

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

Petitioners,

v.

XIFI NETWORKS R&D, INC.

Patent Owner.

Case No. IPR2025-01270

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

**PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 12,114,177**

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Exhibit	Description
EX1001	U.S. Patent 12,114,177 (“’177 Patent”)
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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
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LIST OF CHALLENGED CLAIMS

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 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

Claim	
	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,
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

Claim	
	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
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.

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

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,
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.

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

I. INTRODUCTION

Petitioners Samsung Electronics Co., Ltd. and Samsung Electronics America, LLC (“Petitioner”) request *Inter Partes* Review of claims 1-26 of U.S. Patent No. 12,114,177 (“’177 patent”) assigned to XiFi Networks R&D Inc. (“Patent Owner”). The ’177 patent is directed to methods of improving a “wireless networking system” with multiple wireless transceivers and a processing layer to allocate bandwidth of the transceivers based on a wireless bandwidth requirement. (EX1001, Abstract.) As demonstrated below, this basic architecture involving multi-transceiver devices was ubiquitous in the prior art, and the ’177 patent claims no non-obvious features or implementation.

II. MANDATORY NOTICES

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

The real parties-in-interest for Petitioner are Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Related Patent Office Proceedings

The ’177 patent is in the same family as U.S. Patent Nos. 11,818,591; 11,849,337; 11,856,414; 11,974,143; 11,950,105; 12,003,976; 12,015,933; 12,169,756; 12,190,198; and 12,250,564. Petitioner has filed IPR petitions against the first six of these patents.

2. Related Litigation

Patent Owner is currently asserting the '177 patent against Petitioner in *XiFi Networks R&D, Inc. v Samsung Electronics Co., Ltd. and Samsung Electronics America, Inc.*, Case No. 2:24-cv-01057-JRG (E.D. Tex.)

C. Lead and Backup Counsel and Service Information (37 C.F.R. §§ 42.8(b)(3)-(4))

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D. Payment of Fees (37 C.F.R. § 42.15(a))

The Office is authorized to charge the fee required for this Petition (and any additional fees) to Deposit Account No. 50-5708.

E. Requirements For *Inter Partes* Review (37 C.F.R. §§ 42.101(A)-(C), 42.104(A), and 42.018)

Petitioner certifies that the '177 patent is available for *inter partes* review, that Petitioner is not barred or estopped from challenging the '177 claims on the grounds identified herein, and that the prohibitions of 35 U.S.C. §§ 315(a)-(b) are inapplicable.

III. STATEMENT OF RELIEF REQUESTED AND IDENTIFICATION OF CHALLENGE (37 C.F.R. § 42.104(B))

Petitioner respectfully requests that *inter partes* review of claims 1-26 ("Challenged Claims) on the following grounds:

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

IV. BACKGROUND

A. '177 Patent (EX1002, ¶¶43-53)

1. Earliest Priority Date

The '177 patent is a post-AIA patent whose earliest priority date is October 30, 2013 via U.S. Provisional Application Nos. 61/897,216 and 61/897,219. (EX1002, ¶46.)

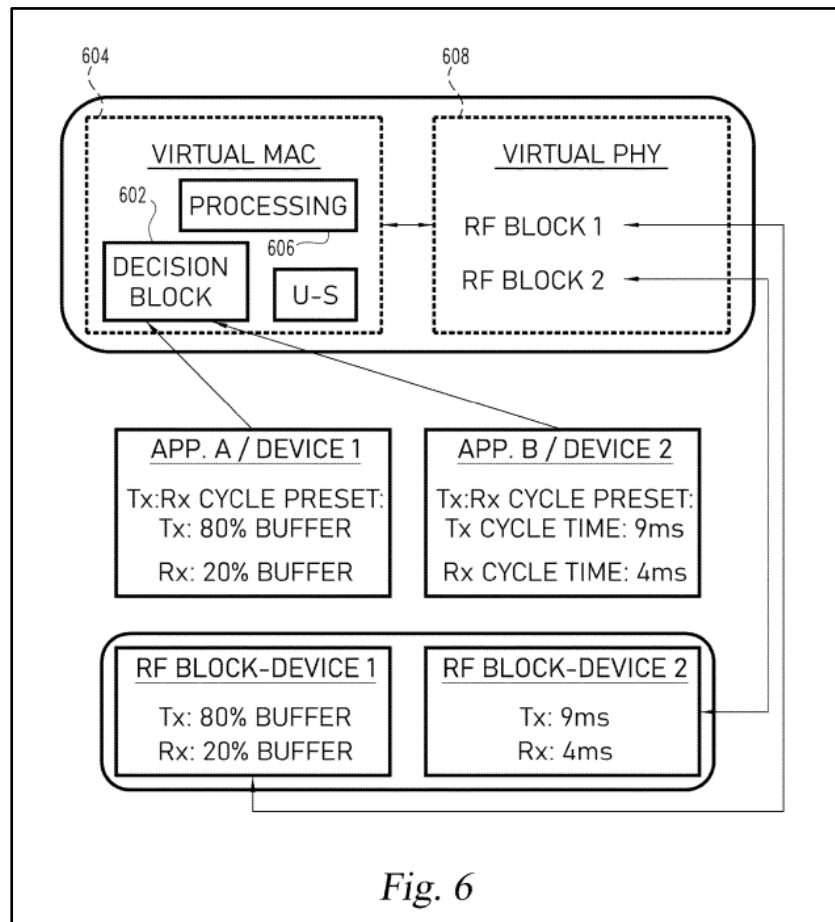
2. Specification (EX1002, ¶¶47-51)

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. (EX1001, Abstract)

The wireless networking architecture 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.*, 2:57-60.) The patent states that the processing layer comprises “virtual MAC and PHY layers” that “enable simultaneous allocation of multiple PHY resources for different signal types associated with different applications.” (*Id.*, 3:51-54.)

In Figure 6, the wireless networking device is stated to use the virtual MAC and PHY layers to configure the resources of two separate transceivers to each handle the bandwidth requirement of a respective application for a single recipient

device using asymmetric transmit and receive cycles. (*Id.*, 5:48-67.)



3. Prosecution History (EX1002, ¶¶52-53)

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"). The applicant's Track One Request was granted on April 18, 2024. (EX1004, April 18, 2024 Track One Request Grant.) The application was initially allowed less than one month later, without any substantive office actions. (EX1004, May 15, 2024 Notice of Allowance.) On June 18, 2024, Applicant submitted amendments broadening the limitations regarding "virtual PHY interfaces" with a

“resource monitoring interface.” (EX1004, June 18, 2024 Request for Continued Examination with Preliminary Amendment.) On June 21, 2024, Applicant submitted additional claim amendments. (EX1004, June 21, 2024 Supplemental Preliminary Amendment.) The amended patent was re-allowed on July 18, 2024. (EX1004, July 18, 2024 Notice of Allowance.) One post-issuance certificate of correction was filed. (EX1004, Oct. 8, 2024 Request for Certificate of Correction.)

B. Asserted Prior Art (EX1002, ¶¶62-68)

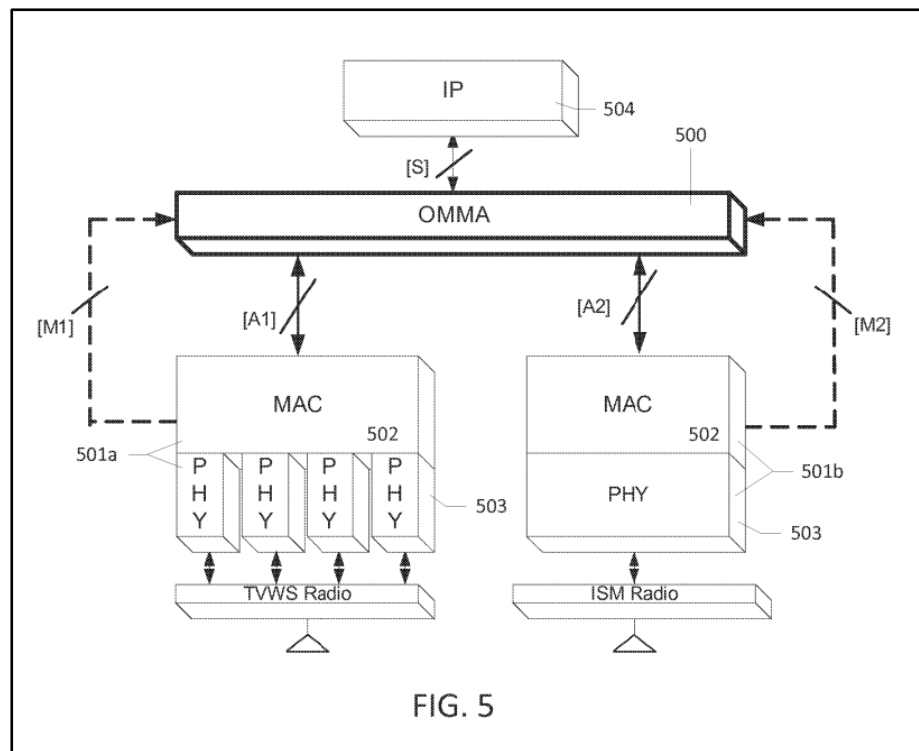
1. Chincholi (EX1005)

WO 2013/126859 (“Chincholi”) has an international filing date of February 24, 2013, and was published on August 29, 2013. It is prior art under § 102(a)(1) and § 102(a)(2.)

Chincholi discloses “manag[ing] multiple radio access technology (RAT) interfaces to enable opportunistic RAT selection and aggregation for sending data traffic over the RAT interfaces.” (EX1005, [0003].) In one embodiment, Chincholi discloses a network terminal, *e.g.*, “access point,” that “may be configured to work in an infrastructure mode or an adhoc mode, for example, in an IEEE 802.11 based Wi-Fi system.” (EX1005, [0115].) An 802.11 access point configured according to Chincholi enables use of “multiple RATs simultaneously [to] provide increased bandwidth and/or increased reliability for an application.” (EX1005, [0194].)

Chincholi discloses an “Opportunistic Multiple-Medium Access Control

(MAC) Aggregation (OMMA) layer,” (EX1005, [0003]), a “single thin software layer” which “enable[s] one RAT to operate over industrial scientific medical (ISM) and another RAT to operate over a TVWS band for the same IP flow,” (EX1005, [0120].) Figure 5 shows an OMMA layer enabling a dual-RAT aggregation device in an 802.11n network with actual MAC and physical interfaces enabling dual transceivers:



The OMMA layer processes single or multiple IP flows (*i.e.*, application data streams) and uses feedback from each RAT to make decisions about how best to allocate transceiver resources to meet the IP flows’ bandwidth requirements. The OMMA layer may “aggregate” the available bandwidth of multiple transceivers, enabling communication paths between network devices using one or more RATs.

(EX1005, [0383].) For example, first and second packets of a single IP flow may be scheduled for simultaneous transmission to a recipient across the first and second RAT. (EX1005, [0385].)

Chincholi was not before the examiner during prosecution of the '177 patent.

2. Clegg (EX1009)

U.S. Patent 9,055,592 (“Clegg”) was filed on January 7, 2013. It is prior art under § 102(a)(2.)

Clegg discloses systems and methods for IEEE 802.11 communication using carrier specific interference mitigation. Clegg “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,” allowing an 802.11 device to “fully utilize the available spectrum.” (EX1007 1:32-37.)

Clegg was first disclosed by the applicant in an October 11, 2024 supplemental IDS filed during prosecution of a successor patent after the '177 patent issued.

V. PERSON OF ORDINARY SKILL

A person of ordinary skill in the art as of the asserted priority date (“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. (EX1002, ¶¶54-56.)

Petitioner's expert, Dr. Almeroth, met this level by the priority date. (EX1002, ¶57.)

VI. CLAIM CONSTRUCTION

No express constructions are required to find the '177 patent claims invalid. As relevant, Petitioner addresses the plain meaning of certain terms in the analysis for the presented Grounds. (EX1002, ¶¶58-60.) The challenged claims have not been construed in other proceedings.

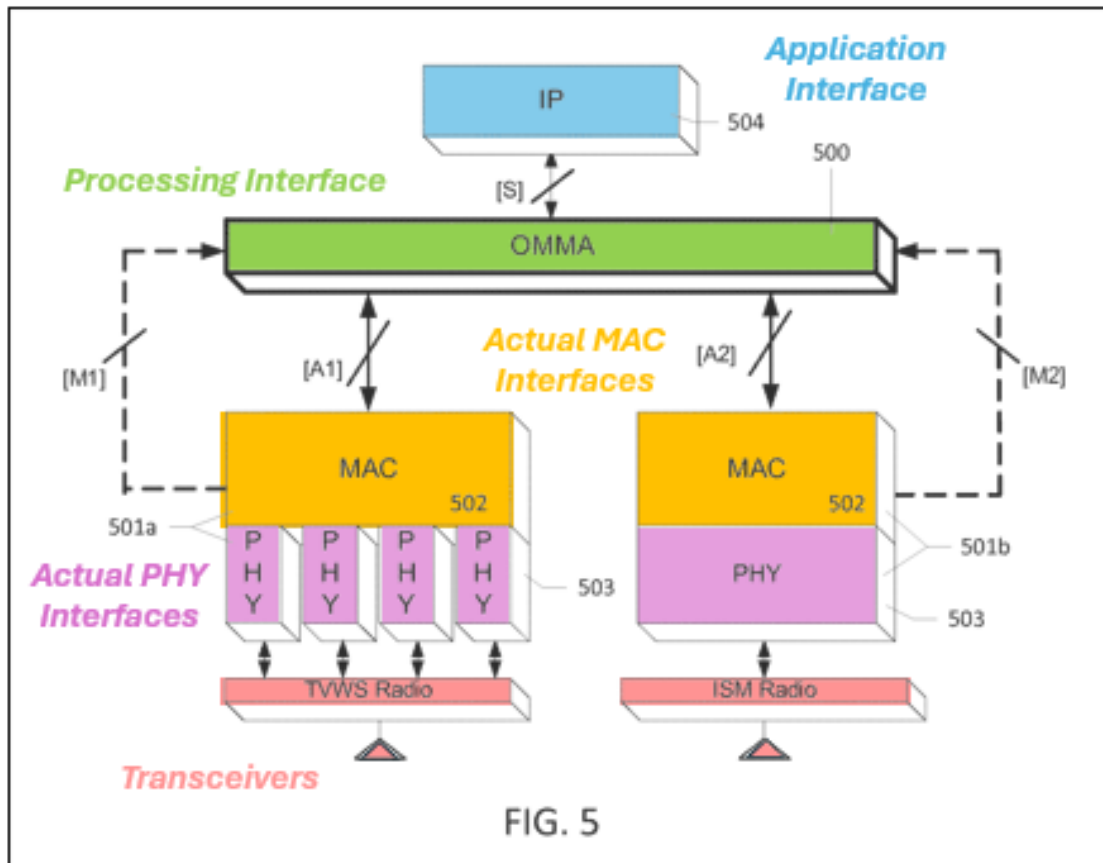
VII. GROUND 1: Chincholi in Combination with Clegg Renders Claims 1-26 Obvious¹

A. Overview and Motivation to Combine

Chincholi in combination with Clegg renders claims 1-26 obvious. (EX1002, ¶69). As discussed in more detail 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

¹ Unless noted otherwise, all emphases in quotes and annotations to figures from prior art references are added.

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, [0122-0123].)



Chincholi teaches continuous monitoring of the “number of available resources on the medium” and techniques for distributing IP packets across the RATs accordingly. (EX1005, [0161].) Chincholi’s approach enables the system to respond to bandwidth channels, or portions of bandwidth channels, becoming unavailable during transmission of a data stream. (EX1002, ¶70.) A POSITA would have understood that Chincholi’s monitoring and response techniques could be

further enhanced by the teachings of Clegg. (EX1002, ¶71.) Clegg teaches techniques for addressing carrier-specific interference within bandwidth channels, allowing for any given channel full usage of the channel bandwidth that is not unavailable for communication. Like Chincholi, Clegg arises in the field 802.11 wireless communication networks and is addressed to increasing bandwidth efficiency. (EX1009, 1:25-37.)

A POSITA would have been motivated to incorporate the teachings of Clegg to improve the Chincholi system by allowing it to more flexibly and efficiently utilize available bandwidth channels that may experience carrier-specific interference within the channels. (EX1002, ¶72.) Chincholi already teaches dynamic allocation of contiguous or non-contiguous channels, and Clegg merely provides additional detail on how to mitigate carrier-specific interference within any given channel. (*Id.*) The teachings of Clegg are complementary to Chincholi, and a POSITA would have recognized that Clegg's teachings could be easily implemented into Chincholi without technical challenge. (*Id.*)

In the analysis below, the combined prior art system will be referred to as Chincholi/Clegg. (EX1002, ¶73).

B. Limitation-By-Limitation Analysis

1. Claim 1

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

To the extent the preamble is limiting, Chincholi/Clegg discloses this limitation. (EX1002, ¶¶74-75.) Chincholi discloses “[s]ystems, methods, and instrumentalities . . . for managing multiple radio access technology (RAT) interfaces ...” (EX1005, Abstract; [0003]) and “[to] enable opportunistic RAT selection and aggregation for sending data traffic over the RAT interfaces.” (EX1005, [0003].) “In multi-RAT systems reception and/or transmission may be performed over multiple RATs. For example, a network terminal (NT) (e.g., an access point (AP) . . .) and a wireless transmit/receive unit (WTRU) . . . may communicate over multiple parallel paths.” (EX1005, [0002].)

Chincholi 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 adhoc mode, for example, in an IEEE802.11 based Wi-Fi system,” i.e., both are a wireless networking device. (EX1005 [0115].) A POSITA would have understood that Chincholi’s techniques would have improved the performance of the circuitry comprising the disclosed network terminals. (EX1002, ¶75.)

Thus, as discussed in the below limitations, Chincholi/Clegg discloses a method for improving the performance of circuitry. (*Id.*)

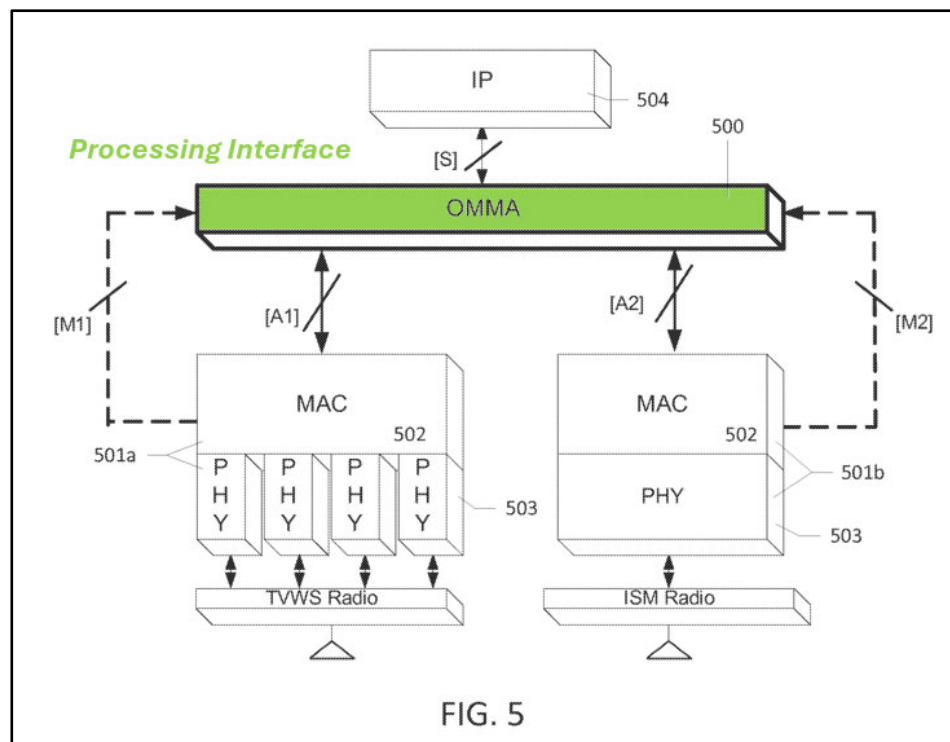
- b) **1[a]: providing a processing interface that is adapted to be connected to an application interface of a wireless networking device, the application interface being associated with a first application, the first application providing, after the circuitry has been connected to the application interface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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶76-81.)

“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*. Chincholi’s *processing interface* is its “**Opportunistic Multiple-Medium Access Control (MAC) Aggregation (OMMA) layer.**” (EX1005, [0003].) A POSITA would have understood that the plain meanings of “interface” and “layer” in the context of the ’143 patent are congruent, which is underscored by the specification describing layers having the same functionality as the claimed interfaces, and the prosecution history of the prior related ’591 patent, where Applicant interchangeably used the terms “layer” and “interface” to describe Figure 1. (See EX1002, ¶77; EX1017, Aug. 8, 2023 Applicant Remarks; Sep. 28, 2023 Applicant Remarks.)

The OMMA layer is a common layer/module between the IP layer/module and the multiple RAT layers/modules. (EX1002, ¶78; EX1005, [0137]; *see also id.* [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 enabling a dual-RAT aggregation device in a 802.11n network is shown in Figure 5:

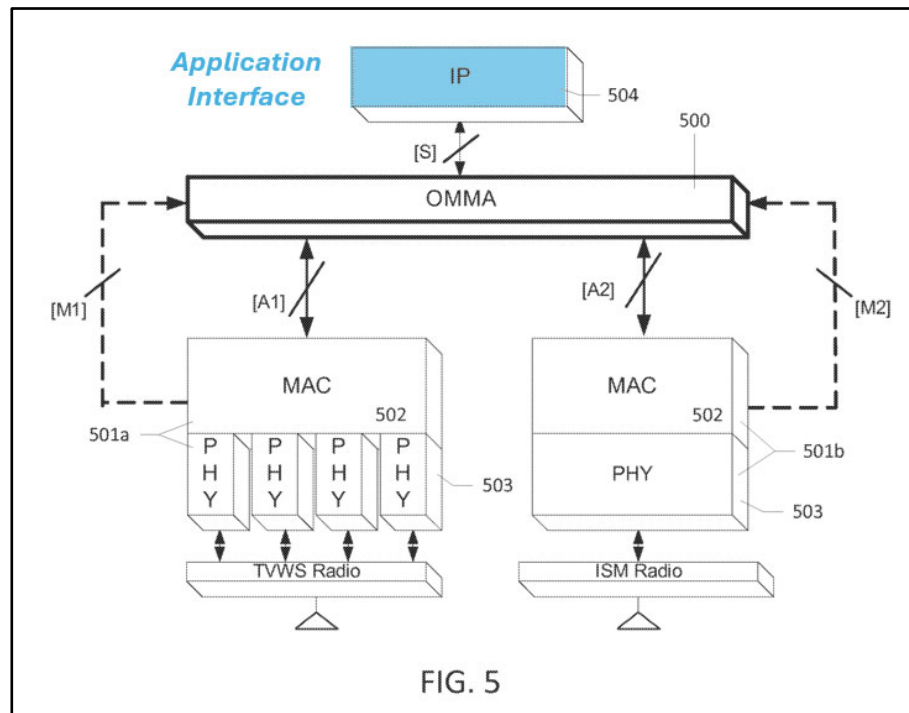


The IP layer (*i.e.*, an “application interface,” as discussed below) is connected to the OMMA layer and provides IP packets that the OMMA layer processes. (EX1005, [0137]); (EX1002, ¶79.) The OMMA “may allow for enhanced throughput and reduced latency for a single IP flow.” (EX1005, [0120].) The OMMA layer is therefore a processing layer, which processes IP packets and

provides an *interface* between the IP layer and actual MAC layers, *i.e.*, a *processing interface*.

“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.” (EX1002, ¶80; EX1005, [0191].) The *first data stream* of a first application is referred to as an “IP flow.” (EX1005, [0132] (“A single IP flow may refer to a stream of IP packets belong to a particular application.”)) In an 802.11 embodiment (Figure 5), IP packets associated with an application data stream come from or are destined for an IP layer 504, and thus the IP flow (*i.e.*, *first data stream*) is provided by the application after the circuitry of the wireless device has been connected to the application interface and *when the wireless networking device is being used*. (EX1005, [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*.



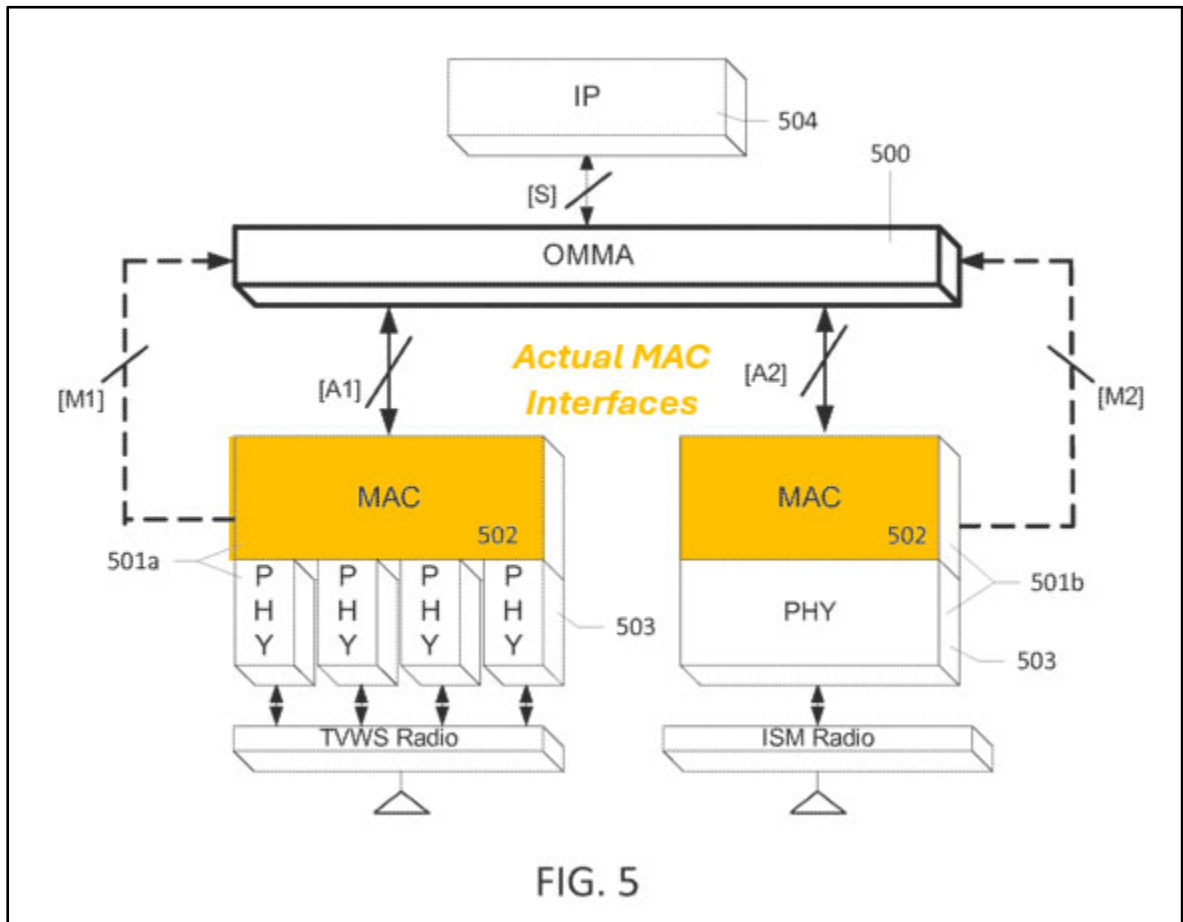
“first application ... having a first wireless bandwidth requirement”

Chincholi teaches “a bandwidth requirement for an IP flow.” (EX1002, ¶81; EX1005, [260].)

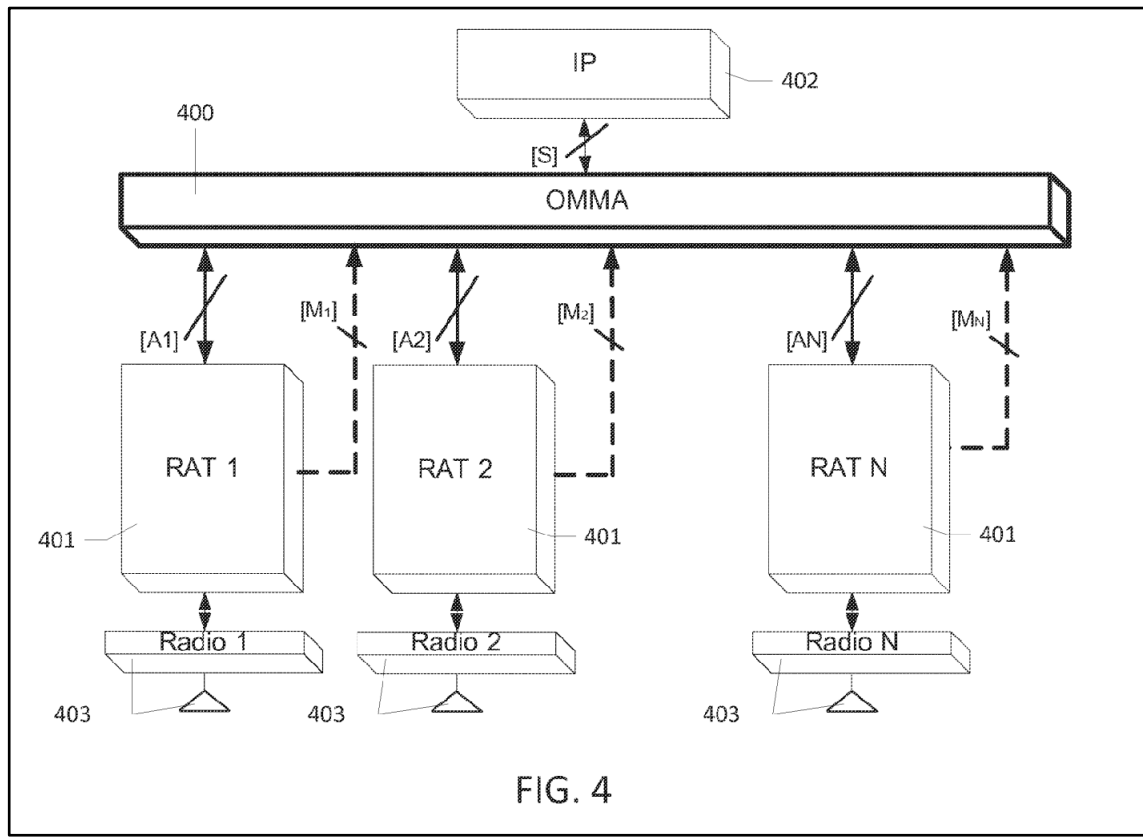
c) 1[b]: connecting first, second and third actual MAC interfaces to the processing interface;

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶82-84.) Chincholi discloses first, second, and third **actual MAC interfaces** connected to the processing interface (*i.e.*, the common OMMA layer.) (EX1002, ¶82.) Figure 5, for example, depicts a “dual-RAT aggregation” with the common OMMA layer existing above and connected to two RATs 501a and 501b, which comprise first and second actual MAC interfaces 502, respectively. (EX1005, [0138] (“***The RATs 501a, 501b may***

comprise a **MAC layer/module 502** and one or more physical layers/modules 503.”.))



While Figure 5 depicts only first and second actual MAC interfaces, Chincholi discloses that there can be any number of MAC interfaces in an 802.11 implementation. (EX1002, ¶83.) For example, Figure 4—a more general block diagram of the architecture set forth in Figure 5—depicts the OMMA layer existing above any number of RATs.

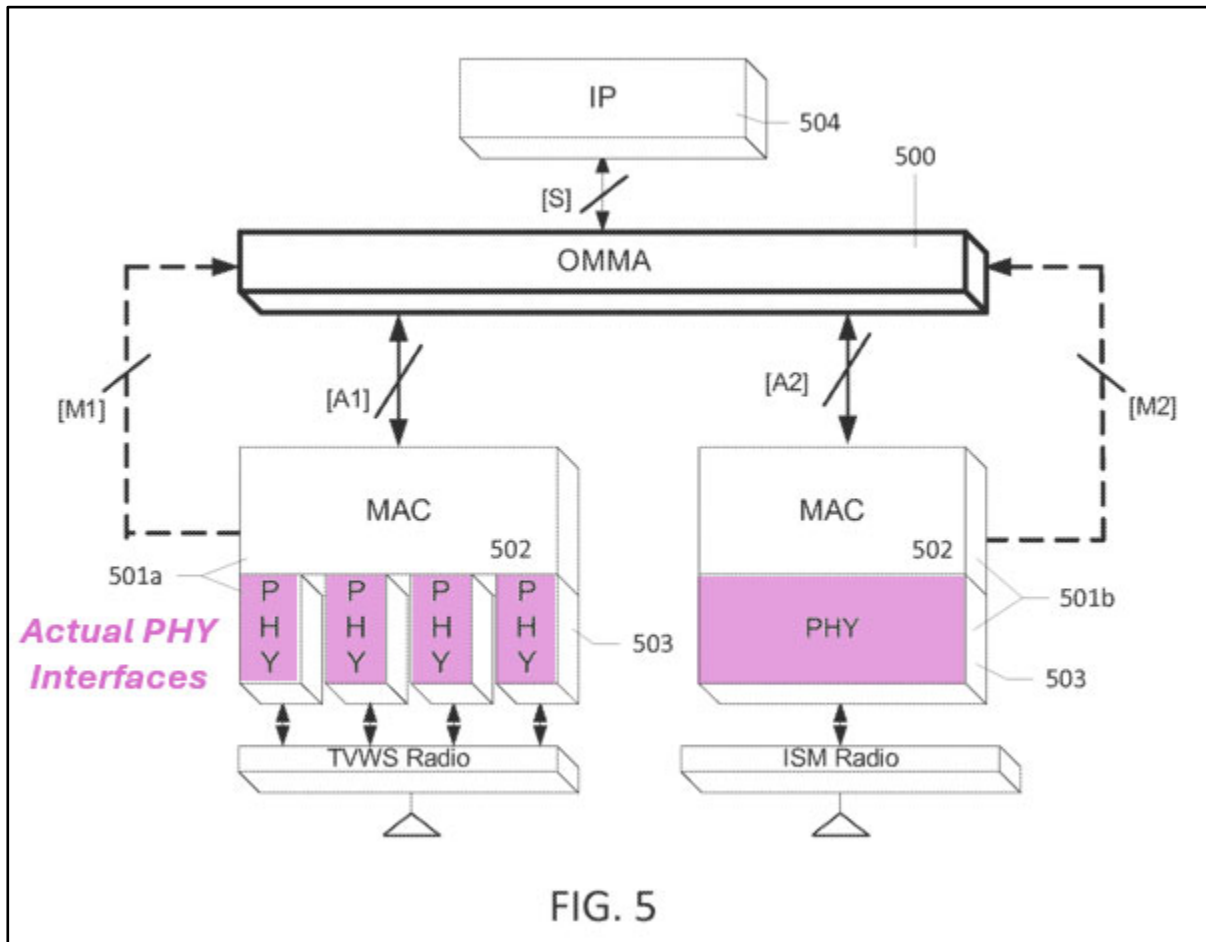


Consistent with Figures 4 and 5, Chincholi explains that a given “RAT 401” can comprise a “PHY/MAC,” i.e. includes an actual MAC interface. (EX1005, [0135].) A POSITA would have understood that in a typical 802.11 implementation, each one of the three RATs would have actual MAC and PHY interfaces. (EX1002, ¶84.)

- 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;

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶85-86.) Each RAT in Chincholi comprises *one or more physical layers*. (EX1005, [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 actual MAC interfaces. (EX1002, ¶85.)



As discussed above, limitation 1[b], Chincholi Figure 4 and its associated description disclose a common OMMA layer existing above any number of RATs. In an 802.11 system, each RAT shown in Figure 4 would correspond to an actual MAC-PHY pair, thus disclosing connecting first, second and third actual PHY interfaces to first, second, and third actual MAC interfaces. (EX1005, [0135]);

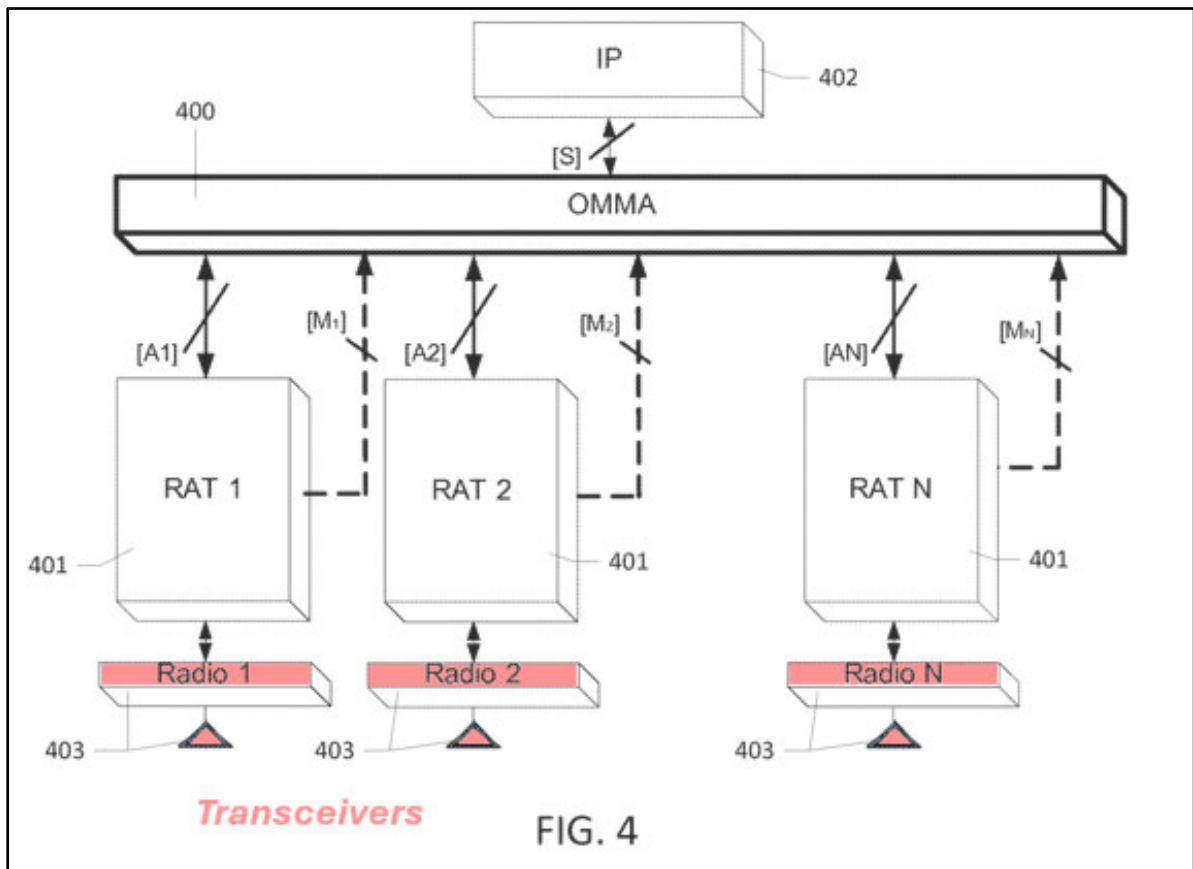
(EX1002, ¶86.)

- 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;**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶87-94.)

“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 how each actual PHY interface of each RAT is associated with an antenna/radio frequency (RF) front-end pair. (EX1005, [0133].) The antenna/radio frequency (RF) front-end pairs in Figures 4 and 5 include first, second, and third transceivers. (EX1002, ¶88.)



A POSITA would have understood that a “transceiver” is a physical device that can both transmit and receive information. (EX1002, ¶89.) Thus, each of Chincholi’s disclosed “antenna/RF front-end pairs” are a transceiver because they operate on wireless protocols that both transmit and receive data, such as IEEE802.11, IEEE802.11ac, IEEE802.11af, LTE, WCDMA, etc. (Ex. 1005, [0134].) A POSITA would have further understood that the transceivers in Figures 4 and 5 would be associated with the actual PHY layer of each respective RAT, as the PHY layer is understood as the physical connection between a transceiver and the rest of the RAT. (*Id.*)

Chincholi also teaches that each RAT may implemented as a Wi-Fi RAT, and thus their associated transceivers are suitable for use in a wireless local area network. (Ex. 1005, [0134]; EX1002, ¶90.)

“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. (EX1002, ¶91.) Indeed, Patent Owner has alleged in the parallel litigation that this limitation may be met by each of the three wireless transceivers having one respective bandwidth availability up to an actual bandwidth. (*Id.*; EX1013, 19-20.)

Consistent with PO’s infringement contentions, a POSITA would have recognized that each transceiver has an “actual” bandwidth (i.e., total bandwidth of the transceiver) with a “bandwidth availability” that may be a subset of the actual bandwidth (*i.e.*, sub-portions of the total bandwidth that are available for use.) (EX1002, ¶92.) Indeed, as Chincholi teaches, the RATs associated with each transceiver provide “meta-data feedback” allowing the OMMA layer to split IP packets amongst the RATs based on their available bandwidth. (EX1005, [0138]; [0161] (listing “Channel bandwidth(s)” sent by the PHY layer as an example of “feedback metric[] used by an OMMA layer”); *id.*, [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 up to an actual bandwidth.

“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 emit radio waves in its own respectively frequency band. (EX1002, ¶93.) Indeed, Patent Owner, has read this limitation to only require that each transceiver emit on a single, mutually exclusive frequency band. For example, in its infringement contentions, Patent Owner alleges that this limitation is met by 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.” (*Id.*; EX1013, 19.)

In Chincholi, the transceivers of each RAT are adapted to emit radio waves in respective different bands of frequencies, consistent with PO’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 2.4GHz ISM band, a 802.11af PHY/MAC operating over 512 MHz-698 MHz TVWS band, an LTE RAT operating of a licensed band (e.g., 700 MHz band), a Bluetooth RAT operating on 2.4 GHz ISM band, etc.” (EX1005,

[0135].) Thus, a POSITA would understand that Chincholi discloses this limitation under PO's interpretation. (EX1002, ¶94.)

- 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;**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶95-103.) According to the '177 patent, the virtual MAC layers “enable[s] simultaneous allocation of multiple PHY resources for different signal types associated with different applications.” (EX1001, 3:51-54.) The patent states that the virtual MAC layer comprises the functionality of “decision,” “processing,” and “ultra streaming” blocks. (EX1001, 3:49-50.) The patent does not disclose or describe a generic “resource monitoring interface” (EX1002, ¶95), which as discussed above, *supra* Section IV.A.3, was added to the claim to replace the originally recited “virtual PHY interfaces” in a post-NOA broadening amendment. (EX1004, June 18, 2024 Request for Continued Examination with Preliminary Amendment).

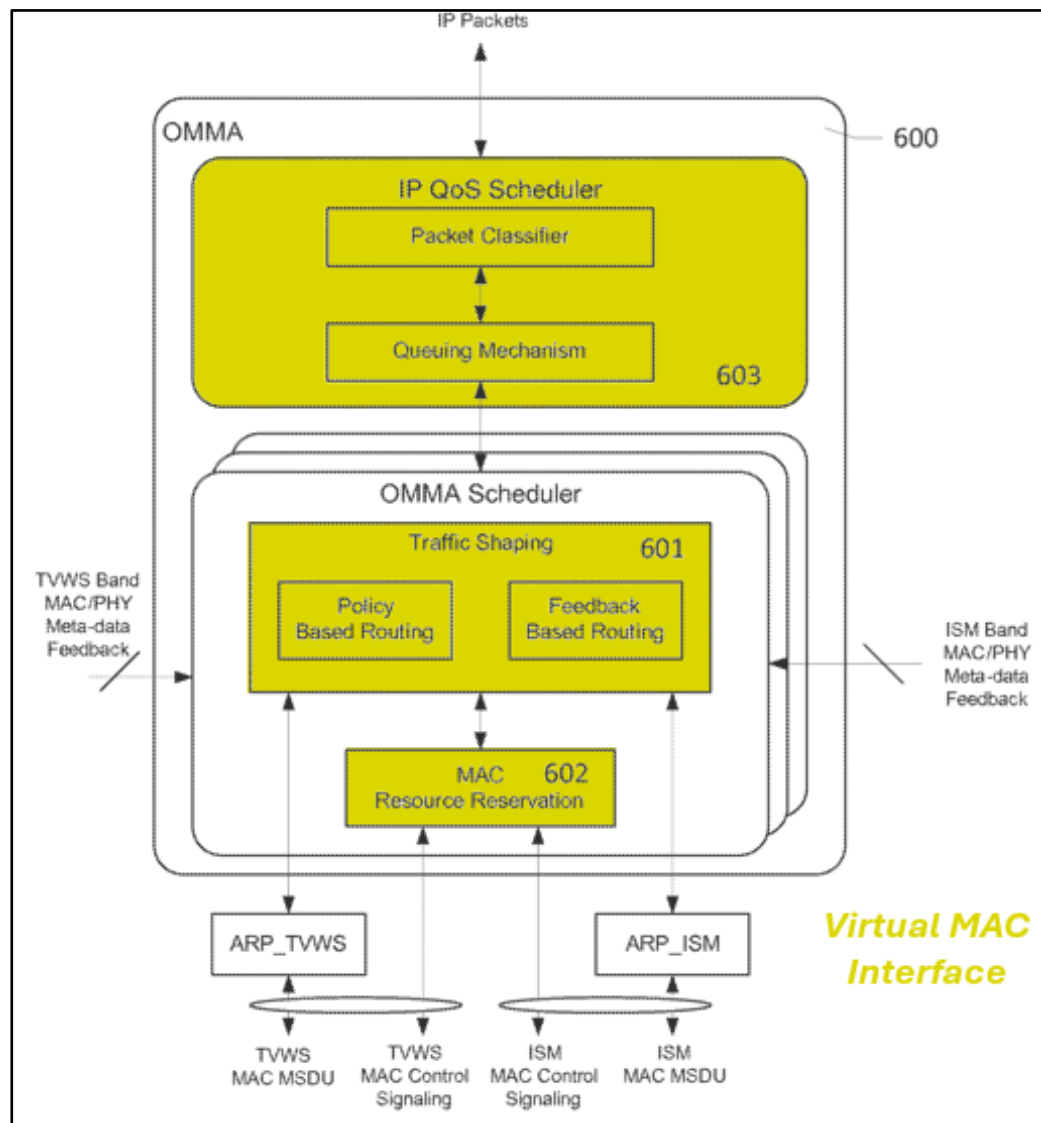
The patent's description of the “virtual PHY layer” provides that a virtual PHY may include multiple RF blocks, each representing the virtual use of some set of allocated transceiver resources. (EX1001, 4:51-54; *see also* Fig. 3 (depicting two

RF blocks associated with “two sets” of transceiver resources.)) “By 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, 6:4-8; EX1002, ¶96.)

First, Chincholi discloses that the OMMA (*i.e.*, the processing interface) includes the claimed “virtual MAC interface” formed within it. Indeed, “OMMA” is an abbreviation for “opportunistic multi-medium access control (MAC) aggregation,” which refers to the fact that the OMMA layer aggregates multiple MAC interfaces, as depicted in Figure 5. (EX1005, [0120].) The OMMA layer includes an interface acting as a “virtual MAC interface” because it transparently “distributes and/or combines” packets between the IP layer and the RATs. (EX1005, [0192].) A POSITA would have recognized that this “virtualizes” a MAC interface because the OMMA would effectively appear to the IP layer as a single interface for exchanging packets that are ultimately sent or received by the actual MAC-PHY pairs. (EX1002, ¶97.)

Chincholi’s OMMA layer also includes all of the functionality that the ’177 patent associates with the “virtual MAC interface.” Specifically, Figure 6 of Chincholi is a block diagram of an OMMA layer, comprising an IP QoS Scheduler 603, a MAC Resource Reservation module 602, and a Traffic Shaping Module 601.

(EX1005, [0139]; EX1002, ¶98.)



The IP QoS Scheduler classifies incoming packets of a packet stream, and may segregate them into distinct IP QoS streams (EX1005, [0143]), which a POSITA would have recognized to fulfill the functionality of the “decision block” of the ’177 patent’s virtual MAC interface (EX1002, ¶99; *see also* EX1001, 8:16-21.) The MAC Resource Reservation module determines the time duration or

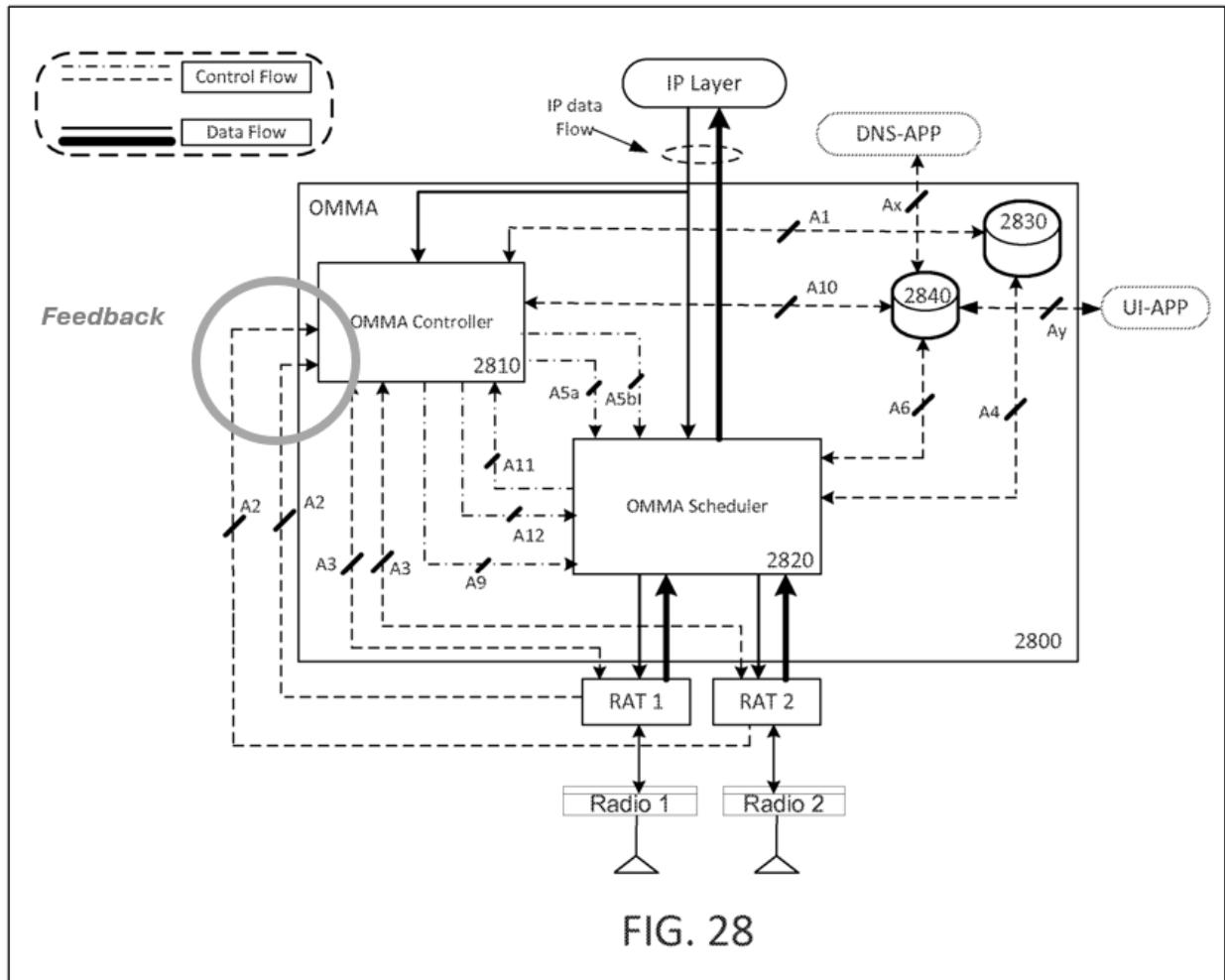
spectral fragment/bandwidth required by a packet or set of packets (EX1005, [0142]), which a POSITA would have recognized to fulfill the functionality of the “processing block” of the ’177 patent’s virtual MAC interface (EX1002, ¶99; *see also* EX1001, 8:21-23.) Finally, the Traffic Shaping module determines the way packets are routed across RATs using either policy-based routing or feedback-based routing (EX1005, [0139]), which a POSITA would have recognized to fulfill the functionality of the “ultra-streaming block” of the ’177 patent’s virtual MAC interface (EX1002, ¶99; *see also* EX1001, 8:23-28.) Thus, a POSITA would have recognized that Chincholi’s OMMA layer includes a “virtual MAC interface.” (EX1002, ¶99.)

Second, Chincholi discloses that its processing interface comprises the “at least one resource monitoring interface formed in the processing interface” that, during operation, feeds information regarding the bandwidth availabilities of the first and second wireless transceivers back to the at least one virtual MAC interface. A POSITA would understand that according to its plain and ordinary meaning, a “resource monitoring interface formed in the processing interface” requires merely a component capable of receiving feedback statistics regarding the available resources of the wireless transceivers. (EX1002, ¶100.)

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

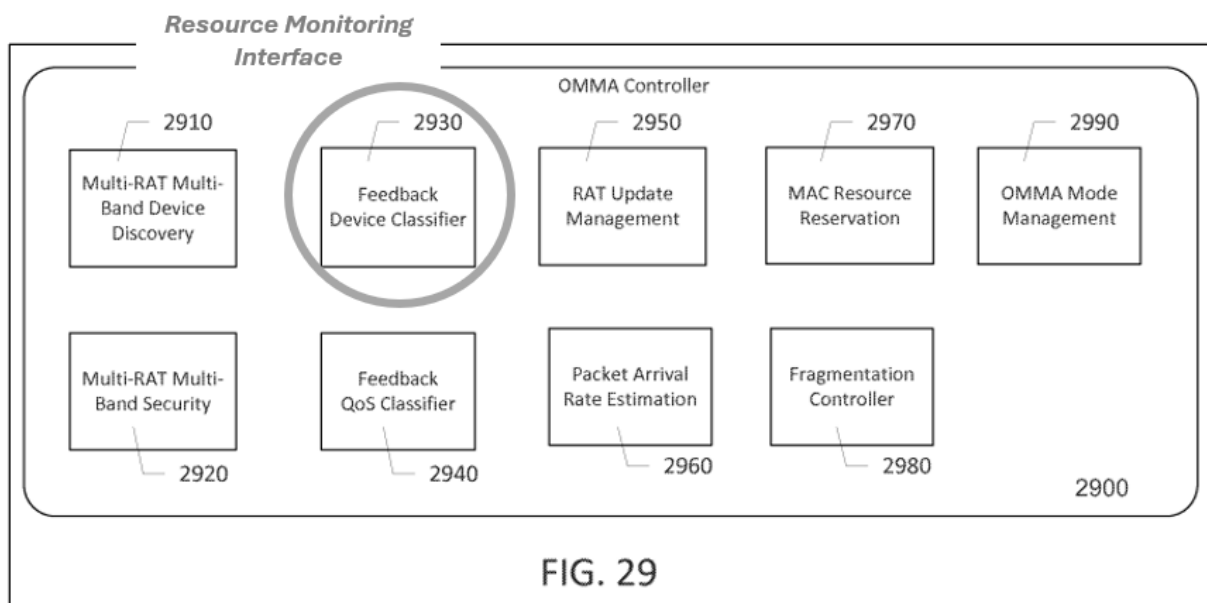
module of the OMMA (*i.e.*, part of the “virtual MAC interface”) may determine packet routing using “feedback based routing.” (EX1005, [0139].) In feedback-based routing, “the OMMA transmitter may use measurement metrics fed back from each RAT,” which include “channel quality metrics and the number of available resources on the medium,” *i.e.* information regarding bandwidth availabilities. (EX1005, [0161]; EX1002, ¶101.)

Figures 28, 29, and their associated descriptions describe how Chincholi collects feedback from each RAT for the traffic shaping module. Figure 28 illustrates how the OMMA layer includes an OMMA Controller, which interfaces with each RAT to collect metrics regarding the channel quality and number of resources available on the medium. Specifically, using 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, [0205]; EX1002, ¶102.)



Moreover, the OMMA Controller includes *a Feedback Device Classifier module 2930*. (EX1005, [0205].) The Feedback Device Classifier collects information regarding the first and second transceiver resources/requirements over the “A2” interfaces in the diagram above 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.” (*Id.*) A POSITA would have recognized that the ability of the *Feedback Device Classifier module* of the OMMA Controller to collect feedback per device, per access category supported by each RAT discloses the “*resource monitoring interface*” as claimed by the ’177 patent. (EX1002, ¶103.)



- 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,**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶104-107.)

“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.*, processing interface) is configured to operate in a manner transparent to any higher layer. For example, Chincholi discloses that “[t]he OMMA layer may be transparent, in that it distributes and/or combines packets from different RATs and forwards the packets to the IP layer.” (EX1005, [0192], [0126].) This is as opposed to a “non-transparent” configuration in which the OMMA layer would “add[] additional headers at the transmitter, and/or reads and removes the headers at the receiver.” (EX1005, [0126]; EX1002, ¶105.)

“(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 for network terminals and WTRUs to discover one another using active and passive scanning procedures. (EX1005, [0145].) After an authentication procedure, Chincholi discloses that WTRUs may transmit a request to associate with one or more RATs of the network terminal and the network terminal may provide an association response signal accepting or rejecting the request of the WTRU. (EX1005, [0149].) A POSITA would have recognized these scanning procedures disclose the ability of Chincholi’s OMMA layer to request or create a first, second, and/or third association between a recipient and the first, second, and/or third actual MAC and PHY interfaces, respectively. (EX1002, ¶106.)

When operating transparently with respect to higher layers, Chincholi’s OMMA layer handles the request/response and creation of associations with WTRUs. (EX1005, [0127] (“[A]ssociation 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.”.) Thus, a POSITA would have recognized that the request or creation by Chincholi’s OMMA layer of associations between recipients and the actual MAC and PHY interfaces would be performed in a manner transparent to

higher level layers. (EX1002 at ¶107.)

- 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,**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶108-110.) Chincholi teaches that NTs and WTRUs communicate with one another over “channels,” which are portions of a transceiver bandwidth availability. Specifically, “[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.*” (EX1005, [0118]; [0121] (“An 802.11 based system may operate in a time division duplexing (TDD) mode, for example, *on a band over a single 20/40MHz 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”); *see also* EX1002, ¶108)

Chincholi also discloses identifying available bandwidth channels for communication. The OMMA layer receives various feedback information from each RAT. (EX1005, [0123].) For example, “the OMMA transmitter may use measurement metrics fed back from each RAT,” which include “channel quality metrics and the *number of available resources on the medium.*” (EX1005, [0161].)

Amongst the available resources provided as part of the feedback information are the “number of channels” and “channel bandwidth” (*i.e.*, the width of the channel, such as 20/40 MHz in the case of the ISM band.) (EX1005, [0161]; EX1002, ¶109.)

A POSITA would have understood that the ability of Chincholi’s OMMA layer to receive from each RAT a number of channels and channel bandwidth is an identification of “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) of the first actual bandwidth of the first wireless transceiver. (EX1002, ¶110.)

A POSITA would have also 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. (*Id.*)

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

Chincholi/Clegg disclose this limitation. (EX1002, ¶¶111-116.) A POSITA would have understood that the plain meaning of a resource being “unavailable” in the context of the ’177 patent broadly includes resources that are partially or completely unavailable or that have less bandwidth availability than another resource. Indeed, during prosecution of the prior related ’591 patent, the applicant expressly stated in arguing patentability to overcome a prior art rejection 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." (See EX1002 ¶¶111; EX1017, Aug. 8, 2023 Applicant Remarks).

As discussed above, *see* limitation 1[e], Chincholi discloses "feedback based routing" wherein the "number of available resources on the medium" of each RAT is monitored and IP packets are distributed across the RATs accordingly. (EX1005, [0161].) The OMMA layer may, for example, maintain a "RAT capability database" storing the available RAT capability for an associated WTRU/NT (EX1005, [0233], and "continuously updat[ing]" this information based on feedback metrics, (EX1005, [235].) A POSITA would have understood Chincholi's use of feedback metrics to continuously monitor available resources to disclose the capability to evaluate whether any given resources of the first identified bandwidth portion are unavailable for communication. (EX1002, ¶112.)

In addition, evaluating unavailability of given resources within the first identified bandwidth portion is further taught by Clegg. (EX1002, ¶113.) Clegg teaches 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, 1:25-28.) To accomplish this, Clegg

teaches the use of an “ultra-wideband tuner to *evaluate* the entire available spectrum between several communication bands.” (EX1009, 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, 4:5-9.) Each carrier is evaluated to determine whether interference is “too high or above a threshold amount.” (EX1009, 7:16-17.) Clegg can use this information to create a “channel map” identifying the available carriers across entire communication bands or discrete sub-channels “so that a user can select subcarriers from across those bands to form a cluster for communication.” (EX1009, 7:19-22.)

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. (EX1002, ¶114.)

For the reasons discussed above, *see* Section VII.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. (EX1002, ¶115.)

Thus, Chincholi/Clegg discloses evaluating the given resources of the first identified actual bandwidth portion to determine whether the portion is unavailable for communication. (EX1002, ¶116.)

- 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;**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶117-121.) Clegg teaches the ability of an 802.11 network terminal to use a first wireless transceiver, without requiring disassociation of the recipient from the access point, to transmit a data stream using only the subset of frequencies that are not unavailable for communication. (EX1002 ¶117.)

Specifically, after evaluating the interference levels of each carrier across the available spectrum, Clegg teaches a capability for “notching out” specific OFDM subcarriers that suffer an unduly high amount of interference. (EX1009, 7:15-19.) The remaining carriers, which are suitable for communication, are selected to comprise a “cluster of carriers for communication.” (EX1009, 4:9-10.) The cluster

of carriers 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, 4:11-15.) A POSITA would have recognized that Clegg’s selection of a cluster of carriers enables transmission of the first data stream using only the subset of frequencies/given resources of the first identified bandwidth portion that are not unavailable. (EX1002, ¶118.)

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. (EX1002, ¶119.)

Indeed, a POSITA would have recognized the desirability of implementing Chincholi combined with the teachings of Clegg to transmit the first data stream to the recipient without requiring “disassociation” of the recipient from either or both of the first and second actual MAC and PHY interfaces. For example, in the field 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-forming associations was inefficient and disruptive. (EX1002, ¶120; *see also* EX1008 (U.S. Patent 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), 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.”) Recognizing this issue, background prior art reference Wang described 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. (*Id.*, 24:63-25:57.)

In light of this background art, a POSITA would have recognized that in implementing the Chincholi/Clegg combination, it would be desirable implement known dynamic AID reassignment techniques to avoid disassociation of recipients during operation including throughout any process of reallocating transceiver, channel, and/or bandwidth resources to a recipient. (EX1002, ¶121.)

- 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,**

Limitation 1[j] is identical to limitation 1[g] except it relates to the second wireless transceiver instead of the first. A POSITA would have recognized from the analysis in limitation 1[g] that the Chincholi/Clegg combination discloses this limitation. (EX1002, ¶122.)

- 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**

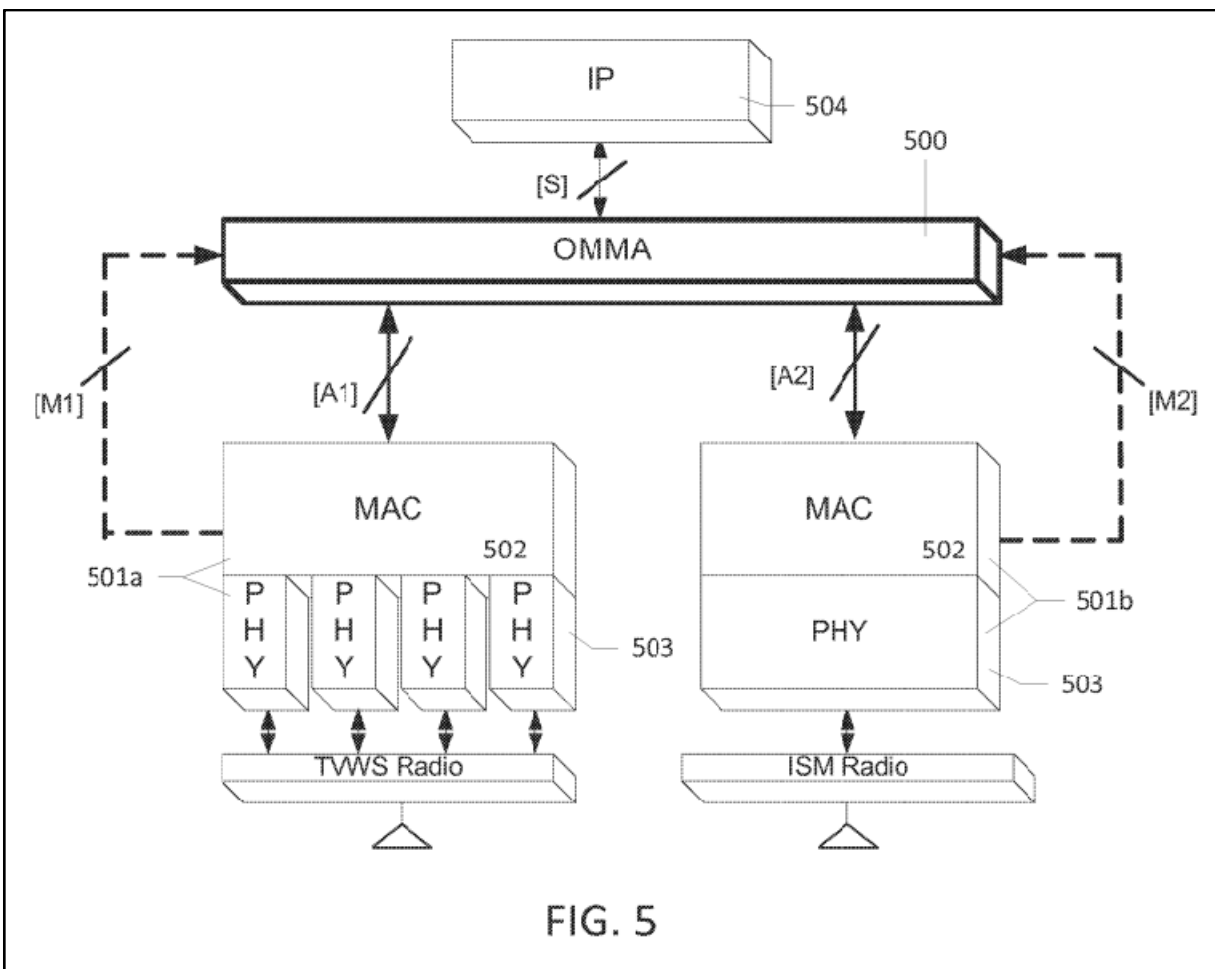
Limitation 1[k] is identical to limitation 1[h] except it relates to the second wireless transceiver instead of the first. A POSITA would have recognized from the analysis in limitation 1[h] that the Chincholi/Clegg combination discloses this limitation. (EX1002, ¶123.)

- 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**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶124-129.) 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 discussed in limitation 1[i], Chincholi/Clegg disclose using only those transceiver resources that are not unavailable to satisfy an application bandwidth requirement. (EX1002, ¶124.)

Moreover, the techniques of Chincholi/Clegg are equally applicable to

reception of a data stream. In addition to managing the transmission of an IP flow from its transceivers, Chincholi discloses how its OMMA layer enables management of the transceiver resources to receive an IP flow. (EX1002, ¶125.) Figure 5, for example, depicts a two-way data flow between the actual MAC layer and the OMMA layer on links “A1” and “A2” (EX1005, FIG. 5):



Further, Table 1 of Chincholi describes the “A1” and “A2” links of Figure 5 as involving both the “Incoming” and “Outgoing” MAC MSDUs (MAC service data units). (EX1005, [0138].) Indeed, Chincholi describes that the OMMA layer

aggregates bandwidth across multiple RATs, in a manner transparent to higher levels, to either “distribute[]” or “*combine[]*” packets from different RATs. (*Id.*) A POSITA would have understood the ability of the OMMA layer to “combine” packets relates to combining simultaneously received packets across multiple RATs from a single IP flow prior to transmission up to the IP layer. (EX1002, ¶126.)

A POSITA would have also recognized that the ability to implement Chincholi’s system to simultaneously transmit the first data stream using the first transceiver and receive the second data stream using the second transceiver. Because Chincholi’s system is capable of implementing multiple antenna/RF pairs, each operating on a different specific frequency band (EX1005, [0136]), a POSITA would have recognized the ability to implement Chincholi as a simultaneous transmit and receive system. (EX1002, ¶127).

Operating a multi-transceiver system like Chincholi to simultaneously transmit from one transceiver and receive from another was well-known and obvious to a POSITA at the time of the patent. (EX1002, ¶128.) This is explained, for example, in background reference U.S. Patent 10,567,147 (“DiFazio”) (EX1010). DiFazio, teaches that a “full duplex” system is one that transmits and receives the radio frequency RF signal simultaneously. (EX1010, 1:24-26.) This is most often accomplished by implementing “frequency division duplexing (FDD) where the Tx and RX bands may be sufficiently separated in frequency such that filters can

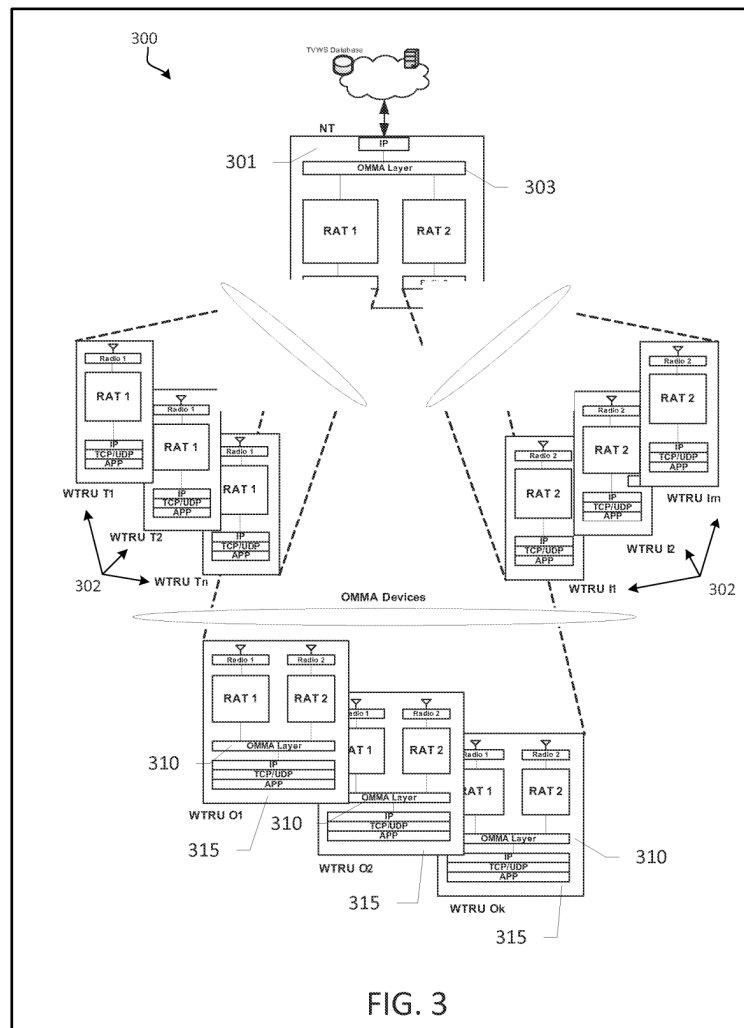
adequately attenuate any energy from the Tx signal that would leak into the Rx signal path and otherwise corrupt the Rx signal and prevent proper operation.” (EX1010, 1:26-31; *see also id.*, 16:51-67, 17:48-18:23.) Additionally, DiFazio teaches a “full duplex single channel” (FDSC) capability, wherein a base station may even simultaneously transmit and receive data streams in a single frequency channel. (EX1010 13:31-56.)

A POSITA would have been motivated to implement a simultaneous transmit and receive functionality into the system taught by Chincholi to achieve greater network efficiency and throughput. (EX1002, ¶129.) As DiFazio teaches, for example, the ability to simultaneously transmit and receive using FDSC can achieve 70% greater throughput as compared to conventional half-duplex systems. (EX1010 16:29-30.) To the extent not explicitly disclosed by Chincholi, implementing a simultaneous transmit and receive functionality into its disclosed system would have been technologically feasible and could be accomplished in straightforward manner with a reasonable expectation of success. (EX1002, ¶129.)

- 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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶130-133.) Chincholi discloses examples of “*multi-WTRU* multi-IP flow cases.” (EX1005, [0328].) For example, “[a] system may comprise *multiple WTRUs*, a single NT, and multiple IP flows from the NT to one or more WTRUs.” (EX1005, [0328].) This is disclosed, for example in Figure 3. (EX1002, ¶130.)



To manage data flows for multiple WTRUs, Chincholi teaches techniques for queuing packets according to their access categories and/or WTRU addresses and optimizing the distribution of packets of multiple streams for multiple WTRUs across multiple RATs. (EX1005, [0351]-[0356].) For example, Chincholi discloses a MAC layer of a given transceiver may implement multiple transmission buffers, denoted Q_{ik} , where “i” refers to the WTRU for which a group of packets is designated and “k” refers to the IP flow associated with the group of packets. (EX1005, [352]; EX1002, ¶131.)

Chincholi further discloses how utilization of the available transceiver bandwidth for one WTRU does not prevent other WTRUs from utilizing a range of frequencies corresponding to the remaining transceiver bandwidth at the same time. As discussed above, Chincholi’s OMMA layer receives feedback metrics from each RAT. (EX1005, [0161].) Amongst the feedback metrics are the “MAC Type,” for example “OFDMA.” (*Id.*, [0161], Table 2.) OFDMA stands for “Orthogonal Frequency Division Multiple Access,” which was a known wireless communication technique for dividing an available bandwidth into smaller subcarriers (*i.e.* frequency ranges) which are then allocated to different users. (EX1002, ¶132.) These subcarriers are described as orthogonal because they do not interfere with each other when simultaneously transmitted. A POSITA would have recognized that OFDMA techniques would allow multiple WTRUs to access different channels of the

transceiver resources simultaneously and without interference. (*Id.*)

Because Chincholi's RATs may provide feedback to the OMMA indicating that they are operating as an OFDMA MAC Type, a POSITA would have recognized that Chincholi discloses the capability to allow multiple WTRUs to simultaneously utilize different portions of a transceiver's available bandwidth. (EX1002, ¶133.)

- 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.**

Limitation 1[n] is identical to limitation 1[m] except it relates to the second wireless transceiver instead of the first. A POSITA would have recognized from the analysis in limitation 1[m] that the Chincholi/Clegg combination discloses this limitation. (EX1002, ¶134.)

- 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.**

Chincholi/Clegg discloses this limitation. (EX1002, ¶135.) Chincholi discloses that the wireless networking device comprises a "wireless access point."

(EX1005, [0002].) An example of Chincholi's network terminal ("NT") is an "access point" (AP.) (EX1005, [0002].) Indeed, Chincholi discloses that a node of its wireless communication network may include a "WiFi access point." (EX1005, [0115].)

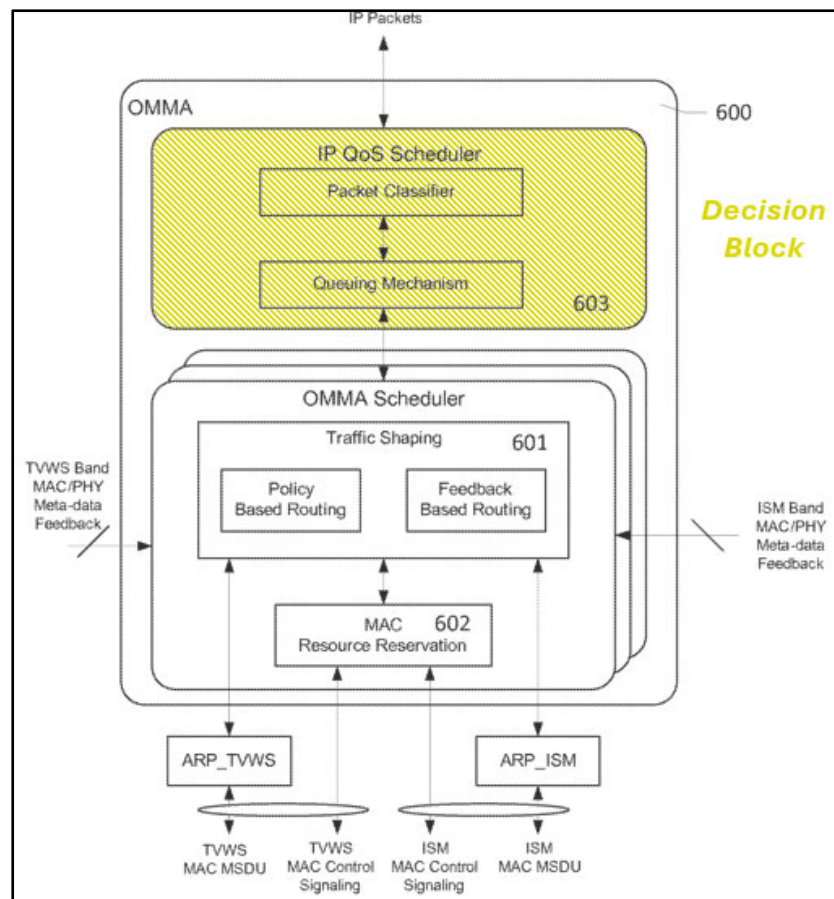
3. Claim 3: The method of claim 1, wherein at least two of the first, second and third frequency bands are specified in at least one member of the family of IEEE 802.11 standards that was in existence as of Oct. 30, 2013.

Chincholi/Clegg discloses this limitation. (EX1002, ¶136.) Chincholi teaches that its techniques can be used to implement an IEEE 802.11 based Wi-Fi system. (EX1005, [0121].) Thus, "[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. Moreover, a POSITA would have recognized that the 802.11 standards expressly disclosed ("11a/b/g/n") were in existence as of October 30, 2013. (EX1002, ¶136.)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶137-138.) 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, 8:16-21.)

Chincholi discloses the claimed *decision block* in the form of the *IP QoS Scheduler module 603*. (EX1002, ¶138.) As Chincholi teaches, “[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, [0143].)

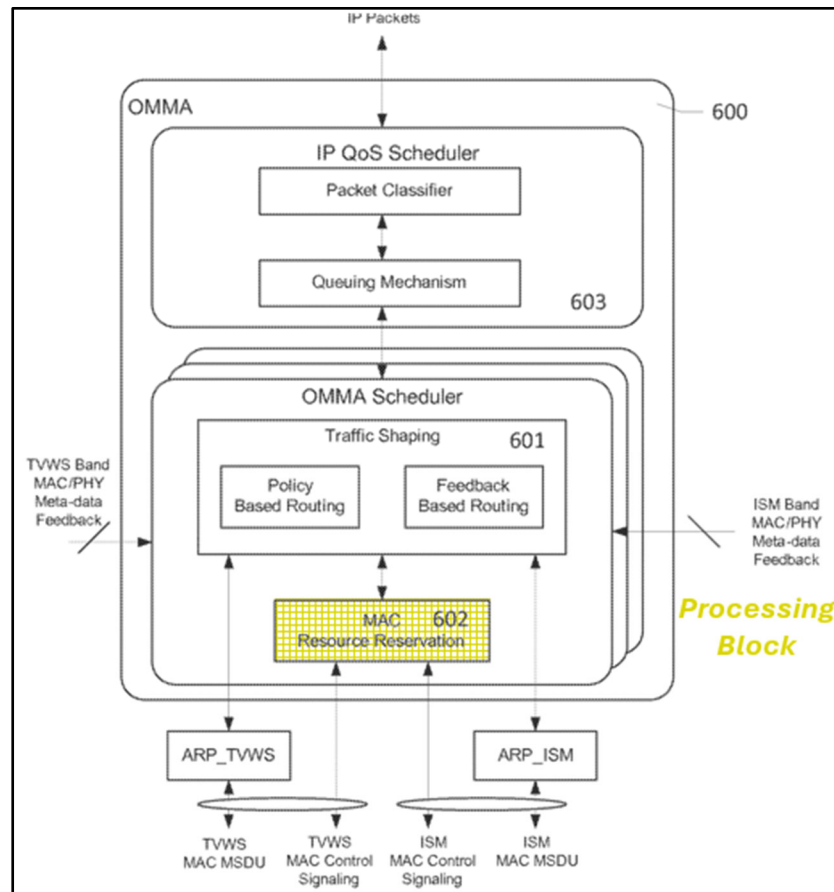


5. **Claim 5: The method of claim 1, wherein the at least one virtual MAC interface includes a processing block.**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶139-140.) 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, 8:21-23.)

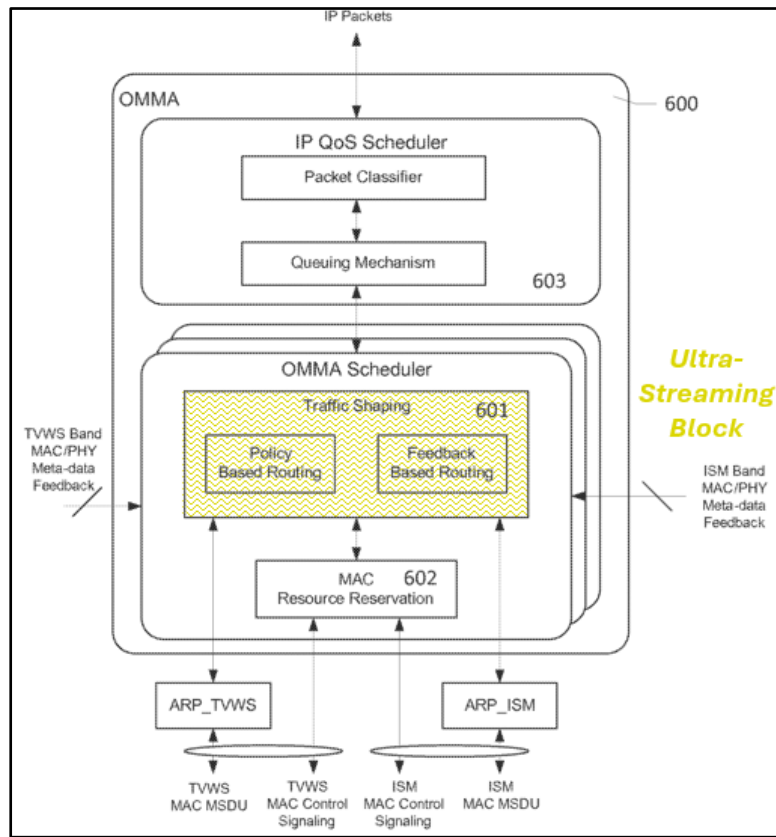
Chincholi discloses the claimed *processing block* in the form of the **MAC Resource Reservation module 602**. (EX1002, ¶140.) As Chincholi teaches, “[t]he **MAC Resource Reservation module 602** may determine an amount of time duration and/or spectral fragment/bandwidth required by a packet or a set of packets. This module may transmit specific requests to the RATs over the A1/A2 interface.” (EX1005 [0142].)



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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶141-142.) 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, 8:23-28.)

Chincholi discloses the claimed *ultra-streaming block* in the form of the *Traffic Shaping Module 601*. (EX1002, ¶142.) 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, [0139].)



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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶143-144.) 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, 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, 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, a POSITA would

have understood the claimed “RF block” to merely be a component of the resource monitoring interface capable of receiving and reporting information about the availability of RF resources. (EX1002, ¶143.)

As discussed for 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” interfaces 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, [0205].) Because this discloses the capability of receiving and reporting information about the availability of the transceiver resources (*i.e.*, RF resources), a POSITA would have understood the Feedback Device Classifier Module (*i.e.*, the “resource monitoring interface”) to comprise an “RF block.” (EX1002, ¶144.)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶145.) As discussed 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, [0205].) As shown in Figure 28, each RAT provides feedback information to the OMMA Controller over its own “A2” interface. (*Id.*, FIG. 28.) Thus, 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. (EX1002, ¶145.)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶146-148.) 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, [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.*)

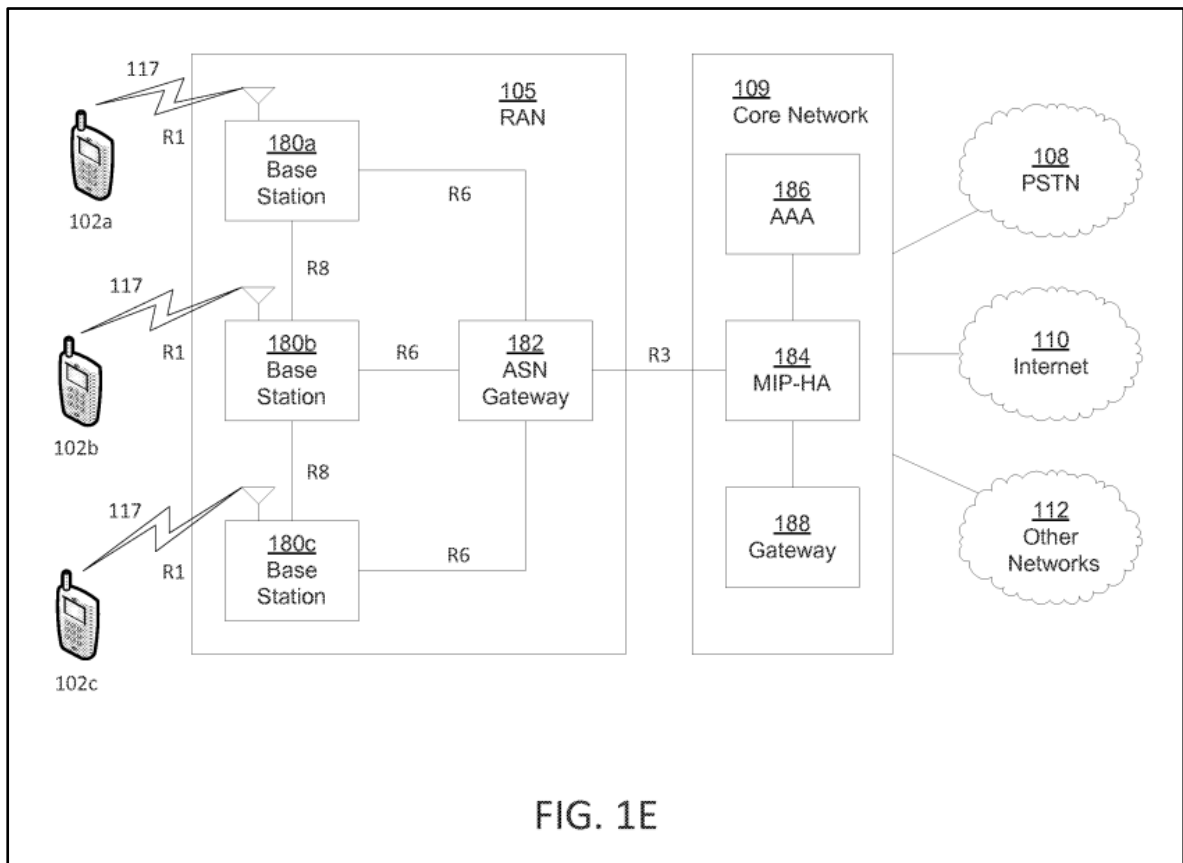
A POSITA would have been motivated to implement multiple Feedback Device Classifier Modules into the OMMA Controller of Chincholi. (EX1002, ¶147.) In a multi-RAT system with groups of similarly configured RATs, a POSITA would have been motivated to implement virtualized physical interfaces, each capable of collecting and consolidating the feedback metrics for its respective

grouping of similarly configured RATs. (*Id.*) Providing this sort of virtualized physical interface for transceivers in an 802.11 system is known to be particularly beneficial as it allows an access point to accommodate communication channels with wireless devices that may operate using various different generations of the 802.11 standards. (*Id.*) Virtualization of the physical interface for this purpose is taught, for example, in background reference U.S. Patent Application 2009/0141691 (“Jain”). (EX1007, [0034-0037]); (EX1002, ¶147.)

In implementing virtualized physical interfaces, a POSITA would recognize that each interface to a grouping of similarly configured RATs would comprise a separate, “resource monitoring interface.” (EX1002, ¶148.)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶149-150.) Chincholi discloses wireless communication systems comprising multiple base stations operating in a radio access network (RAN) that communicate with wireless devices using a multiple input, multiple output (“MIMO”) architecture. (EX1005, [0109].) This is disclosed, for example, in Figure 1E.



A POSITA would have recognized that each base station in Figure 1E would comprise its own OMMA layer (i.e., virtual MAC interface.) (EX1002, ¶150.) A POSITA would have further recognized that an additional obvious implementation would have been to combine the multiple virtual MAC interfaces of the system in Figure 1E into a single wireless communication device. (*Id.*) Combining this functionality into a single device could, for example, leverage common hardware increasing the efficiency of a base station. (*Id.*)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶151-153.) 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. (EX1002, ¶151.)

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, [0139].) In feedback based routing, “the OMMA transmitter may use measurement metrics fed back from each RAT,” which include “channel quality metrics and the ***number of available resources on the medium***.” (EX1005, [0161].) Using this feedback mechanism, the “OMMA layer may intelligently manage data traffic across multiple RATs as a function of the link quality of each RAT.” (EX1005, [0194].) The OMMA layer also 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, [0196].) Thus, the “OMMA layer may utilize MAC resource reservation to achieve ***globally optimal resource allocation*** across RATs.” (*Id.*)

From these disclosures, 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.

(EX1002, ¶153.)

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

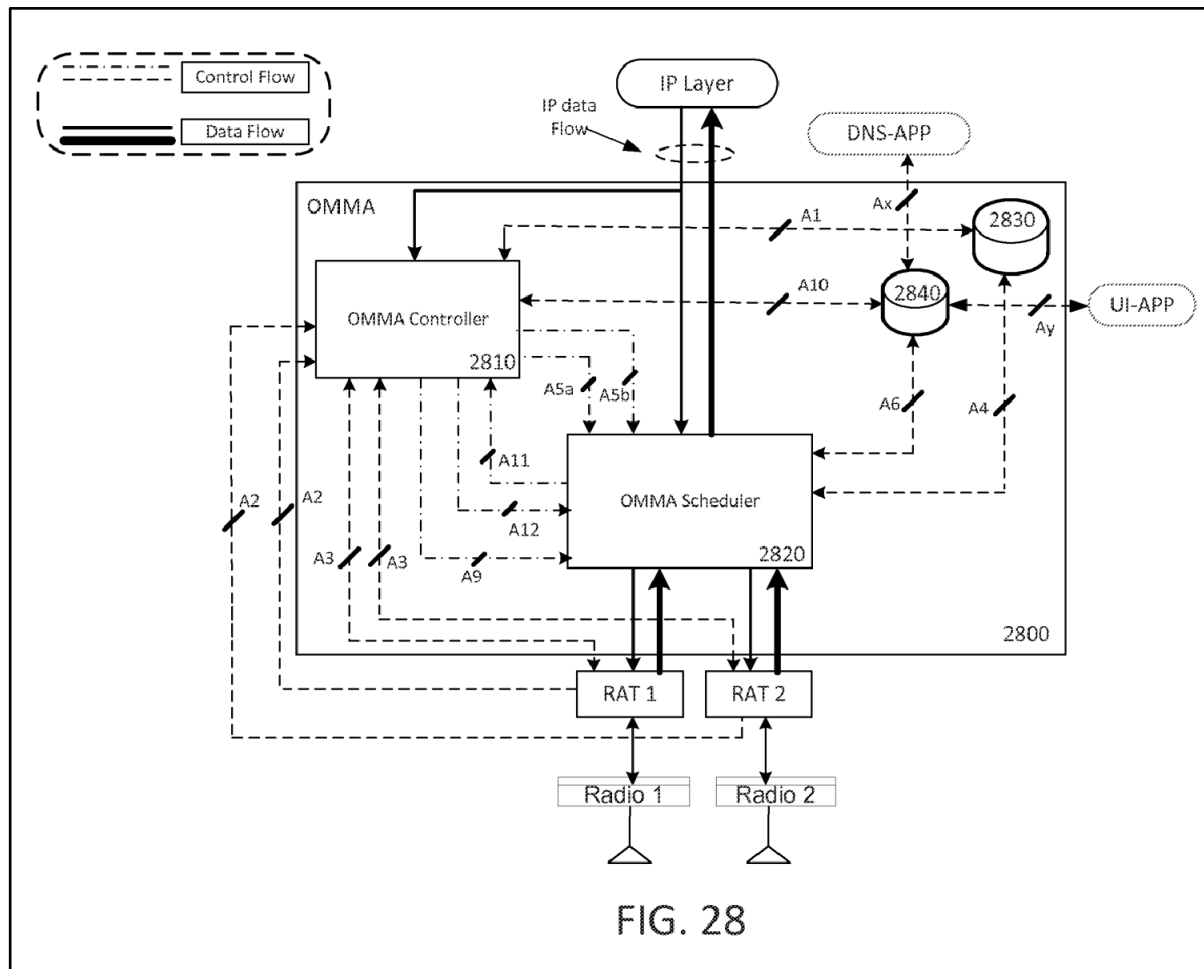
Chincholi/Clegg discloses this limitation. (EX1002, ¶¶154-155.) Chincholi discloses that a “NT and WTRU may communicate with each other over a single radio frequency (RF) spectral band, for example, 2.4GHz ISM band, or 5GHz ISM band, or TVWS band or 60GHz band, using a channel within the band *or aggregating multiple contiguous or noncontiguous channels.*” (EX1005, [0118].) A POSITA would have understood that where Chincholi identifies multiple contiguous channels within the band of the first identified actual bandwidth portion, that portion is contiguous. (EX1002, ¶154.)

Clegg further 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, 4:11-15; EX1002, ¶155.)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶156.) As 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, FIG. 28.) A POSITA would have understood from this disclosure that the resource monitoring interface is not contiguous with the virtual MAC interface. (EX1002, ¶156.)



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

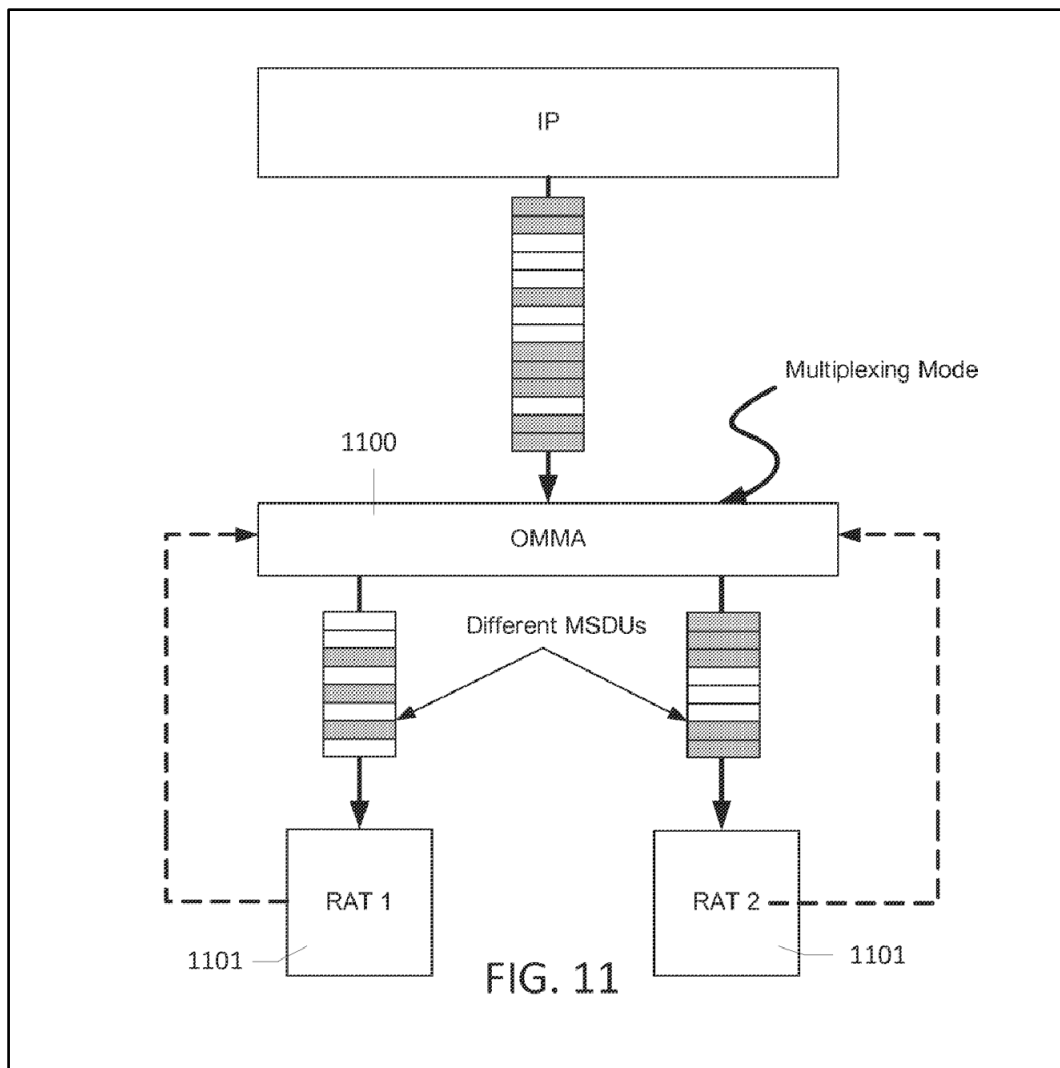
above the processing interface, aggregate the first identified actual bandwidth portion of the first wireless transceiver with an identified first portion of an available bandwidth of the third wireless transceiver to at least partially simultaneously transmit the first data stream to the recipient from both of the first and third wireless transceivers.

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶157-161.) As discussed for limitation 1[g], Chincholi discloses identifying available channels, or aggregations of channels, from multiple different RATs (EX1005, [0118]; [0121].) Based on its evaluation of transceiver bandwidth availability with respect to application bandwidth requirement, Chincholi may “aggregate” the bandwidth availabilities of the two transceivers (*e.g.*, the first and third transceiver) to simultaneously transmit the first data stream to the recipient using identified bandwidth portions of the two transceivers. (EX1005, [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.”); EX1002, ¶157).

Specifically, Chincholi discloses a “multiplexing mode” where, if the channel quality for one or more RATs is determined to exceed an upper threshold, the OMMA layer may transmit different independent IP packets from the same IP flow across one or more of the RATs. (EX1005, [0152].) In this scenario, Chincholi is able to reserve resources (*i.e.*, a specific subset of frequencies corresponding to the

identified portions of available bandwidth) of multiple transceivers and thereby aggregate the identified bandwidth portions of a first and third transceiver for simultaneous transmission. (EX1002, ¶158.)

Chincholi discloses simultaneous transmission of a first data stream using first and second transceivers. Figure 11, for example, shows how the OMMA layer splits a single IP stream of packets (*i.e.*, “MAC Service Data Units” or “MSDUs”) for transmission across two RATs simultaneously. (EX1002, ¶159.)



As Chincholi discloses, “[u]sing multiple RATs *simultaneously* may provide increased bandwidth and/or increased reliability for an application.” (EX1005, [0194]; EX1002, ¶160.)

Chincholi 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, [0192]; [0126]; EX1002, ¶161.)

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.

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶162-163.) As 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 may also “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. (EX1005, [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.”).)

Chincholi 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, [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.

For the reasons disclosed above in Claim 12, Chincholi/Clegg discloses this limitation. (EX1002, ¶164.)

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.

Chincholi/Clegg discloses this limitation. (EX1002, ¶165). As discussed above for Claim 14, Chincholi/Clegg discloses the capability of aggregating bandwidth from multiple transceivers to satisfy a bandwidth requirement of an application. (*Id.*) Additionally, as 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, 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. (EX1002, ¶165.)

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶166.) As 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.

For the reasons discussed above in Claim 12, Chincholi/Clegg discloses this limitation. (EX1002, ¶167.)

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,

For the reasons disclosed in Limitation 1[f], Chincholi/Clegg discloses this limitation. (EX1002, ¶¶168-171.)

- 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,**

For the reasons discussed above in Limitation 1[g], Chincholi/Clegg discloses this limitation. (EX1002, ¶169.) Just as Chincholi discloses identifying a first portion of bandwidth available for communication of the first wireless transceiver, it also discloses identifying a second portion of bandwidth available for communication of the first 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 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,**

For the reasons discussed above in Limitation 1[h], Chincholi/Clegg discloses this limitation. (EX1002, ¶170.)

- 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.

Chincholi/Clegg discloses this limitation. Based on its evaluation of transceiver bandwidth availability with respect to application bandwidth requirement, a POSITA recognizes 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. (EX1002, ¶171; EX1005, [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.*”))

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

Chincholi/Clegg discloses this limitation. (EX1002, ¶172.) Chincholi teaches that NTs and WTRUs communicate with one another over “channels,” which are portions of a transceiver bandwidth availability. (*Id.*) Specifically, “[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.*” (EX1005, [0118]; *id.* at [0121] (“An 802.11 based system may operate in a time division duplexing (TDD) mode, for example, on a band over a single 20/40MHz 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.”)) As such, a POSITA would understand that Chincholi discloses that bandwidth portions of the first wireless transceiver can be noncontiguous. (EX1002, ¶172.)

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,

For the reasons disclosed above in Limitation 1[f], Chincholi/Clegg discloses this limitation. (EX1002, ¶173.)

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,

For the reasons disclosed above in Limitation 1[j], Chincholi/Clegg discloses this limitation. (EX1002, ¶174.) Just as Chincholi discloses identifying a first portion of bandwidth available for communication of the second wireless transceiver, it 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**

For the reasons discussed above in Limitation 1[k], Chincholi/Clegg discloses this limitation. (EX1002, ¶175.)

- 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.**

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶176-177.) Based on its evaluation of transceiver bandwidth availability with respect to application bandwidth requirement, a POSITA recognizes 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. (EX1002, ¶176; EX1005, [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 not unavailable resources of the identified bandwidth portions of the second wireless transceiver to transmit the first data stream.

As discussed above for limitation 1[i], Chincholi’s bandwidth and transceiver management functions are performed without requiring “disassociation” of previously formed associations. (EX1002, ¶177.)

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

For the reasons discussed above in Claim 21, Chincholi/Clegg discloses this limitation. (EX1002, ¶178.)

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.

Chincholi/Clegg discloses this limitation. (EX1002, ¶¶179-180.) As discussed above, for limitation 1[l], Chincholi in light of background reference DiFazio teaches the use of the first transceiver to transmit a first data stream and the use of

the second transceiver to receive a second data stream. As DiFazio teaches, this transmit/receive functionality can be accomplished in a “full-duplex” manner (*i.e.*, simultaneously) using “frequency division duplexing (FDD).” (EX1010 1:26-31; *see also id.* 16:51-67, 17:48-18:23.) Alternatively, DiFazio teaches that this transmit/receive functionality can be accomplished non-simultaneously using “time division duplex (TDD) where the Tx and Rx signals may be separated by timeslots or other access schemes designed to prevent, or minimize, their overlap.” (EX1010 13:43-47; *see also* 1:47-48.) A POSITA recognizes that implementing Chincholi to use the first transceiver to transmit the first data stream and the second transceiver to receive the second data stream in a TDD manner, as taught by DiFazio, would mean that the transmission of the first data stream would *not* be simultaneous with reception of the second data stream. (EX1002, ¶180.)

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.

For the reasons discussed above in limitation 1[I] and Claim 24, Chincholi/Clegg, in light of background reference DiFazio, discloses the capability to transmit the first data stream simultaneously with receiving the second data stream. (EX1002, ¶181.)

- 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.**

For the reasons discussed above in limitation 1[l] and Claim 24, Chincholi/Clegg, in light of background reference DiFazio, discloses the capability to transmit the first data stream simultaneously with receiving the second data stream. (EX1002, ¶182.)

VIII. CONCLUSION

For at least the foregoing reasons, this Petition should be instituted.

Respectfully submitted,

Date: July 10, 2025

/s/ James M. Glass

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CERTIFICATION UNDER 37 C.F.R. § 42.24

Under the provisions of 37 C.F.R. § 42.24, the undersigned hereby certifies that the word count for the foregoing Petition for *inter partes* review (excluding the table of contents, table of authorities, mandatory notices, certificate of service or word count, and appendix of exhibits or claim listing) totals 11,644 words, which is within the word limit allowed under 37 C.F.R. § 42.24(a)(i.)

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. §§ 42.6(e), 42.105(a), the undersigned hereby certifies service on the PO of a copy of this Petition and its respective exhibits at the official correspondence address for the attorneys of record for the '177 patent as shown in USPTO PAIR via FedEx:

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