

Operational Description

The T99FG is a low power VHF, narrowband FM audio surveillance transmitter board used for law enforcement applications. The FM deviation is 5 kHz and the modulation method is direct FM via a varactor diode. The frequency generation scheme is crystal oscillator – frequency multiplier. Power output to the antenna terminals is a nominal 200 mW.

The microphone audio is amplified, limited and filtered by an automatic gain control circuit and external discrete circuits.

All critical circuits are regulated. An internal switching power supply converts 1.5 VDC to 4 VDC for the transmitter. An additional regulator is used to stabilize the oscillator circuit.

Necessary Bandwidth

The necessary bandwidth calculation under 2.202(b) for the H25T99FG transmitter falls under the general FM formula:

$$BW = 2M + 2DK \quad K = 1$$

$$D = 5 \text{ kHz}$$

$$M = 3 \text{ kHz}$$

$$BW = 16 \text{ kHz}$$

Emissions Designator

The emissions designator is 16K0F3E. This emissions designator indicates that this is a NBFM audio channel transmitter with an occupied bandwidth of 16 kHz.

Intended Use

This device is intended to be used under the Police Radio Service section of the Public Safety section of Part 90 for short-term undercover surveillance operations.

Description of Circuitry

The active RF circuitry consists of a single bipolar radio frequency oscillator (Q1), two bipolar frequency multiplier stages (Q2+3) and a power amplifier (Q6). Each multiplier stage is provided with an LC tuned circuit bandpass filter and the final amplifier stage is followed with a multi-section low pass harmonic filter. The antenna connection is via a coax pigtail. Tuned loop antennas and quarter wave tuned wire antennas are used with this transmitter. High phase angle mismatches are handled with this circuit.

Modulation is via an electret microphone and AGC limiter integrated circuit. Ultimate overdeviation limiting is provided by D5, a dual diode. Deviation is set by R14. Audio is rolled off at 3 kHz by the U5 AGC circuit and R23 in conjunction with C9. The processed audio directly frequency modulates the oscillator via varactor diodes D3+4.

Frequency stability is achieved by using a low ESR AT-cut crystal in conjunction with a temperature-corrected bias provided by the U3 and U4 OP-Amp's with compensation

components D2, a temperature proportional reference and RT-1, a thermistor, which drives the varactor diodes.

Voltage regulation is performed and voltage step-up from 1.5 to 4.0 VDC is accomplished by a switching supply comprised of U1 in conjunction with the L14 torriod and D1, a Schottky switching diode.

The oscillator and first tripler stages have base bias regulation provided by U2, a voltage regulator IC. The second tripler, Q3, has base bias compensation via Q4, a diode connected transistor.