

Exhibit 1002

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

WILSON ELECTRONICS, LLC,
Petitioner

v.

CELLPHONE-MATE, INC.,
Patent Owner.

Patent 9,402,190

DECLARATION OF DR. WILLIAM T. RALSTON

1. I, William T. Ralston, am over the age of 18 years, of sound mind, and am under no legal disability. I have personal knowledge of the facts set forth herein and, if called as a witness, could and would competently testify thereto.

I. INTRODUCTION

2. I have been retained by Wilson Electronics, LLC (“Petitioner”) as an independent expert consultant in this proceeding before the United States Patent and Trademark Office (“PTO”) regarding U.S. Patent No. 9,402,190 (the ‘190 Patent). I have been asked to consider whether certain references disclose or suggest the features recited in certain of the claims of that patent (“the challenged claims”). My opinions are set forth below.

3. I am being compensated at my rate of \$400 per hour for the time I spend on this matter. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of this or any other proceeding. I have no other interest in this proceeding.

II. BACKGROUND AND QUALIFICATIONS

4. My qualifications for forming the opinions in this report are summarized here and set forth in more detail in my CV which I understand is provided as Exhibit 1003.

5. I obtained a BS in Electrical Engineering from MIT in 1982, a MS in Electrical Engineering from USC in 1984, and a PhD in Electrical Engineering from the University of Massachusetts in 1993. I have taught classes on wireless communications and related electrical engineering subjects.

6. I have worked professionally as an electrical engineer and a patent attorney for numerous years focusing my efforts on designing communications systems in multiple industries (satellite, military, remote sensing, cellular, mobile, internet), working with and developing multiple telecommunications standards, inventing, leading teams, teaching, and learning. As Chief IP Counsel for ViaSat, I oversee innovation across all of ViaSat's business which spans Internet services, satellites, wireless systems, antennas, radio frequency electronics, networking protocols, semiconductors, and software.

7. I have specific experience with cellular systems through my design work in developing base stations for multiple cellular systems in multiple frequency bands as an employee of Tellabs Wireless, adaptation of cellular technology for satellite systems as an employee of L-3 Communications, and teaching classes on a variety of cellular systems (including multiple frequency bands and ancillary equipment) as a consultant for Telecommunications Research Associates. In the course of my career, I have come across a variety of different types of repeaters, including satellite transponders and amateur radio

repeaters, and the components used in cellular boosters, including low noise amplifiers, power amplifiers, bandpass filters, and other radio frequency components. Most recently, my work has included assisting ViaSat's inventors in obtaining patents on novel types of satellite transponders/repeaters.

III. SUMMARY OF OPINIONS

8. The opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding wireless signal booster technology.

9. In forming my opinions expressed in this Declaration, I reviewed the '190 Patent (Ex. 1001); the prosecution file history for the '190 Patent (Ex. 1004); Chinese Patent No. 201699704 ("Zhuo," Ex. 1005); various TEKO Repeater documents ("TEKO Repeater," Ex. 1006); U.S. Patent Publication No. 2004/0166802 ("McKay," Ex. 1007); U.S. Patent Publication No. 2012/0302188 ("Sahota," Ex. 1008); Duo-i6525 User Manual ("DUO Repeater," Ex. 1009); the Declaration of Patrick Cook (Ex. 1010) and its accompanying exhibits; U.S. Patent No. 7,250,830 ("Layne," Ex. 1011); U.S. Patent No. 9,660,687 ("Ella," Ex. 1012); and any other materials I refer to in this Declaration in support of my opinions.

10. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims and the

specification of the '190 Patent at the time of the alleged invention. I have been asked to initially consider the time of the alleged invention as of April 29, 2013, the filing date of the parent case for the '190 Patent (Ex. 1001, Cover Page). My opinions reflect how a person of ordinary skill in the art would have understood the '190 Patent, the prior art to the patent, and the state of the art at the time of the alleged invention.

11. As I discuss in detail below, it is my opinion that certain references disclose or suggest all of the features recited in claims 1-4, 6, 8, 18-20, and 24 of the '190 Patent and further, to the extent all of the features are not disclosed in a single reference, that a person of ordinary skill in the art would have been motivated to combine references to arrive at the recited claims. I reserve my right to supplement this report.

IV. PERSON OF ORDINARY SKILL IN THE ART

12. Based on my knowledge and experience, I understand what a person of ordinary skill in the art would have known at the time of the alleged invention. My opinions herein are, where appropriate, based on my understanding as to a person of ordinary skill in the art at that time. In my opinion, based on the materials and information I have reviewed, and based on my experience in the technical areas relevant to the '190 Patent, a person of ordinary skill in the art as of the claimed priority date of the '190 Patent includes someone with (a) a

Master's or doctoral degree in electrical engineering, or a similar discipline; (b) a Bachelor's degree in electrical engineering, or similar discipline, and at least two years additional relevant experience; or (c) at least 6 years of relevant experience. Relevant experience means working in electrical engineering systems related to radio frequency signals. I apply this understanding in my analysis herein.

13. My analysis of the '190 Patent and my opinions in this declaration are from the perspective of a person of ordinary skill in the art, as I have defined it above, during the relevant time frame stated above. During this time frame, I possessed at least the qualifications of a person of ordinary skill in the art, as defined above.

V. OVERVIEW OF THE '190 PATENT

14. With the proliferation of cell phone use, mobile communication networks have expanded coverage areas to provide service for a greater quantity of cell phone (or other wireless signal users) subscribers. Those coverage areas are generally provided through the transmission of radio frequency signals (i.e., cell phone signals) through base stations or towers. The strength of cell phone signals is affected by the distance a device is located from a base station or other physical obstructions (e.g., tall buildings, mountains, etc.). Cell phone signal

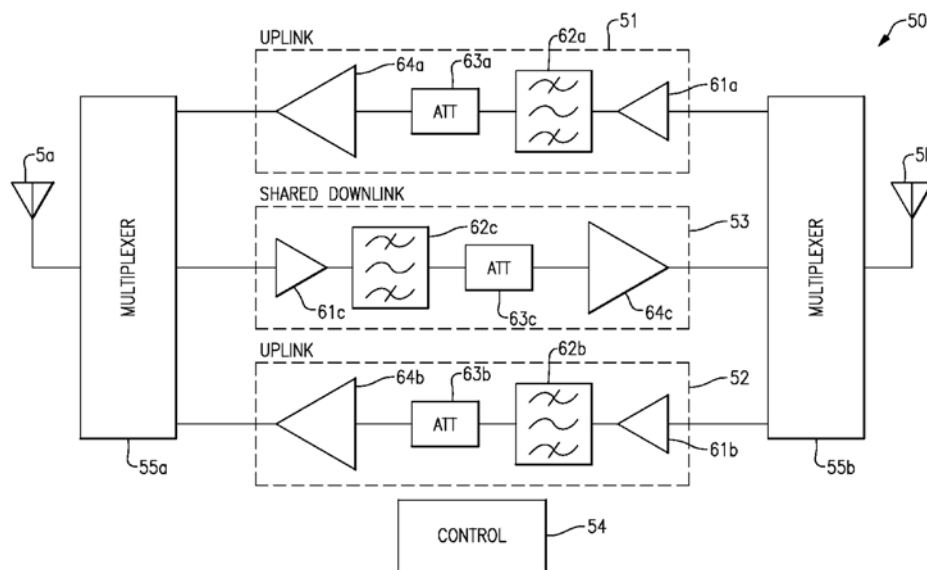
boosters were developed to increase the strength of cell phone signals and, initially, were designed to accommodate single cell phone frequency bands.

15. In its barest form, the '190 Patent discloses a rudimentary cell phone signal booster ('190 Patent, Ex. 1001, Title; "Apparatus and methods for radio frequency signal boosters."). The booster receives a signal from a cell phone station or tower, increases the strength of that signal, and retransmits it to the surrounding area so cell phones have a stronger signal. It also receives signals from a cell phone, increases the strength of that signal, and retransmits the signal to a cell phone station or tower.

16. In the '190 Patent, terms like frequency band, uplink channel, and downlink channel are often used in describing how a cell phone signal booster works. A frequency band is an interval in the signal frequency domain, defined by a lower frequency and an upper frequency. It is not unlike a broadcast radio station that has a certain frequency (e.g., 97.1 MHz) that is broadcast from the radio transmitter to the radio receiver. For cell phones, the frequency bands differ from the broadcast radio band because information is both sent and received. Thus, cell phone frequency bands have two components: (1) an uplink (or send) channel, and (2) a downlink (or receive channel).

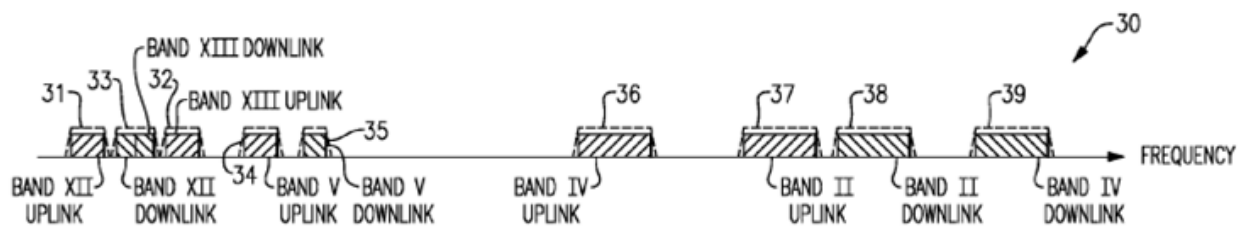
17. FIG. 3 from the '190 is reproduced below and illustrates the claimed booster. That booster amplifies two different frequency bands (e.g., cell

phone Bands XII and XIII). It does so by amplifying two uplink channels through separate paths; one for each of two different cell phone bands. The booster also amplifies the two corresponding downlink channels in a single or common path. ('190 Patent, Ex. 1001, 7:45-47.) In other words, the uplink channel for Band XII and Band XIII are on separate amplification paths, but the downlink channels for Band XII and Band XIII are on the same amplification path.



18. Based on my review of the '190 Patent, its file history, and the file histories of the parent of the '190 Patent, it appears that the alleged point of novelty of the '190 Patent is amplification of shared uplink or downlink channels for two different cell phone frequency bands that are close or abutting on the cell phone signal spectrum. (*Id.*, 10:36-40; "Thus, in contrast to a conventional

signal booster that includes a separate amplification path for each frequency channel that is boosted, the illustrated configuration includes a shared amplification path for amplifying adjacent downlink channels, such as close or abutting downlink channels.”) More specifically, the ‘190 Patent discloses a signal booster that is capable of amplifying the downlink channels for cell phone signal Bands XII and XIII. FIG. 2B from the ‘190 Patent illustrating the location of Bands XII and XIII on the radio spectrum is shown below.



(See *Id.*, FIG. 2B and 7:45-47 which states “As shown in FIG. 2B, the third band-pass filter passband 33 advantageously passes the downlink channels of both Band XII and Band XIII, which are adjacent frequency bands”; and see *id.* 7:52-62 which states “Configuring a signal booster to have a band-pass filter that passes both the Band XII and Band XIII downlink signals can avoid a need for sharp band-pass filters for separately filtering the downlink bands, which can be difficult using relative small and/or low-cost filters such as SAW filters and/or ceramic filters, which can have a non-ideal passband and can provide insufficient channel filtering or selectivity.”) As discussed further below in my Declaration,

passing two cell phone frequency bands through the same band pass filter or the same amplifier is not new to the art of signal boosting.

VI. OVERVIEW OF THE PRIOR ART

A. Zhuo

19. Chinese Patent No. CN201699704 (“Zhuo”) entitled “Tri-Band Wireless Repeater” was filed on June 23, 2010. Zhuo discloses a wireless signal booster configured to receive at least three different frequency bands through a first multiplexer. Those bands are filtered and amplified, then sent through a second multiplexer. (Zhuo, Ex. 1005, Abstract, FIG. 2) FIG. 2 from Zhuo is reproduced below:

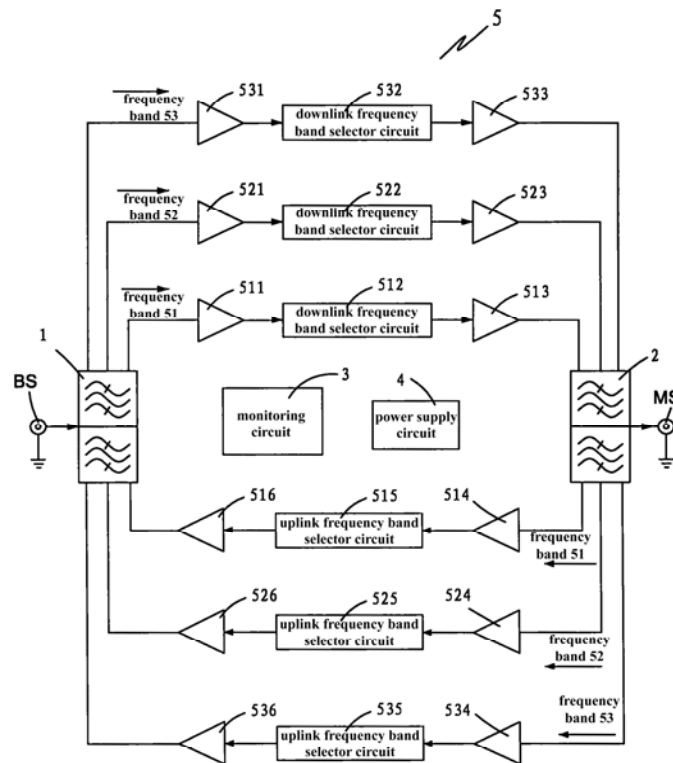


Fig. 2

20. More specifically, Zhuo discloses three different frequency bands (51, 52, and 53) travelling through three different uplink amplification paths and three different downlink amplification paths. After traveling through a multiplexer and being separated into different frequency ranges, each of the signals are processed through a low noise amplifier (e.g., 514, 524, 534), a selector circuit (i.e., a band pass filter, 515, 525, 535), followed by another power amplifier (e.g., 516, 526, 536). (*Id.*, ¶¶ 20-22.) Zhuo discloses that the signal booster can be applied to frequency band selection and amplification of

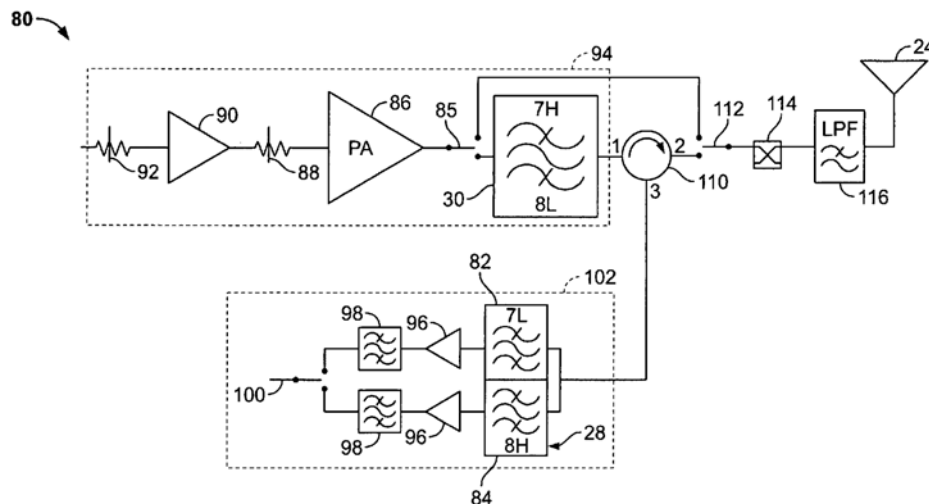
numerous different uplink and downlink mobile communication signals. (*Id.*, ¶29.)

21. Zhuo also notes that as 3G networks evolve, “multiple frequency bands simultaneously present are required” and that use of single band signal boosters in an era of multiple frequency bands is costly, impractical, and not competitive. (*Id.*, ¶ 10.)

B. Layne

22. U.S. Patent No. 7,250,830 (“Layne”) entitled “Dual Band Full Duplex Mobile Radio” was filed on December 30, 2004. Generally speaking, Layne discloses a mobile radio configured to amplify two different frequency bands and their respective uplink and downlink channels. The first frequency band has an uplink (or transmit) channel frequency of 794 MHz to 806 MHz and is referred to as the 7H band. The first frequency band has a downlink (or receive) channel frequency of 764 MHz to 776 MHz and is referred to as the 7L band. The second frequency band has an uplink (or transmit) channel frequency of 806 MHz to 824 MHz and is referred to as the 8L band. The second frequency band has a downlink (or transmit) channel frequency of 851 MHz to 869 MHz and is referred to as the 8H band. (Layne, Ex. 1011, 3:3-21.) In other words, the uplink channel 7H is contiguous with the uplink channel 8L.

23. FIG. 3 from Layne is reproduced below and provides a representation of aspects of the disclosure:



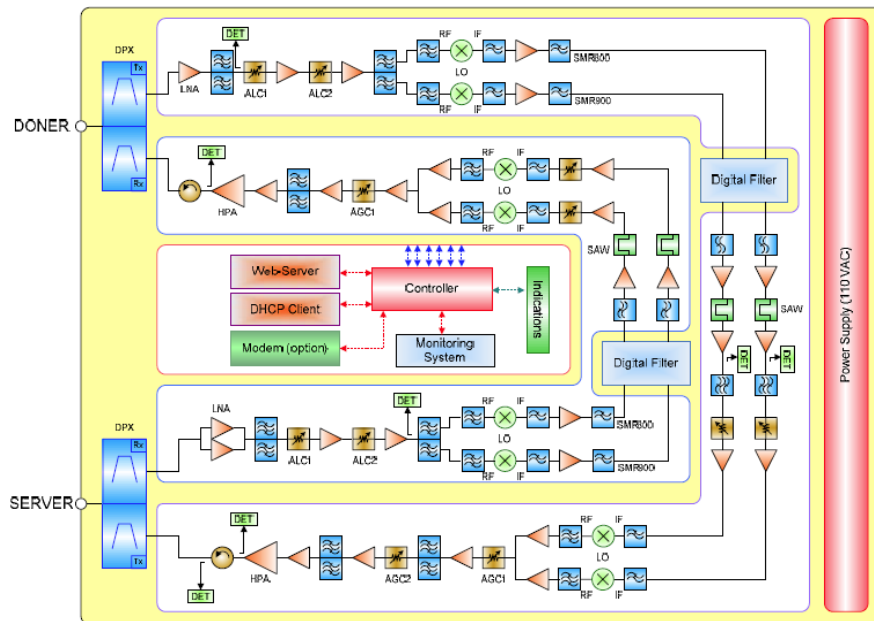
24. As seen in FIG. 3, Layne discloses an uplink amplification path 94 that comprises an amplifier 90, power amplifier 86, and a bandpass filter 30, configured to pass/amplify signals simultaneously in both the 7H and 8L bands. As indicated above, these two bands are contiguous. That is, 7H ranges from 794 MHz to 806 MHz and 8L ranges from 806 MHz to 824 MHz. (*Id.* at FIG.3; *see also id.* at 2:34-39, “In general, various embodiments of the invention provide integration of full duplex operation into a radio chassis by combining the 700 MHz and 800 MHz transmit bands using a single bandpass filter for radio transmission and a diplex filter configured as a dual band front end filter for radio reception.”) Under the broadest reasonable interpretation, adjacent bands

on a shared amplification path are obvious in view of contiguous bands on a shared amplification path.

25. Layne further discloses a downlink amplification path 102 with a first filter 82 configured to pass signals in the 7L band (764 MHz to 776 MHz), and a second filter 84 configured to pass signals in the 8H frequency band (851 MHz to 869 MHz). The 7L and 8H bands are further passed through low noise amplifiers 96 and additional filters 98. The filters disclosed in Layne are configured to pass the desired frequency band by rejecting (or attenuating) other bands. (*Id.* at 3:40-64.)

C. Duo Repeater

26. The Duo Repeater is a user guide for a multiband cell phone signal booster that was available at least from the public records of the Federal Communications Commission as of February 9, 2007. The Duo Repeater is stated to be an “RF repeater which enhances in-building wireless coverage in the most effective and cost efficient way.” (See, DUO Repeater, Ex. 1009, pg. 5.) A block diagram of the amplification path for the DUO Repeater is shown below:

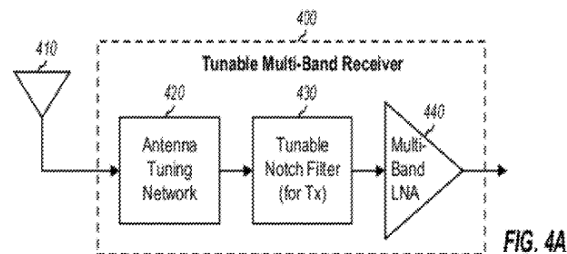


(*Id.* at 9.)

27. Generally speaking, the Duo Repeater filters and amplifies signals for the frequency band designated as SMR800 (downlink channel 851-869 MHz and uplink channel 806-824 MHz) and the frequency band designated as SMR900 (downlink channel 935-940 MHz and uplink channel 896-901 MHz). Signals transmitted and received at the different antennas (i.e., the server and donor) are multiplexed (i.e., filtered) to the desired frequency range and initially sent as a combined signal where they are filtered and amplified in a combined process. They are then separated into their separate frequency bands, and again filtered and amplified. The separate frequency bands are combined, filtered, and amplified again before being multiplexed. (*Id.* at 5, 9-11, 30.)

D. Sahota

28. U.S. Patent Publication No. 2012/0302188 (“Sahota”) entitled “Tunable Multi-Band Receiver” was filed on May 27, 2011. Sahota discloses a multi-band receiver/signal booster with an adjustable or “tunable” notch filter (i.e., a bandpass filter). FIG. 4A from Sahota is shown below.

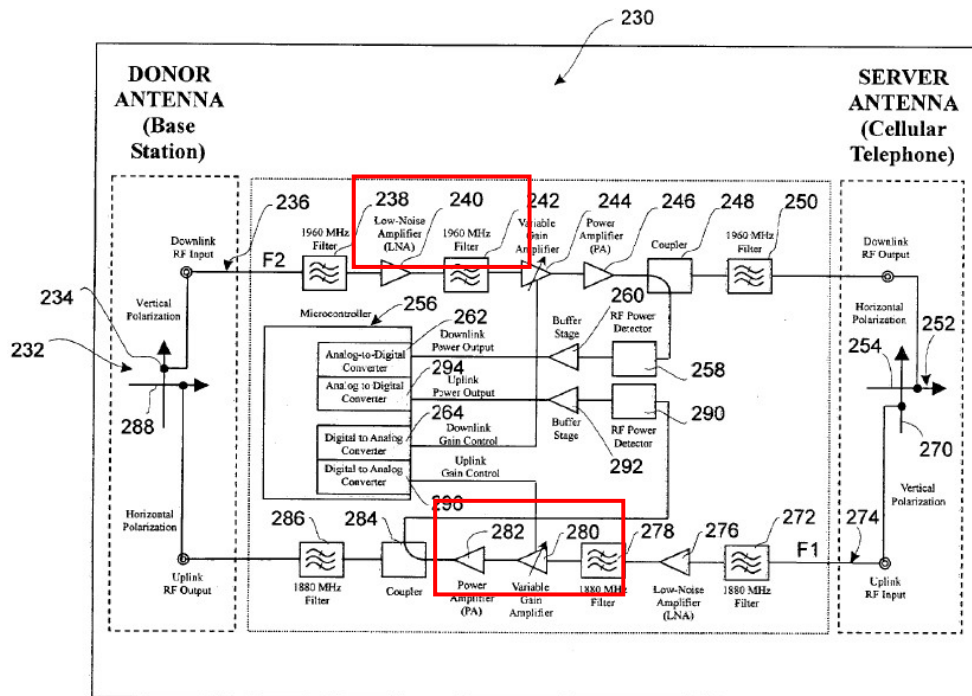


29. The receiver in Sahota is configured to support “any number of frequency bands and any particular frequency band,” including the uplink channel and downlink channel for Bands XII and XIII. (Sahota, Ex. 1008, ¶69, Table 1.)

E. McKay

30. U.S. Patent Publication No. 2004/0166802 (“McKay”) entitled “Cellular Signal Enhancer” was filed on February 26, 2003. McKay discloses a cell phone signal booster that receives a base station signal, amplifies the signal power, and retransmits the amplified signal via a downlink path to an end-user

device. (McKay, Ex. 1007, ¶ 14.) FIG. 19 of McKay, reproduced below, illustrates an example signal booster 230.



31. The red boxes drawn above emphasize the common practice of processing signals using a sequence of a low noise amplifier (LNA) followed by a bandpass filter (BPF) and a power amplifier (PA).

32. More specifically, the McKay signal booster 230 includes uplink and downlink paths 274 and 236. (*Id.*, ¶¶ 96 and 110.) The downlink path 236 includes a first filter 238 coupled to a first antenna 232. (*Id.*, ¶ 96.) The first filter 238 is designed to pass the downlink frequencies to the downlink path 236 and filter out the uplink and other frequencies. (*Id.*) The downlink path 236 further includes a low noise amplifier 240, a second filter 242, a variable gain

amplifier 244, a power amplifier 246, and another filter 250 coupled to a second antenna 252. (*Id.*, ¶¶ 103-105.) The second filter 242 is used for “filtering the frequencies outside of the receiving band to more closely match the ideal receiving band,” and can be same as the first filter 238. (*Id.*, ¶ 103.) The variable gain amplifier 244 controls an output power of the downlink frequencies and can act as an attenuator. (*Id.*) The third filter 250 is the same as the first filter 238 and passes the downlink frequencies to antenna 252. (*Id.*, ¶ 104.)

33. The uplink path 274 includes a first filter 272 coupled to the second antenna 252. (*Id.*, ¶ 110.) The first filter 272 is designed to pass the uplink frequencies to the uplink path 274 and filter out the downlink frequencies and other frequencies. (*Id.*, ¶¶ 96 and 110.) The uplink path 274 further includes a low noise amplifier 276, a second filter 278, a variable gain amplifier 280, a power amplifier 282, and a third filter 286 coupled to the first antenna 232. (*Id.*, ¶ 110.) The components in the uplink path 272 function identically to the corresponding components in the downlink path 236. (*Id.*) McKay additionally discloses that the signal booster includes a housing that encloses an electronic board. (*Id.*, ¶¶ 135, 144-147, FIGs. 25-29 and 35.)

F. TEKO Repeater

34. To my knowledge, the detailed schematics for the TEKO Repeater are not a printed publication as they remain confidential. However, certain

public information for the TEK0 Repeater reference comprises documentation related to a multiband cell phone signal booster that was available at least from the public records of the Federal Communications Commission as of August 9, 2011. Exhibit 1006 contains portions of those documents referred to as an “operational description” (WE-SC 15823 - 15826), “internal photos” (WE-SC 15875 - 15877), and “user manual” (WE-SC 16116 - 16181).

35. The TEK0 Repeater generally discloses a remote wireless signal booster capable of operating in six different frequency bands over five amplification paths: SMR700, SMR800, AMPS850, SMR900, PCS1900 and AWS. (TEK0 Repeater, Ex. 1006, WE-SC 15825-15826.) On the System Specifications for the 6-band unit, the SMR700 Band is noted as servicing two separate uplink frequencies (698-716 MHz and 776-787 MHz) and a single downlink frequency (728-757 MHz). The two uplink frequencies correspond to the U.S. uplink frequencies for Band XII and Band XIII. The single downlink frequency corresponds to the combined downlink frequencies for both Bands XII and XIII. The SMR800 and AMPS850 Bands are combined and correspond to the U.S. frequency for Band 5. The SMR900 frequency listing corresponds to U.S. Band 8. The PCS frequency listing corresponds to U.S. Band 2. And the AWS frequency listing corresponds to U.S. Band 4. (Compare *id.* to Ella Table 2, cols. 8 and 9, Ex. 1012.)

VII. TECHNICAL BACKGROUND

36. In this section, I discuss the most basic aspects of the state of the art with respect to certain radio frequency signal transmission, boosters, and associated components used to make those products at the time of the alleged invention of the '190 Patent. Where applicable, I have made a reference to specific prior art referenced in this Declaration. As I noted above, a radio frequency booster is simply a way to increase the strength of a radio signal. Generally speaking, a booster simply provides an amplified version of a radio signal received at its input. Signal boosters, sometimes called repeaters, were well known solutions to problems related to cell phone signal strength. (See, e.g., Zhuo, Ex. 1005, ¶ 2.) They were developed to receive, amplify, and retransmit the signals to a user device (also referred to as user equipment or UE) in order to extend the distance a cell phone (or other user) might be from a base station; and to receive, amplify, and retransmit signals to a base station from a user device. (See, e.g., McKay, Ex.1007, ¶¶ 2-4 and Zhuo Ex.1005, ¶ 2.)

37. At the time of the alleged invention of the '190 patent, numerous nations around the globe, including the United States, had designated several different radio signal frequency spectrums dedicated to specific radio signal functions. The table shown below provides an example of those spectrums and

the different uplink and downlink components of each frequency band as of September 22, 2011.

Band #	Uplink Band (TX)	Downlink Band (RX)	EU	Asia	Japan	Americas
1	1920 MHz-1980 MHz	2110 MHz-2170 MHz	X	X	X	
2	1850 MHz-1910 MHz	1930 MHz-1990 MHz				X
3	1710 MHz-1785 MHz	1805 MHz-1880 MHz	X	X		
4	1710 MHz-1755 MHz	2110 MHz-2155 MHz				X
5	824 MHz-849 MHz	869 MHz-894 MHz		X		X
6	830 MHz-840 MHz	875 MHz-885 MHz			X	
7	2500 MHz-2570 MHz	2620 MHz-2690 MHz	X	X		
8	880 MHz-915 MHz	925 MHz-960 MHz	X	X		
9	1749.9 MHz-1784.9 MHz	1844.9 MHz-1879.9 MHz			X	
10	1710 MHz-1770 MHz	2110 MHz-2170 MHz				X
11	1427.9 MHz-1447.9 MHz	1475.9 MHz-1495.9 MHz			X	
12	699 MHz-716 MHz	729 MHz-746MHz				X
13	777 MHz-787 MHz	746 MHz-756 MHz				X
14	788 MHz-798 MHz	758 MHz-768 MHz				X
15	Reserved	Reserved				
16	Reserved	Reserved				
17	704 MHz-716 MHz	734 MHz-746 MHz				X
18	815 MHz-830 MHz	860 MHz-875 MHz			X	
19	830 MHz-845 MHz	875 MHz-890 MHz			X	
20	832 MHz-862 MHz	791 MHz-821 MHz	X			
21	1447.9 MHz-1462.9 MHz	1495.9 MHz-1510.9 MHz			X	
22	3410 MHz-3500 MHz	3510 MHz-3600 MHz	X	X	X	X
23	2000 MHz-2020 MHz	2180 MHz-2200 MHz				X
24	1626.5 MHz-1660.5 MHz	1525 MHz-1559 MHz				X
25	1850 MHz-1915 MHz	1930 MHz-1995 MHz				X
26	814 MHz-849 MHz	859 MHz-894 MHz		X		X

(See, e.g., Ella, Ex. 1012, Table 2, cols. 8 and 9; Sahota, Ex. 1008, Table 1, ¶ 69 and Cook Decl., Ex. 1010, ¶¶ 7-15.)

38. At the time of the alleged invention of the ‘190 Patent, signal boosters were in use and/or known to comprise a receiving or “donor” antenna coupled to a receiving multiplexer. The donor antenna receives a signal propagated from the base station and, via a multiplexer, separates the signal into desired frequency band signals. Different frequency band signals are processed

through amplifiers and filters to enhance or boost the signal and then rebroadcast. (See, e.g., FIG. 2 from Zhuo shown below; Ex. 1005.)

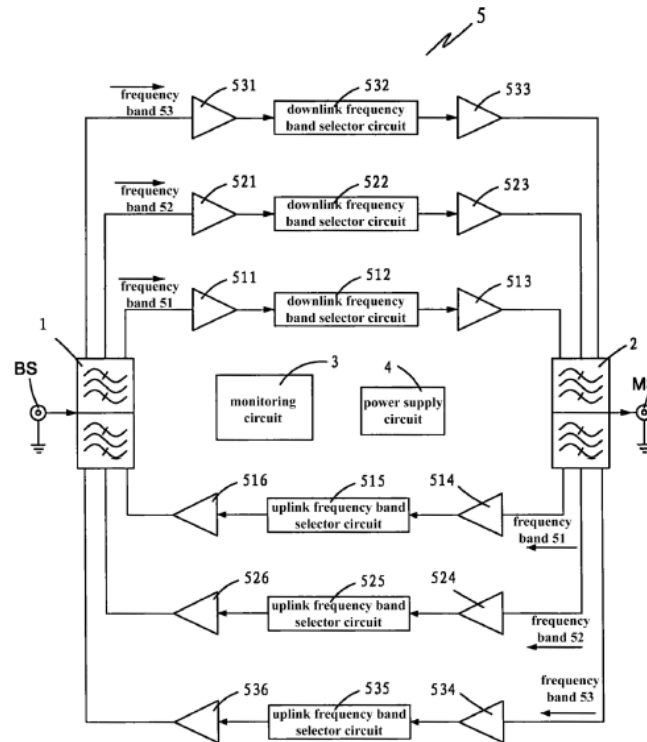


Fig. 2

39. At the time of the alleged invention of the '190 Patent, radio frequency signals were propagated over numerous different frequency bands of various bandwidths and co-exist in the ambient air space together. For example, in an urbanized area, radio signals from all of the major cellphone carriers could be intermixed in the same air space, along with a number of different radio signals from numerous different sources (localized Wi-Fi signals, AM/FM radio transmissions, TV transmissions, etc). The result is a plurality of different

frequency bands that could be received by an antenna on a user device. When these signals are received by signal boosters or user devices, the signals are processed through what is known as a multiplexer. A multiplexer is usually just a series of band pass filters that separates the signal into different subsets of frequencies, including different uplink and downlink channel frequencies. Likewise, a multiplexer is used to combine a plurality of signals into a single signal for rebroadcast. Duplexers, triplexers, and quadplexers are all specific examples of multiplexers and simply reference the number of subsets into which a signal may be separated (or combined). (See, e.g., McKay, Ex.1007, ¶ 74; Zhuo, Ex. 1005, ¶¶ 11-16 and Sahota, Ex. 1008, ¶¶ 22-25.)

40. At the time of the alleged invention of the claims in the ‘190 Patent, it was well known to use a low noise amplifier (LNA) followed by a band pass filter (BPF) and a power amplifier (PA) in series following a signal splitter, such as a duplexer or triplexer. Generally speaking, a low noise amplifier (LNA) is used to overcome loss introduced by the signal splitter. The band pass filter (BPF) is used to further isolate unwanted noise or “interference” from the signal and the subsequent power amplifier (PA) functions to boost the filtered signal. (See, e.g., McKay, Ex. 1007, ¶¶ 103-106; Zhuo, Ex. 1005, ¶ 3.)

41. At the time of the alleged invention of the ‘190 Patent, one of ordinary skill in the art would have appreciated that the design of band pass

filters, low-noise amplifiers, and power amplifiers to extend across a designated frequency spectrum was a well-known and fairly rudimentary process. Their use and basic functions are part of entry level electrical engineering courses. A band pass filter is simply a device that passes frequencies within a certain range and rejects (or attenuates) frequencies outside that range.

42. At the time of the alleged invention of the '190 Patent, band pass filters could be designed to pass desired frequency ranges or sets of frequency ranges. For example, the DUO Repeater discloses where two different frequency bands (SMR800 and SMR 900) are processed through a single low noise amplifier (LNA), band pass filter (BPF), and power amplifier (PA), then in the same pathway, split and separately filtered through separate band pass filters and separate power amplifiers (DUO Repeater, Ex. 1009, pg. 9). In other words, at the time of the alleged invention of the '190 Patent, band pass filters (BPFs) and power amplifiers (PAs) were commonly designed to cover contiguous or non-contiguous frequency bands. (*Id.*) As an example only, based on at least the foregoing, at the time of the alleged invention of the '190 Patent, it was well within the grasp of one of ordinary skill in the art to design a band pass filter and/or amplifier to pass a frequency range extending from 728 MHz to 757 MHz (i.e., the downlink channels for Bands XII and XIII) and attenuate other frequency ranges.

VIII. CLAIM CONSTRUCTION

43. I understand that a claim subject to *inter partes* review receives the broadest reasonable construction that would have been understood by a person of ordinary skill in the art at the time of the alleged invention in light of the specification of the patent in which it appears. I also understand that any term that is not construed should be given its plain and ordinary meaning under the broadest, reasonable construction. I followed these principles in forming my opinions in this declaration.

44. The amplification of adjacent frequency bands suggests that amplification of the separation between the frequency bands is an acceptable trade-off (i.e., between component count and some noise amplification) in light of the reduced size and number of components. Meaning, the person of ordinary skill is willing to amplify a certain amount of noise in order to minimize the number of components it must use in any one design. As the separation between adjacent bands decreases (i.e., less separation, less amplification of noise), there is less concern about amplification of noise between the adjacent bands. Thus, when there is no separation (i.e., abutting or contiguous bands), the concern of that trade-off is non-existent because there is no amplification of unwanted noise. Thus the person of ordinary skill would understand that if adjacent bands may be amplified along a common pathway, abutting or contiguous bands may

also be amplified along a common pathway. The reverse is also true. Meaning, a person of ordinary skill in the art that would amplify abutting or contiguous bands would also amplify adjacent bands on a shared amplification path despite the amplification of noise between the bands at least because it results in fewer components.

45. The terms “contiguous,” “abutting,” and “adjacent,” are terms referred to herein and in the art relating to the proximity of frequency bands on the radio frequency spectrum. While there is some variation in how those terms are used in the art, Petitioner uses the term “contiguous” to mean frequency bands that are overlapping or have a common boundary. For example, downlink band XII (729 MHz to 746 MHz) and downlink band XIII (746 MHz to 756 MHz) share 746 MHz as a common boundary and are thus overlapping or contiguous. Bands that are directly next to each other (e.g., 910 MHz to 920 MHz and 921 MHz to 930 MHz) are “abutting.” Two frequency bands that are not contiguous or abutting would be considered “adjacent” if the bands are separated by a frequency range that does not include another intervening, incompatible frequency band. For example, in the cellular service industry, a first band with a range of 910 MHz to 920 MHz would be considered “adjacent” to a second band with a range of 930 MHz to 940 MHz if there is no intervening cellular service band between the two bands. Under the broadest reasonable

interpretation, abutting bands and/or adjacent bands on a shared an amplification path would be obvious in view of contiguous bands on a shared an amplification path and vice versa. As will be shown more fully below, it was well known in the art to combine contiguous and adjacent frequency bands along a shared amplification path.

IX. THE PRIOR ART DISCLOSES OR SUGGESTS ALL OF THE FEATURES OF CLAIMS 1-4, 6, 8, 18-20, and 24 OF THE ‘190 PATENT

A. The ‘704 Patent (Zhuo) and/or the ‘830 Patent (Layne) and/or the ‘188 Publication (Sahota) disclose or suggest all of the features of claims 1-4, 6, 8, 18-20, and 24 of the ‘190 Patent

46. In my opinion, Zhuo and/or Layne and/or Sahota disclose or suggest all of the features of claims 1-4, 6, 8, 18-20, and 24 of the ‘190 Patent. Below, I address each of these claims and their respective limitations.

i. Claim 1 of the ‘190 Patent

A radio frequency signal booster comprising

47. I have been asked to consider a situation where the preamble of claim 1 is not limiting. Regardless, it is my opinion that Zhuo alone or in combination with Layne and Sahota discloses the limitations recited in the preamble of claim 1. Zhuo discloses “a tri-band wireless repeater” which is a radio frequency signal booster. (Zhuo, Ex. 1005, ¶ 0001.)

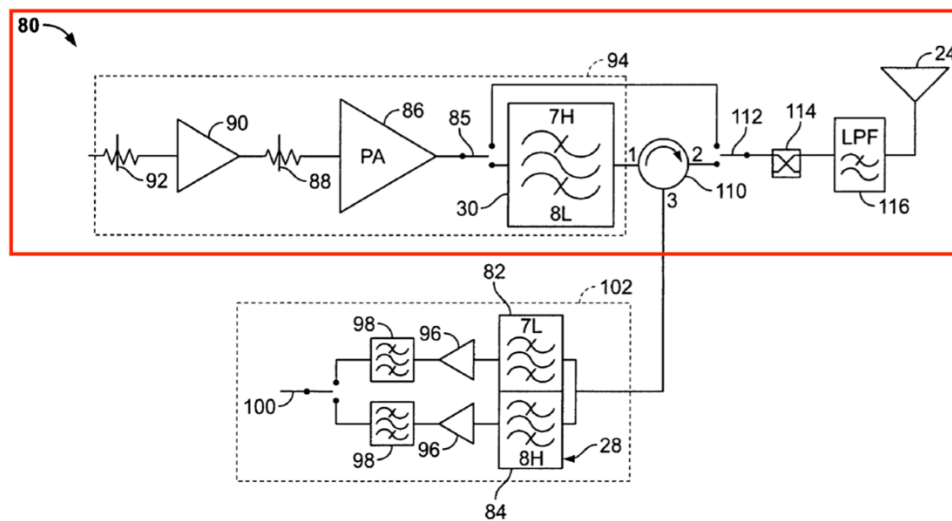
a printed circuit board (PCB) comprising

48. A person of ordinary skill in the art would understand that a printed circuit board (PCB) can be incorporated into this art. It is a well-known implementation of this art. For example, Sahota discloses a printed circuit board radio signal booster implementation. (Sahota, Ex. 1008, ¶ 0081.)

a shared amplification path configured to provide amplification to at least a portion of a first downlink channel of a first frequency band and to provide amplification to at least a portion of a second downlink channel of a second frequency band, wherein the first frequency band and the second frequency band are different frequency bands

49. Layne discloses or suggests this limitation. Specifically, Layne states that “the transmit filter 30 passes signals in the 7H and 8L frequency bands and rejects or filters signals in the 7L and 8H frequency bands.” (Layne, Ex. 1011, 3:57-59) (see FIG. 3 below.) A person of ordinary skill in the art would understand that the transmit filter 30 passes a portion of a first channel (7H) of a first frequency band (700 MHz Public Safety Frequency Band) and passes a portion of a second channel (8L) of a second frequency band (800 MHz Public Safety Frequency Band). A person of ordinary skill in the art would understand

that the 700 MHz Public Safety Frequency Band and the 800 MHz Public Safety Frequency Band are different (i.e., first and second) frequency bands. A person of ordinary skill in the art would also understand that the amplification path of Layne simultaneously amplifies frequency band 7H and frequency band 8L.



(*Id.*, Ex. 1011, FIG. 3, annotated.)

50. The combined frequency band 7H and frequency band 8L are uplink channels. However, the circuitry for amplifying an uplink frequency is no different than the circuitry for amplifying a downlink frequency. (See e.g., McKay, Ex. 1007, ¶ 110, ‘190 Patent, Ex. 1001, 10:60-11:3.)

51. As I noted above, it appears that the alleged point of novelty of the ‘190 Patent is amplification of a combined frequency pathway where two different frequency channels are close or abutting. (See the ‘190 Patent, Ex.

1001, 10:36-40, which states “Thus, in contrast to a conventional signal booster that includes a separate amplification path for each frequency channel that is boosted, the illustrated configuration includes a shared amplification path for amplifying adjacent downlink channels, such as close or abutting downlink channels.”) Layne clearly discloses the concept of a shared amplification path of contiguous cellular bands. Under the broadest reasonable interpretation, adjacent cellular bands on a shared amplification path are obvious in view of contiguous bands on a shared amplification path.

wherein the shared amplification path comprises a first band-pass filter configured to pass the at least a portion of the first downlink channel and the at least a portion of the second downlink channel, wherein the shared amplification path is further configured to simultaneously boost both the at least a portion of the first downlink channel and the at least a portion of the second downlink channel

52. Layne discloses this limitation. “[T]he transmit filter 30 passes signals in the 7H and 8L frequency bands and rejects or filters signals in the 7L and 8H frequency bands.” (Layne, Ex. 1011, 3:57-59.) A person of ordinary skill in the art would understand that the transmit filter 30 passes a portion of a first channel (7H) of a first frequency band (700 MHz Public Safety Frequency Band) and passes a portion of a second channel (8L) of a second frequency band (800

MHz Public Safety Frequency Band). A person of ordinary skill in the art would understand that the amplification path of Layne simultaneously amplifies frequency band 7H and frequency band 8L.

wherein the first downlink channel and the second downlink channel are adjacent in frequency to one another

53. Under the broadest reasonable interpretation, Layne discloses or suggests this limitation. “The transmit filter 30, in this exemplary embodiment, is a single bandpass filter configured to pass signals in the **7H and 8L** frequency bands (e.g., communicating signals in the 7H and 8L frequency band to be transmitted by the radio 20).” (Layne, Ex. 1011, 3:53-56) (Emphasis added.) More specifically, the mobile radio in Layne discloses an uplink amplification path 94 that comprises a signal amplifier 90, power amplifier 86, and a bandpass filter 30 configured to pass signals in both the 7H and 8L bands. (See *id.*, 3:65-4:6; FIG. 3.) 7H ranges from 794 MHz to 806 MHz and 8L ranges from 806 MHz to 824 MHz. (*Id.* at 2:33-38 stating “In general, various embodiments of the invention provide integration of full duplex operation into a radio chassis by combining the 700 MHz and 800 MHz transmit bands using a single bandpass filter for radio transmission and a diplex filter configured as a dual band front end filter for radio reception.”)

54. As shown on FIG. 2 of Layne (reproduced below), frequency bands 7H and 8L are contiguous.

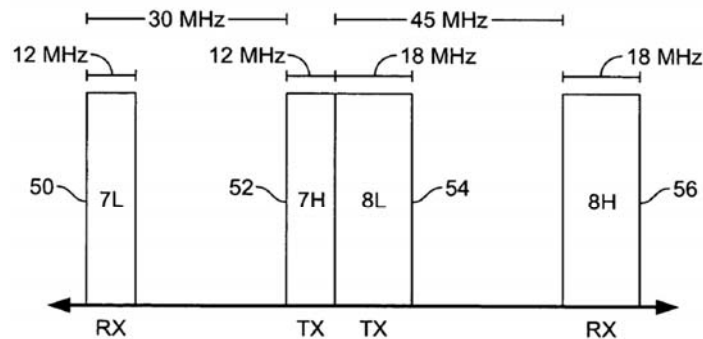


FIG. 2

(Layne, Ex. 1011, FIG. 2.)

55. While the 7H and 8L Bands in Layne are transmission or uplink bands, the amplification of an uplink band is no different than the amplification of a downlink band. The engineering required to filter and amplify uplink signals is the same as the engineering required to filter and amplify a downlink signal. (See e.g., McKay, Ex. 1007, ¶ 110.)

56. During the process of assigning frequency designations for the different bands that would occupy the LTE domain, the downlink frequencies for Band XII and Band XIII were assigned 728-746 MHz and 746-756 MHz. The upper boundary of the downlink frequency for Band XII and the lower boundary of the downlink frequency for Band XIII are contiguous. (See, e.g., Cook Decl., Ex. 1010 at ¶ 14 and Sahota, Ex. 1008, ¶ 69 and Table 1.)

57. At the time of the claimed invention of the '190 Patent, a person of ordinary skill in the art who wanted to accommodate any contiguous or adjacent pair of frequency bands in a repeater would be instructed by Layne to do so.

wherein the shared amplification path further comprises at least one amplifier.

58. Layne discloses that “[t]he input of the transmit filter 30 is connected to a switch 85, a **power amplifier 86** (providing a final amplifier stage) that is connected to a first attenuator 88, an **amplifier 90** and a second attenuator 92.”

(Layne, Ex. 1011, 3:65-4:1.) A person of ordinary skill in the art would understand that the power amplifier 86 and the amplifier 90 are both amplifiers that are included on the common amplification path of the 7H and 8L channels.

59. Layne discloses every element of claim 1 except the implementation of the recited elements on a PCB. As I have noted above, this is a common implementation of signal booster technology and not new or innovative. The person of ordinary skill in the art would understand that Layne would be implemented on a PCB.

ii. Claim 2 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the first band-pass filter is further configured to attenuate both a first uplink channel of the first frequency band and a second uplink channel of the second frequency band.

60. Layne also discloses this limitation. Layne discloses: “Thus, the transmit filter 30 passes signals in the 7H and 8L frequency bands and **rejects or filters signals in the 7L and 8H frequency bands.**” (*Id.*, Ex. 1011, 3:57-58) (Emphasis added.)

61. A person of ordinary skill in the art would understand that the 7L frequency band is a “first channel of the first frequency band.” Layne discloses: “For the **700 MHz frequency band**, the **mobile radio receive band** (frequency band 50 labeled 7L for 700 Low) is 764 MHz to 776 MHz and the **mobile radio transmit band** (frequency band 52 labeled 7H for 700 High) is 794 MHz to 806 MHz.” (*Id.*, Ex. 1011, 3:15-19) (Emphasis added.) A person of ordinary skill in the art would understand that “mobile radio receive band” refers to a “downlink channel,” and “mobile radio transmit band” refers to an “uplink channel.”

62. Therefore, a person of ordinary skill in the art would understand that that 7L frequency band is a “first channel” (i.e., downlink) of a “first frequency band” (i.e. the 700 MHz frequency band).

63. A person of ordinary skill in the art would understand that the 8H frequency band is a “first channel of the second frequency band.” Layne discloses: “In particular, the 800 MHz **mobile radio receive band** (frequency band 56 labeled 8H for 800 High) is 851 MHz to 869 MHz and the 800 MHz **mobile radio**

transmit band (frequency band 54 labeled 8L for 800 Low) is 806 MHz to 824 MHz.” (*Id.*, Ex. 1011, 3:11-15) (Emphasis added.) A person of ordinary skill in the art would understand that “mobile radio receive band” refers to a “downlink channel,” and “mobile radio transmit band” refers to an “uplink channel.”

64. Therefore, a person of ordinary skill in the art would understand that the 8H frequency band is a “first channel” (i.e., downlink) of a “second frequency band” (i.e., the 800 MHz frequency band).

65. Layne discloses: “Thus, the transmit filter 30 passes signals in the 7H and 8L frequency bands and **rejects or filters signals in the 7L and 8H frequency bands.**” (*Id.*, Ex. 1011, 3:57-58) (Emphasis added.) A person of ordinary skill in the art would understand that this discloses a band-pass filter configured to “attenuate both the first channel of the first frequency band and the first channel of the second frequency band.”

66. Layne discloses circuitry that facilitates processing of uplink channels of frequency bands that are contiguous. Circuitry for filtering and/or amplifying uplink channels is the same as that for filtering and/or amplifying downlink channels. (See, e.g., McKay, Ex. 1007, FIG. 19; and see *id.* ¶ 110.) The ‘190 Patent itself notes that the circuitry used for a shared amplification path for a downlink channel is equivalent to that of a shared amplification path for an uplink channel. (‘190 Patent, Ex. 1001, 6:17-31.)

67. A person of ordinary skill in the art wanting to amplify two contiguous bands, like Bands XII and XIII, would have been instructed by Layne to do so. As I noted above, it appears that the alleged point of novelty of the ‘190 Patent is amplification of a combined frequency pathway where two different frequency channels are close or abutting. (‘190 Patent, Ex. 1001, 10:36-40 stating “Thus, in contrast to a conventional signal booster that includes a separate amplification path for each frequency channel that is boosted, the illustrated configuration includes a shared amplification path for amplifying adjacent downlink channels, such as close or abutting downlink channels.”) Layne plainly discloses the concept of a common amplification path of contiguous cellular bands and band pass filters capable of passing two contiguous frequency bands.

iii. Claim 3 of the ‘190 Patent

The radio frequency signal booster of claim 1, wherein the first downlink channel of the first frequency band comprises a Band XII downlink channel, and wherein the second downlink channel of the second frequency band comprises a Band XIII downlink channel.

68. Sahota discloses Band XII and Band XIII. (Sahota, Ex. 1008, Table 1 and ¶ 0069.)

TABLE 1

Frequency Band	Transmit Band Uplink (MHz)	Receive Band Downlink (MHz)	Common Name	Frequency Band
UMTS Band I	1920-1980	2110-2170	IMT-2000	
UMTS Band II	1850-1910	1930-1990	PCS	GSM 1900
UMTS Band III	1710-1785	1805-1880	DCS	GSM 1800
UMTS Band IV	1710-1770	2110-2170		
UMTS Band V	824-849	869-894	Cellular	GSM 850
UMTS Band VI	830-840	875-885		
UMTS Band VII	2500-2570	2620-2690		
UMTS Band VIII	880-915	925-960		
UMTS Band IX	1750-1785	1845-1880		
UMTS Band X	1710-1770	2110-2170		
UMTS Band XI	1428-1453	1476-1501		
UMTS Band XII	698-716	728-746		
UMTS Band XIII	777-787	746-756		
UMTS Band XIV	788-798	758-768		
	890-915	935-960		GSM 900

(Sahota, Ex. 1008, Table 1.)

69. The '190 Patent states that, “[a]lthough specific frequency ranges have been provided above, persons of ordinary skill in the art will appreciate that **the frequencies of the bands can vary by geographical region and/or can change over time based on regulations set by governing agencies such as the Federal Communications Commission (FCC) or the Canadian Radio-television and Telecommunications Commission (CRTC).**” (‘190 Patent, Ex. 1001, 5:39-45) (Emphasis added.)

70. As a result of the extension of the public safety communication services to the 700 MHz band, Layne discloses, “combining the 700 MHz and 800

MHz transmit bands using a single bandpass filter.” (Layne, Ex. 1011, 2:36-37.)

While I believe a more accurate description of the transmit bands in Layne is “contiguous,” Layne states that “the two mobile transmit bands, frequency bands 52 and 54 are adjacent as shown in FIG. 2.” (*Id.*, 3:19-21.)

71. During the process of assigning frequency designations for the different bands that would occupy the LTE domain, the downlink frequencies for Band XII and Band XIII were assigned 728-746 MHz and 746-756 MHz. The upper boundary of the downlink frequency for Band XII and the lower boundary of the downlink frequency for Band XIII are contiguous. (See, e.g., Cook Decl., Ex. 1010, ¶ 14 and Sahota, Ex. 1008, ¶ 69 and Table 1.) Sahota further discloses that the uplink channel of Band XII occupies 698 MHz to 716 MHz and the uplink channel of Band XIII occupies 777 MHz to 787 MHz. (See Sahota, Ex. 1008, Table 1.)

72. Based on the combined teachings of Layne and Sahota, a person of ordinary skill in the art would understand that: (1) uplink or downlink channels that are contiguous can be passed using a single bandpass filter and amplified using a single amplifier, and (2) the downlink channels of Band XII and the downlink channels of Band XIII are contiguous. A person of ordinary skill in the art would also understand that “the frequencies of the bands can vary by geographical region and/or can change over time based on regulations set by governing agencies such

as the Federal Communications Commission (FCC).” (‘190 Patent, Ex. 1001, 5:41-44.) Based on these combined teachings, a person of ordinary skill in the art who wanted to amplify Bands XII and XIII would modify Layne at least with the teachings of Sahota to amplify the downlink channels of Band XII and Band XIII.

iv. Claim 4 of the ‘190 Patent

The radio frequency signal booster of claim 3, wherein the first band-pass filter is further configured to pass at least a portion of a Band XII downlink channel having a frequency range of about 728 MHz to about 746 MHz

73. Sahota discloses that Band XII downlink has a frequency range of about 728 MHz to about 747 MHz. (Sahota, Ex. 1008, Table 1.) Moreover, Sahota notes that a separate system of filters and amplifiers may be used to transmit one or more different frequency bands including the downlink channel for Band XII. (*Id.*, ¶0031.) Sahota proposes to solve that by combining multiple frequency bands into a single pathway using a filter that can be adjusted to accommodate different frequency ranges. (*Id.*, ¶¶ 32, 33.) Based on at least this disclosure, the use of a band pass filter to filter Band XII in a signal booster was well within the grasp of one of ordinary skill and requires no innovative thinking. Importantly, Sahota explicitly discloses that the use of multiple frequency bands may increase cost, board area, and routing complexity. (*Id.*, ¶ 31.)

wherein the first band-pass filter is further configured to attenuate a Band XII uplink channel having a frequency range of about 698 MHz to about 716 MHz

74. Sahota discloses that Band XII uplink has a frequency range of about 698 MHz to about 716 MHz. (Sahota, Ex. 1008, Table 1.) Sahota notes that a separate system of filters and amplifiers may be used to transmit one or more different frequency bands including the uplink channel for Band XII. (*Id.*, ¶0031.) Specifically, Sahota notes “[i]n an aspect, a tunable multi-band receiver may be used to support multiple frequency bands without the need for an individual RX filter for each frequency band. The tunable multi-band receiver may include a single receive path for multiple frequency bands and may provide various advantages such as smaller size, lower cost, better reliability, etc.” (*Id.*, ¶ 0032.)

75. Based on at least this disclosure, the use of a band pass filter to filter Band XII in a signal booster was well within the grasp of one of ordinary skill and requires no innovative thinking.

wherein the first band-pass filter is further configured to pass at least a portion of a Band XIII downlink channel having a frequency range of about 746 MHz to about 757 MHz

76. Sahota discloses that Band XIII downlink has a frequency range of about 746 MHz to about 757 MHz. (Sahota, Ex. 1008, Table 1.) Sahota notes that

a separate system of filters and amplifiers may be used to transmit one or more different frequency bands including the downlink channel for Band XIII. (*Id.*, ¶0031.) Based on at least this disclosure, the use of a band pass filter to filter Band XIII in a signal booster was well within the grasp of one of ordinary skill and requires no innovative thinking. Importantly, Sahota explicitly discloses that the use of multiple frequency bands may increase cost, board area, and routing complexity. (*Id.*)

wherein the first band-pass filter is further configured to attenuate a Band XIII uplink channel having a frequency range of about 776 MHz to about 787 MHz.

77. Sahota discloses that Band XIII uplink has a frequency range of about 776 MHz to about 787 MHz. (Sahota, Ex. 1008, ¶0069, Table 1.) Sahota notes that a separate system of filters and amplifiers may be used to transmit one or more different frequency bands including the uplink channel for Band XIII. (Sahota, Ex. 1008, ¶0031.) Based on at least this disclosure, the use of a band pass filter to filter Band XIII in a signal booster was well within the grasp of one of ordinary skill and requires no innovative thinking. A person of ordinary skill in the art who wanted to accommodate the specific Bands XII and XIII would modify the Layne at least with the teachings of Sahota to amplify the downlink channels of Band XII and Band XIII and attenuate the uplink channels of Band XII and Band XIII.

v. Claim 6 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the first downlink channel of the first frequency band and the second downlink channel of the second frequency band are abutting in frequency.

78. Layne discloses this limitation. “It should be noted that the two mobile transmit bands, frequency bands 52 and 54 are adjacent as shown in FIG. 2.” (Layne, Ex. 1011, 3:19-21.) Under the broadest reasonable interpretation, the adjacent bands in Layne are abutting.

vi. Claim 8 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the shared amplification path further comprises one or more additional band-pass filters, wherein each of the one or more additional band-pass filters are configured to pass the at least a portion of the first downlink channel and the at least a portion of the second downlink channel.

79. Layne discloses this limitation. Layne discloses “[t]he receive filter 28, and more particularly, the output of each of **the first and second filters 82 and 84**, are connected to an amplifier 96, for example, a low-noise amplifier (LNA) or preamplifier. Each of the amplifiers 96 is connected to a **filter 98**, for example, surface acoustic wave (SAW) filters, which are connected to

a switch 100 for selecting between the filtered signals and connecting to a frequency mixer (not shown) as is known. This receive portion 102 provides for receiving signals in either the 7L or 8H frequency bands.” (Layne, Ex. 1011, 3:44-52) (Emphasis added.)

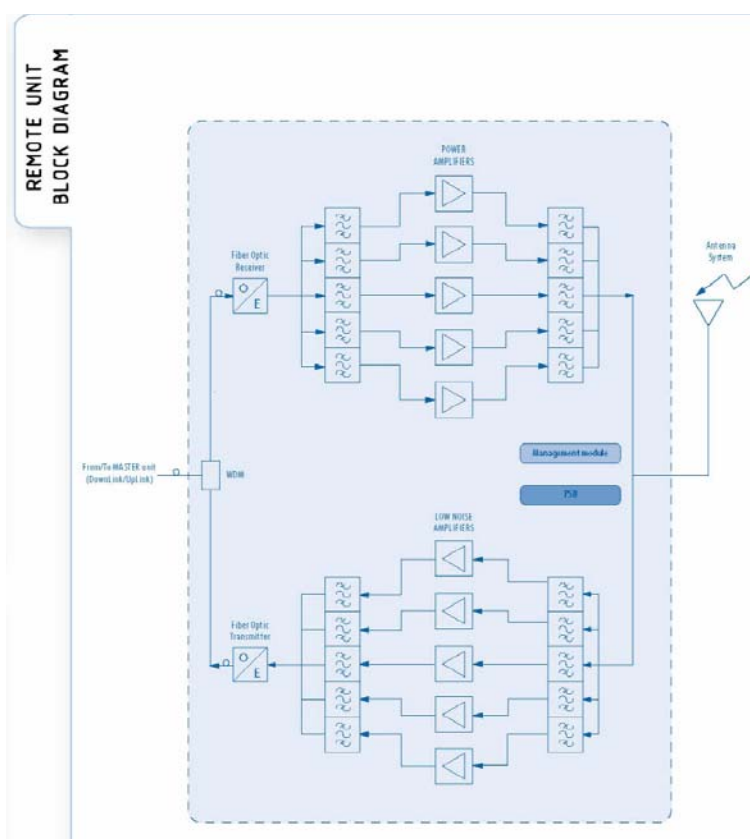
80. It is commonly known to have multiple filters in an amplification path. To the extent this is disputed, based at least on Layne, a person of ordinary skill in the art would understand that multiple filters can be included in an amplification path that function precisely in the manner recited by claim 8. (See, e.g., McKay, Ex. 1007, FIG. 19.)

vii. Claim 18 of the ‘190 Patent

The radio frequency signal booster of claim 1, wherein the PCB is configured to provide amplification to a plurality of frequency bands, wherein the plurality of frequency bands comprise Band II, Band IV, Band V, Band XII, and Band XIII.

81. Sahota discloses Band XII, Band XIII, Band V, Band IV, and Band II. (Sahota, Ex. 1008, ¶0069, Table 1.) The different frequency band ranges used in the spectrums described in the ‘190 Patent, including those listed in this claim, are assigned by the Federal Communications Commission (FCC). At the time of the ‘190 Patent, these bands were all known and in use. (See, e.g., *Id.* ¶ 69 and Cook Decl., Ex. 1010, ¶¶8-15.)

82. The TEK0 Repeater generally discloses a remote wireless signal booster capable of operating in six different frequency bands over five separate amplification paths: (1) SMR700, (2) SMR800 combined with AMPS850, (3) SMR900, (4) PCS1900, and (5) AWS. (TEKO Repeater, Ex. 1006, WE-SC 15825-15826). A portion of the specifications are shown below:



(*Id.*, WE-SC 15825.)

Let us repeat!



TRL7S8SC0A9S19AWAS 6-BAND LOW POWER REMOTE UNIT

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ATOR OPTICAL SYSTEM rfical/AMPS/SMR900/PCS/AWS REMOTE UNIT	SYSTEM SPECIFICATIONS		SMR700	SMR800(*)•AMPS	SMR900	PCS	AWS
	Uplink operating frequency band		698-716MHz 776-787MHz	817-848.5MHz	896.5-902MHz	1850 ÷ 1915 MHz	1710 ÷ 1755 MHz
	Downlink operating frequency band		728-757MHz	862-893.5MHz	935.5-941MHz	1930 ÷ 1995 MHz	2110 ÷ 2155 MHz
	Downlink Output Power GSM/TDMA (**) / CDMA (**)		29dBm (1 carrier)	29dBm (1 carrier)°	29dBm (1 carrier)	29dBm (1 carrier)	29dBm (1 carrier)
			23dBm (4 carriers)	23dBm (4 carriers)°	23dBm (4 carriers)	23dBm (4 carriers)	23dBm (4 carriers)
			17dBm (16 carriers)	17dBm (16 carriers)°	17dBm (16 carriers)	17dBm (16 carriers)	17dBm (16 carriers)
	Downlink Output Power WCDMA (***) / LTE (****)		29dBm (1 carrier)	29dBm (1 carrier)°	29dBm (1 carrier)	29dBm (1 carrier)	29dBm (1 carrier)
			26dBm (2 carriers)	26dBm (2 carriers)°	26dBm (2 carriers)	26dBm (2 carriers)	26dBm (2 carriers)
			23dBm (4 carriers)	23dBm (4 carriers)°	23dBm (4 carriers)	23dBm (4 carriers)	23dBm (4 carriers)
	Spurious emissions and intermodulation products		< -13 dBm (in the frequency band 9 kHz ÷ 12.75 GHz)				
11. setting 1	Noise Figure	6. dB	6. dB	6. dB **	5.5. dB	5. dB	

(Id., WE-SC 15826.)

83. On the System Specifications for the 6-band unit, the SMR700 Band is noted as servicing two separate uplink frequencies (698-716 MHz and 776-787 MHz) and a single downlink frequency (728-757 MHz). (Id.) The two uplink frequencies correspond to the U.S. uplink frequencies for Band XII and Band XIII. The single downlink frequency corresponds to the combined downlink frequencies for both Bands XII and XIII. The SMR800 and AMPS850 Bands are combined and correspond to the U.S. frequency for Band V. The SMR900 frequency listing corresponds to U.S. Band VIII. The PCS frequency listing corresponds to U.S. Band II. And the AWS frequency listing corresponds to U.S. Band IV. At the time of the claimed invention, a person of ordinary skill

in the art wanting to add additional bands to the signal booster, would have modified Zhuo to include the additional bands from the TEKO Repeater.

84. Zhuo discloses a wireless signal booster configured to receive at least three different frequency bands through a first multiplexer. Those bands are filtered and amplified, then sent through a second multiplexer. (Zhuo, Ex. 1005, Abstract, FIG. 2.) FIG. 2 from Zhuo is reproduced below:

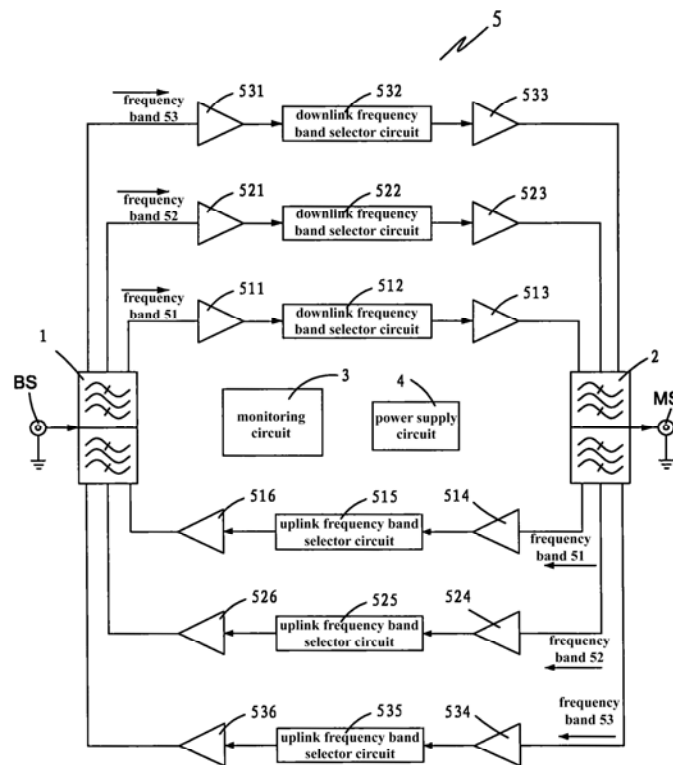


Fig. 2

85. More specifically, Zhuo discloses three different frequency bands (51, 52, and 53) travelling through three different uplink amplification paths and three different downlink amplification paths. After traveling through a

multiplexer and being separated into different frequency ranges, each of the signals are processed through a low noise amplifier (e.g., 514, 524, 534), a selector circuit (i.e., a band pass filter, 515, 525, 535), followed by another power amplifier (e.g., 516, 526, 536). (*Id.*, ¶¶ 20-23.) Zhuo discloses that the signal booster can be applied to frequency band selection and amplification of numerous different uplink and downlink mobile communication signals. (*Id.*, ¶29.)

86. The person of ordinary skill in the art would know from Zhuo and the TEKO Repeater about cellular frequency boosters for amplifying multiple different frequency signals, including all of the bands recited in Claim 18, at least from Sahota and the TEKO Repeater. Sahota and the TEKO Repeater both disclose that the downlink channels for Bands XII and XIII are contiguous frequency bands. The person of ordinary skill would understand from Layne that contiguous frequency bands can be filtered and amplified in a common pathway. Therefore, the person of ordinary skill in the art wanting to amplify the bands recited in Claim 18 would have been motivated to modify Zhuo in view of Layne and Sahota or the TEKO Repeater to do so.

viii. Claim 19 of the '190 Patent

**An apparatus comprising
a printed circuit board (PCB) comprising**

87. A person of ordinary skill in the art would understand that a printed circuit board (PCB) can be incorporated into this art. It is a well-known implementation of this art. For example, Sahota discloses a printed circuit board implementation. (Sahota, Ex. 1008, ¶ 0081.)

**a shared amplification path configured to provide amplification to
a first downlink channel of a first frequency band and to provide
amplification to a second downlink channel of a second frequency
band, wherein the first frequency band and the second frequency
band are different frequency bands, wherein the shared
amplification path is further configured to simultaneously boost
both the first downlink channel and the second downlink channel**

88. Layne discloses or suggests this limitation. Specifically, Layne states that “the transmit filter 30 passes signals in the 7H and 8L frequency bands and rejects or filters signals in the 7L and 8H frequency bands.” (Layne, Ex. 1011, 3:57-59; see also FIG. 3 below.) A person of ordinary skill in the art would understand that the transmit filter 30 passes a portion of a first channel (7H) of a first frequency band (700 MHz Public Safety Frequency Band) and passes a portion of a second channel (8L) of a second frequency band (800 MHz Public

Safety Frequency Band). A person of ordinary skill in the art would understand that the 700 MHz Public Safety Frequency Band and the 800 MHz Public Safety Frequency Band are different frequency bands. A person of ordinary skill in the art would also understand that the common amplification path of Layne can provide amplification to frequency band 7H and frequency band 8L.

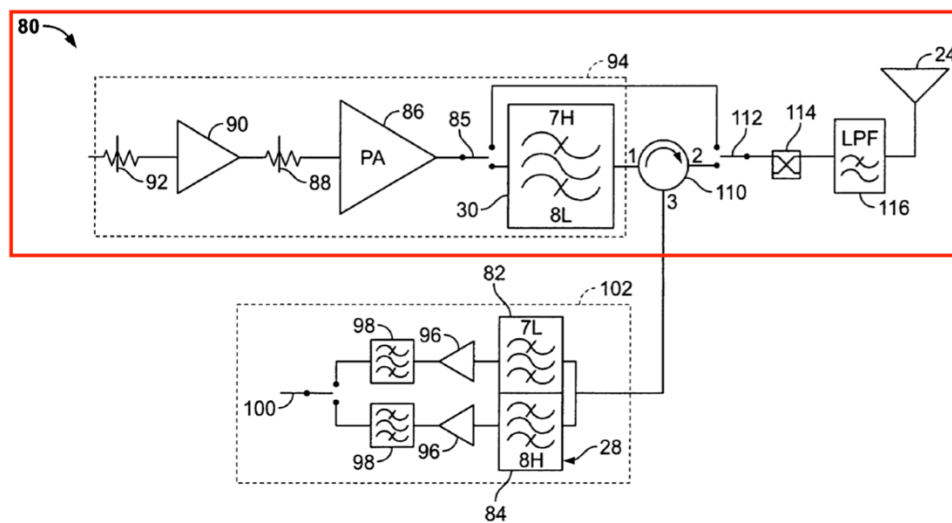


FIG. 3

(Layne, Ex. 1011, FIG. 3, annotated.)

89. The combined frequency band 7H and frequency band 8L are uplink channels. However, the circuitry for amplifying an uplink frequency is no different than the circuitry for amplifying a downlink frequency. (See e.g., McKay, Ex. 1007, ¶110; and see '190 Patent, Ex. 1001, 10:60-11:3.) A person of ordinary skill in the art would be motivated to modify the system of Layne to transmit a combined downlink signal instead of a combined uplink channel. A

person of ordinary skill in the art would understand that the amplification path of Layne simultaneously amplifies frequency band 7H and frequency band 8L.

wherein the shared amplification path comprises a first band-pass filter configured to pass both the first downlink channel of the first frequency band and the second downlink channel of the second frequency band, and to attenuate both a first uplink channel of the first frequency band and a second uplink channel of the second frequency band

90. Layne discloses, “the transmit filter 30 passes signals in the 7H and 8L frequency bands and rejects or filters signals in the 7L and 8H frequency bands.” (Layne, Ex. 1011, 3:57-59.) A person of ordinary skill in the art would understand that the transmit filter 30 passes a portion of a first channel (7H) of a first frequency band (700 MHz Public Safety Frequency Band) and passes a portion of a second channel (8L) of a second frequency band (800 MHz Public Safety Frequency Band). A person of ordinary skill in the art would understand that the common amplification path of Layne can provide amplification to frequency band 7H and frequency band 8L.

91. Layne discloses: “Thus, the transmit filter 30 passes signals in the 7H and 8L frequency bands and **rejects or filters signals in the 7L and 8H frequency bands.**” (*Id.*, Ex. 1011, 3:57-58) (Emphasis added.) A person of ordinary skill in the art would understand that this discloses a band-pass filter

configured to “attenuate both the first channel of the first frequency band and the first channel of the second frequency band.”

wherein the first downlink channel and the second downlink channel are adjacent in frequency to one another

92. Layne discloses or suggests this limitation. Layne discloses, “The transmit filter 30, in this exemplary embodiment, is a single bandpass filter configured to pass signals in the **7H and 8L** frequency bands (e.g., communicating signals in the 7H and 8L frequency band to be transmitted by the radio 20).” (Layne, Ex. 1011, 3:53-56) (Emphasis added.) More specifically, the mobile radio in Layne discloses an uplink amplification path 94 that comprises a low noise amplifier 90, power amplifier 86, and a bandpass filter 30 configured to pass signals in both the 7H and 8L bands. (*Id.*, FIG. 3.) 7H ranges from 794 MHz to 806 MHz and 8L ranges from 806 MHz to 824 MHz. (*Id.*, 3:3-21; and see 2:34-39; “In general, various embodiments of the invention provide integration of full duplex operation into a radio chassis by combining the 700 MHz and 800 MHz transmit bands using a single bandpass filter for radio transmission and a diplex filter configured as a dual band front end filter for radio reception.”)

93. As shown clearly on FIG. 2 of Layne (reproduced below), frequency bands 7H and 8L are contiguous.

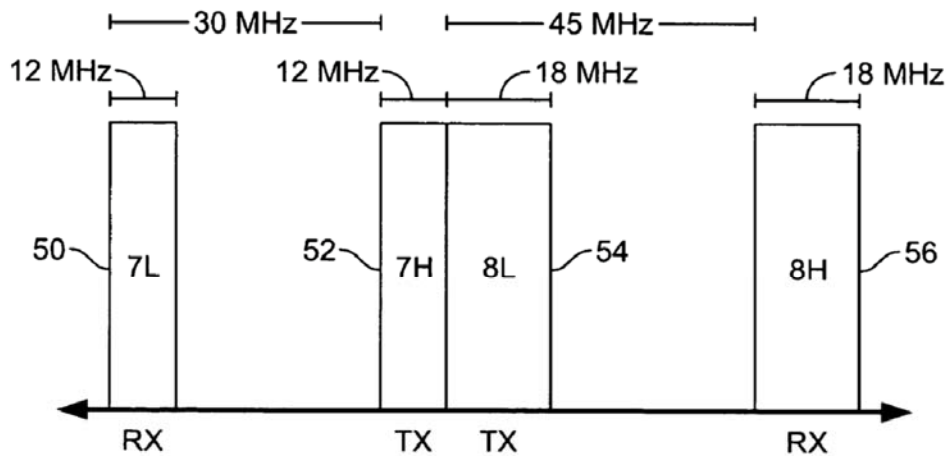


FIG. 2

(Layne, Ex. 1011, FIG. 2.)

94. As noted above, while the 7H and 8L Bands in Layne are transmission or uplink bands, the amplification of an uplink band is no different than the amplification of a downlink band. (See e.g., McKay, Ex. 1007, ¶110; and see ‘190 Patent, Ex. 1001, 10:60-11:3.)

wherein the shared amplification path further comprises at least one amplifier.

95. Layne discloses that “[t]he input of the transmit filter 30 is connected to a switch 85, a **power amplifier 86** (providing a final amplifier stage) that is connected to a first attenuator 88, an **amplifier 90** and a second attenuator 92.” (Layne, Ex. 1011, 3:65-4:1.) A person of ordinary skill in the art would

understand that the power amplifier 86 and the amplifier 90 are both amplifiers that are included on the common amplification path of the 7H and 8L channels.

96. The only limitation in claim 19 that is not disclosed in the Layne is implementation of shared amplification path on a PCB and a shared downlink channel. The person of ordinary skill would understand at least from Sahota (or any other number of prior art references) that signal boosters are implemented on a PCB for ease of manufacturing. The person of ordinary skill would also understand (at least from McKay or any other number of prior art) that the circuitry for amplification of uplink and downlink signals is the same. As such, the person of ordinary skill would modify Layne at least in view of Sahota and McKay to arrive at the claim limitation of claim 19.

ix. Claim 20 of the '190 Patent

The apparatus of claim 19, wherein the first downlink channel of the first frequency band comprises a Band XII downlink channel, and wherein the second downlink channel of the second frequency band comprises a Band XIII downlink channel.

97. Sahota discloses Band XII and Band XIII. (Sahota, Ex. 1008, Table 1 and ¶ 0069.)

TABLE 1

Frequency Band	Transmit Band Uplink (MHz)	Receive Band Downlink (MHz)	Common Name	Frequency Band
UMTS Band I	1920-1980	2110-2170	IMT-2000	
UMTS Band II	1850-1910	1930-1990	PCS	GSM 1900
UMTS Band III	1710-1785	1805-1880	DCS	GSM 1800
UMTS Band IV	1710-1770	2110-2170		
UMTS Band V	824-849	869-894	Cellular	GSM 850
UMTS Band VI	830-840	875-885		
UMTS Band VII	2500-2570	2620-2690		
UMTS Band VIII	880-915	925-960		
UMTS Band IX	1750-1785	1845-1880		
UMTS Band X	1710-1770	2110-2170		
UMTS Band XI	1428-1453	1476-1501		
UMTS Band XII	698-716	728-746		
UMTS Band XIII	777-787	746-756		
UMTS Band XIV	788-798	758-768		
	890-915	935-960		GSM 900

(*Id.*, Ex. 1008, Table 1.)

98. The '190 Patent discloses:

Although specific frequency ranges have been provided above persons of ordinary skill in the art will appreciate that **the frequencies of the bands can vary by geographical region and/or can change over time based on regulations set by governing agencies such as the Federal Communications Commission (FCC) or the Canadian Radio-television and Telecommunications Commission (CRTC).** Additionally, the teachings herein are applicable to configurations in which a signal booster provides amplification to a portion of the sub-bands associated with one or more frequency bands.

('190 Patent, Ex. 1001, 5:39-48) (Emphasis added.)

99. Sahota discloses that the downlink channel of Band XII occupies 728 MHz to 746 MHz and the downlink channel of Band XIII occupies 746 MHz to 756 MHz. (See Sahota, Ex. 1008, Table 1.) Sahota further discloses that the uplink channel of Band XII occupies 698 MHz to 716 MHz and the uplink channel of Band XIII occupies 777 MHz to 787 MHz. (*Id.*)

100. Based on the combined teachings of Layne and Sahota, a person of ordinary skill in the art would understand that: (1) bands that are contiguous can be passed using a single bandpass filter and amplified with a single amplifier, and (2) the downlink channels of Band XII and the downlink channels of Band XIII are contiguous. A person of ordinary skill in the art would also understand that “the frequencies of the bands can vary by geographical region and/or can change over time based on regulations set by governing agencies such as the Federal Communications Commission (FCC).” (‘190 Patent, Ex. 1001, 5:41-44.) Based on these combined teachings, a person of ordinary skill in the art would understand that the downlink channels of Band XII and the downlink channels of Band XIII can be passed using a single bandpass filter.

101. Put another way, one of ordinary skill could easily modify the teachings of Layne to achieve this claim limitation, particularly if the person was interested in accommodating frequency bands XII and XIII. The different frequency band ranges used in the spectrums described in the ‘190 Patent,

including Bands XII and XIII, are assigned by the Federal Communications Commission (FCC). There is nothing unique or special about an uplink frequency being greater or less than the downlink frequency in any particular channel. The frequency ranges are simply segments of the radio signal spectrum naturally available for use in the ambient environment and apportioned by the FCC to facilitate a common system to use that radio signal spectrum. Different governments divide up the spectrum differently. (See, e.g., Cook Decl., Ex. 1010, ¶¶ 7-15). Thus, the use of Band XII or Band XIII require nothing more than the use of known engineering principles to achieve a predictable outcome.

x. Claim 24 of the '190 Patent

The apparatus of claim 19, wherein the first downlink channel of the first frequency band and the second downlink channel of the second frequency band are abutting in frequency.

102. As I have noted previously, I believe that the correct characterization of the transmit bands in Layne is “contiguous.” That said, Layne states “that the two mobile transmit bands, frequency bands 52 and 54 are adjacent as shown in FIG. 2.” (Layne, Ex. 1011, 3:19-21.)

B. The DUO Repeater and Sahota and/or the TEK0 Repeater Disclose or Suggest the Elements Recited in Claims 1-4, 6, 8, 18-20, and 24.

103. Generally speaking, the DUO Repeater is a wireless signal power amplifier designed to amplify the signal strength of cellular signals in the SMR800

and SMR900 frequency channels. The DUO Repeater and Sahota disclose or suggest all of the elements recited in claims 1-4, 6, 8, 18-20, and 24 of the '190 Patent. Below, I address each of these claims and their respective limitations.

i. Claim 1 of the '190 Patent

A radio frequency signal booster comprising

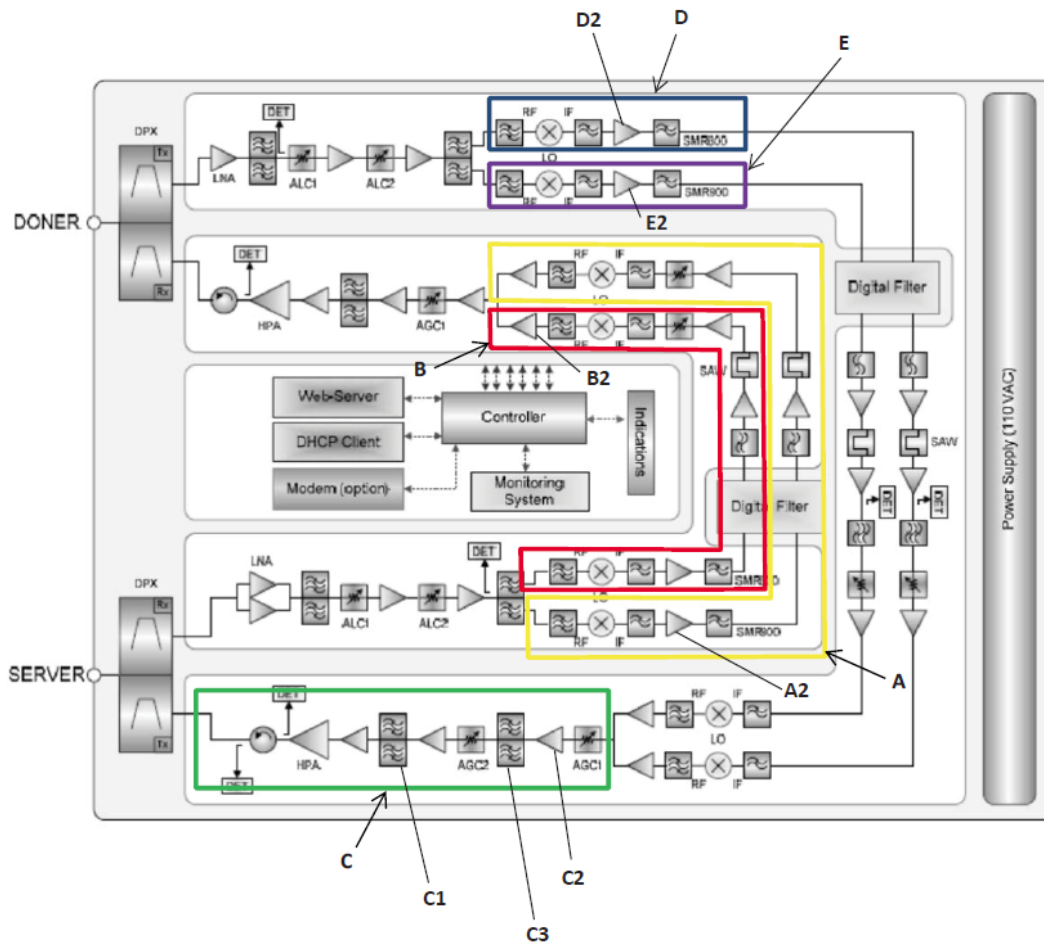
104. I have been asked to consider a scenario where the preamble of claim 1 is not limiting. Even if it is limiting, the DUO Repeater is a radio frequency signal booster. (DUO Repeater, Ex. 1009, at 5)

a printed circuit board (PCB) comprising

105. The DUO Repeater discloses a housing (*Id.* at 6, 7) and a PCB within the cavity of the housing. (*Id.* at 11.)

a shared amplification path configured to provide amplification to at least a portion of a first downlink channel of a first frequency band and to provide amplification to at least a portion of a second downlink channel of a second frequency band, wherein the first frequency band and the second frequency band are different frequency bands

106. The DUO Repeater discloses or suggests this limitation. An annotated schematic for the DUO Repeater is shown below:

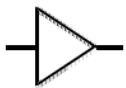


(*Id.*, FIG. 4, annotated.)

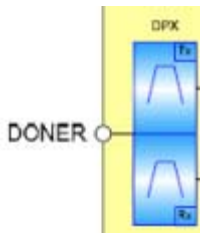
107. There are symbols used in electrical engineering schematics that are known to persons of ordinary skill in the art at the time of the alleged invention of the '190 Patent and which are shown on the DUO Repeater. The following are some symbols that are used in the DUO Repeater and their meaning:



This symbol represents a bandpass filter or BPF. As stated elsewhere in this Declaration, a bandpass filter is a device that passes frequencies within a certain range and rejects (attenuates) frequencies outside that range.



This symbol represents an amplifier. The DUO Repeater specifically identifies this symbol as a signal amplifier. Additional annotations are used to specifically indicate when an amplifier is an LNA (low-noise amplifier) or an HPA (high-power amplifier).



This symbol is sometimes used to represent a duplexer coupled to an antenna. A duplexer (also referred to as a multiplexer) is an electronic device that allows bi-directional communication over a single path. In radio signal systems, it isolates the receiver from the transmitter while permitting them to share a common antenna. Most radio repeater systems include a multiplexer. The antenna (i.e., the open circle) is labeled as a “donor” or “server.” The donor

antenna transmits or receives signals from the cell tower/base station. The server antenna transmits or receives signals from the user device (i.e., the cell phone).

108. The DUO Repeater discloses a plurality of uplink amplification paths shown at A (shown in yellow) and B (shown in red) in the annotated FIG. 4, *supra*. (*See also* DUO Repeater, Ex. 1009, pp. 5, 9, and 30.) The server side of the repeater refers to the antenna that transmits/receives signals from/to the user device (i.e., the cell phone) and the donor side of the repeater refers to the antenna receiving and/or sending information to the cell tower/base station. The amplification paths shown at A and B are uplink amplification paths and comprise a plurality of band pass filters and power amplifiers. (*Id.*)

109. While I think this claim element is ambiguous, I have been asked to consider the scenario where the phrase “second downlink channel of a second frequency band” does not mean that there are two different downlink channels of the second frequency band. Rather, there is a single downlink channel but it is referred to as the “second downlink channel.” Under that scenario, the DUO Repeater discloses this limitation. A plurality of downlink amplification paths are shown at C (shown in green), D (shown in blue), and E (shown in purple). Amplification path D is marked as propagating the SMR800 downlink frequency (i.e., 851 – 869 MHz). Amplification path E is marked as propagating the SMR900 downlink frequency band (i.e., 935-940 MHz). Amplification path C is

a common downlink amplification path that provides amplification to the downlink channel for both the SMR800 and SMR900 bands. (*Id.*, and see annotated FIG. 4, *supra.*)

wherein the shared amplification path comprises a first band-pass filter configured to pass the at least a portion of the first downlink channel and the at least a portion of the second downlink channel, wherein the shared amplification path is further configured to simultaneously boost both the at least a portion of the first downlink channel and the at least a portion of the second downlink channel

110. The DUO Repeater discloses this limitation. The downlink amplification path C discloses bandpass filter or BPF (C1) that passes the downlink channel for the SMR800 and SMR900 Bands. The common downlink amplification path C has one or more power amplifiers (e.g., C2) that amplify the combined downlink signals for the SMR800 and SMR900 Bands. (*Id.* at 9; and see annotated FIG. 4, *supra.*)

wherein the first downlink channel and the second downlink channel are adjacent in frequency to one another

111. The downlink channels for the SMR800 and SMR900 Bands are separated by about 66 MHz. (*Id.* at 30.) Under the broadest reasonable interpretation, these two downlink channels are adjacent. To the extent they are

not considered adjacent by others, one of ordinary skill would be motivated to modify the DUO Repeater so that the downlink channel frequencies were closer together, particularly if a person of ordinary skill wanted to accommodate Bands XII and XIII in the repeater. Different frequency band ranges used in the spectrums described in the '190 Patent, including Bands XII and XIII, are assigned by the Federal Communications Commission (FCC). There is nothing unique or special about the separation between downlink frequency bands. The frequency ranges are simply segments of the radio signal spectrum naturally available for use and apportioned by the FCC to facilitate a common system to use that radio signal spectrum. Different governments divide up the spectrum differently. (See, e.g., Cook Decl., Ex. 1010, ¶¶7-15.) The construction of the DUO Repeater suggests that amplification of the 66 MHz separation between the downlink bands was an acceptable trade-off (i.e., between component count and some noise amplification) in light of the reduced size and number of components. As the separation between adjacent bands decreases (i.e., less separation, less amplification of noise), there is even less concern about amplification of noise between the adjacent bands. Thus, when there is no separation (i.e., abutting or contiguous bands), the concern of that trade-off is non-existent because there is no amplification of unwanted noise.

112. To the extent there is any dispute regarding the ability of a band pass filter and amplifier arrangement to pass two downlink channels that are separated by less than 66 MHz, Layne discloses this concept.

wherein the shared amplification path further comprises at least one amplifier.

113. The common amplification path of the DUO Repeater (shown at C in green) has at least one amplifier. (DUO Repeater, Ex. 1009, pp. 5, 9, 30; see also, e.g., C2 in annotated FIG. 4, supra.)

ii. Claim 2 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the first band-pass filter is further configured to attenuate both a first uplink channel of the first frequency band and a second uplink channel of the second frequency band.

114. The DUO Repeater further discloses a third amplification path (C; shown in green) with a third BPF (C1). (See annotated FIG. 4, supra.) The third amplification path (C) amplifies radio signals in the downlink channel from both the SMR800 and SMR900 frequency bands. (See *id.*) The third BPF (C1) is configured to pass the downlink channel of these two bands (i.e., 851 to 869 MHz and 935 to 940 MHz) and to attenuate all other signals, including radio signals in the uplink channels for both the SMR800 and SMR900 bands. (*Id.*) A

person of ordinary skill in the art would know that a band-pass filter configured to pass certain frequencies is also configured to attenuate all other signals outside of that range.

iii. Claim 3 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the first downlink channel of the first frequency band comprises a Band XII downlink channel, and wherein the second downlink channel of the second frequency band comprises a Band XIII downlink channel.

115. The DUO Repeater suggests this limitation. At the time of the claimed invention of the '190 Patent, Bands XII and XIII had been designed by the 3GPP within the newly (circa 2009) created LTE radio signal frequency bands. This signal space had once been occupied, in part, by UHF TV channels 52-89 but was repurposed by the FCC to accommodate growing cell signal demand. (See, e.g., Cook Declaration, Ex. 1010, ¶¶ 12-14 and Sahota, Ex. 1008, ¶ 69 and Table 1.) Sahota discloses that the downlink channel of Band XII occupies 728 MHz to 746 MHz and the downlink channel of Band XIII occupies 746 MHz to 756 MHz. (See Sahota, Ex. 1008, Table 1.) Sahota further discloses that the uplink channel of Band XII occupies 698 MHz to 716 MHz and the uplink channel of Band XIII occupies 777 MHz to 787 MHz. (Sahota, Ex. 1008, Table 1.) Sahota further

discloses a tunable filter that can be modified to accommodate multiple frequency bands.

116. The '190 Patent discloses:

Although specific frequency ranges have been provided above persons of ordinary skill in the art will appreciate that **the frequencies of the bands can vary by geographical region and/or can change over time based on regulations set by governing agencies such as the Federal Communications Commission (FCC)** or the Canadian Radio-television and Telecommunications Commission (CRTC).

Additionally, the teachings herein are applicable to configurations in which a signal booster provides amplification to a portion of the sub-bands associated with one or more frequency bands.

('190 Patent, Ex. 1001, 5:39-48) (Emphasis added.)

117. Even without Sahota, at the time of the claimed invention, a person of ordinary skill in the art would have modified the components of the DUO Repeater to operate in Bands XII and XIII because those bands, that had recently been auctioned off by the FCC, were being adopted and used by cell service providers. (See, e.g., Cook Declaration, Ex. 1010, ¶¶ 13-14.)

118. There are no unique modifications or changes to the DUO Repeater to accommodate Bands XII and XIII outside of conventional electrical engineering techniques known to persons of ordinary skill in the art. Those

conventional techniques include simply procuring bandpass filters and amplifiers tuned to accommodate the frequencies associated with Bands XII and XIII. This accommodation is nothing more than applying known electrical engineering techniques to achieve a predictable result.

iv. Claim 4 of the '190 Patent

The radio frequency signal booster of claim 3, wherein the first band-pass filter is further configured to pass at least a portion of a Band XII downlink channel having a frequency range of about 728 MHz to about 746 MHz, wherein the first band-pass filter is further configured to attenuate a Band XII uplink channel having a frequency range of about 698 MHz to about 716 MHz

119. One of ordinary skill could easily modify the components of the DUO Repeater to achieve this claim limitation, particularly if the person was interested in accommodating frequency Band XII. The DUO Repeater has a BPF that is designed to pass the downlink channel of the SMR800 and SMR900 Bands and attenuate all other frequencies, including the uplink channel for those two bands. (DUO Repeater, Ex. 1009, pp. 5, 9, and 30.) The different frequency band ranges used in the spectrums described in the '190 Patent, including Bands XII and XIII, are assigned by the Federal Communications Commission (FCC). At the time of the '190 Patent, it was known that the uplink and downlink frequencies for Band XII were 698-716 MHz and 728-746 MHz, respectively, at

least from Sahota. There is nothing unique or special about these frequency ranges. The frequency ranges are simply segments of the radio signal spectrum naturally available for use and apportioned by the FCC to facilitate a common system to use that radio signal spectrum. Different governments divide up the spectrum differently. (See, e.g., Cook Declaration, Ex. 1010, ¶¶7-15.) A band-pass filter could easily be manufactured to pass 728 MHz to 746 MHz and attenuate 698 MHz to 716 MHz.

wherein the first band-pass filter is further configured to pass at least a portion of a Band XIII downlink channel having a frequency range of about 746 MHz to about 757 MHz, wherein the first band-pass filter is further configured to attenuate a Band XIII uplink channel having a frequency range of about 776 MHz to about 787 MHz.

120. One of ordinary skill could easily modify the components of the DUO Repeater to achieve this claim limitation, particularly if the person was interested in accommodating frequency Band XIII. The DUO Repeater has a BPF that is designed to pass the downlink channel of the SMR800 and SMR900 bands and attenuate all other frequencies, including the uplink channel for those two bands. The different frequency band ranges used in the spectrums described in the '190 Patent, including Bands XII and XIII, are assigned by the Federal Communications Commission (FCC). At the time of the '190 Patent, it was

known that the uplink and downlink frequencies for Band XIII were 776-787 MHz and 746-757 MHz, respectively, at least from Sahota. There is nothing unique or special about these frequency ranges. The frequency ranges are simply segments of the radio signal spectrum naturally available for use and apportioned by the FCC to facilitate a common system to use that radio signal spectrum. Different governments divide up the spectrum differently. (See, e.g., Cook Decl., Ex. 1010, ¶¶ 7-15.) A band-pass filter could easily be manufactured to pass 746 MHz to 757 MHz and attenuate 776 to 787 MHz.

v. Claim 6 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the first downlink channel of the first frequency band and the second downlink channel of the second frequency band are abutting in frequency.

121. The downlink channels for the SMR800 and SMR900 bands are separated by about 66 MHz. (DUO Repeater, Ex. 1009, at 30.) As I noted above, the designation of different frequency bands and where they occupy the frequency spectrum is a designation by different government bodies, such as the FCC. During the process of assigning frequency designations for the different bands that would occupy the LTE domain, the downlink frequencies for Band XII and Band XIII were assigned 728-746 MHz and 746-756 MHz. The upper

boundary of the downlink frequency for Band XII and the lower boundary of the downlink frequency for Band XIII are contiguous. (See, e.g., Cook Decl., Ex. 1010, ¶ 14 and Sahota, Ex. 1008, ¶ 69 and Table 1.) At the time of the claimed invention of the '190 Patent, a person of ordinary skill in the art who wanted to accommodate Bands XII and XIII in a repeater would be motivated to modify the DUO Repeater so that the second channel of the first frequency band and the second channel of the second frequency band are abutting.

vi. Claim 8 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the shared amplification path further comprises one or more additional band-pass filters, wherein each of the one or more additional band-pass filters are configured to pass the at least a portion of the first downlink channel and the at least a portion of the second downlink channel.

122. The DUO Repeater discloses this limitation. The common downlink amplification path (C) discloses an additional BPF (C3) that passes the downlink channels for both the SMR800 and SMR900 Bands and attenuates all other signals, including the uplink signals for the SMR800 and SMR900 Bands. (DUO Repeater, Ex. 1009, pp. 5, 9, 30 and annotated FIG. 4, supra.)

vii. Claim 18 of the '190 Patent

The radio frequency signal booster of claim 1, wherein the PCB is configured to provide amplification to a plurality of frequency bands, wherein the plurality of frequency bands comprise Band II, Band IV, Band V, Band XII, and Band XIII.

123. The DUO Repeater suggests this limitation, particularly in view of the TEK0 Repeater and Sahota. As I have noted above, the different frequency band ranges used in the spectrums described in the '190 Patent, including those listed in this claim, are assigned by the Federal Communications Commission (FCC). At the time of the '190 Patent, these bands were all known and in use. (See, e.g., Cook Declaration, Ex. 1010, at ¶¶8-15. and Sahota, Ex. 1008, ¶69 and Table 1.) A person of ordinary skill in the art wanting to accommodate the bands recited in this claim element would modify the DUO Repeater to arrive at this limitation. There is nothing unique about these bands that would require modification of the DUO Repeater in a way that was outside of known techniques with predictable results and additional components similar to those in DUO could be used to accommodate these bands.

124. Indeed, the TEK0 Repeater discloses a signal booster with bands having similar frequencies recited in the claim. (See TEK0 Repeater, Ex. 1006, WE-SC 15823-15826.) There are some minor differences between the exact

frequency ranges reported for some of the amplified bands of the TEKO Repeater and the corresponding U.S. bands, but those differences are simply a function of the different choices of different government entities to divide up the naturally occurring frequency spectrum into different bands to be used by different entities. I also note that the TEKO repeater discloses a combined downlink amplification path for the downlink channels of bands XII and XIII. (*Id.* at WE-SC 15826.) Note that the downlink operating frequency band for the SMR700 band is listed as 728-757 MHz which is the combined frequency band for bands XII and XIII. (DUO Repeater, Ex. 1009, at 30.)

viii. Claim 19 of the '190 Patent

**An apparatus comprising a printed circuit board (PCB)
comprising**

125. The DUO Repeater discloses a housing (*Id.* at 6, 7) and a PCB within the cavity of the housing. (*Id.* at 11.)

**a shared amplification path configured to provide amplification to
a first downlink channel of a first frequency band and to provide
amplification to a second downlink channel of a second frequency
band, wherein the first frequency band and the second frequency
band are different frequency bands, wherein the shared
amplification path is further configured to simultaneously boost
both the first downlink channel and the second downlink channel**

126. While I think this claim element is ambiguous, I have been asked to consider the scenario where the phrase “second downlink channel of a second frequency band” does not mean that there are two different downlink channels of the second frequency band. Rather, there is a single downlink channel but it is referred to as the “second downlink channel.” Under that scenario, the DUO Repeater discloses this limitation. Amplification path C shows a signal amplification path where both the SMR800 and SMR900 downlink channels are amplified. (*Id.*; annotated FIG. 4, *supra.*)

wherein the shared amplification path comprises a first band-pass filter configured to pass both the first downlink channel of the first frequency band and the second downlink channel of the second frequency band, and to attenuate both a first uplink channel of the first frequency band and a second uplink channel of the second frequency band

127. The DUO Repeater discloses this limitation. The common downlink amplification path C discloses bandpass filter or BPF (C1) that passes the downlink channel for the SMR800 and SMR900 Bands. The common downlink amplification path C has one or more power amplifiers that amplify the combined downlink signals for the SMR800 and SMR900 Bands. (*Id.*; annotated FIG. 4, *supra.*) The BPF (C1) is configured to attenuate all other

signals, including radio signals in the uplink channels for both the SMR800 and SMR900 bands. (*Id.*; annotated FIG. 4, *supra.*)

wherein the first downlink channel and the second downlink channel are adjacent in frequency to one another

128. The downlink channels for the SMR800 and SMR900 frequencies are separated by about 66 MHz. (*Id.*, at 30.) In my opinion, these two downlink channels are adjacent. To the extent they are not considered adjacent by others, one of ordinary skill would be motivated to modify the DUO Repeater so that the downlink channel frequencies were closer together, particularly if a person of ordinary skill wanted to accommodate Bands XII and XIII in the repeater. Different frequency band ranges used in the spectrums described in the '190 Patent, including Bands XII and XIII, are assigned by the Federal Communications Commission (FCC). There is nothing unique or special about the separation between downlink frequency bands. The frequency ranges are simply segments of the radio signal spectrum naturally available for use and apportioned by the FCC to facilitate a common system to use that radio signal spectrum. Different governments divide up the spectrum differently. (See, e.g., Cook Decl., Ex. 1010, ¶¶ 7-15.)

wherein the shared amplification path further comprises at least one amplifier.

129. The common amplification path of the DUO Repeater (shown at C in green) has at least one amplifier. (DUO Repeater, Ex. 1009, pp. 5, 9, 30; see also, e.g., C2 in the annotated FIG. 4, supra.)

ix. Claim 20 of the '190 Patent

The apparatus of claim 19, wherein the first downlink channel of the first frequency band comprises a Band XII downlink channel, and wherein the second downlink channel of the second frequency band comprises a Band XIII downlink channel.

130. The DUO Repeater suggests this limitation. The DUO Repeater discloses a booster that filters and amplifies the SMR800 and SMR900 frequency bands. At the time of the claimed invention of the '190 Patent, Bands XII and XIII had been designed by the 3GPP within the newly (circa 2009) created LTE radio signal frequency bands. This signal space had once been occupied, in part, by UHF TV channels 52-89 but was repurposed by the FCC to accommodate growing cell signal demand. (See, e.g., Cook Decl., Ex. 1010, ¶¶ 12-14 and Sahota, Ex. 1008, ¶ 69 and Table 1.)

131. At the time of the claimed invention, a person of ordinary skill in the art would have modified the components of the DUO Repeater to operate in Bands XII and XIII because those bands had recently been auctioned off by the FCC, and were being adopted and used by cell service providers. There are no

unique modifications or changes to the DUO Repeater that would need to be made outside of conventional electrical engineering techniques known to persons of ordinary skill in the art to accommodate these two bands. Meaning, the amplifiers and band pass filters would simply be designed to accommodate a different frequency range. That accommodation is nothing more than applying known electrical engineering techniques to achieve a predictable result.

x. Claim 24 of the '190 Patent

The apparatus of claim 19, wherein the first downlink channel of the first frequency band and the second downlink channel of the second frequency band are abutting in frequency.

132. The downlink channels for the SMR800 and SMR900 bands are separated by about 66 MHz. (DUO Repeater, Ex. 1009, at 30.) As I noted above, the designation of different frequency bands and where they occupy the frequency spectrum is a designation by different government bodies, such as the FCC. During the process of assigning frequency designations for the different bands that would occupy the LTE domain, the downlink frequencies for Band XII and Band XIII were assigned 728-746 MHz and 746-756 MHz. The upper boundary of the downlink frequency for Band XII and the lower boundary of the downlink frequency for Band XIII are contiguous. (See, e.g., Cook Declaration, Ex. 1010, ¶ 14 and Sahota, Ex. 1008, ¶ 69 and Table 1.) At the

time of the claimed invention of the '190 Patent, a person of ordinary skill in the art who wanted to accommodate Bands XII and XIII in a repeater would be motivated to modify the DUO Repeater so that the second channel of the first frequency band and the second channel of the second frequency band are contiguous. Under the broadest reasonable interpretation, those bands would be adjacent.

133. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were 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.

DATED this 20th day of September, 2018.

A handwritten signature in dark ink, appearing to read 'WTR', is written over a horizontal line.

Dr. William T. Ralston