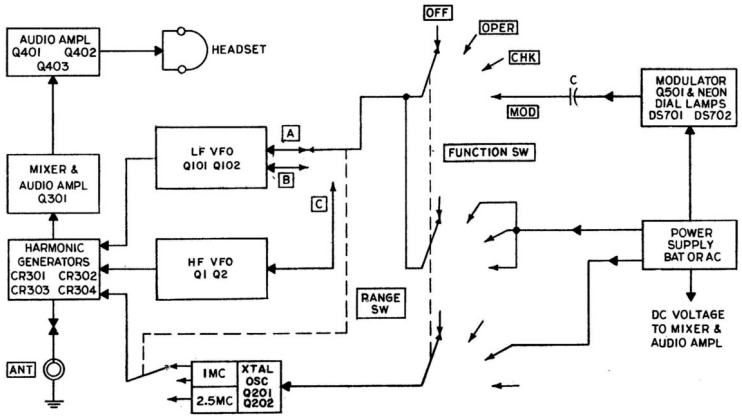
Military FR-149/USM-159 - Frequency Meter



The heterodyne frequency meter FR-149/USM-159 can be considered the solid-state version of the well known SCR-211/BC-221. The sample in the collection was made by Lavoie Laboratories to a 1963 order. Looking at the components used inside, mainly germanium transistors as the Philco micro-alloy-diffused 2N501A, we can assume that the design is to be dated around the late fifties or the very early sixties.

The operating principle is similar to that of BC221, with the beating between the unknown signal and the fundamental or one of the armonics of a precision internal variable oscillator. The accuracy of the variable oscillator is adjusted through its entire tuning range by beating with armonics of a built-in crystal calibrator.



- Simplified block diagram, illustrating the two selectable RF variable oscillators, LF BFO and HF BFO, and the dual-frequency crystal calibrator, connected together with the unknown signal (ANT) to the harmonic generator and then to the mixer. Click to enlarge.

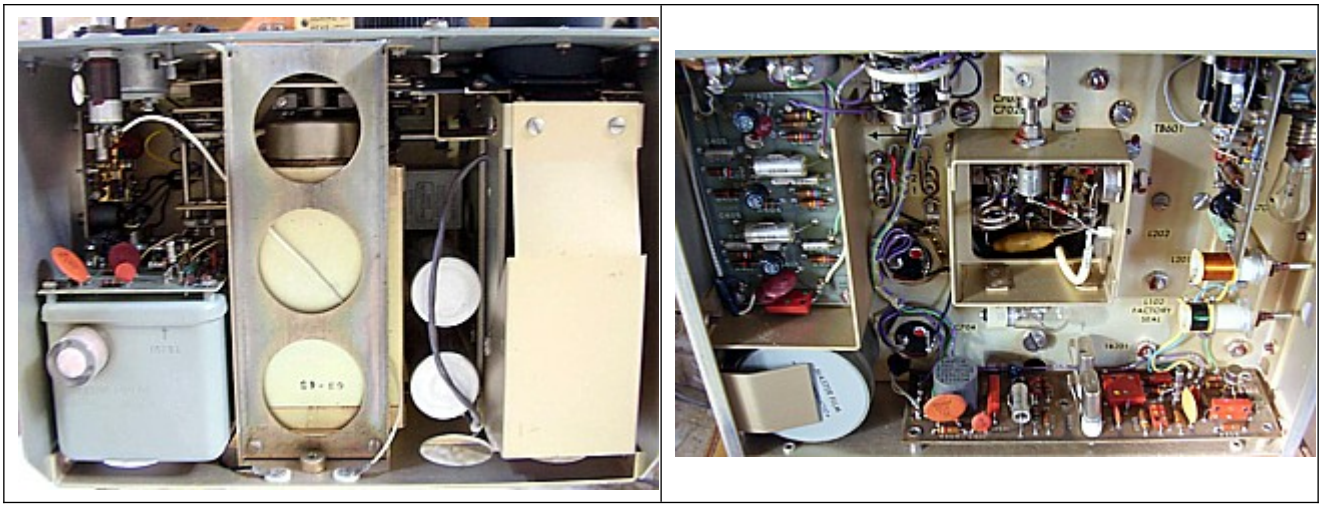
The frequency meter operates over three ranges:

1) 125 kHz to 2.5 MHz, 125 to 250 kHz on fundamental
2) 2.5 to 65 MHz, 2.5 to 5 MHz on fundamental
3) 65 to 1000 MHz, 65 to 130 MHz on fundamental

Overall accuracy is within 0.01% from -20 to 52ºC. The calibration tables in a drawer at the bottom give the harmonics and the nearest calibration points for each range. Operation is possible from batteries or from AC line.

Designers of USM-159 made use of the top technologies and components available at the moment. A 16 mm filmstrip is used to display the fundamental frequency which can be directly read through the magnifying lens on the column corresponding to the selected band. Each filmstrip cartridge is induvidually calibrated to the meter and a master film stored in a can under the chassis. The sealed low frequency coils and the high-frequency oscillator assembly are factory calibrated using a special test equipment which originates the master film with the three frequency dials.

The heterodyne frequency meter can also be used as signal generator. The output of the selected VFO, the fundamental and the harmonics, are fed to the 'ANT' connector. RF signal can be modulated at about 900 Hz. The audio frequency oscillator is also used to feed through a step-up transformer two neon bulbs to illuminate the dial.



- Left, top view showing in the order the sealed coils of the lower ranges, the HF range assembly and the film drive assembly. Right, the bottom view shows the can containg the master film at the left of the calibrator board. Click to enlarge.