

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HEWLETT PACKARD ENTERPRISE COMPANY
and CISCO SYSTEMS, INC.,
Petitioner,

v.

COBBLESTONE WIRELESS LLC,
Patent Owner.

IPR2024-00707
Patent 7,924,802 B2

Before KARL D. EASTHOM, NORMAN H. BEAMER, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

TERMINATION
Granting Joint Motion to Terminate
After Institution of Trial and
Granting Joint Request to Treat Settlement Agreement
as Business Confidential Information
35 U.S.C. § 317; 37 C.F.R. § 42.74

I. INTRODUCTION

With Board authorization, Hewlett Packard Enterprise Company and Cisco Systems, Inc. (“Petitioner”) and Cobblestone Wireless LLC (“Patent Owner”) filed a Joint Motion to Terminate the above-identified proceeding (“Joint Motion”). Paper 31. The parties also filed settlement agreements (Exhibits 1016, 1017) and a Joint Request that we treat the settlement agreements as business confidential information and maintain them separate from the publicly available file of U.S. Patent No. 7,924,802 (“the ’802 patent”) (Paper 32, “Joint Request”).

II. DISCUSSION

In the Joint Motion, Petitioner and Patent Owner represent that they have reached a settlement as to all disputes in this proceeding and seek termination of the above-identified proceeding. Joint Motion 1. The parties also represent that the filed copies of the settlement agreements are each a “true copy” of the agreement between the parties related to this proceeding, and that “[t]here are no other agreements, oral or written, between the parties made in connection with, or in contemplation of, the termination of the proceeding.” *Id.* at 2.

The Board generally expects that a case “will terminate after the filing of a settlement agreement, unless the Board has already decided the merits.” Office Patent Trial Practice Guide, 77 Fed. Reg. 48,756, 48,768 (Aug. 14, 2012); *see* 35 U.S.C. § 317(a); 37 C.F.R. § 42.72. We instituted trial in the above-identified proceeding on September 24, 2024. Paper 17. We have not yet decided the merits of the proceeding, and a final written decision has not been entered. Notwithstanding that the proceeding has moved beyond the preliminary stage, Petitioner and Patent Owner have shown adequately that

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termination of the proceeding is appropriate. *See* 35 U.S.C. § 317(a); 37 C.F.R. §§ 42.5(a), 42.72.

The parties also request that the settlement agreements be treated as business confidential information and be kept separate from the publicly available file of U.S. Patent No. 7,924,802. Joint Request 1–2. After reviewing the settlement agreements filed as Exhibits 1016 and 1017, we find that they contain confidential business information. We determine that good cause exists to treat the settlement agreement as business confidential information pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

III. ORDER

Accordingly, for the reasons discussed above, it is:

ORDERED that the Joint Motion is *granted*, and IPR2024-00707 is *terminated*, pursuant to 35 U.S.C. § 317(a) and 37 C.F.R. § 42.72; and

FURTHER ORDERED that the Joint Request is *granted*, and the settlement agreements filed as Exhibits 1016 and 1017 shall be kept separate from the publicly available file of U.S. Patent No. 7,924,802 B2, and made available only to Federal Government agencies on written request, or to any person on a showing of good cause, pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED,
Petitioner,

v.

COBBLESTONE WIRELESS, LLC,
Patent Owner.

IPR2024-01336
Patent 7,924,802 B2

Before KARL D. EASTHOM, NORMAN H. BEAMER, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Qualcomm Incorporated (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–4, 6–10, 13, 14, 17, and 21–25 (the “challenged claims”) of U.S. Patent No. 7,924,802 B2 (Ex. 1001, “the ’802 patent”). Paper 4 (“Pet.”). Petitioner also filed a Motion for Joinder to IPR2024-00606 (Paper 3) and a Reasons for Parallel Petitions and Petition Ranking (Paper 2). Cobblestone Wireless, LLC (“Patent Owner”) filed a Preliminary Response. Paper 11 (“Prelim. Resp.”). With our permission, Petitioner filed a Preliminary Reply (Paper 12, “Prelim. Reply”), and Patent Owner filed a Preliminary Sur-reply (Paper 13, “Prelim. Sur-reply”).

We have authority to determine whether to institute an *inter partes* review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that “the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) (2020) (“The Board institutes the trial on behalf of the Director.”). The reasonable likelihood standard is “a higher standard than mere notice pleading,” but “lower than the ‘preponderance’ standard to prevail in a final written decision.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing the unpatentability of at least one of the

challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Real Parties in Interest

Petitioner identifies Qualcomm Incorporated and Qualcomm Technologies, Inc. as the real parties in interest. Pet. 105. Petitioner states that it is filing this Petition because “Cobblestone has sued at least one of Qualcomm’s customers for infringing the ’802 Patent” and states that, “[f]or completeness” it “also identifies its customer Cisco Systems, Inc., which has been named as a defendant in a pending litigation involving the ’802 Patent, as an additional real party in interest.” *Id.* Patent Owner identifies Cobblestone Wireless, LLC, as the real party in interest. Paper 6, 1.

C. Related Proceedings

The parties identify the following proceedings involving the ’802 patent: *Cobblestone Wireless, LLC v. Samsung Electronics Co., Ltd.*, No. 2:23-cv-00285 (E.D. Tex.); *Cobblestone Wireless, LLC v. T-Mobile USA, Inc.*, No. 2:23-cv-00381 (E.D. Tex.); *Cobblestone Wireless, LLC v. Cellco Partnership d/b/a Verizon Wireless*, Case No. 2:23-cv-00382 (E.D. Tex.); *Cobblestone Wireless, LLC v. AT&T Services Inc.* No. 2:23-cv-00380 (E.D. Tex.); *Cobblestone Wireless, LLC v. Hewlett Packard Enterprise Company, et al.*, Case No. 2:23-cv-00457 (E.D. Tex.); *Cobblestone Wireless, LLC v. CommScope Holding Company, Inc.*, No. 2:23-cv-00455 (E.D. Tex.); *Cobblestone Wireless, LLC v. Cisco Systems, Inc.*, No. 2:23-cv-00454 (E.D. Tex.); *Hewlett Packard Enterprise Company and Cisco Systems, Inc. v. Cobblestone Wireless, LLC*, IPR2024-00707; *Wireless Communication Systems and Methods*, Re-Examination Appl. No. 90/019,458; *Samsung Elecs. Am., Inc. v. Cobblestone Wireless, LLC*, IPR2024-00606 (PTAB,

filed Feb. 26, 2024); *Hewlett Packard Enterprise Co. v. Cobblestone Wireless, LLC*, IPR2024-00707 (PTAB, filed Mar. 19, 2024); *Cellco Partnership d/b/a Verizon Wireless v. Cobblestone Wireless LLC*, IPR2024-00946 (PTAB, filed Jun. 28, 2024). Pet. 105–106; Paper 6, 1–2.

D. The '802 Patent (Ex. 1001)

The '802 patent is directed to a wireless communication system and method that transmits signals simultaneously over a communication channel at different RF center frequencies. Ex. 1001, code (54), code (57). The Background of the '802 patent explains that “[c]ommunication systems generally contain one or more transmission channels to transmit data from the transmitter to the receiver.” *Id.* at 1:12–14. The Background describes a transmitter in such a system that “is limited to up-converting a signal to one center frequency (or modulation frequency), which is the LO [(local oscillator)] frequency.” *Id.* at 1:29–32. “Typically,” the Background explains, “the amount of information transmitted around the center frequency is limited by the bandwidth of the transmitter around the center frequency,” which “limits the amount of data that can be transmitted.” *Id.* at 1:32–35. Thus, “[t]ypical prior art approaches to improving the information capacity in a wireless communication system involve maximizing the bandwidth around the center frequency to increase the amount of information that may be modulated onto the carrier frequency.” *Id.* at 1:35–40.

To overcome this issue, the '802 patent proposes “a method of transmitting information in a wireless communication channel” that includes “transmitting first information across a first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency, and

simultaneously transmitting second information across a second frequency range using the same wireless transmitter,” where the second frequency range has “a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.” Ex. 1001, 1:60–2:5.

Figure 2 of the '802 patent, reproduced below, “illustrates a wireless communication system according to one embodiment of the present invention.” Ex. 1001, 5:53–54.

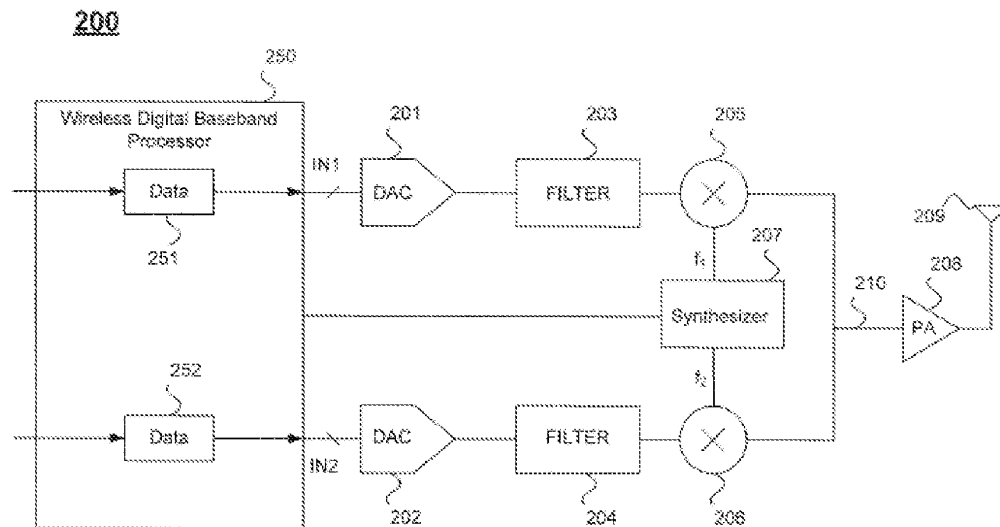


Fig. 2

Figure 2 of the '802 patent illustrates a wireless communication system according to an embodiment of the invention. Ex. 1001, 5:53–54, Fig. 2.

As shown in Figure 2, baseband digital system 250 provides a first digital signal comprising first digital data 251 which is provided as IN1 and a second digital signal comprising second digital data 252 provided as IN2. *Id.* at 5:62–66. The first digital data 251 and second digital data 252 may be

unrelated data streams or data from the same data stream. *Id.* at 6:7–9. Each of the first and second digital signals is transmitted to a digital to analog converter (DAC 201 and 202), a filter (203 and 204), and an up-converter (205 and 206). *Id.* at 6:10–26. The up-converters 205 and 206 each receive a first modulation signal having an RF center frequency (f_1 and f_2 , respectively) from synthesizer 207 and generate first and second up-converted signals that are combined at the input to amplifier 208. *Id.* at 6:22–44, 6:57–60, 7:4–7. Amplifier 208 outputs an amplified up-converted signal comprising the first and second up-converted analog signals, and transmits this signal over antenna 209. *Id.* at 7:7–11.

Figure 3 of the '802 patent, reproduced below, illustrates an example of the frequency content of the signal transmitted from the system disclosed in Figure 2.

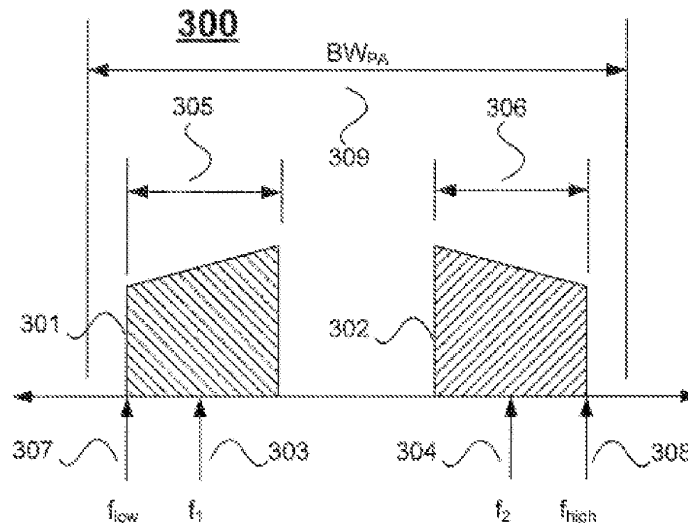


Fig. 3

Figure 3 of the '802 patent illustrates an example of the frequency content of the signal transmitted by the stem of Figure 2. Ex. 1001, 5:58–60, Fig. 3.

Figure 3 shows first up-converted analog signal 301 generated by up-converter 205, which has center frequency f_1 and frequency range 305, and

second up-converted analog signal 302 generated by up-converter 206, which has center frequency f_2 and frequency range 306. *Id.* at 6:26–44. The frequency difference between f_1 and f_2 is greater than the sum of one-half of the first frequency range and one-half of the second frequency range, so that the up-converted signals do not overlap and cause distortion. *Id.* at 6:48–53. The first and second up-converted analog signals 301 and 302 may be transmitted by the antenna over bandwidth BW_{PA} 309. *Id.* at 7:9–14.

E. Illustrative Claims

Of the challenged claims, claims 1, 10, 17, and 24 are independent.

Claim 1 is illustrative and is reproduced below.

1. [pre] A method of transmitting information in a wireless communication channel comprising:

[1a] transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and

[1b] simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency, a second highest frequency, and a second lowest frequency.

Ex. 1001, 13:59–14:3 (bracketed paragraph identifiers added).

F. Applied References

Petitioner relies upon the following references:

Rick et al., U.S. Patent No. 8,693,525 B2, issued Apr. 8, 2014 (Ex. 1021, “Rick”);

Suzuki et al., US 2006/0276146 A1, published Dec. 7, 2006 (Ex. 1004, “Suzuki”);

Fernandez, US 2009/0052556 A1, published Feb. 26, 2009 (Ex. 1005, “Fernandez”);

Montejo et al., US 2005/0135312 A1, published
June 23, 2005 (Ex. 1006, “Montejo”);

Jalali et al., U.S. Patent No. 6,952,454, published
Oct. 4, 2005 (Ex. 1008, “Jalai”);

Chen et al., U.S. Patent No. 6,359,868, issued
Mar. 19, 2002 (Ex. 1009, “Chen”);

Etemad, U.S. Patent No. 8,036,702 B2, issued
Oct. 11, 2011 (Ex. 1014, “Etemad”).

Pet. 4.

Petitioner submits the Declaration of Dr. Kevin C. Almeroth
(Ex. 1003).

G. Asserted Grounds of Unpatentability

Petitioner challenges the patentability of claims 11–17 of the
'028 patent based on the following grounds:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1	103(a) ¹	Rick
1–4, 6–8, 10, 13, 17, 21–22	103(a)	Suzuki
7–9, 22, 23	103(a)	Suzuki, Jalai
14, 24, 25	103(a)	Suzuki, Chen
6, 13, 21	103(a)	Suzuki, Etemad
1–4, 6–8, 10, 13, 17, 21, 22	103(a)	Fernandez, Montejo
7–9, 22, 23	103(a)	Fernandez, Montejo, Jalai
14, 24, 25	103(a)	Fernandez, Montejo, Chen
6, 13, 21	103(a)	Fernandez, Montejo, Etemad

Pet. 4.

¹ 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 '802 patent. Therefore, we apply the pre-AIA version of 35 U.S.C. § 103.

II. DISCUSSION

A. *Discretionary Denial Under General Plastic*

The Petition in this proceeding is a “me-too” petition asserting the same grounds of unpatentability as those upon which we instituted trial in IPR2024-00606. *Compare* Pet. 4 with IPR2024-00606, Paper 3 at 2–3. At this stage of the proceeding, the only dispute between the parties is whether we should exercise our discretion to deny institution of the Petition under *General Plastic Indus. Co. v. Canon Kabushiki Kaisha*, IPR2016–01357. *See* Prelim. Resp. Below, we provide a brief background of the procedural history of this proceeding and other relevant *inter partes* review proceedings involving the ’802 patent, followed by an analysis of the facts of the present case under *General Plastic* and its progeny.

1. *Procedural Background*

On February 26, 2024, Samsung Electronics America, Inc. and Samsung Electronics Co., Ltd. filed IPR2024-00606 challenging claims 1–4, 6–10, 13, 14, 17, and 21–25 of the ’802 patent. IPR2024-00606 (the “Samsung IPR”). On June 14, 2024, Patent Owner responded by filing a Preliminary Response raising a number of substantive arguments challenging Samsung’s prior art grounds and arguing that the Petition failed to show a reasonable likelihood of prevailing. IPR2024-00606, Paper 8. On September 13, 2024, we granted institution in the Samsung IPR, finding that Samsung had demonstrated a reasonable likelihood that at least one claim of the ’802 patent is unpatentable. IPR2024-00606, Paper 13. On November 1, 2024, the parties in the Samsung IPR filed a joint motion to terminate the proceeding due to settlement, which we granted on January 2, 2025. IPR2024-00606, Papers 19, 20.

On March 19, 2024, Hewlett Packard Enterprise Company and Cisco Systems, Inc. filed IPR2024-00707 challenging claims 1–9 of the ’802 patent (the “Cisco IPR”) based on different prior art and unpatentability arguments than those raised in the Samsung IPR. IPR2024-00707, Paper 3. Patent Owner filed a Preliminary Response in the Cisco IPR on June 27, 2024. IPR2024-00707, Paper 7. On September 24, 2024 we granted institution, finding that Hewlett-Packard and Cisco had demonstrated a reasonable likelihood that at least one claim of the ’802 patent is unpatentable. *Id.*, Paper 17. The Cisco IPR remains pending, and an oral hearing is set for July 2, 2025.

On August 28, 2024, Petitioner filed the instant proceeding, which challenged the same claims of the ’802 patent as the Samsung IPR, and raised the identical prior art, arguments, and evidence as the Samsung IPR. Paper 4 (“Pet.”). Petitioner also filed a motion to join the Samsung IPR. Paper 3. Petitioner represented that it expeditiously filed the Petition in this case as a “copycat” of the petition in the Samsung IPR after learning from a filing in the district court that Samsung and Patent Owner had reached an agreement in principle to settle the parties’ dispute. Pet. 104; Ex. 1028.

2. *The General Plastic Decision*

Under *General Plastic*, the Board may deny a petition based on the discretionary authority of § 314(a). *General Plastic*, Paper 19 at 15. In *General Plastic*, the Board articulated a list of non-exclusive factors to be considered in determining whether to exercise discretion under § 314(a) to deny a petition:

1. whether the same petitioner previously filed a petition directed to the same claims of the same patent;

2. whether at the time of filing of the first petition the petitioner knew of the prior art asserted in the second petition or should have known of it;
3. whether at the time of filing of the second petition the petitioner already received the patent owner's preliminary response to the first petition or received the Board's decision on whether to institute review in the first petition;
4. the length of time that elapsed between the time the petitioner learned of the prior art asserted in the second petition and the filing of the second petition;
5. whether the petitioner provides adequate explanation for the time elapsed between the filings of multiple petitions directed to the same claims of the same patent;
6. the finite resources of the Board; and
7. the requirement under 35 U.S.C. § 316(a)(11) to issue a final determination not later than 1 year after the date on which the Director notices institution of review.

General Plastic, Paper 19 at 16 (citing *NVIDIA Corp. v. Samsung Elec. Co.*, IPR2016-00134, Paper 9 at 6–7 (PTAB May 4, 2016)).

3. *The Parties' Arguments*

Patent Owner argues that the *General Plastic* factors weigh in favor of denying institution. Prelim. Resp. 7. For factor 1, Patent Owner argues that Cisco is a customer of Petitioner and a real party in interest in this proceeding, and that the Petition challenges all of the same claims of the '802 patent as the Cisco IPR except for claim 5. *Id.* at 7–9. Patent Owner also asserts that denial is appropriate even though the instant Petition is a “copy-cat” of the one in the Samsung IPR because “the *General Plastic* factors are relevant . . . even when the petition is a follow-on petition.” *Id.* at 9 (quoting *Apple, Inc. v. Uniloc 2017 LLC*, IPR2020-00854, Paper 9 at 8 (PTAB Oct. 28, 2020) (precedential)). “This is because,” Patent Owner

contends, “due to the intimate relationship between Cisco and Qualcomm, it would be as if [Qualcomm] had brought the second challenge to the patent in the first instance,” which “is the kind of serial attack *General Plastic* was intended to address.” *Id.* (quoting *Uniloc* at 4).

For factor 2, Patent Owner argues that Petitioner should have known of the art relied on in the Petition at the time the Cisco IPR was filed because the Petition is a “copy-cat” of the petition in the earlier-filed Samsung IPR. *Id.* at 9–10. For factor 3, Patent Owner argues that Petitioner benefited from the preliminary responses in the Samsung and Cisco IPRs because Petitioner “could have reviewed the petitions and preliminary responses” in those cases, “evaluated the merits of them, and decided which IPR it preferred to join. *Id.* at 11. For factors 4 and 5, Patent Owner asserts that Petitioner waited over five months after the filing of the Samsung IPR to bring this proceeding, and has not provided an adequate explanation for the delay. *Id.* at 11–12. For factors 6 and 7, Patent Owner contends that this proceeding “implicate[s] the efficiency concerns underpinning *General Plastic*.” *Id.* at 13.

Petitioner argues that it is not “one and the same” with Cisco, that “Cisco is just one of Petitioner’s many customers,” and that Petitioner had no involvement in the petition in the Cisco IPR. Prelim. Reply 1. Petitioner distinguishes the instant case from *Uniloc*, asserting that *Uniloc* “presented the very different situation in which the same Petitioner filed a second petition after the Board *denied* institution of an earlier petition.” *Id.* at 1–2 (citing *Uniloc* at 4). On the other hand, Petitioner contends, here “the Board *granted* institution of the earlier relevant petitions *after* Qualcomm filed its petition in the present case. *Id.* at 2. “Thus,” according to Petitioner, “there

is no concern here that Qualcomm seeks an unfair second bite at the apple.”

Id.

Petitioner also argues that the present case is similar to *Qualcomm Inc. v. Network System Technologies*, IPR2024-01081, Paper 14 at 31–33 (PTAB, Oct. 1, 2024). Prelim. Reply 2–3. Petitioner asserts that in *Network System*, the Board instituted a petition where there was an earlier IPR raising the same challenges and unpatentability theories that had settled. *Id.* In particular, according to Petitioner, the Board explained that, under factor 3, “the ‘potential for abuse’ from roadmapping is minimized for a copycat petition that is ‘based on the same prior art and the same unpatentability theories’ as in the earlier petition.” *Id.* at 3 (citing *Network System* at 34–45). “Likewise here,” Petitioner contends, “Patent Owner faces minimal prejudice in responding to patentability arguments to which it had already responded in the Samsung IPR and which the Board has already instituted.” *Id.*

Patent Owner responds that *Network Systems* is “readily distinguishable” from the present case because in *Network Systems* “[t]he Board found that there was not a ‘significant relationship’ between Qualcomm and the prior petitioner in that proceeding (Samsung) because the only connection between Qualcomm and Samsung was that they had both been sued for infringing the same patent by the same plaintiff.” Prelim. Sur-reply 3 (citing *Network System* at 32). Here, by contrast, Patent Owner contends, there is a “significant relationship” between Petitioner and Cisco because Cisco is a customer of Petitioner and Petitioner identified Cisco as a real party in interest in the Petition. *Id.* at 2.

4. *Analysis*

In evaluating the present case, we find that two Board decisions, one a Director Review decision, and the other a precedential Board decision, are particularly pertinent.

In *Code200 v. Bright Data Ltd.*, IPR2022-00861, Paper 18 (PTAB Aug. 23, 2022) (Director Review Decision), petitioner Code200 filed a first petition that the Board discretionarily denied under *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential), and then subsequently sought to join a later petition filed by another party by filing a “copycat” of the petition filed by that party. *Code200* at 2–3 & n.3. The Director held that

“allowing [a petitioner] the opportunity to pursue a decision on the merits” in a second-filed petition, when the first-filed petition was not evaluated on the merits, “best balances the desires to improve patent quality and patent-system efficiency against the potential for abuse of the review process by repeated attacks on patents.” *Intel Corp. v. VLSI Tech. LLC*, IPR2022-00366, Paper 14 (Jun. 8, 2022), 9–10. Holding otherwise would undercut the congressional grant to the United States Patent and Trademark Office of “significant power to revisit and revise earlier patent grants” as a mechanism “to improve patent quality and restore confidence in the presumption of validity that comes with issued patents.” *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 272 (2016) (quoting H.R. Rep. No. 112-98, pt. 1, at 45, 48).

Code200 at 4–4.

The Director explained that “*General Plastic* factor 1 must be read in conjunction with factors 2 and 3,” so that when a “first-filed petition under factor 1 was discretionarily denied or otherwise was not evaluated on the merits, factors 1–3 only weigh in favor of discretionary denial when there are ‘road-mapping’ concerns under factor 3 or other concerns under factor

2.” *Code200* at 5. The Director found “no evidence of road-mapping,” and explained that “‘road-mapping’ concerns are minimized when, as in this case, a petitioner files a later petition that raises unpatentability challenges substantially overlapping with those in the previously-filed petition and the later petition is not refined based on lessons learned from later developments.” *Id.*; *see also Network System* at 34–35 (citing *Code200* for this proposition). Based on the above-noted circumstances in *Code200*, the Director held that discretionary denial under *General Plastic* was not warranted. *Id.* at 5, 7.

In *Uniloc*, the petitioner (Apple) filed a first *inter partes* review petition that was denied on the merits, and then later sought to join another *inter partes* review proceeding raising different arguments brought by a different petitioner (Microsoft) by filing a second petition substantially identical to the one in the Microsoft IPR. *Uniloc* at 2–4, 5–7. Apple’s second petition was filed more than a year after it was sued in district court on the same patent, and therefore, absent joinder, it would have been barred from filing any further petitions challenging the patent at issue under 35 U.S.C. § 315(b). *Id.* at 6. The Board determined that it was proper to exercise its discretion to deny institution. *Id.* at 13. In doing so, the Board explained that “[t]he timing of events here shows that Apple indeed had two Board decisions concerning its first petition, the decision denying institution and a decision of the request for rehearing of that decision.” *Id.* at 10. Thus, the Board determined that Apple’s argument that its second petition was substantially identical to the petition in the Microsoft IPR and that it only sought to join that IPR as an “understudy” was not persuasive. *Id.*

Considering these cases in the context of the *General Plastic* factors, we determine that discretionary denial is not appropriate in the circumstances of this case. With respect to *General Plastic* factor 1, we agree with Patent Owner that Cisco is a customer of Petitioner and was identified by Petitioner as a real party in interest, and therefore has a “significant relationship” with Petitioner under *Valve Corp. v. Elec. Scripting Prods., Inc.*, IPR2019-00062, Paper 11 at 9 (PTAB Apr. 2, 2019) (precedential) (“*Valve*”). However, we are mindful of the Director’s finding in *Code200* that “*General Plastic* factor 1 must be read in conjunction with factors 2 and 3,” and that “[w]here the first-filed petition under factor 1 was discretionarily denied or otherwise was not evaluated on the merits, factors 1–3 only weigh in favor of discretionary denial when there are ‘road-mapping’ concerns under factor 3 or other concerns under factor 2.” *Code200* at 5.

Here, although the petitions in the Samsung and Cisco IPRs were not discretionarily denied, institution was granted, indicating that the Board believed that the challenges to the ’802 claim had merit. Indeed, the Board determined in its institution decision for the Samsung IPR that Petitioner had “made a strong showing of unpatentability that rises well above the minimum sufficiency to meet the statutory institution threshold.” IPR2024-00606, Paper 13 at 42. We also find that there is a lack of “road-mapping” in the present case. The Petition in this case is substantively identical to the petition in the Samsung IPR, and thus could not take into account the points made in the preliminary response or institution decision in that case. Additionally, the petition in the Samsung IPR was filed before the Cisco IPR, and therefore the Petition in this case (which is substantively identical

to that in the Samsung IPR) was not drafted based on learnings from the preliminary response or institution decision in the Cisco IPR. As the Director explained in *Code200*, “‘road-mapping’ concerns are minimized when . . . a petitioner files a later petition that raises unpatentability challenges substantially overlapping with those in the previously-filed petition and the later petition is not refined based on lessons learned from later developments,” which is the case here. *See Code200* at 5.

We disagree with Patent Owner’s argument that Petitioner engaged in “road-mapping” because it “could have reviewed the petitions and preliminary responses” in the Samsung and Cisco IPRs, “evaluated the merits of them, and decided which IPR it preferred to join.” Prelim. Resp. 11. We find that this is not the kind of “road-mapping” described in *General Plastic* because the Petition in this case does not respond to arguments set forth in the preliminary responses and institution decisions in the Samsung and Cisco IPRs, and has not been refined or altered based on proceedings in those IPRs. We also find that the present case is distinguishable from *Uniloc* because, in *Uniloc*, the petitioner’s previous IPR was considered on the merits and institution was denied, while here the Samsung and Cisco IPRs were found to have merit and were instituted.²

Additionally, as in *Code200*, we find that factors 2, 4, and 5 “have limited relevance” due to the lack of “road-mapping.” *See Code 200* at 6.

² We also note that, unlike in *Uniloc*, Petitioner is not time-barred from filing this petition based on 35 U.S.C. § 315(b). Petitioner itself was not sued in district court based on the ‘802 patent, and the Petition in this case was filed on August 28, 2024, which is less than a year after the district court case against Cisco was filed on September 29, 2023. IPR2024-00707, Ex. 2004; IPR2024-00707, Paper 7 at 45.

With respect to factor 6, the Board has already invested significant resources in evaluating and instituting the Samsung IPR, and therefore continuing to evaluate those challenges would be an efficient use of the Board's resources. Here, as in *Code200*, we find that "the Board's mission 'to improve patent quality and restore confidence in the presumption of validity that comes with issued patents' outweighs the impact on Board resources needed to evaluate the merits of" this petition. *Id.* at 6 (quoting *Cuozzo Speed Techs., LLC v. Lee*, 579 U.S. 261, 272 (2016)). Finally, we do not expect there to be an issue in reaching a final determination within one year after institution of this proceeding, so factor 7 does not weigh in favor of discretionary denial.

Consequently, after weighing the *General Plastic* factors, we find that exercising our discretion to deny institution is not warranted in this case.

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented 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, objective evidence of non-obviousness.³ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also "determine

³ At this stage of the proceeding, Patent Owner has not presented objective evidence of non-obviousness.

whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result has weight in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b) (2020). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner contends that a person of ordinary skill in the art at the time of the alleged invention would have had “at least a bachelor’s in EE/CE/CS, physics, or equivalent, and two years of experience with cellular telecommunications, radio-access network architectures, protocols and signal propagation in wireless networks.” Pet. 4 (citing Ex. 1003 ¶¶ 50–51). Petitioner further states that “[m]ore education can supplement practical experience and vice versa.” *Id.* Patent Owner does not offer a proposed level of ordinary skill at this stage of the proceeding. *See* Prelim. Resp.

At this stage of the proceeding, we adopt Petitioner’s assessment of the level of skill in the art, which is consistent with the ’802 patent and the asserted prior art of record.

D. Analysis of the Grounds Raised in the Petition

The Petition is substantively identical to the petition in the Samsung IPR. Moreover, Patent Owner did not raise substantive arguments against the grounds set forth in the Petition, but instead relied only on arguments for discretionary denial. *See* Prelim. Resp. We adopt the analysis set forth in our institution decision in the Samsung IPR and, based on that analysis, determine that Petitioner has established a reasonable likelihood of unpatentability of at least one of the challenged claims of the '802 patent. *See* IPR2024-00606, Paper 13 at 8–37.

III. MOTION FOR JOINDER

As noted above, Petitioner also filed a Motion for Joinder to the Samsung IPR. Paper 3. Because the Samsung IPR has been terminated, we find that the Motion for Joinder is moot, and dismiss it accordingly.

IV. CONCLUSION

Based on the analysis above, we determine that it is not appropriate to exercise our discretion to deny institution of the Petition, and that Petitioner has demonstrated a reasonable likelihood of success in proving that at least one of the challenged claims of the '802 patent is unpatentable. We therefore institute trial on all challenged claims and grounds raised in the Petition. *See PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (a decision whether to institute an *inter partes* review “require[s] a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

V. ORDER

In consideration of the foregoing, it is hereby

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–4, 6–10, 13–14, 17, and 21–25 of the '802 patent is instituted with respect to all grounds set forth in the Petition;

FURTHER ORDERED that the Motion for Joinder is *dismissed*; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '802 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2024-01336
Patent 7,924,802 B2

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

COBBLESTONE WIRELESS, LLC,
Patent Owner.

IPR2024-00606
Patent 7,924,802 B2

Before KARL D. EASTHOM, NORMAN H. BEAMER, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

TERMINATION
Due to Settlement After Institution of Trial
35 U.S.C. § 317; 37 C.F.R. § 42.74

I. INTRODUCTION

With the Board’s authorization, Petitioner and Patent Owner (collectively referred to as “the Parties”) filed a Joint Motion to Terminate the above-identified proceeding due to settlement. Paper 19 (“Joint Motion” or “Mot.”). In support of the Joint Motion, the Parties filed a confidential Release Agreement (Ex. 2009 (“Settlement Agreement”)), as well as a Joint Request to File Settlement Agreement as Business Confidential Information Pursuant to 35 U.S.C. § 317(b) (Paper 18 (“Joint Request”)).

II. DISCUSSION

In the Joint Motion, the Parties represent that they have reached an agreement to jointly seek termination of the above-identified *inter partes* review proceeding, and that the filed copy of the Settlement Agreement is a true and complete copy. Mot. 1–2; Ex. 2009, 6. The Parties further represent that their settlement agreement resolves “all disputes relating to the Patent-in-Suit.” Mot. 3.

Under 35 U.S.C. § 317(a), “[a]n *inter partes* review instituted under this chapter shall be terminated with respect to any petitioner upon the joint request of the petitioner and the patent owner, unless the Office has decided the merits of the proceeding before the request for termination is filed.” Section 35 U.S.C. § 317(a) also provides that if no petitioner remains in the *inter partes* review, the Office may terminate the review.

We instituted a trial in the above-identified proceeding on September 10, 2024. Paper 13. We have not yet decided the merits of the proceeding, and a final written decision has not been entered. Notwithstanding that the proceeding has moved beyond the preliminary stage, the Parties have shown adequately that the termination of the proceeding is appropriate. Under

IPR2024-00606
Patent 7,924,802 B2

these circumstances, we determine that good cause exists to terminate the proceeding with respect to the Parties.

After reviewing the Settlement Agreement between Petitioner and Patent Owner, we find that the Settlement Agreement contains confidential business information regarding the terms of settlement. We determine that good cause exists to treat the Settlement Agreement between Petitioner and Patent Owner as business confidential information pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

III. ORDER

In view of the above, it is

ORDERED that the Joint Motion to Terminate (Paper 19) is *granted*, and IPR2024-00606 is *terminated* with respect to Petitioner and Patent Owner pursuant to 35 U.S.C. § 317(a) and 37 C.F.R. § 42.72; and

FURTHER ORDERED that the Joint Request to File Settlement Agreement as Business Confidential Information Pursuant to 35 U.S.C. § 317(b) (Paper 18) is *granted*, and the Settlement Agreement shall be kept separate from the file of Patent 7,924,802 B2, and made available only to Federal Government agencies on written request, or to any person on a showing of good cause, pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

IPR2024-00606
Patent 7,924,802 B2

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CELLCO PARTNERSHIP D/B/A VERIZON WIRELESS,
T-MOBILE USA, INC., AT&T SERVICES INC.,
AT&T MOBILITY LLC, AT&T CORP.,
NOKIA OF AMERICA CORPORATION, and ERICSSON INC.,
Petitioner,

v.

COBBLESTONE WIRELESS, LLC,
Patent Owner.

IPR2024-00946
Patent 7,924,802 B2

Before KARL D. EASTHOM, NORMAN H. BEAMER, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

DECISION
Settlement Prior to Institution of Trial
37 C.F.R. § 42.74

I. INTRODUCTION

With the Board’s authorization, Petitioners and Patent Owner (collectively referred to as “the Parties”) filed a Joint Motion to Terminate the above-identified proceeding due to settlement. Paper 10 (“Joint Motion” or “Mot.”). In support of the Joint Motion, the Parties filed confidential Release Agreements (Exs. 2001–2007 (collectively, “Settlement Agreements”)), as well as a Joint Request to File Settlement Agreement as Business Confidential Information Pursuant to 35 U.S.C. § 317(b) (Paper 11 (“Joint Request”)).¹

II. DISCUSSION

In the Joint Motion, the Parties represent that they have reached an agreement to jointly seek termination of the above-identified *inter partes* review proceeding, and that the filed copies of the Settlement Agreements are true and complete copies. *See generally* Mot.; Ex. 2001, 7; Ex. 2002, 7; Ex. 2003, 7; Ex. 2004, 6; Ex. 2005, 6; Ex. 2006, 6. The Parties further represent that their Settlement Agreements resolve “all disputes relating to the Patent-in-Suit.” Mot. 3.

This proceeding is at an early stage, and we have not yet decided whether to institute a trial in the proceeding. In view of the early stage of the proceeding and the settlement between the parties, we determine that good cause exists to dismiss the Petition, and terminate the proceeding with respect to the parties.

After reviewing the Settlement Agreements between Petitioners and

¹ We note that the Joint Request does not specify which exhibits shall be kept confidential. We understand the Joint Request to apply to the Settlement Agreements, Exs. 2001–2007, because Patent Owner filed those exhibits as available only to the Board.

Patent Owner, we find that the Settlement Agreements contain confidential business information regarding the terms of settlement. We determine that good cause exists to treat the Settlement Agreements between Petitioners and Patent Owner as business confidential information pursuant to 37 C.F.R. § 42.74(c).

This Order does not constitute a final written decision pursuant to 35 U.S.C. § 318(a).

III. ORDER

In view of the above, it is

ORDERED that the Joint Motion to Terminate (Paper 10) is *granted*, the Petition is dismissed, and the above proceeding is *terminated*; and

FURTHER ORDERED that the Joint Request to File Settlement Agreement as Business Confidential Information Pursuant to 35 U.S.C. § 317(b) (Paper 11) is *granted*, and the Settlement Agreements (Exs. 2001–2007) shall remain designated as “Board” in the Board’s filing system, shall be made available only to Federal Government agencies on written request, or to any person on a showing of good cause, and shall be kept separate from the files of the involved patent and associated preliminary proceeding, pursuant to 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c).

IPR2024-00946
Patent 7,924,802 B2

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

HEWLETT PACKARD ENTERPRISE COMPANY and
CISCO SYSTEMS, INC.,
Petitioner,

v.

COBBLESTONE WIRELESS, LLC,
Patent Owner.

IPR2024-00707
Patent 7,924,802 B2

Before KARL D. EASTHOM, NORMAN H. BEAMER, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Hewlett Packard Enterprise Company and Cisco Systems, Inc. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–9 (the “challenged claims”) of U.S. Patent No. 7,924,802 B2 (Ex. 1001, “the ‘802 patent”). Paper 3 (“Pet.”). Cobblestone Wireless, LLC (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”). With our permission, Petitioner filed a Preliminary Reply (Paper 11, “Pet. Prelim. Reply”), and Patent Owner filed a Preliminary Sur-reply (Paper 12, “PO Prelim. Sur-reply”).

We have authority to determine whether to institute an *inter partes* review, under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that “the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) (2020) (“The Board institutes the trial on behalf of the Director.”). The reasonable likelihood standard is “a higher standard than mere notice pleading,” but “lower than the ‘preponderance’ standard to prevail in a final written decision.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Real Parties in Interest

Petitioner states that “the real parties-in-interest” are “Hewlett Packard Enterprise Company and Cisco Systems, Inc.” Pet. 75. Patent Owner identifies Cobblestone Wireless, LLC as the real party in interest. Paper 5, 2.

C. Related Proceedings

The parties identify the following proceedings between the parties involving the ’802 patent: *Cobblestone Wireless, LLC v. Cisco Systems, Inc.*, No. 2:23-cv-00454 (E.D. Tex.) (the “parallel district court case”); and *Cobblestone Wireless, LLC v. Hewlett Packard Enterprise Company.*, Case No. 2:23-cv-00457 (E.D. Tex.). Pet. 75–76; Paper 5, 2–3. The parties also identify the following proceedings involving the ’802 patent; *Cobblestone Wireless, LLC v. Samsung Electronics Co., Ltd.*, No. 2:23-cv-00285 (E.D. Tex.); *Cobblestone Wireless, LLC v. Celco Partnership d/b/a Verizon Wireless*, Case No. 2:23-cv-00382 (E.D. Tex.); *Cobblestone Wireless, LLC v. T-Mobile USA, Inc.*, No. 2:23-cv-00381 (E.D. Tex.); *Cobblestone Wireless, LLC v. AT&T Services Inc.* No. 2:23-cv-00380 (E.D. Tex.); *Cobblestone Wireless, LLC v. CommScope Holding Company, Inc.*, No. 2:23-cv-00455 (E.D. Tex.); and *Samsung Elecs. Am., Inc. v. Cobblestone Wireless, LLC*, IPR2024-00606. *Id.*

D. The ’802 Patent (Ex. 1001)

The ’802 patent is directed to a wireless communication system and method that transmits signals simultaneously over a communication channel at different RF center frequencies. Ex. 1001, code (54), code (57). The Background of the ’802 patent explains that “[c]ommunication systems generally contain one or more transmission channel to transmit data from the

transmitter to the receiver.” *Id.* at 1:12–14. The Background describes a transmitter in such a system that “is limited to up-converting a signal to one center frequency (or modulation frequency), which is the LO [(local oscillator)] frequency.” *Id.* at 1:29–32. “Typically,” the Background explains, “the amount of information transmitted around the center frequency is limited by the bandwidth of the transmitter around the center frequency,” which “limits the amount of data that can be transmitted.” *Id.* at 1:32–35. Thus, “[t]ypical prior art approaches to improving the information capacity in a wireless communication system involve maximizing the bandwidth around the center frequency to increase the amount of information that may be modulated onto the carrier frequency.” *Id.* at 1:35–40.

To overcome this issue, the ’802 patent proposes “a method of transmitting information in a wireless communication channel” that includes “transmitting first information across a first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency, and simultaneously transmitting second information across a second frequency range using the same wireless transmitter,” where the second frequency range has “a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.” Ex. 1001, 1:60–2:5.

Figure 2 of the ’802 patent, reproduced below, “illustrates a wireless communication system according to one embodiment of the present invention.” Ex. 1001, 5:53–54.

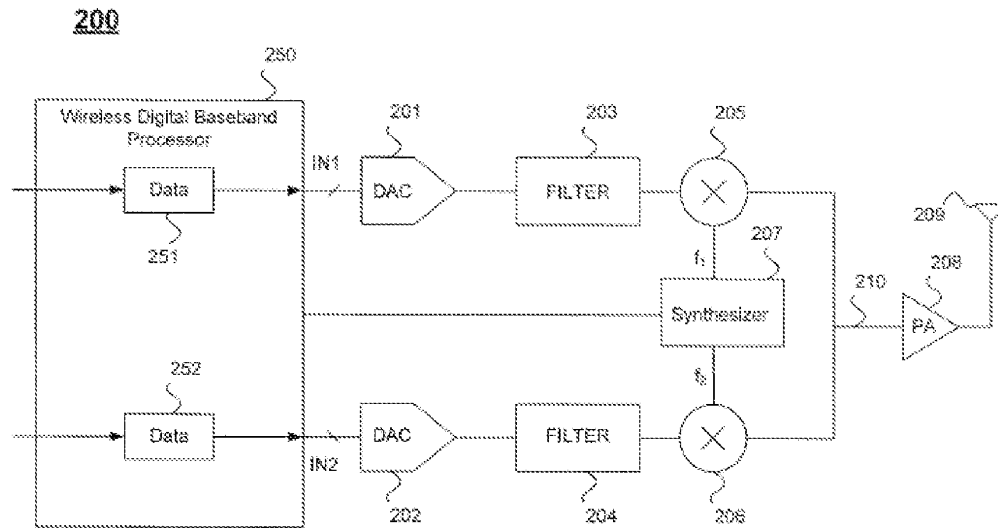


Fig. 2

Figure 2 of the '802 patent illustrates a wireless communication system according to an embodiment of the invention. Ex. 1001, 5:53–54, Fig. 2. As shown in Figure 2, baseband digital system 250 provides a first digital signal comprising first digital data 251 which is provided as IN1 and a second digital signal comprising second digital data 252 provided as IN2. *Id.* at 5:62–66. The first digital data 251 and second digital data 252 may be unrelated data streams or data from the same data stream. *Id.* at 6:7–9. Each of the first and second digital signals is transmitted to a digital to analog converter (DAC 201 and 202), a filter (203 and 204), and an up-converter (205 and 206). *Id.* at 6:10–26. The up-converters 205 and 206 each receive a first modulation signal having an RF center frequency (f_1 and f_2 , respectively) from synthesizer 207 and generate first and second up-converted signals that are combined at the input to amplifier 208. *Id.* at 6:22–44, 6:57–60, 7:4–7. Amplifier 208 outputs an amplified up-converted

signal comprising the first and second up-converted analog signals, and transmits this signal over antenna 209. *Id.* at 7:7–11.

Figure 3 of the '802 patent, reproduced below, illustrates an example of the frequency content of the signal transmitted from the system disclosed in Figure 2.

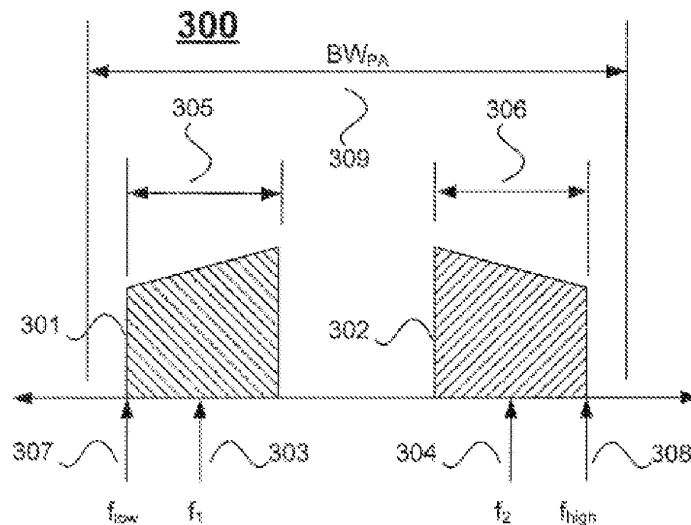


Fig. 3

Figure 3 of the '802 patent illustrates an example of the frequency content of the signal transmitted by the system of Figure 2. Ex. 1001, 5:58–60, Fig. 3. Figure 3 shows first up-converted analog signal 301 generated by up-converter 205, which has center frequency f_1 and frequency range 305, and second up-converted analog signal 302 generated by up-converter 206, which has center frequency f_2 and frequency range 306. Ex. 1001, 6:26–44. The frequency difference between f_1 and f_2 is greater than the sum of one-half of the first frequency range and one-half of the second frequency range, so that the up-converted signals do not overlap and cause distortion. *Id.* at 6:48–53. The first and second up-converted analog signals 301 and 302 may be transmitted by the antenna over bandwidth BW_{PA} 309. *Id.* at 7:9–14.

E. Illustrative Claims

Of the challenged claims, claim 1 is independent. Claim 1 is illustrative and is reproduced below.

1. [pre] A method of transmitting information in a wireless communication channel comprising:

[1a] transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and

[1b] simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency, a second highest frequency, and a second lowest frequency.

Ex. 1001, 13:59–14:3 (bracketed paragraph identifiers added).

F. Applied References

Petitioner relies upon the following references:

IEEE 802.11n Draft 2.0 Draft Standard for Information Technology-Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Feb. 2007 (Ex. 1004, “IEEE 802.11n D2.0”);

IEEE 802.11-2007 Standard for Information Technology-Telecommunications and information exchange between systems-Local and metropolitan area networks-Specific requirements, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications (Ex. 1005, “IEEE 802.111-2007”); and

Shearer et al., US 2006/00018249 A1, published Jan. 26, 2006 (Ex. 1007, “Shearer”).

Pet. 21–22.

Petitioner submits the Declaration of Dr. Kevin Negus (Ex. 1003).
Patent Owner submits the Declaration of Dr. Todor v. Cooklev (Ex. 2001).

G. Asserted Grounds of Unpatentability

Petitioner challenges the patentability of claims 1–9 of the '802 patent based on the following grounds:

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–9	103(a) ¹	IEEE 802.n D2.0, IEEE 802.11-2007
1–4, 7–9	103(a)	Shearer

Pet. 22.

II. DISCUSSION

A. Claim Construction

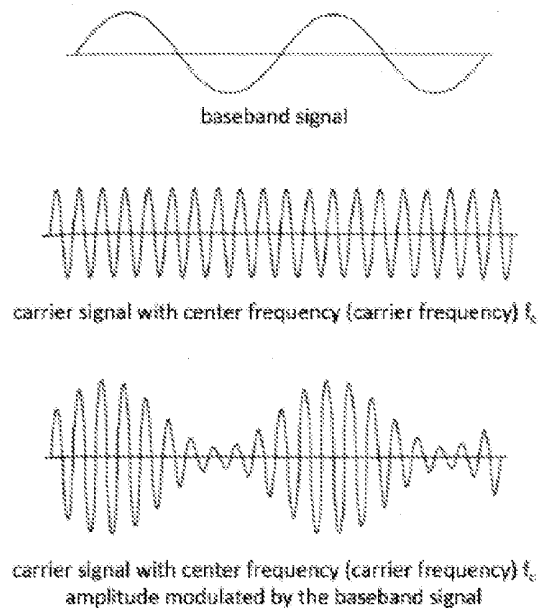
A claim “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b).” 37 C.F.R. § 42.100(b) (2020). The parties dispute the proper construction of the term “center frequency,” which appears in independent claim 1. Prelim. Resp. 4–18; Pet. Prelim. Reply 1–3; PO Prelim. Sur-reply 1–4. This term will be discussed in more detail below.

1. Construction of “Center Frequency”

Patent Owner argues that the term “center frequency” refers to “the carrier signal frequency the baseband signal is upconverted to.” Prelim. Resp. 4. Relying on Dr. Cooklev, Patent Owner explains that a “baseband

¹ 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 '802 patent. Therefore, we apply the pre-AIA version of 35 U.S.C. § 103.

signal represents the information to be transmitted in its raw form” and “generally include[s] frequencies that are very low and close to zero,” which cannot be effectively transmitted by an antenna. *Id.* at 6. Therefore, Patent Owner asserts, the baseband signal must be modulated on a signal at a much higher frequency, called a “carrier signal,” which is referred to as “up-converting” the baseband signal to the carrier signal’s higher frequency. *Id.* Patent Owner submits a diagram from Dr. Cooklev, reproduced below, showing a baseband signal, a carrier signal with a much higher carrier frequency f_c , and the carrier signal modulated by the baseband signal.



Patent Owner’s figure from Dr. Cooklev showing a baseband signal (top), a carrier signal with a carrier frequency f_c (center), and the carrier frequency amplitude modulated by the baseband signal (bottom).

Prelim. Resp. 7 (citing Ex. 2001 ¶¶ 39–41).

Relying on Dr. Cooklev, Patent Owner argues that the ’802 patent makes clear that a “center frequency” is the carrier frequency the baseband signal is upconverted to. Prelim. Resp. 8. Patent Owner argues that the Background of the ’802 patent “explains that the baseband signal is ‘up-

convert[ed]’ to the frequency of the ‘local oscillator (LO),’” and “[t]he output of this up-conversion is amplified and transmitted through the antenna.” *Id.* (citing Ex. 2001 ¶¶ 42–43 (citing Ex. 1001, 1:25–30)) (first alteration in original). According to Patent Owner and Dr. Cooklev, the Background “then explains that its prior art Figure 1 transmitter was ‘limited to up-converting a [baseband] signal to one center frequency (or modulation frequency), which is the LO frequency.’” *Id.* (citing Ex. 2001 ¶¶ 42–43 (citing Ex. 1001, 1:27–30)) (alteration in original). Patent Owner also argues that the ’802 patent “uses the terms ‘center frequency’ and ‘carrier frequency’ interchangeably, further reinforcing that ‘center frequency’ means the carrier frequency the baseband signal is up-converted to.” *Id.* at 11–12 (citing Ex. 1001, 10:64–11:20; Ex. 2001 ¶ 51).

Patent Owner also argues that “the ’802 patent mentions ‘center frequency’ more than 90 times,” and “[e]very time it is used, it means the frequency of the carrier signal to which the baseband signal is upconverted.” Prelim. Resp. 8 (citing Ex. 2001 ¶¶ 42–43). As examples, Patent Owner points to Figures 2 and 3, which show up-converting the first and second baseband signals to first and second center frequencies f_1 and f_2 , respectively, which Patent Owner argues refer to the frequency of the first and second carrier signals. *Id.* at 9–11.

Petitioner responds by arguing that Patent Owner is trying to “impermissibly import” the “concept of up-conversion and/or up-converters” into the challenged claims, even though that concept is not present in the challenged claims. Pet. Prelim. Reply 1. Petitioner asserts that the ’802 patent Specification “refers to up-converting baseband signals to center frequencies in several embodiments,” but “never defines or limits the

claimed ‘center frequency’ in those terms” or “define[s] the invention as requiring a first and second center frequency that have been up-converted from a baseband signal.” *Id.* at 2. “Instead,” according to Petitioner, the ’802 patent “uses permissive language (‘may’) throughout the specification when referring to up-conversion of a baseband signal.” *Id.* Petitioner further contends that the ’802 patent “discloses an embodiment in which center frequencies are shifted within the frequency bandwidth of the power amplifier, which can include post-up conversion shifting,” pointing to Figure 4 and the Specification’s disclosure that “. . . a new frequency content 410 in which the signal 401 has moved in frequency as illustrated by signal 411 having an RF center frequency 413. . . .” *Id.* (citing Ex. 1001, 7:29–31) (alterations in original). “In this embodiment,” Petitioner argues, “the center frequency may not be the carrier signal frequency to which the baseband signal was up-converted, *i.e.*, signal 401.” *Id.* Finally, Petitioner contends that “the plain and ordinary meaning of center frequency” is “a frequency at the middle of the frequency range.” *Id.* at 2–3 (citing Ex. 1004 § 20.3.7; Ex. 1005 § 14.5.14.4).

Patent Owner responds that the Figure 4 embodiment does not support Petitioner’s argument. PO Prelim. Sur-reply 2–3. Patent Owner argues that, in this embodiment, “the ‘center frequency’ changes over time,” which “is done by programming synthesizer 207 to generate different center frequencies at different times, [a]s illustrated in FIG. 2.” *Id.* at 2 (citing Ex. 1001, 7:19–42, 7:48–55) (alteration in original). Figure 2, Patent Owner asserts, “teaches that synthesizer 207 provides the carrier frequency to which the baseband signal is upconverted.” *Id.* (citing Prelim. Resp. 10). “Thus,” according to Patent Owner, “the Figure 4 embodiment changes the ‘center

frequency’ by changing the up-conversion carrier frequency through synthesizer 207,” and does not change the “center frequency” post-up-conversion, as Petitioner contends. *Id.* at 2–3. “Moreover,” according to Patent Owner, “Ppetitioner does not contend that Figure 4 or anything else in the intrinsic record supports its construction of ‘center frequency.’” *Id.* at 3 (citing Pet. Reply 1–3).

We determine that we do not need to resolve this claim construction issue for purposes of institution because, as discussed further below, even if we adopt Patent Owner’s narrower construction of “center frequency,” Petitioner has demonstrated a reasonable likelihood that this limitation is disclosed by the asserted prior art. Consequently, for purposes of this decision, we will apply Patent Owner’s construction of “center frequency” as to “the carrier signal frequency the baseband signal is upconverted to.” The parties may further address the construction of this claim term during the trial.

2. *Other Terms*

We determine that it is not necessary to provide an express interpretation of any other claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

B. *Principles of Law*

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented 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, objective evidence of non-obviousness.² *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b) (2020). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner contends that a person of ordinary skill in the art at the time of the alleged invention would have had “at least a Bachelor’s degree in

² At this stage of the proceeding, Patent Owner has not presented objective evidence of non-obviousness.

Electrical Engineering or a related field and at least two years of professional experience in wireless communications.” Pet. 10 (citing Ex. 1003 ¶¶ 24–25). “Alternatively,” Petitioner asserts, one of ordinary skill “would have had a more advanced degree, such as a Master’s degree in Electrical Engineering or an equivalent field, combined with at least one year of work experience in wireless communication.” *Id.* According to Petitioner, such a person “would also have been familiar with wireless communications networks, equipment, and integrated circuit chips, and would have had a working knowledge of the design of physical layer signal processing and RF systems for wireless communication based at least upon IEEE 802 standards.” *Id.* at 11 (citing Ex. 1003 ¶¶ 24–25).

Patent Owner does not offer a proposed level of ordinary skill at this stage of the proceeding. *See* Prelim. Resp.; PO Prelim. Sur-reply.

At this stage of the proceeding, we adopt Petitioner’s assessment of the level of skill in the art, which is consistent with the ’802 patent and the asserted prior art of record.

D. Ground 1: Obviousness of Claims 1–9 Based on IEEE 802.11n D2.0 in view of IEEE 802.11-2007

Petitioner contends that claims 1–9 would have been obvious over IEEE 802.11n D.20 in view of IEEE 802.11-2007. Pet. 22–55. Patent Owner disagrees, arguing that the proposed combination does not teach transmitting a signal with two different “center frequencies,” as the claims require. Prelim. Resp. 18–33.

1. Overview of IEEE 802.11n D2.0 (Ex. 1004)

IEEE 802.11n D2.0 is an amendment to the Draft Standard for Information Technology-Telecommunications and information exchange

between systems-Local and metropolitan area networks, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications. Ex. 1004, i. This amendment “defines modifications to both the 802.11 physical layers (PHY) and the 802.11 Medium Access Control Layer (MAC) so that modes of operation can be enabled that are capable of much higher throughputs, with a maximum throughput of at least 100MB/s, as measured at the MAC data service access point (SAP).” *Id.*, Abstract (page iv).

2. *Overview of IEEE 802.11-2007 (Ex. 1005)*

IEEE 802.11-2007 is the IEEE Standard for Information technology-Telecommunications and information exchange between systems-Local and metropolitan area networks, Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications. Ex. 1005, 1. It is a revision of IEEE Standard 802.11-1999. *Id.* The document states that “[t]his revision specifies technical corrections and clarifications to IEEE [Standard] 802.11 for wireless local area networks (WLANS) as well as enhancements to the existing medium access control (MAC) and physical layer (PHY) functions.” *Id.* at 4, 6. It further explains that “[t]his revision gives users, in one document, the IEEE 802.11 standard for wireless local area networks (WLANS) with all the amendments that have been published to date.” *Id.* at 6.

3. *Motivation to Combine IEEE 802.11n D.20 and IEEE 802.11-2007*

Petitioner argues that one of ordinary skill would have been motivated to combine IEEE 802.11n D2.0 and IEEE 802.11-2007. Pet. 24. Petitioner asserts that IEEE 802.11n D2.0 defines HT and non-HT duplicate formats

and “leveraged a new 40 MHz channel that was highly desirable to a [person of ordinary skill in the art] because it would increase wireless transmission throughput for commercial devices.” *Id.* at 25 (citing Ex. 1003 ¶¶ 85–119, 261–273). According to Petitioner, these “duplicate formats facilitate the precise functionality recited in the Challenged Claims: simultaneous transmission of information over separate carriers or channels.” *Id.* (citing Ex. 1003 ¶¶ 261–300). Additionally, Petitioner contends, one of ordinary skill would have been motivated to combine IEEE 802.11n D2.0 with the IEEE 802.11-2007 standard because the former is an amendment to the latter, and the amendment includes numerous specific references to the standard. *Id.* at 26 (citing Ex. 1003 ¶¶ 85–89, 121–125, 195, 261–300). Petitioner further argues that there was a “strong commercial interest in designing products with 40 MHz channel bandwidth using at least the IEEE 802.11n HT duplicate or Non-HT duplicate formats,” and that using these formats would have been “highly predictable” in the context of the IEEE 802.11-2007 standard.” *Id.* (citing Ex. 1003 ¶¶ 261–300).

Patent Owner does not present arguments regarding the motivation to combine IEEE 802.11n D2.0 and IEEE 802.11-2007. *See generally* Prelim. Resp.; PO Prelim. Sur-reply.

We determine that, on the record before us, Petitioner’s cited evidence sufficiently supports its arguments that one of ordinary skill would have been motivated to combine IEEE 802.11n D2.0 and IEEE 802.11-2007 as Petitioner proposes.

4. *Analysis of Independent Claim 1*

- a) 1[pre]: “[a] method of transmitting information in a wireless communication channel comprising:”

Petitioner argues that, to the extent the preamble is limiting, IEEE 802.11n D2.0 discloses it. Pet. 27. Specifically, Petitioner asserts, this reference teaches “a high throughput (HT) orthogonal frequency division multiplexing (OFDM) system” that is “applicable to operation in either the 2.4 GHz band or the 5 GHz bands, or both.” *Id.* According to Petitioner, “[t]he HT duplicate and non-HT duplicate formats disclosed by IEEE 802.11n D2.0 are a method of transmitting information in a wireless communication channel,” because in “HT duplicate and Non-HT duplicate formats, the same data are transmitted over two adjacent 20 MHz channels” in which “the 40 MHz channel is divided into 128 sub-carriers and the data are transmitted on carriers -58 to -6 and 6 to 58.” *Id.* Thus, Petitioner contends, one of ordinary skill “would understand the disclosures in IEEE 802.11n D2.0 of ‘data’ that is ‘transmitted’ as ‘an RF signal’ using ‘orthogonal frequency division multiplexing (OFDM)’ (i.e. a ‘method of transmitting information’) over ‘two adjacent 20 MHz channels’ according to the ‘center frequency of the desired channel’ for ‘operation in either the 2.4 GHz band or the 5 GHz bands, or both’ (i.e. ‘in a wireless communication channel’), as constituting a ‘method of transmitting information in a wireless communication channel.’” *Id.* (citing Ex. 1003 ¶¶ 248–274).

Petitioner also argues that one of ordinary skill “would understand that the IEEE 802.11-2007 standard discloses a method of transmitting information in a wireless communication channel.” Pet. 28. Petitioner points to the standard’s statement that it “define[s] one medium access

control (MAC) and several physical layer (PHY) specifications for **wireless connectivity** for fixed, portable, and moving stations (STAs) within a local area.” *Id.* According to Petitioner, “IEEE 802.11-2007 ‘specifies the PHY entity for an orthogonal frequency division multiplexing (OFDM) system’ which ‘uses 52 subcarriers that are modulated’ with ‘data, pilots, or training symbols’ specifically for the ‘5 GHz band.’” *Id.* One of ordinary skill, Petitioner contends, “would understand that these disclosures (among others) of transmitting data using OFDM teach a method of transmitting information in a wireless communication channel.” *Id.* (citing Ex. 1003 ¶¶ 248–274).

Patent Owner does not present arguments regarding the preamble.
See generally Prelim. Resp.

We determine that, on the record before us, Petitioner’s cited evidence sufficiently supports its contentions regarding the preamble.³

b) [1a]: “transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency”; and

[1b]: “simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.”

Petitioner argues that these limitations are disclosed by the combination of IEEE 802.11n D2.0 and IEEE 802.11-2007. Pet. 28. As to the limitations requiring “transmitting” the relevant information “using a wireless transmitter,” Petitioner asserts that one of ordinary skill “would

³ Because we are persuaded that Petitioner has shown that the proposed combination teaches the subject matter recited in the preamble, we need not decide whether the preamble is limiting for purposes of this Decision.

necessarily understand that transmitting information wirelessly requires a ‘wireless transmitter,’” and that the ’802 patent “expressly acknowledges that such transmitters were known in the art.” *Id.* (citing Ex. 1001, Fig. 1; Ex. 1003 ¶¶ 294–299). Petitioner further argues that there would be no practical way to up-convert the relevant signals without a wireless transmitter, and IEEE 802.11-2007 expressly discloses examples of wireless transmitters. *Id.* at 28–29 (citing Ex. 1003 ¶¶ 294–299; Ex. 1003 ¶ 222).

As to the limitations requiring that “first information” be transmitted across a “first frequency range having a *first center frequency*,” and simultaneously, that “second information” be transmitted across a “second frequency range having a *second center frequency greater than the first center frequency*,” Petitioner argues that these limitations are rendered obvious by “a combination of IEEE 802.11n D2.0 with the 802.11 standard.” Pet. 29, 34. “Specifically,” Petitioner contends, “802.11n D2.0 defines two formats of wireless transmission: HT duplicate format and non-HT duplicate format.” *Id.* at 29. “In HT duplicate format,” according to Petitioner, “signals in two halves of the occupied channel width contain the same information,” while “non-HT duplicate format” is a “mode of operation of the PHY that duplicates a 20 MHz non-HT transmission in two adjacent 20 MHz channels, allowing a non-HT BSS [(basic service set)] on either channel to receive the transmission.” *Id.* at 29–30 (citing Ex. 1003 ¶¶ 275–294).

Relying on Dr. Negus, Petitioner argues that IEEE 802.11n D2.0 “sets out the equations (in ‘complex base-band signal notation’) that define the transmissions in HT duplicate and non-HT duplicate format.” Pet. 30 (citing Ex. 1003 ¶¶ 275–281). Specifically, Petitioner points to equations (20-60)

and (20-61) in in Section 20.3.10.11 of IEEE 802.11n D2.0, and argues that these equations “describe the transmission of ‘first information’ across ‘a first frequency range’ that is defined by a ‘first highest frequency,’ and ‘first center frequency,’ and a ‘first lowest frequency,’” as well as “second information” across “a second frequency range” that is defined by a “second center frequency greater than the first center frequency,” a “second highest frequency,” and a “second lowest frequency.” *Id.* at 30–31, 34–35; Ex. 1003 ¶¶ 104–105, 279–280. These equations, along with Dr. Negus’s annotations, are reproduced below.

IEEE 802.11n D2.0 Eq. (20-60) describing HT Duplicate Format

$$r_{HT-DATA}^{(TX)}(t) = \frac{1}{\sqrt{N_{Duplicate}^{(TX)}}} \sum_{n=0}^{N_{SYM}-1} w_{T_{SYM}}(t - nT_{SYM})$$

Example disclosure of both a “first highest frequency” and a “second highest frequency”

$$\sum_{k=-N_{PSS}}^{N_{PSS}} (D_{k,n} + p_{n+2} p_k) ([Q_{k-32}]_{T_{PSS,1}} \exp(j2\pi(k-32)\Delta_f(t - nT_{SYM} - T_{GI}))$$

Example disclosure of a “first center frequency”

$$+ j[Q_{k+32}]_{T_{PSS,2}} \exp(j2\pi(k+32)\Delta_f(t - nT_{SYM} - T_{GI})))$$

Example disclosure of both a “first lowest frequency” and a “second lowest frequency”

Example disclosure of both “first information” and “second information”

Example disclosure of a “second center frequency” that is “greater than the first center frequency”

IEEE 802.11n D2.0 Eq. (20-61) describing Non-HT Duplicate Format

$$r_{\text{LTF}}^{\text{TX}}(t - nT_{\text{SYM}}) = \frac{1}{\sqrt{N_{\text{Tone Duplicate}}}} \sum_{n=0}^{N_{\text{SYM}}-1} w_{T_{\text{SYM}}}(t - nT_{\text{SYM}})$$

Example disclosure of both a "first highest frequency" and a "second highest frequency"

$$\sum_{k=-26}^{26} (D_{k,n} + p_n p_k) (\exp(j2\pi(k-32)\Delta_f(t - nT_{\text{SYM}} - T_{\text{GI}} - T_{\text{CS}}^{\text{TX}})))$$

Example disclosure of a "first center frequency"

$$+ j \exp(j2\pi(k+32)\Delta_f(t - nT_{\text{SYM}} - T_{\text{GI}} - T_{\text{CS}}^{\text{TX}})))$$

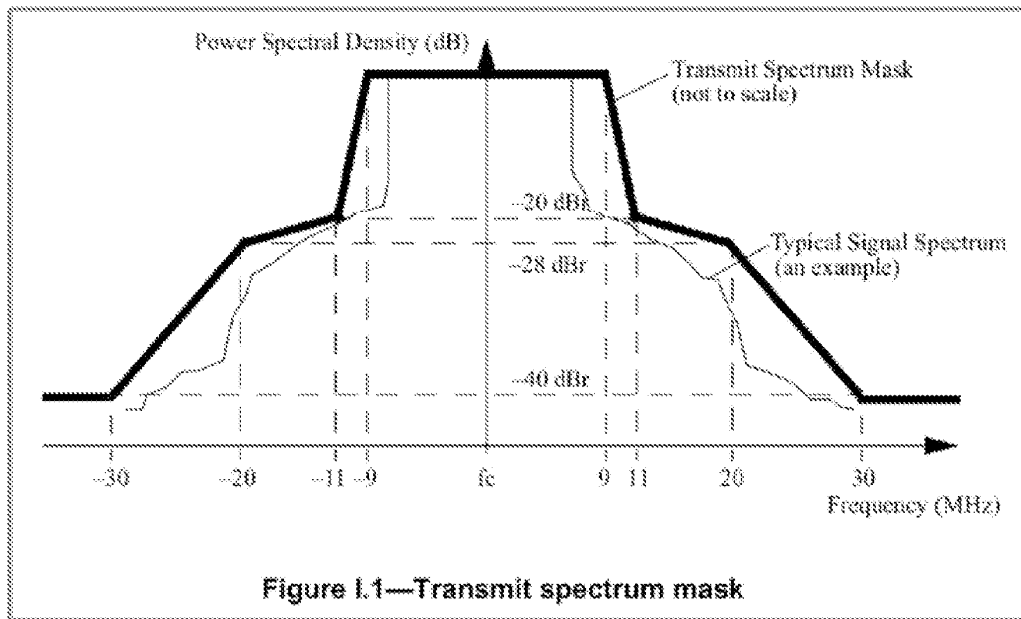
Example disclosure of both a "first lowest frequency" and a "second lowest frequency"

Example disclosure of both "first information" and "second information"

Example disclosure of a "second center frequency" that is "greater than the first center frequency"

Dr. Negus’s annotated figures showing the “first center frequency” in equations (20-60) and (20-61) of IEEE 802.11n D2.0 using a red box and arrow, and the “second center frequency” with a blue box and arrow.” Pet. 30–31 (citing Ex. 1003 ¶¶ 279–280), 34–35 (citing Ex. 1003 ¶¶ 279–280).

Petitioner argues that “[t]hese equations and their disclosure of frequency ranges are reinforced by IEEE 802.11-2007, which includes disclosures of the ‘transmit spectrum mask’ that corresponds to the ‘transmitted spectral density of the transmitted signal.’” Pet. 31 (citing Ex. 1003 ¶¶ 275–294). Dr. Negus provides an annotated version of this “transmit spectrum mask” from Annex I of IEEE 802.11-2007, which is reproduced below.



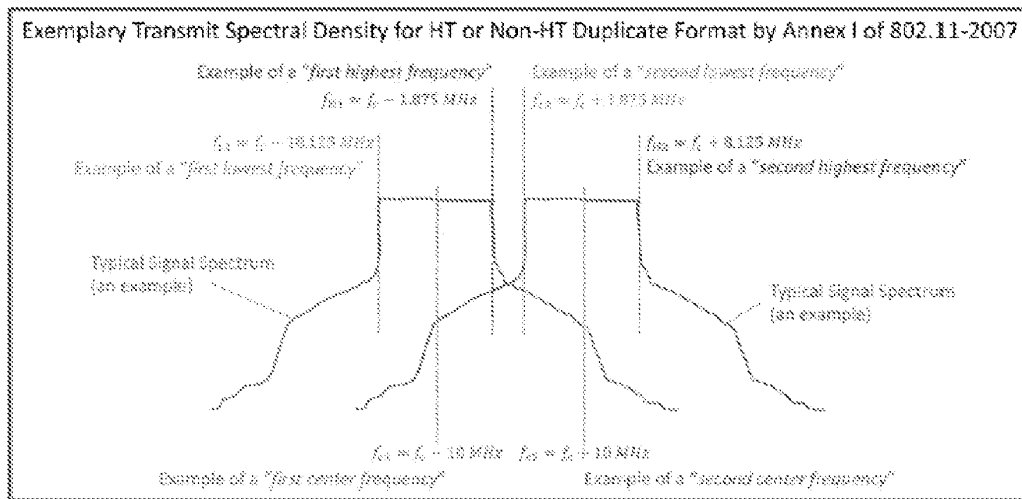
Dr. Negus’s annotated figure showing a “transmit spectrum mask” from Figure I.1 of Annex I of IEEE 802.11-2007. Pet. 31–32 (citing Ex. 1005, Figure I.1).

Petitioner asserts that this “transmit spectrum mask visually illustrates the first highest frequency, the first lowest frequency, and the first center frequency, and thus defines the ‘first frequency range’ across which the first information is transmitted.” *Id.* at 31.

Next, Petitioner argues that “IEEE 802.11n D2.0 expressly teaches that the maximum allowable transmit power by regulatory domain’ is discussed in Annex I of the 802.11 standard.” Pet. 32 (citing Ex. 1003 ¶¶ 275–294; Ex. 1005⁴ § 20.3.20.3). “Thus,” according to Petitioner, one of ordinary skill “would understand that Figure I.1 from IEEE 802.11-2007, when duplicated, shows what transmissions in HT or non-HT duplicate

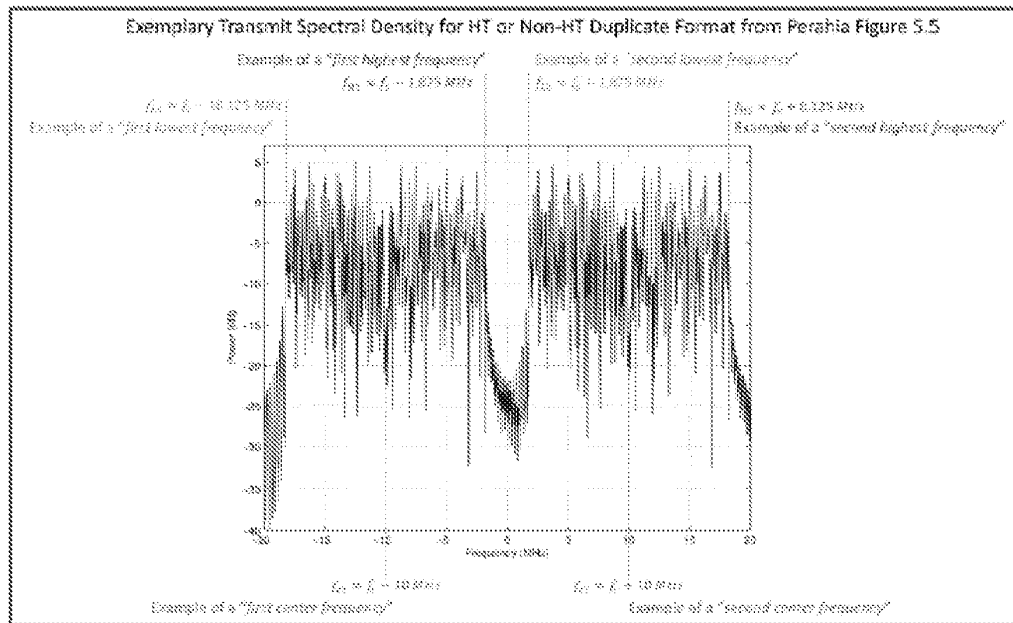
⁴ It appears that Petitioner mistakenly cites to Exhibit 1005 instead of Exhibit 1004. Pet. 32.

format would be like,” as demonstrated in Dr. Negus’s annotated figure reproduced below.



Dr. Negus’s annotated figure showing an “exemplary transmit spectral density for HT or non-HT duplicate format” in Annex I of 802.11-2007, showing a “first center frequency” in red and a “second center frequency” in blue. Pet. 33 (citing Ex. 1003 ¶¶ 290–291), 36 (citing Ex. 1003 ¶¶ 290–291).

Petitioner and Dr. Negus further provide “[a]nother visual representation of what the first frequency range would look like in HT duplicate and non-HT duplicate format” from Figure 5.5 in a textbook entitled “Next Generation Wireless LANs: Throughput, Robustness, and Reliability in 802.11n,” by Eldad Perahia and Robert Stacey” (Ex. 1006, “Perahia”), reproduced below.



Petitioner’s and Dr. Negus’s annotated version of Figure 5.5 of Perahia showing what they identify as a “first center frequency” in red and a “second center frequency” in blue. Pet. 33–34 (citing Ex. 1003 ¶¶ 292–293).

Finally, Petitioner argues that one of ordinary skill reading IEEE 802n D2.0 “would understand that the HT duplicate and non-HT duplicate formats disclosed therein require ‘first’ and ‘second’ information being transmitted ‘simultaneously’ on different carrier frequencies (i.e., on first and second frequencies).” Pet. 36 (citing Ex. 1003 ¶¶ 303–322). Petitioner further contends that IEEE 802.11-2007 shows a wireless transmitter that “transmits first and second information ‘simultaneously.’” *Id.* at 37 (citing Ex. 1003 ¶¶ 296, 303–322).

Therefore, Petitioner asserts, “IEEE 802.11n D2.0 in view of IEEE 802.11-2007 disclose explicitly or render obvious” the claimed “first center frequency” and “second center frequency.” Pet. 34–35.

Patent Owner responds by arguing that Petitioner relies on “the 40 MHz channel disclosed in IEEE 802.11n D2.0 as disclosing two ‘center

frequencies,”” but “the IEEE 802.11n D2.0’s 40 MHz channel makes perfectly clear both in its equations and in its text that it has only *one* center frequency, not two,” as required by claim 1. Prelim. Resp. 18 (citing Pet. 29–36). “This,” Patent Owner explains, “is because the data within the channel is transmitted in one baseband signal that is upconverted to one carrier signal with one center frequency.” *Id.*; see PO Prelim. Sur-reply 4–5.

More specifically, Patent Owner argues that Petitioner “rel[ies] in the alternative on two specific data formats to transmit data within the 40 MHz channel of IEEE 802.11n D2.0: the HT duplicate and non-HT duplicate data formats.” Prelim. Resp. 19. Relying on Dr. Cooklev, Patent Owner asserts that “IEEE 802.n D2.0 is clear that the data in the 40 MHz channel for each of the HT duplicate and non-HT duplicate formats is represented by a single baseband signal that is subsequently up-converted to a single carrier signal which has a single ‘center frequency’ (carrier frequency).” *Id.* at 19–21 (citing Ex. 2001 ¶ 54; Ex. 1004, 240–241, 279–280). In support, Patent Owner contends that IEEE 802.n D2.0 includes two equations (equations (20-60) and (20-61)) for representing the baseband signals in the 40 MHz channels for HT duplicate and non-HT duplicate formats, and a single equation (equation 20-1) representing the single carrier signal that these two baseband signals are upconverted to and that is transmitted by the transmitter. *Id.* at 20–21 (citing Ex. 2001 ¶ 54; Ex. 1004, 240–241, 279–280). Patent Owner also argues that Petitioner and Dr. Negus acknowledged that the HT duplicate and non-duplicate formats are part of “a single composite complex baseband signal.” *Id.* at 19–20 (citing Pet. 36; Ex. 1003 ¶ 318) (emphasis added). Thus, according to Petitioner, the 40 MHz

channel transmitted by the transmitter in IEEE 802.11n D2.0 discloses one center frequency, not two, as required by claim 1. *Id.* at 22, 24.

Additionally, Patent Owner argues that Petitioner's reliance on the signals represented by equations (20-60) and (20-61) in IEEE 802.n D2.0 is misplaced because "the claim requires 'transmitting' first and second data across first and second frequency ranges with first and second center frequencies," and "[t]he standard is clear that equations 20-60 and 20-61 are baseband signals, which are never transmitted." Prelim. Resp. 26 (citing Ex. 1001, claim 1). "[I]nstead," according to Patent Owner, "'the actual transmitted signal' is the up-converted baseband signals, up-converted to the carrier signal with a single center frequency f_c ." *Id.* (citing Ex. 1004, 240–241; Ex. 2001 ¶¶ 55–56). Thus, Patent Owner contends, "Petitioner's annotation" in its figures "of what is supposedly a lowest, highest, or center frequency in a baseband signal is not the frequency values of the signal that is actually transmitted." *Id.*

Patent Owner further argues that the "small dip" in the middle of the frequency profile in Dr. Negus's annotated figures does not support Petitioner's position. Prelim. Resp. 18–19. Patent Owner argues that Dr. Negus's "exemplary transmit spectral density" figure in paragraph 290 of his declaration is "made-up," does not appear in the standard, and contradicts another figure in the standard showing a single frequency range without any dip in the middle. *Id.* at 28–30 (citing Ex. 1004, 294; Pet. 33). In any event, Patent Owner asserts, Dr. Negus's figure "still would not disclose two 'center frequencies' as claimed" because "the entirety of the data within the 40 MHz channel, with or without a dip in the middle, is contained within a single baseband signal that is upconverted to a single carrier signal with a

single center frequency f_c .” *Id.* at 29. Finally, Patent Owner argues that Perahia’s Figure 5.5 does not help Petitioner because “even if the frequency profile of the signal output within the 40 MHz channel of IEEE 802.11n D2.0 contained a ‘dip’ in the middle, that entire signal is still up-converted to a single carrier and contains a single ‘center frequency.’” *Id.* at 30–31 (citing Ex. 1006, Fig. 5.5; Pet. 33).

Petitioner responds that IEEE 802.11n D2.0 “discloses transmission using two 20 MHz frequency ranges, each having a center frequency that was up-converted from a baseband signal.” Pet. Prelim. Reply 3. Relying on Dr. Negus, Petitioner argues that “the draft standard discloses how to calculate two center frequencies—one for each 20 MHz frequency range.” *Id.* at 3–4 (citing Ex. 1003 ¶¶ 279–286, 304–307). “Moreover,” Petitioner asserts, both equations (20-60) and (20-61) “identify the two center frequencies ($-32\Delta_F$ and $+32\Delta_F$) that are calculated during the process of up-converting the baseband signal to carrier signals.” *Id.* at 4 (citing Ex. 1003 ¶¶ 279, 280). According to Petitioner, Patent Owner’s assertion that equations (20-60) and (20-61) show that there is only one center frequency “conveniently ignore[s] § 20.3.8 (Ex. 1004, p. 267),” which states that “‘in the upper/lower 20 MHz of a 40 MHz channel’ the ‘mathematical definition of transmission shall follow that of a 20 MHz channel with f_c in Equation (20-1) replaced by $f_c \pm 10$ MHz,’ *i.e.*, two center frequencies at ‘+10’/’-10.’” *Id.* (citing Ex. 1003 ¶ 101). Petitioner contends that this meets Patent Owner’s construction, because that construction “only requires that the carrier signal frequency be an up-converted baseband signal, which Dr. Negus explains is taught by the art and would be obvious to” a person of ordinary skill. *Id.* (citing Ex. 1003 ¶¶ 299, 322).

With respect to Patent Owner's allegations that Dr. Negus's annotated "Transmit spectrum mask" in paragraph 290 of his declaration is "made up," Petitioner argues that "Dr. Negus explains the origin of his annotations on pages 95, 96, and 99 of his declaration." Pet. Prelim. Reply 4–5. "Likewise," Petitioner asserts, Dr. Negus "explains that neither his annotated figure (page 99 [(paragraph 290)]) nor Fig. 5.5 from Perahia is a 'frequency mask' for a single channel, as [Patent Owner] would have this Board believe." *Id.* at 5. "Instead," according to Petitioner, Dr. Negus's "annotated figures reflect transmit spectral densities for the two frequency ranges transmitted using [IEEE 802.11n D2.0's] HT or Non-HT Duplicate formats." *Id.* (citing Ex. 1003 ¶¶ 290–293). "Moreover," Petitioner contends, "the area in these figures to which [Patent Owner] refers as . . . 'the small dip' actually reflects the intersection of the two separately processed signals, each of which spans their own frequency range and has their own center frequency, as disclosed in [IEEE 802.11n D2.0] and Perahia." *Id.*

Based on the present record, Petitioner has made a sufficient case for purposes of institution that these limitations would have been obvious over IEEE 802.11n D2.0 in view of IEEE 802.11-2007. In particular, we find that Petitioner has made a sufficient showing at this early stage that equations (20-60) and (20-61) disclose first and second "center frequencies" each of which represent "the carrier signal frequency the baseband signal is upconverted to." The evidence supporting this preliminary conclusion will be discussed below.

First, we begin with Dr. Negus's annotated versions of equations (20-60) and (20-61), which are again reproduced below.

IEEE 802.11n D2.0 Eq. (20-60) describing HT Duplicate Format

$$r_{HT-DATA}^{rx}(t) = \frac{1}{\sqrt{N_{Tone\_Duplicate}}} \sum_{n=0}^{N_{SYM}-1} w_{r_{SYM}}(t - nT_{SYM})$$

Example disclosure of both a "first highest frequency" and a "second highest frequency"

$$\sum_{k=-N_{SP}}^{N_{SP}} (D_{k,n} + p_{n+K} P_k) \{ (Q_{k-32})_{I_{PK},1} \exp(j2\pi(k-32)\Delta_F(t - nT_{SYM} - T_{GI})) + j(Q_{k+32})_{I_{PK},1} \exp(j2\pi(k+32)\Delta_F(t - nT_{SYM} - T_{GI})) \}$$

Example disclosure of both a "first lowest frequency" and a "second lowest frequency"

Example disclosure of both "first information" and "second information"

Example disclosure of a "first center frequency"

Example disclosure of a "second center frequency" that is "greater than the first center frequency"

IEEE 802.11n D2.0 Eq. (20-61) describing Non-HT Duplicate Format

$$r_{Non-HT-DUP}^{rx}(t - nT_{SYM}) = \frac{1}{\sqrt{N_{Tone\_Duplicate}}} \sum_{n=0}^{N_{SYM}-1} w_{r_{SYM}}(t - nT_{SYM})$$

Example disclosure of both a "first highest frequency" and a "second highest frequency"

$$\sum_{k=-26}^{26} (jD_{k,n} + p_n P_k) \{ \exp(j2\pi(k-32)\Delta_F(t - nT_{SYM} - T_{GI} - T_{CS}^{TX})) + j \exp(j2\pi(k+32)\Delta_F(t - nT_{SYM} - T_{GI} - T_{CS}^{TX})) \}$$

Example disclosure of both a "first lowest frequency" and a "second lowest frequency"

Example disclosure of both "first information" and "second information"

Example disclosure of a "first center frequency"

Example disclosure of a "second center frequency" that is "greater than the first center frequency"

Dr. Negus testifies that, in these equations, "the '**complex number**' modulation values for each data subcarrier and symbol index, ' $D_{k,n}$ ', of the '**PPDU encoding process**' discloses at least '**transmitting first information.**'" Ex. 1003 ¶ 284. And, he explains that "when the '**secondary channel is above**' the '**primary channel**' then the term ' $-32\Delta_F$ ' discloses that a '**first center frequency**' . . . would be disclosed as ' $f_{c1} = f_c - 32 \Delta_f$ ', or thus since ' $\Delta_f = 312.5 \text{ kHz}$ ', then this '**first center frequency**' for

such a '**primary channel**' would be disclosed as ' $f_{c1} = f_c - 10 \text{ MHz}$ '." *Id.*
¶ 285. "Similarly," Dr. Negus testifies, one of ordinary skill "would understand that when the '**secondary channel . . . is below**' the '**primary channel**', then this '**first center frequency**' for such a '**secondary channel**' would be disclosed as ' $f_{c1} = f_c - 10 \text{ MHz}$ '." *Id.* ¶ 286 (alteration in original). This evidence supports a preliminary determination that equations (20-60) and (20-61) disclose a first frequency range having a first center frequency of $f_{c1} = f_c - 10 \text{ MHz}$, and that this frequency range represents the upconversion of a baseband signal to a carrier (center) frequency of $f_c - 10 \text{ MHz}$.

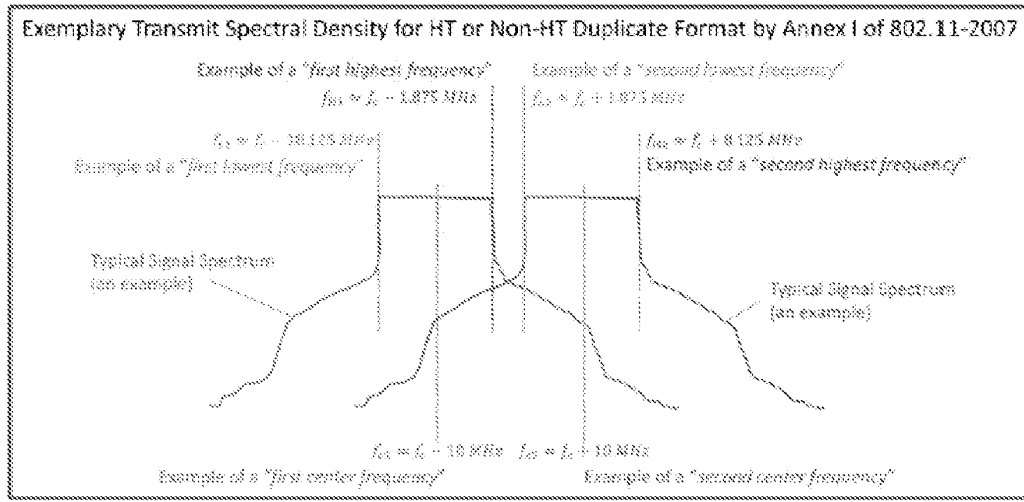
In the same vein, Dr. Negus testifies that "when the **secondary channel is above**' the '**primary channel**'" then "the term '+32 Δ_F ' discloses that a '**second center frequency**' for such a '**secondary channel**' would be disclosed as ' $f_{c2} = f_c + 32\Delta_F$ ', or thus since $\Delta_F = 312.5 \text{ kHz}$ ', then this '**second center frequency**' for such a '**[secondary]⁵ channel**' would be disclosed as ' $f_{c2} = f_c + 10 \text{ MHz}$ '." Ex. 1003 ¶ 306. "Similarly," Dr. Negus explains, one of ordinary skill "would understand that when the '**secondary channel is . . . below**' the '**primary channel**', then this '**secondary center frequency**' for such a '**primary channel**' would be disclosed as ' $f_{c2} = f_c + 10 \text{ MHz}$ '." *Id.* ¶ 307 (alteration in original). This evidence supports a preliminary determination that equations (20-60) and (20-61) disclose a second frequency range having a second center frequency of $f_{c2} = f_c + 10 \text{ MHz}$, and that this frequency range represents the upconversion of a

⁵ Dr. Negus refers to the "primary channel" here in his Declaration, but this appears to be a typographical error because the earlier part of the sentence indicates that the center frequency of the "secondary channel" is being discussed. Ex. 1003 ¶ 306.

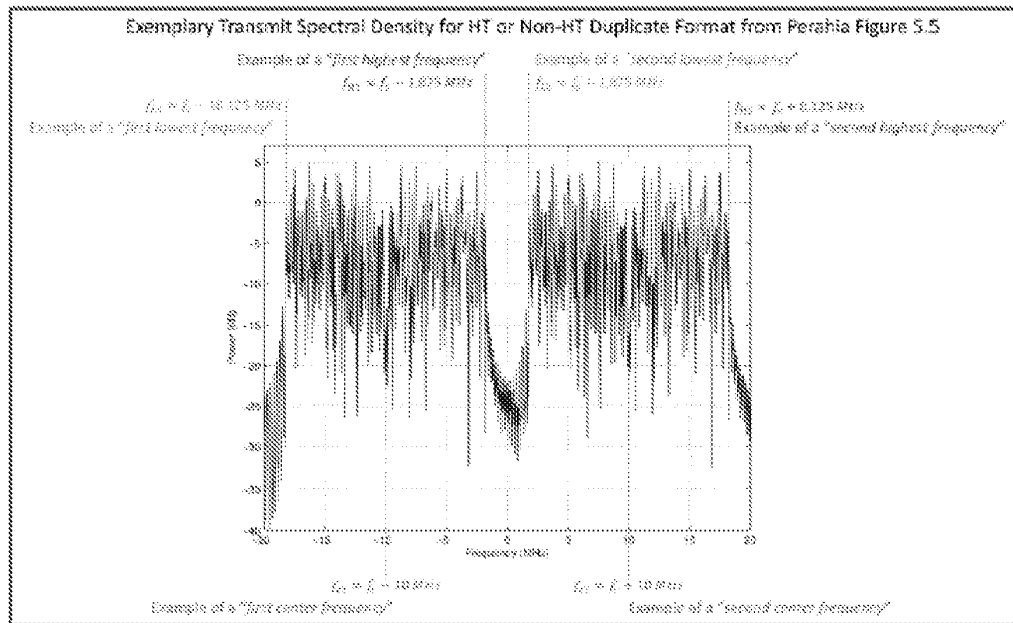
baseband signal to a carrier (center) frequency of $f_c + 10$ MHz. Based on the present record, this testimony appears to be reasonable and consistent with the disclosures of the references.

We also preliminarily agree with Dr. Negus's testimony that "because such '**second center frequency**' of ' $f_{c2} = f_c + 10$ MHz' exceeds such '**first center frequency**' of ' $f_{c1} = f_c - 10$ MHz'" by a value of 20 MHz, equations (20-60) and (20-61) disclose a "second center frequency greater than the first center frequency," as required by limitation [1b]. Ex. 1003 ¶ 308. Additionally, we agree that these equations disclose a "first highest frequency," "first lowest frequency," "second highest frequency," and "second lowest frequency," as Dr. Negus explains. *Id.* ¶¶ 289, 309.

Our preliminary determination is also supported by Dr. Negus's testimony concerning the "transmit spectrum mask" in Annex I of IEEE 802.11-2007. In this regard, Dr. Negus testifies that one of ordinary skill would have understood from the disclosures of IEEE 802.11n D2.0 that Annex I of IEEE 802.11-2007 "specifies the 'Transmit spectrum mask' including 'an example' of a 'Typical Signal Spectrum' that would correspond to the 'transmitted spectral density' of the transmitted signal' for such a '**first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency**' of either the IEEE 802.11n D2.0 '**HT duplicate format**' and '**non-HT duplicate format**' in either a '**primary channel**' or a '**secondary channel**.'" Ex. 1003 ¶ 290. Dr. Negus also testifies that the figure below, which he prepared, shows this "Typical Signal Spectrum" (shown in Figure I.1 of Annex I of IEEE 802.11-2007) for each of the "primary channel" (red) and "secondary channel" (blue). *Id.* ¶¶ 290–291.



This figure is consistent with Dr. Negus's testimony concerning equations (20-60) and (20-61), and both indicate a first signal spectrum (shown in red in the above figure) with a first center frequency of $f_{c1} = f_c - 10 \text{ MHz}$, and a second signal spectrum (shown in blue in the above figure) with a second center frequency of $f_{c2} = f_c + 10 \text{ MHz}$. It is also consistent with Figure 5.5 from the Perahia textbook, which also shows first and second frequency ranges with a "first center frequency" of $f_{c1} = f_c - 10 \text{ MHz}$ and a "second center frequency" of $f_{c2} = f_c + 10 \text{ MHz}$, as shown below with annotations from Dr. Negus's declaration.



At this early stage of the proceeding, we determine that the evidence above is sufficient to establish a reasonable likelihood that the limitations at issue are taught by the combination of IEEE 802.11n D2.0 and IEEE 802.11-2007.

Based on the present record, Patent Owner's arguments do not undermine our determination that Petitioner's evidence has met the threshold showing required for institution. First, even if Patent Owner is correct that the two 20 MHz channels upon which Petitioner relies are further upconverted to another carrier frequency before transmission, this additional step would not appear to alter the fact that the signal still includes first and second frequency ranges with first and second center frequencies, respectively. Second, we preliminarily disagree that the first and second frequency ranges do not have "carrier frequencies" under Patent Owner's proposed construction of that term. Based on Dr. Negus's testimony and the underlying disclosures of the references, the first and second frequency

ranges appear to represent signals that were upconverted from baseband signals at center (carrier) frequencies of $f_{c1} = f_c - 10$ MHz and $f_{c2} = f_c + 10$ MHz. Therefore, these center frequencies appear to be “carrier signal frequencies” that “the baseband signal is upconverted to.” Finally, we have considered Patent Owner’s argument that Dr. Negus’s “exemplary transmit spectral density” figure in paragraph 290 of his declaration is “made-up,” does not appear in the standard, and contradicts another figure in the standard showing a single frequency range without any dip in the middle, but determine that Dr. Negus’s testimony has sufficient basis in the record to warrant going forward at this stage. *Id.* at 28–30 (citing Ex. 1004, 294; Pet. 33). Patent Owner may further challenge Dr. Negus’s opinions, and the bases therefore, during the trial.

Based on the foregoing, we preliminarily determine that, on the record before us, Petitioner’s cited evidence sufficiently supports its contentions regarding this limitation for purposes of institution.

c) Summary for Claim 1

For the foregoing reasons, we are persuaded that Petitioner’s cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

5. Dependent Claims 2–9

Petitioner contends that claims 2–9, which depend from claim 1, are unpatentable based on the proposed combination of IEEE 802.11n D2.0 and IEEE 802.11-2007. Pet. 22, 38–55. Patent Owner does not provide any separate argument against these dependent claims at this stage of the proceeding. *See* Prelim. Resp. 3–41. Based on the evidence of record, we

determine that Petitioner has demonstrated a reasonable likelihood that claims 2–9 are unpatentable over the prior art.

E. Ground 2: Obviousness of Claims 1–4 and 7–9 Based on Shearer

Petitioner contends that claims 1–4 and 7–9 would have been obvious over Shearer. Pet. 55–71. Patent Owner disagrees, arguing that Shearer does not teach transmitting a signal with two different “center frequencies,” as the claims require. Prelim. Resp. 33–40.

1. Overview of Shearer (Ex. 1007)

Shearer is entitled “packet generation systems and methods,” and discloses “various embodiments of methods, systems, and apparatus for increasing packet generation in a digital communication system.” Ex. 1007, code (57). Shearer explains that, “[i]n one exemplary method embodiment, subcarriers are added to a packet in a wireless local area network transmission to increase the data rate.” *Id.* Shearer further discloses an IEEE 802.11 system that creates “a 40 MHz wide packet subcarrier layout” that “match[es] the subcarrier structure of two 20 MHz 802.11 a/g OFDM packets, whose center frequencies are spaced by 10 MHz,” and “adds extra subcarriers to a gap in the middle” of the waveform. *Id.* ¶ 47.

2. Analysis of Independent Claim 1

a) 1[pre]: “[a] method of transmitting information in a wireless communication channel comprising:”

Petitioner argues that, to the extent the preamble is limiting, Shearer discloses it. Pet. 56. Specifically, Petitioner asserts that Shearer discloses “a transmitter for an 802.11 device” to “operate in the 5 GHz band,” as shown in Figure 3 of Shearer. *Id.* at 56–57 (citing Ex. 1003 ¶¶ 415–416; Ex. 1007, Fig. 3, ¶¶ 38–40). According to Petitioner, “Shearer further teaches using

transmitters of the type disclosed to transmit information in a wireless communication channel,” as well as “multi-carrier transmission in which ‘two 20 MHz 802.11a input signals are received at the PHY unit 300 from FIG. 3 substantially simultaneously.’” *Id.* at 57 (citing Ex. 1003 ¶ 416).

Patent Owner does not present arguments regarding the preamble.

See generally Prelim. Resp.

We determine that, on the record before us, Petitioner’s cited evidence sufficiently supports its contentions regarding the preamble.

b) [1a]: “*transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency*”; and

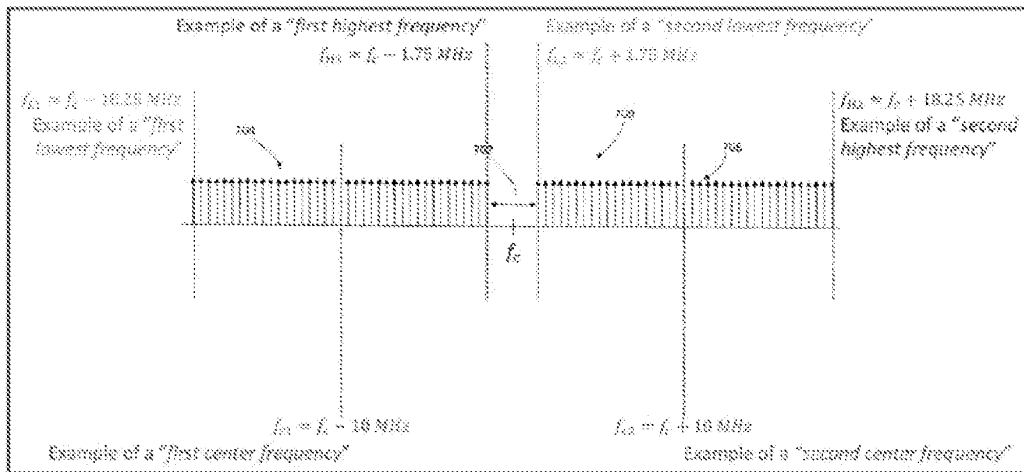
[1b]: “*simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.*”

Petitioner argues that these limitations are taught by Shearer. Pet. 57, 60.

As to the limitations requiring “transmitting” the relevant information “using a wireless transmitter,” Petitioner asserts that one of ordinary skill “would necessarily understand that transmitting information wirelessly requires a ‘wireless transmitter,’” and that the ’802 patent “acknowledges that such transmitters were known in the art.” Pet. 58 (citing Ex. 1001, Fig. 1; Ex. 1003 ¶¶ 294–299). Petitioner further argues that “Shearer discloses a wireless transmitter for multi-carrier transmission.” *Id.* (citing Ex. 1003 ¶¶ 420–430).

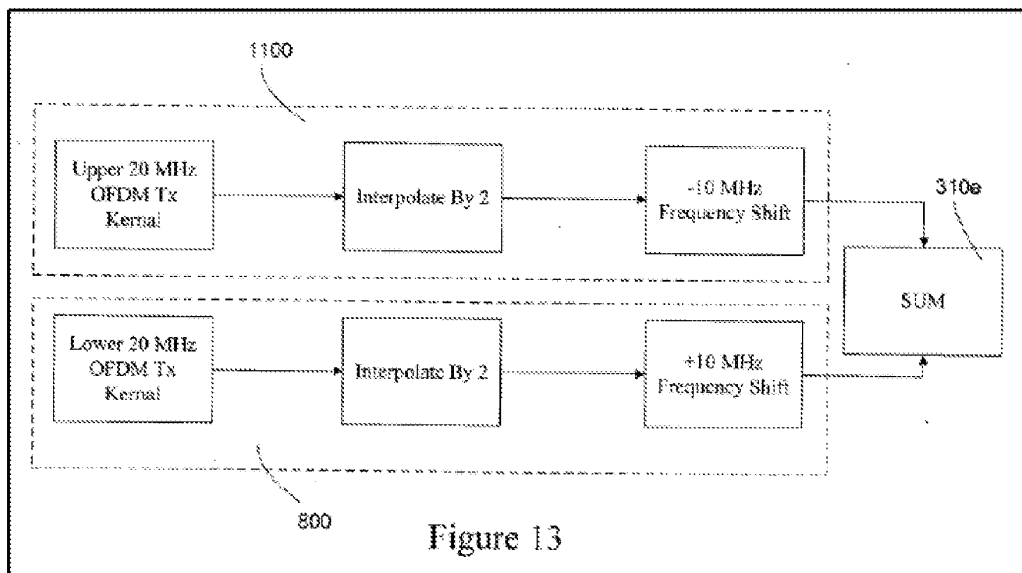
As to the limitations requiring that “first information” be transmitted across a “first frequency range having a *first center frequency*,” and

simultaneously, that “second information” be transmitted across a “second frequency range having a *second center frequency greater than the first center frequency*,” Petitioner argues that these limitations are rendered obvious by Shearer. Pet. 58, 60. Specifically, Petitioner contends, “Shearer teaches transmission in a 40 MHz channel comprised of two 20 MHz channels,” explaining that for “an IEEE 802.11a or IEEE 802.11g OFDM signal, a packet 400 within each 20 MHz channel has fifty-two (52) subcarriers” but “the packet is 20 MHz wide because that is the span of the 64 points in the IFFT” even though “the active (populated) subcarriers span a spectrum somewhat less than 20 MHz wide, about 16.5 MHz.”” *Id.* at 58 (citing Ex. 1003 ¶ 420). According to Petitioner, “Shearer illustrates these frequency ranges in, among other places, Figure 7, by diagramming the ‘subcarrier structure of two 20 MHz 802.11a/g OFDM packets’ wherein the respective ‘center frequencies are spaced by 10 MHz’ and there is an 11 subcarrier gap 702 between the packets.”” *Id.* (citing Ex. 1007, Fig. 7; Ex. 1003 ¶ 421). Dr. Negus submits an annotated version of Figure 7 of Shearer, reproduced below, showing “how these subcarriers teach the transmission across a first frequency range, and define the bounds of the frequency range (i.e., the ‘first lowest frequency,’ the ‘first center frequency,’ and the ‘first highest frequency’).”



Dr. Negus’s annotated version of Shearer’s Figure 7 showing a “first center frequency” (red) and a “second center frequency” (blue). Pet. 59; Ex. 1003 ¶ 421.

“Additionally,” Petitioner argues, “Shearer explains that the transmitter it teaches permits the signal, through ‘mixer 314’ to be ‘unconverted to the desired transmit frequency’ and ‘amplified in the high powered amplifier’ and sent to an ‘antenna 318 for transmission.’” Pet. 59 (citing Ex. 1003 ¶ 427). Petitioner also argues that “Shearer teaches simultaneous transmission of second information across a second frequency range in its disclosure of an upper and lower transmission ‘path’” in Figure 13, reproduced below. *Id.* at 60 (citing Ex. 1007, Fig. 13; Ex. 1003 ¶¶ 420–428, 431–438).



Shearer’s Figure 13 shows an upper path and lower path each of which shifts the signal ± 10 MHz.⁶ Pet. 60; Ex. 1007, Fig. 13; Ex. 1003 ¶¶ 420–428, 431–438).

Petitioner argues that one of ordinary skill would have understood that these signals (the upper path or the lower path) are ‘processed separately’ (albeit substantially simultaneously) and that either can consist of ‘transmitting second information across a second frequency range.’ *Id.* at 60–61 (citing Ex. 1003 ¶ 433).

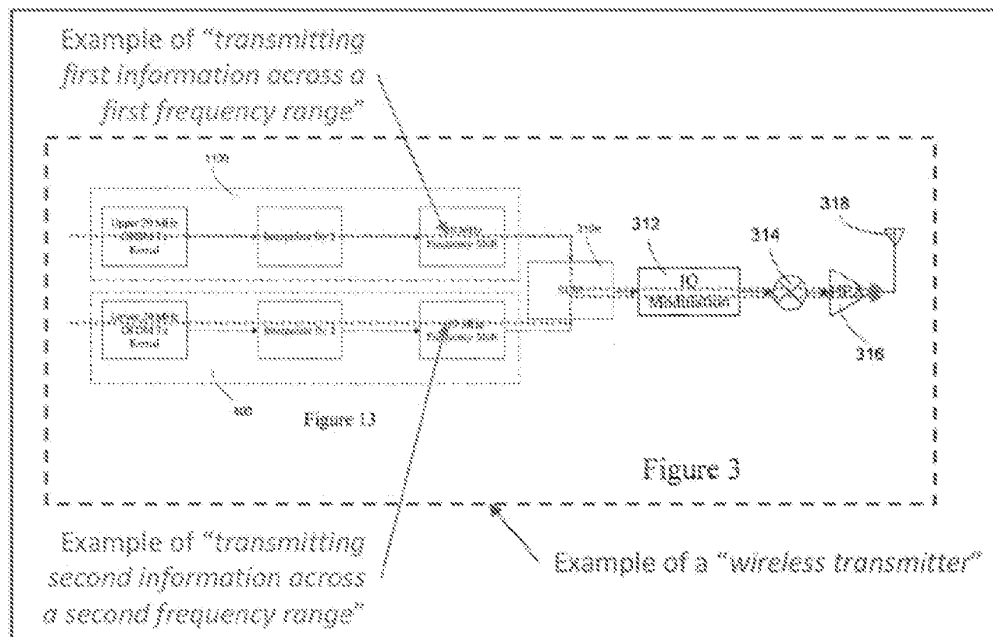
“As for the ‘second center frequency greater than the first center frequency,’” Petitioner argues that “Shearer describes shifting the signal of the lower path down by 10 MHz (to a ‘first center frequency’) and the signal of the upper path up by 10 MHz (to a ‘second center frequency’).” Pet. 61

⁶ Petitioner asserts that Figure 13 has a “clear typographical error” in that it “mistakenly designat[es] the upper path as having a -10 MHz frequency shift and the lower path as having a + 10 MHz frequency shift.” Pet. 61 n.1 (citing Ex. 1003 ¶ 236). According to Petitioner, it is “readily apparent from the specification and the other figures” that “those numbers are meant to be swapped with one another.” *Id.*

(citing Ex. 1003 ¶ 435). Petitioner contends that, as Dr. Negus’s annotated Figure 7 above shows, “a signal shifted up (the upper path) as Shearer requires would necessarily have a center frequency greater than the signal that has been shifted down (the lower path).” *Id.* (citing Ex. 1003 ¶¶ 421, 435).

Patent Owner responds that “Petitioner[’s] second ground shares the same infirmities as its first” because, as Petitioner acknowledges, “Shearer teaches its methods with specific relations to the IEEE 802.11 standard” that formed the basis of Ground 1. Prelim. Resp. 33 (citing Pet. 55). Patent Owner notes that “[s]imilar to Ground 1, Petitioner[] rel[ies] on Shearer’s disclosure of a 40 MHz channel formed by combining two 20 MHz channels in IEEE 802.11.” *Id.* (citing Pet. 57–61). “Just as with Ground 1,” Patent Owner contends, Petitioner “fails to show that Shearer discloses or renders obvious two center frequencies,” and “it is undisputed that Shearer’s 40 MHz channel is formed by upconverting the baseband signal to a single carrier signal with a single center (carrier) frequency.” *Id.* at 33–34 (citing Ex. 2001 ¶¶ 67–68); *see* PO Prelim. Sur-reply 5.

To support this assertion, Patent Owner relies on Dr. Negus’s superimposition of Shearer’s Figures 3 and 13, reproduced below.



Dr. Negus’s figure showing a combination of Figures 3 and 13 of Shearer. Prelim. Resp. 35; Ex. 1003 ¶ 428.

Patent Owner argues that, as shown in the above figure, “the ‘upper 20 MHz’ baseband signal (red) is created in box 1100,” “[t]he ‘lower 20 MHz’ baseband signal (blue) is created in box 800,” and “[t]he two baseband signals are aggregated in element 301e to create 40 MHz baseband signal,” which “is then upconverted in the single upconverter 314, before it is amplified and transmitted.” Prelim. Resp. 35. Thus, Patent Owner contends, “Shearer’s 40 MHz channel performs a single up-conversion to a single carrier with a single center frequency.” *Id.* at 35–39 (citing Ex. 2001 ¶¶ 69–75). This, according to Patent Owner, is different from the ’802 patent’s embodiments, such as Figure 2, that “show two up-conversions, each one to a different carrier signal with a different center frequency.” *Id.* at 35–36 (citing Ex. 1001, Fig. 2).

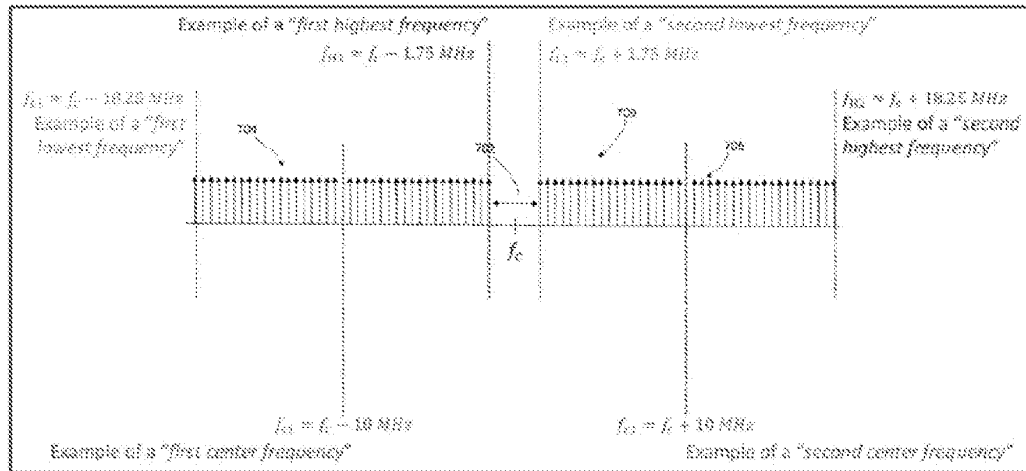
Finally, Patent Owner argues that Dr. Negus’s annotated version of Shearer’s Figure 7 “does not disclose two different center frequencies as claimed.” Prelim. Resp. 40 (citing Pet. 59). Instead, according to Patent Owner, “[t]he entirety of the signal shown” is “still a single baseband signal that is upconverted by a single mixer 314 to a single carrier with a single center frequency.” *Id.* (citing Ex. 1007 ¶ 43); *see* PO Prelim. Sur-reply 5.

Petitioner responds that “Shearer discloses transmission using two adjacent 20MHz frequency ranges, each of which has a center frequency up-converted from a baseband signal.” Pet. Prelim. Reply 5 (citing Ex. 1003 ¶¶ 421–424, 428, 432–437; Pet. 57–62). According to Petitioner, “Shearer also discloses two separate up-conversions applied to each respective one of the two adjacent 20 MHz frequency ranges as Dr. Negus described in detail.” *Id.* (citing Ex. 1003 ¶¶ 422–428). “Given the similarity between IEEE 802.11n D2.0 and Shearer,” Petitioner contends, “and the overlap of [Patent Owner’s] arguments for both grounds, Petitioner’s other arguments apply equally to Shearer.” *Id.*

Based on the present record, Petitioner has made a sufficient case for purposes of institution that the limitations at issue would have been obvious over Shearer. In particular, we find that Petitioner has made a sufficient showing at this early stage that Shearer discloses first and second “center frequencies” each of which represent “the carrier signal frequency the baseband signal is upconverted to.” The evidence supporting this preliminary conclusion will be discussed below.

Shearer explains that, “[i]n an IEEE 802.11 system, as shown in FIG. 7,” waveform 700 “provides a 40 MHz packet’s subcarrier structure matching the subcarrier structure of two 20 MHz 802.11a/g OFDM packets,

whose center frequencies are spaced by 10 MHz” Ex. 1007 ¶ 47 (emphasis added). Dr. Negus illustrates this signal structure in his annotated version of Shearer’s Figure 7, which is again reproduced below.



Dr. Negus testifies that this figure shows a first frequency range 704 having a first “center frequency” of “ $f_{c1} = f_c - 10$ ” MHz and a second frequency range 705 having a second “center frequency” of “ $f_{c2} = f_c + 10 \text{ MHz}$.” Ex. 1003 ¶¶ 424, 434. Shearer also appears to disclose two separate up-conversions applied to each respective one of the two adjacent 20 MHz frequency ranges as Dr. Negus described via Shearer's disclosure of multiplying the baseband signal by $e^{j2\pi f_{shift}t}$ where f_{shift} is respectively -10 MHz or +10 MHz. Pet. Prelim. Reply 5; Ex. 1003 ¶ 422, 432. This evidence supports a preliminary determination that Shearer discloses a first frequency range having a first center frequency of $f_{c1} = f_c - 10 \text{ MHz}$ and a second frequency range having a second center frequency of $f_{c2} = f_c + 10 \text{ MHz}$, and that these frequency ranges represent the upconversion of baseband signals to carrier (center) frequencies of $f_c \pm 10 \text{ MHz}$.

We also preliminarily agree with Dr. Negus’s testimony that because Shearer’s “second center frequency” of $f_{c2} = f_c + 10 \text{ MHz}$ exceeds the “first

center frequency” of $f_{c1} = f_c - 10 \text{ MHz}$, Shearer discloses a “second center frequency greater than the first center frequency,” as required by limitation [1b]. Ex. 1003 ¶ 434. Additionally, we agree that these equations disclose a “first highest frequency,” “first lowest frequency,” “second highest frequency,” and “second lowest frequency,” as Dr. Negus explains. *Id.* ¶¶ 424, 429, 436.

Based on the present record, Patent Owner’s arguments do not undermine our determination that Petitioner’s evidence has met the threshold showing required for institution for similar reasons as for Ground 1. First, as we explained in connection with Ground 1, even if Patent Owner is correct that the two 20 MHz channels upon which Petitioner relies are further upconverted to another carrier frequency before transmission, this additional step would not appear to alter the fact that the signal still includes first and second frequency ranges with first and second center frequencies, respectively. Second, as in Ground 1, we preliminarily disagree that the first and second frequency ranges do not have “center frequencies” that represent “carrier frequencies” under Patent Owner’s proposed construction of the term “center frequency.” Based on Dr. Negus’s testimony and the underlying disclosures of the references, the first and second frequency ranges appear to represent signals that were upconverted from baseband signals at carrier frequencies of $f_{c1} = f_c - 10 \text{ MHz}$ and $f_{c2} = f_c + 10 \text{ MHz}$. Therefore, these center frequencies appear to be “carrier signal frequencies” that “the baseband signal is upconverted to.” Patent Owner may further challenge Dr. Negus’s opinions, and the bases therefore, during the trial.

Based on the foregoing, we preliminarily determine that, on the record before us, Petitioner's cited evidence sufficiently supports its contentions regarding this limitation for purposes of institution.

a) Summary for Claim 1

For the foregoing reasons, we are persuaded that Petitioner's cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

3. Dependent Claims 2–4 and 7–9

Petitioner contends that claims 2–4 and 7–9, which depend from claim 1, are unpatentable over Shearer. Pet. 22, 62–71. Patent Owner does not provide any separate argument against these dependent claims at this stage of the proceeding. See Prelim. Resp. 33–41. Based on the evidence of record, we determine that Petitioner has demonstrated a reasonable likelihood that claims 2–4 and 7–9 are unpatentable over the prior art.

F. Discretionary Denial Under 314(a)/Fintiv

Patent Owner argues we should exercise our discretion under 35 U.S.C. § 314(a) to deny institution of *inter partes* review in view of the parallel district court proceeding. Prelim. Resp. 41–53. Petitioner disagrees. Pet. 71–75. We address the parties' arguments regarding discretionary denial below.

Under Section 314(a), the Director has discretion to deny institution. See 35 U.S.C. § 314(a) (stating “[t]he Director *may not* authorize an *inter partes* review to be instituted unless the Director determines that the information presented in the petition . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition”) (emphasis added); *SAS Inst. Inc. v. Iancu*,

138 S. Ct. 1348, 1356 (2018) (“[Section] 314(a) invests the Director with discretion on the question whether to institute review.” (emphasis omitted)); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016) (“[T]he agency’s decision to deny a petition is a matter committed to the Patent Office’s discretion.”); *Harmonic Inc. v. Avid Tech, Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) (“[T]he PTO is permitted, but never compelled, to institute an IPR proceeding.”).

In determining whether to exercise this discretion based on a related litigation, the Board assesses all relevant circumstances, including the merits, to balance considerations such as system efficiency, fairness, and patent quality. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”); *NHK Spring Co. v. Intriplex Techs., Inc.*, IPR2018-00752, Paper 8 at 19–20 (PTAB Sept. 12, 2018) (precedential). We consider six factors as part of this balanced assessment when determining whether to use our discretion to deny institution:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board’s exercise of discretion, including the merits.

Fintiv, Paper 11 at 5–6. In evaluating these factors, we “take[] a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Id.* at 6.

On June 21, 2022, the Director issued an Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (“Interim *Fintiv* Guidance”).⁷ The Interim *Fintiv* Guidance provides “several clarifications” to “the PTAB’s current application of *Fintiv* to discretionary denial where there is parallel litigation” in response to comments received from stakeholders in response to a Request for Comments. Interim *Fintiv* Guidance 2.

We now apply the six factors to the facts and circumstances present here.

1. Fintiv Factor 1: Stay in the Parallel Proceeding

Under the first *Fintiv* factor, we consider “whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted.” *Fintiv*, Paper 11 at 6. Patent Owner contends that this factor weighs in favor of denial because “Petitioner[] filed a motion to stay in the district court just two days before the filing of this preliminary response,” and “the “motion has not been granted as of the date of this filing, and there is no evidence that it would be granted.” Prelim. Resp. 42. Patent Owner also asserts that prior decisions by the district judge suggest that Petitioner’s motion to stay is unlikely to be granted. *Id.* at 42–43.

⁷ The Interim *Fintiv* Guidance is available at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf.

We will not attempt to predict how the district court in the parallel district court proceeding will decide Petitioner's motion to stay because the determination of whether or not to stay any individual case, including the related one, is based on a variety of circumstances and facts beyond our control and to which the Board is not privy. *Sand Revolution II, LLC v. Cont'l Intermodal Grp. - Trucking LLC*, IPR2019-01393, Paper 24 at 7 (PTAB June 16, 2020) (informative) ("*Sand Revolution*"). Accordingly, we find that factor 1 is neutral.

2. *Fintiv* Factor 2: Trial Date in the Parallel Proceeding

Under the second *Fintiv* factor, we consider the "proximity of the court's trial date to the Board's projected statutory deadline for a final written decision." *Fintiv*, Paper 11 at 6. Patent Owner states that the trial date in the parallel district court case is set for June 23, 2025, which is three months before the September 27, 2025 deadline for a final written decision in this case. Prelim. Resp. 44. Patent Owner also argues that the trial date in this case is approximately 21 months after filing of the complaint, which is in line with the 21.4 month statistics for the average time to trial in the Eastern District of Texas for the 12-month period ending December 31, 2023. *Id.* at 44–45 (citing Ex. 2004, 2; Ex. 1010, 1).

Because the current trial date in the parallel district court proceeding is relatively close in time to the deadline for a final written decision in this case, it is uncertain which will occur first. However, because the district court's projected trial date is earlier than the deadline for our final written decision, we find that factor 2 weighs slightly in favor of exercising discretion to deny institution.

3. *Fintiv Factor 3: Investment by the Court and the Parties in the Parallel Proceeding*

Under the third *Fintiv* factor, we consider the “investment in the parallel proceeding by the court and the parties.” *Fintiv*, Paper 11 at 6. According to the docket control order from the district court submitted by Patent Owner, claim construction briefing will occur from September 26 to November 5, 2024, the claim construction hearing is set for November 26, 2024, fact discovery is set to close on January 15, 2025, and expert discovery is set to close on March 10, 2025. Ex. 1010 (docket control order). Thus, the majority of claim construction briefing, the claim construction hearing, the close of fact discovery, and the close of expert discovery will all occur after our institution date in this case, and there is no indication that the district court will have spent significant resources on unpatentability issues in the case by the time of institution. Because of the significant investment that remains in the parallel district court proceeding, we find that factor 3 weighs against exercising discretion to deny institution.

4. *Fintiv Factor 4: Overlap Between Issues Raised in the Petition and Parallel Proceeding*

Under the fourth *Fintiv* factor, we consider the “overlap between issues raised in the petition and in the parallel proceeding.” *Fintiv*, Paper 11 at 6. Here, Petitioner has stipulated that if this IPR is instituted, it will not pursue the same invalidity grounds in district court. Pet. 73; *see Sand Revolution*. Petitioner also contends that Patent Owner has only asserted a subset of the claims challenged in the present Petition in the parallel district court case. Pet. 73. Because of Petitioner’s *Sand Revolution* stipulation, and the fact that the Petition challenges additional claims not at issue in the district court case, we find that this factor weighs in favor of institution.

5. *Fintiv Factor 5: Whether Petitioner is the Defendant in the Parallel Proceeding*

Under the fifth *Fintiv* factor, we consider “whether the petitioner and the defendant in the parallel proceeding are the same party.” *Fintiv*, Paper 11 at 6. Here, Petitioner is also the defendant in the parallel district court case. Therefore, we find that factor 5 weighs slightly in favor of exercising discretion to deny institution.

6. *Fintiv Factor 6: Other Considerations, Including the Merits*

Under the sixth *Fintiv* factor, we consider “other circumstances that impact the Board’s exercise of discretion, including the merits.” *Fintiv*, Paper 11 at 6. As discussed below, we determine that Petitioner has shown a reasonable likelihood of unpatentability under both Grounds 1 and 2. Because, as discussed below, we find that factors 1–5 weigh in favor of institution, we need not determine whether Petitioner’s case presents “compelling merits” for purposes of this Decision.

7. *Conclusion*

As noted above, we take “a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Fintiv*, Paper 11 at 6. Weighing all of the factors, we are not persuaded that the interests of efficiency and integrity of the system would be best served by invoking 35 U.S.C. § 314(a) to deny institution of a potentially meritorious petition, particularly because the parallel district court case is at a relatively early stage, the trial date is relatively close to the deadline for a final written decision in this case, Petitioner has filed a *Sand Revolution* stipulation, and there are differences in the claims challenged in both proceedings. Thus, based on the record before us, we determine that the facts of this case do not warrant discretionary denial.

III. CONCLUSION

After considering the evidence and arguments presented in the current record, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least one of the challenged claims of the '802 patent is unpatentable. We therefore institute trial on all challenged claims and grounds raised in the Petition. *See PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (a decision whether to institute an *inter partes* review “require[s] a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–9 of the '802 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '802 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2024-00707
Patent 7,924,802 B2

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

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

v.

COBBLESTONE WIRELESS, LLC,
Patent Owner.

IPR2024-00606
Patent 7,924,802 B2

Before KARL D. EASTHOLM, NORMAN H. BEAMER, and
RUSSELL E. CASS, *Administrative Patent Judges*.

CASS, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

A. Background

Samsung Electronics America, Inc., and Samsung Electronics Co., Ltd. (“Petitioner”) filed a Petition requesting an *inter partes* review of claims 1–4, 6–10, 13–14, 17, and 21–25 (the “challenged claims”) of U.S. Patent No. 7,924,802 B2 (Ex. 1001, “the ’802 patent”). Paper 3 (“Pet.”). Cobblestone Wireless, LLC (“Patent Owner”) filed a Preliminary Response. Paper 8 (“Prelim. Resp.”). With our permission, Petitioner filed a Preliminary Reply (Paper 9, “Pet. Prelim. Reply”), and Patent Owner filed a Preliminary Sur-reply (Paper 10, “PO Prelim. Sur-reply”).

We have authority to determine whether to institute an *inter partes* review, under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. An *inter partes* review may not be instituted unless it is determined that “the information presented in the petition filed under section 311 and any response filed under section 313 shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.” 35 U.S.C. § 314 (2018); *see also* 37 C.F.R. § 42.4(a) (2020) (“The Board institutes the trial on behalf of the Director.”). The reasonable likelihood standard is “a higher standard than mere notice pleading,” but “lower than the ‘preponderance’ standard to prevail in a final written decision.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29 at 13 (PTAB Dec. 20, 2019) (precedential).

For the reasons provided below and based on the record before us, we determine that Petitioner has demonstrated a reasonable likelihood that it would prevail in showing the unpatentability of at least one of the challenged claims. Accordingly, we institute an *inter partes* review on all grounds set forth in the Petition.

B. Real Parties in Interest

Petitioner states that “[t]he real parties-in-interest for Petitioner[] are Samsung Electronics America, Inc. and Samsung Electronics Co., Ltd.” Pet. 102. Petitioner also identifies, “[o]ut of an abundance of caution and to avoid additional issues associated with real parties-in-interest, . . . T-Mobile USA, Inc., AT&T Services Inc., AT&T Corp., AT&T Mobility LLC, and Cellco Partnership d/b/a Verizon Wireless because Petitioner’s products are accused of infringement in their respective patent infringement actions.” *Id.*

Patent Owner identifies Cobblestone Wireless, LLC as the real party in interest.” Paper 7, 2.

C. Related Proceedings

The parties identify the following proceedings involving the ’802 patent: *Cobblestone Wireless, LLC v. Samsung Electronics Co., Ltd.*, No. 2:23-cv-00285 (E.D. Tex.) (the “parallel district court proceeding”); *Cobblestone Wireless, LLC v. T-Mobile USA, Inc.*, No. 2:23-cv-00381 (E.D. Tex.); *Cobblestone Wireless, LLC v. Cellco Partnership d/b/a Verizon Wireless*, Case No. 2:23-cv-00382 (E.D. Tex.); *Cobblestone Wireless, LLC v. AT&T Services Inc.* No. 2:23-cv-00380 (E.D. Tex.); *Cobblestone Wireless, LLC v. Hewlett Packard Enterprise Company, et al.*, Case No. 2:23-cv-00457 (E.D. Tex.); *Cobblestone Wireless, LLC v. CommScope Holding Company, Inc.*, No. 2:23-cv-00455 (E.D. Tex.); *Cobblestone Wireless, LLC v. Cisco Systems, Inc.*, No. 2:23-cv-00454 (E.D. Tex.); *Hewlett Packard Enterprise Company and Cisco Systems, Inc. v. Cobblestone Wireless, LLC*, IPR2024-00707; and *Wireless Communication Systems and Methods*, Re-Examination Appl. No. 90/019,458. Pet. 102–103; Paper 7, 2–3.

D. The '802 Patent (Ex. 1001)

The '802 patent is directed to a wireless communication system and method that transmits signals simultaneously over a communication channel at different RF center frequencies. Ex. 1001, code (54), code (57). The Background of the '802 patent explains that “[c]ommunication systems generally contain one or more transmission channels to transmit data from the transmitter to the receiver.” *Id.* at 1:12–14. The Background describes a transmitter in such a system that “is limited to up-converting a signal to one center frequency (or modulation frequency), which is the LO [(local oscillator)] frequency.” *Id.* at 1:29–32. “Typically,” the Background explains, “the amount of information transmitted around the center frequency is limited by the bandwidth of the transmitter around the center frequency,” which “limits the amount of data that can be transmitted.” *Id.* at 1:32–35. Thus, “[t]ypical prior art approaches to improving the information capacity in a wireless communication system involve maximizing the bandwidth around the center frequency to increase the amount of information that may be modulated onto the carrier frequency.” *Id.* at 1:35–40.

To overcome this issue, the '802 patent proposes “a method of transmitting information in a wireless communication channel” that includes “transmitting first information across a first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency, and simultaneously transmitting second information across a second frequency range using the same wireless transmitter,” where the second frequency range has “a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.” Ex. 1001, 1:60–2:5.

Figure 2 of the '802 patent, reproduced below, “illustrates a wireless communication system according to one embodiment of the present invention.” Ex. 1001, 5:53–54.

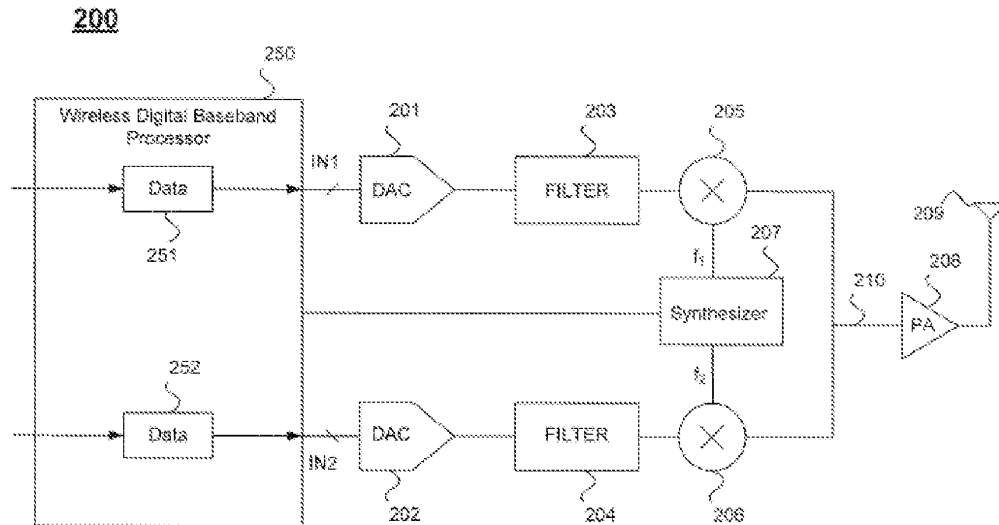


Fig. 2

Figure 2 of the '802 patent illustrates a wireless communication system according to an embodiment of the invention. Ex. 1001, 5:53–54, Fig. 2. As shown in Figure 2, baseband digital system 250 provides a first digital signal comprising first digital data 251 which is provided as IN1 and a second digital signal comprising second digital data 252 provided as IN2. *Id.* at 5:62–66. The first digital data 251 and second digital data 252 may be unrelated data streams or data from the same data stream. *Id.* at 6:7–9. Each of the first and second digital signals is transmitted to a digital to analog converter (DAC 201 and 202), a filter (203 and 204), and an up-converter (205 and 206). *Id.* at 6:10–26. The up-converters 205 and 206 each receive a first modulation signal having an RF center frequency (f_1 and f_2 ,

respectively) from synthesizer 207 and generate first and second up-converted signals that are combined at the input to amplifier 208. *Id.* at 6:22–44, 6:57–60, 7:4–7. Amplifier 208 outputs an amplified up-converted signal comprising the first and second up-converted analog signals, and transmits this signal over antenna 209. *Id.* at 7:7–11.

Figure 3 of the '802 patent, reproduced below, illustrates an example of the frequency content of the signal transmitted from the system disclosed in Figure 2.

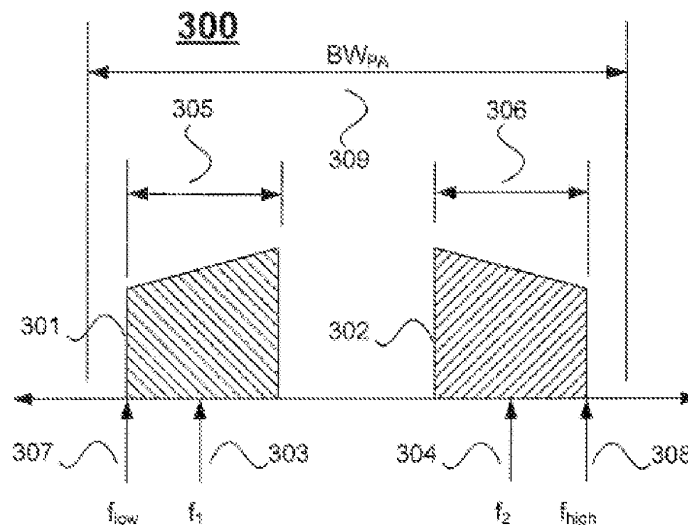


Fig. 3

Figure 3 of the '802 patent illustrates an example of the frequency content of the signal transmitted by the stem of Figure 2. Ex. 1001, 5:58–60, Fig. 3.

Figure 3 shows first up-converted analog signal 301 generated by up-converter 205, which has center frequency f_1 and frequency range 305, and second up-converted analog signal 302 generated by up-converter 206, which has center frequency f_2 and frequency range 306. *Id.* at 6:26–44. The frequency difference between f_1 and f_2 is greater than the sum of one-half of the first frequency range and one-half of the second frequency range, so that the up-converted signals do not overlap and cause distortion. *Id.* at 6:48–53.

The first and second up-converted analog signals 301 and 302 may be transmitted by the antenna over bandwidth BW_{PA} 309. *Id.* at 7:9–14.

E. Illustrative Claims

Of the challenged claims, claims 1, 10, 17, and 24 are independent.

Claim 1 is illustrative and is reproduced below.

1. [pre] A method of transmitting information in a wireless communication channel comprising:

[1a] transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and

[1b] simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency, a second highest frequency, and a second lowest frequency.

Ex. 1001, 13:59–14:3 (bracketed paragraph identifiers added).

F. Applied References

Petitioner relies upon the following references:

Rick et al., U.S. Patent No. 8,693,525 B2, issued Apr. 8, 2014 (Ex. 1021, “Rick”);

Suzuki et al., US 2006/0276146 A1, published Dec. 7, 2006 (Ex. 1004, “Suzuki”);

Fernandez, US 2009/0052556 A1, published Feb. 26, 2009 (Ex. 1005, “Fernandez”);

Montejo et al., US 2005/0135312 A1, published June 23, 2005 (Ex. 1006, “Montejo”);

Jalali et al., U.S. Patent No. 6,952,454, published Oct. 4, 2005 (Ex. 1008, “Jalali”);

Chen et al., U.S. Patent No. 6,359,868, issued Mar. 19, 2002 (Ex. 1009, “Chen”);

Etemad, U.S. Patent No. 8,036,702 B2, issued Oct. 11, 2011 (Ex. 1014, “Etemad”).

Pet. 3–4.

Petitioner submits the Declaration of Dr. Kevin C. Almeroth (Ex. 1003).

G. Asserted Grounds of Unpatentability

Petitioner challenges the patentability of claims 11–17 of the ’028 patent based on the following grounds:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1	103(a) ¹	Rick
1–4, 6–8, 10, 13, 17, 21–22	103(a)	Suzuki
7–9, 22, 23	103(a)	Suzuki, Jalai
14, 24, 25	103(a)	Suzuki, Chen
6, 13, 21	103(a)	Suzuki, Etemad
1–4, 6–8, 10, 13, 17, 21, 22	103(a)	Fernandez, Montojo
7–9, 22, 23	103(a)	Fernandez, Montojo, Jalai
14, 24, 25	103(a)	Fernandez, Montojo, Chen
6, 13, 21	103(a)	Fernandez, Montojo, Etemad

Pet. 4.

II. DISCUSSION

A. Claim Construction

A claim “shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b).” 37 C.F.R. § 42.100(b) (2020). The parties’ arguments

¹ 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 ’802 patent. Therefore, we apply the pre-AIA version of 35 U.S.C. § 103.

at this stage raise three claim construction issues: (1) whether the phrase “in a wireless communication channel” in the preamble of claims 1 and 10 is limiting; (2) whether the word “a” in “a wireless communication channel” requires the claimed method to be performed in *one* wireless communication channel; and (3) the proper construction of the term “wireless communication channel.” Prelim. Resp. 1–8; Pet. Prelim. Reply; PO Prelim. Sur-reply. These issues will be discussed in more detail below.

1. Whether the Phrase “in a Wireless Communication Channel” in the Preamble Is Limiting

Patent Owner argues that the phrase “in a wireless communication channel” in the preamble of claims 1 and 10 is limiting. Pet. 2. Patent Owner asserts that “claim 1 does not define a structurally complete invention in the claim body,” and therefore the preamble “is necessary to give life and meaning to the claim.” *Id.* According to Patent Owner, “[t]he ’802’s specification repeatedly explains that the invention is regarding a specific method within ‘a [wireless] communication channel.’” *Id.* at 2–3 (citing Ex. 1001, code (56), 1:61–63, 2:45–47, 6:60–62, 10:63–66, 12:14–15). “In fact,” Patent Owner contends, “the ’802 provides specific formulas to recover information based on the response of the different frequency ranges within a single communication channel.” *Id.* at 3 (citing Ex. 1001, 13:21–23).

Patent Owner also asserts that the Federal Circuit has explained that “statements of intended purpose in methods of using apparatuses,” such as the preamble here, “ha[ve] tended to result in a conclusion that such preamble language is limiting.” Prelim. Resp. 3 (quoting *Eli Lilly & Co. v. Teva Pharms. Int’l GmbH*, 8 F.4th 1331, 1341 (Fed. Cir. 2021)). “Without the preamble’s limitation that the specific method of transmission is ‘in a

wireless communication channel,” Patent Owner argues, “the claim does not recite a complete structure, and would indiscriminately cover all transmission of information across two frequency ranges as claimed.” *Id.* See also PO Prelim. Sur-reply 1–2.

Petitioner disagrees that the phrase “a wireless communication channel” in the preamble is limiting.” Pet. Prelim. Reply 1–2. Petitioner argues that Patent Owner’s argument to the contrary “is belied by the fact that claim 17, which is an apparatus claim with nearly identical scope as claim 10’s method claim, does not recite ‘a wireless communication channel.’” *Id.* Thus, Petitioner asserts, because “‘a wireless communication channel’ is not structurally necessary for claim 17’s apparatus, it is not necessary for claim 10’s method, either.” *Id.* at 2. “Similarly,” according to Petitioner, “Claim 1’s recitation of simultaneously transmitting information across two frequency ranges is also found in claim 17, where again, there is no limitation that the transmission be ‘in a wireless communication channel.’” *Id.* “In addition,” Petitioner contends, Patent Owner “does not show that ‘a wireless communication channel’ is ‘necessary to provide antecedent basis or that the applicant placed clear reliance on the preamble during prosecution.’” *Id.* (citing *Summit 6, LLC v. Samsung Elecs. Co.*, 802, F3d 1283, 1292 (Fed. Cir. 2015)).

Petitioner further argues that the ’802 patent Specification “makes clear that ‘a wireless communication channel’ is not a structurally necessary limitation for method claims 1 and 10.” Pet. 2. “For example,” Petitioner contends, “Figures 6, 7A and 7B are the only figures that depict methods (and map to claims 1 and 10), yet their corresponding descriptions in the specification do not mention ‘a wireless communication channel,’” which

“indicates that the claim bodies of claims 1 and 10 are structurally complete.” *Id.* (citing Ex. 1001, 5:27–31, 9:9–10:61).

Based on the present record, we preliminarily determine that Petitioner has made a sufficient showing for purposes of institution that the phrase “a wireless communication channel” in the preamble of claims 1 and 10 is not limiting. As the Federal Circuit has noted, “[g]enerally, a preamble is not limiting.” *Summit 6*, 802 F.3d at 1298. However, “a preamble limits the invention if it recites essential structure or steps, or if it is ‘necessary to give life, meaning, and vitality’ to the claim.” *Catalina Mktg. Int’l v. Coolsavings.com, Inc.*, 289 F.3d 801, 808 (Fed. Cir. 2002) (quoting *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999)). “Conversely, a preamble is not limiting ‘where a patentee defines a structurally complete invention in the claim body and uses the preamble only to state a purpose or intended use for the invention.’” *Id.* (quoting *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997)).

Based on the present record, we preliminarily agree with Petitioner that the body of claims 1 and 10 recite a structurally complete invention. Limitations [1a] and [1b] recite, *inter alia*, transmitting first information across a first frequency range using a wireless transmitter (which is a structure for transmitting the information), and simultaneously transmitting second information across a second frequency range using the same wireless transmitter. Patent Owner has not sufficiently explained why these limitations further require that the information be transmitted “in a wireless communication channel” to be structurally complete. Moreover, as Petitioner points out, claim 17 includes similar limitations (as well as limitations similar to those in claim 10) without requiring that the

information be transmitted “in a wireless communication channel,” suggesting that this language is not needed to recite a structurally complete invention, and is not “essential structure or steps” that are “necessary to give life, meaning, and vitality” to the claims. *Compare* Ex. 1001, 16:19–23 and 16:27–36 (claim 17), *with id.* at 13:61–14:3 (claim 1) and 14:58–62 and 14:66–15:7 (claim 10).

Based on the present record, it also does not appear to us that the ’802 patent Specification describes that sending the first and second information “in a wireless communication channel” is an essential (or even important) element of the invention. Patent Owner points to the statement in the ’802 patent’s Abstract that “[e]mbodiments of the present invention transmit signals simultaneously over a communication channel at different RF center frequencies,” and the statement in column 1 that “[i]n one embodiment, the present invention includes a method of transmitting information in a wireless communication channel.” Prelim. Resp. 2–3 (citing Ex. 1001, code (57), 1:61–63). These sentences, however, refer to certain “embodiments” of the invention, and do not indicate that communication “in a wireless communication channel” is a necessary part of *all* embodiments of the invention. Additionally, Patent Owner does not point to any portions of the ’802 patent Specification that clearly state that communication “in a wireless communication channel” is important to the invention, that explain why communication “in a wireless communication channel” is necessary or beneficial, or even explain what it means for communication to occur “in a wireless communication channel” (as opposed to multiple wireless communication channels). *Id.* Moreover, as Petitioner points out, Figures 6, 7A, and 7B and the accompanying text describe embodiments of the method

of the '802 patent, without ever requiring that the communications take place “in a wireless communication channel.” Ex. 1001, Figs. 6, 7A, 7B, 5:27–31, 9:9–10:61. And, while Patent Owner relies on the disclosure at column 13, lines 21–23 discussing recovering information from a received signal, this portion of the Specification does not explain why communication “in a wireless communication channel” is essential, and does not even use the term “wireless communication channel.” See Prelim. Resp. 3; Ex. 1001, 13:21–23.

Finally, we do not find that *Eli Lilly*, relied on by Patent Owner, compels a contrary result. In *Eli Lilly*, the preambles recited “[a] method for treating headache in an individual, comprising” administering an effective amount of a particular monoclonal antibody. *Eli Lilly*, 8 F.4th at 1335. The Federal Circuit found that these preambles were “not merely statements of effect but rather statements of intentional purpose for which the methods must be performed” because “the treatment of vasomotor symptoms such as migraine is central to the invention of the challenged patents” as “reflected in the extensive discussions of such treatment in every section of the patents’ written description.” *Id.* at 1342. The Federal Circuit also explained that the claims only reference such treatments in the preambles, and thus “the preambles are the portions of the claims that embody the essence of the claimed invention—methods for treating vasomotor symptoms.” *Id.* Additionally, the court noted, “[t]he preambles provide the only metric by which one practicing the claim could determine whether the amount administered is an ‘effective amount,’” as the body of the claims require. *Id.* Here, by contrast, the specification does not make clear that communication “in a wireless communication channel” is central to the invention, and the

preamble is not necessary to provide a benchmark for practicing limitations set forth in the body of the claim.

Consequently, based on the present record, we preliminarily determine that the term “in a wireless communication channel” in the preambles of claims 1 and 10 is not limiting.

2. *Whether the Word “a” in “a Wireless Communication Channel” Requires the Method to Be Performed in One Wireless Communication Channel”*

Patent Owner argues that the phrase “in a wireless communication channel” also “requires that the claimed method be performed in a single ‘wireless communication channel.’” Prelim. Res. 5. Patent Owner acknowledges that “the indefinite article ‘a’ generally means ‘one or more’” in open-ended claims containing the transitional phrase “comprising,” but argues that this principle “does not apply where the article ‘a’ appears before ‘comprising,’” relying on *Convolve, Inc. v. Compaq Computer Corp.*, 812 F.3d 1313, 1321 (Fed. Cir. 2016). *Id.* Because the article “a” in the preamble appears before the term “comprising,” Patent Owner argues that “the claimed method must be performed within ‘*a* wireless communication channel,’ not multiple wireless communication channels.” *Id.* at 6.

Patent Owner also relies on *In re Varma v. International Business Machines Corp.*, 816 F.3d 1352 (Fed. Cir. 2016) to support its argument, arguing that the Federal Circuit in *Varma* construed “a statistical analysis request corresponding to two or more selected investments” to require a *single* request that corresponds to at least two investments. Prelim. Resp. 6–7 (citing *Varma* at 1362–1363). Patent Owner also points to *Varma*’s example that “a dog that rolls over and fetches sticks” cannot correspond to “two dogs, each able to perform just one of the tasks.” *Id.* at 7. According

to Patent Owner, “[l]ike the hypothetical dog in *V[a]rma*, it would not suffice to have a portion of the claimed method performed in one ‘wireless communication channel’ and another portion of the claimed method performed in a different ‘wireless communication channel.’” *Id.* See PO Prelim. Sur-reply 3–4.

Finally, Patent Owner argues that “the specification repeatedly explains that the invention is directed at performing the claimed method in a single wireless channel.” Prelim. Resp. 8 (citing Ex. 1001, 1:61–63, 2:45–47, 6:60–62, 10:63–66, 12:14–15). Patent Owner further asserts that “the specification recites specific mathematical methods to recover information based on the responses of the different frequency ranges within a single communication channel.” *Id.* (citing Ex. 1001, 13:21–23).

Petitioner responds by arguing that the exceptions to the general rule that “a” or “an” in a patent claim means “one or more,” “are extremely limited: a patentee must evince a clear intent to limit ‘a’ or ‘an’ to ‘one.’” Prelim. Resp. 3 (citing *Baldwin Graphic Sys., Inc. v. Siebert, Inc.*, 512 F.3d 1338, 1342 (Fed. Cir. 2008)). Petitioner also argues that Patent Owner “misunderstands the holding in *Convolve*,” because, in that case, the court based its decision on the fact that the term “a processor” in the preamble provided antecedent basis for the term “the processor” in the body of the claim, not on the fact that the term “a processor” appeared before the word “comprising.” *Id.* In contrast, Petitioner asserts, the court in *Convolve* held that “a processor” in claim 9 meant “one or more processors” because it did not provide antecedent basis for terms in the remainder of the claim. *Id.* Petitioner further argues that Patent Owner’s argument is not consistent with the ’802 patent Specification’s statement that the received signal “may be

processed in separate analog receiver *channels* and combined digitally.” *Id.* at 4 (citing Ex. 1001, 10:51–53).

As noted above, we preliminarily determine that the preamble of claims 1 and 10 is not limiting. *See* § II.A.1, *supra*. Therefore, for purposes of institution, we need not determine whether the article “a” in “a wireless communication channel” in the preamble means “one or more” or “only one.” However, to the extent Patent Owner continues to advance this argument, we believe the record on this issue would benefit from further development during the trial, including, for example, further discussion as to: (1) the extent to which Federal Circuit caselaw interprets the term “a” differently when it appears before the term “comprising” in the preamble as opposed to being used in the body of the claim; (2) the significance of any differences between the relevant language in claims 1 and 10 and the claim language at issue in *Varma* requiring “a statistical analysis request *corresponding to* two or more selected investments”; and (3) other Federal Circuit cases concerning the issue of whether “a” means “one or more” that use language similar or analogous to that used in claims 1 and 10.

3. *The Proper Construction of “Wireless Communication Channel”*

Although Patent Owner argues that the prior art fails to teach performing the claimed method in a “wireless communication channel,” Patent Owner does not offer a construction of the term “wireless communication channel.” Prelim. Resp. 8–10; PO Prelim. Sur-reply 5. Petitioner also does not construe “wireless communication channel” in the Petition. Pet. 9. In its Preliminary Reply, Petitioner states that “[t]he ’802 patent discloses that, to the extent it is comprehensible, ‘a communication channel’ refers to a single transmission signal, and that it carries multiple

‘carrier frequenc[ies],’” but does not provide a full claim construction analysis for this term. Pet. Prelim. Reply 5 (citing Ex. 1001, 10:63–66).

As noted above, we preliminarily determine that the preamble of claims 1 and 10 is not limiting, and therefore we need not construe the term “wireless communication channel” for purposes of this Decision. However, to the extent Patent Owner continues to assert that the preamble is limiting, the parties should propose constructions of “wireless communication channel” during the trial, along with a full claim construction analysis supporting their proposed constructions.

4. *Other Terms*

We determine that it is not necessary to provide an express interpretation of any other claim terms. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”).

B. *Principles of Law*

A claim is unpatentable under 35 U.S.C. § 103 if “the differences between the subject matter sought to be patented 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, objective evidence

of non-obviousness.² *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When evaluating a combination of teachings, we must also “determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result has weight in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b) (2020). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner contends that a person of ordinary skill in the art at the time of the alleged invention would have had “at least a bachelor’s in EE/CE/CS, physics, or equivalent, and two years of experience with cellular telecommunications, radio-access network architectures, protocols and signal propagation in wireless networks.” Pet. 4 (citing Ex. 1003 ¶¶ 50–51). Petitioner further states that “[m]ore education can supplement practical experience and vice versa.” *Id.* Patent Owner does not offer a proposed level of ordinary skill at this stage of the proceeding. *See* Prelim. Resp.

² At this stage of the proceeding, Patent Owner has not presented objective evidence of non-obviousness.

At this stage of the proceeding, we adopt Petitioner's assessment of the level of skill in the art, which is consistent with the '802 patent and the asserted prior art of record.

D. Ground 1: Obviousness of Claim 1 Based on Rick

Petitioner contends that claim 1 would have been obvious over Rick. Pet. 4, 12–16. Patent Owner disagrees, arguing that Rick does not perform the claimed method in “a wireless communication channel.” Prelim. Resp. 8–10.

1. Overview of Rick (Ex. 1021)

Rick discloses a “multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously.” Ex. 1021, code (57). The multi-carrier transmitter includes “at least one processor and a single radio frequency (RF) transmit chain.” *Id.* The processor(s) “may generate output chips for each of multiple frequency channels, digitally filter and upsample the output chips for each frequency channel to obtain filtered samples, and digitally upconvert the filtered samples for each frequency channel to a different frequency to obtain upconverted samples.” *Id.* The processor(s) “may then combine the upconverted samples for the multiple frequency channels to obtain composite samples, perform pre-distortion on the composite samples for I/Q [(in-phase and quadrature signal)] mismatch compensation, and upsample the pre-distorted samples to obtain output samples,” which “may be converted to an analog signal with a wideband DAC [(digital to analog converter)].” *Id.* The RF transmit chain may then “process the analog signal to generate an RF output signal.” *Id.*

2. *Analysis of Independent Claim 1*

- a) 1[pre]: “[a] method of transmitting information in a wireless communication channel comprising:”

As discussed previously, Petitioner argues that the preamble of claim 1 is not limiting. Pet. Prelim. Reply 1–2. Petitioner further asserts that “Rick discloses ‘[a] multi-carrier transmitter capable of transmitting on one or multiple frequency channels simultaneously’ and that the transmitter ‘may be used for various wireless communication systems.’” *Id.* at 12 (citing Ex. 1021, 1:48–50, 2:38–39; Ex. 1003 ¶ 82).

As discussed above, Patent Owner argues that the preamble of claim 1 is limiting. Prelim. Resp. 2–5. Patent Owner also argues that Rick does not disclose the preamble because it does not disclose that both frequency ranges are transmitted via a single communication channel. *Id.* at 8–10.

As discussed above, we preliminarily determine that the preamble of claim 1 is not limiting. *See* § II.A.1, *supra*. Thus, Rick need not disclose the preamble in order to satisfy claim 1.³

³ We also note that, even if the preamble is limiting, under the interpretation that Petitioner advances (as discussed above), “a wireless communication channel” can include one or more wireless channels. *See* § II.A.2, *supra*. Under this interpretation, Petitioner sufficiently shows that Rick discloses the preamble for purposes of institution by describing “[a] multi-carrier transmitter capable of transmitting on one or more frequency channels simultaneously” and “transmission of N CDMA signals,” each of which “may carry any type of data for any service.” *See* Pet. 12–13 (citing Ex. 1021, 1:48–50, 2:38–39, 3:19, 3:35–36; Ex. 1003 ¶ 82).

- b) [1a]: “transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency; and”

Petitioner argues that “Rick discloses ‘transmission of N CDMA signals,’ each of which ‘may carry any type of data for any service.’” Pet. 12–13 (citing Ex. 1021, 3:19, 3:35–36). “The data for one of the CDMA signals,” Petitioner asserts, “is a **first information**.” *Id.* at 13 (citing Ex. 1003 ¶¶ 83–84). These CDMA signals, according to Petitioner, include a first frequency range and a second frequency range, as shown in Petitioner’s annotated version of Rick’s Figure 1, reproduced below.

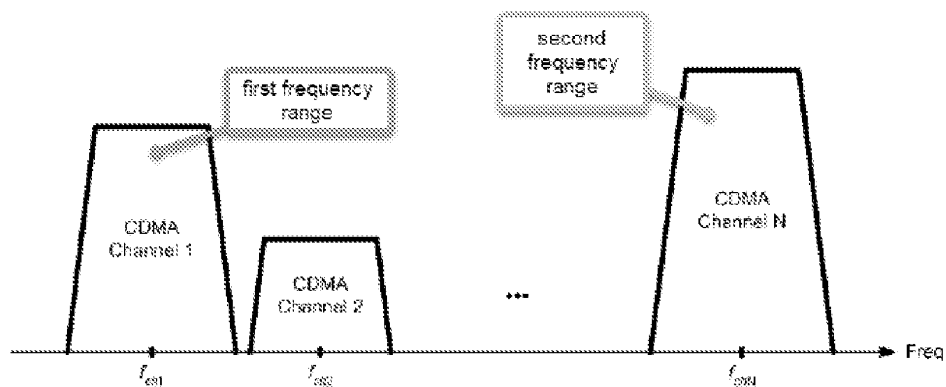


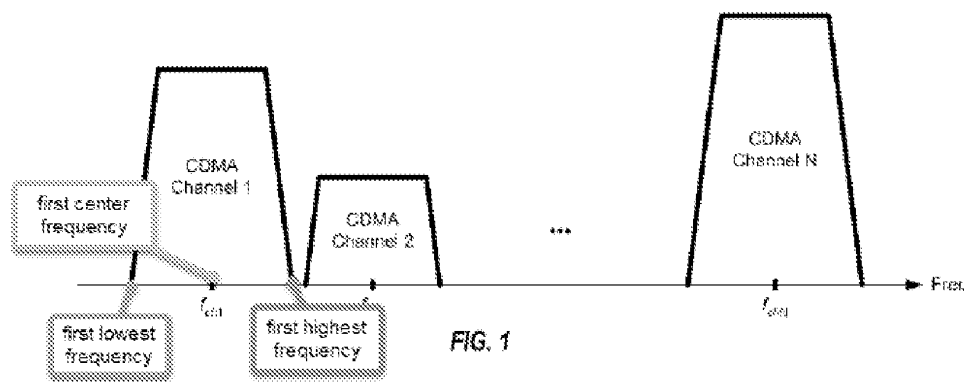
FIG. 1

Petitioner’s annotated version of Rick’s Figure 1 shows the “first frequency range” and the “second frequency range.” Pet. 13.

Petitioner argues that, as shown in its annotated version of Figure 1, Rick’s CDMA Channel 1 is the claimed “first frequency range” having a “first center frequency” of f_{ch1} , and that one of ordinary skill would understand that the term “carrier frequency” refers to the center frequency of the carrier channel. Pet. 13 (citing 1021, 3:21–22; Ex. 1023, 86; Ex. 1003 ¶ 85). Petitioner also asserts that Rick teaches that the CDMA signal is up-converted to the carrier frequency, and one of ordinary skill would understand that such up-conversion raises the frequency center of a signal to

a higher frequency center. *Id.* at 13–14 (citing Ex. 1021, 4:11–16; Ex. 1003 ¶ 85). Petitioner further contends that the CDMA signal is transmitted via an antenna, *i.e.*, a wireless transmitter. *Id.* at 13 (citing Ex. 1021, 4:50–51).

Petitioner also argues that Rick discloses that the first frequency range includes a first center frequency, a first lowest frequency, and a first highest frequency, as illustrated in its annotated version of Rick’s Figure 1, reproduced below.



Petitioner’s annotated version of Rick’s Figure 1 shows the “first center frequency,” “first lowest frequency,” and “first highest frequency” of the first frequency range. Pet. 14 (citing Ex. 1021, 3:16–17, Fig. 1; Ex. 1003 ¶ 86).

Patent Owner does not present arguments regarding this limitation.
See Prelim. Resp. 1–10.

We determine that, on the record before us, Petitioner’s cited evidence sufficiently supports its contentions regarding this limitation.

- c) [1b]: “simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency.”

Petitioner argues that the claimed “second information” is either the CDMA data on channel 2 or the CDMA data on channel N. Pet. 15 (citing

Ex. 1003 ¶¶ 88–89). Petitioner provides an annotated version of Rick’s Figure 1, reproduced below, showing the first and second frequency ranges.

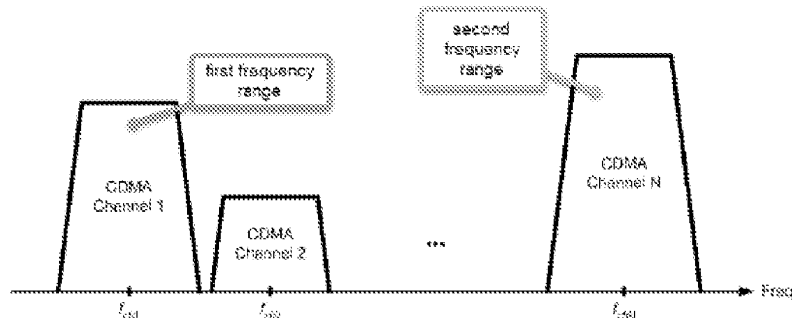


FIG. 1

Petitioner’s annotated version of Rick’s Figure 1 shows the “first frequency range” and the “second frequency range.” Pet. 15.

Petitioner argues that Rick discloses transmitting these multiple CDMA signals simultaneously because they are sent in the frequency domain. Pet. 15. Petitioner further asserts that the signal carrying the first and second information is transmitted via an antenna, *i.e.*, the same wireless transmitter. *Id.* (citing Ex. 1021, 4:50–51). Petitioner also argues that Rick discloses that the second frequency range includes a second center frequency, a second lowest frequency, and a second highest frequency, as illustrated in its annotated version of Rick’s Figure 1, reproduced below.

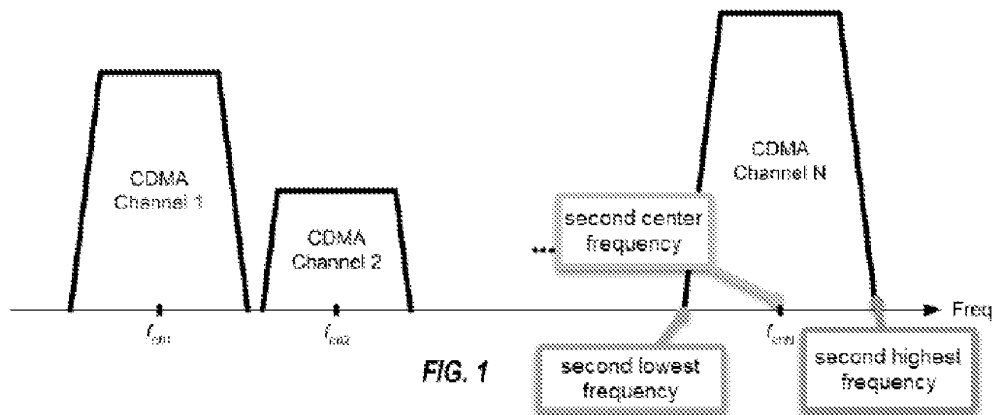


FIG. 1

Petitioner’s annotated version of Rick’s Figure 1 shows the “second center frequency,” “second lowest frequency,” and “second highest frequency” of

the second frequency range. Pet. 16 (citing Ex. 1021, 3:16–17, Fig. 1; Ex. 1003 ¶ 91).

Petitioner also argues that Figure 1 depicts f_{chN} (the second center frequency” as greater than f_{ch1} (the first center frequency). *Id.* at 16 (citing Ex. 1021, 3:16–17).

Patent Owner does not present arguments regarding this limitation. *See* Prelim. Resp. 1–10.

We determine that, on the record before us, Petitioner’s cited evidence sufficiently supports its contentions regarding this limitation.

d) Summary for Claim 1

For the foregoing reasons, we are persuaded that Petitioner’s cited evidence and reasoning demonstrates a reasonable likelihood that Petitioner would prevail in its contentions regarding claim 1.

E. Remaining Grounds

Because Petitioner has demonstrated a reasonable likelihood that it would prevail with respect to claim 1, we grant institution of trial on all challenged claims and grounds raised in the Petition. *See* 35 U.S.C. § 314 (2018); *PGS Geophysical AS v. Iancu*, 891 F.3d 1354, 1360 (Fed. Cir. 2018) (indicating that a decision whether to institute an *inter partes* review “require[s] a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”). However, to provide guidance to the parties, we will address Patent Owner’s remaining arguments below.

1. *Grounds 2–5*

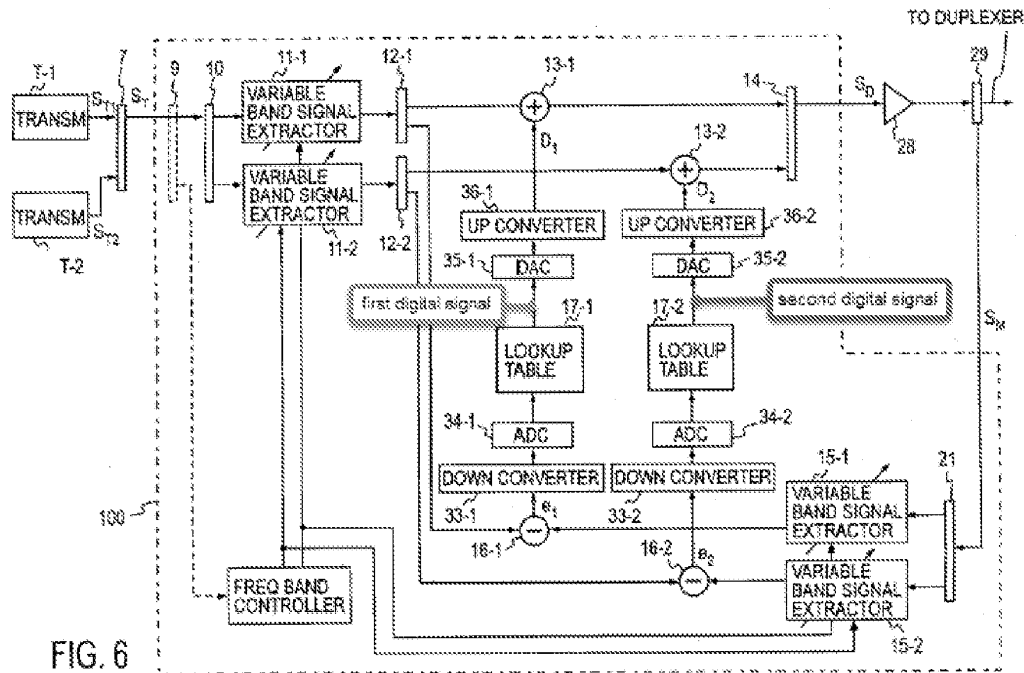
a) *Whether Suzuki Discloses the Preamble of Claims 1 and 10*

Patent Owner argues that Petitioner fails to show that Suzuki discloses or renders obvious the claimed method being performed “in a wireless communication channel,” as the preambles of claims 1 and 10 recite. Prelim. Resp. 12–13. As discussed above, we preliminarily determine that the preambles of claims 1 and 10 are non-limiting. *See* § II.A.1, *supra*. Therefore, we do not agree with Patent Owner that Petitioner’s showing as to claims 1 and 10 is deficient on this basis.

b) *Whether Figure 6 of Suzuki Discloses First/Second Digital Signals Comprising First/Second Data “To Be Transmitted” in Claims 10 and 17*

Patent Owner argues that Suzuki’s Figure 6 does not disclose or render obvious either claim 10 or 17 because it fails to disclose first/second digital signals comprising first/second data “to be transmitted.” Prelim. Resp. 14.

Claim 10 recites “receiving a first digital signal comprising first data *to be transmitted*” and “receiving a second digital signal comprising second data *to be transmitted*,” and claim 17 includes similar limitations. Ex. 1001, 14:44–47; 16:2–5 (emphasis added). Petitioner argues that these signals are disclosed in Suzuki’s Figure 6, and provides an annotated version of that figure, reproduced below, to illustrate its argument.



Petitioner’s annotated version of Suzuki’s Figure 6 shows the “first digital signal” in red and the “second digital signal” in blue. Pet. 31, Fig. 6. Petitioner argues that “input signal S_T including dual frequency bands of transmitting signals is divided into two input side variable band signal extractors 11-1 and 11-2 at the divider 10 and transmitting signals in dual frequency bands are extracted.” *Id.* at 30–31 (citing Ex. 1004 ¶ 45). Then, Petitioner asserts, “[t]he difference between the extracted symbols and monitor signals from S_M is calculated, and used to receive predistortion compensation data from look-up tables 17–1 and 17-2, which are the **first** and **second digital signal**, respectively.” *Id.* at 31 (citing Ex. 1004 ¶ 46). According to Petitioner, “Suzuki discloses these are digital signals because ‘tables 17-1 and 17-2 are implemented through digital signal processing.’” *Id.* (citing Ex. 1004 ¶ 63). “The predistortion compensation data,” Petitioner contends, “**will be transmitted** with their respective frequency band as a predistorted signal.” *Id.* (citing Ex. 1003 ¶ 131).

Patent Owner responds that Petitioner's argument fails because the predistortion signals identified by Petitioner as the first and second digital signals "are not transmitted and do not contain data 'to be transmitted.'" Prelim. Resp. 14. "Rather," Patent Owner asserts, "Suzuki is clear that the signals from lookup tables 17-1 and 17-2 are merely pre-distortion signals that are cancelled in amplifier 28 prior to any transmission." *Id.* at 15 (citing Ex. 1004 ¶¶ 1, 3). Specifically, according to Patent Owner, the output of lookup tables 17-1 and 17-2 are pre-distortion components D_1 and D_2 that are intended to compensate for the distortion caused by the power amplifier 28. *Id.* at 15–16 (citing Ex. 1004 ¶ 63). "[A]dders 13-1 and 13-2," Patent Owner contends, add the distortion compensation data D_1 and D_2 to the underlying signal that is first predistorted and then amplified (cancelling the predistortion) prior to transmission." *Id.* (citing Ex. 1004 ¶¶ 46, 47). Thus, Patent Owner argues: (1) distortion compensation data D_1 and D_2 are not transmitted by the transmitter because they are cancelled by the distortion caused by the power amplifier when the signal is amplified before transmission, and (2) distortion compensation data D_1 and D_2 also do not contain data to be transmitted but instead merely contain distortion compensation components that are cancelled out before transmission. *Id.* at 16–17.

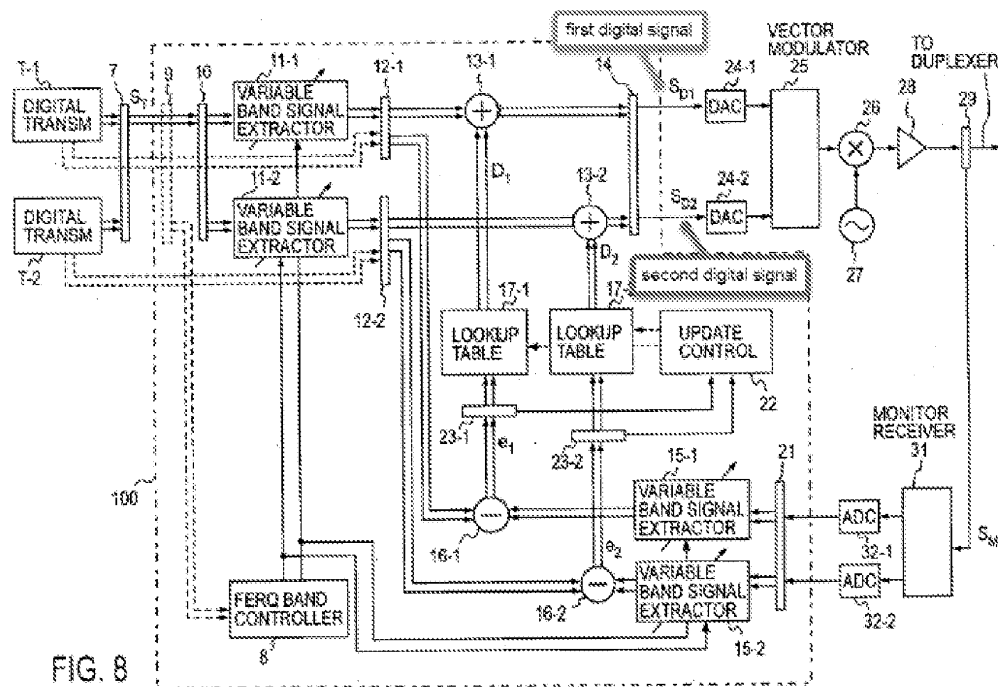
Based on the present record, Patent Owner's arguments that distortion compensation data D_1 and D_2 (which Petitioner points to as the first and second digital signals) do not contain data to be transmitted, and are not actually transmitted as required by the claims, appear reasonable and consistent with Suzuki's disclosure. During the trial, Petitioner may further

address why D₁ and D₂, which Petitioner identifies as the claimed first and second digital signals, include “data to be transmitted” as the claims require.

c) Whether Figure 8 of Suzuki Discloses the Up-Converted Analog Signals and Frequency Ranges as Claimed in Claims 10 and 17

Patent Owner argues that Petitioner fails to show that Suzuki’s Figure 8 discloses or renders obvious claims 10 and 17 because: (1) it does not disclose two distinct up-converted analog signals as claimed, and (2) Suzuki’s up-converted analog signals do not contain two distinct frequency ranges with the claimed properties. Prelim. Resp. 17.

With respect to the first argument, claim 10 recites up-converting the first and second analog signals to first and second RF center frequencies to produce first and second up-converted analog signals, and claim 17 recites similar limitations. Ex. 1001, 14:56–15:7; 16:16–36. Petitioner argues that these signals are disclosed in Suzuki’s Figure 8, and provides an annotated version of that figure, reproduced below, to illustrate its argument.



Petitioner’s annotated version of Suzuki’s Figure 8 shows the “first digital signal” in red and the “second digital signal” in blue. Pet. 32, Fig. 8.

Petitioner argues that Figure 8 shows first and second digital signals in the form of S_{D1} and S_{D2} , respectively. Pet. 32 (citing Ex. 1003 ¶ 132).

Specifically, Petitioner contends that each of the extracted signals from the input signal are added at adders 13-1 and 13-2 to predistortion data from lookup tables 17-1 and 17-2, and are combined at combiner 14 to generate signals S_{D1} and S_{D2} , which are received by DACs 24-1 and 24-2 and will be transmitted by an antenna. *Id.* (citing Ex. 1003 ¶¶ 48, 58).

Patent Owner responds that the outputs of DAC 24-1 and DAC 24-2 are not separately up-converted to produce a “first” and “second” up-converted signal, as the claims require, but instead are combined in Vector Modulator 25 to produce a single combined signal, which is then transmitted to up-converter 26 to produce a single up-converted signal. Prelim. Resp. 19

(citing Ex. 1004 ¶ 58). Patent Owner further argues that Petitioner relies on Suzuki's Figure 13A to show the two distinct up-converted frequency ranges of claims 10 and 17, but Suzuki never discloses that its Figure 13A frequency profile applies to the output signal of Figure 8's predistorter. *Id.* at 21–24.

Based on the present record, Patent Owner's argument that the circuit of Suzuki's Figure 8 does not separately up-convert the signals Petitioner identifies as the first and second analog signals (the outputs of DAC 24-1 and DAC 24-2) appears reasonable and consistent with the disclosure of Suzuki. Petitioner may address this argument during the trial, as well as Patent Owner's argument that the frequency ranges of Figure 13 do not apply to the circuit of Figure 8.

*d) Whether the Combination of Suzuki and Chen Teaches
Claim 24*

Claim 24 requires a "first down-converter" that outputs a "first down-converted signal" and a "second down-converter" that outputs a "second down-converted signal," as well as a filter that "receives the first and second down converted signals." Ex. 1001, 17:4–18:8.

Petitioner argues that Chen teaches first and second down-converters that provide their output to a filter, and provides an annotated version of

Chen's Figure 6, reproduced below, to illustrate this argument.

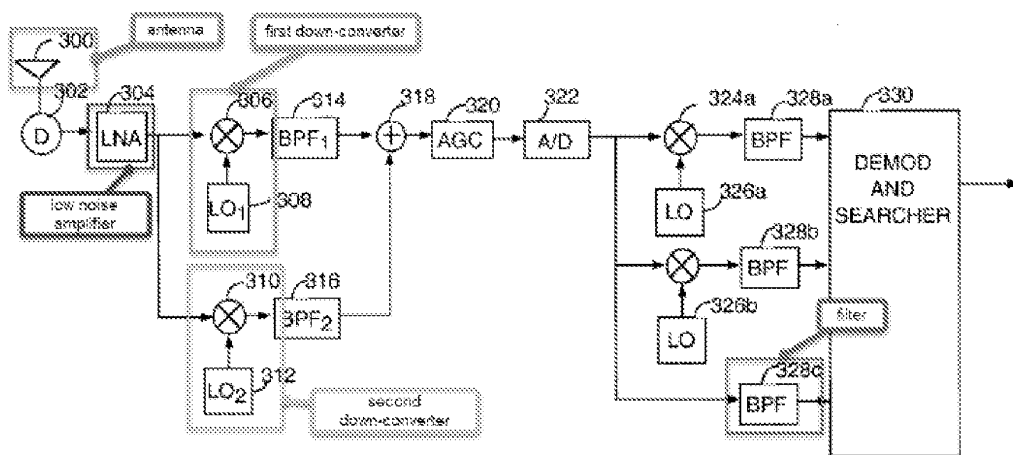


FIG. 6

Petitioner's annotated version of Chen's Figure 6 shows a first down-converter (green), a second down converter (yellow), and a filter (blue).

Pet. 71; Ex. 1009, Fig. 6.

More specifically, Petitioner argues that Chen's mixer 306 connected to local oscillator circuit LO₁ is a "first down-converter circuit," and mixer 310 connected to local oscillator circuit LO₂ is a "second down converter circuit." Pet. 67–69. According to Petitioner, the outputs of these circuits "are, after downconversion, 'already at baseband' and '*provided directly* to filter 328c.'" *Id.* at 70 (citing Ex. 1009, 14:13–15; Ex. 1003 ¶ 220).

Patent Owner responds that the analog outputs of Chen's down-converters 306 and 310 are not received by Chen's filter 328, because they first converted to digital signals in the A/D converter 322, and those digital signals are provided to the filter. Prelim. Resp. 25–31.

Resolution of this issue would benefit from further development during the trial. During the trial, the parties may address what it means for the filter to "receive[]" the first and second down-converted signals," as claim 24 requires, and whether an A/D conversion of the down-converted

signals before they are provided to the filter takes Figure 6 outside of the claim.

2. *Grounds 6–9*

a) *Whether Fernandez Discloses the Preamble of Claims 1 and 10*

Patent Owner argues that Petitioner fails to show that Fernandez discloses or renders obvious the claimed method being performed “in a wireless communication channel,” as the preambles of claims 1 and 10 recite. Prelim. Resp. 33–34. As discussed above, we preliminarily determine that the preambles of claims 1 and 10 are non-limiting. *See* § II.A.1, *supra*. Therefore, we do not agree with Patent Owner that Petitioner’s showing as to claims 1 and 10 is deficient on this basis.

b) *Whether Fernandez Discloses “a Baseband Digital System” That Provides a First and Second Baseband Signal (Claim 17)*

Patent Owner argues that Fernandez does not disclose “a baseband digital system” that provides a first and second baseband signal as required by claim 17. Prelim. Resp. 34–37.

Claim 17 recites “a baseband digital system for providing a first digital signal comprising first data to be transmitted and a second digital signal comprising second data to be transmitted.” Ex. 1001, 16:2–5. Petitioner argues that Fernandez discloses a “baseband digital system,” citing in support the statement in Fernandez’s paragraph 6 that the system can “upconvert[] baseband signal[s]” and the statement in paragraph 11 that “a general method is provided to increase a digitally synthesized signal’s bandwidth by frequency interleaving multiple (i.e., at least 2) digitally synthesized signal sources of narrower bandwidth.” Pet. 96–97.

Patent Owner responds that the portion of Fernandez cited by Petitioner “only discloses the ‘[s]tandard notation for complex baseband and passband signals’” or, in other words, “the mathematical formula for representing a baseband signal.” Prelim. Resp. 35 (citing Ex. 1005 ¶ 6). However, Patent Owner asserts, Fernandez “says nothing whatsoever about ‘a baseband digital system,’ much less one that provides the claimed first and second digital signals.” *Id.* Patent Owner acknowledges that the Petition identifies in Fernandez’s Figure 2A first and second data signals each being fed to a “Baseband and Upconversion DSP, DAC, I/Q modulation, filtering, amplification” signal generator. *Id.* at 36. However, according to Patent Owner, this figure does not disclose where these first and second data signals originate from, and Petitioner does not identify disclosure in Fernandez indicating that they are sent from a “baseband digital system.” *Id.* Patent Owner also argues that Fernandez’s paragraph 11, cited in the Petition, is describing the “present invention,” while Figure 2A is part of the discussion of the admitted prior art, and Petitioner does not demonstrate why or how these disclosures would be combined. *Id.* at 37 (citing Ex. 1005 ¶¶ 5, 6, 8, 9, Figs. 1, 2A–2B).

This issue would benefit from further development during the trial. In particular, Petitioner may point out with greater specificity what disclosure it is relying on to teach or suggest the “baseband digital system,” and flesh out any inherency or obviousness arguments it is relying on. The parties may also consider proposing a construction for the term “baseband digital system.”

c) *Whether One of Ordinary Skill Would Have Been Motivated to Combine Fernandez and Montojo as Proposed (Claims 10, 17)*

Claim 10 recites “combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal” and then “amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal,” and claim 17 includes similar limitations. Ex. 1001, 15:8–13, 16:37–42.

Petitioner argues that, in Fernandez, “each input signal is amplified using its own amplifier, rather than a single amplifier after the signals are combined,” but it would have been obvious to combine Fernandez with Montojo, which “expressly discloses combining multiple signals into a single signal amplified using a single amplifier.” Pet. 74. Relying on Dr. Almeroth, Petitioner argues that one of ordinary skill would have been motivated to use a single amplifier based on Fernandez’s disclosure alone as a matter of design preference because a single amplifier has the advantage of lower complexity, provides only a single potential point of failure, and has a lower cost. *Id.* at 74–75 (citing Ex. 1003 ¶ 235).

Petitioner also argues that “[t]hese well-known benefits” of using a single amplifier “are further underscored by Montojo, which teaches generating a multi-carrier signal and explains that while ‘multiple power amplification circuits, each dedicated to one carrier and each including a power amplifier’ is an option, this runs against ‘limitations on space, manufacturing cost, power consumption and other factors,’ which ‘dictate the need to share resources among the carriers, including power amplification circuitry.’” Pet. 76 (citation omitted) (citing Ex. 1006 ¶ 5; Ex. 1003 ¶ 236). In light of these issues, Petitioner asserts, “Montojo teaches ‘*it would be advantageous* to utilize a *single power amplifier* for

transmission of a plurality of carriers transmitted by a multi-carrier terminal.” *Id.* (citing Ex. 1006 ¶ 5). Relying on Dr. Almeroth, Petitioner contends that one of ordinary skill “would have known that using a single amplifier would achieve these benefits, including lower complexity, single (as opposed to multiple) potential points of failure, and lower cost,” as well as “reduction in space usage and power consumption.” *Id.* (citing Ex. 1003 ¶ 236). Petitioner further argues that one of ordinary skill “would have reasonably expected success in modifying Fernandez to use a single amplifier and antenna based either on Fernandez’s disclosure alone or in combination with Montojo,” and that “[u]sing a single amplifier was well-known, as shown by Montojo, which teaches how to implement a single amplifier for multi-carrier transmissions.” *Id.* at 77 (citing Ex. 1006 ¶¶ 21, 42, Fig. 5; Ex. 1003 ¶ 237).

Patent Owner responds that Petitioner has failed to show why and how one of ordinary skill would have modified Fernandez in view of Montojo. Prelim. Resp. 39. According to Patent Owner, “Montojo explains that even though it may be desirable to share an amplifier among different carriers, it is not practical to do so if all carriers are to be amplified based on their needs.” *Id.* (citing Ex. 1006 ¶ 7). For example, Patent Owner cites Montojo’s disclosure that, “[i]f a multi-carrier terminal has a single power amplifier for simultaneous transmission of different types of carrier signals, the power amplifier may be subject to power constraints imposed by spectral emission requirements, by on-board battery capacity, and also by any priority among the carriers.” *Id.* (quoting Ex. 1006 ¶ 7). “To address this problem,” Patent Owner contends, “Montojo discloses an apportionment system where the power amplifier amplifies the highest priority carrier

according to its needs and will amplify the next priority carrier(s) only to the extent any amplification power is left over.” *Id.* (citing Ex. 1006 ¶¶ 9, 10, 45). According to Patent Owner, “Petitioner has not shown if Montojo’s priority-based power amplifier would be desirable or even functional in a system such as Fernandez, which is why Fernandez discloses that each signal generator has its own power amplifier to begin with.” *Id.* at 40. Indeed, Patent Owner argues that Fernandez discloses a wideband signal generated by summing together narrow band signals which are “substantially equally amplified,” and there is no showing how such a system would work with Montojo’s approach of amplifying based on priority. *Id.* at 40–41 (citing Ex. 1005, Figs. 2A, 2B).

Based on the present record, we find that Petitioner and Dr. Almeroth have provided a sufficient motivation for purposes of institution to replace Fernandez’s multiple amplifiers for each input signal with a single amplifier for the multiple summed signals in order to provide the advantage of lower complexity, a single potential point of failure, and lower cost. However, Patent Owner’s argument that Petitioner does not explain in detail how Montojo’s system of assigning priority of amplification to a particular carrier would be applied to Fernandez’s system, which substantially equally amplifies all signals, appears worthy of further consideration. Petitioner and Dr. Almeroth may wish to further address this point during the trial.

d) Whether the Combination of Fernandez and Chen Teaches Claim 24

Patent Owner argues that the combination of Fernandez and Chen fails to disclose a filter that receives the up-converted signals output from the first and second claimed up-converters for the same reasons set forth with respect to the Suzuki-Chen combination. Prelim. Resp. 44. Our

comments regarding the application of the Suzuki-Chen combination to claim 24 apply equally to the application of the Fernandez-Chen combination to that same claim in this ground. *See* § II.E.1(d), *supra*.

F. Discretionary Denial Under 314(a)/Fintiv

Patent Owner argues we should exercise our discretion under 35 U.S.C. § 314(a) to deny institution of *inter partes* review in view of the parallel district court proceeding. Prelim. Resp. 44–58. Petitioner disagrees. Pet. 101–102. We address the parties’ arguments regarding discretionary denial below.

Under Section 314(a), the Director has discretion to deny institution. *See* 35 U.S.C. § 314(a) (stating “[t]he Director *may not* authorize an *inter partes* review to be instituted unless the Director determines that the information presented in the petition . . . shows that there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition”) (emphasis added); *SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1356 (2018) (“[Section] 314(a) invests the Director with discretion on the question whether to institute review.” (emphasis omitted)); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2140 (2016) (“[T]he agency’s decision to deny a petition is a matter committed to the Patent Office’s discretion.”); *Harmonic Inc. v. Avid Tech, Inc.*, 815 F.3d 1356, 1367 (Fed. Cir. 2016) (“[T]he PTO is permitted, but never compelled, to institute an IPR proceeding.”).

In determining whether to exercise this discretion based on a related litigation, the Board assesses all relevant circumstances, including the merits, to balance considerations such as system efficiency, fairness, and patent quality. *See Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11

(PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”); *NHK Spring Co. v. Intriplex Techs., Inc.*, IPR2018-00752, Paper 8 at 19–20 (PTAB Sept. 12, 2018) (precedential). We consider six factors as part of this balanced assessment when determining whether to use our discretion to deny institution:

1. whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted;
2. proximity of the court’s trial date to the Board’s projected statutory deadline for a final written decision;
3. investment in the parallel proceeding by the court and the parties;
4. overlap between issues raised in the petition and in the parallel proceeding;
5. whether the petitioner and the defendant in the parallel proceeding are the same party; and
6. other circumstances that impact the Board’s exercise of discretion, including the merits.

Fintiv, Paper 11 at 5–6. In evaluating these factors, we “take[] a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Id.* at 6.

On June 21, 2022, the Director issued an Interim Procedure for Discretionary Denials in AIA Post-Grant Proceedings with Parallel District Court Litigation (“Interim *Fintiv* Guidance”).⁴ The Interim *Fintiv* Guidance provides “several clarifications” to “the PTAB’s current application of *Fintiv* to discretionary denial where there is parallel litigation” in response to

⁴ The Interim *Fintiv* Guidance is available at https://www.uspto.gov/sites/default/files/documents/interim_proc_discretionary_denials_aia_parallel_district_court_litigation_memo_20220621_.pdf.

comments received from stakeholders in response to a Request for Comments. Interim *Fintiv* Guidance 2.

We now apply the six factors to the facts and circumstances present here.

1. Fintiv Factor 1: Stay in the Parallel Proceeding

Under the first *Fintiv* factor, we consider “whether the court granted a stay or evidence exists that one may be granted if a proceeding is instituted.” *Fintiv*, Paper 11 at 6. Patent Owner contends that this factor weighs in favor of denial because “a stay has not been sought or granted, and Petitioner has not presented any evidence that a stay would be granted if this proceeding is instituted.” Prelim. Resp. 47. Patent Owner also asserts that the district judge would be unlikely to sever and stay the allegations concerning the ’802 patent when there are other patents involved in the litigation. *Id.* at 46–47. Petitioner argues that the district court has not indicated it will grant or deny a stay, and this factor should be considered neutral. Pet. 101.

We will not attempt to predict how the district court in the parallel district court proceeding would proceed if a stay is requested because the court may determine whether or not to stay any individual case, including the related one, based on a variety of circumstances and facts beyond our control and to which the Board is not privy. *Sand Revolution II, LLC v. Cont’l Intermodal Grp. - Trucking LLC*, IPR2019-01393, Paper 24 at 7 (PTAB June 16, 2020) (informative) (“*Sand Revolution*”). Accordingly, we find that factor 1 is neutral.

2. Fintiv Factor 2: Trial Date in the Parallel Proceeding

Under the second *Fintiv* factor, we consider the “proximity of the court’s trial date to the Board’s projected statutory deadline for a final

written decision.” *Fintiv*, Paper 11 at 6. Petitioner states that “[j]ury selection is scheduled for May 5, 2025, approximately three months before the Board’s FWD deadline.” Pet. 101–102. Patent Owner argues that “the deadline for a final written decision in this IPR is September 14, 2025,” and “[t]he trial date is set for May 5, more than four months⁵ before the FWD deadline here.” Prelim. Resp. 47. Patent Owner also asserts that the district court’s trial date “is consistent with the Federal Court Management Statistics for the Eastern District of Texas,” which “indicate that the average time to trial for the Eastern District of Texas for the 12-month period ending December 31, 2023 is listed as 21.4 months, which is even less than the approximately 23-month period from filing to the trial date set by the district court.” *Id.* at 47–48 (citing Ex. 2002 (trial statistics); Ex. 2003 (docket indicating the complaint was filed on June 6, 2023); Ex. 2001 (docket control order indicating the trial is scheduled for May 5, 2025)).

Because the current trial date in the parallel district court proceeding is approximately four months before the deadline for our final written decision, we find that factor 2 weighs in favor of exercising discretion to deny institution.

3. *Fintiv Factor 3: Investment by the Court and the Parties in the Parallel Proceeding*

Under the third *Fintiv* factor, we consider the “investment in the parallel proceeding by the court and the parties.” *Fintiv*, Paper 11 at 6.

⁵ The discrepancy between the different time frames offered by Petitioner and Patent Owner for the final written decision in this IPR appears to be due to the fact that the Petition was filed on February 26, 2024, but the Board did not issue a Notice of Filing Date Accorded to Petition and Time for Filing Patent Owner Preliminary Response until March 14, 2024. Papers 3, 4.

According to the docket control order from the district court submitted by Patent Owner, claim construction briefing is to commence on October 2, 2024, the claim construction hearing is set for November 13, 2024, fact discovery is set to close on November 22, 2024, and expert discovery is set to close on January 21, 2025. Ex. 2001 (docket control order). Thus, claim construction briefing, the claim construction hearing, the close of fact discovery, and expert discovery will all occur after our institution date in this case, and there is no indication that the district court will have spent significant resources on unpatentability issues in the case by the time of institution. Because of the significant investment that remains in the parallel district court proceeding, we find that factor 3 weighs against exercising discretion to deny institution.

4. Fintiv Factor 4: Overlap Between Issues Raised in the Petition and Parallel Proceeding

Under the fourth *Fintiv* factor, we consider the “overlap between issues raised in the petition and in the parallel proceeding.” *Fintiv*, Paper 11 at 6. Under this factor, Petitioner argues that it “challenges more claims than are being asserted.” Pet. 102. Patent Owner responds that only one claim (claim 25) is challenged in the IPR but not asserted in the district court. Prelim. Resp. 53–54. Patent Owner also acknowledges that the Rick reference is not asserted in the district court, but argues that Petitioner only relies on that reference for one claim in the IPR. *Id.* at 54. We also note that the invalidity contentions in the district court assert many more references and combinations than are asserted in the Petition, including sixteen references that are alleged to anticipate one or more claims of the ’802 patent but are not relied on in the Petition, and at least three obviousness combinations (Suzuki and Brown, various combinations based on Montojo

as primary reference, and various combinations based on Brown as the primary reference) that are not relied on in the Petition. Ex. 2005, 33, 35, 39–40.

Because the Petition and the district court litigation include a number of common issues, as well as significant issues and arguments that differ among the proceedings, we find that this factor is neutral.

5. Fintiv Factor 5: Whether Petitioner is the Defendant in the Parallel Proceeding

Under the fifth *Fintiv* factor, we consider “whether the petitioner and the defendant in the parallel proceeding are the same party.” *Fintiv*, Paper 11 at 6. Here, Petitioner is also the defendant in the parallel district court case. Therefore, we find that factor 5 weighs in favor of exercising discretion to deny institution.

6. Fintiv Factor 6: Other Considerations, Including the Merits

Under the sixth *Fintiv* factor, we consider “other circumstances that impact the Board’s exercise of discretion, including the merits.” *Fintiv*, Paper 11 at 6. As discussed below, we determine that Petitioner has shown a reasonable likelihood of unpatentability at least as to Ground 1. We also determine that, for Ground 1, Petitioner has made a strong showing of unpatentability that rises well above the minimum sufficiency to meet the statutory institution threshold⁶ because: (1) Petitioner presents a strong case that the preamble of claim 1 is not limiting; (2) Petitioner presents a strong case that Rick discloses the limitations in the body of claim 1; and (3) Patent

⁶ In this case, we need not decide whether Petitioner’s showing rises to the level of “compelling” under the Interim *Fintiv* Guidance because, in light of Petitioner’s strong showing as to claim 1, the factors overall weigh in favor of institution.

Owner does not challenge Petitioner's showing that Rick discloses the body of claim 1. Therefore, we find that this factor weighs in favor of institution.

7. *Conclusion*

As noted above, we take “a holistic view of whether efficiency and integrity of the system are best served by denying or instituting review.” *Fintiv*, Paper 11 at 6. Weighing all of the factors, we are not persuaded that the interests of efficiency and integrity of the system would be best served by invoking 35 U.S.C. § 314(a) to deny institution of a potentially meritorious petition, particularly because the parallel district court case is at a relatively early stage and the merits of Ground 1 are strong. Thus, based on the record before us, we determine that the facts of this case do not warrant discretionary denial.

III. CONCLUSION

After considering the evidence and arguments presented in the current record, we determine that Petitioner has demonstrated a reasonable likelihood of success in proving that at least one of the challenged claims of the '802 patent is unpatentable. We therefore institute trial on all challenged claims and grounds raised in the Petition. *See PGS*, 891 F.3d 1354 at 1360 (a decision whether to institute an *inter partes* review “require[s] a simple yes-or-no institution choice respecting a petition, embracing all challenges included in the petition”).

At this stage of the proceeding, we have not made a final determination as to the patentability of any challenged claim or as to the construction of any claim term.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review of claims 1–4, 6–10, 13–14, 17, and 21–25 of the '802 patent is instituted with respect to all grounds set forth in the Petition; and

FURTHER ORDERED that, pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4(b), *inter partes* review of the '802 patent shall commence on the entry date of this Order, and notice is hereby given of the institution of a trial.

IPR2021-00606
Patent 7,924,802 B2

PETITIONER:

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ptong@raklaw.com

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
---	---

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been
 filed in the U.S. District Court Eastern District of Texas on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.);

DOCKET NO. 2:23-cv-00285	DATE FILED 6/16/2023	U.S. DISTRICT COURT Eastern District of Texas
PLAINTIFF COBBLESTONE WIRELESS, LLC		DEFENDANT SAMSUNG ELECTRONICS CO., LTD., SAMSUNG ELECTRONICS AMERICA, INC.,
Format m/d/yyyy		
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 8,891,347	11/18/2014	COBBLESTONE WIRELESS, LLC
2 9,094,888	7/28/2015	COBBLESTONE WIRELESS, LLC
3 10,368,361	7/30/2019	COBBLESTONE WIRELESS, LLC
4 8,554,196	10/8/2013	COBBLESTONE WIRELESS, LLC
5 7,924,802	4/12/2011	COBBLESTONE WIRELESS, LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY	
	☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT		
CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
 Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	WiLinx-P011

CONFIRMATION NO. 8018

40418
HEIMLICH LAW, PC
5671 Santa Teresa Blvd.
Suite 203
SAN JOSE, CA 95123

POWER OF ATTORNEY NOTICE



OC000000071601680

Date Mailed: 04/26/2024

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/24/2024.

- The Power of Attorney to you in this application has been revoked by the applicant. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

/rbell/



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UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	WiLinx-P011

CONFIRMATION NO. 8018

POA ACCEPTANCE LETTER



OC000000071601723

199279

Lowenstein & Weatherwax LLP (Cobblestone)

ATTN: Cobblestone

1016 Pico Blvd

Santa Monica, CA 90405

Date Mailed: 04/26/2024

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/24/2024.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at (571) 272-4000 or (571) 272-4200 or 1-888-786-0101.

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BIB DATA SHEET

CONFIRMATION NO. 8018

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.		
12/018,370	01/23/2008	370	2472	WiLinx-P011		
APPLICANTS INVENTORS Alireza Tarighat-Mehrabani, Marina Del Rey, CA; Rahim Bagheri, Los Angeles, CA; Alireza Mehrnia, Los Angeles, CA; Mahmoud Darvishzadeh, Los Altos Hills, CA;						
** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 02/06/2008						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☒ Yes ☐ No Verified and Acknowledged <u>/AFSAR M QURESHI/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 12	TOTAL CLAIMS 25	INDEPENDENT CLAIMS 4
ADDRESS Lowenstein & Weatherwax LLP (Cobblestone) ATTN: Cobblestone 1016 Pico Blvd Santa Monica, CA 90405 UNITED STATES						
TITLE WIRELESS COMMUNICATION SYSTEMS AND METHODS						
FILING FEE RECEIVED 0.00	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

REEXAMINATION OR SUPPLEMENTAL EXAMINATION – PATENT OWNER POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS FOR REEXAMINATION OR SUPPLEMENTAL EXAMINATION AND PATENT	Control Number(s)	90/019,458
	Filing Date(s)	2024-03-27
	First Named Inventor	Tarighai-Mehrabani
	Title	WIRELESS COMMUNICATION SYSTEMS AND METHODS
	Patent Number	7,924,802
	Examiner Name	David E England
	Attorney Docket No(s)	240419REX-001

I. Power of Attorney. This form may be used to change the Power of Attorney in a reexamination or supplemental examination proceeding (or multiple proceedings where merged). This form may also be used to change the Power of Attorney in the patent file; in such a case, a copy of this form will be placed in both the patent file and the reexamination or supplemental examination proceeding.

A. Revocation of Previous Power of Attorney. I hereby revoke all previous patent owner powers of attorney, if any, given:

- ☒ in the above-identified reexamination or supplemental examination proceeding control number(s) (more than one may be changed only if the proceedings are merged).
- ☒ in the file of the above-identified patent.

(check BOTH boxes if change in BOTH the patent file and the reexamination or supplemental examination proceeding is requested).

B. Designation of Power of Attorney.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) to prosecute the proceeding(s)/patent identified above and selected in section I(A), and to transact all business in the United States Patent and Trademark Office connected therewith:

199279

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the proceeding(s) identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Authorization for the Power of Attorney is provided by the signature on page 2 of this form.

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Please recognize or change the correspondence address for the above-identified reexamination or supplemental examination proceeding control number(s) (more than one may be changed **only** if they are merged proceedings) **and for the file of the above-identified patent** to be:

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OR

☐ The address associated with the Customer Number identified in the box at right:

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Individual
Name

Address

City

State

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NOTE: THE CORRESPONDENCE ADDRESS FOR THE REEXAMINATION OR SUPPLEMENTAL EXAMINATION PROCEEDING CONTROL NUMBER(S) MUST BE THE SAME AS THAT FOR THE PATENT. SEE 37 CFR 1.33.

III. Authorization for Power of Attorney and (if selected) Change of Correspondence Address

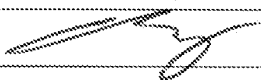
I am the:

☐ inventor, having ownership of the patent being reexamined.

OR

☒ Patent owner.

Statement under 37 CFR 3.73(c) (Form PTO/AiA/96) submitted herewith or filed on _____

Signature of Inventor or Patent Owner		Date	4/23/24
Name	C. Jay Chung	Telephone	323 219 0558
Title and Company	Manager, Cobblestone Wireless LLC		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☒ A total of 2 forms are submitted. If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. The United States Patent and Trademark Office (USPTO) collects the information in this record under authority of 35 U.S.C. 2. The USPTO's system of records is used to manage all applicant and owner information including name, citizenship, residence, post office address, and other information with respect to inventors and their legal representatives pertaining to the applicant's/owner's activities in connection with the invention for which a patent is sought or has been granted. The applicable Privacy Act System of Records Notice for the information collected in this form is COMMERCE/PAT-TM-7 Patent Application Files, available in the Federal Register at 78 FR 19243 (March 29, 2013), <https://www.govinfo.gov/content/pkg/FR-2013-03-29/pdf/2013-07341.pdf>

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Additional USPTO uses of the information in this record may include disclosure to: 1) the International Bureau of the World Intellectual Property Organization, if the record is related to an international application filed under the Patent Cooperation Treaty; 2) the public i) after publication of the application pursuant to 35 U.S.C. 122(b), ii) after issuance of a patent pursuant to 35 U.S.C. 151, iii) if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections, or an issued patent, or iv) without publication of the application or patent under the specific circumstances provided for by 37 CFR 1.14(a)(1)(v)-(vii); and/or 3) the National Archives and Records Administration, for inspection of records.

STATEMENT UNDER 37 CFR 3.73(c)

First Named Inventor/Patent Owner: COBBLESTONE WIRELESS, LLC
Application No./Patent No.: 7,924,802 Filed/Issue Date: 2011-04-12
Titled: WIRELESS COMMUNICATION SYSTEMS AND METHODS
COBBLESTONE WIRELESS, LLC, a Limited Liability Company
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☒ The assignee of the entire right, title, and interest.
2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):
- ☐ The extent (by percentage) of its ownership interest is ____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.
- ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (e.g., bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

- A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached*.
- B. ☒ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: TARIGHAT-MEHRABANI, ALIREZA; BAGHERI, RAHIM; MEHRNIA, ALIREZA; DARVISHZADEH, MAHMOUD To: WILINX CORPORATION

The document was recorded in the United States Patent and Trademark Office at
Reel 020401, Frame 0472, or for which a copy thereof is attached*.

2. From: TARIGHAT-MEHRABANI, ALIREZA; BAGHERI, RAHIM; MEHRNIA, ALIREZA; DARVISHZADEH, MAHMOUD To: WILINX CORPORATION

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[Page 1 of 2]

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-0031. Public burden for this form is estimated to average 12 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email informationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you are a small business, you may, at your option, also select option 2.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: WILINX CORP. To: WILINX CORPORATION

The document was recorded in the United States Patent and Trademark Office at
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4. From: WILINX CORPORATION To: NAVAND TECH CO

The document was recorded in the United States Patent and Trademark Office at
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5. From: NAVAND TECH CO To: COBBLESTONE WIRELESS, LLC

The document was recorded in the United States Patent and Trademark Office at
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6. From: _____ To: _____

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☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ *As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/ Kenneth J. Weatherwax /

2024-04-24

Signature

Date

Kenneth J. Weatherwax

54,528

Printed or Typed Name

Title or Registration Number

Privacy Act Statement

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- 1) law enforcement, in the event that the system of records indicates a violation or potential violation of law;
- 2) a federal, state, local, or international agency, in response to its request;
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- 5) a Member of Congress submitting a request involving an individual to whom the record pertains, when the individual has requested the Member's assistance with respect to the subject matter of the record;
- 6) a court, magistrate, or administrative tribunal, in the course of presenting evidence, including disclosures to opposing counsel in the course of settlement negotiations;
- 7) the Administrator, General Services Administration (GSA), or their designee, during an inspection of records conducted by GSA under authority of 44 U.S.C. 2904 and 2906, in accordance with the GSA regulations and any other relevant (i.e., GSA or Commerce) directive, where such disclosure shall not be used to make determinations about individuals;
- 8) another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c));
- 9) the Office of Personnel Management (OPM) for personnel research purposes; and
- 10) the Office of Management and Budget (OMB) for legislative coordination and clearance.

If you do not furnish the information requested on this form, the USPTO may not be able to process and/or examine your submission, which may result in termination of proceedings, abandonment of the application, and/or expiration of the patent.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Reexam of Patent No. 7,924,802

Confirmation No.: 8018

Control No.: 90/019,458

Group Art Unit: 3992

Filed: March 26, 2024

Examiner: David E. England

For: **WIRELESS COMMUNICATION
SYSTEMS AND METHODS**

Certificate of Service

Mail Stop *Ex Parte* Reexam
Central Reexamination Unit
Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

April 24, 2024

Dear Sir:

In compliance with 37 C.F.R. 1.550(f), the undersigned, on behalf of the Patent Owner, hereby certifies that copies of the following documents are being served on the Third-Party Requester by first class mail on April 24, 2024:

- Power of Attorney
- Statement Under 37 CFR 3.73(c)
- Certificate of Service

The name and address of the party being served is as follows:

Unified Patents, LLC
c/o Steven D. Shipe, Reg. No. 71,944
Barnes & Thornburg LLP
555 12th Street, NW, Suite 1200
Washington D.C. 20006

Respectfully submitted,

/ Kenneth J. Weatherwax /
Kenneth J. Weatherwax (Reg. No. 54,528)
LOWENSTEIN & WEATHERWAX LLP

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
 Stylesheet Version v1.2

EPAS ID: PAT5264282

SUBMISSION TYPE:	NEW ASSIGNMENT	
NATURE OF CONVEYANCE:	ASSIGNMENT	
CONVEYING PARTY DATA		
Name		Execution Date
WILINX CORPORATION		02/27/2015
RECEIVING PARTY DATA		
Name:	NAVAND TECH CO	
Street Address:	6540 LUSK BLVD, STE C259	
City:	SAN DIEGO	
State/Country:	CALIFORNIA	
Postal Code:	92121	
PROPERTY NUMBERS Total: 14		
Property Type	Number	
Patent Number:	7263342	
Patent Number:	7271668	
Patent Number:	7924802	
Patent Number:	7289783	
Patent Number:	7298183	
Patent Number:	7304550	
Patent Number:	7365617	
Patent Number:	8169266	
Patent Number:	7372335	
Patent Number:	8179167	
Patent Number:	7403048	
Patent Number:	7477885	
Patent Number:	7522898	
Patent Number:	7941475	
CORRESPONDENCE DATA		
Fax Number:		
<i>Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.</i>		
Phone:	858-449-0729	
Email:	ghobad@heidari.us	

Correspondent Name:	NAVAND TECH CO
Address Line 1:	6540 LUSK BLVD, STE C259
Address Line 4:	SAN DIEGO, CALIFORNIA 92121
NAME OF SUBMITTER:	GHOBAD HEIDARI
SIGNATURE:	/GHOBAD HEIDARI/
DATE SIGNED:	12/04/2018
	This document serves as an Oath/Declaration (37 CFR 1.63).
Total Attachments: 2 source=PATENT ASSIGNMENT AGREEMENT-signed#page1.tif source=PATENT ASSIGNMENT AGREEMENT-signed#page2.tif	

PATENT ASSIGNMENT AGREEMENT

WiLinx Corporation ("Assignor") is the current owner of the U.S. Patents tabulated below (the "Patents"):

	Patent #	Patent Title	Grant Date
1	7,263,342	High frequency wireless receiver circuits and methods	August 28, 2007
2	7,271,668	Mixer circuits and methods with improved spectral purity	April 14, 2005
3	7,924,802	Wireless communication systems and methods	April 12, 2011
4	7,289,783	Mixer circuits and methods with matched bias currents	October 30, 2007
13	7,298,183	High frequency divider circuits and methods	June 2, 2005
5	7,304,550	Wideband attenuator circuits and methods	December 4, 2007
6	7,365,617	Wideband attenuator circuits and methods	April 29, 2008
7	8,169,266	Mixer circuits and methods	May 1, 2012
8	7,372,335	Wideband circuits and methods	May 13, 2008
11	8,179,167	Wide bandwidth fast hopping frequency synthesizer circuits and methods	May 15, 2012
12	7,403,048	Divider circuits and methods using in-phase and quadrature signals	June 1, 2005
9	7,477,885	DC offset cancellation circuits and methods	January 13, 2009
10	7,522,898	High frequency synthesizer circuits and methods	April 21, 2009
14	7,941,475	Programmable filter circuits and methods	May 10, 2011

Navand Tech, Co. ("Assignee") desires to acquire rights in and to the Patents.

Therefore, for valuable consideration, the receipt of which is acknowledged, Assignor assigns to Assignee 100% of Assignor's right, title and interest in the inventions and Patents to Assignee for the entire term of the Patent and any reissues or extensions and for the entire terms of any patents, reissues or extensions that may issue from foreign applications, divisions, continuations in whole or part or substitute applications filed claiming the benefit of the Patent. The right, title and interest conveyed in this Assignment is to be held and enjoyed by Assignee and Assignee's successors as fully and exclusively as it would have been held and enjoyed by Assignor had this assignment not been made.

Assignor further agrees to: (a) cooperate with Assignee in the protection of the patent rights and prosecution and protection of foreign counterparts; (b) execute, verify, acknowledge and deliver all such further papers, including patent applications and instruments of transfer; and (c) perform such other acts as Assignee lawfully may request to obtain or maintain the Patent and any and all applications and registrations for the invention in any and all countries.

Assignor hereby authorizes and requests the Commissioner of Patents and Trademarks of the United States, and any official of any country or countries foreign to the United States, whose duty is to issue patents to issue the same to Assignee, its successors, legal representatives and assigns, in accordance with the terms of this instrument.

Assignor hereby represents and covenants that it has the full right to convey the entire interest herein assigned, and the Assignor has not executed, and will not execute, any agreement in conflict herewith.

ASSIGNOR

By:

Babak Razi

Name:

Babak Razi

Title:

Managing Partner - Atosh Ventures

Company:

WiLinx Corporation

Date:

2-27-15

State of

CALIFORNIA

)

County of

LOS ANGELES

)

) ss

I, the undersigned, a Notary Public in and for said County, in the State aforesaid, DO HEREBY CERTIFY THAT BABAK CYRUS RAZI personally known to me to be the same person whose name is subscribed to the foregoing instrument, appeared before me this day in person, and acknowledged that He signed, sealed and delivered the said instrument as his/her/their free and voluntary act, for the uses and purposes therein set forth.

Given under my hand and notarial seal this 27th day of FEB, 20 15.

[Signature]

Signature of Notary Public

(Seal)

DANIEL BRADFORD

Printed Name of Notary



My commission expires on OCTOBER 15, 20 18.





UNITED STATES PATENT AND TRADEMARK OFFICE

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Alexandria, Virginia 22313-1450
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/018,370	04/12/2011	7924802	WiLinx-P011	8018

40418 7590 03/23/2011
HEIMLICH LAW
5952 DIAL WAY
SAN JOSE, CA 95129

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment is 718 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site <http://pair.uspto.gov> for additional applicants):

Alireza Tarighat-Mehrabani, Marina Del Rey, CA;
Rahim Bagheri, Los Angeles, CA;
Alireza Mehrnia, Los Angeles, CA;
Mahmoud Darvishzadeh, Los Altos Hills, CA;



03/08/2011 16:48 7604317418

WILINX

PAGE 01/02

PART B - FEES/ TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: **Mail** Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or **Fax** (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

68155 7590 12/22/2010

FOUNTAINHEAD LAW GROUP, PC
Chad R. Walsh
900 LAFAYETTE STREET
SUITE 301
SANTA CLARA, CA 95050

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Rahim Bagheri (Depositor's name)
Rahim Bagheri (Signature)
03/08/2011 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/018,370	01/23/2008	Alireza Tanghat-Mehrabani	000007-001100US	8018

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEMS AND METHODS

APPL. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	03/22/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
QURESHI, AISAR M	2472	370-343000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.303).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB47, Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

Wilinx Corporation

(B) RESIDENCE (CITY AND STATE OR COUNTRY)

Carlsbad, California

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies

4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(3).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature

Rahim Bagheri

Date

March 8, 2011

Typed or printed name

Registration No.

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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PTOL-85 (Rev. 08/07) Approved for use through 08/31/2010.

OMB 0651-0033

U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

03/09/2011 CCHAU2 00000034 12018370
755.00 DP
300.00 DP
01 FC:2501
02 FC:1504



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	000007-001100US

CONFIRMATION NO. 8018

POWER OF ATTORNEY NOTICE



68155
FOUNTAINHEAD LAW GROUP, PC
Chad R. Walsh
900 LAFAYETTE STREET
SUITE 301
SANTA CLARA, CA 95050

Date Mailed: 02/28/2011

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/24/2011.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/tcouch/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	000007-001100US

CONFIRMATION NO. 8018

POA ACCEPTANCE LETTER

40418
HEIMLICH LAW
5952 DIAL WAY
SAN JOSE, CA 95129



Date Mailed: 02/28/2011

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/24/2011.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/tcouch/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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Bib Data Sheet

CONFIRMATION NO. 8018

SERIAL NUMBER 12/018,370	FILING OR 371(c) DATE 01/23/2008 RULE	CLASS 370	GROUP ART UNIT 2472	ATTORNEY DOCKET NO. 000007-001100US
APPLICANTS Alireza Tarighat-Mehrabani, Marina Del Rey, CA; Rahim Bagheri, Los Angeles, CA; Alireza Mehrnia, Los Angeles, CA; Mahmoud Darvishzadeh, Los Altos Hills, CA;				
** CONTINUING DATA *****				
** FOREIGN APPLICATIONS *****				
IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** SMALL ENTITY ** ** 02/06/2008				
Foreign Priority claimed ☐ yes ☐ no 35 USC 119 (a-d) conditions ☐ yes ☐ no ☐ Met after met Allowance		STATE OR COUNTRY CA	SHEETS DRAWING 12	TOTAL CLAIMS 25
Verified and Acknowledged Examiner's Signature _____ Initials _____				INDEPENDENT CLAIMS 4
ADDRESS 40418				
TITLE WIRELESS COMMUNICATION SYSTEMS AND METHODS				
FILING FEE RECEIVED 665	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:		☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit	

POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS	Application Number	12018370
	Filing Date	2008-01-29
	First Named Inventor	A. Tarighat-Mehrabi
	Title	Wireless Communication Systems and Methods
	Art Unit	2472
	Examiner Name	Afsar M. Qureshi
Attorney Docket Number		

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

40418

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Please recognize or change the correspondence address for the above-identified application to:

☐ The address associated with the above-mentioned Customer Number.

OR

☒ The address associated with Customer Number:

40418

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the:

☐ Applicant/Inventor.

OR

☒ Assignee of record of the entire interest. See 37 CFR 3.71.

Statement under 37 CFR 3.73(b) (Form PTO/SB/56) submitted herewith or filed on _____

SIGNATURE of Applicant or Assignee of Record

Signature	<i>Rahim Bagheri</i>	Date	02/22/11
Name	Rahim Bagheri	Telephone	760-710-3075
Title and Company	President/CTO WiLinx Corporation		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1480, Alexandria, VA 22313-1480. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1480, Alexandria, VA 22313-1480.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

COPY

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PTO/SB/96 (01-08)

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U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Alireza Tarighat-Mehrabani et al.

Application No./Patent No.: Not assigned Filed/Issue Date: Herewith

Entitled: Wireless Communication Systems and Methods

Willix Corp., a California Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is _____ %)

In the patent application/patent identified above by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

[Signature]
Signature

Jan 04, 2008
Date

Masoud Dastari
Printed or Typed Name

310-571-1701
Telephone Number

CEO
Title

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

COPY

Attorney Docket No.: 000007-001100US

ASSIGNMENT OF PATENT APPLICATION

JOINT

WHEREAS, Alireza Tarighat-Mehrabani, a citizen of Iran, residing at 13914 Bora Bora Way #D205, Marina Del Rey, CA 90292; Rahim Bagheri, a citizen of Iran, residing at 1317 S. Westgate Ave., #302, Los Angeles, CA 90025; Alireza Mehrnia, a citizen of Iran, residing at 3240 Sawtelle Blvd #207, Los Angeles, CA 90066; and Mahmoud Darvishzadeh a citizen of the United Kingdom, residing at 24612 Olive Tree Lane, Los Altos Hills, CA 94024, hereinafter referred to as "Assignors," are the inventors of the invention described and set forth in the below-identified application for United States Letters Patent:

Title of Invention: Wireless Communication Systems and Methods

Date(s) of execution of Declaration: 01/04/08, 01/03/08; and

Filing Date: 01/23/08

WHEREAS, WiLinx Corp., a corporation of the state of California, located at 12400 Wilshire Blvd., Ste. 370, Los Angeles, CA. 90025, hereinafter referred to as "ASSIGNEE," is desirous of acquiring an interest in the invention and application and in any U.S. Letters Patent and Registrations which may be granted on the same;

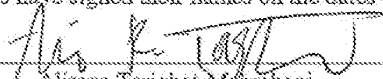
For good and valuable consideration, receipt of which is hereby acknowledged by Assignors, Assignors have assigned, and by these presents do assign to Assignee all right, title and interest in and to the invention and application and to all foreign counterparts (including patent, utility model and industrial designs), and in and to any Letters Patent and Registrations which may hereafter be granted on the same in the United States and all countries throughout the world, and to claim the priority from the application as provided by the Paris Convention. The right, title and interest is to be held and enjoyed by Assignee and Assignee's successors and assigns as fully and exclusively as it would have been held and enjoyed by Assignors had this Assignment not been made, for the full term of any Letters Patent and Registrations which may be granted thereon, or of any division, renewal, continuation in whole or in part, substitution, conversion, reissue, prolongation or extension thereof.

Assignors further agree that they will, without charge to Assignee, but at Assignee's expense, (a) cooperate with Assignee in the prosecution of U.S. Patent applications and foreign counterparts on the invention and any improvements, (b) execute, verify, acknowledge and deliver all such further papers, including patent applications and instruments of transfer, and (c) perform such other acts as Assignee lawfully may request to obtain or maintain Letters Patent and Registrations for the invention and improvements in any and all countries, and to vest title thereto in Assignee, or Assignee's successors and assigns.

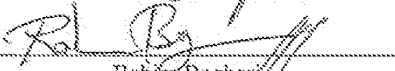
Assignors hereby authorize and request Chad R. Walsh of Fountainhead Law Group P.C., 900 Lafayette St., Ste. 509, Santa Clara, CA 95050, to insert herein above the date of execution of declaration and filing date of said application when known.

IN TESTIMONY WHEREOF, Assignors have signed their names on the dates indicated.

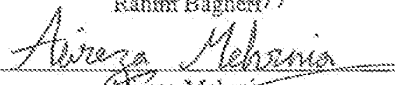
Dated: Jan 4th, 2008


Alireza Tarighat-Mehrabani

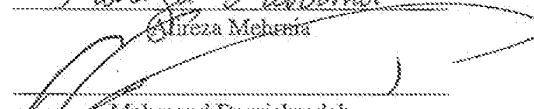
Dated: Jan 4th, 2008


Rahim Bagheri

Dated: Jan 3, 2008


Alireza Mehrnia

Dated: Jan 2, 2008


Mahmoud Darvishzadeh

Electronic Acknowledgement Receipt	
EFS ID:	9524902
Application Number:	12018370
International Application Number:	
Confirmation Number:	8018
Title of Invention:	WIRELESS COMMUNICATION SYSTEMS AND METHODS
First Named Inventor/Applicant Name:	Alireza Tarighat-Mehrabani
Customer Number:	68155
Filer:	Chad Richard Walsh/Velma Hernandez
Filer Authorized By:	Chad Richard Walsh
Attorney Docket Number:	000007-001100US
Receipt Date:	24-FEB-2011
Filing Date:	23-JAN-2008
Time Stamp:	15:00:53
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
------------------------	----

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		7-1100_POA_Statement.pdf	754776 1036b57bb86877935d2838b55bd2fe32b1c899b3	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	Start	End
	Power of Attorney	1	1
	Assignee showing of ownership per 37 CFR 3.73(b).	2	3
Warnings:			
Information:			
Total Files Size (in bytes):		754776	
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.			



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NOTICE OF ALLOWANCE AND FEE(S) DUE

68155 7590 12/22/2010

FOUNTAINHEAD LAW GROUP, PC
Chad R. Walsh
900 LAFAYETTE STREET
SUITE 301
SANTA CLARA, CA 95050

EXAMINER

QURESHI, AFSAR M

ART UNIT

PAPER NUMBER

2472

DATE MAILED: 12/22/2010

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	000007-001100US	8018

TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEMS AND METHODS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	03/22/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
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or Fax (571)-273-2885**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

68155 7590 12/22/2010

FOUNTAINHEAD LAW GROUP, PC
Chad R. Walsh
900 LAFAYETTE STREET
SUITE 301
SANTA CLARA, CA 95050

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	000007-001100US	8018
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TITLE OF INVENTION: WIRELESS COMMUNICATION SYSTEMS AND METHODS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	YES	\$755	\$300	\$0	\$1055	03/22/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
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QURESHI, AFSAR M	2472	370-343000
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1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	000007-001100US	8018
68155	7590	12/22/2010	EXAMINER	
FOUNTAINHEAD LAW GROUP, PC Chad R. Walsh 900 LAFAYETTE STREET SUITE 301 SANTA CLARA, CA 95050			QURESHI, AFSAR M	
			ART UNIT	PAPER NUMBER
			2472	
			DATE MAILED: 12/22/2010	

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 639 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 639 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability	Application No.	Applicant(s)	
	12/018,370	TARIGHAT-MEHRABANI ET AL.	
	Examiner	Art Unit	
	AFSAR M. QURESHI	2472	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to application rcvd. 1/23/2008.

2. ☒ The allowed claim(s) is/are 1-25.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some* c) ☐ None of the:
 1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
 * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
 (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
 (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892) 2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) 3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____ 4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material	5. ☐ Notice of Informal Patent Application 6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ 7. ☐ Examiner's Amendment/Comment 8. ☒ Examiner's Statement of Reasons for Allowance 9. ☐ Other _____.
---	--

/Afsar M Qureshi/ Primary Examiner, Art Unit 2472	12/3/2010
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1. This Office Action is responsive to application received on 1/23/2008.

Claims 1-25 are pending in the application

Reason for Allowance

2. Claims 1-25 are allowed over prior art of record

The following is an examiner's statement of reasons for allowance:

The current invention relates to improving method of transmitting information in a wireless communication system in that frequency difference between first center frequency and a second center frequency is greater than the sum of one-half the frequency range and one-half the second frequency range, first and second information are transmitted using same power amplifier in wireless transmitter wherein bandwidth of power amplifier is greater than the difference between the first lowest frequency and the second highest frequency. The closest prior art of record, Hinson (us 2003/0016701) and Zhang (US 2008/0225761), are in the same field of endeavor, fails to disclose the inventive method steps of "simultaneously transmitting second information across a second frequency range using same wireless transmitter, same frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency (claim 1); Up-converting first analog signal, second analog signal to a second RF center frequency greater than first center RF frequency to produce a second up-converted analog signal wherein the frequency difference between the RF center frequency and the second RF center frequency is greater than the sum of one-half the first frequency range and one-half the second

frequency range (claims 10 and 17); and first and a second downconverter to receive up-converted signal outputting down-converted signal modulated at the RF frequency wherein a filter receiving down-converted signals (claim 24)".

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AFSAR M. QURESHI whose telephone number is (571)272-3178. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Trost can be reached on (571) 272 7872. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

12/3/2010

/Afsar M Qureshi/
Primary Examiner
Art Unit 2472

Notice of References Cited	Application/Control No. 12/018,370	Applicant(s)/Patent Under Reexamination TARIGHAT-MEHRABANI ET AL.	
	Examiner AFSAR M. QURESHI	Art Unit 2472	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2003/0016701	01-2003	Hinson, Scott R.	370/480
*	B	US-2008/0225761	09-2008	Zhang, Ning	370/310
*	C	US-2008/0227424	09-2008	Muhammad et al.	455/341
*	D	US-2003/0020651	01-2003	Crilly et al.	342/378
*	E	US-5,884,181	03-1999	Arnold et al.	455/450
*	F	US-5,832,044	11-1998	Sousa et al.	375/347
*	G	US-2008/0139132	06-2008	Pan et al.	455/93
*	H	US-7,515,652	04-2009	Jensen, Henrik T.	375/308
*	I	US-6,920,185	07-2005	Hinson, Scott R.	375/295
*	J	US-7,805,119	09-2010	Gur et al.	455/205
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.



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BIB DATA SHEET

CONFIRMATION NO. 8018

SERIAL NUMBER 12/018,370	FILING or 371(c) DATE 01/23/2008 RULE	CLASS 370	GROUP ART UNIT 2472	ATTORNEY DOCKET NO. 000007-001100US		
APPLICANTS Alireza Tarighat-Mehrabani, Marina Del Rey, CA; Rahim Bagheri, Los Angeles, CA; Alireza Mehrnia, Los Angeles, CA; Mahmoud Darvishzadeh, Los Altos Hills, CA; ** CONTINUING DATA ***** ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 02/06/2008						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☒ Yes ☐ No Verified and Acknowledged <u>/AFSAR M QURESHI/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 12	TOTAL CLAIMS 25	INDEPENDENT CLAIMS 4
ADDRESS FOUNTAINHEAD LAW GROUP, PC Chad R. Walsh 900 LAFAYETTE STREET SUITE 301 SANTA CLARA, CA 95050 UNITED STATES						
TITLE Wireless Communication Systems and Methods						
FILING FEE RECEIVED 665	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L2	867	Alireza.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:29
L3	0	2 and ((transmit\$4 same inforamtion) same (first and second))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:31
L4	0	2 and "wireless communication systems and Methods". ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:32
L5	34	Bagheri adj Rahim.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:32
L6	0	5 and (informtion same (first adj frequency)). clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:37
L7	0	5 and "wireless communication systems and Methods". ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:37
L9	19	Mehrnia adj alireza.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:38

L10	0	9 and "wireless communication systems and Methods". ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:38
L11	0	9 and (information same (first adj frequency)). clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:38
L12	1	Darvishzadeh adj Mahmoud.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:39
L13	0	12 and (information same (first adj frequency)).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:39
L14	6	Tarighat-Mehrabani adj Alireza.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:40
L15	1	14 and ((simultaneously same second) same information)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:40
L16	0	14 and ((simultaneously same second) same information).clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:40

12/ 5/ 2010 2:41:19 PM

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Issue Classification *1201837 0*	Application/Control No. 12/018,370	Applicant(s)/Patent under Reexamination TARIGHAT-MEHRABANI ET AL.	
	Examiner AFSAR M. QURESHI	Art Unit 2472	

ISSUE CLASSIFICATION									
ORIGINAL					CROSS REFERENCE(S)				
CLASS		SUBCLASS			CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)			
370		343			370	352			
INTERNATIONAL CLASSIFICATION					375	295			
H	0	4	J	1/00	348	E7.052			
H	0	4	B	7/00	455	93			
H	0	4	Q	7/20					
				/					
				/					
(Assistant Examiner) (Date)					/Afsar M. Qureshi/, AU 2472 12/3/2010			Total Claims Allowed: 25	
(Legal Instruments Examiner) (Date)								O.G. Print Claim(s) 1	O.G. Print Fig. 2
					(Primary Examiner) (Date)				

☒ Claims renumbered in the same order as presented by applicant										☐ CPA		☐ T.D.		☐ R.1.47	
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original		
1	1		31		61		91		121		151		181		
2	2		32		62		92		122		152		182		
3	3		33		63		93		123		153		183		
4	4		34		64		94		124		154		184		
5	5		35		65		95		125		155		185		
6	6		36		66		96		126		156		186		
7	7		37		67		97		127		157		187		
8	8		38		68		98		128		158		188		
9	9		39		69		99		129		159		189		
10	10		40		70		100		130		160		190		
11	11		41		71		101		131		161		191		
12	12		42		72		102		132		162		192		
13	13		43		73		103		133		163		193		
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17	17		47		77		107		137		167		197		
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22	22		52		82		112		142		172		202		
23	23		53		83		113		143		173		203		
24	24		54		84		114		144		174		204		
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	26		56		86		116		146		176		206		
	27		57		87		117		147		177		207		
	28		58		88		118		148		178		208		

	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

U.S. Patent and Trademark Office

Part of Paper No. 20101205

Search Notes *12018370*	Application/Control No. 12/018,370	Applicant(s)/Patent under Reexamination TARIGHAT-MEHRABANI ET AL.	
	Examiner AFSAR M. QURESHI	Art Unit 2472	

SEARCHED			
Class	Subclass	Date	Examiner
370	308,310 343,352 353-356 480-486	12/3/2010	AQ
375	135-297	12/3/2010	AQ
375	372,347	12/3/2010	AQ
375	E7.267	12/3/2010	AQ
455	93,127.1	12/3/2010	AQ
455	102,132	12/3/2010	AQ
455	313-341	12/3/2010	AQ
341	155	12/3/2010	AQ
348	E7.052	12/3/2010	AQ
348	E7.094	12/3/2010	AQ

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
370	352,343	12/3/2010	AQ
375	295	12/3/2010	AQ
455	93	12/3/2010	AQ
348/E7.052		12/3/2010	AQ

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
EAST, WEST, EPO, IEEE, USPAT, USOCR, PgPub, Google, JPO, FAST	12/3/2010	AQAQ
Interferene search included	12/3/2010	AQ

Index of Claims *12018370*		Application/Control No. 12/018,370		Applicant(s)/Patent under Reexamination TARIGHAT-MEHRABANI ET AL.	
		Examiner AFSAR M. QURESHI		Art Unit 2472	

√	Rejected	—	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
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Claim		Date						
Final	Original	12/3/10						
1	1	=						
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EAST Search History**EAST Search History (Prior Art)**

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L2	867	Alireza.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:29
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L5	34	Bagheri adj Rahim.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:32
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EAST Search History**EAST Search History (Prior Art)**

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L6	1865	((communication adj systems) same (wireless or cellular)).ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 16:06
L7	239	L6 and ("analog to digital converter" or ADC or modem)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 16:06
L8	0	7 and ("up-convert\$3" same (digital adj signal))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 16:07
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S5	34	Bagheri adj Rahim.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:32

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S9	19	Mehrnia adj alireza.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:38
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S18	1865	((communication adj systems) same (wireless or cellular)).ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:43
S19	1935	((communication adj systems) same (wireless or cellular or RF)).ti.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:43
S20	88	S19 and (transmission adj channel\$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:43
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S22	148	S19 and (wireless adj5 transmitter)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:46

S23	68	S22 and (first same frequency)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:46
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S27	0	S25 and (transmit\$4 same (common adj transmitter))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/12/05 14:48
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EAST Search History**EAST Search History (Interference)**

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
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L18	0	17 and ((simultaneously adj transmit\$4) same (second adj frequency)).clm.	USPAT; UPAD	OR	OFF	2010/12/05 16:24
L19	0	((simultaneously adj transmit\$4) same (second adj frequency)).clm.	USPAT; UPAD	OR	OFF	2010/12/05 16:25
L20	402	17 and "370"/\$.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:25
L21	30	20 and 370/352-356,343.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:25
L22	7	21 and "375"/\$.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:26
L23	0	22 and 375/135,295.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:26
L24	0	22 and 375/135,229,280,281295,297,372,347.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:27
L25	1	22 and "455"/\$.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:27
L26	0	25 and (convert\$3 and (analog and digital)).clm.	USPAT; UPAD	OR	OFF	2010/12/05 16:29
L28	0	21 and 348/E7.052.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:30
L29	0	21 and 348/E7.094.ccls.	USPAT; UPAD	OR	OFF	2010/12/05 16:30

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/018,370	01/23/2008	Alireza Tarighat-Mehrabani	000007-001100US

CONFIRMATION NO. 8018

68155
FOUNTAINHEAD LAW GROUP, PC
900 LAFAYETTE STREET
SUITE 200
SANTA CLARA, CA 95050

PUBLICATION NOTICE



OC000000037045721

Title:Wireless Communication Systems and Methods

Publication No.US-2009-0185545-A1

Publication Date:07/23/2009

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently <http://www.uspto.gov/patft/>.

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Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO.	TOT CLAIMS	IND CLAIMS
12/018,370	01/23/2008	2621	665	000007-001100US	25	4

CONFIRMATION NO. 8018

68155
FOUNTAINHEAD LAW GROUP, PC
900 LAFAYETTE STREET
SUITE 509
SANTA CLARA, CA 95050

FILING RECEIPT



OC000000028162833

Date Mailed: 02/11/2008

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Alireza Tarighat-Mehrabani, Marina Del Rey, CA;
Rahim Bagheri, Los Angeles, CA;
Alireza Mehrnia, Los Angeles, CA;
Mahmoud Darvishzadeh, Los Altos Hills, CA;

Assignment For Published Patent Application

WiLinx, Corp., Los Angeles, CA

Power of Attorney: The patent practitioners associated with Customer Number 68155

Domestic Priority data as claimed by applicant

Foreign Applications

If Required, Foreign Filing License Granted: 02/06/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/018,370**

Projected Publication Date: 07/23/2009

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

Wireless Communication Systems and Methods

Preliminary Class

386

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

UTILITY PATENT APPLICATION TRANSMITTAL (Only for new nonprovisional applications under 37 CFR 1.53(b))	Attorney Docket No.	000007-001100US
	First Inventor	Tarighat-Mehrabani et al.
	Title	Wireless Communication Systems
	Express Mail Label No.	

APPLICATION ELEMENTS See MPEP chapter 600 concerning utility patent application contents.	ADDRESS TO: Commissioner for Patents P.O. Box 1450 Alexandria VA 22313-1450																
1. ☐ Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original and a duplicate for fee processing) 2. ☒ Applicant claims small entity status. See 37 CFR 1.27. 3. ☒ Specification [Total Pages <u>26</u>] Both the claims and abstract must start on a new page (For information on the preferred arrangement, see MPEP 608.01(a)) 4. ☒ Drawing(s) (35 U.S.C. 113) [Total Sheets <u>12</u>] 5. Oath or Declaration [Total Sheets <u>2</u>] a. ☒ Newly executed (original or copy) b. ☐ A copy from a prior application (37 CFR 1.63(d)) (for continuation/divisional with Box 18 completed) i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b). 6. ☒ Application Data Sheet. See 37 CFR 1.76 7. ☐ CD-ROM or CD-R in duplicate, large table or Computer Program (Appendix) ☐ Landscape Table on CD 8. Nucleotide and/or Amino Acid Sequence Submission (if applicable, items a. – c. are required) a. ☐ Computer Readable Form (CRF) b. ☐ Specification Sequence Listing on: i. ☐ CD-ROM or CD-R (2 copies); or ii. ☐ Paper c. ☐ Statements verifying identity of above copies	ACCOMPANYING APPLICATION PARTS 9. ☐ Assignment Papers (cover sheet & document(s)) Name of Assignee _____ 10. ☒ 37 CFR 3.73(b) Statement ☒ Power of Attorney (when there is an assignee) 11. ☐ English Translation Document (if applicable) 12. ☐ Information Disclosure Statement (PTO/SB/08 or PTO-1449) ☐ Copies of citations attached 13. ☐ Preliminary Amendment 14. ☐ Return Receipt Postcard (MPEP 503) (Should be specifically itemized) 15. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed) 16. ☐ Nonpublication Request under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent. 17. ☐ Other: _____																
18. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76: ☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.: _____ Prior application information: Examiner: _____ Art Unit: _____																	
19. CORRESPONDENCE ADDRESS																	
☒ The address associated with Customer Number: <u>68155</u> OR ☐ Correspondence address below																	
<table border="1"><tr><td>Name</td><td colspan="3"></td></tr><tr><td>Address</td><td colspan="3"></td></tr><tr><td>City</td><td>State</td><td>Zip Code</td><td></td></tr><tr><td>Country</td><td>Telephone</td><td>Email</td><td></td></tr></table>		Name				Address				City	State	Zip Code		Country	Telephone	Email	
Name																	
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City	State	Zip Code															
Country	Telephone	Email															
<table border="1"><tr><td>Signature</td><td></td><td>Date</td><td><u>1/23/2008</u></td></tr><tr><td>Name (Print/Type)</td><td>Chad R. Walsh</td><td>Registration No. (Attorney/Agent)</td><td>43,235</td></tr></table>		Signature		Date	<u>1/23/2008</u>	Name (Print/Type)	Chad R. Walsh	Registration No. (Attorney/Agent)	43,235								
Signature		Date	<u>1/23/2008</u>														
Name (Print/Type)	Chad R. Walsh	Registration No. (Attorney/Agent)	43,235														

This collection of information is required by 37 CFR 1.53(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Application Data Sheet

Application Information

Application number::

Filing Date::

Application Type:: Regular

Subject Matter:: Utility

Suggested classification::

Suggested Group Art Unit::

CD-ROM or CD-R??:

Number of CD disks::

Number of copies of CDs::

Sequence Submission::

Computer Readable Form (CRF)?::

Number of copies of CRF::

Title:: Wireless Communication Systems and Methods

Attorney Docket Number:: 000007-001100US

Request for Early Publication:: No

Request for Non-Publication:: No

Suggested Drawing Figure:: 5

Total Drawing Sheets:: 12

Small Entity?:: Yes

Latin name::

Variety denomination name::

Petition included?:: No

Petition Type::

Licensed US Govt. Agency::

Contract or Grant Numbers One::

Secrecy Order in Parent Appl.: No

Applicant Information

Applicant Authority Type:: Inventor
Primary Citizenship Country:: Iran
Status:: Full Capacity
Given Name:: Alireza
Middle Name::
Family Name:: Tarighat-Mehrabani
Name Suffix::
City of Residence:: Marina Del Rey
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 13914 Bora Bora Way #D205
City of Mailing Address:: Marina Del Rey
State or Province of mailing address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 90292

Applicant Authority Type:: Inventor
Primary Citizenship Country:: Iran
Status:: Full Capacity
Given Name:: Rahim
Middle Name::
Family Name:: Bagheri
Name Suffix::
City of Residence:: Los Angeles
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 1317 S. Westgate Ave., # 302
City of Mailing Address:: Los Angeles
State or Province of mailing address:: CA

Country of mailing address:: US
Postal or Zip Code of mailing address:: 90025

Applicant Authority Type:: Inventor
Primary Citizenship Country:: Iran
Status:: Full Capacity
Given Name:: Alireza
Middle Name::
Family Name:: Mehrnia
Name Suffix::
City of Residence:: Los Angeles
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 3240 Sawtelle Blvd., # 207
City of Mailing Address:: Los Angeles
State or Province of mailing address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 90066

Applicant Authority Type:: Inventor
Primary Citizenship Country:: United Kingdom
Status:: Full Capacity
Given Name:: Mahmoud
Middle Name::
Family Name:: Darvishzadeh
Name Suffix::
City of Residence:: Los Altos Hills
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 24612 Olive Tree Lane
City of Mailing Address:: Los Altos Hills

State or Province of mailing address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 94024

Correspondence Information

Name:: Chad R. Walsh, Fountainhead Law Group P.C.
Street or mailing address:: 900 Lafayette St., Suite 509
City of mailing address:: Santa Clara
State or Province of mailing address:: CA
Postal or Zip Code of mailing address:: 95050
Telephone:: (408) 244-6319

Representative Information

Representative Customer Number:: 000068155

Domestic Priority Information

Application:: Continuity Type:: Parent Application:: Parent Filing Date::

Foreign Priority Information

Country:: Application number:: Filing Date::

Assignee Information

Assignee Name:: WiLinx, Corp.
Street of mailing address:: 12400 Wilshire Blvd., Suite #370
City of mailing address:: Los Angeles
State or Province of mailing address:: CA
Country of mailing address:: USA
Postal or Zip Code of mailing address:: 90025

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**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76)**

Title of Invention	Wireless Communication Systems and Methods
-------------------------------	---

As the below named inventor(s), I/we declare that:

This declaration is directed to:

- ☒ The attached application, or
- ☐ Application No. _____ filed on _____
- ☐ As amended on _____ (if applicable);

I/we believe that I/we am/are the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought;

I/we have reviewed and understand the contents of the above-identified application, including the claims, as amended by any amendment specifically referred to above;

I/we acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me/us to be material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

All statements made herein of my/our own knowledge are true, all statements made herein on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001, and may jeopardize the validity of the application or any patent issuing thereon.

FULL NAME OF INVENTOR(S)	
Inventor one: <u>Alireza Tarighat-Mehrabani</u>	Date: <u>Jan 4th, 2008</u>
Signature: <u>[Signature]</u>	Citizen of: <u>Iran</u>
Inventor two: <u>Rahim Bagheri</u>	Date: <u>Jan 4th/08</u>
Signature: <u>[Signature]</u>	Citizen of: <u>Iran</u>
☒ Additional inventors or a legal representative are being named on _____ additional form(s) attached hereto.	

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 1 minute to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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DECLARATION	ADDITIONAL INVENTOR(S) Supplemental Sheet
Page <u>2</u> of <u>2</u>	

Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Alireza		Mehrnia	
Inventor's Signature <i>Alireza Mehnria</i>		Date <i>Jan 3, 2008</i>	
Los Angeles Residence: City	CA State	United States Country	Iran Citizenship
3240 Sawtelle Blvd #207			
Mailing Address			
Los Angeles City	CA State	90066 Zip	United States Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Mahmoud		Daryishzadeh	
Inventor's Signature <i>[Signature]</i>		Date <i>Jan 3 2008</i>	
Los Altos Hills Residence: City	CA State	United States Country	United Kingdom Citizenship
24612 Olive Tree Lane			
Mailing Address			
Los Altos Hills City	CA State	94024 Zip	United States Country
Name of Additional Joint Inventor, if any:		☐ A petition has been filed for this unsigned inventor	
Given Name (first and middle (if any))		Family Name or Surname	
Inventor's Signature		Date	
Residence: City	State	Country	Citizenship
Mailing Address			
City	State	Zip	Country

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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POWER OF ATTORNEY and CORRESPONDENCE ADDRESS INDICATION FORM

Application Number	Unassigned
Filing Date	Herewith
First Named Inventor	Alireza Tarighat-Mehrabani et al.
Title	Wireless Communication
Art Unit	Unassigned
Examiner Name	Unassigned
Attorney Docket Number	000007-001100US

I hereby revoke all previous powers of attorney given in the above-identified application.

I hereby appoint:

☒ Practitioners associated with the Customer Number:

68155

OR

☐ Practitioner(s) named below:

Name	Registration Number

as my/our attorney(s) or agent(s) to prosecute the application identified above, and to transact all business in the United States Patent and Trademark Office connected therewith.

Please recognize or change the correspondence address for the above-identified application to:

☒ The address associated with the above-mentioned Customer Number:

OR

☐ The address associated with Customer Number:

OR

☐ Firm or Individual Name

Address

City

State

Zip

Country

Telephone

Email

I am the:

☐ Applicant/Inventor.

☒ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

SIGNATURE of Applicant or Assignee of Record

Signature		Date	Jan 04, 2008
Name	Masoud Djafari	Telephone	310-571-1701
Title and Company	CEO, WiLinx Corp.		

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Alireza Tarighat-Mehrabani et al.

Application No./Patent No.: Not assigned Filed/Issue Date: Herewith

Entitled: Wireless Communication Systems and Methods

WilInx Corp., a California Corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest; or
2. ☐ an assignee of less than the entire right, title and interest
(The extent (by percentage) of its ownership interest is _____ %)

in the patent application/patent identified above by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

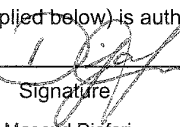
3. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet.

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.


Signature
Masoud Djafari
Printed or Typed Name
CEO
Title

Jan. 04, 2008
Date
310-571-1701
Telephone Number

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

COPY

Attorney Docket No.: 000007-001100US

ASSIGNMENT OF PATENT APPLICATION

JOINT

WHEREAS, Alireza Tarighat-Mehrabani, a citizen of Iran, residing at 13914 Bora Bora Way #D205, Marina Del Rey, CA 90292; Rahim Bagheri, a citizen of Iran, residing at 1317 S. Westgate Ave., #302, Los Angeles, CA 90025; Alireza Mehrnia, a citizen of Iran, residing at 3240 Sawtelle Blvd #207, Los Angeles, CA 90066; and Mahmoud Darvishzadeh a citizen of the United Kingdom, residing at 24612 Olive Tree Lane, Los Altos Hills, CA 94024, hereinafter referred to as "Assignors," are the inventors of the invention described and set forth in the below-identified application for United States Letters Patent:

Title of Invention: Wireless Communication Systems and Methods

Date(s) of execution of Declaration: 01/04/08, 01/03/08; and

Filing Date: 01/23/08

WHEREAS, WiLinX Corp., a corporation of the state of California, located at 12400 Wilshire Blvd., Ste. 370, Los Angeles, CA. 90025, hereinafter referred to as "ASSIGNEE," is desirous of acquiring an interest in the invention and application and in any U.S. Letters Patent and Registrations which may be granted on the same;

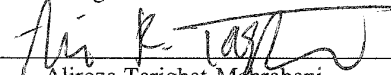
For good and valuable consideration, receipt of which is hereby acknowledged by Assignors, Assignors have assigned, and by these presents do assign to Assignee all right, title and interest in and to the invention and application and to all foreign counterparts (including patent, utility model and industrial designs), and in and to any Letters Patent and Registrations which may hereafter be granted on the same in the United States and all countries throughout the world, and to claim the priority from the application as provided by the Paris Convention. The right, title and interest is to be held and enjoyed by Assignee and Assignee's successors and assigns as fully and exclusively as it would have been held and enjoyed by Assignors had this Assignment not been made, for the full term of any Letters Patent and Registrations which may be granted thereon, or of any division, renewal, continuation in whole or in part, substitution, conversion, reissue, prolongation or extension thereof.

Assignors further agree that they will, without charge to Assignee, but at Assignee's expense, (a) cooperate with Assignee in the prosecution of U.S. Patent applications and foreign counterparts on the invention and any improvements, (b) execute, verify, acknowledge and deliver all such further papers, including patent applications and instruments of transfer, and (c) perform such other acts as Assignee lawfully may request to obtain or maintain Letters Patent and Registrations for the invention and improvements in any and all countries, and to vest title thereto in Assignee, or Assignee's successors and assigns.

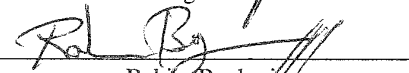
Assignors hereby authorize and request Chad R. Walsh of Fountainhead Law Group P.C., 900 Lafayette St., Ste. 509, Santa Clara, CA 95050, to insert herein above the date of execution of declaration and filing date of said application when known.

IN TESTIMONY WHEREOF, Assignors have signed their names on the dates indicated.

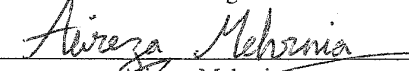
Dated: Jan 4th, 2008


Alireza Tarighat-Mehrabani

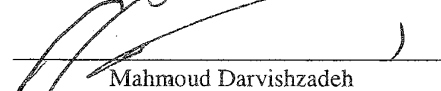
Dated: Jan 4th, 2008


Rahim Bagheri

Dated: Jan 3, 2008


Alireza Mehrnia

Dated: Jan 3, 2008


Mahmoud Darvishzadeh

PATENT APPLICATION

Wireless Communication Systems and Methods

Inventors: Alireza Tarighat-Mehrabani, a citizen of Iran, residing at
13914 Bora Bora Way #D205
Marina Del Rey, CA 90292

Rahim Bagheri, a citizen of Iran, residing at
1317 S. Westgate Ave., #302
Los Angeles, CA 90025

Alireza Mehrnia, a citizen of Iran, residing at
3240 Sawtelle Blvd #207
Los Angeles CA 90066

Mahmoud Darvishzadeh, a citizen of the United Kingdom, residing at
24612 Olive Tree Lane
Los Altos Hills, CA 94024

Assignee: WiLinx, Corp.
12400 Wilshire Blvd., Suite #370
Los Angeles, CA. 90025

Entity: Small

FOUNTAINHEAD LAW GROUP P.C.
900 Lafayette St., Suite 509
Santa Clara, CA 95050
Tel: 408-244-6319

Wireless Communication Systems and Methods

BACKGROUND

5 [0001] The present invention relates to wireless electronics, and in particular, to wireless communication systems and methods.

[0002] Unless otherwise indicated herein, the approaches described in this section are not prior art to the claims in this application and are not admitted to be prior art by inclusion in this section.

10 [0003] Communication systems generally contain one or more transmission channels to transmit data from the transmitter to the receiver. The components included in a transmitter and receiver may vary depending on the attributes of the communication channel, the signaling, and the goals of the transmission channel. Fig. 1 illustrates an example of a transmitter 100 used in a wireless communication system. Here, a digital-to-analog converter (“DAC”) 110 receives a digital input signal (“IN”). The DAC converts a digital signal to an analog signal. This may be necessary in communication systems that take advantage of digital signal processing. The DAC is coupled to the input of filter 120. The filter may be used to remove undesirable frequencies and signal images. The filter is then coupled to mixer 130. The mixer may be used to up-convert the frequency of the signal by combining it with a local oscillator signal (“LO”). The output of the mixer is coupled to power amplifier 140 to amplify the signal for transmission before it is sent through antenna 150. The transmitter 100 is limited to up-converting a signal to one center frequency (or modulation frequency), which is the LO frequency. Typically, the amount of information transmitted around the center frequency is limited by the bandwidth of the transmitter around the center frequency. Accordingly, this limits the amount of data that can be transmitted. Typical prior art approaches to improving the information capacity in a wireless communication system involve maximizing the bandwidth around the center frequency to increase the amount of information that may be modulated onto the carrier frequency.

25 [0004] Another limitation to wireless communication involves allowable output power. In many countries, regional authorities will limit the amount of power that may be transmitted at any given frequency or across a range of frequencies. In other words, when a transmitter transmits a signal at a particular center frequency, the transmitter may be required to output less than a specified upper limit of power per Megahertz. This limitation may limit the

reliability, the range, and the effective throughput of data transmission. Transmission range, reliability, throughput, complexity, and cost all play a role in enabling new wireless applications. Since there is a continuing need for new wireless devices, these and other issues, concerning the transmission and reception of radio frequency (RF) signals, become
5 important. Thus, there is a need for improvements in wireless communication systems and methods.

SUMMARY

[0005] Embodiments of the present invention improve wireless communication systems and methods. In one embodiment, the present invention includes a method of transmitting
10 information in a wireless communication channel comprising transmitting first information across a first frequency range using a wireless transmitter, the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency, and simultaneously transmitting second information across a second frequency range using the same wireless transmitter, the second frequency range having a second center frequency
15 greater than the first center frequency, a second highest frequency, and a second lowest frequency.

[0006] In one embodiment, the frequency difference between the first center frequency and the second center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.

20 [0007] In one embodiment, the first and second information are transmitted using the same power amplifier in said wireless transmitter.

[0008] In one embodiment, the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

[0009] In one embodiment, first information and second information comprise a plurality
25 of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first frequency range and a second symbol is transmitted during the first time slot across the second frequency range, and wherein a third symbol is transmitted during a second time slot across the first frequency range and a fourth symbol is transmitted during the second time slot across a second frequency range.

30 [0010] In one embodiment, the present invention further comprises concurrently changing the first center frequency to a third center frequency and the second center frequency to a

fourth center frequency, wherein the fourth center frequency is greater than the third center frequency, and wherein the first center frequency changes by at least the first frequency range and the second center frequency changes by at least the second frequency range, and wherein the bandwidth of said power amplifier is greater than the difference between the first lowest
5 frequency and the second highest frequency for the changed first and second center frequencies.

[0011] In one embodiment, the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.

[0012] In one embodiment, the first information and the second information are the same
10 data transmitted across two different frequencies.

[0013] In one embodiment, the first information and the second information are produced from the same data stream using coding or data mapping.

[0014] In one embodiment, the present invention includes a method of transmitting information in a wireless communication channel comprising receiving a first digital signal
15 comprising first data to be transmitted, receiving a second digital signal comprising second data to be transmitted, converting the first digital signal into a first analog signal using a first digital-to-analog converter, the first analog signal carrying the first data across a first frequency range, converting the second digital signal into a second analog signal using a second digital-to-analog converter, the second analog signal carrying the second data across a
20 second frequency range, up-converting the first analog signal to a first RF center frequency to produce a first up-converted analog signal, wherein the first up-converted analog signal comprises a first up-converted frequency range from the first RF center frequency minus one-half the first frequency range to the first RF center frequency plus one-half the first frequency range, up-converting the second analog signal to a second RF center frequency greater than
25 the first center RF frequency to produce a second up-converted analog signal, wherein the second up-converted analog signal comprises a second up-converted frequency range from the second RF center frequency minus one-half the second frequency range to the second RF center frequency plus one-half the second frequency range, and wherein a frequency difference between the first RF center frequency and the second RF center frequency is
30 greater than the sum of one-half the first frequency range and one-half the second frequency range, combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal, amplifying the combined up-converted

signal in a power amplifier resulting in an amplified combined up-converted signal, and transmitting the amplified combined up-converted signal on a first antenna, wherein the bandwidth of said power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.

[0015] In one embodiment, the present invention further comprises changing the first and second RF center frequencies, and in accordance therewith, up-converting the first analog signals to the changed first and second RF center frequencies, wherein the first RF center frequency changes by at least the first frequency range and the second RF center frequency changes by at least the second frequency range.

[0016] In one embodiment, the first and second RF center frequencies are changed concurrently.

[0017] In one embodiment, the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol.

[0018] In one embodiment, the second data is the same as the first data, the present invention further comprises receiving the transmitted signal on a second antenna, amplifying the received signal in a low noise amplifier resulting in an amplified received up-converted signal, wherein the bandwidth of said low noise amplifier is greater than the difference between the lowest frequency in the first up-converted frequency range and the highest frequency in the second up-converted frequency range, down-converting the amplified received up-converted signal using a first down-converter and a signal corresponding to the first RF center frequency to produce a fourth analog signal corresponding to the first analog signal, and down-converting the amplified received up-converted analog signal using a second down-converter and a signal corresponding to the second RF center frequency to produce a fifth analog signal corresponding to the second analog signal.

[0019] In one embodiment, the present invention further comprises filtering the fourth analog signal using a third filter and filtering the fifth analog signal using a fourth filter, converting the filtered fourth analog signal into a third digital signal using a first analog-to-digital converter and converting the filtered fifth analog signal into a fourth digital signal using a second analog-to-digital converter, and combining the third and fourth digital signals to receive data corresponding to the first data.

[0020] In one embodiment, the present invention further comprises combining the fourth and fifth analog signals resulting in a sixth signal, and converting the sixth signal into a third digital signal using a first analog-to-digital converter, and in accordance therewith, receiving data corresponding to the first data.

5 [0021] In one embodiment, the present invention includes a wireless communication system comprising a baseband digital system for providing a first digital signal comprising a first data to be transmitted and a second digital signal comprising a second data to be transmitted, a first digital-to-analog converter for receiving the first digital signal and converting the first digital signal into a first analog signal, the first analog signal carrying the
10 first data across a first frequency range, a second digital-to-analog converter for receiving the second digital signal and converting the second digital signal into a second analog signal, the second analog signal carrying the second data across a second frequency range, a first up-converter circuit having a first input coupled to receive the first analog signal and a second input coupled to receive a first modulation signal having a first RF frequency, wherein the
15 first up-converter outputs a first up-converted analog signal comprising a first up-converted frequency range from the first RF frequency minus one-half the first frequency range to the first RF frequency plus one-half the first frequency range, a second up-converter circuit having a first input coupled to receive the second analog signal and a second input coupled to receive a second modulation signal having a second RF frequency, wherein the second up-
20 converter outputs a second up-converted analog signal comprising a second up-converted frequency range from the second RF frequency minus one-half the second frequency range to the second RF frequency plus one-half the second frequency range, and wherein frequency difference between the first RF frequency and the second RF frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range, and a
25 power amplifier coupled to receive the first and second up-converted analog signals, wherein the bandwidth of the power amplifier is greater than the difference between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range.

[0022] In one embodiment, the first RF frequency and the second RF frequency change
30 within the bandwidth of the power amplifier.

[0023] In one embodiment, the first RF frequency and the second RF frequency change concurrently.

[0024] In one embodiment, the first RF frequency and the second RF frequency change periodically.

[0025] In one embodiment, the first data of the first digital signal is encoded using a first wireless protocol and the first data of the second digital signal is encoded using a second
5 wireless protocol.

[0026] In one embodiment, the second data corresponds to the first data, and wherein the power amplifier outputs a third up-converted signal comprising the up-converted first analog signal and the up-converted second analog signal.

[0027] In one embodiment, the first and second data to be transmitted comprise a plurality
10 of OFDM symbols, wherein a first symbol is transmitted during a first time slot across the first up-converted frequency range and a second symbol is transmitted during the first time slot across the second up-converted frequency range, and wherein a third symbol is transmitted during a second time slot across the first up-converted frequency range and a fourth symbol is transmitted during the second time slot across a second up-converted
15 frequency range.

[0028] In another embodiment, the present invention includes an electronic circuit comprising a first down-converter circuit having a first input coupled to receive a first up-converted signal, a second input coupled to receive a first demodulation signal having a first RF frequency, and an output, wherein the first down-converter circuit outputs a first down-
20 converted signal on the first down-converter output, a second down-converter circuit having a first input coupled to receive the first up-converted signal, a second input coupled to receive a second demodulation signal having a second RF frequency different than the first RF frequency, and an output, wherein the second down-converter outputs a second down-converted signal on the second down-converter output, wherein the first up-converted signal
25 comprises a first signal modulated at the first RF frequency and a second signal modulated at the second RF frequency, and a filter having an input coupled to the output of the first down-converter and the output of the second down-converter, and in accordance therewith, the filter receives the first and second down-converted signals.

[0029] In one embodiment, first signal has a first frequency range and the second signal has
30 a second frequency range, and wherein the frequency difference between the first RF frequency and the second RF frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range.

[0030] The following detailed description and accompanying drawings provide a better understanding of the nature and advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] Fig. 1 illustrates a segment of a transmitter in a wireless communication system.

5 [0032] Fig. 2 illustrates a wireless communication system according to one embodiment of the present invention.

[0033] Fig. 3 illustrates an example transmitted signal according to one embodiment of the present invention.

10 [0034] Fig. 4 illustrates an example of wireless communication according to one embodiment of the present invention.

[0035] Fig. 5 illustrates a wireless communication system according to another embodiment of the present invention.

[0036] Fig. 6 illustrates a wireless communication method according to one embodiment of the present invention.

15 [0037] Fig. 7A and 7B illustrate a wireless communication method according to another embodiment of the present invention.

[0038] Fig. 8 illustrates a wireless communication transmitter according to one embodiment of the present invention.

20 [0039] Fig. 9 illustrates a wireless communication receiver according to one embodiment of the present invention.

[0040] Fig. 10 illustrates a wireless communication transmitter according to one embodiment of the present invention.

[0041] Fig. 11 illustrates a wireless communication receiver according to one embodiment of the present invention.

25 DETAILED DESCRIPTION

[0042] Described herein are techniques for wireless communication systems and methods. In the following description, for purposes of explanation, numerous examples and specific details are set forth in order to provide a thorough understanding of the present invention. It will be evident, however, to one skilled in the art that the present invention as defined by the

claims may include some or all of the features in these examples alone or in combination with other features described below, and may further include modifications and equivalents of the features and concepts described herein.

[0043] Fig. 2 illustrates a wireless communication system according to one embodiment of the present invention. System 200 includes digital-to-analog converter (DAC) 201, DAC 202, filter 203, filter 204, up-converter 205 (such as a mixer), up-converter 206, synthesizer 207, power amplifier 208, and antenna 209. Fig. 3 illustrates an example of the frequency content of the transmitted signal 300 which may result from system 200. Information (i.e., data) to be transmitted may be received in a baseband digital system 250, such as a wireless digital baseband processor. The baseband digital system 250 provides a first digital signal that comprises first digital data 251 to be transmitted to "IN1" and provides a second digital signal that comprises second digital data 252 to be transmitted to "IN2". The data 251 and data 252 may be packets of data that conform to a specific wireless communication protocol, for example. Baseband digital system 250 may deserialize a data stream (e.g., using a demultiplexing function) to divide data packets between the two transmitter channels, for example. As another example, the original information data may be passed through an encoder and the output of the encoder would be split into two streams providing inputs 251 and 252. The data of the first digital signal and the data of the second digital may be unrelated data streams or may be data from the same data stream, for example.

[0044] In this example, the input of DAC 201 is coupled to a first data output of the baseband processor 250, and the first digital signal is converted to a first analog signal by DAC 201. Similarly, the input of DAC 202 is coupled to a second data output of baseband processor 250, and the second digital signal is converted to a second analog signal by DAC 202. The output of DAC 201 is coupled to the input of filter 203, and the first analog signal is filtered by filter 203 to remove unwanted frequency content (e.g., remove aliasing). Similarly, the output of DAC 202 is coupled to the input of filter 204, and the second analog signal is filtered by filter 204 to remove unwanted frequency content.

[0045] A first input of up-converter 205 is coupled to the output of filter 203 to receive the first analog signal and a second input of up-converter 205 is coupled to synthesizer 207 to receive a first modulation signal having a first RF center frequency 303 (f_1) as shown in Fig. 3. Accordingly, the first analog signal is up-converted around a center frequency of f_1 by up-converter 205 to generate a first up-converted analog signal 301. The first up-converted

analog signal 301 includes a first up-converted frequency range 305. It can be seen from Fig. 3 that the first up-converted frequency range is from the first RF frequency 303 minus one-half the first up-converted frequency range to the first RF frequency plus the one-half the first up-converted frequency range.

- 5 [0046] Similarly, a first input of up-converter 206 is coupled to the output of filter 204 to receive the second analog signal and a second input of up-converter 206 is coupled to synthesizer 207 to receive a second modulation signal having a second RF center frequency 304 (f_2) as shown in Fig. 3. Accordingly, the second analog signal is up-converted around a center frequency of f_2 by up-converter 206 to generate a second up-converted analog signal
- 10 302. The second up-converted analog signal 302 includes a second up-converted frequency range 306. It can be seen from Fig. 3 that the second up-converted frequency range is from the second RF frequency 304 minus one-half the second up-converted frequency range to the second RF frequency plus the one-half the second up-converted frequency range.
- Additionally, Fig. 3 illustrates that a frequency difference between the first RF center
- 15 frequency and the second RF center frequency is greater than the sum of one-half the first frequency range and one-half the second frequency range so that the up-converted signals do not overlap and thereby cause distortion. In general, either two synthesizers can be used to generate f_1 and f_2 , or a single synthesizer with the capability of producing f_1 and f_2 simultaneously.
- 20 [0047] A power amplifier 208 (PA) is coupled to receive the first and second up-converted analog signals 301 and 302. The first and second up-converted signals may be simply added together at the input of PA. Embodiments of the present invention transmit multiple signals simultaneously over a communication channel at different center frequencies, and may use a single power amplifier and antenna. In another embodiment, two or more power amplifiers
- 25 may be used as part of the power amplifier implementation. In this example, the bandwidth 309 (BW_{PA}) of the PA 208 is greater than the difference between a lowest frequency 307 (f_{low}) in the first up-converted frequency range 305 and highest frequency 308 (f_{high}) in the second up-converted frequency range 306. The input of amplifier 208 is coupled to the outputs of up-converters 205 and 206. Accordingly, the first and second up-converted analog
- 30 signals are combined at the input of amplifier 208 before amplification to produce a combined up-converted signal. The amplifier 208 outputs an amplified up-converted signal comprising the first up-converted analog signal and the second up-converted analog signal. The antenna 209 is coupled to the output of amplifier 208 to transmit the amplified up-

converted signal as an electromagnetic signal. When the bandwidth 309 of PA 208 covers a wide bandwidth, many up-converted signals may be transmitted using the single power amplifier 208 and a single antenna 209. Since only a single antenna is utilized, the application may not require multiple power amplifiers and antennas, which reduces area and cost while increasing data throughput or, as illustrated below, reliability.

[0048] Fig. 4 illustrates an example of how the frequency content can move within a bandwidth according to one embodiment of the present invention. Communication system 200 may generate frequency content 400 comprising the first up-converted analog signal 401 and the second up-converted analog signal 402. The synthesizer 207 may receive instructions from the baseband processor 250, for example, to change the first RF center frequency 403 (f_{1A}) and second frequency RF center frequency 404 (f_{2A}) within a bandwidth 440 (BW_{PA}). The change in frequency may occur concurrently, for example. This may result in a new frequency content 410 in which the signal 401 has moved in frequency as illustrated by signal 411 having an RF center frequency 413 (f_{1B}), and the signal 402 has moved in frequency as illustrated by signal 412 having an RF center frequency 414 (f_{2B}). Some time later the RF frequencies can change again. This may result in a new frequency content 420 in which the signal 411 has changed to 421 with fifth RF frequency 423 (f_{1C}) and the signal 412 has changed to signal 422 with sixth RF frequency 424 (f_{2C}). Some time later the RF frequencies may change again. In this example, another change may return the RF signals to the original locations in frequency illustrated in frequency content 400. This cycle may repeat itself again or begin a different cycle. Different implementations may change the RF center frequencies between a variety of locations. For example, the changes may move the RF signals to adjacent or non-adjacent locations, or the signal 401 may be moved to higher frequencies than signal 401. Additionally, the changes in RF frequency can happen at irregular intervals or at regular intervals (periodically). As illustrated in Fig. 2, synthesizer 207 may be coupled to baseband processor 250 for controlling the frequencies generated at each synthesizer output. For example, synthesizer 207 may be programmed or otherwise configured to generate modulation signals with RF frequencies illustrated in Figs. 3 and 4. Synthesizer 207 may then be reprogrammed or otherwise reconfigured to change the RF frequencies as described above. Furthermore, the spacing between the two RF center frequencies may remain the same or may vary. One or more data streams from the same or different sources may be transmitted using a single power amplifier wherein the bandwidth of said power amplifier is greater than the difference between a lowest frequency in the first up-

converted frequency range (f_{low}) and a highest frequency in the second up-converted frequency range (f_{high}).

[0049] Another embodiment of the invention may utilize a first wireless protocol to encode the first digital data and utilize a second wireless protocol to encode the second digital data.

5 Almost any existing protocol may be used as the first protocol or second protocol. An ultra-wideband (UWB) protocol such as WiMedia, wireless local area network (WLAN) protocol such as 802.11.g, or cellular standard may be used. A Orthogonal frequency domain multiplexing (OFDM) or a code division multiple access CDMA modulation may be used, for example.

10 [0050] Fig. 5 illustrates a wireless communication system according to another embodiment of the present invention. System 500 includes an antenna 501, low noise amplifier 502 (LNA), a down-converter 504, a down-converter 505, a synthesizer 503, filters 506 and 507, and analog-to-digital converters (ADC) 560 and 570. Frequency content 510 may be transmitted as the first electromagnetic signal described above and received by
15 antenna 501. The electromagnetic signal received by antenna 501 may include an up-converted analog signal from a transmitter as described above including signals 511 and 512. As mentioned above, the signals 511 and 512 carry different data from a common data stream or from different data streams, data corresponding to different protocols, or even the same data. Signal 511 may be an analog signal up-converted to a first RF center frequency, and
20 signal 512 may be an analog signal up-converted to a second RF center frequency. A low noise amplifier 502 has an input coupled to antenna 501 to receive the up-converted RF signals, and outputs an amplified up-converted signal. In a differential system the output of the LNA may be two signal lines (i.e., a differential signal), for example. A first down-converter 504 includes a first input that is coupled to the output of LNA 502 to receive the amplified RF
25 signal. The first down-converter 504 includes a second input coupled to receive a signal corresponding to the first RF center frequency (i.e., a demodulation signal having a frequency such as f_1) from synthesizer 503. The first down-converter 504 outputs a first down-converted analog signal. The first down-converted analog signal corresponds to the analog signal carrying information across frequency range 515, which was provided to an up-
30 converter in the transmitter that generated signal 510. A second down-converter 505 includes an input that is coupled to the output of LNA 502 to receive the amplified up-converted signal. The second down-converter 505 includes an input that is coupled to a signal corresponding to the second RF frequency (f_2) from synthesizer 503. The second down-

converter 505 outputs a second down-converted analog signal. The second down-converted analog signal from down-converter 505 corresponds to an analog signal carrying information across frequency range 516, which was provided to an up-converter in the transmitter that generated signal 510. The output of down-converter 504 is coupled to the input of filter 506
5 to receive the first down-converted analog signal. Similarly, the output of down-converter 505 is coupled to the input of filter 507 to receive the second down-converted analog signal. The filters eliminate frequency content outside the frequency band of interest. As illustrated by 520 and 530, signals 515 and 516 are down-converted to baseband and filtered, so that each signal may be processed on separate receiver input channels (e.g., filters, ADCs, and
10 digital processing circuits in baseband processor 550). While the above examples illustrate transmission and reception using direct up and down conversion to and from RF center frequencies, it is to be understood that in other implementations the signals could be up/down-converted to intermediate frequencies in intermediate steps between baseband processing. The filtered signals 522 and 521 may be found at locations 508 and 509, and are
15 illustrated in graphs 520 and 530. Analog-to-digital converter 560 is coupled to the output of filter 506 to receive the first down-converted signal 522 and convert signal 522 to back into a digital signal. Similarly, analog-to-digital converter 570 is coupled to the output of filter 507 to receive the second down-converted signal 521 and convert signal 521 to back into a digital signal. The digital signals may be processed to retrieve the original data. For example, the
20 digital signals may be serialized back into a single data stream (e.g., using a MUX), processed independently according to different protocol requirements, or, if the data is the same data, combined digitally to improve the reliability of the transmission, for example.

[0051] Fig. 6 illustrates a wireless communication method 600 according to one embodiment of the present invention. At 601, a first digital signal, including a first data, is
25 received, and a second digital signal, including a second data, is received. The data may be received from a baseband processor in a wireless transmitter, for example, for up-conversion and transmission as an electromagnetic signal. In one embodiment, the first data may be unrelated to the second data. However, in other embodiments, the first data may correspond to the second data. For example, the same data may be encoded and divided into two streams
30 and up-converted to two different RF center frequencies and then transmitted as described above. At 602, the first digital signal is converted to a first analog signal using a first digital-to-analog converter, for example. The first analog signal carries the first data across a first frequency range. Also at 602, the second digital signal is converted to a second analog signal

using a second digital-to-analog converter, for example. The second analog signal carries the second data across a second frequency range. In one embodiment described in more detail below, the first and second analog signals are carrying different coded versions of the same digital data. At 603, the first analog signal is up-converted to a first RF center frequency.

5 The up-converted first analog signal comprises a first up-converted frequency range from the first RF center frequency minus one-half the first frequency range to the first RF center frequency plus one-half the first frequency range. Also at 603, the second analog signal is up-converted to a second RF center frequency. The up-converted second analog signal comprises a second up-converted frequency range from the second RF center frequency
10 minus one-half the second frequency range to the second RF center frequency plus one-half the second frequency range. The frequency difference between the first RF center frequency and the second RF center frequency may be greater than the sum one-half the first frequency range and one half the second frequency range. Accordingly, the frequency content of the up-converted signals will not overlap. At 604, the first up-converted analog signal and the
15 second up-converted analog signal are combined into a combined up-converted signal. At 605, the combined up-converted signal is amplified (e.g., in a power amplifier) and results in an amplified combined up-converted signal. In one embodiment, the bandwidth of the power amplifier is greater than the difference, in frequency, between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency
20 range. At, 606 the amplified signal is transmitted, for example, by coupling the output of the power amplifier to an antenna.

[0052] Fig. 7A and 7B illustrate a wireless communication method 700 according to another embodiment of the present invention. At 701, a first digital signal, including a first data, is received and a second digital signal, including a second data, is received. In this
25 example, the first and second data include different coded versions of the same data. For example, as mentioned above, one embodiment of the invention may include transmitting the same data at two different RF frequencies and receiving and combining the data. This may be done so that the transmission of the data is more reliable (e.g., fewer errors). Also, using this method may allow for greater transmission range. This method may make the signal data
30 more impervious to noise and interference. At 702, the first digital signal is converted to first analog signal using a first digital-to-analog converter. The first analog signal carries the first data across a first frequency range. Also at 702, the second digital signal is converted to a second analog signal using a second digital-to-analog converter. The second analog signal

carries the second data across a second frequency range. At 703, the first analog signal is up-converted to a first RF center frequency. The up-converted first analog signal comprises a first up-converted frequency range from the first RF center frequency minus one-half the first frequency range to the first RF center frequency plus one-half the first frequency range. Also
5 at 703, the second analog signal is up-converted to a second RF center frequency. The up-converted second analog signal comprises a second up-converted frequency range from the second RF center frequency minus one-half the second frequency range to the second RF center frequency plus one-half the second frequency range. The frequency difference
10 between the first RF center frequency and the second RF center frequency is greater than the sum one-half the first frequency range and one half the second frequency range. At 704, the first up-converted analog signal and the second up-converted analog signal are combined into a combined up-converted signal. At 705, the combined up-converted signal is amplified in a power amplifier and results in an amplified combined up-converted signal. The bandwidth of the power amplifier is greater than the distance between a lowest frequency in the first up-
15 converted frequency range and a highest frequency in the second up-converted frequency range. At, 706 the amplified combined up-converted signal is transmitted on a first antenna.

[0053] At 707, the transmitted signal is received on a second antenna of a receiver. At the receiver the two coded versions of the same data are processed and decoded properly to recover the original data. At 708, the received signal is amplified in a low noise amplifier
20 and results in an amplified received up-converted signal. The bandwidth of the low noise amplifier is greater than the distance between a lowest frequency in the first up-converted frequency range and a highest frequency in the second up-converted frequency range. At 709, the amplified received up-converted signal is down-converted using a first down-converter and a signal corresponding to the first RF center frequency to produce a fourth analog signal corresponding to the first analog signal. Also at 709, the amplified received up-converted signal is down-converted using a second down-converter and a signal
25 corresponding to the second RF center frequency to produce a fifth analog signal corresponding to the second analog signal. The received down-converted analog signals may be processed in separate analog receiver channels and combined digitally, as described above, or the fourth and the fifth analog signals may be combined into a sixth signal, as illustrated at
30 710. At 711, the combined signal is filtered. It is to be understood that filtering may occur before or after the received signals are combined. At 712, the combined signal is converted

into a digital signal using an analog-to-digital converter. The resulting digital signal maybe processed digitally by a baseband processor and output first data.

[0054] Fig. 8 illustrates a wireless communication transmitter according to one embodiment of the present invention. This example provides a transmitter for sending the same data across a communication channel at two different RF carrier frequencies to improve reliability and/or increase the range of the system. A DAC 810 receives the data to be transmitted and converts the digital data into an analog signal. The output of the DAC 810 is coupled to the input of a filter 811 to filter unwanted frequency content, such as aliasing, for example. The output of filter 811 is coupled to the input of a first up-converter 812. Additionally, the output of filter 811 is coupled to the input of a second up-converter 813. Up-converter 812 includes a second input coupled to an output of a synthesizer 814, which may be used to up-convert the analog signal to a RF center frequency f1. Similarly, up-converter 813 includes a second input coupled to another output of a synthesizer 814 (or to a different synthesizer), which may be used to up-convert the analog signal to a RF center frequency f2. The outputs of up-converters 812 and 813 are coupled together and to the input of power amplifier 815. Accordingly, the up-converted signals are combined at the power amplifier input. Power amplifier 815 has a bandwidth sufficient to amplify all of the frequency content in the combined signal. The output of power amplifier 815 is coupled to antenna 850 to transmit the digital data simultaneously as an electromagnetic signal using two different RF carrier frequencies.

[0055] Fig. 9 illustrates a wireless communication receiver according to one embodiment of the present invention. System 900 includes an antenna 901, low noise amplifier 902 (LNA), a down-converter 904, a down-converter 905, a synthesizer 903, a filter 906, and an analog-to-digital converter (ADC) 907. Frequency content 910 may be transmitted as an electromagnetic signal described above and received by antenna 901. The electromagnetic signal received by antenna 901 may include an up-converted analog signal from transmitter 800, for example, including signals 911 and 912. In this example, the signals 911 and 912 carry the same information (data). For example, signal 911 may be an analog signal up-converted to a first RF frequency, and signal 912 may be the same analog signal up-converted to a second RF frequency. A low noise amplifier 902 has an input coupled to antenna 901 to receive the up-converted RF signals, and outputs an amplified up-converted signal on line 909. In a differential system line, 909 may be two signal lines (i.e., a differential signal). A first down-converter 904 includes a first input that is coupled to the output of LNA 902 to

receive the amplified RF signal. The first down-converter includes a second input coupled to receive a signal corresponding to the first RF frequency (i.e., a frequency such as f_1) from synthesizer 903. The first down-converter outputs a baseband analog signal. The analog signal corresponds to the analog signal carrying information across frequency range 915, which was provided to an up-converter in the transmitter that generated signal 910. A second down-converter 905 includes an input that is coupled to the output of LNA 902 to receive the amplified up-converted signal. The second down-converter 905 includes an input that is coupled to a signal corresponding to the second RF frequency (f_2) from synthesizer 903. The second down-converter also outputs a baseband analog signal. The analog signal from down-converter 905 corresponds to an analog signal carrying information across frequency range 916, which was provided to an up-converter in the transmitter that generated signal 910. As mentioned above, frequency range 915 and 916 may carry the same information and may result in the same analog signal when down-converted. A filter 906 is coupled to the output of down-converter 904 to receive the down-converted version of signal 911. Filter 906 may also be coupled to the output of down-converter 905 to receive the down-converted version of signal 912. The filter eliminates frequency content outside the frequency band of interest. As illustrated by 520, the analog signals 911 and 912 are down-converted to the same frequency. In this example, the signals are combined and then filtered. However, it is to be understood that the signals could be filter separately and then combined. In either case, the signals are combined to improve the quality of the signal being received. In this example, the signals are down-converted directly to baseband and combined. However, in other implementations the signals could be down-converted to intermediate frequencies, combined, and then down-converted to baseband. The combined filtered signal may be found at location 908 and is illustrated in graph 920. An analog-to-digital converter 907 is coupled to receive the combined signal, where the combined signal is converted to back into a digital signal. The digital signal may be processed to retrieve the original data. If the second data is the same as the first data, the system could be used to increase the reliability of the communication channel or increase the range of transmission.

[0056] Fig. 10 illustrates a wireless communication transmitter according to one embodiment of the present invention. Communication transmitter 1000 includes digital-to-analog converter (DAC) 1001, DAC 1002, filter 1003, filter 1004, up-converter 1005 (such as a mixer), up-converter 1006, synthesizer 1007, power amplifier 1008, antenna 1009, encoding block 1010, and encoding block 1011. Digital-to-analog converter (DAC) 1001,

DAC 1002, filter 1003, filter 1004, up-converter 1005, up-converter 1006, synthesizer 1007, power amplifier 1008, and antenna 1009 function in a similar manner as corresponding components digital-to-analog converter (DAC) 201, DAC 202, filter 203, filter 204, up-converter 205, up-converter 206, synthesizer 207, power amplifier 208, and antenna 209 function in circuit 200 described above.

[0057] Encoding block 1010 and encoding block 1011 perform an orthogonal frequency domain multiplexing (OFDM) modulation function which utilizes an Alamouti code. This example utilizes Alamouti code, but other orthogonal codes may be utilized. This encoding may be done in software, firmware, or both. Elements 1013, 1014, 1015, and 1016 make up one coding matrix.

$$M1 = \begin{bmatrix} S_1(l), S_2(l) \\ -S_2^*(l), S_1^*(l) \end{bmatrix}$$

Four OFDM symbols comprised of N elements each are transmitted in a first time slot and a second time slot. The first time slot includes OFDM symbol 1017 and OFDM symbol 1018. The second time slot includes OFDM symbol 1023 and OFDM symbol 1024. OFDM symbol 1017 and 1023 are processed through an inverse fast fourier transform (IFFT) 1019 and converted to a serial bit stream with a cyclic prefix 1021. OFDM symbol 1018 and 1024 are processed through an inverse fast fourier transform (IFFT) 1020 and converted to a serial bit stream with a cyclic prefix 1022. The resulting bit streams are converted, up-converted, combined, amplified, and transmitted as described above. The symbols are transmitted over a single antenna. The frequencies f_1 and f_2 may hop to different frequencies as described above.

[0058] Fig. 11 illustrates a wireless communication receiver according to one embodiment of the present invention. Communication receiver 1100 includes antenna 1101, low noise amplifier 1102 (LNA), down-converter 1104, down-converter 1105, synthesizer 1103, filter 1106, amplifier 1108, analog-to-digital converter (ADC) 1107, and decoding block 1109. Antenna 1101, low noise amplifier 1102 (LNA), down-converter 1104, down-converter 1105, synthesizer 1103, filter 1106, and analog-to-digital converter (ADC) 1107 function in a similar manner as corresponding components antenna 901, low noise amplifier 902 (LNA), down-converter 904, down-converter 905, synthesizer 903, filter 906, and analog-to-digital converter (ADC) 907 function in circuit 900 described above. Amplifier 1108 may be an automatic gain control circuit or “AGC” added to provide additional gain prior to conversion

into digital by ADC 1107. The transmitted signal is received on a single antenna and after down-conversion the signals are recombined and share the same signal path through the filter 1106, amplifier 1108, and a single ADC 1107.

- [0059] Decoding block 1109 produces estimates of the information contained in the transmission. The data is converted from serial to parallel data 1110 and then the data is organized into blocks comprising “N” elements. The data is processed by a fast fourier transform (FFT) before estimating the data. This example utilizes Alamouti code, but other orthogonal codes may be utilized. The purpose of the decoding is to recover S_1 and S_2 from element 1114 and element 1115. Other elements are estimated in a similar fashion.
- [0060] $[h_1, h_2, \dots, h_N]$ represents the channel response over band frequency f_1 . $[g_1, g_2, \dots, g_N]$ represents the channel response over band frequency f_2 . Let Y_1 be equal to element 1114, and let Y_2 be equal to element 1115.

$$Y_1 = h_1 S_1(1) + g_1 S_2(1)$$

$$Y_2 = h_1 S_2^*(1) + g_1 S_1^*$$

Estimates

$$S_1 \cong \frac{h_1^* Y_1(1) + g_1 Y_2^*}{|h_1|^2 + |g_1|^2}$$

$$S_2 \cong \frac{g_1^* Y_1(1) - h_1 Y_2^*}{|h_1|^2 + |g_1|^2}$$

The other elements may be estimated in a similar fashion.

- [0060] The above description illustrates various embodiments of the present invention along with examples of how aspects of the present invention may be implemented. The above examples and embodiments should not be deemed to be the only embodiments, and are presented to illustrate the flexibility and advantages of the present invention as defined by the following claims. For example, while one or more embodiments may have been described as having “an input” or “an output”, it is to be understood that this term includes single-ended inputs, differential inputs, or even quadrature inputs. As another example, it is to be understood that the synthesizer used to generate different up/down conversion frequencies may be implemented as a single block or as multiple distinct blocks. Based on the above disclosure and the following claims, other arrangements, embodiments, implementations and equivalents will be evident to those skilled in the art and may be employed without departing from the spirit and scope of the invention as defined by the claims.

WHAT IS CLAIMED IS:

- 1 1. A method of transmitting information in a wireless communication
2 channel comprising:
3 transmitting first information across a first frequency range using a wireless
4 transmitter, the first frequency range having a first center frequency, a first highest frequency,
5 and a first lowest frequency; and
6 simultaneously transmitting second information across a second frequency
7 range using the same wireless transmitter, the second frequency range having a second center
8 frequency greater than the first center frequency, a second highest frequency, and a second
9 lowest frequency.
- 1 2. The method of claim 1 wherein frequency difference between the first
2 center frequency and the second center frequency is greater than the sum of one-half the first
3 frequency range and one-half the second frequency range.
- 1 3. The method of claim 1 wherein the first and second information are
2 transmitted using the same power amplifier in said wireless transmitter.
- 1 4. The method of claim 3 wherein the bandwidth of said power amplifier
2 is greater than the difference between the first lowest frequency and the second highest
3 frequency.
- 1 5. The method of claim 1 further comprising concurrently changing the
2 first center frequency to a third center frequency and the second center frequency to a fourth
3 center frequency, wherein the fourth center frequency is greater than the third center
4 frequency, and wherein the first center frequency changes by at least the first frequency range
5 and the second center frequency changes by at least the second frequency range, and wherein
6 the bandwidth of said power amplifier is greater than the difference between the first lowest
7 frequency and the second highest frequency for the changed first and second center
8 frequencies.
- 1 6. The method of claim 1 wherein the first information corresponds to a
2 first wireless protocol and the second information corresponds to a second wireless protocol.

1 7. The method of claim 1 wherein the first information and the second
2 information are the same data transmitted across two different frequencies.

1 8. The method of claim 1 wherein the first information and the second
2 information are from the same data stream.

1 9. The method of claim 1 wherein first information and second
2 information comprise a plurality of OFDM symbols, wherein a first symbol is transmitted
3 during a first time slot across the first frequency range and a second symbol is transmitted
4 during the first time slot across the second frequency range, and wherein a third symbol is
5 transmitted during a second time slot across the first frequency range and a fourth symbol is
6 transmitted during the second time slot across a second frequency range.

1 10. A method of transmitting information in a wireless communication
2 channel comprising:
3 receiving a first digital signal comprising first data to be transmitted;
4 receiving a second digital signal comprising second data to be transmitted;
5 converting the first digital signal into a first analog signal using a first digital-
6 to-analog converter, the first analog signal carrying the first data across a first frequency
7 range;
8 converting the second digital signal into a second analog signal using a second
9 digital-to-analog converter, the second analog signal carrying the second data across a second
10 frequency range;
11 up-converting the first analog signal to a first RF center frequency to produce
12 a first up-converted analog signal, wherein the first up-converted analog signal comprises a
13 first up-converted frequency range from the first RF center frequency minus one-half the first
14 frequency range to the first RF center frequency plus one-half the first frequency range;
15 up-converting the second analog signal to a second RF center frequency
16 greater than the first center RF frequency to produce a second up-converted analog signal,
17 wherein the second up-converted analog signal comprises a second up-converted frequency
18 range from the second RF center frequency minus one-half the second frequency range to the
19 second RF center frequency plus one-half the second frequency range, and wherein a
20 frequency difference between the first RF center frequency and the second RF center

21 frequency is greater than the sum of one-half the first frequency range and one-half the
22 second frequency range;
23 combining the first up-converted analog signal and the second up-converted
24 analog signal to produce a combined up-converted signal;
25 amplifying the combined up-converted signal in a power amplifier resulting in
26 an amplified combined up-converted signal; and
27 transmitting the amplified combined up-converted signal on a first antenna,
28 wherein the bandwidth of said power amplifier is greater than the difference
29 between a lowest frequency in the first up-converted frequency range and a highest frequency
30 in the second up-converted frequency range.

1 11. The method of claim 10 further comprising changing the first and
2 second RF center frequencies, and in accordance therewith, up-converting the first analog
3 signals to the changed first and second RF center frequencies, wherein the first RF center
4 frequency changes by at least the first frequency range and the second RF center frequency
5 changes by at least the second frequency range.

1 12. The method of claim 11 wherein the first and second RF center
2 frequencies are changed concurrently.

1 13. The method of claim 10 wherein the first digital signal is encoded
2 using a first wireless protocol and the second digital signal is encoded using a second
3 wireless protocol.

1 14. The method of claim 10 wherein the second data is the same as the first
2 data, the method further comprising:
3 receiving the transmitted signal on a second antenna;
4 amplifying the received signal in a low noise amplifier resulting in an
5 amplified received up-converted signal, wherein the bandwidth of said low noise amplifier is
6 greater than the difference between the lowest frequency in the first up-converted frequency
7 range and the highest frequency in the second up-converted frequency range;
8 down-converting the amplified received up-converted signal using a first
9 down-converter and a signal corresponding to the first RF center frequency to produce a
10 fourth analog signal corresponding to the first analog signal; and

11 down-converting the amplified received up-converted analog signal using a
12 second down-converter and a signal corresponding to the second RF center frequency to
13 produce a fifth analog signal corresponding to the second analog signal.

1 15. The method of claim 12 further comprising:
2 filtering the fourth analog signal using a third filter and filtering the fifth
3 analog signal using a fourth filter; and
4 converting the filtered fourth analog signal into a third digital signal using a
5 first analog-to-digital converter and converting the filtered fifth analog signal into a fourth
6 digital signal using a second analog-to-digital converter; and
7 combining the third and fourth digital signals to receive data corresponding to
8 the first data.

1 16. The method of claim 12 further comprising:
2 combining the fourth and fifth analog signals resulting in a sixth signal; and
3 converting the sixth signal into a third digital signal using a first analog-to-
4 digital converter, and in accordance therewith, receiving data corresponding to the first data.

1 17. A wireless communication system comprising:
2 a baseband digital system for providing a first digital signal comprising a first
3 data to be transmitted and a second digital signal comprising a second data to be transmitted;
4 a first digital-to-analog converter for receiving the first digital signal and
5 converting the first digital signal into a first analog signal, the first analog signal carrying the
6 first data across a first frequency range;
7 a second digital-to-analog converter for receiving the second digital signal and
8 converting the second digital signal into a second analog signal, the second analog signal
9 carrying the second data across a second frequency range;
10 a first up-converter circuit having a first input coupled to receive the first
11 analog signal and a second input coupled to receive a first modulation signal having a first RF
12 frequency, wherein the first up-converter outputs a first up-converted analog signal
13 comprising a first up-converted frequency range from the first RF frequency minus one-half
14 the first frequency range to the first RF frequency plus one-half the first frequency range;
15 a second up-converter circuit having a first input coupled to receive the second
16 analog signal and a second input coupled to receive a second modulation signal having a
17 second RF frequency, wherein the second up-converter outputs a second up-converted analog

18 signal comprising a second up-converted frequency range from the second RF frequency
19 minus one-half the second frequency range to the second RF frequency plus one-half the
20 second frequency range, and wherein frequency difference between the first RF frequency
21 and the second RF frequency is greater than the sum of one-half the first frequency range and
22 one-half the second frequency range; and
23 a power amplifier coupled to receive the first and second up-converted analog
24 signals, wherein the bandwidth of the power amplifier is greater than the difference between
25 a lowest frequency in the first up-converted frequency range and a highest frequency in the
26 second up-converted frequency range.

1 18. The communication system of claim 17 wherein the first RF frequency
2 and the second RF frequency change within the bandwidth of the power amplifier.

1 19. The communication system of claim 18 wherein the first RF frequency
2 and the second RF frequency change concurrently.

1 20. The communication system of claim 18 wherein the first RF frequency
2 and the second RF frequency change periodically.

1 21. The communication system of claim 17 wherein the first data of the
2 first digital signal is encoded using a first wireless protocol and the first data of the second
3 digital signal is encoded using a second wireless protocol.

1 22. The communication system of claim 17 wherein the second data
2 corresponds to the first data and wherein the power amplifier outputs a third up-converted
3 signal comprising the up-converted first analog signal and the up-converted second analog
4 signal.

1 23. The communication system of claim 17 wherein first and second data
2 to be transmitted comprise a plurality of OFDM symbols, wherein a first symbol is
3 transmitted during a first time slot across the first up-converted frequency range and a second
4 symbol is transmitted during the first time slot across the second up-converted frequency
5 range, and wherein a third symbol is transmitted during a second time slot across the first up-
6 converted frequency range and a fourth symbol is transmitted during the second time slot
7 across a second up-converted frequency range.

1 24. An electronic circuit comprising:
2 a first down-converter circuit having a first input coupled to receive a first up-
3 converted signal, a second input coupled to receive a first demodulation signal having a first
4 RF frequency, and an output, wherein the first down-converter circuit outputs a first down-
5 converted signal on the first down-converter output;
6 a second down-converter circuit having a first input coupled to receive the first
7 up-converted signal, a second input coupled to receive a second demodulation signal having a
8 second RF frequency different than the first RF frequency, and an output, wherein the second
9 down-converter outputs a second down-converted signal on the second down-converter
10 output, wherein the first up-converted signal comprises a first signal modulated at the first RF
11 frequency and a second signal modulated at the second RF frequency; and
12 a filter having an input coupled to the output of the first down-converter and
13 the output of the second down-converter, and in accordance therewith, the filter receives the
14 first and second down-converted signals.

1 25. The communication system of claim 24 wherein first signal has a first
2 frequency range and the second signal has a second frequency range, and wherein the
3 frequency difference between the first RF frequency and the second RF frequency is greater
4 than the sum of one-half the first frequency range and one-half the second frequency range.

Wireless Communication Systems and Methods

ABSTRACT

Embodiments of the present invention transmit signals simultaneously over a communication channel at different RF center frequencies, and may use a single power amplifier and antenna. In one embodiment the present invention includes a method of transmitting information in a wireless communication channel comprising receiving digital signals having data to be transmitted, converting the signals to analog signals, up-converting each analog signal, combining the up-converted signals, amplifying the combined up-converted signal and transmitting the combined up-converted signal. In one embodiment, the same data is sent over a transmission channel at two different frequencies to improve reliability.

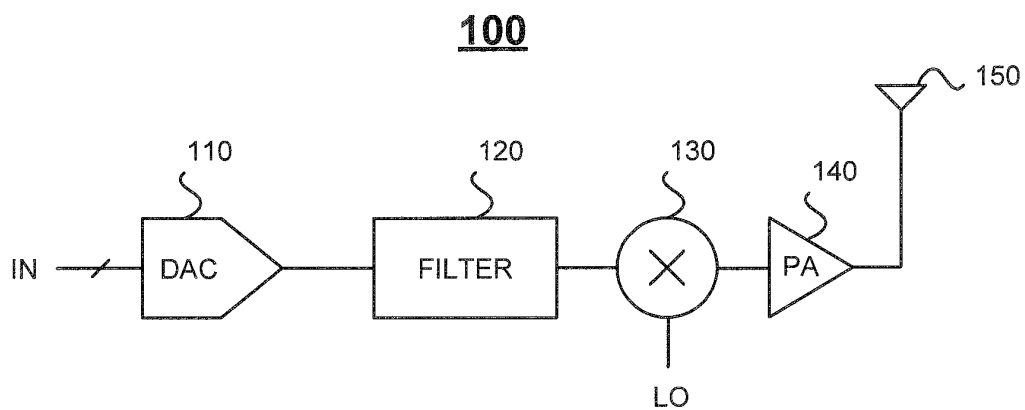


Fig. 1
(prior art)

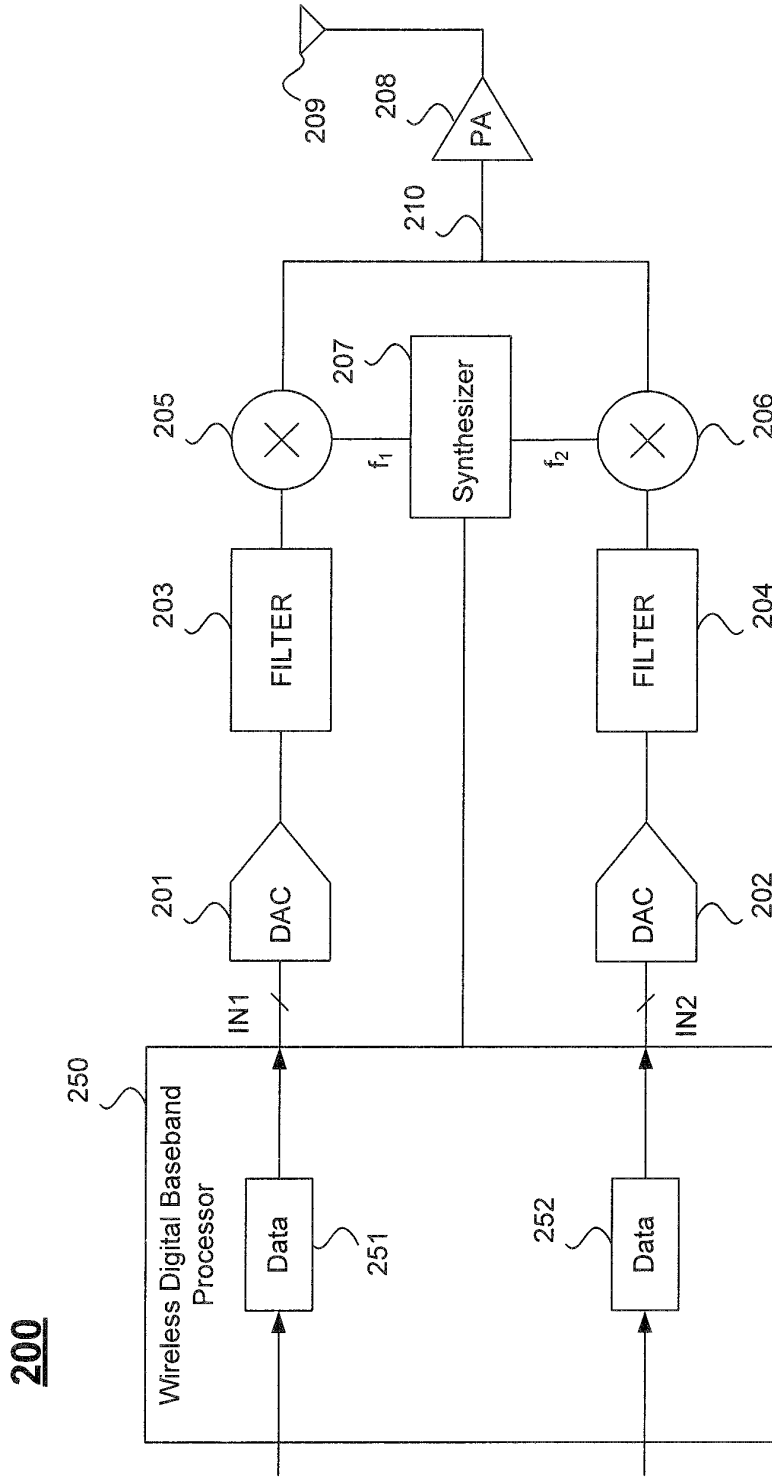


Fig. 2

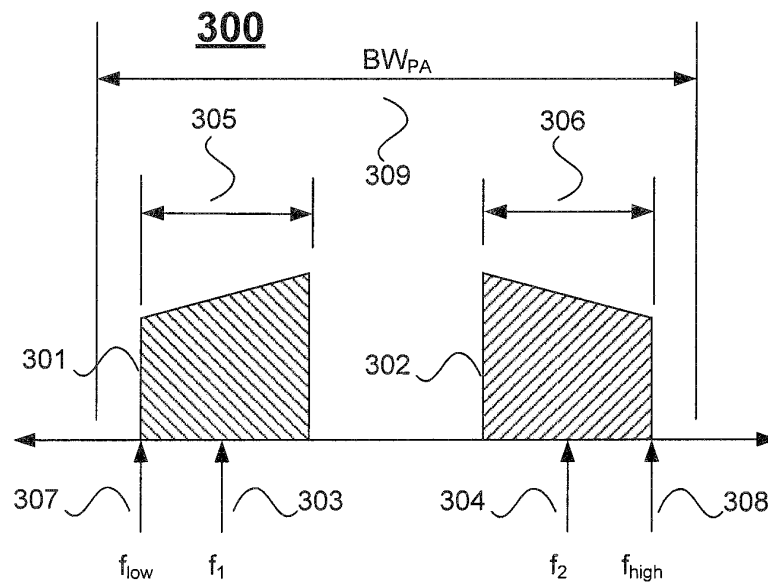


Fig. 3

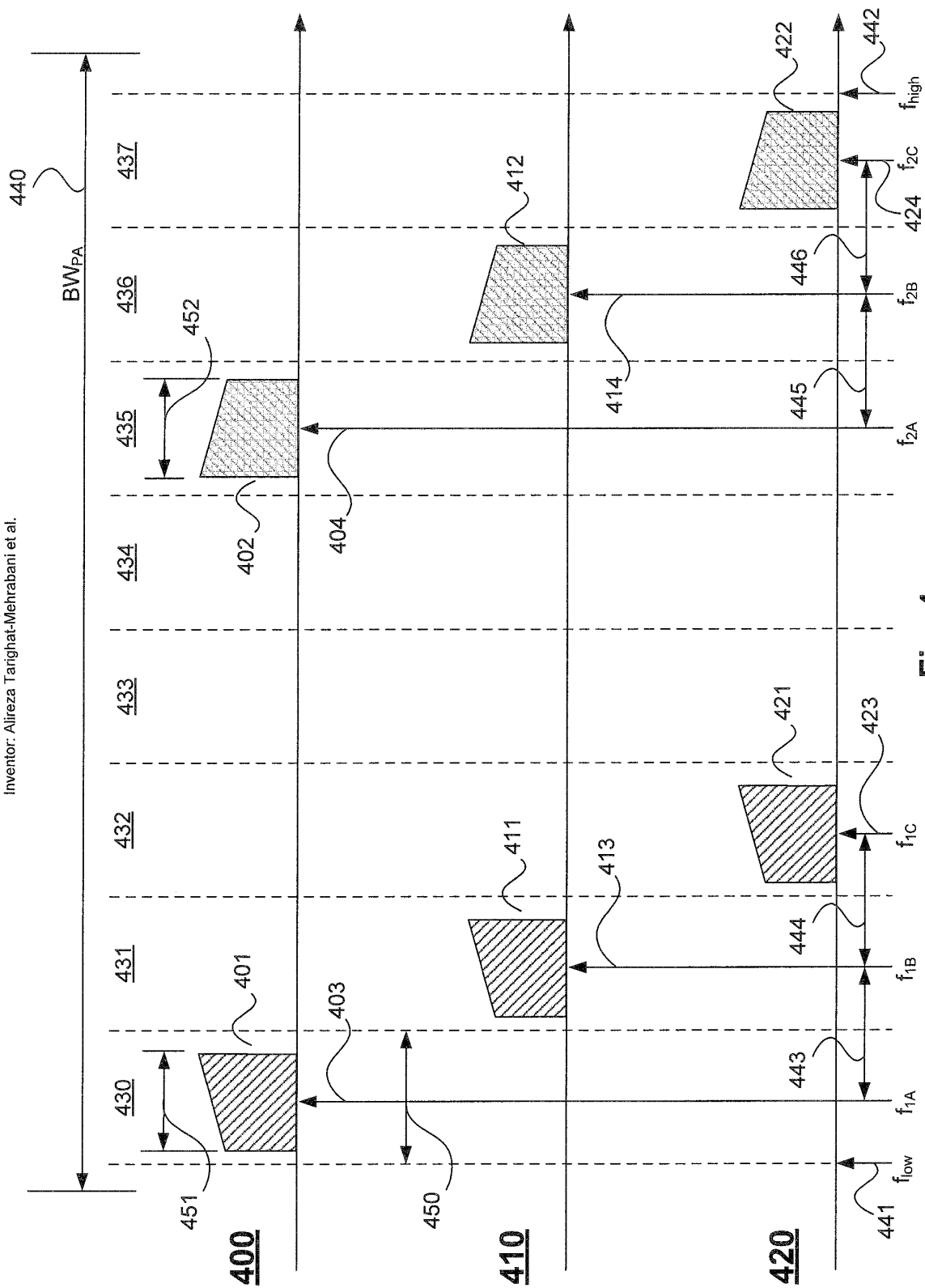


Fig. 4

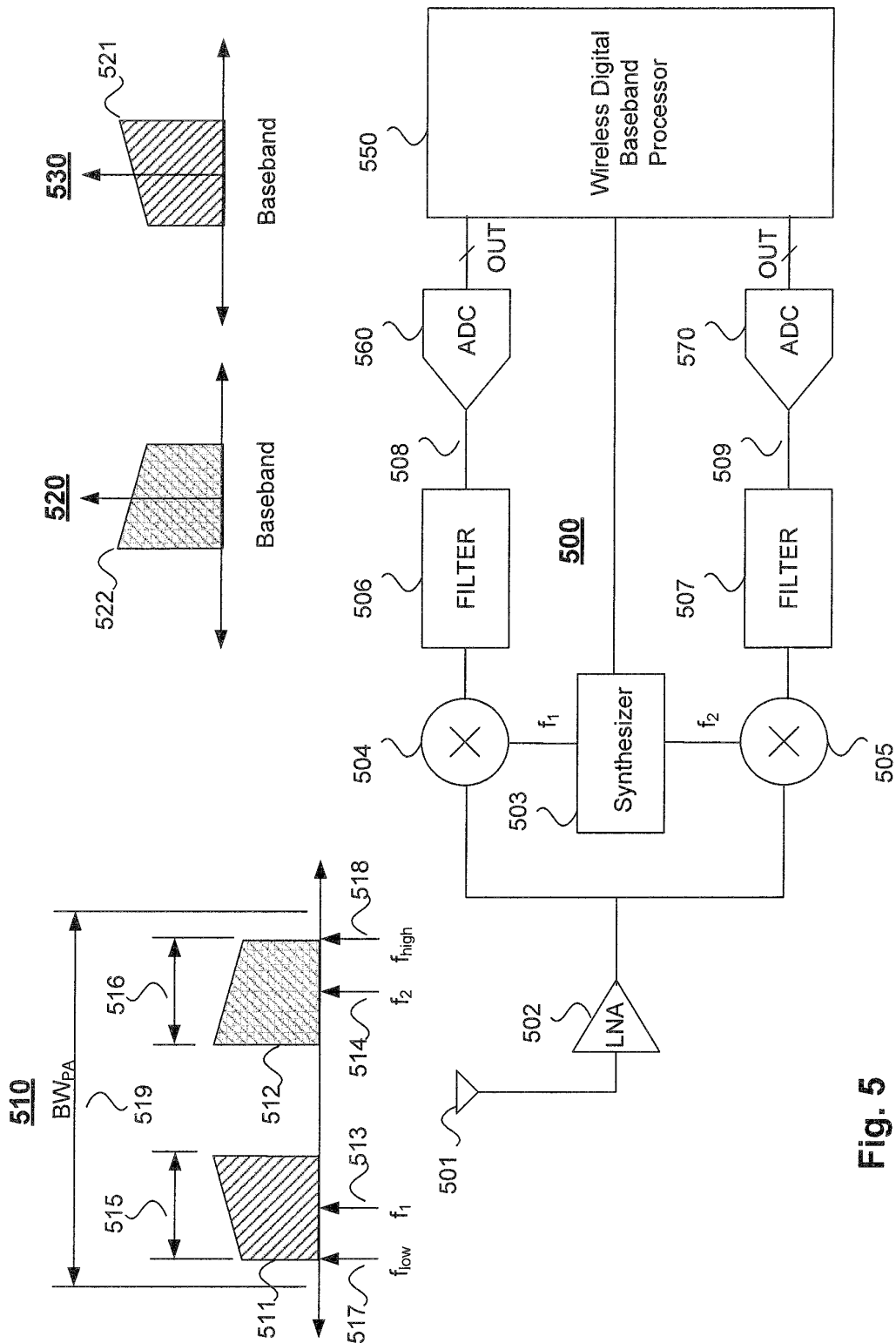


Fig. 5

600

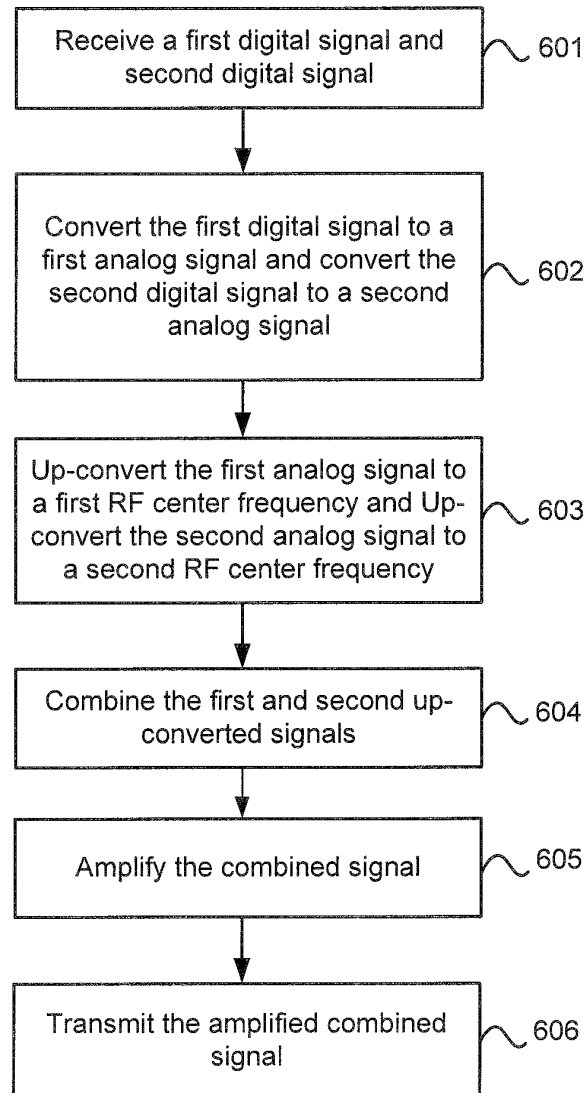
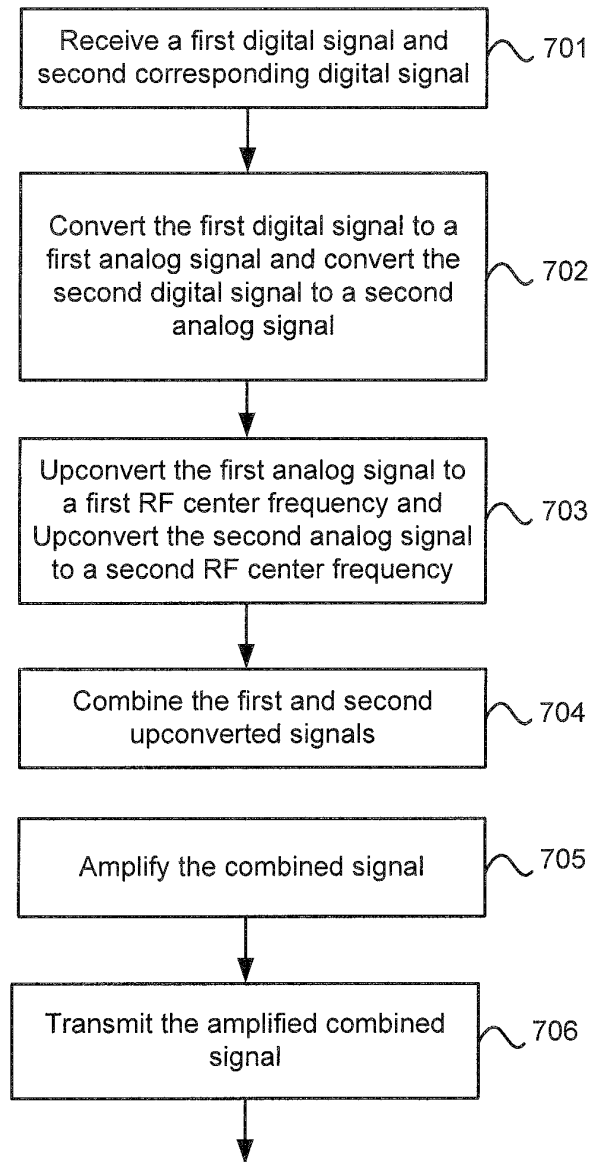


Fig. 6

700



Continued on Fig. 7B

Fig. 7A

Continued from Fig. 7A

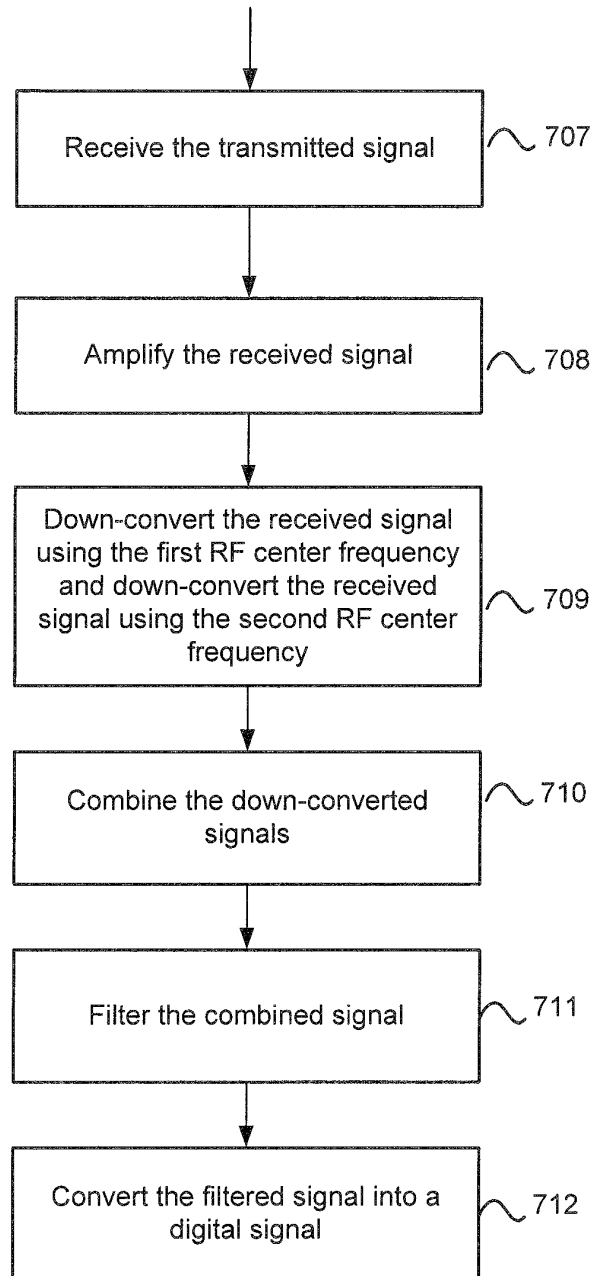


Fig. 7B

800

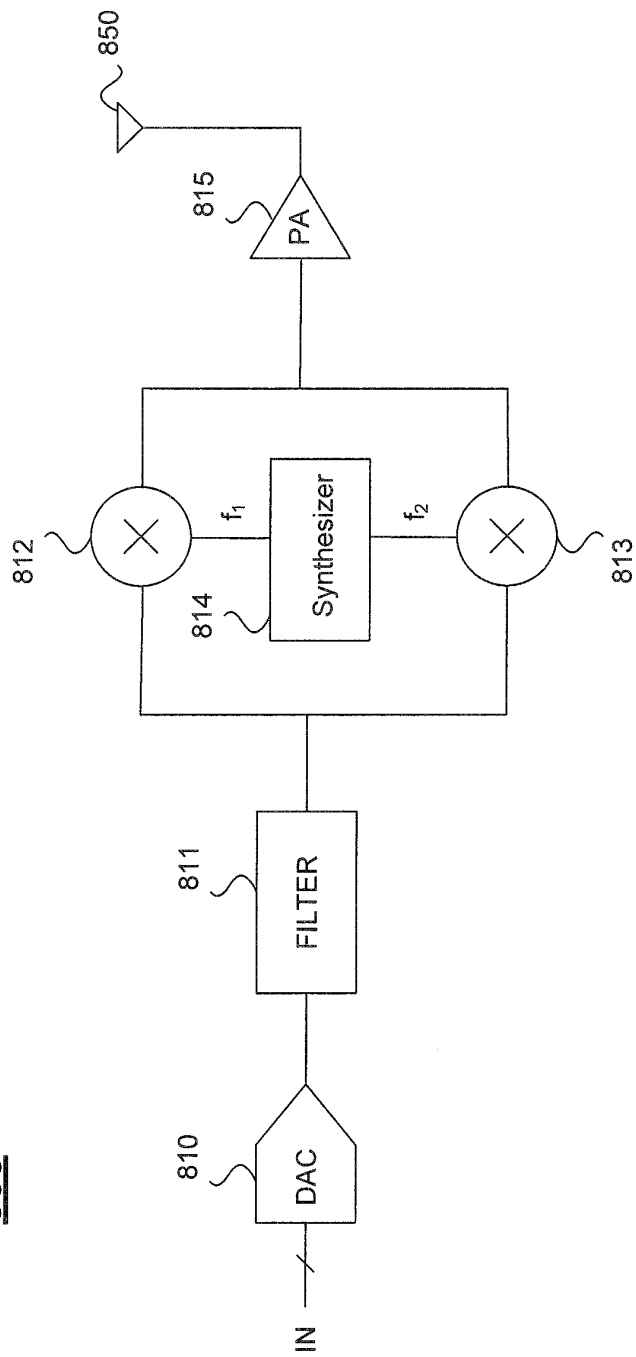


Fig. 8

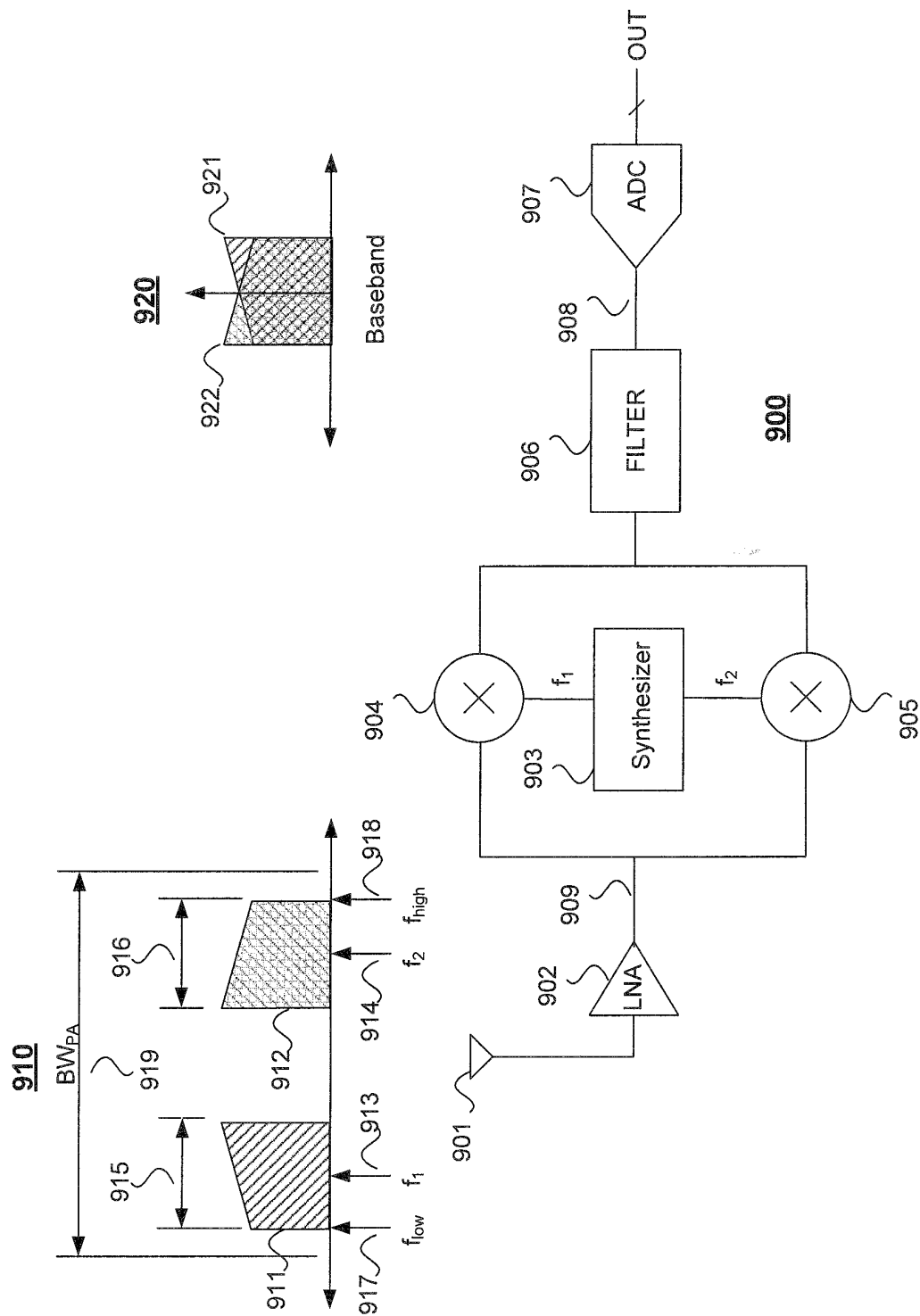


Fig. 9

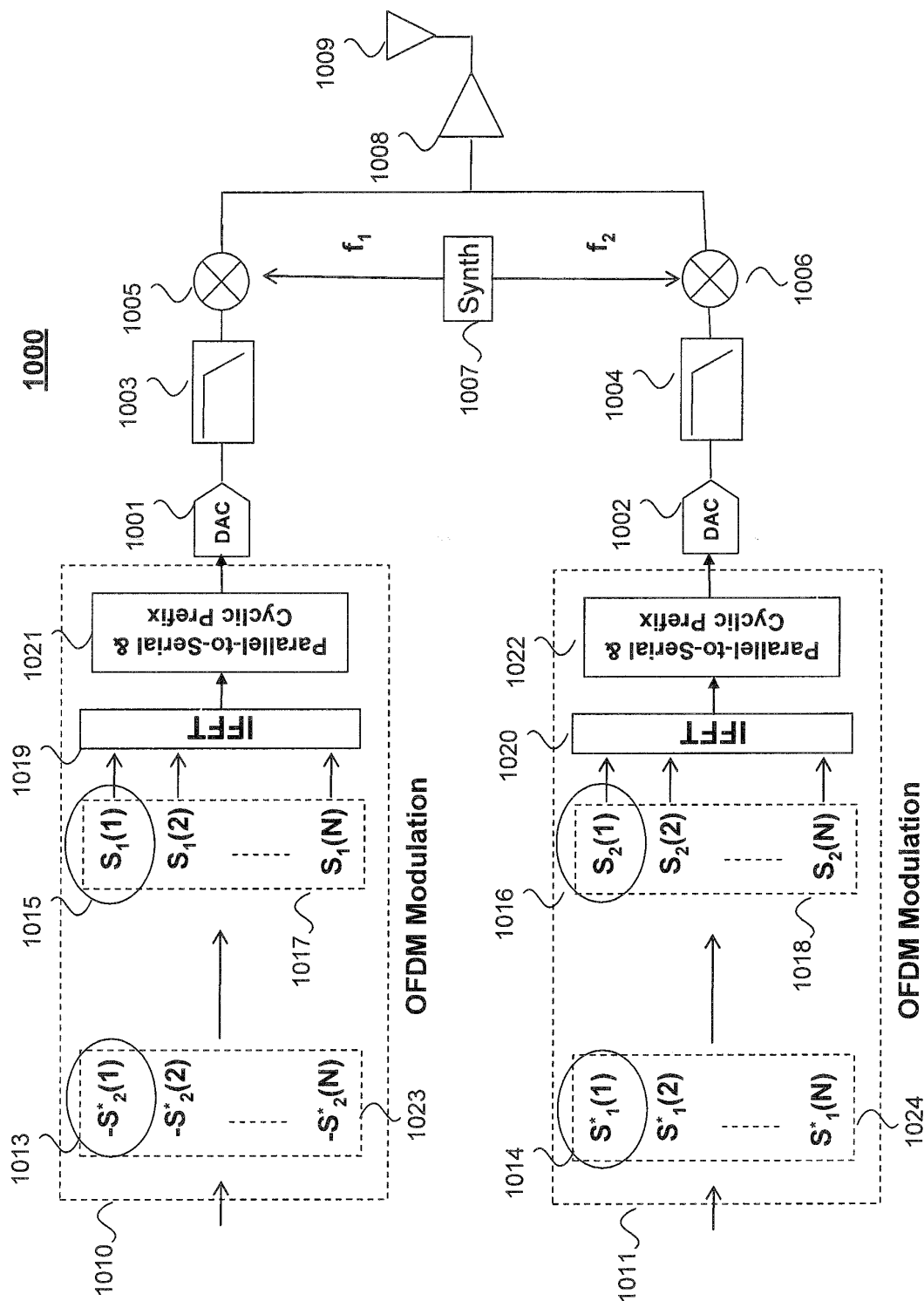


Fig. 10

1100

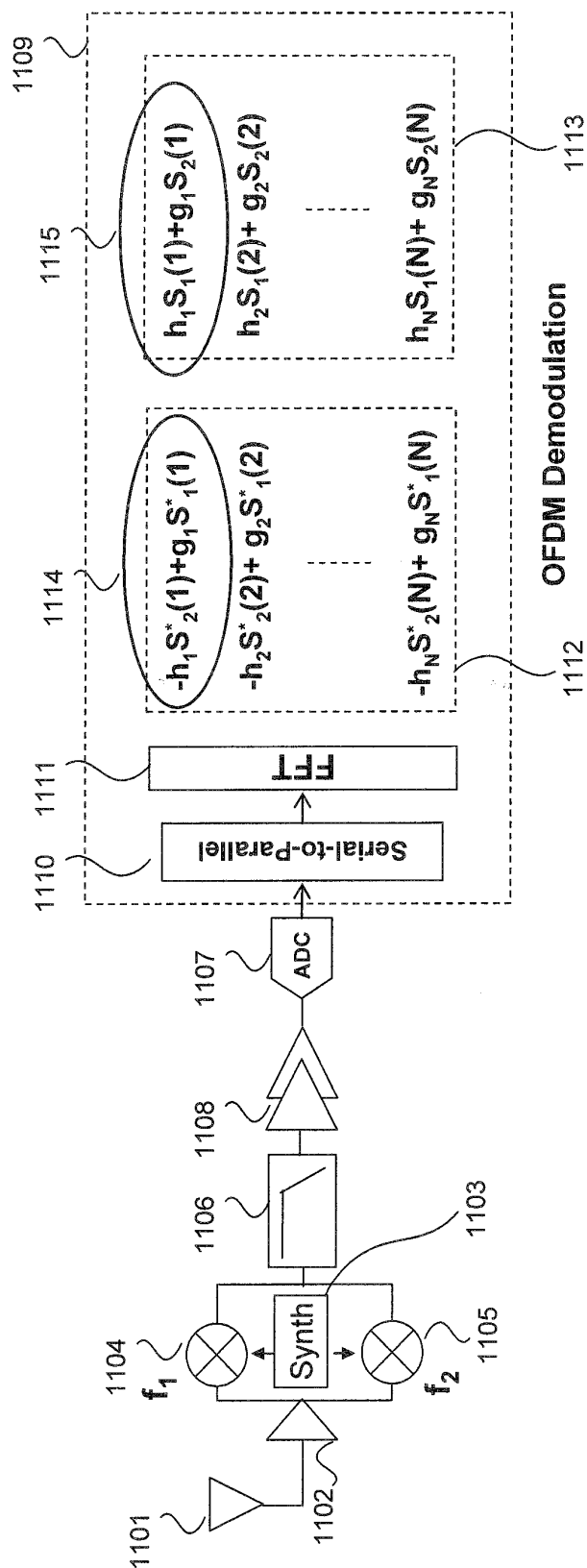


Fig. 11

Electronic Patent Application Fee Transmittal				
Application Number:				
Filing Date:				
Title of Invention:		Wireless Communication Systems and Methods		
First Named Inventor/Applicant Name:		Alireza Tarighat-Mehrabani		
Filer:		Chad Richard Walsh/Julia Moorhead		
Attorney Docket Number:		000007-001100US		
Filed as Small Entity				
Utility Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	75	75
Utility Search Fee	2111	1	255	255
Utility Examination Fee	2311	1	105	105
Pages:				
Claims:				
Claims in excess of 20	2202	5	25	125
Independent claims in excess of 3	2201	1	105	105
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				665

Electronic Acknowledgement Receipt	
EFS ID:	2754504
Application Number:	12018370
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Confirmation Number:	8018
Title of Invention:	Wireless Communication Systems and Methods
First Named Inventor/Applicant Name:	Alireza Tarighat-Mehrabani
Customer Number:	68155
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Attorney Docket Number:	000007-001100US
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Time Stamp:	13:32:54
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Payment Type	Electronic Funds Transfer
Payment was successfully received in RAM	\$ 665
RAM confirmation Number	8046
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
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	Transmittal of New Application	1	1		
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New International Application Filed with the USPTO as a Receiving Office

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01/23/08

Approved for use through 7/31/2006. OMB 0651-0032

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/018,370	
APPLICATION AS FILED – PART I						
(Column 1)		(Column 2)		SMALL ENTITY		OR
OTHER THAN SMALL ENTITY						
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	75	N/A	
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	255	N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	105	N/A	
TOTAL CLAIMS (37 CFR 1.16(j))	25	minus 20 = * 5	X 25=	125	X 50=	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4	minus 3 = * 1	X 105=	105	X 210=	
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR					
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			N/A		N/A	
			TOTAL	665	TOTAL	
* If the difference in column 1 is less than zero, enter "0" in column 2.						
APPLICATION AS AMENDED – PART II						
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY
OTHER THAN SMALL ENTITY						OR
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)
Total (37 CFR 1.16(j))	*	Minus **	=	X =		X =
Independent (37 CFR 1.16(h))	*	Minus ***	=	X =		X =
Application Size Fee (37 CFR 1.16(s))						
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A
				TOTAL		TOTAL
				ADD'T FEE		ADD'T FEE
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY
OTHER THAN SMALL ENTITY						OR
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE (\$)	ADDITIONAL FEE (\$)	RATE (\$)
Total (37 CFR 1.16(j))	*	Minus **	=	X =		X =
Independent (37 CFR 1.16(h))	*	Minus ***	=	X =		X =
Application Size Fee (37 CFR 1.16(s))						
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))				N/A		N/A
				TOTAL		TOTAL
				ADD'T FEE		ADD'T FEE
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.						

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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