

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZYXEL COMMUNICATIONS CORPORATION AND
ZYXEL NETWORKS CORPORATION
Petitioners

v.

ATLAS GLOBAL TECHNOLOGIES LLC
Patent Owner

Case IPR2023-00863
U.S. Patent No. 9,531,520

**PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 9,531,520
PURSUANT TO 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42**

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<i>Snap, Inc. v. SRK Technology LLC</i> , IPR2020-00820 Paper 15 (PTAB Oct. 21, 2020)	6
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PETITIONERS' EXHIBIT LIST

<u>Exhibit No.</u>	<u>Description</u>
EX-1001	U.S. Patent No. 9,531,520
EX-1002	Prosecution History for U.S. Patent No. 9,531,520
EX-1003	Declaration of Paul Min, Ph.D.
EX-1004	U.S. Patent No. 10,257,806 (“Chu806”)
EX-1005	U.S. Patent No. 10,230,497 (“Merlin”)
EX-1006	U.S. Patent Appln. Pub. 2017/0367077 (“Shu”)
EX-1007	U.S. Patent Appln. Pub. 2010/0310003 (“Lauer”)
EX-1008	Complaint
EX-1009	Patent Owner’s Preliminary Infringement Contentions
EX-1010	<i>Curriculum Vitae</i> of Paul Min, Ph.D.
EX-1011	IEEE Std. 802.11-2012 (March 2012)
EX-1012	“Status of Project IEEE 802.11ax,” Background https://www.ieee802.org/11/Reports/tgax_update.htm , retrieved on April 13, 2023.
EX-1013	EP3,275,113 B1
EX-1014	U.S. Provisional Patent Application No. 62/088,257
EX-1015	Nee, R.V. & Prasad R., <u>OFDM For Wireless Multimedia Communications</u> (2000), ISBN: 0-89006-530-6 (“Nee”)
EX-1016	WiMAX Forum, “Mobile WiMax – Part 1: A Technical Overview and Performance Evaluation” (2006).
EX-1017	Etemad, K. & Lai, M.-Y. <u>WiMAX Technology and Network Evolution</u> (2010) (pages xxiii-xxxiv, 83-120). ISBN: 978-0-470-34387-6 (“Etemad”)
EX-1018	“Techniques for Short Downlink Frames,” 11-14-0855-00-00ax-techniques-for-short-downlink-frames (July 2014), https://mentor.ieee.org/802.11/dcn/14/11-14-0855-00-00ax-

<u>Exhibit No.</u>	<u>Description</u>
	techniques-for-short-downlink-frames.pptx , retrieved on April 15, 2023.
EX-1019	“Uplink multi-user transmission,” 11-13-1388-00-0hew-ul-mu-transmission (November 11, 2013), https://mentor.ieee.org/802.11/dcn/13/11-13-1388-00-0hew-ul-mu-transmission.pptx , retrieved on April 15, 2023.
EX-1020	“Consideration on UL MU Transmission,” 11-14-0802-00-00ax-consideration-on-ul-mu-transmission (July 14, 2014), https://mentor.ieee.org/802.11/dcn/14/11-14-0802-00-00ax-consideration-on-ul-mu-transmission.pptx , retrieved on April 15, 2023.
EX-1021	“Frame Exchange Control for Uplink Multi-user Transmission,” 11-14-1190-03-00ax-frame-exchange-control-for-uplink-multi-user-transmission (September 15, 2014), https://mentor.ieee.org/802.11/dcn/14/11-14-1190-03-00ax-frame-exchange-control-for-uplink-multi-user-transmission.pptx , retrieved on April 15, 2023.
EX-1022	Index of Claims 1-20 of U.S. Patent No. 9,531,520

TABLE OF ACRONYMS IN THE '520 PATENT

		<u>520 Patent (EX-1001) Citation</u>
ACK	acknowledgement/acknowledgment	Col. 6:2-3
AP	access point	Col. 5:9
DL	downlink	Col. 1:32
FDMA	Frequency Division Multiple Access	Col. 1:32-33
IEEE	Institute for Electrical and Electronics Engineers	Col. 4:65-66
MAC	medium access control	Col. 6:22
MPDU	MAC Protocol Data Unit	Col. 1:61-62
MU	multi-user	Col. 1:30
MU-MIMO	multi-user multiple-input multiple output	Col. 1:39
OFDM	Orthogonal Frequency Division Multiplexing	Col. 11:29-30
OFDMA	Orthogonal Frequency Division Multiple Access	Col. 1:32-33
PDU	Protocol Data Unit	Col. 5:11
PHY	physical	Col. 6:22-23
STA	station	Col. 5:12
UL	uplink	Col. 4:9-10
WLAN	Wireless local area network	Col. 1:26

I. INTRODUCTION AND RELIEF REQUESTED

ZyXEL Communications Corporation and ZyXEL Networks Corporation (collectively, “Petitioners”) hereby petition for *inter partes* review (“IPR”) under 35 U.S.C. §§ 311–319 and 37 C.F.R. § 42 of Claims 1-20 (“the Challenged Claims”) of U.S. Patent No. 9,531,520 (the “’520 Patent”) (EX-1001). Atlas Global Technologies LLC (“P.O.”) is the assignee of record with the USPTO.

As explained below, there exists a reasonable likelihood that Petitioners will prevail in demonstrating unpatentability of at least one of the Challenged Claims based on teachings set forth in the references presented in this Petition. Indeed, the claims of the ’520 Patent recite nothing more than a well-known technique for coordinating simultaneous uplink (UL) multi-user (MU) transmissions in response to a downlink (DL) multi-user (MU) transmission in a wireless network. Every aspect of the claims was a well-known technique or technology that operates in its known and intended manner to produce an obvious result.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8(B)(1)-(4)

A. Real Party-In-Interest

ZyXEL Communications Corporation and ZyXEL Networks Corporation are the real parties-in-interest.

B. Related Matters

The ’520 Patent has been asserted by P.O. against Petitioners in 6:22-cv-00355 (WDTX) (“Texas Litigation”). The patent is also asserted against Sercomm

Corp. in 6:21-cv-00818-ADA (WDTX); TP-Link Technologies Co., Ltd. et al. in 2:21-cv-00430 (EDTX); D-Link Corporation in 6:22-cv-00520-ADA (WDTX); Acer Inc. in 6:22-cv-00259 (EDTX); and Arcadyan Technology Corporation in 2:22-cv-00349 (EDTX). *See* EX-1002, 187-196.

C. Designation of Counsel and Service Information

Petitioners designate the following Lead Counsel. Filed concurrently with this Petition is a Power of Attorney pursuant to 37 C.F.R. § 42.10(b). Service may be made via hand-delivery at the postal mailing address below or electronically by e-mail at ZyXEL_AGT520_IPR@sjclawpc.com.

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III. GROUNDS FOR STANDING UNDER 37 CFR § 42

A. Grounds for Standing under 37 CFR § 42.104(a)

Petitioners certify that the '520 Patent is available for review under 35 U.S.C. § 311(c) and that Petitioners are not barred or estopped from requesting an IPR on the grounds identified herein.

B. Challenge Under 37 CFR § 42.104(b) and Relief Requested

The following chart demonstrates the proposed grounds against the Challenged Claims. With these grounds and the evidence submitted herein, Petitioners have established a reasonable likelihood that they will prevail in establishing unpatentability of Claims 1-20 and request the institution of IPR and cancellation of these claims.

Ground	Claims	Basis	References
1	1-20	§ 103	U.S. 10,257,806 (“Chu806”)
2	1-20	§ 103	U.S. 10,230,497 (“Merlin”)
3	1-20	§ 103	Appln. Pub. 2017/0367077 (“Shu”)

C. Prior Art Offered for the Present Unpatentability Challenges

The Petition provides patentability challenges under 35 U.S.C. § 103 using the following patents as understood by a POSITA:

Chu806: U.S. Patent No. 10,257,806, entitled “Medium Access Control for Multi-Channel OFDM in a Wireless Local Area Network”, and claimed priority to Provisional Application No. 61/902,413 filed on November 11, 2013, and No. 61/947,922 filed on March 4, 2014, was filed on November 11, 2014, and issued on April 9, 2019, to Chu et al. (EX-1004). Chu806 is prior art to the ’520 Patent under AIA 35 U.S.C. § 102 (a)(2). Chu806 discloses an access point (AP) of a wireless local area network (WLAN) allocates respective sub-channels of an

orthogonal frequency division multiplexing (OFDM) channel to stations (STAs) for uplink orthogonal frequency division multiple access (OFDMA) transmission from the STAs. EX-1004; 5:23-27.

Merlin: U.S. Patent No. 10,230,497, entitled “Protocols for Multiple User Frame Exchanges”, and claimed priority to a Provisional Application No. 61/899,121 filed on November 1, 2013, was filed on October 30, 2014, and issued on March 12, 2019, to Merlin et al. (EX-1005). Merlin is prior art to the ’520 Patent under AIA 35 U.S.C. § 102 (a)(2). Merlin discloses “frame structures and protocols for uplink multiple user (MU) frame exchanges” with acknowledgment (ACK) policies and signaling for allocating multiple-user multiple-input multiple-output (MU-MIMO)... resources to the recipient STAs for the replies. EX-1005; 5:32-38.

Shu: U.S. Patent Application Publication No. 2017/0367077, entitled “Data Transmission Method and Apparatus Used in Wireless Local Area Network”, and claimed priority to a CN Application filed on August 25, 2014, was filed as a PCT on March 18, 2015, by Shu et al. (EX-1006). Shu is prior art to the ’520 Patent under AIA 35 U.S.C. § 102 (a)(2). Shu discloses “sending, by the [AP], an acknowledgment request message to the multiple [STAs]..., where the acknowledgment request message includes channel resource information, and the

channel resource information is used to indicate the channel resources allocated by the [AP] to the multiple [STAs].” EX-1006, [0057].

IV. DISCRETIONARY CONSIDERATIONS FAVOR INSTITUTION—35 U.S.C. §§ 314(a) AND 325(d)

A. Relevant Facts

Petitioners executed a waiver of service on May 27, 2022, thereby accepting service of the Complaint filed by the P.O. in the U.S. District Court for the Western District of Texas (“Texas Court”) alleging infringement of the ’520 Patent. EX-1008. This Petition would be the first IPR petition of the ’520 Patent.

B. The *Advanced Bionics* Test Favors Institution—§ 325(d)

The Examiner did not consider the primary prior art references advanced in this Petition during prosecution. *See* Section V.C. Prosecution concluded prematurely, and the obviousness analysis in this Petition proves that allowance was unwarranted. When, as here, new and non-cumulative prior art demonstrates unpatentability, the Board’s precedent compels institution. *See Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, IPR2019-01469, Paper 6 at 8-9 (PTAB Feb. 13, 2020) (precedential).

C. The *General Plastic* Factors Favor Institution—§ 314(a)

The Board’s “intent in formulating the [*General Plastic*] factors was to take undue inequities and prejudices to P.O. into account” when evaluating second-in-time petitions. *General Plastic Indus. Co. v. Cannon Kabushiki Kaisha*, IPR2016-

01357, Paper 19 at 16 (PTAB Sep. 6, 2017) (precedential). This Petition is the first IPR petition of the '520 Patent. Therefore, none of the *General Plastic* factors favor denial. For example, the Board's finite resources are well spent here. Careful vetting of the '520 Patent's claims did not occur during prosecution, and it is fully consistent with the AIA's goals for the Board to rectify that mistake when prompted by parties accused of infringement. *General Plastic*, p.16. The *General Plastic* factors, therefore, favor institution.

D. The *Fintiv* Factors Favor Institution—§ 314(a)

Consistent with *Fintiv I*, Petitioners ask that the Board alone consider the grounds raised in this Petition. *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 6 (PTAB Mar. 20, 2020) (precedential) ("*Fintiv I*"). As explained above and below, Petitioners' efforts to support fairness and efficiency, paired with the strong merits of Grounds 1-3, provide compelling reasons to institute. *See id.*; *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019 Paper 12 at 20-21 (PTAB Dec. 1, 2020) (precedential); *Snap, Inc. v. SRK Technology LLC*, IPR2020-00820 Paper 15 at 19 (PTAB Oct. 21, 2020) (precedential).

Factor 1 (Stay): This factor is neutral because no party has, as of yet, approached the Texas Court with a motion to stay regarding the '520 Patent. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 15 at 12 (PTAB May 13, 2020) (declining to "infer" how the district court "would rule should a stay be requested")

(informative) (“*Fintiv II*”); *Sand Revolution II, LLC v. Cont’l Intermodal Group—Trucking LLC*, IPR2019-01393, Paper 24 at 7 (PTAB Jun. 16, 2020) (“*Sand Revolution*”) (informative).

Factor 2 (Trial Date): The Texas Court currently sets the trial date on May 16, 2024, or as soon as practicable, which precedes the Board’s projected October 2024 final written decision at most by 5-6 months. Even taken at face value, the Board’s analysis in *Fintiv II* suggests that a six-month advanced trial date should weigh no more than “*somewhat in favor* of discretionary denial” in *Fintiv II*. *See Fintiv II* at 13. And the trial date’s significance is mitigated here compared to *Fintiv II* given Petitioners’ stipulation to avoid coincident obviousness grounds in the Texas Litigation (*see* Factor 4). But, regardless, the Board should not take the current trial date from the Texas Court at face value because the Texas Court also indicates “as soon as practicable” and is intrinsically infirm. *See, e.g., Intel Corp., v. FG SRC LLC*, IPR2020-01449, Paper 13 at 15 (PTAB Mar. 3, 2021) (explaining that estimated trial dates are not firm trial dates); *MediaTek Inc. et al v. Nippon Telegraph and Telephone Corp.*, IPR2020-01404, Paper 14 at 10-11 (PTAB Feb. 16, 2021) (noting statistics regarding trial date extensions in the Texas Court, and also finding that the district court’s “estimated” trial date “does not support that [the] trial date is certain”). With no certainty as to when trial will actually occur, Factor 2 is either neutral or favors institution.

Factor 3 (Investment): The Texas Litigation is currently in its infancy. Petitioners received preliminary infringement contentions eight months ago. *Markman* hearing is currently scheduled on May 1, 2023. At the projected date of institution (October 2023), the fact discovery period will be open, and expert reports will not yet be due. Beyond a *Markman* order, the Texas Court will almost certainly have not issued any substantive orders relevant to validity by the time of institution.

The facts here compare favorably to *Fintiv II*. In that case, as here, “[a]t the time of filing the Petition, the parties were in the midst of preparations for the *Markman* hearing.” *Fintiv II* at 9.

The “informative” guidance in *Sand Revolution* is telling here too. By the time of institution in this proceeding, the Texas Litigation will be at a similar posture where “aside from the district court’s *Markman* Order, much of the district court’s investment relates to ancillary matters untethered to the validity issue itself.” *Sand Revolution* at 10-11. The parallels are also notable because:

[M]uch work remains in the district court case as it relates to invalidity: fact discovery is still ongoing, expert reports are not yet due, and substantive motion practice is yet to come. Thus, although the parties and the district court have invested effort in the related district court litigation to date, further effort remains to be expended in this case before trial.

Id. at 11 (internal citation omitted). Given the alignment with *Sand Revolution*, Factor 3 should weigh “only marginally, *if at all*, in favor of exercising discretion to deny.” *Id.* (emphasis added). Alternatively, it is reasonable to characterize this

factor as firmly neutral given Petitioners' even greater diligence.

Factor 4 (Overlap): This factor favors institution. To start, if *inter partes* review is instituted on Grounds 1-3 in this proceeding, Petitioners will not pursue Grounds 1-3 in the Texas Litigation. Thus, there will be no overlap with the prior art issues before the Board with invalidity grounds in an earlier jury trial (if any). As explained in *Sand Revolution*, a stipulation to avoid using instituted grounds in co-pending litigation "mitigates to some degree the concerns of duplicative efforts between the district court and the Board, as well as concerns of potentially conflicting decisions." *Sand Revolution* at 12.

The fact that this Petition addresses more claims than would be covered in a jury trial also favors institution. Claims 7 and 17 were not asserted in Patent Owner's preliminary infringement contentions, and the asserted claims likely will be narrowed before trial. EX-1009. If the Board denies institution, claims 7 and 17, and any winnowed claims will escape scrutiny despite their obviousness. This will result in significant harm to Petitioner, as Patent Owner could attempt to assert those invalid claims against Petitioners' future products. The interests of justice are best served by instituting review here and now.

Factor 5 (Parties): The parties here and in the Texas Litigation are the same. As explained in *Sand Revolution*, Factor 5 is often neutral because it is "far from an unusual circumstance that a petitioner in *inter partes* review and a

defendant in a parallel district court proceeding are the same.” *Sand Revolution* at 24. Particularly in view of that the actual date of a jury trial is uncertain, Factor 5 could be deemed neutral.

But viewed holistically, the present circumstances favor institution. Indeed, institution offers a unique opportunity to adjudicate the grounds of this Petition exclusively at the PTAB.

Factor 6 (Merits): The merits of this Petition are particularly strong. Section VII below presents three independent prior art combinations (Chu806, Merlin, and Shu) against the ’520 Patent’s claims. As discussed, the prior art and arguments at issue here are materially different from those considered by the Examiner during prosecution. The strength of the merits alone is enough to outweigh any inefficiencies born of parallel litigation. *See Fintiv* at 15.

In addition, the Texas Litigation involves nine patents. If *inter partes* review is instituted in this proceeding, the IPR could simplify the Texas Litigation by removing a patent from a complex case. *Apple v. Seven*, IPR2020-00156, Paper 10, 22 (PTAB June 15, 2020).

V. BACKGROUND

A. The State of the Art in March 2015

WLAN communications systems were well known and standardized prior 2015. For example, the Institute for Electrical and Electronics Engineers (IEEE)

has adopted the techniques to provide parallel transmission, such as OFDM in the 802.11 standards, since at least 1999. UL MU and DL MU transmissions also have been known. EX-1003, ¶¶ 40-61, 66-72.

In addition, as acknowledged by the inventors in the Background Section in the related EP3,275,113B1, MIMO techniques were already well known in the art at the time of the '520 Patent. *See* EX-1013, [0003]. Particularly, it was admittedly known that “an [AP] may transmit a single [DL OFDMA] frame that assigns particular resource units (RUs) to separate [STAs] in the wireless system. Each RU may include data and/or control information that is intended for a [STA] or a set of [STAs].” EX-1013, [0002]. *See also* EX-1003, ¶ 62.

Moreover, the advantages of having an AP to coordinate available resources for multiple receiving STAs were known. EX-1003, ¶¶ 45-61, 63-87. For example, each of Chu806, Merlin, and Shu describes that it was known for an AP to accommodate simultaneous communications to/from STAs with different capabilities. Chu806 teaches that the AP operates with first STAs according to a first communication protocol and with second STAs according to another protocol while increasing efficiency in frame exchanges. EX-1004, 5:31-45. Similarly, Merlin teaches that an AP communicates with non-legacy STAs and legacy STAs, thereby extending the lifetime of an older version of STAs while introducing newer STAs. EX-1005, 8:18-24. Merlin’s disclosure also addresses protocol rules

and enables efficient frame exchange sequences. EX-1005, 5:34-38. *See also* EX-1006, [0067]; EX-1003, ¶ 75.

B. Description of the '520 Patent

The '520 Patent claims priority to Provisional Application No. 62/137,138 filed on March 23, 2015, and No. 62/140,349 filed on March 30, 2015, with March 23, 2015, being the purported earliest effective filing date. EX-1001, cover. The '520 Patent is directed at facilitating UL MU acknowledgment transmission. EX-1001, Abstract. To that end, the '520 Patent discloses an AP transmitting a DL MU protocol data unit (PPDU) to multiple STAs. EX-1001, 5:9-12. "Each [DL] MPDU may include data and/or control frames intended for each respective STA and may be placed in resource units within the DL MU frame assigned/allocated to each respective STA." EX-1001, 14:9-12. The '520 Patent explains that "the resource units may be particular spatial streams or sub-channels of a wireless channel upon which the DL MU frame will be transmitted." EX-1001, 14:12-14; 18:5-8; 20:48-50.

As reflected in Figures 5A and 5B, the AP transmits the DL MU frame addressed to STA1-STA3 including frames intended for each STA and MPDU may be placed in resource units within the DL MU frame to each STA.

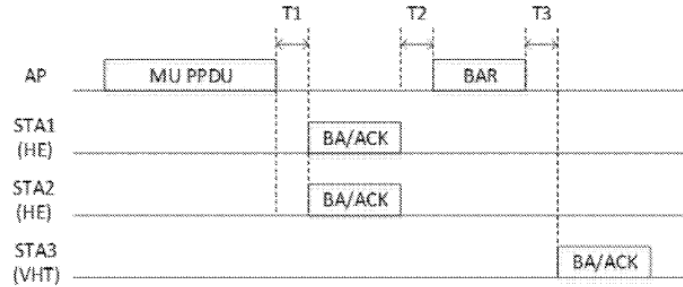


FIG. 5B

C. The '520 Prosecution History

The USPTO issued an Office Action rejecting the original claims under 35 U.S.C. 103(a) as being unpatentable over U.S. 2013/0301569 (Wang). EX-1002, 93-102. In response to the claim rejections, the inventors amended all claims to further require, e.g., uplink multi-user acknowledgements. Amendments made to independent claims 1, 8 and 18 are reproduced below. The inventors also argued, *inter alia*, that “Wang does not disclose UL MU transmissions....” EX-1002, 137-146

	8. (Currently amended) A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising: - receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, and received from an access point in the wireless network; - processing a first MAC Protocol Data Units (MPDU) in the downlink multi-user frame to determine acknowledgement information [[for]] indicating properties of a first multi-user acknowledgement frame to acknowledge the downlink multi-user frame by two or more stations; - generating the first multi-user acknowledgment frame based on the acknowledgement information; and - transmitting the first multi-user acknowledgment frame to the access point ~~based on the acknowledgement information to acknowledge the downlink multi-user frame,~~ <u>wherein the first multi-user acknowledgment frame is transmitted simultaneously to a second multi-user acknowledgment frame transmitted by a second station.</u>
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1. (Currently amended) A method, implemented by a network device in a wireless network, for coordinating an uplink multi-user response transmission to a downlink multi-user transmission, the method comprising: generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units ~~that are each assigned to a station in the plurality of stations (RUs)~~, wherein generating the downlink multi-user frame comprises: <u>assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and</u> <u>including a respective set of MAC Protocol Data Units (MPDUs) in each resource-unit RU of the plurality of resource units RUs,</u> <u>wherein ~~one or more MPDUs~~ an MPDU in ~~each one or more of the resource units~~ RUs in the plurality of RUs ~~downlink multi-user frame~~ includes acknowledgement information [[for]] indicating properties of a multi-user acknowledgement transmission ~~transmitted by each respective that the station in the plurality of stations to which the RU is assigned is requested to transmit~~ to acknowledge the downlink multi-user frame; [[and]]</u> <u>transmitting the downlink multi-user frame to the plurality of stations over a wireless channel, and</u> <u>receiving the uplink multi-user response transmission, the uplink multi-user response transmission including multi-user acknowledgement transmissions respectively and simultaneously transmitted by two or more stations in the plurality of stations,</u> <u>wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.</u>	18. (Currently amended) A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising: receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, wherein the downlink multi-user frame is received from an access point in the wireless network; receiving a multi-user block acknowledgement request frame that solicits acknowledgements from ~~two or more stations~~ <u>the first station and a second station</u>, wherein the multi-user block acknowledgement request frame includes acknowledgement information [[for]] indicating properties of a first multi-user acknowledgement frame ~~that acknowledges receipt of the downlink multi-user frame by the first station,~~ generating the first multi-user acknowledgment frame based on the acknowledgement information; and <u>acknowledging the receipt of the downlink multi-user frame by transmitting the first multi-user acknowledgement frame to the access point based on the acknowledgement information, wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station</u>
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The USPTO issued an Examiner's Statement of Reasons for Allowance by citing all the limitations of the independent claims (as-amended). EX-1002, 151-159. *See also* EX-1003, ¶¶ 38-39.

D. Level of Ordinary Skill

The '520 Patent is directed to a method by an AP to allocate resources to STAs and coordinate simultaneous UL acknowledgment transmission by the STAs in a wireless network. A person of ordinary skill in the art ("POSITA") as of March 23, 2015, would have: (1) a bachelor's degree in electrical engineering or a closely related field, and (2) a minimum of 2-3 years of industry or academic experience with wireless communication physical layer protocols. However, an individual with an advanced degree in a relevant field, such as electrical

engineering, would require less industry or academic experience (*e.g.*, 1-2 years).

See EX-1003, ¶¶ 88-89.

VI. CLAIM CONSTRUCTION

The “words of a claim ‘are generally given their ordinary and customary meaning.’” *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)). “[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a [POSITA] in question at the time of the invention.” *Id.* at 1313. The [POSITA] is deemed to have read the claim term in the context of the entire patent. *Id.* To ascertain the meaning of a claim, a court must look to the claim, the specification, and the prosecution history. *Id.* at 1314-17. Petitioners submit constructions for the terms proposed herein below. All remaining terms should be given their ordinary and customary meaning in view of the specification and file history as understood by a POSITA.¹

A. Independent claim preambles are limiting

Each of claims 1, 8, and 18 introduces elements in the preamble and states such preamble element(s) in subsequent claim limitations. As such, the preambles are

¹ Petitioners reserve the right to seek specific construction for other terms before the district court.

presumed limiting. EX-1003, ¶ 93. In addition, the Patent Owner had agreed in the Texas Litigation that the claim preambles are limiting.

VII. DETAILED EXPLANATION AND SUPPORTING EVIDENCE

A. Overview of the Cited Prior Art

- 1. Chu806 discloses a method where an AP allocates resources to STAs in a DL MU frame and the STAs transmit UL acknowledgment simultaneously.**

Chu806 discloses, *inter alia*, “a method for simultaneously communication with multiple communication devices in a [WLAN] includes allocating, by a first communication device, respective sub-channels of an [OFDM] channel to two or more second communication devices for [UL OFDMA] transmission from the two or more second communication devices,” and “receiving, at the first communication device, an [UL] OFDMA data unit that includes at least a first OFDM data unit from the first one of the two or more second communication devices and a second OFDM data unit from the second one of the two or more second communication devices.” EX-1004, 1:47-2:9; FIG. 6; FIG. 11C. *See* EX-1003, ¶ 94.

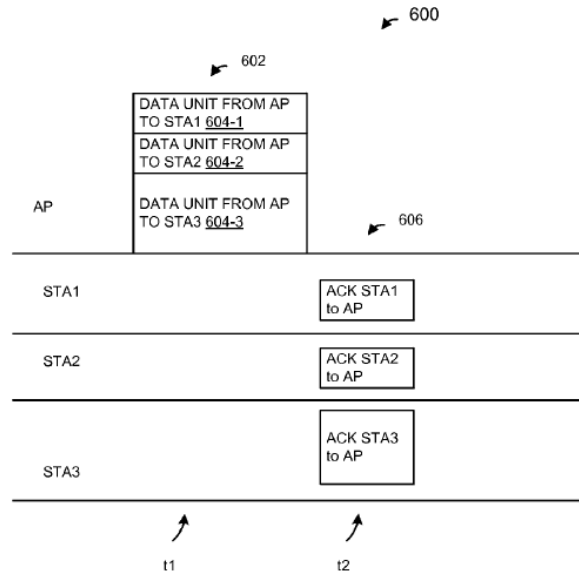


FIG. 6

2. **Merlin discloses a method where an AP allocates resources to STAs in a DL MU frame and the STAs transmit UL acknowledgment simultaneously.**

Merlin discloses frame structures and protocols for uplink (UL) multiple user (MU) frame exchanges. *See* EX-1005, 2:1-13, 28-42; 3:45-53; Fig. 22. *See* EX-1003, ¶ 95.

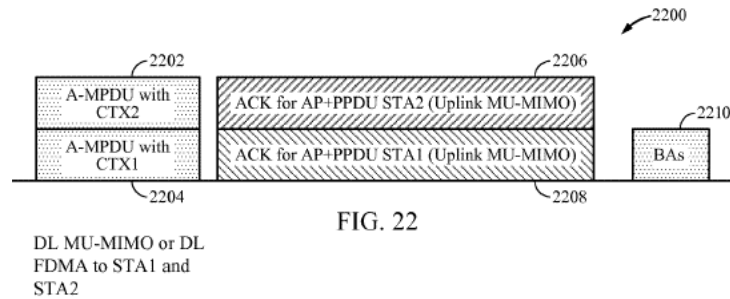


FIG. 22

3. Shu discloses a method where an AP allocates resources to STAs in a DL MU frame and the STAs transmit UL acknowledgment simultaneously.

Shu is directed to wireless transmission method including “sending, by an [AP], a corresponding downlink data frame to each [STA]; and receiving, by the [AP] after the [AP] sends the corresponding downlink data frame to each [STA], acknowledgment messages concurrently sent by the multiple [STAs] on channel resources allocated by the [AP] to the multiple [STAs].” EX-1006, Abstract. As illustrated in Fig. 3, Shu discloses the step 304 where “the [AP] sends the corresponding downlink data frame to each [STA], the [AP] receives acknowledgment messages concurrently sent by the multiple [STAs] on channel resources allocated by the [AP] to the multiple [STAs].” EX-1006, [0054]. *See* EX-1003, ¶ 96.

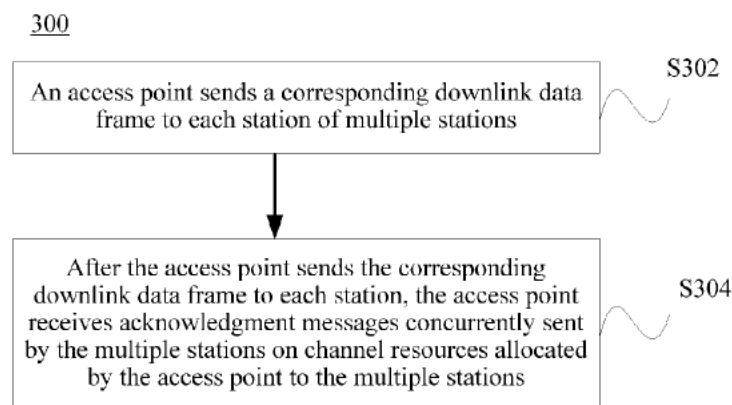


FIG. 3

B. Ground 1: Chu806 renders obvious Claims 1-20.

Chu806 relates to DL MU and UL MU transmissions between an AP and multiple STAs. As set forth below, Chu806 renders Claims 1-20 obvious and unpatentable.

1. Claim 1.

- a. [1pre] A method, implemented by a network device in a wireless network, for coordinating an uplink multi-user response transmission to a downlink multi-user transmission, the method comprising:**

Chu806 discloses [1pre].

Chu806 discusses how AP implements a method of coordinating simultaneous UL responses by STAs. For example, Chu806 teaches “allocating, by a first communication device, respective sub-channels of an orthogonal frequency division multiplexing (OFDM) channel to two or more second communication devices for [UL OFDMA] transmission from the two or more second communication devices....” EX-1004, 1:47-54. As illustrated, e.g., FIG. 1, Chu806’s first device may be an AP and the second devices may be STAs. *See also* EX-1004, 5:31-36; FIGs. 1, 3, 6, 11C, and 20A; EX-1003, ¶ 99.

FIG. 1

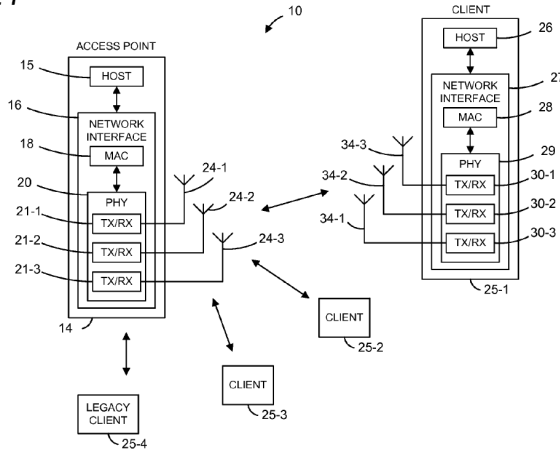
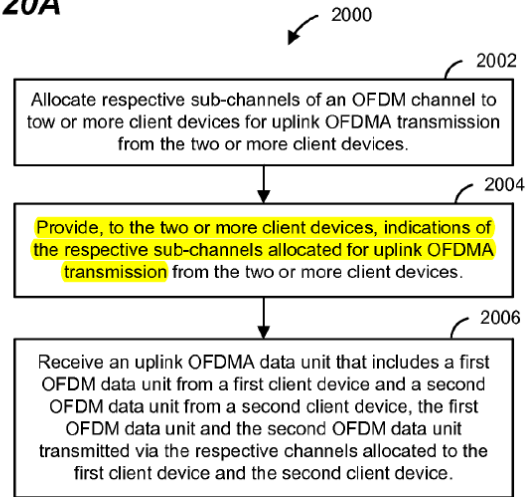


FIG. 20A



b. [1a] generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:

assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and

including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs,

wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame;

Chu806 discloses or renders [1a] obvious.

Chu806 shows how AP generates and transmits a DL MU frame to STAs to indicate the resource allocated to each STA. For example, FIG. 3 illustrates a DL

MU OFDMA data unit by the AP to be transmitted to the STAs. For example, Chu806 discloses “[i]n an embodiment in which *the OFDMA data unit 300 corresponds to a [DL] OFDMA data unit, the OFDMA data unit 300 is generated by the AP 14 such that each OFDM data unit 302 is transmitted to a respective [STA] 25....*” EX-1004, 7:58-8:13 (italics added).

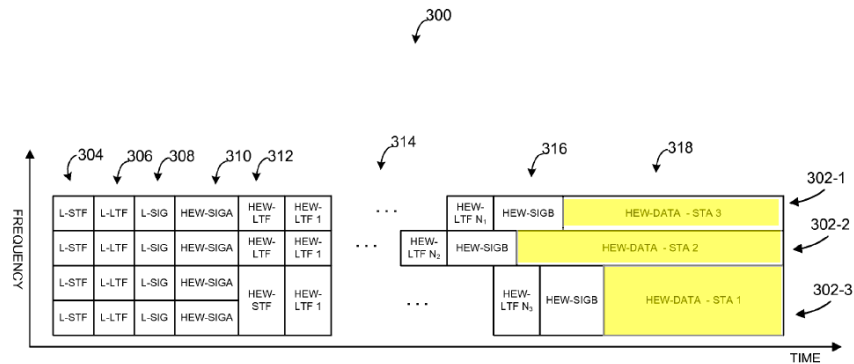
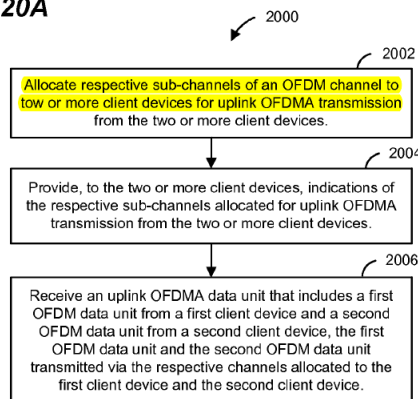


FIG. 3

Chu806 also shows allocating channel resource for UL transmissions by each STA to the AP. For example, Chu806 states “[a] first communication device *allocates respective sub-channels of [OFDM] channel to two or more second communication devices for uplink [OFDMA] transmission from the two or more second communication devices.*” EX-1004, Abstract (italic added). Chu806 also discloses that “the AP 14 allocates different sub-channels to different client [STAs].” EX-1004, 7:11-12. *See also*, e.g., EX-1004, FIGs. 2A-2C; FIG. 20A, 2002. From at least Chu806’s disclosures of the allocations of different sub-channel blocks to STAs, a POSITA would readily understand that Chu806’s AP

allocates and assigns each of the resources to each of the multiple STAs, and that Chu806 renders obvious the [1a] limitation “assigning each RU of the plurality of RUs to a respective station in the plurality of stations.” Alternatively or in addition, particularly since the ’520 Patent inventors describe the phrase “resource units (RU)” used in the ’520 Patent may be “particular spatial streams or sub-channels” (Ex-1001, 14:12-14; 18:5-8; 20:48-50), a POSITA would readily understand that Chu806’s disclosed AP assigns ‘RUs’ to STAs, includes MPDUs in each ‘RU’, and includes ‘RUs’ in a DL MU OFDMA frame to the STAs.

FIG. 20A



Chu806 also shows the DL MU frame including MPDUs, where the MPDUs include information on resource allocated by AP to STAs for UL transmissions. For example, Chu806 illustrates in FIG. 6, a DL frame including an OFDMA data unit 602 including OFDMA data units 604-1, 604-2, 604-3 for each STA1-STA3. See EX-1004, 11:59-60; 12:28-34; FIG. 6. For example, Chu806 describes “in an embodiment... *the OFDM data units 604-1, 604-2, 604-3 are MPDUs.*” EX-1004, 13:22-24 (*italics added*). Chu806 also discloses “[i]n an embodiment, the

preamble of the OFDMA data unit [] includes *a channel allocation field*.” EX-1004, 12:28-34 (italics added). In addition, Chu806 discloses that “*the [STAs] 25 are configured to determine their respective uplink channels based on uplink channel allocation information* included in the control frame and to subsequently transmit data to the AP 14 simultaneously with the other [STAs] 25 as part of an uplink OFDMA transmission to the AP 14, in an embodiment.” EX-1004, 14:7-12 (italic added). Also, *see*, e.g., EX-1004, claim 1 (“receiving, at the first communication device, an uplink OFDMA data unit that includes at least a first OFDM data unit from the first one of the two or more second communication devices and a second OFDM data unit from the second one of the two or more second communication devices, wherein the first OFDM data unit ... is transmitted from the first one of the two or more second communication devices via the first sub-channel allocated to the first one of the two or more second communication devices.”

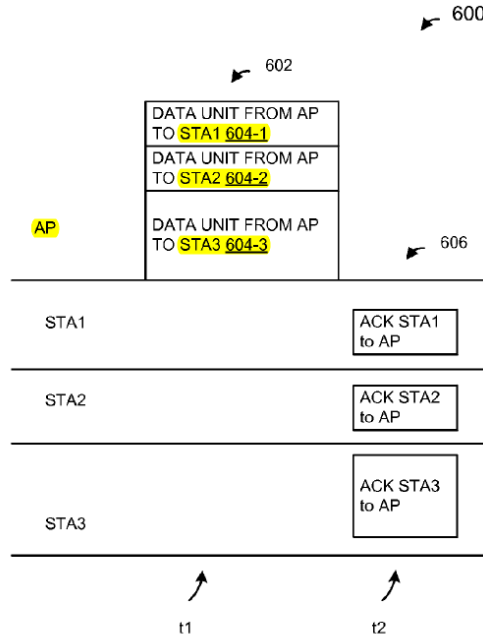


FIG. 6

Chu806 also shows the MPDUs modulated into sub-channels or sub-channel blocks allocated to STAs for DL transmission. For example, Chu806 discloses that the AP 14 generates an OFDMA data unit that includes a different OFDM data unit for each STAs 25 and modulates *the OFDM data units in respective sub-channel blocks* of the STAs. *See EX-1004, 7:6-25 (italics added).*

In an embodiment, the AP 14 is configured to transmit different OFDM units to different client stations 25 simultaneously by forming an OFDMA data unit that includes the different OFDM data units modulated in respective sub-channel blocks of the OFDMA data unit. In an embodiment, the AP 14 allocates different sub-channels to different client stations and forms the OFDMA data unit that includes OFDM data units directed to by modulating the different client stations in sub-channel blocks corresponding to the sub-channels assigned to the client stations. In an embodiment, when the one or more client stations include a legacy client station, the AP assigns a channel that includes a primary channel of the WLAN 10 to the legacy client station, and assigns one or more non-primary communication channels of the WLAN 10 to one or more non-legacy client stations. When the one or more client stations do not include any legacy client stations, the AP assigns the primary and the non-primary communication channels in any suitable manner to the one or more client stations, in various embodiments.

EX-1004: 7:6-25.

Further, Chu806 discloses that the “AP 14 includes... a medium access control (MAC) processing unit 18 and a physical layer (PHY) processing unit 20.” EX-1004, 5:57-60; FIG. 1. Chu806 also discloses that the “AP is configured to operate with client [STAs] according to... *802.11 ax communication protocol*” (EX-1004, 5:31-36) (*italics added*). *See also* EX-1004, FIG. 3. Particularly in view of Chu806’s disclosed components and available protocols for the AP 14, a POSITA would have recognized Chu806’s disclosed OFDMA data unit can correspond to MAC Protocol Data Unit (MPDU) under the 802.11ax protocol. *See* EX-1003 ¶¶ 114-117.

Chu806 also shows the DL MU frame including MPDUs, where the MPDUs include acknowledgement information on resource allocated by AP to STAs for UL MU transmission to acknowledge the DL MU frame. For example, Chu806

discloses an example where “a PHY preamble *or a MAC header of the OFDM data unit* directed to the first [STA] *includes an ACK policy field* set to indicate that an immediate acknowledgement of the data unit is not required, in an embodiment. On the other hand, the OFDM data unit directed to the second [STA] indicates that an immediate acknowledgement is required.” EX-1004, 29:37-43 (italics added).

From at least Chu806’s disclosures of an ACK policy in a MAC header of the OFDM data unit to STAs and acknowledgement frame transmission in the allocated sub-channels, POSITA would readily understand that Chu806 discloses or renders obvious the [1a] limitation “generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs, wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame.” *See* EX-1003, ¶¶ 100-128.

- c. **[1b] transmitting the downlink multi-user frame to the plurality of stations over a wireless channel; and**
- d. **[1c] receiving the uplink multi-user response transmission, the uplink multi-user response transmission including multi-user acknowledgement transmissions respectively and simultaneously transmitted by two or more stations in the plurality of stations,**

Chu806 discloses [1b] and [1c]. Chu806 discloses that “the [STAs] 25 are configured to receive corresponding *data streams that are transmitted simultaneously by the AP 14*. Additionally, [STAs] 25 are configured to transmit corresponding data streams to the AP 14 such that *the AP 14 receives the data streams simultaneously*.” EX-1004, 6:3-8 (italics added). Chu806 illustrates in FIG. 6 that “[d]uring a time t1, the AP 14 transmits an OFDMA data unit 602 directed to a plurality of [STAs].” EX-1004, 11:59-60. Also, Chu806 discloses “[d]uring a time t2, in an embodiment, [STAs] 25 that successfully receive data in the respective sub-channels allocated to the [STAs] 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14.” EX-1004, 13:4-8; FIG. 6. See EX-1003, ¶¶ 129-130.

- e. **[1d] wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.**

Chu806 discloses [1d]. For example, Chu806 discloses that “the AP 14 *allocates different sub-channels to different [STAs]...*,” and “the AP 14 receives the OFDM data units 302 *via respective sub-channels of the WLAN 10 allocated for uplink transmission* of the OFDM data units 302 from the [STAs].” EX-1004, 7:11-15; 8:15-18 (italic added). Chu806 also discloses that “each [STA] 25 transmits its acknowledgement (ACK or BlkAck) frame 606 in the respective sub-channel allocated to the [STA] 25” (EX-1004, 13:8-10), and that “[t]he channel allocation field indicates that the highest 20 MHz channel of the 80 MHz channel is allocated to the [] STA1, the second highest 20 MHz channel...is allocated to the [] STA2....” EX-1004, 12:55-61.

For the foregoing reasons, claim 1 of the '520 Patent is unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 98-134.

2. Claim 2.

[2] The method of claim 1, wherein generating the downlink multi-user frame further comprises: including the acknowledgement information, for indicating properties of the multi-user acknowledgement transmission transmitted by each respective station in the plurality of stations to

acknowledge the downlink multi-user frame, in a header of the one or more MPDUs.

3. Claim 3.

[3] The method of claim 2, wherein the header is a MAC header of the one or more MPDUs.

Chu806 discloses [2] and [3]. Specifically, Chu806 discloses “a MAC header of the OFDM data unit directed to the first [STA] includes an ACK policy field set to indicate that an immediate acknowledgement of the data unit is not required.” EX-1004, 29:37-41. For example, Chu806 discloses that “[d]uring a time t2, the AP 14 transmits OFDM data units 1406 as part of an OFDMA transmission 1404. In an embodiment, a preamble or a header of the OFDM data unit 1406-2... includes an indication that an immediate acknowledgement is not required for the OFDM data unit 1406-2. For example, *an ACK policy field in the PHY preamble or the MAC header of the OFDM data unit 1406-2 indicates that an immediate acknowledgement is not required.*” EX-1004, 30:21-30 (italics added). A POSITA would readily understand Chu806’s disclosed OFDMA data unit to correspond to MPDU under the 802.11ax protocol. *See* Section VII.B.1.b (discussion of Limitation [1a]).

Accordingly, claim 2 and claim 3 are unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 135-136.

4. Claim 4.

[4] The method of claim 1, wherein one of the one or more MPDUs in each of the RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations.

Chu806 discloses or renders [4] obvious. For example, Chu806 discloses that “*WLANs operate in either a unicast mode or a multicast mode.*” EX-1004, 1:39-40 (italics added). For example, “the AP provides to the [STAs] 25 indications of different specific times at which to transmit their respective ACK frames 606, or a specific order in which to transmit their respective ACK frames 606, and the [STAs] 25 transmit the ACK frames 606 at the specific times or in the specific order indicated by the AP....” EX-1004, 13:38-42. *See also* EX-1004; FIG. 11B.

Accordingly, claim 4 is unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 137-143.

5. Claim 5.

[5] The method of claim 4, wherein the trigger frame instigates each respective station in the plurality of stations to transmit the multi-user acknowledgement transmission after an interframe spacing period following receipt of the downlink multi-user frame.

Chu806 discloses or renders [5] obvious. Chu806 discloses “[i]n various frame changes described above with respect to FIG. 6 and FIGS. 8-19, the time t1 generally at the beginning of a TXOP.... Subsequent times, such as time t2,

time t3, time t4, etc. during which certain frames or data units are transmitted the AP 14 or the [STAs] 25, generally begin upon expiration of a predetermined time interval, such as a time interval corresponding to a short *inter-frame space* (SIFS), after completion of transmission or reception of the previous frame or data unit transmitted in the frame exchange.... Accordingly, consecutive frames and data units in the described frame exchanges are generally separated, in time, by certain predetermined time intervals....” EX-1004, 34:31-46 (*italic added*).

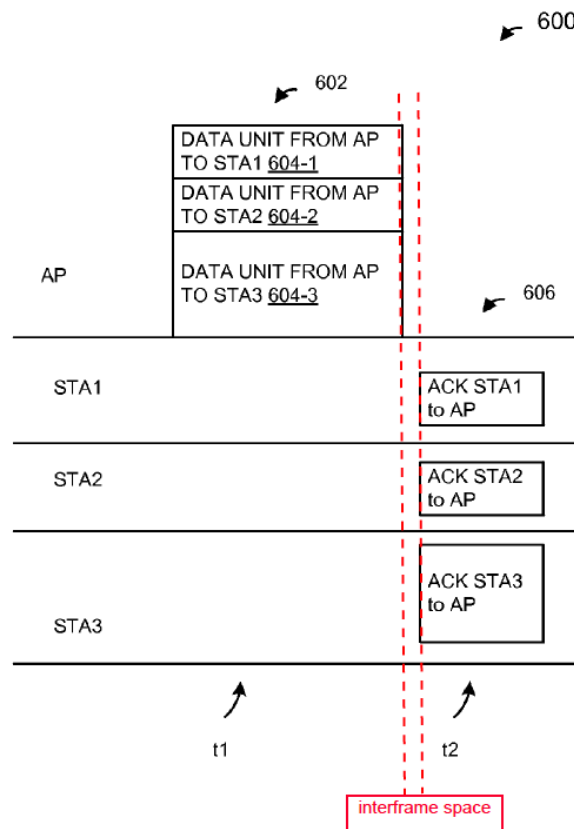


FIG. 6

Accordingly, claim 5 is unpatentable as obvious in view of Chu806. See EX-1003, ¶¶ 144-147.

6. **Claim 6.**

[6] The method of claim 1, further comprising:

generating, by the network device, a multi-user block acknowledgement request frame to solicit acknowledgements from two or more stations of the plurality of stations; and

transmitting the multi-user block acknowledgment request frame following transmission of the downlink multi-user frame.

Chu806 renders [6] obvious. For example, Chu806 discloses a further embodiment where “uplink scheduling information is provided to the client [STAs] 25 by respective separate scheduling frames 1152 transmitted as control frames separate from the OFDM data units 1104” (EX-1004, 24:27-30), and “the scheduling frames 1152 are transmitted to the [STAs] 25 as separate control frames that follow transmission of the respective OFDM data units 1106 to the [STAs] 25.” EX-1004, 24:32-38; FIG. 11C.

Chu806 also indicates that the term “acknowledgement frame” may encompass both an acknowledgement frame and a block acknowledgement frame, as well as the AP can be configured according to “802.11 ax.” *See* EX-1004, 13:42-49, 5:31-36.

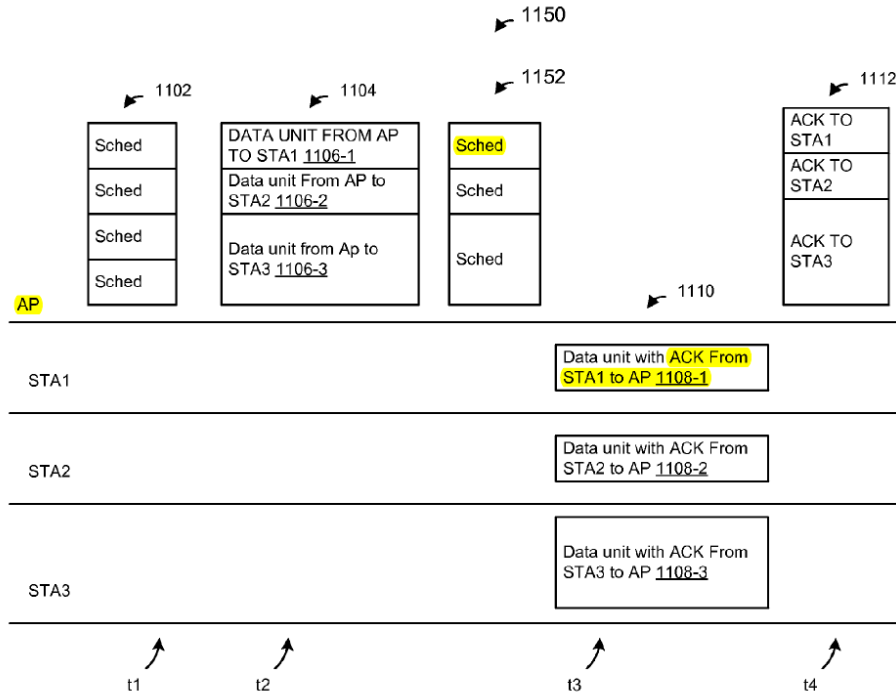


FIG. 11C

In view of at least Chu806's disclosure of separate scheduling frames as one frame and Chu806's indication that ACK may encompass BlkAck, a POSITA also would readily understand that Chu806 discloses the [6] limitation. Accordingly, claim 6 is unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 148-155.

7. Claim 7.

[7] The method of claim 1, wherein the acknowledgement information includes one or more of: (1) an indication of whether the acknowledgement transmission is multi-user or single user, and (2) an indication of whether the acknowledgment transmission is immediate or non-immediate, and further includes resource scheduling

**information when the multi-user acknowledgement
transmission is indicated.**

Chu806 discloses or renders [7] obvious. For example, Chu806 discloses an example where “a PHY preamble or a MAC header of the OFDM data unit directed to the first [STA] includes an ACK policy field set to indicate that *an immediate acknowledgement of the data unit is not required*, in an embodiment. On the other hand, the OFDM data unit directed to the second [STA] indicates that *an immediate acknowledgement is required*, in an embodiment.” EX-1004, 29:37-43 (italic added).

Chu806 also discloses in a further embodiment “the preamble of the OFDMA data unit 602 includes the channel allocation field 550 of FIG. 5B.” EX-1004, 12:50-52. A POSITA would readily understand Chu806’s disclosed OFDMA data unit to provide resource scheduling information.

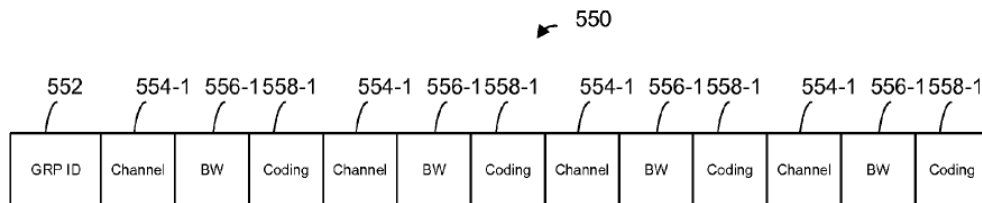


FIG. 5B

Accordingly, claim 7 is unpatentable as obvious in view of Chu806. See EX-1003, ¶¶ 156-162.

8. Claim 8.

[8pre] A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising:

Chu806 discloses [8pre]. For example, Chu806 discloses that “two or more of the [STAs] 25 are configured to transmit corresponding data streams to the AP 14 such that the AP 14 receives the data streams simultaneously.” EX-1004, 6:3-8;. *See* Section VII.B.1; EX-1003, ¶¶ 163-164.

FIG. 1

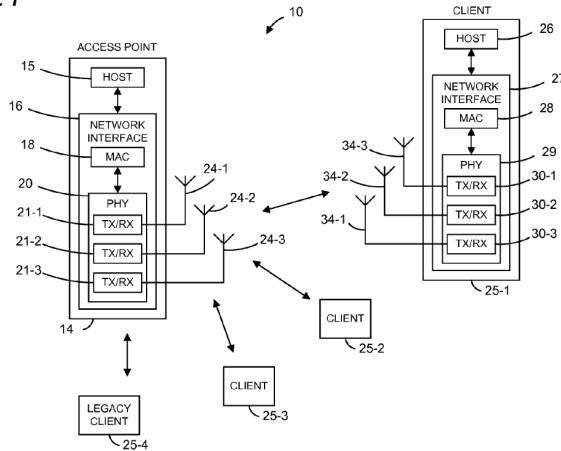
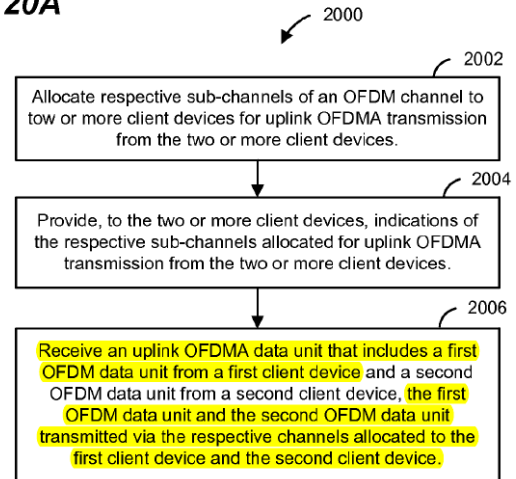


FIG. 20A



- a. [8a] receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, and received from an access point in the wireless network;**

Chu806 discloses or renders [8a] obvious. Specifically, Chu806 discloses that “the client [STAs] 25 are configured to receive corresponding *data streams that are transmitted simultaneously by the AP 14.*” EX-1004, 6:3-5 (*italics added*).

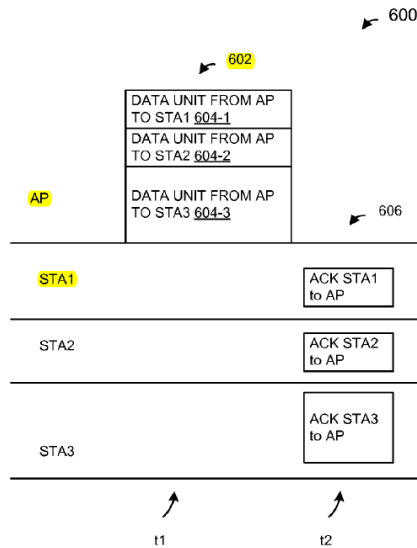
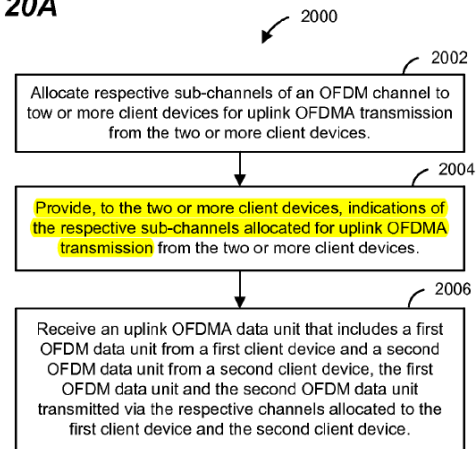


FIG. 6

FIG. 20A



For example, Chu806 discloses that “[d]uring a time t1, the AP 14 transmits an OFDMA data unit 602 directed to a plurality of [STAs].” EX-1004, 11:59-60. Chu806 illustrates a DL frame including an OFDMA data unit 602 directed to multiple STAs, where the OFDMA data unit 602 includes respective OFDMA data units 604-1, 604-2, 604-3. EX-1004, 11:59-60; 12:28-34; FIG. 6. Chu806 also discloses that “[i]n an embodiment, the ACK frames 606 are block acknowledgement (Blk Ack) frames that indicate successful or unsuccessful reception of a plurality of data units, such as of a plurality of data units aggregated in the corresponding A-MPDU 602.” EX-1004, 38-42. *See* EX-1003, ¶¶ 165-169.

- b. [8b] processing a first MAC Protocol Data Units (MPDU) in the downlink multi-user frame to determine acknowledgement information indicating properties of a first multi-user acknowledgement frame;**

Chu806 discloses [8b]. Chu806 discloses that “[a STA] 25-1 includes a host processor 26[,] ...a MAC processing unit 28 and a PHY processing unit 29.” EX-1004, 6:9-11. Chu806 also discloses “a MAC header of the OFDM data unit directed to the first [STA] includes an ACK policy field...,” and “[i]n an embodiment, the ACK frames 606 are block acknowledgement (Blk Ack) frames that indicate successful or unsuccessful reception of a plurality of data units,” EX-1004, 13:38-40, 29:37-41. In addition, Chu806 discloses that “*the [STAs] 25 are configured to determine their respective uplink channels based on uplink channel allocation information included in the control frame and to subsequently transmit data to the AP 14 simultaneously with the other [STAs] 25 .*” EX-1004, 14:7-12 (italic added).

Chu806 also discloses that the “AP is configured to operate with client [STAs] according to... *802.11 ax communication protocol*” (EX-1004, 5:31-36) (italics added). For example, Chu806 describes “in an embodiment... *the OFDM data units 604-1, 604-2, 604-3 are MPDUs.*” EX-1004, 13:22-24 (italic added). Particularly in view of Chu806’s disclosed components and available protocols for the AP 14, a POSITA would have recognized any Chu806’s disclosed OFDMA

data unit can correspond to MAC Protocol Data Unit (MPDU) under the 802.11ax protocol. *See* EX-1003, ¶¶ 167-172.

- c. **[8c] generating the first multi-user acknowledgment frame based on the acknowledgement information; and**
- d. **[8d] transmitting the first multi-user acknowledgement frame to the access point to acknowledge the downlink multi-user frame,**

Chu806 discloses [8c] and [8d]. For example, Chu806 discloses that “[d]uring a time t2, in an embodiment, [STAs] 25 that successfully receive data in the respective sub-channels allocated to the [STAs] 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14.” EX-1004, 13:4-8; FIG. 6. In a further embodiment, “[d]uring a time t3, the [STAs] 25 transmit respective uplink OFDM data units 1108 as parts of an uplink OFDMA transmission 1110 to the AP 14. In an embodiment, the respective uplink data units 1108 from the [STAs] 25 are transmitted in respective uplink channels allocated for uplink transmission by the [STAs] 25 as indicated by the scheduling frame 1102. In an embodiment, each uplink data unit 1108 includes an acknowledgement indicating successful receipt of the corresponding OFDM downlink data unit 1106.” EX-1004, 23:41-50; FIG. 11C. *See* EX-1003, ¶ 173.

- e. **[8e] wherein the first multi-user acknowledgement frame is transmitted simultaneously to a second multi-user acknowledgement frame transmitted by a second station.**

Chu806 discloses [8e]. Specifically, Chu806 discloses that “two or more of the [STAs] 25 are configured to transmit corresponding data streams to the AP 14 such that *the AP 14 receives the data streams simultaneously.*” EX-1004, 6:5-8 (italics added). For example, Chu806 discloses in FIG. 6 that “[d]uring a time t₂, in an embodiment, [STAs] 25 that successfully receive data in the respective sub-channels allocated to the [STAs] 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14.” EX-1004, 13:4-8.

For the foregoing reasons, claim 8 of the '520 Patent is unpatentable as obvious in view of Chu806. *See* Section VII.B.1 (discussion of [1]); *See* EX-1003, ¶¶ 163-175.

9. Claim 9.

[9] The method of claim 8, wherein the first MPDU is located in a first resource unit of the downlink multi-user frame allocated to the first station, wherein the downlink multi-user frame includes a second resource unit that contains a second MPDU that includes acknowledgement information for the second multi-user acknowledgement frame.

Chu806 discloses [9]. For example, Chu806 discloses that “the AP 14 allocates different sub-channels to different client [STAs] and forms the OFDMA data unit that includes OFDM data units directed to by modulating the

different [STAs] in sub-channel blocks corresponding to the sub-channels assigned to the [STAs].” EX-1004, 7:11-15 (*italics added*). Chu806 also discloses that “[i]n an embodiment, the preamble of the OFDMA data unit [] includes a channel allocation field.” EX-1004, 12:28-30. For example, Chu806 discloses that in an embodiment, “[t]he channel allocation field indicates that the highest 20 MHz channel of the 80 MHz channel is allocated to the []STA1... in the illustrated embodiment.” EX-1004, 12:55-61. Chu806 discloses a further embodiment that “the first OFDM data unit 602-1 occupies the highest 20 MHz sub-channel of the 80 MHz channel....” EX-1004, 12:20-25. Particularly since the ’520 Patent inventors describe the phrase “resource units (RU)” used in the ’520 Patent may be “particular spatial streams or sub-channels,” (Ex-1001, 14:12-14; 18:5-8; 20:48-50), a POSITA would readily understand that Chu806’s disclosed the first MPDU is located in a first RU.

Chu806 also discloses an example where “a MAC header of the OFDM data unit directed to the first [STA] includes an ACK policy field set to indicate that an immediate acknowledgement of the data unit is not required.... the OFDM data unit directed to the second [STA] indicates that an immediate acknowledgement is required.” EX-1004, 29:37-43. Accordingly, claim 9 is unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 176-181.

10. Claim 10.

[10] The method of claim 9, wherein the first multi-user acknowledgement frame and the second multi-user acknowledgement frame together form a multi-user acknowledgement frame for acknowledging the downlink multi-user frame.

Chu806 discloses [10]. For example, Chu806 discloses in FIG. 6 that “[d]uring a time t2, in an embodiment, [STAs] 25 that successfully receive data in the respective sub-channels allocated to the [STAs] 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14.” EX-1004, 13:4-8. Accordingly, claim 10 is unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 182-183.

11. Claim 11.

[11] The method of claim 8, wherein processing the first MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame from a header of the first MPDU.

12. Claim 12.

[12] The method of claim 11, wherein the header is a MAC header of the first MPDU.

Chu806 discloses [11] and [12]. Chu806 discloses that “[i]n an embodiment, the preamble of the OFDMA data unit [] includes a channel allocation field.” EX-1004, 12:28-34. Chu806 also discloses “a MAC header of the OFDM data unit directed to the first [STA] includes an ACK policy field set to indicate that an immediate acknowledgement of the data unit is not required, in an embodiment.”

EX-1004, 29:37-41. Accordingly, claims 11 and 12 are unpatentable as obvious in view of Chu806. *See* Section VII.B.2 and VII.B.3 (discussion of [2] and [3]); EX-1003, ¶¶ 184-185.

13. Claim 13.

[13] The method of claim 8, wherein processing the MPDU comprises: extracting the acknowledgement information indicating the properties of the first multi-user acknowledgement frame transmission from a payload of the first MPDU, wherein the first MPDU is a unicast trigger frame.

Chu806 renders [13] obvious. For example, Chu806 discloses that “*WLANs operate in either a unicast mode or a multicast mode.*” EX-1004, 1:39-40 (italics added). Chu806 discloses “in the frame exchange 1130 scheduling for the uplink OFDMA transmission 1110 is provided to [STAs] 25 as part of the downlink OFDMA transmission 1134 to the [STAs].” EX-1004, 23:60-64 *See* Section VII.B.4 (discussion of [4]); EX-1003, ¶¶ 186-189.

14. Claim 14.

[14] The method of claim 13, further comprising: processing a second MPDU in a same resource unit as the first MPDU, wherein the second MPDU includes data intended for the first station.

Chu806 renders [14] obvious. For example, Chu806 discloses “[d]uring a time t2, the AP 14 transmits an OFDMA data unit 1204 directed to [STAs] 25...in respective sub-channels allocated to the [STA] 25,” and “[d]uring a time t4, the AP 14 transmits a second scheduling frame 1212 that includes uplink channel

allocation information for OFDMA uplink transmission by the [STA] 25... via the downlink sub-channels allocated to the [STA] 25.” EX-1004, 25:18-22, 26:4-9.

Chu806 discloses that “[d]uring a time t3, the AP 14 transmits respective acknowledgment frames 1112, acknowledging successful receipt of the OFDM data units 1108. In an embodiment, the respective acknowledgment frames 1112 are transmitted as parts of an OFDMA transmission to the [STAs] 25, in the respective uplink channels allocated to the [STAs] 25.” EX-1004, 23:50-56; FIG. 11C.

Accordingly, claim 14 is unpatentable as obvious in view of Chu806. *See* EX-1003, ¶¶ 190-193.

15. Claim 15.

[15] The method of claim 13, wherein the trigger frame instigates the first station to transmit the first multi-user acknowledgement after an interframe spacing period following receipt of the downlink multi-user frame.

Chu806 discloses or renders [15] obvious. *See* Section VII.B.5 (discussion of [5]); EX-1003, ¶ 194.

16. Claim 16.

[16] The method of claim 8, further comprising: receiving a multi-user block acknowledgement request frame that solicits acknowledgements from the first and second station, wherein the first multi-user acknowledgement frame is

transmitted after receipt of and in response to the multi-user block acknowledgement request frame.

Chu806 discloses or renders [16] obvious. For example, Chu806 discloses a further embodiment where “uplink scheduling information is provided to the client [STAs] 25 by respective separate scheduling frames 1152 transmitted as control frames separate from the OFDM data units 1104.” EX-1004, 24:27-30. Chu806 also discloses that “[d]uring a time t3, the [STAs] 25 transmit respective uplink OFDM data units 1108 as parts of an uplink OFDMA transmission 1110 to the AP 14. In an embodiment, the respective uplink data units 1108 from the [STAs] 25 are transmitted in respective uplink channels allocated for uplink transmission by the [STAs] 25 as indicated by the scheduling frame 1102. In an embodiment, each uplink data unit 1108 includes an acknowledgement indicating successful receipt of the corresponding OFDM downlink data unit 1106.” EX-1004, 23:41-50; FIG. 11C. *See* Section VII.B.6 (discussion of [6]); EX-1003, ¶ 195.

17. Claim 17.

[17] The method of claim 8, wherein the acknowledgement information includes one or more of: (1) an indication of whether the first multi-user acknowledgement frame is part of a multi-user or a single user transmission, and (2) an indication of whether the first multi-user acknowledgement frame is transmitted immediately following receipt of the downlink multi-user frame or upon receipt of a multi-user block acknowledgement request frame, and further includes resource scheduling information when the first multi-user

acknowledgement frame is indicated as being part of the multi-user transmission.

Chu806 discloses or renders [17] obvious.

See Section VII.B.7 (discussion of [7]); EX-1003, ¶ 196.

18. Claim 18.

- a. **[18pre] A method, implemented by a first station in a wireless network, for transmitting an uplink acknowledgment, the method comprising:**

Chu806 discloses [18pre]. *See* Section VII.B.8.a (discussion of Limitation [8pre]).

- b. **[18a] receiving a downlink multi-user frame addressed to a plurality of stations, including the first station, wherein the downlink multi-user frame is received from an access point in the wireless network;**

Chu806 discloses [18a]. *See* Section VII.B.8.b (discussion of Limitation [8a]).

- c. **[18b] receiving a multi-user block acknowledgement request frame that solicits acknowledgements from the first station and a second station, wherein the multi-user block acknowledgement request frame includes acknowledgement information indicating properties of a first multi-user acknowledgement frame;**

Chu806 discloses [18b]. For example, Chu806 discloses that “uplink scheduling information is provided to the client [STAs] 25 by respective separate scheduling frames 1152 transmitted as control frames separate from the OFDM data units 1104.” EX-1004, 24:27-30. Chu806 also indicates that the term

“acknowledgement frame” may encompass a BlkAck, as well as the AP can be configured according to “802.11 ax.” *See* EX-1004, 13:42-49, 5:31-36.

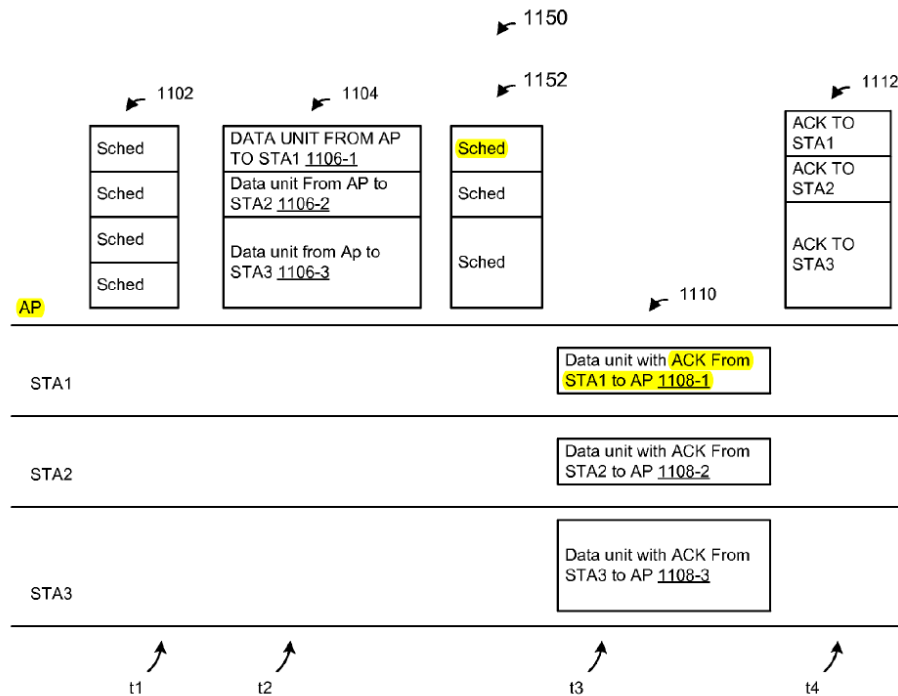


FIG. 11C

In view of at least Chu806’s disclosure of BlkAck, a POSITA also would readily understand that Chu806 discloses or suggests a MU block acknowledgement request frame to solicit such BlkAck.

Chu806 also discloses where “the scheduling frame 1202 indicates to the [STA] 25 that the [STAs] 25 should provide indications of the amount of buffered data at the [STAs] 25 and/or indications of requested medium time for an uplink transmission by the [STAs] 25.” EX-1004, 25:34-38. Particularly since Chu806 describes additional control for a subsequent UL ACK frame, a POSITA would

readily understand Chu806's disclosed the multi-user block acknowledgement request frame to include acknowledgement information indicating properties of a first multi-user acknowledgement frame. *See* Section VII.B.16 (discussion of Claim [16]); EX-1003, ¶¶ 199-202.

- d. **[18c] generating the first multi-user acknowledgment frame based on the acknowledgement information; and**
- e. **[18d] acknowledging the receipt of the downlink multi-user frame by transmitting the first multi-user acknowledgement frame to the access point,**

Chu806 discloses [18c] and [18d]. For example, Chu806 discloses “[d]uring a time t2, in an embodiment, [STAs] 25 that successfully receive data in the respective sub-channels allocated to the [STAs] 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14.” EX-1004, 13:4-8; FIG. 6. *See* Section VII.B.8.b; Section VII.B.8.c.; EX-1003, ¶ 203.

- f. **[18e] wherein the first multi-user acknowledgement frame is transmitted simultaneously with a second multi-user acknowledgement frame generated and transmitted by the second station.**

Chu806 discloses [18e]. Chu806 discloses that “two or more of the [STAs] 25 are configured to transmit corresponding data streams to the AP 14 such that *the AP 14 receives the data streams simultaneously.*” EX-1004, 6:5-8 (italics added). For the foregoing reasons, claim 18 of the '520 Patent is unpatentable as obvious in view of Chu806. *See* Section VII.B.8 (discussion of [8]); EX-1003, ¶¶ 197-205.

19. Claim 19.

[19] The method of claim 18, wherein the acknowledgement information includes one or more of: (1) an indication of whether the first multi-user acknowledgement frame is part of a multi-user or single user transmission and (2) resource scheduling information for the first multi-user acknowledgement transmission.

Chu806 discloses or renders [19] obvious. Chu806 discloses allocating sub-channels to STAs that belong to an OFDMA group, and providing channel allocation information to the STAs, where the STAs subsequently transmit “as part of an OFMDA transmission to the AP” in the allocated sub-channels. *See* EX-1004, 9:17-19; 9:27-31; 9:36-41.

See Section VII.B.6, VII.B.7, and VII.B.18; EX-1003, ¶¶ 206-209.

20. Claim 20.

[20] The method of claim 18, wherein the acknowledgment scheduling information includes properties of the second multi-user acknowledgement frame generated and transmitted by the second station, wherein the first multi-user acknowledgement frame and the second multi-user acknowledgement together form a multi-user transmission.

Chu806 discloses [20]. Chu806 discloses that “the preamble of the OFDMA data unit [] includes a channel allocation field.” EX-1004, 12:28-34. For example, Chu806 discloses that “[t]he channel allocation field indicates that the highest 20 MHz channel of the 80 MHz channel is allocated to the [STA] STA1, the second highest 20 MHz channel of the 80 MHz channel is allocated to the [STA] STA2....” EX-1004, 12:55-61. Chu806 also discloses in FIG. 6 that “[d]uring a

time t2, in an embodiment, [STAs] 25 that successfully receive data in the respective sub-channels allocated to the [STAs] 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14.” EX-1004, 13:4-8.

Accordingly, claim 20 is unpatentable as obvious in view of Chu806. *See* Section VII.B.8.e (discussion of Limitation [8e]); EX-1003, ¶¶ 210-211.

C. Ground 2: Merlin renders obvious Claims 1-20.

As set forth below, Merlin renders Claims 1-20 obvious and unpatentable.

1. Claim 1.

- a. [1pre] A method, implemented by a network device in a wireless network, for coordinating an uplink multi-user response transmission to a downlink multi-user transmission, the method comprising:**

Merlin discloses [1pre]. Merlin discloses a method involving “frame structures and protocols for uplink (UL) multiple user (MU) frame exchanges. Certain aspects provide protocol rules and efficient frame exchange sequences to enable sending multiple block acknowledgments (BAs) in UL and/or downlink (DL) MU multiple-input multiple-output (MIMO).” EX-1005, 5:32-37; FIG. 10; FIG. 25. For example, “an AP may transmit an MU PPDU soliciting immediate response from multiple high efficiency wireless (HEW) STAs.... Therefore, multiple responses (e.g., ACKs/BAs) to the MU PDDU, from multiple STAs, are possible at the same time.” EX-1005, 12:66-13:5. *See* EX-1003, ¶¶ 213-214.

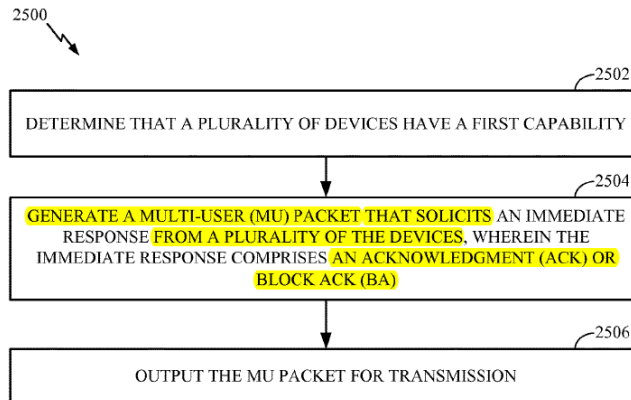


FIG. 25

- b. [1a] generating, by the network device, a downlink multi-user frame addressed to a plurality of stations operating in the wireless network, the downlink multi-user frame including a plurality of resource units (RUs), wherein generating the downlink multi-user frame comprises:
- assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and
- including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs,
- wherein an MPDU in one or more of the RUs in the plurality of RUs includes acknowledgement information indicating properties of a multi-user acknowledgement transmission that the station in the plurality of stations to which the RU is assigned is requested to transmit to acknowledge the downlink multi-user frame;
- c. [1b] transmitting the downlink multi-user frame to the plurality of stations over a wireless channel; and
- d. [1c] receiving the uplink multi-user response transmission, the uplink multi-user response transmission including multi-user acknowledgement

**transmissions respectively and simultaneously
transmitted by two or more stations in the plurality of
stations,**

Merlin discloses or renders [1a], [1b], and [1c] obvious. Merlin discloses that “the AP may solicit multiple immediate responses by *transmitting an MU PPDU including* multiple aggregate medium access control (MAC) protocol data units (A-MPDUs) having *MPDUs that solicit an immediate response...*” EX-1005; 13:11-16 (italic added). For example, Merlin discloses that “*a multi-STA BA request (BAR) frame may simultaneously solicit multiple immediate BAs,*” and “*multiple responses (e.g., ACKs/BAs) to the MU PDDU, from multiple STAs, are possible at the same time.*” EX-1005, 5:39-40; 13:3-5 (italic added).

In addition, Merlin discloses that “*indicating the resource allocation for the STAs to send in UL MU-MIMO... may be accomplished by including the spatial stream/channel allocation and power control for each STA,*” and for example, “the parameters to be used (e.g., duration of the response PPDU, spatial stream/channel allocation, and power allocation) *may also be indicated by bits in the BAR frame.*” EX-1005, 18: 24-28; 19:27-30 (italic added).

Merlin discloses that “the AP may send DL MU-MIMO A-MPDUs to multiple STAs. In the DL MU-MIMO A-MPDUs, the AP may indicate that the transmission opportunity is transferred to the STAs. As discussed above, the recipient STAs may support UL MU-MIMO/FDMA and, thus, *multiple recipient*

STAs may transmit UL MU PPDU's at the same time. According to certain aspects, the UL MU PPDU's may contain data or acknowledgements." EX-1005, 19:53-60 (italic added).

From at least Merlin's disclosures of the AP's allocations of spatial streams/channels to STAs and the indication of resource allocations in a DL MU A-MPDU that solicits UP MU responses, POSITA would readily understand that the AP disclosed in Merlin allocates and assigns each of the resources, such as spatial streams or channels, to a respective one of the multiple STAs, and that Merlin renders obvious the [1a] limitation. *See* EX-1003, ¶¶ 196-205.

In addition, Merlin discloses that "[a]ccording to certain aspects, *STAs may send the response frame using the same spatial streams of the soliciting frame* (e.g., number and position of spatial streams)." EX-1005, 15:65-67 (italic added).

For example, Merlin discloses that "a FDMA transmission may consist of... *MU PPDU's on each channel* (e.g. 20 MHz). Each MU PPDU may be... a MU-MIMO..." EX-1005; 12:6-9 (emphasis added). For example, Merlin discloses in FIG. 10 "*a DL A-MPDU including a BAR frame per each STA,*" and "BAR frame 1002 (DL STA2+BAR2) and BAR frame 1004 (DL STA1+BAR1)... may solicit BAs 1006 (BA STA2) and 1008 (BA STA1) from STAs 2 and 1, respectively." EX-1005; 35-43 (italic added); FIG. 10.

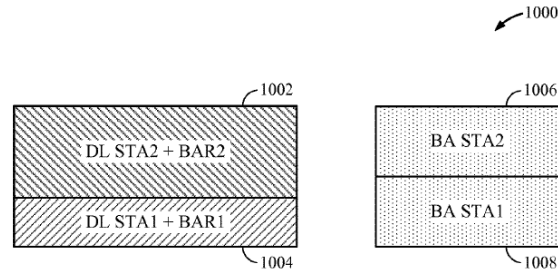


FIG. 10

Especially in view of at least Merlin's disclosures of DL MU-MIMO A-MPDUs and UL MU PPDU responsive to the DL MU-MIMO A-MPDUs, POSITA also would readily understand that the AP disclosed in Merlin discloses or renders obvious the [1b] and [1c] limitations. *See* EX-1003, ¶¶ 215-227.

- e. **[1d] wherein the plurality of RUs respectively correspond to a plurality of simultaneous uplink transmissions, and each of the plurality of simultaneous uplink transmissions uses a sub-channel, spatial stream, or sub-channel and spatial stream combination that is not used by any other of the plurality of simultaneous uplink transmissions.**

Merlin discloses [1d]. For example, Merlin discloses that “each STA that is a recipient of the DL MU PPDU may receive a potentially different BAR, requesting a BA and granting the resources for that STA to reply. **Each STA may be granted a different resource,**” and “the multiple responses may be in different streams and/or different frequencies.” EX-1005; 13:8-10; 17:66-18:2 (emphasis added). Merlin illustrates in FIG. 6 that “the soliciting frame for STA2 may use a first spatial stream 602 and the STA2 may reply using the same spatial stream 604. Similarly, the soliciting frame for STA1 may use a second spatial stream 606 and

the STA1 may reply using the same spatial stream 608.” EX-1005; 16:2-6. *See* EX-1003, ¶¶ 228-230.

For the foregoing reasons, claim 1 of the ’520 Patent is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 212-231.

2. Claim 2.

[2] The method of claim 1, wherein generating the downlink multi-user frame further comprises: including the acknowledgement information, for indicating properties of the multi-user acknowledgement transmission transmitted by each respective station in the plurality of stations to acknowledge the downlink multi-user frame, in a header of the one or more MPDUs.

3. Claim 3.

[3] The method of claim 2, wherein the header is a MAC header of the one or more MPDUs.

Merlin discloses [2] and [3]. Merlin discloses that “the AP may generate a MU packet that solicits an immediate response from a plurality of the devices.... the MU packet may include a plurality of MPDUs, each MPDU being addressed to a different one of the plurality of devices and the response type indication may be provided in... an extended **MAC header**.... **the response type indication may be provided in a PHY header** of the MU packet.... According to certain aspects, **an indication of one or more parameters (e.g., spatial streams to use, channels, a duration, transmission power) to use for sending the immediate using MU MIMO [] may be provided according to any of the alternatives described**

above for explicitly or implicitly providing the response type indication....” EX-1005; 23:58-24:26 (emphasis added). *See* Section VII.C.1.b (discussion of Limitation [1a]).

Accordingly, claims 2 and 3 are unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 232-233.

4. Claim 4.

[4] The method of claim 1, wherein one of the one or more MPDUs in each of the RUs of the plurality of RUs is a unicast trigger frame that contains the acknowledgement information for the respective station in the plurality of stations.

Merlin discloses [4]. For example, Merlin discloses in FIG. 10 “a DL A-MPDU including a BAR frame per each STA,” and “BAR frame 1002 (DL STA2+BAR2) and BAR frame 1004 (DL STA1+BAR1)... may solicit BAs 1006 (BA STA2) and 1008 (BA STA1) from STAs 2 and 1, respectively.” EX-1005; 35-43; FIG. 10. Particularly in view of Merlin’s disclosure of a separate BAR for STA1 and STA2, a POSTIA would readily understand that such a separate BAR is a unicast trigger frame.

As a further embodiment, Merlin also discloses “[a]ccording to certain aspects, a fifth option to indicate the response parameters may be in a special frame aggregated in the A-MPDU,” and “[t]he special frame may be **a trigger frame** or a modified **BAR frame**.” EX-1005, 17:11-13, 17:25-26 (emphasis added).

Accordingly, claim 4 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 234-237.

5. Claim 5.

[5] The method of claim 4, wherein the trigger frame instigates each respective station in the plurality of stations to transmit the multi-user acknowledgement transmission after an interframe spacing period following receipt of the downlink multi-user frame.

Merlin discloses [5]. Merlin discloses that “a short inter-frame space (SIFS) [refers to] a small interval between a data frame or other message and its acknowledgment (ACK),” and “[t]he order and timing for the STA BA transmissions may be sent in the DL-MU-MIMO data.” EX-1005; 11:23-25; 11:33-34; FIG. 15.

Accordingly, claim 5 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 238-239.

6. Claim 6.

**[6] The method of claim 1, further comprising:
generating, by the network device, a multi-user block
acknowledgement request frame to solicit**

acknowledgements from two or more stations of the plurality of stations; and

transmitting the multi-user block acknowledgment request frame following transmission of the downlink multi-user frame.

Merlin discloses [6]. For example, Merlin discloses a further embodiment where “a single multi-STA *BAR frame* 1506 may be sent in a separate DL PPDU subsequent to the DL A-MPDU having data PSDUs 1502 and 1504 addressed to STA2 and STA1, respectively, and *may request BAs 1508 and 1510 from STA2 and STA1, respectively.*” EX-1005, 19:44-49 (italic added); FIG. 15.

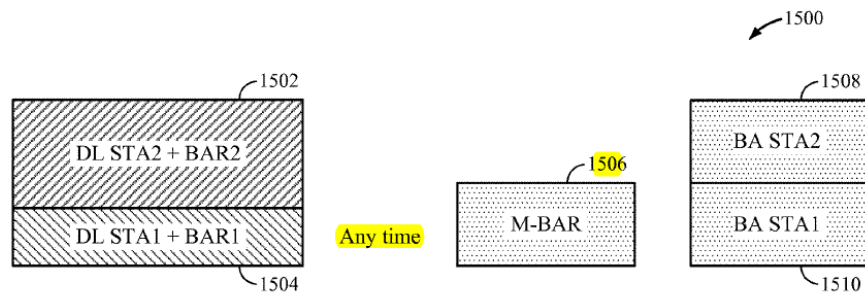


FIG. 15

Accordingly, claim 6 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 240-242.

7. Claim 7.

[7] The method of claim 1, wherein the acknowledgement information includes one or more of: (1) an indication of whether the acknowledgement transmission is multi-user or single user, and (2) an indication of whether the acknowledgment transmission is immediate or non-immediate, and further includes resource scheduling

**information when the multi-user acknowledgement
transmission is indicated.**

Merlin discloses or renders [7] obvious. For example, Merlin discloses that “bits of the BAR information field 912 may be used to *indicate which mode of response is to be used (e.g., SU, UL MU-MIMO, or UL FDMA).*” EX-1005, 18:19-22 (*italic added*). Merlin also discloses that “the BA policy for all data MPDUs may be set to BA (no immediate response)....” EX-1005, 18:31-32. Merlin further discloses “the multi-STA BAR... may...indicate: that the BAR is a multi-STA BAR, which STAs are the recipients, the duration of the allowed response, and resource allocation for the replies in UL MU-MIMO or UL FDMA.” EX-1005, 18:65-19:5.

Accordingly, claim 7 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 243-244.

8. Claim 8.

Merlin discloses [8pre]. For example, Merlin discloses that “each recipient STA that is requested to send an immediate response may know—or be indicated—how the immediate reply (e.g., ACK/BA) should be sent.” EX-1005; 14:12-15. *See* Section VII.C.1; EX-1003, ¶ 245.

Merlin discloses or renders [8a] obvious. Merlin discloses that “each STA that is a recipient of the DL MU PPDU may receive a potentially different BAR, requesting a BA and granting the resources for that STA to reply.” EX-1005;

17:66-18:2. Merlin also discloses that “an AP may transmit an MU PPDU soliciting immediate response from multiple high efficiency wireless (HEW) STAs.... Therefore, multiple responses (e.g., ACKs/BAs) to the MU PDDU, from multiple STAs, are possible at the same time.” EX-1005, 12:66-13:5. For example, Merlin discloses in FIG. 10 “a DL A-MPDU including a BAR frame per each STA,” and “BAR frame 1002 (DL STA2+BAR2) and BAR frame 1004 (DL STA1+BAR1)... may solicit BAs 1006 (BA STA2) and 1008 (BA STA1) from STAs 2 and 1, respectively.” EX-1005; 35-43; FIG. 10. Merlin also discloses that “a multi-STA BAR frame may be used to request BAs from multiple STA.” EX-1005, 18:57-58. *See* EX-1003, ¶ 246.

Merlin discloses [8b]. Merlin discloses that “if a STA determines (e.g., receives an indication, derives...) that UL MU-MIMO... is to be used for an immediate response, the STA may also know which parameters to use for the response. Response parameters may include, for example, which spatial streams/channels to use, what duration to use, and what power to use for the immediate response.” EX-1005; 15:26-33. For example, Merlin discloses that “a response type indication for each STA may be added in each MPDU.... For example, 1 or 2 bits may indicate which mode of response is to be used (e.g., UL SU-MIMO, UL MU-MIMO, or UL FDMA).... the indication may be included in the Quality of Service (QoS) control field, the HT or VHT Control field, the frame

control (FC) field, the A-MPDU delimiter preceding the MPDU, an extended MAC header....” EX-1005; 14:26-35. *See* EX-1003, ¶ 247.

Merlin discloses [8c]. For example, Merlin discloses that “each STA that is a recipient of the DL MU PPDU may receive a potentially different BAR, requesting a BA and granting the resources for that STA to reply. **Each STA may be granted a different resource,**” and “the multiple responses may be in different streams and/or different frequencies.” EX-1005; 13:8-10; 17:66-18:2 (emphasis added). Merlin illustrates that “STAs may send the response frame using the same spatial streams of the soliciting frame (e.g., number and position of spatial streams), as shown in FIG. 6.,” and “the soliciting frame for STA2 may use a first spatial stream 602 and the STA2 may reply using the same spatial stream 604. Similarly, the soliciting frame for STA1 may use a second spatial stream 606 and the STA1 may reply using the same spatial stream 608.” EX-1005; 15:65-16:6. *See* EX-1003, ¶ 248.

Merlin discloses [8d] and [8e]. Merlin discloses that “each STA that is a recipient of the DL MU PPDU may receive a potentially different BAR, requesting a BA and granting the resources for that STA to reply. Each STA may be granted a different resource.” EX-1005; 17:66-18:2. In addition, Merlin discloses that “multiple responses (e.g., ACKs/BAs) to the MU PDDU, from multiple STAs, are possible at the same time.” EX-1005, 13:3-5.

For the foregoing reasons, claim 8 of the '520 Patent is unpatentable as obvious in view of Merlin. *See* Section VII.C.1 (discussion of [1]); EX-1003, ¶¶ 245-250.

9. Claim 9.

Merlin discloses [9]. Merlin illustrates that “the soliciting frame for STA2 may use a first spatial stream 602 and the STA2 may reply using the same spatial stream 604. Similarly, the soliciting frame for STA1 may use a second spatial stream 606 and the STA1 may reply using the same spatial stream 608.” EX-1005; 16:2-6.

Accordingly, claim 9 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 251-253.

10. Claim 10.

Merlin discloses [10]. For example, Merlin discloses that “[a]ccording to certain aspects, BAs/ACKs may be aggregated with the UL PPDU.” EX-1005, 20:21-22. Accordingly, claim 10 is unpatentable obvious in view of Merlin. *See* EX-1003, ¶ 254.

11. Claim 11.

12. Claim 12.

13. Claim 13.

Merlin discloses [11], [12], and [13]. Merlin discloses that “**a response type indication for each STA may be added in each MPDU... in... an extended**

MAC header....” EX-1005; 14:26-35 (emphasis added). Merlin also discloses in FIG. 10 “a DL A-MPDU including a BAR frame per each STA,” and “BAR frame 1002 (DL STA2+BAR2) and BAR frame 1004 (DL STA1+BAR1)... may solicit BAs 1006 (BA STA2) and 1008 (BA STA1) from STAs 2 and 1, respectively.” EX-1005; 35-43. Particularly in view of Merlin’s disclosure of a separate BAR for STA1 and STA2, a POSTIA would readily understand that such a separate BAR is a unicast trigger frame.

Accordingly, claim 11, 12, and 13 are unpatentable as obvious in view of Merlin. *See* Section VII.C.2, VII.C.3, VII.C.4 (discussion of [2], [3], [4]); EX-1003, ¶¶ 255-257.

14. Claim 14.

Merlin discloses or renders [14] obvious. For example, Merlin discloses a further embodiment where “each special frame may be received by one STA and may include the parameter information for that STA only. Alternatively, the special frame(s) (e.g., one special frame per STA or a single broadcast special frame) may be sent in a separate PPDU following the data DL PPDU, as shown in FIG. 8.” EX-1005, 17:13-19.

Accordingly, claim 14 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 258-269.

15. Claim 15.

Merlin discloses [15]. *See* Section VII.C.5 (discussion of [5]); EX-1003, ¶ 260.

16. Claim 16.

Merlin discloses [16]. For example, Merlin discloses a further embodiment where “a single multi-STA BAR frame 1506 may be sent in a separate DL PPDU subsequent to the DL A-MPDU having data PSDUs 1502 and 1504 addressed to STA2 and STA1, respectively, and may request BAs 1508 and 1510 from STA2 and STA1, respectively.” EX-1005, 19:44-49; FIG. 15.

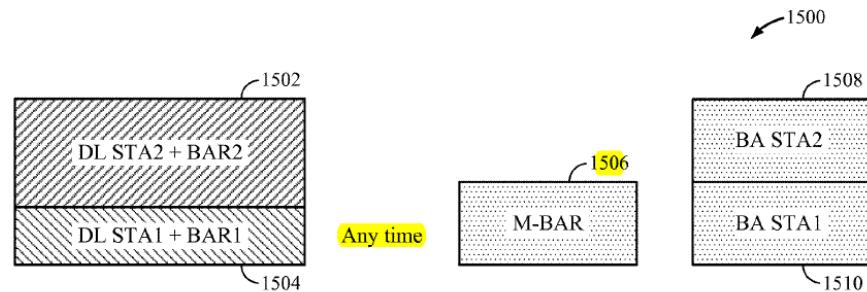


FIG. 15

Accordingly, claim 16 is unpatentable as obvious in view of Merlin. *See* EX-1003, ¶¶ 261-262.

17. Claim 17.

Merlin discloses or renders [17] obvious. *See* Section VII.C.7 (discussion of [7]); EX-1003, ¶ 263.

18. Claim 18.

Merlin discloses [18pre] and [18a]. *See* Section VII.C.8.a abd VII.C.8.b (discussion of Limitation [8pre] and [8a]); EX-1003, ¶¶ 264-265.

Merlin discloses [18b], [18c] and [18d]. For example, Merlin discloses that “each special frame may be received by one STA and may include the parameter information for that STA only. Alternatively, the special frame(s) (e.g., one special frame per STA or a single broadcast special frame) may be sent in a separate PPDU following the data DL PPDU, as shown in FIG. 8.” EX-1005, 17:13-19. Merlin also discloses as “illustrated in FIG. 8, the special frame 804 indicating the parameters for the immediate responses 806 (BA STA2) and 810 (BA STA1) from STA2 and STA1, respectively, may be send in a separate DL PPDU following the DL PPDU 802 (DL STA2) and 808 (DL STA1) soliciting immediate responses from STA2 and STA1, respectively. The special frame may be a trigger frame or a modified BAR frame.” EX-1005, 17:19-26.

See Section VII.C.8.b; Section VII.C.8.c.; EX-1003, ¶ 266.

Merlin discloses [18e]. Merlin discloses that “multiple responses (e.g., ACKs/BAs) to the MU PDDU, from multiple STAs, are possible at the same time.” EX-1005, 13:3-5.

For the foregoing reasons, claim 18 of the '520 Patent is unpatentable as obvious in view of Merlin. *See* Section VII.C.8 (discussion of [8]); EX-1003, ¶¶ 264-268.

19. Claim 19.

Merlin renders [19] obvious. Merlin discloses that “the BAR information field 912 may be used to indicate which mode of response is to be used (e.g., SU, UL MU-MIMO, or UL FDMA),” and “the parameters to be used (e.g., duration of the response PPDU, spatial stream/channel allocation...) may also be indicated... in the BAR frame.” EX-1005, 18:19-22; EX-1005, 18: 24-28. *See* Section VII.C.6, VII.C.7 and VII.C.18; EX-1003, ¶269.

20. Claim 20.

Merlin discloses [20]. *See* Section VII.C.8.e (discussion of Limitation [8e]); EX-1003, ¶ 270.

D. Ground 3: Shu renders obvious Claims 1-20.

As set forth below, Shu renders Claims 1-20 obvious and unpatentable.

1. Claim 1.

Shu discloses [1pre]. For example, Shu discloses “a method 300 for acknowledging transmission of downlink data frames by multiple stations in a wireless local area network.” EX-1006, [0049]; FIG. 3. *See* EX-1003, ¶ 272.

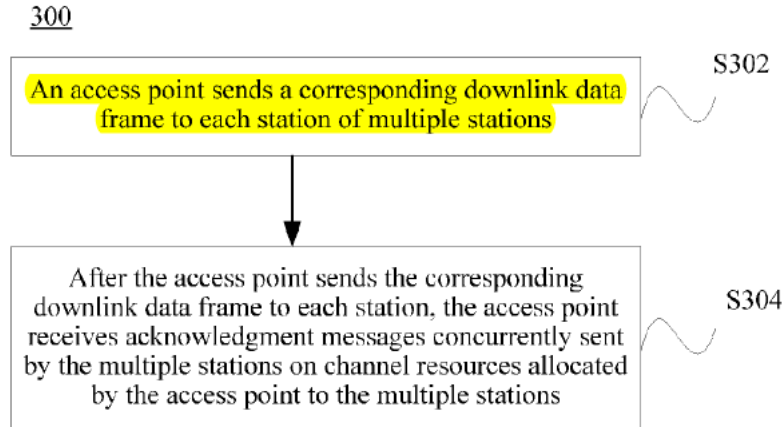


FIG. 3

Shu renders [1a] obvious. Shu discloses “[a]n access point (Access Point, AP for short) can send a downlink data frame to multiple stations (Station, STA for short) at the same time by using the multi-user multiple-input multiple-output (Multi-User Multiple-Input Multiple-Output, MU MIMO for short) or orthogonal frequency division multiple access (Orthogonal Frequency Division Multiple Access, OFDMA for short) technology.” EX-1006, [0003].

Shu discloses that “[t]he [AP] may add channel resource information to an acknowledgment request message sent to the multiple [STAs], where the channel resource information is used to indicate the channel resource allocated by the [AP] to each [STA] of the multiple [STAs]..., [and] where the channel resource information is used to indicate a channel resource allocated by the access point to a station receiving the corresponding downlink data frame.” EX-1006, [0054].

Shu also discloses that in an embodiment, “the downlink data frame includes information used to identify a channel resource allocated to a [STA] corresponding

to the downlink data frame,” and “the information is located in a physical frame convergence procedure header PLCP Header of the downlink data frame.” EX-1006, [0011]-[0012]. *See also* EX-1006; FIG. 7A; FIG. 7B.

Shu also discloses that “*information used to identify a channel resource that is used to send an acknowledgment message and that is allocated by an [AP] to a [STA] corresponding to a downlink data frame may be carried in a header of a physical-layer frame format of the downlink data frame, or may be carried in a header of a Media Access Control (Media Access Control, MAC for short)-layer frame format of the downlink data frame....*” EX-1006, [0069] (italic added).

In view of Shu’s disclosure of a channel resource information in a MAC header and corresponding to a DL frame, a POSITA would readily understand that the frames generated by the AP disclosed in Shu renders obvious the [1a] limitation “generating the downlink multi-user frame comprises: assigning each RU of the plurality of RUs to a respective station in the plurality of stations, and including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs.”

Particularly since the ’520 Patent inventors describe the phrase “resource units (RU)” used in the ’520 Patent may be “particular spatial streams or sub-channels,” (EX-1001, 14:12-14; 18:5-8; 20:48-50), a POSITA would readily

understand that Shu's disclosed AP assigns 'RUs' to STAs and includes 'RUs' in a MAC header of a DL MU frame to the STAs. *See* EX-1006; FIG. 7A; FIG. 7B.

Shu also discloses "[i]n the next-generation WLAN (Wireless Local Area Network, wireless local area network) technology standard IEEE 802.11ax following the IEEE 802.11ac standard, the PLCP Header may further include an HEW SIG (High Efficiency WLAN Signal, high efficiency WLAN signal) field. The added sub-channel index field may be located in the PLCP Header field. For example, the sub-channel index field may be at a location following the L-SIG field and followed by the HEW SIG field. Alternatively, the sub-channel index field may be at a location followed by the L-SIG field." EX-1006, [0067].

Particularly in view of the IEEE Standardization was known to discuss dynamic allocation of resource units, POSITA would readily understand that Shu renders obvious the [1a] limitation. *See* EX-1003, ¶¶ 285-286.

Shu discloses [1b] and [1c]. Shu discloses that "[t]he [AP] may concurrently send the downlink data frame to each station of the multiple [STAs] by using....MU MIMO....," and "[a]fter the [AP] sends the corresponding downlink data frame to each [STA], the [AP] receives acknowledgment messages concurrently sent by the multiple [STA] stations on channel resources allocated by the [AP] to the multiple [STAs]." EX-1006, [0051]; [0053]. *See* EX-1003, ¶ 267.

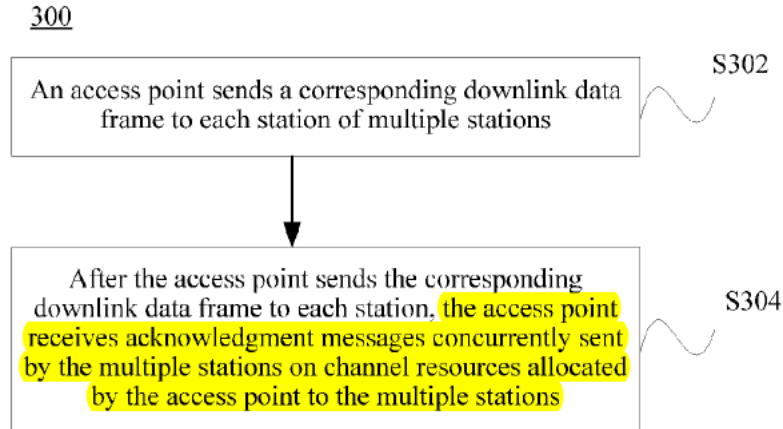


FIG 3

Shu discloses [1d]. For example, Shu discloses that “[t]he multiple [STAs] may use the OFDMA technology to concurrently send the acknowledgment messages to the [AP] by using the channel resources allocated by the [AP] and indicated by the channel resource information, so as to notify the [AP] of whether the downlink data frames are received successfully.” EX-1006, [0054]. Shu also discloses that “[i]f the [AP] allocates the tenth sub-channel to a corresponding [STA], the tenth bit of the 16 binary bits may be set to 1, and remaining binary bits are set to 0, which indicates that the tenth sub-channel is allocated to the corresponding [STA], and the [STA] feeds back an acknowledgment message by using the tenth sub-channel.” EX-1006, [0062].

For the foregoing reasons, claim 1 of the ’520 Patent is unpatentable as obvious in view of Shu. *See* EX-1003, ¶¶ 271-290.

2. Claim 2.

3. Claim 3.

Shu renders [2] and [3] obvious. For example, Shu discloses that “information used to identify a channel resource that is used to send an acknowledgment message and that is allocated by an [AP] to a [STA] corresponding to a downlink data frame may be carried in a header of a physical-layer frame format of the downlink data frame, or may be carried in a header of a Media Access Control (Media Access Control, MAC for short)-layer frame format of the downlink data frame....” EX-1006, [0069]. Shu also discloses that in an embodiment, “the downlink data frame includes information used to identify a channel resource allocated to a [STA] corresponding to the downlink data frame,” and “the information is located in a physical frame convergence procedure header PLCP Header of the downlink data frame.” EX-1006, [0011]-[0012]. *See* Section VII.D.1.b (discussion of Limitation [1a]).

Accordingly, claims 2 and 3 are unpatentable as obvious in view of Shu. *See* EX-1003, ¶¶ 291-292.

4. Claim 4.

Shu renders [4] obvious. For example, Shu discloses that “[t]he [AP] sends BlockAckReq to a corresponding [STA] by means of unicast....” EX-1006, [0064].

Accordingly, claim 4 is unpatentable as obvious in view of Shu. *See* EX-1003, ¶¶ 293-294.

5. Claim 5.

Shu renders [5] obvious. For example, Shu discloses that “[t]he preset time may be a short interframe space (Short Interframe Space, SIFS for short). Values of the SIFS may be different in different IEEE 802.11 standards. For example, in the IEEE 802.11a standard, the value of the SIFS is 16 μ s, and in the IEEE 802.11g standard, the value of the SIFS is 10 μ s.” EX-1006, [0058]. See FIG. 6.

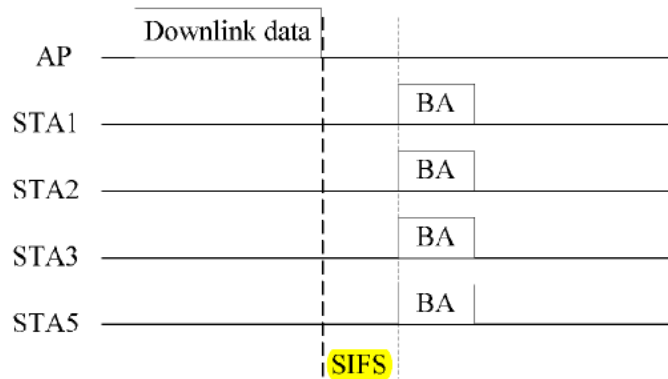


FIG. 6

Accordingly, claim 5 is unpatentable as obvious in view of Shu. *See* EX-1003, ¶¶ 295-296.

6. Claim 6.

Shu renders [6] obvious. For example, Shu discloses a further embodiment where “receiving, by the station after preset time, an acknowledgment request message sent by the access point, where the acknowledgment request message includes channel resource information, and the channel resource information is used to indicate the channel resource allocated by the access point to the station.” EX-1006, [0081]; FIG. 4. Shu also discloses “the acknowledgment request

message may be a block acknowledgment request message BlockAckReq.” EX-1006, [0083].

Accordingly, claim 6 is unpatentable as obvious in view of Shu. *See* EX-1003, ¶¶ 297-299.

7. Claim 7.

Shu renders [7] obvious. Shu discloses that “[t]he acknowledgment request message may be a BlockAckReq” and “[a]fter receiving the acknowledgment request messages, the multiple stations sequentially return acknowledgment messages to the AP in a time division manner.” EX-1006, [0004]. In view of Shu’s disclosures of BAR (which is known as a MU DL frame) and sequential UL ACKs from STAs, a POSITA would readily understand Shu discloses or suggests an indication of SU/MU acknowledgement transmission.

Shu also discloses that “BlockAckReq includes the channel resource information that indicates the channel resources allocated by the [AP] to the multiple [STAs].” EX-1006, [0110]. A POSITA would readily understand Shu’s disclosed acknowledgement request to provide resource scheduling information.

Accordingly, claim 7 is unpatentable as obvious in view of Shu. *See* EX-1003, ¶¶ 300-301.

8. Claim 8.

Shu discloses [8pre]. Shu discloses that “a method for acknowledging transmission of a downlink data frame by a station in a wireless local area network.” EX-1006, [0075]; FIG. 8. *See* Section VII.D.1.; EX-1003, ¶ 302.

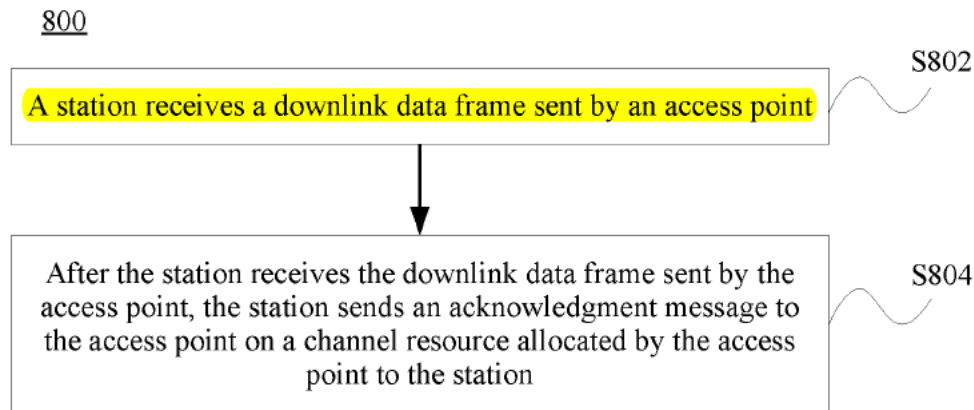


FIG. 8

Shu renders [8a] obvious. For example, Shu discloses that “[t]he station receives a downlink data frame sent by an access point.” EX-1006, [0076]; FIG. 6; FIG. 8. EX-1003, ¶ 303.

Shu discloses [8b]. Shu discloses that “[t]he [AP] may add channel resource information to an acknowledgment request message sent to the multiple [STAs], where the channel resource information is used to indicate the channel resource allocated by the [AP] to each [STA] of the multiple [STAs]..., [and] where the channel resource information is used to indicate a channel resource allocated by the access point to a station receiving the corresponding downlink data frame.” EX-1006, [0054].

Shu also discloses that “information used to identify a channel resource that is used to send an acknowledgment message and that is allocated by an [AP] to a [STA] corresponding to a downlink data frame may be carried in a header of a physical-layer frame format of the downlink data frame, or may be carried in a header of a Media Access Control (Media Access Control, MAC for short)-layer frame format of the downlink data frame....” EX-1006, [0069]. Shu also discloses that in an embodiment, “the downlink data frame includes information used to identify a channel resource allocated to a [STA] corresponding to the downlink data frame,” and “the information is located in a physical frame convergence procedure header PLCP Header of the downlink data frame.” EX-1006, [0011]-[0012]. *See* Section VII.D.1.b (discussion of Limitation [1a]). In view of Shu’s disclosed PLCP header and a MAC header, POSITA would have understood that although Shu does not use the phrase “MPDUs,” Shu still discloses or renders obvious the concept of “MPDU.” EX-1003, ¶¶ 304-305.

Shu discloses [8c] and [8d]. For example, Shu discloses that “[a STA] may find, from a server or from a local data table of the [STA] according to the index number, a channel resource allocated to the [STA].” EX-1006, [0064]; [0071]. Shu also discloses that “[a]fter the [STA] receives the downlink data frame sent by the [AP], the [STA] sends an acknowledgment message to the [AP] on a channel resource allocated by the [AP] to the [STA].” EX-1006, [0077]. EX-1003, ¶ 306.

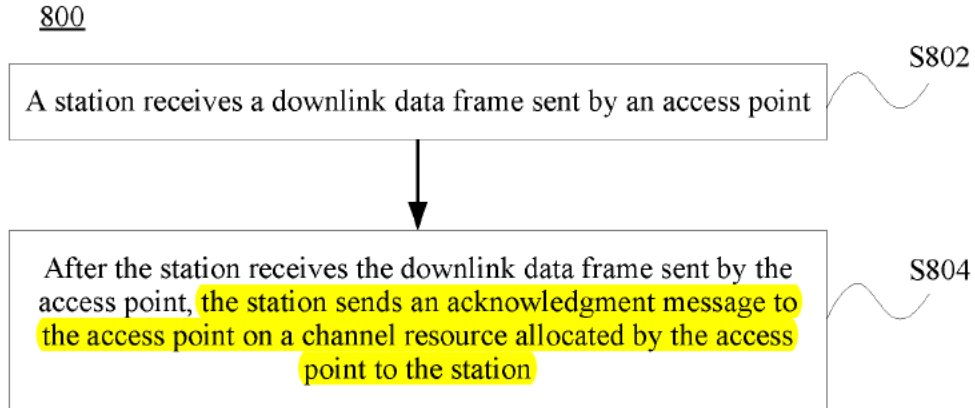


FIG. 8

Shu discloses [8e]. Shu discloses that “[t]he multiple [STAs] may use the OFDMA technology to concurrently send the acknowledgment messages to the [AP] by using the channel resources allocated by the [AP] and indicated by the channel resource information, so as to notify the [AP] of whether the downlink data frames are received successfully.” EX-1006, [0054]. *See* EX-1006, FIG. 6.

For the foregoing reasons, claim 8 of the ’520 Patent is unpatentable as obvious in view of Shu. *See* Section VII.D.1 (discussion of [1]); EX-1003, ¶¶ 302-308.

9. Claim 9.

Shu renders [9] obvious. *See* Section VII.D.1.b (discussion of Limitation [1a]); EX-1003, ¶ 309.

10. Claim 10.

Shu renders [10] obvious. *See* Section VII.D.1.d (discussion of Limitation [1c]); EX-1003, ¶ 310.

11. Claim 11.

12. Claim 12.

Shu renders [11] and [12] obvious. *See* Section VII.D.2 and VII.D.3 (discussion of [2] and [3]); EX-1003, ¶ 311.

13. Claim 13.

Shu renders [13] obvious. *See* Section VII.D.4 (discussion of [4]); EX-1003, ¶ 312.

14. Claim 14.

Shu renders [14] obvious. Shu discloses the AP allocating channel resources to each STA and sending multiple DL MU frames to STAs. *See, e.g.,* EX-1006, [0096], FIG. 4. In view of at least Shu's disclosure of channel resource allocation and multiple DL MU frames by the AP, a POSITA would readily understand that the Shu discloses or renders obvious [14]. *See* EX-1003, ¶¶ 313-316.

15. Claim 15.

Shu renders [15] obvious. *See* Section VII.D.5 (discussion of [5]); EX-1003, ¶ 317.

16. Claim 16.

Shu renders [16] obvious. *See* Section VII.D.6 (discussion of [6]); EX-1003, ¶ 318.

17. Claim 17.

Shu renders [17] obvious. *See* Section VII.D.7 (discussion of [7]); EX-1003, ¶ 319.

18. Claim 18.

Claim 18 of the '520 Patent is unpatentable as obvious in view of Shu. *See* Section VII.D.8 (discussion of [8]); EX-1003, ¶¶ 320-325.

19. Claim 19.

Shu discloses or renders [19] obvious. *See* Sections VII.D.6, VII.D.7 and, VII.D.18; EX-1003, ¶ 326.

20. Claim 20.

Shu discloses or renders [20] obvious. *See* Section VII.D.8.e (discussion of Limitation [8e]); EX-1003, ¶ 327.

VIII. PAYMENT OF FEES

The undersigned authorizes to charge Deposit Account No. 60-0381 for the fee in 37 CFR § 42.15(a) for this Petition and for any other required fees.

IX. CONCLUSION

For the reasons set forth above, Petitioners respectfully request institution of IPR for each of the grounds presented herein and a final written decision finding the Challenged Claims unpatentable.

Respectfully submitted,

Dated: April 18, 2023

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CERTIFICATION UNDER 37 C.F.R. § 42.11

Under the provisions of 37 C.F.R. § 42.11, the undersigned hereby certifies that this Petition and accompanying evidence including Exhibits 1001-1022 are not being presented for an improper purpose and that all legal contentions, allegations, and denials are warranted and have evidentiary support.

Dated: April 18, 2023

/s/Victoria Hao

CERTIFICATION UNDER 37 C.F.R. § 42.24(d)

Under the provisions of 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review contains, as measured by the word-processing system used to prepare this paper, 13,966 words. This word count does not include the table of contents, the table of authorities, the list of exhibits, the table of acronyms, certificates or appendix of exhibits.

Dated: April 18, 2023

/s/Victoria Hao

CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e)(4)(i) et seq. and 42.105(b), the undersigned certifies that on April 18, 2023, a complete and entire copy of this Petition for *Inter Partes* Review and all supporting exhibits were provided via Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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A courtesy copy of this Petition and accompanying exhibits were also served via electronic mail on April 18, 2023, on the Patent Owner's counsel of record in a related District Court litigation at AtlasTT@hpclip.com.

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