

DESCRIPTION

TELEVISION RECEIVER

The present invention relates to a television receiver, particularly which is capable of receiving radio waves of a plurality of television systems having different sound intermediate frequencies (SIFs) and may be suitably applied to a multi-system television tuner, a multi-system video tape-recorder, and the like.

The sound intermediate frequency (SIF) of television broadcasting differs depending on a broadcasting system prescribed by CCIR (International Radio Consultative Committee). For instance, 4.5 MHz is used as the SIF in the case of the M system adopted in Japan, the United States, and other countries; 6.0 MHz in the case of the I system adopted in Hong Kong; 6.5 MHz in the case of the D system adopted in the mainland China; and 5.5 MHz in the case of the B/G system adopted in Singapore, New Zealand, and other countries. In Southeast Asia and Oceania, there is an increasing demand for multi-system television receivers that are capable of receiving radio waves in correspondence with a plurality of systems using different SIFs. In Hong Kong, in particular, there is a strong demand for multi-system television receivers that are capable of receiving both the

I system and the D system with one receiver in order to receive broadcasting from the neighboring mainland China.

Fig. 6 is a block diagram illustrating a configuration of a conventional multi-system television receiver 1 designed to meet such a demand. The multi-system television receiver 1 shown in this diagram comprises a tuner 2, a VIF circuit 3, a video signal processing circuit 4, a CRT 5, an SIF filter 6 for passing the 6.0 MHz band, an SIF filter 7 for passing the 6.5 MHz band, a local oscillating circuit (LOC) 8 for oscillating the 0.5 MHz LOC signal, a mixing/amplifying circuit 9, a detecting circuit 10 for detecting the 6.0 MHz SIF signal, a sound amplifier 11, and a speaker 12.

In this television receiver 1, the television signal of a radio frequency (RF) received by an aerial 13 is tuned by the tuner 2 and is then subjected to IF amplification and video detection by the VIF circuit 3 before the video signal and the sound signal are subjected to processing separately. That is, the video signal is subjected to predetermined processing by the video signal processing circuit 4 and is then supplied to the the CRT 5 to display an image on its screen.

Meanwhile, the sound signal is processed as follows: When a broadcast of the I system is being received, the SIF signal is introduced to the mixing/amplifying circuit 9 via

the 6.0 MHz SIF filter 6; while a broadcast of the D system is being received, the SIF signal is introduced to said circuit via the 6.5 MHz SIF filter 7. Connected to the mixing/amplifying circuit 9 is the 0.5 MHz local oscillating circuit 8 from which 0.5 MHz sinusoidal waves are inputted to the mixing/amplifying circuit 9. When the SIF signal inputted is 6.0 MHz, the mixing/amplifying circuit 9 functions as a mere band limited amplifier and outputs an SIF signal of the same frequency as the input signal. On the other hand, when the SIF signal inputted is 6.5 MHz, the mixing/amplifying circuit 9 functions as a band converting amplifier and outputs an SIF signal of 6.0 MHz in a similar manner. The 6.0 MHz SIF signal thus obtained is detected by the SIF detecting circuit 10. The sound amplifier 11 amplifies the sound signal which is an output from the SIF detecting circuit 10, and the sound signal is outputted as the sound through the speaker 12.

Thus an arrangement is provided so that broadcasts can be received in both systems regardless of whether the SIF frequency is 6.0 MHz or 6.5 MHz without any need to effect manual switching.

In Hong Kong, sound multiplex broadcasting based on digital modulation is presently being planned. The system employed in this scheme is the same as the one used in Great Britain, and the SIF frequency of the digital sound is 6.552

MHz and is transmitted simultaneously with the analog sound of the conventional 6.0 MHz SIF. If a sound multiplex broadcast is received in Hong Kong using a conventional television receiver designed exclusively for the I system, only the analog sound of the 6.0 MHz SIF is detected.

However, if a multiple broadcast is received in Hong Kong using the conventional multi-system television receiver, the analog sound is demodulated, accompanied by noise similar to hiss, or prolonged sibilant sounds, so that the sound thus reproduced is very offensive to the ear. The problem has been confirmed through experimental broadcasting that such an attempt is of no practical use.

This noise is generated owing to the following process: Simultaneously as a monophonic SIF signal of 6.0 MHz passes through the aforementioned circuits 6, 9, the digitally modulated sound signal of 6.552 MHz is frequency converted to 6.052 MHz and mixed with the analog SIF signal of 6.0 MHz in the route of the aforementioned circuits 7, 9 before the signal is subjected to SIF detection. In other words, since the analog sound is frequency modulated, the SIF detecting circuit 10, in a specific term, serves as an FM detector. On the other hand, the digitally modulated sound signal is no more than a random noise-like signal to the FM detector. Accordingly, noise similar to hiss is generated as a result of the detection. In the case of a receiver solely of the I

system, although there is no such noise problem, it is impossible to receive the sound of a broadcast from any other system, for example from mainland China.

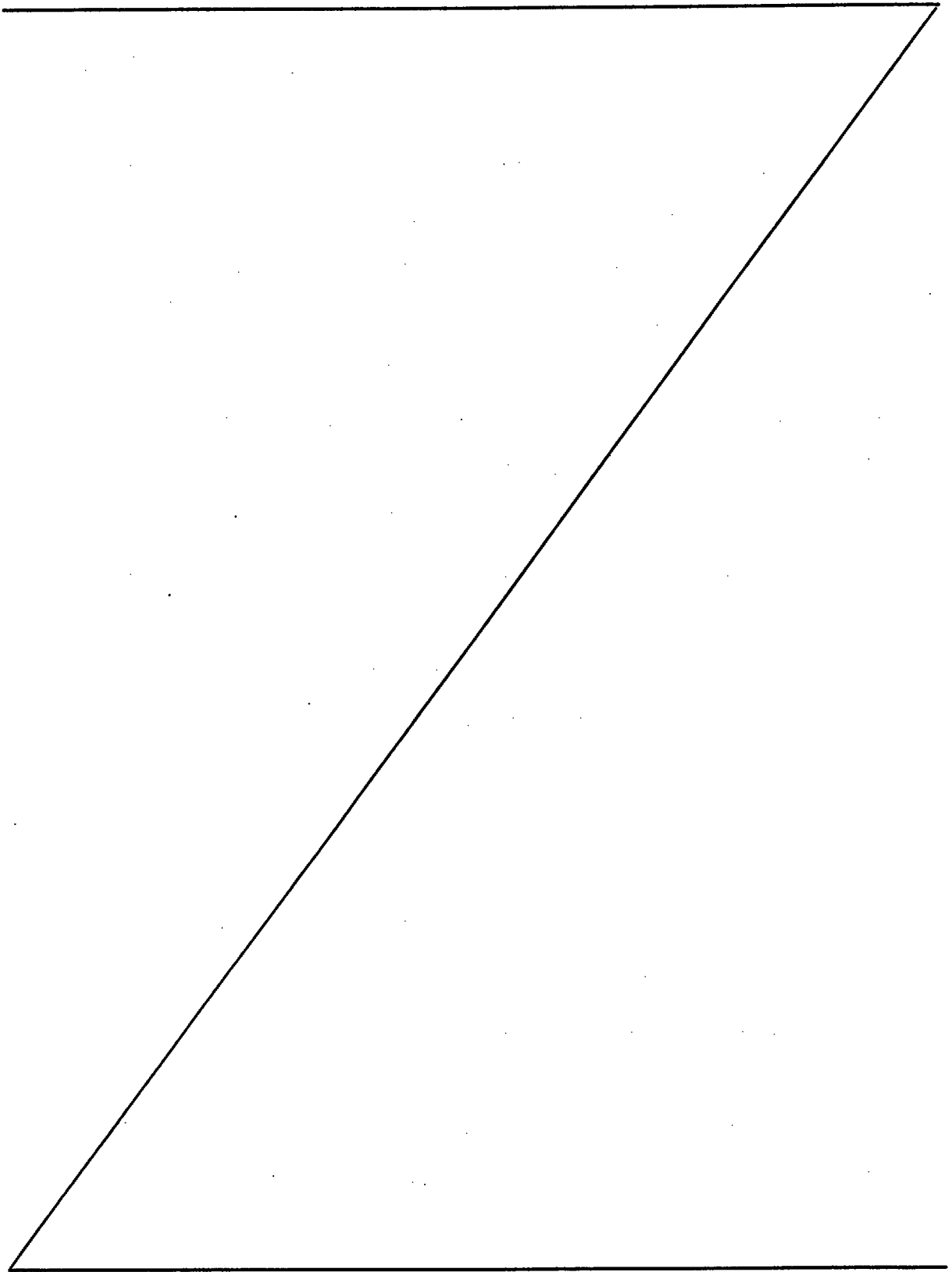
The present invention seeks to provide a multi-system television receiver which is capable of demodulating the analog sound signal into a substantially noise-free signal at the time of reception of a digital sound multiplex broadcast without need for a manual switch, thereby overcoming the above-described drawbacks of the prior art.

According to the present invention there is provided a television receiver comprising a Sound Intermediate Frequency (SIF) pass-band converting means for converting the frequency of at least one of a plurality of incoming SIF signals of different discrete frequencies, into a predetermined frequency, SIF detecting means for detecting a signal of the predetermined frequency at the output from the SIF pass-band converting means, discriminating means for determining the presence of an incoming SIF signal of a particular frequency and an SIF input switching means for preventing the conversion to the predetermined frequency of SIF signals of frequencies other than the particular frequency, if the discriminating means detects the particular frequency among the incoming signals, and for allowing the conversion to the predetermined frequency of SIF signals of frequencies other than the particular frequency if the discriminating means detects the particular frequency signal as absent.

Hence a television receiver may be constructed according to the present invention such that a signal of the predetermined frequency is always applied to the SIF detecting means substantially without noise and regardless of the frequencies of the incoming SIF signals.

In accordance with this aspect of the invention, when it is determined by the discriminating means that a certain kind of SIF signal is present, detection is not effected with respect to an SIF signal having a frequency different from that of that SIF signal, so that it is possible to prevent

noise which is attributable to the SIF signal having the different frequency.



Furthermore, an arrangement may be provided such that the discriminating means outputs a binary signal of high or low level in response to the result of discrimination of the presence of the SIF signal by the discriminating means, and the SIF input switching means performs the prohibiting operation in response to a high-level output from the discriminating means and the allowing operation in response to a low-level output therefrom.

In addition, the multi-system television receiver may further comprise a plurality of SIF filters for filtering respective bands of the plurality of SIF signals having different frequencies, wherein the SIF input switching means is interposed between at least one of the plurality of SIF filters and the SIF pass-band converting means.

The SIF input switching means may be provided in a preceding stage instead of being provided in a following stage of the SIF filter in the manner described above.

In a case where two types of SIF signal, e.g., 6 MHz and 6.5 MHz, are used, an arrangement may be provided such that one unit of SIF input switching means is used, and a local oscillating for supplying an LOC signal of 0.5 MHz to the SIF pass-band converting means may be connected to the converting means. It goes without saying that in a case where two types of SIF signals, 6 MHz and 5.5 MHz, are used, an identical arrangement can be adopted.

Furthermore, in a case where three types of SIF signals, e.g., 6 MHz, 6.5 MHz, and 5.5 MHz, are used, two units of SIF input switching means may be provided and ladder connected. In addition, a tuner, a VIF circuit, a video signal processing circuit, a CRT, a sound signal amplifier, a speaker, and the like may be provided.

There may also be provided a multi-system television receiver including an SIF pass-band converting means for converting the frequencies of a plurality of SIF signals having different frequencies into a predetermined frequency, SIF detecting means for detecting an output from the SIF pass-band converting means, and a local oscillating circuit for oscillating an LOC signal of a predetermined frequency to be supplied to the SIF pass-band converting means, the multi-system television receiver being used commonly for a plurality of television systems having different SIF signal frequencies. The multi-system television receiver is characterized by comprising: (a) discriminating means for determining the presence of one kind of SIF signal among the plurality of SIF signals having different frequencies; and (b) SIF output switching means for prohibiting the inputting of the LOC signal to the SIF pass-band converting means when it is determined by the discriminating means that an SIF signal which is an object of discrimination is present and

for allowing the inputting when it is determined by the discriminating means that the SIF signal is absent.

In this aspect of the invention, an arrangement may be provided such that the discriminating means outputs a binary signal of high or low level in response to the result of discrimination of the presence of the SIF signal by the discriminating means, and wherein the LOC output switching means performs the prohibiting or allowing operation in response to an output from the discriminating means.

Furthermore, this LOC output switching means may be incorporated in the local oscillating circuit.

In a case where two types, 6 MHz and 6.5 MHz, are handled as the SIF, the oscillating frequency of the local oscillating circuit is 0.5 MHz. This also applies to a case where 6 MHz and 5.5 MHz are used as the SIF signals.

In addition, it is possible to provide a plurality of SIF filters, as well as a tuner, a VIF circuit, a video processing circuit, a CRT, a sound signal amplifier, a speaker, and the like in the same way as the first aspect of the present invention.

In accordance with the present invention, when a monophonic SIF signal of a system in which digital sound multiplex broadcasting is adopted is received, the discriminating circuit acts on the switching circuit to effect a changeover in such a manner that other SIF

components are not subjected to SIF detection. Accordingly, a digitally modulated sound signal of a frequency in the vicinity to the SIF of other system is eliminated, thereby making it possible to prevent the mixing in of noise.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a block diagram illustrating a configuration of a multi-system television receiver in accordance with a first embodiment of the present invention, wherein a configuration is shown in which a switching circuit 115 is opened or closed by a circuit 114 for discriminating the 6.0 MHz SIF signal;

Fig. 2 is a block diagram illustrating a configuration of a multi-system television receiver in accordance with a second embodiment of the present invention, wherein a configuration is shown in which SIF signals of 5.5 MHz and 6.0 MHz among the three types of SIF signals are discriminated by a circuit 217 for discriminating a 5.5 MHz SIF signal and a circuit 214 for discriminating a 6.0 MHz SIF signal, respectively, switching circuits 215, 218 being opened or closed by the respective circuits 214, 217;

Fig. 3 is a block diagram illustrating a configuration of a multi-system television receiver in accordance with a third embodiment of the present invention, wherein a configuration is shown in which a switching circuit 315 which is opened or closed by a circuit 314 for discriminating the 6.0 MHz SIF signal is provided in a preceding stage of a 6.5 MHz SIF filter 307;

Fig. 4 is a block diagram illustrating a configuration of a multi-system television receiver in accordance with a fourth embodiment of the present invention, wherein a configuration is shown in which a circuit 414 for discriminating the 6.0 MHz SIF signal is adapted to open or close a switching circuit 415 interposed between a 0.5 MHz local oscillating circuit 408 and a mixing/amplifying circuit 409;

Fig. 5 is a block diagram illustrating a configuration of a multi-system television receiver in accordance with a fifth embodiment of the present invention, wherein a configuration is shown in which a switching circuit 515 which is opened or closed by a circuit 514 for discriminating the 6.0 MHz SIF signal is incorporated in a 0.5 MHz local oscillating circuit 508;

Fig. 6 is a block diagram illustrating an example of a configuration of a conventional multi-system television receiver, wherein a 6.0 MHz SIF filter 6 and a 6.5 MHz SIF

filter 7 are provided in a preceding stage of a mixing/amplifying circuit 9 in correspondence with two types of SIF signals.

Fig. 1 illustrates a configuration of a multi-system television receiver in accordance with an embodiment of the present invention.

The receiver in accordance with this embodiment comprises, in addition to the configuration of the conventional example shown in Fig. 6, a circuit 114 for discriminating the 6.0 MHz SIF signal (hereinafter referred to as the discriminating circuit) and a switching circuit 115 for opening and closing a 6.5 MHz signal route in response to an output of the discriminating circuit 114.

The operation of the multi-system television receiver shown in Fig. 1 will be described hereinafter.

In cases where a broadcast of the I system (the system in which the SIF is 6.0 MHz) is received, an analog sound, i.e., a 6.0 MHz SIF signal, is always present regardless of whether the broadcast sound consists of the analog sound alone or the broadcast is being transmitted in the sound multiplex broadcasting mode. In this case, the discriminating circuit 114 determines that the 6.0 MHz SIF is "present", and outputs, for example, a signal of the "H"

level. The switching circuit 115 is changed over by this signal in such a manner as to open the route of the 6.5 MHz SIF filter 107. As a result, even in the case of the digital sound multiplex broadcasting mode, the 6.552 MHz digital sound signal is not mixed with the 6.0 MHz SIF signal through frequency conversion, so that it is possible to obtain an excellent analog sound which is free of noise.

In cases where a broadcast of the D system (the system in which the SIF is 6.5 MHz) is received, the discriminating circuit 114 determines that the 6.0 MHz SIF is "absent", and outputs, for example, a signal of the "L" level. The switching circuit 115 is changed over in response to this signal in such a manner as to connect the route of the 6.5 MHz SIF filter. Therefore, demodulation is effected in the same way as the conventional multi-system television receiver, and the sound is outputted from a speaker 112.

In the event that, even when a broadcast of the I system is being received, the discriminating circuit 114 has made a misjudgement that the 6.0 MHz SIF is "absent" due to a weak reception field strength, since the route of the 6.5 MHz SIF filter 107 is merely connected to the mixing/amplifying circuit 109, it is possible to avoid the situation where the sound of the I system cannot be heard, although the S/N ratio may be poor.

In New Zealand, television broadcasting is transmitted using the 5.5 MHz SIF in the B/G system, as described above. At present, digital sound multiplex broadcasting services have been commenced in New Zealand as well. In this case, the SIF of the digital sound is 5.85 MHz. If an attempt is made to configure a multi-system television receiver capable of receiving both the B/G system in which the SIF is 5.5 MHz and the I system in which the SIF is 6.0 MHz, it suffices if 6.0 MHz, 6.5 MHz, and 6.552 MHz that have been described in the first embodiment are altered to 5.5 MHz, 6.0 MHz, and 5.85 MHz, respectively. In the configuration in accordance with a conventional example, the digital sound SIF of 5.35 MHz is mixed in the analog sound SIF of 5.5 MHz during the reception of a digital sound multiplex broadcast, so that the demodulated sound is accompanied by noise. This problem can be overcome in accordance with this embodiment.

Fig. 2 illustrates a configuration of a multi-system television receiver in accordance with a second embodiment of the present invention, which is adapted to demodulate three systems of SIF, i.e., B/G, I, and D (5.5 MHz, 6.0 MHz, and 6.5 MHz, respectively). In this embodiment, a multi-system television receiver 201 comprises a 5.5 MHz SIF filter 216, a circuit 217 for discriminating the 5.5 MHz SIF signal, and a switching circuit 218 which is opened or

closed in response to an output of the discriminating circuit 217.

In accordance with this configuration, when it is determined by the discriminating circuit 217 that the 5.5 MHz SIF signal is "present", the routes of the 6.0 MHz and 6.5 MHz filters are opened by the switching circuit 218 through control by the discriminating circuit 217. Accordingly, even in cases where the digital sound multiplex signal of the B/G system or the digital sound multiplex signal of the I system is received, the routes of the SIF filters for frequencies close to the frequency of the digital sound are disconnected, so that it is possible to obtain high quality sound which is free of noise, in the same way as described above.

Fig. 3 illustrates a configuration of a multi-system television receiver in accordance with a third embodiment of the present invention.

In this embodiment, a switching circuit 315 for opening or closing a signal route for the 6.5 MHz SIF is provided in a preceding stage of a 6.5 MHz SIF filter 307. In this case as well, it is possible to obtain an effect similar to that of the first embodiment shown in Fig. 1.

Fig. 4 illustrates a configuration of a multi-system television receiver in accordance with a fourth embodiment of the present invention.

In this embodiment, a switching circuit 415 which is opened or closed by a circuit 414 for discriminating the 6.0 MHz SIF signal is interposed between a 0.5 MHz local oscillating circuit 408 and a mixing/amplifying circuit 409.

In this case, when it is determined by the circuit 414 for discriminating the 6.0 MHz SIF signal that the 6.0 MHz SIF signal is "present", the discriminating circuit 414 outputs a signal of the "H" level to open the switching circuit 415. Consequently, at this juncture, an output of the 0.5 MHz local oscillating circuit 408 is not supplied to the mixing/amplifying circuit 409, and the 6.0 MHz SIF signal supplied to the mixing/amplifying circuit 409 via a 6.0 MHz SIF filter 406 is inputted to a 6.0 MHz SIF detecting circuit 410 without being subjected to band conversion processing and is outputted by way of the speaker 412.

In accordance with this embodiment, even in the case of the digital sound multiplex broadcasting mode the 0.5 MHz LOC signal is not inputted to the mixing/amplifying circuit 409, so that the 6.052 MHz analog signal attributable to the frequency conversion of the 6.552 MHz digital sound signal is not generated. Accordingly, in this case as well, it is possible to prevent the occurrence of noise of the sound signal which is attributable to the mixing of the 6.052 MHz

SIF signal in the 6.0 MHz SIF signal (which is an analog signal).

On the other hand, if it is determined by the circuit 414 for discriminating the 6.0 MHz SIF signal that the signal is "absent", the discriminating circuit 414 outputs a signal of the "L" level to close the switching circuit 415. In this case, the 6.5 MHz SIF signal inputted to the mixing/amplifying circuit 409 via the 6.5 MHz SIF filter 407 is subjected to band conversion by 0.5 MHz in response to a 0.5 MHz LOC signal outputted by the 0.5 MHz local oscillating circuit 408, and is supplied to the 6.0 MHz SIF detecting circuit 410 as the 6.0 MHz SIF signal, thereby allowing the sound to be outputted from the speaker 412.

Fig. 5 illustrates a configuration of a multi-system television receiver in accordance with a fifth embodiment of the present invention.

In this diagram, a switching circuit 515 which is opened or closed by a circuit 514 for discriminating the 6.0 MHz SIF signal is incorporated in a 0.5 MHz local oscillating circuit 508. As a result, in response to the result of discrimination by the circuit 514 for discriminating the 6.0 MHz SIF signal, the 0.5 MHz local oscillating circuit 508 oscillates the 0.5 MHz LOC signal and outputs the signal to a mixing/amplifying circuit 509. Accordingly, when the 6.0 MHz SIF signal is supplied to the

mixing/amplifying circuit 509 via a 6.0 MHz SIF filter 506, the circuit 514 for discriminating the 6.0 MHz SIF signal determines that that signal is "present" and delivers an output of the "H" level, thereby setting the output of the 0.5 MHz local oscillating circuit 508 in the off state. In the digital sound multiplex broadcasting mode, the state of operation becomes similar to that of the fourth embodiment, and an analog sound signal with reduced noise is supplied to a sound signal amplifier 511. On the other hand, if the 6.5 MHz SIF signal is supplied to the mixing/amplifying circuit 509 via the 6.5 MHz SIF filter 507, the circuit 514 for discriminating the 6.0 MHz SIF signal determines that that signal is "absent" and controls the switching of the switching circuit 515. As a result, the 0.5 MHz local oscillating circuit 508 starts oscillation and supplies the 0.5 MHz LOC signal to the mixing/amplifying circuit 509, and band conversion is effected with respect to the 6.5 MHz SIF signal by an amount of 0.5 MHz, thereby allowing the 6.5 MHz SIF signal after being converted to 6.0 MHz to be supplied to the 6.0 MHz SIF detecting circuit 510.

As described above, in accordance with the present invention, the arrangement provided is such that the presence of the analog SIF signal of a broadcasting system adopting digital sound multiplex broadcasting is determined, and the demodulation of an SIF of other system in the

vicinity of the digital SIF concerned is suspended. Therefore, there are advantages in that, during reception of a digital sound multiplex broadcast, it is possible to demodulate the digital sound into a noise-free, excellent analog sound, and that it is possible to eliminate the conventionally encountered problem that the sound of some or all of the systems cannot be demodulated when the electric field is weak. Thus, it is possible to provide a multi-system television receiver having the aforementioned advantages with a simple arrangement and at low cost. In addition, it is possible to eliminate the need for a manual switch, and the problems associated therewith.



CLAIMS

1. A television receiver comprising a Sound Intermediate Frequency (SIF) pass-band converting means for converting the frequency of at least one of a plurality of incoming SIF signals of different discrete frequencies, into a predetermined frequency, SIF detecting means for detecting a signal of the predetermined frequency at the output from the SIF pass-band converting means, discriminating means for determining the presence of an incoming SIF signal of a particular frequency and an SIF input switching means for preventing the conversion to the predetermined frequency of SIF signals of frequencies other than the particular frequency, if the discriminating means detects the particular frequency among the incoming signals, and for allowing the conversion to the predetermined frequency of SIF signals of frequencies other than the particular frequency if the discriminating means detects the particular frequency signal as absent.

2. A receiver as claimed in claim 1, wherein said discriminating means outputs a high-level signal when the particular frequency signal is present, and outputs a low-level signal when the particular frequency signal is absent, and wherein said SIF input switching means prevents the inputting of the SIF signal in response to the high-level output and allows the inputting in response to the low-level output.

3. A receiver as claimed in claim 1 or 2, including a plurality of SIF filters for filtering respective bands of said plurality of SIF signals having different frequencies, wherein said SIF input switching means is interposed between at least one of said plurality of SIF filters and said SIF pass-band converting means.



4. A receiver as claimed in claim 1 or 2, including a plurality of SIF filters for filtering respective bands of said plurality of SIF signals having different frequencies, wherein an SIF signal is inputted to at least one of said plurality of SIF filters via said SIF input switching means.

5. A receiver as claimed in any of claims 1-4, including a local oscillator circuit for providing an LOC signal of 0.5 MHz to be supplied to said SIF pass-band converting means, and wherein the pass-band conversion of the SIF signal by said SIF pass-band converting means is effected by the frequency shift of one of two SIF signals by means of the LOC signal.

6. A receiver as claimed in claim 5, including two discrete discriminating means corresponding to different SIF signals, two discrete SIF input switching means corresponding to different SIF signals, and arranged for use with three SIF signals of 5.5 MHz, 6.0 MHz, and 6.5 MHz frequency respectively.

7. A receiver as claimed in claims 5 or 6, wherein the local oscillator circuit includes the SIF switching means.

8. A receiver as claimed in any preceding claim, wherein two different SIF signals comprise 6.0 MHz and 6.5 MHz signals.

9. A receiver as claimed in any of claims 1-7, wherein two different SIF signals comprise 6.0 MHz and 5.5 MHz signals.

10. A receiver as claimed in any preceding claim, including a tuner for converting a received RF signal into a VIF circuit for detecting the video element of a VIF signal, a video signal processing circuit for providing predetermined processing with respect to a video signal outputted from said VIF circuit, a CRT for displaying an image based on an output from said video signal processing circuit, a sound signal amplifier for amplifying an output of said SIF detecting means, and a speaker for reproducing sound based on a sound signal outputted from said sound signal amplifier.

11. A television receiver substantially as



hereinbefore described with reference to and as illustrated in Fig. 1, Fig. 2, Fig. 3, Fig. 4 and Fig. 5 of the accompanying drawings.

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