

Mixer oscillator stage.

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The invention relates to a mixer oscillator stage. The invention further relates to a mixer oscillator integrated circuit and to a tuner. The invention further relates to a receiver, more particularly but not exclusively to a television receiver.

5 Such a mixer oscillator stage is used in for example television receivers. For such a mixer oscillator stage different solutions are known. As is known television signals comprise signals in the historically called UHF and VHF band, which VHF band is in most of the cases splitted in at least two ranges (VHFL and VHFH).

10 For 3-band tuners often the different bands are named A, B and C, or Low, Mid and High. For 2-band switched tuners it is customary to name the bands VHF-Low, VHF-High and UHF although the UHF band may be capable of receiving frequencies that are transmitted below the UHF band.

The most straight forward solution is to use the so called 3-band concept having for each band its own mixer and oscillator.

15 As the above solution is quite complex nowadays to reduce the costs of three different bands a switching between the low and high VHF signals is used. The range switching is normally done with a switching diode that selects a different coil inductance for VHF-Low and VHF-High. Especially if the mixer oscillator stage is implemented as an integrated circuit also comprises a PLL function, the so called MO-PLL Combi IC, a 3 band
20 tuner is not possible without exceeding the 28 pin structure as the 2 band switched version has. The 28 pin package is one of the biggest cost effective packages available today.

25 To reduce the number of necessary pins it is proposed to pursue asymmetrical input / output functions. To achieve a good performance a good isolation between the mixer/oscillator functions like oscillators, mixers on the one hand and the IF amplifier at the other hand is necessary. By using asymmetrical input /output function it is hardly possible to achieve this good isolation.

Balanced signal pairs and balanced circuitry so far provide the best performance. The performance need to meet the more stringent demands as newly posed by the so called European CENELEC EN55020. The EN55020 is a European directive on EMC

requirements for television and sound broadcast receivers and associated equipment. Special attention need to be paid during tuner design to ensure that the requirements are met.

One of the disadvantages of the known mixer oscillator stages (topologies) is that different mixer oscillator topologies are necessary for the 3-band concept and for the switched 2-band concept making the development of at least two different topologies expensive and time consuming. A further disadvantage is that the 3-band concept (especially MOPLL Combi) requires more input and oscillator pins necessary for the mixer oscillator integrated circuit.

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An object of the invention is to overcome the disadvantages of the prior art and further to provide a mixer oscillator stage, mixer oscillator integrated circuit, a tuner and a television receiver with an improved performance.

To this end a first aspect of the invention provides a mixer oscillator stage as defined in claim 1. A second aspect of the invention provides a mixer oscillator integrated circuit as defined in claim 3. A third aspect of the invention provides a tuner as defined in claim 4. A fourth aspect of the invention provides a receiver as defined in claim 5.

By choosing the number of oscillators greater than the number of mixers and using switching means there between the same mixer oscillator stage can be used for different applications. So the development costs are herewith largely decreased.

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An embodiment of a mixer oscillator stage according to the invention comprises the features of claim 2.

By using three oscillators and using switching means it is possible to use the same mixer oscillator stage for a 2 band switched concept and for a genuine 3 band concept.

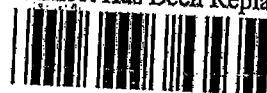
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The invention and additional features which may optionally be used to implement the invention to advantage will be apparent from and elucidated with reference to the examples described below hereinafter and shown in the figures. Herein shows:

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Figure 1 a first embodiment of a tuner according to the invention,
Figure 2 a second embodiment of a tuner according to the invention, and
Figure 3 an embodiment of an input circuit for use in a tuner according to the invention.





Throughout the description same reference numerals will be used for same elements.

Figure 1 shows a first embodiment of a tuner TUN1 according to the invention comprising an input I1 for receiving an antenna signal. The input I1 is coupled to a VHF tuned input circuit VIC1 and to an UHF tuned input circuit UIC1.

The tuned input circuits VIC1 respectively UIC1 are coupled to an amplifier stage respectively VAM1 and UAM1. Each amplifier stage is coupled to a band filter VF1 respectively UF1.

The band filter VF1 is coupled via a varicap diode vd1 to a first input i10 of a mixer oscillator integrated circuit MOIC1.

The band filter UF1 is coupled via a first and a second inductance ind11 and ind12 to a second and a third input i11 and i12 of the mixer oscillator integrated circuit MOIC1.

The first input i10 is coupled to a first mixer MIX1 of the mixer oscillator integrated circuit and the second and third input i11 and i12 are coupled to a second mixer of the mixer oscillator integrated circuit.

The tuner TUN1 further comprises a first, second and third oscillator OSC11, OSC12 and OSC13 which oscillators being part of the mixer oscillator stage MOS1 and are coupled to one of the mixers MIX11 and MIX12 via respectively first and second switching means SW11 and SW12.

The output of each mixer MIX11 respectively MIX12 is coupled to an output O1 of the tuner TUN1 for supplying an IF signal.

The mixer oscillator integrated circuit MOIC1 and the oscillators OSC11, OSC12 and OSC13 being part of the mixer oscillator stage.

The operation of this embodiment of the tuner TUN1 is as follows.

After receiving the antenna signal at the input I1 the signal is in this embodiment splitted in a VHF band and a UHF band, whereby the tuned input circuit VIC1, the amplifier stage VAM1 and the filter VF1 will handle the VHF signals (as is known to the man skilled in the art). The tuned input circuit UIC1, the amplifier stage UAM1 and the filter UF1 will handle the UHF signals (as is also known to the man skilled in the art).

The filtered signals are in this embodiment supplied to the mixer oscillator integrated circuit MOIC1 at input i10 respectively input i11 and i12. The VHF signals are

supplied to the mixer MIX11, which mixer receives via the switching means SW11 at the other input a signal from either the first oscillator OSC11 or the second oscillator OSC12 depending on the part of the VHF band the required signal belongs to. After mixing the mixer supplies the IF signal at the output O1.

5 Nowadays the so called UHF signals are handled symmetrically. The UHF filter UF1 supplies the UHF signal symmetrically via the inductance's ind11 and ind12 to the mixer MIX12, which mixer receives at its other input a signal from either the second oscillator OSC12 or the third oscillator OSC13 depending on the part of the UHF band the required signal belongs to.

10 This mixer oscillator stage can in this way handle all the signals of a switched 2-band concept. Instead of as integrated circuit it is also possible to obtain a mixer oscillator stage with only discrete components.

Figure 2 shows a second embodiment of a tuner TUN2 according to the
15 invention having an input I2 for receiving an antenna signal. The input is coupled to tuned input circuits IC21, IC22 and IC23 respectively.

Each tuned input circuit is coupled to each an amplifying stage AM21, AM22 and AM23 respectively.

Each amplifying stage is coupled with each a filter F21, F22 and F23.

20 The filter F21 is coupled via a varicap diode vd2 to a first input i20 of a mixer oscillator integrated circuit MOIC2.

The filter F22 is coupled via a first and a second inductance ind21 respectively ind22 to a second and a third input i21 respectively i22 of the mixer oscillator integrated circuit.

25 The filter F23 is coupled via a third and a fourth inductance ind23 and ind24 to the second and third input i21 respectively i22 of the mixer oscillator integrated circuit.

The tuner TUN2 further comprises a first, second and third oscillator OSC21, OSC22 and OSC23 which oscillators being part of the mixer oscillator stage MOS2 and are coupled to one of the mixers MIX21 and MIX22 via respectively first and second switching
30 means SW21 and SW22.

The output of each mixer MIX21 respectively MIX22 is coupled to an output O2 of the tuner TUN2 for supplying an IF signal.



The operation of this embodiment of the tuner TUN2 is as follows.

As will be noticed in this embodiment of the tuner TUN2, this tuner is built up as a 3 band concept. Even as in figure 1 the mixer oscillator integrated circuit MOIC2 receives the different filtered signals at either input i20 or as symmetrical signal at the inputs i21 and
5 i22.

Also in this embodiment the mixer oscillator stage MOS2 comprises two mixers MIX21 and MIX22 and three oscillators OSC21, OSC22 and OSC23.

The relevant mixer MIX21 (MIX22) receives at one input (symmetrical input) the filtered signal and at the other input the signal from either oscillator OSC21 or OSC22
10 (OSC22 or OSC23).

The mixer concerned supplies the obtained IF signal to the output of the tuner TUN2.

As shown in relation to figure 1 and 2 the same mixer oscillator stage MOS1, respectively MOS2 can be used for the switched 2-band concept (figure 1) and the 3 band
15 concept (figure 2).

As mentioned above instead of a mixer oscillator integrated circuit it is also possible to implement the mixer oscillator stage using only discrete components.

Figure 3 shows an embodiment of filter means for use in a tuner according to
20 the invention.

At an input I3 the input circuit IC3 receives an antenna signal. A first tuned circuit T1 comprising diode D3 and inductance L3 is coupled via an inductance L6 and a capacitance C1 to the input I3. A second tuned circuit T2 comprising diode D1 and inductance L1 is coupled via inductance L4 to the input I3. A third tuned circuit T3 comprising diode D2
25 and inductance L2 is coupled via an inductance L5 and the capacitance C1 to the input I3. The inductance's L4, L5 and L6 are coupling coils which perform an impedance transformation from the antenna impedance to the varying frequency depending impedance of the tuned circuits T1, T2 and T3.

For signals intended for tuned circuit T1 the filter can be seen as a high pass
30 filter comprised of L4+L1, C1 and L5+L2.

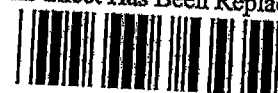
This input circuit has been described extensively in the United States Patent US-A-4,851,796 which patent has been incorporated herein by reference.



In the above description the idea of the invention has been described on the basis of some examples. It is to be noticed that the man skilled in the art will be well aware of a lot of different solutions that fall within the scope of the invention concerned.

- 5 The invention provides a mixer oscillator stage that can be used with the so called switched 2 band concept as with the so called 3 band concept without changing the architecture of the mixer oscillator stage.

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CLAIMS:

1. Mixer oscillator stage comprising mixing means having at least one mixer, oscillator means having at least two oscillators and switching means coupled between the at least one mixer and the at least two oscillators, whereby the number of oscillators is greater than the number of mixers.
- 5 2. Mixer oscillator stage as claimed in claim 1, characterised in that the oscillator means comprises a first, a second and third oscillator, the mixing means comprises a first and a second mixer, and the switching means are coupled between the mixers and oscillators.
- 10 3. Mixer oscillator integrated circuit comprising the mixing means and switching means of claim 1.
4. Tuner comprising a mixer oscillator stage as claimed in claim 1.
- 15 5. Receiver comprising a tuner as claimed in claim 4.



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