

**FTR-710A
FTR-2410A
FTR-5410
FM REPEATERS
INSTRUCTION
MANUAL**

**FL-750 50W PA
FL-2450 50W PA
FL-5450 50W PA**

**INSTRUCTION
MANUAL**

YAESU MUSEN CO., LTD.

C.P.O. BOX 1500

TOKYO, JAPAN

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YAESU
VHF/UHF FM REPEATERS
FTR-710A, -2410A, -5410



GENERAL DESCRIPTION

The FTR-710A (low VHF), FTR-2410A (medium VHF) and FTR-5410 (UHF) are commercial quality 10-watt FM repeaters designed to provide reliable, continuous-duty two-way communications over a wide range of environmental conditions, from either the AC line or 12V DC source.

Designed for easy installation in a standard 19-inch rack, each repeater utilizes glass-epoxy circuit boards and high grade components in all circuits. Standard circuits include automatic time out and hang up delay timers, plus everything needed for non-repeater operation as a semi- or full duplex transceiver; which makes this an ideal system for dual function (repeater/base) stations.

As is, the low power consumption of these repeaters makes them capable of extended operation from batteries during times of power failure, and automatic switching is provided to shift to the DC supply should the AC source fail. During normal AC operation, the DC power terminals present a constant trickle charge to keep batteries in top condition.

Options include matching 50-watt power amplifiers, a CTCSS decoder/encoder for tone squelch operation, tone burst decoder, DTMF decoder, and telephone interfacing equipment. Cavity duplexers are also available for the FTR-2410A and FTR-5410.

SPECIFICATIONS

GENERAL

Frequency ranges:

(one channel crystal controlled)

68–88 MHz (FTR-710A)

Type A: 68–74 MHz

Type B: 74–81 MHz

Type C: 81–88 MHz

136–174 MHz (FTR-2410A)

Type A: 136–146 MHz

Type B: 146–160 MHz

Type C: 160–174 MHz

400–512 MHz (FTR-5410)

Type A: 400–420 MHz

Type B: 420–430 MHz

Type C: 430–450 MHz

Type D: 450–470 MHz

Type E: 470–490 MHz

Type F: 490–512 MHz

Type of Emission:

16F3

Transmit Activation System:

Carrier controlled

Power Requirements:

AC 100/110/117/200/220/234V

DC 12V (Negative ground)

Input Power:

AC 100VA

DC 48W

Operating Temperature Range:

-30°C to +60°C

Duty Cycle:

Continuous

Case Size:

133(H) x 483(W) x 356(D) mm

Weight:

12 kg. (w/o duplexer); 13.4 kg (w/duplexer ;
FTR-2410A, 5410)

TRANSMITTER

RF Power Output:

10 watts

Frequency Stability:

±5 ppm

Frequency Multiplication:

x 6 (FTR-710A, -2410A), x 12 (FTR-5410)

Modulation:

Phase modulation (FM)

Maximum Deviation:

±5 kHz

(4.9 kHz Bessel null)
f₀ = 2033 Hz.
INS LNC
8/2000

Audio Response:

+1, -3 dB/octave pre-emphasis characteristic
from 300 Hz to 3000 Hz

Audio Distortion:

Less than 10% (60% deviation at 1 kHz)

FM Noise Ratio:

Better than 45 dB

Spurious Emissions:

At least 60 dB below carrier

INS LNC
(-62 misu) 8/2000

RECEIVER

Sensitivity:

Better than 0.5 μV for 12 dB SINAD

Better than 1.0 μV for 20 dB QS

Frequency Stability:

±5 ppm

Adjacent Channel Selectivity:

Better than 80 dB (±25 kHz)

Intermodulation:

Better than -65 dB (±25 kHz, ±50 kHz)

Spurious Response:

Better than -80 dB

Squelch Sensitivity:

0.2 μV

Audio Output:

2 watts at 8 ohms (10% THD)

AF Response:

+1, -3 dB/octave de-emphasis characteristic
from 300 Hz to 3000 Hz

DUPLEXER

(Internal; FTR-2410A)

Frequency Range:

148 MHz to 174 MHz

Frequency Separation:

4.5 MHz (min.)

Insertion Loss:

1.2 dB

TX Noise Suppression:

80 dB

RX Isolation at TX:

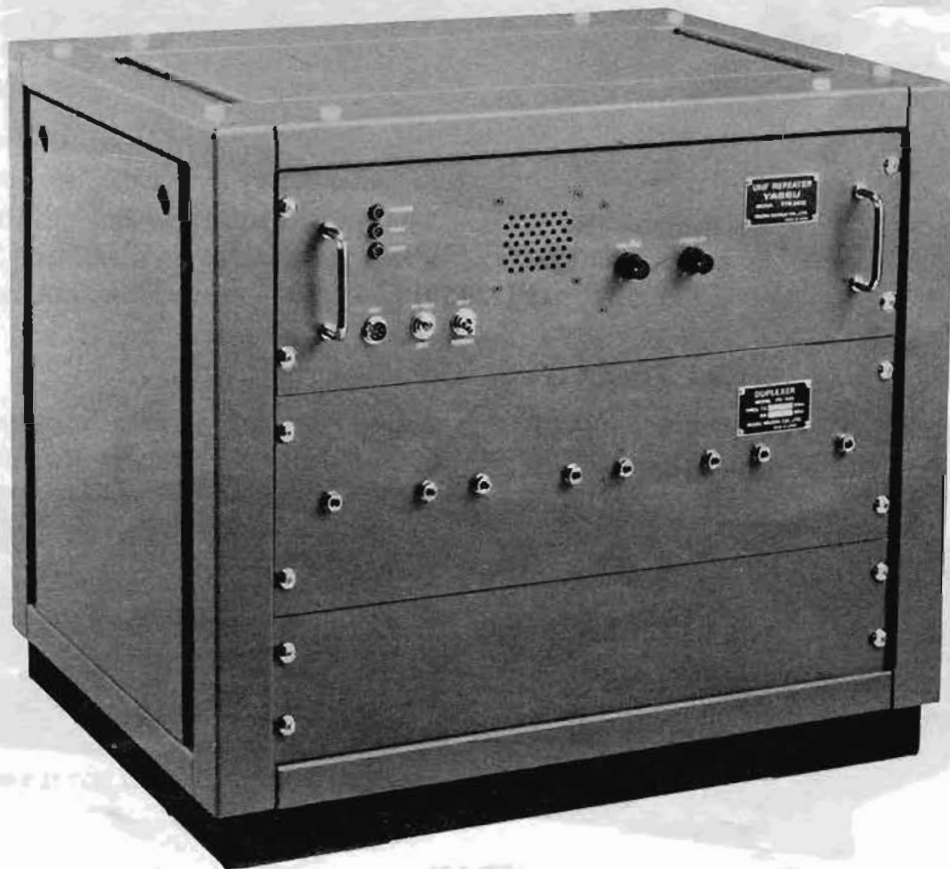
80 dB

Maximum VSWR:

1.5 : 1

Frequency Stability:

2.5 ppm/°F



ACCESSORIES

Supplied:

AC Power Cord

3-wire, 3-prong UL plug (T9013282) 1

3-wire, 3-prong Australian plug (T9013283)

3-wire, 2-prong EU plug (T9013284)

Spare Fuses

AC 2A (100-117V) (Q0000003) 1

1A (200-234V) (Q0000002)

DC 4A (Q0000006) 1

2-pin Small Plug P-2240 (P0090034) 1

Options:

Tone Burst Unit (FTS-5) (D3000257)

Tone Squelch Unit (FTS-32R(RPT)) (D3000258)

DTMF Unit (D3000259)

ID Unit (D3000260)

Mounting Rack (MR-1A) (D3000232)

(MR-2A)* (D3000272)

Duplexer (PD636)* (D3000274)

(PD506)* (D3000275)

(PD479)* (D3000276)

(PD696(A)**) (D3000261)

(PD696(E)**) (D3000232)

50W Power Amplifier

(FL-750)*** (A4130000)

(FL-2450)* (A4110000)

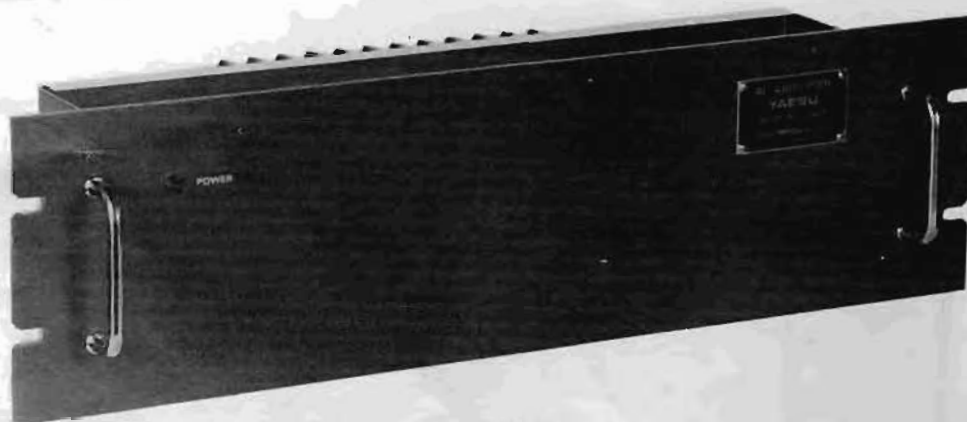
(FL-5450)** (A4120000)

50W PS Unit (FP-15) (A6450000)

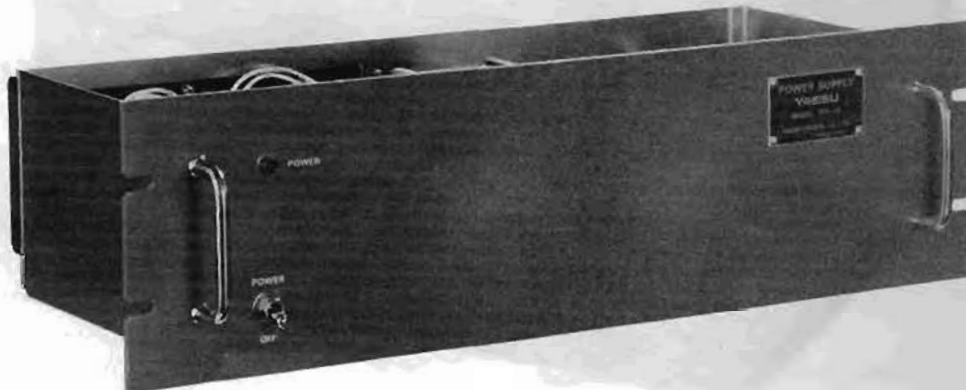
Microphone (YM-30) (D1000026)

Blank Panel (D3000273)

* FTR-2410A, ** FTR-5410, *** FTR-710A

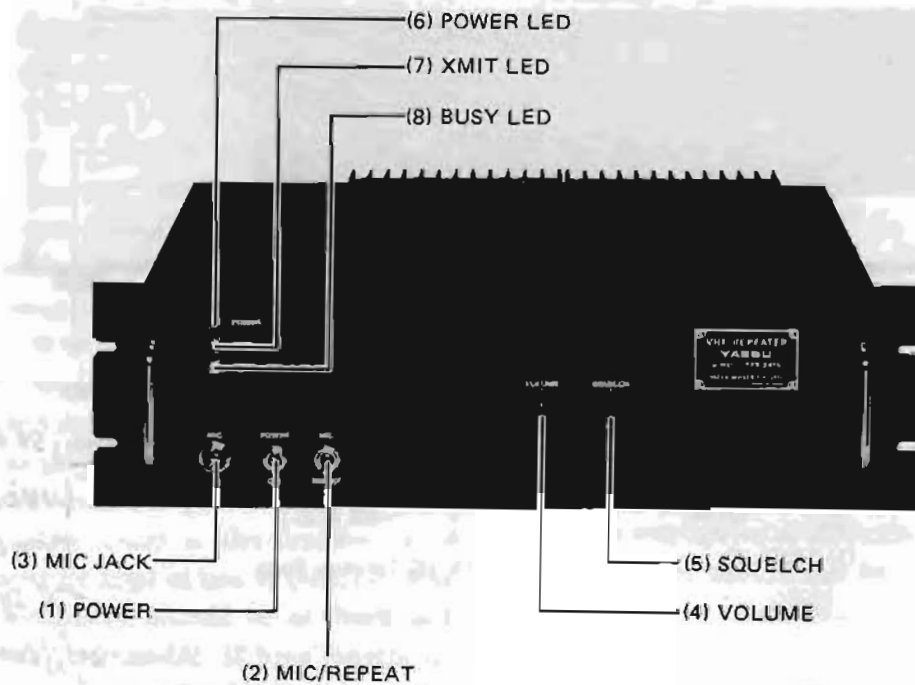


(FL-2450)



(FP-15)

FRONT PANEL CONTROLS AND SWITCHES



(1) POWER

This is the main power switch for the repeater.

(2) MIC/REPEAT

This switch selects the operating function, as a repeater or transceiver. When this switch is in the REPEAT position, the unit functions as a repeater, while in the MIC position, you can speak into the microphone to use it as a transceiver.

(3) MIC Jack

This six-pin connector accepts the microphone input, and provides a standby control line to activate the transmitter when using the transceiver function.

(4) VOLUME

The volume control sets the receiver volume level from the front panel speaker. If desired, this control can be set fully counterclockwise when repeater monitoring is not needed.

(5) SQUELCH

The squelch control silences receiver noise until a signal is received (when using the transceiver or repeater function).

(6) POWER LED

This indicator lamp will glow green whenever AC or DC power is applied, and the POWER switch is on.

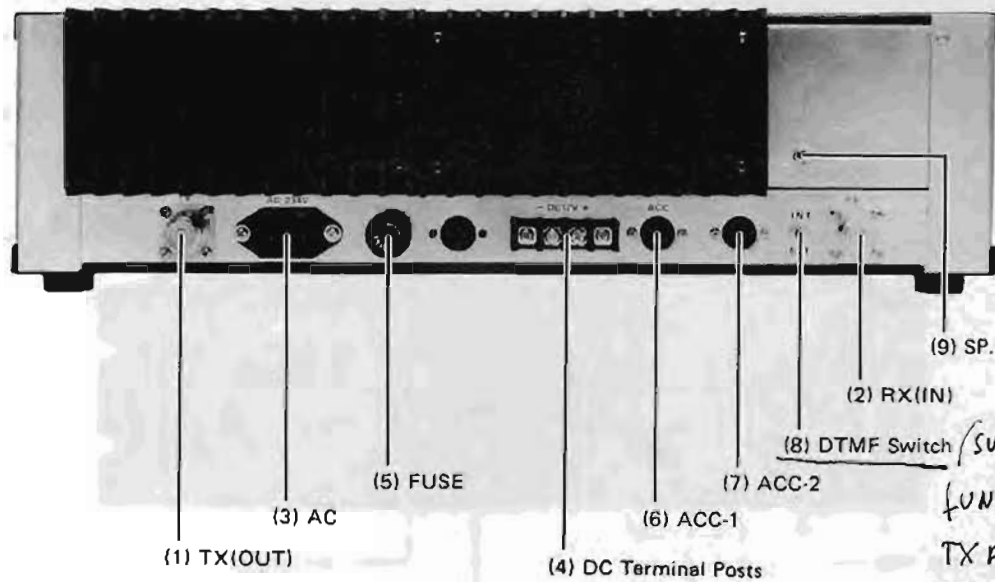
(7) XMIT LED

This red indicator will light up when the transmitter is activated.

(8) BUSY

This indicator will light up when a signal is received (strong enough to break the receiver squelch, as set by the SQUELCH control).

REAR APRON CONNECTIONS



*SU POS. EXT. PWR
FUNK. CON. INDIC.
TX ACC-1 7526
TX SPK-1 7524
30/8/2000 JNS/LNC
VIA RADIO*

(1) TX (OUT)

This coaxial jack provides the transmitter output signal for connection to the transmitting antenna or TX jack on the duplexer, if used. Impedance requirement is 50 ohms.

(2) RX (IN)

This coaxial jack accepts the receiver input signal from the receiving antenna or RX jack on the duplexer, if used. Impedance requirement is also 50 ohms.

(3) AC

This receptacle accepts the AC power cord, which should be connected through the AC terminal on the MR-1A or MR-2A Mounting Rack to the AC mains supply or wall outlet. The AC line voltage must match that for which the repeater is wired.

(4) DC Terminal Posts

These terminal posts accept 12–15 VDC for operating the repeater from a battery or other DC source. When operating from AC, a small trickle current is present at these terminals to maintain battery charge.

(5) FUSE

A properly rated fuse must be installed here for operation from AC power. For 110–117 VAC operation, use only a 2-amp fuse. For 200–234 VAC operation, use only a 1-amp fuse.

(6) ACC-1

This 7-pin DIN jack provides control signals for an external RF power amplifier, such as the FL-750, FL-2450 or FL-5450.

(7) ACC-2

This 8-pin DIN jack provides control signal connections for an external DTMF controller.

(8) DTMF Switch

Set this switch to the EXT position to control the repeater from an external DTMF controller. Otherwise control is by the internal (optional) DTMF Unit, if installed.

(9) SP

This jack is used to accommodate an external speaker. Inserting the plug into this jack automatically disables the internal speaker.

INSTALLATION

Antenna Considerations

Repeater operation without a duplexer requires that two antennas be installed, one for receiving and one for transmitting, in such a manner that the receiving antenna does not pick up too much energy from the transmitting antenna. There are a number of ways that this may be done, depending on the size of the frequency split between the transmitter and receiver, and on the location available for antenna mounting. If a duplexer is used, a single antenna will suffice for both transmitting and receiving simultaneously.

Regardless of the above choice, it is of paramount importance that the antenna(s) be mounted as high and in the clear as possible, preferably within line-of-sight to all areas where repeater users may be located. Furthermore, losses in the feedline(s) to the antenna(s) must be kept as low as possible. For this reason, the feedline(s) should be as short, and of as high a quality, as possible. If long lengths of feedline are necessary, it is preferable to use coaxial hardline (Heliac) cable to reduce losses, particularly at the higher frequencies.

Of course all antennas used with the repeater should have an impedance of 50 ohms at the operating frequency. When separate receive and transmit antennas are used, high-Q narrowband models may serve to minimize interaction. However, when a single antenna is used with a duplexer, it should be a low-Q wideband type.

NEVER TRANSMIT WITHOUT HAVING A TRANSMITTING ANTENNA CONNECTED TO THE REPEATER.

DC Power Supply Backup

For uninterrupted operation during power failures, a 12V rechargeable lead-acid (automotive) storage battery may be connected to the DC terminal posts on the rear apron of the repeater (RED to "+", BLACK to "-"). While the repeater is operating from the AC source, a slight charging current will then maintain battery charge. In the event of a power outage, the automatic power control circuit will automatically switch the repeater to the backup battery, and operation will not be interrupted.

After operation from the battery, it should be disconnected from the repeater and recharged separately before reconnecting, as the trickle charge is not sufficient for recharging a completely discharged battery.

During transmission while operating from a battery or DC supply, the repeater requires approximately 4 amperes (at 12V).

Equipment Location

While the operating temperature range of the repeater is quite broad, the best location is still one in which the air temperature does not approach the extremes or change rapidly. It is necessary to allow for free air circulation around the heatsinks on the rear apron at all times, and in warm climates the repeater should not be sealed in a small closed room.

The repeater must be protected from wind and rain, and extremes in temperature or humidity may shorten the useful life of the equipment. Therefore, for best reliability and performance, try to locate the repeater in an environment that is also comfortable for humans, if possible.

AC Power Supply Voltage Selection

Each repeater is wired for a particular AC mains voltage between 100 and 234 volts. This is generally identified by a label near the AC jack on the rear apron. If no label is present, or if the voltage on the label is different than the local AC line, check the wiring to the power transformer inside the repeater, and change the connections (and label) if necessary, as shown on the following page.

Changing the transformer wiring also requires changing the fuse in the rear apron holder if the voltage is changed from below 117 to above 200V, or vice-versa. Use a 2-amp fuse for 117V or less, or a 1-amp fuse for 200V or more.

OPERATION

Make sure that all connections are made properly, as described in the preceding Installation section, before operating the repeater.

With the POWER switch OFF, preset the controls as follows;

- MIC/REPEAT switch to MIC position.
- VOLUME control fully counterclockwise.
- SQUELCH control fully counterclockwise.

Connect the microphone (YM-30) to the MIC jack, and connect the AC plug to the wall outlet. Tune the POWER switch ON, the green POWER LED and orange BUSY LED should light up. Adjust the VOLUME control for a comfortable level on the background noise, or incoming signal. When the channel is clear, rotate the SQUELCH control clockwise just until the background noise is reduced. After 2 seconds the noise will completely disappear and the BUSY LED will turn off.

To operate the repeater as a transceiver, just squeeze the PTT switch on the microphone to transmit, and release the switch to receive. Alternatively, full duplex transceiving is possible by setting the SEMI/FULL internal switch (S03) on the COR unit to the FULL position.

For normal repeater operation, set the MIC/REPEAT switch to REPEAT. While the repeater is in operation, it is possible to break in on users by squeezing the PTT switch.

SPECIAL FUNCTIONS AND CONTROL

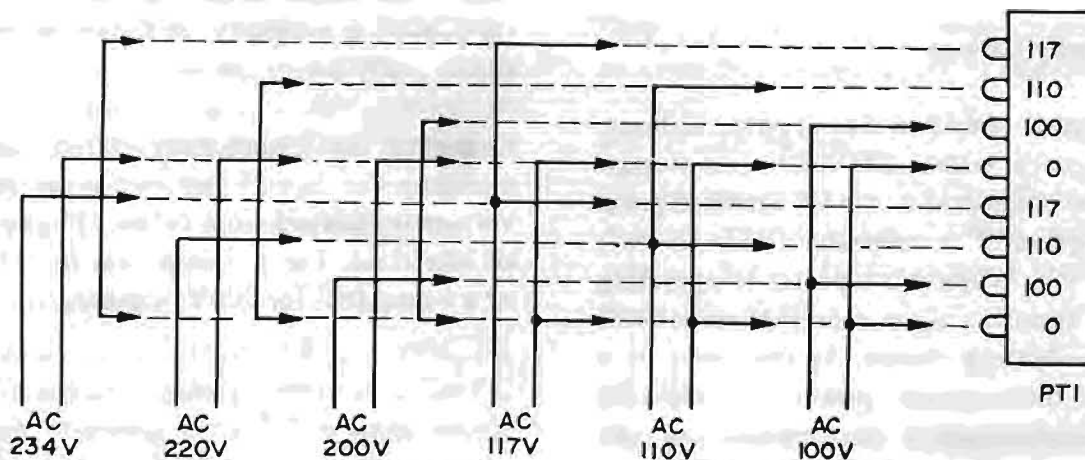
A number of special functions are available as standard accessories and options for repeater operation. Standard functions include a time out timer, and hang up delay timer. These, plus the optional CW ID Unit and DTMF control decoder are described in the following paragraphs.

Time Out Timer

This function measures the amount of time that the repeater is transmitting continuously, and automatically deactivates the transmitter after a preset length of time (set for 3 minutes at the factory). Thus overlong transmissions are automatically interrupted, and users develop the habit of short transmissions. This leads to minimum delays for those stations waiting to use the repeater while it is engaged. Delay times may be set as desired according to the information on pages 44 and 45.

Hang Up Delay Timer

This function holds the transmitter on for a preset length of time (set for 4 seconds at the factory) after a station stops transmitting to the repeater. During this time, another station may call and access the repeater while the repeater transmits continuously (the Time Out Timer will be reset automatically). During the (4 second) hang up delay period, the repeater will transmit the white noise from the receiver at a level 20 dB below the received level. If transmission of the attenuated noise is not desired, it can be removed simply by cutting the jumper wire indicated on page 44.



POWER TRANSFORMER PRIMARY CONNECTIONS

DTMF Control Decoder (Option)

This system allows certain repeater functions to be controlled by certain DTMF tone combinations (control codes) sent to the repeater receiver. The standard decoder circuit allows up to seven different functions to be controlled by two (or three) DTMF tones each, when spaced less than 1.5 seconds apart.

As programmed at the factory, the DTMF control codes each consist of two or three DTMF tone pairs, beginning with either "*" or "#", followed by one or two numbers between 1 and 8, inclusive. Control codes beginning with "*" set the control function, and those beginning with "#" reset the like-numbered function.

Factory-programmed functions and their corresponding DTMF control code key numbers are as follows:

- 1 - ALL RESET (must be preceded by # only); returns all of the control functions to the RESET condition
- 2 - (only used in combination with "3", as follows)
- 3 2 - MIC/REPEAT SELECT: duplicates the function of the switch of the same name on the front panel. When the control code * 3 2 is sent, the MIC (local microphone) mode is SET (activated). # 3 2 returns the machine to the REPEAT(er) mode (RESET).
- 4 - CTCSS OFF: when the tone squelch (CTCSS) option is installed, it is switched off when this code is SET, and on when RESET.
- 5 - TRANSMIT DISABLE: when this code is SET, the repeater will not transmit.
- 6, 7 and 8 - user programmable (not connected at the factory)

Note:

If all of the control codes required for a specific command are not sent within the allotted time (1.5 seconds maximum between tones), the ALL RESET (# 1) command must be sent properly before other commands can be accepted.

CW ID Unit (Option)

When installed in the repeater, this unit will transmit the preprogrammed callsign of the repeater in telegraph code (F2 mode) when the transmitter of the repeater is first activated, and at 10-minute intervals for as long as the repeater is being used. The modulation level of the identifying code is such that it will not interfere with communications. Keying speed can be adjusted by VR₀₁ on the ID Unit.

The callsign is programmed in the PROM at the factory, so it must be specified when ordering the CW ID Unit.

INSTALLATION OF OPTIONS

FTS-32R (RPT) Tone Squelch Unit Installation

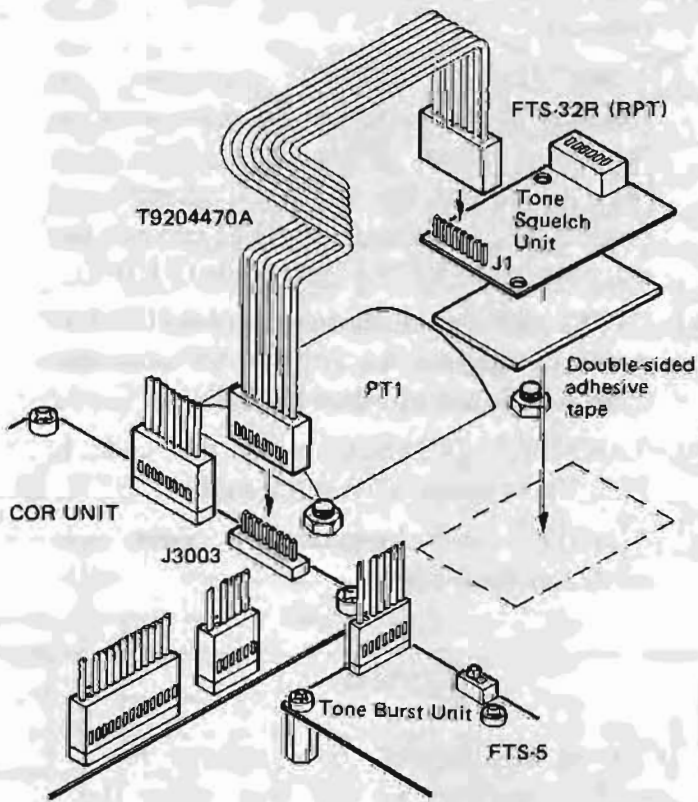
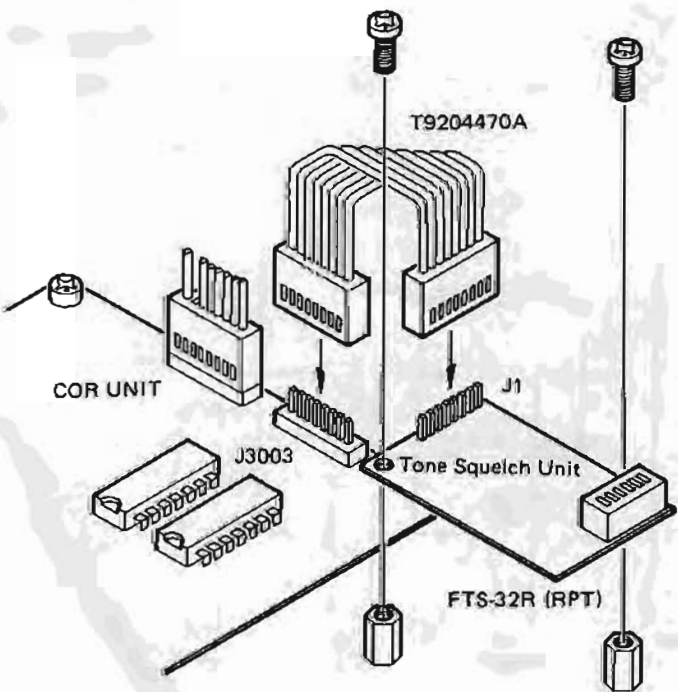
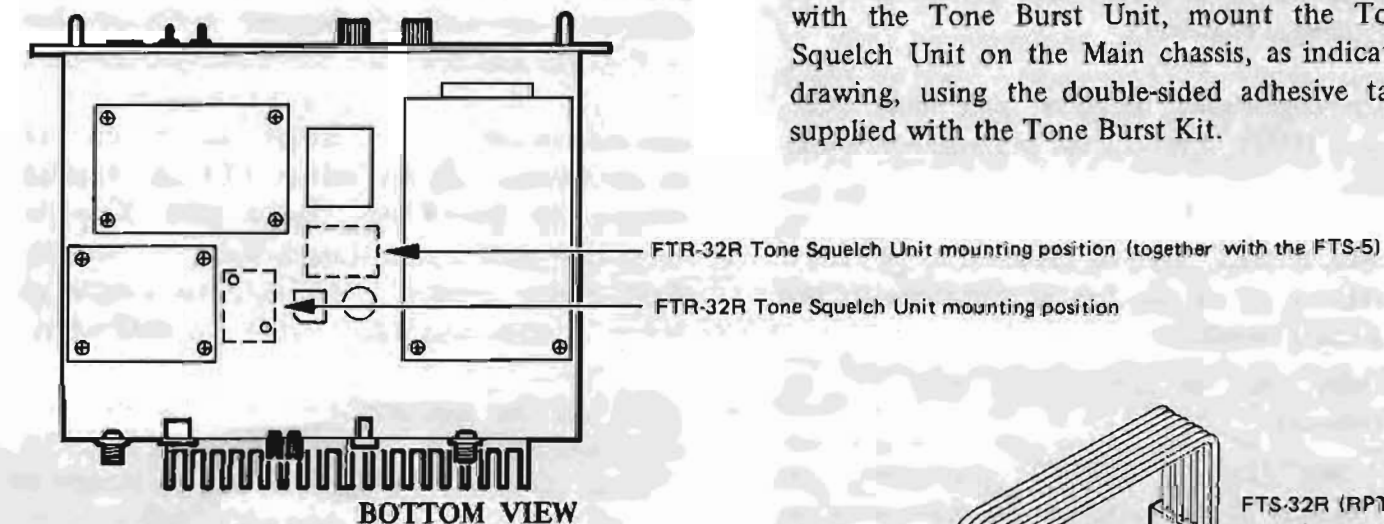
When the Tone Squelch Unit is installed in the repeater, only those incoming signals which include the CTCSS (subaudible) tone preset in the repeater will be retransmitted. Other signals will be heard from the repeater speaker attenuated 20 dB.

Requires:

- Kit number D3000258, consisting of:
 - one Tone Squelch Unit assembly
 - FTS-32R(RPT)
 - one cable and connector assembly T9204470A
 - two panhead screws (ASM 2.6x6)

1. Remove the eight screws affixing the bottom cover.
2. Referring to the diagram, mount the Tone Squelch Unit* using the two screws supplied, noting in particular the location of 8 pin connector (J₁) on the Tone Squelch Unit, which should be nearest the COR Unit.
3. Connect one cable assembly plug to J₁ on the Tone Squelch Unit, and the other cable plug to J₃₀₀₃ on the COR Unit. Installation is now complete. Tone programming is shown in the table on the following page.

* If installing the Tone Squelch Unit together with the Tone Burst Unit, mount the Tone Squelch Unit on the Main chassis, as indicated drawing, using the double-sided adhesive tape supplied with the Tone Burst Kit.



Note:

If the Tone Squelch Unit has been installed and is now being removed from the repeater, replace the dummy plug on J₀₃, or jumper pin 1 to pin 2 (on J₀₃).

**FTS-32R
DIP SWITCH PROGRAMMING**

TONE No.	FREQ. (Hz)	SWITCH NUMBER					
		1	2	3	4	5	(6)*
1	67.0	0	0	0	0	0	
2	71.9	1	0	0	0	0	
3	74.4	0	1	0	0	0	
4	77.0	1	1	0	0	0	
5	79.7	0	0	1	0	0	
6	82.5	1	0	1	0	0	
7	85.4	0	1	1	0	0	
8	88.5	1	1	1	0	0	
9	91.5	0	0	0	1	0	
10	94.8	1	0	0	1	0	
11	97.4	0	1	0	1	0	
12	100.0	1	1	0	1	0	
13	103.5	0	0	1	1	0	
14	107.2	1	0	1	1	0	
15	110.9	0	1	1	1	0	

TONE No.	FREQ. (Hz)	SWITCH NUMBER					
		1	2	3	4	5	(6)*
16	114.8	1	1	1	1	0	
17	118.8	0	0	0	0	1	
18	123.0	1	0	0	0	1	
19	127.3	0	1	0	0	1	
20	131.8	1	1	0	0	1	
21	136.5	0	0	1	0	1	
22	141.3	1	0	1	0	1	
23	146.2	0	1	1	0	1	
24	151.4	1	1	1	0	1	
25	156.7	0	0	0	1	1	
26	162.2	1	0	0	1	1	
27	167.9	0	1	0	1	1	
28	173.8	1	1	0	1	1	
29	179.9	0	0	1	1	1	
30	186.2	1	0	1	1	1	
31	192.8	0	1	1	1	1	
32	203.5	1	1	1	1	1	

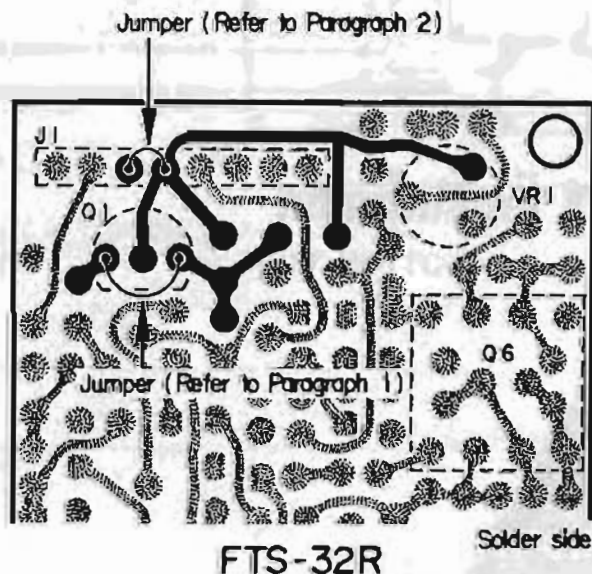
CLOSED = 0 (ON)
 OPEN = 1 (OFF)
 *SW(6) = ON (DECODER ON)
 = OFF (DECODER OFF)

**FTS-32R TONE SQUELCH UNIT
MODIFICATION FOR INSTALLATION IN
YAESU REPEATERS**

The FTS-32R may not be installed directly in Yaesu model FTR-710A, FTR-2410A or FTR-5410 Repeaters because of the unique connections provided in these repeaters. Yaesu thus offers the FTS-32R(RPT) Tone Squelch Unit for these repeaters. The FTS-32R may also be modified to an (RPT) version by the following procedure.

1. The FTS-32R is designed for operation with an unregulated supply voltage of 10.8 to 12 VDC, which is applied to an 8V regulator. As the repeaters provide only regulated 8 VDC for the Tone Squelch Unit, the regulator in the FTS-32R must be bypassed by adding a jumper between the input and output leads of type 78L08A regulator Q₁ on the FTS-32R.
2. If the FTS-32R is installed in the repeater without the optional DTMF Unit also being installed, another jumper must be added from pin 5 to pin 6 jack J₁ on the FTS-32R. When the DTMF Unit is installed, this jumper is not necessary.

3. The FTS-32R is not supplied with the necessary connection cable (part no. T9204470A) for repeater installation. This can be ordered separately through Yaesu representatives, or a cable can be made (to connect 8-pin jack J₃₀₀₃ on the COR Unit in the repeater with J₁ on the FTS-32R, with all pins corresponding).



FTS-5 Tone Burst Decoder Installation

When the FTS-5 Tone Burst Decoder Unit is installed in the repeater, the transmitter will only be activated when the received signal begins with a burst tone between 1700 and 1950 Hz (as adjusted on the FTS-5). Other signals will be ignored by the repeater.

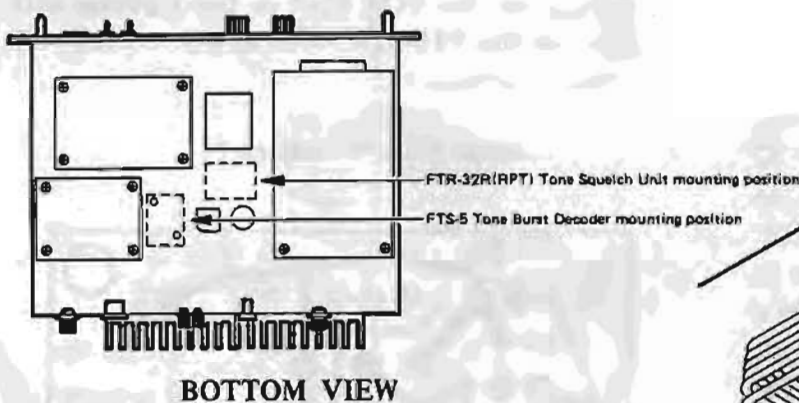
Requires:

Kit number D3000257, consisting of:

- one Tone Burst Unit assembly FTS-5
- one cable and connector assembly T9204618A
- two panhead screws (ASM 2.6x6)
- two pcs double-sided adhesive tape*

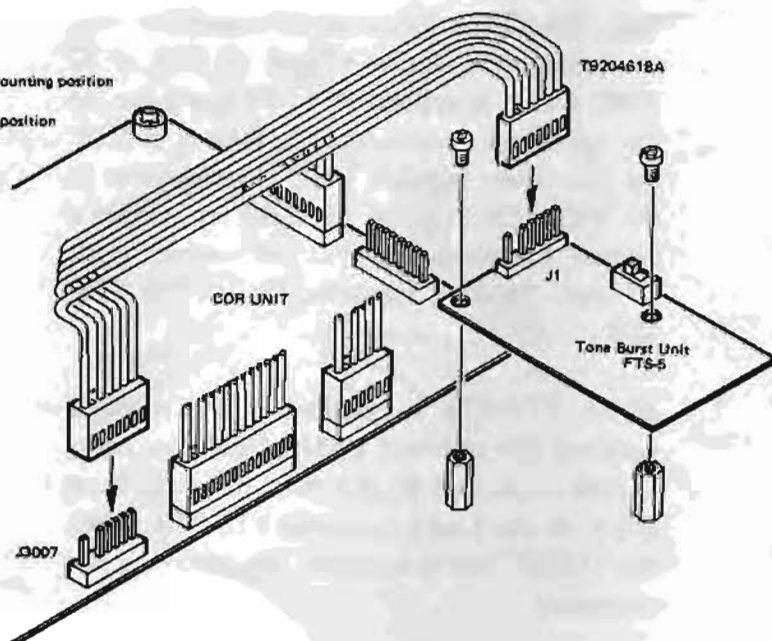
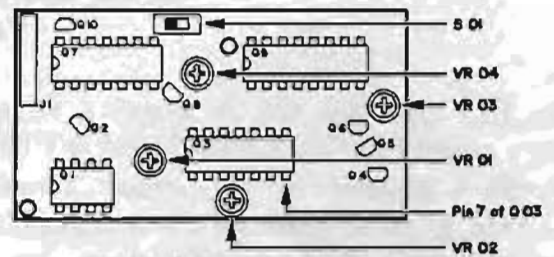
1. Remove the eight screws affixing the bottom cover.
2. Referring to the diagram, mount the Tone Burst Unit using the two screws supplied, noting in particular the location of 8-pin connector (J_1) on the Tone Burst Unit, which should be nearest the COR Unit.
3. Connect one cable assembly plug to J_1 on the Tone Burst Unit, and the other cable plug to J_{3007} on the COR Unit. Installation is complete.

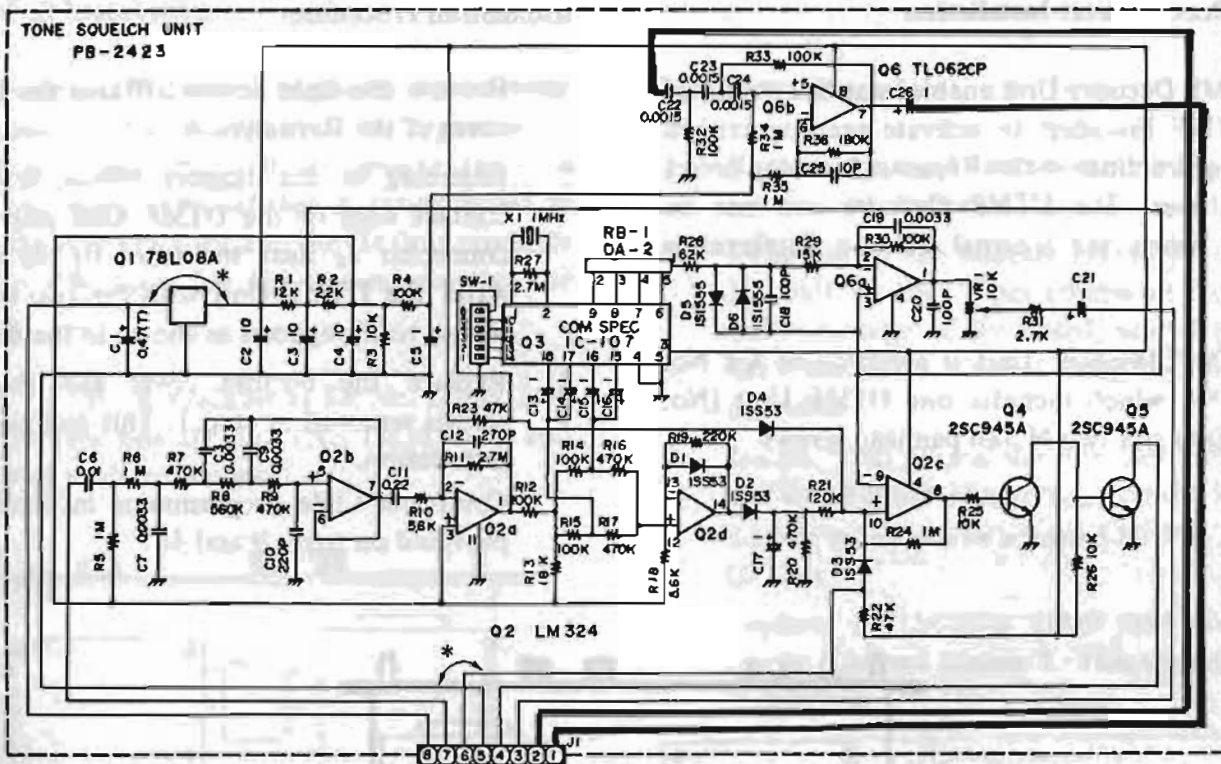
* If also using the Tone Squelch Unit, mount the Tone Squelch Unit on the main chassis, using the double-sided adhesive tape supplied with this kit. Refer to Tone Squelch Installation on page 10.



Adjustment

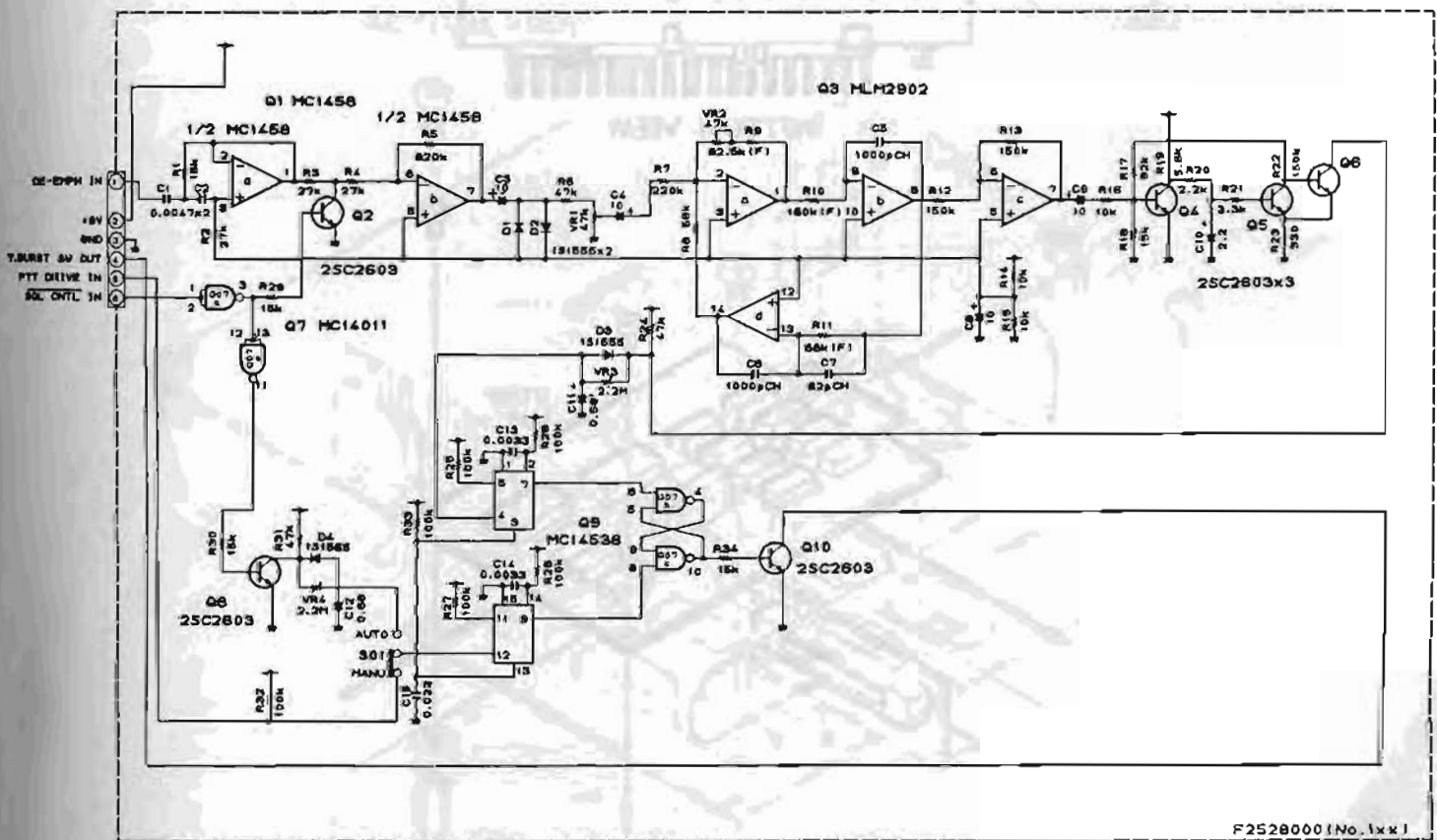
1. Set switch S_{01} on the FTS-5 to the position nearest the adjacent moxex connection.
2. Set an audio generator for 80 mV output at the desired Burst Tone frequency, and connect to pin 1 of J_{01} . Also, connect an AF millivoltmeter to pin 7 of Q_{03} , and preset VR_{01} to midrange. Adjust VR_{02} for maximum deflection on the meter.
3. Adjust VR_{01} for 420 mV on the meter.
4. Switch the audio generator output on and off while adjusting VR_{03} for the desired activating tone length (maximum is 1 second). Then adjust VR_{04} for the desired Burst Tone hang up delay, which is the time after which a station drops his carrier and before which a new tone burst is required.
5. Set switch S_{01} to the desired position, for automatic Burst on each transmission, or for manual accessing Burst.





* See page 11

**FTS-32R
CIRCUIT DIAGRAM**



F25280001 No. 1x1

**FTS-5
CIRCUIT DIAGRAM**

DTMF Decoder Unit Installation

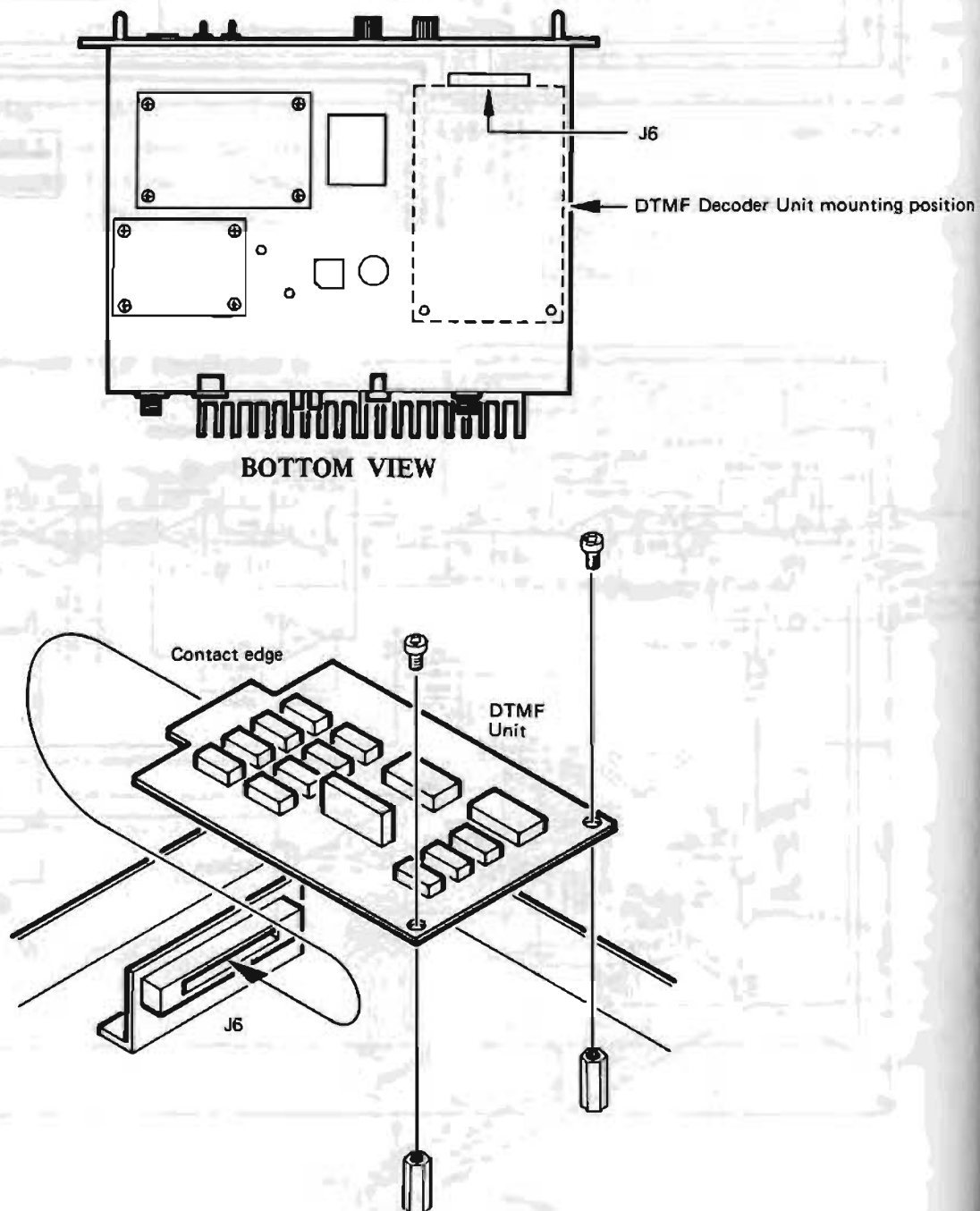
The DTMF Decoder Unit enables stations equipped with DTMF Encoders to activate preprogrammed switching functions in the Repeater by using preset DTMF tones. The DTMF Decoder can not be installed when the internal PD-636 Duplexer is installed.

The DTMF Decoder Unit is available as Kit No. D3000259, which includes one DTMF Unit (No. C024160A) and two M 3x6 panhead screws.

Installation Procedure

1. Remove the eight screws affixing the bottom cover of the Repeater.
2. Referring to the diagram below, insert the contact edge of the DTMF Unit into 14-pin connector J₆ near the front of the chassis. Affix the DTMF Unit with the two supplied screws to the spacers as shown in the diagram.
3. Replace the bottom cover and the eight screws removed in step 1. This completes the installation.

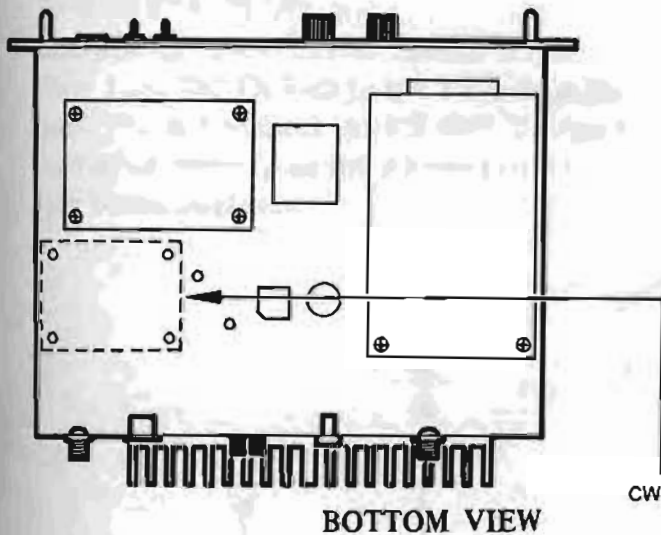
Command Code programming information is provided on pages 9 and 46.



CW ID Unit Installation

The automatic CW ID Unit sends the preprogrammed callsign of the Repeater at the beginning of transmission, and then at 10-minute intervals during operation. The callsign is programmed in the PROM at the factory, and the ID Unit produces an audio CW tone for F2 transmission by the Repeater.

The CW ID Unit is available as Kit No. D3000260, which includes one ID Unit (No. C024170A) and four M 3x6 panhead screws.



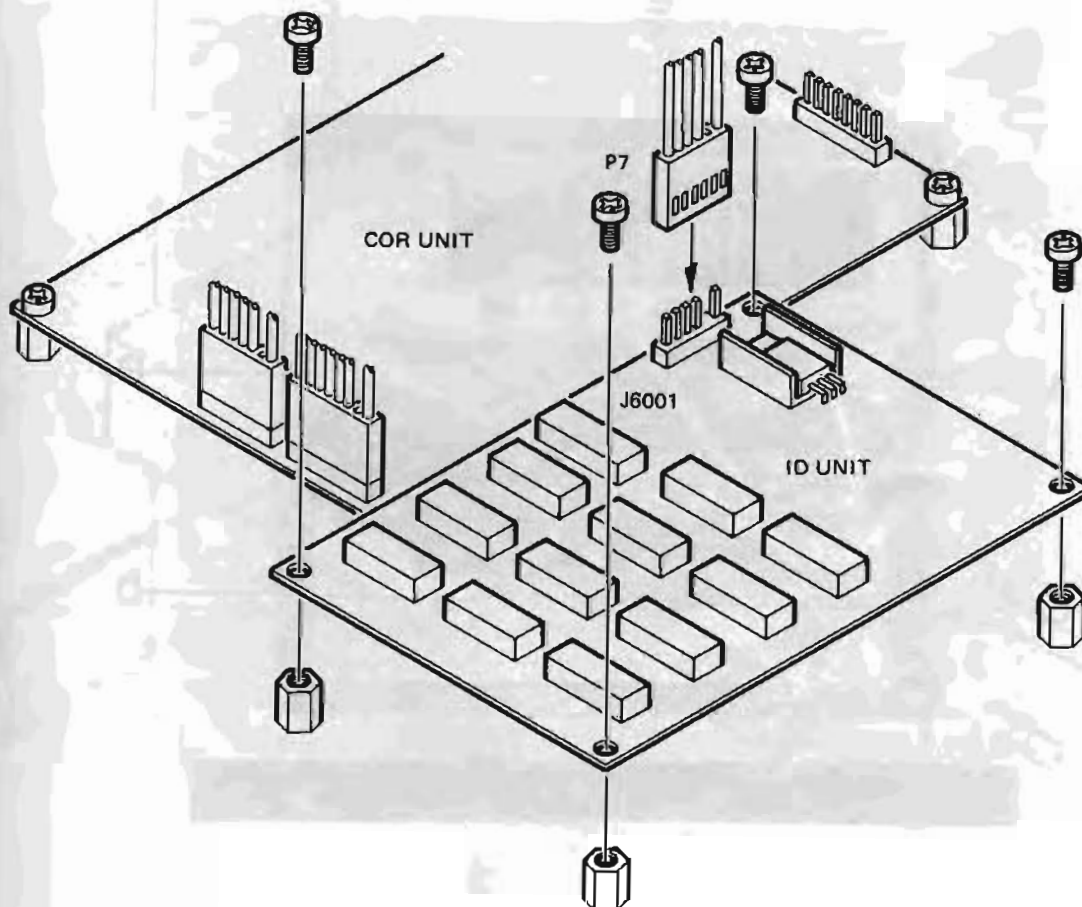
CW ID Unit mounting position

Installation Procedure

1. Remove the eight screws affixing the bottom cover of the Repeater.
2. Referring to the diagram below, position the ID Unit so that 5-pin connector J_{6001} is at the front edge of the board, nearest the COR Unit. Mount the ID Unit using the four screws provided.
3. Locate 5-pin plug in the Repeater marked P_7 , and connect this plug to J_{6001} on the ID Unit. Keying speed can be adjusted by VR_{01} on the ID Unit.
4. Replace the bottom cover and the eight screws removed in step 1. This completes the installation.

Note:

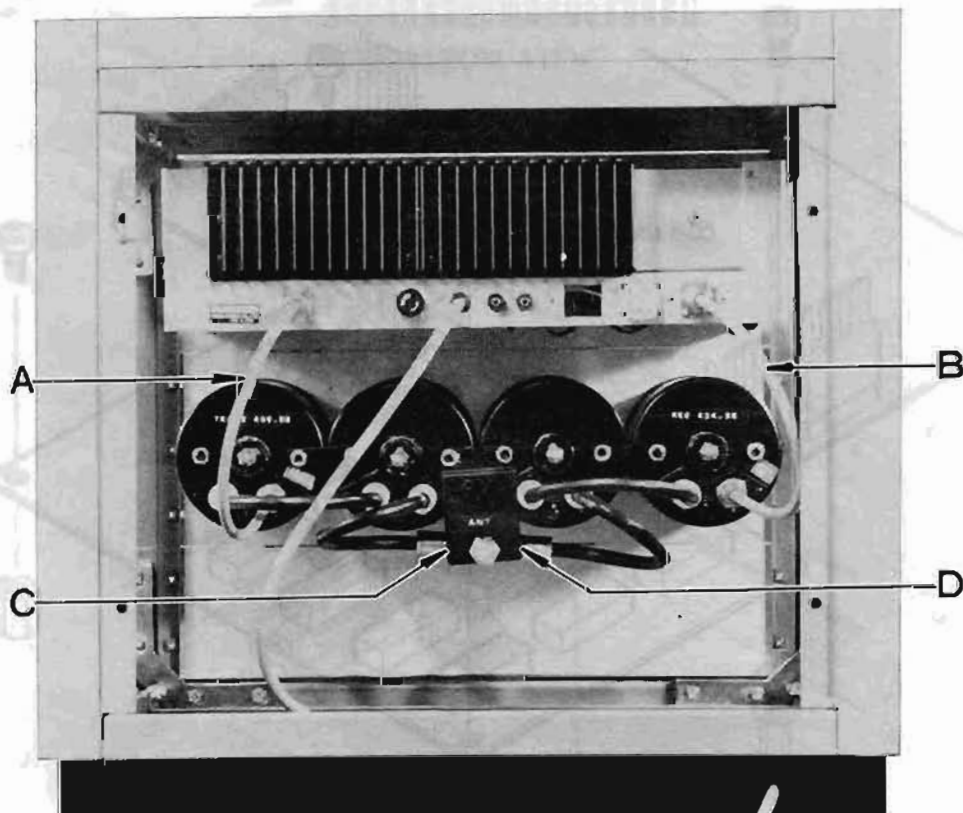
If the PROM is not installed in its socket on the ID Unit, the Unit will cause a continuous audio tone to be transmitted when the Repeater is activated.



External Duplexer Installation

1. Mount the duplexer in the MR-1A or MR-2A mounting rack, using the four screws provided.
2. Referring to the diagram, connect the TX OUTPUT connector from J₃ on the TX Unit to the TX jack on the duplexer, and connect the RX INPUT connector from J₂ on the RX Unit to the RX jack on the duplexer.
3. Connect the TX OUTPUT connector from the duplexer to the jack marked "C" on the duplexer, and connect the RX INPUT connector from the duplexer to the jack marked "D" on the duplexer.

Installation is now complete.



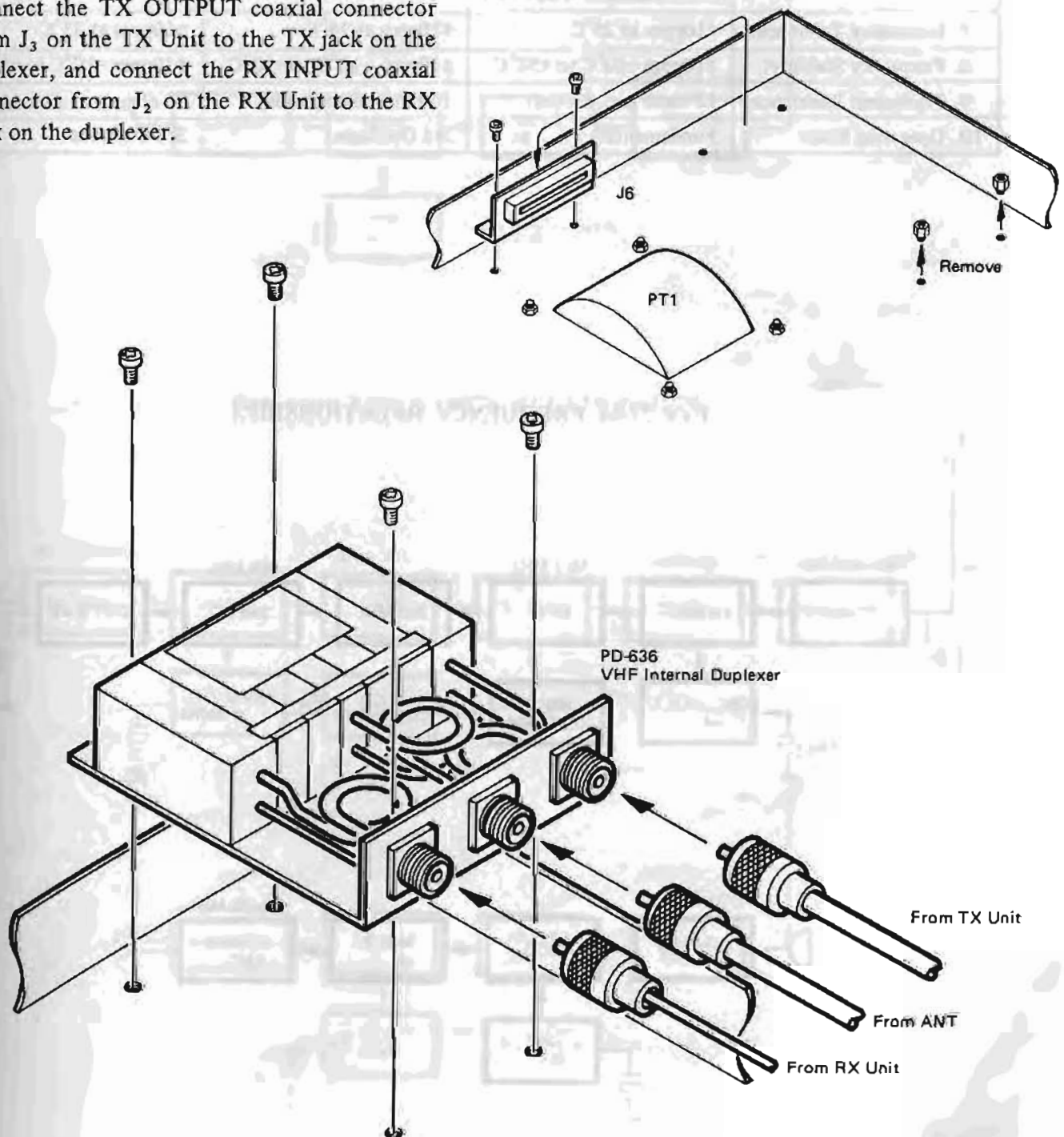
PD-636 VHF Internal Duplexer Installation (FTR-2410A)

The internal duplexer can not be installed when the DTMF Decoder Unit is installed.

1. Remove the eight screws affixing the bottom cover.
2. Move the 14-pin connector (J_6) to the center front position (from the right front edge) as indicated in the drawing.
3. Mount the duplexer unit to the four spacers on the main chassis, using the four screws supplied with the kit.
4. Connect the TX OUTPUT coaxial connector from J_3 on the TX Unit to the TX jack on the duplexer, and connect the RX INPUT coaxial connector from J_2 on the RX Unit to the RX jack on the duplexer.

5. Connect one cable plug to the ANT jack on the duplexer, and the other cable plug to the ANT jack on the inside rear panel.

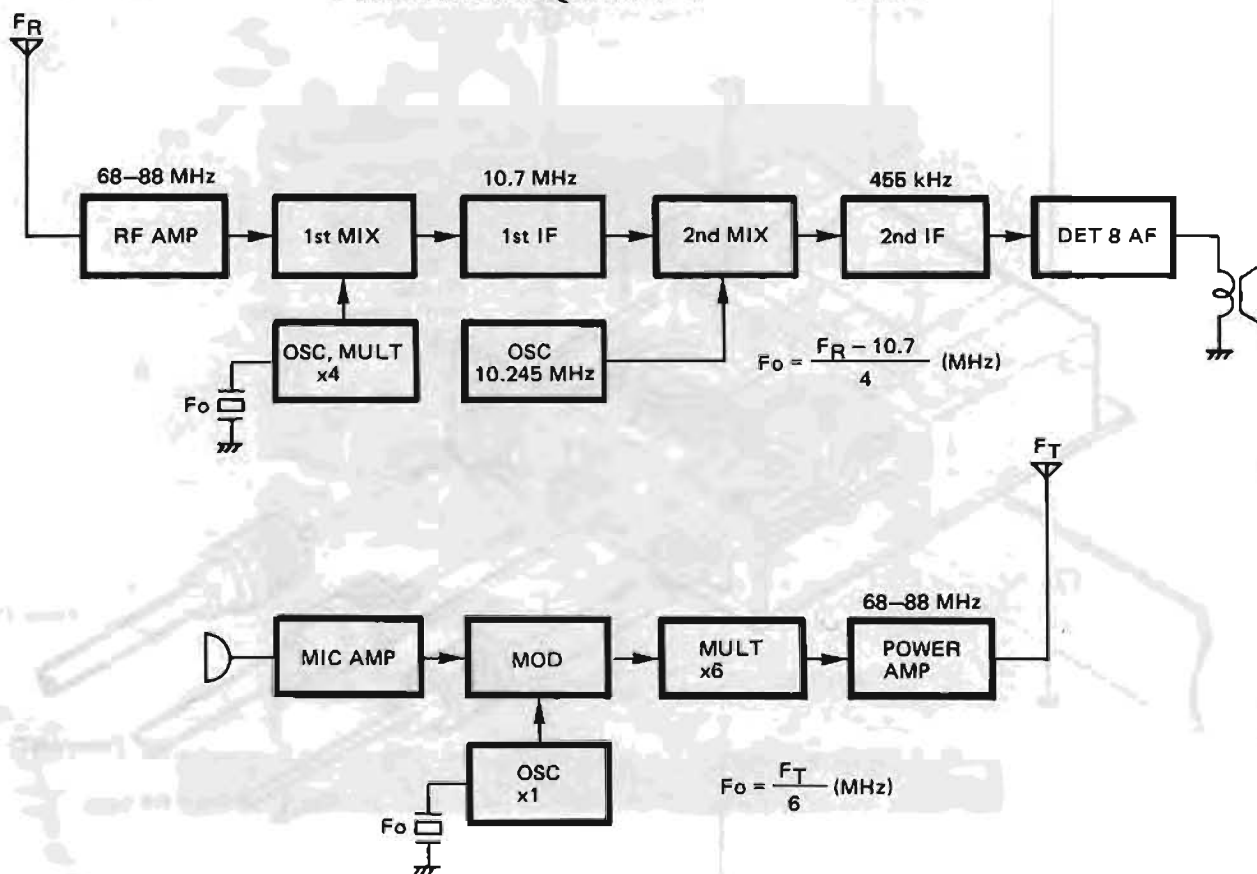
Installation is now complete.



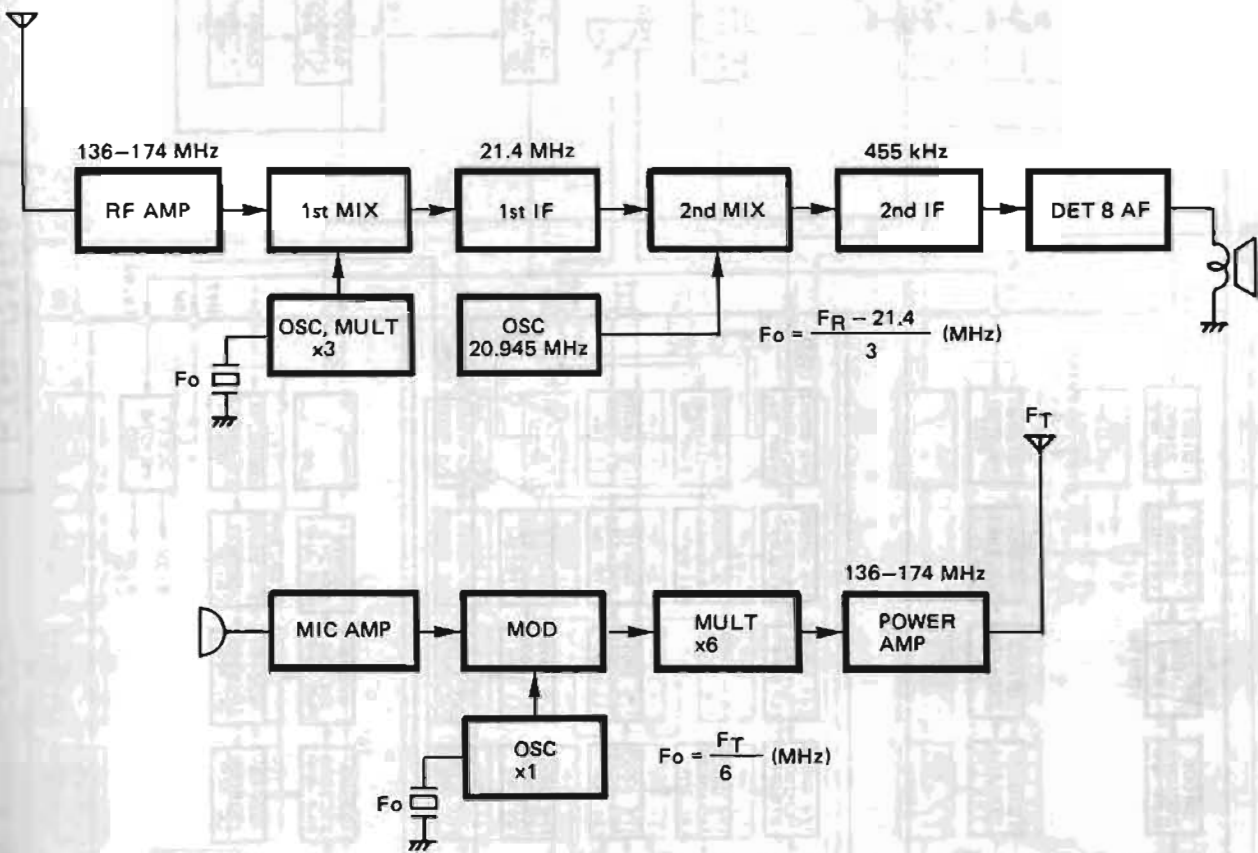
CRYSTAL DATA

	FTR-710A	FTR-2410A	FTR-5410
1. Type of Holder:	HC-25/U	HC-25/U	HC-25/U
2. Channel Frequency:	68MHz – 88MHz	136MHz – 174MHz	400MHz – 512MHz
3. Oscillation Frequency:	TX: CH/6 RX: (CH-10.7)/4	TX: CH/6 RX: (CH-21.4)/3	TX: CH/12 RX: (CH-21.4)/9
4. Load Capacity:	TX: 50pF+60Hz=0 RX: 34.3pF-90Hz=0	45pF	45pF
5. Drive Level:	TS-683/TSM 2mW	TS-683/TSM 2mW	TS-683/TSM 1mW
6. Shunt Capacity:	TX: 12MHz – 4.3pF±0.5 13MHz – 4.5pF±0.5 14MHz – 4.8pF±0.5 RX: 15MHz – 4.5pF±0.5 16MHz – 5.0pF±0.5 17MHz – 4.5pF±0.5 18MHz – 4.8pF±0.5	TX: 5.5pF±0.5 RX: 4.0pF±0.5	7pF
7. Frequency Tolerance:	±10ppm at 25°C	±10ppm at 25°C	±10ppm at 25°C
8. Frequency Stability:	±10ppm -10°C to +50°C	±10ppm -10°C to +50°C	±10ppm -10°C to +50°C
9. Equivalent Resistance:	13 ohms max (Series)	17 ohms max (Series)	70 ohms max (Series)
10. Operation Mode:	Fundamental	3rd Overtone	3rd Overtone

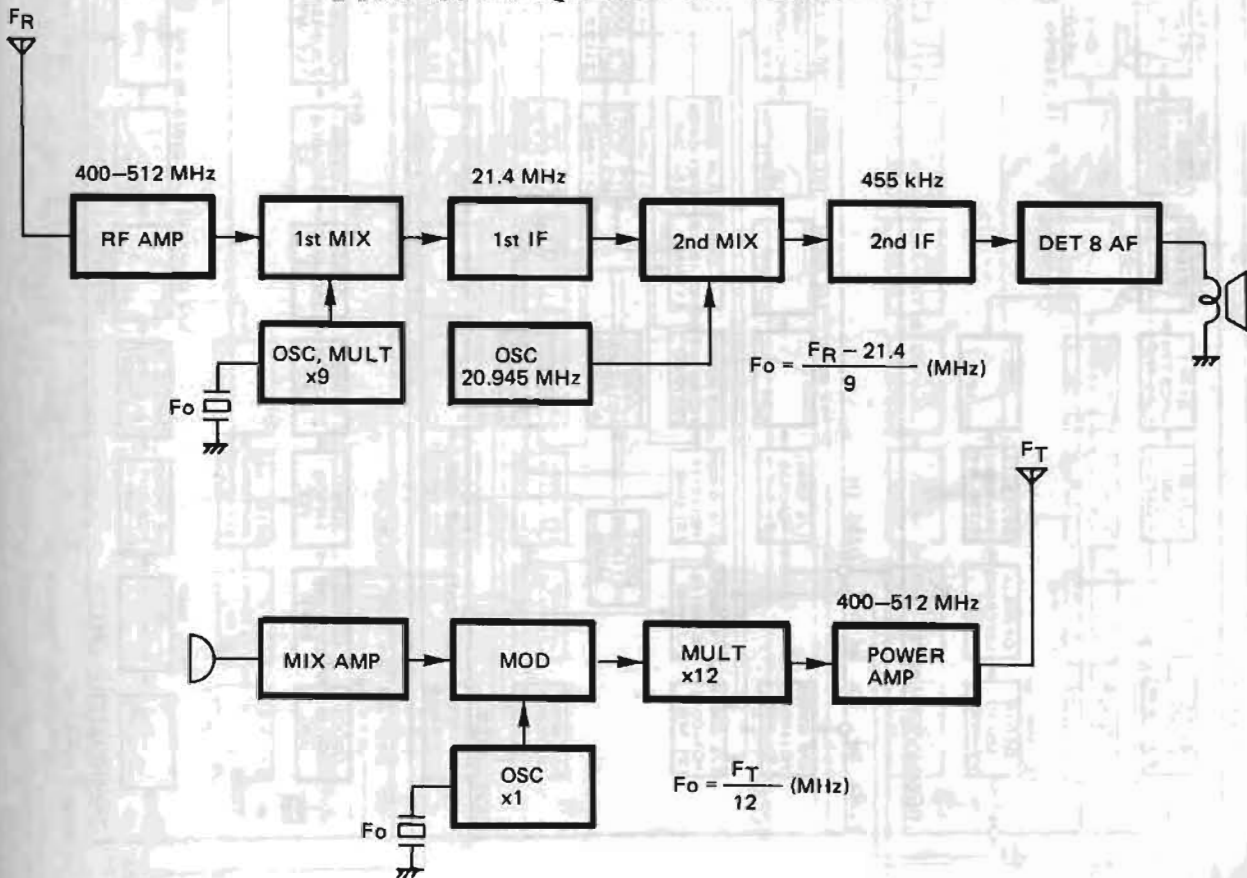
FTR-710A FREQUENCY RELATIONSHIPS

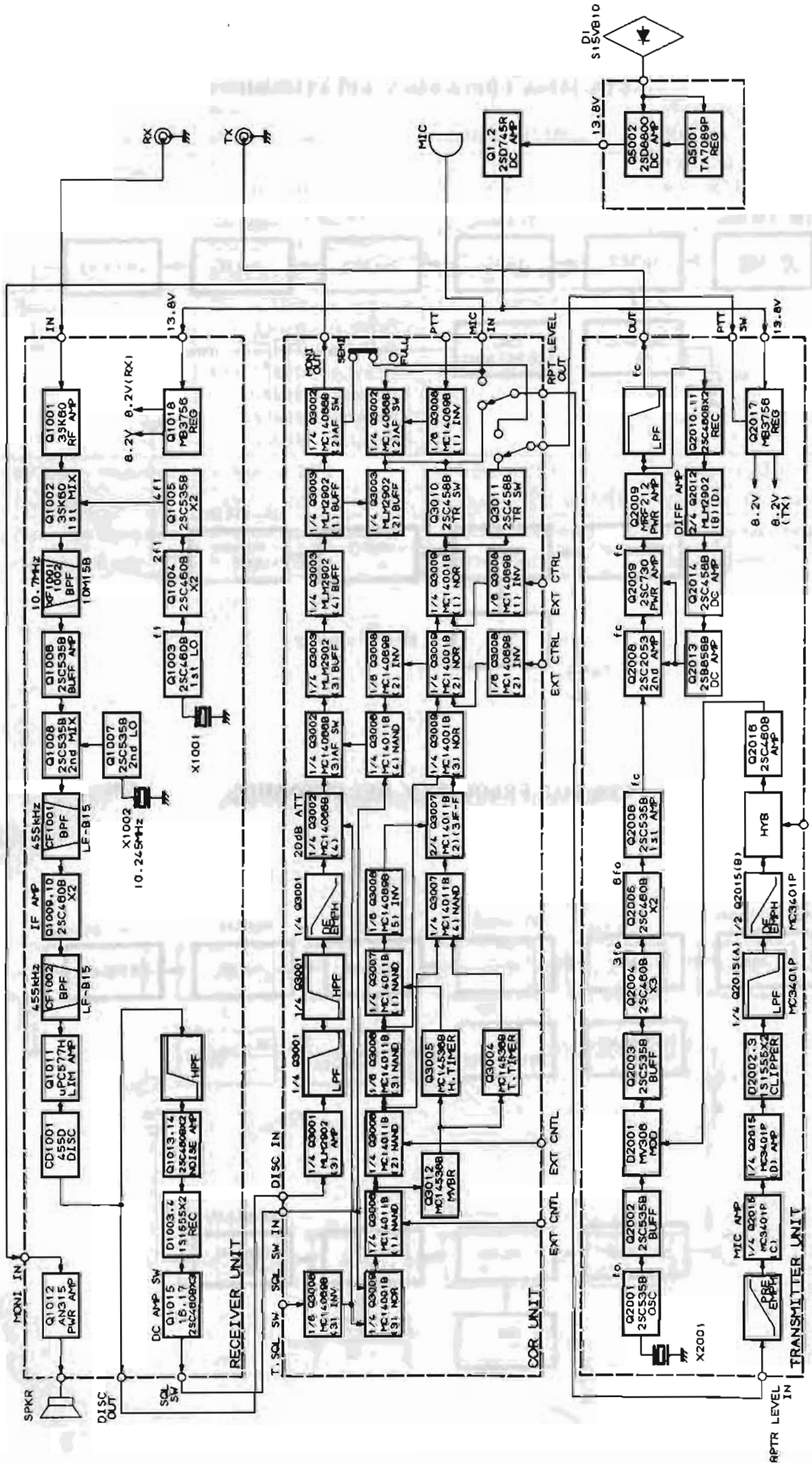


FTR-2410A FREQUENCY RELATIONSHIPS



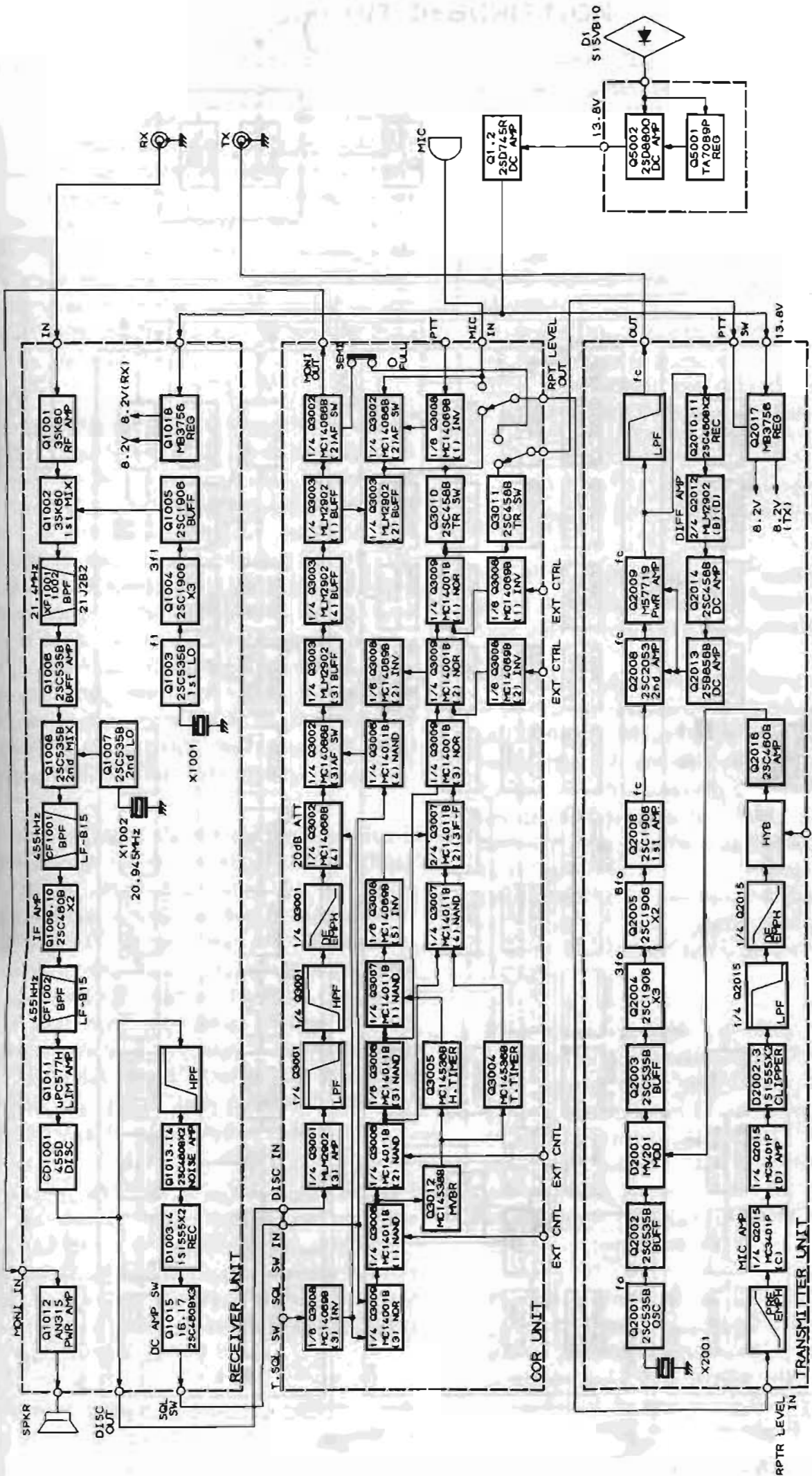
FTR-5410 FREQUENCY RELATIONSHIPS





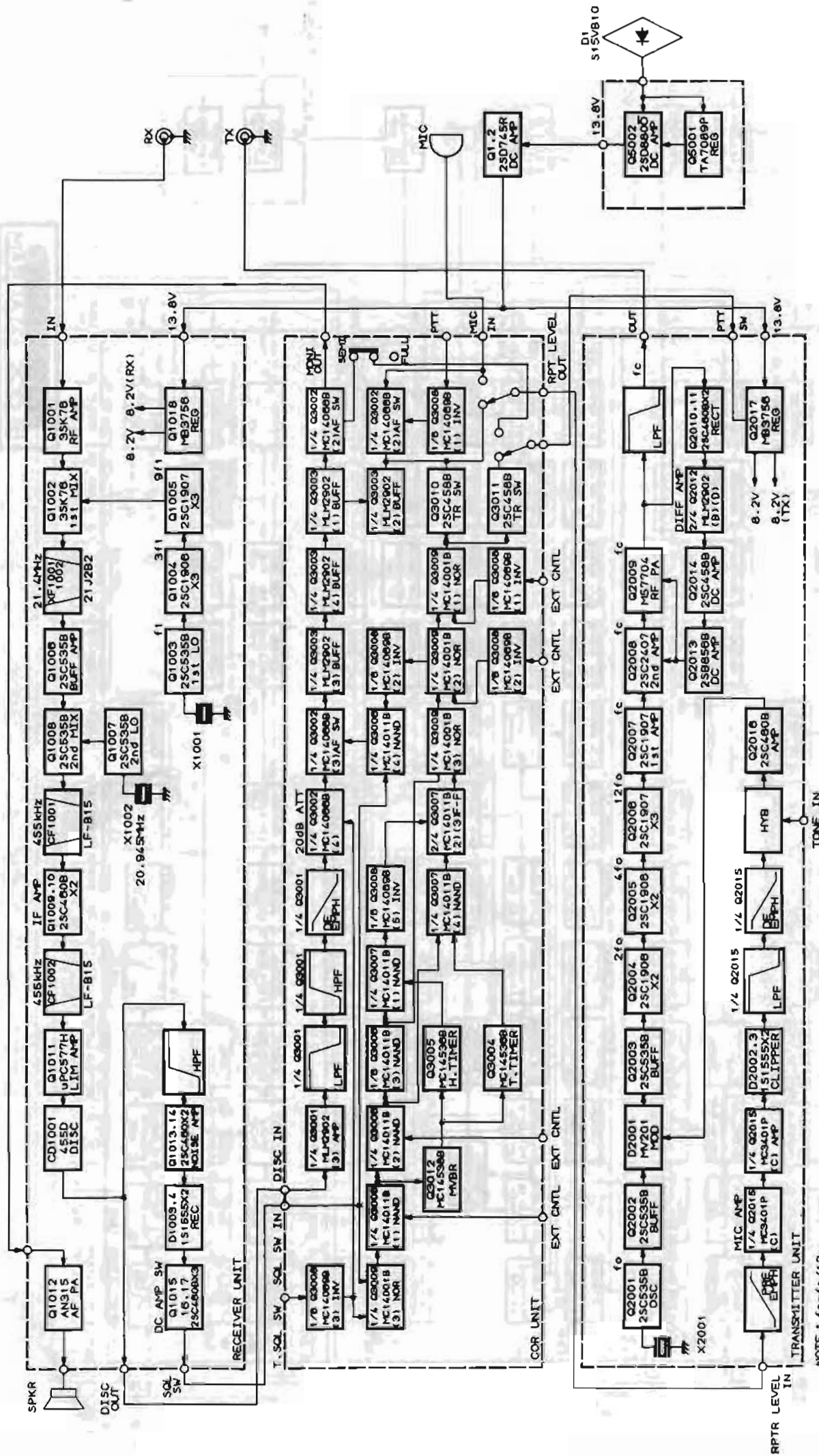
EIR-710A
BLOCK DIAGRAM

NOTE: f_{osc} = 10.7MHz
f₁ = (fc - 10.7MHz) / 2



**EIR-2410A
BLOCK DIAGRAM**

NOTE: $f_c = f_c/8$
 $f_1 = (f_c - 21.4\text{MHz})/3$



ETR-5410
BLOCK DIAGRAM

NOTE: $f_0 = f_c / 12$
 $f_1 = (f_c - 21.4\text{MHz}) / 9$

CIRCUIT DESCRIPTION

RX Unit

The receiver input signal from J_{1004} is fed through a 2-stage resonator circuit to RF amplifier Q_{1001} , and then through another multi-stage resonator circuit to first mixer Q_{1002} . The resonators protect the early stages of the receiver from overload by the nearby transmit signal, and other strong signals close to the receiving channel. In the FTR-5410, the resonators are helical modules, and Q_{1001} and Q_{1002} are both 3SK76s. In the VHF models, Q_{1001} and Q_{1002} are both 3SK60s.

First local oscillator Q_{1003} is temperature compensated by posistor PTH_{1001} , and its output is multiplied up to the required local frequency at Q_{1004} and Q_{1005} before application to the first mixer. In the FTR-710A, the oscillator is a 2SC460B, the oscillating frequency is $(f_R - 10.7)/4$, and Q_{1004} (2SC460B) and Q_{1005} (2SC535B) are both doublers. In the FTR-2410A, the oscillator is a 2SC535B, the oscillating frequency is $(f_R - 21.4)/3$, and Q_{1004} (2SC1906) is a tripler, while Q_{1005} (also 2SC1906) is a buffer. In the FTR-5410, the oscillator is a 2SC535B, the oscillating frequency is $(f_R - 21.4)/9$, and Q_{1004} (2SC1906) and Q_{1005} (2SC1907) are both triplers.

The resulting first IF signal from the first mixer is passed through monolithic crystal filters XF_{1001} and XF_{1002} , and then amplified by Q_{1006} (2SC535B) before being applied to second mixer Q_{1008} (2SC535B). Here the first IF signal is heterodyned with the second local signal generated at Q_{1007} (2SC535B). In the FTR-710A, the first IF is 10.7 MHz, the crystal filters are type 10M2B2, and the second local frequency is 10.245 MHz. In the FTR-2410A and FTR-5410, the first IF is 21.4 MHz, the crystal filters are type 21J2B2, and the second local frequency is 20.945 MHz.

The resulting 455 kHz second IF signal is passed from the second mixer through ceramic filter CF_{1001} (LF-B15) and amplified by Q_{1009} and Q_{1010} (both 2SC460B) before passing through another ceramic filter, CF_{1002} (LF-B15). The highly filtered second IF signal is then applied to limiter-amplifier Q_{1011} (μ PC577H).

The limiting process eliminates amplitude variations in the IF signal, which is then fed to

discriminator CD_{1001} (455D), where an audio response is produced in accordance with a corresponding frequency shift (modulation) in the IF signal. The audio is delivered via J_{1001} and J_{1003} to the COR Unit.

When no carrier is present in the 455 kHz second IF, high frequency noise is present at the discriminator output, which is amplified by noise amplifiers Q_{1013} and Q_{1014} (2SC460Bs), and rectified by D_{1003} and D_{1004} (1S1555s). The resulting DC voltage is amplified by Q_{1015} , Q_{1016} and Q_{1017} (2SC460Bs), and delivered via J_{1001} and J_{1003} to the COR Unit for squelch switching.

COR Unit

The COR (Carrier Operated Relay) Unit is composed of an audio section, a timer (hang up and time out) section, and a transmit switching section.

The audio output from the discriminator on the RX Unit is delivered to quad opamp Q_{3001} (MLM2902), which amplifies, filters and de-emphasizes the receiver audio. This is then gated by the squelch signal delivered from the RX Unit and the tone squelch (switching) signal from the optional Tone Squelch Unit (if installed), at gates three and four of quad analog switch Q_{3002} (MC14066B). Gate four provides 20 dB attenuation of the audio when a signal does not contain a compatible CTCSS tone during tone squelch operation.

When passed through gate three of Q_{3002} , the audio is further amplified by three quarters of quad opamp Q_{3003} (MLM2902), after which a portion of the audio is fed through gate one of Q_{3002} , controlled by SEMI/FULL switch S_{3003} in series with the PTT line (from the microphone), and delivered back to the RX Unit for final amplification by Q_{1012} (AN315) for monitoring in the front panel speaker.

The rest of the audio at the output of the third quarter of Q_{3003} is amplified further by the fourth quarter and fed through VR_{3003} to a normally-closed contact of mic/repeat relay RL_{3001} , which is controlled by the switch of that name on the front panel. The local microphone audio is applied

to the corresponding normally-open contact of RL₃₀₀₁, and also through gate two of Q₃₀₀₂ to the normally-closed contact. This gate is operated by the PTT line, to allow the local operator to override the repeater receiver. The audio at this contact arm of RL₃₀₀₁ is then delivered to the TX Unit as transmitter audio input.

The timer section of the COR Unit is controlled by the squelch switching signal delivered from the RX Unit and the tone squelch switching signal delivered from the Tone Squelch Unit, if installed. These signals activate multivibrator Q₃₀₁₂ (MC14538B), which then feeds a pulse train to counters Q₃₀₀₄ and Q₃₀₀₅ (both MC14536Bs). Q₃₀₀₄ is programmed by DIP switch S₃₀₀₁ to produce the time out pulse after three minutes (this is set at the factory, but can be reprogrammed by the DIP switch to up to 10 minutes). Q₃₀₀₅ is programmed by DIP switch S₃₀₀₂ to produce the hang up pulse four seconds after the squelch signal disappears (and can also be reprogrammed by the DIP switch).

The transmit switching section of the COR Unit consists of logic gates in Q₃₀₀₆ (MC14011B), Q₃₀₀₇ (MC14011B) and Q₃₀₀₉ (MC14001B), and hex inverter Q₃₀₀₈ (MC14069B), which gate together the squelch switching and timer functions to control the analog gates in the audio section and transmit inhibit switches Q₃₀₁₀ and Q₃₀₁₁ (both 2SC458B). Q₃₀₁₀ operates the automatic PTT line (to signal the ID Unit, if installed), and Q₃₀₁₁ shuts off 8V regulator Q₂₀₁₇ on the TX Unit through the normally-closed contact of RL₃₀₀₁.

TX Unit

The audio signal from the COR Unit is amplified by sections C and D of Q₂₀₁₅ (MC3401P), and is then coupled through C₂₀₅₄ to the instantaneous deviation control (IDC) circuit, composed of D₂₀₀₂, D₂₀₀₃ (1S1555s) and R₂₀₅₁–R₂₀₅₃, where the audio is clipped to prevent over-deviation in the transmitted signal. The signal is then cleaned up by the active lowpass filter network consisting of section A of Q₂₀₁₅, R₂₀₅₄–R₂₀₅₇ and C₂₀₅₆–C₂₀₅₈. The resulting audio is pre-emphasized by section B of Q₂₀₁₅, and buffered by Q₂₀₁₆ (2SC460B) before application to phase-modulating varactor D₂₀₀₁.

The carrier is generated by oscillator Q₂₀₀₁

(2SC535B), and buffered by Q₂₀₀₂ (2SC535B) before being modulated by the varactor. Once modulated, the carrier is buffered by Q₂₀₀₃ (2SC535B) before multiplication up to the final transmit channel frequency. In the FTR-710A, the carrier oscillator frequency is around 12 MHz, and Q₂₀₀₄ (2SC460B) serves as a tripler while Q₂₀₀₅ (2SC460B) serves as a doubler, and Q₂₀₀₆ (2SC535B) buffers the 68–88 MHz product. In the FTR-2410A, the carrier oscillator frequency is around 25 MHz, and Q₂₀₀₄ (2SC1906) serves as a triple while Q₂₀₀₅ (2SC1906) serves as a doubler, and Q₂₀₀₆ (2SC1906) buffers the 134–174 MHz product. In the FTR-5410, the carrier oscillator frequency is around 35 MHz, and Q₂₀₀₄ and Q₂₀₀₅ (2SC1906s) each serve as doublers while Q₂₀₀₆ (2SC1907) serves as a tripler, resulting in a 400–512 MHz product.

In the FTR-710A the RF signal is amplified by Q₂₀₀₇ (2SC2053) and driver Q₂₀₀₈ (2SC730) for application to final power amplifier Q₂₀₀₉ (MRF212), resulting in 10W RF output.

In the FTR-2410A the RF signal from Q₂₀₀₆ is amplified by driver Q₂₀₀₈ (2SC2053) and applied to RF power module Q₂₀₀₉ (M57719), resulting in 10W RF output.

In the FTR-5410 the RF signal from Q₂₀₀₆ is amplified by Q₂₀₀₇ (2SC1907) and Q₂₀₀₈ (2SC2407), and applied to RF power module Q₂₀₀₉ (M57704), resulting in 10W RF output.

The RF output is sampled and rectified by Q₂₀₁₀, Q₂₀₁₁, and the resulting ALC voltage is applied to differential amplifier section D of Q₂₀₁₂ (MLM-2902), along with bias developed at Q₂₀₁₁. The DC voltage is amplified by section B of Q₂₀₁₂, and then by Q₂₀₁₄ (2SC458B) and Q₂₀₁₃ (2SB856B). The ALC voltage is then fed back to the RF amplifiers to control their gain.

In the VHF models, Q₂₀₁₀ and Q₂₀₁₁ are both 2SC460Bs, while 2SC535Bs are used in the FTR-5410. In the FTR-710A, ALC controls the VCC and base bias of Q₂₀₀₇ and Q₂₀₀₈, and the bias to final transistor Q₂₀₀₉. In the FTR-2410A and FTR-5410, ALC controls the VCC and base bias of Q₂₀₀₈, and the control input of power module Q₂₀₀₉.

In all models, Q₂₀₁₇ (MB3756) provides the regulated 8V DC for the early transmitter stages.

Power Supply

The power supply includes the power transformer and bridge rectifier D₁ (S15VB10) on the chassis, pass transistors Q₁ and Q₂ (2SD745R) on the heatsink, RL Unit PB-2308 and REG Unit PB-2248.

AC power is applied through POWER switch S₁, fuse F₁ and the primary of transformer T₁. The 18 VAC at the secondary is then rectified by D₁, but with a small portion delivered to the REG Unit as an independent supply for regulator IC Q₄₀₀₁ (TA7089P) after rectification by D₄₀₀₁ and D₄₀₀₂ (10D1), and filtering by C₄₀₀₁.

The output of D₁ is filtered by C₁, also on the chassis, and the resulting DC is applied to the collectors of Q₁ and Q₂ on the heatsink, Q₄₀₀₂ (2SD880-O) on the REG Unit, and regulator IC Q₅₀₀₁ (7812H) on the RL Unit. The control output (pin 14) of regulator Q₄₀₀₁ is applied to the base of Q₄₀₀₂, the emitter of which then controls the bases of Q₁ and Q₂. Thus the DC voltage at the emitters of Q₁ and Q₂ is highly regulated. This output voltage is delivered through relay RL₅₀₀₁ on the RL Unit (activated by the output of Q₅₀₀₁) to supply the 13.8V bus for the rest of the repeater. A sample of the regulated output from the pass transistors is also delivered back through VR₄₀₀₁ on the REG Unit to Q₄₀₀₁ for regulating purposes, and to drive the POWER LED on the front panel.

While operating from AC power, regulated 13.8V DC is fed through R₅₀₀₁ and D₅₀₀₂ (U05B), and then RL₅₀₀₁, POWER switch S₁ and DC fuse F₅₀₀₁ to the positive DC supply terminal, providing a trickle charge for a battery that may be connected. If the AC power source is interrupted, the DC current from the battery then flows back through the DC fuse and S₁ to RL₅₀₀₁, which is now switched (when AC fails) to bypass R₅₀₀₁ and D₅₀₀₂, and apply full battery voltage directly to the DC supply bus.

ID Unit (Option)

The automatic PTT signal from Q₃₀₁₁ on the COR Unit is delivered through RL₃₀₀₁ when the repeater is in the normal repeat mode, and is applied to inverter Q₆₀₁₀ (2SC458B) on the ID Unit. The inverted pulse is then delivered to Q₆₀₀₂ (MC14011B) to trigger the timer circuit, and to inverter differentiator Q₆₀₁₁ (2SC458B) before application to the flip-flop gates of Q₆₀₁₃ (SN74LS00) to trigger the ID READ line.

Q₆₀₀₁ (MC14536B) and crystal X₆₀₀₁ (32.768 kHz) generate a 2-second pulse train, which is passed to Q₆₀₀₃ (MC14566B) for division by 60 when the PTT line is activated. The resulting 2-minute pulse train is divided by 5 at Q₆₀₀₄ (MC14510B) to produce a 10-minute pulse, which is buffered by Q₆₀₁₂ (MC14572B) and applied to the ID READ flip-flop of Q₆₀₁₃ along with the initial signal from Q₆₀₁₁. The timer activating function of Q₆₀₀₂ is reset after ten minutes, or each time the automatic PTT line closes, to activate the transmitter.

The ID READ command from Q₆₀₁₃ activates Q₆₀₀₆ (SN74LS393), which also receives an ID SPEED pulse from oscillator Q₆₀₀₅ (MC14069B), whose frequency is adjusted by VR₆₀₀₁. Q₆₀₀₆ directs Q₆₀₀₈ (SN74LS151) to read the call sign data stored in PROM Q₆₀₀₇ (SN74S188A), which is preprogrammed at the factory. Q₆₀₁₄ (MC14002B) and one gate of Q₆₀₁₅ (MC14011B) sample the data flow and reset the ID READ flip-flop in Q₆₀₁₃ when the data has been read.

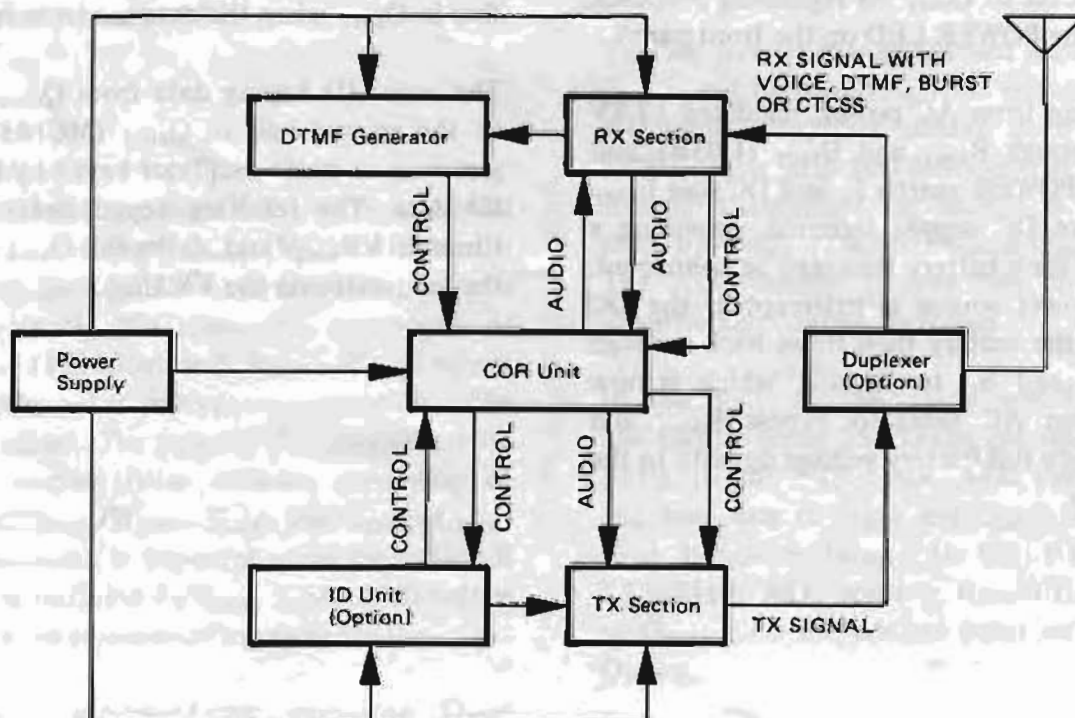
The serial ID keying data from Q₆₀₀₈ is delivered to the second half of Q₆₀₁₂ (MC14572B), which serves as an audio oscillator keyed by the incoming ID data. The resulting keyed audio tone is fed through VR₆₀₀₂ and delivered Q₂₀₁₆, just before the modulator on the TX Unit.

DTMF Unit (Option)

The DTMF decoder unit samples the receiver audio, and detects any DTMF tone codes that may be received for control. These tone codes are translated into switching functions for the rest of the repeater.

The de-emphasized receiver audio is sampled at the output of the fourth section of Q_{3001} on the COR Unit, just before the squelch gates. This audio is delivered to pin 12 of DTMF decoder Q_{7001} (SSI201) on the DTMF Unit, which responds with a 4-bit BCD output whenever a tone code is received. The BCD output is decoded to 16-bit data and presented at the terminals of P_{7011} . These terminals are then jumpered to J_{7002} in such a manner as to determine the type and sequence of tones required for each control function. AND gates Q_{7004} and $Q_{7006}-Q_{7009}$ (MC14081B), and flip-flops Q_{7003} , Q_{7005} (MC14538B) and $Q_{7010}-Q_{7012}$ (MC14013B) then provide control switching signals from the connections at J_{7002} . The control switching signal lines are buffered by $Q_{7014}-Q_{7020}$ (2SC458B). Q_{7013} (MC14536B) serves as a one-shot multivibrator to set the maximum time spacing between successive DTMF tone codes (set for 1.5 seconds from the factory), and this signal is buffered by Q_{7021} (2SA733) for delivery to the COR Unit.

An independently regulated DC supply is provided for decoder Q_{7001} by Q_{7022} (2SC1209) and zener diode D_{7021} . 8 VDC is provided for the other circuits on the DTMF Unit by Q_{7023} (78L08).

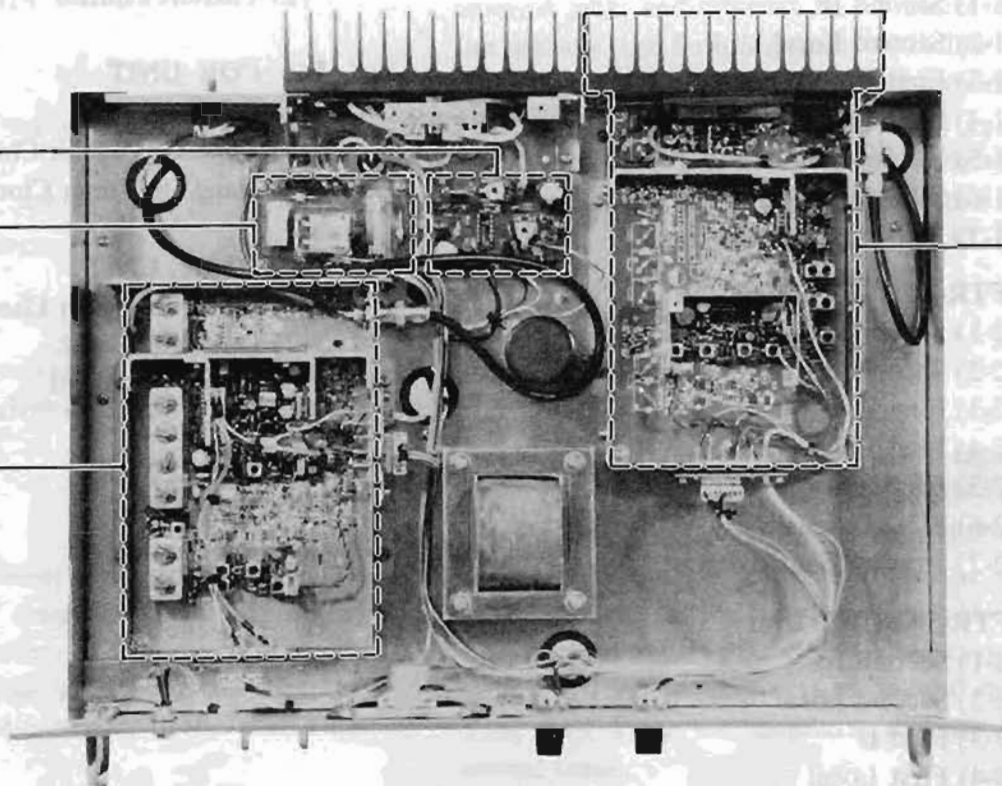


REG UNIT

RELAY UNIT

RX UNIT

TX UNIT



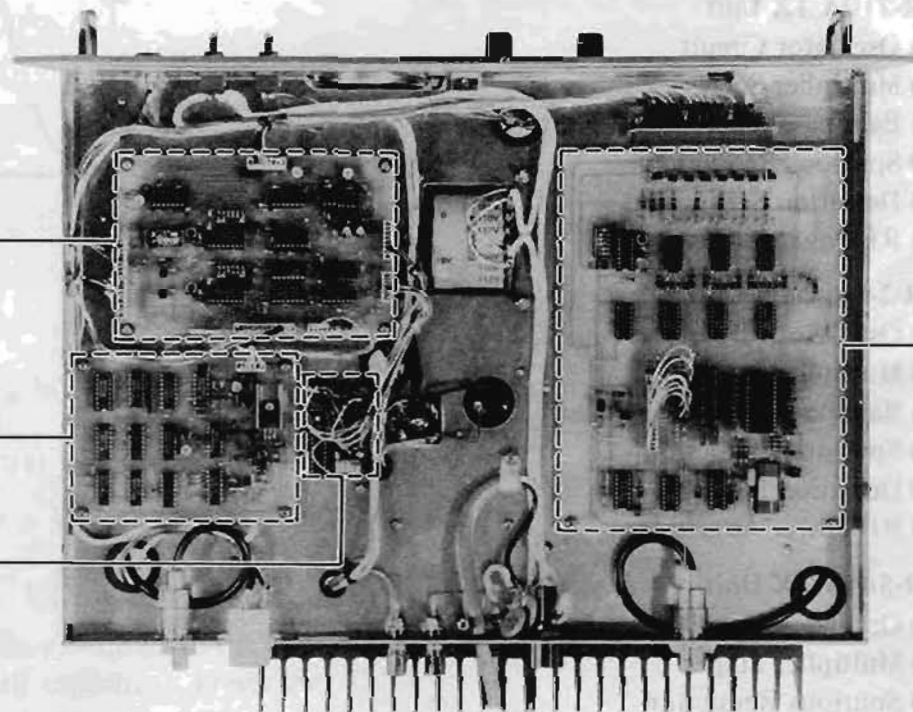
TOP VIEW

COR UNIT

ID UNIT
(OPTION)

TONE
SQUELCH
UNIT
(OPTION)

DTMF UNIT
(OPTION)



BOTTOM VIEW

ALIGNMENT

A. RECEIVER SECTION

- (1) FTR-710A RF Unit
 - 1-1) Second IF
 - 1-2) Second Local
 - 1-3) First IF
 - 1-4) First Local
 - 1-5) RF Section
 - 1-6) SINAD Sensitivity
 - 1-7) Squelch Sensitivity

- (2) FTR-2410A RX Unit
 - 2-1) Second IF
 - 2-2) Second Local
 - 2-3) First IF
 - 2-4) First Local
 - 2-5) RF Section
 - 2-6) SINAD Sensitivity
 - 2-7) Squelch Sensitivity

- (3) FTR-5410 RX Unit
 - 3-1) Second IF
 - 3-2) Second Local
 - 3-3) First IF
 - 3-4) First Local
 - 3-5) RF Section
 - 3-6) SINAD Sensitivity
 - 3-7) Squelch Sensitivity

B. TRANSMITTER SECTION

- (1) FTR-710A TX Unit
 - 1-2) Oscillator Circuit
 - 1-2) Multiplier Stages
 - 1-3) Bandpass Filter Adjustment
 - 1-4) Spurious Reduction
 - 1-5) Deviation Setting
 - 1-6) RF Power Adjustment

- (2) FTR-2410A TX Unit
 - 2-1) Oscillator Circuit
 - 2-2) Multiplier Stages
 - 2-3) Bandpass Filter Adjustment
 - 2-4) Spurious Reduction
 - 2-5) Deviation Setting
 - 2-6) RF Power Adjustment

- (3) FTR-5410 TX Unit
 - 3-1) Oscillator Circuit
 - 3-2) Multiplier Stages
 - 3-3) Spurious Reduction
 - 3-4) Deviation Setting
 - 3-5) RF Power Adjustment

C. POWER SUPPLY

- (1) Regulator Output Voltage
- (2) Current Limiter

D. COR UNIT

- (1) AF Level
- (2) Time Out Timer Clock
- (3) Hang Up Timer Clock

E. DTMF UNIT

- (1) DTMF Decoder Check
- (2) One-shot Check
- (3) Timer Clock Set

F. DUPLEXER

- (1) TX Section
- (2) RX Section

G. FL-2450

A. RECEIVER SECTION

(1) FTR-710A RX Unit

1-1) Second IF

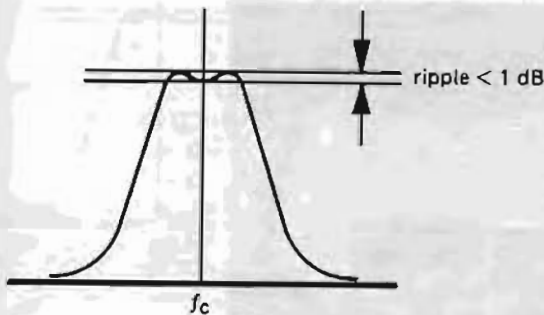
Connect a 455 kHz sweep generator to the base of Q_{1008} , and connect an XY scope (vertical amp input) to pin 1 of J_{1001} . Adjust T_{1007} for maximum p-p indication on the scope.

1-2) Second Local

Connect a precision frequency counter to TP_{1002} . Adjust TC_{1002} for a reading of exactly 10.245 MHz on the counter.

1-3) First IF

Connect a 10.7 MHz sweep generator to gate 2 of Q_{1002} . Connect an XY scope (vertical amp input) through a diode detector, to the secondary of T_{1006} . Now adjust T_{1005} and T_{1006} so that the pattern shown here is obtained, with less than 1 dB of ripple.



1-4) First Local

Connect the RF probe of a VTVM to the base of Q_{1005} (TP_{1001}). Adjust T_{1003} and T_{1004} for maximum indication on the VTVM.

Connect the RF probe of a VTVM to gate 2 of Q_{1002} (TP_{1003}). Adjust L_{1008} and L_{1009} for maximum indication on the VTVM.

Connect a precision frequency counter to the base of Q_{1005} (through a $0.01 \mu\text{F}$ capacitor). Preset the core of T_{1002} to be flush with the top of the shield can. Now adjust TC_{1001} and T_{1001} for the following frequency:

$$f_{\text{test}} = \frac{f(\text{RX channel}) - 21.4 \text{ MHz}}{3}$$

1-5) RF Section

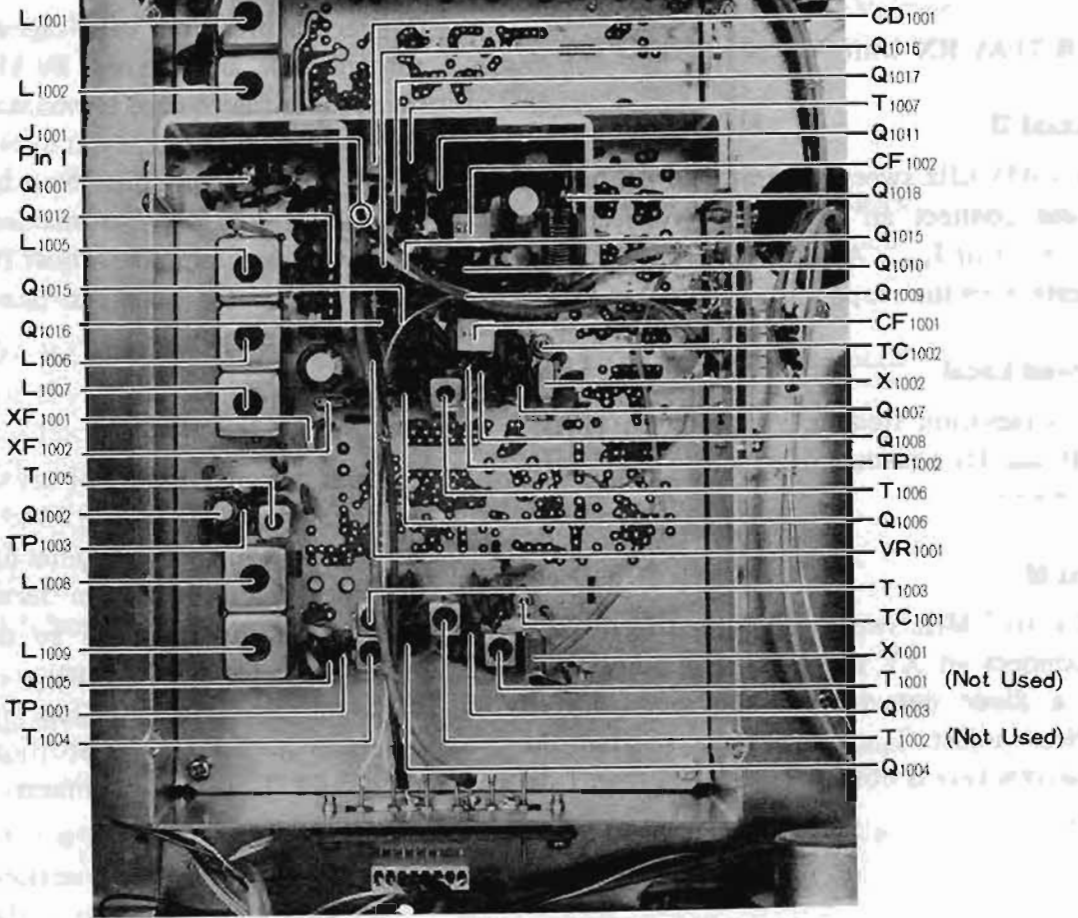
Connect a precision VHF signal generator to the antenna jack, and connect an AF millivoltmeter to the speaker (use 8-ohm termination). Inject a signal on the channel frequency at a level providing about 10 dB of noise quieting. Now adjust L_{1001} , L_{1002} , L_{1005} , L_{1006} and L_{1007} for maximum noise quieting as shown on the meter. Adjust the signal generator level, and meter scale, as needed to provide a meaningful display.

1-6) SINAD Sensitivity

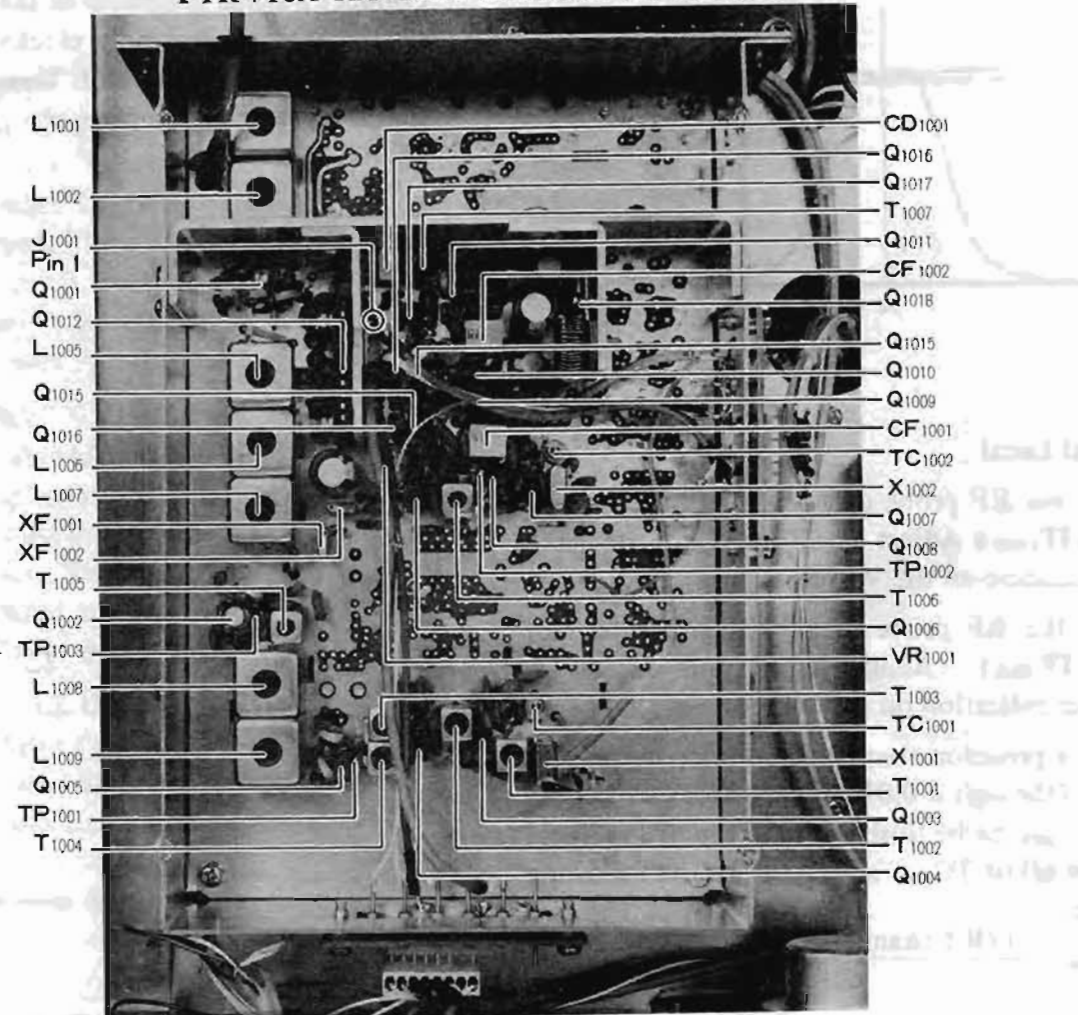
Connect a signal generator set to the channel frequency, with 1 kHz mod @ ± 3 kHz deviation to the ANT jack. Connect an audio distortion meter to the speaker, using 8-ohm termination. Inject a signal from the generator so that the distortion meter indicates 25% distortion. Adjust T_{1005} and T_{1006} for minimum distortion. Now reset the signal generator level for 25% distortion, and again adjust T_{1005} and T_{1006} for minimum distortion. Repeat several times.

1-7) Squelch Sensitivity

Connect a signal generator to the antenna jack, and set the SQL control fully clockwise. Apply a $1 \mu\text{V}$ signal from the generator, and adjust VR_{1001} so that the squelch just opens.



FTR-710A RX UNIT ALIGNMENT POINTS



FTR-2410A RX UNIT ALIGNMENT POINTS

(2) FTR-2410A RX Unit

2-1) Second IF

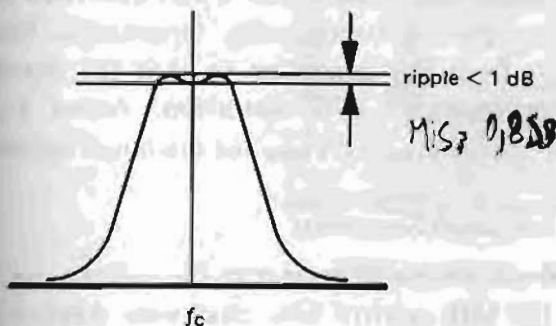
Connect a 455 kHz sweep generator to the base of Q_{1008} , and connect an XY scope (vertical amp input) to pin 1 of J_{1001} . Adjust T_{1007} for maximum p-p indication on the scope.

2-2) Second Local

Connect a precision frequency counter to TP_{1002} . Adjust TC_{1002} for a reading of exactly 20.945 MHz on the counter.

2-3) First IF

Connect a 21.4 MHz sweep generator to gate 2 of Q_{1002} . Connect an XY scope (vertical amp input) through a diode detector, to the secondary of T_{1006} . Now adjust T_{1005} and T_{1006} so that the pattern shown here is obtained, with less than 1 dB of ripple.



2-4) First Local

Connect the RF probe of a VTVM to the base of Q_{1005} (TP_{1001}). Adjust T_{1003} and T_{1004} for maximum indication on the VTVM.

Connect the RF probe of a VTVM to gate 2 of Q_{1002} . Adjust L_{1008} and L_{1009} for maximum indication on the VTVM.

Connect a precision frequency counter to the base of Q_{1005} (through a $0.01 \mu F$ capacitor). Preset the core of T_{1002} to be flush with the top of the shield can. Now adjust TC_{1001} and T_{1001} for the following frequency:

$$f_{\text{test}} = \frac{f(\text{RX channel}) - 21.4 \text{ MHz}}{3}$$

2-5) RF Section

Connect a precision VHF signal generator to the antenna jack, and connect an AF millivoltmeter to the speaker (use 8-ohm termination). Inject a signal on the channel frequency at a level providing about 10 dB of noise quieting. Now adjust L_{1001} , L_{1002} , L_{1005} , L_{1006} and L_{1007} for maximum noise quieting as shown on the meter. Adjust the signal generator level, and meter scale, as needed to provide a meaningful display.

2-6) SINAD Sensitivity

Connect a signal generator set to the channel frequency, with 1 kHz mod @ ± 3 kHz deviation to the ANT jack. Connect an audio distortion meter to the speaker, using 8-ohm termination. Inject a signal from the generator so that the distortion meter indicates 25% distortion. Adjust T_{1005} and T_{1006} for minimum distortion. Now reset the signal generator level for 25% distortion, and again adjust T_{1005} and T_{1006} for minimum distortion. Repeat several times.

2-7) Squelch Sensitivity

Connect a signal generator to the antenna jack, and set the SQL control fully clockwise. Apply a $1 \mu V$ signal from the generator, and adjust VR_{1001} so that the squelch just opens.

(3) FTR-5410 RX Unit

3-1) Second IF

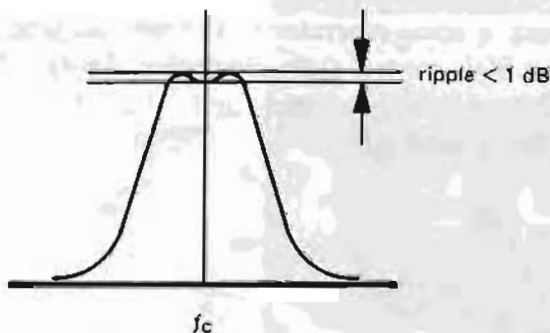
Connect a 455 kHz sweep generator to the base of Q_{1008} , and connect an XY scope (vertical amp input) to pin 1 of J_{1001} . Adjust T_{1007} for maximum p-p indication on the scope.

3-2) Second Local

Connect a precision frequency counter to TP_{1002} . Adjust TC_{1002} for a reading of exactly 20.945 MHz on the counter.

3-3) First IF

Connect a 21.4 MHz sweep generator to gate 2 of Q_{1002} . Connect an XY scope (vertical amp input) through a diode detector, to the secondary of T_{1006} . Now adjust T_{1005} and T_{1006} so that the pattern shown here is obtained, with less than 1 dB of ripple.



3-4) First Local

Connect the RF probe of a VTVM to the base of Q_{1005} (TP_{1001}). Adjust T_{1003} and T_{1004} for maximum indication on the VTVM.

Connect the RF probe of a VTVM to gate 2 of Q_{1002} . Adjust CV_{1003} for maximum indication on the VTVM.

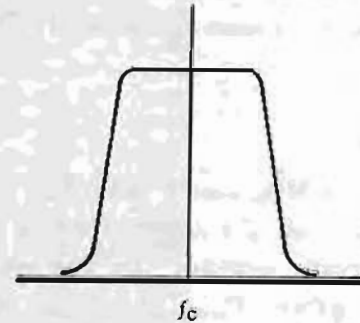
Connect a precision frequency counter to the base of Q_{1005} (through a $0.01 \mu F$ capacitor). Adjust TC_{1002} and T_{1001} for the following frequency:

$$f_{\text{test}} = \frac{f(\text{RX channel}) - 21.4 \text{ MHz}}{3}$$

3-5) RF Section

Connect a tracking generator to the antenna jack, and connect a spectrum analyzer through a 0.5 pF capacitor to gate 1 of Q_{1002} .

Adjust CV_{1001} and CV_{1002} for the passband shown in the following figure.

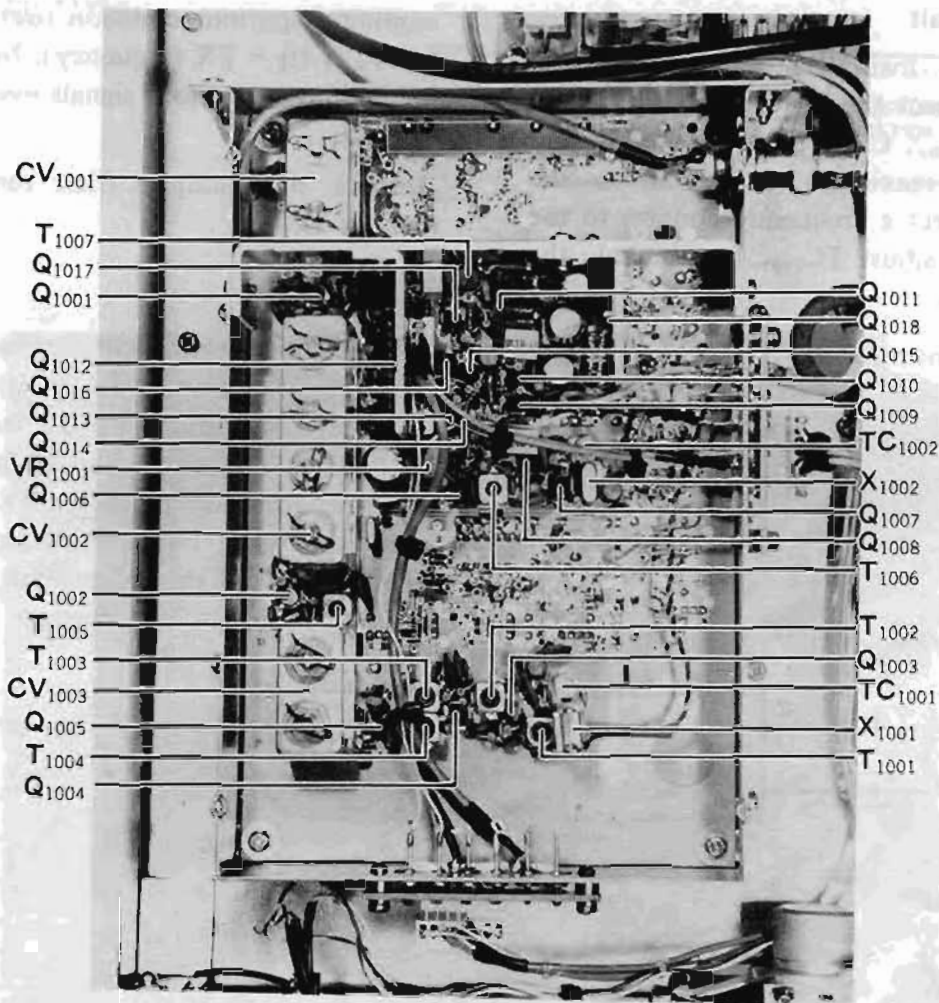


3-6) SINAD Sensitivity

Connect a signal generator set to the channel frequency, with 1 kHz mod @ ± 3 kHz deviation to the ANT jack. Connect an audio distortion meter to the speaker, using 8-ohm termination. Inject a signal from the generator so that the distortion meter indicates 25% distortion. Adjust T_{1005} - T_{1007} and CV_{1001} - CV_{1003} for minimum distortion.

3-7) Squelch Sensitivity

Connect a signal generator to the antenna jack, and set the SQL control fully clockwise. Apply a $1 \mu V$ signal from the generator, and adjust VR_{1001} so that the squelch just opens.



FTR-5410 RX UNIT ALIGNMENT POINTS

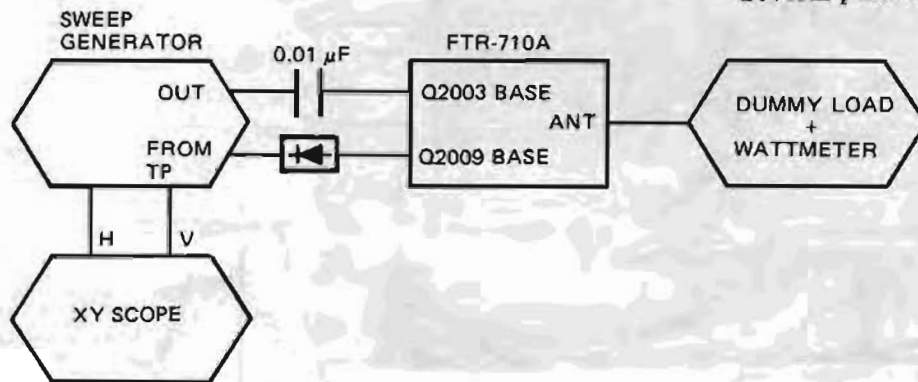
B. TRANSMITTER SECTION

(1) FTR-710A TX Unit

1-1) Oscillator Circuit

Connect a dummy load/VHF wattmeter to the antenna jack. Connect the RF probe of a VTVM to the base of Q₂₀₀₃. Close the PTT switch, and adjust T₂₀₀₃ for maximum deflection on the VTVM. Now connect a frequency counter to the base of Q₂₀₀₃ and adjust TC₂₀₀₁ for precisely the following frequency:

$$f_{\text{test}} = \frac{f(\text{Transmit channel})}{6} \text{ MHz}$$



1-2) Multiplier Stages

Leave the dummy load/wattmeter connected to the antenna jack. Turn VR₂₀₀₂ fully clockwise. Connect a DC voltmeter between TP₂₀₀₂ (negative) and TP₂₀₀₇ (positive). Adjust T₂₀₀₅ and T₂₀₀₆ for maximum indication on the voltmeter. Now connect the meter to TP₂₀₀₃ (negative) and adjust T₂₀₀₇ and T₂₀₀₈ for maximum indication on the meter. Connect the wattmeter to the antenna jack, and adjust T₂₀₀₈, T₂₀₀₉, TC₂₀₀₂, and TC₂₀₀₃ to TC₂₀₀₈ for maximum indication on the wattmeter.

1-3) Bandpass filters

Assemble the test equipment as shown above. Adjust T₂₀₀₆ - T₂₀₀₉ and TC₂₀₀₂ - TC₂₀₀₄ so that the passband illustrated at the right is obtained. Several passes through the alignment procedure may be necessary to achieve the proper bandpass.

1-4) Spurious reduction

Connect a 6 dB hybrid combiner to the antenna jack. Connect a dummy load/wattmeter and a spectrum analyzer to the hybrid. Adjust TC₂₀₀₃ for minimum spurious emission over the range 1/2 f_t to 3/2 f_t (f_t = TX frequency). Now adjust TC₂₀₀₄ for minimum spurious signals over the range 5/6 f_t to 7/6 f_t.

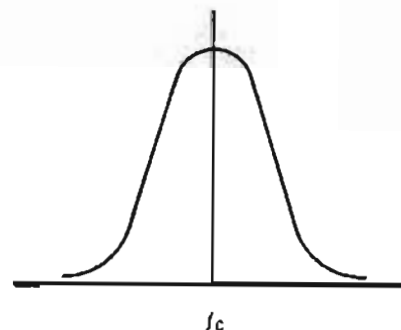
Recheck the bandpass filter tuning after adjustment of TC₂₀₀₄.

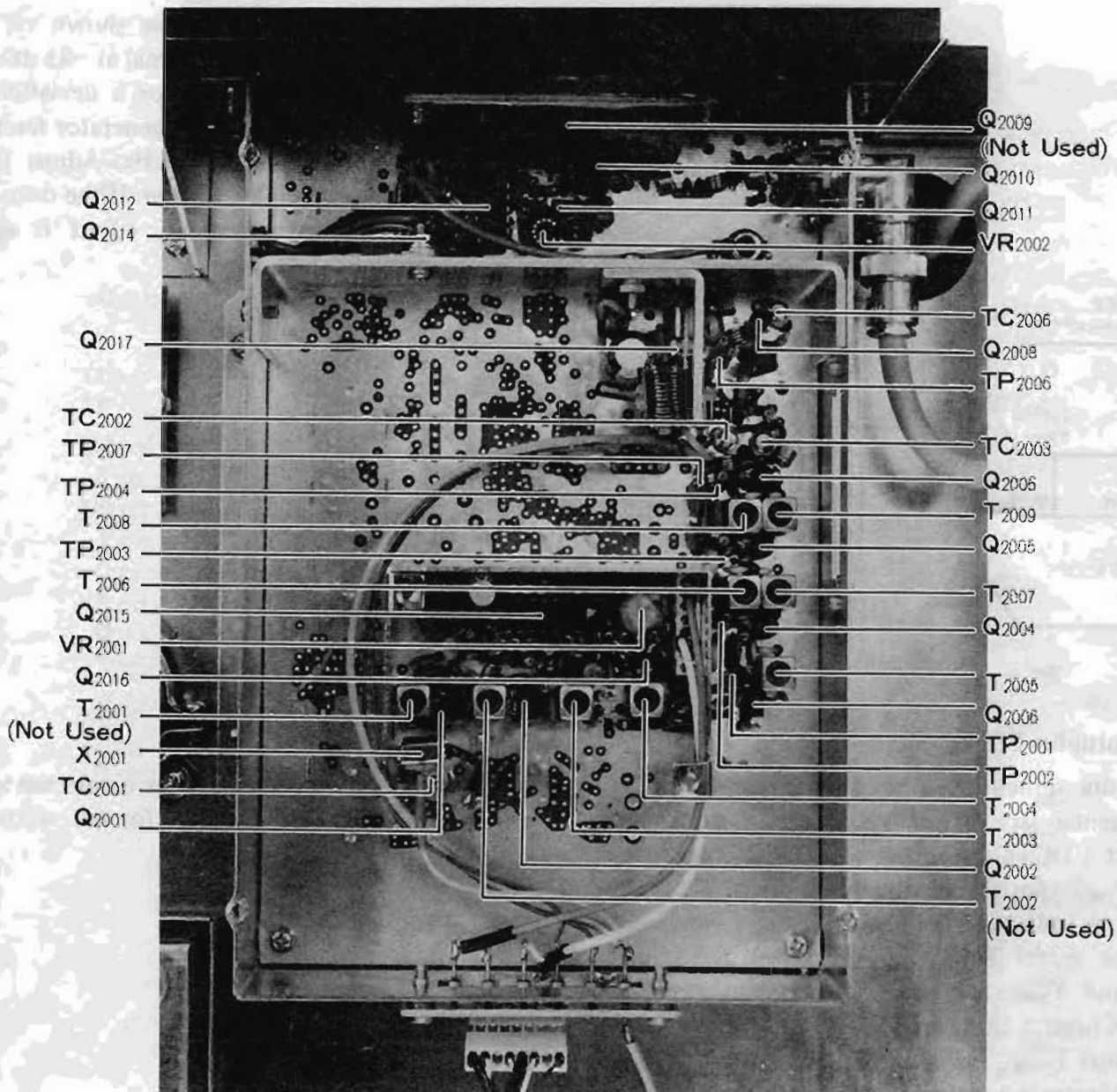
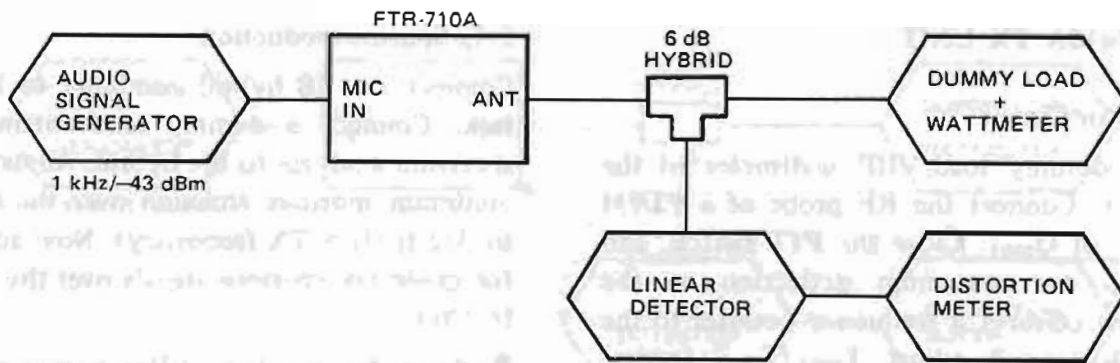
1-5) Deviation

Assemble the test equipment as shown on the following page. Inject a 1 kHz signal at -43 dBm at the mic jack. Adjust VR₂₀₀₁ for a deviation of ±4.9 kHz. Now reduce the AF generator level, so that the deviation reaches ±3 kHz. Adjust T₂₀₀₃ and T₂₀₀₄ for minimum distortion. If the deviation changes during this alignment, adjust it again. Several passes may be necessary.

1-6) RF power

With the dummy load/wattmeter connected to the antenna jack, adjust VR₂₀₀₂ for 10 watts RF output.





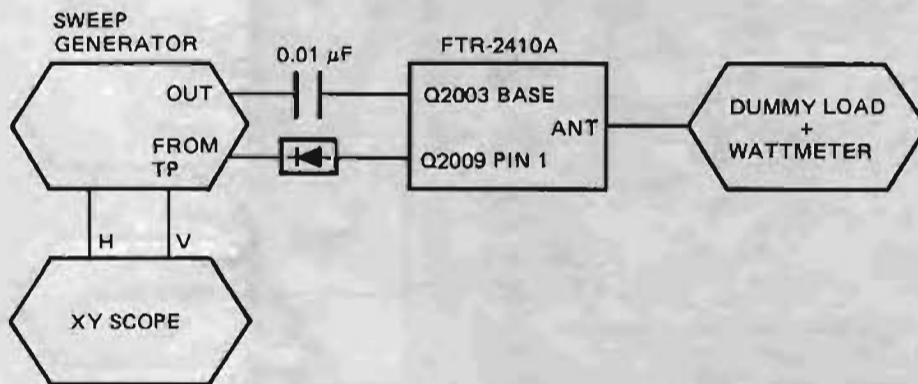
FTR-710A TX UNIT ALIGNMENT POINTS

(2) FTR-2410A TX UNIT

2-1) Oscillator Circuit

Connect a dummy load/VHF wattmeter to the antenna jack. Connect the RF probe of a VTVM to the base of Q_{2003} . Close the PTT switch, and adjust T_{2003} for maximum deflection on the VTVM. Now connect a frequency counter to the base of Q_{2003} and adjust T_{2001}/T_{2002} (coarse tuning) and TC_{2001} for precisely the following frequency:

$$f_{\text{test}} = \frac{f(\text{Transmit channel})}{6} \text{ MHz}$$



2-2) Multiplier Stages

Leave the dummy load/wattmeter connected to the antenna jack. Turn VR_{2002} fully clockwise. Connect a DC voltmeter between TP_{2002} (negative) and TP_{2007} (positive). Adjust T_{2005} and T_{2006} for maximum indication on the voltmeter. Now connect the meter to TP_{2003} (negative) and adjust T_{2007} and T_{2008} for maximum indication on the meter. Connect the wattmeter to the antenna jack, and adjust T_{2008} , T_{2009} , TC_{2002} , TC_{2003} and TC_{2006} for maximum indication on the wattmeter.

2-3) Bandpass filters

Assemble the test equipment as shown above. Adjust $T_{2006} - T_{2009}$ and TC_{2002} , TC_{2003} and TC_{2006} so that the passband illustrated at the right is obtained. Several passes through the alignment procedure may be necessary to achieve the proper bandpass.

2-4) Spurious reduction

Connect a 6 dB hybrid combiner to the antenna jack. Connect a dummy load/wattmeter and a spectrum analyzer to the hybrid. Adjust TC_{2003} for minimum spurious emission over the range $1/2 f_t$ to $3/2 f_t$ ($f_t = \text{TX frequency}$). Now adjust TC_{2006} for minimum spurious signals over the range $5/6 f_t$ to $7/6 f_t$.

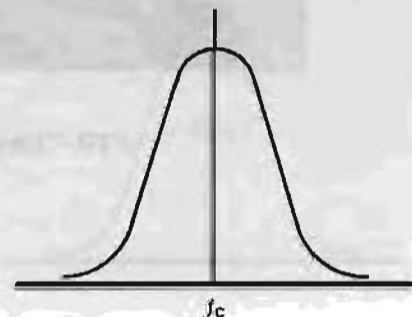
Recheck the bandpass filter tuning after adjustment of TC_{2006} .

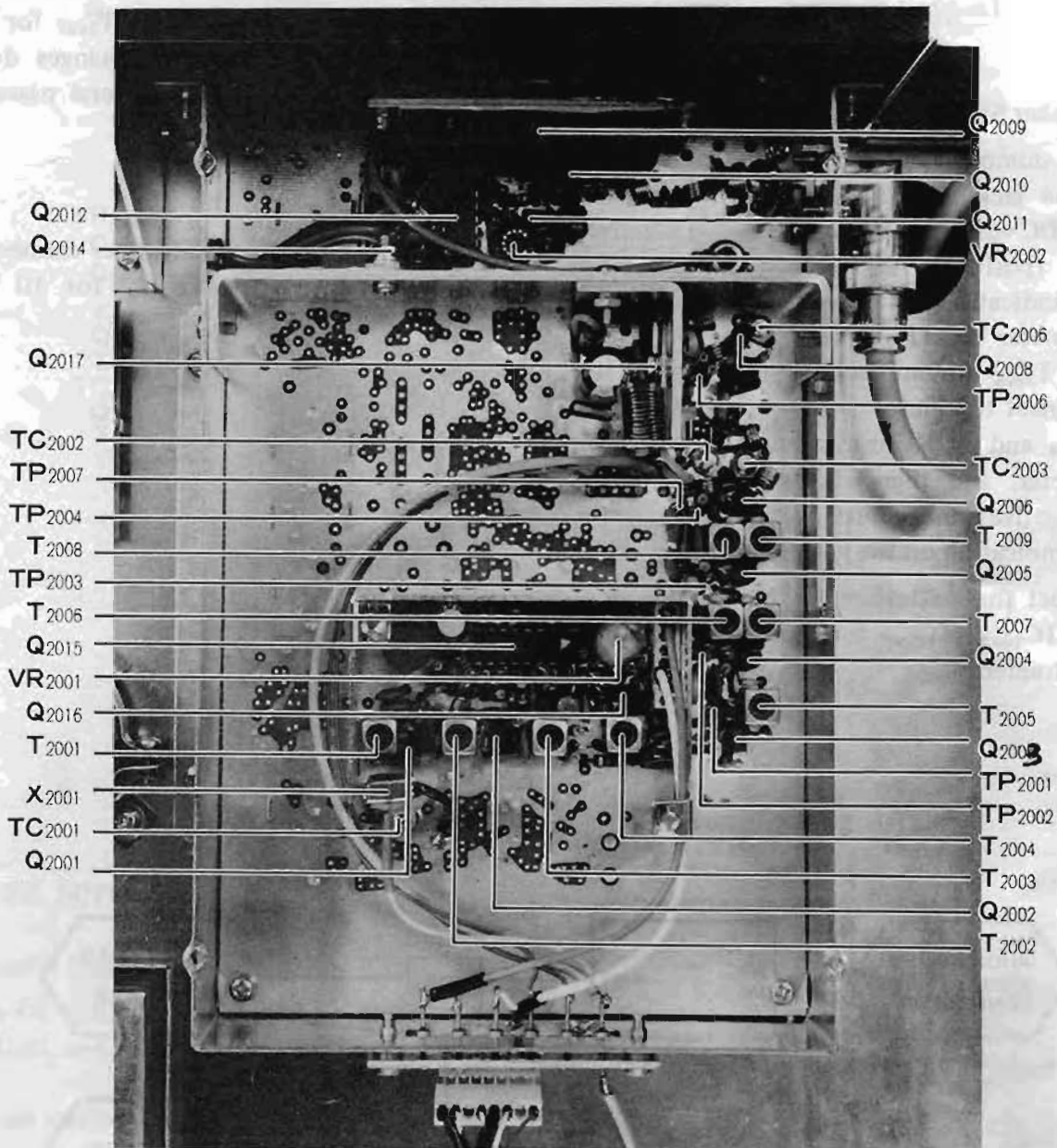
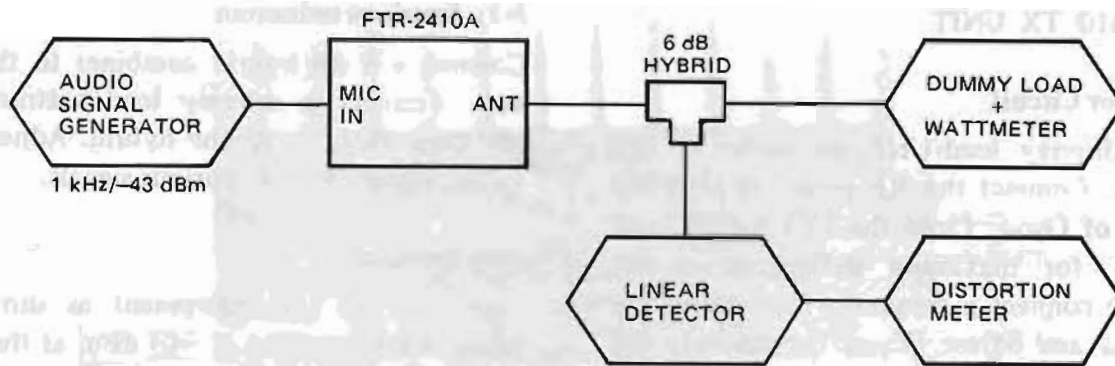
2-5) Deviation

Assemble the test equipment as shown on the following page. Inject a 1 kHz signal at -43 dBm at the mic jack. Adjust VR_{2001} for a deviation of ± 4.9 kHz. Now reduce the AF generator level, so that the deviation reaches ± 3 kHz. Adjust T_{2003} and T_{2004} for minimum distortion. If the deviation changes during this alignment, adjust it again. Several passes may be necessary.

2-6) RF power

With the dummy load/wattmeter connected to the antenna jack, adjust VR_{2002} for 10 watts RF output.





FTR-2410A TX UNIT ALIGNMENT POINTS

(3) FTR-5410 TX UNIT

3-1) Oscillator Circuit

Connect a dummy load/UHF wattmeter to the antenna jack. Connect the RF probe of a VTVM to the base of Q₂₀₀₃. Close the PTT switch, and adjust T₂₀₀₃ for maximum deflection on the VTVM. Now connect a frequency counter to the base of Q₂₀₀₃ and adjust TC₂₀₀₁ for precisely the following frequency:

$$f_{\text{test}} = \frac{f(\text{Transmit channel})}{12} \text{ MHz}$$

3-2) Multiplier Stages

Leave the dummy load/wattmeter connected to the antenna jack. Turn VR₂₀₀₂ fully clockwise. Connect a DC voltmeter between TP₂₀₀₁ (negative) and TP₂₀₀₇ (positive). Adjust T₂₀₀₃ and T₂₀₀₄ for maximum indication on the voltmeter. Now connect the meter to TP₂₀₀₂ (negative) and adjust T₂₀₀₇ and T₂₀₀₈ for maximum indication on the meter. Connect the meter to TP₂₀₀₃ (negative) and adjust T₂₀₀₆ and T₂₀₀₇ for maximum indication on the voltmeter, and then connect the meter to TP₂₀₀₄ (negative) and adjust T₂₀₀₈ and T₂₀₀₉ for maximum indication on the voltmeter.

Now connect the wattmeter to the antenna jack, and adjust TC₂₀₀₂ - TC₂₀₀₇ for maximum indication on the wattmeter.

3-3) Spurious reduction

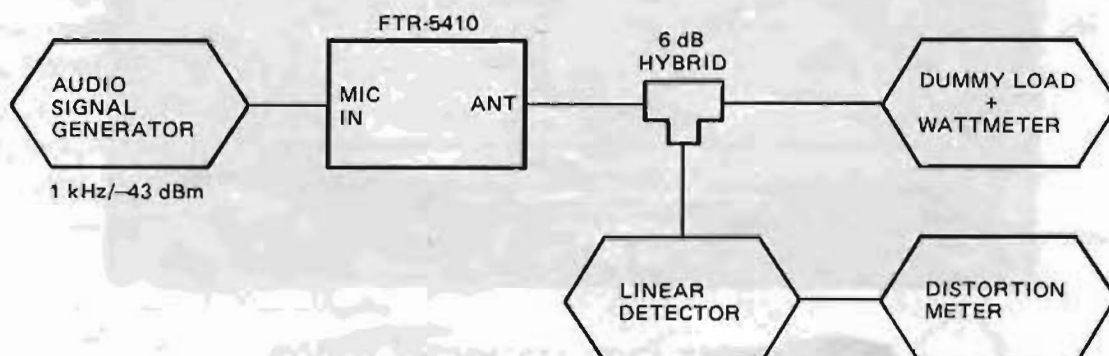
Connect a 6 dB hybrid combiner to the antenna jack. Connect a dummy load/wattmeter and a spectrum analyzer to the hybrid. Adjust TC₂₀₀₂ - TC₂₀₀₇ for minimum spurious signals.

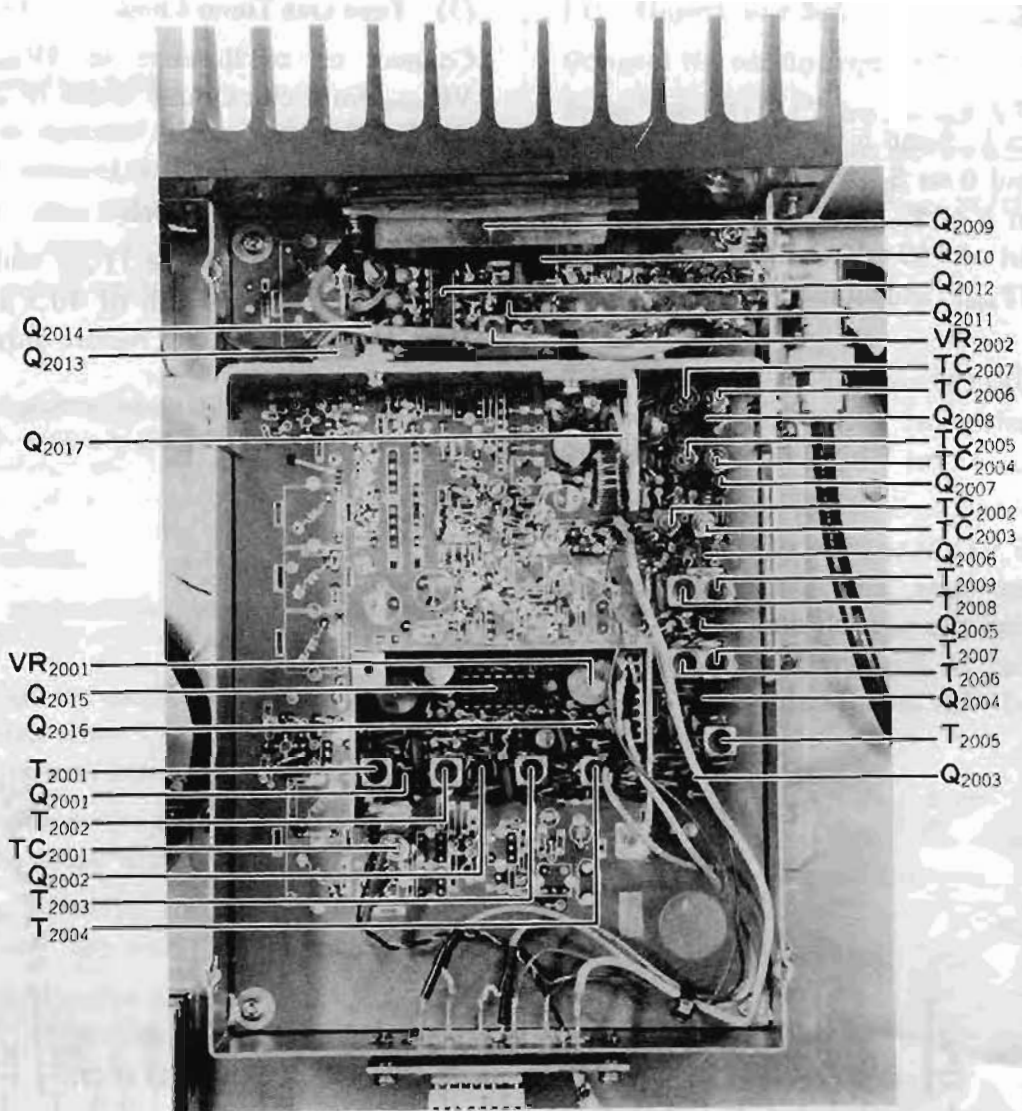
3-4) Deviation

Assemble the test equipment as shown below. Inject a 1 kHz signal at -43 dBm at the mic jack. Adjust VR₂₀₀₁ for a deviation of ±4.9 kHz. Now reduce the AF generator level, so that the deviation reaches ±3 kHz. Adjust T₂₀₀₃ - T₂₀₀₅ for minimum distortion. If the deviation changes during this alignment, adjust it again. Several passes may be necessary.

3-5) RF power

With the dummy load/wattmeter connected to the antenna jack, adjust VR₂₀₀₂ for 10 watts RF output.





FTR-5410 TX UNIT ALIGNMENT POINTS

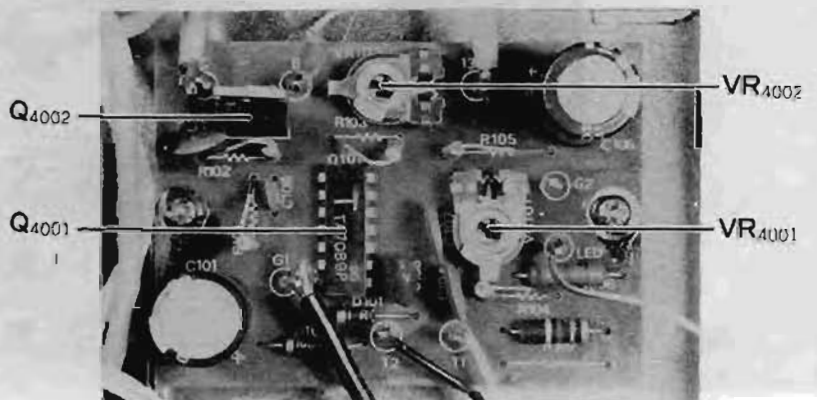
C. POWER SUPPLY

(1) Regulator Output Voltage

Connect a DC voltmeter to the 13.6V terminal on the REG Unit, and adjust VR₄₀₀₁ for 13.8V.

(2) Current Limiter

VR₄₀₀₂ is aligned at the factory to limit power supply current to 6 amperes, and should not require readjustment. However, if repairs are made to the power supply, and the 13.8V output is not obtainable while transmitting, this potentiometer can be readjusted to correct the voltage drop. Before adjusting VR₄₀₀₂, make sure that the current drawn from the supply does not exceed 6 amps during transmission.



REG UNIT ALIGNMENT POINTS

D. COR UNIT

(1) AF Level

Set DIP switches 1, 5 and 6 on S₃₀₀₁ ON, and also switches 4, 5 and 6 on S₃₀₀₂ ON. Connect an AF generator to pin 6 of J₃₀₀₁ (pin 5 is ground), and set for an output of 150 mV at 1 kHz. Connect an AF VTVM to TP₃₀₀₁, and adjust VR₃₀₀₁ for 1.26V on the VTVM.

Preset the SQUELCH control on the front panel so that the squelch just opens, and move the AF VTVM to TP₃₀₀₄. Adjust VR₃₀₀₃ for 1.5 mV on the VTVM.

Connect the AF VTVM to pin 8 of Q₃₀₀₃, and with the squelch just open, note the voltage on the meter. Now close the squelch and adjust VR₃₀₀₂ so that the voltage on the meter is 20 dB below the voltage measured with the squelch open.

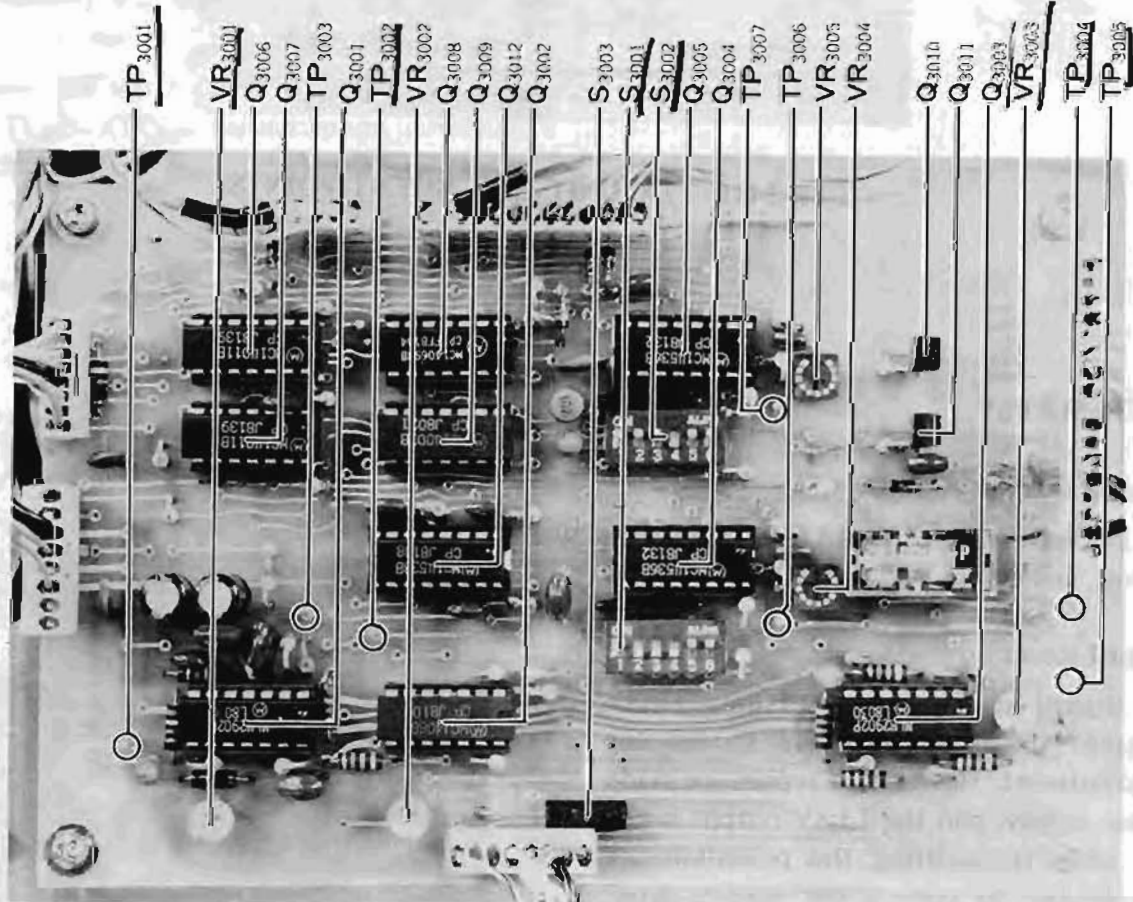
(2) Time Out Timer Clock

Connect an oscilloscope to TP₃₀₀₆ and adjust VR₃₀₀₄ for a clock pulse width of 21.4 μ sec in the REPEAT mode.

(3) Hang Up Timer Clock

Connect the oscilloscope TP₃₀₀₇ and adjust VR₃₀₀₅ for a clock pulse width of 30.5 μ sec during the Hang Up (REPEAT, but receive only) state.

See page 44 for Delay timer setting.



COR UNIT Alignment Points

E. DTMF UNIT

(1) DTMF Decoder check

Connect the oscilloscope to each pin of P₁₁, one at a time, and connect a DTMF test oscillator to pin 13 of the edge connector. Enter the DTMF codes one at a time from the oscillator, while checking each corresponding pin of P₁₁ for a pulse.

If a DTMF test oscillator is not available, use a transceiver with a built-in DTMF encoder.

(2) One-shot check

Connect the oscilloscope to pin 6 of Q₇₀₀₃ (MC14538B).

Check to see that the oscilloscope indication shifts from low to high when "*" is input, and after 1.5 seconds, returns to low.

Connect the oscilloscope to pin 10 of Q₇₀₀₃, and repeat the above check with "#".

Connect the oscilloscope to pin 6 of Q₇₀₀₅, and repeat the previous step with "#".

Connect the oscilloscope to pin 10 of Q₇₀₀₅, and check codes "0" through "9" for a 0.5-second high state.

(3) Timer Clock Set

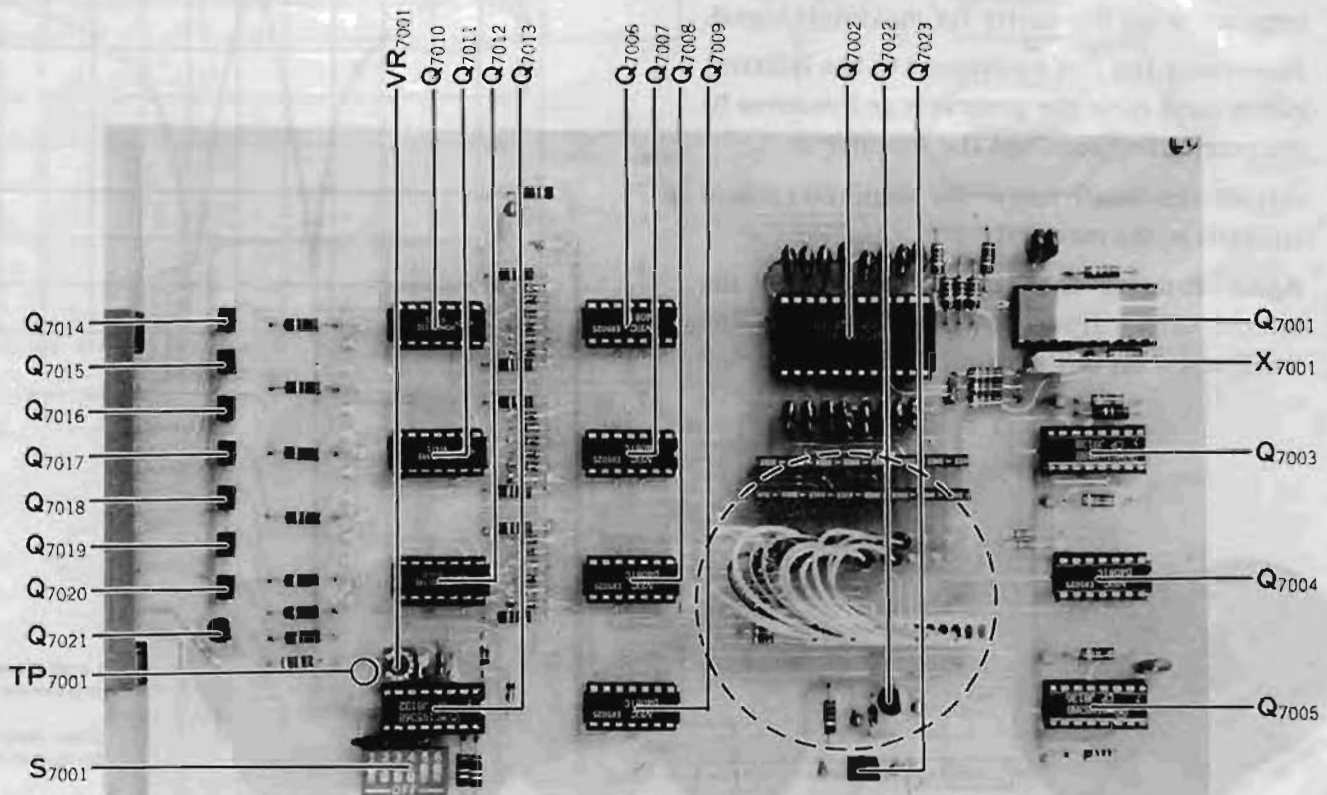
Connect the oscilloscope to TP₇₀₀₁ near VR₇₀₀₁.

Press "* 3 2", and adjust VR₇₀₀₁ for a clock pulse width of 42.8 μsec on the scope.

Set the DIP switches on S₇₀₀₁ as follows:

- 1 – ON
- 2 – OFF
- 3 – OFF
- 4 – OFF
- 5 – ON
- 6 – ON

See page 46 for DTMF Command Code programming.



DTMF UNIT Alignment Points

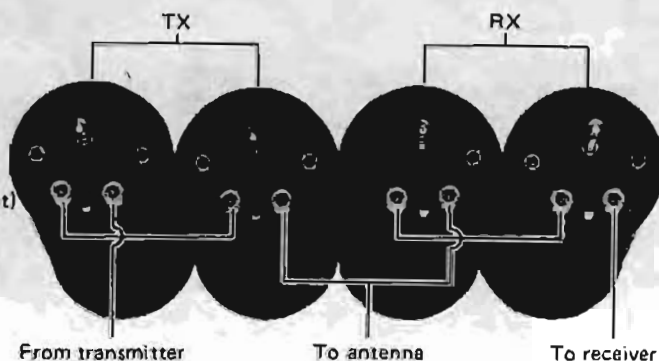
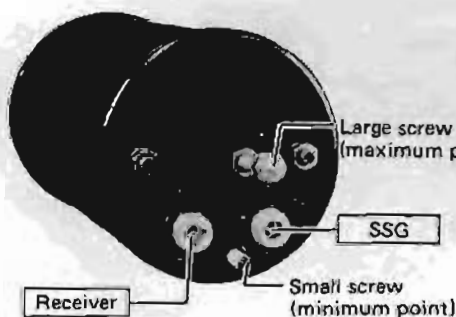
F. DUPLEXER

Alignment of the cavity duplexer is determined by the exact operating frequencies of the repeater, and adjustment is critical. If the transmit or receive frequencies are changed, the cavities must be realigned.

The following procedure is intended to apply to those duplexers having round cylindrical cavities, as shown below. Alignment requires at least a stable signal generator and monitor receiver with signal strength indicator, both of which must be tunable to both the transmit and receive frequencies of the repeater. However, a sweep generator is preferable. Do not alter the order of the alignment steps.

(1) TX Section

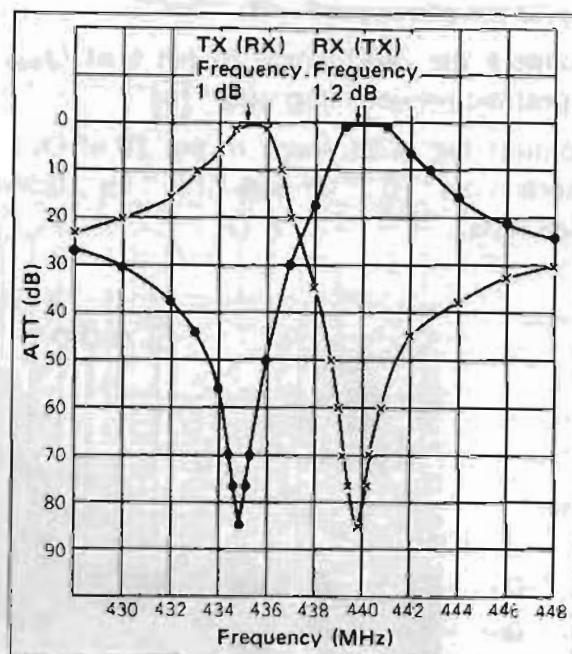
- Connect the test equipment to the leftmost cavity as shown below. Tune the signal generator and monitor receiver to the transmit frequency of the repeater.
- Adjust the large screw for maximum signal in the receiver.
- Now connect the test equipment to the second cavity from the left, and adjust the large screw on this cavity for maximum signal.
- Reconnect the test equipment to the leftmost cavity, and tune the generator and receiver to the receive frequency of the repeater.
- Adjust the small screw for minimum signal strength in the receiver.
- Again connect the test equipment to the second cavity from the left, and adjust the small screw on this cavity for minimum signal.



- : Large screw (maximum point)
- × : Small screw (minimum point)

(2) RX Section

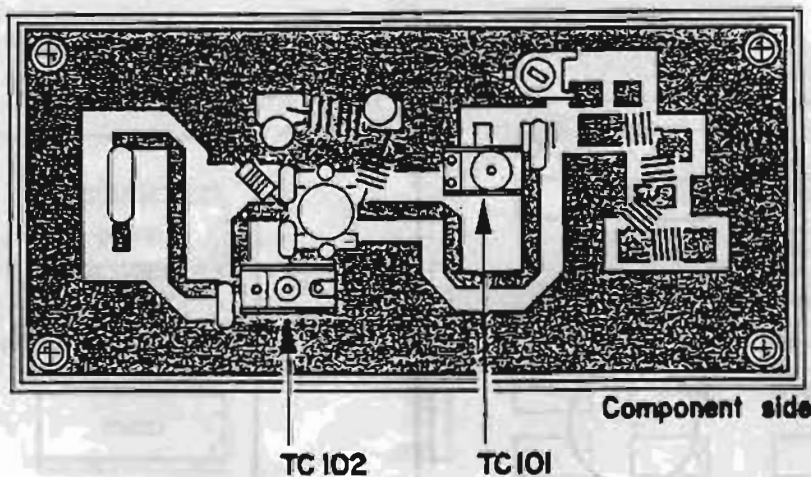
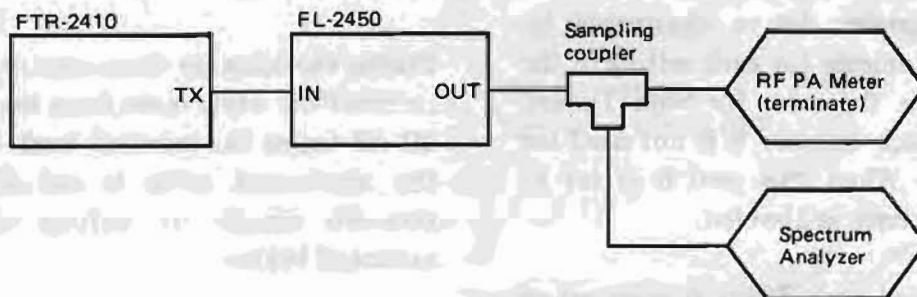
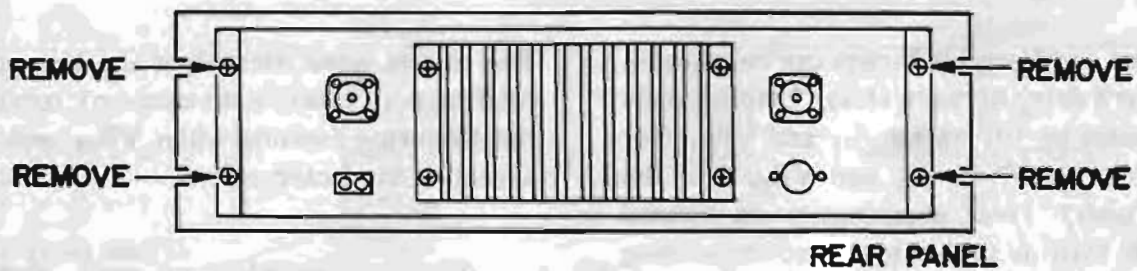
- Connect the test equipment to the rightmost cavity as shown below. Tune the signal generator and monitor receiver to the receive frequency of the repeater.
- Adjust the large screw for maximum signal in the receiver.
- Now connect the test equipment to the second cavity from the right, and adjust the large screw on this cavity for maximum signal.
- Reconnect the test equipment to the rightmost cavity, and tune the generator and receiver to the transmit frequency of the repeater.
- Adjust the small screw for minimum signal strength in the receiver.
- Again connect the test equipment to the second cavity from the right, and adjust the small screw on this cavity for minimum signal.



G. FL-2450 AMPLIFIER

1. Remove the four screws indicated by the arrows in the diagram, and remove the front panel slowly, just enough to gain access to the adjustment points without straining the POWER indicator wiring.
2. Connect the test equipment as indicated below.
3. In the FTR-2410A, adjust VR₁₀₂ on the TX Unit to the fully clockwise position.

4. Activate the repeater transmitter, and adjust TC₁₀₁ and TC₁₀₂ alternately to provide maximum power output on the wattmeter and minimum spurious on the analyzer, simultaneously.
5. Now adjust VR₁₀₂ again in the FTR-2410A so that the wattmeter indicates 50 watts.
6. Remove the test equipment and replace the front panel and the four screws. This completes the alignment.



FL-2450 ALIGNMENT POINTS

ADJUSTMENTS

This section includes directions for adjustment of the Hang Up and Time Out Delay Timers for periods other than those programmed at the factory, according to the preference of the user. Programming instructions for the optional DTMF Decoder Unit are also provided to allow the user to reprogram the Command Codes for his particular needs, and to make use of the three User Modes for user selected commands. Setting of the optional FTS-5 Tone Burst Unit frequency is not included here, as this information is provided on page 11. Also, CTCSS tone frequency programming for the FTS-32R (RPT) is already provided on page 13, and is not reprinted here.

Delay Timer Setting

The Time Out and Hang Up Timers can be adjusted for any desired delay between about 7 milliseconds and 11 minutes by DIP switch S_{01} and VR_{04} (for the Time Out Timer), or S_{02} and VR_{05} (for the Hang Up Timer). These components are located on the COR Unit as shown in the accompanying figure.

The table on the following page indicates the minimum and maximum delays obtainable by adjusting the potentiometer for each setting of the DIP switches. This is the same for both Timers. Notice that DIP switch number 6 is not used for delay programming. When this switch is set to OFF, the respective timer is disabled.

The potentiometer for each Timer is adjusted at the factory, and the DIP switches preset, so that

the Time Out Timer delay is 3 minutes, and the Hang Up Timer delay is 4 seconds. Therefore each may be reset for certain convenient alternate delays by merely resetting the DIP switches. For example, the Hang Up Timer can be reset for 2, 1 or 0.5 seconds by simply moving the DIP switches. No adjustment of the potentiometers is necessary.

If it is necessary to recalibrate the Timers precisely for certain delay times, this can be done by connecting an oscilloscope to TP_{06} (for the Time Out Timer), or TP_{07} . Adjust the Squelch control so that the squelch is open when adjusting the Time Out delay, or closed when adjusting the Hang Up delay.

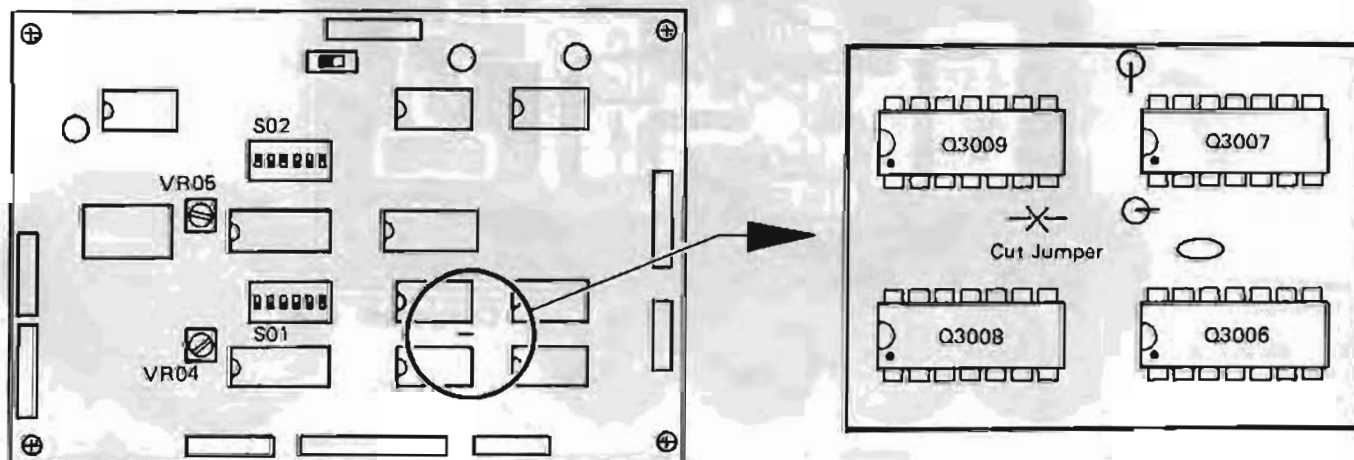
The square wave present at the test point has a total period (risetime-to-risetime) conforming to the following formula when VR_{04} and VR_{05} are aligned at the factory:

$$\text{Waveform period} = \frac{\text{Timer delay} \times 2}{\text{Clock dividing ratio}}$$

VR_{04} and VR_{05} may be readjusted as desired.

During the hang up delay period, the repeater will transmit the white noise from the receiver at a level 20 dB below the received level. If transmission of the attenuated noise is not desired, it can be removed simply by cutting the jumper wire indicated below.

Hang up Delay Timer Modification



DELAY TIMER SETTING

DIP Switch					DIVIDING RATIO	Delay Time (Seconds)	
1	2	3	4	5		minimum VR setting	maximum VR setting
○	○	○	○	○	512	0.002	0.020
X	○	○	○	○	1024	0.015	0.040
○	X	○	○	○	2048	0.03	0.081
X	X	○	○	○	4096	0.061	0.163
○	○	X	○	○	8192	0.123	0.327
X	○	X	○	○	16384	0.245	0.655
X	X	X	○	○	32768	0.491	1.310
X	X	X	○	○	65536	0.983	2.620
○	○	○	X	○	131072	1.960	5.240
X	○	○	X	○	262144	3.390	10.400
○	X	○	X	○	524288	7.860	20.900
X	X	○	X	○	1048576	15.600	41.900
○	○	X	X	○	2097152	31.400	83 (1'23")
X	○	X	X	○	4194304	62 (1'02")	167 (2'47")
○	X	X	X	○	8388608	125 (2'05")	335 (5'35")
X	X	X	X	○	1677216	251 (4'11")	671 (11'11")

○ = ON

X = OFF

DIP Switch (6) ON (○) = TIMER ON
OFF (X) = TIMER OFF

DTMF Command Code Programming

DTMF command code/key relationships are programmed by the connections between the pins of J₇₀₀₂ and the terminals on the DTMF Unit labelled with the key functions. Thus to change the command code for a particular function, it is only necessary to change the wire connections to the terminals.

For example, to change the "*" (SET) and "#" (RESET) functions from the present key codes to the "A" and "B" keys, simply remove the red/white wire (pin 2 of J₇₀₀₂) from the terminal labelled "*" and reconnect it to the "A" terminal. Also move the black/white wire (pin 3 of J₇₀₀₂) from the "#" terminal to the "B" terminal.

Now, if the rest of the terminals are programmed as from the factory, [A] 4 will deactivate the CTCSS tone decoder (as [*] 4 did previously), and [B] 4 will reactivate the decoder (as [#] 4 did previously). Other command functions will be affected in the same manner.

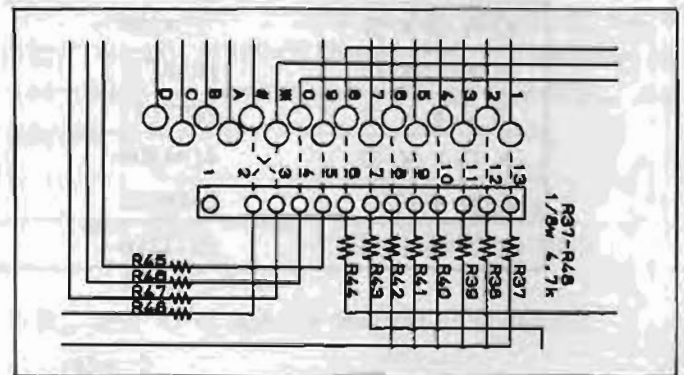
Following are the wire colors corresponding to the pins of J₇₀₀₂, and the command functions of each (as wired at the factory).

J ₇₀₀₂ pin no.	Wire color	Command function	Key Code (factory set)
2	red/white	Function SET prefix	*
3	black/white	Function RESET prefix	#
4	white	no connection	0
5	gray	no connection	9
6	violet	User Mode 3	8
7	blue	User Mode 2	7
8	green	User Mode 1	6
9	yellow	Transmit disable	5
10	orange	CTCSS disable	4
11	red	Local MIC mode	3
12	brown		
13	black	All RESET	1

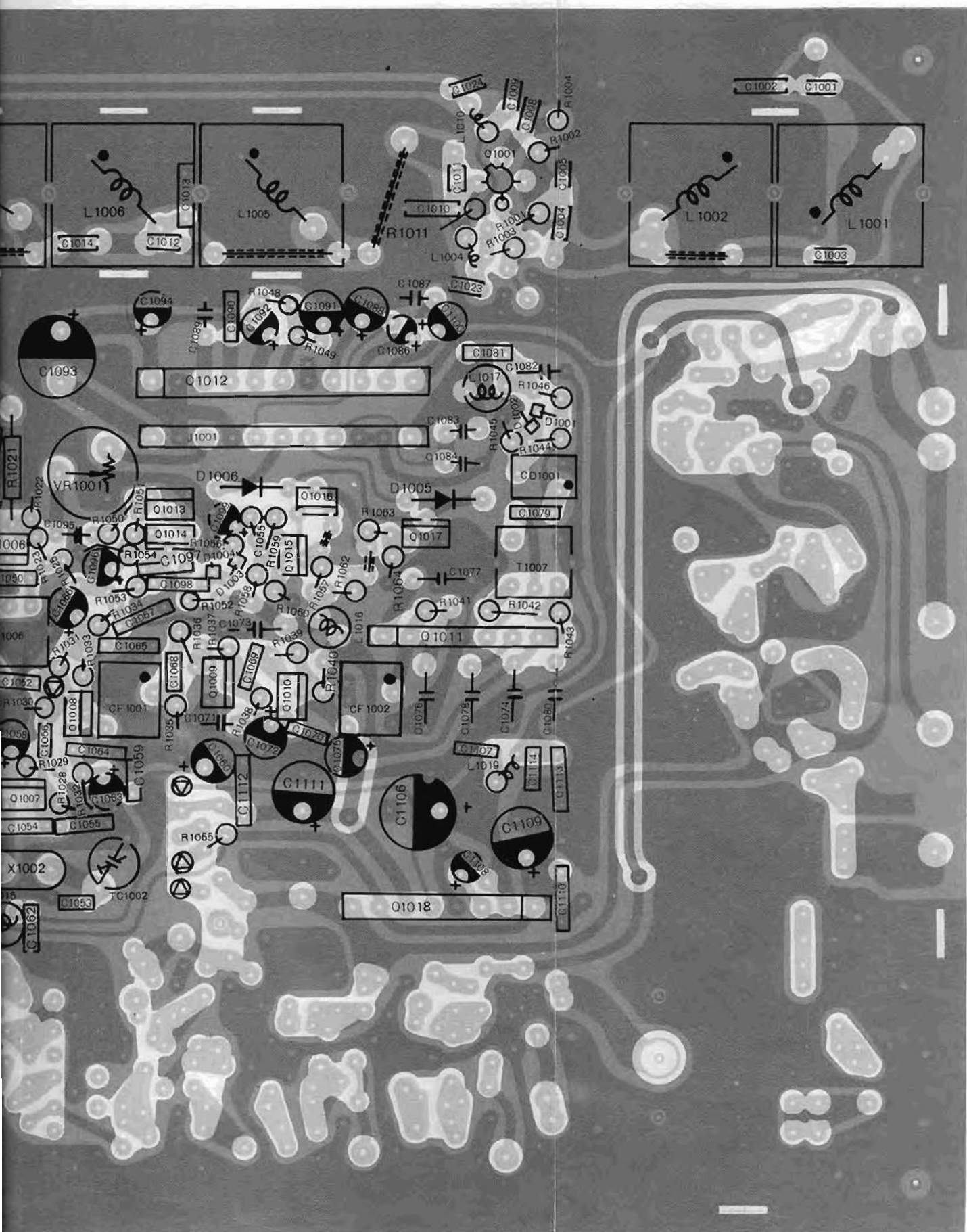
As in the above example, any of these functions (or three user-installed functions) can be programmed to operate from any desired DTMF code pair simply by connecting these wires to the terminals labelled with the desired key symbols.

User Modes

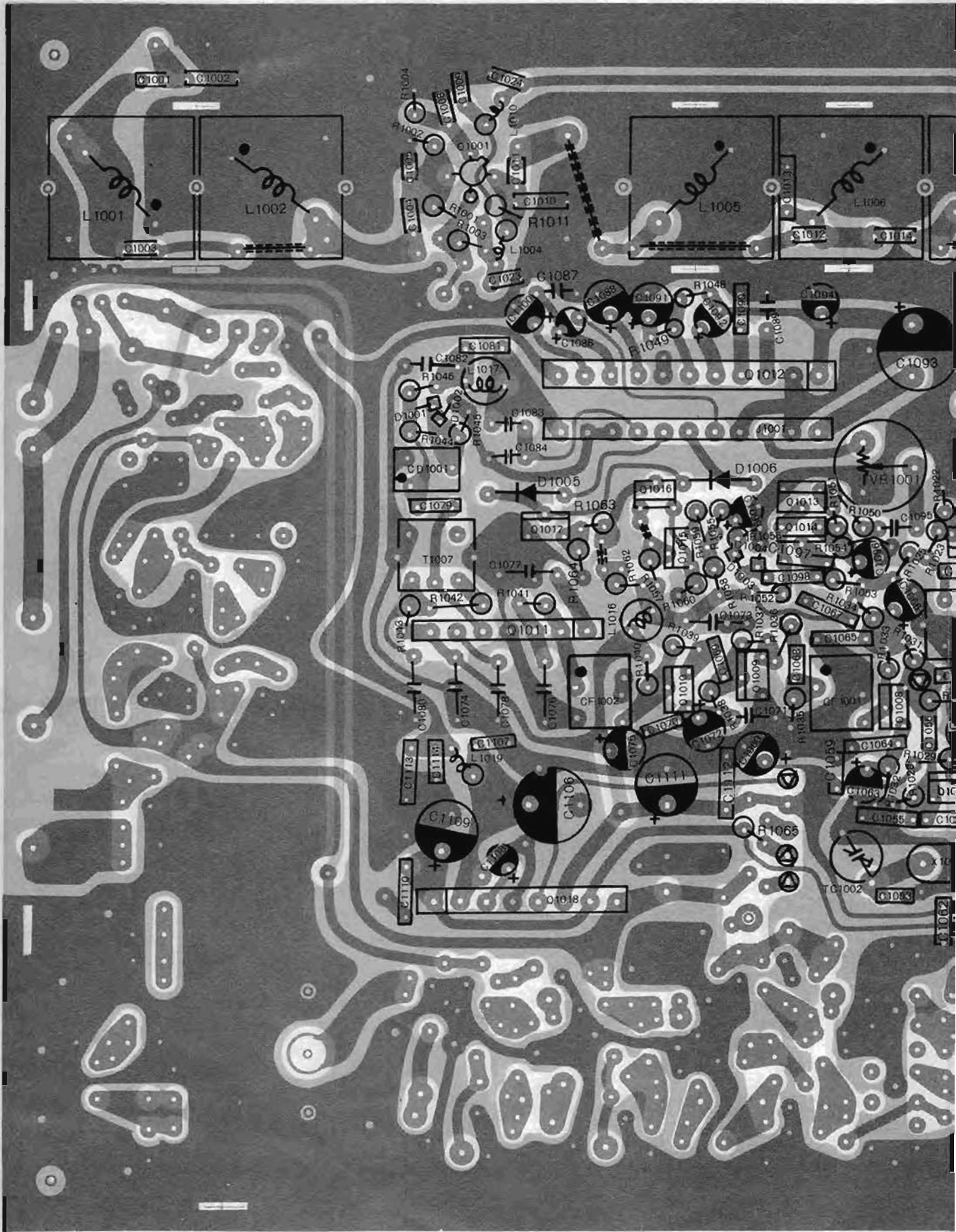
Transistors Q₁₄, Q₁₅ and Q₁₆ are provided for TTL-level switching of user-installed functions, designated User Modes 3, 2 and 1, respectively. Each transistor can be connected so that it is either on or off when the programmed DTMF code is received, by connecting the terminal in line with R₂₃, R₂₄ or R₂₅ to the upper or lower adjacent terminal (Q and \bar{Q} outputs from the flip-flops). The collectors of Q₁₄, Q₁₅ and Q₁₆ are connected to the edge connector, so that actual control connection can be made from the COR Unit (PB-2418A).

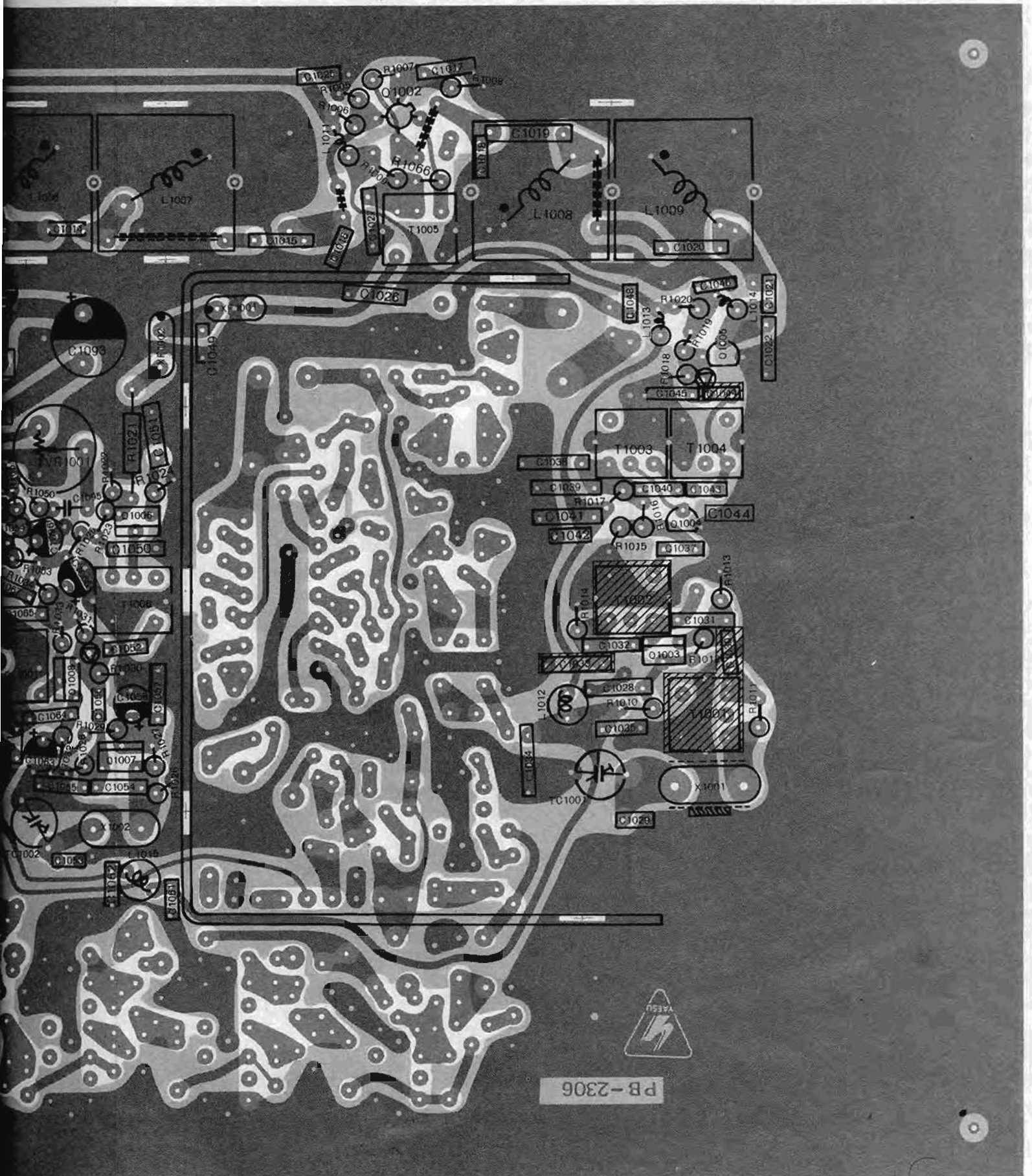


UNIT PARTS LAYOUT



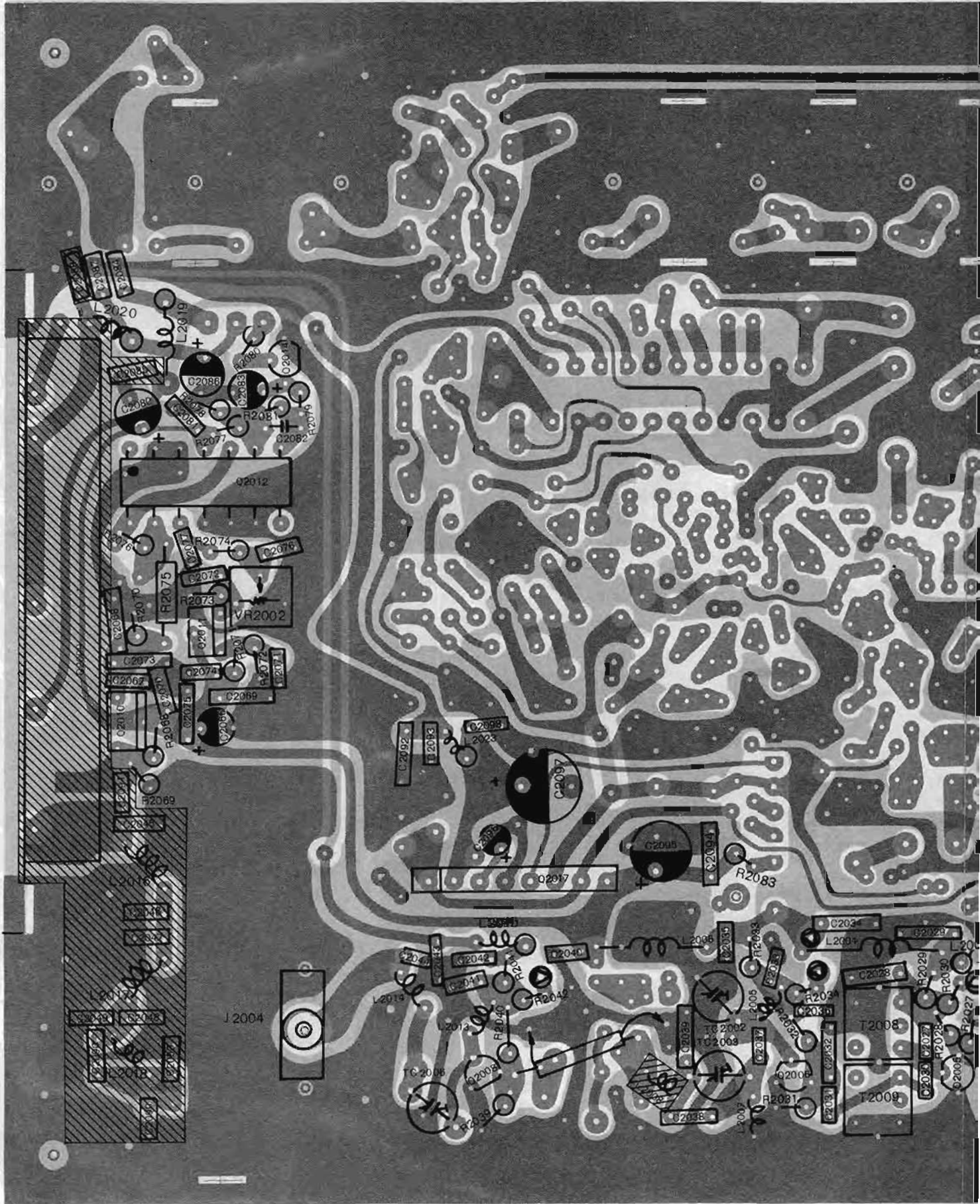
Viewed from component side

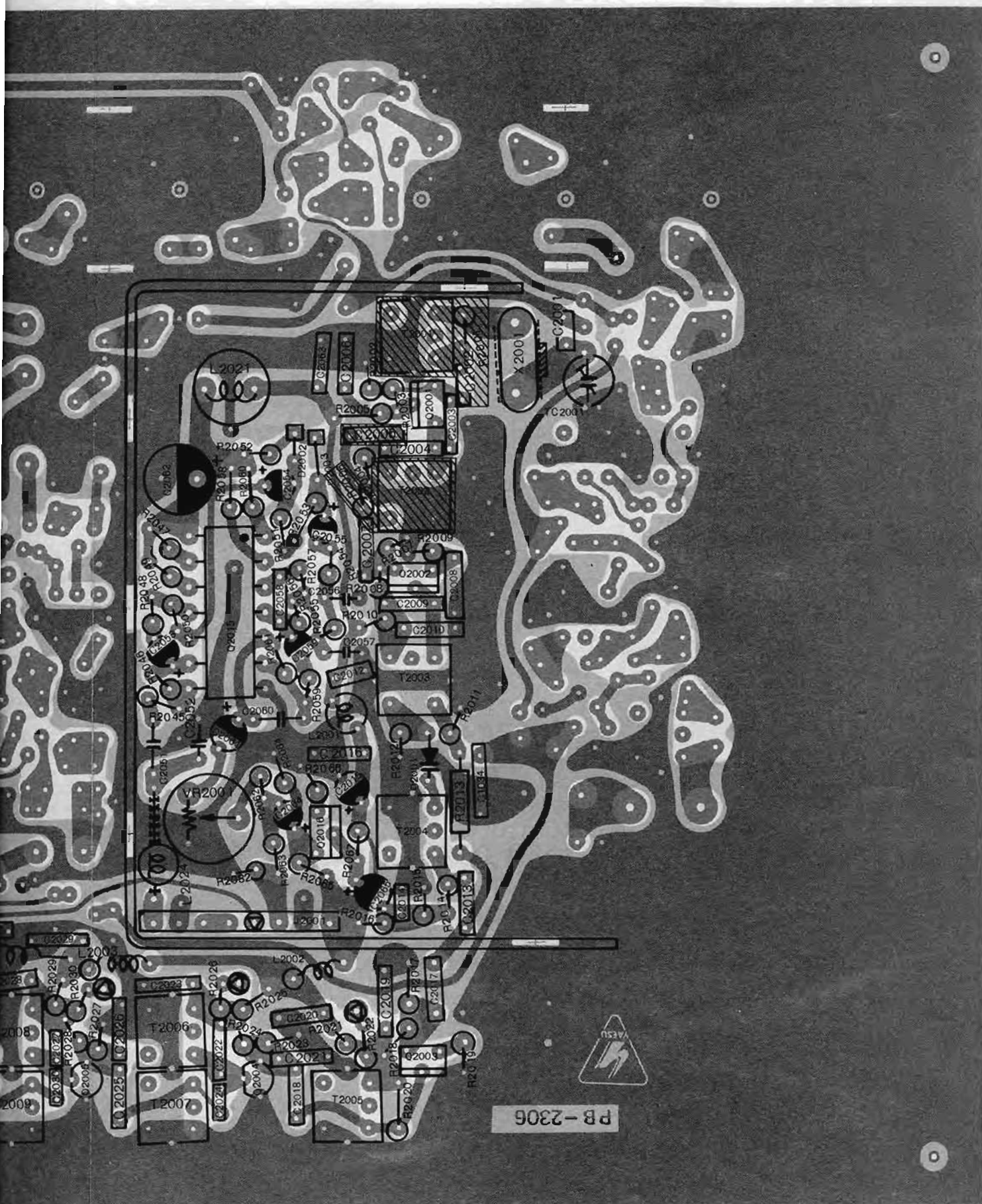




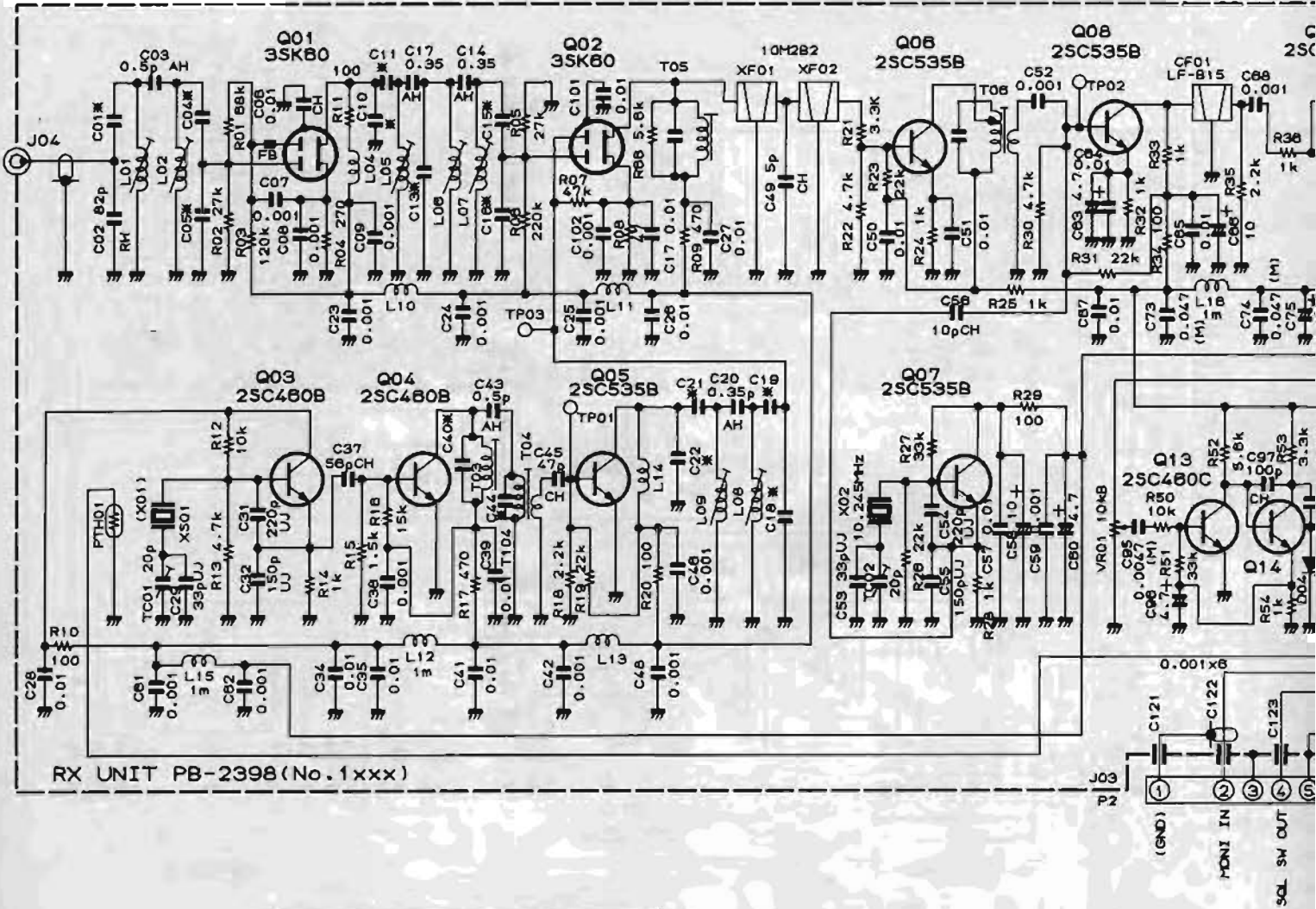
Viewed from solder side







Viewed from solder side

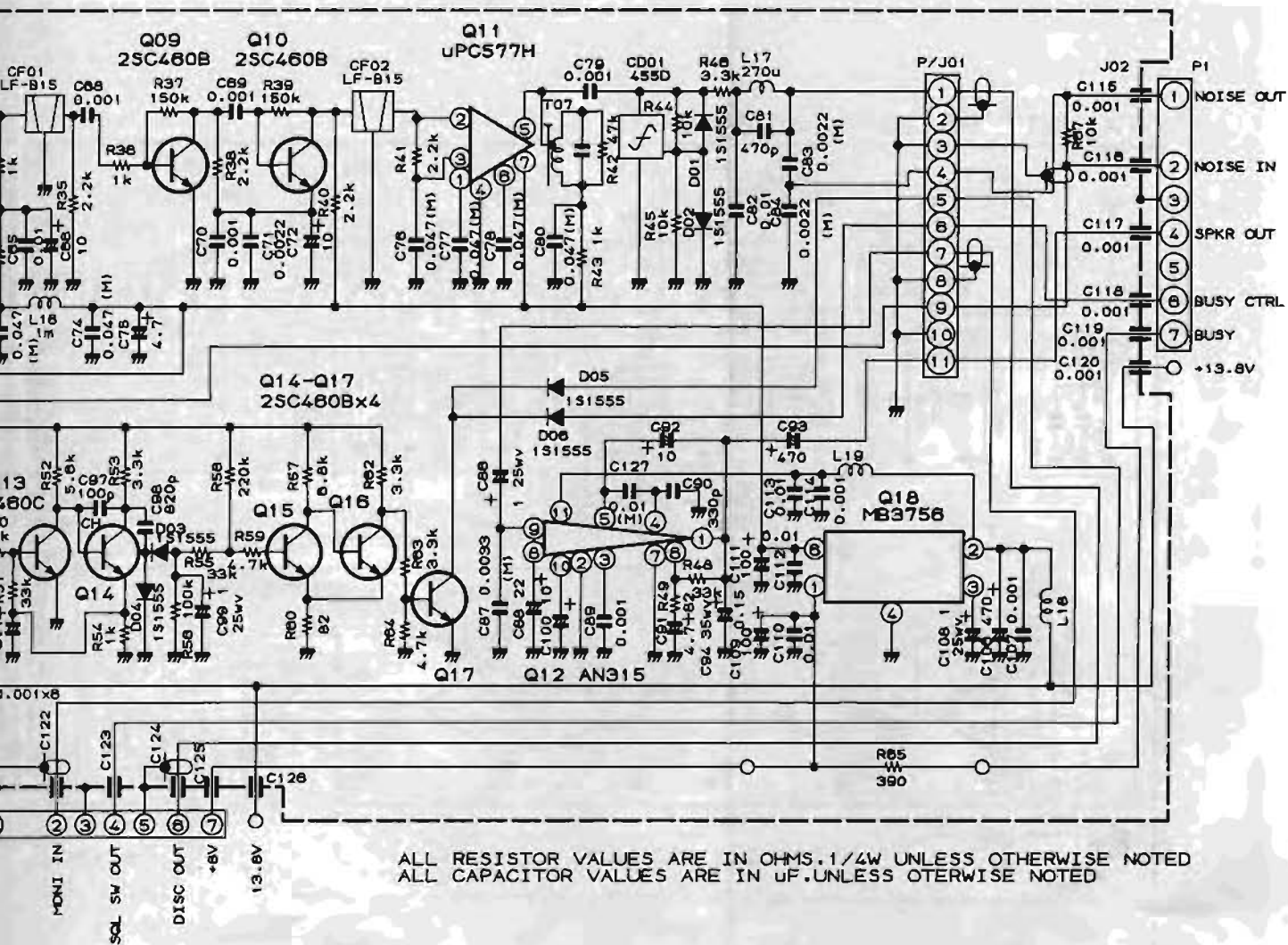


RX UNIT PB-2398 (No. 1xxx)

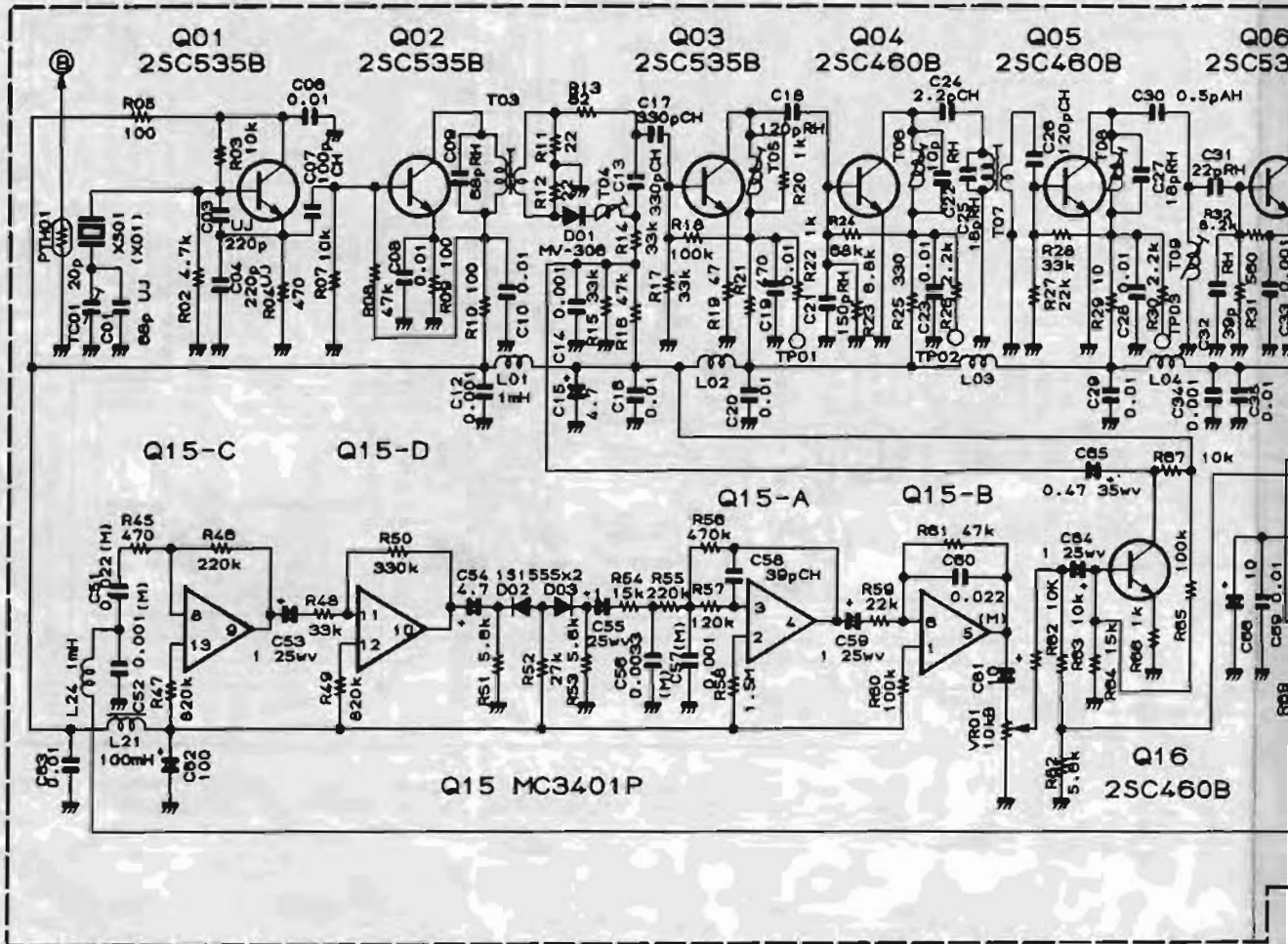
*COMPONENT TABLE

BAND PART	68-74	74-81	81-88
C 01	RH 18pF	RH 15pF	RH 12pF
C 04	RH 68pF	RH 56pF	RH 47pF
C 05	RH 12pF	RH 7pF	RH 4pF
C 10	RH 18pF	RH 15pF	RH 12pF
C 11	RH 39pF	RH 33pF	RH 22pF
C 13	RH 18pF	RH 15pF	RH 12pF
C 15	RH 18pF	RH 15pF	RH 12pF
C 16	RH 68pF	RH 56pF	RH 47pF
C 18	RH 82pF	RH 68pF	RH 18pF
C 19	RH 33pF	RH 27pF	RH 18pF
C 22	RH 82pF	RH 68pF	RH 56pF
C 40	RH 27pF	RH 22pF	RH 15pF
C 44	RH 27pF	RH 22pF	RH 15pF

-710A RX UNIT

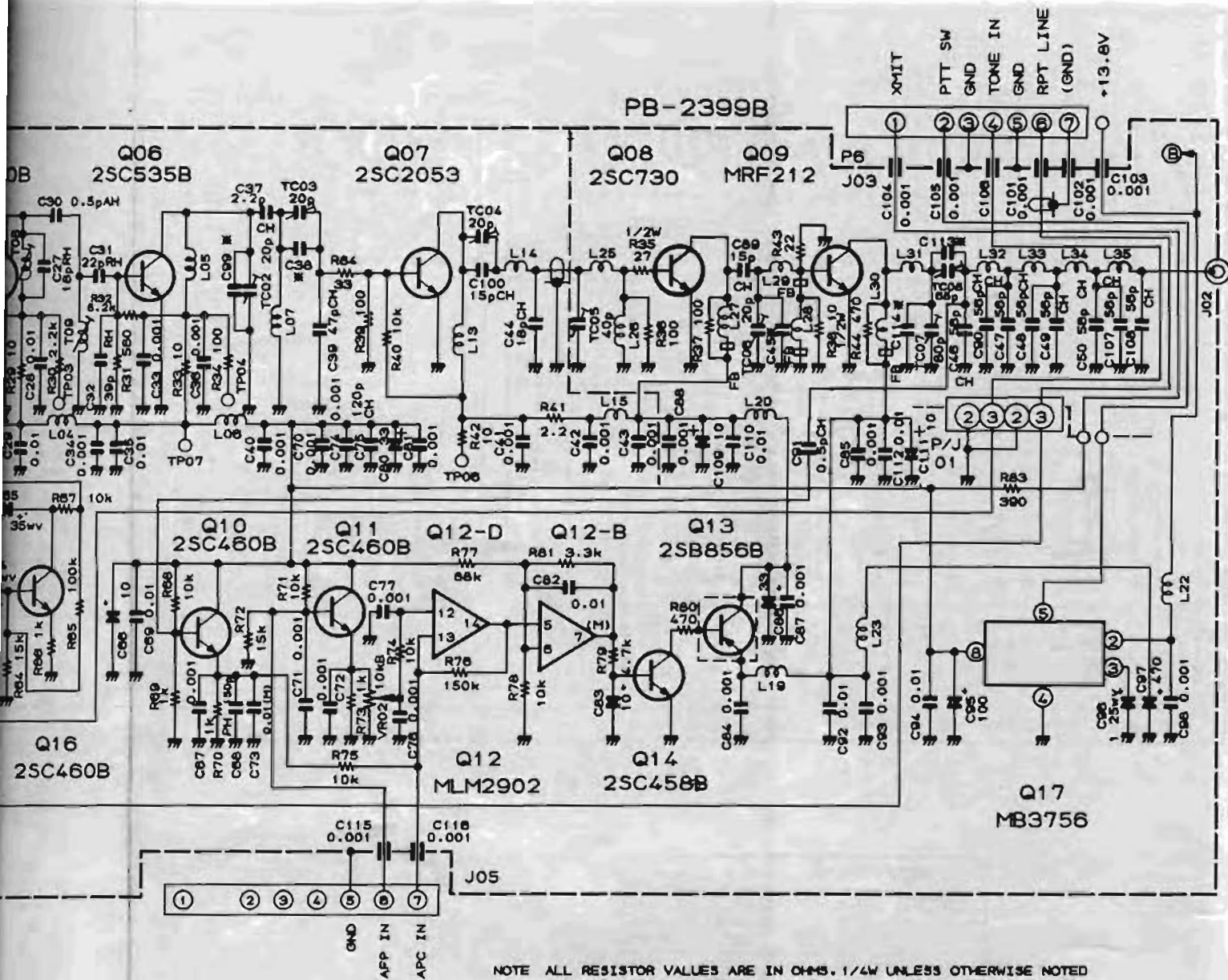


TX UNIT PB-2306 (No. 2xxx)

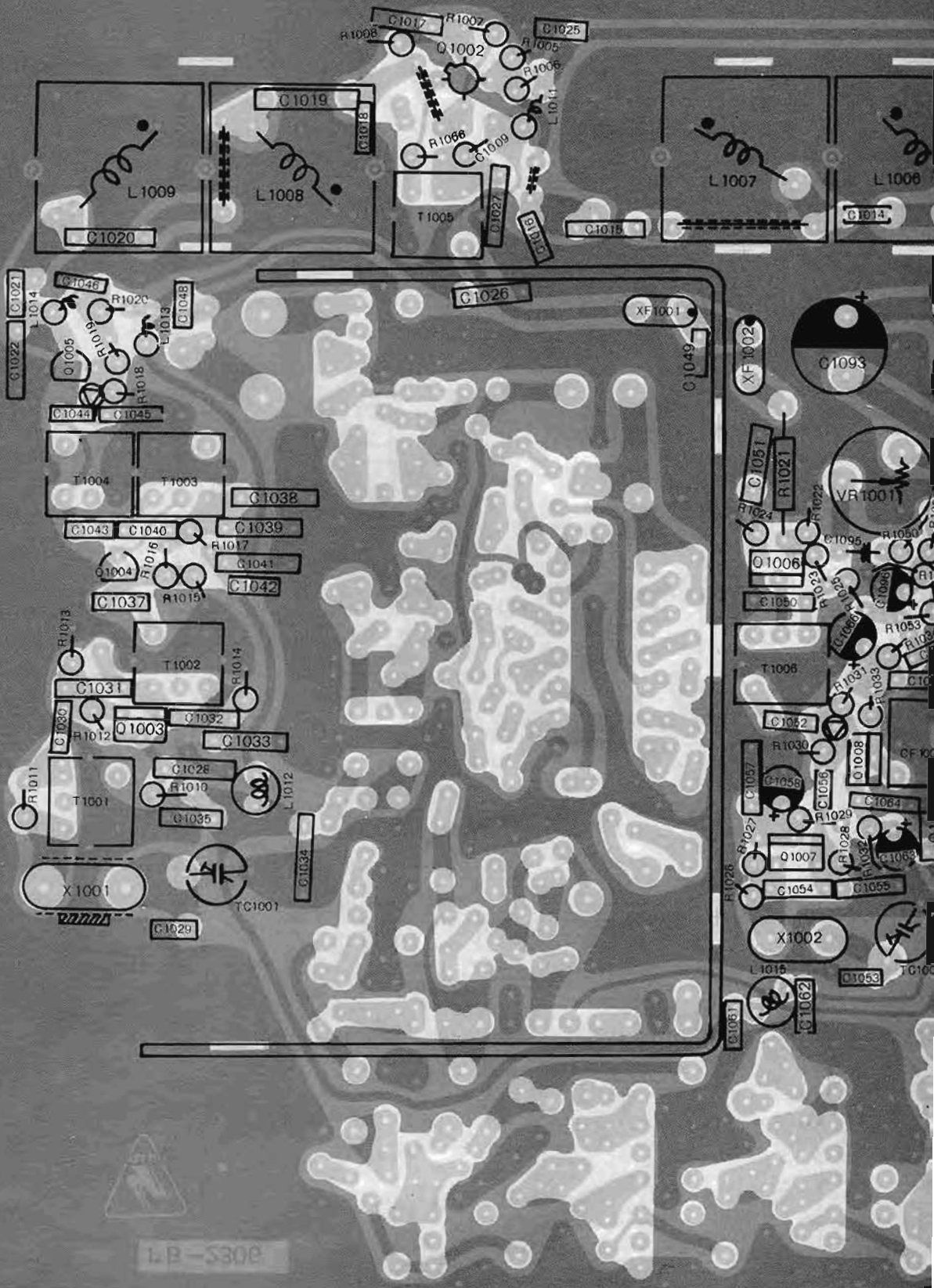


* COMPONENT TABLE

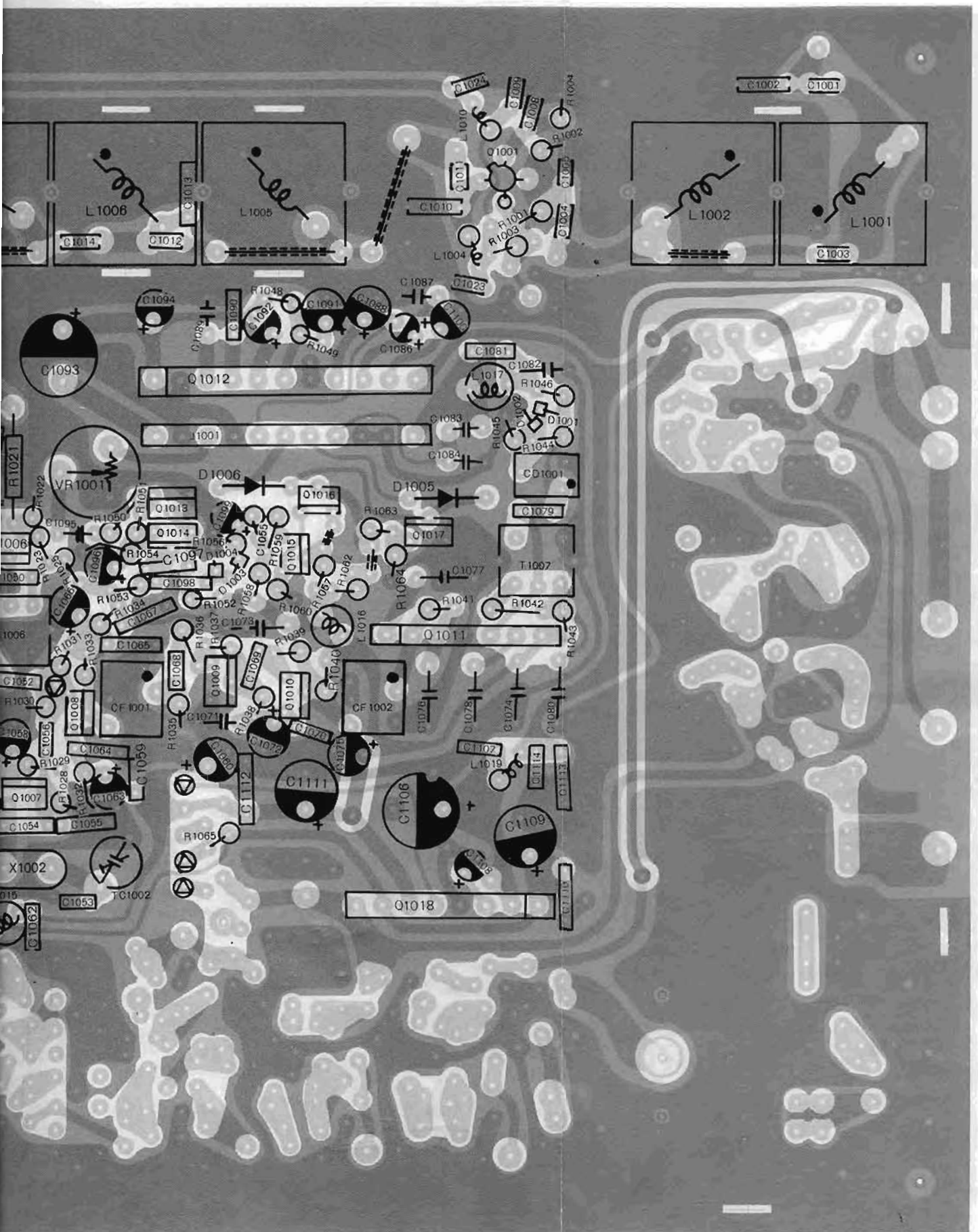
BAND PART	68-74	74-81	81-88
C 38	CH 47pF	CH 39pF	CH 27pF
C 45	CH 47pF	CH 39pF	CH 27pF
C 99	CH 39pF	CH 27pF	CH 22pF
C113	CH 47pF	CH 39pF	CH 15pF
C114	CH 27pF	CH 15pF	CH 5pF



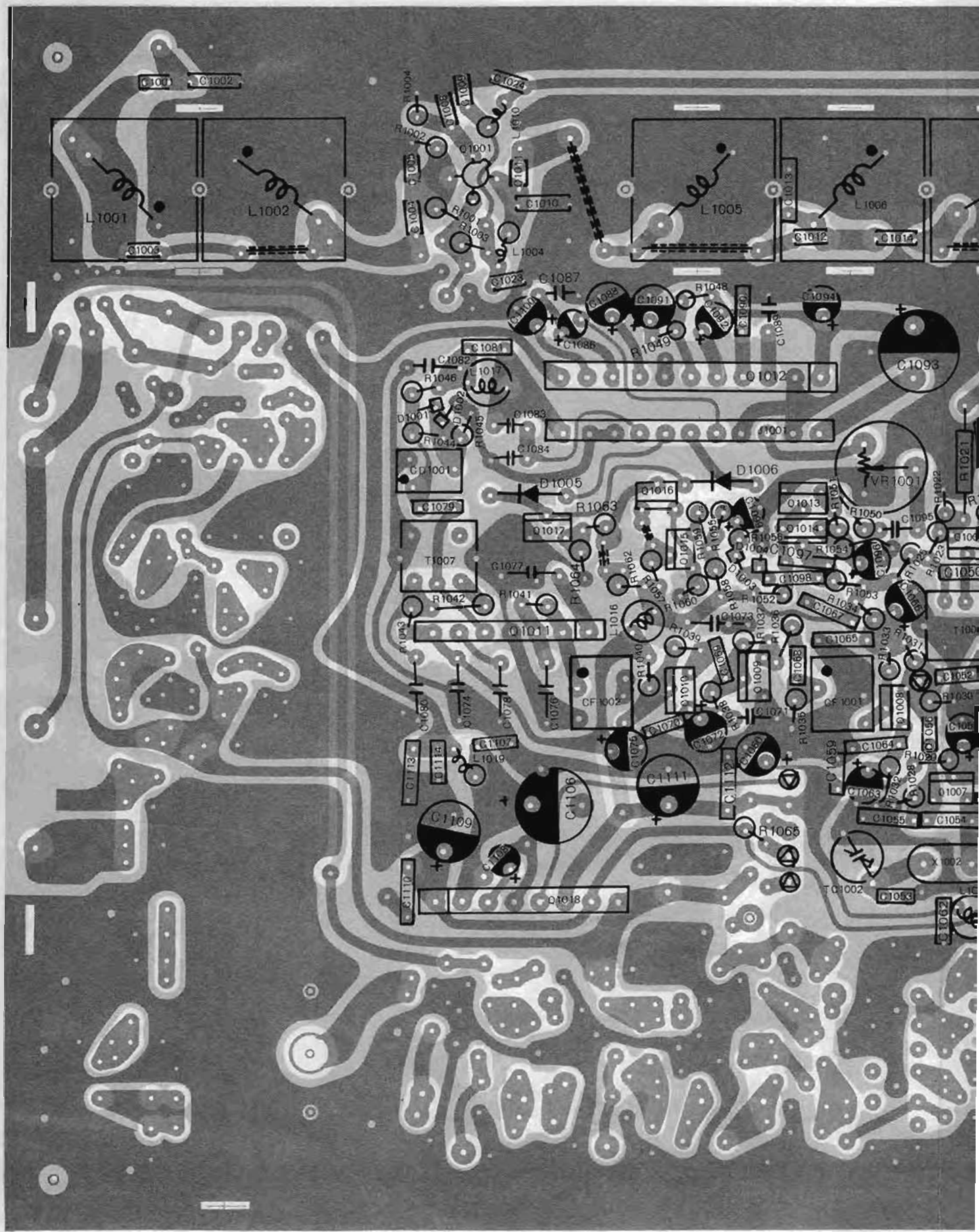
NOTE ALL RESISTOR VALUES ARE IN OHMS, 1/4W UNLESS OTHERWISE NOTED
 ALL CAPACITOR VALUES ARE IN uF, 50V UNLESS OTHERWISE NOTED



K UNIT PARTS LAYOUT

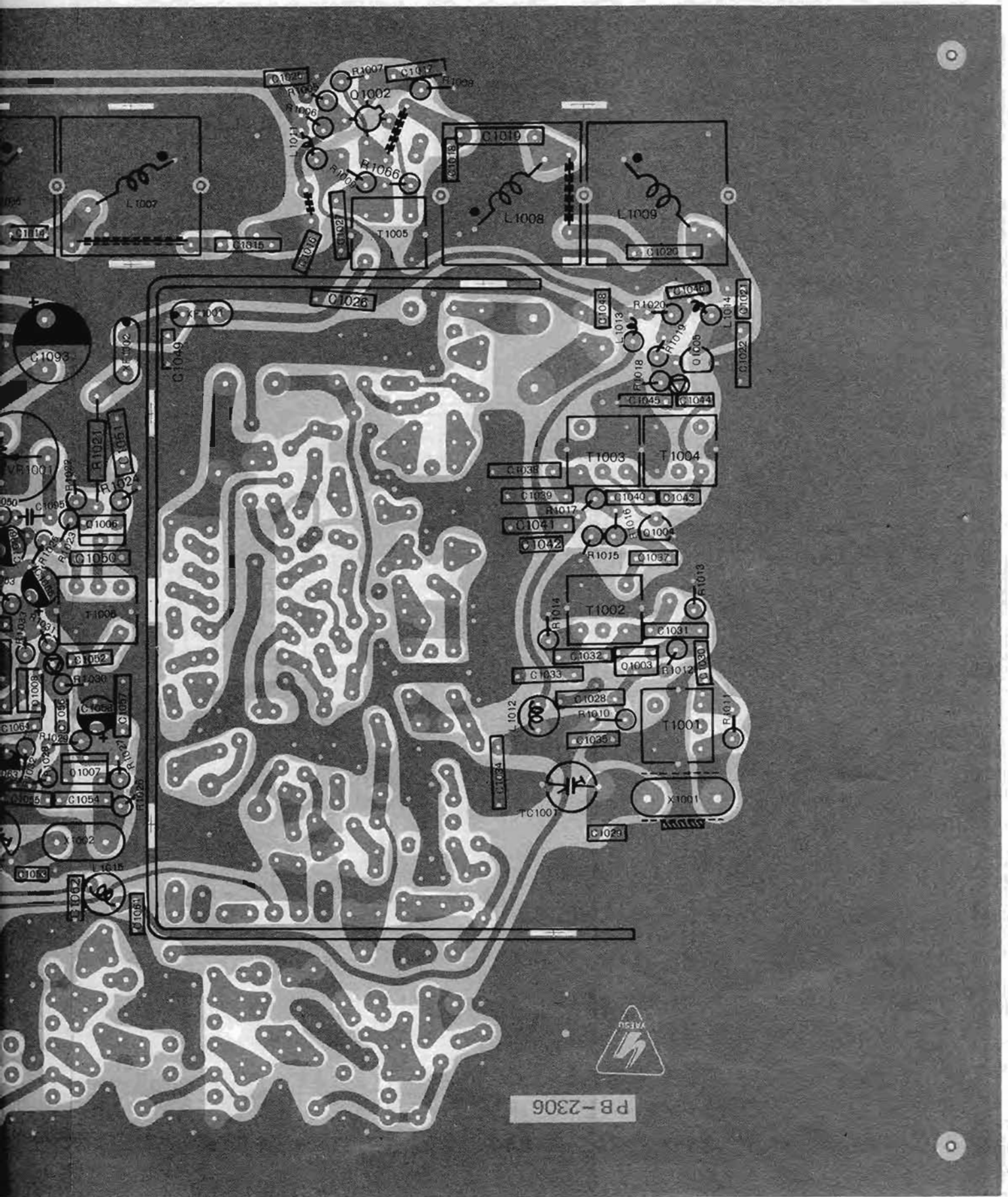


Viewed from component side



Always Use Correct Polarity

RX UNIT PARTS LAYOUT

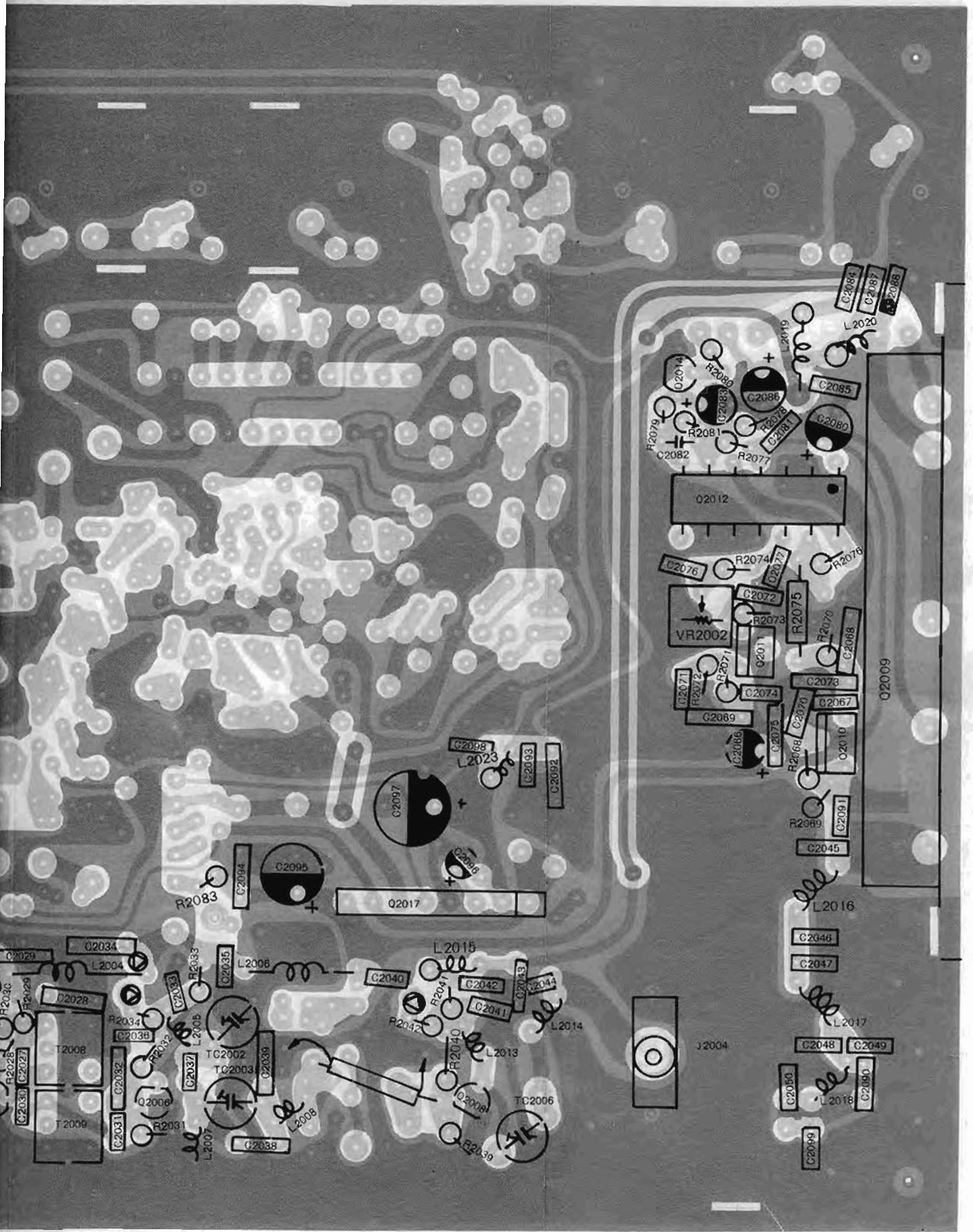


Viewed from solder side

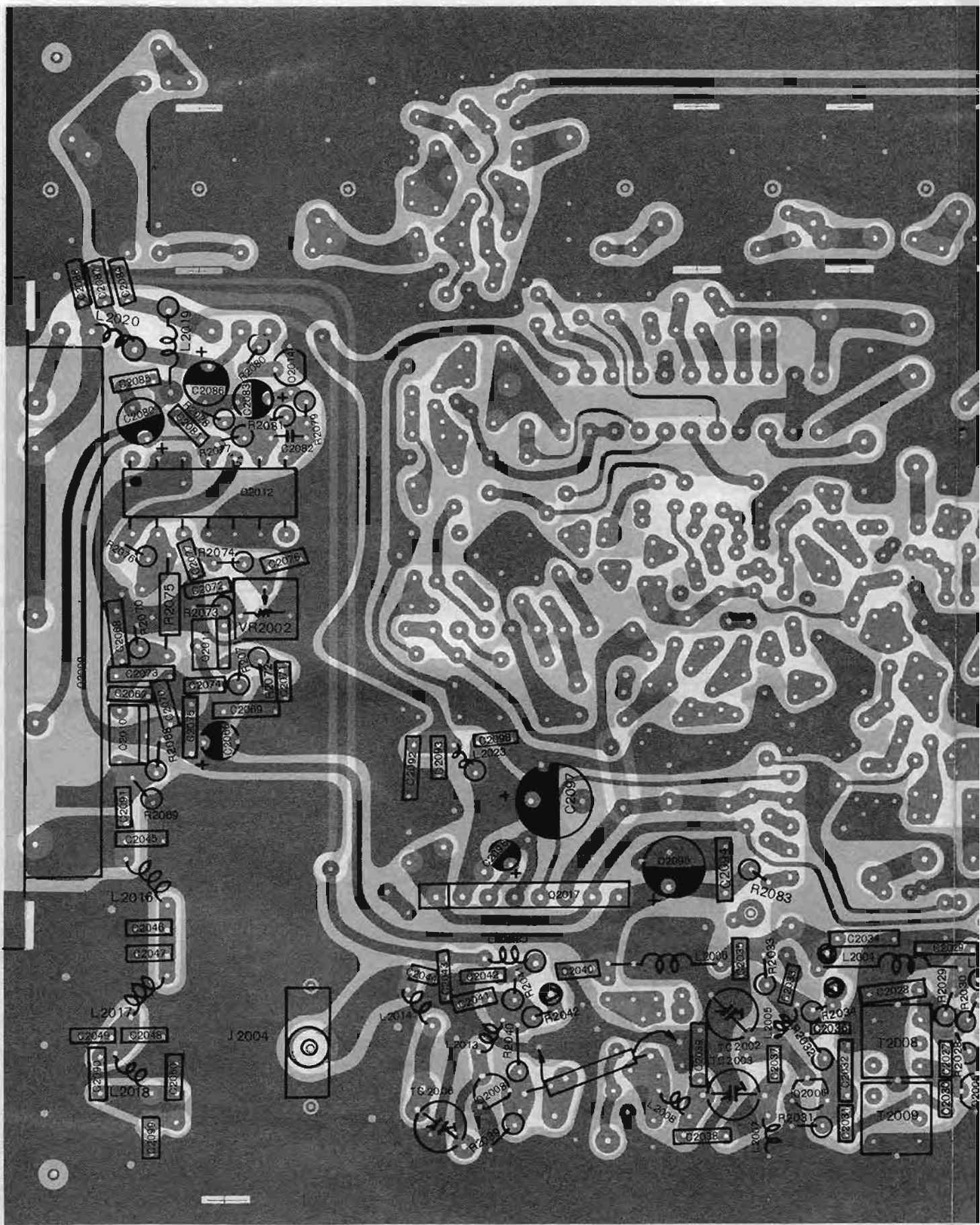


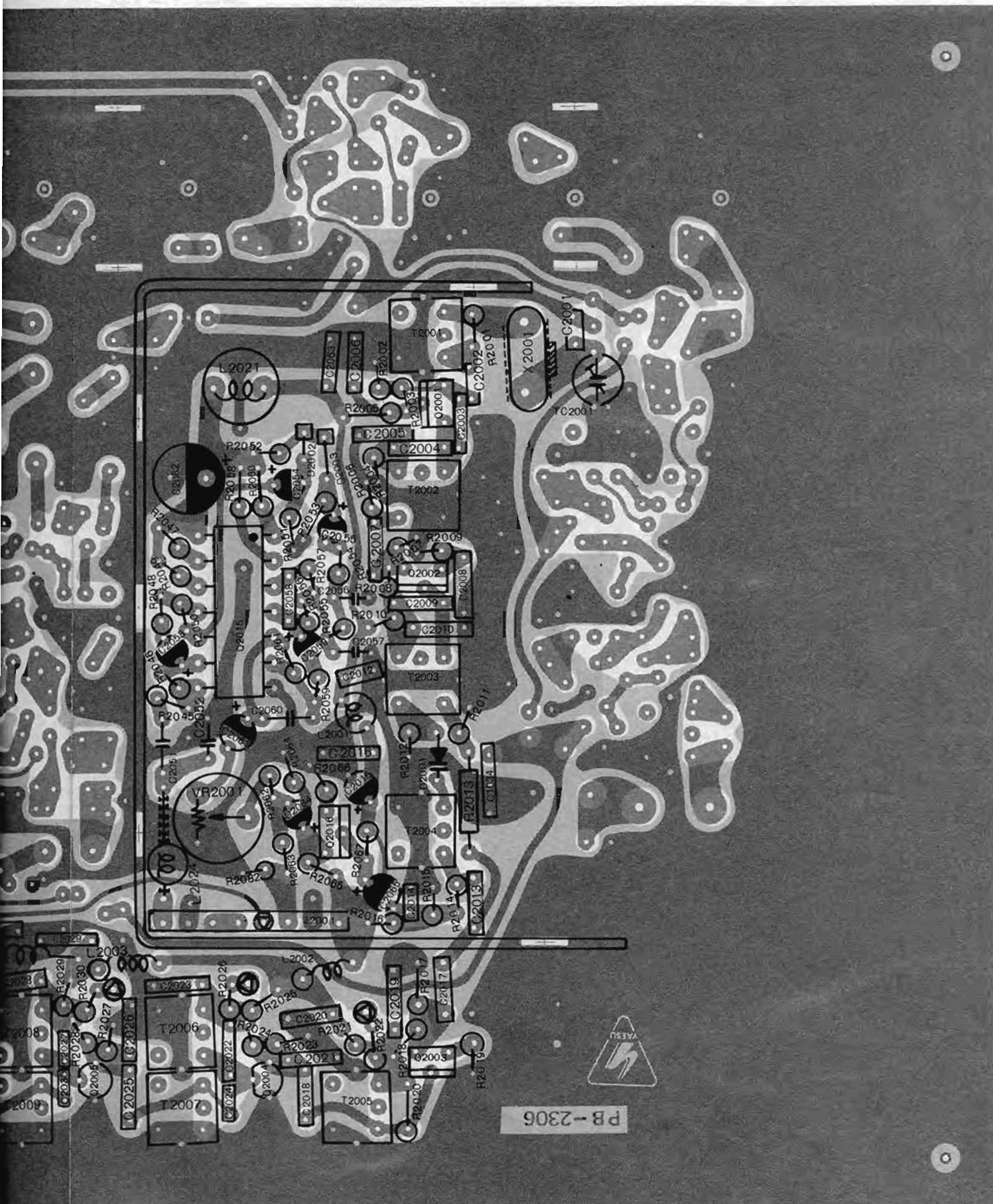
68-3306

X UNIT PARTS LAYOUT

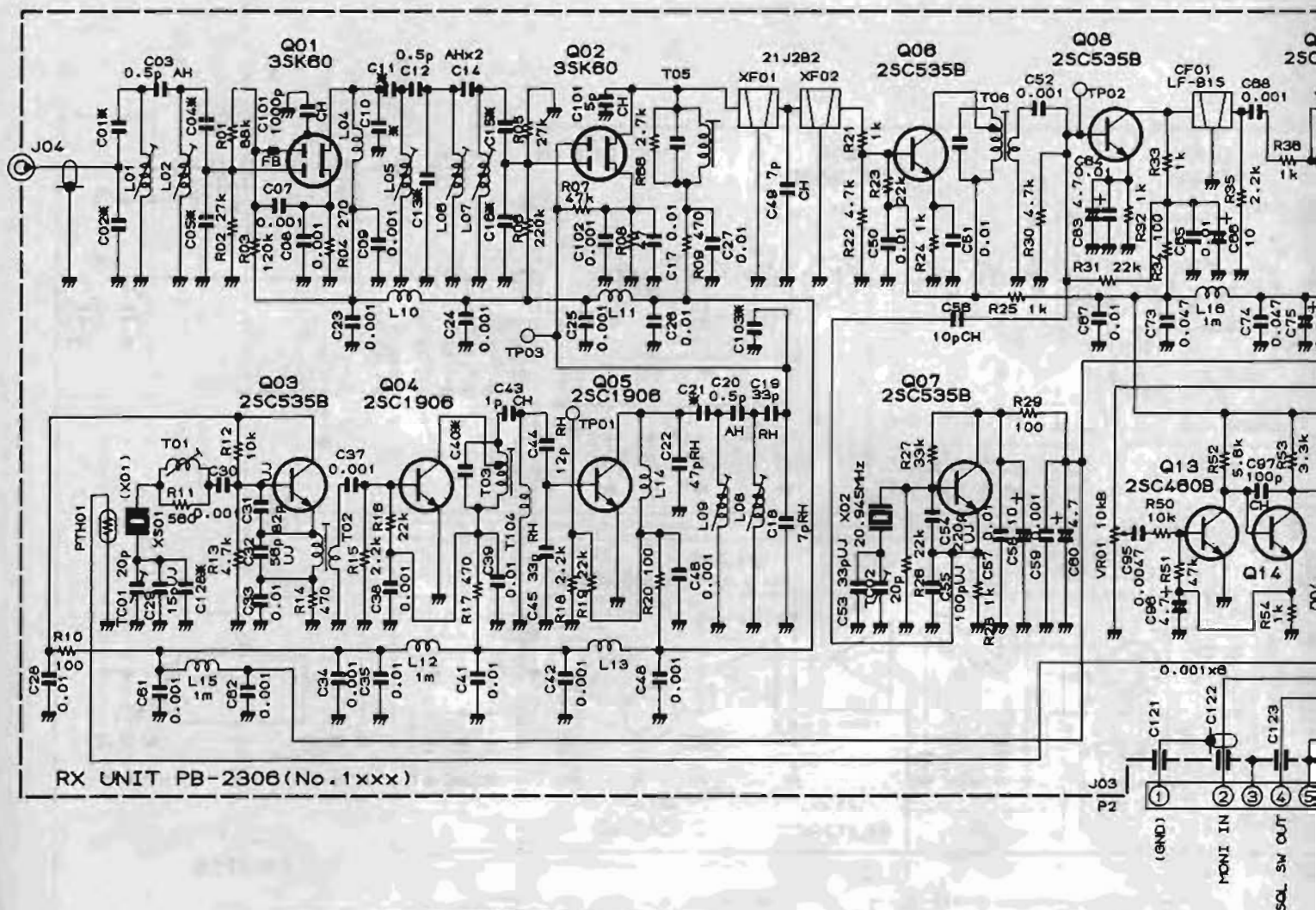


Viewed from component side



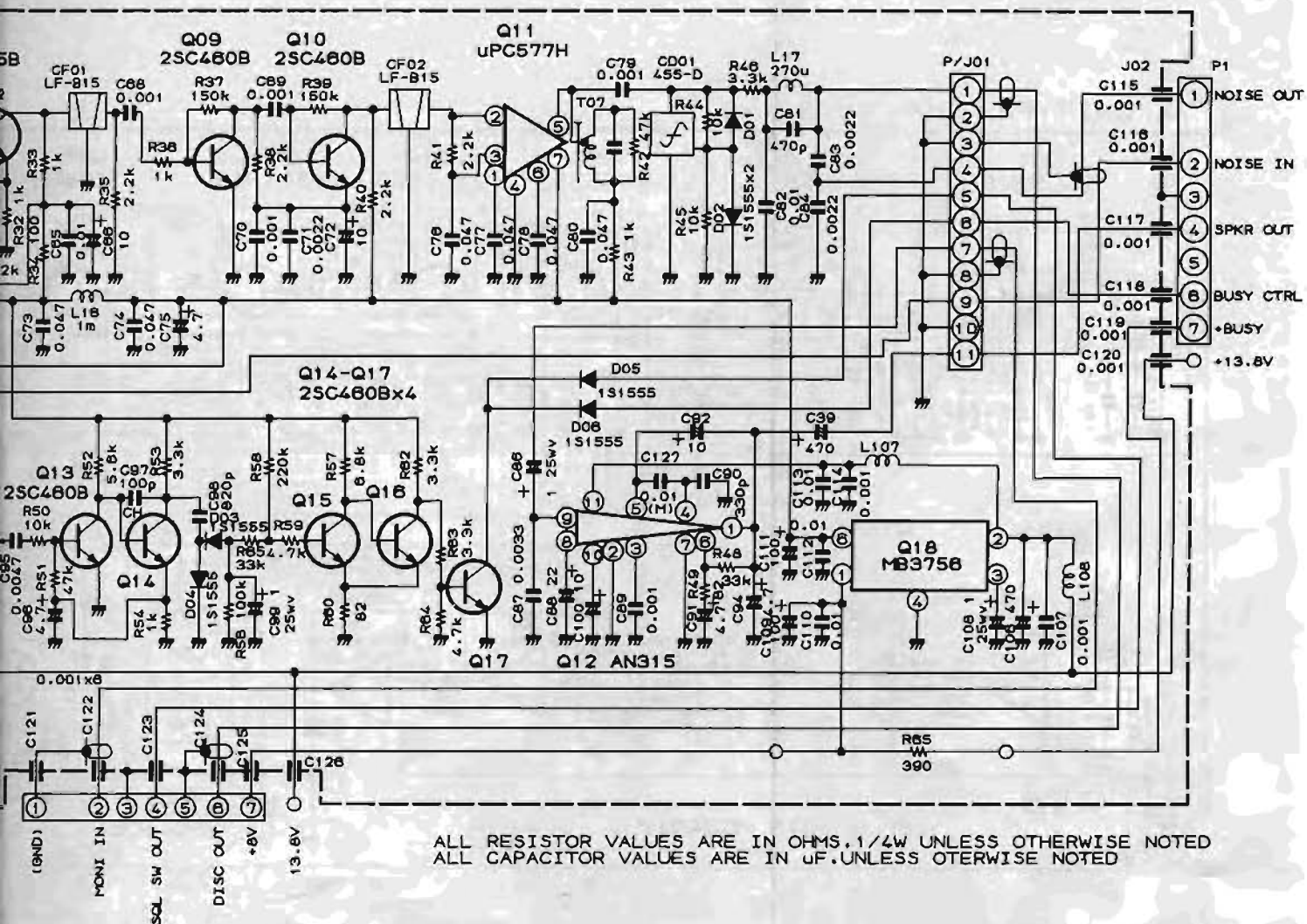


Viewed from solder side

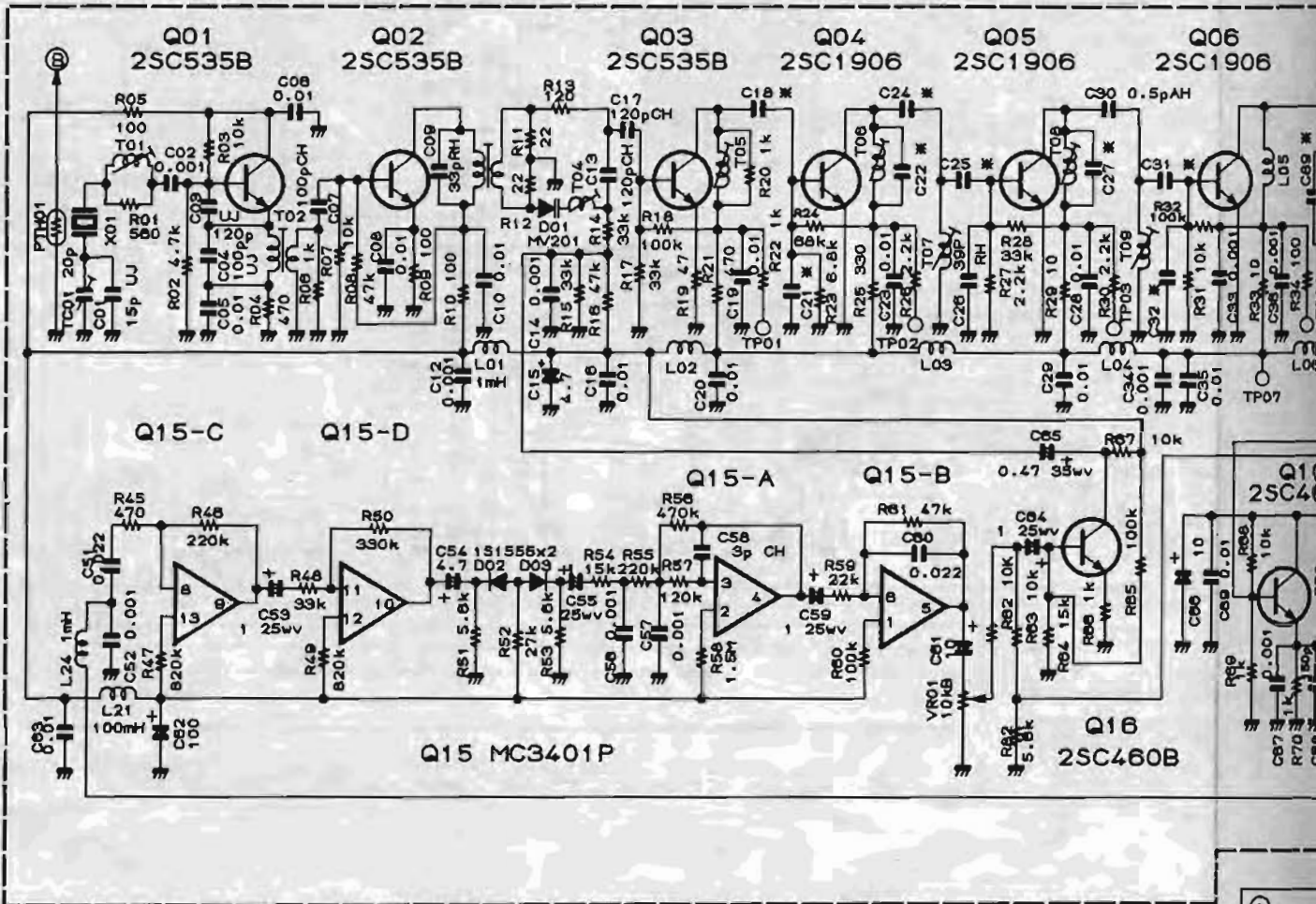


*COMPONENT TABLE

BAND PART	FHz		
	134-148	148-180	180-174
C 01	RH 10pF	RH 7pF	RH 6pF
C 02	RH 39pF	RH 27pF	RH 22pF
C 04	RH 33pF	RH 33pF	RH 27pF
C 05	CH 5pF	CH 3pF	CH 2pF
C 10	RH 39pF	RH 39pF	RH 33pF
C 11	RH 10pF	RH 7pF	RH 6pF
C 13	RH 12pF	RH 8pF	RH 8pF
C 15	RH 33pF	RH 27pF	RH 22pF
C 16	CH 4pF	CH 1pF	
C 21	RH 22pF	RH 15pF	RH 15pF
C 40	RH 10pF	RH 8pF	RH 8pF
C103	CH 10pF	CH 2pF	
C128	UJ 4pF	UJ 4pF	

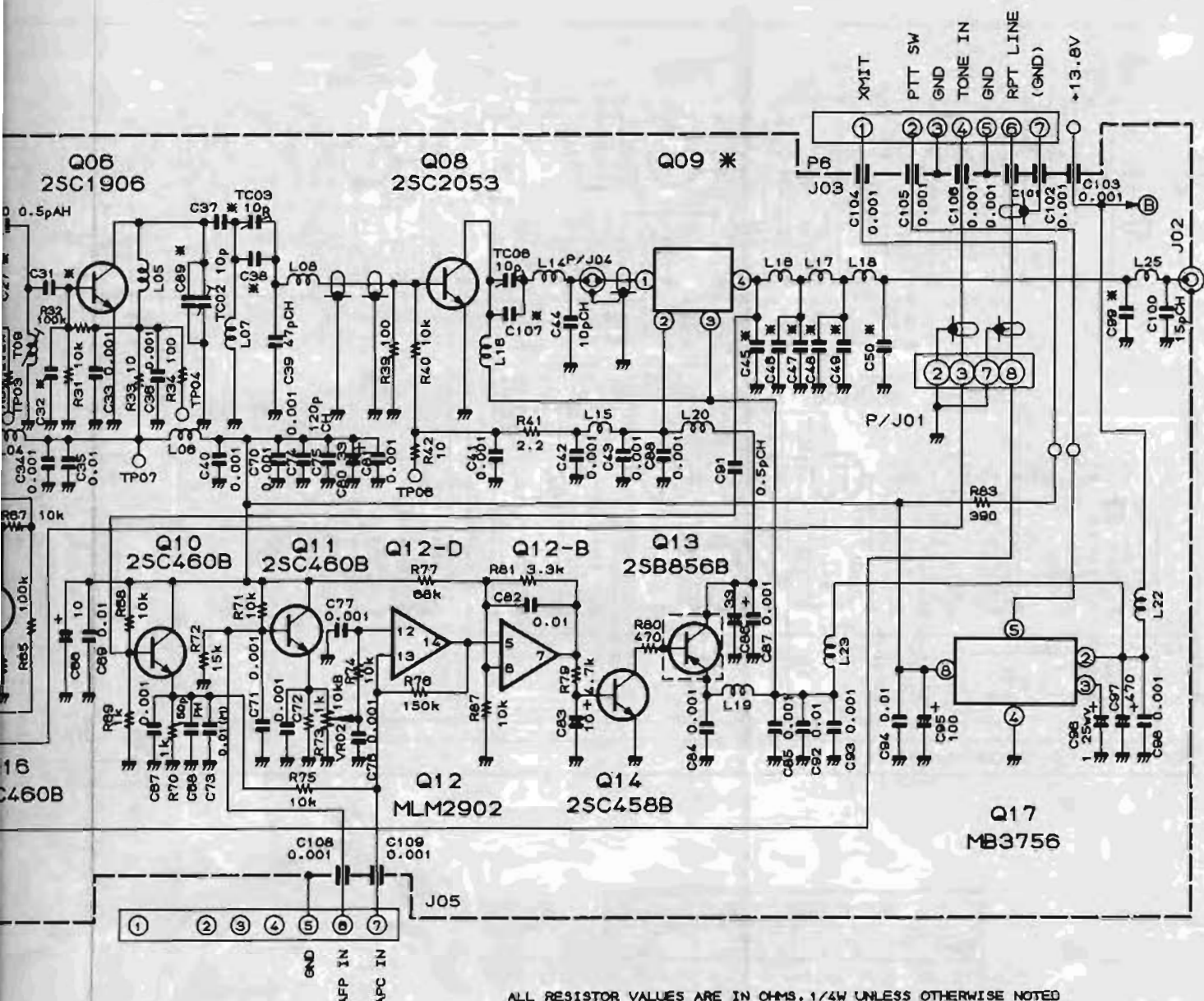


TX UNIT PB-2306 (No. 2xxx)

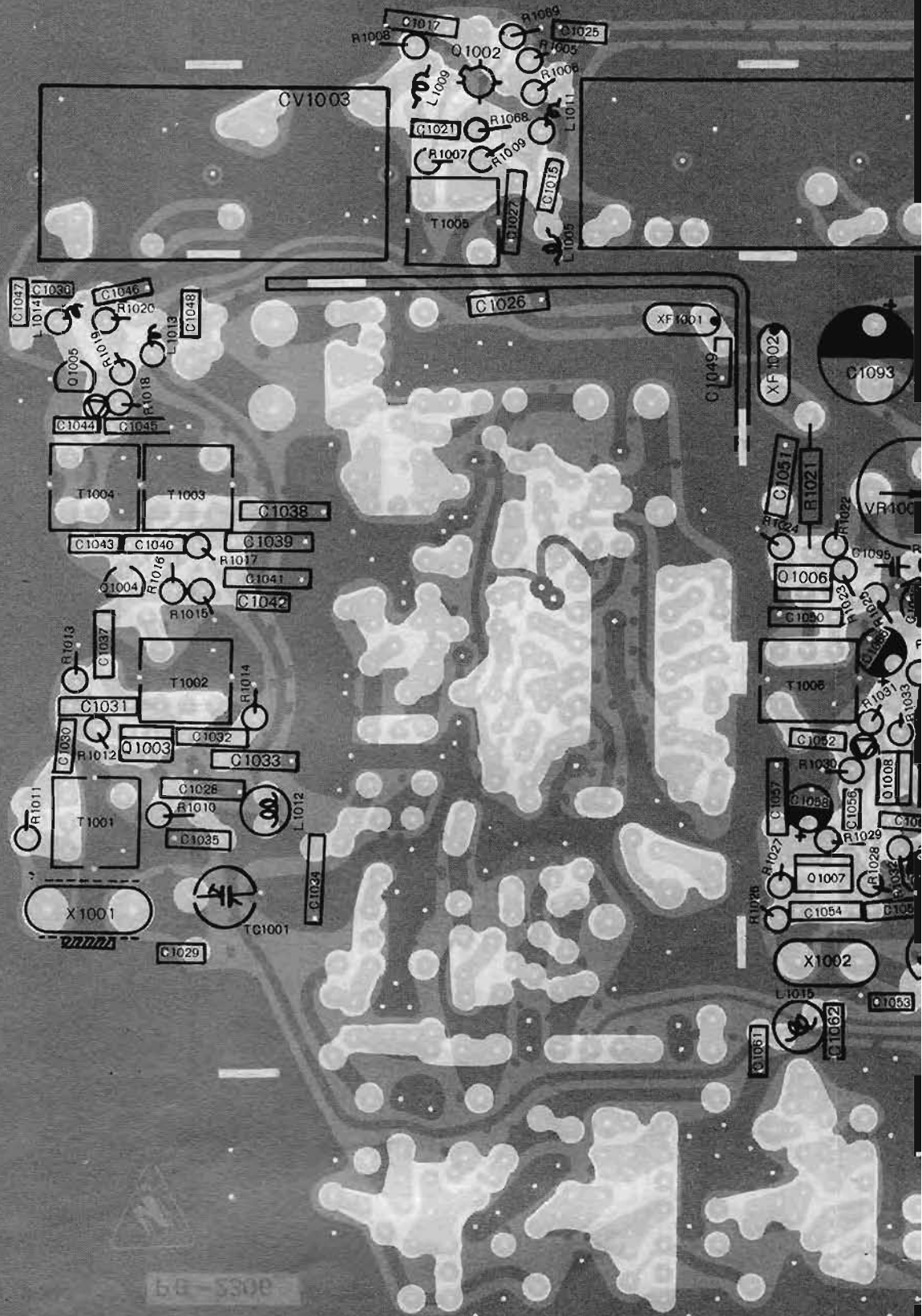


* COMPONENT TABLE

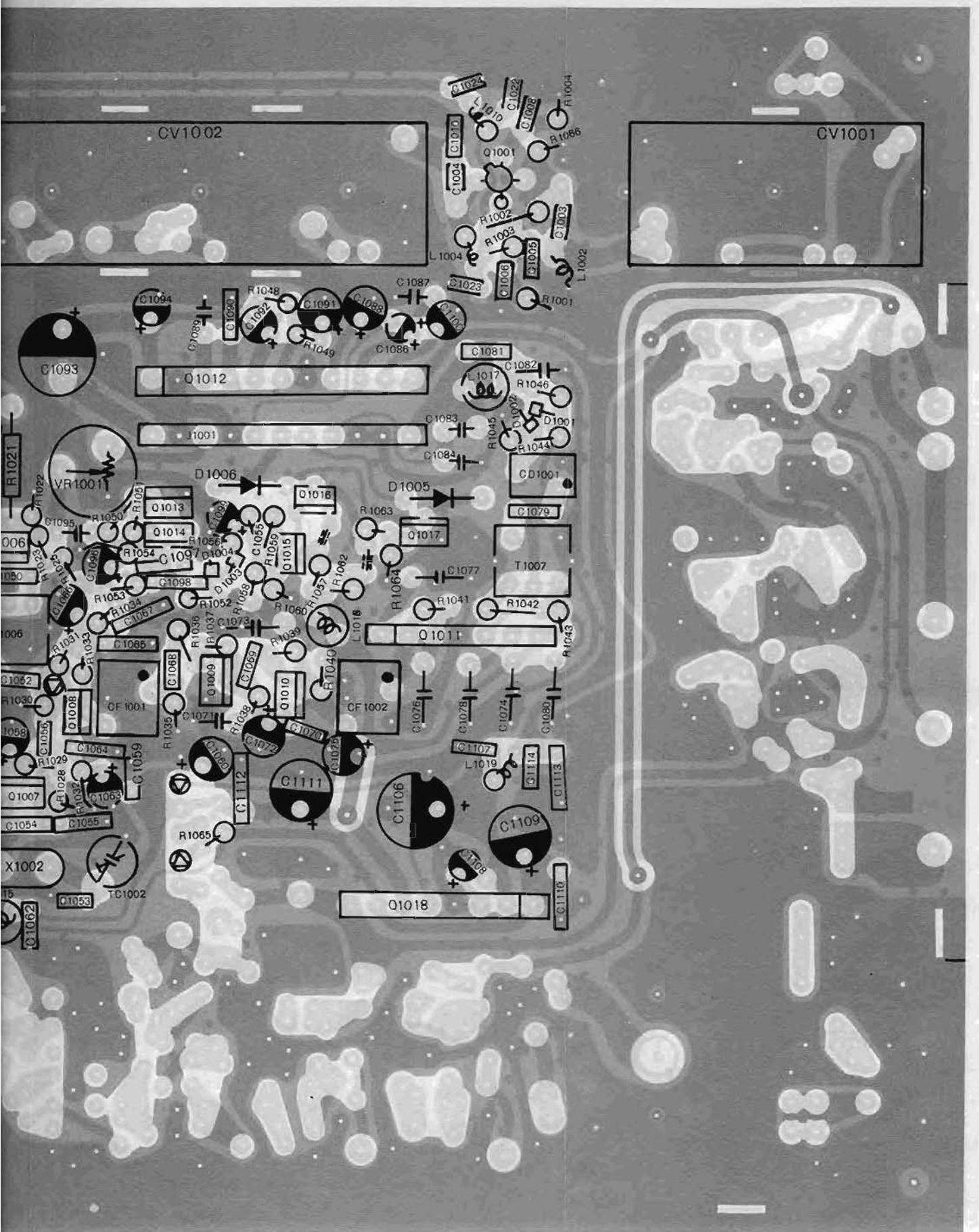
BAND PART	134-148			146-160			160-175		
	BAND PART	134-148	146-160	160-175	BAND PART	134-148	146-160	160-175	
C 18	RH 88pF	RH 56pF	RH 39pF	C 45	CH 10pF	CH 15pF	CH 15pF		
C 21	RH 82pF	RH 68pF	RH 47pF	C 46	CH 12pF	CH 15pF	CH 15pF		
C 22	RH 18pF	RH 15pF	RH 10pF	C 47	CH 10pF	CH 15pF	CH 15pF		
C 24	CH 1pF	CH 1pF	CH 0.5pF	C 48	CH 12pF	CH 15pF	CH 15pF		
C 25	RH 27pF	RH 15pF	RH 12pF	C 49	CH 10pF	CH 15pF	CH 15pF		
C 27	RH 12pF	RH 10pF	RH 8pF	C 50	CH 12pF	CH 15pF	CH 15pF		
C 31	RH 12pF	RH 10pF	RH 8pF	C 89	CH 10pF				
C 32	RH 68pF	RH 47pF	RH 39pF	C 99	CH 10pF				
C 37	CH 1.5pF	CH 2pF	CH 1.5pF	C107	CH 6pF				
C 38	CH 15pF	CH 10pF	CH 10pF	Q 09	M57719L	M57719	M57719		



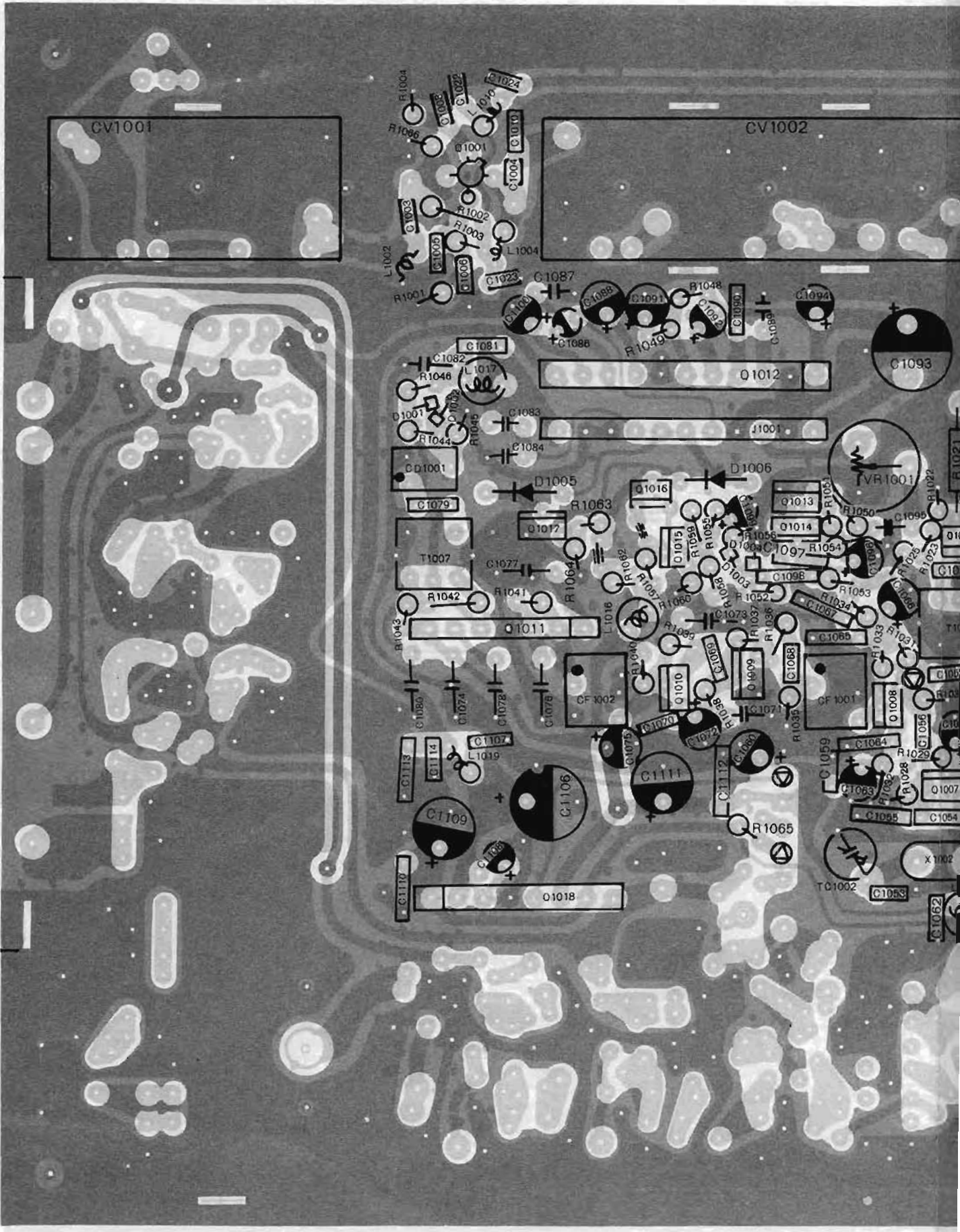
ALL RESISTOR VALUES ARE IN OHMS, 1/4W UNLESS OTHERWISE NOTED
 ALL CAPACITOR VALUES ARE IN UF, 50V UNLESS OTHERWISE NOTED



X UNIT PARTS LAYOUT



Viewed from component side



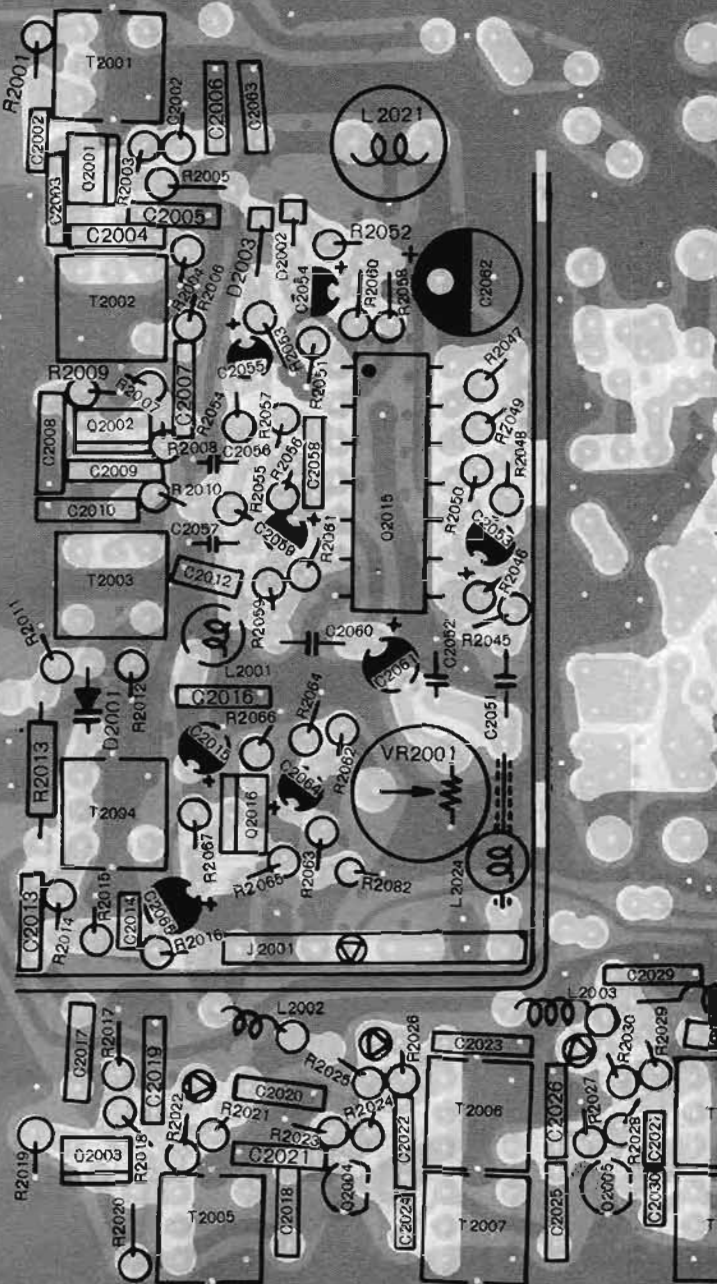
View from reverse, 10x

RX UNIT PARTS LAYOUT

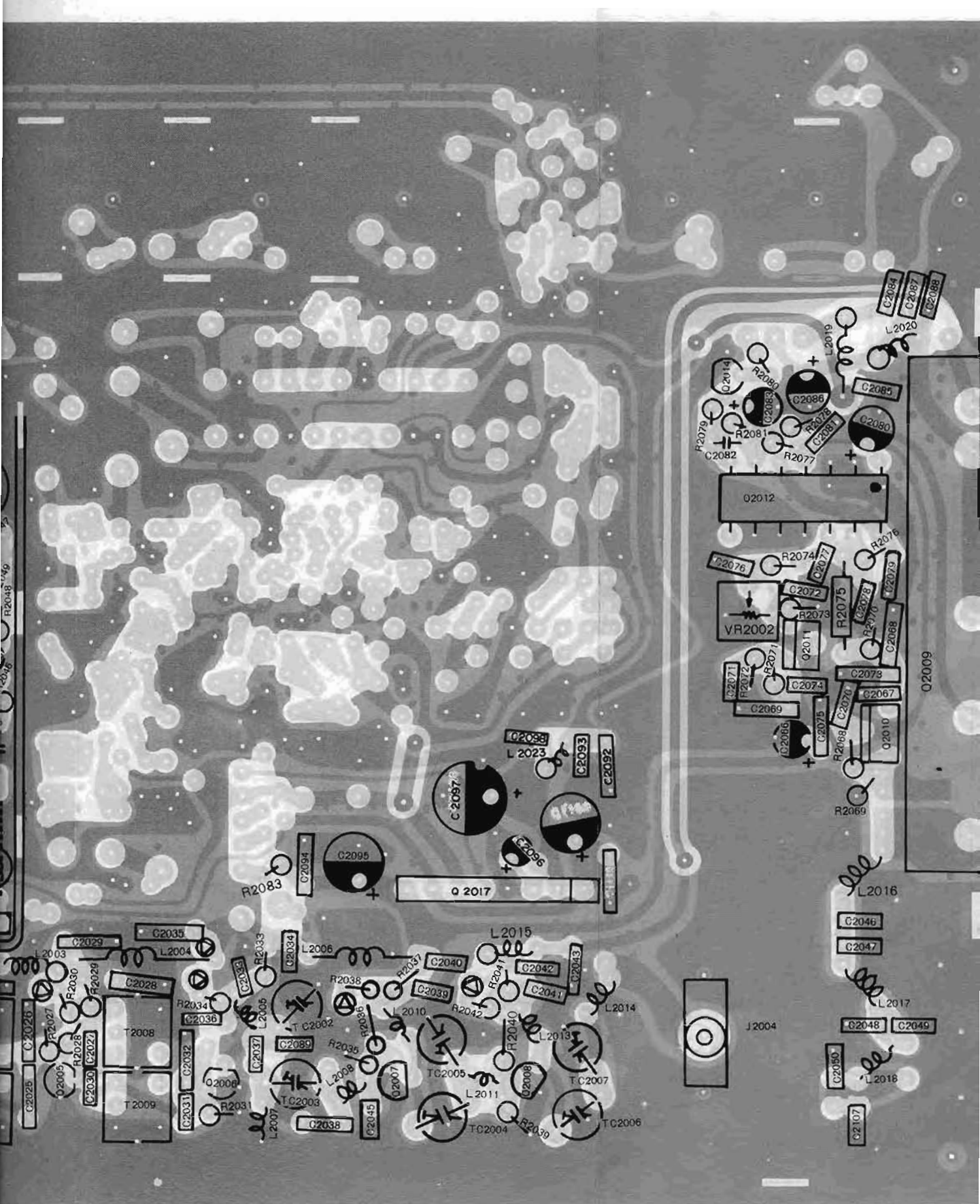


Viewed from solder side

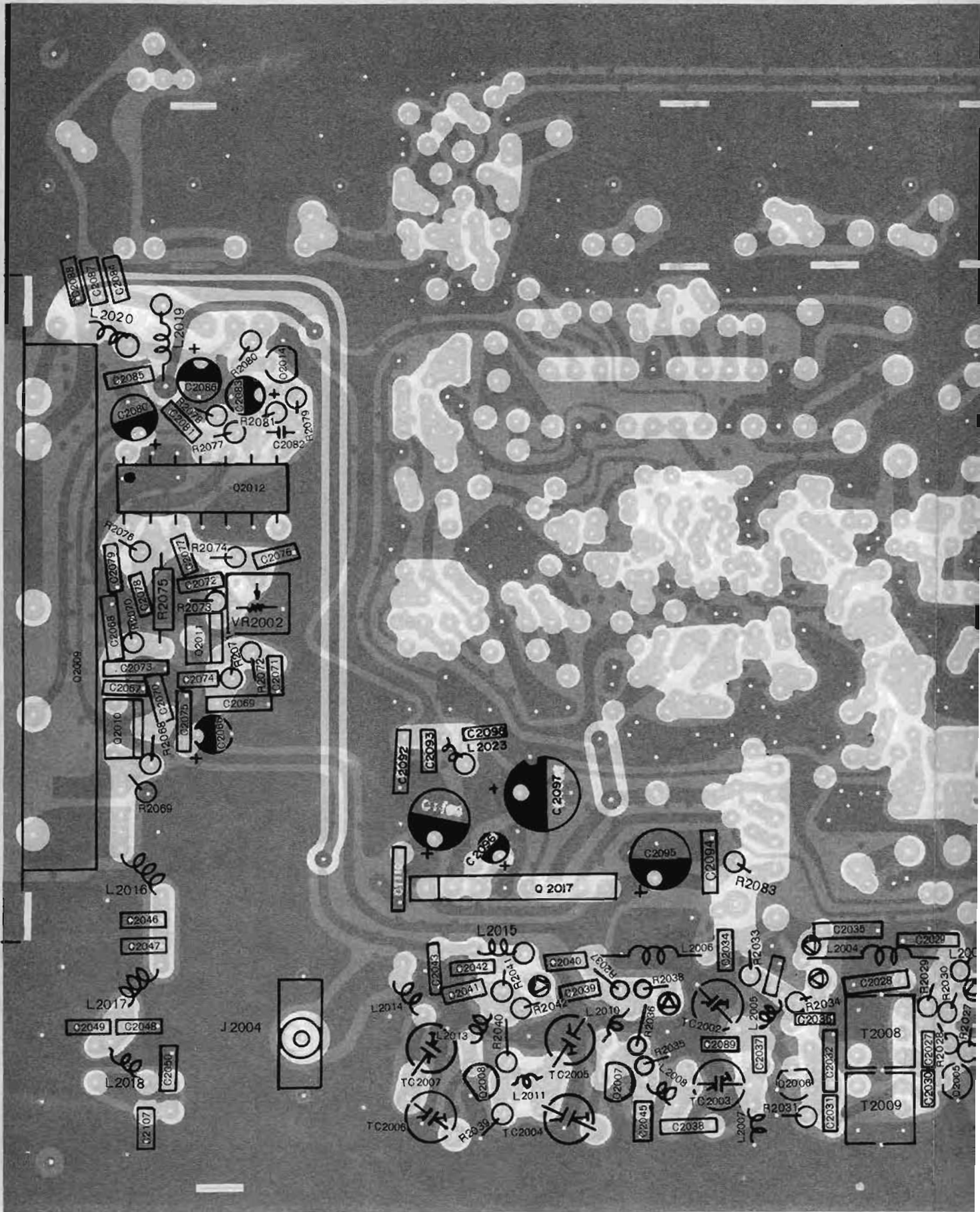
3033-89



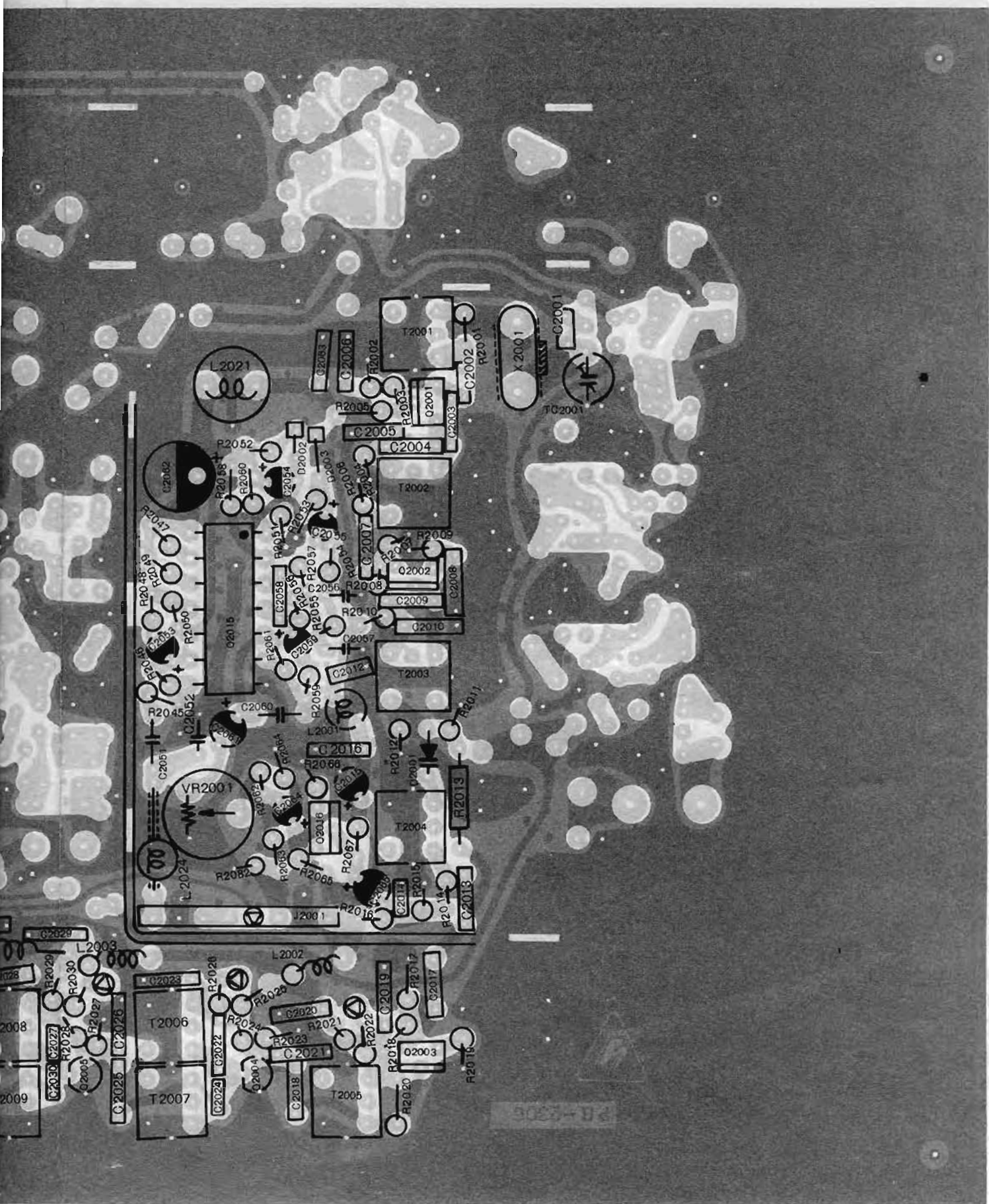
410 TX UNIT PARTS LAYOUT



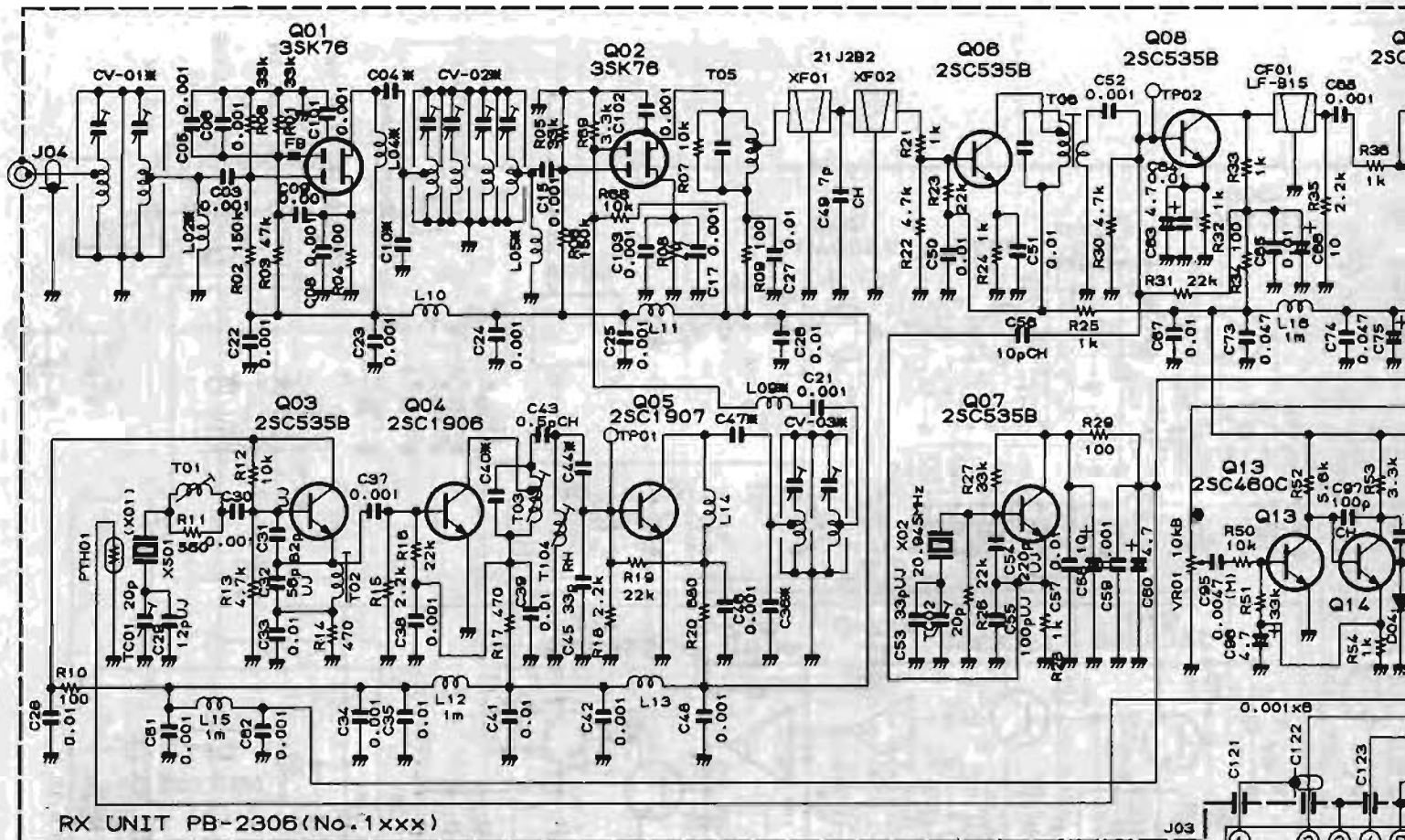
Viewed from component s



UNIT PARTS LAYOUT



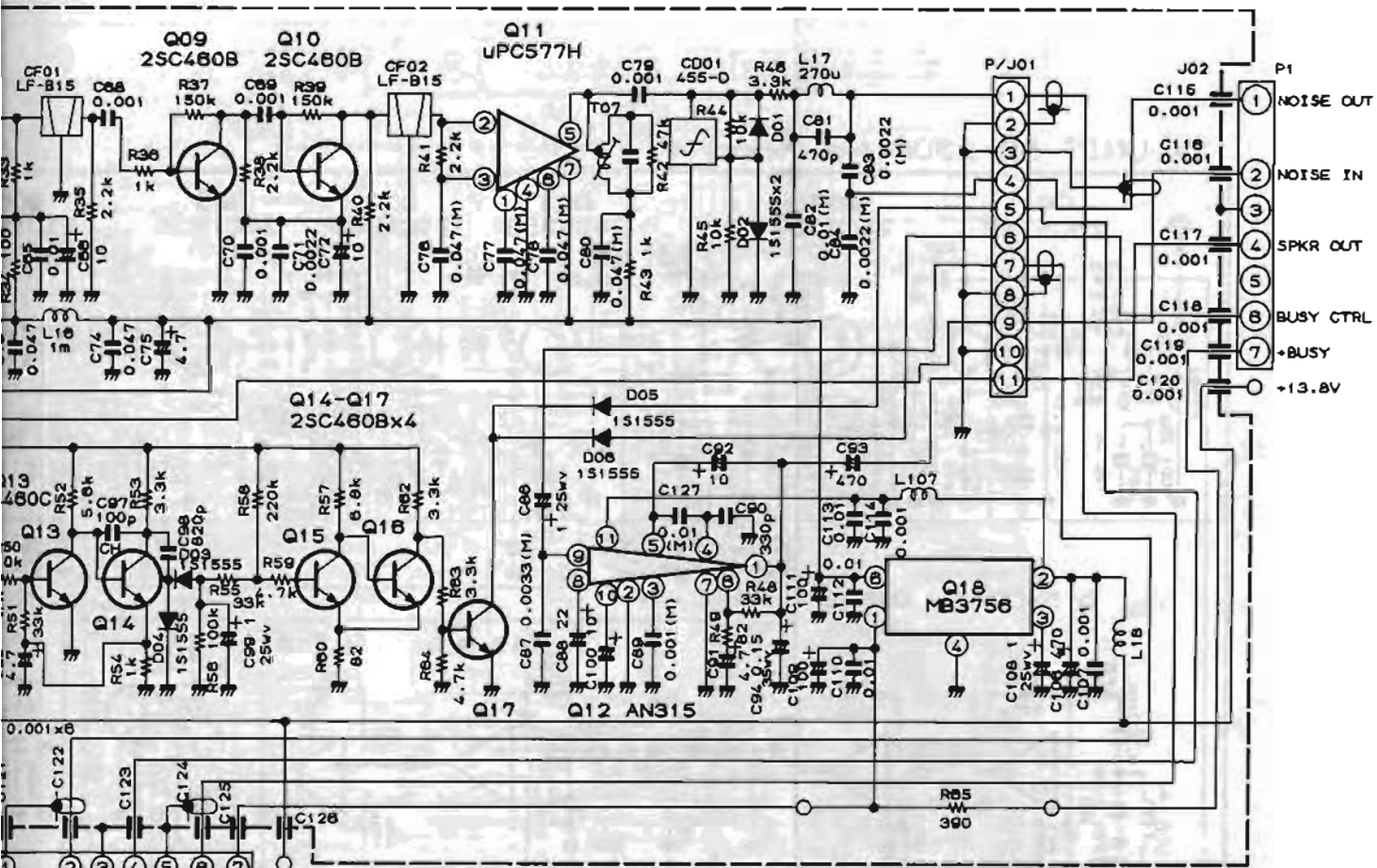
Viewed from solder side



RX UNIT PB-2306 (No. 1xxx)

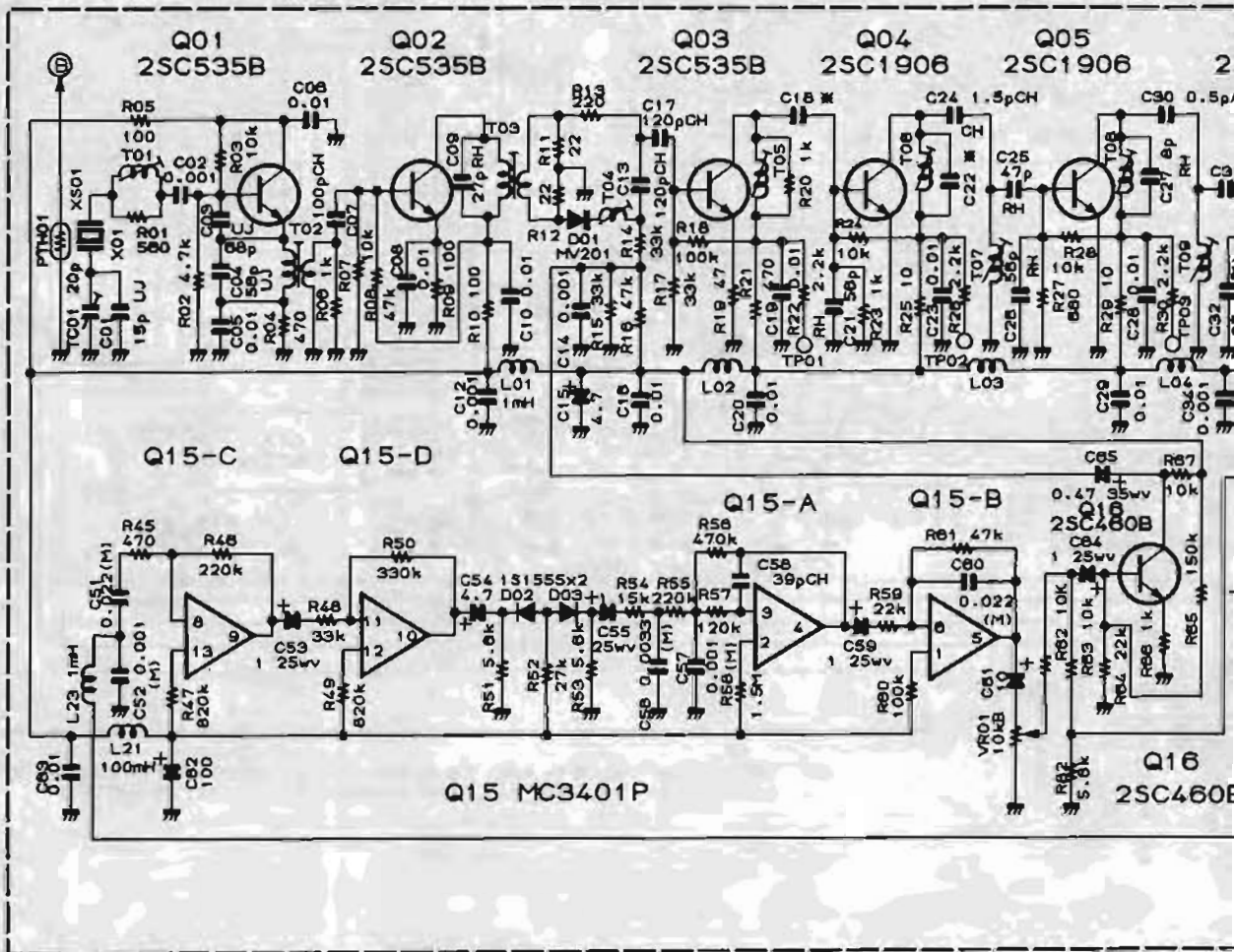
*COMPONENT TABLE

BAND PART	*COMPONENT TABLE					
	400-420	420-430	430-450	450-470	470-490	490-512
C 04	CH 6pF	CH 6pF	CH 5pF	CH 5pF	CH 6pF	CH 6pF
10	CH 12pF	CH 12pF	CH 12pF	CH 12pF	CH 9pF	CH 9pF
36	CH 12pF	CH 12pF	CH 12pF	CH 12pF	CH 12pF	CH 12pF
40	RH 10pF	RH 10pF	RH 8pF	RH 8pF	RH 6pF	RH 6pF
44	RH 12pF	RH 12pF	RH 12pF	RH 12pF	RH 8pF	RH 8pF
45	RH 33pF	RH 33pF	RH 33pF	RH 33pF	RH 22pF	RH 22pF
47	CH 5pF	CH 5pF	CH 5pF	CH 5pF	CH 4pF	CH 4pF
CV 01	1032A	1031A	1067A	1019A	1027A	1028A
02	1023A	1024A	1051A	1009A	1013A	1014A
03	1033A	1032A	1088A	1018A	1026A	1027A



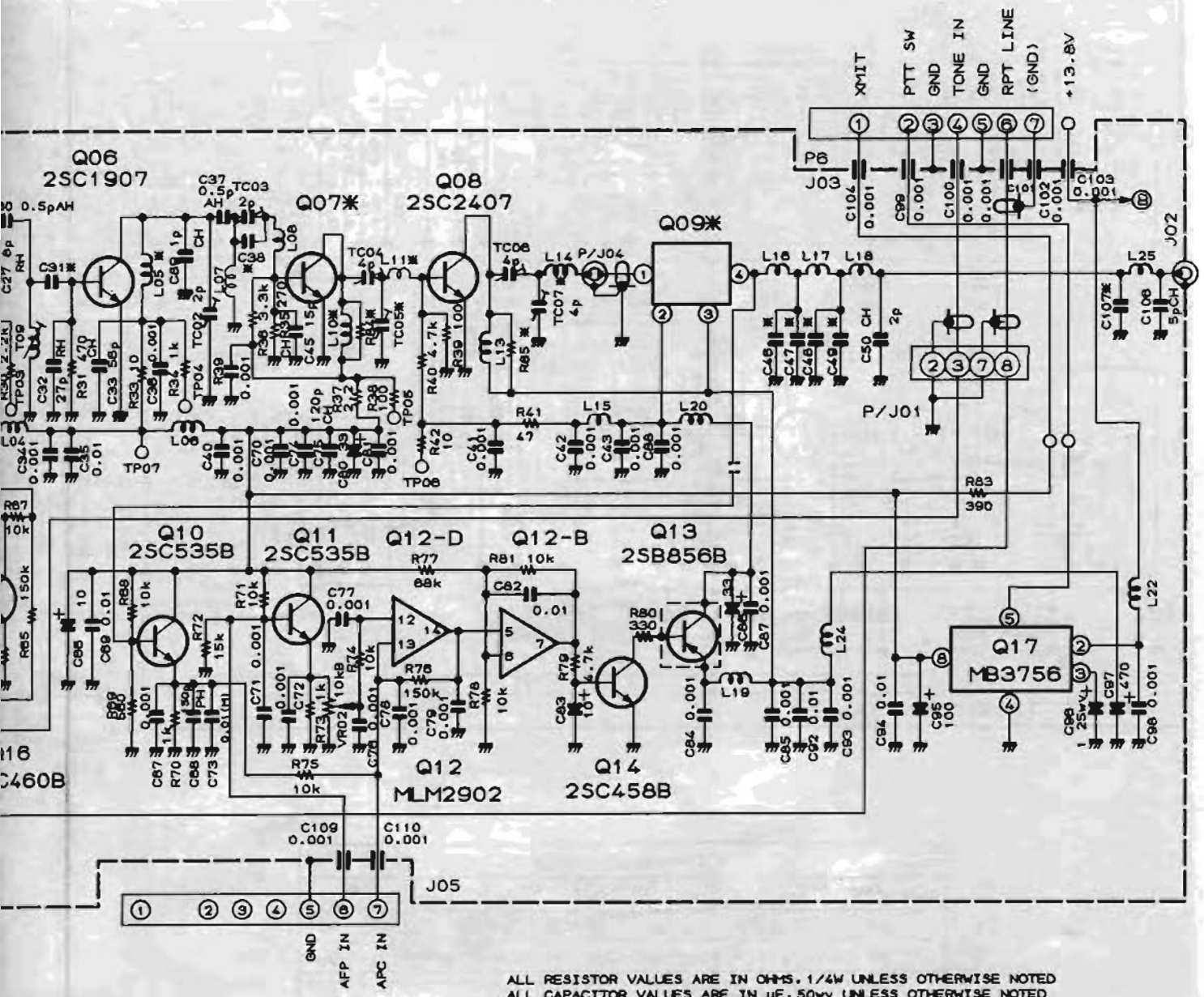
ALL RESISTOR VALUES ARE IN OHMS, 1/4W UNLESS OTHERWISE NOTED
 ALL CAPACITOR VALUES ARE IN uF, UNLESS OTHERWISE NOTED

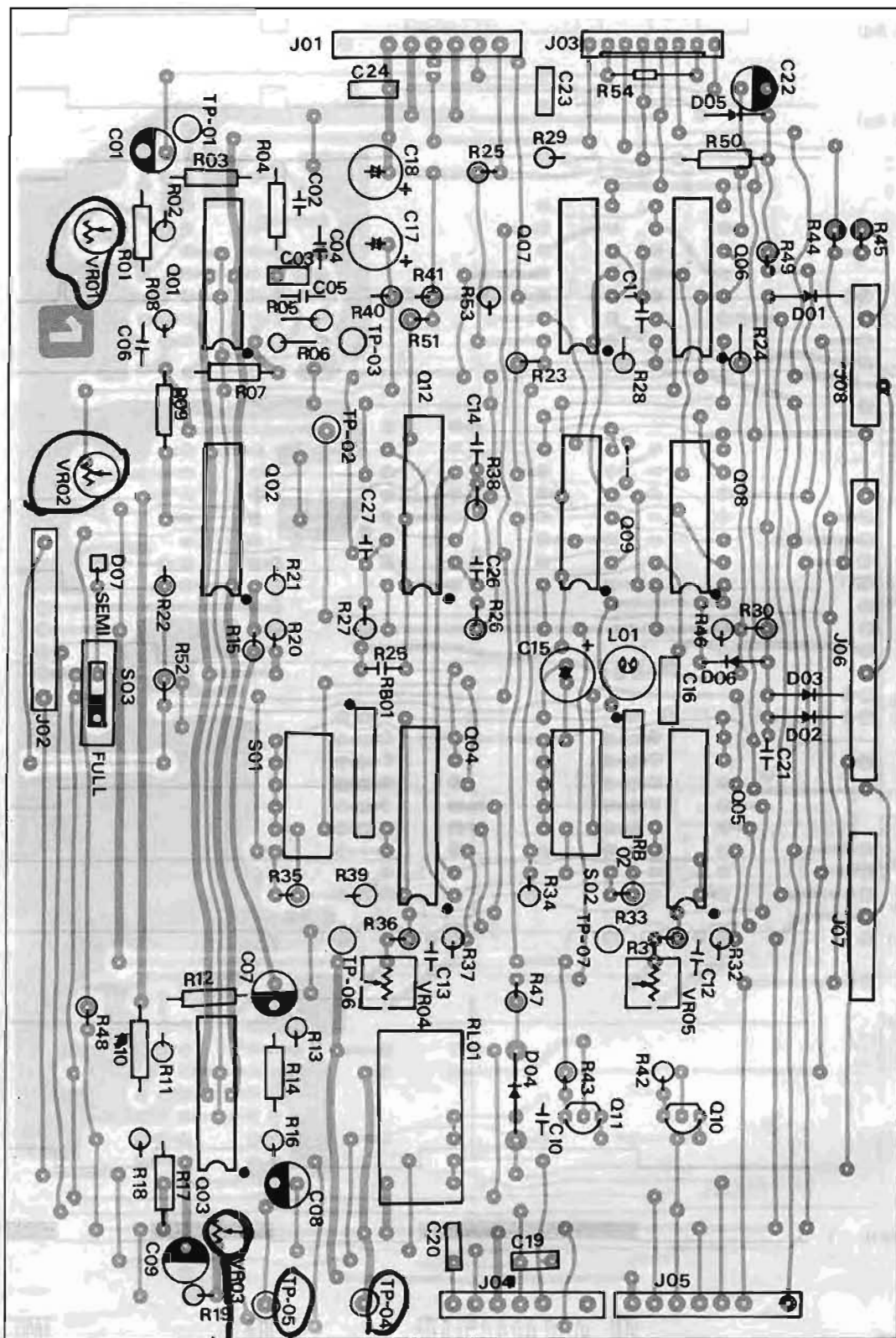
TX UNIT PB-2306 (No. 2xxx)



* COMPONENT TABLE

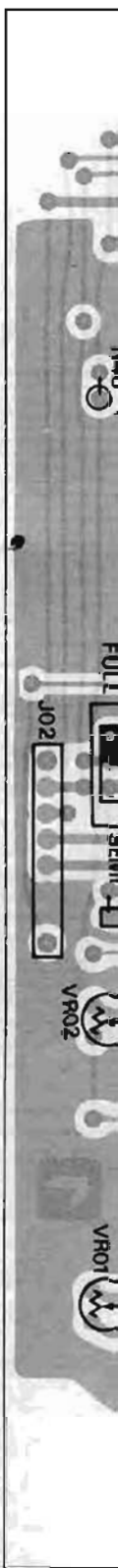
BAND PART	400-420	420-430	430-450	450-470	470-490	490-512
Q 07	25C1907	25C1907	25C1907	25C1907	25C1907	25C2407
Q 09	M57704L	M57704L	M57704M	M57704H	M57704U	M57704SH
C 18	RH 22pF	RH 22pF	RH 18pF	RH 18pF	RH 18pF	RH 15pF
C 22	RH 39pF	RH 39pF	RH 33pF	RH 33pF	RH 33pF	RH 33pF
C 31	RH 18pF	RH 18pF	RH 12pF	RH 12pF	RH 12pF	RH 12pF
C 38	CH 2pF	CH 2pF	CH 1pF	CH 1pF	CH 1pF	CH 1pF
C 46	CH 5pF	CH 5pF	CH 3pF	CH 3pF	CH 3pF	CH 3pF
C 47	CH 5pF	CH 5pF	CH 3pF	CH 3pF	CH 3pF	CH 3pF
C 48	CH 3pF	CH 3pF	CH 2pF	CH 2pF	CH 1pF	CH 1pF
C 49	CH 3pF	CH 3pF	CH 2pF	CH 2pF	PH 1pF	CH 1pF
C107	CH 3pF	CH 3pF	CH 3pF	CH 3pF	CH 3pF	CH 2pF
TC 05	CH 2pF	CH 2pF	CH 2pF	CH 2pF	CH 4pF	CH 4pF
R 84						100
R 85						470



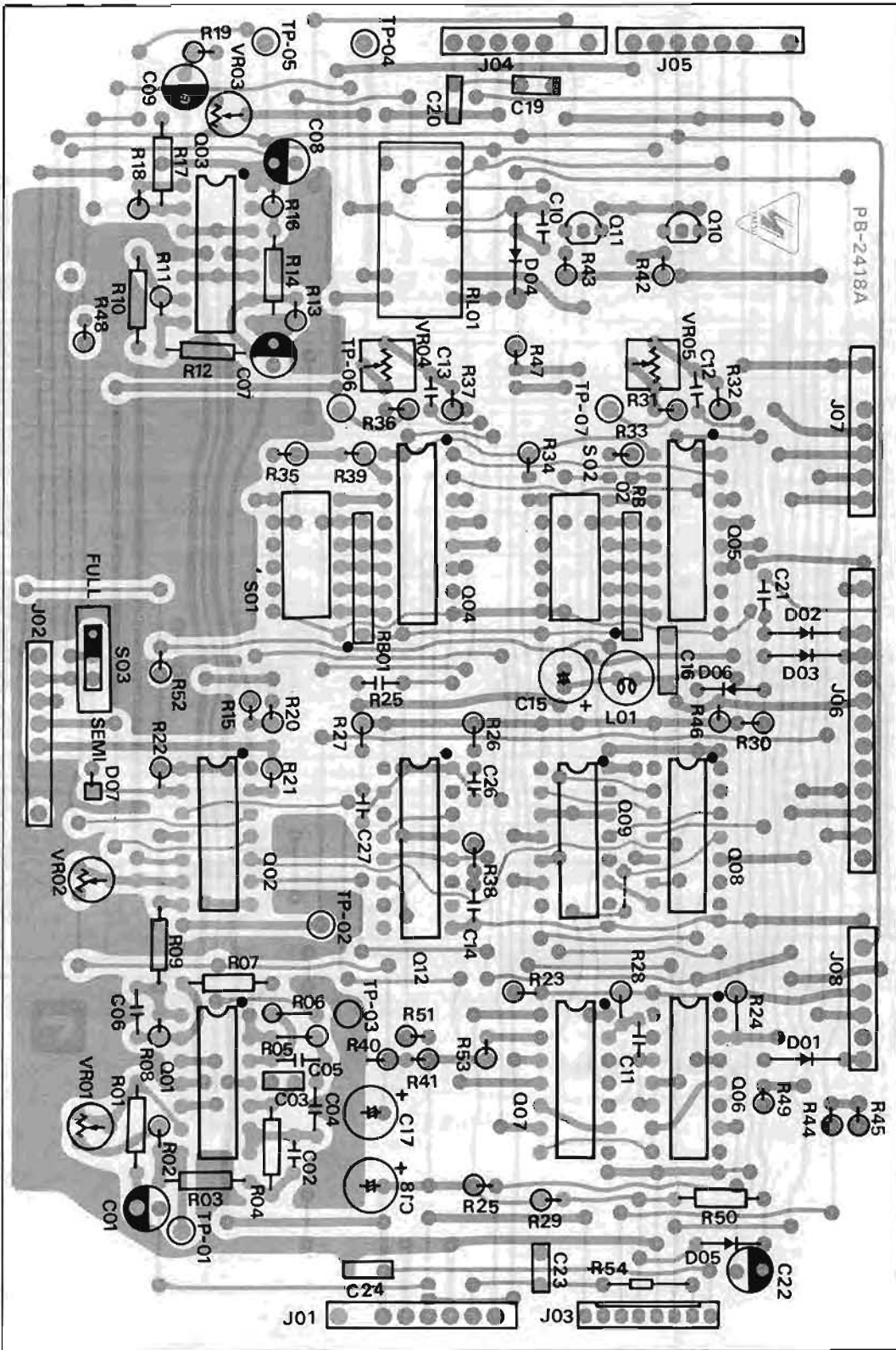


Viewed from component side

TP-04 SIGNAL
 TP-05
 TP-03
 VR03
 VR01
 VR02
 FULL
 SEMI
 D07
 S03
 J02

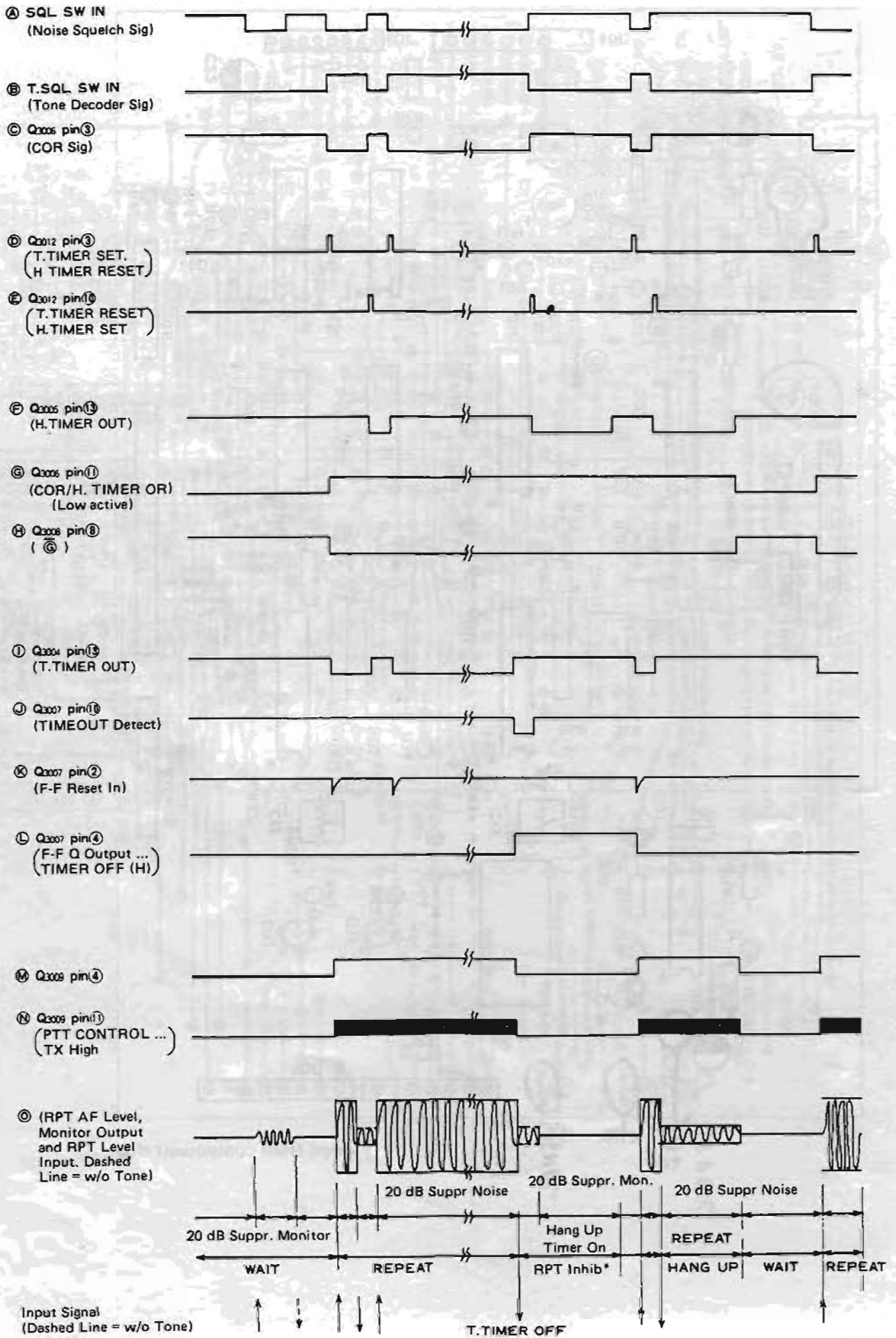


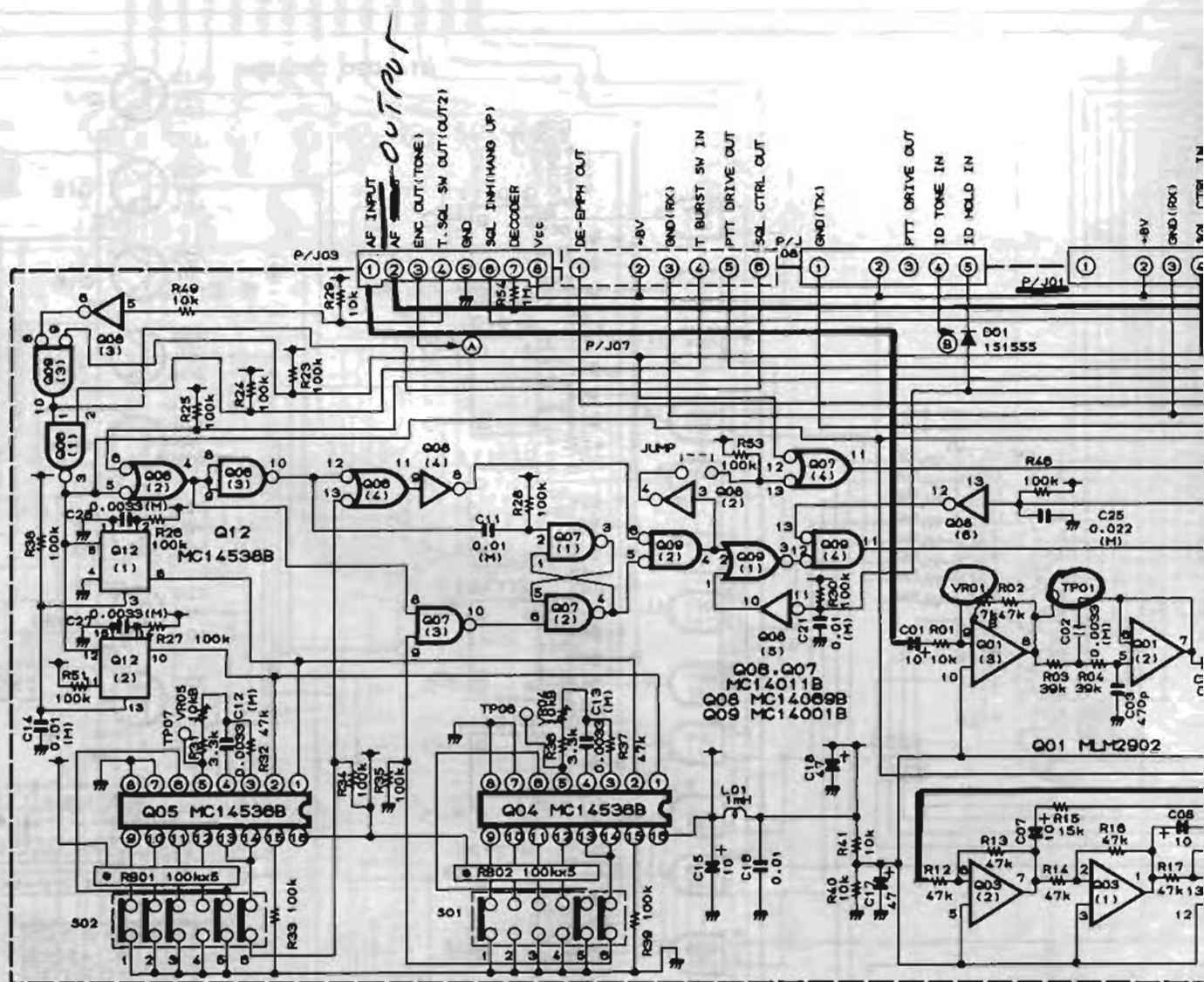
COR UNIT PARTS LAYOUT



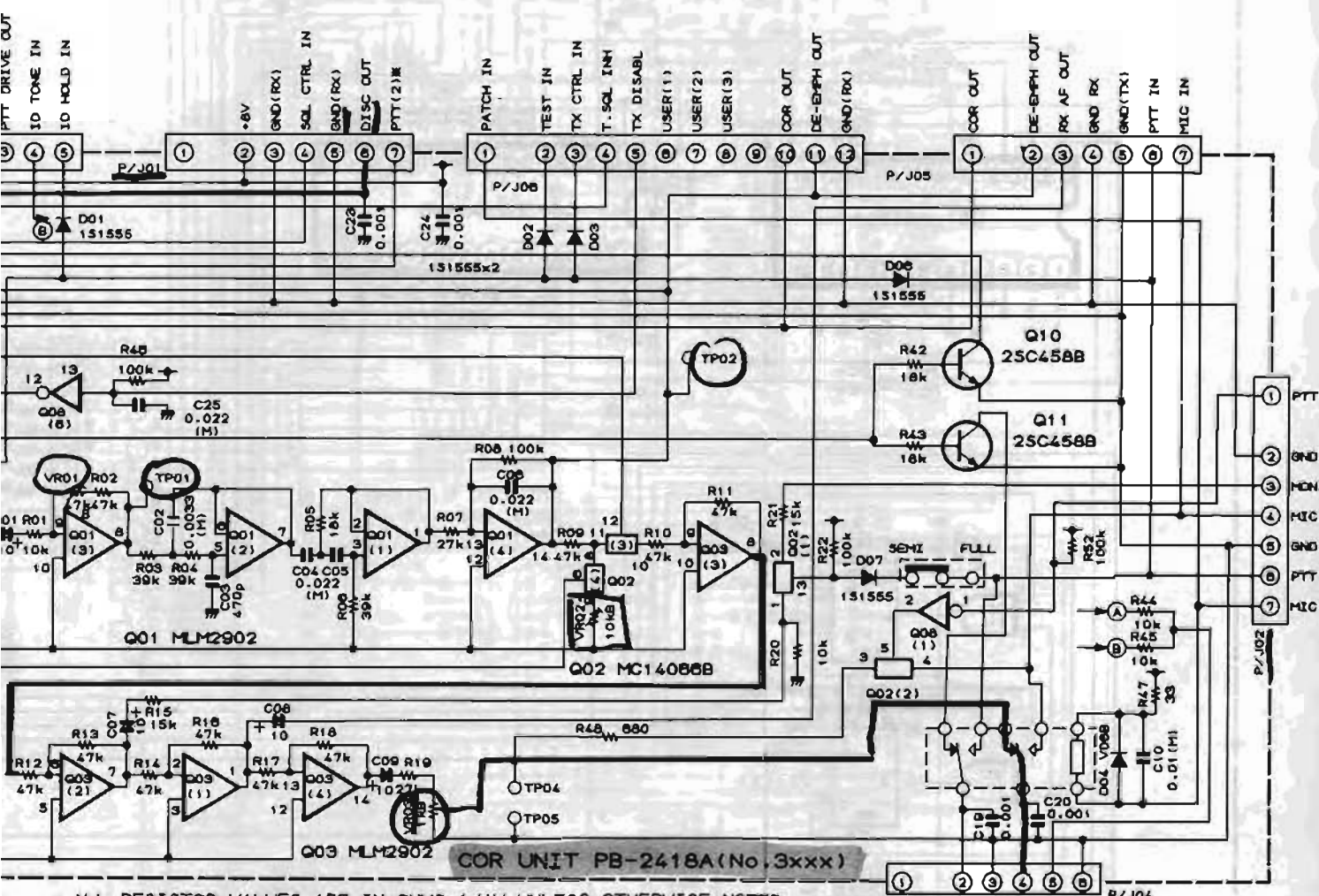
Viewed from solder side

COR TIMING CHART



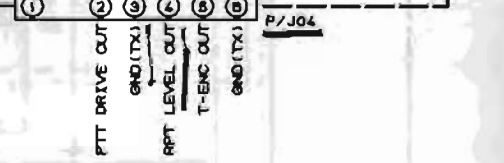


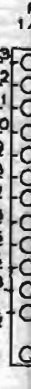
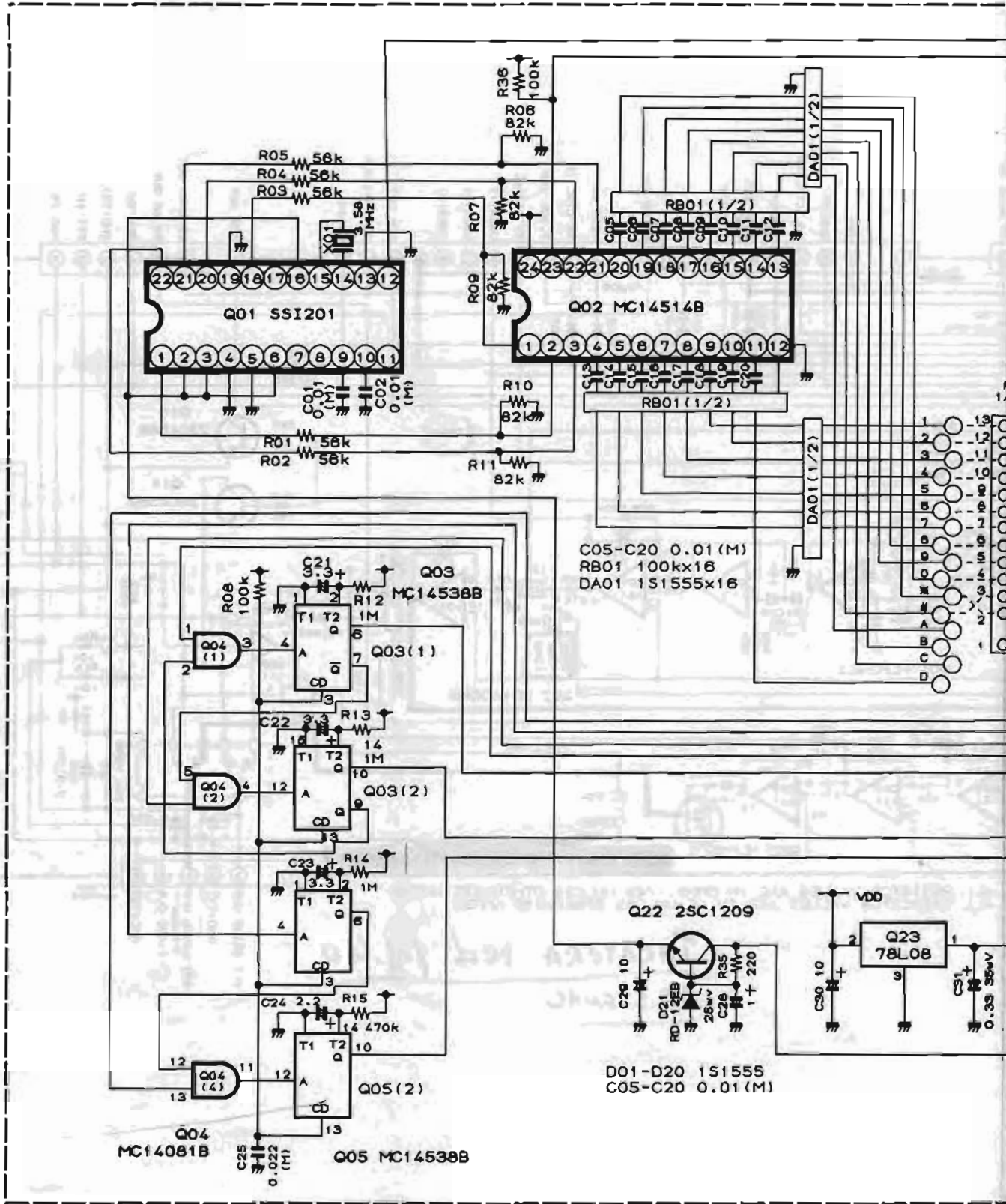
ALL RESISTOR VALUES
 ALL CAPACITOR VALUE



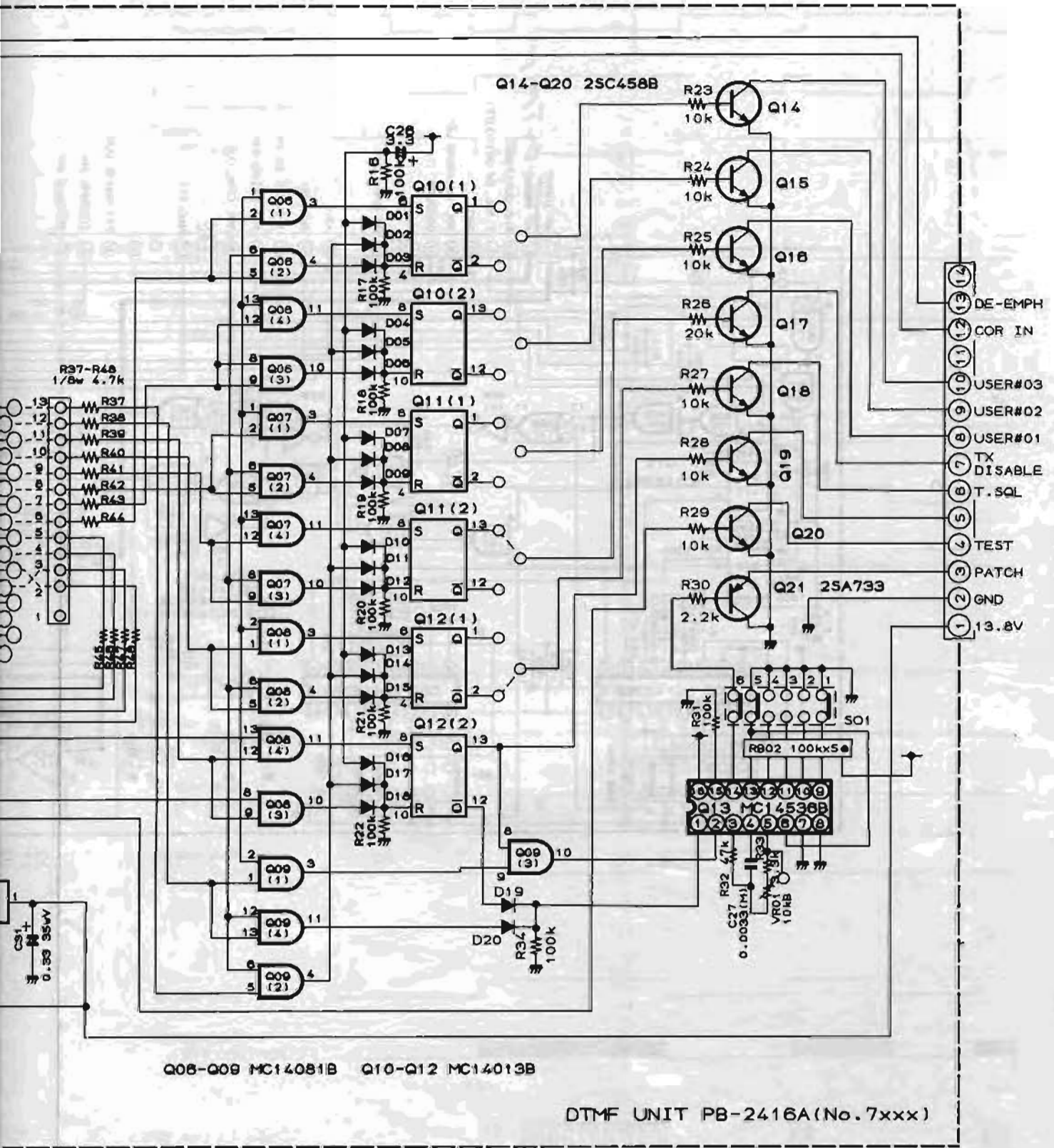
ALL RESISTOR VALUES ARE IN OHMS, 1/4W UNLESS OTHERWISE NOTED
 ALL CAPACITOR VALUES ARE IN uF, UNLESS OTHERWISE NOTED

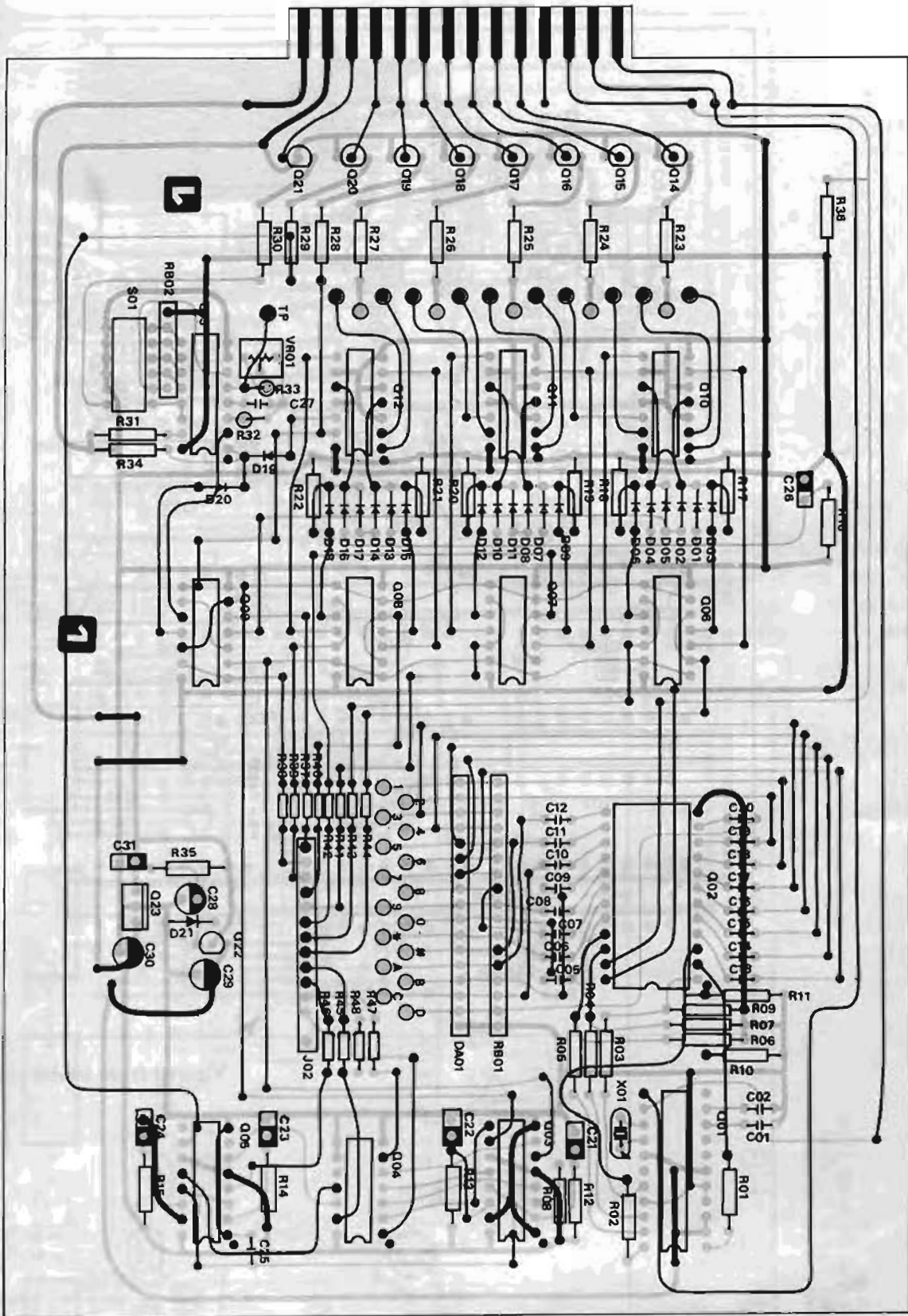
TARATURA ved. pg. 40
AF. SIGNAL





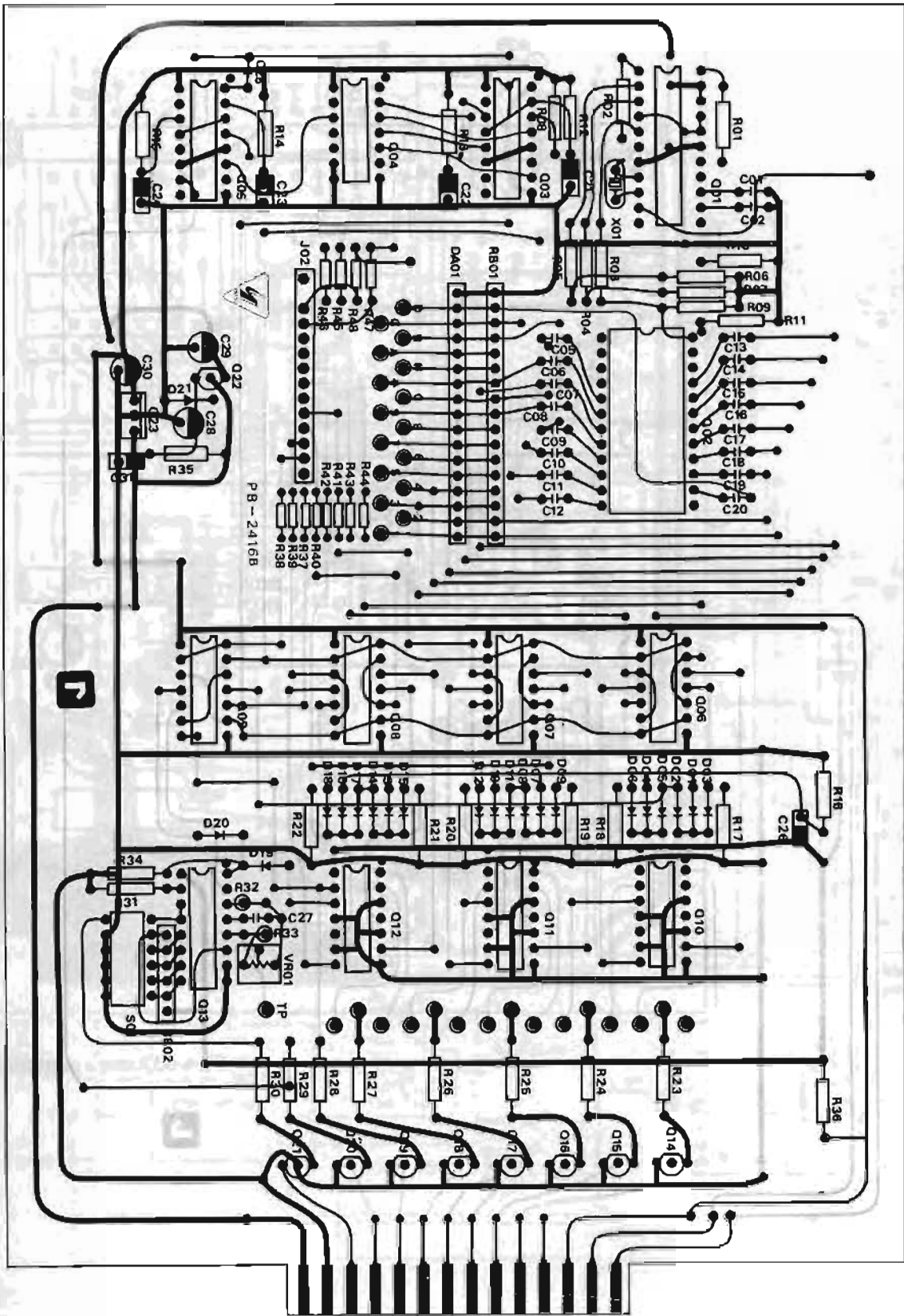
D01-D20 151555
 C05-C20 0.01 (M)





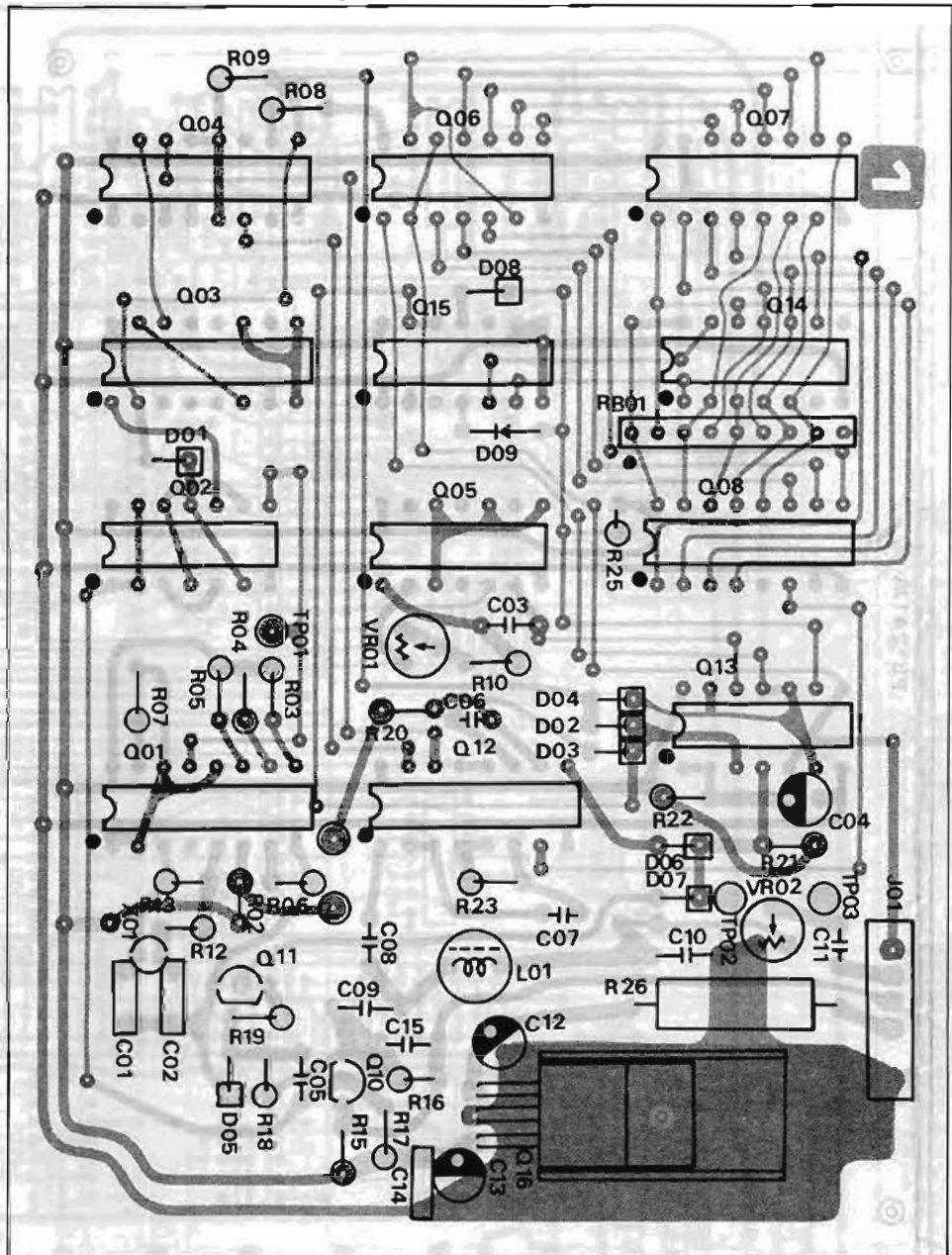
Viewed from component side

DTMF UNIT PARTS LAYOUT



Viewed from solder side

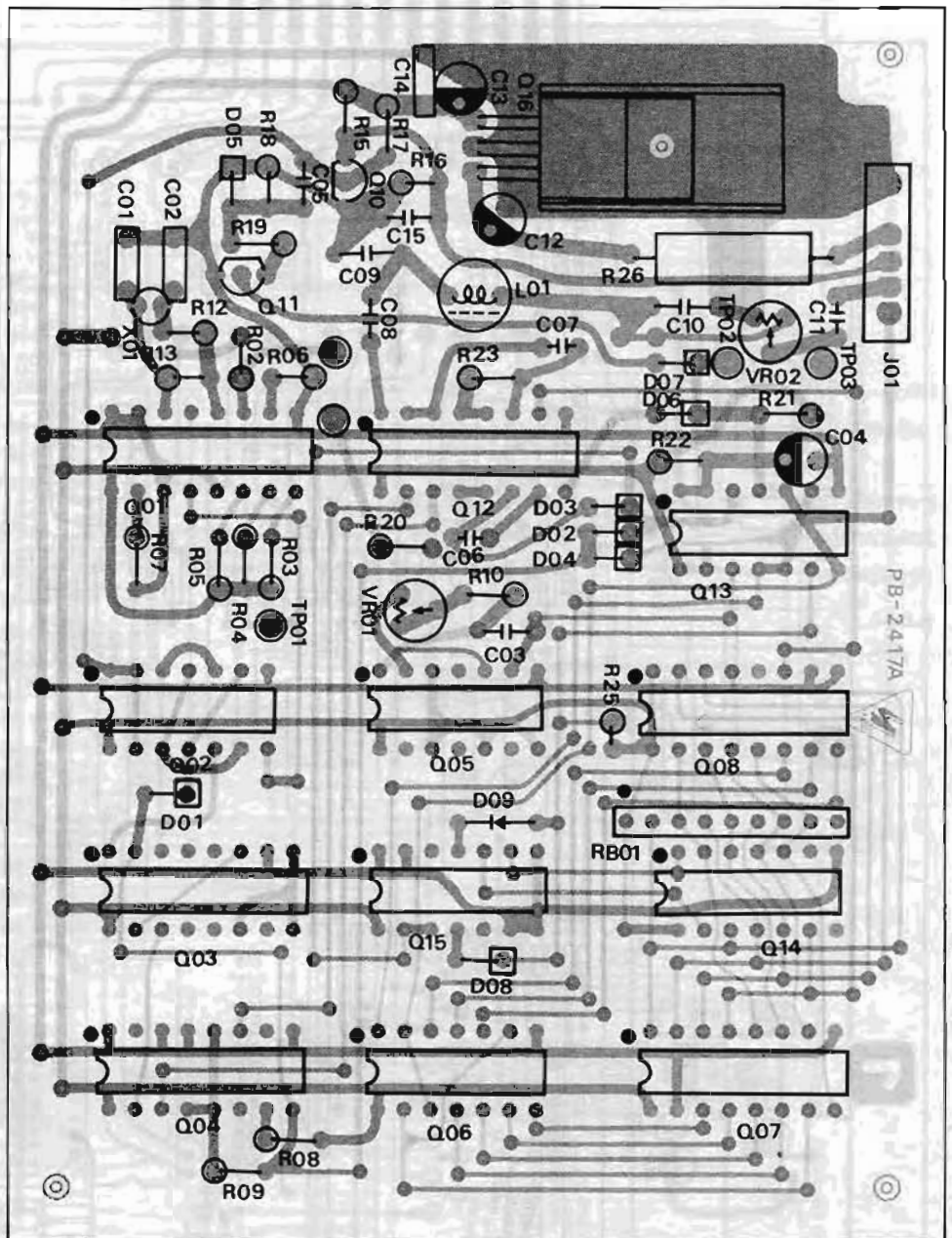
ID UNIT PARTS LAYOUT



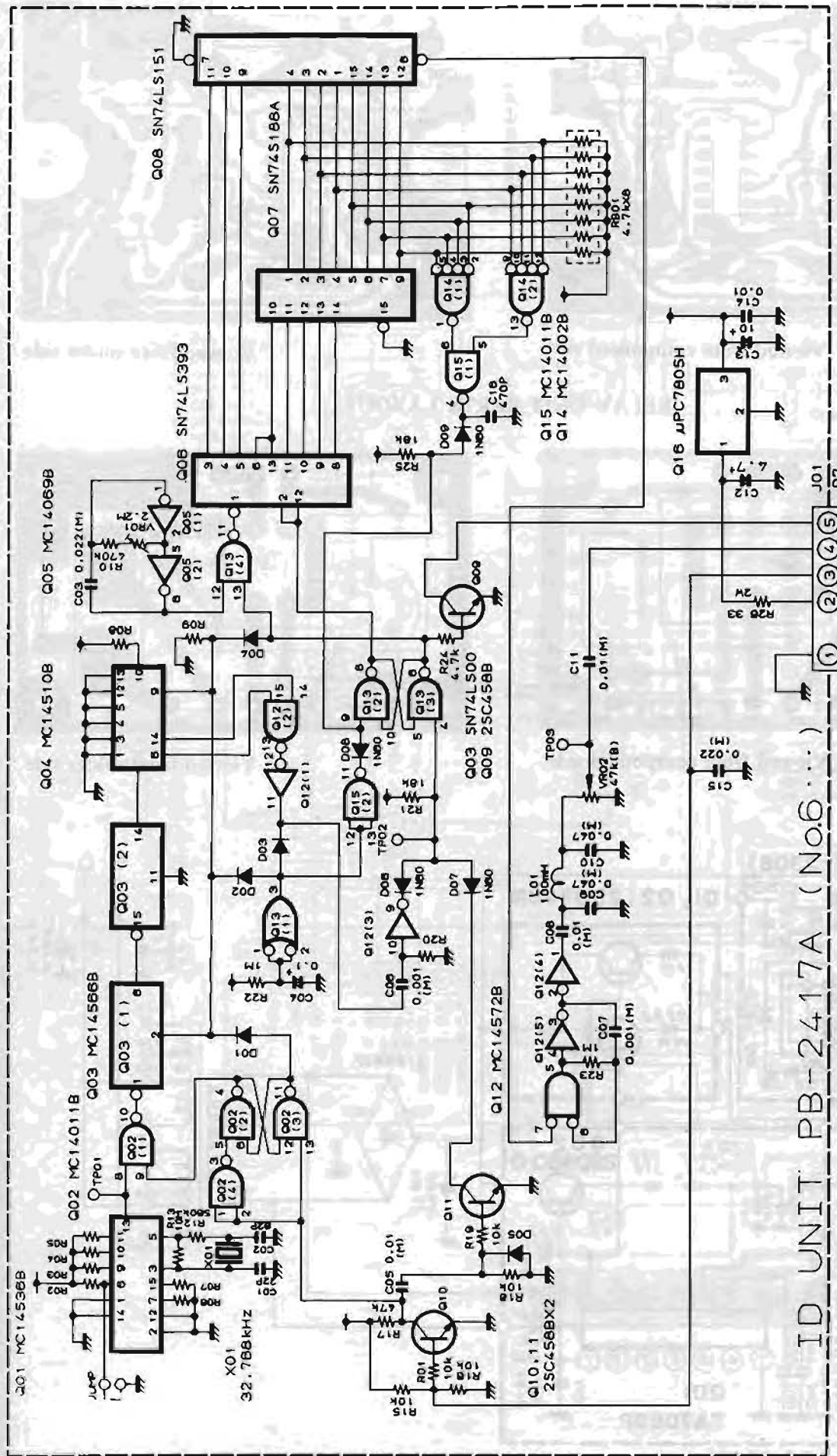
Viewed from component side



Component side



Viewed from solder side

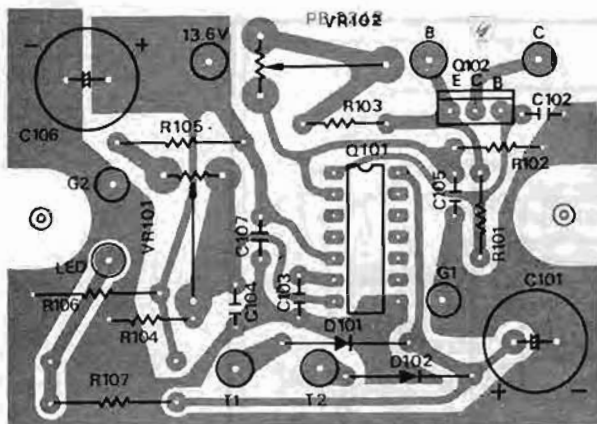


ID UNIT PB-2417A (No.6 ...)

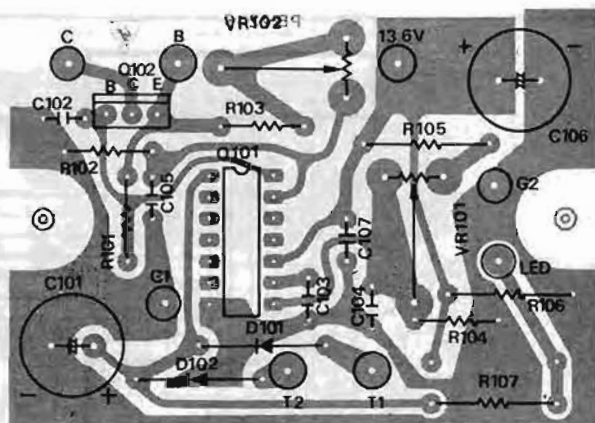
- (1) GND(TX)
- (2)+13V
- (3) PTT DRIVE
- (4) ID TONE OUT
- (5) ID HOLD OUT

DIODES ARE 1N555 UNLESS OTHERWISE NOTED.
 CAPACITOR VALUES ARE IN μ F, 50WV;
 RESISTOR VALUES ARE IN OHMS, 1/4W;
 OTHERWISE 47k, 1/4W.

REG UNIT PARTS LAYOUT

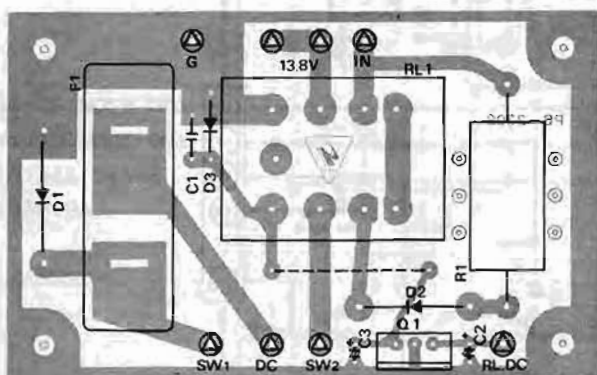


Viewed from component side

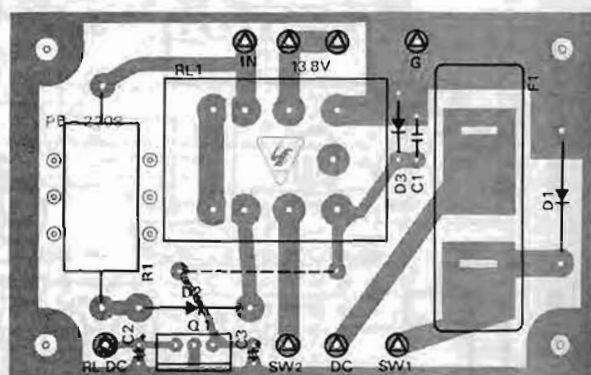


Viewed from solder side

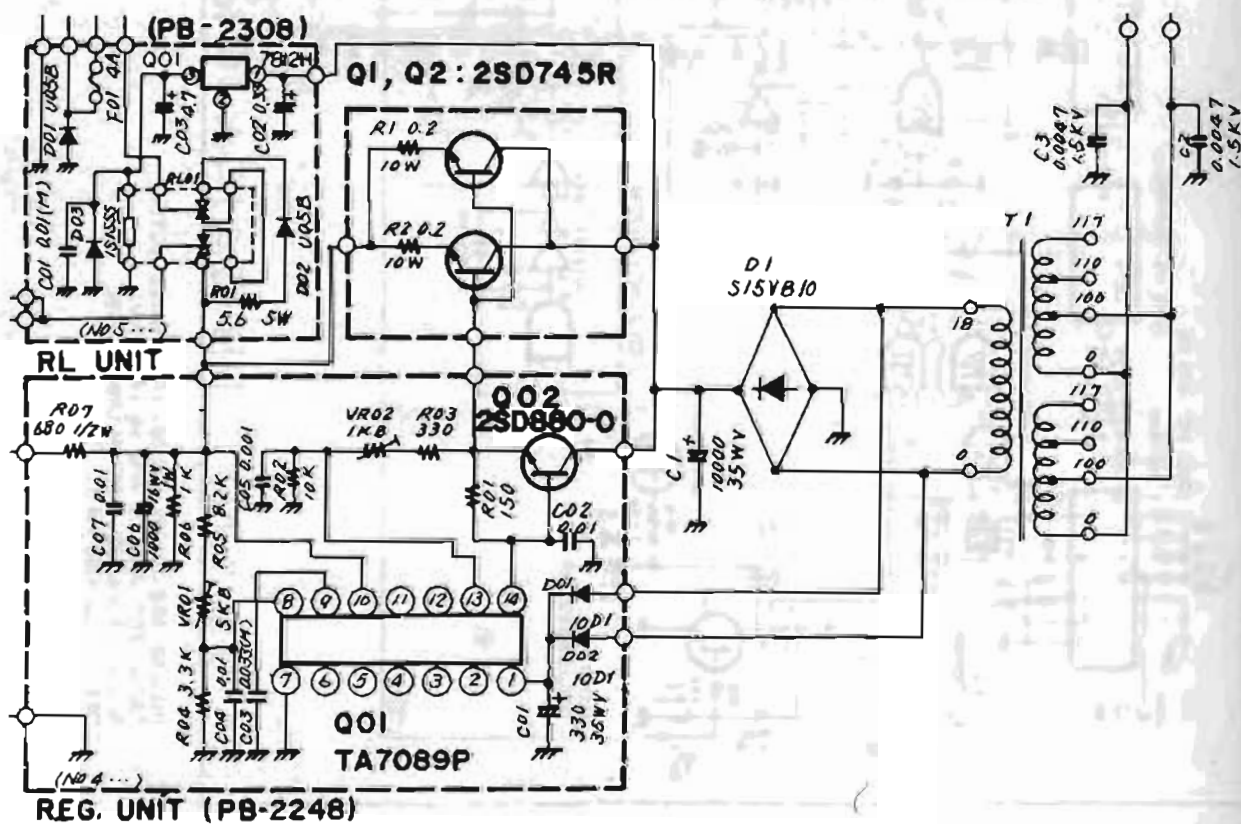
RELAY UNIT PARTS LAYOUT

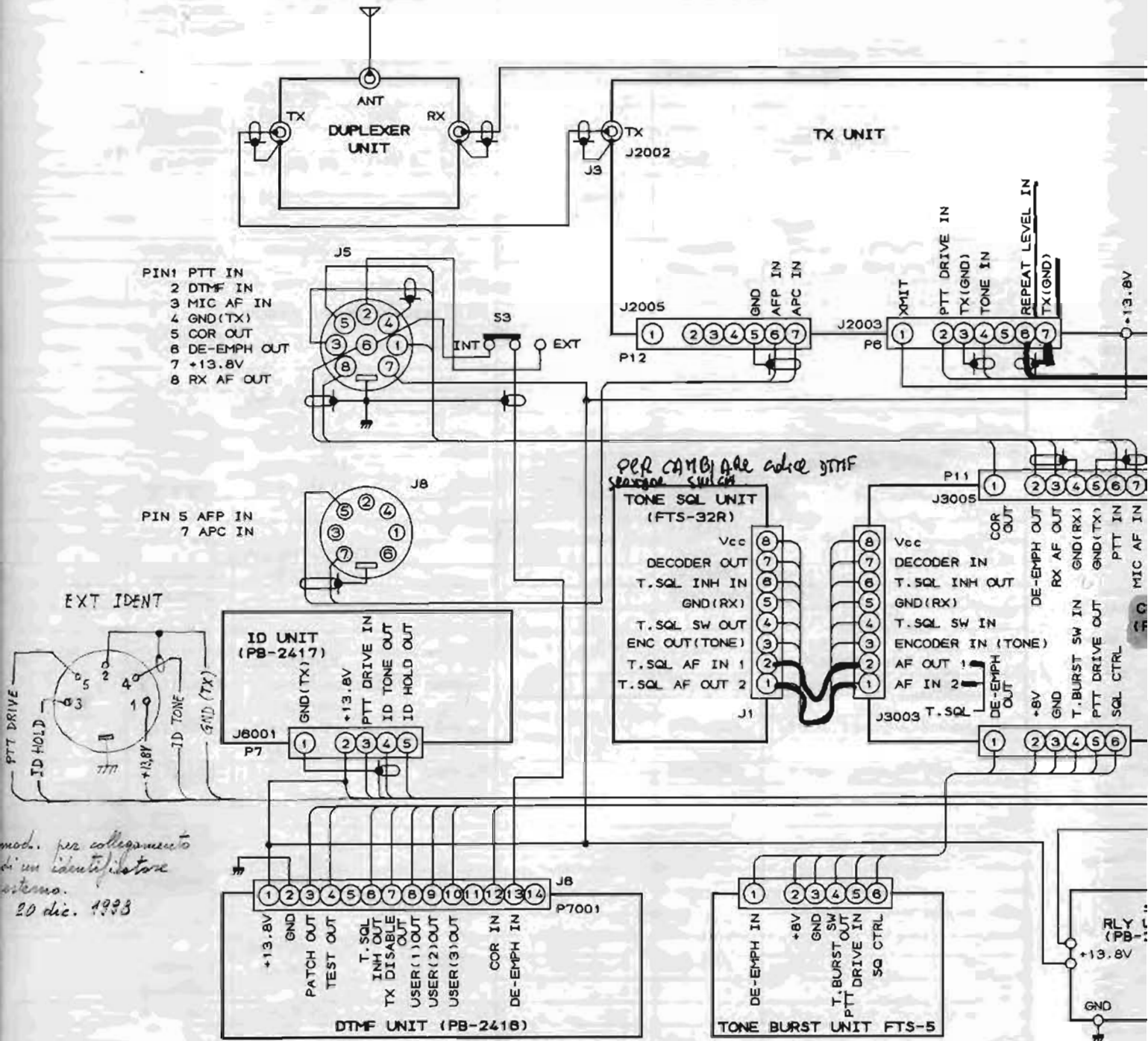


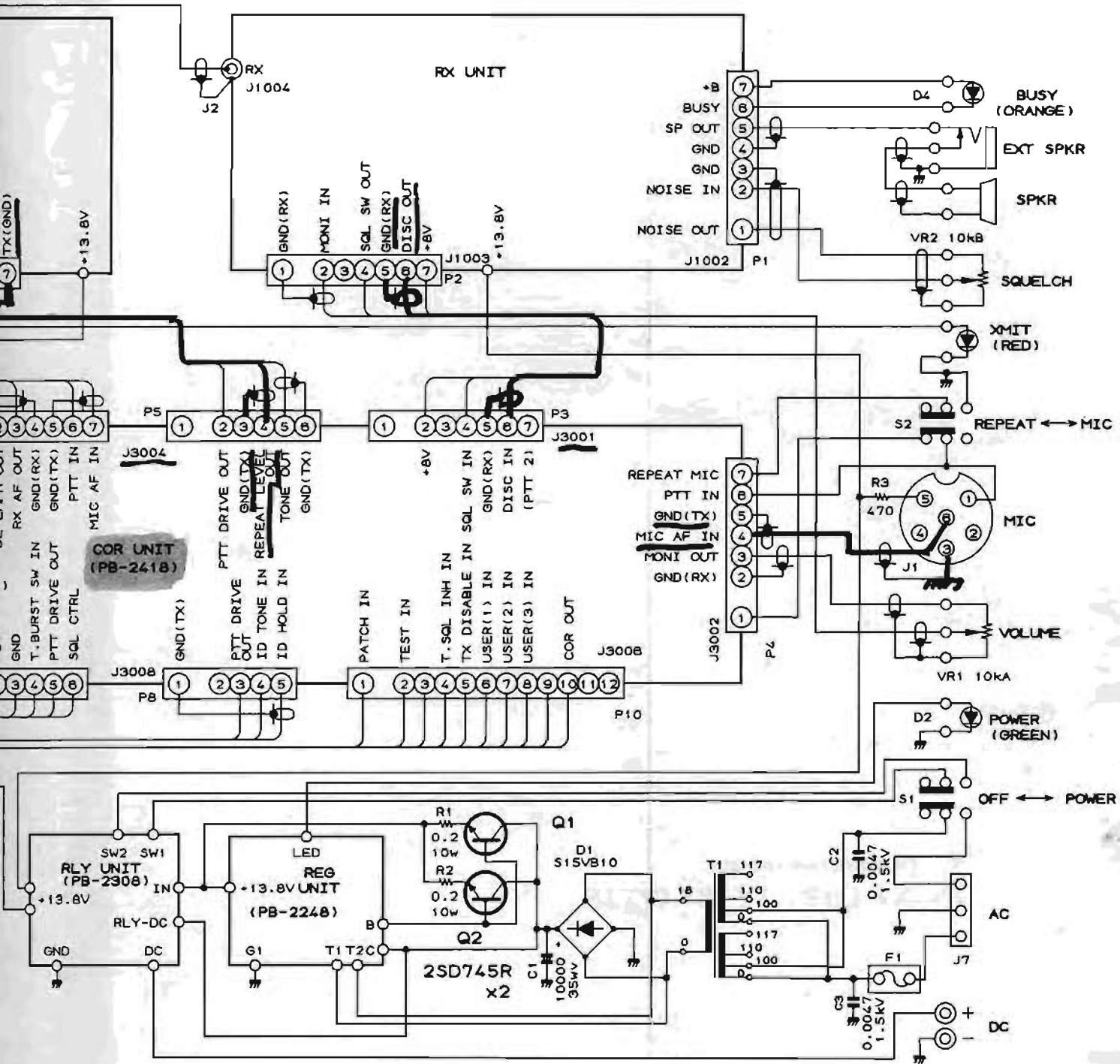
Viewed from component side



Viewed from solder side



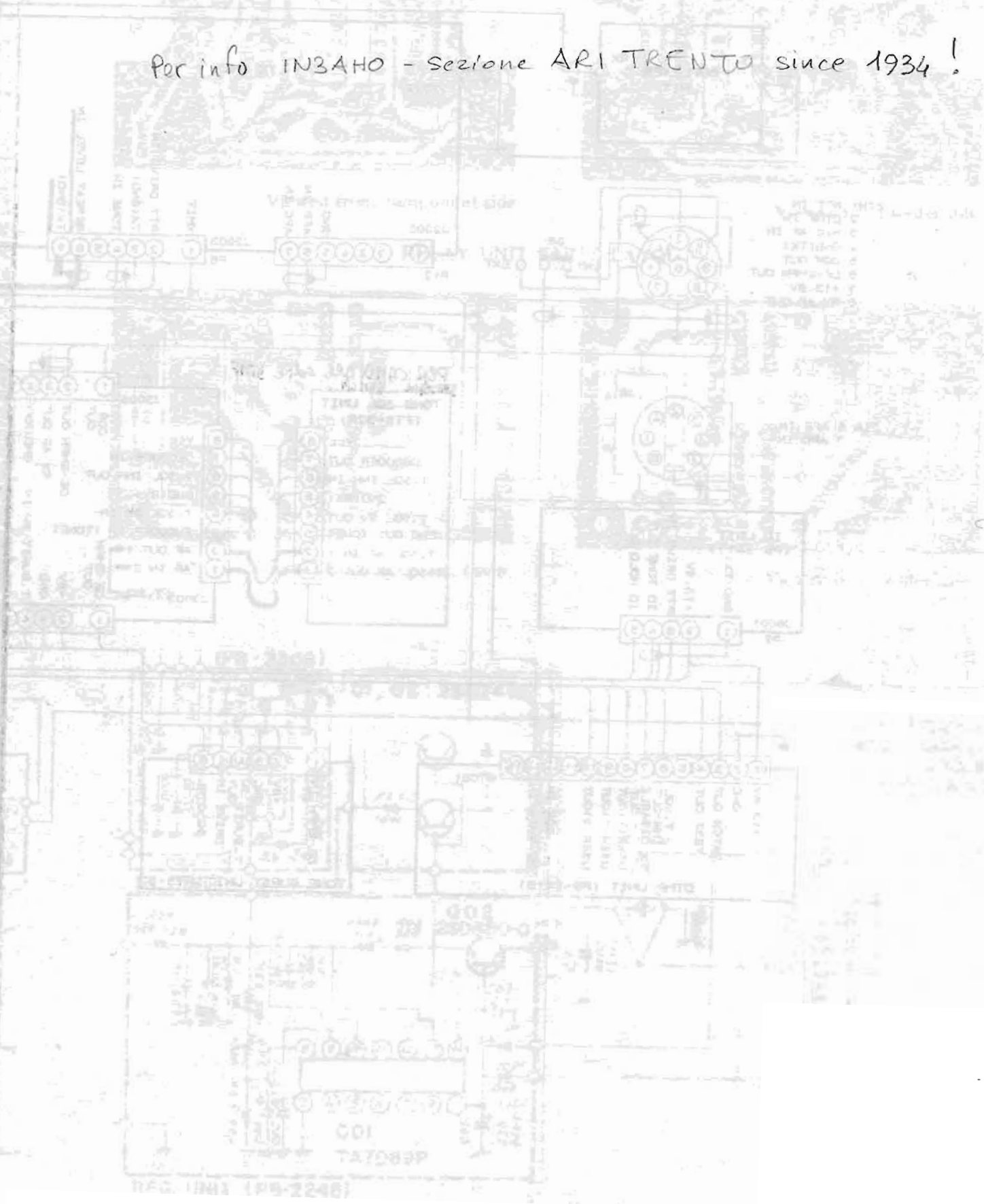




REPEATER UNIT
CONNECTION DIAGRAM

MEMO

Per info IN3AHO - sezione ARI TRENTO since 1934 !



PARTS LIST

MAIN CHASSIS			P2 (with wire)	T9204328A
Symbol No.	Part No.	Description	P4 (")	T9204466
		TRANSISTOR	P6 (")	T9204329C
Q1	G3407450R	2SD745R		
Q2	G3407450R	"		
				TERMINAL BOARD
				Q6000161 M115A-2A
		RESISTOR		
R1	J30406029	Cement 10W 0.2Ω		
R2	J30406029	" " 0.2Ω		FUSE HOLDER
R3	J01245471	Carbon film 1/4W Tj 470Ω	F1	P2000012 SN2059
		TERMINAL BOARD		FUSE
	Q6000030	1L4P (2-0-2)		Q0000003 2A (100-117VAC)
				Q0000001 1A (200-234VAC)
		POWER TRANSFORMER		
T1	L3030093A			TERMINAL POST
				Q5000005 STK-A2
				S5000053 A4 3M
				S5000054 B-7 5M
		DIODE		
D1	G2090046	S15VB10		
D2	G2090203	SDB205BGD		
D3	G2090204	SDB205BRD		CONNECTION CABLE
D4	G2090205	SDB205BAD		T9100950
				T9100990
				T9204632
				T9204633
		POTENTIOMETER		T9204655
VR1	J60800084	VM10A10KΩB		T9302000A
VR2	J60800084	"		
		CAPACITOR		AC POWER CORD
C1	K43160002	Electrolytic 35WV 10000μF (35L10000)		T9013282 3 wire, 3 prong UL plug
C2	K12329002	Ceramic disc 1.5KV 0.0047μF (ECKDAL472PE)		T9013283 3 wire, 3 prong Australian plug
C3	K12329002	" " " 0.0047μF (")		T9013284 3 wire, 2 prong EU plug
		SPEAKER		
SP1	M4090049	SM-77KY-2		
		SWITCH		
S1	N2090028	8B2011		
S2	N2090028	"		
	N2090021	8A1011		
		RECEPTACLE		
J1	P0090012	FM146S		
J2	P1090265	M-261-PA		
J3	P1090265	"		
J4	P1090005	SG-8050-01		
J6	P4090009	3305-014-611SN		
	P1090246	D8-701B-00		
	P0090094	PA125		
	P1090034	D7-7018-00		
		PLUG		
P1 (with wire)	T9204327B			

(FTR-710A) (FTR-2410A) (FTR-5410)

FTR-710A RECEIVER UNIT			CD1001	H7900010	CERAMIC DISCRIMINATOR
Symbol No.	Part No.	Description			455D
PB-2398B	F0002398B	Printed Circuit Board			
		PCB with Components (w/o crystal)			POSISTOR
	C023980A	68-74MHz 25kHz	PTH1001	G9090019	PTH-2928
	C023980C	74-81MHz "			
	C023980E	81-88MHz "			
	C023980B	68-74MHz 12.5kHz			RESISTOR
	C023980D	74-81MHz "	R1001	J02245683	Carbon film 1/4W SJ 68kΩ
	C023980F	81-88MHz "	R1002	J02245273	" " " " 27kΩ
PB-2309	F0002309	Printed Circuit Board (Connector board)	R1003	J02245124	" " " " 120kΩ
			R1004	J02245271	" " " " 270Ω
			R1005	J02245273	" " " " 27kΩ
			R1006	J02245224	" " " " 220kΩ
		IC, FET, TRANSISTOR	R1007	J02245473	" " " " 47kΩ
Q1001	G4800600	3SK60 (FET)	R1008	J02245470	" " " " 47Ω
Q1002	G4800600	" (FET)	R1009	J02245471	" " " " 470Ω
Q1003	G3304600B	2SC460B (TR)	R1010	J02245101	" " " " 100Ω
Q1004	G3304600B	" (TR)	R1011	J02245101	" " " " 100Ω
Q1005	G3305350B	2SC535B (TR)	R1012	J02245103	" " " " 10kΩ
Q1006	G3305350B	" (TR)	R1013	J02245472	" " " " 4.7kΩ
Q1007	G3305350B	" (TR)	R1014	J02245102	" " " " 1kΩ
Q1008	G3305350B	" (TR)	R1015	J02245152	" " " " 1.5kΩ
Q1009	G3304600B	2SC460B (TR)	R1016	J02245153	" " " " 15kΩ
Q1010	G3304600B	" (TR)	R1017	J02245471	" " " " 470Ω
Q1011	G1090072	μPC577H (IC)	R1018	J02245222	" " " " 2.2kΩ
Q1012	G1090218	AN315 (IC)	R1019	J02245223	" " " " 22kΩ
Q1013	G3304600C	2SC460C (TR)	R1020	J02245101	" " " " 100Ω
Q1014	G3304600B	2SC460B (TR)	R1021(25kHz)	J10246332	Carbon composition
Q1015	G3304600B	" (TR)			1/4W GK 3.3kΩ
Q1016	G3304600B	" (TR)	R1021(12.5kHz)	J10246102	" " " " 1kΩ
Q1017	G3304600B	" (TR)	R1022	J02245472	Carbon film 1/4W SJ 4.7kΩ
Q1018	G1090222	MB3756 (IC)	R1023	J02245223	" " " " 22kΩ
			R1024	J02245102	" " " " 1kΩ
			R1025	J02245102	" " " " 1kΩ
		DIODE	R1026	J02245223	" " " " 22kΩ
D1001	G2015550	Si 1S1555	R1027	J02245333	" " " " 33kΩ
D1002	G2015550	" "	R1028	J02245102	" " " " 1kΩ
D1003	G2015550	" "	R1029	J02245101	" " " " 100Ω
D1004	G2015550	" "	R1030	J02245472	" " " " 4.7kΩ
D1005	G2015550	" "	R1031	J02245223	" " " " 22kΩ
D1006	G2015550	" "	R1032	J02245102	" " " " 1kΩ
			R1033	J02245102	" " " " 1kΩ
			R1034	J02245101	" " " " 100Ω
		CRYSTAL	R1035	J02245222	" " " " 2.2kΩ
X1001	H0102009	HC-25/U (FR-10.7)/4(MHz)	R1036	J02245102	" " " " 1kΩ
X1002	H0100720A	HC-18/U 10.245MHz	R1037	J02245154	" " " " 150kΩ
			R1038	J02245222	" " " " 2.2kΩ
			R1039	J02245154	" " " " 150kΩ
		CRYSTAL FILTER	R1040	J02245222	" " " " 2.2kΩ
XF1001 (25kHz)	H1101960	10M2B2(1/2) PAIR	R1041	J02245222	" " " " 2.2kΩ
XF1002 (25kHz)	H1101960	10M2B2(1/2) PAIR	R1042	J02245473	" " " " 47kΩ
XF1001 (12.5kHz)	H1102000	FMT-8B(1/2) PAIR	R1043	J02245102	" " " " 1kΩ
XF1002 (12.5kHz)	H1102000	FMT-8B(1/2) PAIR	R1044	J02245103	" " " " 10kΩ
			R1045	J02245103	" " " " 10kΩ
			R1046	J02245332	" " " " 3.3kΩ
		CERAMIC FILTER	R1048	J02245333	" " " " 33kΩ
CF1001(25kHz)	H3900030	LF-B15	R1049	J02245820	" " " " 82Ω
CF1002(25kHz)	H3900030	LF-B15	R1050(25kHz)	J02245103	" " " " 10kΩ
CF1001(12.5kHz)	H3900140	LF-B8	R1050(12.5kHz)		Not used
CF1002(12.5kHz)	H3900140	LF-B8	R1051	J02245333	Carbon film 1/4W SJ 33kΩ
			R1052	J02245562	" " " " 5.6kΩ
			R1053	J02245332	" " " " 3.3kΩ
			R1054	J02245102	" " " " 1kΩ

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R1055	J02245333	Carbon film 1/4W SJ 33kΩ	C1038	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
R1056	J02245104	" " " " 100kΩ	C1039	K10179015	" " " " 0.01μF (CK45B1H103MY)
R1057	J02245682	" " " " 6.8kΩ	C1041	K10179015	" " " " 0.01μF (CK45B1H103MY)
R1058	J02245224	" " " " 220kΩ	C1042	K10179014	" " " " 0.001μF (CK45B1H102MY)
R1059	J02245472	" " " " 4.7kΩ	C1043	K02182059	" " " " 63WV CH 0.5pF (RD871-1CG-0R5C)
R1060	J02245820	" " " " 82Ω	C1045	K02185470	" " " " CH 47pF (RD872-1CG-470J)
R1062	J02245332	" " " " 3.3kΩ	C1046	K10179014	" " " " 0.001μF (CK45B1H102MY)
R1063	J02245332	" " " " 3.3kΩ	C1048	K10179014	" " " " 0.001μF (" ")
R1064	J02245472	" " " " 4.7kΩ	C1049(25kHz)	K02182050	" " " " CH 5pF (RD870-1CG-5R0C)
R1065	J02245391	" " " " 390Ω	C1049(12.5kHz)	K02185150	" " " " " 15pF (RD870-1CG-150J)
R1066(25kHz)	J02245562	" " " " 5.6kΩ	C1050	K10179015	" " " " 50WV 0.01μF (CK45B1H103MY)
R1066(12.5kHz)	J02245152	" " " " 1.5kΩ	C1051	K10179015	" " " " 0.01μF (" ")
R1067	J10246103	Carbon composition 1/4W GK 10kΩ	C1052	K10179014	" " " " 0.001μF (CK45B1H102MY)
			C1053	K06185330	" " " " 63WV UJ 33pF (RD870-1UJ-330J)
			C1054	K06185221	" " " " " 220pF (RD873-2UJ-221J)
		POTENTIOMETER	C1055	K06185151	" " " " " 150pF (RD872-2UJ-151J)
VR1001	J51723103	H1051A013-10KB	C1056	K02183100	" " " " CH 10pF (RD870-1CG-100D)
			C1057	K10179015	" " " " 50WV 0.01μF (CK45B1H103MY)
			C1058	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
		CAPACITOR	C1059	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C1002	K05185820	Ceramic Disc 63WV RH 82pF (RD872-2RG-820J)	C1060	K70120001	Tantalum 16WV 4.7μF (489D475X0016B1)
C1003	K02182059	" " " " CH 0.5pF (RD870-1CG-0R5C)	C1061	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C1006	K10179015	" " " " 50WV 0.01μF (CK45B1H103MY)	C1062	K10179014	" " " " 0.001μF (" ")
C1007	K10179014	" " " " 0.001μF (CK45B1H102MY)	C1063	K70120001	Tantalum 16WV 4.7μF (489D475X0016B1)
C1008	K10179014	" " " " 0.001μF (" ")	C1064	K10179015	Ceramic Disc 50WV 0.01μF (CK45B1H103MY)
C1009	K10179014	" " " " 0.001μF (" ")	C1065	K10179015	" " " " 0.01μF (" ")
C1012	K08179003	" " " " AH 0.35pF (RAU-04-AK-0R 35C)	C1066	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
C1014	K08179003	" " " " " 0.35pF (RAU-04-AK-0R 35C)	C1067	K10179015	Ceramic Disc 50WV 0.01μF (CK45B1H103MY)
C1017	K10179015	" " " " 0.01μF (CK45B1H103MY)	C1068	K10179014	" " " " 0.001μF (CK45B1H102MY)
C1020	K08179003	" " " " AH 0.35pF (RAU-04-AK-0R 35C)	C1069	K10179014	" " " " 0.001μF (" ")
C1023	K10179014	" " " " 0.001μF (CK45B1H102MY)	C1070	K10179014	" " " " 0.001μF (" ")
C1024	K10179014	" " " " 0.001μF (" ")	C1071	K50177222	Mylar " 0.0022μF (50F2U222M)
C1025	K10179014	" " " " 0.001μF (" ")			
C1026	K10179015	" " " " 0.01μF (CK45B1H103MY)			
C1027	K10179015	" " " " 0.01μF (" ")			
C1028	K10179015	" " " " 0.01μF (" ")			
C1029	K06185330	" " " " 63WV UJ 33pF (RD870-1UJ-330J)			
C1031	K06185221	" " " " " 220pF (RD873-2UJ-221J)			
C1032	K06185151	" " " " " 150pF (RD872-2UJ-151J)			
C1034	K10179015	" " " " 50WV 0.01μF (CK45B1H103MY)			
C1035	K10179014	" " " " 0.001μF (CK45B1H102MY)			
C1037	K02185560	" " " " 63WV CH 10pF (RD872-2CG-560J)			

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C1072	K70120002	Tantalum 16WV 10 μ F (489D106X0016C1)	C1107	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)
C1073	K50176473	Mylar 50WV 0.047 μ F (MRS-473K)	C1108	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)
C1074	K50176473	" " 0.047 μ F (")	C1109	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C1075	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	C1110	K10179015	Ceramic Disc 50WV 0.01 μ F (CK45B1H103MY)
C1076	K50176473	Mylar 50WV 0.047 μ F (MRS-473K)	C1111	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C1077	K50176473	" " 0.047 μ F (")	C1112	K10179015	Ceramic Disc 50WV 0.01 μ F (CK45B1H103MY)
C1078	K50176473	" " 0.047 μ F (")	C1113	K10179015	" " " 0.01 μ F (")
C1079	K10179014	Ceramic disc " 0.001 μ F (CK45B1H102MY)	C1114	K10179014	" " " 0.001 μ F (CK45B1H102MY)
C1080	K50176473	Mylar " 0.047 μ F (MRS-473K)	C1115	K21170002	Feed through " 0.001 μ F (ECKY1H-102WE)
C1081	K10186471	Ceramic Disc 63WV 470pF (RD870-1B-471K)	C1116	K21170002	" " " 0.001 μ F (")
C1082	K50177103	Mylar 50WV 0.01 μ F (50F2U103M)	C1117	K21170002	" " " 0.001 μ F (")
C1083	K50177222	" " 0.0022 μ F (50F2U222M)	C1118	K21170002	" " " 0.001 μ F (")
C1084	K50177222	" " 0.0022 μ F (")	C1119	K21170002	" " " 0.001 μ F (")
C1086	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	C1120	K21170002	" " " 0.001 μ F (")
C1087	K50177332	Mylar 50WV 0.0033 μ F (50F2U332M)	C1121	K21170002	" " " 0.001 μ F (")
C1088	K70120010	Tantalum 16WV 22 μ F (499D226X0016GS1)	C1122	K21170002	" " " 0.001 μ F (")
C1089	K50177102	Mylar 50WV 0.001 μ F (50F2U102M)	C1123	K21170002	" " " 0.001 μ F (")
C1090	K10186331	Ceramic Disc 63WV 330pF (RD870-1B-331K)	C1124	K21170002	" " " 0.001 μ F (")
C1091	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	C1125	K21170002	" " " 0.001 μ F (")
C1092	K70120002	" " 10 μ F (489D106X0016C1)	C1126	K21170002	" " " 0.001 μ F (")
C1093	K40129006	Electrolytic " 470 μ F (16RE470)	C1127	K50177103	Mylar " 0.01 μ F (50F2U103M)
C1094	K70167154	Tantalum 35WV 0.15 μ F (CS15E1VR15M)			
C1095	K50177472	Mylar 50WV 0.0047 μ F (50F2U472M)			TRIMMER CAPACITOR
C1096	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	TC1001	K91000029	ECV-1ZW 20x53T 20pF
C1097	K02185101	Ceramic Disc 63WV CH 100pF (RD874-2CG-101J)	TC1002	K91000029	" " 20pF
C1098	K10185821	" " " " 820pF (RD870-2B-821K)			TRANSFORMER
C1099(25kHz)	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	T1003	L0190011	113KN-6407N
C1099(12.5kHz)	K70140009	" " 2.2 μ F (489D225X0025B1)	T1004	L0190011	"
C1100	K70120002	" " 16WV 10 μ F (489D106X0016C1)	T1005	L0021162	IFT-471K7-H5
C1101	K10179015	Ceramic Disc 50WV 0.01 μ F (CK45B1H103MY)	T1006	L0021162	"
C1102	K10179014	" " " 0.001 μ F (CK45B1H102MY)	T1007	L0020649	7MC-5896T
C1106	K40129006	Electrolytic 16WV 470 μ F (16RE470)			INDUCTOR
			L1001	L0190025	
			L1002	L0190025	
			L1004	L1020081A	
			L1005	L0190025	
			L1006	L0190025	
			L1007	L0190025	
			L1008	L0190025	

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L1009	L0190025		Q2012	G1090220	MLM2902	(IC)
L1010	L1020082A		Q2013	G3208560B	2SB856B	(TR)
L1011	L1020082A		Q2014	G3304580B	2SC458B	(TR)
L1012	L1190017	FL5H-102K 1mH	Q2015	G1090221	MC3401P	(IC)
L1013	L1020082A		Q2016	G3304600B	2SC460B	(TR)
L1014	L1020081A		Q2017	G1090222	MB3576	(IC)
L1015	L1190017	FL5H-102K 1mH				
L1016	L1190017	FL5H-102K 1mH				
L1017	L1190038	FL5H-271K 270μH				DIODE
L1018	L2030060		D2001	G2090222	Varactor	MV306
L1019	L1020080A		D2002	G2015550	Si	IS1555
			D2003	G2015550	"	"
		CRYSTAL SOCKET				
XS1001	P3090002	S2-101P-00				CRYSTAL
			X2001	H0102010	HC-25/U	ft/6 (MHz)
		CONNECTOR				
J1001	P0090059	3022-11A				POSISTOR
J1002	P0090091	5049-07A	PTH2001	G9090019	PTH-2928	
J1003	P0090091	5049-07A				
J1004	P0090113	UG625B/U				
P1001	T9204326					RESISTOR
			R2002	J02245472	Carbon film	1/4W SJ 4.7kΩ
			R2003	J02245103	" "	" " 10kΩ
		TP TERMINAL	R2004	J02245471	" "	" " 470Ω
TP1001	Q5000037	TP-H	R2005	J02245101	" "	" " 100Ω
TP1002	Q5000037	"	R2007	J02245103	" "	" " 10kΩ
TP1003	Q5000037	"	R2008	J02245473	" "	" " 47kΩ
			R2009	J02245101	" "	" " 100Ω
			R2010	J02245101	" "	" " 100Ω
		SHIELD CASE	R2011	J02245220	" "	" " 22Ω
	L9190015		R2012	J02245220	" "	" " 22Ω
			R2013	J10246680	" composition	1/4W GK 68Ω
		FERRITE BEADS	R2014	J02245333	" film	" SJ 33kΩ
	L9190001	Ri 3x3x1	R2015	J02245333	" "	" " 33kΩ
			R2016	J02245473	" "	" " 47kΩ
			R2017	J02245333	" "	" " 33kΩ
			R2018	J02245104	" "	" " 100kΩ
			R2019	J02245470	" "	" " 47Ω
			R2020	J02245102	" "	" " 1kΩ
			R2021	J02245471	" "	" " 470Ω
			R2022	J02245102	" "	" " 1kΩ
			R2023	J02245682	" "	" " 6.8kΩ
			R2024	J02245683	" "	" " 68kΩ
			R2025	J02245331	" "	" " 330Ω
			R2026	J02245222	" "	" " 2.2kΩ
			R2027	J02245222	" "	" " 2.2kΩ
			R2028	J02245333	" "	" " 33kΩ
			R2029	J02245100	" "	" " 10Ω
			R2030	J02245222	" "	" " 2.2kΩ
			R2031	J02245561	" "	" " 560Ω
			R2032	J00245822	" "	" " 8.2kΩ
			R2033	J02245100	" "	" " 10Ω
			R2034	J02245101	" "	" " 100Ω
		IC, TRANSISTOR	R2039	J02245101	" "	" " 100Ω
Q2001	G3305350B	2SC535B (TR)	R2040	J02245103	" "	" " 10kΩ
Q2002	G3305350B	" (TR)	R2041	J02245229	" "	" " 2.2Ω
Q2003	G3305350B	" (TR)	R2042	J02245100	" "	" " 10Ω
Q2004	G3304600B	2SC460B (TR)	R2045	J02245471	" "	" " 470Ω
Q2005	G3304600B	" (TR)	R2046	J02245224	" "	" " 220kΩ
Q2006	G3305350B	2SC535B (TR)	R2047	J02245824	" "	" " 820kΩ
Q2007	G3320530	2SC2053 (TR)	R2048	J02245333	" "	" " 33kΩ
Q2010	G3304600B	2SC460B (TR)	R2049	J02245824	" "	" " 820kΩ
Q2011	G3304600B	" (TR)				

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R2050	J02245334	Carbon film	1/4W SJ	330k Ω	C2013	K00185331	Ceramic Disc	63WV SL	330pF
R2051	J02245562	" "	" "	5.6k Ω			(RD874-2SL-331J)		
R2052	J02245273	" "	" "	27k Ω	C2014	K10179014	" "	50WV	0.001 μ F
R2053	J02245562	" "	" "	5.6k Ω			(CK45B1H102MY)		
R2054	J02245153	" "	" "	15k Ω	C2015	K70120001	Tantalum	16WV	4.7 μ F
R2055	J02245224	" "	" "	220k Ω			(489D475X0016B1)		
R2056	J02245474	" "	" "	470k Ω	C2016	K10179015	Ceramic Disc	50WV	0.01 μ F
R2057	J02245124	" "	" "	120k Ω			(CK45B1H103MY)		
R2058	J02245155	" "	" "	1.5M Ω	C2017	K00185331	" "	63WV SL	330pF
R2059	J02245223	" "	" "	22k Ω			(RD874-2SL-331J)		
R2060	J02245104	" "	" "	100k Ω	C2018	K05185121	" "	" "	RH 120pF
R2061	J02245473	" "	" "	47k Ω			(RD874-2RG-121J)		
R2062	J02245103	" "	" "	10k Ω	C2019	K10179015	" "	50WV	0.01 μ F
R2063	J02245103	" "	" "	10k Ω			(CK45B1H103MY)		
R2064	J02245153	" "	" "	15k Ω	C2020	K10179015	" "	" "	0.01 μ F
R2065	J02245104	" "	" "	100k Ω			(" ")		
R2066	J02245102	" "	" "	1k Ω	C2021	K05185151	" "	63WV RH	150pF
R2067	J02245103	" "	" "	10k Ω			(RD874-2RG-151J)		
R2068	J02245103	" "	" "	10k Ω	C2022	K05183100	" "	" "	10pF
R2069	J02245102	" "	" "	1k Ω			(RD870-1RG-100D)		
R2070	J02245102	" "	" "	1k Ω	C2023	K10179015	" "	50WV	0.01 μ F
R2071	J02245103	" "	" "	10k Ω			(CK45B1H103MY)		
R2072	J02245153	" "	" "	15k Ω	C2024	K02182020	" "	63WV CH	2pF
R2073	J02245102	" "	" "	1k Ω			(RD870-1CG-2ROC)		
R2074	J02245103	" "	" "	10k Ω	C2025	K05185180	" "	" "	RH 18pF
R2075	J10246103	" composition	1/4W GK	10k Ω	C2026	K02185121	" "	" "	CH 120pF
R2076	J02245154	" film	" SJ	150k Ω			(RD874-2CG-121J)		
R2077	J02245683	" "	" "	68k Ω	C2027	K05185180	" "	" "	RH 18pF
R2078	J02245103	" "	" "	10k Ω			(RD870-1RH-180J)		
R2079	J02245472	" "	" "	4.7k Ω	C2028	K10179015	" "	50WV	0.01 μ F
R2080	J02245471	" "	" "	470 Ω			(CK45B1H103MY)		
R2081	J02245332	" "	" "	3.3k Ω	C2029	K10179015	" "	" "	0.01 μ F
R2082	J02245562	" "	" "	5.6k Ω			(" ")		
R2083	J02245391	" "	" "	390 Ω	C2030	K01182059	" "	" "	CH 0.5pF
R2084	J10246330	" composition	1/4W GK	33 Ω	C2031	K05185220	" "	" "	RH 22pF
R2085	J02245472	" film	" SJ	4.7k Ω			(RD870-1RG-220J)		
					C2032	K05185390	" "	" "	39pF
							(RD870-1RG-390J)		
		POTENTIOMETER			C2033	K10179014	" "	50WV	0.001 μ F
VR2001	J51723103	H1051A013-10KB		10k Ω B			(CK45B1H102MY)		
VR2002	J51724103	PN822H103H		10k Ω B	C2034	K10179015	" "	" "	0.01 μ F
							(CK45B1H103MY)		
					C2035	K10179014	" "	" "	0.001 μ F
							(CK45B1H102MY)		
		CAPACITOR			C2036	K10179014	" "	" "	0.001 μ F
C2001	K06185680	Ceramic Disc	63WV UJ	68pF			(RD871-1UG-680J)		
C2003	K06185221	" "	" "	220pF	C2037	K02182030	" "	63WV CH	3pF
							(RD873-2UG-221J)		
C2004	K06185221	" "	" "	220pF	C2039	K02185470	" "	" "	47pF
							(" ")		
C2006	K10179015	" "	50WV	0.01 μ F	C2040	K10179014	" "	50WV	0.001 μ F
							(CK45B1H103MY)		
C2007	K02185101	" "	63WV CH	100pF	C2041	K10179014	" "	" "	0.001 μ F
							(RD874-2CG-101J)		
C2008	K10179015	" "	50WV	0.01 μ F	C2042	K10179014	" "	" "	0.001 μ F
							(CK45B1H103MY)		
C2009	K05189007	" "	63WV RH	68pF	C2043	K10179014	" "	" "	0.001 μ F
							(RD872-2RG-680J)		
C2010	K10179015	" "	50WV	0.01 μ F	C2044	K02185180	" "	63WV CH	18pF
							(CK45B1H103MY)		
C2012	K10179014	" "	" "	0.001 μ F	C2051	K50177223	Mylar	50WV	0.022 μ F
							(CK45B1H102MY)		
							(50F2U223M)		

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C2052	K05177102	Mylar 50WV 0.001 μ F (50F2U102M)	C2087	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)
C2053	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	C2092	K10179015	" " " 0.01 μ F (CK45B1H103MY)
C2054	K70140001	" 16WV 4.7 μ F (489D475X0016B1)	C2093	K10179014	" " " 0.001 μ F (CK45B1H102MY)
C2055	K70140007	" 25WV 1 μ F (489D105X0025A1)	C2094	K10179015	" " " 0.01 μ F (CK45B1H103MY)
C2056	K50177332	Mylar 50WV 0.0033 μ F (50F2U332M)	C2095	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C2057	K50177102	" " 0.001 μ F (50F2U102M)	C2096	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)
C2058	K02185390	Ceramic Disc 63WV CH 39pF (RD871-ICG-390J)	C2097	K40129006	Electrolytic 16WV 470 μ F (16RE470)
C2059	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	C2098	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)
C2060	K50177223	Mylar 50WV 0.022 μ F (50F2U223M)	C2100	K02185150	" " 63WV CH 15pF (RD870-ICG-150J)
C2061	K70120002	Tantalum 16WV 10 μ F (489D106X0016C1)	C2101	K21170002	Feed through 50WV 0.001 μ F (ECKY1H-102WE)
C2062	K40129007	Electrolytic " 100 μ F (16RE100)	C2102	K21170002	" " " 0.001 μ F (" ")
C2063	K10179015	Ceramic Disc 50WV 0.01 μ F (CK45B1H103MY)	C2103	K21170002	" " " 0.001 μ F (" ")
C2064	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	C2104	K21170002	" " " 0.001 μ F (" ")
C2065	K70167474	" 35WV 0.47 μ F (CS15E1VR47)	C2105	K21170002	" " " 0.001 μ F (" ")
C2066	K70120002	" 16WV 10 μ F (489D106X0016C1)	C2106	K21170002	" " " 0.001 μ F (" ")
C2067	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)	C2107	K02185560	Ceramic Disc 63WV CH 56pF (RD872-2CG-560J)
C2068	K07185151	" " 63WV PH 150pF (RD874-2PG-151J)	C2108	K02185560	" " " " 56pF (" ")
C2069	K10179015	" " 50WV 0.01 μ F (CK45B1H103MY)	C2115	K21170002	Feed through 50WV 0.001 μ F (ECKY1H-102WE)
C2070	K10179014	" " " 0.001 μ F (CK45B1H102MY)	C2116	K21170002	" " " 0.001 μ F (" ")
C2071	K10179014	" " " 0.001 μ F (" ")			
C2072	K10179014	" " " 0.001 μ F (" ")			TRIMMER CAPACITOR
			TC2001	K91000029	ECV-1ZW-20x53T 20pF
C2073	K50177103	Mylar " 0.01 μ F (50F2U103M)	TC2002	K91000029	" -20x53T 20pF
			TC2003	K91000029	" -20x53T 20pF
C2074	K10179014	Ceramic Disc " 0.001 μ F (CK45B1H102MY)	TC2004	K91000029	" -20x53T 20pF
C2075	K02185121	" " 63WV CH 120pF (RD874-2CG-121J)			
					TRANSFORMER
C2076	K10179014	" " 50WV 0.001 μ F (CK45B1H102MY)	T2003	L0020820	199CN-11451N
			T2004	L0020652	113CN-6396Z
C2077	K10179014	" " " 0.001 μ F (" ")	T2005	L0020820	119CN-11451N
			T2006	L0190011	113KN-6407N
C2080	K70120009	Tantalum 16WV 33 μ F (489D336X0016E1)	T2007	L0190011	"
			T2008	L0020653	113SN-6397Y
C2081	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)	T2009	L0020653	"
C2082	K50177103	Mylar " 0.01 μ F (50F2U103M)			
					INDUCTOR
C2083	K70120002	Tantalum 16WV 10 μ F (489D106X0016C1)	L2001	L1190017	FL5H-102K 1mH
			L2002	L1020081A	
C2084	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)	L2003	L1020081A	
			L2004	L1020081A	
C2086	K70120009	Tantalum 16WV 33 μ F (489D336X0016E1)	L2005	L0020716	MC-108
			L2006	L1020081A	
			L2007	L0020716	MC-108

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L2013	L0021251		C1018	K05185820	Ceramic Disc 63WV RH 82pF (RD872-2RG-820J)
L2014	L0020716	MC-108			
L2015	L1020079A		C1019	K05185330	" " " " 33pF (RD870-1RG-330J)
L2019	L1020080A				
L2020	L1020080A		C1021	K05185330	" " " " 33pF (")
L2021	L1190041	181LY-104K 100mH			
L2022	L2030060		C1022	K05185820	" " " " 82pF (RD872-2RG-820J)
L2023	L1020080A				
L2024	L1190017	FL5H-102K 1mH	C1040	K05185270	" " " " 27pF (RD870-1RG-270J)
			C1044	K05185270	" " " " 27pF (")
		CRYSTAL SOCKET			
XS2001	P3090002	S2-101P-00	C2038	K02179034	" " " " CH 22pF (2222-638-40229)
			C2099	K02179050	" " " " 39pF (2222-637-10399)
		CONNECTOR			
J2001	P0090092	3022-08A			
J2002	P1090254	BNC-LR			
J2003	P0090091	5049-07A			
J2004	P1090016	SQ3056	74MHz-81MHz BAND		
J2005	P0090091	5049-07A	C1001	K05185150	Ceramic Disc 63WV RH 15pF (RD870-1RG-150J)
P2001	T9204332A		C1004	K05185560	" " " " 56pF (RD871-1RG-560J)
	T9204496				
			C1005	K05183070	" " " " 7pF (RD870-1RG-070D)
		TP TERMINAL			
TP2001	Q5000037	TP-H	C1010	K05185150	" " " " 15pF (RD870-1RG-150J)
TP2002	Q5000037	"			
TP2003	Q5000037	"	C1011	K05185330	" " " " 33pF (RD871-1RG-330J)
TP2004	Q5000037	"			
TP2006	Q5000037	"	C1013	K05185150	" " " " 15pF (RD870-1RG-150J)
TP2007	Q5000037	"			
TP2008	Q5000038	SMF	C1015	K05185150	" " " " 15pF (")
			C1016	K05185560	" " " " 56pF (RD871-1RG-560J)
		PIN PLUG			
P2004	P0090009	SQ4152	C1018	K05185680	" " " " 68pF (RD872-1RG-680J)
			C1019	K05185270	" " " " 27pF (RD870-1RG-270J)
		FERRITE BEADS			
	L9190001	Ri 3x3x1	C1021	K05185270	" " " " 27pF (")
			C1022	K05185680	" " " " 68pF (RD872-1RG-680J)
			C1040	K05185220	" " " " 22pF (RD870-1RG-220J)
			C1044	K05185220	" " " " 22pF (")
FTR-710A BAND TABLE					
Symbol No.	Part No.	Description	C2038	K02183100	" " " " CH 10pF (RD870-1CG-100D)
68MHz-74MHz BAND					
C1001	K05185180	Ceramic Disc 63WV RH 18pF (RD870-1RG-180J)	C2099	K02175150	" " " " 15pF (DD104CH150J50V)
C1004	K05189007	" " " " 68pF (RD872-2RG-680J)			
C1005	K05185120	" " " " 12pF (RD870-1RG-120J)	81MHz-88MHz BAND		
C1010	K05185180	" " " " 18pF (RD870-1RG-180J)	C1001	K05185120	Ceramic Disc 63WV RH 12pF (RD870-1RG-120J)
C1011	K05185390	" " " " 39pF (RD870-1RG-390J)	C1004	K05185470	" " " " 47pF (RD871-1RG-470J)
C1013	K05185180	" " " " 18pF (RD870-1RG-180J)	C1005	K05182040	" " " " 4pF (RD870-1RG-040C)
C1015	K05185180	" " " " 18pF (")	C1010	K05185120	" " " " 12pF (RD870-1RG-120J)
C1016	K05189007	" " " " 68pF (RD872-2RG-680J)	C1011	K05185220	" " " " 22pF (RD870-1RG-220J)

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C1013	K05185120	Ceramic Disc 63WV RH 12pF (RD870-1RG-120J)	C2049	K02185560	Ceramic Disc 63WV CH 56pF (RD872-2CG-560J)
C1015	K05185120	" " " " 12pF (" ")	C2050	K02185560	" " " " 56pF (" ")
C1016	K05185470	" " " " 47pF (RD871-1RG-470J)	C2085	K10179014	" " " " 50WV 0.001μF (CK45B1H102MY)
C1018	K05185560	" " " " 56pF (RD871-1RG-560J)	C2088	K10179014	" " " " 0.001μF (" ")
C1019	K05185180	" " " " 18pF (RD870-1RG-180J)	C2089	K02185150	" " " " 63WV CH 15pF (RD870-1CG-150J)
C1021	K05185180	" " " " 18pF (" ")	C2090	K02185560	" " " " 56pF (RD872-2CG-560J)
C1022	K05185560	" " " " 56pF (RD871-1RG-560J)	C2091	K01182059	" " " " 0.5pF (RD870-1CG-0R5C)
C1040	K05185150	" " " " 15pF (RD870-1RG-150J)	C2107	K02185560	" " " " 56pF (RD872-2CG-560J)
C1044	K05185150	" " " " 15pF (" ")	C2109	K40129004	Electrolytic 16WV 10μF (16RE10)
C2038	K02185270	" " " " CH 27pF (RD871-1CG-270J)	C2110	K10179015	Ceramic Disc 50WV 0.01μF (CK45B1H103MY)
C2099	K02189008	" " " " 22pF (RD871-2CG-220J)	C2111	K40129004	Electrolytic 16WV 10μF (16RE10)
			C2112	K10179015	Ceramic Disc 50WV 0.01μF (CK45B1H103MY)
			C2113 (68-74MHz)	K02185470	" " " " 63WV CH 47pF (RD871-1CG-470J)
			C2113 (74-81MHz)	K02185390	" " " " 39pF (RD871-1CG-390J)
			C2113 (81-88MHz)	K02185150	" " " " 15pF (RD870-1CG-150J)
			C2114 (68-74MHz)	K02185270	" " " " 27pF (RD871-1CG-270J)
			C2114 (74-81MHz)	K02185150	" " " " 15pF (RD870-1CG-150J)
			C2114 (81-88MHz)	K02182050	" " " " 5pF (RD870-1CG-050C)
PA BOARD					
Symbol No.	Part No.	Description			
PB-2399B	F0002399B	Printed Circuit Board			
	C023990A	PCB with Components (68-74MHz)			
	C023990B	" " " (74-81MHz)			
	C023990C	" " " (81-88MHz)			
		TRANSISTOR			
Q2008	G3307300	2SC730			
Q2009	G3090009	MRF212			
					TRIMMER CAPACITOR
			TC2005	K91000022	ECV-12W-40x40 40pF
			TC2006	K91000020	" -20x40 20pF
		RESISTOR	TC2007	K91000058	2222-808-61809 80pF
R2035	J10276270	Carbon composition 1/2W GK 27Ω	TC2008	K91000094	2222-808-61659 65pF
R2036		L2026			
R2037	J10246101	Carbon composition 1/4W GK 100Ω			INDUCTOR
R2038		L2028	L2025	L0021252	
R2043	J02245220	Carbon film 1/4W SJ 22Ω	L2026	L1020003	
R2044	J02245471	" " " " 470Ω	L2027	L0020657	
			L2028	L1020705	
			L2029	L0020658	
			L2030	L0020659	
		CAPACITOR	L2031	L0020660	
C2045 (68-74MHz)	K02185470	Ceramic Disc 63WV CH 47pF (RD872-2CG-470J)	L2032	L0021253	
C2045 (74-81MHz)	K02185390	" " " " 39pF (RD871-1CG-390J)	L2033	L0021253	
C2045 (81-88MHz)	K02185270	" " " " 27pF (RD871-CG-270J)	L2034	L0021253	
C2046	K02185560	" " " " 56pF (RD872-2CG-560J)	L2035	L0021254	
C2047	K02185560	" " " " 56pF (" ")			TP TERMINAL
C2048	K02185560	" " " " 56pF (RD872-2CG-560J)		Q5000037	TP-H
					FERRITE BEADS
				L9190001	Ri 3x3x1

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FTR-2410A RECEIVER UNIT			CD1001	H7900010	CERAMIC DISCRIMINATOR
Symbol No.	Part No.	Description			455D
PB-2306	F0002306	Printed Circuit Board			
		PCB with Components			
		(w/o crystal)			
	C023060A	134-146MHz 25kHz	PTH1001	G9090019	POSISTOR
	C023060C	144-160MHz "			PTH-2928
	C023060E	160-174MHz "			
	C023060B	134-146MHz 12.5kHz			RESISTOR
	C023060D	144-160MHz "	R1001	J02245683	Carbon film 1/4W SJ 68kΩ
	C023060F	160-174MHz "	R1002	J02245273	" " " " 27kΩ
PB-2309	F0002309	Printed Circuit Board	R1003	J02245124	" " " " 120kΩ
		(Connector board)	R1004	J02245271	" " " " 270Ω
			R1005	J02245273	" " " " 27kΩ
			R1006	J02245224	" " " " 220kΩ
		IC, FET, TRANSISTOR	R1007	J02245473	" " " " 47kΩ
Q1001	G4800600	3SK60 (FET)	R1008	J02245470	" " " " 47Ω
Q1002	G4800600	" (FET)	R1009	J02245471	" " " " 470Ω
Q1003	G3305350B	2SC535B (TR)	R1010	J02245101	" " " " 100Ω
Q1004	G3319060	2SC1906 (TR)	R1011	J02245561	" " " " 560Ω
Q1005	G3319060	" (TR)	R1012	J02245103	" " " " 10kΩ
Q1006	G3305350B	2SC535B (TR)	R1013	J02245472	" " " " 4.7kΩ
Q1007	G3305350B	" (TR)	R1014	J02245471	" " " " 470Ω
Q1008	G3305350B	" (TR)	R1015	J02245222	" " " " 2.2kΩ
Q1009	G3304600B	2SC460B (TR)	R1016	J02245223	" " " " 22kΩ
Q1010	G3304600B	" (TR)	R1017	J02245471	" " " " 470Ω
Q1011	G1090072	μPCS77H (IC)	R1018	J02245222	" " " " 2.2kΩ
Q1012	G1090218	AN315 (IC)	R1019	J02245223	" " " " 22kΩ
Q1013	G3304600C	2SC460C (TR)	R1020	J02245101	" " " " 100Ω
Q1014	G3304600B	2SC460B (TR)	R1021(25kHz)	J10246122	Carbon composition
Q1015	G3304600B	" (TR)			1/4W GK 1.2kΩ
Q1016	G3304600B	" (TR)	R1021(12.5kHz)	J10246821	" " " " 820Ω
Q1017	G3304600B	" (TR)	R1022	J02245472	Carbon film 1/4W SJ 4.7kΩ
Q1018	G1090222	MB3756 (IC)	R1023	J02245223	" " " " 22kΩ
			R1024	J02245102	" " " " 1kΩ
			R1025	J02245102	" " " " 1kΩ
		DIODE	R1026	J02245223	" " " " 22kΩ
D1001	G2015550	Si 1S1555	R1027	J02245333	" " " " 33kΩ
D1002	G2015550	" "	R1028	J02245102	" " " " 1kΩ
D1003	G2015550	" "	R1029	J02245101	" " " " 100Ω
D1004	G2015550	" "	R1030	J02245472	" " " " 4.7kΩ
D1005	G2015550	" "	R1031	J02245223	" " " " 22kΩ
D1006	G2015550	" "	R1032	J02245102	" " " " 1kΩ
			R1033	J02245102	" " " " 1kΩ
			R1034	J02245101	" " " " 100Ω
		CRYSTAL	R1035	J02245222	" " " " 2.2kΩ
X1001	H0102029	HC-25/U (FR-21.4)/3 (MHz)	R1036	J02245102	" " " " 1kΩ
X1002	H0102050	HC-18/U 20.945MHz	R1037	J02245154	" " " " 150kΩ
			R1038	J02245222	" " " " 2.2kΩ
			R1039	J02245154	" " " " 150kΩ
		CRYSTAL FILTER	R1040	J02245222	" " " " 2.2kΩ
XF1001	H1101990	21J2B2(1/2) PAIR (25kHz)	R1041	J02245222	" " " " 2.2kΩ
XF1002	H1101990	21J2B2(1/2)	R1042	J02245473	" " " " 47kΩ
XF1001	H1102034	21J2F2(1/2) PAIR (12.5kHz)	R1043	J02245102	" " " " 1kΩ
XF1002	H1102034	21J2F2(1/2)	R1044	J02245103	" " " " 10kΩ
			R1045	J02245103	" " " " 10kΩ
			R1046	J02245332	" " " " 3.3kΩ
		CERAMIC FILTER	R1048	J02245333	" " " " 33kΩ
CF1001	H3900030	LF-B15 (25kHz)	R1049	J02245820	" " " " 82Ω
CF1002	H3900030	LF-B15 (25kHz)	R1050(25kHz)	J02245103	" " " " 10kΩ
CF1001	H3900140	LF-B8A (12.5kHz)	R1050(12.5kHz)	-	Not used
CF1002	H3900140	LF-B8A (12.5kHz)	R1051	J02245333	Carbon film 1/4W SJ 33kΩ
			R1052	J02245562	" " " " 5.6kΩ
			R1053	J02245332	" " " " 3.3kΩ
			R1054	J02245102	" " " " 1kΩ

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C1064	K10179015	Ceramic Disc 50WV (CK45B1H103MY)	0.01 μ F	C1097	K02185101	Ceramic Disc 63WV CH 100pF (RD874-2CG-101J63V)
C1065	K10179015	" " "	0.01 μ F	C1098	K10185821	" " " " 820pF (RD870-2B821K63V)
C1066	K70120002	Tantalum 16WV (489D106X0016C1)	10 μ F	C1099(25kHz)	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)
C1067	K10179015	Ceramic Disc 50WV (CK45B1H103MY)	0.01 μ F	C1099(12.5kHz)	K70140009	" " 2.2 μ F (489D225X0025B1)
C1068	K10179014	" " " (CK45B1H102MY)	0.001 μ F	C1100	K70120002	" 16WV 10 μ F (489D106X0016C1)
C1069	K10179014	" " " (")	0.001 μ F	C1101	K02189050	Ceramic Disc 63WV CH 5pF (RD870-1NPO-050C63V)
C1070	K10179014	" " " (")	0.001 μ F	C1102	K10179014	" " 50WV 0.001 μ F (CK45B1H102MY)
C1071	K50177222	Mylar (50F2U222M)	0.0022 μ F	C1106	K40129006	Electrolytic 16WV 470 μ F (16RE470)
C1072	K70120002	Tantalum 16WV (489D106X0016C1)	10 μ F	C1107	K10179014	Ceramic Disc 50WV 0.001 μ F (CK45B1H102MY)
C1073	K50176473	Mylar 50WV (MRS-473K)	0.047 μ F	C1108	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)
C1074	K50176473	" " " (")	0.047 μ F	C1109	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C1075	K70120001	Tantalum 16WV (489D475X0016B1)	4.7 μ F	C1110	K10179015	Ceramic Disc 50WV 0.01 μ F (CK45B1H103MY)
C1076	K50176473	Mylar 50WV (MRS-473K)	0.047 μ F	C1111	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C1077	K50176473	" " " (")	0.047 μ F	C1112	K10179015	Ceramic Disc 50WV 0.01 μ F (CK45B1H103MY)
C1078	K50176473	" " " (")	0.047 μ F	C1113	K10179015	" " " 0.01 μ F (")
C1079	K10179014	Ceramic Disc " (CK45B1H102MY)	0.001 μ F	C1114	K10179014	" " " 0.001 μ F (CK45B1H102MY)
C1080	K50176473	Mylar " (MRS-473K)	0.047 μ F	C1115	K21170002	Feed through " (ECKY1H-102WE)
C1081	K10186471	Ceramic Disc 63WV (RD870-1B-471K63V)	470pF	C1116	K21170002	" " " 0.001 μ F (")
C1082	K50177103	Mylar 50WV (50F2U103M)	0.01 μ F	C1117	K21170002	" " " 0.001 μ F (")
C1083	K50177222	" " " (50F2U222M)	0.0022 μ F	C1118	K21170002	" " " 0.001 μ F (")
C1084	K50177222	" " " (")	0.0022 μ F	C1119	K21170002	" " " 0.001 μ F (")
C1086	K70140007	Tantalum 25WV (489D105X0025A1)	1 μ F	C1120	K21170002	" " " 0.001 μ F (")
C1087	K50177332	Mylar 50WV (50F2U332M)	0.0033 μ F	C1121	K21170002	" " " 0.001 μ F (")
C1088	K70120010	Tantalum 16WV (499D226X0016GS1)	22 μ F	C1122	K21170002	" " " 0.001 μ F (")
C1089	K50177102	Mylar 50WV (50F2U102M)	0.001 μ F	C1123	K21170002	" " " 0.001 μ F (")
C1090	K10186331	Ceramic Disc 63WV (RD870-1B-331K63V)	330pF	C1124	K21170002	" " " 0.001 μ F (")
C1091	K70120001	Tantalum 16WV (489D475X0016B1)	4.7 μ F	C1125	K21170002	" " " 0.001 μ F (")
C1092	K70120002	" " " (489D106X0016C1)	10 μ F	C1126	K21170002	" " " 0.001 μ F (")
C1093	K40129006	Electrolytic " (16RE470)	470 μ F	C1127	K50177103	Mylar " (50F2U103M)
C1094	K70167154	Tantalum 35WV (CS15E1VR15M)	0.15 μ F			
C1095	K50177472	Mylar 50WV (50F2U472M)	0.0047 μ F	TC1001	K91000029	TRIMMER CAPACITOR ECV-1ZW 20x53T 20pF
C1096	K70120001	Tantalum 16WV (489D475X0016B1)	4.7 μ F	TC1002	K91000029	" " 20pF

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		TRANSFORMER		C023061C	160-174MHz
T1001	L0020346	113CN-3393Y	PB-2309	F0002309	Printed Circuit Board (Connector board)
T1002	L0190013	113KN-6409X			
T1003	L0020343	113SN-3392Y			
T1004	L0020343	"			
T1005	L0020717A	199CC-12843A8W			IC, TRANSISTOR
T1006	L0020647	199CC-11114N	Q2001	G3305350B	2SC535B (TR)
T1007	L0020649	7MC-5896T	Q2002	G3305350B	" (TR)
			Q2003	G3305350B	" (TR)
			Q2004	G3319060	2SC1906 (TR)
		INDUCTOR	Q2005	G3319060	" (TR)
L1001	L0020706		Q2006	G3319060	" (TR)
L1002	L0020706		Q2008	G3320530	2SC2053 (TR)
L1004	L1020081A		Q2009	G1090362	M57719 (IC)
L1005	L0020706		Q2010	G3304600B	2SC460B (TR)
L1006	L0020706		Q2011	G3304600B	" (TR)
L1007	L0020706		Q2012	G1090220	MLM2902 (IC)
L1008	L0020706		Q2013	G3208560B	2SB856B (TR)
L1009	L0020706		Q2014	G3304580B	2SC458B (TR)
L1010	L1020082A		Q2015	G1090221	MC3401P (IC)
L1011	L1020082A		Q2016	G3304600B	2SC460B (TR)
L1012	L1190017	FL5H-102K 1mH	Q2017	G1090222	MB3576 (IC)
L1013	L1020082A				
L1014	L1020081A				
L1015	L1190017	FL5H-102K 1mH			DIODE
L1016	L1190017	" 1mH	D2001	G2090084	Varactor MV201
L1017	L1190038	FL5H-271K 270 μ H	D2002	G2015550	Si 1S1555
L1018	L2030060		D2003	G2015550	" "
L1019	L1020080A				
					CRYSTAL
		CRYSTAL SOCKET	X2001	H0102030	HC-25/U τ /6 (MHz)
XS1001	P3090002	S2-101P-00			
					POSISTOR
		CONNECTOR	PTH2001	G9090019	PTH-2928
J1001	P0090059	3022-11A			
J1002	P0090091	5049-07A			
J1003	P0090091	"			RESISTOR
J1004	P1090050	UG-625B/U	R2001	J02245561	Carbon film 1/4W SJ 560 Ω
			R2002	J02245472	" " " " 4.7k Ω
			R2003	J02245103	" " " " 10k Ω
		TP TERMINAL	R2004	J02245471	" " " " 470 Ω
TP1001	Q5000037	TP-H	R2005	J02245101	" " " " 100 Ω
TP1002	Q5000037	"	R2006	J02245102	" " " " 1k Ω
			R2007	J02245103	" " " " 10k Ω
			R2008	J02245473	" " " " 47k Ω
		SHIELD CASE	R2009	J02245101	" " " " 100 Ω
	L9190015		R2010	J02245101	" " " " 100 Ω
			R2011	J02245220	" " " " 22 Ω
			R2012	J02245220	" " " " 22 Ω
		FERRITE BEADS	R2013	J10246121	" composition 1/4W GK 120 Ω
	L9190001	Ri 3x3x1	R2014	J02245333	" film " SJ 33k Ω
			R2015	J02245333	" " " " 33k Ω
			R2016	J02245473	" " " " 47k Ω
			R2017	J02245333	" " " " 33k Ω
			R2018	J02245104	" " " " 100k Ω
FTR-2410A TRANSMITTER UNIT			R2019	J02245470	" " " " 47 Ω
Symbol No.	Part No.	Description	R2020	J02245102	" " " " 1k Ω
PB-2306	F0002306	Printed Circuit Board	R2021	J02245471	" " " " 470 Ω
		PCB with Components (w/o crystal)	R2022	J02245102	" " " " 1k Ω
			R2023	J02245682	" " " " 6.8k Ω
	C023061A	134-146MHz	R2024	J02245683	" " " " 68k Ω
	C023061B	144-160MHz	R2025	J02245331	" " " " 330 Ω

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R2026	J02245222	Carbon film	1/4W SJ	2.2k Ω	C2003	K06189010	Ceramic Disc	63WV UJ	120pF
R2027	J02245222	"	"	2.2k Ω			(RD872-2UJ-121J63V)		
R2028	J02245333	"	"	33k Ω	C2004	K06189004	"	"	100pF
R2029	J02245100	"	"	10 Ω			(RD871-2UJ-101J63V)		
R2030	J02245222	"	"	2.2k Ω	C2005	K10179015	"	50WV	0.01 μ F
R2031	J02245103	"	"	10k Ω			(CK45B1H103MY)		
R2032	J00245104	"	"	100k Ω	C2006	K10179015	"	"	0.01 μ F
R2033	J02245100	"	"	10 Ω			(")		
R2034	J02245101	"	"	100 Ω	C2007	K02185101	"	63WV CH	100pF
R2039	J02245101	"	"	100 Ω			(RD874-2CG-101J63V)		
R2040	J02245103	"	"	10k Ω	C2008	K10179015	"	50WV	0.01 μ F
R2041	J02245229	"	"	2.2 Ω			(CK45B1H103MY)		
R2042	J02245100	"	"	10 Ω	C2009	K05185330	"	63WV RH	33pF
R2045	J02245471	"	"	470 Ω			(RD871-2RG-330J63V)		
R2046	J02245224	"	"	220k Ω	C2010	K10179015	"	50WV	0.01 μ F
R2047	J02245824	"	"	820k Ω			(CK45B1H103MY)		
R2048	J02245333	"	"	33k Ω	C2012	K10179014	"	"	0.001 μ F
R2049	J02245824	"	"	820k Ω			(CK45B1H102MY)		
R2050	J02245334	"	"	330k Ω	C2013	K02185121	"	63WV CH	120pF
R2051	J02245562	"	"	5.6k Ω			(RD874-2CG-121J63V)		
R2052	J02245273	"	"	27k Ω	C2014	K10179014	"	50WV	0.001 μ F
R2053	J02245562	"	"	5.6k Ω			(CK45B1H102MY)		
R2054	J02245153	"	"	15k Ω	C2015	K70120001	Tantalum	16WV	4.7 μ F
R2055	J02245224	"	"	220k Ω			(489D475X0016A1)		
R2056	J02245474	"	"	470k Ω	C2016	K10179015	Ceramic Disc	50WV	0.01 μ F
R2057	J02245124	"	"	120k Ω			(CK45B1H103MY)		
R2058	J02245155	"	"	1.5M Ω	C2017	K02185121	"	63WV CH	120pF
R2059	J02245223	"	"	22k Ω			(RD874-2CG-121J63V)		
R2060	J02245104	"	"	100k Ω	C2019	K10179015	"	50WV	0.01 μ F
R2061	J02245473	"	"	47k Ω			(CK45B1H103MY)		
R2062	J02245103	"	"	10k Ω	C2020	K10179015	"	"	0.01 μ F
R2063	J02245103	"	"	10k Ω			(")		
R2064	J02245153	"	"	15k Ω	C2023	K10179015	"	"	0.01 μ F
R2065	J02245104	"	"	100k Ω			(")		
R2066	J02245102	"	"	1k Ω	C2026	K05189003	"	63WV RH	39pF
R2067	J02245103	"	"	10k Ω			(RD871-2RG-390J63V)		
R2068	J02245103	"	"	10k Ω	C2028	K10179015	"	50WV	0.01 μ F
R2069	J02245102	"	"	1k Ω			(CK45B1H103MY)		
R2070	J02245102	"	"	1k Ω	C2029	K10179015	"	"	0.01 μ F
R2071	J02245103	"	"	10k Ω			(")		
R2072	J02245153	"	"	15k Ω	C2030	K01182059	"	63WV CH	0.5pF
R2073	J02245102	"	"	1k Ω			(RD870-1CG-0R5C63V)		
R2074	J02245103	"	"	10k Ω	C2033	K10179014	"	50WV	0.001 μ F
R2075	J00245103	"	"	10k Ω			(CK45B1H102MY)		
R2076	J02245154	"	"	150k Ω	C2034	K10179015	"	"	0.01 μ F
R2077	J02245683	"	"	68k Ω			(CK45B1H103MY)		
R2078	J02245103	"	"	10k Ω	C2035	K10179014	"	"	0.001 μ F
R2079	J02245472	"	"	4.7k Ω			(CK45B1H102MY)		
R2080	J02245471	"	"	470 Ω	C2036	K10179014	"	"	0.001 μ F
R2081	J02245332	"	"	3.3k Ω			(")		
R2082	J02245562	"	"	5.6k Ω	C2038	K02179028	"	"	CH 10pF
R2083	J02245391	"	"	390 Ω			(2222-636-10109)		
					C2039	K02185470	"	63WV	47pF
							(RD872-2CG-470J63V)		
		POTENTIOMETER			C2040	K10179014	"	"	0.001 μ F
VR2001	J51723103	H1051A013-10KB		10k Ω B			(CK45B1H102MY)		
VR2002	J51724103	PN822H103H		10k Ω B	C2041	K10179014	"	"	0.001 μ F
							(")		
		CAPACITOR			C2042	K10179014	"	"	0.001 μ F
							(")		
C2001	K06185150	Ceramic Disc	63WV UJ	15pF	C2043	K10179014	"	"	0.001 μ F
		(RD870-1N750-150J63V)					(")		
C2002	K10179014	"	50WV	0.001 μ F	C2044	K02179028	"	"	CH 10pF
		(CK45B1H102MY)					(2222-636-10109)		

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C2045	K02175150	Ceramic Disc 63WV CH 15pF (DD104CH150J50V02)	C2077	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C2046	K02175150	" " " " 15pF (")	C2080	K70120009	Tantalum 16WV 33μF (489D336X0016E1)
C2047	K02175150	" " " " 15pF (")	C2081	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C2048	K02175150	" " " " 15pF (")	C2082	K50177103	Mylar " " 0.01μF (50F2U103M)
C2049	K02175150	" " " " 15pF (")	C2083	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
C2050	K02175150	" " " " 15pF (")	C2084	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C2051	K50177223	Mylar " " 0.022μF (50F2U223M)	C2085	K10179014	" " " " 0.001μF (")
C2052	K50177102	" " " " 0.001μF (50F2U102M)	C2086	K70120009	Tantalum 16WV 33μF (489D336X0016E1)
C2053	K70140007	Tantalum 25WV 1μF (489D105X0025A1)	C2087	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C2054	K70120001	" " 16WV 4.7μF (489D475X0016B1)	C2088	K10179014	" " " " 0.001μF (")
C2055	K70140007	" " 25WV 1μF (489D105X0025A1)	C2091	K01182059	" " " 63WV CH 0.5pF (RD870-1CG-0R5C63V)
C2056	K50177332	Mylar 50WV 0.0033μF (50F2U332M)	C2092	K10179015	" " 50WV 0.01μF (CK45B1H103MY)
C2057	K50177102	" " " " 0.001μF (50F2U102M)	C2093	K10179014	" " " " 0.001μF (CK45B1H102MY)
C2058	K02179066	Ceramic Disc 63WV CH 39pF (RD871-2CG-390J63V)	C2094	K10179015	" " " " 0.001μF (CK45B1H103MY)
C2059	K70140007	Tantalum 25WV 1μF (489D105X0025A1)	C2095	K40129007	Electrolytic 16WV 100μF (16RE100)
C2060	K50177223	Mylar 50WV 0.022μF (50F2U223M)	C2096	K70140007	Tantalum 25WV 1μF (489D105X0025A1)
C2061	K70120002	Tantalum 16WV 10μF (489D106X0016C1)	C2097	K40129006	Electrolytic 16WV 470μF (16RE470)
C2062	K40129007	Electrolytic " " 100μF (16RE100)	C2098	K10179014	Ceramic Disc 50WV 0.001μF (CK45B1H102MY)
C2063	K10179015	Ceramic Disc 50WV 0.01μF (CK45B1H103MY)	C2099	K02175150	" " " " CH 15pF (DD104CH150J50V02)
C2064	K70140007	Tantalum 25WV 1μF (489D105X0025A1)	C2100	K02175150	" " " " 15pF (")
C2065	K70167474	" " 35WV 0.47μF (CS15E1VR47)	C2101	K21170002	Feed through " " 0.001μF (ECKY1H-102WE)
C2066	K70120002	" " 16WV 10μF (489D106X0016C1)	C2102	K21170002	" " " " 0.001μF (")
C2067	K10179014	" " 50WV 0.001μF (CK45B1H102MY)	C2103	K21170002	" " " " 0.001μF (")
C2068	K70185151	Ceramic Disc 63WV PH 150pF (RD874-2PG-151J63V)	C2104	K21170002	" " " " 0.001μF (")
C2069	K10179015	" " 50WV 0.01μF (CK45B1H103MY)	C2105	K21170002	" " " " 0.001μF (")
C2070	K10179014	" " " " 0.001μF (CK45B1H102MY)	C2106	K21170002	" " " " 0.001μF (")
C2071	K10179014	" " " " 0.001μF (")	C2108	K21170002	Feed through " " 0.001μF (ECKY1H-102WE)
C2072	K10179014	" " " " 0.001μF (")	C2109	K21170002	" " " " 0.001μF (")
C2073	K50177103	Mylar " " 0.01μF (50F2U103)			
C2074	K10179014	Ceramic Disc " " 0.001μF (CK45B1H102MY)	TC2001	K91000029	TRIMMER CAPACITOR ECV-1ZW-20x53T 20pF
C2075	K02185121	" " 63WV CH 120pF (RD874-2CG-121J63V)	TC2002	K91000028	" " -10x53T 10pF
C2076	K10179014	" " 50WV 0.001μF (CK45B1H102MY)	TC2003	K91000028	" " " " 10pF
			TC2006	K91000028	" " " " 10pF

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TRANSFORMER			FTR-2410A BAND TABLE		
			Symbol No.	Part No.	Description
T2001	L0020666	113CN-6391Z	134-146MHz BAND		
T2002	L0190011	113CN-6394N			
T2003	L0190011	"	C1001	K05183100	Ceramic Disc 63WV RH 10pF (RD870-1BG-100D)
T2004	L0020652	113CN-6396Z			
T2005	L0020346	113CN-3393Y	C1002	K05185390	" " " " 39pF (RD871-2RG-390J)
T2006	L0020653	113SN-6397Y			
T2007	L0020653	"	C1004	K05185330	" " " " 33pF (RD871-2RG-330J)
T2008	L0020429	113SN-4530Y			
T2009	L0020429	"	C1005	K02182050	" " " " CH 5pF (RD870-1CG-050C)
			C1010	K05185390	" " " " RH 39pF (RD871-2RG-390J)
INDUCTOR					
L2001	L1190017	FLSH-102K 1mH	C1011	K05183100	" " " " 10pF (RD870-1RG-100D)
L2002	L1020081A				
L2003	L1020081A		C1013	K05185120	" " " " 12pF (RD870-1RG-120J)
L2004	L1020081A				
L2005	L0020679		C1015	K05185330	" " " " 33pF (RD871-2RG-330J)
L2006	L1020081A				
L2007	L0020679		C1016	K02182040	" " " " CH 4pF (RD870-1CG-040C)
L2008	L0020852				
L2013	L0020678		C1021	K05185220	" " " " RH 22pF (RD870-1RG-220J)
L2014	L0020679				
L2015	L1020079A		C1040	K05183100	" " " " 10pF (RD870-1RG-100D)
L2016	L0020679				
L2017	L0020679		C1103	K02183100	" " " " CH 10pF (RD870-1CG-100D)
L2018	L0020679				
L2019	L1020080A		C1128	K06182040	" " " " UJ 4pF (RD870-1UG-040C)
L2020	L1020080A				
L2021	L1190041	181LY-104K 100mH	C2018	K05185680	" " " " RH 68pF (RD872-1RG-680J)
L2022	L2030060				
L2023	L1020080A		C2021	K05185820	" " " " 82pF (RD872-2RG-820J)
L2024	L1190017	FL5H-102K 1mH			
L2025	L0020334		C2022	K05185180	" " " " 18pF (RD870-1RG-180J)
			C2024	K02182010	" " " " CH 1pF (RD870-1CG-010C)
CRYSTAL SOCKET					
XS2001	P3090002	S2-101P-00	C2025	K05185270	" " " " RH 27pF (RD870-1RG-270J)
			C2027	K05185120	" " " " 12pF (RD870-1RG-120J)
CONNECTOR					
J2001	P0090092	3022-08A	C2031	K05185120	" " " " 12pF (RD870-1RG-120J)
J2002	P1090254	BNC-LR			
J2003	P0090091	5049-07A	C2032	K05185680	" " " " 68pF (RD872-1RG-680J)
J2004	P1090016	SQ3056			
J2005	P0090091	5049-07A	C2037	K02182159	" " " " CH 1.5pF (RD870-1CG-1R5C)
			C2038	K02185150	" " " " 15pF (RD870-1CG-150J)
TP TERMINAL					
TP2001	Q5000037	TP-H	C2045	K02183100	" " " " 10pF (RD870-1CG-100D)
TP2002	Q5000037	"			
TP2003	Q5000037	"	C2046	K02185120	" " " " 12pF (RD870-1CG-120J)
TP2004	Q5000037	"			
TP2006	Q5000037	"	C2047	K02183100	" " " " 10pF (RD870-1CG-100D)
TP2007	Q5000037	"	C2048	K02185120	" " " " 12pF (RD870-1CG-120J)
			C2049	K02183100	" " " " 10pF (RD870-1CG-100D)
P2004	P0090009	SQ4152	C2050	K02185120	" " " " 12pF (RD870-1CG-120J)
			C2089	K02183100	" " " " 10pF (RD870-1CG-100D)
			C2099	K02183100	" " " " 10pF

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C2107	K02183060	Ceramic Disc 63WV CH 6pF (RD870-1CG-060D)	C2089		Not Used
			C2099		" "
L2008	Q90000043	Jumper A (06-5.0)	C2107		" "
			L2008	L0020852	L0020852
144-160MHz BAND			160-174MHz BAND		
C1001	K05183070	Ceramic Disc 63WV RH 7pF (RD870-1RG-070D)	C1001	K05183060	Ceramic Disc 63WV RH 6pF (RD870-1RG-060D)
C1002	K05185270	" " " " 27pF (RD870-1RG-270J)	C1002	K05185220	" " " " 22pF (RD870-1RG-220J)
C1004	K05189009	" " " " 33pF (RD870-1RG-330J)	C1004	K05185270	" " " " 27pF (RD870-1RG-270J)
C1005	K02182030	" " " CH 3pF (RD870-1CG-030C)	C1005	K02182020	" " " CH 2pF (RD870-1CG-020C)
C1010	K05185390	" " " RH 39pF (RD871-2RG-390J)	C1010	K05185330	" " " RH 33pF (RD871-2RG-330J)
C1011	K05183070	" " " " 7pF (RD870-1RG-070D)	C1011	K05183060	" " " " 6pF (RD870-1RG-060D)
C1013	K05183080	" " " " 8pF (RD870-1RG-080D)	C1013	K05183080	" " " " 8pF (RD870-1RG-080D)
C1015	K05185270	" " " " 27pF (RD870-1RG-270J)	C1015	K05185220	" " " " 22pF (RD870-1RG-220J)
C1016	K02182010	" " " CH 1pF (RD870-1CG-010C)	C1016		Not Used
C1021	K05185150	" " " RH 15pF (RD870-1RG-150J)	C1021	K05185150	Ceramic Disc 63WV RH 15pF (RD870-1RG-150J)
C1040	K05183080	" " " " 8pF (RD870-1RG-080D)	C1040	K05183080	" " " " 8pF (RD870-1RG-080D)
C1103	K02182030	" " " CH 3pF (RD870-1CG-030C)	C1103		Not Used
C1128	K06182040	" " " UJ 4pF (RD870-1UG-040C)	C1128		" "
C2018	K05185560	" " " RH 56pF (RD871-1RG-560J)	C2018	K05185390	Ceramic Disc 63WV RH 39pF (RD871-1RG-390J)
C2021	K05185680	" " " " 68pF (RD872-1RG-680J)	C2021	K05185470	" " " " 47pF (RD871-1RG-470J)
C2022	K05185150	" " " " 15pF (RD870-1RG-150J)	C2022	K05183100	" " " " 10pF (RD871-1RG-100D)
C2024	K02182010	" " " CH 1pF (RD870-1CG-010C)	C2024	K02182059	" " " CH 0.5pF (RD870-1CG-0R5C)
C2025	K05185150	" " " " RH 15pF (RD870-1RG-150J)	C2025	K05185120	" " " RH 12pF (RD870-1RG-120J)
C2027	K05183100	" " " " 10pF (RD870-1RG-100D)	C2027	K05183080	" " " " 8pF (RD870-1RG-080D)
C2031	K05183100	" " " " 10pF (RD870-1RG-100D)	C2031	K05183080	" " " " 8pF (" ")
C2032	K05185470	" " " " 47pF (RD870-1RG-470J)	C2032	K05185390	" " " " 39pF (RD871-1RG-390J)
C2037	K02182020	" " " CH 2pF (RD870-1CG-020C)	C2037	K02182159	" " " CH 1.5pF (RD870-1CG-1R5C)
C2038	K02183100	" " " " 10pF (RD870-1CG-100D)	C2038	K02183100	" " " " 10pF (RD870-1CG-100D)
C2045	K02185150	" " " " 15pF (RD870-1CG-150J)	C2045	K02185150	" " " " 15pF (RD870-1CG-150J)
C2046	K02185150	" " " " 15pF (" ")	C2046	K02185150	" " " " 15pF (" ")
C2047	K02185150	" " " " 15pF (" ")	C2047	K02185150	" " " " 15pF (" ")
C2048	K02185150	" " " " 15pF (" ")	C2048	K02185150	" " " " 15pF (" ")
C2049	K02185150	" " " " 15pF (" ")	C2049	K02185150	" " " " 15pF (" ")
C2050	K02185150	" " " " 15pF (" ")	C2050	K02185150	" " " " 15pF (" ")
			C2089		Not Used
			C2099		" "
			C2107		" "
			L2008	L0020852	L0020852

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FTR-5410 RECEIVER UNIT					CERAMIC DISCRIMINATOR
Symbol No.	Part No.	Description	CD1001	H7900010	455D
PB-2306	F0002306	Printed Circuit Board			
		PCB with Components (w/o crystal)			
	C023062C	400-420MHz 25kHz	PTH1001	G9090019	POSISTOR PTH-2928
	C023062D	420-430MHz "			
	C023062E	430-450MHz "			
	C023062F	450-470MHz "			RESISTOR
	C023062G	470-490MHz "	R1001	J02245333	Carbon film 1/4W SJ 33k Ω
	C023062H	490-512MHz "	R1002	J02245154	" " " " 150k Ω
PB-2309	F0002309	Printed Circuit Board	R1003	J02245473	" " " " 47k Ω
	C023090A	(Connector board)	R1004	J02245101	" " " " 100 Ω
			R1005	J02245333	" " " " 33k Ω
			R1006	J02245154	" " " " 150k Ω
		IC, FET, TRANSISTOR	R1007(25kHz)	J02245103	" " " " 10k Ω
Q1001	G4800760	3SK76 (FET)	R1007(12.5kHz)	J02245272	" " " " 2.7k Ω
Q1002	G4800760	" (")	R1008	J02245470	" " " " 47 Ω
Q1003	G3305350B	2SC535B (TR)	R1009	J02245101	" " " " 100 Ω
Q1004	G3319060	2SC1906 (")	R1010	J02245101	" " " " 100 Ω
Q1005	G3319070	2SC1907 (")	R1011	J02245561	" " " " 560 Ω
Q1006	G3305350B	2SC535B (")	R1012	J02245103	" " " " 10k Ω
Q1007	G3005350B	" (")	R1013	J02245472	" " " " 4.7k Ω
Q1008	G3305350B	" (")	R1014	J02245471	" " " " 470 Ω
Q1009	G3304600B	2SC460B (")	R1015	J02245222	" " " " 2.2k Ω
Q1010	G330460B	" (")	R1016	J02245223	" " " " 22k Ω
Q1011	G1090072	μ PC577H (IC)	R1017	J02245471	" " " " 470 Ω
Q1012	G1090218	AN315 (")	R1018	J02245222	" " " " 2.2k Ω
Q1013	G3304600C	2SC460C (TR)	R1019	J02245223	" " " " 22k Ω
Q1014	G3304600B	2SC460B (")	R1020	J02245681	" " " " 680 Ω
Q1015	G3304600B	" (")	R1021(25kHz)	J10246102	Carbon composition 1/4W GK 1k Ω
Q1016	G3304600B	" (")			
Q1017	G3304600B	" (")	R1021(12.5kHz)	J10246821	" " " " 820 Ω
Q1018	G1090222	MB3756 (IC)	R1022	J02245472	Carbon film " SJ 4.7k Ω
			R1023	J02245223	" " " " 22k Ω
			R1024	J02245102	" " " " 1k Ω
		DIODE	R1025	J02245102	" " " " 1k Ω
D1001	G2015550	Si 1S1555	R1026	J02245223	" " " " 22k Ω
D1002	G2015550	" "	R1027	J02245333	" " " " 33k Ω
D1003	G2015550	" "	R1028	J02245102	" " " " 1k Ω
D1004	G2015550	" "	R1029	J02245101	" " " " 100 Ω
D1005	G2015550	" "	R1030	J02245472	" " " " 4.7k Ω
D1006	G2015550	" "	R1031	J02245223	" " " " 22k Ω
			R1032	J02245102	" " " " 1k Ω
			R1033	J02245102	" " " " 1k Ω
		CRYSTAL	R1034	J02245101	" " " " 100 Ω
X1001	H0102346	HC-25/U (f_R -21.4)/9 (MHz)	R1035	J02245222	" " " " 2.2k Ω
X1002	H0102050	HC-18/U 20.945MHz	R1036	J02245102	" " " " 1k Ω
			R1037	J02245154	" " " " 150k Ω
			R1038	J02245222	" " " " 2.2k Ω
		CRYSTAL FILTER	R1039	J02245154	" " " " 150k Ω
XF1001 (25kHz)	H1101990	21J2B2(1/2) PAIR	R1040	J02245222	" " " " 2.2k Ω
XF1002	H1101990	" (") PAIR	R1041	J02245222	" " " " 2.2k Ω
XF1001(12.5kHz)	H1102034	21J2F2(1/2) PAIR	R1042	J02245473	" " " " 47k Ω
XF1002	H1102034	" (")	R1043	J02245102	" " " " 1k Ω
			R1044	J02245103	" " " " 10k Ω
			R1045	J02245103	" " " " 10k Ω
		CERAMIC FILTER	R1046	J02245332	" " " " 3.3k Ω
CF1001(25kHz)	H3900030	LF-B15	R1048	J02245333	" " " " 33k Ω
CF1002(25kHz)	H3900030	"	R1049	J02245820	" " " " 82 Ω
CF1001(12.5kHz)	H3900146	LF-B8A	R1050(25kHz)	J02245103	" " " " 10k Ω
CF1002(12.5kHz)	H3900146	"	R1050(12.5kHz)		Not Used
			R1051	J02245333	Carbon film 1/4W SJ 33k Ω
			R1052	J02245562	" " " " 5.6k Ω
			R1053	J02245332	" " " " 3.3k Ω

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R1054	J02245102	Carbon film	1/4W SJ	1k Ω	C1035	K10179015	Ceramic Disc	50WV	0.01 μ F
R1055	J02245333	"	"	33k Ω			(CD095XB103K50)		
R1056	J02245104	"	"	100k Ω	C1037	K10179014	"	"	0.001 μ F
R1057	J02245682	"	"	6.8k Ω			(CD050XB102K50)		
R1058	J02245224	"	"	220k Ω	C1038	K10179014	"	"	0.001 μ F
R1059	J02245472	"	"	4.7k Ω			(" ")		
R1060	J02245820	"	"	82 Ω	C1039	K10179015	"	"	0.01 μ F
R1062	J02245332	"	"	3.3k Ω			(CD095XB103K50)		
R1063	J02245332	"	"	3.3k Ω	C1041	K10179015	"	"	0.01 μ F
R1064	J02245472	"	"	4.7k Ω			(CD095XB103K50)		
R1065	J02245391	"	"	390 Ω	C1042	K10179014	"	"	0.001 μ F
R1066	J02245333	"	"	33k Ω			(CD050XB102K50)		
R1067	J10246103	Carbon composition	1/4W GK	10k Ω	C1043	K02182059	"	63WV AH	0.5pF
R1068	J02245103	Carbon film	" SJ	10k Ω	C1046	K10179014	"	50WV	0.001 μ F
R1069	J02245332	"	"	3.3k Ω			(CD050XB102K50)		
					C1048	K10179014	"	"	0.001 μ F
							(" ")		
		POTENTIOMETER			C1049(25kHz)	K02183070	"	63WV CH	7pF
VR1001	J51723103	H1051A013-10KB		10k Ω B			(RD870-1CG070D)		
					C1049(12.5kHz)	K02185120	"	"	12pF
							(RD870-1CG-120J)		
		CAPACITOR			C1050	K10179015	"	50WV	0.01 μ F
C1003	K10179014	Ceramic Disc	50WV	0.001 μ F			(CD095XB103K50)		
C1005	K10179014	"	"	0.001 μ F	C1051	K10179015	"	"	0.01 μ F
		(CD050XB102K50)					(" ")		
C1006	K10179014	"	"	0.001 μ F	C1052	K10179014	"	"	0.001 μ F
		(" ")					(CD050XB102K50)		
C1008	K10179014	"	"	0.001 μ F	C1053	K06189005	"	63WV UJ	33pF
		(" ")					(RD870-2UG-330J)		
C1009	K10179014	"	"	0.001 μ F	C1054	K06185221	"	"	220pF
		(" ")					(RD873-2UG-221J)		
C1015	K10179014	"	"	0.001 μ F	C1055	K06185101	"	"	100pF
		(" ")					(RD871-1UG-101J)		
C1017	K10179014	"	"	0.001 μ F	C1056	K02183100	"	"	CH 10pF
		(" ")					(RD870-1CG-100D)		
C1021	K10179014	"	"	0.001 μ F	C1057	K10179015	"	50WV	0.01 μ F
		(" ")					(CD095XB103K50)		
C1022	K10179014	"	"	0.001 μ F	C1058	K70120002	Tantalum	16WV	10 μ F
		(" ")					(489D106X0016C1)		
C1023	K10179014	"	"	0.001 μ F	C1059	K10179014	Ceramic Disc	50WV	0.001 μ F
		(" ")					(CD050XB102K50)		
C1024	K10179014	"	"	0.001 μ F	C1060	K70120001	Tantalum	16WV	4.7 μ F
		(" ")					(489D475X0016B1)		
C1025	K10179014	"	"	0.001 μ F	C1061	K10179014	Ceramic Disc	50WV	0.001 μ F
		(" ")					(CD050XB102K50)		
C1026	K10179015	"	"	0.01 μ F	C1062	K10179014	"	"	0.001 μ F
		(CD095XB103K50)					(" ")		
C1027	K10179015	"	"	0.01 μ F	C1063	K70120001	Tantalum	16WV	4.7 μ F
		(" ")					(489D475X0016B1)		
C1028	K10179015	"	"	0.01 μ F	C1064	K10179015	Ceramic Disc	50WV	0.01 μ F
		(" ")					(CD095XB103K50)		
C1029	K06185120	"	63WV UJ	12pF	C1065	K10179015	"	"	0.01 μ F
		(RD870-1N750-120J)					(" ")		
C1030	K10179014	"	50WV	0.001 μ F	C1066	K70120002	Tantalum	16WV	10 μ F
		(CD050XB102K50)					(489D106X0016C1)		
C1031	K06189002	"	63WV UJ	82pF	C1067	K10179015	Ceramic Disc	50WV	0.01 μ F
		(RD871-2UG-820J)					(CD095XB103K50)		
C1032	K06185560	"	"	56pF	C1068	K10179014	"	"	0.001 μ F
		(RD871-1UG-560J)					(CD050XB102K50)		
C1033	K10179015	"	50WV	0.01 μ F	C1069	K10179014	"	"	0.001 μ F
		(CD095XB103K50)					(" ")		
C1034	K10179014	"	"	0.001 μ F	C1070	K10179014	"	"	0.001 μ F
		(CD050XB102K50)					(" ")		

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C1071	K50177222	Mylar 50WV 0.0022 μ F (50F2U222)	C1103	K10179014	Ceramic Disc 50WV 0.001 μ F (CD050XB102K50)
C1072	K70120002	Tantalum 16WV 10 μ F (489D106X0016C1)	C1106	K40129006	Electrolytic 16WV 470 μ F (16RE470)
C1073	K50176473	Mylar 50WV 0.047 μ F (MRS-473K)	C1107	K10179014	Ceramic Disc 50WV 0.001 μ F (CD050XB102K50)
C1074	K50176473	" " 0.047 μ F (")	C1108	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)
C1075	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	C1109	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C1076	K50176473	Mylar 50WV 0.047 μ F (MRS-473K)	C1110	K10179015	Ceramic Disc 50WV 0.01 μ F (CD095XB103K50)
C1077	K50176473	" " 0.047 μ F (")	C1111	K40129007	Electrolytic 16WV 100 μ F (16RE100)
C1078	K50176473	" " 0.047 μ F (")	C1112	K10179015	Ceramic Disc 50WV 0.01 μ F (CD095XB103K50)
C1079	K10179014	Ceramic Disc " 0.001 μ r ² (CD050XB102K50)	C1113	K10179015	" " " 0.01 μ F (")
C1080	K50176473	Mylar " 0.047 μ F (MRS-473K)	C1114	K10179014	" " " 0.001 μ F (CD050XB102K50)
C1081	K10186471	Ceramic Disc " 470pF (RD870-1B471K63V)	C1115	K21170002	Feed through " 0.001 μ F (ECKY1H-102WE)
C1082	K50177103	Mylar " 0.01 μ F (50F2U103M)	C1116	K21170002	" " " 0.001 μ F (")
C1083	K50177222	" " 0.0022 μ F (50F2U222M)	C1117	K21170002	" " " 0.001 μ F (")
C1084	K50177222	" " 0.0022 μ F (")	C1118	K21170002	" " " 0.001 μ F (")
C1086	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	C1119	K21170002	" " " 0.001 μ F (")
C1087	K50177332	Mylar 50WV 0.0033 μ F (50F2U332M)	C1121	K21170002	" " " 0.001 μ F (")
C1088	K70120010	Tantalum 16WV 22 μ F (499D226X0016GS1)	C1122	K21170002	" " " 0.001 μ F (")
C1089	K50177102	Mylar 50WV 0.001 μ F (50F2U102M)	C1123	K21170002	" " " 0.001 μ F (")
C1090	K10186331	" " 330pF (RD870-1B331K63V)	C1124	K21170002	" " " 0.001 μ F (")
C1091	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	C1125	K21170002	" " " 0.001 μ F (")
C1092	K70120002	" " 10 μ F (489D106X0016C1)	C1126	K21170002	" " " 0.001 μ F (")
C1093	K40129006	Electrolytic " 470 μ F (16RE470)	C1127	K50177103	Mylar " 0.01 μ F (50F2U103M)
C1094	K70167154	Tantalum 35WV 0.15 μ F (CS15E1VR15MIS)			
C1095	K50177472	Mylar 50WV 0.0047 μ F (50F2U472M)			TRIMMER CAPACITOR
C1096	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	TC1001	K91000029	ECV-1ZW 20x53T 20pF
C1097	K02185101	Ceramic Disc 63WV CH 100pF (RD874-2CG101J)	TC1002	K91000029	" " " 20pF
C1098	K10185821	" " 50WV 820pF (RD870-1B-821K63V)			TRANSFORMER
C1099(25kHz)	K70140007	Tantalum 25WV 1 μ F (489D105X0025A1)	T1001	L0190012	113KN-6405Z
C1099(12.5kHz)	K70140009	" " 2.2 μ F (489D225X0025B1)	T1002	L0190013	113KN-6409X
C1100	K70120002	" 16WV 10 μ F (489D106X0016C1)	T1003	L0020343	113SN-3392Y
C1101	K10179014	Ceramic Disc 50WV 0.001 μ F (CD050XB102K50)	T1004	L0020343	113SN-3392Y
C1102	K10179014	" " " 0.001 μ F (")	T1005	L0020717	199CC-11125BWN
			T1006	L0020647	199CC-11114N
			T1007	L0020649	7MC-5896Y
					INDUCTOR
			LJ1010	L1020082A	
			LJ1011	L1020082A	

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012	L1190017	FL-5H	102K	1mH	Q2010	G3305350B	2SC535B	(TR)
013	L1020082A				Q2011	G3305350B	"	(")
014	L0020675				Q2012	G1090220	MLM2902	(IC)
015	L1190017	FL-5H	102K	1mH	Q2013	G3208560B	2SB856B	(TR)
016	L1190017	"	"	"	Q2014	G3304580B	2SC458B	(")
017	L1190038	"	271K	270μH	Q2015	G1090221	MC3401P	(IC)
018	L2030060				Q2016	G3304600B	2SC460B	(TR)
019	L1020080A				Q2017	G1090222	MB3756	(IC)
		CRYSTAL SOCKET					DIODE	
1001	P3090002	S2-101P-00			D2001	G2090084	Varactor	MV201
					D2002	G2015550	Si	1S1555
					D2003	G2015550	"	"
		CONNECTOR						
001	P0090059	3022-11A						
002	P0090091	5049-07A					CRYSTAL	
003	P0090091	"			X2001	H0102345	HC-25/U	f _T /12 (MHz)
004	P1090191	UG625B/U						
					XS2001	P3090002	S2-101P-00	
		TP TERMINAL						
0001	Q5000037	TP-H					POSISTOR	
0002	Q5000037	"			PTH2001	G9090019	PTH-2928	
	Q5000038	TP-I						
	U00312050	Nylon Screw					RESISTOR	
	U65003050	Fiber Washer			R2001	J02245561	Carbon film	1/4W SJ 560Ω
					R2002	J02245472	" "	" " 4.7kΩ
	R7066320	Insulator			R2003	J02245103	" "	" " 10kΩ
					R2004	J02245471	" "	" " 470Ω
					R2005	J02245101	" "	" " 100Ω
		FERRITE BEADS			R2006	J02245102	" "	" " 1kΩ
	L9190001	Ri 3x3x1			R2007	J02245103	" "	" " 10kΩ
					R2008	J02245473	" "	" " 47kΩ
					R2009	J02245101	" "	" " 100Ω
001 (with wire)	T9204326				R2010	J02245101	" "	" " 100Ω
					R2011	J02245220	" "	" " 22Ω
					R2012	J02245220	" "	" " 22Ω
					R2013	J10246221	Carbon composition	
							"	GK 220Ω
					R2014	J02245333	Carbon film	SJ 33kΩ
					R2015	J02245333	" "	" " 33kΩ
					R2016	J02245473	" "	" " 47kΩ
					R2017	J02245333	" "	" " 33kΩ
					R2018	J02245104	" "	" " 100kΩ
					R2019	J02245470	" "	" " 47Ω
	C023063C	400-420MHz			R2020	J02245102	" "	" " 1kΩ
	C023063D	420-430MHz			R2021	J02245471	" "	" " 470Ω
	C023063E	430-450MHz			R2020	J02245222	" "	" " 2.2kΩ
	C023063F	450-470MHz			R2023	J02245102	" "	" " 1kΩ
	C023063G	470-490MHz			R2024	J02245103	" "	" " 10kΩ
	C023063H	490-512MHz			R2025	J02245100	" "	" " 10Ω
2309	F0002309	Printed Circuit Board			R2026	J02245222	" "	" " 2.2kΩ
	C023090A	(Connector board)			R2027	J02245681	" "	" " 680Ω
					R2028	J02245103	" "	" " 10kΩ
					R2029	J02245100	" "	" " 100Ω
					R2030	J02245222	" "	" " 2.2kΩ
001	G3305350B	2SC535B (TR)			R2031	J02245471	" "	" " 470Ω
002	G3305350B	" (")			R2033	J02245100	" "	" " 10Ω
003	G3305350B	" (")			R2034	J02245102	" "	" " 1kΩ
004	G3319060	2SC1906 (")			R2035	J02245271	" "	" " 270Ω
005	G3319060	" (")			R2036	J02245332	" "	" " 3.3kΩ
006	G3319070	2SC1907 (")			R2037	J02245229	" "	" " 2.2Ω
008	G3324070	2SC2407 (")			R2038	J02245101	" "	" " 100Ω

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R2039	J02245101	Carbon film	1/4W SJ	100Ω	C2008	K10179015	Ceramic Disc 50WV 0.01μF (CD095XB103K50)
R2040	J02245472	"	"	4.7kΩ			
R2041	J02245470	"	"	47Ω	C2009	K05185270	" " 63WV RH 27pF (RD870-1RG270J)
R2042	J02245100	"	"	10Ω			
R2045	J02245471	"	"	470Ω	C2010	K10179015	" " 50WV 0.01μF (CD050XB103K50)
R2046	J02245224	"	"	220kΩ			
R2047	J02245824	"	"	820kΩ	C2012	K10179014	" " " 0.001μF (CD050XB102K50)
R2048	J02245333	"	"	33kΩ			
R2049	J02245824	"	"	820kΩ	C2013	K02185121	" " 63WV CH 120pF (RD874-2CG-121J)
R2050	J02245334	"	"	330kΩ			
R2051	J02245562	"	"	5.6kΩ	C2014	K10179014	" " 50WV 0.001μF (CD050XB102K50)
R2052	J02245273	"	"	27kΩ			
R2053	J02245562	"	"	5.6kΩ	C2015	K70120001	Tantalum 16WV 4.7μF (489D475X0016B1)
R2054	J02245153	"	"	15kΩ			
R2055	J02245224	"	"	220kΩ	C2016	K10179015	Ceramic Disc 50WV 0.01μF (CD095XB103K50)
R2056	J02245474	"	"	470kΩ			
R2057	J02245124	"	"	120kΩ	C2017	K02185121	" " 63WV CH 120pF (RD874-2CG121J)
R2058	J02245155	"	"	1.5MΩ			
R2059	J02245223	"	"	22kΩ	C2019	K10179015	" " 50WV 0.01μF (CD095XB103K50)
R2060	J02245104	"	"	100kΩ			
R2061	J02245473	"	"	47kΩ	C2020	K10179015	" " " 0.01μF (" ")
R2062	J02245103	"	"	10kΩ			
R2063	J02245103	"	"	10kΩ	C2021	K05185560	" " 63WV RH 56pF (RD871-1RG560J)
R2064	J02245223	"	"	22kΩ			
R2065	J02245154	"	"	150kΩ	C2023	K10179015	" " 50WV 0.01μF (CD095XB103K50)
R2066	J02245102	"	"	1kΩ			
R2067	J02245103	"	"	10kΩ	C2024	K02182159	" " 63WV CH 1.5pF (RD870-1CG1R5C)
R2068	J02245103	"	"	10kΩ			
R2069	J02245561	"	"	560Ω	C2025	K05185470	" " " RH 47pF (RD871-1RG470J)
R2070	J02245102	"	"	1kΩ			
R2071	J02245103	"	"	10kΩ	C2026	K05185560	" " " " 56pF (RD871-1RG560J)
R2072	J02245153	"	"	15kΩ			
R2073	J02245102	"	"	1kΩ	C2027	K05183080	" " " " 8pF (RD870-1RG080D)
R2074	J02245103	"	"	10kΩ			
R2075	J02245103	"	"	10kΩ	C2028	K10179015	" " 50WV 0.01μF (CD095XB103K50)
R2076	J02245154	"	"	150kΩ			
R2077	J02245683	"	"	68kΩ	C2029	K10179015	" " " " 0.01μF (" ")
R2078	J02245103	"	"	10kΩ			
R2079	J02245472	"	"	4.7kΩ	C2030	K02182059	" " 63WV CH 0.5pF (RD870-1CG0R5J)
R2080	J02245331	"	"	330Ω			
R2081	J02245103	"	"	10kΩ	C2032	K05185270	" " " RH 27pF (RD870-1RG270J)
R2082	J02245562	"	"	5.6kΩ			
R2083	J02245391	"	"	390Ω	C2033	K02185560	" " " CH 56pF (RD872-2CG560J)
					C2034	K10179014	" " 50WV 0.001μF (CD050XB102K50)
		POTENTIOMETER					
VR2001	J51723103	H1051A013-10KB	10kΩB	C2035	K10179015	" " " 0.01μF (CD095XB103K50)	
VR2002	J51724103	PN822H103H	10kΩB				
				C2036	K10179014	" " " 0.001μF (CD050XB102K50)	
		CAPACITOR					
C2001	K06185150	Ceramic Disc 63WV UJ 15pF (RD870-1UG150J)		C2037	K02182059	" " 63WV CH 0.5pF (RD870-1CG0R5C)	
C2002	K10179014	" " 50WV 0.001μF (CD050XB102K50)		C2039	K10179014	" " 50WV 0.001μF (CD050XB102K50)	
C2003	K06185680	" " 63WV UJ 68pF (RD871-2UG680J)		C2040	K10179014	" " " " 0.001μF (" ")	
C2004	K06189003	" " " " 56pF (RD871-1UG560J)		C2041	K10179014	" " " " 0.001μF (" ")	
C2005	K10179015	" " 50WV 0.01μF (CD095XB103K50)		C2042	K10179014	" " " " 0.001μF (" ")	
C2006	K10179015	" " " " 0.01μF (" ")		C2043	K10179014	" " " " 0.001μF (" ")	
C2007	K02185101	" " 63WV CH 100pF (RD874-2CG-101J)		C2045	K02185150	" " " " 15pF (RD870-1CG150J)	

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C2050	K02172030	Ceramic Disc 50WV 3pF (DD104CH030C50V02)	C2082	K50177103	Mylar 50WV 0.01μF (50F2U103M)
C2051	K50177223	Mylar " 0.022μF (50F2U223M)	C2083	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
C2052	K50177102	" " 0.001μF (50F2U102M)	C2084	K10179014	Ceramic Disc 50WV 0.001μF (CD050XB102K50)
C2053	K70140007	Tantalum 25WV 1μF (489D105X0025A1)	C2085	K10179014	" " " 0.001μF (" ")
C2054	K70120001	" 16WV 4.7μF (489D475X0016B1)	C2086	K70120009	Tantalum 16WV 33μF (489D336X0016E1)
C2055	K70140007	" 25WV 1μF (489D105X0025A1)	C2087	K10179014	Ceramic Disc 50WV 0.001μF (CD050XB102K50)
C2056	K50177332	Mylar 50WV 0.0033μF (50F2U332M)	C2088	K10179014	" " " 0.001μF (" ")
C2057	K50177102	" " 0.001μF (50F2U102M)	C2089	K02182010	" " 63WV CH 1pF (RD870-1CG010C)
C2058	K02185390	Ceramic Disc 63WV CH 39pF (RD871-1CG390J)	C2092	K10179015	" " 50WV 0.01μF (CD095XB103K50)
C2059	K70140007	Tantalum 25WV 1μF (489D105X0025A1)	C2093	K10179014	" " " 0.001μF (CD050XB102K50)
C2060	K50177223	Mylar 50WV 0.022μF (50F2U223M)	C2094	K10179015	" " " 0.01μF (CD095XB103K50)
C2061	K70120002	Tantalum 16WV 10μF (489D106X0016C1)	C2095	K40129007	Electrolytic 16WV 100μF (16RE100)
C2062	K40129007	Electrolytic " 100μF (16RE100)	C2096	K70140007	Tantalum 25WV 1μF (489D105X0025A1)
C2063	K10179015	Ceramic Disc 50WV 0.01μF (CD095XB103K50)	C2097	K40129006	Electrolytic 16WV 470μF (16RE470)
C2064	K70140007	Tantalum 25WV 1μF (489D105X0025A1)	C2098	K10179014	Ceramic Disc 50WV 0.001μF (CD050XB102K50)
C2065	K70167474	" 35WV 0.47μF (CS15E1VR47M1S)	C2099	K21170002	Feed through " 0.001μF (ECKY1H-102WE)
C2066	K70120002	" 16WV 10μF (489D106X0016C1)	C2100	K21170002	" " " 0.001μF (" ")
C2067	K10179014	Ceramic Disc 50WV 0.001μF (CD050XB102K50)	C2101	K21170002	" " " 0.001μF (" ")
C2068	K70185151	" " " PH 150pF (RD874-2PG-151J)	C2102	K21170002	" " " 0.001μF (" ")
C2069	K10179015	" " " 0.01μF (CD095XB103K50)	C2103	K21170002	" " " 0.001μF (" ")
C2070	K10179014	" " " 0.001μF (CD050XB102K50)	C2104	K21170002	" " " 0.001μF (" ")
C2071	K10179014	" " " 0.001μF (" ")	C2106	K02172050	Ceramic Disc " CH 5pF (DD104CH050C50V02)
C2072	K10179014	" " " 0.001μF (" ")	C2108	K10179014	" " " 0.001μF (CD050XB102K50)
C2073	K50177103	Mylar " " 0.01μF (50F2U103M)	C2109	K21170002	Feed through 50WV 0.01μF (ECKY1H102WE)
C2074	K10179014	Ceramic Disc 50WV 0.001μF (CD050XB102K50)	C2110	K21170002	" " " 0.01μF (" ")
C2075	K02185121	" " 16WV CH 120pF (RD874-2CG121J)			
C2076	K10179014	" " 50WV 0.001μF (CD050XB102K50)			TRIMMER CAPACITOR
C2077	K10179014	" " " 0.001μF (" ")	TC2001	K91000029	ECV-1ZW-20x53T 20pF
C2078	K10179014	" " " 0.001μF (" ")	TC2002	K91000060	" -02x53T 2pF
C2079	K10179014	" " " 0.001μF (" ")	TC2003	K91000060	" -02x53T 2pF
C2080	K70120009	Tantalum 16WV 33μF (489D336X0016E1)	TC2004	K91000059	" -04x53T 4pF
C2081	K10179014	Ceramic Disc 50WV 0.001μF (CD050XB102K50)	TC2006	K91000028	" -10x53T 10pF
			TC2007	K91000059	" -04x53T 4pF
					TRANSFORMER
			T2001	L0020346	113CN-3393Y
			T2002	L0190011	113KN-6407N
			T2003	L0190010	" -6406N

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			BAND		
			Symbol No.	Part No.	Description
T2004	L0190014	113KN-6408Z			
T2005	L0020346	113CN-3393Y			
T2006	L0020343	113SN-3392Y	400-420MHz BAND		
T2007	L0020343	" - "	Q2007	G3319070	2SC1907 (TR)
T2008	L0020429	" -4530Y	Q2009	G1090392	MS7704L (IC)
T2009	L0020429	" - "	CV1001	Q9000199	HRW-231MT-1032A
			CV1002	Q9000201	HRQ-232MT-1023A
			CV1003	Q9000200	HRW-231MT-1033A
		INDUCTOR	R2084		Not Used
L2001	L1190017	FL5H-102K 1mH	R2085		" "
L2002	L1020081A		C1004	K02183060	Ceramic Disc 63WV CH 6pF (RD870-1CG-060D)
L2003	L1020081A				
L2004	L1020081A		C1010	K02185120	" " " " 12pF
L2006	L0020081A				(RD870-1CG-120J)
L2007	L0020675		C1036	K02185120	" " " " 12pF
L2008	L0020675				(")
L2013	L0020675		C1040	K05183100	" " " " RH 10pF
L2015	L1020079A				(RD870-1RG-100D)
L2017	L0020677		C1044	K05185120	" " " " 12pF
L2018	L0020677				(RD870-1RG-120J)
L2019	L1020080A		C1045	K05189009	" " " " 33pF
L2020	L1020080A				(RD871-2RG-330J)
L2021	L1190041	181LY-104K 100mH	C1047	K02182050	" " " " CH 5pF
H2022	L2030060				(RD870-1CG-050C)
L2023	L1020080A		C2018	K05185220	" " " " RH 22pF
L2024	L1190017	FL5H-102K 1mH			(RD870-1RG-220J)
L2025	L0021269A		C2022	K05189003	" " " " 39pF
					(RD871-2RG-390J)
			C2031	K05185180	" " " " 18pF
		CONNECTOR			(RD870-1RG-180J)
J2001	P0090092	3022-08A	C2038	K02182020	" " " " CH 2pF
J2002	P1090254	BNC-LR			(RD870-1CG-020C)
J2003	P0090091	5049-07A	C2046	K02182050	" " " " 5pF
J2004	P1090016	SQ3056			(RD870-1CG-050C)
J2005	P0090091	5049-07A	C2047	K02182050	" " " " 5pF
					(")
			C2048	K02182030	" " " " 3pF
					(RD870-1CG-030C)
		TP TERMINAL			
TP2001	Q5000037	TP-H	C2049	K02182030	" " " " 3pF
TP2002	Q5000037	"			(")
TP2003	Q5000037	"	C2107	K02182030	" " " " 3pF
TP2004	Q5000037	"			(")
TP2005	Q5000037	"	TC2005	K91000060	ECV-1ZW-02x53T 2pF
TP2006	Q5000037	"	L1002	L0020675	
TP2007	Q5000037	"	L1004	L0020675	
	Q5000015	TP-A	L1005	L0020675	
	Q5000038	TP-I	L1009	L0020756	
			L2005	L0020676	
	U03312050	Nylon Screw	L2010	L0020675	
	U75003050	Fiber Washer	L2011	L0020675	
			L2014	L0020675	
		PIN PLUG			
P2001	T9204332		420-430MHz BAND		
P2004	P0090009	SQ4152	Q2007	G3319070	2SC1907 (TR)
	T9204496		Q2009	G1090392	MS7704L (IC)
			CV1001	Q9000198	HRW-231MT-1031A
			CV1002	Q9000202	HRQ-232MT-1024A
			CV1003	Q9000199	HRW-231MT-1032A
			D2084		Not Used
			R2085		" "
			C1004	K02183060	Ceramic Disc 63WV CH 6pF (RD870-1CG-060D)
			C1010	K02185120	" " " " 12pF
					(RD870-1CG-120J)

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TC2005	K91000060	ECV-1ZW-02x53T	2pF	CV1001	Q9000240	HRW-231MT-1067A
L1002	L0020675			CV1002	Q9000241	HRQ-232MT-1051A
L1004	L0020675			CV1003	Q9000242	HRW-231MT-1068A
L1005	L0020675			R2084	J02245101	Carbon film 1/4W SJ 100Ω
L1009	L0020756			R2085	J02245471	" " " " 470Ω
L2005	L0020675			C1004	K02182050	Ceramic Disc 63WV CH 5pF (RD870-1CG-050C)
L2010	L0020674					
L2011	L0020675			C1010	K02185120	" " " " 12pF (RD870-1CG-120J)
L2014	L0020675					
				C1036	K02185120	" " " " 12pF (" ")
470-490MHz BAND				C1040	K05183080	" " " " RH 8pF (RD870-1RG-080D)
Q2007	G3319070	2SC1907 (TR)				
Q2009	G1090318	M57704UH (IC)		C1044	K05185120	" " " " 12pF (RD870-1RG-120J)
CV1001	Q9000198	HRW-231MT-1031A				
CV1002	Q9000202	HRQ-232MT-1024A		C1045	K05185330	" " " " 33pF (RD870-2RG-330J)
CV1003	Q9000199	HRW-231MT-1032A				
R2084		Not Used		C1047	K02182050	" " " " CH 5pF (RD870-1CG-050C)
R2085		" "				
C1004	K02183060	Ceramic Disc 63WV CH 6pF (RD870-1CG-060D)		C2018	K05185150	" " " " RH 15pF (RD870-1RG-150J)
C1010	K02185120	" " " " 12pF (RD870-1CG-120J)		C2022	K05189009	" " " " 33pF (RD871-2RG-330J)
C1036	K02185120	" " " " 12pF (" ")		C2031	K05185120	" " " " 12pF (RD870-1RG-120J)
C1040	K05183100	" " " " RH 10pF (RD870-1RG-100D)		C2038	K02182010	" " " " CH 1pF (RD870-1CG-010C)
C1044	K05185120	" " " " 12pF (RD870-1RG-120J)		C2046	K02182030	" " " " 3pF (RD870-1CG-030C)
C1045	K05189009	" " " " 33pF (RD871-2RG-330J)		C2047	K02182030	" " " " 3pF (" ")
C1047	K02182050	" " " " CH 5pF (RD870-1CG-050C)		C2048	K02182010	" " " " 1pF (RD870-1CG-010C)
C2018	K05185180	" " " " RH 18pF (RD870-1RG-180J)		C2049	K02182010	" " " " 1pF (" ")
C2022	K05189009	" " " " 33pF (RD871-2RG-330J)		C2107	K02182020	" " " " 2pF (RD870-1CG-020C)
C2031	K05185120	" " " " 12pF (RD870-1RG-120J)		TC2005	K91000059	ECV-1ZW-04x53T 4pF
C2038	K02182010	" " " " CH 1pF (RD870-1CG-010C)		L1002	L0020675	
C2046	K02182030	" " " " 3pF (RD870-1CG-030C)		L1004	L0020675	
C2047	K02182030	" " " " 3pF (" ")		L1005	L0020675	
C2048	K02182010	" " " " 1pF (RD870-1CG-010C)		L1009	L0020676	
C2049	K02182010	" " " " 1pF (" ")		L2005	L0020674	
C2107	K02182030	" " " " 3pF (RD870-1CG-030C)		L2010	L0020674	
				L2011	L0020674	
				L2014	L0020674	
TC2005	K91000059	ECV-1ZW-04x53T	4pF	FTR-710A FTR-2410A FTR-5410 COR UNIT		
L1002	L0020675			Symbol No.	Part No.	Description
L1004	L0020675			PB-2418C	F0002418C	Printed Circuit Board
L1005	L0020675				C024180C	PCB with components
L1009	L0020756					
L2005	L0020674					
L2010	L0020674					IC, TRANSISTOR
L2011	L0020674			Q3001	G1090220	MLM2902 (IC)
L2014	L0020674			Q3002	G1090257	MC14066B (")
				Q3003	G1090220	MLM2902 (")
				Q3004	G1090375	MC14536B (")
				Q3005	G1090375	" (")
490-512MHz BAND				Q3006	G1090068	MC14011B (")
Q2007	G3324070	2SC2407 (TR)		Q3007	G1090068	" (")
Q2009	G1090319	M57704SH (IC)				

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Q3008	G1090126	MC14069B (IC)	R3042	J02245183	Carbon film 1/4W SJ 18kΩ
Q3009	G1090027	MC14001B (")	R3043	J02245183	" " " " 18kΩ
Q3010	G3304580P	2SC458B (TR)	R3044	J02245103	" " " " 10kΩ
Q3011	G3304580B	" (")	R3045	J02245103	" " " " 10kΩ
Q3012	G1090384	MC14538B (IC)	R3046	J02245104	" " " " 100kΩ
			R3047	J02245330	" " " " 33Ω
			R3048	J02245681	" " " " 680Ω
		DIODE	R3049	J02245103	" " " " 10kΩ
D3001	G2015550	Si 1S1555	R3051	J02245104	" " " " 100kΩ
D3002	G2015550	" "	R3052	J02245104	" " " " 100kΩ
D3003	G2015550	" "	R3053	J02245104	" " " " 100kΩ
D3004	G2090003	" V06B	R3054	J10216105	" composition
D3006	G2015550	" 1S1555			1/8W GK 1MΩ
D3007	G2015550	" "			
					BLOCK RESISTOR
		RESISTOR	RB3001	J40900020	RA1/16K5R 100kΩx5
R3001	J10246103	Carbon composition 1/4W GK 10kΩ	RB3002	J40900020	" "
R3002	J02245683	" film " SJ 68kΩ			
R3003	J10246393	" composition " GK 39kΩ	VR3001	J51745104	H0651A017 100KB 100kΩB
R3004	J10246393	" " " " 39kΩ	VR3002	J51745103	" 013 10KB 10kΩB
R3005	J02245183	" film " SJ 18kΩ	VR3003	J51745102	" 007 1KB 1kΩB
R3006	J02245393	" " " " 39kΩ	VR3004	J51724103	PN822H103H 10kB
R3007	J10246273	" composition GK 27kΩ	VR3005	J51724103	" " 10kB
R3008	J02245104	" film " SJ 100kΩ			
R3009	J10246473	" composition " GK 47kΩ			CAPACITOR
R3010	J10246473	" " " " 47kΩ	C3001	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
R3011	J02245473	" film " SJ 47kΩ	C3002	K50177332	Mylar 50WV 0.0033μF (50F2U332M)
R3012	J10246473	" composition " GK 47kΩ	C3003	K10186471	Ceramic Disc " 470pF (RD870-1B471K63V)
R3013	J02245473	" film " SJ 47kΩ	C3004	K50177223	Mylar " 0.022μF (50F2U223M)
R3014	J10246473	" composition " GK 47kΩ	C3005	K50177223	" " 0.022μF (")
R3015	J02245153	" film " SJ 15kΩ	C3006	K50177223	" " 0.022μF (")
R3016	J02245473	" " " " 47kΩ			
R3017	J10246473	" composition " GK 47kΩ	C3007	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
R3018	J02245473	" film " SJ 47kΩ	C3008	K70120002	" " " 10μF (" ")
R3019	J02245273	" " " " 27kΩ	C3009	K70120002	" " " 10μF (" ")
R3020	J02245103	" " " " 10kΩ			
R3021	J02245153	" " " " 15kΩ			
R3022	J02245104	" " " " 100kΩ			
R3023	J02245104	" " " " 100kΩ			
R3024	J02245104	" " " " 100kΩ	C3010	K50177103	Mylar 50WV 0.01μF (50F2U103M)
R3025	J02245104	" " " " 100kΩ			
R3026	J02245104	" " " " 100kΩ	C3011	K50177103	" " " 0.01μF (" ")
R3027	J02245104	" " " " 100kΩ			
R3028	J02245104	" " " " 100kΩ	C3012	K50177332	" " " 0.0033μF (50F2U332M)
R3029	J02245103	" " " " 10kΩ			
R3030	J02245104	" " " " 100kΩ	C3013	K50177332	" " " 0.0033μF (" ")
R3031	J02245332	" " " " 3.3kΩ			
R3032	J02245473	" " " " 47kΩ	C3014	K50177103	" " " 0.01μF (50F2U103M)
R3033	J02245104	" " " " 100kΩ			
R3034	J02245104	" " " " 100kΩ	C3015	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
R3035	J02245104	" " " " 100kΩ			
R3036	J02245332	" " " " 3.3kΩ	C3016	K10179015	Ceramic Disc 50WV 0.01μF (CD095XB103K50)
R3037	J02245473	" " " " 47kΩ			
R3038	J02245104	" " " " 100kΩ	C3017	K40129002	Electrolytic 16WV 47μF (16RE47)
R3039	J02245104	" " " " 100kΩ			
R3040	J02245103	" " " " 10kΩ	C3018	K40129002	" " " 47μF (")
R3041	J02245103	" " " " 10kΩ			

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C3019	K10179014	Ceramic Disc 50WV 0.001 μ F (CD050XB102K50)				IC, TRANSISTOR
			Q4001	G1090373	TA7089P	(IC)
C3020	K10179014	" " " 0.001 μ F (" ")	Q4002	G34088000	2SD880-O	(TR)
C3021	K50177103	Mylar " 0.01 μ F (50F2U103M)				DIODE
C3023	K10179014	Ceramic Disc " 0.001 μ F (CD050XB102K50)	D4001	G2090001	Si	10D1
			D4002	G2090001	"	"
C3024	K10179014	" " " 0.001 μ F (" ")				
C3025	K50177223	Mylar " 0.022 μ F (50F2U223M)				RESISTOR
			R4001	J01245151	Carbon film	1/4W TJ 150 Ω
C3026	K50177332	" " 0.0033 μ F (50F2U332M)	R4002	J01245103	" " " "	10k Ω
			R4003	J01245331	" " " "	330 Ω
C3027	K50177332	" " 0.0033 μ F (" ")	R4004	J01245332	" " " "	3.3k Ω
			R4005	J01245822	" " " "	8.2k Ω
			R4006	J20306102	Metallic film	1W 1k Ω
			R4007	J10276681	Carbon composition	1/2W GK 680 Ω
		INDUCTOR				
L3001	L1190017	FL5H-102K 1mH				
						POTENTIOMETER
		RELAY	VR4001	J51721502	EVLS3AA00B53	5k Ω B
RL3001	M1190008	FBR-221D-006 6V	VR4002	J51721102	" 13	1k Ω B
		SWITCH				CAPACITOR
S3001	N7090026	SGK-106-2	C4001	K40169003	Electrolytic 35WV	330 μ F
S3002	N7090026	"			(35RE330)	
S3003	N6090008	SSS012	C4002	K10179015	Ceramic Disc 50WV	0.01 μ F
					(CD095XB103K50)	
			C4003	K50177333	Mylar " "	0.033 μ F
					(50F2U333)	
		CONNECTOR				
J3001	P0090054	5048-07A	C4004	K10179015	Ceramic Disc 50WV	0.01 μ F
J3002	P0090054	"			(CD095XB103K50)	
J3003	P0090267	5233-08A	C4005	K10179014	" " " "	0.001 μ F
J3004	P0090051	5048-06A			(CD050XB102K50)	
J3005	P0090054	5048-07A	C4006	K40129011	Electrolytic 16WV	1000 μ F
J3006	P0090038	5048-12A			(16RE1000)	
J3007	P0090051	5048-06A	C4007	K10179015	Ceramic Disc 50WV	0.01 μ F
J3008	P0090042	5048-05A			(CD095XB103K50)	
		TP TERMINAL				TERMINAL
TP3001	Q5000037	TP-H		Q5000011	Wrapping terminal C	
P3005 (with wire)	T9204467A					
P3006 (")	T9204468B					
						RELAY UNIT
			Symbol No.	Part No.	Description	
P3008 (")	T9204469		PB-2308	F0002308	Printed Circuit Board	
				C023080A	PCB with components	
P3003 (")	T9204470A					
						IC
			Q5001	G1090301	μ PC7812H	
		REG UNIT				DIODE
			Symbol No.	Part No.	Description	
PB-2248A	F0002248A	Printed Circuit Board	D5001	G2090034	Si	U05B
	C022480A	PCB with components	D5002	G2090034	"	"
			D5003	G2015550	"	1S1555

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		RESISTOR	D6009	G2090019	Ge	1N60
R5001	J30376569	Cement 5W 5.6Ω				
		CAPACITOR	R6001	J10246103	RESISTOR Carbon composition	
C5001	K50177103	Mylar 50WV 0.01μF (50F2U103)	R6002	J02245473	Carbon film	1/4W GK 10kΩ
C5002	K70167334	Tantalum 35WV 0.33μF (CS15E1VR33M)	R6003	J02245473	" "	" " 47kΩ
C5003	K70120001	" 16WV 4.7μF (489D475X0016B1)	R6004	J02245473	" "	" " 47kΩ
			R6005	J02245473	" "	" " 47kΩ
			R6006	J02245473	" "	" " 47kΩ
			R6007	J02245473	" "	" " 47kΩ
			R6008	J02245473	" "	" " 47kΩ
		RELAY	R6009	J02245473	" "	" " 47kΩ
RL5001	M1090019	HC-2-DC-12V	R6010	J02245474	" "	" " 470kΩ
RLS5001	M1390010	HC-2 (Socket)	R6012	J02245564	" "	" " 560kΩ
			R6013	J02245106	" "	" " 10MΩ
			R6015	J02245103	" "	" " 10kΩ
		FUSE	R6016	J02245103	" "	" " 10kΩ
F5001	Q0000006	4A	R6017	J02245472	" "	" " 4.7kΩ
	P2000003	Fuse Holder F3265	R6018	J02245103	" "	" " 10kΩ
			R6019	J02245103	" "	" " 10kΩ
			R6020	J02245473	" "	" " 47kΩ
		TP TERMINAL	R6021	J02245183	" "	" " 18kΩ
	Q5000037	TP-H	R6022	J02245105	" "	" " 1MΩ
			R6023	J02245105	" "	" " 1MΩ
			R6024	J10246472	Carbon composition	
					" "	GK 4.7kΩ
			R6025	J02245183	Carbon film	" SJ 18kΩ
			R6026	J20336330	Metallic film	2W 33Ω
ID UNIT						
Symbol No.	Part No.	Description				
PB-2417A	F0002417A	Printed Circuit Board				INDUCTOR
	C024170A	PCB with components w/o Q6007	L6001	L1190041	181LY-104K 100mH	
						BLOCK RESISTOR
		IC, TRANSISTOR	RB6001	J40900015	(EXB-P88-472K) 1/4W 4.7kΩx8	
Q6001	G1090375	MC14536B (IC)				
Q6002	G1090068	MC14011B (")				
Q6003	G1090419	MC14566B (")				
Q6004	G1090149	MC14510B (")				POTENTIOMETER
Q6005	G1090126	MC14069B (")	VR6001	J51745225	H0651A027 2.2MB 2.2MΩB	
Q6006	G1090420	SN74LS393N (")	VR6002	J51745473	H0651A017 47KB 47kΩB	
Q6007	G1090020	SN74S188AN (")				
Q6008	G1090421	SN74LS151N (")				
Q6009	G3304580	2SC458B (TR)				CAPACITOR
Q6010	G3304580	" (")	C6001	K00175220	Ceramic Disc 50WV 22pF (DD104SL220J50V02)	
Q6011	G3304580	" (")				
Q6012	G1090037	MC14572B (IC)	C6002	K02175820	" " " CH 82pF (DD104CH820J50V02)	
Q6013	G1090253	NS74LS00N (")				
Q6014	G1090174	MC14002B (")	C6003	K50177223	Mylar " 0.022μF (50F2U223)	
Q6015	G1090068	MC14011B (")				
Q6016	G1090299	μPC7805H (")	C6004	K70167104	Tantalum 35WV 0.1μF (CS15E1V0R1M1S)	
			C6005	K50177103	Mylar " 0.01μF (50F2U103)	
		DIODE	C6006	K50177102	" " 0.001μF (50F2U102)	
D6001	G2015550	Si 1S1555				
D6002	G2015550	" "				
D6003	G2015550	" "	C6007	K50177102	" " 0.001μF (")	
D6004	G2015550	" "				
D6005	G2015550	" "	C6008	K50177103	" " 0.01μF (50F2U103)	
D6006	G2090019	Ge 1N60				
D6007	G2090019	" "	C6009	K50177473	" " 0.047μF (50F2U473)	
D6008	G2090019	" "				

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C6010	K50177473	Mylar 35WV 0.047 μ F (50F2U473)	D7001	G2015550	DIODE	Si	1S1555
C6011	K50177103	" " 0.01 μ F (50F2U103)	D7002	G2015550	"	"	"
C6012	K70120001	Tantalum 16WV 4.7 μ F (489D475X0016B1)	D7003	G2015550	"	"	"
C6013	K70120002	" " 10 μ F (489D106X0016C1)	D7004	G2015550	"	"	"
C6014	K10179015	Ceramic Disc 50WV 0.01 μ F (CD095XB103K50)	D7005	G2015550	"	"	"
C6015	K50177223	Mylar " 0.022 μ F (50F2U223)	D7006	G2015550	"	"	"
C6016	K10186471	Ceramic Disc 63WV 470pF (RD870-1B471K63V)	D7007	G2015550	"	"	"
			D7008	G2015550	"	"	"
			D7009	G2015550	"	"	"
			D7010	G2015550	"	"	"
			D7011	G2015550	"	"	"
			D7012	G2015550	"	"	"
			D7013	G2015550	"	"	"
			D7014	G2015550	"	"	"
			D7015	G2015550	"	"	"
		CRYSTAL	D7016	G2015550	"	"	"
X6001	H0102473	HT-38 32.768kHz	D7017	G2015550	"	"	"
			D7018	G2015550	"	"	"
	P3090033	IC Socket 116-16-30-114	D7019	D2015550	"	"	"
			D7020	G2015550	"	"	"
	P0090042	Connector 5048-05A	D7021	G2090199	Zener	RD-12EB-2	
	R0081800	Heat Sink					
			DA7001	G2090230	Diode Array	1S1555x16	
		TP TERMINAL					
	Q5000037	TP-H			CRYSTAL		
			X7001	H0102347	HC-18/U	3.58MHz	
					RESISTOR		
			R7001	J10246563	Carbon composition	1/4W GK 56k Ω	
DTMF RECEIVER UNIT							
Symbol No.	Part No.	Description	R7002	J10246563	"	"	56k Ω
PB-2416A	F0002416A	Printed Circuit Board	R7003	J10246563	"	"	56k Ω
	C024160A	PCB with components	R7004	J10246563	"	"	56k Ω
			R7005	J10246563	"	"	56k Ω
			R7006	J10246823	"	"	82k Ω
			R7007	J10246823	"	"	82k Ω
		IC, TRANSISTOR	R7008	J10246104	"	"	100k Ω
Q7001	G1090422	SSi201 (IC)	R7009	J10246823	"	"	82k Ω
Q7002	G1090409	MC14514B (")	R7010	J10246823	"	"	82k Ω
Q7003	G1090384	MC14538B (")	R7011	J10246823	"	"	82k Ω
Q7004	G1090053	MC14081B (")	R7012	J10246105	"	"	1M Ω
Q7005	G1090384	MC14538B (")	R7013	J10246105	"	"	1M Ω
Q7006	G1090053	MC14081B (")	R7014	J10246105	"	"	1M Ω
Q7007	G1090053	" (")	R7015	J10246474	"	"	470k Ω
Q7008	G1090053	" (")	R7016	J10246104	"	"	100k Ω
Q7009	G1090053	" (")	R7017	J10246104	"	"	100k Ω
Q7010	G1090067	MC14013B (")	R7018	J10246104	"	"	100k Ω
Q7011	G1090067	" (")	R7019	J10246104	"	"	100k Ω
Q7012	G1090067	" (")	R7020	J10246104	"	"	100k Ω
Q7013	G1090375	MC14536B (")	R7021	J10246104	"	"	100k Ω
Q7014	G3304580B	2SC458B (TR)	R7022	J10246104	"	"	100k Ω
Q7015	G3304580B	" (")	R7023	J10246103	"	"	10k Ω
Q7016	G3304580B	" (")	R7024	J10246103	"	"	10k Ω
Q7017	G3304580B	" (")	R7025	J10246103	"	"	10k Ω
Q7018	G3304580B	" (")	R7026	J10246103	"	"	10k Ω
Q7019	G3304580B	" (")	R7027	J10246103	"	"	10k Ω
Q7020	G3304580B	" (")	R7028	J10246103	"	"	10k Ω
Q7021	G3107330R	2SA733R (")	R7029	J10246103	"	"	10k Ω
Q7022	G3312090	2SC1209 (")	R7030	J10246222	"	"	2.2k Ω
Q7023	G1090080	μ PC78L08 (IC)	R7031	J10246104	"	"	100k Ω
			R7032	J02245473	Carbon film	SJ	47k Ω

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R7033	J02245332	Carbon film 1/4W SJ 3.3kΩ	C7020	K50177103	Mylar 50WV 0.01μF (50F2U103M)
R7034	J10246104	Carbon composition " " " " GK 100kΩ	C7021	K70120006	Tantalum 16WV 3.3μF (489D335X0016B1)
R7035	J10246221	" " " " 220Ω	C7022	K70120006	" " " " 3.3μF (" ")
R7036	J10246104	" " " " 100kΩ	C7023	K70120006	" " " " 3.3μF (" ")
R7037	J10216472	" " 1/8W " 4.7kΩ	C7024	K70127225	" " " " 2.2μF (CS15E1C2R2M1S)
R7038	J10216472	" " " " 4.7kΩ	C7025	K50177223	Mylar 50WV 0.022μF (50F2U223)
R7039	J10216472	" " " " 4.7kΩ	C7026	K70120006	Tantalum 16WV 3.3μF (489D335X0016B1)
R7040	J10216472	" " " " 4.7kΩ	C7027	K50177332	Mylar 50WV 0.0033μF (50F2U332M)
R7041	J10216472	" " " " 4.7kΩ	C7028	K70140007	Tantalum 25WV 1μF (489D105X0025A1)
R7042	J10216472	" " " " 4.7kΩ	C7029	K70120002	" " " " 10μF (489D106X0016C1)
R7043	J10216472	" " " " 4.7kΩ	C7030	K70120002	" " " " 10μF (" ")
R7044	J10216472	" " " " 4.7kΩ	C7031	K70167334	" " " " 0.33μF (CS15E1VR33M1S)
R7045	J10216472	" " " " 4.7kΩ	C7032-7038	K10186102	Ceramic Disc 63WV 0.001μF (RD870-1B102K63V)
R7046	J10216472	" " " " 4.7kΩ			DIP SWITCH
R7047	J10216472	" " " " 4.7kΩ	S7001	N7090026	SGK 106-2
R7048	J10216472	" " " " 4.7kΩ			
R7049	J10246106	" " 1/4W " 10MΩ			
		BLOCK RESISTOR			
RB7001	J40900041	01-0510 100kΩx16			
RB7002	J40900020	RA1/16K5R 100kΩx5			
		POTENTIOMETER			
VR7001	J51745103	PN822H103 10kΩB			
		CAPACITOR			
C7001	K50177103	Mylar 50WV 0.01μF (50F2U103M)	J7001	P0090039	CONNECTOR 5048-13A
C7002	K50177103	" " " " 0.01μF (" ")			
C7005	K50177103	" " " " 0.01μF (" ")			TP TERMINAL
C7006	K50177103	" " " " 0.01μF (" ")	TP7001	Q5000037	TP-H
C7007	K50177103	" " " " 0.01μF (" ")		Q5000036	TP-G
C7008	K50177103	" " " " 0.01μF (" ")	P7001	T9204471B	
C7009	K50177103	" " " " 0.01μF (" ")			IC SOCKET
C7010	K50177103	" " " " 0.01μF (" ")	QS7001	P3090073	C84-22-02
C7011	K50177103	" " " " 0.01μF (" ")			
C7012	K50177103	" " " " 0.01μF (" ")	FTR-710, FTR-2410 COS UNIT		
C7013	K50177103	" " " " 0.01μF (" ")	Symbol No.	Part No.	Description
C7014	K50177103	" " " " 0.01μF (" ")	PB-2307A	F0002307	Printed Circuit Board
C7015	K50177103	" " " " 0.01μF (" ")		C023070A	PCB with components
C7016	K50177103	" " " " 0.01μF (" ")			
C7017	K50177103	" " " " 0.01μF (" ")			IC, TRANSISTOR
C7018	K50177103	" " " " 0.01μF (" ")	Q3001	G1090220	MLM2902 (IC)
C7019	K50177103	" " " " 0.01μF (" ")	Q3002	G1090374	MC1458CP (IC)
			Q3003	G1090124	MC14016B (IC)
			Q3004	G1090052	MC14049B (IC)
			Q3005	G1090052	" (IC)
			Q3006	G3304580B	2SC458B (TR)
			C3007	G3304580B	" (TR)
			Q3008	G1090375	MC14536B (IC)
			Q3009	G3304580B	2SC458B (TR)

(FTR-710A) (FTR-2410) (FTR-5410)

		CONNECTOR	FTS-32R		
J3001	P0090054	5048-07A	Symbol No.	Part No.	Description
J3002	P0090054	"		F0002423	Printed Circuit Board
J3003	P0090054	"			
J3004	P0090051	5048-06A			IC
J3005	P0090054	5048-07A	Q1	G1090123	78L08A
J3006	P0090054	"	Q2	G1090425	LM324
			Q3	G1090426	IC-107
			Q6	G1090427	TL063CP
		TP TERMINAL			
TP3001	Q5000037	TP-H			TRANSISTOR
TP3002	Q5000037	"	Q4,5	G3309451P	2SC945A P/Q
TP3003	Q5000037	"		/Q	
TP3004	Q5000037	"			
TP3005	Q5000037	"			
					DIODE
			D1-4	G2090027	Si 1SS53
			D5,6	G2015550	" 1S1555
					CRYSTAL
			X1	H0102474	UM-1 1MHz
					RESISTOR
			R2	J00215222	Carbon film 1/8W VJ 2.2k Ω
			R31	J00215272	" " " " 2.7k Ω
			R10	J00215562	" " " " 5.6k Ω
			R18	J01215562	" " " TJ 5.6k Ω
			R3,26	J00215103	" " " VJ 10k Ω
			R25	J01215103	" " " TJ 10k Ω
			R1	J00215123	" " " VJ 12k Ω
			R29	J00215153	" " " " 15k Ω
			R13	J01215183	" " " TJ 18k Ω
			R22	J00215473	" " " VJ 47k Ω
			R23	J01215473	" " " TJ 47k Ω
			R28	J00215623	" " " VJ 62k Ω
			R4,32	J00215104	" " " " 100k Ω
			R12,14,15,30,33	J01215104	" " " TJ 100k Ω
			R21	J00215124	" " " VJ 120k Ω
			R36	J00215184	" " " " 180k Ω
			R19	J00215224	" " " " 220k Ω
			R7,20	J00215474	" " " " 470k Ω
			R9,16,17	J01215474	" " " TJ 470k Ω
			R8	J01215564	" " " " 560k Ω
			R5	J01215105	" " " " 1M Ω
			R6,24,34,35	J00215105	" " " VJ 1M Ω
			R11,27	J00215275	" " " " 2.7M Ω
					POTENTIOMETER
			VR1	J51745103	H0651A013-10KB 10k Ω B
					BLOCK RESISTOR
			RB1	J40900023	DA-2
					CAPACITOR
			C25	K00173100	Ceramic disc 50WV SL 10pF (DD104-SL100D50V)
			C18,20	K10176101	" " " B 100pF (DD104B101K50V)
			C10	K10176221	" " " " 220pF (DD104B221K50V)

(FTR-710) (FTR-2410)

(FTS-32R)

C12	K10176271	Ceramic disc 50WV B 270pF (DD104B271K50V)	R2,3,4 R6,24,31	J00215273 J00215473	Carbon film 1/8W VJ 27kΩ " " " " 47kΩ
C7,8,9,19	K23170014	Monolithic ceramic 50WV 0.0033μF (SR155C332M)	R8 R17 R25-28,32,33	J00215683 J00215823 J00215104	" " " " 68kΩ " " " " 82kΩ " " " " 100kΩ
C6	K23170013	" " " 0.01μF (SR155C103M)	R12,13,22 R7	J00215154 J00215224	" " " " 150kΩ " " " " 220kΩ
C11	K23170011	" " " 0.22μF (SR205E224Z)	R5	J00215824	" " " " 820kΩ
C22,23,24	K19149003	Semiconductor " " 0.0015μF (UAT04X152K-L05AE)			POTENTIOMETER
C1	K70140005	Tantalum 25WV 0.47μF (48PD474X0025A1)	VR1,2 VR3,4	J51745473 J51745225	H0651A017-47KB 47kΩB H0651A027-2.2MB 2.2MΩB
C13-17,21,26	K70140007	" " " 1μF (489D105X0025A1)			
C5	K40179001	Electrolytic 50WV 1μF (ECE-A1HK010)			CAPACITOR
C2,3,4	K40129012	" " 16WV 10μF (ECE-A1CK100)	C7 C5,6 C13,14	K02185820 K23170007 K50177332	Ceramic disc 63WV CH 82pF (RD873-2NPO-820J63V) Monolithic Ceramic 50WV " (RPE110C102K50V) 1000pF Mylar " 0.0033μF (50F2U332M)
SW1	N7090026	SGK1062	C1,2 C15	K50177472 K50177223	" " 0.0047μF (50F2U472M) " " 0.022μF (50F2U223M)
		IC SOCKET			
	P3090070	ICC04-004 350T	C11,12	K70167684	Tantalum 35WV 0.68μF (CS15E1V-R68M)
	P3090071	ICC04-007 350T	C10	K70127225	" 16WV 2.2μF (CS15E)C2R2M)
	P3090072	ICC04-009 350T	C3,4,8,9	K70120002	" " 10μF (489D106X0016C1)
FTS-5					
Symbol No.	Part No.	Description			
	F2528000	Printed Circuit Board			SWITCH
			SW1	N6090008	SSS-012148
		IC			
Q1	G1090374	MC1458CP			PIN CONNECTOR
Q3	G1090220	MLM2902P	J1	P0090051	5048-06A
Q7	G1090068	MC14011BCP			
Q9	G1090384	MC1483SBCP			
				T9204618A	CONNECTION CABLE
		TRANSISTOR			
Q2,4-6,8,10	G3326040E	2SC2603E			
		DIODE			
D1-4	G2015550	1S1555			
		RESISTOR			
R9	J20249043	Metallic Film 1/4W F 82.5kΩ (ERO25CKF8252)			
R10	J20249065	" " " " 180kΩ (ERO25CKF1803)			
R11	J20249012	" " " " 68.1kΩ (ERO25CKF6812)			
R23	J00215331	Carbon film 1/8W VJ 330Ω			
R21	J00215332	" " " " 3.3kΩ			
R19	J00215562	" " " " 5.6kΩ			
R14,15,16	J00215103	" " " " 10kΩ			
R1,18,29,30,34	J00215153	" " " " 15kΩ			
R20	J00215223	" " " " 22kΩ			

(FTS-32R) (FTS-5)

FL-2450 MAIN CHASSIS					
			L101	L1020080A	INDUCTOR
Symbol No.	Part No.	Description	L102	L0020354A	
		LED	L103	L0020333	
	G2090203	SDB-205-BGD	L104,107	L0020358A	
			L105,106	L0020661	
			L108,109	L0020353	
		RECEPTACLE			
J1,2	P1090326	M-PA-JJ			
J3	P1090034	D7-701B-00			FERRITE BEADS
J4 (with wire)	T9204642B		FB101	L9190001	Ri 3x3x1
					COAX PLUG/CABLE
			P101,102	T9204644C	MP-3, 3D-QEV
PA UNIT					
Symbol No.	Part No.	Description			
	F2523000	Printed Circuit Board			
	C025230A	PCB with components			
		TRANSISTOR	Symbol	Part No.	Description
Q101	G3326940	2SC2694		F2524000	Printed Circuit Board
				C025240A	PCB with components
		DIODE			
D101-104	G2090118	1SS97			THYRISTOR
			Q201	G3090044	CW12B
		POTENTIOMETER			
VR101	J51721501	EVLS3AA00B52 500ΩB			RESISTOR
			R201	J02245102	Carbon film 1/4W 1kΩ
			R202	J02245224	" " " 220kΩ
		CAPACITOR			
C109,110,120,121	K02182050	Ceramic disc 50WV CH 5pF (RD870-1NPO-050C63V)			POTENTIOMETER
C113,119	K02183070	" " " " 7pF (RD870-1NPO-070D63V)	VR201	J50707103	PN822H103V 10kΩB
C111,112, 114-118	K02183100	" " " " 10pF (RD870-1NPO-100D63V)			
C122,125	K10179015	" " " B 0.01μF (CDS080XB103K50)			CAPACITOR
C123,126	K23170020	" chip " 0.001μF (GR40W5R102M)	C201-203	K10186102	Ceramic disc 63WV 0.001μF (RD870-1B102K63V)
C128-130	K21170002	" Feed thru " 0.001μF (ECK-Y1H-102WE)			
C102	K30279070	Dipped Mica 500WV 39pF (DM15D390J5)			
C103,104	K30279072	" " " 68pF (DM15D680J5)	ACCESSORIES		
C101,108	K30279093	" " " 1000pF (DM19D102J5)	Symbol No.	Part No.	Description
C106	K32279018	Ribbon Mica " 22pF (RM40-2H220DA)		T9100160A	Coaxial Cable
C105	K32279020	" " " 27pF (RM40-2H270DA)		T9101230	Control Cable
C107	K32279060	" " " 250pF (RM20-251J5)			
C124,127	K40129023	Electrolytic 16WV 47μF (16RJ2-47)			
		TRIMMER CAPACITOR			
TC101	K91000032	B2PY 100pF			
TC102	K91000046	C1P2 70pF			

(FL-2450)

FL-5450 MAIN CHASSIS			TC101	K91000123	TRIMMER CAPACITOR	
Symbol No.	Part No.	Description	TC102,103	K91000031	2222-808-31159	15pF
		LED			B-1P	40pF
	G2090203	SDB-205-BGD				
					INDUCTOR	
J1,2	P1090326	RECEPTACLE	L101,102	L0021372		
J3	P1090034	M-PA-JJ	L103-106	L0021373A		
J4 (with wire)	T9204642B	D7-701B-00	L107	L0021374		
			L108	L0020665		
			L109,110	L0021375		
					COAX PLUG/CABLE	
PA UNIT			P101,102	T9204644C	MP-3	3D-QEV
Symbol No.	Part No.	Description				
	F2530000	Printed Circuit Board				
	C025300A	PCB with components				
		TRANSISTOR	AFP UNIT			
Q101	G3326950	2SC2695	Symbol No.	Part No.	Description	
Q102	G3331020	2SC3102		F2524000	Printed Circuit Board	
				C025240A	PCB with components	
		DIODE				
D101-103	G2090118	1SS97				
			Q201	G3090044	THYRISTOR CW12	
		RESISTOR				
R101	J02245561	Carbon film 1/4W SJ 560Ω			RESISTOR	
			R201	J02245102	Carbon film 1/4W	1kΩ
			R202	J02245224	" " "	220kΩ
		POTENTIOMETER				
	J51729201	RV8-FAN 200Ω 200ΩB				
					POTENTIOMETER	
			VR201	J50707103	PN822H103V	10kΩB
		CAPACITOR				
C115	K02182020	Ceramic disc 63WV CH 2pF (RD870-1NPO-020C63V)			CAPACITOR	
C108,109,116	K02182030	" " " " 3pF (RD870-1NPO-030C63V)	C201-203	K10186102	Ceramic disc 63WV 0.001μF (RD870-1B102K63V)	
C110,103	K02182040	" " " " 4pF (RD870-1NPO-040C63V)				
C111-114	K02183070	" " " " 7pF (RD870-1NPO-070D63V)				
C118,121,124	K10179015	" " " B 0.01μF (CDS080XB103K50)				
			ACCESSORIES			
C101	K22171211	" chip 50WV CH 10pF (C3216CH1H100DFA)	Symbol No.	Part No.	Description	
C102	K22171221	" " " " 27pF (C3216CH1H270JFA)		T9100160A	Coaxial Cable	
C117,120,123	K22171801	" " " B 0.001μF (C3216B1H102KFA)		T9101230	Control Cable	
C126-128	K21170002	" Feed thru 0.001μF (ECK-Y1H-102KWE)				
C104	K32279016	Ribbon Mica " 18pF (RM40-2H180DA)				
C105,106	K32279018	" " " " 22pF (RM40-2H220DA)				
C107	K32279028	" " " " 56pF (RM40-2H560FA)				
C119,122,124	K40129023	Electrolytic 16WV 47μF (16RJ2-47)				

(FL-5450)

**FP-15
MAIN CHASSIS**

AVR UNIT

Symbol No.	Part No.	Description	Symbol No.	Part No.	Description
		TRANSISTOR		F0002248A	Printed Circuit Board
				C022480A	PCB with components
Q1-4	G3090014	2N3055			
Q5	G3408800D	2SD880D			
					IC
		DIODE	Q101	G1090373	TA7089P
	G2090121	S25VB10			
	G2090203	SDB-205-BGD (LED)			
			D101,102	G2090001	DIODE 10D1
		RESISTOR			
R1-4	J30406029	Cement 10W 0.2Ω			
					RESISTOR
			R103	J01245470	Carbon film 1/4W TJ 47Ω
		CAPACITOR	R101	J01245151	" " " " 150Ω
C1	K43170002	Electrolytic 50WV 22000μF (50RL 22000)	R104	J01245332	" " " " 3.3kΩ
			R105	J01245822	" " " " 8.2kΩ
C3,4	K12329002	Ceramic 1.4kV 0.0047μF (ECK-DAL472PE)	R102	J01245103	" " " " 10kΩ
			R106	J20306102	Metalic " 1W 1kΩ
C5	K10179015	" 50WV B 0.01μF (CDS080XB103K50)	R107	J10276681	Carbon Composition 1/2W 680Ω
		POWER TRANSFORMER			POTENTIOMETER
PT1	L3030071		VR101	J51721502	EVL-S3AA00B53 5kΩB
			VR102	J51721102	EVL-S3AA00B13 1kΩB
		RELAY			
RL1	M1090010	FRL-263D012/0.2CK-0E			CAPACITOR
			C105	K12171102	Ceramic disc 50WV E 0.001μF (DD104E102P50V)
		SWITCH	C102,104,107	K13179008	" " " F 0.01μF (DD106F103Z50V)
SW1	N2090028	8B2011	C103	K50177103	Mylar " 0.01μF (50F2U103M)
		FUSE HOLDER	C101	K40169003	Electrolytic 35WV 330μF (35RE330)
FH1	P2000012	SN2059 (AC)			
FH2	P2000025	H203 (DC)	C106	K40129011	" 16WV 1000μF (16RE1000)
		FUSE			
F1	Q0000012	6A (100-117VAC)			
	Q0000004	3A (200-234VAC)			
F2	Q0000008	15A (DC)			
					RELAY CONTROL UNIT
			Symbol No.	Part No.	Description
		RECEPTACLE		F2522000	Printed Circuit Board
	P0090094	PA125		C025220A	PCB with components
		THRU TERMINAL			IC
	Q6000161	M115A-2AK		G1090301	μPC7812H
	Q6000162	M115A-3AK			
	S6000058	" COVER			
					DIODE
				G2090211	V06C
		TERMINAL			
	Q6000036	1L6P (3-0-3)			
					RESISTOR
			R201	J20336330	Metallic film 2W 33Ω
		PLUG/CABLE	R202	J30375569	Cement 5W 5.6Ω
P7 (with wire)	T9204496	(2SD880D)			
P2 (")	T9204643A	(DC OUT)			

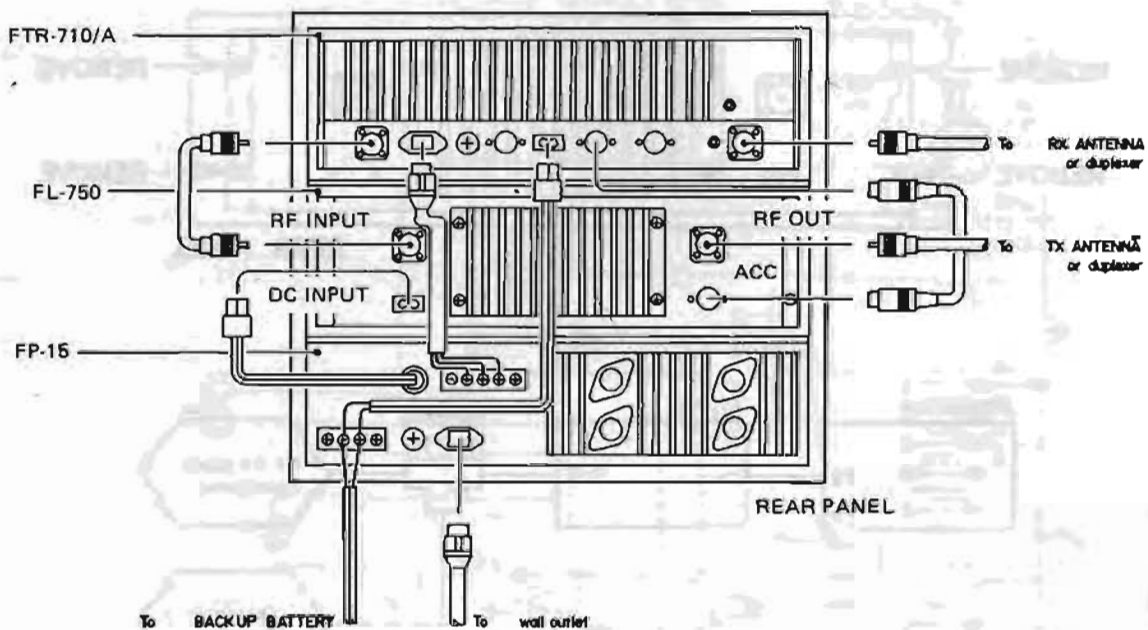
FL-750 50W VHF REPEATER POWER AMPLIFIER

The FL-750 is a commercial-grade, continuous-duty class C VHF power amplifier designed to boost the RF power output of the FTR-710/A VHF Repeater to 50 watts. Designed to match the Repeater, the FL-750 mounts easily in the 19-inch rack just beneath the FTR-710/A. For operation from the AC line, the rack-mounting FP-15 AC Power Supply can be used to supply the required DC voltage for the FL-750.

Specifications

Frequency range	68–88 MHz
Exciter power	8 watts RF
Output power	50 watts RF
Spurious radiation	–60 dBc or better
Input/output impedance	50 ohms
Power requirements	13.6 VDC @ 8A
Operating temperature range	–30 to +60°C
Dimensions (WDH)	432 x 185 x 133 mm
Weight	approx. 3.5 kg (7.7 lb)

Interconnections



DC INPUT

This jack accepts 13.6 VDC @ 8 Amps from a DC power supply. The DC output cable from the FP-15 mates with this jack, and the POWER indicator on the front of the FL-750 will be lit whenever power is applied here.

RF INPUT

The TX output jack from the FTR-710/A should be connected to this coaxial jack using the coaxial cable supplied with the FL-750. During transmission, the repeater will supply 10W RF to this jack.

ACC

Beginning from production lot 8, this jack is

provided along with a connection cable, for connection to the ACC jack on the FTR-710/A. This connection is not needed on earlier models.

RF OUTPUT

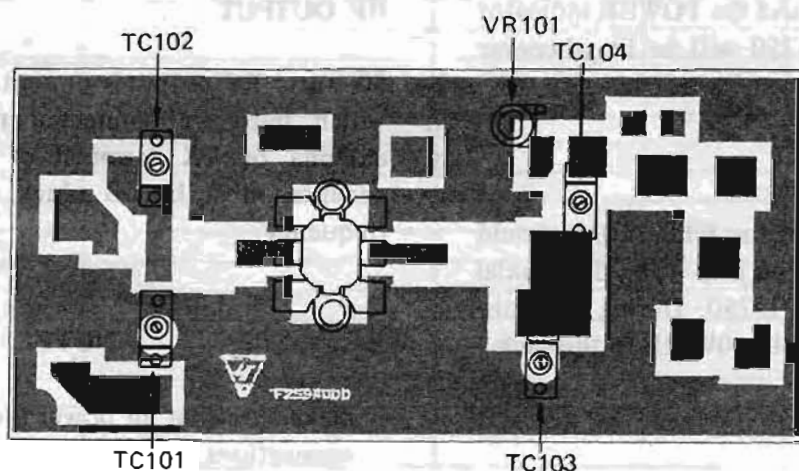
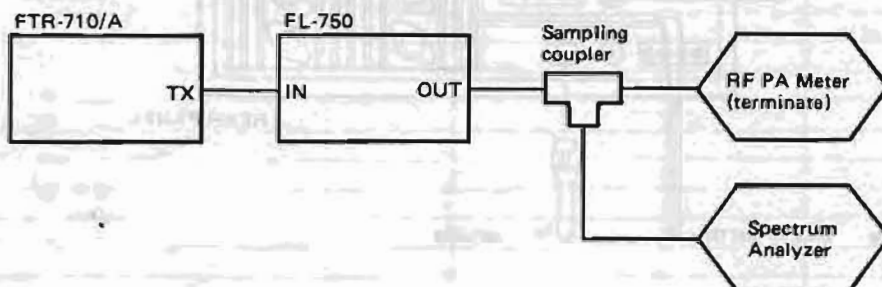
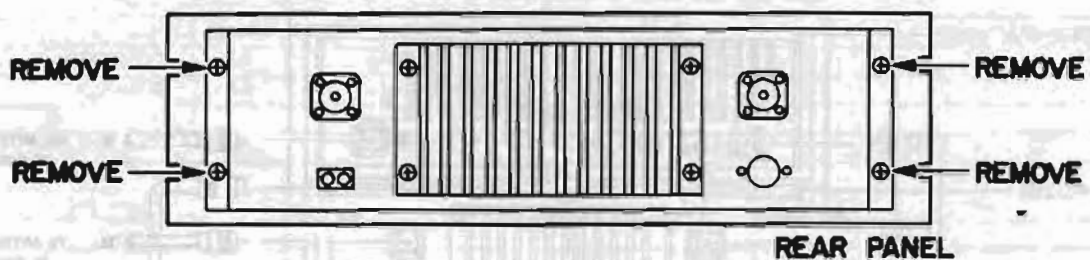
50 watts RF output is present at this coaxial jack, which must be connected to the transmitting antenna or TX terminal of the Duplexer. Impedance must be 50 ohms at the transmitting frequency.

NOTE:

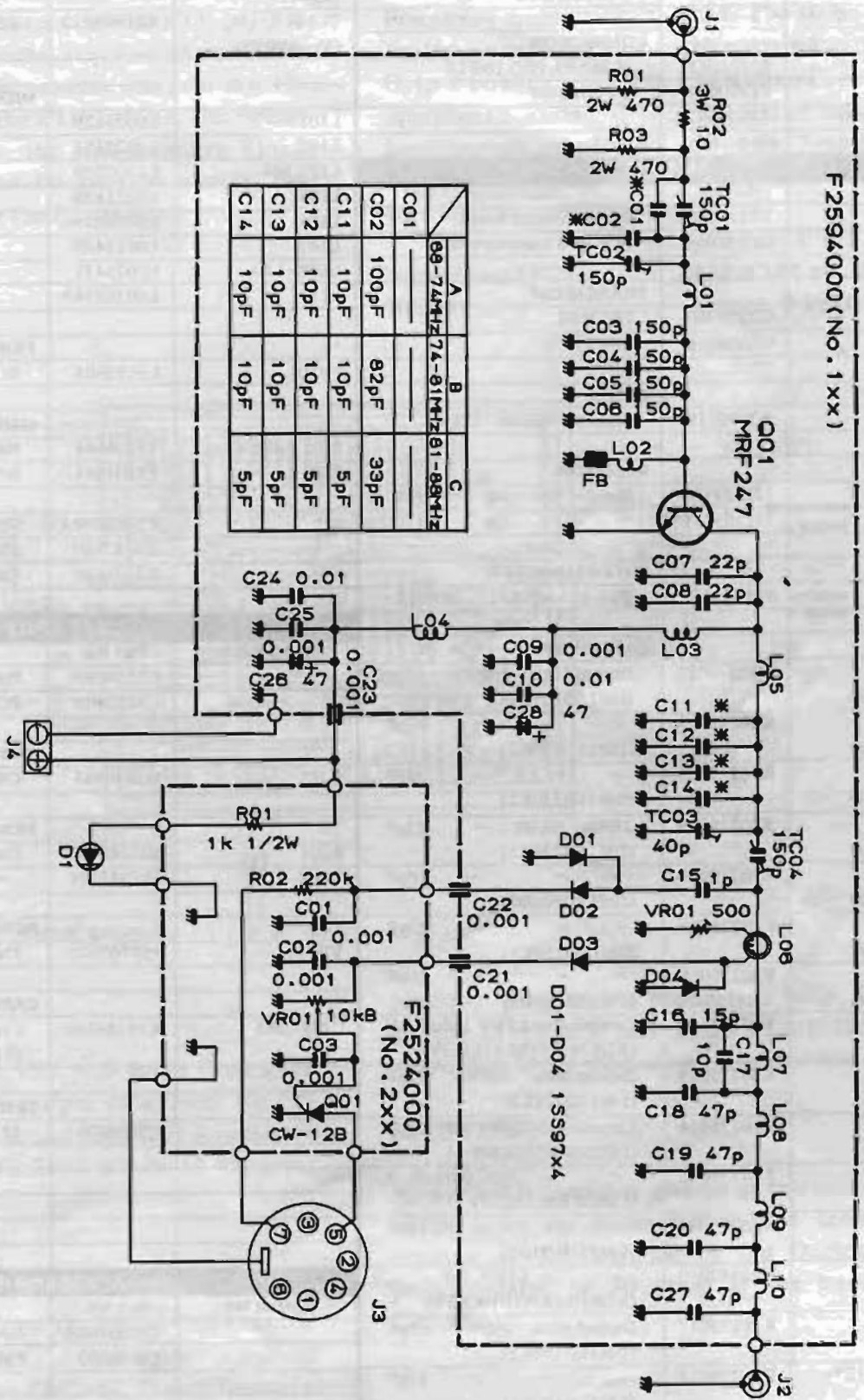
Make sure that all power is off before making connections.

Alignment

1. Remove the four screws indicated by the arrows in the diagram, and remove the front panel slowly, just enough to gain access to the adjustment points without straining the POWER indicator wiring.
2. Connect the test equipment as indicated below.
3. In the FTR-710/A, adjust VR₁₀₂ on the TX Unit to the fully clockwise position.
4. Activate the repeater transmitter, and adjust TC₁₀₁ through TC₁₀₄ alternately to provide maximum power output on the wattmeter and minimum spurious on the analyzer, simultaneously.
5. Now adjust VR₁₀₂ again in the FTR-710/A so that the wattmeter indicates 50 watts.
6. Remove the test equipment and replace the front panel and the four screws. This completes the alignment.



F25594000(No.1xx)

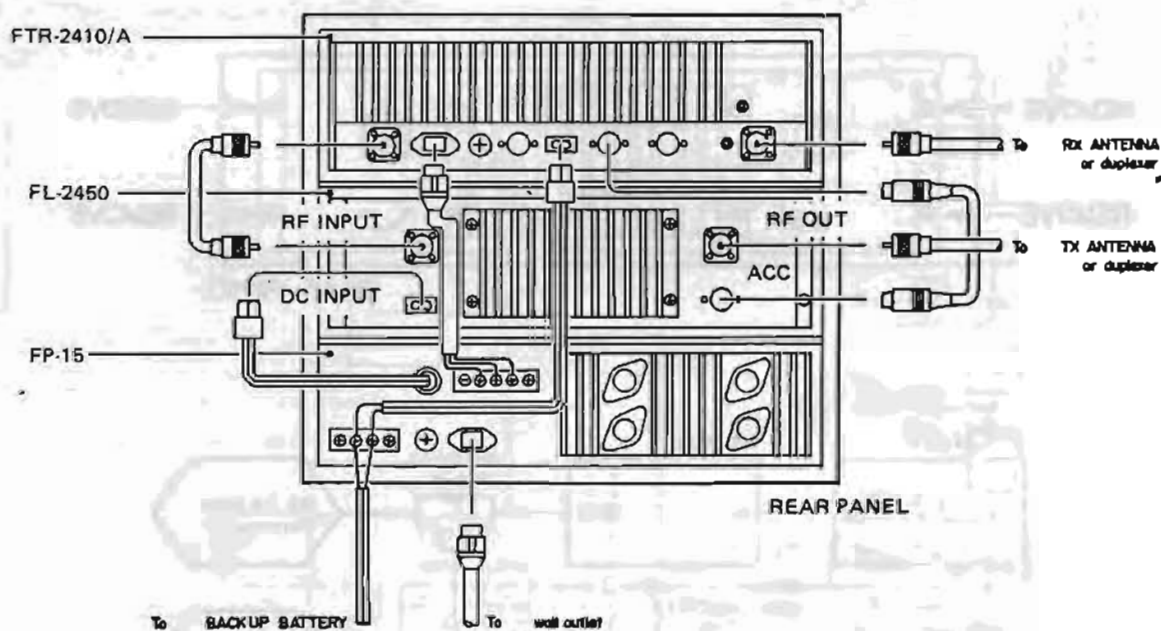


FL-750
CIRCUIT DIAGRAM

FL-2450 50W VHF REPEATER POWER AMPLIFIER

The FL-2450 is a commercial-grade, continuous-duty class C VHF power amplifier designed to boost the RF power output of the FTR-2410/A VHF Repeater to 50 watts. Designed to match the Repeater, the FL-2450 mounts easily in the 19-inch rack just beneath the FTR-2410/A. For operation from the AC line, the rack-mounting FP-15 AC Power Supply can be used to supply the required DC voltage for the FL-2450.

Interconnections



DC INPUT

This jack accepts 13.6 VDC @ 8 Amps from a DC power supply. The DC output cable from the FP-15 mates with this jack, and the POWER indicator on the front of the FL-2450 will be lit whenever power is applied here.

RF INPUT

The TX output jack from the FTR-2410/A should be connected to this coaxial jack using the coaxial cable supplied with the FL-2450. During transmission, the repeater will supply 10W RF to this jack.

ACC

Beginning from production lot 8, this jack is

Specifications

Frequency range	134–174 MHz
Exciter power	10 watts RF
Output power	50 watts RF
Spurious radiation	–60 dBc or better
Input/output impedance	50 ohms
Power requirements	13.6 VDC @ 8A
Operating temperature range	–10 to +50°C
Dimensions (WDH)	432 x 185 x 133 mm
Weight	approx. 3 kg (6.6 lb)

provided along with a connection cable, for connection to the ACC jack on the FTR-2410/A. This connection is not needed on earlier models.

RF OUTPUT

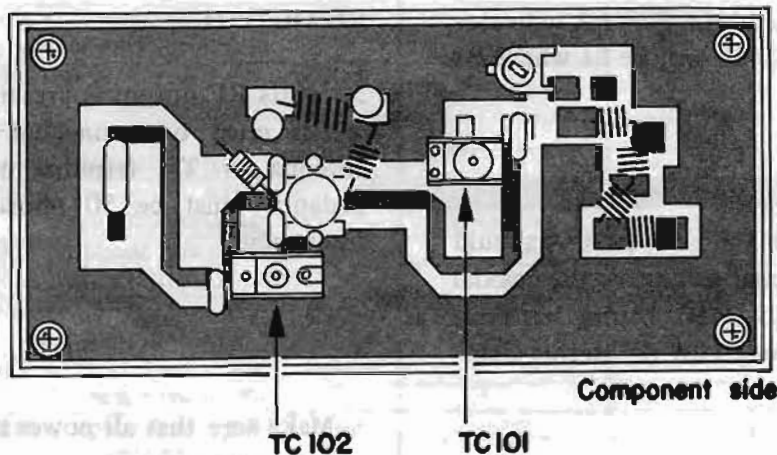
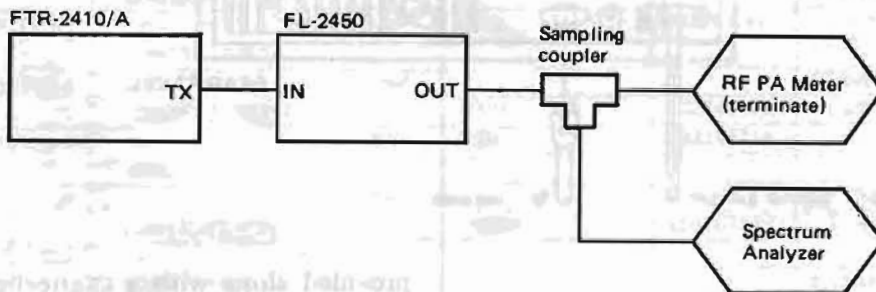
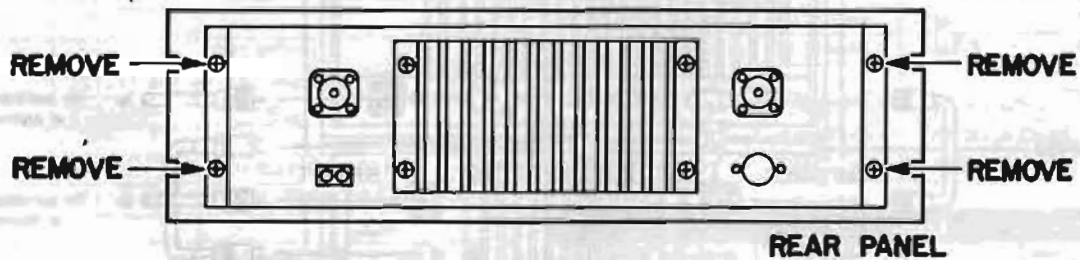
50 watts RF output is present at this coaxial jack, which must be connected to the transmitting antenna or TX terminal of the Duplexer. Impedance must be 50 ohms at the transmitting frequency.

NOTE:

Make sure that all power is off before making connections.

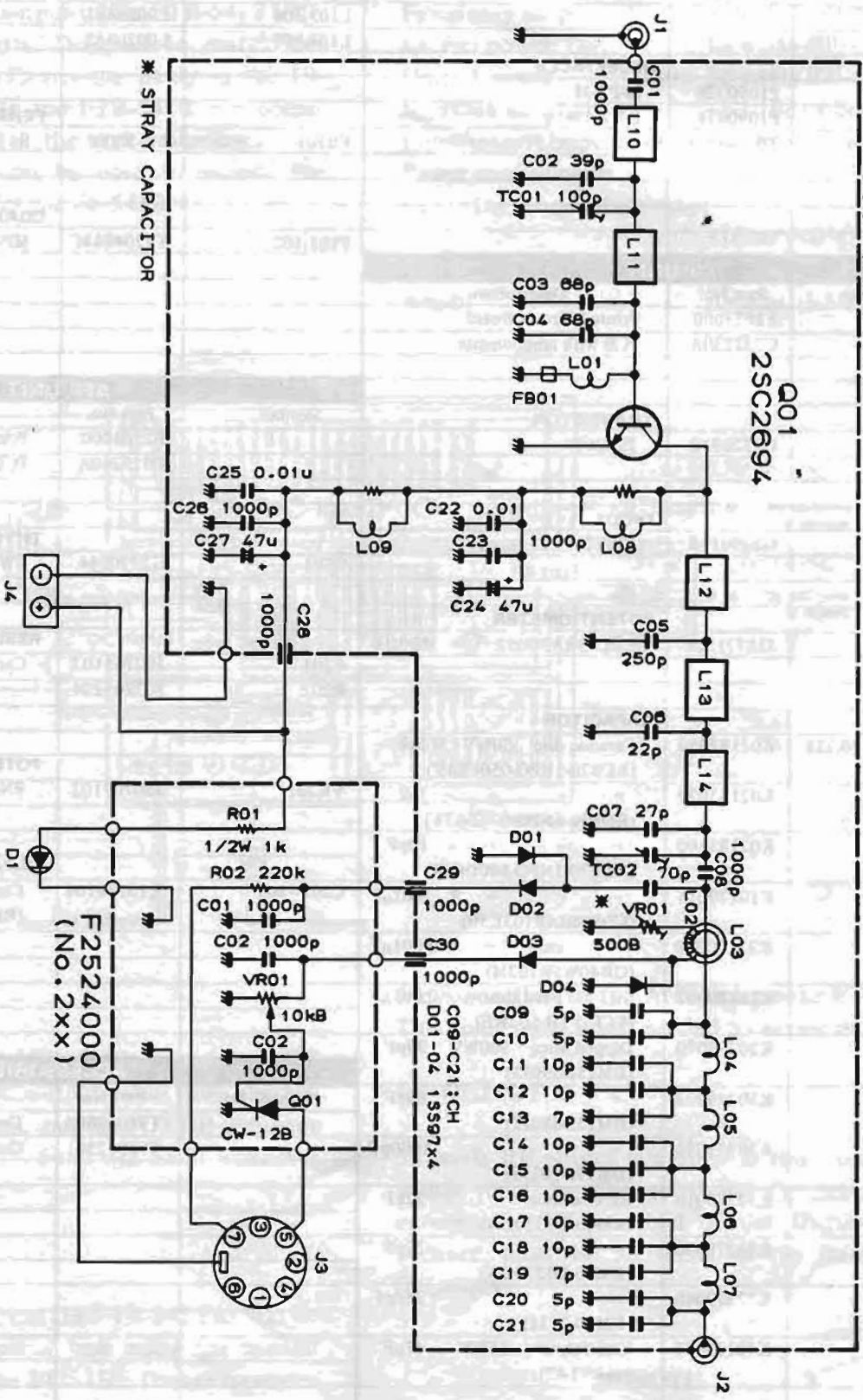
Alignment

1. Remove the four screws indicated by the arrows in the diagram, and remove the front panel slowly, just enough to gain access to the adjustment points without straining the POWER indicator wiring.
2. Connect the test equipment as indicated below.
3. In the FTR-2410/A, adjust VR₁₀₂ on the TX Unit to the fully clockwise position.
4. Activate the repeater transmitter, and adjust TC₁₀₁ and TC₁₀₂ alternately to provide maximum power output on the wattmeter and minimum spurious on the analyzer, simultaneously.
5. Now adjust VR₁₀₂ again in the FTR-2410/A so that the wattmeter indicates 50 watts.
6. Remove the test equipment and replace the front panel and the four screws. This completes the alignment.



F2523000 (No. 1XX)

Q01
2SC2694



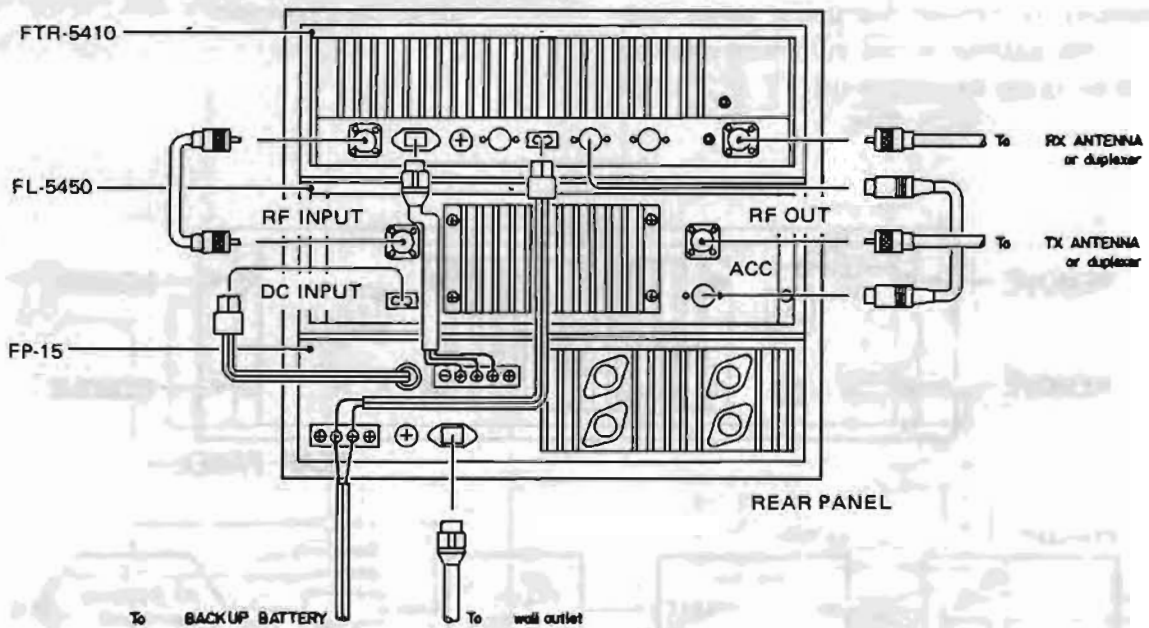
FL-2450
CIRCUIT DIAGRAM

FL-2450 MAIN CHASSIS					INDUCTOR
Symbol No.	Part No.	Description	L101	L1020080A	
			L102	L0020354A	
		LED	L103	L0020333	
D1	G2090203	SDB-205-BGD	L104,107	L0020358A	
			L105,106	L0020661	
			L108,109	L0020353	
		RECEPTACLE			
J1,2	P1090326	M-PA-JJ			
J3	P1090034	D7-701B-00			FERRITE BEADS
J4 (with wire)	T9204642B		FB101	L9190001	Ri 3x3x1
					COAX PLUG/CABLE
			P101,102	T9204644C	MP-3, 3D-QEV
PA UNIT			AFP UNIT		
Symbol No.	Part No.	Description	Symbol	Part No.	Description
	F2523000	Printed Circuit Board		F2524000	Printed Circuit Board
	C025230A	PCB with components		C025240A	PCB with components
		TRANSISTOR			
Q101	G3326940	2SC2694			
		DIODE			THYRISTOR
D101-104	G2090118	1SS97	Q201	G3090044	CW12B
		POTENTIOMETER			RESISTOR
VR101	J51721501	EVLS3AA00B52 500ΩB	R201	J02245102	Carbon film 1/4W 1kΩ
			R202	J02245224	" " " 220kΩ
		CAPACITOR			POTENTIOMETER
C109,110,120,121	K02182050	Ceramic disc 50WV CH 5pF (RD870-1NPO-050C63V)			
C113,119	K02183070	" " " " 7pF (RD870-1NPO-070D63V)	VR201	J50707103	PN822H103V 10kΩB
C111,112, 114-118	K02183100	" " " " 10pF (RD870-1NPO-100D63V)			CAPACITOR
C122,125	K10179015	" " " B 0.01μF (CDS080XB103K50)	C201-203	K10186102	Ceramic disc 63WV 0.001μF (RD870-1B102K63V)
C123,126	K23170020	" chip " 0.001μF (GR40W5R102M)			
C128-130	K21170002	" Feed thru " 0.001μF (ECK-Y1H-102WE)			
C102	K30279070	Dipped Mica 500WV 39pF (DM15D390J5)			
C103,104	K30279072	" " " 68pF (DM15D680J5)	ACCESSORIES		
			Symbol No.	Part No.	Description
C101,108	K30279093	" " " 1000pF (DM19D102J5)		T9100160A	Coaxial Cable
C106	K32279018	Ribbon Mica " 22pF (RM40-2H220DA)		T9101230	Control Cable
C105	K32279020	" " " 27pF (RM40-2H270DA)			
C107	K32279060	" " " 250pF (RM20-251J5)			
C124,127	K40129023	Electrolytic 16WV 47μF (16RJ2-47)			
		TRIMMER CAPACITOR			
TC101	K91000032	B2PY 100pF			
TC102	K91000046	C1P2 70pF			

FL-5450 50W UHF REPEATER POWER AMPLIFIER

The FL-5450 is a commercial-grade, continuous-duty class C UHF power amplifier designed to boost the RF power output of the FTR-5410 UHF Repeater to 50 watts. Designed to match the Repeater, the FL-5450 mounts easily in the 19-inch rack just beneath the FTR-5410. For operation from the AC line, the rack-mounting FP-15 AC Power Supply can be used to supply the required DC voltage for the FL-5450.

Interconnections



Specifications

Frequency range	400–512 MHz
Exciter power	10 watts RF
Output power	50 watts RF
Spurious radiation	–60 dBc or better
Input/output impedance	50 ohms
Power requirements	13.6 VDC @ 10A
Operating temperature range	–10 to +50°C
Dimensions (WDH)	432 x 185 x 133 mm
Weight	Approx. 3.5 kg (7.7 lb)

DC INPUT

This jack accepts 13.6 VDC @ 10 Amps from a DC power supply. The DC output cable from the FP-15 mates with this jack, and the POWER indicator on the front of the FL-5450 will be lit whenever power is applied here.

RF INPUT

The TX output jack from the FTR-5410 should be connected to this coaxial jack using the coaxial cable supplied with the FL-5450. During transmission, the repeater will supply 10W RF to this jack.

ACC

This jack is provided along with a connection cable,

for connection to the ACC jack on the FTR-5410. This connection is not needed on earlier models.

RF OUTPUT

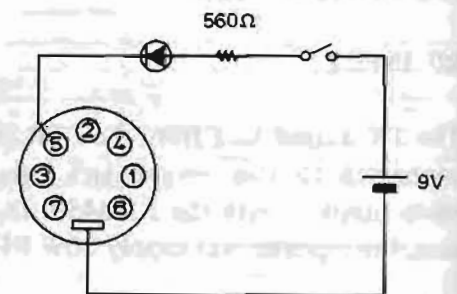
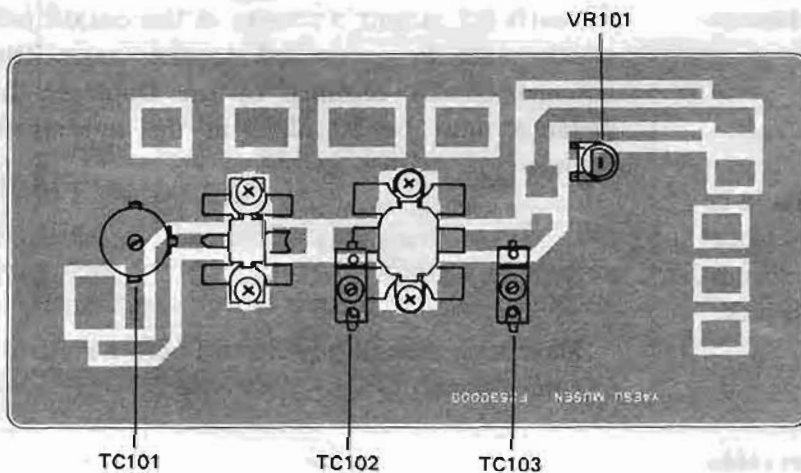
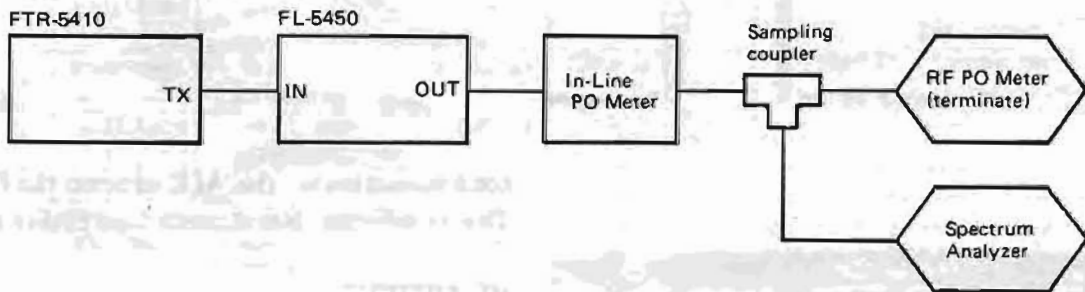
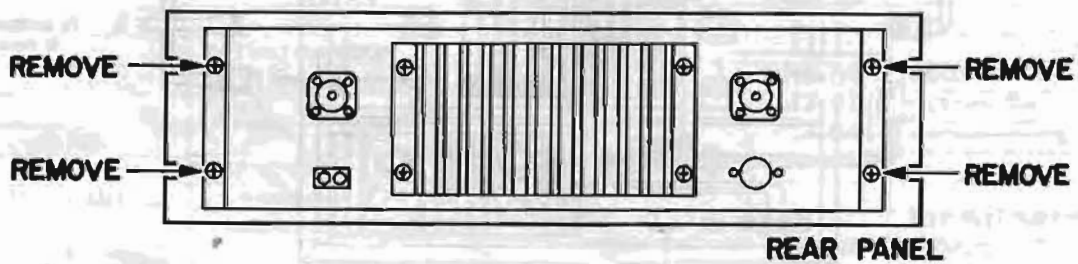
50 watts RF output is present at this coaxial jack, which must be connected to the transmitting antenna or TX terminal of the Duplexer. Impedance must be 50 ohms at the transmitting frequency.

NOTE:

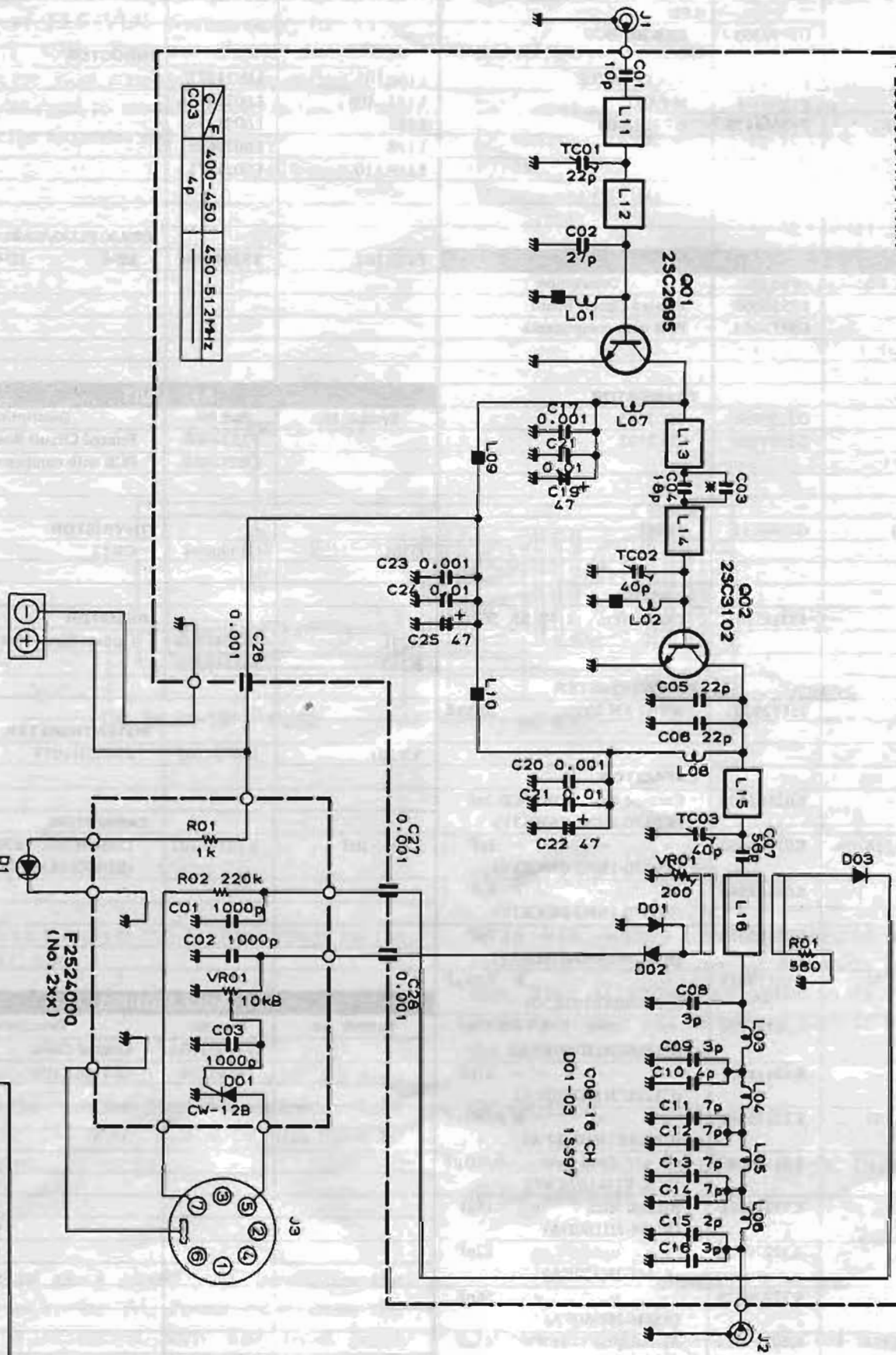
Make sure that all power is off before making connections.

Alignment

1. Remove the four screws indicated by the arrows in the diagram, and remove the front panel slowly, just enough to gain access to the adjustment points without straining the POWER indicator wiring.
2. Connect the test equipment as indicated below.
3. In the FTR-5410, adjust VR_{2002} on the TX Unit to the fully clockwise position.
4. Activate the repeater transmitter, and adjust TC_{101} , TC_{102} and TC_{103} (in the FL-5450) alternately to provide maximum power output on the wattmeter and minimum spurious on the analyzer, simultaneously.
5. Connect a DC voltmeter to the AFP terminal and adjust VR_{101} for minimum DC voltage (null). Remove the load from the wattmeter output, and connect the test circuit shown on the following page to 7-pin DIN jack J_3 . Close the test switch and adjust VR_{201} on the AFP Unit just to the point where the test LED lights. Now release the PTT and reconnect the load. Again key the transmitter to ensure that the test LED does not light.
6. Now adjust VR_{2002} again in the FTR-5410 so that the wattmeter indicates 50 watts.
7. Remove the test equipment and replace the front panel and the four screws. This completes the alignment.



F2530000 (No. 1xx)



FL-5450
CIRCUIT DIAGRAM

FL-5450 MAIN CHASSIS					TRIMMER CAPACITOR	
Symbol No.	Part No.	Description	TC101	K91000123	2222-808-31159	15pF
			TC102,103	K91000031	B-1P	40pF
		LED				
D1	G2090203	SDB-205-BGD				
						INDUCTOR
J1,2	P1090326	RECEPTACLE	L101,102	L0021372		
J3	P1090034	M-PA-JJ	L103-106	L0021373A		
J4 (with wire)	T9204642B	D7-701B-00	L107	L0021374		
			L108	L0020665		
			L109,110	L0021375		
						COAX PLUG/CABLE
PA UNIT			P101,102	T9204644C	MP-3	3D-QEV
Symbol No.	Part No.	Description				
	F2530000	Printed Circuit Board				
	C025300A	PCB with components				
		TRANSISTOR	AFP UNIT			
Q101	G3326950	2SC2695	Symbol No.	Part No.	Description	
Q102	G3331020	2SC3102		F2524000	Printed Circuit Board	
				C025240A	PCB with components	
		DIODE				
D101-103	G2090118	1SS97			THYRISTOR	
			Q201	G3090044	CW12	
		RESISTOR				
R101	J02245561	Carbon film 1/4W SJ 560Ω			RESISTOR	
			R201	J02245102	Carbon film 1/4W 1kΩ	
			R202	J02245224	" " " 220kΩ	
		POTENTIOMETER				
VR101	J51729201	RV8-FAN 200Ω 200ΩB			POTENTIOMETER	
			VR201	J50707103	PN822H103V 10kΩB	
		CAPACITOR				
C115	K02182020	Ceramic disc 63WV CH 2pF (RD870-1NPO-020C63V)			CAPACITOR	
C108,109,116	K02182030	" " " " 3pF (RD870-1NPO-030C63V)	C201-203	K10186102	Ceramic disc 63WV 0.001μF (RD870-1B102K63V)	
C110,103	K02182040	" " " " 4pF (RD870-1NPO-040C63V)				
C111-114	K02183070	" " " " 7pF (RD870-1NPO-070D63V)				
C118,121,124	K10179015	" " " B 0.01μF (CDS080XB103K50)				
			ACCESSORIES			
			Symbol No.	Part No.	Description	
C101	K22171211	" chip 50WV CH 10pF (C3216CH1H100DFA)		T9100160A	Coaxial Cable	
C102	K22171221	" " " " 27pF (C3216CH1H270JFA)		T9101230	Control Cable	
C117,120,123	K22171801	" " " B 0.001μF (C3216B1H102KFA)				
C126-128	K21170002	" Feed thru 0.001μF (ECK-Y1H-102KWE)				
C104	K32279016	Ribbon Mica " 18pF (RM40-2H180DA)				
C105,106	K32279018	" " " " 22pF (RM40-2H220DA)				
C107	K32279028	" " " " 56pF (RM40-2H560FA)				
C119,122,124	K40129023	Electrolytic 16WV 47μF (16RJ2-47)				

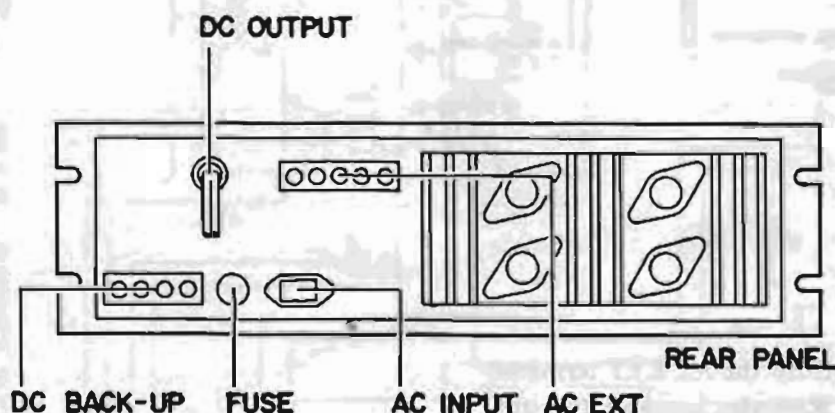
FP-15 AC POWER SUPPLY FOR 50W REPEATER POWER AMPLIFIERS

The FP-15 Power Supply provides up to 10 Amperes at 13.6 VDC continuously, for Yaesu VHF and UHF Repeater Power Amplifiers. Available for most standard AC line voltages, the FP-15 is designed to mount directly in the 19-inch rack with the Repeater and Amplifier.

Specifications

AC voltage requirements	100/110/117/200/220 or 234 VAC
DC output voltage	13.6 VDC
DC output current	up to 10 A
Ripple	50 mV p-p or better
Dimensions (WDH)	432 x 245 x 133 mm
Weight	10 kg (22 lb)
Emergency backup voltage	12V battery (not supplied)

Interconnections



AC INPUT

This 3-pin jack accepts the AC line voltage via the supplied AC cable.

FUSE

For operation from 100/110 or 117 VAC, a 6 Amp fuse must be installed here. For operation from 200/220 or 234 VAC, a 3 Amp fuse must be installed here.

AC EXT

This terminal block provides AC power for the Repeater when the AC Power cable from the Repeater is connected here. The front panel POWER switch on the FP-15 will then control power to both the Repeater and Amplifier, as indicated on the front panel indicator.

DC BACKUP

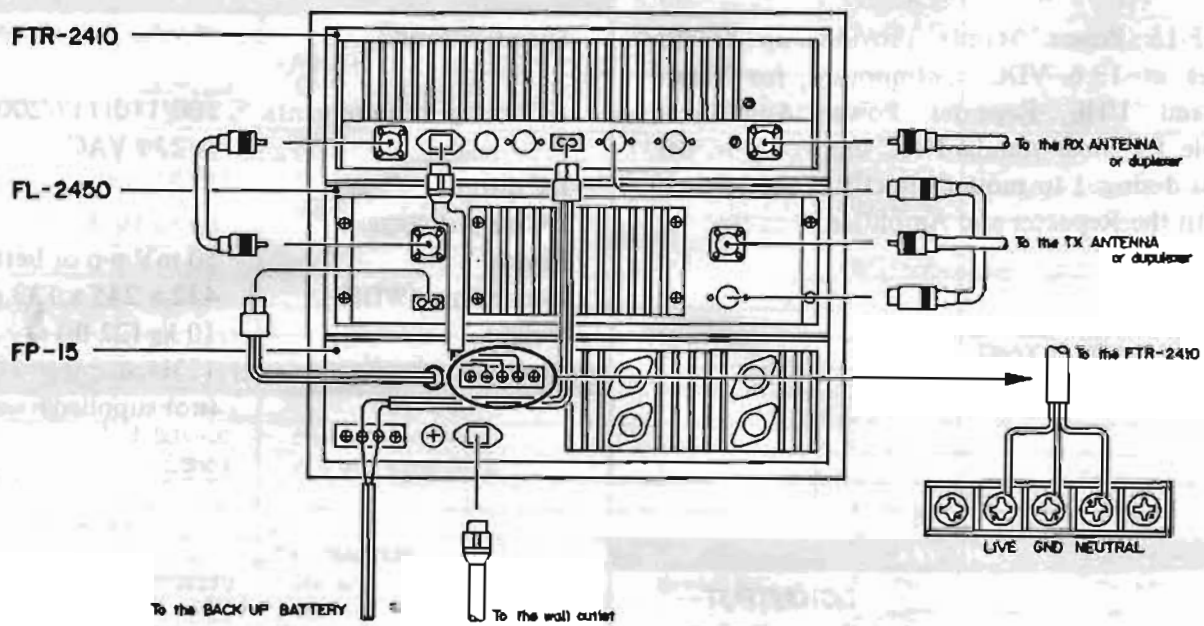
A 12 VDC battery may be connected here for emergency backup in case of AC mains interruption. While AC voltage is supplied to the FP-15, a charging voltage will be present here to maintain the backup battery charge.

DC OUTPUT

Connect this cable directly to the DC INPUT jack on the Amplifier.

NOTE:

Make sure that power is removed from all equipment before making interconnections.

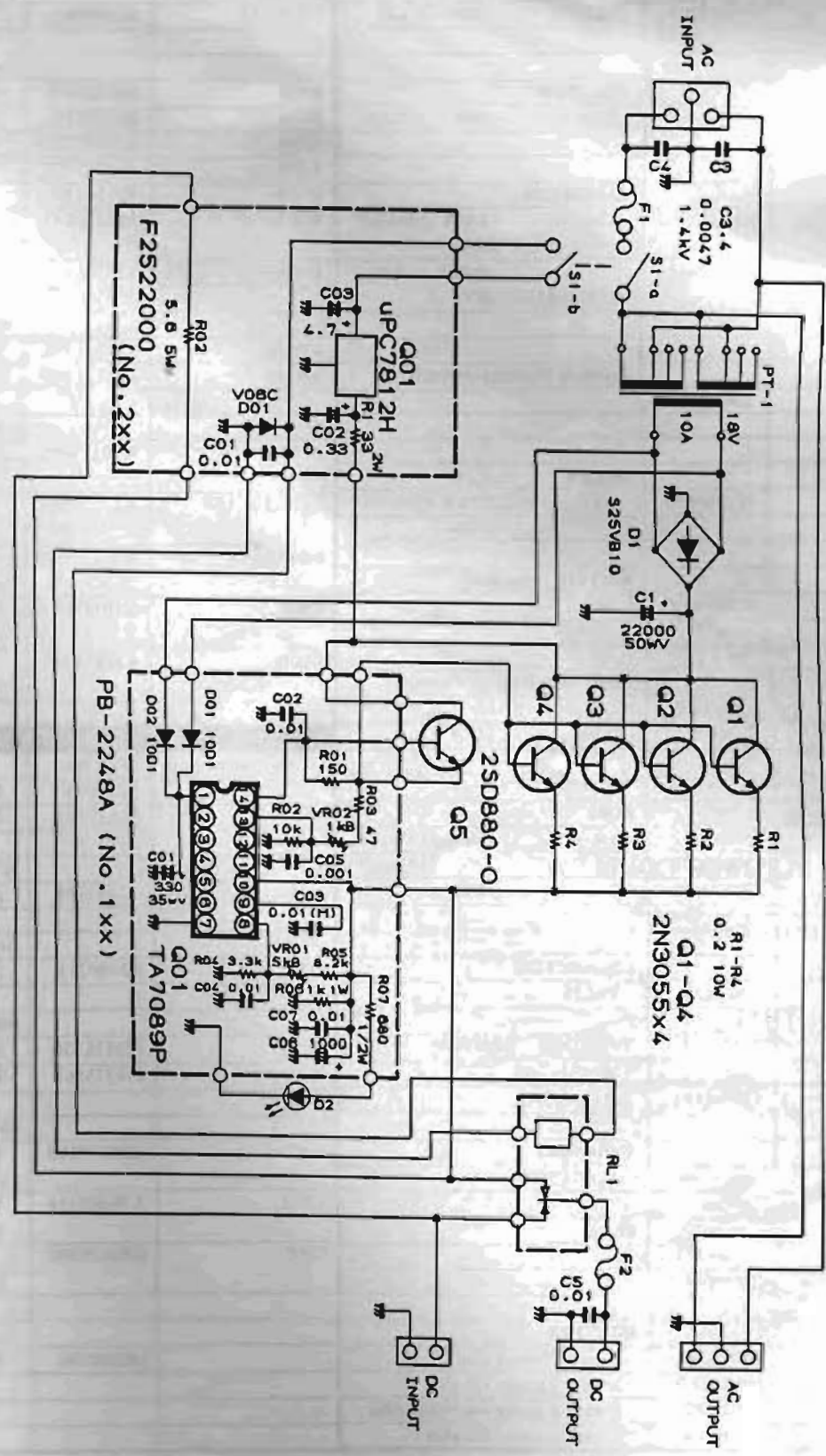


When it is desired to utilize the AC EXT terminals to supply AC to the Repeater, remove the plug from the AC power cord of the Repeater, and connect the power cord wires to the AC EXT terminal block as indicated below.

POWER CORD TYPE

TERMINAL	UL	EU/AUS
GND	green	grn/yel
NEUTRAL	white	blue
LIVE	black	brown

- NOTE
- 1 ALL RESISTOR VALUES ARE IN OHMS, 1/4W UNLESS OTHERWISE NOTED
 - 2 ALL CAPACITOR VALUES ARE IN UF, 50WV UNLESS OTHERWISE NOTED
 - 3 ALL ELECTROLYTIC CAPACITOR VALUES ARE IN UF, 16V UNLESS OTHERWISE NOTED
 - 4 (M) CAPACITORS ARE MYLAR FILM, 50WV



FP-15
CIRCUIT DIAGRAM

FP-15 MAIN CHASSIS				REG UNIT		
Symbol No.	Part No.	Description	Symbol No.	Part No.	Description	
			PB-2248A	F0002248A	Printed Circuit Board	
		TRANSISTOR		C022480A	PCB with components	
Q1-4	G3090014	2N3055				
Q5	G34088000	2SD8800			IC	
			Q101	G1090373	TA7089P	
		DIODE				
D1	G2090121	Si S25VB10			DIODE	
D2	G2090203	LED SDB-205BGD	D101,102	G2090001	Si 10D1	
					RESISTOR	
		RESISTOR	R103	J01245470	Carbon film 1/4W TJ 47Ω	
R1-4	J30406029	Cement 10W 0.2Ω	R101	J01245151	" " " " 150Ω	
			R104	J01245332	" " " " 3.3kΩ	
			R105	J01245822	" " " " 8.2kΩ	
		CAPACITOR	R102	J01245103	" " " " 10kΩ	
C3,4	K12329002	Ceramic 1.4kV 0.0047μF (ECK-DAL472PE)	R107	J10276681	" Composition 1/2W GK 680Ω	
C5	K10179015	" 50WV 0.01μF (CK45B1H103MY)	R106	J20306102	Metallic film 1W 1kΩ	
					POTENTIOMETER	
			VR102	J51721102	EVL-S3AA00B13 1kΩB	
		POWER TRANSFORMER	VR101	J51721502	EVL-S3AA00B53 5kΩB	
PT1	L3030071A				CAPACITOR	
			C105	K12171102	Ceramic 50WV E 0.001μF (DD104E102P50V)	
		RELAY	C102,104,107	K12179008	" " F 0.01μF (DD106F103Z50V)	
RL1	M1090010	FRL-263-0012/02CK-0E	C103	K50177103	Mylar " " 0.01μF (50F2U103M)	
		SWITCH	C101	K40169003	Electrolytic 35WV 330μF (35RE330)	
S1	N2090028	8B2011	C106	K40129011	" 16WV 1000μF (16RE1000)	
		FUSE HOLDER				
FH1	P2000012	SN2059 (AC)				
FH2	P2000025	H203 (DC)				
					CONTROL UNIT	
			Symbol No.	Part No.	Description	
		FUSE		F2522000	Printed Circuit Board	
F1	Q0000012	6A (100-117VAC)		C025220A	PCB with components	
F1	Q0000004	3A (200-234VDC)			IC	
F2	Q0000008	15A (DC)	Q201	G1090301	μPC7812H	
					DIODE	
J1	P0090094	PA125	D201	G2090211	Si V06C	
		THROUGH TERMINAL			RESISTOR	
	Q6000161	M115A-2AK	R201	J20336330	Metallic film 2W 33Ω	
	Q6000162	M115A-3AK	R201	J30375569	Cement 5W 5.6Ω	
		TERMINAL			CAPACITOR	
	Q6000036	1L6P (3-0-3)	C201	K50177103	Mylar 50WV 0.01μF (50F2U103)	
		PLUG	C202	K70167334	Tantalum 35WV 0.33μF (CS15E1VR33M1S)	
P1 (with wire)	T9204496		C203	K70120001	" 16WV 4.7μF (489D475X0016B1)	
P2 (")	T9204643A					
		AC CORD				
	T9013280	2 wire, 2 prong plug		Q5000036	TP-G terminal	
	T9013282	3 wire, 3 prong UL plug				
	T9013283	3 wire, 3 prong Australian plug				
	T9013284	3 wire, 2 prong EU plug				