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Automatic gain control.

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The invention relates to a method and device for automatic gain control in receivers for both TV and FM radio.

WOA-94/06244 discloses a variable gain amplifier. Front-end portions of television receivers or video tape recorders are described, each of which uses separate intermediate-frequency (IF) amplifiers for the FM sound carrier and vestigial AM picture carrier. In each front end, the two IF amplifiers comprise matched cascade connections of the variable gain amplifiers with tracking automatic gain control (AGC). The AGC signals are generated by an AGC detector supplied composite video signal from a video detector, which video detector responds to amplified IF signal supplied by the IF amplifier for the vestigial AM picture carrier. This apparatus is not suitable for a receiver for both TV and FM radio, as in FM radio receipt mode the video detector does not receive TV signals on which AGC control signals can be based.

US-A-5,144,439 discloses a mono FM radio in a television receiver which includes a single tuner for tuning both television signals and broadcast FM stations. The tuner is operated at a fixed gain setting in FM reception mode.

It is, inter alia, an object of the invention to provide an automatic gain control for both TV reception and FM radio reception. To this end, the invention provides an automatic gain control as defined in the independent claims. Advantageous embodiments are defined in the dependent claims.

In a method of automatic gain control for both TV and FM radio signals, the TV and FM radio signals are controllably amplified to obtain amplifier output signals, the amplifier output signals are tuner processed to obtain tuner output signals, the tuner output signals are applied as control signals to the controllable amplifier, a bandwidth of a thus formed AGC loop being wide enough for a TV channel, and the tuner output signals are narrow-band filtered to obtain narrow-band filtered signals having a bandwidth substantially corresponding to a bandwidth of an FM radio channel.



These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter. Herein shows:

5                   Figure 1 an embodiment of a receiver in accordance with the present invention, and

                  Figure 2 a second embodiment of a receiver in accordance with the present invention.

10                   In the drawing, antenna signals from an antenna A are applied to an AGC amplifier AGC-AMP, the output of which is applied to a cascade connection of an IF filter F, a mixer MIX and an IF amplifier IF-AMP. An output of the IF amplifier IF-AMP is applied to a ceramic filter CF having an output connected to an FM sound demodulator IC FM Snd Dem. A sound processor Snd Proc processes output signals of the FM sound demodulator IC FM Snd Dem to furnish (stereo) load-speaker signals to load-speakers L. The output of the IF amplifier IF-AMP is also applied to a surface acoustic wave filter SAW having an output that is connected to a TV IF IC. A TV processor TV Proc processes output signals of the TV IF IC to furnish (color) image signals to a TV display TVD.

                  The output of the IF amplifier IF-AMP is fed back to the AGC amplifier AGC as a tuner-internal AGC signal T-AGC. Optionally, a conventional AGC signal TV-AGC from the TV IF IC is also applied as a control signal to the AGC amplifier AGC. Optionally, an FM AGC signal from the FM sound processor IC FM Snd Proc is also applied as a control signal to the AGC amplifier AGC.

                  During FM radio reception, protection of the mixer MIX and IF amplifier IF-AMP is needed because of the varying strength and proximity of adjacent FM channels. Adjacent FM channels are 200 kHz apart as compared to 6, 7 or 8 MHz for TV. Since the RF bandwidth during FM reception is in the order of a few MHz, a wide-band predetermined AGC or software-selectable AGC is provided. The bandwidth of this wide-band AGC is wide enough to cope with TV signals (intended for the TV IF IC). This wide-band AGC peaks at the IF before the ceramic filter CF that has a typical bandwidth of 200 kHz and based on a predetermined level decides to act or not. This prevents the tuner stages from overloading.

                  The proposed tuner-internal wide-band AGC can be used together with the conventional TV AGC or instead of the conventional TV AGC.



Figure 2 shows a second embodiment of a receiver REC2 in accordance with the present invention. The same elements as in figure 1 are denoted with corresponding reference numerals.

Antenna signals from an antenna A2 are applied to an AGC amplifier AGC-AMP2, the output of which is applied to a tuner unit TUNIT2. The tuner unit TUNIT2 comprises for example the IF filter, mixer and IF amplifier as shown in figure 1. The output of the tuner unit TUNIT2 is coupled to the output of the tuner TUN2 for supplying to both the sound demodulation and processing unit SDPU2 and the TV demodulation and processing unit TVDPU2 the output signals.

These two units are only given block schematic and can for example comprise the same elements as the corresponding parts in figure 1. The output of the sound demodulation and processing unit SDPU2 is coupled to loudspeakers L2 and the output of the TV demodulation and processing unit TVDPU2 is coupled to a TV display TVD2.

The TV demodulation and processing unit TVDPU2 comprises further a control output for supplying a control signal TVAGC2 corresponding to the control signal as described in relation to figure 1. This control signal is supplied to the tuner TUN2 to be a control signal for the AGC amplifier AGC-AMP2. The AGC amplifier further receives an internal control signal TAGC2 which is the same or corresponding as in figure 1.

The difference with the tuner of this figure and the tuner TUN of figure 1 is that the control signal from the TV demodulation and processing unit TVDPU2 is now supplied to the AGC amplifier AGC-AMP2 via switching means ST2. This switching means are controlled in such a way that during reception of FM radio signals the switch is open and during receiving TV signals switch is closed. In this way the undefinable output signal of the TV demodulation and processing unit TVDPU2 during reception of FM radio signals have no influence on the AGC amplifier AGC-AMP2. In this way the operation of the tuner and that of the receiver is further improved.

It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. The word "comprising" does not exclude the presence of elements or steps other than those listed in a claim. The word "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention can be implemented by means of hardware



comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means can be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be  
5 used to advantage.

## CLAIMS:

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1. A method of automatic gain control for both TV and FM radio signals, the method comprising the steps of:  
controllably amplifying (AGC-AMP) the TV and FM radio signals to obtain amplifier output signals;  
5 tuner processing (F, MIX, IF-AMP) the amplifier output signals to obtain tuner output signals; and  
applying the tuner output signals as control signals (T-AGC) to the controllably amplifying step (AGC-AMP), a bandwidth of a thus formed AGC loop being wide enough for a TV channel.
- 10 2. A method as claimed in claim 1, further comprising the step of:  
IF processing (SAW; TV IF) the tuner output signals to obtain further control signals (TV-AGC) for the controllably amplifying step (AGC-AMP).
- 15 3. A method according to claim 2, further comprising the step of coupling respectively decoupling the further control signals for the controllably amplifying step.
4. A method as claimed in claim 1, further comprising the steps of:  
narrow-band filtering (CF) the tuner output signals to obtain narrow-band  
20 filtered signals having a bandwidth substantially corresponding to a bandwidth of an FM radio channel, and  
FM demodulating (FM Snd Dem) the tuner output signals to obtain further control signals (FM-AGC) for the controllably amplifying step (AGC-AMP).
- 25 5. A device for automatic gain control for both TV and FM radio signals, the device comprising:  
a controllable amplifier (AGC-AMP) for the TV and FM radio signals to obtain amplifier output signals;



a tuner (F, MIX, IF-AMP) for processing the amplifier output signals to obtain tuner output signals; and

means (T-AGC) for applying the tuner output signals as control signals to the controllable amplifier (AGC-AMP), a bandwidth of a thus formed AGC loop being wide  
5 enough for a TV channel.

6. A receiving apparatus for both TV and FM radio signals, the apparatus comprising:

a device as claimed in claim 5; and

10 IF processing means for processing the tuner output signals for obtaining further control signals for the controllable amplifier.

7. A receiving apparatus as claimed in claim 6 further comprising:

a narrow-band filter (CF) for the tuner output signals to obtain narrow-band  
15 filtered signals having a bandwidth substantially corresponding to a bandwidth of an FM radio channel,

FM sound processing circuitry (FM Snd Dem, Snd Proc) to obtain load-speaker signals from the obtain narrow-band filtered signals; and

image signal processing circuitry (SAW, TV IF, TV Proc) to obtain display  
20 signals from the tuner output signals.

8. A receiving apparatus as claimed in claim 6 further comprising:

switching means for coupling respectively decoupling the further control signals to the controllable amplifier.

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9. A display apparatus comprising:

a receiving apparatus as claimed in claim 6; and

an image display (TVD for displaying the display signals.

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