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PATENT APPLICATION

WIDEBAND TUNER ARCHITECTURE

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WIDEBAND TUNER ARCHITECTURE

CROSS-REFERENCES TO RELATED APPLICATIONS

- 5 **[0001]** The present application claims benefit under 35 USC 119(e) of U.S. provisional application number 61/170,526, filed April 17, 2009, entitled “Wideband Tuner Architecture,” the content of which is incorporated herein by reference in its entirety.

BACKGROUND OF THE INVENTION

- 10 **[0002]** This invention relates to wideband receiver systems and methods having a wideband receiver that is capable of receiving multiple radio frequency channels located in a broad radio frequency spectrum. In particular, the invention relates to wideband receiver systems that are capable of receiving multiple desired television channels that extend over multiple non-contiguous portions of the broad frequency spectrum and grouping them into a contiguous, or
15 substantially-contiguous frequency spectrum.

- [0003]** Receivers used to down-convert and selectively filter TV channels are referred to as tuners, and tuners designed to concurrently receive several TV channels are referred to as wideband tuners. Existing tuners for these applications down-convert a swath of channels to an intermediate frequency which are then sent to a demodulator. Because the swath of channels are
20 not contiguous, this swath includes the desired channels as well as undesired channels. The demodulator employs a high-speed data converter to capture this swath of desired and undesired channels in the digital domain and subsequently filters out the desired channels.

- [0004]** In general, television channels broadcasted over the air or over cable networks are distributed across a broad frequency spectrum. That is, the channel frequencies may not be
25 adjacent to each other. In certain applications such as DVR and picture-in-picture, the receiver system may have to concurrently receive several desired channels that may or may not be contiguous. The wideband receiver requirement poses a trade-off to the system to limit either the dynamic range of the wideband tuner or reduce the bandwidth covered by the tuner so that fewer channels may be received and processed by the demodulator.

[0005] FIG. 1 shows a conventional wideband tuner 100. Tuner 100 may be a direct conversion tuner and includes a low noise amplifier LNA1 having an input terminal coupled to a radio frequency (RF) input signal 102 and an output terminal coupled to a mixer M1. The RF signal may include one or more television channels receiving from a cable network via an RF connector or wirelessly via an antenna. The RF input signal may include the VHF and UHF television channels in a terrestrial television broadcasting system or the CATV channels in cable networks. In order to receive all broadcasted channels present in the RF input signal, LNA1 must necessarily have a wide tuning range, high linearity, and low noise. Mixer M1 is coupled to a synthesizer S1 that can generate an oscillator frequency located around the center of the RF signal. Mixer M1 frequency down-converts the received RF input signal to a more convenient intermediate frequency (IF) band. Tuner 100 includes an amplifier V1 having a programmable gain for amplifying the IF signal, which is then band-pass filtered by a filter F1 before outputting to a demodulator.

[0006] In general, the RF signal includes multiple desired channels that are located in non-contiguous portions of a radio frequency spectrum. As shown in FIG. 1, the swath of channels 110 occupies a bandwidth BW1 120 at an RF center frequency f_{rfc} 130. Synthesizer S1 may be tuned to a frequency around the center frequency f_{rfc} 130 for mixing channels 110 to an intermediate frequency f_{ife} 160, the frequency down-mixed channels 140 are amplified by amplifier V1 and then filtered by F1 to produce a swath of channels 170 centered around frequency f_{ife} 160. In an exemplary application shown in FIG. 1, bandwidth BW1 contains 10 channels. In the case where channels are TV channels that are spaced at either 6 MHz or 8 MHz in most parts of the world, bandwidth BW1 120 would span from 60-80MHz, i.e., the down-converted bandwidth at the intermediate frequency would require a bandwidth equal to at least BW1, or at least 80 MHz when such architecture is used. It is noted that in other applications where the desired RF channels are located in the low band such as channels numbers 2 to 6 (VHF in the terrestrial TV broadcast or CATV) and in the high band such as channels numbers 14 to 83 of the UHF TV broadcast or channel numbers 63-158 of the CATV's ultra band, the bandwidth BW1 can be 800 MHz or higher. This wide bandwidth of 800 MHz would require a very expensive digital processing circuitry such as very high-speed analog to digital conversion and high-speed processor in the demodulator.

[0007] It is desirable to have wideband receiver systems that can increase the dynamic range without requiring expensive data conversion, filtering and channel selection at the demodulator.

BRIEF SUMMARY OF THE INVENTION

[0008] An embodiment of the present invention includes a wideband receiver system that is configured to concurrently receive multiple radio frequency (RF) channels including a number of
5 desired channels that are located in non-contiguous portions of a frequency spectrum and group the desired channels in a contiguous or substantially-contiguous frequency band at an intermediate frequency spectrum, where the term “substantially-contiguous” includes spacing the desired channels close to each other (e.g. as a fraction of the total system bandwidth, or relative to a channel bandwidth) but with a spacing that can be variable to accommodate the needs of
10 overall system. The term “contiguous” heretofore encompasses “substantially-contiguous.” The term “spacing” is referred to as the frequency difference between adjacent channels. The system includes a wideband receiver having a complex mixer module for down-shifting the multiple RF channels and transforming them to an in-phase signal and a quadrature signal in the baseband or low intermediate frequency (IF) band. The system further includes a wideband analog-to-digital
15 converter module that digitizes the in-phase and quadrature signals. The digital in-phase and quadrature signals are provided to a digital frontend module that contains a bank of complex mixers that frequency-shift the number of desired channels to a baseband where the desired channels are individually filtered.

[0009] The digital frontend module may also include a decimator module that decimates the
20 desired RF channels by a factor M before demodulating them to a digital data stream.

[0010] In certain embodiments of the present invention, the wideband receiver system additionally includes an up-converter module having multiple complex up-mixers, each of the complex up-mixers is configured to frequency up-shift each one of the desired RF channels to a sub-portion of an IF spectrum, wherein all sub-portions of the desired channels are adjacent to
25 each another and form a contiguous frequency band in the IF spectrum. The act of frequency shifting the desired channels to the IF spectrum allows the wideband receiver system to directly interface with commercially available demodulators. Allowing the spacing of the desired channels in the contiguous spectrum to be variable allows a system to optimize placement of these desired channels for the purposes of avoiding sensitive portions of the spectrum which may
30 either be vulnerable to spurious signals and interference; or which may generate interference directly or as a harmonic product, to other systems.

[0011] In another embodiment of the present invention, a multi-tuner receiver system having two or more tuners is provided to receive multiple desired RF channels that extend over several non-contiguous sub-portions of a broad frequency spectrum and group them into a contiguous frequency spectrum. The multi-tuner system includes at least a first tuner that processes a first sub-portion of the broad frequency spectrum into a first in-phase signal and a first quadrature signal and a second tuner that processes a second sub-portion of the broad frequency spectrum into a second in-phase signal and a second quadrature signal. The multi-tuner receiver system further includes a first analog-to-digital converter module that digitizes the first in-phase and quadrature signals and a second analog-to-digital converter module that digitizes the second in-phase and quadrature signals. In addition, the multi-tuner system includes a first digital frontend module having a first number of complex mixers corresponding to a first number of the desired RF channels located in the first sub-portion of the broad frequency spectrum and a second digital frontend module having a second number of complex mixers corresponding to a second number of the desired RF channels located in the second sub-portion of the broad frequency spectrum. The first digital frontend module frequency shifts the first number of the desired RF channels to a first plurality of baseband signals and the second digital frontend module frequency shifts the second number of the desired RF channels to a second plurality of baseband signals.

[0012] The multi-tuner system further includes a first up-converter module having a plurality of N complex mixers, wherein N is an integer value equal to the number of desired channel. The first up-converter module frequency up-shifts the first plurality of the baseband signals to a first portion of an intermediate frequency. In addition, the multi-tuner system includes a second up-converter module that frequency up-shifts the second plurality of the baseband signals to a second portion of an intermediate frequency. The first and the second portions of the intermediate frequency are non-overlapping and located adjacent to each other to form a contiguous intermediate frequency (IF) band. The multi-tuner system further includes a digital-to-analog converter that converts the contiguous IF band to an analog waveform signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a schematic block diagram of a conventional wideband tuner;

[0014] FIG. 2 is a schematic block diagram of a wideband receiver system according to an embodiment of the present invention;

[0015] FIG. 3 is a simplified circuit diagram of a complex down-mixer according to an embodiment of the present invention;

[0016] FIG. 4 is a simplified schematic block diagram of a wideband receiver system according to another embodiment of the present invention;

5 [0017] FIG. 5 is a simplified circuit diagram of a complex up-mixer according to an embodiment of the present invention;

[0018] FIG. 6 is a simplified schematic block diagram of a wideband multi-tuner receiver system according to an embodiment of the present invention;

10 [0019] FIG. 7 is a block diagram illustrating an exemplary digital front end according to an embodiment of the present invention in more detail;

[0020] FIG. 8 is a block diagram illustrating an exemplary tiled up-converter module according to an embodiment of the present invention in more detail;

[0021] FIG. 9 is a simplified block diagram of a wideband multi-tuner receiver system 900 according to an embodiment of the present invention; and

15 [0022] FIG. 10 is a simplified block diagram of a wideband multi-tuner receiver system 1000 according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

20 [0023] FIG. 2 is a schematic block diagram of a wideband receiver system 200 according to an embodiment of the present invention. Wideband receiver system 200 includes a radio front end 210 and a digital front end 230. Radio front end 210 may be a single very wide-band tuner receiver that captures the desired swath of channels located in non-contiguous portions of the spectrum having a frequency bandwidth BW1 120. In this example, the number of available channels in BW1 120 are assumed to be 10 with each channel occupying an 8 MHz bandwidth
25 for a total of 80 MHz. Radio front end 210 is shown as including a low noise amplifier LNA 202 having an input terminal configured to receive an RF input signal 102. In the example shown, RF signal 102 includes four desired RF channels having the respective carrier frequency f_{rf1} , f_{rf2} , f_{rf3} , and f_{rf4} that are located in non-contiguous portions of the wide frequency spectrum BW1. It is understood, however, that spectrum BW1 120 may have any other number of desired

frequencies that are not contiguous. LNA 202 has a very low noise figure and very high linearity and a wide tuning range (i.e., very high IIP2 and IIP3 intercept points) to maximize a signal-to-noise-and distortion ratio (SNDR) at the amplifier output. LNA 202 may have a programmable gain to amplify RF signal 102 to adequate voltage levels for mixers M1 211 and M2 221.

5 **[0024]** Mixers M1 211 and M2 221 may be conventional mixers formed using, for example, differential Gilbert cells. Each of the mixers 211 and 221 multiplies (mixes) a amplified RF signal 203 with a respective first oscillator frequency signal 205 and a second oscillator frequency signal 207 to generate an in-phase signal 212 and a quadrature signal 222 that have a phase shift of 90° degree between them. Mixers 211 and 221 are identical so that the amplitude of the in-phase signal 212 and quadrature signal 222 are the same. The first and second oscillator frequencies 205 and 207 are identical and have a 90° degree phase shift generated through a 90° degree phase shifter P1 206. Synthesizer S1 may be a single local oscillator operable to generate the oscillator frequency 205 for converting the receive RF signal 102 to a zero-IF or low-IF band. Synthesizer S1 can be a coarse (large step) phase locked loop.

10 of the in-phase signal 212 and quadrature signal 222 are the same. The first and second oscillator frequencies 205 and 207 are identical and have a 90° degree phase shift generated through a 90° degree phase shifter P1 206. Synthesizer S1 may be a single local oscillator operable to generate the oscillator frequency 205 for converting the receive RF signal 102 to a zero-IF or low-IF band. Synthesizer S1 can be a coarse (large step) phase locked loop.

15 Synthesizer S1 can also be programmable to cover the wideband frequency of the analog and digital terrestrial broadcast and/or the cable television system. The RF signal 102 may have relatively uniform signal strength in a cable network. However, its signal strength may extend in several orders of magnitude in a terrestrial broadcast system, thus, LNA 202 and/or mixers M1 211, M2 221 are required to have a relatively high dynamic range to handle the large variations in the signal strength.

20 in the signal strength.

[0025] In-phase signal 212 and quadrature signal 222 are further amplified and filtered by respective amplifiers V1 213, V2 223 and filters F1 215, F2 225 to generate a filtered in-phase signal 216 and a filtered quadrature signal 226. Filters F1 215 and F2 225 may be passive or active low-pass filters to filter out any unwanted frequency components of the signals 214 and 224 before digitizing them for further processing in digital front end 230. It is understood that the in-phase path 216 and the quadrature path 226 must have the same amplitude spectrum and maintain a fixed phase relationship, i.e., amplifiers V1 213, V2 223 and filters F1 215, F2 225 must be substantially identical. Because the two paths 216 and 226 are in quadrature, the spectral components from both positive and negative frequencies can be overlaid so that the bandwidth (cutoff frequency) of filters F1 215 and F2 225 can be one half of the BW1 bandwidth

25 224 before digitizing them for further processing in digital front end 230. It is understood that the in-phase path 216 and the quadrature path 226 must have the same amplitude spectrum and maintain a fixed phase relationship, i.e., amplifiers V1 213, V2 223 and filters F1 215, F2 225 must be substantially identical. Because the two paths 216 and 226 are in quadrature, the spectral components from both positive and negative frequencies can be overlaid so that the bandwidth (cutoff frequency) of filters F1 215 and F2 225 can be one half of the BW1 bandwidth

30 bandwidth (cutoff frequency) of filters F1 215 and F2 225 can be one half of the BW1 bandwidth 120.

[0026] Analog-to-digital converters ADC1 218 and ADC2 228 are high-speed (i.e., high sampling rate) converters to maximize the dynamic range. In an exemplary application, radio front end 210 operates as a nominal zero-IF down-mixer so that signals 216 and 226 have a nominal bandwidth 290 equal to one half of the RF signal bandwidth BW1 thanks to the complex down-mixer architecture. In other embodiment, radio front end 210 operates as a low-IF down-mixer so that the nominal bandwidth 290 of signals 216 and 226 is greater than one half of the bandwidth BW1. In practice, the sampling rate of ADC1 218 and ADC2 228 is chosen to be higher than the Nyquist sampling requirement, i.e., the filtered analog quadrature signals 216 and 226 may be over-sampled in order to reduce or avoid aliasing of undesired signals into the digitized I and Q signals.

[0027] ADC1 218 generates a digital signal I 232 that is a digital representation of the analog filtered signal 216; ADC2 228 generates a digital signal Q 242 that is a digital representation of the analog filtered signal 226. Digital signals I 232 and Q 242 are then applied to a bank of N complex mixers 250, wherein N is an integer value corresponding to the number of desired RF channels located in the non-contiguous portions of the frequency spectrum BW1. It is understood that the number N can be any integer value. In one embodiments, N can be equal to the number of all available channels that exist in the licensed frequency spectrum to provide system flexibility. In other embodiments, N can be equal to the number of all receivable channels within a geographic area. In yet another embodiments, N can be an integer value less than the number of receivable channels with the geographic area to reduce system costs. In the exemplary embodiment shown in FIG. 2, the number of desired channels are 4. That is, each of the 4 complex mixers 250 mixes in-phase and quadrature signals 232 and 242 with an associated frequency to generate a corresponding baseband, which is then individually filtered, decimated and provided to an associated demodulator.

[0028] Each of the N complex mixers 250 receives the digital signals I 232 and Q 242 from ADCs 218 and 228 to extract a different one of the desired channels and frequency-shifts the extracted signals to the baseband frequency. Each of the frequency shifted desired channels 252 is filtered by an associated filter module (identified as 260a to 260n). In an embodiment, each of the filtered signals 260a to 260n may be sent directly to an associated demodulator (identified as 270a to 270n) for extracting the original information transmitted in the associated desired channel. In another embodiment, each of the filtered signals 262a to 262n is further decimated

before providing to a demodulator. A path of digital front end 230 is described in more detail below.

[0029] FIG. 3 is a simplified circuit diagram of one of the signal paths 272a to 272n of digital front end 230 shown in Figure 2 according to an embodiment of the present invention. In an embodiment, digital signal I 232 may be further filtered by a filter 311 to obtain a filtered signal 312. Similarly, digital signal Q 242 may be further filtered by a filter 321 to obtain a filtered signal 322. Thus, digital signals 312 and 322 only contain low-frequency components with undesired high-frequency components being eliminated by respective filters 311 and 321. It is noted that filtered signals 312 and 322 are interposed between the respective ADCs 218, 228 and the bank of N complex mixers 250.

[0030] Mixer 300, which represents one of the N complex mixers 250, includes four multipliers 313, 315, 323, and 325. Multipliers 313 and 315 multiply the filtered signal 312 with respective $\cos(\omega_{ci}t)$ and $\sin(\omega_{ci}t)$ signals and generate respective products 314 and 316.

Similarly, multipliers 323 and 325 multiply the filtered Q signal 322 with respective $\cos(\omega_{ci}t)$ and $\sin(\omega_{ci}t)$ signals and generate respective products 324 and 326. An adder 317 sums the products 314 and 326 to generate a frequency-shifted signal I 318. An adder 327 sums the products 324 and 316 to generate a frequency-shifted signal Q 328. Basically, complex mixer 300 causes a frequency shift of the filtered components 312 and 322 to respective baseband signals 318 and 328 in the digital domain according to the operation:

$$Y(t) = X(t) * e^{-j\omega_c t} \quad (1)$$

or taken the Fourier transform, we obtain:

$$Y(\omega) = X(\omega - \omega_c) \quad (2)$$

[0031] Multipliers 313, 315, 323, and 325 are identical digital multipliers. In an embodiment, a numerically controlled oscillator with quadrature output generates the $\cos(\omega_{ci}t)$ and $\sin(\omega_{ci}t)$ signals. Numerically controlled oscillators (NCO) can be implemented using a phase accumulator and a look-up table. NCOs are known to those of skill in the art and will not be described herein. The frequency ω_{ci} is so chosen that each one of the desired channels embedded in the digital signals I 232 and Q 242 will be downshifted to the baseband. In the given example shown in FIG. 2, the bank of N complex mixers will have four complex mixers,

each one of the N (i.e., four) complex mixers is coupled to an individual NCO having a distinct frequency ω_{ci} so that when mixing the filtered digital I and Q signals 312 and 322 with that frequency, each one of the complex mixers will generate the signals I (318) and Q (328) of a corresponding one of the desired channels at the baseband.

5 **[0032]** In an embodiment, baseband signals 318 and 328 are further individually filtered by respective filters 330 and 340 that are identified as one of the filters 260a-n in FIG. 2. Filters 330 and 340 may be band-pass or low-pass filters having a narrow bandwidth equal to the bandwidth of a desired channel. In certain embodiments, filters 330 and 340 can be analog
10 passive or active low-pass or complex band-pass filters such as polyphase filters. In another embodiment, filters 330 and 340 can be digital low-pass filters, such as finite impulse response (FIR) filters to eliminate high frequency components that may be aliased back to the baseband signals I_i (332) and Q_i (342) when decimated by subsequent decimator 350.

[0033] The reduced sampling rate of the N desired baseband channels will be sent as a serial or parallel digital data stream to a demodulator using a serial or parallel data interface according to
15 commonly known methods, as shown in FIG. 2. This approach provides several advantages over conventional tuner architectures. First, it eliminates the need of expensive data conversion, filtering and channel selection on the demodulator side. Second, it removes undesired channels from the signal path at an early stage, thus relieves the large dynamic range requirement in the demodulator.

20 **[0034]** FIG. 4 shows a simplified schematic block diagram of a wideband receiver system 400 according to another embodiment of the present invention. Wideband receiver system 400 includes a radio front end 410, a digital front end 430, a tiled up-conversion module 450, and a summing digital-to-analog converter module DAC 470. Radio front end 410 includes a low noise amplifier LNA1 that receives an RF input signal 102 and provides an amplified RF signal
25 403 to mixers M1 411 and M2 421. Mixer M1 411 is coupled to an oscillator frequency 405 of a synthesizer S1 whereas mixer M2 421 is coupled with the oscillator frequency 405 via a phase shifter P1 406 that generates a 90° degree phase-shift to the oscillator frequency 405. Mixers M1 411 and M2 421 generate respective in-phase signal 412 and quadrature signal 422 that are further amplified by respective amplifiers V1 413 and V2 423. The amplified in-phase and
30 quadrature signals 414, 424 are then filtered by filters F1 415 and F2 425 to eliminate undesired frequency components that would be aliased back to the in-phase and quadrature signals when

digitally sampled by subsequent analog-to-digital converters ADC1 418 and ADC2 428. Digital signals I 422 and Q 442 at the input of digital front end 430 are digital representations of the filtered analog in-phase and quadrature signals 416, 426 before the ADCs. Digital front end 430 include a bank of N complex mixers 432 comprising 432a to 432n identical mixers, where N is an integer value corresponding to the number of the desired channels located in non-contiguous portions of the frequency spectrum. Each of the N complex mixers 432a to 432n frequency down-converts signals I 432 and Q 442 to an associated baseband. Each of the frequency down-converted I and Q signals are coupled to respective low-pass, band-pass, or decimating filters 434. In this regard, the radio front end 410 and the digital front end 430 are similar to respective radio front end 210 and digital front end 230 of FIG. 2 that have been described in detail above.

[0035] In an alternative embodiment of the present invention, the N filtered and decimated channels 438a to 438n (where indices a to n correspond to the associated number of desired channels) are not provided to a demodulator for demodulation. Instead, the N filtered and decimated channels 438a to 438n are further frequency up-converted to an intermediate frequency (IF) spectrum. In order to achieve that, the N filtered and decimated channels are coupled to a tiled up-conversion module 450 that includes a bank of N complex up-mixers, where N is an integer value correspond to the number of desired received channels. The N complex up-mixers include identical digital mixers 452a to 452n that will be described further in detail below with reference to FIG. 5. The N up-shifted channels are then filtered by a subsequent bank of channel filters 454 that, in an embodiment, comprises N individual finite impulse response (FIR) filters. The N filtered channels are then digitally combined and converted to the analog domain by a summing digital-to-analog converter module DAC 470. The N up-shifted channels are adjacent to each other and form a contiguous or substantially-contiguous set of channels 475 in the IF spectrum centered around f_{if} as illustrated in FIG. 4. In an embodiment, the spectra of the mixed products are spaced in such a way so as to avoid overlap with known frequency bands containing potential or actual interferers. In another embodiment, the spectra of the mixed products are spaced in such a way so as to avoid overlap with frequency bands that might introduce interference to other systems. In general, because the bandwidth BW2 is substantially lower than BW1, the IF frequency f_{if} can be set proportionally lower, e.g., typically about 16 MHz to accommodate the spectrum of BW2 of up to 32 MHz (corresponding to the total bandwidth of the four desired channels, each having a bandwidth of 8 MHz in this example).

[0036] The up-conversion approach of FIG. 4 provides several advantages over conventional tuner architectures. First, it allows the demodulator to operate the data converter at a lower data rate and with lower resolution (fewer bits) due to the fact that the contiguous channels have a narrower bandwidth. Second, the up-conversion approach provides full compatibility with existing demodulators that require an analog IF signal. Third, it removes undesired channels from the signal path at an early stage, thus relieves the requirement of a high dynamic range requirement of the demodulator's analog-to-digital converter and the demodulator itself.

[0037] FIG. 5 shows a simplified exemplary circuit diagram of a complex up-mixer 500 according to an embodiment of the present invention. Up-mixer 500 is one of the N complex up-mixers 452a to 452n in tiled up-conversion module 450 shown in FIG. 4. Up-mixer 500 includes filter 510 and 520 configured to eliminate unwanted frequency components present in respective input signals I 501 and Q 502. Filtered signals 512 and 522 are provided to up-mixers UMI 515 and UMQ 525 that multiply the filtered signals 512 and 522 with respective $\cos(\omega_u t)$ and $\sin(\omega_u t)$. The products 516 and 526 are summed in an adder 530 to generate an IF signal 532 according to the following equation:

$$IF(t) = I(t) * \cos(\omega_u t) + Q(t) * \sin(\omega_u t) \quad (3)$$

[0038] Up-mixers UMI 515 and UMQ 525 are identical digital multipliers that multiply the respective filtered signal 512 and 522 with a cosine function 505 and a sine function 506 that can be generated from a NCO using a digital phase accumulator and a look-up table.

[0039] As described above, TV channels are grouped into multiple frequency bands in North America. For example, channels 2 through 6 are grouped in VHF-low band (aka band I in Europe), channels 7 through 13 in VHF-high band (band III), and channels 14 through 69 in UHF band (bands IV and V). In order to receive such a wide frequency spectrum, the low noise amplifier and mixer must have very low noise, wide tuning range, and high linearity as described above in the wideband receiver systems 200 and 400. However, a wideband receiver having a single tuner with high sensitivity may have a high power consumption. For certain applications, it may be advantageous to use multiple tuners that are optimized for a given frequency band, such as a dedicated tuner for the low VHF band, another dedicated tuner for the high VHF band and the UHF band, and yet other dedicated tuners for receiving the digital video broadcasting (DVB) via satellite (DVB-S), via cable (DVB-C), or terrestrial digital video broadcasting

(DVB-T). The multi-tuner approach may also be advantageously applied to cable networks that carry TV programs on an 88 MHz to 860 MHz according to the Data Over Cable Service Interface Specification (DOCSIS) protocol.

[0040] FIG. 6 shows a simplified schematic block diagram of a wideband multi-tuner receiver system 600 according to an embodiment of the present invention. In an embodiment, multi-tuner system 600 includes low noise amplifier A1602 for receiving an RF input signal 601. Amplifier A1 602 is coupled to at least a tuner1 610 and a tuner2 620. In another embodiment, multi-tuner system 600 may not include amplifier 602 so that RF input signal 601 can be received directly at each tuner 610 and 620.

[0041] Tuner1 610 includes an amplifying filter AF1 613 that filters and amplifies a first portion BWtuner1 604 of a broad frequency spectrum 608 that contains a first plurality of RF channels 606 including desired channels 607 having respective channel frequencies f_{rf1} and f_{rf2} . The first portion of the broad frequency spectrum BWtuner1 604 is then frequency down-converted to a low-IF or zero-IF in-phase signal I1 612 and a quadrature signal Q1 622 through respective mixer M1 611 and M2 621. Signals I1 612 and Q1 622 are further amplified and low-pass filtered before applying to respective analog-to-digital converters ADC1 618 and ADC2 628 that convert analog signals Ia1 616 and Qa1 626 to respective digital in-phase signal Id1 631 and digital quadrature signal Qd1 641. Because tuner1 610 only covers a portion BWtuner1 604 of the entire frequency spectrum 608 having fewer channels, the ADC1 618 and ADC2 628 can be slower-speed analog-to-digital converters with a large number of bits, i.e., large dynamic range.

[0042] Digital signals Id1 631 and Qd1 641 are then provided to a digital front end DFE 630 that includes a first bank of N complex mixers 632 and channel and decimating filters 634. The first bank of N complex filters 632 has N identical complex mixers, where N is an integer value equal to the number of desired channels located in the first portion BWtuner1 604 of the broad frequency spectrum 608. In an embodiment, each one of the first bank of N complex mixers includes four digital mixers that multiply digital stream Id1 631 and Qd1 641 with respective digitized cosine function and sine function to generate the sum and difference frequency components, as shown in FIG. 3. The digitized cosine and sine frequency, i.e., the mixer frequency is so chosen so that when mixing signals Id1 631 and Qd1 641 will move them to a baseband or a low-IF band. In an embodiment, channel and decimating filters have similar structures as filters 330 and 340 and demodulator 350 as shown in FIG. 3. That is, channel and

decimating filters include digital low-pass filters 330 and 340 that eliminates unwanted high frequency components of the baseband signals I and Q prior to applying them to a decimator 350 (FIG. 3) that reduces the sample frequency without any loss of information since Id1 631 and Qd1 641 are sampled at a much higher frequency by the respective ADC1 618 and ADC2 628.

5 [0043] The decimated desired channels are then provided to an up-converter module 650 that includes a bank of N up-mixers. The bank of N up-mixers includes N identical up-mixers whose structure is shown in FIG. 5. In an embodiment, N is an integer value equal to the number of desired channels present in BWtuner1 604. Each one of the up-mixer frequency-shifts the baseband signals I and Q of each one of the desired channels to an appropriate portion of the
10 intermediate frequency band according to Equation (3). In other words, the bank of N up-mixers is “frequency multiplexing” the desired channels onto a first portion 682 of an IF band 686.

[0044] Similarly, tuner2 720 includes an amplifying filter AF2 713 that is configured to receive a second portion BWtuner2 704 of the broad frequency spectrum 608. The second portion 704 contains a second plurality of RF channels 706 including a second number of desired
15 channels. In the exemplary illustration of FIG. 6, the second portion 704 has a frequency bandwidth of BWtuner2 that contains desired channels 707 having respective channel frequencies f_{rf3} and f_{rf4} . Tuner2 720 includes elements such as mixers M3 711, M4 721, amplifiers V3 714, V4 724, filters F3 715, F4 725 and analog-to-digital converters ADC3 731 and ADC4 741 that are substantially the same as the like-named elements of the signal path of
20 tuner1 610. Thus, redundant description is omitted herein.

[0045] Digital in-phase signal Id2 731 and digital quadrature signal Qd2 741 are then provided to digital front end 740. Digital front end 740 includes a bank of L complex filters, where L is an integer value equal to the number of desired channels in the second portion BWtuner2 704 of the broad frequency spectrum 608. Each one of the bank of L complex filters is a digital complex
25 mixer configured to transform the signals Id2 731 and Qd2 741 to baseband signals that are further filtered by individual digital low-pass filters such as FIR filters before decimated by a subsequent decimator. The elements of digital front end 740 are substantially similar to those described in digital front end 630. Thus, redundant description is omitted herein.

[0046] The decimated baseband I and Q channels are further provided to a subsequent up-
30 conversion module 760 that performs a function substantially similar to that of the up-conversion module 650 already described above. The outputs of up-conversion module 650 and 760 can be

5 tiled to generate a contiguous set of IF frequencies 682, 684 centered at f_{if} 686. In an embodiment, the outputs of up-conversion module 650 and 760 are digitally summed and converted to an analog signal by summing DAC 670. In another embodiment, the up-conversion modules 650 and 760 and the digital summing function 672 can be performed using an inverse discrete Fourier transform or an inverse Fast Fourier transform operation.

[0047] The multi-tuner architecture provides the flexibility that multiple commercially available tuners can be used without the need of designing a wideband tuner. For example, a tuner designed for a terrestrial broadcast digital TV can be used together with a tuner dedicated to receiving a cable signal and/or a tuner for receiving a satellite broadcast signal. The multi-tuner receiver system provides an additional advantage that other tuners can be added quickly to the system to accommodate any future applications. Additionally, the multi-tuner architecture allows the use of slower speed (i.e., lower cost) analog-to-digital converters with a larger number of bits for achieving large dynamic range.

[0048] FIG. 7 shows a block diagram of an exemplary digital front end of the invention in more detail. In an embodiment, in-phase signal Id2 731 and quadrature signal Qd2 741 at the output of respective ADC converters 718 and 728 are provided to each of the L complex mixers 732 comprising mixers 732A to 732L. A more detailed description of each of L complex mixers is shown in FIG. 3. Mixer 732A multiplies Id2 731 and Qd2 741 with a cosine signal and a sine signal that are generated from an NCO1 and produces an I-732A signal and a Q-732A signal that are further individually filtered by an FIR filter before decimating. The bank of L complex mixers corresponds to the block 732 in FIG. 6; and the set of FIR filters and decimator corresponds to the block 734 in FIG. 6. Each decimated pair of I-732i/M in the baseband, where the index “i” is from A to L, is further provided to a subsequent up-mixer for frequency-shifting to an intermediate frequency as shown in FIG. 8.

[0049] FIG. 8 shows an exemplary embodiment of a bank of L complex up-mixers according to the present invention. Each decimated pair of complex signals I-732i/M and Q-732i/M is provided to an associated complex up-mixer, whose frequency is so chosen that when mixing with the pair of complex signals I-732i/M and Q-732i/M will generate an associated channel at a predetermined sub-portion of the intermediate frequency band 686 (FIG. 6). A more detailed schematic block of one of the L up-mixers is described above together with FIG. 5.

[0050] FIG. 9 is a simplified block diagram of a wideband multi-tuner receiver system 900 according to an embodiment of the present invention. In an embodiment, system 900 includes a crossbar switch 910 having at least an input terminal 912 configured to receive signals from an analog-to-digital converter (ADC) 912 and an input terminal 922 configured to receive signals from an ADC 922. Crossbar switch 910 also includes an output terminal 924 that is coupled to a digital front end 930. In an embodiment, input terminals 912 and 922 of crossbar switch 910 have P inputs, where P is an integer value that is equal to the total number of desired channels received by tuner1 610 and tuner2 720. Output terminal 924 of crossbar switch 910 have Q outputs, where Q is an integer value that is equal to the total number of desired channels received by tuner1 610 and tuner2 720.

[0051] In an embodiment, digital front end 930 may include a bank of R complex mixers that frequency shifts the received channels to a baseband. Digital front end 930 may combine digital front end 630 and 740 shown in FIG. 6. Similarly, a tiled up-conversion module 950 may include up-converter modules 650 and 760 of FIG. 6.

[0052] System 900 further includes a summing DAC that operates similarly as summing DAC 470 and 670 that have been described in detail in relation with respective FIG. 4 and FIG. 6 above. Thus, redundant description is omitted herein.

[0053] FIG. 10 is a simplified block diagram of a wideband multi-tuner receiver system 1000 according to another embodiment of the present invention. System 1000 includes at least tuner1 610 coupled with digital front end 630 through an analog-to-digital converter 620 and tuner2 720 coupled with digital front end 740 through an analog-to-digital converter 730. System 1000 further includes a crossbar switch 1010 that is interposed between digital front ends 630, 740 and up-conversion modules 650, 760. Crossbar switch 1010 includes an input terminal 1012 having S inputs coupled with DFE 630 and an input terminal 1022 having T inputs coupled with DFE 740. In an embodiment, S is an integer value equal to the number of desired channels processed in DFE 630 and T is an integer value equal to the number of desired channels processed in DFE 740. Crossbar switch 1010 further includes an output terminal 1024 having U outputs coupled with up-converter module 650 and an output terminal 1024 having V outputs coupled with up-converter module 760. In an embodiment, the total number of the outputs U and V is equal to the sum of the inputs S and T. Thus, crossbar switch 1010 allows the routing of any channel from either DFE 630 or DFE 740 to up-converters 650 or 760. It is understood

that system 1000 is not as flexible as system 900 because DFE 630 and DFE 740 are already pre-assigned to respective tuner1 (610) and tuner2 (720). However, this pre-assigned arrangement allows a simpler implementation of crossbar switch 1010 that operates at lower speeds.

[0054] While several embodiments in accordance with the present invention have been

5 described, it is to be understood that the above description is intended to be illustrative and not restrictive. Many embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined not with reference to the above description, but instead should be determined with reference to the appended claims along with their full scope of equivalents.

WHAT IS CLAIMED IS:

- 1 1. A wideband receiver system comprising:
2 a wideband receiver configured to concurrently receive a plurality of desired RF
3 channels; said wideband receiver comprising:
4 a mixer module coupled to the plurality of desired RF channels and having a first
5 mixer configured to generate an in-phase signal and a second mixer configured to
6 generate a quadrature signal;
7 a wideband analog-to-digital converter (ADC) module having a first wideband
8 ADC coupled with the in-phase signal and configured to generate a digitalized in-phase signal
9 and a second wideband ADC coupled with the quadrature signal and configured to generate a
10 digitalized quadrature signal; and
11 a digital frontend (DFE) module having a plurality of complex mixers coupled to
12 the digital in-phase and quadrature signals, each one of the plurality of complex mixers
13 frequency-shifting a different one of the plurality of the desired RF channels to a baseband
14 signal.
- 1 2. The system of claim 1 further comprises a local oscillator having an
2 oscillator frequency centered around the plurality of the desired RF channels.
- 1 3. The system of claim 2 wherein the local oscillator comprises a phase-
2 locked loop.
- 1 4. The system of claim 1 wherein the plurality of desired RF channels
2 conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol.
- 1 5. The system of claim 1 wherein each one of the plurality of complex
2 mixers comprises a pair of digital multipliers, each pair of the digital multipliers is coupled to a
3 numerically controlled oscillator.
- 1 6. The system of claim 1 wherein the DFE module further comprises a
2 plurality of channel filters, each one of the plurality of channel filters is coupled to each one of

the plurality of complex mixers and configured to filter one of the plurality of the desired channels.

7. The system of claim 6 wherein each one of the plurality of channel filters is a finite impulse response filter.

8. The system of claim 1 wherein the DFE module further comprises a decimator module configured to decimate each one of the plurality of the desired channels in the baseband.

9. The system of claim 1 wherein the DFE module further comprises a digital interface module configured to communicate the decimated plurality of the desired channels to a demodulator.

10. The system of claim 1 further comprising:
an up-converter module configured to frequency-shift the plurality of desired RF channels in the baseband to an intermediate frequency band.

11. The system of claim 10 wherein the up-converter module comprises a plurality of N up-mixers having a plurality of associated oscillator frequencies,
wherein N is an integer value equal to the plurality of the desired RF channels;
wherein the plurality of associated oscillator frequencies are so chosen so that when mixing with the plurality of desired channels in the baseband, the mixed products occupy a contiguous frequency spectrum, or a substantially-contiguous frequency spectrum with one or more spacings between the desired channels,
wherein the one or more spacings are variable, and
wherein the one or more spacings are smaller than or comparable to a channel bandwidth, or small measured as a fraction of the bandwidth of the first and second wideband ADCs.

12. The system of claim 11 wherein the mixed products comprise spectra that are spaced in such a way so as to avoid overlap with known frequency bands containing potential or actual interferers.

1 13. The system of claim 11 wherein the mixed products comprise spectra that
2 are spaced in such a way so as to avoid overlap with known frequency bands that introduce
3 interference to other systems.

1 14. The system of claim 11 wherein each one of the plurality of N up-mixers
2 is a digital complex mixer and each one of the plurality of associated oscillator frequencies is
3 generated by a numerically controlled oscillator.

1 15. The system of claim 1 further comprises a digital-to-analog converter
2 configured to convert the contiguous group of channels in the intermediate frequency spectrum
3 to an analog waveform.

1 16. A multi-tuner receiver system for receiving a plurality of desired radio
2 frequency (RF) channels that extend over multiple non-contiguous portions of a broad frequency
3 spectrum and grouping them in a contiguous frequency spectrum, the system comprising:

4 a first tuner configured to receive a first portion of the broad frequency spectrum,
5 the first tuner includes a first mixer module coupled to a first oscillator and is configured to
6 generate a first in-phase signal and a first quadrature signal;

7 a second tuner configured to receive a second portion of the broad frequency
8 spectrum, the second tuner includes a second mixer module coupled to a second oscillator and is
9 configured to generate a second in-phase signal and a second quadrature signal;

10 a first analog-to-digital converter module configured to digitize the first in-phase
11 and quadrature signals;

12 a second analog-to-digital converter module configured to digitize the second in-
13 phase and quadrature signals;

14 a first digital frontend (DFE) module having a first bank of down-mixers coupled
15 to the first digital in-phase and quadrature signals, each of the first bank of down-mixers is
16 configured to frequency shift one of the desired RF channels in the first portion of the broad
17 frequency spectrum; and

18 a second digital frontend (DFE) module having a second bank of down-mixers
19 coupled to the second digital in-phase and quadrature signals, each of the second bank of down-

mixers is configured to frequency shift one of the desired RF channels in the second portion of the broad frequency spectrum;
wherein the first DFE module frequency-shifts the desired RF channels in the first portion of the broad frequency spectrum to a first portion of a baseband signal;
wherein the second DFE module frequency-shifts the desired RF channels in the second portion of the broad frequency spectrum to a second portion of the baseband signal.

17. The multi-tuner receiver system of claim 16 further comprising a crossbar switch interposed between the first and second analog-to-digital converter modules and the first and second DFE modules.

18. The multi-tuner receiver system of claim 16 further comprises:
a first up-converter module having a first bank of up-mixers coupled to the first portion of the baseband signal and configured to frequency shift the first portion of the baseband signal to a first portion of an intermediate frequency spectrum;
a second up-converter module having a second bank of up-mixers coupled to the second portion of the baseband signal and configured to frequency shift the second portion of the baseband signal to a second portion of the intermediate frequency spectrum; and
a digital-to-analog converter configured to convert the first and second portions of the intermediate frequency spectrum to an analog waveform signal.

19. The multi-tuner receiver system of claim 18 further comprising a crossbar switch interposed between the first and second DFE modules and the first and second up-converter modules.

20. The multi-tuner receiver system of claim 16 wherein the first and second portions are adjacent to each other and non-overlapping.

21. The multi-tuner receiver system of claim 16 wherein each one of the first bank of down-mixers comprises a pair of digital multiplier having an input terminal coupled to a numerically controlled oscillator.

22. The multi-tuner receiver system of claim 16 wherein the first DFE module further comprises a plurality of channel filters, each one of the plurality of channel filters is

coupled to each one of the first bank of down-mixers and configured to filter one of the frequency down-shifted RF channels.

23. The multi-tuner receiver system of claim 16 wherein the plurality of desired RF channels conform to one of a digital video broadcasting (DVB) standard.

24. The multi-tuner receiver system of claim 16 wherein the plurality of desired RF channels conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol.

25. The multi-tuner receiver system of claim 16 wherein the plurality of RF channels conform to a television broadcasting standard.

26. A method of receiving a plurality of radio frequency (RF) channels including a number of desired channels that are located in non-contiguous portions of a frequency spectrum and grouping the desired channels in a contiguous frequency spectrum, the method comprising:

- concurrently receiving the plurality of RF channels;
- producing an in-phase signal and a quadrature signal by mixing the plurality of RF channels with a first oscillator frequency and a second local frequency;
- digitizing the in-phase and quadrature signals; and
- frequency down-shifting the digital in-phase and quadrature signals to a baseband signal using a number of complex mixers,

wherein the first and second oscillator frequencies are identical and have a phase shift of 90° degree between them,

wherein the number of complex mixers correspond to the number of desired channels.

27. The method of claim 26 further comprises:

- frequency up-shifting the baseband signal to an intermediate frequency; and
- converting the frequency up-shifted baseband signal to an analog waveform.

ABSTRACT OF THE DISCLOSURE

A wideband receiver system is provided to concurrently receive multiple RF channels including a number of desired channels that are located in non-contiguous portions of a radio frequency spectrum and to group the number of desired channels into a contiguous frequency band. The system includes a wideband receiver having a complex mixer for down-shifting the multiple RF channels and transforming them to an in-phase signal and a quadrature signal in the baseband. The system further includes a wideband analog-to-digital converter module that digitizes the in-phase and quadrature signals and a digital frontend module that transforms the digital in-phase and quadrature signals to baseband signals that contains only the number of desired RF channels, that are now located in a contiguous frequency band. An up-converter module up-shifts the baseband signals to a contiguous band in an IF spectrum so that the system can directly interface with commercially available demodulators.

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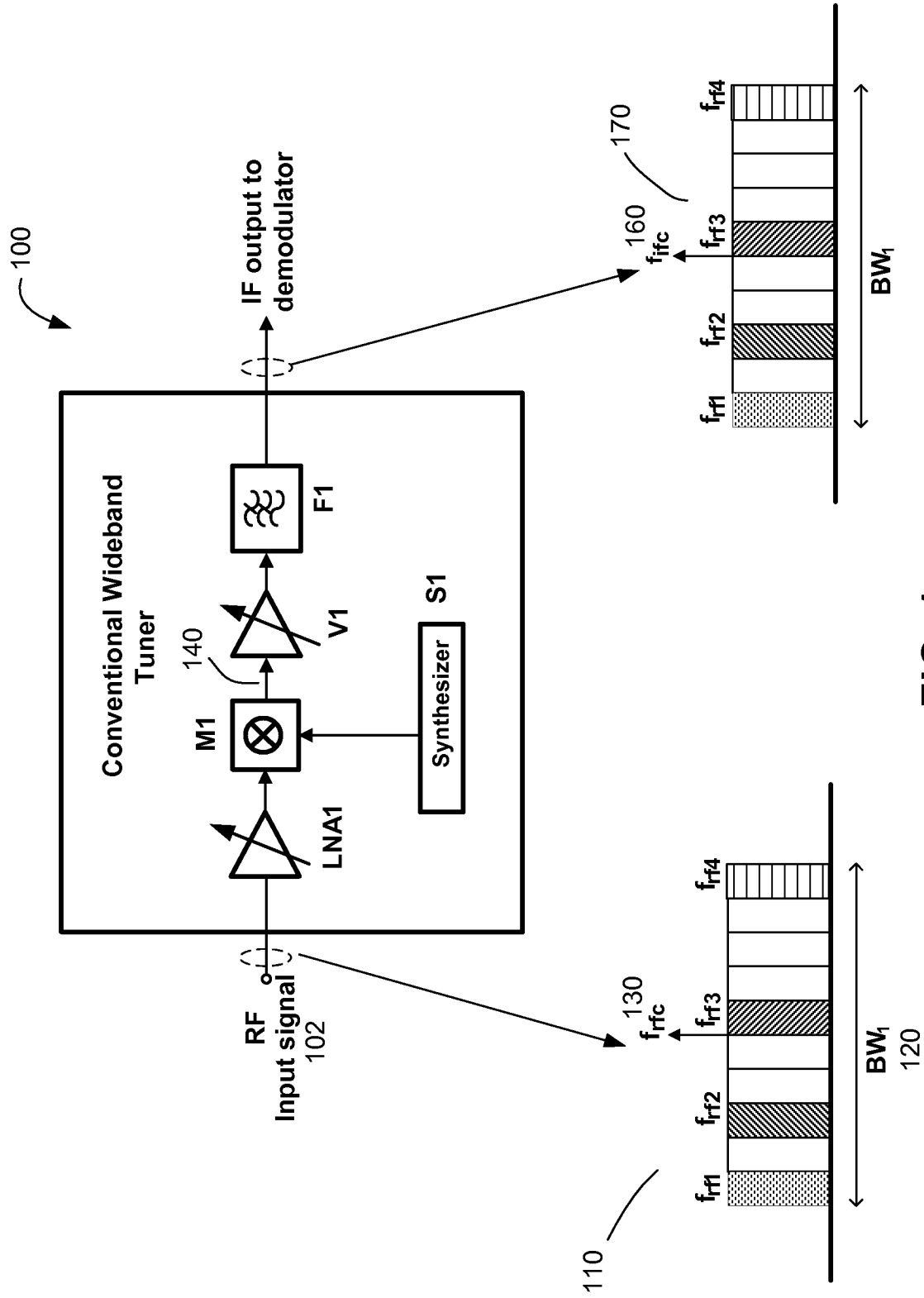
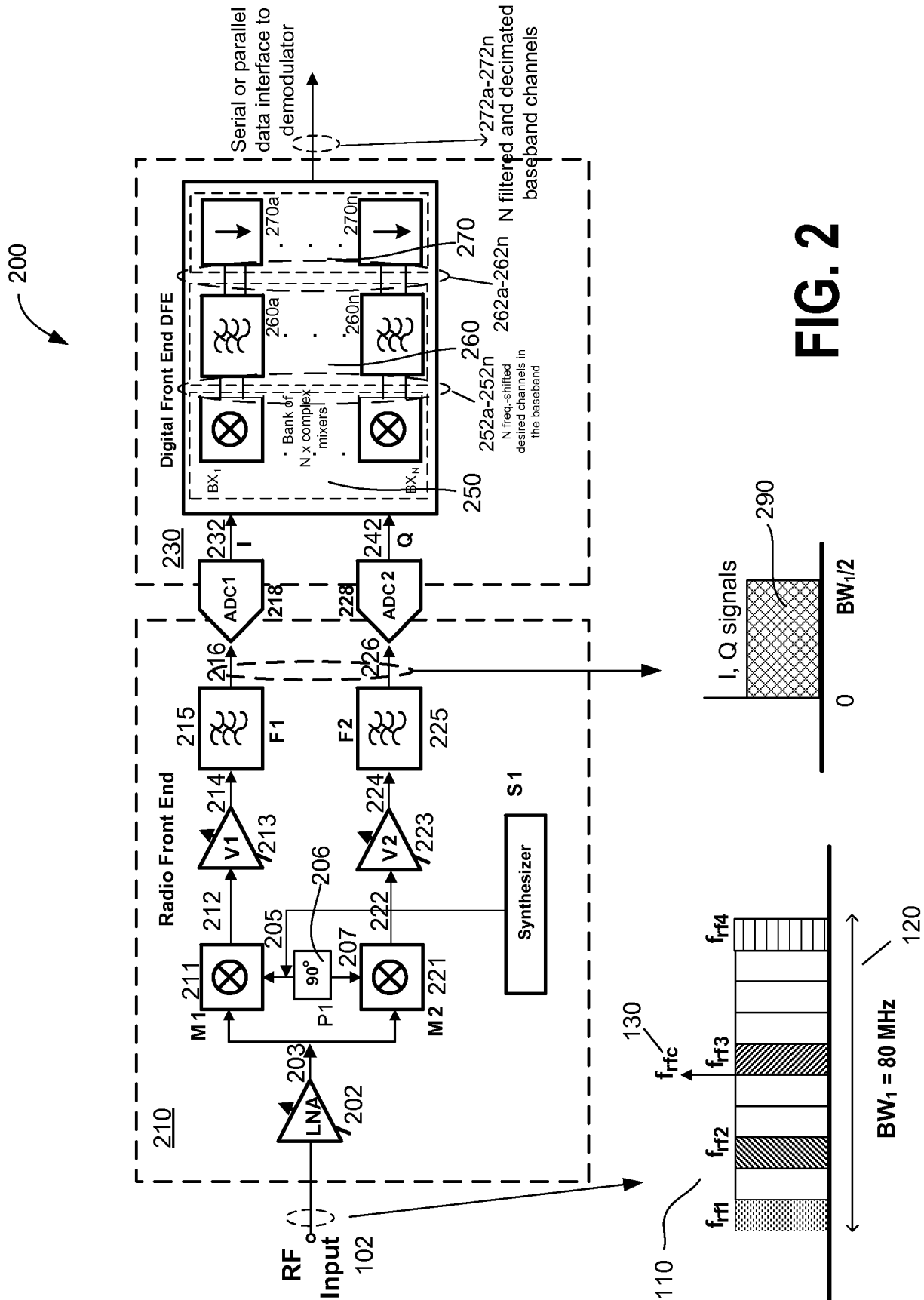


FIG. 1
(prior Art)



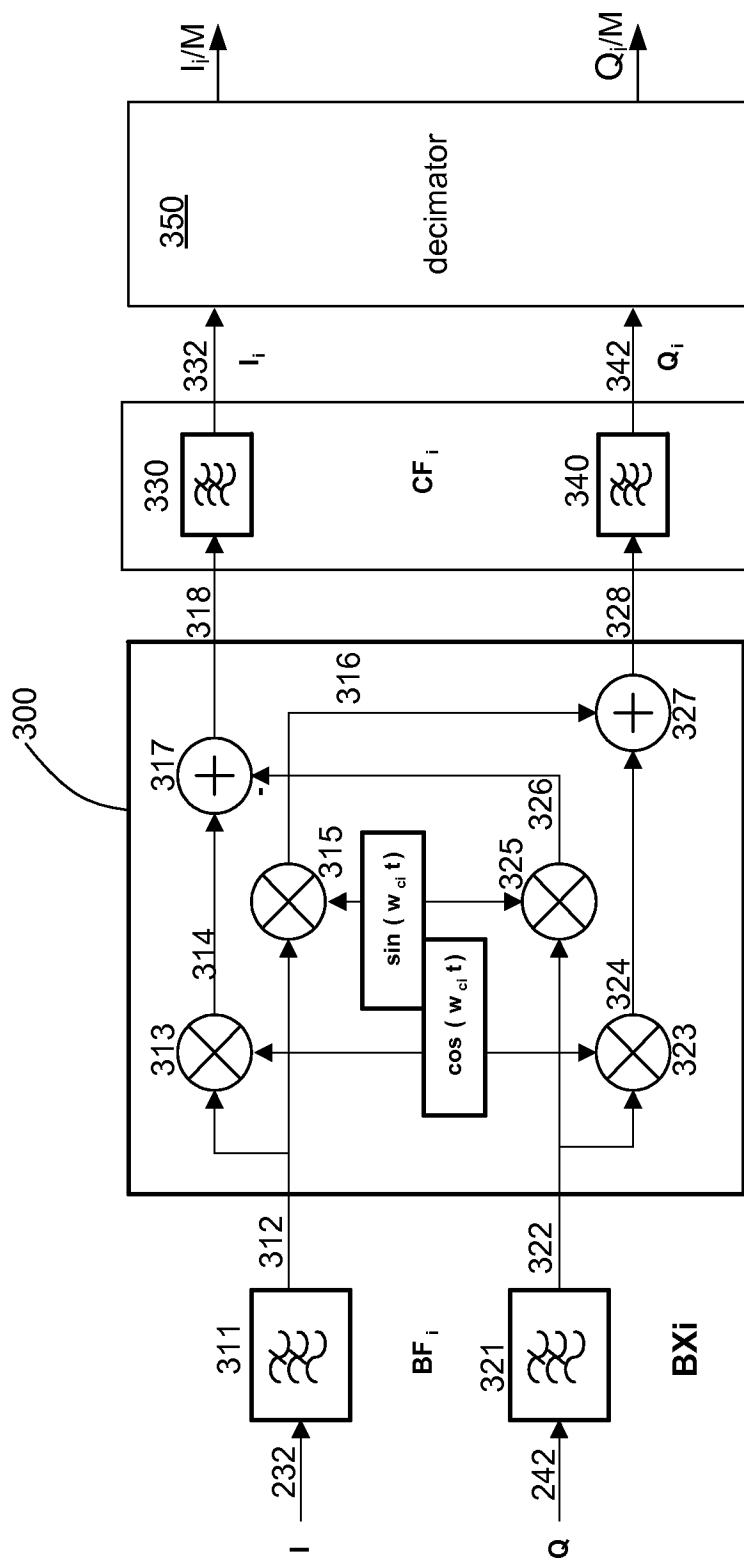


FIG. 3

400

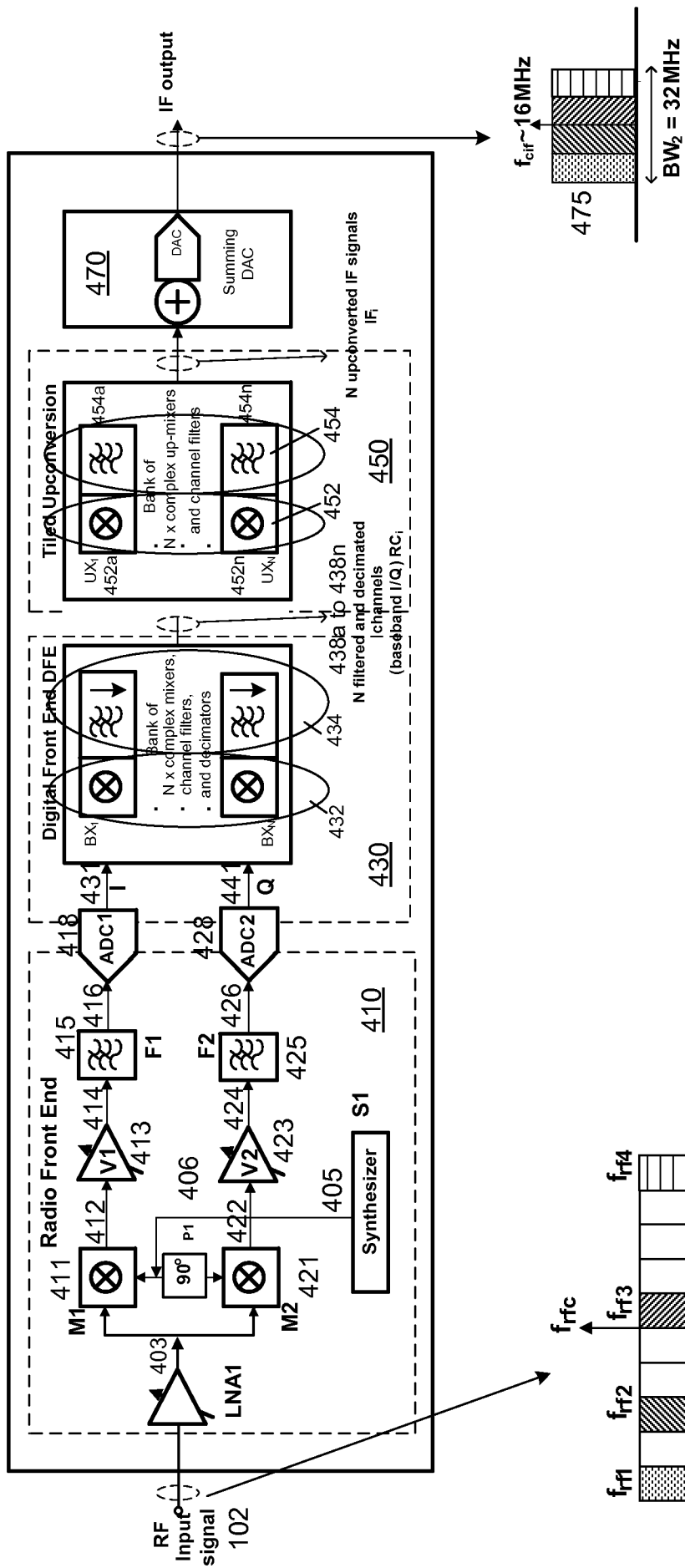


FIG. 4

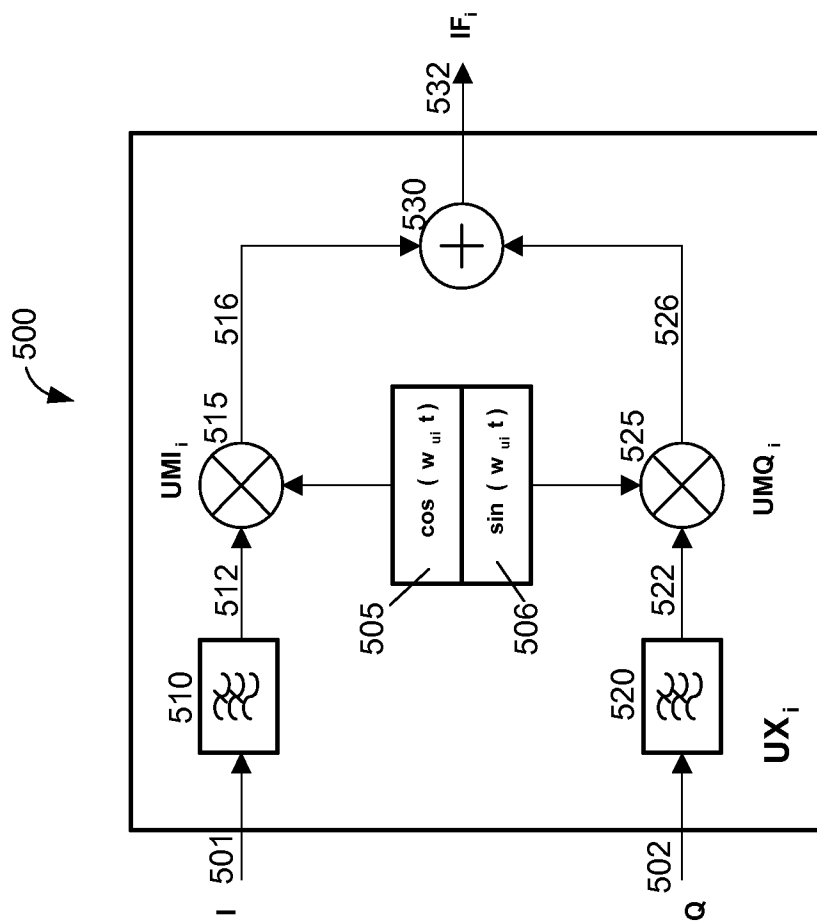


FIG. 5

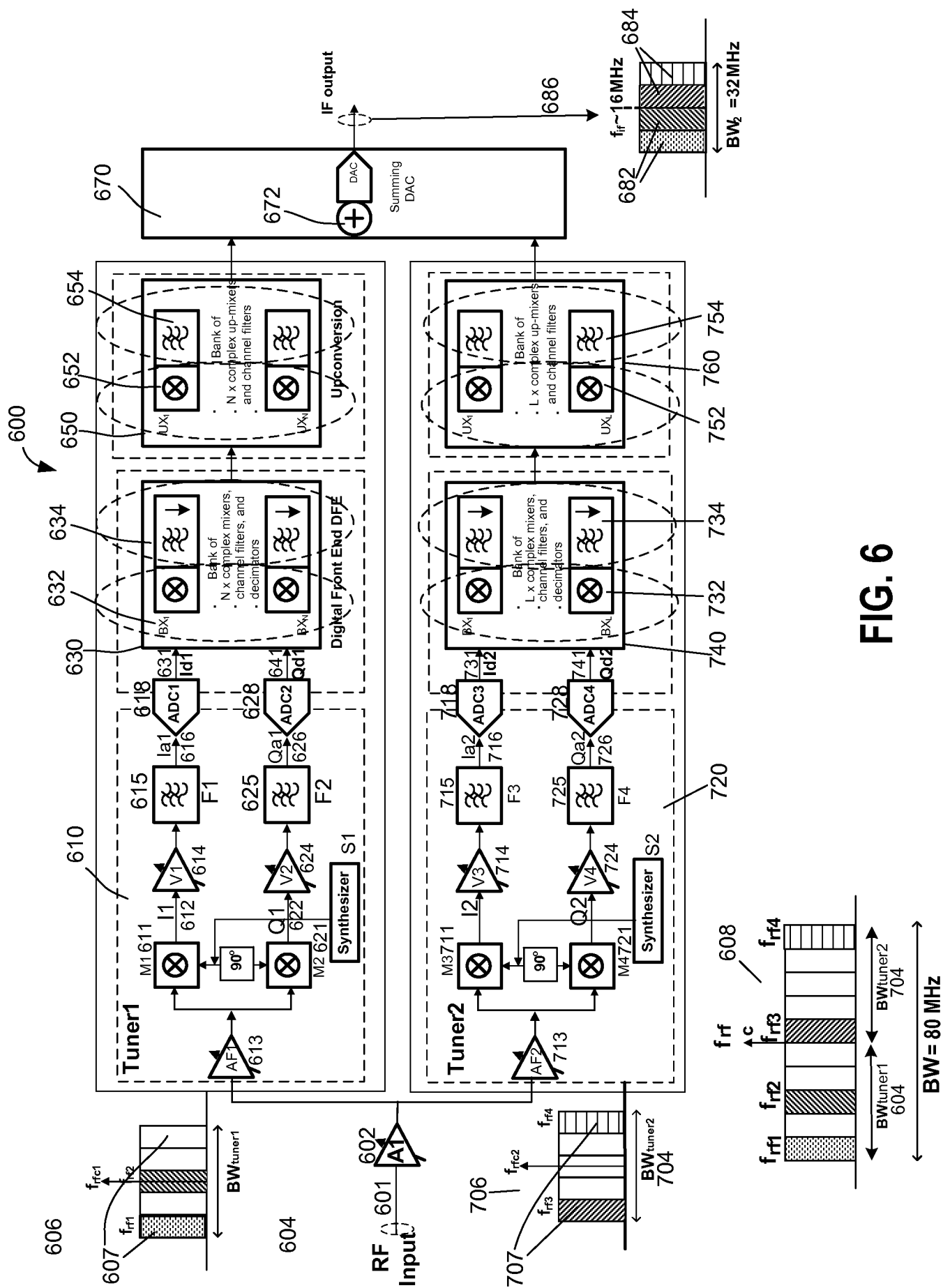


FIG. 6

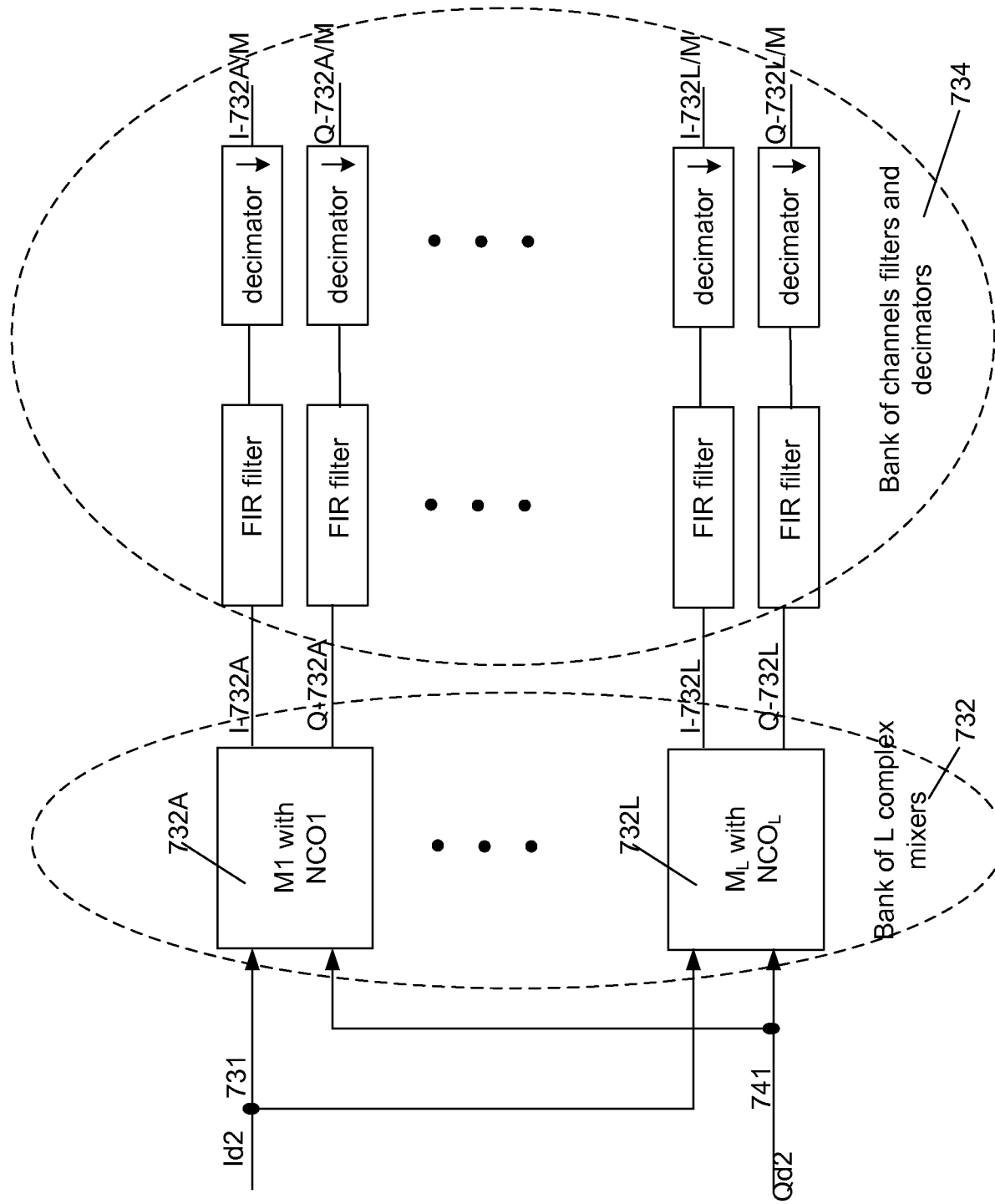


FIG. 7

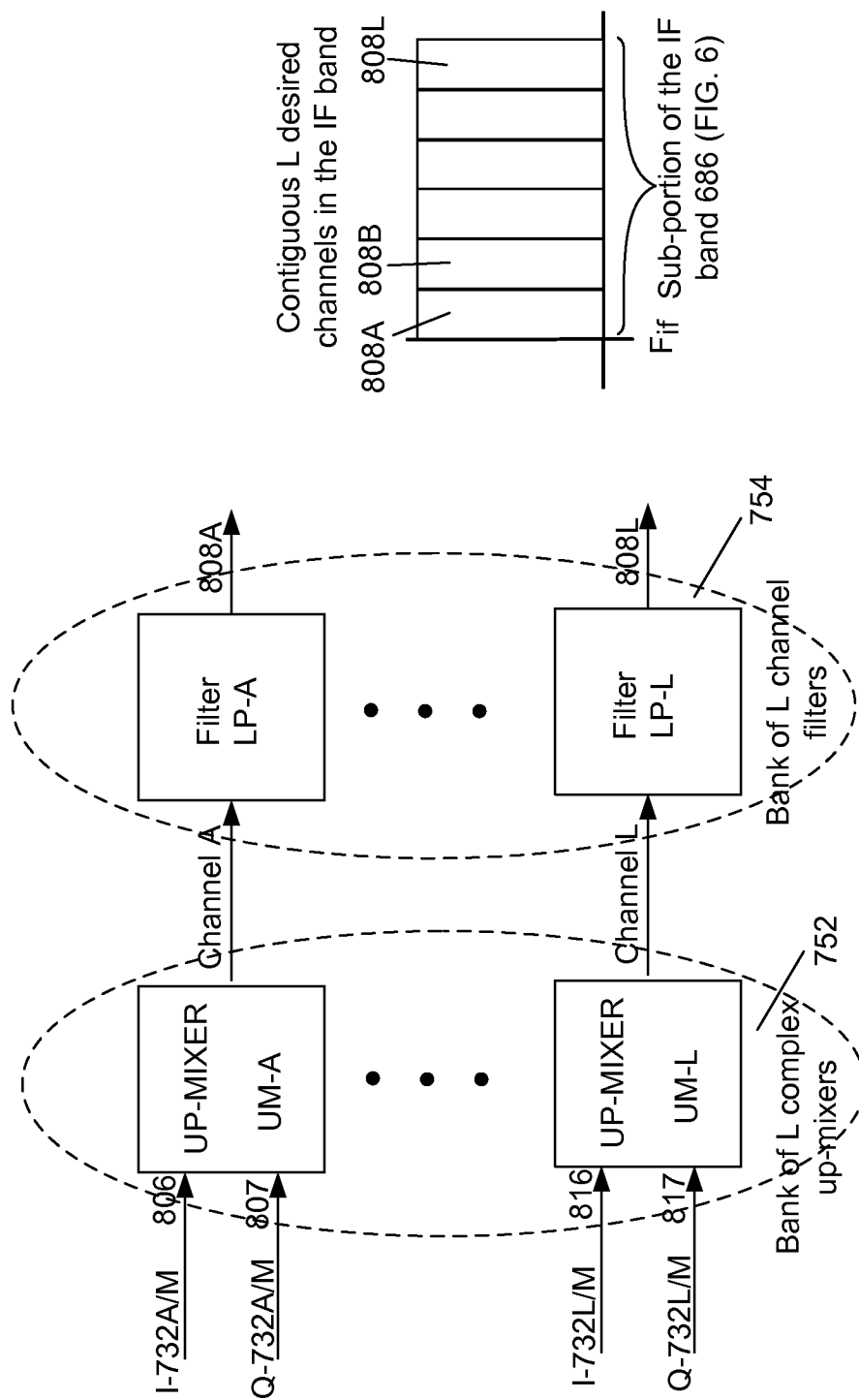


FIG. 8

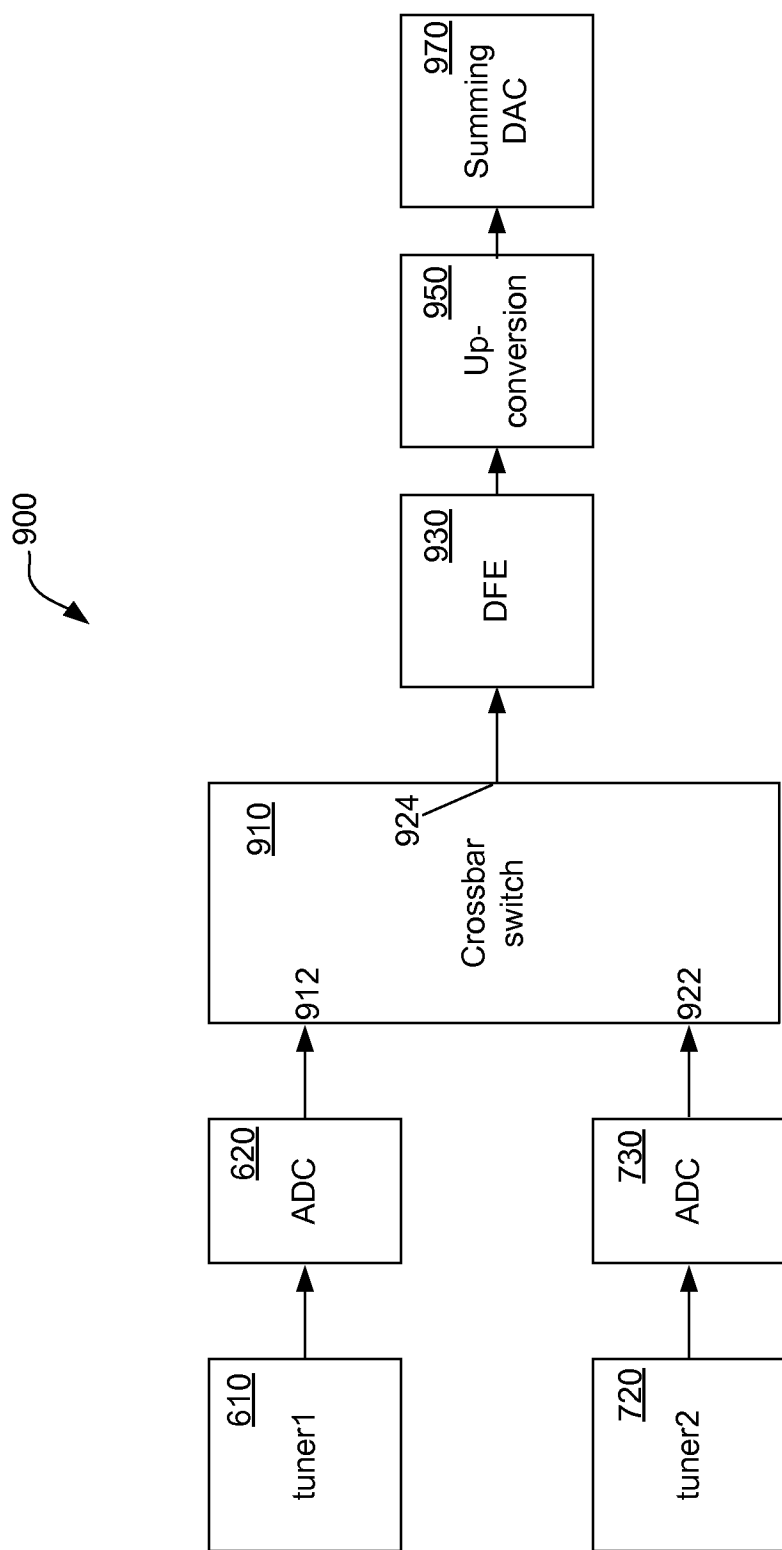


FIG. 9

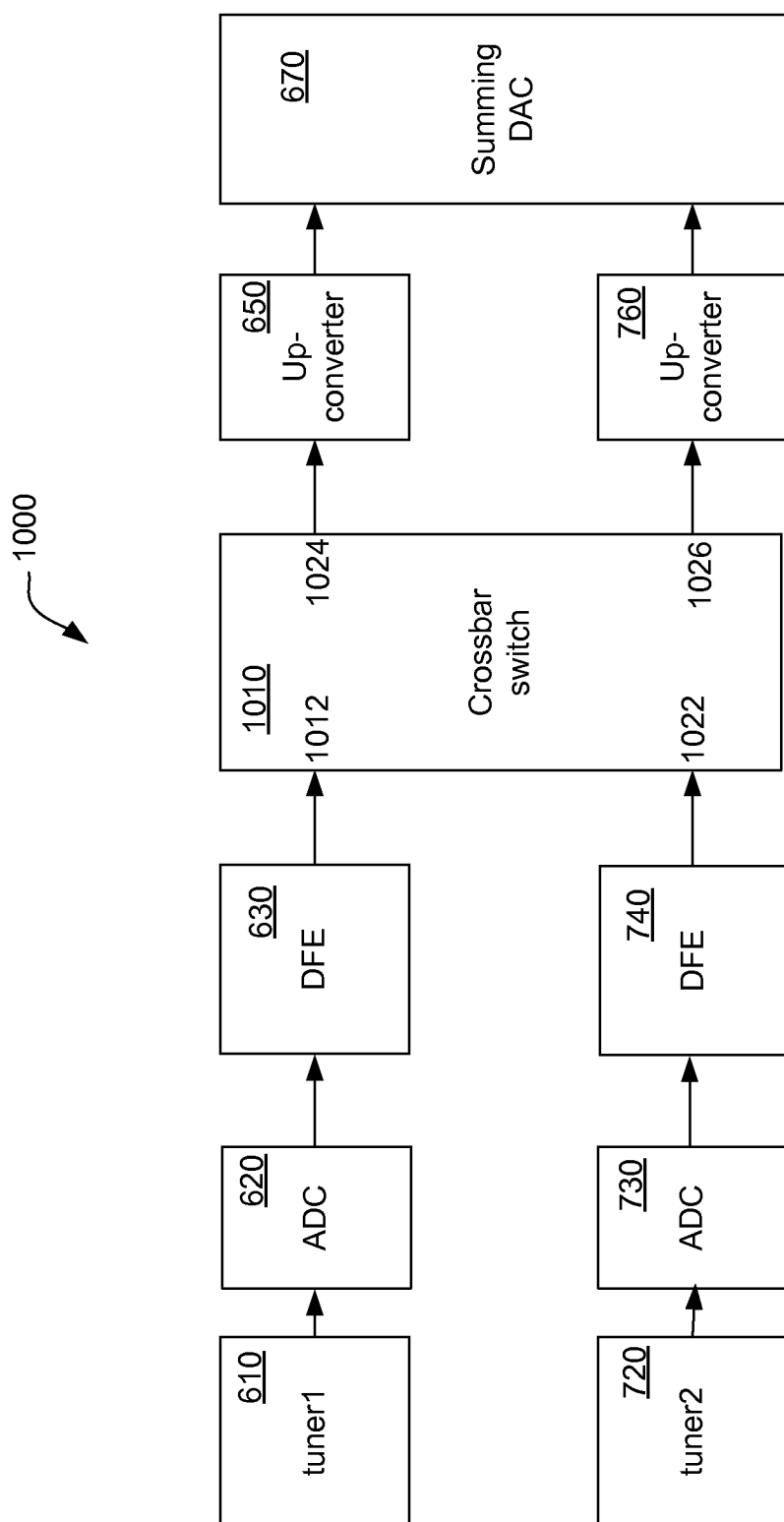


FIG. 10

Application Data Sheet

Application Information

Application number::

Filing Date::

Application Type:: Regular

Subject Matter:: Utility

Suggested classification::

Suggested Group Art Unit::

CD-ROM or CD-R??::

Number of CD disks::

Number of copies of CDs::

Sequence Submission::

Computer Readable Form (CRF)?::

Number of copies of CRF::

Title:: WIDEBAND TUNER ARCHITECTURE

Attorney Docket Number:: 022287-002710US

Request for Early Publication:: No

Request for Non-Publication:: No

Suggested Drawing Figure::

Total Drawing Sheets:: 10

Small Entity?:: Yes

Latin name::

Variety denomination name::

Petition included?:: No

Petition Type::

Licensed US Govt. Agency::

Contract or Grant Numbers One::

Secrecy Order in Parent Appl.: No

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Country of mailing address:: US
Postal or Zip Code of mailing address:: 92011

Correspondence Information

Correspondence Customer Number:: 20350

Representative Information

Representative Customer Number:: 20350

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This Application	An Appn claiming benefit under 35 USC 119(e) of	61/170,526	04/17/09

Foreign Priority Information

Country::

Application number::

Filing Date::

Assignee Information

Assignee Name::

Street of mailing address::

City of mailing address::

State or Province of mailing address::

Country of mailing address::

Postal or Zip Code of mailing address::

Electronic Acknowledgement Receipt

EFS ID:	7442922
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	20350
Filer:	Ardeshir Tabibi/Eleanor Taylor
Filer Authorized By:	Ardeshir Tabibi
Attorney Docket Number:	022287-002710US
Receipt Date:	19-APR-2010
Filing Date:	
Time Stamp:	17:17:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Application.pdf	139632 162b5419bb4905cfa706fad9c40fd905e6c5056f	yes	23

	Multipart Description/PDF files in .zip description								
	Document Description		Start	End					
	Specification		1	17					
	Claims		18	22					
	Abstract		23	23					
Warnings:									
Information:									
2	Drawings-only black and white line drawings	Drawings.pdf	171595	no	10				
			36fb6b99f8cb4d119a85fee1aed9e8d6d0eb68ff						
Warnings:									
Information:									
3	Application Data Sheet	Application_Data_Sheet.pdf	55897	no	4				
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US

CONFIRMATION NO. 4444

FORMALITIES LETTER



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Date Mailed: 05/03/2010

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
Applicant must submit \$82 to complete the basic filing fee for a small entity.
- The oath or declaration is missing.
A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date, is required.
Note: If a petition under 37 CFR 1.47 is being filed, an oath or declaration in compliance with 37 CFR 1.63 signed by all available joint inventors, or if no inventor is available by a party with sufficient proprietary interest, is required.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of **\$182** as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of **\$65** for a small entity in compliance with 37 CFR 1.27, must be submitted with the missing items identified in this notice.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **\$709** for a small entity

- **\$82** Statutory basic filing fee.
- **\$65** Surcharge.
- The application search fee has not been paid. Applicant must submit **\$270** to complete the search fee.

- The application examination fee has not been paid. Applicant must submit **\$110** to complete the examination fee for a small entity in compliance with 37 CFR 1.27.
- Total additional claim fee(s) for this application is **\$182**
 - **\$182** for **7** total claims over 20.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/762,900	04/19/2010	2617	0.00	022287-002710US	27	3

CONFIRMATION NO. 4444

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SAN FRANCISCO, CA 94111-3834

FILING RECEIPT



OC000000041354296

Date Mailed: 05/03/2010

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

Applicant(s)

Madhukar Reddy, Carlsbad, CA;
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Assignment For Published Patent Application

MaxLinear, Inc., Carlsbad, CA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/170,526 04/17/2009

Foreign Applications

If Required, Foreign Filing License Granted: 04/28/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/762,900**

Projected Publication Date: To Be Determined - pending completion of Missing Parts

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

WIDEBAND TUNER ARCHITECTURE

Preliminary Class

455

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER**Title 35, United States Code, Section 184****Title 37, Code of Federal Regulations, 5.11 & 5.15****GRANTED**

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as

set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign Assets Control, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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

Date: **04/19/2010**

Approved for use through 7/31/2006. OMB 0651-0032

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

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875					Application or Docket Number 12/762,900	
APPLICATION AS FILED – PART I						
(Column 1)		(Column 2)		SMALL ENTITY		OR
FOR	NUMBER FILED	NUMBER EXTRA	RATE (\$)	FEE (\$)	RATE (\$)	FEE (\$)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	82	N/A8	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	270	N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	110	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	27	minus 20	X\$ 26	182	2X\$52	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3	X\$110	0	1X\$220	
APPLICATION SIZE FEE (37 CFR 1.16(s))						
12/10/9 MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			195			
390			TOTAL	644	TOTAL	0
APPLICATION AS AMENDED – PART II						
(Column 1)		2 (Column 2)		(Column 3)		OR
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDI-TIONAL FEE (\$)
	Total (37 CFR 1.16(i))	Minus **	=		X =	
	Independent (37 CFR 1.16(h))	Minus ***	=		X =	
	Application Size Fee (37 CFR 1.16(s))					
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					
				TOTAL ADD'T FEE		
(Column 1)		(Column 2)		(Column 3)		OR
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT	HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE (\$)	ADDI-TIONAL FEE (\$)
	Total (37 CFR 1.16(i))	Minus **	=		X =	
	Independent (37 CFR 1.16(h))	Minus ***	=		X =	
	Application Size Fee (37 CFR 1.16(s))					
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))					
				TOTAL ADD'T FEE		

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1:

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☒ Practitioners associated with the Customer Number:

20350

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b). I further authorize any of the above-identified practitioners to execute a Statement Under 37 CFR 3.73(b) on the undersigned's behalf to certify the chain of title and establish the undersigned's ownership in any and all patent applications in which rights have been assigned to the undersigned.

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☒ The address associated with Customer Number:

20350

OR

☐ Firm or Individual Name			
Address			
City	State	Zip	
Country			
Telephone			Email

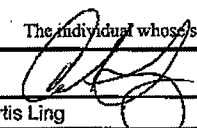
Assignee Name and Address:

MaxLinear, Inc.
2051 Palomar Airport Road, Suite 100
Carlsbad, CA 92011-1462

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	16 JUN 2009
Name	Curtis Ling	Telephone	760-692-0711
Title	Chief Technology Officer		

STATEMENT UNDER 37 CFR 3.73(b)Applicant/Patent Owner: Madhukar Reddy et al.Application No./Patent No.: 12/762,900 Filed/Issue Date: April 19, 2010Titled: WIDEBAND TUNER ARCHITECTURE

MaxLinear, Inc., a corporation
 (Name of Assignee) (Type of Assignee: corporation, partnership, university, government agency, etc.)

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;
2. ☐ an assignee of less than the entire right, title, and interest in
 (The extent (by percentage) of its ownership interest is _____ %); or
3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

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

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

OR

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

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/Ardeshir Tabibi/
 Signature

July 1, 2010
 Date

Ardeshir Tabibi, Reg. No. 48,750
 Printed or Typed Name

Attorney for Applicants
 Title

Attorney Docket No.: 022287-002710US

ASSIGNMENT OF PATENT APPLICATION

JOINT

WHEREAS, **Madhukar Reddy** of 2051 Palomar Airport Road, Suite 100, Carlsbad, CA 92011-1462; **Curtis Ling** of 2051 Palomar Airport Road, Suite 100, Carlsbad, CA 92011; and **Tim Gallagher** of 2051 Palomar Airport Road, Suite 100, Carlsbad, CA 92011, hereinafter referred to as "Assignors," are the inventors of the invention described and set forth in the below-identified application for United States Letters Patent:

Title of Invention: WIDEBAND TUNER ARCHITECTURE

Filing Date: April 19, 2010

Application No.: 12/762,900; and

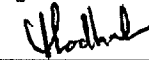
WHEREAS, **MaxLinear, Inc.**, a corporation of the state of Delaware, located at 2051 Palomar Airport Road, Suite 100, Carlsbad, CA 92011-1462, hereinafter referred to as "ASSIGNEE," is desirous of acquiring an interest in the invention and application and in any U.S. Letters Patent and Registrations which may be granted on the same;

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

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

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

Dated: 6/28/10



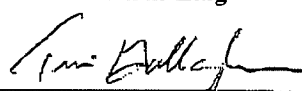
Madhukar Reddy

Dated: 28 June 2010



Curtis Ling

Dated: 6/28/2010



Tim Gallagher

62575229 v1

Electronic Patent Application Fee Transmittal				
Application Number:		12762900		
Filing Date:		19-Apr-2010		
Title of Invention:		WIDEBAND TUNER ARCHITECTURE		
First Named Inventor/Applicant Name:		Madhukar Reddy		
Filer:		Ardeshir Tabibi/Eleanor Taylor		
Attorney Docket Number:		022287-002710US		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	82	82
Utility Search Fee	2111	1	270	270
Utility Examination Fee	2311	1	110	110
Pages:				
Claims:				
Claims in excess of 20	2202	7	26	182
Miscellaneous-Filing:				
Late filing fee for oath or declaration	2051	1	65	65

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				709

Electronic Acknowledgement Receipt

EFS ID:	7943304
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	20350
Filer:	Ardeshir Tabibi/Eleanor Taylor
Filer Authorized By:	Ardeshir Tabibi
Attorney Docket Number:	022287-002710US
Receipt Date:	01-JUL-2010
Filing Date:	19-APR-2010
Time Stamp:	21:56:23
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	\$ 709
RAM confirmation Number	8053
Deposit Account	201430
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	Declaration.pdf	123789	no	2
			e549c1f45cce1234e9ead282b48f57a14fce1308		
Warnings:					
Information:					
2	Application Data Sheet	Supplemental_Application_Data a_Sheet.pdf	56701	no	4
			b44b9a88bb8d28daca7d33aa4dca4a429d461a13		
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3	Power of Attorney	Power_of_Attorney.pdf	69855	no	1
			600b72e26789447b1746d88e64c9102f8d5687bb		
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73(b).	Statement_Under_37_CFR_373 B.pdf	122976	no	2
			51ec23f9f13ec2a0c631b16d32aba2063b067905		
Warnings:					
Information:					
5	Fee Worksheet (PTO-875)	fee-info.pdf	38386	no	2
			58464a229e0d691172b9a19862d35fbc7c419cf2		
Warnings:					
Information:					
Total Files Size (in bytes):			411707		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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

Title of
Invention

WIDEBAND TUNER ARCHITECTURE

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

This declaration is directed to:

- ☐ The attached application, or
☒ Application No. 12/762,900, filed on April 19, 2010
☐ as amended on _____ (if applicable);

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

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

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

WARNING:

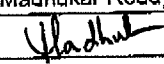
Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization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

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

FULL NAME OF INVENTOR(S)

Inventor one: Madhukar Reddy

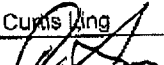
Date: 6/28/10

Signature: 

Citizen of: United States

Inventor two: Curtis King

Date: 6/28/10

Signature: 

Citizen of: United States

☒ Additional inventors or a legal representative are being named on 1 additional form(s) attached hereto.

**DECLARATION (37 CFR 1.63) FOR UTILITY OR DESIGN APPLICATION USING AN
APPLICATION DATA SHEET (37 CFR 1.76) –
ADDITIONAL INVENTOR(S)
Supplemental Sheet 1 of 1**

FULL NAME OF INVENTOR(S)	
Inventor three: <u>Tim Gallagher</u>	Date: <u>6/28/2010</u>
Signature: <u><i>Tim Gallagher</i></u>	Citizen of: <u>United States</u>
Inventor four: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor five: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor six: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor seven: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor eight: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor nine: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor ten: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor eleven: _____	Date: _____
Signature: _____	Citizen of: _____
Inventor twelve: _____	Date: _____
Signature: _____	Citizen of: _____

62576218 v1

Supplemental Application Data Sheet

Application Information

Application number::	12762900
Filing Date::	04/19/10
Application Type::	Regular
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R??::	
Number of CD disks::	
Number of copies of CDs::	
Sequence Submission::	
Computer Readable Form (CRF)?::	
Number of copies of CRF::	
Title::	WIDEBAND TUNER ARCHITECTURE
Attorney Docket Number::	022287-002710US
Request for Early Publication::	No
Request for Non-Publication::	No
Suggested Drawing Figure::	
Total Drawing Sheets::	10
Small Entity?::	Yes
Latin name::	
Variety denomination name::	
Petition included?::	No
Petition Type::	
Licensed US Govt. Agency::	
Contract or Grant Numbers One::	
Secrecy Order in Parent Appl.::	No

Applicant Information

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Madhukar
Middle Name::
Family Name:: Reddy
Name Suffix::
City of Residence:: Carlsbad
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 2051 Palomar Airport Road, Suite 100
City of Mailing Address:: Carlsbad
State or Province of mailing address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 92011-1462

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Curtis
Middle Name::
Family Name:: Ling
Name Suffix::
City of Residence:: Carlsbad
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 2051 Palomar Airport Road, Suite 100
City of Mailing Address:: Carlsbad
State or Province of mailing address:: CA
Country of mailing address:: US

Postal or Zip Code of mailing address:: 92011

Applicant Authority Type:: Inventor
Primary Citizenship Country:: US
Status:: Full Capacity
Given Name:: Tim
Middle Name::
Family Name:: Gallagher
Name Suffix::
City of Residence:: Carlsbad
State or Province of Residence:: CA
Country of Residence:: US
Street of Mailing Address:: 2051 Palomar Airport Road, Suite 100
City of Mailing Address:: Carlsbad
State or Province of mailing address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 92011

Correspondence Information

Correspondence Customer Number:: 20350

Representative Information

Representative Customer Number:: 20350

Domestic Priority Information

Application::	Continuity Type::	Parent Application::	Parent Filing Date::
This Application	An Appn claiming benefit under 35 USC 119(e) of	61/170,526	04/17/09

Foreign Priority Information

Country:: Application number:: Filing Date::

Assignee Information

Assignee Name:: MaxLinear, Inc.
Street of mailing address:: 2051 Palomar Airport Road, Suite 100
City of mailing address:: Carlsbad
State or Province of mailing address:: CA
Country of mailing address:: US
Postal or Zip Code of mailing address:: 92011-1462

Submitted by:

Signature /Ardeshir Tabibi/ Date 2010-07-01
Printed Name Ardeshir Tabibi Registration Number 48,750

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	12/762,900
				Filing Date	April 19, 2010
				First Named Inventor	Reddy, Madhukar
				Art Unit	2617
				Examiner Name	Unassigned
Sheet	1	of	2	Attorney Docket Number	022287-002710US

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number Kind Code ² (if known)			
	AA	US-5768260 A	06-16-1998	Kline et al.	
	AB	US-5705949 A	01-06-1998	Alayunas et al.	
	AC	US-5590156 A	12-31-1996	Carney	
	AD	US-2007/0263754 A1	11-15-2007	Currian et al.	
	AE	US-2007/0179649 A1	08-02-2007	Mitsuno	
	AF	US-2007/0032220 A1	02-08-2007	Feher	
	AG	US-2007/0002961 A1	01-04-2007	Hector et al.	
	AH	US-2003/0228855 A1	12-11-2003	Hertz et al.	
	AI	US-2003/0158614 A1	08-21-2003	Friel et al.	
	AJ	US-12/762,950	Filed: 04-19-2010	Walsh et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Country Code ³	Number ⁴	Kind Code ⁵ (if known)		
						☐

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials *	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
	AK	International Search Report of the International Searching Authority for Application No. PCT/US2010/031627, mailed on June 18, 2010, 2 pages.	☐
	AL	Written Opinion of the International Searching Authority for Application No. PCT/US2010/031627, mailed on June 18, 2010, 5 pages.	☐
	AM	International Search Report of the International Searching Authority for Application No. PCT/US2010/031631, mailed on June 17, 2010, 2 pages.	☐

Examiner Signature		Date Considered	
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*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kind Codes of U.S. Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	12/762,900
				Filing Date	April 19, 2010
				First Named Inventor	Reddy, Madhukar
				Art Unit	2617
				Examiner Name	Unassigned
Sheet	2	of	2	Attorney Docket Number	022287-002710US

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials *	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
	AN	Written Opinion of the International Searching Authority for Application No. PCT/US2010/031631, mailed on June 17, 2010, 6 pages.	☐

Examiner Signature		Date Considered	
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¹EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ² Applicant's unique citation designation number (optional). ³ See Kind Codes of U.S. Patent Documents at www.uspto.gov or MPEP 901.04. ⁴ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁵ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁶ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. ⁷ Applicant is to place a check mark here if English language Translation is attached.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 22287-27-1PC	FOR FURTHER ACTION see Form PCT/ISA/220 as well as, where applicable, item 5 below.	
International application No. PCT/US2010/031627	International filing date (<i>day/month/year</i>) 19 April 2010	(Earliest) Priority Date (<i>day/month/year</i>) 17 April 2009
Applicant MAXLINEAR, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed
- ☐ a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

b. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II)

3. ☐ **Unity of invention is lacking** (see Box No. III)

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant
- ☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant
- ☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 4
- ☒ as suggested by the applicant
- ☐ as selected by this Authority, because the applicant failed to suggest a figure
- ☐ as selected by this Authority, because this figure better characterizes the invention
- b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2010/031627

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H04B 1/06 (2010.01)

USPC - 455/260

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - H04B 1/06, 1/00 (2010.01)

USPC - 455/260, 209, 42, 180.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

MicroPatent

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 2007/0032220 A1 (FEHER) 08 February 2007 (08.02.2007) entire document	1-3, 5, 6, 10-15, 26 and 27 ----- 4, 7-9 and 16-25
Y	US 2007/0263754 A1 (CURRIVAN et al) 15 November 2007 (15.11.2007) entire document	4 and 16-25
Y	US 2007/0002961 A1 (HOCTOR et al) 04 January 2007 (04.01.2007) entire document	7-9
A	US 5,590,156 A (CARNEY) 31 December 1996 (31.12.1996) entire document	1-27
A	US 5,768,260 A (KLINE et al) 16 June 1998 (16.06.1998) entire document	1-27

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:	"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 26 May 2010	Date of mailing of the international search report 18 JUN 2010
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2005)

A 1 T
PA

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

ARDESHIR TABIBI
TOWNSEND AND TOWNSEND AND CREW
LLP
8TH FLOOR
TWO EMBARCADERO CENTER
SAN FRANCISCO, CA 94111

022287-002710PC

Date of mailing
(day/month/year)

18 JUN 2010

Applicant's or agent's file reference
22287-27-1PC

FOR FURTHER ACTION

See paragraph 2 below

International application No. ✓
PCT/US2010/031627International filing date (day/month/year)
19 April 2010 ✓Priority date (day/month/year)
17 April 2009 ✓International Patent Classification (IPC) or both national classification and IPC
IPC(8) - H04B 1/06 (2010.01)
USPC - 455/260

Applicant MAXLINEAR, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220. 02-17-11

09-18-10

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Date of completion of this opinion 26 May 2010	Authorized officer: Blaine Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774
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Form PCT/ISA/237 (cover sheet) (April 2007)

✓ Docketed _____ Undocketed

_____ Transferred _____ Noted

_____ Not Docketed

_____ Abandoned

Action: Resp to written opinion

Due: 02-17-11

By: pmd 06-23-10

Townsend and Townsend and Crew LLP

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2010/031627

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - ☒ the international application in the language in which it was filed.
 - ☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:
 - a. type of material
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material
 - ☐ on paper
 - ☐ in electronic form
 - c. time of filing/furnishing
 - ☐ contained in the international application as filed
 - ☐ filed together with the international application in electronic form
 - ☐ furnished subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2010/031627

Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement			
1. Statement				
Novelty (N)	Claims	4, 7-9 and 16-25	YES	
	Claims	1-3, 5, 6, 10-15, 26 and 27	NO	
Inventive step (IS)	Claims	None	YES	
	Claims	1-27	NO	
Industrial applicability (IA)	Claims	1-27	YES	
	Claims	None	NO	
2. Citations and explanations:				
Claims 1-3, 5, 6, 10-15, 26 and 27 lack novelty under PCT Article 33(2) as being anticipated by Feher. Regarding claim 1, Feher discloses a wideband receiver system (paragraph [0231]) comprising: a wideband receiver configured to concurrently receive a plurality of desired RF channels (in-phase and quadrature-phase baseband channels, paragraph [0276]); said wideband receiver comprising: a mixer module (multipliers also known as mixers, paragraphs [236] and [0243]) coupled to the plurality of desired RF channels and having a first mixer (mixer 11.13 of Fig. 17b) configured to generate an in-phase signal and a second mixer (mixer 11.16 of Fig. 17b) configured to generate a quadrature signal (an in-phase (I) and quadrature (Q) channels, Fig. 6 and paragraph [0237]); a wideband analog-to-digital converter (ADC) module (paragraph [0247]) having a first wideband ADC (19.15 of Fig. 19) coupled with the in-phase signal and configured to generate a digitalized in-phase signal and a second wideband ADC (19.8 of Fig. 19) coupled with the quadrature signal and configured to generate a digitalized quadrature signal (paragraph [0257]); and a digital frontend (DFE) module (5.17 and 5.5 of Fig. 5) having a plurality of complex mixers (5.8 and 5.20 of Fig. 5) coupled to the digital in-phase and quadrature signals, each one of the plurality of complex mixers frequency-shifting a different one of the plurality of the desired RF channels to a baseband signal (paragraph [0236]). Regarding claim 2, Feher discloses a local oscillator (5.9 and 5.21 of Fig. 5) having an oscillator frequency centered around the plurality of the desired RF channels (paragraph [0236]). Regarding claim 3, Feher discloses that the local oscillator comprises a phaselocked loop (paragraph [0247]). Regarding claim 5, Feher discloses that each one of the plurality of complex mixers comprises a pair of digital multipliers (5.8 and 5.20 of Fig. 5), each pair of the digital multipliers is coupled to a numerically controlled oscillator (5.9 and 5.21 of Fig. 5) (multipliers 5.8 and 5.20 of Fig. 5 are coupled to oscillators 5.9 and 5.21 of Fig. 5, respectively, paragraph [0236]). Regarding claim 6, Feher discloses that the DFE module (5.17 and 5.5 of Fig. 5) further comprises a plurality of channel filters (5.6 and 5.18 of Fig. 5), each one of the plurality of channel filters is coupled to each one of the plurality of complex mixers (5.8 and 5.20 of Fig. 5) and configured to filter one of the plurality of the desired channels (paragraph [0236]). Regarding claim 10, Feher discloses an up-converter module (20.4b of Fig. 20) configured to frequency-shift the plurality of desired RF channels in the baseband to an intermediate frequency band (paragraph [0258]). Regarding claim 11, Feher discloses that the up-converter module (20.4b of Fig. 20) comprises a plurality of N up-mixers (5.8 and 5.20 of Fig. 5) having a plurality of associated oscillator frequencies (5.9 and 5.21 of Fig. 5), wherein N is an integer value equal to the plurality of the desired RF channels (paragraph [0261]); wherein the plurality of associated oscillator frequencies are so chosen so that when mixing with the plurality of desired channels in the baseband, the mixed products occupy a contiguous frequency spectrum, or a substantially-contiguous frequency spectrum with one or more spacings between the desired channels (paragraphs [0246] and [0280]), wherein the one or more spacings are variable (inherent in a spread frequency spectrum), and wherein the one or more spacings are smaller than or comparable to a channel bandwidth, or small measured as a fraction of the bandwidth of the first and second wideband ADCs (paragraphs [0236], [0237] and [0257]). Regarding claim 12, Feher discloses that the mixed products comprise spectra that are spaced in such a way so as to avoid overlap with known frequency bands containing potential or actual interferers (paragraph [0261]). Regarding claim 13, Feher discloses that the mixed products comprise spectra that are spaced in such a way so as to avoid overlap with known frequency bands that introduce interference to other systems (paragraph [0261]).				

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Regarding claim 14, Feher discloses that each one of the plurality of N up-mixers is a digital complex mixer (5.8 and 5.20 of Fig. 5) and each one of the plurality of associated oscillator frequencies (5.9 and 5.21 of Fig. 5) is generated by a numerically controlled oscillator (numerically controlled oscillator, paragraph [0247]).

Regarding claim 15, Feher discloses a digital-to-analog converter (paragraphs [0247] and [0254]) configured to convert the contiguous group of channels in the intermediate frequency spectrum to an analog waveform.

Regarding claim 26, Feher discloses a method of receiving a plurality of radio frequency (RF) channels including a number of desired channels (paragraphs [0221] and [0231]) that are located in non-contiguous portions of a frequency spectrum and grouping the desired channels in a contiguous frequency spectrum (paragraph [0261]), the method comprising: concurrently receiving the plurality of RF channels; producing an in-phase signal and a quadrature signal by mixing the plurality of RF channels (in-phase and quadrature-phase baseband channels, paragraph [0276]) with a first oscillator frequency 5.9 of Fig. 5) and a second local frequency (5.21 of Fig. 5); digitizing the in-phase and quadrature signals (19.10a of Fig. 19); and frequency down-shifting the digital in-phase and quadrature signals to a baseband signal using a number of complex mixers (mixers 11.13 and 11.16 of Fig. 17b, paragraphs [236] and [0243]), wherein the first and second oscillator frequencies are identical and have a phase shift of 90° degree between them, wherein the number of complex mixers correspond to the number of desired channels (Feher, paragraph [0243]).

Regarding claim 27, Feher discloses frequency up-shifting the baseband signal to an intermediate frequency; and converting the frequency up-shifted baseband signal to an analog waveform (paragraphs [0247] and [0254]).

Claims 4 and 16-25 lack an inventive step under PCT Article 33(3) as being obvious over Feher in view of Currivan.

Regarding claims 4 and 24, Feher discloses that the desired RF channels conform to Video over Internet Protocol (ViIP) as well as Voice over Internet Protocol (VoIP) (paragraph [0236]). However, Feher fails to disclose that the plurality of desired RF channels conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol. In the same field of endeavor, Currivan discloses that the plurality of desired RF channels conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol (paragraphs [0027] and [0028]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Currivan to incorporate the above features into the invention of Feher for the benefit of providing an equivalent data throughput of N channels to a user, though the user perceives a single channel (Currivan, paragraph [0027]).

Regarding claim 16, Feher discloses a multi-tuner receiver system (paragraphs [0221] and [0231]) for receiving a plurality of desired radio frequency (RF) channels (in-phase and quadrature-phase baseband channels, paragraph [0276]) that extend over multiple non-contiguous portions of a broad frequency spectrum and grouping them in a contiguous frequency spectrum, the system comprising: a first tuner (multiple receiver, paragraph [0200]) configured to receive a first portion of the broad frequency spectrum, the first tuner includes a first mixer (mixer 11.13 of Fig. 17b) module coupled to a first oscillator (5.9 of Fig. 5) and is configured to generate a first in-phase signal and a first quadrature signal (an in-phase (I) and quadrature (Q) channels, Fig. 6 and paragraph [0237]); a second tuner (multiple receiver, paragraph [0200]) configured to receive a second portion of the broad frequency spectrum, the second tuner includes a second mixer module (mixer 11.16 of Fig. 17b) coupled to a second oscillator (5.21 of Fig. 5) and is configured to generate a second in-phase signal and a second quadrature signal (an in-phase (I) and quadrature (Q) channels, Fig. 6 and paragraph [0237]); a first analog-to-digital converter module (19.10a of Fig. 19) configured to digitize the first in-phase and quadrature signals; a second analog-to-digital converter module (19.2 of Fig. 19) configured to digitize the second in-phase and quadrature signals (paragraphs [0247] and [0254]). Feher fails to disclose first and second digital frontends. In the same field of endeavor, Currivan discloses a first digital frontend (DFE) module (112 sub 1 of Fig. 1) having a first bank of down-mixers coupled to the first digital in-phase and quadrature signals, each of the first bank of down-mixers is configured to frequency shift one of the desired RF channels in the first portion of the broad frequency spectrum (paragraphs [0019], [0031] and [0078]); and a second digital frontend (DFE) module (112 sub 2 of Fig. 1) having a second bank of down-mixers coupled to the second digital in-phase and quadrature signals, each of the second bank of down-mixers is configured to frequency shift one of the desired RF channels in the second portion of the broad frequency spectrum; wherein the first DFE module frequency-shifts the desired RF channels in the first portion of the broad frequency spectrum to a first portion of a baseband signal (paragraphs [0019], [0031] and [0078]); wherein the second DFE module frequency-shifts the desired RF channels in the second portion of the broad frequency spectrum to a second portion of the baseband signal (paragraphs [0018]-[0021]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Currivan to incorporate the above features into the invention of Feher for the benefit of selecting a first baseband signal corresponding to a first channel and for selecting a second baseband signal corresponding to a second channel, respectively (Currivan, paragraph [0019]).

Regarding claim 17, Currivan discloses a crossbar switch (a carrier adjustment module) interposed between the first and second analog-to-digital converter modules and the first and second DFE modules (paragraph [0019]).

Regarding claim 18, Feher discloses a first up-converter module (20.3b of Fig. 20) having a first bank of up-mixers (mixer 11.13 of Fig. 17b) coupled to the first portion of the baseband signal and configured to frequency shift the first portion of the baseband signal to a first portion of an intermediate frequency spectrum (5.9 of Fig. 5 and an in-phase (I) and quadrature (Q) channels, Fig. 6 and paragraph [0237]); a second up-converter module (20.4b of Fig. 20) having a second bank of up-mixers (mixer 11.16 of Fig. 17b) coupled to the second portion of the baseband signal and configured to frequency shift the second portion of the baseband signal to a second portion of the intermediate frequency spectrum (5.21 of Fig. 5 and an in-phase (I) and quadrature (Q) channels, Fig. 6 and paragraph [0237]); and a digital-to-analog converter (19.10a and 19.2 of Fig. 19) configured to convert the first and second portions of the intermediate frequency spectrum to an analog waveform signal (paragraphs [0247] and [0254]).

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2010/031627

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of:

Regarding claim 19, Currivan discloses a crossbar switch interposed between the first and second DFE modules and the first and second up-converter modules (a carrier adjustment module).

Regarding claim 20, Feher discloses that the first and second portions are adjacent to each other and non-overlapping (paragraph [0261]).

Regarding claim 21, Feher discloses that each one of the first bank of down-mixers comprises a pair of digital multiplier having an input terminal coupled to a numerically controlled oscillator (multipliers also known as mixers, paragraphs [236] and [0243]).

Regarding claim 22, Feher discloses that the first DFE module (5.17 of Fig. 5) further comprises a plurality of channel filters (5.6 and 5.18 of Fig. 5), each one of the plurality of channel filters is coupled to each one of the first bank of down-mixers (5.8 and 5.20 of Fig. 5) and configured to filter one of the frequency down-shifted RF channels (paragraph [0236]).

Regarding claim 23, Feher discloses that the plurality of desired RF channels conform to one of a digital video broadcasting (DVB) standard (paragraph [0190]).

Regarding claim 25, Feher discloses that the plurality of RF channels conform to a television broadcasting standard (paragraph [0231]).

Claims 7-9 lack an inventive step under PCT Article 33(3) as being obvious over Feher in view of Hctor.

Regarding claim 7, Feher discloses a plurality of channel filters (5.6 and 5.18 of Fig. 5). Feher fails to disclose that each one of the plurality of channel filters is a finite impulse response filter. In the same field of endeavor, Hctor discloses that each one of the plurality of channel filters is a finite impulse response filter (paragraph [0061]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Hctor to incorporate the above features into the invention of Feher for the benefit of processing signals processed by the decimation filter (Hctor, paragraph [0061]).

Regarding claim 8, Feher discloses a plurality of channel filters (5.6 and 5.18 of Fig. 5). Feher fails to disclose that the DFE module further comprises a decimator module configured to decimate each one of the plurality of the desired channels in the baseband. In the same field of endeavor, Hctor discloses that the DFE module (paragraph [0067]) further comprises a decimator module (paragraph [0061]) configured to decimate each one of the plurality of the desired channels in the baseband (paragraph [0059]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Hctor to incorporate the above features into the invention of Feher for the benefit of eliminating undesirable signals and reduce the sampling rate to an appropriate frequency for baseband operation (Hctor, paragraph [0059]).

Regarding claim 9, Feher discloses a plurality of channel filters (5.6 and 5.18 of Fig. 5). Feher fails to disclose that the DFE module further comprises a decimator module configured to decimate each one of the plurality of the desired channels to a demodulator. In the same field of endeavor, Hctor discloses that the DFE module (paragraph [0067]) further comprises a decimator module (paragraph [0061]) configured to decimate each one of the plurality of the desired channels to a demodulator (paragraph [0064]). It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Hctor to incorporate the above features into the invention of Feher for the benefit of eliminating undesirable signals and reduce the sampling rate to an appropriate frequency for baseband operation (Hctor, paragraph [0059]).

Claims 1-27 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in industry.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 22287-28-1PC	FOR FURTHER ACTION	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/US 10/31631	International filing date (<i>day/month/year</i>) 19 April 2010 (19.04.2010)	(Earliest) Priority Date (<i>day/month/year</i>) 17 April 2009 (17.04.2009)
Applicant MAXLINEAR, INC.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of:

- ☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6bis(a)).

c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. ☐ **Certain claims were found unsearchable** (see Box No. II).

3. ☐ **Unity of invention is lacking** (see Box No. III).

4. With regard to the **title**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

- ☒ the text is approved as submitted by the applicant.
☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. With regard to the **drawings**,

- a. the figure of the **drawings** to be published with the abstract is Figure No. 1
☒ as suggested by the applicant.
☐ as selected by this Authority, because the applicant failed to suggest a figure.
☐ as selected by this Authority, because this figure better characterizes the invention.
- b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 10/31631

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G06F 17/00 (2010.01)

USPC - 700/94

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
USPC - 700/94Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 370/203, 206, 215, 297, 307, 310, 464, 546; 700/94; 704/500 (keyword limited; see terms below)Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(PGPB,USPT,EPAB,JPAB); Google Patents; Google. Search Terms Used: record, save, store, radio, channel, broadcast, program, frequency, RBDS, RDS, baseband, base, band, analog, digital, ADC, A/D, digitize, DSP, signal, processing, storage, disc, flash, memory, hard, disk, demodulate, user, owner, operator, human, control, interface, display, co

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ----- Y	US 2003/0228855 A1 (Hertz et al.) 11 December 2003 (11.12.2003) entire document, especially: Fig. 2, Abstract, para. [0012]-[0014], [0018], [0025], [0045], [0048], [0049], [0053], [0055], [0056], [0062]-[0070], [0076], [0078], [0087], [0092], [0093], [0095], [0106]-[0108], [0112]-[0114], [0119]	1-5, 7-14, 16-25, 27-43 ----- 6, 15, 26
Y	US 2003/0158614 A1 (Friel et al.) 21 August 2003 (21.08.2003) para. [0002]	15, 26
Y	US 5,705,949 A (Alelyunas et al.) 06 January 1998 (06.01.1998) Fig. 1, col. 3, ln 10-24	6
A	US 2007/0179649 A1 (Mitsuno) 02 August 2007 (02.08.2007) entire document	1-43

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

31 May 2010 (31.05.2010)

Date of mailing of the international search report

17 JUN 2010

Name and mailing address of the ISA/US

Mail Stop PCT, Attn: ISA/US, Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

A1T
PA

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To: ARDESHIR TABIBI
TOWNSEND AND TOWNSEND AND CREW
LLP
TWO EMBARCADERO CENTER
8TH FLOOR
SAN FRANCISCO, CA 94111-3834

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

022287-002810PC

Date of mailing
(day/month/year)

17 JUN 2010

Applicant's or agent's file reference
22287-28-1PC

FOR FURTHER ACTION

See paragraph 2 below

International application No.

PCT/US 10/31631

International filing date (day/month/year)

19 April 2010 (19.04.2010)

Priority date (day/month/year)

17 April 2009 (17.04.2009)

International Patent Classification (IPC) or both national classification and IPC

IPC(8) - G06F 17/00 (2010.01)

USPC - 700/94

Applicant MAXLINEAR, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220. 02-17-11

09-17-10

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1450, Alexandria, Virginia 22313-1450
Facsimile No. 571-273-3201

Date of completion of this opinion

31 May 2010 (31.05.2010)

Authorized officer:

Lee W. Young

PCT Helpdesk: 571-272-4300
PCT OBP: 571-272-7774

Form PCT/ISA/237 (cover sheet) (July 2009)

☒ Docketed ☐ Undocketed
☐ Transferred ☐ Noted
☐ Not Docketed
☐ Abandoned

Action: Resp to written opinion
Due: 02-17-11

By: pm206-23-10
Townsend and Townsend and Crew LLP

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 10/31631

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
☒ the international application in the language in which it was filed.
☐ a translation of the international application into _____ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).
2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:
 - a. (means)
☐ on paper
☐ in electronic form
 - b. (time)
☐ in the international application as filed
☐ together with the international application in electronic form
☐ subsequently to this Authority for the purposes of search
4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 10/31631

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	6, 15, 26	YES
	Claims	1-5, 7-14, 16-25, 27-43	NO
Inventive step (IS)	Claims	None.	YES
	Claims	1-43	NO
Industrial applicability (IA)	Claims	1-43	YES
	Claims	None.	NO

2. Citations and explanations:

Claims 1-5, 7-14, 16-25 and 27-43 lack novelty under PCT Article 33(2) as being anticipated by US 2003/0228855 A1 to Hertz et al. (hereinafter 'Hertz').

As per claim 1, Hertz teaches a wideband multimedia recorder for recording a plurality of radio channels (Abstract, para. [0012]) comprising: a wideband receiver (antenna, 100) configured to concurrently receive the plurality of radio channels (Fig. 2, para. [0013]); an analog-to-digital converter (ADC, 237) configured to digitize the plurality of radio channels (Fig. 2, [0066]); a digital front end module configured to frequency down-convert the digitalized plurality of radio channels to a number of radio channels in a baseband (para.[0045], [0069]); a demodulator module configured to demodulate the number of radio channels to a corresponding number of data streams (para. [0048], [0067]); a digital signal processing circuitry configured to process the demodulated number of data streams (para. [0049]); a storage unit (removable storage, 255) configured to store the processed number of data streams (Fig. 2, para.[0055], [0119]); and a control circuitry having a user interface for receiving control commands (para. [0053], [0108]).

As per claim 2, Hertz further teaches a first mixer and a second mixer, the first mixer is configured to generate an in-phase signal from the digitalized plurality of channels and a second mixer is configured to generate a quadrature signal from the digitized plurality of channels (para. [0087], [0093]).

As per claim 3, Hertz further teaches a pre-select filter that precedes the analog-to-digital converter and is configured to pass through the plurality of channels to the analog-to-digital converter (para. [0062], [0078]).

As per claim 4, Hertz further teaches wherein the radio front end module comprises: a wideband low noise amplifier configured to concurrently receive the plurality of radio channels (para. [0062], [0078]); a frequency synthesizer configured to generate an oscillator frequency (para. [0067]); a mixer module coupled to the low noise amplifier and the frequency synthesizer and configured to generate the in-phase and quadrature signals (para. [0093]); and a low-pass filter configured to eliminate unwanted frequency components in the in-phase and quadrature signals (para. [0062]).

As per claim 5, Hertz further teaches wherein the digital front end comprises a number of mixers, each one of the mixers is coupled to the digital in-phase and quadrature signals and configured to generate an associated radio channel in the baseband (para. [0069], [0093]).

As per claim 7, Hertz further teaches wherein the digital front end module further comprises a decimator module configured to decimate each one of the number of radio channels in the baseband (para. [0070], [0092]).

As per claim 8, Hertz further teaches wherein the demodulator module comprises a number of frequency modulation (FM) demodulators (para. [0067]).

As per claim 9, Hertz further teaches wherein the digital signal processing circuitry comprises a plurality of compression engines that are capable of encoding anyone of the demodulated number of data streams with one of a plurality of compression schemes (para. [0106]).

As per claim 10, Hertz further teaches wherein one of the plurality of compression schemes is one of the W AV, MP3, AC3, WMA, AAC audio formats (WMA, para. [0106]).

As per claim 11, Hertz further teaches wherein the digital processing circuitry comprises at least a decompression engine configured to decompress one of the stored encoded number of data streams (para. [0025]).

As per claim 12, Hertz further teaches wherein the storage unit comprises one of the optical compact disc, magnetic hard-disk, or flash memory (flash memory, para. [0055]).

As per claim 13, Hertz further teaches wherein the control circuitry manages playback and recording operations based on the user's control commands (Abstract, para. [0013], [0108]).

As per claim 14, Hertz further teaches wherein the playback is performed on a third-party device (para. [0013], [0052]).

---See Supplemental Sheet---

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.

PCT/US 10/31631

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V.2 Citations and explanations:

As per claim 16, Hertz further teaches an RBDS decoder for parsing radio broadcast data service information embedded in the demodulated number of data streams (para. [0112], [0113]).

As per claim 17, Hertz further teaches wherein the act of parsing comprises determining an occupancy, a location, an identity, and/or content that is associated with at least one of the demodulated number of data streams (para. [0112], [0113]).

As per claim 18, Hertz further teaches wherein the RBDS decoder comprises a plurality of digital decoding circuits that operate in parallel (para. [0018]).

As per claim 19, Hertz further teaches wherein the parsed radio broadcast data service information is stored in a first section of the storage unit (para. [0114]).

As per claim 20, Hertz further teaches an output unit configured to transmit wirelessly at least one of the number of data streams in response to a user's control commands (para. [0056], [0095]).

As per claim 21, Hertz teaches a wideband personal radio recorder system (Abstract, para. [0012]) comprising: at least a first tuner and a second tuner (para. [0076]), the first tuner configured to receive a first frequency spectrum (AM band) including a first plurality of radio channels (para. [0076]) and convert the first frequency spectrum to a first in-phase signal and a first quadrature signal (para. [0087], [0093]), the second tuner configured to receive a second frequency spectrum (FM band) including a second plurality of radio channels (para. [0076]) and convert the second frequency spectrum to a second in-phase signal and a second quadrature signal (para. [0087], [0093]); at least a first analog-to-digital converter module and a second analog-to-digital module (para. [0076]), the first analog-to-digital converter module (para. [0076]) configured to digitize the first in-phase and quadrature signals (para. [0087], [0093]), the second analog-to-digital converter module (para. [0076]) configured to digitize the second in-phase and quadrature signals (para. [0087], [0093]); at least a first digital front end module (para. [0076]) having a first plurality of complex mixers configured to frequency down-convert the first digital in-phase and quadrature signals to a first number of radio channels in a baseband (para. [0045], [0069]), a second digital front end module (para. [0076]) having a second plurality of complex mixers configured to frequency down-convert the second digital in-phase and quadrature signals to a second number of radio channels in the baseband (para. [0045], [0069]); a demodulator module coupled to the first and second digital front end modules (para. [0076]) and configured to demodulate the first and second numbers of radio channels to obtain a plurality of data streams (para. [0048], [0067]); a digital signal processing circuitry coupled to the demodulator module and configured to encode the plurality of data streams (para. [0049]); a storage unit (removable storage, 255) coupled to the digital processing circuitry and configured to store the encoded plurality of data streams (Fig. 2, para. [0055], [0119]); and a control circuitry having a user interface for receiving control commands from a user (para. [0053], [0108]).

As per claim 22, Hertz further teaches wherein the first and second tuners, the first and second analog-to-digital converter modules, and the first and second digital front end modules are configured to operate concurrently (para. [0076]).

As per claim 23, Hertz further teaches wherein the digital signal processing circuitry further comprises an RBDS decoder for parsing radio broadcast data service (RBDS) information embedded in the demodulated number of data streams (para. [0112], [0113]).

As per claim 24, Hertz further teaches wherein the parsed RBDS information is stored in a first section of the storage unit (para. [0114]).

As per claim 25, Hertz further teaches wherein the digital signal processing circuitry further comprises at least a decoding engine configured to decode at least one of the stored plurality of data streams for playback (para. [0025]).

As per claim 27, Hertz teaches a method of recording a plurality of radio channels with a wideband receiver (Abstract, para. [0012]) comprising: receiving a radio signal including the plurality of radio channels (para. [0013]); converting the radio signal to an in-phase signal and a quadrature signal (para. [0093]); digitizing the in-phase and quadrature signals (para. [0066]); frequency-shifting the plurality of radio channels to a baseband by mixing the digital in-phase and quadrature signals concurrently with a plurality of complex mixers (para. [0045], [0069]); demodulating the plurality of radio channels in the baseband to obtain a corresponding plurality of data streams (para. [0048], [0067]); encoding the plurality of data streams (para. [0106]); and storing the encoded plurality of data streams (para. [0055], [0119]).

As per claim 28, Hertz further teaches filtering and decimating the frequency-shifted plurality of channels before demodulating (para. [0097]).

As per claim 29, Hertz further teaches retrieving the stored plurality of data streams (para. [0025]); and decoding at least one of the plurality of data streams for playback (para. [0025]).

As per claim 30, Hertz further teaches wherein the encoding comprises at least one of a plurality of audio compression schemes (para. [0106]).

As per claim 31, Hertz further teaches parsing radio broadcast data service (RBDS) information embedded in the plurality of demodulated data streams (para. [0012]-[0014]); storing the radio data service information (para. [0012]-[0014]); and building a directory based on the stored RBDS information (para. [0014]).

As per claim 32, Hertz further teaches wherein the parsing comprises determining an occupancy, a location, an identity, and/or content that is associated with at least one of the plurality of demodulated data streams (para. [0112], [0113]).

---See Supplemental Sheet---

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 10/31631

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:
Box V.2 Citations and explanations:

As per claim 33, Hertz further teaches transmitting wirelessly, in response to user's control commands, at least one of the plurality of data streams (para. [0056]).

As per claim 34, Hertz teaches a method of recording a plurality of radio channels with a multi-tuner receiver (Abstract, para. [0012]) comprising: providing at least a first tuner and a second tuner (para. [0076]), the first and second tuners configured to operate concurrently (para. [0076]), the first tuner configured to receive a first frequency (AM band) spectrum including a first plurality of radio channels (para. [0076]), the second tuner configured to receive a second frequency spectrum (FM band) including a second plurality of radio channels (para. [0076]), the first tuner (para. [0076]) being configured to convert the first frequency spectrum to a first in-phase signal and a first quadrature signal (para. [0087], [0093]), and the second tuner (para. [0076]) configured to convert the second frequency spectrum to a second in-phase signal and a second quadrature signal (para. [0087], [0093]); converting the first frequency spectrum to a first in-phase and a first quadrature signal (para. [0076], [0087], [0093]); converting the second frequency spectrum to a second in-phase and a second quadrature signal (para. [0076], [0087], [0093]); digitizing the first and second in-phase and quadrature signals (para. [0076]); multiplying the first in-phase and quadrature signals with a first plurality of complex mixers to obtain a first plurality of in-phase and quadrature signals at a baseband (para. [0045], [0069]), wherein each one of the first number of in-phase and quadrature signals represents one of the first plurality of radio channels (para. [0045], [0069]); multiplying the second in-phase and quadrature signals with a second plurality of complex mixers to obtain a second plurality of in-phase and quadrature signals at the baseband, wherein each one of the second number of in-phase and quadrature signals represents one of the second plurality of radio channels (para. [0045], [0069]); demodulating the each one of the first and second pluralities of in-phase and quadrature signals to obtain a plurality of data streams (para. [0048], [0067]); encoding the plurality of data streams (para. [0049]); and storing the encoded plurality of data stream para. [0055], [0119]).

As per claim 35, Hertz further teaches filtering and then decimating the each one of the first and second pluralities of in-phase and quadrature signals before demodulating (para. [0097]).

As per claim 36, Hertz further teaches playing back at least one of the stored plurality of data streams (para. [0025]).

As per claim 37, Hertz further teaches wherein the encoding comprises at least one of the WAV, MP3, AC3, AAC, WMA audio compression formats (WMA, para. [0106]).

As per claim 38, Hertz further teaches wherein the digitizing the first and second inphase and quadrature signals is performed concurrently. (para. [0076]).

As per claim 39, Hertz further teaches wherein the demodulating the each one of the first and second pluralities of in-phase and quadrature signals is performed concurrently (para. [0095]).

As per claim 40, Hertz further teaches wherein the encoding is performed in parallel for each one of the plurality of data streams (para. [0020]).

As per claim 41, Hertz further teaches parsing radio broadcast data service (RBDS) information embedded in the plurality of demodulated data streams (para. [0012]-[0014]); storing the radio data service information (para. [0012]-[0014]); and building a directory based on the stored RBDS information (para. [0114]).

As per claim 42, Hertz further teaches wherein the parsing comprises determining an occupancy, a location, an identity, and/or content that is associated with at least one of the plurality of demodulated data streams (para. [0112], [0113]).

As per claim 43, Hertz further teaches transmitting wirelessly, in response to a user's control commands, at least one of the plurality of data streams (para. [0056]).

Claims 15 and 26 lack an inventive step under PCT Article 33(3) as being obvious over Hertz in view of US 2003/0158614 A1 to Friel et al. (hereinafter 'Friel').

As per claim 15, Hertz does not teach a battery configured to supply power to the recorder for continual operation in the event that an external power supply is turned off. However, Friel does teach a battery configured to supply power to the recorder for continual operation in the event that an external power supply is turned off (para. [0002]). It would have been obvious to one of ordinary skill in the art to modify the recorder, as taught by Hertz, so as to include the use of a battery, as taught by Friel, because the battery ensures that the recorder will maintain tower, thus saving the memory storage and user controls.

As per claim 26, Hertz does not teach a battery configured to supply power to the recorder for continual operation in the event that an external power supply is turned off. However, Friel does teach a battery configured to supply power to the recorder for continual operation in the event that an external power supply is turned off (para. [0002]). It would have been obvious to one of ordinary skill in the art to modify the recorder, as taught by Hertz, so as to include the use of a battery, as taught by Friel, because the battery ensures that the recorder will maintain tower, thus saving the memory storage and user controls.

---See Supplemental Sheet---

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US 10/31631

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Box V.2 Citations and explanations:

Claim 6 lacks an inventive step under PCT Article 33(3) as being obvious over Hertz in view of US 5705949 A to Alelyunas et al. (hereinafter 'Alelyunas').

As per claim 6, Hertz does not teach wherein each one of the plurality of mixers is a digital complex mixer comprising four digital multipliers and two digital adders. However, Alelyunas does teach wherein each one of the plurality of mixers is a digital complex mixer comprising four digital multipliers and two digital adders (Fig. 1). It would have been obvious to one of ordinary skill in the art to modify the recorder, as taught by Hertz, so as to include a portion of the circuit to include 4 multipliers and 2 adders, as taught by Alelyunas, because they provide for compensation of phase error, thus reducing the potential of errors in the recorder (col. 3, ln 10-24).

Claims 1-43 have industrial applicability as defined by PCT Article 33(4) because the subject matter can be made or used in industry.

Electronic Acknowledgement Receipt

EFS ID:	8064836
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	20350
Filer:	Ardeshir Tabibi/Mary Chacon
Filer Authorized By:	Ardeshir Tabibi
Attorney Docket Number:	022287-002710US
Receipt Date:	21-JUL-2010
Filing Date:	19-APR-2010
Time Stamp:	19:13:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

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

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		022287_002710US_Information_Disclosure_Statement_07_21_10.pdf	152432 2e0fe5772aea700795b9d50fd53e8b14d4298a19	yes	5

	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	3	
	Information Disclosure Statement (IDS) Filed (SB/08)		4	5	
Warnings:					
Information:					
2	NPL Documents	PCTUS2010031627_ISR_06_18_10.pdf	118760 1c4e0d79091ad19a933ec38b150ba61236b1b30	no	2
Warnings:					
Information:					
3	NPL Documents	PCTUS2010031627_Written_Opinion_06_18_10.pdf	393578 8b813df315c0acb7a1fa6336807f4733cb8b1cc	no	5
Warnings:					
Information:					
4	NPL Documents	PCTUS2010031631_ISR_06_17_10.pdf	127493 45eb6fe159288b5c2d757d9cee12d9cd6977f8ef	no	2
Warnings:					
Information:					
5	NPL Documents	PCTUS2010031631_Written_Opinion_06_17_10.pdf	425720 a7dd63e8a25f6450a94bd3df09e0e481de77e80a	no	6
Warnings:					
Information:					
Total Files Size (in bytes):			1217983		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

I hereby certify that this correspondence is being filed via
EFS-Web with the United States Patent and Trademark Office
on July 21, 2010.

PATENT
Attorney Docket No.: 022287-002710US

TOWNSEND and TOWNSEND and CREW LLP

By: /Mary K. Chacon/
Mary K. Chacon

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Madhukar Reddy et al.

Application No.: 12/762,900

Filed: April 19, 2010

For: WIDEBAND TUNER
ARCHITECTURE

Customer No.: 20350

Confirmation No.: 4444

Examiner: Unassigned

Art Unit: 2617

INFORMATION DISCLOSURE
STATEMENT UNDER 37 CFR §1.97 and
§1.98

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

The references cited on attached form PTO/SB/08A&B are being called to the attention of the Examiner. Copies of the references [in compliance with the requirements of 37 CFR §1.98(a)(2)] are enclosed.

It is respectfully requested that the cited references be expressly considered during the prosecution of this application, and the references be made of record therein and appear among the "references cited" on any patent to issue therefrom.

Reference AJ cited in this IDS is a commonly owned unpublished U.S. Patent Application. A copy of the application and its prosecution history are available on PAIR and are believed to be readily accessible to the Examiner.

References AA, AC, AD, AF, and AG cited in this IDS were cited in an International Search Report mailed on June 18, 2010 (cited in this IDS as reference AK) in related Application No. PCT/US2010/031627.

References AB, AE, AH, and AI cited in this IDS were cited in an International Search Report mailed on June 17, 2010 (cited in this IDS as reference AM) in commonly owned Application No. PCT/US2010/031631.

As provided for by 37 CFR §1.97(g) and (h), no inference should be made that the information and references cited are prior art merely because they are in this statement and no representation is being made that a search has been conducted or that this statement encompasses all the possible relevant information.

Applicant believes that no fee is required for submission of this statement.

However, if a fee is required, the Commissioner is authorized to deduct such fee from the undersigned's Deposit Account No. 20-1430. Please deduct any additional fees from, or credit any overpayment to, the above-noted Deposit Account.

Respectfully submitted,

/Ardeshir Tabibi/

Ardeshir Tabibi
Reg. No. 48,750

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62778944 v1



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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY. DOCKET NO	TOT CLAIMS	IND CLAIMS
12/762,900	04/19/2010	2617	709	022287-002710US	27	3

CONFIRMATION NO. 4444

UPDATED FILING RECEIPT



20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

Date Mailed: 01/24/2011

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

Applicant(s)

Madhukar Reddy, Carlsbad, CA;
Curtis Ling, Carlsbad, CA;
Tim Gallagher, Carlsbad, CA;

Assignment For Published Patent Application

MaxLinear, Inc., Carlsbad, CA

Power of Attorney: The patent practitioners associated with Customer Number 20350

Domestic Priority data as claimed by applicant

This appln claims benefit of 61/170,526 04/17/2009

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see <http://www.uspto.gov> for more information.)

If Required, Foreign Filing License Granted: 04/28/2010

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 12/762,900**

Projected Publication Date: 05/05/2011

Non-Publication Request: No

Early Publication Request: No

**** SMALL ENTITY ****

Title

WIDEBAND TUNER ARCHITECTURE

Preliminary Class

455

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at <http://www.uspto.gov/web/offices/pac/doc/general/index.html>.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, <http://www.stopfakes.gov>. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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NOT GRANTED

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875						Application or Docket Number 12/762,900			
APPLICATION AS FILED - PART I									
(Column 1)		(Column 2)		SMALL ENTITY		OTHER THAN SMALL ENTITY			
FOR	NUMBER FILED	NUMBER EXTRA	RATE(\$)	FEE(\$)	RATE(\$)	FEE(\$)			
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	82	N/A				
SEARCH FEE (37 CFR 1.16(k), (l), or (m))	N/A	N/A	N/A	270	N/A				
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	110	N/A				
TOTAL CLAIMS (37 CFR 1.16(j))	27	minus 20 = * 7	x 26 =	182					
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3	minus 3 = *	x 110 =	0.00					
APPLICATION SIZE FEE (37 CFR 1.16(s)) If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$270 (\$135 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			0.00						
			0.00						
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))			0.00						
			TOTAL	644	TOTAL				
* If the difference in column 1 is less than zero, enter "0" in column 2.									
APPLICATION AS AMENDED - PART II									
(Column 1)		(Column 2)		(Column 3)		SMALL ENTITY		OTHER THAN SMALL ENTITY	
AMENDMENT A		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		x =	
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		TOTAL ADD'L FEE	
AMENDMENT B		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE(\$)	ADDITIONAL FEE(\$)	RATE(\$)	ADDITIONAL FEE(\$)
	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		x =	
	Application Size Fee (37 CFR 1.16(s))								
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))								
						TOTAL ADD'L FEE		TOTAL ADD'L FEE	
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20". *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3". The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.									



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US

CONFIRMATION NO. 4444

POA ACCEPTANCE LETTER

20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834



Date Mailed: 01/24/2011

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/01/2010.

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

/twoldeyes/

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



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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US

CONFIRMATION NO. 4444

PUBLICATION NOTICE



OC000000047515397

20350
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

Title:WIDEBAND TUNER ARCHITECTURE

Publication No.US-2011-0105068-A1

Publication Date:05/05/2011

NOTICE OF PUBLICATION OF APPLICATION

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

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

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently <http://pair.uspto.gov/>. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

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

To: Docket@kilpatricktownsend.com,ipefiling@kilpatricktownsend.com,jlhice@kilpatrick.foundationip.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 20350

May 06, 2011 05:48:15 AM

Dear PAIR Customer:

KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 20350 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

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The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12762900	NTC.PUB	05/05/2011	022287-002710US

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US	4444

20350 7590 08/30/2012
KILPATRICK TOWNSEND & STOCKTON LLP
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SAN FRANCISCO, CA 94111-3834

EXAMINER

JACKSON, BLANE J

ART UNIT	PAPER NUMBER
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2618

NOTIFICATION DATE	DELIVERY MODE
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08/30/2012

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

Docket@kilpatricktownsend.com
ipefiling@kilpatricktownsend.com
jlhice@kilpatrick.foundationip.com

Office Action Summary	Application No.	Applicant(s)	
	12/762,900	REDDY ET AL.	
	Examiner	Art Unit	
	BLANE J. JACKSON	2618	

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 April 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 5) ☒ Claim(s) 1-27 is/are pending in the application.
- 5a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 6) ☒ Claim(s) 16-25 is/are allowed.
- 7) ☒ Claim(s) 1-6,9 and 26 is/are rejected.
- 8) ☒ Claim(s) 7,8,10-15 and 27 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 19 April 2010 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) ☒ Notice of References Cited (PTO-892) | 4) ☐ Interview Summary (PTO-413) |
| 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) ☒ Information Disclosure Statement(s) (PTO/SB/08) | 5) ☐ Notice of Informal Patent Application |
| Paper No(s)/Mail Date ____. | 6) ☐ Other: ____. |

DETAILED ACTION

Information Disclosure Statement

The Information Disclosure Statement filed 21 July 2010 is made of record.

Claim Objections

Claim 26 objected to (and rejected) because the preamble includes the key concept phrase of "and grouping the desired channels in a contiguous frequency spectrum" which is not supported in the body of the claim and is consequently not given patentable weight. Amendment is suggested to support this inventive concept.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6, 9 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Safarian et al. US 2009/0075613 in view of Claxton et al. US 6,735,421.

As to claim 1, Safarian teaches a wideband receiver system comprising:
a wideband receiver configured to concurrently receive a plurality of desired RF channels (figure 1, paragraph 0023), said wideband receiver comprising:

a mixer module coupled to the plurality of desired RF channels and having a first mixer configured to generate an in-phase signal and a second mixer configured to generate a quadrature signal (figure 1, paragraph 0024, the second down conversion stage has quadrature branches comprising complex I/Q mixers driven by LO2 in quadrature),

a wideband analog-to-digital converter (ADC) module having a first wideband 8 ADC coupled with the in-phase signal and configured to generate a digitalized in-phase signal and a second wideband ADC coupled with the quadrature signal and configured to generate a digitalized quadrature signal (figure 1, paragraph 0024, after the mixers, each I/Q signal passes through a low pass filter, a variable gain amplifier to set the appropriate signal level for the analog to digital converters), and

a digital front end (DFE) module (paragraph 0024, the I/Q ADCs are coupled to a digital signal processor (DSP).

Safarian teaches an RF front end and a digital (baseband) front end (DFE) but is silent to the DFE comprising a plurality of complex mixers coupled to the digital in-phase and quadrature signals, each one of the plurality of complex mixers frequency-shifting a different one of the plurality of the desired RF channels to a baseband signal.

Claxton teaches a wideband wireless receiver comprising down conversion and a quadrature ADC (62) which is coupled to a DFE comprising a specialized digital channelizer (22) and DSP (not shown), figures 1, 2, 5, 10 and 11, column 4, lines 1-61. Claxton teaches the digital channelizer comprises an array of quadrature mirror filters or an array of digital sub-band tuners (DSBTs) that digitally converts individual carrier

Art Unit: 2618

signals from all received signals based on a programmable center frequencies with programmable bandwidth where these separated signal frequency bands can then be processed in the normal manner by a subsequent DSP, column 4, line 62 to column 5, line 4 and column 12, lines 4-34.

Since Claxton discloses each channelizer may be implemented as a programmable digital signal processor, column 12, lines 19-34, it would have been obvious to one of ordinary skill in the art at the time of the invention to realize the digital signal processor of the wideband receiver of Safarian include the channelizer functions of Claxton to process multiple received signals simultaneously at any particular time.

As to claim 2, Safarian teaches the system of claim 1 further comprises a local oscillator having an oscillator frequency centered around the plurality of the desired RF channels (figure 1, paragraph 0024, a UWB dual conversion receiver with a second LO to further down convert the IF signal to zero/ low IF I and Q signals)

As to claim 3, Safarian teaches the system of claim 2 wherein the local oscillator comprises a phase- locked loop (figure 1, paragraph 0024, LO2).

As to claim 4, Claxton of Safarian modified teaches the system of claim 1 wherein the plurality of desired RF channels 2 conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol (Safarian and Claxton discuss a wideband

receiver for application with protocols and standards used in wireless communication but Claxton suggest other standards depending on the particular application).

As to claim 5, Claxton of Safarian modified teaches the system of claim 1 wherein each one of the plurality of complex mixers comprises a pair of digital multipliers, each pair of the digital multipliers is coupled to a numerically controlled oscillator (figures 11-14 column 12, lines 4-59, each channelizer (22) comprises a digital multiplier coupled to a necessary NCO).

As to claim 6, Claxton of Safarian modified teaches the system of claim 1 wherein the DFE module further comprises a plurality of channel filters, each one of the plurality of channel filters is coupled to each one of the plurality of complex mixers and configured to filter one of the plurality of the desired channels (column 12, lines 19-34, the DSBT digitally filters the individual carrier data stream with programmable bandwidth).

As to claim 9, Claxton of Safarian modified teaches the system of claim 1 wherein the DFE module further comprises a digital interface module configured to communicate the decimated plurality of the desired channels to a demodulator (figure 12, column 12, lines 35-59, output formatter (280)).

As to claim 26, Safarian teaches a method of receiving a plurality of radio frequency (RF) channels including a number of desired channels that are located in non-contiguous portions of a frequency spectrum *and grouping the desired channels in a contiguous frequency spectrum*, the method comprising:

concurrently receiving the plurality of RF channels (figure 1, paragraph 0023, an UWB zero/ low IF dual conversion receiver),

producing an in-phase signal and a quadrature signal by mixing the plurality of RF channels with a first oscillator frequency and a second local frequency (figure 1, paragraph 0024, the second down conversion stage has quadrature branches comprising complex I/Q mixers driven by LO2 in quadrature),

digitizing the in-phase and quadrature signals (figure 1, paragraph 0024, after the mixers, each I/Q signal passes through a low pass filter, a variable gain amplifier to set the appropriate signal level for the analog to digital converters), and

frequency down-shifting the digital in-phase and quadrature signals to a baseband signal using a number of complex mixers, wherein the first and second oscillator frequencies are identical and have a phase shift of 90° degree between them, wherein the number of complex mixers correspond to the number of desired channels.

Safarian teaches a RF front end and a digital front end (DFE) but is silent to the DFE frequency down shifting the digital in phase and quadrature signals to a baseband signal using a number of complex mixers with the oscillator frequencies are in quadrature wherein the number of complex mixers correspond to the number of desired channels.

Claxton teaches a wideband wireless receiver comprising down conversion and a quadrature ADC (62) which is coupled to a DFE comprising a specialized digital channelizer (22) and DSP (not shown), figures 1, 2, 5, 10 and 11, column 4, lines 1-61. Claxton teaches the digital channelizer comprises an array of quadrature mirror filters or an array of digital sub-band tuners (DSBTs) that digitally converts individual carrier signals from all received signals based on a programmable center frequencies with programmable bandwidth where these separated signal frequency bands can then be processed in the normal manner by a subsequent DSP, column 4, line 62 to column 5, line 4 and column 12, lines 4-34.

Since Claxton discloses each channelizer may be implemented as a programmable digital signal processor, column 12, lines 19-34, it would have been obvious to one of ordinary skill in the art at the time of the invention to realize the digital signal processor of the wideband receiver of Safarian include the channelizer functions of Claxton to process multiple received signals simultaneously at any particular time.

Allowable Subject Matter

Claims 7, 8, 10-15 and 27 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 16-25 are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BLANE J. JACKSON whose telephone number is (571)272-7890. The examiner can normally be reached on Monday through Friday, 8:30 AM-5:30 PM, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Urban can be reached on (571) 272-7899. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

/BLANE J JACKSON/
Primary Examiner, Art Unit 2618

Notice of References Cited	Application/Control No. 12/762,900		Applicant(s)/Patent Under Reexamination REDDY ET AL.	
	Examiner BLANE J. JACKSON		Art Unit 2618	Page 1 of 1

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*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2009/0075613	03-2009	Safarian et al.	455/232.1
*	B	US-6,735,421	05-2004	Claxton et al.	455/207
*	C	US-6,262,981	07-2001	Schmutz, Thomas R.	370/347
*	D	US-6,282,184	08-2001	Lehman et al.	370/342
*	E	US-2004/0058661	03-2004	Hsu et al.	455/311
*	F	US-6,760,342	07-2004	Skones et al.	370/437
*	G	US-6,253,094	06-2001	Schmutz, Thomas R.	455/562.1
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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

Search Notes 	Application/Control No. 12762900	Applicant(s)/Patent Under Reexamination REDDY ET AL.
	Examiner BLANE J JACKSON	Art Unit 2618

SEARCHED			
Class	Subclass	Date	Examiner
455	132, 140, 313, 315, 323, 324, 325, 334	08/24/12	BJJ

SEARCH NOTES		
Search Notes	Date	Examiner
Search of EAST database; review of IDS; no DP to FAOM	08/23/12	BJJ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

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EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	30	(455/205-326.ccls. or "370".clas.) and (DOCSIS or wideband adj6 receiver) and quadrature with mix\$4 and channeliz\$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 14:31
L2	149	(455/205-326.ccls. or "370".clas.) and (DOCSIS or wideband adj6 receiver) and quadrature with mix\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 14:41
L3	6	(455/205-326.ccls. or "370".clas.) and channeliz\$7 with (FFT or DSP) and quadrature with mix\$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:18
L4	133	(455/205-326.ccls. or "370".clas.) and channeliz\$7 with (FFT or DSP)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:22
L5	17	(455/205-326.ccls. or "370".clas.) and quadrature same channeliz\$7 with (FFT or DSP)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:23
L6	17	("5572213" "5790529" "5805574" "6016426" "6052085" "6262981" "6282184" "6324391" "6442148" "6473602" "6504867").PN. OR ("6760342").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/21 15:25
L7	2	"20090075613"	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/21 15:27
L8	1	"8090320".pn.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/21 15:31
L9	0	(455/205-326.ccls. or "370".clas.) and quadrature with mix\$2 same channeliz\$7 same (FFT or DSP)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:34
L10	7	(455/205-326.ccls. or "370".clas.) and quadrature same wideband and channeliz\$7 same (FFT or DSP)	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2012/08/21 15:34

			EPO; JPO; DERWENT; IBM_TDB			
L11	147	(455/205-326.ccls. or "370".clas.) and wideband and quadrature same channeliz\$7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:36
L12	2	"8090320".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:48
L13	3	"20090075613"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:48
L14	110	(455/205-326.ccls. or "370".clas.) and wideband adj6 receiver and channeliz\$7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:50
L15	18	(455/205-326.ccls. or "370".clas.) and wideband adj6 receiver and (IQ or quadrature) with channeli\$7	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 15:53
L16	12	Reddy-Madhukar.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 16:03
S88	3	"20100035554"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/08 10:29
S89	17	455/114.2,114.3,115.1.ccls. and updat\$4 with complex same (LUT or table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/08 12:25
S90	0	455/114.2,114.3,115.1.ccls. and updat\$4 with complex same (bypass or disable) with(LUT or table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/08 12:51
S91	0	455/114.2,114.3,115.1.ccls. and updat\$4 with complex same (bypass\$4 or disable\$4) with (LUT or	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2012/08/08 12:51

		table)	EPO; JPO; DERWENT; IBM_TDB			
S92	10	455/114.2,114.3,115.1.ccls. and (bypass\$4 or disable\$4) with (LUT or table)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/08 12:51
S93	1	Peiris-Bemini-Hennadige-Janath.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/08 12:54
S94	2	"7379715".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/09 11:13
S95	13	455/114.2-115.2.ccls. and calibrat\$5 same (peak or detect\$4) same image	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/13 11:58
S96	1	(455/450-453.ccls. or 370/329.ccls.) and cognitive adj5 radio same grow\$4 with bandwidth	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/15 11:54
S97	1	(455/450-453.ccls. or 370/329.ccls.) and cognitive adj5 radio same grow\$4 with bandwidth	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/15 11:55
S98	7	(455/450-453.ccls. or 370/329.ccls.) and cognitive adj5 radio same occupied with bandwidth	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/15 11:59
S99	4	("20040047324" "20070189348" "20080130519" "7957451").PN. OR ("8145230").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/15 12:05
S100	46	callaway\$4-Edgar\$4.in.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/15 12:06
S101	9	callaway\$4-Edgar\$4.in. and cognitive	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/15 12:06
S102	3	"20070032220"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 09:43

S103	2	"5768260".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:09
S104	2	"5705949".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:10
S105	2	"5590156".pn.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:11
S106	3	"20070263754"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:25
S107	2	"20070179649"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:26
S108	3	"20070032220"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:32
S109	3	"20070002961"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:35
S110	3	"20030228855"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:42
S111	2	"20030158614"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:43
S112	13	455/205-326.ccls. and wideband adj6 receiver same channeliz\$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 10:50

S113	1	455/205-326.ccls. and wideband adj6 receiver same quadrature same channeliz\$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 11:59
S114	6	(455/205-326.ccls. or "370".clas.) and wideband adj6 receiver same quadrature same channeliz\$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 12:00
S115	21	(455/205-326.ccls. or "370".clas.) and wideband adj6 receiver and quadrature same channeliz\$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 12:01
S116	8	("5613234" "6115363" "6437718" "6498535" "6504515").PN. OR ("6735421").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/08/21 12:04
S117	8	(455/205-326.ccls. or "370".clas.) and wideband adj6 receiver and quadrature with mix\$4 same channeliz\$6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/08/21 12:11

8/ 21/ 2012 4:06:23 PM
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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Use as many sheets as necessary)				Complete if Known	
				Application Number	12/762,900
				Filing Date	April 19, 2010
				First Named Inventor	Reddy, Madhukar
				Art Unit	2617
				Examiner Name	Unassigned
Sheet	1	of	2	Attorney Docket Number	022287-002710US

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number Kind Code ² (if known)			
	AA	US-5768260 A	06-16-1998	Kline et al.	
	AB	US-5705949 A	01-06-1998	Alelyunas et al.	
	AC	US-5590156 A	12-31-1996	Carney	
	AD	US-2007/0263754 A1	11-15-2007	Currian et al.	
	AE	US-2007/0179649 A1	08-02-2007	Mitsuno	
	AF	US-2007/0032220 A1	02-08-2007	Feher	
	AG	US-2007/0002961 A1	01-04-2007	Hector et al.	
	AH	US-2003/0228855 A1	12-11-2003	Hertz et al.	
	AI	US-2003/0158614 A1	08-21-2003	Friel et al.	
	AJ	US-12/762,950	Filed: 04-19-2010	Walsh et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document		Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Country Code ³	Number ⁴	Kind Code ⁵ (if known)		
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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.J./

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Examiner Initials *	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
	AK	International Search Report of the International Searching Authority for Application No. PCT/US2010/031627, mailed on June 18, 2010, 2 pages.	☐
	AL	Written Opinion of the International Searching Authority for Application No. PCT/US2010/031627, mailed on June 18, 2010, 5 pages.	☐
	AM	International Search Report of the International Searching Authority for Application No. PCT/US2010/031631, mailed on June 17, 2010, 2 pages.	☐
Examiner Signature	/Blane Jackson/		Date Considered 08/20/2012

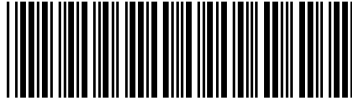
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Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	12/762,900
				Filing Date	April 19, 2010
				First Named Inventor	Reddy, Madhukar
				Art Unit	2617
				Examiner Name	Unassigned
Sheet	2	of	2	Attorney Docket Number	022287-002710US

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/B.J./	AN	Written Opinion of the International Searching Authority for Application No. PCT/US2010/031631, mailed on June 17, 2010, 6 pages.	☐

Examiner Signature	/Blane Jackson/	Date Considered	08/20/2012
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¹EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ² Applicant's unique citation designation number (optional). ³ See Kind Codes of U.S. Patent Documents at www.uspto.gov or MPEP 901.04. ⁴ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁵ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁶ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. ⁷ Applicant is to place a check mark here if English language Translation is attached.

<i>Index of Claims</i> 	Application/Control No. 12762900	Applicant(s)/Patent Under Reexamination REDDY ET AL.
	Examiner BLANE J JACKSON	Art Unit 2618

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47										
CLAIM		DATE								
Final	Original	08/24/2012								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	O								
	8	O								
	9	✓								
	10	O								
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	20	=								
	21	=								
	22	=								
	23	=								
	24	=								
	25	=								
	26	✓								
	27	O								

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Application	Document	Mailroom Date	Attorney Docket No.
12762900	CTNF	08/30/2012	022287-002710US
	CTNF	08/30/2012	022287-002710US
	892	08/30/2012	022287-002710US
	1449	08/30/2012	022287-002710US

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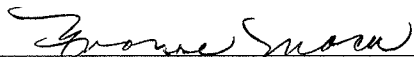
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PATENT
Attorney Docket No.: 89194-002710US-784817

KILPATRICK TOWNSEND & STOCKTON LLP

By: _____


Yvonne Mock

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Madhukar Reddy et al.

Application No.: 12/762,900

Filed: April 19, 2010

For: WIDEBAND TUNER
ARCHITECTURE

Customer No.: 20350

Confirmation No.: 4444

Examiner: Blane J. Jackson

Technology Center/Art Unit: 2618

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

In response to the Office Action mailed August 30, 2012, please enter the following amendments and remarks:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks/Arguments begin on page 9 of this paper.

Amendments to the Specification:

Please replace paragraph [0040] with the following amended paragraph:

[0040] FIG. 6 shows a simplified schematic block diagram of a wideband multi-tuner receiver system 600 according to an embodiment of the present invention. In an embodiment, multi-tuner system 600 includes low noise amplifier A1602 for receiving an RF input signal 601. Amplifier A1 602 is coupled to at least a tuner1 610 and a tuner2 ~~[[620]]~~ 720. In another embodiment, multi-tuner system 600 may not include amplifier 602 so that RF input signal 601 can be received directly at each tuner 610 and ~~[[620]]~~ 720.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Currently amended) A wideband receiver system comprising:
a wideband receiver configured to concurrently receive a plurality of desired RF channels located in non-contiguous portions of an RF spectrum; said wideband receiver comprising:
a mixer module coupled to the plurality of desired RF channels and having a first mixer configured to generate an in-phase signal and a second mixer configured to generate a quadrature signal;
a wideband analog-to-digital converter (ADC) module having a first wideband ADC coupled with the in-phase signal and configured to generate a digitalized in-phase signal and a second wideband ADC coupled with the quadrature signal and configured to generate a digitalized quadrature signal; and
a digital frontend (DFE) module having a plurality of complex mixers coupled to the digital in-phase and quadrature signals, each one of the plurality of complex mixers frequency-shifting a different one of the plurality of the desired RF channels to form a baseband signal contiguous spectrum of channels.
2. (Original) The system of claim 1 further comprises a local oscillator having an oscillator frequency centered around the plurality of the desired RF channels.
3. (Original) The system of claim 2 wherein the local oscillator comprises a phase-locked loop.
4. (Original) The system of claim 1 wherein the plurality of desired RF channels conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol.

5. (Original) The system of claim 1 wherein each one of the plurality of complex mixers comprises a pair of digital multipliers, each pair of the digital multipliers is coupled to a numerically controlled oscillator.

6. (Original) The system of claim 1 wherein the DFE module further comprises a plurality of channel filters, each one of the plurality of channel filters is coupled to each one of the plurality of complex mixers and configured to filter one of the plurality of the desired channels.

7. (Original) The system of claim 6 wherein each one of the plurality of channel filters is a finite impulse response filter.

8. (Original) The system of claim 1 wherein the DFE module further comprises a decimator module configured to decimate each one of the plurality of the desired channels in the baseband.

9. (Original) The system of claim 1 wherein the DFE module further comprises a digital interface module configured to communicate the decimated plurality of the desired channels to a demodulator.

10. (Original) The system of claim 1 further comprising:
an up-converter module configured to frequency-shift the plurality of desired RF channels in the baseband to an intermediate frequency band.

11. (Original) The system of claim 10 wherein the up-converter module comprises a plurality of N up-mixers having a plurality of associated oscillator frequencies, wherein N is an integer value equal to the plurality of the desired RF channels; wherein the plurality of associated oscillator frequencies are so chosen so that when mixing with the plurality of desired channels in the baseband, the mixed products occupy a contiguous frequency spectrum, or a substantially-contiguous frequency spectrum with one or more spacings between the desired channels,

wherein the one or more spacings are variable, and

wherein the one or more spacings are smaller than or comparable to a channel bandwidth, or small measured as a fraction of the bandwidth of the first and second wideband ADCs.

12. (Original) The system of claim 11 wherein the mixed products comprise spectra that are spaced in such a way so as to avoid overlap with known frequency bands containing potential or actual interferers.

13. (Original) The system of claim 11 wherein the mixed products comprise spectra that are spaced in such a way so as to avoid overlap with known frequency bands that introduce interference to other systems.

14. (Original) The system of claim 11 wherein each one of the plurality of N up-mixers is a digital complex mixer and each one of the plurality of associated oscillator frequencies is generated by a numerically controlled oscillator.

15. (Currently amended) The system of claim 1 further comprises a digital-to-analog converter configured to convert the contiguous ~~group~~ spectrum of channels in the intermediate frequency spectrum to an analog waveform.

16. (Original) A multi-tuner receiver system for receiving a plurality of desired radio frequency (RF) channels that extend over multiple non-contiguous portions of a broad frequency spectrum and grouping them in a contiguous frequency spectrum, the system comprising:

a first tuner configured to receive a first portion of the broad frequency spectrum, the first tuner includes a first mixer module coupled to a first oscillator and is configured to generate a first in-phase signal and a first quadrature signal;

a second tuner configured to receive a second portion of the broad frequency spectrum, the second tuner includes a second mixer module coupled to a second oscillator and is configured to generate a second in-phase signal and a second quadrature signal;

a first analog-to-digital converter module configured to digitize the first in-phase and quadrature signals;

a second analog-to-digital converter module configured to digitize the second in-phase and quadrature signals;

a first digital frontend (DFE) module having a first bank of down-mixers coupled to the first digital in-phase and quadrature signals, each of the first bank of down-mixers is configured to frequency shift one of the desired RF channels in the first portion of the broad frequency spectrum; and

a second digital frontend (DFE) module having a second bank of down-mixers coupled to the second digital in-phase and quadrature signals, each of the second bank of down-mixers is configured to frequency shift one of the desired RF channels in the second portion of the broad frequency spectrum;

wherein the first DFE module frequency-shifts the desired RF channels in the first portion of the broad frequency spectrum to a first portion of a baseband signal;

wherein the second DFE module frequency-shifts the desired RF channels in the second portion of the broad frequency spectrum to a second portion of the baseband signal.

17. (Original) The multi-tuner receiver system of claim 16 further comprising a crossbar switch interposed between the first and second analog-to-digital converter modules and the first and second DFE modules.

18. (Original) The multi-tuner receiver system of claim 16 further comprises:
a first up-converter module having a first bank of up-mixers coupled to the first portion of the baseband signal and configured to frequency shift the first portion of the baseband signal to a first portion of an intermediate frequency spectrum;

a second up-converter module having a second bank of up-mixers coupled to the second portion of the baseband signal and configured to frequency shift the second portion of the baseband signal to a second portion of the intermediate frequency spectrum; and

a digital-to-analog converter configured to convert the first and second portions of the intermediate frequency spectrum to an analog waveform signal.

19. (Original) The multi-tuner receiver system of claim 18 further comprising a crossbar switch interposed between the first and second DFE modules and the first and second up-converter modules.

20. (Original) The multi-tuner receiver system of claim 16 wherein the first and second portions are adjacent to each other and non-overlapping.

21. (Original) The multi-tuner receiver system of claim 16 wherein each one of the first bank of down-mixers comprises a pair of digital multiplier having an input terminal coupled to a numerically controlled oscillator.

22. (Original) The multi-tuner receiver system of claim 16 wherein the first DFE module further comprises a plurality of channel filters, each one of the plurality of channel filters is coupled to each one of the first bank of down-mixers and configured to filter one of the frequency down-shifted RF channels.

23. (Original) The multi-tuner receiver system of claim 16 wherein the plurality of desired RF channels conform to one of a digital video broadcasting (DVB) standard.

24. (Original) The multi-tuner receiver system of claim 16 wherein the plurality of desired RF channels conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol.

25. (Original) The multi-tuner receiver system of claim 16 wherein the plurality of RF channels conform to a television broadcasting standard.

26. (Currently amended) A method of receiving a plurality of radio frequency (RF) channels including a number of desired channels that are located in non-contiguous portions of a frequency spectrum ~~and grouping the desired channels in a contiguous frequency spectrum~~, the method comprising:

concurrently receiving the plurality of RF channels;
producing an in-phase signal and a quadrature signal by mixing the plurality of RF channels with a first oscillator frequency and a second local frequency;
digitizing the in-phase and quadrature signals; and
grouping the desired channels to a contiguous frequency spectrum by frequency
down-shifting the digital in-phase and quadrature signals ~~to a baseband signal~~ using a number of complex mixers,

wherein the first and second oscillator frequencies are identical and have a phase shift of 90° degree between them,

wherein the number of complex mixers ~~correspond~~ corresponds to the number of desired channels.

27. (Currently amended) The method of claim 26 further comprises:
frequency up-shifting the ~~baseband signal~~ contiguous frequency spectrum to an intermediate frequency; and
~~converting the frequency up-shifted baseband signal to an analog waveform.~~

REMARKS/ARGUMENTS

Paragraph [0040] has been amended to correct minor typographical mistakes. Claims 1, 15, 26 and 27 are amended to more fully define the scope of the invention recited therein. Support for the amendments can be found throughout the originally filed specification. No new matter is added. Accordingly, upon entry of this amendment, claims 1-27 remain pending.

Claim 26 has been amended to recite “grouping the desired channels to a contiguous frequency spectrum by frequency down-shifting the digital in-phase and quadrature signals using a number of complex mixers” to overcome the claim objection. Withdrawal of the objection to claim 26 is thus respectfully requested.

Applicants thank the Examiner for indicating that claims 16-25 are allowed.

Claims 1-6, 9 and 26 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Safarian et al. (US Pub. No. 2009/0075613, hereinafter “Safarian”) in view of Claxton et al. (US 6,735,421, hereinafter “Claxton”). Claims 7, 8, 10-15 and 27 stand objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Without conceding the merits of the rejection as applied to the previously presented claim 1, Applicants respectfully submit that amended claim 1 is allowable for at least the following reasons.

In connection with the rejection of claim 1, the Examiner correctly points out:

“Safarian is silent to the DFE comprising a plurality of complex mixers coupled to the digital in-phase and quadrature signals, each one of the plurality of complex mixers frequency-shifting a different one of the plurality of the desired RF channels to a baseband signal.

In applying Claxton to reject claim 1, the Examiner asserts:

“Claxton teaches a wideband receiver comprising down conversion and a quadrature ADC (62) which is coupled to a DFE comprising a specialized digital channelizer (22) and DSP (not shown), figures 1, 2, 5, 10 and 11, column 4, lines 1-61. Claxton teaches the digital channelizer comprises an array of quadrature mirror filters or an array of digital sub-band tuners (DSBTs) that digitally converts individual carrier signals from all received signals based on a programmable center frequencies with programmable bandwidth where these separated signal frequency bands can then be processed in the normal manner by a subsequent DSP, column 4, line 62 to column 5, line 4 and column 12, lines 4-34).

Claim 1, as amended, recites in part that “a wideband receiver configured to concurrently receive a plurality of desired RF channels located in non-contiguous portions of a RF spectrum,” and “each one of the plurality of complex mixers frequency-shifts a different one of the plurality of the desired RF channels to form a contiguous spectrum of channels.”

Applicants submit that there is no teaching or suggestion in Claxton of “a plurality of complex mixers frequency-shifting a different one of the plurality of the desired RF channels to form a contiguous spectrum of channels,” as recited in claim 1. As well known in the art, quadrature mirror filters perform filter bank filtering and are thus different from complex mixers that perform frequency shifting. As best understood, Claxton appears directed to using digital sub-band tuners (DSBTs) for filtering individual carrier signals. Specifically, cited portions of Claxton discuss:

“Specifically, FIGs. 11 and 14 show that the preferred channelizer 22 has a plurality of DSBTs 274. Each DSBT 274 digitally filters individual carrier signals from a digital multi-carrier signal based on a programmable center frequency f_c . The specifics of each DSBT 274 can be seen in FIG. 10. With continuing reference to FIG. 14, it will be appreciated that each DSBT 274 also digitally filters the individual carrier signals based on a programmable bandwidth. Thus, all of the remaining in-band content from the A/D converters 20 is routed to the DSBTs 274.

The DSBTs 274 can be allocated based on frequency or modulation format. For example, the first DSBT 274a could digitally filter individual carrier data streams having a first modulation format (e.g., CDMA), and a second DSBT 274b could digitally filter individual carrier data streams having a second modulation format (e.g., GSM). An FFT could also be used to efficiently extract carriers and bands with a large number of regularly spaced carriers.”
(Claxton: col. 12, lines 8-26)

As is shown in the portions reproduced above, in Claxton the DSBTs appear to perform digital filtering to separate the contiguous carrier signals into their respective frequency bands (for example, CDMA or GSM bands) whereas, in accordance with claim 1, each of the complex mixers frequency-shifts a different one of the desired RF channels that is located in non-contiguous portions of an RF spectrum to a continuous spectrum of channels, which Claxton does not disclose or suggest.

Claim 1 is thus allowable over Safarian and Claxton for at least these reasons. Claims 2-15 depend from claim 1 and are thus allowable over Safarian and Claxton for at least the same reasons as is claim 1. Claims 2-15 are further allowable for reciting additional elements that Safarian and Claxton fail to teach or suggest. For example, claim 3 recites “wherein the local oscillator comprises a phase-locked loop.”

In rejecting claim 3, the Examiner refers to figure 1 and paragraph [0024] of Safarian. Applicants respectfully disagree. The cited paragraph of Safarian merely discusses a local oscillator LO₂. There is no teaching in Safarian of the claimed “phase-locked loop.” Claim 3 is thus allowable for this additional reason.

Claim 4 is further allowable for reciting the additional limitation of “the plurality of desired RF channels conform to a Data Over Cable Service Interface Specification (DOCSIS) protocol,” which the combination of Safarian and Claxton fails to teach or suggest.

In rejecting claim 4, the Examiner writes:

“Safarian and Claxton discuss a wideband receiver for application with protocols and standards used in wireless communication but Claxton suggest other standards depending on the particular application.”

Applicants respectfully disagree and submit that Safarian and Claxton are silent about the claimed desired RF channels conform to a DOCSIS protocol. Claim 4 is thus allowable for this additional reason.

Claim 26, as amended, recites similar limitations as those of claim 1. For example, claim 26 recites in part “grouping the desired channels to a contiguous frequency spectrum by frequency down-shifting the digital in-phase and quadrature signals using a number of complex mixers.”

As discussed in connection with claim 1, Safarian and Claxton, taken alone or in combination, fail to teach or suggest this limitation. Claim 26 and its dependent claim 27 are thus allowable over the cited references for at least this reason.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. Further, the Commissioner is hereby authorized to charge any additional fees or credit any overpayment in connection with this paper to Deposit Account No. 20-1430.

Appl. No. 12/762,900
Amdt. dated February 27, 2013
Reply to Office Action of August 30, 2012

PATENT

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

/Ardeshir Tabibi/

Ardeshir Tabibi
Registration No. 48,750

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A1T/kdp/gs
64541066v.1

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)Docket Number (Optional)
89194-002710US-784817

Application Number 12/762,900

Filed April 19, 2010

For WIDEBAND TUNER ARCHITECTURE

Art Unit 2618

Examiner Blane J. Jackson

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

	Fee	Small Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	\$150	\$75	\$_____
☐ Two months (37 CFR 1.17(a)(2))	\$570	\$285	\$_____
☒ Three months (37 CFR 1.17(a)(3))	\$1,290	\$645	\$645
☐ Four months (37 CFR 1.17(a)(4))	\$2,010	\$1,005	\$_____
☐ Five months (37 CFR 1.17(a)(5))	\$2,730	\$1,365	\$_____

☒ Applicant claims small entity status. See 37 CFR 1.27.☐ A check in the amount of the fee is enclosed.☐ Payment by credit card. Form PTO-2038 is attached.☐ The Director has already been authorized to charge fees in this application to a Deposit Account.☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to
Deposit Account Number 20-1430.☒ Payment made via EFS-Web.**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.**

I am the

☐ applicant/inventor.☐ assignee of record of the entire interest. See 37 CFR 3.71 Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).☒ attorney or agent of record. Registration Number 48,750☐ attorney or agent acting under 37 CFR 1.34. Registration number _____

/Ardeshir Tabibi/

Signature

Ardeshir Tabibi

Typed or printed name

February 27, 2013

Date

(650) 326-2400

Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☒ Total of 1 form is submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

Electronic Patent Application Fee Transmittal

Application Number:	12762900			
Filing Date:	19-Apr-2010			
Title of Invention:	WIDEBAND TUNER ARCHITECTURE			
First Named Inventor/Applicant Name:	Madhukar Reddy			
Filer:	Ardeshir Tabibi/Yvonne Mock			
Attorney Docket Number:	022287-002710US			
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with \$0 paid	2253	1	645	645

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Miscellaneous:				
Total in USD (\$)				645

Electronic Acknowledgement Receipt

EFS ID:	15071528
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	20350
Filer:	Ardeshir Tabibi/Yvonne Mock
Filer Authorized By:	Ardeshir Tabibi
Attorney Docket Number:	022287-002710US
Receipt Date:	27-FEB-2013
Filing Date:	19-APR-2010
Time Stamp:	18:37:06
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$645
RAM confirmation Number	9202
Deposit Account	201430
Authorized User	TABIBI, ARDESHIR

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:					
Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		AMD_EXT_89194-002710US-784817.PDF	643762 d5f80648d10122942ad3c27c84225c47735b8841	yes	14
	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Specification		2	2	
	Applicant summary of interview with examiner		3	9	
	Applicant Arguments/Remarks Made in an Amendment		10	13	
	Extension of Time		14	14	
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30504 6cac7246ba3a25d6c3d3de00e6282684d2dc7624	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			674266		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					



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NOTICE OF ALLOWANCE AND FEE(S) DUE

20350 7590 05/06/2013
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

EXAMINER

JACKSON, BLANE J

ART UNIT

PAPER NUMBER

2649

DATE MAILED: 05/06/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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12/762,900

04/19/2010

Madhukar Reddy

022287-002710US

4444

TITLE OF INVENTION: WIDEBAND TUNER ARCHITECTURE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	08/06/2013

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

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

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

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

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

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

PART B - FEE(S) TRANSMITTAL

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

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

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

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

20350 7590 05/06/2013
KILPATRICK TOWNSEND & STOCKTON LLP
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EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

Certificate of Mailing or Transmission

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US	4444

TITLE OF INVENTION: WIDEBAND TUNER ARCHITECTURE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	08/06/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
JACKSON, BLANE J	2649	455-324000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.	2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 1 _____ 2 _____ 3 _____
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

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

4a. The following fee(s) are submitted: ☐ Issue Fee ☐ Publication Fee (No small entity discount permitted) ☐ Advance Order - # of Copies _____	4b. Payment of Fee(s): (Please first reapply any previously paid issue fee shown above) ☐ A check is enclosed. ☐ Payment by credit card. Form PTO-2038 is attached. ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).
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5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

☐ Applicant asserting small entity status. See 37 CFR 1.27

☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US	4444

20350 7590 05/06/2013
KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

EXAMINER

JACKSON, BLANE J

ART UNIT	PAPER NUMBER
----------	--------------

2649

DATE MAILED: 05/06/2013

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

The Patent Term Adjustment to date is 349 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 349 day(s).

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

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

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

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 12/762,900	Applicant(s) REDDY ET AL.	
	Examiner BLANE J. JACKSON	Art Unit 2649	AIA (First Inventor to File) Status No

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

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

1. ☒ This communication is responsive to the amendment filed 27 February 2013.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are 1-27. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

- a) ☐ All b) ☐ Some *c) ☐ None of the:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Interim copies:

- a) ☐ All b) ☐ Some c) ☐ None of the: Interim copies of the priority documents have been received.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

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

DETAILED ACTION

Allowable Subject Matter

Claims 1-27 are allowed. Reference the applicant's Remarks filed 27 February 2013 for reasons for allowance.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BLANE J. JACKSON whose telephone number is (571)272-7890. The examiner can normally be reached on Monday through Friday, 8:30 AM-5:30 PM, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Urban can be reached on (571) 272-7899. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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

Application/Control Number: 12/762,900

Page 3

Art Unit: 2649

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/BLANE J JACKSON/

Primary Examiner, Art Unit 2649

Notice of References Cited	Application/Control No. 12/762,900	Applicant(s)/Patent Under Reexamination REDDY ET AL.	
	Examiner BLANE J. JACKSON	Art Unit 2649	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,920,185	07-2005	Hinson, Scott R.	375/295
*	B	US-2009/0258629	10-2009	Ritchey et al.	455/313
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

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

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



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BIB DATA SHEET

CONFIRMATION NO. 4444

SERIAL NUMBER 12/762,900	FILING or 371(c) DATE 04/19/2010 RULE	CLASS 455	GROUP ART UNIT 2649	ATTORNEY DOCKET NO. 022287-002710US		
APPLICANTS Madhukar Reddy, Carlsbad, CA; Curtis Ling, Carlsbad, CA; Tim Gallagher, Carlsbad, CA; ** CONTINUING DATA ***** This appln claims benefit of 61/170,526 04/17/2009 ** FOREIGN APPLICATIONS ***** ** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ** ** SMALL ENTITY ** 04/28/2010						
Foreign Priority claimed ☐ Yes ☒ No 35 USC 119(a-d) conditions met ☐ Yes ☒ No Verified and Acknowledged <u>/BLANE J JACKSON/</u> Examiner's Signature		☐ Met after Allowance Initials	STATE OR COUNTRY CA	SHEETS DRAWINGS 10	TOTAL CLAIMS 27	INDEPENDENT CLAIMS 3
ADDRESS KILPATRICK TOWNSEND & STOCKTON LLP TWO EMBARCADERO CENTER EIGHTH FLOOR SAN FRANCISCO, CA 94111-3834 UNITED STATES						
TITLE WIDEBAND TUNER ARCHITECTURE						
FILING FEE RECEIVED 709	FEES: Authority has been given in Paper No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:			☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit		

Issue Classification 	Application/Control No. 12762900	Applicant(s)/Patent Under Reexamination REDDY ET AL.
	Examiner BLANE J JACKSON	Art Unit 2649

CPC		
Symbol	Type	Version

CPC Combination Sets				
Symbol	Type	Set	Ranking	Version

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION														
CLASS			SUBCLASS			CLAIMED					NON-CLAIMED									
455			207			H	0	4	B	1 / 16 (2006.01.01)										
CROSS REFERENCE(S)																				
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)																			
455	214																			

NONE		Total Claims Allowed: 27	
(Assistant Examiner) _____ (Date) _____ /BLANE J JACKSON/ Primary Examiner.Art Unit 2649 (Primary Examiner) _____ (Date) _____			
		O.G. Print Claim(s)	O.G. Print Figure
		1	4

Issue Classification 	Application/Control No. 12762900	Applicant(s)/Patent Under Reexamination REDDY ET AL.
	Examiner BLANE J JACKSON	Art Unit 2649

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47															
Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	17	17												
2	2	18	18												
3	3	19	19												
4	4	20	20												
5	5	21	21												
6	6	22	22												
7	7	23	23												
8	8	24	24												
9	9	25	25												
10	10	26	26												
11	11	27	27												
12	12														
13	13														
14	14														
15	15														
16	16														

NONE (Assistant Examiner) _____ (Date) _____		Total Claims Allowed: 27	
/BLANE J JACKSON/ Primary Examiner.Art Unit 2649 (Primary Examiner) _____ (Date) _____		O.G. Print Claim(s) 1	O.G. Print Figure 4

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	"20070032220"	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/04/29 11:35
L2	12	Reddy-Madhukar.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/04/29 11:36
L6	7	455/130-334.ccls. and plurality with mixers same channel and DOCSIS	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/04/29 11:43
L7	11	455/130-334.ccls. and contiguous with channel and DOCSIS	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/04/29 11:51

4/ 29/ 2013 12:33:31 PM

Search Notes 	Application/Control No. 12762900	Applicant(s)/Patent Under Reexamination REDDY ET AL.
	Examiner BLANE J JACKSON	Art Unit 2618

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	132, 140, 313, 315, 323, 324, 325, 334	08/24/12	BJJ

SEARCH NOTES		
Search Notes	Date	Examiner
Search of EAST database; review of IDS; no DP to FAOM	08/23/12	BJJ
Review of amendment; update search to issue	04/29/13	BJJ

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	no interference listed class/ subclass	04/29/13	BJJ

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To: ipefiling@kilpatricktownsend.com,jlhice@kilpatrick.foundationip.com,mcollins@kilpatricktownsend.com
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Application	Document	Mailroom Date	Attorney Docket No.
12762900	NOA	05/06/2013	022287-002710US
	892	05/06/2013	022287-002710US

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or Fax (571)-273-2885**

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

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/762,900	04/19/2010	Madhukar Reddy	022287-002710US	4444

TITLE OF INVENTION: WIDEBAND TUNER ARCHITECTURE

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	\$890	\$300	\$0	\$1190	08/06/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
JACKSON, BLANE J	2649	455-324000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached. ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.	2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.	KILPATRICK TOWNSEND 1 & STOCKTON LLP 2 Ardeshir Tabibi 3
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3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

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

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MAXLINEAR, INC.

(B) RESIDENCE: (CITY and STATE OR COUNTRY)
Carlsbad, California

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

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

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

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- ☐ A check is enclosed.
☒ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 20-1430 (enclose an extra copy of this form).

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

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see form PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

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

Authorized Signature _____ /Ardeshir Tabibi/

Date _____ August 5, 2013

Typed or printed name _____ Ardeshir Tabibi

Registration No. _____ 48,750

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Electronic Patent Application Fee Transmittal				
Application Number:		12762900		
Filing Date:		19-Apr-2010		
Title of Invention:		WIDEBAND TUNER ARCHITECTURE		
First Named Inventor/Applicant Name:		Madhukar Reddy		
Filer:		Ardeshir Tabibi/Gloria Sikora		
Attorney Docket Number:		022287-002710US		
Filed as Small Entity				
Utility under 35 USC 111(a) Filing Fees				
Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	2501	1	890	890
Publ. Fee- Early, Voluntary, or Normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD(\$)
Extension-of-Time:				
Miscellaneous:				
Total in USD (\$)				1190

Electronic Acknowledgement Receipt

EFS ID:	16499409
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	20350
Filer:	Ardeshir Tabibi/Gloria Sikora
Filer Authorized By:	Ardeshir Tabibi
Attorney Docket Number:	022287-002710US
Receipt Date:	05-AUG-2013
Filing Date:	19-APR-2010
Time Stamp:	14:13:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	\$ 1190
RAM confirmation Number	480
Deposit Account	201430
Authorized User	KILPATRICK TOWNSEND & STOCKTON, LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees)

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Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	002710_IFee.pdf	81424	no	2
			51e423c399611a9d9e9c5b6cf292915807452f8f		

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	31796	no	2
			4dd3a2ac704272a86630d748ef003a1e0ad4d2e0		

Warnings:

Information:

Total Files Size (in bytes):			113220
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This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Substitute for form 1449/PTO INFORMATION DISCLOSURE STATEMENT BY APPLICANT <i>(Use as many sheets as necessary)</i>				Complete if Known	
				Application Number	12/762,900
				Filing Date	April 19, 2010
				First Named Inventor	Reddy, Madhukar
				Art Unit	2617
				Examiner Name	Unassigned
Sheet	1	of	2	Attorney Docket Number	022287-002710US

U.S. PATENT DOCUMENTS					
Examiner Initials*	Cite No. ¹	Document Number Number Kind Code ² (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	AA	~~US-5768268-A~~	06-16-1998	Kline et al.	5,768,268
	AB	US-5705949 A	01-06-1998	Alelyunas et al.	
	AC	US-5590156 A	12-31-1996	Carney	
	AD	US-2007/0263754 A1	11-15-2007	Curry et al.	
	AE	US-2007/0179649 A1	08-02-2007	Mitsuno	
	AF	US-2007/0032220 A1	02-08-2007	Feher	
	AG	US-2007/0002961 A1	01-04-2007	Hector et al.	
	AH	US-2003/0228855 A1	12-11-2003	Hertz et al.	
	AI	US-2003/0158614 A1	08-21-2003	Friel et al.	
	AJ	US-12/762,950	Filed: 04-19-2010	Walsh et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials*	Cite No. ¹	Foreign Patent Document Country Code ³ Number ⁴ Kind Code ⁵ (if known)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T ⁶
						☐

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /B.J./

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials *	Cite No. ¹	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T ⁶
	AK	International Search Report of the International Searching Authority for Application No. PCT/US2010/031627, mailed on June 18, 2010, 2 pages.	☐
	AL	Written Opinion of the International Searching Authority for Application No. PCT/US2010/031627, mailed on June 18, 2010, 5 pages.	☐
	AM	International Search Report of the International Searching Authority for Application No. PCT/US2010/031631, mailed on June 17, 2010, 2 pages.	☐
Examiner Signature	/Blane Jackson/		Date Considered 08/20/2012

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. ¹ Applicant's unique citation designation number (optional). ² See Kind Codes of U.S. Patent Documents at www.uspto.gov or MPEP 901.04. ³ Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). ⁴ For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. ⁵ Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. ⁶ Applicant is to place a check mark here if English language Translation is attached.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
12/762,900	09/03/2013	8526898	89194-002710US-784817	4444

20350 7590 08/14/2013

KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

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

The Patent Term Adjustment is 486 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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

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

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

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

Madhukar Reddy, Carlsbad, CA;
Curtis Ling, Carlsbad, CA;
Tim Gallagher, Carlsbad, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

To: ipefiling@kilpatricktownsend.com,jlhice@kilpatrick.foundationip.com,mcollins@kilpatricktownsend.com
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 20350

Aug 15, 2013 05:27:17 AM

Dear PAIR Customer:

KILPATRICK TOWNSEND & STOCKTON LLP
TWO EMBARCADERO CENTER
EIGHTH FLOOR
SAN FRANCISCO, CA 94111-3834
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 20350 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:

The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12762900	ISSUE.NTF	08/14/2013	89194-002710US-784817

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY.DOCKET NO./TITLE	REQUEST ID
12/762,900	04/19/2010	Madhukar Reddy	89194-002710US-784817	25824

Acknowledgement of Loss of Entitlement to Entity Status Discount

The entity status change request below filed through Private PAIR on 09/29/2016 has been accepted.

CERTIFICATIONS:

Change of Entity Status:

☒ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be notification of loss of entitlement to small or micro entity status, as applicable.

This portion must be completed by the signatory or signatories making the entity status change in accordance with 37 CFR 1.4(d)(4).

Signature:	/Craig C. Largent/
Name:	Craig C. Largent
Registration Number:	56400

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:



Practitioners associated with the Customer Number:

23446

OR



Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:



The address associated with Customer Number:

23446

OR

☐ Firm or Individual Name			
Address			
City	State	Zip	
Country			
Telephone			Email

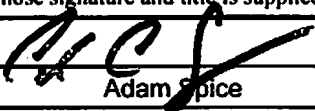
Assignee Name and Address:

Maxlinear, Inc.
5966 La Place Court, Suite 100
Carlsbad, CA 92008

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	8-18-15
Name	Adam Spice	Telephone	
Title	Chief Financial Officer		

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

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

Electronic Acknowledgement Receipt

EFS ID:	41719787
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	20350
Filer:	Wayne Bradley/Laura Foley
Filer Authorized By:	Wayne Bradley
Attorney Docket Number:	89194-002710US-784817
Receipt Date:	22-JAN-2021
Filing Date:	19-APR-2010
Time Stamp:	14:50:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	28427US00_373c_Statement_A IA-96.pdf	118167 63e2764c4367487648e45e3e015efcac4a9d 3717	no	3

Warnings:

Information:					
2	Power of Attorney	Maxlinear_PreAIA_POA.pdf	59090	no	1
			b22cfa4a5f2f83556b2fff07ae2c11edc5e05e54		
Warnings:					
Information:					
Total Files Size (in bytes):			177257		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: MADHUKAR REDDY, CURTIS LING, TIM GALLAGHERApplication No./Patent No.: 8,526,898 Filed/Issue Date: 09-03-2013Titled: WIDEBAND TUNER ARCHITECTURE

Maxlinear, Inc. _____, a corporation

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

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

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

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

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

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

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

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

- A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 024628, Frame 0565, or for which a copy thereof is attached.
- B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:
1. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.
2. From: _____ To: _____
The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

[Page 1 of 2]

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

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

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

4. From: _____ To: _____

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

5. From: _____ To: _____

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

6. From: _____ To: _____

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

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

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

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

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

/Wayne H. Bradley/

Signature

Wayne H. Bradley

Printed or Typed Name

January 22, 2021

Date

Atty 39,916

Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	89194-002710US-784817

CONFIRMATION NO. 4444

POWER OF ATTORNEY NOTICE



OC000000122942786

20350
Kilpatrick Townsend & Stockton LLP - West Coast
Mailstop: IP Docketing - 22
1100 Peachtree Street
Suite 2800
Atlanta, GA 30309

Date Mailed: 01/29/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/22/2021.

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

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

/yfeferra/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	89194-002710US-784817

CONFIRMATION NO. 4444

POA ACCEPTANCE LETTER

23446
MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661



Date Mailed: 01/29/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/22/2021.

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

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

/yfeferra/

To: mhmpato@mcandrews-ip.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 23446

Jan 29, 2021 04:03:19 AM

Dear PAIR Customer:

MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 23446 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:

The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12762900	N570	01/29/2021	89194-002710US-784817
	N570	01/29/2021	89194-002710US-784817

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒

Practitioners associated with Customer Number:

23,446

OR

☐

Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number

Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒

The address associated with Customer Number:

23,446

OR

☐

Firm or individual name

Address

City

State

Zip

Country

Telephone

Email

Assignee name and address: ENTROPIC COMMUNICATIONS, LLC
1345 AVENUE OF THE AMERICAS, 46TH FLOOR
NEW YORK, NY 10105

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature /Andrea L. Gothing/

Date 2021-05-04

Name Andrea L. Gothing

Telephone 415-830-0613

Title Licensing Officer and Authorized Signatory, Entropic Communications, LLC

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	42755054
Application Number:	12762900
International Application Number:	
Confirmation Number:	4444
Title of Invention:	WIDEBAND TUNER ARCHITECTURE
First Named Inventor/Applicant Name:	Madhukar Reddy
Customer Number:	23446
Filer:	Ronald H. Spuhler/Deborah Wilson
Filer Authorized By:	Ronald H. Spuhler
Attorney Docket Number:	89194-002710US-784817
Receipt Date:	18-MAY-2021
Filing Date:	19-APR-2010
Time Stamp:	16:26:28
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	28427US00_373c_Statement_A IA-96.pdf	120593 a3e727f7742386eaa235717b0f66da9c78684e50	no	3

Warnings:

Information:					
2	Power of Attorney	Entropic- POA_General_Assignee_Entrop icCommunications_ALG.pdf	487892 51444e06ae84b241bfc127dc47c5d6c6469 44dd7	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			608485		
This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503. <u>New Applications Under 35 U.S.C. 111</u> If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application. <u>National Stage of an International Application under 35 U.S.C. 371</u> If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course. <u>New International Application Filed with the USPTO as a Receiving Office</u> If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.					

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)Applicant/Patent Owner: ENTROPIC COMMUNICATIONS, LLCApplication No./Patent No.: 12/762,900 Filed/Issue Date: 2010-04-19Titled: WIDEBAND TUNER ARCHITECTUREENTROPIC COMMUNICATIONS, LLC, a limited liability company

(Name of Assignee)

(Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

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

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

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

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

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

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

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

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

1. From: Madhukar Reddy, Curtis Ling, Tim Gallagher To: MAXLINEAR, INC.The document was recorded in the United States Patent and Trademark Office at
Reel 024628, Frame 0565, or for which a copy thereof is attached.2. From: MAXLINEAR, INC. To: ENTROPIC COMMUNICATIONS, LLCThe document was recorded in the United States Patent and Trademark Office at
Reel 055898, Frame 0230, or for which a copy thereof is attached.

[Page 1 of 2]

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

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

STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

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

4. From: _____ To: _____

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

5. From: _____ To: _____

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

6. From: _____ To: _____

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

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

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

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

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

/Ronald H. Spuhler/

2021-05-18

Signature

Date

Ronald H. Spuhler

52245

Printed or Typed Name

Title or Registration Number

Privacy Act Statement

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
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6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	

23446
MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661

CONFIRMATION NO. 4444
POA ACCEPTANCE LETTER



Date Mailed: 05/25/2021

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/18/2021.

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

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

/nrhayden/



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
12/762,900	04/19/2010	Madhukar Reddy	89194-002710US-784817

CONFIRMATION NO. 4444

POWER OF ATTORNEY NOTICE



OC000000125827217

23446
MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661

Date Mailed: 05/25/2021

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/18/2021.

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

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

/nrhayden/

To: mhmpto@mcandrews-ip.com,,
From: PAIR_eOfficeAction@uspto.gov
Cc: PAIR_eOfficeAction@uspto.gov
Subject: Private PAIR Correspondence Notification for Customer Number 23446

May 25, 2021 03:49:59 AM

Dear PAIR Customer:

MCANDREWS HELD & MALLOY, LTD
500 WEST MADISON STREET
SUITE 3400
CHICAGO, IL 60661
UNITED STATES

The following USPTO patent application(s) associated with your Customer Number, 23446 , have new outgoing correspondence. This correspondence is now available for viewing in Private PAIR.

The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

Disclaimer:

The list of documents shown below is provided as a courtesy and is not part of the official file wrapper. The content of the images shown in PAIR is the official record.

Application	Document	Mailroom Date	Attorney Docket No.
12762900	N570	05/25/2021	
	N570	05/25/2021	

To view your correspondence online or update your email addresses, please visit us anytime at <https://sportal.uspto.gov/secure/myportal/privatepair>.

If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov with 'e-Office Action' on the subject line or call 1-866-217-9197 during the following hours:

Monday - Friday 6:00 a.m. to 12:00 a.m.

Thank you for prompt attention to this notice,

UNITED STATES PATENT AND TRADEMARK OFFICE
PATENT APPLICATION INFORMATION RETRIEVAL SYSTEM