# INSTRUCTION MANUAL

# FT-227R

# MEMORIZER

**YAESU MUSEN CO , LTD.**

TOKYO JAPAN.

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FT-227-R MEMORIZER
2 METER FM TRANSCEIVER

## GENERAL

The model FT-227R is a new synthesized 2 meter FM transceiver specifically designed to provide high performance for amateur VHF/FM communications.

The transceiver utilizes the famed Yaesu computer theory, and is completely solid state. The unit has provision for the operation of 800 digital Phase Lock Loop channels* in 5 kHz steps between 144 to 148 MHz. An "optical coupling" system eliminates rotary switches which always used to get oxidized and noisy. The digital LED's display the selected channel in MHz, 100 kHz, and 1 kHz. The bright display lets you easily read the frequency in the bright sunlight without difficulty.

A memory circuit memorizes any channel out of 800 channels. A touch of a switch brings you back to the memorized channel instantly.

In addition to a conventional $\pm$600 kHz repeater split, any transmitter offset frequency is memorized with a touch of a push-button for operation on any ODD split frequency repeater.

The tone burst generator is built in for tone burst accessed repeater operation, and is fully adjustable for pitch, duration and level.

An optional tone guarded squelch (TGS) is provided for a silent monitoring. Placed in the TGS mode, a tone guarded signal automatically opens the receiver squelch circuit. The tone frequency can be selected within 160 Hz to 250 Hz.

The BUSY lamp lights up if the channel is occupied by another station when the tone guarded squelch is in use. This also works as an alarm when the receiver volume is accidentally set too low.

The advanced circuit design features prevent damage to the transistors in case of high antenna VSWR, or reversed power supply polarity.

The FT-227R is manufactured with a high regard for quality, utilizing a diecast front panel and a heavy gauge metal case which provides an extremely rugged package which minimizes the effects of shock and vibration.

* Channels can be limited to 400 within either 144-146 MHz or 146-148 MHz.

The FT-227R VHF/FM transceiver is supplied complete with all mounting hardware, cables, connectors and accessories required for a mobile installation, as shown in Figure 1.

Figure 1.

1. Transceiver with built-in 3" speaker.

2. Dynamic push-to-talk microphone with retractable coiled cord.

3. Universal mounting bracket (with screws, washers and nuts).

4. Power cable.

5. Cigarette lighter adapter.

6. Spare fuses.

7. Microphone hanger.

8. Miniature phone plug for external speaker.

9. Accessory plug.

10. Tap connector.

## HOW TO USE THE TAP CONNECTOR

(a) Do NOT strip insulation from wires.

(b) The tap connector will handle most wire sizes used in automotive instrument panels.

(c) Slice the "hot" lead into tap connector as shown.

(d) Insert transceiver power lead 3/4 of the way into connector (just past metal connector element).

(e) Using pliers, press the metal connector element until it is FLUSH.

(f) Fold the hinged cover over the connector element and snap firmly in place.

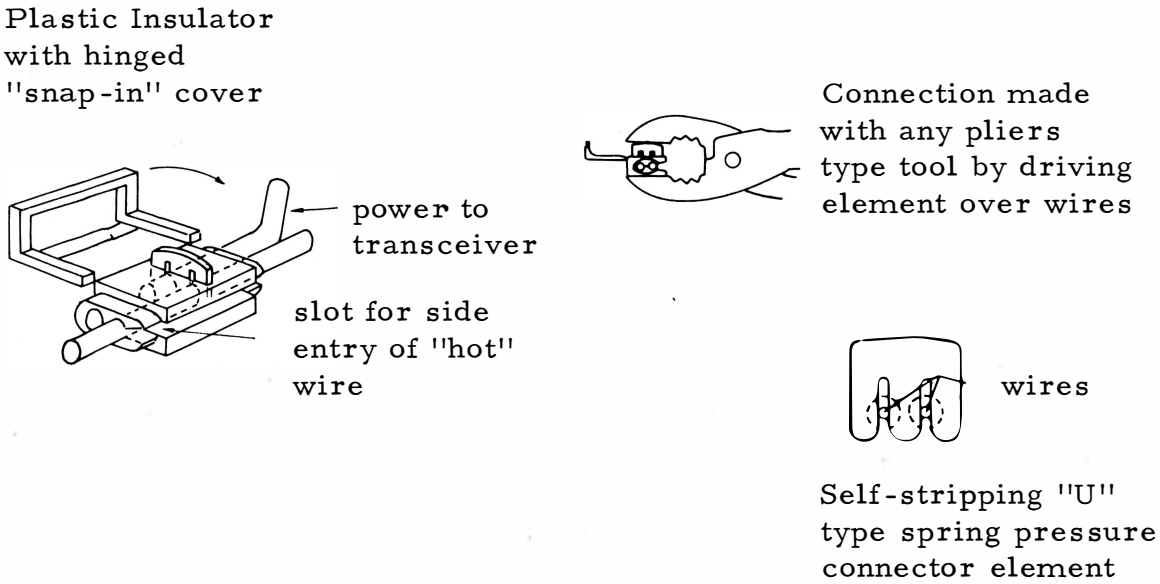



Figure 2.

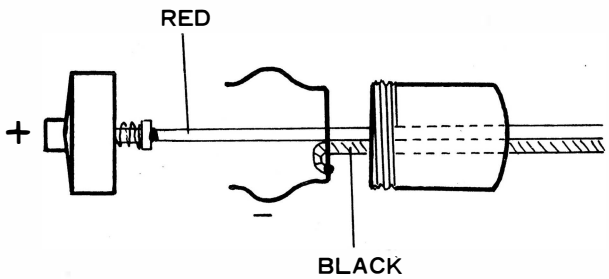



Figure 3.

The compact design of the FT-227R transceiver makes it ideal for mobile installation, operating directly from the vehicle's 12 Volt battery. For base station, use AC Power Supply rated 2.5 ampere at 13.8 V DC.

# SPECIFICATIONS

## GENERAL

| | |
|---|---|
| Frequency Coverage | 144 to 148 MHz* |
| Number of Channels | 800 channels* |
| Speaker | Internal 3" dynamic speaker with provision for connecting an external 8 ohm dynamic speaker |
| Microphone | Dynamic push-to-talk microphone with retractable coiled cord. |
| Power Requirement | 13.8 Volts DC, ± 10% |
| Current Consumption | 0.5 Amps Receive<br>1.0 Amps Transmit (LOW)<br>2.5 Amps Transmit (HI) |
| Metering | Illuminated front panel meter indicates relative received signal strength and transmitter power output |
| Dimensions | 180 (W) x 60 (H) x 220 (D) mm |
| Weight | 2.7 kg. |

## TRANSMITTER

| | |
|---|---|
| RF Output | 10 Watts (HI) or 1 Watt (LOW) into 50 ohms load at 13.8 Volts DC |
| Frequency Stability | ± 0.002% |
| Modulation | F3 |
| Deviation | ± 5 kHz |
| Audio Response | +1, -3 dB of 6 dB/Octave pre-emphasis characteristic from 300 to 2500 Hz |
| Spurious Emissions | 60 dB below carrier minimum |
| Tone Burst | Nominally one second at 1800 Hz |
| Repeater Split | ± 600 kHz or any frequency in 5 kHz increments |

RECEIVER

| | |
|---|---|
| Type | Double conversion super-heterodyne |
| Intermediate Frequency | 10.7 MHz first IF: 455 kHz second IF |
| Sensitivity | 0.3 µV for 20 dB quieting |
| Selectivity | ± 6 kHz at 6 dB: ± 12 kHz at 60dB |
| Audio Output | 1.5 Watts at 8 ohms |

## INSTALLATION

GENERAL

The model FT-227R transceiver is designed primarily for mobile service, requiring only an antenna and a 13.8 Volt DC power source for operation.

The transceiver has been factory pre-tuned and requires no adjustments for normal operation into a 50 ohm load.

The antenna location is the most important consideration in either a base or mobile installation, with effective communication range directly related to antenna height. The antenna should always be in the clear and as high as possible; however, a minimum distance of 5 feet should be maintained between the VHF and other antennas. Also, in mobile installation, it is advisable to locate the antenna as far from the engine as practical, in order to minimize ignition noise pick-up. In all installations, ensure that the antenna VSWR is less than 1.5:1.

For mobile installation, the popular antenna types are either a 1/4 wave length whip with unity gain, or a 5/8 wave length affording approximately 3.5 dB gain. Mobile antennas are available at your dealer.

To minimize losses in the antenna system, use the shortest length of coaxial cable that is practical, avoiding any sharp angles or kinks. Use type RG-8/U cable if the transmission line length exceeds 25 feet, while RG-58U is suitable for shorter lengths. For all bends, form the cable into a radius of not less than 10 times its diameter.

## MOBILE INSTALLATION

For mobile service, the FT-227R should be installed where the controls, indicators, and microphone are easily visible and accessible for operation. The unit may be mounted in any position without loss of performance. Suitable locations are under the dash, atop transmission tunnel, etc. A universal bracket is supplied with the transceiver for this purpose. Install the FT-227R as follows (refer to figure 4).

1. Use the universal mounting bracket as a template to locate the mounting holes. Use a 3/16" diameter drill for these holes and allow clearance for the transceiver, its controls, and connecting cables. Secure the mounting bracket with the screws, washers and nuts supplied, as shown in '4A.'

2. Install the transceiver in the mounting bracket, sliding it into the guide rail of the bracket, and tighten the screws on both sides.

3. Microphone hanger may be affixed to any convenient place for handling the microphone.

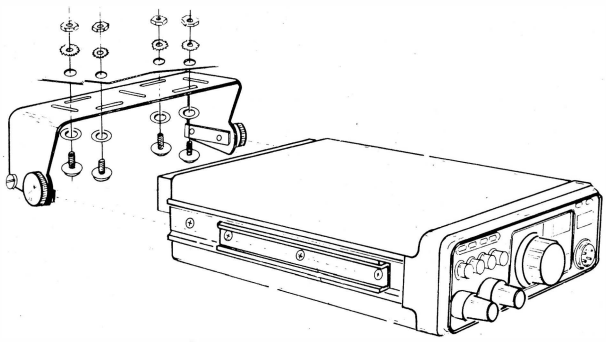


Figure 4 A.

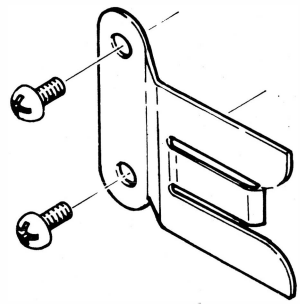


Figure 4 B.

4. The supplied power cable may be plugged directly into the vehicle's cigarette lighter receptacle for casual operation if desired. For permanent installation, the lighterplug may be removed and the leads routed directly to the battery (red positive, black negative or ground), or the nearest termination to the battery, i.e. ignition switch, fuse block, etc. If it is necessary to extend the power leads, use #16AWG insulated copper wire and do not extend the leads further than required to avoid excessive voltage drop. The frequency will shift to 147.000 MHz or 147.005 when the supply voltage is accidentally opened by a loose contact of the power adaptor.

CAUTION

BEFORE CONNECTING THE POWER CABLE TO THE TRANSCEIVER, CHECK THE BATTERY VOLTAGE WITH THE ENGINE RUNNING (BATTERY CHARGING). IF THE VOLTAGE EXCEEDS 15 VOLTS DC, THE REGULATOR SHOULD BE READJUSTED SO THE HIGHEST CHARGING RATE DOES NOT EXCEED 15 VOLTS. ALSO, BE SURE TO OBSERVE PROPER POLARITY WHEN MAKING BATTERY CONNECTIONS (REVERSED POLARITY WILL NOT DAMAGE THE FT-227R DUE TO THE PROTECTIVE CIRCUITRY INCORPORATED IN THE DESIGN, HOWEVER, THE EQUIPMENT WILL NOT OPERATE UNDER THIS CONDITION).

5. Connect the power cable to the POWER receptacle on the rear panel.

6. Connect the 50 ohm antenna cable to the ANT receptacle on the rear panel.

7. Connect the microphone cable to the 4-pin microphone receptacle on the front panel.

8. An external 8 ohm speaker may be connected at the SP receptacle on the rear panel if desired (this automatically disconnects the internal speaker). Use the external speaker plug supplied.

## BASE STATION INSTALLATION

As a base station, the FT-227R requires a source of 13.8 Volts DC at 2.5 amperes.

## CONTROLS & SWITCHES

The FT-227R has been designed for ease of operation. However, the operator may not be familiar with some controls since it utilizes modern computer technology. Be sure you throughly understand the function of each control and indicator before operating the equipment.

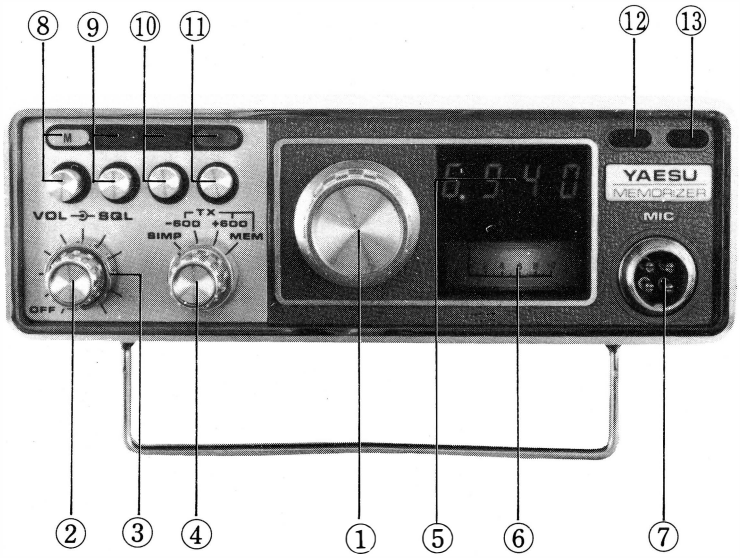



Figure 5

| | |
|---|---|
| 1. Channel Selector | Endless optical coupling selects 800 channels. |
| 2. VOL inner control | The VOLUME control adjusts the receiver audio output level and turns power off when rotated to an extreme CCW position. |
| 3. SQL Outer control | The SQUELCH control adjusts the receiver squelch threshold sensitivity. |
| 4. FUNCTION Switch | Selects the transmitting frequency. SIMP-Simplex operation. +600-the transmitting frequency is 600 kHz higher than the receive frequency<br>-600-the transmit frequency is 600 kHz lower than the receive frequency<br>MEM-Transmit on memorized frequency. |

| | |
|---|---|
| 5. DIAL Display | The digital display indicates the operating frequency. |
| 6. METER | The meter indicates the signal strength on receive and the relative power output on transmit. |
| 7. MIC receptacle | Four pin connector is used for microphone input and push-to-talk relay actuation. |
| 8. MEMORY switch | When pressed, the frequency on the dial is memorized and M lamp lights up. To release the memorized frequency, press the switch a second time. |
| 9. 5UP switch | The channel frequency shifts 5 kHz up and 5UP lamp lights up. |
| 10. TONE SQUELCH switch | An optional TONE SQUELCH circuit is activated when pressed and TONE SQ lamp lights up. |
| 11. MEMORY RECALL switch | When pressed, the memorized frequency is recalled and MR lamp lights up. |
| 12. BUSY indicator | The lamp lights up when a signal is received. |
| 13. ON AIR indicator | The lamp lights up when in the transmit mode. |

REAR PANEL

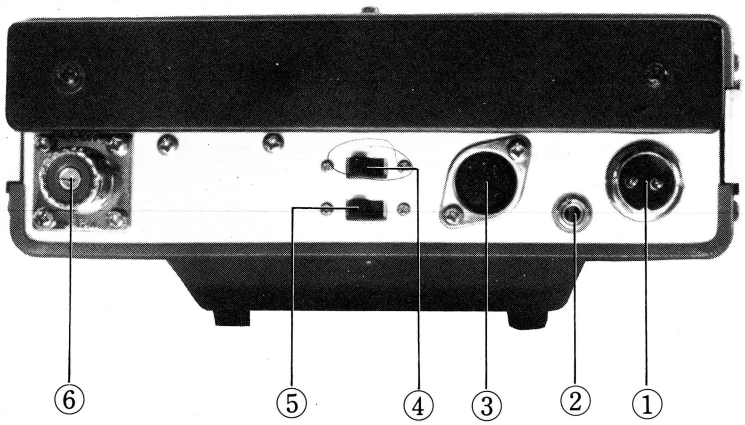



Figure 6

| | |
|---|---|
| 1. POWER receptacle | A two-pin connector is used for connection to 13.8 Volts DC (negative ground) power source, vehicle battery, or AC power supply. |
| 2. SP receptacle | Audio output is provided at this receptacle for an external speaker. (Output impedance is 8 ohms and the internal speaker will be disabled when a plug is inserted). |
| 3. ACC socket | The ACCESSORY socket is used for external control of the transceiver. |
| 4. BURST switch | The BURST switch applies a short "tone burst" to the carrier at the start of each transmission in the "ON" position. This is normally used only with "tone access" repeater actuation. |
| 5. HI/LOW switch | The HI/LOW switch selects the desired RF power output, 10 Watts in HI position or 1 Watt in LOW position. |
| 6. ANT receptacle | UHF type coaxial receptacle for connection of antenna. |

# OPERATION

## INITIAL CHECK

1. Rotate the VOLUME control switch in a clockwise direction to apply power. The meter will illuminate and the channel frequency is automatically set to 147.000 MHz (with 5 kHz up at depressed position) regardless of channel knob position. However, a memorized frequency can be retained when the MEMORY switch is left in the depressed position.

2. Rotate the SQUELCH control fully counterclockwise.

3. Adjust the VOLUME control for a normal listening level (background noise or a station if one is transmitting).

4. When the channel is clear, (background noise only), rotate the SQUELCH control clockwise until the receiver is silenced and the busy lamp turns off. Perform this step carefully so as not to go beyond the silencing point or the receiver will not respond to weak signals.

5. Set the HI-LOW switch on the rear panel to the desired power output position.

## FREQUENCY SELECTION

The channel select knob selects the frequency at every 10 kHz step. Clockwise rotation increases the frequency up to 148.000 MHz and counterclockwise rotation reduces the frequency down to 143.990 MHz. When the 5 kHz up switch is pressed, the channel frequency is shifted 5 kHz higher. On 144.8005 and 143.990 kHz, the transmitter section is automatically disabled to prevent transmission outside amateur bands.

NOTE: When the memorized frequency is recalled with the channel outside the amateur band (143.990 on 148.005 MHz), the guard circuit is still on, therefore, the transmitter cannot be activated by the PTT switch.

**CAUTION**

Channel selection should not be done while the transmitter is keyed.

## MEMORY OPERATION

Select the channel desired with the channel select knob. Then press the M (Memory) switch. The M lamp lights up indicating the channel is memorized. The memorized frequency shifts 5 kHz up when the 5UP switch is pressed and shifts down when the 5UP switch is released. After the frequency is memorized, the channel selector knob can be used to select other frequencies. To recall the memorized frequency, press the MR (memory recall) switch.

The MR lamp lights up and the memorized frequency is displayed on the dial window. When the MR switch is pressed again, the frequency goes back to the frequency preset by the use of the channel selector knob. The channel selector knob can then be used to select a new frequency. To release the memorized frequency, press the M switch again.

The memorized frequency is kept in the memory when the power is turned off by the front panel switch. However, the memory disappears when the power cord is removed from the power source.

The memory circuit works with the FUNCTION switch in any position.

When the FUNCTION switch is in the MEM position, the MR switch is inoperative and the memorized frequency is transmitted by the PTT switch.

REPEATER OPERATION

The transmitting frequency may be shifted to either the lower or higher side for repeater operation. When the FUNCTION switch is set to ± 600 kHz, the transmitting frequency shifts 600 kHz up from the displayed receive frequency. With the FUNCTION switch at -600 kHz, the transmitting frequency shifts 600 kHz down.

The MEMORY function can be used with the function switch on the repeater position and the receive frequency is memorized.

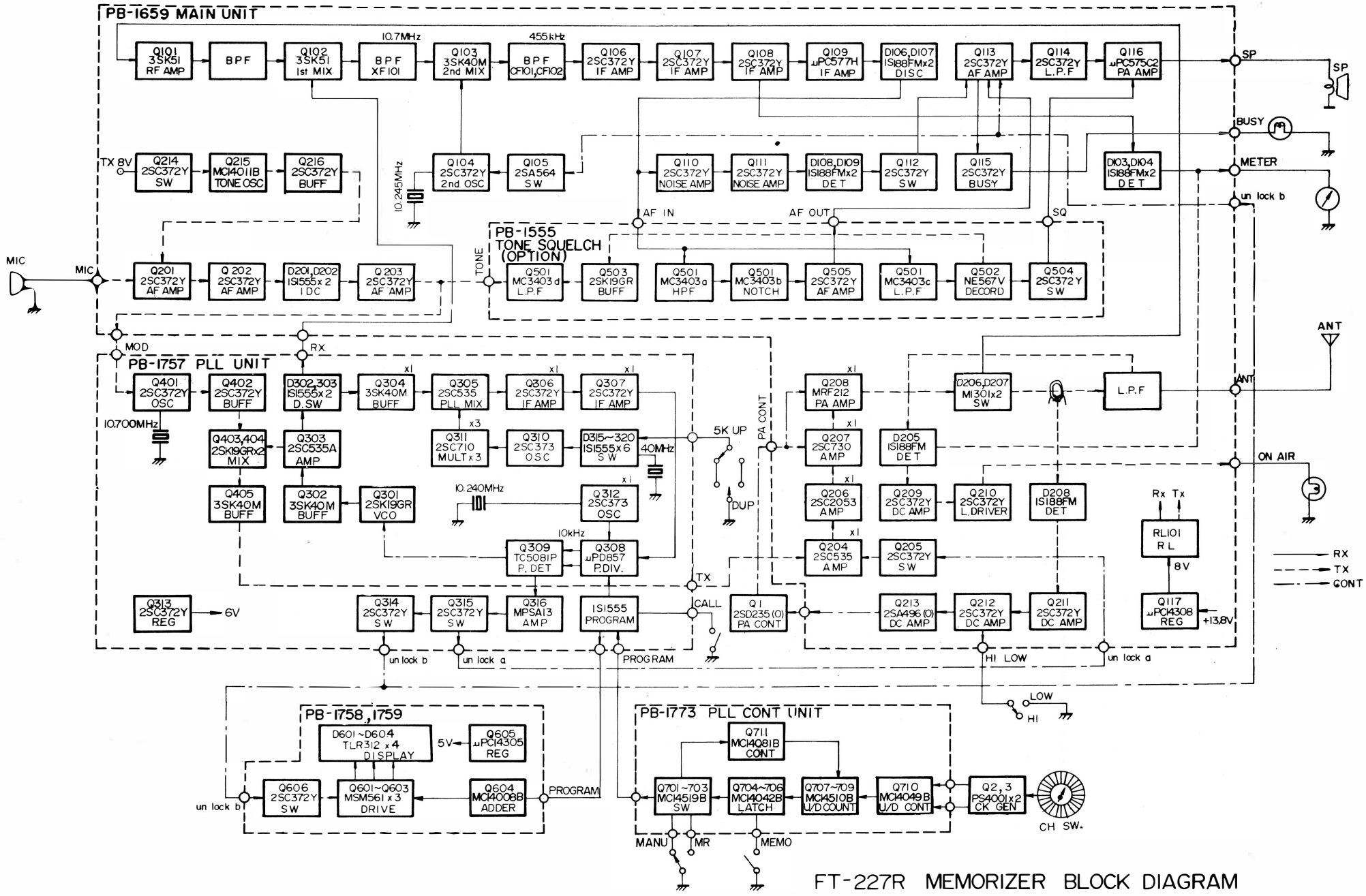
For non-standard offset, first memorize the transmit frequency. Then find the receive frequency using the channel selector knob. Set the FUNCTION switch to MEM position. Now the transceiver transmits on the memorized frequency and receives the frequency displayed in the channel window.

Extreme caution should be observed so as not to transmit outside the amateur bands with the FUNCTION switch at ± 600 kHz and MEM POSITION.

If operating on a repeater channel requiring "tone access," set the BURST switch on the rear panel to the "ON" position. The "tone burst" will be applied to the carrier each time the push-to-talk lever on the microphone is depressed.

NOTE: Refer to the Tone Adjustments paragraph to change the tone frequency or duration (factory set for 1800 Hz and one second).

When ready to transmit, hold the microphone close to your mouth, depress the push-to-talk lever and speak distinctly at a normal conversation level. Check that the red "transmit" indicator illuminates and the meter indicates upward.




FT-227R MEMORIZER BLOCK DIAGRAM

Figure 7

## THEORY OF OPERATION

The block diagram and the circuit description that follows will provide you with a better understanding of this transceiver. Refer to the schematic diagram for circuit details.

The transceiver consists of a transmitter, and a double conversion super heterodyne receiver utilizing a digital phase lock loop synthesizer, capable of operating on any of the 800 channels within the frequency range of 144 to 148 MHz. Solid state circuitry is employed throughout and computer theory is utilized for frequency selection. The transceiver is designed to operate from a 13.8 Volts $\pm$10% negative ground power source.

### TRANSMITTER

The transmitter produces a Frequency Modulated (FM) signal. The audio signal from the microphone is set to a proper level by VR201 and amplified by Q201, Q202 and Q203, (2SC372Y). The audio output from Q202 is coupled to the IDC (Instantaneous Deviation Control) circuit where both positive and negative peaks are clipped by diodes D201 and D202, (1S1555). The output from the last amplifier Q203 is fed through a low-pass filter which attenuates frequencies above the speech range caused by the clipping at the level set by the deviation control potentiometer VR202. This control is nominally set for a deviation of $\pm$5 kHz. The speech signal is then applied to a phase modulator varactor diode, D401, (ISV50) which varies the frequency of the 10.7 MHz crystal controlled oscillator, Q401 (2SC372Y). The frequency modulated 10.7 MHz signal is then amplified by a buffer amplifier Q402, (2SC372Y) and then fed to a balanced mixer consisting of Q403 and Q404, (2SK19GR) where the signal is converted up to 144-148 MHz signal by mixing with the 133.3-137.3 MHz signal delivered from the VCO (voltage controlled oscillator). The output frcm the balanced mixer is fed through the tuned circuits consisting of T404-T407 to an amplifier Q405, (35K40M). T404-T407 is tuned to the transmitting frequency by varactor diodes D403-D406 of whose capacitance changes in accordance with the DC output Voltage from the PLL circuit. The 144-148 MHz signal is then amplified by the amplifier stages consisting of Q204, (25C535A), Q206,(2SC2053), Q207, (2SC730) and Q208, (MRF212) which delivers 10 Watts of RF energy through a diode switch and low pass filter into a 50 ohm load.

Diodes D205, and D211 (1S188FM) rectify a small portion of the RF output and applies the resultant DC voltage to the meter which indicates relative power output from the transmitter.

The DC output from D205 also is delivered to the lamp driver Q209 and Q210, (2SC372Y) which turns the ON AIR lamp on during the transmission.

If the transmitter is keyed without an antenna being connected, or, if a high VSWR exists in the antenna system, the reflected power is detected through T202 and a diode, D208, (1S188FM) which produces DC voltage. Q211, (2SC372Y) conducts with DC voltage applied through VR205 causing a decrease in Q212, (2SC372Y)'s collector current.

Thus, the collector voltage of Q213, (2SA496) drops, causing Q11, (2SD235) to decrease current and supply voltage to the PA amplifier which is lowered to prevent damage to the transistor. The threshold level is set by VR205. This circuit is also used to switch the output power down to 1 Watt when the HI-LOW switch is set to LOW. The amount of power reduction may be adjusted with VR206.

The antenna change-over circuit consists of switching of diodes D206 and D207, (MI301).

The tone burst circuit consists of a timing generator and a gated multivibrator. With the BURST switch at the "ON" position, a DC voltage is applied to the tone burst circuit. When the transmitter is keyed, Q214, (2SC372Y) conducts and triggers the one-shot multivibrator Q215, (MC14011B). The other half of Q215 generates a tone signal which is amplified by a buffer Q216, (2SC372Y) and applied to the microphone circuit of the transmitter.

The tone frequency is adjustable by VR207, while the output level (deviation) is adjustable by VR209 and the burst duration by VR208.

RECEIVER SECTION

The input signal from the antenna is fed through the low-pass filter consisting of L1, L214, L213, C1 and C243-C245 and the diode change-over switch consisting of D206, D207 and L212 to the FET amplifier Q101, (3SK51). The amplified signal is then applied through four stage high Q coax resonators to the first mixer Q102, (3SK51). The use of a dual gate FET RF amplifier together with high Q coax resonators, minimizes effects of cross modulation and other spurious responses while providing a low noise figure for the receiver front end.

The 144 to 148 MHz signal is heterodyned with the first local oscillator and produces a 10.7 MHz first IF signal. The first local oscillator is delivered from the PLL (Phase Lock Loop) VCO circuit.

The first IF signal is fed through a crystal filter XF101 which has a pass band of ±7.5 kHz, to the second mixer Q103, (3SK40M) which produces a 455 kHz second IF signal by heterodyning with the 10.245 MHz output signal of the second local oscillator Q104, (2SC372Y). Q105, (2SA564) works as a switch which disconnects the supply voltage to Q104 when the PLL circuit is unlocked.

The second IF circuit consists of Q106, Q107, Q108, (2SC372Y) and Q109, (μPC577H). The cascade connected ceramic filters CF101 and CF102 provide narrow band selectivity for the receiver and the limiting action of Q109 removes any amplitude variation to the ceramic discriminator consisting of CD101, D106, and D107, (1S188FM).

The discriminator produces an audio output in response to a corresponding frequency shift in the IF signal. The output audio signal is amplified by Q113, Q114, (2SC372Y) and is applied across the VOLUME control VR1 to the input of the audio amplifier Q116, (μPC575C2). The output from Q116 is applied in series through the ACC socket to the internal speaker. The low-pass filter between Q113 and Q114 attenuates the audio frequency spectrum above 3 kHz to increase readability of the received signal.

A portion of the 455 kHz IF signal is rectified by D103, D104, (1S188FM) for S-meter indication. VR101 is used to adjust the meter sensitivity.

When no carrier is present in 455 kHz IF, the high frequency noise at the discriminator output is amplified by Q110 and Q111, (2SC372Y) then detected by D108 and D109, (1S188FM) to produce a DC voltage. This voltage is then applied to turn Q112, (2SC372Y) on. With the conduction of Q112, the base of Q113 is grounded to squelch the audio amplifiet. When a carrier is present in the 455 kHz IF, the noise is removed from the discriminator output and the audio amplifier then recovers normal operation.

The squelch circuit opening causes Q113 to conduct, causing lamp driver Q115, (2SC372Y) to draw current to light up the BUSY LAMP. The SQUELCH controls, VR2 and VR102, set the threshold level.

HETERODYNE OSCILLATOR

The heterodyne signal is generated by the PLL (phase lock loop) circuit consisting of VCO (voltage controlled oscillator), reference crystal oscillator, programmable divider and phase comparator.

The VCO oscillator, Q301 (2SK19GR) generates 133.3-137.3 MHz signals. The oscillator frequency is controlled by a varactor diode D301, (1S2209) which varies the capacitance of a tuned circuit consisting of L301, TC301, C302 and C304 in accordance with a DC voltage supplied from a phase comparator Q309, (TC5081P).

The output signal from Q301 is amplified by a buffer amplifier Q302, (3SK40M) and Q303, (2SC535A) and fed through a diode switch, D302 and D303, (1S1555) to the receiver or transmitter mixers.

A portion of the output from Q303 is fed through a buffer amplifier Q304, 3SK40M to a PLL mixer, Q305, (2SC535A) which produces 1-5 MHz PLL IF signaled by mixing with the PLL heterodyne signal.

The PLL heterodyne signal is generated by a overtone crystal controlled oscillator Q310, (2SC373). The crystal frequency is shown in Table 1.

| X-Tal | Frequency | PLL Het. Freq. | Remarks |
|---|---|---|---|
| X301 | 44.10000 MHz | 132.300 | Simplex |
| X302 | 43.90000 | 131.700 | TX-600 kHz shift |
| X303 | 44.30000 | 132.900 | TX+600 kHz shift |
| X304 | 44.10166 | 132.305 | Simplex 5 kHz up |
| X305 | 43.90166 | 131.705 | TX-600 kHz 5kHz up |
| X306 | 44.30166 | 132.905 | TX+600 kHz 5kHz up |

Table 1.

The diode switch D315-D320, 1S1555 selects the appropriate crystal in accordance with the FUNCTION switch and 5kHz up switch. The output from Q310 is fed to a tripler Q311, (2SC710) which produces the PLL heterodyne signal.

The PLL IF signal is fed through a low pass filter consisting of L305, C331 and C332 to the amplifiers Q306 and Q307, (2SC372Y). The amplified signal is then fed to a programmable divider, Q308, (uPD857C).

The crystal oscillator, Q312, (2SC373) generates 10.24 MHz signal, and its output is fed to the scaler/divider Q308 (uPD857C), where the 10.24 MHz signal generates a 10 kHz reference signal.

The digital phase comparator Q309, TC5081P compares the phase of the PLL IF signal with that of the reference signal, and any phase difference is converted into an error correcting voltage. This error correcting voltage is fed to the varactor diode D301 which changes the output signal phase to lock with that of the reference signal.

When the VCO is locked, the constant voltage at pin 4 of Q309 is applied to Q316, (MPSA13) to conduct, and in turn Q315, (2SC372Y) cuts off. The "H" voltage at the collector of Q315 turns Q205, (2SC372Y) to conduct and it supplies DC voltage to the exciter younger stages Q204 and Q206. When the VCO is unlocked, the DC voltage at the emitter of Q205 drops to prevent a normal operation of Q204 and Q206.

The output voltage from Q315 is reversed in polarity by Q314, (2SC372Y) and applied to the Q606, (2SC372Y) keeping the collector of Q606 in "H" level in order to drive Q601 through Q603 for the display of the channel frequency. The voltage is also applied to Q105, (2SA564) which supplies DC voltage to a second heterodyne oscillator Q104, (2SC372Y).

When the VCO is unlocked, the collector DC voltage drops causing the LED's to turn off and simultaneously the second heterodyne oscillator ceases to oscillate. Thus the receiver is muted until VCO lock occurs.

PLL CONTROL SECTION

The optical coupling system utilizes two photo-interrupters Q2 and Q3, (PS-4001) to generate two signal outputs which are applied to a PLL counter unit. The signal applied to CK terminal is fed through a waveshaper Q710, (MC14049B) to BCD up down counter, Q707 (10 kHz), Q708 (100 kHz) and Q709 (1 MHz), using MC14510B as a clock signal.

The signal applied to U/D terminal is inverted by a unit of Q710 and controls the up-down counter. The output from Q707-Q709 is fed to a 4 bit data selector, Q701-Q703 (MC1451B) and Quad latch, Q704-Q706, (MC14042B), which are used for memory when the MEMORY switch is pressed.

The output from Q701-Q703 is fed to a programmable divider, Q308, (μPD857C).

Q711, (MC14081B) (for high end) and Q712, (MC14028B) (for low end) cut off Q713, (2SC735Y) to prevent any transmission outside the amateur bands.

The BCD signals at the input of the programmable divider are also fed to the LED driver, Q601-Q603, (MSM561) to drive LED, D601-D603, TLR 312.

4-BIT full adder, Q604, (MC14008B) is used as a binary adder to produce 4-8 display on MHz range.

LED, D604, (TLR312) displays 0 or 5 by the 5 UP switch.

The display LED will be turned off by Q605, (2SC372Y) when an unlocked signal is received.

POWER SUPPLY

DC 13.8 Volt supply is used for the audio power amplifier Q116, relay and lamps. The supply voltage to the driver and final power amplifier is

fed through the voltage regulator, Q11 (2SD235D) which is controlled by the HI/LOW switch and the automatic final protection circuit.

Voltage regulator, Q605 (μPC14305) regulates the supply voltage at 5 Volts to supply Q308 and the display unit, Q313, (2SC372Y) and D301, (RD6.8EB) regulates the supply voltage at 6 Volts for the VCO and phase comparator. The 5 Volts supply for the PLL control unit is regulated by a zener diode, D3, (WZ050) and is connected directly to keep memory when the power switch is turned off with M switch pressed.

A regulated 8 Volt supply using Q117, (μPC14308) is used for all other circuits.

When the function switch is at MEM position, D4 (WZ050) supplies 5 Volts to the receiver and D5, (WZ050) supplies 5 Volts to the transmitter.

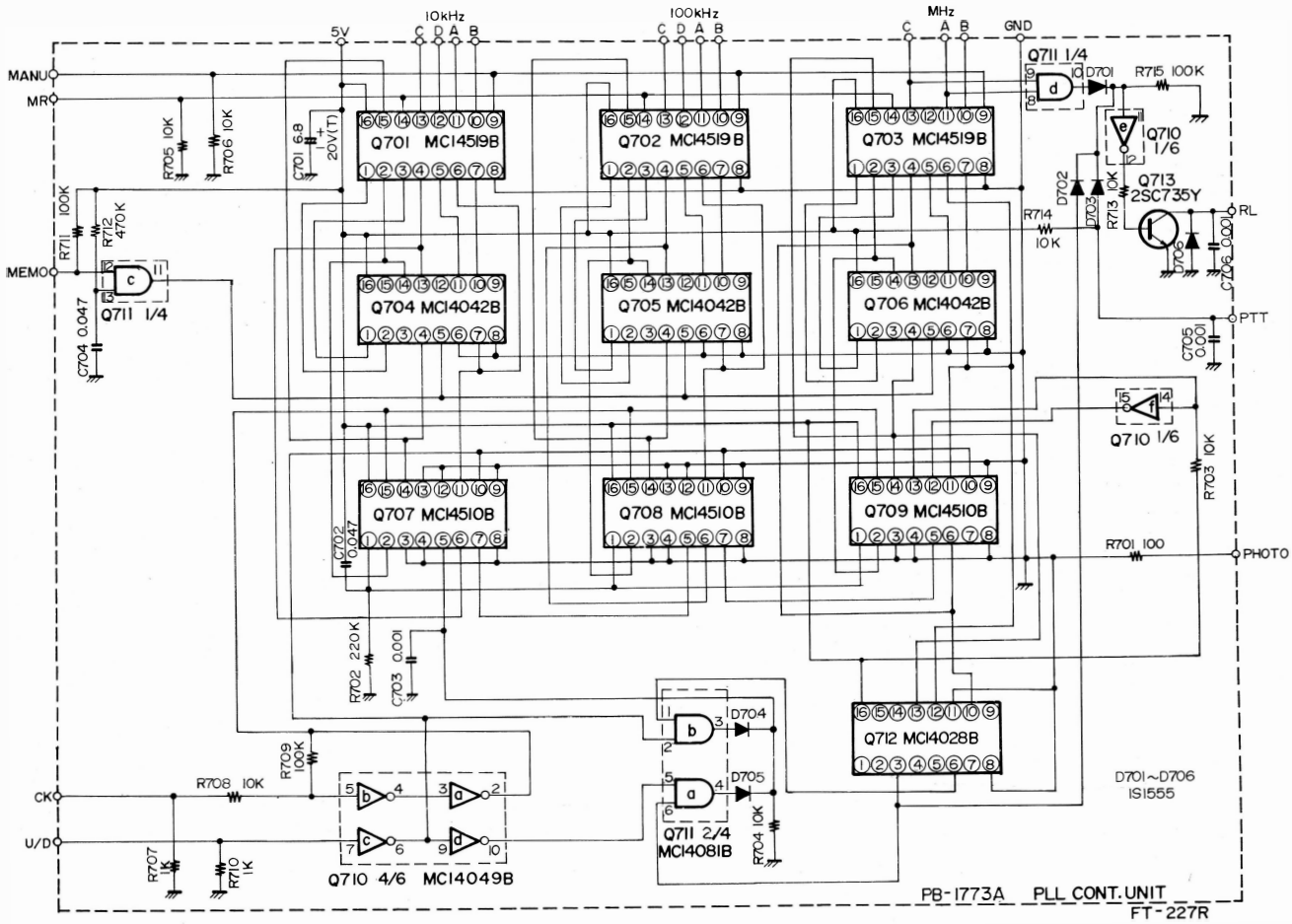



Figure 8

## OPTIONAL TONE SQUELCH CIRCUIT

The Tone Squelch operation permits private communications on crowded channels. The tone squelch circuit disables the audio circuit of receiver until a preset tone signal is received.

The transmitted signal is modulated by the tone signal within 70 Hz to 250 Hz which is below the 300 Hz to 3000 Hz voice frequency range used in radio communications.

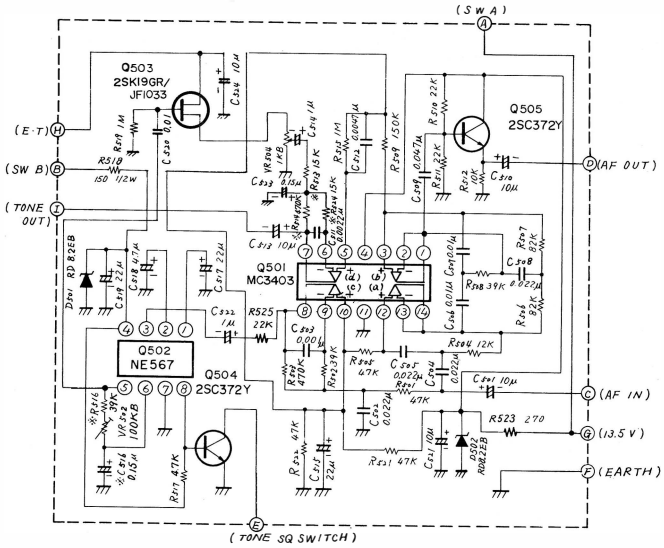
The tone signal is generated by Q502, NE567 and its frequency is set by R516, VR502 and C516. The level of the tone signal is set by VR504 and it is fed through a buffer amplifier Q503, 2SK19GR to the low-pass filter consisting of unit "d" of an operational amplifier Q501, MC3403. The tone signal is then superimposed to the speech signal by Q202. The constants for preset frequency are obtained from the chart.

The audio output signal from the receiver discriminator is fed to the unit "a" of Q501, MC3403. The unit "a" of Q501 forms a high-pass filter and the unit "b" of Q501 forms a T-notch filter. Both filters remove the tone signal from the audio signal which is then fed through an audio amplifier Q505, 2SC372Y to the receiver audio amplifier Q111.

The tone signal passes through a low pass filter by unit "c" of Q501 and is fed to Q502, NE567. When the tone signal has the same frequency as preset for transmitting, the voltage of pin 8 of Q502 becomes low causing Q504, 2SC372Y to "OFF". In turn, proper bias voltage is applied to Q119 for normal operation.

Without proper tone signal, Q504 conducts, removing the proper bias from Q119 to disable the audio circuit.

As the conventional carrier squelch circuit is operative when the tone squelch is switched in, the busy lamp lights up when any carrier is received.




TONE SQUELCH (PB-1555A) OPTION

Figure 9

| | C 516※ | R 516※ | R 513※ | R 514※ | R 524※ |
|---|---|---|---|---|---|
| 70Hz ~ 160Hz | 0.15μF | 39KΩ | 15KΩ | 470KΩ | 15KΩ |
| 160Hz ~ 250Hz | 0.1μF | 33KΩ | 8.2KΩ | 270KΩ | 8.2KΩ |

Table 2

# MAINTENANCE & ALIGNMENT

## GENERAL

The model FT-227R transceiver has been carefully aligned and tested at the factory prior to shipment. The reliability of the solid-state devices used in the FT-227R should provide years of trouble free service if the transceiver is not abused and normal, routine maintenance is carried out.

THE FOLLOWING PRECAUTIONS SHOULD BE OBSERVED TO PREVENT DAMAGE TO THE TRANSCEIVER:

(1) Do not exceed 14 Volts DC, at the POWER receptacle. When operating mobile, check the battery voltage under the load (transmitter "keyed" in FM mode) with the engine running fast enough so the ammeter shows a "change." In addition, do not operate the FT-227R if the supply voltage is below 12 Volts DC.

(2) Avoid direct exposure to sunshine or water.

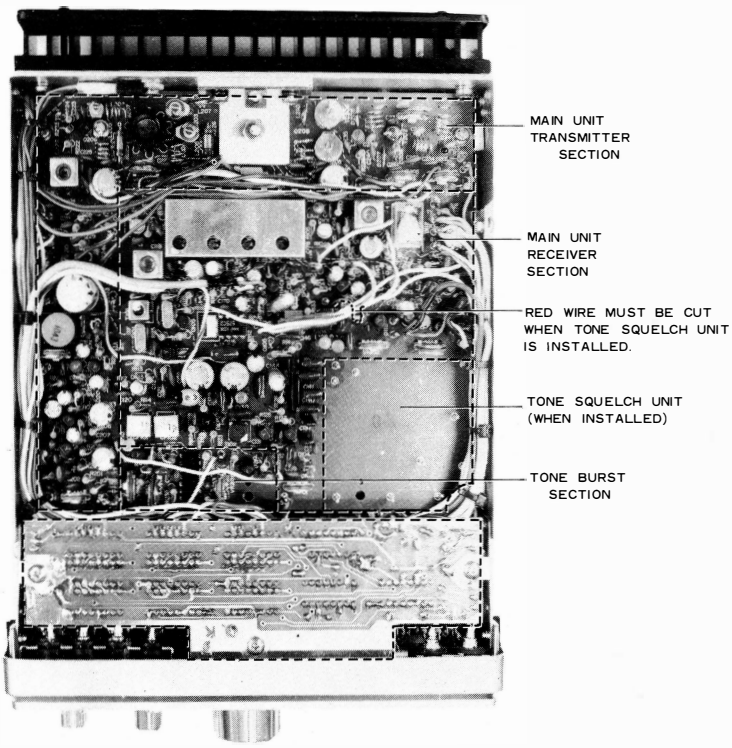



Figure 10 TOP VIEW

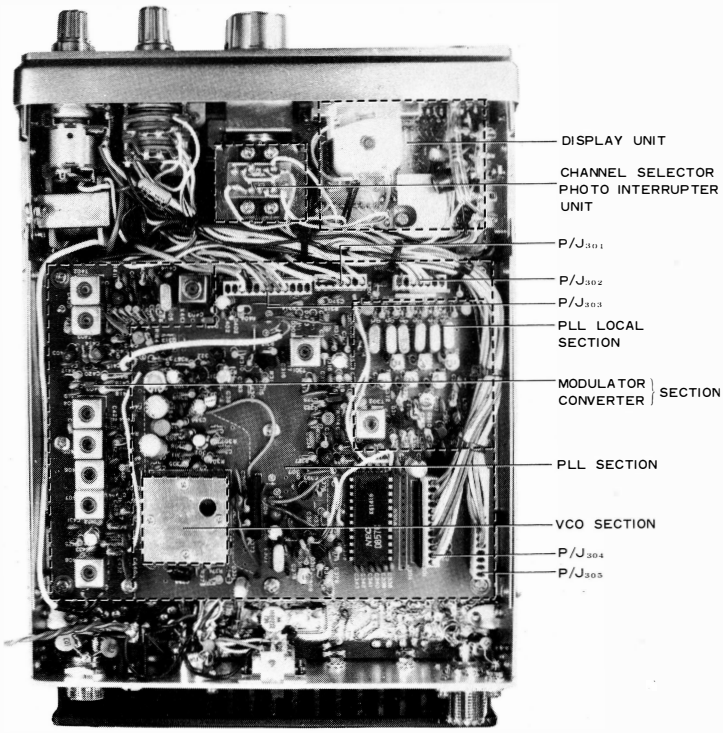



Figure 11 BOTTOM VIEW

## ROUTINE MAINTENANCE

Routine maintenance should be limited to keeping the transceiver clean, and periodic performance checks of the transmitter RF power output and the receiver sensitivity.

### Cleaning:

When the transceiver has been used in dusty or sandy areas, the interior should be periodically cleaned. A vacuum-cleaner should be used, while any caked or accumulated dirt may be removed with a soft brush. Check the interior to make sure that it is thoroughly dry before replacing the case and/or operating equipment. Wipe the exterior with a damp cloth whenever required.

## PERFORMANCE CHECKS

Make all performance checks at 13.5 Volts DC (under load).

Check the transmitter output as follows:

(a) Connect a suitable 50 ohm dummy load/RF wattmeter to the ANT receptacle.

(b) Set the channel selector to any channel and key the transmitter while observing the power output. The power should be approximately 10 Watts, andthe S-meter should read between 6 and 8 relative power output.

Check the receiver sensitivity as follows:

(a) Connect an AC VTVM to the SP receptacle, and set the SQUELCH control fully counter-clockwise.

(b) Connect the RF output of a precision, VHF signal generator to the ANT receptacle and with no signal input note the VTVM reading. Adjust the VOLUME control and VTVM range, as required, to obtain an approximate full scale reading. (DO NOT change the VOLUME control setting after this adjustment is made).

(c) Set the signal generator to the receiving frequency of the transceiver and adjust the output amplitude of the signal generator until the VTVM reads 1/10th (20 dB decrease) of the reading in step (b). The signal generator output voltage at this point is the 20 dB quieting sensitivity, and should be approximately 0.3 uV.

If the above performance checks indicate a need for realignment it is recommended that the transceiver be returned to the dealer for alignment. The alignment procedures require special test equipment and techniques not normally available to the average owner. Attempts to realign the tuned circuits without proper test equipment may result in degraded performance of the transceiver.

ALIGNMENT

SOME OF THE FOLLOWING ALIGNMENT PROCEDURES REQUIRE SPECIAL TEST EQUIPMENT AND TECHNIQUES AND SHOULD ONLY BE DONE BY AN EXPERT TECHNICIAN.

TRANSMITTER

(1) RF Power Amplifier

a) Set the channel to 147.0 MHz. Connect a YP-150 50 ohm dummy load/watt meter to the antenna connector. Connect a VTVM between TP1 and ground (1V DC range).

b) Key the transmitter and peak T201 for maximum VTVM reading.

c) Set the HI/LOW switch to HIGH position and VR205 to extreme CCW position. Peak TC201 through TC206 for maximum power output as indicated on the YP-150.

d) Set the HI/LOW switch to LOW position and set VR206 for 1 Watt output.

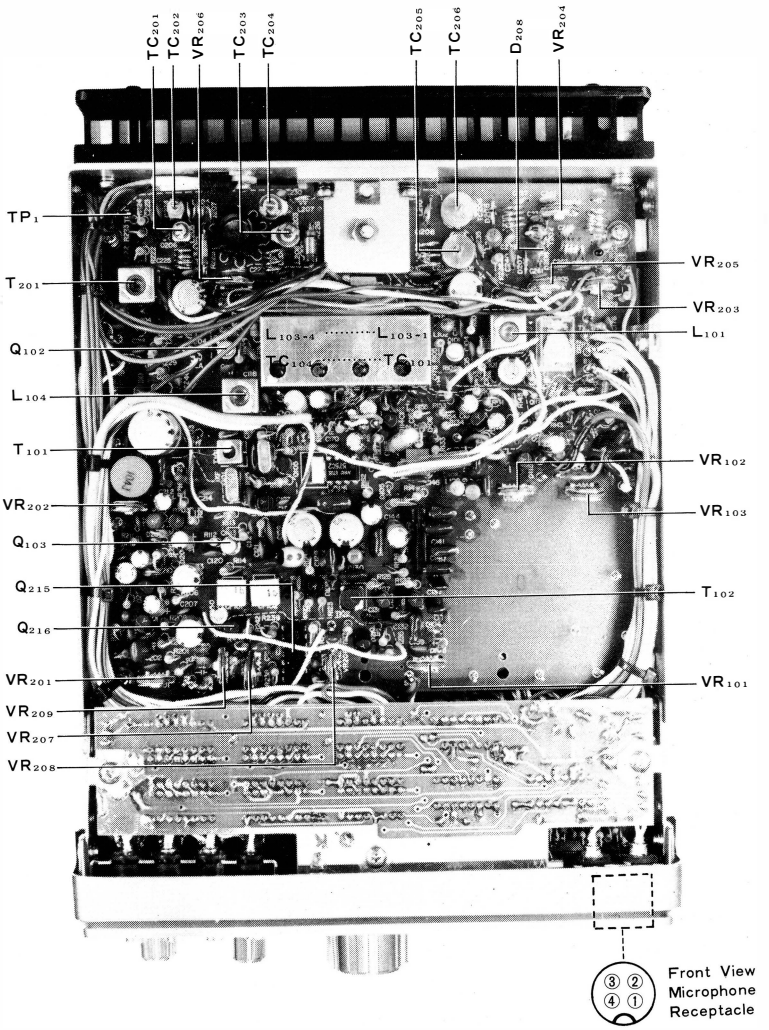



Figure 12 ALIGNMENT POINT

(2) AFP (Automatic Final Protection)

a) Connect the YP-150 to the antenna connector. Set VR205 to the extreme CCW position. Connect the VTVM to cathode (+) of D208 and ground (-) and adjust VR204 for minimum VTVM reading.

b) Slowly advance VR205 in CW (Clockwise) direction until the output power is about to decrease.

(3) PO Meter

Set VR203 to the point where S meter shows 8 with full output.

(4) Deviation

a) Connect YP-150 to the antenna connector, the output of an audio oscillator between pin 2 (hot) and 1 (ground) of microphone receptacle and a deviation meter as illustrated in Fig. 13. Set the audio output level to 25 mV at 1 kHz.

b) Connect a frequency counter between TP3 of the PLL unit and ground.

c) Key the transmitter by grounding pin 3 of microphone receptacle. Adjust T401 for a 10.7 MHz counter reading.

d) Set the output level of the audio signal generator to 25 mV at 1 KHz and adjust VR202 for ±5 kHz deviation.

e) Set the audio level to 2.5 mV. Adjust VR201 for a deviation of ±2.5 kHz.

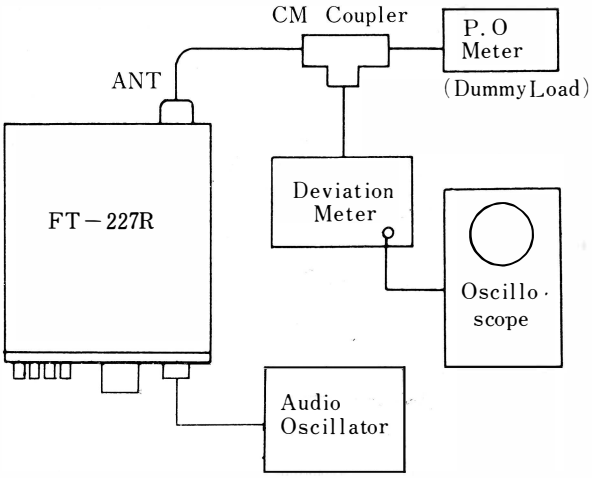



Figure 13

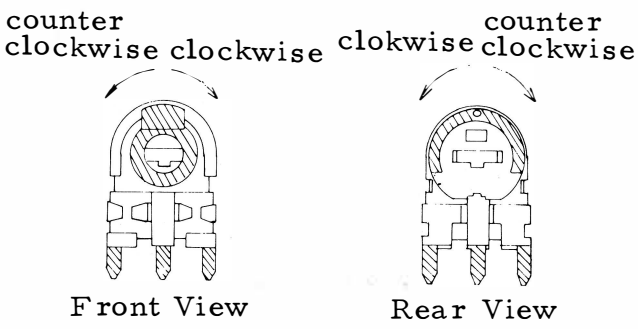



Figure 14

(5) Tone Burst

a) Connect a YP-150 dummy load to the antenna connector and disconnect the microphone to prevent accidental voice modulation.
b) Temporarily connect pin 5 of Q215 to pin 14.
c) Connect a YC-500 frequency counter to the emmiter of Q216, and set TONE BURST switch to the ON position.
d) Key the transmitter and adjust VR207 to the desired burst frequency.
e) Connect VTVM to MIC IN terminal and adjust VR209 for 2.5 mV VTVM reading.
f) Remove the temporarily connected wire in step (b). Key the transmitter and adjust VR208 for desired burst duration.

RECEIVER

(1) RF Amplifier

a) Connect the calibrated signal generator to the antenna connector and set the channel selector to 147.0 MHz.
b) Tune the signal generator to the receive frequency and peak L101 through L104 and TC101 through TC104 for maximum S meter reading.

(2) First IF Amplifier

a) Connect a sweep generator to the second gate of Q102. Connect a oscilloscope through a detector to the drain of Q103.

b) Set the frequency of the sweep generator to 10.7 MHz and apply its output Adjust T101 until the scope pattern illustrated in Fig. 15 is available.

c) Disconnect the sweep generator and scope. Measure the RF injection voltage to the second gate of Q103. A nominal value is 0.8-1.0 Volt rms.

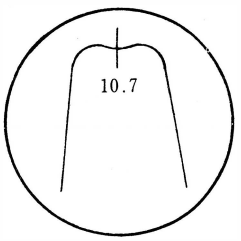



Figure 15

(3) S Meter Sensitivity

a) Apply the signal generator output to the antenna connector. Peak T102 for maximum S meter reading.
b) Set the output level of the signal generator to 20dB and adjust VR101 for full scale indication on the S meter.

(4) Noise Squelch Threshold

a) Receive 0 dB signal from the signal generator.
b) Set the SQL control on the front panel to TONE position and slightly advance clockwise direction to minimum SQL position. Set VR102 to the point where the squelch starts to open.

PLL Circuit

a) Set the channel frequency to 146.00 MHz.

b) Connect the YC500S frequency counter to TP3 of the PLL unit and adjust TC309 for 5.1200 MHz, and make sure the RF voltage of the emitter of Q312 is approximately 1.6 Volts rms.

c) Connect RF probe of the VTVM to the base of Q311 and peak TC308 for maximum VTVM reading. Slowly rotate TC308 in the direction of increasing capacitance until the VTVM reading becomes 5% lower than peak indication (approx. 60 mV rms).

d) Connect RF probe of the VTVM to the base of Q305. Key the transmitter and peak T302 for maximum VTVM reading (approx. 170 mV rms).

e) Connect the YC-500S frequency counter between cathode of D302 in PLL unit and the ground. Set the FUNCTION switch to SIMP. Adjust TC301 for 135.300 MHz counter reading.

f) Set the FUNCTION switch to -600. Key the transmitter and adjust TC302 for 134.700 MHz counter reading. Adjust TC303 for 135.900 MHz at +600.

g) Set the FUNCTION switch to SIMP. Press 5UP switch down. Adjust TC304 for 135.305 MHz in receive mode. Key the transmitter at -600 and adjust TC305 for 134.705 MHz, at +600 kHz adjust TC306 for 135.905 MHz.

h) Connect VTVM (DC10V range) between the cathode of D324 and ground. Adjust TC301 for 3.4 Volt VTVM reading.

i) Connect RF probe of VTVM between TX out terminal and ground in PLL unit. Peak T402-T408 for maximum VTVM reading in transmit.

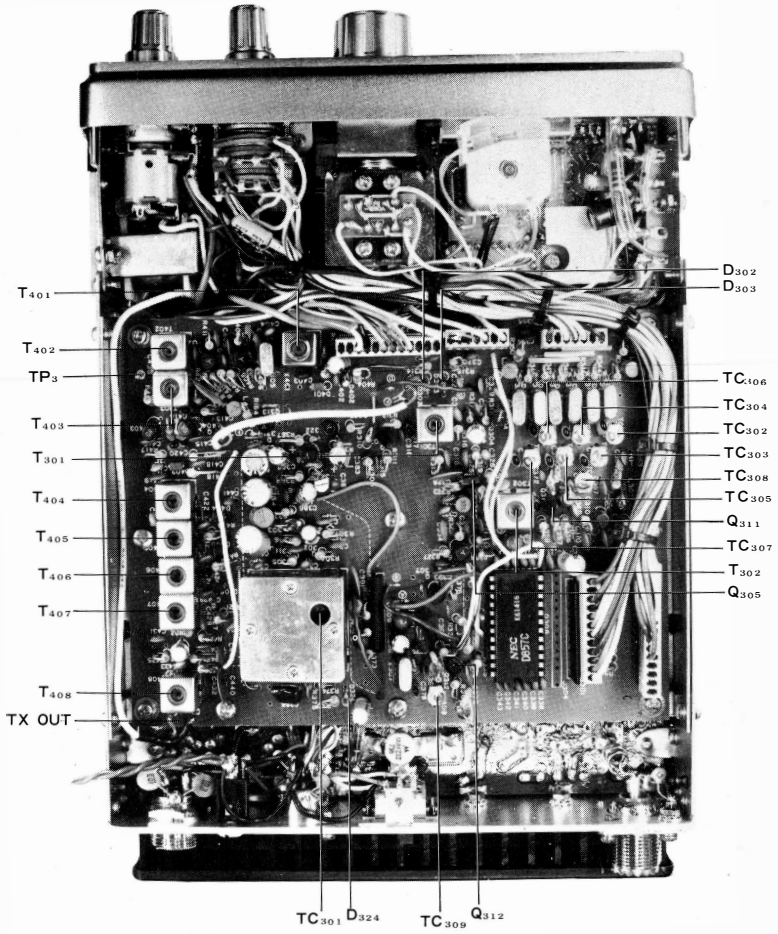



Figure 16 **ALIGNMENT POINT**

Optional tone squelch

The optional tone squelch unit has been set to 77 Hz operation at the factory, however, the tone squelch frequency can be chosen to any frequency between 70 Hz to 160 Hz by the setting of VR502. The transmitting level of the tone signal is set by VR504.

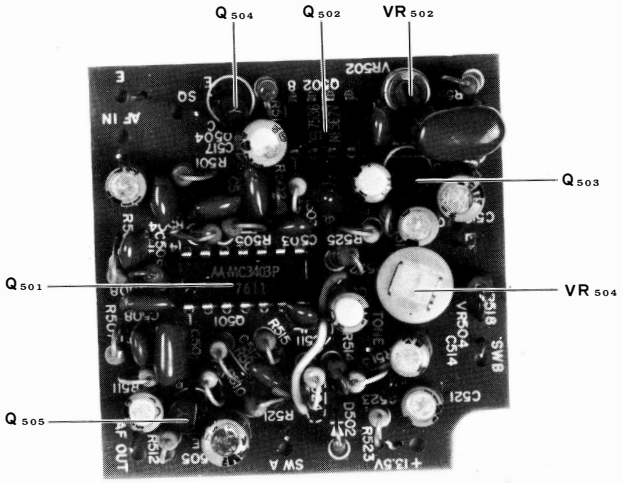
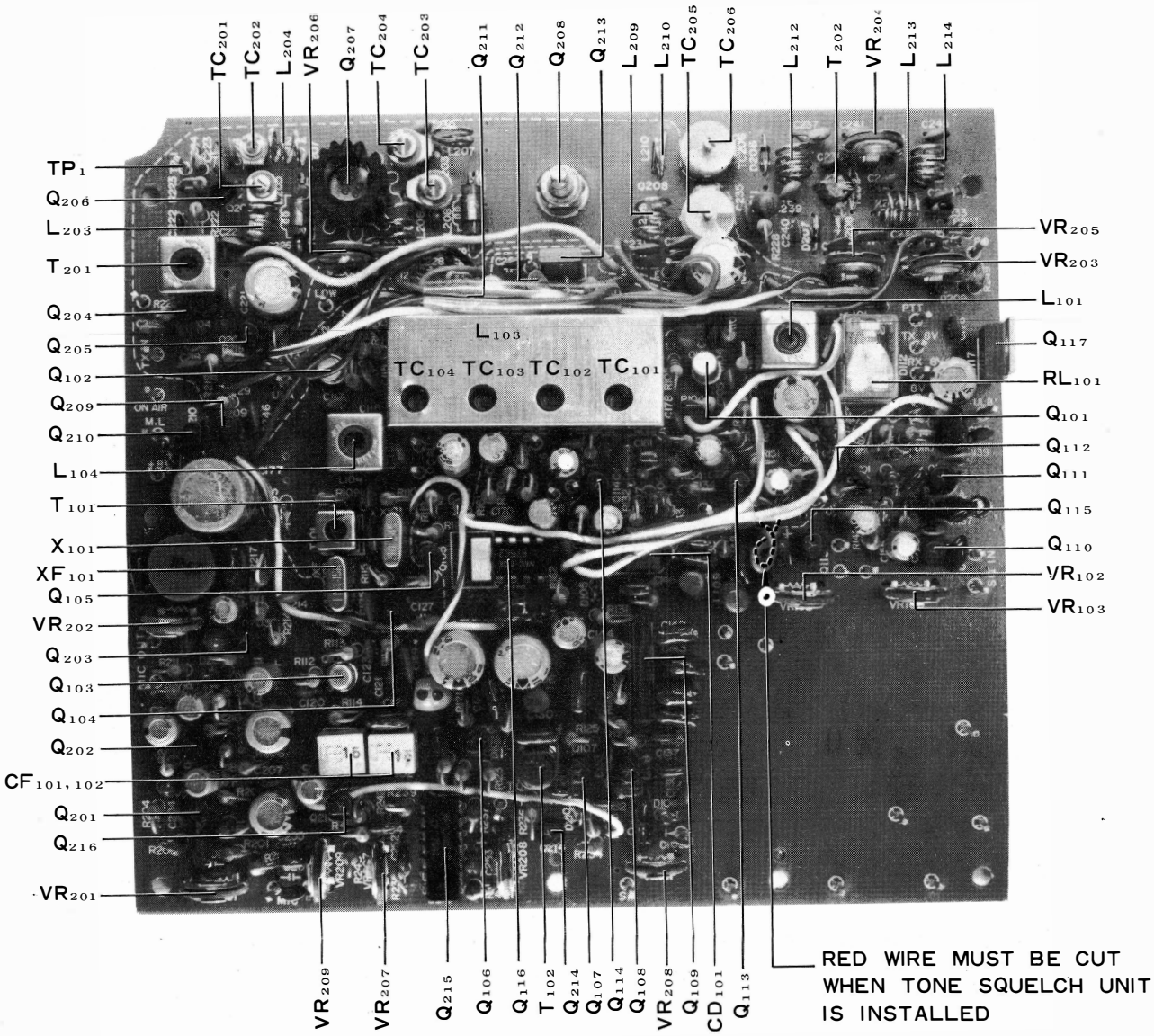
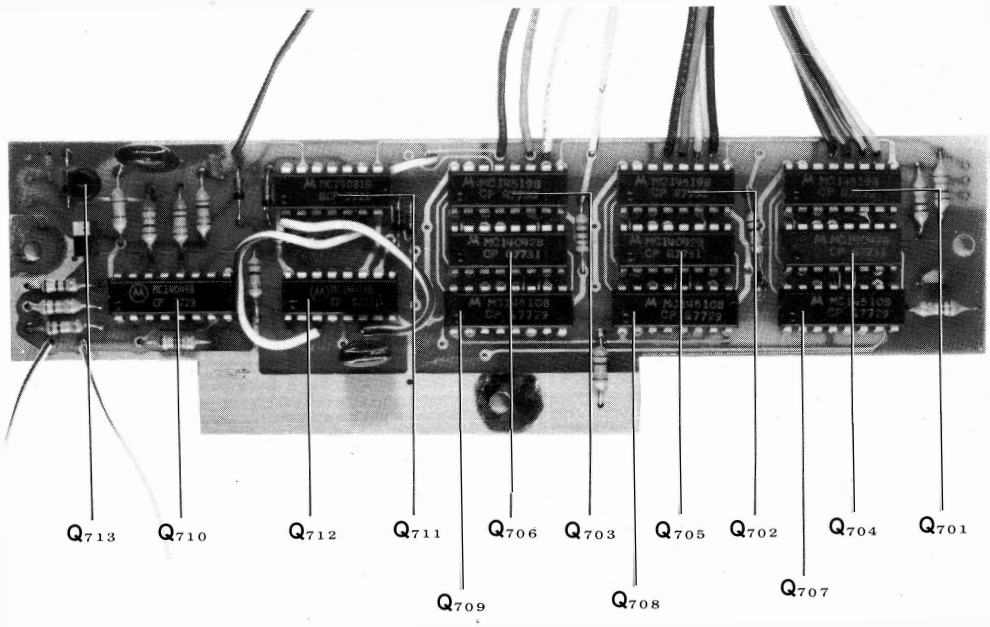
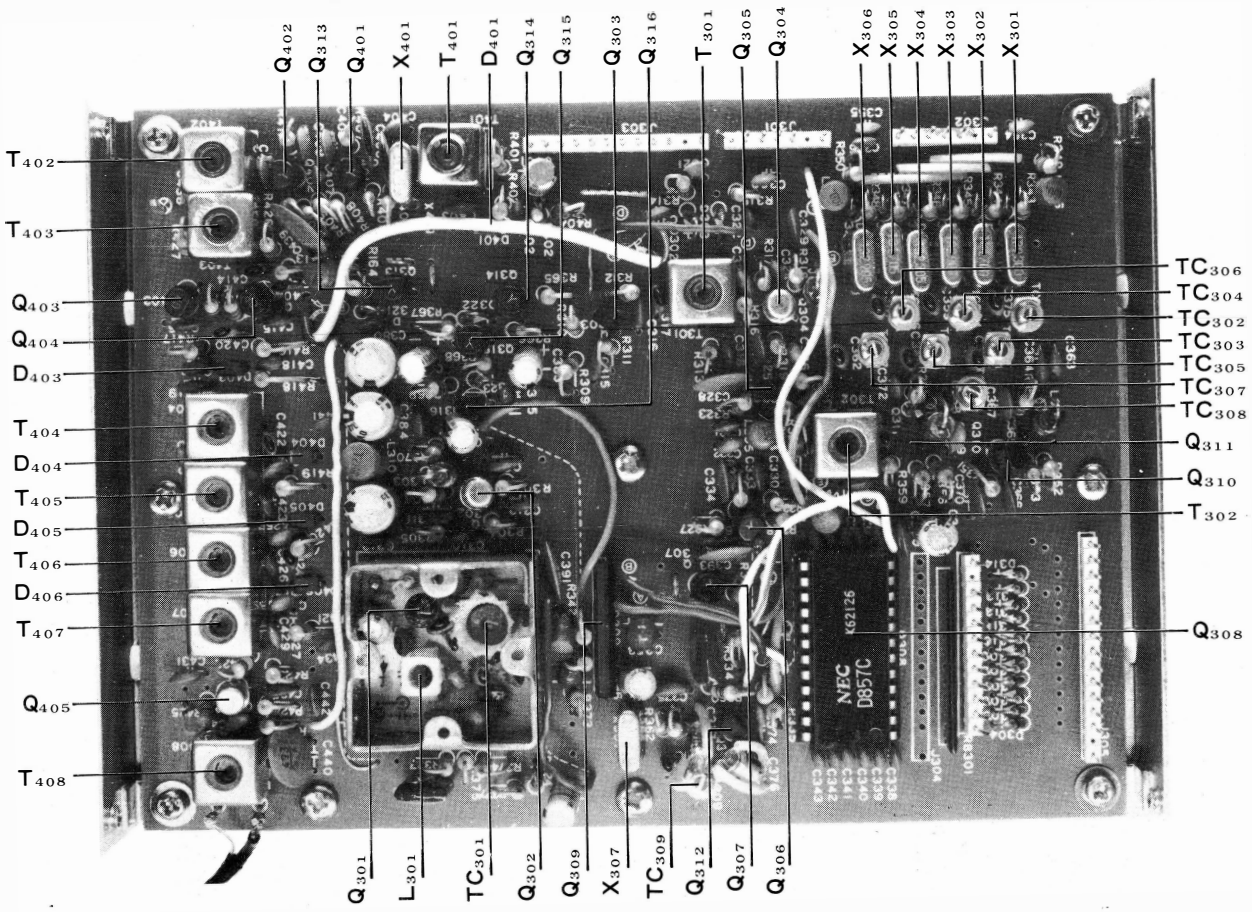



Figure 17

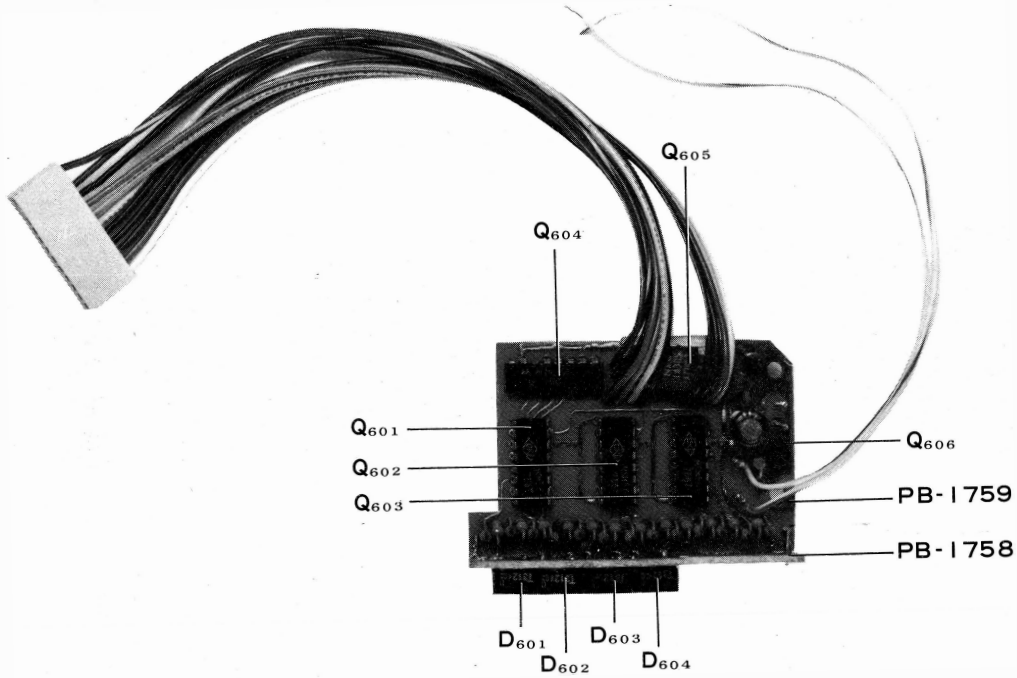



PLL CONTROL UNIT




PLL UNIT




DISPLAY UNIT

# PARTS LIST

## MAIN CHASSIS

| Symbol Number | Parts Number | Description |
|---|---|---|
| | | **TRANSISTOR** |
| Q1 | 22402353 | Silicon Transistor 2SD235 |
| | | |
| | | **DIODE** |
| D1 | 2 090130 | Silicon Diode U05B |
| D2 | 21015550 | Silicon Diode 1S1555 |
| D3,D4,D5 | 21090111 | Zener Diode WZ050 |
| | | |
| | | **RESISTOR** |
| R4 | 40143100 | Carbon Film ¼W VJ 10Ω |
| R3 | 40143821 | 〃 〃 〃 〃 820Ω |
| R6,7 | 42144821 | 〃 Composition 〃 GK 820Ω |
| R5 | 42144103 | 〃 〃 〃 〃 10KΩ |
| R8 | 42124220 | 〃 〃 ½W 〃 22Ω |
| R1 | 42124471 | 〃 〃 〃 〃 470Ω |
| | | |
| | | **POTENTIOMETER** |
| VR1(with S1) | 49800079 | DM11A 5M1111 10KB/10KA |
| | | |
| | | |
| | | **CAPACITOR** |
| C1 | 31829150 | Ceramic 50WV SL 15PF |
| C2 | 30820102 | Ceramic 50WV 0.001μF |
| C8,C9,C10 | 30820103 | Ceramic 50WV 0.01μF |
| C3,C6,C7 | 34220106 | Electrolytic 16WV R 10μF |
| C5 | 34220226 | Electrolytic 16WV R 22μF |
| C4 | 34120107 | Electrolytic 10WV R 100μF |
| | | |
| | | **INDUCTOR** |
| L1 | 55003160 | Lowpass Coil #220196 |
| | | |
| | | |
| CH | 50000010 | AF Choke Coil #230012 |
| | | |
| | | |
| | | **METER** |
| M1(with PL6) | 74000310 | AP-120 200μA |
| | | |
| | | |
| | | **SPEAKER** |
| SP1 | 76000013 | SM-77K-Y 8Ω 1W |
| | | |
| | | |
| | | **SWITCH** |
| S6,S7 | 63000002 | SSF-22-08 |
| S8 | 62000026 | BS2-4-4 |
| | | |
| | | |
| | | **CONNECTOR** |
| J1 | 68020006 | FM-142S |
| J2 | 68020012 | SG-8050 |
| J3 | 68050003 | CS-250 |
| J4 | 68000007 | JSO-239 |
| J5 | 68040003 | FM-144S |
| | | |
| | | |
| | | **PILOT LAMP** |
| PL1～PL5,PL7 | 14000025 | BQ054-32732A |
| | | |
| TB1 | 90030003 | Terminal Board 1L6P(S) |
| | | |
| | | **KNOB** |
| | 94000037 | FT-30T (Channel Selector) |
| | 94000041 | FT-16P (Volume) |
| | 94000042 | FT-16PA (Tx Selector) |
| | 94000040 | FT-16PD (Squelch) |

## MAIN UNIT

| •Symbol Number | Parts Number | Description |
|---|---|---|
| PB-1659B | 60316592 | Printed Circuit Board |
| | | |
| | | **IC, FET & Transistor** |
| Q109 | 25000118 | IC μPC577H |
| Q116 | 25000119 | 〃 μPC575C2 |
| Q117 | 25000116 | 〃 μPC14308 |
| Q215 | 25000114 | 〃 MC14011B |
| Q103 | 23800401 | FET 3SK40M |
| Q101,102 | 23800510 | 〃 3SK51 |
| Q213 | 22104963 | Transistor 2SA496O |
| Q105 | 22105640 | 〃 2SA564 |
| Q104,106～108,110 | 22303724 | 〃 2SC372Y |
| Q111～115,201～203 | | |
| Q205,209～212,214 | | |
| Q216 | | |
| Q204 | 22305351 | 〃 2SC535A |
| Q207 | 22307300 | 〃 2SC730 |
| Q206 | 22320530 | 〃 2SC2053 |
| Q208 | 22390005 | 〃 MRF212 |
| | | |
| | | **DIODE** |
| D103,104,106～109 | 21001880 | Germanium Diode 1S188FM |
| D205,208,209,211 | 〃 | |
| D101,102,105,110 | 21015550 | Silicon Diode 1S1555 |
| D111～113,201～204 | | |
| D210,212 | | |
| D206,207 | 21090128 | 〃 〃 MI301 |
| | | |
| | | **CRYSTAL** |
| X101 | 71500046 | HC-18/U 10.245MHz |
| | | |
| | | **MONOLITHIC FILTER** |
| XF101 | 71200015 | FMT-15A |
| | | |
| | | **CERAMIC FILTER** |
| CF101,102 | 71200016 | LFB-15 |
| | | |
| | | **CERAMIC DISCRIMINATOR** |
| CD101 | 70900001 | SFD455S4 |
| | | |
| | | **RESISTOR** |
| R224 | 40143479 | Carbon Film ¼W-VJ 4.7Ω |
| R248 | 41143220 | 〃 〃 〃 TJ 22Ω |
| R102,105,107,112 | 40143560 | 〃 〃 〃 VJ 56Ω |
| R110,124,131,157 | 40143101 | 〃 〃 〃 VJ 100Ω |
| R201,208,220 | | |
| R252 | 41143101 | 〃 〃 〃 TJ 100Ω |
| R123 | 40143151 | 〃 〃 〃 VJ 150Ω |
| R147,162,215 | 40143221 | 〃 〃 〃 VJ 220Ω |
| | | |
| R126,128,129,163 | 40143471 | 〃 〃 〃 VJ 470Ω |
| R223,228,232 | | |
| R209 | 40143561 | 〃 〃 〃 VJ 560Ω |
| R117 | 40143681 | 〃 〃 〃 VJ 680Ω |
| R206,216,219 | 40143102 | 〃 〃 〃 VJ 1KΩ |
| R114,142,151 | 40143152 | 〃 〃 〃 VJ 1.5KΩ |
| R202 | 40143182 | 〃 〃 〃 VJ 1.8KΩ |

# PARTS LIST

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| R149,161,221,233 | 40143222 | Carbon Film ¼W-VJ 2.2KΩ | | C207,214,217,223 | 30820102 | Ceramic 50WV 0.001μF | |
| R120,210 | 40143272 | 〃 〃 〃 VJ 2.7KΩ | | C226,228,232,235 | | | |
| R111,138,140,204 | 40143332 | 〃 〃 〃 VJ 3.3KΩ | | C240,247,257～261 | | | |
| R122,218 | 40143392 | 〃 〃 〃 VJ 3.9KΩ | | C103,105,115,116 | 30820103 | Ceramic 50WV 0.01μF | |
| R156,222,229 | 40143472 | 〃 〃 〃 VJ 4.7KΩ | | C120,121,127,139 | | | |
| R231,235,236,244 | | | | C181,182,219,221 | | | |
| R132,133,141,203 | 40143562 | 〃 〃 〃 VJ 5.6KΩ | | C224,225,227,231 | | | |
| R217,230 | | | | C234,236,242,246 | | | |
| R109,154,155 | 40143682 | 〃 〃 〃 VJ 6.8KΩ | | C264 | 30825103 | Ceramic Chip 25WV 0.01μF | |
| R115 | 40143822 | 〃 〃 〃 VJ 8.2KΩ | | C128,131～133,135 | 36825102 | Mylar Film 50WV 0.001μ | |
| R118,119,134,205,211 | 40143103 | 〃 〃 〃 VJ 10KΩ | | C147,179,251,252 | | | |
| R213 | | | | C162 | 36825472 | 〃 〃 〃 0.0047μF | |
| R143 | 41143103 | 〃 〃 〃 TJ 10KΩ | | C137,146,151,152 | 36825103 | 〃 〃 〃 0.01μF | |
| R121 | 40143183 | 〃 〃 〃 VJ 18KΩ | | C154,161,254 | | | |
| R103,104,135,234 | 40143223 | 〃 〃 〃 VJ 22KΩ | | C255 | | | |
| R249 | | | | C148～150,153,203 | 36825223 | 〃 〃 〃 0.022μF | |
| R101,106,108,113 | 40143473 | 〃 〃 〃 VJ 47KΩ | | C122,129,130,134 | 36825473 | 〃 〃 〃 0.047μF | |
| R116,125,127,146 | | | | C136,140～143,215 | | | |
| R158 | | | | C216 | | | |
| R144 | 40143563 | 〃 〃 〃 VJ 56KΩ | | C172 | 36825104 | 〃 〃 〃 0.1μF | |
| R145,152 | 40143823 | 〃 〃 〃 VJ 82KΩ | | C266 | 36416107 | Tantalum 3.15WV 100μF | |
| R153,242,243 | 40143104 | 〃 〃 〃 VJ 100KΩ | | C159 | 36226475 | 〃 16WV 4.7μF | |
| R160 | 40143124 | 〃 〃 〃 VJ 120KΩ | | C205 | 36226106 | 〃 〃 10μF | |
| R137,139,159,212,214 | 40143154 | 〃 〃 〃 VJ 150KΩ | | C253 | 36526104 | 〃 35WV 0.47μF | |
| R239 | 40143184 | 〃 〃 〃 VJ 180KΩ | | C144,169,171,209 | 34120476 | Electrolytic 10WV R 47μF | |
| R207 | 40143274 | 〃 〃 〃 VJ 270KΩ | | C165,175,206,213 | 34120107 | 〃 〃 R 100μF | |
| R238 | 40143824 | 〃 〃 〃 VJ 820KΩ | | C173 | 34120227 | 〃 〃 R 220μF | |
| R237,240,241 | 40143105 | 〃 〃 〃 VJ 1MΩ | | C158,160,164,166 | 34820105 | 〃 50WV R 1μF | |
| R225,226,246 | 42124101 | 〃 Composition ½W GK100Ω | | C208,210,262 | | | |
| | | | | C155,156,168 | 34320475 | 〃 25WV R 4.7μF | |
| | | **THERMISTOR** | | C163,183,211,212,250 | 34220106 | 〃 16WV R 10μF | |
| TH101 | 29090001 | SDT-250 | | C174,229,263 | 34220107 | 〃 〃 R 100μF | |
| | | | | C177 | 34220108 | 〃 〃 R 1000μF | |
| | | **POTENTIOMETER** | | | | | |
| VR204 | 49902501 | TR-11R3 500ΩB | | | | **TRIMMER CAPACITOR** | |
| VR202,209 | 49902102 | 〃 1KΩB | | TC101～104,201 | 39000010 | ECV-1ZW 10×53 10PF | |
| VR206 | 49902202 | 〃 2KΩB | | TC202 | 39000011 | 〃 20×53 20PF | |
| VR102,201 | 49902502 | 〃 5KΩB | | TC203,204 | 39000002 | 〃 20×32 20PF | |
| VR101,103,205 | 49902103 | 〃 10KΩB | | TC205,206 | 39000066 | TC-10 65PF | |
| VR203 | 49902503 | 〃 50KΩB | | | | | |
| VR207 | 49902104 | 〃 100KΩB | | | | **INDUCTOR** | |
| VR208 | 49902205 | 〃 2MΩB | | L101,104 | 54140910 | R12-4091 #220105 | |
| | | | | L203,212,213,214 | 55003093 | #220196 | |
| | | **CAPACITOR** | | L204,206,209 | 55003086 | #220190 | |
| C238 | 31829059 | Ceramic 50WV SL 0.5PF | | L207,210 | 55003098 | #220194 | |
| C233 | 31829010 | 〃 〃 SL 1PF | | L103 | 55003173 | #220302 | |
| C239,241 | 31829030 | 〃 〃 SL 3PF | | L205,208 | 55003100 | #220253 | |
| C118,220 | 31820030 | 〃 〃 CH 3PF | | L102,211 | 53020016 | Micro Inductor 2.2μH | |
| C108,110,112,114 | 31820050 | 〃 〃 CH 5PF | | L105 | 53010004 | 〃 〃 220μH | |
| C119 | 31829100 | 〃 〃 SL 10PF | | L106,108,109 | 53020001 | 〃 〃 1mH | |
| C101,102 | 31820100 | 〃 〃 CH 10PF | | L201 | 53050001 | 〃 〃 100mH | |
| C243 | 31829150 | 〃 〃 SL 15PF | | | | | |
| C107,113 | 31820150 | 〃 〃 CH 15PF | | | | **TRANSFORMER** | |
| C109,111 | 31820180 | 〃 〃 CH 18PF | | T101 | 55003083 | IFT #220187 | |
| C180 | 31829200 | 〃 〃 SL 20PF | | T102 | 55003084 | 〃 #220188 | |
| C230,237 | 31829220 | 〃 〃 SL 22PF | | T201 | 54141020 | R12-4102 #220111 | |
| C222 | 31829270 | 〃 〃 SL 27PF | | T202 | 55003090 | CM Coupler #220069 | |
| C244,245 | 31829300 | 〃 〃 SL 30PF | | | | | |
| C124 | 31820470 | 〃 〃 CH 47PF | | | | **RELAY** | |
| C218 | 31829560 | 〃 〃 SL 56PF | | RL101 | 70000030 | G2E 12V DC | |
| C157 | 31829101 | 〃 〃 SL 100PF | | | | | |
| C125,126 | 31829151 | 〃 〃 SL 150PF | | | 56000024 | Ferrate Beads 4A-RI 3×3-1 | |
| C104,106,117,123 | 30820102 | 〃 〃 0.001μF | | | 91100008 | wrapping Terminal C | |
| C138,167,170,176 | | | | | 95000004 | Heat Sink C To-5 ℓ=15mm | |
| C178,201,202,204 | | | | | 80038283 | Resonator Case | |

# PARTS LIST

| PLL UNIT | | |
|---|---|---|
| Symbol Number | Parts Number | Description |
| PB-1757A | 60317571 | Printed Circuit Board |
| PB-1765 | 60317650 | 〃 〃 |
| | | |
| | | **IC, FET & Transistor** |
| Q309 | 25000087 | IC TC5081P |
| Q308 | 25000086 | 〃 μPD857C |
| Q301,403,404 | 22800195 | FET 2SK19GR |
| Q302,304,405 | 23800401 | MOS FET 3SK40M |
| Q306,307,313～315 | 22303724 | Transistor 2SC372Y |
| Q401,402 | | |
| Q310,312 | 22303730 | 〃 2SC373 |
| Q303,305 | 22305351 | 〃 2SC535A |
| Q311 | 22307104 | 〃 2SC710 |
| Q316 | 22390001 | 〃 MPSA13 |
| | | |
| | | **IC SOCKET** |
| QS401 | 68240001 | 116-24-30-114 |
| | | |
| | | **DIODE** |
| D302～320,322～324 | 21015550 | Silicon Diode 1S1555 |
| D402 | 29090004 | 〃 MV-103 |
| D321 | 21090131 | Zener Diode RD6.8EB |
| D301,403~406 | 21022090 | Varactor Diode 1S2209 |
| D401 | 21090108 | 〃 1SV50 |
| | | |
| | | **CRYSTAL** |
| X301,401 | 71800073 | HC-18/U 44.100MHz |
| X302 | 71800080 | 〃 43.9MHz |
| X303 | 71800081 | 〃 44.3MHz |
| X304 | 71800082 | 〃 44.10166MHz |
| X305 | 71800083 | 〃 43.90166MHz |
| X306 | 71800084 | 〃 44.30166MHz |
| X307 | 71800075 | 〃 10.240MHz |
| X401 | 71800062 | 〃 10.700MHz |
| | | |
| | | **RESISTOR** |
| R364,425,428 | 40143560 | Carbon Film ¼W-VJ 56Ω |
| R302,303,307,312 | 40143101 | 〃 〃 〃 VJ 100Ω |
| R319,354,358,359 | | |
| R360,371,408,418 | | |
| R311,412～415 | 40143221 | 〃 〃 〃 VJ 220Ω |
| R373 | 40143681 | 〃 〃 〃 VJ 680Ω |
| R355 | 40143821 | 〃 〃 〃 VJ 820Ω |
| R324,327,361,365 | 40143102 | 〃 〃 〃 VJ 1KΩ |
| R367,369,407,411 | | |
| R334 | 40143122 | 〃 〃 〃 VJ 1.2KΩ |
| R323,356,372,375 | 40143152 | 〃 〃 〃 VJ 1.5KΩ |
| R313,328,349,350 | 40143222 | 〃 〃 〃 VJ 2.2KΩ |
| R314,315,343～348 | 40143332 | 〃 〃 〃 VJ 3.3KΩ |
| R404 | 40143562 | 〃 〃 〃 VJ 5.6KΩ |
| R309,321,325,335～ | 40143103 | 〃 〃 〃 VJ 10KΩ |
| R337,352,357,363 | | |
| R409,426,427 | | |
| R368,374 | 40143153 | 〃 〃 〃 VJ 15KΩ |
| R317,353,362,366 | 40143223 | 〃 〃 〃 VJ 22KΩ |
| R401,406,410 | | |
| R326 | 40143273 | 〃 〃 〃 VJ 27KΩ |
| R310,318,402,424 | 40143333 | 〃 〃 〃 VJ 33KΩ |
| R322,423 | 40143393 | 〃 〃 〃 VJ 39KΩ |
| R376,405 | 40143473 | 〃 〃 〃 VJ 47KΩ |
| R304～306,316,342 | 40143104 | 〃 〃 〃 VJ 100KΩ |
| R370,377,416,417 | | |
| R419～422,429 | | |

| | | |
|---|---|---|
| R301 | 40143474 | Carbon Film ¼W-VJ 470KΩ |
| | | |
| | | **BLOCK RESISTER** |
| | | |
| RB301 | 47000005 | 11×100KΩ |
| | | |
| | | **POTENTIOMETER** |
| | | |
| | | |
| | | |
| | | **CAPACITOR** |
| C423,426 | 31829059 | Ceramic 50WV SL 0.5PF |
| C326 | 31829010 | 〃 〃 SL 1PF |
| C303 | 31820010 | 〃 50WV CH 1PF |
| C420,422,424 | 31820020 | 〃 〃 CH 2PF |
| C333 | 31829030 | 〃 〃 SL 3PF |
| C306 | 31820030 | 〃 〃 CH 3PF |
| C357～362 | 31820040 | 〃 〃 CH 4PF |
| C404 | 31827040 | 〃 〃 UJ 4PF |
| C304 | 31825040 | 〃 〃 N330 4PF |
| C310,435 | 31829050 | 〃 〃 SL 5PF |
| C317 | 31820050 | 〃 〃 CH 5PF |
| C421,425,428 | 31827060 | 〃 〃 UJ 6PF |
| C302,305 | 31820070 | 〃 〃 CH 7PF |
| C373 | 31820080 | 〃 〃 CH 8PF |
| C417,418 | 31827080 | 〃 〃 UJ 8PF |
| C323,327,332,369 | 31829100 | 〃 〃 SL 10PF |
| C301,307 | 31820120 | 〃 〃 CH 12PF |
| C368 | 31820150 | 〃 〃 CH 15PF |
| C331 | 31829180 | 〃 〃 SL 18PF |
| C413,414 | 31820200 | 〃 〃 CH 20PF |
| C429 | 31829270 | 〃 〃 SL 27PF |
| C365,378,438 | 31820330 | 〃 〃 CH 33PF |
| C370 | 31820390 | 〃 〃 CH 39PF |
| C374,407,438 | 31829470 | 〃 〃 SL 47PF |
| C314 | 31829101 | 〃 〃 SL 100PF |
| C405,406 | 31820101 | 〃 〃 CH 100PF |
| C403 | 31827101 | UJ 100PF |
| C308,313,319～ | 30820102 | 〃 〃 0.001μF |
| C322,324,338～348 | | |
| C354～356,363,364 | | |
| C372,380,390,392, | | |
| C395,402,432,434,437 | | |
| C441 | | |
| C311,312,315,316 | 30820103 | 〃 〃 0.01μF |
| C318,325,329,330 | | |
| C333,335,366 | | |
| C367,371,375,384 | | |
| C394,408～411,415 | | |
| C416,419,430,431,442 | | |
| C334 | 30820223 | 〃 〃 0.022μF |
| C328,350~352,391,393,439,440 | 30820473 | 〃 〃 0.047μF |
| C388,397 | 36825473 | Mylar Film 〃 0.047μF |
| C376 | 36824101 | Styrol 〃 100PF |
| C377 | 36824221 | 〃 〃 220PF |
| C385 | 36526104 | Tantalum 35WV 0.1μF |
| C387 | 36526475 | 〃 〃 4.7μF |
| C353 | 36526106 | 〃 〃 10μF |
| C349 | 34120476 | Electrolytic 10WV-R 47μF |
| C379,381,389 | 34120107 | 〃 〃 R 100μF |
| C309,382,396 | 34220106 | 〃 16WV-R 10μF |
| C383,386,398,401 | 34820105 | 〃 50WV-R 1μF |
| | | |
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| | | |

# PARTS LIST

| | | | |
|---|---|---|---|
| | | **TRIMMER CAPACITOR** | |
| TC301 | 39000069 | TZOIY 070A | 7PF |
| TC302～309 | 39000011 | ECV-1ZW 20×53 | 20PF |
| | | | |
| | | | |
| | | **INDUCTOR** | |
| L301 | 55003189 | VCO Coil | #220359 |
| L309 | 55003150 | | #220205 |
| L303,304,307 | 55003120 | | #220206 |
| L302 | 53020005 | Micro Inductor | 3.3μH |
| L306,308 | 53020018 | 〃 〃 | 10μH |
| L305 | 53020025 | 〃 〃 | 33μH |
| L313 | 53020026 | 〃 〃 | 47μH |
| L312 | 53020021 | 〃 〃 | 220μH |
| L311,401 | 53020001 | 〃 〃 | 1mH |
| L310 | 53020003 | 〃 〃 | 4mH |
| | | | |
| | | | |
| | | **TRANSFORMER** | |
| T301,302,404～408 | 54141020 | R12-4102 | #220111 |
| | | | |
| T401 | 55003213 | | #221024 |
| T402,403 | 54140730 | R12-4073 | #220149 |
| | | | |
| | | **MINI CONNECTOR** | |
| J301,302 | 67060005 | 5048-06A | |
| J303,304 | 67110004 | 5048-11A | |
| J305 | 67140001 | 5048-14A | |
| | | | |
| P301 | 68060008 | 5047-06 with Wire | #240046 |
| P302 | 68060009 | 〃 〃 | #240047 |
| P303 | 68110006 | 5047-11 | #240048 |
| P304 | 68110007 | 〃 〃 | #240049 |
| P305 | 68140007 | 5047-14 | #240050 |
| | | | |
| | 80041041 | VCO Case | |
| | 80041051 | VCO Case Cover | |
| | 91100008 | Wrapping Terminal C | |
| | | | |

**PLL CONTROL UNIT**

| Symbol Number | Parts Number | Description |
|---|---|---|
| PB-1773A | 60517730 | Printed Circuit Board |
| | | |
| | | **IC, TRANSISTOR** |
| Q701～703 | 25000089 | MOS IC MC14519B |
| Q704～706 | 25000090 | MOS IC MC14042B |
| Q707～709 | 25000091 | MOS IC MC14510B |
| Q710 | 25000092 | MOS IC MC14049B |
| Q711 | 25000093 | MOS IC MC14081B |
| Q712 | 25000136 | MOS IC MC14028B |
| Q713 | 22307354 | Transistor 2SC735Y |
| | | |
| | | |
| | | **DIODE** |
| D701～706 | 21015550 | Silicon Diode 1S1555 |
| | | |
| | | |
| | | **RESISTOR** |
| R701 | 41143101 | Carbon Film ¼W-TJ 100Ω |
| R707,710 | 41143102 | 〃 〃 〃 TJ 1KΩ |
| R703～706,708,713,714 | 41143103 | 〃 〃 〃 TJ 10KΩ |
| R709,711,715 | 41143104 | 〃 〃 〃 TJ 100KΩ |
| R702 | 41143221 | 〃 〃 〃 TJ 220KΩ |
| R712 | 41143474 | 〃 〃 〃 TJ 470KΩ |

| | | |
|---|---|---|
| | | **CAPACITOR** |
| C703,705,706 | 30820102 | Ceramic 50WV 0.001μF |
| C702,704 | 36825473 | Mylar Film 〃 0.047μF |
| C701 | 36226685 | Tantalum 20WV 6.8μF |
| | | |
| | | |
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| | | |

**DISPLAY UNIT**

| Symbol Number | Parts Number | Description |
|---|---|---|
| | | **PRINTED CIRCUIT BOARD** |
| PB-1758 | 60417580 | Display Board |
| PB-1759 | 60417590 | Driver Board |
| | | |
| | | |
| | | **IC & TRANSISTOR** |
| Q605 | 25000109 | IC μPC14305 |
| Q601～603 | 25000085 | 〃 MSM561 |
| Q604 | 25000088 | 〃 MC14008B |
| Q606 | 22303724 | Transistor 2SC372Y |
| | | |
| | | |
| | | **DIODE** |
| D601～604 | 21090122 | LED TLR312D |
| | | |
| | | |
| | | **RESISTOR** |
| R623 | 40143181 | Carbon Film ¼W-VJ 180Ω |
| R625 | 40143331 | 〃 〃 ⅛W-VJ 330Ω |
| R601～622 | 40143471 | 〃 〃 〃 VJ 470Ω |
| R624 | 40143681 | 〃 〃 〃 VJ 680Ω |
| R626 | 40143103 | 〃 〃 ¼W-VJ 10KΩ |
| | | |
| | | |
| | | **CAPACITOR** |
| C601 | 30820102 | Ceramic 50WV 0.001μF |
| C602 | 36526474 | Tantalum 35WV 0.47μF |
| C603 | 34120107 | Electrolytic 10WV-R 100μF |
| | 80039531 | Heat Sink A |
| | 67200003 | Board Joint 163740 |
| | 91100008 | Wrapping Terminal C |

**SWITCH BOARD**

| Symbol Number | Parts Number | Description |
|---|---|---|
| | | **SWITCH BOARD** |
| PB-1763A | 60317631 | Printed Circuit Board |
| | | |
| | | **PUSH SWITCH** |
| S2～S5 | 65000022 | ZU-EE-20 |
| | | |
| | | |
| | | |
| | | |

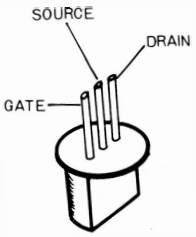
**PHOTO INTERRUPTER BOARD**

| Symbol Number | Parts Number | Description |
|---|---|---|
| | | **PHOTO INTERRUPTER BOARD** |
| PB-1690A | 60316901 | Printed Circuit Board |
| | | |
| | | **PHOTO INTERRUPTER** |
| Q2,Q3 | 29090010 | PS4001 |
| | | |
| | | |
| | | |
| | | |
| | | |

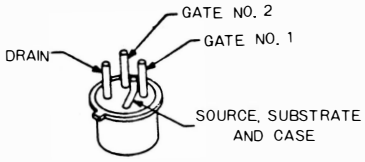
# PARTS LIST

| | ACCESSORIES | | | TONE SQUELCH UNIT | | | | |
|---|---|---|---|---|---|---|---|---|
| Symbol Number | Parts Number | Description | | Symbol Number | Parts Number | Description | | |
| | | ACCESSORIES | | | | Tone Squelch Board with Components | | |
| | 77000011 | Microphone Assembly YE-11 | | PB-1555A | 60315551 | Printed Circuit Board | | |
| | | with Microphone Hanger, Screws | | | | | | |
| | 67040001 | Microphone Plug | FM-144P | | | IC, FET & TRANSISTOR | | |
| | | | | Q501 | | IC | MC3403 | |
| | 67050003 | ACC Plug | CP-0084 | Q502 | | 〃 | NE567 | |
| | | | | Q503 | 22800195 | FET | 2SK19GR | |
| | 96000020 | Power Cord Assembly | #240028 | Q504,505 | 22303724 | Tr | 2SC372Y | |
| | 67020006 | Power Plug | FM-142P | | | | | |
| | 69000002 | Fuse Holder | SN-1102 | | | DIODE | | |
| | 73000003 | Fuse | 3A | D501 | 21090131 | Zener Diode | RD8.2EB | |
| | | | | | | | | |
| | 67020008 | Sigarette Lighter Adapter | | | | RESISTOR | | |
| | | | | R518 | 40143101 | Carbon Film | ¼W | VJ 100Ω |
| | | | | R512 | 40143103 | 〃 〃 | 〃 | 〃 10KΩ |
| | | | | R504 | 40143123 | 〃 〃 | 〃 | 〃 12KΩ |
| | 73000003 | Fuse | 3A | R510,511,517 | 40143223 | 〃 〃 | 〃 | 〃 22KΩ |
| | | | | R502,508 | 40143393 | 〃 〃 | 〃 | 〃 39KΩ |
| | 67020003 | External Speaker Plug | P-2240 | R501,505,521,522 | 40143473 | 〃 〃 | 〃 | 〃 47KΩ |
| | | | | R506,507 | 40143823 | 〃 〃 | 〃 | 〃 82KΩ |
| | 93100046 | Tap Connector | No. 560 | R509,514 | 40143154 | 〃 〃 | 〃 | 〃 150KΩ |
| | | | | R503 | 40143474 | 〃 〃 | 〃 | 〃 470KΩ |
| | 80038631 | Stand | | R515,519 | 40143105 | 〃 〃 | 〃 | 〃 1MΩ |
| | | | | R513,524 | 40143153 | 〃 〃 | 〃 | 〃 15KΩ |
| | 80038661 | Mobile Bracket Assembly | | R516 | 40143393 | 〃 〃 | 〃 | 〃 39KΩ |
| | | with Set Screws | | R513,524※ | 40143822 | 〃 〃 | 〃 | 〃 8.2KΩ |
| | | | | R514※ | 40143274 | 〃 〃 | 〃 | 〃 270KΩ |
| | | | | R516※ | 40143333 | 〃 〃 | 〃 | 〃 33KΩ |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | POTENTIOMETER | | |
| | | | | VR501,504 | 49905102 | SR-19R | | 1KΩB |
| | | | | VR502 | 49800084 | TM062P | | 100KΩB |
| | | | | | | | | |
| | | | | | | CAPACITOR | | |
| | | | | C503 | 36825102 | Mylar | 50WV | 0.001μF |
| | | | | C512 | 36825472 | 〃 | 〃 | 0.0047μF |
| | | | | C506,507,520 | 36825103 | 〃 | 〃 | 0.01μF |
| | | | | C502,504,505,508,511 | 36825223 | 〃 | 〃 | 0.022μF |
| | | | | C509 | 36825473 | 〃 | 〃 | 0.047μF |
| | | | | C516 | 36825154 | 〃 | 〃 | 0.15μF |
| | | | | C516※ | 36825104 | 〃 | 〃 | 0.1μF |
| | | | | C514,522 | 34820105 | Electrolytic | 50WV | 1μF |
| | | | | C501,510,513,521,524 | 34226106 | 〃 | 16WV | 10μF |
| | | | | C515,517,519 | 34226226 | 〃 | 〃 | 22μF |
| | | | | C523 | 36226154 | Tantalum | 35WV | 0.15μF |
| | | | | C518 | 36226475 | 〃 | 〃 | 4.7μF |

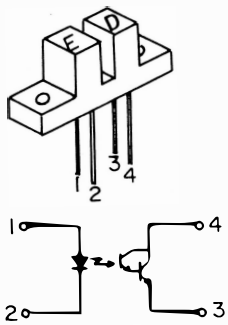
# TRANSISTOR & IC CONNECTIONS



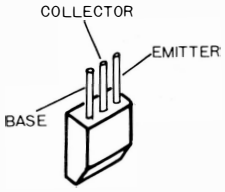

2SK19Y
2SK19GR



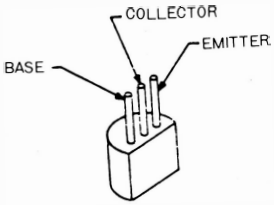

3SK40M
3SK51




PS4001




2SC535A

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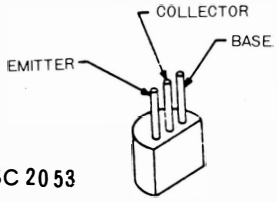


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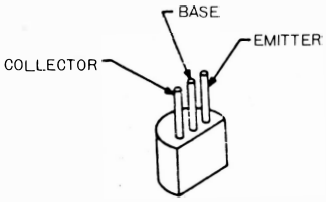


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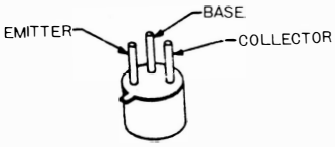


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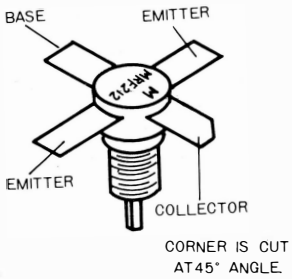


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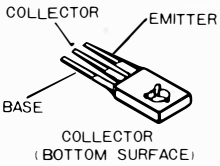


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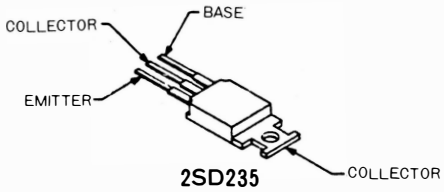


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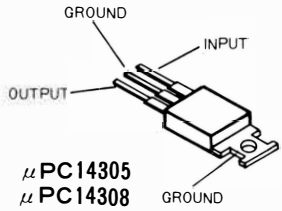


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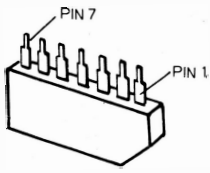


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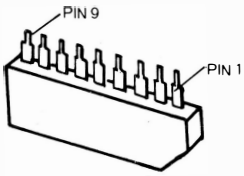


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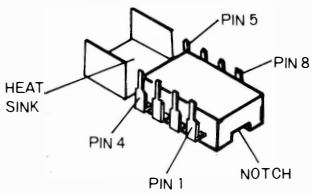


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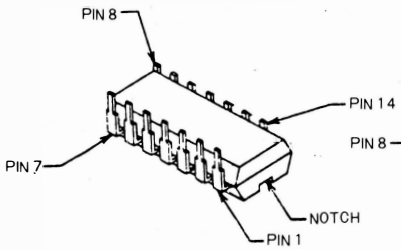
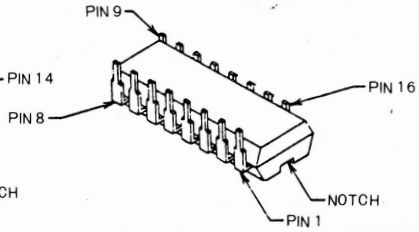
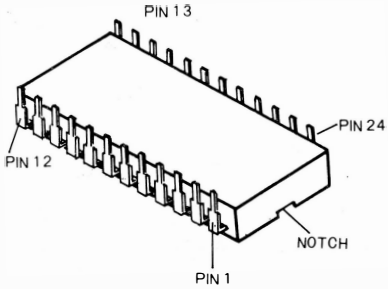



MC14011B
MC14081B




MSM561 MC14049B
MC14008B MC14510B
MC14028B MC14511B
MC14042B MC14519B

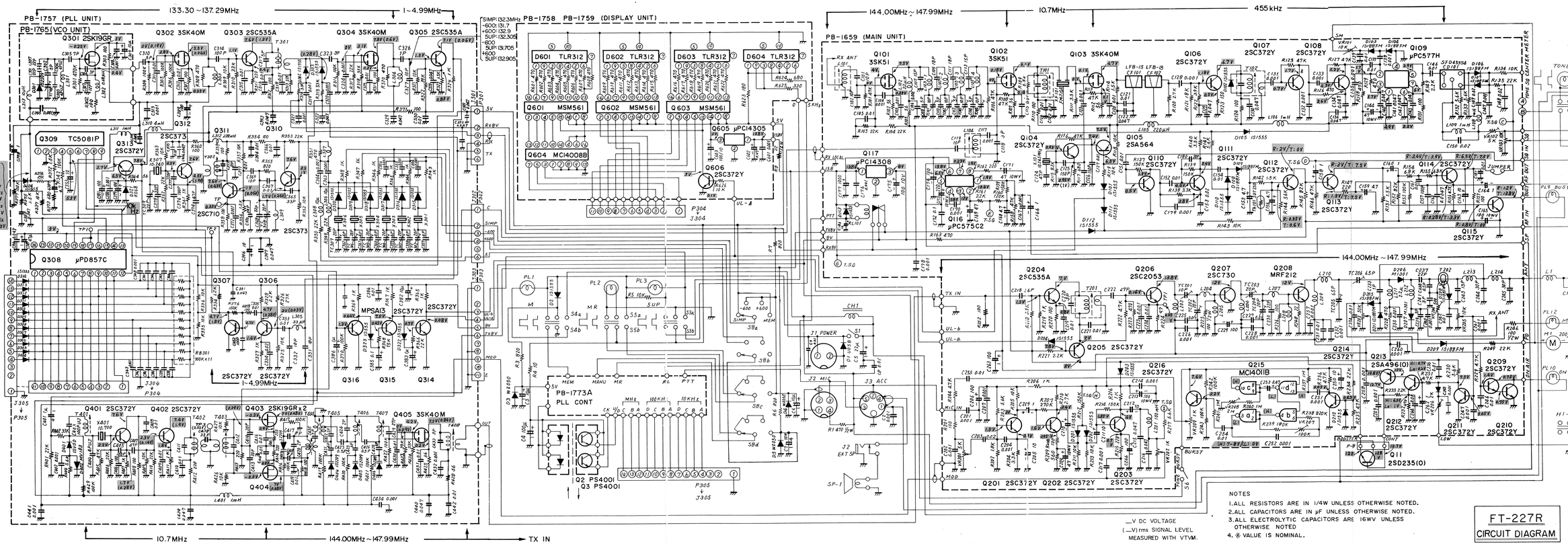



μPD857C

Q308 (μPD857C) PROGRAMMABLE DIVIDER CODE

| Q308 PROGRAMMABLE INPUT PIN → | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P/J305 → | | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| P/J304 → | | | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
| FREQUENCY ↓ | DIAL DISPLAY ↓ | PROGRAMMABLE DIVIDER RATIO ↓ | $P_1$ | $P_2$ | $P_3$ | $P_4$ | $P_5$ | $P_6$ | $P_7$ | $P_8$ | $P_9$ | $P_{10}$ | $P_{11}$ |
| 144.00 | 4.000 | 1/100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.01 | 4.010 | 1/101 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.02 | 4.020 | 1/102 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.03 | 4.030 | 1/103 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.04 | 4.040 | 1/104 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.05 | 4.050 | 1/105 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.06 | 4.060 | 1/106 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.07 | 4.070 | 1/107 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.08 | 4.080 | 1/108 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.09 | 4.090 | 1/109 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 144.10 | 4.100 | 1/110 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.11 | 4.110 | 1/111 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.12 | 4.120 | 1/112 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.13 | 4.130 | 1/113 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.14 | 4.140 | 1/114 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.15 | 4.150 | 1/115 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.16 | 4.160 | 1/116 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.17 | 4.170 | 1/117 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.18 | 4.180 | 1/118 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 4.19 | 4.190 | 1/119 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 144.20 | 4.200 | 1/120 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 4.30 | 4.300 | 1/130 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 4.40 | 4.400 | 1/140 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 4.50 | 4.500 | 1/150 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 4.60 | 4.600 | 1/160 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 4.70 | 4.700 | 1/170 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 4.80 | 4.800 | 1/180 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 4.90 | 4.900 | 1/190 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 145.00 | 5.000 | 1/200 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.01 | 5.010 | 1/201 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.02 | 5.020 | 1/202 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.03 | 5.030 | 1/203 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.04 | 5.040 | 1/204 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.05 | 5.050 | 1/205 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.06 | 5.060 | 1/206 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.07 | 5.070 | 1/207 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.08 | 5.080 | 1/208 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.09 | 5.090 | 1/209 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.10 | 5.100 | 1/210 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| 145.20 | 5.200 | 1/220 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| 145.30 | 5.300 | 1/230 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 145.40 | 5.400 | 1/240 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 145.50 | 5.500 | 1/250 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 |
| 145.60 | 5.600 | 1/260 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 145.70 | 5.700 | 1/270 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| 145.80 | 5.800 | 1/280 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 145.90 | 5.900 | 1/290 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 146.00 | 6.000 | 1/300 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| 147.00 | 7.000 | 1/400 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 147.99 | 7.990 | 1/499 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |

※1 HIGH LEVEL (5V)
※0 LOW LEVEL (0V)

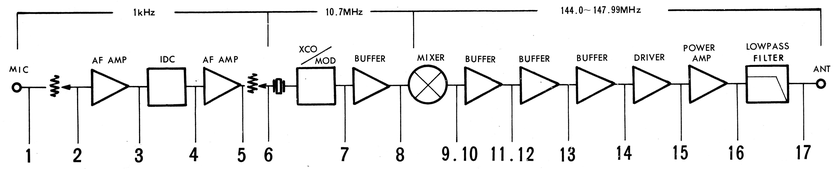


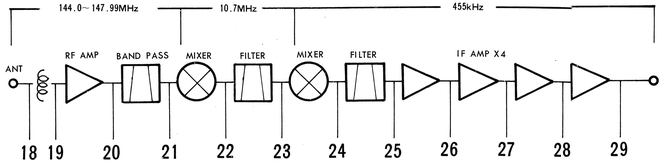

NOTES

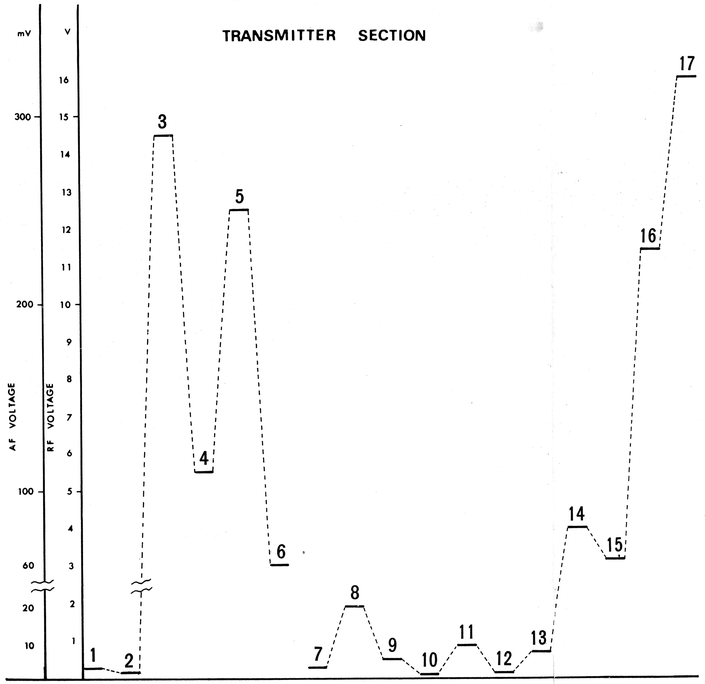
1. ALL RESISTORS ARE IN 1/4W UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN μF UNLESS OTHERWISE NOTED.
3. ALL ELECTROLYTIC CAPACITORS ARE 16WV UNLESS OTHERWISE NOTED
4. ※ VALUE IS NOMINAL.

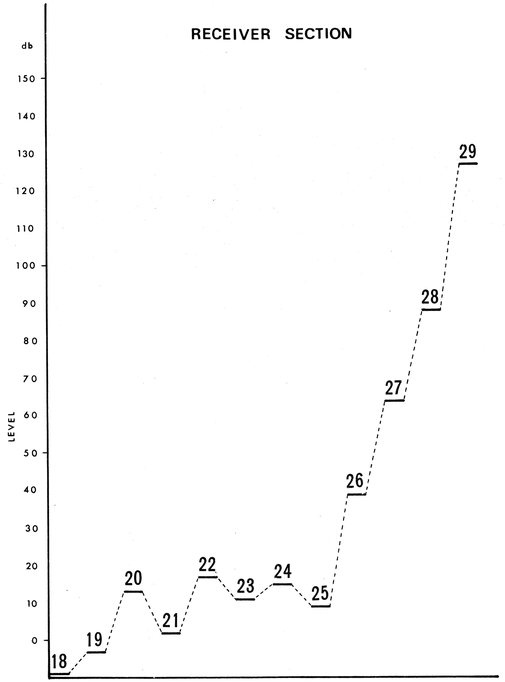
__V DC VOLTAGE
(__V) rms SIGNAL LEVEL
MEASURED WITH VTVM.

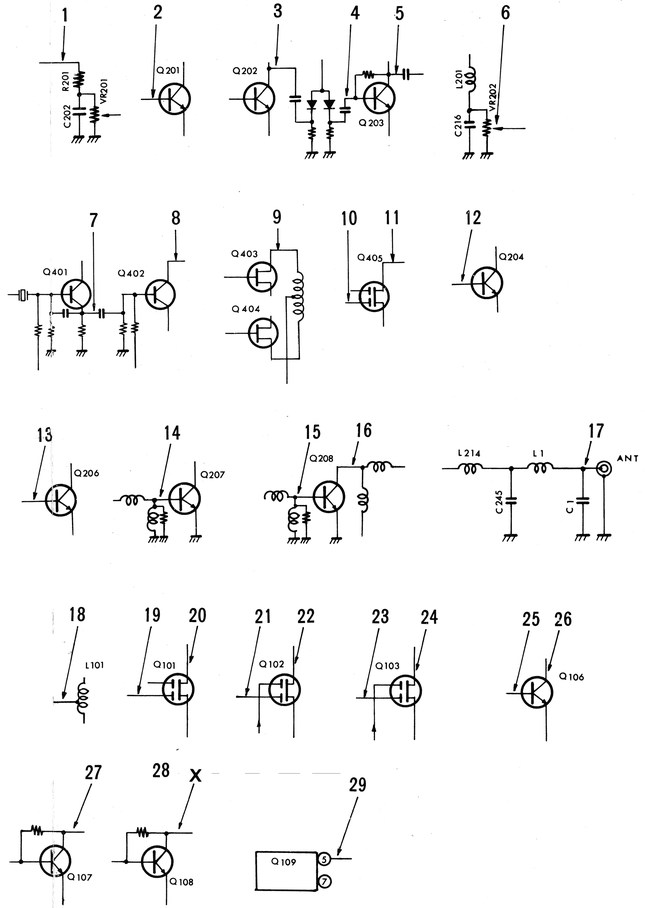
# FT-227R
## CIRCUIT DIAGRAM




LEVEL DIAGRAM

Meus mais sinceros agradecimentos a generosidade de PY2WFG Wilson da Willtec Comunicação
por ceder este e centenas de outros manuais para serem scaneados. Se voce baixou um manual
raro de equipamento nacional ou importado, provavelmente veio do Wilson.
Scaneado em Nov. 2021 por PU2SEX Alexandre Souza
DISTRIBUICAO GRATUITA - www.tabalabs.com.br/esquemateca

YAESU