

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZYXEL COMMUNICATIONS CORPORATION AND
ZYXEL NETWORKS CORPORATION,
Petitioner,

v.

ATLAS GLOBAL TECHNOLOGIES LLC,
Patent Owner

Case IPR2023-00863
Patent 9,531,520

**DECLARATION OF DR. KONSTANTINOS PSOUNIS IN SUPPORT OF
PATENT OWNER'S PRELIMINARY RESPONSE TO PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 9,531,520**

TABLE OF CONTENTS

I.	INTRODUCTION	1
II.	PROFESSIONAL BACKGROUND AND QUALIFICATIONS.....	1
III.	MATERIALS REVIEWED.....	5
IV.	LEGAL PRINCIPLES	5
	A. Claim Interpretation	5
	B. Anticipation.....	6
	C. Obviousness	8
	D. Person of Ordinary Skill in the Art	11
	E. Priority Dates	11
V.	THE '520 PATENT DISCLOSURE	11
VI.	THE ASSERTED REFERENCES	16
	A. Chu 806	16
	B. Merlin 497.....	17
	C. Shu.....	18
VII.	CHU '806 DOES NOT RENDER OBVIOUS THE CHALLENGED CLAIMS	19
	A. Limitation 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;	19
	B. Limitation 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. 30

C. Limitation 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;.....31

D. Limitation 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; 34

VIII. Merlin 497 Fails To Disclose Or Render Obvious Several '520 Claim Limitations 35

A. Limitation 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; 35

B. Limitation 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;.....41

IX. Shu Fails To Disclose Or Render Obvious Several '520 Claim Limitations ..42

A. Limitation 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; 42

B. Limitation 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;.....47

X. MISCELLANEOUS 47

I. INTRODUCTION

1. My name is Kostantinos Psounis. I am over eighteen years of age, of sound mind, and qualified to make the statements set forth in this Declaration. With the exception of the legal principles counsel has supplied to me, all the facts and statements contained herein are within my personal knowledge and are in all respects true and correct.

2. I have been asked by Atlas Global Technologies, LLC (“Atlas”) to submit this declaration in response to a petition filed by Zyxel Communications Corporation and Zyxel Networks Corporation (the “Petition”) and declaration submitted by Dr. Paul Min (the “Min Report”) regarding U.S. Patent No. 9,531,520 (“the ‘520 Patent”).

II. PROFESSIONAL BACKGROUND AND QUALIFICATIONS

3. I have summarized in this section some of my educational background, career history, publications, and other relevant qualifications. My full *curriculum vitae* is attached as Exhibit 2003 to this expert report. During the past 4 years, I submitted declarations or expert reports in connection with the following proceedings:

- *Sercomm Corp. v. Atlas Global Technologies, LLC*, IPR2022-01519
- *Sercomm Corp. v. Atlas Global Technologies, LLC*, IPR2022-01520
- *Zyxel Communications Corporation and Zyxel Networks Corporation v. Atlas Global Technologies LLC*, IPR2023-00877
- *Zyxel Communications Corporation and Zyxel Networks Corporation v. Atlas Global Technologies LLC*, IPR2023-00863
- *Atlas Global Technologies LLC v. OnePlus Technology (Shenzhen) Co., Ltd.*, Case No. 6:21-cv-1217-ADA (W.D. Tex.)

- *Atlas Global Technologies LLC v. Sercomm Corp.*, Case No. 6:21-cv-00818 (W.D. Tex.)
- *Atlas Global Technologies LLC v. ASUSTeK Computer Inc.*, Case No. 6:21-cv-00820 (W.D. Tex.)
- *Atlas Global Technologies LLC v. TP-LINK Technologies Co., Ltd., TP-LINK Corporation Limited, TP-LINK International Ltd.*, Case No. 2:21-cv-00430 (E.D. Tex.)
- *Brown vs Google LLC*, Case No. 4:20-CV-03664-LHK (N.D. Cal.)
- *Broadcom vs Netflix*, Case No. 3:20-cv-04677-JD (N.D. Cal.)
- *AVAGO vs Netflix*, No. 2:21-CV-00080-JRG-RSP (E.D. Tex.)

4. I am a Professor and Associate Chair of Electrical and Computer Engineering and Professor of Computer Science at the University of Southern California. I joined the University of Southern California in 2003, after completing my PhD at Stanford University as a Stanford Graduate Fellow.

5. My professional career has spanned more than 20 years. As set forth in Exhibit 2003, I have extensive experience in the field of networked distributed systems, including the Internet and the web, Wi-Fi and cellular wireless systems, spectrum sharing wireless systems, sensor and IoT wireless systems, mobile ad hoc and delay tolerant wireless systems, data centers and cloud systems, peer to peer systems, and autonomous vehicles/drones systems.

6. I have published more than 100 technical papers in these fields, which have been cited tens of thousands of times. I have also been awarded numerous grants and significant funding from the government and industry leaders to advance these fields. As a result, I have been named an Institute of Electrical and Electronics

Engineers (IEEE) Fellow, the highest grade of membership, for “fundamental contributions in the theory and practice of wireless networks”, and a Distinguished Member of the Association of Computing Machinery (ACM).

7. Throughout my career, I have analyzed, designed, and developed efficient networked distributed systems for the Internet and the Web, Wi-Fi and cellular wireless systems, spectrum sharing wireless systems, sensor and IoT wireless systems, mobile ad hoc and delay tolerant wireless networks, data centers and cloud systems, peer to peer systems, and autonomous vehicles/drones systems. As such, I have acquired extensive expertise in the analysis and development of those systems and associated products.

8. I have extensive experience with and made contributions specifically towards analyzing and designing efficient Wi-Fi, cellular and other wireless systems. In particular, I have received multiple funding awards from the National Science Foundation (NSF), the leading governmental agency for funding computer engineering and computer science research, to work on wireless systems, including Wi-Fi systems. I have also received multiple funding awards from the industry leaders in the area of networking and in particular wireless networking, to work on these systems. I have published several papers in the most selective academic journals and conferences on wireless systems. I have also been the faculty in charge of the entire networking curriculum at the Electrical and Computer Engineering

department at USC for more than a decade and teach networking classes and in particular the graduate wireless networking class yearly.

9. I also have extensive practical experience with networked distributed systems. For example, I was a co-founder of SpaceMUX, Inc. (whose IP was later acquired by Quantenna Communications, Inc.), where I designed and developed systems to increase the speed of wireless networked systems using modern wireless networking technologies and techniques. Also, I was the Technology Architect for Fineground Networks (later acquired by Cisco Systems, Inc.), where I designed and developed systems to accelerate the delivery of content over the World Wide Web. In addition, for over 20 years both at Stanford University and at the University of Southern California I have designed and implemented efficient algorithms, protocols and systems for a variety of distributed networked systems, and I have consulted for industrial leaders, and produced prototype systems. I have also applied for and been granted numerous patents, which are owned by network industry leaders and prestigious academic institutions.

10. In sum, I have extensive experience in and familiarity with the fields of networked distributed systems and in particular with wireless networking systems including Wi-Fi systems, and extensive experience and contributions towards the analysis, design and implementation of such systems.

III. MATERIALS REVIEWED

11. In forming my opinions in this proceeding, I have reviewed each of the references cited in this Declaration including the '520 Patent, the Petition, the Min Report, and the references that the Petition and Min Report rely upon as invalidating prior art.

IV. LEGAL PRINCIPLES

12. I am not a lawyer. In forming my opinions as set forth in this Declaration, I have relied upon legal principles supplied to me by attorneys for Atlas. In forming my opinions, I have not relied upon Atlas' attorneys for any purpose other than the following legal principles.

A. Claim Interpretation

13. I understand that claims are to be interpreted from the perspective of one of ordinary skill in the art at the time of the invention and have considered such an interpretation in forming my opinions on validity. I also understand that claim construction is a matter of law and that claims are to be construed by the Board.

14. It is my understanding that the claims of the patent are construed consistent with the so-called intrinsic evidence, which includes the language of the claim itself, the specification of the patents, other claims of the patent and the relevant prosecution histories from the U.S. Patent and Trademark Office ("USPTO"). Other materials (such as dictionaries) not in the written records of the

patents, i.e., extrinsic evidence, may also be considered if they are consistent with (and not contradictory to) the intrinsic evidence.

15. I understand that claims are construed from the perspective of a person of ordinary skill in the art (“POSITA”) at the time of the purported invention. I understand that in the context of an *inter partes* review proceeding, absent a disclaimer or express definition, claim terms are given their plain and ordinary meaning to a POSITA in view of the specification and file history and the knowledge of a POSITA. Unless otherwise noted, I have applied what I consider to be the plain and ordinary meaning of all terms as understood by a POSITA at the time of the invention, which I understand to be on or around March of 2015.

B. Anticipation

16. I understand that in an *inter partes* review, the challenger must show that the claim is invalid by a preponderance of the evidence. I understand the preponderance of the evidence to require the greater weight of evidence in favor of the challenger.

17. I understand that, in general, the anticipation analysis under 35 U.S.C. § 102 is limited to the use of a single reference. I further understand that portions of additional documents may be relied upon as part of the anticipation analysis if the primary reference incorporates the additional documents by reference. In order for the primary reference to incorporate additional documents by reference, the primary

reference must identify with detailed particularity what specific material it incorporates and clearly indicate where that material is found in the additional documents. A mere reference to another document is insufficient to incorporate that document by reference. Moreover, the referenced document must, itself, be publicly available to be properly incorporated by reference.

18. I understand that the phrase “printed publication” as used in § 102(a) means sufficiently accessible to the public interested in the art and depends upon dissemination and accessibility. Even a document that has been distributed is not necessarily a printed publication if, for example, distribution is governed by a binding agreement of confidentiality.

19. I understand that, although not expressly disclosed, subject matter may be inherently disclosed in a prior art reference where that subject matter is necessarily present in the subject matter disclosed and would be understood to be so by those of ordinary skill in the art. I understand that the fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic.

20. I understand that a claim is invalid if each and every element of the claim is disclosed in a single prior art reference with the elements arranged as specified in the claim, either expressly or inherently. I understand that invalidity

based on the disclosure of a single prior art reference in this manner is called anticipation.

C. Obviousness

21. It is my understanding that a claim is invalid for obviousness under 35 U.S.C. § 103 if, for example, two or more prior art references in combination disclose every claim limitation so to render the claim, as a whole, obvious. The relevant standard for obviousness (from 35 U.S.C. §103, AIA) is as follows:

A patent for a claimed invention may not be obtained, notwithstanding that the claimed invention is not identically disclosed as set forth in section 102, if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains. Patentability shall not be negated by the manner in which the invention was made.

22. In determining whether or not a patented invention would have been obvious, the following factors must be considered: (a) the scope and content of the prior art; (b) the differences between the prior art and the claims at issue; (c) the level of ordinary skill in the art; and (d) whatever “secondary considerations” may be present.

23. I understand that certain “secondary considerations” may be relevant in determining whether or not an invention would have been obvious, and that these

secondary considerations may include commercial success of a product using the invention, if that commercial success is due to the invention; long-felt need for the invention; evidence of copying of the claimed invention; industry acceptance; initial skepticism; failure of others; praise of the invention; and the taking of licenses under the patents by others. And any evidence of secondary considerations must be considered as part of the obviousness analysis.

24. I understand that a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. Most, if not all, inventions rely on building blocks of prior art. But multiple prior art references or elements may, in some circumstances, be combined to render a patent claim obvious. I understand that I should consider whether there is an “apparent reason” to combine the prior art references or elements in the way the patent claims. To determine whether such an “apparent reason” to combine the prior art references or elements in the way a patent claims, it will often be necessary to look to the interrelated teaching of multiple patents, to the effects of demands known to the design community or present in the marketplace, and to the background knowledge possessed by a person having ordinary skill in the art. Further, one must consider the prior art as a whole—not just cherry-picking certain disclosures from a prior art reference and ignoring other prior art references or other disclosures from the same prior art references.

25. I also understand that when the prior art “teaches away” from combining prior art references or certain known elements, discovery of a successful means of combining them is more likely to be non-obvious. A prior art reference may be said to “teach away” from a patent when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the patent or would be led in a direction divergent from the path that was taken by the patent. Additionally, a prior art reference may “teach away” from a claimed invention when substituting an element within that prior art reference for a claim element would render the claimed invention inoperable.

26. I also understand that it is not permissible to use hindsight in assessing whether a claimed invention is obvious. Rather, I understand that, to assess obviousness, you must place yourself in the shoes of a person having ordinary skill in the relevant field of technology at the time the inventions were made who is trying to address the issues or solve the problems faced by the inventor and ignore the knowledge you currently now have of the inventions. The prior art itself, and not the inventor’s achievements, must establish any obviousness. Further, I understand that defining the problem to be solved in terms of its solution reveals improper hindsight in the selection of the prior art relevant to obviousness. Further, an overly narrow statement of the problem can represent a form of hindsight, because often the inventive contribution lies in defining the problem in a new revelatory way.

Similarly, an assertion that a person of ordinary skill could combine the references, rather than that they would have been motivated to do so, is an impermissible form of hindsight. Moreover, knowledge of a problem and motivation to solve it are entirely different from motivation to combine particular references to reach the particular claimed method.

D. Person of Ordinary Skill in the Art

27. I understand that the meaning of claim terms and a patent's validity are to be determined from the vantage point of one of ordinary skill in the art at the time of the invention. In determining who would be one of such ordinary skill, I understand it is appropriate to consider criteria such as: (a) the type of problems encountered in the art; (b) prior art solutions to those problems; (c) the rapidity with which innovations are made; (d) the sophistication of the technology; and (e) the education level of active workers in the field.

E. Priority Dates

28. I also understand that a later-filed patent may be entitled to the earlier priority date of a provisional application to which it claims priority if that provisional application provides support for both (1) the disclosures in the later-filed patent and (2) at least one claim of the later-filed patent.

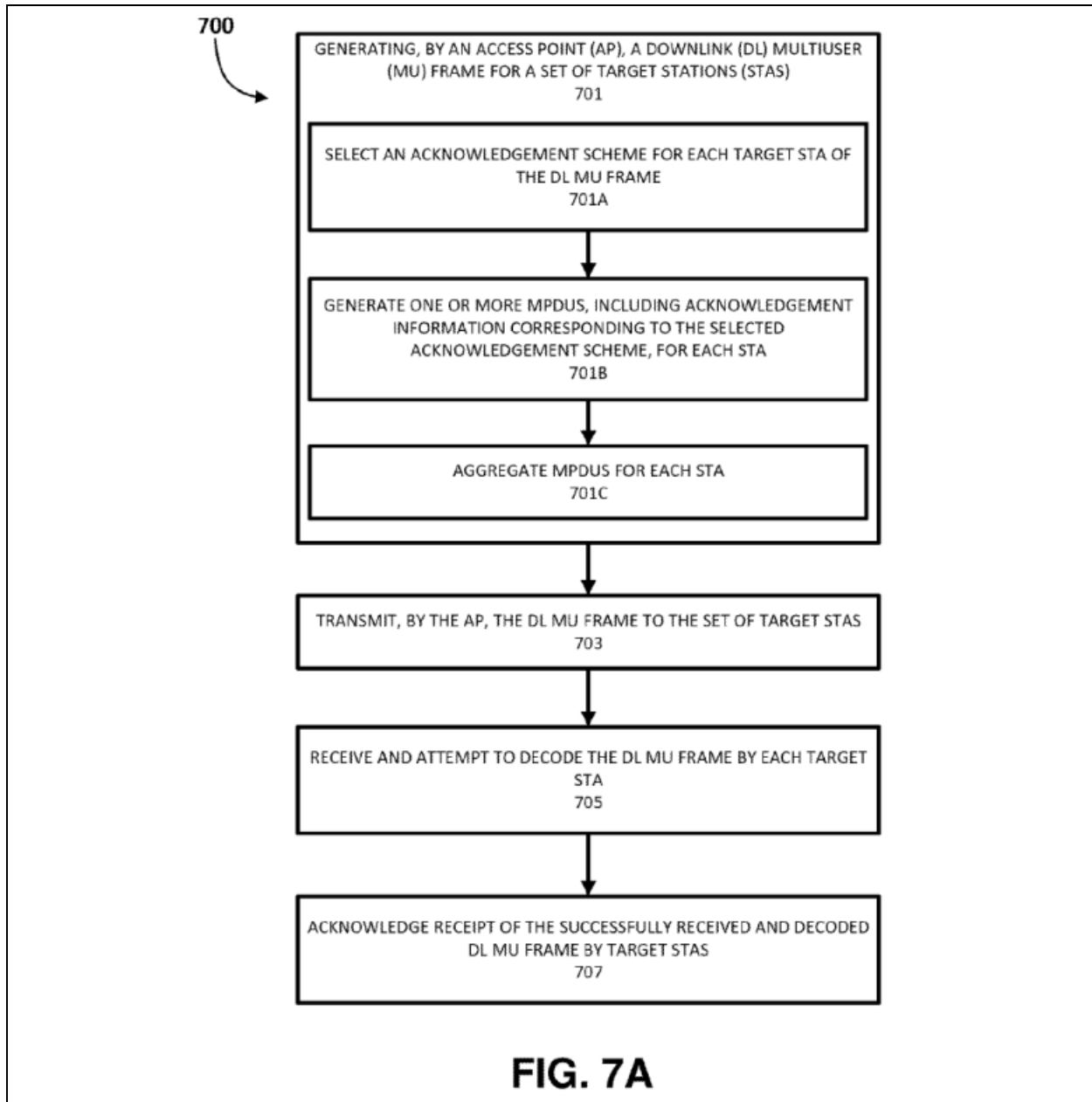
V. THE '520 PATENT DISCLOSURE

29. The '520 Patent is titled "Apparatus and Method for Downlink and Uplink Multi-User Transmissions." '520 Patent at Title Page. It was invented by

Young Hoon Kwon and Ahmad Reza Hedayat while working on the next-generation IEEE 802.11ax standard (aka Wi-Fi 6) at Newracom. *Id.*; *see also id.* at 6:57-60, 13:25-27. The '520 Patent claims priority to March 23, 2015 and March 30, 2015. *Id.* It issued on December 27, 2016. *Id.*

30. The '520 Patent generally relates to methods for sending and receiving multi-user triggering frames that solicit a multi-user acknowledgement transmission and include acknowledgement information indicating properties of the multi-user acknowledgement transmission.

31. By way of example, the embodiments corresponding to Figures 7A and 7B describe a process whereby the AP coordinates simultaneous UL MU acknowledgement/response transmissions to a DL MU transmission. *See, e.g.*, '520 Pat. at 19:50-21:51. The flowchart of Figure 7A summarizes the steps of the process:



'520 Pat. at Fig. 7A.

32. In the Figure 7 embodiments, the transmitting device, such as an AP, generates a DL MU frame. '520 Pat. at 19:58-20:6. The DL MU frame may be addressed to multiple STAs operating in the network and each STA is allocated separate resources within the DL MU frame. *Id.* at 20:6-18. In this example, there

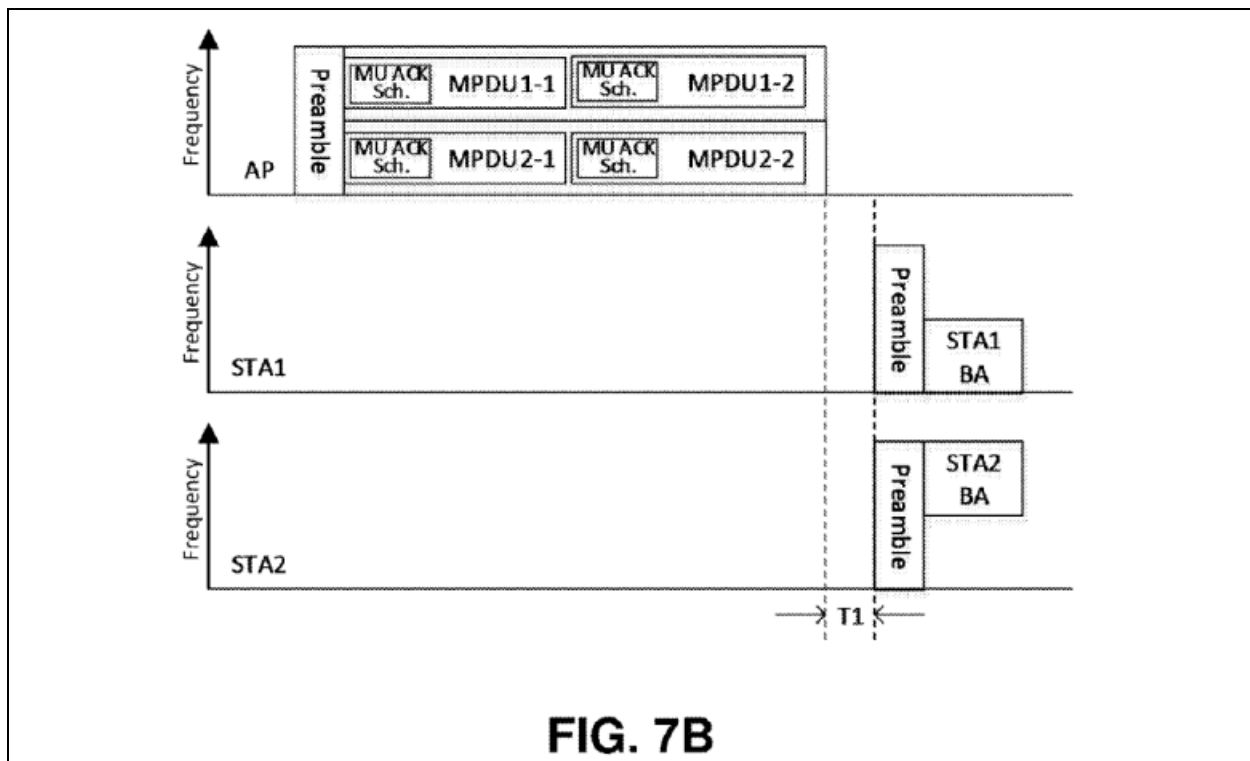
are two STAs denoted “STA1” and “STA2” and STA1 is allocated a first RU (a lower half of the transmission bandwidth) while STA2 is allocated a second RU (an upper half of the transmission bandwidth). *Id.*

33. The AP selects an acknowledgement scheme for the target STAs and determines properties or characteristics of the acknowledgement such as “(1) whether the acknowledgement is immediate or non-immediate, (2) whether the acknowledgement is s multi-user or single user, and/or (3) scheduling information (e.g., a resource unit within a UL transmission) when a multi-user acknowledgement is selected.” *Id.* at 20:19-28.

34. Following selection of the acknowledgement scheme, the AP generates MPDUs and places each MPDU in a RU of the DL MU frame. *Id.* at 20:44-48. The RUs may be particular spatial streams or sub-channels of a wireless channel upon which the DL MU frame will be transmitted; in the example embodiment of Figure 7, the RUs are sub-channels. *Id.* at 20:48-50. The MPDUs includes information indicating the properties of the acknowledgment scheme selected for each STA. *Id.* at 20:51-65. Following generation of the DL MU frame and its contents, the DL MU frame is transmitted to the target STAs. *Id.* at 21:17-24.

35. Next, the target STAs receive and decode the DL MU frame, checking the headers of one or more MPDUs to determine the properties of the acknowledgment scheme selected for that STA. *Id.* at 21:25-36. If the DL MU frame

is successfully received and decoded, the STA may generate and transmit a UL acknowledgement frame according to the acknowledgement information extracted from the DL MU frame. *Id.* at 21:37-51. In particular, if indicated by the acknowledgement information, STA1 and STA2 may simultaneously send UL acknowledgement transmissions after a time period, such as a SIFS, where each STA uses a different RU or set of RUs (e.g., 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). *Id.* This is further illustrated in Figure 7B:



'520 Pat. at Fig. 7B.

36. Thus, the '520 Patent teaches the use of DL MU triggering frames to synchronize and schedule uplink OFDMA and MU-MIMO, thereby using network resources more efficiently. By embedding scheduling information in resource units of a downlink multi-user transmission, the access point specifies timing and resource allocations for the corresponding uplink multi-user response.

VI. THE ASSERTED REFERENCES

37. I understand that the Petitioner has asserted three grounds of invalidity based on (1) U.S. Patent No. 10,257,806 (“Chu 806” or “Chu”), (2) U.S. Patent No. 10,230,497 (“Merlin 497” or “Merlin”), and (3) U.S. Patent Publication No. 2017/0367077 (“Shu”):

Ground	Claims	References	Statutory Basis
1	1-20	Chu 806	§103
2	1-20	Merlin 497	§103
3	1-20	Shu	§103

Pet. at 3. I provide an overview of each of these references below.

A. Chu 806

38. Chu 806 is titled “Medium Access Control for Multi-Channel OFDM in a Wireless Local Area Network.” Chu characterizes itself as disclosing a “first communication device allocates respective sub-channels of an orthogonal frequency division multiplexing (OFDM) channel to two or more second communication

devices for uplink orthogonal frequency division multiple access (OFDMA) transmission from the two or more second communication devices. A first sub-channel is allocated to a first one of the second communication devices and a second sub-channel is allocated to a second one of the second communication devices. The first communication device provides, to the second communication devices, indications of the respective sub-channels allocated to the second communication devices. The first communication device receives an uplink OFDMA data unit that includes a first OFDM data unit transmitted from the first one of the second communication devices via the first sub-channel, and a second OFDM data unit transmitted from the second one of the second communication devices via the second subchannel.” *Id.* at Abstract. As I discuss in more detail below, Chu lacks many key concepts of the ’520 Patent claims, such as the concept of downlink resource units, the claimed acknowledgement information, and the concept of embedding MPDUs in resource units.

B. Merlin 497

39. Merlin 497 is titled “Protocols for Multiple User Frame Exchanges.” Merlin 497 at Title Page. Merlin 497 generally relates to the “frame structures and protocols for uplink multiple user (MU) frame exchanges.” Merlin 497 at 1:15-17. It explains that an AP may send a DL frame that solicits an immediate response from a plurality of STAs, and those STAs may immediately respond with an UL

acknowledgment—either an ACK or a block ACK. *Id.* at 1:63-2:3. The AP’s DL MU frame may signal “which STAs are solicited for immediate response (e.g., for immediate BAs), which STAs may use existing ACK policy indications, [and] which mode is to be used for the replies (e.g., UL SU-MIMO, UL MU-MIMO, or UL MU FDMA).” *Id.* at 12:60-65. Further, Merlin 497 teaches “a response type indication for each STA may be added [to the DL MU PPDU]. 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 OFDMA).” *Id.* at 14:26-30. And the “indication may be included in the Quality of Service (QoS) control field,” for example. *Id.* at 14:30-32. Merlin 497 also discloses various acknowledgment policies, including “normal ACK,” “No ACK,” and “delayed BA” policies. *Id.* at 13:11-57. As I discuss in more detail below, Merlin 497 lacks many key concepts of the ’520 Patent claims, such as the concept of downlink resource units, the claimed acknowledgement information, and the concept of embedding MPDUs in resource units.

C. Shu

40. Shu is titled “Data Transmission Method and Apparatus Used in Wireless Local Area Network.” Shu characterizes itself as disclosing “method and an apparatus for acknowledging transmission of downlink data frames by multiple stations in a wireless local area network. The method includes: sending, by an access point, a corresponding downlink data frame to each station of the multiple stations;

and receiving, by the access point after the access point sends the corresponding downlink data frame to each station, acknowledgment messages concurrently sent by the multiple stations on channel resources allocated by the access point to the multiple stations. According to the method and the apparatus provided in the embodiments of the present invention, time required by the multiple stations to feed back the acknowledgment messages can be reduced.” *Id.* at Abstract. As I discuss in more detail below, Shu lacks many key concepts of the ’520 Patent claims, such as the concept of downlink resource units, downlink resource allocation, and the concept of embedding MPDUs in resource units.

VII. CHU ’806 DOES NOT RENDER OBVIOUS THE CHALLENGED CLAIMS

A. Limitation 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;

41. Chu 806, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

42. Chu 806 does not teach or render obvious “a plurality of resource units (RUs).” It is unclear from Dr. Min’s analysis why he believes any feature of Chu 806 is the claimed “resource units”.

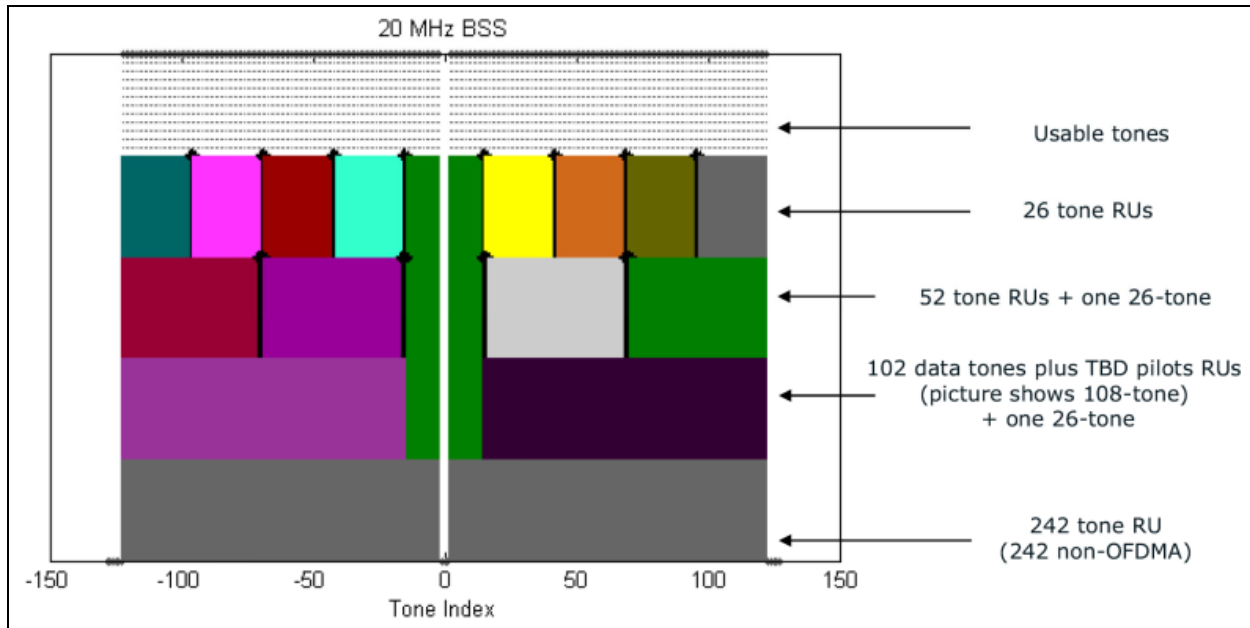
43. In the context of the ’520 Patent, a POSITA would understand the plain and ordinary meaning of “resource units (RUs)” to connote particular units of wireless channel resources. For example, resource units can be formed by dividing the wireless channel into predefined frequency subchannels. Each predefined frequency subchannel may thus be viewed as predefined “unit” of “resources” that can be used for transmitting information. It is important that resources be partitioned into particular “units” so that resource allocations can be efficiently and reliably signaled by the transmitting device and understood by the receiving devices.

44. The ’520 Patent’s teachings confirm this plain and ordinary meaning of “resource units,” for example: “The resource units may be particular spatial streams or sub-channels of a wireless channel upon which the DL MU frame will be transmitted.” ’520 at 14:12-14. This disclosure makes clear that an ad hoc or arbitrary allocation of wireless channel resources is not a “resource unit” in the context of the ’520 Patent. Rather, a resource unit must consist of “particular” predefined units of resources.

45. The ’520 Patent also makes repeated reference to the 802.11 standard and explains the invention exists within the context of ongoing 802.11

standardization activities related to multi-user (“MU”) communications. *See, e.g.*, ’520 at 4:65-5:3 (“During the standardization activities of the Institute of Electrical and Electronics Engineers (IEEE) 802.11, multiuser (MU) simultaneous transmission techniques such as Orthogonal Frequency Division Multiple Access (OFDMA) and Multi-User Multiple Input Multiple Output (MUMIMO) are considered to improve network efficiency.”) The inventors of the ’520 Patent were participants in ongoing 802.11ax standardization activities. A POSITA reading the ’520 Patent would understand the plain and ordinary meaning of “resource units” within this context of ongoing 802.11ax standardization.

46. The TGax submission “IEEE 802.11-15/0330r1 - OFDMA Numerology and Structure” is dated March 9, 2015. EX2005 at 1. This document discusses subdividing the 242 tones of the 20 MHz channel into defined “resource units” as small as 26 tones each, i.e., the 20MHz channel would be subdivided into up to nine resource units. *Id.* at 13. This is illustrated graphically in the document:



47. *Id.* at 24. This document illustrates that a POSITA at the time of the '520 Patent would have understood “resource units” to connote particular, predefined units of resources, not merely any allocation of resources. In the context of 802.11ax, as well as in prior versions of 802.11, resources cannot be allocated on an ad hoc or arbitrary basis. A wireless device can only allocate particular units of resources. Thus, for example, a device can allocate up to nine resource units in a 20MHz channel, but cannot allocate, for example, twelve resource units. Nor can a device allocate a fraction of a resource unit. Instead, “resource units” are limited to particular, predefined units of resources, i.e., 26 tones, 52 tones, 102 tones, and/or 242 tones in a 20MHz channel.

48. The document “IEEE 802.11-15/0330r1 - OFDMA Numerology and Structure” also states at Slide 28 “Fixed Position of Building Blocks ... The

proposed resource units are at fixed positions (as shown below) – RUs are building blocks for the scheduler to assign them to different users.” This further emphasizes that a POSITA would understand “resource units” to connote fixed, predefined building blocks of resources, rather than an arbitrary or ad hoc allocation of resources.

49. Among the authors of IEEE 802.11-15/0330r1 are Liwen Chu, Hongyuan Zhang, and Yakun Sun, three alleged inventors of Chu 806. This strongly suggests that the inventors of Chu 806 were aware of the concept of “resource units” in the context of 802.11 standardization. However, these inventors appear to have made the deliberate choice to not teach “resource units” in Chu 806. Neither the term “resource unit” nor any equivalent term appears in Chu 806. Instead, the inventors of Chu 806 chose to describe a different kind of system from the one claimed in the ’520 Patent—one that allocates resources without using particular “resource units.”

50. Additionally, the term “resource units (RUs)” in the context of Claim 1 of the ’520 Patent refers specifically to resource units in a downlink multi-user frame. This limitation recites “a downlink multi-user frame ... including a plurality of resource units (RUs).”

51. Dr. Min cites to various disclosures in Chu 806 that use the term “OFDM data unit.” *See, e.g.*, Min Report ¶¶ 44, 56-57, 61, 65, 94, 100-104, 106-

108, 115-121, 127-129, 131. It is unclear whether Dr. Min believes the “OFDM data unit” is a resource unit.

52. The “OFDM data unit” discussed in Chu 806 is not a resource unit. The OFDM data unit is a unit of data, not a unit of channel resources. For example, Chu 806 states “a first OFDM data unit and a second OFDM data unit are transmitted from respective client stations in a same sub-channel.” Chu 806 at 29:59-62 (emphasis added); *see also id.* at 29:12-13 (describing “transmission of multiple OFDM data units in a single channel allocated to multiple client stations”). This clearly shows that multiple OFDM data units can share the same channel resources. This is only possible because “OFDM data units” are units of data, not units of resources, *i.e.*, resource units.

53. Chu 806 also states “the OFDM data units 604-1, 604-2, 604-3 are MPDUs.” Chu 806 at 13:22-24. This disclosure further makes clear that OFDM data units are units of data, such as MPDUs, rather than units of resources. Claim 1 of the ’520 requires “including a respective set of MAC Protocol Data Units (MPDUs) in each RU.” This makes clear that the claimed RUs cannot be MPDUs, instead the RUs must contain MPDUs. Thus, OFDM data units cannot be the claimed RUs, since they are units of data not units of resources.

54. Dr. Min also cites to various disclosures of “channels,” “sub-channels,” or “sub-channel blocks” being allocated. *See, e.g.*, Min Report at ¶¶ 94, 99-100, 106,

108, 109-112, 118-121, 123-126, 128. These disclosures do not teach or render obvious the claimed resource units.

55. Dr. Min cites Chu 806 stating: “[t]he channel allocation field indicates that the highest 20 MHz channel of the 80 MHz channel is allocated to the client station STA1, the second highest 20 MHz channel of the 80 MHz channel is allocated to the client station STA2... in the illustrated embodiment.” Min Report ¶¶ 106, 131 (citing Chu 806 at 12:55-61). He further cites the statement: “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 client [STAs] in sub-channel blocks corresponding to the sub-channels assigned to the client [STAs].” *Id.* ¶ 131 (citing Chu806 at 7:11-15).

56. These passages do not disclose resource units because they do not disclose allocating particular, predefined unit of resources. An allocation of a channel or sub-channel is not necessarily a resource unit in the context of the ’520 Patent. Instead, a resource unit must be a particular, predefined unit of resources. For example, in the context of 802.11ax as it existed at the time of the ’520 Patent, a group of 26 subcarriers could be a resource unit, but a group of, *e.g.*, 20 subcarriers could not be a resource unit. Chu 806 does not teach or suggest the allocation of resources into resource units. Chu 806 instead teaches away from the concept of resource units by permitting channels and/or sub-channels to be allocated in any

arbitrary manner. This is antithetical to the concept of “resource units” in the ’520 Patent as particular, predefined units of resources.

57. Chu 806 emphasizes that its allocation of channels and/or sub-channels is arbitrary and ad hoc by teaching that any level of “granularity” may be used: “In some embodiments, sub-channel allocating with granularity of less than 20 MHz is utilized. For example, the AP 14 is configured to allocate sub-channels having bandwidths less than 20 MHz, such as 10 MHz sub-channels, 5 MHz sub-channels, 1 MHz sub-channels, or other suitable bandwidth sub-channels to at least some of the client stations 25. Each of one or more of the channel position subfields 554 and corresponding one or more of the channel bandwidth subfields 556 include greater than two bits to accommodate the higher sub-channel granularity, in such embodiments.” *Id.* at 10:58-67. This disclosure makes clear that the sub-channels of Chu can be any “suitable bandwidth” rather than being “particular” resource units. Thus, Chu 806 teaches a concept of channel allocation that has nothing to do with “resource units.” As discussed above, the inventors of Chu 806 were familiar with the concept of particular, predefined “resource units” as they existed in the context of the developing 802.11ax standard, but they deliberately chose not to disclose “resource units” and instead taught a very different approach whereby channels and sub-channels are allocated on an ad hoc basis with any arbitrary level of “granularity.”

58. Because Chu 806 does not teach or render obvious the claimed “resource units” it also does not teach or render obvious “assigning each RU of the plurality of RUs to a respective station in the plurality of stations” or “including a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs.”

59. Chu 806 also does not teach or render obvious “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.”

60. Chu at 12:62-13:10 states “Each of the client stations 25 receives the channel allocation field in the primary channel of the WLAN 10 (e.g., in the lowest 20 MHz channel) and determines, based on the channel allocation field, which channel of the WLAN 10 includes data directed to the client station 25...” This statement is describing a “channel allocation field” that allocates channels in the downlink frame to stations. It does not indicate “properties of a multi-user acknowledgement transmission.” Additionally, the cited passage does not say that the “channel allocation field” is located in an MPDU in one or more RUs. Rather, it is located in “the primary channel” and not in any MPDU or any RU addressed “to a respective station.”

61. Chu 806 also states “[i]n an embodiment, client stations 25 that successfully receive data in the respective sub-channels allocated to the client stations 25 transmit respective acknowledgement (ACK or BlkAck) frames 606 to the AP 14,” and “[i]n an embodiment, each client station 25 transmits its acknowledgement (ACK or BlkAck) frame 606 in the respective sub-channel allocated to the client station 25.” Chu 806 at 13:4-10. This passage is referring to the same “channel allocation field” discussed in column 12 of Chu 806. As I explain in the preceding paragraph, this field is not located in an MPDU in one or more RUs.

62. Dr. Min also cites various other disclosures of Chu 806 in which “respective sub-channels of an OFDM channel are allocated to two or more client devices for uplink OFDMA transmission.” *See, e.g.*, Min Report ¶ 123 (citing Chu 806 at 37:8-11, Fig. 20A). None of these passages say that this information is located in any MPDU or any RU addressed “to a respective station.” In fact, the cited passage states that this information is included in a separate “scheduling frame” and not in an MPDU of the DL MU frame. Chu 806 at 37:14.

63. Dr. Min also cites Chu 806 at 29:37-43: “PHY preamble or a MAC header of the OFDM data unit directed to the first client station 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 client station indicates that an immediate acknowledgement is required,

in an embodiment.” Min Report ¶ 127. The purpose of this embodiment is “to prevent an acknowledgement frame from the first client station to interfere with transmission of the OFDM data unit.” *Id.* at 29:31-33. In other words, the purpose of this ACK policy field being described here is to prevent the two stations from transmitting simultaneously as part of an MU acknowledgement. The first client station is told by the Ack policy field that it should not send an immediate acknowledgement, whereas the second client station is told that it should send an immediate acknowledgement. The result is that the second station and the first station acknowledge sequentially via single user acknowledgements, not as part of a simultaneous multi-user acknowledgement. But this claim limitation requires “acknowledgement information indicating properties of a multi-user acknowledgement transmission.” Accordingly, this passage cannot disclose this claim limitation, because the “ACK policy field” described in column 29 of Chu 806 relates to a single-user acknowledgement.

64. Dr. Min states repeatedly that “a POSITA would readily understand Chu806 discloses or renders obvious” various elements of limitation 1a, but does not explain why he believes this. *See, e.g.*, Min Report ¶¶ 104-105, 108, 111-113, 117, 121-122, 125, 128. As I explain above, Chu 806 does not disclose limitation 1a, and instead teaches concepts that are contrary to the ’520 Patent. Dr. Min’s conclusory statements that a POSTA would “understand” certain limitations demonstrates those

limitations are not actually present. Instead, Dr. Min is simply using hindsight to attempt to add disclosures where none exist. A POSITA would not understand Chu 806 to disclose or render obvious limitation 1a.

B. Limitation 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.

65. Chu 806, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

66. As I describe above, Chu 806 does not teach or render obvious a “plurality of RUs.”

67. Chu 806 also does not teach or render obvious “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.”

68. Chu 806 repeatedly teaches that the same sub-channels can be assigned to multiple STAs for uplink transmissions. *See, e.g.*, Chu 806 at 7:22-25 (“the AP assigns the primary and the non-primary communication channels in any suitable manner to the one or more client stations”); *id.* at 29:47-57 (“the AP allocates a particular sub-channel for uplink transmission by multiple client stations as part of an OFDMA transmission from a plurality of client stations to the AP ... transmission

of the multiple OFDM uplink data units in a single channel is multiplexed in time among the multiple client stations”).

69. None of the passages cited by Dr. Min disclose this claim limitation. He cites one passage in which “the AP 14 allocates different [downlink] sub-channels to different client [STAs].” Min Report ¶ 131 (citing Chu 806 at 7:11-15). However, this disclosure relates to downlink, and it does not say that “each” STA will use a different sub-channel to send simultaneous “uplink” transmissions. At most, it implies that some of the downlink sub-channels will be allocated to different STAs. Dr. Min’s citations in paragraphs 132 and 133 of his report suffer from the same defects.

70. In sum, Chu 806 does not teach or render obvious this limitation, and instead teaches away by expressly disclosing embodiments where multiple STAs share the same sub-channel for uplink transmissions, which is the opposite of what this claim element requires.

C. Limitation 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;

71. Chu 806, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

72. I explain above in limitation 1a that Chu 806 does not disclose or render obvious “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.” Chu 806 fails to teach or render obvious this claim limitation for the same reasons, and I incorporate my opinions above.

73. As discussed above, Chu 806 at 29:37-43 does not disclose this claim element, because this claim limitation requires “acknowledgement information indicating properties of a first multi-user acknowledgement frame,” but the “ACK policy field” described in column 29 of Chu 806 relates to a single-user acknowledgement. Specifically, Chu 806 at 29:37-43 says: “PHY preamble or a MAC header of the OFDM data unit directed to the first client station 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 client station indicates that an immediate acknowledgement is required, in an embodiment.” The purpose of this embodiment is “to prevent an acknowledgement frame from the first client station to interfere with transmission of the OFDM data unit.” *Id.* at 29:31-33. In other words, the purpose of this ACK policy field being described here is to prevent the two stations from transmitting simultaneously as part of an MU acknowledgement. The first client station is told by the Ack policy field that it should not send an immediate acknowledgement,

whereas the second client station is told that it should send an immediate acknowledgement. The result is that the second station and the first station acknowledge sequentially via single user acknowledgement, not as part of a simultaneous multi-user acknowledgement. But this claim limitation requires “acknowledgement information indicating properties of a multi-user acknowledgement transmission.” Accordingly, this passage cannot disclose this claim limitation, because the “ACK policy field” described in column 29 of Chu 806 relates to a single-user acknowledgement. *See also* Chu 806 at 29:56-58 (“transmission of the multiple OFDM uplink data units in a single channel is multiplexed in time among the multiple client stations, in an embodiment”).

74. As also discussed above, the other passages cited by Dr. Min likewise fail to disclose this limitation, because they do not say that any acknowledgement information is located in an MPDU. Instead, Column 12 says the “channel allocation field” is located in “the primary channel” and not in any MPDU addressed “to a respective station.”

75. Accordingly, the “channel allocation field” cannot be the claimed “acknowledgement information” at least because it is not located in an MPDU, and the “ACK policy field” cannot be the claimed “acknowledgement information” at least because it does not indicate any properties of a multi-user transmission, but rather is used to multiplex single user transmissions in the time domain.

76. A POSITA would not understand Chu 806 to teach or render obvious this limitation because the only information located in an MPDU, the “ACK policy field” described in column 29 of Chu 806, relates to a single-user acknowledgement. Chu 806 never teaches any “properties of a multi-user acknowledgement” being located in an MPDU, and expressly teaches in column 12 that the “channel allocation field” is not located in an MPDU.

D. Limitation 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;

77. Chu 806, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

78. I explain above in limitation 1a and 8b that Chu 806 does not disclose or render obvious “acknowledgement information indicating properties of a first multi-user acknowledgement frame.” Chu 806 fails to teach or render obvious this claim limitation for the same reasons, and I incorporate my opinions above.

79. Dr. Min cites Chu 806 at 24:27-30 where it states “uplink scheduling information is provided to the client [STAs] 25 by respective separate scheduling frames 1152 transmitted as control frames”. Min Report ¶ 199. Chu 806 does not say that these “respective separate scheduling frames” indicate properties of a multi-user acknowledgement frame, but rather state that “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.” Chu 806 at 25:34-38. In other words, the “respective separate scheduling frames” request specific information from individual stations, and do not indicate “properties of a first multi-user acknowledgement frame.”

VIII. Merlin 497 Fails To Disclose Or Render Obvious Several '520 Claim Limitations

A. Limitation 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;

80. Merlin 497, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

81. Merlin 497 fails to disclose or render obvious “a plurality of resource units (RUs).”

82. As I discuss above in the context of Limitation 1a and Chu 806, in the '520 Patent, a POSITA would understand the plain and ordinary meaning of

“resource units (RUs)” to connote particular units of wireless channel resources. An ad hoc or arbitrary allocation of wireless channel resources is not a “resource unit” in the context of the ’520 Patent. Rather, a resource unit must consist of “particular” predefined units of resources. I incorporate that discussion above fully into this section.

83. Furthermore, as I explain above, in the context of ’520 claim 1 the claimed “plurality of resource units (RUs)” are in the “downlink multi-user frame.” This claim element requires downlink resource units.

84. Merlin 497 does not disclose or render obvious the claimed “resource units.” Among the authors of IEEE 802.11-15/0330r1 are Simone Merlin, Gwendolyn Barriac, and Hemanth Sampath, the three alleged inventors of Merlin 497. This strongly suggests that the inventors of Merlin 497 were aware of the concept of “resource units” in the context of 802.11 standardization. However, these inventors appear to have made the deliberate choice to not teach “resource units” in Merlin 497. Neither the term “resource unit” nor any equivalent term appears in Merlin 497. Instead, the inventors of Merlin 497 chose to describe a different kind of system from the one claimed in the ’520 Patent—one that allocates resources without using particular “resource units.”

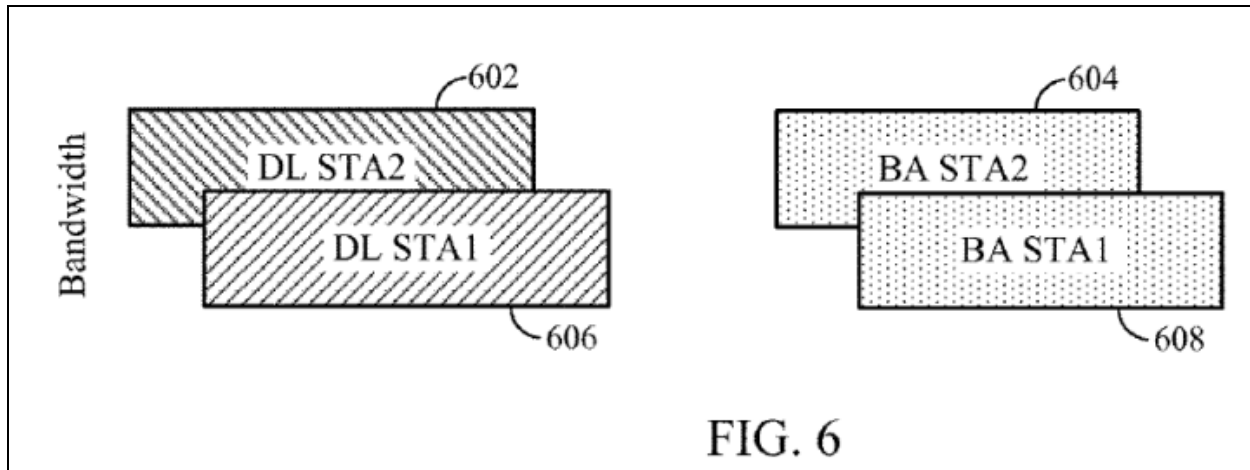
85. Dr. Min provides a cropped quote of Merlin 497 at 18:24-28. Min Report ¶ 216. That passage does not describe downlink resource units. Instead it

states “some of the 8 reserved bits in the BAR control field 910 may be used for the variable length BAR information field 912 to indicate the resource allocation for the responses ... 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.” *Id.* at 18:16-28 (emphasis added). This passage describes a “resource allocation,” but this allocation is for the uplink response, it is not an allocation of downlink resources. Moreover, this passage describes “resources” generally, but not resource units, *i.e.*, particular, predefined units of resources.

86. Dr. Min quotes Merlin 497 at 7:9-15: “[a]n OFDMA system utilizes orthogonal frequency division multiplexing (OFDM), which is a modulation technique that partitions the overall system bandwidth into multiple orthogonal sub-carriers. These sub-carriers may also be called tones, bins, etc. With OFDM, each sub-carrier may be independently modulated with data.” Min Report ¶ 220. This passage discloses sub-carriers, but does not disclose resource units because it do not disclose allocating particular, predefined unit of resources. An allocation of sub-carriers is not necessarily a resource unit in the context of the ’520 Patent. Instead, a resource unit must be a particular, predefined unit of resources. Rather than teaching resource units, Merlin 497 teaches that any arbitrary “partition[]” of bandwidth can be allocated, which is different from the concept of particular resource units.

87. Dr. Min quotes Merlin 497 at 15:65-67: “[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).” Min Report ¶ 221. This passage simply says that the uplink and downlink MU frame may use the same number and position of spatial streams. It does not teach any assignment of particular “units” of downlink spatial streams to particular recipients.

88. Dr. Min quotes Merlin 497 at 3:66-4:2 and 16:2-6: “FIG. 6 illustrates an example frame exchange with spatial streams used for response frames equal to the spatial streams used for the frames soliciting the responses” 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.” Min Report ¶ 222. It is not clear whether Figure 6 is depicting a “downlink multi-user frame” within the meaning of this claim, since Figure 6 depicts the downlink frame to STA 1 being non-simultaneously with the downlink frame to STA 2, and the uplink frames appear to be similarly non-simultaneous:



89. Moreover, while these passages mention “spatial streams,” they do not teach or disclose assignment of particular downlink “resource units” to particular STAs. Rather, resources are being allocated in an ad hoc manner. Each STA simply uses whatever stream has been allocated to that STA on an ad hoc basis, rather than being assigned particular, predefined units of resources.

90. Dr. Min opines that a POSITA “would readily understand” these passages to teach resource units, or else a POSITA would understand Merlin 497 to teach resource units in view of the “State of the Art.” Min Report ¶¶ 219, 224. I disagree. A POSITA familiar with the state of the art would recognize that Merlin 497 does not disclose resource units, and instead discloses a system in which resources are allocated on an arbitrary or ad hoc basis without the use of particular, predefined resource units. In other words, a POSITA would recognize that the approach taken by Merlin 497 deliberately avoided the use of resource units and thereby teaches away from such an approach.

91. Merlin 497 does not disclose or render obvious “assigning each [downlink] RU of the plurality of RUs to a respective station in the plurality of stations.” As explained above, Merlin 497 does not disclose or render obvious the claimed “resource units.” Merlin 497 also does not disclose “assigning” any downlink resources, let alone assigning them to “each” station. As described above, Merlin 497 discusses “the resource allocation for the responses” but does not teach or render obvious any downlink allocation of resources. This is true in each of the passages cited by Dr. Min. Either no resource allocation is disclosed at all, or the allocation relates only to an allocation of uplink resources, not downlink resources.

92. Merlin 497 does not disclose or render obvious “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.” Dr. Min cites several passages from Merlin 497 that mention “A-MPDUs,” but those passages do not say any MPDUs are located in “resource units” or that any MPDUs contain “acknowledgement information indicating properties of a multi-user acknowledgement transmission.” Min Report at ¶¶ 215, 217, 225-227.

93. Dr. Min cites Merlin 497 at 12:6-9: “a FDMA transmission may consist of... MU PPDU on each channel (e.g. 20 MHz). Each MU PPDU may be... a MU-MIMO...” Min Report ¶ 2216. This passage does not teach or disclose MPDUs, but rather PPDU. Also, this passage does not disclose any resource units, but merely

discloses a “channel (e.g. 20 MHz).” As I explain in more detail above, an arbitrary channel is not a “resource unit” within the meaning of the ’520 Patent because it is not a “particular” unit of resources.

B. Limitation 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;

94. Merlin 497, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

95. As I explain above in connection with Limitation 1a, Merlin 497 does not disclose or render obvious “an MPDU ... includes acknowledgement information indicating properties of a multi-user acknowledgement transmission.” Merlin 497 fails to teach or render obvious this claim limitation for the same reasons, and I incorporate my opinions above.

96. Dr. Min quotes Merlin 497 at 15:26-33 discussing “response parameters,” but the quoted passage does not say that any response parameters are included in any MPDU, nor does the quoted passage say that the “response parameters” correspond to a “first multi-user acknowledgement frame.” *See* Min Report ¶ 247.

97. Dr. Min quotes Merlin 497 at 14:26-35: “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.” Min Report ¶ 247. This “response type indication” does not “indicat[e] properties of a first multi-user acknowledgement frame.” Rather, it merely indicates whether or not the response is multi-user at all. It does not appear to provide any “properties” of a first multi-user frame to be transmitted by a first station. Moreover, this “response type indication” is different from the “response parameters” discussed in the same paragraph. This highlights the inconsistencies in Dr. Min’s analysis, in which he points to different and incompatible elements of Merlin 497 as allegedly supplying the same claim limitation.

IX. Shu Fails To Disclose Or Render Obvious Several ’520 Claim Limitations

A. Limitation 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;

98. Shu, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

99. Shu fails to disclose or render obvious “a plurality of resource units (RUs).”

100. As I discuss above in the context of Limitation 1a and Chu 806, in the ’520 Patent, a POSITA would understand the plain and ordinary meaning of “resource units (RUs)” to connote particular units of wireless channel resources. An ad hoc or arbitrary allocation of wireless channel resources is not a “resource unit” in the context of the ’520 Patent. Rather, a resource unit must consist of “particular” predefined units of resources. I incorporate that discussion above fully into this section.

101. Furthermore, as I explain above, in the context of ’520 claim 1 the claimed “plurality of resource units (RUs)” are in the “downlink multi-user frame.” This claim element requires downlink resource units.

102. Dr. Min cites Shu at [0054], which states: “That the access point allocates a channel resource to each station of the multiple stations may be implemented in different manners. ... The multiple stations may use the OFDMA technology to concurrently send the acknowledgment messages to the access point by using the channel resources allocated by the access point and indicated by the channel resource information, so as to notify the access point of whether the downlink data frames are received successfully.” *See* Min Report ¶ 273. This disclosure describes allocating uplink acknowledgement channel resources, not

downlink resource units. Moreover, the “channel resource” described here is not a “resource unit” within the meaning of the ’520 Patent because it does not disclose particular, predefined units of resources.

103. Dr. Min cites Shu at [0069]: “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.” *See* Min Report ¶ 274. Again, this disclosure related to an uplink “channel resource that is used to send an acknowledgment message,” and not downlink resource units. Moreover, the “channel resource” described here is not a “resource unit” within the meaning of the ’520 Patent because it does not disclose particular, predefined units of resources.

104. Dr. Min cites Shu at [0008]: “the receiving, by the access point, acknowledgment messages concurrently sent by the multiple stations on channel resources allocated by the access point to the multiple stations is specifically: receiving, by the access point, the acknowledgment messages concurrently sent by the multiple stations on the channel resources indicated by the channel resource information included in the acknowledgment request message.” *See* Min Report ¶ 278. Again, this disclosure related to uplink channel resources that are used to send

“acknowledgment messages,” and not downlink resource units. Moreover, the “channel resource” described here is not a “resource unit” within the meaning of the ’520 Patent because it does not disclose particular, predefined units of resources.

105. Dr. Min cites Shu at [0011]-[0012]: “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.” *See* Min Report ¶ 279. Again, the “channel resource allocated” here is for an uplink transmission. This is demonstrated by preceding paragraph [0006], which is describing the same embodiment, and which references: “acknowledgement messages concurrently sent by the multiple stations on channel resources allocated by the access point to the multiple stations.” In other words, the “channel resource allocated” are for the uplink “acknowledgement messages concurrently sent by the multiple stations.” These passages do not disclose any downlink resource units. Moreover, the “channel resource” described here is not a “resource unit” within the meaning of the ’520 Patent because it does not disclose particular, predefined units of resources.

106. Dr. Min cites Shu at [0003] “[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.” See Min Report ¶¶ 283-284. This passage does not mention resources or resource units.

107. Shu fails to disclose or render obvious “assigning each RU of the plurality of RUs to a respective station in the plurality of stations.” In addition to the fact that Shu does not disclose “resource units,” Shu also does not disclose “assigning” any downlink channel resources to “each” station. As discussed above, the cited passages only describe allocating uplink “channel resources” and never describe assigning any downlink resources. Moreover, none of the cited passages state that “each” resource must be assigned.

108. Shu fails to disclose or render obvious “a respective set of MAC Protocol Data Units (MPDUs) in each RU of the plurality of RUs.” None of the cited paragraphs mention “MPDUs” or “MAC Protocol Data Units.” These terms appear nowhere in Shu. Paragraph [0069] refers to “a Media Access Control-layer frame format of the downlink data frame,” but does not say that this is an MPDU, and does not say that this “Media Access Control-layer frame format” is in any way associated with resource units or resources. In particular, the cited paragraphs do not disclose a “respective set of MAC Protocol Data Units (MPDUs) in each RU” in a downlink frame.

B. Limitation 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;

109. Shu, alone or in combination with the knowledge of a POSITA, fails to teach or render obvious this claim limitation.

110. As I explain above in connection with Limitation 1a, Shu does not disclose or render obvious “MAC Protocol Data Units (MPDUs).” Shu never mentions MPDUs at all. Shu fails to teach or render obvious this claim limitation for the same reasons, and I incorporate my opinions above.

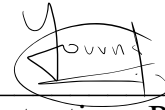
X. MISCELLANEOUS

111. My work on this matter is being billed at an hourly rate of \$700 per hour and is not contingent on the outcome of this proceeding. I am also being reimbursed for reasonable expenses I incur in relation to my services provided for this proceeding.

112. All statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true. I further understand that willful false statement and the like are punishable by fine or imprisonment, or both under Section 1001 of Title 18 of the United States Code. I declare under penalty of perjury that the foregoing is true and correct.

Date: August 11, 2023

By:

A handwritten signature in black ink, appearing to read 'Konstantinos Psounis', is written over a horizontal line.

Dr. Konstantinos Psounis