Title: TUNER AND BROADCAST RECEIVER HAVING THE SAME

Abstract: A tuner and a broadcast receiver having the tuner are provided. The tuner comprises a tuner unit converting one of broadcasting signals, which is selectively input, into a signal having an intermediate frequency and a demodulator demodulating the converted signal having the intermediate frequency through a demodulation mode of the input signal.
Description
TUNER AND BROADCAST RECEIVER HAVING THE SAME

Technical Field
[1] The present disclosure relates to a tuner and a broadcast receiver having the tuner.

Background Art
[2] As broadcasting media are digitalized, a terrestrial broadcasting service and a satellite broadcasting service have been launched. Recently, a cable broadcasting service has also been digitalized. The digitalization of broadcasting signals will accelerate a convergence service combining broadcasting, computing, and communication as the media using compression technology spreads widely. The digitalization of the broadcasting signals makes it possible to internationalize the media, realize a multi-channel, and provide a variety of data services.

Disclosure of Invention

Technical Problem
[3] Embodiments provide a tuner that is designed to process signals that are modulated through difference modes, and a broadcast receiver having the tuner.
[4] Embodiments provide a tuner that is designed to process not only a digital terrestrial broadcasting signal but also a digital cable broadcasting signal, and a broadcast receiver having the tuner.
[5] Embodiments provide a tuner that is designed to convert one of a digital terrestrial broadcasting signal and a digital cable broadcasting signal into an intermediate frequency and demodulate the intermediate frequency, and a broadcast receiver having the tuner.

Technical Solution
[6] An embodiment provides a tuner comprising: a tuner unit converting one of broadcasting signals, which is selectively input, into a signal having an intermediate frequency and a demodulator demodulating the converted signal having the intermediate frequency through a demodulation mode of the input signal.
[7] An embodiment provides a broadcast receiver comprising: a tuner unit converting one of broadcasting signals, which is selectively input, into a signal having an intermediate frequency, a demodulator demodulating the converted signal having the intermediate frequency in accordance with a broadcasting mode and outputting the demodulated signal as a transport stream, and a decoder decoding the transport stream output from the demodulator.

Advantageous Effects
[8] According to the embodiments, since different broadcasting signals are processed by
one tuner, the number of tuner can be reduced.

[9] In addition, since more than two signals can be processed by one tuner, the number of tuner and cables can be reduced and a radio frequency (RF) splitter and a switch for transport stream can be omitted.

[10] Further, a size of a set such as a TV set, a set-top box, a digital versatile disk (DVD) player, or a personal video recorder (PVR), in which a tuner is mounted, can be reduced.

[11] Furthermore, since different signals can be selectively received and reproduced in accordance with a broadcasting receiving environment, the user convenience can be improved.

**Brief Description of the Drawings**

[12] Fig. 1 is a schematic diagram of a broadcast receiver according to a first embodiment.

[13] Fig. 2 is a schematic diagram of a broadcast receiver according to a second embodiment.

[14] Fig. 3 is a schematic diagram of a broadcast receiver according to a third embodiment.

[15] Fig. 4 is a schematic diagram of a broadcast receiver according to a fourth embodiment.

**Best Mode for Carrying Out the Invention**

[16] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings.

[17] Fig. 1 is a schematic diagram of a broadcast receiver according to a first embodiment.

[18] Referring to Fig. 1, a broadcast receiver 100 comprises a tuner 110 and a decoder 120. The tuner 110 comprises a tuner unit 112 and a demodulator 114.

[19] The broadcast receiver 100 selectively receives modulated signals, which are modulated in different modes, in a set 101, and processes and decodes the received signals. Here, the set 101 may be a TV set, a set-top box, a DVD (DEV-RW, DVD+RW, and the like), a PVR, and the like.

[20] The tuner 110 receives one (RF input) of signals having different modulation modes through an input terminal 102. That is, the tuner 110 receives one of two different digital broadcasting signals, which is selected by a user.

[21] The tuner unit 112 of the tuner 110 selectively receives at least two signals that are modulated through different modes and converts the received signal into a signal having an intermediate frequency. The demodulator 114 demodulates the signal having the intermediate frequency. That is, the tuner unit 112 receives one of, for example,
first and second signals and converts the received signal into a signal having the intermediate frequency. The demodulator 114 demodulates the signal having the intermediate frequency in accordance with a broadcasting mode of the received signal.

The first signal is a digital terrestrial broadcasting mode and the second signal is a digital cable broadcasting signal. The digital broadcasting signal is a signal that is modulated through an orthogonal frequency division multiplexing (OFDM) mode and the digital cable broadcasting signal is a signal that is modulated through a quadrature amplitude modulation (QAM) mode. Frequency bands of the first and second signals are same within a predetermined range (e.g., 44-860 MHz). The frequency bands may vary.

The tuner unit 112 may comprise an amplifier (not shown), a filter (not shown), and a mixer oscillator phase looked loop integrated circuit (MOPPLL IC) (not shown). The amplifier is provided to reduce noise and enhance receiving sensitivity. The amplifier may be a low noise amplifier (LNA). The filter may be a band pass filter (BPF). The MOPPLL IC comprises a PLL, an OSC, and a mixer. The PLL outputs a reference frequency and the OSC generates a local frequency. The mixer mixes the received signal and the local frequency with each other to output an intermediate frequency. The structure and operation of the tuner unit 112 may vary.

The tuner unit 112 is a single unit but processes at least two broadcasting signals. Therefore, the number of the tuner can be reduced. When the number of the tuner unit 112 is reduced, the number of cables connected to the tuner unit 112 can be reduced. In addition, the RF splitter disposed on a front end of the tuner unit 112 can be omitted.

The demodulator 114 comprises different demodulating circuits. The demodulator 114 demodulates the intermediate frequency converted by the tuner unit 112 in accordance with the broadcasting mode of the signals input and outputs the demodulated intermediate frequency as a transport stream.

The tuner 110 may be a network interface module (NIM) tuner or a half NIM tuner. The NIM tuner comprises the tuner unit 112 and the demodulator 114. The half NIM tuner may not comprise the demodulator. Description will be exemplarily made on the NIM tuner.

The transport stream demodulated by the demodulator 114 is input to the decoder 120. The decoder 120 decodes the transport stream and outputs the decoded transport stream as a video signal, an audio signal, or the like. At this point, the transport stream may be, for example, an MPEG-2 transport stream. The video signal decoded by the decoder 120 may be a composite video banking synchronization (CVBS) signal and the audio signal decoded by the decoder 120 may be a stereo signal, a dual signal, and a mono signal.

The decoder 120 may communicate with the tuner 110 through serial communication
(I2C: SCL, SDA).

Even when one of the signals that are modulated through difference modes is input, the broadcast receiver 110 converts the input signal into a signal having the intermediate frequency, demodulates the converted signal having the intermediate frequency using a demodulation mode of the corresponding signal, and decodes the demodulated signal.

Fig. 2 is a schematic diagram of a broadcast receiver according to a second embodiment. In the second embodiment, parts identical to those of the first embodiment will not be described.

Referring to Fig. 2, a broadcast receiver 100A comprises a tuner unit 112, a demodulator 114, a decoder 120, and a board 105.

The tuner unit 112 receives one of broadcasting signals through a input terminal 102. At this point, the tuner unit 112 may receive a first signal that is modulated through a first mode or a second signal that is modulated through a second mode. The first signal may be a digital terrestrial broadcasting signal that is modulated through an OFDM mode and the second signal may be a digital cable broadcasting signal that is modulated through a QAM mode.

The tuner unit 112 selectively receives one of the first and second signals and converts the received signal into a signal having an intermediate frequency.

The demodulator 114 comprises first and second signal demodulating circuits 115 and 116. When the first signal is input through the tuner unit 112, the first signal demodulating circuit 115 demodulates the first signal using a first signal modulating mode. When the second signal is input through the tuner unit 112, the second signal demodulating circuit 116 demodulates the second signal using a second signal modulating mode. That is, the first signal demodulating circuit 115 demodulates the modulated signal using the OFDM mode and the second signal demodulating circuit 116 demodulates the modulated signal using the QAM mode.

Here, a controller (not shown) controls the first and second signal demodulating circuits 115 and 116 in accordance with the signal input to the tuner unit 112. At this point, when the first signal is input to the tuner unit 112, the controller activates the first signal demodulating circuit 115. When the second signal is input to the tuner unit 112, the controller deactivates the first signal demodulating circuit 115. On the contrary, when the second signal is input to the tuner unit 112, the controller activates the second signal demodulating circuit 116. When the first signal is input to the tuner unit 112, the controller deactivates the second signal demodulating circuit 116.

The decoder 120 decodes the transport stream output from one of the first and second signal demodulating circuits 115 and 116 and outputs the decoded transport stream as a video or audio signal.
The board 105 functions as an interface between the components. The tuner unit 112, first signal demodulating circuit 115, and decoder 120 are disposed on a top surface the board 105 and the second signal demodulating circuit 116 is disposed on an undersurface of the board 105. As the top and under surfaces of the board 105 are used to dispose the components, the set space can be efficiently used.

Further, the first and second signal demodulating circuits 115 and 116 are commonly connected to a common port of the decoder 120, the decoder 120 can receive the transport stream through the common port even when the first and second signal demodulating circuits 115 and 116 are not connected to respective ports. Accordingly, there is no need to provide a separate switch for converting and transferring the transport stream on the front end of the decoder 120.

Fig. 3 is a schematic diagram of a broadcast receiver according to a third embodiment. In the third embodiment, parts identical to those of the first embodiment will not be described.

Referring to Fig. 3, a broadcast receiver IOOB comprises a first signal demodulating circuit 115, a second signal demodulating circuit 116, and a decoder 120, which are mounted on a top surface of a board 105.

As all of the components of the broadcast receiver IOOB are disposed on the top surface of the board 105, the number of processes for disposing the components on the board 105 can be reduced.

Fig. 4 is a schematic diagram of a broadcast receiver according to a fourth embodiment. In the fourth embodiment, parts identical to those of the first embodiment will not be described.

Referring to Fig. 4, a broadcast receiver IOOC comprises a first input terminal 102A, a second input terminal 102B, a switch 108, a tuner 110, and a decoder 120.

A terrestrial signal that is a first signal may be input through the first input terminal 102A and a cable signal that is a second signal may be input through the second input terminal 102B. The terrestrial signal is a digital broadcasting signal of an OFDM mode and the cable signal is a digital broadcasting signal of a QAM mode. When the first and second signals are input through the first and second input terminals 102A and 102B, the switch selects and outputs one of the first and second signals.

The tuner 110 comprises a tuner unit 112 that converts the signal input through the switch 108 into a signal having an intermediate frequency and the demodulator 114 demodulates the signal having the intermediate frequency in accordance with a broadcasting mode and outputs a transport stream.

In the fourth embodiment, even when two different signals are simultaneously input to a set 101, only one of the signals is selected by the switch 108 and the selected signal is transferred to the tuner 110. The tuner 110 processes the transferred signal.
According to the embodiments of the present disclosure, the cable broadcasting signal and the terrestrial broadcasting signal that are input through the input terminal are converted into signals each having the intermediate frequency and the converted signals are demodulated by the two demodulating circuits 114 in response to the respective digital terrestrial broadcasting signal and the digital cable broadcasting signal. The demodulated signals are decoded by the decoder 120 and output. That is, the two different signals (the digital terrestrial broadcasting signal and the digital cable broadcasting signal) can be processed by one tuner unit 112. Therefore, the structure of the set can be simplified, slimmed, and minimized.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that the embodiments are provided for descriptive purposes and not for limitation. A person of ordinary skill in the art would understand numerous other modifications and embodiments can be devised that will fall within the spirit and scope of the principles of this disclosure.

**Industrial Applicability**

Embodiments can provide a tuner that can process signals that are modulated through different modes.

Embodiments can provide a tuner that can selectively process the terrestrial and cable signals and can be used for a TV, DVD player, PVR, and set-top box.
Claims

[1] A tuner comprising:
a tuner unit converting one of broadcasting signals, which is selectively input, into a signal having an intermediate frequency; and
a demodulator demodulating the converted signal having the intermediate frequency through a demodulation mode of the input signal.

[2] The tuner according to claim 1, wherein the tuner unit selectively receives one of a first signal modulated through a first mode and a second signal modulated through a second mode and converts the received signal into the signal having the intermediate frequency.

[3] The tuner according to claim 2, wherein the demodulator comprises a first signal demodulating circuit demodulating the intermediate frequency of the first signal modulated through the first mode and a second signal demodulating circuit demodulating the intermediate frequency of the second signal modulated through the second mode.

[4] The tuner according to claim 1, comprising a single input terminal is provided on a front end of the tuner unit and one of a digital terrestrial broadcasting signal and a digital cable broadcasting signal is input through the input terminal.

[5] The tuner according to claim 1, wherein the tuner unit receives one of a digital broadcasting signal of an orthogonal frequency division multiplexing mode and a digital broadcasting signal of a quadrature amplitude modulation mode.

[6] The tuner according to claim 1, wherein the tuner receives one of signals that are within an identical frequency band and modulated through different modulating modes.

[7] A broadcast receiver comprising:
a tuner unit converting one of broadcasting signals, which is selectively input, into a signal having an intermediate frequency;
a demodulator demodulating the converted signal having the intermediate frequency in accordance with a broadcasting mode and outputting the demodulated signal as a transport stream; and
a decoder decoding the transport stream output from the demodulator.

[8] The broadcast receiver according to claim 7, wherein the demodulator comprises a first signal demodulating circuit demodulating a first signal and a second signal demodulating circuit demodulating a second signal, wherein the first and second demodulating circuits are commonly connected to one port of the decoder.

[9] The broadcast receiver according to claim 7, wherein the tuner unit converts one of a first signal of an orthogonal frequency division multiplexing mode and a
second signal of a quadrature amplitude modulation mode into the signal having the intermediate frequency.

[10] The broadcast receiver according to claim 7, wherein the tuner unit is a single unit and converts one of a digital terrestrial broadcasting signal of an orthogonal frequency division multiplexing mode and a digital cable broadcasting signal of a quadrature amplitude modulation mode into the signal having the intermediate frequency.

[11] The broadcast receiver according to claim 8, comprising a board on which the tuner unit, modulator, and decoder are mounted, wherein the first demodulating circuit is disposed on a first surface of the board and the second demodulating circuit is disposed on a second surface of the board.

[12] The broadcast receiver according to claim 7, wherein the tuner unit and the modulator are provided in the form of network interface module type tuners.

[13] The broadcast receiver according to claim 7, comprising a switch that is disposed on a front end of the tuner to select one of the broadcasting signals input through a plurality of input terminals.

[14] The broadcast receiver according to claim 7, wherein the tuner unit comprises an amplifier, a filter, and a mixer oscillator phase locked loop integrated circuit.