

Paper No. ____

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

T-MOBILE USA, INC.
Petitioner

v.

DALI WIRELESS, INC.
Patent Owner

Case IPR _____
U.S. Patent No. 11,026,232
Issued: June 1, 2021
Filed: July 30, 2020

**PETITION FOR *INTER PARTES* REVIEW OF U.S. PAT. NO. 11,026,232
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 41.100 ET SEQ.**

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Mandatory Notices

A. Real Parties-in-Interest

T-Mobile USA, Inc., and T-Mobile US, Inc. are the real parties-in-interest.

B. Related Matters

The PTAB already instituted *inter partes* review against the ‘232 Patent in *CommScope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242 (PTAB Mar. 17, 2023), which Petitioner seeks to join, based on the same prior art references asserted in the present Petition.

The challenged patent was asserted against Petitioner in a complaint in *Dali Wireless, Inc. v. T-Mobile US, Inc., et al.*, Case No. 2:22-cv-414 (E.D. Texas) (served October 24, 2022).

The challenged patent is also subject to the following matters:

- *Dali Wireless, Inc. v. Ericsson Inc.*, 6:22-cv-1313 (W.D. Tex.);
- *Dali Wireless, Inc. v. AT&T Corp.*, 2:22-cv-00012 (E.D. Tex.);
- *Ericsson, Inc. v. Dali Wireless, Inc.*, IPR2022-01570 (decision on institution pending);
- *AT&T Corp. et al v. Dali Wireless, Inc.*, IPR2023-00844 (decision on institution pending, filed with motion to join the instituted CommScope IPR).

C. Lead and Back-Up Counsel

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D. Service Information

Please address all correspondence and service to both counsel listed above.

Petitioner consents to service by email at the email addresses listed.

Preliminary Matters

A. Standing

Petitioner certifies that IPR is available for the '232 Patent; Petitioner is not barred or estopped.

B. Identification of Challenge

Petitioner requests invalidation of claims 1-20.

	Claims	Basis for Unpatentability
Ground 1	1-7, 9, 11-17, 19-20	Obvious: Hettstedt plus Wellington
Ground 2	1-7, 9, 11-17, 19-20	Obvious: Hettstedt itself
Ground 3	1-7, 9, 12-17, 19-20	Obvious: Wu itself
Ground 4	1-7, 9, 12-17, 19-20	Obvious: Wu plus Sabat
Ground 5	8, 18	Obvious: any of Grounds 1-4 when further combined with Fischer
Ground 6	10	Obvious: any of Grounds 1-4 when further combined with Conyers
Ground 7	11	Obvious: Wu plus Sabat and Hettstedt

C. Supporting Declaration

Petitioner submits a declaration from Dr. Acampora (EX-1003).

D. Fees

Petitioner authorizes the Patent Office to charge Deposit Account No. 502880 for the fee set forth in 37 C.F.R. § 42.15(a) and any other required fees.

Introduction

The PTAB already instituted *inter partes* review against the ‘232 Patent on the same grounds as the present Petition in *CommScope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242 (PTAB Mar. 17, 2023) (“CommScope IPR”). This Petition is accompanied by a Motion for Joinder to, and seeks institution on the same grounds supported by an identical declaration from the same expert as, the CommScope IPR.

Summary of the Challenged Patent

A. Distributed Antenna Systems

A distributed antenna system (“DAS”) extends wireless coverage to devices in hard-to-reach areas, e.g., inside of a building, tunnel, or other region shielded by terrain from cell towers. EX-1003 ¶¶42-45. The conventional elements of a DAS include a central host unit and a plurality of remote antenna units distributed throughout the desired coverage area and coupled by cables back to the host unit. *Id.* A base station provides its signal to the central host unit (instead of to a conventional cell tower), and the host unit relays them to the remote antenna units to be re-broadcast closer to the end-user devices (e.g., cell-phones). *Id.*

B. The ‘232 Patent disclosure

The ‘232 patent discloses a “reconfigurable” DAS. EX-1001 at 6:4-5. The DAS comprises “digital access units” (DAUs) and “remote radio head units”

(RRUs). *Id.* at 6:29-32, Fig. 1, 6:8-24. The DAU performs the role of a central host unit by serving as an interface between the base station and RRUs. EX-1001 at 6:13- 17, Fig. 4.¹

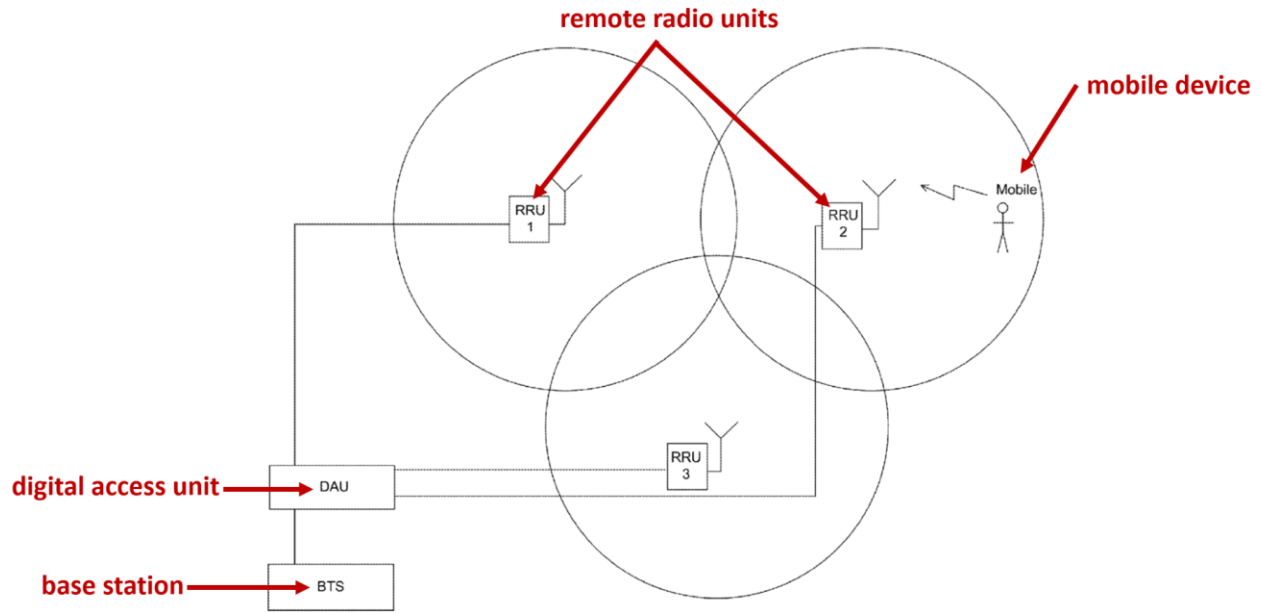


Figure 4 Indoor Localization System of GSM and LTE

EX-1001 at Fig. 4.

The '232 patent explains that movement of subscribers complicates allocation of base station RF carriers (radio resources). *Id.* at 1:42-58. When subscribers move from office floors to the cafeteria during lunchtime, for example, resources assigned to office floors may be under-used and resources assigned to the cafeteria may be over-used. *Id.* at 1:46-58.

¹ All annotations, emphasis, and highlighting added.

To address this, the DAU can assign different subsets of radio resources to the RRUs, which the ‘232 specification calls “flexible” simulcast. *Id.* at 4:17-23.

Figure 1 shows this:

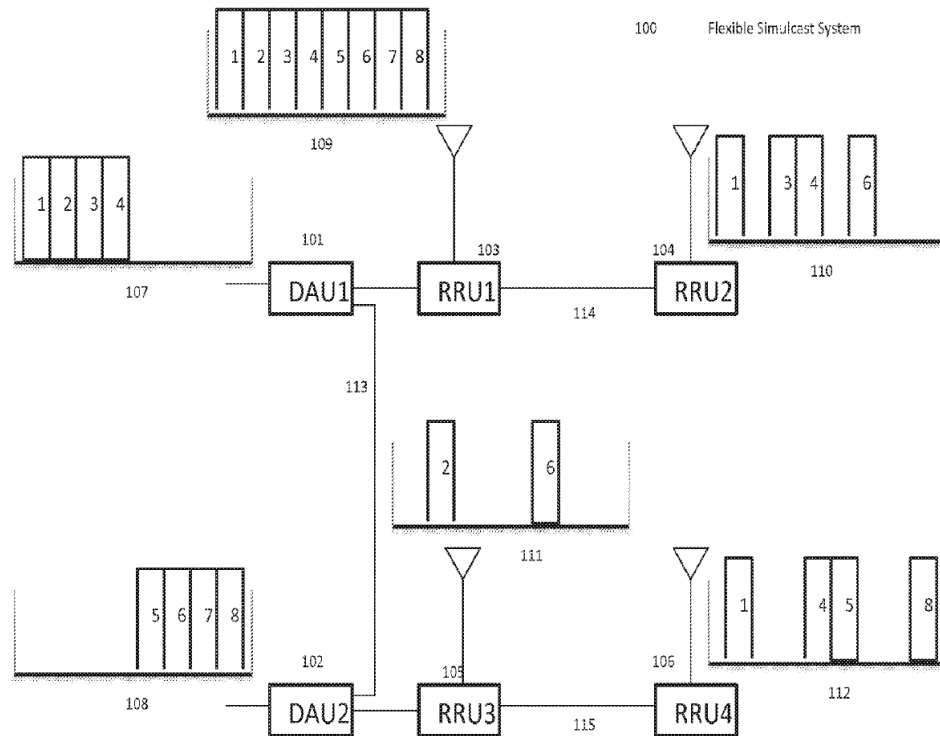


Figure 1: Flexible Simulcast Downlink Example

Id. at Fig. 1. The DAUs receive signals (107, 108) from base stations (not shown). *Id.* at 6:32-39. Signals 107, 108 comprise eight carriers. *Id.* Each carrier signal is a “radio resource.” *Id.* at 4:17-19. The DAU assigns for use at each RRU a subset of the carriers—e.g., up to the full set of eight carriers at RRU1 for the cafeteria at lunchtime.

The DAU “detects which carriers and corresponding time slots for each carrier are active for each RRU.” *Id.* at 12:5-13. This can “help identify” when a carrier is “loaded by a percentage greater than a predetermined threshold.” *Id.* This threshold is disclosed as a simple “value” communicated to the DAU. *Id.* at 12:10-13.

C. Claims

The claims use different terminology than the specification. The claims recite: “central node,” “wireless access point,” and “operator hub.” None of these appears in the specification. The claims appear to use “central node” to refer to the digital access unit (DAU) in the specification, “wireless access point” to refer to the remote radio unit (RRU), and “operator hub” to refer to the base station in the specification. The examiner applied the terms this way. *See, e.g.*, EX-1002 at A119 (“operator hub (base station 14)”, “wireless access points (remote unit 16)”).

There are 3 independent claims (1, 12, 20). They recite similar limitations but are written as a system (claim 1), method (claim 12), and computer-readable storage media that cause a processor to perform the steps of a method (claim 20). Claim 1 is representative of claims 12 and 20. EX-1003 ¶¶53-55. The Claims Appendix lists the text of each of the claims and labels each element (A, B, C, etc.).

D. Prosecution History

The '232 patent had an accelerated prosecution. Applicant requested Track One examination. EX-1002 at A1. Six weeks later, the Examiner issued a Notice of Allowance (NOA). *Id.* at A61-69.

After the NOA, the Applicant and Examiner had an interview about a new reference: EP1,924,109 to Heinz-Dieter Hettstedt (EX-1034). *See* EX-1002 at A123, A175. The Examiner referred to this reference by the inventors' first name (Heinz-Dieter), but this petition uses the last name (Hettstedt EP). The interview summary described Hettstedt EP as a potential reference that "teaches all of the allowable subject matter of claims 1, 12, and 20." *Id.* Patent Owner, therefore, "agreed to amend claims 1, 12, and 20." *Id.* Patent Owner authorized an Examiner Amendment to add the following underlined language about a "threshold" to each independent claim:

1. (Currently Amended) A wireless system comprising:

one or more central nodes that receive a number of a plurality of radio resources from an operator hub that enables wireless communications and that provides the plurality of radio resources to a radio access network using the Common Public Radio Interface (CPRI) protocol; and

a plurality of wireless access points that is coupled to the one or more central nodes and distributes one or more wireless signals to one or more wireless subscribers, the plurality of wireless access points including at least a first access point and a second access point, wherein one or more central nodes assigns a first subset of the

number of the plurality of radio resources to the first access point and a second subset of the number of the plurality of radio resources to the second access point, the first subset including more radio resources than the second subset, and

wherein, in response to a change in need of a number of wireless subscribers coupled to the second access point and which of the second subset is loaded beyond a threshold, the one or more central nodes assign additional radio resources of the plurality of radio resources to the second access point.

EX-1002 at A117-A119. The Examiner issued a Supplemental NOA that cited this amended limitation. EX-1002 at A119-A121.

Patent Owner then filed two IDSs with RCEs. EX-1002 at A130-A137, A178-A184. There was no discussion of the references in these IDSs. The Examiner issued a new NOA that cited back to the prior NOA “for the same reasons.” EX-1002 at A147-A148, A194-A195.

E. Related IPR proceedings

The PTAB has already found similar patent claims of Patent Owner to be invalid as obvious in two prior IPRs.

First, the ‘232 claims priority to Patent No. 9,531,473 (‘473 patent, EX-1042). Like the ‘232 patent, the ‘473 patent claims recite a “first subset” and “second subset” of signals and “CPRI.” EX-1042 at claims 6, 10. The PTAB issued a final written decision finding all the challenge claims invalid as obvious over the same Wu reference in this petition. EX-1041.

Second, the ‘232 patent has an overlapping specification with Patent Owner’s Patent No. 10,080,178 (‘178 patent, EX-1038). *Compare* EX-1001 with EX-1038. Like the ‘232 patent, the ‘178 patent claims recite a “first” and “second” set of signals with different number of signals and “load balancing.” EX-1038 at claims 1, 4. Again, the PTAB found Wu compelling and instituted review. EX-1039. Faced with Wu, Patent Owner cancelled all claims, and the PTAB entered adverse judgment against Patent Owner. EX-1040. Dr. Acampora illustrates the overlap between the ‘232 claims and the now-invalid ‘178 claims. EX-1003 ¶¶56-67.

Summary of the Asserted Prior Art

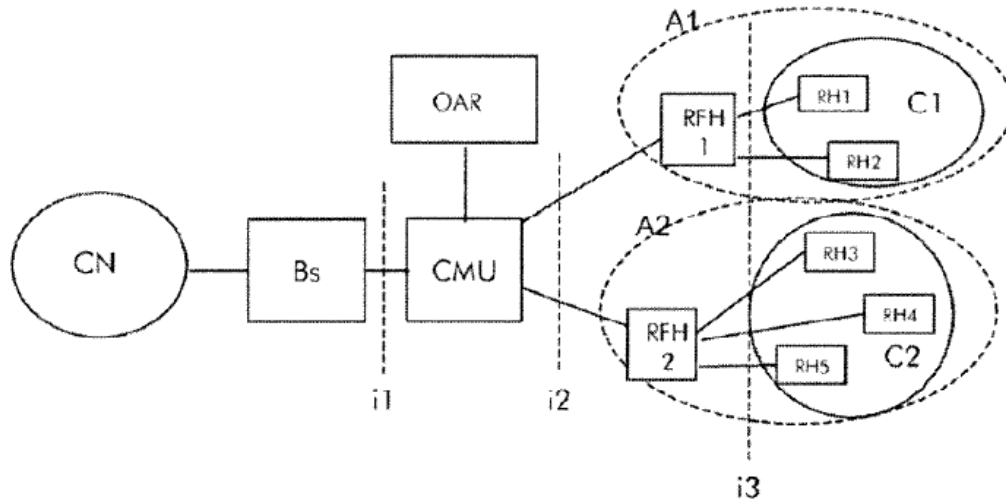
A. Primary References

1. “Hettstedt”: U.S. Patent Pub. No. 2008/0119198

“Hettstedt” (EX-1005) published May 22, 2008. It is 102(a)-(b) art. The “Heinz-Dieter” reference during prosecution is the foreign counterpart to this published U.S. patent application.

Hettstedt discloses a method and system with “improved cell and load balancing management.” EX-1005 ¶0008. Hettstedt achieves this by adding a “cell management unit” (CMU) that can de-activate, shift, and activate carriers within the system of distributed radio heads. *Id.* ¶0029, ¶¶0043-0044. Figure 3 shows Hettstedt’s system:

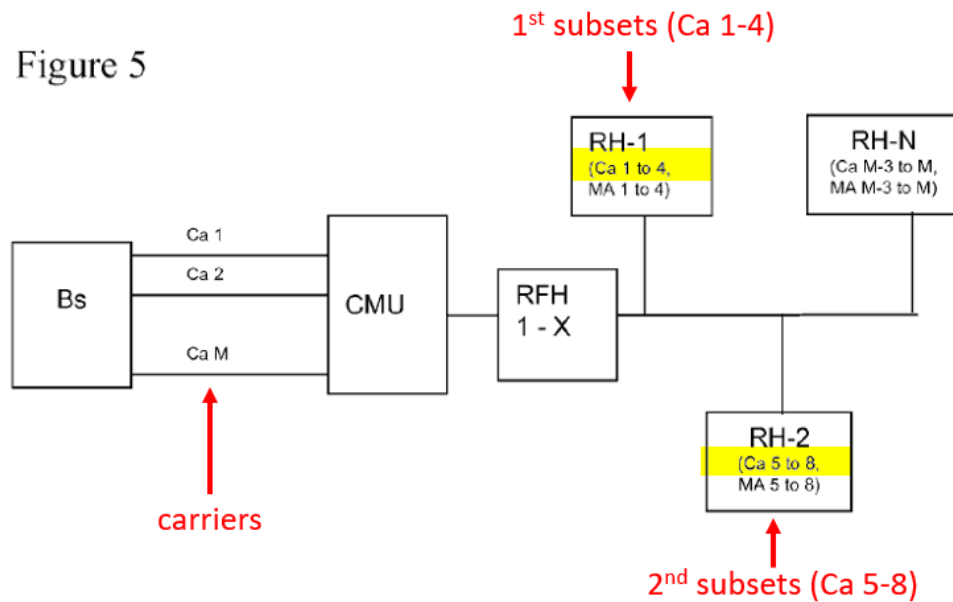
Figure 3



EX-1005 at. Fig. 3. “Bs” is the base station; “CMU” is the cell management unit; “RH1-RH5” are radio heads. EX-1005 ¶0039. Circles A1-A2 are “indoor location area[s]” (e.g., buildings) where the radio heads are distributed. EX-1005 ¶0051; ¶0002. i1-i3 are digital interfaces (e.g., CPRI). EX-1005 ¶0040.

Figure 5 illustrates an “example” of the CMU distributing carriers to the radio heads:

Figure 5



EX-1005 at Fig. 5. The base station provides a set of “M” carriers, and the CMU distributes different subsets of the carriers to each radio head. EX-1005 ¶0053, ¶0045. Carriers 1-4 are distributed to RH-1 using MAC addresses 1-4 (“MA 1 to 4”). EX-1005 ¶0053. Carriers 5-8 are distributed to RH-2 using MAC addresses 5-8. *Id.*

This distribution is not fixed. The CMU provides “flexible” management for “adaptive cell re-configuration.” EX-1005 ¶0042, ¶0044. The CMU does this “through the shifting of un-used carriers from radio heads inside areas of low traffic load to radio heads inside areas of high traffic load.” *Id.* ¶0044. Thus, “capacity can follow moving users in complex buildings, such as airports, stations, etc., with dynamic distribution of hot-spots.” EX-1005 ¶0029.

Hettstedt discloses (in its own claims) that the shifted carriers are activated at radio heads that “are loaded over a predetermined value” (i.e., a threshold). EX-1005 at Claim 3.

2. “Wu”: U.S. Patent Application Pub. No. 2010/0128676

Wu (EX-1006) was filed Nov. 11, 2009. It is at least 102(e) art. Wu describes carrier transport systems for use by wireless operators to transport signals from base stations into wireless coverage areas. EX-1006 ¶¶0003-0004.

Wu discloses an improved system that allows “fine grained” control over carrier channels from a single band or multiple bands by splitting carrier channels from their bands and routing channels “individually, collectively as shown, or in arbitrary groups” to remote transceiver units (RTUs) as desired using a matrix switch according to a routing policy, where the routing policy can be updated or reconfigured as desired. EX-1006 ¶0049; *see also* ¶0009, ¶0011; ¶¶0038-39, ¶0047. Wu discloses that “more channels” can be allocated when needed to increase the bandwidth available in a particular region. *Id.* ¶0046; ¶¶0039-45. Wu teaches using processors to implement a routing policy having rules based on “threshold criteria” relating to metrics such as “current traffic load” for triggering a reconfiguration “to allocate more channels.” *Id.* ¶¶0040-0046.

Figure 1 of Wu shows its carrier transport system:

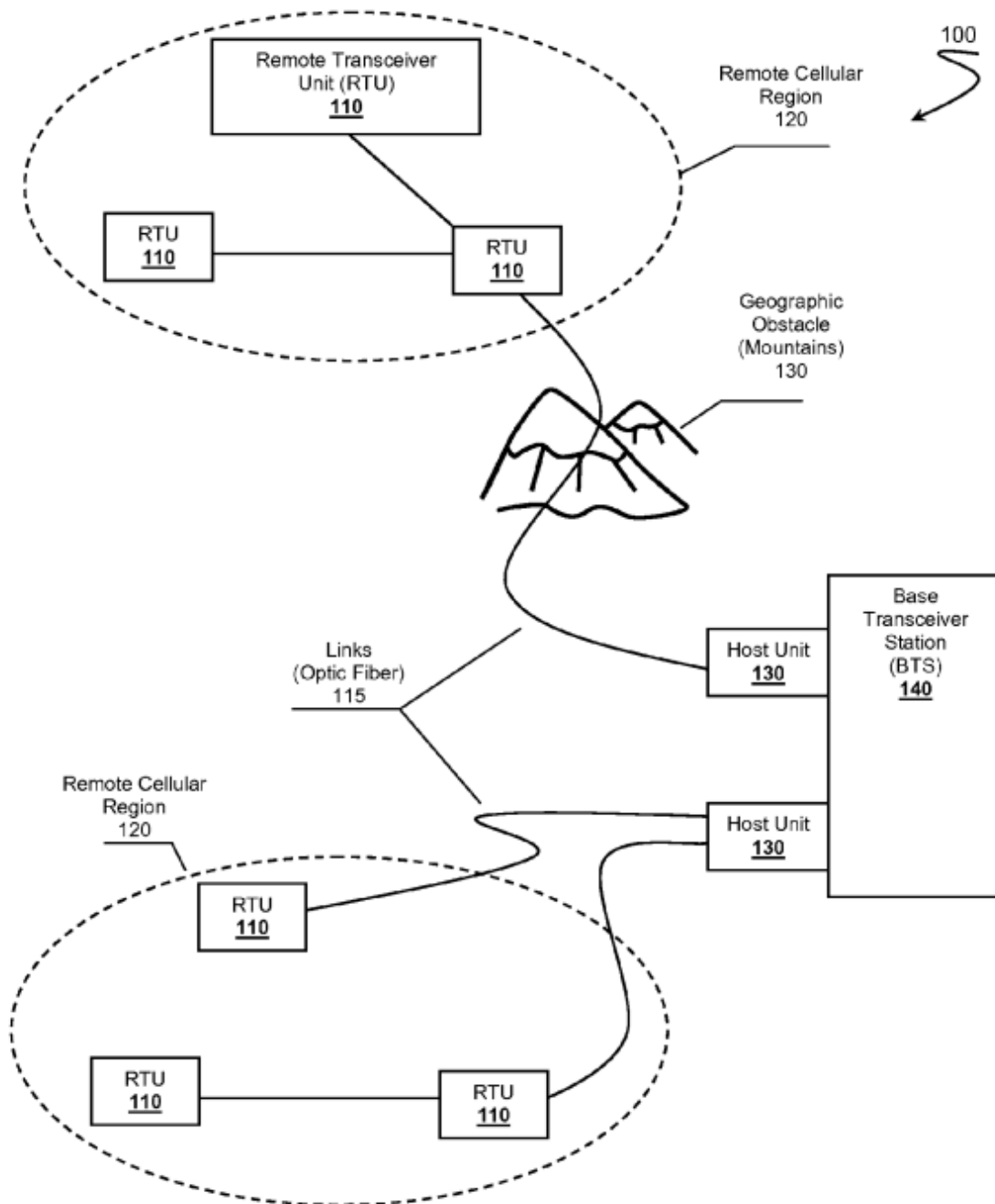


Figure 1

EX-1006 at Fig. 1.

Figure 2 of Wu, shows the matrix switch 250 that, in combination with units 230, can individually route different channels to different remote transceiver units 410. EX-1006 ¶¶0038-40.

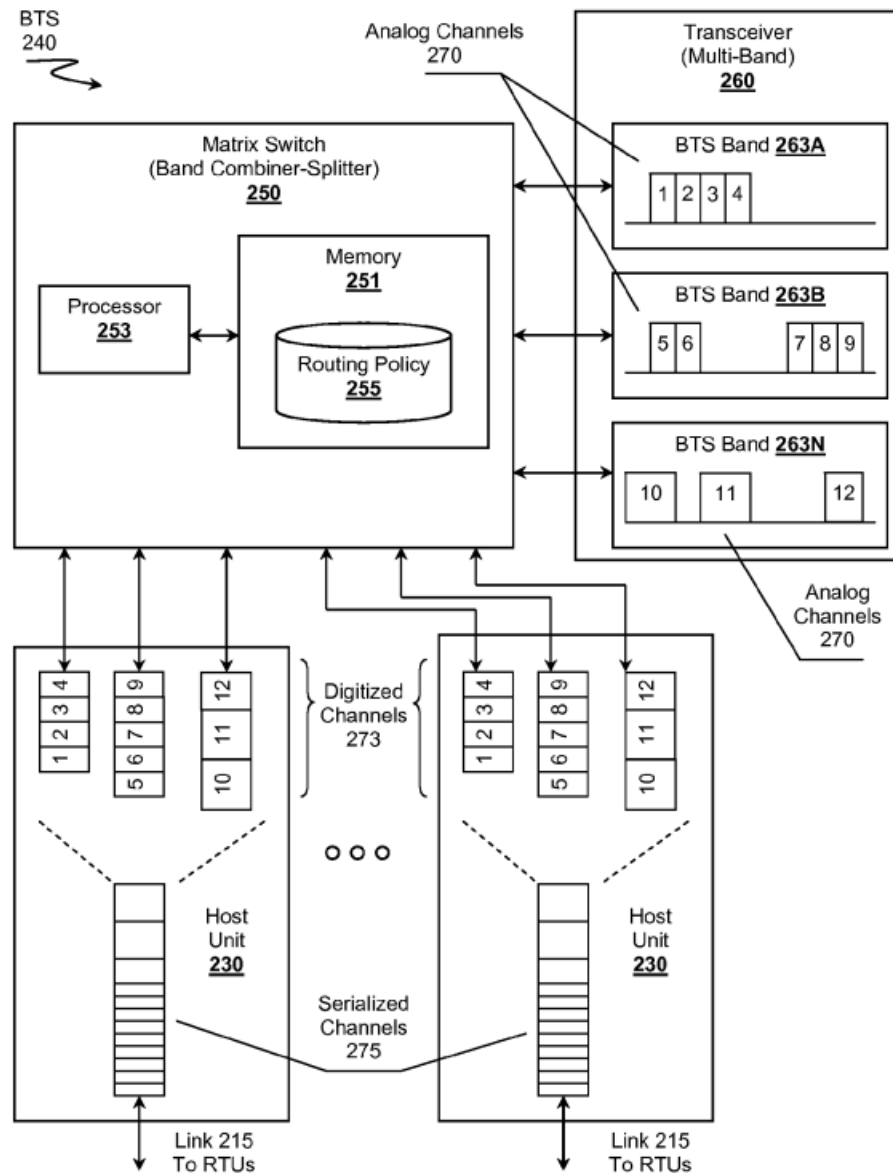


Figure 2

EX-1006 at Fig. 2.

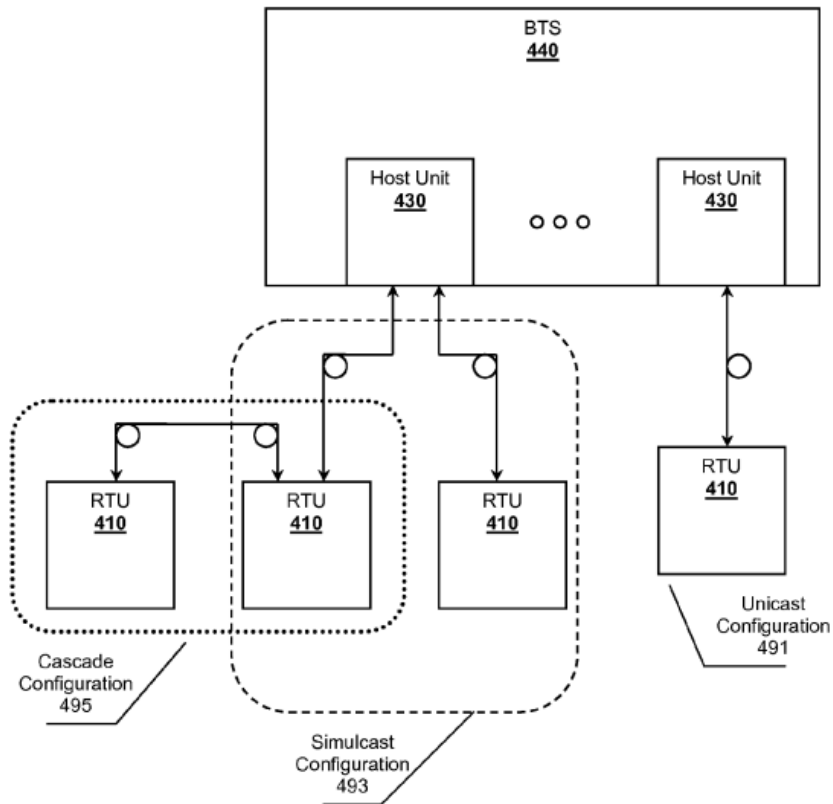


Figure 4

EX-1006 at Fig. 4.

B. Secondary References

1. “Wellington”: U.S. Patent No. 8,112,094

“Wellington” (EX-1007) is a new reference, filed in 2005. It is 102(e) prior art. Wellington discloses a “methodology of managing cell congestion by adding a carrier.” EX-1007 4:59-60. Figure 2 illustrates the method:

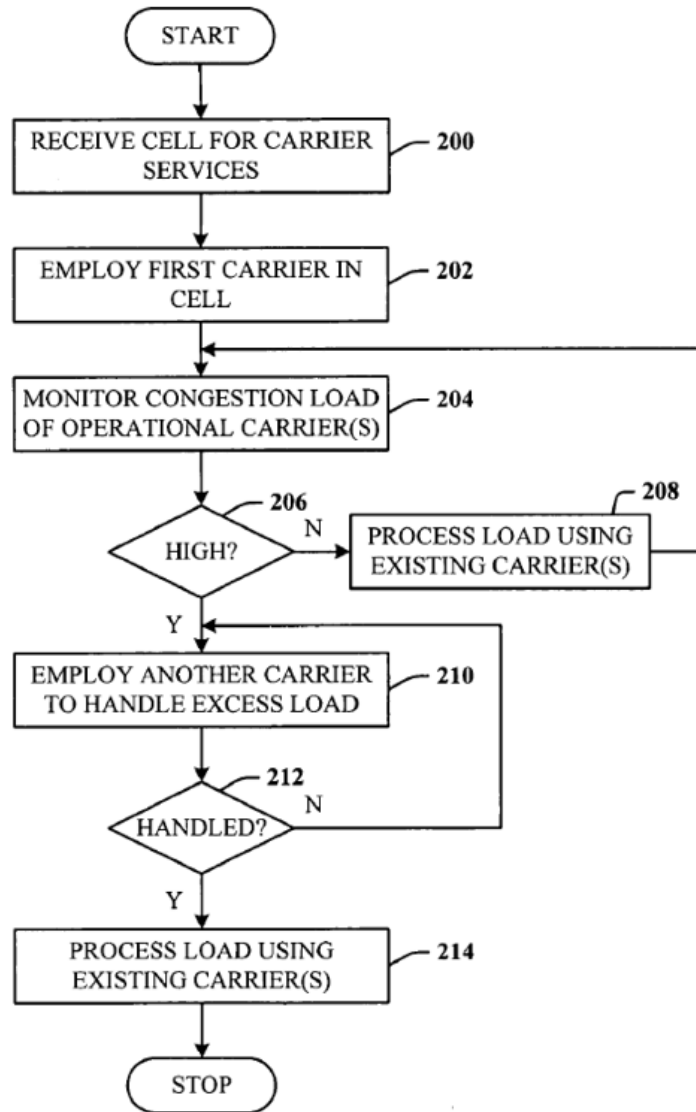


FIG. 2

EX-1007; *see also* Fig. 3. At step 204, the system monitors the “congestion load of operational carrier(s)” (i.e., how the subset of carriers is loaded). EX-1007 5:9-10. At step 206, the system determines if the congestion load is “high,” which triggers the allocation of “another carrier” in step 210. EX-1007 5:10-17.

Wellington explains: “When congestion in *the one or more carriers* reaches a

predetermined level, another carrier can be automatically added to handle the overload.” EX-1007 1:61-63.

Figure 4 illustrates components of the system, including a “trigger component” (404):

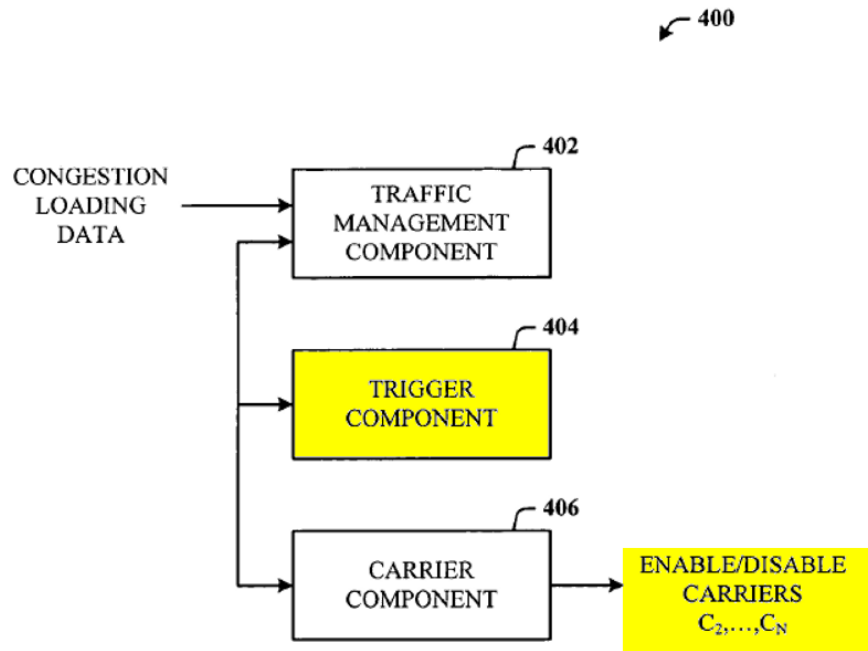


FIG. 4

EX-1007 at Fig. 4, 5:56-6:18. The trigger component “monitors one or more triggers which indicate that congestion in the existing carrier or carriers is at a point that requires an additional carrier.” EX-1007 5:65-67. The “trigger component” can use a “**predetermined threshold**” as a trigger, i.e., compare the congestion load to the threshold. EX-1007 claim 8 (16:15-18).

2. “Sabat”: U.S. Patent Application Pub. No. 2009/0180426A1

Sabat (EX-1010) discloses a DAS in which the central hub communicates with base stations using the “CPRI” protocol. EX-1010 ¶0032, ¶0036, ¶0038. It is 102(b) prior art. It published July 16, 2009.

3. “Fischer”: U.S. Patent Application Pub. No. 2010/0177759

Fischer (EX-1008) is a new reference. It discloses that a DAS can also transport internet protocol (IP) communications to support wireless LAN devices (e.g., WiFi devices). EX-1008 Figs. 1-5, Title, Abstract, ¶¶0004, ¶¶0014-0021, ¶¶0023-0024, ¶¶0027-0033. It is 102(e) and 102(a) prior art.

4. “Conyers”: U.S. Patent No. 7,398,106

Conyers (EX-1009) is a new reference. It discloses that software modules in wireless radio communication systems could be used to dynamically adjust the power levels of radio frequency transmissions from remote radio head units. EX-1009 2:63-3:3; 2:32-38; 6:45-53; 6:13-17; 6:60-7:12; Figs. 2, 1A, 1B. It is 102(b) prior art. It issued July 8, 2008.

Claim Construction

Petitioner presently believes the plain meaning is enough to resolve this petition, but notes that a district court has construed terms such as “radio resources” and “operator hub.” EX-1059, 2-3.

Level of Ordinary Skill

A person of ordinary skill in the art (POSITA) would have a bachelor’s degree in electrical engineering (or equivalent field) *with* 2-3 years of work experience in wireless communications. EX-1003 ¶¶20-22.

Discretionary Issues

This Petition presents the same grounds and arguments against the ‘232 patent and is supported by the same expert declaration as the already instituted CommScope IPR which Petitioner seeks to join. This Petition is accompanied by a motion for joinder.

Discretionary denial is not warranted because (1) in the related litigation against Petitioner, *Dali Wireless, Inc. v. T-Mobile US, Inc., et al.*, No. 2:22-cv-414 (E.D. Tex.), no trial date has been set and (2) the PTAB has already found the identical arguments and grounds present compelling evidence of unpatentability. EX-1047 at 2. The PTAB already found it highly likely that the combination of Hettstedt and Wellington invalidates claim 1 in the ’232 patent. *CommScope Techs. LLC v. Dali Wireless, Inc.*, IPR2022-01242, Paper 24 at 61-74 (PTAB Mar. 17, 2023) (Institution Decision). The Board specifically found the challenge based

on the Hettstedt and Wellington references met the compelling case standard. *Id.* at 74.

Petitioner's lead ground (Hettstedt plus Wellington) is not the same or substantially the same as any combination previously presented to the Patent Office during prosecution. Wellington is a new reference that discloses the "threshold" element the examiner believed all the other art failed to disclose. The combination fills the precise gap at issue during prosecution.² Therefore, there is no need to show an error and discretionary denial is unwarranted.

² Patent Owner may argue Ground 2 (Hettstedt itself) overlaps with the prosecution. (1) Ground 2 relies on a portion of Hettstedt (its own claims) that was not discussed during prosecution. (2) The examiner's amendment and notice of allowance show an error occurred because the examiner missed a teaching in Hettstedt. The examiner entered an examiner's amendment to distinguish Hettstedt by adding the claim language "...loaded beyond a threshold." *Supra* 7-8. Hettstedt, however, similarly disclosed "...loaded over a predetermined value." *Infra* 51-53. The '232 patent teaches the claimed threshold is a predetermined value, i.e., the subject matter taught in Hettstedt. The examiner's notice of allowance showed the examiner focused on Hettstedt's Paragraphs 16-20, not the

If Patent Owner argues the examiner considered Hettstedt, that misses the point. The examiner did not consider Hettstedt *in combination* with a reference that disclosed the threshold element like Wellington—the examiner believed that element was missing from the art.

Petitioner’s other grounds based on Wu do not warrant a discretionary denial. The examiner never discussed Wu or issued any rejection based on Wu. Patent Owner merely listed Wu on an IDS after the initial notice of allowance, which is insufficient by itself to merit a discretionary denial because there is no evidence the examiner evaluated the portions of Wu identified here. Further, the notice of allowance demonstrates that a material error occurred. The examiner concluded that none of the art disclosed the final limitation as amended to include using a “threshold.” *Compare* EX-1002 at A148 (NOA after IDS with Wu citing to NOA on 11/20/2020) *with* A116-121 (NOA on 11/20/2020). Wu, however, expressly discloses using a threshold as claimed. Thus, the examiner misapprehended teachings in Wu that directly impacted the reason for allowance, which constitutes a material error. The PTAB found a discretionary denial

portion that disclosed the example of “loaded over a predetermined value.” EX-1002 at A120.

inappropriate *under these same facts for the same Wu reference* in a prior IPR between the parties. EX-1039 at 9-17. This petition also presents additional authority about Wu, including PTAB decisions instituting and invalidating very similar claims based on the Wu reference. *See, e.g.*, EX-1039-1040 (regarding Patent Owner's '178 patent).

Finally, discretionary denial is not warranted because this petition presents compelling evidence of unpatentability. Wellington and Wu expressly disclose the only feature Patent Owner used to distinguish the art during prosecution (a “threshold”). The PTAB has already found Wu compelling in two prior IPRs against Patent Owner’s patents with similar claims to the ‘232 patent. *Supra* 8-9.

Argument

Ground 1: The combination of Hettstedt plus Wellington renders claims 1-7, 9, 11-17, 19-20 obvious

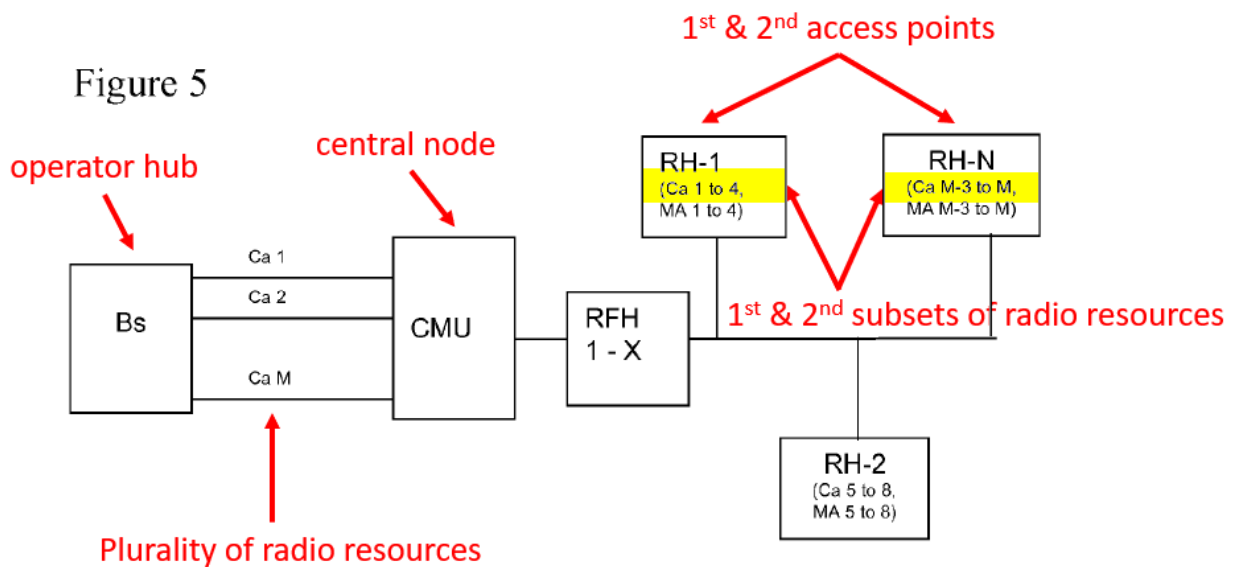
Patent Owner purportedly distinguished Hettstedt during prosecution by adding the clause: “which of the second subset is loaded beyond a threshold.” EX-1002 at A117-A123, A175. The new Wellington reference provides any disclosure missing from Hettstedt for the added clause.

A. Independent Claim 1

1. Element 1A (and 12A)

“A wireless system comprising...”

Hettstedt discloses a “system for *wireless* cellular indoor communications,” which discloses the preamble. EX-1005 ¶0008, *see also* EX-1005 ¶¶0040-0041, ¶0050, Figs. 2-6; EX-1003 ¶¶82-83. Figure 5 is exemplary:



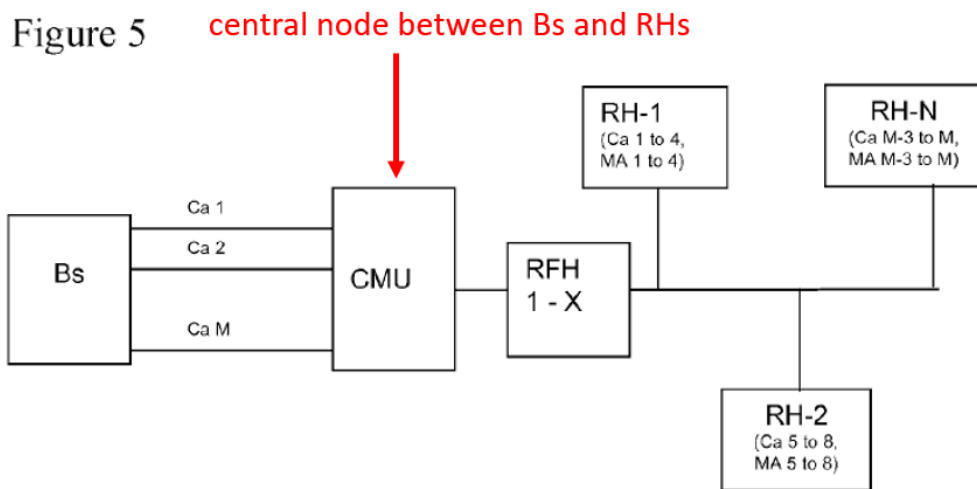
EX-1005 at Fig. 5.

2. Elements 1B & 1C (and 12B, 12C, 20B, 20C)

“...one or more central nodes that receive a number of a plurality of radio resources from an operator hub that enables wireless communications and that provides the plurality of radio resources to a radio access network using the Common Public Radio Interface (CPRI) protocol”

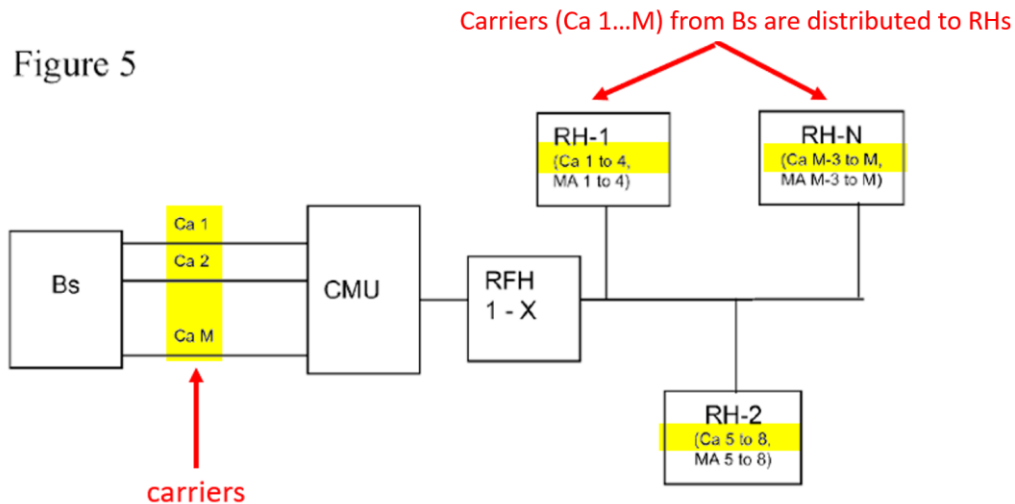
Hettstedt’s “cell management unit” (CMU) is “*one or more central nodes.*”

EX-1003 ¶¶85-86. It is a central node between the base station (Bs) and remote radio heads (RHs):



EX-1005 at Fig. 5, ¶0042. This parallels the disclosure in the ‘232 patent where the disclosed DAU (central node) serves as the interface between the base station and RRUs. EX-1001 at 6:14-17. Hettstedt’s CMU also performs centralized functions, e.g., packaging, addressing, and frequency allocation. EX-1005 ¶0028, ¶¶0043-0048.

Hettstedt's CMU receives a number of "carriers" from the base station, which is an example of receiving "*a number of a plurality of radio resources from an operator hub*":



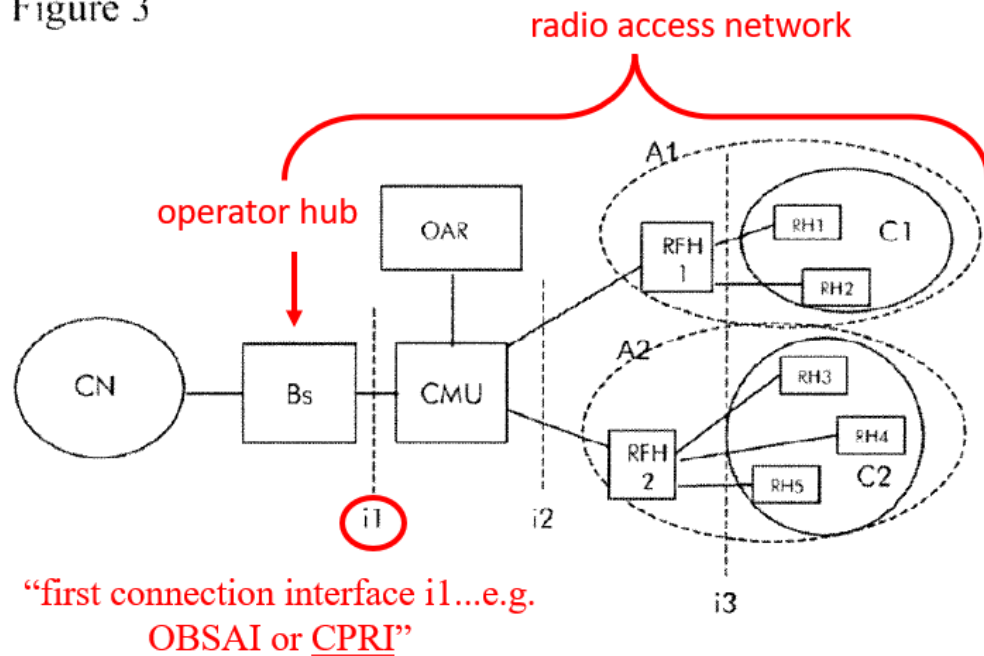
EX-1005 at Fig. 5, ¶10053; see also EX-1005 ¶10054 (CMU receives four carriers from each of eight base stations, i.e., 32 carriers); EX-1003 ¶¶88-90. The "carriers" in Hettstedt are "*radio resources.*" They are the resources used by Hettstedt *radio* heads. EX-1005 ¶10050 ("remote radio heads are equipped to transmit four carriers..."); EX-1003 ¶¶89, 93; EX-1017 at 26 ("in the form of in-phase and quadrature modulation"). The radio heads transmit the carriers to end user mobile devices. *Id.* Hettstedt parallels the disclosure in the '232 patent. Like Hettstedt, the '232 patent teaches that central node (DAU) receives "carriers" from a "base station." EX-1001 at 6:33-36. The '232 patent teaches that RF "carriers"

are “radio resources.” EX-1001 at 12:15-16 (“radio resources (such as RF carriers, CDMA codes or TDMA time slots)”).³

Finally, Hettstedt discloses the final language in “*an operator hub that enables wireless communications and that provides the plurality of radio resources to a radio access network using the Common Public Radio Interface (CPRI) protocol.*” EX-1003 ¶¶94-98. Hettstedt’s base station is an “*operator hub*”—it provides services from “operators.” EX-1005 ¶0054; EX-1003 ¶¶86-87. Notably, the only apparent support for the term “operator hub” in the specification of the ‘232 patent is a base station. EX-1001 at 6:11-39. The examiner read “operator hub” on a base station. EX-1002 at A119. Annotated Figure 3 shows this part of the claim limitation:

³ Hettstedt teaches the carriers may be received in digital form using CPRI. EX-1005 ¶40. Patent Owner has alleged digital CPRI signals are radio resources (EX-1046 ¶118), and the claim itself refers to “CPRI.”

Figure 3

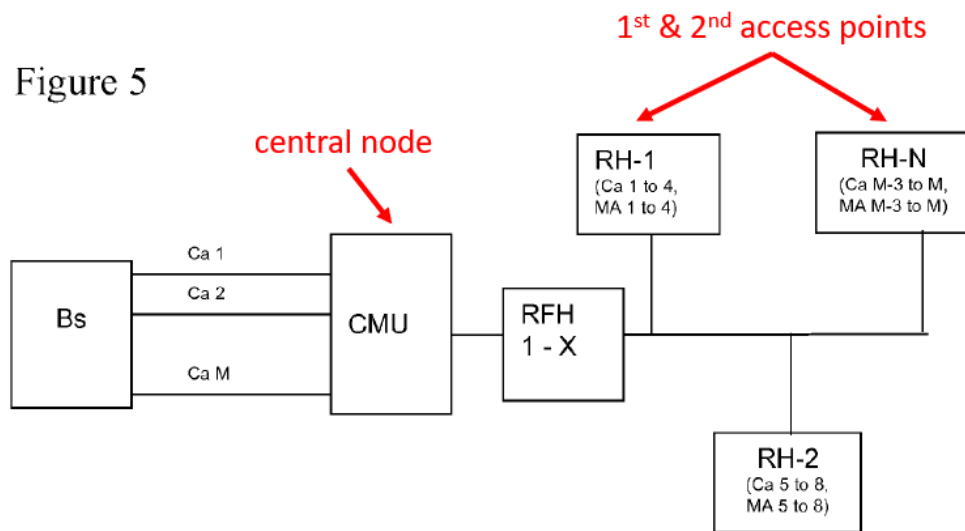


EX-1005 at Fig. 3. To unpack this, (1) Hettstedt’s base station (*operator hub*) enables wireless communication by communicating with the core network and modulating the desired communication messages onto carriers. EX-1005 ¶¶0040-0041, ¶0008; EX-1003 ¶95. (2) Hettstedt’s base station (*operator hub*) provides the modulated carriers to the CMU and radio heads, which comprise a radio access network. EX-1005 at Figs. 3-6; EX-1003 ¶96. They provide the radio (RF) link for the end user devices to access the larger network. EX-1005 ¶0050; ¶0041. (3) Hettstedt teaches that the base station (*operator hub*) can use “CPRI” to provide the carriers over the “i1” interface to the other components of the RAN. EX-1005 ¶0040; EX-1003 ¶97.

3. Element 1D

“a plurality of wireless access points that is coupled to the one or more central nodes and distributes one or more wireless signals to one or more wireless subscribers, the plurality of wireless access points including at least a first access point and a second access point,”

Hettstedt discloses a plurality of remote radio heads (RHs) coupled to the CMU, which satisfies this limitation. EX-1005 ¶¶0039, ¶0050, ¶0029, Figs. 3-6; EX-1003 ¶¶99-102. Figure 5 shows this:



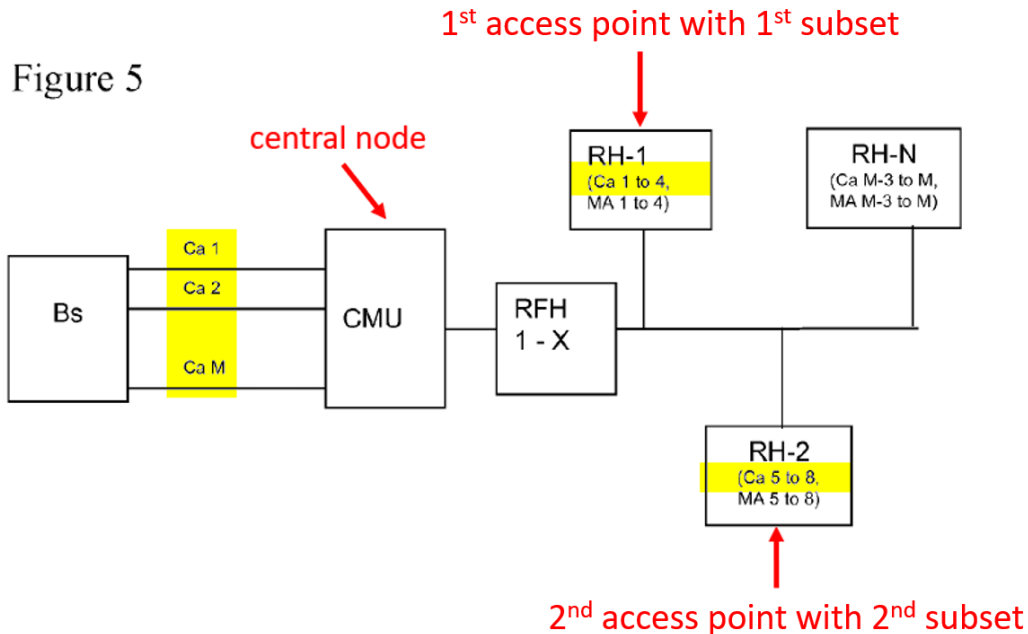
EX-1005 at Fig. 5, ¶0053; *see also* Figs. 3-4, 6. Hettstedt’s RHs are “*wireless access points*.” EX-1003 ¶¶100-101. They provide wireless service and access to the network for the end-user devices. EX-1005 ¶0050 (“...RF air interfaces to users providing a digital interface to the network”), ¶0053 (“wireless”). They communicate “radio signals” (*wireless signals*) to “mobile stations” (*wireless subscribers*). EX-1005 ¶¶0040-0041, ¶0050; EX-1003 ¶102.

4. Element 1E (and 12E, 20E)

“wherein one or more central nodes assigns a first subset of the number of the plurality of radio resources to the first access point and a second subset of the number of the plurality of radio resources to the second access point, the first subset including more radio resources than the second subset, and”

Hettstedt discloses this limitation through its disclosure that the CMU (*central node*) performs (a) “mapping” of carriers to individual RHs (such that the RRHs each have a subset) and (b) de-activating, shifting, activating the carriers between the RRHs (such that some RRH have more carriers). EX-1005 ¶¶0043-0045, ¶¶0028-0029; EX-1003 ¶¶103-112.

First, Hettstedt discloses that the CMU (*a central node*) assigns subsets of carriers (*radio resources*) to the RHs (*access points*). EX-1003 ¶¶104-106. The CMU “comprises” the functionality for “mapping” of the “carriers” “to individual radio heads.” EX-1005 ¶¶0043, ¶¶0045. The CMU “performs the frequency allocation of the remote radio heads.” EX-1005 ¶¶0028. Figure 5 shows an example of a first and second subset of carriers assigned by the CMU:



EX-1005 at Fig. 5, ¶0053. The CMU assigns carriers 1-4 (*first subset*) to RH-1 (*first access point*) and carriers 5-8 (*second subset*) to RH-2 (*second access point*).
Id.

Second, Hettstedt discloses that the set of carriers at one RH can include more carriers than another RH. EX-1003 ¶¶107-112. Figure 5 shows an example where each RRH has four carriers. But this is merely an initial “example.” EX-1005 ¶0037. The CMU further performs “adaptive cell reconfiguration.” EX-1005 ¶0044. The CMU comprises the means for (1) “de-activation” of un-used carriers, (2) “shifting” these carriers “from radio where these carriers are not used for radio heads with high load on their active carriers,” and (3) “activation of the shifted carriers” at radio heads of “high loading.” EX-1005 ¶0044, ¶0029. The actions of de-activating, shifting, and activating carriers changes the number of

carriers in the subsets such that some RHs will have more carriers than others. EX-1003 ¶¶108-112. Consider the example where the CMU de-activates two carriers at RH2 in Figure 5. Now, the first subset of carriers at RRH1 has more carriers than the second subset of carriers at RRH2 (four carriers compared to two carriers). EX-1003 ¶110. The Examiner concluded the related-EP version of Hettstedt disclosed assigning a first and second subset with the “first subset including more radio resources than the second subset” and cited the teachings about de-activating, shifting, and activating carriers. EX-1002 at A120-A121.

5. Element 1F (and 12F, 20F)

“wherein, in response to a change in need of a number of wireless subscribers coupled to the second access point and which of the second subset is loaded beyond a threshold, the one or more central nodes assign additional radio resources of the plurality of radio resources to the second access point.”

Patent Owner only distinguished Hettstedt from this limitation during prosecution by adding the underlined clause: “which of the second subset is loaded beyond a threshold.” *Supra* 6-8. The prefatory language “which of the second subset” was not the distinction. The “second subset” refers to the prior claim element, which the Examiner found Hettstedt disclosed. EX-1002 at A120-A121. The apparent distinction was the concept of being loaded beyond a “threshold.” The combination of Hettstedt and Wellington discloses the added clause and renders the claim obvious. This section first discusses the other parts of this

limitation. Patent Owner did not dispute Hettstedt discloses these other parts during original prosecution.

Hettstedt discloses the CMU responds to “*a change in need of a number of wireless subscribers coupled to the second access point.*” EX-1003 ¶¶114-117. Hettstedt teaches that the CMU performs load balancing by shifting carriers from RHs inside areas of “low traffic load” to RHs inside areas of “high traffic load.” EX-1005 ¶0044, ¶0029. The traffic load at the RH is one measure of the need of the wireless subscribers at the RH. EX-1003 ¶115. Hettstedt teaches that traffic load changes, for example, because of “moving users.” EX-1005 ¶0029. Hettstedt recognizes that “hot-spots” develop (see ¶0029), and the system must adapt to the “current” scenarios (see ¶0028). When the traffic load for an RH changes from low to high, that is an example of *a change in need of the wireless subscribers coupled to the RH* (and the RH where the change can be considered the *second access point*). EX-1003 ¶116. Hettstedt teaches to measure the load at “each” carrier of each remote radio head, which would include at a “*second access point.*” EX-1005 ¶0044.

Hettstedt’s disclosure parallels the ‘232 patent. The lead example in the ‘232 patent for when subscriber need changes is when users inside buildings move and gather in one place (e.g., the cafeteria). EX-1001 at 1:42-58, 6:57-60. Likewise, Hettstedt discloses the purpose of load balancing is so that “capacity can

follow moving users in complex buildings” with dynamic distribution of “hot-spots” (i.e., the spot where users gather). EX-1005 ¶0029.

Hettstedt also discloses the CMU “*assigns additional radio resources of the plurality of radio resources to the second access point*” in response to the change in need. EX-1003 ¶¶118-121. The CMU shifts carriers (*radio resources*) to the radio heads with high load and activates those carriers at those radio heads. EX-1005 at ¶¶0043-0044; ¶0029. The actions of shifting carriers to a radio head and activating those carriers is an example of “assign[ing] additional radio resources” to that radio head. EX-1003 ¶119. The radio heads with high load can be considered the “*second access point*” recited in the claim. The shifted carriers are “additional” radio resources for the high load radio head because those radio heads did not formerly have those carriers; rather, the carriers had to be shifted and activated at those radio heads. *See, e.g.*, EX-1005 at Fig. 5 (showing radio heads starting with unique sets of carriers); EX-1003 ¶¶119-121.

“which of the second subset is loaded beyond a threshold”

Hettstedt discloses at least part of this added clause. The language “*the second subset*” refers back to the prior claim limitation, which the examiner found Hettstedt discloses. EX-1002 at A120-A121. Hettstedt further teaches to shift the carriers to the radio heads with “high load on their active carriers” (i.e., their *subset*). EX-1005 ¶0044. Hettstedt discloses (in its own claims) the specific

example: “where the remote radio heads are **loaded over a predetermined value.**”

Id. at Hettstedt’s claim 3. The example threshold disclosed in the ‘232 patent is a predetermined value. EX-1001 at 12:10-13 (“...loaded by a percentage greater than a **predetermined** threshold whose **value** is communicated to the DAU”). Even assuming these teachings do not explicitly disclose the recited threshold, the combination of Hettstedt and Wellington render this obvious.⁴

The Wellington (EX-1007) reference discloses the concept of allocating additional carriers in a radio access network when a subset of carriers is loaded beyond a threshold. EX-1003 ¶¶125-127. Figure 2 illustrates this concept:

⁴ Here, Petitioner only assume, but does not concede, this point.

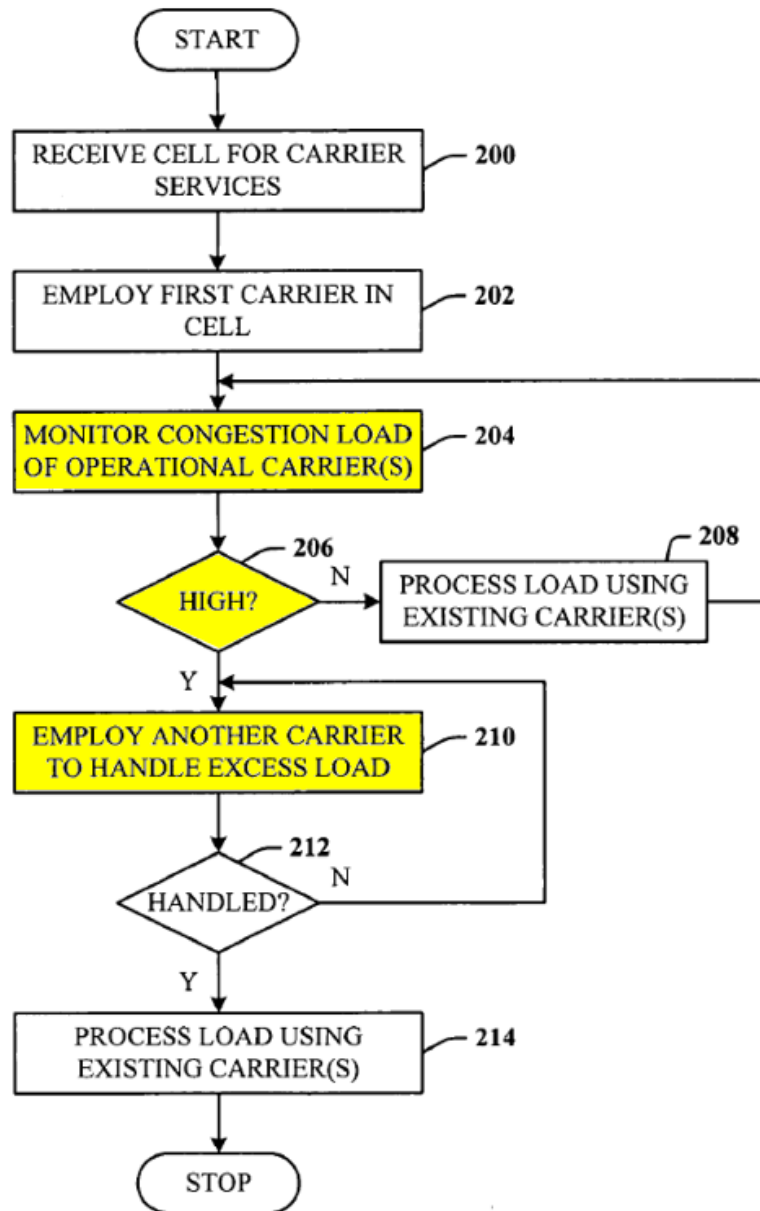


FIG. 2

EX-1007 at Fig. 2, *see also* Fig. 3. At step 204, the system monitors the congestion load of the current “operational carrier(s)” (i.e., the *subset*). *Id.* at 5:9-10. At step 206, the system determines if the congestion load is “high,” which triggers the allocation of “another carrier” in step 210. *Id.* at 5:10-17. Step 206 is

an example of using a threshold. As a further example, Wellington explains:

“When congestion in ***the one or more carriers*** reaches a ***predetermined level***, another carrier can be automatically added to handle the overload.” *Id.* at 1:61-63.

This is an example of the recited *assigning an additional radio resource* (here “another carrier”) when the *subset* (here “the one or more carriers”) is *loaded beyond a threshold* (here “a predetermined level”). EX-1003 ¶¶126-127. A predetermined level is a threshold. EX-1036 (threshold: “***a level***, point, or value above which something is true or will take place and below which it is not or will not”); EX-1037 (threshold: “A value used to denote predetermined ***levels***.”).

Wellington teaches its trigger component can use a “predetermined *threshold*.” EX-1007 at 5:56-67 (discussing “trigger component”), Wellington’s claim 8 (“trigger component is further configured to...predetermined ***threshold***”); EX-1003 ¶127.

A POSITA would have found it obvious to combine Hettstedt with Wellington’s teaching. EX-1003 ¶128. Specifically, a POSITA would have found it obvious to trigger Hettstedt’s load balancing to activate additional carriers when it determines the load on the existing set of carriers at a high traffic radio head is beyond a threshold as taught by Wellington. *Id.*

Motivation to Combine. A POSITA would have been motivated to implement Wellington’s teaching to *obviate the need for a human user to perform*

the load balancing (i.e., improve the system by making it automatic). EX-1003 ¶130. A threshold-based trigger avoids the need for the system to wait for user inputs. *Id.* A POSITA would naturally use a threshold for the trigger as taught by Wellington because a threshold is readily programmable and machine-executable. *Id.* Additionally, a POSITA would have been motivated to implement Wellington’s teaching to improve the *adaptability of the system*. *Id.* A benefit of a threshold-based trigger is that system can fine-tune the load balancing by adjusting the threshold. *Id.* There is no need to reprogram significant software. *Id.*

Hettstedt and Wellington support the combination. First, Hettstedt’s goal is “efficient” load balancing. EX-1005 ¶¶0011, ¶0021, ¶0044. Wellington improves this goal by eliminating the inefficiency of waiting for a user’s input. Hettstedt contemplates scenarios where waiting for a user input for load balancing is not realistic such as sudden “hot-spots” that need “dynamic distribution.” EX-1005 ¶0029; EX-1003 ¶131. Wellington’s method solves this: “Thus, carrier deployment and removal can *occur quickly to handle dynamically* changing characteristics in cell congestion.” EX-1007 at 4:50-52. Second, Hettstedt contemplates that its system could be made “automatically adaptive.” EX-1005 ¶0028. Wellington discloses exactly those triggers to make the system automatic. EX-1007 at 5:56-6:18, 8:48-9:7. Thus, Wellington naturally improves Hettstedt. In sum, the combination (a) improves Hettstedt’s stated goal (efficient load

balancing), and (b) furthers Hettstedt's existing suggestion to make the system automatic and adaptive, and (c) does so in a way that is easy to implement (because a threshold-based trigger is readily programmable and machine-executable).

Reasonable expectation of success. Hettstedt already discloses how to determine the load. EX-1005 ¶0044 (air activity detection). The step of comparing the load to a threshold merely require a simple "if/then" statement (e.g., IF load > threshold, THEN...). EX-1003 ¶132. No special components are required, just a standard processor. *Id.*; see also EX-1006 ¶0040, ¶0048. Nothing in the '232 patent disclosure suggests the marginal step of using a threshold value is new, unpredictable, or requiring special programming. Determining whether the load is beyond a "threshold" is a mathematical-type operation (e.g., IF load > threshold, THEN...). EX-1003 ¶132. Thus, it yields predictable results. *Id.*

Additional reasons supporting obviousness. The *KSR* case identifies two further rationales that support obviousness: (1) where a modification is merely a predictable variation and (2) where the modification merely calls for using a known technique to improve a similar device. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 417, 127 S. Ct. 1727, 1740 (2007). Both apply here. EX-1003 ¶¶132-135. First, even if the PTAB concludes Hettstedt itself does not explicitly disclose the recited threshold, Hettstedt certainly suggests using a threshold where it

teaches to identify which radio heads (a) have “high load on their active carriers” (i.e., their subset) and (b) are “loaded over a predetermined value.” *Supra* 32-33; EX-1003 ¶135. Second, Hettstedt and Wellington involve similar systems: both involve multi-carrier wireless cellular systems that operate using the same type of radio resource (carriers). *Compare* EX-1005 ¶0053 *with* EX-1007 at 4:59-5:24; *see also* EX-1003 ¶¶133-134. A POSITA would recognize that Wellington would improve Hettstedt in a similar way because both references rely on the same underlying concept of activating/de-activating carriers based on monitoring the load on the carriers. *Compare* EX-1005 ¶0044 *with* EX-1007 at 5:16-55, Figs. 2-3.

B. Independent Claim 12

Claim 12 recites essentially the same limitations as claim 1, except in the form of a “method.” Hettstedt’s and Wellington’s disclosure equally applies to a “method.” EX-1005 ¶0008, ¶¶0016-0025, Fig. 5; EX-1007 at 3:1-13, 4:59-60. Using Hettstedt’s system and Wellington’s teaching described above for claim 1, results in performing the methods recited in claim 12 and renders claim 12 obvious for the same reasons discussed above. EX-1003 ¶¶137-141.

C. Independent Claim 20

Claim 20 recites the same limitations as claim 12 and is obvious for the same reasons, except that Claim 20 recites a different preamble: “One or more non-transitory computer readable storage media storing instructions ...” EX-1001.

The combination of Hettstedt and Wellington renders obvious the preamble of Claim 20. EX-1003 ¶¶142-150.

Hettstedt inherently discloses the preamble. EX-1003 ¶¶143-145. Hettstedt teaches that CMU can perform its cell management using “software control” and “automatically.” EX-1005 ¶0028. A POSITA would know that the CMU must contain a processor to execute the software and non-transitory computer readable storage media to store the software instructions for automatic execution. For example, the CMU’s software control involves “mapping” means (EX-1005 ¶0045) to map the carriers to radio heads (i.e., *instructions*), and a POSITA would store such mapping instructions in non-transitory storage instead of transitory storage because Hettstedt’s system is not intended for transitory or temporary operation. EX-1003 ¶144. Cellular systems like Hettstedt’s are designed to operate for years and accommodate power loss and failure (by using non-transitory storage). *Id.*

Alternatively, a POSITA would find the preamble obvious in view of Hettstedt itself or Wellington. EX-1003 ¶¶146-149. By the relevant time (2010), processors and non-transitory computer readable storage media for storing instructions were extremely well-known standard components to implement software. EX-1003 ¶¶146-147. They were part of the basic background art and common knowledge for implementing software. *Id.* Wellington, for example,

teaches to use a “processing unit” (1204) and “non-volatile memory” (1210) when implementing carrier management systems like Hettstedt:

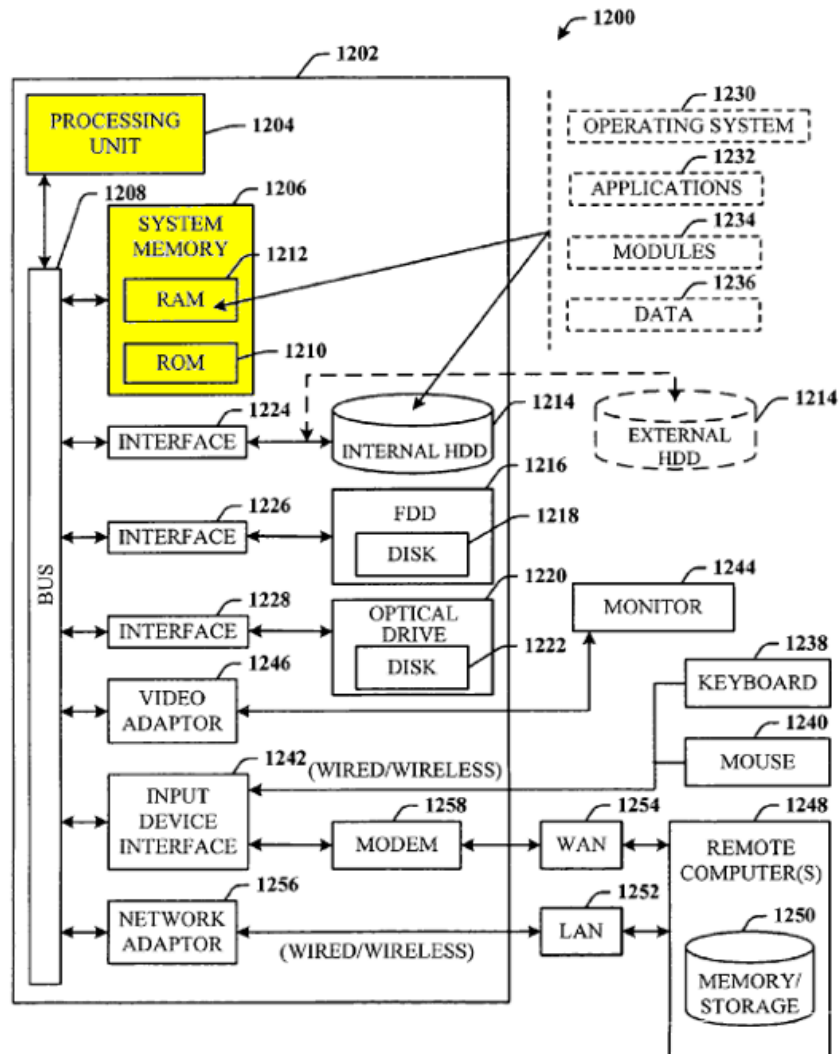


FIG. 12

EX-1007 at Fig. 12, 13:35-56, *see also* EX-1007 at 13:4-21, 3:1-13, 12:48-64, claims 36-40. A POSITA would have a reasonable expectation of success: the recited components were standard components. EX-1003 ¶147. A POSITA would have been motivated to include the elements recited in the preamble to obtain the

benefit of using standard, widely available components when implementing Hettstedt. *Id.*

Therefore, Claim 20 is obvious in view of Hettstedt and Wellington.

D. Dependent Claims

1. Claims 2 and 13⁵

“2. The wireless system of claim 1, wherein the change in need is determined based on a change in capacity needed by the number of wireless subscribers coupled to the second access point or a change in throughput needed by the number of wireless subscribers coupled to the second access point.”

Hettstedt discloses at least the “capacity needed...” option in these claims.

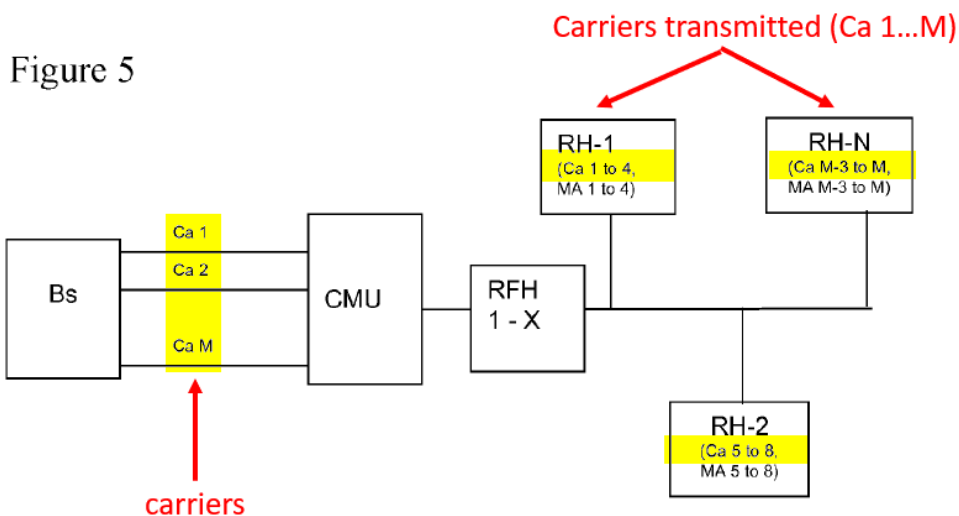
EX-1003 ¶¶151-156. First, a Hettstedt explains its technique means that “*capacity* can follow moving users in complex buildings” for “dynamic distribution of hot spots.” EX-1005 ¶0029. Thus, a POSITA understands the recited determination is based on where the capacity is needed. EX-1003 ¶¶152-153. A “hot spot” is an example of a change in the capacity needed by the wireless subscribers coupled to the radio head at the location of the hot spot (i.e., *the second access point*). *Id.* Hettstedt’s disclosure parallels the ‘232 patent’s disclosure. The ‘232 patent’s

⁵ Claim 2 is representative of claim 13; claim 13 is invalid for the same reasons.

The same is true for each of the following sections listing multiple dependent claims.

example of a change in capacity needed is when users gather at one location (i.e., form a hot spot). EX-1001 at 6:57-60; 1:46-52.

Second, Hettstedt determines whether to perform load balancing (i.e., whether there is change in need) based on the load on the carriers at each radio head. EX-1005 ¶¶0044; EX-1003 ¶¶154-155. The “load” on the carriers at a radio head is a measure of the capacity needed by the wireless subscribers coupled to the radio head. EX-1003 ¶154. The carriers are the capacity supplied by the base station:



EX-1005 at Fig. 5, ¶¶0050, ¶¶0053-0054. Because Hettstedt does this load identification for “each of the radio heads,” Hettstedt’s disclosure covers the “second access point.” EX-1005 ¶¶0044; EX-1003 ¶154.

2. Claims 3 and 14

“3. The wireless system of claim 1, wherein the additional resources are included in the first subset prior to being assigned to the second access point, and wherein the one or more central nodes assign the additional radio resources of the plurality of radio resources to the second access point comprises removing the additional resources from the first subset assigned to the first access point.”

Hettstedt discloses these additional claim elements. Hettstedt’s load balancing involves the carriers (“*additional resources*”) being both (1) “de-activated” at the RHs with low traffic load (i.e., “*removed*”) and (2) “shifted” to RHs with high traffic load where they are “activated” (i.e., “*assigned*”). EX-1005 ¶¶0029; ¶0044. Hettstedt’s disclosure of shifting the carriers “from radio heads” in low traffic areas “to radio heads” inside high traffic load areas means the carrier was included in the subset of the low traffic RH (*first subset*) prior to being assigned to the high traffic RH (*second access point*). EX-1005 ¶0044; EX-1003 ¶¶157-160.

3. Claims 4 and 15:

“4. The wireless system of claim 1, wherein the one or more central nodes analyze one or more transmission parameters associated with the second access point to determine the change in need.”

As explained for Claim 1, Hettstedt teaches that the CMU (*central node*) determines changes in need (e.g., high load vs. low load) of the radio heads (*access points*) during load balancing. Hettstedt further teaches that the CMU analyzes the same transmission parameter that is disclosed in the ‘232 specification. EX-1003

¶¶163-164. The ‘232 specification discloses a module that “detects” which carriers are “active” to determine how the carrier is loaded. EX-1001 at 12:6-8. Likewise, Hettstedt teaches that the CMU performs “*activity detection*” for each carrier. EX-1005 ¶0044. The level of activity on the carriers (e.g., high vs. low activity) is an example of *one or more transmission parameters*. EX-1003 ¶163. Because Hettstedt teaches to perform this analysis for “each” radio head, it discloses *analyzing one or more transmission parameters associated with the second access point*. EX-1005 ¶0044; EX-1003 ¶163. Therefore, Hettstedt discloses these additional claim elements.

4. Claim 5:

“5. The wireless system of claim 1, wherein the one or more central nodes determines the change in need by determining that at least one transmission parameter associated with the second access point is greater than a threshold.”

As shown in the prior claim, Hettstedt teaches that the CMU (*central node*) determines the change in need by analyzing the same transmission parameter that is disclosed in the ‘232 specification (the level of activity on the carriers).

Hettstedt further teaches to do this analysis (1) for “each carrier on each of the radio heads” (EX-1005 ¶0044) (2) to identify “where the remote radio heads are loaded over a predetermined value” (EX-1005 claim 3). To the extent this is not already a disclosure of this claim element, this claim is obvious as discussed above in view of Wellington’s teaching to monitor a parameter (e.g., the recited

transmission parameter) and trigger additional carriers when the parameter reaches a “predetermined level” or “predetermined threshold.” EX-1007 at 1:61-63 (“predetermined level”), Wellington’s claim 8 (“predetermined threshold”), Fig. 2 (determine if “HIGH?”). For the same reasons discussed for the independent claim, a POSITA would have found it obvious to combine Hettstedt with Wellington’s teaching such that the CMU includes a trigger condition that monitors the level of activity on the carriers (the *transmission parameters*) and triggers the process of shifting carriers to the high activity radio heads (the *second access point*) when the level of activity on the existing carriers is greater than the “predetermined level” or “predetermined threshold” defined by the trigger. EX-1003 ¶¶165-167, ¶¶128-135.

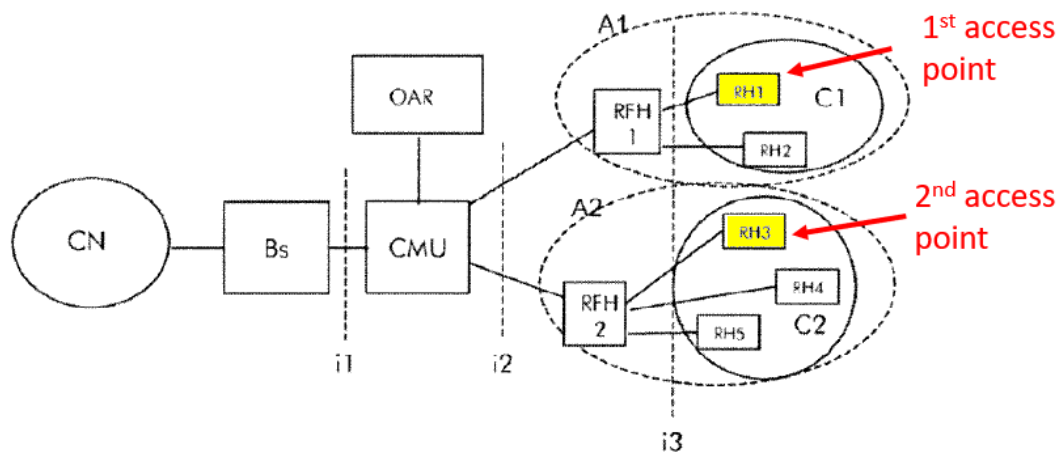
5. Claims 6 and 16:

“6. The wireless system of claim 1, wherein the first access point belongs to a first sector and the second access point belongs to a second sector.”

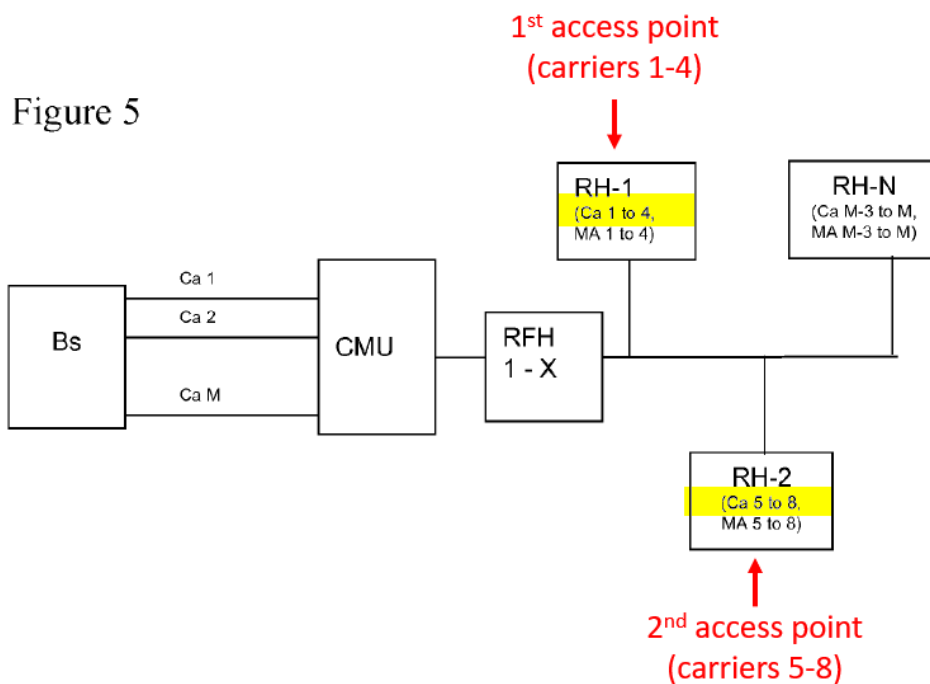
The ‘232 patent specification does not use the term “sector.” POSITAs use “sector” when referring either to distinct coverage areas or distinct radio resources. EX-1003 ¶¶168-173. Which meaning applies does not matter—Hettstedt discloses both. EX-1003 ¶¶173-180.

Hettstedt teaches that the radio heads (*access points*) may belong to “different” coverage areas. EX-1005 ¶0052; EX-1003 ¶174. Figure 3 shows this:

Figure 3



EX-1005 at Fig. 3, ¶¶0051-0052. RH1-2 belong to “first cell area” (C1); RH3-5 belongs to “second cell area” (C2). *Id.* ¶0051. Hettstedt also teaches that radio heads can have distinct sets of carriers (radio resources):



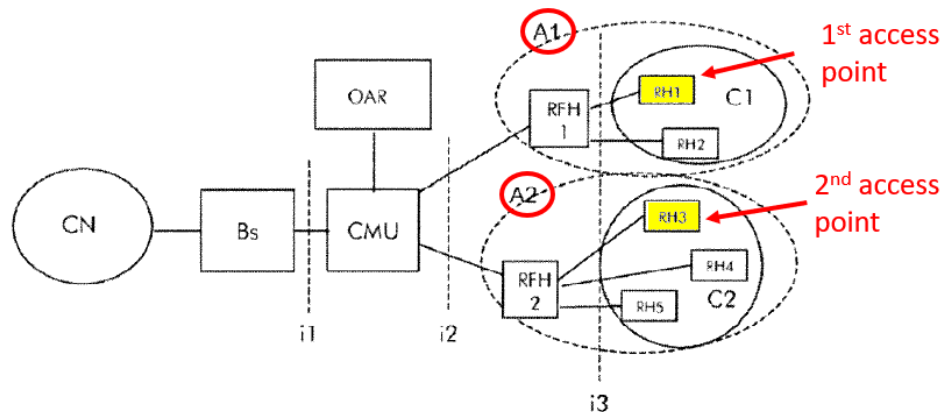
EX-1005 at Fig. 5, ¶0053; EX-1003 ¶¶176-178. Because Hettstedt’s radio heads may belong to distinct cells, locations, and carrier sets, Hettstedt discloses these claim limitations. EX-1003 ¶¶174-180.

6. Claims 7 and 17:

“7. The wireless system of claim 1, wherein the first access point belongs to a first building and the second access point belongs to a second building.”

Hettstedt’s radio heads may belong to different indoor location areas. EX-1005 ¶¶0051-0052. Figure 3 shows an example:

Figure 3



A1 and A2 are “first” and “second” indoor location areas, which may be “buildings.” EX-1005 ¶0051, ¶0002 (“...in buildings”); ¶0029 (“complex buildings”). Therefore, Hettstedt discloses these additional claim elements. EX-1003 ¶¶181-182.

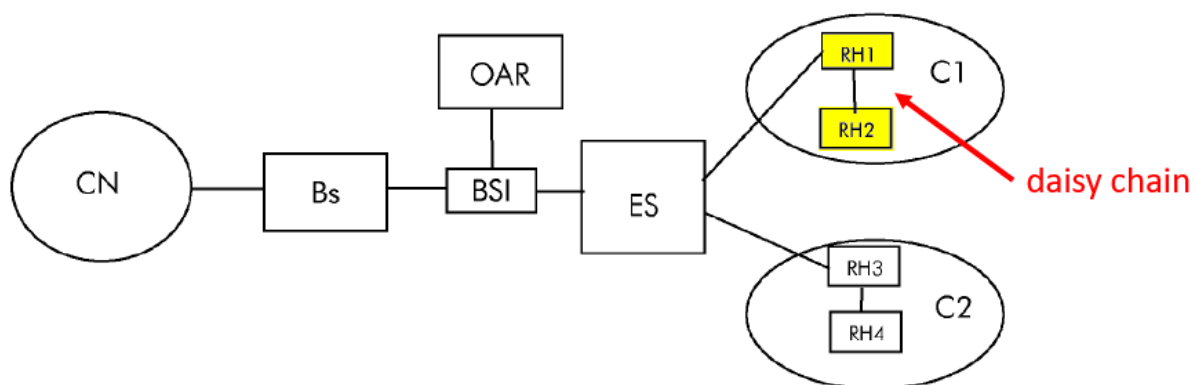
7. Claim 9 and 19

“9. The wireless system of claim 1, wherein at least two of the plurality of wireless access points are connected in a daisy chain manner to relay communications between at least a subset of the plurality of wireless access points.”

Hettstedt itself renders these claim limitations obvious. EX-1003 ¶¶183-192. Hettstedt teaches a plurality of radio heads (*wireless access points*). EX-1005 ¶0039, Figs. 3-6. A POSITA would have found it obvious to daisy-chain at least two of the radio heads.

First, Hettstedt illustrates daisy-chaining in its background discussion of a similar “known indoor communications system” shown in Figure 2:

Figure 2



EX-1005 at Fig. 2, ¶0006; EX-1003 ¶184. Hettstedt identifies an example of the system in Figure 2: U.S. 2005/0157675 (‘675 publication). EX-1005 ¶0006. The ‘675 publication explains how radio heads may be “cascaded” (i.e., daisy-chained). EX-1018 ¶¶0025-0028 (how to cascade), ¶0026 (“Alternatively, the functionality

of this processor may be located *within one or more of the RRHs.*”). Thus, Hettstedt’s own specification advises a POSITA of the option to daisy-chain remotes.

Second, Hettstedt teaches to deploy its system in scenarios well-recognized in the art as implicating daisy-chaining. EX-1003 ¶185. Hettstedt applies to “tunnels” and “airports,” which both include long corridors. EX-1005 ¶0002, ¶0029; EX-1003 ¶185; EX-1019 at 1:40-44, 2:57-59 (background art on this point). In these scenarios, the closest connection point for each radio head is the prior radio head, not the CMU at the start of the tunnel or terminal. EX-1003 ¶185. Daisy-chaining the radio heads reduces the cabling and installation effort compared to running each cable back to the CMU at the start of the tunnel. *Id.* ¶¶185-186.

Motivation. A POSITA would have been motivated to daisy-chain Hettstedt’s radio heads to obtain the well-known benefits of: (1) reduced cabling and cost and (2) ease of installation/maintenance. *Id.* ¶186. Hettstedt implicate these benefits because Hettstedt disclosure involves “tunnels” and “airports.”

Reasonable expectation of success. A POSITA would have a reasonable expectation of success. *Id.* ¶¶187-192. (1) Daisy-chaining wireless access points involves adding a port to connect a cable between them. EX-1001 7:14-15 (“optical cable 115 performs the function of daisy chaining”). Hettstedt’s radio

heads necessarily already include a port (to connect to the upstream RFH); thus, this change calls for duplicating an existing type of structure. EX-1003 ¶¶187-192. Further, it was well known how to relay communications in a daisy-chain, e.g., by forwarding in the downlink and summing in the uplink. *Id.* Hettstedt communications have addresses, and a POSITA knows that addressing can be used to relay communications. *Id.* (2) Hettstedt’s specification points a POSITA to an example that explained how to daisy-chain radio heads. *Id.* ¶184. (3) The ‘232 patent does not disclose there is anything inventive or unexpected about incorporating the claimed daisy-chain interface.

8. Claim 11:

“11. The wireless system of claim 1, wherein the one or more one or more central nodes are coupled to a plurality of operator networks via the operator hub.”

Hettstedt’s CMU (the *central node*) connects to the core network (*operator network*) via a base station (the *operator hub*). EX-1005 ¶¶0039-0040, Figs. 3-6; EX-1003 ¶¶193-200. Hettstedt further disclose a “plurality of operator networks” because Hettstedt teaches that the CMU provides “*multi-operator*” functions. *Id.* ¶¶0026-0027 (“multi-operator”), ¶0042 (“multi-operator”). Each of the “multi” operators has a corresponding operator network. EX-1003 ¶195, ¶¶198-199. Hettstedt discloses an example where the CMU connects to eight base stations (see Fig. 6) with the base stations corresponding to plural “different operators.” EX-

1005 ¶0054 (“different operators”), Fig. 6, ¶0028 (“cell management for different services and operators”). The disclosure of plural “different operators” means there are a plurality of operator networks because each operator must have a network to function. EX-1003 ¶195, ¶¶198-199. Hettstedt disclosure parallels the ‘232 patent. The ‘232 patent discloses a “multi-operator” DAU coupled to different base stations where the base stations belong to different operators, which is precisely what Hettstedt discloses. EX-1001 at 7:59-8:9; 6:32-38.

Ground 2: Hettstedt itself renders obvious 1-7, 9, 11-17, 19-20

Ground 1 showed Hettstedt discloses all the limitations of these claims, except it assumed (based on the amendment added during prosecution, discussed above) that Hettstedt does not teach which of the second subset “is loaded beyond a threshold.”

The examiner, however, erred during prosecution because the examiner overlooked that Hettstedt discloses in its own claims the example that the shifted carriers are activated at radio heads that “are ***loaded over a predetermined value.***” EX-1005 at claim 3. None of the examiner’s citations to Hettstedt identified this disclosure. EX-1002 at A120. The example threshold disclosed in the ‘232 patent is a predetermined value. EX-1001 12:10-13 (“...loaded by a percentage greater than a ***predetermined*** threshold whose ***value*** is communicated to the DAU...”). The ordinary meaning of “threshold” refers to a “value.” EX-1036 (threshold: “a

level, point, or **value** above which something is true or will take place and below which it is not or will not”); EX-1037 (threshold: “A **value** used to denote predetermined levels.”). There is no discussion of or explanation in the record why this language in Hettstedt is not sufficient to disclose or render obvious the added limitation regarding a “threshold.”

A POSITA would have found the added clause at least obvious in view of Hettstedt’s disclosure that:

- Each radio head has a “subset.” EX-1005 at Fig. 5.
- The CMU shifts and activate additional carriers to radio heads with “high load on their active carriers” (their *subset*). *Id.* ¶0044.
- The CMU identifies the load on “each carrier on each of the radio heads.” *Id.* ¶0044.
- The CMU activates the carriers at the radio heads “are *loaded over a predetermined value*.” *Id.* at claim 3.

EX-1003 ¶¶203-205. A POSITA would have found it obvious to implement these teaching together, i.e., to identify which radio heads have a high load on their active carriers by determining whether the load on their active carriers is “loaded over” (i.e., “*loaded beyond*”) the predetermined value (i.e., the “*threshold*”). EX-1003 ¶203. In other words, a POSITA would have found it obvious to have the CMU assign an additional radio resource (by shifting and activated a carrier) when the load on the subset at a radio head exceeds the predetermined value. *Id.* Any of

“high” load subsets constitutes an example of the recited “*second subset*.”⁶ *Id.* A POSITA would have found it obvious to use Hettstedt’s “predetermined value” as a threshold—that is within the ordinary meaning of threshold.

Motivation. A POSITA would have been motivated to use Hettstedt’s predetermined value as the recited threshold to realize Hettstedt’s teaching to identify which radio heads have “high” load and enable the CMU to perform its cells management “automatically” (by simply comparing the load to the threshold). EX-1003 ¶204.

Reasonable expectation of success. Hettstedt already discloses the building blocks, including a predetermined value and how to identify the load on the subsets (by activity detection). EX-1003 ¶205. Determining whether the load is over the predetermined value is a simple mathematical comparison. *Id.*

Ground 1 shows Hettstedt discloses all the other limitations in these claims. Therefore, Hettstedt renders these claims obvious

⁶ Furthermore, because Hettstedt teaches its process examines “each carrier on each of the radio heads” (EX-1005 ¶0044), it is obvious to examine all the subsets, including the second subset.

Grounds 3 and 4: Wu renders claims 1-7, 9, 12-17, 19-20 obvious either alone or in combination with Sabat

The PTAB has already found the Wu reference renders obvious very similar claims in Patent Owner's overlapping '473 and '178 patents. Patent Owner cancelled very similar claims in its overlapping '178 patent when faced with Wu.

A. Independent Claims 1 and 12

By showing claim 1 is unpatentable as set out below, claim 12 is for the same reasons unpatentable because using Wu's systems would result in performing the method of claim 12.

Here are annotated Figs. 1, 2, and 4 of Wu showing the claimed *central node, wireless access points, and operator hub*.

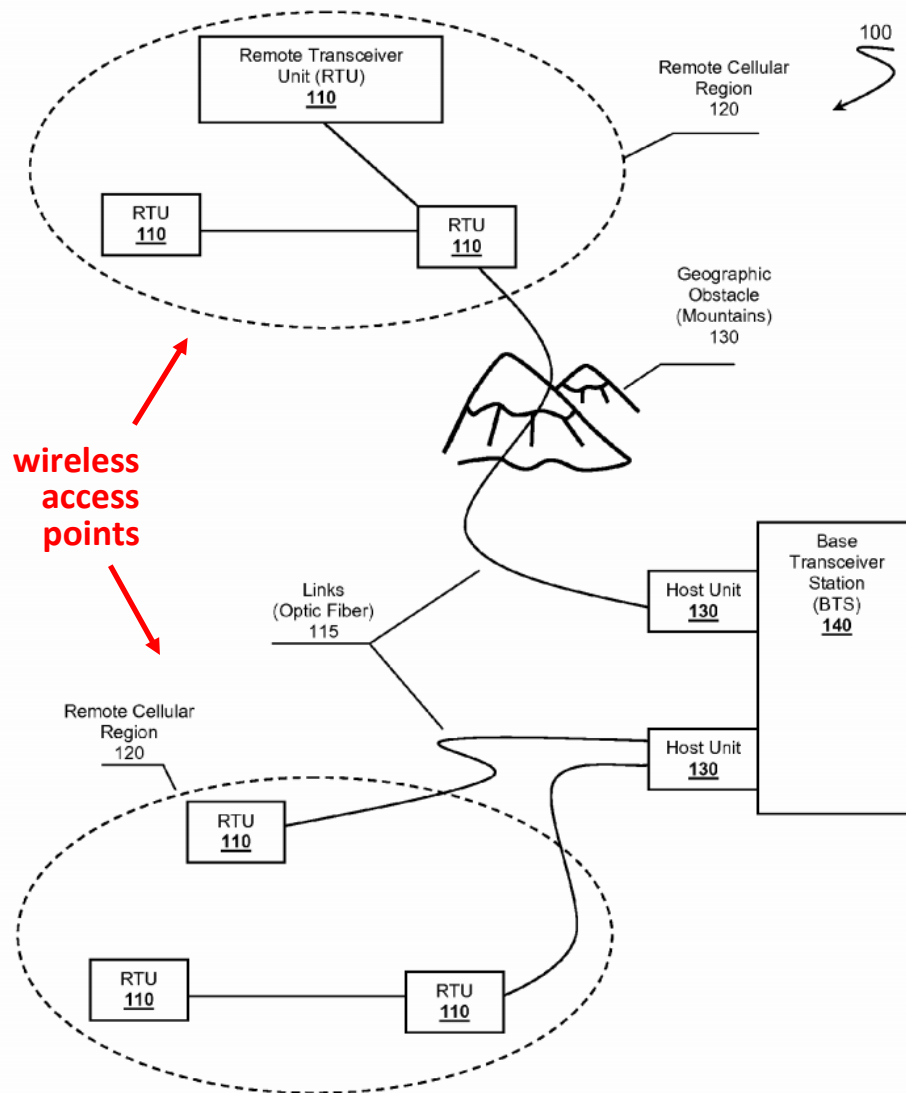


Figure 1

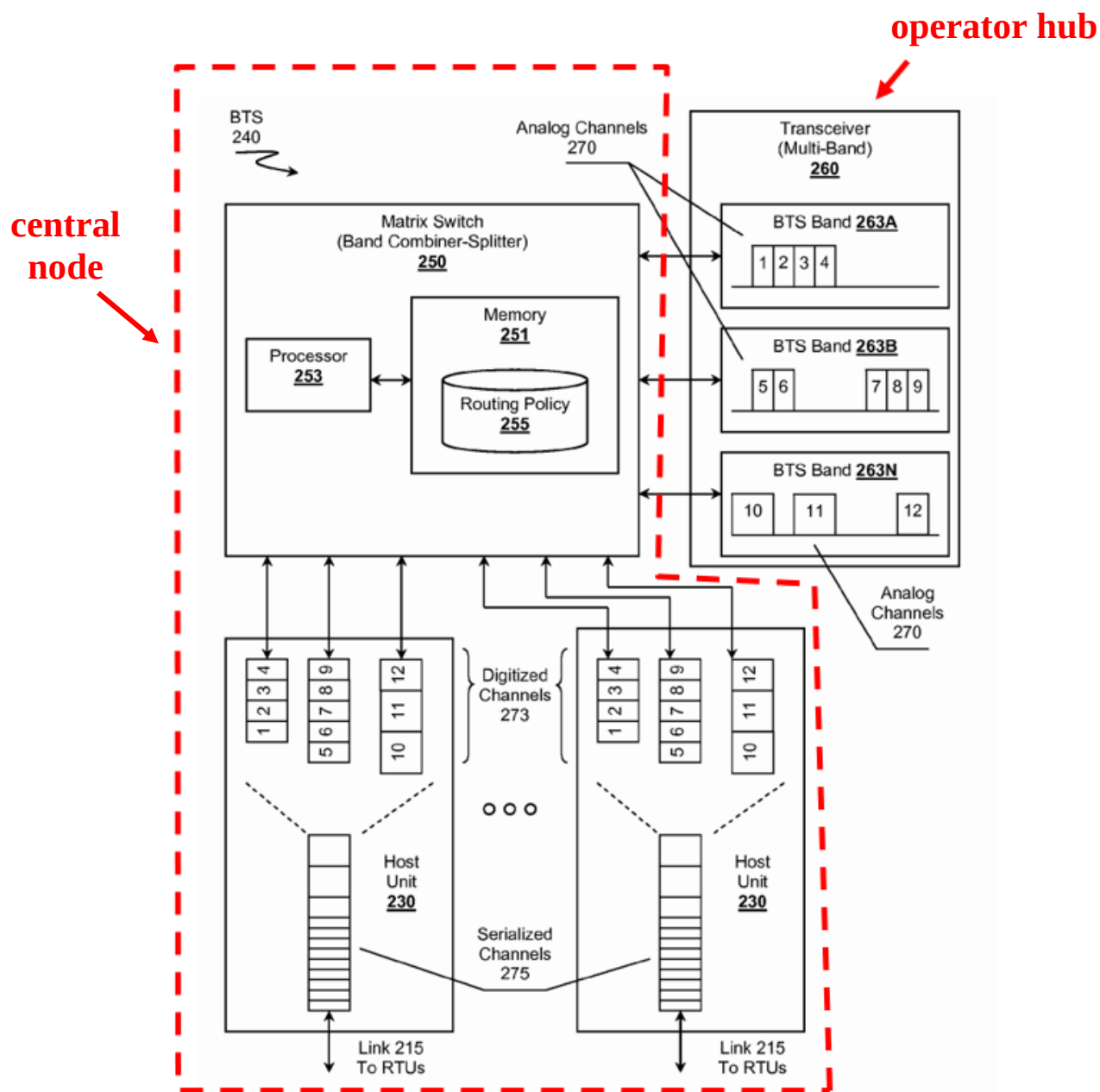
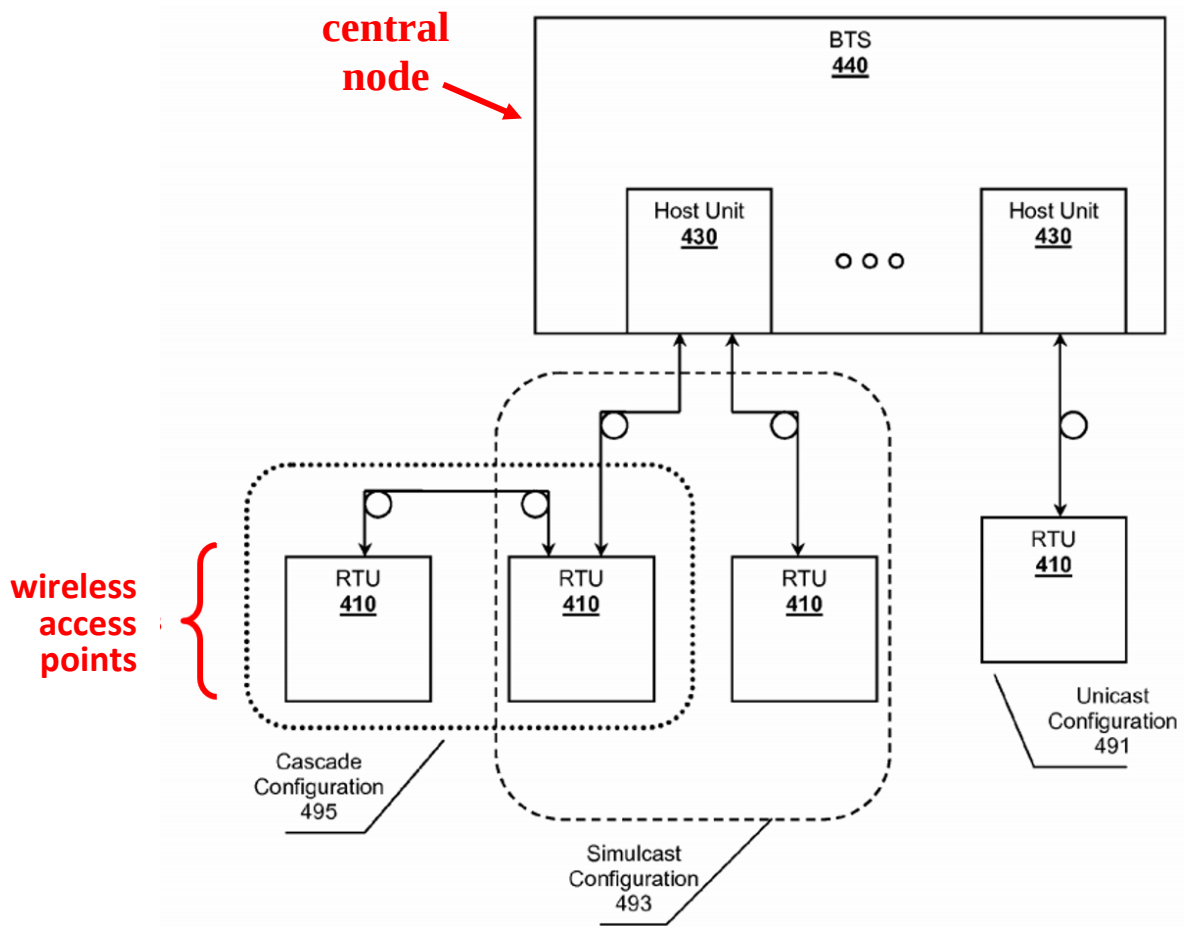


Figure 2



1. Element 1A (and 12A):

“A wireless system comprising...”

Wu’s discloses both a system and method. EX-1006 ¶¶0011 (“...*systems and methods* in which a carrier channel distribution system.”) Wu’s system and method are “wireless.” EX-1006 ¶¶0002 (“...*wireless* carrier channel technologies.”); EX-1003 ¶¶221-222. Wu’s RTUs (remote transceiver units) transmit and receive wireless communications. EX-1006 ¶¶0004, ¶¶0030. Thus, Wu discloses the preamble of claims 1 and 12.

2. Element 1B (and 12B, 20B):

“...one or more central nodes that receive a number of a plurality of radio resources from an operator hub that enables wireless communications and that provides the plurality of radio resources to a radio access network...”

First, the combination of the matrix switch 250 and units 130, 230 in Wu correspond to the claimed “*central node.*” EX-1003 ¶223.

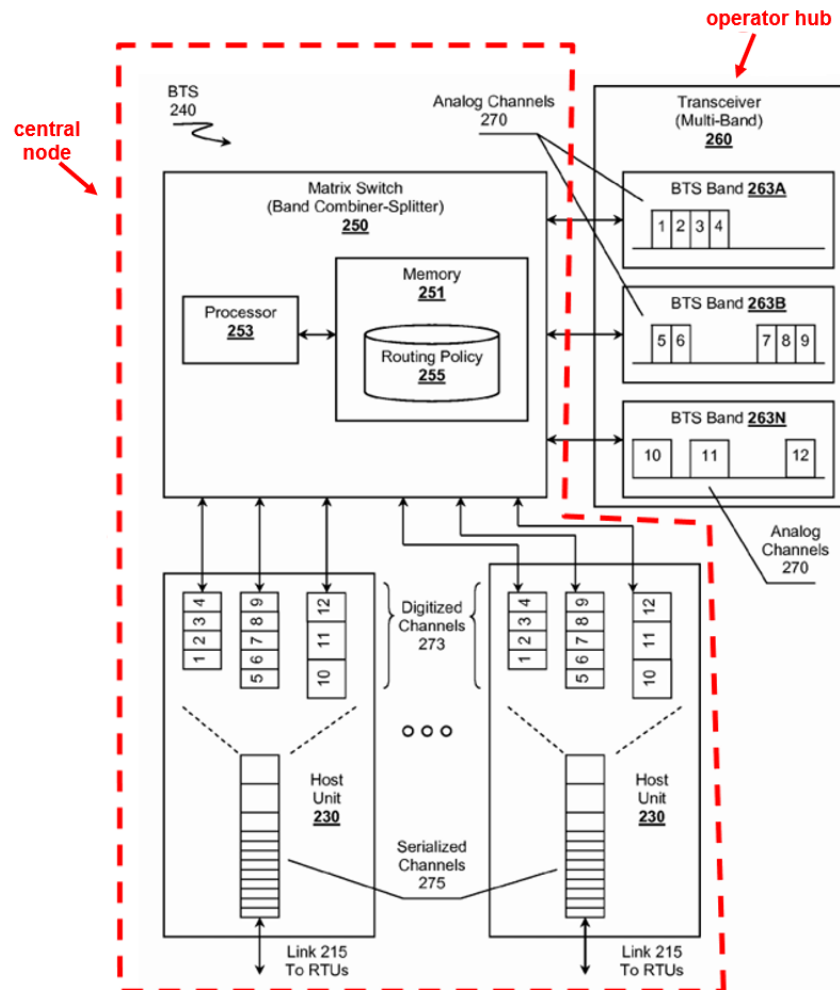
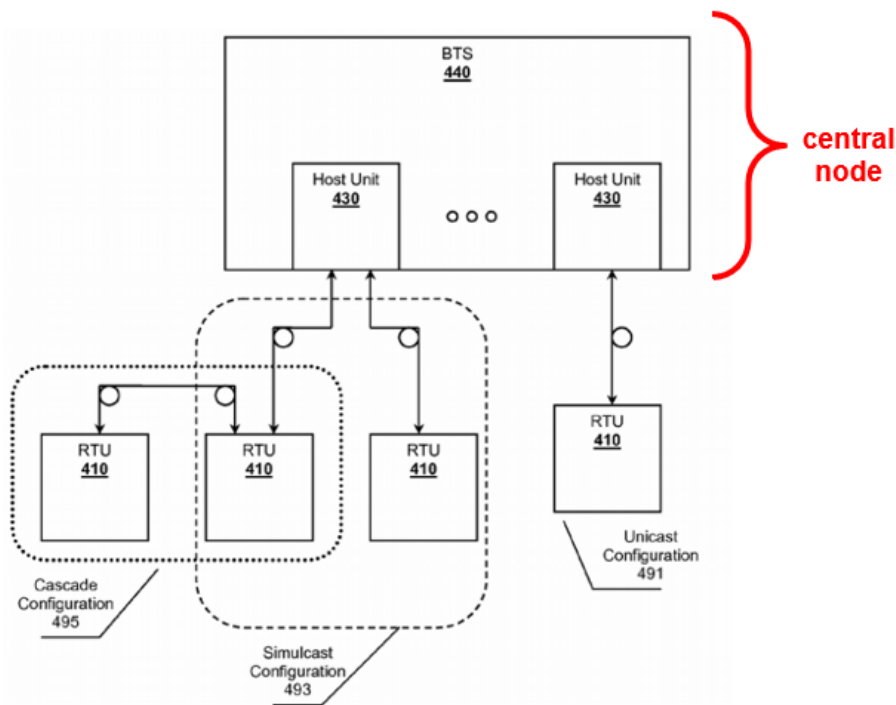


Figure 2



EX-1006 Figs. 2, 4. The combination of switch 250 and units 230 manages communications to and from the distributed RTUs and transceiver 260 (the *operator hub*). Units 130 are co-located at the centralized BTS in Figs. 1 and 4. Figure 2 shows a matrix switch is centrally located in the system between units 230 (which are the same units 130 from Fig. 1) and the BTS transceiver 260.

Alternatively, it would have been obvious to combine Wu's matrix switch and host units 130, 430 at a single central node. This combination would merely result in them both performing the same sequence of operations described in Wu and producing the same predictable result. One of skill in the art would have been motivated to do so, for example, to reduce the system complexity, reduce

installation costs by simplifying installation, and also minimize errors in coupling separate components.

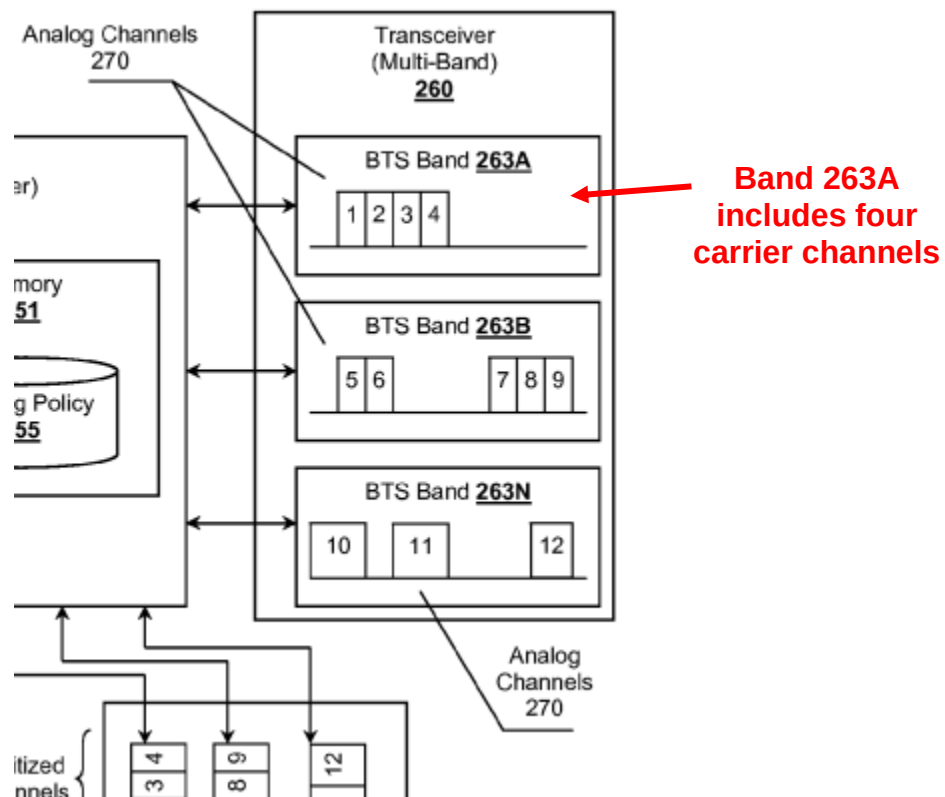
Prior Finding of the PTAB. The PTAB has already found that Wu’s matrix switch 250 and host units 130, 230 can be considered part of the same unit in the two prior IPRs mentioned above and expressly rejected contrary arguments by Patent Owner. EX-1041 at 21-22 (“We are persuaded that Wu discloses the claimed host unit as a combination of the matrix switch and host units... we also agree with Petitioner that it would have been obvious to place the functionality of both Wu’s matrix switch and host units *in a single unit*.”); EX-1039 at 27-28.⁷

Second, Wu’s multiband transceiver 260 corresponds to the claimed “*operator hub*” of Claim 1. EX-1003 ¶224. Wu teaches that the multiband transceiver may be co-located with the BTS matrix switch 250 as shown in the figures or alternatively may be located at a remote location. EX-1006 ¶0034. The multiband transceiver 260 “*enables wireless communications*” by receiving and transmitting signals within multiple frequency bands, including the well-known

⁷ The PTAB may treat these decisions as having preclusive effect, but that is not critical for this petition. There is a final adverse judgment in both IPRs, and Patent Owner did not appeal the adverse judgment against the ‘178 patent.

radio frequency bands used for wireless communications such as the bands around 800 MHz, 850 MHz, etc.... EX-1006 ¶0035.

Third, each band from the multi-band transceiver 260 includes multiple carrier channels or channels, which are “*radio resources*.” EX-1006 ¶0030, ¶0035, Fig. 2; EX-1003 ¶225. Wu’s Figure 2 shows multiple radio resources in each band:



An RF carrier channel is an RF carrier, which the ‘232 patent identifies is a “*radio resource*.” EX-1001 4:18-19 (“radio resources (such as RF carriers...)”). Band 263A, for example, includes four different RF channels.

Fourth, Wu’s multiband transceiver 260 (the operator hub) “*enables wireless communications and that provides the plurality of radio resources to a radio access network.*” In the downlink direction, the bands of channels are transmitted from the multi-band transceiver to the host units via the matrix switch and from the host units to the remote transceiver units. EX-1006 ¶0036. At the RTUs, the signals are transmitted wirelessly into the desired coverage areas at radio frequencies to wireless devices. *Id.* ¶0004. Because Wu’s system provides wireless radio frequency cellular communications over the air to and from wireless devices, it is a “*radio access network.*” EX-1003 ¶225.

3. Element 1C (and 12C, 20C):

“...using the Common Public Radio Interface (CPRI) protocol”

Element 1C refers to the operator hub providing the plurality of radio resources to a radio access network using a specific protocol: “CPRI.” CPRI was a well-known public standardized protocol for transmitting digital representations of RF carriers between portions of base station equipment, which was intentionally designed to support communication where the components are remote from each other. EX-1003 ¶226-236; EX-1017 at 9 (“radio base station system architectures involving *remote* radio equipment shall be supported.”).

Wu expressly discloses CPRI. Wu discloses using the CPRI protocol to communicate the channels between the host unit (part of the *central node*) and the

distributed RTUs because the RTUs are remote from the host unit. EX-1006 ¶¶0031, ¶¶0049, ¶¶0050; ¶¶0055.

Wu does not state that CPRI is used between the multi-band transceiver 260 and matrix switch 250. But it would have been obvious based on Wu alone or in combination with Sabat (EX-1010) to use the CPRI protocol for the communication link between Wu's multi-band transceiver 260 (*the operator hub*) and Wu's matrix switch / host units (*the central node*). EX-1003 ¶¶231-245. As explained below, the PTAB has already twice agreed with this in prior IPRs.

Obviousness based on Wu alone. In the embodiment in Figure 2, the transceiver is co-located with the matrix switch. Wu discloses, however, that the multi-band transceiver 260 could alternatively be remote. EX-1006 ¶¶0034 (“could be remotely coupled to transceiver 260”). As demonstrated by Wu itself which uses CPRI for communication to remote RTUs, the CPRI protocol was specifically designed to link remote components of a base station. EX-1003 ¶¶234. The CPRI protocol, because it was digital, provided advantages for remote communication links. EX-1003 ¶¶235. Digital signals are more immune to imperfections in electronic systems, have greater noise immunity, and can enable transport over longer distances. *Id.* Further, the open base station architecture standards such as CPRI were intentionally developed to provide a “flexible, cheaper and more scalable modular environment” for a radio access network. EX-1003 ¶¶236; EX-

1033 at A278 (lines 7-14). These known advantages would have motivated a POSITA to employ the digital CPRI protocol when locating the transceiver 260 remotely from the matrix switch 250 of the central node.

Further, a POSITA would have been motivated to use CPRI upstream of the matrix switch 250 to simplify Wu's system. Digital signal processing components can be less expensive, more reliable, and easier to manipulate than the radio circuitry necessary for processing analog RF signals. Wu's system could be simplified by removing the expensive analog circuits in the host units (see Figure 6-2 showing analog amplifiers, mixers, analog-to-digital converters). EX-1003 ¶237-238.

Still further, Wu discloses that the matrix switch only "preferably" operates in the analog domain. See EX-1006 ¶0038 ("Matrix switch 250 can operate as a combiner/splitter, *preferably* an analog combiner/splitter...." (emphasis added)). By indicating the matrix switch is only "preferably" analog, Wu tacitly acknowledges that a matrix switch could alternatively operate in the digital domain, that is, on digital signals. EX-1003 ¶239.

Reasonable expectation of success. A POSITA would have a reasonable expectation of success implementing this modification because CPRI was a standardized protocol already used by Wu for other remote links. *Id.* Extending the CPRI links to the upstream side of the central node is merely a predictable

variation of Wu's system when the matrix switch is digital. When implementing digital signals for the links upstream from the matrix switch (to and from the transceiver), it would have been obvious to continue to use CPRI, an existing, off-the-shelf protocol that was already being used in Wu for the digital links between units 130/230 and the RTUs. EX-1003 ¶¶233-239.

Obviousness based on the Sabat reference. Sabat disclosed that wireless service providers used not only analog base stations, but also digital base stations. EX-1010 ¶0014 (“a new class of base stations with digital inputs and outputs...”). When using a digital DAS (Wu is a digital DAS) with a digital base station, Sabat taught the communication link between the central node of the DAS and the base station (the “donor side” interface) can use the CPRI protocol. EX-1010 ¶0014, ¶¶0031-32, ¶0034, ¶0038.

It would have been obvious to use CPRI as the protocol between the matrix switch and signal source (multi-band transceiver) in Wu in light of Sabat so Wu's system could support digital base stations. EX-1003 ¶¶240-245.

Motivation to combine. A POSITA would have been motivated to combine Wu with Sabat for the same reasons identified above (e.g., the well-known benefits of digital transmission links and to avoid the unnecessary expense of analog circuitry in the central node). EX-1003 ¶243. Further, a POSITA would have been

motivated to combine Wu with Sabat to obtain the benefit taught by Sabat, i.e., enable Wu to distribute signals from digital base stations. *Id.*

Reasonable expectation of success. A POSITA would have a reasonable expectation of success for the same reasons given above, e.g., Wu already uses CPRI for his other remote communication links. Further, the similarity of the two systems (both employing matrix switches) would support a reasonable expectation of success. EX-1010 ¶¶0046-0050, ¶¶0036-37, ¶0038; EX-1003 ¶244.

Prior Finding of the PTAB. The PTAB previously addressed modifying Wu to use CPRI in the prior IPR for the related ‘473 patent. Claims 10 and 16 of the ‘473 patent required the central unit of the system (the “host unit” in the ‘473 claims) to packetize upstream signals “in compliance with the Common Public Interface Standard (CPRI).” EX-1042 at 13:49-52; 14:35-38. In the Final Written Decision, the PTAB found that it would have been obvious—both based on Wu itself and based on Wu combined with Sabat—to use the CPRI protocol between the matrix switch and its multi-band transceiver:

Petitioner persuasively shows that, in light of Wu’s disclosure of communication between a remote unit and host unit using CPRI, it would have been obvious to use CPRI to communicate upstream signals between the matrix switch and the base station. Pet. 90–91. Alternatively, Petitioner persuasively argues that it would have been obvious to modify Wu to use a digital CPRI link as taught by Sabat, between the matrix switch of Wu and the multiband transceiver 260. *Id.* at 90–91.

EX-1041 at 31-34. That same reasoning applies here.

4. Element 1D:

“a plurality of wireless access points that is coupled to the one or more central nodes and distributes one or more wireless signals to one or more wireless subscribers, the plurality of wireless access points including at least a first access point and a second access point,”

Wu’s plurality of remote transceiver units (RTUs) satisfy this limitation.

See, e.g., EX-1006 at Fig. 1, ¶0030, ¶0033, ¶0011; EX-1003 ¶246. Wu’s RTUs are coupled to Wu’s host units (part of the *central node*) via optical fibers. EX-1006 ¶0049, ¶0051.

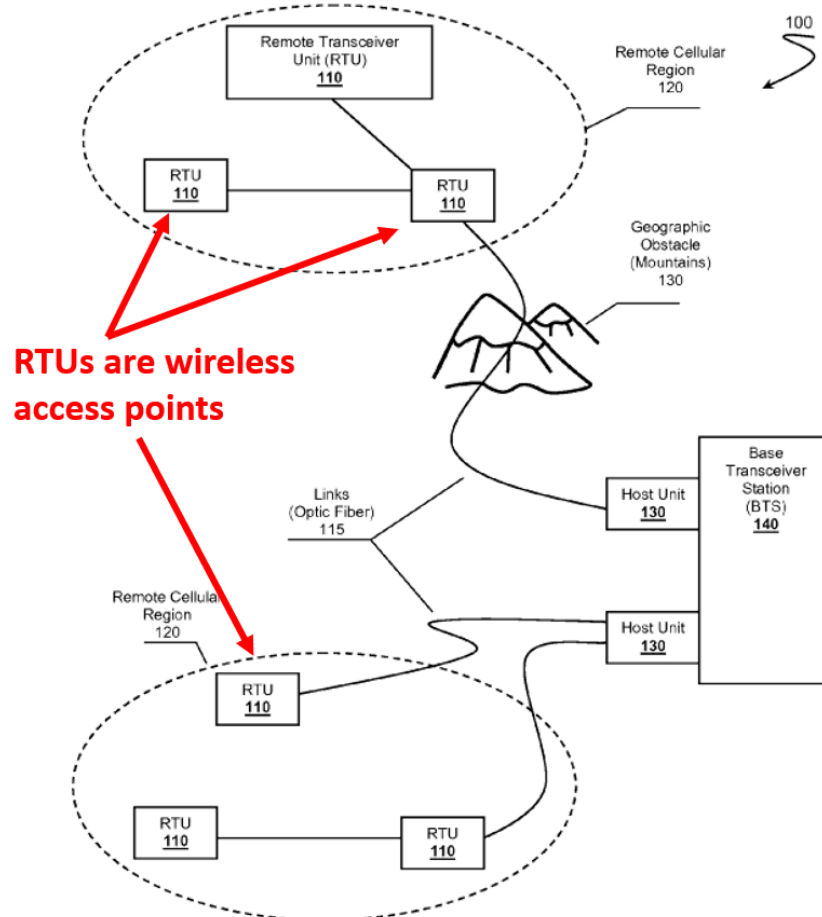


Figure 1

The RTUs transmit and receive (“*distributes*”) wireless cellular signals to and from wireless devices (the “*wireless subscribers*”) in their associated cellular coverage area. EX-1006 ¶0004.

5. Element 1E (and 12E, 20E):

“wherein one or more central nodes assigns a first subset of the number of the plurality of radio resources to the first access point and a second subset of the number of the plurality of radio resources to the second access point, the first subset including more radio resources than the second subset, and”

The matrix switch (part of the *central node*) performs this function in Wu. Wu’s disclosure emphasizes that the matrix switch employs a routing policy that provides fine-grained control to allocate sets of downlink channel signals individually or in arbitrary groups to different RTUs. EX-1006 Abstract, ¶0009, ¶0011, ¶¶0038-39, ¶0047, ¶0049; EX-1003 ¶¶247-250. Wu’s matrix switch splits each band into individual channels or groups of channels, so different sets of channels can be routed to different RTUs depending on current conditions such as usage, load, weather, or events. EX-1006 ¶¶0038-0039, ¶¶0040-0047. Each of Wu’s channels is a radio resource, and Wu provides examples where different subsets of the radio resources having different numbers of channels are allocated to different RTUs. *See, e.g.*, EX-1006 ¶0043 (“The first region could be allocated a large number of channels during business hours while a residential region might have a smaller number of channels during the same time frame.”); ¶0047 (carrier 1

to an RTU while two carriers (carriers 5 and 6) routed together to an RTU); ¶0046 (“allocate more channels” to increase the bandwidth available to victim or aid workers in a particular region when a disaster occurs); EX-1003 ¶¶247-250.

Prior Finding of the PTAB. In the prior IPR for the related ‘473 patent, the PTAB found Wu’s matrix switch/host units practice a similar limitation reciting that a unit is configurable to transmit a “first subset” and a “second subset.” EX-1041 at 6, 19-24. In the prior IPR for the overlapping ‘178 patent, the PTAB further found Wu’s matrix switch/host units practice a similar limitation reciting that the “number” of channels in the first and second set are different (i.e., one is more than the other). EX-1039 at 7, 25-26, 28.

6. Element 1F (and 12F, 20F):

“wherein, in response to a change in need of a number of wireless subscribers coupled to the second access point and which of the second subset is loaded beyond a threshold, the one or more central nodes assign additional radio resources of the plurality of radio resources to the second access point.”

Wu’s matrix switch employs a routing policy that satisfies this limitation. Wu explains that the number of channels routed to an RTU may change by means of the routing policy that includes rules for reacting to events and conditions. EX-1006 ¶0041 (“The rules of policy 255 can include one or more criterion representing a trigger ...When the criteria are met, matrix switch 250 can take appropriate routing action.”), ¶¶0038-47, ¶0039 (...usage, load, weather,

events...”). The triggered routing actions include, e.g., “to allocate more channels” to a region “to increase the bandwidth available.” EX-1006 ¶¶0046.

Wu describes that the channel allocations can be distributed in response to government/police requests or events that create special needs to support wireless service to aid workers or victims (e.g., disasters or weather events). EX-1006 ¶¶0046. EX-1003 ¶¶251-255. Wu also describes that the channel allocations can be triggered based on a “threshold” relating to metrics such as current traffic load. EX-1006 ¶¶0041-42 (“one or more criterion representing a trigger for an action... a **threshold**...”); ¶¶0044 (policy 255 “routes, allocates, or distributes channels based on a current traffic load”); ¶¶0045 (“threshold criteria” may establish a triggering criteria); ¶¶0046-47. Wu explains that the processor 253 within the matrix switch (part of the *central node*) can be configured to analyze the traffic metrics to determine whether a triggering condition relating to current traffic load has been satisfied. *Id.* ¶¶0044.

Measuring network conditions such as usage, traffic rate, and consumed bandwidth are each different ways to determine subscriber needs in the coverage area of an RTU. EX-1003 ¶¶254. For example, consumed bandwidth is a measure of the amount of radio resources assigned to an RTU that are actually in use, i.e., carrying traffic. *Id.* Triggering an allocation of more channels to an RTU based on a threshold criteria relating to current traffic load (such as by determining whether

the consumed bandwidth of the carrier channels currently assigned to an RTU have exceeded a threshold) as disclosed in Wu's routing policy satisfies this limitation.

Id.

Prior Finding of the PTAB. In the prior IPR for the overlapping '178 patent, the PTAB found Wu's matrix switch 250 and host units 130, 230 discloses similar limitations reciting configuring the set of signal based on "a change in subscriber needs" and "load balancing." EX-1039 at 31; *compare* EX-1038 at claims 5, 4, 17 *with* EX-1040 at 3.

B. Independent Claim 20

Claim 20 recites the same limitations as Claim 12, with a different preamble: "One or more non-transitory computer readable storage media storing instructions ..." EX-1001. Wu discloses this preamble. Wu discloses that his carrier channel distribution system includes "software instructions stored on a computer readable media" and "at least one processor configured to execute" the software instructions. EX-1006 ¶0029; EX-1003 ¶257. Wu's Figure 2 shows this:

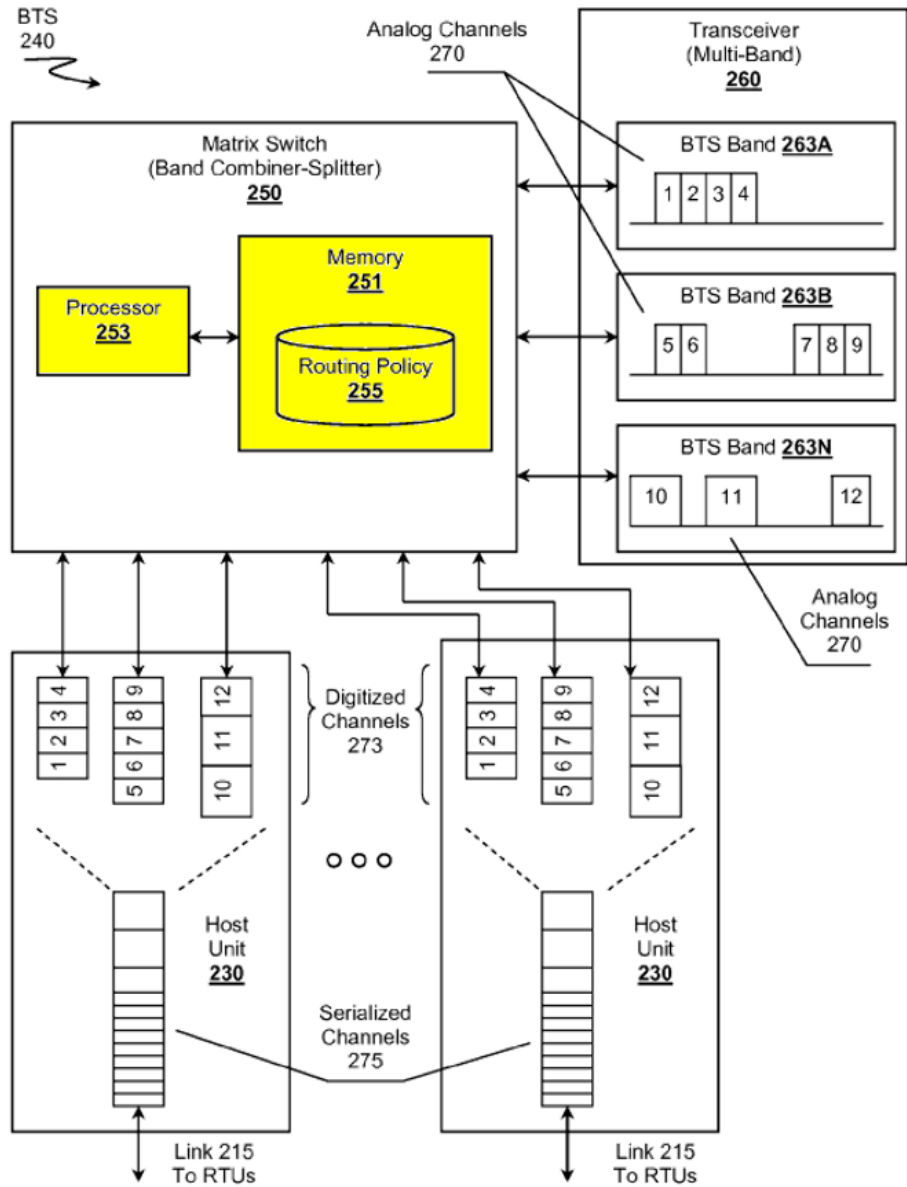


Figure 2

Wu explains that the routing policy that controls the switch “is considered to include programmatic instructions stored on a computer readable memory 251 that can be executed within processor 253 that configures switch 250 to properly route

the channels.” EX-1006 ¶¶0040. Wu identifies non-transitory memory storage media: “flash card, hard drive...” EX-1006 ¶¶0048.

The body of claim 20 recites the same limitations as claims 12. Therefore, claim 20 is obvious based on Wu alone or in combination with Sabat for the same reasons discussed above.

C. Dependent Claims

1. Claims 2 and 13:

“2. The wireless system of claim 1, wherein the change in need is determined based on a change in capacity needed by the number of wireless subscribers coupled to the second access point or a change in throughput needed by the number of wireless subscribers coupled to the second access point.”

Wu discloses this limitation multiple ways. First, Wu teaches its routing policy changes allocations in response to government/police requests, events that create special needs to support wireless service to aid workers or victims (e.g., disasters), or threshold criteria based on observed or calculated traffic load metrics. EX-1006 ¶¶0046, ¶¶0042-44. These are examples of ways to determine when there is a change in capacity needed or throughput needed by subscribers in the region serviced by a particular RTU. EX-1003 ¶¶258.

Second, Wu also teaches that the routing policy makes allocation decisions based on a schedule or events that coincide with increased need for capacity or throughput which also satisfies this limitation. EX-1003 ¶¶259. For example, Wu

discloses allocating additional bandwidth (capacity and throughput) during business hours where there are a significant number of commercial businesses or to locations of a pre-scheduled sporting event. EX-1006 ¶¶0043, ¶0046. This parallels the example in the ‘232 patent specification—where the need for capacity near a business cafeteria increases during lunch. EX-1001 at 1:46-58 and 6:54-60.

2. Claims 3 and 14:

“3. The wireless system of claim 1, wherein the additional resources are included in the first subset prior to being assigned to the second access point, and wherein the one or more central nodes assign the additional radio resources of the plurality of radio resources to the second access point comprises removing the additional resources from the first subset assigned to the first access point.”

Wu discloses this limitation multiple ways. First, Wu’s system allocates carrier channels “from” one cell region “to” another. EX-1006 ¶0005. This is a disclosure of not only adding radio resources where needed, but taking those resources “from” other regions, i.e., “*removing the additional resources from the first subset*”. EX-1003 ¶261. Wu gives a specific example: during business hours a region with commercial businesses is allocated additional bandwidth, while “during the same time frame” a smaller number of channels is allocated to a residential region. EX-1006 ¶0043. Second, Wu discloses programming the routing policy to perform “load balancing,” which was known to include de-allocating resources in order to “balance” the burden on a radio resource to be re-

allocated to other locations where demand or load is spiking. EX-1006 ¶0044; EX-1003 ¶261.

If Patent Owner disputes Wu's disclosure, alternatively, this element is obvious in light of Wu. Wu's flexible routing policy is intended to enable allocating resources in response to variable conditions (load, weather, events, or other circumstances). EX-1006 ¶0039. It would have been obvious, once the system detected a triggering event requiring additional resources at a needy location, to take a radio resource from (i.e., de-allocate or remove from) an RTU at a location having less need of it so that the resource could be less burdened for use in the more needy region. EX-1003 ¶262. A POSITA would have been motivated to do because removing the resource from the RTU in less needy region increases the amount of available capacity on that resource that will be available for the RTU in the more needy region (i.e., improves the ability to satisfy the need). *Id.*

3. Claims 4 and 15:

“4. The wireless system of claim 1, wherein the one or more central nodes analyze one or more transmission parameters associated with the second access point to determine the change in need.”

Wu discloses that the routing policy being executed by the matrix switch (part of the *central node*) includes rules based on metrics such as observed metrics measured by the matrix switch or calculated metrics that satisfy this limitation. EX-1006 ¶0042, ¶0044-45. Wu discloses “Processor 253 can be configured to

analyze traffic metrics (e.g., data rate, call rate, consumed bandwidth, etc.) and correlate various metrics with a signature of potential traffic issues, load balancing for example.” *Id.* ¶0044. The metrics are associated with RTUs or with remote regions associated with one or more RTUs. EX-1006 ¶¶0042-0043 (metric values “of BTS 240 or RTUs”), ¶0038 (“matrix switch 250 routes analog channels 270 ... for distribution to remote regions or RTUs.”), ¶0051, ¶0031. Traffic metrics are examples of transmission parameters associated with an RTU (*access point*) that are used by the routing policy to determine a change in need. EX-1003 ¶¶264-265. Therefore, Wu discloses the added limitation of claims 4 and 15.

4. Claim 5:

“5. The wireless system of claim 1, wherein the one or more central nodes determines the change in need by determining that at least one transmission parameter associated with the second access point is greater than a threshold.”

Wu discloses that the routing policy executed by the matrix switch (part of the *central node*) can define triggers to change channel allocations using metrics including a “threshold” or “threshold criteria.” EX-1006 ¶0045, ¶0042; EX-1003 ¶266. Wu teaches that such a “threshold” can be applied to any of the disclosed metrics used by the routing policy, which includes the metrics discussed for the prior claim as examples of transmission parameters. EX-1006 ¶0045, ¶0042, ¶0044. Therefore, Wu discloses this limitation.

5. Claims 6 and 16:

“6. The wireless system of claim 1, wherein the first access point belongs to a first sector and the second access point belongs to a second sector.”

As mentioned in Ground 1, a POSITA uses “sector” to refer to either distinct coverage areas or distinct radio resources. Which meaning applies does not matter—these claims are obvious under either meaning.

Wu discloses that each RTU can (a) be located in a different coverage area and (b) receive different radio resources. Figure 1 shows multiple remote cellular regions 120:

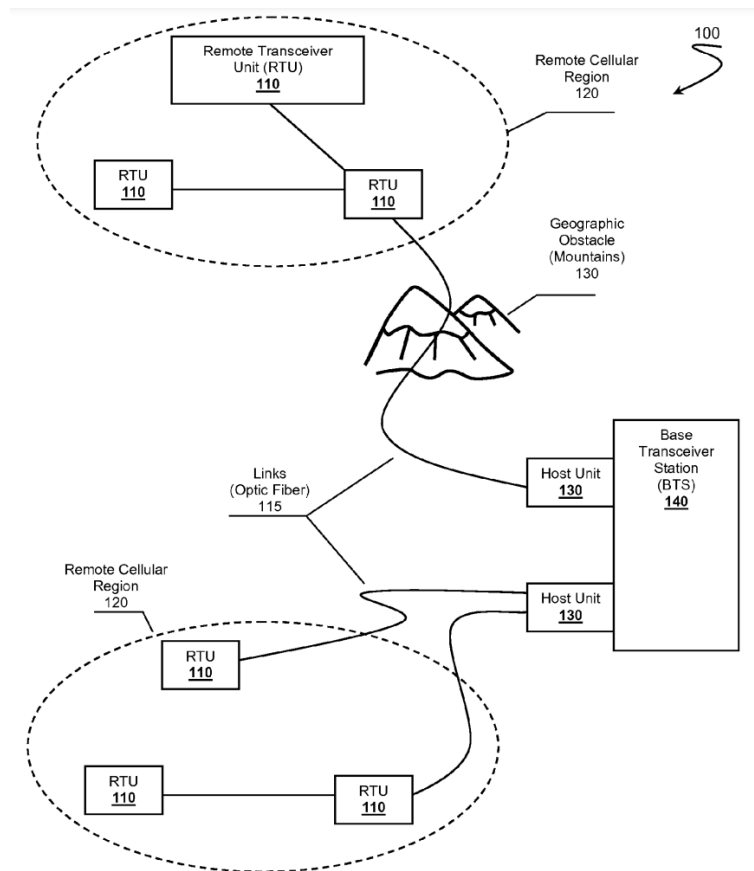


Figure 1

The examples shown include three RTUs having adjacent coverage areas within each region. The regions shown convey sectorization first in that they are shown in groups of three adjacent RTU areas. (Set of three at top of Figure 1 and set of three at the bottom.) In addition, the RTUs can be supplied with either the same (simulcast) or independent radio resources from the base transceiver station via the operation of the matrix switch routing carrier channels independently or in arbitrary groups to each RTU. EX-1006 ¶¶0047. Wu, therefore, also discloses a first access point that belongs to a first sector (e.g., uppermost RTU in Figure 1) and a second access point that belongs to a second sector (e.g., lowermost RTU in Figure 1 or the lowermost RTU in upper cellular region 120 both of which are in a different coverage area and can be supplied with independent radio resources from a different transceiver than the uppermost RTU). EX-1003 ¶¶267-268.

Furthermore, Sabat expressly discloses the use of sectors. Sabat discloses that the hub of a digital distributed antenna system, like the matrix switch of Wu, is coupled to multiple base stations where the signals from each base station are each a different “sector.” EX-1010 at Figs. 5 and 6 (Sectors 1...K); ¶¶0027-0028. Each different base station sector, which Sabat describes as a group of RF carriers (¶0010), is presented to the switched hub of Sabat for distribution to a different group of remote digital radio units. *See, e.g.*, EX-1010 ¶¶0044-0046 (“In Fig. 5, each sector is treated as a separate grouping of remote units with their associated

base station sector.”) (“... multi-sector DDR Hub 510...Any single DDR 504 can be connected to any base station sector 502”). A POSITA would have been motivated to use Wu’s system to deliver multiple sector signals, as shown to be desirable in Sabat, each to a different group of RTUs. Incorporating this feature would make Wu capable of implementing frequency reuse schemes to most efficiently utilize limited radio resources. EX-1003 ¶¶269-270. Therefore, it would have been obvious for a first and second of Wu’s RTUs to belong to a first sector and sector, respectively.

6. Claims 7 and 17:

“7. The wireless system of claim 1, wherein the first access point belongs to a first building and the second access point belongs to a second building.”

Wu discloses the limitation in claims 7 and 17 because it teaches RTUs are deployed in “*indoor* or outdoor environments.” EX-1006 ¶0050. Indoor environments include buildings. Wu teaches that each RTUs may be deployed in a different location. Ex-1006 ¶¶0032-0033, Fig. 1. Therefore, Wu discloses that a first RTU belongs to a first indoor environment (i.e., first building) and a second RTU belongs to a second indoor environment (i.e., second building). EX-1003 ¶271.

Alternatively, this limitation is obvious in view of Wu itself. Wu’s background section discusses known systems for carrier channel distribution (*see*

EX-1006 ¶¶0006-0008), and each of these references disclosed that remote antenna units of a carrier transport system can be distributed within buildings to improve coverage inside them. EX-1043 at 10:2-6 (“[Remote microcell antenna] units may be deployed on the roof of a building or *within a building*...”; 2:27-30; 26:22-25; EX-1044 ¶0018 (“The antenna's may be distributed *inside* or outside several *buildings*.”). Wu itself describes locating RTUs at plural “commercial businesses.” EX-1006 ¶0043. It would have been obvious that these could have been, for example, two different commercial buildings. EX-1003 ¶272.

Even if not obvious based on Wu alone, Sabat discloses using the distributed antenna system inside buildings. EX-1010 ¶0005 (“An example is *in-building* coverage....”). A POSITA would have been motivated to place the RTUs of Wu within buildings to obtain the same advantages taught by Sabat, i.e., it avoids the cost of placing a base station within each building. EX-1010 ¶0005; EX-1003 ¶¶273-274.

7. Claims 9 and 19:

“9. The wireless system of claim 1, wherein at least two of the plurality of wireless access points are connected in a daisy chain manner to relay communications between at least a subset of the plurality of wireless access points.”

Wu teaches to connect RTUs (*wireless access points*) in a “cascade configuration” to “forward” communications between them. EX-1006 ¶0012.

“Cascade configuration” is another term for “*daisy chain manner*” and

“forwarding” communications discloses “to relay communications.” EX-1003

¶¶275-276. Wu’s Figure 1 illustrates this:

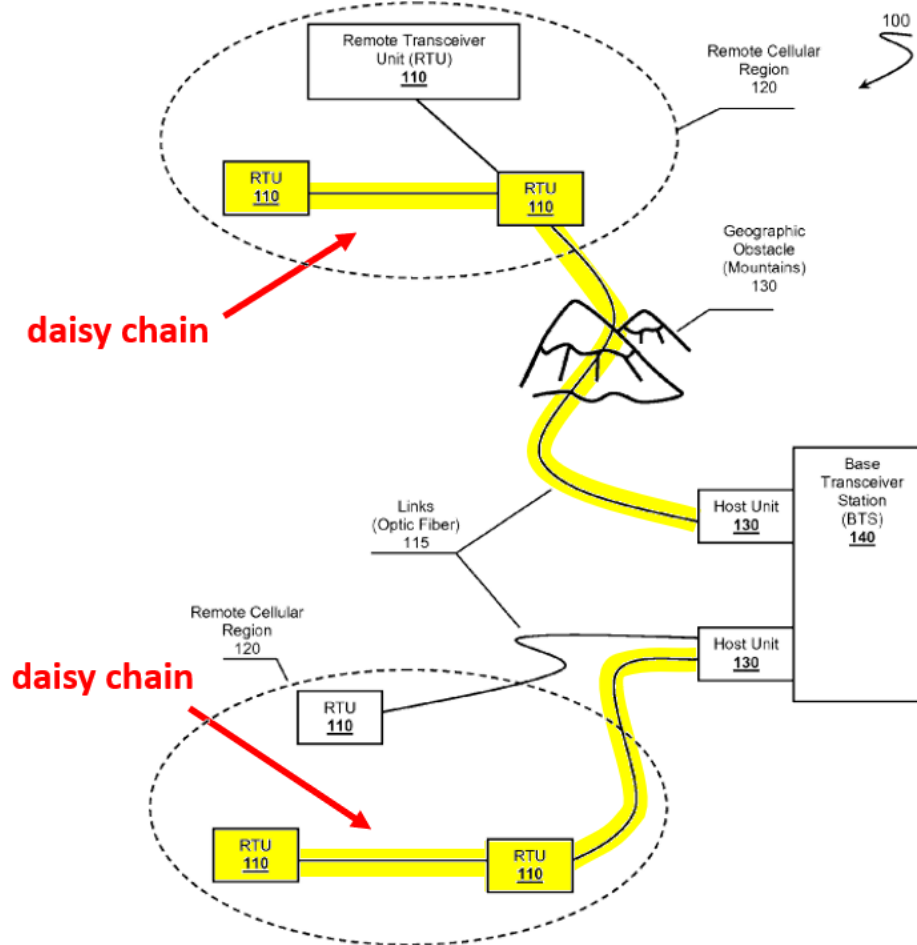


Figure 1

EX-1006 at Fig. 1; see also Figs. 4, 5-1, ¶¶0012; ¶¶0051. Wu’s disclosure aligns with the ‘232 specification. EX-1001 at 6:62-63 (“Optical cable 114 performs the function of daisy chaining”); EX-1006 ¶¶0051 (“Cascade configuration 495...over another *optic link*.”). Therefore, Wu discloses these limitations (claims 1, 19).

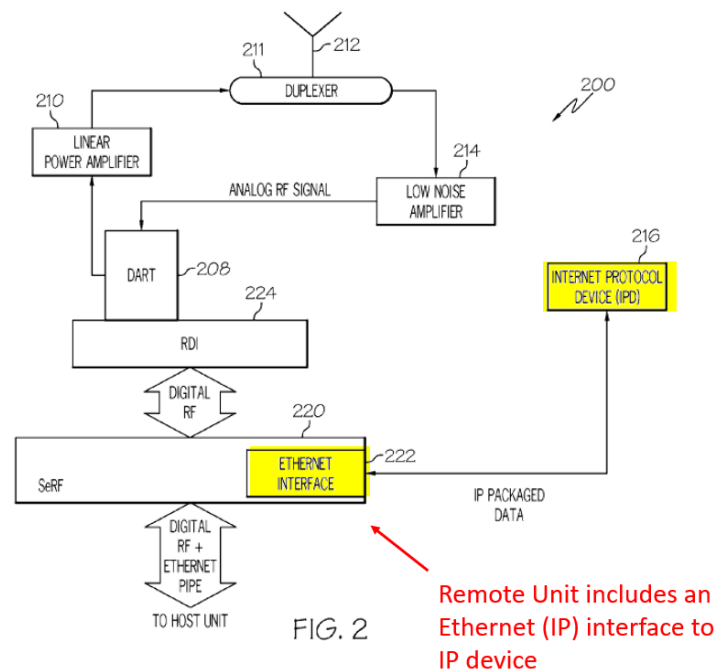
Ground 5: Claims 8 and 18 are obvious in further view of Fischer

Claims 8 and 18:

“8. The wireless system of claim 1, wherein at least one of the plurality of wireless access points enables communication between an IP device and the one or more central nodes.”

Claims 8 and 18 are obvious based on any of Grounds 1-4 when further combined with US2010/0177759 (“Fischer”) (EX-1008).

Fischer discloses: “System and Methods *for IP Communication over a Distributed Antenna System Transport.*” Fischer recognized it is desirable to transport internet protocol (IP) communications from IP devices along with digitized RF signals from base stations. EX-1008 at Figs. 1-5, ¶0004, ¶¶0014-0021, ¶¶0023-0025, ¶¶0027-0033. Fischer teaches to include IP interfaces (e.g., Ethernet interfaces) in the host and remote units:



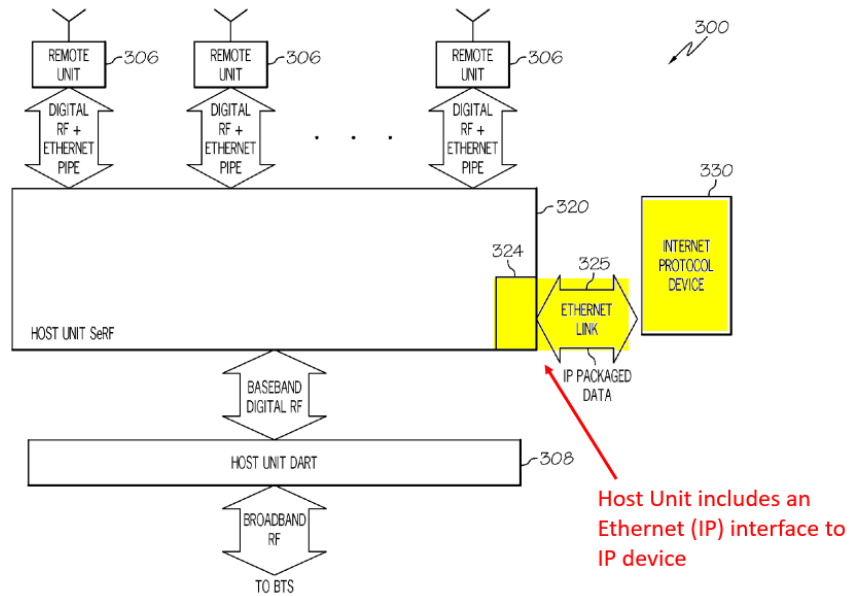


FIG. 3

EX-1008 at Figs. 2-3, ¶¶0024-0025, ¶0028. These IP interfaces enable an IP device near the remote unit to communicate IP signals through the remote unit to the host unit which forward them via the IP interface to an IP network. *Id.*; see also EX-1003 ¶¶277-282. Fischer teaches the system can multiplex the IP data with the RF samples:

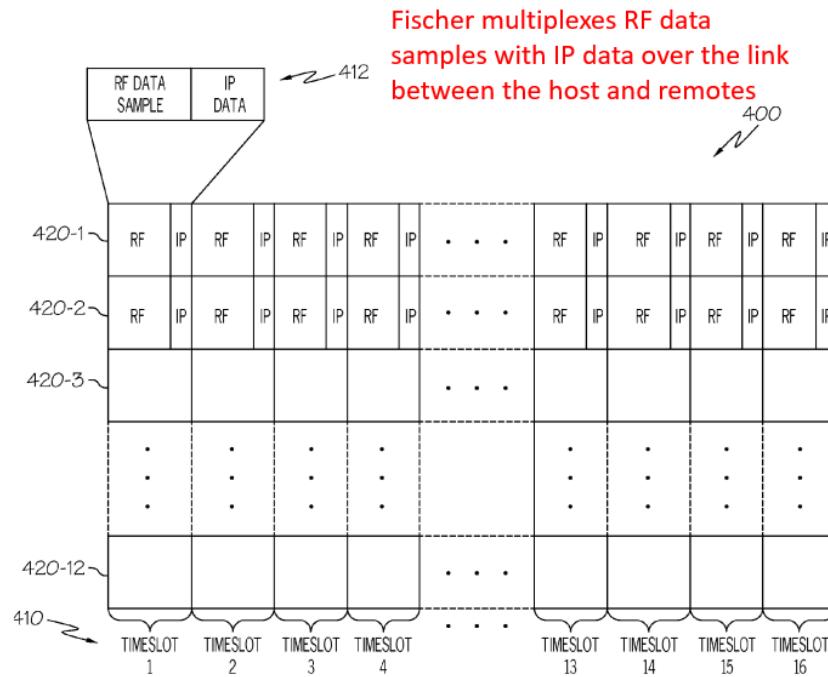


FIG. 4

EX-1008, Fig. 4.

It would have been obvious to combine Fischer's teaching to multiplex IP communications with digitized RF with Wu's distributed antenna system or in Hettstedt's system with distributed radio heads.

Motivation to combine. A POSITA would have been motivated to make these combinations for the reasons given in Fischer: capitalizing on the inherent infrastructure already present in the system having distributed remote units. EX-1003 ¶280. Fischer teaches that this same infrastructure can advantageously be used simultaneously to transport IP communications such as Wi-Fi services. EX-1008 ¶¶0004, 0014. Using the same architecture to carry two different services

saves considerable resources by eliminating the cost of building a parallel Wi-Fi cabling infrastructure. EX-1008 ¶¶0004-0005; EX-1003 ¶280.

Reasonable expectation of success. A POSITA would have a reasonable expectation of success in modifying Wu or Hettstedt to simultaneously carry IP traffic because (1) IP communication protocols and interfaces were well-known and standardized and (2) multiplexing different types of digital data over a digital communication link is a routine operation. EX-1003 ¶281.

Ground 6: Claim 10 is obvious in further view of Conyers

Claim 10:

“10. The wireless system of claim 1, wherein a transmission power provided by at least one of the plurality of wireless access points is configurable via software.”

Claim 10 is obvious based on any of Grounds 1-4 when further combined with U.S. Patent No. 7,398,106 (“Conyers”) (EX-1009).

Conyers teaches that “software defined radios” were known and that it was known to use software to configure the radio parameters. EX-1009 at 1:62-2:8. Conyers teaches that software modules could adjust the “power level” parameters used by remote radio head antenna units to communicate with wireless subscriber units. EX-1009 at 2:63-3:3 (“...power level adjustment parameters from the call processing software module”); 6:45-53 (“...dynamic readjustment of the signal power level...”); 6:13-17 (“...adjust the signal gain (i.e. the signal power level) of RF signals transmitted by radio head unit 104....”); Figs. 2, 1A-1B.

Conyers parallels the example disclosed in the ‘232 patent. The ‘232 patent teaches that software can adjust the “gain” parameter of DUCs and DDCs. EX-1001 at 7:1-5. Likewise, Conyers teaches that a software module can adjust the gain parameters in digital up/down converter (DUCs/DDCs) to “adjust the signal power level” of “RF signals transmitted by radio head unit” (i.e., the *transmission power*). EX-1009 at 6:13-17, 6:60-7:12; EX-1003 ¶¶283-288. Figure 1B illustrates this:

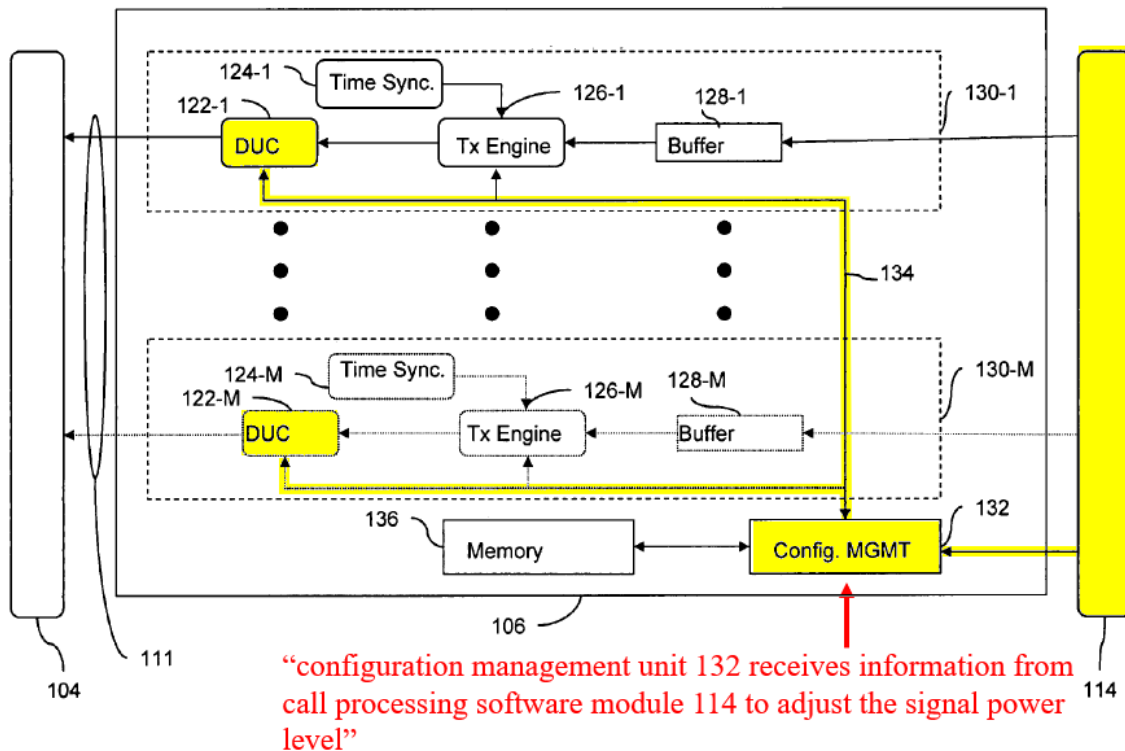


Fig. 1B

Id. at Fig. 1B, 6:60-7:29; *see also* Figs. 1C, 2, 8:27-9:39.

Motivation to combine. Conyers identifies many reasons why controlling power levels using software is desired. EX-1009 at 1:59-2:38 (enable dynamic

adjustment, maintain signal quality, minimize interference, conserve power, adaptability); EX-1003 ¶¶285-286. A POSITA would be motivated to make the transmission power of Wu’s RTUs or Hettstedt’s RRHs configurable by software for the reasons identified by Conyers, including, for example, to enable dynamic or automatic adjustment of the power levels and to maintain acceptable signal quality. *Id.* Wu and Hettstedt are trying to achieve dynamic/automatic systems. EX-1005 ¶¶0028-0029; EX-1006 at Claim 11, ¶¶0041, ¶¶0048.

Reasonable expectation of success. Wu and Hettstedt teach their systems work with software. EX-1005 ¶¶0028; EX-1006 ¶¶0029. Further, Wu and Hettstedt describe systems that include digital components for digitally manipulating and digitally transporting the RF channels. EX-1006 ¶¶0029-0031, ¶¶0049-0050; EX-1005 ¶¶0040, ¶¶0042. Because these systems already manipulate and distribute the signals digitally, a POSITA would have a reasonable expectation of success implementing additional software on the already-present digital components for configuring the transmit power. EX-1003 ¶¶287.

Ground 7: Wu and Sabat in light of Hettstedt renders claim 11 obvious

Claim 11:

“11. The wireless system of claim 1, wherein the one or more one or more central nodes are coupled to a plurality of operator networks via the operator hub.”

Wu discloses that the matrix switch (part of the *central node*) can be coupled to multiple transceivers. Ex.1006 ¶¶0034 (“more than one multi-band transceiver”).

Wu does not expressly state that the multiple transceivers are part of different operator networks. But it was well-known that when multiple base transceiver stations are coupled to a distributed antenna system, the base stations can be operated by different operators (i.e., each would be part of and coupled to a different operator network). EX-1003 ¶290; EX-1005 at Fig. 6, ¶0054 (“The eight BS can cover *different services of different operators.*”); EX-1035 at 2:60-64 (“multiple base stations, of the same or even *different wireless service providers...*”).

It would have been obvious based on Wu’s disclosure of coupling the system to multiple transceivers that the transceivers could be part of different operator networks so that the operators could share Wu’s system.

Motivation. A POSITA would have been motivated to do so to reduce the cost to any one operator of acquiring, installing, and deploying the system. EX-1003 ¶291.

Reasonable expectation of success. A POSITA would have had a reasonable expectation of success for this modification because allowing different operators to share the system merely relates to who operates the transceivers, not a physical change to the transceivers themselves—it is merely another use of the already disclosed system. EX-1003 ¶292.

Additionally, Claim 11 would have been obvious in view of Hettstedt. Hettstedt teaches that where the central node of a wireless distribution system is coupled to multiple base stations, those base stations could be from multiple operator networks. EX-1005 Fig. 6, ¶¶0054 (“The eight BS can cover different services of different operators.”), ¶¶0026-0027 (“multi-operator functions...”); EX-1003 ¶292. A POSITA would be motivated to make this modification to Wu for the same reasons discussed above.

Conclusion

There is at least a reasonable likelihood claims 1-20 are invalid.

Respectfully submitted,

Dated: April 17, 2023

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Claims Listing Appendix

U.S. Patent No. 11,026,232

Claims 1-20

Designation	D. Claim 1
Element 1A	1. A wireless system comprising:
Element 1B	one or more central nodes that receive a number of a plurality of radio resources from an operator hub that enables wireless communications and that provides the plurality of radio resources to a radio access network
Element 1C	using the Common Public Radio Interface (CPRI) protocol; and
Element 1D	a plurality of wireless access points that is coupled to the one or more central nodes and distributes one or more wireless signals to one or more wireless subscribers, the plurality of wireless access points including at least a first access point and a second access point,
Element 1E	wherein one or more central nodes assigns a first subset of the number of the plurality of radio resources to the first access point and a second subset of the number of the plurality of radio resources to the second access point, the first subset including more radio resources than the second subset, and
Element 1F	wherein, in response to a change in need of a number of wireless subscribers coupled to the second access point and which of the second subset is loaded beyond a threshold, the one or more central nodes assign additional radio resources of the plurality of radio resources to the second access point.
Claim 2	2. The wireless system of claim 1, wherein the change in need is determined based on a change in capacity needed by the number of wireless subscribers coupled to the second access point or a change in throughput needed by the number of wireless subscribers coupled to the second access point.

Claim 3	3. The wireless system of claim 1, wherein the additional resources are included in the first subset prior to being assigned to the second access point, and wherein the one or more central nodes assign the additional radio resources of the plurality of radio resources to the second access point comprises removing the additional resources from the first subset assigned to the first access point.
Claim 4	4. The wireless system of claim 1, wherein the one or more central nodes analyze one or more transmission parameters associated with the second access point to determine the change in need.
Claim 5	5. The wireless system of claim 1, wherein the one or more central nodes determines the change in need by determining that at least one transmission parameter associated with the second access point is greater than a threshold.
Claim 6	6. The wireless system of claim 1, wherein the first access point belongs to a first sector and the second access point belongs to a second sector.
Claim 7	7. The wireless system of claim 1, wherein the first access point belongs to a first building and the second access point belongs to a second building.
Claim 8	8. The wireless system of claim 1, wherein at least one of the plurality of wireless access points enables communication between an IP device and the one or more central nodes.
Claim 9	9. The wireless system of claim 1, wherein at least two of the plurality of wireless access points are connected in a daisy chain manner to relay communications between at least a subset of the plurality of wireless access points.
Claim 10	10. The wireless system of claim 1, wherein a transmission power provided by at least one of the plurality of wireless access points is configurable via software.
Claim 11	11. The wireless system of claim 1, wherein the one or more one or more central nodes are coupled to a plurality of operator networks via the operator hub.

Designation	Claim 12
Element 12A	12. A method comprising:
Element 12B	receiving a plurality of radio resources from an operator hub
Element 12C	that operates using a Common Public Radio Interface (CPRI) protocol;
Element 12E	assigning a first subset of the plurality of radio resources to a first access point included in a plurality of wireless access points and a second subset of the plurality of radio resources to a second access point included in the plurality of wireless access points, the first subset including more radio resources than the second subset; and
Element 12F	in response to a change in need of a number of wireless subscribers coupled to the second access point and which of the second subset is loaded beyond a threshold, assigning one or more additional radio resources of the plurality of radio resources to the second access point.
Claim 13	13. The method of claim 12, wherein the change in need is determined based on a change in capacity needed by the number of wireless subscribers coupled to the second access point or a change in throughput needed by the number of wireless subscribers coupled to the second access point.
Claim 14	14. The method of claim 12, wherein the one or more additional resources are included in the first subset prior to being assigned to the second access point, and wherein assigning the one or more additional radio resources comprises removing the one or more additional resources from the first subset assigned to the first access point.
Claim 15	15. The method of claim 12, further comprising analyzing one or more transmission parameters associated with the second access point to determine the change in need.
Claim 16	16. The method of claim 12, where the first access point belongs to a first sector and the second access point belongs to a second sector.

Claim 17	17. The method of claim 12, where the first access point belongs to a first building and the second access point belongs to a second building.
Claim 18	18. The method of claim 12, wherein at least one of the plurality of wireless access points enables communication between an IP device and one or more central nodes.
Claim 19	19. The method of claim 12, wherein at least two of the plurality of wireless access points are connected in a daisy chain manner to relay communications between at least a subset of the plurality of wireless access points.

Designation	Claim 20
Element 20A	20. One or more non-transitory computer readable storage media storing instructions that, when executed by one or more processors, cause the one or more processors to perform the steps of:
Element 20B	receiving a plurality of radio resources from an operator hub
Element 20C	that operates using a Common Public Radio Interface (CPRI) protocol;
Element 20E	assigning a first subset of the plurality of radio resources to a first access point included in a plurality of wireless access points and a second subset of the plurality of radio resources to a second access point included in the plurality of wireless access points, the first subset including more radio resources than the second subset; and
Element 20F	in response to a change in need by a number of wireless subscribers coupled to the second access point and which of the second subset is loaded beyond a threshold, assigning one or more additional radio resources of the plurality of radio resources to the second access point.

Appendix B: Exhibit List

Exhibit No.	Exhibit Description
1001	U.S. Patent No. 11,026,232
1002	Prosecution History of U.S. Patent No. 11,026,232
1003	Declaration of Dr. Anthony Acampora as originally filed in IPR2022-01242
1004	<i>Curriculum Vitae</i> of Dr. Anthony Acampora
1005	U.S. Patent Application Publication No. 2008/0119198 A1 to Hettstedt et al. (“Hettstedt”)
1006	U.S. Patent Application Publication No. 2010/0128676 A1 to Wu et al. (“Wu”)
1007	U.S. Patent No. 8,112,094 (“Wellington”).
1008	U.S. Patent Application Publication No. 2010/0177759 (“Fischer”)
1009	U.S. Patent No. 7,398,106 (“Conyers”)
1010	U.S. Patent Application Publication No. 2009/0180426 A1 (“Sabat”).
1011	U.S. Patent No. 6,266,531 (“Zadeh”)
1012	U.S. Patent No. 5,796,722 (“Kotzin”)
1013	U.S. Patent No. 5,241,685 (“Bodin”)
1014	U.S. Patent No. 5,454,026 (“Tanaka”)
1015	U.S. Patent No. 5,666,356 (“Fleming”)
1016	U.S. Patent No. 5,790,955 (“Tomoike”)
1017	Common Public Radio Interface (CPRI) Interface; Interface Specification V4.0 (2008-06-30)
1018	U.S. Patent Application Publication No. 2005/0157675 A1 (“Feder”)
1019	U.S. Patent No. 8,958,789 (“Bauman”)
1020	U.S. Patent No. 8,346,091 (“Kummetz”)
1021	U.S. Patent No. 6,801,767 (“Schwartz”)
1022	U.S. Patent No. 6,785,558 (“Stratford”)
1023	U.S. Patent No. 7,313,415 (“Wake”)
1024	U.S. Patent No. 8,737,454 (“Wala”)
1025	U.S. Patent No. 8,583,100 (“Koziy”)
1026	U.S. Patent No. 8,204,544 (“Beaudin”)
1027	U.S. Patent No. 7,474,891 (“Toms”)
1028	U.S. Patent No. 7,848,747 (“Wala”)
1029	U.S. Patent No. 5,644,622 (“Russell”)
1030	U.S. Patent Application Publication No. 2008/0174502 A1 (“Oren”)
1031	U.S. Patent No. 6,349,200 (“Sabat 200”)

1032	Newton’s Telecom Dictionary, p. 785 (2000).
1033	Provisional App. No. 61/382836
1034	EP Patent Application Publication No. EP 1 924 109 A1 (“Hettstedt EP”)
1035	U.S. Patent No. 6,963,552 (“Sabat 552”)
1036	MERRIAM-WEBSTER’S COLLEGIATE DICTIONARY (10 th ed. 2002)(excerpt)
1037	HARGRAVE’S COMMUNICATIONS DICTIONARY (IEEE 2001)
1038	U.S. Patent No. 10,080,178 (“the ‘178 patent”)
1039	IPR2020-01473 Institution Decision (‘178 patent IPR)
1040	IPR2020-01473 Judgment (‘178 patent IPR)
1041	IPR2018-00571 Final Written Decision (‘473 patent IPR)
1042	U.S. Patent No. 9,531,473 (“the ‘473 patent”)
1043	U.S. Patent No. 5,642,405
1044	U.S. Patent Application Publication No. 2006/0258305A1
1045	U.S. Patent No. 7,286,507 (“Oh”)
1046	Complaint in Civil Action No. 2:22-cv-00012-RWS-RSP (E.D. Tex.)
1047	Interim Procedure for Discretionary Denials Memo from the Director
1048	Complaint in Civil Action No. 2:22-cv-414-RWS-RSP (E.D. Tex.)
1049	Complaint in Civil Action No. 6:22-cv-104-ADA (W.D. Tex.)
1050	U.S. District Courts Statistics as of June 30, 2022
1051	Standing Order Governing Proceedings (OGP) 1.2—Patent Cases (W.D. Tex. Waco)
1052	ECF 77 in <i>Dali Wireless, Inc. v. Cellco P’ship, et al.</i> . Case No. 6:22-cv-104-ADA (Stipulation Regarding Narrowing of Issues)
1053	Complaint in Civil Action No. 2:22-cv-00012-RWS-RSP (E.D. Tex.)
1054	ECF 79 in <i>Dali Wireless, Inc. v. AT&T Corp., et al.</i> . Case No. 2:22-cv-00012-RWS-RSP (Stipulation Regarding Narrowing of Issues)
1055	PACER Docket in Civil Action No. 2:22-cv-414 (E.D. Tex.) as of Dec. 5, 2022
1056	Email to counsel from Clerk of Court to Honorable Judge Albright of U.S. Dist. Ct. W.D. Tex.
1057	Email from Patent Owner’s counsel regarding transfer of W.D. case
1058	Intentionally blank
1059	Claim Construction Order in Civil Action No. 6:22-cv-1313-ADA (W.D. Tex.)

CERTIFICATION UNDER 37 CFR § 42.24(d)

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petition for *Inter Partes* Review totals 13,966 words per Microsoft Word word count tool, which complies with requirement of 14,000 words allowed under 37 CFR § 42.24(a)(i).

Respectfully submitted,

Dated: April 17, 2023

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR §§ 42.6(e)(4)(i) *et seq.* and 42.105(b), the undersigned certifies that on April 17, 2023 a complete and entire copy of this PETITION FOR INTER PARTES REVIEW OF UNITED STATES PATENT NO. 11,026,232 PURSUANT TO 35 U.S.C. §§ 311–319, 37 C.F.R. § 42, Motion for Joinder, Power of Attorney, and all supporting exhibits were provided by Federal Express, to the Patent Owner by serving the correspondence address of record as follows:

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Dated: April 17, 2023

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