

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent of:	Woojin Ahn, et al.	Attorney Docket No. 39843-0199IP1
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Filing Date:	July 23, 2021	
Title:	WIRELESS COMMUNICATION METHOD USING ENHANCED DISTRIBUTED CHANNEL ACCESS, AND WIRELESS COMMUNICATION TERMINAL USING SAME	

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**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT 11,516,879 PURSUANT TO
35 U.S.C. §§ 311–319, 37 C.F.R. § 42**

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EXHIBITS

SAMSUNG-1001	U.S. Patent No. 11,516,879 to Ahn, et al. (“the ‘879 Patent”)
SAMSUNG-1002	Excerpts from the Prosecution History of the ‘879 Patent (“the Prosecution History”)
SAMSUNG-1003	Declaration and Curriculum Vitae of Matthew Valenti, Ph.D.
SAMSUNG-1004	U.S. Pub. No.: 2017/0202023 (“Zhou”)
SAMSUNG-1005	Provisional Patent Application No. 62/278,268 (“Zhou-Prov”)
SAMSUNG-1006	U.S. Pub. No.: 2017/0325264 (“Cherian”)
SAMSUNG-1007	Provisional Patent Application No. 62/333,745 (“Cherian-Prov”)
SAMSUNG-1008	U.S. Pub. No.: 2018/0034595 (“Kim”)
SAMSUNG-1009	U.S. Pub. No.: 2018/0352572 (“Cariou”)
SAMSUNG-1010	U.S. Patent No.: 9,197,482 (“Bharghavan”)
SAMSUNG-1011	Complaint, <i>Wilus Institute of Standards and Technology Inc., v. Samsung Electronics Co., Ltd., et al.</i> , 2-24-cv-00765 (EDTX) filed September 20, 2024
SAMSUNG-1012	IEEE-802.11-16/1180r0
SAMSUNG-1013	Excerpts from the Prosecution History of U.S. Patent 11,116,035
SAMSUNG-1014	ADS for Zhou-Prov Provisional Patent Application No. 62/278,268

SAMSUNG-1015	ADS for Cherian-Prov Provisional Patent Application No. 62/333,745
SAMSUNG-1016	<i>CWAP: Certified Wireless Analysis Professional, Official Study Guide</i> , McGraw Hill, 2004.
SAMSUNG-1017	<i>802.11: Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Standard</i> , IEEE Computer Society, 2012
SAMSUNG-1018	U.S. Pub. No.: 2010/0195664 (“Ho”)
SAMSUNG-1019	Patent Trial and Appeal Board (PTAB) Boardside Chat: Interim Processes Relating to institution in AIA Proceedings (Apr. 17, 2025)
SAMSUNG-1020	Coke Morgan Stewart, Interim Processes for PTAB Workload Management (Mar. 26, 2025)
SAMSUNG-1021	Stipulation
SAMSUNG-1022	IEEE 802.11-16/0024r1

LISTING OF CHALLENGED CLAIMS

Claim 1	
[1pre]	A wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the wireless communication terminal comprising:
[1.1]	a transceiver; and a processor, wherein the processor is configured to:
[1.2]	receive, from the base wireless communication terminal, a trigger frame using the transceiver, wherein the trigger frame triggers a orthogonal frequency division multiple access (OFDMA) uplink transmission of the wireless communication terminal,
[1.3]	transmit, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) in response to the trigger frame using the transceiver,
[1.4]	switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal,
[1.5]	when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends,
[1.6]	when the MPDU included in the trigger-based PPDU requests an immediate response, set the second parameter set timer for the access category of the MPDU for which immediate response is received,
[1.7]	when the second parameter set timer expires, terminate an application of the second parameter set, and
[1.8]	access a channel according to a priority of data to be transmitted to the base communication terminal by the wireless communication terminal and the parameter set.
Claim 2	
[2]	The wireless communication terminal of claim 1, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.
Claim 3	

[3]	The wireless communication terminal of claim 1, wherein the processor is configured to receive a beacon frame from the base wireless communication terminal and obtain information indicating a period of the second parameter set timer from the beacon frame.
Claim 4	
[4pre]	The wireless communication terminal of claim 1, wherein the processor is configured to calculate a random integer value within a contention window (CW),
[4.1]	set a backoff timer based on the random integer value, and
[4.2]	access the channel based on the back off timer and a predetermined slot time,
[4.3]	wherein the parameter set comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW.
Claim 5	
[5Pre]	The wireless communication terminal of claim 1, wherein the processor is configured to calculate a random integer value in a contention window (CW),
[5.1]	set a backoff timer based on the random integer value,
[5.2]	access the channel based on the back off timer and a predetermined slot time, and
[5.3]	if a value of the CW is greater than the maximum value (CWmax) of the CW according to a priority of the data to be transmitted, sets the value of the CW to the CWmax.
Claim 6	
[6pre]	The wireless communication terminal of claim 1, wherein the processor is configured to operate a plurality of queues that are classified according to an access category of data stored in a queue and performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of queues, and
[6.1]	when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, perform no operation at a slot boundary of the backoff timer,
[6.2]	wherein the backoff timer is set based on a random integer value calculated in a contention window (CW), and is reduced when the channel is idle for a predetermined slot time.

Claim 7	
[7]	The wireless communication terminal of claim 1, wherein when there is no data stored in the queue and the backoff timer corresponding to the queue is 0, the processor is configured to maintain the backoff timer to be 0.
Claim 8	
[8pre]	An operation method of a wireless communication terminal that wirelessly communicates with a base wireless communication terminal, the method comprising:
[8.1]	receiving, from the base wireless communication terminal, a trigger frame; wherein the trigger frame triggers a orthogonal frequency division multiple access (OFDMA) uplink transmission of the wireless communication terminal,
[8.2]	transmitting, to the base wireless communication terminal, a trigger-based physical layer protocol data unit (PPDU) in response to the trigger frame;
[8.3]	switching a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal;
[8.4]	when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request the immediate response, setting a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends;
[8.5]	when the MPDU included in the trigger-based PPDU requests the immediate response, setting the second parameter set timer for the access category of the MPDU for which immediate response is received;
[8.6]	when the second parameter set timer expires, terminating an application of the second parameter set;
[8.7]	accessing a channel according to a priority of data to be transmitted to the base wireless communication terminal and the parameter set; and
[8.8]	transmitting the data through the channel.
Claim 9	

[9]	The method of claim 8, wherein the MPDU included in the trigger-based PPDU is a QoS data frame.
Claim 10	
[10]	The method of claim 8, the method further comprising: receiving a beacon frame from the base wireless communication terminal; and obtaining information indicating a period of the second parameter set timer from the beacon frame.

I. INTRODUCTION

Samsung Electronics Co., Ltd. (“Petitioner”) petitions for *Inter Partes* Review (“IPR”) of claims 1-10 (“the Challenged Claims”) of U.S. Patent No. 11,516,879 (“the ‘879 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.

II. REQUIREMENTS FOR IPR

A. Grounds for Standing

Petitioner certifies that the ‘879 Patent is available for IPR. This petition is being filed within one year of service of a complaint against Petitioner. Petitioner is not barred or estopped from requesting review of the Challenged Claims on the below-identified grounds.

B. Challenge and Relief Requested

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

SAMSUNG-1003, 0024-0025, 0110, 0216-0217.

Ground	Claim(s)	35 U.S.C. §102/103
1	1-3, 8-10	Zhou, Cherian, Kim
2	4-5	Zhou, Cherian, Kim, Ho
3	6-7	Zhou, Cherian, Kim, Bharghavan

As shown in the table below, all references presented in this Petition pre-date September 7, 2016 and, thus, constitute prior art.

Reference	Filing Date
Zhou Pub. No.: US 2017/0202023	January 13, 2016
Cherian Pub. No.: US 2017/0325264	May 9, 2016
Kim Pub. No.: US 2018/0034595	January 29, 2016
Ho Pub. No.: US 2010/0195664	January 29, 2010
Bharghavan U.S. Patent No. 9,197,482	December 29, 2009

1. Dynamic Drinkware Analysis

AIA §§102(a)(2) and 102(d) do not require *Dynamic Drinkware* analysis of Zhou and Cherian, because “under the AIA, a reference patent document need only meet the ‘ministerial requirements’ of §§ 119 and 120, and the provisional ... to which the reference patent document claims a right of priority must ‘describe[] the subject matter’ relied upon in the reference patent document as prior art.”

Penumbra, Inc. v. Rapidpulse, Inc., IPR2021-01466, Paper 34, 32, 28-35 (PTAB March 10, 2023) (precedential).

a. Zhou

Zhou claims priority to Provisional Patent Application No. 62/278,268

(SAMSUNG-1005) (“Zhou-Prov”) filed on January 13, 2016. Zhou properly claimed benefit of the provisional ((SAMSUNG-1004), (60)), was filed while copending with (SAMSUNG-1004, (22)), and shared common inventors (SAMSUNG-1004, (72)) with Zhou-Prov. SAMSUNG-1014; *see* AIA 35 U.S.C. §102(d); MPEP §2154.01(b). Thus, Zhou was effectively filed on January 13, 2016, and qualifies as prior art under AIA §102(b).

b. Cherian

Cherian claims priority to Provisional Patent Application No. 62/333,745 (SAMSUNG-1007) (“Cherian-Prov”) filed on May 9, 2016. Cherian properly claimed benefit of the provisional ((SAMSUNG-1006), (60)), was filed while copending with (SAMSUNG-1006, (22)), and shared common inventors (SAMSUNG-1006, (72)) with Cherian-Prov. SAMSUNG-1015; *see* AIA 35 U.S.C. §102(d); MPEP §2154.01(b). Thus, Cherian was effectively filed on May 9, 2016, and qualifies as prior art under AIA §102(b).

c. Support for Zhou and Cherian

Parallel citations to Zhou and Cherian’s respective provisional applications are included in Dr. Valenti’s Declaration, and Dr. Valenti testifies that a POSITA would have understood that the relied upon portions in these references are supported by their respective provisional applications. Petitioner notes that Zhou and Cherian explicitly incorporate the disclosures of the above provisional

applications by reference. *See* SAMSUNG-1004, 0001; SAMSUNG-1006, 0001; SAMSUNG-1003, 0074-0076.

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 statutory requirements, nor is Petitioner waiving any arguments concerning claim scope or grounds that can be raised only in district court.

D. Level of Ordinary Skill in the Art

For purposes of this IPR, a person of ordinary skill in the art (“POSITA”) would have had a bachelor’s degree in electrical engineering, computer engineering, computer science, or a related field, and at least 3 years of experience in the research, design or development of wireless communication devices, systems, and/or networks, or the equivalent, as of the Critical Date. SAMSUNG-1003, 0026-0028. Increased educational experience can make up for less work experience, and vice versa. *Id.*

E. Technology Background¹

A general technology background is provided in Dr. Valenti's declaration to explain the operations of contention-based transmissions using backoff timers and the scheduling of Uplink Multi-User transmissions using trigger frames.

SAMSUNG-1003, 0051-0066.

III. THE '879 PATENT

A. Brief Description

The '879 Patent is directed to "a wireless communication terminal that communicates wirelessly" with a base communication terminal. SAMSUNG-1001, Abstract. The disclosure focuses on improving the efficiency of wireless communication, particularly in scenarios involving contention-based channel access and multi-user uplink (UL-MU) transmissions. SAMSUNG-1001, 11:20-32; SAMSUNG-1003, 0067.

The problem purportedly addressed by this patent is disclosed as arising particularly when multi-user uplink (UL-MU) transmissions are scheduled. SAMSUNG-1001, 10:24-31. In UL-MU transmission, a base station (e.g., a Wi-Fi access point) can allocate resources allowing multiple wireless terminals to transmit data to it simultaneously, often using technologies like Orthogonal

¹ An acronym table is provided as Appendix B to Dr. Valenti's Declaration.

Frequency-Division Multiple Access (OFDMA). SAMSUNG-1001, 11:3-32. A UL-MU transmission is useful when a large number of stations (STAs) need to transmit at the same time. *Id.*; SAMSUNG-1003, 0068. However, if a terminal continues to use its normal contention-based behavior during a scheduled UL-MU transmission, it could interfere with the coordination and reduce the overall efficiency of the transmission, including its interactions with other participating terminals. SAMSUNG-1001, 11:33-52.

The proposed solution involves a wireless communication terminal dynamically adapting its channel access behavior based on whether it is scheduled to participate in a multi-user uplink transmission. SAMSUNG-1001, 36:57-37:9. This involves establishing two sets of channel access parameters, a set of “legacy” parameters, which are suitable for conditions without UL-MU transmissions and a set of MU parameters for use when the STA is scheduled for UL-MU transmissions. SAMSUNG-1001, 12:38-43, 30:27-28. A stated goal is to make a terminal that is scheduled for UL-MU transmission use the MU parameters that, to prevent collisions, cause a STA to be less aggressive in its contention for the channel. SAMSUNG-1001, 12:35-62 SAMSUNG-1003,0069.

To ensure the less aggressive MU EDCA parameters are not used indefinitely, which if allowed would result in delayed contention-based transmissions, the patent describes the use of MU EDCA timers. SAMSUNG-

1001, 19:43-61, 22:49-64. These timers can be utilized based on events like receiving a trigger frame. *Id.* When the timer expires, the terminal may revert to its “legacy” EDCA parameters, thereby reverting to “legacy” contention-based timing. SAMSUNG-1001, 21:62-22:48, 24:59-25:31. Consequently, the system configured in such a manner is disclosed as providing the advantage(s) of reducing the number of contention-based collisions when stations receive indication (via a trigger frame) of a multi-STA uplink (UL-MU transmission). SAMSUNG-1001, 19:46-20:16; SAMSUNG-1003, 0070.

B. Prosecution History

During prosecution of the '879 Patent, no claim rejections were made. Rather, the application was allowed following an examiner interview discussing some formalities, and the cancellation of two dependent claims by examiner's amendment. SAMSUNG-1002, 40, 1590.

During prosecution of the '879 Patent's parent application², a non-final rejection issued rejecting certain claims as being obvious over various combinations of Cherian, IEEE (SAMSUNG-1012), Zhou, Liu, and Baron. SAMSUNG-1013, 732-737; SAMSUNG-1003, 0072.

In response, Applicant amended claims to include two “when” clauses,

² Application No. 16/294,883, which issued as Patent No. 11,160,035.

which correspond to elements [1.5] and [1.6] in the Petition. These two “when” clauses will be explained in more detail in the analysis of the prior art, but each describes conditions for actions taken based on two separate, mutually exclusive conditions. SAMSUNG-1013, 700-712; SAMSUNG-1003, 0071-0073.

IV. THE CHALLENGED CLAIMS ARE UNPATENTABLE

A. [GROUND 1] – Claims 1-3, 8-10

1. Overview of Zhou

Zhou describes methods and apparatus for selecting enhanced distributed channel access (EDCA) parameters for different stations in a wireless communication system and, in that regard, is analogous to the '879 Patent.

SAMSUNG-1005, Title, 0001, 0010. Zhou acknowledges that wireless networks often rely on the carrier sense multiple access (CSMA) mechanism for channel access, where devices sense the medium for idleness before transmitting.

SAMSUNG-1005, 0032. However, Zhou teaches that, in dense network environments, relying on idleness sensing can lead to inefficiencies, increased latency, and reduced throughput. SAMSUNG-1005, 0033. The increasing demand for bandwidth and the growing number of active wireless devices exacerbate these issues. SAMSUNG-1005, 0033; SAMSUNG-1003, 0077.

To overcome these challenges, especially with the advent of technologies allowing multiple stations (STA) to communicate simultaneously with a single access point (AP) via multi-user (MU) transmissions (such as MU-MIMO and UL-

OFDMA for uplink (UL) communications), Zhou proposes a system for selecting and signaling enhanced distributed channel access (EDCA) parameters to different STAs. SAMSUNG-1005, 0051; SAMSUNG-1003, 0078. Zhou teaches the use of UL-MU transmissions (often associated with newer standards like 802.11ax) in combination with the EDCA parameters. SAMSUNG-1005, 0011.

Zhou teaches that an AP could select different EDCA parameters, such as shorter transmission opportunity (TXOP) limits and/or larger minimum contention windows (CW_{min}) for STAs operating in different modes (UL-MU or UL-SU). SAMSUNG-1005, 0010-0011, 0043, FIG. 5; SAMSUNG-1003, 0079. This adjustment aims to allow UL-MU enabled STAs to organize UL-MU transmissions in a more fair and efficient manner than legacy EDCA parameters used in legacy transmissions. *Id.*

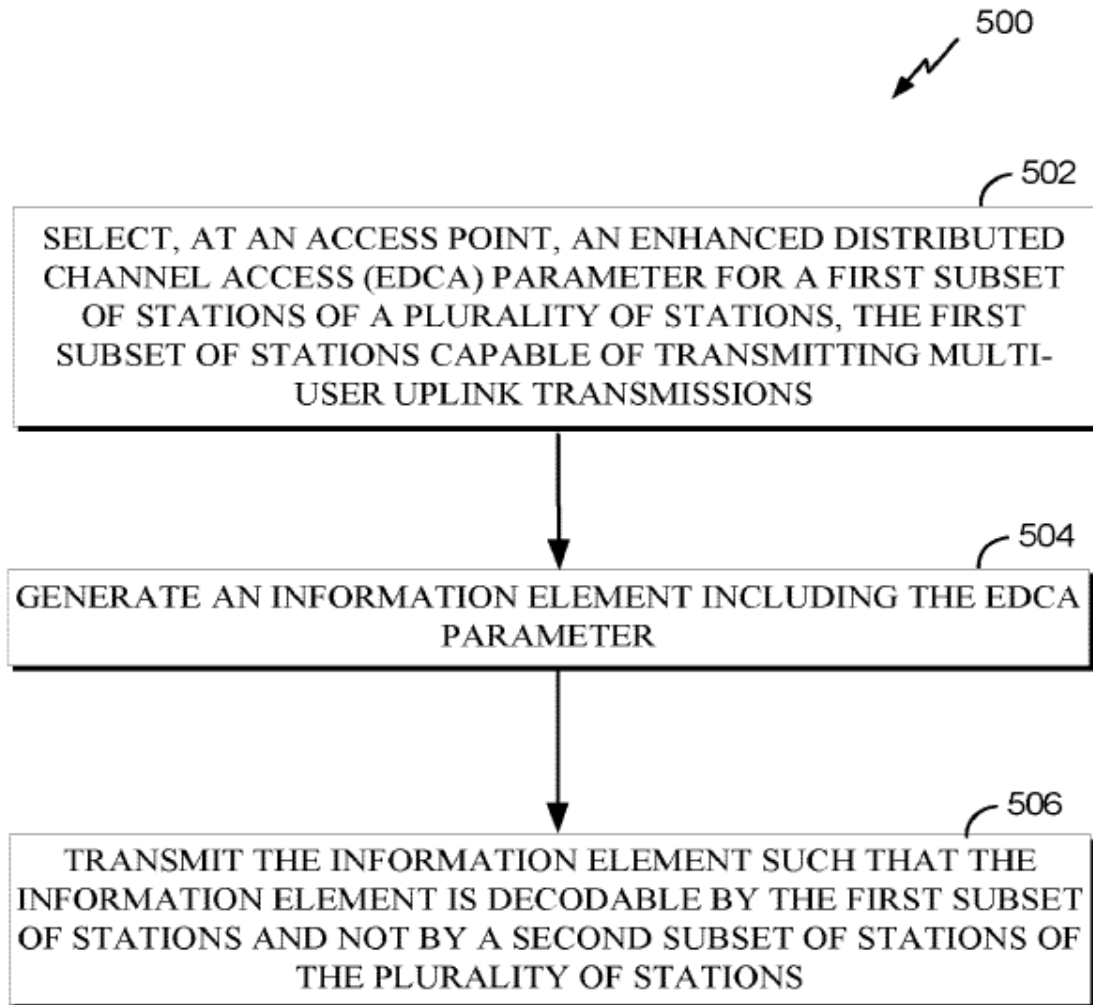


FIG. 5

SAMSUNG-1004, FIG. 5.

2. Overview of Cherian

Analogous to the '879 Patent, Cherian addresses challenges in wireless communication systems exacerbated by increased demand for bandwidth and the deployment of next-generation standards like IEEE 802.11ax. SAMSUNG-1007, 0002, 0014; SAMSUNG-1003, 0080. Cherian's advancements aim to allow multiple user terminals to communicate with a single access point by sharing channel resources, often utilizing technologies like Multiple-Input Multiple-Output (MIMO). *Id.* While these multi-user (MU) modes promise higher throughput, Cherian focuses on the intricacies of devices transitioning between traditional single-user (SU) operation and the more efficient MU modes. SAMSUNG-1007, Title, 0005, 0016-0017, 0026. Cherian recognizes that, in dense network environments, the conventional Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) mechanism used for channel access in single user (SU) mode can become inefficient, leading to increased delays and reduced per-user throughput. SAMSUNG-1007, 0041-0045.

To improve performance, especially in scenarios supporting both SU and MU operations, Cherian's disclosure centers around managing the backoff procedures of a station (STA) as it switches EDCA parameters between these modes. SAMSUNG-1007, 0005, 0017, 0026, 0041-0042, 0052. A backoff procedure, effectively an enforced random delay before transmission, is used in a

WLAN to manage multiple transmissions by sensing when the channel is free.

SAMSUNG-1007, 0005, 0015; SAMSUNG-1003, 0081. Cherian highlights that STAs might operate in SU mode by default and then transition to MU mode upon receiving a trigger frame from an access point (AP). SAMSUNG-1007, 0047, 0052-0053, 0058, 0066, 0068. However, Cherian recognizes that a STA in MU mode might need to revert to SU mode if it fails to receive subsequent trigger frames from the AP within a certain timeframe. SAMSUNG-1007, 0049, 0055, 0058, FIG. 4.

Furthermore, Cherian discloses a MU EDCA Parameter Set element, which is used by the AP to provide quality of service (QoS) related parameters (e.g., EDCA parameters) for MU operation. SAMSUNG-1007, 0042, 0060-0064, FIG. 5. Cherian also describes how STAs may update their EDCA parameters based on the received MU EDCA Parameter Set elements and the expiration of timers related to MU operation. SAMSUNG-1007, 0065-0066. Ultimately, Cherian aims to optimize transmissions by intelligently managing backoff procedures, thereby improving overall wireless network efficiency and throughput, especially in dense deployment scenarios utilizing advanced 802.11 standards. SAMSUNG-1007, 0041-0042; SAMSUNG-1003, 0082.

3. Overview of Kim

Kim teaches a method for transmitting and receiving acknowledgement (ACK) or negative-acknowledgement (NACK) signals in a Wireless LAN (WLAN) system based on an ACK policy and is analogous to the '879 Patent. SAMSUNG-1003, 0083. This is particularly relevant in scenarios involving Uplink (UL) Multi-User (MU) transmission schemes, where an Access Point (AP) receives data from multiple stations (STAs) simultaneously because collisions may occur and each STA can ensure their respective transmissions were received through acknowledgments. *Id.*; SAMSUNG-1008, 0004-0006.

Kim discusses using different ACK policies in a STA to control how an AP responds to data received from the STAs. SAMSUNG-1008, 0007-0015. Notably, Kim details an ACK policy field within the QoS control field of a UL-MU frame, which uses 2 bits to indicate four different ACK policy values (Normal ACK, no ACK, PSMP ACK, or Block ACK). SAMSUNG-1008, 0094, Tables 6-9; SAMSUNG-1003, 0084.

Kim includes discussion of trigger frames transmitted by the AP that initiate the UL-MU transmission, and the subsequent ACK/NACK procedures are governed by the ACK policy set by the transmitting STAs. SAMSUNG-1008, 0096, 0102; SAMSUNG-1003, 0085.

4. Combination of Zhou-Cherian-Kim

The interrelated and analogous teachings of Zhou, Cherian, and Kim regarding wireless communication, compliant with IEEE 802.11ax, demonstrate a recognized need to optimize resource sharing among multiple user STAs communicating with a single AP. SAMSUNG-1005, 0004-0005; SAMSUNG-1007, 0002-0004, 0014; SAMSUNG-1003, 0091. Traditional single-user channel access mechanisms, such as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), can become inefficient in dense network environments and when dealing with devices having varying capabilities. SAMSUNG-1005, 0032-0034; SAMSUNG-1007, 0015, 0041-0044. Recognizing this, a POSITA would have been aware of ongoing efforts to enhance network performance by managing both channel access parameters and transitions between different operational modes, either of which can exacerbate the above-noted inefficiencies. SAMSUNG-1005, 0001-0004; SAMSUNG-1007, 0002-0004, 0014; SAMSUNG-1003, 0091. In view of the disclosures of Zhou, Cherian, and Kim, a POSITA would have understood the relevance of needed improvements to both channel access mechanisms and the management of transitions between single-user (SU) and multi-user (MU) operation are relevant considerations. SAMSUNG-1005, 0004-0005; SAMSUNG-1007, 0002, 0045-0046; SAMSUNG-1003, 0091.

Consequently, a POSITA would have found it logical to consider the

teachings of both the Zhou and Cherian references in combination. SAMSUNG-1003, 0092. Zhou discloses methods and apparatuses for selecting channel access parameters (specifically, EDCA parameters) for stations having differing device capabilities, and, in doing so, differentiating between those stations capable of multi-user uplink (UL-MU) transmissions and those that are not. SAMSUNG-1005, 0061, 0064; SAMSUNG-1007, 0058, 0060-0064. Similarly, Cherian focuses on the transitions between SU and MU modes, highlighting the need to manage backoff procedures for efficient operation in both scenarios. SAMSUNG-1007, 0005, 0065-0066.

A POSITA seeking to optimize wireless network performance in environments supporting both SU and MU operation would naturally have sought ways to integrate the concepts of (i) tailoring channel access parameters based on device capabilities (Zhou), (ii) ensuring smooth and efficient transitions between operating modes through intelligent backoff management (Cherian), and (iii) ensuring transmissions were effectively communicated between APs and STAs with acknowledgement policies (Kim). SAMSUNG-1003, 0093 This combined approach would aim to create a more holistic solution for improving throughput and reducing delays in modern wireless networks.

Specifically, a POSITA would have been motivated by at least the following factors: First, a POSITA would have been motivated to optimize transitions

between SU and MU Modes. SAMSUNG-1003, 0094-0095. Zhou discusses the use of EDCA parameters to manage contention-based communications in a wireless network. SAMSUNG-1005, 0046-0048. Cherian focuses on transitions between EDCA parameters for the SU and MU modes. SAMSUNG-1007, 0050-0053. Specifically, Cherian discloses using EDCA parameter sets and EDCA parameter timers to control the duration in which the parameters are used. SAMSUNG-1007, 0050-0053, 0063, FIG. 4. Kim similarly illustrates using trigger frames to initiate a transition between UL-SU and UL-MU transmissions. SAMSUNG-1008, 0080-0081, 0096, Table 3. A POSITA recognizing the need for efficient mode transitions as highlighted by Cherian, would have been motivated to combine Zhou's architecture with Cherian's parameter sets and timer, and Kim's acknowledgement of the various transmissions. SAMSUNG-1003, 0095. Such a combination would have provided predictable solutions for devices moving between contention-based access parameters, thereby ensuring efficient channel utilization while preventing performance degradation during transitions between modes, a problem known in the field. SAMSUNG-1003, 0095.

Second, Zhou's recognition of the need for improved efficiency and decreased overhead would have motivated a POSITA to reduce wasted overhead in controlling the period of time a station uses particular EDCA parameters. SAMSUNG-1005, 0005; SAMSUNG-1003, 0096. In that regard,

Cherian teaches the exacting use of EDCA parameters and an EDCA parameter timer to precisely control the transition between transmission modes. SAMSUNG-1007, 0005, 0017, 0026, 0041-0042, 0052. And Kim describes specifics of controlling particular transmission modes based on whether acknowledgements are requested. SAMSUNG-1008, 0094, Tables 6-9. A POSITA looking to reduce the communications overhead of stations transitioning across various modes would have employed Cherian's directed EDCA parameters and EDCA parameter timer to efficiently switch the station back to SU mode after a period of time. Additionally, a POSITA would have been motivated to employ Kim's acknowledgement polices with said timer in a logical manner based on whether a STA is waiting for an acknowledgement. SAMSUNG-1003,0096.

Third, the combination would have addressed a known design need for robust wireless networks. The need for reliable and efficient data transfer in wireless LANs was a well-established design need. SAMSUNG-1003, 0097; SAMSUNG-1007, 0014-0017. A POSITA would have recognized that optimizing channel access (Zhou) and managing mode transitions (Cherian) are crucial for efficiency. *Id.* However, without a mechanism to more clearly define the periods of time in which the mode transmission occurs (Kim), the benefits of these optimizations could be undermined by inefficient practices. Therefore, incorporating an acknowledgement mechanism as disclosed by Kim was a logical

and necessary step to address the known need for robust communication in wireless LAN systems. SAMSUNG-1003, 0097. In other words, given the limited number of choices as to *when to set* Cherian's EDCA parameter set timer, it would have been obvious for a POSITA to try Kim's method of *when to use* a timer. As highlighted in *KSR*, "When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a [POSITA] has good reason to pursue the known options within his or her technical grasp".

Fourth, acknowledgement protocols (Kim) were a well-known and widely used technique in various communication systems, including wireless networks, to ensure reliable data delivery. SAMSUNG-1003, 0098. Because Zhou and Cherian disclose methods for enhancing channel access and managing mode transitions in a WLAN, it would have been an obvious adaptation of a standard technique to incorporate an acknowledgement mechanism, such as the contention-based acknowledgements described by Kim, to improve the overall reliability and quality of service of the proposed wireless communication methods. As stated in *KSR*, "if a technique has been used to improve one device, and a [POSITA] in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond that person's skill".

Fifth, the combination of Zhou, Cherian, and Kim offers a potential for

enhanced performance across multiple dimensions of a wireless LAN system—a well-recognized goal at the time. SAMSUNG-1003, 0099. Zhou focuses on optimizing channel access, Cherian addresses efficient transitions between communication modes, and Kim provides a means for using acknowledgement signals in such transmissions. Combining these would have predictably led to a system that is not only more efficient in utilizing the wireless medium but also more reliable in delivering data, representing a natural and obvious optimization strategy for a POSITA seeking to improve overall WLAN performance.

SAMSUNG-1003, 0099. The determination of obviousness considers the level of ordinary skill in the pertinent art, and such a POSITA—who is not an automaton—would have been motivated to pursue optimizations in both efficiency and reliability. *KSR*, 550 U.S., 421.

Drawing on the guidance in *KSR*, a POSITA would have possessed the common sense understanding that these aspects are interrelated and contribute to the overall performance of a WLAN. SAMSUNG-1003, 0100. For instance, while Zhou addresses efficient channel access and Cherian focuses on smooth mode transitions, the success of these mechanisms is linked to the reliable delivery of data—the same reliability sought through Kim’s disclosure of acknowledging transmissions. A POSITA, faced with the goal of improving WLAN performance, would logically have considered integrating techniques that enhance efficiency

(Zhou, Cherian) with those that ensure reliability (Kim). As *KSR* points out, a POSITA can often fit the teachings of multiple patents together like pieces of a puzzle, especially when the teachings address different facets of a common technological goal within the same field. The motivation to combine would stem from the known design need for robust and efficient wireless communication, and a POSITA would have readily recognized the predictable benefit of ensuring reliable data transfer in a system optimized for channel access and mode transitions.

5. Analysis

a. Claim 1

[1.0]³

Zhou-Cherian-Kim renders obvious [1.0]. SAMSUNG-1003, 0111. For example, Zhou discloses “wireless communication systems” that “allow multiple user terminals (UTs) [(*a wireless communication terminal*)] to communicate with a single access point [(*that wirelessly communicates with a base wireless communication terminal*)] by sharing the channel resources.” SAMSUNG-1005, 0001-0004. Zhou discloses through Figures 1-2 and related description, the

³ For the purposes of this petition, Petitioner does not concede that the preambles of the Challenged Claims are limiting.

composition of the “terminal” (*the wireless communication terminal comprising*), e.g., (STAs) employing various devices “configured to communicate via a wireless medium.” SAMSUNG-1005, 0023-0024, 0031. Example UT STAs include laptops, cellphones, and TVs. SAMSUNG-1005, FIG. 1.

More specifically, Zhou discloses the transmission of wireless signals “according to a high-efficiency 802.11 protocol using orthogonal frequency-division multiplexing (OFDM).” SAMSUNG-1005, 0020-0024; SAMSUNG-1003, 0112.

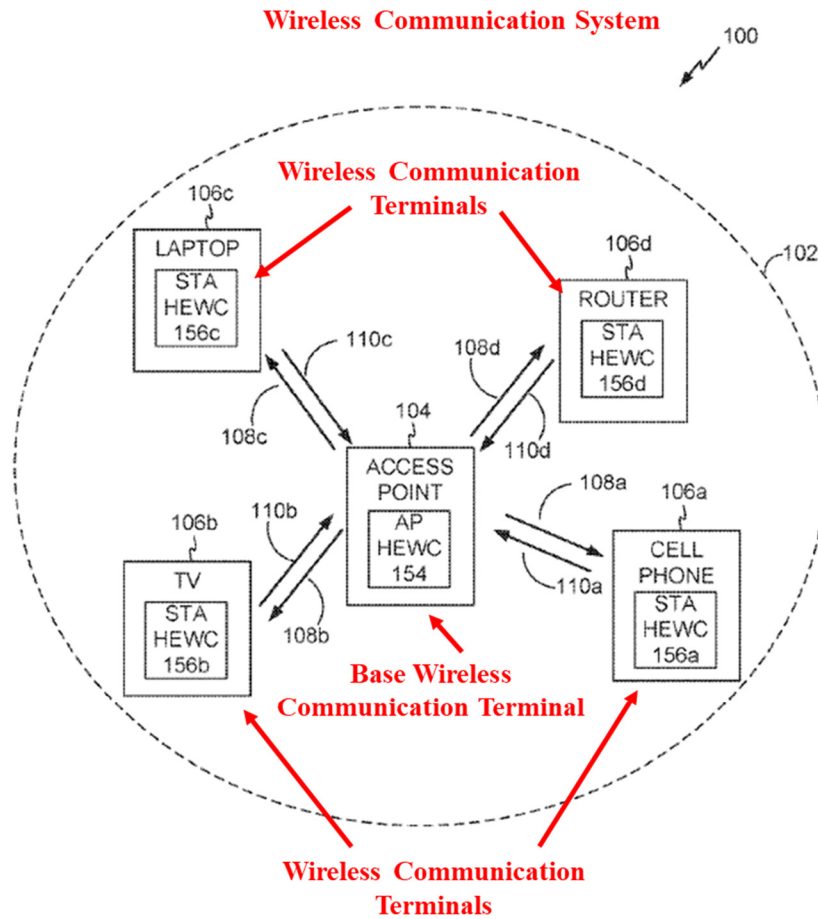


FIG. 1

SAMSUNG-1005, FIG. 1⁴.

Similarly, Cherian discloses a User Terminal (UT) (*[a] wireless communication terminal*) that wirelessly communicates with and Access Point (AP) (*a base wireless communication terminal*). SAMSUNG-1007, FIG. 1-2,

⁴ All figures are annotated in color unless otherwise noted.

0025 (“FIG. 1 illustrates a multiple-access multiple-input multiple-output (MIMO) system 100 with access points and user terminals.”); SAMSUNG-1003, 0113.

[1.1]

Zhou-Cherian-Kim renders obvious [1.1]. For example, Zhou discloses a “wireless device 202” as an example user terminal (wireless device 202) including “*a processor 204*” and “*a transceiver 214*.” SAMSUNG-1005, 0037-0038, 0040, 0045, FIG. 2; SAMSUNG-1003, 0114.

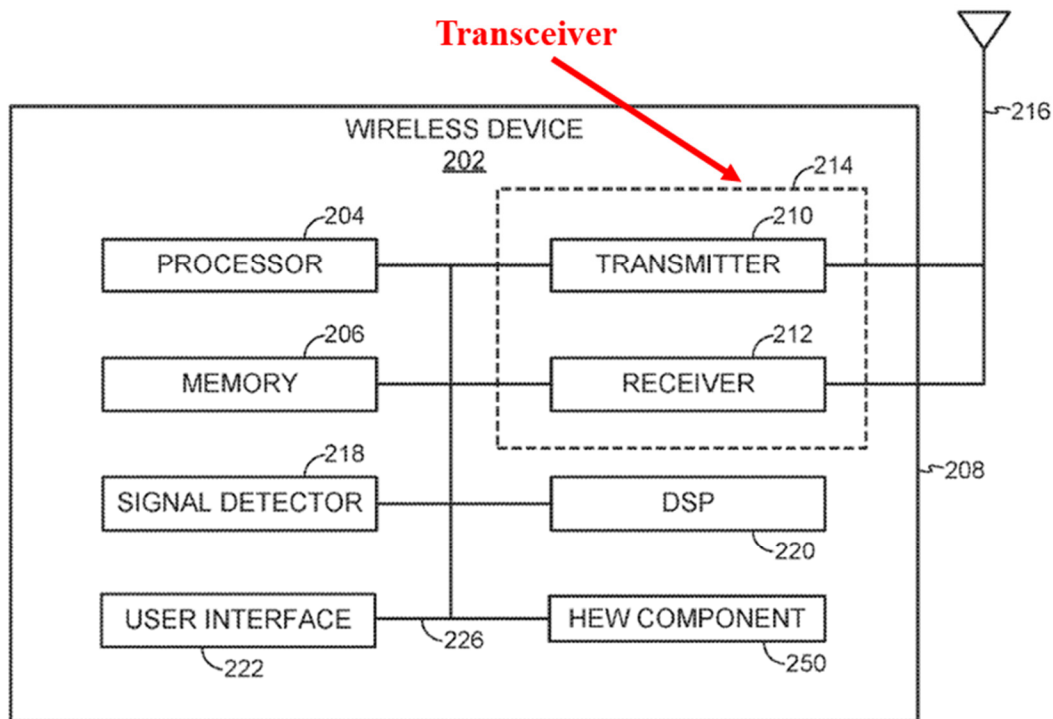


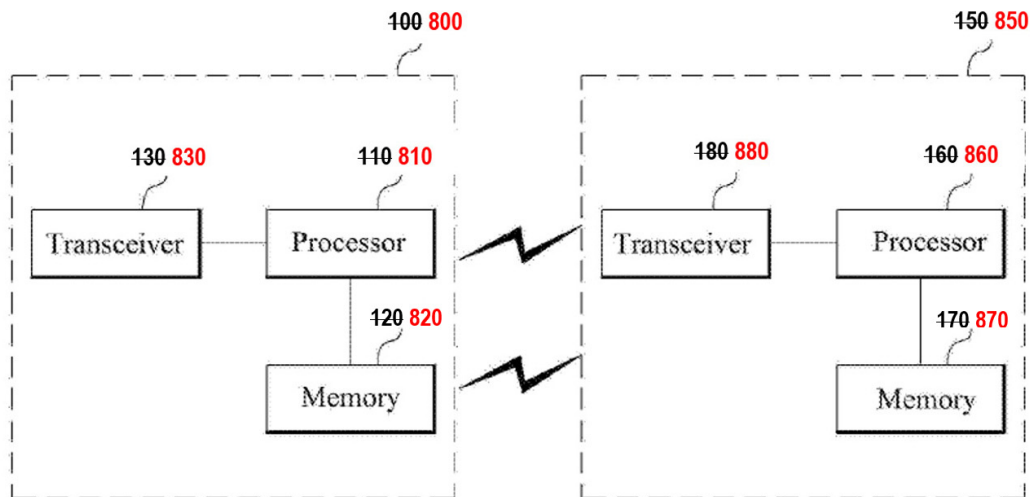
FIG. 2

SAMSUNG-1005, FIG. 2.

Cherian teaches that wireless communication terminals (Cherian’s UTs) include *a transceiver and a processor*. SAMSUNG-1007, FIG. 2, 0031, 0035,

0070-0072; SAMSUNG-1003, 0115.

Kim similarly describes a wireless communication terminal (STA or station 800) comprising at least processors and transceivers. SAMSUNG-1008, 0131-0134. “The *processors* 810 and 860 and/or the *transceivers* 830 and 880 may include an Application-Specific Integrated Circuit (ASIC), a chipset, a logical circuit, and/or a data processor.” SAMSUNG-1008, 0131-0134; SAMSUNG-1003, 0116.



SAMSUNG-1008, FIG. 27⁵.

⁵ As issued, Kim Fig. 27 has incorrect reference numerals. In the annotated version above, the original, incorrect reference numerals (**black**) are struck-

Zhou teaches that *the processor is configured to* “implement not only the functionality described above with respect to the processor 204, but also to implement the functionality described above with respect to the signal detector 218 and/or the DSP [digital signal processor] 220.” SAMSUNG-1005, 0041; SAMSUNG-1003, 0117. Zhou describes several various processes that the processor is “*configured to*” perform. SAMSUNG-1005, 0039 (“The instructions, when executed by the one or more processors, cause the processing system to perform the various functions described herein.”). SAMSUNG-1007, FIG. 2, 0031, 0070-0072.

Thus, Zhou-Cherian-Kim renders obvious that the wireless communication terminal comprises *a transceiver; and a processor, wherein the processor is configured to* perform the recited functions following “configured to:”. SAMSUNG-1003, 0118.

[1.2]

Zhou-Cherian-Kim renders obvious [1.2]. For example, Zhou discloses wireless communication between the access point (AP) and mobile stations (STA).

through, and the correct reference numerals (**red**) substituted in their place to match the corresponding prose description.

SAMSUNG-1005, 0048-0050. Specifically, Zhou teaches that “a UL-MU trigger frame [is] sent by the AP 104 [i.e., the claimed ‘*base wireless communication terminal*’] to the STAs [i.e., the claimed ‘*wireless communication terminal*’] 106c and 106d.” SAMSUNG-1005, 0048. Thus, the STAs *receive, from the base wireless communication terminal* (Zhou’s AP), *a trigger frame using the transceiver* (Zhou component 214). SAMSUNG-1003, 0119. A POSITA would have understood and found obvious that, given Zhou’s context and disclosure of (i) the APs and STAs communicating wirelessly, and (ii) the transceivers within both components, that signals, including the trigger frame, would have been received *using* Zhou’s *transceiver* 214. *See* [1.1]; SAMSUNG-1005, 0041, FIG. 1; SAMSUNG-1007, FIG. 2. SAMSUNG-1003, 0119.

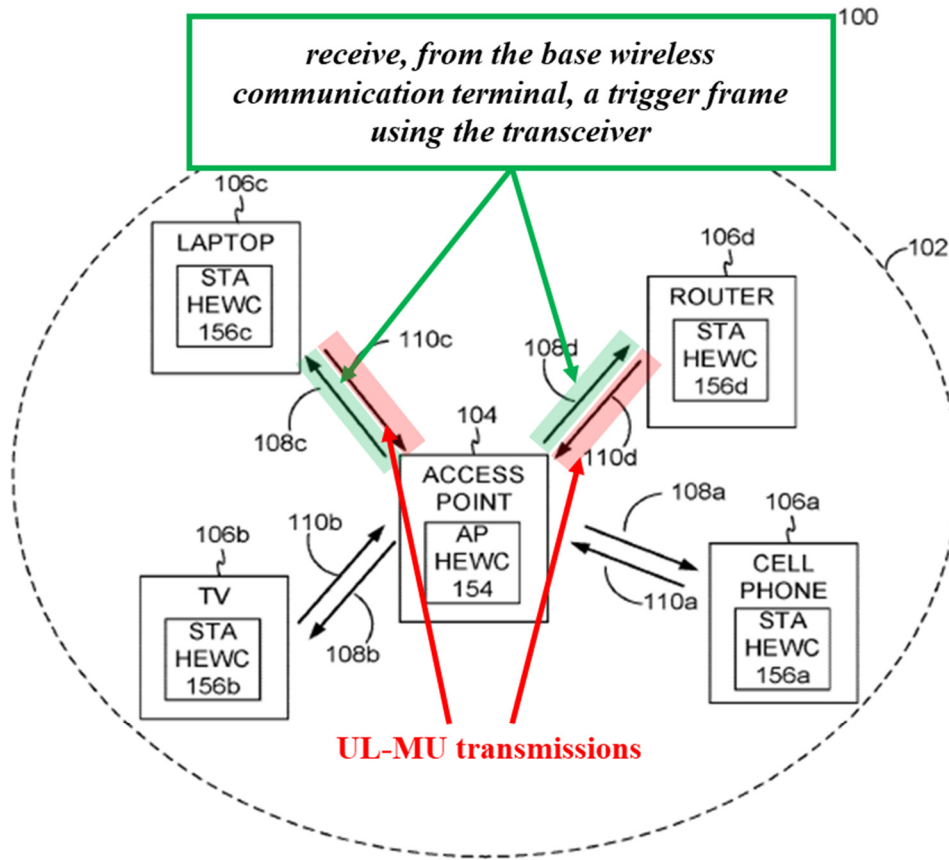


FIG. 1

SAMSUNG-1004, FIG. 1.

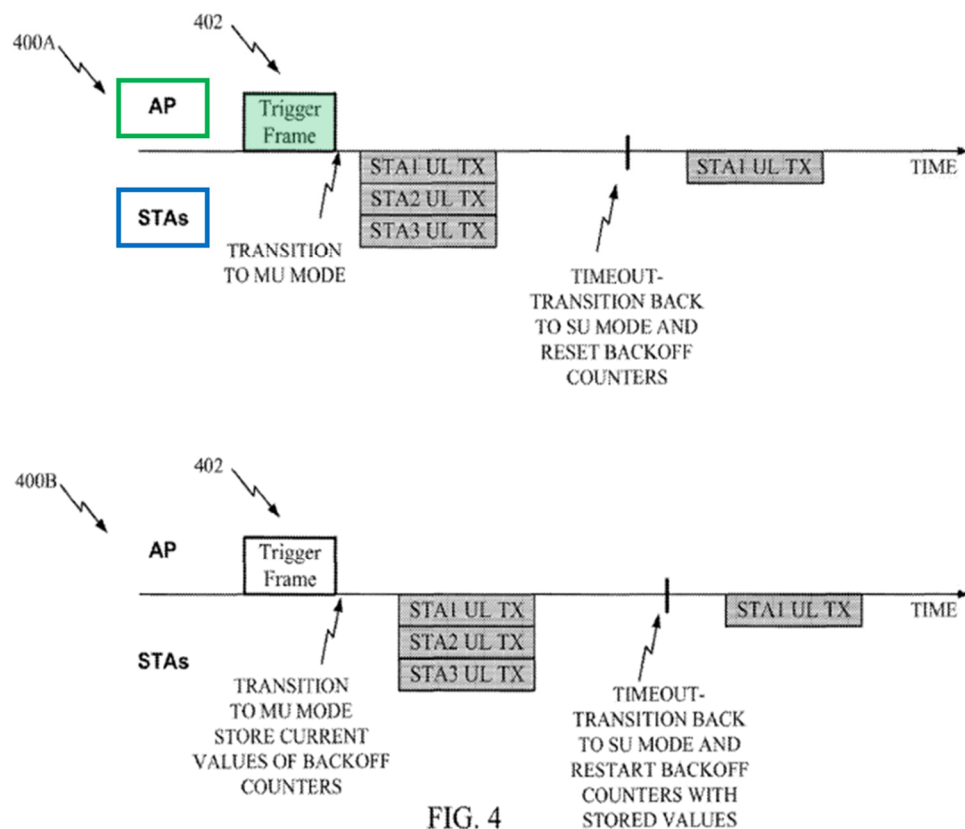
In Figure 1, Zhou teaches the STA's responsive transmission of "the UL-MU signals 110c and 110d (e.g., UL-MU-MIMO or UL-OFDMA transmissions) may be based on a UL-MU trigger frame sent by the AP 104 to the STAs 106c and 106d." SAMSUNG-1005, 0048. Thus, the UL-OFDMA signals or **OFDMA uplink transmissions** can be responsive to "a UL-MU trigger frame sent by the AP 104 to the STAs." In other words, the UL-MU **trigger frame** sent from Zhou's AP to the

STA can *trigger[] a orthogonal frequency division multiple access (OFDMA) uplink transmission*. SAMSUNG-1005, 0050 (OFDMA “UL frames can be [] triggered by the AP 104 (e.g., via MU-MIMO, UL OFDMA or other UL-MU transmission).”). A POSITA would have understood and found obvious that Zhou’s disclosure of “an STA 106 whose UL frames can be ... triggered by the AP 104” teaches that the AP sends to the STA a *trigger frame* that *triggers a . . . (OFDMA) uplink transmission*. SAMSUNG-1005, 0050; SAMSUNG-1003, 0120.

Finally, Zhou teaches that the “STAs . . . may transmit UL-MU signals 110c and 110d.” and that “the UL-MU signals 110c and 110d (e.g., UL-MU-MIMO or UL-OFDMA transmissions) may be based on a UL-MU trigger frame sent by the AP 104 to the STAs 106c and 106d.” SAMSUNG-1005, 0048. Thus, Zhou teaches that the *uplink transmission* is transmitted from *the wireless communication terminal* (e.g., “transmitted by” Zhou’s STA). SAMSUNG-1003, 0121.

Similarly, Cherian teaches that STAs *receive, from the base wireless communication terminal, a trigger frame using the transceiver, wherein the trigger frame triggers a orthogonal frequency division multiple access (OFDMA) uplink transmission of the wireless communication terminal*. SAMSUNG-1007, FIG. 4. Specifically, Cherian states that a “serving AP generally performs the function of the coordinator by broadcasting a trigger frame scheduling resources

(e.g., time and frequency resources) for multiple STAs for simultaneous UL transmissions.” SAMSUNG-1007, 0046-0047, 0049. These simultaneous transmissions would utilize OFDMA. SAMSUNG-1007, 0045 (“In OFDMA, however, multiple users are allowed to access channels at the same time.”); SAMSUNG-1003, 0122.



SAMSUNG-1006, FIG. 4.

Kim also teaches the use of trigger frames used to initiate UL-MU OFDMA transmissions. Kim’s disclosure below provides an example in which UL-MU transmission of an OFDMA “type” “may be initialized when an AP transmits a

trigger frame to a plurality of STAs”. SAMSUNG-1008, 0080; SAMSUNG-1003, 0123.

A UL MU transmission scheme ... may be initialized when an AP transmits a trigger frame to a plurality of STAs The trigger frame may include UL MU allocation information (e.g. resource location and size, STA IDs, an MCS, and an MU type (MIMO, OFDMA, etc.)). SAMSUNG-1008, 0080.

Kim further teaches a method where a STA “receiv[es] a trigger frame from the AP” corresponding to the claimed *receiv[ing], from the base wireless communication terminal* (AP), *a trigger frame*. A POSITA would have understood and found obvious that receipt of the wireless signals by Kim’s STA is accomplished *using the transceiver* of Kim. SAMSUNG-1008, 0018-0019 (“a transceiver configured to receive a trigger frame transmitted to a plurality of STAs”), cl. 13, FIG. 27; SAMSUNG-1003, 0124. The STA then proceeds to “transmitting data to the AP through a multi-user frame in response to the trigger frame”. SAMSUNG-1008, cl. 13. Kim describes the UL-MU transmission can be of an OFDMA type, thus disclosing that *the trigger frame triggers a orthogonal frequency division multiple access (OFDMA) uplink transmission of* (or by) *the wireless communication terminal*. SAMSUNG-1008, 0080. A POSITA would have understood and found obvious that Kim’s “multi-user frame” would consist

of one of Kim's disclosed multi-user (MU) types "(MIMO, OFDMA, etc.)."

SAMSUNG-1008, 0080; SAMSUNG-1003, 0124.

Thus, a POSITA would have understood and found obvious in light of Zhou, Cherian, and Kim, that the STAs *receive, from the base wireless communication terminal, a trigger frame using the transceiver, wherein the trigger frame triggers a orthogonal frequency division multiple access (OFDMA) uplink transmission of the wireless communication terminal*. SAMSUNG-1003, 0125.

[1.3]

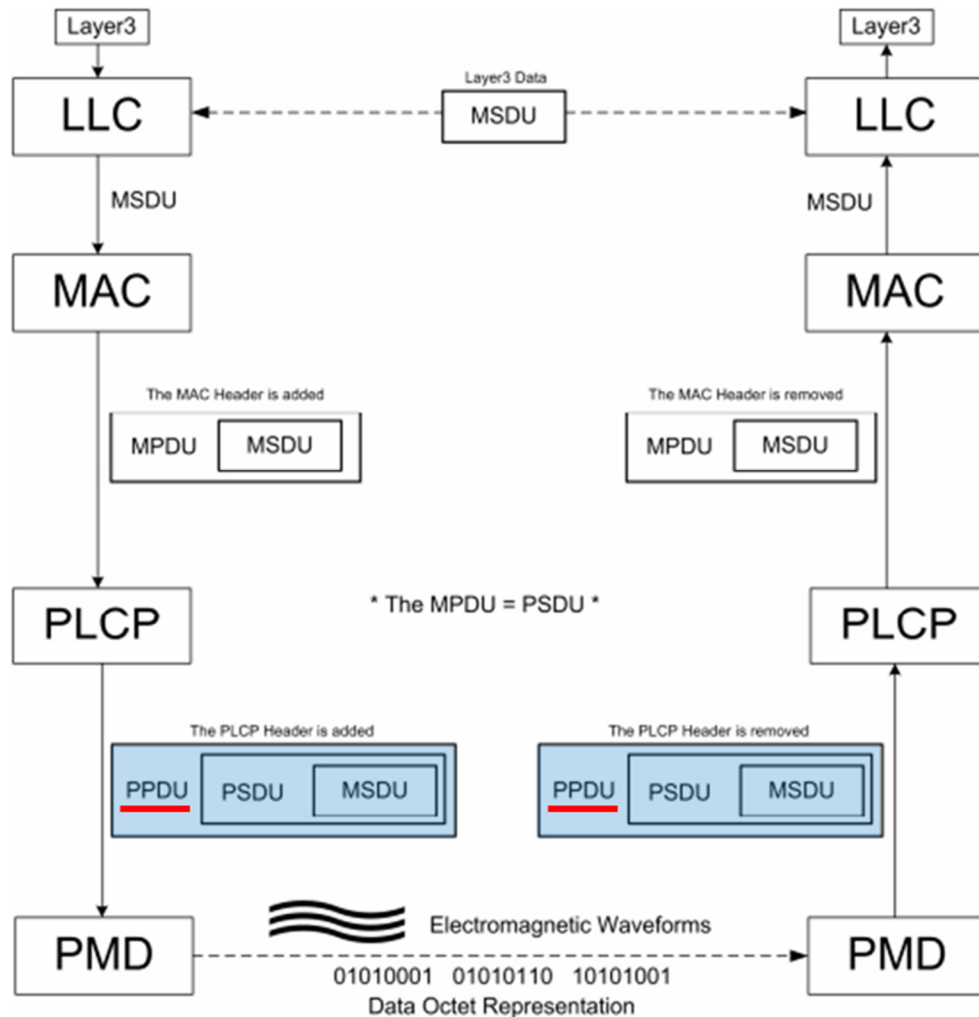
Zhou-Cherian-Kim renders obvious [1.3]. Specifically, Zhou discloses the transmission of UL-MU transmissions between the STA and the AP in response to receiving trigger frames. SAMSUNG-1005, 0027, 0048("the UL-MU signals 110c and 110d (e.g., UL-MU-MIMO or UL-OFDMA transmissions) may be based on a UL-MU trigger frame sent by the AP 104 to the STAs"), 0081 ("The trigger frame could be a trigger frame that triggers UL OFDMA random access."). A POSITA would have understood and found obvious that transmissions responsive to Zhou's trigger frame can use physical layer protocol data units (PPDU) or "packets" in accordance with the 802.11 standards. SAMSUNG-1005, 0041("In some aspects, the data unit may comprise a physical layer convergence procedure (PLCP) protocol data unit (PPDU). In some aspects, the PPDU is referred to as a packet."), 0047; SAMSUNG-1003, 0126. Indeed, Zhou teaches that data is transmitted using

PPDUs. SAMSUNG-1005, 0041. A POSITA would have come to the foregoing conclusion for the following reason.

A POSITA would have understood and found obvious that transmissions in an 802.11 architecture such as Zhou's utilized physical layer convergence protocol (PLCP) protocol data units (PPDUs). SAMSUNG-1016, pp.166-169, 248-252⁶. In fact, prior to the Critical Date, 802.11 textbooks explains that a PPDU is a fundamental unit used for transmission. SAMSUNG-1016, p. 166 ("The PPDU is . . . to be transmitted onto the RF medium as symbols representing the 0s and 1s of the PPDU"). Thus, communication from one station to another (e.g., between a STA and an AP) is achieved using PPDUs. SAMSUNG-1003, 0127-0131.

⁶ Page numbers refer to the PDF pagination unless otherwise noted.

FIGURE 5.1 Frame Nomenclature



SAMSUNG-1016, FIG. 5.1.

Zhou describes that STAs *transmit, to the base wireless communication terminal*, UL-MU signals *in response to the trigger frame using the transceiver* as seen in Zhou's annotated Figure 1 below. SAMSUNG-1005, 0048-0049, 0050. Because Zhou's transmissions are based on receipt of a trigger (trigger-based) and 802.11 transmissions utilize PPDU's, a POSITA would have understood and found

obvious that Zhou's UL-MU transmissions, which are disclosed as including PPDU transmissions, satisfy "*a trigger-based physical layer protocol data unit (PPDU)*," making it an obvious implementation. SAMSUNG-1003, 0132.

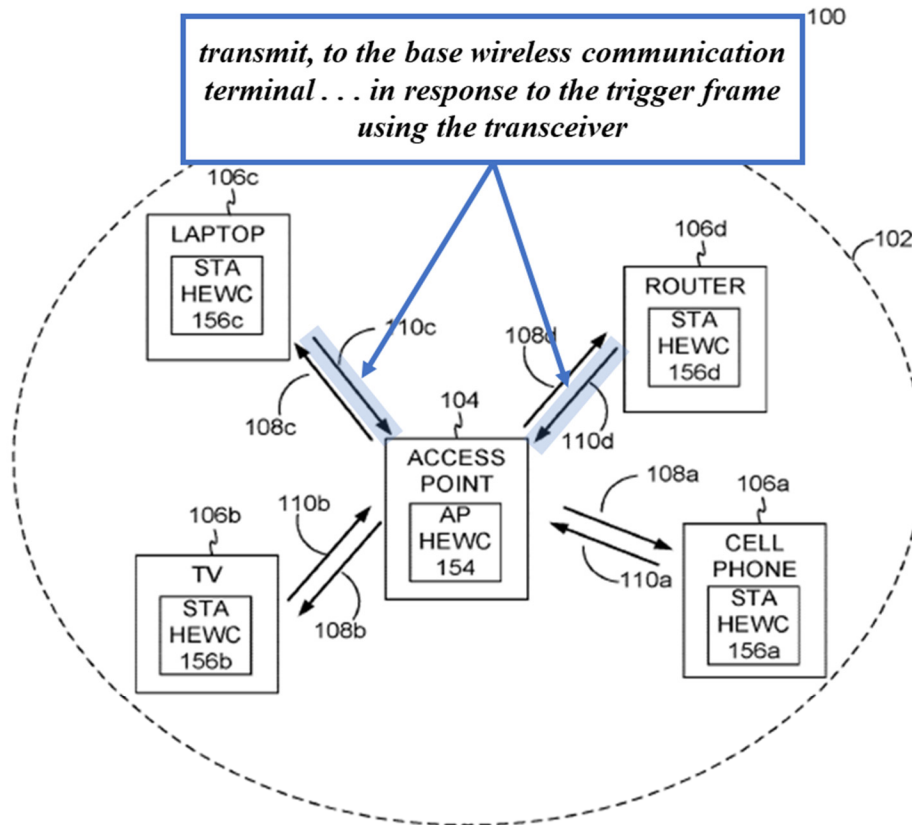


FIG. 1

SAMSUNG-1004, FIG. 1.

Dr. Valenti explains that a POSITA would have understood and found obvious that the "trigger-based" responsive communications are scheduled UL-MU transmissions because 1) they are responsive to a trigger frame prompt (e.g.,

not contention based) and 2) the prompt schedules an UL-MU transmission responsive to the information within the trigger frame (e.g., not a contention-based transmission). SAMSUNG-1003, 0133. Thus, when Zhou's STA responds to the UL-MU transmission request received from the AP, the resulting transmission, which includes PPDUs, is *in response to the trigger frame. Id.*

More specifically, Zhou teaches that "the UL-MU signals 110c and 110d (e.g., UL-MU-MIMO or UL-OFDMA transmissions) may be based on a UL-MU trigger frame sent by the AP 104 to the STAs 106c and 106d." SAMSUNG-1005, 0048-0049, 0050; *see* [1.1]. The responsive *trigger-based PDU* "uplink (UL) signal or packet 110 [is transmitted] from multiple STAs 106 to the AP 104." SAMSUNG-1005, 0047-0048. Thus, Zhou's STAs *transmit, to the base wireless communication terminal* UL-MU signals, communications, or transmissions *in response to the trigger frame*. These responsive signals, communications, or transmissions would utilize the 802.11 defined PPDUs for transmission and thus be *trigger-based PPDUs*. SAMSUNG-1003, 0134. A POSITA would have understood and found obvious that wireless 802.11 transmissions described in Zhou between the STAs and APs is accomplished *using the transceiver. Id.*

[1.4]

Zhou-Cherian-Kim renders obvious [1.4]. Zhou teaches using EDCA parameters for different STAs in communication with the AP. SAMSUNG-1005,

0002, 0047. Zhou further describes applying particular EDCA parameter sets to particular stations. SAMSUNG-1005, 0010 (“The method includes selecting, at an access point, an enhanced distributed channel access (EDCA) parameter for communication with a station. The method further includes transmitting an indication of the selection to the station.”), 0011. The selection in Zhou can be based on whether the STA is capable of, and is called upon to participate in, UL-MU transmissions. SAMSUNG-1005, 0043, 0047 (“the AP 104 may define EDCA parameters to facilitate UL-MU transmissions.”), 0050 (“adjusting EDCA parameters for STAs capable of and willing for transmitting UL[-]MU transmissions”); SAMSUNG-1003, 0135.

Cherian teaches switching between using different EDCA parameter set selections. SAMSUNG-1007, 0058, 0065. Specifically, Cherian describes switching between single user (SU) and multiuser (MU) modes, each mode using different EDCA parameters. SAMSUNG-1007, 0058, 0065. More specifically, Cherian discloses “transitioning from a Single-User (SU) mode . . . to a Multi-User (MU) mode” which corresponds to the claimed *switch[ing] a parameter set*. SAMSUNG-1007, 0005, 0058, 0060 (“EDCA Parameter Set element provides information needed by STAs for proper operation of the QoS facility during the CP”), 0065, FIG. 3; SAMSUNG-1003, 0136.

Cherian states that different modes include “backoff counters”⁷ [that] are used to attempt to access a medium” or *a parameter set, which is a set of parameters used for the channel access*. SAMSUNG-1007, cl. 1-2. Given the teachings of Zhou and Cherian, a POSITA would have understood and found obvious, that in the context of CSMA/CA access to the medium using access categories encompasses accessing the channel because a channel is a portion of the overall medium. SAMSUNG-1007, cl. 2; SAMSUNG-1003, 0137. For example, Cherian explains that its “modes” are related to sets of EDCA parameters. SAMSUNG-1007, 0005(“transitioning from a Single-User (SU) mode, in which a first set of one or more backoff counters are used to attempt to access a medium, to a Multi-User (MU) mode, in which a second set of one or more backoff counters are used to attempt to access the medium,”), 0053, FIG. 3; SAMSUNG-1003, 0137-0138. Cherian acknowledges that a POSITA would have understood and found obvious that EDCA parameters are used in controlling backoff timers used for channel

⁷ Cherian and Zhou use a combination of the terms “timer” and “counter.” A POSITA would have understood and found obvious that in the context of contention-based transmissions, “timer” and “counter” both refer to the same backoff procedures describe in the 802.11 standard.

access. SAMSUNG-1007, 0045(“WLAN employs contention based distributed channel access”) 0054-0055, 0054(“EDCA parameters including the values of the backoff counters”); SAMSUNG-1003, 0137-0138. Thus, Cherian teaches that a STA can *switch a parameter set, which is a set of parameters used for the channel access, from a first parameter set to a second parameter set. Id.*

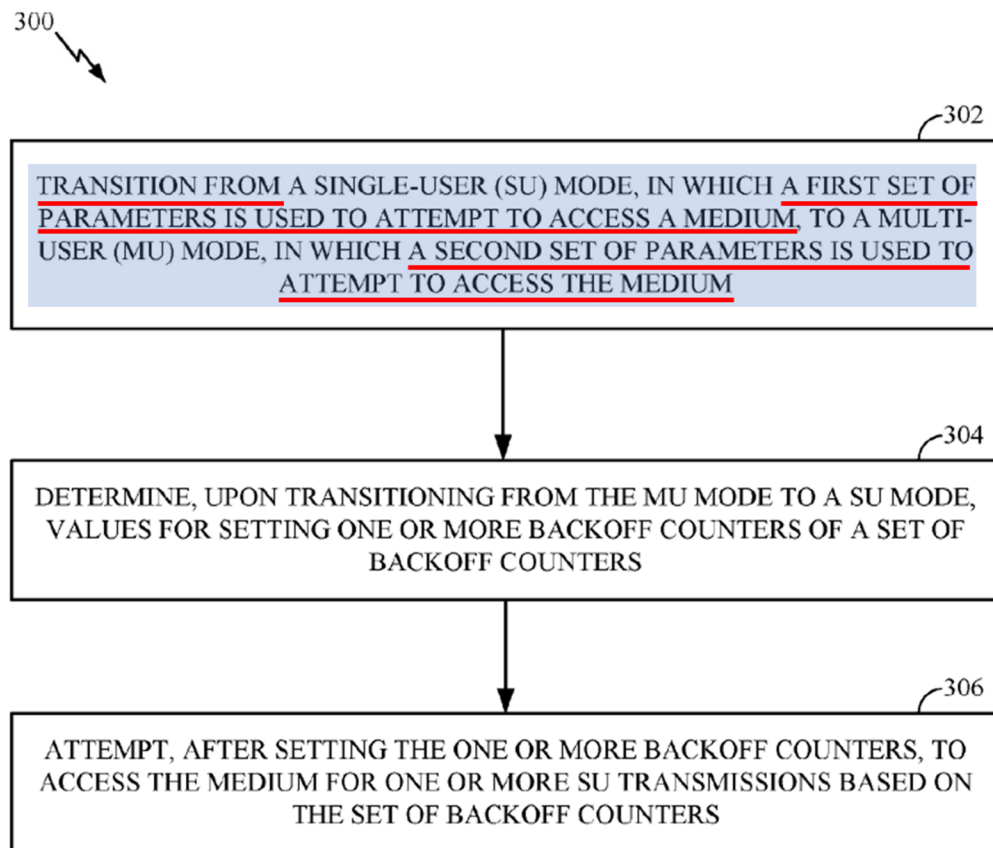


FIG. 3

SAMSUNG-1006, FIG. 3.

Cherian and Zhou describe the distinction between a set of EDCA parameters (*first parameter set*) for UL-SU and a set of parameters (*second*

parameter set) for UL-MU transmission. SAMSUNG-1005, 0043, 0047, 0050; SAMSUNG-1007, 0058, 0065, FIG. 3, cl. 1-2. Specifically, Cherian teaches “a trigger frame is transmitted by AP at 402 scheduling UL resources to stations STA1, STA2, and STA3 for simultaneous UL transmission [(*multi-user uplink transmission participation*)].” SAMSUNG-1007, 0058. “In response to receiving the trigger frame at 402, the STAs 1-3 transition to the MU mode and, simultaneously transmit packets on the UL on resources scheduled by the trigger frame received at 402.” *Id.* Cherian describes the “transition to MU mode” as the STA “switching from SU to MU” where the “STA that receives a trigger frame. . . may update its EDCA parameters” in response to a trigger frame. SAMSUNG-1007, 0065, 0058 (“In response to receiving the trigger frame at 402, the STAs 1-3 transition to the MU mode.”). Thus, a POSITA would have understood and found obvious that when Cherian describes transmitting, to the STA, a trigger frame for “switching from SU to MU,” it refers to the EDCA parameters switch *from a first parameter set* (SU parameters) *to a second parameter set* (MU parameters) *based on whether the base wireless communication terminal triggers a multi-user uplink transmission participation of the wireless communication terminal.* SAMSUNG-1007, 0047, 0065; SAMSUNG-1003, 0139.

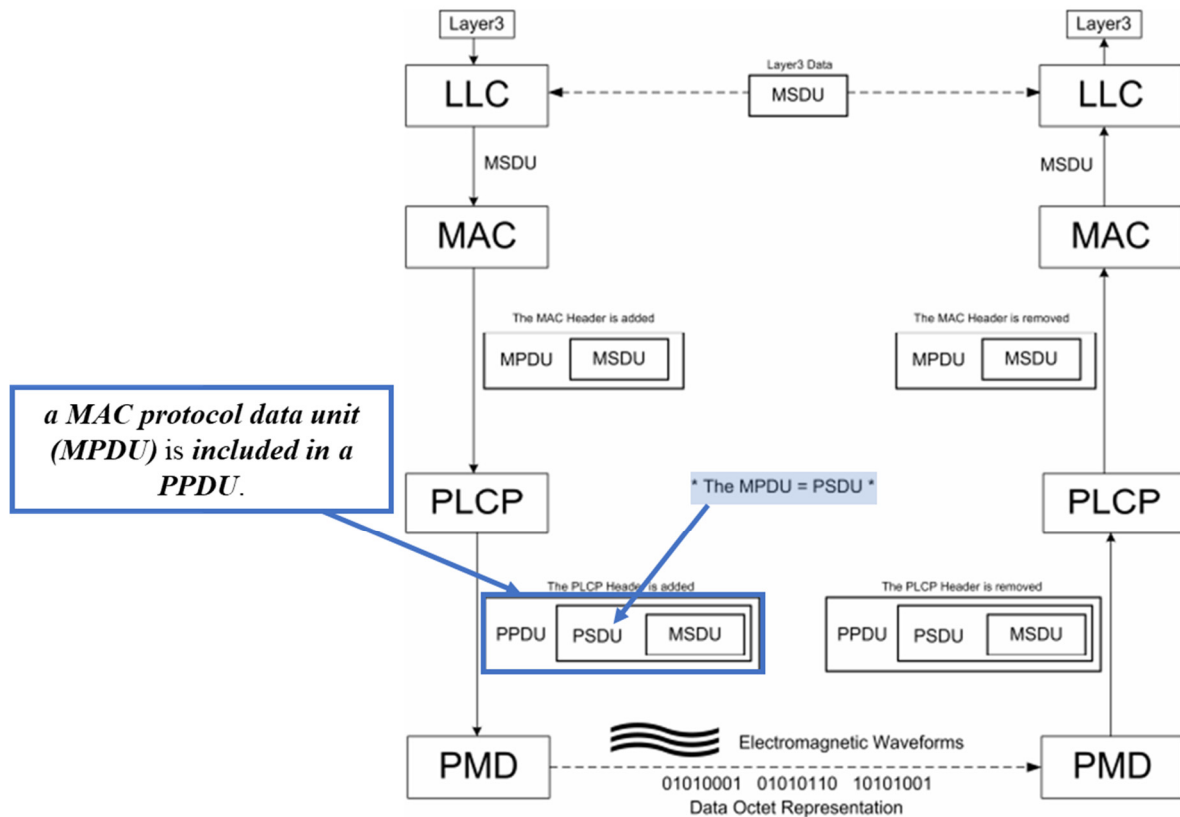
[1.5]

Zhou-Cherian-Kim renders obvious [1.5]-[1.6]. For example, both Zhou and

Cherian disclose a STA switching between EDCA parameter sets for a MU mode during which UL-MU transmissions occur. The transition is in response to a trigger frame being received by the STA. SAMSUNG-1005, 0048, 0081; SAMSUNG-1007, 0058. Cherian discloses use of a timer with a value corresponding to the period of time during which UL-MU transmissions should occur. SAMSUNG-1007, 0058, 0063. Elements [1.5] and [1.6] concern whether or not the MPDU requests an immediate response (e.g., an ACK signal) from the AP, and using that condition to determine when the MU EDCA timer is set. First, if no ACK is requested [1.5] sets the timer when transmission of the trigger-based PPDU ends and, second, if an ACK is requested, [1.6] sets the timer upon receipt of the ACK signal. SAMSUNG-1003, 0140. For at least the following reasons, Zhou-Cherian-Kim render obvious both of these configurations. *Id.*

First, Zhou-Cherian-Kim teaches *a MAC protocol data unit (MPDU) included in the trigger-based PPDU*. SAMSUNG-1003, 0141. As discussed previously, a POSITA would have understood and found obvious that *a MAC protocol data unit (MPDU) is included in a PPDU*. See [1.3]; SAMSUNG-1003, 0141. This well-known concept is displayed in the CWAP textbook, describing how the MPDU is handed down to the physical layer where it is combined with a PLCP preamble and the PLCP header to form the PPDU. SAMSUNG-1016, p. 166. Thus, as shown in the figure below, a *MPDU* is *included in a PPDU*. *Id.*

FIGURE 5.1 Frame Nomenclature



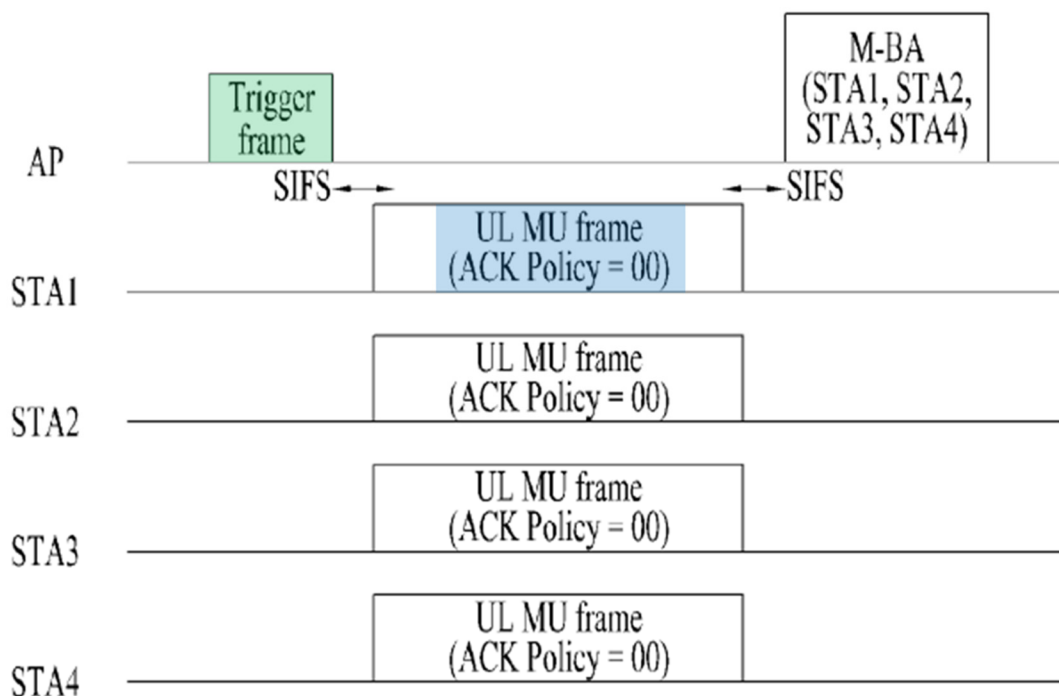
SAMSUNG-1016, FIG. 5.1.

As discussed previously, a *trigger-based PPDU* is a PPDU sent in response to receiving a trigger. See [1.3]; SAMSUNG-1003, 0142.

Second, Zhou-Cherian-Kim renders obvious configurations *when a (MPDU). . . does not request an immediate response*. SAMSUNG-1003, 0143. For example, Kim describes processes similar to Zhou and Cherian where “an AP may transmit a trigger frame to STA 1 to STA 4 to cause them to transmit ULMU frames.” SAMSUNG-1008, 0060, 0096-0097, 0107-09. In figures 14-23 of Kim, various UL-MU transmissions have different acknowledgment policies.

SAMSUNG-1008, FIG. 14-23. Specifically, Kim teaches, through at least Tables 1-2 and 6-9, various configurations of acknowledgements: e.g., “normal acknowledgement” and “no acknowledgement.” SAMSUNG-1008, 0064-0065, Tables 1, 6-9. As shown in Kim’s Figure 21, in response to the trigger frame, “STA 1 to STA 4 may include an ACK policy in MPDUs and transmit ULMU frames.” SAMSUNG-1008, 0096.

FIG. 21



SAMSUNG-1008, FIG. 21.

To account for various configurations based on each STA, Kim teaches “a method of flexibly transmitting an ACK/NACK [(acknowledgment)/(no-

acknowledgement)] signal on the basis of an ACK policy value per STA.”

SAMSUNG-1008, 0091. Kim goes on to describe how the “ACK policy” across different STAs can include four options “Normal ACK,” “No ACK,” “No explicit acknowledgement or PSMP ACK,” and “Block ACK.” SAMSUNG-1008, 0094-

0096, Tables 6-9. Thus, Kim teaches the option of having “an ACK policy value per STA,” e.g., a policy that includes *when a MAC protocol data unit (MPDU) ...*

does not request an immediate response. A POSITA would have understood and found obvious that whether an *MPDU* includes, or *does not* include, a *request* for *an immediate response* is a design choice contemplated by Kim. SAMSUNG-

1003, 0144. Thus, Kim teaches [1.5], *a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response.*

TABLE 7

ACK Policy == 01
No ACK
The addressed recipient takes no action upon receipt of the frame. The ACK Policy subfield is set to this value in all individually addressed frames in which the sender does not require acknowledgment. The ACK Policy subfield is also set to this value in all group addressed frames that use the QoS frame format except with a TID for which a block ACK agreement exists. This value of the ACK Policy subfield is not used for QoS Data frames with a TID for which a block ACK agreement exists. The ACK Policy subfield for group addressed QoS Null (no data) frames is set to this value.

SAMSUNG-1008, Table 7.

In more detail, Kim describes transmissions from several STAs and considers available options depending on whether an acknowledgment (*an immediate response*) to those transmissions is requested. SAMSUNG-1008, 0064-0065, FIG. 10, 12; SAMSUNG-1003, 0145. Further, these acknowledgement policies are contained within the MPDUs. SAMSUNG-1008, 0096, Tables 6-7. At least two of the configurations are shown below in Tables 6-7. SAMSUNG-1008, Tables 1, 6-7.

TABLE 6

ACK Policy == 00

Normal ACK or Implicit Block ACK Request.

In a frame that is a non-A-MPDU frame or VHT single MPDU:

The addressed recipient returns an ACK or QoS +CF-ACK frame after a short interframe space (SIFS) period, according to the procedures defined in ACK procedure and HCCA transfer rules. A non-DMG STA sets the ACK Policy subfield for individually addressed QoS Null (no data) frames to this value.

Otherwise:

The addressed recipient returns a Block ACK frame, either individually or as part of an A-MPDU starting an SIFS after the PPDU carrying the frame, according to the procedures defined in Block ACK procedure, Generation and transmission of Block ACK frames by an HT STA or DMG STA, Operation of HT-delayed block ACK, Rules for RD initiator, Rules for RD responder, and Explicit feedback beamforming.

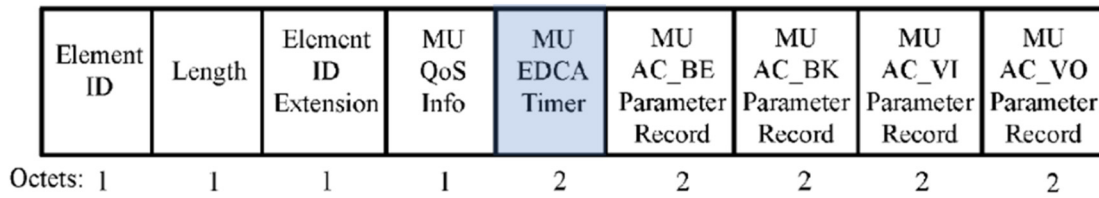
SAMSUNG-1008, Table 6.

TABLE 7

ACK Policy == 01
No ACK
The addressed recipient takes no action upon receipt of the frame.
The ACK Policy subfield is set to this value in all individually addressed frames in which the sender does not require acknowledgment. The ACK Policy subfield is also set to this value in all group addressed frames that use the QoS frame format except with a TID for which a block ACK agreement exists.
This value of the ACK Policy subfield is not used for QoS Data frames with a TID for which a block ACK agreement exists.
The ACK Policy subfield for group addressed QoS Null (no data) frames is set to this value.

SAMSUNG-1008, Table 7.

Third, Zhou-Cherian-Kim renders obvious that the STA can *set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends*. Zhou and Cherian teach periods of time in which a STA would operate using MU EDCA parameters. SAMSUNG-1005, 0073, 0081, FIG. 3; SAMSUNG-1007, 0063, FIG. 5. In Cherian's Figure 6, the "MU EDCA Timer" is sent via a data frame to communicate the period of time in which the STA should operate with MU EDCA parameters. SAMSUNG-1007, 0060, 0063, FIG. 5; SAMSUNG-1003, 0146.

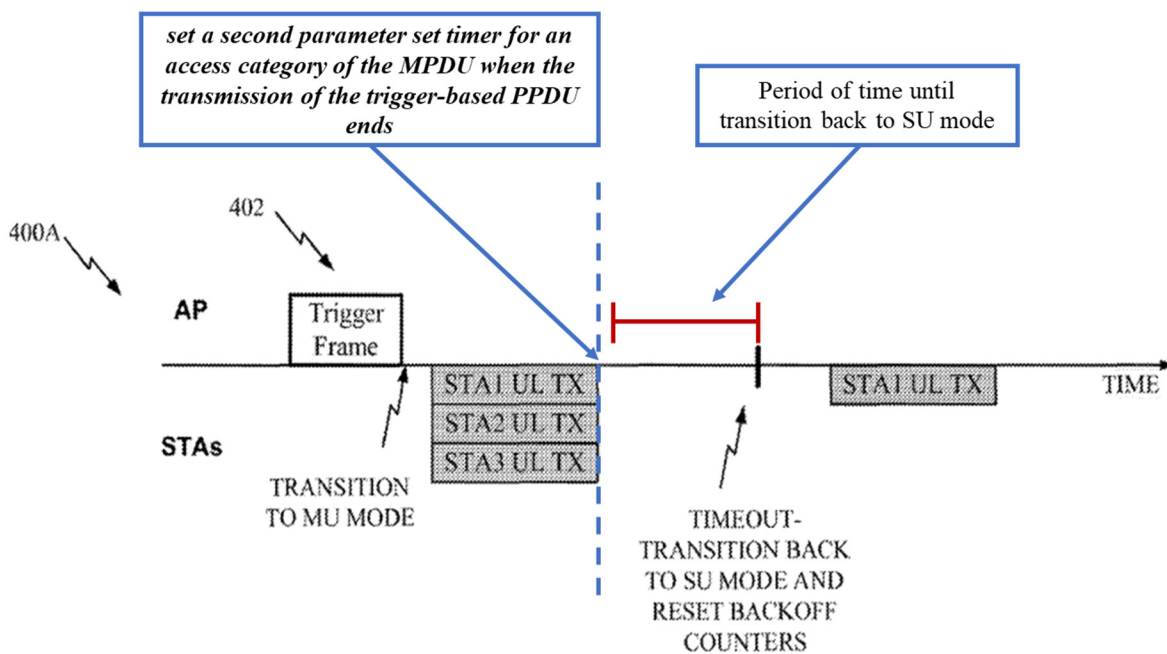


SAMSUNG-1006, FIG. 6.

Specifically, Cherian teaches using a MU EDCA timer (*a second parameter set timer*) for the purpose of controlling the period of time in which UL-MU EDCA parameters are used by the STA. SAMSUNG-1007, 0063, FIG. 5. Cherian describes the MU EDCA timer “indicates the duration of time, in units of TUs, for which the provided MU EDCA parameters are valid after reception of a Trigger frame.” SAMSUNG-1007, 0042, 0063, 0058 (“Once the timeout period expires, each STA transitions back to an SU mode.”); SAMSUNG-1003, 0147. Recall in [1.4] that the STA switches the EDCA parameter set from SU EDCA parameters (*a first parameter set*) to MU EDCA parameters (*a second parameter set*).

Zhou’s disclosure of resetting the timer “after the STA 106 transmits a scheduled UL transmission, or transmits a scheduled UL transmission and gets an ACK message” or “after the STA 106 transmits a non-scheduled UL transmission, or transmits a non-scheduled UL transmission and gets an ACK message” demonstrates various times at which the setting or resetting of a timer could have occurred. SAMSUNG-1005, 0081. Here, a POSITA would have understood and

found obvious in the context of Zhou, Cherian, and Kim that Zhou's "after" the STA transmits teaches the claimed "*when the transmission of the trigger-based PPDU ends.*" SAMSUNG-1003, 0148. In combination with Cherian's defined "EDCA timer" a POSITA would have understood and found obvious that, in Zhou-Cherian-Kim when no immediate response is requested the STA *set[s] a second parameter set timer . . . when the transmission of the trigger-based PPDU ends.* SAMSUNG-1007, 0049, 0058 ("Once the timeout period expires, each STA transitions back to an SU mode."), FIG. 4, FIG. 6; SAMSUNG-1003, 0148.



SAMSUNG-1006, FIG. 4(a).

In more detail, determining when to set the timer is a design choice—described in Zhou—with a finite number of options available to a POSITA. SAMSUNG-1005, 0081; SAMSUNG-1003, 0149. For example, setting the timer

immediately after transmission of a PPDU or after acknowledgement of that PPDU are both choices available under the 802.11 standard, described in Kim and Zhou, and understood by a POSITA. SAMSUNG-1005, 0081; SAMSUNG-1008, Table 1; SAMSUNG-1003, 0149. Moreover, a POSITA would have found obvious that, when a station is transmitting UL-MU transmissions without a request for ACK, the waiting period dictated by the EDCA timer is set after the UL-MU transmission is complete e.g., *when the transmission of the ... PPDU ends*. Indeed, Zhou teaches various obvious times at which the “reset” of a timer could occur, the end of a transmission being one of them. SAMSUNG-1005, 0081.

In more detail, a POSITA would have understood and found obvious that if an immediate response were requested the STA would wait for acknowledgement from the AP (to ensure the transmission did not fail) before Zhou’s timer is reset. SAMSUNG-1003, 0150. A POSITA would have understood that the purpose of an ACK request is to verify whether the STA does not need to re-transmit the data. SAMSUNG-1018, 0009 (“A successful transmission occurs when the node either receives an expected acknowledgment correctly, or transmits a frame that does not require an acknowledgement.”) Thus, the transmission requiring an immediate response is not complete until the immediate response is received. SAMSUNG-1003, 0150. A POSITA would have recognized that waiting to set the timer after acknowledgment is received would ensure the transmission is complete and no re-

transmission is necessary, thus allowing the MU EDCA timer to be set and wait for further instructions before switching back to SU mode. *Id.* In the case where an ACK is requested, the timer would not be set until after the immediate response is received. In the case where no immediate response is received (as here in [1.5]), not delaying setting the timer would have been the logical option to a POSITA. *Id.* A POSITA is not an automaton, and would have understood the known methods (ACK policies) and how to apply them to achieve predictable results. *Id.*; *KSR*, 550 U.S., 421

Thus, a POSITA reviewing Zhou, Cherian, and Kim would have understood and found obvious that the STA can *set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends* because no ACK is requested and therefore not expected. SAMSUNG-1005, 0081; SAMSUNG-1003, 0151.

Finally, Zhou-Cherian-Kim teaches *a second parameter set timer for an access category*. In its background section, Zhou describes the well-known use of EDCA parameters with access categories. SAMSUNG-1005, 0002(“EDCA defines separate data traffic access categories, which may include best effort, background, video and voice”); SAMSUNG-1003, 0152.

Zhou’s disclosure teaches that, by utilizing EDCA parameters that define “separate data traffic categories,” “high-priority traffic has more opportunity of

being sent than a low-priority traffic because a station with high priority data traffic waits for less time before sending such a data packet.” SAMSUNG-1005, 0002. A POSITA would have understood and found obvious that Zhou’s description of EDCA parameters used for channel access with separate categories where each category can “wait[]” for transmission, teaches the well-known EDCA parameter based backoff timers for *access categories*. SAMSUNG-1003, 0153.

Similarly, Cherian describes the different *access categories* used in combination with EDCA parameters as demonstrated in Cherian’s Figure 6. SAMSUNG-1007, 0042, FIG. 5; SAMSUNG-1003, 0154.

Element ID	Length	Element ID Extension	MU QoS Info	MU EDCA Timer	MU AC_BE Parameter Record	MU AC_BK Parameter Record	MU AC_VI Parameter Record	MU AC_VO Parameter Record
Octets: 1	1	1	1	2	2	2	2	2

SAMSUNG-1006, FIG. 6.

A POSITA would have understood and found obvious that when setting the parameter set timer, which Cherian describes “indicates the duration of time, in units of TUs, for which the provided MU EDCA parameters are valid,” applies to at least *an access category*. SAMSUNG-1007, 0042, 0063, 0058 (“Once the timeout period expires, each STA transitions back to an SU mode.”). Specifically, Cherian teaches that “MU EDCA parameters are valid” for one or more of *an access category* until the “duration of time” expires. *Id.*; SAMSUNG-1003, 0155.

Because, Cherian's EDCA parameters are used in backoff timers for the access categories, a POSITA would have understood and found obvious that the *parameter set timer* defines a period of time in which one or more of *an access category of the MPDU* is to the current set of MU EDCA parameters.

SAMSUNG-1003, 0155. Therefore, Zhou-Cherian-Kim teaches *set a second parameter set timer for an access category of the MPDU*.

Additionally, a POSITA would have understood and found obvious that the "access category of the MPDU" is determined by the Traffic Identifiers (TID) field in its QoS Control field, which reflects the User Priority (UP) of the data it carries.

SAMSUNG-1017, pp.664, 792, Table 9-1, Figure 8-192, Table 8-106;

SAMSUNG-1003, 0156. The transmitting STA uses this UP to indicate the access category for transmitting within an MPDU. *Id.* For example, the 802.11 standard defines a QoS field in the Mac Layer frame (MPDU). SAMSUNG-1017, Chapter 8. Within the QoS field are bits identifying the type of traffic being transmitted.

SAMSUNG-1017, p.389-391. The 802.11 standard states "the AP's MAC sublayer shall derive the access category from the priority using the mapping in Table 9-1."

SAMSUNG-1017, p.98, 100.

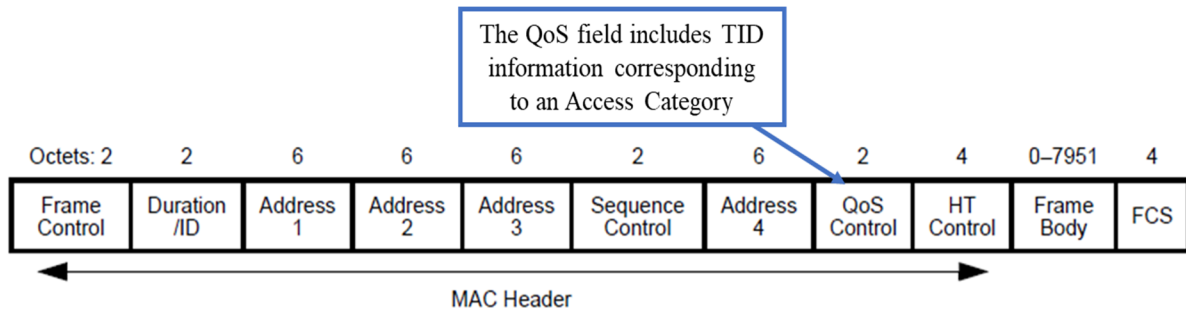


Figure 8-1—MAC frame format

SAMSUNG-1017, FIG 8.1.

Table 9-1—UP-to-AC mappings

Priority	UP (Same as 802.1D user priority)	802.1D designation	AC	Designation (informative)
Lowest ↓ Highest	1	BK	AC_BK	Background
	2	—	AC_BK	Background
	0	BE	AC_BE	Best Effort
	3	EE	AC_BE	Best Effort
	4	CL	AC_VI	Video
	5	VI	AC_VI	Video
	6	VO	AC_VO	Voice
	7	NC	AC_VO	Voice

SAMSUNG-1017, Table 9.1.

Thus, a POSITA would have understood and found obvious 1) that Cherian and Zhou contemplate setting a parameter set timer for all access categories (*an access category*) to be used for the MU EDCA parameters and 2) that an MPDU carries a QoS field with a TID and UP corresponding to *an access category of the*

MPDU. SAMSUNG-1003, 0157.

Thus, Zhou-Cherian-Kim renders obvious that, *when a MAC protocol data unit (MPDU) included in the trigger-based PPDU does not request an immediate response, set a second parameter set timer for an access category of the MPDU when the transmission of the trigger-based PPDU ends*. SAMSUNG-1003, 0158.

[1.6]

As discussed in [1.5], Zhou-Cherian-Kim renders obvious [1.5]-[1.6]. First, as shown in [1.5], a POSITA would have understood and found obvious that *the MPDU [is] included in the trigger-based PPDU*. SAMSUNG-1016, p. 166; *See* [1.5]. Second, Zhou-Cherian-Kim renders obvious configurations in which the MPDU *requests an immediate response*. SAMSUNG-1008, 0064-0065, 0094, 0096, Tables 6-9; *See* [1.5]; SAMSUNG-1003, 0159.

TABLE 6

ACK Policy == 00

Normal ACK or Implicit Block ACK Request.

In a frame that is a non-A-MPDU frame or VHT single MPDU:

The addressed recipient returns an ACK or QoS +CF-ACK frame after a short interframe space (SIFS) period, according to the procedures defined in ACK procedure and HCCA transfer rules. A non-DMG STA sets the ACK Policy subfield for individually addressed QoS Null (no data) frames to this value.

Otherwise:

The addressed recipient returns a Block ACK frame, either individually or as part of an A-MPDU starting an SIFS after the PPDU carrying the frame, according to the procedures defined in Block ACK procedure, Generation and transmission of Block ACK frames by an HT STA or DMG STA, Operation of HT-delayed block ACK, Rules for RD initiator, Rules for RD responder, and Explicit feedback beamforming.

SAMSUNG-1008, Table 6.

TABLE 7

ACK Policy == 01

No ACK

The addressed recipient takes no action upon receipt of the frame.

The ACK Policy subfield is set to this value in all individually addressed frames in which the sender does not require acknowledgment. The ACK Policy subfield is also set to this value in all group addressed frames that use the QoS frame format except with a TID for which a block ACK agreement exists.

This value of the ACK Policy subfield is not used for QoS Data frames with a TID for which a block ACK agreement exists.

The ACK Policy subfield for group addressed QoS Null (no data) frames is set to this value.

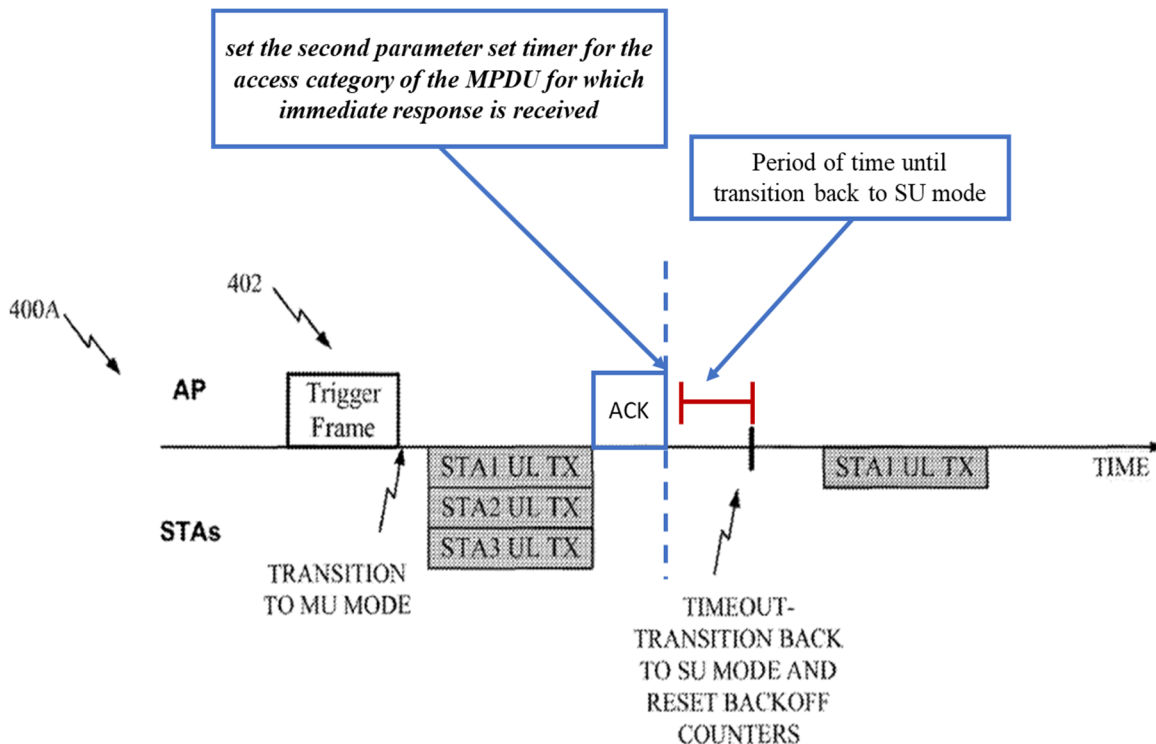
SAMSUNG-1008, Table 7.

Third, Zhou-Cherian-Kim renders obvious that the STA can *set the second parameter set timer for the access category of the MPDU for which immediate response is received*. As discussed in [1.5] when a MPDU requests immediate response (equivalently, acknowledgement or ACK), the STA pauses to confirm the transmission was successfully received. *See* [1.5]; SAMSUNG-1003, 0160. When acknowledgement is received (*for which immediate response is received*) the STA *set[s] the second parameter set timer for the access category of the MPDU. Id.*

Dr. Valenti explains that this configuration would have been understood and obvious to a POSITA because the EDCA timer serves to control the amount of time that the MU EDCA contention parameters are used as Cherian teaches. SAMSUNG-1007, 0042, 0063 (“indicates the duration of time, in units of TUs, for which the provided MU EDCA parameters are valid,”), 0058 (“Once the timeout period expires, each STA transitions back to an SU mode.”); SAMSUNG-1003, 0161. When entering MU mode and transmitting the simultaneous transmissions described in Zhou-Cherian-Kim, the MU mode parameters are meant to reduce the probability of collision between contention transmissions and the triggered UL-MU transmission. *Id.* After the STAs complete transmission of the coordinated MU transmissions, the EDCA timer maintains the MU parameter set in operation for a period of time in case other UL-MU transmissions are scheduled. *Id.* A STA measures the “completion” of the transmission by receiving an ACK—if an ACK

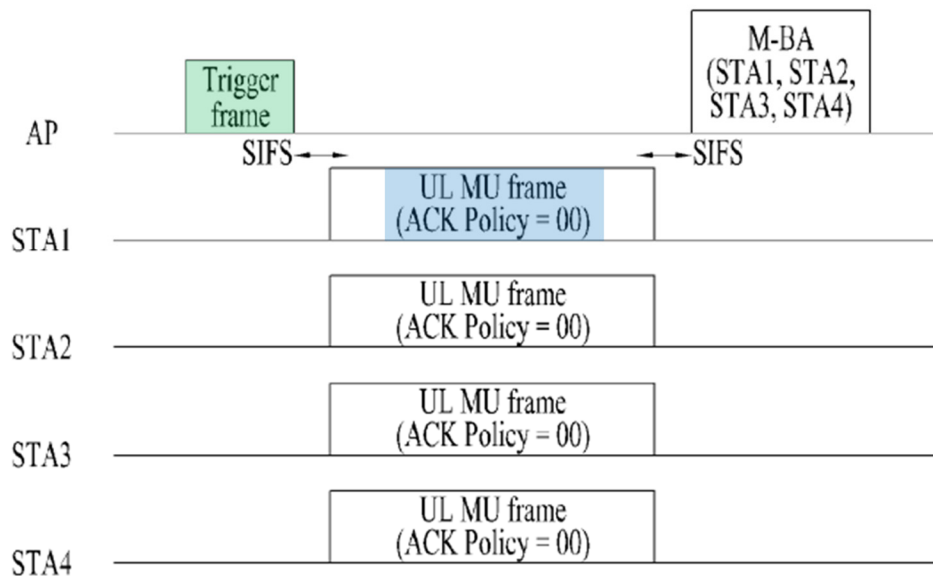
is requested—or upon completion of the physical transmission. These two options for setting a timer would have been obvious to a POSITA. *See* [1.5]; SAMSUNG-1003, 0161.

In more detail, Zhou teaches the STA may “reset [the] timer/counter to zero after the STA 106 . . . transmits a scheduled UL transmission [(UL-MU transmission)] and gets an ACK message.” SAMSUNG-1005, 0081. The incorporation of Zhou’s teaching of when to set the timer with Cherian’s “EDCA timer” and Kim’s ACK, is demonstrated in Cherian and Kim’s annotated figures below. SAMSUNG-1003, 0162



SAMSUNG-1006, FIG. 4(a).

FIG. 21



SAMSUNG-1008, FIG. 21.

In addition, elements [1.5]-[1.6] can include an aggregated MPDU or A-MPDU. SAMSUNG-1003, 0163. An A-MPDU is a collection of MPDUs sent as a single unit. SAMSUNG-1017, p.814 (“An A-MPDU is a sequence of MPDUs carried in a single PPDU.”) When aggregated, each MPDU may contain different acknowledgement requirements (e.g., element [1.5] where the MPDU “does not request immediate response” and element [1.6] where the MPDU “requests immediate response”). The ’879 Patent provides an example of these A-MPDUs with mixed acknowledgement policies in figure 17. SAMSUNG-1001, FIG. 17.

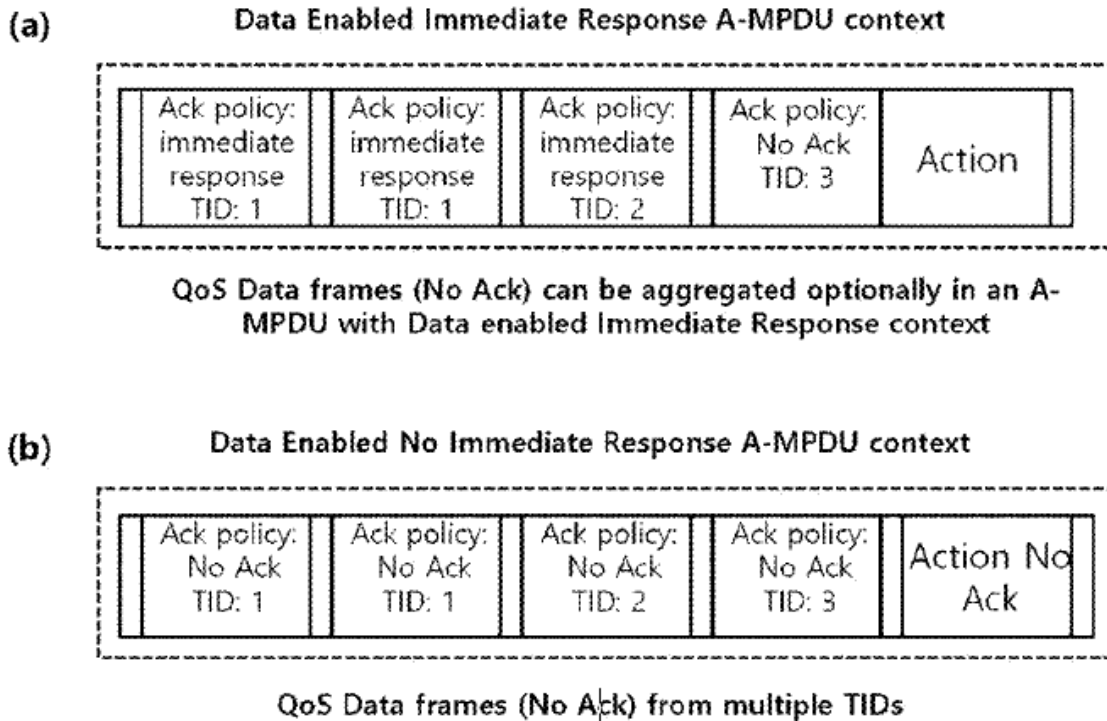


FIG. 17

SAMSUNG-1001, FIG. 17.

A POSITA would have understood and found obvious that the foregoing configuration of aggregating MPDUs into an A-MPDU was possible because it is taught in the 802.11 standard that precedes the Critical Date by four years. SAMSUNG-1017, p.1; SAMSUNG-1003, 0164. For example, Tables 8-283 through 8-287 explain when the contents of an A-MPDU would require immediate response. SAMSUNG-1017, pp.814-817. If an A-MPDU has at least one MPDU that requests immediate response, there will be an immediate response following

the A-MPDU. SAMSUNG-1003, 0164. Particularly, Table 8-285 shows that for there to be “no immediate response,” no MPDUs that request an immediate response may be present in the A-MPDU. SAMSUNG-1017, pp.814-817.

Table 8-283—A-MPDU Contexts

Name of Context	Definition of Context	Table defining permitted contents
Data Enabled Immediate Response	The A-MPDU is transmitted outside a PSMP sequence by a TXOP holder or an RD responder including potential immediate responses.	Table 8-284
Data Enabled No Immediate Response	The A-MPDU is transmitted outside a PSMP sequence by a TXOP holder that does not include or solicit an immediate response. See NOTE.	Table 8-285
PSMP	The A-MPDU is transmitted within a PSMP sequence.	Table 8-286
Control Response	The A-MPDU is transmitted by a STA that is neither a TXOP holder nor an RD responder that also needs to transmit one of the following immediate response frames: Ack BlockAck with a TID for which an HT-immediate Block Ack agreement exists	Table 8-287
NOTE—This context includes cases when no response is generated or when a response is generated later by the operation of the delayed Block Ack rules.		

SAMSUNG-1017, Table 8-283.

Table 8-285—A-MPDU contents in the data enabled no immediate response context

MPDU Description	Conditions
Delayed BlockAcks	BlockAck frames for a TID for which an HT-delayed Block Ack agreement exists with the BA Ack Policy subfield equal to No Acknowledgment.
Delayed Block Ack data	QoS Data MPDUs with a TID that corresponds to a Delayed or HT-delayed Block Ack agreement. These have the Ack Policy field equal to Block Ack.
Data without a Block Ack agreement	QoS Data MPDUs with a TID that does not correspond to a Block Ack agreement. These have the Ack Policy field equal to No Ack and the A-MSDU Present subfield equal to 0.
Action No Ack	Management frames of subtype Action No Ack.
Delayed BlockAckReqs	BlockAckReq MPDUs with the BA Ack Policy subfield equal to No Acknowledgment and with a TID that corresponds to an HT-delayed Block Ack agreement.

SAMSUNG-1017, Table 8-283.

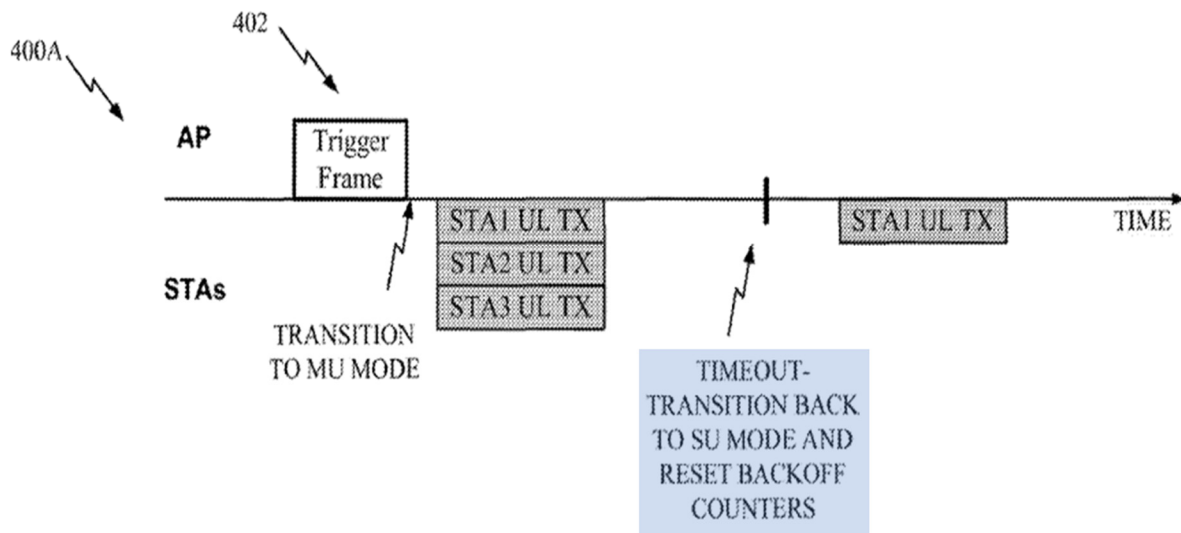
Thus, a POSITA would have understood and found obvious that if the “MPDU” recited in elements [1.5]-[1.6] were an A-MPDU, the claim limitations would still be met. For example, if an A-MPDU contained no MPDUs requesting immediate response (e.g., [1.5] all MPDUs “do[] not request immediate response”) then the STA would operate according to [1.5] and set the timer at the end of the transmission. But if the A-MPDU contained at least one MPDU requesting immediate response (e.g., [1.6]), then the STA would wait for the “immediate response” or acknowledgement before setting the timer. SAMSUNG-1003, 0165.

Therefore, a POSITA would have understood and found obvious that, whether an A-MPDU or an MPDU, *when the MPDU included in the trigger-based PPDU requests an immediate response*, the STA can *set the second*

parameter set timer for the access category of the MPDU for which immediate response is received (e.g., after the ACK is received). SAMSUNG-1003, 0166.

[1.7]

Zhou-Cherian-Kim renders obvious [1.7]. For example, Cherian describes that after a “timeout” period (*when the second parameter set timer expires*), the STA transitions back to SU EDCA parameters or, in other words, *terminate[s] an application of the second parameter set* (MU EDCA parameter set). SAMSUNG-1007, 0049-0050, 0058 (“Once the timeout period expires, each STA transitions back to an SU mode.”), cl. 8 (“the transition back to the SU mode is based on failure to receive, while in the MU mode, a trigger frame from the AP before expiration of a timeout period.”), FIG. 4; SAMSUNG-1003, 0167.



SAMSUNG-1006, FIG. 4(a).

Additionally, Zhou teaches a “transition from operating in scheduled mode [(UL-MU mode)] to operating in legacy mode [(UL-SU mode)]” and when a STA switches parameter sets, operations using the previous set of EDCA parameters are “terminate[d].” SAMSUNG-1005, 0073, 0079. Thus, when Zhou’s timer—reset with Cherian’s value for the MU EDCA timer—expires, use of the previous EDCA parameter set is terminated. SAMSUNG-1003, 0168.

A POSITA would have understood and found obvious that, *when* Cherian’s EDCA timer (*the second parameter set timer*) *expires*, the transition back to SU MODE (the claimed *first parameter set*) *terminate[s] application* of the MU EDCA parameters (the claimed *second parameter set*). SAMSUNG-1003, 0169.

[1.8]

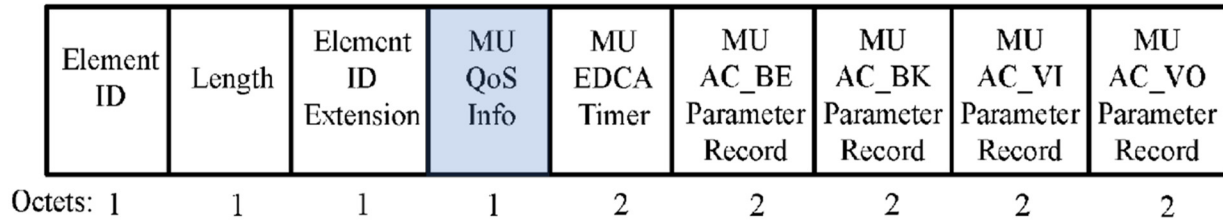
Zhou-Cherian-Kim renders obvious [1.8]. For example, Zhou discloses equipment using 802.11 standards that “operate under a carrier sense multiple access (CSMA) mechanism for medium access.” SAMSUNG-1005, 0032. A POSITA would have understood and found obvious that CSMA uses EDCA parameters (SU or MU) to *access a channel according to a priority of data to be transmitted*. SAMSUNG-1005, 0032 (“According to CSMA, devices sense the medium and only transmit when the medium is sensed to be idle.”); SAMSUNG-1017, p.11 (definition of EDCA); SAMSUNG-1003, 0170. Indeed, Zhou teaches “[u]tilizing EDCA, high-priority data traffic has more opportunity of being sent

than a low-priority data traffic because a station with high priority data traffic waits for less time before sending such a data packet, on average, than a station with low priority data traffic.” SAMSUNG-1005, 0002. Cherian also teaches using AC categories and QoS “to attempt access to a medium.” SAMSUNG-1007, 0051, 0042(“... if packets of different ACs are ready for transmission when a backoff timer expires, the AC with the higher priority may be granted access. Several backoff counters may be implemented with one or more different AC queues per counter (e.g., sharing one transmitter).”). A POSITA would have understood and found obvious that EDCA parameters, known in the art and taught by Zhou and Cherian, serve to enable *access [to] a channel according to a priority of data to be transmitted*. SAMSUNG-1003, 0170-0171.

b. Claim 2

[2.0]

Zhou-Cherian-Kim renders obvious [2.0]. For example, Cherian teaches the inclusion of a “MU QoS Info” field within the EDCA parameter set element sent by the AP to the STA, thus creating instructing the STA to use *a QoS data frame* when transmitting using the MU mode. SAMSUNG-1007, 0062, FIG. 5. Because an MPDU that carries QoS data frame is transported within a PPDU, *the MPDU included in the trigger-based PPDU is a QoS data frame*. See [1.6]; SAMSUNG-1003, 0172.



SAMSUNG-1006, FIG. 6.

Moreover, a POSITA would have understood that the 802.11 standard defines a QoS data frame to be a data frame sent by a QoS STA, which is a “STA that implements the QoS facility”. SAMSUNG-1007, p. 19, 414. Such data frames have MAC header that includes “the QoS [Quality of Service] control field.” SAMSUNG-1003, 0173; SAMSUNG-1017, p.31. Additionally, whenever a wireless communication system uses “access categories” or “EDCA” it necessarily includes QoS data frames in at least some transmissions. SAMSUNG-1007, 0042 (“Quality of service (QoS) may be implemented by utilizing several access categories (AC)”); SAMSUNG-1003, 0173. For example, the 802.11 standard defines “access category” and “EDCA” as follows:

access category (AC): A label for the common set of enhanced distributed channel access (EDCA) parameters that are used by a quality-of-service (QoS) station (STA) to contend for the channel in order to transmit medium access control (MAC) service data units (MSDUs) with certain priorities. SAMSUNG-1017, p.5.

enhanced distributed channel access (EDCA): The

prioritized carrier sense multiple access with collision avoidance (CSMA/CA) access mechanism used by quality-of-service (QoS) stations (STAs) in a QoS basic service set (BSS). SAMSUNG-1017, p.11.

Thus, when the MPDU transmits QoS data related to use of EDCA parameters, *the MPDU included in the trigger-based PPDU* necessarily contains *a QoS data frame*. SAMSUNG-1003, 0174.

The 802.11 standard also defines a QoS field in the MPDU. When communicating using EDCA parameters, a POSITA would have understood and found obvious that the MPDUs transmitted in response to a trigger frame include a QoS control field with information to manage the quality of service for that data flow (e.g., EDCA parameter information). SAMSUNG-1003, 0175. Thus, when using the QoS field, *the MPDU included in the trigger-based PPDU is a QoS data frame. Id.*

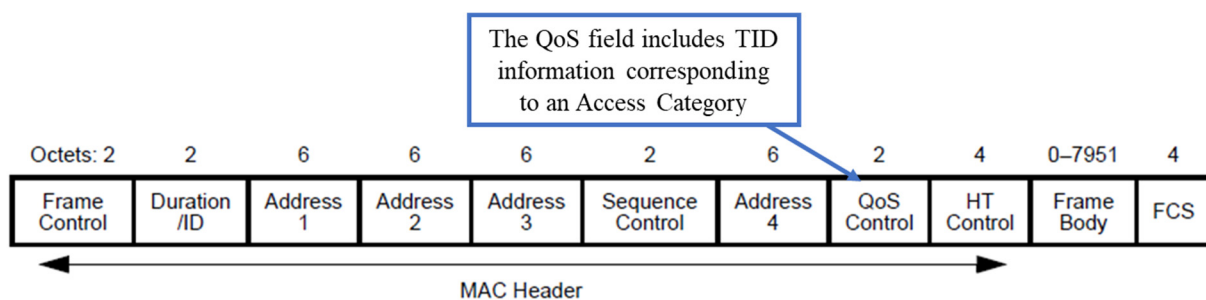


Figure 8-1—MAC frame format

SAMSUNG-1017, FIG. 8.1.

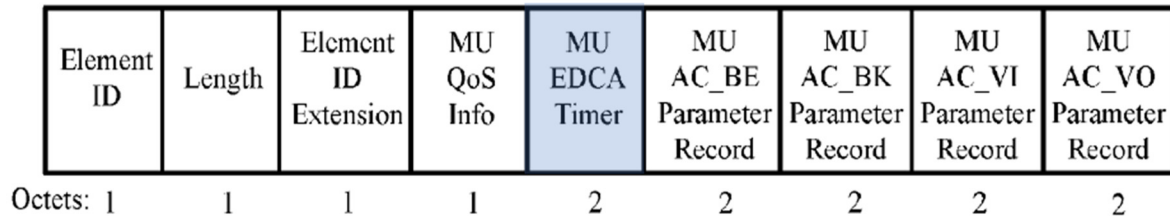
c. Claim 3

[3.0]

Zhou-Cherian-Kim renders obvious [3.0]. For example, Zhou states that “EDCA parameters may be . . . included in a beacon frame” received from the AP. SAMSUNG-1005, 0047, 0050, 0066. Because beacon frames are management frames periodically sent by APs that can contain scheduling and other network information, a POSITA would have understood and found obvious that the STA’s *processor is configured to receive a beacon frame from the base wireless communication terminal*. SAMSUNG-1003, 0176.

A POSITA would have understood that the EDCA parameter set element was broadcast network information and therefore could be sent using a beacon frame. Cherian’s EDCA parameter set element includes “[t]he MU EDCA Timer [that] indicates the duration of time, in units of TUs, for which the provided MU EDCA parameters are valid after reception of a Trigger frame.” SAMSUNG-1007, 0063, FIG. 5; SAMSUNG-1017, pp.419-420. First, Cherian’s MU EDCA timer is data (i.e., *information*) because it is carried within the EDCA parameter set element. SAMSUNG-1003, 0177. Second, Cherian’s description above demonstrates the “MU EDCA Timer” is *information indicating a period of the second parameter set timer*. *Id.*; SAMSUNG-1007, 0063 (“MU EDCA Timer indicates the duration of time, . . . for which . . . MU EDCA parameters are

valid.”). Cherian’s “duration of time” would have been understood and found obvious to equate to a “*period of time*.” SAMSUNG-1003, 0177.



SAMSUNG-1006, FIG. 6.

Zhou teaches that beacon frames are sent by the AP to the STA and can include the EDCA Parameters. SAMSUNG-1005, 0047. When the AP sends a beacon frame, the STA will *receive [the] beacon frame from the base wireless communication terminal* (i.e., the AP). SAMSUNG-1003, 0178. As taught by Cherian, the EDCA Parameter element contains the “MU EDCA Timer.”

SAMSUNG-1007, 0063, FIG. 5. With the EDCA Parameter element sent in a beacon frame, the STA can *obtain information indicating a period of the second parameter set timer from the beacon frame*. SAMSUNG-1003, 0178.

d. Claim 8

[8.0]

Zhou-Cherian-Kim renders obvious [8.0]. Zhou describes “methods and apparatuses for selecting enhanced distributed channel access (EDCA) parameters for multi-user (MU) transmissions” to/from the AP. SAMSUNG-1005, 0001, 0006.

Zhou's method is for "a wireless communication system" allowing a plurality of stations to communicate. SAMSUNG-1005, 0008, cl. 1("A method for configuring channel access parameters in a wireless communication system"). Zhou's figure 1 demonstrates the wireless communication method as well as Cherian's figure 1, both reproduced below. SAMSUNG-1005, FIG. 1; SAMSUNG-1007, FIG. 1. Both Zhou and Cherian disclose communication in a wireless network between STAs and APs (*base wireless communication terminal*). SAMSUNG-1003, 0179. Specifically, Zhou teaches that various devices (STAs) (*wireless communication terminal*) can *wirelessly communicate[] with a base wireless communication terminal*; and Cherian provides examples of user terminals (STAs) (*wireless communication terminal*) *that wirelessly communicates with a base wireless communication terminal*. SAMSUNG-1005, 0004("multiple user terminals (UTs) [(STAs)] to communicate with a single access point") FIG. 1; SAMSUNG-1007, 0002, FIG. 1.

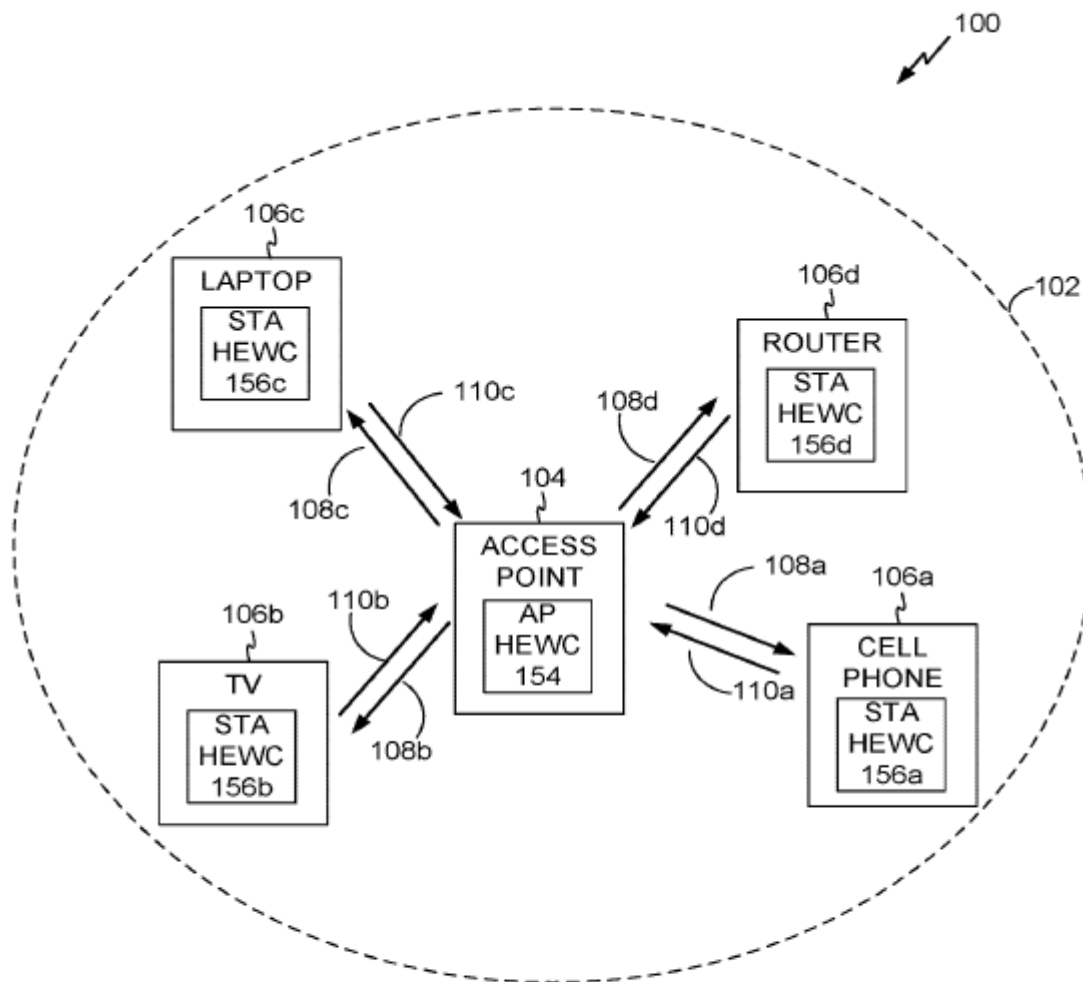


FIG. 1

SAMSUNG-1004, FIG. 1.

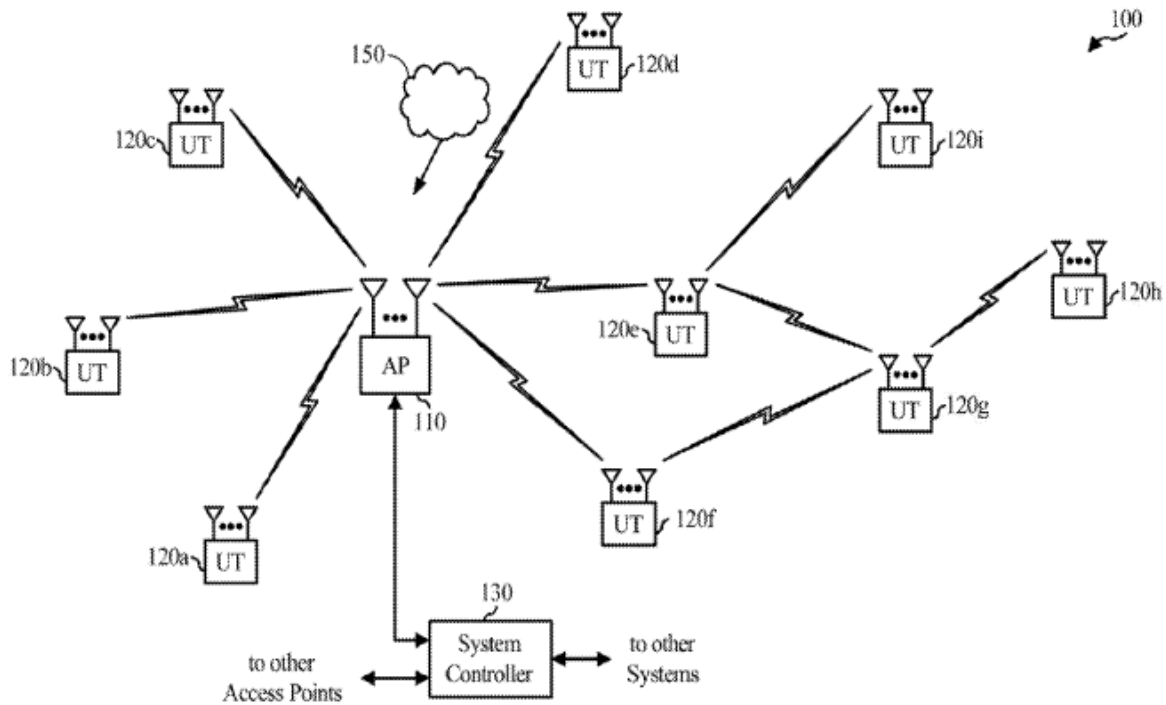


FIG. 1

SAMSUNG-1006, FIG. 1.

Thus, Zhou-Cherian-Kim renders obvious [8.0]. SAMSUNG-1003, 0180.

[8.1]

See [1.2]; SAMSUNG-1003, 0181.

[8.2]

See [1.3]. Dr. Valenti explains the obvious use how such “transmitting” occurs. SAMSUNG-1003, 0182.

[8.3]

See [1.4]; SAMSUNG-1003, 0183.

[8.4]

See [1.5]; SAMSUNG-1003, 0184.

[8.5]

See [1.6]; SAMSUNG-1003, 0185.

[8.6]

See [1.7]; SAMSUNG-1003, 0186.

[8.7]

See [1.8]; SAMSUNG-1003, 0187.

[8.8]

Zhou-Cherian-Kim renders obvious [8.8]. As discussed previously, Zhou/Cherian teaches that the stations (Zhou's STAs and Cherian's UTs) can "communicate with a single access point by sharing channel resources." SAMSUNG-1005, 0004; SAMSUNG-1007, 0002. Zhou describes that STAs and APs are able to "transmit the information element such that the information element is decodable" by the STA or AP that receives it. SAMSUNG-1005, 0007, 0029("the STA 106 may transmit a reference signal, such as an association probe or request, to the AP 104"). Further, Zhou and Cherian discuss transmission of data (according to a priority of that data) using EDCA parameters to "contend[] for channel access to transmit UL signals." *See* [1.8]; SAMSUNG-1005, 0002, 0048; SAMSUNG-1007, 0042, 0069. Indeed, a POSITA would have understood and found obvious that the very purpose of "enhanced distributed channel access (EDCA)" is for "channel access." SAMSUNG-1005, 0002, 0084; SAMSUNG-

1003, 0188. Zhou even claims selecting these “channel access parameters” and “transmitting” data to a STA. SAMSUNG-1005, cl. 10, 13.

Thus, a POSITA would have understood and found obvious, through Zhou and Cherian’s disclosure of EDCA parameters for transmission and channel access, that Zhou-Cherian-Kim renders obvious *transmitting the data through the channel*. SAMSUNG-1003, 0189.

e. Claim 9

[9.0]

See [2.0]; SAMSUNG-1003, 0190.

f. Claim 10

[10.0]

See [3.0]; SAMSUNG-1003, 0191.

B. [GROUND 2] – Claims 4-5

1. Overview of Ho

Ho describes specific procedures governing the selection and adjustment of the contention window (CW) value within a Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) framework for obtaining contended allocations and is analogous to the ’879 Patent. SAMSUNG-1018, Abstract, 0002-0003.

Central to this mechanism is a backoff counter, utilized by a wireless communications device (STA) to determine the transmission start time for a contended allocation. SAMSUNG-1018, 0004; SAMSUNG-1003, 0086. When a

node possesses traffic designated for transmission, particularly when the backoff counter is at a zero value, the counter is initialized by selecting an integer value at random. SAMSUNG-1018, 0008. More specifically, the value is selected at randomly from the interval (1, CW), where the upper bound, CW, is a contention window value chosen based upon the priority of the traffic designated for transmission. SAMSUNG-1018, 0021, 0024. The backoff counter, once set, is decremented for each idle contention slot detected, contingent upon the counter being in an unlocked state. SAMSUNG-1018, 0021.

When the backoff counter reaches zero, the device attempts transmission. SAMSUNG-1018, 0040, 0045. If this transmission endeavor proves unsuccessful, defined by the absence or incorrect reception of an acknowledgment, the CW value is recalibrated. SAMSUNG-1018, 0028-0030. The method prescribes a doubling mechanism for adjusting the CW value after a failed transmission. SAMSUNG-1018, 0010; SAMSUNG-1003, 0087. This doubling process is subject to an explicit upper bound: the CW value is not permitted to exceed CW_{max} for the relevant user priority. *Id.*

2. Combination of Zhou-Cherian-Kim-Ho

A POSITA would have been motivated to combine Zhou-Cherian-Kim with Ho because of the potential for improved stability in wireless communication through a standardized and bounded contention backoff mechanism following

transmission failures (e.g., limiting backoff timers to $CW_{\max}$). SAMSUNG-1018, 0010, 0025-0031; SAMSUNG-1003, 0101. Zhou provides methodologies for selecting EDCA parameters tailored to different stations, Cherian describes procedures for transitioning between SU/MU mode, and Kim outlines the acknowledgement policies for transmissions. The incorporation of Ho's teachings offers a specific and well-defined approach to managing retransmissions via the doubling of the contention window with an upper bound at $CW_{\max}$. *See* Section III.A.4 (Zhou-Cherian-Kim); SAMSUNG-1018, 0031("the node doubles CW . . . but if doubling the CW would exceed $CW_{\max}[UP]$, the node shall set the CW to $CW_{\max}[UP]$."); SAMSUNG-1003, 0101.

Furthermore, the explicit mention in Ho of the contention window doubling, but not exceeding $CW_{\max}$, is a technically sound and inherently obvious design constraint rooted in the fundamental principles of the Distributed Coordination Function (DCF) and EDCA. SAMSUNG-1017, pp.837, 879; SAMSUNG-1003, 0102. The maximum contention window ($CW_{\max}$) is a defined parameter that prevents excessively long backoff periods, which could lead to significant delays and reduced throughput. SAMSUNG-1003, 0102. The mathematical outcome of repeatedly doubling a value until it reaches a predefined maximum is a well-understood and basic computational process, and its application in limiting the exponential backoff is a common practice in the art. A POSITA implementing the

dynamic EDCA parameter selection of Zhou and the mode transition mechanisms of Cherian would naturally have understood the common practice of bounding the contention window during backoff procedures to maintain acceptable network performance. SAMSUNG-1003, 0102. Demonstrated in the annotated figure below, the principle of a bounded exponential backoff is a widely used technique in wireless communication to handle contention, and its integration here is a logical application to enhance the reliability of the combined Zhou-Cherian-Kim system. SAMSUNG-1018, 0010; SAMSUNG-1017, pp.937, 879, FIG. 9-10. As *KSR* points out: “Common sense teaches . . . that familiar items may have obvious uses beyond their primary purposes, and in many cases a [POSITA] will be able to fit the teachings of multiple patents together like pieces of a puzzle.” *KSR Int’l Co*, 420.

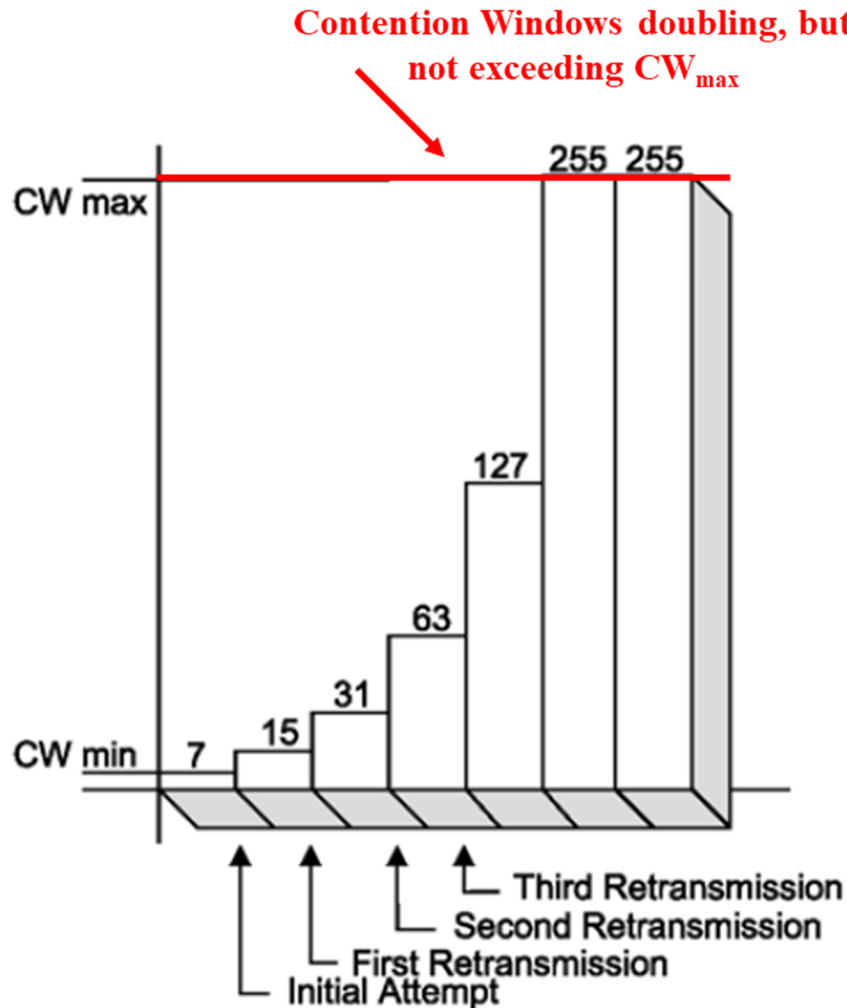


Figure 9-10—Example of exponential increase of CW

SAMSUNG-1017, Figure 9-10.

In line with *Virtek*, the motivation to combine is not merely the independent existence of these features. *Virtek Vision Int'l ULC v. Assembly Guidance Sys., Inc.*, 97 F.4th 882, 887 (Fed. Cir. 2024). Instead, the technical motivation lies in the recognized need for reliable data transmission in wireless networks.

Incorporating Ho's specified backoff mechanism provides a clear and effective

way to address potential collisions that might occur within the more complex channel access schemes enabled by the combined Zhou-Cherian-Kim framework. SAMSUNG-1003, 0103. This integration would have had a reasonable expectation of success because it leverages known and reliable techniques to enhance the robustness of the overall system, aligning with the principles of obviousness as outlined in KSR. *KSR Int'l Co*, 417.

3. Analysis

a. Claim 4

[4.0]

Zhou-Cherian-Kim-Ho renders obvious [4.0] through disclosure of using the EDCA parameters to calculate back off timers for different access categories (ACs). Both Zhou and Ho teach using “channel access parameters [that] can include (but are not limited to) minimum contention window (CW_{min}), maximum contention window (CW_{max}).” SAMSUNG-1005, 0046; SAMSUNG-1018, 0021, 0024-0031; SAMSUNG-1003, 0192. Specifically, Ho discloses setting “the backoff counter to an integer selected at random from the interval [1, CW] *[(calculate a random integer value within a contention window (CW))]*” SAMSUNG-1018, 0021. The contention window described in Ho includes “a minimum and maximum CW value.” SAMSUNG-1018, 0024, Table 1.

Contention Window Values

TABLE 1



User Priority	Traffic designation	CWmin	CWmax
0	Background (BK)	16	64
1	Best effort (BE)	16	32
2	Excellent effort (EE)	8	32
3	Controlled load (CL)	8	16
4	Video (VI)	4	16
5	Voice (VO)	4	8
6	Network control	2	8
7	Emergency or medical event report	1	4

SAMSUNG-1018, Table 1.

Ho describes a circuit or *processor* “selecting a new backoff counter value from a range of values defined in part by the new contention window”.

SAMSUNG-1018, cl. 15. Thus, a POSITA would have understood and found obvious from Ho that when using EDCA parameters for channel access, *the processor is configured to calculate a random integer value within a contention window (CW)* for use in the backoff timers for each access category. SAMSUNG-1003, 0193.

[4.1]

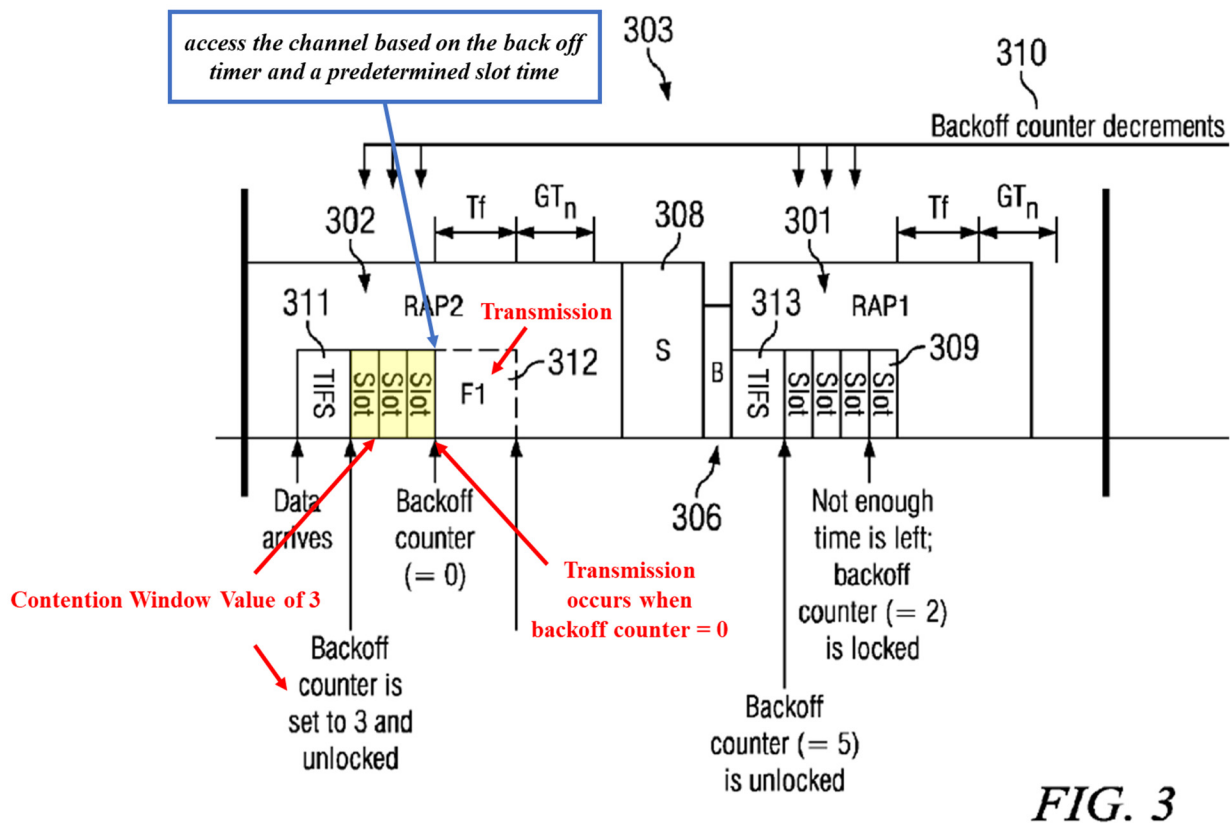
As discussed in [4.0], Ho describes “[t]he *backoff counter [(timer)]* value (i.e. 3) is *set by randomly selecting an integer value* between 1 and CW”.

SAMSUNG-1018, 0045, Abstract, cl 1, 20. A POSITA would have understood and found obvious that a timer or counter used in the context of EDCA parameter

backoff procedures are among a finite number of obvious solutions. Thus, the Zhou-Cherian-Kim-Ho combination teaches *set[ting] a backoff timer based on the random integer value*. SAMSUNG-1003, 0194.

[4.2]

Zhou-Cherian-Kim-Ho renders obvious [4.2]. Ho describes that a node will “decrement[] the backoff counter for each detected idle contention slot until the backoff counter reaches 0 . . . then transmit[] data frames.” SAMSUNG-1018, 0045. A POSITA would have understood and found obvious that the purpose of backoff timers were to use the EDCA (i.e., “enhanced distributed channel access”) parameters for *access to the channel based on the back off timer and a predetermined slot time*. SAMSUNG-1003, 0195. Specifically, Ho demonstrates that at a *predetermined slot time* (e.g., a number of time slots equaling the value of the backoff timer), the channel is accessed. SAMSUNG-1018, 0045, Fig. 3, cl. 11 (“transmitting a message on the shared communications channel when a backoff counter reaches zero;”)SAMSUNG-1003, 0195.



SAMSUNG-1018, FIG. 3 (cropped).

Thus, a POSITA would have understood and found obvious that when using EDCA parameters for channel access in a contention model, a STA can *access the channel based on the back off timer and a predetermined slot time*. SAMSUNG-1003, 0196.

[4.3]

Zhou-Cherian-Kim-Ho renders obvious [4.3]. Specially, Ho discloses “examples of values for CW min and CWmax that may be used in obtaining a contended allocation.” SAMSUNG-1018, 0024, Table 1. The group of values

include CWmin and CWmax values for each of the access categories used with EDCA parameters and are thus a “set.” SAMSUNG-1005, 0070; SAMSUNG-1018, 0024, Table 1. Thus, Ho’s table 1 discloses *the parameter set that comprises a minimum value (CWmin) of the CW and a maximum value (CWmax) of the CW*. See [4.0]; SAMSUNG-1018, 0024, Table 1; SAMSUNG-1003, 0197.

Contention Window Values

TABLE 1

User Priority	Traffic designation	CWmin	CWmax
0	Background (BK)	16	64
1	Best effort (BE)	16	32
2	Excellent effort (EE)	8	32
3	Controlled load (CL)	8	16
4	Video (VI)	4	16
5	Voice (VO)	4	8
6	Network control	2	8
7	Emergency or medical event report	1	4

SAMSUNG-1018, Table 1.

b. Claim 5

[5.0]

See [4.0]; SAMSUNG-1003, 0198.

[5.1]

See [4.1]; SAMSUNG-1003, 0199.

[5.2]

See [4.2]; SAMSUNG-1003, 0200.

[5.3]

Zhou-Cherian-Kim-Ho renders obvious [5.3]. For example, Ho teaches that “[a]fter a failed transmission, CW is set by alternately doubling the CW value, but not to exceed CW max for the user priority [(UP)].” SAMSUNG-1018, 0010. Ho further teaches that “if doubling the CW would exceed CW max[UP], the node shall set the CW to CWmax [UP].” SAMSUNG-1018, 0031. Thus, Ho teaches that when doubling the CW value, *if a value of the CW is greater than* (Ho describes as exceeding) *the maximum value (CWmax) of the CW according to a priority* [or user priority (UP)] *of the data to be transmitted, sets the value of the CW to the CWmax*. Likewise, the 802.11 standard teaches that the “contention window for an access category does not exceed the CWmax and instead is maintained at the CWmax.” SAMSUNG-1017, pp.879, 837(“Once [the CW] reaches aCWmax, the CW shall remain at the value of a CWmax until the CW is reset”). The 802.11 standard’s Figure 9-10 exemplifies this concept. SAMSUNG-1003, 0201.

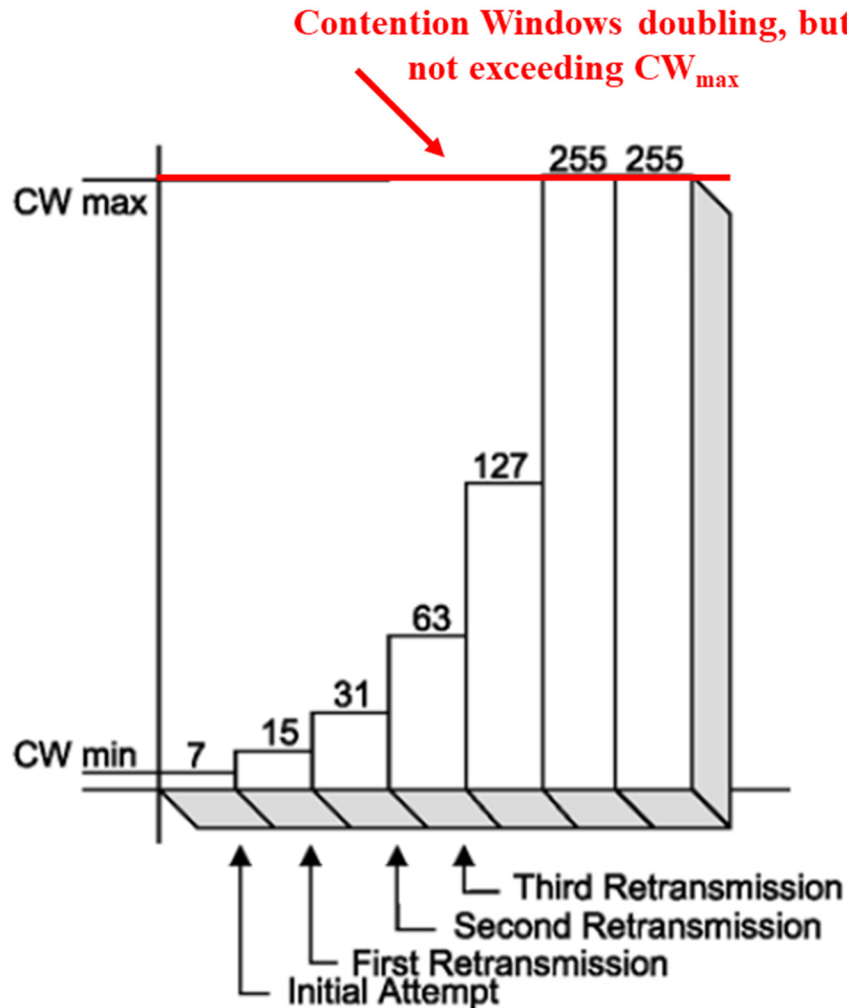


Figure 9-10—Example of exponential increase of CW

SAMSUNG-1017, FIG. 9-10.

C. [GROUND 3] – Claims 6-7

1. Overview of Bharghavan

Bharghavan focuses on optimizing QoS in wireless networks and is analogous to the '879 Patent. SAMSUNG-1010, Title, Abstract. A key aspect of managing QoS in shared wireless mediums is handling contention for various

levels of QoS between devices trying to transmit. SAMSUNG-1010, 2:3-11.

Bharghavan describes a mechanism using backoff timers and a contention window to address that aspect. SAMSUNG-1010, 4:65-5:53; SAMSUNG-1003, 0088.

Specifically, when the communication medium is considered open or idle after an AIFS (automatic inter-frame spacing) time, each node seeking to transmit enters a contention time. SAMSUNG-1010, 4:65-5:53. During the contention time, each node selects a random amount of time to wait (the backoff time) before attempting to access the medium. SAMSUNG-1010, 4:65-5:53. Importantly, if a backoff timer expires while the medium is busy, the timer pauses and resumes its countdown once the medium becomes idle again after the AIFS period, giving an advantage to nodes that have already begun their backoff. SAMSUNG-1010, 4:65-5:53; SAMSUNG-1003, 0089.

Figure 3 in Bharghavan's patent conceptually illustrates a method where an AP determines QoS (e.g., an access category), queues data flows in each access category, and then sets channel access parameters, including the Contention Window Time (318, 324) and Back-Off Parameter (322, 328), based on whether there is traffic for a particular queue (316). SAMSUNG-1010, 8:1-63; SAMSUNG-1003, 0090.

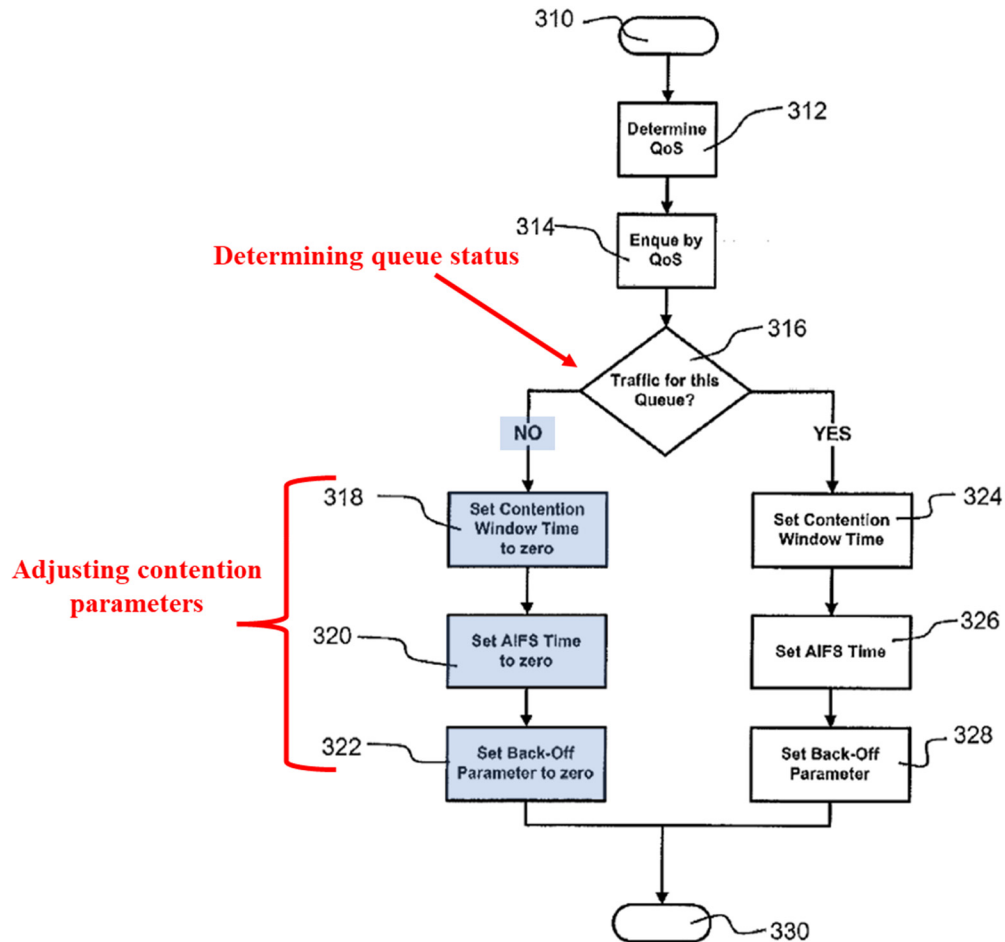


Figure 3

SAMSUNG-1010, FIG. 3.

2. Combination of Zhou-Cherian-Kim-Bharghavan

A POSITA would have been motivated to combine Zhou-Cherian-Kim with Bharghavan because of the potential for enhanced QoS management and more efficient medium access control in wireless networks by dynamically adapting channel access parameters based on real-time traffic conditions (queue status). SAMSUNG-1010, 8:5-56; SAMSUNG-1003, 0104. With Zhou's methods for selecting EDCA parameters for diverse STAs, Cherian's disclosure of mechanisms

for transitions between SU and MU communication modes, and Kim's acknowledgement policies, the incorporation of Bharghavan's teachings offers an efficient mechanism to dynamically adjust these parameters and behaviors in response to queue status and contention levels associated with different QoS requirements. *See* Section IV.A.4; SAMSUNG-1010, 8:34-52; SAMSUNG-1003, 0104.

Specifically, a POSITA seeking to improve the performance of a wireless system in line with the motivations described in Section IV.A.4 would have sought to refine STA behavior based on the presence or absence of traffic in QoS-queues, as contemplated by Bharghavan. Integrating Bharghavan's queue management into Zhou-Cherian-Kim's selection process would allow for a more context-aware adjustment of STA transmission behavior. SAMSUNG-1003, 0105. For instance, if Bharghavan detects an empty queue for a particular QoS level, the system, informed by Zhou's methods, could dynamically adjust the backoff timer for that QoS level. SAMSUNG-1010, 8:19-52. For example, setting the contention window parameters for an empty queue to zero serves to effectively remove that QoS level from the current contention process, thus favoring the QoS levels having actual traffic. This dynamic adaptation addresses a design need for efficient resource utilization by preventing unnecessary contention for channels when certain traffic types are inactive. SAMSUNG-1003, 0105-0106. As stated in *KSR*, market

demand, rather than scientific literature, will drive design trends, and the demand for efficient QoS management in wireless networks provides a clear impetus for such an integration. *KSR Int'l Co*, 419.

When integrated with Cherian's SU/MU mode transitions, Bharghavan's contention-aware parameter adjustments could be particularly beneficial. For example, after a period of MU transmissions orchestrated by a trigger frame (as per Cherian), if Bharghavan's mechanisms detect low or empty queues for certain QoS levels, the system could influence the backoff procedures potentially allowing stations with higher priority traffic (that had data queued) to contend for the medium more quickly. SAMSUNG-1010, 8:34-52; SAMSUNG-1003, 0107. This proactive adjustment, based on queue status, provides a technical advantage in maintaining QoS across different operational modes and aligns with the principle in *KSR* that, if a technique has been used to improve one device, and a POSITA would recognize that it would improve similar devices in the same way, using the technique is obvious. *KSR Int'l Co*, 417. Here, the concept of adjusting channel access parameters (e.g., setting a contention window to zero) based on contention, as suggested by Bharghavan, could be logically applied to enhance the mode transition mechanisms described by Cherian.

The implementation of such a combined system would rely on the hardware and software capabilities disclosed by Zhou-Cherian-Kim ([1.1]), where processors

and memory would have been used to execute the algorithms for EDCA parameter selection (Zhou), mode transition management (Cherian), and the dynamic adjustments based on queue status and contention (Bharghavan). SAMSUNG-1010, 8:34-52; SAMSUNG-1003, 0108. This integration leverages known building blocks to achieve a predictable improvement in network performance and QoS, a concept acknowledged in KSR. *KSR Int'l Co*, 416.

As highlighted in *Virtek*, the motivation to combine must be more than just the independent existence of these technologies. *Virtek Vision Int'l ULC*, 887. The technical motivation here stems from the recognized need for improved QoS and efficient resource management in wireless networks, where dynamically adapting channel access parameters based on real-time traffic conditions and differentiated priorities (as suggested by the integration of Bharghavan with Zhou-Cherian-Kim) provides a logical and obvious solution for a POSITA. SAMSUNG-1003, 0109. The focus on queue status and the implied impact of inactivity from Bharghavan would have addressed these recognized needs. *Id.*

3. Analysis

a. Claim 6

[6.0]

Zhou-Cherian-Kim-Bharghavan renders obvious [6.0]. Bharghavan describes the operation of the multiple 802.11 access categories or queues which can “include ‘VO’(voice), ‘VI’ (video), ‘BE’ (best efforts) or ‘BG’ (background).”

SAMSUNG-1010, 6:33-52, 8:1-62; SAMSUNG-1017, p.568, Table 8-104. The data is “processed in separate queues according to QoS indication.” SAMSUNG-1010, 6: 33-52. A POSITA would have understood and found obvious that Bharghavan describes the same access categories taught by the 802.11 standard shown in Table 8-104 below. SAMSUNG-1003, 0202.

Table 8-104—ACI-to-AC coding

ACI	AC	Description
00	AC_BE	Best effort
01	AC_BK	Background
10	AC_VI	Video
11	AC_VO	Voice

SAMSUNG-1017, Table 8-104.

The 802.11 standard further corroborates Bharghavan’s description of the well-known use of “queues” for each of the access categories. SAMSUNG-1017, p.874; SAMSUNG-1007, 0042 (“Quality of service (QoS) may be implemented by utilizing several access categories (AC) which help effectively establish different back-off generation procedure per queue, where each AC uses different queue.”); SAMSUNG-1003, 0203.

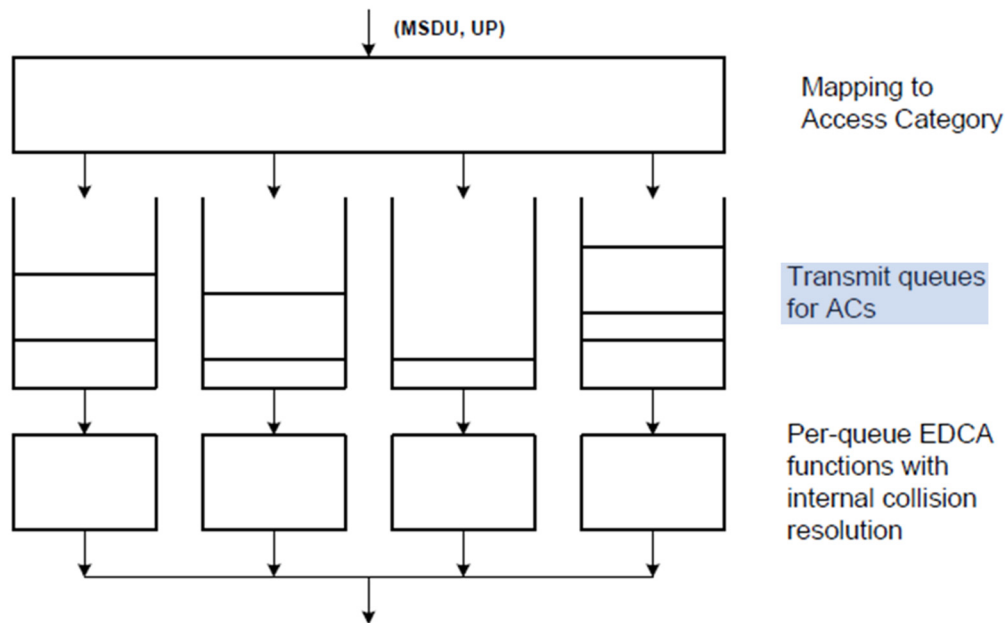


Figure 9-19—Reference implementation model

SAMSUNG-1017, FIG. 9-19.

A POSITA would have understood and found obvious that Bharghavan's queuing of "data flows (or individual messages, or individual message units) in response to their associated QoS" uses the defined access categories (VO, VI, BK, BE) described in Cherian, Bharghavan, and the 802.11 standard. SAMSUNG-1007, 0042; SAMSUNG-1010, 8:1-62; SAMSUNG-1017, pp.568, 874. Thus, Bharghavan describes the method *to operate a plurality of queues that are classified according to an access category of data stored in a queue*. SAMSUNG-1003, 0204

In operating a queue for each access category, Bharghavan performs the 802.11 standard's defined "backoff procedure." SAMSUNG-1010, 5:29-53;

SAMSUNG-1017, pp.878-879. As Cherian describes, this procedure controls the countdown of the backoff timer until the timer reaches zero and a transmission occurs. SAMSUNG-1007, 0041-0042; SAMSUNG-1017, pp.878-879. When a collision in transmission occurs, the backoff procedure will generate the integer random number within the range of CWmin and CWmax as established in the EDCA parameters discussed in [4.0]-[4.3]. SAMSUNG-1007, 0041-0043; SAMSUNG-1010, 5:29-53 (“Each node selects a random waiting time within the range of the contention window.”); SAMSUNG-1017, 878-879 (“The backoff timer is set to an integer value chosen randomly with a uniform distribution taking values in the range [0,CW[AC]] inclusive.”), 875-876; *see* [4.0]-[4.3]. Finally, like Cherian, Bharghavan describes using backoff procedures to contend “for access to the medium separately for each type of traffic in response to the one or more contention parameters.” SAMSUNG-1007, 0017, 0051, 0042(“utilizing several access categories (AC) which help effectively establish different back-off generation procedure per queue, where each AC uses different queue . . . packets of different ACs are ready for transmission when a backoff timer expires,”); SAMSUNG-1010, cl.8; SAMSUNG-1003, 0205.

Thus, a POSITA would have understood and found obvious that Zhou-Cherian-Kim-Bharghavan *performs backoff procedure of accessing a channel based on a time corresponding to a backoff timer in each of the plurality of*

queues because of the description of managing queues according to the backoff procedure for each category so that the STA can access the medium for each access category. SAMSUNG-1003, 0206.

[6.1]

Zhou-Cherian-Kim-Bharghavan renders obvious [6.1]. Bharghavan describes a process to “determine that it is justified in transmitting a message unit in response to differing criteria for distinct queues.” SAMSUNG-1010, 8:1-52. During this process, the STA may “transmit a message unit in response to any queue that is not empty.” *Id.* Thus, a transmission occurs for queues that are not empty. A POSITA would have understood and found obvious that when a queue is empty there is nothing to transmit. SAMSUNG-1003, 0207. Indeed, the common sense of a POSITA would lead to the logical conclusion that there is no need to transmit the “absence” of information in a queue—when the queue is empty, no transmission should occur. This concept is explicitly reflected in the 802.11 standard, which states to “[d]o nothing for that access function” when a queue is empty. See SAMSUNG-1017, pp.875–876, 878–879. Thus, when Bharghavan describes determining if a transmission from a queue is “justified,” and a POSITA would have understood and found obvious that *when there is no data stored in the queue and the backoff timer corresponding to the queue is 0*, the STA *perform no operation* for that queue *at a slot boundary of the backoff timer*. SAMSUNG-

1003, 0207.

[6.2]

Zhou-Cherian-Kim-Bharghavan renders obvious [6.2]. Specifically, like Cherian, Bharghavan teaches that each STA “selects a random waiting time within the range of the contention window.” SAMSUNG-1007, 0041 (“the node starts the backoff procedure by selecting a random initial value for the backoff counter.”); SAMSUNG-1010, 5:29-53. The STA “waits for the medium to be *idle*. . . [and t]he timer is then restarted.” SAMSUNG-1010, 5:29-53. Bharghavan’s teaching is corroborated by the 802.11 standard, which similarly teaches that the backoff timer is based on a value between the CW_{min} and CW_{max} . SAMSUNG-1017, pp.836-837. This range is called the “contention window.” SAMSUNG-1017, p.820 (“The contention window limits a CW_{min} and a CW_{max} , from which the random backoff is computed”). Bharghavan’s selection of the random waiting period is accomplished when a random integer value is “drawn from a uniform distribution over the interval $[0, CW]$, where CW is an integer within the range of values of the PHY characteristics aCW_{min} and aCW_{max} .” SAMSUNG-1010, 5: 29-53; SAMSUNG-1017, pp.836-837; SAMSUNG-1003, 0208.

Thus, a POSITA would have understood and found obvious , that *the backoff timer is set based on a random integer value calculated in a contention window (CW)*. SAMSUNG-1003, 0209

Cherian describes that the *backoff timer is reduced when the channel is idle for a predetermined slot time*. For example, Cherian teaches that the STA can sense the channel is busy by sensing a transmission “from either other nodes within the same WLAN or those belonging to another WLAN.” SAMSUNG-1007, 0041. Similarly, the STA can detect when the channel is “free” or *idle*. Cherian teaches that when the channel is *idle* the “countdown is resumed.” Thus, Cherian teaches that the *backoff timer is reduced when the channel is idle for a predetermined slot time* or unit of time in which each transmission can occur. SAMSUNG-1007, 0021 (“terminals to share the same frequency channel by dividing the transmission signal into different *time slots*,”); SAMSUNG-1003, 0210-0211.

The 802.11 standard corroborates this teaching when describing four functions available at a slot boundary: 1) transmission, 2) “[d]ecrement the backoff timer for that access function,” 3) invoke another backoff procedure due to collision, 4) do nothing. SAMSUNG-1017, pp.875-876. Thus, the basic function of the backoff timer (e.g., decrement until transmission), would have been understood and obvious to a POSITA. SAMSUNG-1003, 0212.

Of the four available options for a backoff timer defined in the 802.11 standard, only two conditions would satisfy the channel being “idle.” SAMSUNG-1003, 0213. First, if the backoff timer is a non-zero value then transmission does not occur and the access channel is “idle” (e.g., not transmitting). Second, if the

backoff timer is zero and there is nothing in the queue, then the channel is “idle” (e.g., not transmitting). A POSITA would have understood that in the first of these two situations (where the timer is non-zero), the timer should be decremented in order to progress to transmission—indeed that is the point of the backoff timers for each access category. *Id.* Conversely, no decrementing is needed for a backoff timer at zero with nothing in the queue. *Id.* Therefore, Zhou-Cherian-Kim-Bharghavan renders obvious that *the backoff timer . . . is reduced when the channel is idle for a predetermined slot time. Id.*

b. Claim 7

[7.0]

Zhou-Cherian-Kim-Bharghavan renders obvious [7.0]. For example, when describing figure 3, Bharghavan, like Zhou and Cherian, teaches a method of using QoS access categories for transmission. SAMSUNG-1005, 0002; SAMSUNG-1007, 0042; SAMSUNG-1010, 8:1-62, FIG. 3. Specifically, when an AC has no data to transmit, “a contention window time for that queue is set to zero.” *Id.* Additionally, the “back-off parameter for that queue is set to zero.” *Id.* A POSITA would have understood and found obvious that the determination of a CW (what the 802.11 standard calls “the backoff procedure”) occurs when the backoff timer reaches zero. SAMSUNG-1003, 0124; SAMSUNG-1017, pp.878-880, 2420. Thus, the determination that the queue is empty would occur when *the backoff timer*

corresponding to the queue is 0. SAMSUNG-1003, 0214.

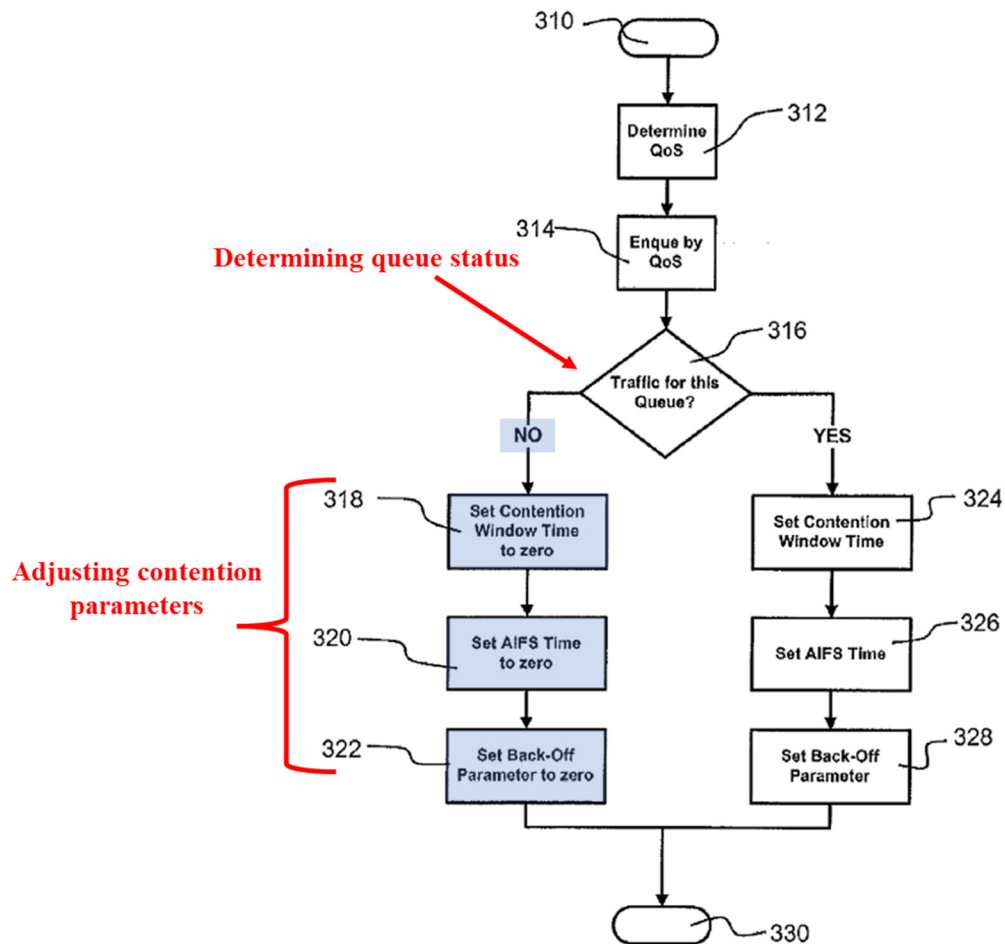


Figure 3

SAMSUNG-1010, FIG. 3.

Thus, Zhou-Cherian-Kim-Bharghavan renders obvious [7.0]. SAMSUNG-1003, 0215.

V. PTAB DISCRETION SHOULD NOT PRECLUDE INSTITUTION

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

Owner to the contrary. *See* SAMSUNG-1019; SAMSUNG-1020; Video at

<https://uspto.cosocloud.com/p9xpz6s4jn75/>; SAMSUNG-1021.

VI. CONCLUSION AND FEES

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)

The ‘879 Patent is the subject of civil action *Wilus Institute of Standards and Technology Inc., v. Samsung Electronics Co., Ltd., et al.*, 2-24-cv-00765 (EDTX) filed September 20, 2024; and *Wilus Institute of Standards and Technology Inc. v. HP Inc.*, 2-24-cv-00764 (EDTX) filed September 20, 2024. Petitioner is not aware of any disclaimers, reexamination certificates, or IPR petitions addressing the ‘879 Patent.

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

Petitioner provides the following designation of counsel.

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D. Service Information

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

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Respectfully submitted,

Dated May 29, 2025

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CERTIFICATION UNDER 37 CFR § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for Inter Partes Review totals 13,989 words, which is less than the 14,000 allowed under 37 CFR § 42.24.

Dated May 29, 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 May 29, 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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