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 IPR2025-01270

U.S. Patent No. 12,114,177

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. 12,114,177 (the "'177 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.

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 '177 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 CHINCHOLIAND CLEGG, AND THE COMBINATION THEREOF

45. Dr. Almeroth opines that claims 1-26 of the '177 Patent are obvious in view of the combination of Chincholi and Clegg (Ground 1). I disagree with Dr. Almeroth's opinions regarding the combination of Chincholi and Clegg, for the reasons discussed below.

A. Opinion on Chincholi Compared to Various Limitations of the '177 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 '177 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, ¶¶97-99; 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 '177 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 '177 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 '177 Patent associates with the 'virtual MAC interface.'" EX1002, ¶98. 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 '177 Patent.

57. A POSITA would understand that Chincholi is missing important

functionality conducted by the virtual MAC interface of the '177 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 '177 Patent.

58. Dr. Almeroth opines that the "virtual MAC layer comprises the functionality of 'decision,' 'processing,' and ultra-streaming' blocks" disclosed in the '177 Patent and compares the functions of those three blocks to three modules within Chincholi's OMMA layer. EX1002, ¶¶95, 98-99. He opines that a POSITA would understand the traffic shaping module 601 of Chincholi to be the functional equivalent of the '177 Patent's ultra-streaming block; that Chincholi's MAC resource reservation module 602 would be understood to perform the functions of '177 Patent's processing block; and the IP QoS Scheduler module 603 would be understood to be the functional equivalent of the '177 Patent's decision block. *Id*. I disagree that the virtual MAC interface of claim 1 of the '177 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 '177 Patent's virtual MAC interface's "decision block." *See* EX1002, ¶¶95, 98-99. 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, ¶99.

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 '177 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 '177 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 '177 Patent. EX1002, ¶99. 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 '177 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 '177 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 "[i]n [his] opinion, a POSITA would understand that, according to its plain and ordinary meaning, a 'resource monitoring interface formed in the processing interface' merely requires a component capable of receiving feedback statistics regarding the available resources of the wireless transceivers." *Id.*, ¶100. A POSITA would not understand "feedback statistics" to satisfy the claim's requirement to "feed information regarding the bandwidth availabilities of the first, second, and third wireless transceivers…" EX1001, 12:35-37. 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 "evaluate whether any of the given resources of the first identified actual bandwidth portion are unavailable for communication." *Id.*, 12:54-56. 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, ¶ 101 (quoting EX1006, [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, ¶ 102 (quoting EX1006, [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, 12:35-38. 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, ¶¶101-103. Therefore, Dr. Almeroth does not identify a structure in Chincholi that "feed[s] 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 '177 Patent.

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

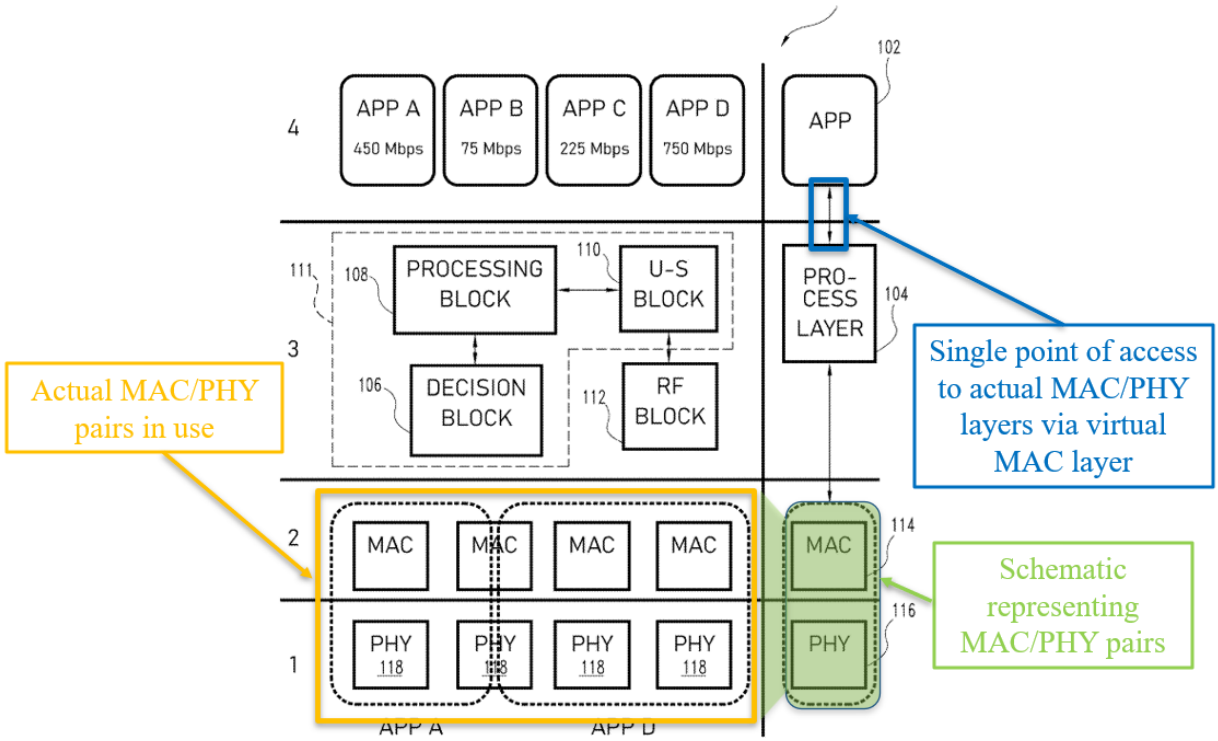
63. I understand that Dr. Almeroth opines that Chincholi discloses the claim limitation [1.f] of the '177 Patent, which recites, "wherein the processing interface is configured to, … in a manner transparent to any layer of the wireless networking device above the processing interface…" perform multiple claimed

functions.[1] EX1002, ¶105. Dr. Almeroth opines that Chincholi includes this 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 '177 Patent, would understand that "the processing interface" of claim 1 performs the various claimed

[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[f]); identifying a portion of the bandwidth of the first wireless transceiver (claim 1[g]); evaluating whether that portion is unavailable for communication (claim 1[h]); using that portion that is not unavailable to transmit the recited data stream to the recipient (claim 1[i]); identifying a portion of the bandwidth of the second wireless transceiver (claim 1[j]); evaluating whether that portion is unavailable for communication (claim 1[k]); and using that portion that is not unavailable to transmit the recited data stream to the recipient (claim 1[l]). EX1001, 12:44-13:16.

functions "in a manner transparent to any layer of the wireless networking device above the processing interface." EX1001, 12:42-43. A POSITA would also understand that the "processing interface" of claim 1 includes "at least one virtual MAC interface." *Id.*, 12:31-32. Thus, a POSITA would understand that, consistent with the fundamental point of the '177 Patent, the virtual MAC interface allows for the transparent bandwidth decision making in the four 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 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 '177 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.*, 12:42-13:17. 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 '177 Patent that performs the claimed functions "in a manner transparent to any layer of the wireless networking device

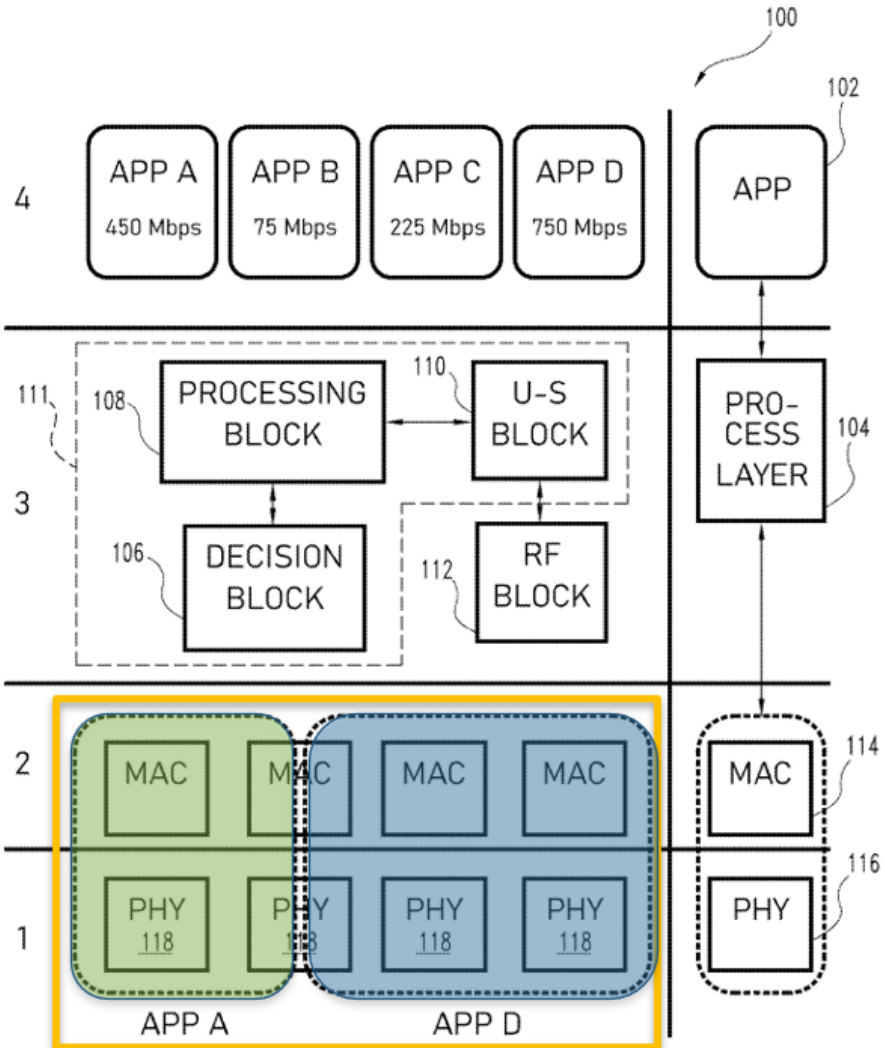
above the processing interface." *See* Section VII.A.1.

4. "wherein, after the circuitry has been connected to the application interface and when the wireless networking is being used, the wireless networking device's utilization of the first available bandwidth portion of the … wireless transceiver does 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.m] of the '177 Patent, which recites, "wherein, after the circuitry has been connected to the application interface and when the wireless networking is being used, the wireless networking device's utilization of the first available bandwidth portion of the first wireless transceiver does 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 bandwidth portion is being used for data transmission purposes," and limitation 1[n], which recites "wherein, after the circuitry has been connected to the application interface and when the wireless networking is being used, the wireless networking device's utilization of the first available bandwidth portion of the second wireless transceiver does not prevent any wireless networking device from utilizing a range of

frequencies corresponding to the remaining portion of the bandwidth availability of the second wireless transceiver for data transmission or reception purposes at the same time that the first bandwidth portion is being used for data reception purposes." EX1002, ¶¶131-134. I disagree.

67. Limitations 1[m] and [n] recite that a first device's utilization of the first available bandwidth portion of the recited transceiver "does not prevent" any other device from using the remaining portions of the that first available bandwidth portion at the same time. EX1001, 13:18-39. 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 '177 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 '177 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, ¶130 (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, ¶132. 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, ¶¶117, 124. I disagree.

72. A POSITA would understand that limitations 1[i] and 1[l] and the claim language "without requiring disassociation" indicates that claim 1 of the '177 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 '177 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 '177 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 '177 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, ¶¶71-72, 113-125. I disagree.

81. Dr. Almeroth opines that "a POSITA would have recognized that integrating Clegg's techniques into the Chincholi system could be achieved without technical difficulty." *Id.*, ¶72. 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.i] and [1.l]). EX1002, ¶¶117-121, 125. Dr. Almeroth relies on the fact that "Clegg teaches the capability to 'notch out' specific OFDM subcarriers that suffer an unduly high amount of interference." *Id.*, ¶118. 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."

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.

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 October 17 , 2025 in Dallas, Texas.

Dr. Robert Akl, D.Sc.