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### FT-790R MODEL CHART

MODEL	FREQUENCY RANGE	PRESET FREQUENCY	FREQUENCY STEP		REPEATER SHIFT (FM)	TONE CALL FREQUENCY
			SSB	FM		
A	430 - 439.9999 MHz	436.000 MHz	100 Hz/1 kHz	25 kHz/100 kHz	±5 MHz	1800 Hz
B	430 - 439.9999 MHz	433.400 MHz	100 Hz/1 kHz	25 kHz/100 kHz	-7.6 MHz REV	1750 Hz
C	430 - 439.9999 MHz	433.400 MHz	100 Hz/1 kHz	25 kHz/100 kHz	+1.6 MHz REV	1750 Hz
F	430 - 439.9999 MHz	433.000 MHz	100 Hz/1 kHz	10 kHz/100 kHz	±5 MHz	-

Note: Model F is for use in Japan only, and cannot be readily converted to other Models.

## FT-790R 0.7 METER PORTABLE TRANSCEIVER



### INTRODUCTION

The FT-790R is a fully portable, compact multi-mode transceiver for the 70 cm amateur band. Featuring PLL synthesis in 100 Hz, 1 kHz, 25 kHz, or 100 kHz steps, the FT-790R utilizes a Liquid Crystal Display for digital readout of the operating frequency. Ten memories, scanning of the band or memory channels, two VFOs, and receiver offset tuning make the FT-790R a significant breakthrough in technology.

Powered by eight "C" size dry cells or Ni-Cd batteries (not supplied), the FT-790R is completely self-contained and portable. A high-performance noise blanker is also included, for minimizing interference caused by impulse noise.

Power output is 1 watt, switchable to 0.2 watt for battery conservation. For memory backup purposes, a lithium cell is included, providing an estimated lifetime of five years because of the extremely low current consumption of the memory circuitry. The light weight, portability, and efficiency of the FT-790R make it suitable for field satellite operation, emergency FM work, or vacation enjoyment.

We recommend that you read this manual in its entirety, so as to understand more completely the many features of the exciting new FT-790R. With proper care in operation, this equipment will provide many years of reliable performance.

## SPECIFICATIONS

### GENERAL

**Frequency coverage:**  
430.0 – 440.0 MHz

**Modes of operation:**  
SSB (USB, LSB), CW and FM

**Synthesizer steps:**  
SSB/CW: 100 Hz, 1 kHz  
FM: 25 kHz, 100 kHz

**Power requirements:**  
8 C - size dry battery cells or  
8 C - size Ni-Cd battery cells  
External: 8 – 15V DC  
Memory backup: built-in lithium bat-  
tery cell

**Current consumption:**  
100 mA on receive; (FM)  
750 mA on transmit (1W RF, FM)

**Antenna impedance:**  
50 ohms

**Case size:**  
58(H) x 150(W) x 195(D) mm

**Weight:**  
1.3kg. without batteries

### TRANSMITTER

**Power output:**  
1 watt at 12 volts

**Carrier suppression:**  
Better than 40 dB

**Spurious radiation:**  
Better than –50 dB

**Unwanted sideband suppression:**  
Better than 40 dB

**Tone burst frequency:**  
1800 Hz (A model)  
1750 Hz (other models)

**Frequency response:**  
300 – 2700 Hz (–6 dB)

**FM deviation:**  
±5 kHz

**Microphone impedance:**  
600 ohms

### RECEIVER

**Circuit type:**  
SSB/CW: Double conversion  
superheterodyne  
FM: Triple conversion  
superheterodyne

**Intermediate frequencies:**  
1st IF 67.3 MHz  
2nd IF 10.7 MHz  
3rd IF 455 kHz (FM)

**Sensitivity:**  
SSB/CW: 0.16µV for 10 dB S/N  
FM: 0.25µV for 12 dB SINAD

**Selectivity:**  
SSB/CW: 2.4 kHz at 6 dB down;  
4.1 kHz at 60 dB down  
FM: 12 kHz at 6 dB down;  
25 kHz at 60 dB down

**Image rejection:**  
Better than –60 dB

**Audio output impedance:**  
8 ohms

**Audio output:**  
1 watt @10% THD

### RPT SHIFT

Model A ±5 MHz  
Model B –7.6 MHz, REV  
Model C +1.6 MHz, REV

## SEMICONDUCTORS

### ICs:

HD44820-A62 1  
MC3357P 1  
MC14069UB 3  
ND487C2-3R 1  
(Ring Module)  
TP0401 1  
µPC575C2 1  
µPC577H 1  
µPC1037H 1  
µPC1170H 1  
µPD2819C 1  
TC-5082P 1

### FETs:

2SK168D 1  
2SK184Y 2  
2SK192GR 1  
2SK193K 4  
2SK241GR 3  
3SK51-03 1  
3SK73Y 3

### Transistors:

2SA733AP 7  
2SA1175E 3  
2SB548P 1  
2SC535B 6  
2SC945AP 21  
2SC1815GR 1  
2SC2026 1  
2SC2120Y 1  
2SC2407 1  
2SC2570A 4  
2SC2785E 2  
2SC3019 1  
2SC3020 1

### Diodes:

1S188FM (Ge) 4  
1S1555 (Si) 3  
1SS53 (Si) 67  
1SS97 5  
(Schottky Barrier)  
1T25 (Varactor) 1  
FC53M-4 (Varactor) 6  
HZ4C3 (Zener) 1  
HZ6C2L (Zener) 1  
HZ7B1 (Zener) 1  
HZ9B2L (Zener) 1  
MV-11 (Varistor) 2  
TLG205 (LED) 1  
TLR205 (LED) 1  
U05B (Si) 1  
V06C (Si) 2

**Liquid Crystal Display:**  
H1313A 1

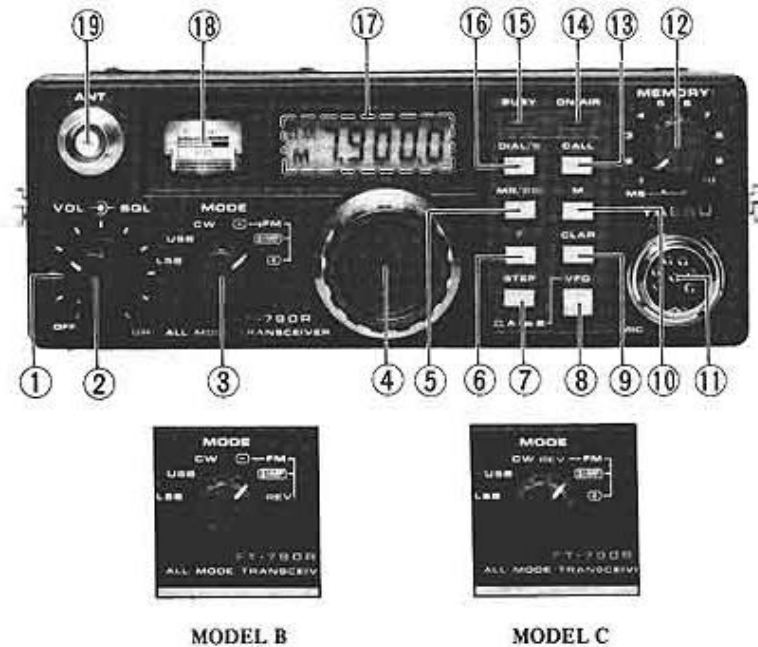
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## ACCESSORIES

Whip Antenna (Q3000031) 1  
Microphone (M3090033) 1  
Microphone Hanger (R0071360) 1  
Shoulder Strap (R7070600) 1  
External DC Plug (P1090139) 1  
External Speaker Plug (P0090034) 1



## FRONT PANEL CONTROLS AND SWITCHES



### (1) SQL

The squelch control silences the receiver in the FM mode when no stations are being received on the channel in use. The SQL control should only be advanced to the threshold point of background noise silencing; further advancing this control will lead to reduced sensitivity to weak signals.

### (2) VOL

This is the audio gain control for the receiver, as well as the main ON/OFF switch for the transceiver.

### (3) MODE

This selector determines the desired operating mode: LSB, USB, CW or FM. The  $\ominus$ , **SIMP** and  $\oplus$  positions select FM simplex or transmitter offsets for FM repeater operation. The  $\oplus$  position is labelled **REV** in Model B, indicating that the transmit and receive frequencies are reversed. The  $\ominus$  position is labelled **REV** in Model C for the same reason.

### (4) MAIN DIAL

The main tuning dial is used for selection of operating frequencies using the two main VFOs or the clarifier. In the LSB, USB, and CW modes, synthesizer steps of 100 Hz or 1 kHz are programmed, while on FM the channel steps are 25 kHz or 100 kHz each. In the clarifier mode, the synthesizer moves in 100 Hz steps.

### (5) MR/PRI

This switch selects either the memory recall mode or priority channel operation. If only the MR/PRI switch is pressed, the memory channel selected by the MEMORY rotary switch will be activated. If the yellow F button is first pressed and then the MR/PRI button, priority channel operation will be selected.

### (6) F

The yellow "F" (Function) button activates either the priority channel mode or the memory split mode. The F button itself does not select a mode, but it programs the microprocessor to select the mode labeled in yellow letters on either of the two switches immediately above the F button: DIAL/S or MR/PRI.

### (7) STEP

This switch selects the desired synthesizer steps. In the LSB, USB, or CW mode, the preset mode\* is 100 Hz per step. Press the STEP button to switch to 1 kHz steps. A second press of this switch returns you to 100 Hz steps. In the FM mode, the preset is for 25 kHz steps. Pressing the STEP switch selects 100 kHz steps, while a second press returns you to 25 kHz steps.

### (8) VFO Switch

The VFO button selects one of the two internal VFOs on the FT-790R. Press the VFO switch to select VFO-B, and dial up the new frequency. A second press of the button releases the switch, returning you to VFO-A.

\* When the lithium memory backup is on, switch-on (preset) conditions will be the same as when the transceiver was last switched off.

#### (9) CLAR

This switch activates the receiver offset tuning feature (Clarifier). The clarifier allows  $\pm 9.9$  kHz of offset from the transmit frequency, tuned in 100 Hz steps (all modes).

#### (10) M

The M (Memory) button is used to store a frequency in memory.

#### (11) MIC

This seven pin jack accepts microphone audio input, the scanning control lines, and the PTT (Push to Talk) control line. Microphone impedance is 500 ohms.

#### (12) MEMORY

The memory channel selector is used to choose any of the 10 memory channels. In the MS (Memory Scan) position, scanning of the memories may be performed.

#### (13) CALL

When this button is pressed (FM mode only), an 1800 Hz tone will be superimposed on the microphone line, and the PTT switch line will be grounded, activating the transmitter. This allows manual-length access of repeaters requiring a burst tone.

#### (14) ON AIR

This indicator lights up while transmitting.

#### (15) BUSY

This indicator lights up when the main squelch is opened up by an incoming signal.

#### (16) DIAL/S

When the DIAL/S button alone is pushed, tuning is accomplished by the main dial on either VFO-A or VFO-B. If the F button is pushed and then the DIAL/S button, the memory split mode will be selected; for receiving on the memory while transmitting on the VFO.

#### (17) DIGITAL DISPLAY

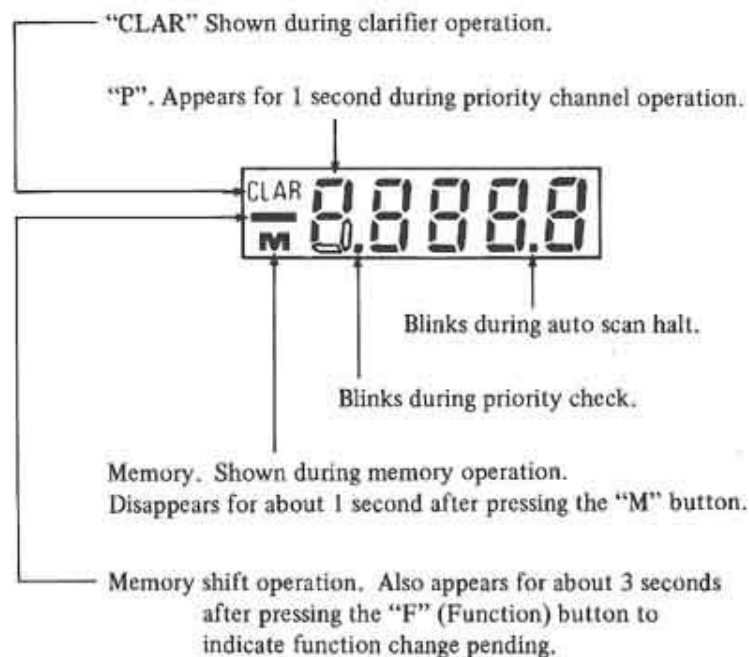
The digital display uses an LCD for indication of the operating frequency and mode. The frequency readout displays the last five digits of the operating frequency, with resolution to 0.1 kHz. Indicators are also provided for indication of clarifier operation ("CLAR"), priority channel operation ("P"), memory channel operation ("M"), or memory split operation ("—" on transmit).

#### (18) S/PO METER

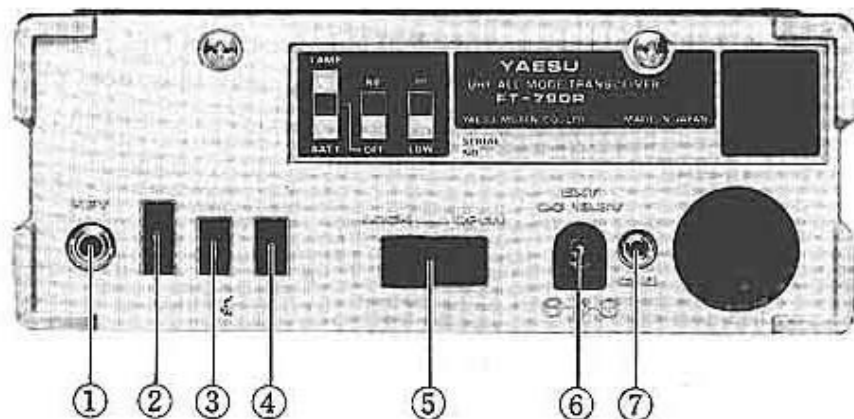
The meter allows determination of incoming signal strength and relative power output. The meter is also used for checking battery condition.

#### (19) ANTENNA

The ANTENNA jack is a BNC type connector for quick connection of the rubber flex antenna or an external antenna.



## REAR APRON SWITCHES AND JACKS



### (1) KEY

This jack is used for the keying input line. Use a miniature phone plug for connection to your telegraph key or keyer. The key-up voltage is 7V, and the key-down current is 0.3 mA.

### (2) LAMP/BATT

With this switch in the LAMP position, the front panel meter and display will become illuminated for nighttime operation. If the power switch (on the VOL control) is off, this lamp will stay off, thus preventing inadvertent battery discharge.

In the BATT position, the battery voltage is checked. The meter needle should deflect at least to the dividing line between the green and white zones of the meter scale. If not, the batteries require replacement or recharging.

### (3) NB

This switch activates the built-in noise blanker. This blanker helps in minimizing pulse-type noise such as that caused by automotive ignition systems.

### (4) HI/LOW

This switch selects power outputs of 1.0 watt (HI) or 0.2 watt (LOW).

### (5) CASE LATCH

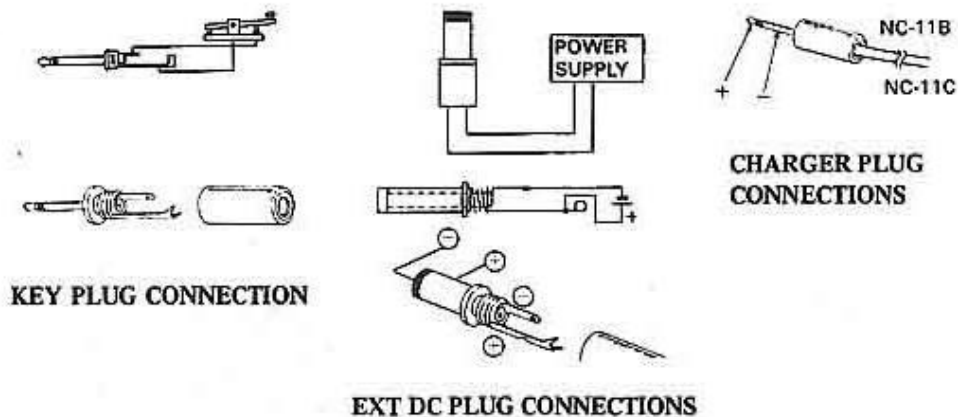
This mechanism provides easy opening and closing of the cabinet for battery replacement.

### (6) EXT DC 13.8V

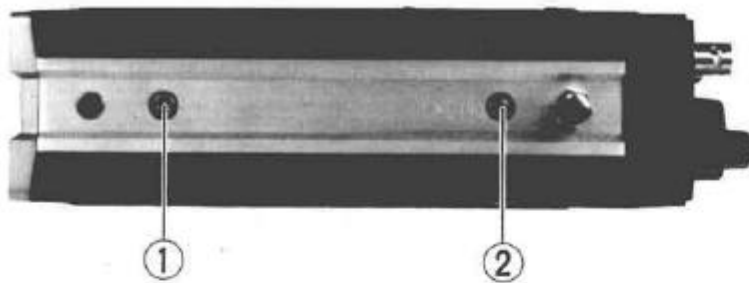
Use this jack for connection to an external DC supply. Never exceed 15 volts at this jack, and never apply AC power of any kind at this point. Also, be absolutely certain that DC power of the proper polarity is applied; when replacing DC plugs, check to be sure that the plug is wired correctly, as there is no standardized wiring polarity for the power plug used for the FT-790R. Failure to observe these simple precautions will void any and all warranties on this equipment.

### (7) CHG

The external charge jack accepts charging voltage from the NC-11B/C battery charger (option). When using alkaline or other dry cell batteries, do not attempt to recharge them. Use only C size Ni-Cd cells (available from your Yaesu dealer) if you intend to recharge the cells.



## SIDE PANEL JACKS

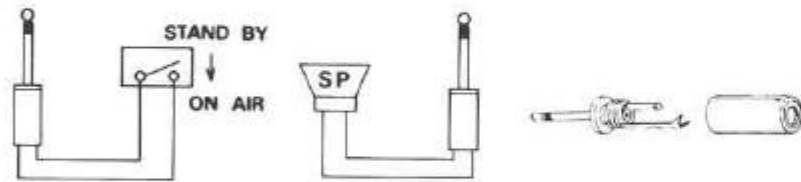


### (1) STAND BY

This jack is wired in parallel with the PTT line of the microphone, allowing the use of a footswitch to activate the transmitter.

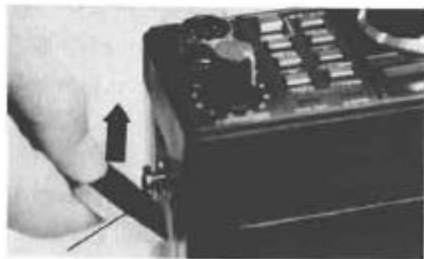
### (2) EXT SP

Use this jack to connect an external speaker. The output impedance is 8 ohms.



## SHOULDER STRAP ATTACHMENT AND REMOVAL

### ATTACHMENT



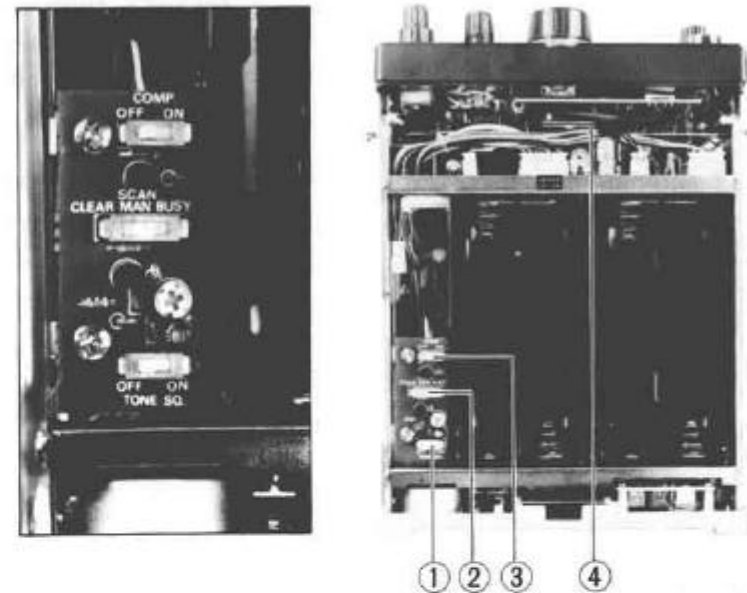
Press pin into hole, then pull up tab.

### REMOVAL



Press with thumb while lifting tab, swiveling back and forth slightly until pin disengages.

## INTERNAL SWITCHES



### (1) TONE SQ.

When the optional tone squelch unit is installed, this switch will place the unit in operation.

### (2) SCAN

This switch selects automatic scan stop on a busy or clear channel, per your requirements. Manual scanning can also be selected, if desired.

### (3) COMP

This switch activates the audio speech compressor for the SSB and FM modes. Average power in the SSB mode will be increased, with some loss of fidelity.

### (4) BACKUP

This switch activates the lithium memory backup feature, and may be turned on and left on indefinitely. See the Operation section for details.

## ANTENNA CONSIDERATIONS

The FT-790R comes equipped with a 1/2 wavelength rubber flexible antenna, which should be sufficient for local work through repeaters, etc. Different types of antennas may be connected to the top panel BNC connector.

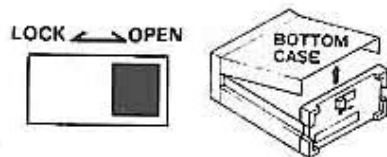
An external antenna must have an impedance of 50 ohms, and should be fed with good quality cable. If your current antenna has a connector which differs from the BNC type, consult your dealer regarding the purchase of a suitable adapter.

For base station use, gain antennas such as the yagi, quad, stacked vertical, etc., will enhance long distance communications. These antennas are also available from most Yaesu dealers.

## BATTERY INFORMATION

The FT-790R is designed for use with eight size C Ni-Cd rechargeable cells or eight dry cells of the same size. When using alkaline cells or other dry cell types, no "dummy" battery is required, as the FT-790R will tolerate the slightly elevated voltage of these batteries as compared to Ni-Cd cells.

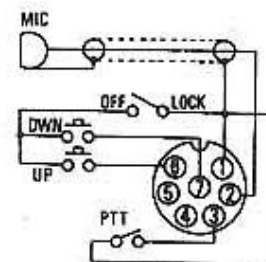
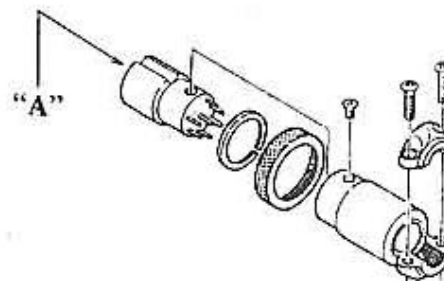
To install batteries, set the rear panel lever to OPEN to unlock the case. The bottom cover may then be carefully removed, exposing the battery holder. Install the eight new cells, being absolutely certain to observe the proper polarity.



### WARNING

Serious damage can occur if incorrect battery polarity is used. Our warranty does not cover damage caused by incorrect polarity in the battery compartment.

## MICROPHONES



Viewed from "A" Side

## MICROPHONE PLUG CONNECTIONS

YM-47



YM-49  
OPTIONAL SPEAKER  
MICROPHONE



YM-50  
OPTIONAL DTMF  
MICROPHONE



If Ni-Cd cells are used, the optional NC-11B/C battery charger may be used to return the cells to a full charge. Allow the cells to discharge to the minimum operating voltage before recharging them. If the cells are only partially exhausted, and repeatedly recharged in this condition, they may develop a memory for this level, and not provide full discharge capability.

Ni-Cd cells suitable for use in the FT-790R are available from your Yaesu dealer. Ask also for the MMB-11 Mobile Mounting Bracket, FL-7010 Linear Amplifier, YM-49 and YM-50 microphones, and CSC-1A vinyl carrying case for the FT-790R.



NC-11B (117V AC)



NC-11C (220-234V)



FT-790R/MMB-11/YM-47/FL-7010



FT-790R/CSC-1/CSC-1A/YM-47

## OPERATION

The tuning procedure for this transceiver is not complicated. However, because microcomputer circuitry is used extensively throughout the transceiver, this section should be read thoroughly, so as to understand all of the features that are made available. Note that off-frequency operation could occur without proper setting of the controls.

### INITIAL CHECK

Before operating the transceiver, be certain that the necessary batteries are installed in the case, as described previously. If an external voltage source is used instead of batteries, confirm that the proper DC voltage is being applied to the rear panel jack, and that the proper polarity is used.

### FREQUENCY READOUT

Frequency display is provided by a five-digit Liquid Crystal Display (LCD) system. Resolution of the last five digits of the operating frequency is provided to 0.1 kHz.

When operating on a memory channel, the letter "M" will appear on the left side of the display. The memory channel number is shown on the selector switch labeling, and the actual memorized frequency appears on the digital display.



## SSB OPERATION

Preset the controls and switches as follows:

VOL	OFF (Fully counterclockwise)
SQL	Fully counterclockwise
MODE	Desired mode, USB or LSB
MEMORY	Channel 1
LAMP (Rear apron)	OFF
NB ( " " )	OFF
HI/LOW ( " " )	HI

Rotate the VOL switch out of the click-stop, and adjust the volume level for comfortable audio output from the speaker. The display will indicate the operating frequency. When the transceiver is switched OFF, the lithium backup feature will ensure that the transceiver retains the frequency, step and mode (dial or memory) last used.

The STEP switch is used to select the desired synthesizer step, 1 kHz or 100 Hz per step (SSB/CW modes). If you rotate the main tuning dial, initially the synthesizer will provide 1 kHz steps. Press the STEP button once, and you will note that the steps are now 100 Hz (0.1 kHz) each. Another pressing of the STEP button will return the selection to 1 kHz/step.

Rotate the main tuning dial until an SSB signal is heard. Using the 100 Hz/step mode, tune in the signal until a natural reproduction of the voice signal is obtained.

To transmit, close the microphone PTT switch, and speak at a normal level into the microphone. Release the PTT switch for receiver recovery. The microphone amplifier gain is preset in this transceiver and requires no adjustment for normal operation.

If the station you are in contact with begins to drift, you may follow the station by activating the receiver offset tuning control (CLARIFIER). Push the CLAR button, and then rotate the main tuning dial (or push the scanning controls) until the desired frequency is reached. In the CLAR mode, the synthesizer automatically is set to the 100 Hz/step mode, and the STEP button is disabled. The clarifier leaves the transmit frequency unchanged.

Push the CLAR button again to return to normal operation with the clarifier off. If you switch the clarifier on again, the receiver will not return to the last offset frequency, but rather will initiate on the current operating frequency.

For satellite operation, it is possible for the transmit frequency to be varied while transmitting.

If pulse-type noise is encountered, the rear apron NB (Noise Blanker) switch may be activated. The FT-790R noise blanker is helpful in reducing interference caused by pulse noise such as that produced by automobile ignition systems.

To reduce power for local communication, place the HI/LOW power switch in the LOW position. In this position, the PEP output power is approximately 200 mW. Battery consumption will be greatly reduced by using the low power position whenever possible.

## CLARIFIER OPERATION

Offset tuning is provided on receive, for tracking of unstable or Doppler-shifted signals. The clarifier may be used either on VFO frequencies or memory frequencies.

To activate the clarifier, push the CLAR button once. The letters "CLAR" will appear on the digital display. Now, tune the receiver as needed to follow the unstable signal. The synthesizer automatically programs 100 Hz steps for clarifier operation. A frequency shift of up to 10 kHz can be accomplished by using the clarifier.

When you close the PTT switch, the digital display will revert to the frequency programmed before the clarifier was switched on. In other words, your transmit frequency has remained unchanged, while your receive frequency has been varied.

A second press of the CLAR button will cancel clarifier operation. If the CLAR button is then pressed again, switching the clarifier back on, the clarifier is zeroed to the original operating frequency (before any offset), not to the offset frequency tuned previously.

THE UP/DWN CONTROLS ON THE MICROPHONE MAY BE USED FOR SCANNING DURING CLARIFIER OPERATION.

## VFO SELECTION

Two VFOs are available on the FT-790R for split frequency operation. The VFO selector button is the largest of the eight selector buttons on the front panel of the FT-790R. This switch is a push-push type, not the momentary type used for the other selector buttons.

For VFO B operation, push the VFO button once; the switch will hold inward, and the desired frequency may then be dialed up. Be certain, of course, that you are in the DIAL mode. To return to VFO A, simply push the VFO button again to release the switch.

It is not possible to receive on one VFO while transmitting on another. For frequency splits of 10 kHz or less, use the clarifier to achieve this function. Otherwise, use the MEMORY SPLIT mode described elsewhere in this manual.

## NOTE REGARDING BACKUP OPERATION

When a backup battery or main batteries are first installed in the FT-790R (after service or replacement), it is necessary to reset the microcomputer properly. Failure to follow a simple sequence of steps may cause erratic operation.

- (1) Set both the VOL and memory backup switches (memory backup switch is located inside the cabinet, as shown on page 11) to OFF.
- (2) Replace the memory backup battery and main batteries (if removed).
- (3) Turn the VOL control out of the click-stop, turning the transceiver ON.
- (4) Now turn the backup switch to ON. The CPU is now reset, and the backup switch may be left on indefinitely, owing to the very low current drain in the backup mode.

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## MEMORY OPERATION

Ten memory channels are available for storage and recall of favorite operating frequencies. The procedure for entry and recall of memory channels is extremely simple.

Push the DIAL switch for normal tuning, using the main tuning dial. When you have found a frequency you wish to store in memory (for example 432.525 MHz), rotate the MEMORY switch to 1 (channel 1) and push the M (memory store) button. If you wish to store 438.500 MHz in channel 2, rotate the main dial to that frequency, rotate the MEMORY switch to channel 2, push M, and so forth. This procedure may be repeated for all 10 memory channels.

To recall these frequencies, push the MR button (memory recall) and rotate the MEMORY switch to select the desired channel. One push of the MR button will keep you on memory recall operation until the DIAL button is pushed again to return you to main dial tuning. Note that there is no formal erasure procedure for memory channels. When you push the M button, the previous frequency stored in that position will be erased. Until a frequency is programmed into a memory channel (from initial switch on of the transceiver), 436.000 MHz (or 433.4 MHz) will be preset in all memory channels.

## SCANNER OPERATION

The UP/DWN scanning controls on the microphone may be used to control the operating frequency.

When in the DIAL mode, one push of the UP button will cause the frequency to advance upward by one step of the synthesizer (the step size being programmed by the mode switch and the STEP button). If you hold the UP button down for more than 1/2 second, the scanner will become engaged, and you will begin scanning up the band. Push the UP or DWN button or the PTT switch to halt the scan.

Scanning toward a lower frequency is achieved by using the same procedure, only using the DWN button on the microphone.

To scan only the memory channels, rotate the MEMORY selector to either of the MS (Memory Scan) positions, and press the MR button. Now, when you push and hold the UP or DWN button, the scanner will search the memory channels only. Manual halting of the scan is accomplished by pushing the UP, DWN, or PTT switches as before.

Inside the case of the radio, the SCAN switch allows selection of one of three scan halt modes. In the MAN (Manual) position, scanning is halted as discussed above. If the BUSY position is selected (see Page 11), the scanner will search until a busy channel (one occupied by a station strong enough to break the main squelch) is received. The scan will then pause on that frequency for five seconds. If you choose to stay on that frequency, press one of the scan control buttons or the PTT switch. While in the PAUSE mode, the decimal point farthest to the right will blink; when you push a button to halt the resumption of the scan, the blinking will stop.

To scan for a clear channel (one where the squelch does not open), set the SCAN switch to CLEAR. The scan will halt, and the decimal point will blink, as in the previous section. Press the UP, DWN, or PTT switch to cancel the pause/resume feature and hold on the frequency you stopped at.

Memory scan halting follows the same format as main dial scanning.

## PRIORITY CHANNEL OPERATION

Priority channel operation uses a combination of the main dial VFO and the memory. It can be used in conjunction with the automatic scan stop feature of the microprocessor, if desired. The steps for priority channel operation are detailed below.



- (1) Program into memory the desired priority channel. Do not recall the channel at this time.
- (2) Dial up a basic operating frequency on the main VFO. This will be your main operation channel during priority channel operation.
- (3) Set the SCAN switch to BUSY or CLEAR, as desired.
- (4) Now push the yellow F button, followed immediately by a press of the MR/PRI button. The letter "P" will appear on the digital display, signifying priority channel operation. The display will then show the VFO frequency, with a flash every five seconds to the memory channel being checked for activity. When the memory channel is busy or clear (depending on your instructions), the scanner will halt on the memory channel. The pause/restart feature does not function in this mode; to restart, simply press the F and MR/PRI buttons again.
- (5) If the SCAN switch is set to the MAN position, the CPU will have no instructions for halting the scan. Simply press the DIAL or MR button to select the desired channel under this mode of operation. If you hit the PTT switch during manual priority channel operation, the checking of the priority channel will be delayed by five seconds.

## MEMORY SPLIT OPERATION

The memory split operation mode is useful for covering unusual repeater splits or other occasions where the receive frequency may be fixed, but the transmit frequency is variable. In this mode, you receive on a memory channel, while transmitting on the VFO.

- (1) Store the desired receive frequency into a memory channel.
- (2) Dial up the desired transmit frequency on the main dial.
- (3) Now press the yellow F and DIAL/S buttons. You will be receiving on the memory, while transmitting on the VFO.
- (4) For transmitting purposes, either VFO A or VFO B may be used. Set the VFO selector as needed.

## CIRCUIT DESCRIPTION

The following circuit description, together with the block diagram (insert), is intended to provide an understanding of the basic circuit functions of this transceiver. Refer to the schematic diagram for more specific circuit and component details.

### RECEIVER

The incoming RF signal from the antenna jack is passed through a lowpass filter, antenna relay RL<sub>1001</sub> and helical resonator CV<sub>1001</sub> to RF amplifier Q<sub>1001</sub> (2SC2570A). After amplification the signal is filtered by helical resonator CV<sub>1002</sub> and applied to 1st mixer Q<sub>1002</sub> (2SC2570A), which also receives the 1st local signal, resulting in a 1st IF signal at 67.3 MHz.

The 1st IF signal is passed through the bandpass filter composed of T<sub>1001</sub> through T<sub>1003</sub>, and then applied to 2nd mixer Q<sub>1003</sub> (3SK51) along with the 78.025 MHz 2nd local signal, resulting in a 2nd IF signal at 10.7 MHz. This signal is passed through XF<sub>1001</sub> (10M30B x 2), a matched pair of monolithic crystal filters, between which the partially filtered signal is sampled for the noise blanker, mentioned later. From XF<sub>1001</sub> a portion of the signal is fed to FM IF amplifier Q<sub>1007</sub> (2SK241GR), while another portion is fed to IF amplifier Q<sub>1009</sub> (3SK73Y) for the other modes.

The noise sample signal from the middle of XF<sub>1001</sub> is applied to noise amplifier Q<sub>1004</sub> (μPC577H), the output of which is rectified by D<sub>1003</sub> and D<sub>1004</sub> (1S188FM) to switch Q<sub>1006</sub> (2SC945AP), which in turn biases Q<sub>1007</sub> and Q<sub>1009</sub> off for the duration of a noise pulse. A portion of the output of Q<sub>1004</sub> is also rectified by D<sub>1001</sub> and D<sub>1002</sub> (1S188FM x 2) and then amplified by Q<sub>1005</sub> (2SC945AP) to provide noise blanker AGC back to Q<sub>1004</sub>.

During FM operation, the amplified 2nd IF signal from Q<sub>1007</sub> is applied to the mixer section of Q<sub>1008</sub> (MC3357P), where the signal is mixed with a 10.245 MHz 3rd local signal generated within Q<sub>1008</sub> from crystal X<sub>1001</sub>. The 455 kHz resulting signal is passed through ceramic filter CF<sub>1001</sub>, and then back into the limiter amplifier section of Q<sub>1008</sub>, which amplifies the



signal and removes variations in amplitude. From the limiter amplifier section the signal is fed to the discriminator section, which produces an audio output corresponding to frequency variations in the 455 kHz IF signal.

When no carrier is present in the 455 kHz IF, the high frequency noise at the discriminator output, which is passed through a highpass filter, is amplified by the noise amplifier section of Q<sub>1008</sub> and detected by D<sub>1005</sub> (1S1555), producing a DC voltage. This voltage is fed to the squelch switch section of Q<sub>1008</sub>, which biases off Q<sub>1022</sub> (2SC945P) to interrupt the audio signal between the discriminator section of Q<sub>1008</sub> and the AF amplifier. The squelch switch section of Q<sub>1008</sub> also controls scan switch Q<sub>7001</sub> (2SC945P) on SW Unit B, which then informs the microprocessor on the Control Unit of signal conditions on the operating frequency for automatic scanning and tone squelch "BUSY" control functions.

When a carrier is present in the 455 kHz 3rd IF, the noise no longer appears at the discriminator and the audio amplifier then receives the voice signal from the discriminator, while the microprocessor is informed that the channel is busy. The SQL control on the front panel sets the threshold level of the noise quieting required to activate squelch switching.

SSB and CW signals in the 10.7 MHz 2nd IF are amplified by Q<sub>1009</sub> and passed through crystal filter XF<sub>1002</sub> to amplifiers Q<sub>1010</sub> and Q<sub>1011</sub> (3SK73Y) before being applied to balanced demodulator Q<sub>1012</sub> ( $\mu$ PC1037H) and AGC detectors D<sub>1024</sub> (1S188FM) and D<sub>1025</sub> (1SS97). Q<sub>1012</sub> is also fed with a carrier signal from carrier oscillator Q<sub>1015</sub> (2SC535B), and thus produces an audio output which is passed to the audio amplifiers.

The AF amplifier consists of preamplifier Q<sub>1023</sub> (2SC945P), lowpass filter Q<sub>1024</sub> (2SC945P) and audio power module Q<sub>3005</sub> ( $\mu$ PC575C-2). The FM audio from squelch switch Q<sub>1022</sub> or the SSB/CW audio from Q<sub>1012</sub> is amplified by Q<sub>1023</sub> and then filtered by Q<sub>1024</sub>, where the audio above 3 kHz is cut off. The audio is then delivered to Q<sub>3005</sub> on the AF Unit, where it is boosted to approximately 1 watt to drive the speaker.

The portion of the SSB/CW signal from Q<sub>1011</sub> rectified by D<sub>1024</sub> and D<sub>1025</sub> is then fed to DC amplifier Q<sub>1018</sub> (2SC1815GR), the output of which is applied to gate 2 of the MOSFETs in the IF amplifier chain. A portion of this AGC signal is buffered by Q<sub>1020</sub> (2SK184Y) and amplified by Q<sub>1021</sub> (2SA1175SE) for delivery to the meter for S-unit indication during reception.

## TRANSMITTER

The audio input signal from the microphone is amplified first by Q<sub>1025</sub> ( $\mu$ PC1170H), which also acts as an audio compressor when switched by Q<sub>7002</sub> (2SC945P). The output of Q<sub>1025</sub> is then applied to amplifier Q<sub>1026</sub> along with the burst oscillator tone from Q<sub>3007</sub> (TC5082), if activated from the Call switch via Q<sub>3006</sub> (2SA733P). The audio is then further amplified by Q<sub>1027</sub> (2SC945P) and filtered of components above 3 kHz by Q<sub>1028</sub> (2SC945P) before delivery to switch Q<sub>1030</sub> (2SC2120Y) for FM, and switch Q<sub>1031</sub> (2SC945P) for SSB. Q<sub>1026</sub>, Q<sub>1027</sub> and Q<sub>1028</sub> all are switched off by Q<sub>1029</sub> (2SA733P) during CW operation.

## SSB

When the SSB mode is selected, the amplified audio is passed through switch Q<sub>1031</sub> to balanced modulator module Q<sub>1012</sub> ( $\mu$ PC1037H), which also receives the 10.7 MHz signal from carrier oscillator Q<sub>1015</sub> (2SC535B), whose frequency is offset slightly for the selected sideband or mode. The resulting modulated IF output is passed through Q<sub>1013</sub> (2SC2785E) during SSB transmission, and then the desired sideband is passed through 10.7 MHz crystal filter XF<sub>1002</sub>, where the unwanted sideband is removed. The resulting single sideband signal is then amplified by Q<sub>1010</sub> (3SK73Y), which also receives an ALC control voltage. Output from Q<sub>1010</sub> is delivered to the transmit mixer composed of Q<sub>1034</sub> and Q<sub>1035</sub> (2SK193K x 2), which also receives the 78 MHz local signal from local oscillator Q<sub>1032</sub> (2SC535B) after buffering by Q<sub>1033</sub> (2SC535B). The resulting 67.3 MHz output from the mixer is passed through a bandpass filter to buffer Q<sub>1036</sub> (2SK241GR) and then delivered to the TX Unit (PB-2410, PB-2411).

On the TX Unit the signal is passed through a lowpass filter to mixer Q<sub>2002</sub> (ND487C2-3R), which also receives a 362.7 – 372.7 MHz local signal after it has first been buffered by Q<sub>2001</sub> (2SC2570A) and filtered by helical resonator CV<sub>2001</sub> (CV370). The output of the mixer at the operating frequency is buffered by Q<sub>2003</sub> (2SC2570A), filtered by helical resonator CV<sub>2002</sub> (CV441B), and then buffered again by Q<sub>2004</sub> (2SC2407) before being fed to driver Q<sub>2005</sub> (2SC3019) and then TX RF amplifier Q<sub>2006</sub> (2SC3020). The one watt output is then passed through a lowpass filter and delivered to antenna relay RL<sub>1001</sub> on the Main Unit, followed by another lowpass filter, to the antenna. A sample of the RF output delivered from the TX Unit is fed to the PO/ALC detector composed of D<sub>1068</sub> – D<sub>1070</sub>, which provide a DC voltage for power output indication on the PO meter, and an ALC voltage for amplification by AGC/ALC amplifier Q<sub>1018</sub> (2SC1815GR). The level of this detected ALC voltage applied to Q<sub>1018</sub> is reduced by a variable resistor added to ground when the HI/LOW switch is set to the LOW position, and the amplified output of Q<sub>1018</sub> is applied to IF amplifier Q<sub>1010</sub> to regulate its gain, preventing overdriving of the TX amplifiers.

## FM

During FM transmission the audio from the microphone amplifiers and lowpass filter is passed through switch Q<sub>1030</sub> to varactor D<sub>1031</sub> (FC52M) in the oscillator loop of Q<sub>1032</sub>. The audio thus modulates the 78 MHz signal produced by this oscillator; the output of which is buffered by Q<sub>1033</sub> (2SC535B) and then delivered to the transmit mixer composed of Q<sub>1034</sub> and Q<sub>1035</sub> mentioned earlier in the SSB transmission description. The remainder of the transmit signal path for FM is the same as that for SSB. When the CALL button is activated from the front panel, switch Q<sub>3006</sub>, mentioned at the beginning of the Transmit description as activating burst oscillator Q<sub>3007</sub>, also switches Call control Q<sub>1057</sub> (2SC945P), which closes the PTT line, activating Q<sub>1058</sub> (2SC945P) and relay RL<sub>1002</sub> to switch the 6.8V DC supply from the receiver to the transmitter circuitry.

## CW

The keying signal is applied to CW Keying Control gates in Q<sub>1049</sub> (1/3 MC-14669UB), which operate Unlock (UL) switch Q<sub>1037</sub> (2SC945P), biasing

transmit IF amplifier Q<sub>1010</sub> and final exciter buffer Q<sub>1036</sub> on when the key is closed. Carrier oscillator Q<sub>1015</sub> generates the carrier signal at 10.7 MHz in the same way as for USB, and thus the carrier signal is allowed to pass through the transmit signal path in the same manner as SSB when the key is closed, except that audio is blocked by switch Q<sub>1031</sub>. The keying signal is also applied to the Sidetone Control gate of Q<sub>1049</sub> (1/6 MC14069UB), and then to the sidetone oscillator formed by two more gates of Q<sub>1049</sub>, whose output is delivered to audio amplifier module Q<sub>3005</sub>.

## PLL Circuit

The PLL system employs a  $\mu$ PD2819C (Q<sub>1044</sub>), which contains a programmable divider and latch, phase detector, and reference oscillator. The synthesis scheme allows tuning of the 10 MHz operating range of the transceiver in 100 Hz steps.

VCO (Voltage-Controlled Oscillator) Q<sub>1038</sub> (2SK192GR) generates a signal at 120.8916 – 124.2216 MHz, which is buffered by Q<sub>1039</sub> (2SK241GR). A portion of this signal is then multiplied by three at Q<sub>1040</sub> (2SC2026), and passed through helical resonator CV<sub>1003</sub> (CV370) for delivery to 1st receive mixer Q<sub>1001</sub>, and final transmit mixer Q<sub>2002</sub> after buffering by Q<sub>2001</sub> and filtering by CV<sub>2001</sub> on the TX Unit.

The other portion of the buffered VCO signal is further buffered by Q<sub>1041</sub> (2SK168D) and applied to PLL mixer Q<sub>1042</sub> (2SC535B), which also receives a 119.225 MHz signal from crystal oscillator Q<sub>1047</sub> (2SC535B). The resulting 1.666 – 4.997 MHz mixer product is amplified by PLL IF amp Q<sub>1043</sub> (2SC535B) and applied to the programmable divider section of Q<sub>1044</sub>. This section is instructed by frequency dividing signals delivered from the Control Unit via the Latch section of Q<sub>1044</sub>, and the divided output is then applied to the phase detector section of Q<sub>1044</sub>, where the phase of the divided signal is compared with that of the 4.266 MHz crystal reference oscillator section. Any resulting phase difference causes a DC voltage to be fed through lowpass filters Q<sub>1045</sub> (2SK184Y) and then Q<sub>1046</sub> (2SC945P), after which the DC voltage is applied to varactor D<sub>1035</sub> (1T25) in the VCO circuit to shift the VCO frequency slightly, thus correcting the phase difference between the VCO and the crystal reference oscillator.

If the phase difference exceeds a correctable value as detected by the phase detector in Q<sub>1044</sub>, an Unlock signal triggers Q<sub>1037</sub> (2SC945P), which in turn biases off RX and TX IF amplifier Q<sub>1010</sub>, as well as final exciter buffer Q<sub>1036</sub>, thus preventing transmission from occurring when the PLL is not locked.

### Control Unit

The essence of the control system is 4-bit microprocessor Q<sub>4001</sub> (HD-44820A62), which processes all data for control of the operating frequency, display and special functions. Hex inverter Q<sub>4002</sub> (MC14069UB) shapes the pulses from the photo-interrupter on the tuning dial before application to Q<sub>4001</sub>. Hex inverter Q<sub>4005</sub> (MC14069UB) serves various power, transmit disable and display clock functions. Q<sub>4006</sub>, Q<sub>4007</sub> and Q<sub>4008</sub> (all 2SC945AP) are switches for BUSY, minus repeater shift and plus repeater shift, respectively. Display data is routed along with front panel switch I/O through the Keyboard Unit to display driver Q<sub>6001</sub> (TP0401) on the Display Unit, which then feeds LCD DS<sub>6001</sub> (HI313A).

## ALIGNMENT

This equipment has been carefully aligned and tested at the factory prior to shipment. If the instrument is not abused, it should not require other than the usual attention given to electronic equipment.

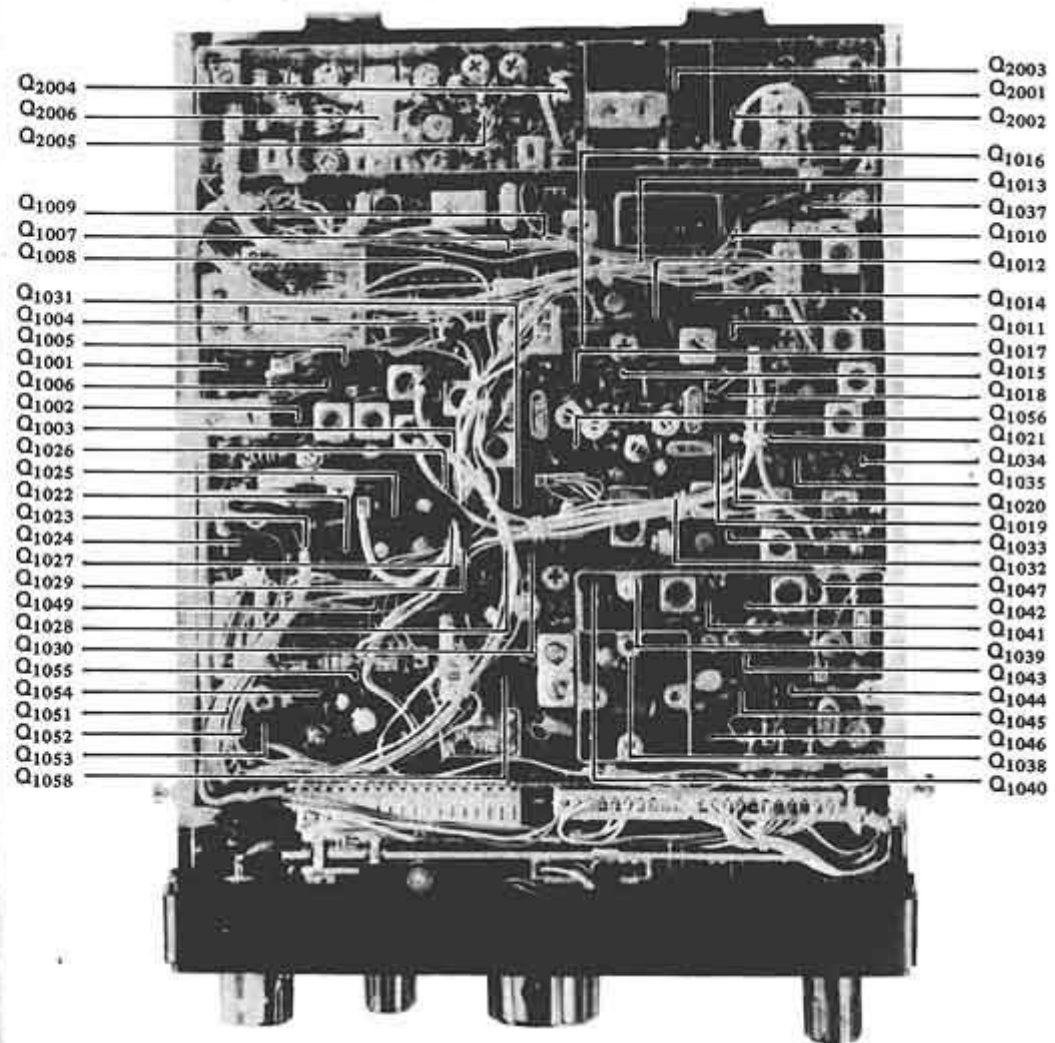
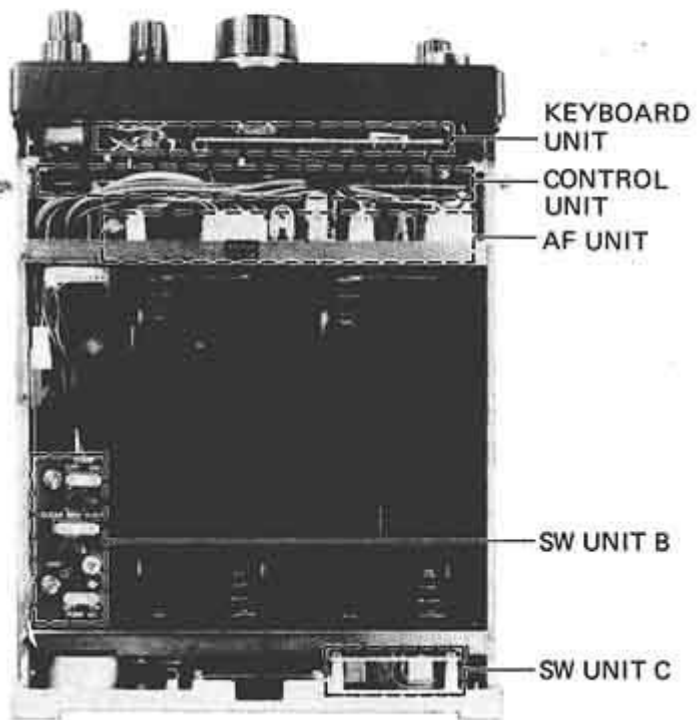
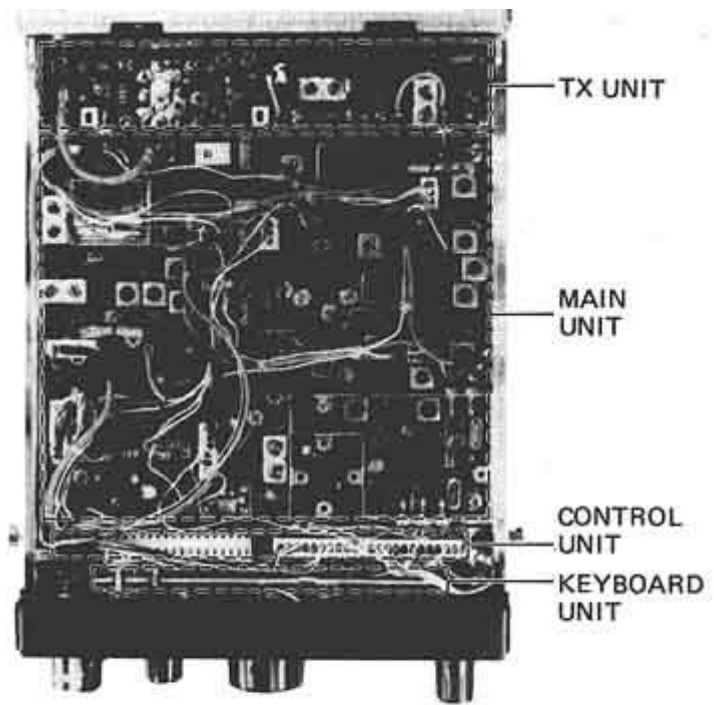
Service or replacement of a major component may require considerable realignment. Under no circumstances, though, should realignment be attempted unless the operation of the transceiver is fully understood, the malfunction has been carefully analyzed, and the fault has definitely been traced to misalignment rather than part failure. Service work must only be performed by experienced personnel using the proper test equipment.

Never align this transceiver without having a 50 ohm dummy load connected to the antenna jack. Troubleshooting using an antenna can result in misleading indications on the test equipment.

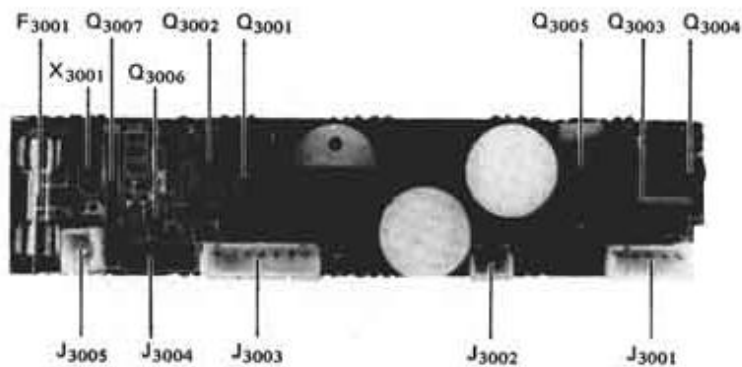
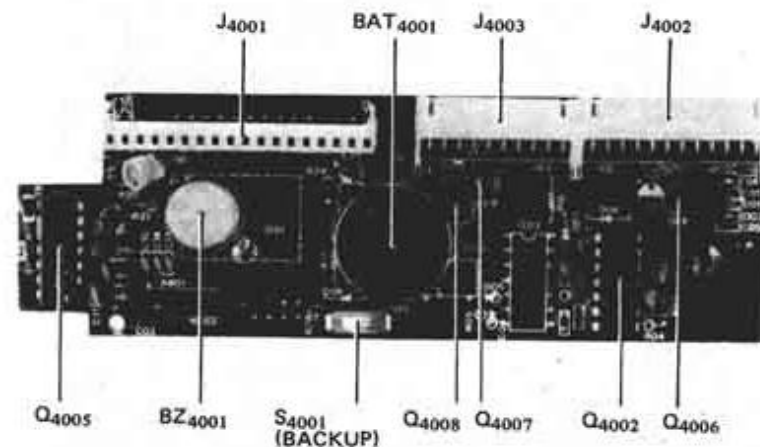
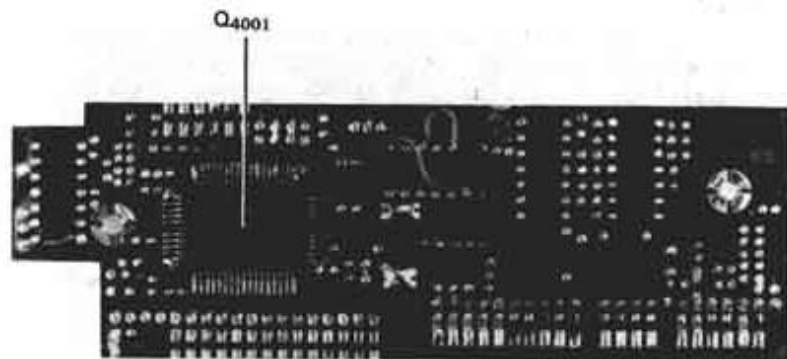
### EQUIPMENT REQUIRED

1. RF Signal Generator: Hewlett-Packard Model 8640B or equivalent with one volt output at 50 ohms and frequency coverage to 500 MHz
2. Vacuum Tube Voltmeter (VTVM): Hewlett-Packard Model 410B or equivalent with an RF probe good to 500 MHz
3. Dummy Load/Wattmeter: Bird Model 43 with 3W UHF slug + UHF Dummy Load
4. AF Signal Generator: Hewlett-Packard Model 200AB or equivalent
5. IF Seep Generator: capable of output at 10.7 MHz
6. RF Sweep Generator: capable of output at 420 – 460 MHz
7. Oscilloscope: Hewlett-Packard Model 1740A or equivalent
8. FM Deviation Meter
9. Precision Frequency Counter: Yaesu Model YC-500E or equivalent with resolution to 0.01 kHz and frequency coverage to 500 MHz









## PLL CIRCUIT ALIGNMENT

The PLL circuit alignment procedure requires an environment in which the ambient temperature is held constant within the range of 15 to 30°C during alignment. The transceiver must also be thermally acclimatized to the ambient temperature of the alignment environment, so it should be allowed to sit at the alignment temperature for several hours before beginning alignment if it has been located in a very warm or cold environment.

## VOLTAGE ADJUSTMENT

### 1. 5.7 VDC

- (a) Connect the DC voltmeter between the cathode of D<sub>1060</sub> and ground.
- (b) Adjust VR<sub>1012</sub> for a reading of 5.7 VDC on the meter.

### 2. Battery Check

- (a) Apply 8.5 VDC from an external source to the EXT DC 13.8V terminal.
- (b) Set the LAMP/BATT switch to the BATT position and adjust VR<sub>3001</sub> so that the meter deflects exactly to the dividing line between the white and green zones on the meter scale.

### 1. PLL Local and IF

- (a) Set the MODE selector to the FM position and tune the transceiver to 439.9999 MHz.
- (b) Connect the oscilloscope to R<sub>1163</sub> and adjust T<sub>1020</sub> for maximum amplitude on the scope.

### 2. VCV Line

- (a) With the transceiver tuned to the same frequency as above, connect the DC voltmeter to the top of R<sub>1173</sub> and adjust L<sub>1011</sub> for a reading of 5.0 volts on the meter.
- (b) Retune the transceiver to 430.0000 MHz and check the meter for a reading of about 1 volt.

### 3. PLL Local Frequency

- With the MODE selector set to FM, tune the transceiver to 435.0000 MHz.
- Connect the oscilloscope to R<sub>1163</sub> and adjust T<sub>1021</sub> for maximum amplitude on the scope.

### 4. PLL Output BPF

- Disconnect P<sub>1001</sub> and connect a 50 ohm resistor across the plug. Connect the RF probe of the VTVM across the resistor.
- With the transceiver tuned to 435.0000 MHz, adjust CV<sub>1003</sub> for maximum reading on the VTVM.
- Tune the transceiver to 439.9999 MHz and check that the VTVM reading remains approximately the same.

### 5. PLL Local Frequency

With the transceiver set to the FM mode at 435.0000 MHz, connect the frequency counter to P<sub>1001</sub> and adjust TC<sub>1006</sub> for 367.6750 MHz on the counter.

## 78 MHZ LOCAL OSCILLATOR ALIGNMENT

- Set the transceiver for FM operation at 435.0000 MHz, and preset VR<sub>1007</sub>, VR<sub>1010</sub> and VR<sub>1013</sub> to their center positions. VR<sub>1007</sub> and VR<sub>1013</sub> are realigned in the Transmitter Section, FM Deviation procedure.
- Connect the RF probe of the VTVM to the cathode of D<sub>1033</sub>, and adjust T<sub>1012</sub> - T<sub>1014</sub> for maximum deflection on the meter.
- Now adjust T<sub>1004</sub> for minimum deflection on the meter, which should be less than 70 mV rms.
- Set the MODE selector to CW, transceiver frequency to 435.9993 MHz, and connect the frequency counter to the cathode of D<sub>1033</sub>. Now adjust L<sub>1009</sub> for a reading of 78.0250 MHz on the counter.

- Set the transceiver to 435.9992 MHz and adjust VR<sub>1010</sub> for a reading of 78.0349 MHz on the counter.
- Now recheck the voltage with the RF probe on the cathode of D<sub>1033</sub>, and repeat step (c) in the FM mode at 435.0000 MHz, if necessary.

## RECEIVER ALIGNMENT

### 1. FM IF and Detector

- With the MODE selector set to FM, connect the signal generator to gate 1 of Q<sub>1003</sub> and set the SSG for 10.7 MHz low-level output with 1 kHz modulation at 3.5 kHz deviation.
- Connect an external speaker to the EXT SP jack, and connect the oscilloscope across this speaker. Set the VOL control to its center position, and adjust the SSG output level for a comfortable listening level.
- Adjust T<sub>1005</sub>, T<sub>1006</sub> and T<sub>1008</sub> for the purest possible sine wave of maximum amplitude and minimum noise. (This adjustment may also be made using a SINAD meter in place of the scope.)

### 2. SSB IF

- With the MODE selector set to FM, connect the signal generator to gate 1 of Q<sub>1003</sub>. Set the SSG output for 10.7 MHz low-level output with no modulation.
- Adjust T<sub>1009</sub>, T<sub>1010</sub> and T<sub>1011</sub> for maximum S-meter deflection, while adjusting the SSG output level to maintain a useful range on the S-meter.

### 3. RF Stages

- Connect the sweep generator to the antenna jack, and the oscilloscope to the emitter of Q<sub>1002</sub>.
- Preset TC<sub>1001</sub> for minimum capacitance, and adjust CV<sub>1001</sub> and CV<sub>1002</sub> to obtain the waveform of Figure 1 at maximum amplitude. TC<sub>1001</sub> is readjusted in the next procedure.

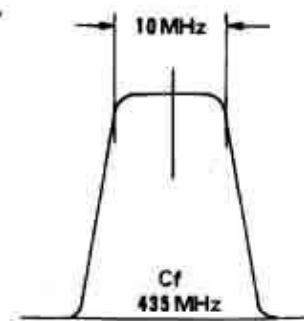


Figure 1

#### 4. 1st IF

- (a) Connect the signal generator to the ANT jack, and set the SSG for an unmodulated output at 435 MHz sufficient to produce a deflection of several S-units on the meter with the transceiver tuned to the same frequency.
- (b) Adjust TC<sub>1001</sub>, T<sub>1001</sub> - T<sub>1004</sub>, T<sub>1013</sub> and T<sub>1014</sub> for maximum S-meter deflection, reducing the SSG output level when required to keep deflection below S-9.

#### 5. S-Meter

- (a) Set the MODE selector to CW and connect the SSG to the ANT jack. Set the SSG for 10 dB $\mu$  unmodulated output at the same frequency as the transceiver, 435 MHz. Adjust VR<sub>1004</sub>, if necessary, to obtain an S-meter reading of exactly S-9.
- (b) Disconnect the SSG from the ANT jack and adjust VR<sub>1003</sub> to the threshold point just before that at which the S-meter begins to deflect (with no signal input).
- (c) Repeat steps (a) and (b).

#### 6. Noise Blanker

- (a) With the MODE set to CW, connect the SSG to the ANT jack and set the SSG for 50 dB $\mu$  unmodulated output at the center frequency of the transceiver.
- (b) Connect the DC voltmeter to TP<sub>1002</sub>, and adjust T<sub>1007</sub> for minimum indication on the voltmeter.

#### 7. Squelch

- (a) Set the MODE to FM, and the SQL control to the 12 o'clock position.
- (b) With no signal input, adjust VR<sub>7001</sub> so that the squelch just closes off the noise.

#### 8. Sidetone

- (a) Set the MODE to CW, and the VOL control fully counterclockwise. Connect a key to the KEY jack.

- (b) Depress the key and adjust VR<sub>1011</sub> for comfortable sidetone volume. At the factory, this control is preset for 150 mV rms at the speaker terminals.

### TRANSMITTER ALIGNMENT

The dummy load must be connected to the ANT jack on the transceiver at all times during the following procedures.

#### 1. Exciter

- (a) Set the MODE selector to FM and the HI/LOW switch to HI power. Preset VR<sub>1002</sub> fully clockwise, and preset VR<sub>1001</sub>, VR<sub>1005</sub> and VR<sub>1009</sub> to their center positions.
- (b) Disconnect P<sub>2002</sub> from J<sub>1007</sub>, and connect the RF probe of the VTVM to J<sub>1007</sub>. Now key the transmitter and adjust T<sub>1015</sub> - T<sub>1019</sub> for maximum deflection on the VTVM.
- (c) Set VR<sub>1006</sub> to its center position, and connect the audio generator to the MIC jack. Set the AG for 20 mV rms output at 1.5 kHz.
- (d) Set the MODE selector to USB, key the transmitter, and adjust TC<sub>1003</sub> for maximum deflection on the VTVM.
- (e) Set the MODE selector to LSB, key the transmitter, and adjust TC<sub>1002</sub> for maximum deflection on the VTVM.

#### 2. Idling Current

- (a) With P<sub>2002</sub> disconnected from J<sub>1007</sub>, preset VR<sub>2001</sub> and VR<sub>2002</sub> fully counterclockwise.
- (b) Remove P<sub>2003</sub> from J<sub>2001</sub>, and connect the ammeter in its place. Key the transmitter and adjust VR<sub>2001</sub> for a reading of 4.5 mA on the meter.
- (c) Remove P<sub>2004</sub> from J<sub>2002</sub> and connect the ammeter in its place. Key the transmitter and adjust VR<sub>2002</sub> for a reading of 75 mA on the meter.
- (d) Reconnect P<sub>2002</sub> to J<sub>1007</sub>, P<sub>2003</sub> to J<sub>2001</sub>, and P<sub>2004</sub> to J<sub>2002</sub>.



### 3. RF Power Amplifier

- (a) With the MODE selector set to FM and the HIGH/LOW switch set to the LOW position, tune the transceiver to 435 MHz. Connect a wattmeter with the dummy load at the ANT jack.
- (b) Key the transmitter and adjust CV<sub>2001</sub>, CV<sub>2002</sub>, TC<sub>2004</sub>, TC<sub>2003</sub> and TC<sub>2002</sub> for maximum output power on the wattmeter.

### 4. SSB Carrier Point

- (a) With the MODE set to USB, connect the audio generator to the microphone jack, and set the AG for 1.5 kHz at a level sufficient to produce an output of 500 mW on the wattmeter.
- (b) Now tune the AG to 300 Hz and note the power output. Then tune the AG to 2700 Hz and again note the output.
- (c) Adjust TC<sub>1003</sub>, if necessary, and repeat step B until the output at both 300 Hz and 2700 Hz is equal (less than 500 mW).
- (d) Set the MODE selector to LSB and repeat the above steps, adjusting TC<sub>1002</sub>, if necessary.

### 5. FM Frequency

- (a) Set the MODE selector to FM, and remove all microphone input.
- (b) Connect the frequency counter to TP<sub>1003</sub> and adjust TC<sub>1004</sub> to obtain a reading of exactly 10.70000 MHz on the counter.

### 6. CW Frequency

- (a) Perform the following step with the MODE selector set to CW, key connected to the KEY jack, and PTT switch closed.
- (b) With the frequency counter connected to TP<sub>1003</sub>, depress the key and adjust TC<sub>1005</sub> for a reading of 10.70070 MHz on the counter.

### 7. HI/LOW Power

- (a) With the wattmeter and dummy load connected to the ANT jack and the transceiver set to the FM mode, set the HI/LOW switch (rear panel) to the LOW position.
- (b) Close the PTT line and adjust VR<sub>1002</sub> for 250 mW (or as desired) on the wattmeter.
- (c) Now set the HI/LOW switch to HI, and adjust VR<sub>1009</sub> for 1 watt output.

### 8. PO Meter Alignment

- (a) On the rear panel, set the LAMP/BATT switch to the OFF (center) position.
- (b) With the transceiver set for FM, HI power, adjust VR<sub>1005</sub> to obtain PO meter deflection in the center of the green zone on the meter scale.

### 9. FM Deviation

- (a) Connect the test equipment to the transceiver as shown in Figure 2.
- (b) Set the MODE selector to FM, COMP switch OFF, and transceiver frequency to 435.0000 MHz.
- (c) Set the Audio Generator for a 1 kHz output at 25 mV rms to the MIC jack, and adjust VR<sub>1013</sub> for maximum deviation. Now adjust VR<sub>1007</sub> for  $\pm 4.5$  kHz deviation.
- (d) Now reduce the AG output to 2 mV rms and check to ensure that deviation is  $\pm 3 - 4$  kHz.

### 10. Carrier Balance

- (a) Temporarily short R<sub>1119</sub> using a jumper wire. Set the MODE to USB.
- (b) Monitor the carrier output at the antenna jack on the spectrum analyzer or monitor receiver, key the transmitter, and adjust VR<sub>1001</sub> for minimum carrier output.
- (c) Switch the MODE selector to LSB and back to USB, comparing the carrier levels of both modes and adjusting VR<sub>1001</sub> for equal carrier nulling.



## 11. SSB Microphone Gain

- (a) With the transceiver set to USB mode and the COMP switch OFF, connect the audio generator to the MIC jack and set for an output of 1.5 kHz at 1.5 mV.
- (b) Key the transmitter and adjust VR<sub>1006</sub> for an output power of 800 mW.

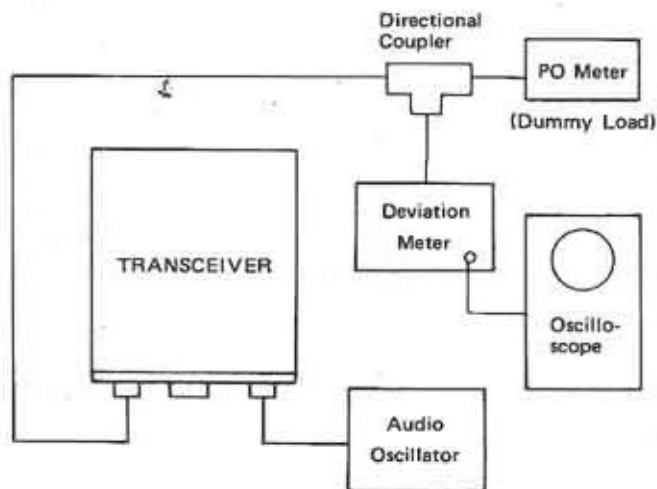


Figure 2

## PARTS LIST

MAIN CHASSIS			
Symbol No.	Part No.	Description	
<b>TRANSISTOR</b>			
Q1	G3205480 P/Q/R	2SB548P/Q/R	
<b>DIODE</b>			
D3	G2090027	SI	1SS53
D1	G2090034	"	U05B
D2	G2090211	"	V06C
<b>RESISTOR</b>			
R2	J10246680	Carbon Composition	1/4W GK 68Ω
R1	J00215101	Carbon Film	1/8W VJ 100Ω
<b>POTENTIOMETER</b>			
VR1 (with S1)	J62800057	K12B61004-5N1211-5KB, 10KA	
<b>CAPACITOR</b>			
C1, 4, 06, 07	K10186102	Ceramic Disc	63WV B 0.001μF (RD870-1B102K63V)
C5	K40129011	Electrolytic	16WV 1000μF (16RE1000)
<b>SWITCH</b>			
S2	N0190111	SRN 2046N	
S3	Q9000193	EWT-XDDS2050B	
S4	N0190084	SRS101C	
S5	N6090028	SSHP-23-05	
S6, 7	N6090029	SSFYP-22-07	
<b>MEMORY SWITCH BOARD</b>			
PB-2240	F0002240	Printed Circuit Board	
	C3001271	P.C.B. with S4	
<b>SWITCH BOARD C</b>			
PB-2409	F0002409	Printed Circuit Board	
	C024090A	P.C.B. with S5, 6, 7, R1, 2, C4, 6, 7	
<b>CONNECTOR</b>			
J1, 7	P1090201	UK-0002	

J2	P1090197	SG-8021
J3	P1090051	SG-8512
J4	P0090190	HEC0630
J5	P0090241	FM214-7SS(A)
J6	P1090293	BNC-R(1)
		<b>METER</b>
M1	M0290023	T-22
		<b>SPEAKER</b>
SP1	M090028A	VS-50Y
		<b>BATTERY HOLDER</b>
	Q9000116C	C-12A with Wire
	Q9000117C	" "
		<b>RECEPTACLE</b>
P1 (with wire)	T9302700	TMP-15DP
P2 ( " " )	T9204420A	XHP-5
P3 ( " " )	T9204421	XHP-3
P4 ( " " )	T9204422	"
P5 ( " " )	T9204423	XHP-5
P6 ( " " )	T9204424	XHP-7
P8 ( " " )	T9204425	XHP-2
P9 ( " " )	T9204426	XHP-4
P10 ( " " )	T9204427	XHP-7
P11 ( " " )	T9204428A	XHP-2
P12 ( " " )	T9204429	XHP-5
P13 ( " " )	T9204430A	XHP-10
P14 ( " " )	T9204431A	XHP-12
P15 ( " " )	T9204432	5208-11
Model A		
P15 ( " " )	T9204433	5231-08
Model B, F		
		<b>PLUG</b>
P2003, 2004	P1090249	EMCM0201 (with short wire)
		<b>KNOB</b>
	R3068750	FT-32T Main Tuning
	R3068780	FT-14K MODE, M.CH
	R3068790	FT-12K VOL
	R3068800	FT-16DS SQL
	R3062161	Push Button A FUNCTION
	R3056500	Push Button B VFO

MAIN UNIT		
Symbol No.	Part No.	Description
PB-2426A	F0002426A	Printed Circuit Board
	C024260A	P.C.B. with Components Model A
	C024260B	" " Model B, C
		<b>IC</b>
Q1008	G1090145	MC3357P
Q1049	G1090126	MC14069UB
Q1004	G1090072	μPC577H
Q1012	G1090101	μPC1037H
Q1025	G1090415	μPC1170H
Q1044	G1090237	μPD2819C
		<b>FET</b>
Q1041	G3801680D	2SK168D
Q1020, 1045	G3801840Y	2SK184Y
Q1038	G3801920G	2SK192GR
Q1034, 1035, 1056	G3801930K/ F/P	2SK193K or F or P
Q1007, 1036, 1039	G3802410G	2SK241GR
Q1003	G4800510C	3SK51-03
Q1009-1011	G4800730Y	3SK73Y
		<b>TRANSISTOR</b>
Q1014, 1016, 1017, 1029, 1050, 1051,	G3107331P/ Q	2SA733A P or Q
Q1019, 1021, 1054	G3111750E	2SA1175E
Q1015, 1032, 1033, 1042, 1043, 1047	G3305350B	2SC535B
Q1005, 1006, 1022-1024, 1026-1028, 1031, 1037, 1046, 1052, 1053, 1058 1057(A,B,C)	G3309451P/ Q	2SC945A P or Q
Q1018	G3318150G	2SC1815GR
Q1040	G3320260	2SC2026
Q1030	G3321200Y	2SC2120Y

Q1001, 1002	G3325701	2SC2570A	
Q1013, 1055	G3327850E	2SC2785E	
		<b>DIODE</b>	
D1001, 1002, 1004, 1024	G2001880F	Ge	1S188FM
D1005	G2015550	Si	1S1555
D1003, 1006-1023, 1026-1030, 1033, 1034, 1036-1039, 1042-1059, 1063, 1064, 1066, 1067, 1071	G2090027	"	1SS53
D1025, 1068-1070	G2090118	Schottky	ISS97
D1035	G2090107	Varactor	1T25
D1031	G2090179	"	FC53M-4
	G2090180	"	FC53M-5
D1062	G2090227	Zener	HZ9B2L
D1061	G2090226	"	HZ4C3
D1065	G2090225	"	HZ6C2L
D1032, 1072	G9090017	Varistor	MV11
D1060	G2090211	Si	V06C
		<b>CRYSTAL</b>	
X1006	H0102372	HC18/T	4.266 MHz
X1001	H0100720A	HC18/U	10.245 MHz
X1002	H0102466	HC18/T3P	10.6985 MHz
X1004	H0102465	HC18/T3P	10.7007 MHz
X1003	H0102467	RW18/T3P	10.7015 MHz
X1005	H0102463A	HC18/T3P	78.025 MHz
X1007(A,B,C)	H0102483	HC18/T3P	119.225 MHz
		<b>CRYSTAL FILTER</b>	
XF1001	H1102027	10M30B	
XF1002	H1102064	XF-10.7LS	
		<b>CERAMIC FILTER</b>	
CF1001	H3900204	LF-H15S	

		<b>RESISTOR</b>			
R1105, 1187	J00215220	Carbon Film	1/8W	VJ	22 $\Omega$
R1009, 1012, 1218	J00215560	" "	" "	" "	56 $\Omega$
R1111, 1144	J00215680	" "	" "	" "	68 $\Omega$
R1007, 1015, 1042, 1043, 1052, 1053, 1057, 1058, 1101, 1108, 1120, 1125, 1134, 1142, 1145, 1150, 1152, 1174, 1181, 1208, 1217	J00215101	" "	" "	" "	100 $\Omega$
R1006, 1113	J00215221	" "	" "	" "	220 $\Omega$
R1149	J00215271	" "	" "	" "	270 $\Omega$
R1046, 1096, 1114, 1216	J00215331	" "	" "	" "	330 $\Omega$
R1039, 1169, 1206	J00215391	" "	" "	" "	390 $\Omega$
R1001, 1026, 1139, 1154, 1170, 1219, 1220	J00215471	" "	" "	" "	470 $\Omega$
R1005	J10246471	" Composition	"	GK	470 $\Omega$
R1034	J00215561	" Film	"	VJ	560 $\Omega$
R1003, 1025, 1048	J00215681	" "	" "	" "	680 $\Omega$
R1017, 1157	J00215821	" "	" "	" "	820 $\Omega$
R1037, 1051, 1056, 1062, 1123, 1136, 1147, 1160, 1172, 1207	J00215102	" "	" "	" "	1k $\Omega$
R1119	J10246102	" Composition	1/4W	GK	1k $\Omega$
R1171	J00215122	" Film	1/8W	VJ	1.2k $\Omega$
R1028, 1029, 1112, 1161	J00215152	" "	" "	" "	1.5k $\Omega$
R1168	J00215182	" "	" "	" "	1.8k $\Omega$
R1047, 1063, 1075, 1100, 1102, 1118, 1133, 1155	J00215222	" "	" "	" "	2.2k $\Omega$
R1088, 1115, 1137, 1138, 1163	J00215272	" "	" "	" "	2.7k $\Omega$

R1221	J10216332	Carbon Composition	1/8W	GK	3.3k $\Omega$
R1185	J00215392	" Film	"	VJ	3.9k $\Omega$
R1016, 1036, 1074, 1086, 1211	J00215472	" "	"	"	4.7k $\Omega$
R1059, 1069, 1071, 1089, 1097, 1203, 1204	J00215562	" "	1/8W	VJ	5.6k $\Omega$
R1021, 1067, 1110	J00215822	" "	"	"	8.2k $\Omega$
R1008, 1014, 1033, 1040, 1044, 1060, 1061, 1073, 1084, 1087, 1091, 1104, 1109, 1121, 1126-1128, 1131, 1140, 1141, 1146, 1191, 1212, (A,B,C) 1214, 1215	J00215103	" "	"	"	10k $\Omega$
	J00215123	" "	"	"	12k $\Omega$
R1173	J10246123	" Composition	1/4W	GK	12k $\Omega$
R1065, 1079	J00215153	" Film	1/8W	VJ	15k $\Omega$
R1083, 1098, 1099, 1116, 1117, 1129	J00215183	" "	"	"	18k $\Omega$
R1032, 1093 1103, (A,B,C) 1210	J00215223	" "	"	"	22k $\Omega$
R1013, 1179	J00215273	" "	"	"	27k $\Omega$
R1194	J00215333	" "	"	"	33k $\Omega$
R1011, 1019, 1020, 1027, 1031, 1049, 1054, 1064, 1066, 1068, 1070, 1072, 1076, 1077, 1090, 1124, 1143, 1192 1201, 1202, 1209, 1213 (A,B,C)	J00215473	" "	"	"	47k $\Omega$

R1030	J00215513	Carbon Film	1/8W	VJ	51k $\Omega$
R1198	J00215563	" "	"	"	56k $\Omega$
R1092, 1132	J00215683	" "	"	"	68k $\Omega$
R1178	J00215823	" "	"	"	82k $\Omega$
R1002, 1004, 1010, 1038, 1080, 1094, 1130, 1148, 1151, 1156, 1165-1167, 1180, 1193, 1196	J00215104	" "	"	"	100k $\Omega$
R1199, 1200	J00215154	" "	"	"	150k $\Omega$
R1153, 1159	J00215184	" "	"	"	180k $\Omega$
R1162	J10246184	" Composition	1/4W	GK	180k $\Omega$
R1023, 1081, 1082, 1095, 1135, 1184, 1197	J00215224	" Film	1/8W	VJ	220k $\Omega$
R1035	J00215274	" "	"	"	270k $\Omega$
R1050, 1055	J00215334	" "	"	"	330k $\Omega$
R1122	J00215394	" "	"	"	390k $\Omega$
R1024, 1106, 1188, 1189	J00215474	" "	"	"	470k $\Omega$
R1205	J00215684	" "	"	"	680k $\Omega$
R1018, 1041, 1164, 1190	J00215105	" "	"	"	1M $\Omega$
R1078	J02245225	" "	1/4W	SJ	2.2M $\Omega$
R1022, 1085	J02245335	" "	"	"	3.3M $\Omega$
		<b>POTENTIOMETER</b>			
VR1001	J51752105	RGS6-FAN-1M	1M $\Omega$		
VR1002, 1005, .1011	J51752503	RGS6-FAN-50k	50k $\Omega$		
VR1003, 1009	J51752203	RGS6-FAN-20k	20k $\Omega$		
VR1004	J51752104	RGS6-FAN-100k	100k $\Omega$		
VR1006	J51745222	H0651A009-2.2KB	2.2k $\Omega$ B		
VR1012	J51745472	H0651A011-4.7KB	4.7k $\Omega$ B		
VR1007, 1013	J51745103	H0651A013-10KB	10k $\Omega$ B		
VR1010	J51745223	H0651A015-22KB	22k $\Omega$ B		
		<b>THERMISTOR</b>			
TH1001	G9090013	25D29			
TH1002	G9090008	31D26			



		CAPACITOR			
C1135, 1143, 1236	K00179001	Ceramic Disc (DD104SL0R5C50V02)	50WV	SL	0.5pF
C1011, 1017, 1168, 1172, 1237	K00172010	" " (DD104SL010C50V02)	"	"	1pF
C1164	K02179003	" " (DD104CK020C50V02)	"	CH	2pF
	K00172030	" " (DD104SL030C50V02)	"	"	3pF
C1081, 1146, 1160	K02179004	" " (DD104CH030C50V02)	"	"	3pF
C1002	K02172040	" " (DD104CH040C50V02)	"	"	4pF
C1027, 1030, 1156	K02172050	" " (DD104CH050C50V02)	"	"	5pF
C1171	K00172050	" " (DD104SL050C50V02)	"	SL	5pF
C1003	K00173060	" " (DD104SL060D50V02)	"	"	6pF
C1152	K02173060	" " (DD104CH060D50V02)	"	CH	6pF
C1153, 1154	K06173060	" " (DD104UJ060J50V02)	"	UJ	6pF
C1001	K02173070	" " (DD104CH070D50V02)	"	CH	7pF
C1162	K07183080	" " (RD870-1N150-8R0D63V)	63WV	PH	8pF
C1194	K06173080	" " (DD104UJ080D50V02)	50WV	UJ	8pF
C1133	K00173080	" " (DD104SL080D50V02)	"	SL	8pF
C1155	K06173090	" " (DD104UJ090J50V02)	"	UJ	9pF
C1018, 1020, 1040, 1142, 1144	K00173100	" " (DD104SL100D50V02)	"	SL	10pF
C1137, 1138	K02173100	" " (DD104CH100D50V02)	"	CH	10pF
C1204	K05173100	" " (DD104RH100D50V02)	"	RH	10pF
C1157	K02175120	" " (DD104SL120J50V02)	"	CH	12pF
C1013	K00175150	" " (DD104SL150J50V02)	"	SL	15pF
C1163	K07185150	" " (RD870-1N150-150J63V)	63WV	PH	15pF

C1004, 1016	K00175220	Ceramic Disc (DD104SL220J50V02)	50WV	SL	22pF
C1005	K00175270	" " (DD104SL270J50V02)	"	"	27pF
C1070, 1072, 1076, 1195	K06175330	" " (DD104UJ330J50V02)	"	UJ	33pF
C1181, 1182	K00175330	" " (DD104SL330J50V02)	"	SL	33pF
C1036	K06175390	" " (DD104UJ390J50V02)	"	UJ	39pF
C1007, 1032, 1057, 1083, 1249, 1251, 1255	K00175470	" " (DD104SL470J50V02)	"	SL	47pF
C1074	K06179009	" " (DD105UJ560J50V02)	"	UJ	56pF
C1177, 1178	K00175560	" " (DD104SL560J50V02)	"	SL	56pF
C1196	K06185680	" " (RD871-1N750-680J63V)	63WV	UJ	68pF
C1037, 1079, 1129, 1130	K06185101	" " (RD871-1N750-101J63V)	63WV	"	100pF
C1044, 1082	K00175101	" " (DD105SL101J50V02)	50WV	SL	100pF
C1053, 1058	K10186221	" " (RD870-1B221K63V)	63WV	B	220pF
C1078	K06185221	" " (RD873-2N750-221J63V)	"	UJ	220pF
C1222	K10186471	" " (RD870-1B471K63V)	"	B	470pF
C1014, 1015, 1033, 1043, 1052, 1054, 1062, 1068, 1069, 1071, 1073, 1075, 1077, 1087-1092, 1100, 1101, 1103, 1104, 1106, (A,B,C) 1109, 1111, 1112, 1123-1125, 1127, 1128, 1148-1151, 1158, 1161,	K10186102	" " (RD870-1B102K63V)	"	"	0.001μF

C1165, 1169, 1170, 1173, 1183, 1192, 1201, 1211-1215, 1217, 1220, 1225, 1226, 1228, 1229, 1230 (A,B,C) 1231-1235, 1238-1240, 1252	K10186102	Ceramic Disc (RD870-1B102K63V)	63WV B	0.001 $\mu$ F
C1008, 1009, 1021, 1034, 1035, 1042, 1080, 1132, 1134, 1136, 1139-1141, 1145, 1147, 1167, 1174, 1175, 1179, 1180, 1185, 1188	K14180103	" " (RD873-1FZ-103Z63V)	" FZ	0.01 $\mu$ F
C1097, 1118	K19149003	Semiconductor Ceramic (UAT04X152K-L05AE)	25WV	0.0015 $\mu$ F
C1096, 1117	K19149007	" " (UAT05X332K-L05AE)	"	0.0033 $\mu$ F
C1028	K19149009	" " (UAT05X472K-L05AE)	"	0.0047 $\mu$ F
C1122*	K19149011	" " (UAT05X682K-L05AE)	"	0.0068 $\mu$ F
C1047, 1095, 1205, 1208-1210, 1221,	K19149013	" " (UAT05X103K-L05AE)	"	0.01 $\mu$ F
C1085	K19149017	" " (UAT06X223K-L05AE)	"	0.022 $\mu$ F
C1105, 1190	K19149019	" " (UAT08X333K-L45AE)	"	0.033 $\mu$ F
C1010, 1019, 1022-1026, 1031, 1041, 1048, 1049, 1051, 1055, 1056, 1059-1061, 1063-1066, 1094	K19149021	" " (UAT08X473K-L45AE)	"	0.047 $\mu$ F

C1006, 1166, 1250, 1253, 1254	K23140005	Ceramic Chip (GR40W5R102M50V)	50WV	0.001 $\mu$ F
C1241-1243, 1246, 1247	K21170002	Feed through (ECKL1H-102PE)	50WV	0.001 $\mu$ F
C1093, 1114, 1115, 1120	K40179001	Electrolytic (50RC2-1)	50WV	1 $\mu$ F
C1050, 1086, 1098, 1099, 1102, 1115, 1119, 1131, 1184, 1216, 1218, 1219, 1223, 1227	K40129012	" (16RC2-10)	16WV	10 $\mu$ F
C1107	K40089005	" (ECE-A1CK10016V10)	6.3WV	22 $\mu$ F
C1116	K40109009	" (ECE-A1AK33010V33)	10WV	33 $\mu$ F
C1113, 1248	K40109002	" (10RE47)	"	47 $\mu$ F
C1224	K40129002	" (16RE47)	16WV	47 $\mu$ F
C1159, 1176, 1189	K40109001	" (10RE100)	"	100 $\mu$ F
C1038, 1039, 1045	K70167104	Tantalum (CS15E1V0R1M)	35WV	0.1 $\mu$ F
C1207	K70167474	" (CS15E1VR47)	"	0.47 $\mu$ F
C1084, 1121, 1206	K70147105	" (CS15E1E010E)	25WV	1 $\mu$ F
C1126	K70127225	" (CS15E1C2R2M)	16WV	2.2 $\mu$ F
C1046, 1191	K70120001	" (489D475X0016B1)	"	4.7 $\mu$ F
C1110	K70080001	" (489D685X0006A1)	6.3WV	6.8 $\mu$ F
C1186	K70100003	" (489D106X0010B1)	10WV	10 $\mu$ F
C1029	K70080004	" (489D226X0006C1)	6.3WV	22 $\mu$ F
C1108	K70080006	" (489D476X0006D1)	"	47 $\mu$ F
<b>TRIMMER CAPACITOR</b>				
TC1001	K91000059	ECVIZW04 x 53	4pF	
TC1002-1006	K91000029	ECVIZW20 x 53	20pF	

		<b>CAVITY</b>	
CV1003	Q9000214	CV370	
CV1001, 1002	Q9000114	CV441B	
		<b>INDUCTOR</b>	
L1012	L1190004	FL4HR68M	0.68 $\mu$ H
L1010, 1015	L1190005	FL4H1R0M	1 $\mu$ H
L1016, 1018	L1190014	FL4H100K	10 $\mu$ H
L1006	L1190023	FL5H220K	22 $\mu$ H
L1017	L1190017	FL5H102K	1mH
L1020	L1190090	LAL04102K-NA	1mH
L1001	L0020767		
L1002	L0020743		
L1004	L0021259		
L1007, 1008	L0021261		
L1009	L0021257		
L1011	L0190015		
L1013	L0020725		
L1014	L1020680		
L1019	L0020978		
L1021	L0020745B		
		<b>TRANSFORMER</b>	
TI005-1007	L0021161		
TI010, 1015	L0021163		
TI009, 1011	L0021164		
TI001-1003, 1016-1019	L0021165		
TI008	L0020887	5MMC-044X	
TI004, 1012- 1014	L0021256		
TI020, 1021	L0020345	113SN6146F	
		<b>RELAY</b>	
RL1001	M1190042	G4Y-152P	DC6.8V
RL1002	M1190035	BR211CD006M	
		<b>CONNECTOR</b>	
J1001, 1002, 1007	P1090255	TMP-JA	
J1008	P1090210	TMP-JV	
J1004, 1005	P0090192	B3B-XH-A	
J1003, 1006	P0090194	B5B-XH-A	
J1010	P0090195	B6B-XH-A	

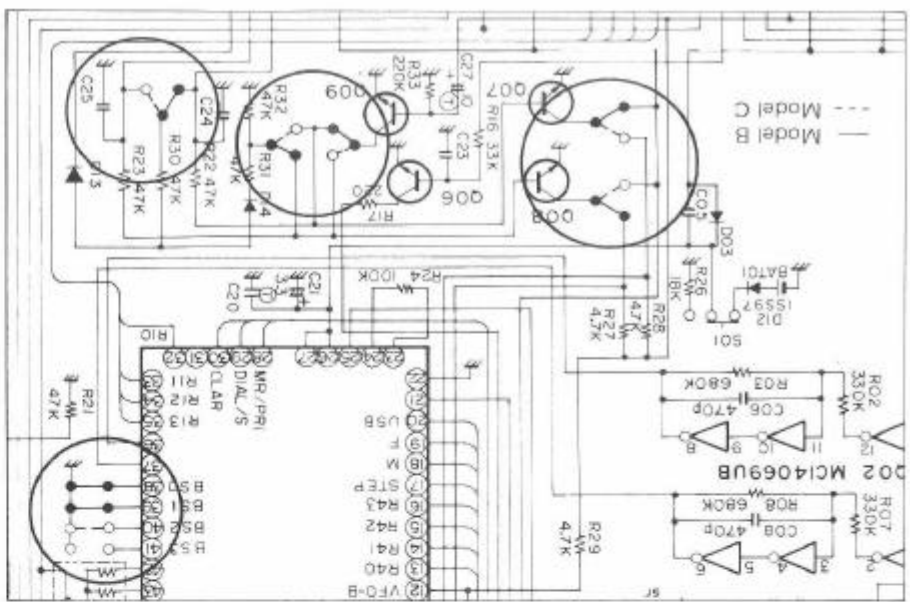
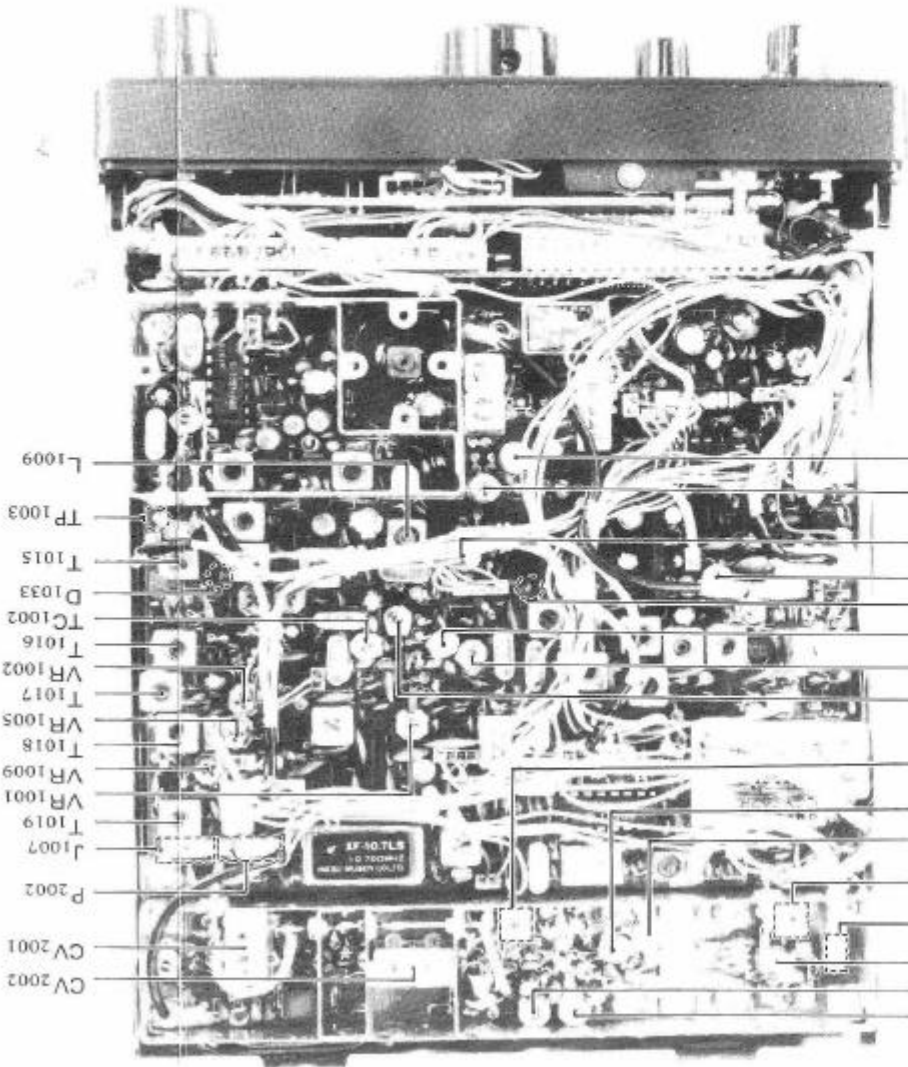
J1009	P0090196	B7B-XH-A	
JP1001	T9204342		
JP1002	T9204343		
JP1003	T9204344		
JP1004	T9204345		
JP1005	T9204346		
JP1006	T9204347		
JP1007	T9204348		
JP1008	T9204349		
JP1009	T9204350A		
JP1010	T9204351		
JP1011	T9204352		
JP1012	T9204353A		
		<b>TP TERMINAL</b>	
TP1001-1003	Q5000036	TP-G MK1095	
		<b>TX UNIT</b>	
Symbol No.	Part No.	Description	
PB-2410	F0002410	Printed Circuit Board	A Board
	F0002411	Printed Circuit Board	B Board
	C024100A	P.C.B. with Components	
	C024110A	"	
		<b>TRANSISTOR</b>	
Q2004	G3324070	2SC2407	
Q2001, 2003	G3325700	2SC2570A	
Q2005	G3330190	2SC3019	
Q2006	G3330200	2SC3020	
		<b>DIODE ARRAY</b>	
Q2002	G2090135	ND487C2-3R	
		<b>DIODE</b>	
D2002, 2003	G2015550	SI	1S1555
D2001	G2090027	"	1SS53

RESISTOR					
R2019	J00215100	Carbon Film	1/8W	VJ	10Ω
R2005	J00215270	" "	" "	" "	27Ω
R2002, 2008	J00215560	" "	" "	" "	56Ω
R2015	J00215820	" "	" "	" "	82Ω
R2018	J00215101	Carbon Composition	"	GK	100Ω
R2012	J00215121	" Film	"	VJ	120Ω
R2014	J00215391	" "	" "	" "	390Ω
R2004, 2006	J00215471	" "	" "	" "	470Ω
R2001, 2011	J00215102	" "	" "	" "	1kΩ
R2021	J10216221	" Composition	"	GK	220Ω
POTENTIOMETER					
VR2001	J51752102	RGS6-FAN-1k	1kΩ		
VR2002	J51752202	RGS6-FAN-2k	2kΩ		
CAPACITOR					
C2012	K02179003	Ceramic Disc (DD104CK020C50V02)	50WV	CH	2pF
C2032	K02179004	" " (DD104CH030C50V02)	" "	" "	3pF
C2010, 2011, 2014	K02172040	" " (DD104CH040C50V02)	" "	" "	4pF
C2030	K02173060	" " (DD104CH060D50V02)	" "	" "	6pF
C2017	K02173070	" " (DD104CH070D50V02)	" "	" "	7pF
C2004, 2031	K02175120	" " (DD104CH120J50V02)	" "	" "	12pF
C2027	K02179008	" " (DD104CH200J50V02)	" "	" "	20pF
C2001	K02175270	" " (DD104CH270J50V02)	" "	" "	27pF
C2005, 2006	K00175390	" " (DD104SL390J50V02)	" "	SL	39pF
C2007	K02175390	" " (DD105-257CH390J50V02)	" "	CH	39pF
C2021	K02185390	" " (RD871-1NPO-390J63V)	63WV	" "	39pF
C2003, 2008, 2009, 2013, 2015, 2018, 2020, 2022, 2024, 2026, 2029	K10186102	" " (RD870-1B102K63V)	" "	B	0.001μF

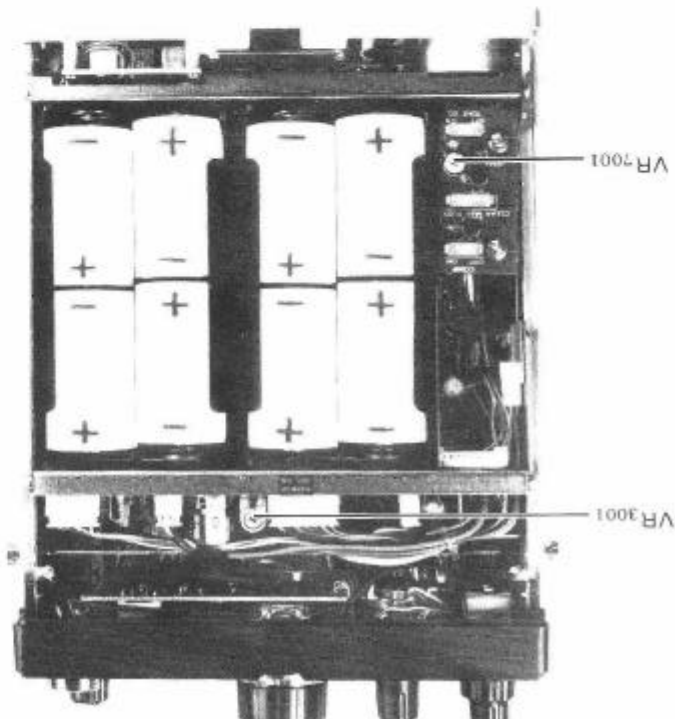
C2033-2037	K21170002	Ceramic Disc (ECK-Y1H-102WE)	50WV		0.001μF
C2002	K23140005	Ceramic Chip (GR40W5R102M)	50V		0.001μF
C2016, 2019, 2023, 2025, 2028	K40129012	Electrolytic (ECEA1CK100)	16WV		10μF
TRIMMER CAPACITOR					
TC2001	K91000059	ECV1ZW 04x53			4pF
TC2004	K91000028	ECV1ZW 10x53			10pF
TC2002, 2003	K91000029	ECV1ZW 20x53			20pF
INDUCTOR					
L2001	L0020876				
L2002	L0020824				
L2003	L1020677				
L2004, 2005, 2009, 2012	L0021263				
L2006, 2013	L1020677				
L2007, 2014	L1020671				
L2008, 2011	L0021262				
L2010	L1020677				
L2015	L0021260				
L2016, 2017	L0020767				
TRANSFORMER					
T2001, 2002	L0190007	FKMA070PB01-BR			
CAVITY					
CV2001	Q9000214	CV-370			
CV2002	Q9000114	CV-441B			
FERRITE BEADS					
FB2001-2004	L9190001	Ri 3x3-1			
CONNECTOR					
J2001, 2002	P0090248	EMCS0252M			
J2003	P1090255	TMP-JA			
TP TERMINAL					
TP2001, 2002	Q5000036	TP-G MK1095			



TRANSMITTER SECTION ALIGNMENT POINTS



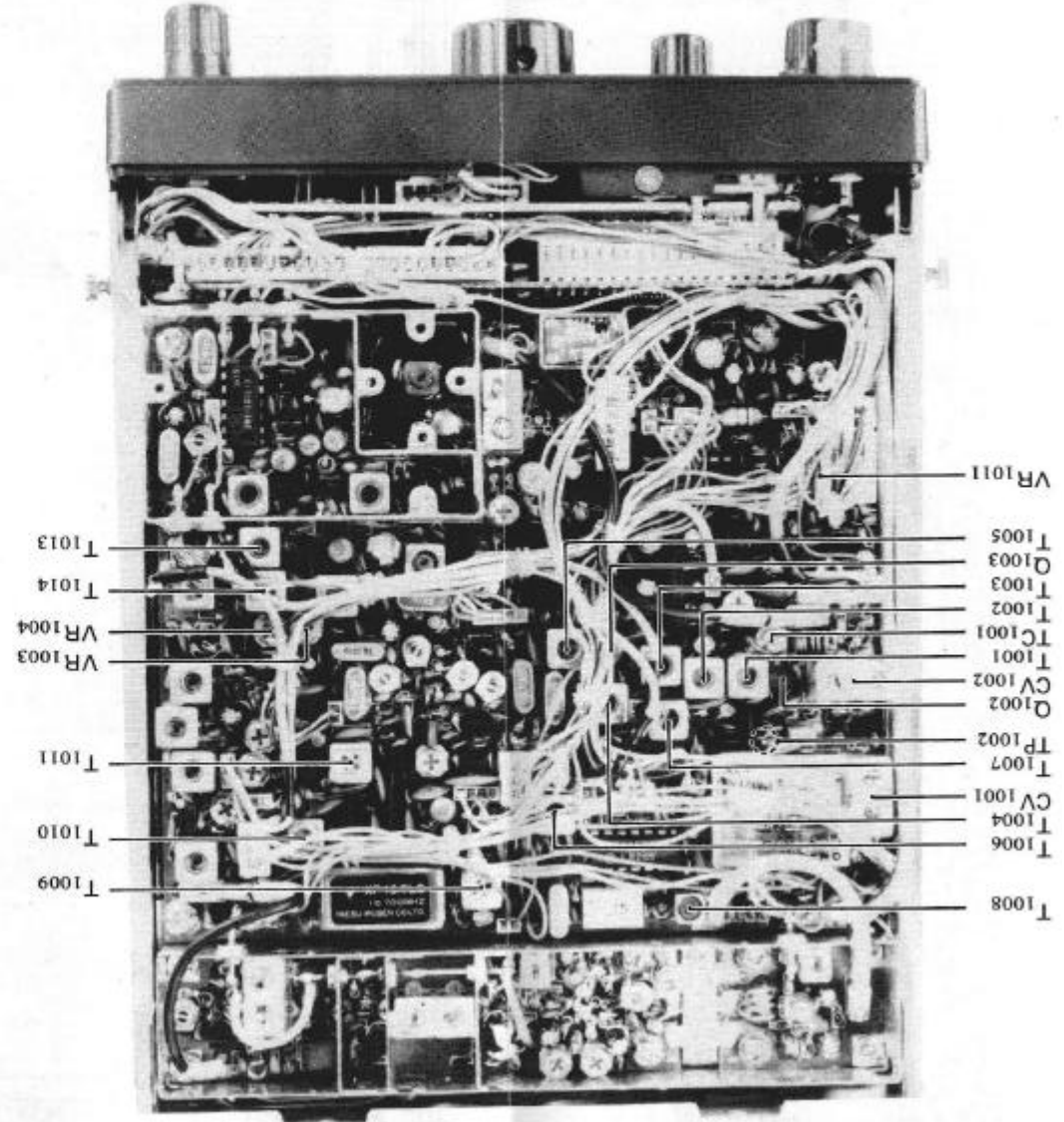
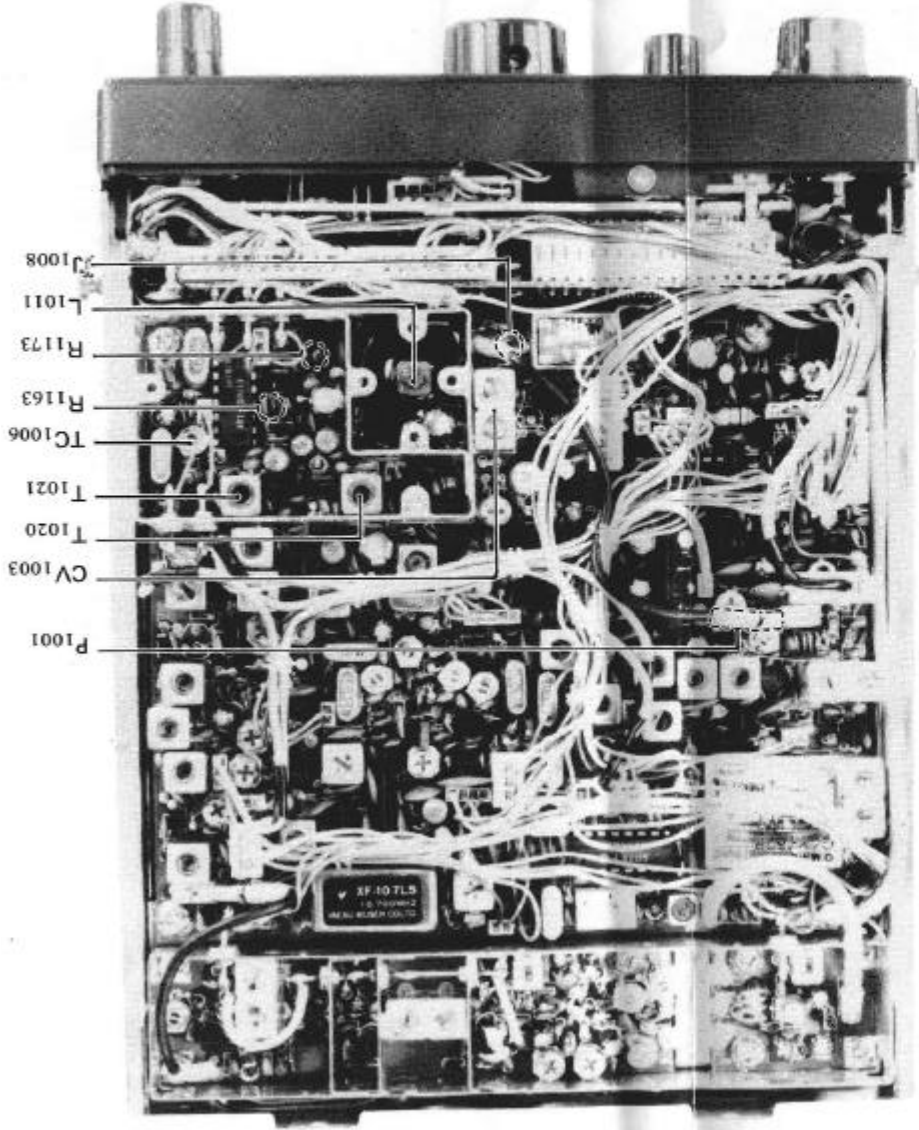
METER (BATTERY CHECK),  
 SQUELCH PRESET ALIGNMENT POINTS



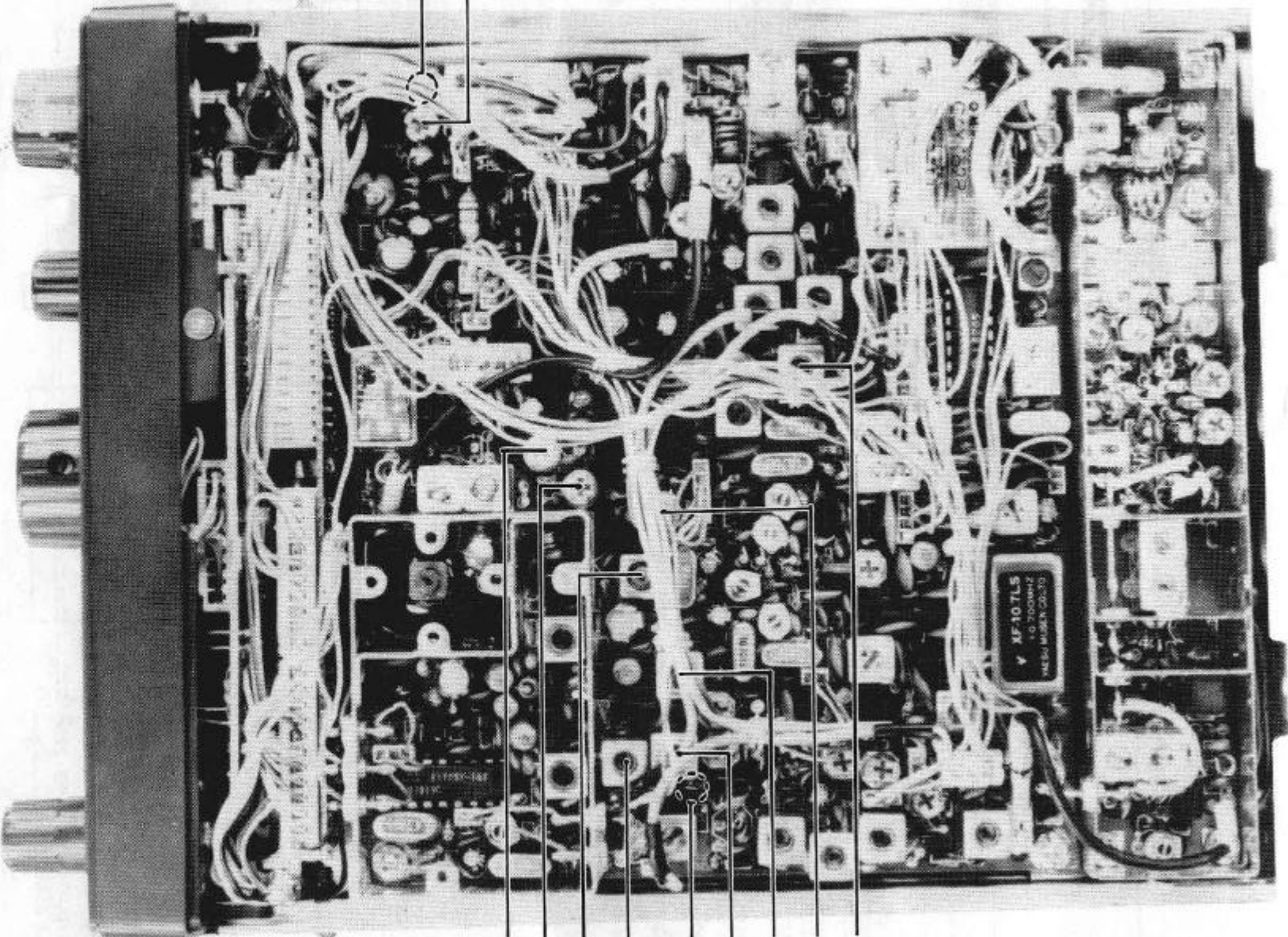
PLL SECTION ALIGNMENT POINTS

RECEIVER SECTION ALIGNMENT POINTS

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RadioAmateur.EU



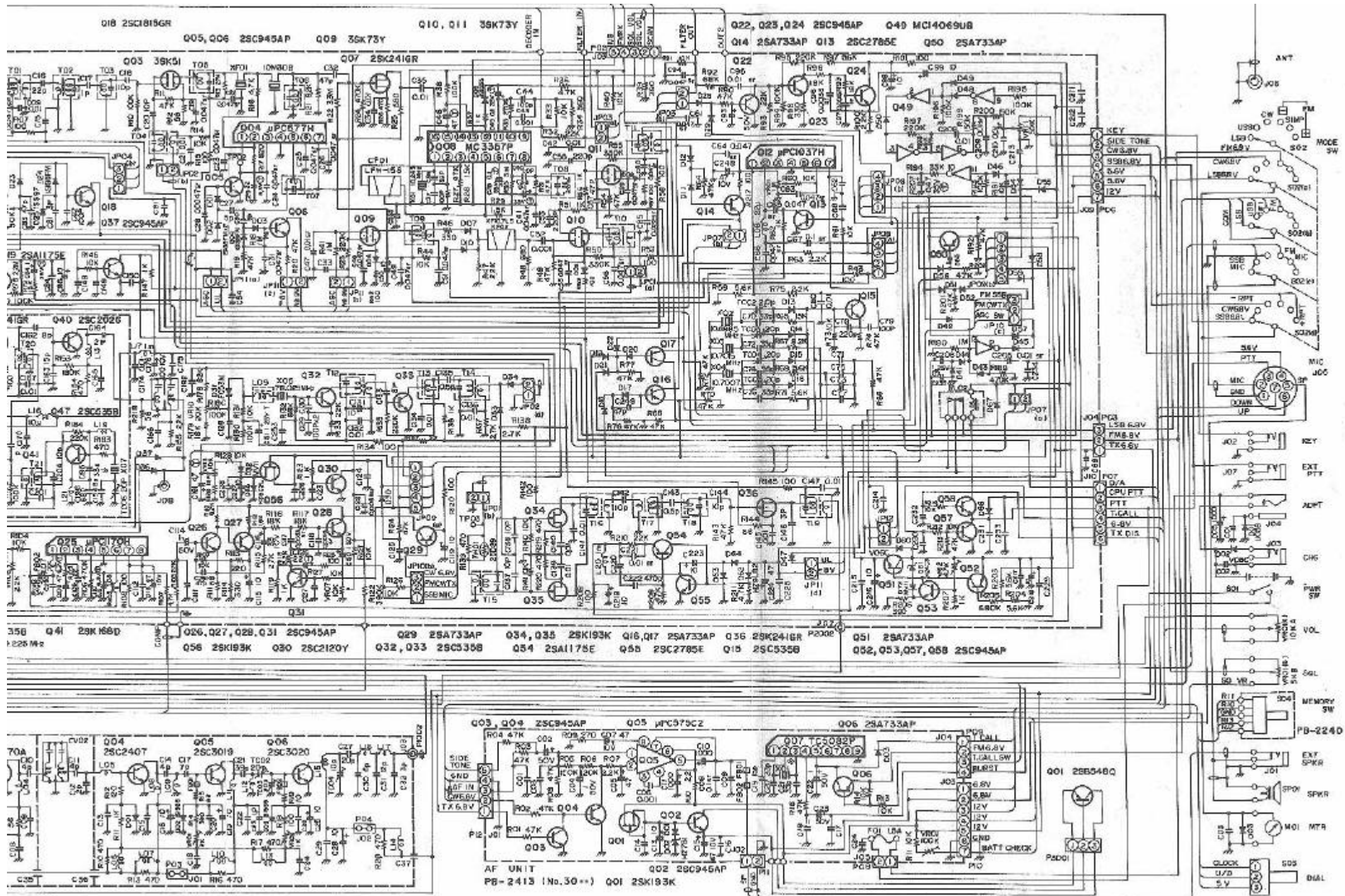




VR1012  
D1060

T1004  
VR1013  
T1012  
T1014  
D1033  
T1013  
L1009  
VR1010  
VR1007

78 MHz LOCAL SECTION ALIGNMENT POINTS

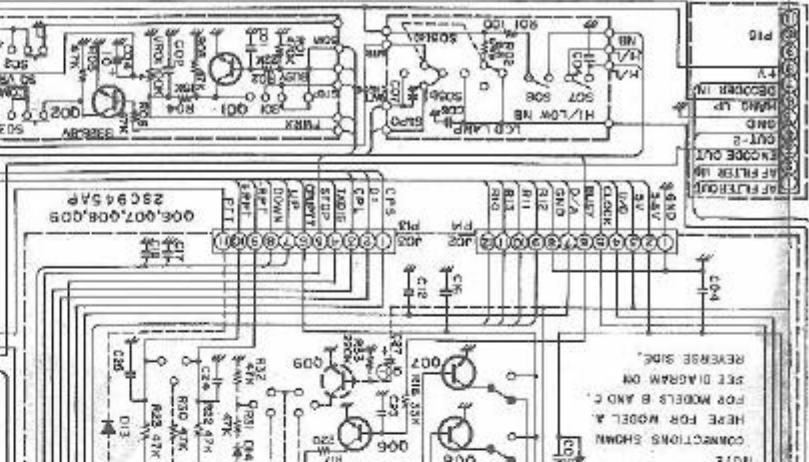
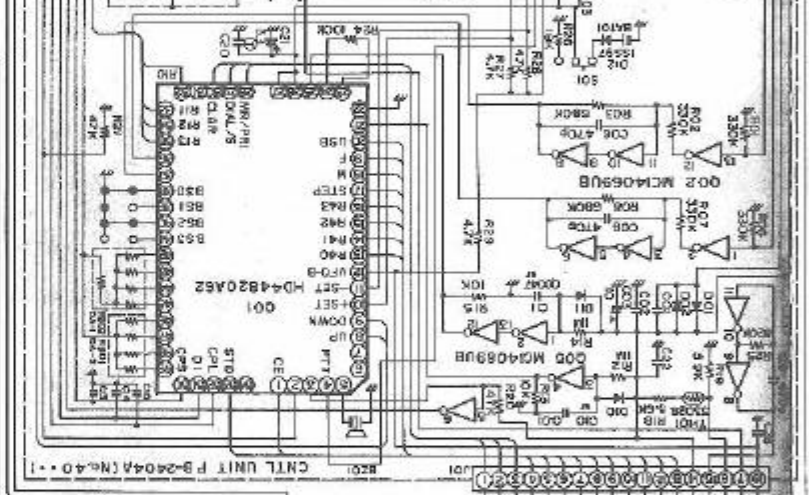
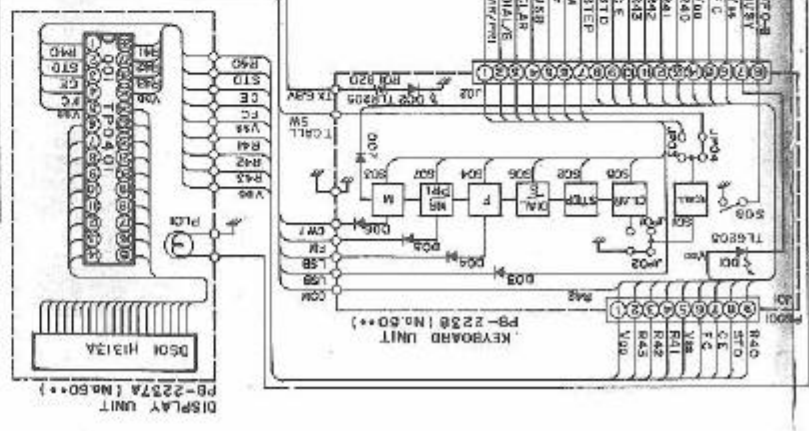
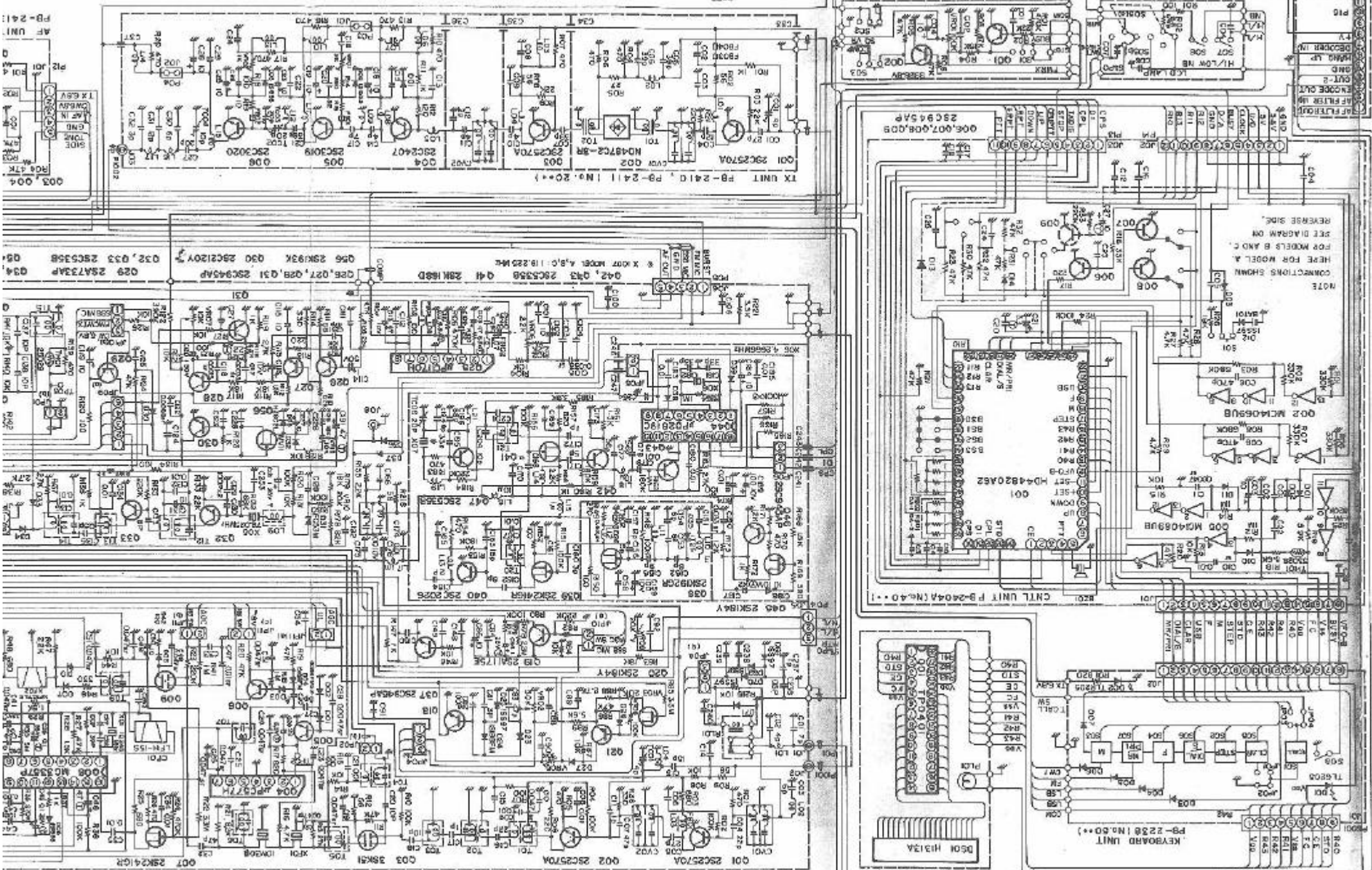


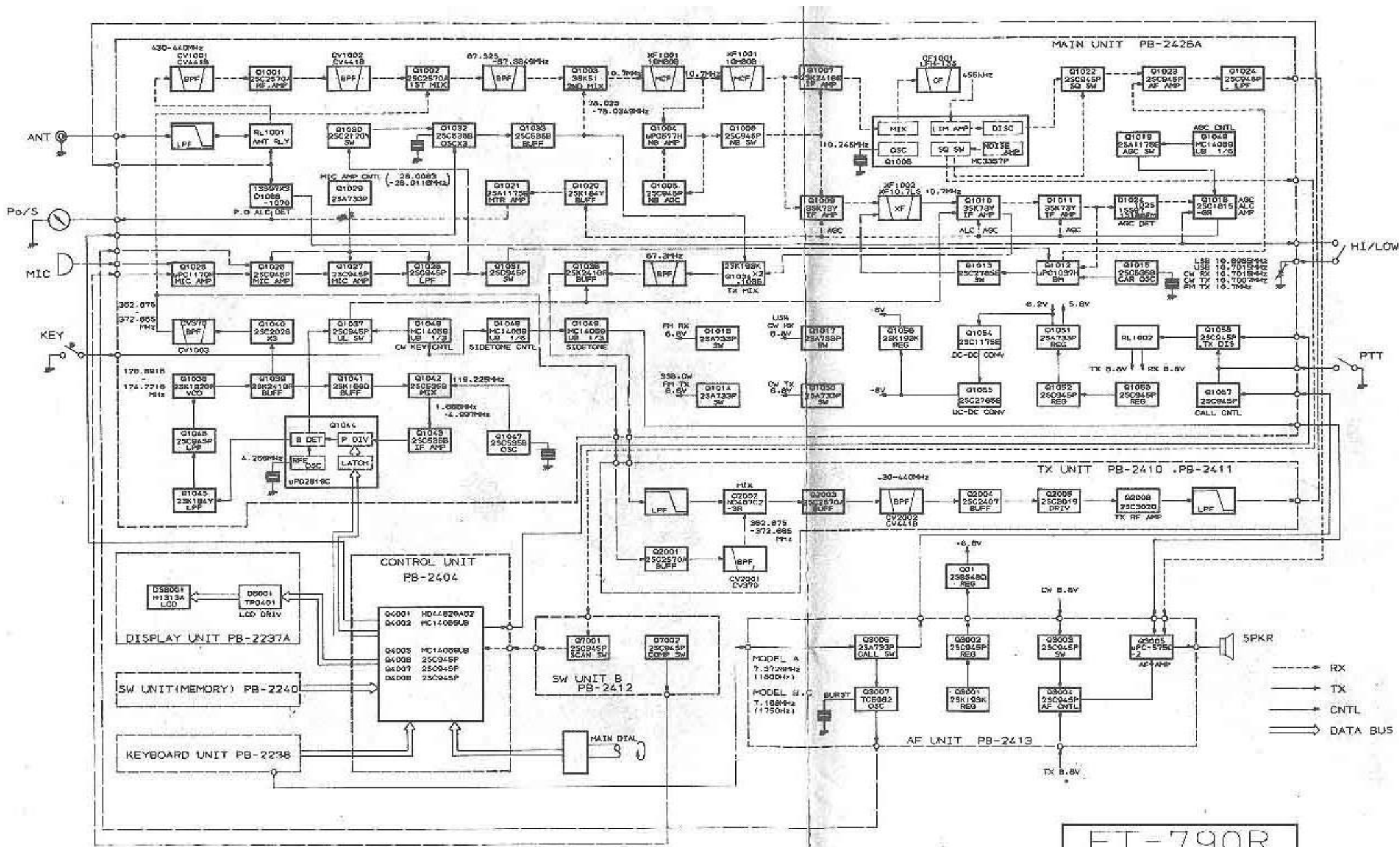
UNLESS NOTED, 3. CAPACITOR VALUES ARE IN  $\mu$ F, 50V; EXCEPT ELECTROLYTICS, WHICH ARE 16V; RESISTOR VALUES ARE IN  $\Omega$ , 1/5W, OTHERWISE NOTED.

X 1001 MODEL A : 7.373 MHz  
MODEL B,C : 7.168 MHz

**FT-790R**  
CIRCUIT DIAGRAM





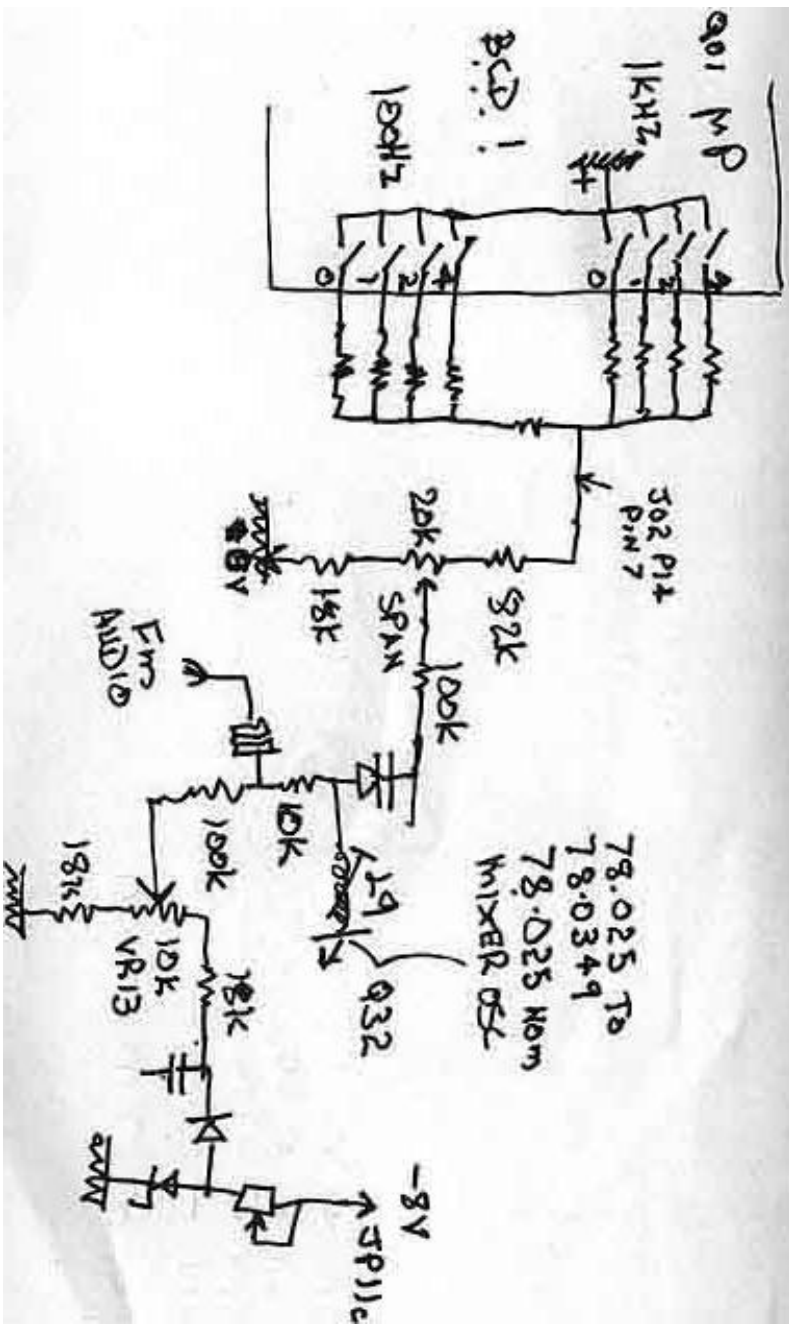


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FT-790R  
BLOCK DIAGRAM

A.B.C

# FINE FREQUENCY CONTROL DETAIL





## FM OPERATION

Preset the controls and switches as described for SSB operation, but set the MODE switch to FM/SIMP.

Rotate the SQL (Squelch) control fully counterclockwise. Now turn the VOL control out of the click-stop to turn the transceiver on. Advance the volume control for a comfortable listening level.

When the channel is clear, adjust the SQL control so the background noise just disappears. This threshold point is the point of maximum sensitivity, and the squelch control should not be advanced beyond this point too far, or the squelch will not respond to weak signals.

In the FM mode, the synthesizer steps provided are 25 kHz and 100 kHz per step (the clarifier steps are still 100 Hz/step). When you are changing modes from SSB to FM, and were last operating on other than a 25 kHz or 100 kHz step, the microprocessor will automatically move you to the next higher or lower 25 kHz or 100 kHz step upon the first click of the main tuning dial (or first stepping of the scanner).

Rotate the main tuning dial (or operate the scanning controls) until the desired frequency is reached. To transmit, close the PTT switch, and speak into the microphone in a normal voice. Release the PTT switch for receiver recovery.

For repeater operation, selection of the standard splits\* is provided on the front panel. For -shift, set the MODE switch to FM/-, and for +shift, select FM/+. This selection can be made either during main dial or memory operation.

For operation on odd splits, use a combination of the memory system and the main tuning dial. First, store the desired receive frequency in any

\* Standard splits for various models are shown in the Model Chart on the inside front cover of this manual, and additional details are given on page 4, item 3.

memory channel. Now use the main dial to select the desired transmit frequency. Next push the yellow F and S buttons. You will now be receiving on the memory channel just programmed. When you close the PTT switch, you will be transmitting on the main dial frequency. If you desire to listen on several memory channels, the memory channel selector may be rotated as desired.

The front panel CALL switch activates a manual-length 1750- or 1800 Hz tone for repeater access. When this button is pushed, the transmitter is activated and the access tone is superimposed on the transmit signal.

## CW OPERATION

- (1) The synthesizer steps selected in the CW mode are identical to those used for SSB operation.
- (2) Connect a key to the rear panel KEY jack, using a miniature phone plug. The key-up voltage is 7V, while the key-down current is 0.3mA, so most electronic keyers that close completely to ground will work well with the FT-790R.
- (3) Set the MODE switch to CW.
- (4) Close the PTT switch on the microphone to switch to the transmit mode. If desired, a footswitch may be used with the FT-790R. The STAND BY jack, located on the side of the transceiver, is wired in parallel with the PTT line on the microphone. This may be used in situations where the microphone is not the most efficient means of activating the transmitter.
- (5) The clarifier may be used for following unstable signals. The clarifier allows offset tuning in 100 Hz steps away from the transmit frequency. See the section on clarifier operation for details.