



SERVICE MANUAL

2-WAY PORTABLE
HANDHELD PMR
RADIO

TECtalk

Jan. 2000

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1. GENERAL

1.1 GENERAL

TECtalk is a minimum sized two-way portable handheld radio.

The frequency range is 446.00625 ~ 446.09375MHz, 8 UHF operating channels according to European PMR 446 international agreement are available.

1.2 CHARACTERISTICS AND FEATURES

- a) All active devices in this radio are semiconductors and high density IC.
- b) The radio is designed very compact and the weight is approximately 140g including battery.
- c) The unit is equipped with CPU HD404889 from HITACHI.
- d) Power supply is designed for battery operation with 4 cells alkaline (1.5V AAA)

batteries or

4 cells rechargeable NiMH batteries of the same size.

e) The radio is shipped with fixed (non-detachable) rubber duck antenna and belt clip and carrying strip. It comes without batteries. Other equipment is optional.

2. SPECIFICATION

2.1 GENERAL SPECIFICATIONS

- a) Frequency Range : 446.00625 ~ 446.09375 MHz
- b) Output Impedance : 50Ω unbalanced
- c) Modulation Type : 8K0F3E
- d) Communication Mode : semi-duplex
- e) Channel Capacity : 8 channels
- f) Channel spacing : 12.5 kHz
- g) Power : 6.0V(alkaline), 4.8 V (NiMH)
- h) Battery Life : ALKALINE: at 1000mAh >30 hours (Tx5%, Rx5%, Stand-by 90%)
- i) Operating Temperature : -20 degrees C to +60 degrees C
- j) Dimension : 95.5(H)x 50(W)x 26(D)mm
- k) Weight : 132 g (with Battery)

2.2 ELECTRICAL SPECIFICATION

a) TRANSMITTER

- 1) Output power : Max. 500 mW
- 2) Frequency Stability : ±5 ppm(-20 ~+ 60)
- 3) Modulation Method : FM
- 4) Oscillation Method : PLL SYNTHESIZER
- 5) Max. Frequency Deviation : < +/- 2.5 kHz (with tone)
- 6) Cooling Method : air-cooling Method
- 7) Spurious Emission : < -36dBm /-30dBm
- 8) FM Hum/Noise : > -40dB (1kHz 60% modulation,w/CCITT)
- 9) Distortion : < 5% (1kHz 60% modulation)
- 10) Tx Audio Response : 6dB /OCT +/- 3dB PRE-EMPHASIS (300Hz~2.5kHz)

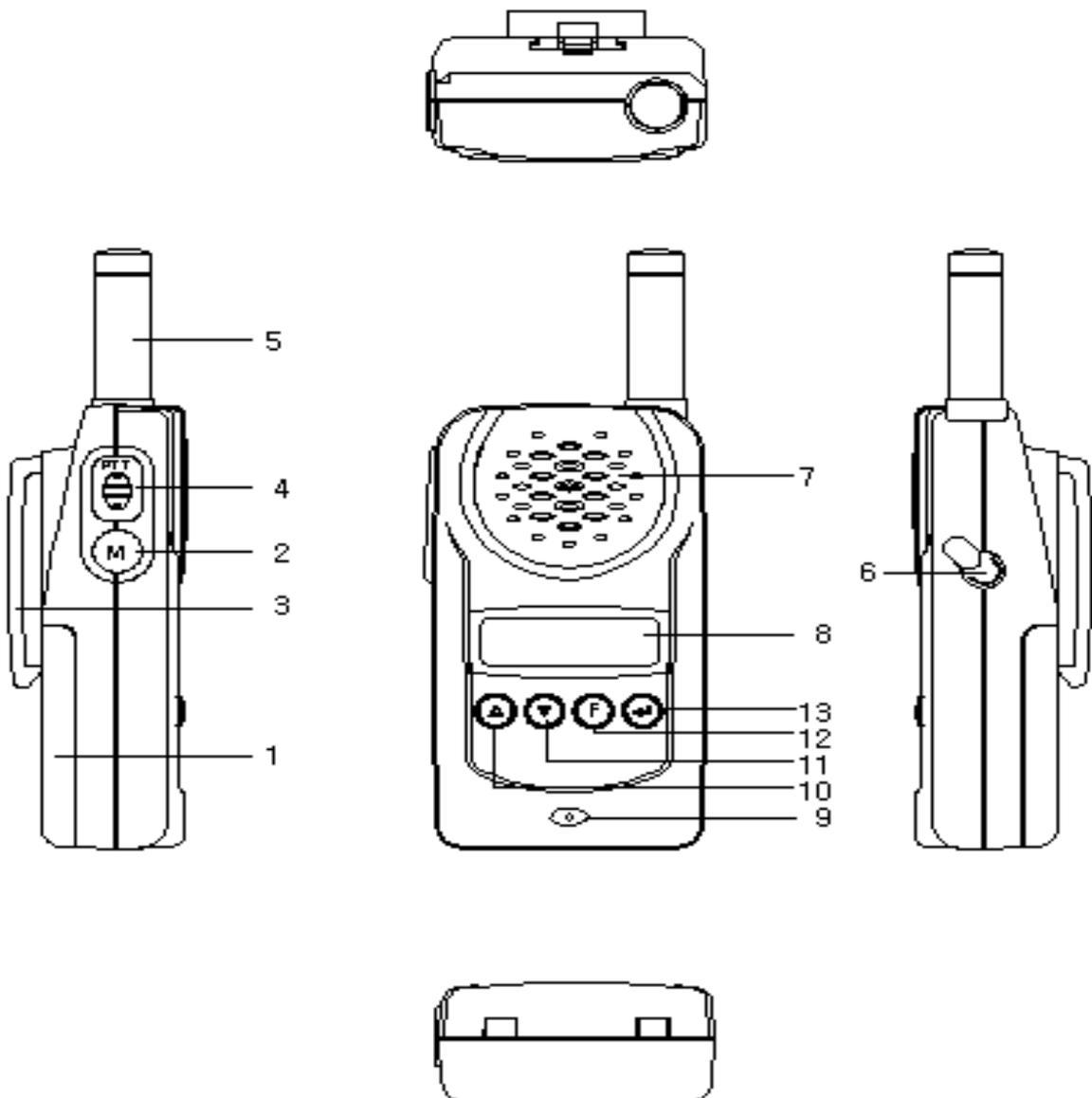
b) RECEIVER

- 1) Receive Method : Double Super Heterodyne
- 2) Receive Sensitivity : < 0.28uV(20dB SINAD w/CCITT)
- 3) Squelch Sensitivity : 6 to 8 dB at 12dB SINAD
- 4) Bandwidth : > 3kHz (6dB ATT point)
- 5) Selectivity : < -60dB (25kHz)
- 6) Local Frequency Stability : +/- 5 ppm(between -20 degrees C and +60 degrees C)
- 7) Spurious Response : > 40dB
- 8) Audio output : 200mW (Internal 8 Ohms load THD 10%) Ext: 100mW

- 9) Distortion : < 5% (1kHz 60% Modulation)
 10) RX Audio Response : 6dB/OCT +/- 3dB DE-EMPHASIS (300Hz to 2.5kHz)
 11) S/N Ratio : < 40dB (1kHz 60% modulation w/CCITT)
 12) IF : 1'st IF = 21.7MHz
 2'nd IF = 450kHz
 13) Local Frequency :
 1st Local Frequency = $f_c - 21.7\text{MHz}$
 2nd Local Frequency = 21.25MHz

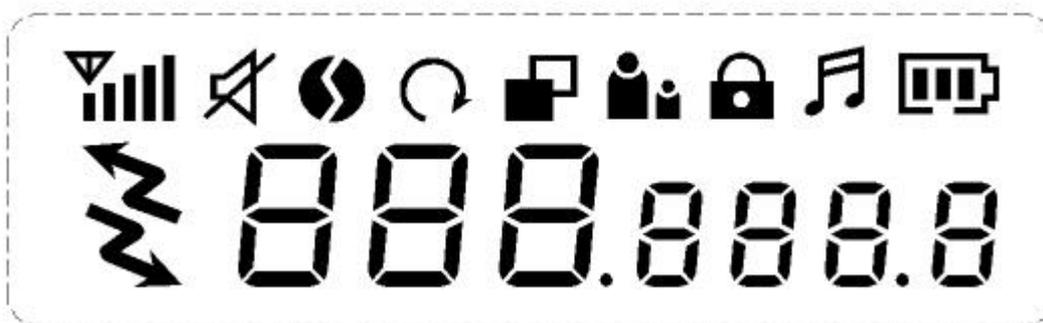
3. OPERATION

3.1 Push Buttons and Controls



- 1) Battery Door
- 2) Monitor Button
- 3) Detachable Belt Clip
- 4) Push-To-Talk (PTT) Button
- 5) Antenna
- 6) External Mic / Speaker
- 7) Built-in Speaker
- 8) LCD Panel
- 9) Built-in Microphone
- 10) Up Button & Volume Control
- 11) Down Button & Volume Control
- 12) Function Button
- 13) Power On/Off & Enter Button

3.2 ICONS on LCD



Appears when the monitor button is used.

3) CTCSS Indicator



Blinks when the correct CTCSS tone is entered.

4) Auto Channel Scan Indicator



Appears in the auto scan mode or when the auto scan mode is activated.

5) Dual Watch Scan Indicator



Appears in dual watch scan mode or when the dual watch scan mode is activated.

6) Key Lock Indicator



Blinks in auto lock selection mode or when the key lock is activated.

7) VOX Indicator



Blinks in VOX selection mode or appears when VOX is activated.

8) Battery Level Indicator



Battery Level Meter indicates the remaining battery strength.

9) Power Save Display



Blinks when the power save is activated.

The rate at which the icon blinks varies with the power saving ratio.

Fast indicates a lower power saving while slow indicates a higher Power saving ratio.

10) Tx Indicator



Appears when a signal is being transmitted.

11) Rx Indicator



Appears when a signal is being received.

12) Large Segment Display



Indicates the channel number in use at the normal mode.
When the Function Button is pressed, it displays the function menu in sequence: CH / SC / dW / UO / Udt / ALo / CAL / ton

13) Small Segment Display



Displays the CTCSS tone option at the normal mode.
CTCSS option is displayed in Hz.
Displays the SUBMENU of each MENU in the function mode.
(e.g. CH 1~69 / SC: up, dn / dW: channel number /
UO: high, off,low / Udt: 5sec, 3sec, 2sec, 1sec / ALo: off, auto /
CAL number:1-7 / ton:no-Freq) 3.3 Key Function

3.3 Key Functions

3.3.1 ENTER BUTTON (#13)

1) Short Touch - Power On

Press this button (#13) briefly to turn the unit on.
A short confirming melody will play.

2) Long Touch - Power Off

Press this button (#13) for longer than 1.5 seconds to turn the unit off.
Note: Press it to confirm the required option for respective functions during function edit mode.

3.3-2 FUNCTION BUTTON (#12)

1) Short Touch

Press this button briefly to enter function edit mode in standby mode.

2) Long Touch

Press for longer than 1.5 seconds to activate the KEY LOCK in the standby mode.

Please note all buttons will be disabled except the Monitor Button (#2) and PTT Button (#4) will remain fully operational.

3.3.3 UP BUTTON (#10)

1) Short Touch

In the standby mode, press this button briefly to move to the next higher main volume level.

In the function edit mode, press briefly to shift from the current option in each submenu to the next option in the same submenu.

2) Long Touch

Pressing this button for more than 1.5 seconds will allow you to navigate at a more rapid rate through different volume level in the standby mode or through different menus in the function edit mode.

3.3.4 DOWN BUTTON (#11)

1) Short Touch

In the standby mode, press this button briefly to move to the next higher main volume level.

In the function edit mode, press briefly to shift from the current option in each submenu to the previous option in the same submenu.

2) Long Touch

Pressing this button for more than 1.5 seconds will allow you to navigate at a more rapid rate through different volume level in the standby mode or through different menus in the function edit mode.

3.3.5 PUSH-TO-TALK (PTT) BUTTON (#4)

Press it firmly and speak into the Built-in Microphone (#9) to transmit. The red Tx LED Indicator at the right side of the LCD Panel (#8) will be on.

Release it to revert to standby mode. When an incoming call is received, the green Rx LED Indicator on the left side of the LCD Panel (#10) will be on.

Call Tone Transmission

Press the PTT Button twice quickly to call another party on the same channel. The word CALL and the Tx icon will appear in the display. The user selected call ringer melody will play.

3.3.6 MONITOR BUTTON (#2)

Press it to check activity on the current channel before you try to transmit.

Adjust the Volume Control (#10, #11) if necessary.

When you press the Monitor Button, the LCD Panel (#8) will be illuminated with an amber color back-light and both the Tx and Rx LED Indicators will be on.

If you press the Monitor Button during the function edit mode, you will return to standby mode directly.

3.3.7 EXTERNAL MIC/SPEAKER (#6)

This jack accepts an optional headset/microphone for totally handsfree operation.

Please refer to the user manual or Albrecht catalogue.
See also section regarding VOX SELECTION MODE.

3.4 Setting and Operation

3.4.1 BASIC CHANNEL SELECTION

In order to communicate with other PMR units, both you and the receiving party must be on the same channel. Tectalk has 8 channels (1-8) as indicated by the large digits in the LCD Display Panel (#8).

Before, trying to transmit on the selected channel, you should press the Monitor Button (#2) to check the activity on that channel.

If someone is already on the selected channel, you should try another channel which is not occupied.

To change the basic channel, in the standby mode, press the **Up Button (#10)** briefly to move to the next higher main channel number.

Press the **Down Button (#11)** briefly to move to the next lower main channel number.

3.4.2 CTCSS (Coded Tone Controlled Squelch System) SUB-CHANNEL SELECTION MODE

This feature allows you to have more privacy on the main channel by using tone codes (international numbering system 00-38) within a main channel. This enables you to communicate with Your partners on the same main channel when all partner stations use the same subcode. This helps to avoid congestion on the main channel and filters out unwanted noise, static and other stations using different codes.

There are 38 CTCSS subchannels for each main channel.

To change the CTCSS subchannel,

Press the Function Button (#12) until the word cTc appears in the LCD Panel (#8).

Press the Up Button (#10) or the Down Button (#11) to choose the desired subchannel to use. The corresponding subcode frequency will be displayed in the lower right corner.

Press the Enter Button (#13) to confirm your selection.

NOTE:

To communicate with other PMR units, they must be switched to the same channel and CTCSS subcode. To communicate with other LPD units that do not have subcodes, switch your unit to the same channel with the subcode set to OFF.

3.4.3 AUTO CHANNEL SCAN MODE

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

To access the Auto Channel Scan menu, press the Function Button (#12) until the auto channel icon blinks and SC appears in the LCD Panel (#8).

Press the Up Button (#10) or the Down Button (#11) to choose scanning up or down from the current channel number.

Press the Enter Button (#13) to confirm your selection.

The unit will begin scanning for an active main channel. If a transmission is detected, the Rx and RSSI icons will appear in the LCD Panel (#8).

To turn off the auto channel scan feature in the standby mode, simply press the Function Button (#12) once.

3.4.4 DUAL WATCH SCAN MODE

This feature allows you to monitor two different 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 Dual Watch Scan menu,
Press the Function Button (#12) until the dual watch icon blinks and dW appears in the LCD Panel (#8).

Press the Up Button (#10) or the Down Button (#11) to select the desired channel number you wish to closely monitor.

Press the Enter Button (#13) to confirm your selection.

To turn off the dual watch feature in the standby mode, simply press the Function Button (#12) once.

3.4.5 VOX SELECTION MODE

The Voice Activated Transmission (VOX) function allows your voice to activate transmission automatically when the Communicator is used with an optional handsfree mic/headset, or even with the built-in Microphone. (#4) without using the PTT button.

To access the VOX Selection menu,
Press the Function Button (#12) until the VOX icon blinks and UO appears in the LCD Panel (#8).

Press the Up Button (#10) or the Down Button (#11) to select from high, low or off. High or low setting determines VOX response sensitivity.

Press the Enter Button (#13) to confirm your selection.

To turn off the VOX feature, enter the VOX selection mode and then select Off.

3.4.6 VOX RECOVERY TIME SELECTION MODE

This allows the response characteristics of the VOX function to be precisely adjusted to suit individual needs.

To access the VOX Recovery Time Selection menu, press the Function Button (#12) until Udt appears in the LCD Panel (#8) with the VOX icon blinking.

Press the Up Button (#10) or the Down Button (#11) to select from 5, 3, 2 or 1 second setting. This setting determines the delay time between transmitting and receiving.

Press the Enter Button (#13) to confirm your selection.

Please note you may need to try different VOX time settings to determine the best value to suit your speaking habit.

To turn off the VOX feature, enter the VOX selection mode and then select Off.

3.4.7 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 the Up, Down and Enter Buttons.

To access the Auto Key Lock Selection menu, press the Function Button (#12) until the auto lock icon blinks and ALo appears in the LCD panel (#8).

Press the Up Button (#10) or Down Button (#11) to select the Auto option.

Press the ENTER key to confirm your selection.

If you do not press any key for more than 15 seconds in the standby mode, all respective keys will automatically be locked.

To turn the auto key lock on or off in standby mode, simply press and hold the Function Button (#12) for more than 1.5 seconds.

To quickly activate the Auto Key Lock, hold the Function Button (#12) for more than 1.5 seconds.

3.4.8 CALL RINGER MELODY SELECTION MODE

This feature provides 7 user selectable call ringer melodies to alert you of a calling party.

To select your favorite Call Ringer melody, press the Function Button (#12) until the call icon blinks and CAL appears in the LCD panel (#8).

Press the Up Button (#10) or Down Button (#11) to preview the 7 available melodies.

Press the ENTER key to confirm your selection.

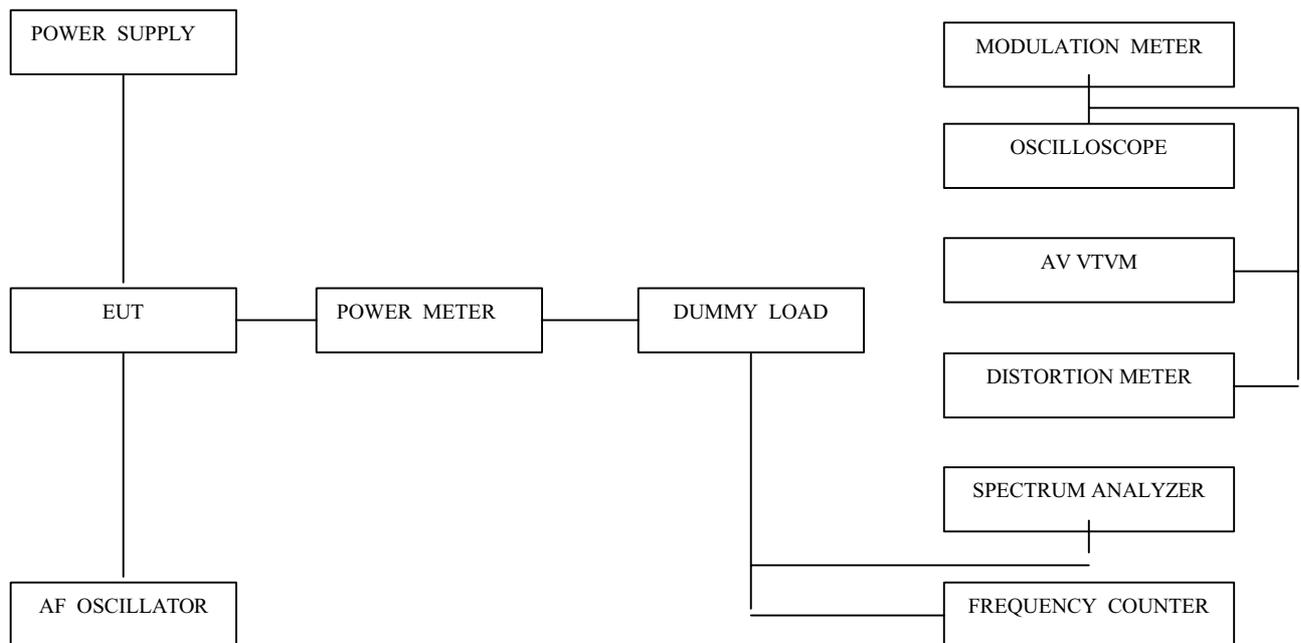
4. SERVICE AND ADJUSTMENT

4.1 Frequency synthesizer (PLL)

- Open the radio, disconnect the antenna and connect a power meter and a 50 Ohms dummy load with the internal antenna connecting point of TECtalk.
- Check the voltage between TP & GND in digital volt meter.
- Then set the low channel of TECtalk the lowest frequency.
- After pressed PTT key of TECtalk, trim VC1 for adjusting the lowest frequency of Tx channel to DC 1.5V in the voltage of TP1.
- After releasing the PTT key, And then check if the highest frequency of Rx channel is within DC 1.0V in the voltage of TP,

4.2 TRANSMITTER

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



- Connect DC 6.0V, voltage preset to EUT.
- Connect "power meter" & "dummy load (50 Ohms)".
- Adjust Tx frequency according to trimming trimmer VC2.
- Connect AF oscillator to mic terminal for conform modulation degree.
- Adjust the frequency of AF oscillator to 1kHz and adjust AF level should be 100mV.
- Checking oscilloscope and modulation meter. max. frequency deviation should be in +/- 2.5 kHz.

4.3 TRANSMITTER TEST

a) Output Power Test

power(6.0V DC) should be Max.500mW 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 to 3kHz. Check the audio level for 300Hz to 3kHz based on frequency standard, 1kHz.

c) Modulation Degree Test

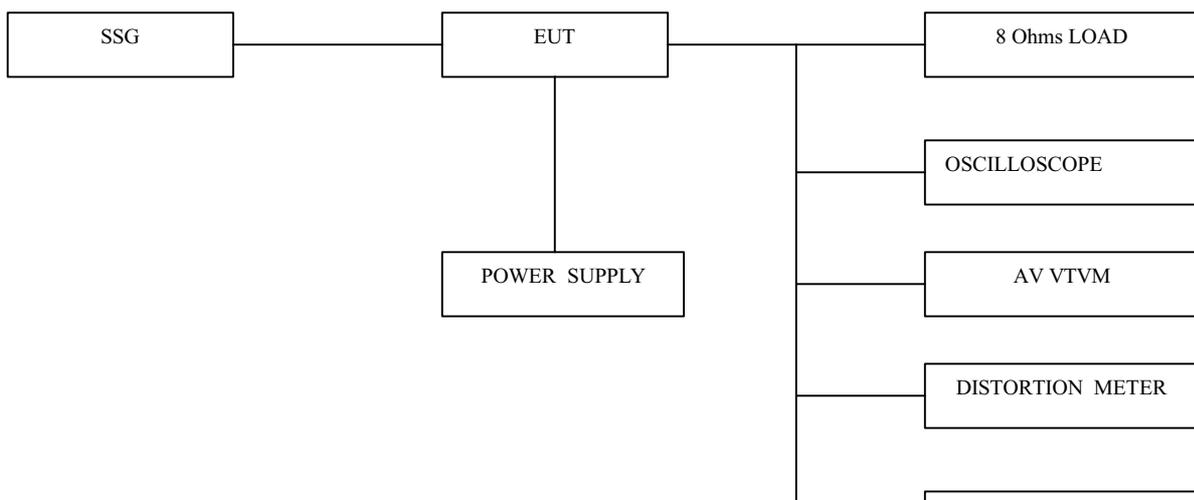
- 1) Connect AF oscillator to the MIC terminal and then adjust the level to 100mV
- 2) Measure the oscilloscope wave and he point needle of modulation meter after pressing PTT key.
- 3) Sweep gradually the frequency of AF oscilloscope from 300Hz to 3kHz.
- 4) At this time, the point needle of modulation meter should be in the limit of +/- 2.5 kHz.

d) Spectrum Test

- 1) terminate antenna output with 50 Ohms and use a power attenuator of 20 dB, to avoid harmonics generated by analyzer overload.be 20dB more.
- 2) observe the spectrum with pressing PTT key. The harmonics should be less than -36/-30 dBm (with 20 dB external attenuator the reading will be -56/-30 dBm).

4.4 RECEIVER**a) Preparation**

- 1) Adjust the power supply to DC 6.0V
- 2) Adjust Voltage level to 0.7Vrms(at 8 Ohms speaker output load) after power on.

b) Connection method

c) Signal generator Adjustment for RX sensitivity test

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

d) Check and adjust Squelch sensitivity

- 1) Set the standard channel.
- 2) In squelch mode, SQ volume RV1 must be turned counterclockwise to open the squelch.
- 3) After adjusting SSG to channel frequency, the RF level of SSG is set so that a SINAD of 8 6dB is obtained. Turn potentiometer carefully so that Squelch just opens at that point.

4.5 RECEIVER TEST**a) Rx sensitivity test**

SSG should be adjusted to 12dB of SINAD's point needle

Observe waveform of oscilloscope at signal generator signal modulated with 1kHz audio and 1.5 kHz frequency deviation. The 12 dB Sinad point should be reached with an RF level of -110 to -107Bm. This is a good sensitivity.

b) Audio Distortion Test

- 1) SSG should be adjusted like way of point a) and RF level set to -47dBm.
- 2) Adjust to 0.7Vrms(at 8 Ohms load) observing audio wave form.
- 3) Read the needle of distortion meter (it should be less than 5% distortion).

c) Squelch Test

After RF level of SSG should be set to the lowest level, RF level should be gradually increased until speaker makes audio sound. At this point, check RF level(Check if the SINAD is 8 6 dB). Check that squelch will close when Level is reduced to minimum. If not, readjust RV 1 and check again.

4.6 Symtoms, Check point & Correction**a) Diagnosis method**

- 1) Check each switch to work well.
- 2) Check voltage of battery.
- 3) Problem whether problem comes from transmitter or receiver?

b) Troubleshooting

a) Transmitter

Power key is on condition but does not work.

Battery could completely be discharged.

Battery cell wrong inserted?

Contact problem between Battery and Radio?

Fail to transmit

Run out of battery or charge problem.

Fault of PTT key

Fault of Q4, Q5.

Transmitter works but frequency is unmatched

defective frequency synthesizer.

defective X-tal (X2).

No audio modulation (Tx power and Tx frequency are normal)

Problem of microphone or mic connector.

IC U7 problem.

Tx is set when switch is on.

Tx switch problem

2) RECEIVER

Rx does not work

Speaker line open problem or connector problem.

Receiver power circuit problem.

Audio amplifier Base band IC U4 problem.

Only noise sound

U12 problem.

VCO problem.

Rx sensitivity is weak

Antenna mounting problem.

Front-End circuit problem.

Local oscillation frequency deviation.

SF1 SAW filter fail.

VCO problem.

Squelch does not work

U12 problem.

Control logic 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 D1,Q8,Q9,C81,C75,VC1,L1,C74,C76. VCO control voltage through loop filter adjusts frequency and microphone signal through modulation terminal generates FM modulation.

b) PLL IC

PLL IC is adjustable IC to produce the desired frequency which VCO provides through loop filter. It has internal counter using 21.25MHz reference frequency to generate 6.25kHz as reference Signal. VCO frequency from prescaled input is divided signal and 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 R48,R49,C84,C85 and forms pulses from pin14 into to DC and eliminates harmonic components in pulses.

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'st IF than Rx frequency. It is called low side injection. Second IF is 450kHz. 2nd 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(L5,L6,L7,C42,C43,C46,C47) and receiver resonance circuit composed of L8,C1. When transmitting, voltage through R25,L12,D6 supplies, D7 of receive input is short and Tx is on condition. When PIN diode is off in condition of Rx, L8 and C1 resonate serially and make impedance matching at receiver bandpass filter. (SF1).

b) Front End

Front-End has Q1 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 Q1 input and output.

c) Mixer

Mixer has one base BFQ 67W(Q2) to feature high low noise quality. It has RF signal through L7, L8, SF1,SF2 and Q1 RF signal from Local oscillator mixed.

It develops 1'st IF ,21.7MHz. 1st IF goes to 1st IF amplifier Q3(KTC4080) base through X-tal filter XF1.

IF of mixing signals is selected and enters the 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 within the pass band, and attenuation characteristic of stop band. X-tal filter is composed of two pole monolithic X-tal filter, with 8kHz of IF bandwidth. R11 is used as impedance matching with 1'st IF Amp Q3.

d) IF AMP and Detection

1'st IF AMP Q3 supplies IF(U12) mixer input pin16 through output resistor R13 and C21 to need gain in insertion loss of X-tal filter and last stage circuit. Multi-use IF IC makes up of mixer IF AMP. pin1 2'nd local frequency enter to pin 1.

It supplies mixer of internal IC. Mixer output of 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 T1(Quad Coil) is amplified and comes out to pin 9.

Detected audio signal through R22, VR1 and input in audio amp IC U4 through C22.

e) Squelch Circuit

Noise component of detected outputs has amplification

Squelch threshold is controlled by Resistor R18,C31,R15

f) Audio Amplifier

Demodulated audio signal enters to pin2 of U4. After above signal is amplified in U4 the audio output for the speaker is reached at pin 5 (through C220).

5.3 Transmitter

When Tx starts with pressing PTT switch, VCO output amplifies through Q4,Q5 transmits by antenna through low pass filter.

Tx RF signal produced from Tx VCO is amplified by DRIVER Q5 through C53 and entered Q4 POWER TR input terminal with final amplification.

After this stage, the signal is emitted at antenna through 50 Ohms matching circuit to low pass filter(L7,L6,L5,C42,C43,C44,C46,C47) to eliminate harmonics.

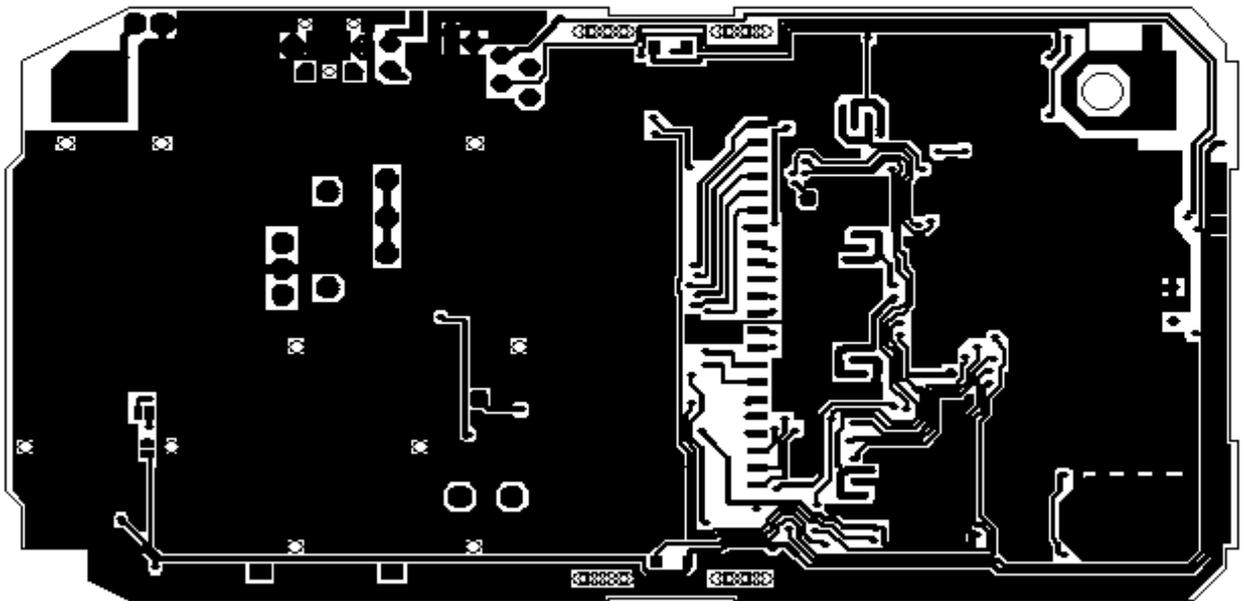
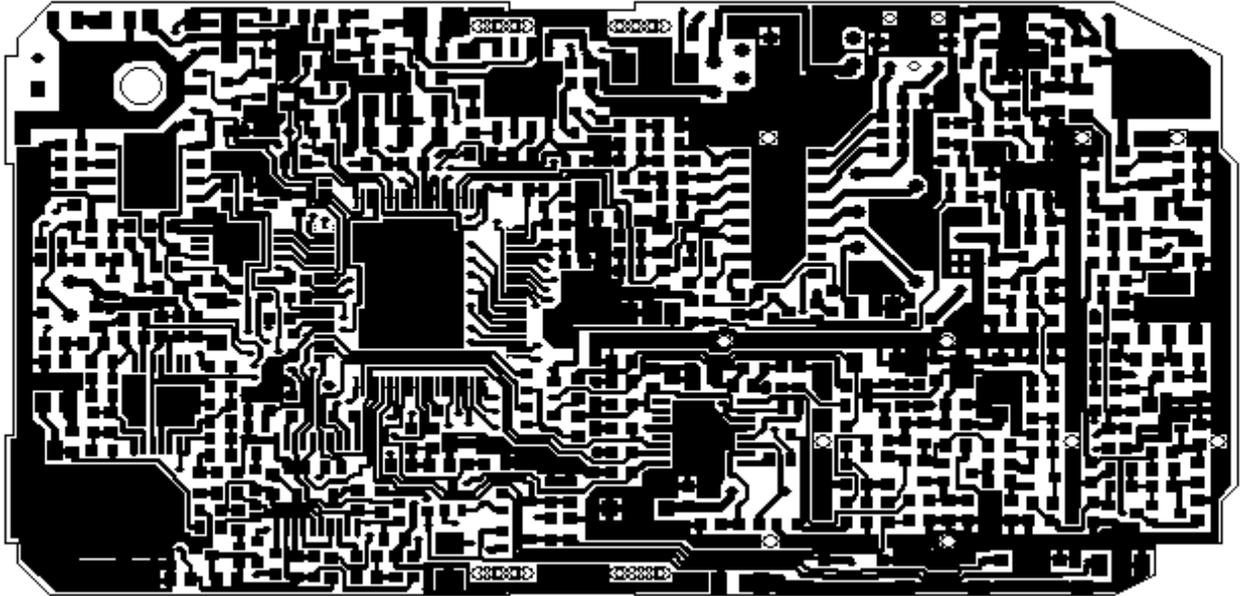
5.3.1 Audio Modulation and Audio Amplification

Audio signal produced by external or internal microphone is amplified and limited by IC U7. The output signal enters to VCO through low pass filter and U2. Max. Frequency modulation deviation is adjusted by VR1

Audio modulation and audio amplification has preemphasis characteristic of 6dB/OCT by U7(NJM324V).

11. CHANNEL DATA

CH	Frequency (MHz)		CH	Local Oscillator (MHz)
1	446.00625		1	424.30625
2	446.01875		2	424.31875
3	446.03215		3	424.33215
4	446.04375		4	424.34375
5	446.05625		5	424.35625
6	446.06875		6	424.36875
7	446.08125		7	424.38125
8	446.09375		8	424.39375

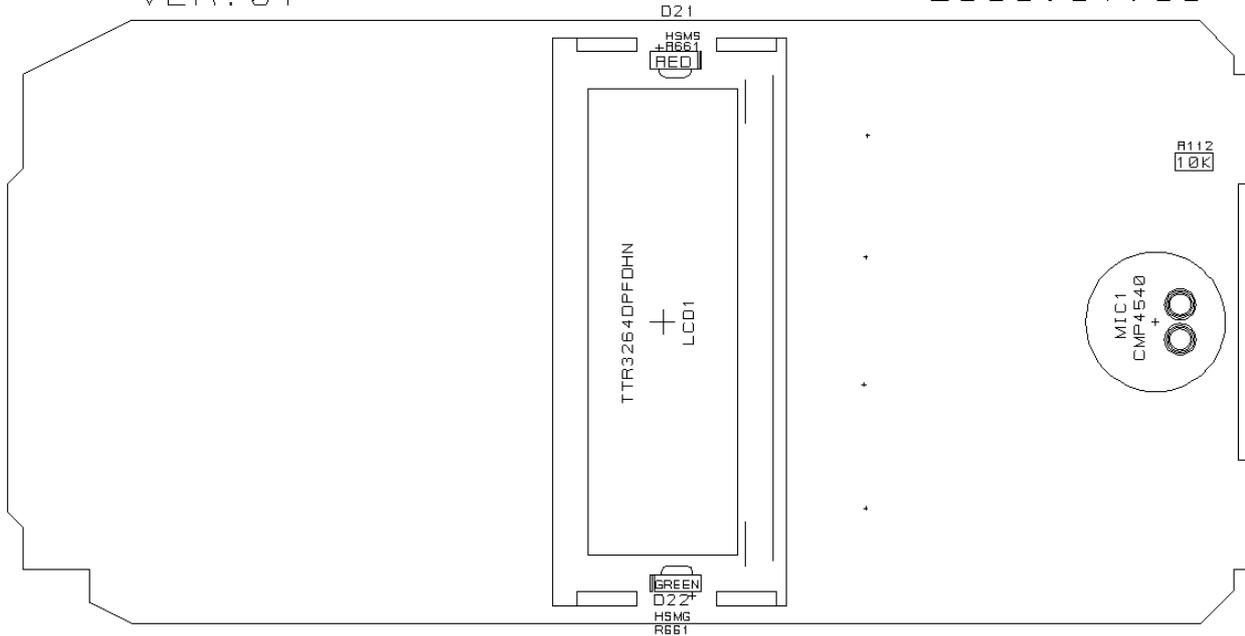


BOTTOM SIDE REF/VALUE MAP

VER. 01

FILE NAME : JDH10C.C00

2000.01.08



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