

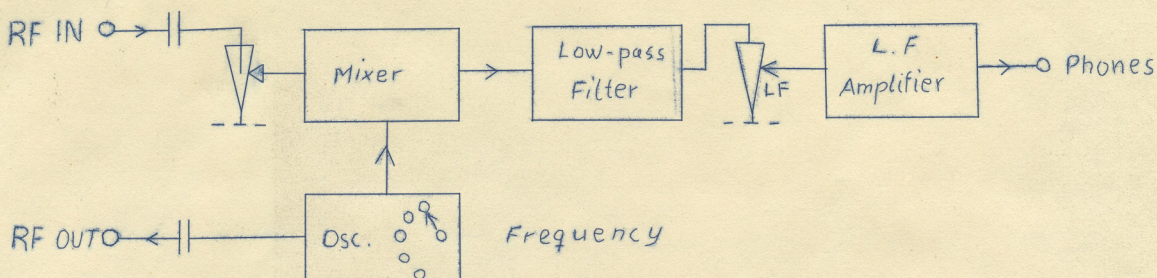
RF Standard

Type HFN3c

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Description

In principle the instrument consists of an oscillator, mixer stage, low-pass filter and low frequency amplifier.



The oscillator can be set to one of the frequencies 10 kc, 100 kc, 1 Mc, or 50 Mc/s. In a mixer stage mixing is obtained of the frequency of the oscillator f_{osc} and its harmonics $n \times f_{osc}$ with the frequency f_x which is fed to the jack "RF IN". Via filter and volume control mixer frequencies $f_x \pm (n \times f_{osc})$ are fed to the LF amplifier to the output of which a pair of headphones are connected (impedance 2 k Ω or more)

Use

Connect the line cord to the power line and switch on the power. When most accurate measurements are required, the instrument should be switched on half an hour before commencing the measurements. The frequency to be checked (e.g. the output voltage from a signal generator) is fed to the jack "RF IN". 100 mV will generally be sufficient. The headphones are connected to the chassis jack and one of the two jacks above.

The switch is set to e.g. 100 kc. The "LF" adjustment is rotated until hum voltages and noise voltages begin to be disturbing in the headphones, and the "RF" adjustment is set to about 2 on the dial (1/5 turned on).

When the signal generator is set to some 100 kc a loud tone must be heard in the headphones. The frequency of this tone will decrease when

the signal generator is set to a position still nearer 100 kc, and when the signal generator is set to zero beat, its frequency is exactly the same as that of the oscillator of the RF Standard (f_{osc}). At $2 \times f_{osc}$, consequently 200 kc, a similar beatnote will be heard, and also at 300 kc, 400 kc etc. At the high harmonics, e.g. the 30th harmonic, corresponding to 3 Mc/s, it will be necessary to turn the "RF" adjustment fully on, if only some 100 mV are fed to the jack "RF IN". Generally the highest harmonic audible will be about No. 40-50.

3 Mc/s can, of course, also be checked as the 3rd harmonic of 1 Mc/s when the switch of the Radio Frequency Standard is set to 1 Mc. Direct frequency control can be made with the HFN3 in the frequency range 10 kc/s to some 200 Mc/s but only at frequencies which are multiples of the oscillator frequencies present in the HFN3.

Weak zero beats, however, can be obtained at "simple" frequency relations between the unknown frequency f_x and the frequency f_{osc} of the oscillator.

E.g. $\frac{f_x}{f_{osc}} = \frac{3}{2}, \frac{5}{2}, \frac{7}{2}$ etc. will give usable measurements, especially if the signal f_x supplied is strong.

As will be seen from the above, the HFN3 cannot be used for checking or measuring an arbitrary frequency, but only for checking frequencies that are multiples of 10 kc, 100 kc etc. If e.g. you want to check a signal generator at 3.2 Mc, set the HFN3 to 1 Mc and find 3 Mc on the signal generator. Then set the HFN3 to 100 kc and vary the frequency of the signal generator from 3 Mc to 3.1 Mc at which a zero beat is heard. Then go on to 3.2 Mc where zero beat No. 2 will be. In this way you count until you reach the correct figure, the next higher oscillator frequency of the HFN3 serving as guidance, in this case 1 Mc.

The HFN3 is provided with a jack marked "RF OUT" from which the oscillator voltage can be drawn (about 10 volts at 10 kc). This voltage can be used to advantage when checking receivers or when checking low frequencies by means of an oscilloscope.

When the HFN3 is set to 10 kc a weak 10 kc tone is heard in the headphones. This is due to the fact that the low-pass filter of the instrument has no indefinitely high damping at 10 kc. When setting the HFN3

to 50 Mc, a hum due to the a-c voltage on the filament of the mixer tube is heard. These nuisances cannot be removed right away, but generally they are of no importance.

Accuracy

The construction of the oscillator circuits of the HFN3 is most stable so that the frequencies keep constant even during long periods. The low frequencies 10 kc, 100 kc and 1 Mc will thus under normal conditions keep within 0.1% for a year or more. However, this applies only if the instrument is not exposed to violent shocks or temperature fluctuations. The frequencies 10 Mc and 50 Mc are hardly as stable, but they can always be checked by comparison with the low frequencies as stated below. In the type HFN3c the oscillator is crystal-controlled when set at 100 kc. The accuracy of this frequency will therefore be better than that mentioned above.

Checking oscillator frequencies

It is very easy to make a comparison between the various oscillator frequencies, and it should at least be made every 6 months, or when the instrument has been exposed to strong mechanical or thermic influence.

A signal generator or another variable oscillator which can keep a constant frequency for only one minute is used for the comparison. The signal generator is set to 100 kc by setting it to zero beat with the HFN3 set to 100 kc. The HFN3 is then set to 10 kc and the beat occurring between the signal generator and the 10th harmonic of the HFN3 must have a frequency which is lower than some 50 c/s. Generally it will be down at 20-50 c/s corresponding to an agreement of 0.02-0.05% between the 10 kc and the 100 kc oscillator. Comparisons between the other oscillator frequencies is made in a similar way. When comparing the 10 Mc and 50 Mc oscillator, it may sometimes be convenient to set the signal generator to 25 Mc.

Re-adjustment of the various oscillators is made by rotating the coil or trimmer adjustments which become accessible when the circular cover plate for the corresponding oscillator is loosened.

The 100 kc oscillator can be compared with the broadcasting station

Droitwich I (200.00 kc) by means of a radio receiver tuned to Droitwich. A weak coupling between the antenna of the receiver and "RF OUT" on the HFN3 will cause a beat the frequency of which is equal to the difference between Droitwich's frequency and $2 \times$ the oscillator frequency. As the tone may be as low as a couple of c/s, the receiver should be provided with a tuning indicator which can register the low beat-frequency.