antennas 34.” SAMSUNG-1004, [0037]. “The transceiver(s) 30 is/are configured to transmit the generated data units via the antenna(s) 34” over the WLAN network 10 and “to receive data units via the antenna(s) 34,” where the data units may include PPDU, A-MPDU, and/or MPDU. SAMSUNG-1004, [0043], [0053]. As illustrated in FIG. 1 (reproduced below), the transceiver(s) 30 are located within the same network interface 27, and are connected to the MAC

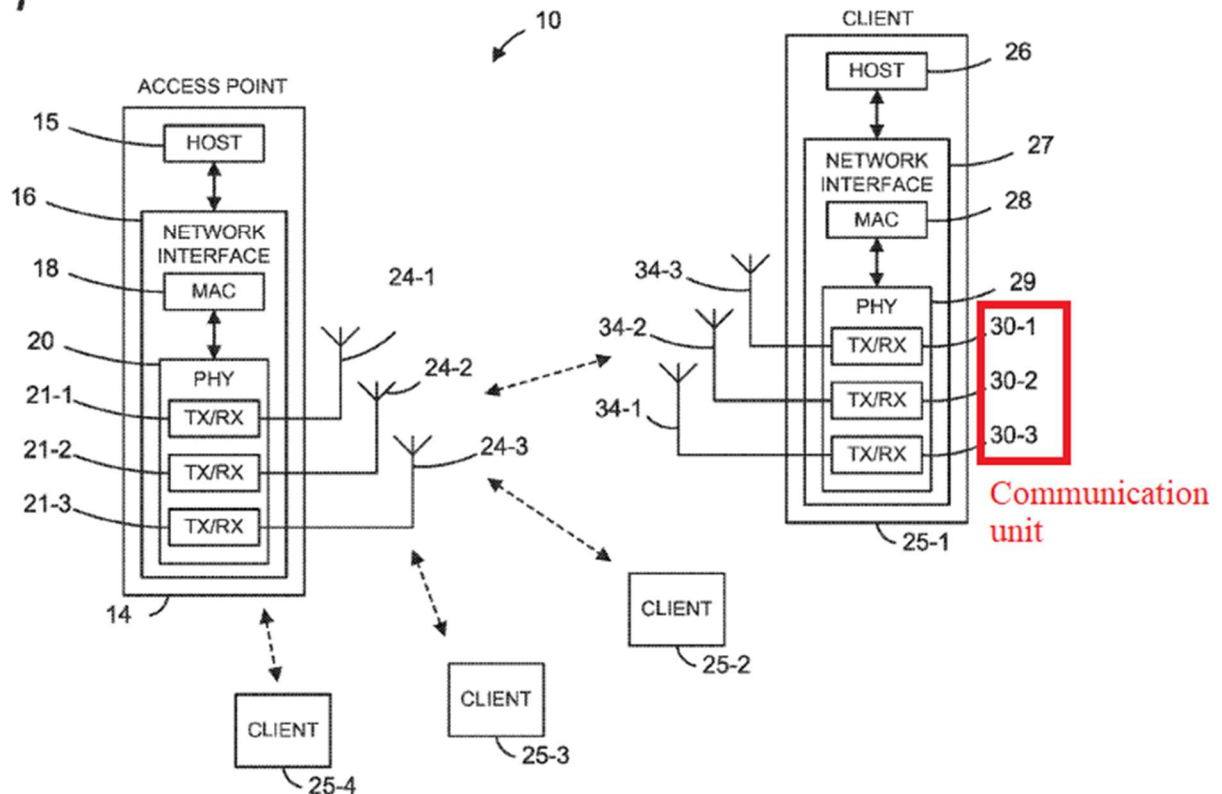
processor 28 and PHY processor 29 that “are configured to process . . . data units”

received from the transceiver(s) 30. SAMSUNG-1004, [0041], FIG. 1. Thus, the

transceivers 30, individually or collectively, are a “*communication unit*.”

SAMSUNG-1003, ¶85.

**FIG. 1**



SAMSUNG-1004, FIG. 1.

[1c]

First Mapping

Under the first mapping, Chu’s PHY processor 20 (“*wherein the processor*”) of the AP *is configured to receive* PHY data units “such as PHY

protocol data units (PPDUs)” (each of which corresponds to the claimed “*a PPDU*”) “that were received via the antennas 24, and extract MAC layer data units [“*an A-MPDU (Aggregate-MAC Protocol Data Unit) in which one or more MPDUs . . . are aggregated*”] encapsulated within the PHY data units . . . [T]he PHY processor 20 provides the extracted MAC layer data units to the MAC processor 18, which processes the MAC layer data units.” SAMSUNG-1004, [0040], [0045]-[0059]. For clarity, Chu’s MAC layer data units correspond to the “*one or more MPDUs*,” and a single MPDU<sup>12</sup> or the aggregate of one or more of these data units corresponds to the claimed “*A-MPDU*.” SAMSUNG-1003, ¶88.

### Second Mapping

Under the second mapping, Chu’s PHY processor 29 (“*wherein the processor*”) of the client station *is configured to receive* PHY data units such as PHY protocol data units (PPDUs)” (each of which corresponds to the claimed “*a PPDU*”) “that were received via the antennas 34, and extract MAC layer data units [“*an A-MPDU (Aggregate-MAC Protocol Data Unit) in which one or more MPDUs . . . are aggregated*”] encapsulated within the PHY data units. In an

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<sup>12</sup> The ’926 Patent describes that an A-MPDU includes S-MPDU. *See* Section II.A (citing SAMSUNG-1001, 11:27-33; 15:61-62; FIGS. 6(b), 7(c), 10(c); 16:17-38; 12:43-13:33; 15:53-16:27).

embodiment, the PHY processor 29 provides the extracted MAC layer data units to the MAC processor 28, which processes the MAC layer data units.” SAMSUNG-1004, [0042]-[0059]. For clarity, Chu’s MAC layer data units correspond to the “*one or more MPDUs*,” and a single MPDU or the aggregate of *one or more* of these units corresponds to the claimed “*A-MPDU*.” SAMSUNG-1003, ¶88.

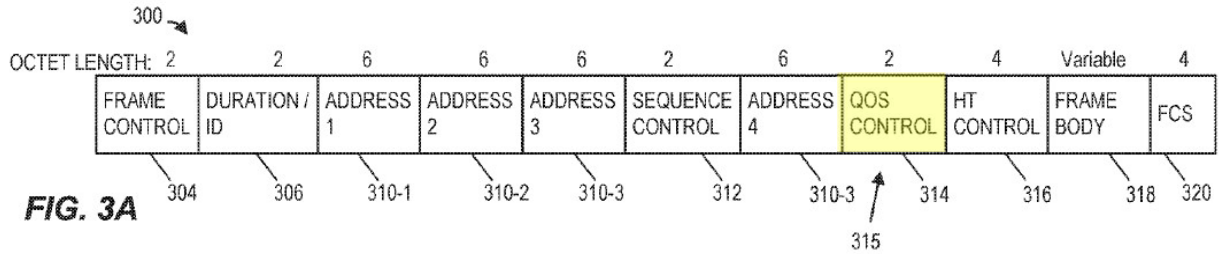
[1d]

*The ’926 Patent’s Ack Policy information*

For context, the ’926 Patent explains that the *Ack policy information related to a BlockAck* is indicated by an Ack-policy subfield of a QoS control field of a MAC header. SAMSUNG-1001, 14:32-65. “The Ack policy subfield may indicate the acknowledgment policy for data via four different field values . . . First, if the Ack policy subfield [of the QoS control field] is set to the **first value**, the recipient responds to a data frame with **a general Ack or an implicit BlockAck**. If the acknowledgment policy is general Ack or implicit BlockAck, an **immediate response** to the data frame is solicited. That is, the recipient transmits an Ack frame or a BlockAck frame a **SIFS** after a PPDU carrying the data frame. In this case, the BlockAck frame may be transmitted individually or as a part of the A-MPDU.” SAMSUNG-1001, 14:32-65; SAMSUNG-1003, ¶¶76-77.

Under both mappings, Chu discloses an “A-MPDU [that] includes Ack policy information related to a block Ack for the one or more MPDUs”

Chu’s FIG. 3A (reproduced below) “is a diagram of an example MPDU 300 for a data frame” that is included in “a downlink (DL) data unit transmitted by the AP 14 to one or more client stations 25” and “in an uplink (UL) data unit transmitted by a single client station 25 to the AP 14.” SAMSUNG-1004, [0055]-[0056]. In some examples, MPDU 300 “is included in each of a plurality of data units within an uplink A-MPDU.” SAMSUNG-1004, [0055]-[0056]. In some examples, “the MPDU 300 is included in a downlink or uplink single A-MPDU transmitted in a SU PPDU.” SAMSUNG-1004, [0057]. Moreover, for example, “[t]he MPDU 300 generally corresponds to a MAC frame format as described in the IEEE 802.11-2012 Standard” and includes a QoS control field 314. SAMSUNG-1004, [0058]. “[T]he QoS control field 314 includes an acknowledgment policy field 315 having two bits that identify an acknowledgment policy (Ack Policy) that is followed upon delivery of the corresponding MPDU.” SAMSUNG-1004, [0059]. Chu explains that the same QoS control field 314 in MPDU 300 can be used for MPDUs in an A-MPDU 500. SAMSUNG-1004, [0070], [0073]-[0075]; SAMSUNG-1003, ¶90.



SAMSUNG-1004, FIG. 3A.

In some cases, Chu's "AP 14 or client station 25 sets i) the acknowledgment policy bits of the corresponding QoS control field 314 to an immediate Ack/BA ["Block Ack"] and ii) sets the EOF field 532 of the corresponding MPDU delimiter 530 to 1 [or 0] and the MPDU Length field 534 to a non-zero value in order to indicate an acknowledgment policy for the corresponding MPDU within an OFDMA A-MPDU." SAMSUNG-1004, [0073]-[0076], [0129]-[0133], [0161], claims 12, 15; SAMSUNG-1003, ¶91.



FIG. 5A

520 = Example of one or more  
A-MPDU subframes 502, 504, 506

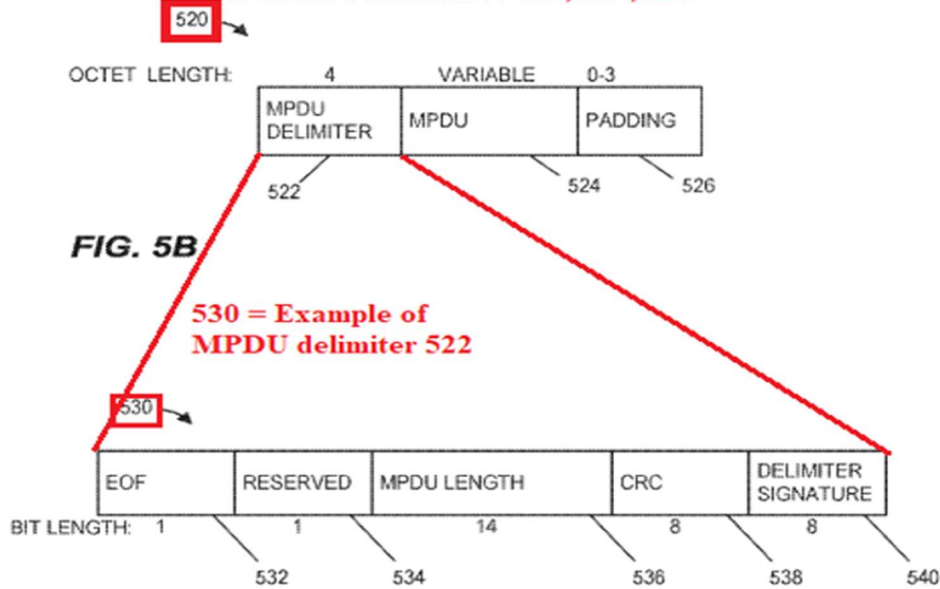


FIG. 5C

SAMSUNG-1004, FIGS. 5A-5C.

“[T]he AP 14 utilizes the EOF field 532 and the MPDU Length field 534 to differentiate between a normal acknowledgment request and a block acknowledgment request,” since “the acknowledgment policy bits of the QoS control field 314 by themselves do not provide for an indication to differentiate Ack and BA within an A-MPDU.” SAMSUNG-1004, [0073]-[0076], [0129]-[0133], [0161], claims 12, 15. SAMSUNG-1003, ¶¶91-92.

For example, in some cases, “the AP 14 sets the **EOF field 532 to 1**, sets the **MPDU length field 536 to a non-zero value**, and sets the acknowledgment policy

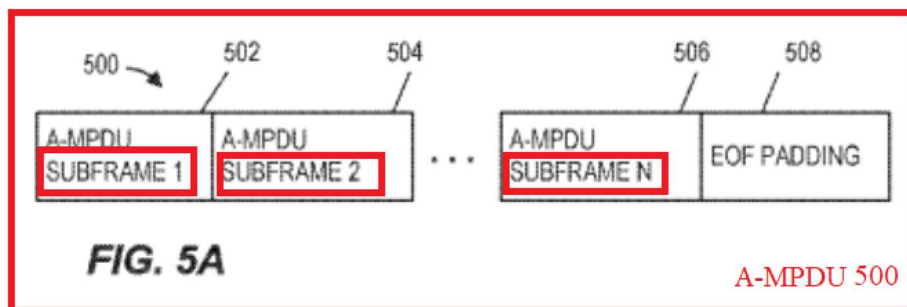
bits of the corresponding QoS control field 314 [e.g., within MPDU of A-MPDU 500] to a **normal acknowledgment policy** (e.g., a value of ‘00’).” SAMSUNG-1004, [0074], [0073], [0129]-[0133] (explaining that the client station performs similar operations), [0161]; SAMSUNG-1021, 11-12; SAMSUNG-1005, 219 (193); SAMSUNG-1006, 4. In some cases, “the AP 14 sets the **EOF field 532 to 0**, sets the **MPDU length field 536 to a non-zero value**, and sets the acknowledgment policy bits of the corresponding QoS control field 314 [e.g., within MPDU of A-MPDU 500] to an **implicit block acknowledgment request** (e.g., a value of ‘00’).” SAMSUNG-1004, [0075], [0073], [0129]-[0133] (explaining that the client station performs similar operations); SAMSUNG-1021, 11-12; SAMSUNG-1005, 219 (193); SAMSUNG-1006, 4. Because both the AP and the client station can set bits in the QoS control field in an A-MPDU to specify an “implicit block acknowledgment request” in the above-noted matter, Chu discloses “*wherein the A-MPDU includes Ack policy information related to a block Ack for the one or more MPDUs.*” SAMSUNG-1003, ¶¶93-94.

Chu’s claim 15 confirms Chu’s disclosure of [1d]. For example, claim 15 recites that a communication device “set[s] an acknowledgment policy field of a quality of service (QoS) control field of the first MPDU to a predetermined value that indicates an immediate block acknowledgment.” SAMSUNG-1004, claim 15; SAMSUNG-1003, ¶95.

Moreover, a POSITA would have recognized that Chu's policy value (e.g., "00") representing "immediate Ack/BA" is consistent with the well-known 802.11-based policy setting for the A-MPDU, where the policy value (e.g., 00) represents either "normal ack" policy or "implicit block ack" policy. *See* SAMSUNG-1009, 651 (650), Table 9-9; SAMSUNG-1015, 489-490 (391-392), Table 8-6; SAMSUNG-1020, 64 (34); SAMSUNG-1003, ¶96.

*Under both mappings, Chu discloses A-MPDU that includes one or more subframes*

Chu's FIG. 5A (reproduced below) depicts an "A-MPDU 500 [that] includes a sequence of an integer number N of A-MPDU subframes, where N is one, two, three, or more." SAMSUNG-1004, [0071], FIG. 5A (reproduced below, annotated). This A-MPDU 500 with one or more subframes corresponds to the same A-MPDU 500 containing Ack policy information in the QoS control field 314, as described above. SAMSUNG-1004, [0073]-[0076] (describing that the A-MPDU 500 format is used by both the client station and the AP and includes one or more subframes); SAMSUNG-1003, ¶89.



SAMSUNG-1004, FIG. 5A.

**[1e] and [1f]**

As discussed in [1d] and shown below in Chu's FIGS. 5A-5C, Chu discloses an aggregate MPDU (A-MPDU) 500 that includes subframes A-MPDU subframes 502, 504, and 506. SAMSUNG-1004, FIG. 5A, [0070]. A-MPDU subframe 520 "corresponds to one or more of the A-MPDU subframes 502, 504, or 506." SAMSUNG-1004, [0071]. "The A-MPDU subframe 520 includes [(***each of the one or more subframes includes***)] an MPDU delimiter field 522 (4 bytes) [(***MPDU identifier information***)], an MPDU 524 having a variable length [(***and an MPDU of the one or more MPDUs length field***)], and optionally a padding field 526 (0 to 3 bytes). The MPDU delimiter 530 of FIG. 5C corresponds to the MPDU delimiter 522" in FIG. 5B. SAMSUNG-1004, [0070], [0071]; SAMSUNG-1003, ¶89.

Further, as shown in Chu's FIG. 5C below, Chu's MPDU delimiter 532/522 includes (***MPDU identifier information includes***) an EOF subfield 532 (1 bit) (***an end of frame (EOF) field***) and an MPDU length subfield 536 (14 bits) (***and a length field***). SAMSUNG-1004, FIGS. 5A-5C, [0071]. Thus, Chu discloses [1e] and [1f] under both mappings. SAMSUNG-1003, ¶89.



**FIG. 5A**

520 = Example of one or more  
A-MPDU subframes 502, 504, 506

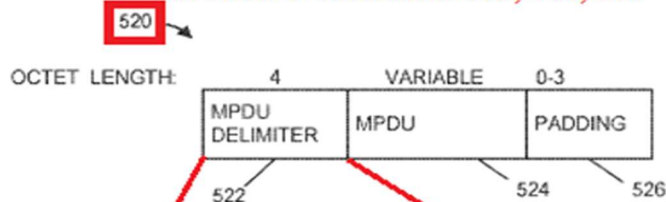


**FIG. 5B**

530 = Example of  
MPDU delimiter 522

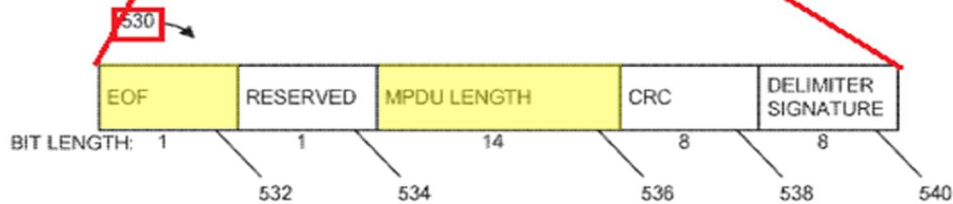


**FIG. 5C**

SAMSUNG-1004, FIGS. 5A-5C.

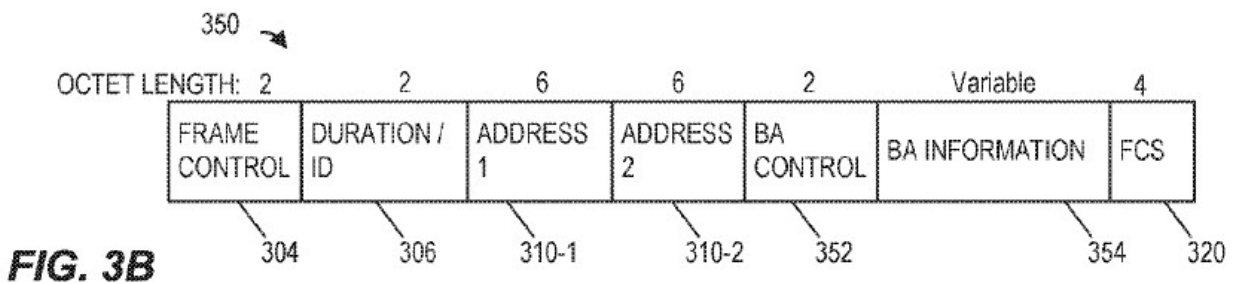
[1g]

First Mapping

Chu's "PHY processor 20 is configured to receive PHY data units that were received via the antennas 24, and extract MAC layer data units encapsulated within the PHY data units." SAMSUNG-1004, [0040]-[0041]. "The MAC processor 18 and the PHY processor 20 of the AP 14 are configured to process received data units [("*the PPDU*") conforming to the first communication protocol and having

formats described hereinafter and to determine that such data units conform to the first communication protocol.” SAMSUNG-1004, [0041]. “The AP 14 generates an acknowledgment data unit to acknowledge receipt of the multiple data units” [(“*transmit a response frame in response to the PPDU*”). SAMSUNG-1004, [0044]; SAMSUNG-1003, ¶97.

“FIG. 3B [(reproduced below)] is a diagram of an example MPDU 350 for acknowledgment of an A-MPDU . . . the MPDU 350 is included in an acknowledgment data unit **in response to** a received A-MPDU,” which is included in the PPDU. SAMSUNG-1004, [0060]. “In an embodiment and/or scenario, the MPDU 350 is included in an acknowledgment data unit transmitted **by the AP 14 to a single [or multiple] client station[s] 25 to acknowledge** an uplink data unit **received** by the AP 14 from the single [or multiple] client station[s] 25.” SAMSUNG-1004, [0060]-[0063], [0075], [0125]-[0133]; SAMSUNG-1003, ¶97.



SAMSUNG-1004, FIG. 3B.

Second Mapping

Chu's "PHY processor 29 is configured to receive PHY data units that were received via the antennas 34, and extract MAC layer data units encapsulated within the PHY data units." SAMSUNG-1004, [0042]-[0043]. "The MAC processor 28 and the PHY processor 29 of the client station 25-1 are configured to process received data units [(*"the PPDU"*)] conforming to the first communication protocol and having formats described hereinafter and to determine that such data units conform to the first communication protocol." SAMSUNG-1004, [0043]. The "client station 25 generates **an acknowledgment data unit** to acknowledge receipt of the multiple data units" [(*"transmit a response frame in response to the PPDU"*)]. SAMSUNG-1004, [0044]. Referring to FIG. 3B above, "the MPDU 350 is included in an acknowledgment data unit transmitted **by a single client station 25 to the AP 14 to acknowledge** a downlink data unit **received** by the single client station 25 from the AP 14." SAMSUNG-1004, [0060]-[0063], [0125]-[0133]; SAMSUNG-1003, ¶97.

**[1h]**

*A. The Ack Response Frame*

The '926 Patent discloses that an *Ack frame* may be transmitted in response to a single MPDU (S-MPDU), "[when] the value of the EOF field is set to 1 and

the value of the MPDU length field is set to a non-zero value,” and when the policy value is set to the “first value.” *See* Table 1 in Section II.A; *see also supra* [1d]; SAMSUNG-1001, 15:54-67, FIGS. 6(b), 7(c), 10(c).

As explained by Dr. Mahon, this S-MPDU (or A-MPDU containing a single MPDU) aligns with the industry definition of “VHT single MPDU [VHT S-MPDU],” which is defined as an “MPDU that is the only MPDU in an A-MPDU and that is carried in an A-MPDU subframe with 1 in the *EOF field*.” SAMSUNG-1009, 1371 (1370); SAMSUNG-1003, ¶¶100-101.

Consistent with the '926 Patent, Chu describes the claimed *Ack frame* under both mappings. SAMSUNG-1003, ¶¶99-107. In particular, Chu discloses determination of an *Ack response frame* based on (1) the *type of the MPDU* determined by *EOF* and *length field*, and (2) the policy bits or value (“*the Ack policy information*”) in a received PPDU, as described below. *Id.*

First, Chu discloses that “one or more of the OFDM 270 data units 270 [or “OFDM data unit 200”] is a single MPDU (e.g., a **single VHT MPDU . . .**) . . . included in a PPDU,” where the “**VHT single MPDU**” has *EOF field* 532 set by “the AP 14 or client station 25” to **1** “in an MPDU delimiter of a VHT single MPDU.” SAMSUNG-1004, [0053], [0072], [0045], [0047], [0049]; SAMSUNG-1003, ¶101. Moreover, as explained by Dr. Mahon and further confirmed by corroborating prior art, the MPDU length indicated by a *length field* of MPDU

delimiter of VHT single MPDU is nonzero since there is MPDU present.

SAMSUNG-1003, ¶101 (*citing* SAMSUNG-1005, 132 (106), SAMSUNG-1009, 1290 (1289), SAMSUNG-1020, 145 (115)).

Second, Chu explains that when “an end of frame field [***“EOF field”***] of an MPDU delimiter” is set to a “first predetermined value,” e.g., EOF=1, such EOF value “indicates a **normal acknowledgment policy to acknowledge a single data unit** to be transmitted to the second communication device.” SAMSUNG-1004, [0159], [0129]-[0133], [0074]. “In some embodiments and/or scenarios, the **AP 14 or client station 25** aggregates a management frame or a data frame that corresponds to a **normal acknowledgment** (e.g., which asks for Ack [***“Ack frame”***]).” SAMSUNG-1004, [0073], [0129]-[0133]. In such context, a “normal Ack” MPDU is one where the EOF=1, length≠0, and the acknowledgment policy field is set to a value such as “00.” SAMSUNG-1004, [0073]-[0074]. SAMSUNG-1003, ¶102.

Third, as described in Chu and further confirmed by corroborating prior art references, “the acknowledgment policy bits of the corresponding QoS control field” of the VHT S-MPDU would be set to a value that indicates “**a normal acknowledgment policy**” or “implicit block acknowledgment policy,” for example, “a value of ‘00’” [***“the policy information”***] that can correspond to “Normal Ack or Implicit Block Ack Request.” SAMSUNG-1004, [0074], [0161],

; SAMSUNG-1003, ¶103; SAMSUNG-1009, 651 (650); SAMSUNG-1020, 64 (34); SAMSUNG-1009, 1371 (1370) (noting that for VHT single MPDU, “[d]ata frame could indicate an Ack Policy of ‘Normal Ack’, which solicits an Ack frame immediate response”).

Accordingly, Chu describes determination of an *Ack frame* in response to receiving a VHT single MPDU (“*A-MPDU*”) that has (1) a single standalone MPDU or single normal ACK MPDU (“*type of the MPDU*”) determined by “*EOF field* . . . [being] set to 1” and nonzero MPDU length (nonzero “*length field*”) and (2) policy bits (e.g., “00”) (“*the Ack policy information*”) indicating normal acknowledgment or implicit block acknowledgment. SAMSUNG-1004, [0053], [0047], [0049], [0072]-[0074], [0129]-[0133], [0159]; SAMSUNG-1003, ¶104.

Moreover, Chu’s determination of an Ack frame in response to a VHT single MPDU is also consistent with the IEEE 802.11 standards that Chu’s system is compatible with and incorporated “fully by reference” in Chu. SAMSUNG-1003, ¶105; SAMSUNG-1004, [0004], [0035]-[0036], [0058]-[0059], [0062], [0072]. For instance, 802.11 standards, such as the 802.11ac standard and the 802.11 standard (2016), disclose that “[t]he addressed recipient returns an ACK [*“Ack frame”*]” in response to “VHT single MPDU.” SAMSUNG-1003, ¶105 (*citing* SAMSUNG-1020, 64 (34), 38 (8); SAMSUNG-1009, 1319 (1318), 1371 (1370), 651 (650), Table 9-9, 1290 (1289), Table 9-422). Accordingly, a POSITA would

have understood that a VHT single MPDU is respond to with an Ack frame as a matter of standard protocol. SAMSUNG-1003, ¶105.

The prior art's disclosure of [1h] are also obvious when Chu's teachings are considered in combination with the 802.11ax disclosure (SAMSUNG-1005, SAMSUNG-1006). SAMSUNG-1003, ¶¶106-107. Chu explains that the IEEE Standard 802.11ax was "incorporated herein fully by reference." SAMSUNG-1004, [0004].

Under the IEEE 802.11ax standard, for example, "[i]f the preceding PPDU contains an MPDU that requires an Ack frame response, a single Ack frame" is generated. The standard explains that "[a]n Ack frame might be sent in immediate response carried in SU format to a Single MPDU in the VHT MU [multi-user] PPDU," confirming that *a type of the response frame is determined as an Ack frame* in response to a VHT Single MPDU. SAMSUNG-1003, ¶107 (citing SAMSUNG-1005, 145-146 (119-120), 135 (109); SAMSUNG-1013, 31, 41; SAMSUNG-1012, 9-10; SAMSUNG-1006).

#### *B. Compressed BlockAck frame*

The '926 Patent discloses that a *compressed BlockAck frame* may be transmitted when "MPDUs soliciting an immediate response belong to the same TID." SAMSUNG-1001, 16:1-27. For example, as described above, the '926 Patent explains that "MPDUs soliciting an immediate response [which] belong to

the same TID” may correspond to a single-TID A-MPDU having (1) each of multiple MPDUs with MPDU delimiter with EOF=0 and length≠0 and (2) the policy value being set to the “first value” soliciting “general Ack or an implicit BlockAck” in an immediate context. *See supra* Table 1, [1d]; SAMSUNG-1001, 11:10-16, FIGS. 6(a) and 10(b).

Consistent with the '926 Patent's disclosure, Chu describes the claimed *compressed BlockAck frame* under both mappings. SAMSUNG-1003, ¶¶108-114. In particular, Chu discloses determination of *compressed BlockAck frame* based on (1) *the type of the MPDU* determined by *the EOF* and *length field* and (2) the policy bits or value (“*the Ack policy information*”). SAMSUNG-1003, ¶¶108-114.

First, Chu explicitly discloses that “the *EOF field* 532 and the *MPDU Length field* 534 [can be used] to differentiate between a normal acknowledgment request and a block acknowledgment request [of MPDU]” and explains that setting the EOF field to a “second predetermined value,” such as **EOF = 0**, “indicates a **block acknowledgment policy** to acknowledge **multiple data units** to be transmitted to the second communication device.” SAMSUNG-1004, [0073]-[0075], [0129]-[0133], [0159], claims 12, 15. Chu explains that such MPDU “that has an acknowledgment policy corresponding to a **block acknowledgment** (e.g.,

where the recipient responds with a BlockAck after SIFS period)” can be referred to as a “**‘block ack’ MPDU.**” SAMSUNG-1004, [0075]; SAMSUNG-1003, ¶110.

Chu also explains that “in response to the receipt of an *MPDU* corresponding to an *EOF field* 532 being **set to 0** and [an] implicit block acknowledgment request,” which has “**policy bits**” set to, e.g., “**a value of ‘00’**” [“*Ack policy information*”], “the recipient acknowledges the MPDU with a **BlockAck after a SIFS period** [“*compressed BlockAck frame*”].” SAMSUNG-1004, [0075]; SAMSUNG-1003, ¶111.

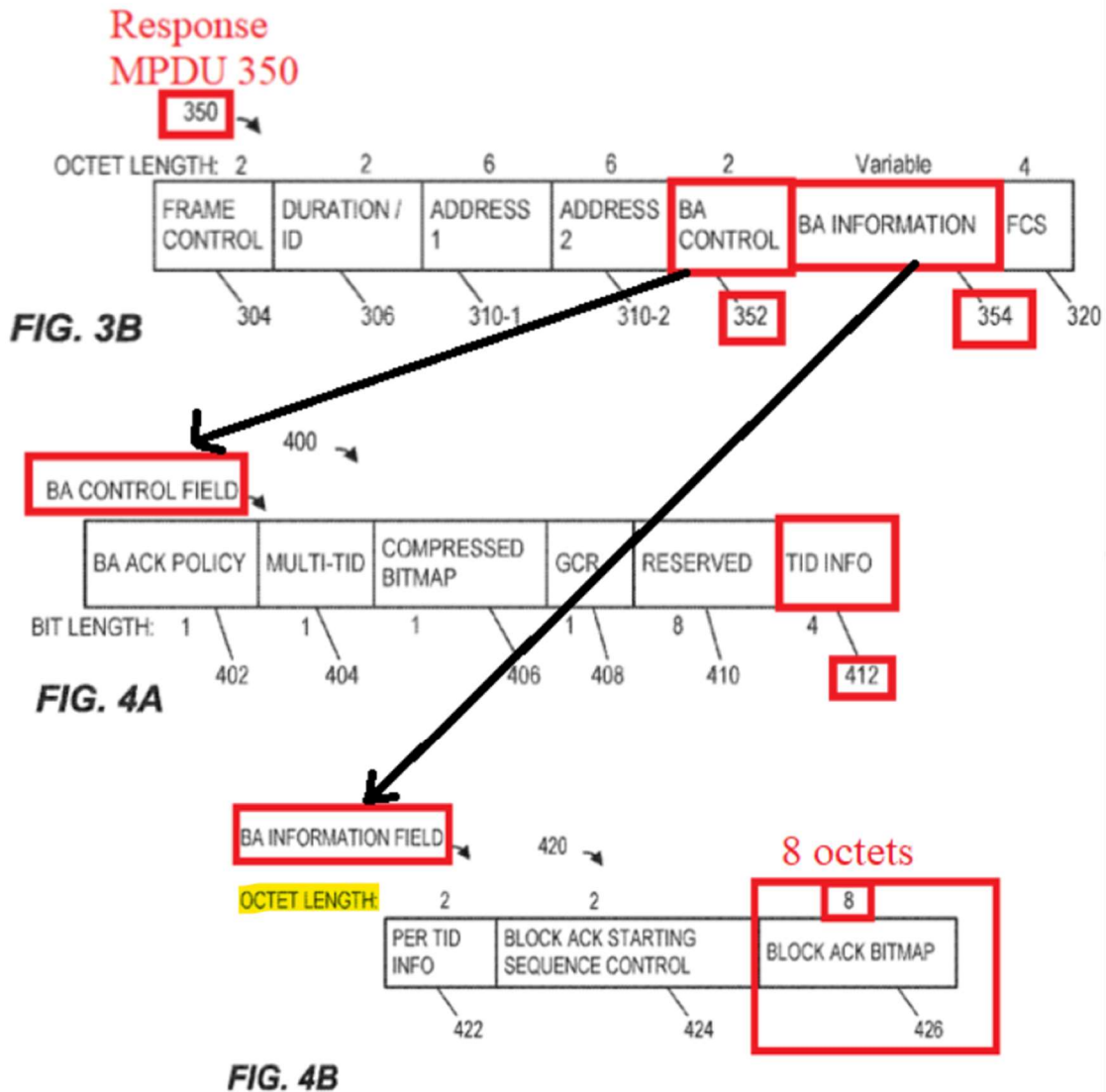
Further, Chu states that such block acknowledgment (e.g., BlockAck after a SIFS period (“*compressed BlockAck frame*”)) “indicates respective acknowledgments for multiple MPDUs belonging to a single TID [single-TID A-MPDU]” SAMSUNG-1004, [0081]; SAMSUNG-1003, ¶112.

Second, as explained by Dr. Mahon, Chu’s disclosure of a “BlockAck after a SIFS period” that acknowledges a single-TID A-MPDU corresponds to the “*compressed BlockAck frame*,” as defined in the 802.11 standards (2012, 2016) standards and 802.11ax standard. SAMSUNG-1003, ¶113 (citing SAMSUNG-1009, 679-680 (678-679); SAMSUNG-1015, 509-510 (411-412); SAMSUNG-1005, 61-62 (35-36)). This is supported by Chu’s description and figures, which describe that the response frame (e.g., MPDU 350 or an acknowledgment unit including MPDU 350) includes **(1) a TID INFO subfield** (e.g., “TID INFO” 412,

614, 716) of BA Control field and **(2) a BA information field** (e.g., “BA information field” 420, 620, 720) **structured in the compressed format**, in which the BA information field has the **Block Ack bitmap subfield** (e.g., “Block Ack bitmap subfield” 426, 626, 726) **limited to 8 octets** (64 bits), consistent with the IEEE 802.11 definition of a Compressed BlockAck frame.<sup>13</sup> SAMSUNG-1004, FIGS. 3B & 4A-4B (reproduced below, annotated), 6A-6B, 7A-7B, [0060], [0064]-[0069], [0077]-[0085]; SAMSUNG-1003, ¶¶63, 113. Chu further confirms the functionality of a compressed BlockAck frame described in the ’926 Patent by disclosing that this block acknowledgment indicates “respective acknowledgments for multiple MPDUs belonging to a single TID,” and describes that such response frame can be generated and transmitted by AP or the client station. SAMSUNG-1003, ¶113; SAMSUNG-1004, [0081], [0060]).

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<sup>13</sup> According to Chu, (1) BA control field including the TID INFO subfield and (2) BA information field can be applied to MPDU 350 of FIG. 3B or an acknowledgment data unit, which can correspond to the response frame. SAMSUNG-1004, [0060], [0064]-[0069], [0077]-[0085]; FIGS. 3B, 4A-4B, 6A-6B, 7A-7B.



SAMSUNG-1004, FIGS. 3B, 4A-4B.

Thus, Chu discloses that the *response frame* (e.g., MPDU 350 or acknowledgment data unit including MPDU 350) is determined as a *compressed BlockAck* response frame based on a combination of (1) *the type of the MPDU* (e.g., “block ack” MPDU(s), a sequence of MPDUs that belong to single TID within an A-MPDU) that is determined by EOF = 0 (“*EOF field*”) and the nonzero

value of the MPDU length field (“**length field**”), and (2) the policy bits (e.g., “00”) [“**the Ack policy information**”] indicating normal acknowledgment or implicit block acknowledgment. SAMSUNG-1003, ¶114.

*C. Multi-STA BlockAck (M-BA) – 1<sup>st</sup> Instance*

The ’926 Patent describes that a “Multi-STA BlockAck (M-BA) frame” is used “if the received A-MPDU consists of MPDUs of two or more TIDs soliciting an immediate response . . . When a response is transmitted via the M-BA frame, a response may be performed through the per AID TID information field which is independent for each TID. If an MPDU with the value of the EOF field set to 1 is present in the received A-MPDU, the value of the Ack type subfield of the per AID TID information field corresponding to the MPDU may be set to 1 so that the BA bitmap is omitted.” SAMSUNG-1001, 16:16-27.

Consistent with the ’926 Patent, Chu describes the claimed “**multi-STA BlockAck frame**” under both mappings. In particular, Chu discloses determination of a “multi-TID block acknowledgment” response (“**Multi-STA BlockAck frame**”) based on a combination of (1) the **type of the MPDU** determined by **EOF and length field**, and (2) the **Ack policy information**. SAMSUNG-1003, ¶¶115-123.

First, Chu discloses “multi-TID A-MPDU (e.g., an A-MPDU having A-MPDU subframes with at least some different TIDs)” and generation of “A-MPDU to include multiple normal ACK MPDUs,” where each normal ACK MPDU frame

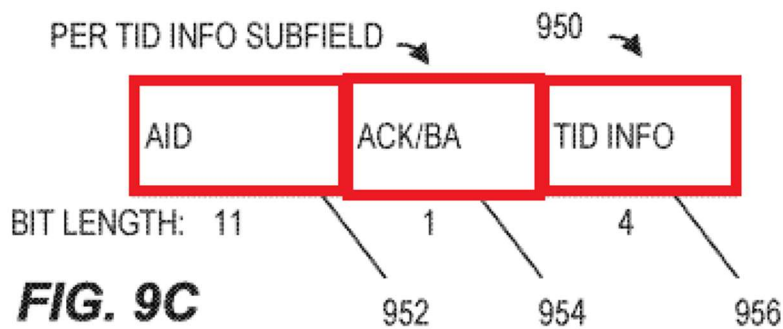
is associated with “each [different] TID.” SAMSUNG-1004, [0069], [0060]-[0061], [0074]. Moreover, each “normal ACK MPDU” has (1) EOF = 1 and length  $\neq$  0 and (2) policy bits set to “a normal acknowledgment policy (e.g., a value of ‘00’) [*“the Ack policy information”*].” SAMSUNG-1004, [0074], [0161], [0159]; SAMSUNG-1003, ¶117.

Second, Chu explains acknowledging such multi-TID A-MPDU using a multi-TID block acknowledgment response (*“multi-STA BlockAck frame”*). SAMSUNG-1003, ¶118. For instance, Chu explains that “[t]he AP 14 or client station 25 generates the MPDU 350,” which can be used as “a broadcast frame which includes a multi-TID block acknowledgment [e.g., “block acknowledgments for multiple TIDs” or “multi-TID A-MPDU”] for multiple stations or as a unicast frame which includes a multi-TID block acknowledgment for a single station.” SAMSUNG-1004, [0089], [0094], [0107], [0069]; *see supra* Table 2; SAMSUNG-1003, ¶118.

Third, as explained by Dr. Mahon, the structure of the response frame described in Chu corresponds to the *multi-STA BlockAck frame* described in the IEEE 802.11ax standard. SAMSUNG-1003, ¶119. The 802.11ax standard explains that the M-BA format includes “Per STA Info subfields,” where each subfield includes an “AID [Association Identifier],” “Ack Type,” and “TID.” SAMSUNG-1003, ¶119; SAMSUNG-1013, 16-17; SAMSUNG-1005, 63-64 (37-

38). The 802.11ax standard further provides that the presence or omission of a BlockAck bitmap may be governed by the “Ack Type” field: “If the Ack Type subfield is 1 . . . Block Ack Bitmap are not present.” SAMSUNG-1013, 16-17; SAMSUNG-1005, 64(38); SAMSUNG-1003, ¶119.

Consistent with this structure, and as explained by Dr. Mahon and shown at least in FIGs. 9C, 10C, and 12B of Chu, the response frame used for Chu’s “multi-TID block acknowledgment” corresponds to the *multi-STA BlockAck frame*. SAMSUNG-1004, FIGs. 9C, 10C, 12B, [0089]-[0099], [0106]-[0111]; SAMSUNG-1003, ¶120. For example, Chu’s FIG. 9C illustrates a “per TID information subfield 950” that includes three elements: an “AID” field 952 (11 bits), an “Ack/BA [Ack type]” subfield 954 (1 bit), and a “TID value” subfield 956 (4 bits). SAMSUNG-1004, [0091], FIG. 9C; SAMSUNG-1003, ¶120.



SAMSUNG-1004, FIG. 9C.

Chu explains that “the device identifier 952 includes an identifier associated with the device or client station 25,” and that, in some cases, this “device identifier

is an association ID (e.g., 11 bits),” or AID. SAMSUNG-1004, [0091]. Moreover, Chu explains that “the Ack/BA field 954 indicates whether the Block Ack starting sequence control subfield 924 and the Block Ack bitmap subfield 926 follow the per TID information subfield 922.” SAMSUNG-1004, [0090]. The conditional omission of bitmap fields may be governed by the “Ack/BA” subfield 954 (also referred to as “acknowledgment type subfield 954”), which indicates whether an Ack-type response or a full BlockAck is required, consistent with the IEEE 802.11ax standard. SAMSUNG-1004, [0090]-[0092]; SAMSUNG-1003, ¶121.

This configuration, in which each acknowledgment entry may be indexed by an AID and TID combination, confirms that Chu’s response frame mirrors the structure defined for the Multi-STA BlockAck frame of IEEE 802.11ax standard at the time and maps to the claimed *multi-STA BlockAck frame*. SAMSUNG-1003, ¶122.

Thus, Chu discloses that the response frame is determined as a “multi-TID block acknowledgment” response frame (“*Multi-STA BlockAck frame*”) based on a combination of (1) “*the type of the MPDU*” (e.g., a standalone MPDU that is part of multi-TID A-MPDU, “multiple normal ACK MPDUs”) that is *determined by* EOF=1 (“*EOF field*”) and the “non-zero value” of “MPDU length field” (“*length field*”), and (2) the policy bits set to “a normal acknowledgment policy (e.g., a value of ‘00’)” [“*the Ack policy information*”]. SAMSUNG-1003, ¶123.

Additionally and/or alternatively, as noted in Tables 3 and 4, IEEE-D1 or IEEE-D2 further corroborates Chu's disclosure regarding [1h] above and/or suggests this 1<sup>st</sup> instance of the M-BA frame determination. *See supra* Tables 3, 4; SAMSUNG-1006, 4-5; SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1003, ¶¶142, 148.

*D. Mult-STA BlockAck (M-BA) – 2<sup>nd</sup> Instance*

Chu in view of IEEE-D1 or IEEE-D2 also renders obvious feature [1h]. For instance, as described above in the “Chu-IEEE-D1 or IEEE-D2 combinations” section, IEEE-D1 or IEEE-D2 introduces a “2<sup>nd</sup> instance” of the Multi-TID block acknowledgment response. *See supra* Section III.A.5; Table 4; SAMSUNG-1003, ¶¶140-142, 148-149; *see generally id.*, ¶¶138-157.

As noted above in Tables 3 and 4 (“2<sup>nd</sup> instance”), each of the Chu-IEEE-D1 or Chu-IEEE-D2 combination (1) allows A-MPDU to include multiple MPDUs having different policies (e.g., Ack and BlockAck) and (2) allows MPDUs that form a sequence (e.g., EOF=0, length≠0) to be mixed with standalone MPDU(s) (e.g., EOF=1, length≠0) within an A-MPDU. *See* Tables 3, 4; SAMSUNG-1003, ¶¶140-142, 148-149. When the A-MPDU contains both “multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 1, one for each TID that solicits Ack [e.g., requesting “*Ack frame*”] and[] multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to **0**, one for each TID

that solicits BlockAck [e.g., requesting “*compressed BlockAck frame*”]—the terminal “shall respond with a *Multi-STA BlockAck frame*.” SAMSUNG-1005, 219-220 (193-194); SAMSUNG-1006, 4-5; SAMSUNG-1003, ¶¶140-142, 148.

Accordingly, Chu-IEEE-D1 and IEEE-D2 disclose that the response frame is determined as a *Multi-STA BlockAck frame* based on a combination of:

- (1) *type of the MPDU* (co-existence of (i) standalone MPDU(s) having a unique TID or normal ACK MPDU(s) and (ii) “block ack” MPDUs or a sequence of MPDUs that belong to single TID within an A-MPDU) that is *determined by* EOF=0 and 1 (“*EOF field*”) and the “non-zero value” of “MPDU length field” (“*length field*”), and
- (2) the policy bits set to “immediate Ack/BA” such as “a normal acknowledgment policy (e.g., a value of ‘00’)” or “implicit block acknowledgment request (e.g., a value of “00”)” [“*the Ack policy information*”]. SAMSUNG-1003, ¶¶147-149, 94-96, Table 4.

[1i]

As described above with respect to [1h], Chu discloses that *when* an MPDU has EOF = 0, length ≠ 0, and “acknowledgment policy bits . . . [are set] to an implicit block acknowledgment request (e.g., a value of “00”) [“*the policy information*”],” the recipient [“*wireless terminal*”] responds [“*transmit[s]*”] with a BlockAck after a SIFS period [“*compressed BlockAck*”].” SAMSUNG-1004, [0075]; *see supra* [1h].

Chu further explains that each BlockAck response (e.g., “*compressed BlockAck frame is used to transmit*”) “indicates respective acknowledgments for multiple MPDUs [“*to the one or more MPDUs*”] belonging to [“*correspond to*”] a single [same] TID [“*one TID*”]” *when* these multiple MPDUs (“*to the one or more MPDUs*”) having the “single TID” (“*one TID*”) are within the received *A-MPDU* of *PPDU* that may have “the plurality of data units correspond[ing] to one, two, three, or more . . . traffic specification identified by different traffic identifications (TIDs) [“*among one or more TIDs*”]” or that may have just the “single TID” (“*one TID*” “*among one . . . TID*[”]). SAMSUNG-1004, [0056]-[0057], [0060]-[0061], [0081]; *see* [1g]; SAMSUNG-1003, ¶131.

As explained by Dr. Mahon, it was known in the art that the compressed BlockAck frame is used to transmit a response based on the received A-MPDU including the one or more MPDUs corresponding to the one (same) TID. SAMSUNG-1003, ¶132 (citing SAMSUNG-1012, 11-12, Table 9-421; SAMSUNG-1013, 27-28; SAMSUNG-1009, 1293 (1292), Table 9-425; SAMSUNG-1009, 153 (152); SAMSUNG-1015, 125 (27)).

(ii) Claim 2

[2]

Chu’s MPDU “is included in a plurality of data units of a plurality of uplink

A-MPDUs.” SAMSUNG-1004, [0056]. The A-MPDU can include multiple MPDUs (“*one or more MPDUs*”) that solicit Ack response, with each MPDU having a different TID. SAMSUNG-1004, [0061], [0069], [0074], [0081], *see supra* [1h], [1d]. “[T]he plurality of data units (“*one or more MPDUs*”) correspond to one, two, three, or more traffic classes (TC) or traffic specification identified by different traffic identifications (*TIDs*).” SAMSUNG-1004, [0056]-[0057]. “In at least some embodiments, **the plurality of data units** is transmitted from a plurality of client stations [or from a single client station based on a single-user (SU) PPDU] and corresponds to *one or more different TIDs*.” *Id*; SAMSUNG-1003, ¶¶125-126.

Thus, Chu provides “*wherein the A-MPDU further includes the one or more TIDs corresponding to the one or more MPDUs*.” SAMSUNG-1003, ¶127 (explaining that it was known in the art that an A-MPDU includes one or more TIDs corresponding to the one or more MPDUs of the A-MPDU).

### (iii) Claim 3

[3]

Claim 3 recites, among other features, “a number of TIDs indicating an immediate response among the one or more TIDs.” A POSITA would have understood the “number of TIDs” to include “one or more TIDS,” as explicitly

recited in the claim. SAMSUNG-1003, ¶129. Consistent with this understanding, claim 3 is obvious under Grounds 1A and 1B for at least the following reasons.

First, Chu discloses that an *Ack* response frame (“*type of the response frame*”) is transmitted “after a short interframe space (SIFS) period” (“*immediate response*”). In this example, a single TID [“*considering a number of TIDs... among the one or more TIDs*”] received by a receiving device is used to determine that *an immediate Ack response frame* should be sent in response. SAMSUNG-1004, [0053], [0072], [0074], [0146]; SAMSUNG-1003, ¶129 (*citing* SAMSUNG-1009, 651 (650), 1319 (1318), Table 9-9).

Second, in the case of multiple MPDUs associated with either multiple TIDs or the same TID—each indicating an *immediate response* (e.g., based on “implicit block acknowledgment” policy, “normal acknowledgment policy,” or policy bits of “00”)—it would have been evident that the appropriate response frame type is (1) an **M-BA frame** (“*type of the response frame*”) for acknowledging “multi-TID A-MPDU (e.g., an A-MPDU having A-MPDU subframes with at least some different TIDs [“*considering a number of TIDs*”])” or (2) a **C-BA frame** (“*type of the response frame*”) for acknowledging “multiple MPDUs belonging to a single TID [“*considering a number of TIDs*”]). SAMSUNG-1004, [0061], [0069], [0075], [0081]; SAMSUNG-1003, ¶¶130-134; *see supra* [1h].

In this regard, a POSITA would have understood that the number of TIDs indicating an immediate response—among the one or more TIDs present in the A-MPDU—can serve as an additional criterion that is consistent with, or supplements, the criteria outlined [1h]. SAMSUNG-1003, ¶134. As explained by Dr. Mahon, this distinction would have been obvious, as it was known in the art that the M-BA frame and C-BA contexts are determined based on whether multiple MPDUs within an A-MPDU share the same TID. SAMSUNG-1003, ¶134 (citing SAMSUNG-1012, 11-12, Table 9-421 (illustrating Ack, HT-immediate BlockAck (e.g., C-BA), Multi-STA BA in immediate response context); SAMSUNG-1013, 27-28; SAMSUNG-1015, 913-914 (815-816), Table 8-284; SAMSUNG-1009, 1293 (1292), Table 9-425).

Alternatively/additionally, in the Chu-IEEE-D1 (or IEEE-D2) combination, IEEE-D1 (or IEEE-D2) teachings further mandate that the response frame is a “Multi-STA BlockAck” (“*type of the response frame*”) when received A-MPDU corresponds to multi-TID MPDU, in which the “multi-TID A-MPDU may contain . . . MPDU delimiters with EOF subfield equal to 1, one for each TID that solicits Ack [*“considering a number of TIDs indicating an immediate response”*] and/or multiple noncontiguous nonzero length MPDU delimiters with EOF subfield equal to 0, one for each TID that solicits BlockAck [*“considering a number of TIDs*

*indicating an immediate response”].” SAMSUNG-1005, 219-220 (193-194);*

SAMSUNG-1006, 4-5; SAMSUNG-1003, ¶¶135-136.

Accordingly, a POSITA would have understood the number of TIDs indicating an immediate response to be a relevant criterion in determining the response frame type, whether based on Chu alone or in view of the IEEE 802.11ax framework disclosed in IEEE-D1 or IEEE-D2. SAMSUNG-1003, ¶137.

#### (iv) Claim 4

[4]

As described above with respect to [1h] and [3], Chu discloses that the type of the response frame is the *Ack frame* when the A-MPDU includes *only one TID indicating the immediate response* and the *Ack policy information indicates a normal Ack*. See *supra* [1h], [3].

Chu describes that when *the wireless communication terminal* receives a single MPDU (e.g., a VHT single MPDU) having EOF=1, length≠0, and a policy value (e.g., “00”) (“*the Ack policy information*”) that encompasses “normal acknowledgment policy” and “implicit block acknowledgment” policy, the policy value (“*the Ack policy information*”) indicates a “normal acknowledgment policy” (“*normal Ack*”) and the resulting response an *Ack frame*. See *supra* [1h]; SAMSUNG-1004, [0072], [0074], [0159]; SAMSUNG-1009, 1319 (1318) (explaining that an “*Ack frame* might be sent in *immediate response* to a VHT

single MPDU”); SAMSUNG-1020, 64 (34); SAMSUNG-1009, 1371 (1370)

(noting that for VHT single MPDU, “[d]ata frame could indicate an Ack Policy of ‘Normal Ack’, which solicits an Ack frame immediate response”). SAMSUNG-1003, ¶¶99-107, 129-130.

Here, the single MPDU is associated with *only one TID*, and “normal acknowledgment policy” solicits *immediate response* (e.g., response after “a short interframe space (SIFS) period”). SAMSUNG-1004, [0074], [0159]; *see also supra* [1h], [2]. A POSITA would have understood that when an A-MPDU includes *only one TID* and a single MPDU requesting immediate acknowledgment (“*only one TID indicating the immediate response*”), resulting response frame would be the *Ack frame*. SAMSUNG-1003, ¶130.

Further, because it was known in the art that (1) the policy information of VHT single MPDU (associated with *one TID*) corresponds to a policy value (e.g., “00”) (“*the Ack policy information*”) that solicits “Normal Ack or Implicit Block Ack,” (2) such policy value (“*the Ack policy information*”) associated with *one TID* solicits *immediate response* (“after a short interframe space (SIFS) period”), and (3) “*Ack frame* might be sent in immediate response to a VHT single MPDU,” it would have been obvious to a POSITA that, in the context of Chu’s single MPDU or VHT single MPDU, the policy value (“*the Ack policy information*”)

*indicates a normal Ack* and triggers an *Ack frame*. SAMSUNG-1003, ¶¶129-130 (citing SAMSUNG-1009, 651 (650), 1319 (1318), 1371 (1370), Table 9-9).

(v) **Claim 5**

[5]

As described above with respect to [1i], [1h], and [3], Chu discloses that the type of the response frame is the compressed BlockAck frame when a number of the TIDs indicating the immediate response is one or more and the one or more TIDs are the same. *See supra* [1i], [1h], [3].

Specifically, Chu explains that when an MPDU has **EOF=0**, **length≠0** and “implicit block acknowledgment” policy, the response requested is a “BlockAck after a SIFS period” (“*compressed BlockAck frame*”). *See supra* [1h], SAMSUNG-1004, [0075]. Chu further explains that the BlockAck response (e.g., “BlockAck after a SIFS period”) “indicates respective acknowledgments for multiple MPDUs belonging to a single [same] TID [*“a number of the TIDs indicating the immediate response is one or more and the one or more TIDs are the same”*].” SAMSUNG-1004, [0081].

Additionally and/or alternatively, as explained by Dr. Mahon, it was known in the art that the *compressed BlockAck frame* was used to transmit a response based on the received A-MPDU including the one or more MPDUs corresponding to the same TID indicating the immediate response. SAMSUNG-1003, ¶¶131-132.

(vi) **Claims 6 and 7**

[6]-[7]

As described above with respect to [1h] and Section III.A.4, each of IEEE-D1 and IEEE-D2 provides explicit guidance that, when (1) multiple MPDUs have different policies (e.g., Ack and BlockAck) and (2) MPDUs that form a sequence (e.g., *EOF=0, length≠0* of “*second MPDU delimiter information*”) are mixed with standalone MPDU(s) (e.g., *EOF=1, length≠0* of “*the first MPDU delimiter information*”), such context may correspond to a multi-TID block acknowledgment (e.g., *Multi-STA BlockAck*) context. *See supra* [1h], Table 4. That is, as noted in Table 4 (“2<sup>nd</sup> instance”), the Chu-IEEE-D1 or Chu-IEEE-D2 combinations disclose (1) an A-MPDU that includes multiple MPDUs having different policies (e.g., Ack and BlockAck) and [2] the MPDUs form a sequence (e.g., *EOF=0, length≠0*) to be mixed with standalone MPDU(s) (e.g., *EOF=1, length≠0*) within an A-MPDU, thereby rendering obvious [6]. *See supra* [1h], Table 4.

Moreover, as described above, each of the combinations provide that *the type of the response frame* is *Multi-STA BlockAck* based on whether the A-MPDU includes a subframe including the *first MPDU delimiter information* (*EOF=1, length≠0*), and whether the A-MPDU includes at least one subframe

including the *second MPDU delimiter information* (*EOF=0, length≠0*), thereby

rendering obvious feature [7]. *See supra* [1h], Table 4.

**(vii) Claim 8**

**[8pre]**

*See supra* [1pre].

**[8a]**

*See supra* [1c].

**[8b]**

*See supra* [1d].

**[8c]-[8d]**

*See supra* [1e]-[1f].

**[8e]**

*See supra* [1g].

**[8f]**

*See supra* [1h].

**[8g]**

*See supra* [1i].

**(viii) Claim 9**

[9]

*See supra* [2], [8].

**(ix) Claim 10**

[10]

*See supra* [3], [9].

**(x) Claim 11**

[11]

*See supra* [4], [10].

**(xi) Claim 12**

[12]

*See supra* [5], [10].

**(xii) Claims 13 and 14**

[13]-[14]

*See supra* [6]-[8].

**B. [GROUND 2] – CLAIMS 1 and 8 ARE OBVIOUS OVER IEEE-D3**

**1. Overview of IEEE-D3**

The IEEE-D3 describes wireless communication protocols encompassing various Medium Access Control (MAC) and Physical Layer (PHY) enhancements, including mechanisms for aggregated frame transmissions (A-MPDUs) and

various acknowledgment procedures. SAMSUNG-1009, 123 (122) (“The purpose of this standard is to provide wireless connectivity. . . This standard also offers regulatory bodies a means of standardizing access to one or more frequency bands. . .”), 12 (11) (“this revision specifies technical corrections and clarifications to IEEE Std 802.11 as well as enhancements to the existing medium access control (MAC) and physical layer (PHY) functions”), 1288 (1287) (disclosing dedicated section for A-MPDU), 651 (650) (“The Ack Policy subfield... identifies the acknowledgment policy that is followed upon the delivery of the MPDU”), 1288-1295 (1287-1294). SAMSUNG-1003, ¶160.

Notably, the standard discloses multiple types of acknowledgment frames for MAC layer and PHY layer data units exchanged between wireless communication terminals —such as Ack, Compressed BlockAck, and Multi-TID BlockAck—and explicitly describes that various acknowledgment frames including the **Ack frame** can be selectively employed based on the characteristics of the transmitted MAC layer data units, including information derived from the EOF and length fields of MPDU delimiters, as well as the Ack Policy subfield. SAMSUNG-1009, 1319 (1318), 1290 (1289), 153 (152), 1295 (1294), Table 9-428, 676 (675), 1461 (1460). SAMSUNG-1003, ¶161.

As will be further explained in detail below, IEEE-D3 provides specific details on (i) the structure of A-MPDUs, (ii) the use of MPDU delimiters

(including EOF and length fields), (iii) acknowledgment policies, and (iv) the determination of appropriate acknowledgment response frames depending on both the delimiter information of the MPDU(s) and associated policy settings, thereby rendering obvious [1] and [8]. *See infra*, III.B.2.(i)-(ii); SAMSUNG-1003, ¶162.

Lastly, IEEE-D3 qualifies a prior art under 35 U.S.C. § 102(a)(1). SAMSUNG-1027, ¶¶5-12. For example, as explained in the Declaration of June Ann Munford, the IEEE-D3 was published and publicly accessible, at least via the IEEE Explore website, on December 14, 2016. *Id.*

## 2. Analysis

### (i) Claim 1

#### [1pre]

Even if the preamble is limiting, the IEEE-D3 renders [1pre] obvious. SAMSUNG-1003, ¶163; *see supra* III.A.6.[1pre].

The IEEE-D3 explains that each of an AP (e.g., AP STA) and non-AP STA (“*wireless communication terminals*”), operates using MAC/PHY specifications and is configured to receive and transmit PPDU. SAMSUNG-1009, 123 (122), 129 (128), 187 (186), 197-198 (196-197). SAMSUNG-1003, ¶163.

#### [1a]

The IEEE-D3 generally describes “one medium access control (MAC) and several physical layer (PHY) specifications for wireless connectivity for fixed,

portable, and moving stations (STAs) within a local area.” *See* SAMSUNG-1009, 123 (122).

As explained by Dr. Mahon, it would have been obvious to a POSITA that the wireless station and/or access point described within the IEEE-D3 (IEEE 802.11 standard (2016)), which implements MAC layer and PHY layer functions for wireless connectivity, include *a processor*. SAMSUNG-1003, ¶164.

Specifically, as further noted by Dr. Mahon, the standard describes numerous operations that require *a processor* to carry out protocol logic, decision-making, and computation. SAMSUNG-1003, ¶165. For example, the standard describes that the stations are responsible for generating, parsing, and acknowledging MAC frames (e.g., SAMSUNG-1009, 1288-1293 (1287-1292), 651 (650); *see generally id.*, section “Frame formats”), performing synchronization and association procedures (e.g., SAMSUNG-1009, 186 (185), 1598 (1597)), implementing acknowledgment policies regarding communication of MPDU(s) or A-MPDU(s) between AP and non-AP STA (e.g., SAMSUNG-1009, 651-652 (650-651)), and supporting various MAC-layer aggregation and control mechanisms (e.g., SAMSUNG-1009, 198 (197), 1288-1296 (1287-1295), 1368-1375 (1367-1374)). For example, IEEE-D3 specifies that various MAC and PHY layer functions (e.g., data generation, frame aggregation, transmission, reception, and protocol management) are performed by stations (e.g., High-Throughput (HT)

STA, Very High Throughput (VHT) STA). SAMSUNG-1009, 197-199 (196-198);

*see generally id.* Indeed, all of these functions require processing capabilities.

SAMSUNG-1003, ¶165.

Further, as explained by Dr. Mahon, “it was well known in the art that the wireless station and/or access point that implements the IEEE-D3 (IEEE 802.11 standard) would include *a processor*.” SAMSUNG-1003, ¶166 (citing SAMSUNG-1016, [0037], [0041], claims 6, 8, 9; SAMSUNG-1017, [0134], [0135]; SAMSUNG-1004, [0034]-[0043]).

#### [1b]

As explained by Dr. Mahon, it would have been obvious to a POSITA that the non-AP STA and/or AP described within the IEEE-D3, which implements MAC layer and PHY layer functions for wireless connectivity, include a transceiver (“*communication unit*”). SAMSUNG-1003, ¶167.

For instance, the standard defines various physical layer (PHY) signaling techniques and interface functions that are controlled by the MAC layer, and specifies that stations transmit and receive wireless frames in compliance with these PHY specifications. *See* SAMSUNG-1009, 123 (122), 123-124 (122-123), 197-199 (196-198); SAMSUNG-1003, ¶167.

Moreover, as explained by Dr. Mahon, it was well known in the art that the non-AP STA and/or AP that implements the IEEE 802.11 standard would include a

transceiver (“*communication unit*”). SAMSUNG-1003, ¶168 (citing SAMSUNG-1016, [0037], [0041], claims 6, 8, 9; SAMSUNG-1017, [0134], [0135]; SAMSUNG-1004, [0034]-[0043]).

[1c]

The IEEE-D3 describes that station, such as an HT or a VHT station (which can be a non-AP station or AP, includes a processor (as described above with respect to [1a]) that is configured to *receive a PPDU that includes an A-MPDU, where the A-MPDU includes one or more MPDUs that are aggregated.* SAMSUNG-1003, ¶¶170, 163-168.

For example, the IEEE-D3 explains that “*A-MPDU* consists of a sequence of one or more [aggregate-MPDU] *A-MPDU subframes*” and that “an A-MPDU is . . . carried in a single *PPDU*.” SAMSUNG-1009, 1288-89 (1287-1288), 1292 (1291), 1293 (1292). SAMSUNG-1003, ¶171.

Moreover, the IEEE-D3 describes the transmission of *PPDU* (containing *A-MPDU*) and solicitation of immediate response, indicating that the recipient (e.g., non-AP STA or AP) receiving the *PPDU* should acknowledge with the immediate response, thus confirming the reception of the *PPDU*. SAMSUNG-1003, ¶172; SAMSUNG-1009, 1292-1293 (1291-1292), 1292-95 (1291-1294), Tables 9-424-429, 1318 (1317).

[1d]

The IEEE-D3 discloses A-MPDU that includes Ack policy information related to a block Ack

As described above, the '926 Patent explains that the acknowledgement policy information related to a BlockAck is indicated by, for example, **“first value” of Ack-policy subfield of a QoS control field** within A-MPDU. See SAMSUNG-1001, 14:32-65. See *supra* Section III.A.6.[1d]. For instance, the '926 Patent describes that Ack-policy subfield of the QoS control field indicates policy values for “general Ack or implicit BlockAck,” where “if the Ack policy subfield [of the QoS control field] is set to the first value, the recipient responds to a data frame with a general Ack or an implicit BlockAck.” See SAMSUNG-1001, 14:32-65; *see also supra* Section III.A.6.[1d].

Similarly, the IEEE-D3 discloses an Ack-policy subfield of a QoS control field within an A-MPDU, in which the Ack-policy subfield indicates the acknowledgment type. See SAMSUNG-1009, 1292 (1291) (“All QoS Data frames within an **A-MPDU** that have a TID for which an HT-immediate block ack agreement exists have the same value for the **Ack Policy subfield of the QoS Control field**”), 1293 (1292) ([1] disclosing that in the HT-immediate BlockAck response context, the received (“preceding”) A-MPDU of PPDU contains “implicit . . . block ack request,” [2] disclosing the “[o]ne or more QoS Data frames [within

an A-MPDU] with the **Ack Policy field equal to Implicit Block Ack Request**”),  
651 (650) (“The **Ack Policy subfield** is 2 bits in length and **identifies the acknowledgment policy**”), Table 9-9 (disclosing that “00” bits that represent the **Normal Ack / Implicit Block Ack** policy, where the Table 9-9 is reproduced below and annotated). SAMSUNG-1003, ¶173.

**Table 9-9—Ack Policy subfield in QoS Control field of QoS Data frames**

| Bits in QoS Control field |       | Meaning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bit 5                     | Bit 6 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 0                         | 0     | <b>Normal Ack or Implicit Block Ack Request.</b><br><br>In a frame that is a non-A-MPDU frame or VHT single MPDU:<br>The addressed recipient returns an Ack or QoS +CF-Ack frame after a short interframe space (SIFS) period, according to the procedures defined in 10.3.2.9 and 10.22.3.5. A non-DMG STA sets the Ack Policy subfield for individually addressed QoS Null (no data) frames to this value.<br><br>Otherwise:<br>The addressed recipient returns a BlockAck frame, either individually or as part of an A-MPDU starting a SIFS after the PPDU carrying the frame, according to the procedures defined in 10.3.2.9, 10.24.7.5, 10.24.8.3, 10.28.3, 10.28.4, and 10.32.3. |

SAMSUNG-1009, Table 9-9 (illustrating a portion of the table).

Moreover, the four different policy values in Table 9-9 of the IEEE-D3 are consistent with four different policy values disclosed in the '926 Patent. *See* SAMSUNG-1009, Table 9-9; SAMSUNG-1001, 14:37-65, 15:1-7. In particular, the first value (“00” bits), representing “Normal Ack or Implicit Block Ack” policy in the standard, corresponds to the '926 Patent’s “first value,” which is reflected in feature [1d] as “*Ack policy information related to a block Ack.*” As will be further discussed below in [1h], this policy value allows for at least one of a Ack

frame, a compressed BlockAck frame, or a multi-TID BlockAck frame to be transmitted. SAMSUNG-1003, ¶174.

The IEEE-D3 discloses A-MPDU that includes one or more subframes

As illustrated below, an example A-MPDU format that can be included within the PPDU is shown. SAMSUNG-1009, FIG. 9-741 (reproduced below, annotated). Moreover, for example, IEEE-D3 describes A-MPDU of HT PPDU and VHT PPDU and explains that HT PPDU and VHT PPDU use the same or similar A-MPDU format, except variations regarding padding feature in HT PPDU. SAMSUNG-1009, 1288-1289 (1287-1288), FIG. 9-741; *see also* 1288-1295 (1287-1294); SAMSUNG-1003, ¶175. Accordingly, an A-MPDU of the PPDU (including HT **PPDU** and the VHT **PPDU**) includes **one or more subframes**. SAMSUNG-1003, ¶175.

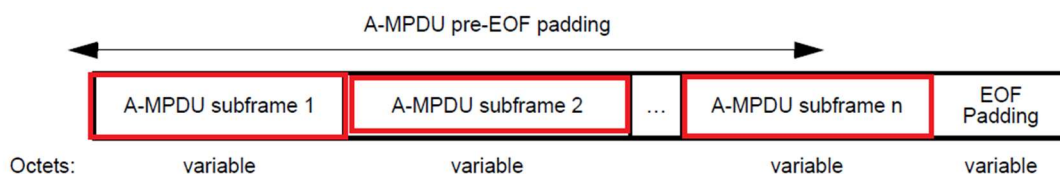


Figure 9-741—A-MPDU format

SAMSUNG-1009, FIG. 9-741.

**[1e] and [1f]**

As illustrated in FIGS. 9-743 and 9-744 below, the IEEE-D3 discloses that each of one or more subframes of an **A-MPDU** includes (1) an **MPDU delimiter**

containing identifier fields: an *EOF field* and a *length field* specifying the size of the MPDU, and (2) an *MPDU (of the one or more MPDUs)*. See SAMSUNG-1009, 1288-1289 (1287-1288), FIGS. 9-741, 9-743, 9-744 (reproduced below, annotated); SAMSUNG-1003, ¶176.

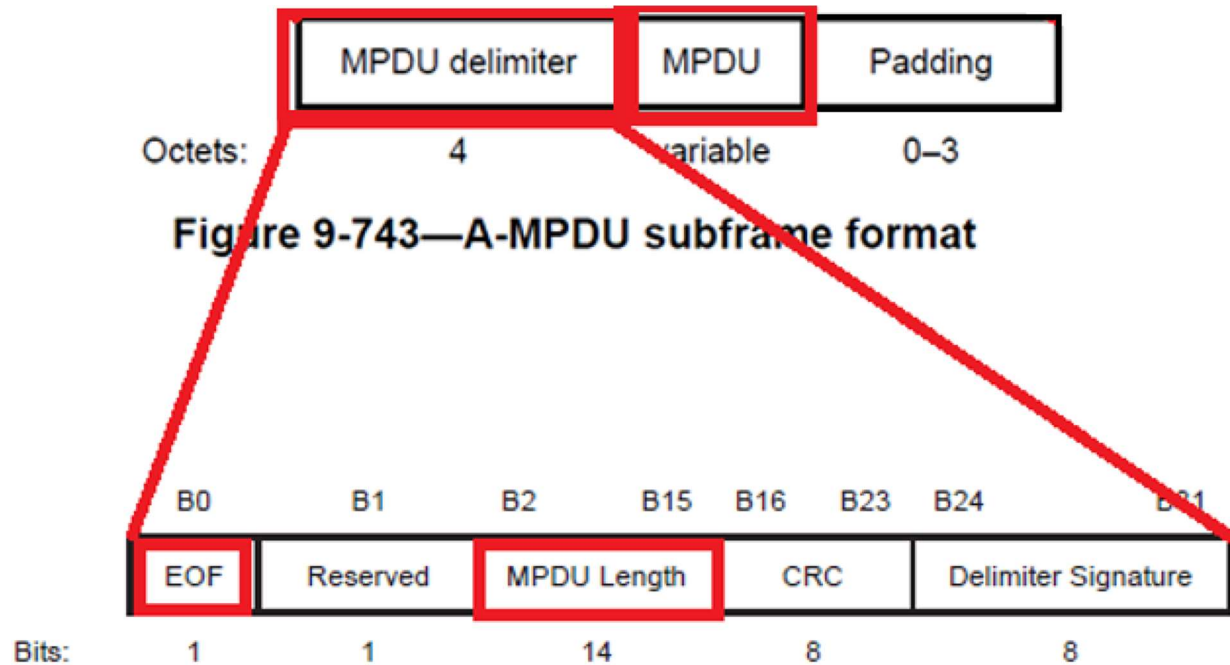


**Figure 9-744—MPDU delimiter (non-DMG)**

SAMSUNG-1009, FIGS. 9-743, 9-744.

[1g]

The IEEE-D3 describes and/or suggests that, in response to the PPDU (including the HT PPDU or the VHT PPDU), the non-AP STA or AP generates and *transmits* a response frame. For instance, as described above with respect to [1c] and [1d], the IEEE-D3 describes different acknowledgement response contexts for the recipient (e.g., non-AP STA or AP), which indicates that the non-

AP STA or AP receives the PPDU (containing A-MPDU) and responds with corresponding response frames. *See* SAMSUNG-1009, 1292-1295 (1291-1294), Tables 9-424-429. SAMSUNG-1003, ¶177.

The IEEE-D3 explains that, in some cases, (1) the STA (which can be AP STA or non-AP STA) “also needs to transmit one of the following immediate response frames: Ack, BlockAck frame with a TID for which an HT-immediate block ack agreement exists,” (2) “Ack frame is transmitted in response to an MPDU [within A-MPDU of PPDU] that requires an Ack frame” and (3) in the context of VHT single MPDUs (which correspond to the claimed *A-MPDU* as described above with respect to discussion of [1h] in the first ground), “[t]he addressed recipient returns an Ack . . . after a short interframe space (SIFS) period.” *See* SAMSUNG-1009, 1292 (1291), 1295 (1294) (disclosing Tables 9-424, 9-428), 651-652 (650-651) (disclosing Table 9-9), 1319 (1318); SAMSUNG-1003, ¶178.

Thus, the IEEE-D3 describes transmitting a response frame in response to the PPDU, rendering obvious feature [1g]. SAMSUNG-1003, ¶179.

#### **[1h]**

As described above with respect to the feature [1h] of the first ground, the claimed A-MPDU corresponds to the S-MPDU or VHT S-MPDU in the Ack

response context—one of the three different response contexts—according to the specification of the '926 Patent. *See supra* III.A.6.[1h].

Similarly, the IEEE-D3 describes the Ack context in which, for example, the received S-MPDU or VHT S-MPDU has EOF = 1 and length  $\neq$  0, with Ack policy bits set to “00” that indicates Normal Ack or Implicit Block Ack request. Under these conditions, the corresponding response frame is an Ack frame. SAMSUNG-1009, 1319 (1318), 1290 (1289), Table 9-422, 1371 (1370); SAMSUNG-1003, ¶181.

In particular, the IEEE-D3 defines “VHT single MPDU” as an “MPDU that is the only MPDU in an *A-MPDU* and that is carried in an *A-MPDU subframe* with 1 in the *EOF field*.” SAMSUNG-1009, 170 (169), 1371 (1370); *see also supra* Section III.A.6.[1h]. Moreover, as explained by Dr. Mahon, the MPDU length indicated by a *length field* of MPDU delimiter of VHT single MPDU is nonzero since there is MPDU present. SAMSUNG-1003, ¶¶182, 101 (*citing* SAMSUNG-1005, 132 (106), SAMSUNG-1009, 1290 (1289), SAMSUNG-1020, 145 (115)).

Further, the IEEE-D3 explains that, in the context of VHT single MPDU (having EOF = 1 and length  $\neq$  0), corresponding policy value is set to “00” (“*the Ack policy information*”), and the resulting response frame is an “*Ack frame*.” *See* SAMSUNG-1009, 1371 (1370) (noting that for VHT single MPDU, “[d]ata

frame could indicate an Ack Policy of ‘Normal Ack’, which solicits an Ack frame immediate response”), 651 (650), Table 9-9 (disclosing that policy bits of “00” indicate either “Normal Ack or Implicit Block Ack Request” and in the context of VHT single MPDU, “Ack [response] frame” is triggered), 1319 (1318) (explaining that an “*Ack frame*” might be sent in immediate response to a VHT single MPDU”), 1290 (1289), Table 9-422 (describing that length is non-zero when there is MPDU present and that EOF is “[s]et to 1 in the MPDU delimiter of a VHT single MPDU”); *see* SAMSUNG-1012, 9-10 (corroborating the definition of VHT single MPDU). SAMSUNG-1003, ¶182

Accordingly, the IEEE-D3 discloses or suggests that the “*Ack frame*” is determined as a response frame when the A-MPDU corresponds to the VHT S-MPDU, which is (1) a single standalone MPDU (“*a type of the MPDU* with EOF = 1 (“*EOF field*”) and length  $\neq$  0 (“*length field*”), and (2) has corresponding policy value or bits [“*the policy information*”] of “00,” that solicits Ack or Implicit BlockAck. SAMSUNG-1003, ¶183.

Thus, IEEE-D3 renders obvious feature [1h]. SAMSUNG-1003, ¶184.

[1i]

The IEEE-D3 explains that when multiple QoS Data frames—each of which corresponds to an MPDU—share the same TID under an HT-immediate block acknowledgment agreement, they are acknowledged using a compressed BlockAck

frame. SAMSUNG-1009, 153 (152), 1292-1293 (1291-1292), 651 (650);  
SAMSUNG-1003, ¶186.

As an initial matter, the HT-immediate block acknowledgment response corresponds to the claimed “*compressed BlockAck frame*.” For instance, the IEEE-D3 defines HT-immediate block acknowledgment as “[a]n immediate block ack mechanism that requires the use of the *compressed BlockAck frame* and an implicit block ack request.” SAMSUNG-1009, 153 (152); SAMSUNG-1003, ¶187.

Moreover, the IEEE-D3 explains that HT-immediate block acknowledgment mechanism applies “if the preceding PPDU [received PPDU] contains an implicit or explicit block ack request for a TID [“*one TID among an one or more TIDs*”] for which an **HT-immediate block ack agreement** exists,” and that in such cases, “at most one BlockAck frame [“*compressed BlockAck frame*”] for **this TID**” is transmitted. SAMSUNG-1009, 1293-1295 (1292-1294), Table 9-425, Table 9-428; SAMSUNG-1003, ¶188.

Additionally, the IEEE-D3 confirms that under this **HT-immediate block ack agreement**, “QoS Data frames [*MPDUs*] with [“*corresponding to*”] the same TID [“*one TID among an one or more TIDs*”]” are acknowledged.” SAMSUNG-1009, 1292-1295 (1291-1294); SAMSUNG-1003, ¶189.

Thus, the IEEE-D3 renders obvious [1i]. SAMSUNG-1003, ¶190.

**(ii) Claim 8**

**[8pre]**

*See* Section III.B.2.(i).[1pre].

**[8a]**

*See* Section III.B.2.(i).[1c].

**[8b]**

*See* Section III.B.2.(i).[1d].

**[8c]-[8d]**

*See* Section III.B.2.(i).[1e]-[1f].

**[8e]**

*See* Section III.B.2.(i).[1g].

**[8f]**

*See* Section III.B.2.(i).[1h].

**[8g]**

*See* Section III.B.2.(i).[1i].

**IV. TRIAL SHOULD BE INSTITUTED**

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.

**V. PAYMENT OF FEES – 37 C.F.R. § 42.103**

Petitioner authorizes the Patent and Trademark Office to charge Deposit Account No. 06-1050 for the fee set in 37 C.F.R. § 42.15(a) for this Petition and further authorizes payment for any additional fees to be charged to this Deposit Account.

**VI. CONCLUSION**

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

**VII. 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)**

Patent Owner has asserted the '926 Patent in the following civil actions against:

- Samsung Electronics Co., LTD., et al., 2-25-cv-00070 (EDTX);  
SAMSUNG-1016, 42.
- HP Inc., 2-25-cv-00069 (EDTX).
- Askey Computer Corp., 2-24-cv-00766 (EDTX).

Petitioner is not aware of any disclaimers, reexamination certificates or IPR petitions for the '926 Patent.

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

Petitioner provides the following designation of counsel.

| Lead Counsel                                                                                                                                                                                                                                     | Backup 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 [IPR39843-0203IP1@fr.com](mailto:IPR39843-0203IP1@fr.com) (referencing No. 39843-0203IP1 and cc'ing [PTABInbound@fr.com](mailto:PTABInbound@fr.com)).

Attorney Docket No.: 39843-0203IP1  
IPR of U.S. Patent No. 11,664,926  
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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 13,917 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated June 24, 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 24, 2025, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided by Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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