

THEORY OF OPERATION

21-1846

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This FRS/GMRS transceiver provides accurate and stable operation.

The basic functions consist of 9 main sections:

- **Power Supply Unit**
- **Receiver Stage**
- **Squelch Control**
- **Transmit Stage**
- **VCO and PLL**
- **Micro-controller**
- **CTCSS (QUIET)**
- **CALL**
- **VOX**
- **Power**

The unit is powered with an AC 117V adapter with output 6V DC.

1. 6V voltage is regulated to 3.3V by IC4 a low drop regulator TK11330 for the VCO & PLL power, as well as for MCU power, TX and RX power control circuitry. Q4 as a power switch for RX and TX. They are controlled by RX and TX CTL from MCU.
2. The power for the RF-power amplifier, is directly driven by 6V.
3. The power for the Audio amplifier section.

● **Receive Stage**

RF signal is received through the antenna and is passed onto a low pass filter network and amplified by Q101. This allows only the required band signal to pass through to the SAW band pass filter (BPF) F103. The mixer Q103 converts the incoming signal down to 21.4MHz. This signal again passes to a 21.4MHz XTAL band pass filter F101. This gives a better channel selectivity. The selected 21.4MHz signal is amplified by IF amplifier Q104 before it is passed to the second converter IC101 DBL5018. This converts the 21.4MHz signal down to 450kHz. This 450kHz signal is sent to discriminator. The detected audio signal passes through IC103, the 300Hz high pass filter and volume control. The audio signal then is amplified by audio amplifier IC105 LM386, and then fled to the speaker.

● **Squelch Control**

Squelch control circuitry consists of IC101 DBL5018 and its related circuit. The squelch signal output from IC101 pin 9 pass through filter amplifier circuit composed by pin 10 and pin 11. The signal is amplified and detected by IC101 and generate a control voltage at pin 13 of IC101 for MCU to detect. Pin 13 of IC101 will output a Hi to MCU IC5 pin 42 to indicate an incoming signal is detected.

● **Transmit Stage**

When the PTT switch goes down, the transceiver is switched into transmit mode through the TX/RX exchange control. Q4 is turned on for the power to the transmitter. The voice is picked up by the condenser MIC and passes through the 300Hz band pass filter IC104A LM324 and is amplified by IC104B LM324 MIC amplifier circuit. The signal modulates with the carrier in the form of FM modulation. The modulated signal from the VCO goes into the power amplifier unit which consists of a buffer amplifier Q112, a driver amplifier Q109 and the RF power amplifier Q106. The signal then is finally radiated out through antenna.

● **VCO and PLL**

PLL circuitry is composed of IC102 KB8825 the high frequency PLL and VCO. The channel information from the MCU is sent to the shift register in IC102 from pin 7. A control voltage is generated through the

low pass filter to the VCO from pin 3 and is used to control RF frequency from Q110. Q107 is the RX/TX exchange switch. RF signal from the VCO passes through the buffer amplifier Q112 and then is fed into PLL IC102. In receive mode, the signal is fed to the receiver first mixer Q103 to convert the received signal to 21.4MHz. In transmit mode, this signal modulations with the audio signal and is passed through to the transmit power amplifier unit for transmission.

- **Microcontroller**

The Microcontroller EM78P567 is the main control of the whole transceiver unit. It is also used to drive the LCD to show the status of the unit. On the LCD, there is current working channel display, transmit indication, receive indication, QUIET indication, and low battery indication. The MCU scans the keypad to detect key pressed and released, then execute the function accordingly.

- **CTCSS (QUIET)**

The CTCSS consists of transmit and receive section. In CTCSS transmit, a CTCSS signal is added to the audio and modulated for transmission. MCU pin19 output a CTCSS signal. The output is a analog waveform, and then is filtered by a low pass filter and mixed with the audio. The receive section consists of a CTCSS decoder circuit which is used to separate the audio signal and a CTCSS signal for the existing of a CTCSS signal. The CTCSS signal is filtered and amplified by IC103 LM324. The signal then is input to the MCU and is determined the CTCSS signal value for the valid CTCSS received.

- **CALL**

When the CALL button is pressed, the transceiver is switched into transmit mode through the MCU control. MCU generates a ringer audio signal. This signal is amplified in the MIC amplifier unit and modulated for transmission.

- **VOX**

The signal from the microphone is amplified by IC104A and IC104D. Mcu will detect the amplitude of the Ac signal and determine controlling level.

ADJUSTMENT PROCEDURE

Step	Adjustment	Test Point	Procedure
1.	L102 PLL PD Voltage	TP2	1. Connect a digital voltmeter to TP2 on PCB. 2. Set 462.5625MHz. 3. Adjust L102. 4. TP2 Voltage read 1.1VCD (0.9~1.3VCD). 5. Press PTT to check. PD Voltage read 1.7V $\pm$0.2V.
2.	VC101 PLL Frequency	ANT	1. Connect the coupler output to a frequency counter. 2. Set channel to channel 1(frequency=462.5625MHz). 3. Adjust VC101 to obtain a frequency reading 462.5625MHz $\pm$200Hz.
3.	VR103 Modulation	ANT	1. Connect the coupler output to an FM linear detector. 2. Connect audio oscillator to microphone jack. 3. Set unit to transmit mode. 4. Set audio oscillator output to -23dBm1kHz. 5. Adjust VR103 to obtain $\pm$2.5kHz deviation. 6. Set audio oscillator output to -43dBm 1kHz. 7. Read deviation meter [$\pm$1.2 to $\pm$1.5kHz].
4.	L101 L103 L104 L105 T101 Receiver	SPK Jack	1. Connect a UHF signal generator to the antenna connector. 2. Connect a SINAD meter to Ext. Speaker jack. 3. Set signal generator to output 1kHz modulation signal with $\pm$1.5kHz deviation. 4. At frequency 462.5625MHz, adjust T101 to get maximum and minimum distortion. 5. Adjust L101, L103, L104, L105 RF coil to get maximum sensitivity.
5.	L115 L117 L118 L101 Transistor	ANT	1. Connect the coupler output to a frequency counter. 2. Set channel to channel 1(frequency=462.5625MHz). 3. Adjust L115,L117,L118, RF coil to obtain a RF power reading 600mW $\pm$50mW.