

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

XIFI NETWORKS R&D, INC.
Patent Owner.

Case No. IPR2025-01270

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

DECLARATION OF KEVIN ALMEROOTH, PH.D., IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW OF
U.S. PATENT NO. 12,114,177

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LIST OF EXHIBITS

Exhibit	Description
EX1001	U.S. Patent No. 12,114,177 (“’177 patent”)
EX1002	Declaration of Kevin Almeroth, Ph.D.
EX1003	Certificate of Correction for U.S. Patent No. 12,114,177
EX1004	File History of U.S. Patent No. 12,114,177
EX1005	WO 2013/126859 (“Chincholi”)
EX1006	Intentionally Omitted
EX1007	U.S. Patent Application 2009/0141691 (“Jain”)
EX1008	U.S. Patent 9,379,868 (“Wang”)
EX1009	U.S. Patent 9,055,592 (“Clegg”)
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
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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	Intentionally Omitted
EX1017	File History of U.S. Patent 11,818,591 (“’591 Patent”)

I, Dr. Kevin Almeroth, declare as follows:

I. Introduction

1. I have been retained by Quinn Emanuel Urquhart & Sullivan, LLP on behalf of the Petitioner Samsung Electronics Co., Ltd. (“Petitioner”) as an independent expert in this *inter partes* review (this “Proceeding”) before the Patent Trial and Appeal Board of the United States Patent and Trademark Office (the “Board”) to review claims 1-26 (“the challenged claims”) of U.S. Patent No. 12,114,177 (“the ’177 patent”). I have been asked by the Petitioner to assist in evaluating the claims and the disclosure of the ’177 patent.

A. Qualifications

2. EX1011 is a true and correct copy of my current CV, which describes my education, patents and publications, employment and research history, and professional activities and awards.

1. Educational Background

3. I hold three degrees from the Georgia Institute of Technology: (1) a Bachelor of Science degree in Information and Computer Science (with minors in Economics, Technical Communication, and American Literature) earned in June 1992; (2) a Master of Science degree in Computer Science (with specialization in Networking and Systems) earned in June 1994; and (3) a Doctor of Philosophy (Ph.D). degree in Computer Science (Dissertation Title: Networking and System

Support for the Efficient, Scalable Delivery of Services in Interactive Multimedia System, minor in Telecommunications Public Policy) earned in June 1997. I have taken a wide variety of courses as demonstrated by my minor. My undergraduate degree also included a number of courses more typical of a degree in electrical engineering, including digital logic, signal processing, and telecommunications theory.

2. Career

4. I am a Professor Emeritus in the Department of Computer Science at the University of California, Santa Barbara (UCSB). While active at UCSB, I held faculty appointments and was a founding member of the Computer Engineering (CE) Program, Media Arts and Technology (MAT) Program, and the Technology Management Program (TMP). I was the Associate Director of the Center for Information Technology and Society (CITS) from 1999 to 2012. I have been a faculty member at UCSB since July 1997.

5. One of the major concentrations of my research has been the delivery of multimedia content and data between computing devices, including various network architectures. In my research, I have studied large-scale content delivery systems, and the use of servers located in a variety of geographic locations to provide scalable delivery to hundreds or thousands of users simultaneously. I have also studied smaller-scale content delivery systems in which content is exchanged

between individual computers and portable devices. My work has emphasized the exchange of content more efficiently across computer networks, including the scalable delivery of content to many users, mobile computing, satellite networking, delivering content to mobile devices, and network support for data delivery in wireless networks.

6. In 1992, the initial focus of my research was on the provision of interactive functions (*e.g.*, VCR-style functions like pause, rewind, and fast-forward) for near video-on-demand systems in cable systems; in particular, how to aggregate requests for movies at a cable head-end and then how to satisfy a multitude of requests using one audio/video stream broadcast to multiple receivers simultaneously. This research has continually evolved and resulted in the development of techniques to scalably deliver on-demand content, including audio, video, web documents, and other types of data, through the Internet and over other types of networks, including over cable systems, broadband telephone lines, and satellite links.

7. An important component of my research has been investigating the challenges of communicating multimedia content, including video, between computers and across networks including the Internet. I have worked on a variety of research problems and used a number of systems that were developed to deliver multimedia content to users. One content-delivery method I have researched is the

one-to-many communication facility called “multicast,” first deployed as the Multicast Backbone, a virtual overlay network supporting one-to-many communication. Multicast is one technique that can be used on the Internet to provide streaming media support for complex applications like video-on-demand, distance learning, distributed collaboration, distributed games, and large-scale wireless communication. The delivery of media through multicast often involves using Internet infrastructure, devices and protocols, including protocols for routing and TCP/IP.

8. Starting in 1997, I worked on a project to integrate the streaming media capabilities of the Internet together with the interactivity of the web. I developed a project called the Interactive Multimedia Jukebox (IMJ). Users would visit a web page and select content to view. The content would then be scheduled on one of a number of channels, including delivery to students in Georgia Tech dorms delivered via the campus cable plant. The content of each channel was delivered using multicast communication.

9. In the IMJ, the number of channels varied depending on the capabilities of the server including the available bandwidth of its connection to the Internet. If one of the channels was idle, the requesting user would be able to watch their selection immediately. If all channels were streaming previously selected content, the user’s selection would be queued on the channel with the shortest wait time. In

the meantime, the user would see what content was currently playing on other channels, and because of the use of multicast, would be able to join one of the existing channels and watch the content at the point it was currently being transmitted.

10. The IMJ service combined the interactivity of the web with the streaming capabilities of the Internet to create a jukebox-like service. It supported true Video-on-Demand when capacity allowed, but scaled to any number of users based on queuing requested programs. As part of the project, we obtained permission from Turner Broadcasting to transmit cartoons and other short-subject content. We also connected the IMJ into the Georgia Tech campus cable television network so that students in their dorms could use the web to request content and then view that content on one of the campus's public access channels.

11. More recently, I have also studied issues concerning how users choose content, especially when considering the price of that content. My research has examined how dynamic content pricing can be used to control system load. By raising prices when systems start to become overloaded (*i.e.*, when all available resources are fully utilized) and reducing prices when system capacity is readily available, users' capacity to pay as well as their willingness can be used as factors in stabilizing the response time of a system. This capability is particularly useful in systems where content is downloaded or streamed on-demand to users.

12. As a parallel research theme, starting in 1997, I began researching issues related to wireless devices and sensors. In particular, I was interested in showing how to provide greater communication capability to “lightweight devices,” *i.e.*, small form-factor, resource-constrained (*e.g.*, CPU, memory, networking, and power) devices. Starting in 1998, I published several papers on my work to develop a flexible, lightweight, battery-aware network protocol stack. The lightweight protocols we envisioned were similar in nature to protocols like Bluetooth, Universal Plug and Play (UPnP) and Digital Living Network Alliance (DLNA).

13. From this initial work, I have made wireless networking—including ad hoc, mesh networks and wireless devices—one of the major themes of my research. My work in wireless networks spans the protocol stack from applications through to the encoding and exchange of data at the data link and physical layers.

14. At the application layer, even before the large-scale “app stores” were available, my research looked at building, installing, and using apps for a variety of purposes, from network monitoring to support for traditional computer-based applications (*e.g.*, content retrieval) to new applications enabled by ubiquitous, mobile devices. For example, my research has looked at developing applications for virtually exchanging and tracking “coupons” through “opportunistic contact” among mobile wireless devices (*i.e.*, communication among devices moving into communication range with each other). In many of the courses I have taught there is

a project component. Through these projects I have supervised numerous efforts to develop new “apps” for download and use across a variety of mobile platforms.

15. Toward the middle of the protocol stack, my research has also looked to build wireless infrastructure support to enable communication among a set of mobile devices unaided by any other kind of network infrastructure. These kinds of networks are useful either in challenged network environments (e.g., when a natural disaster has destroyed existing infrastructure) or when suitable support for network communication never existed. The deployment of such networks (or even the use of traditional network support) are critical to support services like disaster relief, catastrophic event coordination, and emergency services deployment.

16. Yet another theme is monitoring wireless networks, in particular different variants of IEEE 802.11 compliant networks, to (1) understand the operation of the various protocols used in real-world deployments, (2) use these measurements to characterize use of the networks and identify protocol limitations and weaknesses, and (3) propose and evaluate solutions to these problems. I have successfully used monitoring techniques to study wireless data link layer protocol operation and to improve performance by enhancing the operation of such protocols. For wireless protocols, this research includes functions like network acquisition and channel bonding.

17. One theme in my wireless network research has been cross-layer solutions and innovations. As mentioned above, with greater wireless device use and network support, we envisioned new application paradigms and services, for example, when mobile devices come into contact with each other. Instead of relying on existing infrastructure to relay communication, the devices are able to discover each other and communicate directly. Other examples include discovering and using location information to enhance users' experiences. Network support and novel applications use a variety of network architectures supporting users on foot, in vehicles, and across varying terrains and environments. Finally, we studied how communication efficiency can be supported through intelligent handoffs as well as location and movement prediction.

18. Protecting networks, including their operation and content, has been an underlying theme of my research almost since the beginning of my research career. Starting in 2000, I have been involved in several projects that specifically address security, network protection, and firewalls. After significant background work, a team on which I was a member successfully submitted a \$4.3M grant proposal to the Army Research Office (ARO) at the Department of Defense to propose and develop a high-speed intrusion detection system. Key aspects of the system included associating streams of packets and analyzing them for viruses and other malware. Once the grant was awarded, we spent several years developing and meeting the

milestones of the project. A number of my students worked on related projects and published papers on topics ranging from intrusion detection to developing advanced techniques to be incorporated into firewalls. I have also used firewalls, including their associated malware detection features, in developing techniques for the classroom to ensure that students are not distracted by online content.

19. Recent work ties some of the various threads of my past research together. I have investigated content delivery in online social networks and proposed reputation management systems in large-scale social networks and marketplaces. On the content delivery side, I have looked at issues of caching and cache placement, especially when content being shared and the cache has geographical relevance. We were able to show that effective caching strategies can greatly improve performance and reduce deployment costs. Our work on reputation systems showed that reputations have economic value, and as such, creates a motivation to manipulate reputations. In response, we developed a variety of solutions to protect the integrity of reputations in online social networks. The techniques we developed for content delivery and reputation management were particularly relevant in peer-to-peer communication.

20. My involvement in the research community extends to leadership positions for several academic journals and conferences. I am the co-chair of the Steering Committee for the ACM Network and System Support for Digital Audio

and Video (NOSSDAV) workshop and on the Steering Committees for the International Conference on Network Protocols (ICNP), ACM Sigcomm Workshop on Challenged Networks (CHANTS), and IEEE Global Internet (GI) Symposium. I have served or am serving on the Editorial Boards of IEEE/ACM Transactions on Networking, IEEE Transactions on Mobile Computing, IEEE Network, ACM Computers in Entertainment, AACE Journal of Interactive Learning Research (JILR), and ACM Computer Communications Review. I have co-chaired a number of conferences and workshops including the IEEE International Conference on Network Protocols (ICNP), IEEE Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON), International Conference on Communication Systems and Networks (COMSNETS), IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS), the International Workshop On Wireless Network Measurement (WinMee), ACM Sigcomm Workshop on Challenged Networks (CHANTS), the Network Group Communication (NGC) workshop, and the Global Internet Symposium, and I have served on the program committees for numerous conferences.

21. Furthermore, in the courses I taught at UCSB, a significant portion of my curriculum covered aspects of the Internet and network communication including the physical and data link layers of the Open System Interconnect (OSI) protocol stack, and standardized protocols for communicating across a variety of

physical media such as cable systems, telephone lines, wireless, and high-speed Local Area Networks (LANs). The courses I have taught also cover most major topics in Internet communication, including data communication, multimedia encoding, and mobile application design. My research and courses have covered a range of physical infrastructures for delivering content over networks, including cable, Integrated Services Digital Network (ISDN), Ethernet, Asynchronous Transfer Mode (ATM), fiber, and Digital Subscriber Line (DSL). For a complete list of courses I have taught, see my curriculum vitae (EX1011).

22. I co-founded a technology company called Santa Barbara Labs that was working under a sub-contract from the U.S. Air Force to develop very accurate emulation systems for the military's next generation internetwork. Santa Barbara Labs' focus was in developing an emulation platform to test the performance characteristics of the network architecture in the variety of environments in which it was expected to operate, and, in particular, for network services including IPv6, multicast, Quality of Service (QoS), satellite-based communication, and security. Applications for this emulation program included communication of a variety of multimedia-based services, including video conferencing and video-on-demand.

23. In addition to having co-founded a technology company myself, I have worked for, consulted with, and collaborated with companies for nearly 30 years. These companies range from well-established companies to start-ups and include

IBM, Hitachi Telecom, Turner Broadcasting System (TBS), Bell South, Digital Fountain, RealNetworks, Intel Research, Cisco Systems, and Lockheed Martin.

24. Through my graduate education, leadership with CITS, involvement in TMP, role in the development of the Internet2 infrastructure, and consulting with ISPs, I have gained a strong understanding in the role of the Internet in our society and the challenges of deploying large-scale production networking infrastructure. CITS, since its inception, has looked at the role of the Internet in society, including how the evolution of technology has created communication opportunities and challenges, including, for example, through disruptive technologies like P2P. TMP looks to focus on non-purely technical issues, including, for example, state-of-the-art business methods, strategies for successful technology commercialization, new venture creation, and best practices for fostering innovation. Through my industry collaborations and Internet2 work, I have developed significant experience in the challenges of deploying, monitoring, managing, and scaling communication infrastructure to support evolving Internet services like streaming media, conferencing, content exchange, social networking, and e-commerce.

25. Additional details about my employment history, fields of expertise, and publications are further included in my CV (EX1011).

3. Other Relevant Qualifications

26. I am a Member of the Association of Computing Machinery (ACM) and a Fellow of the Institute of Electrical and Electronics Engineers (IEEE).

27. As an important component of my research program, I have been involved in the development of academic research into available technology in the market place. One aspect of this work is my involvement in the Internet Engineering Task Force (IETF). The IETF is a large and open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet. I have been involved in various IETF groups including many content delivery-related working groups like the Audio Video Transport (AVT) group, the MBone Deployment (MBONED) group, Source Specific Multicast (SSM) group, the Inter-Domain Multicast Routing (IDMR) group, the Reliable Multicast Transport (RMT) group, the Protocol Independent Multicast (PIM) group, etc. I have also served as a member of the Multicast Directorate (MADDOGS), which oversaw the standardization of all things related to multicast in the IETF. Finally, I was the Chair of the Internet2 Multicast Working Group for seven years.

28. I am an author or co-author of approximately 200 technical papers, published software systems, IETF Internet Drafts and IETF Request for Comments (RFCs). A complete list of my publications is in my CV (EX1011).

29. I have been awarded numerous teaching awards, including Computer Science Outstanding Faculty Member (1997-98, 1998-99, 1999-2000, 2004-06, UCSB Spotlight on Excellence Award (2000-01), and UCSB Academic Senate Distinguished Teaching Award (2006-07).

B. Previous Expert Witness Testimony

30. The list of recent matters in which I have testified can be found at the end of EX1011.

C. Preparation for this Declaration

31. In forming my opinions, I have considered the '177 patent specification, including the Abstract, the figures, and the claim language itself, as would have been understood by a person of ordinary skill in the art as of the priority date of the '177 patent (a "POSITA"). My understanding of "POSITA" and "priority date" are set forth below. I have also reviewed the file history of the '177 patent, the Exhibits that are listed in the list of Exhibits, and any other material cited in this declaration.

32. In forming my opinions, I have relied on my personal knowledge and professional experience, and on the documents and information referenced in this declaration.

33. This declaration explains, based on facts and information available to me to date, the subject matter and opinions related to this Proceeding. As such, I am

prepared to provide expert testimony regarding opinions formed resulting from my analysis of the issues considered in this declaration if asked about those issues by the Board or by the private parties' attorneys.

34. Additionally, I may discuss my own work, teachings, and knowledge of the state of the art in the relevant time period. I may rely on handbooks, textbooks, technical literature, and the like to demonstrate the state of the art in the relevant period and the evolution of relevant technologies.

35. Throughout this declaration, I refer to specific pages of the '177 patent and other documents. The citations are intended to be exemplary and are not intended to convey that the citations are the only source of evidence to support the propositions for which they are cited.

36. I am being compensated for my time spent on this matter at a rate of \$850 per hour, and my compensation is in no way contingent upon the outcome of this matter or on the opinions I offer. All of the opinions expressed in this declaration are my own.

II. Legal Understanding

37. In this section, I describe my understanding of certain legal standards that I have relied upon in forming my opinions set forth in this declaration. I have been informed of these legal standards by Petitioner's attorneys. I am not an attorney,

and I have not thoroughly researched the law on patent invalidity. I am relying only on instructions from Petitioner's attorneys for these legal standards.

A. Claim Construction

38. I have been instructed by counsel that claim construction is a matter of law. I understand that in an *inter partes* review, claims are construed using the same claim construction standard that would be used to construe the claim in a civil action, namely according to their plain and ordinary meaning to a POSITA.

39. I understand that a patent may include two types of claims, independent claims and dependent claims. An independent claim stands alone and includes only the limitations it recites. A dependent claim can depend on an independent claim or another dependent claim. I understand that a dependent claim includes all the limitations that it recites in addition to the limitations recited in the claim from which it depends.

B. Anticipation

40. I understand that a patent claim is anticipated when a single piece of prior art describes every element of the claimed invention, either expressly or inherently, arranged in the same way as in the claim. For inherent anticipation to be found, it is required that the missing descriptive material is necessarily present in the prior art. I understand that, for the purpose of an *inter partes* review, prior art that

anticipates a claim can include both patents and printed publications from anywhere in the world.

C. Obviousness

41. I understand that a patent claim is unpatentable and invalid if the subject matter of the claim as a whole would have been obvious to a POSITA as of the time of the invention at issue. My understanding of a POSITA is set forth below. I understand that the following factors must be evaluated to determine whether the claimed subject matter is obvious: (1) the scope and content of the prior art; (2) the difference or differences, if any, between each claim of the patent and the prior art; and (3) the level of ordinary skill in the art at the time the patent was filed. Unlike anticipation, which allows consideration of only one item of prior art, I understand that obviousness may be shown by considering more than one item of prior art. Moreover, I have been informed and I understand that the so-called objective indicia of non-obviousness, also known as “secondary considerations,” are also to be considered when assessing obviousness. These include: (1) commercial success; (2) long-felt but unresolved needs; (3) copying of the invention by others in the field; (4) initial expressions of disbelief by experts in the field; (5) failure of others to solve the problem that the inventor solved; and (6) unexpected results. I also understand that evidence of objective indicia of non-obviousness must be commensurate in scope with the claimed subject matter.

42. At this time, I am not aware of any evidence of secondary considerations of non-obviousness, have not seen anything identified by the Patent Owner, and do not think anything would overcome the strong showing of obviousness, but I reserve the right to respond if Patent Owner presents evidence or argument of secondary considerations of non-obviousness.

III. The '177 patent

43. The '177 patent is titled "Method and Apparatus for Processing Bandwidth Intensive Data Streams Using Virtual Media Access Control and Physical Layers."

44. The '177 patent lists inventor Sal C. Manapragada.

45. The '177 patent was filed as U.S. Patent Application No. 18/603,732 on March 13, 2024, and issued on October 8, 2024.

A. Priority Date

46. The '177 patent claims priority to U.S. Prov. Patent Application Nos. 61/897,216 and 61/897,219, both of which were filed on October 30, 2013.

B. Specification

47. The '177 patent relates to evaluating the wireless bandwidth requirements of applications and the wireless bandwidth availabilities of wireless transceiver resources, and allocating bandwidth of the wireless transceivers to satisfy the bandwidth requirements of the applications. (Ex. 1001 ('177 patent) at Abstract).

48. The wireless networking architecture described in the '177 patent “includes an application layer, actual MAC and PHY layers, and a processing layer between the actual MAC and PHY layers.” (*Id.* at 2:57-60). The patent describes how the processing layer may comprise “virtual MAC and PHY layers” which “enable simultaneous allocation of multiple PHY resources for different signal types associated with different applications.” (*Id.* at 3:51-54).

49. In one embodiment, a wireless networking system is show in an abstract “layer” context, described in Figure 1 below. (*Id.* at 3:15-17).

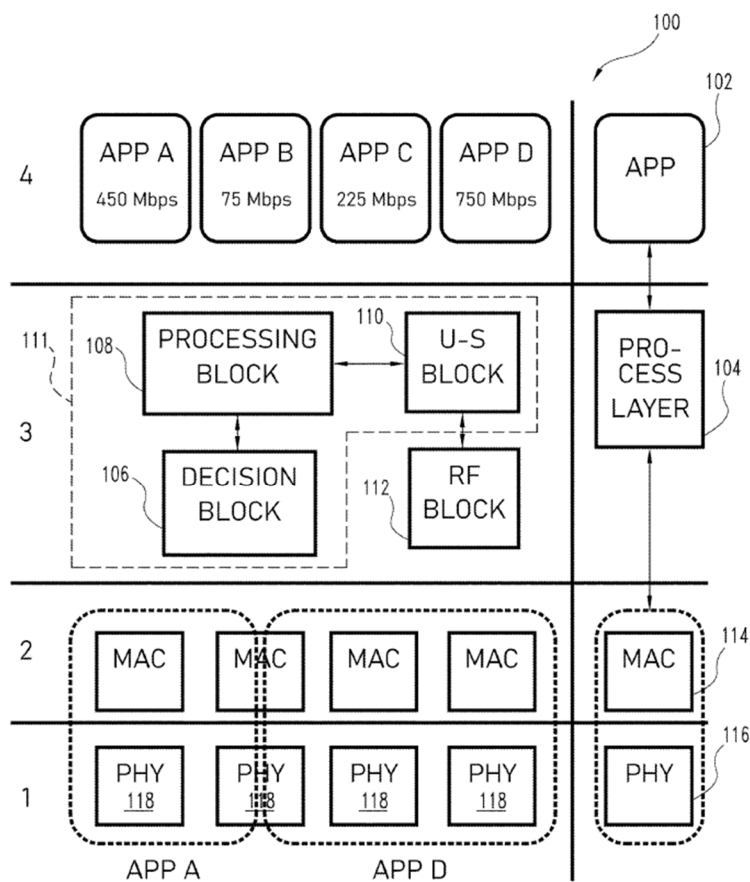


Fig. 1

50. The application layer 102 cooperates with a process layer at 104, which “determines available resources in the actual MAC and PHY layers 114 and 116” and “allocates the available resources to satisfy the bandwidth demands” of the various applications. (*Id.* at 4:24-29).

51. Also illustrative is the embodiment of Figure 6, which demonstrates how the virtual MAC and PHY layers enable the wireless networking device to configure the resources of two separate transceivers to each handle the bandwidth requirement of a respective application. (*Id.* at 5:48-67).

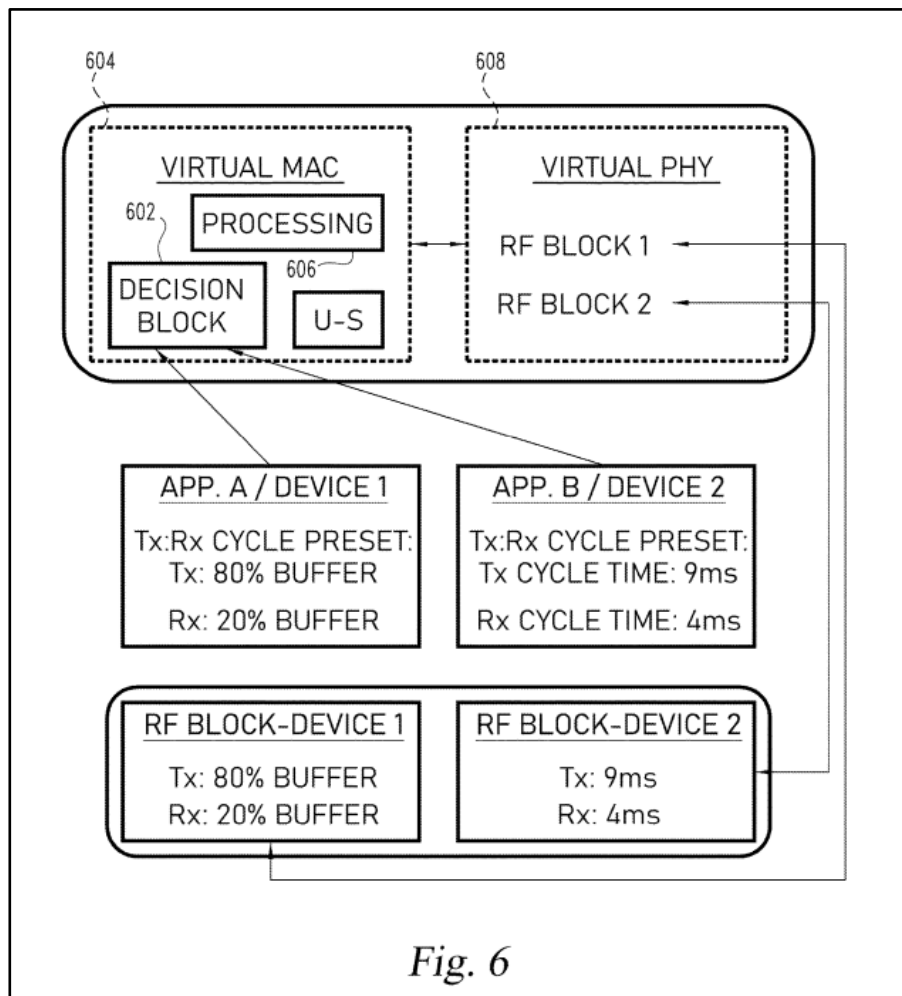


Fig. 6

C. Prosecution History

52. Based on my review of the prosecution history, it is my understanding that the '177 patent was filed on March 13, 2024 as application 18/603,732, which was a continuation of application 18/532,175 now U.S. Patent 11,950,105 (“’105 patent”). Applicant requested that the '177 Patent be designated as a Track One patent in a request which was granted on April 18, 2024. (EX1004, at April 18, 2024 Track One Request Grant).

53. The '177 Patent was allowed less than one month after filing, without any substantive office actions. (EX1004 at May 15, 2024 Notice of Allowance). On June 18, 2024, the Applicant submitted amendments that broadened the limitations related to “virtual PHY interfaces” with a “resource monitoring interface.” (EX1004 at June 18, 2024 Request for Continued Examination with Preliminary Amendment). Additional claim amendments were submitted on June 21, 2024. (EX1004 at June 21, 2024 Supplemental Preliminary Amendment). The amended application was subsequently re-allowed on July 18, 2024. (EX1004 at July 18, 2024 Notice of Allowance). A post-issuance Certificate of Correction was later filed. (EX1004 at Oct. 8, 2024 Request for Certificate of Correction).

D. Level of Ordinary Skill in the Art

54. I understand that a person of ordinary skill in the art (“POSITA”) is a hypothetical person who is presumed to be aware of all pertinent art, thinks along

conventional wisdom in the art, and is a person of ordinary creativity—not an automaton. In deciding the level of ordinary skill, I understand that the following factors may be considered:

- The levels of education and experience of persons working in the field;
- The types of problems encountered in the field; and
- The sophistication of the technology.

55. I understand that asserted claims must be evaluated from the perspective of a POSITA. I understand that the relevant point in time for determining the qualifications of a person of ordinary skill in the state-of-the-art is the time of the alleged invention, which I assume to be the earliest effective filing date for the patent. Here, I understand that the earliest alleged priority date is October 30, 2013.

56. In my opinion, a person of ordinary skill in the art at the time of the '177 patent ("POSITA") 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.

57. I meet these criteria now and met them at the time of the alleged invention. I have applied this level of skill in my analysis. My opinions would not change if a slightly higher or lower level of ordinary skill applied.

E. Claim Construction

58. I have been instructed by Petitioner to perform my technical analysis of the disclosures of the prior art by applying the plain and ordinary meaning of all claim terms, as understood by a POSITA in view of the specification and prosecution history.

59. I reserve the right to provide additional opinions concerning claim construction or the application of certain claim constructions to the prior art, as appropriate, and to respond to any particular claim construction-related argument advanced by PO and/or its expert.

60. As described in more detail in the remainder of this declaration, the prior art discloses or renders obvious the challenged claims under any reasonable potential claim interpretation.

F. Challenged Claims

61. I understand that claims 1-26 are at issue in Petitioner's petition for *inter partes* review. They are reproduced below for reference.

Claim	
1[pre]	A method of improving the performance of circuitry, comprising the steps of:
1[a]	providing a processing interface that is adapted to be connected to an application interface of a wireless networking device, the application interface being associated with a first application, the first application providing, after the circuitry has been connected to the application interface and when the wireless networking

Claim	
	device is being used, a first data stream and having a first wireless bandwidth requirement;
1[b]	connecting first, second and third actual MAC interfaces to the processing interface;
1[c]	connecting first, second and third actual PHY interfaces respectively to the first, second and third actual MAC interfaces;
1[d]	respectively associating first, second and third wireless transceivers with the first, second and third actual PHY interfaces, wherein each of the first, second and third wireless transceivers is suitable for use in a wireless local area network, and the first, second and third wireless transceivers, respectively, (i) have a first, second and third bandwidth availability up to first, second and third actual bandwidths, and (ii) are adapted to emit radio signals in first, second and third bands of frequencies, at least two of the first, second and third bands of frequencies being different;
1[e]	forming in the processing interface (i) at least one virtual MAC interface and (ii) at least one resource monitoring interface that, after the circuitry has been connected to the application interface and during operation of the wireless networking device, feeds information regarding the bandwidth availabilities of the first, second and third wireless transceivers back to the at least one virtual MAC interface;
1[f]	wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, and in a manner transparent to any layer of the wireless networking device above the processing interface, (a) request or create (i) a first association between a recipient and the first actual MAC and PHY interfaces, (ii) a second association between the recipient and the second actual MAC and PHY interfaces, and (iii) a third association between the recipient and the third actual MAC and PHY interfaces,
1[g]	(b) identify at least one first portion of the first actual bandwidth of the first wireless transceiver, the identified at least one first portion comprising a set of given resources,

Claim	
1[h]	(c) evaluate whether any of the given resources of the first identified actual bandwidth portion are unavailable for communication,
1[i]	(d) use the first wireless transceiver to transmit the first data stream to the recipient, without requiring disassociation of the recipient from any of the first, second and third actual MAC and PHY interfaces, using a subset of frequencies corresponding to only the given resources of the first bandwidth portion that are not unavailable for communication to thereby at least partially satisfy the first wireless bandwidth requirement of the first application;
1[j]	(e) identify at least one first portion of the second actual bandwidth of the second wireless transceiver, the identified at least one first portion of the second actual bandwidth of the second wireless transceiver comprising a set of given resources,
1[k]	(f) evaluate whether any of the given resources of the first identified actual bandwidth portion of the second wireless transceiver are unavailable for communication, and
1[l]	(g) use the second wireless transceiver to receive a second data stream from the recipient, without requiring disassociation of the recipient from any of the first, second and third actual MAC and PHY interfaces, using a subset of frequencies corresponding to only the given resources of the first bandwidth portion of the second wireless transceiver that are not unavailable for communication to thereby at least partially satisfy a wireless bandwidth requirement associated with the second data stream; and
1[m]	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

Claim	
1[n]	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.
2	The method of claim 1, wherein the processing interface is adapted to be connected to an application interface of a wireless access point.
3	The method of claim 1, wherein at least two of the first, second and third frequency bands are specified in at least one member of the family of IEEE 802.11 standards that was in existence as of Oct. 30, 2013.
4	The method of claim 1, wherein the at least one virtual MAC interface includes a decision block.
5	The method of claim 1, wherein the at least one virtual MAC interface includes a processing block.
6	The method of claim 1, wherein the at least one virtual MAC interface includes an ultra-streaming block.
7	The method of claim 1, wherein the resource monitoring interface includes an RF block.
8	The method of claim 7, wherein the resource monitoring interface include first, second and third RF blocks.
9	The method of claim 1, wherein the processing interface comprises multiple resource monitoring interfaces.
10	The method of claim 1, wherein the processing interface comprises multiple virtual MAC interfaces.
11	The method of claim 1, wherein the processing interface includes a bandwidth allocator.
12	The method of claim 1, wherein the first identified actual bandwidth portion is contiguous.
13	The method of claim 1, wherein the resource monitoring interface is not contiguous with the at least one virtual MAC interface.

Claim	
14	The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, and in a manner transparent to any layer of the wireless networking device above the processing interface, aggregate the first identified actual bandwidth portion of the first wireless transceiver with an identified first portion of an available bandwidth of the third wireless transceiver to at least partially simultaneously transmit the first data stream to the recipient from both of the first and third wireless transceivers.
15	The method of claim 14, wherein the first data stream is substantially simultaneously transmitted to the recipient from both of the first and second wireless transceivers.
16	The method of claim 14, wherein the identified first portion of the available bandwidth of the third wireless transceiver is contiguous.
17	The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, and in a manner transparent to any layer of the wireless networking device above the processing interface, aggregate the second identified actual bandwidth portion of the second wireless transceiver with an identified first portion of an available bandwidth of the third wireless transceiver to at least partially simultaneously receive the second data stream from the recipient.
18	The method of claim 17, wherein the second data stream is substantially simultaneously received.
19	The method of claim 17, wherein the identified first portion of the available bandwidth of the third wireless transceiver is contiguous.
20	The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, in a manner transparent to any layer of the wireless networking device above the processing interface,
20[a]	(a) identify at least one second portion of bandwidth available for communication of the first wireless transceiver, the identified at

Claim	
	least one second portion of the first wireless transceiver comprising a set of given resources,
20[b]	(b) evaluate whether any of the given resources of the first and second identified bandwidth portions of the first wireless transceiver are not unavailable for communication,
20[c]	(c) use the first wireless transceiver to transmit the first data stream to the recipient, without requiring disassociation of any of the first, second and third associations, using a specific subset of frequencies corresponding to the given resources of the identified first and second bandwidth portions of the first wireless transceiver that are not unavailable for communication to thereby at least partially satisfy the first wireless bandwidth requirement of the first application.
21	The method of claim 20, wherein the first and second identified bandwidth portions of the first wireless transceiver are not contiguous.
22	The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, in a manner transparent to any layer of the wireless networking device above the processing interface,
22[a]	(a) identify at least one second portion of bandwidth available for communication of the second wireless transceiver, the identified at least one second portion comprising a set of given resources,
22[b]	(b) evaluate whether any of the given resources of the first and second identified portions of the second wireless transceiver are not unavailable for communication, and
22[c]	(c) use the second wireless transceiver to transmit the first data stream to the recipient, without requiring disassociation of any of the first, second and third associations, using a specific subset of frequencies corresponding to the given resources of the identified first and second bandwidth portion of the second wireless transceiver that are not unavailable for communication to thereby at least partially satisfy a wireless bandwidth requirement associated with the second data stream.
23	The method of claim 22, wherein the first and second identified bandwidth portions of the first wireless transceiver are not contiguous.

Claim	
24	The method of claim 1, wherein the transmission of the first data stream to the recipient does not occur simultaneously with the reception of the second data stream from the recipient.
25	The method of claim 1, wherein the transmission of the first data stream to the recipient occurs at least partially simultaneously with the reception of the second data stream from the recipient.
26	The method of claim 25, wherein the transmission of the first data stream to the recipient occurs simultaneously with the reception of the second data stream from the recipient.

IV. State of the Art

62. As the '177 patent recognizes, various signal protocols for transmitting and receiving data existed well before its priority date. (EX1001 at 4:1-11). In fact, prior to the '177 patent priority date, developments in networking protocols had given rise to each of the concepts covered by the asserted claims.

63. For example, the foundational principles of Multiple-Input Multiple-Output (MIMO) technology were well-established in the 1990s, centering on the use of multiple antennas to exploit multipath propagation. Instead of treating multiple signal paths as interference, MIMO leverages them to improve data throughput and link reliability. The two primary techniques that defined this capability were spatial multiplexing and spatial diversity. Spatial multiplexing, in particular, was a significant development as it allowed for the transmission of multiple, independent data streams over a single radio frequency channel. This concept was extensively detailed in foundational works of the period, including U.S. Patent No. 5,345,599

(“Paulraj”, EX1014) and a 1996 paper from Bell Labs by Gerard J. Foschini, which described a “Layered Space-Time Architecture” for achieving linear increases in data rates by adding antennas (Foschini, *Bell Labs Technical Journal*, 1(2), at 41-59, EX1015).

64. The subsequent formalization of these long-standing MIMO principles into industry standards serves as clear evidence of their maturity and status as established art. The development of the IEEE 802.11n standard, initiated in the early 2000s, was not based on the invention of new MIMO concepts, but rather on the codification of the well-understood techniques from the previous decade. The standard’s primary purpose was to leverage the known benefits of spatial multiplexing and related space-time coding schemes to achieve the significant leap in Wi-Fi data rates that the market was demanding. The integration of these established MIMO techniques into a major interoperability standard like IEEE 802.11n confirms that the technology’s fundamental aspects were considered thoroughly vetted and were already part of the existing body of technical knowledge.

65. Concepts of link and bandwidth aggregation similarly predated the ’177 patent. As taught by WO 2013/126859A2 (“Chincholi”), a unique control layer, referred to as an “Opportunistic Multiple-Medium Access Control (OMMA) Aggregation” sits below the device’s IP layer but above the individual network technology stacks. (EX1005 at [0003]). This layer makes intelligent decisions about

how to route and potentially split IP packet traffic across the available networks. *Id.* at [0004]-[0007]. It operates by monitoring the estimated data arrival rate for each network interface and sending packets over a specific network when a corresponding variable, which increments with data arrival, exceeds a set threshold. *Id.* This allows the system to aggregate bandwidth and make efficient use of multiple network connections based on real-time conditions and feedback.

66. Concepts of addressing carrier-specific interference in bandwidth channels also existed during this timeframe. U.S. Patent 9,055,592 (“Clegg”) discloses an IEEE 802.11 system designed for carrier specific interference mitigation. Clegg’s technique “utilize[s] carriers across multiple sub-channels, even across disjointed bands (e.g., 2.4 GHz, 5 GHz, and or 60 GHz bands), without regard to whether those carriers are within an otherwise unavailable sub-channel.” (EX1009 at 1:32-37). This allows an 802.11 device to “fully utilize the available spectrum.” (EX1009 at 1:32).

67. Additionally, work was being done to enable full-duplex single channel (FDSC) communication and managing the interference caused by a device transmitting and receiving on the same frequency simultaneously. For example, U.S. Patent 10,567,147 (“DiFazio”) describes a system designed to support a mix of devices, including a “first wireless transmit/receive unit (WTRU) configured for FDSC communication” and a “second WTRU configured for half-duplex (HD)

communication,” managing them on a single channel by allocating appropriate timeslots (EX1010 at 2:33-54). DiFazio offers a robust, multi-layered approach, noting that the system may have “at least three levels of interference . . . suppression,” which it specifies as “antenna, analog, and/or digital.” *Id.* at 30:39-43. To achieve this, the system’s suppression algorithms are initially set using “preconfigured data” that can be “read from memory when the device may be powered-on.” *Id.* at 31:1-7. This provides a starting point that aides or speeds convergence to a more optimal state, which is then refined as the “algorithms operate” to adapt to changing conditions and achieve a much higher degree of interference suppression. *Id.* at 31:8-13.

68. Further, in the field of 802.11 systems, each associated terminal is assigned a unique association identifier (“AID”), and it was well-known that avoiding disassociation after initial association was desirable, as repeatedly re-forming associations was inefficient and disruptive. For example, U.S. Patent 9,379,868 (“Wang”), describing how an AP operating device must dissociate a non-AP device with undesirable AID and re-associate it with more desirable AID, states that such an approach is “undesirable, can be blunt and can disrupt the on-going services (e.g., requires disassociation).” EX1008 at 24:42-43; *see also id.* at 24:57-62 (“The lack of update/change of the AID values . . . after an initial AID assignment is inherently inflexible and can prevent the realization power saving, among other

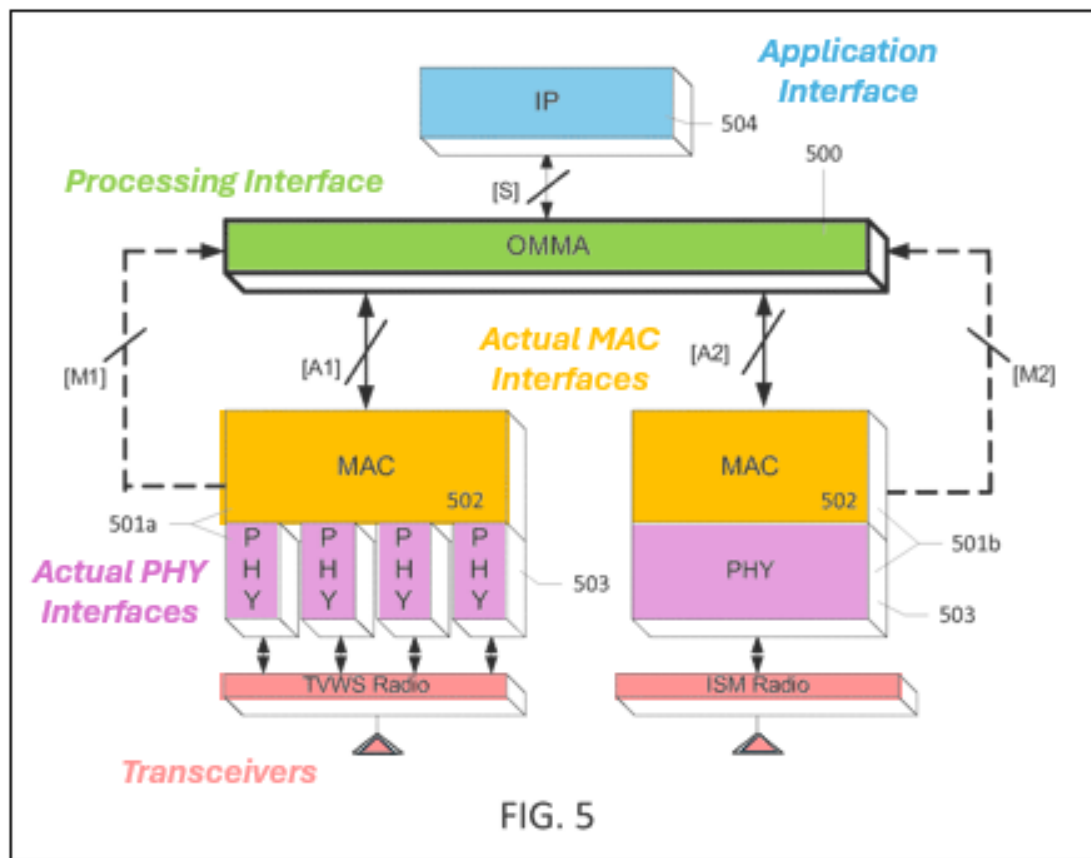
considerations, that an update/change of the AID values can provide.”) Indeed, recognizing this issue, Wang describes techniques in a multiple transceiver/MIMO system for effectuating an update to a recipient’s unique association identifier (“AID”) through various interactions with the system without requiring a disassociation of a wireless device from an access point. (EX1008 at 24:63-25:57).

V. Ground 1: Chincholi in Combination With Riggert Renders Claims 1-2, 13-30 Obvious

Ground	Basis	Reference	Claims
1	§103	WO 2013/126859 (“Chincholi”) in combination with U.S. Patent 9,055,592 (“Clegg”)	1-26

A. Background

69. In my opinion, Chincholi in combination with Clegg renders claims 1-26 obvious. As I explain below, Chincholi teaches the same architecture as the ’177 patent, including a wireless networking device with multiple transceivers, each having actual MAC and PHY interfaces. Chincholi uses a single “*Opportunistic Multiple-Medium Access Control (MAC) Aggregation layer*,” positioned above the actual MAC-PHY layers of each transceiver, to aggregate available bandwidth portions to efficiently meet the requirements of data streams from one or more applications. (EX1005 at [0122-0123]).



70. Chincholi also teaches the continuous monitoring of the “number of available resources on the medium,” along with techniques for distributing IP packets across multiple RATs based on this information. (EX1005 at [0161]). This approach allows the system to dynamically respond to changes in bandwidth availability, including situations where entire channels or portions of channels become unavailable during the transmission of a data stream.

71. A POSITA would have understood that Chincholi’s monitoring and response techniques could be further enhanced by incorporating the teachings of Clegg. Clegg discloses techniques for mitigating carrier-specific interference within

bandwidth channels, thereby allowing each channel to make full use of the portions of bandwidth that remain available for communication. Like Chincholi, Clegg is directed to the field of 802.11 wireless communication networks and is aimed at improving bandwidth efficiency. (EX1009 at 1:25–37).

72. A POSITA would have been motivated to incorporate the teachings of Clegg to enhance the Chincholi system by enabling more flexible and efficient utilization of bandwidth channels that may be subject to carrier-specific interference. Chincholi already teaches the dynamic allocation of contiguous and non-contiguous channels, and Clegg supplements this by providing additional techniques for mitigating interference within a given channel. The teachings of Clegg are complementary to those of Chincholi, and a POSITA would have recognized that integrating Clegg's techniques into the Chincholi system could be achieved without technical difficulty and with a reasonable expectation of success.

73. In my analysis below, the combined prior art system will be referred to as Chincholi/Clegg.

B. Limitation-By-Limitation Analysis

1. Claim 1

a) 1[pre]: A method of improving the performance of circuitry, comprising the steps of:

74. In my opinion, to the extent the preamble is deemed limiting, the combination of Chincholi and Clegg discloses this limitation. Chincholi describes “[s]ystems, methods, and instrumentalities . . . for managing multiple radio access technology (RAT) interfaces ...” (EX1005, Abstract; [0003]) and further teaches systems configured “[to] enable opportunistic RAT selection and aggregation for sending data traffic over the RAT interfaces.” (EX1005 at [0003]). Additionally, Chincholi explains that in multi-RAT systems, “reception and/or transmission may be performed over multiple RATs,” and provides an example in which a network terminal (NT) (*e.g.*, an access point) and a wireless transmit/receive unit (WTRU) communicate “over multiple parallel paths.” (EX1005 at [0002]).

75. Chincholi also discloses that a network terminal (“NT”), such as an access point, or a wireless transmit/receive unit (“WTRU”) “may be configured to work in an infrastructure mode or an ad hoc mode, for example, in an IEEE 802.11 based Wi-Fi system”—*i.e.*, both constitute wireless networking devices. (EX1005 at [0115]). A POSITA would have understood that the techniques disclosed in Chincholi, including those enhanced by Clegg, would improve the performance of

the circuitry comprising the disclosed network terminals. Accordingly, as further discussed in the following limitations, the Chincholi/Clegg combination discloses a method for improving the performance of circuitry.

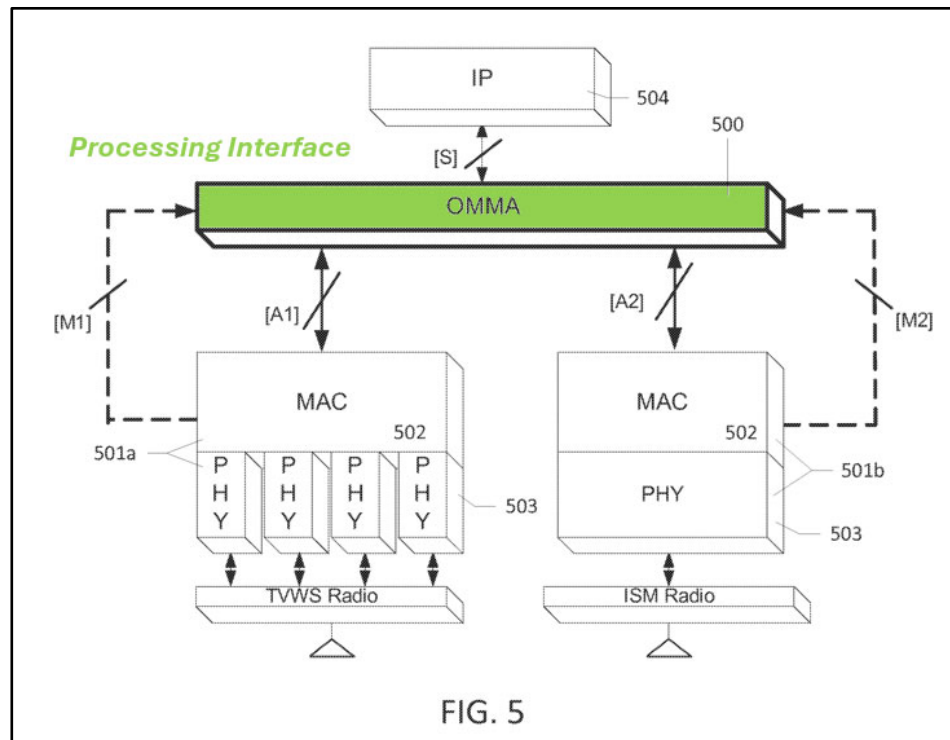
- b) **1[a]: providing a processing interface that is adapted to be connected to an application interface of a wireless networking device, the application interface being associated with a first application, the first application providing, after the circuitry has been connected to the application interface and when the wireless networking device is being used, a first data stream and having a first wireless bandwidth requirement;**

76. In my opinion, Chincholi/Clegg discloses this limitation.

77. *“providing a processing interface that is adapted to be connected to an application interface of a wireless networking device”*: Chincholi discloses a processing interface connected to an application interface. Specifically, Chincholi identifies *its processing interface* as the “**Opportunistic Multiple-Medium Access Control (MAC) Aggregation (OMMA) layer.**” (EX1005 at [0003].) A POSITA would have understood that the plain meanings of “interface” and “layer” in the context of the ’143 patent are functionally congruent. This understanding is reinforced by the specification, which describes layers performing the same functionality as the claimed interfaces, as well as by the prosecution history of the prior related ’591 patent, where the Applicant used the terms “layer” and “interface”

interchangeably in reference to Figure 1. (EX1017, at Aug. 8, 2023 Applicant Remarks; Sep. 28, 2023 Applicant Remarks.)

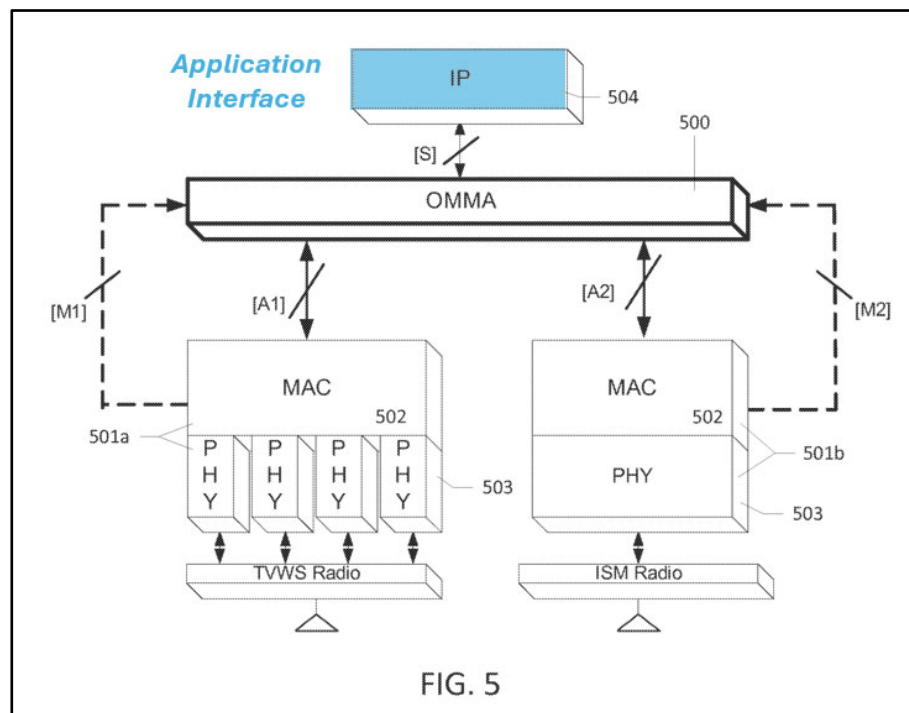
78. The OMMA layer functions as a common layer or module situated between the IP layer/module and the multiple RAT layers/modules. (EX1005 at [0137]; *see also id.* at [0120] (“[T]he single thin software layer may enable one RAT to operate over industrial scientific medical (ISM) and another RAT to operate over a TVWS band for the same IP flow.”)). An exemplary OMMA layer that enables a dual-RAT aggregation device in an 802.11n network is illustrated in Figure 5 of Chincholi.



79. The IP layer—functioning as the “application interface,” as discussed below—is connected to the OMMA layer and provides IP packets for processing.

(EX1005 at [0137]). Chincholi explains that the OMMA layer “may allow for enhanced throughput and reduced latency for a single IP flow.” (EX1005 at [0120]). Accordingly, the OMMA layer operates as a processing layer that handles IP packets and serves as an interface between the IP layer and the underlying MAC layers—*i.e.*, it functions as a *processing interface*.

80. “*application interface being associated with a first application ... providing, after the circuitry has been connected to the application interface and when the wireless networking device is being used, ... a first data stream*”: Chincholi also discloses that “[u]sing multiple RATs simultaneously may provide the benefit of increased bandwidth for an *application* (e.g., an IP flow) as well as increased reliability” (EX1005 at [0191]). The *first data stream* of a first application is referred to as an “IP flow” (EX1005 at [0132] (“A single IP flow may refer to a stream of IP packets belong to a particular application”)). In the 802.11 embodiment shown in Figure 5, IP packets associated with an application data stream originate from or are destined for an IP layer 504, and thus the IP flow (*i.e.*, *the first data stream*) is provided by the application after the circuitry of the wireless device has been connected to the application interface and *while the wireless networking device is in use* (EX1005 at [0138], Table 1 (“S” interface is for “Incoming/Outgoing IP Packets”)). The interface from the IP layer for the IP stream (“S”) is therefore an *application interface associated with a first application*.

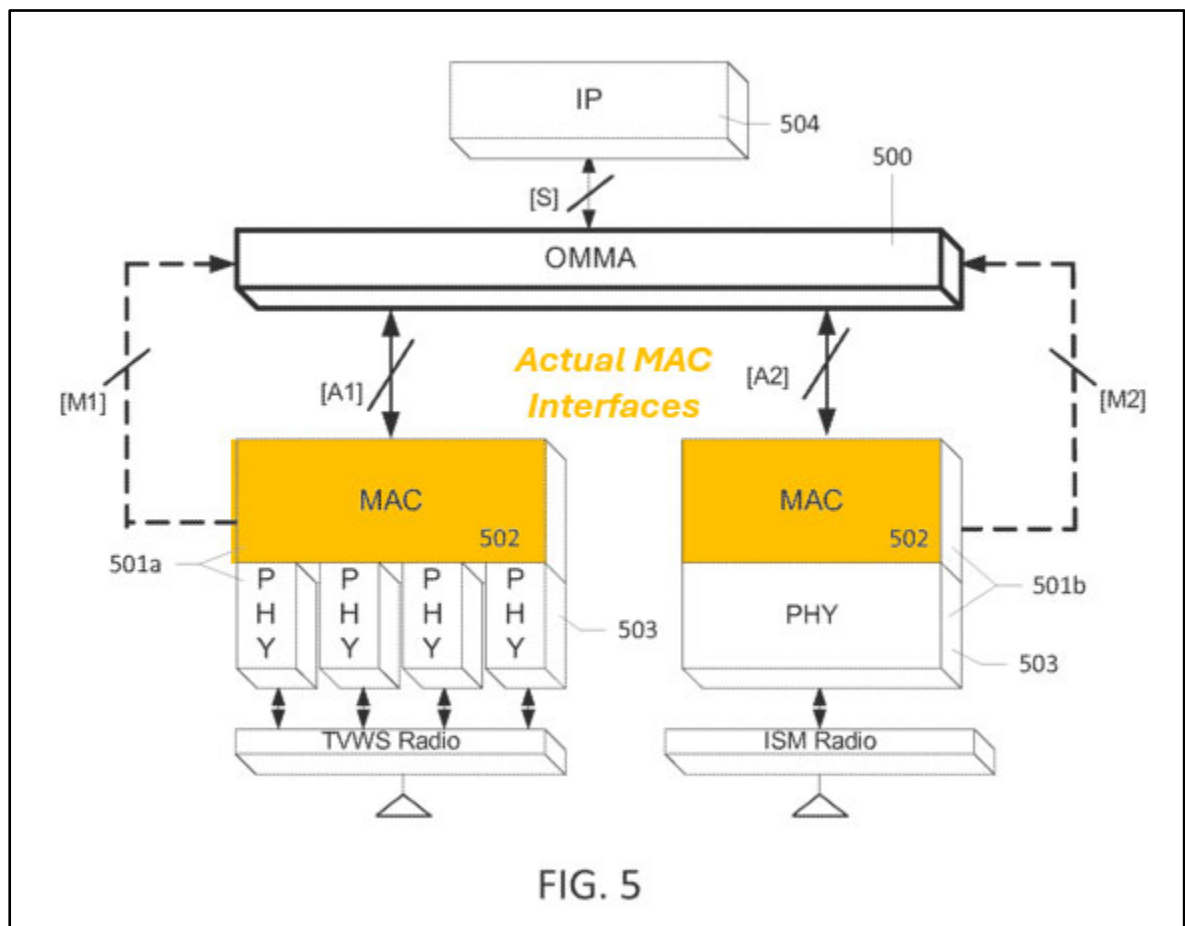


81. ***“first application ... having a first wireless bandwidth requirement”:***

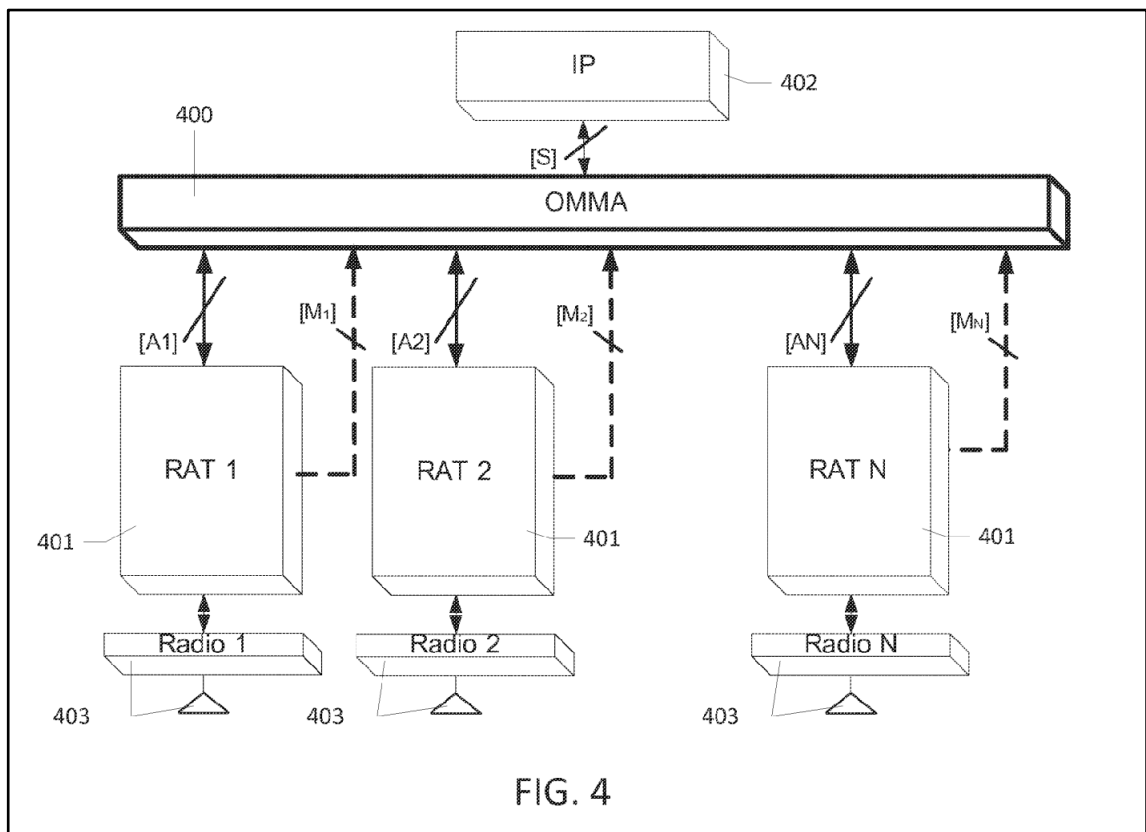
Chincholi teaches “a bandwidth requirement for an IP flow.” (EX1005, at [260]).

c) 1[b]: connecting first, second and third actual MAC interfaces to the processing interface;

82. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi discloses first, second, and third ***actual MAC interfaces*** connected to the processing interface—*i.e.*, the common OMMA layer. For example, Figure 5 depicts a “dual-RAT aggregation” in which the OMMA layer sits above and connects to two RATs, 501a and 501b, each comprising a MAC interface 502 (EX1005 at [0138] (“***The RATs 501a, 501b may comprise a MAC layer/module 502*** and one or more physical layers/modules 503”))).



83. While Figure 5 depicts only the first and second actual MAC interfaces, Chincholi discloses that an 802.11 implementation may include any number of MAC interfaces. For instance, Figure 4—which presents a more general block diagram of the architecture illustrated in Figure 5—shows the OMMA layer positioned above and interfacing with an arbitrary number of RATs, thereby supporting configurations with more than two MAC interfaces.

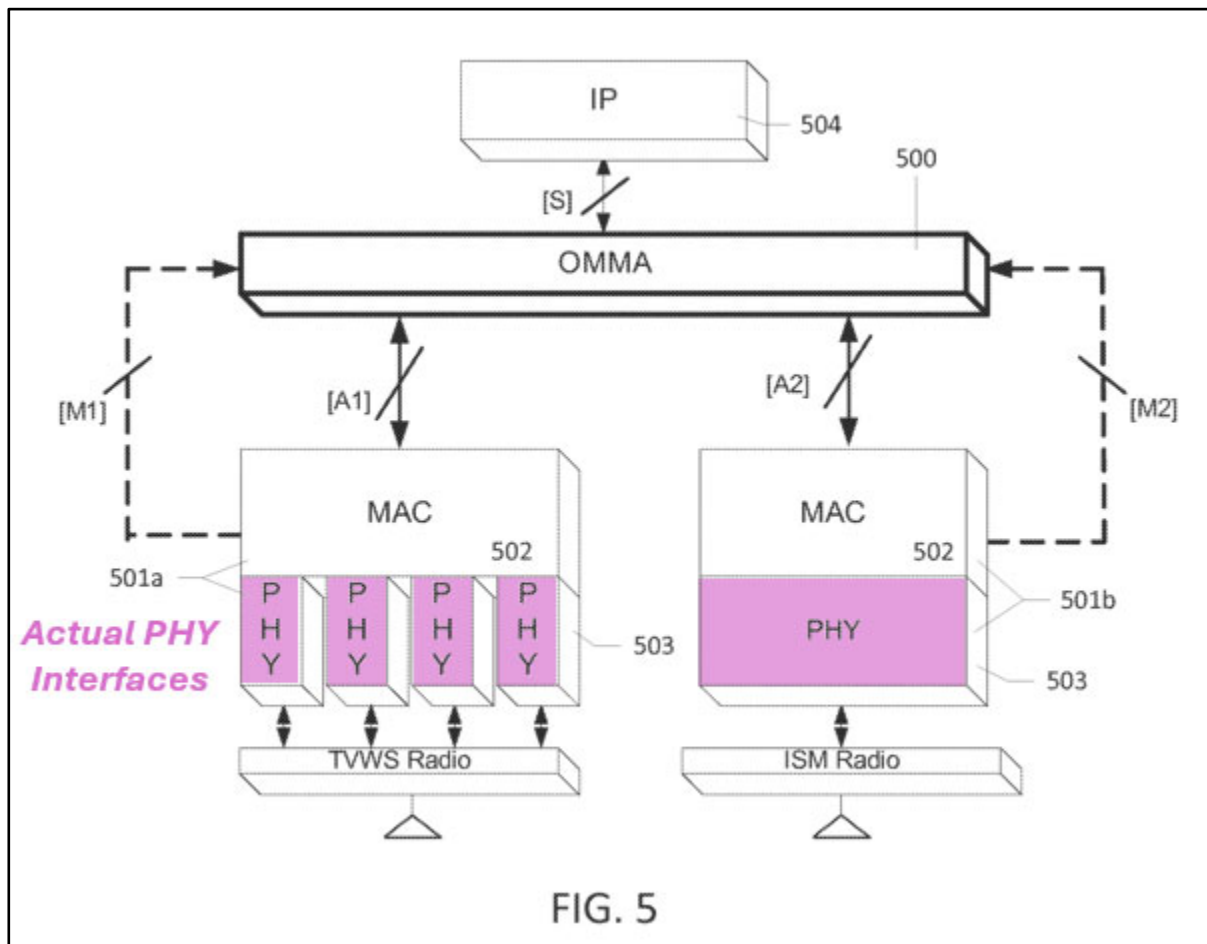


84. Consistent with Figures 4 and 5, Chincholi explains that a given “RAT 401” can comprise a “PHY/MAC,” meaning it includes an actual MAC interface (EX1005 at [0135]). A POSITA would have understood that, in a typical 802.11 implementation, each of the three RATs would include both actual MAC and PHY interfaces.

- d) 1[c]: connecting first and second actual PHY
connecting first, second and third actual PHY
interfaces respectively to the first, second and third
actual MAC interfaces;

85. In my opinion, Chincholi/Clegg discloses this limitation. Each RAT in Chincholi comprises *one or more physical layers* (EX1005 at [0138]) (“The RATs

501a, 501b may comprise a MAC layer/module 502 and *one or more physical layers/modules 503*”). The actual PHY layers are respectively connected to the corresponding actual MAC interfaces.



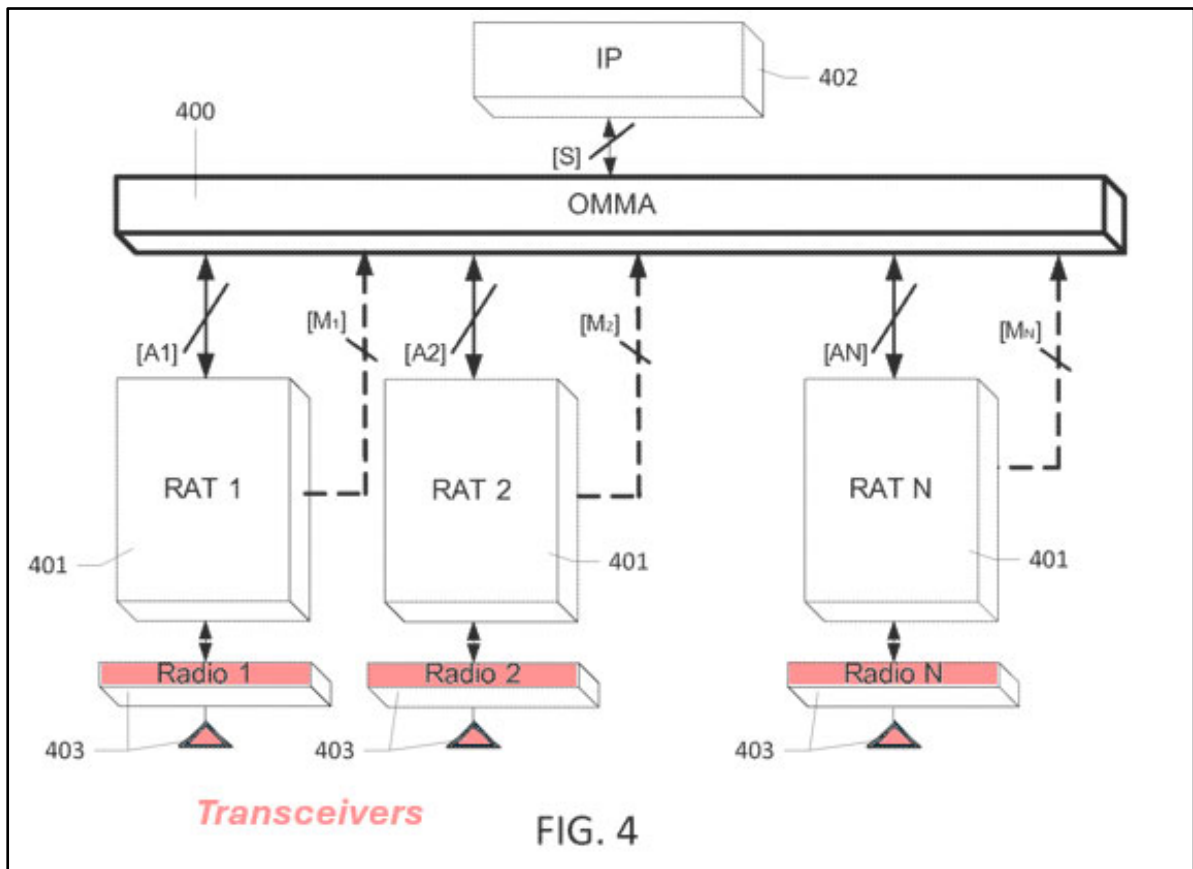
86. As I discussed above for limitation 1[b], Chincholi Figure 4 and its accompanying description disclose a common OMMA layer positioned above any number of RATs. In the context of an 802.11 system, each RAT depicted in Figure 4 would correspond to an actual MAC-PHY pair, thereby disclosing the connection

of first, second, and third actual PHY interfaces to corresponding first, second, and third actual MAC interfaces (EX1005 at [0135]).

- e) **1[d]: respectively associating first, second and third wireless transceivers with the first, second and third actual PHY interfaces, wherein each of the first, second and third wireless transceivers is suitable for use in a wireless local area network, and the first, second and third wireless transceivers, respectively, (i) have a first, second and third bandwidth availability up to first, second and third actual bandwidths, and (ii) are adapted to emit radio signals in first, second and third bands of frequencies, at least two of the first, second and third bands of frequencies being different;**

87. In my opinion, Chincholi/Clegg discloses this limitation.

88. *“associating first, second, and third wireless transceivers respectively with the first, second, and third actual PHY interfaces ... suitable for use in a wireless local area network”*: Chincholi Figures 4 and 5 illustrate that each actual PHY interface of each RAT is associated with an antenna/radio frequency (RF) front-end pair (EX1005 at [0133]). The antenna/RF front-end pairs shown in Figures 4 and 5 correspond to first, second, and third transceivers..



89. In my opinion, a POSITA would have understood a “transceiver” to be a physical device capable of both transmitting and receiving information. Accordingly, each of Chincholi’s disclosed “antenna/RF front-end pairs” qualifies as a transceiver, as they operate using wireless protocols that support bidirectional communication, such as IEEE 802.11, IEEE 802.11ac, IEEE 802.11af, LTE, and WCDMA (EX1005 at [0134]). A POSITA would have further understood that the transceivers depicted in Figures 4 and 5 are associated with the actual PHY layer of each respective RAT, since the PHY layer serves as the physical connection between the transceiver hardware and the remainder of the RAT stack.

90. Chincholi also teaches that each RAT may be implemented as a Wi-Fi RAT, and therefore the associated transceivers are suitable for use in a wireless local area network (WLAN) (EX1005 at [0134]).

91. ***“the first, second and third wireless transceivers, respectively, (i) have a first, second and third bandwidth availability up to first, second and third actual bandwidths”***: The plain meaning of this limitation is that each of the wireless transceivers, respectively, has a single bandwidth availability up to an actual bandwidth. Indeed, the Patent Owner has alleged in the parallel litigation that this limitation may be satisfied where each of the three wireless transceivers has one respective bandwidth availability extending up to an actual bandwidth (EX1013 at 19–20).

92. Consistent with the Patent Owner’s infringement contentions, a POSITA would have understood that each transceiver has an “actual” bandwidth—i.e., the total bandwidth capacity of the transceiver—with a “bandwidth availability” that may constitute a subset of that total bandwidth (i.e., the portions of the total bandwidth currently available for use). As Chincholi teaches, the RATs associated with each transceiver provide “meta-data feedback” that allows the OMMA layer to distribute IP packets among the RATs based on their available bandwidth (EX1005 at [0138]; [0161] (listing “Channel bandwidth(s)” reported by the PHY layer as an example of a “feedback metric[] used by an OMMA layer”); *see also id.* at [0167]

(“At startup, the OMMA layer may receive the available bandwidth of each of the one or more RATs.”)). Thus, Chincholi discloses that each of the three transceivers has a bandwidth availability that is up to its respective actual bandwidth.

93. *“the first, second and third wireless transceivers, respectively...(ii) are adapted to emit radio signals in first, second and third bands of frequencies, at least two of the first, second and third bands of frequencies being different”*: The plain meaning of this limitation is that each of the three transceivers emits radio waves in its own respective frequency band. Indeed, the Patent Owner has interpreted this limitation to require only that each transceiver operate within a single, mutually exclusive frequency band. For example, in its infringement contentions, the Patent Owner asserts that this limitation is satisfied by the implementation of the Wi-Fi 7 Draft Standard, where “[t]he first transceiver is the 2.4 GHz transceiver,” the second is “one of the 5 GHz and 6 GHz transceivers,” and the third is “the other one of the 5 GHz and 6 GHz transceivers” (EX1013 at 19).

94. In Chincholi, the transceivers of each RAT are adapted to emit radio waves in respective, different frequency bands, consistent with the Patent Owner’s infringement contentions. In the context of Figure 4, Chincholi discloses that “[f]or multiple RATs 401, each RAT 401 may be operating on a specific band. For example, a 802.11n PHY/MAC operating over [the] 2.4 GHz ISM band, a 802.11af PHY/MAC operating over [the] 512 MHz–698 MHz TVWS band, an LTE RAT

operating [on] a licensed band (e.g., 700 MHz band), a Bluetooth RAT operating on [the] 2.4 GHz ISM band, etc.” (EX1005 at [0135]). Accordingly, a POSITA would understand that Chincholi discloses this limitation as interpreted by the Patent Owner.

- f) 1[e]: forming in the processing interface (i) at least one virtual MAC interface and (ii) at least one resource monitoring interface that, after the circuitry has been connected to the application interface and during operation of the wireless networking device, feeds information regarding the bandwidth availabilities of the first, second and third wireless transceivers back to the at least one virtual MAC interface;**

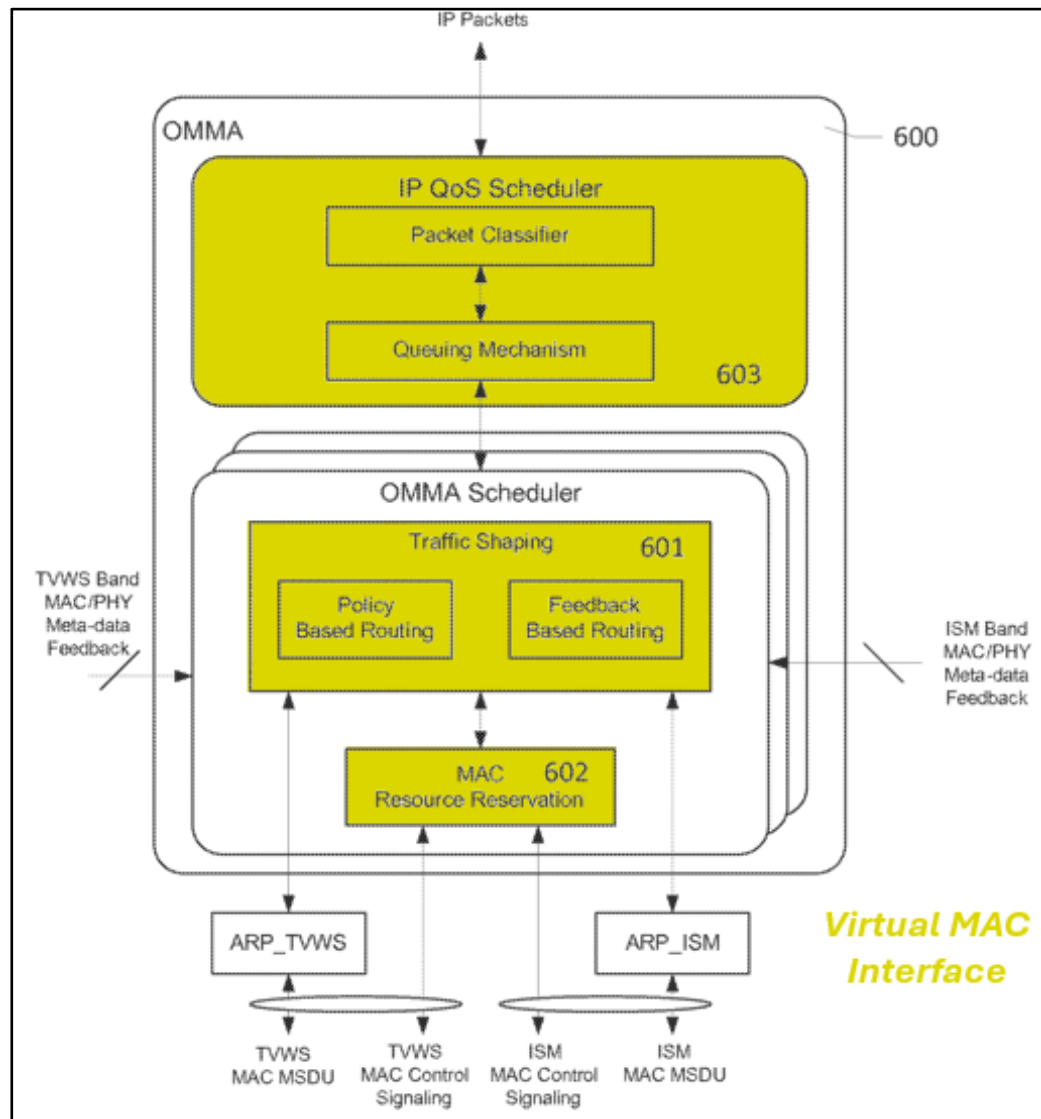
95. In my opinion, Chincholi/Clegg discloses this limitation. According to the '177 patent, the virtual MAC layer “enable[s] simultaneous allocation of multiple PHY resources for different signal types associated with different applications” (EX1001 at 3:51–54). The patent further states that the virtual MAC layer comprises the functionality of “decision,” “processing,” and “ultra-streaming” blocks (EX1001 at 3:49–50). Notably, the patent does not disclose or describe a generic “resource monitoring interface,” which—as discussed above in Section IV.A.3—was introduced into the claim language as a replacement for the originally recited “virtual PHY interfaces” through a post-Notice of Allowance (NOA) broadening amendment. (EX1004 at June 18, 2024 Request for Continued Examination with Preliminary Amendment).

96. The 177 patent describes the “virtual PHY layer” as potentially including multiple RF blocks, with each RF block representing the virtual use of a particular set of allocated transceiver resources (EX1001 at 4:51-54; see also Fig. 3 (depicting two RF blocks associated with “two sets” of transceiver resources)). The patent further explains that “[b]y employing a virtual MAC and virtual PHY between an application layer and an actual MAC and PHY layer, wireless transceiver resources may be allocated more efficiently to handle various data bandwidth requirements from different applications” (EX1001 at 6:4-8).

97. First, Chincholi discloses that the OMMA layer (*i.e.*, the processing interface) includes the claimed “virtual MAC interface” formed within it. “OMMA” stands for “opportunistic multi-medium access control (MAC) aggregation,” reflecting its function of aggregating multiple MAC interfaces, as shown in Figure 5 (EX1005 at [0120]). The OMMA layer functions as a virtual MAC interface because it transparently “distributes and/or combines” packets between the IP layer and the RATs (EX1005 at [0192]). A POSITA would have recognized that this functionality effectively “virtualizes” the MAC interface, as the OMMA layer appears to the IP layer as a single interface for exchanging packets that are ultimately transmitted or received via the underlying MAC-PHY pairs.

98. Chincholi’s OMMA layer also includes all of the functionality that the ’177 patent attributes with the “virtual MAC interface.” For example, Figure 6 of

Chincholi (reproduced below with annotations) presents a block diagram of the OMMA layer, which comprises an IP QoS Scheduler 603, a MAC Resource Reservation module 602, and a Traffic Shaping Module 601 (EX1005 at [0139]).



99. The IP QoS Scheduler classifies incoming packets of a packet stream and may segregate them into distinct IP QoS streams (EX1005 at [0143]), which a POSITA would have recognized as fulfilling the functionality of the “decision

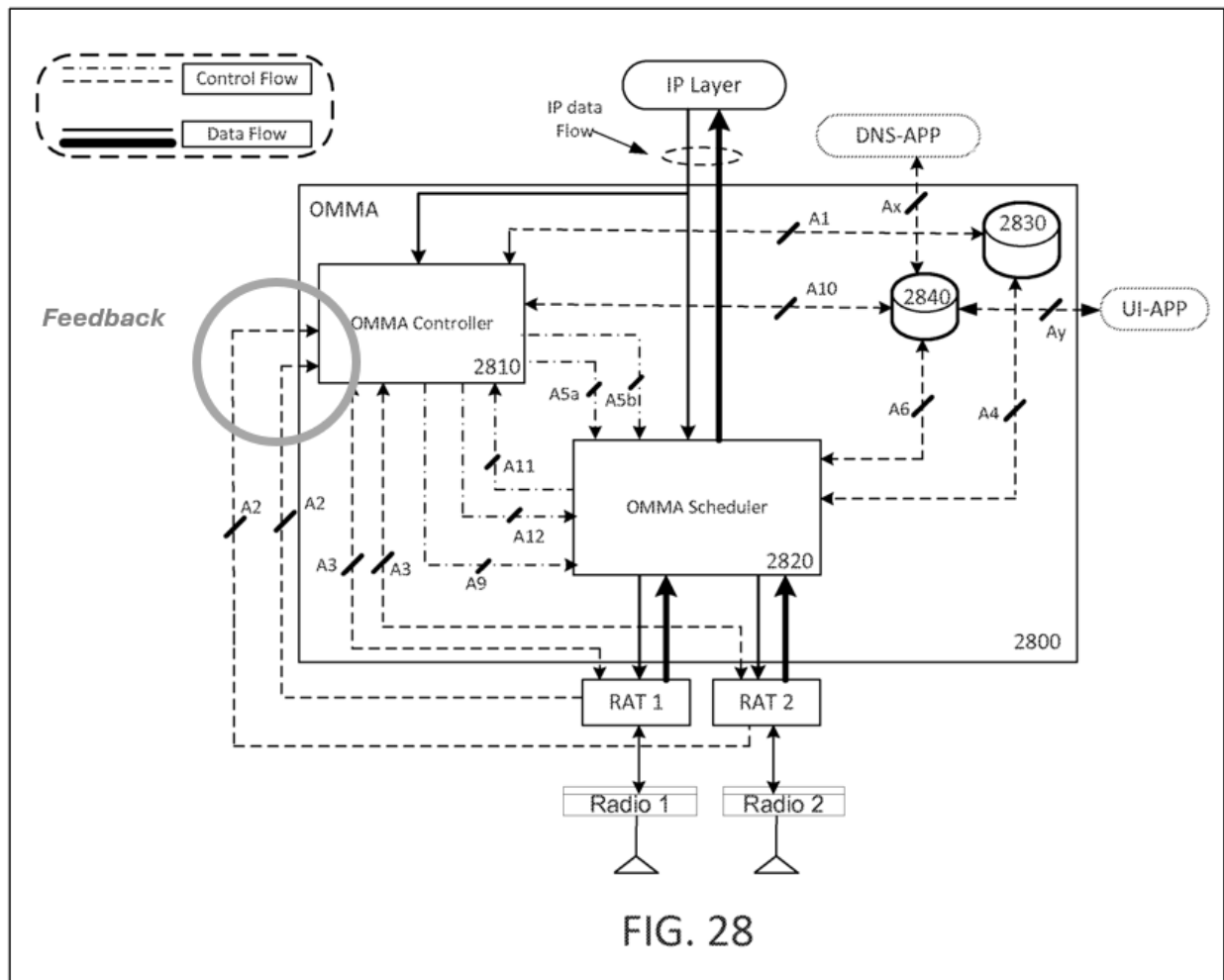
block” of the ’177 patent’s virtual MAC interface (EX1001 at 8:16-21). The MAC Resource Reservation module determines the time duration or spectral fragment/bandwidth required by a packet or set of packets (EX1005 at [0142]), which a POSITA would have recognized as fulfilling the functionality of the “processing block” (EX1001 at 8:21-23). Finally, the Traffic Shaping Module determines how packets are routed across RATs using either policy-based routing or feedback-based routing (EX1005 at [0139]), which a POSITA would have recognized as fulfilling the functionality of the “ultra-streaming block” (EX1001 at 8:23-28). Thus, a POSITA would have understood that Chincholi’s OMMA layer includes a “virtual MAC interface.”

100. Second, Chincholi discloses that its processing interface comprises the “at least one resource monitoring interface formed in the processing interface,” which, during operation, feeds information regarding the bandwidth availabilities of the first and second wireless transceivers back to the at least one virtual MAC interface. In my 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.

101. Chincholi discloses the capability of receiving feedback statistics regarding the available resources of the wireless transceivers. Specifically, the

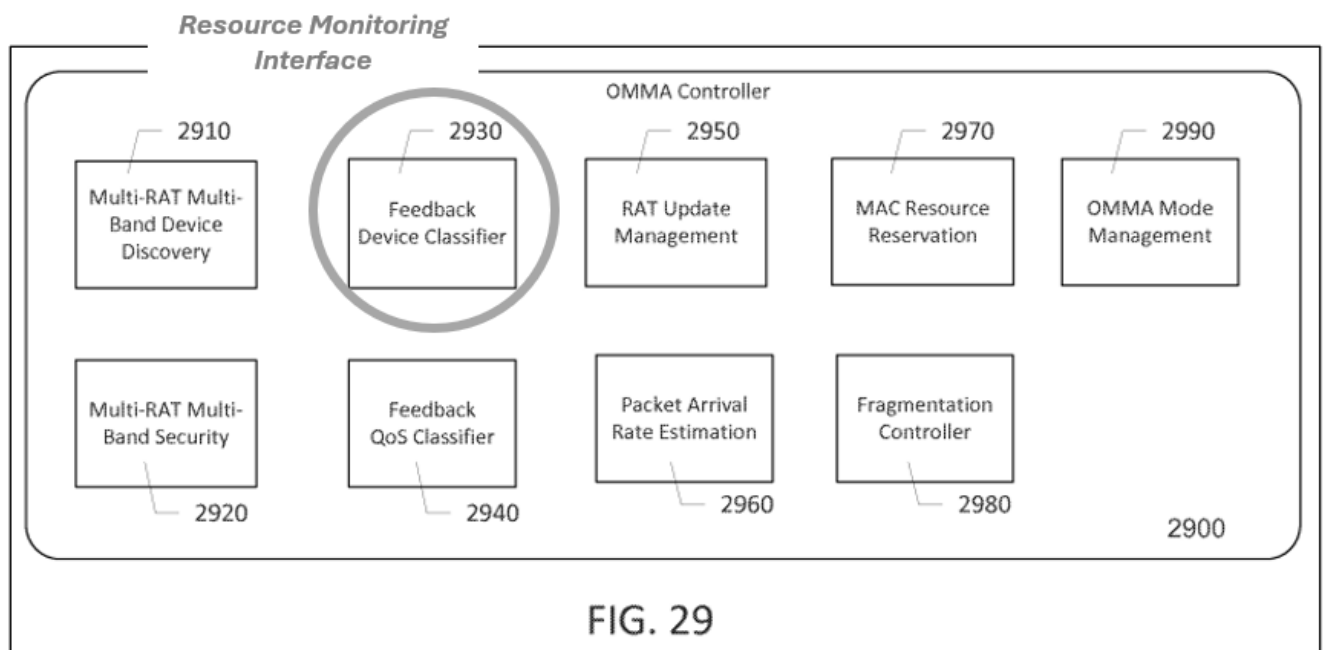
Traffic Shaping Module of the OMMA layer (*i.e.*, part of the “virtual MAC interface”) may determine packet routing using “feedback based routing” (EX1005 at [0139]). In such routing, “the OMMA transmitter may use measurement metrics fed back from each RAT,” including “channel quality metrics and the number of available resources on the medium,” *i.e.*, information regarding bandwidth availabilities (EX1005 at [0161]).

102. Figures 28 and 29, along with their associated descriptions, explain how Chincholi collects feedback from each RAT for use by the Traffic Shaping Module. Figure 28 shows that the OMMA layer includes an OMMA Controller, which interfaces with each RAT to gather metrics related to channel quality and the number of available resources on the medium. Specifically, via interface A2 in Figure 28, “[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” (EX1005 at [0205]).



103. The OMMA Controller includes *a Feedback Device Classifier module 2930* (EX1005 at [0205]). The Feedback Device Classifier collects information regarding the first and second transceiver resources and requirements via the “A2” interfaces shown in the diagram, enabling this information to be fed back to the OMMA Scheduler. Specifically, “[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.” (*Id.*). In my opinion, a POSITA would have recognized that the ability of *the Feedback Device Classifier module* within the OMMA Controller to collect such feedback on a per-device, per-access-category basis discloses the claimed “*resource monitoring interface*” of the ’177 patent.



- g) **1[f]: wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, and in a manner transparent to any layer of the wireless networking device above the processing interface, (a) request or create (i) a first association between a recipient and the first actual MAC and PHY interfaces, (ii) a second association between the recipient and the second actual MAC and PHY interfaces, and (iii) a third association between the recipient and the third actual MAC and PHY interfaces,**

104. In my opinion, Chincholi/Clegg discloses this limitation.

105. *“wherein the processing interface is configured to...in a manner transparent to any layer of the wireless networking device above the processing interface”*: Chincholi discloses that its OMMA layer (*i.e.*, the processing interface) is configured to operate transparently with respect to higher layers. 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 at [0192], [0126]). This contrasts with a “non-transparent” configuration, in which the OMMA layer would “add[] additional headers at the transmitter, and/or read[] and remove[] the headers at the receiver” (EX1005 at [0126]).

106. *“(a) request or create (i) a first association between a recipient and the first actual MAC and PHY interfaces, (ii) a second association between the*

recipient and the second actual MAC and PHY interfaces, and (iii) a third association between the recipient and the third actual MAC and PHY interfaces”:

Chincholi discloses techniques by which network terminals and WTRUs may discover one another using active and passive scanning procedures (EX1005 at [0145]). Following an authentication process, Chincholi further discloses that WTRUs may transmit a request to associate with one or more RATs of the network terminal, and the network terminal may respond with an association response signal either accepting or rejecting the request (EX1005 at [0149]). In my opinion, a POSITA would have recognized that these scanning and association procedures disclose the ability of Chincholi’s OMMA layer to request or establish a first, second, and/or third association between a recipient and the respective first, second, and third actual MAC and PHY interfaces.

107. When operating transparently with respect to higher layers, Chincholi’s OMMA layer manages the request, response, and creation of associations with WTRUs. For example, Chincholi states that “association request/response frames may be updated by the OMMA layer to include OMMA device discovery parameters, for example, such as but not limited to OMMA modes, OMMA schemes, OMMA packet distribution modes, etc.” (EX1005 at [0127]). In my opinion, a POSITA would have recognized that the OMMA layer’s role in

requesting or creating associations between recipients and the actual MAC and PHY interfaces is performed in a manner that is transparent to higher-level layers.

- h) 1[g]: (b) identify at least one first portion of the first actual bandwidth of the first wireless transceiver, the identified at least one first portion comprising a set of given resources,**

108. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi teaches that NTs and WTRUs communicate with one another over “channels,” which are portions of a transceiver’s bandwidth availability. Specifically, Chincholi states that “[t]he NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4 GHz ISM band, or 5 GHz ISM band, or TVWS band, or 60 GHz band, *using a channel within the band or aggregating multiple contiguous or noncontiguous channels*” (EX1005 at [0118]). Additionally, Chincholi explains that “[a]n 802.11 based system may operate in a time division duplexing (TDD) mode, for example, *on a band over a single 20/40 MHz channel in the case of ISM band or a single 5/10/20 MHz channel in television white space (TVWS) band* using contiguous/non-contiguous carrier aggregation” (EX1005 at [0121]).

109. Chincholi also discloses identifying available bandwidth channels for communication. The OMMA layer receives various forms of feedback information from each RAT (EX1005 at [0123]). For example, “the OMMA transmitter may use

measurement metrics fed back from each RAT,” including “channel quality metrics and the number of available resources on the medium” (EX1005 at [0161]). Among the available resources provided as part of this feedback are the “number of channels” and the “channel bandwidth” (i.e., the width of each channel, such as 20/40 MHz in the case of the ISM band) (EX1005 at [0161]).

110. In my opinion, a POSITA would have understood that Chincholi’s OMMA layer, by receiving from each RAT information regarding the number of channels and the channel bandwidth, is effectively identifying “at least one first and second portions of the first actual bandwidth”—i.e., available channels or an aggregation of multiple contiguous or non-contiguous channels—within the first actual bandwidth of the first wireless transceiver. A POSITA would have further understood that each identified bandwidth portion is comprised of a number of frequency carriers, which are a set of given resources for the identified channel.

- i) **1[h]: (c) evaluate whether any of the given resources of the first identified actual bandwidth portion are unavailable for communication,**

111. In my opinion, Chincholi/Clegg disclose this limitation. A POSITA would have understood that the plain meaning of a resource being “unavailable” in the context of the ’177 patent broadly encompasses scenarios in which resources are either partially or completely unavailable, or where a given resource has less bandwidth availability than another. This interpretation is consistent with the

prosecution history of the prior related '591 patent, in which the applicant explicitly stated that “[i]t is applicant’s intention that these words [‘unavailable’ and ‘unavailability’] refer to, for example, a partial or complete loss of certain transceiver resources as well as a situation where a different band than the one currently in use provides more bandwidth available for transmission” (EX1017, Aug. 8, 2023 Applicant Remarks).

112. As I discussed above for limitation 1[e], Chincholi discloses “feedback based routing,” wherein the “number of available resources on the medium” for each RAT is monitored and IP packets are distributed across the RATs accordingly (EX1005 at [0161]). For example, the OMMA layer may maintain a “RAT capability database” that stores the available RAT capabilities for an associated WTRU/NT (EX1005 at [0233]) and may “continuously update” this information based on feedback metrics (EX1005 at [0235]). In my opinion, a POSITA would have understood that Chincholi’s use of feedback metrics to continuously monitor available resources discloses the capability to evaluate whether any given resources within the first identified bandwidth portion are unavailable for communication.

113. Moreover, evaluating the unavailability of given resources within the first identified bandwidth portion is further taught by Clegg. Clegg discloses a technique for a multi-band 802.11 device to “increase data throughput by aggregating one or more of the available sub-channels for simultaneous use in

transmitting and receiving data” (EX1009 at 1:25–28). To facilitate this, Clegg teaches the use of an “ultra-wideband tuner to evaluate the entire available spectrum between several communication bands” (EX1009 at 3:60–63). Specifically, an 802.11 access point may “search across 1) available bands (e.g., the 2.4 GHz, 5 GHz, and/or 60 GHz bands), and 2) sub-channels within each band, and measure interference on a carrier-by-carrier basis across those bands and sub-channels” (EX1009 at 4:5–9). Each carrier is then evaluated to determine whether interference is “too high or above a threshold amount” (EX1009 at 7:16–17). Based on this evaluation, Clegg generates a “channel map” identifying available carriers across entire bands or discrete sub-channels “so that a user can select subcarriers from across those bands to form a cluster for communication” (EX1009 at 7:19–22).

114. In my opinion, a POSITA would have understood Clegg’s carrier-by-carrier evaluation of interference to disclose an evaluation of whether any of the given resources of the first identified bandwidth portion are unavailable for communication.

115. Furthermore, as I discussed above in Section V.A, a POSITA would have been motivated to combine Clegg’s teachings about how to mitigate carrier-specific interference into system of Chincholi. The resulting combination would implement Chincholi’s ability to dynamically allocate contiguous or non-contiguous bandwidth channels along with Clegg’s ability to mitigate interference within

channels on a carrier-by-carrier basis, thus increasing the bandwidth efficiency of the combined system.

116. Thus, Chincholi/Clegg discloses evaluating the given resources of the first identified actual bandwidth portion to determine whether the portion is unavailable for communication.

- j) **1[i]: (d) use the first wireless transceiver to transmit the first data stream to the recipient, without requiring disassociation of the recipient from any of the first, second and third actual MAC and PHY interfaces, using a subset of frequencies corresponding to only the given resources of the first bandwidth portion that are not unavailable for communication to thereby at least partially satisfy the first wireless bandwidth requirement of the first application;**

117. In my opinion, Chincholi/Clegg discloses this limitation. Clegg teaches that an 802.11 network terminal can use a first wireless transceiver to transmit a data stream using only the subset of frequencies that are not unavailable for communication—without requiring disassociation of the recipient from the access point.

118. Specifically, after evaluating the interference levels of each carrier across the available spectrum, Clegg teaches the capability to “notch out” specific OFDM subcarriers that experience an unduly high level of interference (EX1009 at 7:15–19). The remaining carriers—those suitable for communication—are then

selected to form a “cluster of carriers for communication” (EX1009 at 4:9–10). This cluster may include: “1) contiguous carriers in a single sub-channel, 2) contiguous carriers spanning across more than one sub-channel, 3) discontinuous carriers in a single sub-channel, or 4) discontinuous carriers spanning across more than one sub-channel” (EX1009 at 4:11–15). In my opinion, a POSITA would have recognized that Clegg’s selection of a cluster of carriers enables the transmission of the first data stream using only the subset of frequencies—or given resources—within the first identified bandwidth portion that are not unavailable.

119. Thus, in my opinion, the Chincholi/Clegg combination would not “require” disassociation of a recipient from any of the MAC and PHY interfaces during the bandwidth management operations described above.

120. It is further my opinion that a POSITA would have recognized the desirability of implementing Chincholi in combination with the teachings of Clegg to enable transmission of the first data stream to the recipient without requiring disassociation from either or both first and second actual MAC and PHY interfaces. For example, in the context of 802.11 systems—where each associated terminal is assigned a unique association identifier (“AID”)—it was well known that avoiding disassociation after initial association was desirable, as repeatedly re-establishing associations was inefficient and disruptive. (EX1008 (U.S. Patent No. 9,379,868) (“Wang”) at 24:42–43 (“This approach is undesirable, can be blunt and can disrupt

the on-going services (e.g., requires disassociation)"); *id.* at 24:57–62 (“The lack of update/change of the AID values . . . after an initial AID assignment is inherently inflexible and can prevent the realization [of] power saving, among other considerations, that an update/change of the AID values can provide.”)). Recognizing this issue, Wang described techniques in a multiple transceiver/MIMO system for updating a recipient’s AID through system-level interactions—without requiring disassociation of the wireless device from the access point. (*Id.* at 24:63–25:57).

121. Considering this background art, in my opinion, a POSITA would have recognized that, in implementing the Chincholi/Clegg combination, it would be desirable to incorporate known dynamic AID reassignment techniques in order to avoid disassociation of recipients during operation—including throughout any process of reallocating transceiver, channel, and/or bandwidth resources to a recipient.

- k) **1[j]: (e) identify at least one first portion of the second actual bandwidth of the second wireless transceiver, the identified at least one first portion of the second actual bandwidth of the second wireless transceiver comprising a set of given resources,**

122. Limitation 1[j] is identical to limitation 1[g] except it relates to the second wireless transceiver instead of the first. As such, it is my opinion that a

POSITA would have recognized from the analysis in limitation 1[g] that the Chincholi/Clegg combination discloses this limitation.

- l) 1[k]: (f) evaluate whether any of the given resources of the first identified actual bandwidth portion of the second wireless transceiver are unavailable for communication, and**

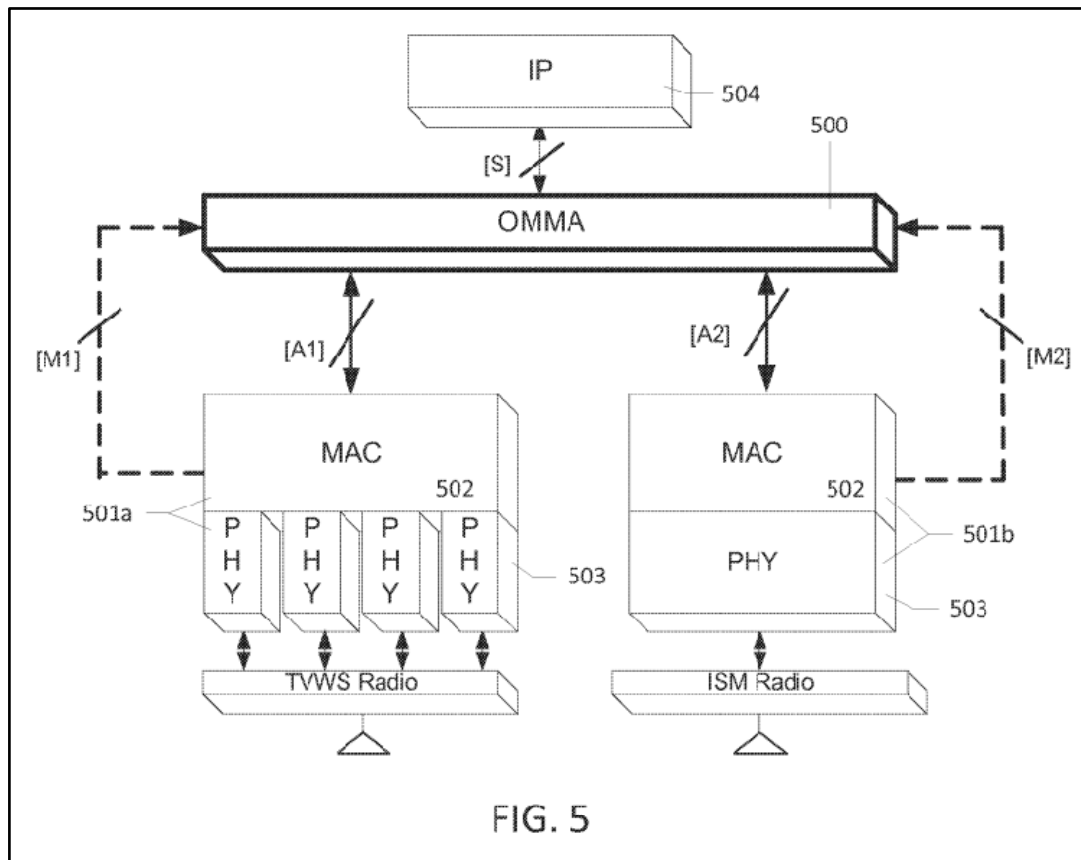
123. Limitation 1[k] is identical to limitation 1[h] except it relates to the second wireless transceiver instead of the first. As such, it is my opinion that a POSITA would have recognized from the analysis in limitation 1[h] that the Chincholi/Clegg combination discloses this limitation.

- m) 1[l]: (g) use the second wireless transceiver to receive a second data stream from the recipient, without requiring disassociation of the recipient from any of the first, second and third actual MAC and PHY interfaces, using a subset of frequencies corresponding to only the given resources of the first bandwidth portion of the second wireless transceiver that are not unavailable for communication to thereby at least partially satisfy a wireless bandwidth requirement associated with the second data stream; and**

124. In my opinion, Chincholi/Clegg discloses this limitation. Limitation 1[l] is identical to limitation 1[i] except it relates to the second wireless transceiver instead of the first and relates to data reception as opposed to data transmission. As such, as I discussed above in limitation 1[i], Chincholi/Clegg disclose using only

those transceiver resources that are not unavailable to satisfy an application bandwidth requirement.

125. Moreover, the techniques disclosed in Chincholi and Clegg are equally applicable to the reception of a data stream. In addition to managing the transmission of an IP flow from its transceivers, Chincholi describes how the OMMA layer enables the management of transceiver resources for receiving an IP flow. For example, Figure 5 illustrates a bidirectional data flow between the actual MAC layer and the OMMA layer via links “A1” and “A2,” indicating that the OMMA layer facilitates both uplink and downlink communication. (EX1005, at FIG.5):



126. Further, Table 1 of Chincholi describes the “A1” and “A2” links in Figure 5 as supporting both “Incoming” and “Outgoing” MAC service data units (MSDUs). (EX1005 at [0138]). Chincholi explains that the OMMA layer aggregates bandwidth across multiple RATs in a manner transparent to higher layers, allowing it to either “distribute[]” or “combine[]” packets from different RATs. (*Id.*) In my opinion, a POSITA would have understood that the OMMA layer’s ability to “combine” packets refers to the aggregation of simultaneously received packets across multiple RATs from a single IP flow before forwarding them to the IP layer.

127. In my opinion, a POSITA would have also recognized that Chincholi’s system may be implemented to simultaneously transmit the first data stream using the first transceiver while receiving the second data stream using the second transceiver. Because Chincholi’s architecture supports the use of multiple antenna/RF front-end pairs, each operating on a distinct frequency band. (EX1005 at [0136]), in my opinion, a POSITA would have understood that the system can be configured to support simultaneous transmission and reception across separate transceivers.

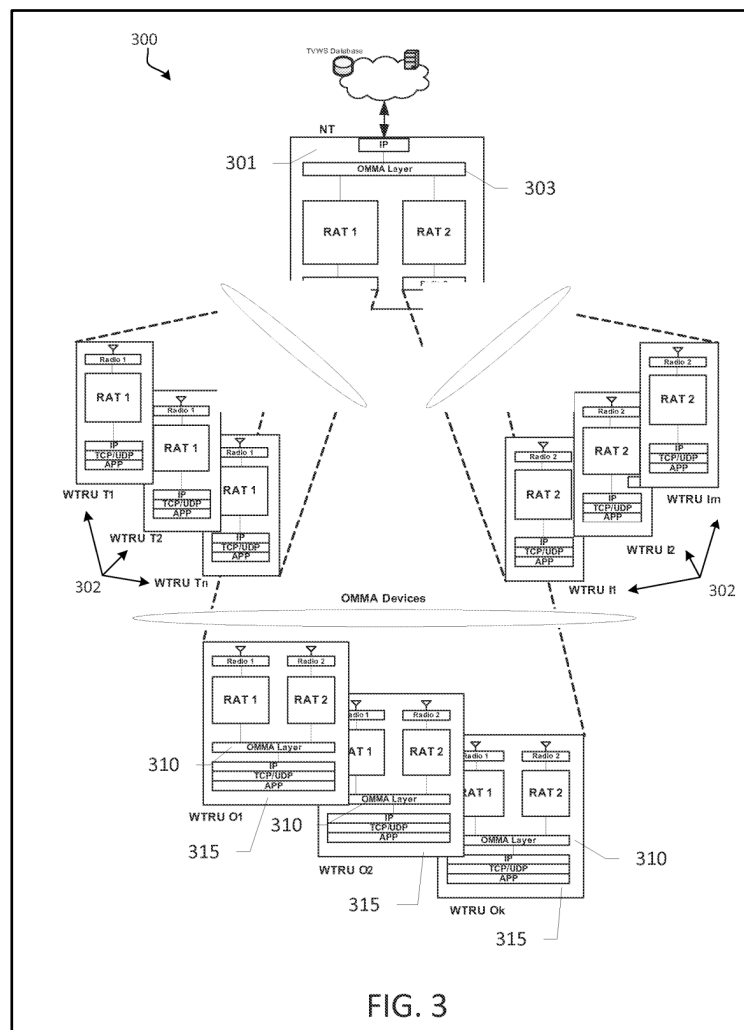
128. Operating a multi-transceiver system such as Chincholi’s to simultaneously transmit from one transceiver and receive from another was well known and, in my opinion, obvious to a POSITA at the time of the ’177 patent. This is illustrated, for example, in background reference U.S. Patent No. 10,567,147

(“DiFazio”) (EX1010). DiFazio explains that a “full duplex” system is one that transmits and receives a radio frequency (RF) signal simultaneously. (EX1010 at 1:24–26). This is most commonly implemented using “frequency division duplexing (FDD), where the Tx and Rx bands may be sufficiently separated in frequency such that filters can adequately attenuate any energy from the Tx signal that would leak into the Rx signal path and otherwise corrupt the Rx signal and prevent proper operation” (EX1010 at 1:26–31; *see also id.* at 16:51–67, 17:48–18:23). Additionally, DiFazio discloses a “full duplex single channel” (FDSC) capability, wherein a base station may simultaneously transmit and receive data streams within a single frequency channel. (EX1010 at 13:31–56).

129. In my opinion, a POSITA would have been motivated to implement simultaneous transmit-and-receive functionality into the system taught by Chincholi in order to improve network efficiency and throughput. As DiFazio explains, the use of full duplex single channel (FDSC) capability can yield up to a 70% increase in throughput compared to conventional half-duplex systems. (EX1010 at 16:29–30). To the extent such functionality is not explicitly disclosed by Chincholi, in my opinion, implementing simultaneous transmit-and-receive capability within Chincholi’s architecture would have been technologically feasible and could have been accomplished in a straightforward manner with a reasonable expectation of success.

- n) **1[m]: 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**

130. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi discloses examples of “multi-WTRU multi-IP flow cases.” (EX1005 at [0328]). For instance, Chincholi states that “[a] system may comprise multiple WTRUs, a single NT, and multiple IP flows from the NT to one or more WTRUs.” (*Id.*). This configuration is illustrated, for example, in Figure 3.



131. To manage data flows for multiple WTRUs, Chincholi teaches techniques for queuing packets based on their access categories and/or WTRU addresses, and for optimizing the distribution of packets from multiple streams across multiple RATs. (EX1005 at [0351]–[0356]). For example, Chincholi discloses that the MAC layer of a given transceiver may implement multiple transmission buffers, denoted Q_{ik} , where “i” identifies the WTRU for

which a group of packets is intended, and “k” refers to the IP flow associated with that group of packets. (EX1005 at [0352]).

132. Chincholi further discloses that utilization of available transceiver bandwidth by one WTRU does not preclude other WTRUs from simultaneously using remaining portions of that bandwidth. As discussed above, Chincholi’s OMMA layer receives feedback metrics from each RAT. (EX1005 at [0161]). Among these metrics is the “MAC Type,” which may indicate, for example, “OFDMA” (*id.*; Table 2). OFDMA—Orthogonal Frequency Division Multiple Access—is a well-known wireless communication technique in which available bandwidth is divided into smaller subcarriers (*i.e.*, frequency ranges), which are then allocated to different users. These subcarriers are orthogonal in the sense that they do not interfere with one another when transmitted simultaneously. In my opinion, a POSITA would have recognized that the use of OFDMA techniques enables multiple WTRUs to access different portions of the transceiver bandwidth concurrently and without mutual interference.

133. Because Chincholi’s RATs may provide feedback to the OMMA indicating that they are operating as an OFDMA MAC Type, in my opinion, a POSITA would have recognized that Chincholi discloses the capability for multiple WTRUs to simultaneously utilize different portions of a transceiver’s available bandwidth.

- o) 1[n]: 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.**

134. Limitation 1[n] is identical to limitation 1[m] except it relates to the second wireless transceiver instead of the first. As such, it is my opinion that a POSITA would have recognized from the analysis in limitation 1[m] that the Chincholi/Clegg combination discloses this limitation.

2. Claim 2: The method of claim 1, wherein the processing interface is adapted to be connected to an application interface of a wireless access point.

135. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi states that the wireless networking device comprises a “wireless access point” (EX1005 at [0002]). Specifically, it identifies the network terminal (“NT”) as an example of an “access point” (AP). (EX1005 at [0002]). Moreover, Chincholi explicitly discloses that a node within its wireless communication network may include a “WiFi access point.” (EX1005 at [0115]).

3. Claim 3: The method of claim 1, wherein at least two of the first, second and third frequency bands are specified in at least one member of the family of IEEE 802.11 standards that was in existence as of Oct. 30, 2013.

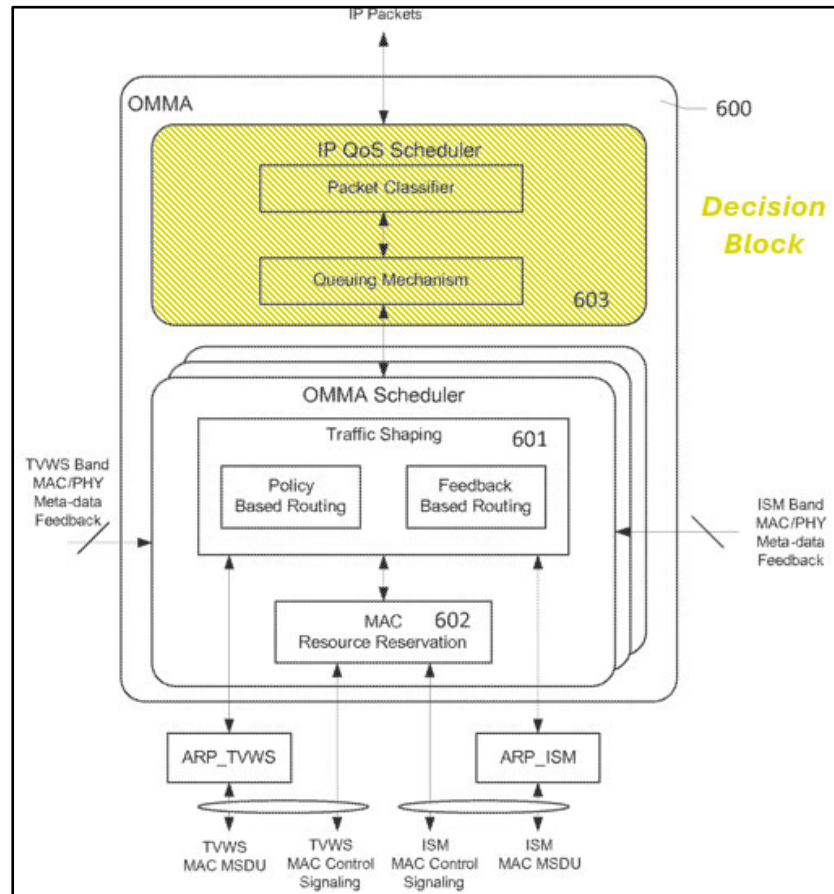
136. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi teaches that its techniques can be used to implement an IEEE 802.11-based Wi-Fi system. (EX1005 at [0121]). For example, “[t]he NT 201 may operate using one flavor of the 802.11 system (e.g., 11a/b/g/n) at any given time over a specific band (e.g., 2.4GHz or 5GHz) when communicating with a WTRU.” (*Id.*) Chincholi was filed prior to October 30, 2013. In my opinion, a POSITA would have recognized that the 802.11 standards expressly disclosed in Chincholi (i.e., 11a/b/g/n) were in existence as of that date.

4. Claim 4: The method of claim 1, wherein the at least one virtual MAC interface includes a decision block.

137. In my opinion, Chincholi/Clegg discloses this limitation. The ’177 patent states that the claimed decision block “determines the size and type of data stream being received, and the type of processing necessary to put the stream in a format where it is capable of being transmitted.” (EX1001 at 8:16–21).

138. Chincholi discloses the claimed decision block through the IP QoS Scheduler module 603. As Chincholi explains, “[t]he IP QoS Scheduler 603 may segregate single IP packet stream comprising multiple IP QoS types into distinct IP QoS streams, for example, so that the traffic shaping module 601 may treat each IP

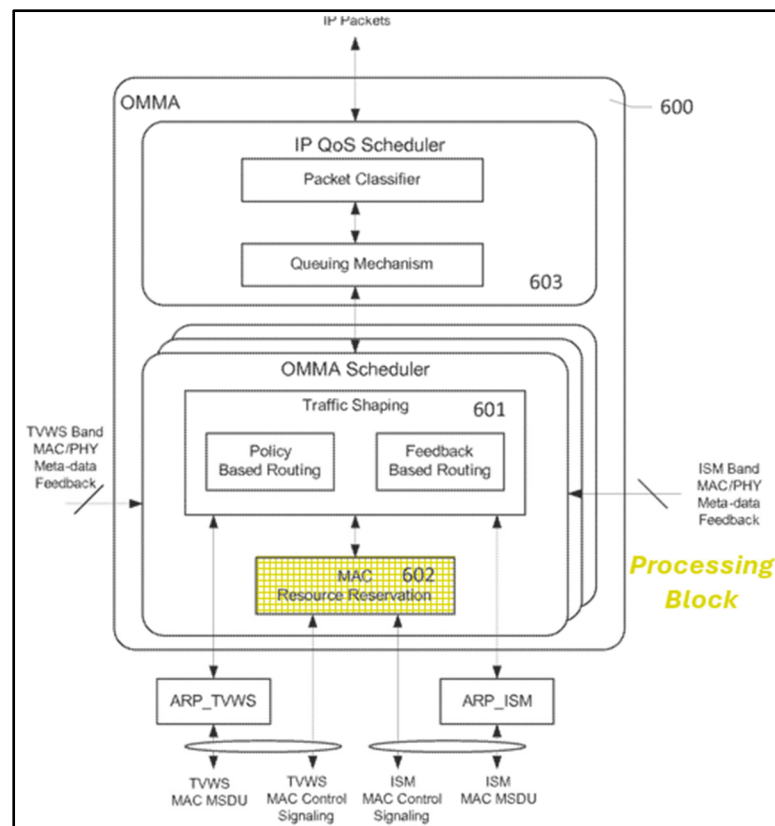
QoS stream independently and satisfy the specific QoS requirements when routing IP packets.” (EX1005 at [0143]).



5. Claim 5: The method of claim 1, wherein the at least one virtual MAC interface includes a processing block.

139. In my opinion, Chincholi/Clegg discloses this limitation. The '177 patent states that the claimed processing block “processes the data stream as determined by the decision block, and couples to an ultra-streaming block.” (EX1001 at 8:21-23).

140. Chincholi discloses *the claimed processing block* in the form of the *MAC Resource Reservation module 602*. As Chincholi explains, “[t]he MAC Resource Reservation module 602 may determine an amount of time duration and/or spectral fragment/bandwidth required by a packet or a set of packets. This module may transmit specific requests to the RATs over the A1/A2 interface” (EX1005 at [0142]).

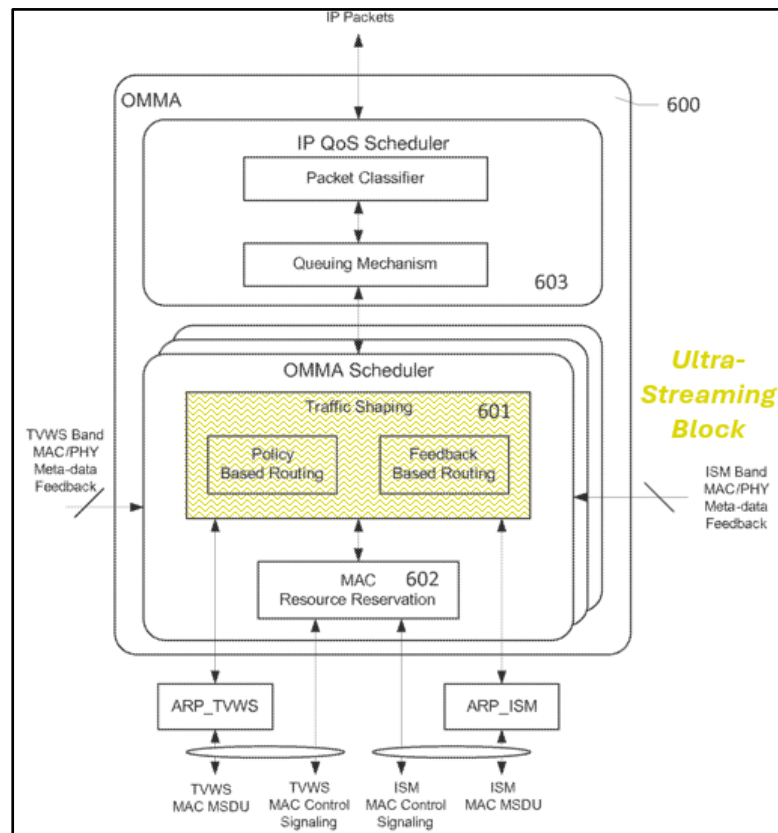


6. Claim 6: The method of claim 1, wherein the at least one virtual MAC interface includes an ultra-streaming block.

141. In my opinion, Chincholi/Clegg discloses this limitation. The '177 patent states that the claimed 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 sufficient processed streams or sub-streams.” (EX1001 at 8:23-28).

142. Chincholi discloses the claimed ***ultra-streaming block*** in the form of the ***Traffic Shaping Module 601***. As Chincholi teaches, “[t]he traffic shaping module 601 may [be] responsible for determining the way packets are routed across RATs. For example, the traffic shaping module may determine the way a packet is routed using policy based routing or feedback based routing.” (EX1005 at [0139]).



7. Claim 7: The method of claim 1, wherein the resource monitoring interface includes an RF block.

143. In my opinion, Chincholi/Clegg discloses this limitation. The '177 patent does not define the functionality of the claimed "RF block." The patent teaches that "the RF block" may "form[] a virtual PHY layer," (EX1001 at 8:38) and that a virtual PHY layer may comprise multiple RF blocks "denot[ing] the virtual use of two sets of allocated transceiver resources." (EX1001 at 4:51-54.) The RF block may communicate with the ultra-streaming block "about actual resource availability" or alternatively may communicate directly with the virtual MAC decision block and/or processing block. (EX1001, 4:54-58.) Thus, in my opinion, a POSITA would have understood the claimed "RF block" to merely be a component of the resource monitoring interface that is capable of receiving and reporting information about the availability of RF resources.

144. As I discussed above in limitation 1[e], Chincholi discloses that the Feedback Device Classifier Module of the OMMA Controller receives feedback metrics regarding resource availability from RATs over the "A2" interface so that this information may be fed back to the OMMA Scheduler. Specifically, "[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.” (EX1005 at [0205]). Because this discloses the capability of receiving and reporting information about the availability of the transceiver resources (*i.e.*, RF resources), in my opinion, a POSITA would have understood the Feedback Device Classifier Module (*i.e.*, the “resource monitoring interface”) to comprise an “RF block.”

8. Claim 8: The method of claim 7, wherein the resource monitoring interface include first, second and third RF blocks.

145. In my opinion, Chincholi/Clegg discloses this limitation. As I discussed above for limitation 1[e], “[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.” (EX1005 at [0205].) As shown in Figure 28, each RAT provides feedback information to the OMMA Controller over its own “A2” interface. (*Id.* at FIG. 28). Thus, in my opinion, a POSITA would have recognized that the Feedback Device Classifier Module (*i.e.*, the “resource monitoring interface”) to comprise first, second, and third “RF blocks” (*i.e.*, one per transceiver), for purposes of receiving and reporting information about the availability of the transceiver resources.

9. Claim 9: The method of claim 1, wherein the processing interface comprises multiple resource monitoring interfaces.

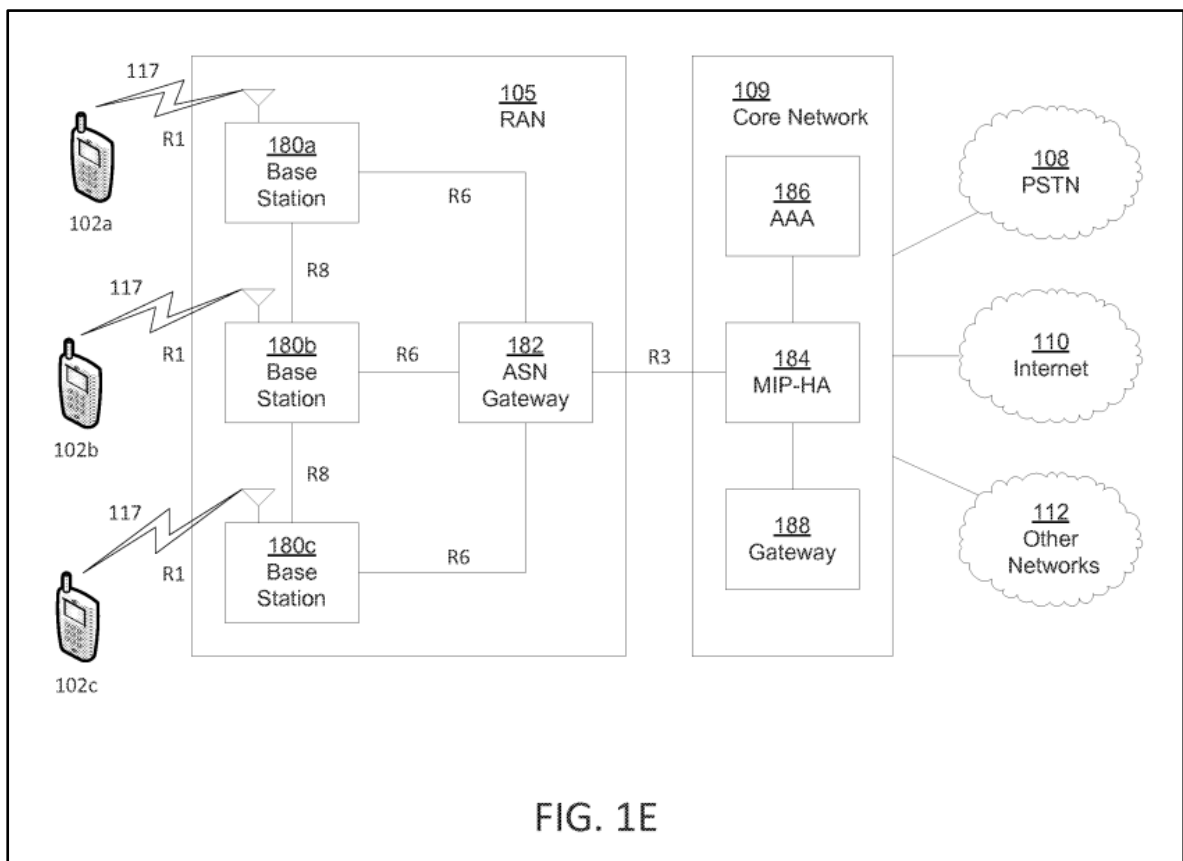
146. In my opinion, Chincholi/Clegg discloses this limitation. As discussed for limitation 1[e], Chincholi discloses an OMMA Controller that interfaces with each RAT on the “A2” interfaces to collect metrics regarding channel quality and resources. (EX1005 at [0205]). The OMMA Controller comprises a *Feedback Device Classifier module 2930*, which is a “resource monitoring interface” for collecting and analyzing this feedback information. (*Id.*).

147. In my opinion, POSITA would have been motivated to implement multiple Feedback Device Classifier Modules into the OMMA Controller of Chincholi. In a multi-RAT system with groups of similarly configured RATs, a POSITA would have been motivated to implement virtualized physical interfaces, each capable of collecting and consolidating feedback metrics for its respective group of similarly configured RATs. Providing such virtualized physical interfaces for transceivers in an 802.11 system is known to be particularly advantageous, as it allows an access point to support communication with wireless devices operating under various generations of the 802.11 standards. This type of physical interface virtualization is taught, for example, in background reference U.S. Patent Application 2009/0141691. (“Jain”) (EX1007 at [0034]–[0037]).

148. In implementing virtualized physical interfaces, it is my opinion that a POSITA would recognize that each interface to a grouping of similarly configured RATs would comprise a separate, “resource monitoring interface.”

10. Claim 10: The method of claim 1, wherein the processing interface comprises multiple virtual MAC interfaces.

149. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi discloses wireless communication systems comprising multiple base stations operating within a radio access network (RAN) that communicate with wireless devices using a multiple input, multiple output (MIMO) architecture. (EX1005 at [0109]). This is disclosed, for example, in Figure 1E.



150. In my opinion, a POSITA would have recognized that each base station in Figure 1E would comprise its own OMMA layer (i.e., virtual MAC interface.). It is further my opinion that a POSITA would have further recognized that an additional obvious implementation would be to combine the multiple virtual MAC interfaces shown in the system of Figure 1E into a single wireless communication device. Consolidating this functionality into a single device could, for example, leverage shared hardware resources and thereby increase the efficiency of a base station.

11. Claim 11: The method of claim 1, wherein the processing interface includes a bandwidth allocator.

151. In my opinion, Chincholi/Clegg discloses this limitation. A POSITA would have understood that a *bandwidth allocator* refers to functionality within the processing layer capable of allocating the bandwidth availabilities of multiple transceivers to meet a bandwidth requirement of one or more data streams.

152. Chincholi discloses the functionality of the claimed “bandwidth allocator.” Specifically, Chincholi teaches that “the traffic shaping module may determine how a packet is routed using policy based routing or feedback based routing.” (EX1005 at [0139]). In feedback-based routing, “the OMMA transmitter may use measurement metrics fed back from each RAT,” including “channel quality metrics and the number of available resources on the medium.” (EX1005 at [0161]).

Using this feedback, “the OMMA layer may intelligently manage data traffic across multiple RATs as a function of the link quality of each RAT.” (EX1005 at [0194]). Additionally, the OMMA layer has the capability “to readjust the assigned medium resources to a WTRU on each RAT, for example, based on global knowledge of resource assignment on other RATs.” (EX1005 at [0196]). Thus, “the OMMA layer may utilize MAC resource reservation to achieve globally optimal resource allocation across RATs” (*Id.*).

153. From these disclosures, it is my opinion that a POSITA would have recognized Chincholi/Clegg discloses a processing layer capable of allocating the bandwidth availabilities of multiple transceivers to meet a bandwidth requirement of one or more data streams.

12. Claim 12: The method of claim 1, wherein the first identified actual bandwidth portion is contiguous.

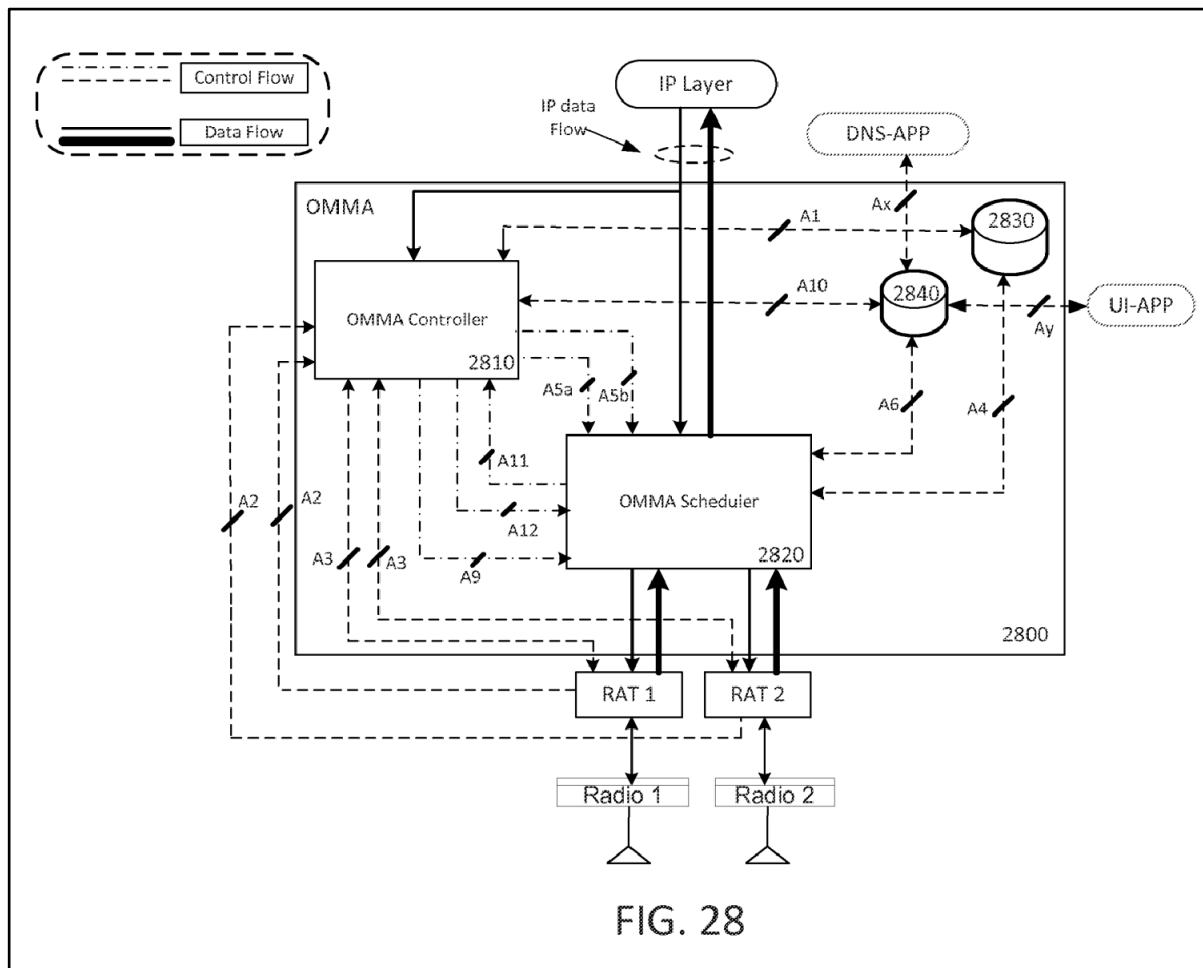
154. In my opinion, Chincholi/Clegg discloses this limitation. Chincholi discloses that an “NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4GHz ISM band, or 5GHz ISM band, or TVWS band or 60GHz band, using a channel within the band or aggregating multiple contiguous or noncontiguous channels.” (EX1005 at [0118]). In my opinion, a POSITA would have understood that when Chincholi refers to multiple

contiguous channels within the band of the first identified actual bandwidth portion, that portion constitutes a contiguous bandwidth portion.

155. Clegg also teaches how a “cluster of carriers” for communication may comprise: “1) *contiguous carriers in a single sub-channel*, 2) *contiguous carriers spanning across more than one sub-channel*, 3) discontinuous carriers in a single sub-channel, or 4) discontinuous carriers spanning across more than one sub-channel.” (EX1009 at 4:11-15).

13. Claim 13: The method of claim 1, wherein the resource monitoring interface is not contiguous with the at least one virtual MAC interface.

156. In my opinion, Chincholi/Clegg discloses this limitation. As I discussed for limitation 1[e], Chincholi’s OMMA Controller includes a Feedback Device Classifier module. As shown in Figure 28, the OMMA Controller and the OMMA Scheduler are distinct blocks that communicate via control flow interfaces. (EX1005, at FIG. 28.) In my opinion, a POSITA would have understood from this disclosure that the resource monitoring interface is not contiguous with the virtual MAC interface.



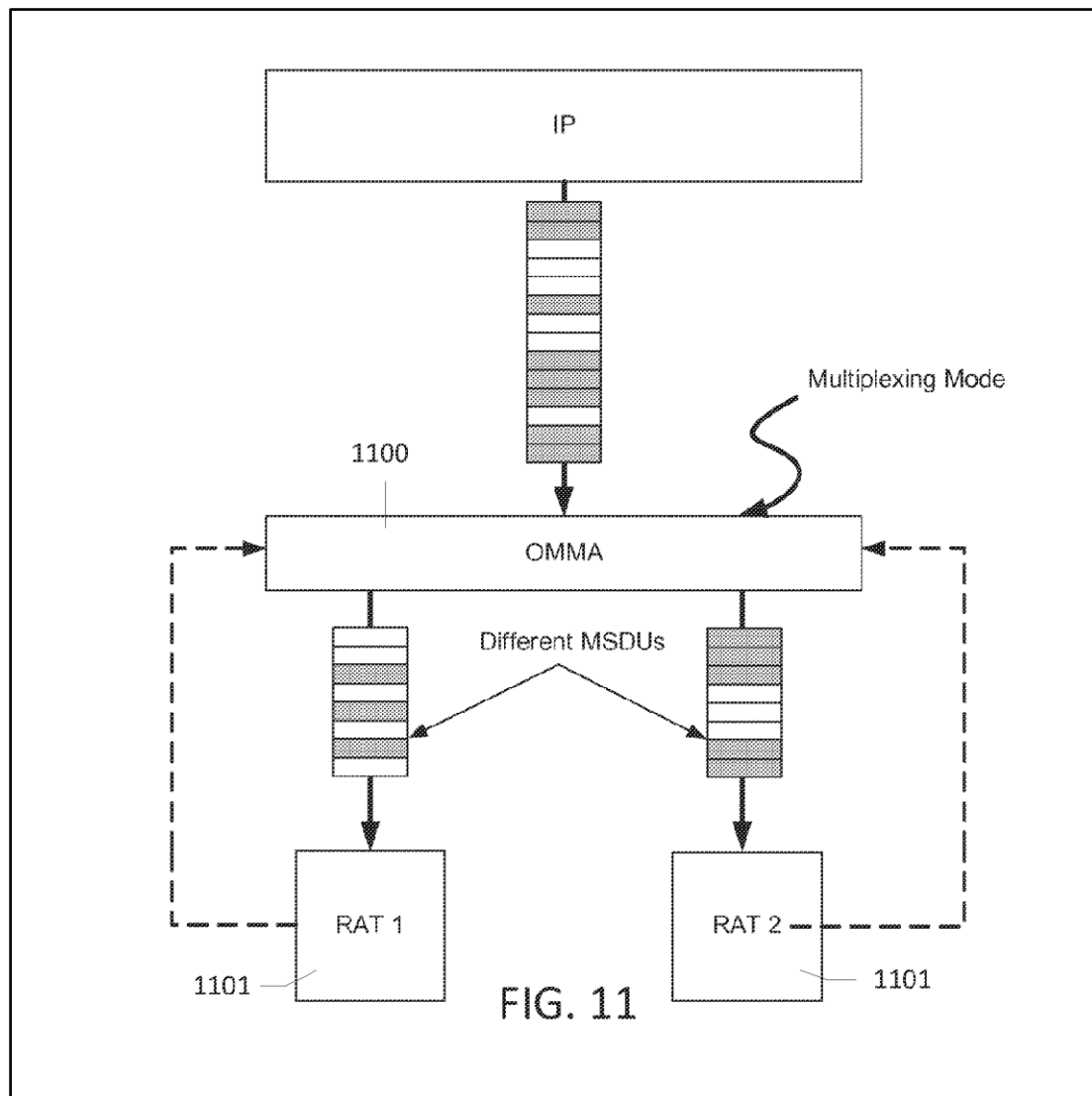
14. Claim 14: The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, and in a manner transparent to any layer of the wireless networking device above the processing interface, aggregate the first identified actual bandwidth portion of the first wireless transceiver with an identified first portion of an available bandwidth of the third wireless transceiver to at least partially simultaneously transmit the first data stream to the recipient from both of the first and third wireless transceivers.

157. In my opinion, Chincholi/Clegg discloses this limitation. As I discussed above for limitation 1[g], Chincholi discloses identifying available channels, or

aggregations of channels, from multiple different RATs (EX1005 at [0118], [0121]). Based on its evaluation of transceiver bandwidth availability relative to an application's bandwidth requirement, Chincholi may aggregate the bandwidth availabilities of two transceivers (*e.g.*, the first and third transceivers) to simultaneously transmit the first data stream to the recipient using identified bandwidth portions of both transceivers. (EX1005 at [0120] (“A mechanism to aggregate two or more RATs operating independently on two or more bands to enhance the total IP throughput of the link may be described herein.”)).

158. Specifically, Chincholi discloses a “multiplexing mode” in which, if the channel quality for one or more RATs exceeds an upper threshold, the OMMA layer may transmit different independent IP packets from the same IP flow across one or more RATs. (EX1005 at [0152]). In such a scenario, Chincholi is able to reserve resources—*i.e.*, specific subsets of frequencies corresponding to the identified portions of available bandwidth—from multiple transceivers and thereby aggregate the bandwidth portions of the first and third transceivers for simultaneous transmission.

159. Chincholi further discloses the simultaneous transmission of a single data stream using two transceivers. For example, Figure 11 shows how the OMMA layer splits a single IP stream of packets (*i.e.*, MAC Service Data Units or “MSDUs”) for concurrent transmission across two RATs.



160. Chincholi further discloses, “[u]sing multiple RATs *simultaneously* may provide increased bandwidth and/or increased reliability for an application.” (EX1005 at [0194]).

161. Chincholi also discloses that the transceiver selection, data stream preparation, and simultaneous transmission is all performed by the OMMA in a manner transparent to higher levels: “[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 at [0192]; [0126]).

15. Claim 15: The method of claim 14, wherein the first data stream is substantially simultaneously transmitted to the recipient from both of the first and second wireless transceivers.

162. In my opinion, Chincholi/Clegg discloses this limitation. As I discussed above for claim 14, Chincholi may “aggregate” bandwidth portions of the first and third wireless transceivers to transmit the first data stream simultaneously from the first and third wireless transceivers. Chincholi also teaches that its system may “aggregate” bandwidth portions of the first and second wireless transceivers to transmit the first data stream simultaneously from the first and second transceivers in a similar manner. As Chincholi explains, “[a] mechanism to aggregate two or more RATs operating independently on two or more bands to enhance the total IP throughput of the link may be described herein.” (EX1005 at [0120]).

163. Chincholi also teaches that the transceiver selection, data stream preparation, and simultaneous transmission is all performed by the OMMA in a manner transparent to higher levels: “[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 at [0192], [0126]).

16. Claim 16: The method of claim 14, wherein the identified first portion of the available bandwidth of the third wireless transceiver is contiguous.

164. For the reasons I disclosed above in Claim 12, it is my opinion that Chincholi/Clegg discloses this limitation.

17. Claim 17: The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, and in a manner transparent to any layer of the wireless networking device above the processing interface, aggregate the second identified actual bandwidth portion of the second wireless transceiver with an identified first portion of an available bandwidth of the third wireless transceiver to at least partially simultaneously receive the second data stream from the recipient.

165. As I discussed above for Claim 14, it is my opinion that Chincholi/Clegg discloses this limitation as the combination teaches the capability of aggregating bandwidth from multiple transceivers to satisfy a bandwidth requirement of an application. Additionally, as I discussed for Claim limitation 1[1], the transceiver and bandwidth management techniques disclosed by Chincholi are applicable to reception of a data stream as well as transmission of a data stream. Thus, it is my opinion that a POSITA would have understood Chincholi/Clegg to disclose aggregating bandwidth portions of the second and third transceivers to simultaneously receive (which satisfies “at least partially” simultaneously receive) the second data stream from the recipient.

18. Claim 18: The method of claim 17, wherein the second data stream is substantially simultaneously received.

166. In my opinion, Chincholi/Clegg discloses this limitation. As I discussed above for Claim 17, Chincholi discloses aggregation of bandwidth from a second and third transceiver to enable simultaneous receipt (which satisfies “substantially” simultaneous receipt) of a data stream from the recipient.

19. Claim 19: The method of claim 17, wherein the identified first portion of the available bandwidth of the third wireless transceiver is contiguous.

167. For the reasons I discussed above in Claim 12, it is my opinion that Chincholi/Clegg discloses this limitation.

20. Claim 20: The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, in a manner transparent to any layer of the wireless networking device above the processing interface,

168. For the reasons I discussed above for Limitation 1[f], it is my opinion that Chincholi/Clegg discloses this limitation.

a) Claim 20[a]: (a) identify at least one second portion of bandwidth available for communication of the first wireless transceiver, the identified at least one second portion of the first wireless transceiver comprising a set of given resources,

169. For the reasons I discussed above for Limitation 1[g], it is my opinion that Chincholi/Clegg discloses this limitation. Chincholi discloses identifying a first

portion of bandwidth available for communication by the first wireless transceiver, and further discloses identifying a second portion of bandwidth available for communication by that same transceiver. For example, Chincholi states that “[t]he NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4 GHz ISM band, or 5 GHz ISM band, or TVWS band, or 60 GHz band, *using a channel within the band or aggregating multiple contiguous or noncontiguous channels.*” (EX1005 at [0118]).

- b) Claim 20[b]: (b) evaluate whether any of the given resources of the first and second identified bandwidth portions of the first wireless transceiver are not unavailable for communication,**

170. For the reasons I discussed above for Limitation 1[h], it is my opinion that Chincholi/Clegg discloses this limitation.

- c) Claim 20[c]: (c) use the first wireless transceiver to transmit the first data stream to the recipient, without requiring disassociation of any of the first, second and third associations, using a specific subset of frequencies corresponding to the given resources of the identified first and second bandwidth portions of the first wireless transceiver that are not unavailable for communication to thereby at least partially satisfy the first wireless bandwidth requirement of the first application.**

171. In my opinion, Chincholi/Clegg discloses this limitation. Based on its evaluation of transceiver bandwidth availability with respect to application bandwidth requirement, it is my opinion that a POSITA would recognize that

Chincholi may “aggregate” the first and second identified bandwidth portions of a single transceiver and use those portions simultaneously for transmission of the first data stream to the recipient using the first wireless transceiver. (EX1005 at [0118] (“The NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4 GHz ISM band, or 5 GHz ISM band, or TVWS band, or 60 GHz band, *using a channel within the band or aggregating multiple contiguous or noncontiguous channels.*”).))

21. Claim 21: The method of claim 20, wherein the first and second identified bandwidth portions of the first wireless transceiver are not contiguous.

172. It is my opinion that Chincholi/Clegg discloses this limitation. Chincholi teaches that NTs and WTRUs communicate with one another over “channels,” which are portions of a transceiver’s bandwidth availability. Specifically, Chincholi states that “[t]he NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4 GHz ISM band, or 5 GHz ISM band, or TVWS band, or 60 GHz band, using a channel within the band or aggregating multiple contiguous or noncontiguous channels.” (EX1005 at [0118]). Additionally, Chincholi explains that “[a]n 802.11 based system may operate in a time division duplexing (TDD) mode, for example, on a band over a single 20/40 MHz channel in the case of ISM band or a single 5/10/20 MHz channel in television white space (TVWS) band using contiguous/non-

contiguous carrier aggregation” (*Id.* at [0121]). In my opinion, a POSITA would understand from these disclosures that Chincholi teaches that bandwidth portions of the first wireless transceiver can be noncontiguous.

22. Claim 22: The method of claim 1, wherein the processing interface is configured to, after the circuitry has been connected to the application interface and when the wireless networking device is being used, in a manner transparent to any layer of the wireless networking device above the processing interface,

173. For the reasons I disclosed above for Limitation 1[f], it is my opinion that Chincholi/Clegg discloses this limitation.

a) Claim 22[a]: (a) identify at least one second portion of bandwidth available for communication of the second wireless transceiver, the identified at least one second portion comprising a set of given resources,

174. For the reasons I disclosed above for Limitation 1[j], it is my opinion that Chincholi/Clegg discloses this limitation. As I previously explained, Chincholi discloses identifying a first portion of bandwidth available for communication of the second wireless transceiver. (*See* Limitation 1[g]). Chincholi also discloses identifying a second portion of bandwidth available for communication of the second wireless transceiver. (EX1005, [0118] (“[t]he NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4 GHz ISM band, or 5 GHz ISM band, or TVSWS band, or 60 GHz band,

using a channel within the band or aggregating multiple contiguous or noncontiguous channels.”).)

- b) Claim 22[b]: (b) evaluate whether any of the given resources of the first and second identified portions of the second wireless transceiver are not unavailable for communication, and**

175. For the reasons discussed above for Limitation 1[k], it is my opinion that Chincholi/Clegg discloses this limitation.

- c) Claim 22[c]: (c) use the second wireless transceiver to transmit the first data stream to the recipient, without requiring disassociation of any of the first, second and third associations, using a specific subset of frequencies corresponding to the given resources of the identified first and second bandwidth portion of the second wireless transceiver that are not unavailable for communication to thereby at least partially satisfy a wireless bandwidth requirement associated with the second data stream.**

176. In my opinion, Chincholi/Clegg discloses this limitation. Based on its evaluation of transceiver bandwidth availability with respect to application bandwidth requirement, it is my opinion that a POSITA would recognize that Chincholi may “aggregate” the first and second identified bandwidth portions of a single transceiver and use those portions simultaneously for transmission of the first data stream to the recipient using the first wireless transceiver. (EX1005 at [0118] (“The NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4 GHz ISM band, or 5 GHz ISM band,

or TVSWS band, or 60 GHz band, *using a channel within the band or aggregating multiple contiguous or noncontiguous channels.*’).)) Thus, Chincholi discloses using the resources of the identified bandwidth portions of the second wireless transceiver that are not unavailable to transmit the first data stream.

177. As I discussed above for limitation 1[i], Chincholi’s bandwidth and transceiver management functions are performed without requiring “disassociation” of previously formed associations.

23. Claim 23: The method of claim 22, wherein the first and second identified bandwidth portions of the first wireless transceiver are not contiguous.

178. For the reasons I discussed above in Claim 21, it is my opinion that Chincholi/Clegg discloses this limitation.

24. Claim 24: The method of claim 1, wherein the transmission of the first data stream to the recipient does not occur simultaneously with the reception of the second data stream from the recipient.

179. In my opinion, Chincholi/Clegg discloses this limitation. As I discussed above for limitation 1[l], Chincholi, in view of the background reference DiFazio, teaches the use of a first transceiver to transmit a first data stream and a second transceiver to receive a second data stream. As DiFazio explains, this transmit/receive functionality may be implemented in a “full-duplex” manner—*i.e.*, simultaneously—using frequency division duplexing (FDD). (EX1010 at 1:26–31;

see also id. at 16:51–67, 17:48–18:23). Alternatively, DiFazio teaches that this functionality may also be implemented in a non-simultaneous fashion using time division duplexing (TDD), “where the Tx and Rx signals may be separated by timeslots or other access schemes designed to prevent, or minimize, their overlap.” (EX1010 at 13:43–47; *see also id. at 1:47–48*).

180. In my opinion, a POSITA would recognize that implementing Chincholi in a TDD configuration, as taught by DiFazio, would allow the first transceiver to transmit the first data stream and the second transceiver to receive the second data stream, but not simultaneously.

25. Claim 25: The method of claim 1, wherein the transmission of the first data stream to the recipient occurs at least partially simultaneously with the reception of the second data stream from the recipient.

181. For the reasons I discussed above for limitation 1[l] and Claim 24, it is my opinion that Chincholi/Clegg, in light of background reference DiFazio, discloses the capability to transmit the first data stream simultaneously with receiving the second data stream.

26. Claim 26: The method of claim 25, wherein the transmission of the first data stream to the recipient occurs simultaneously with the reception of the second data stream from the recipient.

182. 180. For the reasons I discussed above for limitation 1[l] and Claim 24, it is my opinion that Chincholi/Clegg, in light of background reference DiFazio,

discloses the capability to transmit the first data stream simultaneously with receiving the second data stream.

VI. Conclusion

183. In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

* * *

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,



Kevin C. Almeroth, Ph.D.

Date: July 10, 2025