

PGR2025-00069
Patent No. 12,250,564

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG ELECTRONICS CO., LTD.,
SAMSUNG ELECTRONICS AMERICA, INC.,

Petitioners,

v.

XIFI NETWORKS R&D, INC,

Patent Owner

Case PGR2025-00069

U.S. Patent No. 12,250,564

**DECLARATION OF DR. ROBERT AKL, D.SC.
IN SUPPORT OF PATENT OWNER PRELIMINARY RESPONSE**

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I. INTRODUCTION

1. I have been retained by XiFi Networks R&D, Inc., (“XiFi”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office.

2. I am over 21 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein.

3. I have been asked by Patent Owner to provide my opinions on the validity of US. Patent No. 12,250,564 (the “’564 Patent”) and to rebut arguments made by Petitioners and Dr. Almeroth.

4. Throughout this declaration, I refer to specific pages, figures, and/or line numbers of various exhibits. These citations are illustrative and are not intended to suggest that they are the only support for the propositions for which they are cited.

5. I am being compensated for my time at my normal hourly rate. My compensation is in no way contingent upon the nature of my findings, the presentation of my findings in testimony, or the outcome of this proceeding.

II. QUALIFICATIONS AND BACKGROUND

6. I am an expert in the field of wireless networks. I have studied, taught, practiced, and researched this field for over 30 years. I have summarized in this section my educational background, work experience, and other relevant

qualifications. A true and accurate copy of my curriculum vitae is attached as Ex. 2013.

7. I earned two Bachelor of Science degrees in Electrical Engineering and Computer Science *summa cum laude* with a grade point average of 4.0/4.0 and a ranking of first in my undergraduate class from Washington University in St. Louis in 1994. In 1996, I earned my Master of Science degree in Electrical Engineering from Washington University in St. Louis with a grade point average of 4.0/4.0. I earned my Doctor of Science in Electrical Engineering from Washington University in St. Louis in 2000, again with a grade point average of 4.0/4.0, with my dissertation being on “Cell Design to Maximize Capacity in Cellular Code Division Multiple Access (CDMA) Networks.”

8. While a graduate student, from 1997 through 1999, I worked at MinMax Corporation in St. Louis, where I designed software packages that provided tools to flexibly allocate capacity in a CDMA communications network and maximize the number of subscribers. I also validated the hardware architecture for an Asynchronous Transfer Mode (ATM) switch capable of channel group switching, as well as performed logical and timing simulations, and developed the hardware architecture for the ATM switch. I also worked with Teleware Corporation in Seoul, South Korea, where I designed and developed algorithms that were commercially

deployed in a software package suite for analyzing the capacity in a CDMA network implementing the IS-95 standard to maximize the number of subscribers.

9. After obtaining my Doctor of Science degree, I worked as a Senior Systems Engineer at Comspace Corporation from October of 2000 to December of 2001. At Comspace, I designed and developed advanced data coding and modulation methods for improving the reliability and increasing the available data rates for cellular communications. I coded and simulated different encoding schemes (including Turbo coding, Viterbi decoding, trellis coded modulation, and Reed-Muller codes) and modulation techniques using amplitude and phase characteristics and multi-level star constellations. This work further entailed the optimization of soft decision parameters and interleavers for additive white Gaussian and Rayleigh faded channels. In addition, I also extended the control and trunking of Logic Trunked Radio (LTR) to include one-to-one and one-to-many voice and data messaging.

10. In January of 2002, I joined the faculty of the University of New Orleans in Louisiana as an Assistant Professor in the Department of Electrical Engineering. While in this position, I designed and taught two new courses called "Computer Systems Design I and II." I also developed a Computer Engineering Curriculum with a strong hardware-design emphasis, formed a wireless research

group, and advised graduate and undergraduate students.

11. In September of 2002, I received an appointment as an Assistant Professor in the Department of Computer Science and Engineering at the University of North Texas (UNT), in Denton, Texas. In May of 2008, I earned tenure and was promoted to the rank of Associate Professor. Between January of 2015 and August of 2022, I was appointed to Associate Chair of Graduate Studies. In May of 2023, I was promoted to the rank of Professor.

12. As a faculty member, I have authored and co-authored over 100 journal publications, conference proceedings, technical papers, book chapters, and technical presentations in a broad array of communications-related technologies, including networking and wireless communication. I have also developed and taught over 100 courses related to communications and computer systems, including 2G, 3G, 4G, 5G, 6G, CDMA/WCDMA, GPS, GSM, LTE, NFC, NR, RFID, UMTS, VoIP, VPLS, ad-hoc networks, antenna design and beamforming, Bluetooth, call admission control, channel coding, channel estimation, communication interfaces and standards, compression, computer architecture, Internet protocols, MIMO systems, multi-cell network optimization, network security, packet-networks, ring-networks, switches and routers, telephony, Wi-Fi (802.11), 802.15.4, Zigbee, wireless communication, and wireless sensors. A complete list of my publications

and the courses I have developed and/or taught is also contained in my *curriculum vitae*.

13. I am also the director of the Wireless Sensor Lab (“WiSL”) at UNT. I am a member of the Center for Information and Cyber Security (CICS). It is the only program in the U.S. to be federally certified by the National Security Agency as a Center of Academic Excellence in Information Assurance Education and Research *and* Cyber Defense Research. I was also a member of the NSF Net-Centric & Cloud Software & Systems: Industry-University Cooperative Research Center (I/UCRC). Several of my research projects are funded by industry and the National Science Foundation and published in *IEEE* conference proceedings and journals.

14. In addition to advising and mentoring students at UNT, I was asked to join the faculty of the University of Arkansas in Little Rock as an Adjunct Assistant Professor from 2004 to 2008 in order to supervise the research of two Ph.D. graduate students who were doing research in wireless communications. At UNT, I have advised and supervised more than 250 undergraduate and graduate students, several of whom received a master’s or doctorate degree under my guidance.

15. Between 2005 and 2017, I have received over a million dollars in funding from the State of Texas, Texas Higher Education Coordination Board, the National Science Foundation, and industry to design and conduct robotics, video,

and mobile gaming (*e.g.*, Xbox, PC, mobile device) programming summer camps for middle and high school students at UNT. By using video and mobile gaming as the backdrop, participants have learned coding and programming principles and developed an understanding of the role of physics and mathematics in video game design.

16. Between 2011 and 2013, I was director of the Bio-Com Project that was funded by Raytheon. The project evaluated the feasibility study using Surface Electromyography (EMG) and bend resistive sensors, that are attached to each of the five fingers of the hand, for hand gesture recognition. This approach is sometimes known as a “data glove.” A prototype was developed and demonstrated at Raytheon, to help soldiers in close-combat situations communicate with hand gestures and hand signals that would be recognized and transmitted to other soldiers’ Head Up Display (HUD) without breaking radio silence.

17. In addition to my academic work, I have remained active in the communication industry through my consulting work. In 2002, I consulted for Input/Output Inc. and designed and implemented algorithms for optimizing the frequency selection process used by sonar for scanning the bottom of the ocean. In 2004, I worked with Allegiant Integrated Solutions in Ft. Worth, Texas to design and develop an integrated set of tools for fast deployment of wireless networks, using

the 802.11 standard. Among other features, these tools optimize the placement of Access Points and determine their respective channel allocations to minimize interference and maximize capacity. I also assisted the Collin County Sheriff's Office (Texas) in a double homicide investigation, analyzing cellular record data to determine user location.

18. My professional affiliations include services in various professional organizations and serving as a reviewer for a number of technical publications, journals, and conferences. I have also received a number of awards and recognitions, including the *IEEE* Professionalism Award (2008), UNT College of Engineering Outstanding Teacher Award (2008), and Tech Titan of the Future (2010) among others, which are listed in my *curriculum vitae*.

19. I have also served as an expert in certain legal proceedings. A list of cases in which I have testified at trial, hearing, or by deposition (including those during the past five years) is provided in my *curriculum vitae*. Over the years, I have been retained by both petitioners as well as patent owners.

III. MATERIALS CONSIDERED AND BASIS OF OPINION

20. In forming my opinions, I have reviewed the parties' papers and exhibits, and any other document cited in this declaration. In the cited references, all emphasis is added unless otherwise noted.

21. I have also relied on my education, experience, research, training, and knowledge in the relevant art, and my understanding of any applicable legal principles described in this declaration.

22. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my understanding of how a person of ordinary skill in the art would have understood the claims of the patent at the time of the earliest claimed priority date.

23. I reserve the right to supplement and amend any of my opinions in this declaration based on documents, testimony, and other information that becomes available to me after the date of this declaration.

IV. LEGAL PRINCIPLES

24. I am not a lawyer. For the purposes of this declaration, I have been informed about certain aspects of the law that are relevant to my analysis and opinions. In preparing this declaration and in rendering my opinions below, I have applied these legal principles.

25. I have been informed that there are two ways in which prior art may render a patent claim unpatentable. First, I have been informed that the prior art can “anticipate” a claim. Second, I have been informed that the prior art can render a

claim “obvious” to a person of ordinary skill in the art. I understand that a claim is patentable if it was not anticipated and would not have been obvious by the prior art at the effective filing date of the patent.

26. I have been informed that a dependent claim is a patent claim that refers back to another patent claim. I have been informed that a dependent claim includes all of the limitations of the claim to which it refers.

27. I have been informed that in *inter partes* review proceedings, such as this one, the party challenging the patent bears the burden of proving unpatentability by a preponderance of the evidence. I understand that a preponderance of the evidence means “more likely than not.”

28. For purposes of this declaration, I have been asked to provide my opinions on issues regarding unpatentability. I have been informed of the following legal standards, which I have applied in forming my opinions.

A. Prior Art

29. I have been advised and understand the information used to evaluate whether an invention was new and not obvious when made is generally referred to as “prior art.” I understand that prior art includes patents and printed publications that existed before the earliest claimed priority date or the earliest filing date of the patent (which I have been informed is also called the “effective filing date”). I have

been informed and understand that a patent or published patent application is prior art if it was filed before the earliest filing date of the claimed invention and that a printed publication is prior art if it was publicly available before the earliest filing date.

B. Anticipation

30. I have been informed that under 35 U.S.C. § 102, a patent claim is unpatentable for anticipation if the claimed subject matter was patented or described in a printed publication before the effective filing date of the claimed invention. I have been informed that this is referred to as unpatentability by anticipation. I have been informed that a patent claim is anticipated under § 102 if a single prior art reference discloses all limitations of the claimed invention.

C. Obviousness

31. I have been informed that obviousness under 35 U.S.C. § 103, a patent claim is unpatentable if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious to a person having ordinary skill in the art to which said subject matter pertains at the time the invention was made. I have been informed that this is referred to as unpatentability by obviousness.

32. I have been informed that a proper obviousness analysis includes the

following:

- Determining the scope and content of the prior art;
- Ascertaining the differences between the prior art and the claims at issue;
- Resolving the level of ordinary skill in the pertinent art; and
- Considering evidence of secondary indicia of non-obviousness (if available).

33. I have been informed that the relevant time for considering whether a claim would have been obvious to a person of ordinary skill in the art is the time of invention.

34. I have been informed that a reference may be modified or combined with other references or with a person of ordinary skill in the art's own knowledge if the person would have found the modification or combination obvious. I have also been informed that a person of ordinary skill in the art is presumed to know all the relevant prior art, and the obviousness analysis may take into account the inferences and creative steps that a person of ordinary skill in the art would employ.

35. I have been informed that whether a prior art reference renders a patent claim obvious is determined from the perspective of a person of ordinary skill in the art. I have also been informed that, while there is no requirement that the prior art

contain an express suggestion to combine known elements to achieve the claimed invention, and while a suggestion to combine known elements to achieve the claimed invention may come from the prior art as a whole or individually and may consider the inferences and creative steps a person of ordinary skill in the art would employ, as filtered through the knowledge of one skilled in the art, obviousness grounds cannot be sustained by mere conclusory statements and must include some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.

36. In determining whether a prior art reference could have been combined with another prior art reference or other information known to a person having ordinary skill in the art, I have been informed that the following principles may be considered:

- A combination of familiar elements according to known methods is likely to be obvious if it yields predictable results;
- The substitution of one known element for another is likely to be obvious if it yields predictable results;
- The use of a known technique to improve similar items or methods in the same way is likely to be obvious if it yields predictable results;
- The application of a known technique to a prior art reference that is

ready for improvement to yield predictable results;

- Any need or problem known in the field and addressed by the reference can provide a reason for combining the elements in the manner claimed;
- A person of ordinary skill often will be able to fit the teachings of multiple references together like a puzzle; and
- The proper analysis of obviousness requires a determination of whether a person of ordinary skill in the art would have a “reasonable expectation of success”—but not “absolute predictability” of success—in achieving the claimed invention by combining prior art references.

37. I have been informed that, when a work is available in one field, design alternatives and other market forces can prompt variations of it, either in the same field or in another. I have been informed that if a person of ordinary skill in the art could have implemented a predictable variation and would have seen the benefit of doing so, that variation is likely to have been obvious. I have been informed that, in many fields, there may be little discussion of obvious combinations, and in these fields market demand—not scientific literature—may drive design trends. I have been informed that, when there was a design need or market pressure and there are a finite number of predictable solutions, a person of ordinary skill in the art would have had a good reason to pursue those known options.

38. I have been informed that the law permits the application of “common sense” in examining whether a claimed invention would have been obvious to a person skilled in the art. For example, I have been informed that combining familiar elements according to known methods and in a predictable way may suggest obviousness when such a combination would yield nothing more than predictable results. I understand, however, that a claim is not obvious merely because every claim element is disclosed in the prior art and that a party asserting obviousness must still provide a specific motivation to combine or modify the references as recited in the claims and explain why one skilled in the art would have reasonably expected to succeed in doing so.

39. I have been informed that there is no rigid rule that a reference or combination of references must contain a “teaching, suggestion, or motivation” to combine references. But I also understand that the “teaching, suggestion, or motivation” test can be a useful guide in establishing a rationale for combining elements of the prior art. I have been informed that this test poses the question as to whether there is an express or implied teaching, suggestion, or motivation to combine prior art elements in a way that realizes the claimed invention, and that it seeks to counter impermissible hindsight analysis.

40. I have been informed that, in an obviousness analysis, prior art must be

analogous prior art to the patent being considered. I have been informed that a prior art reference is considered to be analogous, or in the same field of art, if the reference is either (1) in the same field of endeavor as the challenged patent, regardless of the problems the challenged patent and the prior art address, or (2) reasonably pertinent to the particular problem being solved by the challenged patent.

D. Subject Matter Eligibility, Written Description, and Indefiniteness

40.1. I understand that under U.S. patent law, a claim is invalid for ineligible subject matter under 35 U.S.C. § 101 if it is directed to a law of nature, a natural phenomenon, or an abstract idea. I understand that the law first considers whether the claims as a whole are directed to excluded subject matter, including with reference to the written description. If the claims are directed to excluded subject matter as a whole, the law considers whether additional elements transform the claim into a patent-eligible application. I understand that this step may be satisfied (such that a claim is patent-eligible) where claims are directed to specific structures or specific techniques, and where claims are directed to improvements to the functionality of a computer or network platform.

40.2 I understand that under U.S. patent law, a claim is invalid for inadequate written description under 35 U.S.C. § 112(a) if the specification fails to convey with reasonable clarity to those of skill in the art that the inventor was in possession of

the invention. I am informed that the specification need not recite the claim word for word, but must set forth enough detail to allow a person of ordinary skill in the art to understand what is claimed and to recognize that the inventor invented what is claimed. I also understand that the determination of the adequacy of written description is made from the perspective of a person of skill in the art at the time the priority application was filed.

40.3 I understand that under U.S. patent law, a claim is invalid for indefiniteness under 35 U.S.C. § 112(b) if the claim, read in light of the specification and the prosecution history, fails to inform, with reasonable certainty, those skilled in the art about the scope of the invention. I understand that the purpose of this requirement is to ensure that the public is put on notice of what is and is not claimed, such that others may avoid infringement. I am informed that absolute precision is not required, but that a claim must be sufficiently definite so that a person of skill in the art can understand the boundaries of the claim when read in light of the intrinsic evidence. I also understand that the determination of indefiniteness is made from the perspective of a person of skill in the art at the time the patent was filed.

V. LEVEL OF ORDINARY SKILL

41. I understand there is a concept in patent law known as a person having ordinary skill in the art (“POSITA”). I understand that this concept refers to a person

who is trained in the relevant technical field of a patent without possessing extraordinary or otherwise exceptional skill. I further understand that factors such as the education level of those working in the field, the sophistication of the technology, the types of problems encountered in the art, prior art solutions to those problems, and the speed at which innovations are made may help establish the level of skill in the art.

42. I understand that Petitioners have proposed that a POSITA at the time of the '564 Patent had “at least a Bachelor of Science in electrical engineering, computer engineering, or similar fields and at least two years of practical experience in the field of computer networks and wireless communication applications. More education can supplement for less practical experience, and vice versa.”

43. For purposes of this declaration only, I have applied the definition provided by Petitioners with regard to the level of skill in the art. I do not necessarily agree with particular statements in the Petition and supporting materials about what a POSITA would have known, what they would understand, or how they would be motivated.

44. Based at least on my educational and work experience, under Petitioners' definition, I was at least a POSITA as of the date of the invention. And while I note that my qualifications and experiences exceed this definition of a

POSITA, in arriving at the conclusions in this Declaration, I have considered the issues from the perspective of a person of ordinary skill of the art at the relevant time.

VI. ANALYSIS OF CHINCHOLI, CHOI, AND CLEGG, AND THE COMBINATION THEREOF

45. Dr. Almeroth opines that claims 1-29 of the '564 Patent are obvious in view of the combination of Chincholi, Choi, and Clegg (Ground 1). I disagree with Dr. Almeroth's opinions regarding the combination of Chincholi, Choi, and Clegg, for the reasons discussed below.

A. Opinion on Chincholi Compared to Various Limitations of the '564 Patent Claims

46. I understand that Petitioners and Dr. Almeroth primarily rely on International Application WO/2013126859 to Chincholi, entitled "Opportunistic Radio Access Technology Selection and Aggregation," and which has an international filing date of February 24, 2013 with a publication date of August 29, 2013 (EX1005, or "Chincholi").

47. I understand that Dr. Almeroth opines, and Petitioners assert, that various of the limitations of claim 1 of the '564 Patent are disclosed by Chincholi. I disagree with many of Dr. Almeroth's opinions regarding Chincholi's disclosure, and, for purposes of this declaration, describe certain of my disagreements with Dr.

Almeroth below. If required later in these proceedings, I may provide additional opinions regarding my disagreements with Dr. Almeroth and/or the disclosure of Chincholi.

1. “virtual MAC interface”

48. I understand that Dr. Almeroth opines that Chincholi discloses the “virtual MAC interface” of claim 1[e] via its “opportunistic multiple media access control aggregation (OMMA) layer” that may reside between the IP layer and the RAT protocol stacks.” EX1002, ¶¶102-104; EX1005, Abstract. I disagree.

49. First, I note that, based on my review of Chincholi, Chincholi does not use the word “virtual” or any variant of “virtual” within its disclosure. *See* EX1005.

50. Second, Dr. Almeroth does not address the meaning of the word “virtual,” a term that would have been known and understood to a POSITA by its plain and ordinary meaning. A POSITA would understand that “virtual” means that which is not physical or tied to the physical world, but rather software-based, abstract, or logical. For example, a “virtual reality” is a reality not defined by physical reality. A “virtual machine” is a machine that is software-defined, and not physically defined. Similarly, a “virtual MAC address” or a “virtual MAC interface” is a software or logical construct that has an address that can be changed, and which need not be static. This is consistent with contemporary dictionary definitions of

“virtual.” *See* EX2009 (2012 American Heritage Dictionary) (“virtual” means “[c]reated, simulated, or carried on by means of a computer or computer network” and “[e]xisting ...not in actual fact or form”).

51. This understanding of “virtual” is also consistent with the contrast with the “actual MAC interface” claimed in the ’564 Patent, which a POSITA would have understood to be permanent and installed by the manufacturer, *i.e.*, physical. *See, e.g.*, EX2010 (Tanenbaum) at 339 (“MAC addresses are installed by the manufacturer and guaranteed to be unique worldwide...”).

52. This understanding of “virtual MAC interface” and “actual MAC interface” is consistent with usage in contemporary patents, which make clear that a “virtual MAC interface” sits between the actual MAC interface and higher layers, such that it obscures the actual MAC interface’s address from higher layers via its programmable, non-static—virtual—address. *See, e.g.*, EX2011 (U.S. Patent No. 8,078,208) at 6:39-40 (“A single virtual MAC address 311 hides the MAC addresses of the several NICs ...”); *see also id.* at Abstract (invention contains a “virtual layer that hides the multiple physical network interfaces from higher layers of a node’s network protocol stack”). Where a virtual MAC interface is present, a POSITA would understand that packets are passed up the protocol stack from the virtual MAC interface with the virtual MAC address in the payload.

53. As explained above, a virtual MAC interface would have a programmed, non-static address. *See, e.g.*, EX1001, Fig. 1; *id.* at 2:63-65. This is unlike Chincholi's OMMA layer. In fact, Chincholi's OMMA layer is not disclosed as being a separately addressable entity at all. A POSITA would understand that Chincholi's OMMA layer acts as a conduit to pass on packets received from different RATs (each with its own actual MAC address), taking multiple inputs and sending them out as one output. EX1005 at [0137]-[0143], [0383].

54. In doing so, Chincholi's OMMA sends aggregated packets to the IP layer with the payload of each packet containing the actual MAC address (a "device address") of the RAT from where it originated. Indeed, a POSITA would understand that the OMMA layer communicates with the RAT protocol stacks, *i.e.*, the MAC and PHY layers, by using the "device address," some examples of which are a WTRU (wireless transmit-receive unit) or NT (network terminal) address. *Id.*, [0205], Fig. 5. A POSITA would understand that the OMMA layer also communicates to other components at each component's "device address."

55. This is in contrast to the '564 Patent, which teaches a virtual layer between the upper layers and the actual MAC and PHY layers. EX1001, 2:56-65. It is that virtual layer that "manages the signals" between the upper layers, such as the application layer, and the actual MAC and PHY layers. *Id.*, 4:46-49. A POSITA

would understand, therefore, that packets are addressed using the virtual MAC address and that the upper layers do not see the actual MAC addresses.

56. I understand that Dr. Almeroth opines that a POSITA would understand the OMMA layer of Chincholi discloses a “virtual MAC interface” because “Chincholi’s OMMA layer ... includes all of the functionality that the ’564 Patent associates with the ‘virtual MAC interface.’” EX1002, ¶103. I disagree that a POSITA would understand Chincholi’s OMMA layer to be a “virtual MAC interface” because of the functions it performs, and I disagree that Chincholi’s OMMA layer performs the same functions as the “virtual MAC interface” of the ’564 Patent.

57. A POSITA would understand that Chincholi is missing important functionality conducted by the virtual MAC interface of the ’564 Patent. For example, the claimed virtual MAC interface controls the operation and bandwidth allocation decisions with respect to the actual MAC layers below it. EX1001, 2:65-3:3, 3:28-50 10:35-39. Chincholi states that the OMMA layer is merely a “mechanism to aggregate two or more RATs *operating independently* on two or more bands to enhance the total IP throughput of the link.” EX1005, [0120]. By stating that the RATs operate independently, a POSITA would understand that the RATs are not directed by the OMMA layer—unlike the actual MAC interfaces of

the '564 Patent.

58. Dr. Almeroth opines that the “virtual MAC layer comprises the functionality of ‘decision,’ ‘processing,’ and ultra-streaming’ blocks” disclosed in the '564 Patent and compares the functions of those three blocks to three modules within Chincholi’s OMMA layer. EX1002, ¶¶100, 103-104. He opines that a POSITA would understand the traffic shaping module 601 of Chincholi to be the functional equivalent of the '564 Patent’s ultra-streaming block; that Chincholi’s MAC resource reservation module 602 would be understood to perform the functions of '564 Patent’s processing block; and the IP QoS Scheduler module 603 would be understood to be the functional equivalent of the '564 Patent’s decision block. *Id.* I disagree that the virtual MAC interface of claim 1 of the '564 Patent can be reduced to these three functions. I further disagree that the modules within Chincholi’s OMMA layer that Dr. Almeroth identifies perform the same functions as the blocks within the virtual MAC interface to which Dr. Almeroth compares them.

59. I disagree that a POSITA would have recognized the IP QoS Scheduler to perform the functionality of the '564 Patent’s virtual MAC interface’s “decision block.” *See* EX1002, ¶¶100, 103-104. The IP QoS Scheduler “may segregate a single IP packet stream comprising multiple IP QoS types into distinct IP QoS

streams.” EX1005, [0143]. Meanwhile, the decision block determines “the size and type of data being received,” as well as the “type of processing necessary to put the stream in a format where it is capable of being transmitted.” EX1001, 3:31-34. A POSITA would not understand segregating packet streams to be equivalent to determining the size and type of data being received, nor determining the type of processing necessary to put the stream in a format for transmission. A POSITA would understand these functions to be distinct, and Dr. Almeroth gives no explanation whatsoever as to why a POSITA would consider them equivalent. *See* EX1002, ¶104.

60. I also disagree with Dr. Almeroth that a POSITA would recognize the MAC resource reservation module of Chincholi’s OMMA layer to “fulfill the functionality of the ‘processing block’ of the ’564 Patent’s ‘virtual MAC interface.’” *Id.* The MAC resource reservation module “may determine an amount of time duration and/or spectral fragment/bandwidth required by a packet or a set of packets.” EX1005, [0142]. Meanwhile, the processing block of the ’564 Patent “processes the data stream as determined by the decision block” in order “to put the stream in a format where it is capable of being transmitted.” EX1001, 3:31-36. These two functions are in fact not of the same kind at all—the MAC resource reservation module determines time and resources required; in contrast, the

processing block puts the data into a format required for transmission, as determined by the decision block. Therefore, POSITA would not understand these functions to be the same—nor does Dr. Almeroth explain why one would.

61. Finally, I disagree with Dr. Almeroth’s opinion that the traffic shaping module of Chincholi performs the functions of the ultra-streaming block of the ’564 Patent. EX1002, ¶104. The traffic shaping module of Chincholi’s OMMA “may determine the way a packet is routed using policy based routing or feedback based routing.” EX1005, [0139]. This can be done in one of two ways—“policy based routing or feedback based routing.” *Id.*, [0140]-[0141]. On the other hand, the ’564 Patent’s ultra-streaming block “manages the processing of signal streams or sub-streams given the available resources (memory, processing speed, number of available radios, etc.), and packetizes sufficiently processed streams or sub-streams,” then feeding data to the virtual PHY interface, while also monitoring resource availability. EX1001, 3:36-48. A POSITA would not understand the traffic shaping module to perform the functions of the ultra-streaming block. For example, the disclosure of Chincholi would not indicate to a POSITA that the traffic shaping block performs the packetizing function of the ultra-streaming block. Dr. Almeroth does not provide any explanation to suggest why a POSITA would understand these functionalities to be the same.

2. “resource monitoring interface”

62. I understand that Dr. Almeroth opines that Chincholi discloses the ’564 Patent’s “resource monitoring interface” via the OMMA Controller’s Feedback Device Classifier module. EX1002, ¶¶102-103. I disagree with Dr. Almeroth that Chincholi discloses the “resource monitoring interface” for multiple reasons. First, I disagree with Dr. Almeroth’s conclusion that “[a] POSITA would understand that the ‘resource monitoring interface formed in the processing interface’ requires merely a component capable of receiving feedback statistics regarding the available resources of the wireless transceivers.” *Id.*, ¶105. A POSITA would not understand “feedback statistics” to satisfy the claim’s requirement to “feed[] information regarding the bandwidth availabilities of the first and second wireless transceivers...” EX1001, 12:27-30. This is especially so because a POSITA would also understand the resource monitoring interface, a part of the processing interface, in light of the claim’s additional requirement that the processing interface be configured to use identified portions of bandwidth that are “available for communication” depending upon which one has better data transfer characteristics. *Id.*, 12:48-13:4. Both of these claim limitations require reporting of current bandwidth availability, not historical “statistics” as to how components have performed in the past. In fact, the Dr. Almeroth does not point to, and Chincholi

does not disclose, any ability to report current bandwidth availability. Rather, Dr. Almeroth points to disclosure in Chincholi discussing ““measurement metrics fed back from each RAT’ including “channel quality metrics and the number of available resources on the medium,”” (EX1002, ¶ 106 (quoting EX1005, [0161])) and “feedback metrics, (e.g., a vector comprising a value of serving rate, jitter, packet delay, and packet loss rate on its MAC)” (EX1002, ¶ 107 (quoting EX1005, [0205])). But a POSITA would understand these “feedback metrics” to represent historical data, and would not understand these “statistics” to provide current information regarding bandwidth availability—the requirement of the claim. This is especially so because Chincholi repeatedly refers to “feedback metrics” that represent “averages”—an indication to a POSITA that the system of Chincholi is collecting data over a longer period of time and not reporting current availability. *See* EX1005, [0141], [0161] & Table 2.

62.1. Second, the resource monitoring interface must “feed[] information ... back to the at least one virtual MAC interface.” EX1001, 12:28-30. It is unclear what Dr. Almeroth identifies as the virtual MAC interface. He appears to identify the Traffic Shaping Module of the OMMA layer as capable of receiving feedback, but does not suggest that the OMMA Controller feeds information to the Traffic Shaping Module. EX1002, ¶¶106-108. Therefore, Dr. Almeroth does not identify

a structure in Chincholi that “feeds information ... back to the at least one virtual MAC interface.” In any event, as described above, nothing in Chincholi or its OMMA layer is “virtual,” and so nothing Dr. Almeroth could point to would qualify as a “virtual MAC interface” to which the resource monitoring interface would feed information. *See supra*, ¶¶48-55. I therefore disagree with Dr. Almeroth that Chincholi discloses the resource monitoring interface of the '564 Patent.

3. “processing interface configured to” perform claimed functions “in a manner transparent to any layer of the wireless networking devices”

63. I understand that Dr. Almeroth opines that Chincholi discloses the claim limitation [1.f] of the '564 Patent, which recites, “wherein the processing interface is configured to, ... in a manner transparent to any layer of the wireless networking device above the processing interface...” perform multiple claimed functions.¹ EX1002, ¶110. Dr. Almeroth opines that Chincholi includes this

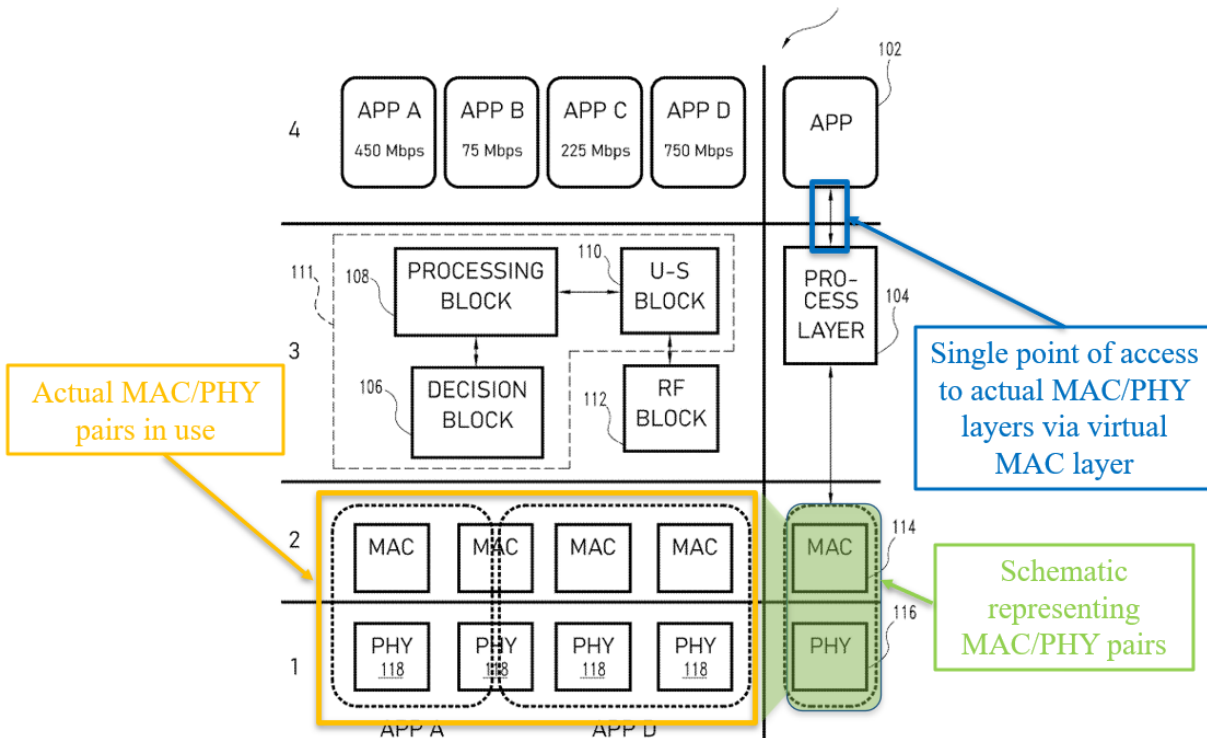
¹ These claimed functions are, described generally for context and not as a substitute for claim language: the creation of associations between the recipient and the recited actual MAC and PHY interfaces (claim 1[g]); identifying a portion of the bandwidth of the first wireless transceiver (claim 1[h]); evaluating the data characteristics of the identified bandwidth portions (claim 1[i]); and using that

disclosure because Chincholi states that “the OMMA layer may be transparent in that it distributes and/or combines packets from different RATs and forward the packets to the IP layer.” *Id.* (quoting EX1005, [0192], citing [0126]). I disagree that a POSITA would understand this disclosure of Chincholi to demonstrate limitation [1.f].

64. A POSITA, in possession of claim 1 of the '564 Patent, would understand that “the processing interface” of claim 1 performs the various claimed functions “in a manner transparent to any layer of the wireless networking device above the processing interface.” EX1001, 12:31-34. A POSITA would also understand that the “processing interface” of claim 1 includes “at least one virtual MAC interface.” *Id.*, 12:25-27. Thus, a POSITA would understand that, consistent with the fundamental point of the '564 Patent, the virtual MAC interface allows for the transparent bandwidth decision making in the claimed functions, obscuring the addresses and operation of the actual MAC and PHY layers to the upper layers. *See, e.g.*, EX1001 at Abstract. In this way, through the functioning of the virtual MAC layer, the higher layers receive the information that they are interacting with only

portion that is not unavailable to transmit the recited data stream to the recipient (claims 1[j] and 1[k]). EX1001, 12:35-13:4.

one MAC/PHY pair—the virtual MAC interface—rather than the many actual MAC/PHY pairs below the virtual MAC interface:



Id. at Fig. 1 (annotations added).

65. A POSITA would therefore understand that claim 1 of the '564 Patent requires transparency achieved by a processing interface that includes a virtual MAC interface, and where the virtual MAC interface is what allows for the claimed functions to be performed “in a manner transparent to any layer of the wireless networking device above the processing interface.” *Id.*, 12:25-13:5. Thus, though a POSITA would understand that Chincholi discloses a transparent mode, a POSITA would also understand that Chincholi—lacking a virtual MAC interface—does not

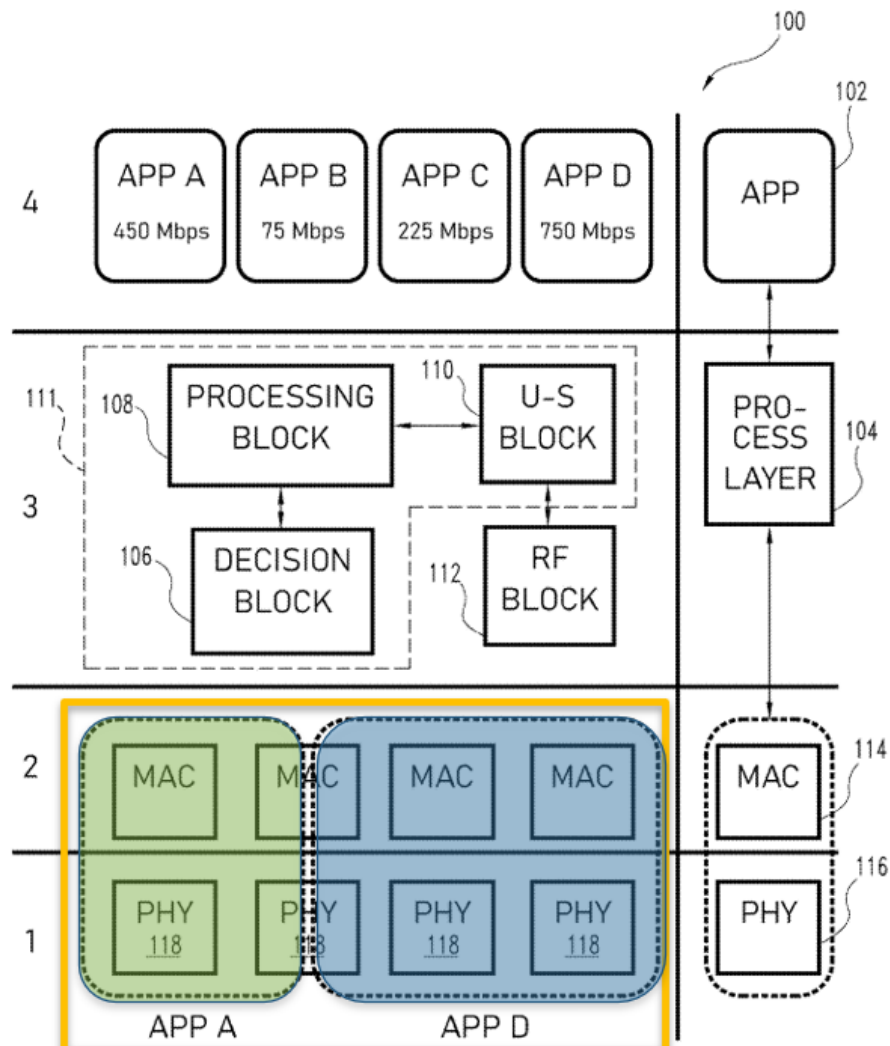
disclose the processing interface of the '564 Patent that performs the claimed functions “in a manner transparent to any layer of the wireless networking device above the processing interface.” *See* Section VII.A.1.

4. **“wherein, when the wireless networking is being used, the wireless networking device’s utilization of the first and second identified bandwidth portions do not prevent any wireless networking device from utilizing a range of frequencies corresponding to the remaining portion of the bandwidth availability of the first wireless transceiver...”**

66. I understand that Dr. Almeroth opines that Chincholi discloses limitation [1.1] of the '564 Patent, which recites, “wherein, when the wireless networking is being used, the wireless networking device’s utilization of the first and second identified bandwidth portions do not prevent any wireless networking device from utilizing a range of frequencies corresponding to the remaining portion of the bandwidth availability of the first wireless transceiver for data transmission or reception purposes at the same time that the first or second identified bandwidth portions are being used for data transmission purposes.” EX1002, ¶¶132-135. I disagree.

67. Limitation 1[1] recites that a first device’s utilization of the first and second identified bandwidth portion of the recited transceiver “do not prevent” any other device from using the remaining portions of the those first and second identified bandwidth portions at the same time. EX1001, 13:5-13. A POSITA

would understand this to mean that two devices or two applications could share a single MAC/PHY pair at the same time. This functionality is depicted in Figure 1 of the '1564 Patent, where App A (green) and App D (blue) are shown sharing the use of the second MAC/PHY pair:



EX1001, Fig. 1 (annotations added). A POSITA would understand that this ability to share a single transceiver's bandwidth among two separate users denoted by the

use of different applications is a key benefit of the '564 Patent's invention.

68. Dr. Almeroth points to Chincholi's disclosure of "multi-WTRU multi-IP flow cases" and systems that "may comprise multiple WTRUs." EX1002, ¶132 (citing EX1005 at [0328], Fig. 3). I disagree that this disclosure from Chincholi shows an ability of one transceiver to be shared between applications or devices. A system comprising multiple WTRUs and where packets are queued and distributed sequentially is not necessarily a system where a single transceiver's resources are shared simultaneously. Instead, Chincholi makes clear that its architecture allows only one WTRU to access a channel at a time, since the WTRUs "may *contend with each other*" for channel access if they share an operating frequency. EX1005, [0117]; *see also id.* [0130] ("WTRUs 315 operating on a particular spectral band may contend with each other for wireless medium access."); *id.* [0119] ("delay per channel may be high due to contention among WTRUs"). A POSITA would understand that where the WTRUs communicating on the same band are "contending" for channel access, the winner of the contention locks out" the others from using that channel at the same time. Given this contention, which causes lock out, a POSITA would understand that the various WTRUs of Chincholi do not share the channel bandwidth at the same time.

69. To the extent Chincholi discloses that "[a] WTRU may be able to

communicate (e.g., simultaneously) with a NT over, for example, an ISM channel and a TVWS channel” (EX1005, [0117]), such capability exists only where the two WTRUs are using different bands. A POSITA would understand that Chincholi teaches either operating on different bands or “contending” for the transceiver—but not teach sharing bandwidth at the transceiver.

70. I understand that Dr. Almeroth further opines that Chincholi discloses this limitation because “Chincholi’s OMMA layer receives feedback metrics from each RAT,” including the “MAC Type” “OFDMA.” EX1002, ¶134. A POSITA would understand that OFDMA, or “Orthogonal Frequency Division Multiple Access” is a technology that is only incorporated into certain wireless standards—e.g., Wi-Fi 6 (IEEE 802.11ax) and later, which was officially certified in 2019. Chincholi cites only older versions of the standard—including 802.11 a/b/g/n, which were certified in 2009 or before. EX1005, [0116]. These versions of the standard do not implement OFDMA. Nor does any part of Chincholi, including the text and figures of its specification, describe any deviation or variation from those standards, or how to modify its Wi-Fi only WTRUs to implement OFDMA. Therefore, a POSITA would not understand Chincholi to demonstrate use of OFDMA.

**5. “without requiring disassociation of the recipient from ...
MAC and PHY interfaces”**

71. I understand that Dr. Almeroth opines that Chincholi discloses

transmission of a data stream “without requiring disassociation of the recipient from ... MAC and PHY interfaces.” EX1002, ¶¶123-131. I disagree.

72. A POSITA would understand that limitations 1[j] and 1[k] and the claim language “without requiring disassociation” indicates that claim 1 of the '564 Patent does not operate based on a concept known colloquially as “break before make.” To transmit data over a network, there needs to be an association between the transmitter and receiver of the data. In prior art Wi-Fi networks, when a decision was made to switch from one transmitter/receiver operating on one band to a different transmitter/receiver on a different band, or from one channel in one band to different channel on that band, the current association had to be broken before a new association could be created. This—“break before make”—was necessary to reduce interference. However, the process of breaking and creating a new association can cause delay and latency as a new association is created.

73. The '564 Patent avoids the need to “break before make” in these type of situations by employing the virtual MAC interface. That interface provides a single, consistent MAC address for accessing the corresponding physical layer for which it is responsible, and in so doing, avoids the delay and latency associated with “break before make.”

74. A POSITA would not understand that Chincholi adopts the '564

Patent’s “without disassociating” functionality, and would rather understand Chincholi to employ the typical “break before make” functionality. Chincholi discloses that, in a “dynamic RAT switching mode,” the “the OMMA layer 1300 may select the best RAT possible... and not use the remaining RATs”—and wherein a RAT with the low channel quality may be *disabled*.” EX1005, [0154]-[0155]. A POSITA would understand this to mean that, once a different RAT is chosen, the previous one is effectively released or disabled. A POSITA would understand that “disabling” a RAT would involve the OMMA layer disassociating from that RAT at the MAC/PHY level. A POSITA would also recognize that this is consistent with other portions of Chincholi that discuss “enabl[ing] RATs at different times” based on availability as indicating that OMMA would disassociate from RATs to make them available. *Id.* at [0207]. A POSITA would understand this disassociating before forming a new association discussed throughout Chincholi to be the conventional “break before make” methodology—and not the novel transmission of a data stream “without requiring disassociation of the recipient from ... MAC and PHY interfaces” claimed by the ’564 Patent.

B. [RESERVED]

75. [Intentionally left blank]

76. [Intentionally left blank]

77. [Intentionally left blank]

78. [Intentionally left blank]

79. [Intentionally left blank]

C. Opinion on the Combination of Chincholi and Clegg and the Disclosure of Clegg

80. I understand that Dr. Almeroth opines that a POSITA would be motivated to combine Chincholi with U.S. Patent No. 9,055,592 to Clegg (EX1009, or “Clegg”). EX1002, ¶¶78-80, 127. I disagree.

81. Dr. Almeroth opines that “a POSITA would have recognized that Clegg’s teachings could be easily implemented into the Chincholi system without technical challenge.” *Id.*, ¶80. I disagree. Clegg is directed to “[w]ireless communication under IEEE 802.11 standards utilizing carrier specific interference mitigation,” and specifically, via the employment of “an ultra-wideband tuner.” EX1009 at Abstract, 9:60-10:13. A POSITA would understand that, according to the FCC, an “ultra-wideband tuner” requires fractional bandwidth of equal to or greater than 20% or where the absolute bandwidth is at least 500 MHz. *See* 47 C.F.R. § 15.503(d) (2002). A POSITA would Chincholi employ typical transceivers that communicate on single Wi-Fi bands under the prevailing wireless standards. *See* EX1005, [0118] (referencing 2.4GHz and 5 GHz bands). A POSITA would also know that these standards are not ultra-wideband—a 2.4GHz band has a bandwidth

of 83.5 MHz and a 5 GHz band has a bandwidth of 160 MHz. Therefore, a POSITA would understand that Chincholi would not utilize an ultra-wideband tuner, and would further understand that combining Clegg, and its ultra-wideband tuner, with Chincholi would necessitate extensive technical reworking. Consequently, a POSITA would not look to Clegg to modify Chincholi.

82. Dr. Almeroth opines that Clegg discloses the “without disassociating” limitations of claim 1 ([1.j] and [1.k]). EX1002, ¶¶127, 131. Dr. Almeroth relies on the fact that “Clegg teaches the ‘notching out’ specific OFDM subcarriers that suffer an unduly high amount of interference.” *Id.*, ¶127. I disagree. This disclosure has nothing to do with “make before break,” and OFDM and all standards referenced in Clegg only operate on a “break before make” basis. Clegg does not have any disclosure of any deviations from specifically mentioned standards to implement make before break or OFDMA.

83. Clegg employs the prior art “break before make” norm. Clegg states that, an access point or user equipment will “take steps necessary to ... prepare communication using the candidate carriers,” which “may involve tuning to the appropriate carriers.” *See* EX1009 at 11:4-22. A POSITA would understand that this process of tuning the carriers in order to prepare for communication would require “breaking before making,” because the POSITA would recognize this means that the

system was routing other inter-cell and intra-cell traffic away from the candidate carriers and tuning to the new carriers only after they are confirmed acceptable. This informs a POSITA that existing traffic must be moved first (broken), then the new carriers are prepared (made). A POSITA would recognize that when the access point/user equipment sends a list of candidate carriers, the peer then has to first check if those carriers are available, and then, if yes, prepare the modulation timing for those carriers. The process does not involve *immediate parallel preparation*; instead, it's conditional and stepwise. That informs a POSITA of break-before-make signaling, because the other apparatus must first free up those carriers (*i.e.*, move traffic away), tune and configure them, and only then acknowledge or refine the set. This informs a POSITA of a gap during which the carriers are not yet usable for communication. That gap is understood by a POSITA to define “break before make.”

84. Because Clegg does not itself disclose “break before make,” a POSITA would be unmotivated to combine Chincholi with Clegg to achieve the “without disassociating” limitation of claim 1 of the '117 Patent, since none of those references teaches that functionality. On the other hand, even if Dr. Almeroth were correct that Chincholi “would not ‘require’ disassociation” (I disagree with him), a POSITA would not look to combine Clegg with Chincholi, since Clegg is break

before make. EX1002, ¶119. In either case, therefore, a POSITA would not be motivated to combine Clegg with Chincholi.

D. Opinion on the Combination of Chincholi/Clegg and Choi, and the Disclosure of Choi

85. I understand that Dr. Almeroth opines that a POSITA would be motivated to combine Chincholi/Clegg with U.S. Patent No. 7,206,840 to Choi (EX1016, or “Choi”). EX1002, ¶¶81-82, 117-118, 120-122, 126-126, 129-130. I disagree.

86. Choi employs the prior art “break before make” norm. Choi explicitly grounds itself in 802.11a, an early wireless standard that employs “break before make,” and recites an “802.11a OFDM PHY.” EX1016, 8:43-48; *see also id.*, 6:30-34, 8:44-45 (additional references to OFDM). A POSITA would understand that conventional networks of this era employing 802.11 standards did not accommodate having a transceiver’s resources shared by multiple users/applications at the same time. *See supra*, ¶70. A POSITA would also understand that OFDM, or “Orthogonal Frequency Division Multiplexing,” operates on a “break before make” basis, as it is a “single user” technique, unlike the later OFDMA. Choi does not have any disclosure of any deviations from specifically mentioned standards to implement “make before break” or OFDMA.

87. Because Choi does not itself disclose “break before make,” a POSITA

would be unmotivated to combine Chincholi/Clegg with Choi to achieve the “without disassociating” limitation of claim 1 of the ’564 Patent, since none of those references teaches that functionality.

88. Dr. Almeroth opines that Chincholi does not “require disassociation.” EX1002, ¶163; *see also id.*, ¶128. I disagree with that opinion for reasons described above in Section VI.A.4. But were he correct about Chincholi, a POSITA would not look to combine Choi with Chincholi, since Choi is “break before make.” Dr. Almeroth further opines that “a POSITA would have recognized that integrating Choi’s teachings could be implemented into Chincholi without undue technical challenge and with a reasonable expectation of success.” *Id.*, ¶82. I disagree. A POSITA would have recognized that combining a conventional “break before make” system (Choi) with a “make before break” system that maintains associations (Dr. Almeroth’s view of Chincholi, with which I disagree) would require significant modifications and would not have a reasonable expectation of success.

VII. OPINIONS ON SUBJECT MATTER, WRITTEN DESCRIPTION, AND DEFINITENESS

A. Opinion on the Subject Matter of the ’564 Patent

89. I understand that Dr. Almeroth opines that the claims of the ’564 Patent “recite no inventive concept,” “that they merely require conventional networking components that were well-known to a POSITA, *e.g.*: a processing interface, actual

and virtual MAC and PHY interfaces, and wireless transceivers,” and that the claims “simply recite generic components doing generic things.” EX1002, ¶201. I disagree. To the contrary, a POSITA would understand that the invention of the ’564 Patent improves upon wireless networking technology via the location of the virtual MAC interface at a novel position within the networking stack, allowing for efficient, transparent operations.

90. As background to the ’564 Patent, at the time of its priority date, a POSITA would understand wireless networking systems were conceptualized as a layer stack. A POSITA would also understand that each layer, known interchangeably as interfaces, serves a distinct purpose or function. A well-known layer stack model is the Open Systems Interconnection (“OSI”) model, shown, for example, in the Tanenbaum “Computer Networks” text. *See* EX2010 at 41-42.

91. A POSITA would have recognized that the OSI model, like other layer stack models, has multiple layers. The layer at the “top” of the stack, is typically called the application layer. As Tanenbaum explains, the application layer contains protocols needed by users, such as the HTTP protocol for the internet, as well as protocols for applications such as file transfer and email. *See* EX2010 at 45.

92. At the other end, or “bottom” of the stack, is the physical layer, whose function is to govern the transmission of raw bits of data over a communication

channel. *See* EX2010 at 43. Immediately above the physical layer is the data link layer, whose function is to transform the raw data as transmitted by the physical layer into data frames that appear to the next higher layer (the network layer) as error-free. EX2010 at 43. The network layer is responsible for routing decisions across the network, and works to avoid bottlenecks and congestion. *See* EX2010 at 43-44. A POSITA would also be aware of the transport layer, session layer, and presentation layer, each with their own functions not relevant here. *See* EX2010 at 44-45.

93. A POSITA would understand that the data link layer conventionally includes two distinct sublayers. The upper layer, closest to the network layer, is typically referred to as the Logic Link Control (“LLC”) sublayer. The lower layer, closest to the physical layer, is known as the medium access control (“MAC”) sublayer. A depiction of the two conventional sublayers of the data link layer is below:

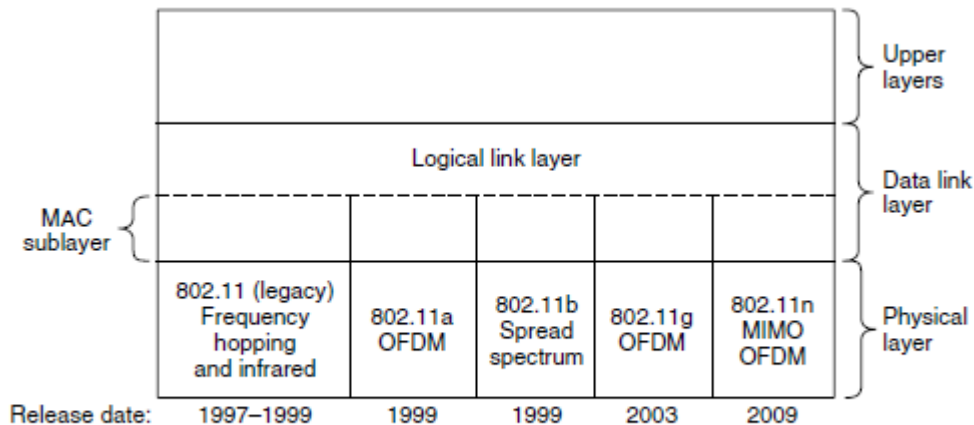


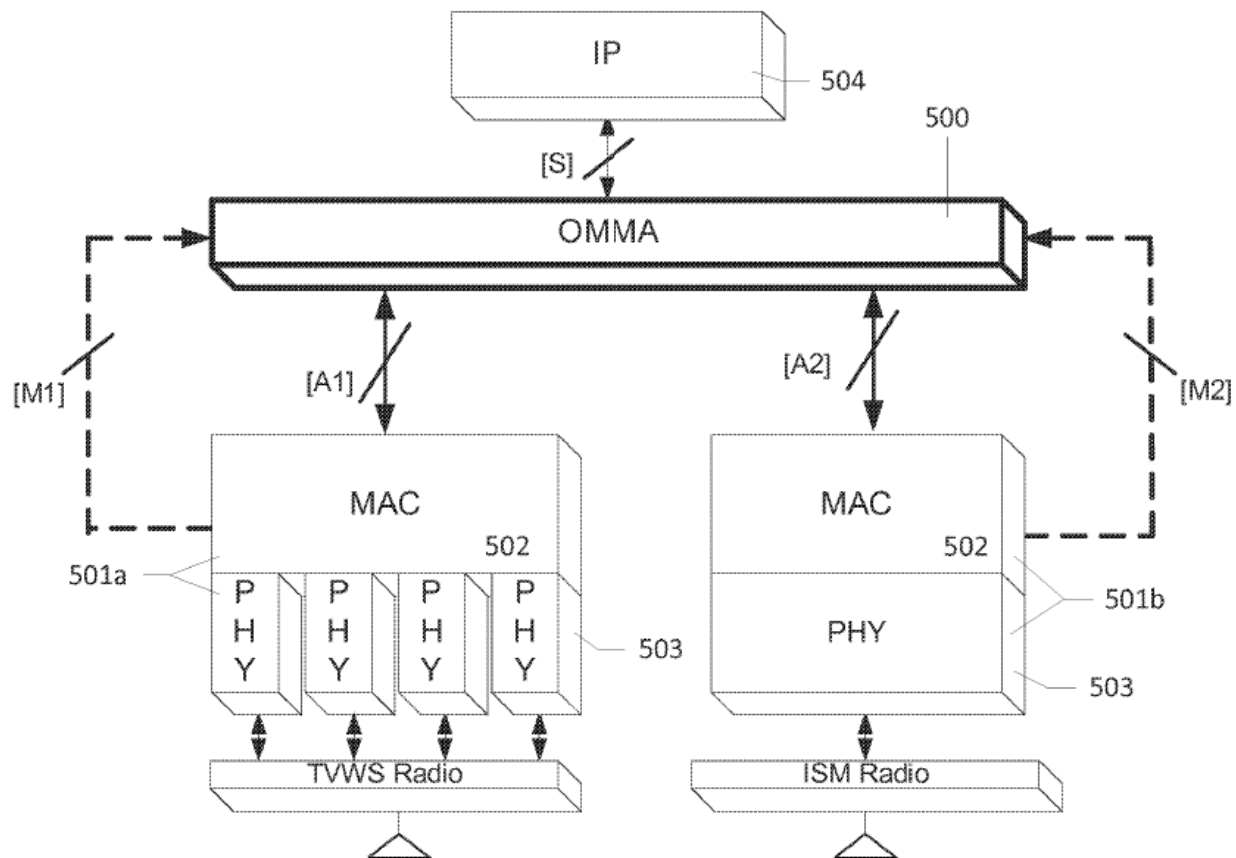
Figure 4-24. Part of the 802.11 protocol stack.

EX2010 at 300.

94. The LLC sublayer acts as an interface between the network layer and the MAC sublayer, and has the principal functions of providing multiplexing for multiple network protocols to implement flow control and handle error management. The MAC sublayer facilitates access to a shared communications channel. It controls access to the network, prevents data collisions, and ensures reliable transmission. Key functions include defining packet formats, handling physical addressing (MAC addresses), and providing error detection. The MAC sublayer has what is known as a service access point (“MAC SAP”). This is the point through which the upper layers of network accesses the MAC sublayer and thus the underlying physical media.

95. A POSITA would understand that, in wireless networking stacks, any particular layer can only “talk” to, or communicate with, the layer immediately

above or below it. At the time of the '564 Patent's priority date, conventional wireless networks such as Chincholi (EX1005) made resource allocation decisions at the network layer. In Chincholi, this is demonstrated in Figure 5:



EX1005, Fig. 5. In Figure 5, PHY modules 503 represent the physical layer, MAC modules 502 represent the MAC sublayer of the data link layer, and the OMMA layer 500 sits above the data link layer in the network layer. This is also made clear by Chincholi's Figure 7, which states that the "OMMA at the transmitter distributes packets *per IP flow* across RATs based on feedback *from the lower layers i.e. MAC/PHY.*" EX1005, Fig. 7. By stating that OMMA distributes packets "per IP

flow,” Chincholi demonstrates that the OMMA layer sits within the network layer, sometimes also called the “IP layer.” Further, by calling the MAC and PHY layers “the lower layers,” Chincholi demonstrates that the OMMA layer sits above those layers.

96. In conventional prior art systems like Chincholi, making resource allocation decisions at the network layer limited the speed and efficiency/granularity of resource allocation decisions, because those systems made such decisions at the network layer. *See* EX2010 at 43-44. In making these resource allocation decisions, interfaces in the network layer could not consult with the physical layer regarding current resource availability and characteristics, because the data link layer was in between the physical layer and the network layer. The claims of the ’564 Patent addressed this constraint in a novel way: by inserting a virtual MAC interface and a resource monitoring interface into and as part of the MAC sublayer. By placing these components within the data link layer, they can communicate with both the physical layer and the network layer, as well as with the actual MAC interfaces located below the virtual MAC interface in the MAC sublayer, and upper portions of the datalink layer.

97. Further, as described above, the ’564 Patent recites transparent operations that are the result of the processing interface (and its components,

including the virtual MAC interface and the resource monitoring interface) being part of the MAC sublayer of the data link layer. *See supra*, ¶¶64-65. With the benefit of the disclosure of the '564 Patent and its disclosure of the virtual MAC interface in particular, a POSITA would understand that making band allocation decisions at the data link layer (also known as Layer 2) makes those operations transparent to the layers above. I understand that Dr. Almeroth opines that the claims do “not say how to implement transparency.” EX1002, ¶202. I disagree. There is no additional instrumentality required to achieve the transparency claimed by the '564 Patent. Rather, the transparency is achieved by virtue of the inventive location of the processing interface and the virtual MAC interface within it.

98. Similarly, by being able to communicate with the physical layer, the processing interface can access the full range of channels available, as shown in Figure 1. Indeed, the specification describes multiple direct interactions between components of the physical layer with either or both the virtual MAC interface and/or the resource monitoring interface—which could only take place if the processing interface is either in the physical layer (which it clearly is not) or in the layer above, the MAC sublayer/data link layer. *E.g.*, EX1001, Fig. 1, (process layer 104 communicates with MAC 114 and PHY 116 as noted in bidirectional line); Fig. 4 (virtual MAC management layer 302 can communicate with PHY of device 1 and

device 2, as noted by bidirectional line); Fig. 5B & 5:38-41 (programmable register 508 provides a way to specify the storage capacities of each of the buffers, thus enabling control of the respective transmit and receive time).

99. Further, a POSITA would understand that the location of the processing layer (containing the virtual MAC interface and the resource monitoring interface) in the stack allows the system of the '564 Patent to make allocation decisions at a much more granular level and with reduced latency. This is for at least two reasons—first, the MAC sublayer of the data link layer is closer to the actual physical resources on the physical layer than the typical placement on the network layer; second, the virtual nature of the virtual MAC interface allows greater flexibility in resource allocation.

B. Opinion on the Written Description Supporting the Claims of the '564 Patent

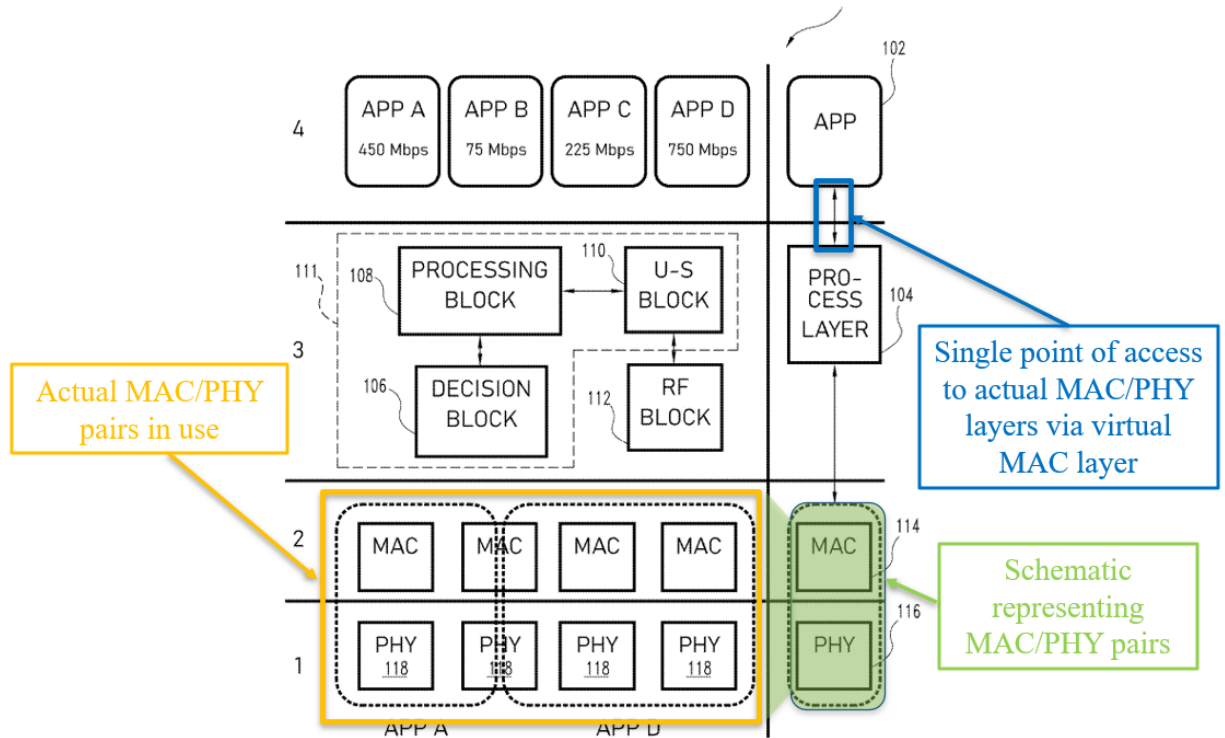
1. “transparent”

100. I understand that Dr. Almeroth opines that there is not adequate written description in the '564 Patent specification to support the claim term “in a manner transparent to any layer ... above the processing interface.” EX1002, ¶210. Dr. Almeroth further opines that noting in the cited August 8, 2023 remarks to the Patent Office evidence an understanding that the '216 provisional application supports the “transparency” limitation. I disagree.

101. First, as discussed above, a POSITA would understand that the virtual MAC interface of the processing interface operates in such a way that a POSITA would understand that it obscures the addresses and operation of the actual MAC and PHY layers from the upper layers, and therefore allows for the transparent bandwidth decision making in the claimed functions. *See supra*, ¶64.

102. Similarly, a POSITA in possession of the '216 provisional would also understand the transparent operations due to the position and operation of the virtual MAC interface, as depicted in Figure 1. As Patent Owner explained, “[n]one of the interfaces of the wireless networking device above the processing interface are aware of the processing interface’s routing decisions.” EX1017 at 557 (8/8/2023 amendments remarks). Therefore, rather than not addressing transparency, Patent Owner confirmed the '216 provisional and Figure 1 specifically demonstrated transparency.

103. This is because a POSITA would recognize that the single point of access between the upper layers and the actual MAC/PHY pairs below would represent transparent operations:



EX1001, Fig. 1 (annotations added). The double-headed arrow highlighted in blue above would convey to a POSITA that, by transmitting information from the MAC/PHY pairs in the lower layers through a single MAC service access point (rather than, for example, having direct communication between the network layer and each one of the MAC/PHY pairs), layers above the single MAC SAP would be indifferent to the manner of implementation by the processing layer or below, while all decision making is performed below the MAC SAP. This would demonstrate to a POSITA that these operations are transparent.

2. “evaluating data transfer characteristics”

104. I understand Dr. Almeroth opines that there is no adequate written

description for the “evaluating data transfer characteristics” limitation, and that indeed, the specification does not contain description of data transfer characteristics. EX1002, ¶213. I disagree, and it is my opinion that a POSITA in possession of the ’564 Patent specification would understand it to discuss the evaluation of data transfer characteristics.

105. At the priority date of the ’564 Patent, a POSITA would have understood that data transfer characteristics refer to a known set of quality of service parameters, such as throughput, signal strength, bandwidth, delay, jitter, and loss. *See* EX2010 (Tanenbaum) at 405. A POSITA would know that these characteristics are present in any data transmission via a wireless networking system like that described in the ’564 Patent’s disclosure.

106. For example, both the ’216 provisional application and the ’564 Patent’s specification discusses the evaluation of data transfer characteristics, including as related to discussion of determination of “insufficient bandwidth” (such that the bandwidth was evaluated). EX1001, 5:1-8; EX1017 at 557-558 (describing evaluation of bandwidth in ’216 provisional). The specification further discusses “continuous updating based on environmental conditions,” where a POSITA would consider “environmental conditions” in the area where the wireless networking device is used like interference from other sources and physical obstructions that

have effects on such data transfer characteristics as delay/latency, jitter, packet loss, bandwidth, reliability, and throughput. EX1001, 5:8-11. Further, references to “enabl[ing] efficient wireless access ... by users that might be outside the range of a single wireless access point” would also indicate to a POSITA that the invention of the ’564 Patent includes evaluation of data transfer characteristics, such as received signal strength. EX1001, 10:49-52; *see also id.* at 6:65-7:44, 9:9-35, Figs. 7 & 11 (also demonstrating evaluation of signal strength).

3. “resource monitoring interface”

107. I understand that Dr. Almeroth opines that there is no adequate written description for the limitation “resource monitoring interface” in the ’564 Patent specification. EX1002, ¶217. I disagree.

108. First, I note that Dr. Almeroth professes elsewhere in his opinion that a POSITA would be able to understand what a “resource monitoring interface” is. He opines, “A POSITA would understand that ‘resource monitoring interface’ formed in the processing interface requires merely a component capable of receiving feedback statistics regarding the available resources of the wireless transceivers.” *Id.*, ¶105. For the reasons explained above in Section VI.A.2, I disagree with Dr. Almeroth that his articulation is how a POSITA would understand a resource monitoring interface. But I agree with Dr. Almeroth that a POSITA, in possession

of the '564 Patent specification, would have no trouble understanding the meaning of the term “resource monitoring interface.”

109. Indeed, the '564 Patent specification discloses a resource monitoring interface that “feeds information regarding the bandwidth availabilities of the first and second wireless transceivers back to the at least one virtual MAC interface,” as recited in the claim, through several alternative embodiments that describe how the RF block forms a virtual layer that communicates with the ultra-streaming block about actual resource availability in order to perform the monitoring role. As one example, the specification describes that “[f]or one embodiment, the RF block(s) communicate directly with the ultra-streaming block about actual resource availability, and the ultra-streaming block sends information back to the decision block in the virtual MAC layer.” EX1001, 4:54-58. As an alternative embodiment, the specification further describes, “Alternatively, the virtual PHY RF block may directly communicate with the virtual MAC decision block and/or the processing block.” EX1001, 4:58-60. The specification also describes that, in some embodiments, the ultra-streaming block works with the RF block in carrying out the monitoring operation: “While not explicitly shown in FIG. 1, the ultra-streaming block carries out a monitoring function, more fully described below, that feeds back wireless resource availability to the decision block 106.” EX1001, 3:41-45; *accord*

id., 8:29-32. Considering these examples, a POSITA would understand that the specification discloses alternate components/pathways for gathering information about bandwidth availability and feeding it to the decision block of the virtual MAC, performed in all of these embodiments by the RF block, and in some embodiments, together with the ultra-streaming block.

110. The '564 Patent specification also discloses that the RF block and virtual PHY interface perform a number of other tasks, including controlling transmit/receive times (“cycle times”) and/or configuring transmit and receive buffer sizes. *E.g.*, EX. 1001, 5:56-60, Figs. 5A, 5B & 6. While a POSITA would understand that these functions are unrelated to feeding information about resource availability back to the virtual MAC interface, a POSITA would recognize that the RF block and virtual PHY layers are essentially software/firmware constructs that can be programmed or “formed” to perform desired tasks and not others.

4. “adapted to emit radio waves to different bands of frequencies”

111. I understand that Dr. Almeroth opines that the “adapted to emit radio waves to different bands of frequencies” limitation also lacks adequate written description, stating “Nowhere does the specification describe one transceiver operating in one band of frequency and another transceiver operating in a mutually exclusive, different one.” EX1002, ¶219. I disagree.

112. Dr. Almeroth recognizes that WiFi 4 (IEEE 802.11n) was released in 2009. *Id.*, ¶205. A POSITA would understand that 802.11n, released several years prior to the priority date for the '564 Patent, included the ability for Wi-Fi radios to emit radio waves on different bands of frequencies, such as 2.4 GHz and 5GHz. The specification of the '564 Patent makes multiple references to WiFi standards and multiple WiFi radios. *See* EX1001, 3:15-18 (“Referring to FIG. 1, one embodiment of a wireless networking system, generally designated 100, is shown in an abstract ‘layer’ context. Generally speaking, the system may involve a WiFi network,...”); 3:64-67 (referencing “multiple radios”); 4:1-4 (“The actual PHY layer transceivers may transmit and receive data consistent with ... the IEEE 802.11 Standard). Additionally, the ‘216 provisional to which the '564 Patent claims priority also mentions “Wi-Fi” radios and the WiFi standard. EX1017 at 556 (““On page two of the 10/30/2013 '216 provisional, ‘Wi-Fi radios’ and ‘multiple radios’ are referenced...”), 559 (“Page 2 of the 10/20/2013 '216 provisional discloses ‘Wi-Fi radios’ and page 3 mentions ‘IEEE 802.11.’”). These references would indicate to a POSITA that the first and second wireless transceivers of the '564 Patent’s invention are “adapted to emit radio waves in first and second different bands of frequencies.”

113. A POSITA would further understand that the “multiple radios” of the

'564 Patent, as shown by the multiple MAC/PHY pairs in Figure 1 and as disclosed at the citations above, represent an ability to “emit radio waves to different bands of frequencies.” This is consistent with what Patent Owner expressed to the Office in the August 8, 2023 remarks. EX1017 at 556 (“On page two of the 10/30/2013 '216 provisional, ‘Wi-Fi radios’ and ‘multiple radios’ are referenced. A single radio is associated with each individual actual PHY layer. Each radio has bandwidth availability up to an actual bandwidth. Wi-Fi radios emit radio waves in different bands of frequencies such as, for example, 2.4 GHz, 5 GHz and 6 GHz.”). This further confirms a POSITA would understand the “adapted to emit radio waves in first and second different bands of frequencies” limitation to be supported by the written description.

5. “creating associations” between a recipient and actual MAC/PHY interface

114. Dr. Almeroth opines that the limitation “request or create (i) a first association between a recipient and the first actual MAC and PHY interfaces and (ii) a second association between the recipient and the second actual MAC and PHY interfaces...” is unsupported by written description in the '564 Patent specification. EX1002, ¶222. I disagree.

115. As Dr. Almeroth recognizes (*id.*, ¶223), the '216 provisional explains that “the RF block in the virtual PHY layer communicates directly with the Ultra-

Streaming Block about actual resource availability and the Ultra-Streaming Block sends the information back to the Decision Block in the virtual MAC layer,” and also that “Figure 1 of that application [that] shows four actual PHY layers each of which contains a radio.” EX1017 at 557-558; EX1001 at Fig. 1. From this disclosure, a POSITA would understand that the actual MAC and PHY interfaces create associations with the recipient.

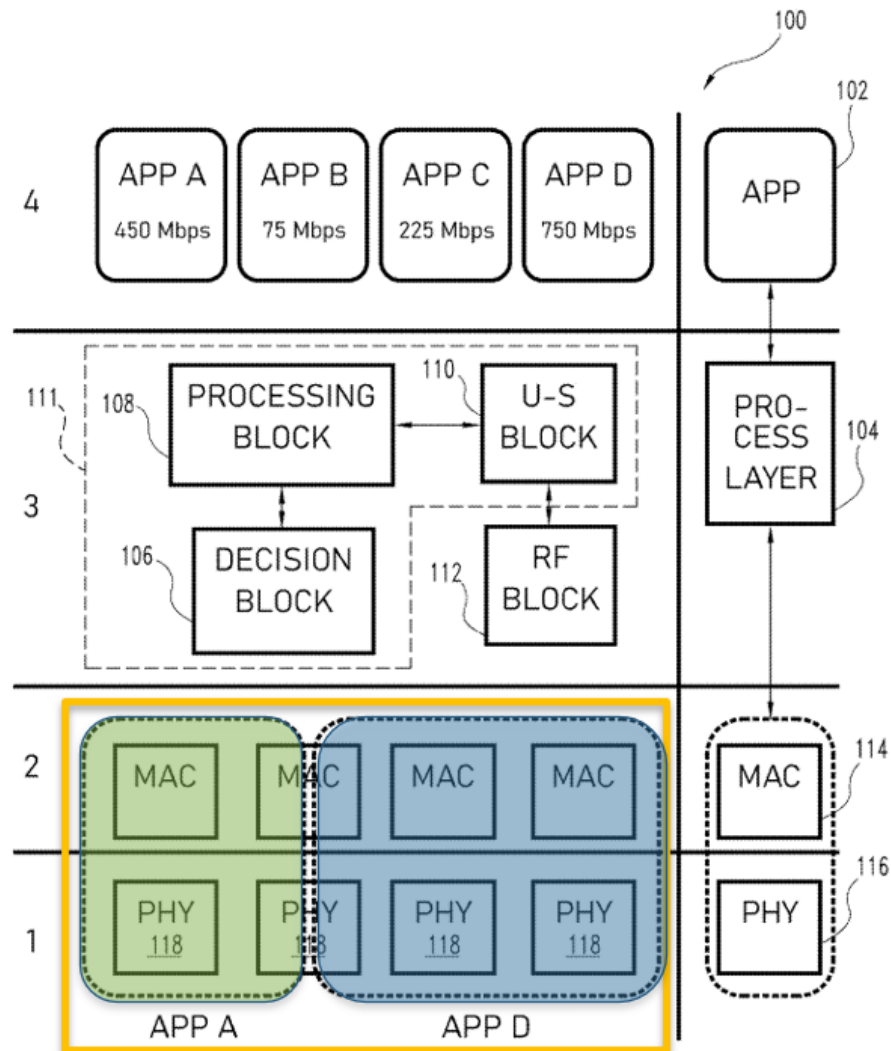
116. A POSITA would understand (as explained in the Tanenbaum textbook) that, in a Wi-Fi system like that of the '564 Patent, “association” merely indicates that the two components are in radio range of each other and connect with each other. *See, e.g.*, EX2010 (Tanenbaum) at 311. As Patent Owner has explained to the Office, a POSITA would understand that a user or a device has an association with the actual MAC and PHY layers. *See* EX1017 at 557. Moreover, a POSITA understand that a “recipient” is the entity that receives the data in a data transmission, which, in the case of the '564 Patent’s wireless system, is a user or device engaging with that system. This understanding of “recipient” is reflected in the Tanenbaum textbook multiple times. EX2010 (Tanenbaum) at 390, 463 (textbook using “recipient” to refer to entity receiving data transmission in multiple contexts).

6. “without requiring disassociation”

117. I understand that Dr. Almeroth opines that the “without requiring

disassociation” limitations lack adequate written description. EX1002, ¶222. I disagree.

118. Rather, a POSITA would understand that both the '564 Patent's specification and the '216 provisional support this limitation. Both the '562 Patent specification and the '216 provisional contain Figure 1, which in turn displays four radios used by App A and App D, where each App A and D uses multiple radios, including one that they share. EX1001, Fig. 1; EX1017 at 557-558.



EX1001, Fig. 1 (annotations added). From the fact that each application is using multiple radios/transceivers, a POSITA would understand that “make before break” is being employed. A POSITA would find this to be consistent with the ’564 Patent’s disclosure describing the functioning of the virtual MAC suggests make-before-break, because the virtual MAC allows for assignment of resources without needing a one-to-one correspondence, and without requiring channel lock-out. This

is demonstrated by portions of the '564 specification, including the disclosure that, “[b]y employing a virtual MAC and virtual PHY between an application layer and an actual MAC and PHY layer, wireless transceiver resources may be allocated more efficiently to handle various data bandwidth requirements from different applications” and “should a given resource be unavailable, such as through insufficient bandwidth or having an existing assignment, a replacement resource may be identified and assigned.” EX1001, 5:508, 6:4-8; From this, a POSITA would understand that the “without requiring disassociation” limitations are supported by adequate written description.

119. I also disagree with Dr. Almeroth’s opinion that “without requiring disassociation” is a negative limitation based on the word “without.” EX1002, ¶229. My understanding is that a negative limitation states what it excludes. The “without requiring disassociation” is not indicating to a POSITA a set of choices that are unavailable, but rather indicates to the POSITA that this system is “make-before-break,” as opposed to “break-before-make.” In effect, a POSITA would view “without requiring disassociation” as a positive command to implement a make-before-break system.

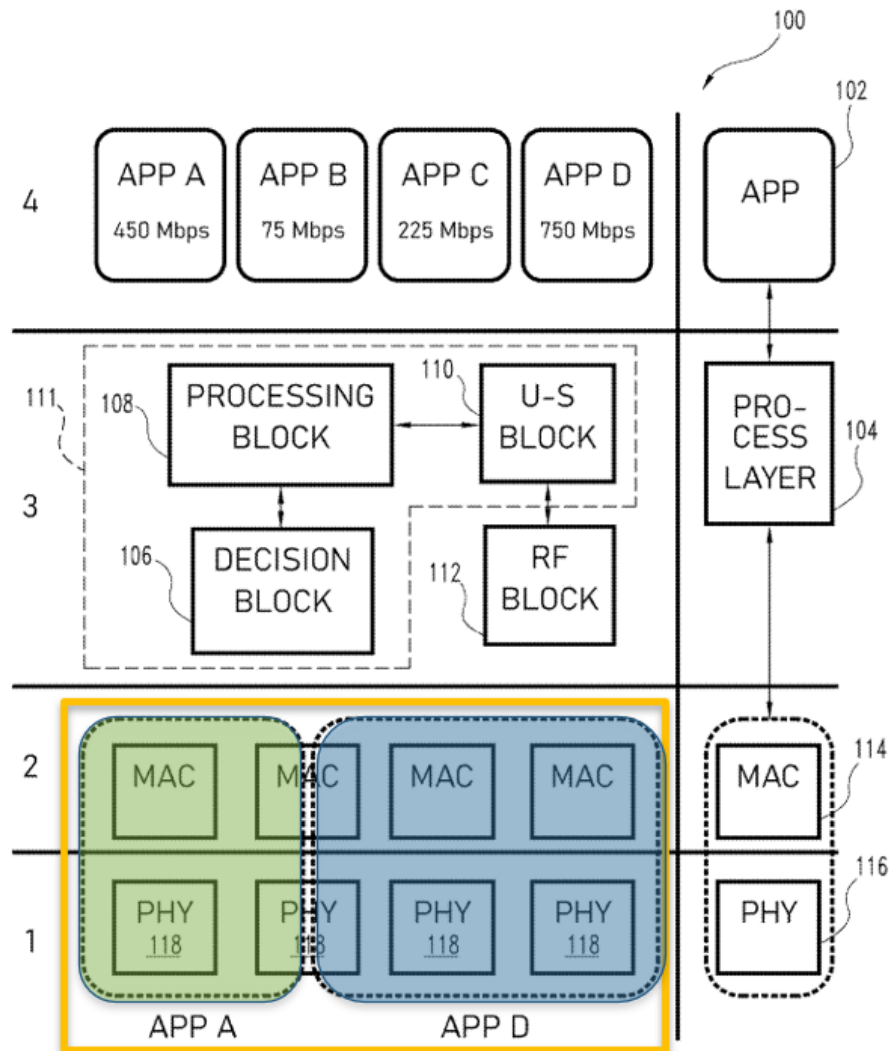
7. “do not prevent”

120. I understand that Dr. Almeroth opines that the “do not prevent”

limitation is not supported by adequate written description in the '564 specification.

I disagree with this opinion. EX1002, ¶231.

121. The limitation recites in relevant part, “wherein ... the wireless networking device's utilization of the first and second identified bandwidth portions do not prevent any wireless networking device from utilizing a range of frequencies corresponding to the remaining portion of the bandwidth availability of the first wireless transceiver...” EX1001, 13:5-13. A POSITA would understand this limitation to express the ability for resource sharing of the various actual PHY interfaces or the transceivers depicted in Figure 1—including as being shared by two applications:



EX1001, Fig. 1 (annotations added); *see also* EX1017 at 558.

122. Similar to the “without requiring disassociation” limitation, a POSITA would understand that the operation of the virtual MAC interface of the ’564 patent and its use of virtual (software-based) addressing allows for assignment of resources that is not a one-to-one correspondence with the manufacturer’s assigned address, and without any channel lock-out. For the same reasons described above with regard

to “without requiring disassociation” and the fact that a POSITA would understand that the ’564 Patent’s system allows for “make-before-break” capability, a POSITA would also understand it also allows for resource sharing by multiple wireless networking devices. Also for the same reasons as above, I disagree that this is a negative limitation (EX1002, ¶239)—rather, it is a positive limitation that tells a POSITA that the system includes resource sharing and “make-before-break.”

123. I also disagree with Dr. Almeroth’s opinion that Figure 1 only shows a downlink transmission to a single client. EX1002, ¶¶234-235. In my opinion, a POSITA would understand that Figure 1 shows an uplink and downlink transmission where two clients (*e.g.*, two phones) are sharing a single access link. This is demonstrated in the ’564 Patent specification’s description of Figure 1, at least where the specification makes clear that “the wireless networking system may be employed and/or embedded into a variety of electronic devices, including wireless access points [and] base stations....” EX1001, 4:12-19. From this, a POSITA would understand that Figure 1 shows multiple uplinks and downlinks to multiple devices.

C. Opinion on the Definiteness of the Claims of the ’564 Patent

1. “partially simultaneously”/“substantially simultaneously”

124. I understand that Dr. Almeroth opines that “partially simultaneously” and “substantially simultaneously” are indefinite because the Patent does not define

their scope. EX1002, ¶240. I disagree, and it is my opinion that a POSITA would understand the scope of the claim limitations.

125. A POSITA would understand that transmission in a system such as that of the '564 Patent takes place during set “transmission opportunities,” or TXOPs. *See* EX2010 at 309. A POSITA would further understand that, in parallel transmissions on two different bands, both transmissions would take place during a given TXOP. A POSITA would understand that two parallel transmissions could not be perfectly simultaneous as a matter of physical reality, but could be “substantially,” or essentially, simultaneous—where the two parallel transmissions were transmitting the same amount of frames during the TXOP span. *Id.* A POSITA would further understand that, if the two transmissions were of different data amounts, the one transmitting less data would finish first within the TXOP’s duration. *Id.* This would mean the transmissions were “partially simultaneous”—overlapping while both were transmitting, but not fully or substantially—because the larger transmission would take longer to finish.

126. I understand that Dr. Almeroth opines that this limitation is “a ‘term of degree’-upon a –‘term of degree.’” I do not understand how he applies that term or what he means by it, and therefore I disagree. EX1002, ¶240.

2. “better than”

127. I understand that Dr. Almeroth opines that the term “better than” is indefinite as “indeterminable and subjective.” EX1002, ¶243. I disagree.

128. This claim limitation describes that the processing interface must evaluate whether data transfer characteristics are “better” for a first or second identified bandwidth portion, and selects the “better one.” EX1001, 12:48-13:4. A POSITA reading this claim would be able to understand, in the context of evaluating data characteristics, what “better” means.

129. As described above, there are many data transfer characteristics, such as throughput, signal strength, bandwidth, delay, jitter, and loss. Likewise, Dr. Almeroth lists “levels of bandwidth, received signal strength, frame packet error rate, frequency offset, and latency.” Dr. Almeroth at EX1002, ¶246. A POSITA would understand that, for any single characteristic, a “better” result is that which more efficiently and effectively achieves the transmission

130. While each may have a different metric for evaluation, a POSITA would understand that a more effective transmission based on the metric the characteristics including all listed above would almost always be more or less effective in concert. For example, a POSITA would understand that, generally, a transmission with greater throughput would also have a lower frame packet error

rate. A POSITA would be familiar with Shannon's formula dating back to 1948, as reproduced in Tanenbaum:

$$\text{maximum number of bits/sec} = B \log_2 (1 + S/N)$$

EX2010 at 94. That formula shows that a higher bits/second rate is correlated with a higher bandwidth (B), higher signal power (S), and lower noise (N). *Id.* at 94-95. Therefore, a POSITA would understand that, that whatever metric was used or whatever data characteristic might be highlighted, the bandwidth portion with "better" characteristics would be the same.

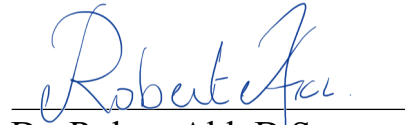
131. Dr. Almeroth raises a hypothetical conflict, "where link A may indicate a stronger received signal than link B, but link B indicates a lower frame packet error rate" EX1002, ¶246. First, in my opinion, such a conflict (where one data transfer characteristic was stronger or better on link A and another characteristic were weaker on link A, while the opposite was true on link B), would be quite rare. Second, even in the case of such a rare conflict, a POSITA would understand that certain data characteristics are more important to efficient transmission, and a POSITA would therefore have no trouble determining a hierarchy of characteristics in determining which link was "better." A POSITA would understand that the most important data characteristics are error rate, latency, and throughput, which all indicate the success of the transmission. Meanwhile, other characteristics such as signal strength are

only a means to the end of the transmission. Therefore, in the case of Dr. Almeroth's hypothetical, a POSITA would have no trouble understanding that the lower packet error rate would be more important than the stronger received signal, and the bandwidth portion with the lower error rate (link B) would be "better." Therefore, a POSITA would be able to understand the scope of the claim term including "better than."

Declaration of Robert Akl, D.Sc.
PGR2025-00069
Patent No. 12,250,564

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on November 1, 2025 in Dallas, Texas.



Dr. Robert Akl, D.Sc.