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 No. IPR2025-01204

U.S. Patent No. 11,818,591

SUPPLEMENTAL DECLARATION OF KEVIN ALMEROTH, PH.D.

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LIST OF EXHIBITS

Exhibit	Description
EX1001	U.S. Patent No. 11,818,591 ("the '591 patent")
EX1002	Declaration of Kevin Almeroth, Ph.D.
EX1003	10/1/2024 and 10/29/2024 Certificates of Correction
EX1004	File History of U.S. Patent No. 11,818,591
EX1005	WO 2013/126859 ("Chincholi")
EX1006	Published U.S. Patent Application 2011/0320625 ("Riggert")
EX1007	U.S. Patent Application 2009/0141691 ("Jain")
EX1008	U.S. Patent 9,379,868 ("Wang")
EX1009	Exhibit Intentionally Omitted
EX1010	U.S. Patent 10,567,147 ("DiFazio")
EX1011	Curriculum Vitae of Kevin Almeroth Ph.D.
EX1012	PO's District Court Infringement Contentions Cover Pleading
EX1013	PO's District Court Infringement Chart for U.S. Patent No. 11,818,591
EX1014	U.S. Patent 5,345,599 ("Paulraj")
EX1015	Gerard J. Foschini, "Layered Space-Time Architecture" (Foschini, Bell Labs Technical Journal, 1(2), 41-59) (1996)
EX1016	Exhibit Intentionally Omitted
EX1017	Exhibit Intentionally Omitted
EX1018	Exhibit Intentionally Omitted
EX1019	Exhibit Intentionally Omitted
EX1020	Patent Owner's March 26, 2025 P.R. 3-1 Infringement Contentions
EX1021	Exhibit Intentionally Omitted

EX1022	Exhibit Intentionally Omitted
EX1023	Eastern District of Texas Calendar Events Set for October 19, 2026 (Oct. 9, 2025, 4:50 PM)
EX1024	Excerpt of Federal Court Management Statistics (June 30, 2025), https://www.uscourts.gov/sites/default/files/document/fcms_na_dist profile0630.2025.pdf
EX1025	Declaration of Patrick Schmidt in Support of Petitioner's Motion for Pro Hac Vice Admission
EX1026	Supplemental Declaration of Kevin Almeroth, Ph.D.
EX1027	Claim Construction Order (Dkt. 107) in *XiFi Networks R&D, Inc. v. Samsung Electronics Co., et al.*, No. 2:24-cv-01057 (E.D. Tex.)
EX1028	Joint Claim Construction Chart Pursuant to Patent Rule 4-5 (Dkt. 85) in *XiFi Networks R&D, Inc. v. Samsung Electronics Co., et al.,* No. 2:24-cv-01057-JRG (E.D. Tex.)

I. Introduction

1. I, Dr. Kevin Almeroth, submit this supplemental declaration in support of Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc. in connection with IPR2025-01204 concerning U.S. Patent No. 11,818,591.

2. I previously submitted a declaration in this proceeding, which I understand has been submitted as EX1002. My qualifications, experience, curriculum vitae, compensation, and prior testimony are set forth in that declaration and its accompanying exhibits. I incorporate those statements here and do not repeat them in full.

3. I have been asked to provide additional support for my opinions and to respond to Patent Owner's Response and the opinions of Patent Owner's expert, Dr. Robert Akl. I have also been asked to provide additional technical explanation regarding certain opinions set forth in my First Declaration.

4. In preparing this supplemental declaration, I have considered my First Declaration, the '591 patent, the materials cited in my First Declaration, Patent Owner's Response, Dr. Akl's Declaration, the Board's Institution Decision, and any additional materials cited in this supplemental declaration. I have also considered the stipulated and proposed claim constructions and the district court's claim-construction order in the parallel district court proceeding.

5. I continue to apply the same level of ordinary skill in the art that I applied in my First Declaration. I also continue to apply the same legal understandings set forth in my First Declaration, except where I have been asked to address a specific claim construction or argument raised by Patent Owner or Dr. Akl.

6. The opinions expressed in this supplemental declaration are my own. I reserve the right to supplement or amend these opinions if additional information becomes available or if Patent Owner or Dr. Akl offers additional opinions.

II. Claim Construction

7. I understand that, in the district court proceeding, the parties agreed on constructions for seven terms, four of which were agreed to have their plain and ordinary meaning. Those agreed-upon constructions are set forth below.

DISTRICT COURT AGREED UPON CLAIM CONSTRUCTIONS

Claim 1 Term	Agreed Construction
"virtual MAC interface"	"a software- or logical-based interface that is separately addressable from the recited actual MAC interfaces and that obscures the recited actual MAC interfaces from higher protocol stack layers"
"in a manner transparent to any layer of the wireless networking device above the processing interface"	"in a manner where any protocol stack layer of the wireless networking device above the processing interface is unaware of the operation of the processing interface"
"recipient"	Plain and ordinary meaning
"virtual PHY interface"	Plain and ordinary meaning
"does not prevent other wireless networking device from utilizing a range of	Plain and ordinary meaning

frequencies corresponding to the remaining portion of the bandwidth availabilities"	
"data stream"	Plain and ordinary meaning
"wireless transceivers"	"a physical component that wirelessly transmits and receives data"

8. I further understand that the district court has now issued constructions for the preambles, "wireless networking device," "different bands of frequencies," and "information regarding the bandwidth availabilities of the first, second, and third wireless transceivers." The district court's constructions (along with the parties' competing positions) are summarized below.

DISTRICT COURT CONSTRUCTIONS ON DISPUTED TERMS

Claim 1 Term	PO Proposed Construction	Petitioner Proposed Construction	District Court's Construction
Preambles	Not limiting	Limiting	Limiting as to "wireless networking device"; otherwise, not limiting
"wireless networking device"	No construction necessary	"a device that relays or provides network access to another device"	"device that sends and receives data over a wireless network"
"different bands of frequencies"	No construction necessary	"different ranges of frequencies that are defined or allocated by a regulatory or	"different ranges of frequencies in which the transceivers are capable of operating"

		standards body as a band”	
“information regarding the bandwidth availabilities of the first, second, and third wireless transceivers”	“information regarding current bandwidth availabilities of the recited wireless transceivers, that can be obtained directly from at least the recited actual PHY interface(s) and the recited actual MAC interface(s)”	“information regarding current bandwidth availabilities of each of the wireless transceivers”	“information regarding current bandwidth availabilities of each of the wireless transceivers”

9. I have considered the District Court’s constructions. It remains my opinion that the challenged claims are unpatentable for the reasons set forth in my First Declaration and this supplemental declaration under the stipulated constructions and the district court’s constructions.

10. Where I address terms having their plain and ordinary meaning, I have applied the understanding of a POSITA in view of the claim language and specification, consistent with the legal framework described in my First Declaration.

11. I understand the district court construed “wireless networking device” as “a device that sends and receives data over a wireless network.” Chincholi’s NT, including when operating as an access point, satisfies that understanding because it

sends and receives data over a wireless network to WTRUs. Chincholi's WTRU may also operate in ad-hoc mode and send and receive data to other devices over a wireless network. Thus, my opinions in EX1002 ¶¶75-76 remain unchanged under the district court's construction.

12. I understand that the district court construed the preambles as limiting as to "wireless networking device," and otherwise not limiting. I have considered that construction. In my First Declaration, I recognized that the preambles may be limiting and explained that Chincholi discloses a wireless networking device. See EX1002 ¶¶75-76. My opinions remain unchanged under the district court's construction.

13. I understand the district court construed "different bands of frequencies" as "different ranges of frequencies in which the transceivers are capable of operating." I have considered that construction. My opinions in EX1002 ¶¶94-96 remain unchanged under the district court's construction.

14. I understand that the parties stipulated that "virtual MAC interface" means "a software- or logical-based interface that is separately addressable from the recited actual MAC interfaces and that obscures the recited actual MAC interfaces from higher protocol stack layers." I have considered that construction. As explained below, it remains my opinion that Chincholi's OMMA satisfies that construction.

15. I understand that the parties stipulated that "in a manner transparent to any layer of the wireless networking device above the processing interface" means "in a manner where any protocol stack layer of the wireless networking device above the processing interface is unaware of the operation of the processing interface." I have considered that construction. As explained below, my opinions regarding Chincholi's transparent OMMA operation remain unchanged under that construction.

16. I understand that the parties stipulated that "wireless transceiver(s)" means "a physical component that wirelessly transmits and receives data." I have considered that construction. Chincholi's antenna/RF front-end pairs associated with the RATs satisfy that construction because they are physical components used to wirelessly transmit and receive data. My opinions in EX1002 ¶¶87-96 remain unchanged under that construction.

17. I understand that the parties agreed that "recipient," "virtual PHY interface," "does not prevent other wireless networking device from utilizing a range of frequencies corresponding to the remaining portion of the bandwidth availabilities," and "data stream" have their plain and ordinary meaning. I have considered those agreed constructions, and they do not change my opinions in my First Declaration or in this supplemental declaration.

18. I understand the district court construed "information regarding the bandwidth availabilities of the first and second wireless transceivers" as "information regarding current bandwidth availabilities of each of the wireless transceivers." I have considered that construction. As explained below, Chincholi discloses such information, including feedback regarding channel-quality metrics, available resources, available bandwidth, RSSI values, and instantaneous channel quality/availability. My opinions in EX1002 ¶¶101-106 remain unchanged under the district court's construction.

19. I understand that Patent Owner proposed construing "information regarding the bandwidth availabilities of the first and second wireless transceivers" to require "information regarding current bandwidth availabilities of the recited wireless transceivers, that can be obtained ***directly*** from at least the recited actual PHY interface(s) and the recited actual MAC interface(s)." I understand the district court did not adopt that "directly" requirement. I agree that the claim does not require the information to be obtained "directly" from the actual PHY and actual MAC interfaces.

20. Claim 1 recites "first, second, and third virtual PHY interfaces" that, during operation, "feed information regarding the bandwidth availabilities of the first, second, and third wireless transceivers back to the at least one virtual MAC interface." In my opinion, the plain meaning of "feed information regarding the

bandwidth availabilities . . . back to" encompasses both direct and indirect feedback and does not preclude the information passing through intervening layers. The claim language describes the information that is fed back and where it is fed back; it does not specify that the information must travel directly from the actual PHY or MAC interfaces without passing through any intermediate interface, layer, or module. Nor does the claim language require the processing interface to occupy any particular protocol-stack layer.

21. This understanding is consistent with the '591 patent's Figure 1 embodiment. Figure 1 depicts an application layer, a process layer, an actual MAC layer, and an actual PHY layer as distinct layers. The actual PHY layer is not shown as directly adjacent to the process layer; the actual MAC layer is between them. A POSITA would therefore understand that information originating at, or relating to, the PHY layer could pass through the intervening MAC layer before reaching the process layer. That embodiment would be excluded under Patent Owner's construction requiring that the information be obtained directly from the actual PHY interface without any intervening layer or interface.

22. I have been informed that the prosecution history may be considered in understanding how a POSITA would read a claim term in view of the intrinsic record. I have also been informed that, to narrow claim scope based on the prosecution history, there must have been a disavowal which requires that the

prosecution history reflect a clear and unmistakable limitation or surrender of claim scope. I understand that this inquiry is assessed from the perspective of a POSITA reading the prosecution history in context. I have applied that understanding in evaluating Patent Owner's and Dr. Akl's reliance on prosecution-history statements.

23. I understand that Patent Owner relied on prosecution-history statements from related patents to support its view that the processing interface, including the virtual MAC interface and virtual PHY interfaces, must be located in the MAC sublayer of the Data Link Layer, and to support its proposed "direct" feedback requirement. See POR 12–13, 17–23; EX2017 ¶¶56, 62–70. I have reviewed the prosecution-history statements Patent Owner and Dr. Akl cite, and I do not understand them to establish either requirement. Patent Owner and Dr. Akl do not attempt to show that any prosecution-history statements rise to the level of clear and unmistakable disavowal.

24. For example, I understand that Dr. Akl states that the applicant's prosecution statements locate "the virtual MAC interface, as a component of the processing interface, in the MAC sublayer of the data link layer." EX2017 ¶56. I disagree. A POSITA would not have understood the claim language itself to impose that requirement. Nor would a POSITA understand the prosecution-history statements cited by Patent Owner and Dr. Akl to require that the processing interface,

or the virtual MAC interface formed within it, must be located in the MAC sublayer of the data link layer.

25. I understand that Patent Owner's proposed construction of "information regarding the bandwidth availabilities of the first and second wireless transceivers" would require information that can be obtained "directly from at least the recited actual PHY interface(s) and the recited actual MAC interface(s)." EX2017 ¶62. Dr. Akl states that this requirement is "consistent with a POSITA's understanding of the intrinsic record of the '591 Patent, including both the specification and the prosecution history." Id. He further relies on the '591 patent's layer descriptions and Figures 1 and 4 to support his view that the processing interface, virtual PHY interfaces, and virtual MAC interface would be understood to be in the Data Link Layer and adjacent to the actual PHY layer. EX2017 ¶¶63-65. I disagree.

26. The claim language recites that the virtual PHY interfaces feed information regarding bandwidth availabilities back to the virtual MAC interface; it does not require that the information be obtained directly from both the actual PHY interfaces and the actual MAC interfaces. Likewise, although the claim recites connections among the processing interface, application interface, and actual MAC/PHY interfaces, it does not require the processing interface to be adjacent to the physical layer or located in any particular layer of the OSI model. Nor would a POSITA understand the specification's layer descriptions or figures to require that

the processing interface, virtual PHY interfaces, or virtual MAC interface be located in the MAC sublayer or adjacent to the actual PHY layer.

27. I also disagree with Dr. Akl's opinion that statements in the '591 prosecution history show that "the wireless transceiver bandwidth availability information must be able to be directly communicated to the processing interface, which must be in the same layer or an adjacent layer." EX2017 ¶66. The prosecution statements Dr. Akl discusses refer to feedback of bandwidth-availability information generally. They do not say that the feedback must be direct, and they do not require the processing interface, virtual MAC interface, or virtual PHY interface to be located in any specific protocol-stack layer. A POSITA would not read those statements as imposing a requirement that the processing interface be in the MAC sublayer or adjacent to the physical layer.

28. I also understand that Patent Owner and Dr. Akl rely on later prosecution statements that refer back to the '591 prosecution history. See POR 18–20; EX2017 ¶67. Dr. Akl characterizes those later file histories as showing that the claims were allowed because "the bandwidth availability information can be communicated directly from the Physical Layer to a processing layer in the Data Link Layer." EX2017 ¶67. I disagree. Those later references, as I understand them, refer back to the earlier feedback-related prosecution discussion. They do not convert that discussion into a requirement that bandwidth-availability information

must be communicated directly from the actual PHY or actual MAC interfaces, or that the processing interface must reside in the MAC sublayer.

29. I also understand that Patent Owner relies on statements from the prosecution history of the ’756 patent, including the statement that “each actual MAC and each actual PHY in a particular wireless networking device communicates directly with the processing layer to allow it to receive information regarding bandwidth availabilities from the wireless transceiver associated with each MAC/PHY pair.” POR 21–22; EX2017 ¶68. I understand Dr. Akl to rely on that statement to conclude that “each actual MAC and each actual PHY can communicate directly with the processing interface.” EX2017 ¶68. I disagree that this supports Patent Owner’s proposed limitation for claim 1 of the ’591 patent.

30. As I understand the ’756 prosecution history, the quoted statement was made in connection with the applicant discussing Figure 1 for purposes of trying to establish that then pending dependent claims 16 and 17 had written description support. EX2026 at 7-8. Notably, dependent claims 16 and 17 (eventually issued as claims 15 and 16 of the ’756 patent) expressly recited information being received “directly” from actual PHY or actual MAC interfaces. A POSITA would not have understood statements about dependent claims that expressly recite “directly” to impose the same requirement on independent claims that do not use that term.

31. Finally, I understand that Patent Owner and Dr. Akl rely on additional prosecution-history statements concerning the location of the processing interface. See POR 21–23; EX2017 ¶¶69–70. Dr. Akl states that these file histories "distinguished the prior art by explaining that the processing layer was no higher in the protocol stack than the Data Link Layer." EX2017 ¶69. I disagree. Many of the cited statements were made in preliminary amendments or after allowance, and the statements identify multiple alleged distinctions from the prior art, including the presence of a virtual MAC interface, feedback to the virtual MAC interface, and transparent operation. A POSITA reading those statements in context would not have understood the applicant to be clearly imposing a requirement that the processing interface must be located in the MAC sublayer or adjacent to the physical layer.

32. Accordingly, I agree with the district court's rejection of Patent Owner's proposed construction to the extent it required bandwidth-availability information to be obtained directly from the actual PHY and actual MAC interfaces. A POSITA would not have understood the specification or prosecution-history statements cited by Patent Owner and Dr. Akl to impose a direct-feedback requirement or a requirement that the processing interface be located adjacent to the physical layer on the claims.

III. Chincholi Discloses The Disputed Limitations

A. Chincholi Discloses a "Virtual MAC Interface"

33. In my First Declaration, I opined that Chincholi's OMMA included a "virtual MAC interface" under the plain and ordinary meaning of that term. *See* EX1002 ¶¶98-100.

34. Since my First Declaration, I understand that the parties have stipulated in the parallel district court proceeding to a construction for the "virtual MAC interface" term. I understand that stipulated construction is that the "virtual MAC interface" is "a software- or logical-based interface that is separately addressable from the recited actual MAC interfaces and that obscures the recited actual MAC interfaces from higher protocol stack layers." It is my opinion that this stipulated construction is consistent with how a POSITA would have understood the plain and ordinary meaning of "virtual MAC interface." Therefore, it remains my opinion that a POSITA would have understood Chincholi's OMMA to include a "virtual MAC interface" under this construction.

35. ***First***, it is my opinion that Chincholi's OMMA includes a "software- or logical-based interface." As I noted in my First Declaration, EX1002 ¶79, Chincholi describes the OMMA layer as a "single thin software layer" that "may reside above the medium access control (MAC) layers of the protocol stacks but below the IP layer." EX1005 at [0120].

36. Thus, the OMMA is comprised of software-based modules, and a POSITA would have understood it to include a "software- or logical-based interface."

37. ***Second***, it is my opinion that Chincholi includes an interface within the OMMA that is "separately addressable." In my First Declaration, I described how the OMMA Controller of Chincholi was capable of collecting and feeding back bandwidth availability information from each RAT "per device (e.g., WTRU or NT) per access category supported at that RAT." EX1002 ¶102. This is accomplished through a signaling protocol to update RAT availability between communicating devices. *E.g.*, EX1005 at [0242]-[0243] & Fig. 31. The multi-link wireless devices in Chincholi are capable of maintaining a database tracking the capabilities of other, associated devices with which each RAT may communicate. In order for the devices to communicate their capabilities for purposes of maintaining these databases, Chincholi teaches that the OMMA is "separately addressable" per the stipulated claim construction.

38. To explain this analysis in further detail: Chincholi teaches a "[d]ynamic management of RAT availability" for any WTRU-NT pair. EX1005 at [0242]. Using this technique, "a NT knows the RAT availability for an associated WTRU and a WTRU knows the RAT availability for the associated NT." *Id.*

39. Figure 31 illustrates the signaling protocol between devices to update RAT availability. NT devices send beacons advertising their capabilities, which allow WTRUs to learn of the RAT capabilities of an NT and store them in a WTRU RAT Capability Database. EX1005 at [0243]. A WTRU that receives a beacon may respond by sending a STA_RAT_Availability message over the air, back to the NT, identifying the list of available RATs on that WTRU. EX1005 at [0244]. The sending of the STA_RAT_Availability message from the WTRU to the NT is annotated below in red.

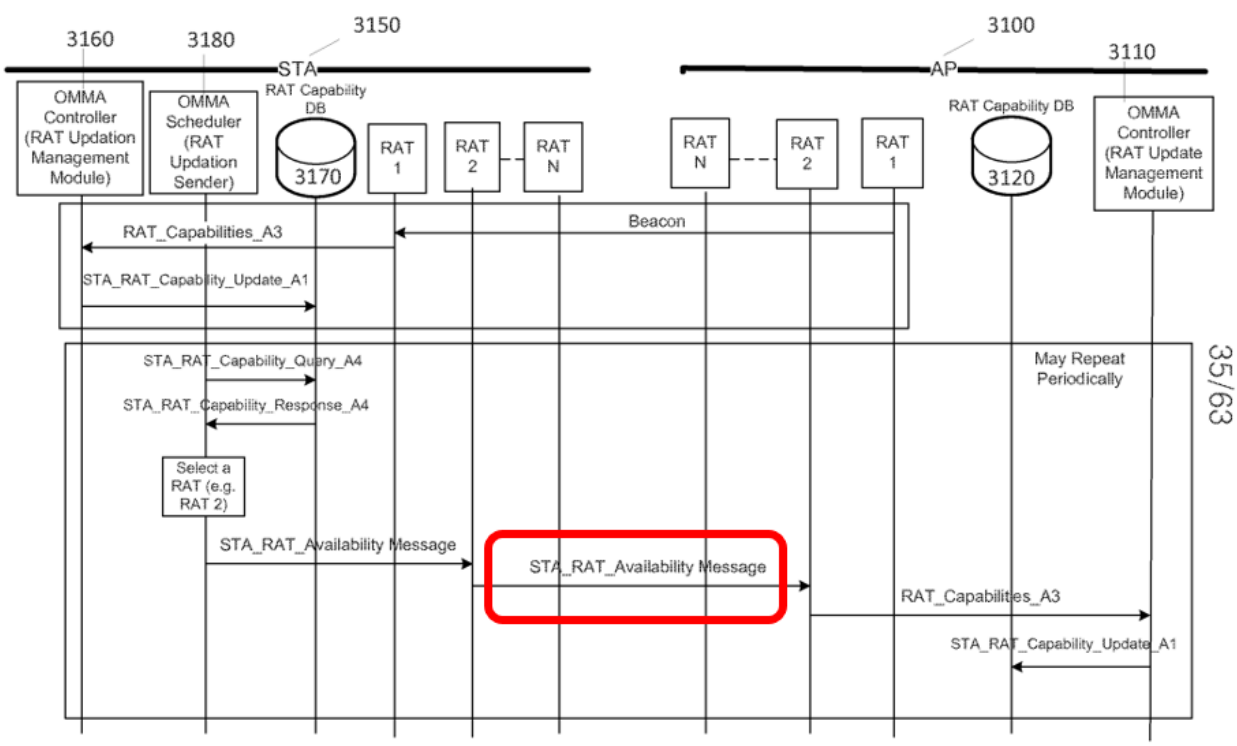

FIG. 31

40. Importantly, the STA_RAT_Availability message sent from the WTRU to the NT includes the following parameters: "STA_Addr," which is the self-address

of the WTRU, "AP_Addr," which is the device-level address of the NT to which the message is sent, and "RAT_Ids," which is a list of the available RATs on the WTRU. EX1005 at [0244]. After the NT receives the STA_RAT_Availability message, it then signals the OMMA Controller to update information of the WTRU RAT availability in the RAT Capability Database. *Id.* at [0245].

41. Thus, to summarize, multi-link WTRU stations in Chincholi send messages regarding their RAT availability to an associated NT. These messages are received by the RAT of the NT and directed to the OMMA Controller for purposes of updating a capability database. These messages are addressed to "AP_Addr," which is a device-level address for the NT that results in the availability message being directed to the OMMA Controller. The purpose of the message is to provide RAT-availability information to OMMA functionality so that the OMMA Controller can update the RAT Capability Database.

42. A POSITA would have recognized that Chincholi's OMMA Controller is separately addressable because the STA_RAT_Availability message is directed to OMMA functionality of the NT, and the OMMA Controller receives that information and updates the RAT Capability Database. A POSITA would have understood Chincholi's OMMA-directed signaling to the NT's OMMA Controller as demonstrating that the OMMA Controller is an addressable logical interface distinct from the actual MAC interfaces.

43. The STA_RAT_Availability message includes addressing information for the OMMA of the destination NT/AP, including AP_Addr. EX1005 [0244]-[0245]. A POSITA would have understood AP_Addr to be destination address information for the NT, separate from the actual MAC addresses of the NT's individual RATs. A POSITA would further understand that this address information is used to exchange signaling packets between WTRUs and the OMMA functionality of associated NTs over the wireless medium. Thus, the STA_RAT_Availability signaling confirms that the OMMA of the NT is separately addressable from the actual MAC interfaces.

44. ***Third***, it is my opinion that Chincholi includes an interface within the OMMA that "obscures the recited actual MAC interfaces from higher protocol stack layers." In my First Declaration, I opined that Chincholi's OMMA layer "'virtualizes' a MAC interface because the OMMA would effectively appear to the IP layer as a single interface for exchanging packets that are ultimately sent or received by the actual MAC-PHY pairs." EX1002 ¶98. This opinion describes how the "virtual MAC interface" of Chincholi "obscures the recited actual MAC interfaces from higher protocol stack layers."

45. To explain this analysis further, Chincholi's Table 1 identifies the interface between the OMMA layer and IP layer as carrying "Incoming/Outgoing IP Packets," and identifies the interfaces between the OMMA layer and the MAC layers

as carrying "Incoming/Outgoing MAC MSDUs." EX1005 [0138] & Table 1. A POSITA would have understood that IP packets and MSDUs, as handled at these OMMA interfaces, do not include the actual MAC-layer headers added below OMMA by the actual MAC layer. A POSITA understands that "MSDU" in the 802.11 context is a well-known acronym that stands for "MAC service data unit." The MSDU is the data or "payload" portion of a wireless frame that an 802.11 system would transmit.

46. In a typical 802.11 implementation at the time of Chincholi, the MAC sublayer would perform the function of encapsulating or "wrapping" an outgoing MSDU into a MAC Protocol Data Unit ("MPDU"). This process would involve the MAC sublayer adding a MAC header to the MSDU. The MAC header generally comprised four MAC address fields: (1) receiver MAC address ("RA"); (2) transmitter MAC address ("TA"); (3) destination address ("DA"); and (4) source address ("SA"). This MPDU, or "wireless frame," would then be passed to the physical layer for further preparation prior to being sent on the wireless channel. Thus, a POSITA would have understood that the MAC layer receives MSDUs containing higher-layer data payloads and wraps those payloads with MAC headers to generate MPDUs for transmission.

47. In the incoming direction, the 802.11 MAC sublayer would perform a de-encapsulation process in which the MAC header would be removed from the MPDU, leaving only the MSDU. The MSDU would then be passed to higher layers.

48. Because Chincholi describes the OMMA handling incoming and outgoing "MSDUs," a POSITA would have understood that the data packets processed by the OMMA would lack the MAC headers containing the actual MAC addresses.

49. Chincholi's OMMA operates as a common layer immediately above the MAC layers. EX1005 at [0138] and Figure 5. Because the OMMA is between the higher layers and the MAC layers, no layer above the OMMA has visibility into the form of data being handled at the MAC layer.

50. Because the MAC addresses exist only in the MAC headers of the MPDUs, which are added and stripped at the MAC layer, and because the OMMA layer stands between the MAC layers and the higher layers, it is my opinion that Chincholi's OMMA includes an interface that "obscures the recited actual MAC interfaces from higher protocol stack layers."

51. PO's expert, Dr. Akl has opined that "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." EX2017 ¶79. That is not correct. Chincholi never describes that actual MAC

addresses are included in the payload of the packets sent to the IP layer. Chincholi, in fact, discloses the opposite by describing the data at the OMMA layer as existing in the form of MSDUs—*i.e.*, data packets lacking MAC headers.

52. Dr. Akl also conflates the "MAC address" with what Chincholi describes as a "device address." EX2017 ¶79. To the extent Dr. Akl suggests that the "device address" described at paragraph 205 of Chincholi is the same as a MAC address, I disagree. The "device address" mentioned at paragraph 205 is referring to device-level addresses for recipient devices with which the device of Chincholi communicates. EX1005 at [0205] ("A RAT (*e.g.*, each RAT) may provide feedback metrics (*e.g.*, a vector comprising a value of serving rate, jitter, packet delay, and packet loss rate on its MAC) to the OMMA Controller 2900 per device (*e.g.*, WTRU or NT) per access category supported at that RAT."). Indeed, Paragraph 205 is part of a broader discussion in Chincholi about the ability of the RATs to send feedback information to the OMMA. This discussion references a "Multi-RAT Multi-Band Device Discovery module 2910" that keeps track of "other devices (*e.g.*, WTRU or NT) that the RATs discover and/or associate with. EX1005 at [0203]. Chincholi describes how the OMMA Controller may save the maximum RAT capabilities of other associated devices in a RAT Capability Database. *Id.* Thus, contrary to Dr. Akl's suggestion, the "device address" mentioned in paragraph 205 of Chincholi does not imply that the OMMA is receiving MAC addresses of its associated RATs.

The "device address" refers to the ability of the OMMA to receive and store device-level addresses of other devices that the device of Chincholi may associate with.

53. Dr. Akl also criticizes my opinion that the OMMA "'virtualizes' a MAC interface because the OMMA would effectively appear to the IP layer as a single interface for exchanging packets that are ultimately sent or received by the actual MAC-PHY pairs," because this does not address the obscuring requirement. EX2017 ¶80. But, as discussed above, it is the positioning of the OMMA between the MAC layers and the higher layers that accomplishes the function of "obscur[ing] the actual MAC interface from higher protocol stack layers." Thus, my opinion from my First Declaration fully accords with Chincholi obscuring the actual MAC interface from higher protocol stack layers—indeed, the obscuring function is the result of the virtualization between the MAC interface and the higher layers that I pointed out in my First Declaration.

54. I understand that Patent Owner argues that Chincholi's OMMA does not disclose the claimed virtual MAC interface because the Petition allegedly relies on an "equivalents-type" analysis. I disagree. My opinion is not that Chincholi discloses something merely equivalent to a virtual MAC interface. Rather, my opinion is that a POSITA would have understood Chincholi's OMMA itself to include the claimed virtual MAC interface under the parties' stipulated construction. As discussed above, Chincholi's OMMA includes a software/logical interface that

is separately addressable and which obscures the actual MAC interfaces from higher protocol-stack layers.

55. I also disagree with Patent Owner's argument that Chincholi's RATs cannot be directed by the OMMA because the RATs may operate independently from one another. Chincholi's OMMA architecture includes modules that manage how traffic is distributed to and scheduled across the underlying RATs. For example, as I explained in my First Declaration, Chincholi discloses a MAC Resource Reservation Module and a Traffic Shaping Module. A POSITA would have understood these modules as part of the OMMA functionality that manages, schedules, shapes, or directs traffic toward the appropriate RAT resources. The fact that individual RATs also have their own MAC/PHY functionality does not mean that the OMMA fails to direct use of those RAT resources.

56. I also understand that Patent Owner and Dr. Akl characterize Chincholi's OMMA as a mere conduit that passes packets received from different RATs to higher layers. I disagree. That characterization ignores the transmit direction. Chincholi's OMMA does not merely pass packets along; it uses feedback and scheduling functionality to select and direct traffic among RAT/MAC/PHY paths, so higher layers exchange packets with OMMA rather than selecting the underlying actual MAC interfaces themselves. For example, Chincholi's IP QoS Scheduler segregates IP packet streams by QoS type so that the traffic shaping

module can treat each IP QoS stream independently when routing packets. EX1005 [0143]. Chincholi also states that the OMMA Scheduler may determine how packets are routed across one or more RATs and may determine RAT selection based on QoS requirements and feedback from the controller and RATs. EX1005 [0213]. Chincholi also describes feedback-based routing in which the OMMA transmitter uses measurement metrics fed back from each RAT to determine packet distribution across RATs. EX1005 [0161].

57. Chincholi further confirms that OMMA is not a passive conduit through its packet-distribution modes, traffic-shaping/feedback-based routing, and packet-scheduling logic. Chincholi discloses diversity, multiplexing, hybrid, and dynamic RAT-switching modes for distributing packets across multiple RATs. EX1005 [0150]-[0156], Figs. 10-13. It also discloses traffic shaping at the OMMA layer to distribute IP packets across different RATs, including policy-based and feedback-based routing. EX1005 [0157]-[0161]. And Chincholi discloses packet-scheduling logic in which the OMMA layer receives a packet, determines whether it belongs to a new or existing IP flow, determines whether it is UDP or TCP, determines how to route it, and for a new IP flow determines the best transport based on capacity, latency, jitter, or similar criteria. EX1005 [0187]-[0188], Fig. 25. A POSITA would have understood these disclosures to confirm that OMMA—not higher layers—selects and directs packets among the underlying RAT/MAC/PHY paths.

58. I also understand that Patent Owner criticizes my comparison of Chincholi's IP QoS Scheduler to the '591 patent's decision-block description. I disagree with that criticism. As I explained in my First Declaration, Chincholi's IP QoS Scheduler "may segregate a single IP packet stream comprising multiple IP QoS types into distinct IP QoS streams," so that the traffic shaping module may treat each IP QoS stream independently and satisfy the specific QoS requirements when routing IP packets. EX1005 [0143]; EX1002 ¶159. A POSITA would have understood this as decision-making functionality because the IP QoS Scheduler examines or classifies incoming packet traffic according to QoS type and determines how that traffic should be separated for subsequent processing and routing.

59. That functionality is consistent with the '591 patent's description of a decision block. The '591 patent describes the decision block as determining the size and type of data being received and the type of processing necessary to put the stream in a format capable of being transmitted. EX1001 3:15-18. A POSITA would have understood Chincholi's IP QoS Scheduler to perform the same kind of decision-making function: it identifies the type of incoming packet traffic based on QoS type and determines how the traffic should be handled so that downstream OMMA modules can process and route the packets according to their QoS requirements. Dr. Akl's criticism improperly treats Chincholi's segregation of packets into QoS streams as unrelated to determining data type or processing needs, but a POSITA

would have understood QoS classification and segregation to be a way of determining how different types of packet traffic should be processed and routed.

60. I also disagree with Patent Owner's argument that Chincholi cannot disclose a virtual MAC interface because the OMMA is allegedly limited to layer 3. Chincholi is not so limited. Chincholi teaches that "[t]he OMMA layer may not be an independent layer, but rather the functionality of the OMMA layer may reside partially on one or more layers (e.g., the IP layer, the MAC layer, etc.) of the protocol stack." EX1005 [0122]. A POSITA would therefore have understood Chincholi to disclose OMMA functionality that may reside at, or be implemented in connection with, the MAC layer. Thus, even under Patent Owner's attempt to impose a layer-specific requirement, Chincholi discloses OMMA functionality satisfying that requirement.

B. Chincholi Discloses "Information Regarding The Bandwidth Availabilities Of The First, Second, And Third Wireless Transceivers"

61. In my First Declaration, I opined that Chincholi discloses the claimed "information regarding the bandwidth availabilities of the first, second, and third wireless transceivers." See EX1002 ¶¶101-102. In particular, I explained that Chincholi's OMMA Controller collects measurement metrics fed back from each RAT, including channel quality metrics and the number of available resources on the medium.

62. I understand that Patent Owner and Dr. Akl contend that Chincholi does not disclose feeding back information regarding bandwidth availabilities because, in their view, Chincholi is limited to historical metrics or averages and does not disclose "current" bandwidth availability information. I disagree.

63. Chincholi's feedback architecture is not limited to historical averages. Chincholi teaches that the OMMA Controller receives measurement metrics fed back from the RATs, including "channel quality metrics" and "the number of available resources on the medium." EX1005 [0161], [0205]. A POSITA would have understood both categories of information to concern the availability of communication resources on the RATs. "Channel quality metrics" indicate the condition of the wireless channel, and the "number of available resources on the medium" directly indicates how many resources are available for use on that medium.

64. Chincholi's disclosure of "channel quality metrics" and "the number of available resources on the medium" is consistent with Chincholi's additional express disclosures discussed below, including available bandwidth, RSSI values, and instantaneous channel quality/availability. A POSITA would not have understood Chincholi's feedback architecture to be limited to historical-only metrics.

65. Chincholi expressly discloses that "[a]t startup, the OMMA layer may receive the available bandwidth of each of the one or more RATs." EX1005 [0167].

A POSITA would have understood "available bandwidth" received at startup to be the then-existing bandwidth availability for each RAT. That is current bandwidth availability information, not merely a historical average.

66. The same paragraph further teaches that, "[a]t the beginning of the ramp-up phase, the OMMA layer may receive RSSI values as seen by the one or more RATs." EX1005 [0167]. RSSI is a signal-quality measurement. A POSITA would have understood RSSI values received at the beginning of a ramp-up phase to reflect current channel conditions observed by the RATs at that time. Those current channel conditions inform the OMMA's selection and use of available RAT resources.

67. Chincholi further confirms that the OMMA may make decisions based on "instantaneous channel quality/availability of the RATs." EX1005 [0154]. The word "instantaneous" would have been understood by a POSITA to refer to then-current channel quality or availability, not historical-only information. Thus, Chincholi expressly contemplates the use of current channel availability information in making RAT selection and traffic distribution decisions.

68. I do not agree with Dr. Akl's apparent view that Chincholi's reference to feedback metrics that "may reflect the average state of the system operating on each RAT" means that Chincholi is limited to historical averages. The word "may" is permissive, and Chincholi expressly describes other feedback, including available

bandwidth, RSSI values, instantaneous channel quality/availability, and the number of available resources on the medium. EX1005 [0154], [0161], [0167], [0205]. A POSITA would not have understood Chincholi to exclude information regarding then-existing channel or resource conditions. Chincholi also identifies feedback metrics such as RSSI "level," "number of channels," and "channel bandwidth," and describes the OMMA Scheduler as using feedback metrics such as RSSI and medium-access delay for feedback-based routing. EX1005 [0215]-[0216]. A POSITA would have understood these examples as further confirming that Chincholi's feedback is not limited to historical-only averages. For example, RSSI level is a signal-strength metric, while number of channels and channel bandwidth are resource-availability metrics.

69. I also understand that Patent Owner argues that Chincholi does not disclose the claimed "information regarding the bandwidth availabilities of the first, second, and third wireless transceivers" because the feedback is not obtained "directly" from actual MAC and PHY interfaces and because, in Patent Owner's view, the processing interface must be located at layer 2. As explained above, I disagree that the claim imposes those requirements. I understand the district court likewise did not adopt Patent Owner's proposed "directly" requirement. In any event, Chincholi teaches that "[t]he OMMA layer may not be an independent layer, but rather the functionality of the OMMA layer may reside partially on one or more

layers (e.g., the IP layer, the MAC layer, etc.) of the protocol stack." EX1005 [0122]. A POSITA would have understood that disclosure to contemplate OMMA functionality implemented at or in connection with the MAC layer, including receiving feedback relating to RAT/MAC-layer operation. Thus, even under Patent Owner's layer-based theory, Chincholi contemplates feedback to OMMA functionality at the MAC layer.

70. Accordingly, it remains my opinion that Chincholi discloses feeding back "information regarding the bandwidth availabilities of the first, second, and third wireless transceivers."

C. Chincholi Discloses "Transparent" Operation

71. In my First Declaration, I opined that Chincholi discloses the claimed requirement that the processing interface perform the claimed functions "in a manner transparent to any layer of the wireless networking device above the processing interface." See, e.g., EX1002 ¶107.

72. I understand that the parties have stipulated to the following construction: "in a manner where any protocol stack layer of the wireless networking device above the processing interface is unaware of the operation of the processing interface." I agree that Chincholi satisfies that construction.

73. Chincholi expressly discloses that the OMMA layer may operate in transparent mode. For example, Chincholi states that "[t]he OMMA layer may be

transparent, in that it distributes and/or combines packets from different RATs and forwards the packets to the IP layer." EX1005 [0192]. Chincholi similarly contrasts transparent mode with non-transparent mode, where the OMMA adds, reads, and removes additional headers. EX1005 [0126]. A POSITA would have understood that distinction to mean that, in transparent mode, higher layers need not be aware of additional OMMA-specific processing or headers.

74. This is consistent with Chincholi's architecture. The OMMA layer is a common layer between the IP layer and the underlying RAT protocol stacks, and Chincholi expressly states that, in transparent mode, the OMMA "distributes and/or combines packets from different RATs and forwards the packets to the IP layer." EX1005 [0192]. A POSITA would have understood that Chincholi's transparent mode allows the OMMA to perform its internal packet distribution, combination, routing, and RAT-selection operations while forwarding packets upward to the IP layer in a manner that does not require higher protocol-stack layers to be aware of those OMMA operations. Chincholi further confirms that the "transparency" limitation is met in its TCP discussion. Chincholi explains that packets sent over different RATs may arrive out of order, causing the receiving TCP entity to believe a packet was dropped and to trigger retransmission or congestion-control behavior. EX1005 [0171]-[0173]. To address this issue, the OMMA layer may reorder packets based on OMMA sequence numbers and may hold packets temporarily until the next

expected packet arrives, before passing them up to higher layers. EX1005 [0176]-[0178]. Similarly, the OMMA of the transmitting device may also use MAC feedback to schedule packets in a manner that avoids triggering TCP congestion-control mechanisms. EX1005 [0179]. These disclosures further confirm that the OMMA manages multi-RAT operation "in a manner where any protocol stack layer of the wireless networking device above the processing interface is unaware of the operation of the processing interface."

75. I understand that Dr. Akl contends that Chincholi's transparency disclosure is insufficient because, in his view, the claimed processing interface must include a virtual MAC interface that performs the recited functions in a transparent manner, and Chincholi allegedly lacks such a virtual MAC interface. I disagree. As discussed above, Chincholi's OMMA includes a virtual MAC interface under the parties' stipulated construction. The OMMA is a software or logical layer, presents a common interface above multiple actual MAC/PHY pairs, and obscures those actual MAC/PHY pairs from higher protocol-stack layers.

76. In particular, Chincholi describes the data handled at the OMMA layer as MSDUs. A POSITA would have understood that MAC headers containing actual MAC addresses are added to outgoing packets by the actual MAC layer below the OMMA and stripped from incoming packets before the resulting MSDUs are passed upward to OMMA and higher layers. Thus, the higher layers above OMMA are not

exposed to the actual MAC-layer frame processing or actual MAC-interface selection performed below OMMA. Chincholi's software OMMA layer is positioned above the actual MAC layers, presents a common interface to the IP layer, includes functionality to handle MSDUs rather than actual MAC-layer MPDUs and thereby obscures the actual MAC interfaces from higher protocol-stack layers, and is separately addressable from the actual MAC interfaces.

77. Dr. Akl's analysis also improperly treats Chincholi's transparent-mode disclosure as though it were limited to a sentence in isolation. It is not. Chincholi repeatedly distinguishes transparent and non-transparent operation, describes mode-management functionality for managing whether the OMMA Scheduler operates in Transparent or Non-Transparent mode, and illustrates a transparent OMMA Receiver embodiment. EX1005 [0212], [0256], Fig. 34. A POSITA would have viewed these disclosures together as describing an OMMA architecture that can operate transparently to higher layers.

78. I also disagree with Patent Owner's suggestion that Chincholi's transparency is limited to "above layer 3." Chincholi discloses embodiments in which the OMMA layer is above the 802.11 MAC/PHY layers and below the IP layer. I understand the parties' stipulated construction does not require transparent operation to be limited to, or located within, any particular protocol-stack layer. A POSITA would have understood that, in those embodiments, protocol-stack layers

above the OMMA are unaware of the OMMA's internal operations, including its distribution, combination, routing, and RAT-selection decisions.

79. Accordingly, Chincholi discloses operation in a manner where any protocol-stack layer above the processing interface is unaware of the operation of the processing interface, and therefore discloses the claimed transparent operation.

D. Chincholi Discloses "Does Not Prevent"

80. In my First Declaration, I opined that Chincholi discloses the claim limitation requiring that utilization of identified bandwidth portions "does not prevent" another wireless networking device from utilizing the remaining portion of the bandwidth availability at the same time. See EX1002 ¶¶124-127.

81. I understand that Patent Owner and Dr. Akl contend that Chincholi does not disclose this limitation because Chincholi allegedly teaches only sequential queuing and because WTRUs may contend for channel access. I disagree.

82. Chincholi discloses multi-WTRU, multi-IP-flow operation. For example, Chincholi teaches that "[a] system may comprise multiple WTRUs, a single NT, and multiple IP flows from the NT to one or more of the WTRUs." EX1005 [0328]. A POSITA would have understood that this describes a system in which multiple wireless devices and multiple IP flows (*i.e.*, application data streams) are managed through the OMMA architecture.

83. Chincholi also discloses techniques for managing packet flows for multiple WTRUs, including queuing packets according to WTRU address and/or access category and optimizing distribution across multiple RATs. The fact that Chincholi describes queuing does not mean the system is limited to sequential use of all available transceiver bandwidth by only one WTRU or one application at a time. Queuing is a scheduling mechanism; it does not preclude simultaneous allocation of different frequency resources where the MAC technology supports that allocation.

84. Chincholi expressly identifies OFDMA as a MAC type in the feedback metrics provided to the OMMA layer. EX1005 [0161] & Table 2. OFDMA stands for Orthogonal Frequency Division Multiple Access. A POSITA would have understood OFDMA to be a multiple-access technique in which different users may be assigned different orthogonal frequency resources within available bandwidth. Because those frequency resources are orthogonal, different users may transmit or receive using different allocated resources without one user's allocation preventing another user from using remaining allocated resources.

85. While OFDMA had not been included into the version of IEEE 802.11 at the time of Chincholi, OFDMA was nevertheless a well-known technique. It was also well-known to a POSITA at this time that OFDMA could be implemented with then-existing IEEE 802.11 systems. Thus, Chincholi's discussion of OFDMA in an

IEEE 802.11 communications system would be understood as a possible, conventional implementation and well within the ordinary skill in the art.

86. Accordingly, a POSITA would have understood Chincholi's disclosure of OFDMA, in the context of multi-WTRU and multi-IP-flow operation, to disclose that one wireless networking device's use of certain bandwidth resources does not prevent another wireless networking device from using remaining available frequency resources at the same time.

87. I understand that Dr. Akl contends that Chincholi's references to "contention" show that only one WTRU may access a channel at a time. I disagree. Chincholi's contention disclosures refer to WTRUs sharing an operating frequency channel. Contention-based access in that circumstance does not negate Chincholi's separate disclosure of OFDMA, nor does it mean that different WTRUs cannot simultaneously use different orthogonal frequency resources or channels within the available bandwidth.

88. I also disagree with Dr. Akl's suggestion that Chincholi's OFDMA disclosure should be disregarded because certain earlier 802.11 standards did not implement OFDMA. Chincholi is not limited to those standards. Chincholi expressly identifies OFDMA as a MAC type, and a POSITA would have understood OFDMA as a known, well-understood technique for allowing multiple users to share available bandwidth through different orthogonal frequency resources. A POSITA would not

disregard that express disclosure merely because Chincholi also discusses other 802.11 implementations.

89. Thus, Chincholi's disclosure of multi-WTRU/multi-IP-flow operation, together with its express identification of OFDMA, discloses or at least renders obvious the claimed "do not prevent" limitation.

E. Motivation to Combine Chincholi with Riggert

90. In my First Declaration, I opined that a POSITA would have been motivated to combine Chincholi with Riggert. See EX1002 ¶¶64, 68-73, 103-106. My opinions remain unchanged.

91. I understand that Patent Owner and Dr. Akl contend that a POSITA would not have combined Chincholi with Riggert because Riggert's "bondable virtual interfaces" are allegedly used for transmitting streaming data between devices, rather than for collecting feedback within a device, and because Riggert allegedly operates at a different layer of a protocol stack. I disagree.

92. My opinion does not require using Riggert to replace Chincholi's feedback architecture. Chincholi already discloses an OMMA architecture that collects feedback metrics from RATs, including channel-quality metrics and information regarding available resources, and uses those metrics for feedback-based routing and allocation decisions. The relevant teaching of Riggert for purposes

of the combination is its virtualized-interface teaching—i.e., the use of bondable virtual interfaces as flexible interfaces to underlying physical interfaces.

93. A POSITA would have understood that Riggert's virtualized-interface teachings could be applied within Chincholi's existing OMMA architecture. In particular, as I explained in my First Declaration, it would have been obvious to incorporate virtual PHY interfaces into Chincholi's OMMA Controller to collect the feedback metrics from each RAT over Chincholi's A2 interface and feed that information back to the virtual MAC interface. See EX1002 ¶¶102-106. That combination uses Riggert's virtualized-interface teaching to provide further implementation detail for Chincholi's already-disclosed feedback path; it does not require replacing Chincholi's OMMA feedback mechanism.

94. I also disagree with Patent Owner's and Dr. Akl's suggestion that Riggert is irrelevant because Riggert describes transmitting streaming data. A POSITA would not have understood Riggert's teaching to be limited to the particular data-streaming example identified by Patent Owner. Rather, a POSITA would have recognized that Riggert teaches a general virtualized-interface technique that can provide a flexible, generic interface to differently configured physical interfaces. That broader teaching is what the Petition applies to Chincholi.

95. A POSITA would have understood that the same virtualized-interface technique could be used in Chincholi for the purpose identified in the Petition:

collecting feedback metrics from each RAT over the A2 interfaces and providing that information to Chincholi's traffic-shaping functionality. The fact that Riggert describes one use of bondable virtual interfaces in a streaming-data context does not negate a POSITA's understanding that the virtualized-interface technique could be applied to Chincholi's feedback-collection architecture. Riggert also confirms that its bondable virtual interfaces can gather feedback information. For example, in the discussion of Figure 8, Riggert teaches that bondable virtual interface 236 "gathers information regarding data sent over the multiple data communication channels," and sends that information through traffic proxy 248 to traffic monitor 234. EX1006 [0113]. A POSITA would recognize that information gathered by the bondable virtual interface and provided to a traffic monitor is feedback information regarding communications over the multiple data communication channels.

96. I also disagree with Patent Owner's and Dr. Akl's layer-stack argument. The challenged claims do not require the virtual PHY interfaces to reside at any particular OSI layer or MAC sublayer. Nor do they require the processing interface to be located at Layer 2. The Petition's combination places the virtualized interfaces in Chincholi's OMMA Controller to interface with Chincholi's RATs and collect the feedback metrics that Chincholi already discloses. A POSITA would not have viewed Riggert's protocol-stack context as preventing that combination.

97. A POSITA would have had a concrete, non-hindsight reason to apply Riggert's virtualized-interface teachings to Chincholi. Chincholi already contemplates multiple 802.11 RATs, including RATs based on different 802.11 generations. A POSITA would have understood that virtualized PHY interfaces between Chincholi's OMMA layer and those RATs would provide a flexible, reconfigurable, and generic interface for differently configured PHY interfaces.

98. Applying Riggert's virtualized-interface teaching to Chincholi would therefore have predictably improved Chincholi's multi-RAT system by increasing flexibility and interoperability with different recipient devices and networks. This is a predictable use of a known virtualized-interface technique to improve Chincholi's feedback-based multi-RAT architecture, not hindsight reconstruction.

99. Accordingly, it remains my opinion that a POSITA would have been motivated to combine Chincholi and Riggert, and would have had a reasonable expectation of success in doing so.

* * *

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on the information and belief are believed to be true; and further that these statements were 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.

Respectfully submitted,

/s/ Kevin C. Almeroth

Date: June 30, 2026

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