

## INDEX

GENERAL .....	1
SPECIFICATIONS .....	2
SEMICONDUCTORS .....	3
ACCESSORIES .....	3
TOP PANEL CONTROLS AND SWITCHES .....	4
FRONT PANEL SWITCHES .....	5
BOTTOM PANEL CONNECTIONS .....	7
BATTERY PACK INFORMATION .....	8
BATTERY CHARGER INFORMATION .....	10
OPERATION .....	16
BLOCK DIAGRAM .....	24
CIRCUIT DESCRIPTION .....	25
MAINTENANCE AND ALIGNMENT .....	29
PARTS LIST .....	38

## FT-708R MICROPROCESSOR CONTROLLED 0.7 METER BAND FM HAND-HELD TRANSCEIVER

### GENERAL

The FT-708R is an all-new microprocessor-based 70 cm FM transceiver for the demanding amateur operator. Featuring one watt of RF output, the FT-708R provides 10 MHz coverage in 25 kHz or 50 kHz steps, along with 10 memories for storage of favorite channels.

The microprocessor-controlled scanner allows sweeping of the band with automatic holding on busy or clear channels. Scanning of the 10 memories may also be selected. An important new feature in the FT-708R is the limited band scanning mode, whereby a favorite segment of the band may be scanned, instead of the entire band. The FT-708R may also be programmed to exclude a given section of the band, if you wish.

Digital display of the last four digits of the operating frequency is provided by an LCD display. A nighttime display illumination lamp is provided, along with a lithium cell for memory backup. The lithium cell has an estimated lifetime of approximately five years. The front panel keyboard allows entry of all channels, up/down scanning and repeater split programming, as well as two-tone (DTMF) encoding for autopatch or control purposes.

We encourage you to read this manual in its entirety, so as to become more familiar with the fantastic new FT-708R. With proper care, this equipment will provide many years of reliable performance.

MODEL	FREQUENCY RANGE	PRESET FREQUENCY	FREQUENCY STEP	REPEATER SHIFT	STONE BURST
A	(MHz) 440.000- 449.975	(MHz) 446.000	(kHz) 25/50	(MHz) ± 5	-
• B	430.000- 439.975	433.400	25/50	± 7.6	1750
X	430.000- 439.975	436.000	25/50	± 5	-

FT-708R MODEL CHART

## SPECIFICATIONS

### GENERAL

**Frequency coverage:**  
440,000–449,975 MHz  
(Model A)  
430,000–439,975 MHz  
(Model B, X)

**Number of channels:**  
400 (25 kHz steps)

**Emission type:**  
F3

**Batteries:**  
Ni-Cd battery pack FNB-2

**Voltage requirement:**  
10.8 VDC (maximum 13V)

**Current consumption:**  
RX 150 mA  
(20 mA squelched)  
TX 500 mA (HI),  
300 mA (LOW)

**Case dimensions:**  
168 (H) x 61 (W) x 49 (D) mm

**Weight:** 720 g Approx.  
(with battery pack, rubber antenna)

### TRANSMITTER

**Power output:**  
1 watt (HIGH)  
200 mW (LOW)

**Deviation:**  
±5 kHz

**Spurious radiation:**  
–50 dB or better

**Microphone:**  
Condenser type,  
2000 ohms impedance

### RECEIVER

**Circuit type:**  
Double conversion  
superheterodyne

**Intermediate frequencies:**  
1st IF = 46.255 MHz  
2nd IF = 455 kHz

**Sensitivity:**  
Better than 0.4 μV for 12 dB  
SINAD  
Better than 1 μV for S/N  
30 dB

### Selectivity:

±1.5 kHz at –60 dB

### Audio output:

500 mW at 10% THD

\* Specifications subject to change without notice or obligation.

## SEMICONDUCTOR

### ICs:

HD44820A07	1
MC3357	1
MC14069UB	1
TC5082P	1*
TP0401	1
μPC577H	1
μPD2819C	1
MK5087	1

### FETs:

2SK184Y	1
2SK192Y	1
2SK193K	3

\* Model B only

### Transistors:

2SA950Y	1
2SA1175E	3
2SC1780	1
2SC2026	1
2SC2120Y	1
2SC2131	2
2SC2407	2
2SC2549	1
2SC2785E	9
2SC2786L	10
2SC2787L	1
2SD892Q/R	1

### LCD

HI301	1
-------	---

### Diodes:

1S1555 (Si)	1
1SS53 (Si)	15
V06B (Si)	1
1SS97	
(Schottky Barrier)	1
1SV69 (Varactor)	6
1T25 (Varactor)	1
FC53 (Varactor)	1
MV11 (Varistor)	1
MV103 (Varistor)	1
HZ6B-1L (Zener)	1
HZ7A-2 (Zener)	1
HZ7B-1L (Zener)	1
SG235D (LED)	1
SR535D (LED)	1

## ACCESSORIES

Rubber Whip Antenna	YHA-44	(Q3000019)	1
Ni-Cd Battery Pack	FNB-2	(Q9000088)	1
Ni-Cd Battery Charger	NC-9B (117V)	(Q9000071)	1
	NC-9C (200–234V)	(Q9000072)	
Carrying Case (Vinyl)		(R7068220)	1
Shoulder Strap with Ring		(R7048792B)	1
Earphone		(M4190001)	1

## TOP PANEL CONTROLS AND SWITCHES



### VOL

This is the main volume and power ON/OFF switch for the transceiver.

### SQL/TONE

The squelch control silences the receiver audio until a signal is received. When rotated to the TONE position, this switch will activate the optional Tone Squelch Unit, FTS-32, which provides silent monitoring of busy channels.

### MIC

This connector accommodates the optional YM-24A Remote Speaker/Microphone.

### ANT

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

### EAR

This is a miniature phone jack used to accommodate an external earpiece.

### HIGH/LOW

This switch selects transmitter powers of 1 watt RF output or 200 mW of RF output.

### SHIFT

This switch selects the repeater transmit frequency offset desired. In the SIMP position, the transmit and receive frequencies are the same. Shifts of  $\pm 5$  MHz (7.6 MHz: per local requirements) and auxiliary splits ( $\pm$ SET) can be selected. When set to the MS position, you will receive on the dial frequency, while transmission will occur on the memory channel selected. See the "Operation" Section for details.

## FRONT PANEL SWITCHES



### PTT Switch

The Push to Talk switch activates the transmitter. Release the switch for receiver recovery.

### TONE BURST Switch (Model B only)

When the TONE BURST switch is squeezed along with the PTT switch, a 1750 Hz tone will be superimposed on the transmitted signal. The repeater access tone is manually actuated; the tone signal length can thus be controlled by the operator.

### LAMP Switch

This switch activates the LCD illumination lamp (for nighttime operation).

### ON AIR

This indicator lights up while you are transmitting.

## BUSY

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

## KEYBOARD

On receive, the keyboard controls frequency programming, up/down scanning, and setting of auxiliary repeater splits. On transmit, the keyboard becomes a 16 button dual-tone multi-frequency encoder for autopatch or control purposes.

## KEY

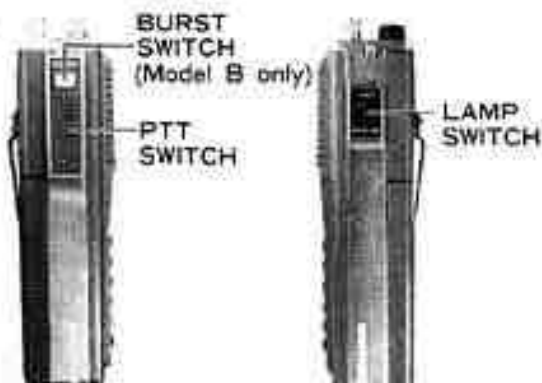
This control disables the keyboard, so as to prevent accidental frequency change caused by inadvertent bumping of one of the buttons on the keyboard. When the keyboard is in the "LOCK" mode, the letter "L" will be shown on the LCD display.

## BUSY-MAN-CLEAR

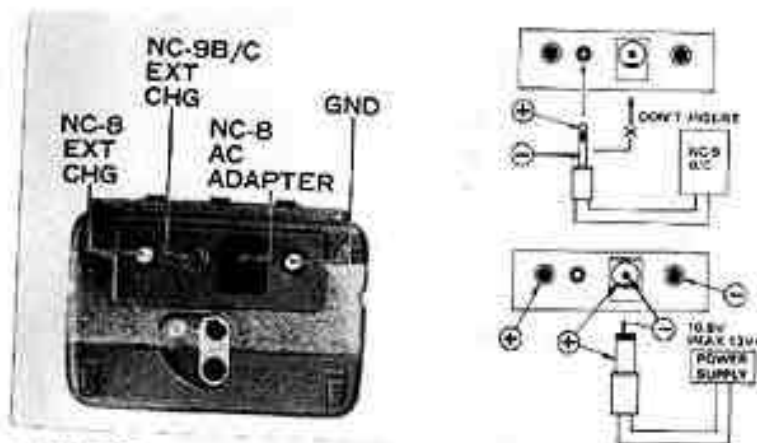
This switch selects the STOP mode of the scanner.

## STEP

This switch selects the desired synthesizer step. When this switch is set to the X2 position, 50 kHz steps are programmed. When not in the X2 position, 25 kHz steps are programmed.



## BOTTOM PANEL CONNECTIONS



## EXT CHG

This jack is used for connection to the external NC-9B/C Ni-Cd charger.

## CHG TERMINAL

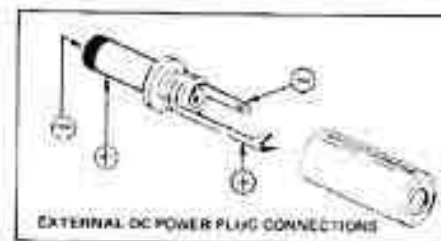
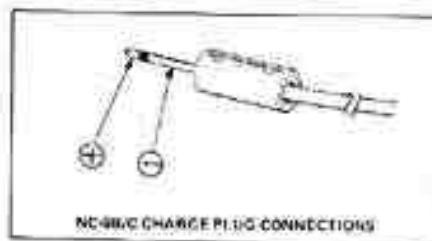
This terminal is for use with the NC-7 and NC-8 chargers.

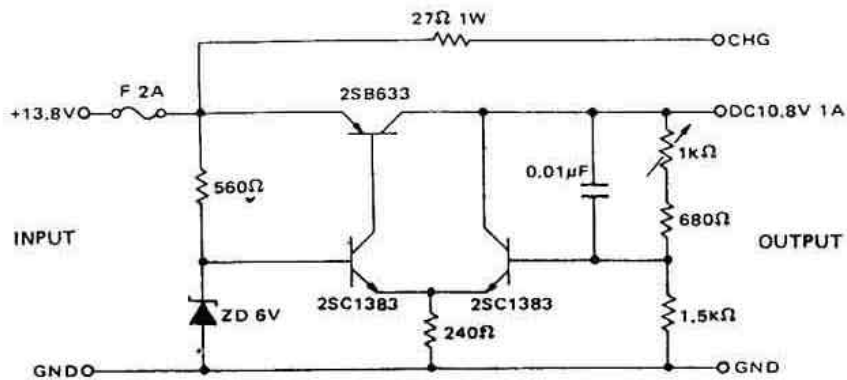
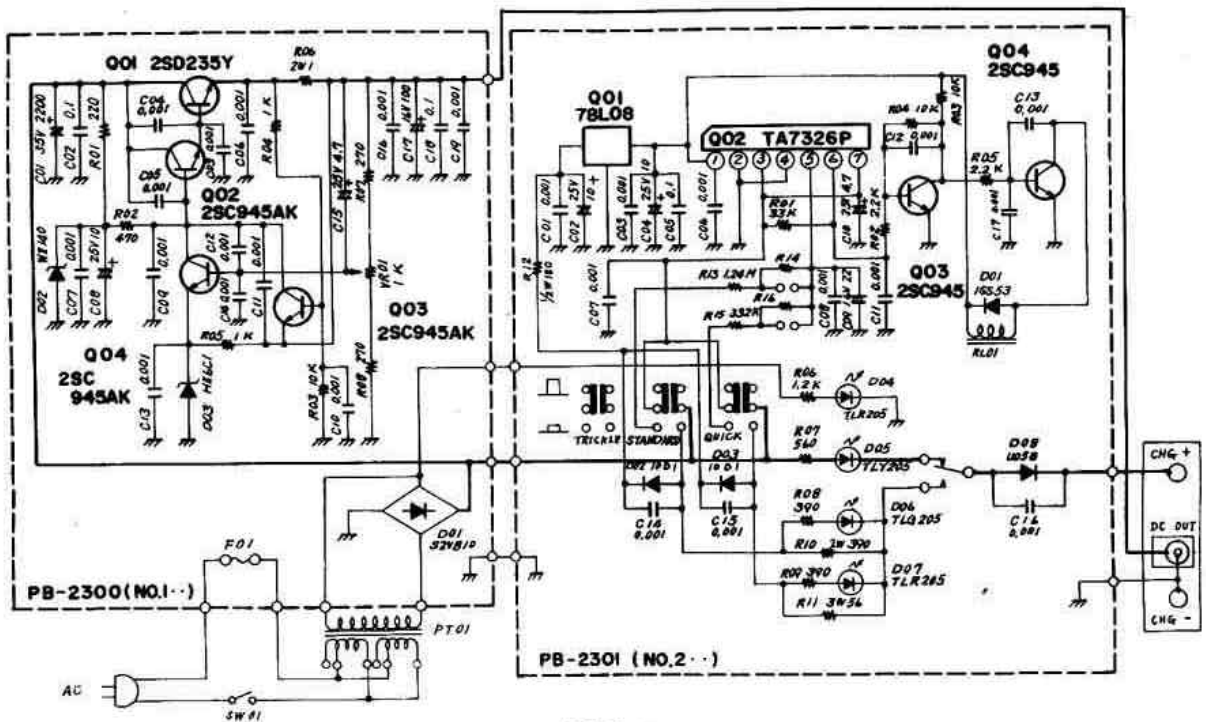
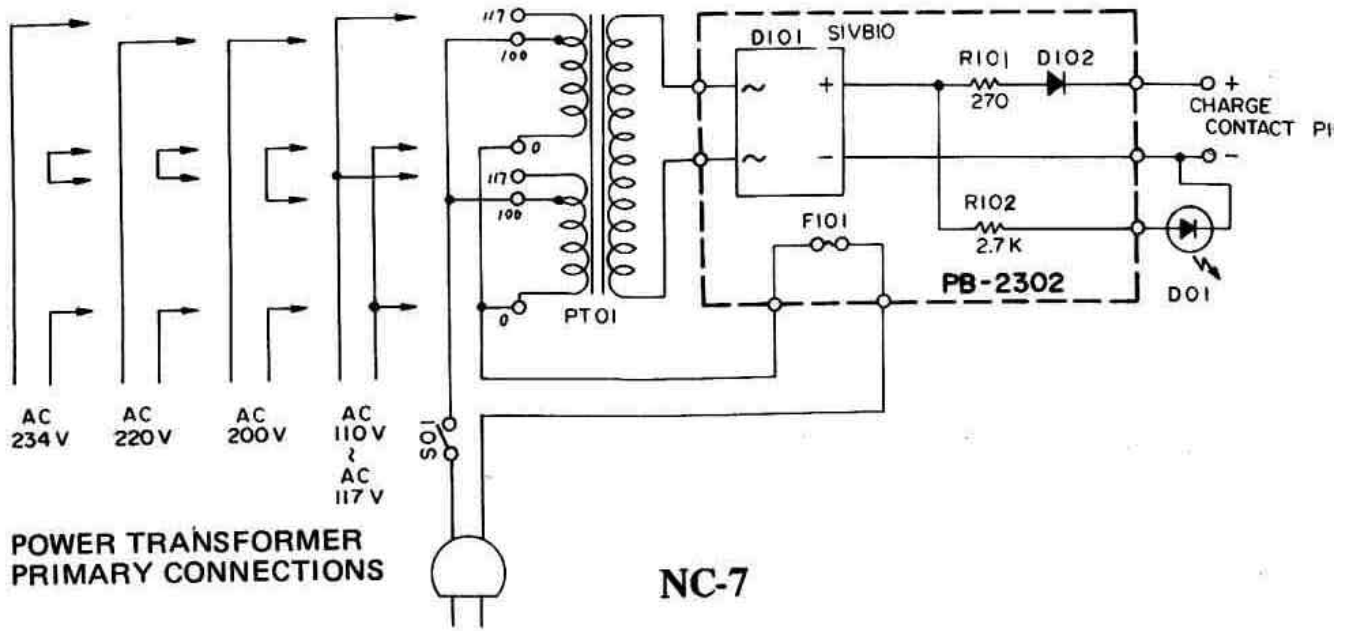
## EXT DC

This jack accommodates an external DC power supply. When a plug is inserted, the Ni-Cd battery is automatically switched off.

## CAUTION

Never attempt to insert the charge plug from the NC-9B/C or other metal material to the DC adapter jack on the bottom of the FT-708R, as the internal protection fuse will blow.







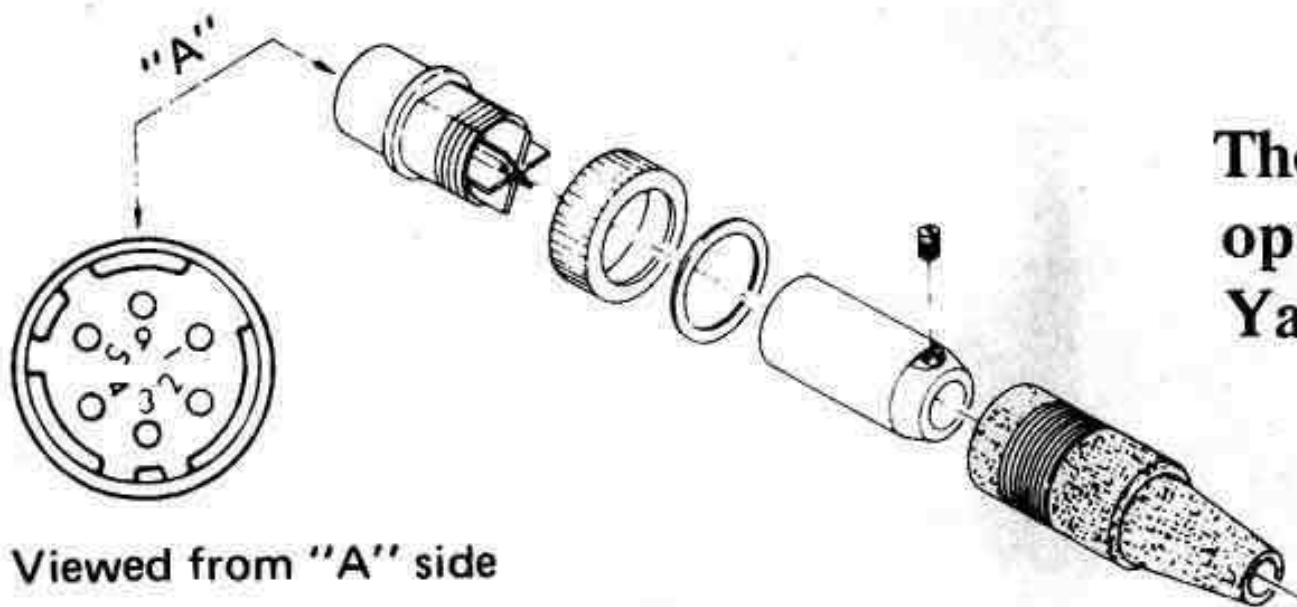
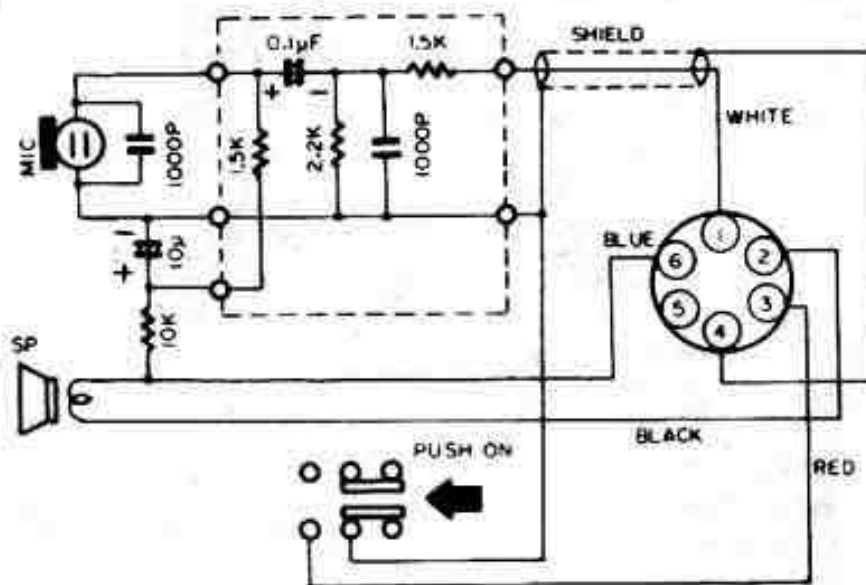
NC-9B (for 117V AC)



NC-9C (for 200-234V AC)



PA-3



## YM-24A Speaker/Microphone Connection

## OPERATION

### A. Basic Operation

1. Preset the controls and switches as follows:

SHIFT	SIMP position
VOL	OFF position
SQL	Position just before the click-stop
KEY	UNLOCK (left) position
CLEAR-MAN-BUSY	MAN position
STEP	X1 (left) position
BACKUP	ON position (located in the battery compartment) See page 23

2. Make certain that the battery pack is correctly installed and that the antenna has been properly connected.
3. Turn the VOL control clockwise out of the click-stop position. The digital display will indicate "6.000", meaning 446.000 MHz (Model B: "3.400" = 433.400 MHz; Model X: "6.000" = 436.000 MHz). Gradually rotate the VOL control for a comfortable level on the background noise or incoming signals.
4. When the channel is clear, rotate the SQL control clockwise until the background noise is just silenced. Do not go beyond this threshold point, or the receiver will not respond to weak signals.
5. Squeeze the push-to-talk (PTT) switch to transmit. Release the PTT switch for receiver recovery. If your FT-708R (Model B) is equipped with a tone burst switch, press this switch, along with the PTT switch, to transmit a 1750 Hz tone to access repeaters.

### B. Entering Frequencies from the Keyboard

1. When a frequency is entered from the keyboard, the last four digits of the operating frequency must be entered. This frequency must be divisible by 25 kHz (e.g., 6.325, 6.350, etc.).

2. To enter 446.025 MHz (model B/X: 436.025 MHz), press "6025" on the keyboard. The digital display will now show those digits. Now press the DIAL key, and the decimal point will appear between the "6" and the "025". You are now operating on 446.025 MHz (model C/X: 436.025 MHz).
3. Let's try another example: To operate on 447.725 MHz (model B/X: 437.725 MHz), press "7725" and DIAL.

### C. Entry and Recall of Memory Channels

1. To store a frequency in memory, the desired channel is first entered on the dial. Then press the desired memory channel number, 0 to 9, and then press M. Now the frequency is stored in the memory.
2. To store 443.475 MHz (model B/X: 433.475 MHz) in memory channel 1, press "3475", DIAL, "1", and then "M".
3. Now store another frequency in memory channel 2. For example, to store 448.125 MHz (model B/X: 438.125 MHz) press "8125", "DIAL", "2", and then "M".
4. Now memory channels 1 and 2 have been programmed. If you desire additional memory channels, store the frequencies in the same manner described in Steps 2 and 3.
5. To recall a memory channel, push the desired memory channel number (0 to 9) and then "MR". For example, to recall the frequencies stored in the above examples, first press "1" and then "MR". The digital display will show "3.475", which is the frequency stored in memory channel 1. To recall memory channel 2, press "2" and then "MR". The display will then show "8.125". If other memory channels have been stored, press the corresponding channel number and "MR", and the digital display will show the desired frequency.
6. To return to the dial frequency, press "DIAL", and the display will return to 8.125, unless other frequencies were stored in the memory



channels during Step 4. If you wish to operate on frequencies other than the memory channel, press the desired frequency and "DIAL". The display will then show the frequency and allow operation on that frequency. For example, press "5775" and "DIAL" to operate on 445.775 MHz (model B/X: 435.775 MHz).

#### D. Priority Channel Operation

1. First enter into the memory all desired memory channels for priority use.
2. Now enter another frequency onto the dial. In this example, we will use 443.500 MHz (model B/X: 433.500 MHz). Press "3500" and "DIAL". The display will show "3.500".
3. Now recall any of the stored memory channels. As 448.125 MHz was previously stored in memory channel 2, press "2" and "MR" to recall that frequency. Now press the "#" key. The display will indicate "8.125 P", and every few seconds the display will switch to the dial frequency "3.500".
4. When the CLEAR-MAN-BUSY switch is in the BUSY position, the transceiver will lock on the memory channel for as long as a carrier is present when the channel is checked by the priority search feature. If you place the CLEAR-MAN-BUSY switch in the CLEAR position, the search will stop when the memory channel is clear (no signal is present).
5. To use different memory channels with priority channels, enter the priority frequency from the keyboard and press "DIAL". Now press the number of the desired memory channel for recall, and then press "#". The transceiver will search the memory channel from the dial frequency every few seconds.

#### E. Repeater Operation

1. Repeater shifts of +5 MHz and -5 MHz (model B: ±7.6 MHz) are built into the FT-708R. To select the shift frequency, set the SHIFT switch to either the +RPT or -RPT position.
2. When nonstandard repeater shifts (other than the built-in shifts of the FT-708R) are required, the repeater shift can be programmed from the keyboard. For example, to program a split of ±1.6 MHz, push "1600" and then the "S" key. Now the repeater shift is programmed. Set the SHIFT switch to the +SET position, and close the PTT switch. The display will indicate the frequency that is +1.6 MHz from the receive frequency. If the SHIFT switch is in the -SET position, the transmit frequency will be -1.6 MHz from the receive frequency.

#### F. Split Operation

1. To transmit on the dial frequency and receive on one of the memory frequencies, set the SHIFT switch to the MS position, and enter the desired transmit frequency from the keyboard.
2. Now recall the desired memory channel for receive. Close the PTT switch, and the display will indicate the dial frequency during transmission. Release the PTT switch to return to the receive mode (on the memory channel).

#### G. Scanner Operation

1. With the CLEAR-MAN-BUSY switch in the MAN position and the STEP switch in the X1 position (left side), press the UP or DOWN switch to move 25 kHz up or down, respectively. If you push the UP or DOWN switch for more than 1 second, the scanner will become activated.

2. To stop the scan, press the UP, DOWN, or PTT switch. If you hit the PTT switch while scanning, no transmission will occur. Release the PTT switch momentarily, then press the PTT switch again to transmit.
3. To stop the scanner on a busy or clear channel, place the CLEAR-MAN-BUSY switch to the desired position, and press the UP or DOWN switch for a moment. The scanner will search until a busy or clear channel is found. After a 5 second stop on the channel for monitoring, the scanner will again start to search other channels. If you wish to stop on a channel, momentarily close the PTT switch.
4. To scan only the memory channels, press the MR switch, and then either the UP or DOWN switch. The scanner will move to search all ten memory channels. Press the PTT switch on the channel you wish to remain on. You may choose the desired scan mode as described in the above steps.

#### H. Limited Band Scanner Operation

1. To scan between a dial frequency and one of the memory channels, enter the desired frequency from the keyboard, and then call the memory frequency and press the "#" key. The priority function will then be activated. Now, press either the UP or DOWN switch. If UP is pressed with the CLEAR-MAN-BUSY switch in the MAN position, the display will move from the dial frequency to the memory channel continuously. If the CLEAR-MAN-BUSY switch is placed in the BUSY position, the scanner will stop at a channel where a carrier is present, and start scanning again after 5 seconds.
2. For example, enter 448.750 (model B/X: 438.750 MHz) into memory channel 1, and press "7750". Next, press "DIAL", "1", and finally "#". The priority function will then be activated. When the UP switch is pressed, the transceiver will scan up to "8.750", and then the display will jump back to 447.750 MHz (model B/X: 437.750 MHz), continuing the scan up to 448.750 MHz.

3. If the DOWN key is pressed instead, the display will drop from 447.750 MHz (model B/X: 437.750 MHz) to the low band edge of "0.000" and then jump to the high band edge of "9.975". From this band edge, the scanning moves to the memory frequency of "8.750", and then jumps to the dial frequency of "7.750", omitting the frequencies in between. This scanning function will repeat itself until you stop on a specific frequency.

#### Note:

The frequencies of "0.000", "0.025", "9.950" and "9.975" cannot be programmed as the band edges for the limited band scanning function.

#### I. Miscellaneous

1. To disable the keyboard and lock the FT-708R on the frequency you are currently using, slide the LOCK switch to the right side. This will provide protection against accidental frequency changes. When the LOCK switch is moved to the right, the display will indicate "L". Locking the keyboard will not disable the two-tone (DTMF) generator during transmission.
2. To activate the memory backup in the CPU, place the BACKUP switch in the ON position. The built-in lithium battery will serve to backup the memory frequency, programmable shift frequency, etc., while the power switch is OFF, or while the transceiver is without battery power. The battery has an estimated lifetime of more than 5 years. After this period, please ask your Yaesu Dealer for a replacement.
3. The top panel HIGH-LOW switch may be set to either the HIGH (1 watt output) or LOW (200 mW output) position, allowing you to select different transmitter output powers.

## Error Modes

1. If you inadvertently program a frequency incorrectly (e.g., by pushing "7353" and DIAL), the display will indicate "E" to tell you an error has been made. If this occurs, push C (Clear Entry) to return to the previous frequency.
2. If you program a repeater shift outside the amateur band, such as +5 MHz shift at 449.000 MHz (Model B/X; 439.000 MHz), the display will indicate "E" when the PTT switch is closed. No transmission will occur under this condition.

## K. Tone Squelch Operation (Option)

1. When the optional FTS-32 tone squelch unit is installed, it may be activated by placing the SQL control in the TONE position (click-stop).
2. When a signal is received which contains a similar subaudible tone signal, the FT-708R squelch will open normally. If the incoming signal does not contain the subaudible tone squelch signal, the receiver will remain silent, but the BUSY indicator will become illuminated. This will alert the operator to the fact that the channel is in use.
3. On transmit, a subaudible tone will be superimposed on your voice signal, activating the receiver of other stations equipped with a similar tone squelch system. The tone frequency (both transmit and receive) can be selected by the DIP switch mounted on the FTS-32. Refer to the frequency chart supplied with the optional FTS-32 to determine the tone frequency you require.
4. For autopatch or control purposes, the two-tone (DTMF) encoder can be activated from the keyboard by pushing the PTT switch and dialing the required access codes and telephone number.

For installation information regarding the FTS-32 Tone Squelch and FTS-32AE Tone Encoder, please refer to the instructions supplied with the respective units.

## Memory Backup Information

The FT-708R memory channels are protected by a memory backup lithium cell in the transceiver. When the transceiver is delivered from our factory, the memory backup switch is in the OFF position in order to clear the information in the memory. To activate the memory backup, turn the memory backup switch in the battery compartment to the ON position. Once this switch is turned on, it is not necessary to turn it off because of the extremely low current consumption of approximately 0.1  $\mu$ A. The estimated life of the cell is more than five years. If, after this period, the memory backup becomes intermittent, ask your Yaesu dealer for a replacement cell.



## CIRCUIT DESCRIPTION

The block diagram and circuit description to follow should provide the owner with a better understanding of the FT-708R transceiver. Please refer to the schematic diagram for details.

### RECEIVER

The UHF signal from the antenna is fed through relay  $RL_{401}$  to RF amplifier  $Q_{101}$  (2SC2549), which is protected by a two-stage helical resonator which minimizes intermodulation caused by strong out-of-band signals. The amplified signal from  $Q_{101}$  is fed to the first mixer,  $Q_{102}$  (2SC2026), where the RF signal is mixed with the first IF signal delivered from  $Q_{103}$  (2SC1780), producing a 46.255 MHz first IF. The IF signal is passed through a monolithic crystal filter,  $XF_{101}$ , which has a 3 dB bandwidth of  $\pm 14$  kHz, and is fed to the second mixer,  $Q_{104}$  (2SC2786L). Here the first IF signal is heterodyned with the second local oscillator signal (45.8 MHz) delivered from  $Q_{105}$  (2SC2786L), resulting in a second IF of 455 kHz. The IF signal is passed through a ceramic filter,  $CF_{101}$ , amplified by  $Q_{106}$  (2SC2787L), then fed through another ceramic filter,  $CF_{102}$ . The highly filtered IF signal is then fed to  $Q_{107}$  (MC3357), which functions as an IF amplifier, limiter, discriminator, and squelch control. The amplification and limiting process eliminates amplitude variations in the IF signal, which is then fed to the discriminator section of  $Q_{107}$ , where an audio response is produced in accordance with a corresponding frequency shift in the IF signal. The audio signal is then amplified by  $Q_{401}$  (2SC2785E),  $Q_{402}$  (2SA1175E),  $Q_{403}$  (2SC2120Y), and  $Q_{404}$  (2SA950Y). The audio PA section delivers 500 mW of audio output power to the speaker.

When no carrier is present in the 455 kHz IF, the high frequency noise at the output of the discriminator is amplified by the noise amplifier section of  $Q_{107}$ . This amplified signal drives a squelch switch in the same IC, which in turn biases  $Q_{401}$  (2SC2785E) and  $Q_{402}$  (2SA1175E) such that DC voltage is removed from AF amplifier  $Q_{403}$ , thus silencing the receiver.

When a carrier is present in the 455 kHz IF, the noise is removed from the discriminator output, and  $Q_{403}$  is then biased for normal operation, thus allowing receiver recovery.  $VR_{102}$  sets the squelch sensitivity level. Scanning control voltages are also provided by  $Q_{107}$ , allowing interactive operation with the Central Processing Unit for control of the SCAN STOP function.

## TRANSMITTER

The transmitter produces a frequency modulated signal. The audio input from the microphone or DTMF encoder  $Q_{304}$  (MK5087) is amplified by  $Q_{217}$  ( $\mu$ PC577H), which also limits the maximum amplitude of the audio input and filters out signal components above the normal speech range. The audio signal is then applied to varactor diode  $D_{209}$  (FC53), which varies the frequency of a 15.4183 MHz crystal oscillator,  $Q_{213}$  (2SC2786L). This signal is then delivered to the balanced mixer and frequency multiplier stages.

A portion of the output from  $Q_{201}$  is fed through buffer amplifier  $Q_{207}$  (2SC2786) to PLL mixer  $Q_{103}$  (2SC2876L), where the signal is mixed with a local signal of 129.5733 MHz (low band model B/X: 126.240 MHz) delivered from  $Q_{209}$  (2SC2786L). This results in a 1.675–5.00 MHz PLL IF signal.

The PLL IF signal is amplified by  $Q_{204}$  and  $Q_{203}$  (2SC2786L) and then fed to  $Q_{206}$  ( $\mu$ PD2819C). This programmable divider divides the signal by a factor of 201–600, producing basic 8.3333 kHz steps for the synthesizer. One section of  $Q_{206}$  acts as a 5.3333 MHz oscillator, which, in turn, is divided into 8.3333 kHz steps. The phase comparator section of  $Q_{206}$  then compares the phase of the PLL IF signal with that of the PLL reference signal, and any difference in phase produces an error-correcting voltage, which is used to control varactor diodes to lock the PLL onto the correct frequency. This feedback system produces a highly stable output signal.

The IF signal is fed to a balanced mixer,  $Q_{214}/Q_{212}$  (2SK193K), where the 15.4183 MHz FM signal is mixed with a local signal from the VCO, with the output being at 1/3 the ultimate transmitting frequency. A three-stage

auto-tune resonator between  $Q_{214}/Q_{212}$  and  $Q_{216}$ , along with a filter immediately following  $Q_{216}$  (2SC2786L), provide superior rejection of spurious signals.

The signal is then multiplied by a factor of three by  $Q_{109}$  (2SC2407) and delivered to a three-stage RF power amplifier consisting of  $Q_{110}$  (2SC2407),  $Q_{111}$  (2SC2131), and  $Q_{112}$  (2SC2131), resulting in a power output of 1 watt.

## HETERODYNE OSCILLATOR

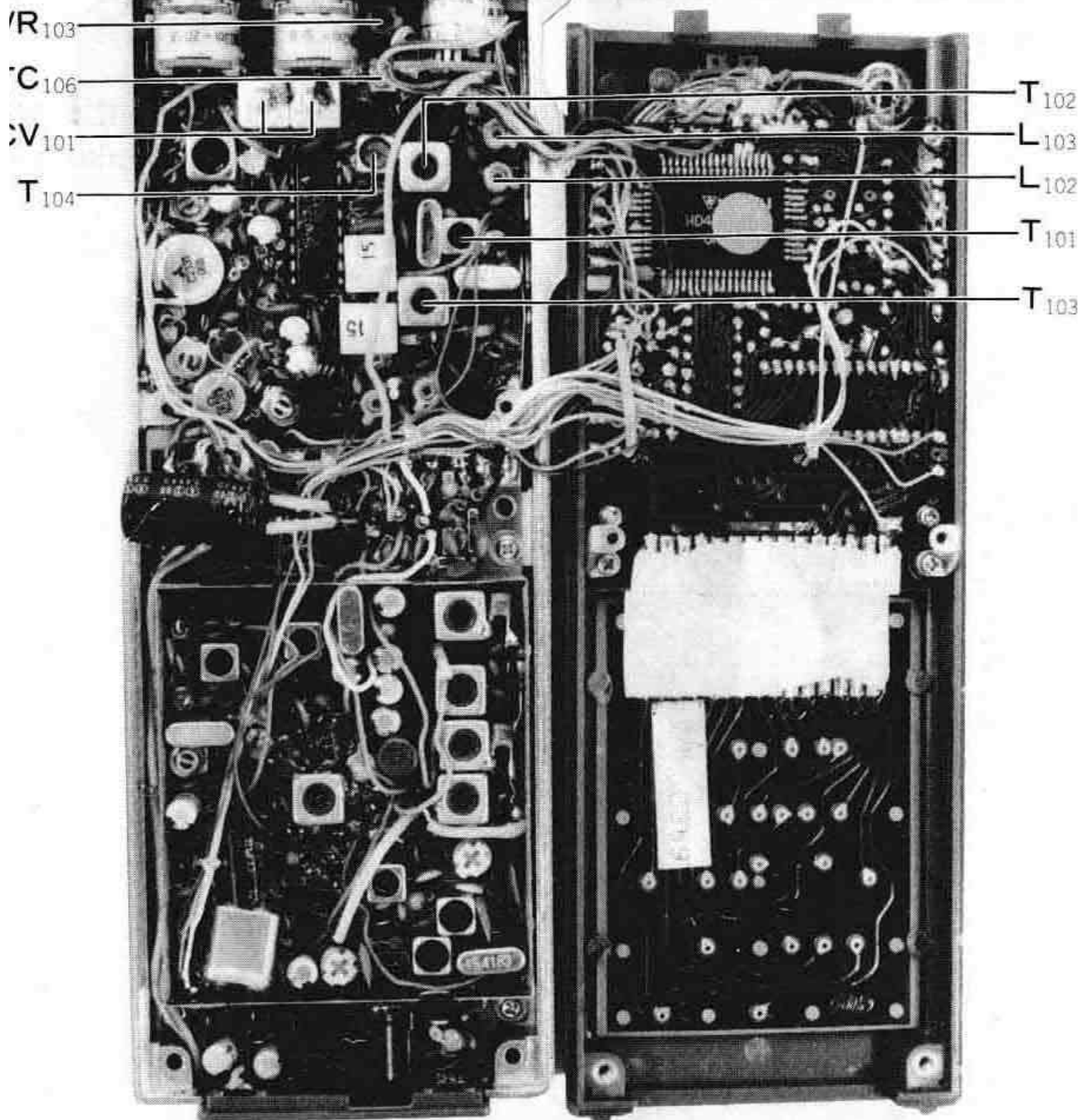
The heterodyne signal of 131.2483 – 134.5733 MHz (low band model B/X: 127.915 – 131.240 MHz) for the receiver and transmitter is generated by a PLL (Phase Locked Loop) circuit.

The VCO oscillator,  $Q_{201}$  (2SK192Y), generates a signal of 131.2483 – 134.5733 MHz. The oscillator frequency is controlled by varactor diode  $D_{201}$  (1T25), which varies the capacitance of the oscillator tuned circuit in accordance with a control voltage. This control voltage is generated by phase comparator  $Q_{206}$  ( $\mu$ PD2819C) and delivered through a lowpass filter consisting of  $Q_{207}$  (2SK184Y) and  $Q_{208}$  (2SC2785E), to the VCO.

This voltage is then fed to varactor diode  $D_{201}$ , which changes the output phase of the VCO to lock with that of the reference signal. The control voltage is also used to tune the transmitter bandpass filters and local signal amplifier filter, thus providing optimum spurious attenuation.

## PLL CONTROL SECTION

The PLL control Unit employs a 4-bit microprocessor chip,  $Q_{301}$  (HD-44820A07), which provides various control information for display control, transmit disable, DTMF encoder, etc. The reader is referred to the block diagram of the PLL control Unit for an explanation of the functions of the CPU. A full description of every logic state is well beyond the scope of this manual.



RECEIVER SECTION ALIGNMENT POINTS

### III. Transmitter Alignment

#### A. Power Amplifier Alignment

1. Connect a dummy load/wattmeter to the ANT jack, and set the transceiver frequency to 445 MHz (435 MHz).
2. Close the PTT switch, and adjust  $T_{210}$ ,  $L_{105}$ ,  $L_{106}$ , and  $TC_{101}$  through  $TC_{104}$  for maximum RF output on the wattmeter.

#### B. TX Balance Mixer Alignment

1. Connect a dummy load through a directional coupler to the ANT jack, and the sampled output from the directional coupler to a spectrum analyzer.
2. Close the PTT switch and adjust  $VR_{201}$  for a minimum spurious level which appears  $\pm 15.4$  MHz away from the carrier frequency.

#### Note:

If a spectrum analyzer is not available, never adjust  $VR_{201}$ , as serious spurious radiation may result.

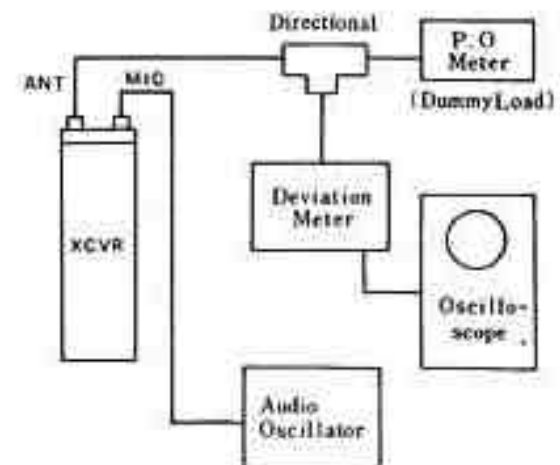
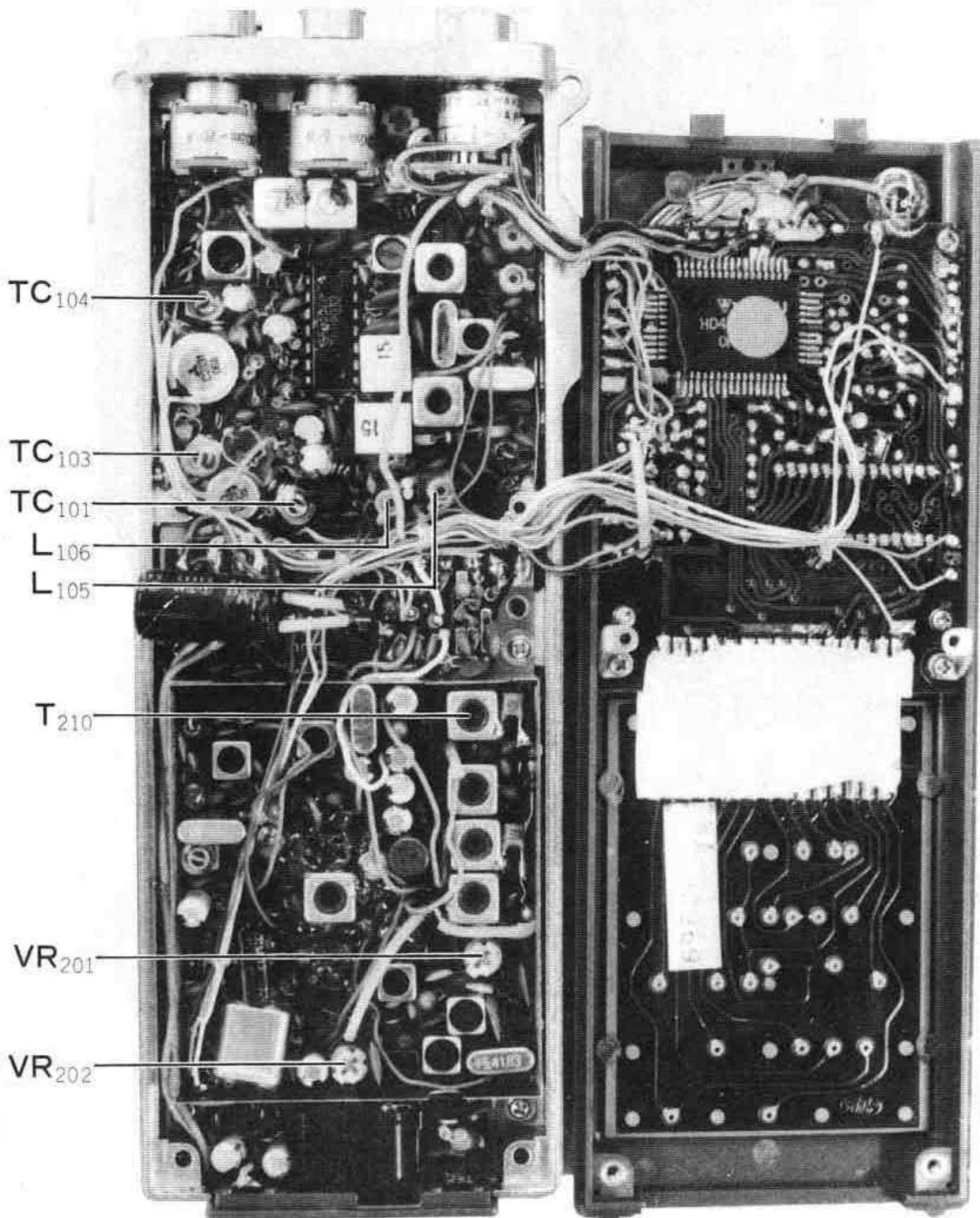


Figure 2

## 2. Deviation Adjustment

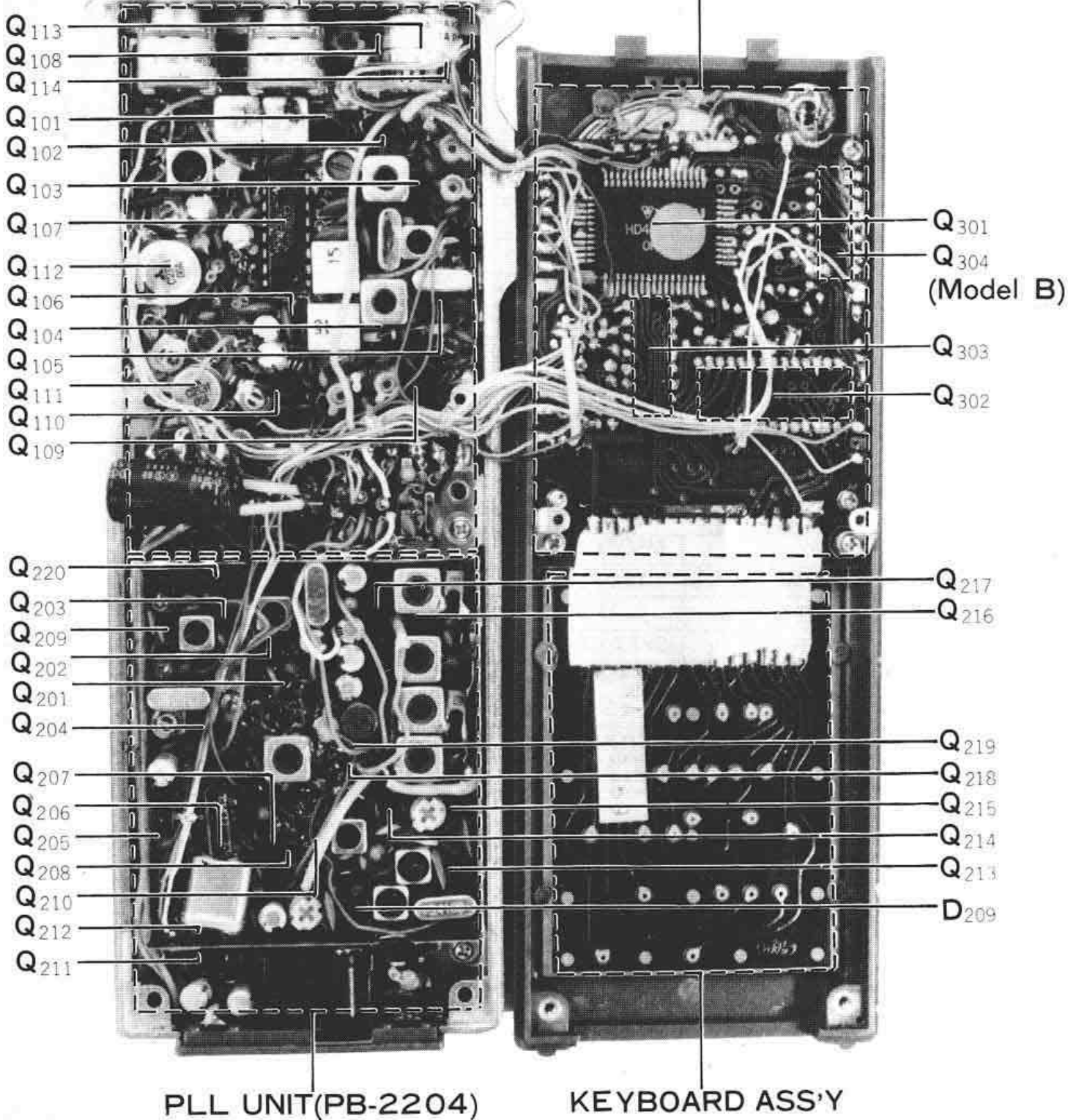
1. Connect a dummy load through a directional coupler to the ANT jack, and a portion of the output from the directional coupler to the deviation meter. Apply a 1 kHz 25 mV signal to the external microphone from an audio oscillator.
2. Adjust VR<sub>202</sub> for a deviation of  $\pm 5$  kHz on the deviation meter (refer to Figure 2).



**TRANSMITTER SECTION ALIGNMENT POINTS**

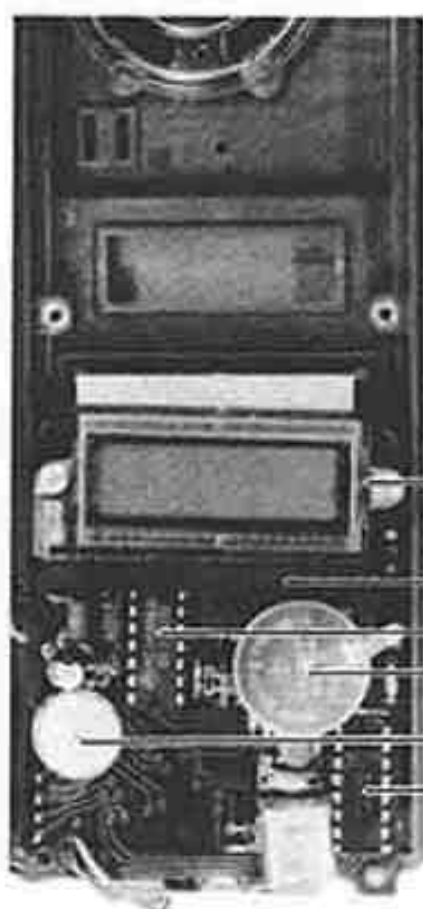
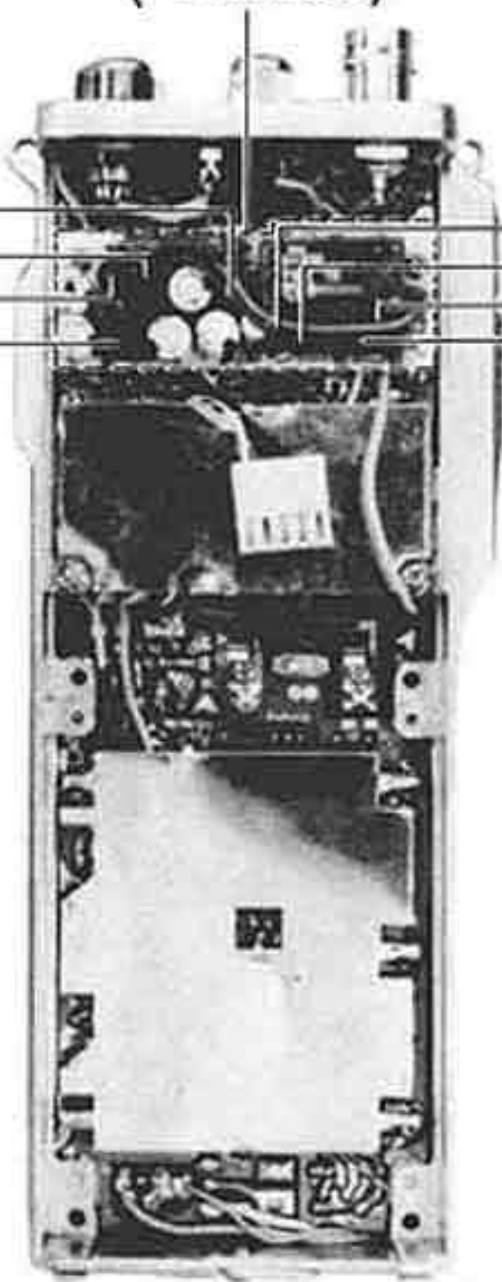


MAIN UNIT(PB-2203) CONTROL UNIT(PB-2205)



**AF UNIT  
(PB-2206)**

- Q 403
- Q 404
- Q 405
- Q 406
- Q 402
- Q 401
- Q 407
- Q 408



LCD

Q 302

Q 303

BUZZER

BUZZER

Q 304

## PARTS LIST

## MAIN CHASSIS

Symbol No.	Part No.	Description
		<b>RESISTOR</b>
R1	J01215101	Carbon film 1/8W TJ 100 $\Omega$
		<b>POTENTIOMETER</b>
VR1	J50747104	P6S2X-100k $\Omega$ 100k $\Omega$ B
		<b>CAPACITOR</b>
C1	K02182030	Ceramic disc 50WV CH 3pF (RD870-1NP0-3R0C63V)
C2	K40129006	Electrolytic 16WV 470 $\mu$ F (16RE470)
		<b>SWITCH</b>
S1	N6090025	SST(C) 12-04V
S2	N0190080	JRA-1-12-9
S3,4	K4090040	KHG10901
S5	N3090041	KHC10904
S6	N5090006	KEA5A021
		<b>RECEPTACLE</b>
J1	P1090197	SG-8021
J2	P1090052	SR 30-10R-6S
J3	P1090191	UG-6250/U
		<b>CONNECTOR</b>
P1 (with wire)	T9204050	Housing 3021-05 (Contact 5159T)
		<b>MICROPHONE</b>
M1	M3290001	EM-76
		<b>SPEAKER</b>
SP1	M4090050	VS-40A 8 $\Omega$ 0.1W
		<b>FERRITE BEADS</b>
FBI,2	1,9190001	R $\epsilon$ 3X3X1
		<b>CABLE</b>
	T9204090	
		<b>LITHIUM BATTERY</b>
BAT1	Q9000106	CR-2025
<b>MAIN UNIT</b>		
Symbol No.	Part No.	Description
PB-2203B	F0002203B	Printed Circuit Board
	C0022030	P.C.B. with Components

		<b>IC</b>
Q107	G1090145	MC3357
		<b>TRANSISTOR</b>
Q114	G3111750E	2SA1175E
Q103	G3317800	2SC1780
Q102	G3320260	2SC2026
Q111,112	G3321310	2SC2131
Q109,110	G3324070	2SC2407
Q101	G3325490	2SC2549
Q108,113	G3327850E	2SC2785E
Q104,105	G3327860L	2SC2786L
Q106	G3327870L	2SC2787L
		<b>DIODE</b>
D101,103	G2090027	SI 1SS53
D102	G2015550	" 1S1555
		<b>CRYSTAL</b>
X101	H0102375	HC-18/T 45.8MHz
		<b>FILTER</b>
XF101	H1102029	HCM46F1A
CF101,102	H3900030	LFB-15
		<b>RESISTOR</b>
R141	J01215100	Carbon Film 1/8W TJ 10 $\Omega$
R138,140	J00215560	" " " VJ 56 $\Omega$
R144	J10246560	" Composition 1/4W GK 33 $\Omega$
R136	J01215820	" Film 1/8W TJ 82 $\Omega$
R111	J10246101	" Composition 1/4W GK 100 $\Omega$
R117	J00215101	" Film 1/8W VJ 100 $\Omega$
R105,108,109	J00215331	" " " " 330 $\Omega$
R151	J01215471	" " " TJ 470 $\Omega$
R139	J00215561	" " " VJ 560 $\Omega$
R130	J01215681	" " " TJ 680 $\Omega$
R128	J00215102	" " " VJ 1k $\Omega$
R125	J00215152	" " " " 1.5k $\Omega$
R133,135	J00215182	" " " " 1.8k $\Omega$
R114,116,118	J00215222	" " " " 2.2k $\Omega$
R121,129	J00215472	" " " " 4.7k $\Omega$
R134	J00215682	" " " " 6.8k $\Omega$
R122	J10246103	" Composition 1/4W GK 10k $\Omega$
R103,147,148,149	J01215103	" Film 1/8W TJ 10k $\Omega$
R124	J00215223	" " " VJ 22k $\Omega$
R131	J00215333	" " " " 33k $\Omega$
R120	J00215473	" " " " 47k $\Omega$
R119	J00215513	" " " " 51k $\Omega$

R102	J00215563	Carbon Film	1/8W VJ	56k $\Omega$
R107	J00215683	" "	" "	68k $\Omega$
R127	J10246823	" Composition	1/4W GK	82k $\Omega$
R132	J10246104	" Composition	1/4W GK	100k $\Omega$
R150	J00215104	" Film	1/8W VJ	100k $\Omega$
R110,115	J00215124	" "	" "	120k $\Omega$
R104	J00215224	" "	" "	220k $\Omega$
R126	J00215274	" "	" "	270k $\Omega$
R112	J00215334	" "	" "	330k $\Omega$
<b>POTENTIOMETER</b>				
VR101 (with S101)	J60800075	K121B100KE-5N1111-20K $\Omega$ A		
VR102 (with S102)	J60800076	" " -5N1111-5K $\Omega$ B		
VR103	J51745103	H0651A001 10K $\Omega$ B		
<b>CAPACITOR</b>				
C106,116,149	K00182059	Ceramic Disc (RD870-15L0R5C63V)	63WV SL	0.5pF
C155	K02182020	" " (RD870-1NPO2R0C63V)	" CH	2pF
C117,146	K04182030	" " (RD870-1N150-3R0C63V)	" PG	3pF
C164,170	K02182030	" " (RD870-1NPO-3R0C63V)	" CH	3pF
C114	K04182050	" " (RD870-1N150-5R0C63V)	" PG	5pF
C119	K00182050	" " (RD870-15L-5R0C63V)	" SL	5pF
C110	K04183060	" " (RD870-1N150-6R0D63V)	" PG	6pF
C162	K02183060	" " (RD870-1NPO-6R0D63V)	" CH	6pF
C163	K02183080	" " (RD870-1NPO-8R0D63V)	" "	8pF
C111	K02183100	" " (RD870-1NPO-100D63V)	" "	10pF
C130	K00183100	" " (RD870-15L-100D63V)	" SL	10pF
	K04185150	" " (RD870-1N150-150J63V)	" PG	15pF
C172	K02179040	" " (2222-637-1(159))	" CH	15pF
C151	K07185330	" " (RD871-1N150-330J63V)	" PG	33pF
C122	K06185230	" " (RD870-1N750-220J63V)	" UJ	22pF

C123	K06185330	" " (RD870-1N750-330J63V)	" "	33pF
C169	K02185470	" " (RD872-1NPO470J63V)	" CH	47pF
C103,105,107, 108,112,113, 118,134,135, 140,141, 143-145,147, 148,152-154, 156,158,160, 161,165-168	K10186102	Ceramic Disc (RD870-1B102K63V)	63WV B	0.001 $\mu$ F
C124	K14180103	" " (RD871-1FZ-103Z63V)	" "	0.01 $\mu$ F
C120,132	K19149013	Semiconductor (UAT05X103K-L05AE)	25WV X	0.01 $\mu$ F
C125,126,128, 129,131,139	K19149017	" " (UAT06X223K-L45AE)	" "	0.022 $\mu$ F
C104,115,166, 167,171,173, 174-178	K23140005	" Chip (GR40W5R102M)	50WV	0.001 $\mu$ F
C133,136	K40179002	Electrolytic (50RC2-R1)	"	0.1 $\mu$ F
C127,138,157, 159	K40129012	" (16RC2-10)	16WV	10 $\mu$ F
C137	K70127475	Tantalum (CS15E)C4R7M)	"	4.7 $\mu$ F
<b>TRIMMER CAPACITOR</b>				
TC101,106	K91000059	ECV-12W04x53		4pF
TC103,104	K91000029	ECV-12W20x53		20pF
<b>CAVITY</b>				
CV101	Q9000114B	CV-441B		
<b>INDUCTOR</b>				
L101	L1020675			
L102,105,106	L0190021			
L103	L0190022			
L104	L00207458			
L107,109,117	L1020677			
L108,118	L0020878A			
L110	L0020877A			
L111	L1020684			
L112,116	L0020876			
L114	L1020685			
L115,119	L0020875A			

POTENTIOMETER				
VR201	J51745471	B0651A001470QB	470Ω(B)	
VR202	J51745332	H061A0013.3KQB	3.3KΩ(B)	
THERMISTOR				
TH201	G9090008	31D-26		
CAPACITOR				
C264	K02182059	Ceramic disc (RD870-1NPO-0R5C63V)	63WV CH	0.5pF
C209	K02182010	" " (RD870-1NPO-1R0C63V)	" "	1pF
C212	K00182020	" " (RD870-1SL-2R0C63V)	" SL	2pF
C0311	K02179045	" " (2222-636-09208)	" CH	2pF
C201,202	K06182040	" " (RD870-1N750-4R0C63V)	" UJ	4pF
C262	K04182040	" " (RD870-1N150-4R0C63V)	" PG	4pF
C205,229,263, 266,270	K06182050	" " (RD870-1N750-5R0C63V)	" UJ	5pF
C256	K04182050	" " (RD870-1N150-5R0C63V)	" PG	5pF
C203,206,237, 238	K06183060	" " (RD870-1N750-6R0D63V)	" UJ	6pF
C202	K06183060	" " (RD870-1N750-6R0D63V)	" "	6pF
C298	K00183060	" " (RD870-1SL-6R0D63V)	" SL	6pF
C236	K06183070	" " (RD870-1N750-7R0D63V)	" UJ	7pF
C204	K02183080	" " (RD870-1NPO-8R0D63V)	" CH	8pF
C235	K04183080	" " (RD870-1N150-8R0D63V)	" PG	8pF
	K06185120	" " (RD870-1N750-120J63V)	" UJ	12pF
C210	K04185120	" " (RD870-1N150-120J63V)	" PG	12pF

C234,267,293	K00185150	" " (RD870-1SL-150J63V)	" SL	15pF
C214	K00185220	Ceramic disc (RD870-1SL-220J63V)	63WV SL	22pF
C224,225,294, 295	K00185330	" " (RD870-1SL-330J63V)	" "	33pF
C230	K06185330	" " (RD870-1N750-330J63V)	" UJ	33pF
C252	K07179014	" " (2222-637-34399)	50WV	39pF
C253	K07185390	" " (RD871-1N150-390J63V)	63WV PG	39pF
C231	K06185680	" " (RD871-1N750-680J63V)	" UJ	68pF
C246-248	K06185331	" " (RD874-2N750-331J63V)	" "	330pF
C249	K10185471	" " (RD870-1B471J63V)	" B	470pF
C208,211,217, 233,237,238, 254,255,260, 268,271,283, 284,286, 288-292,296, 299,0300	K10186102	" " (RD870-1B102K63V)	" "	0.001μF
C215,219,241, 242,244,251, 275	K14180103	" " (RD871-1FZ-103Z63V)	" "	0.01μF
C213,220,221, 228,297	K19149013	Semiconductor Ceramic (UAT05X103K-L05AE)	25WV	0.01μF
C281,282	K19149019	" " (UAT08X333K-L45AE)	"	0.033μF
C274	K23170006	" " (RPF112C473K50)	50WV	0.047μF
C0301-0309 0312	K23140005	" chip (GR40W5R102M)	"	0.001μF
C0313	K23140001	Ceramic chip (GR42Y5V103Z)	25WV	0.01μF
C273	K70167104	Tantalum (CS15E1V0R1M)	35WV	0.1μF
C226,227,272	K70127225	" " (CS15E1C2R2M)	16WV	2.2μF
C222	K70127475	" " (CS15E1C4R7M)	"	4.7μF
C216	K70127106	" " (CS15E1C100M)	"	10μF
C218,250,287	K70107106	" " (CS15E1A100M)	10WV	10μF

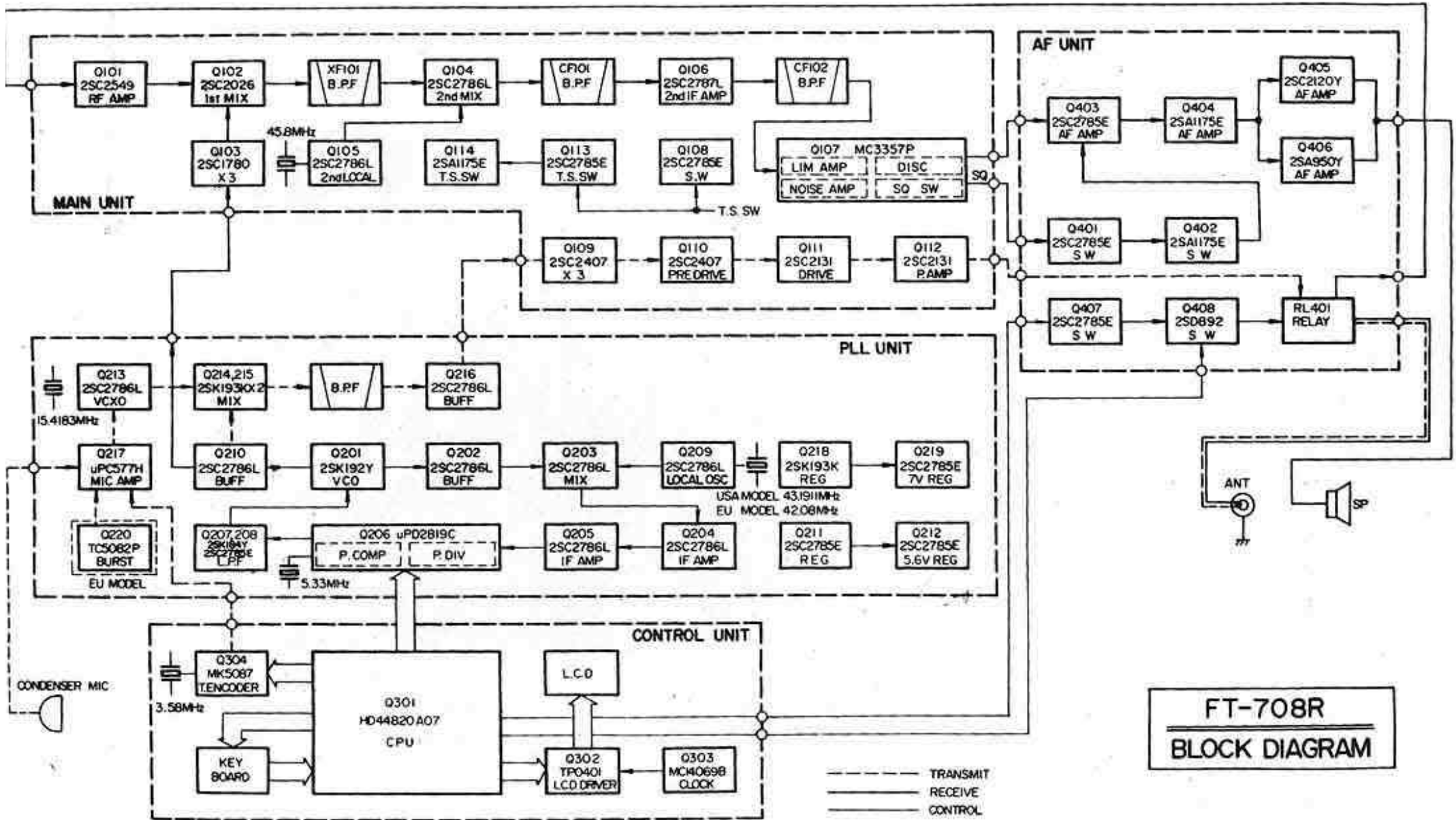
C277	K70087106	Tantalum (CS15E01100MIS)	6.3WV	10 $\mu$ F
C240	K40179001	Electrolytic (50RC2-1)	50WV	1 $\mu$ F
C207, 243, 245, 276, 278-280, 285	K40129012	- (16RC2-10)	16WV	10 $\mu$ F
C239	K40129008	- (16RE33)	-	33 $\mu$ F
		<b>TRIMMER CAPACITOR</b>		
TC201	K91000029	ECV-12W20x53	20pF	
		<b>INDUCTOR</b>		
L302	L1190108	FL3H-R68M	0.68 $\mu$ H	
L301	L1190105	FL3H-1R0M	1 $\mu$ H	
L303	L1190019	FL5H-150K	15 $\mu$ H	
L206	L1190115	S-154K	150mH	
L304	L0020978A			
L305	L00207450			
		<b>TRANSFORMER</b>		
T201	L0020904			
T202-204	L0020747			
T205	L0020905			
T206	L0020906			
T207-210	L0020907			
		<b>SWITCH</b>		
S201	N6090026A	SSS212005		
		<b>CONNECTOR</b>		
J201	P0090187	DCE-20		
J202	P1090127	2.5E11		
		<b>FUSE</b>		
F201	Q0000022	MFA-5	5A	
		<b>TP TERMINAL</b>		
	Q5000036	TPG		

<b>CONTROL UNIT</b>				
Symbol No.	Part No.	Description		
PB-2205B	F0002205B	Printed Circuit Board		
	C0022050	P.C.B with Components		
		<b>IC</b>		
Q301	G1090345	HD44820A03		
Q302	G1090346	TP-0401		
Q303	G1090126	MC14069B		
Q304	G1090330	MK5087		
		<b>LCD</b>		
DS301	G6090021	HI301		
		<b>DIODE</b>		
D301-305, 308, 309	G2090027	Si	ISS53	
D306	G2090118	Shotky barrier	ISS97	
D311	G2090182	Zener	HZ7A-2	
		<b>LED</b>		
D310	G2090175	SR-535D		
D312	G2090173	SG-235D		
		<b>BUZZER</b>		
BZ301	M4290001	EFBRE-25D02		
		<b>CRYSTAL</b>		
X301	H0102320	HC-18/T	3.579545MHz	
		<b>RESISTOR</b>		
R309	J01215471	Carbon Film	1/8W TJ 470 $\Omega$	
R310	J01215152	" "	" " 1.5k $\Omega$	
R313	J01215223	" "	" " 2.2k $\Omega$	
R304	J01215472	" "	" " 4.7k $\Omega$	
R305	J01215562	" "	" " 5.6k $\Omega$	
R301	J00215104	" "	" VJ 100k $\Omega$	
R311, 312	J01215224	" "	" TJ 220k $\Omega$	
R302	J00215684	" "	" VJ 680k $\Omega$	
R306	J01215824	" "	" TJ 820k $\Omega$	
R307, 308	J00215105	" "	" VJ 1M $\Omega$	
R303	J20219001	Metallic "	" 90.9k $\Omega$	
		<b>THERMISTOR</b>		
TH301	G9090016	33D-28		

CAPACITOR					
C305	K10186471	Ceramic Disc (RD870-1B471K63V)	63WV	B	470pF
C302,304	K10186102	" "	" "	" "	0.001 $\mu$ F
		(RD870-1B102K63V)			
C306	K19149009	Semiconductor Ceramic (UAT05X472K-L05AE)	25WV		0.0047 $\mu$ F
C307	K19149013	" "	" "		0.01 $\mu$ F
		(UAT05X103K-L05AE)			
C301	K70127335	Tantalum (CS15E1C3R3M)	16WV		3.3 $\mu$ F
C303	K40129012	Electrolytic (16RC2-10)	"		10 $\mu$ F
LAMP					
PL301	Q1000046	BQ031-30103A			
AF UNIT					
Symbol No.	Part No.	Description			
PB-2006A	F0002206A	Printed Circuit Board			
	C0022060	P.C.B with Components			
TRANSISTOR					
Q406	G3109500Y	2SA950Y			
Q402,404	G3111750E	2SA1175E			
Q408	G3312800A	2SC1280A			
Q405	G3321200Y	2SC2120Y			
Q401,403,407	G3327850E	2SC2785E			
Q408	G34089200 /R	2SD892Q or R			
DIODE					
D402,403	G2090027	Si	ISS53		
D401	G9090017	Varistor	MV-11		
RESISTOR					
R411,412	J10246279	Carbon Composition	1/4W	GK	2.7 $\Omega$
R406	J00215560	" Film	1/8W	VJ	56 $\Omega$
R410	J00215121	" "	" "	" "	120 $\Omega$
R408	J00215151	" "	" "	" "	150 $\Omega$
R409	J00215221	" "	" "	" "	220 $\Omega$
R405	J00215102	" "	" "	" "	1k $\Omega$
R407	J00215222	" "	" "	" "	2.2k $\Omega$
R414	J10246472	" Composition	1/4W	GK	4.7k $\Omega$
R417	J10246562	" Composition	"	GK	5.6k $\Omega$

R401	J00215103	Carbon Film	1/8W	VJ	10k $\Omega$
R402	J00215473	" "	" "	" "	47k $\Omega$
R403	J00215823	" "	" "	" "	82k $\Omega$
R416	J01215823	" "	1/8W	TJ	82k $\Omega$
R404	J00215224	" "	" "	VJ	220k $\Omega$
R413	J10246224	" Composition	1/4W	GK	220k $\Omega$
R415	J20336390	Metallic Film	2W		33 $\Omega$
CAPACITOR					
C410-413	K10185102	Ceramic Disc (RD870-1B102K63V)	63WV	B	0.001 $\mu$ F
C402,404,414	K19149013	Semiconductor Ceramic (UAT05X103K-L05AE)	25WV		0.01 $\mu$ F
C406	K23170003	Barrier Layer (RPE112F104Z50V)	50WV		0.1 $\mu$ F
C401	K40129012	Electrolytic (16RC2-10)	16WV		10 $\mu$ F
C407-409	K40129014	" (16RC2-33)	"		33 $\mu$ F
C403,405	K40109010	" (10RC2-47)	10WV		47 $\mu$ F
RELAY					
RL401	M1190027	G2V-282P	190 $\Omega$		
ACCESSORIES					
Symbol No.	Parts No.	Description			
	Q3000019	Antenna YHA-44			
	Q9000088	Battery Pack FNB-2			
	M4190001	Ear Phone			
	Q9000071	Battery Charger		NC-9B (for 117V)	
	Q9000072	"		NC-9C (for 220-240V)	
	R7068220	Carrying Case (Vinyl)			
	R7048792B	Shoulder Strap			
	S5000013	Triangle Ring			

# BLOCK DIAGRAM



**FT-708R**  
**BLOCK DIAGRAM**