

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

QUALCOMM INCORPORATED,
Petitioner,

v.

COBBLESTONE WIRELESS LLC,
Patent Owner.

Case IPR2024-01336
Patent 7,924,802

EXHIBIT 2013
DECLARATION OF TODOR V. COOKLEV, PH.D.

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I. INTRODUCTION

1. My name is Todor V. Cooklev. I am an expert in mobile telecommunications and wireless technology. I have been retained as an expert witness to provide my independent opinion regarding certain matters at issue in *inter partes* review of U.S. Patent No. 7,924,802 (“the ’802 patent”) in IPR2024-01336. I have been retained by Cobblestone Wireless LLC (“Cobblestone”), the Patent Owner in the above proceedings. The Petitioner is Qualcomm Inc. (“Petitioner”).

2. For my work on this case, I am being compensated for my time at my typical consulting rate of \$700 per hour. I am also being reimbursed for expenses that I incur during the course of this work. My compensation does not depend on the substance of my opinions or the outcome of the case.

3. My analysis of the materials produced in this matter is ongoing and I will continue to review any new material as it is provided. This declaration represents only those opinions I have formed to date. I reserve the right to amend or supplement my opinions based on additional documents or evidence I am presented, including without limitation any arguments or expert declarations advanced by Petitioner in this case.

4. I am not a legal expert and offer no opinions on the law. However, I have been informed by counsel of the various legal standards that apply, and I have applied those standards in arriving at my conclusions.

II. QUALIFICATIONS

5. I am currently the Professor in the Department of Electrical and Computer Engineering at Purdue University in Fort Wayne, Indiana, where I have had several faculty and administrative positions. I have received research funding from the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA), the U.S. Air Force Research Laboratory, the Office of Naval Research, and private companies, including major technology companies.

6. I am a named inventor on more than thirty U.S. patents, most of which relate to the hardware or software aspects of communication systems. In 1999, I was inducted into the Purdue Inventors Hall of Fame. I have also authored and co-authored more than one hundred peer-reviewed articles. A list of my publications and patents appears in my *curriculum vitae* attached as Exhibit 2014. Among my publications is the textbook “Modern Communications Systems: A First Course” that was recently published by Michigan Publishing. According to the University of Michigan, the textbook has been used at close to 200 universities in the United States and at a similar number of universities abroad.

7. I graduated from the Technical University of Sofia, Bulgaria in 1988 with a Diploma of Engineering in the field of Electrical Engineering. I graduated from Tokyo Institute of Technology in Tokyo, Japan in 1995 with a Doctor of Philosophy (Ph.D.) degree in Electrical Engineering.

8. My experience is not only academic. I have worked in the computer and data communications industries. I worked in research and development, but also contributed to product firmware and software development, including digital signal processing algorithms for communication systems.

9. I have contributed to the development of several major standards for communication systems and numerous amendments, including Bluetooth, DSL, Wi-Fi, cellular, and radio systems for intelligence and tactical operations. I have participated in many meetings of standards committees and I have chaired some committee meetings and served in other leadership roles.

10. Around 1998 - 1999 I participated in the Bluetooth Special Interest Group (SIG). I was among the authors of the Bluetooth 1.0 specification, contributing to the Host Controller Interface (HCI). In 1999 I participated in the group that established the license agreement between the Bluetooth SIG and the IEEE 802. Subsequently I joined IEEE 802.

11. From 2000 to 2002, and from 2005 to 2008 I was a Voting Member of the IEEE 802.11 Working Group and attended almost all meetings during those years. Generally, meetings were held every other month. During that time, I prepared, submitted, and presented documents to IEEE 802.11. On a couple of occasions, I was involved in the drafting of liaison letters between 802.11 and other standards committees.

12. From 2005-2006 to around 2007-2008 I was Chair of a Study Group within 802.11 until the entire Working Group approved my proposal to create a Task Group. For my work I received an IEEE Standards Association award in 2012.

13. I have also contributed to or reviewed and voted on other standards. Around 2007-2011 I participated in the Software-Defined Radio Forum (later renamed the Wireless Innovation Forum).

14. Around 2011-2012, I attended several 3GPP meetings. During that time, I contributed to 3GPP documents relevant to LTE-Advanced and submitted them to 3GPP for consideration.

15. In 2020 I was elected to serve on the Board of Governors of the IEEE Standards Association as a Member-at-Large. The Board of Governors provides overall leadership of the IEEE Standards Association. The Board also interacts with other standards organizations and government entities in the U.S. and the world.

16. Since 2017 I have been the Series Editor for Wireless and Radio Communications for the IEEE Communications Standards Magazine (which is the premier journal in the field of communication standards). As member of the Editorial Board I coordinate the review of scholarly manuscripts that relate to the most recent communications standards.

17. I have previously prepared expert reports and testified in a number of cases concerning systems for wireless communication, wireless communication protocols, and hardware and software of communication devices.

18. A detailed record of my professional qualifications is set forth in Exhibit 2014, which is my *curriculum vitae*, including a list of publications, awards, courses I teach in electrical and computer engineering subjects, research grants, and professional activities.

III. LEGAL STANDARDS

19. I am not a lawyer, and I do not intend to offer any opinions as to the interpretation of the law. When considering the '802 patent and stating my opinions, I rely on the following legal standards as described to me by the attorneys for Cobblestone Wireless.

A. Priority Date of a Patent.

20. I understand that the analysis of alleged obviousness of the Patent should be performed from the perspective of a POSITA as of the priority date of the Patent. The Patent claims priority to January 23, 2008. My opinions in this matter are from the perspective of a POSITA as of that date; however, my opinions do not change if the priority date is slightly changed.

B. Level Of Ordinary Skill in The Art.

21. My opinions in this declaration are based on the understandings of a person of ordinary skill in the art, as of the time of the invention. I understand that the person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art at the time of the invention. By “relevant,” I mean relevant to the challenged claims of the ’802 patent.

22. I understand that various factors should be considered when determining the person of ordinary skill in the art in connection with a particular patent. I understand that these factors include, without limitation, the type of problems encountered in the art, the prior solutions to those problems found in the prior art references, the rapidity with which innovations are made, the sophistication of the technology, the level of education of active workers in the field, and my own experience working with those of skill in the art at the time of the invention.

23. Dr. Almeroth opines that a POSITA “would have had at least a bachelor’s degree in electrical engineering, computer engineering, computer science, physics, or the equivalent, and at least two years of experience working in the field. Relevant working experience would include experience with cellular telecommunications and networking, radio-access network architectures, protocols, and signal propagation in wireless networks. More education can supplement practical experience and vice versa.” Ex. 1003 [Almeroth-Decl.] ¶ 51. For the

purpose of this declaration, I will apply the same definition of the level of skill of a POSITA.

24. Based on my experience, education, and training, I met the definition of a POSITA as of the priority date of the Patent. My qualifications at that time far exceeded that of a POSITA. However, the opinions that I provide in this Declaration are from the perspective of a POSITA, as defined above. Further, my opinions as stated in this declaration are valid even if the Board adopts a slightly different level of ordinary skill in the art.

C. Claim Construction.

25. I understand that claims in a patent-at-issue in an IPR are generally interpreted according to the district court-type claim construction.

26. I further understand that claim terms are interpreted as they would have been interpreted by a person of ordinary skill in the art at the time of the invention, in light of the specification and the patent's prosecution history in the patent office. I understand that claim terms are generally given their plain and ordinary meaning, as would have been understood by a person of ordinary skill in the art at the time of the priority date, unless there is a specific construction for a term. I have applied the plain and ordinary meaning unless otherwise noted in my Declaration.

D. Obviousness Legal Standard.

27. I understand that a patent claim is unpatentable if the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the invention.

28. I understand that an obviousness analysis involves comparing a claim to the prior art to determine whether the claimed invention would have been obvious to a person of ordinary skill in the art at the time of the invention in view of the prior art and in light of the general knowledge in the art as a whole. I also understand that obviousness is ultimately a legal conclusion based on underlying facts of four general types, all of which must be considered: (1) the scope and content of the prior art; (2) the level of ordinary skill in the art; (3) the differences between the claimed invention and the prior art; and (4) any objective indicia of non-obviousness, including any praise of the invention. Objective indicia of non-obviousness may include, for example, commercial success of an embodiment, a long-felt need, scepticism, failure by others to find the solution provided by the claimed invention, copying by others of the subject matter of the claim invention, unexpected results of the claimed invention, acceptance of others and industry praise, and licensing of the patents.

29. I also understand that obviousness may be established under certain circumstances by combining or modifying the teachings of the prior art. However,

I have been informed that a claim is not proved obvious merely by demonstrating that each of the elements was independently known in the prior art. I have been informed that many, if not all, inventions rely on building blocks already previously known, and claimed discoveries almost of necessity will likely be combinations of what is already known. I have been informed that it is important to identify whether a reason existed at the time of the invention that would have motivated a person of ordinary skill in the art in the relevant field to combine the known elements in the way the claimed invention does. Specific teachings, suggestions, or motivations to combine any first prior art reference with a second prior art reference can be explicit or implicit, but must have existed before the date of purported invention. I understand that prior art references themselves may be one source of a specific teaching or suggestion to combine features of the prior art, but that such suggestions or motivations to combine art may come from the knowledge that a person of ordinary skill in the art would have had.

30. I understand that a reference may be relied upon for all that it teaches, including uses beyond its primary purpose, but also including teachings that lead away from the invention. I understand that a reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, although the mere disclosure of alternative designs does not teach away.

31. I further understand that whether there is a reasonable expectation of success in combining references in a particular way is also relevant to the analysis.

32. I understand that it is improper to use hindsight to combine references or elements of references to reconstruct the invention using the claims as a guide. My analysis of the prior art is made from the perspective of a person of ordinary skill in the art at the time of the invention.

33. I am not offering any legal opinions in this declaration nor am I qualified to do so. I only consider such legal standards in framing my opinions and conclusions as well as placing assertions made by Petitioner in the Petition into the proper context. Additionally, from a subject matter perspective, I understand that the petitioner always has the burden of persuasion regarding a challenge of patentability of an invention under an inter partes review.

IV. CLAIMS-AT-ISSUE

34. I understand that Petitioner has challenged claims 1-4, 6-10, 13, 14, 17, and 21-25 of the '802 Patent. The Petitioner presented the below chart identifying the Grounds in the Petition:

Ground	Basis	Reference(s)	Claims
1	§103	Rick	1
2	§103	Suzuki	1-4,6-8,10,13,17,21-22
3	§103	Suzuki, Jalali	7-9,22-23
4	§103	Suzuki, Chen	14,24-25
5	§103	Suzuki, Etemad	6,13,21
6	§103	Fernandez, Montojo	1-4,6-8,10,13,17,21-22
7	§103	Fernandez, Montojo, Jalali	7-9,22-23
8	§103	Fernandez, Montojo, Chen	14,24-25
9	§103	Fernandez, Montojo, Etemad	6,13,21

Pet., 4.

V. RESPONSE TO DR. ALMEROOTH'S DECLARATION AND THE GROUNDS PUT FORWARD IN THE PETITION

A. Rick Does Not Render Claim 1 Obvious (Ground 1)

35. Petitioner has not shown that Rick discloses the limitations of claim 1 or otherwise renders the claim obvious.

36. Claim 1 sets for the following limitations; I have put in bold those I will be discussing below:

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.

37. The “first information” and “second information” in claim 1 are part of the “information” that is transmitted via the method as a whole. The preamble recites “information”, which provides the antecedent basis for “first information” and second information”. According to the claim, information is transmitted in an organized way, involving "first information" and "second information". The claim therefore defines the first and second information as related to one another, and part of the information to be transmitted recited in the preamble.

38. The '802 patent specification provides several examples of “first” and “second” information that demonstrate this relationship. In the first example, the transmitted information comprises a plurality of OFDM symbols, with a first symbol corresponding to the first information and the second information corresponding to a second symbol. Ex. 1001, 2:16-20. In the second example, the information transmitted is wireless protocols, and the first information corresponds to a first wireless protocol and the second information corresponds to a second protocol. *Id.*, 2:36-38. In the third example, the information is the same data at two different frequencies. *Id.*, 2:39-41. In the fourth example, the first and second information are produced from the same data stream using coding or data mapping. *Id.*, 2:42-44. In each embodiment, the first and second information are related to one another and part of a greater information package that is transmitted. These examples align with how a POSITA would have read the “first information” and “second information.”

39. In Ground 1, the Petitioner does not identify a first and second information that are part of a larger set of information or that have any relationship to one another. Instead, the Petitioner points only to Rick's disclosure of a multi-carrier transmitter that can transmit on multiple frequency channels. Pet., 13, 15-16. The Petitioner argues that the disclosure in Rick regarding the “transmission of N CDMA signals,” each of which “may carry any type of data for any service,” provide the claimed “first information” and “second information.”

40. But these transmissions in Rick that occur on multiple frequencies are random and unrelated to one another and are not part of any “information”. At least for this reason, separate unrelated transmissions are not the claimed “first information” and “second information”. This makes sense in light of the problem to be solved by Rick, namely allowing multiple types of wireless devices wielded by potentially multiple users to transmit simultaneously. Ex. 1021, 1:21-23. Because Rick does not teach “information”, “first information”, and “second information”, Rick does not disclose or render obvious claim 1 under Ground 1.

B. Suzuki (Grounds 2-5)

41. It is my opinion that Petitioner has failed to show that Suzuki in combination with Jalai, Chen, or Etemad discloses or renders obvious the challenged claims. Suzuki fails to disclose multiple limitations of the independent claims and

Petitioner has failed to show those claims are rendered obvious in light of the identified combinations. I explain these opinions in greater detail below.

1. Suzuki Does Not Render Claim 1 Obvious (Ground 2)

42. As explained above, claim 1 requires simultaneous transmission of a first information and a second information that are therefore, and part of the “information” recited in the preamble. Petitioner only points to a disclosure in Suzuki that discusses transmission of signals at two different frequency ranges for this limitation. Pet., 19-21. Petitioner does not assert that the alleged “first information” and “second information” are part of “information.” I agree that Suzuki contains no disclosure that these two transmissions (that the Petitioner alleges are the claimed first and second information) are related to one another or part of any “information”.

43. This lack of disclosure makes sense in light of the problem to be solved that is posed in Suzuki. Suzuki looks to solve the problem of using multiple wireless systems simultaneously, and providing a single hub. Ex. 1004, [0004-0006]. Suzuki gives as one example two different businesses using two different frequencies. *Id.*, 1004, [0006]. But two different business with two different wireless systems that send two completely different and unrelated data streams randomly at the same time is not the claimed method of transmitting information in an organized way, where that information is sent as first information and second information simultaneously.

Petitioner's argument as to Claim 1 under Ground 2 fails for an additional reason. Dr. Almeroth (and Petitioner) identifies "predistortion compensation data from lookup tables 17-1 and 17-2" as the "first information" and "second information." See Almeroth Declaration at ¶¶ 131-132. Pet., 19 ("Thus, one of the predistorted signals is the *first information*."), 21 (identifying a second predistorted signal as the second information). This predistortion compensation data has no information content to be transmitted. The predistortion compensation data is used by a digital predistortion system to counteract the distortion introduced by nonlinear elements such as power amplifiers. It is not "information" as claimed.

2. *Suzuki Does Not Render Obvious Independent Claims 10 and 17*

44. For claims 10 and 17, Petitioner argues that Suzuki renders these claims obvious, relying on Figures 6 and 8 as "alternative theories." Pet., 31. But neither embodiment discloses nor renders obvious the claim limitations that Petitioner relies upon them for. The Figure 6 embodiment that Petitioner relies upon does not disclose first and second digital signals that contain data "to be transmitted." What the Petitioner points to as the first and second digital signals are in fact pre-distortion signals. These predistortion signals of Suzuki are not data to be transmitted because they have no information content. And in any case, there is "no information" as claimed by the '802 patent.

45. Figure 8 of Suzuki also does not disclose the claim limitations. First, Figure 8 does not disclose both a “first” and “second” upconverted signal. Regarding Figure 8 Dr. Almeroth asserts “Thus, a POSITA would understand that Suzuki discloses that frequency-converter 26 upconverts the analog signals to the frequency band centers used in the transmission signal, which is depicted as f1 and f2 in Figure 13A.” I disagree with Dr. Almeroth for the following reasons.

46. First, Figure 13A (which contains two frequency ranges) relates to the 8th embodiment of Suzuki, while Figure 8 relates to the 5th embodiment.

47. Second, frequency-converter 26 is a single converter. It has a *single* analog input and upconverts that single analog signal. Consequently, it does not upconvert “the analog signals to the frequency band centers used in the transmission signal, which is depicted as f1 and f2 in Figure 13A”, even if we put aside the fact that Figure 13A relates to a different embodiment of Suzuki.

48. I note that Petitioner relies on Suzuki alone for the limitations discussed in greater detail below and does not argue that these limitations are present in the other art identified in Grounds 2-5 or that the missing limitations would be otherwise obvious.

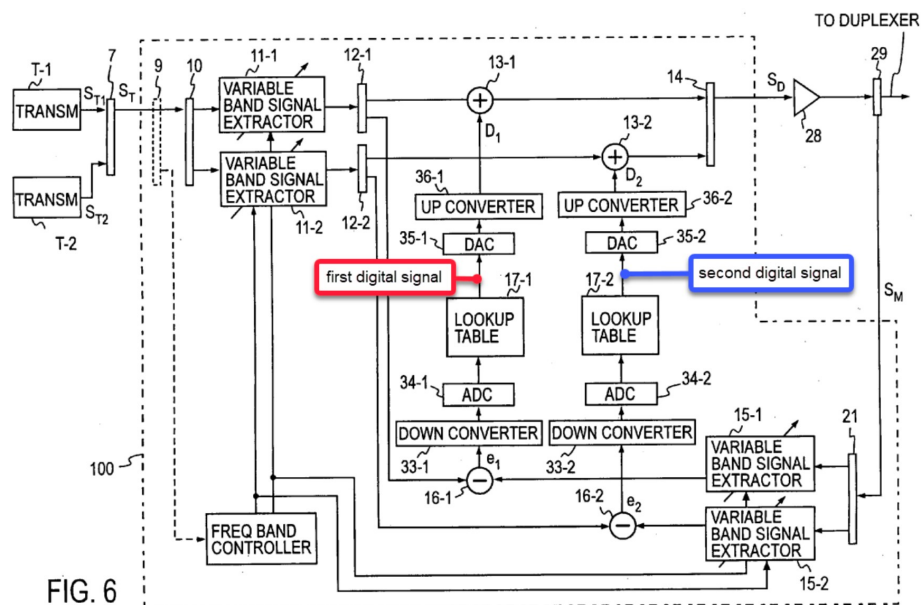
i. Petitioner's Reliance on Suzuki Fig. 6 Fails

49. Suzuki's Fig. 6 does not disclose or render obvious either claim 10 or 17 because it fails to disclose first/second digital signals comprising first/second data "*to be transmitted*," as required by both independent claims.

50. Claim 10 requires "receiving a first digital signal comprising first data *to be transmitted*." Ex. 1001 [’802] cl. 10. It also requires "receiving a second digital signal comprising second data *to be transmitted*." *Id.* Claim 17 similarly requires first and second digital signals comprising first and second data to be transmitted. *Id.*, cl. 17. Petitioner contends that these limitations are satisfied by two predistortion signals in Suzuki's Figure 6. Pet., 31. But these predistortion signals are *never transmitted* and do not contain any data that to be transmitted. The predistortion signals are cancelled out by Suzuki's amplifier.

51. Even if a portion of the predistortion signal reaches the antenna and is therefore converted into an electromagnetic wave, a POSITA would not have considered the predistortion signal to be "transmitted". The predistortion signal has no information content and is not "information". It is of no interest to any receiver. Communication systems are not built to transmit predistortion signals. A POSITA would have understood the claim term "transmitting information" to mean information which the communication system is built to transmit.

52. Looking more closely at Figure 6 and Petitioner’s arguments, Petitioner relies on the output of the lookup tables 17-1 and 17-2 as the claimed first and second digital signals that allegedly act as the first and second data to be transmitted:



53. Pet., 31. Petitioner relies on what it calls a “first digital signal” and “second digital signal” added in red and blue, respectively, by the Petitioner.

54. These signals are not transmitted and do not contain data “to be transmitted.” As Suzuki explains, the signals output from lookup tables 17-1 and 17-2 are pre-distortion signals that are cancelled in amplifier 28 before transmission. Suzuki discloses a “predistorter that compensates for a distortion of a power amplifier” in a transmitter. Ex. 1004 [Suzuki] [0001]. The amount of the predistortion that needs to be applied to the input signal of the power amplifier is determined through a lookup table. *Id.*, [0003]. Suzuki explains that the output of

lookup tables 17-1 and 17-2 are these pre-distortion components D_1 and D_2 that are intended to compensate for the distortion caused by the power amplifier 28:

The distortion compensation data D_1 and D_2 read out from the lookup tables 17-1 and 17-2 are converted into analog signals at the DACs 35-1 and 35-2, further converted into high frequency signals at the upconverters 36-1 and 36-2 and provided to adders 13-1 and 13-2.

Ex. 1004 [Suzuki] [0063]. The adders 13-1 and 13-2 add the distortion compensation data D_1 and D_2 to the underlying signal that is first predistorted and then amplified (cancelling the predistortion) prior to transmission. *Id.*, [0047]; *see also id.*, [0046] (“The distortion compensation data are such one for canceling the detected distortion components.”).

55. Petitioner does not dispute that the output of lookup tables 17-1 and 17-2 are predistortion compensation signals, and that it relies on this predistortion signals as the claimed first and second digital signals. Pet., 31 (“...used to receive predistortion compensation data from lookup tables 17-1 and 17-2, which are the first and second digital signal, respectively.”). But, again, the output of lookup tables 17-1 and 17-2 (distortion compensation data D_1 and D_2) are not digital signals that are either transmitted by the transmitter or contain “data to be transmitted.” Distortion compensation data D_1 and D_2 are not transmitted by the transmitter because they are cancelled by the distortion caused by the power amplifier when the signal is amplified before transmission. Distortion compensation data D_1 and D_2 also

do not contain data to be transmitted; instead, they merely contain distortion compensation components that are cancelled out before transmission.

56. In addition, the embodiment of Figure 6 is an “analog circuit,” its input is analog, which does not meet the claim limitation requiring receiving a first/second “digital signal.” Ex. 1004 [Suzuki] [0063]. The input and output of the lookup table 17-1 and 17-2 are the only digital signals in Figure 6 because those lookup tables “are implemented through digital signal processing.” *Id.*

57. Petitioner fails to show that Suzuki’s Figure 6 embodiment discloses either claim 10 or 17.

ii. Petitioner’s Reliance on Suzuki Fig. 8 Fails

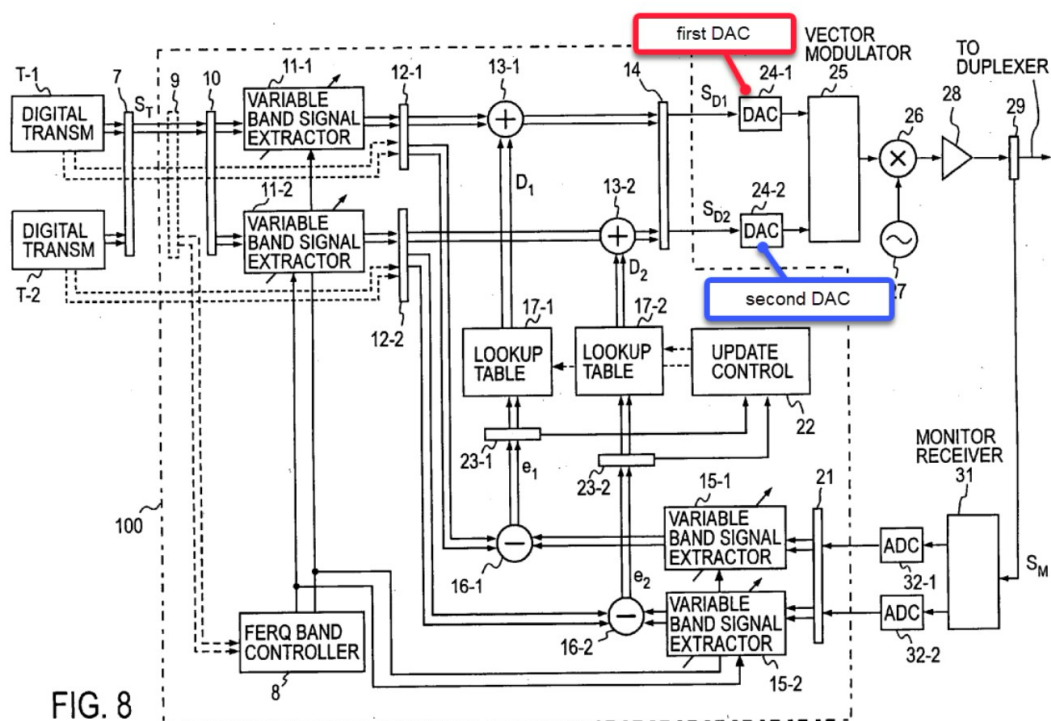
58. Petitioner fails to show that Suzuki’s Figure 8 discloses or renders obvious either claim 10 or claim 17 for two reasons. First, Petitioner fails to show that Suzuki discloses two distinct up-converted analog signals as required by the claims. Second, Petitioner fails to show that the up-converted analog signals of Suzuki’s Figure 8 contain two distinct frequency ranges with the specifically claimed properties.

1. Petitioner Fails to Show the Disclosure
of a First and a Second Up-Converted
Signal

59. Claim 10 requires “up-converting the first analog signal to a first RF center frequency to produce a *first* up-converted analog signal.” Ex. 1001 [’802] cl.

10. Claim 10 then requires “up-converting the second analog signal to a first RF center frequency to produce a *second* up-converted analog signal.” *Id.* Claim 17 recites similar limitations. *Id.*, cl. 17. On their face, the claims require two different upconverted analog signals. Petitioner fails to show that Suzuki Figure 8 discloses this limitation.

60. Petitioner relies on the output of the Digital-to-Analog Converters (DAC) 24-1 and 24-2 as the two claimed analog signals that are up-converted:



Pet., 34. Petitioner next contends that the outputs of DAC 24-1 and 24-2 are upconverted in up-converter 26:

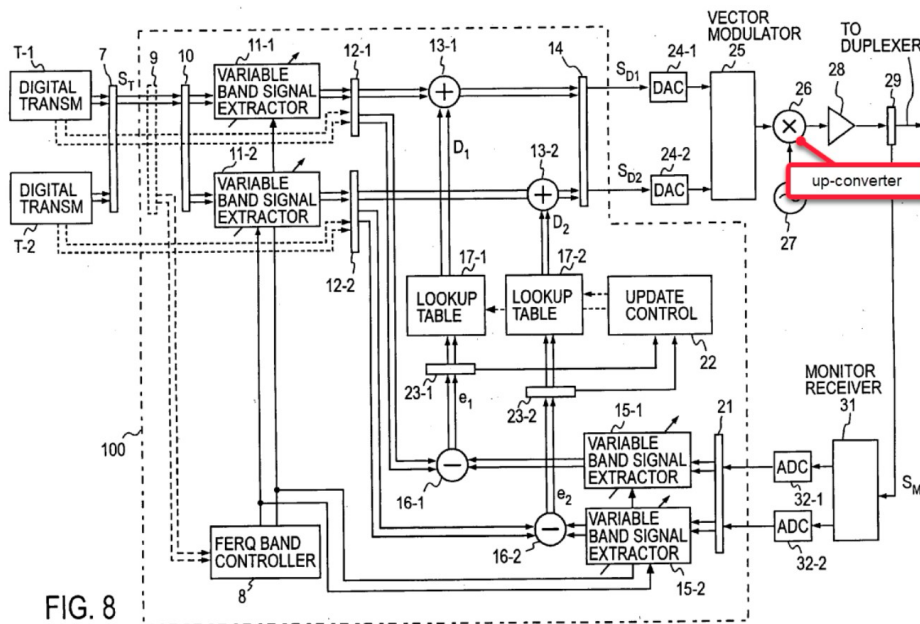


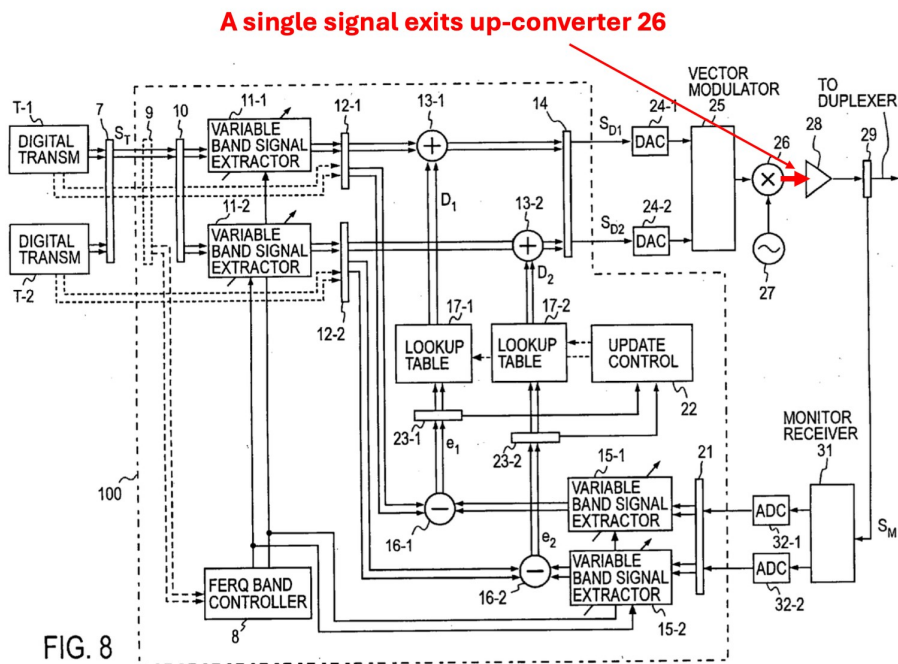
FIG. 8

Pet., 37. But as is shown in Figure 8, the outputs of DAC 24-1 and 24-2 are not separately up-converted to produce a “first” and a “second” up-converted signal. Instead, they are combined in Vector Modulator 25 to produce a single combined signal, which is then transmitted to up-converter 26 to produce a single up-converted signal. Suzuki explains this as follows:

The vector modulated *signal* is *frequency-converted into a transmission signal* of a radio frequency band by a carrier signal from a local oscillator 27 and power amplified at the power amplifier 28 and supplied to an antenna (not shown) via a duplexer (not shown).

Ex. 1004 [Suzuki] [0058]; *see also id.*, [0069] (explaining that Figure 8 is similar to Figure 5 as relevant for this discussion).

61. This is also shown in Figure 8, which shows a single line coming out of the up-converter 26:



i. Petitioner Fails to Show Disclosure of Two Up-Converted Frequency Ranges as Claimed

62. Claims 10 and 17 also require two distinct up-converted frequency ranges with specific properties. Specifically, claim 10 requires that “the first up-converted analog signal comprises *a first up-converted frequency range*” that spans one-half of the up-converted frequency range on either side of the first RF center frequency. Ex. 1001 [’802] cl. 10. Claim 10 further requires “the second up-converted analog signal comprises *a second up-converted frequency range*” that spans one-half of the up-converted frequency range on either side of the second RF center frequency. *Id.* Claim 10 further requires that the “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.” *Id.* Claim 17 requires corresponding limitations. So, claim 10 and claim 17 each require two distinct up-converted frequency ranges and two RF center frequencies.

63. Under an alternative theory under Figure 8, Petitioner, again, relies upon Suzuki’s Figure 8’s predistorter. Pet., 40. To argue that the output of Suzuki Figure 8’s predistorter contains two separate up-converted frequency ranges with the specifically claimed properties, Petitioner relies on Suzuki Figure 13A, which discloses a graph showing a signal with two different frequencies bands. Pet., 40.

64. Petitioner assumes that Figure 13A applies to Figure 8’s embodiment and shows the frequency profile of the signal output from Figure 8’s predistorter. Pet., 34, 18-20. But Figure 13A does not apply to Figure 8 and Suzuki teaches against Petitioner’s assumption.

65. Suzuki’s Figure 8 is part of Suzuki’s “fifth embodiment.” Ex. 1004 [Suzuki] [0069]. Suzuki Figure 13A, by contrast, is a part of Suzuki’s “eighth embodiment” (Fig. 12). Ex. 1004 [Suzuki] [0078]-[0079]. Suzuki confirms that the “eighth embodiment” does not relate to Figure 8. Instead, the eighth embodiment discloses a “frequency band controller 8” for the embodiments disclosed in Figures 1, 6, 7 and 9, but **not** Figure 8:

FIG. 12 shows an exemplary configuration of a frequency band controller 8 for automatically controlling the variable band signal extractors 11-1, 11-2, 15-1 and 15-2 in the embodiment of each analog predistorter shown in **FIGS. 1, 6, 7 and 9**.

Ex. 1004 [Suzuki] [0078].

66. Suzuki never states that the Figure 13A frequency profile applies to the output signal of Figure 8's predistorter; it instead confirms that Figure 13A does *not* apply to Figure 8. Suzuki further states that the output signal of Figure 8's predistorter contains only a single frequency band, not two frequency bands as shown in Figure 13A (and as required by the claims). Suzuki explains that its Figure 8 embodiment is similar to its Figure 5 embodiment, except that the lookup tables 17-1 and 17-2 in the Figure 8 embodiment can be updated. Ex. 1004 [Suzuki] [0069]. In its Figure 5 embodiment, Suzuki discloses the output signal of the pre-distorter as containing a single frequency band, not two distinct frequency bands as disclosed in Figure 13A:

The vector modulated signal is frequency-converted into a transmission signal *of a radio frequency band* by a carrier signal from a local oscillator 27 and power amplified at the power amplifier 28 and supplied to an antenna (not shown) via a duplexer (not shown).

Ex. 1004 [Suzuki] [0058].

67. I also disagree with a number of Dr. Almeroth's opinions regarding Suzuki's Figure 8 that are contained in his Declaration.

68. First, Dr. Almeroth opines that S_{D1} and S_{D2} are the first and second digital signal that will be transmitted. *See* Almeroth at ¶ 132. However, contrary to what Dr. Almeroth asserts, Figure 8 does not have two up-conversion operations. *See* Almeroth at 139-140. Figure 8 shows a single up-converter, element 26.

69. Second, I disagree with Dr. Almeroth's opinion that "a POSITA would understand that Suzuki discloses that frequency-converter 26 upconverts the analog signals to the frequency band centers used in the transmission signal, which is depicted as f1 and f2 in Figure 13A." Almeroth at ¶ 139. The converter 26 is a single up-converter. A single up-converter is unable to upconvert to two center frequencies f1 and f2. A single up-converter up-converts to a single center frequency.

70. Third, I disagree with the alternative theory that Dr. Almeroth that "...[a] POSITA would have found it obvious to use a down-converter after the variable band signal extractor 11-1 and 11-2 to down-convert the signal to baseband frequency (a lower frequency spectrum), and then use an up-converter after the DAC 24-1 and 24-2 to return the signal to the desired high frequency bands in Figure 13A for transmission" *See* Almeroth at ¶ 140. The resulting circuit, as articulated by Dr. Almeroth, would be inoperable. At a minimum, it would require downconverters before the ADCs 32-1 and 32-2. Without downconverting these signals the circuit would be inoperable. This aspect has not been considered by Dr. Almeroth. Further, the circuit suggested by Dr. Almeroth requires too many circuit elements, increasing its cost. This increased cost would not lead to an improved operation and Dr. Almeroth does not assert that it does. This is another aspect that is not addressed by Dr. Almeroth. Adding multiple downconverters and upconverters would also negatively impact the power consumption, nonlinear behavior, and noise behavior.

Adding many circuit elements must only be done if there is a compelling advantage. The only purpose of the additional elements suggested by Dr. Almeroth is to allegedly disclose the invention claimed by the '802 patent, which is hindsight. A POSITA would not have been motivated to make these modifications to Fig. 8, other than using the '802 patent as a roadmap to recreate the invention.

71. Fourth, I disagree with another reason Dr. Almeroth provided to modify Fig. 8, that "...[b]aseband frequencies are much wider than higher frequencies and are less subject to noise and interference for wired communications." Almeroth at ¶ 140. This argument appears to be poorly worded, but in any case, it is wrong. As an initial matter, the bandwidth of the baseband signal is not wider than the bandwidth of the upconverted signal. In double side-band up-conversion it is actually the opposite, the bandwidth of the baseband signal is narrower than the bandwidth of the upconverted signal. *See* Figure 4.1 in Ex. 1023 (Lathi) illustrating double sideband modulation. In other cases (single-sideband and quadrature up-conversion), the bandwidth of the baseband signal is equal to the bandwidth of the upconverted signal. *See* Figure 4.15 in Ex. 1023 (Lathi) illustrating single sideband (SSB) modulation. Since the power of white Gaussian noise is proportional to bandwidth (*See* e.g., Example 11-11 in Ex. 1023), baseband signals are not less

subject to noise¹. They are at least equally subject to noise. Even if Dr. Almeroth's argument is correct (which it is not), it is not a motivation for a POSITA to modify Figure 8 because the Suzuki reference relates to wireless and not wired systems. Dr. Almeroth's comment about "wired communications" is technically incorrect. Therefore, it is not a question whether "a POSITA would have also reasonably expected this modification to succeed" as Dr. Almeroth opines (Almeroth ¶ 140), but whether, without the benefit of hindsight, a POSITA would have gone down that path in the first place. Based on the foregoing, a POSITA would not have gone down the path of modifying Fig. 8 as suggested by Dr. Almeroth.

72. Fifth, I disagree with another modification to Fig. 8 that Dr. Almeroth provided: "It would have been obvious to a POSITA to modify Figure 8's embodiment to combine the signals after up-conversion, as claimed. Whether to combine signals before or after up-conversion is merely one of two discrete choices that had predictable results." Almeroth at ¶ 146. Dr. Almeroth reduces circuit and system design as "merely a matter of two choices", which – as a technical approach – is incorrect. A POSITA would not have considered circuit and system design "merely a matter of two choices". Further, a POSITA would have realized that there are numerous design considerations depending on the combiner circuit. Combining

¹ At least with respect to white Gaussian noise. There are other types of noise that can impact differently baseband and passband signals, which were however not identified by Dr. Almeroth.

after up-conversion requires the combiner to operate at RF. The power of the signals would have been an additional consideration. Thus, combining signals was not a straightforward design exercise. What Dr. Almeroth fails to consider is that combining the signals in Fig. 8 as he suggests, does not work with the vector modulator 25 and mixer 26 in Suzuki. Dr. Almeroth does not consider that the vector modulator 25 and mixer 26 need to be removed and replaced by upconverters and a combiner, or somehow redesigned. The vector modulator and mixer are important characteristics of Suzuki. A POSITA would not have replaced them as suggested by Dr. Almeroth.

73. Petitioner has fails to meet its burden to show that Suzuki's Figure 8 embodiment discloses either claim 10 or 17.

3. Suzuki in view of Jalali (Ground 3)

74. Petitioner relies on Jalali in combination with Suzuki for Ground 3. According to Petitioner, "Jalali contains several teachings that would have been obvious to incorporate into Suzuki: claim 9 and 23's disclosure of time-division in an OFDM signal and claim 7, 8, and 22's disclosure of using the same data or data stream." Pet., 47.

75. "Turning first to claims 7, 8, and 22, Petitioner argues that the combination renders the claims obvious based on a sentence in Jalali that "the overall transmission channel is essentially divided into a number of (L) parallel sub-

channels that are used to transmit the same or different data.” Pet., 51-52. But “the overall transmission channel” and this statement from Jalali applies to only one of the frequency bands. The fact that within one frequency band the same data can be transmitted does not mean that the same data will be transmitted within the other frequency band. Therefore, the Petition is incorrect to assert that “In the Suzuki-Jalali combination, Suzuki would likewise transmit information that is the same data or from the same data stream or correspond with each other, on different frequency bands.” *Id.*, 52. Although Petitioner cites Dr. Almeroth’s declaration (paragraphs 175-177), Dr. Almeroth only repeats the same language and does not offer additional support or evidence. I also disagree that “This description of an OFDM signal [citing Jalali at 8:50-56] matches that of the signal output by Suzuki and depicted in Suzuki’s Figure 13A”. See Almeroth Declaration at ¶ 168 and Petition at p. 49. Dr. Almeroth alleges that this is a reason to combine Jalali with Suzuki. But Dr. Almeroth is wrong. Figure 13A of Suzuki has nothing do with OFDM. It does not match Jalali’s description. Jalali’s paragraph, which I quote for completeness, says “With OFDM modulation, the overall transmission channel is essentially divided into a number of (L) parallel sub-channels that are used to transmit the same or different data. The overall transmission channel occupies the total operating bandWidth of W, and each of the sub-channels occupies a sub-band having a bandwidth of W/L and centered at a different center frequency.” Jalali at 8:50-56.

This paragraph does not match Figure 13A of Suzuki and has nothing to do with it. The frequency spectrum of OFDM (which actually matches Jalali's description) is illustrated on page 2 of Ex. 1020 and is different from Figure 13A of Suzuki. Therefore, Dr. Almeroth has not established a reason to combine Jalali with Suzuki. As I explained above with respect to Ground 2, this opinion is based on hindsight. Prior to the '802 invention, a POSITA would not have considered that there are "just two choices". The '802 patent claims a novel hardware architecture. It was not known how to achieve the benefit of diversity using hardware architectures in the manner claimed by the '802 patent. There were other choices to obtain diversity using, for example, the digital signal processing method of space-time block coding. In addition, as I discussed above, the goal of Suzuki was not about sending the same data or same information. Instead, Suzuki looked to solve the problem of sending multiple different signals from multiple different devices. There is no teaching in Suzuki that sending the same data was desirable or obvious, just the opposite. In addition, I disagree that a POSITA would have been motivated to Suzuki and Jalali, absent hindsight. *See* ¶ 75, *supra*. An additional reason this combination was not obvious at the time of the invention is that OFDM (as disclosed in Jalali and relied upon by Petitioner for Ground 4) leads to very high values of the Peak-to-Average Power Ratio (PAPR) of the transmitted signal: "One of the major drawbacks of multicarrier transmission is the high peak-to-average power ratio (PAPR) of the

transmit signal ... This may severely impair the system's performance ...” *See* Ex. 1020 at p. 5. *See also* Ex. 1015 at p. 6. The PAPR is a major practical consideration. Suzuki is concerned with power amplifier nonlinearity and pre-compensation. Because of the high PAPR, OFDM will exacerbate the power amplifier nonlinearity in Suzuki. At least for this reason a POSITA would not have been motivated to combine Jalali and Suzuki.

4. *Petitioner Fails to Show That Suzuki/Chen Discloses or Renders Obvious Claims 24 and 25 (Ground 4)*

76. Ground 4 challenges independent claim 24 and dependent claim 25 based the combination of Suzuki and Chen. But Petitioner failed to show that Suzuki, alone or in combination with Chen, discloses or renders obvious claims 24 and 25.

77. Claim 24 requires “a first down-converter” that outputs a “first downconverted signal,” and “a second down-converter” that outputs a “second downconverted signal.” Ex. 1001 [’802] cl. 24. The claim then requires a filter that “receives the first and second down-converted signals.” *Id.* Petitioner only to Chen for this limitation. Petitioner relies on Chen’s down-converters 306 and 310 as the claimed first and second down-converters, and on Chen’s filter 328c as the claimed filter. Pet., 70. Petitioner then argues that the outputs of Chen’s down-converters 306 and 310 are “provided directly to [Chen’s] filter 328c.” Pet., 70 (citing Ex. 1009 14:13-15).

78. But the analog outputs of Chen's down-converters 306 and 310 are *not* received by Chen's filter 328c. The analog outputs are instead converted to digital signals in the Analog to Digital Converter 322. These modified, digitalized signals, and not the analog outputs of down-converters 306 and 310, are provided to the filter 328c. Because of this, Chen does not disclose that the "first" and "second" "down-converted signal[s]" output from the two down-converters are "receive[d]" by the claimed "filter." I note that in the '802's embodiments, the down-converted signals are provided to the filter first and are then changed from analog to digital.

79. Petitioner relies on Chen's Figure 6 embodiment for the disclosure of a filter (blue), arguing that it receives the claimed first and second down-converted signals output from the two downconverters (green and orange):

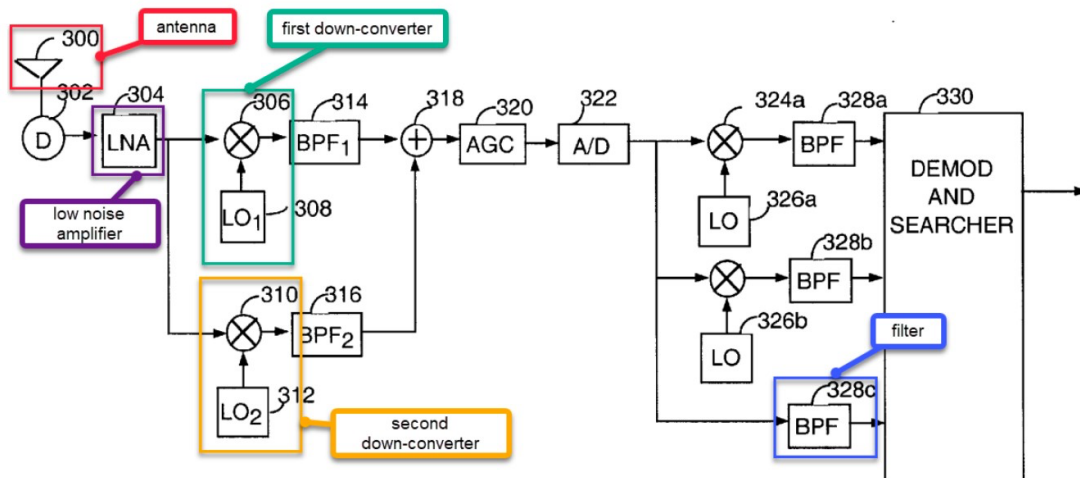
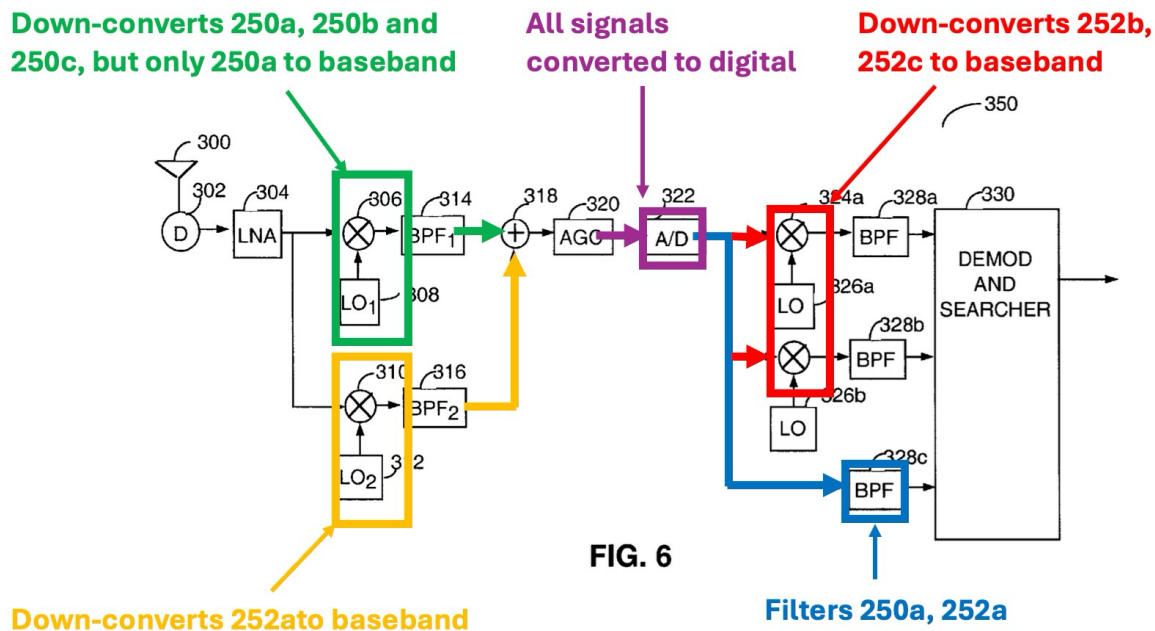


FIG. 6

Pet., 70-71. But Chen's filter 328c does not receive the *analog* down-converted signals output from down-converters 306 and 310. Rather, it receives different, *digital* signals.

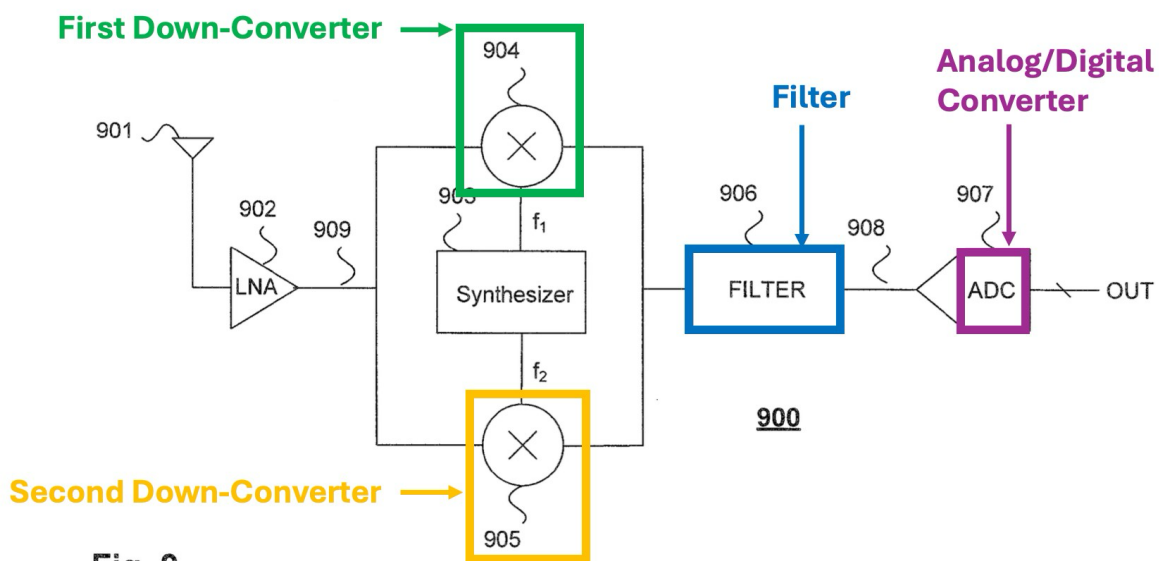
80. The annotated version of Figure 6 below explains this:



As can be seen in the annotated Figure, filter 328c does not receive the *analog* outputs of down-converters 306 and 310. Down-converter 306 (green) down-converts signals 250a, 250b and 250c. Ex. 1009 [Chen] 13:63-66. Downconverter 310 (orange) down-converts signal 252a. *Id.*, 14:1-3. The outputs of the down-converters 306 and 310 are combined and then pass through (among other circuit elements) analog to digital converter (A/D 322) (purple), *where the signals are converted from analog to digital*. *Id.*, 14:7-12. It is these modified, *digitalized*

signals 250a and 252a—not the analog outputs of down-converters 306 and 310—that are provided to filter 328c (blue). *Id.*, 14:13-15. Further, there are additional circuit elements between the downconverters 306 and 310, and the filter 328c. These elements are filters 314, 316, combiner (or adder) 318, and automatic gain control 320.

81. The '802's specification provides additional evidence that supports this explanation, Figure 9 of the '802 patent (annotated below) discloses a receiver embodiment where the claimed filter 906 (blue) receives the first and second down-converted signals from down-converters 904 and 905 (green and orange), before those signals are converted to digital signals by Analog to Digital Converter 907 (purple):



Ex. 1001 ['802] Fig. 5; *see also id.*, 11:60-64.

82. I note that a POSITA would have understood that analog and digital signals have particularly notable differences. For example, one of Petitioner's exhibits explains that, over a given time interval, "an infinite number of possible different" analogue waveforms exist, "in contrast to only a finite number of possible digital messages." Ex. 1023 [Lathi] 11-12. This is because a digital signal contains only binary messages, whereas an analog signal is "characterized by data whose values vary over a continuous range." *Id.* As another example, in a digital signal: the data can be recovered correctly as long as the distortion and the noise are within limits. In contrast, the waveform in an analog message is important, and even a slight distortion or interference in the waveform will cause an error in the received signal. Clearly, a digital communication system is more rugged than an analog communication system in the sense that it can better withstand noise and distortion (as long as they are within a limit). Ex. 1023 [Lathi] 11. As another difference, Lathi explains, "[t]he main reason for the superiority of digital systems over analog ones is the viability of regenerative repeaters in the former." *Id.*

83. Petitioner also wrongly argues that:

Chen discloses the output of the mixer 306 and downconverter 310 are, after downconversion, "already at baseband" and "provided directly to filter 328c." Ex. 1009, 14:13-15.

Pet., 71. But, as I explain *supra*, this is contradicted by the Chen reference.

84. As noted in connection with Chen's annotated Figure 6 above, that embodiment processes four signals: 250a, 250b, 250c and 252a. Ex. 1009 [Chen] 13:51-57. Down-converter 310 (orange) only processes signal 252a and downconverts it to baseband. *Id.*, 14:1-6. The remaining three signals 250a, 250b and 250c are all down-converted by mixer 306 (green), but only signal 250a is downconverted all the way to baseband. *Id.*, 13:63-66, 14:10-14. The other two signals, 250b and 250c, are down-converted to an intermediate frequency. *Id.* The signals 250b and 250c are later down-converted to baseband in down-converters 324a and 324b (red) after being converted to digital signals (purple). *Id.*, 14:10-16. This process is schematically shown in the annotated Fig. 6 above.

85. Chen explains that, after signals 250a and 252a are converted to digital signals in A/D 322 (blue), they are "provided directly" to filter 328c since they are already down-converted to baseband and, unlike signals 250b and 250c, do not need further down-conversion:

The filtered signal from filter 314 is summed with the filtered signal from filter 316 in summer 318. ***The summed signal is amplified*** by automatic gain control (AGC) 320. ***The amplified signal is provided to analog to digital (A/D) converter 322.*** The digital signals are provided to downconverters 324a, 324b and filter (BPF) 328c. ***Downconverters 324a and 324b bring the signals carried on carriers 250b and 250c down to base band. The signal carried on carriers 250a and 252a are already at baseband and is provided directly to filter 328c.***

Ex. 1009 [Chen] 14:7-16. Chen's statement that the signals 250a and 252a are "provided directly to filter 328c" does not mean that the downconverted signals that are the outputs of the down-converters 306 and 310 are "provided directly" to filter 328c. Instead, "provided directly" means that the signals are already at baseband and do not need to be further downconverted before being sent to the filter 328c. Ex. 1009 [Chen] 14:13-15. Chen teaches that the output of down-converters 306 and 310 are summed, then changed to digital signals, and it is these modified, digital signals that are transmitted to filter 328c, not the analog output of the down-converters.

5. *Petitioner Fails to Show That Suzuki/Chen Discloses or Renders Obvious Claim 7*

86. Claim 7 depends from claim 1 and adds the further limitation that the first and second data are the same data across two different frequencies. Petitioner and Dr. Almeroth do not identify anything in Suzuki or Chen disclosing transmission of the same data as claimed. Instead, Petitioner points to a disclosure in Suzuki that it can "transmit[] both signals in 800 MHz band **and** in 1.5 GHz simultaneously." [citing Suzuki ¶7]. A POSITA would therefore understand that the same information is being transmitted across two different frequencies." Pet., 29 (citing Ex. 1003, ¶ 123. I disagree. Dr. Almeroth does not provide any support for this argument, just copies the words from the Petition. But Petitioner's argument is also not supported and contrary to the understanding of a POSITA.

Even if, *arguendo*, Suzuki transmits “both signals in 800 MHz band **and** in 1.5 GHz simultaneously”, a POSITA would not conclude that the same information is transmitted. Transmitting the same information does not follow from transmitting at two different frequency bands and Petitioner and Dr. Almeroth do not provide support for this position.

87. The Petitioner argues that a POSITA “would be faced with limited design choices for data to be transmitted using Suzuki’s system—...either send the same data on the two frequencies or send different data.” Pet., 29 (citing Ex. 1003, ¶ 124). This opinion is based on hindsight. At least based on their educational background, a POSITA would not have considered communication system design as “either send the same data on the two frequencies or send different data.” Prior to the ’802 invention a POSITA would not have considered that there are “just two choices”. The ’802 patent claims a novel hardware architecture. It was not known how to achieve the benefit of diversity using hardware architectures in the manner claimed by the ’802 patent. There were other choices to obtain diversity using, for example, the digital signal processing method of space-time block coding. In addition, as I discussed above, the goal of Suzuki was not about sending the same data or same information. Instead, Suzuki looked to solve the problem of sending multiple different signals from multiple different devices. There is no teaching in Suzuki that sending the same data was desirable or obvious, just the opposite.

6. *Suzuki in view of Etemad (Ground 5)*

88. For Ground 5, Petitioner relies on the combination of Suzuki and Etemad. I disagree that a POSITA would have been motivated to combine these references so as to render the claimed inventions obvious. Claim 6 adds the requirement that “the first information corresponds to a first wireless protocol and the second information corresponds to a second wireless protocol. Claim 13 adds the requirement that “the first digital signal is encoded using a first wireless protocol and the second digital signal is encoded using a second wireless protocol.” Claim 21 adds a similar limitation. Petitioner relies on Etemad for its alleged disclosure of “a multicarrier signal where the first and second signals use different wireless protocols under Patent Owner’s apparent construction.” Pet., 72.

89. Petitioner argues that “[a] POSITA would have been motivated to combine Suzuki with Etemad’s teachings of using TDD and FDD for the different carriers” (Pet., 72) and that “[a] POSITA would have been motivated to make this modification because of the well-known benefits of using TDD/FDD in a multi-carrier signal.” Pet., 73. I disagree.

90. First, Petitioner continues to arbitrarily mix different technologies within the communications field, without providing a motivation to do so.

91. Second, TDD and FDD are ways to separate uplink from downlink. In TDD, the downlink and uplink occupy the same frequency band and are separated

in time. In FDD, downlink and uplink occupy different frequency bands. So FDD/TDD and FDMA/TDMA are different concepts. FDMA/TDMA are main ways to separate users on the uplink, while FDD/TDD are ways to separate uplink from downlink. The choice between TDD and FDD is separate from the modulation technique. Uplink and downlink are separated either in time or in frequency. It is inappropriate to suggest that “using TDD/FDD” in a multi-carrier signal is beneficial. Another reason this is inappropriate is that “using TDD/FDD” would have the same benefits (of separating uplink from downlink) if frequency modulation (which is a single-carrier signal as it is not obtained using OFDM) is used.

92. Based on the foregoing, “The above benefits of FDD and TDD together are why the European Telecommunications Standards Institute chose to include FDMA and TDMA in the GSM standard” is incorrect. *See* Almeroth at ¶ 226.

93. At least for these reasons, I disagree that “Given the variations of device needs within a network, a POSITA would understand it would be beneficial to be able to use TDD or FDD or both in a multi-carrier signal. Almeroth at ¶ 227.

94. Dr. Almeroth opines that “A POSITA would have found it obvious to modify Fernandez to use Montojo’s single amplifier instead of having each signal

generating system perform its own amplification.” Almeroth at ¶ 234. I disagree as I explain *infra*.

C. Fernandez (Grounds 6-9)

95. It is my opinion that Petitioner has failed to show that Fernandez in combination with Montojo or in combination with Montojo and Jalai, Chen, or Etemad renders obvious the challenged claims. In particular, it is my opinion that Fernandez and Montojo fail to disclose multiple limitations of the independent claims and Petitioner has failed to show those claims are rendered obvious in light of the identified combinations. I explain these opinions in greater detail below.

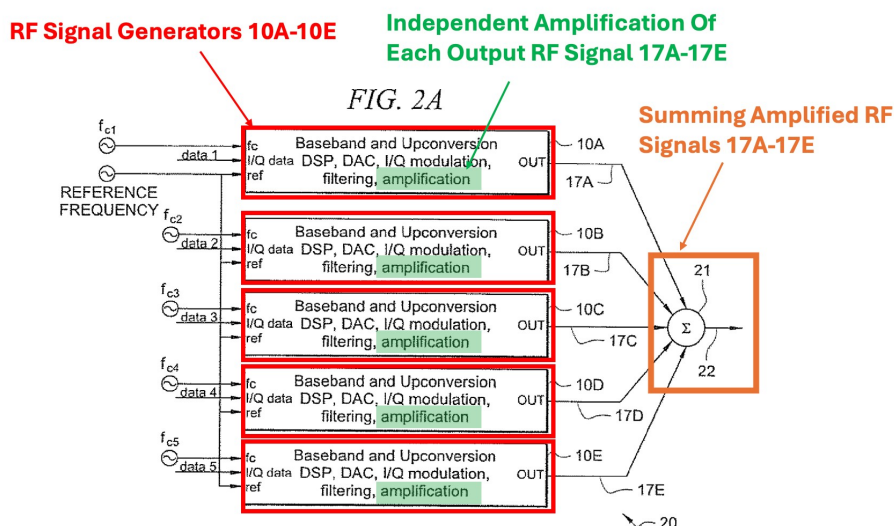
1. Fernandez in view of Montojo Does Not Render Claim 1 Obvious (Ground 6)

96. As explained above, claim 1 requires simultaneous transmission of a first information and a second information that are related and part of the “information” recited in the preamble. Petitioner points to “data 1” and “data 2” in Fernandez’s Figure 2A as the “first information” and “second information” of claim 1. Pet., 80-81. But there is no disclosure in Fernandez that transmitting data is organized into “first” and “second” as claimed by the ‘802 patent. Fernandez does not even describe the data contained in “data 1” and “data 2,” focusing instead of the use of multi-signal generators. Ex.1005, [0008]. Petitioner does not point to anything in Montojo as meeting this limitation or argue that it would otherwise be

obvious. Petitioner again fails to meet its burden to show that the asserted art discloses or otherwise renders obvious claim 1.

2. *Fernandez/Montojo Do Not Render Obvious Independent Claims 1, 10, and 17*

97. Claim 10 recites “amplifying the combined up-converted signal in a power amplifier.” *Id.*, cl. 10. Claim 17 recites “a power amplifier” that receives the first and second upconverted signals. Ex. 1001 [’802] cl. 17. Fernandez does not disclose either limitation and the Petitioner does not point to anything in Fernandez for this limitation. Pet., 95. Specifically, as shown in Fernandez’s Fig. 2A, each RF signal generator 10A-10E has its own power amplifier, and the amplified RF signals are then summed together in summer 21. Therefore, there is no single power amplifier in Fernandez that receives and amplifies both the first and second up-converted signals.



98. Petitioner instead relies upon the combination of Fernandez and Montojo for this limitation. Pet., 95 (discussing claim 10), 98 (relying on discussion of claim 10 for claim 17); *see also* Ex. 1003 [Almeroth Decl.] ¶ 273 (“In my opinion, Fernandez in view of Montojo renders obvious this limitation.”).

99. But Montojo and Fernandez teach against such a combination. Montojo explains that even though it may be desirable to share an amplifier among different carriers, it is not practical to do so if all carriers are to be amplified based on their needs:

If a multi-carrier terminal has a single power amplifier for simultaneous transmission of different types of carrier signals, the power amplifier may be subject to ***power constraints imposed by spectral emission requirements, by on-board battery capacity, and also by any priority among the carriers.***

Ex. 1006 [Montojo] [0007].

100. To address this problem, Montojo discloses an apportionment system where the power amplifier amplifies the highest priority carrier according to its needs and will amplify the next priority carrier(s) only to the extent any amplification power is left over. Ex. 1006 [Montojo] [0009]-[0010]. This is how Montojo’s Figure 5 embodiment works. *See* Pet., 77, 95.

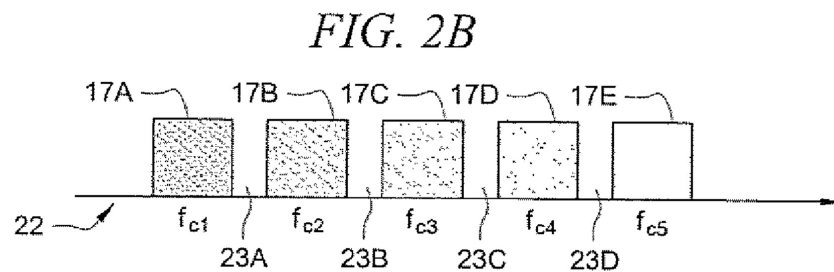
101. Montojo explains that the power amplifier accesses a “priority list 512” to obtain the priority and power needs of the different carriers. *Id.*, [0045]. Then:

According to the priority appointment scheme, the highest priority carrier is allocated as much of MaxTxPowerAnalog as is necessary to

satisfy whatever transmission requirements apply to it. Any lower priority carrier (say, carrier y) will be accorded whatever remains of MaxTxPowerAnalog after allocation to active carriers with higher priority.

Ex. 1006 [Montejo] [0045].

102. Petitioner has not shown if Montejo's priority-based power amplifier would be desirable or even functional in a system such as Fernandez, which is why Fernandez discloses that each signal generator has its own power amplifier to begin with. Specifically, Fernandez is directed at "wideband signal generation." Ex. 1004 [Fernandez] [0001]. Similarly, in its background of the invention (relied upon by Petitioner), Fernandez discusses a system for generating wideband signals. *Id.*, [0005] ("A desire often arises for generating a wideband digital signal."). Fernandez discloses that this wideband signal is generated by summing together multiple narrower band signals. *Id.*, [0008]. This wideband signal generated by summing together narrower band signals (as Fernandez explains was done in its prior art) is shown in Fig. 2A, where all narrow band signals 17A-17E are shown as substantially equally amplified:



103. Petitioner makes no attempt to show how (or why) a priority-based amplifier that amplifies only the first signal based on its needs and may or may not amplify other signals depending on the left-over, would be either functional or desirable in Fernandez. For example, Petitioner does not address how Fernandez's system would work if the first signal (17A in Fig. 2A) is fully amplified, but the second signal (17B in Fig. 2B) is only partially amplified, and the remaining signals are not amplified at all.

104. And the combination of Fernandez and Montojo does not render obvious using a single amplifier and subsequent single antenna in Fernandez. Petitioner argues that a POSITA would have been motivated to combine Fernandez with Montojo because "a single amplifier has several advantages compared to multiple amplifiers, including lower complexity, a single (vs. multiple) potential point of failure, and lower cost." Pet., 76-77. I disagree. Montojo teaches a POSITA that using a single amplifier has substantial, and potentially impractical, drawbacks. Ex. 1006 [Montojo] [0007] ("the power amplifier may be subject to power constraints imposed by spectral emission requirements, by on-board battery capacity, and also by any priority among the carriers."); [0008] ("it would be desirable that the power of the multi-carrier waveform transmitted by the multicarrier terminal be limited to a level such that spectral emission goals are not compromised. It is further desirable to preserve these power constraints while

requiring little modification to the equipment and operation of existing communication systems.”).

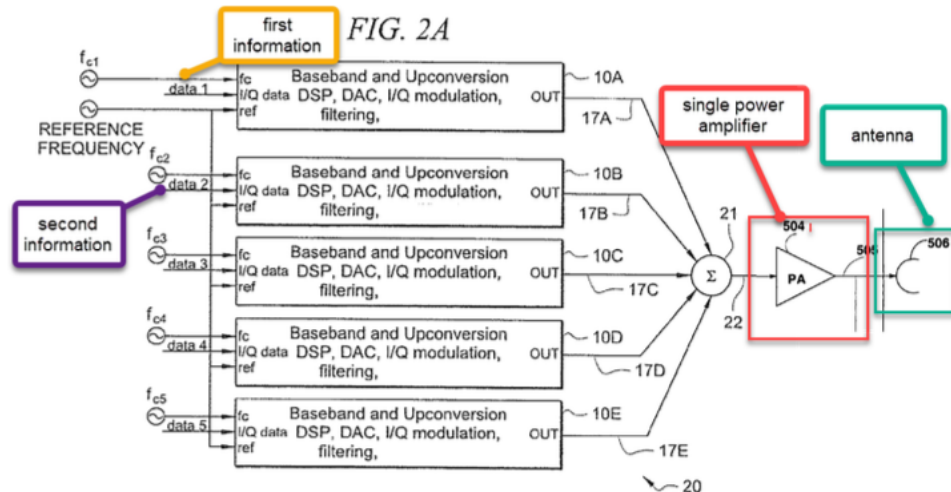
105. A POSITA would have concluded that a single amplifier did not have these advantages and it was not “a simple matter of design preference” (Pet., 77). Further, a single amplifier must have wider bandwidth, and therefore potential stability issues. A POSITA would have recognized that the bandwidth-gain product of an amplifier is an important consideration. A single amplifier would use more circuit elements at least because of the wider bandwidth. Therefore, it cannot be said that there will be “a reduction in space usage and power consumption” (Pet. 77).

106. Because of these drawbacks, Montojo discloses a need in the art for a system that would allow practically sharing a single power amplifier, which Montojo teaches a POSITA to be possible through its priority-based apportionment discussed above:

Therefore, there is a need in the art for a scheme for allocating the transmit power of a carrier according to a priority in a multi-carrier terminal in which a single power amplifier is utilized for transmitting a plurality of carrier signals simultaneously.

Ex. 1006 [Montojo] [0009].

107. Claim 1 requires transmission of first and second information from the *same transmitter*. Petitioner does not contend that Fernandez discloses this limitation, relying instead on a combined Fernandez/Montojo circuit, adding Montojo’s power amplifier and antenna after Fernandez’s signal summation.



Pet., 82 (“In Fernandez-Montojo, this signal is sent over a single antenna....”). For the reasons explained above, a POSITA would not have been motivated to combine Fernandz and Montojo.

3. *Fernandez/Montojo also Do Not Disclose the “Baseband Digital System” that Provides a First and Second Baseband Signal (Claims 17 and 21-23)*

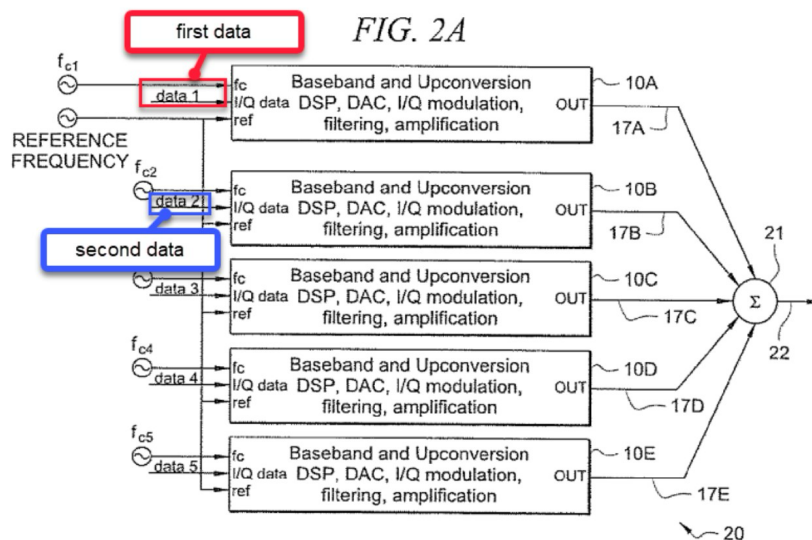
108. Independent Claim 17 recites “[a] wireless communication system comprising: a baseband digital system for providing a first digital signal comprising a first data to be transmitted and a second digital signal comprising a second data to be transmit- ted.” Ex. 1001 [’802] cl. 17.² In light of this, the “baseband digital system” provides both the first and second digital signals to be transmitted. Petitioner contends that Fernandez discloses this limitation by pointing to two digital

² Claims 21-23 depend from claim 17 and are likewise patentable over the identified art.

signals (Pet., 98) but does not identify a “baseband digital system” that provides these two signals (*i.e.*, the putative first and second digital signals). Pet., 96.

109. Petitioner argues that “Fernandez further discloses a baseband digital system.” Pet., 98 (citing Ex. 1005 [Fernandez] [0006]). The cited portion of Fernandez, however, only discloses the “[s]tandard notation for complex baseband and passband signals.” Ex. 1005 [Fernandez] [0006]. So, all Fernandez discloses is the mathematical formula for representing a baseband signal. *Id.* It does not disclose “a baseband digital system,” and not one that provides the claimed first and second digital signals.

110. The Petition (at 98) also cites its discussion of limitation 10a, but that does not teach the missing limitation. With respect to limitation 10a, Petitioner relies upon the following version of Fernandez’s Figure 2A, and specifically on “data 1” and “data 2,” which Petitioner identifies as the claimed first and second digital data signals:



111. Pet., 88. Figure 2A, however, does not disclose where data 1 and data 2 originate from. The figure and the corresponding disclosure do not indicate that these data signals are sent from a “baseband digital system.” *See also* Ex. 1005 [Fernandez] [0008].

112. The Petition (at 96) also cites Ex. 1005 [Fernandez] [0011], which states that “a general method is provided to increase a digitally synthesized signal’s bandwidth by frequency interleaving.” Paragraph 11 relates to “embodiments of [Fernandez’s] *present invention* ...” But Petitioner does not rely on Fernandez’s present invention. Rather, it relies exclusively upon Fernandez’s discussion of admitted prior art for all other claim limitations. Pet., 87-98 (citing Ex. 1005 [Fernandez] ¶¶ 5-6, 8-9 & Figs. 1, 2A-2B). Petitioner does not demonstrate why the teachings of Fernandez’s invention apply to the prior art Fernandez claims to have improved upon, nor does it explain how a POSITA would modify Fernandez’s prior

art in view of its invention to satisfy the claims or why a POSITA would be motivated to do such a thing with a reasonable expectation of success. For example, Fernandez's invention produces signals that have completely different frequency profiles than the signals Petitioner relies upon for the alleged disclosure of the claims. *Compare* Ex. 1005 [Fernandez] Fig. 2A (frequency profile of Fernandez's prior art relied upon by Petitioner) *with* Fig. 6 (frequency profile of a Fernandez embodiment).

113. For the foregoing reasons, Petitioner fails to show that the Fernandez grounds disclose claim 17.

4. Petitioner Fails to Show that Fernandez/Montojo and Chen Disclose Independent Claim 24 and Dependent Claim 14 and 25 (Ground 8)

114. For claim 24, Petitioner exclusively relies on its discussion in Ground 4 (based on Suzuki). Pet., 100 ("As discussed in Ground 4, Chen describes a receiver that processes multi-carrier wireless transmissions as claimed by claims 14 and 24. ... And it would have been obvious to combine the Fernandez-Montojo transmitter with Chen's receiver for the same reasons discussed in Ground 4"). However, as discussed in above with respect to Ground 4, Chen does not disclose a filter that receives the upconverted signals output from the first and second claimed up-converters.

115. With respect to claim 14, Petitioner argues that it would have been obvious to combine Fernandez, Montojo, and Chen, to add in Jalali disclosure that “the overall transmission channel is essentially divided into a number of (L) sub-channels that are used to transmit the same or different data. Pet. 101-102. I note that Ground 8 does not include Jalali. I also disagree that it would have been obvious to modify the combination to transmit the same data as claimed for the reasons I explained above.

VI. CONCLUSION

116. For the foregoing reasons, based on my expertise and experience and the record of this case that I have reviewed, it is my opinion that the challenged claims are not shown to be disclosed or obvious.

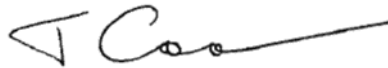
117. I understand that my opinions discussed above support a legal conclusion that the challenged claims are nonobvious.

In signing this declaration, I recognize that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in the case and that cross-examination will take place within the United States. If cross-examination is required, I will appear for cross-examination within the United States during the time allotted.

I hereby declare that all statements made herein of my own knowledge are true and all statements made herein on information and belief were and are believed by me to be true, and that all statements herein were and are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code and that any such willful false statements may jeopardize the validity of the proceeding or application or any patents issued thereon.

Respectfully Submitted,

June 13, 2025

A handwritten signature in black ink, appearing to read 'T. Cooklev', with a long horizontal stroke extending to the right.

Todor V. Cooklev, Ph.D.