

Tuner.

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The invention relates to a tuner.

In tuners which comprise at least two signal-processing branches for processing RF signals in preferably different frequency bands, a conventional construction principle uses first filter stages for each frequency band at an input *via* which the RF signals can be supplied, for example from an antenna, through which filter stages the associated frequency bands are selected. Such a circuit arrangement is shown in Fig. 1; the first filter stages in this Figure are denoted by the reference numerals 1, 2 and 3, and the input for the RF signals is denoted by the reference numeral 4. RF signals of only the filtered frequency band can then be taken from outputs 5, 6, 7 of the first filter stages 1, 2, 3. These signals are applied *via* controllable amplifier stages 8, 9 and 10 and subsequent filter stages 11, 12 and 13 to associated mixer stages 14, 15 and 16, respectively, in which they are down-converted in frequency. The down-converted RF signals can be applied to a common output 19 *via* a signal junction constituted in the arrangement of Fig. 1 by a node 17 and an output amplifier 18. From a conceptual point of view, the signal junction may optionally be the node 17 only; together with the output 19, the output amplifier 18 is already associated with an output branch which is common for all signal-processing branches.

To generate the oscillation required for down-conversion of the RF signals, a common oscillation generator comprising a phase-locked loop 20 and an oscillator stage 21 which are interconnected in known manner is used in the arrangement of Fig. 1. The frequency of the oscillation supplied by the oscillation generator is adjustable *via* a data input 22. The oscillation generator 20, 21 is further connected to a crystal oscillator 23 used as a frequency reference.

The controllable amplifier stages 8, 9, 10 have a control input 24 *via* which the gain of the amplifier stages 8, 9, 10 is adjustable. The controllable amplifier stages 8, 9, 10 may then be incorporated in a control loop for amplitude control of the RF signals.

It is an object of the invention to implement a tuner of the type shown in Fig. 1 in such a way that it is suitable for a further simplification of the structure and a reduction of the volume required for this purpose.

This object is solved by a tuner having at least two signal-processing



branches for frequency-selective reception, amplification and/or frequency conversion of RF signals by means of a switching stage *via* which the RF signals, which can be supplied from an input, can optionally be passed through one of the signal-processing branches, each signal-processing branch comprising a filter stage connected to the switching stage, a controllable
5 amplifier stage arranged subsequent to the filter stage, and a mixer stage succeeding the amplifier stage, the outputs of the mixer stages being connected to a common output branch *via* a signal junction.

To achieve sufficiently high amplitudes of the received RF signals and sufficiently high signal-to-noise ratios, the filter stages and amplifier stages which were
10 available in the past necessitated an amplification of the received RF signals right after a first frequency selection. However, the frequency selection following the amplification was not yet sufficient to effectively suppress unwanted harmonics occurring upon a subsequent down-conversion. For this reason, further filter stages for improving the frequency selection of the frequency bands were inserted between the amplifier stages and the mixer stages.

15 However, integration of particularly all semiconductor components of such a tuner has the drawback that such an integrated component must have input terminals and output terminals for the amplifier stages, as well as input terminals for the mixer stages. However, the number of terminals of an integrated component influences its cost to a considerable extent. Particularly in mass production, a minimum number of terminals is
20 preferred.

The invention is based on the recognition that particularly in modern filter stages such a high frequency selection at a simultaneously low signal-to-noise ratio and particularly such a low signal attenuation can be achieved that an amplification is not required until after a complete frequency selection. Consequently, in the sequence of stages
25 of signal-processing branches, the filter stages can be arranged at the beginning and the amplifier stages can be connected to the mixer stages. Then it is very simple to combine the amplifier stages and the mixer stages to a compact component having a small number of terminals. This leads to a considerable reduction of cost and volume of a tuner implemented in this way. To suppress unwanted frequency bands, such an arrangement uses the switching
30 stage *via* which only one of the signal-processing branches receives an RF signal at a time. This switching stage can be implemented in a very simple and inexpensive way.

To achieve a further reduction of volume and manufacturing cost, the controllable amplifier stages and the mixer stages of all signal-processing branches in an integrated component can be combined with an oscillation generator which is common for all

the mixer stages. This integrated component may comprise a phase-locked loop and an oscillator stage constituting the oscillation generator. Only a frequency element implemented as a crystal oscillator and connected to the oscillation generator should then preferably be connected to the integrated component.

5 The integrated component is preferably an integrated semiconductor circuit.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment described hereinafter.

In the drawing:

10 Fig. 1 shows a known embodiment,

Fig. 2 shows an embodiment according to the invention, in which components shown in Fig. 1 have the same reference numerals.

In the embodiment of the tuner shown in Fig. 2, the arrangement comprising the mixer stages 14, 15, 16, the node 17, the output amplifier 18, the output 19, 15 the oscillation generator 20, 21, the data input 22, the crystal oscillator 23 and the control input 24 corresponds to that shown in Fig. 1. However, according to the invention, the sequence of the controllable amplifier stages 8, 9, 10 and the filter stages 11, 12, 13 described with reference to Fig. 1 has been changed in the signal-processing branches. Consequently, each signal-processing branch comprises, in succession and as regards RF 20 signal passage, switching contacts 25, 26, 27 of the switching stage 28, the filter stages 11, 12, 13, the controllable amplifier stages 8, 9, 10 and the mixer stages 14, 15, 16, respectively, between the input 4 for the RF signals and the node 17. The switching contacts 25, 26, 27 of the switching stage 28 are optionally rendered conducting or non-conducting via a data line 29 in accordance with the selected frequency band, so that each time only one 25 of the signal-processing branches is connected to the input 4; that is to say, only one of the switching contacts 25, 26, 27 is conducting. Likewise as the data input 22, the data line 29 may be connected to a control unit (not shown) for receiver operation of the tuner.

The filter stages 11, 12, 13 are connected to the phase-locked loop 20 via line 30. Reference oscillations for the frequency selection of oscillation generator 20, 21 may 30 be applied via this line in the conventional manner.

This tuner is preferably suitable for use in RF processing stages of satellite tuners and video recorders.



CLAIMS:

1. A tuner having at least two signal-processing branches for frequency-selective reception, amplification and/or frequency conversion of RF signals by means of a switching stage *via* which the RF signals, which can be supplied from an input, can optionally be passed through one of the signal-processing branches, each signal-processing
5 branch comprising a filter stage connected to the switching stage, a controllable amplifier stage arranged subsequent to the filter stage, and a mixer stage succeeding the amplifier stage, the outputs of said mixer stages being connected to a common output branch *via* a signal junction.
2. A tuner as claimed in Claim 1, characterized in that the mixer stages of
10 all signal-processing branches are connected to a common oscillation generator.
3. A tuner as claimed in Claim 2, characterized in that the oscillation generator comprises a phase-locked loop and an oscillator stage.
4. A tuner as claimed in Claim 3, characterized in that, together with the oscillation generator, the controllable amplifier stages and the mixer stages of all signal-
15 processing branches are combined in an integrated component.
5. Television reception apparatus including a tuner as claimed in one or more of the preceeding claims.

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