

**GMRS-1525**

**SERVICE MANUAL**

**2-WAY PORTABLE**

**HANDHELD**

**RADIOS**

**2000 January 27**

**J-communications co., ltd**

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## **1. GENERAL**

### **1.1 GENERAL**

This equipment, GMRS-1525 is called 2 way portable handheld radio.  
The frequency range is 462.5625 ~ 462.7250MHz, UHF operating  
Channels for international 2 way radio.

### **1.2 CHARACTERISTIC**

- a) All active device in this radio is composed of semiconductor and high density IC.
- b) To design this radio in compact and weight approximately 140g with out battery.
- c) CPU of this equipment is M38223M4-HP from MITSUBISHI.
- d) It's power can operate by use of alkaline 4 cell(1.5V AAA) battery.

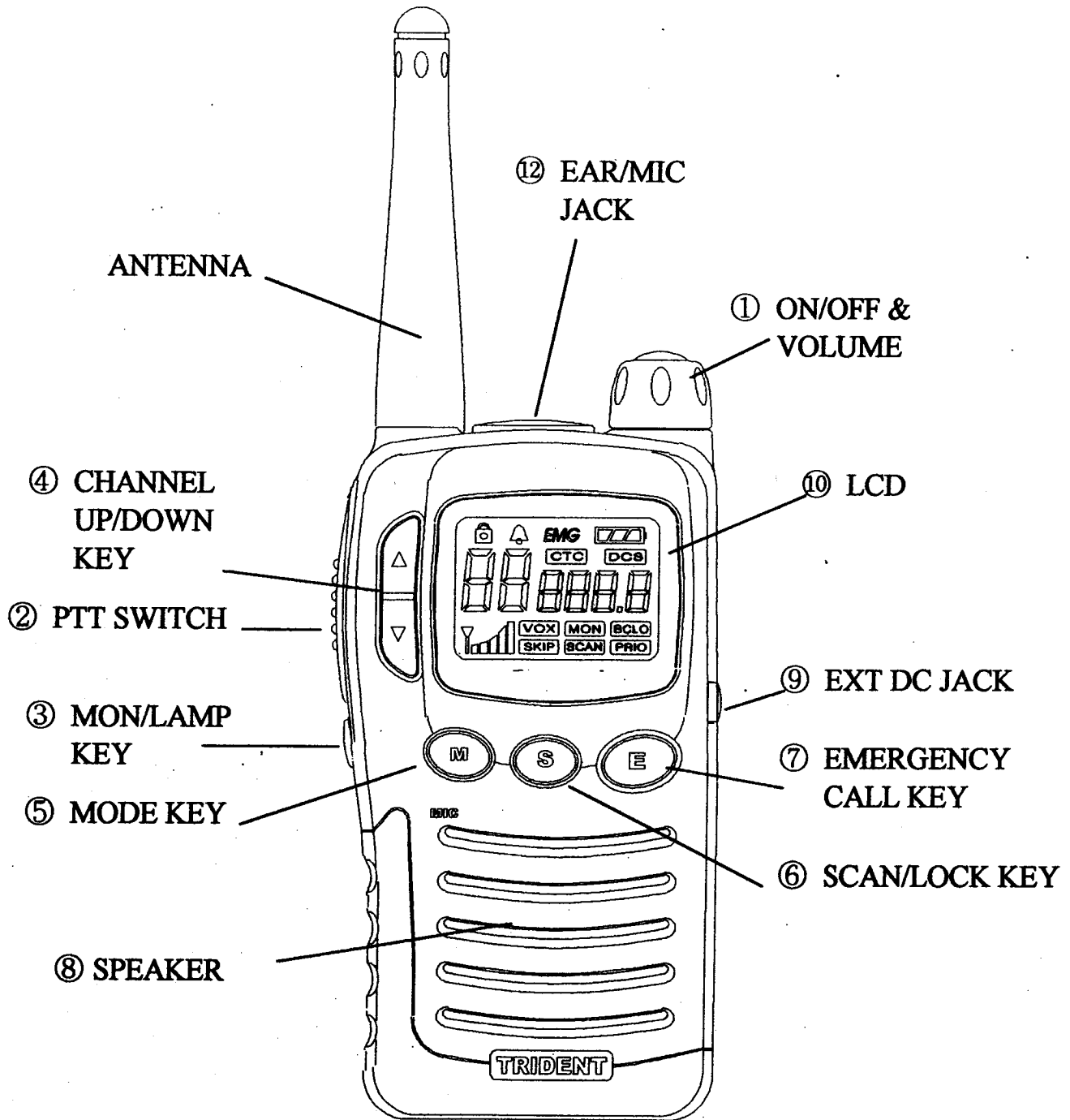
### **1.3 COMPOSITION**

This radio is composed of following.

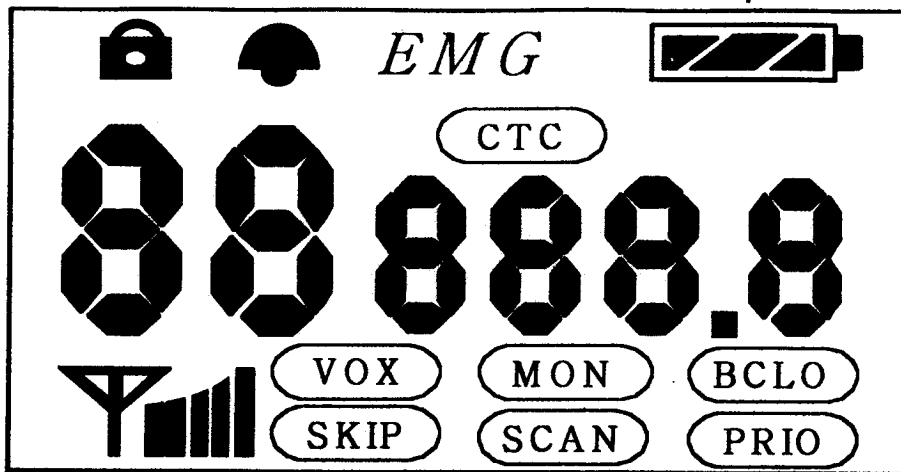
- a) Transceiver (W/Antenna)
- b) Belt clip

### 3. OPERATION

Name



### 3.2 ICONS on LCD



- 1) Key lock indicator : Indicates that the key lock function is in use.
- 2) Receive signal indicator : Appears when receiving signal or squelch noise is existing.
- 3) Monitor indicator : Appears when the CTCSS isn't in use and squelch is open.
- 4) Emergency channel indicator : Indicates while receiving a emergency channel.
- 5) Scan indicator : Indicates that scan is enabled.
- 6) CTCSS indicator : Appears when the CTCSS function is in use.
- 7) Priority scan indicator : Indicates that the priority scan function is in use.
- 8) Beep ON/OFF indicator : Appears while key tone is in use.
- 9) Battery indicator : Indicates the battery status
- 10) CTCSS readout : Shows the operating CTCSS frequency or code.
- 11) BCLO (Busy Channel Lock Out) Indicator : Appears to inhibit transmitting whenever there is another conversation is on the channel.
- 12) VOX (Voice Activated Transmit) Indicator : Turning on the power while pressing PTT button activates VOX function.
- 13) Channel readout : Shows the current channel number.
- 14) Skip channel indicator : Appears when a non-select scan channel is selected.

### 3.3 Key Function

- 1) Volume controls : Turn the power on and adjusts the audio level.
- 2) PTT switch : Push and hold to transmit ; release to receive.
- 3) Monitor / Lamp Key : Press and hold this key for over 2 seconds to enable the receive CTCSS feature. And Push this button momentarily to switch on for off the LCD back-lighting.
- 4) Channel Up/Down key : Push to select the operating channel Push and hold to change the current channel rapidly.
- 5) Mode (Function) key : Push to select the following function setting mode.  
  
Brief press mode : 1'st press -- CTCSS 2' nd press --  
VOX level ,  
3' rd press -- Scan skip list 4'th press -  
Beep ON/OFF,  
5' th press -- BCLO ON/OFF 6'th press --
- 6) Scan / Lock key : Push this key to momentarily to enable or disable the scan. Press and hold this key for over 2seconds to lock or unlock keypad.
- 7) Emergency Channel key : Push this key to momentarily change to emergency channel (462.6750Mhz).
- 8) Speaker / Microphone
- 9) External DC power jack : Connect a 4.8 to 6.5V DC power source with the cable to the GCH-120NC wall charger for charging.
- 10) LCD (Liquid Crystal Display)
- 11) Transmit indicator : Light red while transmitting.
- 12) External speaker/mic jacks : Connect an optional speaker/mic or headset, if desired. The internal mic and speaker will not function when either is connected.

## 2) Function display



1) **Key lock indicator** : Indicates that the key lock function is in



2) **Receive signal indicator** : Appears when receiving signal



3) **Monitor indicator** : Appears when any CTCSS isn' t in use and squelch



4) **Emergency Channel indicator** : Appears when emergency



5) **Scan indicator** : Indicates that scan is enabled.



6) **CTCSS indicator**: Appears when the CTCSS function is in



7) **Priority scan indicator** : Indicates that the priority scan function is



8) **Beep ON/OFF indicator** : Appears while key tone is



9) **Battery indicator** : Indicates the battery



10) **CTCSS Frequency readout** : Shows the operating CTCSS frequency.



11) **BCLO (Busy Channel Lock Out) Indicator** : Appears to inhibit transmitting whenever there is another



12) **VOX (Voice Activated Transmit) Indicator** : Turning on the power while pressing PTT button activates VOX function.



13) **Skip channel indicator** : Appears when a non-select scan channel is selected.



14) **Channel readout** : Shows the current channel number .

### 3-4. SETTING AND OPERATION

#### 1) **Basic Channel Selection**

In order to communicate with other GMRS units, both you and the receiving party must be on the same channel.

GMRS1525 has 15 channels indicated by the large digits on the LCD display panel. Before trying to transmit on the selected channel, you should press the **Monitor Button** to check the activity on that channel. If someone is already on the selected channel, you should try another channel that is clear

To change the basic channel,

- In the standby mode, press the **Up Button** briefly to move to the next higher main channel number.
- Press the **Down Button** briefly to move to the next lower main channel number.

#### 2) **Sub Channel Selection**

CTCSS (Continuous Tone Coded Squelch System) with 38 Sub-Frequency.

This feature allows you to utilize a less used channel range (00 ~ 38) within a main channel.

This enables you to communicate with another party on the same main Channel using the same sub-code.

This helps to avoid congestion on the main channel and filters out unwanted Noise and static.

There are 38 CTCSS Sub-channels for each main channel.

To change the CTCSS Sub-channel,

- Press the **Mode Button** until the Icon (CTC) appears in the LCD panel.
- Press the **Up Button** or **Down Button** to choose the desired **sub-channel** to use.
- The corresponding sub-code frequency will be displayed in the lower right corner.
- Press the **PTT Button** to confirm your selection.



*NOTE : To communicate with other PMR units, they must be switched to the same channel and CTCSS sub-code. To communicate with other GMRS units that do not have sub-codes, switch your unit to the same channel with the sub-code set to OFF.*

### **3) Auto Channel Scan List Selection Mode**

This feature allows you to scan for an active channel and communicate with the party transmitting.

To access the Auto Channel Scan Skip List menu,

- Press the **Mode Button** until the Icon (**SKIP**) blinks on the LCD panel.
- Press the **Up Button** to choose the desired **Scan access channel**, or **Down Button** to choose the desired **Scan skip channel**.
- Press the **PTT Button** to confirm your selection.
- The unit will begin scanning for an active main channel.
- To turn off the auto channel scan feature while scanning mode, simply press the **SCAN button** once.
- When Press the **SCAN button** ,(SC-- ) appears in the LCD panel.
- Even when scan appears on LCD, operation such as transmission for this communication is same as one for the normal.
- When it doesn't emit any signal and you want to TX , press the PTT switch to return to home channel operation.
- It will resume to scan automatically about 3 second after the Receiver and transmit is finished.
- At last press the Scan button for simply to leave the scan mode.

### **4) Priority Scan Channel Selection Mode**

This feature allows you monitor one special channel and all scan channels at the same time. If you pre-set any priority channel other than the current channel in use, the pre-set channel will be scanned every 0.5 second and signals you when a call is received.

To access the Priority Scan menu,

- Press the **Mode button** until the (**PRIO**) icon blinks on the LCD panel.
- Press the **Up button** or **Down button** to select the desired channel number You wish to closely monitor.
- Press the **PTT button** to confirm your selection.

- To turn off the Priority Scan feature while scanning mode, simply press the **Scan button** once.

### 5) **VOX Selection Mode**

The Voice Activated Transmission (VOX) function allows your voice to activate transmission automatically when the Communicator is used with the optional hands-free mic/head-set (refer to enclosed Accessory Order Form). It also allows hands-free use when a mic/head-set is not being used without having to the PTT button.

To access the VOX Selection menu,

- Press the **Mode button** until the VOX icon blinks and (Vo 01) appears on the LCD Panel.
- Press the **Up button** or **Down button** to select from 01 ~ 10 Voice Level.
- 01 ~ 10 Level setting determines VOX response sensitivity.
- Press the **PTT button** to confirm your selection.
- To turn on the VOX feature, press **PTT button + Power ON**.
- To turn off the VOX feature, **Power ON** again

### 6) **Auto Key Lock Selection Mode**

This feature prevents accidental channel change and disturbance to the preferred settings of the communicator. Auto Key Lock temporarily disables to Up, Down and PTT button.

To access the Auto Key Lock selection menu,

- Press and hold the **Scan button** for over 2 seconds to **Lock** or **Unlock** the Key except PTT and On/Off switch.

### 7) **BCLO (Busy Channel Lock Out) Selection Mode**

This feature inhibit transmitting whenever there is another conversation is on the same channel.

To access the Busy Channel Lock Out selection menu,

- Press the **Mode button** until the **BCLO** icon blinks on the LCD panel
- Press the **Up button** or **Down button** to select the **BCLO ON/OFF** option.
- Press the **PTT button** to confirm your select.

### 8) Call Ringer Selection Mode

This feature provides 5 user selectable call ringer signal to alert you of a calling party.

To select your favorite call ringer signal.

- Press **Emergency button + Power ON**. Appears the (C 01) icon blanks on the LCD panel.
- Press the **Up button** or **Down button** to preview the 5 available signal.
- Press the **PTT button** to confirm your selection.
- To quickly activate the Call, Simply press **PTT button 2 time click**.

### 9) TOT(Time Out Timer) Selection Mode

This feature is sometimes necessary or desirable to restrict a single transmission to a specific maximum times.

This feature can be useful when particularly trying to conserve battery Power.

To access the Time Out Timer selection menu,

- Press **Mode button + Power ON**. Appears the (T OFF) on the LCD panel
- Press the **Up button** or **Down button** to select the 30sec,60sec,180sec or Off.
- Press the **PTT button** to confirm your selection.

### 10) Emergency Channel Mode

The Emergency Channel can be used to special frequency (10Channel : 462.6750Mhz) within your transceiver. No matter what mode the transceiver

is in, the, Emergency Channel always can be Selected quickly.

To access the Emergency Channel mode,

- Press **Emergency button**. Appears the (EMG) and 10 channel readout on the LCD panel.
- To turn off the Emergency Channel feature while Emergency Channel mode, simply press the **Emergency button** once.

## 4. ADJUSTMENT

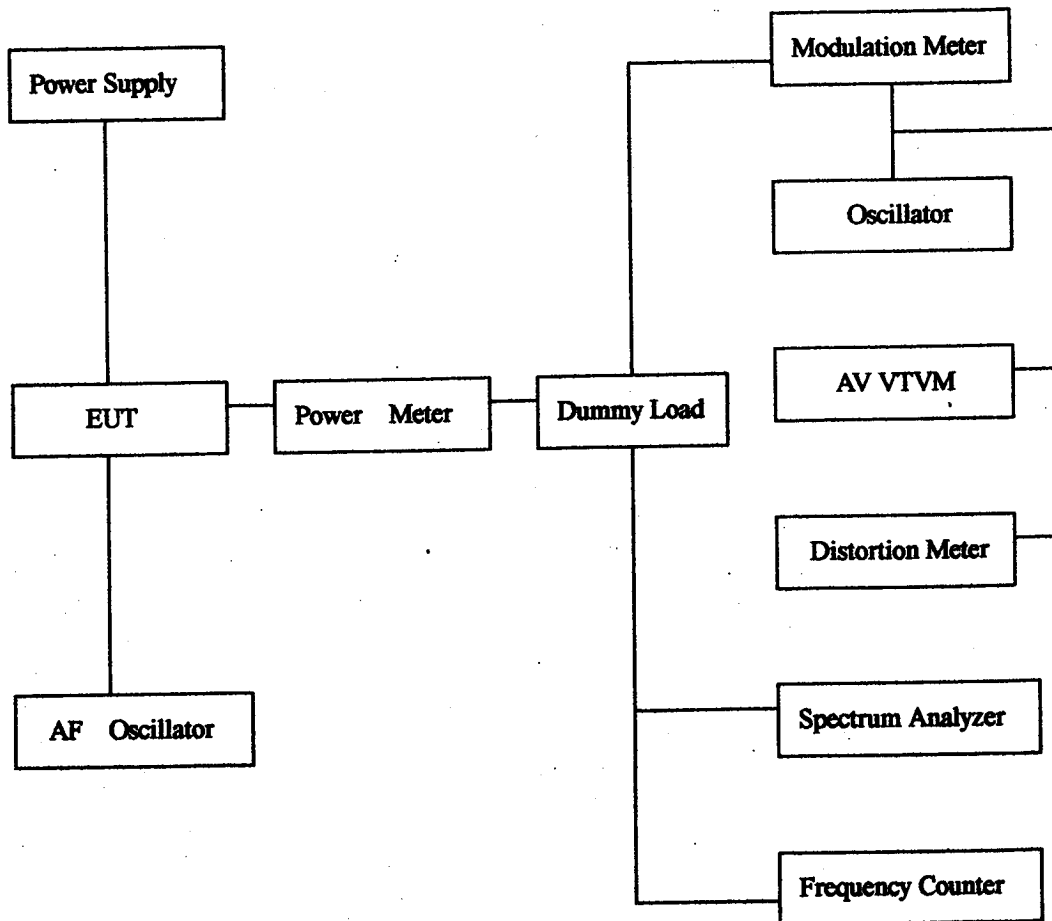
### 4-1. Frequency synthesizer

- a) After connecting the power meter and dummy load(50 ohm), join the antenna connector of TMR-300 with above equipment.

- b) Check the voltage between TP & GND in digital volt meter.
- c) Then set the low channel of TMR-300 the lowest frequency.
- d) After pressed PTT key of TMR-300, check if the lowest frequency of Tx channel to DC 1.5V in the voltage of test point(D401).
- e) After releasing the PTT key of TMR-300, check if the highest frequency of Rx channel is within DC 1.0V in the voltage of test point(D401).

**4-2. Transmitter**

- a) Connect EUT & measure equipment according to block diagram below.



- b) Connect DC 6.0V voltage preset to EUT.
- c) Connect 'Power Meter' and 'Dummy Load ( 50Ω )

- d) Adjust Tx frequency according to trimming trimmer VC201.
- e) Connect AF Oscillator to mic terminal for conform modulation degree.
- f) Adjust the frequency of AF Oscillator to 1 kHz and adjust AF level  
Should be 100mV.
- g) Checking Oscilloscope and Modulation Meter.  
Max deviation should be in  $\pm 2.5$  kHz.

#### **4-3. Transmitter Test**

##### **a) Output Power Test**

Power(DC 6.0V) should be Max. 2 W(ERP) and in  $-50\%$  range.

##### **b) Audio Response**

Connect AF oscillator to Mic terminal and then firm the audio level that doesn't distortion the wave of Oscilloscope in the frequency range, 300Hz~ 3kHz. Check the audio level for 300Hz~ 3kHz based on frequency standard, 1kHz.

##### **c) Modulation Degree Test**

- 1) Connect AF oscillator to the MIC terminal and then adjust the level to 100 mV
- 2) Measure the Oscilloscope wave and the point needle of Modulation Meter after pressing PTT key.
- 3) Sweep gradually the frequency of AF Oscilloscope from 300Hz to 3kHz.
- 4) At this time, the point needle of Modulation Meter should be in  $\pm 2.5$  kHz

##### **d) Spectrum Test**

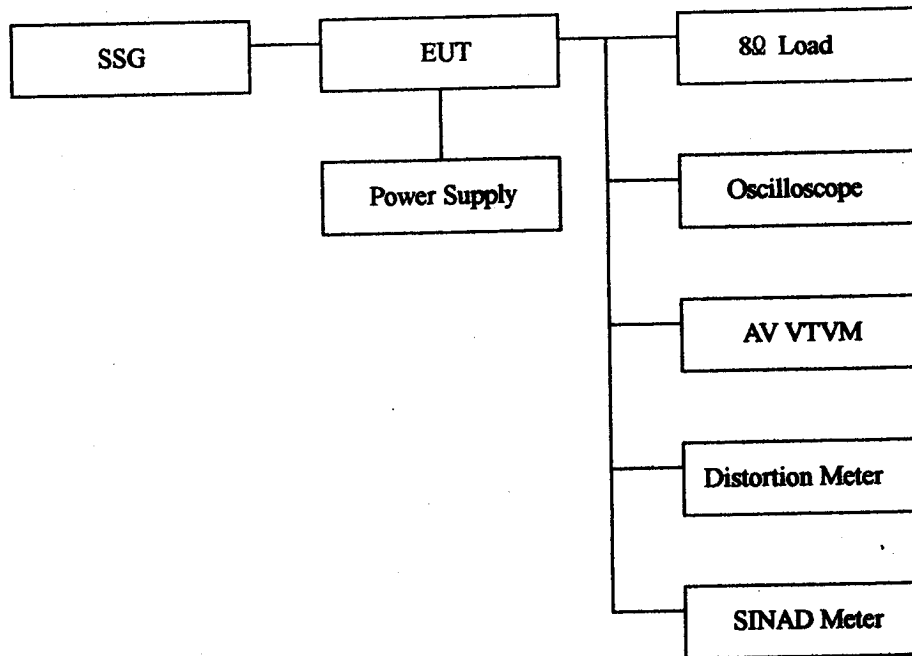
- 1) Antenna is 50 $\Omega$  and attenuation degree should be 20 dB more.
- 2) Observe the Spectrum with pressing PTT key.  
The harmonics should be less  $-36 \sim -30$ dBm than carrier.

#### 4-4. Receiver

##### a) Preparation

- 1) Adjust the power supply to DC 6.0V.
- 2) Adjust Voltage level to 0.7Vrms(4Ω load) after power on.

##### b) Connection method



##### c) The Conform of Rx sensitivity

- 1) Adjust SSG to channel frequency.
- 2) Adjust modulation frequency, 1Khz to modulation degree, 1.5kHz.
- 3) After adjusting the frequency of SSG to channel frequency, RF level sets to -47dBm.

##### d) The Conform of Squelch sensitivity

- 1) Set the standard channel.
- 2) In squelch mode, SQ volume VR301 must be turned counterclockwise.
- 3) After adjusting SSG to channel frequency, the RF level of SSG is set On SINAD 8~6 dB.

#### 4-5. Receiver Test

##### a) Rx sensitivity test

SSG should be adjusted to 12 dB of SINAD point needle seeing wave of Oscilloscope as SSG sets in 1kHz frequency deviation.

At this time , normal RF level is  $-110 \sim -107$ dBm.

##### b) Audio Distortion Test

1) SSG should be adjusted like way of point "a)" and RF level sets to  $-47$  dBm.

2) Adjust to  $0.7V_{rms}$ ( $4\Omega$  load) seeing Audio wave.

3) Read the needle of Distortion Meter (Normal condition would be less than 5% distortion)

##### c) Squelch Test

After RF level of SSG should be set to the least level, RF level should be Gradually increased until speaker makes audio sound.

At this point, check RF level (Check if the SINAD is  $8 \sim 6$  dB).

#### 4-6. Symptoms, Check point & Correction

##### a) Diagnosis method

1) Check each switch to work well.

2) Check voltage of battery.

3) Problem develops from transmitter or receiver?

##### b) Troubleshooting

###### 1) Transmitter

- Power key is on condition but does not work.

(a) Battery could completely discharge.

(b) Battery cell twist ..

(c) Touch problem come between Battery and Radio.

- Fail to transmit.

(a) Run out of battery or charge problem.

(b) Fault of PTT key.

(c) Fault of Q201, Q202, Q203.

- Transmitter works but frequency is unmatched

(a) Out of order in frequency synthesizer.

(b) Out of order in X-tal frequency(X201)

- Audio does not sound (Tx power and Tx frequency are normal)
  - Ⓐ Problem of microphone or mic connector.
  - Ⓑ ASP(Audio Signal Processor) IC U102 problem.
- Tx is set when switch is on
  - Ⓐ Tx switch(PTT) problem.

## **2) Receiver**

- Rx does not work
  - Ⓐ Speaker line open problem or connector problem.
  - Ⓑ Receiver power circuit problem.
  - Ⓒ Audio amplifier Base band IC U103 problem.
- Only noise sound
  - Ⓐ IF IC U301 problem.
  - Ⓑ VCO circuit problem.
- Rx sensitivity is weak
  - Ⓐ Antenna mounting problem.
  - Ⓑ Receiver front-end circuit problem.
  - Ⓒ Local oscillation frequency deviation.
  - Ⓓ FL301,FL302 SAW filter fail.
  - Ⓔ VCO circuit problem.
- Squelch does not work
  - Ⓐ IF IC U301 problem.
  - Ⓑ Control logic circuit problem.



## 5. DESCRIPTION OF RADIO CIRCUIT

### 5-1. Frequency synthesizer

Frequency synthesizer consists of VCO, PLL IC (built in PRESCALER) and loop filter.

#### a) VCO

VCO is composed of One VCO. Oscillation circuit takes colpitts circuit using variable Diode. And VCO is composed of D401, L402, C401, C402, C403 D402, Q401, Q402.

VCO control voltage through loop filter adjusts frequency and Microphone Signal through Modulation terminal makes modulation.

#### b) PLL IC

PLL IC is adjustable IC to produce the wished frequency which VCO provides through loop filter. It has internal counter using 21.25Mhz reference frequency to make 6.25kHz as reference Signal. VCO frequency from prescaled input is divided signal is compared with Reference signal phase in phase comparator. Built-in charger pump changes voltage (until two signals are in phase) and charged voltage supplies VCO through loop filter to produce the desired frequency.

Frequency data associated with channel goes to PLL IC by CPU through CLOCK, DATA. PLL IC enables by strobe line of CPU.

#### c) Loop Filter

Loop filter is composed of R217, R218, R219, C3, C240, C241 and changes pulse from pin7 to DC. And eliminates harmonic component in pulse. It helps VCO oscillate clearly as DC voltage is supplied into Varicap.

### 5-2. Receiver

This is composed of Dual Conversion Super Heterodyne. First IF is 21.7Mhz. Local oscillator frequency is lower in 1<sup>st</sup> IF than Rx frequency. It is called low side injection. Second IF is 450kHz. 2<sup>nd</sup> local oscillator Frequency comes to 21.25MHz.

**a) Rx / Tx Conversion Circuit**

Rx signal goes to Rx / Tx conversion circuit through FIXED antenna connector, low pass filter (L201,L202,L203,C210,C202,C203,C204) and receiver resonance circuit composed of L204,C206. When transmitting, Voltage through R209,L211,D201 supplies,D202 of receive input is short and Tx is on condition. When PIN diode is off in condition of Rx, C301,C302 L301 resonate serially and make impedance matching at receiver bandpass filter.(FL301,FL302)

**b) Front End**

Front-end has Q301 to provide a high sensitivity and low noise feature. It employs SAW filter as band pass filter to eliminate image frequency and to produce enough pass band by Q301 input and output.

**c) Mixer**

Mixer has two gate 3SK228(Q302) to feature high ,low noise quality. It has RF signal through Q301 and FL302,C306 and RF signal from Local Oscillator mixed.

It develops 1'st IF 21.7MHz. 1'st IF goes to 1'st IF amplifier Q303 base through X-tal filter FL303.

If of mixing signals is selected and taken into X-tal filter.

Output impedance of mixer is direct matched with input impedance of X-tal filter.

Matching of filter satisfies pass bandwidth of filter, ripple elimination with in pass band, and attenuation characteristic of stop band.

X-tal filter is composed of two pole monolithic X-tal filter, 8kHz of IF Bandwidth. R307 is used as impedance matching with 1'st IF Amp Q303.

**d) IF AMP and Detection**

1'st IF AMP Q303 supplies IF IC (U301) mixer input pin16 through output resistor R308 and C311 to need gain in insertion loss of X-tal filter and last stage circuit. Multi-use IF IC makes up of mixer IF AMP.

2'nd local frequency enter to IF IC pin1.

It supplies mixer of internal IF IC. Mixer output of IF IC through pin3 passes 450kHz ceramic filter, supplies 2'nd IF amplifier and limits.

After 2'nd IF AMP has a process of enough gain and AM rejection, it comes to quadrature detection. Demodulated audio signal by X301 is amplified and comes out to pin9. Detected audio signal through R313, VR1 and input in audio amp. Audio IC U105 through R149.

**e) Squelch Circuit**

Noise component of detected outputs has amplification squelch threshold Is controlled by Resistor R310,R312,VR301.

**f) Audio Amplifier**

Demodulated audio signal enters to pin3 of AF IC (U105).

After above signal amplifies in U105 pin1 and pin8 through C140,R150.

It comes out to pin5 then, it reaches at speaker.

**5-3. Transmitt**

When Tx develops with pressing PTT switch, VCO output amplifies through Q204,Q203,Q202,Q201 transmits by antenna through low pass filter.

Tx RF signal produced from Tx VCO is amplified by Buffer Q204, Pre-driver Q203, Driver Q202 through C212 and entered Q201 Power Transistor input terminal with final amplification. After this stage, the signal is emitted at antenna through 50 $\Omega$  matching circuit to low pass filter (L201,L202,L203 C201,C202,C203,C204) to eliminate harmonic.

**a) Audio Modulation and Audio Amplification**

Audio signal produced by external or internal microphone, limits amplification, low pass filter by IC U102.

Max. Frequency modulation deviation is adjusted by R127,VR2 keeps noise and audio from entering to VCO at time of Tx. Audio modulation and Audio Amplification has characteristic of 6 dB/OCT pre-emphasis by U102.