GMRS X1

SERVICE MANUAL

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1. INTRODUCTION

GMRS X1 is FM handhold transceiver operating 462MHz. With the output power of 2 W ERP, the radio is capable of communicating up to 5 miles.

In addition to its small size, GMRS X1 offers many advanced features that could only be found in the most expensive GMRS.

Like other HJC quality products, GMRS X1 carries a 12 months limited warranty. Please call our technical or customer service representatives at +Tel 1 562 407 2188 when you need help, or visit us on the Web www.chatterboxusa.com.

2. TECHNICAL SPECIFICATIONS

A. GENERAL

1) Frequency Range	: 462.5500 ~ 462.7250 MHz
2) Modulation Type	: 16KOF3E (FM)
3) Channel capacity	: 15 channels
4) Channel spacing	: 25KHz
5) Power Supply	: DC 4.8V, Ni-Mh Rechargeable Pack
6) Current Drain	: Transmitter (2W) ----- <1100mA (Ni-Mh Rechargeable Pack) Receiver (0.5W) ---------<300mA
7) Battery Life	: 8hrs. talk time; 20 hrs. stand-by time
8) Operating Temperature	: -20°C to +60°C
9) Dimensions	: 65(H) x 132(W) x 39(D) mm
10) Weigh	: 8 oz.(with battery)

B. TRANSMITTER

1) Power Output	: 2W
2) Frequency Stability	: Better than +/- 5ppm within operating temperature
3) Hum & Noise	: -40dBc(with 300Hz to 3KHz audio filter)
4) Spurious & Harmonics	: -60dBc
5) Audio Distortion	: Less than 5% (1KHz tone 6 0% modulation)

C. RECEIVER

1) Sensitivity (12dB SINAD)	: 0.25Uv(-119dBm SINAD)
2) Selectivity	: -60dB
3) Inter-modulation	: -60dB
4) Spurious and image rejection	: -60dB
5) Maximum Audio Output	: More than 200mW
6) Audio Distortion	: less than 5%

3. THERORY OF OPERATION

INTRODUCTION

GMRS X1 is a micro size15 channel portable FM transceiver constructed with a microprocessor controlled, temperature compensated Phase Locked Loop (PLL) frequency synthesizer. The radio features a double conversion receiver and a direct FM transmitter modulator. A special integrated circuit provides support to sub-audible signaling (CTCSS) and most of the receiving parts are switched off periodically in the power saver mode to reduce battery current drain during standby.

The Block Diagram RF and Control Circuit Diagrams for GMRS X1 shall be used in associate with the following circuit description.

CIRCUIT DESCRIPTIONS

1) PHASE-LOCK LOOP (PLL) CIRCUIT

*** REFERENCE OSCILLATOR**
The reference oscillator consists of X301 in U301 with a frequency of 12.8MHz.
This comparison frequency is selected by decoding the first three bits of the data input from microcomputer.

*** PROGRAMMABLE DIVIDER**
The programmable divider in U301 consists of a prescaler with a 7 bit control register followed by a 11-bit internal programmable divider. The overall division ratio is selected by a single 19-bit world located on the serial data bus.

*** PHASE COMPARATOR**
A digital-type phase comparator in U301 with output and an open drain lock detect output compares divided VCO frequency with the comparison frequency. It generates a correction voltage that is applied to a low-pass filter consisting of R319,R318,R317 and C317,EC302,C316,C315 then sent to the VCO circuit.

*** VCO CIRCUIT**
The transmit/receive frequency is directly generated by the Colpitts oscillation circuit contains Q302. The oscillation frequency is variable by applying the VCO control voltage to variable to variable capacitors D304.

2) TRANSMITTER

*** MIC AMP CIRCUIT**
Voice signal from the microphone is applied to microphone amplifier U506 contains a high-pass filter, low-pass filter that has a 6dB/oct response between 300Hz and 3 kHz,and eliminates hamonics above 3 kHz. The pre-emphasized audio signal is applied to VR501 to adjust maximum frequency deviation.

*** VCO AND AMPLIFIER**
The VCO signal output is through amplified by Q203, Q202 and then fed to power amplifier Q201.

*** POWER AMPLIFIER CIRCUIT**
Q201 provides approximately 4.8V DC power source.
Signals from Q201 is supplied through antenna switch D201 to a low-pass filter made up of L204, L203, L202 and C201-CC207, then applied to Antenna Jack.

3) RECEIVER

*** ANT SWITCHING CIRCUIT**
Signals from antenna connector fed to the antenna switching circuit throught the low pass filter consisting of L204, L203, L202 and C201-C207. In receive mode, D201 is turned off, isolates the antenna from the transmitter circuit and matching circuitry, so that the incoming signals are fed to the RF amplifier through L101.

*** RF AMPIFIER CIRCUIT**
The signals from the switching circuit are fed to the RF amplifier Q104 through a band pass filter.

*** FIRST MIXER CIRCUIT**
The amplified signals are fed to Gate 1 of the first mixer Q102 through C110.

First local oscillator signal is supplied to Gate 2 of Q102 form the PLL circuit through C126 to convert the RF signals into 21.4MHz first IF signal.

*** IF CIRCUIT**

The first IF signals from Q102 are fed to the matched pair crystal filter XCF101, then IF signals are amplified in Q103. And those signals are fed to U401 which is composed of the second local oscillator, second mixer, limiter amplifier, quadrature detector and active filter circuit. The second local oscillator at 20.945MHz with X402,and is fed to the second mixer with the first IF signals to convert into 455kHz second IF signals..

The second IF signals leave through pin 3,and are fed to external ceramic filters FL401 which has excellent selectivity, then fed to U101 (pin 5) again to be amplified and detected.

The detected AF signals are output from pin 9.

*** AUDIO AND SQUELCH CIRCUIT**

The detected audio signals are put through a 6dB/oct de-emphasis circuit made up of C507 and R519. The signal is then applied to audio power amplifier U505 through the volume control U507 to obtain enough power to driver the speaker.

Part of the recovered noise signal is fed to the integrated operational amplifier inside U401 which, with C403,R405, C405, C404,R406 makes up an low pass filter . The DC signal detected by U401 (pin13) reaches the integrated DC amplifier in U101 which has hysteresis to prevent jitter. The sensitivity of squelch is adjusted by U2.

4) HAND FREE

It connects the telephone to jack J2 and checks the connection in PIN4 of U503. During the calling, it turns MONITOR switch of Q506, Q507, Q508, Q509 off, then RF stops

5) AUDIO IN

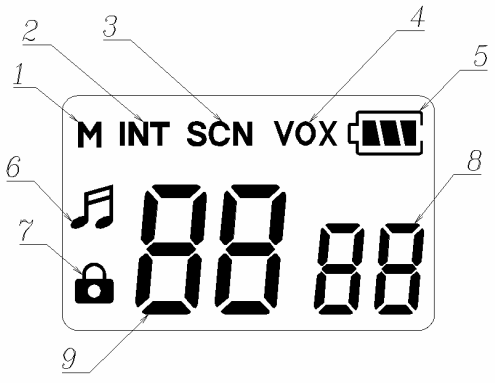
Jack J506 receives external AUDIO, and amplifies in U505. When RF signal is received, AUDIO IN switch of U504 is off, then it receives RF signal.

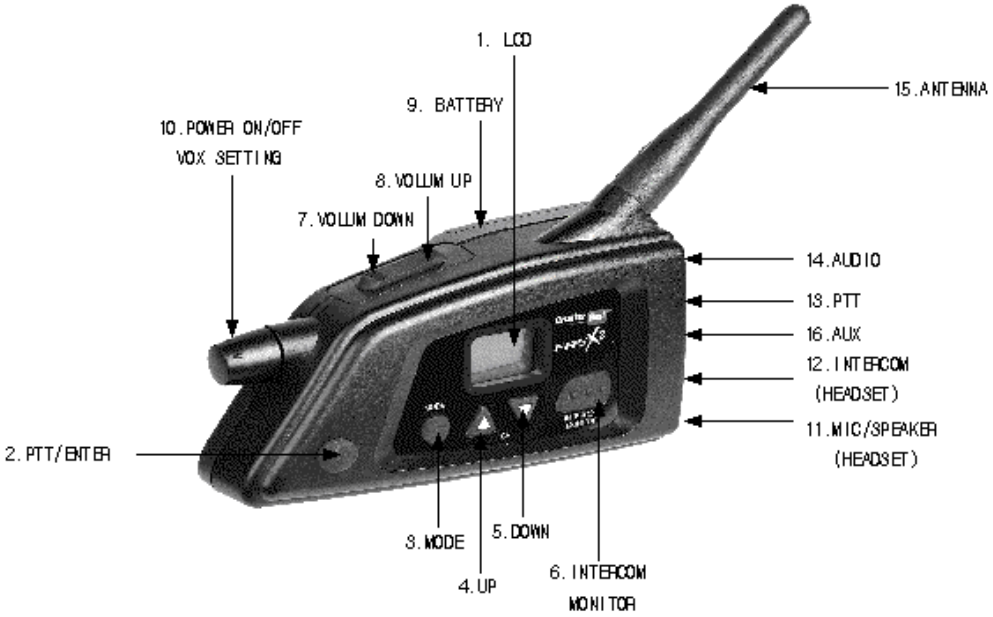
OPERATION

Please refer to the user's manual for details

HJC-PMR X2 user's manual

1. description





(1) LCD

LCD	description
1	MODE
2	INTERCOM MODE
3	SCAN MODE
4	VOX
5	BATTERY
6	BEEP
7	KEY LOCK
8	CTCSS SUB TONE
9	CHANNEL

(2) PTT button
hold down to transmit and release to receive.

(3) MODE button
press to go several mode.

(4) UP BUTTON
to select the channel and option in mode operation.

(5) DOWN BUTTON
to select the channel and option in mode operation.

(6) INTERCOM BUTTON
to go INTERCOM mode and to monitor

(7) VOLUM DOWN BUTTON
to reduce the volume level

(8) VOLUM UP BUTTON
to increase the volume level

(9) BATTERY

(10) POWER ON/OFF KNOB
to power on or off and to select VOX level

(11) EXTERNAL SPEAKER/MIC SOCKET
to connect to external speaker/mic

(12) INTERCOM SPEAKER/MIC SOCKET
to connect to INTERCOM speaker/mic

(13) External PTT

(14) AUDIO IN SOCKET
to connect external AUDIO IN.

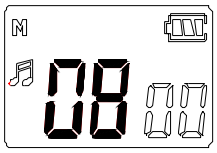
(15) ANT

(16) HAND FREE SOCKET
to connect the telephone

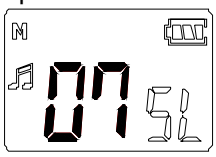
2. Operation

power ON/OFF
Turn the transceiver on by rotating switch in a clockwise direction.

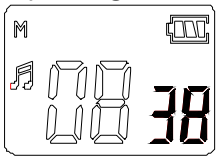
1) channel select
Choose the desired channel with pressing UP/DOWN BUTTON, and press PTT BUTTON to complete



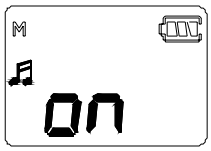
2) volume level select
Choose the desired volume level with VOLUME UP/DOWN BUTTON, and press PTT BUTTON to complete. The radio is mute when the volume level is selected '00'

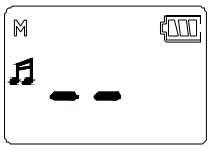


3) Tone select
Press MODE BUTTON one times. During the tone number blinking, choose the desired tone number with pressing UP/DOWN BUTTON. Press PTT BUTTON to complete.

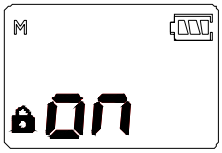


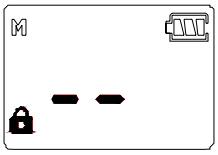
5) beep ON/OFF select
Press MODE BUTTON two times. Choose BEEP ON or OFF with pressing UP/DOWN BUTTON and press PTT BUTTON to complete.

BEEP ON : 

BEEP OFF 

6) key lock ON/OFF select
Press MODE BUTTON three times. Choose key lock ON/OFF with pressing UP/DOWN BUTTON and press PTT BUTTON to complete

KEY LOCK ON: 

KEY LOCK OFF: 

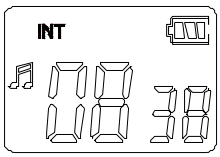
7) scan
Press MODE BUTTON four times. During the channel number blinking, press UP BUTTON to upward scan or press DOWN BUTTON to downward scan. The radio stops scanning after detecting a signal and remains on the same channel until the signal drops out for 2 seconds. Press PTT BUTTON to stop scanning.

8) power save level select
Press MODE BUTTON five times. Choose the desired power save level with pressing UP/DOWN BUTTON and press PTT BUTTON to complete

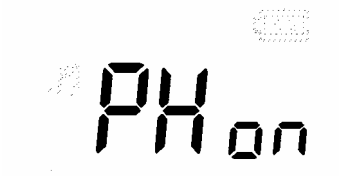
POWER SAVE OFF NORMAL POWER SAVE HIGH POWER SAVE

9) INTERCOM
Press INTERCOM BUTTON over 2 seconds.

10) monitor
Press INTERCOM BUTTON shortly to monitor, and press it shortly again to stop.



11) hand free
Connect the telephone to HAND FREE SOCKET. When the telephone signal comes, press the MONITER BUTTON to receive with hand free. Press MONITOER BUTTON again to finish.



4. Alignment Procedure

Measurement Condition

The following sections describes the alignment procedure for GMRS X1 transceiver under the following reference environment conditions:

Temperature	:	25℃ (77℉)
Relative Humidity	:	65%
Power Supply Voltage	:	4.8VDC +/- 5%

Test Equipment / Tools required

The following list of equipment is recommended for use in setting up the radio properly. Please ensure the test equipment are calibrated according to the manufacturer's instructions:

- Frequency counter more than 1000MHz +/-100Hz tolerance, high input impedance and high sensitivity
- UHF FM Signal generator, 1000MHz with adjustable frequency, FM deviation, and RF output attenuators. 50Ω Output impedance.
- Oscilloscope, high input impedance.
- 16Ω 1 Watt resistor as loudspeaker load
- Audio Signal Generator, 10Hz to 20KHz, 600Ω impedance with attentuators.
- RF Watt meter, with 50Ω 1 Watt termination resistor (Or RF Voltmeter with 50Ω termination and external 50Ω attenuators)
- Regulated Power Supply 4.6VDC 1A output
- Digital A-V-O Multi-meter
- SINAD Meter
- External Speaker Mic plug (or special audio test jig)
- Interconnection test cable for RF and Control PCB
- Circuit Diagram for GMRS X1
- PCB layout diagram for GMRS X1
- Tuning tools for RF/IF transformer and the VR potentiometers

Transmitter Adjustment

- X-TAL frequency

On receiving mode, check X-TAL(X301)output (pin 2) is at 12.8MHz

VCO control voltage

Over 1V (RX), less than 3.3V (TX) On 1CH(462.5500MHz)

- Transmitter Frequency

Connect RF Power meter to ANT1, Activate PTT to transmit on Ch1 (462.5500MHz) check transmitting frequency error is within +/- 250Hz. (adjust with VC301.)

- Transmitter Output Power

Activate PTT to transmit on CH1, Set adjust with VR201 for 2W power output at ANT1. Repeat test on Ch8.

- Transmitter Deviation Limit

Set radio to transmit on CH1, with CTCSS code 38 (250.3Hz) and no audio modulation. At the external microphone input, inject 1KHz tone at –20dBm. Adjust VR501 for 2.0KHz deviation. Reduce 1KHz tone input to –40dBm, check deviation dropped to 1.2 to 1.5KHz. Repeat test on Ch8.

Receiver Circuit Adjustment

- FM Demodulator Adjustment

Set radio to receive on Ch1, No CTCSS Connect RF Signal Generator to ANT1, Set generator to 462.5625MHz at –60dBm (50Ω) output with 1KHz tone modulation at 1.5KHz deviation

- Receiver Sensitivity

After adjusting the FM demodulator, reduce the output level of RF Signal Generator. Check the receiver sensitivity at 12dB SINAD to be around –120dBm

- Receiver Squelch Adjustment

After checking the receiver sensitivity, further lower the RF Signal Generator output to 8-10dB SINAD and observe the squelch circuit operates. Adjust VR401 if necessary.

5. Operational Test

Conduct operational test on all major features and transmit/receive on all the channels. Observe all LCD displays and alert tones are operative and all the buttons are functional. Refer to user manual for details.