

MAINTENANCE SERVICE MANUAL FTC-4610/4625



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FOREWORD

The purpose of this manual is to provide information critical to the long-term operation and maintenance of the FTC-4610 and FTC-4625 UHF FM Mobile Transceivers. In the interest of clarity, descriptions have been kept brief and somewhat informal, while photographs and drawings are utilized liberally.

We believe the material presented herein to be correct and factual. However, should typographical or other errors be present, Yaesu assumes no liability for damage resulting from such errors. Your cooperation in pointing out any inconsistencies in the technical information would be appreciated.

The rugged, straightforward design of the FTC-4610 and FTC-4625 makes it unlikely that you will have frequent recourse to this manual. We hope and trust, however, that the material to follow will meet your service requirements.

Your attention to the note below is requested.

Yaesu Musen Company, Ltd.
Tokyo, Japan

IMPORTANT NOTE

Any adjustments to the FTC-4610 or FTC-4625 which affect the transmitter characteristics or operating frequency must be performed only by an FCC licensed technician holding a Second Class (or higher) certificate.

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YAESU FTC-4610/FTC-4625 UHF LAND MOBILE TRANSCEIVERS



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GENERAL DESCRIPTION

The FTC-4610 and FTC-4625 are compact, high performance UHF FM transceivers for land mobile applications. Fully solid state, these transceivers provide operation within a 3 MHz (TX) or 5 MHz (RX) range anywhere in the 450–512 MHz land mobile band. The transmitter section of the FTC-4610 puts out 10 watts, while the FTC-4625 output is 25 watts. The receiver section provides high sensitivity, yet excellent rejection of inter-modulation and cross modulation products.

Designed for use in a variety of land mobile applications, these transceivers are packaged in rugged, extremely compact cases, thus minimizing the chance of damage from shock or vibration. The FTC-4610 and FTC-4625 are also fully protected against damage from reversed power supply polarity and high antenna SWR.

The FTC-4610 and FTC-4625 are supplied with all mounting hardware and cables, required for mobile installation.

GENERAL

PERFORMANCE SPECIFICATIONS

Frequency range:

7 spot frequencies within a 3 MHz (TX) or
5 MHz (RX) spread over the range 450–512
MHz

Oscillation system:

Crystal control

Weight:

1.5 kg (FTC-4610)
1.6 kg (FTC-4625)

Dimensions:

50(H) x 122(W) x 192(D) mm (FTC-4610)
50(H) x 122(W) x 243(D) mm (FTC-4625)

Power requirements:

DC 13.8 volts, negative ground

Power consumption:

Standby : Less than 0.1 A
Receive : Less than 0.3 A
Transmit : Less than 3.0 A (FTC-4610)
Transmit : Less than 6.0 A (FTC-4625)

Number of channels:

7

TRANSMITTER

Power output:

10 watts (FTC-4610)
25 watts (FTC-4625)

Frequency stability:

Better than ± 5 ppm

Modulation type:

16F3

Deviation:

± 5 kHz

Audio response:

+1, -3 dB of 6 dB/octave pre-emphasis
characteristic from 300 Hz to 3000 Hz

FM noise:

-40 dB @ 1000 Hz, ± 3 kHz deviation

Spurious emissions:

At least 60 dB below carrier

AF distortion:

10% or less @ 1000 Hz, ± 3 kHz deviation

Antenna impedance:

50 ohms

Microphone type:

Low impedance (600 ohm) dynamic

Crystal multiplication:

x 12

RECEIVER

Sensitivity:

Better than $0.5\mu\text{V}$ for 20 dB noise quieting
Better than $0.35\mu\text{V}$ for 12 dB SINAD

Adjacent channel selectivity:

Better than 80 dB

Image rejection:

Better than 80 dB

Intermodulation:

Better than -70 dB

Squelch sensitivity:

$0.20\mu\text{V}$

AF output:

0.5 watts for Internal Speaker
(@ 16 ohms, 10% THD)
1.5 watts (@ 8 ohms, 10% THD), 3 watts
(@ 4 ohms, 10% THD) for External Speaker.

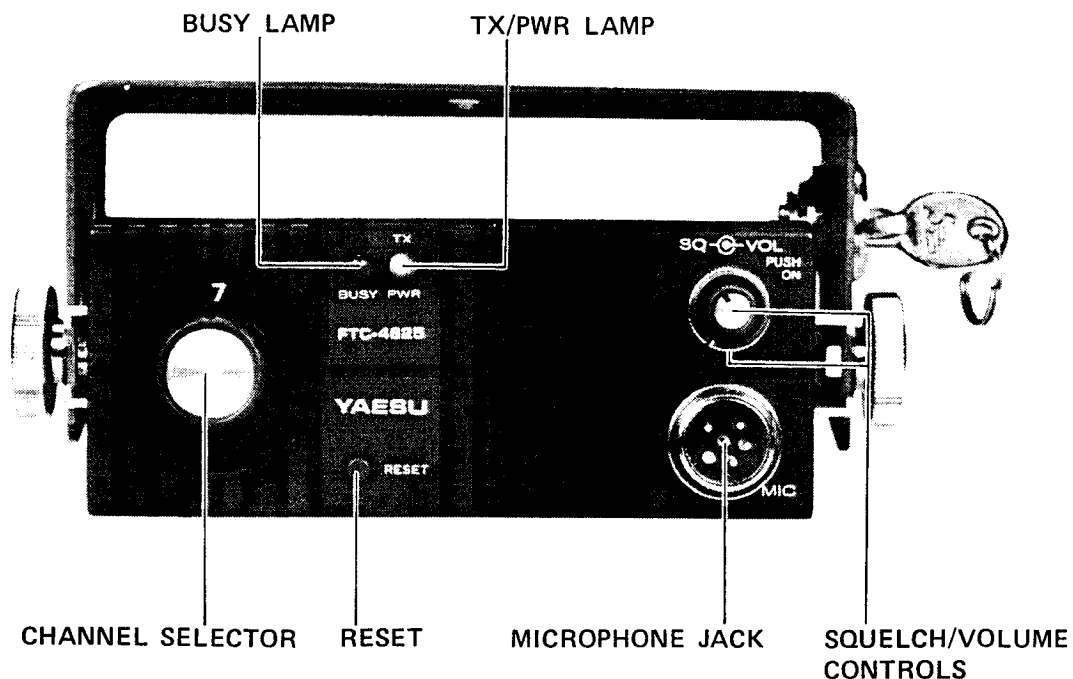
Specifications subject to change without notice or
obligation.

SEMICONDUCTORS

IC		Silicon diodes	
μPC577H	1	1S1555 (FTC-4610)	11
M57704H	1	(FTC-4625)	10
MLM2902	1	MC301	14
MB3756	1		
AN315	1	Varactor diodes	
		FC52M	2
FET		MV201	1
3SK76	2		
		Light emitting diodes	
Transistors		TLO114	1
2SA671B	1	GL52RG	1
2SC458B	5		
2SC460B	8	Thyristor	
2SC535B (FTC-4610)	9	CW01B (FTC-4625)	1
(FTC-4625)	8		
2SC1906	3	Schottky barrier diodes	
2SC1907	3	1SS97 (FTC-4625)	3
2SC2407	1		
2SC2695 (FTC-4625)	1		
 TONE SQUELCH UNIT			
IC			
MLM2902	3		
Transistors			
2SC460B	9		
Silicon diodes			
1S1555	4		

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FRONT PANEL CONTROLS AND SWITCHES



(1) CHANNEL SELECTOR

This control selects the desired channel.

(2) RESET

When the optional two-tone sequential decoder is installed, this control will reset the system following a hailing call.

(3) MICROPHONE JACK

This jack accepts the microphone input, push-to-talk control and receiver muting line (see Tone Squelch and Operation).

(4) SQL/VOL

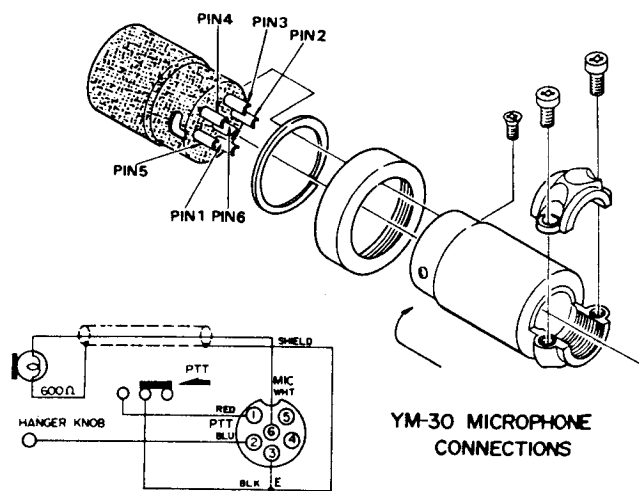
The squelch (SQL) control silences the receiver audio output until a signal is received. The volume (VOL) control sets the receiver volume level. The VOL control should be pushed to turn on the set, and pushed again to turn it off.

(5) TX/PWR LEDs

This lamp will glow red during transmission (TX), and green during standby with DC power applied (PWR).

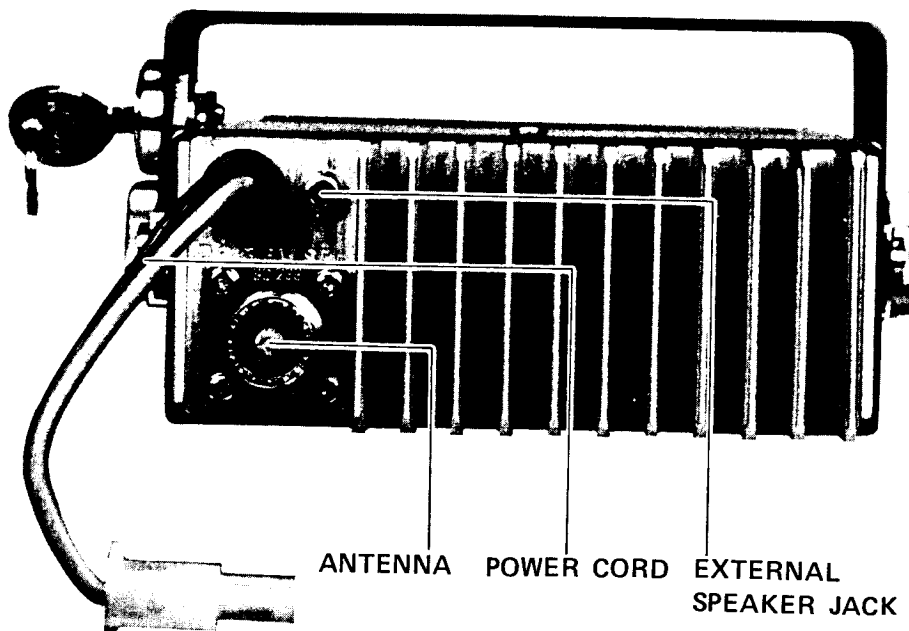
(6) BUSY

This indicator will light up when a signal is received (one strong enough to break the receiver squelch).



REAR APRON CONNECTIONS

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(1) POWER

Connect the main DC power cord to this cord stub/connector. Do not apply AC power to this transceiver at any time.

(2) SP

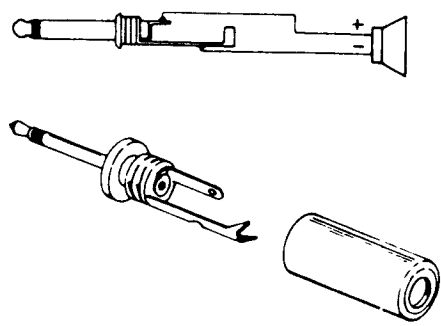
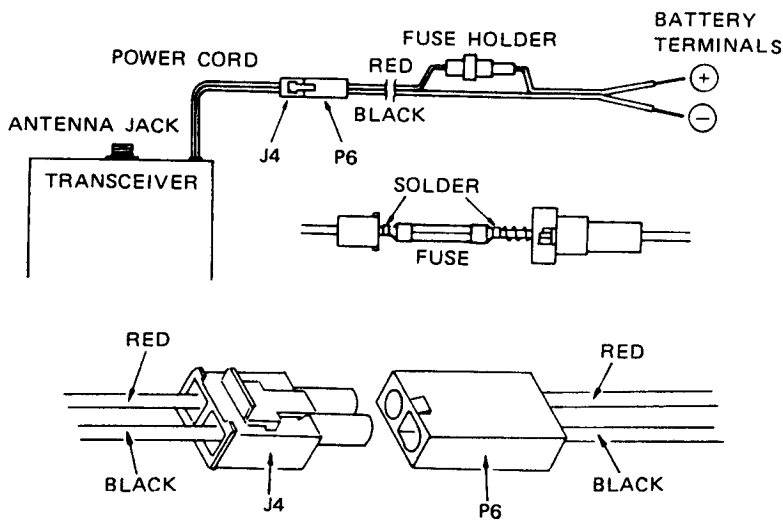
This is a miniature phone jack for connection to an external 4 ohm or 8 ohm speaker.

(3) ANTENNA

This is a "UHF" connector for connection to the station antenna. The antenna impedance should be 50 ohms.

WARNING

DO NOT CONNECT AC POWER TO THE DC POWER RECEPTACLE. REPLACE FUSES ONLY WITH A 10 AMP FUSE (FTC-4610A: 4 AMP FUSE). FAILURE TO OBSERVE THESE WARNINGS WILL VOID THE WARRANTY.



Speaker Plug

POWER CORD DIAGRAM

OPERATION

GENERAL

Included with each transceiver is an "OPERATION MANUAL" which presents basic operating instructions in an easy-to-understand format.

The service technician should become familiar with the operating manual, in order to be able to answer questions that may arise.

The sections to follow are exact reproductions of the corresponding sections of the Owner's Manual. They are presented in this format so as to acquaint you with the terminology familiar to the owner.

HOW TO USE YOUR YAESU FTC-4610/FTC-4625 FM TRANSCEIVER

Operation of your YAESU two-way radio is extremely straightforward. The following section will describe the operating procedure.

IMPORTANT NOTE

Before commencing operation, confirm that the power supply connections have been correctly made to rear apron jack and supply. Furthermore, be certain that a 50 ohm antenna is connected to the antenna jack.

Never connect AC power to the rear apron POWER jack.

1. Check to see that all connections have been made correctly.
2. Push the front panel VOL switch to activate the transceiver. The front panel PWR lamp will glow (green).
3. Rotate the squelch control to the point where the background noise is just silenced.
4. To transmit, squeeze the microphone push-to-talk switch. Release the switch for receiver recovery. The TX lamp will turn red during transmission.
5. The channel selector may be rotated, as desired, for selection of the desired channel.
6. The RESET button is not used unless the optional two-tone sequential decoder is installed.

TONE SQUELCH OPERATION

The optional tone squelch (CTCSS) unit will provide for silent monitoring of the busy channels. See your YAESU dealer for installation of the tone squelch option.

Your microphone mounting knob and the microphone hanger form an integral part of the tone squelch system. For proper operation, the microphone hanger must be affixed to the automobile metal body.

Here's how to use the tone squelch system:

1. Place the microphone into its hanger. This will activate the tone squelch system.
2. On receiver, your radio will remain silent until a call is received from a station using an identical tone squelch system. When the correct tone signal is received, normal output from the speaker will occur.
3. To transmit, just remove the microphone from its hanger, and call in the normal manner. When you squeeze the push-to-talk switch, a subaudible tone (one too low for your ear to perceive) will sent along with your voice signal. This will activate the receiver of the other party, in the same way that your receiver responded.
4. Note that when a signal is received which does not have a tone squelch signal on it, the orange BUSY lamp will light up. This will alert you to the fact channel is occupied, even though you cannot hear the calling station. You should wait until the channel is clear before making a call of your own.
5. When you remove the microphone from its hanger, the receiver tone squelch system is defeated, and normal monitoring of all stations on the channel (including those not using tone squelch) will occur.

INSTALLATION

The FTC-4610/4625 are designed primarily for mobile installation, requiring only an antenna and 13.8 VDC power source for operation. The transceivers have been pretuned at the factory, and no adjustment is required for operation into a 50 ohm load.

For mobile installations, three basic factors must be considered. These are: the antenna system and feedline; the physical location of the transceiver; and the power connections. We will consider each of these individually in the following sections.

ANTENNA CONSIDERATIONS

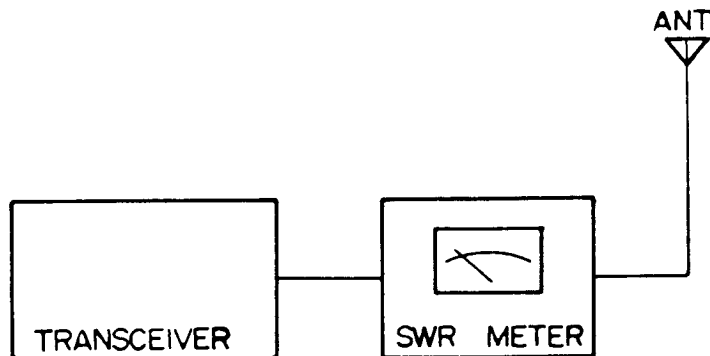
The FTC-4610/4625 are designed for operation into a 50 ohm antenna system. While variations of a few ohms from this figure are of no consequence whatsoever, the automatic final amplifier protection circuitry will reduce the power output when a high SWR exists on the feedline.

Preferably, the antenna should be located away from the automobile engine, if possible, in order to avoid unnecessary noise pickup. A typical location would be in the center of the car roof or the center of the trunk lid. Where ground connections are made, they should be scraped clean of all paint and corrosion, so as to ensure adequate bonding. Lossy ground connections can have seriously detrimental effects on the antenna system impedance and radiation pattern.

To minimize losses in the antenna system, the shortest possible length of coaxial cable should be used. For mobile installations, type RG-58A/U is suitable because of its small size, with Teflon @ dielectric types being better. For base stations, however, larger sizes are to be preferred. Base station systems requiring more than 25 feet of coaxial cable should utilize type RG-8A/U, and extremely long runs of many hundreds of feet generally require the use of type RG-17A/U, aluminum-jacketed "foamflex" coax, or air-dielectric "heliac" coax.

The antenna should be tuned for the center of the 3 MHz working band of the transceiver. To check the SWR, install a 50 ohm SWR meter between the transceiver antenna jack and the antenna. Place the selector switch into the FORWARD position on the meter, and transmit briefly (make certain that the channel is clear). Rotate the FORWARD SET or SWR SET control for a full scale reading. Now switch to REFLECTED on the meter, and read the SWR. If it is below 1.5, you are in good shape. If not, check below or above the 3 MHz range of the transceiver. If the SWR is very high (more than 3 : 1), there may be trouble in the coaxial cable. Check the SWR with the meter installed at the antenna, or test the coax by replacement with cable known to be good.

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1. SWITCH TO FORWARD
2. SET METER FOR FULL SCALE
3. SWITCH TO REFLECTED
4. READ SWR ON METER.

TYPICAL SWR TEST SETUP

GENERAL

PHYSICAL LOCATION OF TRANSCEIVER

The FTC-4610/4625 may be installed at any angle desired without loss of performance. Typical locations are atop the transmission tunnel, below or in the dash board, or overhead (in trucks, etc.).

When considering a possible location for the transceiver, several factors must be considered. First, there must be room for the transceiver cables, the microphone, and heat sink. We recommend that several inches of space be available around the heat sink to allow free air circulation. Also, we recommend that the transceiver not be located directly in the path of the output vent from the car heater.

Another consideration is the routing of cables to the desired installation location. If the power cable to the battery or the coaxial cable to the antenna must be extended greatly in order to meet aesthetic considerations, the increased losses may degrade performance. Fortunately, the common under-dash installation lends itself well to efficient performance, as the power cable can be fed through the fire wall.

One final consideration is safety. The transceiver and its microphone must never be installed in a position that may interfere with driver vision or operation of the vehicle. Be especially wary of stick shifts in compact cars, and allow plenty of room for unobstructed manipulation of the controls. The FTC-4610/4625 are very compact units, so there is no reason ever to compromise safety during installation.

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POWER CONNECTIONS

For mobile installation, direct connection to the battery is to be preferred. If power connections are made at the ignition switch, unnecessary noise pickup may occur. Also, if power is taken from the automobile lighting, cigarette lighter, or other circuits, the circuit line fuse will probably blow because of insufficient capacity. A fuse (4 amp for FTC-4610, 10 amp for FTC-4625) is located in the DC power cord for the transceiver, protecting that circuit.

The power connection procedure is detailed below. Once the power connections are made, but before the power cord is connected to the transceiver, you should check the battery charging voltage with the engine running fast enough for the car ammeter to show a charge. If the voltage exceeds 15 volts, the car voltage regulator must be adjusted to limit the maximum voltage to less than 15 volts.

CAUTION

Permanent damage will result if reversed polarity supply voltage is applied to this transceiver. Our warranty does not cover damage caused by reversed power supply connections.

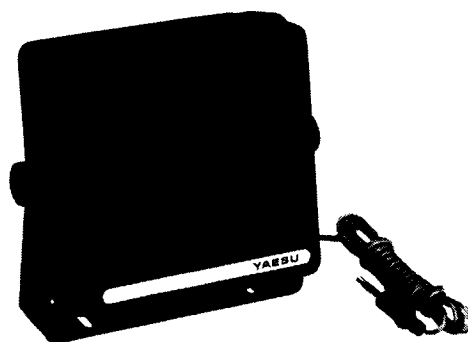
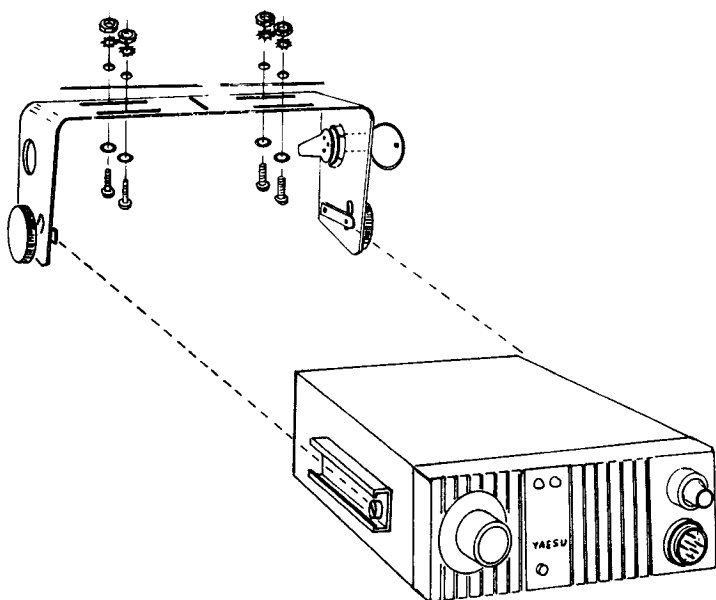
Also, when making power supply connections, you must be absolutely certain that the proper supply polarity is observed.

WARNING

NEVER APPLY AC POWER TO THIS TRANSCEIVER. NEVER CONNECT A DC POWER SOURCE OF GREATER THAN 15 VOLTS TO THE REAR PANEL POWER JACK. ALWAYS REPLACE FUSES WITH A FUSE OF THE PROPER RATING. FAILURE TO OBSERVE THESE SIMPLE PRECAUTIONS WILL VOID ALL WARRANTIES ON THIS EQUIPMENT.

INSTALLATION STEP-BY-STEP OUTLINE

1. Determine the optimum location for the transceiver, making certain that there is sufficient space for the transceiver, its cables and switches, and the microphone. Leave several inches of space around the heat sink, to permit free air flow.
2. A universal bracket is supplied with the transceiver. Use the universal bracket as a template for positioning the mounting holes. Use a 3/16" diameter bit for drilling these holes, allowing clearance for the transceiver and all accessories and cables. Secure the mounting bracket with the screws, washers, and nuts supplied, as shown in the drawing.
3. Ease the transceiver into the guide rail, and slide it into the desired position. Tighten the knobs on the outside of the universal bracket to secure the transceiver.
4. The key lock mechanism may be mounted either on the left or right side of the mounting bracket. Just remove the four screws holding the cover plate on the bracket, and install the key lock in its place. The plate can then be installed on the side opposite the lock.
5. Confirm that the installation does not obstruct normal, safe operation of the vehicle.
6. Route the transceiver power cable through the fire wall to the battery. Avoid proximity to ignition cables if at all possible. Lay out the power cable so as not to have it interfere with the normal operation of the fan belt or other engine components.
7. Connect the RED battery lead to the POSITIVE (+) side of the battery. Connect the BLACK lead to the NEGATIVE (-) side of the battery.
8. If the optional FSP-1 (8 ohms impedance) or FSP-2 (4 ohms impedance) external speaker is to be installed, it may be connected to the rear apron SP jack. The speaker can then be mounted wherever convenient for the operator. Insertion of the speaker plug into the rear apron automatically cuts off the internal speaker of the transceiver.



FSP-1/FSP-2
EXTERNAL SPEAKER

GENERAL

BASE STATION INSTALLATION

For base station installations, the FP-5 (for FTC-4610 only) and FP-6 (both FTC-4610 and 4625) AC power supply options provide a convenient means of providing the required 13.8 VDC for the FTC-4610/FTC-4625, transceivers.

Before commencing operation with the FP-5 or FP-6, be absolutely certain that the power transformer primary has been wired correctly for the local line voltage in your area. Both FP-5 and FP-6 are marketed throughout the world, and a unit that you receive from a customer who recently has been abroad may be wired for 234 volts or similar. Operation of the FP-5 or FP-6 from an improper supply voltage will void all warranties on the set.

For installation to the FP-5, connect the two pin cord stub/connector J4 to the internal connector P1 of the FP-5.

For installation to the FP-6, connect the attached DC cable to rear apron terminals; RED cord lead to positive (+), the BLACK lead to the NEGATIVE (-) supply lead. Then, connect cord stub/connector to power connector J4 of FTC-4610/4625. The four-pin socket should not be used; the jumper plug (sold with the FP-6) must be plugged into the four-pin socket, so as to provide proper connections. However manual on/off switching of the FP-6 will be required.

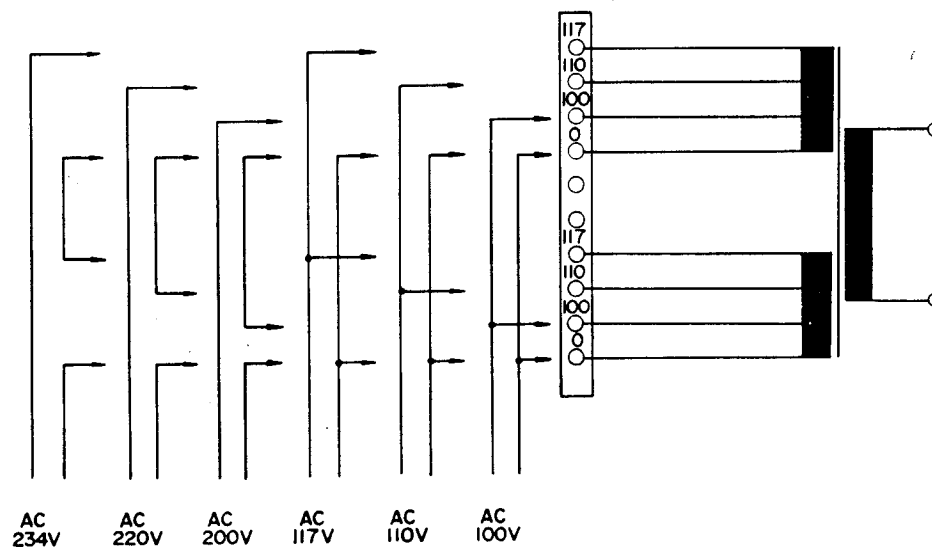
Plug in the FP-5 or FP-6 AC cable to the wall outlet. Now turn the power supply switch ON, and then turn the transceiver power switch ON. The radio will now be ready for operation, if you have the antenna and microphone connected.

The FP-5 and FP-6 contain a quality speaker for base station installation. Connect the miniature phone plug from the FP-5 or FP-6 to the SP jack on the rear apron of the transceiver.

CAUTION

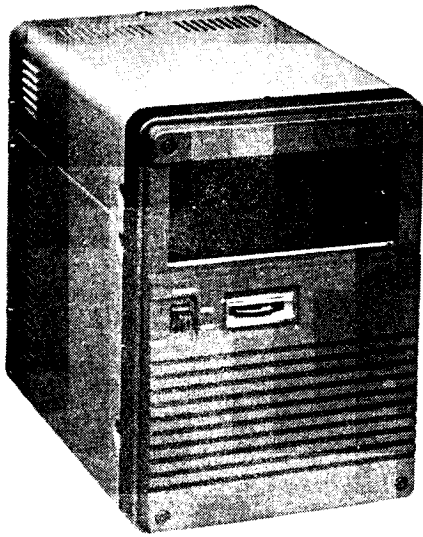
When performing service on the FP-5 or FP-6, be absolutely certain that the voltage specification on the rear apron matches your local supply voltage. Improper connections will void our warranty.

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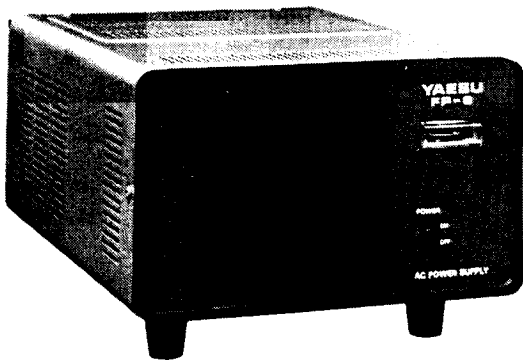
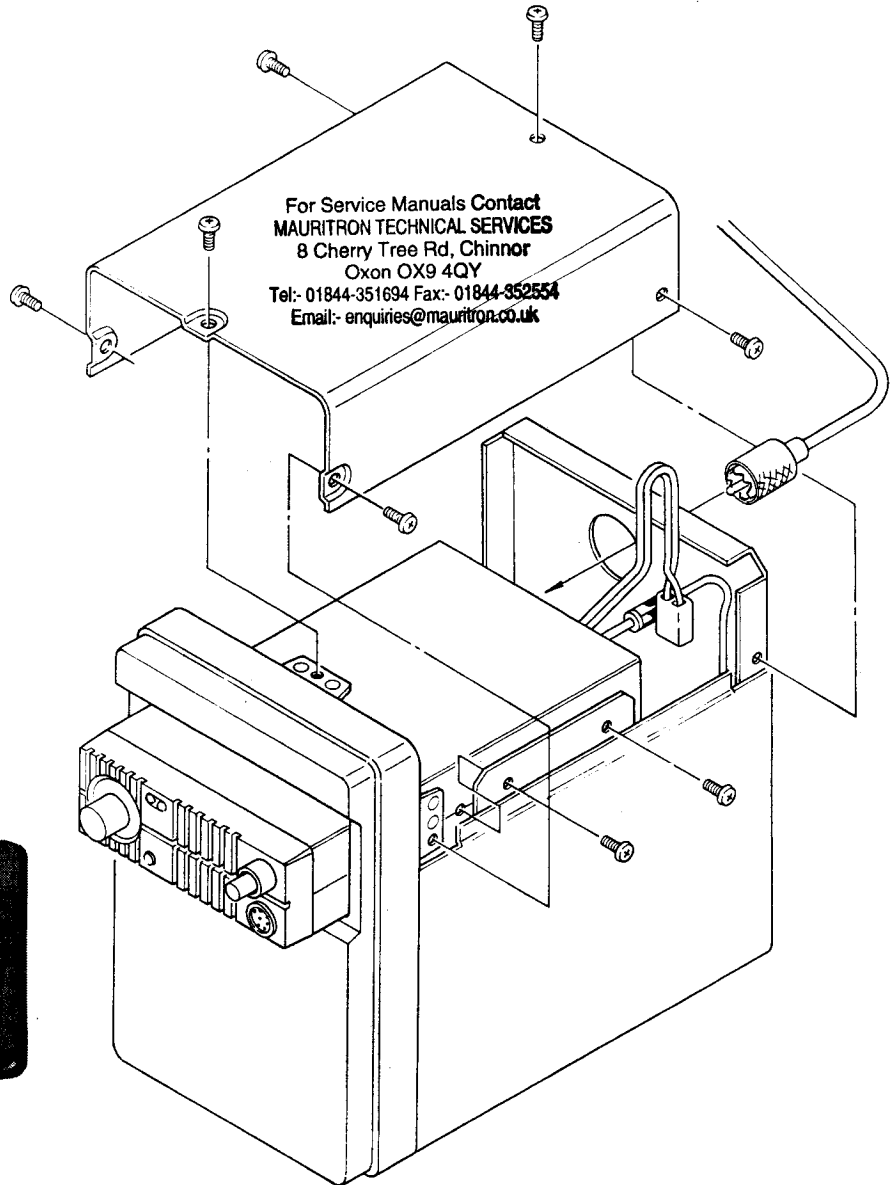


POWER TRANSFORMER PRIMARY
CONNECTIONS

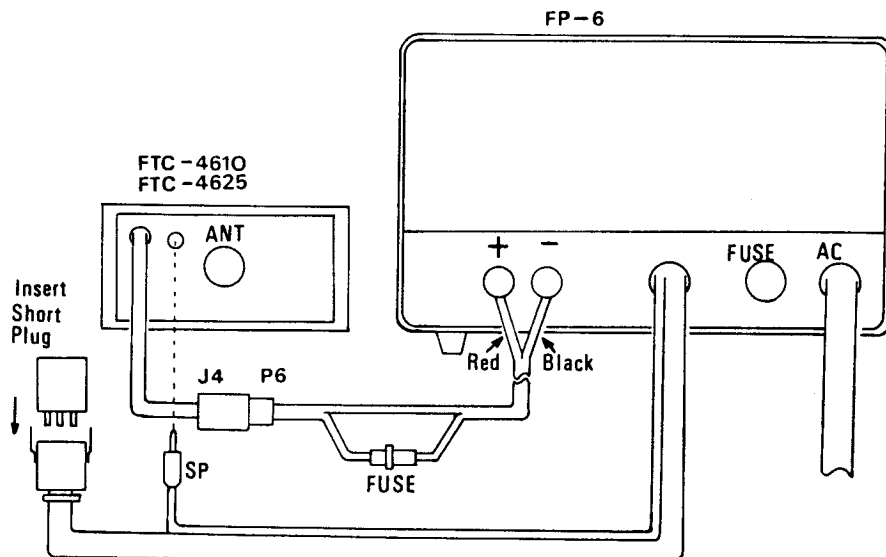
INTERCONNECTIONS



FP-5



FP-6



GENERAL

TONE SQUELCH INSTALLATION

The FTS-2 CTCSS module option can easily be installed in a matter of minutes. Inspect the frequency table accompanying this section, and select the resistor appropriate for the tone signal to be used. Install the selected R₇₆₄, and R₇₆₅, onto the FTS-2/PB board, and be certain to use only a 1% tolerance metal film resistor.

Refer to Figure 1, and unplug P₄ from its jack J₁₀₁. Install the FTS-2 into correct position and connect P₇₀₂ into J₁₀₁, and P₇₀₁ into J₂₀₁.

* US models use the FTS-32ED module. See your Yaesu dealer for details of the FTS-32ED for the US model.

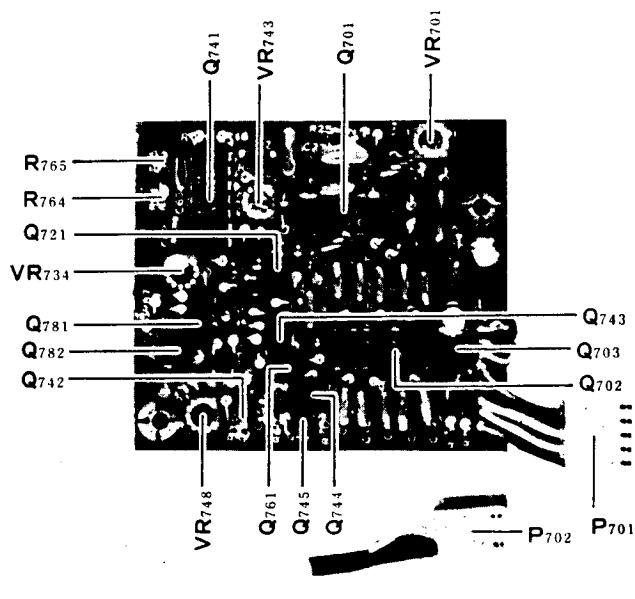
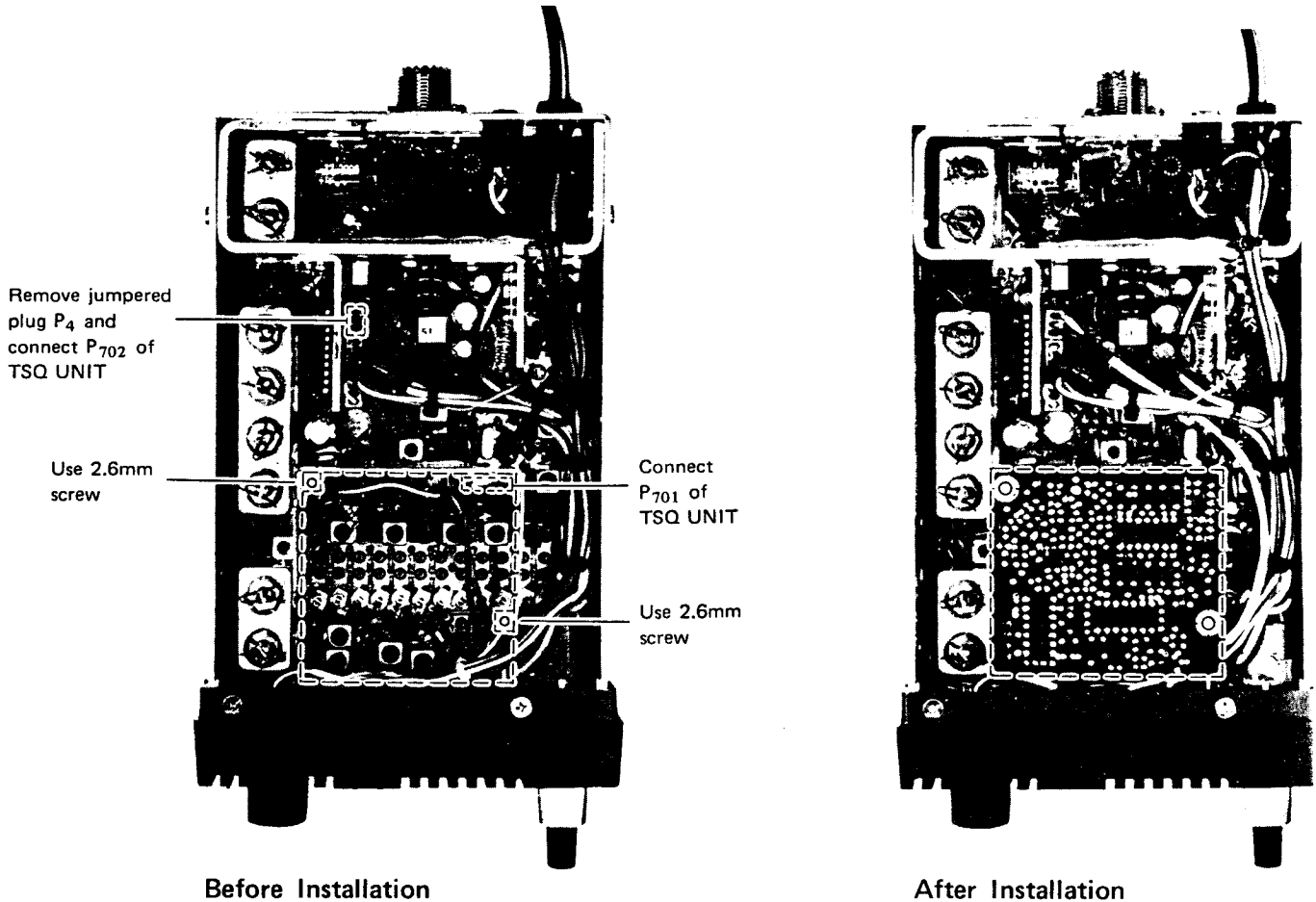


Figure 1

Tone Squelch Unit

TONE SQUELCH TUNING RESISTOR CHART

Tone Freq.	R ₇₆₄	R ₇₆₅
67.0 (Hz)	1 (MΩ)	374 (kΩ)
71.9	"	191
74.4	"	115
77.0	"	40.2
82.5	562 (kΩ)	344
85.4	"	284
88.5	"	226
91.5	"	174
94.8	"	124
100.0	"	54.9
103.5	442	133
107.2	"	95.3
110.9	"	59.7
114.8	300	169
118.8	"	137
123.0	"	107
127.3	"	80.6
131.8	"	54.9
136.5	"	30.9
141.3	"	8.87
146.2	137	152
151.4	"	132
156.7	"	114
162.2	"	97.6
167.9	"	81.6
173.8	"	67.3
179.9	"	53.6
186.2	68.1	110
192.8	"	97.6
203.5	"	80.6
210.7	"	70.6
218.1	"	61.9
225.7	"	53
233.6	"	44.8
241.8	"	37.4
250.3	"	30.5

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Table 1

GENERAL

THEFT GUARD INSTALLATION USING FHR-1

The Theft Guard feature of the FHR-1 Horn Relay box can be an effective deterrent to burglary. When the line from the FHR-1 box to the FTC-4610/4625 is cut, the horn will begin blaring on and off, and further tampering with the car will probably be discouraged.

In order to make it difficult for a thief to disable the Theft Guard, we recommend that the FHR-1 be installed under the hood of the automobile in a fairly dry location. Alternatively, it may be installed in some inaccessible location under the dash. The only time that ON/OFF switching should be needed is in the event of an attempted burglary, as the current drain is negligible in the standby mode. To quiet the horn, turn the FHR-1 power switch to OFF.

Installation Procedure:

- (1) Refer to Figure 2 and mount the FHR-1 box in the desired location. The unit is not waterproof, so a position not exposed to moisture is to be preferred.
- (2) Refer to the interconnection diagram (Page 2-5), and hook up the wires as shown. The two heavy red wires (bare ends, with no connector) should be wired in parallel with the main steering wheel horn switch of the car. The three leads from the molded connector are connected as follows: the white lead goes to the FTC-4610/4625 HORN RELAY terminal (Figures 3 and 4); the red lead goes to an auxiliary post on the fuse block, if one is available (10 amp fuse is OK); the black lead goes to ground.
- (3) Inside the FHR-1 are two miniature potentiometers, shown in Figure 5. VR₁₀₁ controls the ON time of the beeping horn; while VR₁₀₂ controls the OFF time. Either control provides an adjustment range of 2 to 25 seconds in the on and off times.
- (4) The customer should be educated in the importance of being able to turn off the horn relay quickly, so as to minimize the disturbance to others. Also, discuss with the customer the importance of maintaining good connections to the HORN RELAY jack, etc., so as not to induce false triggering of the

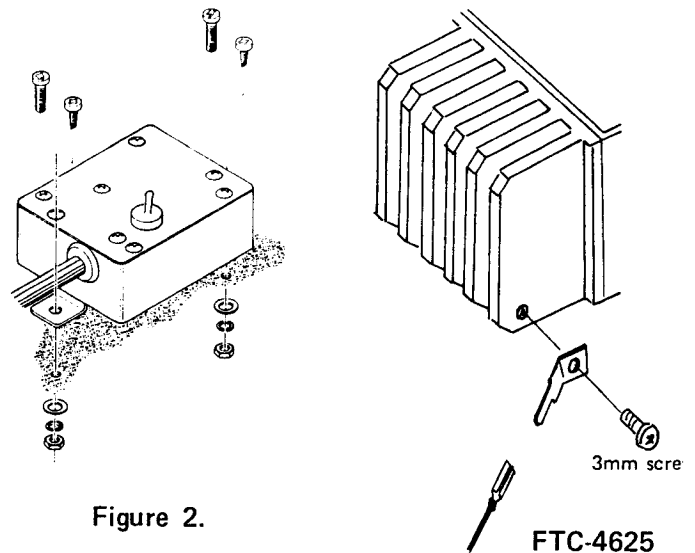
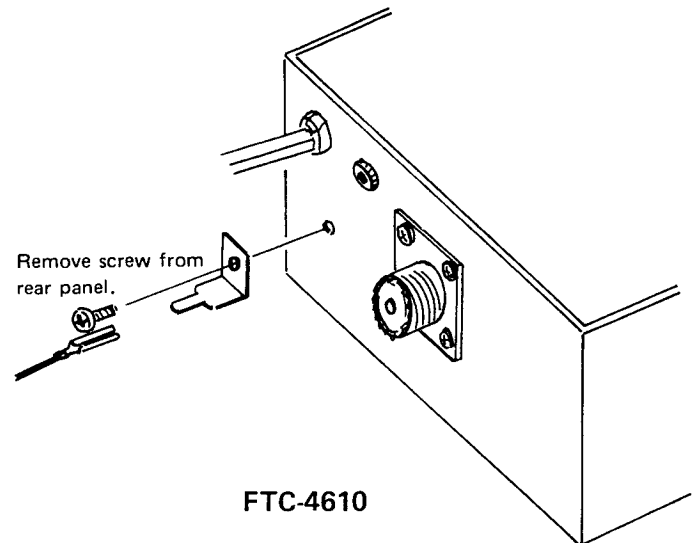


Figure 2.

FTC-4625
Figure 3.



FTC-4610

Figure 4.

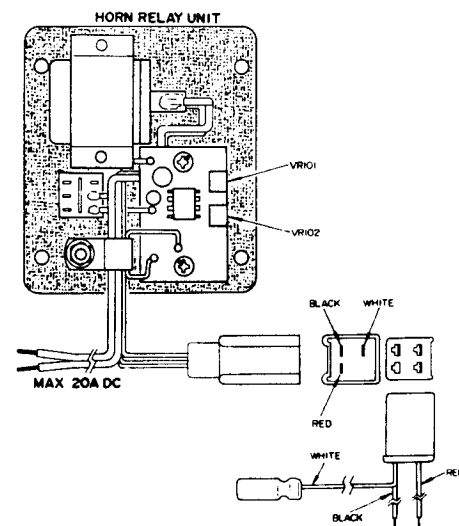
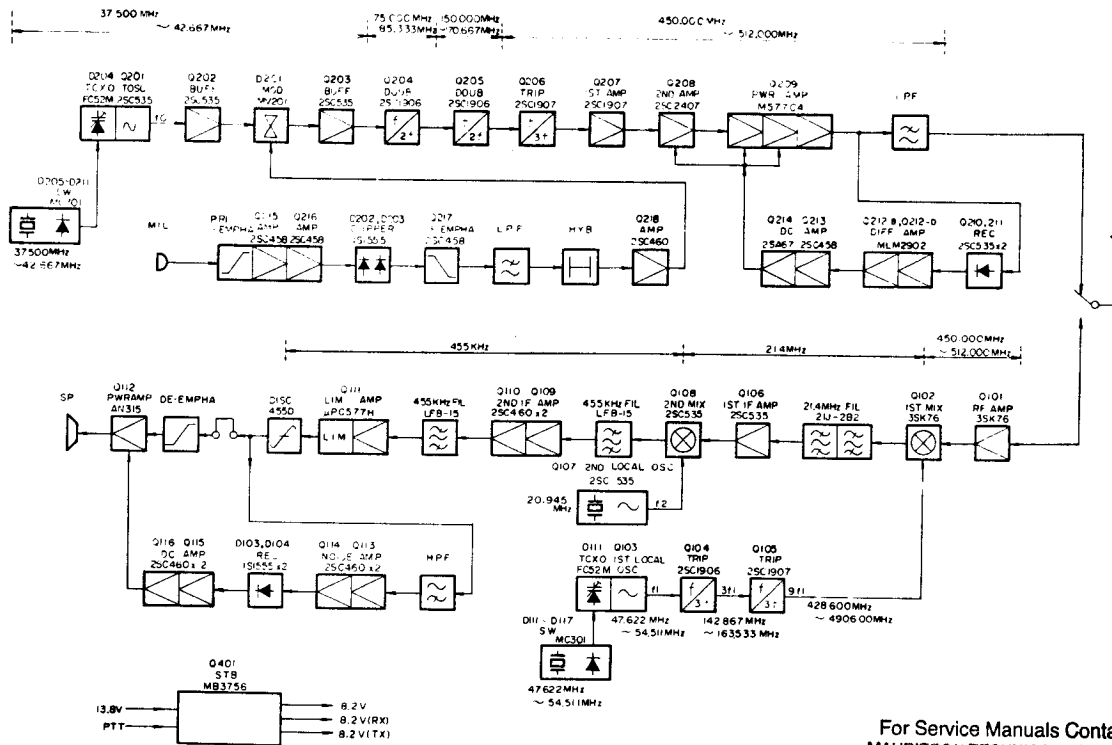


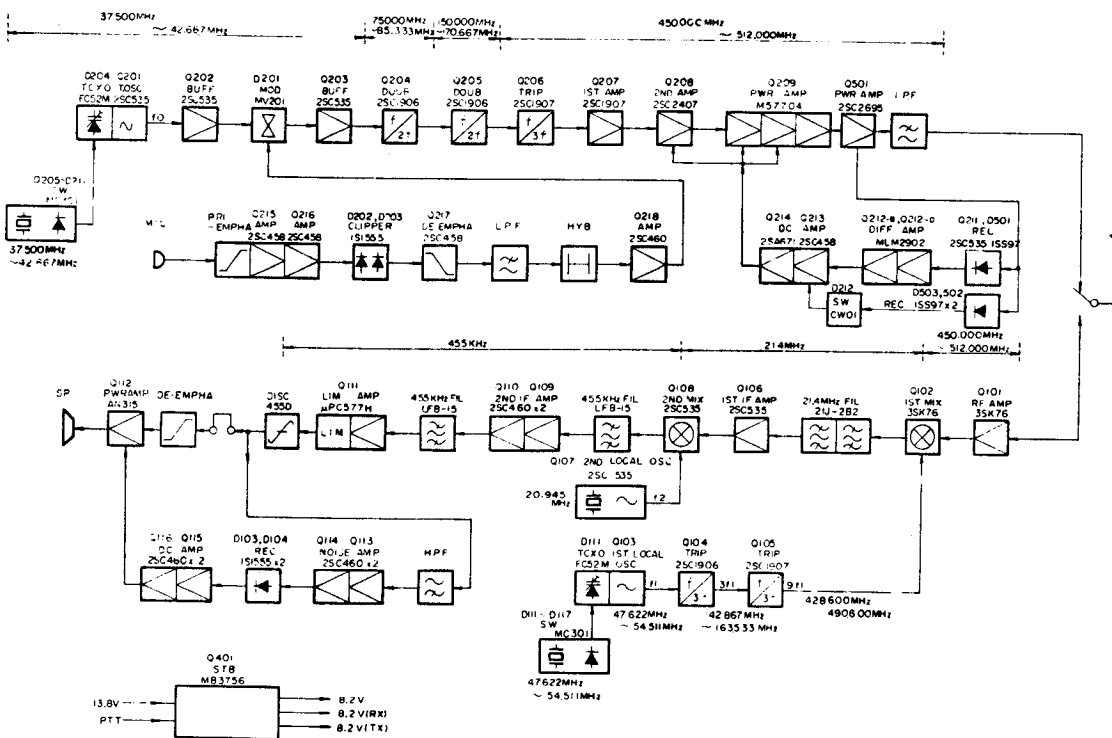
Figure 5.

BLOCK DIAGRAM



FTC-4610 BLOCK DIAGRAM

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FTC-4625 BLOCK DIAGRAM

CIRCUIT DESCRIPTION

RECEIVER

The incoming signal from the antenna is coupled through helical resonator CV_{101} to RF amplifier Q_{101} (3SK76), a dual-gate MOS FET with excellent rejection of cross modulation. The amplified signal is then passed through a four-stage helical resonator to the first mixer, where the RF signal is mixed with the first local signal delivered from Q_{103} (2SC535B), resulting in a 21.4 MHz first IF. Local oscillator Q_{103} uses up to seven HC-25/U crystals operating in the third overtone mode, and individual trimmer capacitors for each crystal allow precise adjustment of the channel frequency. The output from Q_{103} is coupled through C_{137} to oscillator multipliers Q_{104} (2SC1906) and Q_{105} (2SC1907), then link coupled through CV_{103} to gate 2 of the first mixer, Q_{102} (3SK76).

The output from the first mixer is tuned by T_{105} to the difference frequency of the input signals, then passed through monolithic crystal filters XF_{101} and XF_{102} and amplified by Q_{106} (2SC535B). The IF signal is then delivered to the second mixer, where the 21.4 MHz first IF signal is mixed with a 20.945 MHz local signal generated by Q_{107} (2SC535B), producing a 455 kHz second IF.

The second IF signal is fed through filter CF_{101} , amplified by Q_{110} (2SC460B), and fed through another ceramic filter, CF_{102} . The IF signal is then fed to amplifier/limiter Q_{111} (μ PC577H). The limiting action of Q_{111} eliminates any amplitude variation in the IF signal, which subsequently is fed to the discriminator.

The discriminator consists of D_{101}/D_{102} (1S1555) and CD_{101} , a ceramic discriminator element. The output from the limiter is coupled through C_{179} to CD_{101} , then rectified by D_{101} and D_{102} , producing an audio output in response to a corresponding frequency shift in the IF signal.

The audio output signal from the discriminator is fed to a notch filter, which tunes out the 455 kHz IF signal present. The signal is then fed through pin 1 of J_{101} to the optional tone squelch unit. When the tone squelch unit is not installed, the signal is fed via a jumper to the de-emphasis

network, consisting of R_{147} and C_{185} . The de-emphasized audio output is fed through the audio volume control, VR_{1b} , to audio amplifier Q_{112} (AN315), which delivers 1.5 watts of audio output power to the speaker.

When no carrier is present in the 455 kHz IF, the high frequency noise present at the discriminator output is amplified by Q_{113} and Q_{114} (2SC460B), then detected by D_{103} and D_{104} (1S1555), producing a DC voltage. This voltage is amplified by Q_{115} and Q_{116} (2SC460B) and fed to pin 10 of Q_{112} , cutting off the audio amplifier. A portion of the DC voltage is also used to control Q_{117} (2SC460B) for BUSY lamp operation. When a carrier is present in the 455 kHz IF, the noise is removed from the discriminator output, and the audio amplifier then recovers to normal operation. The opening of the squelch causes Q_{117} to be activated, causing the BUSY lamp to become illuminated.

TRANSMITTER

The speech input signal from the microphone is amplified by Q_{215} and Q_{216} (2SC458B) and coupled through C_{254} to the instantaneous deviation control (IDC), consisting of D_{202} and D_{203} . In the Q_{215}/Q_{216} amplifier stages, the audio is also applied through a pre-emphasis network, consisting of C_{251} , R_{243} , C_{252} , R_{246} , R_{247} , and C_{253} . The output from the IDC is then fed to a de-emphasis network and fed through a low-pass filter, consisting of L_{221} , C_{259} , and C_{260} . The resulting audio signal, free of components above 3 kHz, is fed to the modulator.

Crystal oscillator Q_{201} (2SC535B) generates a fundamental signal, with temperature compensation provided by D_{204} (FC52M), TH_{202} (SDT-250), and TH_{201} (SDT-1000). The carrier signal is fed through buffer Q_{202} (2SC535B) to the phase modulator, consisting of D_{201} (MV201) and associated circuitry. The carrier signal from Q_{202} is varied in phase by the audio signal from Q_{218} , and the resulting modulated signal is amplified by Q_{203} (2SC535B).

The frequency multiplier stages consist of Q_{204} , Q_{205} (2SC1906), and Q_{206} (2SC1907); the total multiplication factor is 12. The output from Q_{206} is amplified by Q_{207} (2SC1907), Q_{208} (2SC2407),

and Q₂₀₉ (M57704H). The RF output signal is fed through a low pass filter, consisting of L₂₁₆, L₂₁₇, L₂₁₈, C₂₄₆, C₂₄₇, C₂₄₈, C₂₄₉, and C₂₅₀. In the FTC-4610, the RF signal is then fed through antenna relay RL₃₀₁ to the antenna connector. In the FTC-4625, the RF output signal is fed to Q₅₀₁ (2SC2695), located on the BOOSTER Unit. The output signal is then fed through a low pass filter, consisting of L₅₀₇, L₅₀₈, L₅₀₉, C₅₁₇, C₅₁₈, C₅₁₉, C₅₂₀, C₅₂₁, C₅₂₂, C₅₂₅, and C₅₂₆. The signal is then delivered through the antenna relay to the antenna jack.

Automatic Power Control (APC) Circuit

A portion of the RF signal from Q₂₀₉ is coupled through stray capacitance on the circuit board trace to the base of Q₂₁₀ (2SC535B), which acts as a rectifier. The resulting DC voltage is fed to section (d) of Q₂₁₂ (MLM2902), where it is compared with a reference voltage delivered from Q₂₁₁ (2SC535B). The DC voltage is then fed through a DC amplifier at Q₂₁₂ (b), Q₂₁₄ (2SC458B), and Q₂₁₃ (2SA671) to Q₂₀₉ on the RF power module, controlling the supply voltage to the final amplifier stage. In the FTC-4625, the rectified output from the directional coupler is fed to Q₂₁₂ (d) for amplification.

FTC-4625 Automatic Final Protection Circuit

The directional coupler produces a rectified DC voltage when reflected power is sensed. This voltage is fed to D₂₁₂ (CW-01B), which sends a cutoff command to Q₂₁₁, the reference voltage regulator.

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TONE SQUELCH UNIT

The tone squelch unit is comprised of a HPF, LPF, BPF, oscillator and control circuits.

(1) HPF

The output signal from the discriminator is fed through VR₇₀₁ to buffer amplifier Q_{701b} (MLM2902) and then delivered to the HPF and LPF circuits. The HPF consists of four 12 dB/oct active filter stages. Q_{702a-d} (MLM2902) rejects the unwanted CTCSS tones while a buffer stage acts as a switch for the AF amplifier.

(2) LPF

A portion of the output signal from Q_{701b} is passed through the LPF consisting of three stages of 12 dB/oct active low-pass filters which pass only CTCSS tone signals. The output signal from the LPF is clipped by D₇₀₁ and D₇₀₂ (both 1S1555) for stable operation against the varying input level. The clipped CTCSS tone signal is applied to the BPF circuit.

(3) BPF

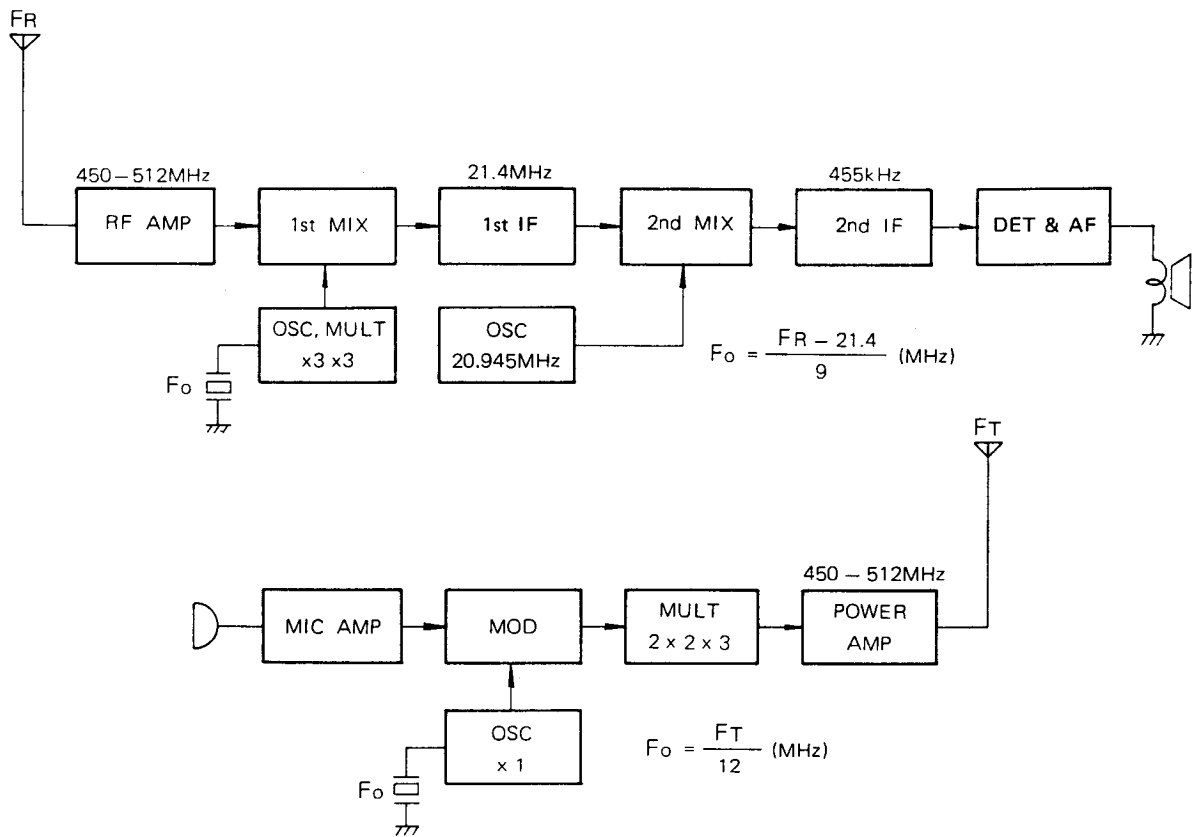
The BPF circuit which consists of Q_{741b-d} (MLM2902) is extremely stable. The filtered tone signal from the BPF is amplified by Q_{741a} and activates the control circuit. Frequency setting is accomplished by R₇₆₄ and VR₇₆₅; VR₇₄₃ for fine tuning.

(4) Control circuit

On receive, the CTCSS tone signal is rectified by Q₇₄₃ (2SC460B) and amplified by DC amplifiers Q₇₄₄ and Q₇₄₅ (both 2SC460B). The output DC voltage activates the Q₇₆₁ (2SC460B) to mute the receiver.

On transmit, switching transistor Q₇₈₂ (2SC460B) conducts to activate the amplifier Q₇₈₁ (2SC460B), while the BPF provides the feedback needed to start oscillation at specified tone frequency. The oscillated tone signal is amplified by Q₇₄₂ (2SC460B) and fed through P₇₁₁ to Q₂₁₆ in the IDC circuit.

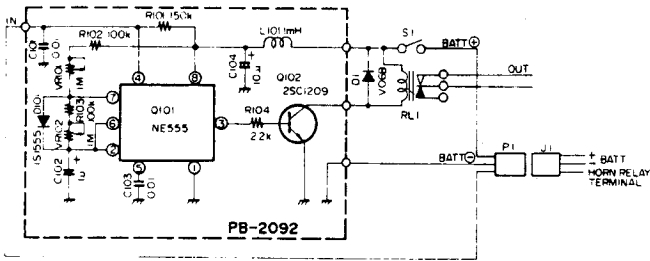
FREQUENCY RELATIONSHIPS



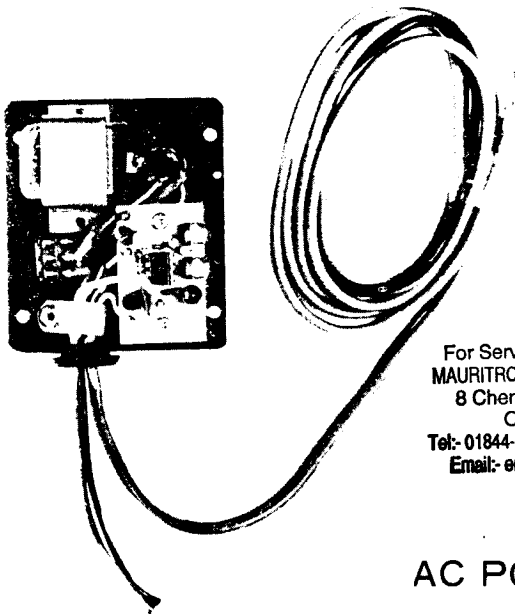
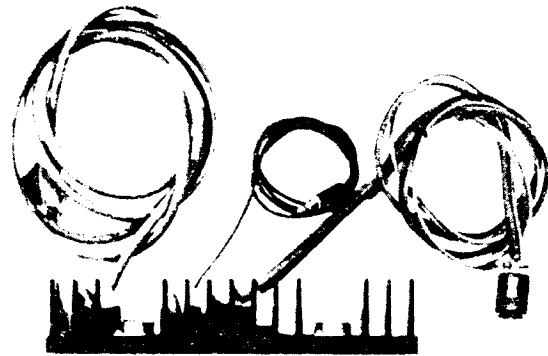
CRYSTAL DATA

1. Type of holder:	HC-25/U or HC-42/U
2. Channel Frequency:	450 MHz ~ 512 MHz
3. Oscillation Frequency:	TX: CH/12 MHz RX: (CH-21.4 MHz)/9 MHz
4. Load Capacity:	TX: 40pF +50 Hz = 0 RX: 32pF -120 Hz = 0
5. Drive Level:	TS-683/TMS 2mW
6. Shunt Capacity:	TX: 37 MHz - 4.7pF ±0.5pF 38 MHz - 4.8pF ±0.5pF RX: 47 MHz - 4.4pF ±0.5pF 48 MHz - 4.5pF ±0.5pF
7. Frequency Tolerance:	±10ppm at 25°C
8. Frequency Stability:	+8ppm ~ +2ppm at -20°C to 0ppm ~ -8ppm at +60°C (25°C reference)
9. Equivalent Resistance:	16Ω max (series)
10. Operation Mode:	3rd order overtone

HORN RELAY UNIT FHR-1

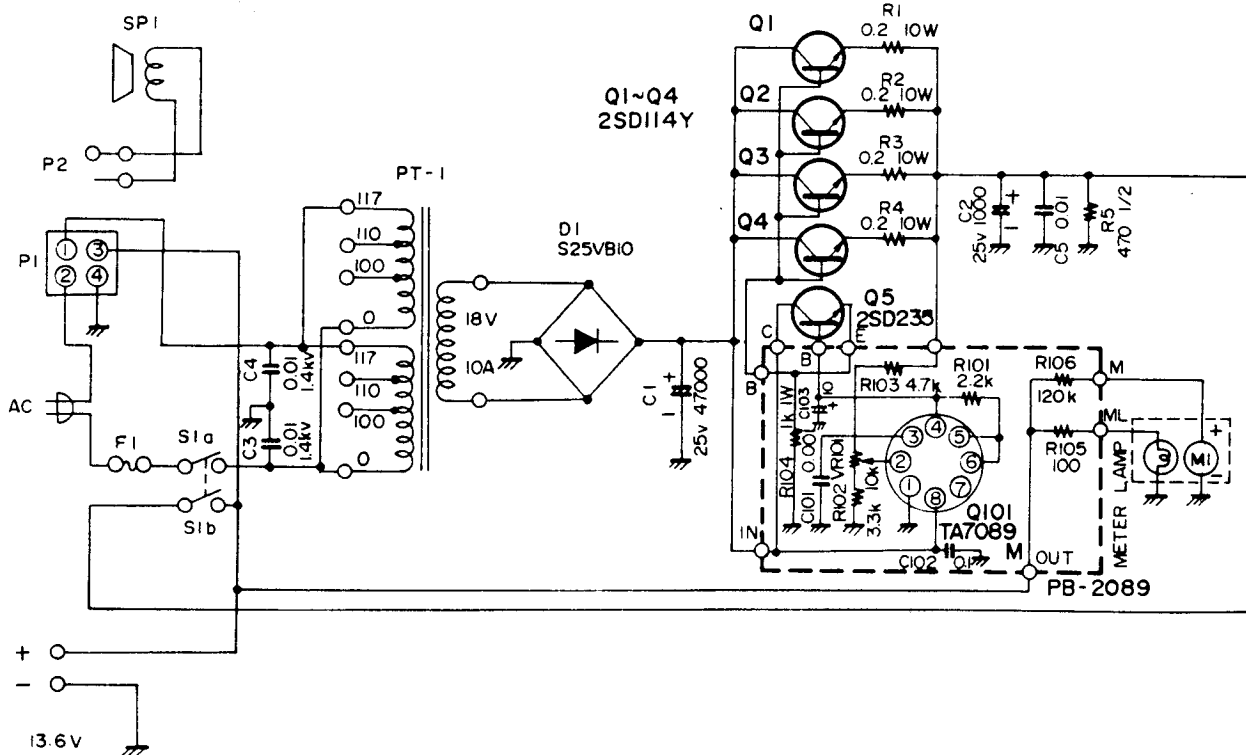


FHR-1
HORN RELAY UNIT



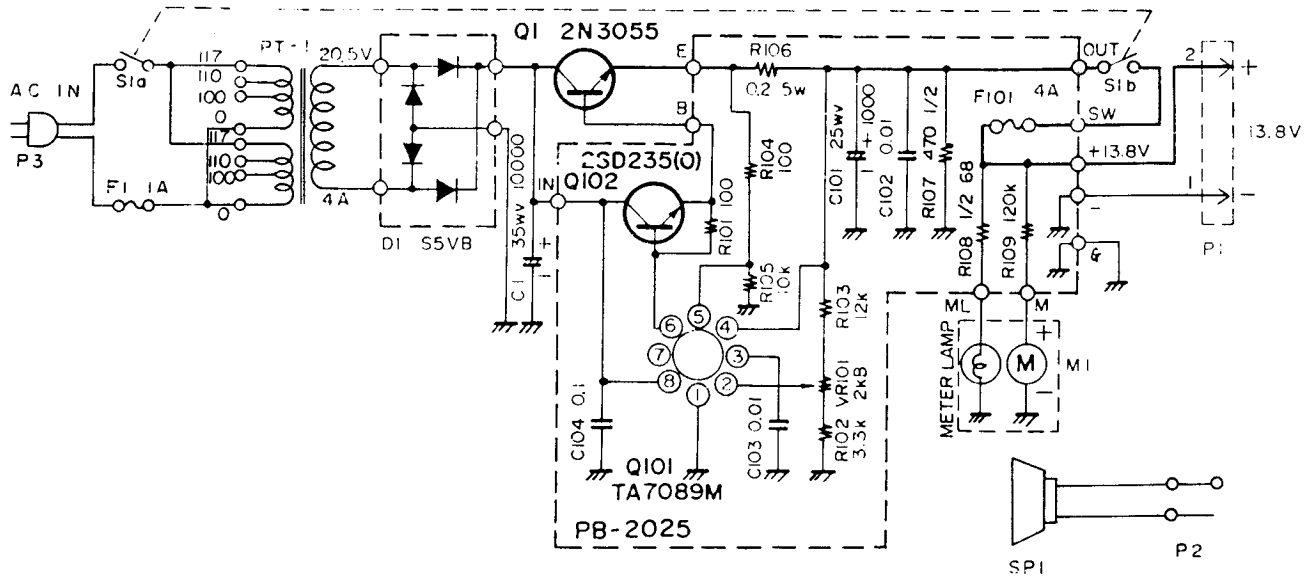
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AC POWER SUPPLY FP-6



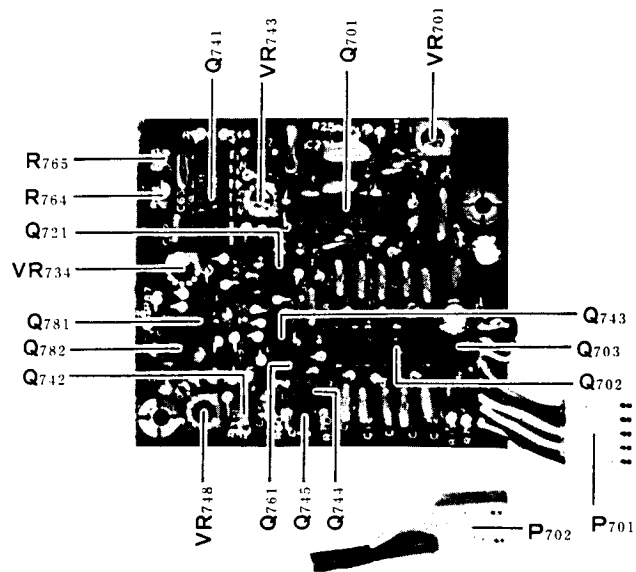
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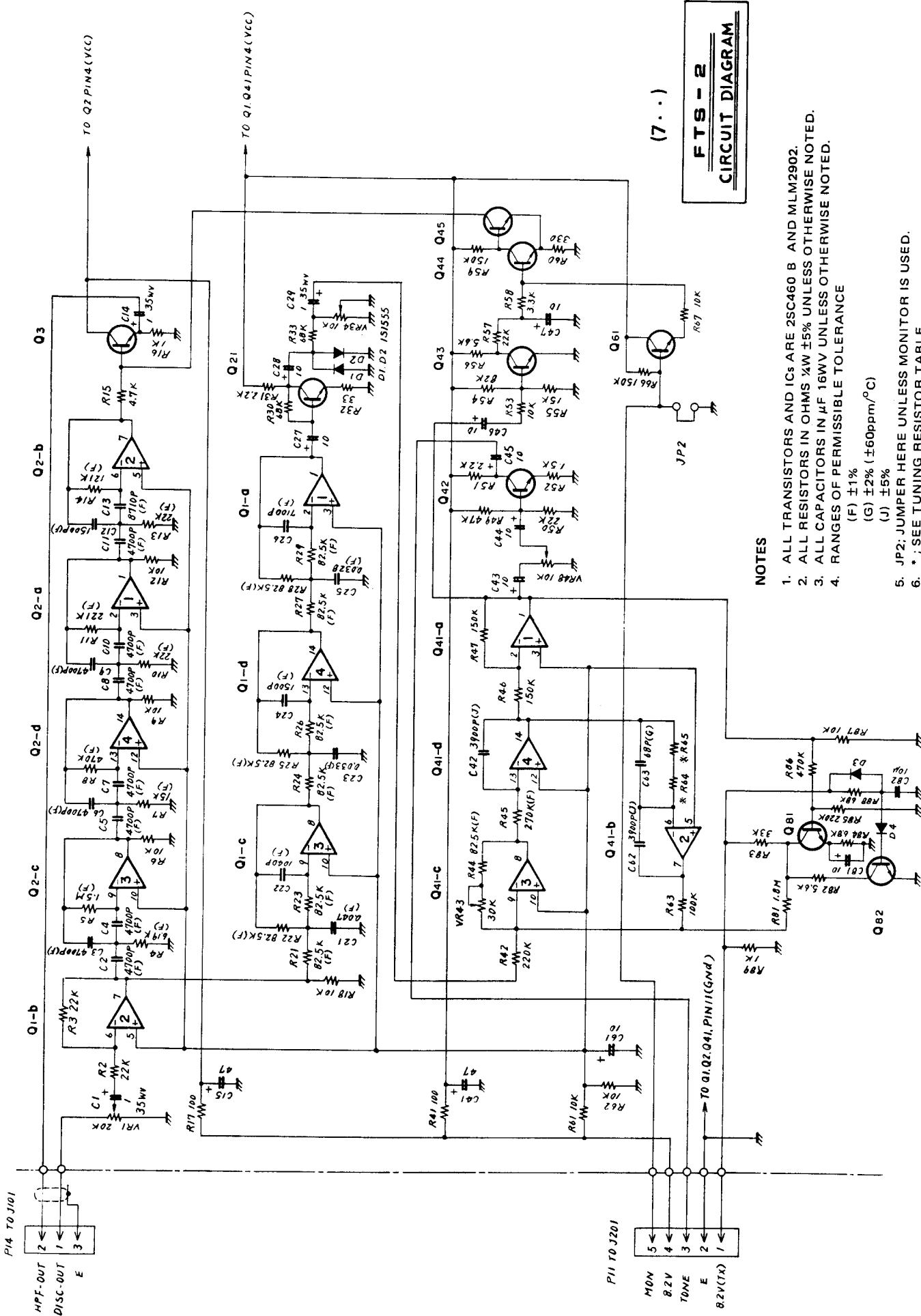
AC POWER SUPPLY FP-5



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TONE SQUELCH UNIT FTS-2





(7..)

F T S - 2
CIRCUIT DIAGRAM

NOTES

1. ALL TRANSISTORS AND ICs ARE 2SC460 B AND MLM2902.
2. ALL RESISTORS IN OHMS %W ±5% UNLESS OTHERWISE NOTED.
3. ALL CAPACITORS IN μF 16WV UNLESS OTHERWISE NOTED.
4. RANGES OF PERMISSIBLE TOLERANCE
(F) ±1%
(G) ±2% (±60ppm/°C)
(J) ±5%
5. JP2; JUMPER HERE UNLESS MONITOR IS USED.
6. * ; SEE TUNING RESISTOR TABLE.

PJ.D4 1S1535

CHANNEL CHANGES

1. Channel Modifications within Present 3 MHz (TX) or 5 MHz(RX) Operating Range.

Channel change within the existing operating range of the transceiver are simple to perform.

- (a) Insert the desired crystals into the local crystal sockets (see the "CRYSTAL DATA"
 - on page 2-4 for crystal specifications).
- (b) Connect a frequency counter to the base of Q₁₀₅ through a 0.01 μ F capacitor, and adjust the appropriate trimmer (TC₁₀₃ through TC₁₀₉) for the correct frequency: (RX Channel Frequency - 21.4)/9 MHz.
- (c) Now, connect a frequency counter to the base of Q₂₀₃. While transmitting, adjust the appropriate trimmer capacitor (TC₂₀₈ through TC₂₁₄) for the correct frequency: (TX Channel Frequency)/12 MHz.
- (d) If the channel modification is very close to the present band edge, and the set has not been in for alignment for some time, it's a good idea to verify that the receiver sensitivity and transmitter power output are satisfactory.

2. Channel Modification to a new 3 MHz(TX) or 5 MHz(RX).

If a new 3 MHz(TX) or 5 MHz(RX) range is required (within the existing 450 - 470 MHz, 470 - 490 MHz, or 490 - 512 MHz bands), proceed as follows:

- (a) Insert the proper crystals into the sockets appropriate for the channels to be changed.
- (b) Connect the RF probe of a VTVM to the collector of Q₁₀₄, and adjust T₁₀₂ for maximum reading on the VTVM. Then, detune T₁₀₂ until 80% of the maximum reading provides a stable output.
- (c) Set the receive crystal to the correct frequency, as outlined above (1-b).
- (d) Connect the RF probe of a VTVM to the base of Q₂₀₂, and adjust T₂₀₂ for maximum reading on the VTVM. Then, detune T₂₀₂ until 80% of the maximum reading provides a stable output.
- (e) Set the transmit crystals precisely to the correct channel frequency.
- (f) Align the transceiver strip, as described in the "ALIGNMENT: TRANSMITTER" section on page 3-30.

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BAND TABLE

TECHNICAL NOTES

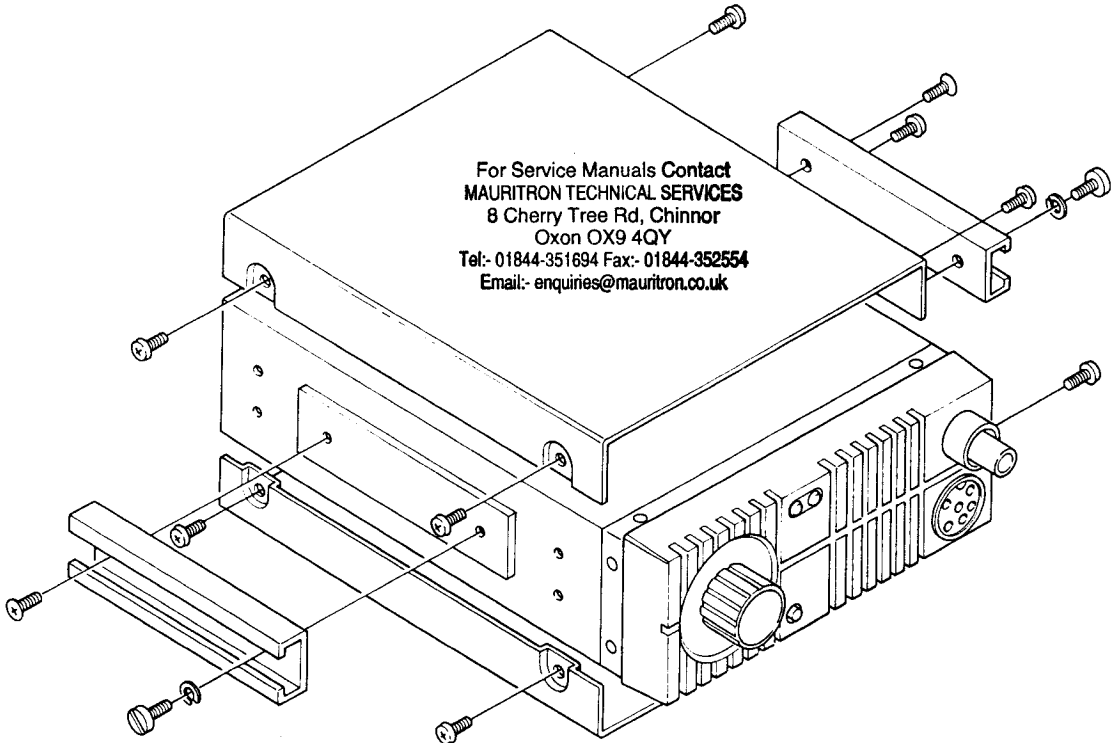
Location Number	450 – 470 MHz		470 – 490 MHz		490 – 512 MHz	
	Part number	Description	Part number	Description	Part number	Description
Q209	G1090228	M57704H	G1090318	M57704UH	G1090319	M57704SH
C104	K05179002	Ceramic RH 5pF (2222-636-39508)	K05179002	Ceramic RH 5pF (2222-636-39508)	K05179003	Ceramic RH 6pF (2222-636-39608)
C107	K05179008	" RH 12pF (2222-636-40129)	K05179008	" RH 12pF (2222-636-40129)	K05179006	" RH 9pF (2222-636-39908)
C136	K05179008	" RH 12pF (2222-636-40129)	K05179008	" RH 12pF (2222-636-40129)	K05179008	" RH 12pF (2222-636-40129)
C140	K05179005	" RH 8pF (2222-636-39808)	K05179003	" RH 6pF (2222-636-39608)	K05179003	" RH 6pF (2222-636-39608)
C144	K05179008	" RH 12pF (2222-636-40129)	K05179005	" RH 8pF (2222-636-39808)	K05179005	" RH 8pF (2222-636-39808)
C145	K05179013	" RH 33pF (2222-637-40339)	K05179011	" RH 22pF (2222-637-40229)	K05179011	" RH 22pF (2222-637-40229)
C147	K05179002	" RH 5pF (2222-636-39508)	K05179001	" RH 4pF (2222-636-39408)	K05179001	" RH 4pF (2222-636-39408)
C222	K05179013	" RH 33pF (2222-637-40339)	K05179012	" RH 27pF (2222-637-40279)	K05179012	" RH 27pF (2222-637-40279)
C227	K05179007	" RH 10pF (2222-636-40109)	K05179005	" RH 8pF (2222-636-39808)	K05179005	" RH 8pF (2222-636-39808)
C247	K02179004	" CH 3pF (DD104CH030C50V02)	K02179004	" CH 3pF (DD104CH030C50V02)	-	-
C249	K02179003	" CH 2pF (DD104CK020C50V02)	K02179003	" CH 2pF (DD104CK020C50V02)	-	-
C250	K02179004	" CH 3pF (DD104CH030C50V02)	K02179004	" CH 3pF (DD104CH030C50V02)	-	-
C517	K02179004	" CH 3pF (DD104CH030C50V02)	K02179004	" CH 3pF (DD104CH030C50V02)	-	-
C518	K02179003	" CH 2pF (DD104CH020C50V02)	-	-	K02179003	" CH 2pF (DD104CH020C50V02)
C519	K02179004	" CH 3pF (DD104CH030C50V02)	-	-	K02179004	" CH 3pF (DD104CH030C50V02)
C521	K02172040	" CH 4pF (DD104CH040C50V02)	K02172040	" CH 4pF (DD104CH040C50V02)	-	-
C522	K02172040	" CH 4pF (DD104CH040C50V02)	K02172040	" CH 4pF (DD104CH040C50V02)	K02172040	" CH 4pF (DD104CH040C50V02)
C525	K02179052	" CH 5pF (2222-636-09508)	K02179052	" CH 5pF (2222-636-09508)	K02179055	" CH 3pF (2222-636-09308)
C526	K02179052	" CH 5pF (2222-636-09508)	K02179052	" CH 5pF (2222-636-09508)	K02179053	" CH 4pF (2222-636-09408)
CV101	Q9000079	HRW-231MT-1019A	Q9000100	HRW-231MT-1027A	Q9000098	HRW-231MT-1028A
CV102	Q9000090	HRQ-232MT-1009A	Q9000101	HRQ-232MT-1013A	Q9000099	HRQ-232MT-1014A
CV103	Q9000081	HRW-231MT-1018A	Q9000102	HRW-231MT-1026A	Q9000100	HRW-231MT-1027A
L102	L0020675		L0020675		L0020674	
L104	L0020675		L0020675		L0020674	
L105	L0020675		L0020675		L0020674	
L109	L0020756		L0020676		L0020676	
L216	L0020677		L0020677		L0020886	
L506	L0020794		L0020794		L0020886	
L507	L0020798		L0020798		L0020794	
L508	L0020798		L0020798		L0020794	
L509	L0020798		L0020794		L0020794	

▲ FTC-4610
* FTC-4625

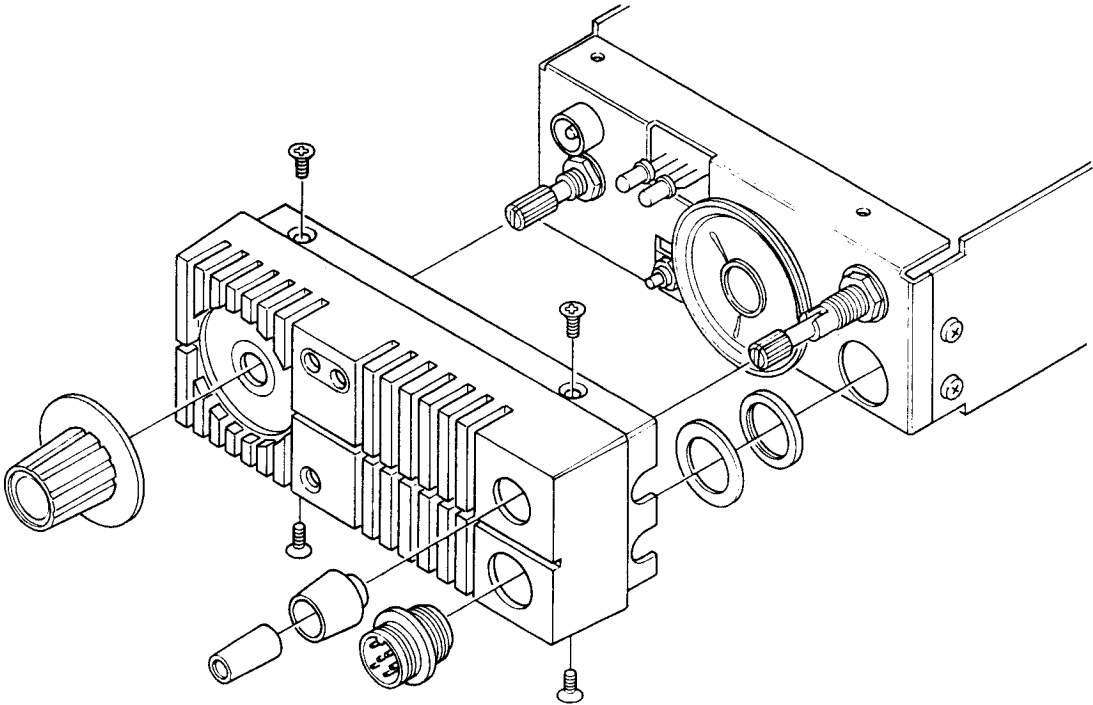
MEMO

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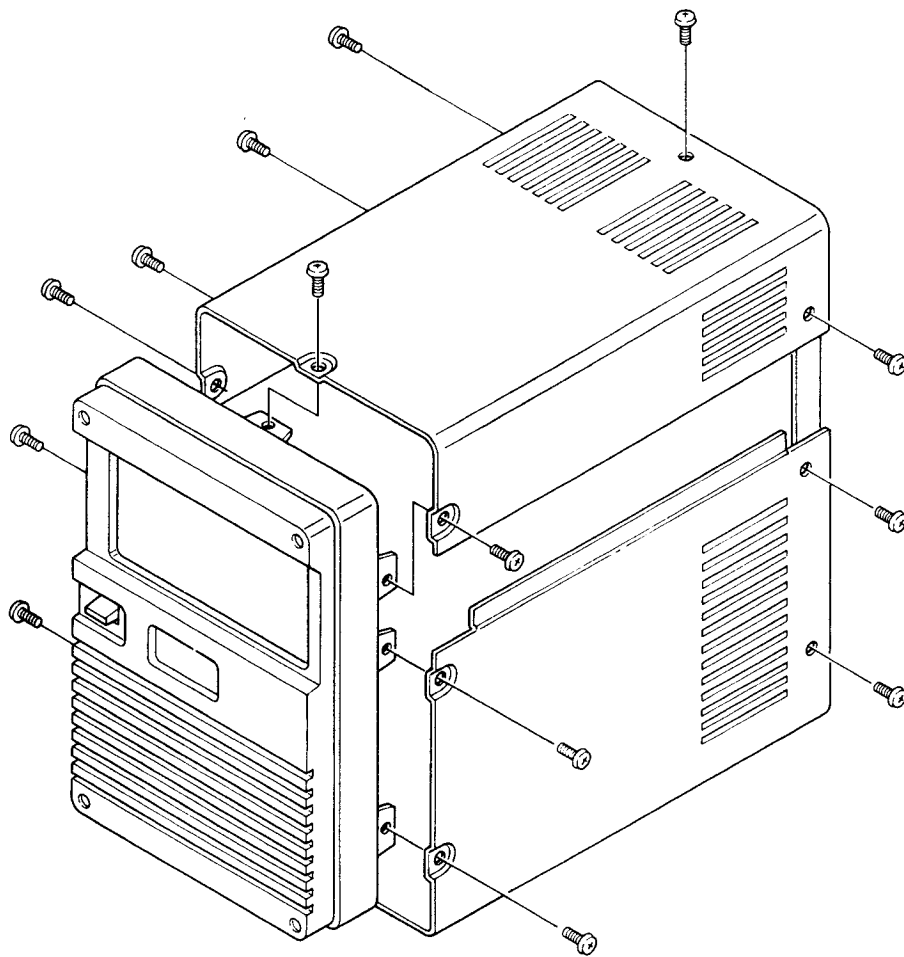
OUTER COVER REMOVAL



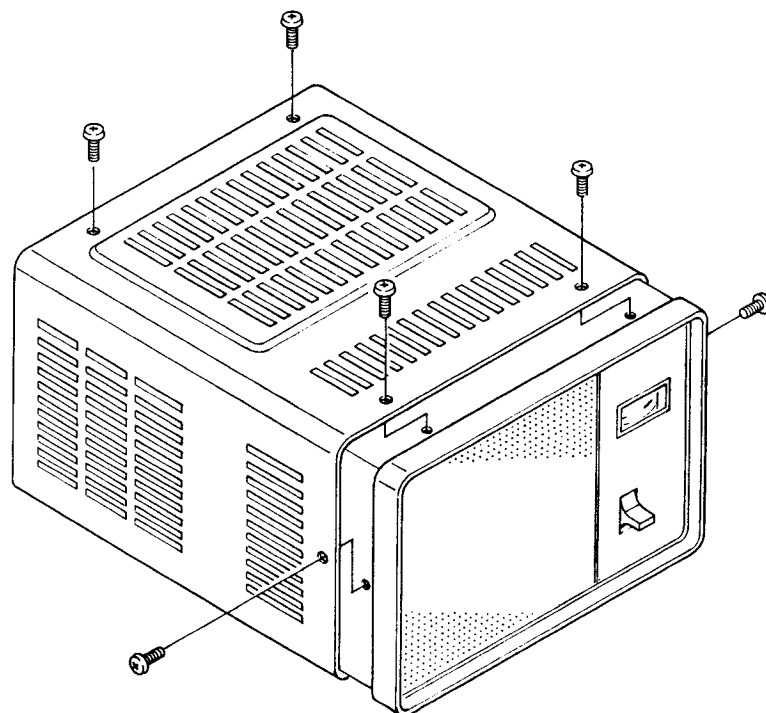
FRONT PANEL REMOVAL



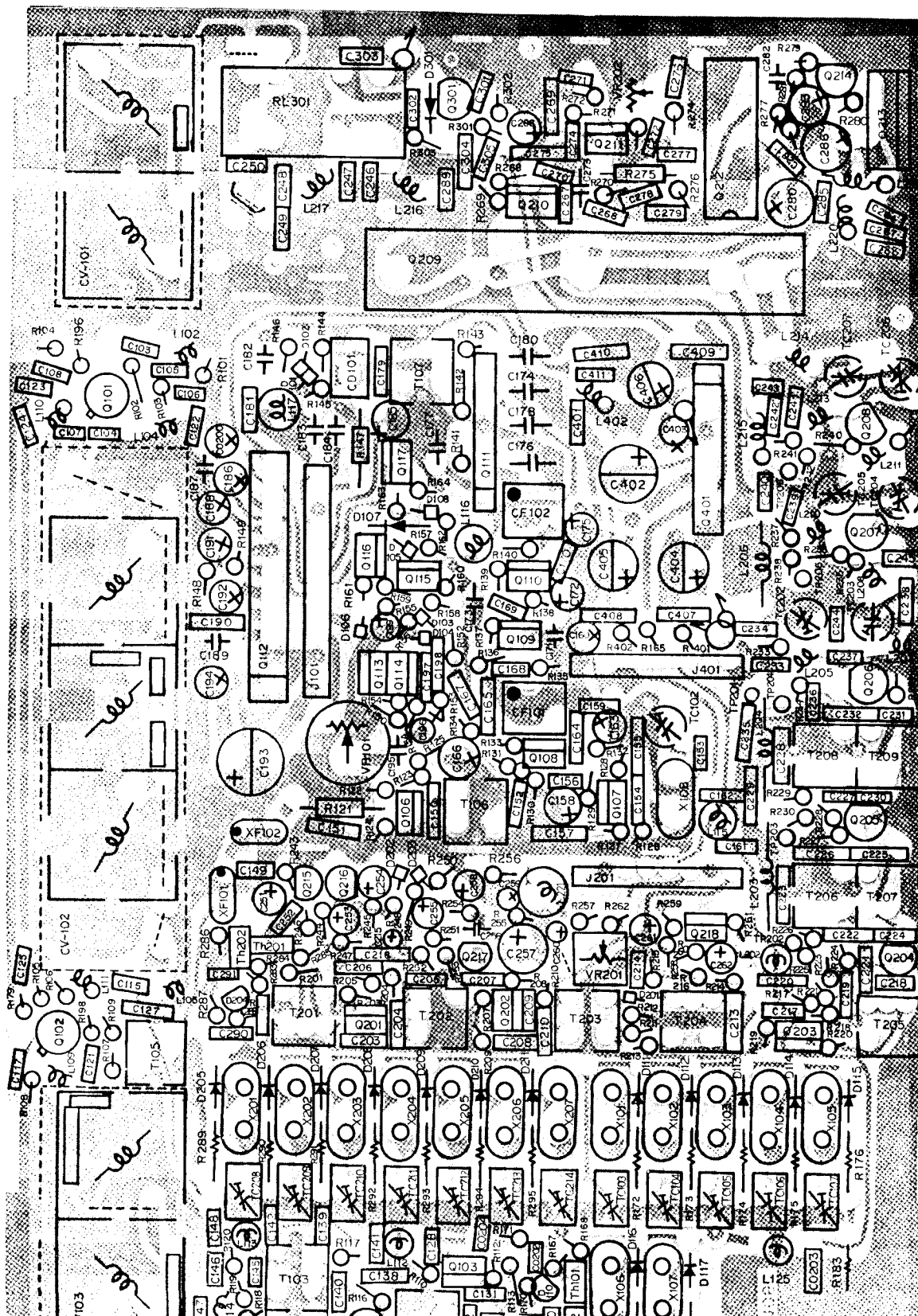
FP-5 OUTER COVER REMOVAL



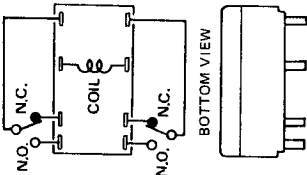
FP-6 OUTER COVER REMOVAL



PARTS LAYOUT (FTC-4610 MAIN BOARD)



RELAY CONNECTIONS
 RL301 (FTC-4610)
 FBR221 D006

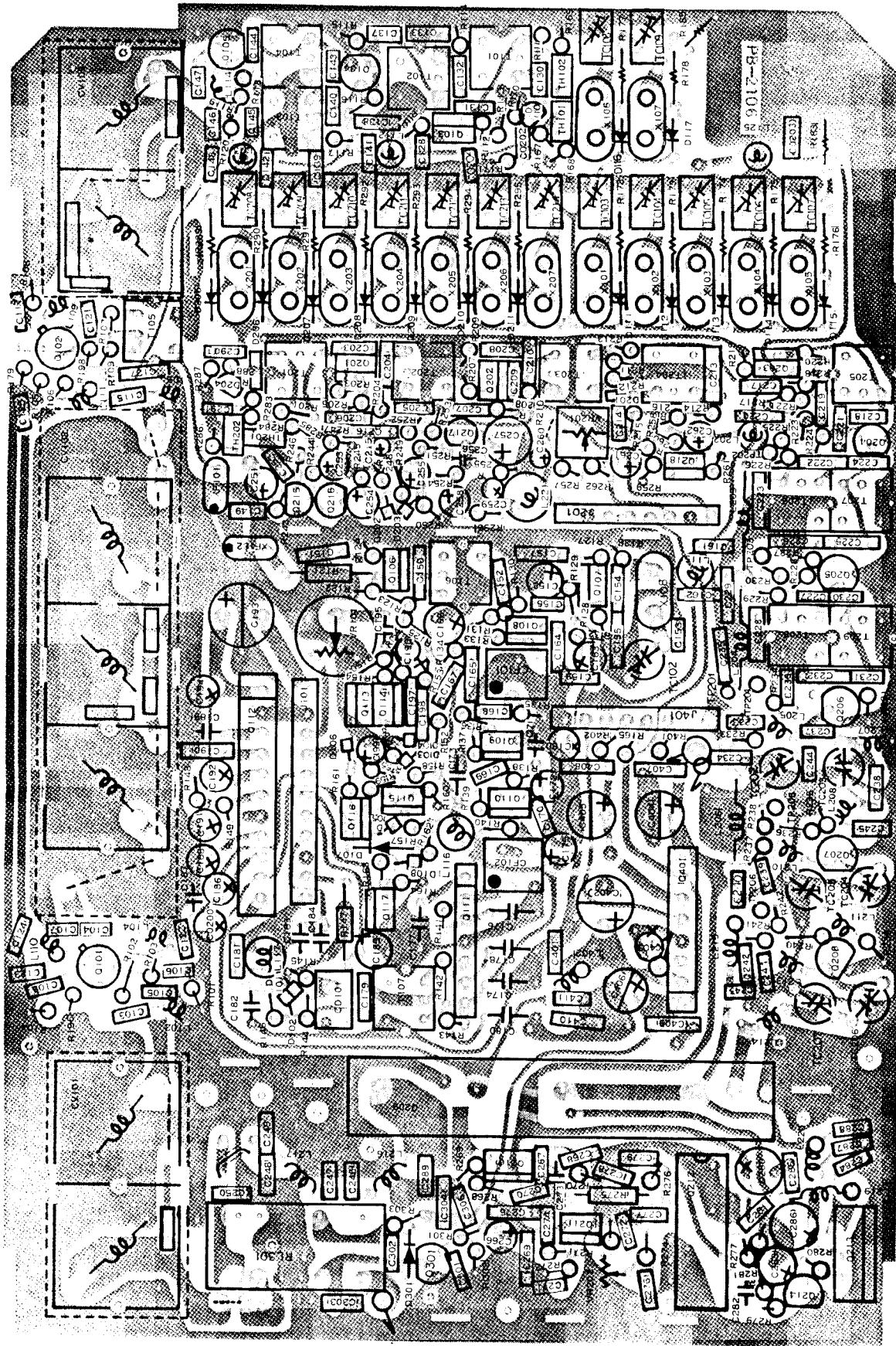


SIDE VIEW

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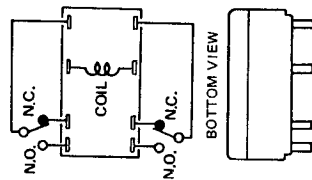
Viewed from Component Side

PARTS LAYOUT (FTC-4610 MAIN BOARD)



Viewed from Solder Side

RELAY CONNECTIONS
 RL301 (FTC-4610)
 FBR221 D006

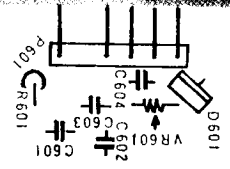
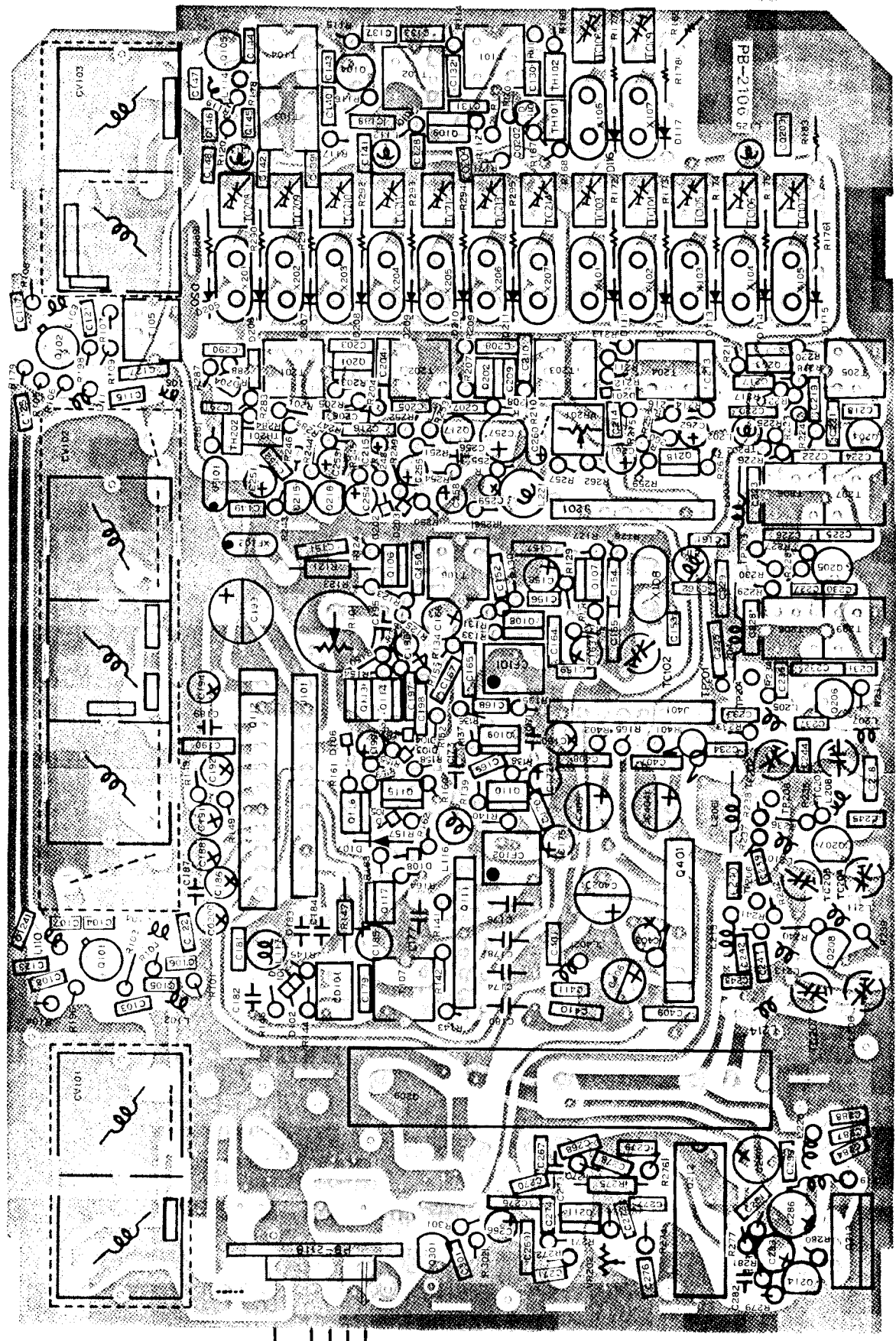


SIDE VIEW



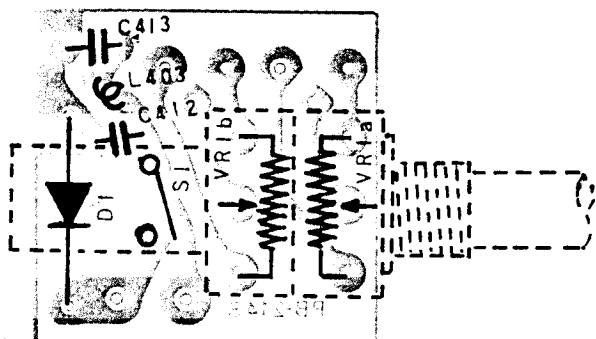
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PARTS LAYOUT (FTC-4625 MAIN BOARD)

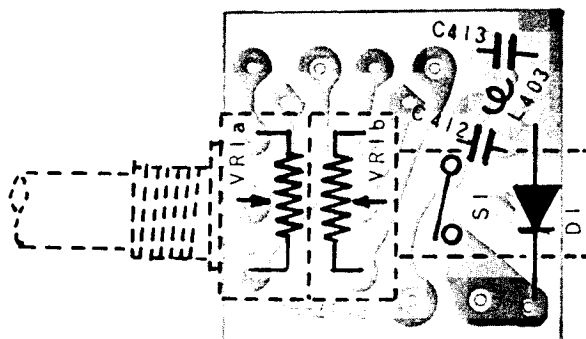


Viewed from Solder Side

VR UNIT PARTS LAYOUT



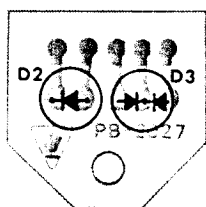
Viewed from Component Side



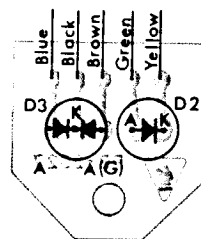
Viewed from Solder Side

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LED UNIT PARTS LAYOUT



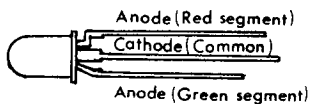
Viewed from Component Side



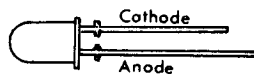
A - Anode
 K - Cathode
 (R) - Red segment
 (G) - Green segment

Viewed from Solder Side

GL-52RG

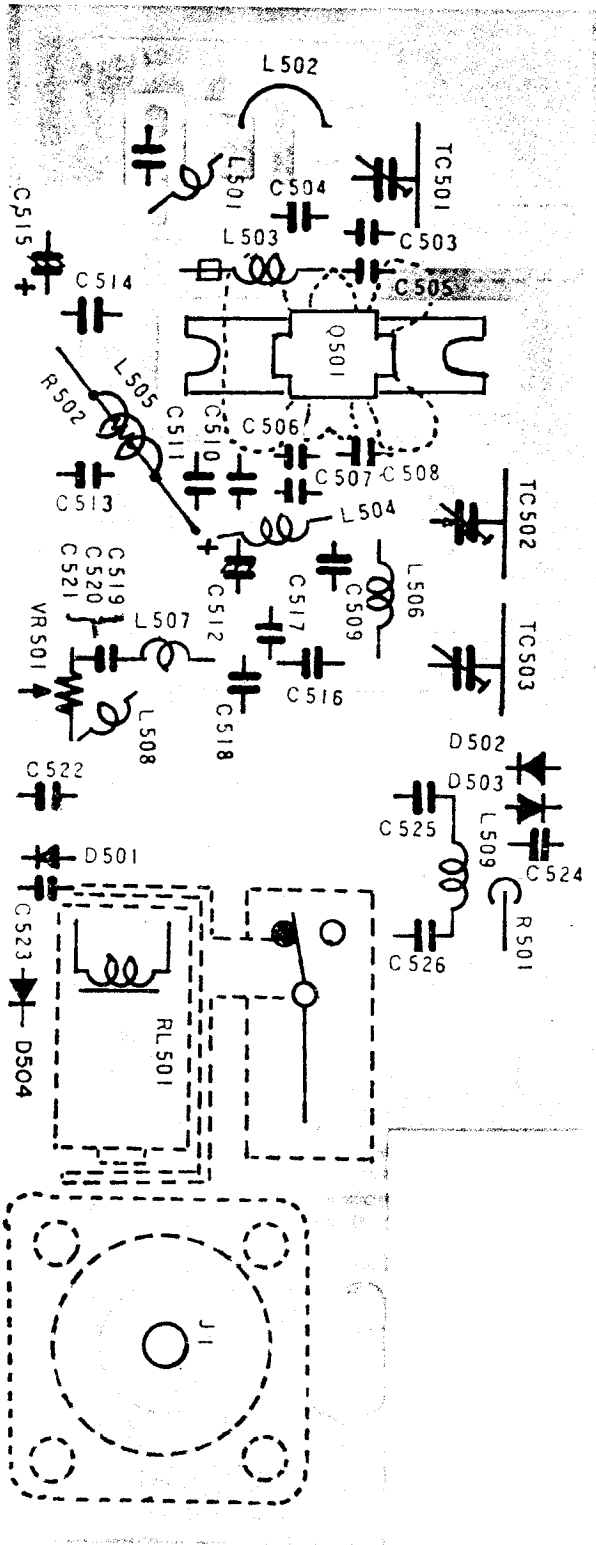


TLO-114

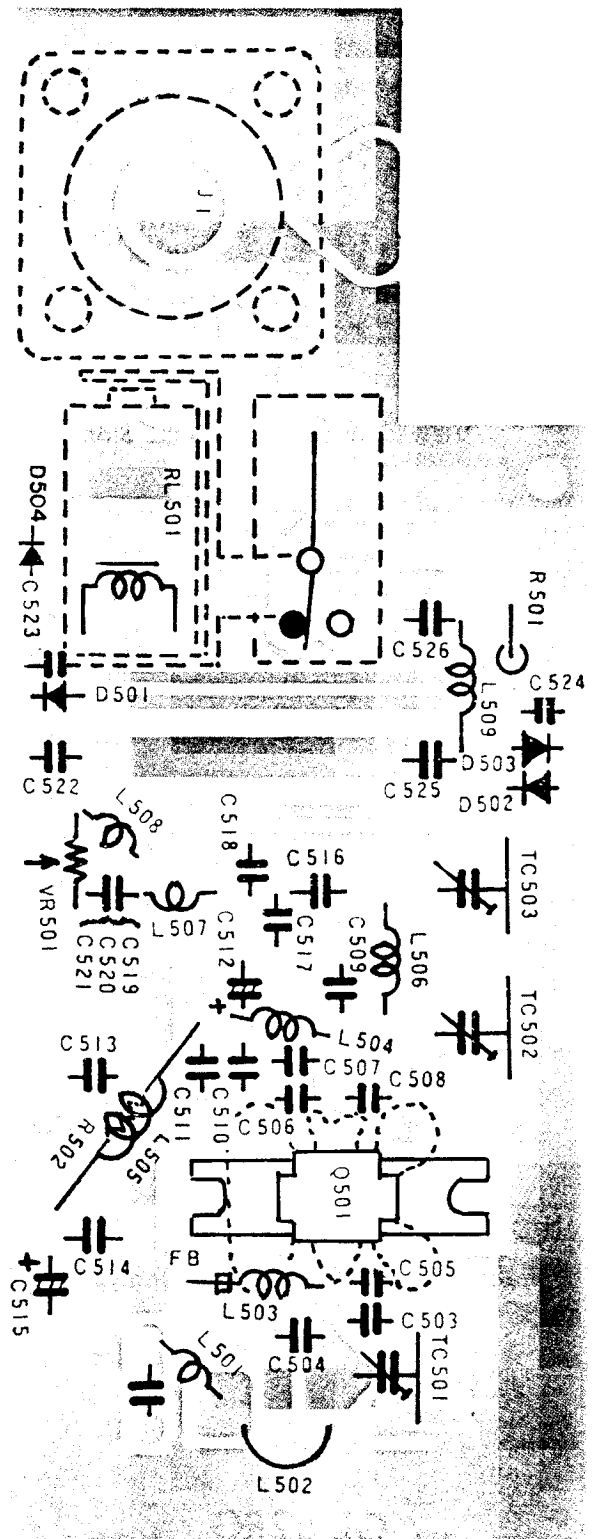


LED Connections

BOOSTER UNIT PARTS LAYOUT

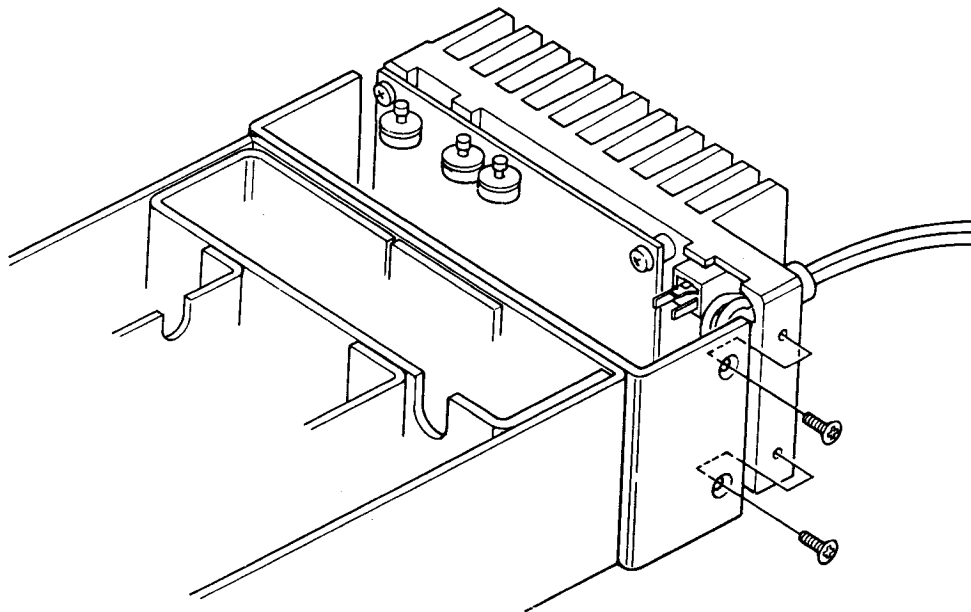
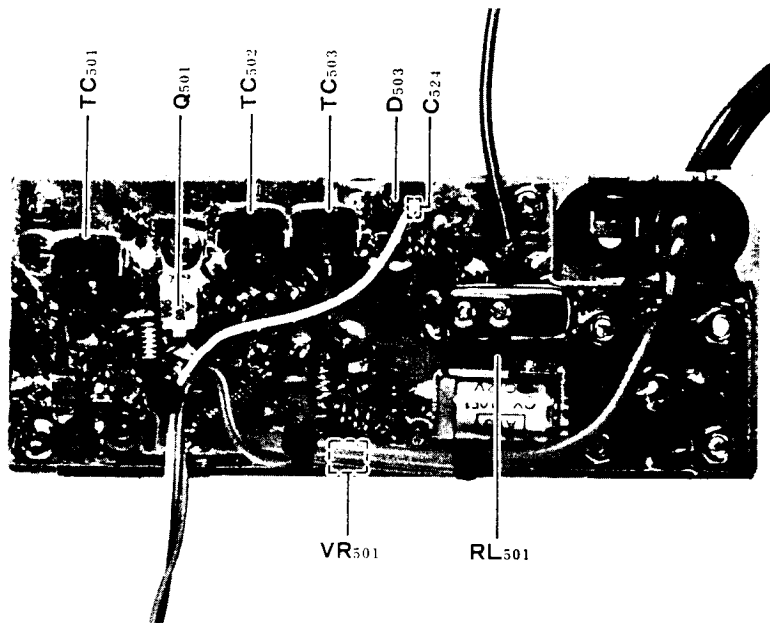


Viewed from Component Side

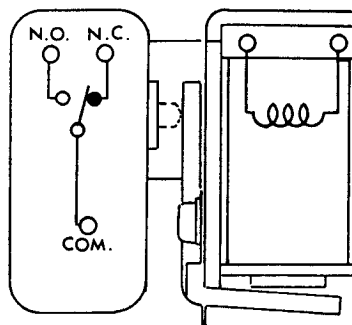


Viewed from Solder Side

BOOSTER UNIT MOUNTING DETAIL



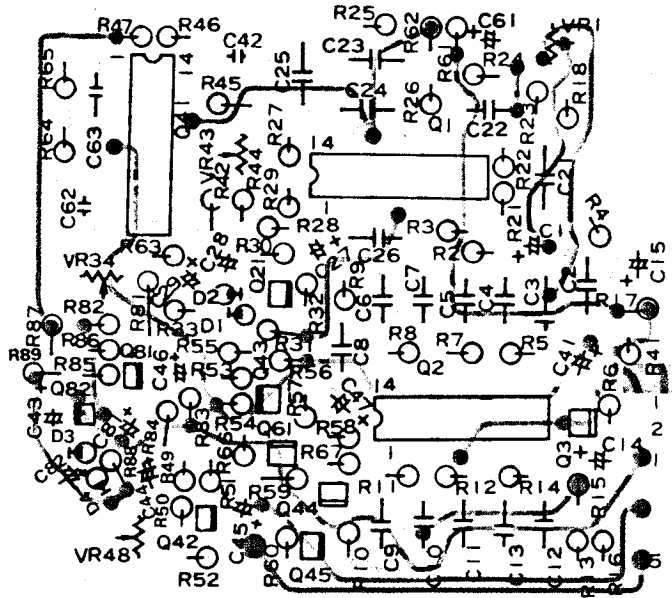
RELAY CONNECTIONS RL501



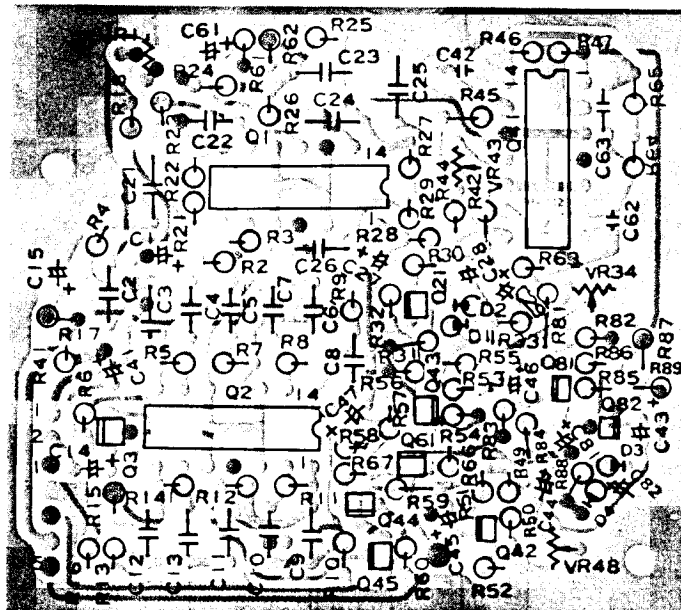
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TONE SQUELCH UNIT PARTS LAYOUT

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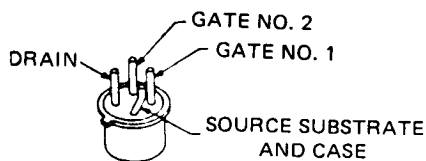


Viewed from Component Side

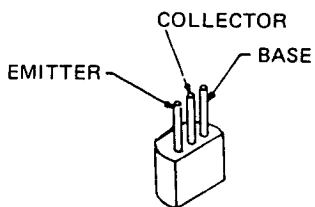


Viewed from Solder Side

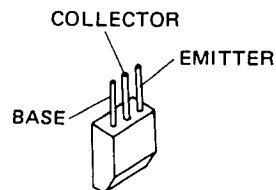
SEMICONDUCTOR CONNECTIONS



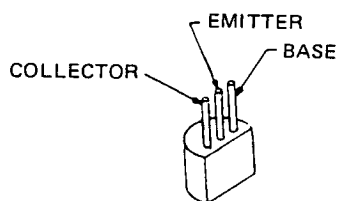
3SK76



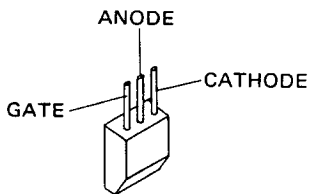
2SC458B*
2SC1906
2SC1907



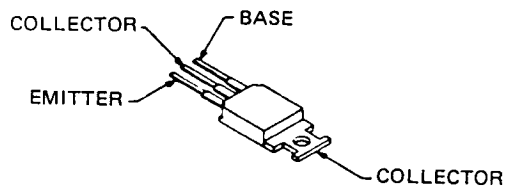
2SC535A/B
2SC458B*
2SC460B



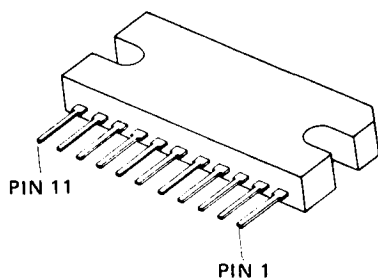
2SC2407



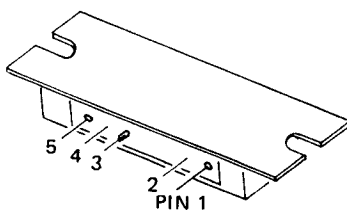
CW-01B



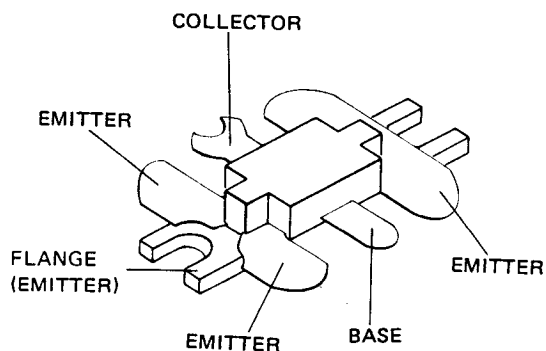
2SA671



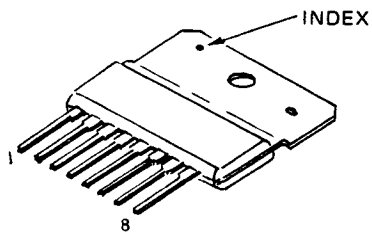
AN315



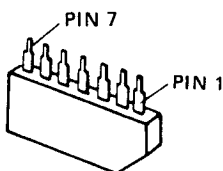
M57704H/UH/SH



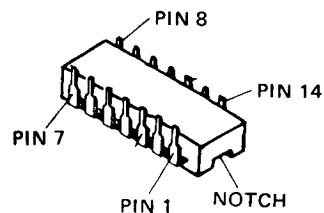
2SC2695



MB3756

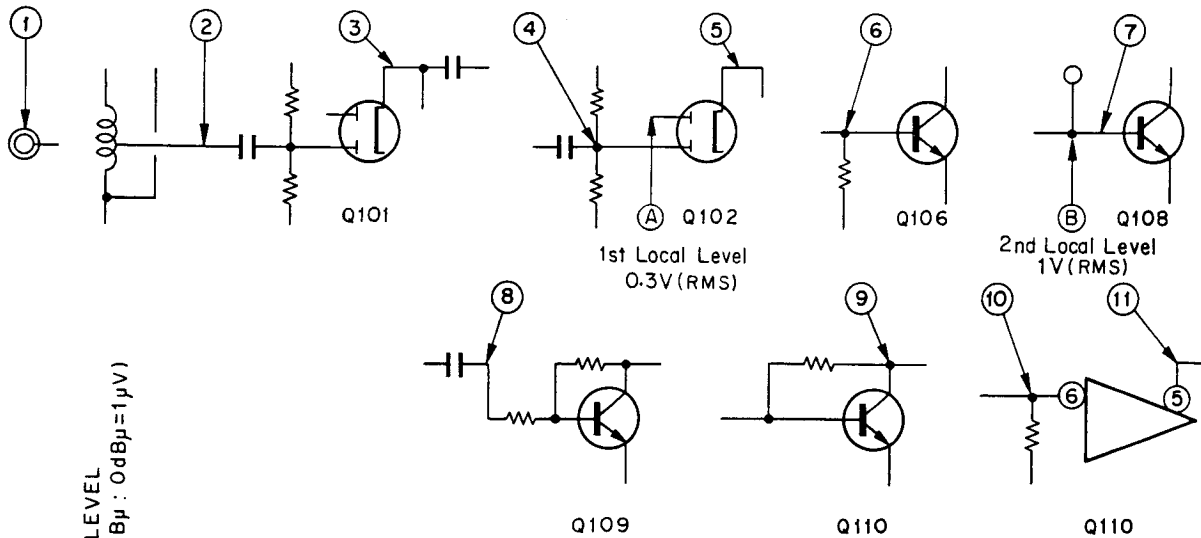
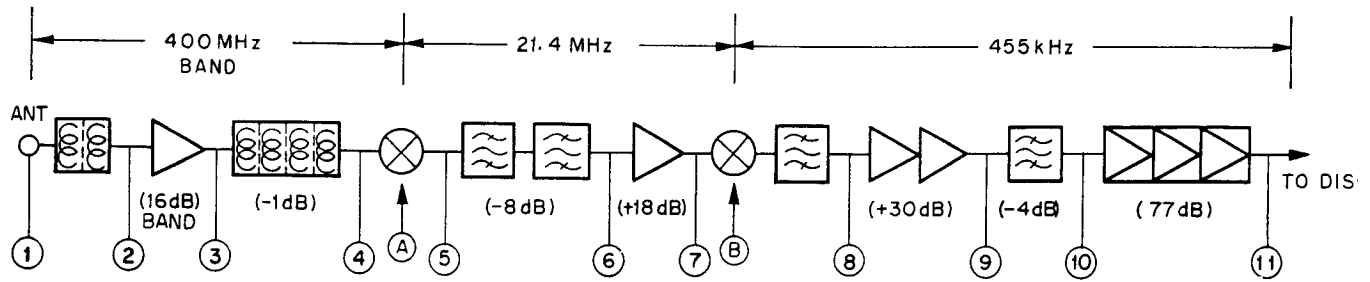


μPC577H

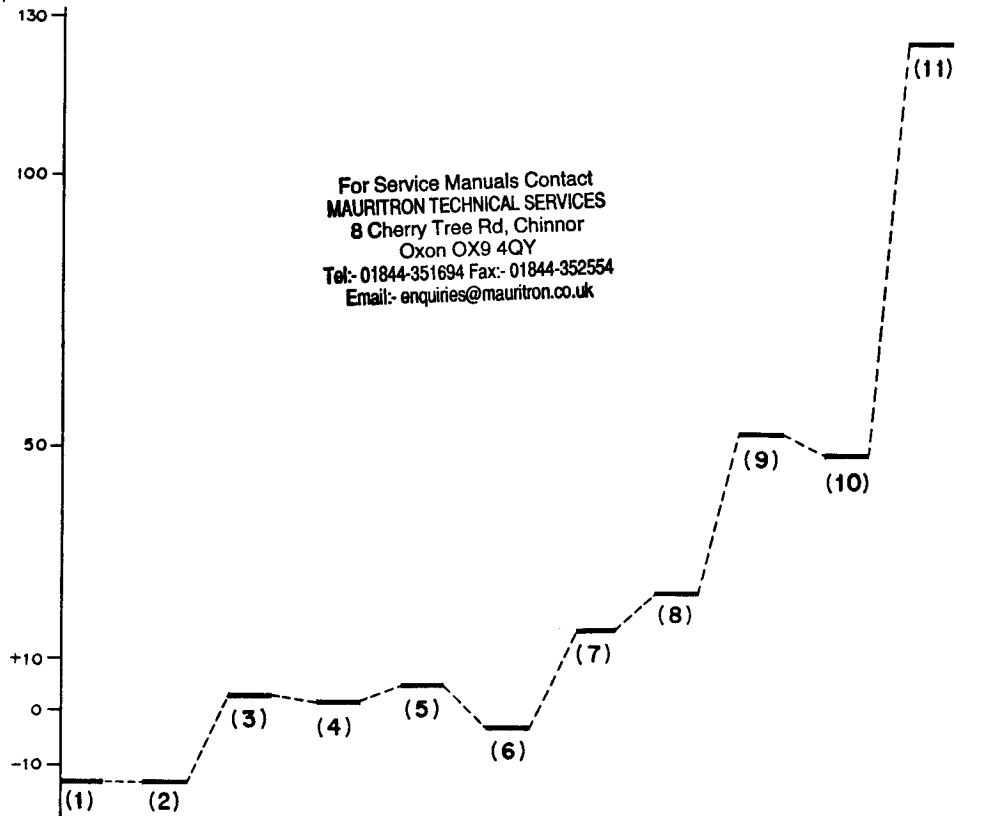


MLM2902

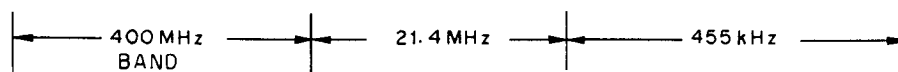
LEVEL DIAGRAM (RECEIVER SECTION)



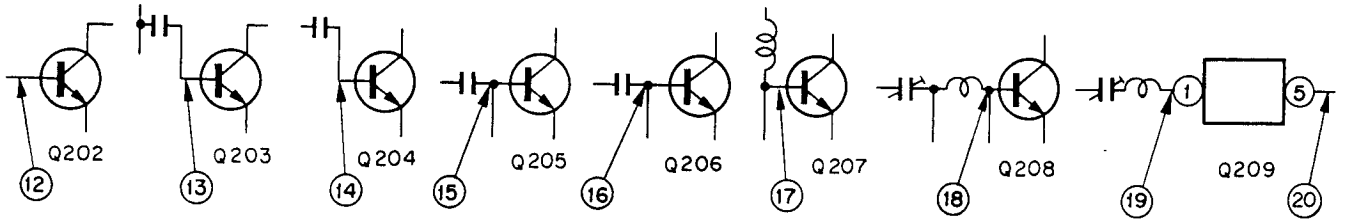
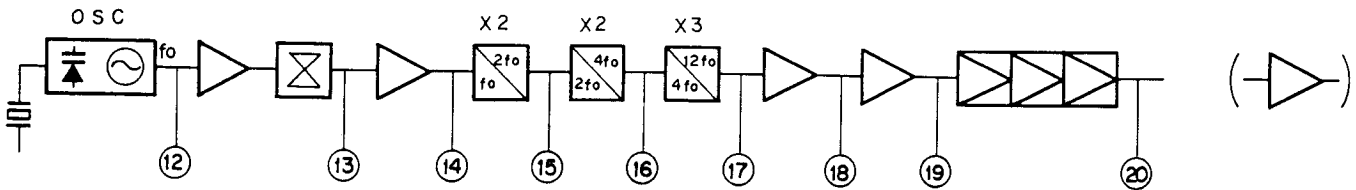
LEVEL
(dBμ : 0dBμ=1μV)



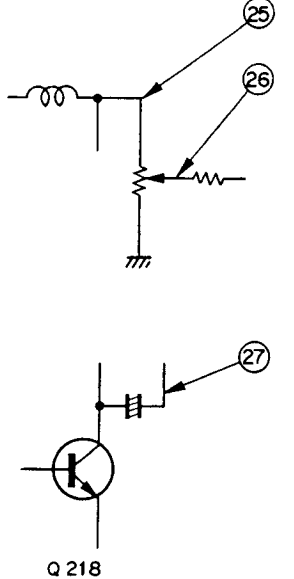
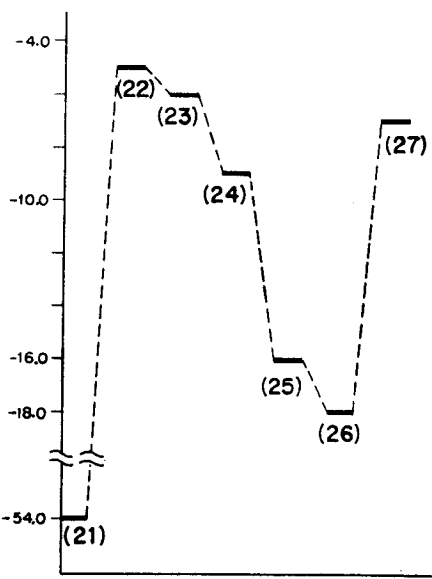
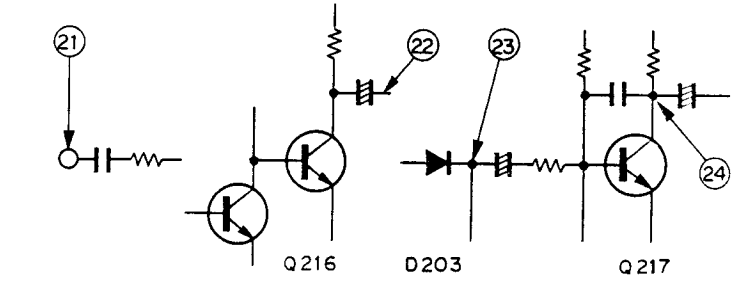
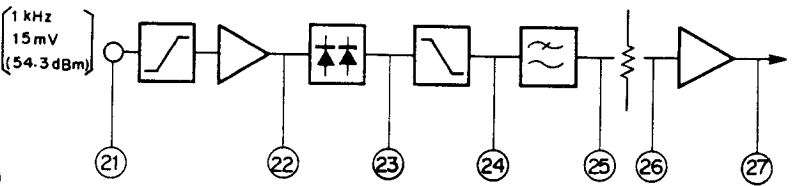
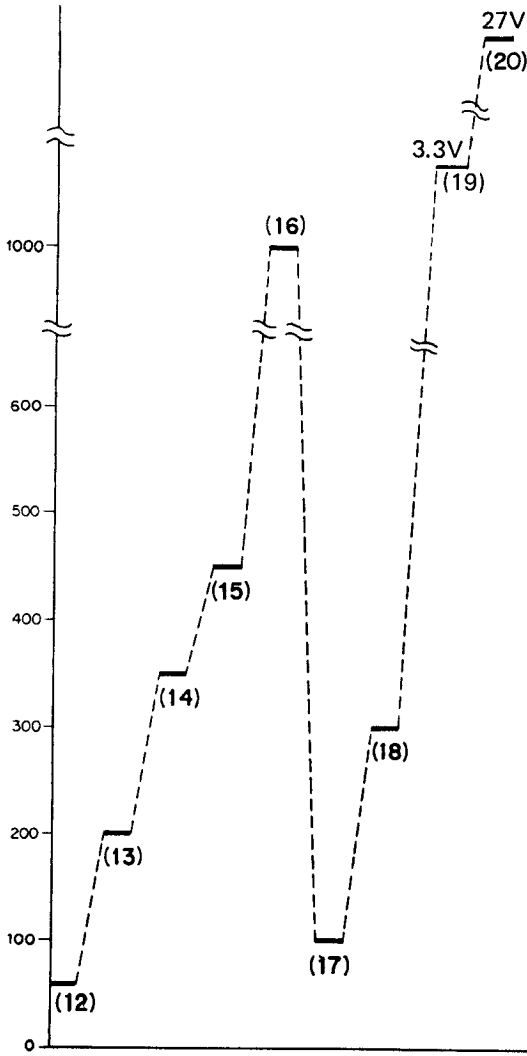
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LEVEL DIAGRAM (TRANSMITTER SECTION)



VOLATGE (RF)
mV (RMS)



VOLTAGE CHART

(DC VOLTS)

	B (G)	C (D)	E (S)			B	C	E	
Q101	1.3/2.9 ^V	7.0 ^V	1.0 ^V	G ₁ /G ₂	Q203	0.9 ^V	6.9 ^V	0.1 ^V	
Q102	1.2/1.7	6.0	0.5	G ₁ /G ₂	Q204	0.7	8.0	0	
Q103	2.2	7.1	1.5		Q205	0.5	8.1	0	
Q104	0.4	5.5	0		Q206	0	8.2	0	
Q105	0.3	3.4	0		Q207	0.6	8.1	0	
Q106	1.2	7.3	0.5		Q208	0.3	13.6	0	
Q107	2.7	7.9	2.2		▲Q210	0.4/0.4	8.1/8.1	1.5/1.0	APC: OPEN 10W
Q108	1.4	7.3	0.7		Q211	4.5	8.1	3.8	
Q109	0.7	2.3	0		Q213	12.9/12.4	12.6/9.1	12.0/13.1	APC: OPEN 25W
Q110	4.7	6.3	4.4		Q214	0.8/0.7	0.1/10.1	0	"
Q113	0.7	2.1	0		Q215	0.7	1.7	0	
Q114	2.1	3.6	1.4		Q216	1.7	3.6	1.1	
Q115	0.8/1.1	0.3/1.8	0.1/0.5	SQ OFF/ON	Q217	3.6	6.6	3.0	
Q116	0.1/1.2	13.4/0.7	0.1/0.5	"	Q218	0.9	5.1	0.3	
Q117	0.7/0.5	0.8/6.8	0	"	▲Q301	0/0.8	8.1/5.7	0	RX/TX
Q201	2.2	7.6	1.5		★Q301	0/0.8	13.6/0.1	0	RX/TX
Q202	1.1	7.6	0.3		★Q501	0	13.6	0	

PIN															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
Q111	5.2	1.6	1.7	0	6.6	2.7	8.2	-	-	-	-	-	-	-	
Q112	5.4 [*]	0	1.3 [*]	6.7 [*]	10.4 [*]	5.4 [*]	0	5.5 [*]	5.3 [*]	13.2 [*]	13.6	-	-	-	* SQ ON (L) Level
Q209	-	13.0 [*]	13.0 [*]	13.6	-	-	-	-	-	-	-	-	-	-	* Nominal Value
Q212	-	0	0	8.1/8.1	5.1/0.8	3.7/0.8	4.9/0.7	-	0	0	0	3.8/1.6	3.4/1.6	5.0/0.8	APC: OPEN/25W
Q401	8.2	13.6	8.2	0	1.9/0	8.2/0	-	0/8.2	-	-	-	-	-	-	RX/TX

Measured with VTVM.

▲FTC-4610

★FTC-4625

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CIRCUIT/DEVICE INFORMATION

1. Input final RF device: Q₂₀₉ (M57704H/UH/SH)

Pin	DC volts	DC current
1	0	
2	* 13.0	0.98A
3	* 13.0	0.98A
4	13.8	1.56A
5	0	

* Nominal Value

2. Spurious reduction at antenna jack

Spurious radiation from the antenna terminal is suppressed by: (1) a low-pass filter, consisting of L₂₁₆, C₂₈₉, C₂₄₆, L₂₁₇, C₂₄₇, C₂₄₈, and C₂₄₉ in a pi configuration for harmonic reduction of better than 60 dB; (2) T₂₀₆, C₂₂₂, T₂₀₇, C₂₂₄, C₂₂₅, C₂₂₆, T₂₀₈, C₂₂₇, C₂₃₀, T₂₀₉, C₂₃₁, C₂₃₂, L₂₀₅, C₂₄₄, TC₂₀₂, C₂₃₇, L₂₀₇, TC₂₀₃, and C₂₃₈, which attenuate non-harmonic spurious more than 60 dB.

Spurious radiation from the case, power cable, etc.

The following capacitors ensure maximum attenuation of spurious signals from the case, power cable, and other areas: C₂₁₆, C₂₂₀, C₂₂₉, C₂₃₄, C₂₃₅, C₂₄₀, C₂₄₁, C₂₄₂, C₂₄₃, C₁₄₁, C₁₄₂, C₁₄₈, and C₁₅₉. Coils are sealed where they could cause spurious radiation.

Deviation circuit

The Instantaneous Deviation Control Circuit (IDC) consists of D₂₀₂, D₂₀₃, R₂₄₈, R₂₄₉, and R₂₅₀, which control the deviation level.

Power control circuitry

The Automatic Power Control (APC) circuitry consists of Q₂₁₀, Q₂₁₁, R₂₇₅, VR₂₀₂, Q₂₁₂ (d) (b), Q₂₁₄, and Q₂₁₃. VR₂₀₂ provides precise setting of the output power.

Audio filtering

An audio filter, consisting of L₂₂₁, C₂₅₉, and C₂₆₀, provides attenuation of audio frequencies above 3 kHz of -18 dB/octave referenced to 1 kHz. The filter is of the constant-k type.

3. Frequency stability/adjustment/channel selection

Diode switches D₂₀₅-D₂₁₁ select crystals X₂₀₁-X₂₀₇, thus providing for channel selection.

The oscillator acts in the third overtone mode, and the tuned circuits at the emitter of Q₂₀₁ ensure minimum spurious radiation. Feedback capacitors C₂₀₃ and C₂₀₄ provide temperature compensation, and parts chosen for this position have an N value of at least 750.

Frequency adjustment is provided by TC₂₀₈-TC₂₁₄, connected in series with the channel crystals.

Temperature compensation is chiefly provided by thermistors TH₂₀₁ and TH₂₀₂ plus resistors R₂₈₄, R₂₈₅, and R₂₈₆, which provide a variable voltage in proportion to temperature change, the control voltage driving varicap diode D₂₀₄ (FC52M) to keep the channel frequency to within 5 ppm over the temperature range -30° to +60°C. This specification will be held so long as crystals made to our specifications (+8 to +14 ppm at -20°C ref. 25°C, AT cut, 3rd overtone) are used.

The supply voltage for the oscillator is stabilized by Q₄₀₁, which decreases voltage change caused by variations in temperature.

SERVICING

SOLDERING AND DESOLDERING TECHNIQUE ON PRINTED CIRCUIT BOARDS

The FTC-4610/4625 circuit boards are tough, but mishandling during soldering can cause circuit traces to "lift." While this does no permanent damage to the board, much servicing trouble can result, because of the tendency for this lifted trace to break. A few simple precautions will keep your circuit boards in A-1 condition.

1. Use only a 12 to 30 watt chisel-tip soldering iron. Yes, some "repairmen" have been known to use small blowtorches on cards.
2. Use only a soldering iron equipped with a three-wire cord, with the tip grounded. Also acceptable is a soldering iron isolated through a transformer. An old soldering iron or gun may have 117 volts on the tip, and will certainly cause more damage than it repairs!
3. USE ONLY 60/40 ROSIN CORE SOLDER. Acid core solder should be thrown away if you find it in your radio shop!
4. Use a solder sucker and solder tape to ensure a professional repair job.
5. If you do lift a trace, don't worry! Read on to find out how to repair traces like a pro.

NOTES ON USE OF CMOS COMPONENTS:

As CMOS devices are extremely sensitive to damage from static electricity, special precautions must be observed.

In storage, use only a non-inductive sponge.

When installing a CMOS part in a socket, or on a circuit board, be certain that the power is off. In addition, the technician should rest his hand on the chassis as the component is inserted, so as to place his hand at the same level as the chassis (better to discharge small amounts of static electricity through your fingers than through a \$5 IC!).

When soldering a CMOS part onto a circuit board, use a low wattage iron, and be sure to ground the tip with a clip lead, if the tip is not grounded through a three-wire power cord.

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INSERTION OF PARTS ON CIRCUIT BOARDS

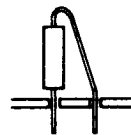
All of the below are acceptable ways of inserting components into circuit board mounting holes.



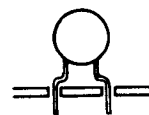
(a) Bend leads slightly



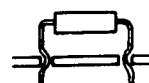
(b) Straight-in mounting



(c) Vertical mounting

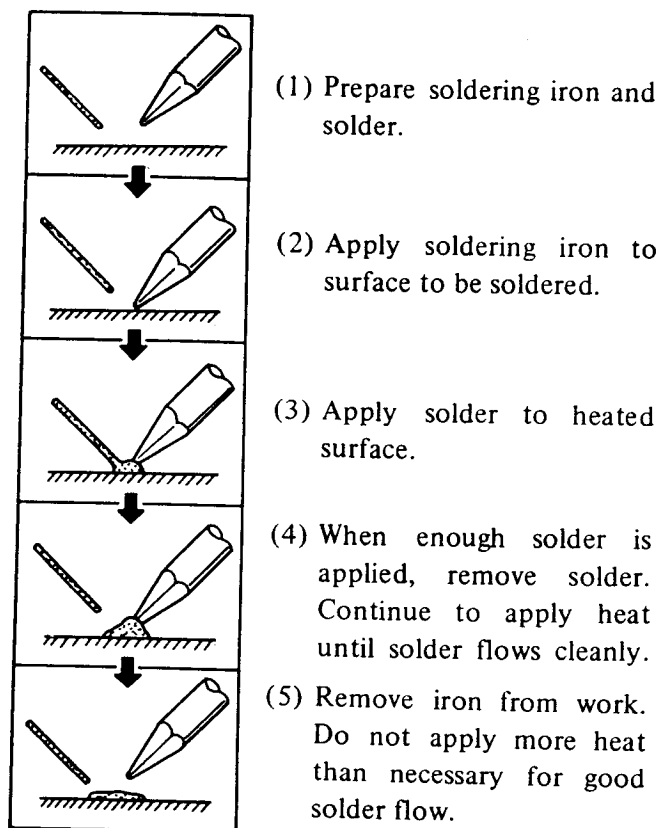


(d) Preformed disc ceramic capacitor



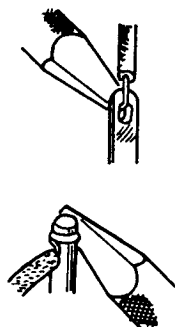
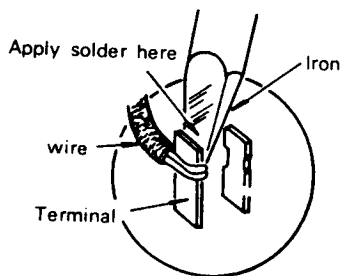
(e) Preformed resistor, diode, etc.

BASIC SOLDERING PRACTICE

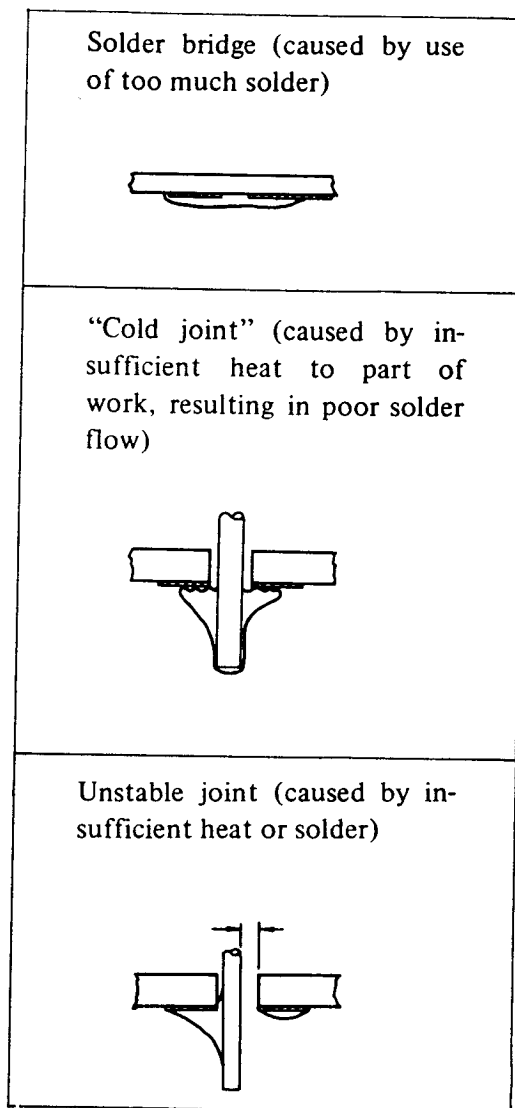


Soldering to terminal posts:

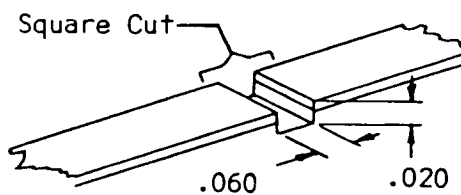
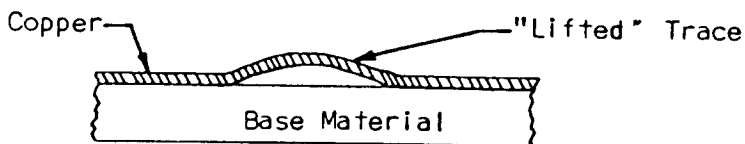
(Be certain to apply heat to both post and wire.)



EXAMPLES OF POOR SOLDERING PRACTICE



If you have previously lifted a trace, make an etch cut on each side of the lifted trace, and install a wire bridge as shown in the drawing.



Coat Cut Area With Eastman 910

SERVICING

FAULT LOCALIZATION

While the process of fault localization is highly individualistic, it is generally agreed that there is no substitute for a logical, step-by-step diagnostic check.

Begin your troubleshooting procedure with a visual inspection of the radio. Use your nose, too: burned resistors smell differently than do transformers, etc. Check for charred or loose components inside the cabinet.

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If the preliminary inspection turns up nothing, connect a dummy load to the antenna jack, and a 13.8 VDC bench supply to the power cord. The supply should be capable 4 amperes continuous for the FTC-4610 and 10 amperes continuous for the FTC-4625

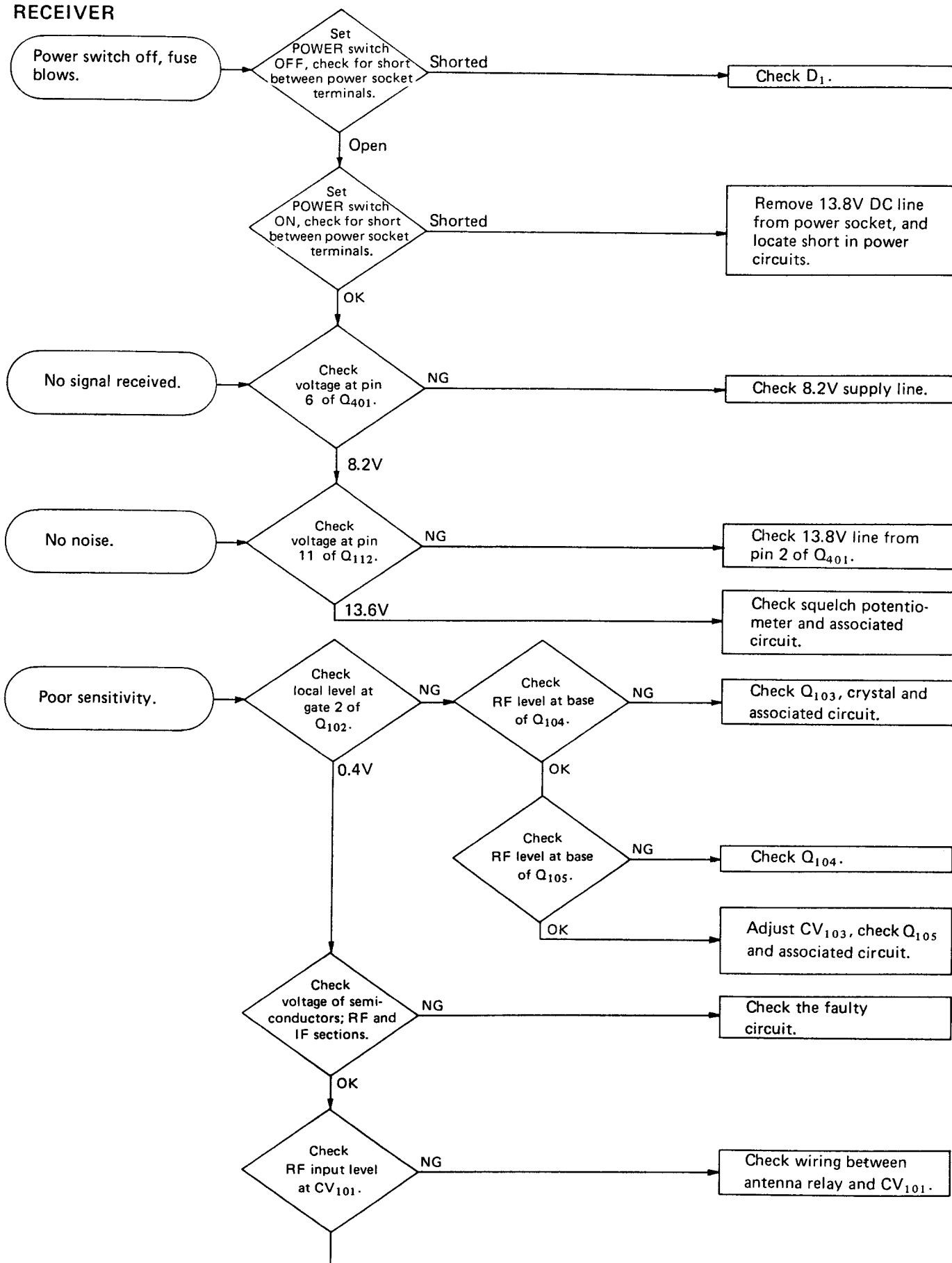
Turn the power switch on, and begin a systematic check. Do the lamps light up? If not, check the fuse. Is the trouble not apparent? Perhaps it only happens on transmit. Check for noises, pops, sparks, or smoke inside the cabinet – these are unmistakable declarations by the radio that something is awry!

TYPICAL PART FAILURES, CAUSES, AND SYMPTOMS

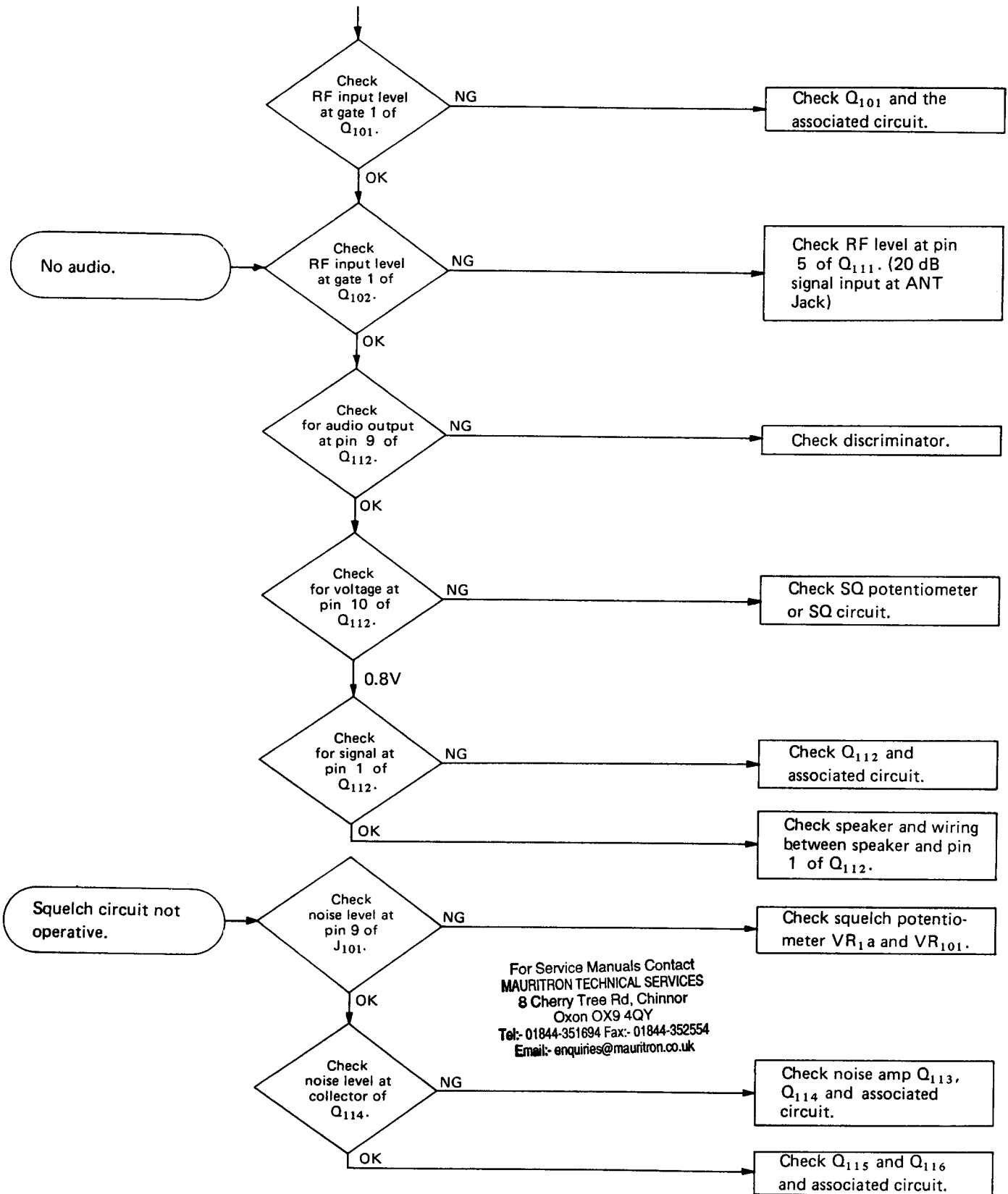
PARTS	CAUSE OF TROUBLE	SYMPTOMS
Semiconductors (IC, FET, TR)	High supply voltage Open circuit Excessive drive High temperature	Short or open circuit Output decreases to 1/2 at 80°C Internal noise Instability
MOS FET MOS IC	Static electricity	Total failure
Crystal Crystal filter	Shock High temperature	Crystal destroyed Frequency drift Filter bandpass change
Resistor	Excessive power Aging High temperature	Component burned Value changed Open circuit
Potentiometer	Excessive power Shock	Component burned Open circuit Noise Unsmooth rotation
Capacitor	Excess voltage High temperature Excess power	Shorted Leakage Open/decreased capacitance
Variable capacitor Trimmer capacitor	Ratings exceeded Dust between plates Shock, forced rotation	Shorted Leakage Unsmooth rotation
Coils	Ratings exceeded Variation	Open or short circuit Leakage or shorted turns Detuned
Switch	Ratings exceeded Aging	Poor contact Unsmooth operation Open circuit
Relay	Ratings exceeded Humidity	Poor contact Noise Coil open

TROUBLESHOOTING

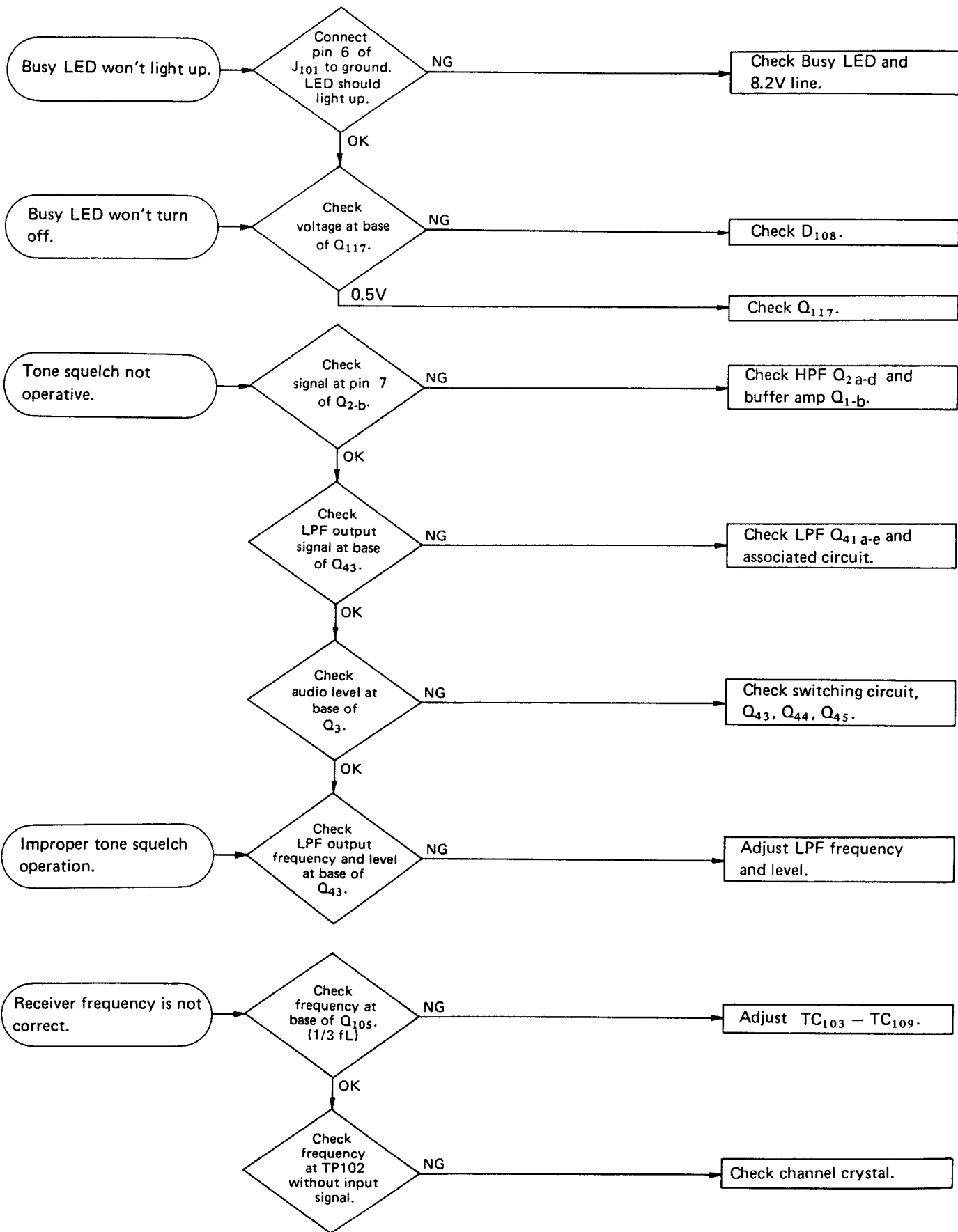
RECEIVER



SERVICING

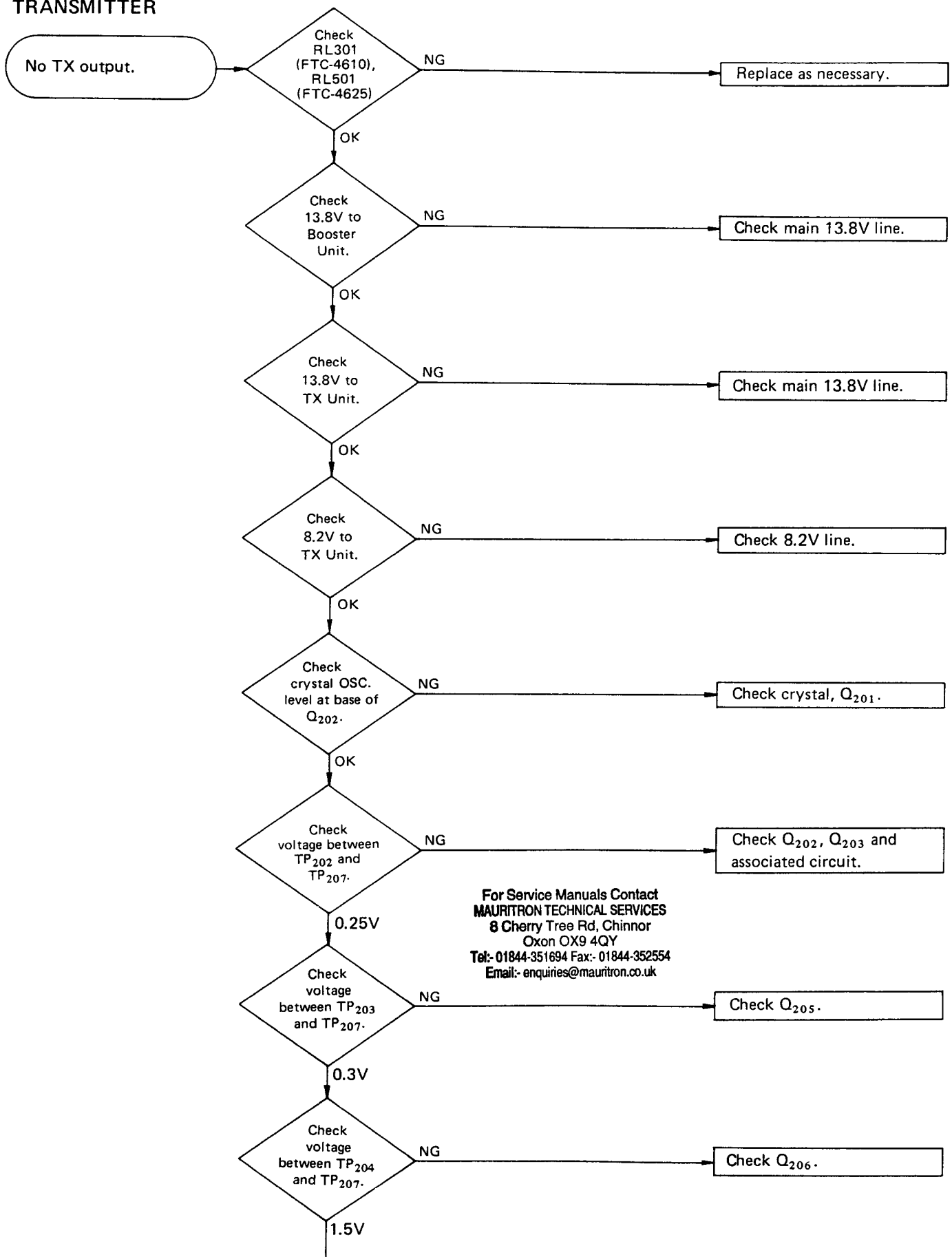


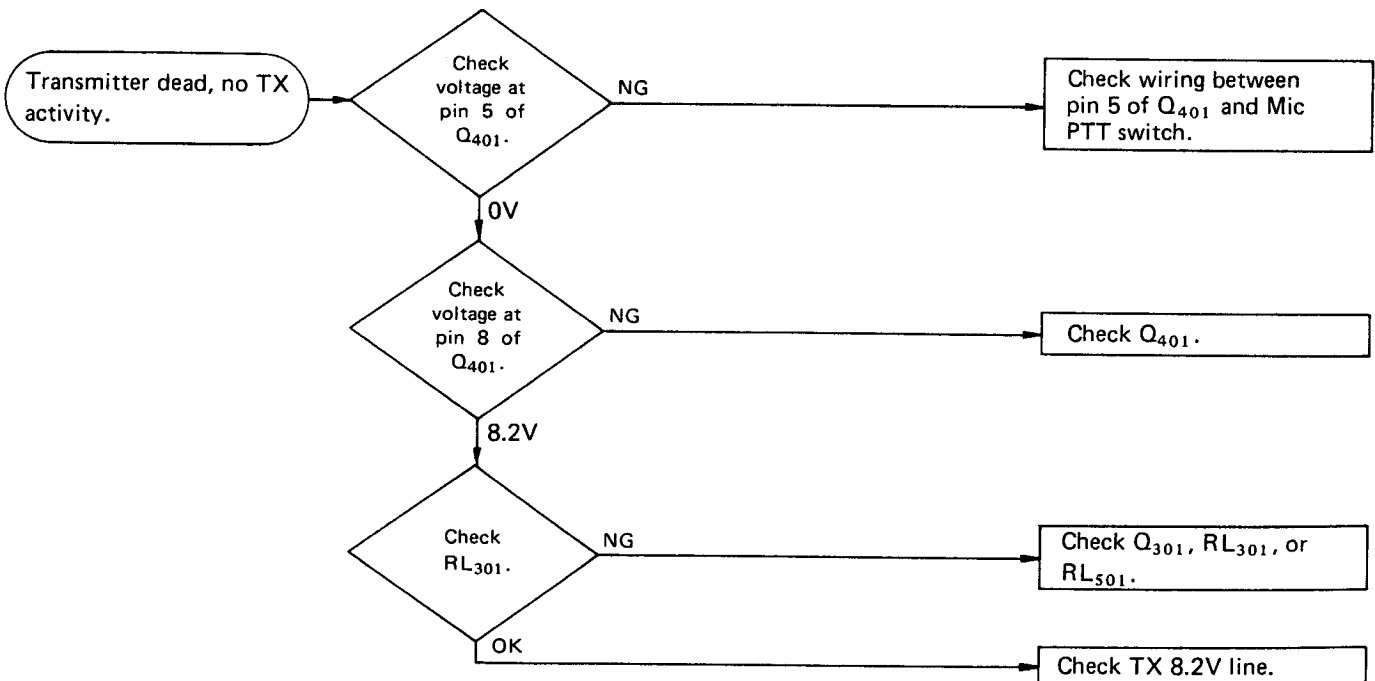
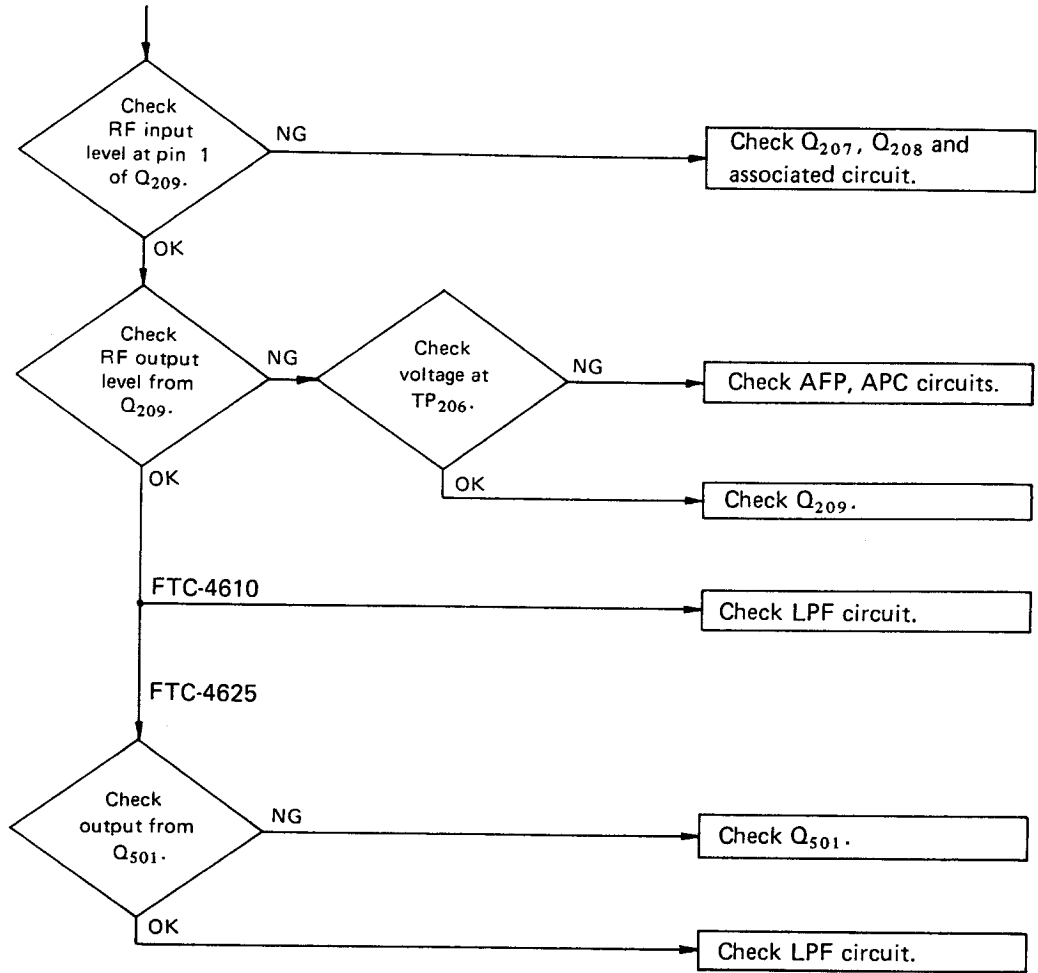
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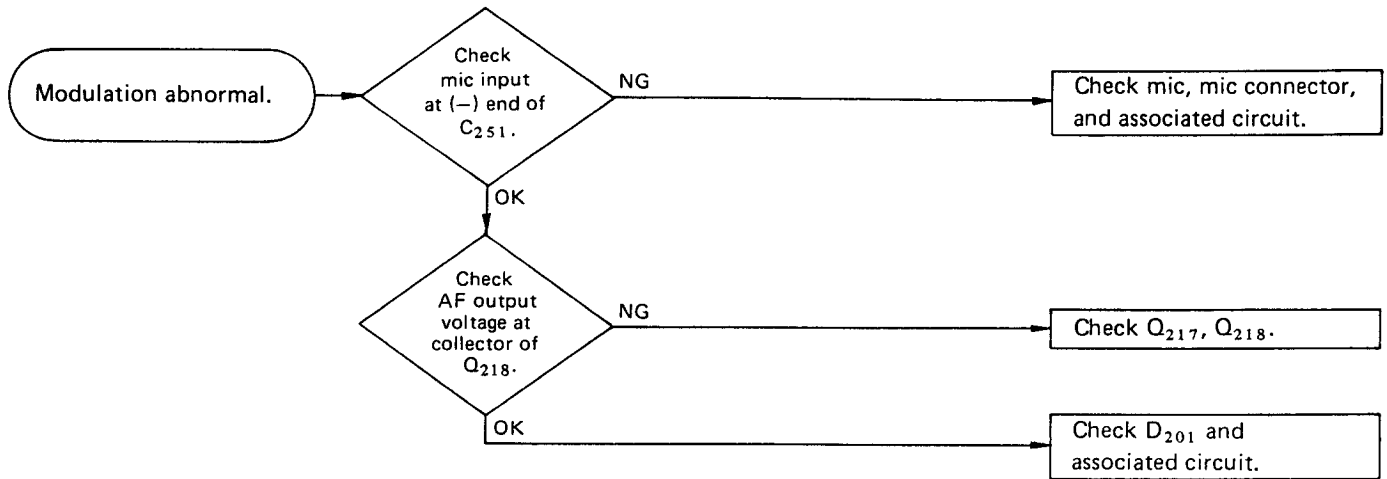
SERVICING

TRANSMITTER

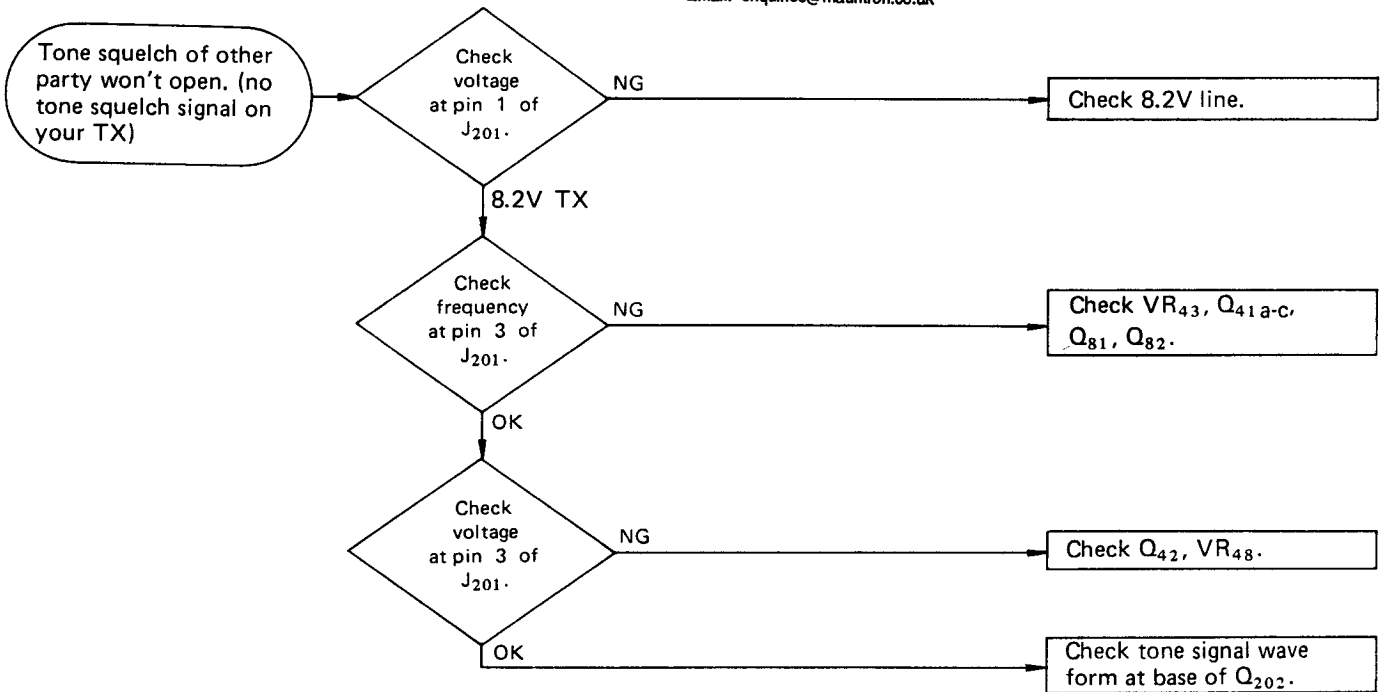




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MAINTENANCE AND SERVICING

REGULAR MAINTENANCE PLAN

Because of the rugged design and construction of the FTC-4610/FTC-4625, little maintenance should be required if the radio is not abused. As a Yaesu dealer, though, you are best in a position to determine the individual needs of your customers. Operation in extremely harsh environments may warrant more frequent checks of transceiver performance.

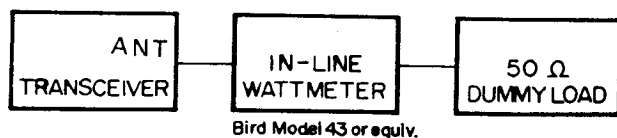
We recommend that your customers return their sets to your service facility once every two years for routine checks of the transmitter power output and the receiver sensitivity. In the meantime, keep in frequent touch with your customers regarding their expanding communications requirements. Not only will this give you the opportunity to introduce new Yaesu products, but your customers' particular service requirements will become evident.

PERFORMANCE CHECKS

Make all performance checks at 13.8 volts DC under load.

Check the transmitter power output as follows:

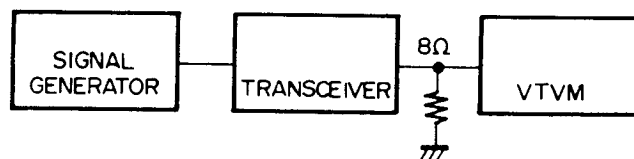
- Connect a suitable dummy load/wattmeter to the antenna jack.
- Set the channel selector to any channel. Close the push-to-talk switch, and observe the power output. For the FTC-4610, the output should be at least 10 watts, while the FTC-4625 should provide at least 25 watts output.



PO TEST SETUP

Check the receiver sensitivity as follows:

- Connect an audio voltmeter to the SP jack, and set the squelch control fully counter-clockwise.
- Connect the RF output of a precision UHF signal generator to the antenna jack, and note the audio voltmeter reading with no signal present. Adjust the volume control and voltmeter range, as necessary, to obtain roughly a full-scale reading.
- Set the signal generator to the receiving frequency of the radio, and adjust the output amplitude of the signal generator until the voltmeter indicates a 20 dB decrease (1/10th voltage) of the reading in step b). The signal generator output voltage at this point is the 20 dB quieting sensitivity, and it should be approximately $0.5 \mu\text{V}$.



RX SENSITIVITY TEST SETUP

If the above checks are both OK, then clean out the transceiver by applying moderate-force compressed air throughout the chassis area. This will remove any dust that may be present. If there is accumulated dirt inside the cabinet, a soft brush may be used to loosen it. Wipe the outer cabinet of the transceiver with a damp cloth, and use the compressed air to dislodge accumulated dust present in the corners of the radio.

ALIGNMENTS

PRELIMINARY ADJUSTMENTS

Internal adjustments should, undermost circumstance, be limited to those described in the paragraphs below.

Remove the four screws, (five screws: FTC-4625) from the top cover. Then the four screws, (five screws: FTC-4625) from the bottom cover, in order to provide full access to the transceiver circuitry.

NOTE:

Use nonmetallic tuning wands to adjust trimmer capacitors and coils.

Equipment needed:

1. Precision UHF signal generator.
2. Precision UHF frequency counter.
3. Sweep generator (cover upto 500MHz).
4. Alignment scope.
5. Audio Voltmeter.
6. DC voltmeter.
7. Vacuum-tube voltmeter, 20Kohms/volt, useable upto 500MHz.
8. Bench power supply.

9. Alignment tools.
10. Interconnection cables.

Alignment steps:

I Receiver

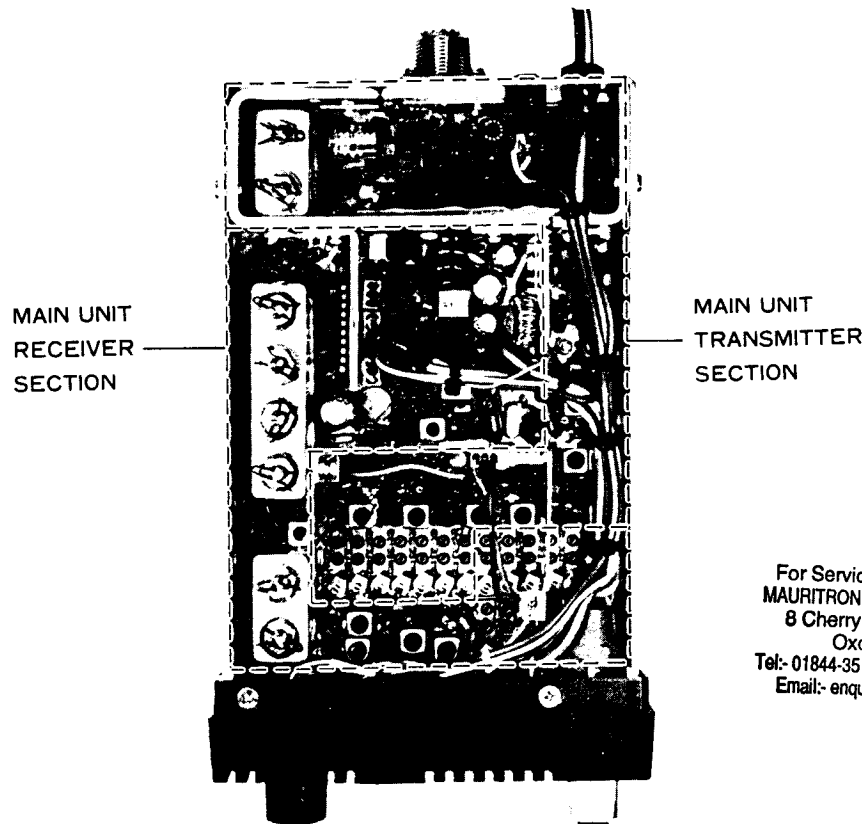
- 1-1) Second IF
- 1-2) Second local
- 1-3) First IF
- 1-4) First local
- 1-5) RF section
- 1-6) Sensitivity peaking
- 1-7) Squelch sensitivity

II Transmitter

- 2-1) Oscillator
- 2-2) Multiplier stages
- 2-3) Bandpass filter
- 2-4) Spurious reduction
- 2-5) Deviation setting
- 2-6) RF power output
- 2-7) AFP circuit

III Tone Squelch

- 3-1) Encoder output level adjustment
- 3-2) Decoder input level adjustment
- 3-3) Tone frequency adjustment



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ALIGNMENT: RECEIVER

1-1) Second IF

Connect a 455 kHz sweep generator to the base of Q_{108} , and connect an XY scope (vertical amp. input) to pin 5 of J_{101} . Adjust T_{107} for maximum p-p indication on the scope.

1-2) Second Local

Connect a precision frequency counter, through a 20 pF capacitor, to the collector of Q_{108} . Adjust TC_{102} for a reading of exactly 20.945 MHz on the counter.

1-3) First IF

Connect a 21.4 MHz sweep generator to gate 2 of Q_{102} . Connect an XY scope (vertical amp. input), through a diode detector, to the secondary of T_{106} . Now adjust T_{105} and T_{106} so that the pattern shown in Figure 6 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_{105} . Adjust T_{103} and T_{104} for maximum indication on the VTVM.

Connect the RF probe of a VTVM to gate 2 of Q_{102} . Adjust CV_{103} for maximum indication on the VTVM.

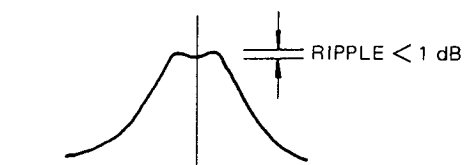
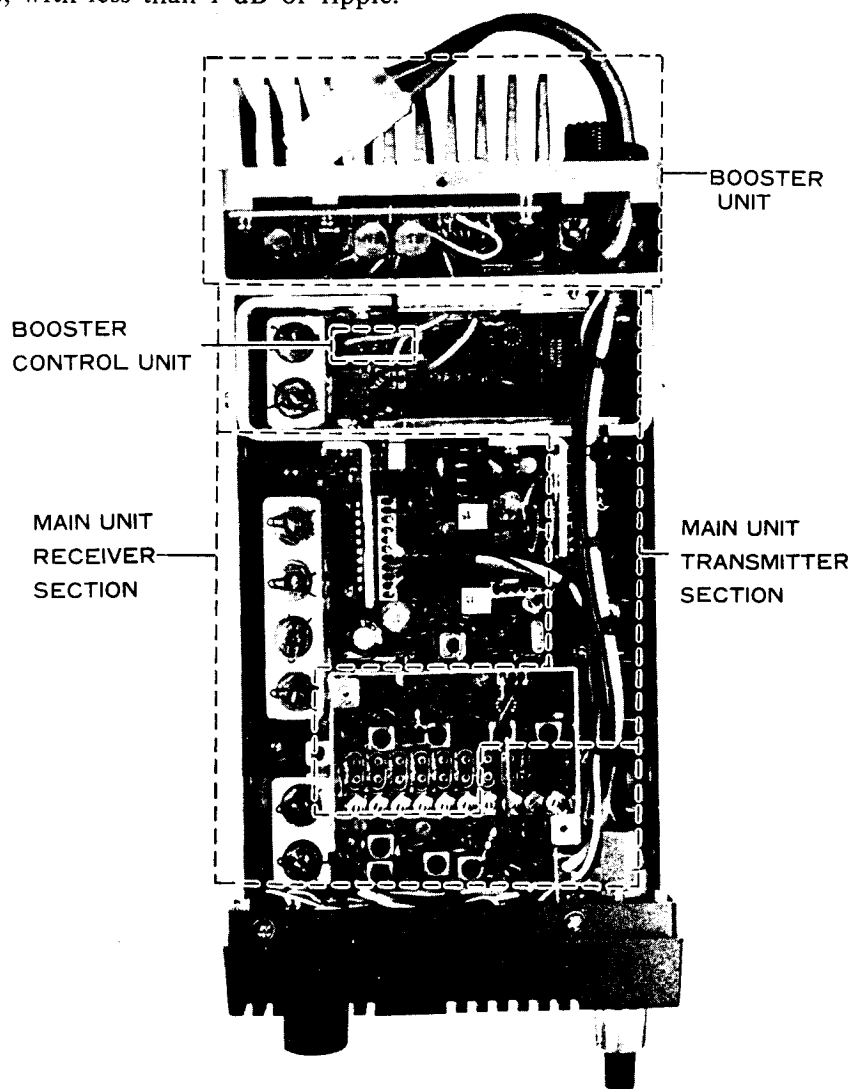


Fig. 6



FTC-4625 TOP VIEW

SERVICING

Connect a precision frequency counter to the base of Q_{105} (through an $0.01 \mu\text{F}$ capacitor). Preset the core of T_{102} to be flush with the top of the shield can. Now adjust TC_{103} through TC_{109} (one for each channel) for the following frequency:

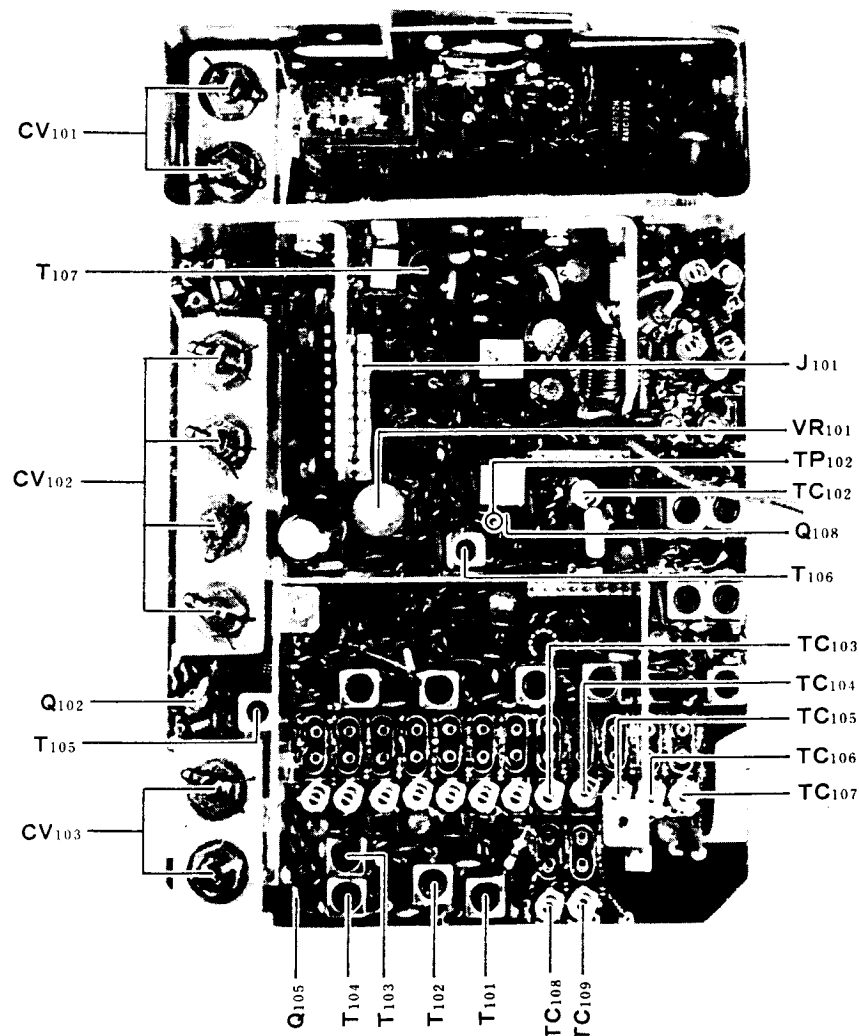
$$f_{\text{test}} = \frac{f(\text{RX channel}) - 21.4 \text{ MHz}}{3}$$

We do not recommend adjustment of T_{101} for frequency compensation because its alignment is extremely critical.

1-5) RF Section

Connect a precision UHF signal generator to the antenna jack, and connect an AF millivoltmeter to the speaker jack (use 8 ohm termination). Inject a signal on the channel frequency at a level providing about 10 dB of noise quieting. Now adjust CV_{101} - CV_{103} for maximum noise quieting as shown on the meter. Adjust the signal generator level, and meter scale, as needed, to provide a meaningful display.

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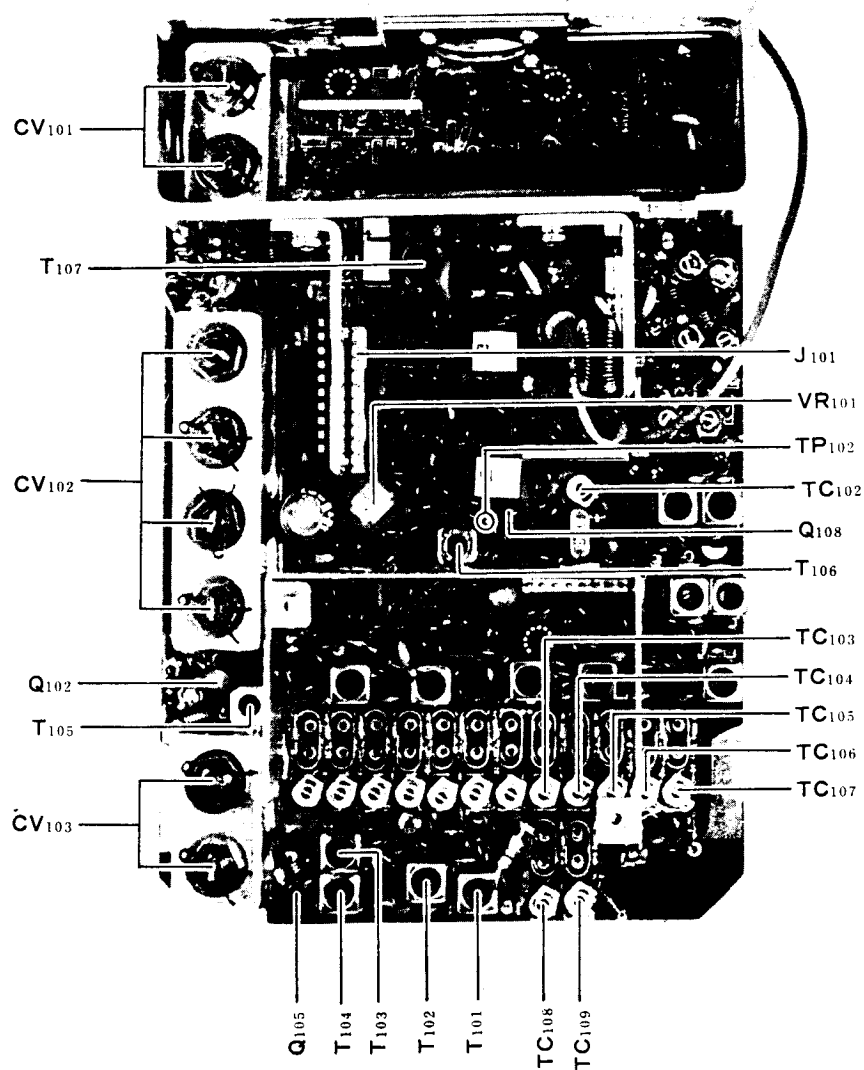
FTC-4610 RECEIVER SECTION ALIGNMENT POINTS

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 jack, using an 8 ohm termination. Inject a signal from the generator so that the distortion meter indicates 25% distortion. Adjust T_{105} and T_{106} for minimum distortion. Now reset the signal generator level for 25% distortion, and again adjust T_{105} and T_{106} for minimum distortion. Repeat several times.

1-7) Squelch Adjustment

Connect a signal generator to the ANT receptacle, set the deviation to 60% at 1 kHz, and adjust the frequency to the desired channel frequency. Set the output to $0.2\mu V$. Rotate the SQL knob on the front panel to the 270 degree position, then adjust VR_{101} just to the position where the squelch opens.



FTC-4625 RECEIVER SECTION ALIGNMENT POINTS

ALIGNMENT: TRANSMITTER

2-1) Oscillator Circuit

Connect a dummy load/UHF wattmeter to the antenna jack. Connect the RF probe of a VTVM to the base of Q₂₀₃. Close the PTT switch, and adjust T₂₀₃ for maximum deflection on the VTVM. Now connect a frequency counter to the base of Q₂₀₃, and adjust TC₂₀₈ - TC₂₁₄ (one for each channel) for exactly the following frequency:

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

T₂₀₂ should be adjusted as follows:

Connect the RF probe of a VTVM to base of Q₂₀₂ and adjust T₂₀₂ for maximum reading on the VTVM. Detune it until 80% of the maximum reading provides a stable output. Do not adjust T₂₀₁, because it is for frequency compensation and its alignment is extremely critical.

2-2) Multiplier Stages

Leave the dummy load/wattmeter connected to the antenna jack. Turn VR₂₀₂ fully clockwise. Now connect a DC voltmeter between TP₂₀₂ (-) and TP₂₀₇ (+). Adjust T₂₀₅ for maximum indication on the voltmeter. Now

connect the voltmeter to TP₂₀₃ (-) and TP₂₀₇ (+), and adjust T₂₀₆ and T₂₀₇ for maximum indication on the meter. Connect the meter to TP₂₀₄ (-) and TP₂₀₇ (+), and adjust T₂₀₈ and T₂₀₉ for maximum deflection. Adjust TC₂₀₂ through TC₂₀₆ for maximum indication on the wattmeter.

2-3) Bandpass Filter Adjustment

Assemble the test equipment as shown in Figure 7. Adjust T₂₀₆ - T₂₀₉ and TC₂₀₂ - TC₂₀₇ so that the display shown in Figure 8 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 TC₂₀₃ for minimum spurious emission over the range 1/3 f_t to 4/3 f_t (f_t = TX frequency). Now adjust TC₂₀₇ for minimum spurious signals over the range 10/12 f_t to 14/12 f_t.

Recheck the bandpass filter tuning after adjustment of TC₂₀₇.

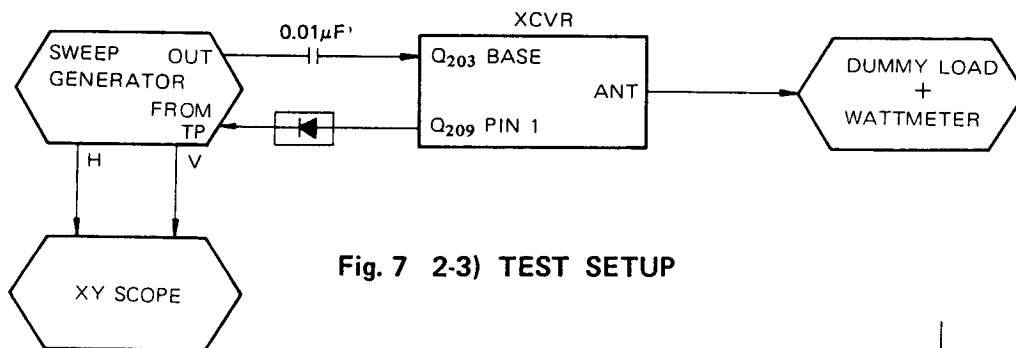


Fig. 7 2-3) TEST SETUP

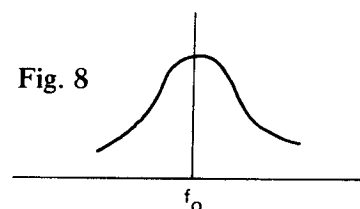


Fig. 8

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2-5) Deviation Setting

Assemble the test equipment as shown in Figure 9. Inject a 1 kHz signal of 5.5 mV at the mic jack. Adjust VR₂₀₁ for a deviation of ± 4.9 kHz. Now reduce the AF generator

level, so that the deviation reaches ± 3 kHz. Adjust T₂₀₃ and T₂₀₄ for minimum distortion. If the deviation changes during this alignment, adjust it again. Several passes may be necessary.

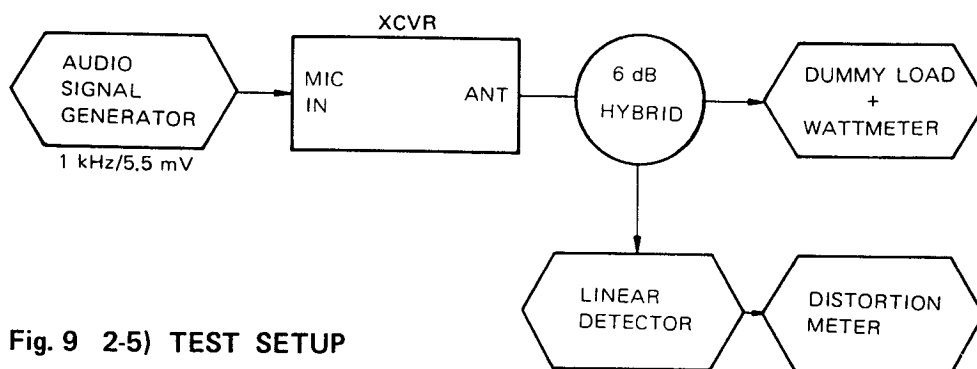
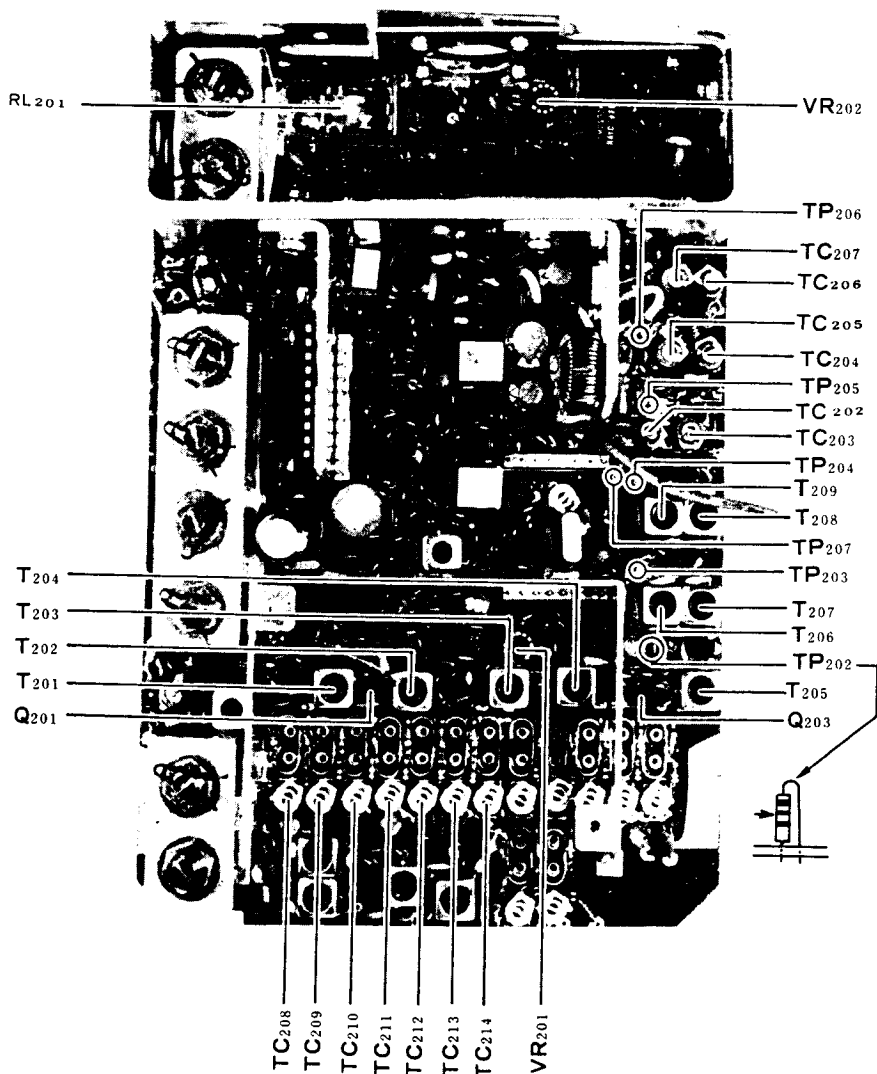


Fig. 9 2-5) TEST SETUP



ETC 4610 TRANSMITTER SECTION ALIGNMENT POINTS

SERVICING

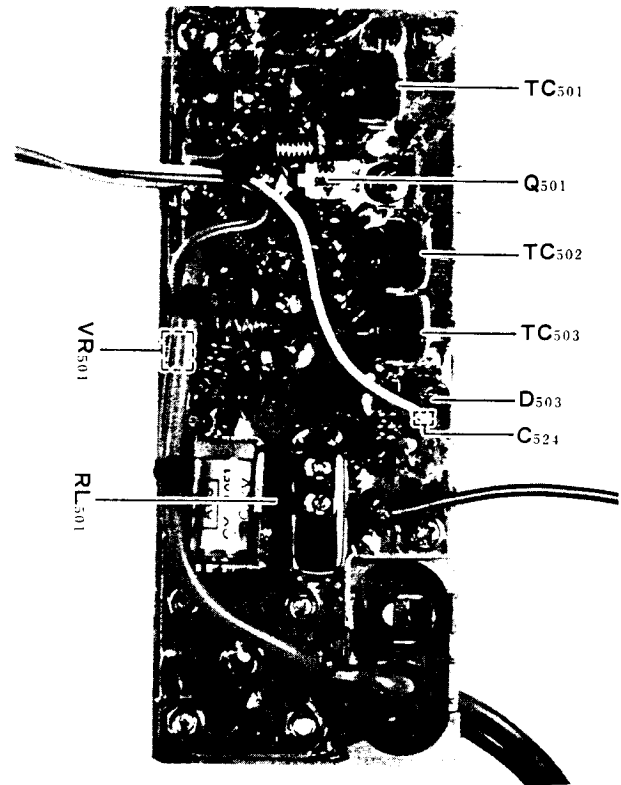
2-6) RF Power Adjustment

With the dummy load/wattmeter connected to the antenna jack, adjust VR₂₀₂ for 10 watts (FTC-4610) or 25W (FTC-4625) RF output.

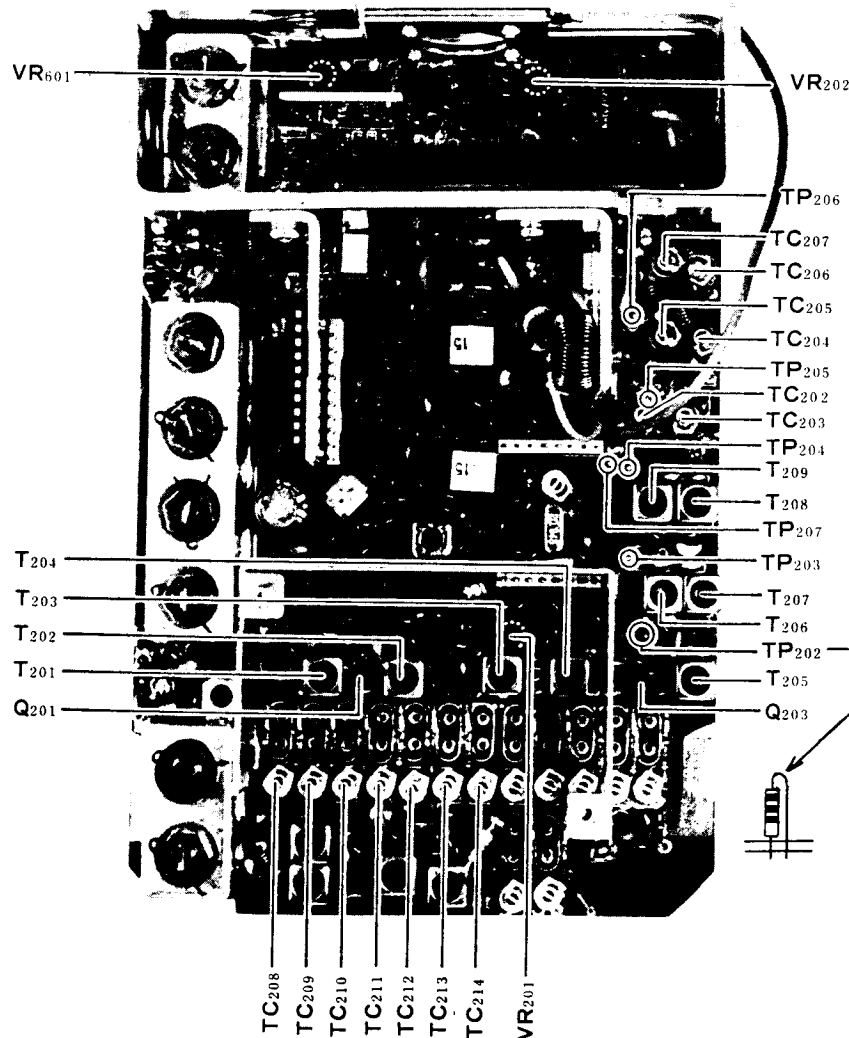
2-7) AFP CIRCUIT (FTC-4625)

Connect the dummy load/wattmeter to the antenna connector. Connect the voltmeter (+) lead to the cathode of D₅₀₃ (connection of D₅₀₃ and C₅₂₄), and (-) lead to ground. Adjust VR₅₀₁ for minimum deflection on the meter.

Rotate VR₆₀₁ slowly clockwise from the fully counterclockwise position; the output power will cut off, and note that point. Then rotate VR₆₀₁ counterclockwise 2/3 into the cut off point.



BOOSTER UNIT ALIGNMENT POINTS



FTC-4625 TRANSMITTER SECTION ALIGNMENT POINTS

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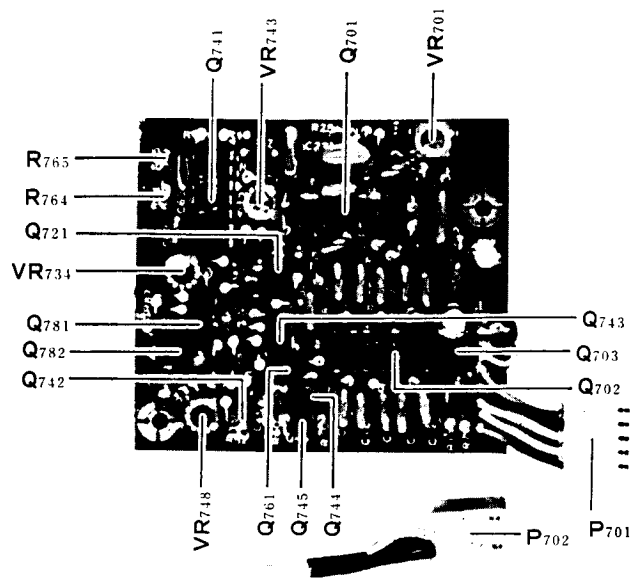
ALIGNMENT; TONE SQUELCH

3-1) Encoder Output Level Adjustment

Assemble the test equipment as shown in Figure 10.

Adjust VR₇₄₈ for deviation of ± 0.5 kHz without any mic input signal. Connect audio generator to the mic jack, then apply a 5.5 mV 1 kHz signal.

If the maximum deviation is other than ± 4.9 kHz, readjust VR₂₀₁.



TONE SQUELCH UNIT ALIGNMENT POINTS

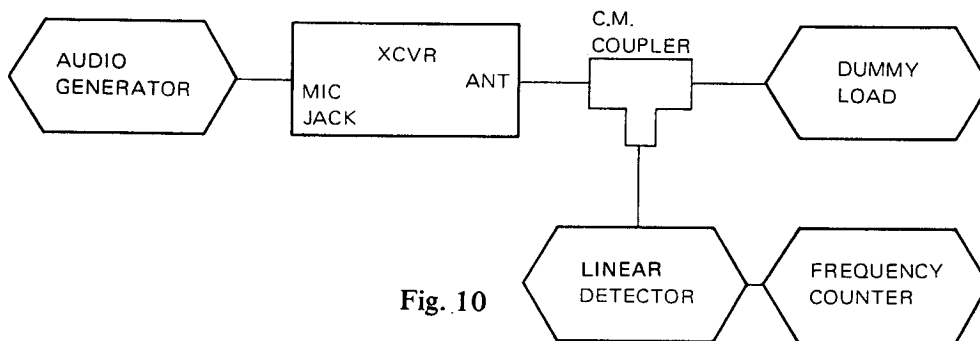


Fig. 10

3-2) Decoder Input Level Adjustment

Assemble the test equipments as shown in Figure 11.

Set the output of the signal generator to 30 dB μ with modulation of 1 kHz, ± 0.5 kHz deviation. Connect the level meter to pin 7 of Q₇₀₁. Adjust VR₇₀₁ for an output level of 10 mV.

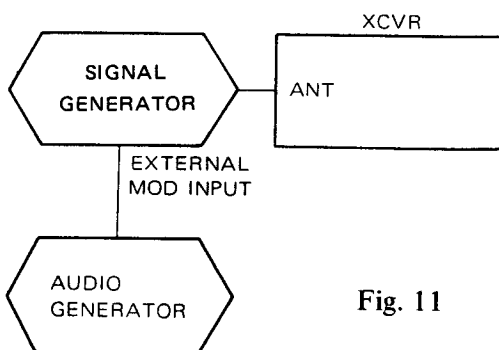


Fig. 11

3-3) Tone Frequency Adjustment

When the tone frequency needs to be changed, Replace R₇₆₄, R₇₆₅ according to Table 1.

You need not to readjust VR₇₄₃ as long as 1% tolerance resistors are used.

When the tone frequency is changed, the tone squelch activating point must be adjusted as follows.

Connect the signal generator to the antenna jack and set the output of SSG for 30 dB μ , ± 0.5 kHz deviation.

Reduce the audio input level by 9 dB at the external mod. terminal of the signal generator. Adjust VR₇₃₄ to the point where the tone squelch just opens.

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PARTS LIST AND ORDERING DATA

If you live in the United States, you may order parts from Yaesu Electronics Corporation. In other countries, you should order parts from the Yaesu agent for your country. In countries where Yaesu is not currently represented, you may order spare parts directly from Yaesu Musen Company, Ltd. in Tokyo.

When ordering, please specify the exact model number of the transceiver that the part is for. Many parts are standard, such as resistors and disc ceramic capacitors, but you should use particular care when ordering such items as electrolytics, tantalum capacitors, and the like.

The parts list to follow identifies the board that the parts belong to, as well as the circuit designation and part description. A "Part Number" is also specified, and this number will allow immediate identification by our parts department of the item you require.

Shipment of parts from Yaesu USA is usually made by UPS, COD. Allow at least a week for the parts department to process your order. You will receive prompt notification that your order has been received, and if parts are back ordered, or if additional information is required, you will be so informed.

PARTS ORDER EXAMPLE

QUANTITY	TRANSCEIVER IDENTIFICATION	LOCATION	**PART NUMBER	CIRCUIT DESIGNATION
1	FTC-4610	PB-2106	G4800760	Q ₁₀₁ 3SK76

**Note: In earlier transceivers, no part numbering system was used in the manual. For this reason, the nomenclature "3SK76" will suffice for the part number. All transceivers have a part number for each component.

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 YAESU ELECTRONICS CORPORATION — 6851 Walthall Way, Paramount, CA 90723
 YAESU ELECTRONICS CORPORATION — 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

ORDER BLANK

QUANTITY	TRANSCEIVER IDENTIFICATION	LOCATION	PART NUMBER	CIRCUIT DESIGNATION

I authorize shipment via: Best Way Parcel Post
 UPS Other

Ship To: Name: _____
 (Print or Type) Address: _____
 City: _____ State: _____ Zip: _____
 Country: _____

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FTC-4610/4625 PARTS LIST

REPAIR PARTS

MAIN CHASSIS			Q401	G1090222	IC	MB3756
Symbol Number	Part Number	Description	Q212	G1090220	"	MLM2902
		DIODE	Q111	G1090072	"	μPC577H
D1	G2090034	Si U05B	Q101, 102	G4800760	FET	3SK76
D2	G2090086	LED TLO-114	Q213	G3106710B	TR	2SA671B
D3	G2090087	" GL-52RG	Q214 - 217, 301	G3304580B	"	2SC458B
PB-2027	F0002027	LED Mounting Printed Board	Q109, 110	G3304600B	"	2SC460B
	C0020270	PB-2027 with LEDs	113 - 117, 218			
			Q103, 106 - 108	G3305350B	"	2SC535B
			201 - 203, 210			
		RESISTOR	211			
R1	J10306120	Carbon Composition 1W GK 12Ω	Q104, 204, 205	G3319060	"	2SC1906
R2	J10246560	" " ¼W GK 56Ω	Q105, 206, 207	G3319070	"	2SC1907
R3	J01245471	" film " TJ 470Ω	Q208	G3324070	"	2SC2407
		POTENTIOMETER				
VR1(a)(b) with S1	J62800038	DM92R514A-5M2211-10KΩ Bx2			DIODE	
PB-2148	F0002148	VR1 Mounting Printed Board	D101 - 108, 202	G2015550	Si	1S1555
	C0021480	PB-2148 with components (VR1, D1, C412, C413, L403)	203			
			D111 - 117	G2090044	"	MC301
			205 - 211			
		SPEAKER	D110, 204	G2090165	Varactor	FC52M-5
SP1	M4090023A	SM-45Y	D201	G2090084	"	MV201
		SWITCH				
S1 (with VR1)	-				CRYSTAL	
S2	N0190064	SRN-1017, N, L=25	X101 - 107	-		See CRYSTAL DATA
S3	N4090021	MS-402 (BLACK)	X201 - 207	-	" " "	
			X108	H0102050	HC-18/U	20.945MHz
		RECEPTACLE				CRYSTAL FILTER
J1	P1090026	SO-239	XF101, 102	H1101990		21J2B2
J2	P0090012	FM-146S				
J3	P1090005	SG-8050-01				CERAMIC FILTER
			CF101, 102	H3900030		LF-B15
P2 (with wire)	T9201950	3021-03				
P3 (")	T9203270	3021-08 (FTC-4610)				CERAMIC DISCRIMINATOR
P3 (")	T9203270	3021-08 (FTC-4625)	CD101	H7900010		455-D
P4 (")	T9201970	3021-03				
P5 (")	T9201990	5047-07				THERMISTOR
			TH101, 201	G9090011		SDT-1000
		LAMP	TH102, 202	G9090012		SDT-250
PL1	Q1000041	T4.2 14V 60mA				
		POWER CORD (FTC-4610)	R237	J01245229	Carbon film	¼W TJ 2.2Ω
P6	P1090124	Power connector 3191-02R1	R225, 229, 233	J01245100	" " " "	10Ω
P6 (with wire)	T9012999A		242			
		POWER CORD (FTC-4625)	R211, 212	J01245220	" " " "	22Ω
P6	P1090124	Power connector 3191-02R1	R303	J01245330	" " " "	33Ω
P6 (with wire)	T9013399		R108, 219, 241	J01245470	" " " "	47Ω
			R149, 160	J01245820	" " " "	82Ω
			R104, 109, 110	J01245101	" " " "	100Ω
			129, 134, 205			
			209, 210, 238			
			239			
MAIN UNIT						
Symbol Number	Part Number	Description				
PB-2106	F0002106	Printed Circuit Board	R213	J01245221	" " " "	220Ω
(FTC-4610)	C0021060	P.C.B. with Components (without channel crystal)	R235	J01245271	" " " "	270Ω
(FTC-4625)	C0021061	P.C.B. with Components (without channel crystal)	R280	J01245331	" " " "	330Ω
			R165, 401, 402	J01245391	" " " "	390Ω
		IC, FET, TRANSISTOR	R114, 117, 204	J01245471	" " " "	470Ω
Q112	G1090218	IC AN315	221, 243			
Q209*	G1090228	" M57704H	R201, 209	J01245561	" " " "	560Ω

REPAIR PARTS

R120, 227	J01245681	Carbon film ¼W TJ 680Ω	R214	J10246333	Carbon Composition ¼W GK 33KΩ
R124, 125, 128 132, 133, 136 143, 154, 220 223, 234, 256 270, 273	J01245102	" " " " 1KΩ	R166	J10216104	" " " " 100KΩ
					POTENTIOMETER
			VR201	J51724102	PN822H102H 1KΩB
			VR202	J51724103	PN822H103H 10KΩB
			VR101	J51723103	SR19R 10KΩB
					CAPACITOR
R115, 118, 135 138, 140, 141 226, 230, 247 254	J01245222	" " " " 2.2KΩ	C143, 230, 237	K08179001	Ceramic 50WV AH 0.5pF (2222 636 03507)
			C224	K02179002	" " AH 1.5pF (DD104CK 1R5C50V02)
R146, 153, 162 163, 197, 236 244	J01245332	" " " " 3.3KΩ	C249	K02179003	" " AH 2pF (DD104CK020C50V02)
			C244	K02179045	" " CH 2pF (2222 636 09208)
R113, 122, 130 159, 164, 240 255	J01245472	" " " " 4.7KΩ	C238	K02189002	" " CH 2.2pF (RD870-2NPO2R2C63V)
			C247, 248, 250	K02172030	" " CH 3pF (DD104CH030C50V02)
R152, 168, 171 285, 288	J01245562	" " " " 5.6KΩ	C246, 306	K02172040	" " CH 4pF (DD104CH040C50V02)
R157, 301	J01245682	" " " " 6.8KΩ	C104, 147	K05179002	" " RH 5pF (2222 636 39508)
R245, 253	J01245822	" " " " 8.2KΩ	C149	K02179038	" " CH 7pF (2222 636 09708)
R107, 112, 144 145, 150, 198 203, 207, 224 228, 231, 252 257, 260, 262 268, 271, 274 278, 281	J01245103	" " " " 10KΩ	C140	K05179005	" " RH 8pF (2222 636 39808)
			C227	K05179007	" " CH 10pF (2222 636 40109)
R272	J01245153	" " " " 15KΩ	C156	K02179028	" " CH 10pF (2222 636 10109)
R116, 119, 123 126, 131, 161 169, 251, 259 286	J01245223	" " " " 22KΩ	C107, 136, 144 231	K05179008	" " RH 12pF (2222 636 10129)
			C0208-0214 292-298	K06179051	" " UJ 12pF (2222 637 58129)
R101, 105, 127 148, 155, 167 196, 215, 217, 246, 248, 284	J01245333	" " " " 33KΩ	C245	K02185150	" " CH 15pF (RD870-1NPO150J63V)
			C209	K05179010	" " RH 18pF (2222 637 10189)
R270	J01245393	" " " " 39KΩ	C218, 232	K05179011	" " RH 22pF (2222 637 40229)
R103, 142, 151 208, 216, 249 250, 302	J01245473	" " " " 47KΩ	C153	K06179021	" " UJ 33pF (2222 636 58339)
			C145, 222	K05179013	" " RH 33pF (2222 637 40339)
R277	J01245683	" " " " 68KΩ	C225	K05179015	" " RH 47pF (2222 637 40479)
R156, 170, 218 276, 283, 287	J01245104	" " " " 100KΩ	C204	K06179023	" " UJ 56pF (2222 637 58569)
			C221, 226	K05179016	" " RH 56pF (2222 637 40569)
R102, 106, 137 139, 258, 276	J01245154	" " " " 150KΩ	C233	K0279042	" " CH 56pF (2222 637 10569)
			C132	K06179024	" " UJ 68pF (2222 637 58689)
R158	J01245224	" " " " 220KΩ	C155	K06179041	" " UJ 100pF (2222 637 58101)
R210	J10246101	Carbon Composition ¼W GK 100Ω	C197, 207	K02179049	" " CH 100pF (2222 637 10101)
R114	J10246471	" " " " 470Ω	C131, 203	K06179042	" " UJ 120pF (2222 637 58121)
R187	J10216471	" " " " 1/8W " 470Ω	C213, 217, 275 304	K02179032	" " CH 120pF (2222 637 10121)
R186, 0304	J10216561	" " " " 560Ω			
R111	J10246561	" " " " 560Ω			
R261	J10246681	" " " " 680Ω			
R186	J10216102	" " " " 1KΩ			
R121, 0303	J10246102	" " ¼W " 1KΩ			
R202, 279	J10216472	" " " " 4.7KΩ			
R282	J10246562	" " " " 5.6KΩ			
R172-178 289-295	J10216103	" " 1/8W " 10KΩ			
R275	J10245103	" " ¼W " 10KΩ			
R147	J12046223	" " " " 22KΩ			
R179-185 296-0302	J10216333	" " 1/8W " 33KΩ			

▲ FTC-4610
 * FTC-4625
 * See BAND TABLE (Page 2-9).

REPAIR PARTS

C268	K05179001	Ceramic 50WV PH 150pF (2222 637 34151)	C160, 163, 175 191, 196, 215	K70127475	" 16WV 4.7μF (CS15E1C4R7M)			
C154	K06179022	" " UJ 220pF (2222 637 58221)	C158, 166, 172 183, 188, 192	K70127106	Tantalum 16WV 10μF (CS15E1C100M)			
C190	K10179012	" " 330pF (2222 660 02331)	0200, 258, 261 262, 266, 283					
C181	K10179011	" " 470pF (2222 660 02471)	C280, 286	K70127336	" " 33μF (CS15E1C330M)			
C198	K10179013	" " 820pF (2222 660 02821)	C257	K70127476	" " 47μF (CS15E1C470M)			
C103, 105, 106 108, 115, 117 121-125, 128 130, 133 137-139, 141 142, 146, 148 152, 159, 161 162, 168-170 179, 0201-0207 202, 205, 206 208, 210, 214 216, 219, 220 234, 236 239-243, 252 267, 270-272 274, 276-279 281, 284, 285 287, 288, 290 291, 301, 302 303, 305, 401 411-413	K10179014	" " 0.001μF (CK45B1H102MY)	C404-406	K40129007	Electrolytic 16WV 100μF (16RE100)			
			C193, 402	K40129006	" " 470μF (16RE470)			
								TRIMMER CAPACITOR
			TC202, 203	K91000060	ECV-1ZW 02x53 2pF			
			TC204, 205, 207	K91000059	ECV-1ZW 04x53 4pF			
			TC206	K91000028	ECV-1ZW 10x53 10pF			
			TC102 - 109 208 - 214	K91000029	ECV-1ZW 20x53 20pF			
								CAVITY
			CV101	Q9000079	HRW-231MT-1011A			
			CV102	Q9000080	HRQ-232MT-1005A			
			CV103	Q9000081	HRW-231MT-1010A			
					INDUCTOR			
C126, 127, 150 151, 157, 164 165, 167, 223 228, 229, 235 269, 273 407-410	K10179015	" " 0.01μF (CK45B1H103MY)	L102, 104, 105 114, 208, 213 214	L0020675				
			L109	L0020756				
			L205, 207, 210	L0020674				
			L211	L0020676				
			L216, 217	L0020677				
C189	K50177102	Mylar 50WV 0.001μF (50F2U102M)	L110, 111	L1020082A				
C171, 183, 184	K50177222	" " 0.0022μF (50F2U222M)	L203, 204, 206	L1020081A				
			L215	L1020079A				
C187	K50177332	" " 0.0033μF (50F2U332M)	L219, 220, 402	L1020080A				
			L117	L1190038	FL-5H 271K 270μH			
C195	K50177472	" " 0.0047μF (50F2U472M)	L112, 113, 115 116, 125, 202 403	L1190017	FL-5H 102K 1mH			
C182, 256, 282	K50177103	" " 0.01μF (50F2U103M)	L221	L1190102	S-104K 100mH			
			L401	L2030060				
C173, 174 176-178, 180	K50176473	" " 0.047μF (MRS-473K)						
C259, 260	K70160001	Tantalum 35WV 0.047μF (MDST473F)			TRANSFORMER			
C185	K70167104	" " 0.1μF (CS15E1V0R1M)	T101	L0190012	113KN-6405Z			
			T102	L0190013	113KN-6409X			
C194	K70167154	" " 0.15μF (CS15E1VR15M)	T103, 104, 206 207	L0020343	113SN-3392Y			
			T105	L0020717	199CC-11125BWN			
C253	K70167224	" " 0.22μF (CS15E1VR22M)	T106	L0020647	199CC-11114N			
			T107	L0020649	7MC-5896Y			
C251	K70167684	" " 0.68μF (CS15E1VR68M)	T201, 205	L0020667	113CN-3393Y			
			T202	L0190011	113KN-6407N			
C186, 199, 254 255, 403	K70147105	" 25WV 1μF (CS15E1E010M)	T203	L0190010	113KN-6406N			
			T204	L0190014	113KN-6408Z			
			T208, 209	L0020429	113SN-4530Y			

FB101	L9190024	RI 3x3x1	C510, 513, 523 524	K23170001	Ceramic chip 50WV 0.01μF (GR42Y5U103Z)
			C512	K70167106	Tantalum 35WV 10μF (CS15E1V100M)
		RELAY			
RL301	M1190008	FBR-221D006	C515	K70127226	" 16WV 22μF (CS15E1C220M)
		CONNECTOR			
J401	P0090054	5048-07A			
J201	P0090092	3022-08A			
J101	P0090059	3022-11A			
					TRIMMER CAPACITOR
		CRYSTAL PIN SOCKET	TC502, 503	K91000073	2222-808-61159 15pF
XS	P1090099	50865-8	TC501	K91000072	2222-808-51229 22pF
		TP TERMINAL			
TP	Q5000037	TP-H For Service Manuals Contact MAURITRON TECHNICAL SERVICES 8 Cherry Tree Rd, Chinnor Oxon OX9 4GY Tel: 01844-351694 Fax: 01844-352554 Email: enquiries@mauritron.co.uk			INDUCTOR
			L501, 506	L0020794	
			L502	L0020795	
			L503	L0020889	
			L504	L0020797	
			L507-509	L0020798	
			L505	L1020663	
BOOSTER UNIT (FTC-4625)					
Symbol Number	Part Number	Description			
PB-2107	F0002107	Printed Circuit Board			
	C0021070	P.C.B. with Components			RELAY
			RL501	M1590002	CX-1051 DC-12V
		TRANSISTOR			
Q501	G3326950	2SC2695			FERRITE BEADS
			FB501	L9190024	RI 3x3x1
		DIODE			
D501-503	G2090118	Schottky barrier 1SS97			
D504	G2015550	Si 1S1555			
		RESISTOR	BOOSTER CONTROL UNIT (FTC-4625)		
R501	J01245560	Carbon film ¼W TJ 560Ω	Symbol Number	Part Number	Description
R502 (L505)	-	470Ω	PB-2118	F0002118	Printed Circuit Board
				C0021180	P.C.B. with Components
					DIODE
			D601	G2090140	Thyristor CW01B
		POTENTIOMETER			
VR501	J50707501	PN822H501V 500ΩB			RESISTOR
			R601	J01245224	Carbon film ¼W TJ 220KΩ
		CAPACITOR			
C518, 520	K02179003	Ceramic 50WV CH 2pF (DD104CH020C50V02)			
C517, 519	K02179055	" " CH 3pF (2222-636-09308)			POTENTIOMETER
C521, 522	K02179053	" " CH 4pF (2222-636-09408)	VR601	J50707103	PN822H103V 10KΩB
C502, 525, 526, 527	K02172050	" " CH 5pF (DD104CH050C50V02)			CAPACITOR
C503-509	K02173090	" " CH 9pF (DD104CH090D50V02)	C601-603	K10179014	Ceramic 50WV 0.001μF (CK45B1H102MY)
C511, 514	K02179049	" " CH 100pF (2222-637-10101)	C604	K70127475	Tantalum 16WV 4.7μF (CS15E1C4R7M)
C501, 516	K10179014	" " 0.001μF (CK45B1H102MY)			

REPAIR PARTS

R764	186.2 Hz	J20249092	Metallic film ¼W 68.1KΩ (ERO-25 CHD 6812)	146.2 Hz	J20249182	Metallic film ¼W 152KΩ (ERO-25 CHD 1523)
	188.0 Hz			151.4 Hz	J20249183	" " " 132KΩ (ERO-25 CHD 1323)
	192.8 Hz			156.7 Hz	J20249184	" " " 114KΩ (ERO-25 CHD 1143)
	203.5 Hz			162.2 Hz	J20249185	" " " 97.6KΩ (ERO-25 CHD 9762)
	209.0 Hz			167.9 Hz	J20249186	" " " 81.6KΩ (ERO-25 CHD 8162)
	210.7 Hz			169.0 Hz	J20249202	" " " 78.7KΩ (ERO-25 CHD 7872)
	218.1 Hz			173.8 Hz	J20249187	" " " 67.3KΩ (ERO-25 CHD 6732)
	225.7 Hz			179.9 Hz	J20249188	" " " 53.6KΩ (ERO-25 CHD 5362)
	233.6 Hz			186.2 Hz	J20249189	" " " 110KΩ (ERO-25 CHD 1103)
	241.8 Hz			188.0 Hz	J20249203	" " " 106KΩ (ERO-25 CHD 1063)
	250.3 Hz			192.8 Hz	J20249185	" " " 97.6KΩ (ERO-25 CHD 9762)
				203.5 Hz	J20249070	" " " 80.6KΩ (ERO-25 CHD 8062)
				209.0 Hz	J20249204	" " " 73.2KΩ (ERO-25 CHD 7322)
				210.7 Hz	J20249190	" " " 70.6KΩ (ERO-25 CHD 7062)
				218.1 Hz	J20249191	" " " 61.9KΩ (ERO-25 CHD 6192)
				225.7 Hz	J20249192	" " " 53.0KΩ (ERO-25 CHD 5302)
				233.6 Hz	J20249193	" " " 44.8KΩ (ERO-25 CHD 4482)
				241.8 Hz	J20249194	" " " 37.4KΩ (ERO-25 CHD 3742)
				250.3 Hz	J20249195	" " " 30.5KΩ (ERO-25 CHD 3052)
						POTENTIOMETER
				VR701	J51724203	PN822H 203H 20KΩB
				VR734, 748	J51724103	" 103H 10KΩB
				VR743	J51724303	" 303H 30KΩB
						CAPACITOR
				C763	K02179037	Ceramic 50WV 68pF (2222 637 10689)
				C742, 762	K23170004	" 50WV 3900pF (PRE 111 CH 392350V10)
				C722	K55209001	Mylar 100WV 1040pF (PRA1041F 1040pF)
				C712, 724	K55209002	" " 1500pF (PRA1501F 1500pF)
				C702-711	K55209003	" " 4700pF (PRA4701F 4700pF)
				C726	K55209004	" " 7100pF (PRA7101F 7100pF)
				C713	K55209005	" " 8710pF (PRA8711F 8710pF)
				C725	K55209006	" " 0.0328μF
R765	67 Hz	J20249172	(ERO-25 CHD TYPE ±0.5%, 50 PPM) Metallic film ¼W 374KΩ (ERO-25 CHD 3743)			
	71.9 Hz	J20249173	" " " 191KΩ (ERO-25 CHD 1913)			
	74.4 Hz	J20249196	" " " 115KΩ (ERO-25 CHD 1153)			
	77.0 Hz	J20249174	" " " 40.2KΩ (ERO-25 CHD 4022)			
	79.7 Hz	J20249197	" " " 407KΩ (ERO-25 CHD 4073)			
	81.0 Hz	J20249198	" " " 379KΩ (ERO-25 CHD 3793)			
	82.5 Hz	J20249175	" " " 344KΩ (ERO-25 CHD 3443)			
	85.4 Hz	J20249199	" " " 284KΩ (ERO-25 CHD 2843)			
	88.5 Hz	J20249176	" " " 226KΩ (ERO-25 CHD 2263)			
	90.0 Hz	J20249200	" " " 200KΩ (ERO-25 CHD 2003)			
	91.5 Hz	J20249201	" " " 174KΩ (ERO-25 CHD 1743)			
	94.8 Hz	J20249177	" " " 124KΩ (ERO-25 CHD 1243)			
	100.0 Hz	J20249095	" " " 54.9KΩ (ERO-25 CHD 5492)			
	103.5 Hz	J20249064	" " " 133KΩ (ERO-25 CHD 1333)			
	107.2 Hz	J20249178	" " " 95.3KΩ (ERO-25 CHD 9532)			
	110.9 Hz	J20249179	" " " 59.7KΩ (ERO-25 CHD 5972)			
	114.8 Hz	J20249079	" " " 169KΩ (ERO-25 CHD 1693)			
	118.8 Hz	J20249171	" " " 137KΩ (ERO-25 CHD 1373)			
	123.0 Hz	J20249086	" " " 107KΩ (ERO-25 CHD 1073)			
	127.3 Hz	J20249070	" " " 80.6KΩ (ERO-25 CHD 8062)			
	131.8 Hz	J20249095	" " " 54.9KΩ (ERO-25 CHD 5492)			
	136.5 Hz	J20249180	" " " 30.9KΩ (ERO-25 CHD 3092)			
	141.3 Hz	J20249181	" " " 8.87KΩ (ERO-25 CHD 8871)			

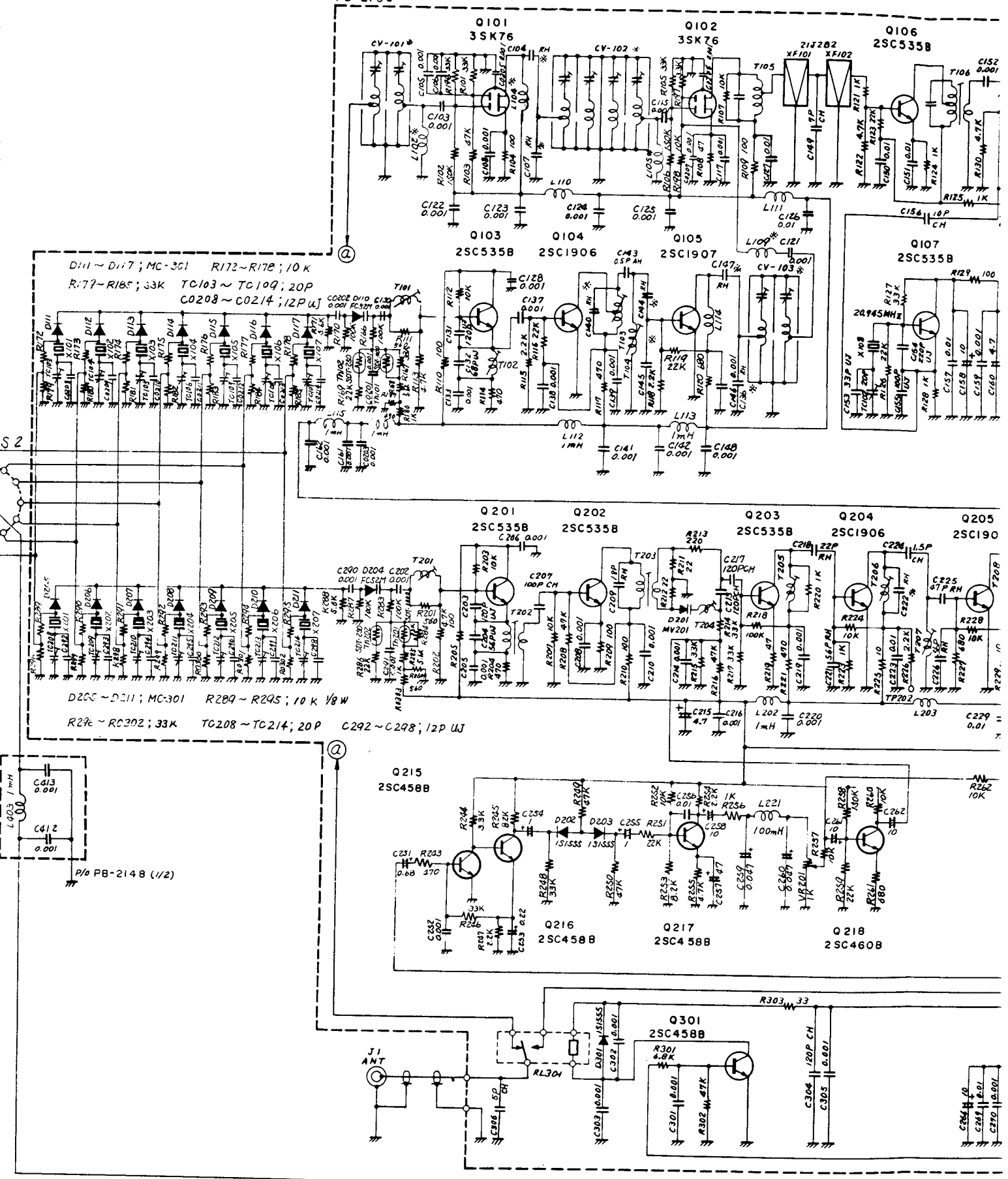
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REPAIR PARTS

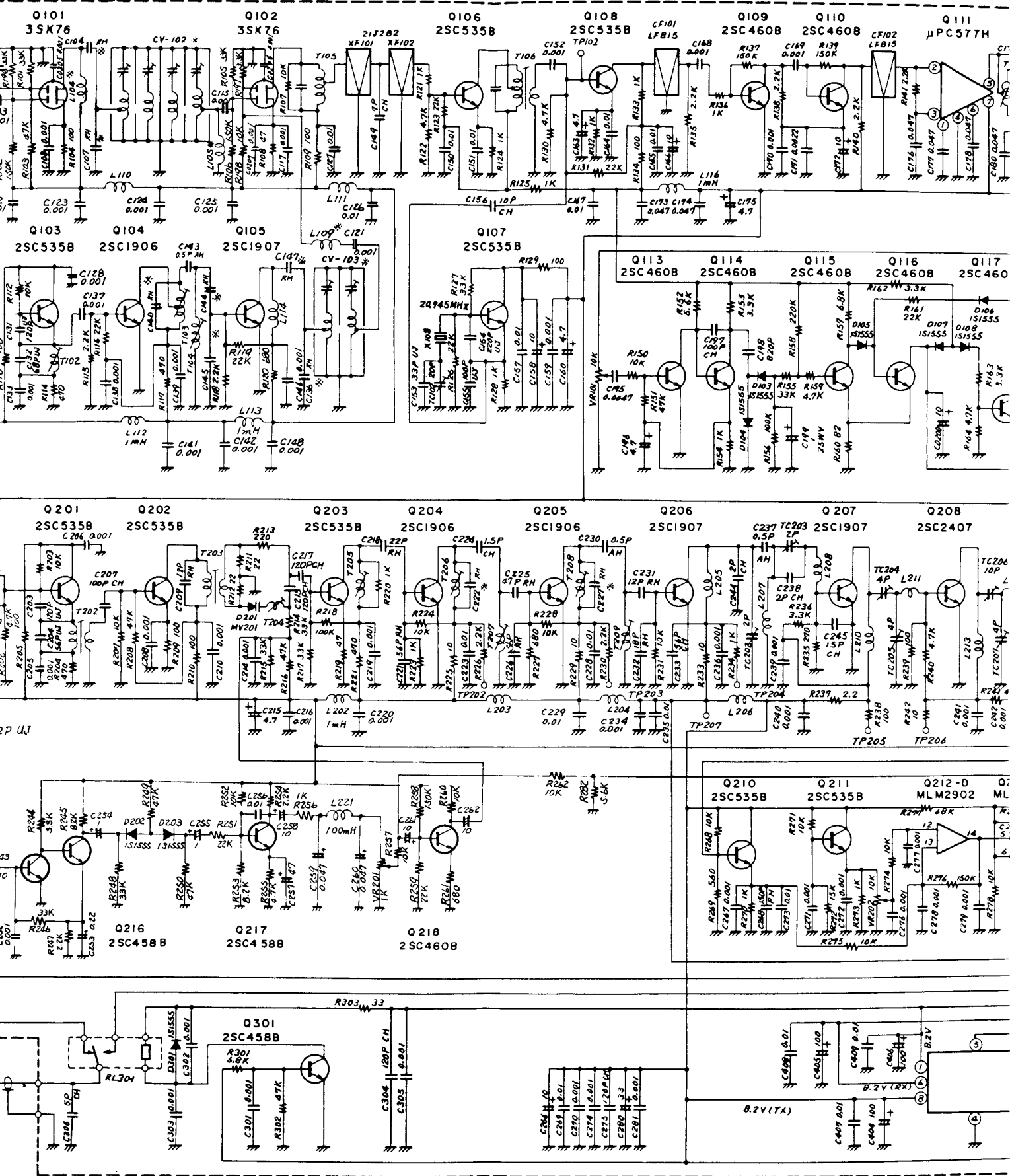
C723	K55209007	Mylar 100WV 0.033 μ F (PRA3302F 0.033 μ F)			AC CORD
C721	K55209008	0.047 μ F (PRA4702F 0.047 μ F)		T9000580	2 wire, 2 prong plug
C701, 714, 729	K70167105	Tantalum 35WV 1 μ F (CS15E1V010M)		T9000482	3 wire, 3 prong plug (UL)
C727, 728 743-747, 761	K70127106	16WV 10 μ F (CS15E16V100M)		T9000684	3 wire, 2 prong EU plug
C781	K40129008	Electrolytic 16WV 33 μ F (16RE33)		T9000680	3 wire, 3 prong Australian plug
C715, 741	K40129002	16WV 47 μ F (16RE47)			
			REGULATOR UNIT		
			Symbol Number	Part Number	Description
			PB-2025	F0002025	Printed circuit board
				C0020250	P.C.B. with components
			IC & TRANSISTOR		
P711	P1090195	3021-05 (with wire T9201940)	Q101	G1090036	IC TA7089M
P714	P1090186	3021-03 (with wire T9201980)	Q102	G3402350Y	TR 2SD235(Y)
			RESISTOR		
			R101	J01245101	Carbon film 1/4W TJ 100 Ω
			R104	J01245221	" " " " 220 Ω
			R102	J01245332	" " " " 3.3K Ω
			R105	J01245103	" " " " 10K Ω
			R103	J01245123	" " " " 12K Ω
			R109	J01245124	" " " " 120K Ω
			R108	J10276151	" composition 1/2W GK150 Ω
			R107	J10276471	" " " " 470 Ω
			R106	J30376029	Cement 5W 0.2 Ω (SQ51)
AC POWER SUPPLY FP-5					
MAIN CHASSIS					
Symbol Number	Part Number	Description			
TRANSISTOR					
Q1	G3090014	2N3055			
DIODE					
D1	G2090022	S5VB			
CAPACITOR					
C1	K43160002	Electrolytic 35WV 10000 μ F (35L 10000)			
POWER TRANSFORMER					
PT1	L3030016				
AC FUSE HOLDER					
FH1	P2000017	SN2050			
AC FUSE					
F1	Q0000003	2A 100V-117V			
	Q0000002	1A 200V-234V			
SWITCH					
S1	N3090017	M2022-N			
	S6000022	AT449B (Black knob)			
SPEAKER					
SP1	M4090034	SE-77KY-T			
METER					
M1	M0290014				
			ACCESSORIES		
			Symbol Number	Part Number	Description
			AC FUSE		
				Q0000003	2A (100V-117V)
P2	P0090034	P-2240 (SP)		Q0000002	1A (200V-234V)
P1 (with wire)	T9013099A	3191-02P (DC OUT)			
			DC FUSE		
				Q0000006	4A

REPAIR PARTS

AC POWER SUPPLY FP-6			FUSE		
			F1	Q0000012	6A (100V-117V)
			F1	Q0000004	3A (200V-234V)
MAIN CHASSIS					
Symbol Number	Part Number	Description			
		TRANSISTOR			AC POWER CORD
Q1-4	G3401140Y	2SD114Y		T9000482	3 wire, 3 prong plug (UL) UP365A04
Q5	G3402350Y	2SD235Y		T9000684	3 wire, 2 prong EU plug EP011E03
		For Service Manuals Contact MAURITRON TECHNICAL SERVICES 8 Cherry Tree Rd, Chinnor Oxon OX9 4QY Tel: 01844-351694 Fax: 01844-352554 Email: enquiries@mauritron.co.uk		T9000680	3 wire, 3 prong Australian plug SP-400-004
		DIODE			
D1	G2090121	S25VB10			
		RESISTOR			
R5	J10276471	Carbon composition 1/2W GK 470Ω			
R1-4	J30406029	Cement 10W 0.2Ω (SQ10L-R20)	REGULATOR BOARD		
			Symbol Number	Part Number	Description
			PB-2089	F002089	Printed circuit board
				C0020890	P.C. Board with components
					IC
			Q101	G1090036	TA7089M
					RESISTOR
			R106	J10246124	Carbon composition 1/4W GK 120KΩ
			R105	J10276101	" " 1/2W " 100Ω
			R101	J10276222	" " " 2.2KΩ
			R102	J10276332	" " " 3.3KΩ
			R103	J10276472	" " " 4.7KΩ
			R104	J20306102	Metallic film 1W 1KΩ (RS1PJ)
					POTENTIOMETER
			VR101	J51721103	EVL-S3A 00B14 10KΩB
					CAPACITOR
			C101	K50177223	Mylar 50WV 0.022μF (50F2U 222M)
			C102	K50177104	" " 0.1μF (50F2U 104M)
				Q5000011	Wrapping terminal C
					METER
M1	M0290014				
			ACCESSORIES		
			Symbol Number	Part Number	Description
					FUSE
			P1	P1090049	QMS-P4-FC (DC OUT) (with wire T9202480A)
			P2	P0090034	P-2240 (SP)
					JUMPER PLUG
				Q9000086	QS-P4M with rubber cap
					FUSE HOLDER
FH1	P2000017	SN-2050			

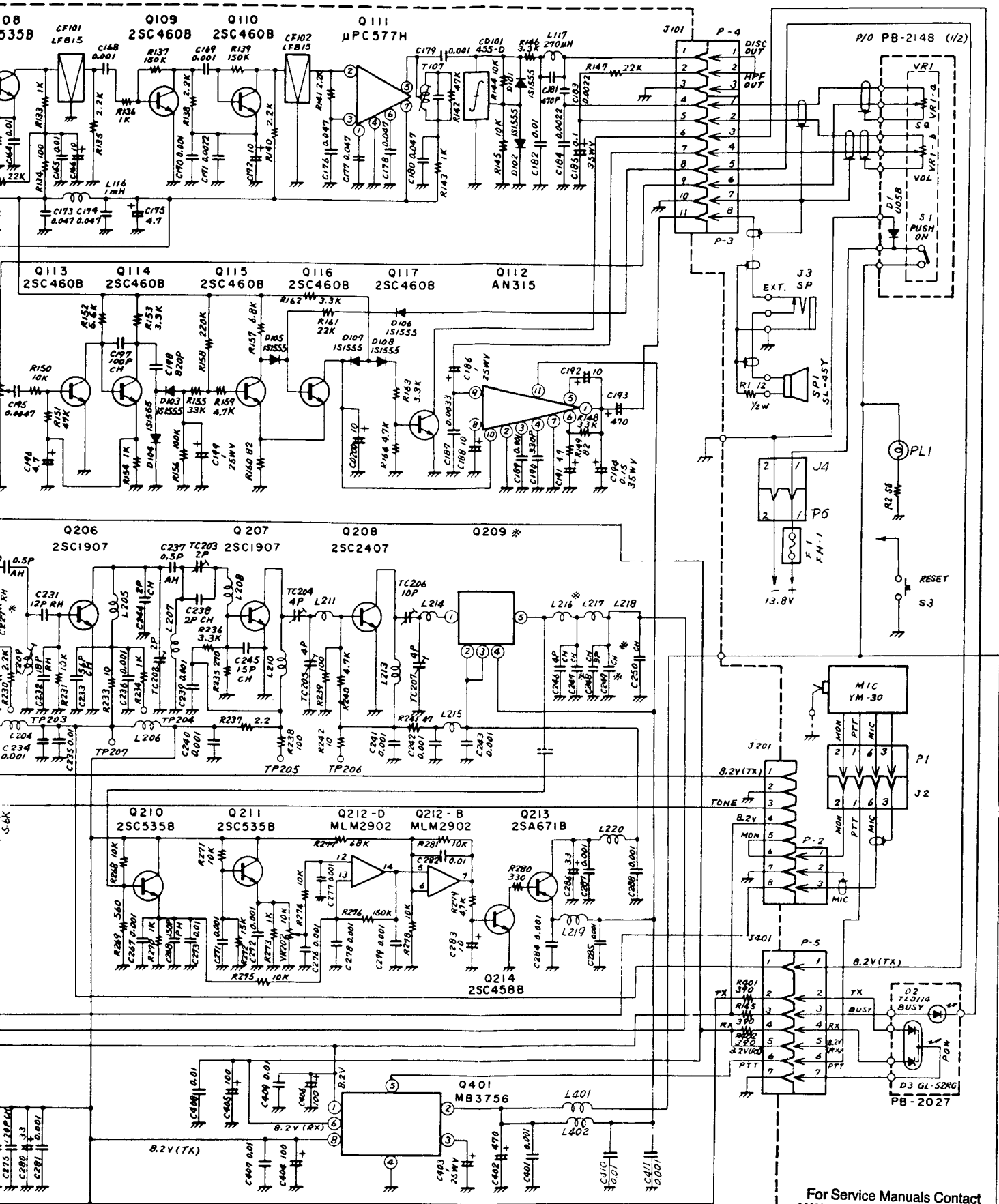


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NOTES

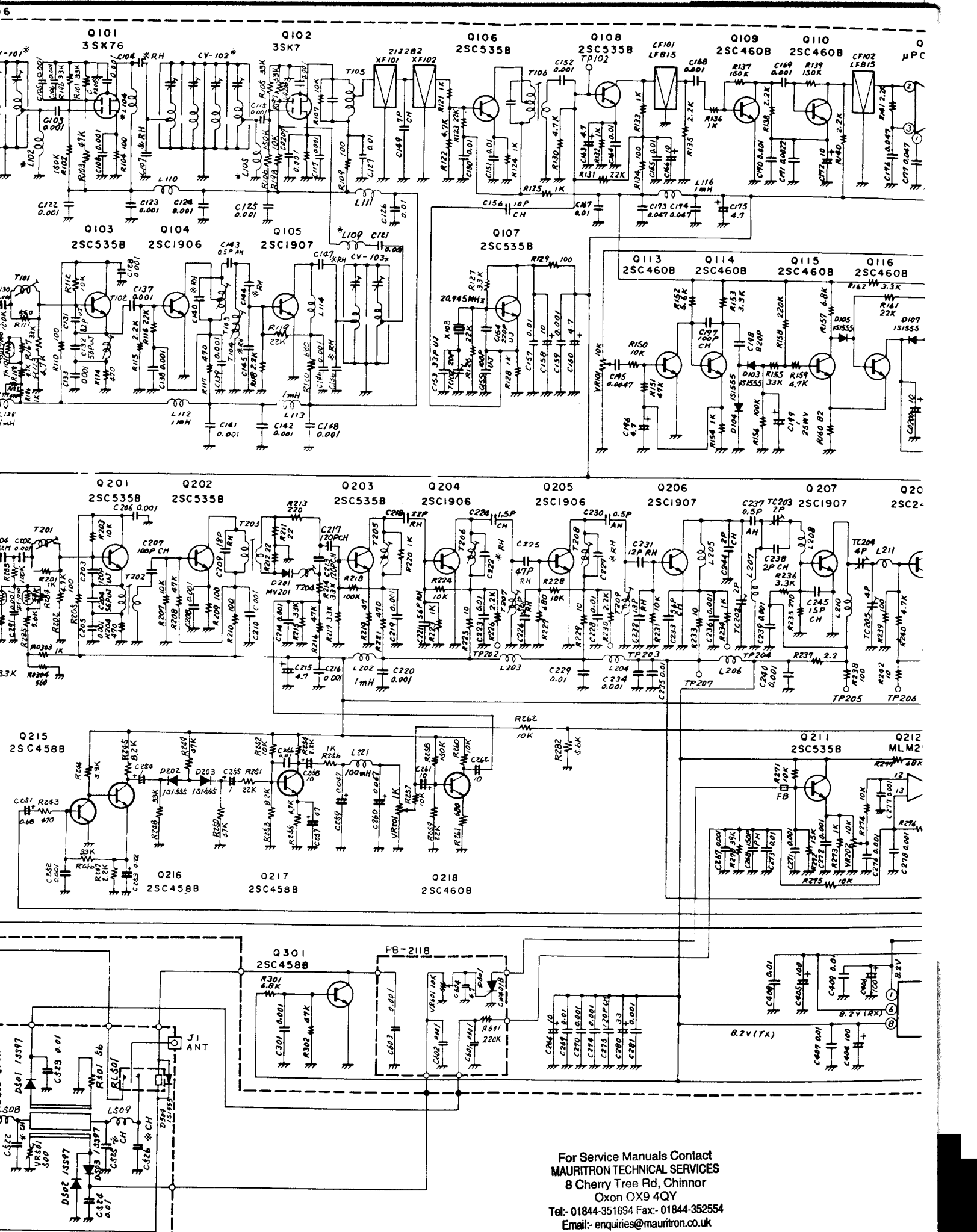
1. ALL RESISTORS IN Ω 1/4W \pm 10% UNLESS OTHERWISE NOTED
2. ALL CAPACITORS IN μ F 16WV

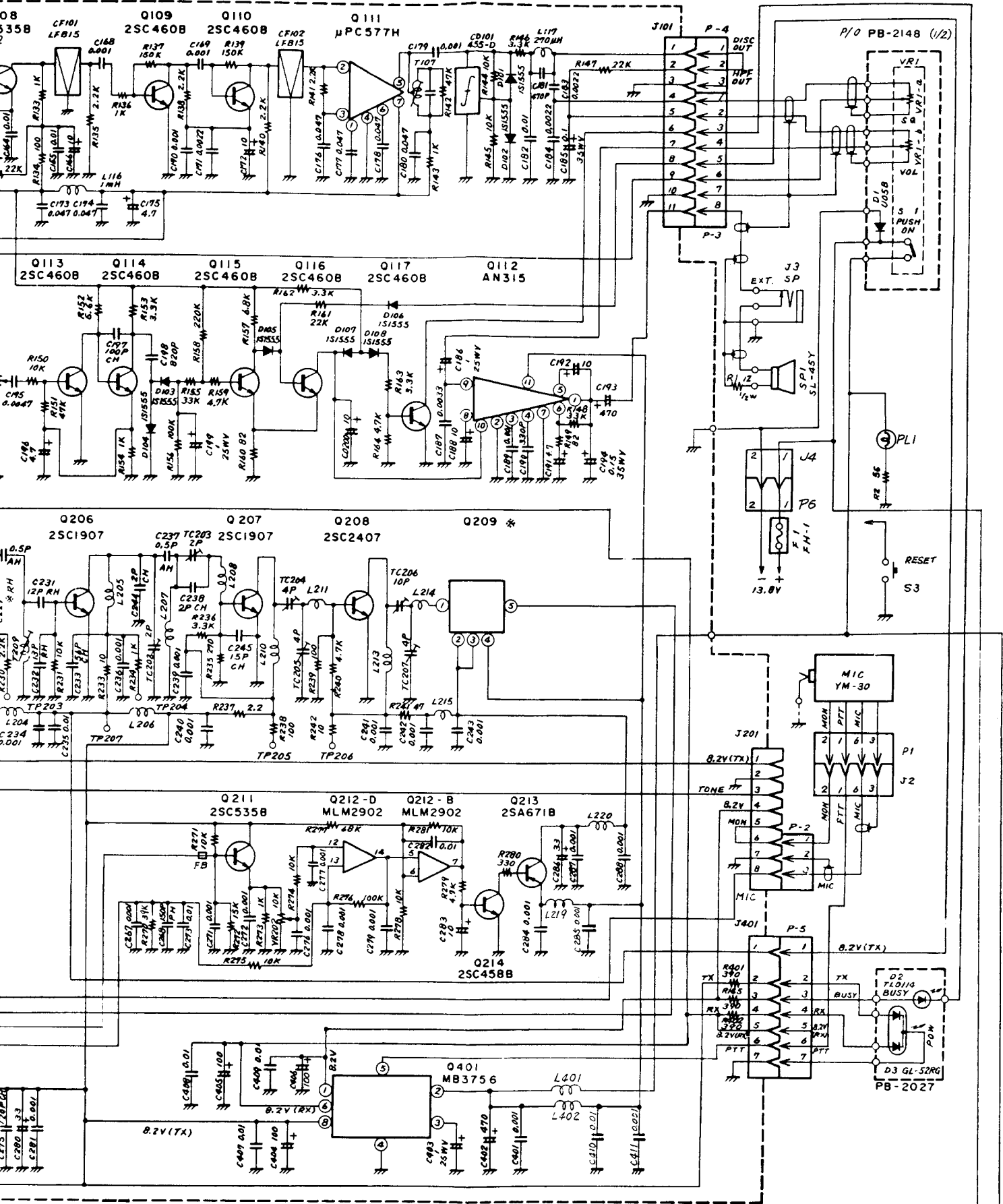


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- NOTES
1. ALL RESISTORS IN Ω / μ W $\pm 10\%$ UNLESS OTHERWISE NOTED
 2. ALL CAPACITORS IN μ F / μ WV

FTC-4610
CIRCUIT DIAGRAM





- NOTES
1. ALL RESISTORS IN Ω 1/4W 10% UNLESS OTHERWISE NOTED
 2. ALL CAPACITORS IN μ F 16V UNLESS OTHERWISE NOTED
 3. * COMPONENT SEE BAND TABLE

FTC-4625
CIRCUIT DIAGRAM