

Operational Description

The H25PB3 (Package Beacon Three) is a covert VHF beacon/alarm transmitter module used for law enforcement applications. Two modes are supported; "Beacon" (a train of four unmodulated pulses) used for tracking which are sent at 1s, 2s or 4s intervals and "Confidence/Alarm" a 1000 Hz tone-burst transmission which is repeated every 30s for confidence or every second at a 50% duty cycle for alarm. The beacon pulse-train transmission consists of four 15 mS wide, unmodulated pulses, each separated by 15 mS. The maximum FM deviation of the Confidence/Alarm mode is 5 kHz and the modulation method is direct FM via a varactor diode. The frequency generation scheme in all modes of the PB3 is crystal oscillator – frequency multiplier. Power output to the antenna terminals is 1W maximum.

A single PIC microprocessor with an independent 3.58 MHz reference, Y2, controls all transmission timing, triggering and tone generation functions, but it is not related to any RF frequencies generated. On-board 3-axis motion detection is used in the tracking beacon mode. Parked, stopped and motion conditions are recognized and produce 4s, 2s or 1s transmission rates of the four pulse beacon signal, respectively. Additionally "make and break-wire" change-of-state signals are accepted as trigger signals for the alarm transmission. Once an alarm transmission is initiated, the only way to stop the transmission is to remove power. A screw-type terminal strip J2, allows solderless connections for external DC power and the mode and "make and break-wire" functions.

Modulation limiting and low pass filtering in the alarm mode is performed by internal discrete circuits.

The transmitter requires a nominal voltage of 6VDC. A 2 VDC linear regulator, U2, is used to stabilize the oscillator circuit and other critical circuits. Another regulator, U4, provides regulated 3.2 VDC power with a power-on reset function for the microprocessor.

The antenna connector on the PB3 is an MMCX female. A coaxial half wave dipole antenna is shipped with the unit.

Necessary Bandwidth

The necessary bandwidth calculation under 2.202(b) for the H25PB3 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 16K0F3W under §90.207(a). This emissions designator indicates that this is a transmitter that operates in a combination of emissions modes. The primary emission is a NBFM audio tone with an occupied bandwidth of 16 kHz and the second is an unmodulated pulse mode with a much narrower occupied bandwidth. Both signals are 1 watt peak power.

Intended Use

This device will be used under the Police Radio Service in the Public Safety section of Part 90 for short-term undercover surveillance and tracking operations.

Description of Circuitry

The active RF circuitry consists of a single bipolar radio frequency oscillator/tripler (Q1), an additional bipolar frequency tripler (Q2), a driver (Q3) and a final 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 coaxial MMCX connector. A half-wave coaxial dipole antenna is supplied with this transmitter. High phase angle antenna mismatches up to 12:1 are handled with this circuit.

Tone Modulation is generated by filtering a square wave output from the microprocessor (U1) with an active low-pass filter, Q7. Deviation limiting is inherent, since the tone has a fixed amplitude. Deviation is set by a potentiometer, RV1. The processed audio directly frequency modulates the oscillator via varactor diodes D3+4.

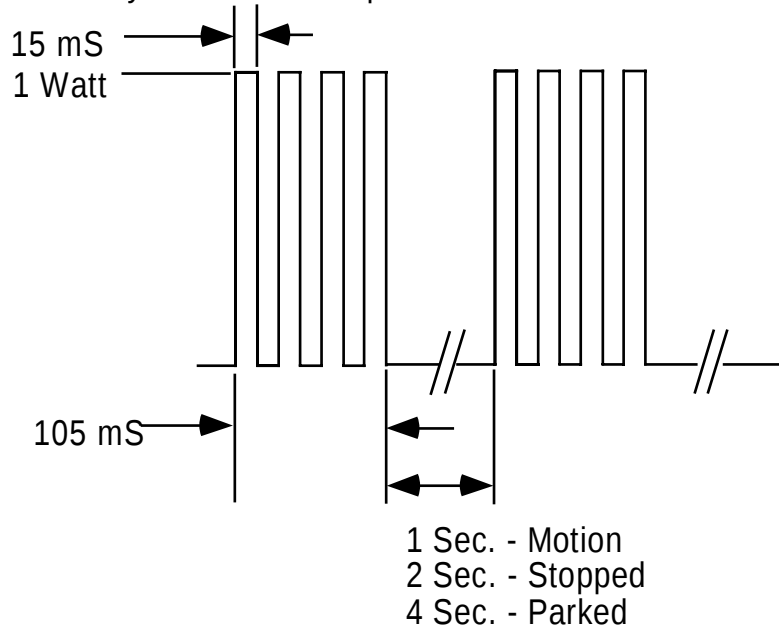
Frequency stability is achieved by using a low ESR, AT-cut, crystal and oscillator which is frequency corrected by a bias provided by the U3 OP-Amp stages in conjunction with compensation components D2, a temperature proportional reference and RT-1, a thermistor, which drives the varactor diodes.

The oscillator and first tripler stages have base bias regulation provided by U2, a 2.0 VDC regulator IC. The second tripler, Q3, has base bias compensation via Q4, a diode connected transistor.

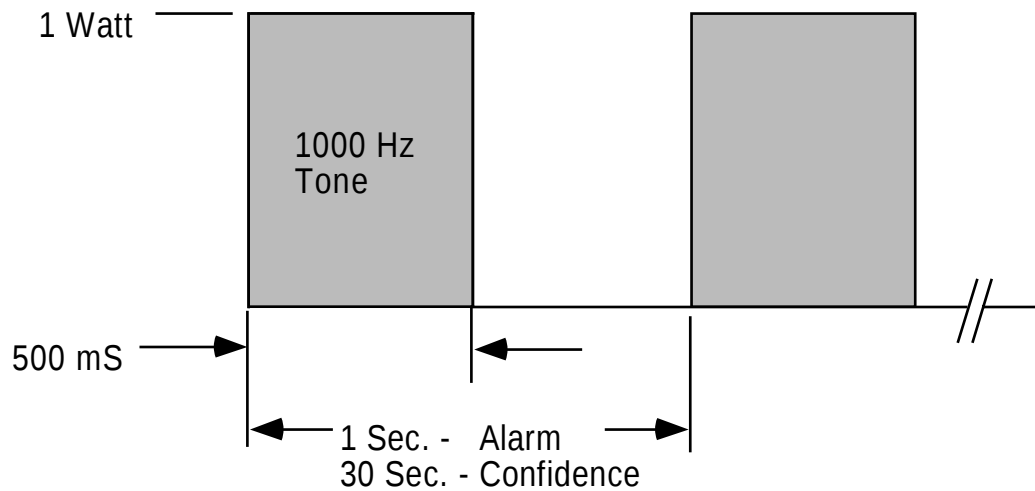
The oscillator stage is turned on by the microprocessor in conjunction with U2, the oscillator regulator. This occurs 5 mS before the second multiplier, driver and power amplifier are keyed.

Final amplifier keying is also initiated by the microprocessor and carried out with mosfet switch Q5 and dual mosfet series switches in U5.

MODE 1 "BEACON" - PB-3 sends a group of four 15 ms wide (spaced by 15 mS), unmodulated, 1 Watt peak, RF pulses very second for "motion"; every 2 seconds for "stopped" or every 4 seconds for "parked".



MODE 2 "ALARM/CONF." - PB-3 sends 500 mS wide, 1000 Hz tone modulated, 1 Watt peak, RF pulses every second for "alarm" or every 30 seconds for "confidence".



PB3 TIMING DIAGRAM