IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent of Alireza Tarighat-Mehrabani, *et al.* U.S. Patent No. 7,924,802	REQUEST FOR *EX PARTE* REEXAMINATION Attorney Docket No.: 63549-396656
Filed: January 23, 2008	
Issued: April 12, 2011	
Title: WIRELESS COMMUNICATION SYSTEMS AND METHODS	

REQUEST FOR *EX PARTE* REEXAMINATION

UNDER 35 U.S.C. §§ 302-306

Mail Stop *Ex Parte* Reexam
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir/Madam:

Pursuant to the provisions of 35 U.S.C. §§ 301-307, Unified Patents, LLC ("Requester") hereby requests an *ex parte* reexamination of claims 1-15 and 17-23 ("Challenged Claims") of U.S. Patent No. 7,924,802 ("the '802 Patent," EX1001) that issued on April 12, 2011, to Alireza Tarighat-Mehrabani, *et al.*, resulting from U.S. Patent Application No. 12/018,370 filed on January 23, 2008. The '802 Patent is currently assigned to Cobblestone Wireless, LLC ("Cobblestone"). Assignment is recorded in the U.S. Patent and Trademark Office ("USPTO") reel/frame 063974/0935.

Requester hereby asserts that the Challenged Claims of the '802 Patent are invalid over prior art references and arguments that were not previously before the Patent Office, that are non-cumulative of the prior art that was before the Examiner during the original prosecution of the '802 Patent, and that raise substantial new questions of patentability. Requester therefore requests that an order for reexamination be issued, and that the Office reject and cancel the Challenged Claims.

Ex Parte Reexamination Filing Requirements

Pursuant to 37 C.F.R. § 1.510(b)(1), statements pointing out at least one substantial new question of patentability based on material, non-cumulative reference patents and printed publications for the Challenged Claims of the '802 Patent are provided in Sections I.A and I.G of this Request.

Pursuant to 37 C.F.R. § 1.510(b)(2), reexamination of the Challenged Claims of the '802 Patent is requested, and a detailed explanation of the pertinence and manner of applying the cited references to the Challenged Claims is provided in Section II of this Request.

Pursuant to 37 C.F.R. § 1.510(b)(3), copies of every patent or printed publication relied upon or referred to in the statement pointing out each substantial new question of patentability or in the detailed explanation of the pertinence and manner of applying the cited references are provided as Exhibits 1001-1008 and in Section II of this Request.

Pursuant to 37 C.F.R. §1.510(b)(4), a copy of the '802 Patent is provided as Exhibit 1001 of this Request, along with a copy of any disclaimer, certificate of correction, and reexamination certificate issued corresponding to the patent.

Pursuant to 37 C.F.R. § 1.510(b)(5), the attached Certificate of Service indicates that a copy of this Request, in its entirety, has been served on Patent Owner at the following address of record for Patent Owner, in accordance with 37 C.F.R. § 1.33(c):

HEIMLICH LAW, PC
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San Jose, CA 95123

In accordance with 37 C.F.R. § 1.510(b)(6), Requester hereby certifies that the estoppel provisions of 35 U.S.C. § 315(e)(1) or 35 U.S.C. § 325(e)(1) do not prohibit Requester from filing this ex parte reexamination request. Requester has not previously challenged the '802 Patent and has not been involved in any proceeding involving the '802 Patent.

Also submitted herewith is the fee set forth in 37 C.F.R. § 1.20(c)(l). The Director is authorized to charge any additional needed costs for timely entry, with fees for extensions and shortages in other fees, being applied to Deposit Account No. 02-1010 (63549-396656).

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I. STATEMENT POINTING OUT SUBSTANTIAL NEW QUESTIONS OF PATENTABILITY

A. Summary of Substantial New Questions of Patentability

This Request presents substantial new questions of patentability for the Challenged Claims of the '802 Patent. This Request relies on prior art (Shearer, Jaentti, Rao, Kim, Balakrishnan, Rofougaran, and Zheng) that was not previously considered by the Office with respect to the Challenged Claims. The prior art cited in this Request renders unpatentable the Challenged Claims of the '802 Patent on the basis of anticipation and obviousness grounds that have not been considered by the Office before.

Shearer, Jaentti, Rao, Kim, and Balakrishnan as presented below each raise a substantial new question of patentability because none of those references were considered during prosecution of the '802 Patent, and because Requester shows below at Section II that Shearer and combinations of Shearer, Jaentti, Rao, Kim, and Balakrishnan each disclose the limitations of the claims.

As shown below and confirmed in the Declaration of Mr. Mark R. Lanning (hereinafter, "Expert Declaration," EX1003), the technology claimed in the '802 Patent was not new. The references presented in this Request anticipated and/or rendered obvious the Challenged Claims, which should be canceled as unpatentable.

B. Overview of the '802 Patent

1. Technology Overview and Summary

The '802 Patent's challenged claims relate to wireless communication systems and methods. ('802 Patent, EX1001, Abstract.) The '802 Patent discloses a communication system 200 that includes pairs of digital-to-analog converters (DACs) 201, 202, filters 203, 204, and up-converters (such as mixers) 205, 206, as well as a single power amplifier 208 and antenna 209. *Id.* 5:53-58. A baseband digital system 250 provides first and second digital data 251, 252 to be transmitted. *Id.* 5:63-66. Each of the data streams 251, 252 may be packets that conform to a

specific wireless protocol, and may be unrelated data streams or may be data from the same data stream. *See id.* 5:66-6:9.

The first digital output of the baseband processor 250 is converted to a first analog signal by the DAC 201, which is filtered by the filter 203. *Id.* 6:10-21. Output of the filter 203 is coupled to the up-converter 205, which up-converts the first analog signal around a center frequency f_1 to generate a first up-converted analog signal 301. *Id.* 6:22-34. Similarly, the second digital output of the baseband processor 250 is converted to a second analog signal by the DAC 202, which is filtered by the filter 204. *Id.* 6:13-21. Output of the filter 204 is coupled to the up-converter 206, which up-converts the second analog signal around a center frequency f_2 to generate a second up-converted analog signal 302. *Id.* 6:35-48. The frequency difference between the first RF center frequency (i.e., f_1) and the second RF center frequency (i.e., f_2) is greater than the sum of one-half of the frequency range 305 of the first up-converted analog signal 301 and one-half of the frequency range 306 of the second up-converted analog signal 302. *Id.* 6:48-56; *see also id.* fig. 3.

The power amplifier 208 receives the first and second up-converted analog signals 301, 302, which may be simply added together. *Id.* 6:57-60. The first and second up-converted analog signals 301, 302 are combined at the input of the power amplifier 208 before amplification to produce a combined, amplified up-converted signal, which is transmitted by the antenna 209. *Id.* 7:11. In an example, the bandwidth of the power amplifier 208 is greater than the difference between the lowest frequency in the first up-converted frequency range 305 and the highest frequency in the second up-converted frequency range 306. *Id.* 6:65-7:2. Frequency content of the up-converted signals may be changed, for example by changing the first and second RF center frequencies concurrently at various times. *See id.* 7:19-62, fig. 4.

The '802 Patent further discloses a system 500 that includes an antenna 501, a low noise amplifier (LNA) 502, and pairs of down-converters 504, 505, filters 506, 507, and analog-to-digital

converters (ADCs) 560, 570. *Id.* 8:6-11. The antenna 501 may receive an up-converted analog signal including combined signals 511, 512, similar to the transmitted signals discussed above. *See id.* 8:11-22. The LNA 502 outputs an amplified up-converted signal. *Id.* 8:22-26. The down-converter 504 receives the amplified up-converted signal and a first RF center frequency f_1 and outputs a first down-converted analog signal, which is filtered by the filter 506 and converted back to digital by the ADC 560. *See id.* 8:26-66. Similarly, the down-converter 505 receives the amplified up-converted signal and a second RF center frequency f_2 and outputs a second down-converted analog signal, which is filtered by the filter 507 and converted back to digital by the ADC 570. *See id.* 8:36-9:2.

For the sake of reference, the challenged claims 1-15 and 17-23 are reproduced below. Claims 1, 10, and 17 are independent claims, and the remaining challenged claims depend directly or indirectly from those claims.

1. A method of transmitting 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 greater than the first center frequency, a second highest frequency, and a second lowest frequency.

2. The method of claim 1 wherein 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.

3. The method of claim 1 wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter.

4. The method of claim 3 wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

5. The method of claim 1 further comprising 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 frequency and the second highest frequency for the changed first and second center frequencies.

6. The method of claim 1 wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol.

7. The method of claim 1 wherein the first information and the second information are the same data transmitted across two different frequencies.

8. The method of claim 1 wherein the first information and the second information are from the same data stream.

9. The method of claim 1 wherein first information and second information comprise a plurality 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.

10. A method of transmitting information in a wireless communication channel comprising:

receiving a first digital signal 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 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 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 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.

11. The method of claim 10 further comprising 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.

12. The method of claim 11 wherein the first and second RF center frequencies are changed concurrently.

13. The method of claim 10 wherein the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol.

14. The method of claim 10 wherein the second data is the same as the first data, the method further comprising:

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.

15. The method of claim 12 further comprising:

filtering the fourth analog signal using a third filter and filtering the fifth analog signal using a fourth filter; and

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.

17. 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 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 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-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 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.

18. The communication system of claim 17 wherein the first RF frequency and the second RF frequency change within the bandwidth of the power amplifier.

19. The communication system of claim 18 wherein the first RF frequency and the second RF frequency change concurrently.

20. The communication system of claim 18 wherein the first RF frequency and the second RF frequency change periodically.

21. The communication system of claim 17 wherein 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 wireless protocol.

22. The communication system of claim 17 wherein 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.

23. The communication system of claim 17 wherein first and second data to be transmitted comprise a plurality 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 frequency range.

C. Priority Date of the '802 Patent

The '802 Patent was filed as Application No. 12/018,370 ("'370 Application") (EX1002) on January 23, 2008. Accordingly, the priority date of the '802 Patent is assumed to be January 23, 2008. All the prior art cited in the proposed grounds of rejection predates January 23, 2008 (see Section I.F below).

D. Prosecution History and Reasons for Allowance

The '802 Patent was filed as Application No. 12/018,370 ("'370 Application"). (*See* '802 PH, EX1002.) In response to the application, the examiner issued a Notice of Allowance that allowed each of originally filed claims 1-25. *See id.* 18-22. The Notice of Allowance indicated that the closest prior art of record, U.S. 2003/00176701 by Hinson and U.S. 2008/0225761 by Zhang, fail disclose all of the elements of independent claims 1, 10, 17, and 24. *Id.* 19. No information disclosure statement ("IDS") was filed in the case.

However, as shown below in Section II, the Challenged Claims are anticipated and/or rendered obvious by prior art not considered by the examiner. (Expert Declaration, EX1003 ¶¶ 46-234.)

E. Claim Construction

The '802 Patent is not expired. Thus, this Request analyzes the Challenged Claims according to their broadest reasonable interpretation in light of the specification. MPEP 2258 § I.G. For the purposes of this Request, all terms should be interpreted in accordance with their broadest reasonable interpretation.

F. Citation of Prior Art Patents and Printed Publications

In accordance with 37 C.F.R. § 1.510(b)(3), reexamination of the Challenged Claims of the '802 Patent[1] is requested in view of the following references:

Prior Art References	
EX1004	U.S. Patent No. 7,742,388 to Shearer et al. ("Shearer").
EX1005	U.S. Patent No. 6,516,206 to Jaentti ("Jaentti")
EX1006	Rao, K. D., & Murthy, T. S. N. (2007, July). *Analysis of Effects of Clipping and Filtering on the Performance of MB-OFDM UWB Signals*. In 2007 15th International Conference on Digital Signal Processing (pp. 559-562). IEEE. ("Rao")
EX1007	U.S. Patent Application Pub. No. 2007/0081613 by Kim et al. ("Kim")
EX1008	U.S. Patent Application Pub. No. 2005/0237923 by Balakrishnan et al. ("Balakrishnan")
EX1009	U.S. Patent No. 8,416,879 to Rofougaran et al. ("Rofougaran")
EX1010	U.S. Patent Application Pub. No. 2010/0062726 by Zheng et al. ("Zheng")

1. Prior Art Qualification of Cited Prior Art Patents and Printed Publications

Shearer et al. issued on June 22, 2010 and was filed on July 20, 2005 and claims priority to U.S. provisional application serial number 60/589,158, which was filed on July 20, 2004, and is thus prior art under at least 35 U.S.C. § 102(e).

Jaentti issued on February 4, 2003 and was filed on May 29, 2001, and is a continuation of international application no. PCT/FI00/00825, which was filed on September 27, 2000, and claims priority to Finnish application no. 992113, which was filed on September 30, 1999, and is thus prior art under at least 35 U.S.C. § 102(b).

Rao published no later than July 31, 2007 and is thus prior art under at least 35 U.S.C. § 102(a).

Kim et al. published on April 12, 2007 and was filed on July 21, 2006 and is thus prior art under at least 35 U.S.C. §§ 102(a), (e).

[1] The '802 Patent has an effective filing date before the enactment of the America Invents Act ("AIA"). Thus, the pre-AIA statutory framework applies.

Balakrishnan et al. published on October 27, 2005 and was filed on April 26, 2005, and claims priority to U.S. provisional application serial number 60/565,570, which was filed on April 26, 2004, and is thus prior art under at least 35 U.S.C. § 102(b).

Rofougaran et al. issued on April 9, 2013 and was filed on March 15, 2006 and claims priority to U.S. provisional application serial number 60/741,572, which was filed on December 1, 2005, and is thus prior art under at least 35 U.S.C. §§ 102(a), (e).

Zheng et al. published on March 11, 2010 and is a national stage entry of international application no. PCT/SG06/00359, which was filed on November 22, 2006, and is thus prior art under at least 35 U.S.C. § 102(e).

G. Identification of Substantial New Questions of Patentability

In this Request, substantial new questions (SNQs) of patentability are raised as set forth below. This subject matter is disclosed or taught by Shearer and/or by combinations of Shearer, Jaentti, Rao, Kim, and Balakrishnan and thus a substantial new question of patentability is raised by each reference and/or combination.

1. Shearer Raises a Substantial New Question of Patentability

Shearer raises a substantial new question of patentability because it discloses or renders obvious every limitation of the challenged claims 1-4, 6, and 9, and it was not considered during prosecution of the '802 Patent. The disclosure and teachings of that reference is summarized below in Section II.A.1.

2. Shearer in view of Jaentti Raises a Substantial New Question of Patentability.

The combination of Shearer in view of Jaentti raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claim 4, and

none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.A.1 and II.B.2.

3. Shearer in view of Rao and Jaentti Raises a Substantial New Question of Patentability.

The combination of Shearer in view of Rao and Jaentti raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claim 5, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.A.1, II.B.2, and II.C.2.

4. Shearer in view of Kim Raises a Substantial New Question of Patentability.

The combination of Shearer in view of Kim raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claim 6, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.A.1 and II.D.2.

5. Shearer in view of Balakrishnan Raises a Substantial New Question of Patentability.

The combination of Shearer in view of Balakrishnan raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claims 7 and 8, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.A.1 and II.E.2.

6. Rao in view of Shearer Raises a Substantial New Question of Patentability.

The combination of Rao in view of Shearer raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claims 1-6 and

9, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.C.2 and II.A.1.

7. Rao in view of Shearer and Balakrishnan Raises a Substantial New Question of Patentability.

The combination of Rao in view of Shearer and Balakrishnan raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claims 7 and 8 and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.C.2, II.A.1, and II.E.2.

8. Rofougaran Raises a Substantial New Question of Patentability.

Rofougaran raises a substantial new question of patentability because it discloses or renders obvious every limitation of the challenged claims 10-13 and 17-22, and it was not considered during prosecution of the '802 Patent. The disclosure and teachings of that reference is summarized below in Section II.H.1.

9. Rofougaran in view of Jaentti Raises a Substantial New Question of Patentability.

The combination of Rofougaran in view of Jaentti raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claims 10-13 and 17-22, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.H.1 and II.B.2.

10. Rofougaran (and alternatively, Rofougaran and Jaentti) in view of Rao Raises a Substantial New Question of Patentability.

The combination of Rofougaran (and alternatively, Rofougaran and Jaentti) in view of Rao raises a substantial new question of patentability because it discloses or renders obvious every

limitation of challenged claims 11 and 20, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.H.1 and II.C.2.

11. Rofougaran (and alternatively, Rofougaran and Jaentti) in view of Shearer Raises a Substantial New Question of Patentability.

The combination of Rofougaran (and alternatively, Rofougaran and Jaentti) in view of Shearer raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claims 12, 19, and 23, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.H.1 and II.A.1.

12. Rofougaran (and alternatively, Rofougaran and Jaentti) in view of Balakrishnan and Zheng Raises a Substantial New Question of Patentability.

The combination of Rofougaran (and alternatively, Rofougaran and Jaentti) in view of Balakrishnan and Zheng raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claims 14-15, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.H.1, II.E.2, and II.L.3.

13. Rao in view of Shearer and Kim Raises a Substantial New Question of Patentability.

The combination of Rao in view of Shearer and Kim raises a substantial new question of patentability because it discloses or renders obvious every limitation of challenged claim 6, and none of these references were considered during prosecution of the '802 Patent. The disclosure and teachings of these references are summarized below in Sections II.C.2, II.A.1, and II.D.2.

H. Summary of Proposed Rejections

In accordance with 37 C.F.R. § 1.510(b)(2), reexamination of the Challenged Claims of the '802 Patent is requested based on the following proposed rejections:

Proposed Rejection	Claims	Statutory Basis
1	1-4, 6, and 9	Anticipated by Shearer
2	4	Obvious over Shearer and Jaentti
3	5	Obvious over Shearer in view of Rao and Jaentti
4	6	Obvious over Shearer in view of Kim
5	7 and 8	Obvious over Shearer in view of Balakrishnan
6	1-6 and 9	Obvious over Rao in view of Shearer
7	7 and 8	Obvious over Rao and Shearer in view of Balakrishnan
8	10-13, 17-22	Anticipated by Rofougaran
9	10-13, 17-22	Obvious over Rofougaran in view of Jaentti
10	11, 20	Obvious over Rofougaran (and alternatively Rofougaran with Jaentii) in view of Rao
11	12, 19, 23	Obvious over Rofougaran (and alternatively Rofougaran with Jaentii) in view of Shearer
12	14-15	Obvious over Rofougaran (and alternatively Rofougaran with Jaentii) in view of Balakrishnan and Zheng
13	6	Obvious over Rao in view of Shearer and Kim

II. DETAILED EXPLANATION OF THE PERTINENCE AND MANNER OF APPLYING THE PRIOR ART REFERENCES TO EVERY CLAIM FOR WHICH REEXAMINATION IS REQUESTED

The proposed rejections detailed below show that claims 1-15 and 17-23 of the '802 Patent are unpatentable. (Expert Declaration, EX1003 ¶¶ 46-234.)

A. Proposed Rejection 1: Claims 1-4, 6, and 9 are anticipated by Shearer.

The Office has not considered Shearer. Requester shows below that Shearer discloses every limitation of the Challenged Claims 1-4, 6, and 9.

1. Overview of Shearer

Similar to the '802 Patent, Shearer discloses methods, systems, and apparatus for a digital communication system and particularly techniques to increase data rate for a wireless local area network transmission. (*See* Shearer, EX1004, Abstract.) Shearer further discloses a wireless local area network (WLAN) system 200 in which devices are implemented according to various 802.11 standards. *See id.* 4:26-61. Shearer further discloses a transmitter for an 802.11 device that includes a PHY unit 300. *Id.* 4:62-63, fig. 3. The PHY unit 300 includes an orthogonal frequency division multiplex (OFDM) transmit kernel 320, an interleaver/mapper 304, a symbol wave shaper/interpolator/shifter/summer 310, an IQ modulator 312, a mixer 314, a high power amplifier (HPA) 316, and an antenna 318. *Id.* 4:63-5:4.

Shearer further discloses that the PHY 300 can include two 20 MHz signal processing paths. *Id.* 8:25-26. A lower 20 MHz path, shown in FIG. 8, includes a lower OFDM Tx kernel 320a as well as an interpolator 310a and −10 MHz frequency shifter 310b. *Id.* 8:26-29. An upper 20 MHz path, shown in FIG. 11, includes an upper OFDM Tx kernel 320b as well as an interpolator 310c and a +10 MHz frequency shifter 310d. *Id.* 8:61-63. In an exemplary embodiment shown in FIG. 13, the output from each of the lower 20 MHz path and the upper 20 MHz path is aggregated in adder 310 to achieve an aggregated signal 1400. *Id.* 9:16-22.

In use, the PHY unit 300 receives two 20 MHz 802.11a input signals substantially simultaneously. *Id.* 8:22-25. A signal from the lower 20 MHz OFDM transmit kernel 320a is interpolated by 2 and then shifted down by 10 MHz. *Id.* 8:39-54; *see also id.* fig. 10 (illustrating down-shifted signal 1000). Another signal from the upper 20 MHz OFDM transmit kernel 320b is interpolated by 2 and then shifted up by 10 MHz. *Id.* 8:61-9:10; *see also id.* fig. 12 (illustrating up-shifted signal 1200). The output from each of the upper and lower 20 MHz signal paths (i.e., the down-shifted signal 1000 and the up-shifted signal 1200) are aggregated by the adder 310e to generate the aggregated signal 1400, with 40 MHz bandwidth. *Id.* 9:16-24; *See also* fig. 14

(illustrating aggregated signal 1400). The output from the symbol wave shaper/interpolator/shifter/summer 310 (i.e., the aggregated signal 1400) is sent to modulator 312, which modulates the encoded data with conventional OFDM modulation techniques. *Id.* 5:29-33. The modulated data is sent to the mixer 314, which upconverts the signal to the desired transmit frequency, and then the upconverted signal is amplified by the HPA 316 and sent to the antenna 318 for transmission. *Id.* 5:37-42.

Shearer further discloses more generalized methods for aggregating an arbitrary number (greater than two) of simultaneous input signals. *Id.* 9:25-10:31; *see also* figs. 15-18. In particular, Shearer discloses separate methods for aggregating an even number of signals, *id.* 9:31-60, and for aggregating an odd number of signals, *id.* 9:61-10:23. As an example illustrated in FIGS. 15-16, Shearer describes a process for shifting and aggregating six simultaneous signals. *Id.* 9:33-54. In this example, for an even number of signals "[e]ach simultaneous input is interpolated and shifted from the center frequency by a progressive odd multiple of BW/2 on alternating sides of the center frequency." *Id.* 9:45-48. Similarly, in an example shown in FIGS. 17-18 for an odd number of signals (i.e., five signals in the illustrative example), "[e]ach substantially simultaneous input is interpolated and shifted from the center frequency by a progressive multiple of the BW on alternating sides of the center frequency." *Id.* 10:13-16.

Shearer at FIG. 19 illustrates a graph of each signal and its frequency versus time relationship. *Id.* 10:32-33. As shown in FIG. 19, each of Signals 1 and 2 are in separate frequency ranges, but each of Signals 1 and 2 start at the same start time 1902 and end at the same end time 1904. Each signal's start time and end time are preferably substantially equivalent to eliminate problems with multiple signal acquisition and termination. *Id.* 10:33-38.

Shearer at FIGS. 21-22 illustrates two types of packets that can be supported by an exemplary embodiment. *Id.* 11:23-48. As shown, each of the packets 2100, 2200 include various preamble/header signals that are followed by multiple "data symbols" 2112, 2208, respectively.

Thus, Shearer discloses that multiple data symbols (i.e., OFDM symbols) are transmitted in sequence.

2. Application of Shearer to Claims 1-4, 6, and 9

Shearer anticipates every element of claims 1-4, 6, and 9. For reference, examples are outlined from Shearer that disclose each associated claim limitation below. Discussion of the cited portions of Shearer are provided by expert declarant, Mark Lanning. (Expert Declaration, EX1003 ¶¶ 46-55.) A more detailed mapping of Rejection 1 is provided in Appendix AA.

Regarding claim 1, Shearer anticipates **[a] method of transmitting information in a wireless communication channel** (although the preamble may not be limiting; *see* Shearer at Abstract, 1:31-34; 3:61-62, 4:62-65); for example, Shearer discloses 802.11 wireless LAN transmission of orthogonal frequency division multiplex (OFDM) symbols over a wireless channel with can include multiple 20 MHz bands with effective 16.5 MHz width. (*See also* Expert Declaration, EX1003 ¶¶ 51-52, 57, 59-60.) Shearer further discloses **comprising transmitting first information across a first frequency range using a wireless transmitter,** (*see*, *e.g.*, *id.* figs. 3, 8-14, 15-16, 2:63-64, 3:4-5, 5:1-6, 5:30-33, 8:22-25, 8:32-51); for example, transmitting an 802.11a input signal as a down-shifted signal in a down-shifted frequency range. Shearer further discloses **the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency;** (*see, e.g., id.* figs. 10, 14, 16, 5:43-44, 5:50-54, 5:62-64, 8:32-51, 8:55-56); for example, Shearer's down-shifted signal has a center frequency of f_c – 10 MHz, a highest frequency of about f_c – 1.75 MHz, and a lowest frequency of about f_c – 18.25 MHz. Shearer further discloses **and simultaneously transmitting second information across a second frequency range** (*see*, *e.g.*, *id.* figs. 3, 8-14, 15-16, 8:22-25, 8:32-51, 8:66-9:7, 9:19-20; for example, Shearer simultaneously transmits another 802.11a input signal as an up-shifted signal in an up-shifted frequency range; as another example, Shearer at FIG. 16 illustrates simultaneous

transmission of multiple (e.g., six) signals across multiple frequency ranges). Shearer further discloses **using the same wireless transmitter** (*see*, *e.g.*, figs. 3, 8, 11, 13, 2:63-64, 3:4-5, 3:9-11, 5:26-28, 8:27-31, 8:51-52, 8:61-66, 9:7-8); for example, using the same PHY unit as shown in FIG. 3. Shearer further discloses **the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency** (*see*, *e.g.*, *id.* figs. 10, 12, 14, 16, 5:43-44, 5:50-54, 5:62-64, 8:66-9:7; for example, Shearer's up-shifted signal has a center frequency f_c + 10 MHz greater than the center frequency of the down-shifted signal (i.e., f_c – 10 MHz), and also has a highest frequency of about f_c + 18.25 MHz and a lowest frequency of about f_c + 1.75 MHz).

Regarding claim 2 (which depends on claim 1), Shearer discloses **wherein 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** (*see*, *e.g.*, *id.* figs. 10, 12, 16, 5:43-44, 5:50-54, 5:62-64, 8:32-51, 8:66-9:7, 9:25-10:31); for example, the frequency difference between the center frequency of the down-shifted signal (*i.e.*, f_c – 10 MHz) and the center frequency of the up-shifted signal (*i.e.*, f_c + 10 MHz) is 20 MHz, which is greater than the sum of one-half of the down-shifted frequency range plus one-half of the up-shifted frequency range, which is about 16.5 MHz; as another example, Shearer at FIG. 16 illustrates simultaneous transmission of multiple (e.g., six) signals across multiple frequency ranges, and the frequency difference between non-adjacent frequency ranges (e.g., signals 1604, 1606) is greater than the sum of one-half of each frequency range. (*See also* Expert Declaration, EX1003 ¶ 62.)

Regarding claim 3 (which depends on claim 1), Shearer anticipates **wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter** (*see*, *e.g.*, *id.* fig. 3, 2:63-64, 3:4-5, 3:9-11, 5:40-43); for example, the combined

down-shifted and up-shifted signals are transmitted using the same high power amplifier (HPA) 316.

Regarding claim 4 (which depends on claim 3), Shearer discloses **wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency** (*see*, *e.g.*, *id.* figs. 3, 16, 2:63-64, 3:4-5, 3:9-11, 9:31-54); for example, Shearer discloses that the HPA 316 simultaneously amplifies and transmits at least two bands (or sub-bands) for at least 40 MHz of bandwidth. FIG. 16 of Shearer also illustrates simultaneous amplification and transmission of six signals across multiple frequency ranges, and thus has bandwidth *greater than* the difference between the lowest frequency of signal 1604 and the highest frequency of signal 1606 (among other examples). In other words, the HPA 316 has a bandwidth greater than the 40 MHz of combined signals of bands 1604 and 1602, in order to accommodate the other bands such as 1612, 1068, 1606, and/or 1610. Conceivably, from 1612 to 1610 could represent an HPA bandwidth of nearly 3 times greater than defined by the lowest frequency of band 1604 and the highest frequency of band 1602, for example. The same comparison can be applied to other groupings of Shearer's bands. (*See also* Expert Declaration, EX1003 ¶¶ 64-67.)

Regarding claim 6 (which depends on claim 1), Shearer discloses **wherein the first information corresponds to a first wireless protocol** (*see*, *e.g.*, *id.* 1:39-42; 8:22-25; for example, one of the two 802.11a input signals are transmitted as an OFDM signal including information that corresponds to an 802.11 wireless protocol). Shearer further discloses **the second information corresponds to a second wireless protocol** (*see*, *e.g.*, *id.* 1:39-42; 8:22-25; for example, another one of the two 802.11a input signals are transmitted as an OFDM signal that corresponds to an 802.11 wireless protocol). (*See* Expert Declaration, EX1003 ¶68.1. This is true at least where there is no limitation in the claim indicating that the second wireless protocol must be different from the first wireless protocol.

Regarding claim 9 (which depends on claim 1), Shearer discloses **wherein first information and second information comprise a plurality of OFDM symbols,** (*see*, *e.g.*, *id.* 5:30-33); for example, Shearer discloses that the modulator modulates encoded data into OFDM symbols in accordance with conventional OFDM techniques. Shearer further discloses **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,** (*see*, *e.g.*, *id.* figs. 10, 12, 14, 19, 5:30-33, 8:23-26, 9:19-22, 10:32-38); for example, as shown in FIG. 19, the first symbol is transmitted across the down-shifted frequency range, and the second symbol is transmitted across the up-shifted frequency range during the same time slot between start time 1902 and end time 1904.

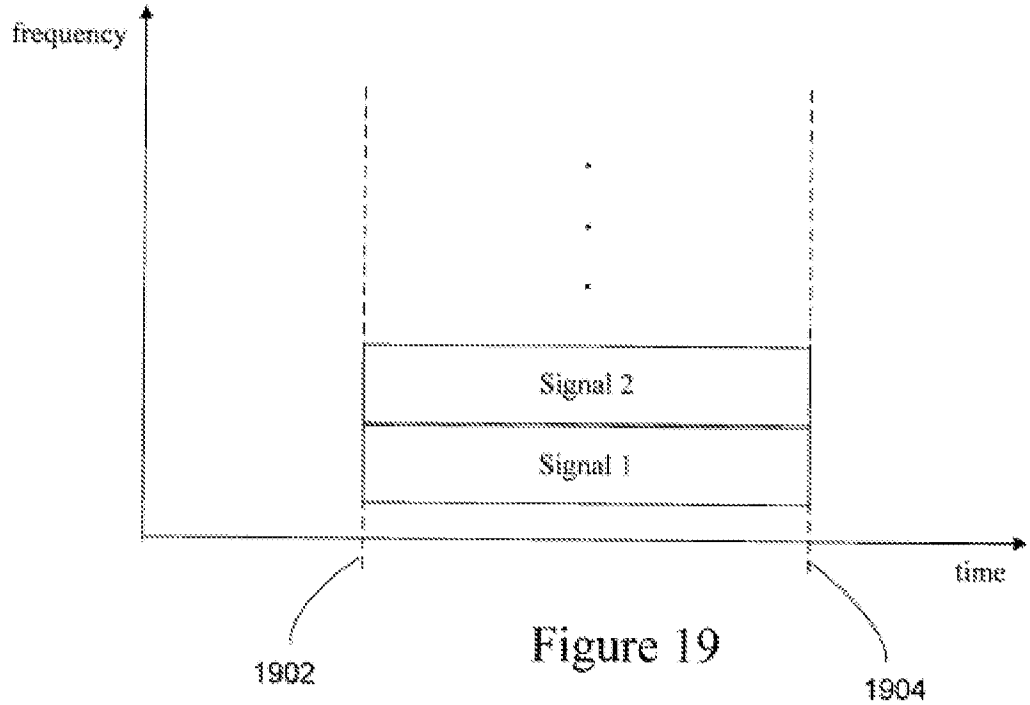

Figure 19

Shearer further discloses **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** (*see*, *e.g.*, *id.* figs. 10, 12, 14, 19, 21-22, 5:30-

33, 8:23-26, 9:19-22, 10:32-38, 11:23-24, 11:26-29, 11:46-48); for example, FIG. 19 is also generally descriptive of each transmission, and illustrates how the third symbol is transmitted across the down-shifted frequency range, and the fourth symbol is transmitted across the up-shifted frequency range during a time slot between start time 1902 and end time 1904 (*see id.*, 10:32-33 ("FIG. 19 is a graph of <u>each</u> signal") (emphasis added); continuing that example, as shown in FIGS. 21-22, data is transmitted as "packets" that each include the multiple "data symbols," and as a sequence of the data stream, which discloses transmission of the third and fourth symbols during "the second time slot" (e.g., simultaneously at a different time from the first time slot). *See* Expert Declaration, EX1003 ¶ 69; discussing Shearer 10:63-64 ("new incoming packet")).

B. Proposed Rejection 2: Claim 4 is rendered obvious by Shearer in view of Jaentti.

The Office has not considered Shearer or Jaentti. Requester shows below that Shearer in view of Jaentti discloses or renders obvious every limitation of the Challenged Claim 4.

1. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

2. Overview of Jaentti

Jaentti discloses a method of implementing transceiver operation at a base station. (*See* Jaentti, EX1005, Abstract.) The disclosure of Jaentti relates to third generation mobile systems, including wideband code division multiple access (WCDMA) technology. *Id.* 2:9-26. Jaentti discloses that prior art mobile systems have sectored base stations, with the transmitter functions of two sectors having different carriers implemented with different transmitters. *Id.* 1:27-30. Each sector-specific transmitter includes its own power amplifier and associated cabling, which introduces high costs due to the amount of components, the amount of expensive cabling required, and the amount of space required. *Id.* 1:30-43.

Jaentti discloses a transmitter in a radio system comprising a signal block 100, *id.* 4:43-44, which comprises two transmitter units 300, 302 for generating signals to be transmitted, *id.* 4:64-66. Those signals generated by the transmitter units 300, 302 have different frequencies, which are typically implemented by generating in each transmitter unit a carrier that is on a different frequency for each transmitter unit. *See id.* 4:66-5:4. "When carriers are at different frequencies, they are typically on entirely different frequency ranges, or frequency bands." *Id.* 5:7-9.

Those signals having different carrier frequencies are combined in an "adder" in the transmitter block. *Id.* 5:12-14. After combination, the signals are amplified in a "multifrequency amplifier," which is implemented as a linear amplifier that enables simultaneous processing of several signals at different frequencies. *Id.* 5:15-22. The multifrequency amplifier simultaneously amplifies at least two combined signals at different carrier frequencies. *Id.* 5:25-27. After amplification, the combined signals are filtered and then transmitted on sector-specific antennas 318, 320. *Id.* 5:28-51. Thus, Jaentti teaches to transmit, using the same amplifier, multiples of Shearer's combined signal (Shearer, FIGs. 9-12), which includes an amplifier having bandwidth greater than the individual combined signal to support the multiple combined signals. Additionally, Jaentti confirms the use of a single amplifier with bandwidth for Shearer's six bands as in Shearer's FIG. 16, which is greater than the bandwidth from the lowest of band 1604 to the highest of band 1602, for example.

3. Application of Shearer and Jaentti to Claim 4

The combination of Shearer and Jaentti renders every element of claim 4 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert

Declaration, EX1003 ¶¶ 29-32, 72-81.) A more detailed mapping of Rejection 2 is provided in Appendix AA.

Regarding claim 4 (which depends on claim 3), Shearer as modified by Jaentti renders obvious **wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency** (*see*, *e.g.*, Jaentti at fig. 3, 4:65-67, 5:7-9, 5:13-15, 5:16-27; for example, Jaentti discloses a multifrequency power amplifier 306 capable of amplifying at least two combined signals at different carrier frequencies). Thus, Jaentti confirms the use of a single amplifier with bandwidth for Shearer's six bands as in Shearer's FIG. 16, which is greater than the bandwidth from the lowest of Shearer's band 1604 to the highest of band 1602, for example.

A POSITA would have been motivated to combine the teachings of Shearer with those of Jaentti with a reasonable expectation of success. (Expert Declaration, EX1003 ¶ 76-80.) First, the references are analogous art to the '802 Patent (and each other), as each discloses wireless communication transmission devices and techniques using multiple frequencies. (Expert Declaration, EX1003 ¶ 80; EX1001, Abstract, 5:53-58; Shearer (EX1004), Abstract, 4:26-63; Jaentti (EX1005), Abstract, 2:9-26, 4:43).

Additionally, combining the teachings of Shearer with Jaentti would have been no more than the simple substitution of one known element for another to obtain predictable results, as a use of known technique to improve similar devices and/or methods in the same way, and/or otherwise as applying a known technique to a known device and/or method ready for improvement to yield predictable results. Both Shearer and Jaentti are concerned with the same problem, amplification of a multi-frequency signal in a wireless communication transmitter. (Expert Declaration, EX1003 ¶ 80.) Both Shearer and Jaentti propose solutions to address the same problem—how to amplify a multi-frequency signal before transmission. (Expert Declaration, EX1003 ¶ 76.) As discussed above, Shearer discloses that a high-power amplifier (HPA) 316

amplifies a combined, upconverted signal for transmission. (Shearer, EX1004 5:37-42.) Jaentti discloses a multi-frequency amplifier where the "bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency," as applied to Shearer's multiband technique. (Expert Declaration, EX1003 ¶76.) The result of using Jaentti's multi-frequency amplifier in place of Shearer's HPA 316 would have been predictable because it would simply involve applying as the HPA 316 component as shown in FIG. 3 of Shearer a multi-frequency amplifier as disclosed by Jaentti's 306. (Expert Declaration, EX1003 ¶ 78.) A POSITA would have also appreciated the benefits of simultaneous processing of several combined signals at different frequencies using a single amplifier implementation such as Jaentti suggests, including reduction of the number, space, and/or connections of components required to support many different amplifiers. (Jaentti at 1:27-43; Expert Declaration, EX1003 ¶ 77.) This replacement would have been predictable because a similar component function is being replaced. (Expert Declaration, EX1003 ¶ 78.) Based on those predictable results, a POSITA would have had a reasonable expectation of success in such a combination, and a POSITA would have understood that the combination would be used with no meaningful modification, as it simply entails replacing Shearer's transmitter component with Jaentti's transmitter component. (Expert Declaration, EX1003 ¶ 78.) Moreover, a POSITA would have appreciated the benefits of applying a single amplifier implementation, such as Jaentti suggests, including reduction of the number, space, and/or connections of components required to support many different amplifiers. (Expert Declaration, EX1003 ¶ 77 (see Jaentti 1:27-43).)

Thus, a POSITA would have found it obvious at the time of alleged invention to adapt Shearer's method as modified by Jaentti's method to include a multifrequency amplifier having bandwidth of said power amplifier being greater than the difference between the first lowest frequency and the second highest frequency, for one or more of the reasons as mentioned just above. (Expert Declaration, EX1003 ¶ 72.)

C. Proposed Rejection 3: Claim 5 is rendered obvious by Shearer in view of Rao and Jaentti.

The Office has not considered Shearer, Rao, or Jaentti. Requester shows below that Shearer in view of Rao and Jaentti discloses or renders obvious every limitation of the Challenged Claims 5 and 9.

1. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

2. Overview of Rao

Rao describes an ultra-wideband (UWB) system as an attractive solution for very high data rate short-range wireless communication applications. (Rao, EX1006, Abstract.) In particular, Rao describes the Multi band Orthogonal Frequency Division Multiplexing (MB-OFDM) approach for using the available UWB spectrum. *Id.*

In particular, the FCC has approved UWB to operate in a spectrum from 3.1 GHz to 10.6 GHz. *Id.* at 559 col. 1. For MB-OFDM UWB, this spectrum has been divided into fourteen sub-bands that each have a channel spacing of 528 MHz. *Id.* at 559 col. 2. The fourteen sub-bands are grouped into five band groups, and transmitted OFDM signals are time-interleaved across sub bands. *Id.* Table 1 of Rao, reproduced below, shows the band number, lower frequency, center frequency, and upper frequency for each of the band groups.

TABLE 1 – OFDM PHY BAND ALLOCATION

Band Group	Band ID	Lower Frequency (MHz)	Center Frequency (MHz)	Upper Frequency (MHz)
1	1	3168	3432	3696
	2	3696	3960	4224
	3	4224	4488	4752
2	4	4752	5016	5280
	5	5280	5544	5808
	6	5808	6072	6336
3	7	6336	6600	6864
	8	6864	7128	7392
	9	7392	7656	7920
4	10	7920	8184	8488
	11	8488	8712	8976
	12	8976	9240	9504
5	13	9504	9768	10032
	14	10032	10296	10560

Rao further provides a mathematical description of the MB-OFDM UWB signals. *Id.* at 560, col. 1. In particular, Rao explains how input data (128-tone (16-QAM symbols) coefficients) are inverse transformed to obtain data block samples. *Id.* Each MB-OFDM symbol includes a 32-sample zero prefix, the data block, and a 5-sample guard interval suffice, making the total symbol length 165 samples, or about 312.5 ns. *Id.* Rao further explains that MB-OFDM signals hop between the 14 band center frequencies according to a specified time-frequency code. *Id.* The time-frequency code specifies the number of bands to hop between and the number of OFDM periods to dwell in each band. *Id.* As shown in Table 2, potential time-frequency codes include 3 bands, e.g., the number of sub-bands in each of band groups 1-4.

Table 2–The number of bands and dwells for MB-OFDM signals

Signal	Bands	Dwell
MB-1	1	1
MB-2	3	1
MB-3	3	2
MB-4	7	1
MB-5	7	2
MB-6	7	6
MB-7	13	1
MB-8	13	2
MB-9	13	12

Rao also illustrates an MB-OFDM UWB signal transmitter in Figure 1, reproduced below. As shown, the transmitter includes an input QAM coupled to IFFT, which provides signals to the MB-OFDM signal generation, up converter, and HPA.

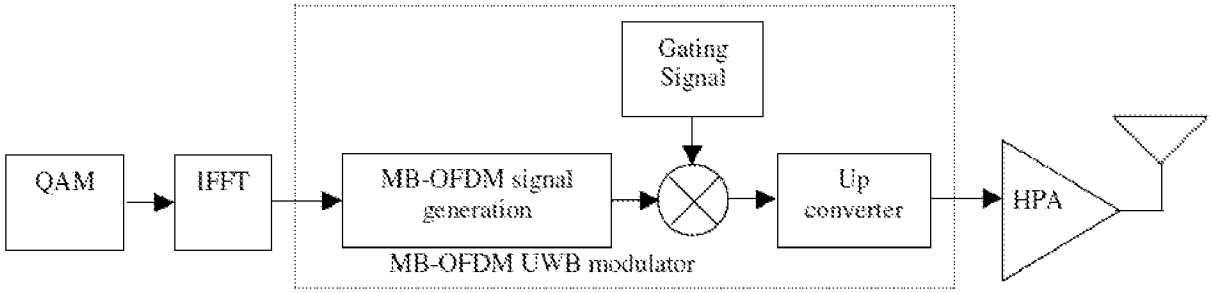

Figure 1. MB-OFDM UWB signal transmitter

3. Overview of Jaentti

Jaentti is described in detail above. *See* Section II.B.2, *supra*.

4. Application of Shearer, Rao, and Jaentti to Claim 5

The combination of Shearer, Rao, and Jaentti renders every element of claim 5 obvious. For reference, examples are outlined from the cited references that disclose each associated claim

limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 82-102.) A more detailed mapping of Rejection 5 is provided in Appendix AA.

Regarding claim 5 (which depends on claim 1), Shearer as modified by Rao and/or Jaentti discloses **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,** (*see*, *e.g.* Rao at 560, col. 1 and Table 1); for example, Rao discloses that MB-OFDM signals hop (i.e., change, and concurrently change, as applied to Shearer) between 14 band center frequencies according to a time-frequency code. Continuing that example, Rao's changed frequencies include selection from its 14 bands such that the fourth center frequency is greater than the third center frequency. As an illustrative example, the first center frequency may be 3432 MHz, corresponding to band 1 in band group 1, and the second center frequency may be 5016 MHz, corresponding to band 4 in band group 2. The third center frequency may be 3960 MHz, corresponding to band 2 in band group 1, and the fourth center frequency may be 5544 MHz (which is greater than 3960 MHz), corresponding to band 5 in band group 2. In that example, the time-frequency code may be selected to include three bands and a single dwell, for example selecting the three respective sub-bands of band groups 1 and 2. Rao further discloses **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,** (*see*, *e.g.*, Rao at Table 1); for example, each adjacent frequency band spans 528 MHz and thus each center frequency changes by at least 528 MHz. A POSITA applying Rao's teachings for frequency hopping to Shearer would have taken the same approach to Shearer's specific frequency ranges including to avoid overlapping between Shearer's hopped frequency range and its original frequency range for each of the first and second center frequencies to avoid risk of interference in

seeking the benefits of frequency hopping for each signal as discussed herein. EX1003, ¶95. As discussed above, Shearer and/or Jaentti further discloses **and wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies** (*see*, *e.g.*, Shearer figs. 3, 16, 2:63-64, 3:4-5, 3:9-11, 9:31-54; Jaentti at fig. 3, 4:65-67, 5:7-9, 5:13-15, 5:16-27); for example, Shearer discloses that the HPA 316 simultaneously amplifies and transmits at least two 20 MHz bands for at least 40 MHz of bandwidth, and FIG. 16 of Shearer illustrates capacbility of simultaneous amplification and transmission of as many as six signals across multiple frequency ranges equal to as much as 120 MHz bandwidth. Continuing the example of Shearer's signals 1602, 1604 in FIG. 16, hopping these signals to frequencies equivalent to signals 1606, 1610 respetively using Shearer's 120 MHz amplifier is greater than the same 36.5MHz span, and maintaining the same span of broadcast frequency range for the hopped signals can avoid increased broadcast power consumption. Thus, Shearer discloses amplifier bandwidth *greater than* the difference between the lowest frequency of signal 1604 and the highest frequency of signal 1606 (among other examples), and with application of Rao's teachings for frequency hopping would have maintained an amplifier bandwidth *greater than* the difference between the lowest frequency of signal and the highest frequency for the changed ranges for changed first and second center frequencies at least to operate within Shearer's existing parameters; to avoid increased power consumption; and/or as a selection between maintaining, reducing, or increasing the hopped frequency range as selection between finite identified, predictable solutions, with a reasonable expectation of success. EX1003, ¶95. Additionally, as discussed above in connection with Proposed Rejection 2, Jaentti further discloses a multifrequency power amplifier 306 capable of amplifying at least two combined signals at different carrier frequencies as applied to Shearer.

A POSITA would have been motivated to combine the teachings of Shearer with those of Rao and/or Jaentti with a reasonable expectation of success. (Expert Declaration, EX1003 ¶¶ 89-

100.) First, the references are analogous art to the '802 Patent (and each other), as each discloses wireless communication transmission devices and techniques using multiple frequencies. (Expert Declaration, EX1003 ¶ 100; EX1001, Abstract, 5:53-58; Shearer (EX1004), Abstract, 4:26-63; Jaentti (EX1005), Abstract, 2:9-26, 4:43; Rao (EX1006), Abstract.)

A POSITA would have been motivated to combine multi-frequency transmission of Shearer with frequency hopping of Rao for the inherent benefits of frequency hopping in wireless communications, including reduced average transmitted power as well as other benefits to bandwidth, error correction and/or avoidance, and/or potential interference/eavesdropping. (Rao (EX1006) at 559, col. 2 (indicating average transmitted power with time-interleaving across sub-bands is same as system designed to operate over entire bandwidth); Expert Declaration, EX1003, ¶ 94.) As discussed above, Shearer discloses transmitting first information across a first frequency range having a first center frequency and transmitting second information across a second frequency range having a second center frequency. (Shearer, EX1004, 8:22-9:24.) Rao also discloses transmitting information across a frequency range having a center frequency, and further discloses changing the center frequency between bands, where each band is separated by at least the frequency range. (Rao, EX1006, at 560, col. 1, Table 1.) A POSITA would have been motivated to combine multi-frequency transmission of Shearer with frequency hopping of Rao, for example, to reduce average transmitted power to be the same as a system designed to operate over the entire bandwidth. Rao at 559, col. 2; (Expert Declaration, EX1003 ¶ 94.) A POSITA would have been motivated to select frequencies such that the fourth center frequency is greater than the third center frequency, for example, to frequency hop each center frequency using a time-frequency code within one of the band groups in the OFDM PHY band allocation, and also as a selection from a finite number of identified solutions with reasonable expectation of success from Shearer and Rao's designated bands/sub-bands. Rao at 559, col. 2; (Expert Declaration, EX1003 ¶ 95.) A POSITA would have had a reasonable expectation of success because a POSITA would

understand that Shearer's context of 802.11 WLAN remains wireless communication which can benefit from general techniques of other wireless communication techniques, including other standards and frequencies; and/or may apply other standard and frequencies in other embodiments or context. Shearer 4:40-45; (Expert Declaration, EX1003 ¶ 96.) Also, a POSITA reading Shearer would have been aware that other standards such as MB-OFDM UWB use frequency hopping between bands. (Expert Declaration, EX1003 ¶ 92.)

Additionally, as discussed above in connection with Proposed Rejection 2, combining the teachings of Shearer with Jaentti would have been no more than the simple substitution of one known element for another to obtain predictable results, as a use of known technique to improve similar devices and/or methods in the same way, and/or otherwise as applying a known technique to a known device and/or method ready for improvement to yield predictable results, and/or for the benefits of reduced componentry. Both Shearer and Jaentti are concerned with the same problem, amplification of a multi-frequency signal in a wireless communication transmitter. (Expert Declaration, EX1003 ¶ 80.) Both Shearer and Jaentti propose solutions to address the same problem—how to amplify a multi-frequency signal before transmission. (Expert Declaration, EX1003 ¶ 76.) As discussed above, Shearer discloses that a high-power amplifier (HPA) 316 amplifies a combined, upconverted signal for transmission. (Shearer, EX1004 5:37-42.) Jaentti discloses a multi-frequency amplifier where the "bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency." (Expert Declaration, EX1003 ¶ 76.) The result of using Jaentti's multi-frequency amplifier in place of Shearer's HPA 316 would have been predictable because it would simply involve replacing the HPA 316 component as shown in FIG. 3 of Shearer with Jaentti's multi-frequency amplifier 306, which enables simultaneous processing of several signals at different frequencies. (Expert Declaration, EX1003 ¶ 78.) A POSITA would have also appreciated the benefits of simultaneous processing of several combined signals at different frequencies using a single

amplifier implementation such as Jaentti suggests, including reduction of the number, space, and/or connections of components required to support many different amplifiers. (Expert Declaration, EX1003 ¶ 77.) This replacement would have been predictable because a similar component function is being replaced. (Expert Declaration, EX1003 ¶ 78.) Based on those predictable results, a POSITA would have had a reasonable expectation of success in such a combination, and a POSITA would have understood that the combination would be used with no meaningful modification, as it simply entails replacing Shearer's transmitter component with Jaentti's transmitter component. (Expert Declaration, EX1003 ¶ 78.)

Thus, a POSITA would have found it obvious at the time of alleged invention to have modified Shearer's method with Rao's method to include band hopping, including 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 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, as recited in claim 5, for one or more of the reasons mentioned just above. Further (alternatively), a POSITA would have found that Shearer's method as modified by Jaentti's method to include the multifrequency amplifier renders obvious the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency, as recited in claim 5, for one or more of the reasons mentioned just above.

D. Proposed Rejection 4: Claim 6 is rendered obvious by Shearer in view of Kim.

The Office has not considered Shearer or Kim. Requester shows below that Shearer in view of Kim discloses or renders obvious every limitation of the Challenged Claim 6.

1. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

2. Overview of Kim

Kim discloses an ultra-wideband network transmitter and receiver, and a method capable of switching to a high-speed mode and a low-speed mode. (Kim, EX1007, Abstract.) Kim describes two currently available UWB communication methods: multi-band orthogonal frequency division multiplexing (MB-OFDM) and direct sequence code division multiple access (DS-CDMA). *Id.* ¶ [0007]. Kim discloses a UWB network transmitter 200 that includes an MB-OFDM modem 210 and a DS-CDMA modem 212. *Id.* ¶ [0046]. The MB-OFDM modem 210 and the DS-CDMA modem 212 are connected to a mode switch 220, which passes a selected transmission signal to a mixer 240 and an amplifier 250 for transmission via an antenna. *See id.* ¶¶ [0046], [0048], [0051].

Kim further recognizes that by sharing DS-CDMA type communication and MB-OFDM type communication in one device, "system resources can be saved compared with using two different devices for each type of communication." *Id.* ¶ [0082]. Kim additionally states, "Further, when the MB-OFDM transceiver and the DS-CDMA transceiver are used at the same time according to an exemplary embodiment of the present invention, the problem of the frequencies of each other's transceivers operating as noise and interference is resolved." *Id.* ¶ [0086].

3. Application of Shearer and Kim to Claim 6

The combination of Shearer and Kim renders every element of claim 6 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 103-114.) A more detailed mapping of Rejection 4 is provided in Appendix AA.

Regarding claim 6 (which depends on claim 1), Shearer as modified by Kim renders obvious **wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol** (*see*, *e.g.*, Shearer at 1:39-42; 8:22-25; Kim at fig. 2, ¶¶ [0007], [0046]-[0048], [0051]); for example, Shearer discloses transmitting multiple 802.11a input signals as OFDM signals that correspond to an 802.11 wireless protocol. As another example, Kim discloses transmitting information using two communication protocols, MB-OFDM and direct sequence code division multiple access (DS-CDMA).

A POSITA would have been motivated to combine the teachings of Shearer and those of Kim with a reasonable expectation of success. (Expert Declaration, EX1003 ¶¶ 106-112.) First, the references are analogous art to the '802 Patent (and each other), as each discloses using multiple wireless channels to transfer information, and in particular wireless communication using multiple frequencies and the OFDM protocol. (Expert Declaration, EX1003 ¶ 113; EX1001, Abstract, 5:53-58; Shearer, EX1004, Abstract, 4:26-63; Kim, EX1007, Abstract.)

Combining the teachings of Shearer and Kim would have been no more than the combination of prior art elements according to known methods to yield predictable results. Both Kim and Shearer disclose using multiple wireless channels to transfer information. Kim discloses a method where a different protocol can be used on each band. (Kim ¶ [0007]; Shearer 4:40-45; Expert Declaration, EX1003 ¶ 107.) The result of using Kim's two different protocols on the bands would have been predictable because both Kim and Shearer use the OFDM protocol on one of the bands. This replacement would have predictable because a well-known protocol of DS-CDMA is being used on the other band for wireless communications. (Expert Declaration, EX1003 ¶ 110.) Additionally, a POSITA would have appreciated that Kim's diversity of protocols would have improved Shearer's system because it affords flexibility to communications, broader compatibility with other devices and systems, and otherwise reduces constriction in communications. (Expert Declaration, EX1003 ¶ 112.)

Thus, a POSITA would have found its obvious at the time of alleged invention to have modified Shearer's method by Kim's method to include a first wireless protocol and a second wireless protocol, the first information corresponding to a first wireless protocol and the second information corresponding to a second wireless protocol, as recited in claim 6, for one or more of the reasons mentioned above. (Expert Declaration, EX1003 ¶ 106.)

E. Proposed Rejection 5: Claims 7 and 8 are rendered obvious by Shearer in view of Balakrishnan.

The Office has not considered Shearer or Balakrishnan. Requester shows below that Shearer in view of Balakrishnan discloses or renders obvious every limitation of the Challenged Claims 7 and 8.

1. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

2. Overview of Balakrishnan

Balakrishnan concerns a transmitter for high data rate multi-band orthogonal frequency division multiplex communication. (Balakrishnan, EX1008, Abstract.) Balakrishnan at FIG. 2 illustrates a wireless transmitter 200 suitable for transmitting OFDM symbols. *Id.* ¶ [0023]. Balakrishnan at FIG. 4, further discloses another transmitter 320 that promotes higher data rates using multi-band OFDM techniques. *Id.* ¶ [0028]. In this transmitter, bits of an information bit stream 340 may be provided by a higher layer application and are encoded, interleaved, and divided into two parallel bit streams by an encoder/interleaver component 342. *Id.* ¶ [0029]. The parallel bit streams may each include, for example, every other bit of the original information bit stream 340 in a "spatial multiplexing mode." *Id.* Alternatively, the parallel bit streams may each include every bit of the information bit stream 340 in a "transmit diversity mode." *Id.* The transmit

diversity mode may "increase the probability that the combination of the third and fourth bit streams may be correctly demodulated at the receiver 322." *Id.*

After interleaving, the two parallel bit streams are mapped onto frequency tones, which are transformed by an inverse fast Fourier transformer (IFTT) to generate time domain signals, which are each conditioned for transmission by sets of components similar to those transmitter of FIG. 2 (e.g., a digital-to-analog converter, up converter, amplifier, etc.). *Id.* ¶ [0030]. Those time domain signals are transmitted using multiple antennas 324, 326 but employing the same portions of spectrum (e.g., the same 528 MHz sub-band). *Id.*

3. Application of Shearer and Balakrishnan to Claims 7 and 8

The combination of Shearer and Balakrishnan renders every element of claims 7 and 8 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 115-127.) A more detailed mapping of Rejection 5 is provided in Appendix AA.

Regarding claim 7 (which depends on claim 1), Shearer and/or Balakrishnan renders obvious **wherein the first information and the second information are the same data transmitted across two different frequencies** (*see*, *e.g.*, Balakrishnan ¶ [0029]); for example, Balakrishnan discloses a transmit diversity mode in which the information bit stream is encoded into two bit streams for transmission that each include every bit of the information bit stream.

A POSITA would have been motivated to combine the teachings of Shearer with those of Balakrishnan with a reasonable expectation of success. (Expert Declaration, EX1003 ¶ 118-125.) A POSITA would have been motivated to combine the teachings of Shearer with Balakrishnan because the references are analogous art to the '802 Patent (and each other), as each concerns

transmitting information using a multi-frequency OFDM signal in a wireless communication transmitter, and each proposes solutions to address how to transfer multiple information streams using an OFDM signal. (Expert Declaration, EX1003, ¶ 126; EX1001, Abstract, 5:53-58; Shearer, EX1004, Abstract, 4:26-63; Balakrishnan, EX1008 ¶ [0029], Abstract.) A POSITA would have been motivated to transmit the same data in order to provide transmit diversity and increase the probability that the data is correctly demodulated by the receiver. (Balakrishnan ¶ [0029]; Expert Declaration, EX1003 ¶ 124.)

Additionally, a POSITA would have a reasonable expectation of success, because combining the teachings of Shearer with Balakrishnan would have been no more than simple substation of one known element for another to obtain predictable results. As described above, Shearer includes an interleaver/mapper 304, and Balakrishnan includes an encoder/interleaver 342, which have similar functionality including producing two information streams from a single input data stream. (Expert Declaration, EX1003 ¶ 122.) Replacing the interleaver/mapper 304 of Shearer with the encoder/interleaver 342 of Balakrishnan, in which the two streams can carry different or the same information, would have been predictable because a similar component function is being replaced. (Expert Declaration, EX1003 ¶ 122.) A POSITA would have a reasonable expectation of success in such a combination because the POSITA would have understood that the combination could be used with no meaningful modification as it simply entails replacing and/or integrating Shearer's interleaver/mapper function with Balakrishnan's encoder/interleaver function for its predictable results. (Expert Declaration, EX1003 ¶ 123.)

Thus, a POSITA would have found it obvious to have modified Shearer's method by Balakrishnan's method to transmit such that the first information and the second information are the same data transmitted across two different frequencies, as recited in claim 7, for one or more of the reasons mention above. (Expert Declaration, EX1003 ¶ 118.)

Regarding claim 8 (which depends on claim 1), Shearer and/or Balakrishnan renders obvious **wherein the first information and the second information are from the same data stream** (*see*, *e.g.*, Balakrishnan ¶ [0029]; for example, Balakrishnan discloses that an information bit stream may be encoded, interleaved, and divided into two parallel bit streams for transmission).

A POSITA would have been motivated to combine the teachings of Shearer with those of Balakrishnan with a reasonable expectation of success. (Expert Declaration, EX1003 ¶ 118-125.) A POSITA would have been motivated to combine the teachings of Shearer with Balakrishnan because the references are analogous art to the '802 Patent (and each other), as each concerns transmitting information using a multi-frequency OFDM signal in a wireless communication transmitter, and each proposes solutions to address how to transfer multiple information streams using an OFDM signal. (Expert Declaration, EX1003, ¶ 126; EX1001, Abstract, 5:53-58; Shearer, EX1004, Abstract, 4:26-63; Balakrishnan, EX1008, Abstract. A POSITA would have been motivated to transmit the parallel data streams from the same information bit stream in order to promote higher data rates. (Balakrishnan ¶¶ [0028]-[0029]; Expert Declaration, EX1003 ¶ 125.)

Additionally, a POSITA would have a reasonable expectation of success, because combining the teachings of Shearer with Balakrishnan would have been no more than simple substation of one known element for another to obtain predictable results. As described above, Shearer includes an interleaver/mapper 304, and Balakrishnan includes an encoder/interleaver 342, which have similar functionality including producing two information streams from a single input data stream. (Expert Declaration, EX1003 ¶ 122.) Replacing the interleaver/mapper 304 of Shearer with the encoder/interleaver 342 of Balakrishnan, in which the two streams can carry different or the same information, would have been predictable because a similar component function is being replaced. (Expert Declaration, EX1003 ¶ 122.) A POSITA would have a reasonable expectation of success in such a combination because the POSITA would have understood that the combination could be used with no meaningful modification as it simply entails

replacing or integrating Shearer's interleaver/mapper function with Balakrishnan's encoder/interleaver function for its predictable result. (Expert Declaration, EX1003 ¶ 123.)

Thus, a POSITA would have found it obvious at the time of the alleged invention to have modified Shearer's method by Balakrishnan's method to transmit such that the first information and the second information are from the same data stream, as recited in claim 8, for one or more of the reasons mentioned above. (Expert Declaration, EX1003 ¶ 118.)

F. Proposed Rejection 6: Claims 1-6 and 9 would have been obvious over Rao in view of Shearer.

The Office has not considered Rao or Shearer. Requester shows below that Rao in view of Shearer discloses or renders obvious every limitation of the Challenged Claims 1-6 and 9.

1. Overview of Rao

Rao is described in detail above. *See* Section II.C.2, *supra*.

2. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

3. Application of Rao and Shearer to Claims 1-6 and 9

The combination of Shearer and Rao renders every element of claims 1-6 and 9 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 128-143). A more detailed mapping of Rejection 6 is provided in Appendix BB.

Regarding claim 1, Rao and Shearer renders obvious **[a] method of transmitting information in a wireless communication channel** (although the preamble may not be limiting; *See*, *e.g.*, Rao at Abstract, 559, col. 1; for example, Rao discloses ultrawideband (UWB)

technology as a wireless protocol for high-speed data transmission over short distances). Rao further discloses **comprising transmitting first information across a first frequency range using a wireless transmitter,** (*see*, *e.g.*, Rao fig. 1, 559, col. 2, 560, col. 1; for example, Rao discloses transmitting MB-OFDM symbols in one of 14 sub-bands (e.g., sub-band 1)). Rao further discloses **the first frequency range having a first center frequency, a first highest frequency, and a first lowest frequency;** (*see, e.g.,* Rao at 559, col. 2, table 1; for example, Rao discloses that sub-band 1 has a center frequency of 3432 MHz, a highest frequency of 3696 MHz, and a lowest frequency of 3168 MHz). Rao as modified by Shearer renders obvious **and simultaneously transmitting second information across a second frequency range** (*see*, *e.g.*, Rao at fig. 1, 559, col. 2, 560, col. 1; Shearer figs. 10, 12, 14, 8:22-25, 8:32-51, 8:66-9:7, 9:19-20; for example, Rao discloses transmitting MB-OFDM symbols in another one of 14 sub-bands (e.g., sub-band 4); continuing that example, Shearer discloses simultaneously transmitting two signals in two frequency ranges (e.g., transmitting downshifted signal 1000 and upshifted signal 1200 simultaneously as aggregated signal 1400); as another example, Shearer at FIG. 16 discloses simultaneously transmitting multiple (e.g., six) signals in six frequency ranges). Rao and Shearer each further discloses **using the same wireless transmitter,** (*see*, *e.g.*, Rao fig. 1; Shearer at figs. 3, 8, 11, 13, 2:63-64, 3:4-5, 3:9-11, 5:26-28, 8:27-31, 8:51-52, 8:61-66, 9:7-8; for example, Rao at FIG. 1 discloses a single MB-OFDM UWB transmitter that transmits in all bands; Shearer at FIG. 3 discloses simultaneous transmission on multiple frequency ranges using the same PHY unit, which is a wireless transmitter). Rao further discloses **the second frequency range having a second center frequency greater than the first center frequency, a second highest frequency, and a second lowest frequency** (*see*, *e.g.*, Rao at 559, col. 2, table 1; for example, Rao discloses that sub-band 3 has a center frequency of 5016 MHz (greater than the center frequency 3432 MHz of sub-band 1), a highest frequency of 5280 MHz, and a lowest frequency of 4752 MHz).

A POSITA would have been motivated to combine the teachings of Rao with those of Shearer with a reasonable expectation of success. (Expert Declaration, EX1003 ¶¶ 130-142.) First, the references are analogous art to the '802 Patent (and each other), as each is based on an OFDM multi-channel transmitter that is capable of transmitting information on at least two channels concurrently. (Expert Declaration EX1003 ¶¶ 131, 136; EX1001, Abstract, 5:53-58; Rao, EX1006, Abstract; Shearer, EX1004, Abstract, 4:26-63.) Additionally, both Rao and Shearer are concerned with the same problem of transmitting information in at least two OFDM channels concurrently using a multi-frequency signal in a wireless communication transmitter, and both propose solutions on how to transmit different information streams in a multi-channel OFDM signal. (Expert Declaration, EX1003 ¶¶ 132-133.)

Second, combining the teachings of Rao with Shearer would have been no more than the combination of prior art elements according to known methods to yield predictable results. A POSITA would understand that combining the multiband technique of Rao with the simultaneous transmission of Shearer would be predictable because it would simply involve selecting two of Rao's frequency bands (or two of Rao's band groups) to use for simultaneously transmitting the information. (Expert Declaration, EX1003 ¶ 134.) This replacement is predictable because it simply involves selecting two of the frequency bands for transmission while using the same functionality otherwise. (Expert Declaration, EX1003 ¶ 135.) Moreover, such a modification increases data rate and affords related benefits to bandwidth. Shearer, Abstract; 1:10-15; 5:65-67; (Expert Declaration EX1003 ¶ 137).

Thus, a POSITA would have found that Rao's method as modified by Shearer's method to include simultaneous transmission in different sub-bands renders obvious simultaneously transmitting the second information across the second frequency range.

Regarding claim 2 (which depends on claim 1), Rao renders obvious **wherein 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 (*see*, *e.g.*, Rao 559, col. 2, table 1); for example, Rao discloses the frequency difference between center frequencies of bands 1 and 3 is 1056 MHz, which is greater than the sum of one-half of both frequency ranges, which is 528 MHz.

Regarding claim 3 (which depends on claim 1), Rao as modified by Shearer renders obvious **wherein the first and second information are transmitted using the same power amplifier in said wireless transmitter** (*see*, *e.g.*, Rao fig. 1; Shearer fig. 3, 2:63-64, 3:4-5, 3:9-11, 5:40-43; for example, Rao shows that the MB-OFDM UWB transmitter in FIG. 1 includes a single high power amplifier (HPA), and Shearer shows that the combined up-shifted and down-shifted signals are transmitted using the same HPA 316).

Regarding claim 4 (which depends on claim 3), Rao and/or Shearer renders obvious **wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency** (*see*, *e.g.*, Rao fig. 1; Shearer figs. 3, 16, 2:63-64, 3:4-5, 3:9-11, 9:31-54; for example, Rao discloses MB-OFDM UWB transmitter with a single HPA for all sub-bands with center frequencies from 3432 MHz to 10,296 MHz; continuing that example, Shearer discloses that the HPA 316 simultaneously amplifies and transmits at least two 20 MHz channels for at least 40 MHz of bandwidth, and the difference between the first lowest frequency and the second highest frequency is about 36.5 MHz; as another example, FIG. 16 of Shearer illustrates simultaneous amplification and transmission of six signals across multiple frequency ranges, and thus has band width *greater than* the difference between the lowest frequency of signal 1604 and the highest frequency of signal 1606 (among other examples)).

A POSITA would have been motivated to combine the teachings of Rao with those of Shearer with a reasonable expectation of success. (Expert Declaration, EX1003 ¶¶ 130-142.) First, the references are analogous art to the '802 Patent (and each other), as each is based on an OFDM multi-channel transmitter that is capable of transmitting information on at least two channels

concurrently. (Expert Declaration EX1003 ¶¶ 131, 136; EX1001, Abstract, 5:53-58; Rao, EX1006, Abstract; Shearer, EX1004, Abstract, 4:26-63.) Additionally, both Rao and Shearer are concerned with the same problem of transmitting information in at least two OFDM channels concurrently using a multi-frequency signal in a wireless communication transmitter, and both propose solutions on how to transmit different information streams in a multi-channel OFDM signal. (Expert Declaration, EX1003 ¶¶ 132-133.)

Second, combining the teachings of Rao with Shearer would have been no more than the combination of prior art elements according to known methods to yield predictable results. Rao understood that high power amplifiers used to amplify a large multi-frequency signal bandwidth in a wireless communication transmitter were prone to create distortion in the signal because many of these amplifiers were nonlinear across the complete frequency range. (Expert Declaration, EX1003 ¶ 91). The result of using or more of Rao's methods for reducing the Peak to Average Power Ratio (PAPR) of the signal would have been predictable as shown by Rao's results. (Expert Declaration, EX1003 ¶ 98). Such predictable results would have led a POSITA to have had a reasonable expectation of success by clipping the signals and/or including a bandpass filter, and a POSITA would have understood, or at least have found obvious, that the combination could be used with a non-substantial modification. (Expert Declaration, EX1003 ¶ 99).

Thus, a POSITA would have found that Rao's method as modified by Shearer's method to include simultaneous transmission in different sub-bands renders obvious the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

Regarding claim 5 (which depends on claim 1), Rao as modified by Shearer renders obvious **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**, (*see*, *e.g.*, Rao at 560, col. 1, table 1; for example,

Rao discloses that MB-OFDM signals hop (i.e., change) between 14 band center frequencies according to a time-frequency code; continuing that example, the changed frequencies could be selected from those 14 bands such that the fourth center frequency is greater than the third center frequency; Shearer discloses that simultaneous signals advantageously have the same start time and end time and thus concurrently change center frequencies). Rao further discloses **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,** (*see*, *e.g.*, Rao at 559, col. 1, table 1; for example, each adjacent frequency band spans 528 MHz and thus each center frequency changes by at least 528 MHz). A POSITA applying Shearer's teachings for multiple concurrent signals at different frequencies to Rao's communications would have achieved first and second center frequencies of modified-Rao that would hop to other sub-bands of Rao that are at least separated by their original frequency range. Rao's underlying structure is merely applied with two concurrent signals at two different frequencies as taught by Shearer, for the same data rate and/or bandwidth benefits as discussed earlier, while maintaining Rao's frequency hopping benefits including to avoid interference. EX1003, ¶140. Rao and Shearer further render obvious **and wherein the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency for the changed first and second center frequencies** (*see*, *e.g.*, Rao fig. 1; Shearer figs. 3, 16, 2:63-64, 3:4-5, 3:9-11, 9:31-54; for example, Rao discloses MB-OFDM UWB transmitter with a single HPA for all sub-bands which includes the entire range of sub-band bandwidth and yet can be applied with hopping between less than the maximum range (e.g., sub-band IDs 1 and 4, have narrower collective span than sub-band IDs 1 through 14); continuing that example, Shearer discloses that the HPA 316 simultaneously amplifies and transmits at least two 20 MHz channels for at least 40 MHz of bandwidth, and the difference between the first lowest frequency and the second highest frequency is about 36.5 MHz and as another example, FIG. 16 of Shearer illustrates simultaneous amplification and transmission

of six signals across multiple frequency ranges, and thus explicitly discloses bandwidth *greater than* the difference between the lowest frequency of signal 1604 and the highest frequency of signal 1606 (among other examples)). Applying Shearer's multiple concurrent signals to Rao would have resulted in the amplifier bandwidth *greater than* the span of the changed first and second center frequencies at least to operate within Rao's existing parameters; to avoid increased power consumption; and/or as a selection between maintaining, reducing, or increasing the hopped frequency range as selection between finite identified, predictable solutions, with a reasonable expectation of success. EX1003, ¶140.

A POSITA would have been motivated to combine the teachings of Rao with those of Shearer with a reasonable expectation of success. (Expert Declaration, EX1003 ¶ 134.) First, the references are analogous art to the '802 Patent (and each other), as each is based on an OFDM multi-channel transmitter that is capable of transmitting information on at least two channels concurrently. (Expert Declaration EX1003 ¶¶ 131, 136; EX1001, Abstract, 5:53-58; Rao, EX1006, Abstract; Shearer, EX1004, Abstract, 4:26-63.) Additionally, both Rao and Shearer are concerned with the same problem of transmitting information in at least two OFDM channels using a multi-frequency signal in a wireless communication transmitter, and both propose solutions on how to transmit different information streams in a multi-channel OFDM signal. (Expert Declaration, EX1003 ¶¶ 132-133.)

Second, combining the teachings of Rao with Shearer would have been no more than the combination of prior art elements according to known methods to yield predictable results. Rao understood that high power amplifiers used to amplify a large multi-frequency signal bandwidth in a wireless communication transmitter were prone to create distortion in the signal because many of these amplifiers were nonlinear across the complete frequency range. (Expert Declaration, EX1003 ¶ 91). The result of using or more of Rao's methods for reducing the Peak to Average Power Ratio (PAPR) of the signal would have been predictable as shown by Rao's results. (Expert

Declaration, EX1003 ¶ 98). Such predictable results would have led a POSITA to have had a reasonable expectation of success by clipping the signals and/or including a bandpass filter, and a POSITA would have understood, or at least have found obvious, that the combination could be used with a non-substantial modification. (Expert Declaration, EX1003 ¶ 99).

A POSITA would have understood that same advantages for using the same start time and end time disclosed by Shearer apply to using the same time to change center frequencies when frequency hopping, because changing the center frequency is functionally equivalent to stopping one signal and starting another signal. (Expert Declaration, EX1003 ¶ 140.) A POSITA would have additionally understood that, for the simultaneous transmission of Rao as modified by Shearer, performing the frequency hopping concurrently in both simultaneous signals results in advantages including eliminating problems with signal acquisition and termination of signals that are not being simultaneously transmitted and received. (Expert Declaration, EX1003 ¶ 141.)

Thus, a POSITA would have found that Rao's method as modified by Shearer's method to include simultaneous transmission in different sub-bands renders obvious the bandwidth of said power amplifier is greater than the difference between the first lowest frequency and the second highest frequency.

Regarding claim 6 (which depends on claim 1), Rao renders obvious **wherein the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol** (*see*, *e.g.*, Rao at 560, col. 1; for example, Rao discloses transmitting first information according to the MB-OFDM protocol and second information according to the MB-OFDM protocol).

Regarding claim 9 (which depends on claim 1), Rao and/or Shearer renders obvious **wherein first information and second information comprise a plurality of OFDM symbols,** (*see*, *e.g.*, Rao at 560, col. 1; for example, Rao discloses MB-OFDM symbols *u*). Rao and Shearer further renders obvious **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, (*see*, *e.g.*, Rao at 559, col. 2, 560, col. 1; Shearer fig. 19, 5:30-33, 8:23-26, 9:19-22, 10:32-38; for example, Rao discloses first and second MB-OFDM symbols (e.g., symbols u_k and u_{k+1}) are transmitted during MB-OFDM symbol period time slots across respective frequency sub-bands (e.g., sub-band 1 and 3 or other sub-bands); continuing that example, Shearer discloses in FIG. 19, the first symbol is transmitted across the down-shifted frequency range, and the second symbol is transmitted across the up-shifted frequency range during the same time slot between start time 1902 and end time 1904)). (*See also* Expert Declaration, EX1003 ¶¶ 57, 142.) Rao and Shearer further render obvious **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** (*see*, *e.g.*, Rao at 559, col. 2, 560, col. 1; Shearer fig. 19, 21-22, 5:30-33, 8:23-26, 9:19-22, 10:32-38, 11:23-24, 11:26-29, 11:46-48; for example, Rao discloses third and fourth MB-OFDM symbols (e.g., symbols u_{k+2} and u_{k+3}) are transmitted during MB-OFDM symbol period time slots across respective frequency sub-bands (e.g., sub-band 1 and 3 or other sub-bands); continuing that example, Shearer discloses in FIG. 19, the third symbol is transmitted across the down-shifted frequency range, and the fourth symbol is transmitted across the up-shifted frequency range during the same time slot between start time 1902 and end time 1904)).

A POSITA would have been motivated to combine the teachings of Rao with those of Shearer with a reasonable expectation of success. (Expert Declaration, EX1003 ¶ 130-142.) First, the references are analogous art to the '802 Patent (and each other), as each is based on an OFDM multi-channel transmitter that is capable of transmitting information on at least two channels concurrently. (Expert Declaration EX1003 ¶¶ 131, 136; EX1001, Abstract, 5:53-58; Rao, EX1006, Abstract; Shearer, EX1004, Abstract, 4:26-63). Additionally, both Rao and Shearer are concerned with the same problem of transmitting information in at least two OFDM channels concurrently

using a multi-frequency signal in a wireless communication transmitter, and both propose solutions on how to transmit different information streams in a multi-channel OFDM signal. (Expert Declaration, EX1003 ¶¶ 132-133.)

Second, combining the teachings of Rao with Shearer would have been no more than the combination of prior art elements according to known methods to yield predictable results. Rao understood that high power amplifiers used to amplify a large multi-frequency signal bandwidth in a wireless communication transmitter were prone to create distortion in the signal because many of these amplifiers were nonlinear across the complete frequency range. (Expert Declaration, EX1003 ¶ 91). The result of using or more of Rao's methods for reducing the Peak to Average Power Ratio (PAPR) of the signal would have been predictable as shown by Rao's results. (Expert Declaration, EX1003 ¶ 98). Such predictable results would have led a POSITA to have had a reasonable expectation of success by clipping the signals and/or including a bandpass filter, and a POSITA would have understood, or at least have found obvious, that the combination could be used with a non-substantial modification.

Thus, a POSITA would have found that Rao's method as modified by Shearer's method to include simultaneous transmission in different sub-bands renders obvious 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.

G. Proposed Rejection 7: Claims 7 and 8 are rendered obvious by Rao and Shearer further in view of Balakrishnan.

1. Overview of Rao

Rao is described in detail above. *See* Section II.C.2, *supra*.

2. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

3. Overview of Balakrishnan

Balakrishnan is described in detail above. *See* Section II.E.2, *supra*.

4. Application of Rao and Shearer further in view of Balakrishnan to Claims 7 and 8.

Balakrishnan is applied in light of Rao and Shearer in the same manner as discussed in detail concerning Balakrishnan with Shearer only, incorporated herein. *See* Section II.E.3, *supra.* Accordingly, a POSITA would have found it obvious at the time of the alleged invention to have modified Rao as applied with Shearer further by Balakrishnan's method to transmit such that the first information and the second information are the same data transmitted across two different frequencies, as recited in claim 7, for one or more of the reasons mention above in those sections and by Balakrishnan's method to transmit such that the first information and the second information are from the same data stream, as recited in claim 8, for one or more of the reasons mentioned above in those sections. (Expert Declaration, EX1003 ¶¶ 118-125, 143.1.)

H. Proposed Rejection 8: Claims 10-13 and 17-22 are anticipated by Rofougaran.

The Office has not considered Rofougaran. Requester shows below that Rofougaran discloses every limitation of the Challenged Claims 10-13 and 17-22.

1. Overview of Rofougaran

Rofougaran discloses exemplary communication systems capable of various communications modes, such as cellular communication, wireless networking, television communication, etc. Rofougaran 2:36-3:6. In the exemplary system shown in FIG. 1, the communication system 100 receives two baseband signals as input, which may correspond to different communication protocols (e.g., a variety of wireless communication protocols and/or

standards). *Id.* 3:7-23. The system 100 further includes a spectral placement module 110 that spectrally shifts the first baseband signal to one or more frequency bands that are substantially distinct from the frequency bands occupied by the second baseband signal. *Id.* 3:35-44. "Occupying such substantially distinct frequency bands, the spectrally shifted first baseband signal may, for example, be combined with the second baseband signal for simultaneous transmission with no interference, relatively little interference, or an acceptable level of interference." *Id.* 3:44-49. The system 100 further includes a signal combiner 130 that generates a composite signal simultaneously comprising components associated with various inputs such as inputs based on the first and second baseband signals. *Id.* 4:33-58. The system 100 further includes an upconverter 140 that upconverts the composite signal for transmission. *Id.* 5:24-28. The system 100 also includes an RF transmission stage 150 adapted to transmit an RF signal, such as the upconverted, composite signal output by the upconverter 140. *Id.* 5:39-46.

Rofougaran further discloses various additional features and scenarios applicable to the system 100. For example, "the spectral placement module 110 may be adapted to implement a frequency-hopping scheme with the first baseband signal." *Id.* 3:50-52. Continuing that example, the first baseband signal may be hopped to "numerous consecutive frequency spaces (or bands) that are substantially distinct from the second frequency space." *Id.* 3:52-58.

Rofougaran further discloses that the system may also include a second spectral placement module that may shift the spectrum of the second baseband signal, which allows either or both of the first and second baseband signals to be spectrally shifted and/or frequency hopped. *Id.* 4:16-32. As another example, the first and second baseband signals may be combined without spectral shifting, for example if the spectra of the first and second baseband signals do not overlap. *Id.* 4:48-62.

Rofougaran illustrates additional exemplary communication systems in FIGS. 2-7, which all may share any or all characteristics with the previously discussed systems. For example, the

system 200 shown in FIG. 2 may share any or all characteristics of the system 100 of FIG. 1. *Id.* 6:5-11. In particular, FIG. 2 illustrates the various spectra associated with the signals transmitted by the system 200. As shown, the system 200 receives two input baseband signals 201, 202 having spectra 203, 204, respectively. *Id.* 6:12-31. Those signals illustratively represent Bluetooth and IEEE 802.11 communications, respectively. *Id.* As shown, the first baseband signal 201 is spectrally shifted, resulting in frequency 211 including an upper spectral image 212 and a lower spectral image 213 (which may be filtered out). *Id.* 6:46-57. The spectrally shifted first baseband signal is combined with the second baseband signal, resulting in a composite signal with spectrum 231 including first portion 233 associated corresponding to the first signal component and second portion 232 corresponding to the second signal component. *Id.* 6:66-7:18. The composite signal is upconverted, resulting in an RF signal having frequency spectrum 241 with first portion 243 corresponding to the first signal component and second portion 242 corresponding to the second signal component. *Id.* 7:25-42. The spectrum 241 also may include mirror portions 244, 245, which may be removed. *Id.* 7:42-46.

Rofougaran also discloses that "[v]arious components of the exemplary communication system 100 (and other communication systems illustrated and discussed herein) may be implemented in analog and/or digital circuitry." *Id.* 5:64-67. For example, FIG. 5 illustrates a system 500 that includes a first digital-to-analog converter (DAC) 592 and a second DAC 594. *Id.* 9:14-29. The first ADC converts the first baseband signal to the analog domain, and the second ADC converts the second baseband signal to the analog domain. As disclosed by Rofougaran, the system 500 may share any or all characteristics with the systems 100-300 illustrated in FIGS. 1-3. *Id.* 9:14-20.

Rofougaran discloses at FIG. 7 a system 700 that upconverts the first and second baseband signals with two different mixers prior to generating the composite signal for transmission. As disclosed by Rofougaran, the system 700 may share any or all characteristics with the systems

100-600 illustrated in FIGS. 1-6. *Id.* 10:16-22. Specifically, the system 100 includes a first mixer 744 that receives a signal based on the first baseband signal and a first RF mixing signal, which is illustratively a 2.446 GHz signal generally associated with Bluetooth. *Id.* 10:23-28. The second mixer 748 receives a signal based on the second baseband signal and a second RF mixing signal, which is illustratively a 2.486 MHz signal generally associated with IEEE 802.11(g). *Id.* 10:28-34. The output from each of the mixers 744, 748 is received by an RF signal combiner 730 which generates an RF composite signal. *Id.* 10:35-40. An RF transmission stage 750 receives the RF composite signal and transmits the signal. *Id.* 10:40-43.

Although illustrated in FIG. 7 as including a spectral placement module 710 and an optional second spectral placement module 720, Rofougaran also discloses that in some scenarios the first and second baseband signals may be combined without being spectrally shifted. *Id.* 4:48-62; *see also id.* 13:28-40 (discussing method of FIG. 8, which may share any or all functional characteristics with systems 100-700 of FIGS. 1-7).

2. Application of Rofougaran to Claims 10-13 and 17-22

Rofougaran anticipates every element of claims 10-13 and 17-22. For reference, examples are outlined from Rofougaran that disclose each associated claim limitation below. Discussion of the cited portions of Rofougaran are provided by expert declarant, Mark Lanning. (Expert Declaration, EX1003 ¶¶ 144-177.) A more detailed mapping of Rejection 7 is provided in Appendix CC.

Regarding claim 10, Rofougaran anticipates **[a] method of transmitting information in a wireless communication channel** (although the preamble may not be limiting; *see*, *e.g.*, Rofougaran 2:38-44, 2:60-3:3); for example, Rofougaran discloses communication system or device comprising characteristics of any of a variety of mobile wireless communication devices

with multiple communication modes, such as cellular communication, wireless networking, television, etc.

Rofougaran further discloses **comprising receiving a first digital signal comprising first data to be transmitted** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4; 9:30-34; 10:18-22); for example, Rofougaran discloses the system 700 receives a first baseband signal. Rofougaran further discloses that the system 700 shares any or all characteristics with other systems, including system 500, which includes the DAC 592 receiving the first baseband signal. Therefore, the first baseband signal is a digital signal. Rofougaran further discloses **receiving a second digital signal comprising second data to be transmitted** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4; 9:30-38; 10:18-22); for example, Rofougaran discloses the system 700 receives a second baseband signal; Rofougaran further discloses that the system 700 shares any or all characteristics with other systems, including system 500, which includes the DAC 594 receiving the second baseband signal; therefore, the second baseband signal is a digital signal.

Rofougaran further discloses **converting the first digital signal into a first analog signal using a first digital-to-analog converter** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 9:30-34, 10:18-22); for example, Rofougaran discloses the DAC 592 converts the first baseband signal to the analog domain. Rofougaran further discloses **the first analog signal carrying the first data across a first frequency range** (*see*, *e.g.*, Rofougaran fig. 2, 6:12-20, 10:18-22); for example, Rofougaran discloses that the system 700 shares any or all characteristics with other systems, including system 200, and Rofougaran at FIG. 2 illustrates the spectrum 203 associated with the first baseband signal. Rofougaran further discloses **converting the second digital signal into a second analog signal using a second digital-to-analog converter** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 9:30-38, 10:18-22); for example, Rofougaran discloses the DAC 594 converts the second baseband signal the analog domain. Rofougaran further discloses **the second analog signal carrying the second data across a second frequency range** (*see*, *e.g.*, Rofougaran fig. 2,

6:21-31, 10:18-22); for example, Rofougaran discloses that the system 700 shares any or all characteristics with other systems, including system 200, and Rofougaran at FIG. 2 illustrates the spectrum 204 associated with the second baseband signal.

Rofougaran further discloses **up-converting the first analog signal to a first RF center frequency to produce a first up-converted analog signal** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran discloses the mixer 744 with local oscillator 742 upconverts the first baseband signal to an RF signal at RF center frequency 2.446 GHz; as another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with first portion 243 that corresponds to the first baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran at fig. 7 discloses that the first analog signal is upconverted using a mixer with a local oscillator at the first RF center frequency (2.446 GHz). This means that the upshifted signal has a frequency range centered on the first RF center frequency (i.e., a symmetric frequency range), with the same width as the first analog signal (*see* Expert Declaration, EX1003 ¶ 155). As another example, Rofougaran at fig. 2 illustrates that the first portion 243 of the upshifted RF signal 241 corresponding to the first analog signal has a symmetric frequency range.

Rofougaran further discloses **up-converting the second analog signal to a second RF center frequency greater than the first center RF frequency to produce a second up-converted analog signal** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran discloses the mixer 748 with local oscillator 746 upconverts the second baseband signal to an RF signal at RF center frequency 2.486 GHz, which is greater that the first center RF frequency (e.g., 2.446 GHz). As another example, Rofougaran at fig. 2 illustrates

upconverted frequency spectrum 241 with second portion 242 that corresponds to the second baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:8-9, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran at fig. 7 discloses that the second analog signal is upconverted using a mixer with a local oscillator at the second RF center frequency (2.486 GHz), meaning that the upshifted signal has a frequency range centered on the second RF center frequency (i.e., a symmetric frequency range), with the same width as the second analog signal (*see* Expert Declaration, EX1003 ¶ 156). As another example, Rofougaran at fig. 2 illustrates that the second portion 242 of the upshifted RF signal 241 corresponding to the second analog signal has a symmetric frequency range about its RF center frequency f_{RF}. Rofougaran further discloses **and wherein a frequency difference between the first 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** (*see e.g.*, Rofougaran figs. 2, 7, 6:12-31, 7:35-42, 10:23-28, 10:28-34); for example, in relation to Rofougaran at FIG. 7, the frequency difference between the first RF center frequency and the second RF center frequency is 40 MHz. Although the frequency range of the signals in FIG. 7 is not expressly described, in other examples that also include combined Bluetooth and 802.11 signals, Rofougaran indicates that the upconverted, composite signal includes portions in distinct frequency bands that do not overlap. For example, the diagram at FIG. 2 illustrates the upconverted, composite signal with a frequency spectrum 241 including first portion 243 corresponding the first signal and second portion 242 corresponding to the second signal, and the portions 242, 243 do not overlap, meaning that their center frequencies are separated by a difference greater than one-half of the range of the portion 243 plus one-half of the range of the portion 242.

Rofougaran further discloses **combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal** (*see e.g.*, Rofougaran figs. 2, 7, 7:26-29, 7:35-42, 10:18-22, 10:35-40); for example, the RF signal combiner 730 combines the up-converted signals output from the mixers 744, 748. Rofougaran further discloses **amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal** (*see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives the RF composite signal and transmits the signal. Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including a power amplifier 252. Rofougaran further discloses **and transmitting the amplified combined up-converted signal on a first antenna** (*see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives the RF composite signal and transmits the signal; Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including an antenna 254.

Rofougaran discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 4:16-27, 7:31-34, 7:35-42, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses the RF transmission stage 750 that receives and transmits the RF composite signal, and thus must have bandwidth at least the difference between the lowest and highest frequencies in the up-converted composite signal. As another example, Rofougaran at FIG. 2 discloses a similar RF transmission stage 250 including a power amplifier 252 that amplifies upshifted composite signal 241 including portions 242, 243 and thus the power amplifier 252 must have bandwidth at least the difference between the lowest and highest frequencies in the upconverted composite signal 241.

As discussed above, Rofougaran discloses "amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal . . . 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," because the RF transmission stage 250, 750 is described as amplifying and transmitting a composite RF signal that includes distinct portions associated with the first signal and the second signal, and thus must have sufficient bandwidth to perform that amplification. (Expert Declaration, EX1003 ¶ 159.)

Additionally, because Rofougaran discloses frequency hopping using the same power amplifier, the power amplifier must have sufficient bandwidth to perform amplification for the frequency ranges before and after frequency hopping. The frequency ranges after frequency hopping are distinct from the frequency ranges before frequency hopping, and are therefore outside of the frequency ranges before frequency hopping. Therefore, the power amplifier must have bandwidth greater than the difference between the lowest and the highest frequencies in the upconverted composite signal. (Expert Declaration, EX1003 ¶ 160.)

Regarding claim 11, Rofougaran discloses **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** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27; 10:18-22, 10:23-28, 10:28-34); for example, Rofougaran discloses a "frequency-hopping scheme" in which one or both of the first baseband signal and the second baseband signal are shifted to different frequency spaces (or bands); thus, Rofougaran discloses upconverting to changed first and second RF center frequencies. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran fig. 7, 3:55-58, 4:16-27, 10:18-22); for example, Rofougaran discloses a frequency hopping one or both of the first and second baseband signals to "consecutive frequency spaces (or bands)"; because the hopped

frequency spaces are "consecutive," their center frequencies must be separated by at least the associated frequency range, or they would overlap. (*See also* Expert Declaration, EX1003 ¶ 161.)

Regarding claim 12, Rofougaran discloses **wherein the first and second RF center frequencies are changed concurrently** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped, which indicates that the signals are changed concurrently. (*See also* Expert Declaration, EX1003 ¶ 162).

Regarding claim 13, Rofougaran discloses **wherein the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol** (*see*, *e.g.*, Rofougaran 2:63-3:3, 3:9-14, 3:17-23, 5:64-6:4, 10:18-22, 10:24-27, 10:29-33); for example, Rofougaran at FIG. 7 discloses the first baseband signal is associated with the Bluetooth communication protocol and the second baseband signal is associated with the IEEE 802.11(g). As another example, Rofougaran more generally discloses that each of the first baseband signal and the second baseband signal may correspond to a variety of communication protocols including various cellular protocols, wireless networking protocols, various television communication standards, etc., and that various components may be implemented in analog and/or digital circuitry.

Regarding claim 17, Rofougaran anticipates **[a] wireless communication system** (although the preamble may not be limiting; *see*, *e.g.*, Rofougaran 2:38-44, 2:60-3:3); for example, Rofougaran discloses communication system or device comprising characteristics of any of a variety of mobile wireless communication devices with multiple communication modes, such as cellular communication, wireless networking, television, etc.

Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 9:30-38,

10:18-22, 11:60-12:3, 12:60-13:4); for example, Rofougaran discloses the system 700 receives a first baseband signal and a second baseband signal. Rofougaran further discloses that the system 700 shares any or all characteristics with other systems, including system 500, which includes the DACs 592, 594 receiving the first baseband signal and the second baseband signal. Therefore, the first baseband signal and the second baseband signals are digital signal.

Rofougaran further discloses **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 first data across a first frequency range** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 6:12-20, 9:30-34, 10:18-22); for example, Rofougaran discloses the DAC 592 converts the first baseband signal to the analog domain. Continuing that example, Rofougaran at FIG. 2 illustrates the spectrum 203 associated with the first baseband signal.

Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 6:21-31, 9:30-38, 10:18-22); for example, Rofougaran discloses the DAC 594 converts the second baseband signal the analog domain. Continuing that example, Rofougaran at FIG. 2 illustrates the spectrum 204 associated with the second baseband signal.

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 first up-converter outputs a first up-converted analog signal (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran discloses the mixer 744 with local oscillator 742 upconverts the first baseband signal to an RF signal at RF center frequency 2.446 GHz; as another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with first portion 243 that corresponds to the first baseband signal. Rofougaran further discloses **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 (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran at fig. 7 discloses that the first analog signal is upconverted using a mixer with a local oscillator at the first RF center frequency (2.446 GHz). This means that the upshifted signal has a frequency range centered on the first RF center frequency (i.e., symmetric), with the same width as the first analog signal (*see* Expert Declaration, EX1003 ¶ 168). As another example, Rofougaran at fig. 2 illustrates the first portion 243 of the upshifted RF signal 241 corresponding to the first analog signal has a symmetric frequency range.

Rofougaran discloses **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-converter outputs a second up-converted analog signal** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran discloses the mixer 748 with local oscillator 746 upconverts the first baseband signal to an RF signal at RF center frequency 2.486 GHz, which is greater that the first center RF frequency (e.g., 2.446 GHz). As another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with second portion 242 that corresponds to the second baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:8-9, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran at fig. 7 discloses that the second analog signal is upconverted using a mixer with a local oscillator at the second RF center frequency (2.486 GHz), meaning that the upshifted signal has a frequency range centered on the second RF center frequency (i.e., symmetric), with the same width as the second analog signal (*see* Expert Declaration, EX1003 ¶ 169). As another example, Rofougaran at fig. 2 illustrates the second portion 242 of the upshifted RF signal 241 corresponding to the second

analog signal has a symmetric frequency range about its RF center frequency f_{RF}. Rofougaran further discloses **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** (*see e.g.*, Rofougaran figs. 2, 7, 6:12-31, 7:35-42, 10:23-28, 10:28-34); for example, in relation to Rofougaran at FIG. 7, the frequency difference between the first RF center frequency and the second RF center frequency is 40 MHz. Although the frequency range of the signals in FIG. 7 is not expressly described, in other examples that also include combined Bluetooth and 802.11 signals, Rofougaran indicates that the upconverted, composite signal includes portions in distinct frequency bands that do not overlap. For example, the diagram at FIG. 2 illustrates the upconverted, composite signal with a frequency spectrum 241 including first portion 243 corresponding the first signal and second portion 242 corresponding to the second signal, and the portions 242, 243 do not overlap, meaning that their center frequencies are separated by a difference greater than one-half of the range of the portion 243 plus one-half of the range of the portion 242.

Rofougaran further discloses **a power amplifier coupled to receive the first and second up-converted analog signals** (*see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives the RF composite signal and transmits the signal. Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including a power amplifier 252. Rofougaran discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 4:16-27, 7:31-34, 7:35-42, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses the RF transmission stage 750 that receives and transmits the RF composite signal, and thus must have bandwidth at least the difference between the lowest and highest frequencies in the up-converted composite signal. As another example, Rofougaran at FIG. 2

discloses a similar RF transmission stage 250 including a power amplifier 252 that amplifies upshifted composite signal 241 including portions 242, 243 and thus the power amplifier 252 must have bandwidth at least the difference between the lowest and highest frequencies in the upconverted composite signal 241.

As discussed above, Rofougaran discloses "amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal . . . 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," because the RF transmission stage 250, 750 is described as amplifying and transmitting a composite RF signal that includes distinct portions associated with the first signal and the second signal, and thus must have sufficient bandwidth to perform that amplification. (Expert Declaration, EX1003 ¶ 171.)

Additionally, because Rofougaran discloses frequency hopping using the same power amplifier, the power amplifier must have sufficient bandwidth to perform amplification for the frequency ranges before and after frequency hopping. The frequency ranges after frequency hopping are distinct from the frequency ranges before frequency hopping, and are therefore outside of the frequency ranges before frequency hopping. Therefore, the power amplifier must have bandwidth greater than the difference between the lowest and the highest frequencies in the upconverted composite signal. (Expert Declaration, EX1003 ¶ 172.)

Regarding claim 18, Rofougaran discloses **wherein the first RF frequency and the second RF frequency change within the bandwidth of the power amplifier** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27; 10:18-22, 10:23-28, 10:28-34); for example, Rofougaran discloses a "frequency-hopping scheme" in which one or both of the first baseband signal and the second baseband signal are shifted to different frequency spaces (or bands); thus, Rofougaran discloses upconverting to changed first and second RF center frequencies. Rofougaran also

discloses that the same RF transmission stage 250, 750 is used with the frequency-hopping scheme; therefore, the first RF frequency and the second RF frequency must change within the bandwidth of the power amplifier of the RF transmission stage 250, 750.

Regarding claim 19, Rofougaran discloses **wherein the first RF frequency and the second RF frequency change concurrently** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped, which indicates that the signals are changed concurrently. *See also* Expert Declaration, EX1003 ¶¶ 92, 174).

Regarding claim 20, Rofougaran discloses **wherein the first RF frequency and the second RF frequency change periodically** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped, which indicates that the signals are changed periodically. *See also* Expert Declaration, EX1003 ¶ 175).

Regarding claim 21, Rofougaran discloses **wherein 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 wireless protocol** (*see*, *e.g.*, Rofougaran 2:63-3:3, 3:9-14, 3:17-23, 5:64-6:4, 10:18-22, 10:24-27, 10:29-33); for example, Rofougaran at FIG. 7 discloses the first baseband signal is associated with the Bluetooth communication protocol and the second baseband signal is associated with the IEEE 802.11(g). As another example, Rofougaran more generally discloses that each of the first baseband signal and the second baseband signal may correspond to a variety of communication protocols including various cellular protocols, wireless networking protocols, various television communication standards, etc., and that various components may be implemented in analog and/or digital circuitry.

Regarding claim 22, Rofougaran discloses **wherein the second data corresponds to the first data** (*see*, *e.g.*, Rofougaran fig. 7, 3:24-34, 10:18-22, 10:24-30); for example, Rofougaran

discloses that the first and second baseband signals may be generated in a "dependent" manner, for example by utilizing both first and second baseband signals for a single communication. Rofougaran further discloses **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** *see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives an RF composite signal including up-converted signals for the first baseband signal and the second baseband signal and transmits the signal. Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including a power amplifier 252.

I. Proposed Rejection 9: Claims 10-13 and 17-22 would have been obvious over Rofougaran in view of Jaentti.

The Office has not considered Rofougaran or Jaentti. Requester shows below that Rofougaran in view of Jaentti discloses or renders obvious every limitation of the Challenged Claims 10-13 and 17-22.

1. Overview of Rofougaran

Rofougaran is described in detail above. *See* Section II.H.1, *supra*.

2. Overview of Jaentti

Jaentti is described in detail above. *See* Section II.B.2, *supra*.

3. Application of Rofougaran and Jaentti to Claims 10-13 and 17-22

The combination of Rofougaran and Jaentti renders every element of claims 10-13 and 17-22 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's

Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 178-196). A more detailed mapping of Rejection 9 is provided in Appendix CC.

Regarding claim 10, Rofougaran and Jaentti renders obvious **[a] method of transmitting information in a wireless communication channel** (although the preamble may not be limiting; *see*, *e.g.*, Rofougaran 2:38-44, 2:60-3:3); for example, Rofougaran discloses communication system or device comprising characteristics of any of a variety of mobile wireless communication devices with multiple communication modes, such as cellular communication, wireless networking, television, etc.

Rofougaran further discloses **comprising receiving a first digital signal comprising first data to be transmitted** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4; 9:30-34; 10:18-22); for example, Rofougaran discloses the system 700 receives a first baseband signal. Rofougaran further discloses that the system 700 shares any or all characteristics with other systems, including system 500, which includes the DAC 592 receiving the first baseband signal. Therefore, the first baseband signal is a digital signal. Rofougaran further discloses **receiving a second digital signal comprising second data to be transmitted** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4; 9:30-38; 10:18-22); for example, Rofougaran discloses the system 700 receives a second baseband signal; Rofougaran further discloses that the system 700 shares any or all characteristics with other systems, including system 500, which includes the DAC 594 receiving the second baseband signal; therefore, the second baseband signal is a digital signal.

Rofougaran further discloses **converting the first digital signal into a first analog signal using a first digital-to-analog converter** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 9:30-34, 10:18-22); for example, Rofougaran discloses the DAC 592 converts the first baseband signal to the analog domain. Rofougaran further discloses **the first analog signal carrying the first data across a first frequency range** (*see*, *e.g.*, Rofougaran fig. 2, 6:12-20, 10:18-22); for example, Rofougaran discloses that the system 700 shares any or all characteristics with other systems,

including system 200, and Rofougaran at FIG. 2 illustrates the spectrum 203 associated with the first baseband signal. Rofougaran further discloses **converting the second digital signal into a second analog signal using a second digital-to-analog converter** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 9:30-38, 10:18-22); for example, Rofougaran discloses the DAC 594 converts the second baseband signal the analog domain. Rofougaran further discloses **the second analog signal carrying the second data across a second frequency range** (*see*, *e.g.*, Rofougaran fig. 2, 6:21-31, 10:18-22); for example, Rofougaran discloses that the system 700 shares any or all characteristics with other systems, including system 200, and Rofougaran at FIG. 2 illustrates the spectrum 204 associated with the second baseband signal.

Rofougaran further discloses **up-converting the first analog signal to a first RF center frequency to produce a first up-converted analog signal** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran discloses the mixer 744 with local oscillator 742 upconverts the first baseband signal to an RF signal at RF center frequency 2.446 GHz; as another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with first portion 243 that corresponds to the first baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran at fig. 7 discloses that the first analog signal is upconverted using a mixer with a local oscillator at the first RF center frequency (2.446 GHz). This means that the upshifted signal has a frequency range centered on the first RF center frequency (i.e., a symmetric frequency range), with the same width as the first analog signal (*see* Expert Declaration, EX1003 ¶ 181). As another example, Rofougaran at fig. 2 illustrates that the first portion 243 of the upshifted RF signal 241 corresponding to the first analog signal has a symmetric frequency range.

Rofougaran further discloses **up-converting the second analog signal to a second RF center frequency greater than the first center RF frequency to produce a second up-converted analog signal** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran discloses the mixer 748 with local oscillator 746 upconverts the second baseband signal to an RF signal at RF center frequency 2.486 GHz, which is greater that the first center RF frequency (e.g., 2.446 GHz). As another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with second portion 242 that corresponds to the second baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:8-9, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran at fig. 7 discloses that the second analog signal is upconverted using a mixer with a local oscillator at the second RF center frequency (2.486 GHz), meaning that the upshifted signal has a frequency range centered on the second RF center frequency (i.e., a symmetric frequency range), with the same width as the second analog signal (*see* Expert Declaration, EX1003 ¶ 182). As another example, Rofougaran at fig. 2 illustrates that the second portion 242 of the upshifted RF signal 241 corresponding to the second analog signal has a symmetric frequency range about its RF center frequency f_{RF}. Rofougaran further discloses **and wherein a frequency difference between the first 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** (*see e.g.*, Rofougaran figs. 2, 7, 6:12-31, 7:35-42, 10:23-28, 10:28-34); for example, in relation to Rofougaran at FIG. 7, the frequency difference between the first RF center frequency and the second RF center frequency is 40 MHz. Although the frequency range of the signals in FIG. 7 is not expressly described, in other examples that also include combined Bluetooth and 802.11 signals, Rofougaran indicates that the upconverted, composite

signal includes portions in distinct frequency bands that do not overlap. For example, the diagram at FIG. 2 illustrates the upconverted, composite signal with a frequency spectrum 241 including first portion 243 corresponding the first signal and second portion 242 corresponding to the second signal, and the portions 242, 243 do not overlap, meaning that their center frequencies are separated by a difference greater than one-half of the range of the portion 243 plus one-half of the range of the portion 242.

Rofougaran further discloses **combining the first up-converted analog signal and the second up-converted analog signal to produce a combined up-converted signal** (*see e.g.*, Rofougaran figs. 2, 7, 7:26-29, 7:35-42, 10:18-22, 10:35-40); for example, the RF signal combiner 730 combines the up-converted signals output from the mixers 744, 748. Rofougaran further discloses **amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal** (*see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives the RF composite signal and transmits the signal. Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including a power amplifier 252. Rofougaran further discloses **and transmitting the amplified combined up-converted signal on a first antenna** (*see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives the RF composite signal and transmits the signal; Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including an antenna 254.

Rofougaran and/or Rofougaran as modified by Jaentti discloses **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** (*see, e.g.*, Rofougaran figs. 2, 7, 4:16-27, 7:31-34, 7:35-42, 7:47-57, 10:18-22, 10:40-43; Jaentti fig. 3, 4:65-67, 5:7-9, 5:13-15, 5:16-27); for example, Rofougaran discloses the RF transmission stage 750 that receives and transmits the RF composite signal, and thus must have

bandwidth at least the difference between the lowest and highest frequencies in the up-converted composite signal. As another example, Rofougaran at FIG. 2 discloses a similar RF transmission stage 250 including a power amplifier 252 that amplifies upshifted composite signal 241 including portions 242, 243 and thus the power amplifier 252 must have bandwidth at least the difference between the lowest and highest frequencies in the upconverted composite signal 241. As another example, if it is found that the RF transmission stages 250, 750 of Rofougaran do not disclose bandwidth greater than this difference, it would be obvious to substitute with the multifrequency power amplifier 306 of Jaentti.

As discussed above, Rofougaran discloses "amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal . . . 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," because the RF transmission stage 250, 750 is described as amplifying and transmitting a composite RF signal that includes distinct portions associated with the first signal and the second signal, and thus must have sufficient bandwidth to perform that amplification including by its frequency hopping scheme. (Expert Declaration, EX1003 ¶¶ 157-160.)

If, however, it is determined that Rofougaran does not disclose "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," it would have been obvious to substitute the power amplifier of Rofougaran with the multi-frequency amplifier of Jaentti. The multi-frequency amplifier of Jaentti amplifies several signals simultaneously that are on entirely different frequency ranges, and thus has bandwidth greater than the difference between the lowest frequency and the highest frequency of the upconverted frequency range. (Expert Declaration, EX1003 ¶ 188.) As disclosed in Jaentti, using a multi-frequency amplifier may reduce component costs or save space. (Expert Declaration, EX1003 ¶

189.) Therefore, a POSITA would be motivated to combine Rofougaran with Jaentti with a reasonable expectation of success. (Expert Declaration ¶¶ 189-192.)

Regarding claim 11, Rofougaran discloses **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** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27; 10:18-22, 10:23-28, 10:28-34); for example, Rofougaran discloses a "frequency-hopping scheme" in which one or both of the first baseband signal and the second baseband signal are shifted to different frequency spaces (or bands); thus, Rofougaran discloses upconverting to changed first and second RF center frequencies. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran fig. 7, 3:55-58, 4:16-27, 10:18-22); for example, Rofougaran discloses a frequency hopping one or both of the first and second baseband signals to "consecutive frequency spaces (or bands)"; because the hopped frequency spaces are "consecutive," their center frequencies must be separated by at least the associated frequency range, or they would overlap. (*See also* Expert Declaration, EX1003 ¶¶ 192-193.)

Regarding claim 12, Rofougaran discloses **wherein the first and second RF center frequencies are changed concurrently** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped, which indicates that the signals are changed concurrently. (*See also* Expert Declaration, EX1003 ¶ 194).

Regarding claim 13, Rofougaran discloses **wherein the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol** (*see*, *e.g.*, Rofougaran 2:63-3:3, 3:9-14, 3:17-23, 5:64-6:4, 10:18-22, 10:24-27, 10:29-33); for example, Rofougaran at FIG. 7 discloses the first baseband signal is associated with the

Bluetooth communication protocol and the second baseband signal is associated with the IEEE 802.11(g). As another example, Rofougaran more generally discloses that each of the first baseband signal and the second baseband signal may correspond to a variety of communication protocols including various cellular protocols, wireless networking protocols, various television communication standards, etc., and that various components may be implemented in analog and/or digital circuitry.

Regarding claim 17, Rofougaran and Jaentti renders obvious **[a] wireless communication system** (although the preamble may not be limiting; *see*, *e.g.*, Rofougaran 2:38-44, 2:60-3:3); for example, Rofougaran discloses communication system or device comprising characteristics of any of a variety of mobile wireless communication devices with multiple communication modes, such as cellular communication, wireless networking, television, etc.

Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 9:30-38, 10:18-22, 11:60-12:3, 12:60-13:4); for example, Rofougaran discloses the system 700 receives a first baseband signal and a second baseband signal. Rofougaran further discloses that the system 700 shares any or all characteristics with other systems, including system 500, which includes the DACs 592, 594 receiving the first baseband signal and the second baseband signal. Therefore, the first baseband signal and the second baseband signals are digital signal.

Rofougaran further discloses **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 first data across a first frequency range** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 6:12-20, 9:30-34, 10:18-22); for example, Rofougaran discloses the DAC 592 converts the first baseband signal to the analog domain. Continuing that example, Rofougaran at FIG. 2 illustrates the spectrum 203 associated with the first baseband signal.

Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 5, 7, 5:64-6:4, 6:21-31, 9:30-38, 10:18-22); for example, Rofougaran discloses the DAC 594 converts the second baseband signal the analog domain. Continuing that example, Rofougaran at FIG. 2 illustrates the spectrum 204 associated with the second baseband signal.

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 first up-converter outputs a first up-converted analog signal (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran discloses the mixer 744 with local oscillator 742 upconverts the first baseband signal to an RF signal at RF center frequency 2.446 GHz; as another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with first portion 243 that corresponds to the first baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:23-28); for example, Rofougaran at fig. 7 discloses that the first analog signal is upconverted using a mixer with a local oscillator at the first RF center frequency (2.446 GHz). This means that the upshifted signal has a frequency range centered on the first RF center frequency (i.e., symmetric), with the same width as the first analog signal (*see* Expert Declaration, EX1003 ¶ 168). As another example, Rofougaran at fig. 2 illustrates the first portion 243 of the upshifted RF signal 241 corresponding to the first analog signal has a symmetric frequency range.

Rofougaran discloses **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-converter outputs a second up-**

converted analog signal (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran discloses the mixer 748 with local oscillator 746 upconverts the first baseband signal to an RF signal at RF center frequency 2.486 GHz, which is greater that the first center RF frequency (e.g., 2.446 GHz). As another example, Rofougaran at fig. 2 illustrates upconverted frequency spectrum 241 with second portion 242 that corresponds to the second baseband signal. Rofougaran further discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 7:8-9, 7:25-34, 7:35-42, 10:18-22, 10:28-34); for example, Rofougaran at fig. 7 discloses that the second analog signal is upconverted using a mixer with a local oscillator at the second RF center frequency (2.486 GHz), meaning that the upshifted signal has a frequency range centered on the second RF center frequency (i.e., symmetric), with the same width as the second analog signal (*see* Expert Declaration, EX1003 ¶ 169). As another example, Rofougaran at fig. 2 illustrates the second portion 242 of the upshifted RF signal 241 corresponding to the second analog signal has a symmetric frequency range about its RF center frequency f_{RF}. Rofougaran further discloses **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** (*see e.g.*, Rofougaran figs. 2, 7, 6:12-31, 7:35-42, 10:23-28, 10:28-34); for example, in relation to Rofougaran at FIG. 7, the frequency difference between the first RF center frequency and the second RF center frequency is 40 MHz. Although the frequency range of the signals in FIG. 7 is not expressly described, in other examples that also include combined Bluetooth and 802.11 signals, Rofougaran indicates that the upconverted, composite signal includes portions in distinct frequency bands that do not overlap. For example, the diagram at FIG. 2 illustrates the upconverted, composite signal with a frequency spectrum 241 including first portion 243 corresponding the first signal and second portion 242 corresponding to the second

signal, and the portions 242, 243 do not overlap, meaning that their center frequencies are separated by a difference greater than one-half of the range of the portion 243 plus one-half of the range of the portion 242.

Rofougaran further discloses **a power amplifier coupled to receive the first and second up-converted analog signals** (*see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives the RF composite signal and transmits the signal. Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including a power amplifier 252. Rofougaran and/or Rofougaran as modified by Jaentti discloses **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** (*see*, *e.g.*, Rofougaran figs. 2, 7, 4:16-27, 7:31-34, 7:35-42, 7:47-57, 10:18-22, 10:40-43; Jaentti fig. 3, 4:65-67, 5:7-9, 5:13-15, 5:16-27); for example, Rofougaran discloses the RF transmission stage 750 that receives and transmits the RF composite signal, and thus must have bandwidth at least the difference between the lowest and highest frequencies in the up-converted composite signal. As another example, Rofougaran at FIG. 2 discloses a similar RF transmission stage 250 including a power amplifier 252 that amplifies upshifted composite signal 241 including portions 242, 243 and thus the power amplifier 252 must have bandwidth at least the difference between the lowest and highest frequencies in the upconverted composite signal 241. As another example, if it is found that the RF transmission stages 250, 750 of Rofougaran do not disclose bandwidth greater than this difference, it would be obvious to substitute with the multifrequency power amplifier 306 of Jaentti.

As discussed above, Rofougaran discloses "amplifying the combined up-converted signal in a power amplifier resulting in an amplified combined up-converted signal . . . 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," because the RF transmission stage 250, 750 is described as amplifying and transmitting a composite RF signal that includes distinct portions associated with the first signal and the second signal, and thus must have sufficient bandwidth to perform that amplification. Expert Declaration ¶ 185-187.

If, however, it is determined that Rofougaran does not disclose "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," it would have been obvious to substitute the power amplifier of Rofougaran with the multi-frequency amplifier of Jaentti. The multi-frequency amplifier of Jaentti amplifies several signals simultaneously that are on entirely different frequency ranges, and thus has bandwidth greater than the difference between the lowest frequency and the highest frequency of the upconverted frequency range. Expert Declaration ¶ 188. As disclosed in Jaentti, using a multi-frequency amplifier may reduce component costs or save space. Therefore, a POSITA would be motivated to combine Rofougaran with Jaentti with a reasonable expectation of success. Expert Declaration ¶¶ 189-191.

Regarding claim 18, Rofougaran discloses **wherein the first RF frequency and the second RF frequency change within the bandwidth of the power amplifier** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27; 10:18-22, 10:23-28, 10:28-34); for example, Rofougaran discloses a "frequency-hopping scheme" in which one or both of the first baseband signal and the second baseband signal are shifted to different frequency spaces (or bands); thus, Rofougaran discloses upconverting to changed first and second RF center frequencies. Rofougaran also discloses that the same RF transmission stage 250, 750 is used with the frequency-hopping scheme; therefore, the first RF frequency and the second RF frequency must change within the bandwidth of the power amplifier of the RF transmission stage 250, 750. (*See also* Expert Declaration, EX1003 ¶ 195.)

Regarding claim 19, Rofougaran discloses **wherein the first RF frequency and the second RF frequency change concurrently** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped, which indicates that the signals are changed concurrently. *See also* Expert Declaration, EX1003 ¶ 194).

Regarding claim 20, Rofougaran discloses **wherein the first RF frequency and the second RF frequency change periodically** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped, which indicates that the signals are changed periodically. *See also* Expert Declaration, EX1003 ¶ 196).

Regarding claim 21, Rofougaran discloses **wherein 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 wireless protocol** (*see*, *e.g.*, Rofougaran 2:63-3:3, 3:9-14, 3:17-23, 5:64-6:4, 10:18-22, 10:24-27, 10:29-33); for example, Rofougaran at FIG. 7 discloses the first baseband signal is associated with the Bluetooth communication protocol and the second baseband signal is associated with the IEEE 802.11(g). As another example, Rofougaran more generally discloses that each of the first baseband signal and the second baseband signal may correspond to a variety of communication protocols including various cellular protocols, wireless networking protocols, various television communication standards, etc., and that various components may be implemented in analog and/or digital circuitry.

Regarding claim 22, Rofougaran discloses **wherein the second data corresponds to the first data** (*see*, *e.g.*, Rofougaran fig. 7, 3:24-34, 10:18-22, 10:24-30); for example, Rofougaran discloses that the first and second baseband signals may be generated in a "dependent" manner, for example by utilizing both first and second baseband signals for a single communication. Rofougaran further discloses **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 *see e.g.*, Rofougaran figs. 2, 7, 7:47-57, 10:18-22, 10:40-43); for example, Rofougaran discloses RF transmission stage 750 receives an RF composite signal including up-converted signals for the first baseband signal and the second baseband signal and transmits the signal. Rofougaran at FIG. 2 illustrates a similar RF transmission stage 250 including a power amplifier 252.

J. Proposed Rejection 10: Claims 11 and 20 would have been obvious over Rofougaran (and alternatively Rofougaran with Jaentti) in view of Rao.

The Office has not considered Rofougaran or Rao. Requester shows below that Rofougaran (and, alternatively Rofougaran with Jaentti) in view of Rao discloses or renders obvious every limitation of the Challenged Claims 11 and 20.

1. Overview of Rofougaran

Rofougaran is described in detail above. *See* Section II.H.1, *supra*

2. Overview of Rao

Rao is described in detail above. *See* Section II.C.2, *supra*.

3. Application of Rofougaran and Rao to Claims 11 and 20

The combination of Rofougaran and Rao (and, alternatively, the combination of Rofougaran as modified by Jaentti with Rao) renders every element of claims 11, and 20 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 197-203). A more detailed mapping of Rejection 10 is provided in Appendix CC.

Regarding claim 11, Rofougaran discloses **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** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27; 10:18-22, 10:23-28, 10:28-34); for example, Rofougaran discloses a "frequency-hopping scheme" in which one or both of the first baseband signal and the second baseband signal are shifted to different frequency spaces (or bands); thus, Rofougaran discloses upconverting to changed first and second RF center frequencies. Rofougaran as modified by Rao further renders obvious **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** (*see*, *e.g.*, Rofougaran fig. 7, 3:55-58, 4:16-27, 10:18-22; Rao at 559 col. 1, 560 col. 1, Table 1); for example, Rofougaran discloses a frequency hopping one or both of the first and second baseband signals to "consecutive frequency spaces (or bands)." Rao also discloses frequency hopping according to a time-frequency code between 14 different sub-bands, and the center frequency of each sub-band is separated by 528 MHz, which is the same as (i.e., "at least") the frequency range of each band). (Expert Declaration, EX1003 ¶ 200.)

As discussed above in connection with Proposed Rejection 8, Rofougaran discloses a frequency-hopping scheme in which the baseband signals are frequency-hopped between consecutive frequency spaces (or bands). Rofougaran does not expressly disclose that the first and second RF center frequencies change by the respective first and second frequency range. Rao, in an analogous field, discloses a time-frequency interleaving scheme in which transmissions hop between sub-bands having center frequencies separated by the frequency range of each band. Therefore, Rao discloses that for every change in sub-band, the center frequency changes by "at least" the frequency range of the respective band. A POSITA would be motivated to combine the frequency hopping of Rofougaran with the band center frequency spacing of Rao in order to prevent interference between signals. (Expert Declaration, EX1003 ¶ 201.)

Regarding claim 20, Rofougaran as modified by Rao discloses **wherein the first RF frequency and the second RF frequency change periodically** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22; Rao at 560, col. 1); for example, Rofougaran discloses a frequency-hopping scheme. Continuing that example, Rao also discloses frequency hopping based on a time-frequency code, and the hops occur periodically based on the length of the MB-OFDM symbol period. (Expert Declaration, EX1003 ¶ 202.)

As discussed above in connection with Proposed Rejection 8, Rofougaran discloses a frequency-hopping scheme in which the baseband signals are frequency-hopped between consecutive frequency spaces (or bands). Proposed Rejection 8 asserts that such a frequency-hopping scheme implicitly discloses "periodically" changing frequencies. However, Rofougaran does not appear to expressly disclose that the first and second RF center frequencies change "periodically." Rao, in an analogous field, discloses a time-frequency interleaving scheme in which transmissions hop between sub-bands at time intervals based on the period of the MB-OFDM symbols. Therefore, Rao discloses changing RF frequencies periodically. A POSITA would be motivated to combine the frequency hopping of Rofougaran with the periodic changes of Rao in order to generate even levels of transmission power across frequencies and to prevent interference between signals. (Expert Declaration, EX1003 ¶ 203.)

K. Proposed Rejection 11: Claims 12, 19, and 23 would have been obvious over Rofougaran (and alternatively Rofougaran with Jaentti) in view of Shearer.

The Office has not considered Rofougaran or Shearer. Requester shows below that Rofougaran (and, alternatively Rofougaran with Jaentti) in view of Shearer discloses or renders obvious every limitation of the Challenged Claims 12, 19, and 23.

1. Overview of Rofougaran

Rofougaran is described in detail above. *See* Section II.H.1, *supra*

2. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

3. Application of Rofougaran and Shearer to Claims 12, 19, and 23

The combination of Rofougaran and Shearer (and, alternatively, the combination of Rofougaran as modified by Jaentti with Shearer) renders every element of claims 12, 19, and 23 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 204-214). A more detailed mapping of Rejection 10 is provided in Appendix CC.

Regarding claims 12 and 19, Rofougaran as modified by Shearer renders obvious **wherein the first and second RF center frequencies are changed concurrently** (*see*, *e.g.*, Rofougaran fig. 7, 3:50-58, 4:25-27, 10:18-22; Shearer fig. 19, 10:32-38); for example, Rofougaran discloses that either or both of the first and second baseband signals may be frequency hopped; Shearer discloses that simultaneous signals have substantially equivalent start time and end time in order to eliminate problems with multiple signal acquisition and termination, which indicates that the signals are changed concurrently.

As discussed above in connection with Proposed Rejection 8, Rofougaran discloses a frequency-hopping scheme in which the baseband signals are frequency-hopped between consecutive frequency spaces (or bands). Rofougaran does not expressly disclose that the first and second RF center frequencies are changed concurrently. Shearer, in an analogous field, discloses that simultaneously transmitted signals have substantially equivalent start times and end times, and that this eliminates problems with multiple signal acquisition and termination. A POSITA would be motivated to modify the frequency hopping of Rofougaran such that the first and second RF

center frequencies are changed concurrently so that the resulting frequency hopped signals have substantially the same start times and end times as disclosed by Shearer in order to prevent the problems with multiple signal acquisition and termination described by Shearer. (Expert Declaration, EX1003 ¶¶ 207-212.)

Regarding claim 23, Rofougaran as modified by Shearer renders obvious **wherein first and second data to be transmitted comprise a plurality of OFDM symbols** (*see e.g.*, Shearer 5:30-33, 8:23-26, 9:19-22); for example, Shearer discloses 802.11a input signals that include multiple OFDM symbols. Rofougaran as modified by Shearer discloses **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** (*see*, *e.g.*, Shearer figs. 10, 12, 14, 19, 5:30-33, 8:23-26, 9:19-22, 10:32-38); for example, as shown in Shearer at FIG. 19, the first symbol is transmitted across the down-shifted frequency range, and the second symbol is transmitted across the up-shifted frequency range during the same time slot between start time 1902 and end time 1904. Rofougaran as modified by Shearer further discloses **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 frequency range** (*see*, *e.g.*, Shearer figs. 10, 12, 14, 19, 21-22, 5:30-33, 8:23-26, 9:19-22, 10:32-38, 11:23-24, 11:26-29, 11:46-48); for example, as shown in Shearer at FIG. 19, the third symbol is transmitted across the down-shifted frequency range, and the fourth symbol is transmitted across the up-shifted frequency range during a time slot between start time 1902 and end time 1904; continuing that example, as shown in FIGS. 21-22, data is transmitted as "packets" that include multiple "data symbols" arranged sequentially, which discloses transmission of the third and fourth symbols during "the second time slot" (e.g., simultaneously at a different time from the first time slot).

As discussed above, Rofougaran discloses simultaneously transmitting two different signals in distinct frequency bands, and further discloses that those signals may include IEEE 802.11g signals. However, Rofougaran doesn't expressly disclose that the signals to be transmitted include OFDM symbols. Shearer, in an analogous field, discloses simultaneous transmission of multiple 802.11a signals, which include OFDM symbols. A POSITA would understand that combining the communication system of Rofougaran with the OFDM symbols of Shearer would yield predictable results of simultaneous transmission of 802.11a signals, including OFDM symbols. (Expert Declaration, EX1003 ¶ 213.)

Similarly, Rofougaran also does not expressly disclose simultaneously transmitting symbols in multiple frequency ranges during consecutive time slots. Shearer, in an analogous field, discloses that simultaneously transmitted signals have substantially equivalent start times and end times, and that this eliminates problems with multiple signal acquisition and termination. A POSITA would be motivated to modify the transmission system of Rofougaran such that first and second symbols in different frequency ranges are transmitted during a first time slot and that third and fourth symbols are transmitted in those frequency ranges during a second time slot so that the resulting symbols have substantially the same start times and end times as disclosed by Shearer, which prevents the problems with multiple signal acquisition and termination described by Shearer. (Expert Declaration, EX1003 ¶ 215.)

L. Proposed Rejection 12: Claims 14-15 would have been obvious over Rofougaran (and alternatively Rofougaran with Jaentti) in view of Balakrishnan and Zheng.

The Office has not considered Rofougaran, Balakrishnan, or Zheng. Requester shows below that Rofougaran (and, alternatively Rofougaran with Jaentti) in view of Balakrishnan and Zheng discloses or renders obvious every limitation of the Challenged Claims 14-15.

1. Overview of Rofougaran

Rofougaran is described in detail above. *See* Section II.H.1, *supra*

2. Overview of Balakrishnan

Balakrishnan is described in detail above. *See* Section II.E.2, *supra*.

3. Overview of Zheng

Zheng discloses a "uniform RF transceiver" that can be suitable for multiple types of ultra-wideband (UWB) radio including direct sequence-ultrawideband (DS-UWB), multiband-orthogonal frequency division multiplexing (MB-OFDM), and carrier-less impulse radio UWB communications. *Id.* ¶¶ [0001], [0020]. The disclosed transceiver 100 includes a transmitter 102 and a receiver 104. *Id.* ¶ [0025]. The transceiver includes analog to digital converters (ADCs) 112, 114 and digital to analog converters (DACs) 116, 118 for interfacing the RF transceiver with a baseband processor. *Id.*

The disclosed transmitter 102 includes, among other components, two mixers 128, 130 coupled to a combiner 140, a power amplifier 134, and an antenna 144. *Id.* ¶¶ [0027]-[0028]. For dual-band DS-UWB communications, dual bands from 3.1 to 4.85 GHz and 6.2 to 9.7 GHz are used. *Id.* ¶ [0048]. Dual-band frequency upconversion and combining are performed on input signals using the mixers 128, 130 and the combiner 140. *Id.* ¶ [0049]. The baseband signals cover a frequency range from 0.5 to 4 GHz with a central frequency of 2.25 GHz. *Id.* ¶ [0052]. To shift the central frequency to the low frequency band (3.1 to 4.85 GHz), a local oscillator (LO) frequency of 792 MHz is used, which results (with shaping) in an upconverted frequency range from 3.1 to 4.792 GHz. *Id.* To shift the central frequency to the high frequency band (6.2 to 9.7 GHz), a LO frequency of 6.072 GHz is used, so that the upconverted frequency band is from 6.572 to 10.072 GHz. *Id.* A frequency synthesizer 106 generates the two LO frequency tones for the DS-UWB scheme. *Id.* ¶¶ [0032], [0052].

The disclosed receiver 104 includes, among other components, a low noise amplifier (LNA) 152 coupled to the antenna 144 and two mixers 154, 156 that receive output from the LNA 152. *Id.* ¶ [0029]. The mixers 154, 156 can be employed to downconvert the different band signals to the baseband. *Id.* Low-pass filters (LPFs) 162, 164 are coupled to the respective mixers 154, 156 and are used to extract the desired baseband signal. *Id.* ¶ [0031]. Output from the LPFs 162, 164 are coupled to respective variable gain amplifiers (VGAs) 166, 168, which drive the ADCs 112, 114. *Id.* ¶ [0031].

For dual-band DS-UWB communications, in the receiver, frequency downconversion is performed first. *Id.* [0053]. Thus, the mixers 154, 156 downconvert the received signal using the same LO frequencies used in the transmitter, that is, 792 MHz and 6.072 GHz. *See id. Id.* ¶¶ [0032], [0052] (common frequency synthesizer 106). The LPFs 162, 164 are used to recover the signal from each band, *id.* ¶ [0055], and the ADCs 112, 114 sample the recovered signals, *id.* ¶ [0057].

4. Application of Rofougaran, Jaentti, Balakrishnan, and Zheng to Claims 14-15

The combination of Rofougaran, Balakrishnan, and Zheng (and, alternatively, the combination of Rofougaran as modified by Jaentti with Balakrishnan and Zheng) renders every element of claims 14-15 obvious. For reference, examples are outlined from the cited references that disclose each associated claim limitation below. Further, a framework for a person of ordinary skill in the art's (POSITA's) background knowledge and motivations to combine are provided by Requestor's Expert. (Expert Declaration, EX1003 ¶¶ 29-32, 215-234). A more detailed mapping of Rejection 11 is provided in Appendix CC.

Regarding claim 14, Rofougaran as modified by Balakrishnan renders obvious **wherein the second data is the same as the first data** (*see*, *e.g.*, Balakrishnan ¶ [0029]); for example,

Balakrishnan discloses a transmit diversity mode in which the information bit stream is encoded into two bit streams for transmission that each include every bit of the information bit stream.

As discussed above, Rofougaran discloses receiving first data and second data to be transmitted; however, Rofougaran does not expressly disclose that the second data is the same as the first data. Balakrishnan, in an analogous field, discloses that each of the transmitted parallel bit streams includes every bit of the same information bit stream which may be encoded in a known way to increase the probability that the streams are correctly demodulated at the receiver. Balakrishnan indicates that this "transmission involving duplication of information" may be termed transmit diversity mode. A POSITA would be motivated to combine the transmission of Rofougaran with the transmit diversity mode of Balakrishnan in order to increase transmission reliability. (*See* Expert Declaration, EX1003 ¶ 223-224.) The combination of Rofougaran and Balakrishnan discloses the second data is the same as the first data.

Rofougaran as modified by Zheng further renders obvious **receiving the transmitted signal on a second antenna** (*see*, *e.g.*, Zheng fig. 1, ¶ [0024], [0029]); for example, Zheng discloses that ultrawideband (UWB) signals are received by antenna 144. Although Zheng illustrates a transceiver device with a single antenna 144, nothing in claim 14 appears to recite that the "second antenna" must be included in the same transmitter device as the "first antenna." Additionally, while Zheng discloses that a single antenna can be used for transmitting and receiving by using the antenna switch 142, a POSITA would understand that a separate antenna could be used for the transmitter and receiver and switch 142 would not be required, as an ordinary design choice and/or routine implementation of known techniques. (Expert Declaration, EX 1003 ¶ 225.)

Rofougaran as modified by Zheng further discloses **amplifying the received signal in a low noise amplifier resulting in an amplified received up-converted signal** (*see*, *e.g.*, Zheng fig. 1, ¶¶ [0024], [0029]); for example, Zheng discloses the LNA 152 amplifies the received

signals, resulting in the amplified received up-converted signal. Zheng further discloses **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** (*see*, *e.g.*, Zheng fig. 1, ¶¶ [0053]-[0054]); for example, Zheng discloses amplifying input signal y(t) with same LNA 152 to recover both baseband signals. Thus, the LNA 152 must have bandwidth greater than the difference between the lowest and highest frequencies in the up-converted frequency range. (*See also* Expert Declaration, EX1003 ¶ 226.)

Rofougaran as modified by Zheng further discloses **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** (*see*, *e.g.*, Zheng fig. 1, ¶ [0029], [0052]-[0054]); for example, Zheng discloses down-converting the amplified received signal using the mixer 154 and a signal from the local oscillator 106 corresponding to the lower frequency band, which is illustratively 792 MHz. This downconversion recovers the original baseband signal $x_1(t)$.

Rofougaran as modified by Zheng further discloses **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** (*see*, *e.g.*, Zheng fig. 1, ¶ [0029], [0052]-[0054]); for example, Zheng discloses down-converting the amplified received signal using the mixer 156 and a signal from the local oscillator 106 corresponding to the upper frequency band, which is illustratively 6.072 GHz. This downconversion recovers the original baseband signal $x_2(t)$.

As discussed above, Rofougaran discloses a transmitter that transmits multiple signals simultaneously in distinct frequency bands; however, Rofougaran does not expressly disclose a receiver. Zheng, in an analogous field, discloses a uniform RF transceiver that performs both multi-band transmission and multi-band reception. A POSITA would recognize that combining

the multi-band transmitter device and method of Rofougaran with the multi-band receiver device and method of Zheng would have the predictable results of receiving and processing the transmitted signals. (Expert Declaration, EX1003 ¶ 229.) Further, a POSITA would be motivated to combine the transmitter of Rofougaran with the receiver of Zheng in order to maximize block utility efficiency and to optimize power consumption, as disclosed by Zheng. (Expert Declaration, EX1003 ¶ 229.) The combination of Rofougaran with Zheng as discussed above reaches all of the elements of claim 14.

With regard to claim 15, it is noted that claim 15 recites "[t]he method of claim ***12***" (emphasis added). However, claim 15 also recites elements such as the "the fourth analog signal" and "the fifth analog signal" that do not have antecedent basis in claim 12. For this reason, it is assumed that claim 15 should depend upon claim 14, rather than claim 12.

That being said, Rofougaran as modified by Zheng renders obvious **filtering the fourth analog signal using a third filter and filtering the fifth analog signal using a fourth filter** (*see*, *e.g.*, Zheng fig. 1, ¶¶ [0031], [0055]); for example, Zheng discloses low-pass filters (LPFs) 162, 164 that filter the analog signals output from the mixers 154, 156 and extract the baseband signals.

Rofougaran as modified by Zheng further discloses **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** (*see*, *e.g.*, Zheng fig. 1, ¶¶ [0035], [0057]); for example, Zheng discloses analog-to-digital converters (ADCs) 112, 114 that convert signals output from the LPFs 162, 165.

Rofougaran as modified by Zheng further discloses **combining the third and fourth digital signals to receive data corresponding to the first data** (*see*, *e.g.*, Zheng fig. 1, ¶ [0054]); for example, baseband signals $x_1(t)$, $x_2(t)$ received from the ADCs 112, 114 are demodulated and converted to serial sequence x(t) by the DS demodulator 184.

As discussed above, Rofougaran discloses a transmitter that transmits multiple signals simultaneously in distinct frequency bands; however, Rofougaran does not expressly disclose a receiver. Zheng, in an analogous field, discloses a uniform RF transceiver that performs both multi-band transmission and multi-band reception. A POSITA would recognize that combining the multi-band transmitter device and method of Rofougaran with the multi-band receiver device and method of Zheng would have the predictable results of receiving and processing the transmitted signals. (Expert Declaration, EX1003 ¶ 234.) Further, a POSITA would be motivated to combine the transmitter of Rofougaran with the receiver of Zheng in order to maximize block utility efficiency and to optimize power consumption, as disclosed by Zheng. (Expert Declaration, EX1003 ¶ 234.) The combination of Rofougaran with Zheng as discussed above reaches all of the elements of claim 15.

M. Proposed Rejection 13: Claim 6 is rendered obvious by Rao and Shearer further in view of Kim.

1. Overview of Rao

Rao is described in detail above. *See* Section II.C.2, *supra*.

2. Overview of Shearer

Shearer is described in detail above. *See* Section II.A.1, *supra*.

3. Overview of Kim

Kim is described in detail above. *See* Section II.D.2, *supra*.

4. Application of Rao and Shearer further in view of Kim to Claim 8.

Kim is applied in light of Rao and Shearer in the same manner as discussed in detail concerning Kim with Shearer only, incorporated herein. *See* Section II.D.3, *supra*. Accordingly, a POSITA would have found it obvious at the time of the alleged invention to have modified Rao as applied with Shearer further by Kim's method where two different wireless protocols (e.g., MB-

OFDM and DS-CDMA) can be used to transmit on two different bands such that the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol, as recited in claim 6, for one or more of the reasons mention above in that section. (Expert Declaration, EX1003 ¶¶ 106-113, 243.10.)

III. THIS REQUEST IS NOT REDUNDANT AND SHOULD NOT BE DENIED UNDER 35 U.S.C. § 325(d).

As discussed in Sections I.A and I.G above, this Request raises substantial new questions of patentability with respect to the Challenged Claims. This Reexamination Request should not be rejected under 35 U.S.C. §325(d), because the prior art and arguments in this Request are not "the same or substantially the same prior art or arguments" previously presented to the Office, and more specifically, applies different art in a distinct manner from those previously presented. See 35 U.S.C. §325(d) ("In determining whether to institute or order a proceeding under this chapter, chapter 30, or chapter 31, the Director may take into account whether, and reject the petition or request because, the same or substantially the same prior art or arguments previously were presented to the Office.").

Appellant notes that the '802 Patent has been petitioned for *inter partes* review by a different party in each of IPR2024-00606 and IPR2024-00707. Despite these petitions, neither of which have been instituted as of the date of this request, this request should be granted at least because the prior art applied in this request is distinct on its own or in its combination with other prior art, and/or this request addresses additional claims of the '802 Patent. Notably, the Application Publication of the Shearer reference is cited in IPR2024-00707 as U.S. Patent Pub. No. 2006/0018249. This request, however, applies Shearer in combination with different art for different rejections, and also applies Shearer to at least claims 5-8 not addressed by the prior art in the corresponding petition. Accordingly, grant of this request is supported within § 325(d).

IV. LIST OF EXHIBITS

EX1001	U.S. Patent No. 7,924,802 ("the '802 Patent")
EX1002	Prosecution History of U.S. Patent 7,924,802 ("'802 PH")
EX1003	Declaration of Mark R. Lanning ("Expert Declaration")
EX1004	U.S. Patent No. 7,742,388 to Shearer et al. ("Shearer").
EX1005	U.S. Patent No. 6,516,206 to Jaentti ("Jaentti")
EX1006	Rao, K. D., & Murthy, T. S. N. (2007, July). Analysis of Effects of Clipping and Filtering on the Performance of MB-OFDM UWB Signals. In 2007 15th International Conference on Digital Signal Processing (pp. 559-562). IEEE. ("Rao")
EX1007	U.S. Patent Application Pub. No. 2007/0081613 by Kim et al. ("Kim")
EX1008	U.S. Patent Application Pub. No. 2005/0237923 by Balakrishnan et al. ("Balakrishnan")
EX1009	U.S. Patent No. 8,416,879 to Rofougaran et al. ("Rofougaran")
EX1010	U.S. Patent Application Pub. No. 2010/0062726 by Zheng et al. ("Zheng")
EX1011	Declaration of Sylvia Hall-Ellis

V. CONCLUSION

For the reasons set forth above, substantial new questions of patentability are raised in connection with the Challenged Claims, by this Request for Ex Parte Reexamination, because the Challenged Claims are anticipated and rendered obvious in view of the above-listed prior art references. Therefore, Requester asks that this Request for Reexamination be granted and that the Challenged Claims be canceled.

As identified in the attached Certificate of Service and in accordance with 37 C.F.R. §§ 1.33(c) and 1.510(b)(5), a copy of the present Request, in its entirety, is being served to the address of the attorney or agent of record.

Please direct all correspondence in this matter to the undersigned.

Respectfully submitted,

/ Steven D. Shipe /

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