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Paper 10
Date: January 15, 2021

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MERCEDES-BENZ USA, LLC,
Petitioner,

v.

CARUCEL INVESTMENTS, L.P.,
Patent Owner.

IPR2019-01298
Patent 7,221,904 B1

(Consolidated with IPR2019-01635)

Before THOMAS L. GIANNETTI, DANIEL J. GALLIGAN, and PAUL J. KORNICZKY, *Administrative Patent Judges.*

GIANNETTI, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Mercedes-Benz USA, LLC ("Petitioner" or "Mercedes-Benz") filed a Petition requesting *inter partes* review of claims 22, 23, 28–35, 40, 50, and 51 of U.S. Patent No. 7,221,904 B1 (Ex. 1001, the "'904 patent"). Paper 2 ("Pet."). Carucel Investments, L.P. ("Patent Owner") filed a Preliminary Response. Paper 6 ("Prelim. Resp.").

Pursuant to 35 U.S.C. § 314, we instituted this *inter partes* review as to all of the claims challenged and all grounds raised in the Petition. Paper 7 ("Institution Dec.").

Two months after filing its Petition, Mercedes-Benz filed a separate petition challenging claims 56–59 of the '904 patent. IPR2019-01635, Paper 1 ("IPR1635 Pet.").[1] With that petition, Mercedes-Benz filed a motion ("Joinder Motion") seeking to join IPR2019-01635 with this proceeding. IPR1635, Paper 3. As explained by Mercedes-Benz, a second petition was necessitated due to Patent Owner's assertion of claims in the district court infringement action involving the '904 patent that were not being asserted when the Petition here was filed. IPR1635 Pet. 74–75. We instituted *inter partes* review of claims 56–59 in IPR2019-01635 and granted Petitioner's Joinder Motion. IPR1635, Paper 9. Subsequently, the Federal Circuit decided *Facebook, Inc. v. Windy City Innovations, LLC*, 973 F.3d 1321 (Fed. Cir. 2020), prohibiting same-party joinder in IPRs, and we therefore

[1] Citations to the record are to IPR2019-01298, unless indicated otherwise by "IPR2019-01635" or by the prefix "IPR1635."

advised the parties that going forward, we would deem this case and IPR2019-01635 as consolidated. Paper 13, 3 n.2.

Following institution, Patent Owner filed a Response. Paper 16 ("PO Resp."). Subsequently, Petitioner filed a Reply to Patent Owner's Response (Paper 25, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 31, "PO Sur-reply").

On December 2, 2020, we held a consolidated oral hearing with several related cases involving Patent Owner.[2] A transcript of the hearing is included in the record. Paper 34 ("Hearing Tr.").

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision, issued pursuant to 35 U.S.C. § 318(a). For the reasons we discuss below, we determine that Petitioner has proven by a preponderance of the evidence that claims 22, 23, 28–35, 40, 50, 51, and 56–59 (the "challenged claims") of the '904 patent are unpatentable.

B. Related Proceedings

The parties identify the following district court proceedings involving the '904 patent: *Carucel Investments, LP* v. *Fiat Chrysler Automobiles US LLC et al.*, 3:18-cv-03331 (N.D. Tex.); *Carucel Investments, LP v. General Motors Company*, 3:18-cv-03332 (N.D. Tex.); *Carucel Investments, LP v. Volkswagen Group of America, Inc.,* 3:18-cv-03333 (N.D. Tex.); and *Carucel Investments, LP v. Mercedes-Benz USA, et al.*, 3:18-cv-03334 (N.D. Tex.). Pet. 78; Paper 4.

[2] IPR2019-01404 (Patent 7,979,023 B2), IPR2019-01441 (Patent 8,718,543 B2), and IPR2019-01442 (Patent 7,848,701 B2).

The ’904 patent was also asserted in *Carucel Investments, LP, v. Novatel Wireless, Inc.*, 16-cv-118 (S.D. Cal.) (“the *Novatel* litigation”), resulting in a jury verdict of non-infringement. *See* Ex. 2106, 2–5 (Order on Carucel’s motion for JMOL or new trial).

In addition to this Petition, the ’904 patent is challenged by a different party in IPR2019-01101 and IPR2019-01573. Patents related to the ’904 patent are challenged in IPR2019-01102, IPR2019-01103, IPR2019-01104, IPR2019-01105, IPR2019-01404, IPR2019-01440, IPR2019-01441, IPR2019-01442, and IPR2019-01079. Paper 4, 1.

C. Real Parties-in-Interest

Petitioner identifies “Daimler AG, Daimler North America Corporation, Mercedes-Benz USA, LLC and Mercedes-Benz U.S. International, Inc.” as the real parties-in-interest. Pet. 77. Patent Owner identifies Carucel Investments, L.P. as the real party-in-interest. Paper 4, 1.

D. The ’904 Patent

The ’904 patent is titled “Mobile Communication System with Moving Base Station.” Ex. 1001, (54). According to the patent, “[a] problem with existing mobile telephone systems is the considerable time required in handoffs. This becomes a particular problem in urban areas which are highly congested.” *Id.* at 1:51–54.

The ’904 patent addresses this problem by providing “a moving base station which is interposed between a moving mobile telephone unit and a fixed base station.” *Id.* at 3:18–21. The “movable base station moves with the traffic at a rate of speed which is comparable to the speed of the traffic and communicates with a moving mobile telephone unit via standard mobile radio transmission.” *Id.* at 3:22–25. The movable base station

"communicates by radio signals with a plurality of fixed antennas spaced along the path of travel of the mobile base station." *Id.* at 3:25–28.

This is illustrated by Figure 1 of the '904 patent, reproduced below.

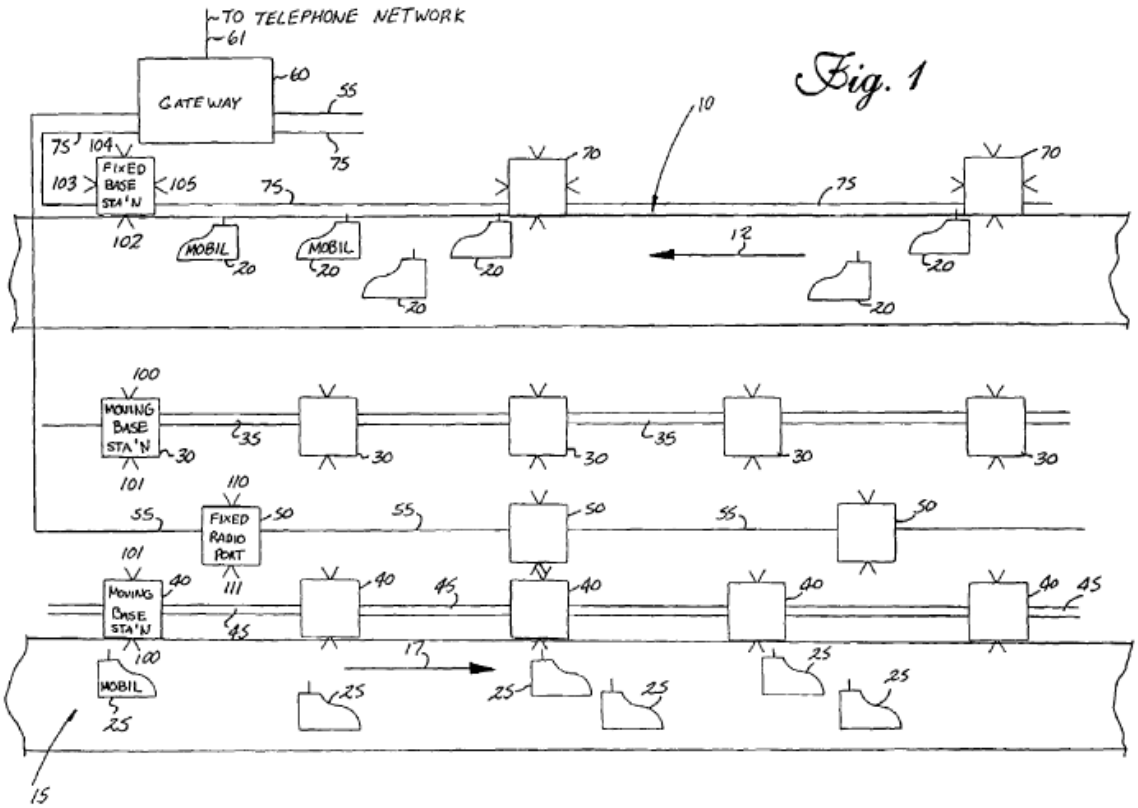

Fig. 1 is a block diagram representation of a roadway structure with fixed base stations, moving base stations, and fixed radio ports. *Id.* at 2:65–67.

In Figure 1, a divided highway has mobile units 20 traveling on first roadway 10, in one direction, and mobile units 25 traveling along second roadway 15, in the opposite direction. *Id.* at 3:66–4:2. Moving base stations 30 are disposed along one side of roadway 10. *Id.* at 4:2–4. The base stations are spaced apart by a selected distance equivalent to the diameter of the cell served by the moving base station. *Id.* at 4:4–6.

Moving base stations 30 may be moved by means of rail 35 or other suitable conveying device, which may include an automotive vehicle

traveling on the roadway, in the same direction as the traffic flow on roadway 10, as indicated by arrow 12. *Id.* at 4:6–10. Similarly, moving base stations 40 are disposed along adjacent roadway 15, moving in the direction of the traffic as indicated by arrow 17. *Id.* at 4:11–13. Moving base stations 40 are moved along rail 45. *Id.* at 4:13–14.

In operation, base stations 30 move in the direction of the flow of the traffic at a rate of, for example, 60 miles per hour, which may be faster than some traffic and slower than other traffic. *Id.* at 4:39–42. The moving base stations handle telecommunications with mobile units 25, which travel at a rate of not more than 30 miles per hour faster or slower than the moving base stations. *Id.* at 4:42–45. Fixed base stations 70 accommodate communications with mobile units traveling at speeds of less than 30 miles per hour, including pedestrian traffic and stationary units. *Id.* at 4:48–51.

According to the ’904 patent, the advantage of this system is reducing the number of handoffs by providing a moving base station:

> The system in accordance with the invention differs from the prior art primarily in that the base stations 30, 40 are moving with the traffic and communicate with the gateway office 60 via fixed radio ports 50. Furthermore, the various call-handling functions, including handoff, are performed by the moving base station.
>
> Advantageously, *because of movement of the base station in the same direction as the traveling mobile unit, the number of handoffs is greatly reduced*.

Id. at 5:10–19 (emphasis added).

Each of the moving base stations is provided with multiple antennas. *Id.* at 5:20–21. Antennas 100 on moving base stations 30, 40 are used to communicate with mobile units 20, 25, whereas antennas 101 on moving

base stations 30, 40 are used to communicate with fixed radio ports 50. *Id.* at 5:25–29.

E. Illustrative Claims

The '904 patent has 69 claims. Seventeen claims (22, 23, 28–35, 40, 50, 51, and 56–59) are challenged in this proceeding. *See supra.* Of the challenged claims, four claims (22, 34, 50, and 56) are independent. Claims 22 and 34 are directed to an apparatus. Claim 22 recites:

> [22a]. An apparatus adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports, the apparatus comprising:
>
> [22b] a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted from each of the plurality of fixed radio ports within a frequency band having a lower limit greater than 300 megahertz;
>
> [22c] a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals; and
>
> [22d] a processor adapted to maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.

Id. at 12:65–13:11 (reference numbers in brackets added).

Claims 50 and 56 are directed to a method. Claim 56 recites:

> [56a]. A method of providing a communication connection between a communication network and a plurality of mobile units having a motion relative to a plurality of fixed ports, wherein the plurality of fixed ports are communicatively coupled to the communication network, the method comprising the steps of:
>
> [56b] establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of

> fixed ports through a movable base station having a motion in accordance with the motion of the mobile units; and
>
> [56c] simultaneously handing off the plurality of mobile units to a second fixed port of the plurality fixed ports.

Ex. 1001, 15:57–16:2 (reference numbers in brackets added).

F. References and Other Evidence

The challenges by Petitioner rely on the following references:

1. U.S. Patent No. 5,276,686, issued January 4, 1994 (Ex. 1003, "Ito"),

2. U.S. Patent No. 5,101,501, issued March 31, 1992 (Ex. 1004, "Gilhousen501"),

3. U.S. Patent No. 5,519,761, issued May 21, 1996 (Ex. 1005, "Gilhousen761"), and

4. U.S. Patent No. 5,103,459, issued April 7, 1992 (Ex. 1006, "Gilhousen459").

Pet. 12–19; IPR1635 Pet. 10–16.

In addition, in this proceeding, Petitioner submitted a Declaration of Jeffrey Fischer (Ex. 1008, "Fischer Decl.") with the Petition and a further Declaration of Mr. Fischer (Ex. 1106, "Fischer Reply Decl.") with its Reply. Patent Owner submitted the Declaration of Mark R. Lanning (Ex. 2001,[3] "Lanning Decl.") with its Patent Owner Response. Also, in IPR2019-01635, Petitioner submitted a Declaration of Mr. Fischer (IPR1635, Ex. 1008,

[3] This declaration filed as Exhibit 2001is labeled Exhibit 2100.

"Fischer II Decl.") with its petition. Both parties have submitted deposition transcripts for these declarants.[4]

G. Asserted Grounds of Unpatentability

Petitioner asserts the challenged claims are unpatentable on the following grounds.

Claim(s) Challenged	35 U.S.C. §	Reference(s)
22, 23, 28–35, 40, 50, 51	103(a)[5]	Ito, Gilhousen501
22, 23, 28–35, 40, 50, 51	103(a)	Gilhousen761, Gilhousen501
22, 23, 28–35, 40, 50, 51	103(a)	Ito, Gilhousen459
56–59	103(a)	Ito, Gilhousen501
56	102(a)	Gilhousen761
56–59	103(a)	Gilhousen761, Gilhousen501
56–59	103(a)	Ito, Gilhousen459

Pet. 11–12; IPR1635 Pet. 10; PO Resp. 1.

II. PRELIMINARY MATTERS

A. Level of Ordinary Skill

Petitioner contends: "One of ordinary skill in the art would have at least a Bachelor's degree in Electrical Engineering, Computer Science, or an equivalent area of study, and at least three years of graduate study or

[4] Ex. 1101 ("Lanning I Dep."); Ex. 1102 ("Lanning II Dep."); Ex. 2108-1 ("Fischer I Dep."); Ex. 2108-2 ("Fischer II Dep.").
[5] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), included revisions to 35 U.S.C. § 103 that became effective after the filing of the application that led to the '904 patent. Therefore, we apply the pre-AIA version of 35 U.S.C. § 103.

professional experience with wireless and/or cellular communications or similar experience." Pet. 8–9 (citing Fischer Decl. ¶ 33).[6]

Patent Owner contends a person of ordinary skill in the art "at or near the filing date of the earliest priority application of the '904 Patent would have had (i) a Bachelor of Science degree in electrical engineering or computer engineering or related field of study; (ii) at least two years of experience with wireless communications systems; and (iii) would also be familiar with cellular communication technology." PO Resp. 8–9. Further, Patent Owner contends "[a] lack of experience can be compensated with additional education and a lack of education can be compensated with additional work experience." *Id.* at 9 (citing Lanning Decl. ¶ 65).

The formulations differ slightly, in that Patent Owner's formulation specifically calls for familiarity with cellular communication technology, whereas Petitioner's formulation is more general, requiring a comparable level of experience (three years versus two years) with mobile wireless communications.

We regard these formulations as not materially different, however, because familiarity with mobile wireless communications would normally include knowledge of cellular communication technology. Furthermore, we do not regard the one-year difference in experience levels as significant. Both formulations, also, are consistent with the prior art before us and with the level of skill reflected in the '904 patent. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001) (prior art itself may reflect an appropriate level of skill). As the formulations are not materially different, we adopt

[6] In IPR2019-01635, Petitioner's formulation is similar. IPR1635 Pet. 6–7.

Patent Owner's more specific description, with the exception of the open-ended language "at least." However, we would reach the same result on the ultimate question of patentability of the challenged '904 patent claims under either formulation.

B. Claim Construction

For this *inter partes* review, the Board applies the same claim construction standard as that applied in federal courts. *See* 37 C.F.R § 42.100(b) (2019). In this context, claim terms "are generally given their ordinary and customary meaning" as understood by a person of ordinary skill in the art in question at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312–13 (Fed. Cir. 2005) (citations omitted) (en banc). "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (*citing Phillips*, 415 F.3d at 1312–17). Extrinsic evidence is "less significant than the intrinsic record in determining 'the legally operative meaning of claim language.'" *Phillips*, 415 F.3d at 1317.

Petitioner proposes that the term "adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports" should be construed to mean "that a movable base station moves 'in accordance with' a mobile unit when the mobile unit is inside the same vehicle as the movable base station." Pet. 10. Petitioner further states that "all other terms are sufficiently clear, should be given their plain and

ordinary meaning as understood by a person of ordinary skill in the art . . . at the time of the alleged invention, and do not require construction." *Id.*

Patent Owner seeks construction of the following terms appearing in the challenged claims: "fixed port," "fixed radio port," "adapted to," and "mobile unit." PO Resp. 10–15.

Petitioner responds by opposing Patent Owner's proposed construction of "mobile unit." Pet. Reply 2–7. Petitioner contends that Patent Owner's proposed definition "does not reflect the term's ordinary meaning." *Id.* at 2. Petitioner "proposes that this term is sufficiently clear on its face that construction is not necessary." *Id.* at 7. As to the remaining constructions proposed by Patent Owner, Petitioner contends "that each of the Grounds [asserted by Petitioner] renders the challenged claims unpatentable even under [Patent Owner's] proposed construction of 'fixed port/radio ports' and 'adapted to,' and that therefore no construction for these terms is required." *Id.*

1. "fixed port"/"fixed radio port"

Patent Owner proposes that we adopt the district court's construction of these terms in the *Novatel* litigation, which are as follows: "fixed port"—"a stationary device at which signals can enter and exit a communication network"; "fixed radio ports"—"stationary devices that each transmit and receive radio frequency signals to provide access to a communication network." PO Resp. 10; Ex. 2105, 12.[7] Petitioner contends "that each of the Grounds [asserted by Petitioner] renders the challenged claims unpatentable

[7] Patent Owner misquotes the district court's construction of "fixed port" as saying "enter and exit" rather than "enter or exit." Ex. 2105, 12. This has error has no bearing on our Decision.

even under [Patent Owner's] proposed construction of 'fixed port/radio ports." Pet. Reply 7. We agree with Petitioner that no construction of these terms is necessary.[8]

2. "adapted to"

Petitioner proposes that the term "adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports" should be construed to mean "that a movable base station moves 'in accordance with' a mobile unit when the mobile unit is inside the same vehicle as the movable base station." Pet. 10.

In the *Novatel* litigation, the district court construed "adapted to," appearing in the preambles of claims 22 and 34, as "constructed to move with the traffic at a rate of speed which is comparable to the speed of the traffic." Ex. 2105, 14–16.[9] Patent Owner contends that the preamble is limiting and urges us to adopt this construction. PO Resp. 10–13.

Petitioner responds that the challenged claims are unpatentable under Patent Owner's proposed construction, and that therefore no construction is necessary. Pet. Reply 7. However, Patent Owner disputes the further attempt by Patent Owner to distinguish Gilhousen761 by limiting "traffic" to automotive traffic. *See id.* at 28–29. That dispute centers around the meaning of "traffic," a term that does not appear in the claims but does appear in the district court's construction of "adapted to." *Id.* Patent Owner

[8] The parties agree that there is no difference between the terms "fixed port" and "fixed radio port." Hearing Tr. 27:9–23; 88:12–13.
[9] The phrase "adapted to" appears in the bodies of claims 22 and 34 as well. The district court's construction focuses on the "adapted to move" language of the preamble. Ex. 2105, 14–16.

relies on this proposed further limitation to the district court's construction in discussing the prior art Gilhousen761 patent, where Patent Owner states: "An airplane does not move with traffic as it is not bound to predetermined roads." PO Resp. 57; *see also* PO Sur-reply 33. Because we do not reach the challenges based on Gilhousen561 (*see infra*, Section III.C), we do not need to resolve this dispute.

Because both Petitioner and Patent Owner accept the district court's construction (but not Patent Owner's further limitation limiting "traffic" to automotive traffic), we apply that construction in our analysis. However, as we determine *infra* that the prior art discloses the subject matter recited in the preambles, we do not express an opinion on the question of whether the preambles are limiting as that is not necessary to resolve a controversy.

3. "mobile unit"[10]

Prior to our Institution Decision, neither party advanced a construction for this term. Patent Owner contends that such mobile units are "also known as cell phones or mobile phones." PO Resp. 7. Patent Owner asks us construe "mobile unit" as "a device that must register with and be able to directly communicate with the cellular network." *Id.* at 13. Patent Owner contends that this is "the plain and ordinary meaning of the term." *Id.* Patent Owner asserts that a "mobile unit" also includes the "capability to be switched back-and-forth between either a direct connection with the fixed base station or a connection with a moving base station." *Id.* Patent Owner argues: "A mobile unit is more than just a cordless phone handset." *Id.*

[10] The parties agree that the term "mobile unit" has the same meaning as "mobile device." Hearing Tr. 88:14–16.

Patent Owner relies mainly on the '904 patent specification: "The '904 Patent specification teaches that a mobile unit must be capable of directly communicating with either a fixed cellular base station or a moving base station." PO Resp. 13 (citing Ex. 1001, 4:48–51). Furthermore, according to Patent Owner, "the mobile unit's capability to be switched back-and-forth between either a direct connection with the fixed base station or a connection with a moving base station is discussed repeatedly and throughout the specification." *Id.* at 13–14 (citing Ex. 1001, 11:1–15). Patent Owner cites also the discussion in the '904 patent that describes registration by the mobile unit:

> When a mobile unit set is first powered up or first enters a service area, the mobile unit must register in the manner described earlier, by transmitting its unique address in the new service area. The address will be received by the closest moving base station 30 and transmitted via a fixed radio port and the gateway switch 60 to the telephone network.

Ex. 1001, 9:64–10:2 (partially quoted at PO Resp. 14). Patent Owner also relies on testimony from its expert, Mr. Lanning. *See* PO Resp. 13–15 (citing Lanning Decl. ¶¶ 64, 71–76, 86).

Petitioner opposes Patent Owner's proposed construction of "mobile unit." Pet. Reply 2–7. Petitioner contends that Patent Owner's proposed definition "does not reflect the term's ordinary meaning." *Id.* at 2. Petitioner asserts that Patent Owner's proposed construction is "flatly inconsistent" with a construction Patent Owner proposed in the *Novatel* litigation. *Id.* Petitioner describes the previous construction advanced by Patent Owner as "non-cellular": "[Patent Owner] should not be permitted to propose a broad construction to capture infringing devices in litigation, then make an about-face in an IPR to avoid the prior art." *Id.* Petitioner asserts

also that the construction proposed here by Patent Owner "contradicts the claims, the specification and the prosecution history." *Id.* at 3. Finally, Petitioner "proposes that this term is sufficiently clear on its face that construction is not necessary." *Id.* at 7.

Having reviewed and considered the record presented, including Petitioner's and Patent Owner's submissions, we are not persuaded to adopt Patent Owner's construction of "mobile unit." Our reasoning follows.

As instructed by *Phillips*, we first look to the words of the claims. *Phillips*, 415 F.3d at 1312. We find that the language of the challenged claims does not support Patent Owner's construction. As Petitioner points out, the challenged claims themselves do not require the mobile unit to register or communicate directly with a cellular network. Pet. Reply 1. In fact, the claims are not directed to the mobile unit. The '904 patent claims the mobile base station, not the mobile units. Hearing Tr. 52:21–53:5. Patent Owner identifies the moving base station and not the mobile units as the invention: "Most importantly to the issues presented here, Mr. Gavrilovich invented a 'mobile base station' that significantly improved wireless communications by acting as an intermediary between cell towers and mobile units." PO Resp. 2. And this is consistent with the Summary of the Invention in the '904 patent itself, which states: "These and other problems of the prior art are overcome in accordance with this invention by means of a moving base station which is interposed between a moving mobile telephone unit and a fixed base station." Ex. 1001, 3:18–21.

As Petitioner shows, in the challenged claims, it is the mobile base station that communicates directly with the fixed ports, not the mobile unit.

Pet. Reply 3. This important aspect of the '904 patent claims was explored with Patent Owner's counsel at the oral argument:

> [PATENT OWNER'S COUNSEL]: The purpose of the invention is to allow all five different mobile devices to be connected through a moving base station so that there's only one hand-off. If you did that at the mobile phone level, that wouldn't be accomplishing the same purpose. . . .
>
> [THE BOARD]: -- the mobile device doesn't have to be a cellular device in order to do that as long as the base station can communicate with the cellular network; isn't that correct? I mean it's actually -- the base station in your claims, it's the base station that's communicating with the cellular network not the mobile device.
>
> [PATENT OWNER'S COUNSEL:]: Right.

Hearing Tr. 53:20–54:6.

As Patent Owner acknowledges, the mobile base station acts as "an intermediary" between the mobile unit and the network. PO Resp. 2. The challenged claims describe the communications passing between the moving base station (the recited "apparatus" in the claim) and the fixed ports and between the moving base station and the mobile unit. Pet. Reply 3–4. Thus, for example, independent claim 22 recites that the claimed "apparatus" (the mobile base station) has "a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted *from each of the plurality of fixed radio ports*" and "a transmitter adapted to transmit, within the frequency band, a resultant signal *to the mobile unit*." Ex. 1001, 13:1–7 (emphasis added). Claim 34 similarly recites that the claimed "apparatus" (mobile base station) has "a first radio interface adapted to communicate with the plurality of fixed radio ports" and "a second radio interface adapted to communicate with the plurality of mobile units." *Id.* at 13:66–14:4. The claims do not refer to signals passing directly between the mobile units and fixed ports.

Similarly, independent method claims 50 and 56 reflect two different communication paths: one between the fixed radio ports and the mobile base station, and the other between the mobile base station and the mobile unit. Claim 50 recites "receiving a plurality of signals at the movable base station, each of the plurality of signals transmitted from each of the plurality of fixed radio ports" and "transmitting, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals." *Id.* at 15:33–40. There is no mention of signals passing directly between the mobile units and the fixed radio ports.

Likewise, claim 56 recites "establishing a first communication link between the plurality of mobile units and a first fixed port of the plurality of fixed ports *through a movable base station.*" *Id.* at 15:63–65 (emphasis added). We find, therefore, that the challenged claims do not require the mobile device to communicate directly with a cellular network.

Furthermore, the claims do not associate the signals transmitted by the mobile unit with a cellular network, or identify the recited mobile unit as a device that communicates with a cellular network. As Mr. Fischer testifies: "[T]he '904 patent includes several claims directed to frequency bands that were not in the range typically used in cellular networks at the time of the alleged invention . . . and a [person of ordinary skill] would have understood that a mobile unit/device that communicated in those frequency ranges is not a cellular phone." Fischer Reply Decl. ¶ 10. Based on the foregoing, we find that the challenged claims of the '904 patent do not require a mobile unit that is capable of communicating with a cellular network.

Moreover, we find that the '904 patent specification does not support Patent Owner's construction of "mobile unit" as a phone capable of

communications directly with a cellular network. *Cf.* PO Resp. 15; PO Sur-reply 6–10. As stated in *Phillips*, "the specification is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." *Phillips,* 415 F.3d at 1315 (internal quotes and citation omitted).

First, we do not see in the specification of the '904 patent a clear indication supporting Patent Owner's contention that conventional non-cellular cordless phones should be excluded. *Cf.* PO Resp. 13 ("A mobile unit is more than just a cordless phone handset."). In the Background section, the '904 patent describes the goal of the patent as encompassing "all applications" including cordless phones: "What is desirable is an infra structure which allows use of such terminals *in all applications*, whether in the home or office as a *cordless phone* . . . ." Ex. 1001, 2:44–46 (emphasis added); Fischer Reply Decl. ¶ 7.

While the '904 patent does refer to the fixed base stations as "cell site[s]" (Ex. 1001, 4:63–64), it also describes the radio interfaces between the mobile devices and the base stations in more general terms. Pet. Reply 4; Ex. 1001, 6:43–49. Thus, the '904 patent describes the radio interface between the mobile units and both the moving and fixed base stations as "a standard radio interface, well known in the art." Ex. 1001, 6:43–45. This generic description in the patent of the radio interfaces as "standard" is broader that "cellular," and is consistent with the patent's stated goal of providing "an infra structure which allows use of . . . a cordless phone." Pet. Reply 4–5 (citing Ex. 1001, 2:44–48); Fischer Reply Decl. ¶¶ 7–8. Elsewhere, the patent states this interface "*may* be the standard [cellular] air

interface standard," confirming that a cellular interface is not a requirement for the mobile units. Ex. 1001, 6:66–7:1 (emphasis added).

We find further support for our conclusion that Patent Owner's construction of "mobile unit" as requiring the ability to direct communicate with the cellular network is too limiting in the '904 patent's description of an embodiment where the mobile unit is prevented from communicating directly with the fixed ports. Ex. 1001, 3:51–56. In this embodiment, the power levels for the signals between the moving base station and the mobile unit are chosen to *avoid* direct communication between the mobile device and the fixed radio ports. *Id.* at 3:43–56. This embodiment is consistent with the claim language, which we find describes the mobile base station, not the mobile units, communicating with the cellular network. *See* discussion *supra*.

Phillips instructs us that the prosecution history may also be relevant in construing the claims. 415 F.3d at 1317; *see* Pet. Reply 5 (discussing prosecution history). The prosecution history of the '904 patent does not support Patent Owner's construction of "mobile unit." During prosecution of the '904 patent, in an appeal brief to the Board, the applicant did not limit mobile units to cellular devices, but instead told the Board that radios and telephones were included: "The present invention is directed to methods and devices for providing communication services to moving mobile units *such as telephones, radio modems, or other types of radios.*" Ex. 1002, 289 (emphasis added). We agree with Petitioner and find that this prosecution history describing the mobile units as "telephones" and "radios" contradicts Patent Owner's construction limiting such devices to "a device that must register with and be able to directly communicate with the cellular network."

Pet. Reply 5. Petitioner also cites an October 4, 2004, Office Action in which the Examiner found that the claim term "mobile unit" read on a reference (Yokoi) disclosing a cordless phone. *Id.* (citing Ex. 1002, 328). Petitioner notes that Patent Owner's response did not challenge this finding by the Examiner. *Id.* (citing Ex. 1002, 338 *et seq.*).

Patent Owner responds its proposed construction is "[c]orrect," and that Petitioner "attempts to . . . broadly construe the term 'mobile device' in a vacuum." PO Sur-reply 5–6. Patent Owner contends Petitioner's analysis "is premised on incorrect legal standards." *Id.* at 6. Patent Owner further argues that "[s]ince the '904 Patent specification describes the invention as a whole, it should be limited as such." *Id.* at 7. Patent Owner continues: "Specifically, the '904 Patent relates to and describes as a whole improving the wireless connections of <u>mobile devices within cellular telephone systems</u> via a moving base station . . . ." *Id.* (footnote omitted).

We are not persuaded by these arguments, as they are contrary to the claim language, the specification, and the other intrinsic evidence discussed above. In the claims it is the mobile base station that communicates with the cellular network, not the mobile units. *See* discussion *supra*. As explained there, the challenged claims focus on the mobile base station; they do not describe the mobile units as cellular devices, which according to the prosecution history, can be radios and telephones. *See* discussion above. While the '904 patent may discuss cellular networks, we find the disclosure and the claims do not limit the claimed "mobile unit" to cellular phones, for the reasons given above.

Patent Owner asserts that "[t]he purpose of the invention is only

achieved within a cellular infrastructure." PO Sur-reply 5. Patent Owner argues that "the '904 Patent explicitly and exclusively relates to improving the wireless connections of mobile devices within cellular telephone systems" and cites numerous references in the patent to cellular communications. *Id.* at 8–10 (emphasis and internal quotation marks omitted). Only one of the quotes provided by Patent Owner refers to the communications interface between the mobile unit and the moving base station. *Id.* at 9 (citing Ex. 1001, 6:66–7:1). That one reference refers to a CDMA ("Code Division Multiple Access")-based cellular standard (IS-95), which it indicates "may" be the interface between the mobile unit and the moveable base. Ex. 1001, 6:66–67. This description in the specification making use of a cellular standard optional does not support Patent Owner's argument that the patent "explicitly and exclusively relates to improving the wireless connections of mobile devices within cellular telephone systems." The other cited quotes are general references to cellular systems. The specification, in fact, supports Petitioner's argument that communications between the mobile unit and the mobile base station are not required to follow cellular protocols. Thus, the '904 patent states the interface between the mobile units and the mobile base stations "is a standard radio interface." Ex. 1001, 6:43–45. And as discussed *supra*, the patent explains that this interface "may" follow the cellular protocol IS-95, indicating that it is not required it to do so. *Id.* at 6:66–7:1; *cf.* PO Sur-reply 9.

Moreover, this argument focusing on the "cellular infrastructure" does not address the fact that the challenged claims are directed to the mobile base station. The fact that in some alternative embodiments the mobile unit may be able to communicate with the cellular network does not erase the

fact that the challenged claims and the stated objectives of the '904 patent, i.e., to provide a mobile base station as an intermediary between the mobile units and the cellular network, do not require this direct communication.

Patent Owner relies on "Federal Circuit precedent [that] forbids an overly broad interpretation of the claims." PO Sur-reply 6–7 (citing *Pacing Techs., LLC v. Garmin Int'l, Inc.*, 778 F.3d 1021, 1025 (Fed. Cir. 2015)). In *Pacing Technologies*, the Federal Circuit found evidence of "a clear and unmistakable statement of disavowal or disclaimer" in the stated objects of the invention, including a statement that the objects would be accomplished by the particular feature (a "repetitive motion pacing system") to which the Court limited the claims. 778 F.3d at 1025. Here, in contrast, for the reasons discussed above, there is no corresponding "clear and unmistakable statement" limiting the scope of the mobile unit to "a device that must register with and be able to directly communicate with the cellular network." *Pacing Technologies* does not support Patent Owner' argument. "To disavow claim scope, the specification must contain 'expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope.'" *Retractable Techs., Inc. v. Becton, Dickinson & Co.*, 653 F.3d 1296, 1306 (Fed. Cir. 2011) (quoting *Epistar v. Int'l Trade Comm'n*, 566 F.3d 1321, 1335 (Fed. Cir. 2009)); *SciMed Life Sys., Inc. v. Advanced Cardiovascular Sys., Inc.*, 242 F.3d 1337, 1341 (Fed. Cir. 2001) ("Where the specification makes clear that the invention does not include a particular feature, that feature is deemed to be outside the reach of the claims of the patent, even though the language of the claims, read without reference to the specification, might be considered broad enough to encompass the feature in question."). As discussed above, the '904 patent claims are directed to the

mobile base station communicating with the cellular network, and the specification describes an embodiment which prevents the mobile unit from communicating with the fixed ports. There is no "disavowal or disclaimer" of mobile units that do not communicate directly with a cellular system.

Patent Owner argues further that "it is well established that 'when the scope of the invention is clearly stated in the specification, and is described as the advantage and distinction of the invention, it is not necessary to disavow explicitly a different scope.'" PO Sur-reply 8 (quoting *On Demand Mach. Corp. v. Ingram Indus.*, 442 F.3d 1331, 1340 (Fed. Cir. 2006)). Patent Owner contends: "The Federal Circuit's analysis in *On Demand* is similar to the Patent Owner's claim construction." *Id.* We disagree. As Patent Owner's quotation from *On Demand* makes clear, it is not necessary to find an explicit disavowal "when the scope of the invention is clearly stated in the specification, and is described as the advantage and distinction of the invention." 442 F.3d at 1340 (quoted at PO Sur-reply 8). However, in our analysis above of Patent Owner's position, we find that the scope of the invention and its advantages as described in the '904 patent center on the mobile base station, not the mobile unit. The '904 patent specification, therefore, does not favor Patent Owner's narrow construction of "mobile unit." Thus, *On Demand*'s exception to the normal requirement for an explicit disavowal is not applicable here.

We are not persuaded by Patent Owner's explanation that "the movable base station addressed the handoff problems and data bandwidth constraints of conventional consumer cellular networks in 1995." *Id.* at 11–12. There is no dispute that improving cellular technology is included among the goals described in the '904 patent. But Patent Owner

acknowledges that the claims require the movable base station, not the mobile unit, be able to communicate directly with the cellular network. PO Sur-reply 11; *see also* discussion *supra*. Patent Owner therefore fails to support its argument that the '904 patent "explicitly *and exclusively* relates to improving the wireless connections of mobile devices within 'cellular telephone systems.'" PO Sur-reply 8 (original emphasis omitted; emphasis added). We find, based on the analysis above, that the claims, specification, and prosecution history of the '904 patent reveal a broader goal of also improving wireless communications involving non-cellular devices, such as radios and telephones.

Nor are we persuaded by Patent Owner's suggestion that the patent specification requires the mobile unit to "register . . . with the cellular network." PO Resp. 7–8. Such a registration requirement is not supported by in the claims or prosecution history.

The challenged claims do not call for registration. Registration of a mobile unit with a base station is mentioned in the '904 patent specification (*see* PO Resp. 7, PO Sur-reply 6–7), but the registration process described there occurs only "[w]hen a mobile unit set is first powered up or first enters a service area," and involves the mobile device transmitting its address to the moving base station, not the fixed base stations. Ex. 1001, 9:64–10:2 ("The address will be received by the closest moving base station 30 and transmitted . . . to the telephone network"). Thus, we find that in this description, the moving base station, rather than the mobile unit, handles the registration process with the fixed base station, as well as subsequent hand-offs. The transmission of an address by the mobile unit to the moving base station during start-up uses a generic "standard radio interface."

However, even if the specification were to include an embodiment describing registration by the mobile unit, that would not alter the fact that the claims are directed to a mobile base station that communicates directly with the cellular network and a mobile unit that communicates directly with the mobile base station through a "standard radio interface," but not directly with that cellular network. Thus, the alleged ability of the mobile unit to communicate directly with the cellular network, or any other network or device for that matter, is not relevant to patentability of the claimed 'apparatus.'"

In summary, having considered all the arguments and evidence presented on this issue, we find that Patent Owner's proposed construction for "mobile unit" is not supported by the claim language of the '904 patent or the intrinsic evidence, and, therefore, we do not adopt a construction that would limit "mobile unit" to cellular phones or other devices "that must register with and be able to directly communicate with the cellular network" and that would exclude conventional cordless phones.

We agree, therefore, with Petitioner's reasoning that no construction of "mobile unit" is necessary. Pet. 10; Pet. Reply 7.

C. Description of Prior Art References

Petitioner's challenge relies on Ito, Gilhousen501, Gilhousen761, and Gilhousen459. *See* Pet., *passim*. Because our Decision relies on Ito and Gilhoousen501, we provide the following description of those references.

1. Ito (Exhibit 1003)

Ito is a patent titled "Mobile Radio Communication System Having Mobile Base and Portable Devices as a Mobile Station." Ex. 1003, (54). Ito relates to a cellular-type automobile telephone system that has been known

as a mobile radio communication system. *Id.* at 1:15–16. As described in Ito, in known cellular mobile radio telephone systems, each of the mobile stations is connected by a radio channel to a base station for the radio communication zone where it is currently located. *Id.* at 1:22–24. The mobile stations are further connected to a wire telephone network by way of the base station and a control station. *Id.* at 1:24–26.

The automobile telephone main unit and the handset assembly are connected by a signal cord. The cradle and the handset are connected by a curled cord. *Id.* at 1:51–54. According to Ito, "[w]ith such an arrangement, the curled cord can constitutes [sic] an annoying obstacle when the driver drives and speaks into the telephone transmitter simultaneously. Moreover, the handset cannot be moved away beyond a limit posed by the curled wire . . . ." *Id.* at 1:55–59.

Thus, Ito describes a cellular mobile radio communication system that wirelessly connects a mobile station, or a mobile base device, and a portable device by a radio channel, in order to eliminate the necessity of wiring the mobile base device and portable telephone device together and increasing the maneuverability of the telephone handset. *Id.* at 2:5–12.

This is illustrated by Figure 6 of Ito, reproduced below.

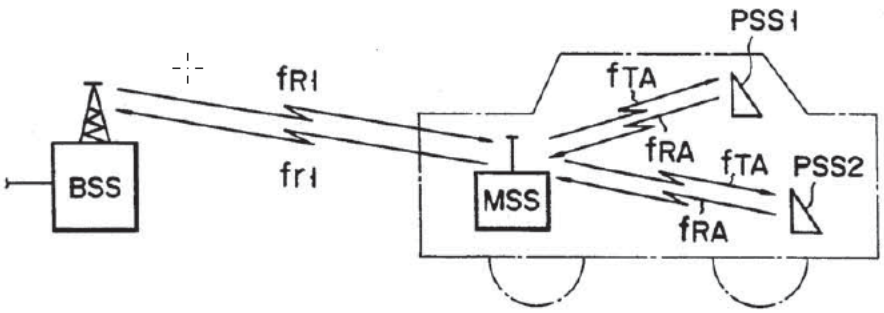

FIG. 6

Figure 6 of Ito depicts a mobile radio communication system. *Id.* at 5:16–18.

In Figure 6 of Ito, mobile base device MSS is wirelessly connected simultaneously with two portable devices PSS1 and PSS2. Ex. 1003, 12:52–56. Base station BSS and mobile base device MSS communicate with each other by way of radio frequencies f_{T1} and f_{R1}.[11] *Id.* at 12:57–63. Mobile base device MSS and portable devices PSS1 and PSS2 communicate with each other by way of radio frequencies f_{TA} and f_{RA}. *Id.* As described by Ito, referring to Figure 3 (not shown), mobile base device MSS has two transmitter-receiver units. *Id.* at 7:9–12. The first transmitter-receiver unit is used for radio communication with base station BSS by way of a first radio channel. The second transmitter-receiver unit is used for radio communication with its portable devices PSS by way of a second radio channel. *Id.* at 7:12–17.

Further, Ito describes that high speed fading phenomena cause errors in signals. *Id.* at 16:59–60. The rate of errors in signals due to the high

[11] Figure 6 of Ito mislabels f_{T1} as f_{r1}. *See* Ex. 1003, 12:57–63.

speed fading phenomena is increased due to the distance of a signal's communication path. *See id.* at 16:56–61. In particular, Ito describes that the communication path between the mobile base device MSS and the portable device PSS is shorter, and therefore has a smaller rate of errors, than the communication path between the mobile base device MSS and the base station BSS. *Id.*

The embodiment described in Ito makes use of TDMA (Time Division Multiple Access) and FDMA (Frequency Division Multiple Access) techniques for communications between the base station BSS and mobile base device MSS and between the mobile base device and the portable device PSS. *Id.* at 5:47–50.

2. Gilhousen501 (Ex. 1004)

Gilhousen501 is a patent titled "Method and System for Providing a Soft Handoff in Communications in a CDMA Cellular Telephone System." Ex. 1004, (54). Gilhousen501 describes a "soft" handoff scheme employed for a CDMA cellular telephone system in which a new cell-site modem is assigned to a mobile unit while the old cell-site continues to service the call. *Id.* at 3:9–12. When the mobile unit is located in the transition region between the two cell-sites, the call can be switched back and forth between cell-sites as signal strength dictates. *Id.* at 3:12–15. When mobile unit communications are firmly established with the new cell-site, e.g. the mobile unit is well within the new cell, the old cell-site discontinues servicing the call. *Id.* at 3:19–22. Gilhousen501 describes this "soft" handoff as a "make-before-break switching function," in contrast to previous cellular telephone systems which used a "break-before-make switching function." *Id.* at 3:24–28.

Figure 1 of Gilhousen501, reproduced below, depicts a schematic overview of an exemplary CDMA cellular telephone system. *Id.* at 7:1–3.

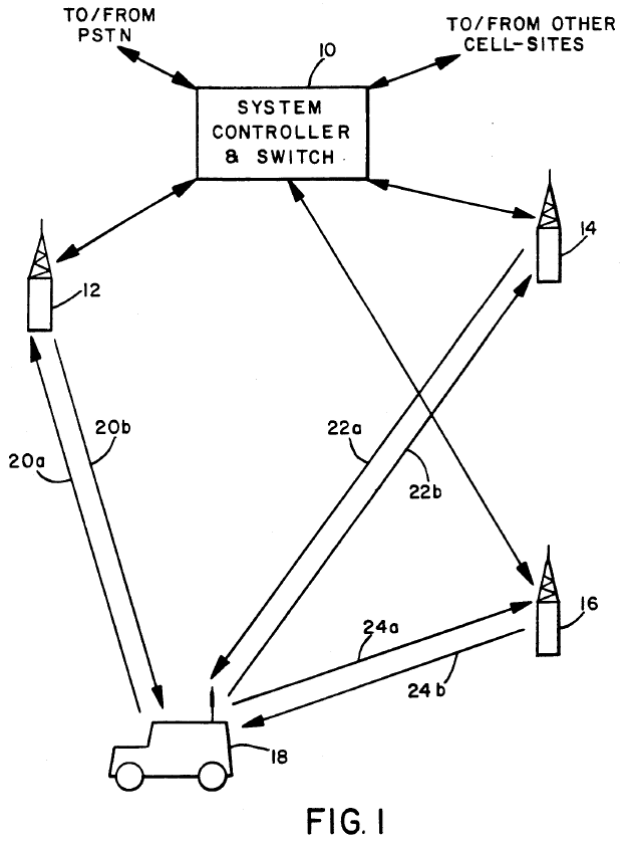

Figure 1 of Gilhousen501 depicts a CDMA cellular telephone system. *Id.*

Gilhousen501 explains that in a CDMA cellular telephone system, the same frequency band is used for all cells. *Id.* at 2:58–59. Gilhousen501 further describes that:

> In the CDMA cellular telephone system, each cell site transmits a "pilot carrier" signal. This pilot signal is used by the mobile units to obtain initial system synchronization and to provide robust time, frequency and phase tracking of the cell-site transmitted signals.
>
> Each cell-site also transmits a "setup" channel comprised of spread spectrum modulated information, such as cell-site

> identification, system timing, mobile paging information and various other control signals.

Id. at 3:45–53. When the mobile unit identifies the appropriate setup code for a given cell-site, system information is received and processed. *Id.* at 4:10–12. The mobile unit further monitors the setup channel for control messages, such as messages indicating that a call is waiting for transfer to the mobile unit. *Id.* at 4:12–15.

III. ANALYSIS OF THE CHALLENGED CLAIMS

A. Anticipation and Obviousness

The Federal Circuit addressed the legal standard for anticipation in *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331 (Fed. Cir. 2016):

> Under 35 U.S.C. § 102(b), a prior art reference will anticipate if it "disclose[s] each and every element of the claimed invention . . . arranged or combined in the same way as in the claim."

815 F.3d at 1341 (citation omitted). The Federal Circuit went on to explain:

> "However, a reference can anticipate a claim even if it 'd[oes] not expressly spell out' all the limitations arranged or combined as in the claim, if a person of skill in the art, reading the reference, would 'at once envisage' the claimed arrangement or combination."

Id.

A claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any

differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) where in evidence, so-called "secondary considerations" may be found, including commercial success, long-felt but unsolved needs, failure of others, and unexpected results. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966) ("the *Graham* factors"). Neither the Petitioner nor the Patent Owner presents evidence on the fourth *Graham* factor. We therefore do not consider that factor in this Decision.

B. Ito and Gilhousen501 Challenges

Petitioner contends claims 22, 23, 28–35, 40, 50, 51, and 56–59 would have been obvious over Ito in view of Gilhousen501. Pet. 19–26; IPR1635 Pet. 16–40. Mr. Fisher testifies that each limitation of these claims is disclosed by the combination of Ito and Gilhousen501. Fischer Decl. ¶ 101; Fischer II Decl. ¶¶ 105–139. Petitioner provides an element-by-element analysis for each of the challenged claims in relation to Ito and Gilhousen501. Pet. 26–47; Fischer Decl. ¶¶ 117–155; IPR1635 Pet. 24–40; Fischer II Decl. ¶¶ 105–139. We are persuaded by Petitioner's analysis that each element of these claims is met by the combination. Our analysis begins with independent claim 22.

1. Independent claim 22

Petitioner provides an element-by-element analysis of claim 22 in relation to Ito and Gilhousen501. Pet. 26–35. Petitioner demonstrates that each limitation of the claim (including the preamble) is taught by Ito and Gilhousen501. *Id.* Petitioner provides supporting testimony from Mr. Fischer. Fischer Decl. ¶¶ 117–129.

22[a]. An apparatus adapted to move in accordance with a movement of a mobile unit moving relative to a plurality of fixed radio ports

Petitioner contends that the preamble of claim 22 (to the extent limiting)[12] is disclosed by Ito's mobile base device MSS. Pet. 26–28; Fischer Decl. ¶ 117. We find that for the reasons given by Petitioner, Ito teaches the preamble of claim 22 by disclosing "a 'mobile base device MSS' (i.e., an apparatus, or movable base station) and a 'portable device PSS' (i.e., a mobile unit) inside a vehicle that moves relative to a plurality of 'base stations BSS' (i.e., fixed radio ports)." Pet. 26–27 (citing Ex. 1003, Fig. 1 & 5:31–46); Fischer Decl. ¶¶ 117–118.

22[b]. a receiver adapted to receive a plurality of signals, each of the plurality of signals transmitted from each of the plurality of fixed radio ports

To meet the "receiver" limitation, Petitioner relies on "[t]he modified system of Ito in view of the teachings of Gilhousen501." Pet. 28–30; Fischer Decl. ¶¶ 119–121. Referring to Ito's Figure 1, Petitioner shows that Ito describes a "cellular type automobile telephone system" that "normally comprises a control station, *a plurality of base stations* and a plurality of mobile stations." Pet. 28 (quoting Ex. 1003, 1:15–21) (internal quotation marks omitted). Petitioner explains: "As shown in Figure 1 . . ., the MSS in each mobile station [in Ito] receives radio signals at frequency f_{R1} from respective base stations BSS to which it is connected." *Id.* at 29 (citing Ex. 1003, 11:11–15). Mr. Fischer testifies that the terrestrial base stations in Ito

[12] As noted *supra,* because we find that the prior art references cited by Petitioner disclose the preambles of the challenged independent claims, we do not express an opinion on whether those preambles are limiting.

and Gilhousen501 provide the claimed "fixed ports" and "base stations." Fischer Decl. ¶ 102. Further, Petitioner asserts that "[a person of ordinary skill] would have been motivated to modify the system described in Ito to use Gilhousen501's CDMA technique, and accordingly would employ the CDMA radio communication components, protocols, and in the CDMA frequency bands." Pet. 29.

We find that for the reasons given by Petitioner, the receiver limitation is met by Ito and Gilhousen501. As Petitioner demonstrates, "[i]n the modified Ito system with Gilhousen501's teachings, the modified Ito MSS may connect to multiple base stations simultaneously when the mobile station MS is on the periphery of more than one cell-site during handoff, in order to determine which base station has better signal quality." *Id.* at 29–30 (citing Ex. 1004, 3:12–15, 3:29–44; Fig. 1); Fischer Decl. ¶ 121. Patent Owner does not dispute that the "receiver" limitation is met by the combined teachings of Ito and Gilhousen501. We discuss Patent Owner's challenge to the motivation to combine these references *infra*.

22[b1]. within a frequency band having a lower limit greater than 300 megahertz

Petitioner contends that the "frequency band" limitation is met by Gilhousen501. Pet. 30–31; Fischer Decl. ¶ 122. Petitioner explains that Gilhousen501 discloses a soft-handoff technique in a CDMA cellular telephone system. *See* discussion of Gilhousen501, *supra*. Mr. Fischer testifies: "In Gilhousen501, radio communications between the mobile unit and base stations occur in the 850 megahertz frequency band." Fischer Decl. ¶ 122 (citing Ex. 1004, 8:59–9:2). Because 850 megahertz is greater than 300 megahertz, we find that the combination of Ito and Gilhousen501

discloses this limitation. Patent Owner does not dispute that the "frequency band" limitation is met by the combined teachings of Ito and Gilhousen501. We discuss Patent Owner's challenge to the motivation to combine these references *infra*.

22[c]. a transmitter adapted to transmit, within the frequency band, a resultant signal to the mobile unit in accordance with at least one of the plurality of signals

Petitioner contends this limitation is met by "[t]he modified system of Ito in view of the teachings of Gilhousen501." Pet. 31; Fischer Decl. ¶¶ 123–125. Petitioner explains: "Ito's mobile base device MSS has a second transmitter-receiver unit 80 that wirelessly communicates with portable device PSS." Pet. 31 (citing Ex. 1003, 7:9–17); Fischer Decl. ¶ 123.

Patent Owner contends that the Petition fails to demonstrate that Ito and Gilhousen501 meet the "transmitter" limitation. PO Resp. 33–36; PO Sur-reply 27–28. Patent Owner contends that "*Gilhousen501* does not disclose any apparatus (i.e., a moving base station) of any type, let alone an apparatus that comprises a transmitter 'adapted to transmit, within the frequency band, a resultant signal to the mobile unit,' as required by Claim 22." PO Resp. 35. We are not persuaded by this argument, as it is not responsive to Petitioner's contentions. Petitioner relies on Ito, not Gilhousen501, for disclosure of the claimed moving "apparatus," i.e., the mobile base station. *See* Pet. 31. As Petitioner explains: "The mobile base device [in Ito], installed in a vehicle, is constructed to move with the traffic at a rate of speed which is comparable to the speed of the traffic." *Id.*

Referring to an annotated version of Gilhousen501's Figure 1, Patent Owner contends that "*Gilhousen501* only discloses a direct communication

between its single mobile unit (18) and one or more cell-sites (i.e., fixed base stations)." PO Resp. 35–36. Further, according to Patent Owner, Ito fails to show transmission "within the frequency band, a resultant signal to the mobile unit." *Id.* at 36. We are not persuaded by these arguments directed to Ito alone and Gilhousen501 alone. Petitioner relies on the combination of Ito and Gilhousen501, as noted *supra*. Petitioner shows that Gilhousen501 discloses radio communications between the mobile unit and base stations in the 850 megahertz frequency band. Pet. 32. Petitioner demonstrates that Ito discloses mobile unit PSS and mobile base station MSS. Petitioner explains that in Ito "a communication path is created between the BSS and the PSS, . . . and signals transmitted to the PSS by the MSS are 'in accordance with' the signals from 'at least one of the plurality of signals' from the 'plurality of fixed radio ports' because signals associated with a given call are transmitted from the BSS to the MSS, processed, and retransmitted to the PSS." *Id.* (citing Ex. 1003, 11:65–12:10; Fischer Decl. ¶ 124).

Mr. Fischer testifies that modifying Ito in light of Gilhousen501's teachings would have achieved "the predictable result of a CDMA communication path between Ito's PSS and BSS via a modified MSS." Fischer Decl. ¶ 125. He further testifies: "As the modified Ito system uses CDMA both for the modified BSS-MSS path and the MSS-PSS path, signals associated with a telephone call transmitted from the BSS to the PSS are 'within the frequency band' of CDMA and 'in accordance with' the signals from the BSS for at least the same reasons as Ito alone, described above." *Id.* We find this explanation persuasive, and we therefore find that the combination of Ito and Gilhousen501 meets the "transmitter" limitation.

Patent Owner's Sur-reply faults Ito for not disclosing "transmitting a resulting signal" and Gilhousen501 for not disclosing an "apparatus (i.e., moving base station)." PO Sur-reply 27–28. This analysis is unpersuasive because it focuses in the references individually, rather than the combination. Where, as here, obviousness is based on a combination of reference, one cannot show nonobviousness by attacking references individually. *See In re Keller*, 642 F.2d 413, 426 (CCPA 1981); *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Referring back to its proposed claim construction, Patent Owner contends also that the "mobile unit" recited in this limitation of claim 22 is not disclosed by Ito. PO Resp. 36–38; PO Sur-reply 28. Patent Owner states: "While *Ito* does disclose a portable device (PSS), this portable device does not register with or directly communicate with the cellular network as required for a 'mobile unit' in the context of the entire '904 Patent." PO Resp. 37. Patent Owner further asserts Ito's "portable device is similar to a cordless phone system," and, therefore, is excluded under Patent Owner's construction of "mobile unit." *Id*.

Patent Owner's arguments are based on its proposed construction of "mobile unit" as "a device that must register with and be able to directly communicate with the cellular network." *See* discussion *supra*, Section II.B.3. Because we have not adopted Patent Owner's claim construction, we are not persuaded by those arguments. We find that Ito's portable device PSS meets the requirement of claim 22 for a mobile unit for the reasons given by Petitioner and summarized *supra*. *See* Pet. 27–28; Fischer Decl. ¶¶ 123–125.

In any event, we find that Ito meets this limitation even under Patent Owner's proposed construction. Pet. Reply 20–21. As Petitioner explains (*id.* at 20), Ito's PSS generates a call signal containing the ID code of the station and sends the signal to the mobile base device. The MSS then initiates communication with the BSS. Ex. 1003, 9:64–10:50. This description is consistent with the description of registration in '904 patent relied on by Patent Owner. *Cf.* PO Resp. 7. Likewise, a person of ordinary skill would have understood that as the system controller performs handoff of Gilhousen501's mobile unit, it must communicate directly with the base station and make its identity, and the area in which it is located, known to the network. Fischer Reply Decl. ¶ 12 (citing Ex. 1004, 4:54–5:11, 7:50–8:10).

As discussed *supra*, we agree with Patent Owner's assertion that the '904 patent "relates to and describes as a whole improving the wireless connections of mobile devices within cellular telephone systems." PO Sur-reply 7 (emphasis omitted). We find that Ito does so as well. Ito directs its invention to a "mobile radio communication system." Ex. 1003, 1:15–16, 5:31–33. Ito explains that "[a] cellular type automobile telephone system has been known as a mobile radio communication system." *Id.* at 1:15–16. Thus, like the '904 patent, we find that Ito operates within a cellular network and also provides a moving base station that links a portable radio device to a cellular network.

We further find that for the reasons given, Ito and Gilhousen501 together teach the "transmitter" limitations of claim 22. Pet. 26–35; Fischer Decl. ¶¶ 117–129.

> *22[d]. a processor adapted to maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.*

Petitioner shows persuasively that this "processor" limitation is met by Ito and Gilhousen501. Pet. 33–35; Fischer Decl. ¶¶ 126–129. Petitioner explains that "Gilhousen501 expressly discloses a mobile unit that monitors signals received from all base stations to which it is connected, and initiates hand-off when the pilot signal from a neighboring cell is stronger than the signal from the currently selected cell." Pet. 33 (citing Ex. 1004, 4:31–53). "This process is performed by control processor 46, which provides control signals from the connected base stations to digital data receivers 40 and 42 for processing." *Id.* at 33–34 (citing Ex. 1004, 10:16–18).

The claim calls for the processor to "maximize an amount of transferred information." Ex. 1001, 13:8–9. Petitioner shows that the "maximize" limitation is met by providing Ito with Gilhousen501's soft handoff: "The combined mobile base station of Ito's automobile telephone system with Gilhousen501's CDMA soft-handoff technique would use the teachings of Gilhousen501 to 'maximize an amount of transferred information to the mobile unit by evaluating a quality of each of the plurality of signals transmitted from the plurality of fixed radio ports.'" Pet. 35 (citing Fischer Decl. ¶ 129).

Patent Owner does not dispute that the "processor" limitation is disclosed by the combination of Ito and Gilhousen501. Patent Owner contends that there is insufficient evidence of a motivation to combine the references. PO Resp. 28 ("Petitioner also attempts to further combine the CDMA processor of *Gilhousen501's* fixed base station into *Ito's*

FDMA/TDMA mobile base stations (MSS).") We find that Ito and Gilhousen501 disclose this limitation for the reasons given. We discuss the motivation to combine *infra*.

In summary, we find that for the reasons given, Ito and Gilhousen501 teach each limitation of claim 22. Pet. 26–35; Fischer Decl. ¶¶ 117–129.

Rationale for Combining Ito and Gilhousen501

Petitioner provides a persuasive rationale for combining the teachings of Ito and Gilhousen501. Pet. 19–25. Petitioner explains that the proposed combination applies Gilhousen501's teaching of a "soft handoff" implemented using CDMA (*see supra,* Section II.C.2) to the mobile communication system taught by Ito. *Id.* at 20. Petitioner demonstrates that a person of ordinary skill would have adapted other aspects of Gilhousen501, including its processor, to produce the "resultant signal" of claims 22, 29–31, and 50. Pet. 32–33, 37–39, 46–47.

Specifically, we find that a person of ordinary skill would have been aware of CDMA techniques at the time of the alleged invention of the '904 patent. *Id.* at 22 (citing Fischer Decl. ¶ 106). Patent Owner's expert describes CDMA as a "breakthrough technology over the previous FDMA and TDMA cellular systems." Lanning Decl. ¶ 141 (heading). Moreover, Gilhousen501 itself teaches that CDMA has "significant advantages" over the FDMA/TDMA technique disclosed in Ito. Ex. 1004, 1:18–23. We find that these advantages (including soft handoff) would have motivated a person of ordinary skill to combine the teachings of Ito and Gilhousen501. Pet. 22; Ex. 1004, 2:58–66, 3:12–18.

Petitioner also asserts that incorporating the CDMA techniques of Gilhousen501 into the system described in Ito "would have been readily

accomplished, and a [person of ordinary skill] would have been motivated to do so with at least a reasonable expectation of success." Pet. 25–26 (citing Fischer Decl. ¶ 116). As Mr. Fischer explains: "Doing so would have been readily accomplished by inserting CDMA's protocols, radio communication components and base stations in place of those used by TDMA or FDMA systems without diminishing the other aspects of Ito's disclosure." Fischer Decl. ¶ 103. Mr. Fischer refers to developments in the telecommunications industry that would have led a person of ordinary skill to apply Gilhousen501's CDMA technology to Ito's disclosures "given the advantages of CDMA over FDMA/TDMA." *Id.* ¶¶ 104–109. We find Mr. Fischer's testimony credible and persuasive.

Patent Owner disputes Petitioner's evidence of a motivation to combine the teachings of Ito and Gilhousen501. PO Resp. 27–29; PO Sur-reply 23–25. Patent Owner contends "*Ito's* FDMA/TDMA system is not compatible with CDMA systems." PO Resp. 22–23; PO Sur-reply 23–24. Patent Owner contends "*Ito* explicitly teaches away from utilizing CDMA techniques." PO Resp. 27. Patent Owner states that "*Ito's* FDMA/TDMA system is not capable of utilizing CDMA modulation techniques or even transmitting CDMA signals without replacing *Ito's* current FDMA/TDMA circuitry with entirely new CDMA circuitry." *Id.* (citing Lanning Decl. ¶ 145). Mr. Lanning testifies that "these compatibility issues would prohibit *Ito's* mobile base stations (BSS) from transmitting CDMA signals and further prohibit *Ito's* mobile base stations (MSS) from receiving CDMA signals, as Petitioner proposes." Lanning Decl. ¶ 146. We are not persuaded by these arguments. Our reasoning follows.

Patent Owner cites *KSR* as requiring the Board to consider the motivation to combine in determining obviousness. PO Sur-reply 22. But, as the Federal Circuit has emphasized, in analyzing obviousness, *KSR* assumes that the person of ordinary skill "is not an automaton":

> *KSR* does not require that a combination only unite old elements without changing their respective functions. Instead, *KSR* teaches that "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton." And it explains that the ordinary artisan recognizes "that familiar items may have obvious uses beyond their primary purposes, and in many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle."

ClassCo, Inc. v. Apple, Inc., 838 F.3d 1214, 1219 (Fed. Cir. 2016) (citations omitted, alteration in original)). The Federal Circuit further cautioned, in *ClassCo*, that "the rationale of *KSR* does not support [the] theory that a person of ordinary skill can only perform combinations of a puzzle element A with a perfectly fitting puzzle element B." *Id.*

We disagree with Patent Owner's assertion that Petitioner has failed to demonstrate a motivation to combine the teachings of Ito and Gilhousen501. We find that Petitioner has provided persuasive evidence of such a rationale. Pet. 19–25; Fischer Decl. ¶¶ 103–115; *see* discussion *supra*. As noted, Mr. Lanning testifies that CDMA was a "breakthrough technology." Lanning Decl. ¶ 141 (heading). Given the high level of ordinary skill in the pertinent art before us, we find that a person having such ordinary skill (an experienced wireless communications systems engineer "familiar with cellular communication technology") would have readily recognized that combining Ito with Gilhousen501's teachings of CDMA technology would

have the advantages identified by Petitioner and summarized *supra*. Pet. 19–25; Fischer Decl. ¶¶ 103–109.

Moreover, we find that such a highly skilled person would have been able to combine the teaching of those references using known technology with a reasonable expectation of success. Fischer Decl. ¶¶ 116 ("When designing the system described in Ito, a [person of ordinary skill] would have naturally implemented known and commercially available radio communication components and software with the mobile base station and base station in the Ito system."). We are persuaded by Petitioner's explanation that a person of ordinary skill would have made the substitution of these known techniques of communications with a reasonable expectation of success. Moreover, this conclusion is further supported by Mr. Lanning's testimony that the hardware and software necessary to convert a base station, such as in Ito, to CDMA was available from Motorola during the relevant time period. Pet. Reply 12; Lanning I Dep. 42:23–43:22.

We have considered Patent Owner's arguments and find them unpersuasive. As Petitioner points out, Patent Owner's approach is flawed because it assumes the bodily incorporation of "unmodified CDMA components from Gilhousen501 into Ito's *unmodified* system." Pet. Reply 10. We agree that Patent Owner's approach is flawed. "[T]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art." *MCM Portfolio LLC v. Hewlett-Packard Co.*, 812 F.3d 1284, 1294 (Fed. Cir. 2015) (quoting

Keller, 642 F.2d at 425); s*ee also In re Sneed*, 710 F.2d 1544, 1550 (Fed. Cir. 1983) ("[I]t is not necessary that the inventions of the references be physically combinable to render obvious the invention under review."); and *In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the *teachings* of references does not involve an ability to combine their specific structures.").

We are not persuaded by the testimony of Patent Owner's expert, Mr. Lanning, on this issue. *Cf.* Lanning Decl. ¶¶ 144–162. His testimony mirrors arguments in Patent Owner's Response about the combination of Ito and Gilhousen501 resulting in "incompatible systems" and requiring additional "design and circuitry details." *See id.* ¶¶ 150, 156, 160. As discussed *supra*, we find that those arguments are unpersuasive and contrary to *KSR*, and Mr. Lanning's testimony is similarly unpersuasive.

We have considered Patent Owner's additional arguments and find them no more persuasive. For example, Patent Owner argues repeatedly that Petitioner's rationale for combining Ito and Gilhousen501 and other references relied on by Petitioner, and the supporting testimony from Mr. Fischer are "conclusory." PO Resp. 21, 23; PO Sur-reply 19. We disagree. We find that Petitioner's explanation of the rationale for combining the teachings of the references and Mr. Fischer's supporting testimony, summarized *supra*, are persuasive for the reasons given above.

Nor do we agree with Patent Owner's argument that the Petition is "fatally defective" because it does not explain "in sufficient detail" how to combine Ito and Gilhousen501 (and other references). PO Resp. 20–25. According to the '904 patent, the invention uses "well-known" equipment and functions. *See, e.g.*, Ex. 1001, 4:28, 5:5–6, 5:23, 5:50, 5:62, 6:15, 6:26, 6:42, 6:45, 6:54–55, 9:19–20, 9:33, 9:63. CDMA was a well-known

technique at the time of the alleged invention. Fischer Decl. ¶ 106 (citing Ex. 1026, 50 (stating that CDMA was "[c]ommercially introduced in 1995")). We are persuaded that a more detailed explanation of how to combine such well-known equipment and techniques is not required. *See* Fischer Decl. ¶ 116 ("Starting with Ito, a [person of ordinary skill] familiar with wireless technology such as CDMA would have naturally sought to implement Ito using CDMA, . . . and to do so would have required only the application of ordinary skill."). Mr. Fischer provided additional details at his deposition. Fischer I Dep. 89:11–91:17. Moreover, Mr. Lanning's testimony establishes that the necessary hardware and software for the transition was available from Motorola. Lanning I Dep. 42:23–43:22; *see* discussion *supra*.

Nor do we agree that "*Ito* explicitly teaches away from utilizing CDMA techniques." PO Resp. 27. A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant. *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). The mere fact that Ito chose an alternative technology (TDMA/FDMA) is not sufficient to teach away from substituting CDMA. *See id.*

We find, therefore, that for these reasons, Petitioner has demonstrated by a preponderance of the evidence, including expert testimony and the references themselves, a motivation to combine the teachings of Ito and Gilhousen501 with a reasonable expectation of success.

Accordingly, for the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or

suggests each element of claim 22, and further, that it would have been obvious to combine the teachings of those references as proposed by Petitioner with a reasonable expectation of success. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 22 would have been obvious in light of Ito and Gilhousen501.

2. Independent claim 34

Petitioner demonstrates that each element of claim 34 is taught by Ito and Glihousen501. Pet. 41–46; Fischer Decl. ¶¶ 144–151. Petitioner shows that the preamble ("An apparatus adapted to move in accordance with a movement of a plurality of mobile units moving relative to a plurality of fixed radio ports at a velocity greater than a relative velocity of movement between each of the mobile units of the plurality of mobile units") is met by Ito. Pet. 42; Fischer Decl. ¶¶ 144–145. Petitioner explains that in Ito, "[w]hen in motion, the vehicle will travel relative to base station BSS at a higher speed than the relative speed between personal stations PSS1 and PSS2." Pet. 42; Fischer Decl. ¶ 145.[13]

Petitioner shows the recited "first radio interface" is met by Ito's MSS: "Ito explains that these two radio channels are established using two transmitter-receivers in the MSS." Pet. 43–44 (citing Ex. 1003, Figs. 1 & 3); Fischer Decl. ¶ 146–147. Likewise, Petitioner relies on Ito for teaching the recited "second radio interface." Pet. 45; Fischer Decl. ¶ 149. Finally, for disclosing the recited "processor," Petitioner relies on Gilhousen501 and Ito,

[13] As noted *supra,* because we find that the prior art references cited by Petitioner disclose the preambles of the challenged independent claims, we do not express an opinion on whether those preambles are limiting.

in combination: "Gilhousen501's processor establishes a communication link between the mobile units and fixed radio ports based on signal quality indicators for each fixed radio port." Pet. 45; Fischer Decl. ¶¶ 150–151.

Patent Owner challenges this analysis on several grounds. PO Resp. 47–52. First, Patent Owner contends that Gilhousen501 does not meet the "frequency bandwidth greater than 300MHz" limitation: "Critically, *Gilhousen501* does not disclose any apparatus (i.e., a moving base station) of any type, let alone an apparatus comprised of 'a second radio interface adapted to communicate with the plurality of mobile units in the frequency bandwidth, the frequency having a lower limit greater than 300 megahertz.' . . . ." *Id.* at 47. We are not persuaded by this argument, as it is not responsive to Petitioner's contentions, which rely on Ito and Gilhousen501, in combination. Pet. 42–45. Thus, for this limitation, Petitioner contends that Ito (not Gilhousen501) provides the teaching of a movable base station with an interface to the mobile units. *Id.* at 42–43. Petitioner relies on Gilhousen501 for meeting the frequency band limitation. *Id.* at 45. As Patent Owner acknowledges, the CDMA technology disclosed in Gilhousen501 provides a teaching of RF signals above 300 megahertz "in the 850 MHz frequency band." PO Resp. 47.

Patent Owner contends also that the "processor" limitation is not met. PO Resp. 48–52. Patent Owner contends that "Petitioner improperly relies on the control processor (100) of *Gilhousen501's* mobile unit" while the claim is directed to the mobile base station. *Id.* at 49 (emphasis omitted). We are not persuaded by this argument, as Petitioner relies on the combination of Ito and Gilhousen501 (not Gilhousen501 alone) to meet this limitation. *See* Pet. 45. Next, Patent Owner contends that Gilhousen501

"does not disclose any apparatus (i.e., a moving base station) of any type, let alone an apparatus comprised of a processor required by the limitation of Claim 34." PO Resp. 49–50. Again, Patent Owner's argument is unpersuasive because it addresses Gilhousen501 separately, and not the combination of Ito and Gilhousen501 proposed by Petitioner. *Cf.* Pet. 45 ("[T]he combination of Ito and Gilhousen501 discloses establishing a communication link between a plurality of mobile units and at least one fixed radio port."). Finally, Patent Owner's assertion of an alleged failure of Ito and Gilhousen501 to disclose a "mobile unit" (PO Resp. 52) is based on Patent Owner's rejected claim construction. This argument has been addressed previously and is not persuasive for the reasons already given. *See* discussion of claim element 22[c] *supra*, Section III.B.1.

In any event, as discussed *supra,* we find that Ito meets this limitation, even under Patent Owner's proposed construction. Pet. Reply 20–21. *See supra,* Section III.B.1.

Accordingly, for the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of claim 34, and further, that it would have been obvious to combine the teachings of those references as proposed by Petitioner with a reasonable expectation of success. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 34 would have been obvious in light of Ito and Gilhousen501.

3. Independent Claim 50

Claim 50 is directed to a method and is similar to the challenged apparatus claims. Petitioner provides a table identifying each limitation of

claim 50 (and dependent claim 51)[14] with a corresponding limitation of claim 22. Relying mainly on its analysis of claim 22, Petitioner demonstrates that each element of claim 50 is "expressly disclosed" by Ito and Glihousen501. Pet. 46–47; Fischer Decl. ¶ 155.[15]

Patent Owner, in turn, relies on its analysis of claim 22 in responding to Patent Owner's challenge. PO Resp. 55–56. For the reasons already discussed in connection with claim 22, we do not find those arguments persuasive.

Accordingly, for the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of claim 50. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 50 would have been obvious in light of Ito and Gilhousen501.

4. Dependent Claims 23, 35, and 51

Claims 23, 35, and 51 depend, respectively, from independent claims 22, 34, and 50, and recite that "the frequency band has a lower limit of 300 megahertz." Ex. 1001, 13:12–13, 14:12–13, 15:46–47. Petitioner asserts that this limitation is met by Gilhousen501: "Gilhousen501 discloses that CDMA radio communications take place in the 850 megahertz band." Pet. 36. Further, "[a person of ordinary skill] at the time of the '904 patent's alleged invention would have known that cellular radio communications typically used frequency bands within UHF, the low end of which the

[14] The Petition incorrectly identifies claim 51 as independent. Pet. 46.
[15] For the preamble of claim 50, Petitioner relies on its analysis of claim 33. Pet. 47.

International Telecommunications Union identifies as 300 megahertz." *Id.* (citing Fischer Decl. ¶ 130). Mr. Fischer testifies that "[s]electing any sub-band within that range within the UHF range would have been nothing more than a simple design choice." Fischer Decl. ¶ 130. Petitioner relies on the same analysis for claims 35 and 51. Pet. 46–47; Fischer Decl. ¶¶ 152, 155.

Patent Owner does not separately address these claims and does not dispute separately Petitioner's contentions as to these claims. We are persuaded by Petitioner's contentions and evidence, and we conclude that the subject matter recited in claims 23, 35, and 51 would have been obvious based on the combination of Ito and Gilhousen501.

5. Dependent Claim 28

Claim 28 depends from claim 22, and recites, "the processor is further adapted to determine a best fixed radio port of the plurality of fixed radio ports, the best fixed radio port enabling the maximization of the amount of transferred information to the mobile unit." Ex. 1001, 13:23–27. Petitioner relies on Gilhousen501 as disclosing this limitation. Pet. 36–37. Petitioner refers to Gilhousen501's comparison of signals from two or more cell sites during handoffs, as discussed in connection with claim 22. *Id.* Petitioner also relies on Gilhousen501's disclosure of diversity combiner 104 comparing the signal quality indicators accompanying the information bits from the two or more cell-site signals. *Id.* at 37 (citing Ex. 1004, 14:8–14). Petitioner asserts: "This process also identifies the 'best fixed radio port' because the best radio port in the plurality is the one with the strongest and most reliable signal." *Id.* (citing Ex. 1001, 10:35–37; Fischer Decl. ¶¶ 132–133.

Patent Owner's response begins by referring back to claim 22. PO Resp. 38. Patent Owner then addresses the additional subject matter in claim 28 calling for identifying "the best fixed radio port" by referring to Gilhousen501 separately, and not to the combination of references proposed by Petitioner. *Id.* at 38–40. Patent Owner argues that "Petitioner improperly relies on the 'diversity combiner 104' of *Gilhousen501's* mobile unit," whereas the claim requires the processor of the moving base station to determine the best fixed radio port. *Id.* at 38–39. Similarly, Patent Owner again asserts "*Gilhousen501* does not disclose any apparatus (i.e., a moving base station) in accordance with claim 22." *Id.* at 39. We have addressed similar arguments *supra* and do not agree with them because they do not address Petitioner's contentions based on combining Ito and Gilhousen501.

Accordingly, for the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of claim 28, including determining the best fixed radio port. We are persuaded by Petitioner's contentions and evidence, and find that Gilhousen501 discloses the additional subject matter in claim 28. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 28 would have been obvious in light of Ito and Gilhousen501.

6. Dependent Claim 29–31

These claims depend indirectly from claim 22. Claim 29 depends from claim 28 and recites that "the transmitter is further adapted to transmit the resultant signal in accordance with the signal transmitted from the best fixed radio port." Ex. 1001, 13:28–31. Petitioner refers to claim 22 and argues that this additional subject matter is met by Gilhousen501. Pet. 37.

Claim 30 depends from claim 29 and recites that "the processor is further adapted to determine a plurality of best fixed radio ports and to combine a group of signals of the plurality of signals to produce the resultant signal, the group of signals transmitted from the plurality of best fixed radio ports." Ex. 1001, 13:32–37. Petitioner refers to claim 22 and argues that this additional subject matter is met by Gilhousen501's diversity combiner: "Gilhousen501 discloses that its processor uses 'diversity combining' to combine a group of two or more signals transmitted from a plurality of fixed radio ports." Pet. 38 (citing Ex. 1004, 5:22–6:35).

Claim 31 depends from claim 30 and recites that "the processor is further adapted to combine the group of signals by synchronizing the group of signals to produce a plurality of synchronized signals and combining the plurality of synchronized signals in accordance with the quality of each of the plurality of synchronized signals to produce the resultant signal." Ex. 1001, 13:38–44. Petitioner refers to claim 30 and asserts that this additional subject matter is met by Ito and Gilhousen501. Pet. 39.

Patent Owner's response to these claims as a group refers to claims 22 and 28. PO Resp. 38, 41. For the additional limitation of claim 30 referring to determining the "best radio port," Patent Owner refers to its previous contention that "neither Ito nor Gilhousen501 disclose the limitation of 'determin[ing] a best fixed radio port' required by Claim 28." Pet. 41–43. We have discussed that argument in connection with claim 28, and find it unpersuasive for the reason given there.

For claim 30, Patent Owner presents the additional argument that "Petitioner improperly equates *Gilhousen501's* disclosure of determining 'the strongest two paths from each cell-site' to that of the '904 Patent's

required limitation of 'determin[ing] a plurality of best fixed radio ports.'" PO Resp. 44 (alteration in original). According to Patent Owner, "[t]he '904 Patent provides that 'determin[ing] a best fixed radio port' is more than just analyzing the strongest signal." *Id.* at 45 (second alteration in original). Patent Owner argues that this limitation requires "at a minimum—an analysis of the signal quality (i.e., error rate) in addition to the signal strength when viewed in the entire context of the '904 Patent." *Id.* (citing Lanning Decl. ¶ 212). We are not persuaded by this argument.

The portion of the '904 patent relied on by Patent Owner describes the mobile unit's operation in monitoring the signal from the base stations: "Each mobile unit monitors pilot signals from fixed and moving base stations and synchronizes to the base station providing the best signal." Ex. 1001, 11:15–18. The claim, however, is directed to the functionality of the recited "apparatus," i.e., the moving base station, not the mobile unit. *See* discussion *supra*, Section II.B.3. Nor does the claim specify any particular metrics (such as error rate) that must be evaluated by the claimed apparatus to select a "best fixed radio port."

In essence, Patent Owner's argument is another instance of trying to use the specification to limit the claims without demonstrating an express disavowal of claim scope. *See* Pet. Reply 23–24 and discussion *supra*. We are not persuaded by Patent Owner's argument that the claims should be read to require basing the determination of the best radio port "on signal strength and error rate."

Patent Owner's response to claim 31 presents no new arguments and refers to claim 30, from which it depends. PO Resp. 46.

For the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of claims 29–31. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claims 29–31 would have been obvious in light of Ito and Gilhousen501.

7. Dependent Claims 32 and 33

Claim 32 depends from claim 22 and recites

> wherein the amount of information transferred to the mobile unit is maximized by transmitting the information through at least one of the plurality of fixed radio ports, the at least one fixed radio port providing a greatest quality communication link between the at least one fixed radio port and the mobile unit in relation to other communication links between other fixed radio ports of the plurality of fixed radio ports and the mobile unit.

Ex. 1001, 13:45–53. Petitioner refers to claim 30 and argues that this additional subject matter is met by Gilhousen501. Pet. 40. Claim 33 depends from claim 32, and requires that the "greatest quality communication link" comprise "a first wireless communication link between the at least one fixed radio port and the receiver," and "a second wireless communication link between the transmitter and the mobile unit." Ex. 1001, 13:55–59. Petitioner relies on its analysis of claim 29, *supra*, and Figure 3 of Ito and associated text to meet this limitation. Pet. 40–41; Fischer Decl. ¶¶ 141–142.

Patent Owner relies on its response to claim 28, from which these claims depend, and presents no new arguments beyond those already discussed above. PO Resp. 41 (addressing claims 29–33).

For the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of

claims 32 and 33. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claims 32 and 33 would have been obvious in light of Ito and Gilhousen501.

8. Dependent Claim 40

Claim 40 depends from claim 34 and recites "wherein the processor is further adapted to establish a second communication link between the plurality of mobile units and at least a second fixed radio port of the plurality of fixed radio ports based on the plurality of signal quality indicators." Ex. 1001, 14:23–27. Petitioner's analysis refers to claim 30 and shows that this additional subject matter is met by Gilhousen501. Pet. 46; Fischer Decl. ¶¶ 153–154. As Mr. Fischer explains: "As discussed with respect to claim 30, *supra*, Gilhousen501 discloses 'The system controller then performs diversity combining of the signals received by the two cell-sites while the mobile unit performs diversity combining of the signals received from the two cell-sites.'" Fischer Decl. ¶ 154 (quoting Ex. 1004, 6:16–21).

Patent Owner relies on its response to claim 34, from which this claim depends. PO Resp. 53. Patent Owner further responds by repeating its argument that "neither *Ito* nor *Gilhousen501* disclose the limitation of a 'processor adapted to establish a communication link between the plurality of mobile units and at least one of the plurality of fixed radio ports based on a plurality of signal quality indicators' required by Claim 34." *Id.* We are not persuaded by this argument for the reasons discussed in connection with claim 34.

Accordingly, for the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or

suggests each element of claim 40. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 40 would have been obvious in light of Ito and Gilhousen501.

9. Claim 56–59

Petitioner contends that these claims would have been obvious over Ito in view of Gilhousen501. IPR1635 Pet. 16. Mr. Fisher testifies that each limitation of claims 56–59 is disclosed by the combination of Ito and Gilhousen501. Fischer II Decl. ¶¶ 105–139. Petitioner provides an element-by-element analysis for each of the challenged claims in relation to Ito and Gilhousen501. IPR1635 Pet. 24–40.

We are persuaded by Petitioner's analysis that for the reasons given by Petitioner, each element of these claims is met by the combination of Ito and Gilhousen501. Generally, Petitioner asserts that the proposed combination applies Gilhousen501's teaching of a "soft handoff" implemented using CDMA (*see supra*) to the mobile communication system taught by Ito. *Id.* at 16.

Petitioner contends that the first limitation of claim 56 (element 56a) is met by Ito and Gilhousen501: "Ito establishes a first communication link between its mobile units (PSS) and a fixed port (BSS) through a movable base station (MSS)." *Id.* at 27. Petitioner also asserts that both Ito and Gilhousen501 "disclose a plurality of mobile units that have a communication connection with a base station (fixed port)." *Id.* (emphasis omitted) (citing Fischer II Decl. ¶¶ 110–111). Similarly, Petitioner contends the second limitation of claim 56 (element 56b) is met by the combination: "Ito describes a 'cellular type automobile telephone system' that 'normally

comprises a control station, a plurality of base stations and a plurality of mobile stations.'" *Id.* (citing Ex. 1001, 1:15–21; Fischer II Decl. ¶¶ 113–114).

Petitioner also contends that a person of ordinary skill would have adapted other aspects of Gilhousen501, including its processor (*see* discussion *supra*), to meet the dependent claims, such as the "resultant signal" of claims 57 and 58. *Id.* at 17 (citing Fischer II Decl. ¶ 91).

Petitioner asserts that a person of ordinary skill would have been motivated to combine Ito and Gilhousen501 in the way claimed by the '904 patent. IPR1635 Pet. 16–23. Specifically, Petitioner asserts that a person of ordinary skill would have been aware of CDMA techniques at the time of the alleged invention of the '904 patent. *Id.* at 19 (citing Fischer II Decl. ¶ 94); *see also* Ex. 1026, 44, 50 (textbook discussion of CDMA). Moreover, Gilhousen501 itself teaches that CDMA has "significant advantages" over the FDMA/TDMA technique disclosed in Ito. Ex. 1004, 1:18–23. According to Petitioner, these advantages (including soft handoff) would have motivated a person of ordinary skill to combine the teachings of Ito and Gilhousen501. IPR1635 Pet. 20; Ex. 1004, 2:58–66; 3:12–18; *see also* discussion *supra*, Section III.B.1.

Petitioner asserts that incorporating the CDMA techniques of Gilhousen501 into the system described in Ito "would have been readily accomplished, and a [person of ordinary skill] would have been motivated to do so with at least a reasonable expectation of success." IPR1635 Pet. 23; Fischer II Decl. ¶ 104. As Mr. Fischer explains: "Starting with Ito, a [person of ordinary skill] familiar with wireless technology such as CDMA would have naturally sought to implement Ito using CDMA, which allows

the improvement of Gilhousen501's soft handoff, instead of Ito's FDMA/TDMA system, and to do so would have required only the application of ordinary skill." Fischer II Decl. ¶ 104.

Patent Owner responds that these claims are not unpatentable over the combination of Ito and Gilhousen501. PO Resp. 88–89. Addressing claim 56, Patent Owner refers back to its argument that "[n]either *Ito* nor *Gilhousen501* [d]isclose '[m]obile [u]nits.'" *Id.* at 88. We addressed this argument in connection with claim 22. *See* Section III.B.1, *supra*. We do not agree with this argument for the reasons discussed in connection with claim 22.

Further addressing claim 56, Patent Owner contends that "*Ito* does not disclose any type of hand-off method between a moveable base station and a fixed port, as Petitioner proposes." PO Resp. 89. We are not persuaded by this argument because it fails to address the combination of references proposed by Petitioner. Specifically, as Petitioner explains, Patent Owner "does not contest that (1) Ito discloses a moving base station, or (2) that Gilhousen501 discloses handoff—only that each reference lacks express disclosure of different aspects of the claim." Pet. Reply 28. Accordingly, for the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of claim 56. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 56 would have been obvious in light of Ito and Gilhousen501.

For claims 57–59, which depend from claim 56, Patent Owner presents no new arguments and refers to its arguments for claim 56, just addressed. PO Resp. 90.

For the reasons given, we find that Petitioner has demonstrated that Ito in combination with Gilhousen501 discloses or suggests each element of claim 56–59. We agree with and adopt Petitioner's analysis of those claims. Based on Petitioner's analysis and for the reasons explained above, we find Petitioner has shown by a preponderance of evidence that claim 56–59 would have been obvious in light of Ito and Gilhousen501.

C. Other Grounds

As noted above in Section I.G, Petitioner presents additional challenges to claims 22, 23, 28–35, 40, 50, 51, and 56–59. Because we determine that these claims are unpatentable in light of Ito and Gilhousen501 for the reasons discussed above, we do not separately assess the patentability of these claims based on the remaining grounds in this proceeding. 35 U.S.C. § 318(a) (2018) ("If an inter partes review is instituted and not dismissed under this chapter, the Patent Trial and Appeal Board shall issue a final written decision with respect to the patentability of any patent claim challenged by the petitioner and any new claim added under section 316(d)."); *Beloit Corp. v. Valmet Oy*, 742 F.2d 1421, 1423 (Fed. Cir. 1984) (finding that an administrative agency is at liberty to reach a decision based on a single dispositive issue).

IV. CONSTITUTIONAL CHALLENGE

Patent Owner contends that "adjudication of the '904 patent violates the U.S. Constitution." PO Resp. 95.

In *Arthrex v. Smith & Nephew*, 941 F.3d 1320, 1338 (Fed. Cir. 2019), *cert. granted sub nom. United States v. Arthrex, Inc.*, 2020 WL 6037206 (Oct. 13, 2020), the Federal Circuit determined that the current structure of the Board does not violate Article II as of the date of that precedential

decision. *See also Arthrex, Inc. v. Smith & Nephew, Inc.*, 953 F.3d 760, 764 (Fed. Cir. 2020) (Moore, J., concurring in denial of rehearing) ("Because the APJs were constitutionally appointed as of the implementation of the severance, inter partes review decisions going forward were no longer rendered by unconstitutional panels."). Furthermore, in *Arthrex*, the Federal Circuit found "no constitutional infirmity in the institution decision as the statute clearly bestows such authority on the Director pursuant to 35 U.S.C. § 314." 941 F.3d at 1340.

Therefore, we disagree with Patent Owner that this adjudication "violates the U.S. Constitution." PO Resp. 95.

V. CONCLUSION

For the foregoing reasons, we determine that Petitioner has demonstrated by a preponderance of the evidence that claims 22, 23, 28–35, 40, 50, 51, and 56–59 of the '904 patent are not patentable.

A summary of our conclusions is set forth in the table below.

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
22, 23, 28–35, 40, 50, 51, 56–59	103(a)	Ito, Gilhousen501[16]	22, 23, 28–35, 40, 50, 51, 56–59	
22, 23, 28–35, 40, 50, 51, 56–59	103(a)	Gilhousen761, Gilhousen501		
22, 23, 28–35, 40, 50, 51, 56–59	103(a)	Ito, Gilhousen459		

[16] Because we determine that all of the challenged claims are unpatentable on this ground, we decline to address the remaining grounds in the Petitions.

56	102(a)	Gilhousen761		
Overall Outcome			22, 23, 28–35, 40, 50, 51, 56–59	

VI. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 22, 23, 28–35, 40, 50, 51, and 56–59 of the ’904 patent are not patentable;

FURTHER ORDERED that because this is a Final Written Decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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