TECHNICAL DESCRIPTION

Model FRS132

FCC: BBOFRS132

IC: 906B-FRS132

A). GENERAL DESCRIPTION

The FRS132 radio is a self-contained transceiver unit intended for use as a general communication tool. The FRS132 model has 14 channels. The useable range, while dependent upon terrain and other radio propagation principles, is typically two miles based on the transmit power specified at 0.5 watts ERP. Product features are as follows:

FEATURES	FRS132
FRS Channels	14
Channel Indicator	LCD
Range	2 Mile
Alkaline Battery Source	4 x AAA (not included)
Transmitter Output Power	500 mW
Auto Squelch	Yes
Automatic Battery Save	Yes
Automatic Channel State Saver	Yes
Call/ Ring Alert	1 Tone
PWR Button	Keypad
Supported Accessories	Removable belt clip

B). FREQUENCY DETERMINING CIRCUITS

The fundamental frequency for both the transmitter and the receiver local oscillators are controlled by a phase lock loop (PLL) circuit internal to U300. The frequency of operation of the voltage controlled oscillator (VCO), composed of Q50 and Q51 operating in cascode, is phase locked to a voltage controlled crystal reference (VCXO) operating at 10.25 MHz (X300). Compensation for temperature variations on the crystal reference is accomplished using a thermister (TH300) to change the reactance of the reference crystal circuitry. Compensation for voltage variations on the crystal reference is accomplished through a supply voltage regulator

The VCO is locked to the fundamental of the transmit signal in the transmit mode and is locked to the receive 1st LO (Fundamental channel frequency plus 10.7 MHz) in the receive mode. The crystal reference frequency is used as the second LO connected internally in U300 to the second mixer to produce the second IF of 450KHz.

TECHNICAL DESCRIPTION
Model FRS132
FCC: BBOFRS132
IC: 906B-FRS132

C). TRANSMITTER CIRCUITS

The transmitter amplifies the 0 dBm signal from the VCO to approximately 27dBm that is fed to the antenna. The transmitter is a two stage amplifier composed of Q200, and Q201. The first stage is operated class A, and the final is operated class AB. The fundamental transmit signal is fed through a low pass filter in order to suppress the harmonics to below –60 dBc. The desired frequency modulation of the carrier is accomplished by modulating the current in the VCO directly with the microphone audio signal. The microphone audio is conditioned with a high pass filter at 300 Hz, a hard clipper circuit (internal to U300) to limit maximum deviation to +/- 2.5 kHz and a three-pole low pass or splatter filter at 2.8 kHz (internal to U300). The low pass filter insures that the occupied bandwidth of the FM modulated signal meets FCC requirements under all input conditions.

D). RECEIVER CIRCUITS

The received signal from the antenna is band limited to 600 Mhz by the transmitter harmonic filter. The desired signal is fed to a low noise amplifier (LNA – Q101) centered from 460 to 470 MHz that provides approximately 15 dB of gain. The output of the LNA is filtered through an LC network. The filtered receive signal is one input to the 1st mixer, the other mixer input (1st LO) is the output of the VCO at the desired channel frequency plus 10.7 MHz. The output of the mixer is tuned to the 1st IF of 10.7 MHz. The 1st IF fed to a crystal filter centered at 10.7 MHz with a bandwidth of 15 kHz. The filtered 1st IF is then fed through the 1st IF amplifier to the 2nd mixer internal to the multi-function radio IC (U300). The 2nd LO (10.25 MHz) is generated by the 10.25 MHz VCXO that is the reference frequency for the PLL. The 2nd mixer output of 450 kHz is filtered through a 4 section ceramic filter that in combination with the 10.7 MHz crystal filter provides approximately 55 dB of adjacent channel attenuation. The 450 kHz 2nd IF is then amplified, limited and fed to a quadrature detector for FM demodulation. The resulting audio output signal is bandpass filtered from 300 to 3 kHz (internal to U300) and amplified to provide 200 mW of audio power (U150), which differentially drives the 16 ohm speaker. A squelch circuit is provided (U300 pins 29,30 and40) to mute the receiver noise under low signal conditions. The squelch circuit amplifies and detects noise in a narrow bandwidth at approximately 7 kHz. When the detected noise exceeds a threshold set to trigger at approximately 12 dB SINAD receive signal strength, the audio output is muted.

E). TRANSMIT/RECEIVE SWITCH

When the radio is in the transmit mode, pin diode switches D200 and D100 are both turned on (representing less than 0.7 ohms). D200 allows the transmit signal to pass to the antenna and D100 shorts one leg of a Pi matching network (C2,L100,and C101) to ground in the receive path. This results in a parallel tuned circuit high impedance being presented to the transmit signal so that the receive path does not load the transmit signal. In the receive mode, both D200 and D100 are off, resulting in the antenna signal being coupled into the receive LNA through the 50 ohm Pi matching network and the unwanted load of the transmit final amplifier is reduced to less than 1 pF by D200.

TECHNICAL DESCRIPTION

Model FRS132

FCC: BBOFRS132

IC: 906B-FRS132

F). RADIO CONTROL CIRCUIT

A microprocessor (U400) is used to control the transceiver. User stimulus is provided through a tack switch for PTT (push to talk), along with the keypad for channel selection, channel monitor, and page. Pressing the PTT switch instructs U400 to switch to the transmit mode. This is accomplished by loading the proper channel counter information through a 3-wire serial link to the multi-function radio IC (U300), turning on power to the PLL and VCO, microphone and transmit audio circuits and the transmit RF amplifiers. Pressing the channel Up/Down buttons instructs U400 to increment or decrement respectively the channel frequency by one channel from the channel previously selected.

In receive mode the microcontroller periodically switches on the VCO and receiver power and checks for a valid received signal by monitoring the squelch circuit output. If a valid signal is present, the audio output is turned on and receive power is maintained for the duration of the valid signal. If the valid signal is removed or no valid signal is present, the microcontroller removes power from the VCO and receiver, waits for approximately 100 ms and then checks again. This periodic cycling of the power to the receiver circuits results in a much longer battery life vs. leaving power on continuously. The total period of the cycling is selected such that the worst-case delay in 'seeing' a valid receive signal is not disruptive to normal two-way voice communications.