MAINTENANCE SERVICE MANUAL FT-180/180A

YAESU MUSEN CO., LTD.
C.P.O. BOX 1500
TOKYO, JAPAN

YAESU U.S.A.
17210 Edwards Rd.
Cerritos, California 90701
U.S.A.

CONTENTS

PREFACE

The purpose of this manual is to provide the reader with information critical to the maintenance and repair of the FT-180/180A transceiver, as well as information useful for understanding its functions and operation more thoroughly. Technical explanations are geared toward providing a clear understanding of the overall system design, rather than attempting to cover many specific circuit details. Therefore descriptions have been kept brief, although photographs and drawings are utilized liberally.

Use of this manual is entirely at the owner's risk. The FT-180/180A uses high quality components and a design and construction intended to last a long time without the need for alignment or servicing. Should the reader discover any errors in this manual, however, we invite any corrections; although Yaesu can not assume liability for damage which may occur when this manual is used as a reference.

Your attention to the note below is requested.

Yaesu Musen Company, Ltd.
Tokyo

YAESU
FT-180/180A
HF SSB SOLID STATE TRANSCEIVER

GENERAL DESCRIPTION

The FT-180/180A is a rugged, compact SSB transceiver for base or mobile HF applications. Designed to provide a typical PEP power output of 10, 50 or 100 watts over the 1.6 to 18 MHz range, the FT-180/180A employs modern FET and bipolar technology for state-of-the-art performance and reliability.

As many as 6 channels may be installed in the FT-180/180A. Once installation is completed, no further tuning procedure is required for full operation on each channel. The FT-180/180A is packaged in a heavy gauge metal case for excellent mechanical stability, and the final amplifier transistors are fully protected against possible damage from high antenna SWR.

SPECIFICATIONS

GENERAL

Frequency coverage:
1.6 – 18 MHz (except for ±1 MHz near the 10.7 MHz IF)

Emission type:
J3E (USB, LSB), H3E (AM)
(LSB filter optional)

Number of channels:
6 simplex or 3 semi-duplex

Operating temperature range:
−10°C to +50°C

Power requirements:
13.4 volts DC ±10% negative ground

Power consumption:
20 amps transmit,
1 amp receive (100W w/o oven ±10 PPM type)

Case size:
100W type: 95(H) x 240(W) x 310(D) mm
50W type: 95(H) x 240(W) x 290(D) mm
10W type: 95(H) x 240(W) x 260(D) mm

Weight:
100W type: 6 kg.
50W type: 5.5 kg.
10W type: 5.0 kg.

TRANSMITTER

Power output:
As per power amplifiers
SSB – 100 watts; AM – 35 watts
SSB – 50 watts; AM – 17 watts
SSB – 10 watts; AM – 3.5 watts

Unwanted sideband suppression:
Better than 50 dB

Carrier suppression:
Better than 50 dB

Spurious emissions:
Better than 65 dB down

Third order distortion products:
Better than 31 dB down

Transmitter frequency response:
300 – 2700 Hz (−6 dB)

Maximum bandwidth:
3 kHz (SSB)

Stability:
Better than ±10 ppm

Distortion products:
−20 dB or better

Microphone impedance:
600 ohms (dynamic)

Tone signal:
1500 Hz

Antenna output impedance:
50 ohms nominal

RECEIVER

Sensitivity:
SSB better than 1 μV for 20 dB S/N
AM better than 10 μV for 20 dB S/N

Selectivity:
SSB 2.4 kHz at −6 dB, 4.0 kHz at −60 dB
AM 6.0 kHz at −6 dB, 12 kHz at −50 dB

Receiver type:
Single superheterodyne

Intermediate frequency:
10.7 MHz

IF rejection:
Better than 60 dB

Image rejection:
Better than 60 dB

Audio output power:
2 watts @ 10% THD

Audio output impedance:
4 ohms

Specifications subject to change without notice.

AKH9TUFT-180A
FCC Rule Part No. 21.900(K)
74.402(D), 81, 83, 87 & 90

SEMICONDUCTORS

Integrated Circuits (IC):

AN6551	1	
ICL7660CPA	1	
MC1496P	1	
MC14016BCP	1	
MC14572UB	1	
μPC151A	1	
μPC2002V	1	
μPC7808H	1	***
μPC78L08	2	* **
	1	***

Field Effect Transistors:

2SK192AGR	3	
2SK125	4	
3SK73GR	9	

Transistors:

2SA564Q	2	
2SA564R	1	
2SC496Y	1	***
2SC732GR	2	
2SC732BL	1	
2SC1583	3	
2SC1589	1	* **
2SC1815Y	16	
2SC1815GR	2	
2SC1815BL	1	
2SC1923R	3	
2SC1959Y	2	
2SC2166	1	***
2SC2290	2	* **
2SC2395	2	* **
2SC2407	2	
2SC2509	2	***
2SD288K	1	* **
2SD717O	2	
2SD844K	1	

Diodes:

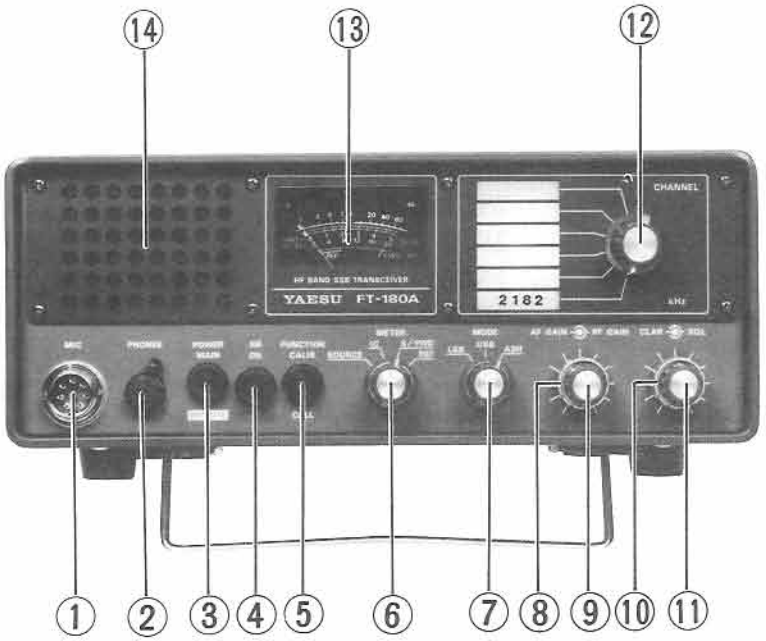
1N270	17	
1S1555 (Si)	17	
1S2208 (Varactor)	1	
1SS53 (Si)	27	
1SS97 (Schottky barrier)	22	
1N60 (Ge)	9	
10E1 (Si)	14	
10D10 (Si)	4	* **
BZ140 (Zener)	1	
HZ5C-1 (Zener)	2	
HZ9C1 (Zener)	1	
HZ3C1 (Zener)	1	* **
	(2)	***
FC63 (Varactor)	1	

* 100W model
** 50W model
*** 10W model
( ) with crystal oven

ACCESSORIES

Microphone (M3090026)	(YM-36)	1
DC Power Cord		1
10W model	(T9006806)	
50W model	(T9006815)	
100W model	(T9006820)	
Miniature External Speaker Plug (P2240) (P0090034)		1
Headphone Plug (P0090007)	(SH3010)	1
Accessory Plug		
FT-180 (P1090164)	(FM-148P)	
FT-180A (P0090078)	(SC-12CM)	
Coaxial Antenna Plug (P0090021)	(MP-5)	1
Spare Fuse		1
10W model	6A (Q0000012)	
50W model	15A (Q0000008)	
100W model	20A (Q0000009)	
Remote Control Plug (P0090128)	(P-1620BA-CA)	1

FRONT PANEL CONTROLS AND SWITCHES



(1) MIC

This eight-pin connector accepts the microphone input, as well as push-to-talk control (PTT) line. The microphone input impedance is 600 ohms.

(2) PHONES

This is a standard phone jack for accommodation of the headphone plug. Audio output impedance is 8 ohms. Insertion of the headphone plug into this jack automatically disconnects the internal speaker.

(3) POWER ON/OFF (REMOTE . . . FT-180A)

This is the main ON/OFF switch for the transceiver and accessories, when used. The FH-180 Remote Controller is only switched on when this switch is set to the REMOTE (lower) position. The FC-420 Remote Controlled Antenna Coupler and/or optional crystal oven are switched on in either the ON (upper) or REMOTE position.

(4) NB

This switch activates the noise blanker.

(5) FUNCTION CALIB/CALL

This is a momentary switch used for sending tone calling signals, as well as for calibrating the transceiver for incoming signals.

(6) METER

This switch selects the display function for the front panel meter. On receive, this meter functions as a signal strength meter (S-meter). On transmit, the source voltage, final amplifier collector current, relative power output or reflected power can be displayed.

(7) MODE

This switch selects the operating mode: LSB, USB (J3E) or AM (H3E) (LSB filter optional). Do not operate this switch while transmitting.

(8) RF GAIN

This is a manual gain control for the RF and IF stages of the receiver. Counterclockwise rotation decreases the RF and IF gain.

(9) AF GAIN

This control sets the audio output (volume) level for the receiver. Clockwise rotation increases the volume level.

(10) SQL

The squelch control quiets the receiver when no signals are being received. This control should be set to the point where the background noise just disappears, in order to retain maximum sensitivity.

(11) CLAR

This control allows fine tuning of the signal received, for precise tracking of unstable or off-frequency signals.

(12) CHANNEL

This switch selects the operating channel. Do not operate this switch while transmitting.

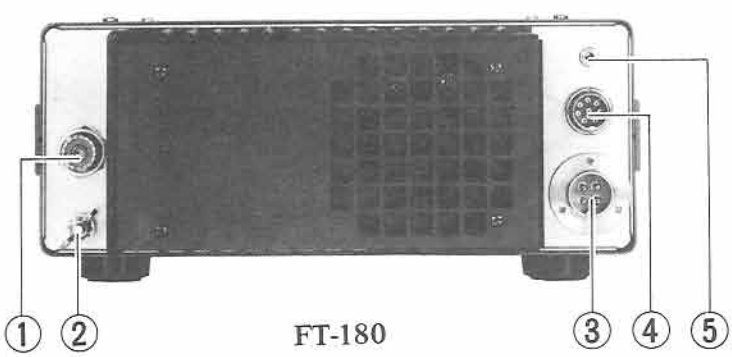
(13) METER

This is the front panel S-meter, FWD/REF PO meter, IC meter and source voltage meter.

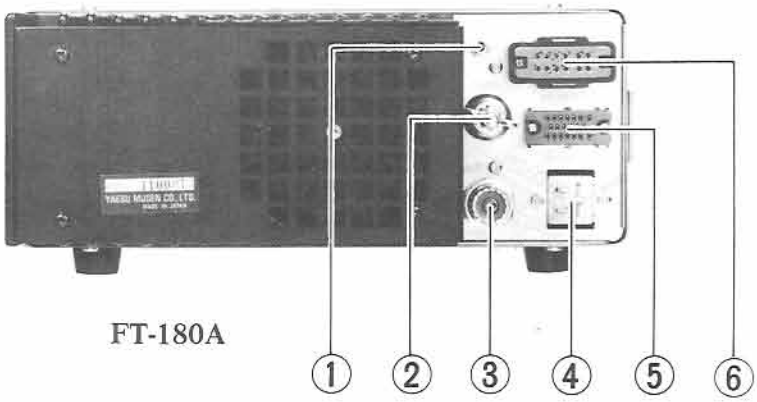
(14) SPEAKER

This is the grill for the internal speaker.

REAR PANEL CONNECTIONS



FT-180



FT-180A

(1) EXT SP (FT-180A)

This is the external speaker output jack. Insertion of a plug into this jack automatically disconnects the internal speaker.

(2) GND

For best performance and safety, a good ground should be connected at this point.

(3) ANT (FT-180A)

This SO-239 jack accepts the antenna cable connector.

(4) POWER (FT-180A)

Connect the DC power cord at this point. Never apply AC power or improper DC input voltages to this transceiver.

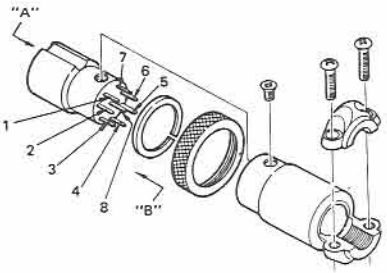
(5) REMOTE (FT-180A)

This blue, 20-pin connector accepts the power and control signals from the optional FH-180 Remote Controller, which provides remote control of the CHANNEL selector, AF GAIN and CLAR functions, as well as microphone input and audio output from a telephone handset and/or speaker. However, to use the FH-180, certain modifications must be made within the FT-180A, the details of which are described on page 42.

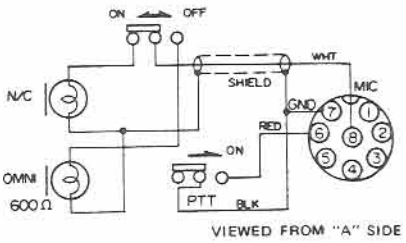
(6) ANTENNA COUPLER (FT-180A)

This 12-pin connector provides power and channel switching control signals for the optional FC-420 Remote Controlled Antenna Coupler, which will then match the antenna impedance for each channel as selected by the FT-180A or FH-180 CHANNEL selector.

YM-36



MICROPHONE/ACC PLUG

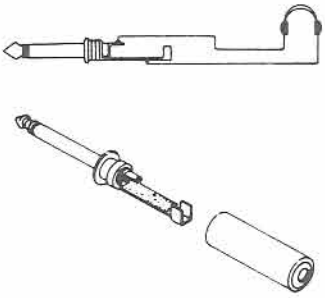


YM-36 MICROPHONE CONNECTIONS

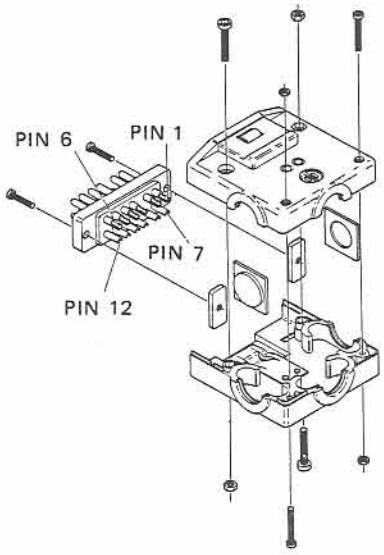
VIEWED FROM "B" SIDE

PIN		
	1	CH 6 GND
	2	CH 5 GND
	3	CH 4 GND
	4	CH 3 GND
	5	CH 2 GND
	6	CH 1 GND
	7	GND
	8	+12V

ACC PLUG CONNECTIONS (FT-180)

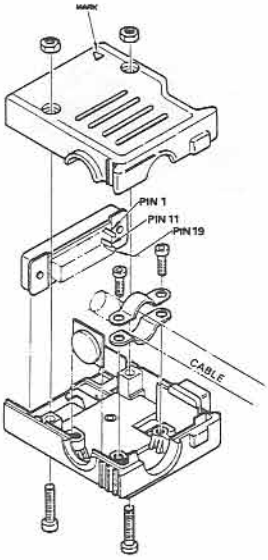


HEADPHONE CONNECTIONS



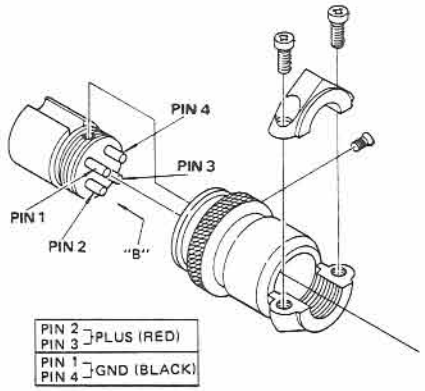
PIN		
	1	CH 1
	2	CH 2
	3	CH 3
	4	CH 4
	5	CH 5
	6	CH 6
	7	CH 7
	8	CH 8
	9	CH 9
	10	CH 10
	11	N.C
	12	+12V

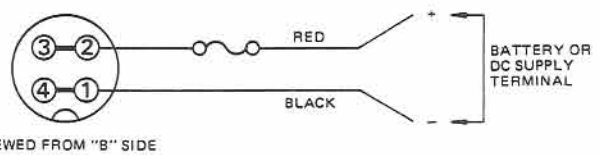
ANTENNA COUPLER PLUG CONNECTION



PIN		
	1	+13.4V
	2	+8V
	3	CLARI
	4	MIC OUT
	5	GND
	6	GND
	7	AF IN
	8	PTT
	9	CALL
	10	TONE
	11	N.C
	12	N.C
	13	N.C
	14	BAND SW A
	15	BAND SW B
	16	BAND SW C
	17	BAND SW D
	18	GND
	19	GND
	20	POWER

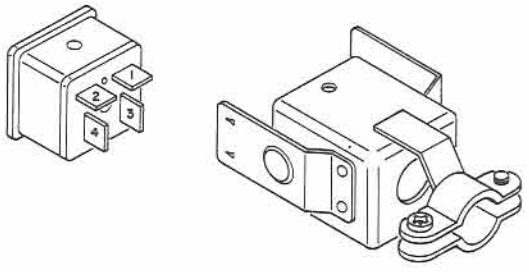
REMOTE PLUG CONNECTION (FT-180A)

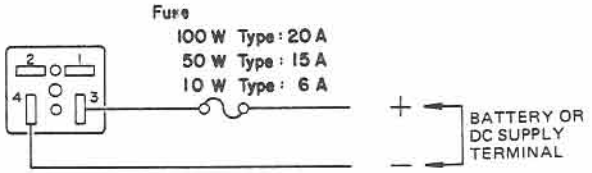




VIEWED FROM "B" SIDE

FT-180





FT-180A

DC POWER CORD CONNECTIONS

INSTALLATION

ANTENNA CONSIDERATIONS

Next to the transceiver, the antenna is the most important component in a successful communications station, as the communication range is directly related to the efficiency of the antenna. Therefore, great care should be taken in the installation of the antenna system.

If a proper antenna is not otherwise available, see your Yaesu dealer for a specially factory adjusted YA-10 single band dipole antenna, YA-11 dual band dipole antenna, or RSL series antenna (for mobile installations). These antennas are capable of meeting most requirements.

The FT-180/180A requires a load impedance of 50 ohms at the operating frequency. If the load impedance differs greatly from this figure, the final amplifier protective circuit will cause the power output to decrease. If this impedance cannot be secured on all desired channels an antenna tuner must employed in order to provide a 50 ohm load impedance for the transmitter.

The following section will describe two common types of antennas which satisfy the impedance requirement of the FT-180/180A.

(1) Doublet Antenna

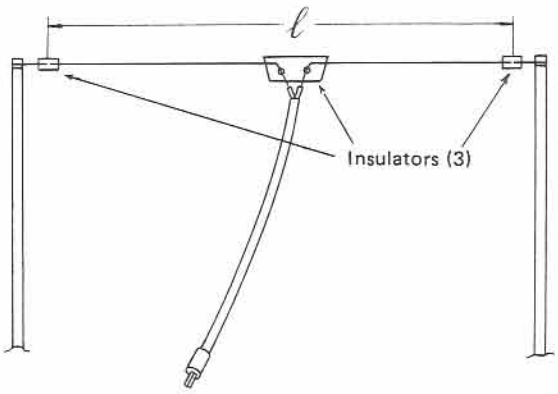
The Doublet, or Dipole antenna consists of a half-wavelength of wire, cut into two equal sections and fed at the center. At this feeding point, an antenna balun may be utilized to prevent unwanted radiation from the coaxial cable. Maximum radiation exists at right angles to the wire. Ceramic insulators should be installed on both ends of the antenna, and a suitable center insulator must also be used. However, some types of antenna baluns include mounting hooks for the antenna elements, thus eliminating the need for a center insulator. These parts may be obtained from your Yaesu dealer. The correct length for a doublet or dipole antenna can be determined by using one of the following formulas:

$$\text{Length} = \frac{468}{\text{Freq (MHz)}} \text{(feet)}$$

$$\text{Length} = \frac{142.5}{\text{Freq (MHz)}} \text{(meters)}$$

Cut the appropriate length of wire (allowing some extra length for fastening) into two equal pieces. Tie one end of each to a ceramic insulator, and connect the other ends to the antenna balun (or center insulator). Connect the coaxial feedline (type RG8A/U or equivalent) to the antenna balun. If an antenna balun is not being used, connect the center conductor of the coaxial feedline to one side of the center insulator's wire, and connect the shield of the coaxial line to the other side of the center insulator (there is no direct connection of one half of the dipole to the other). The far ends of the wire elements may then be secured, using nylon rope tied to the insulators. Using supporting poles, hoist the antenna as high an in the clear as possible.

Check to see that the SWR is less than 1:1.5 at the operating frequency. If so, the installation is complete. The dipole antenna works best if it is placed high and in the clear, so use the highest support possible. When building the supports, remember that they should form a line perpendicular to the line representing the shortest distance to the station with which communication is desired.



Doublet Antenna

(2) Quarter Wave Wire Antenna

Usually constructed in a vertical configuration, the quarter wave antenna is sometimes used in base station installations. However, it is more commonly used on ships or yachts, especially when the space for a doublet antenna is not available. The length of the quarter wave antenna can be determined by using one of the following formulas:

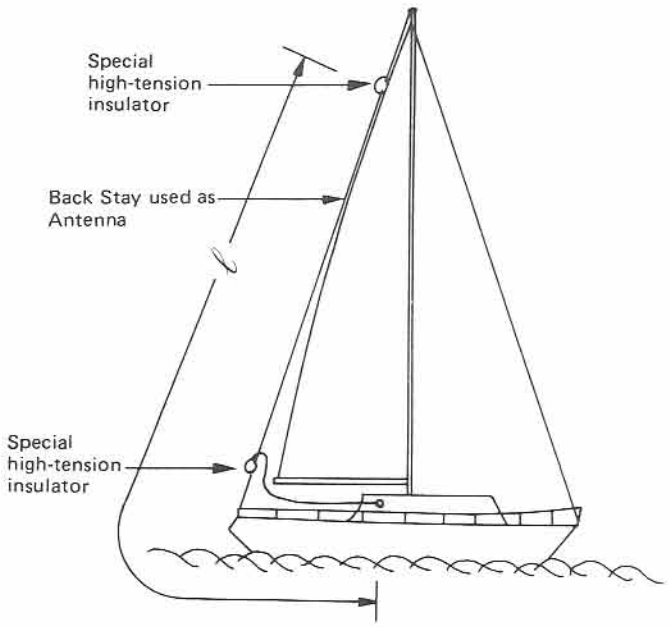
$$\text{Length} = \frac{234}{\text{Freq (MHz)}} \text{ (feet)}$$

$$\text{Length} = \frac{71.25}{\text{Freq (MHz)}} \text{ (meters)}$$

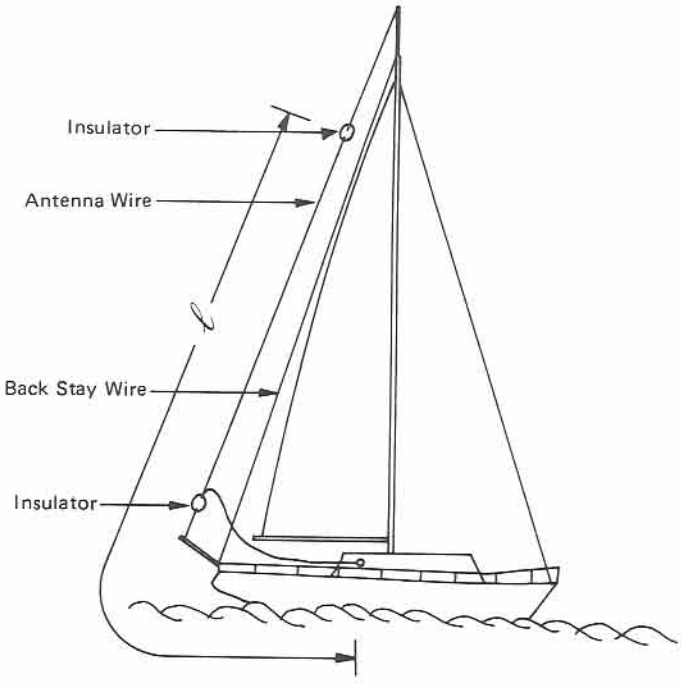
The wire has one end connected to a ceramic insulator, which is, in turn, hoisted up a non-metallic mast. The other end of the wire is connected to the center conductor of the coaxial cable. For base station installations at the higher frequency channels, the vertical element may be made of aluminum tubing (self-supporting).

The shield of the coax is connected to a good RF ground. The ground system may consist of six to twelve wires 3% longer than the radiator, extending radially from the center of the antenna and buried slightly beneath the surface of the ground. A cold water pipe may provide a usable ground in many instances. On yachts, the ground foil in the hull must be used. The vertical radiator must be insulated from ground, and it should not touch any trees, buildings, etc.

For all antenna types, be certain that the FT-180/180A meter needle, when switched to the PO (REF) position, stays in the GREEN zone of the meter scale while transmitting. If the deflection is outside of the GREEN zone, your antenna must be checked or readjusted for the correct impedance.



Back Stay used as Antenna Element



Antenna Element installed separately

GROUND CONNECTION

The FT-180/180A should be connected to a good earth ground for best performance and safety. Use a heavy braided wire, not more than 3 meters in length, for connection to the station ground bus. The ground connection at the transceiver may be made at the rear panel GND stud.

POWER SUPPLY CONNECTIONS

DC OPERATION

The FT-180A comes equipped for operation from a DC supply. The DC supply should be capable of 20 amperes (100 watt model) for 13.4 volt operation.

Before connecting the power connector to the rear apron, be sure the power supply voltage does not exceed 15 volts. Adjust the power supply voltage, if necessary, to ensure a safe supply level.

A fuse is located in the DC cord for the transceiver. For 13.4 volt operation, a 20 ampere fuse is used. When replacing fuses, be absolutely certain to use a fuse of the proper rating. Before connecting the power connector to the transceiver, verify that a fuse of the proper rating has been installed.

CAUTION

Our warranty does not cover damage caused by the use of incorrect fuses. Unless otherwise specified, proper fuses are as follows:

100 watt model:	20 ampere fuse
50 watt model:	15 ampere fuse
10 watt model:	6 ampere fuse

Connect the RED power supply lead to the POSITIVE supply post, and connect the BLACK power supply lead to the NEGATIVE supply post. The DC cord is included with the transceiver.

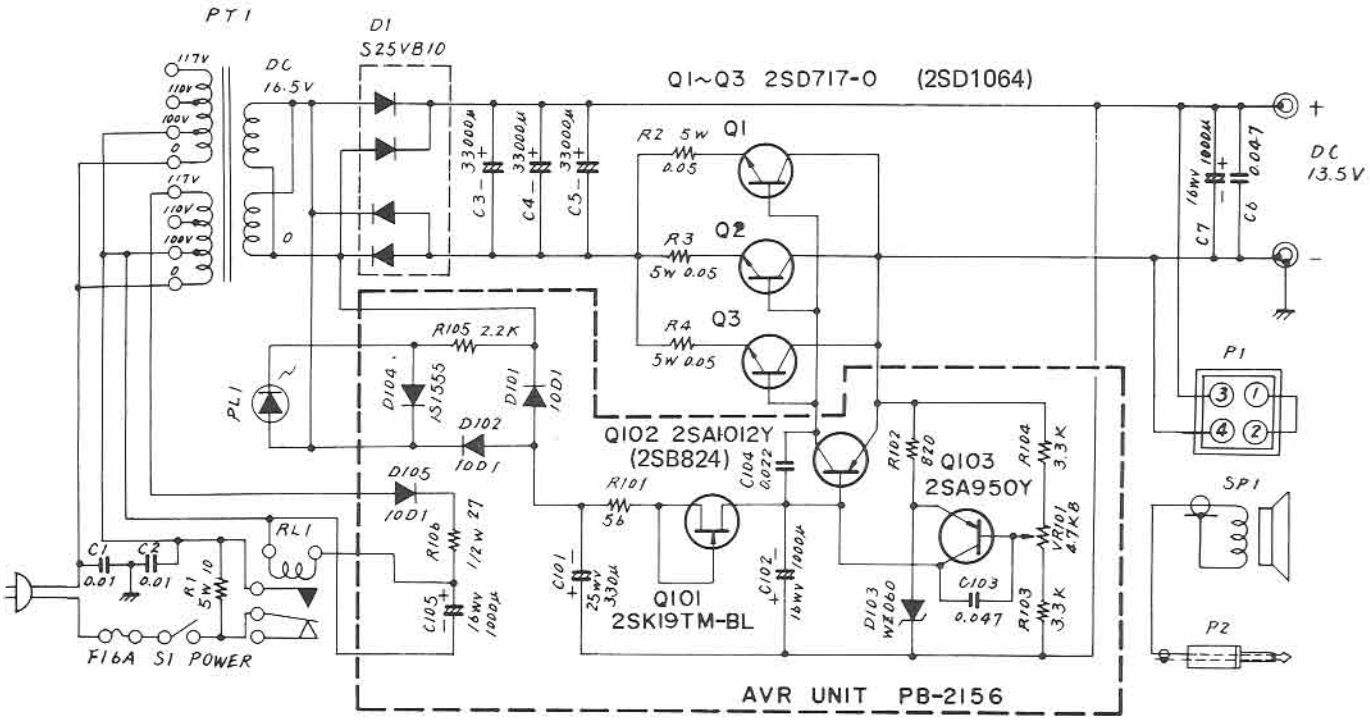
AC OPERATION

The FP-700 will allow operation from AC supply voltages of 100/110/117/200/220/234 volts, 50/60 Hz. Before commencing operation with the FP-700, be absolutely certain that the voltage specification marked on the rear of the FP-700 is the same as your local AC supply voltage. Do not connect the FP-700AC cord to a DC supply. Also, be certain that a fuse of the proper rating is in use. For 100/110/117 volt operation, use a 6 ampere fuse in the FP-700. For 200/220/234 volt operation, use a 3 ampere fuse.

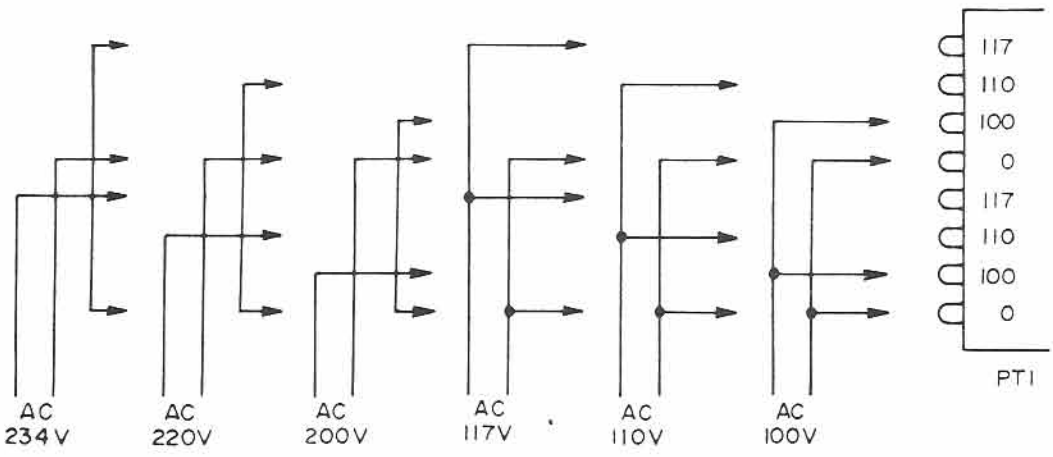
CAUTION

Our warranty does not cover damage caused by improper power supply connections, nor damage caused by the use of an incorrect fuse.

When all voltage inspections have been completed, connect the FP-700 output voltage cable to the FT-180A rear panel POWER jack. Plug the FP-700 power cord into the wall outlet. AC installation is now complete.



FP-707
CIRCUIT DIAGRAM



POWER TRANSFORMER PRIMARY CONNECTIONS

MOBILE INSTALLATION

A DC cable for mobile installation is included with the transceiver. If the DC cable needs to be extended, a heavy, low resistance cable must be used to avoid excessive voltage drop in the cable.

For under-dash mounting, a special mobile mounting bracket is available from Yaesu dealers. This bracket, model MMB-2 (or MMB-16), allows easy mobile installation of the FT-180A.

The FT-180A should be mounted where there is adequate space around the heat sink to allow free circulation of air. Allow a space of about 20 cm behind and around the heat sink, and do not position the transceiver directly in the path of the heater ducts.

When making battery connections, be absolutely certain that the proper polarity of the power cord is observed.

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.

Power connections should be made directly to the battery instead of to the ignition switch. The battery provides considerable filtering against ignition noise, while connection to the ignition switch can place the FT-180A in a noise-producing circuit. The power leads must be kept as short as possible, and should be kept away from ignition cables as much as possible.

When making battery connections, be certain to connect the RED power cable lead to the POSITIVE (+) battery terminal, and the BLACK lead to the NEGATIVE (–) terminal.

Before connecting the DC cable to the transceiver, check the battery voltage with the engine running fast enough to show a charge on the vehicle's ammeter, or immediately after starting the engine. If the voltage exceeds 15 volts, the automobile voltage regulator should be adjusted, so as to limit the maximum voltage to less than 15 volts.

This transceiver should not be operated from a power source of less than 12 volts. The transceiver should always be turned off when the car is started, to prevent transients in the automobile electrical system from damaging the transistor circuitry of the FT-180A.

CAUTION

Be certain to observe proper polarity of the power cord when making connections to the vehicle battery.

FT-180/MMB-2

MMB-2
MOBILE MOUNT INSTALLATION

1. Listed below are the parts included in the MMB-2 kit. Only the parts shown with an asterisk (*) are required for FT-180/180A installation.

*1)	Universal bracket MMB-2		1
2)	Catch chip	(S5000038)	2
3)	Right (90°) angle hinge	(R0061920)	2
*4)	Knob screws		8
5)	Screws for the catch clip	(M3x4)	4
6)	Screws for right-angle hinge	(M3x6)	4
*7)	Screws for the MMB-2	(M5x10)	4
*8)	Lock washers for the MMB-2		4
*9)	Flat washers for the MMB-2		4
*10)	Nut for the MMB-2		4

2. Use the universal mounting bracket as a template for positioning the mounting holes. Use a 3/16" diameter bit for drilling these holes, allowing enough room for the transceiver, its cables, microphone and controls. Secure the mounting bracket with the screws, washers and nuts supplied, as shown in the drawing.

3. Using the slotted knob screws, attach the FT-180/180A to the MMB-2 universal bracket.

4. The angle of the transceiver may be adjusted to whatever position is most convenient and easily accessible.

CAUTION

If the FT-180/180A is installed in a car which has an Electronic Fuel Injection carburetor, we strongly recommend that the FT-180/180A be installed as far away as possible from any equipment related to the carburetor located within the passenger compartment.

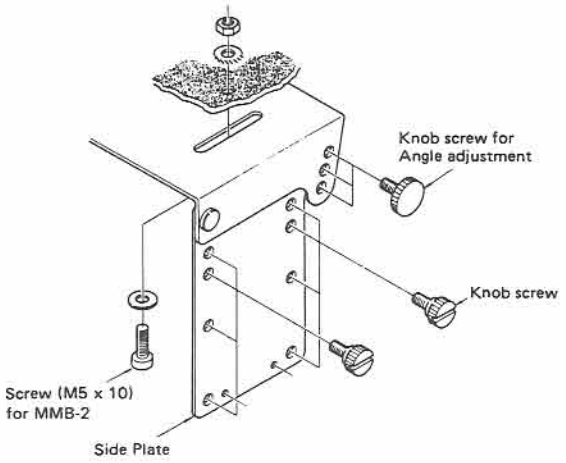


Figure 1

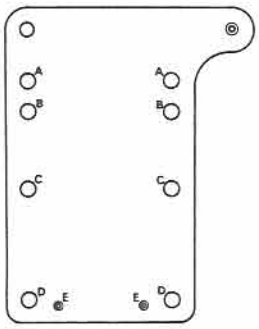
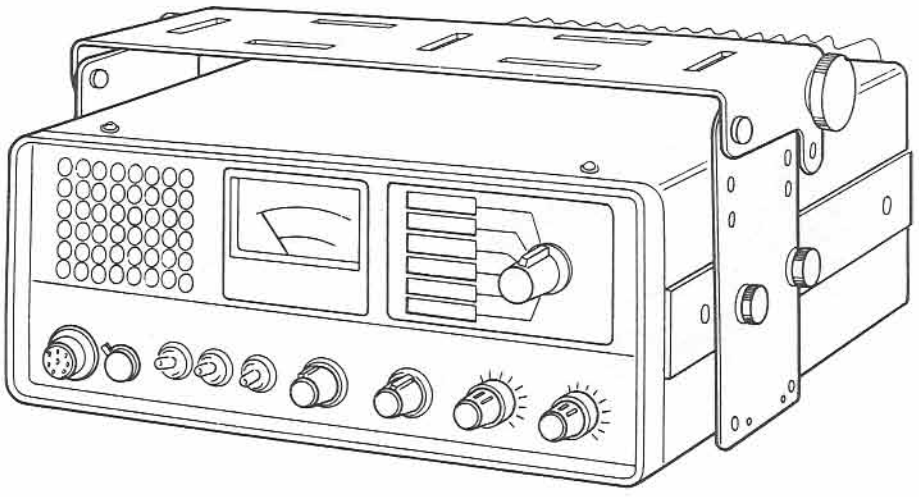


Figure 2



MMB-16
MOBILE MOUNT INSTALLATION

1. Note that the FT-180/180A have three mounting holes in each side, only two of which are used for mobile mounting. Select which two holes to use according to the desired distance that the equipment is to project forward of the bracket in the final mounting position.

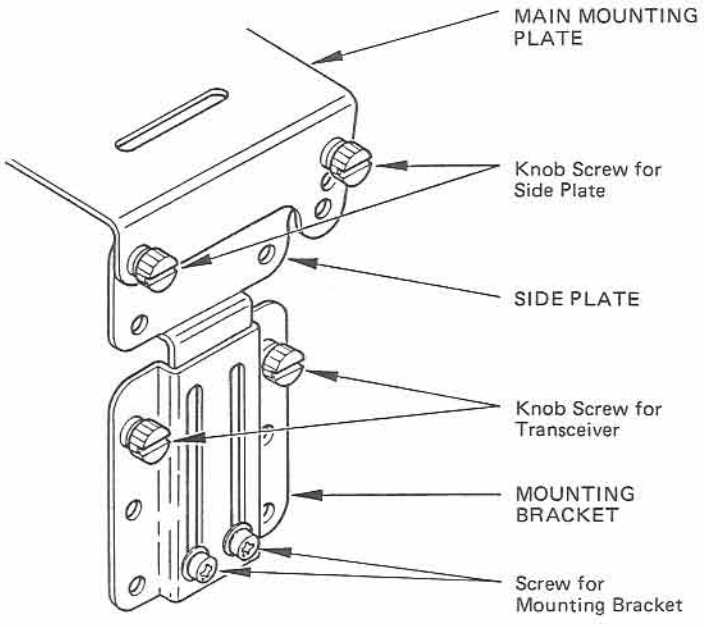
2. Preassemble the slotted mounting brackets to the side plates using the four small screws. If installing an amateur transceiver only, the mounting brackets are not needed.

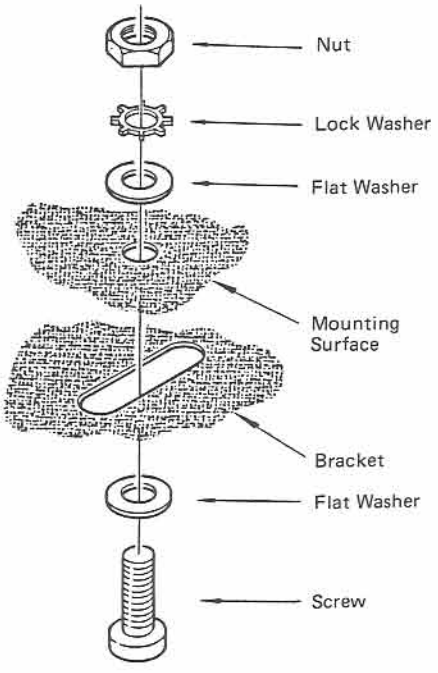
3. Bolt the side plate/bracket assemblies to the transceiver using the upper holes in the mounting brackets.

4. Temporarily bolt the main mounting plate to the side plates, and determine the proper mounting location in the vehicle. This must allow for several inches of clearance around the heat sink, and sufficient clearance for all cables (front and rear) and controls. In general, the FT-180/180A is designed to function properly regardless of the mounting position, but it should not be mounted directly in the path of the vehicle heater vents, nor where it could interfere with driver vision or vehicle operation.

5. Now remove the main mounting plate, and use it as a template to locate the mounting holes on the vehicle. Use a 3/16 inch (4.8mm) bit for drilling the holes.

6. Affix the main mounting plate to the vehicle as shown in the diagram, and then finally affix the side plates, with the equipment affixed, to the main mounting plate. Notice that there are three possible positions for the rear bolt, allowing several choices of mounting angle.





FH-180 REMOTE CONTROLLER INSTRUCTIONS

The FH-180 Remote Controller is specifically designed for use with the FT-180A HF Transceiver, after the Transceiver has been appropriately modified. A ten meter cable is supplied with the FH-180 to allow complete control of the FT-180A from any convenient location, and the FC-420 Remote Antenna Coupler, when used with the FT-180A, is also controlled by the FT-180. The part number of the Modification Kit required for the FT-180A is D3000266, and the procedure is given on page 3-16.

Specifications

Power requirements:
13.4 VDC at 1 A, and 8 VDC at 50 mA (supplied by the FT-180A)

Functions:
Power ON/OFF, Channel selection, AF gain control, Clarifier adjustment, Tone CALL, Microphone input, Receiver output (from Handset and Speaker), PTT (Push-To-Talk)

AF Output:
Speaker; 2 W (4 ohms)
Handset earpiece; 0.2 W (4 ohms)

Handset Microphone:
–68 dBm output (600 ohms)

Dimensions (WHD):
80 x 120 x 240 mm

Weight:
1.4 kg.

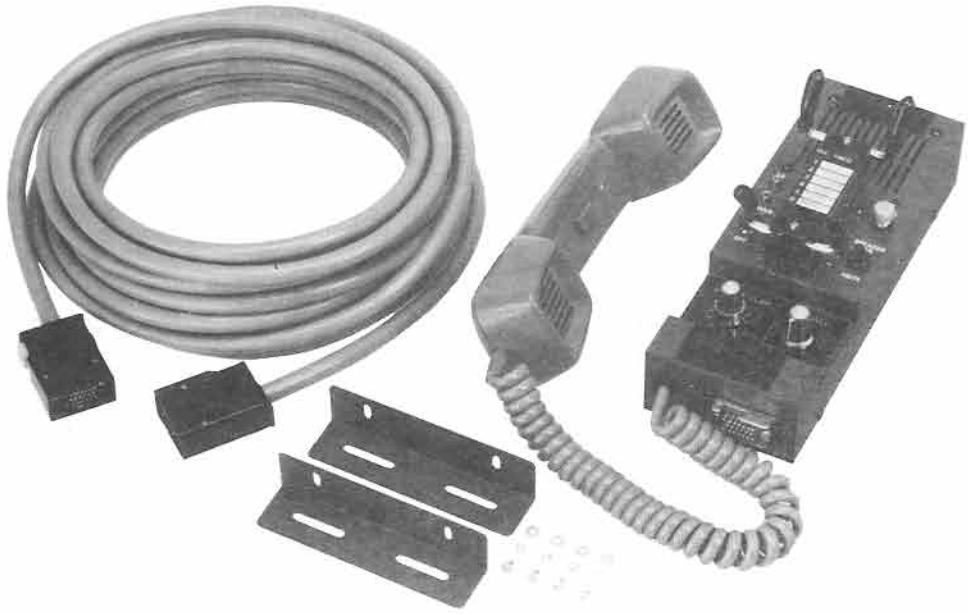
Installation

The FH-180 can be installed in any desired mounting position, and on any surface.

1. The supplied mounting brackets can be positioned so that the mounting screws are either under the Controller, or on either side, according to individual requirements. If the mounting screws are to be located underneath the Controller, temporarily bolt the brackets to the Controller and hold it in the mounting position while marking the positions of the brackets on either side. Then remove the brackets from the Controller and use the brackets as templates for locating and drilling the mounting holes.

2. If the channel frequencies are not already shown on the channel plate beneath the handset, write the frequencies on the label paper and install it under the channel plate.

3. After the FT-180A has been modified, connect the female connector on the Controller Cable to the FH-180, and the male connector to the REMOTE jack on the modified FT-180A.



Operation

Set the POWER switch on the FT-180A to the REMOTE position, and set the FH-180 POWER switch to ON. The green lamp will light.

Select the desired channel using the CHANNEL selector on the FH-180. Set the SPEAKER switch to ON, and adjust the AF GAIN control for the desired volume level. This control and the AF GAIN control on the FT-180A function independently, so that only the control on the transceiver will affect the speaker in the transceiver, and only the control on the FH-180 will affect the volume from the FH-180 speaker or earpiece.

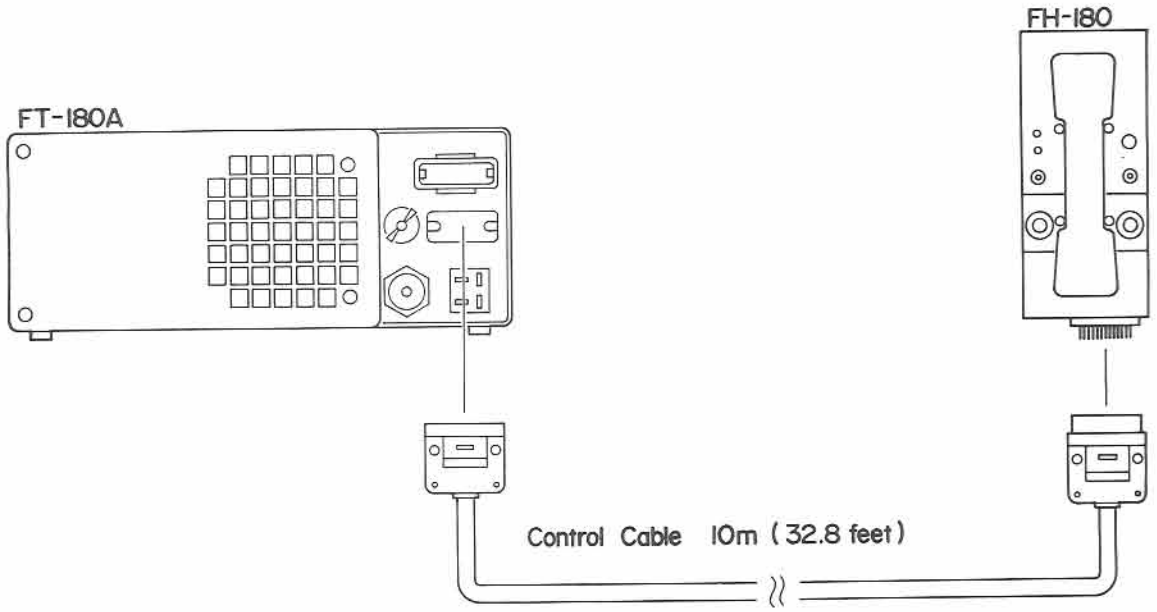
When privacy is desired, communications may be conducted only through the handset. To disable the FH-180 speaker, set the SPEAKER switch to the MUTE position. This will silence the FH-180 speaker when the handset is removed from the cradle, though the speaker will be reactivated when the handset is replaced.

To transmit when using the FH-180, squeeze the PTT switch on the inside center of the handset handle, and talk. Release this switch to return to receive.

The CALL and CLAR controls on the FH-180 function identically to their counterparts on the FT-180A.

NOTE

The handset must always be pressed snugly into the cradle when not in use. Otherwise the FH-180 speaker will be disabled if the SPEAKER switch is set to the MUTE position, and incoming calls may not be heard.



OPERATION

(1) Make certain that all power supply and ground connections have been correctly made.

(2) Connect a 50-ohm antenna for the desired operating frequency to the rear panel ANT jack.

(3) Insert the microphone plug into the front panel MIC jack. If a non-standard microphone is used, be sure that the microphone has an impedance of 600 ohms. Connect your headphones, if used, to the front panel PHONE jack.

(4) Refer to the CAUTION notice on this page, and preset the controls and switches as follows:

MODE	To desired mode
AF GAIN	Adjust later to comfortable level
RF GAIN	Fully clockwise
METER	S/FWD
CLARIFIER	12 o'clock position
CHANNEL	Desired channel
SQL	Fully counterclockwise

(5) Turn the POWER switch ON. The panel lamps and indicators should become illuminated.

(6) Adjust the AF GAIN control to a comfortable listening level.

(7) Adjust the CLARIFIER control for a natural sounding reproduction of the incoming signal.

(8) Adjust the SQL control to the point where the background noise just disappears when the channel is clear, in order to provide maximum squelch sensitivity.

(9) If pulse-type noise is present on the incoming signal, turn the NB switch ON. Most pulse-type noises will be eliminated by the blanker, although some atmospheric and man-made white noise will not be totally removed.

(10) To transmit, press the microphone push-to-talk switch, and speak with a normal voice into the microphone. Release the switch for receiver recovery.

SELECTIVE CALLING FEATURE

A 1500 Hz tone generator is available for selective calling. Calibration and operation using this feature are simple:

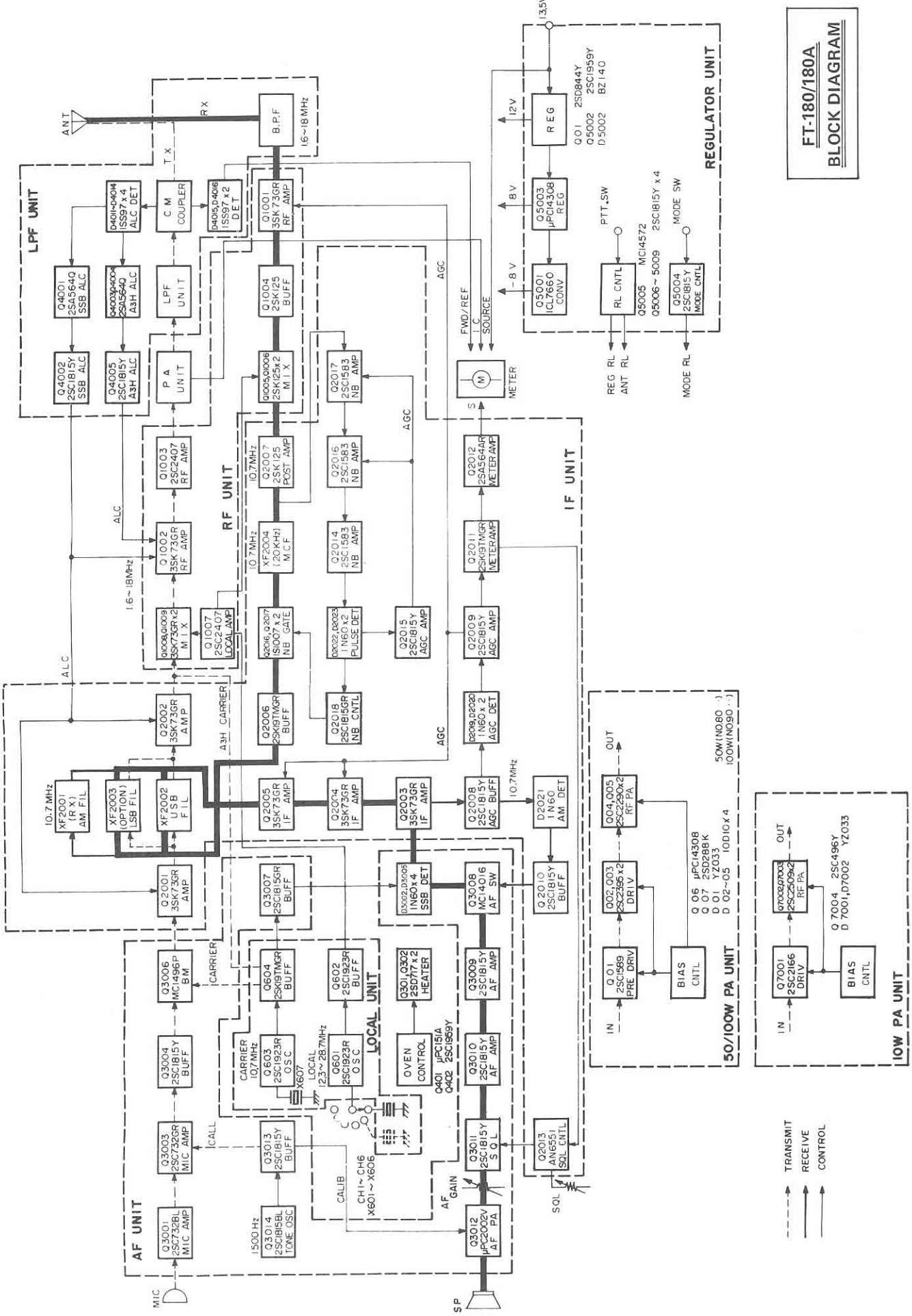
(1) When a 1500 Hz tone is received from another station, set the CALIB/CALL switch to CALIB and rotate the CLARIFIER control so your tone matches that of the incoming signal. Your set is now calibrated to the same frequency as that of the other station.

(2) To transmit the 1500 Hz tone, push the CALIB/CALL switch up to the CALL position. The transmitter will be activated and the 1500 Hz tone sent for as long as you hold this switch.

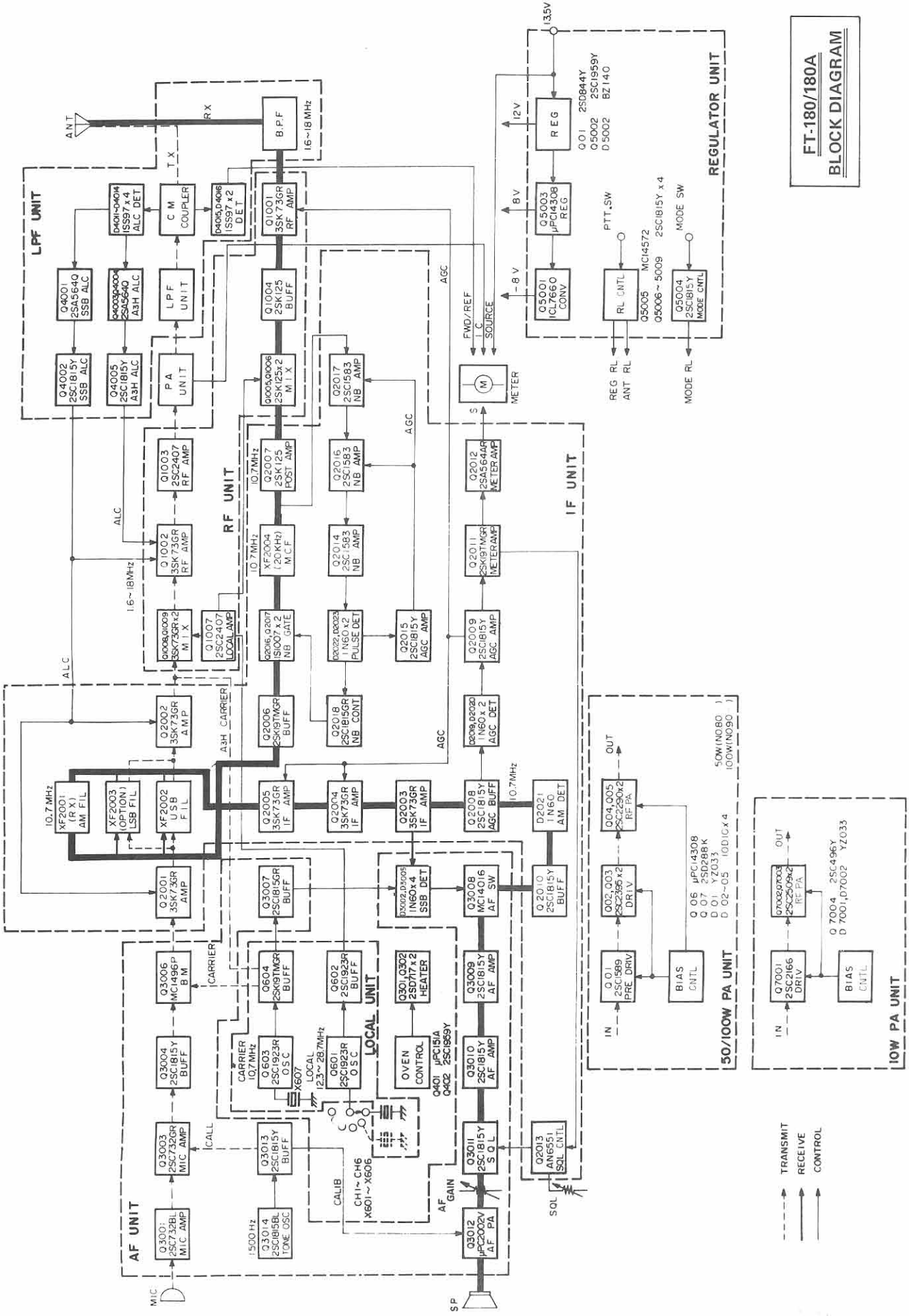
CAUTION

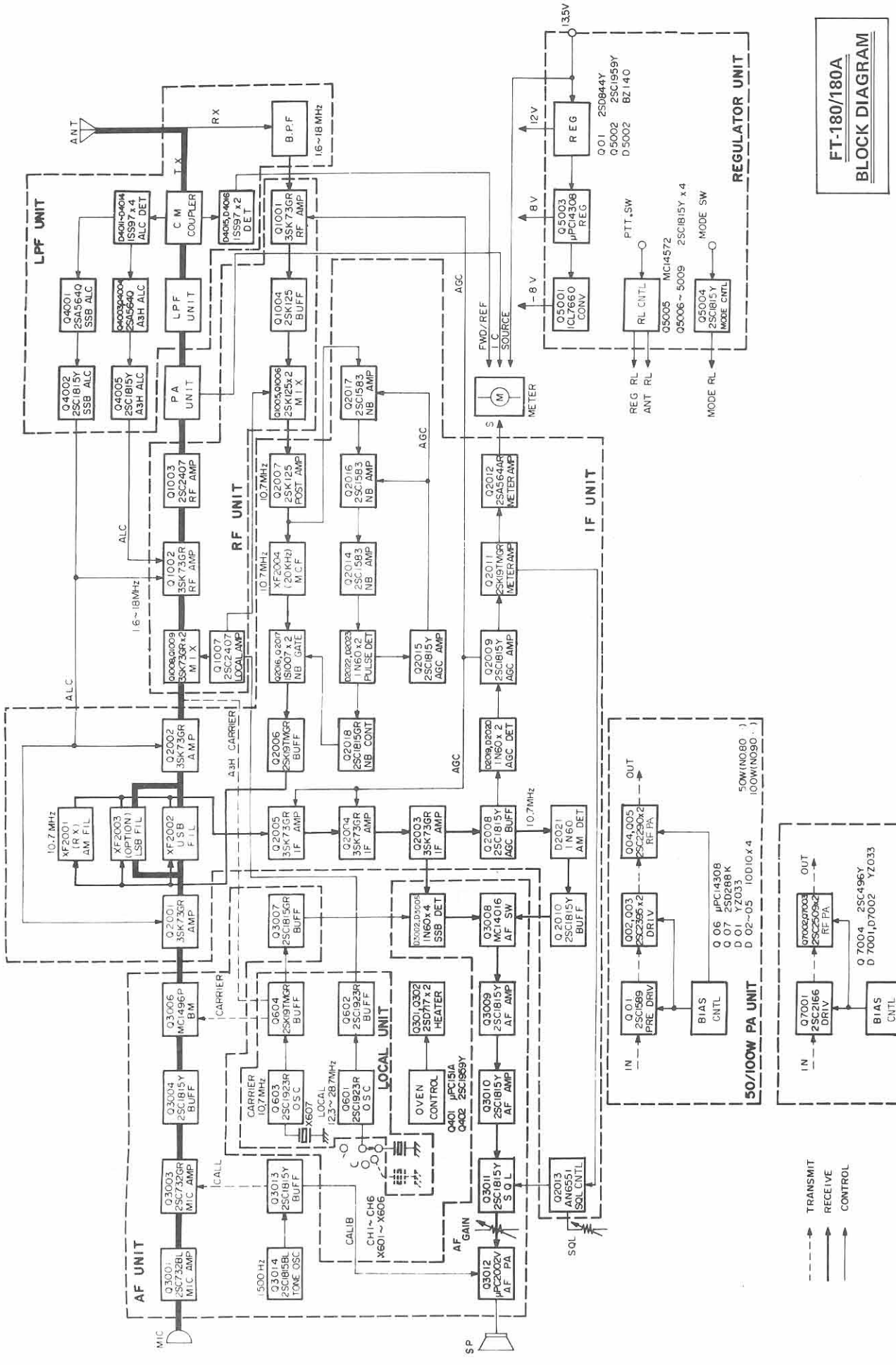
NEVER CHANGE CHANNELS OR MODES WHILE TRANSMITTING, AS DAMAGE TO THE TRANSCEIVER MAY RESULT. ALWAYS RELEASE THE PTT SWITCH AND/OR CALL SWITCH TO DEACTIVATE THE TRANSMITTER WHEN CHANGING CHANNELS OR MODES.

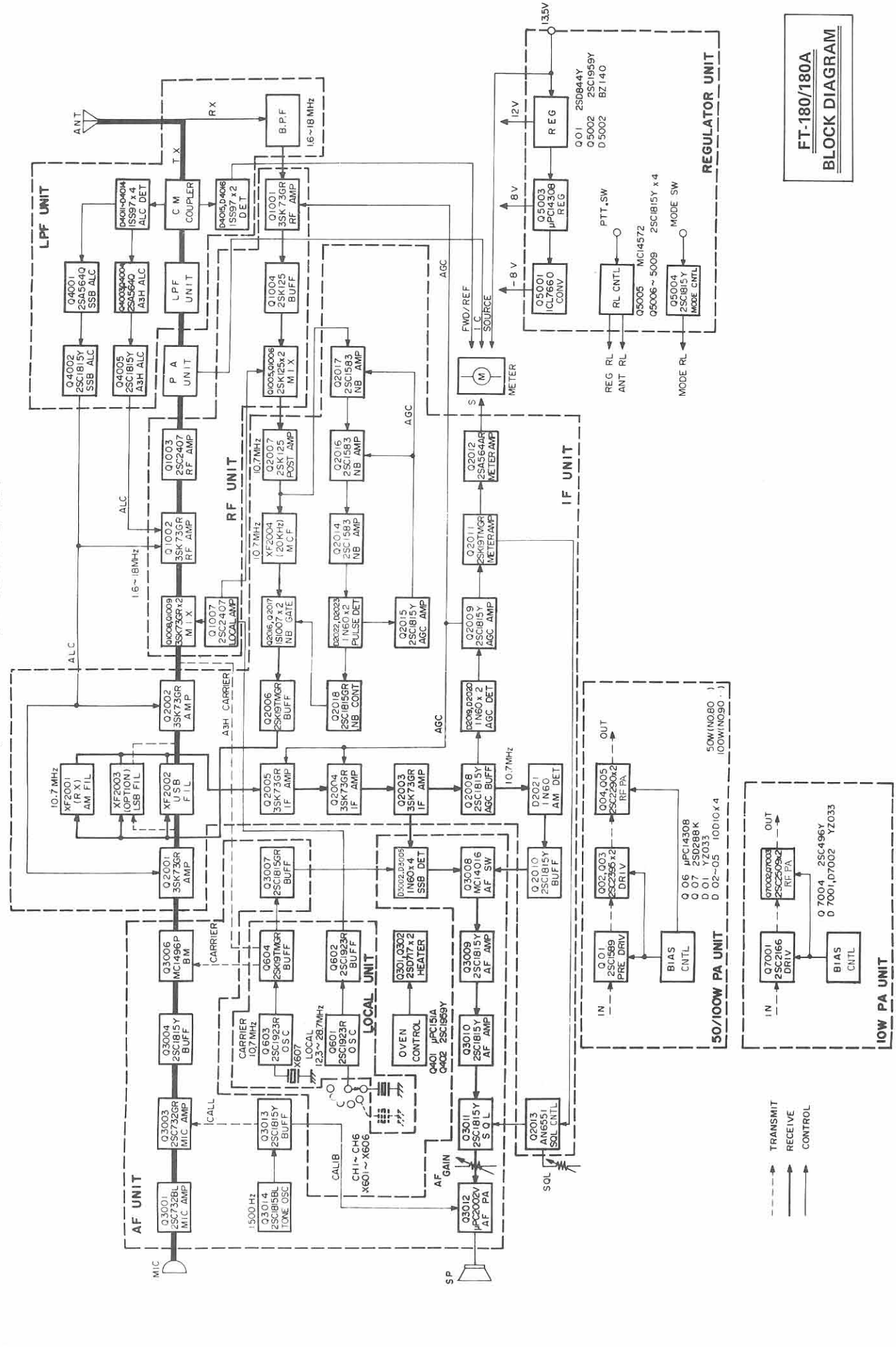
FT-180/180A SSB MODE RX



FT-180/180A A3H MODE RX




FT-180/180A SSB MODE TX
FT-180/180A
BLOCK DIAGRAM
ANT
RX
TX
B.P.F
1.6~18 MHz
LPF UNIT
C M COUPLER
LPF UNIT
PA UNIT
Q4001 2SA5640 SSB ALC
Q4002 2SC1815Y SSB ALC
Q4003,Q4004 2SA5640 A3H ALC
Q4005 2SC1815Y A3H ALC
D4011~D4014 1SS97 x4 ALC DET
D4005,D4006 1SS97 x2 DET
Q1001 3SK73GR RF AMP
Q1004 2SK125 BUFF
Q1005,Q1006 2SK125x2 MIX
RF UNIT
Q1003 2SC2407 RF AMP
Q1002 3SK73GR RF AMP
Q1008,Q1009 3SK73GR x2 MIX
Q1007 2SC2407 LOCAL AMP
XF2004 (20KHz) MCF
Q2006,Q2017 1SI007 x2 NB GATE
Q2018 2SC1815GR NB CONT
Q2017 2SC1583 NB AMP
Q2016 2SC1583 NB AMP
Q2014 2SC1583 NB AMP
Q2007 2SK125 POST AMP
D2022,D2023 1N60 x2 PULSE DET
Q2015 2SC1815Y AGC AMP
Q2009 2SC1815Y AGC AMP
Q2012 2SA564AR METER AMP
Q2011 2SK19TMGR METER AMP
D2009,D2020 1N60 x2 AGC DET
IF UNIT
Q2002 3SK73GR AMP
Q2001 3SK73GR AMP
XF2001 (RX) AM FIL
XF2003 (OPTION) LSB FIL
XF2002 USB FIL
Q2005 3SK73GR IF AMP
Q2004 3SK73GR IF AMP
Q2003 3SK73GR IF AMP
Q2008 2SC1815Y AGC BUFF
D2021 1N60 AM DET
Q2010 2SC1815Y BUFF
D3002,D3005 1N60 x4 SSB DET
Q3008 MC14016 AF SW
Q3007 2SC1815GR BUFF
Q3006 MC1496P BM
Q3004 2SC1815Y BUFF
Q3003 2SC732GR MIC AMP
Q3001 2SC732BL MIC AMP
Q3013 2SC1815Y BUFF
Q3014 2SC1815BL TONE OSC
Q3009 2SC1815Y AF AMP
Q3010 2SC1815Y AF AMP
Q3011 2SC1815Y SQL
Q3012 μPC2002V AF PA
Q2013 AN6551 SQL CNTL
Q604 2SK19TMGR BUFF
Q602 2SC1923R BUFF
Q603 2SC1923R OSC
Q601 2SC1923R OSC
X607
LOCAL 2.3~28.7MHz
CARRIER 10.7MHz
LOCAL UNIT
Q301,Q302 2SD717 x2 HEATER
OVEN CONTROL
Q401 μPC151A
Q402 2SC1959Y
Q2002,Q2003 2SC2290 x2 RF PA
Q04,Q05 2SC2290 x2 RF PA
Q02,Q03 2SC2396 x2 DRIV
Q01 2SC1969 PRE DRIV
BIAS CNTL
Q 06 μPC1430B
Q 07 2SD288K
D 01 YZ033
D 02~05 1SD10 x4
50W(NO.80)
100W(NO.90)
50/100W PA UNIT
Q7001 2SC2166 DRIV
Q7002,Q7003 2SC2509 x2 RF PA
Q 7004 2SC496Y
D 7001,D7002 YZ033
10W PA UNIT
REGULATOR UNIT
REG
Q5003 μPC1430B REG
Q5001 ICL7660 CONV
Q01 2SD844Y
Q5002 2SC1959Y
D5002 BZ140
PTT SW
RL CNTL
Q5005 MC14572
Q5006~5009 2SC1815Y x4
MODE SW
Q5004 2SC1815Y MODE CNTL
REG RL
ANT RL
MODE RL
13.5V
12V
8V
-8V
FWD/REF
I C
SOURCE
METER
S
M
ALC
AGC
A3H CARRIER
CARRIER
10.7MHz
1.6~18MHz
1500Hz
CALL
CALIB
CH1~CH6 X601~X606
AF GAIN
SQL
MIC
SP
IN
OUT
TRANSMIT
RECEIVE
CONTROL


FT-180/180A A3H MODE TX
FT-180/180A
BLOCK DIAGRAM
LPF UNIT
RF UNIT
IF UNIT
AF UNIT
LOCAL UNIT
REGULATOR UNIT
50/100W PA UNIT
10W PA UNIT
ANT
RX
TX
B.P.F
16~18MHz
C M COUPLER
LPF UNIT
P A UNIT
ALC
A3H CARRIER
AGC
FWD/REF
SOURCE
METER
REG
PTT,SW
RL CNTL
MODE SW
MODE CNTL
REG RL
ANT RL
MODE RL
MIC
SP
SQL
CALL
CALIB
AF GAIN
CARRIER
OVEN CONTROL
BIAS CNTL
TRANSMIT
RECEIVE
CONTROL

CIRCUIT DESCRIPTION

The block diagrams and circuit description to follow will provide you with a better understanding of this transceiver. Please refer to the schematic diagrams for specific component details.

RECEIVER

The RF input signal from the antenna is fed through relay RL_{4011}, lamp fuse F_{4001}, and then a highpass filter before delivery to pin 2 of J_{1001} on the RF Unit.

The signal passes through individual antenna coils for each channel and a 10.7 MHz trap, and is then amplified by Q_{1001} (3SK73GR), a dual gate MOS FET with excellent freedom from cross modulation and intermodulation. The amplified signal is fed through an individual diode-switched tuned circuit, which protects the mixer from out-of-band signals.

The RF signal is buffered by Q_{1004} (2SK125) and the output from the source of Q_{1004} is fed to a single balanced mixer, consisting of Q_{1005}, Q_{1006} (2SK125), where the RF signal is mixed with a local signal delivered from Q_{1007} (2SC2407). This results in a 10.7 MHz IF signal which is delivered through J_{1004} to the IF unit.

The local signal applied to the local amplifier, Q_{1007}, is produced in the following manner: the local oscillator, consisting of Q_{601}/Q_{6001} (2SC1923R) and a local crystal, generate a signal for each individual channel. The crystal for each channel is selected by a diode switch, $D_{601}-D_{606}/D_{6001}-D_{6006}$ (1SS53) provided for each crystal. The control voltage from the channel switch is applied to these diode switches to activate the appropriate crystal. The output from the collector of Q_{601}/Q_{6001} is fed to a buffer Q_{602}/Q_{6002} (2SC1923R), and then delivered through P_{605} (P_{6005})/J_{1005} to Q_{1007} on the RF unit.

> **NOTE:**
>
> In order to discriminate CARRIER/LOCAL OSC Units with and without the optional crystal oven, units with the oven have part numbers of the form 6XX, and units without the oven have part numbers of the form 60XX.

The 10.7 MHz IF signal is fed to a common gate J-FET amplifier, Q_{2007} (2SK125), and the output passes through XF_{2004}, a 20 kHz bandwidth monolithic crystal filter, which provides early protection against IMD products while allowing enough bandwidth and delay time for the noise blanker circuit. The signal then passes through noise blanker diodes $D_{2016}-D_{2018}$, which act as switches driven by noise blanker controller Q_{2018} (2SC1815GR). The IF signal is amplified by Q_{2006} (2SK192AGR), and then delivered to a crystal filter for USB, LSB or AM, where unwanted adjacent signals are cut out. Finally, the IF signal from the crystal filter is fed through diode switches to a three-stage IF amplifier, $Q_{2003}-Q_{2005}$ (3SK73GR), where the IF signal is amplified to a sufficient level to drive the SSB and AM detectors.

A portion of the output from Q_{2003} is fed to buffer Q_{2008} (2SC1815Y) and detected by D_{2019}, D_{2020} (1N60), resulting in a fluctuating DC voltage. This voltage is amplified by Q_{2009} (2SC1815Y), where the recovery time of this DC voltage is also determined. This DC voltage acts as the AGC control voltage, which is fed to gate 2 of the RF and IF amplifiers. This voltage is also delivered to S-meter buffer Q_{2011} (2SK192AGR). Output from the buffer is delivered to S-meter amplifier Q_{2012} (2SA564AR) and squelch control amplifier Q_{2013} (AN6551).

The buffered output from the emitter of Q_{2008} is also delivered through AM detector diode D_{2021} (1N60) to AF buffer Q_{2010} (2SC1815Y), and it is then delivered to AF analog switch Q_{3008} (MC14016BCP) on the AF unit. This analog switch selects output from either the AM detector or the SSB demodulator, depending on the mode of operation.

The SSB signal from Q_{2003} on the IF unit is delivered to J_{3004} on the AF unit, where it is fed to product detector $D_{3002}-D_{3005}$ (1N60), and converted to an audio signal, using the carrier signal supplied by crystal oscillator Q_{603}/Q_{6003} (2SC1923R) and buffer Q_{604}/Q_{6004} (2SK192AGR). The carrier oscillator changes its frequency depending on the activated mode, and clarifies the control voltage with diode switches D_{607}/D_{6007}, D_{608}/D_{6008} (1SS53) and variable capacitor diode D_{609}/D_{6009} (1S2208).

The selected AF signal from analog gate Q_{3008} is delivered to an active lowpass filter at Q_{3009} (2SC1815Y), which eliminates any high-pitch noise on the audio signal. It is then delivered to buffer Q_{3010} (2SC1815Y). Next, this signal passes through a potentiometer, which controls the AF output, to audio power amplifier Q_{3012} (μPC2002V), and is then delivered through J_{3006} to the speaker.

A portion of the RX IF signal from Q_{2007} is delivered to three stages of noise amplifier, Q_{2017}, Q_{2016} and Q_{2014} (2SC1583). Each individual transistor contains two sections, which are configured as differential amplifiers. When a carrier or noise-free signal is received, the noise signal is rectified by D_{2022}, D_{2023} (1N60), producing a DC voltage. This DC voltage is amplified by Q_{2015} (2SC1815Y), which charges C_{2120} for noise blanker AGC purposes.

The AGC time constant is designed so as not to respond to pulse-type noises. This AGC voltage is used to control the gain of Q_{2017} and Q_{2016}. When pulse-type noise is received, D_{2022} and D_{2023} rectify the noise signal, which controls noise blanker switch Q_{2018}.

Noise pulses are of very short duration, but high amplitude. Because of the very short time constant of the R_{2097}/C_{2118} discharge path, AGC voltage is not induced by these short duration pulses. Therefore, the noise amplifiers operate at full gain, providing maximum voltage to the base of Q_{2018}. When a desired signal and noise pulse are received simultaneously, the blanking action is not impaired, because the relative difference between the desired signal and the noise pulse is still high.

TRANSMITTER

SSB

The audio input signal from microphone jack J_{01} is fed to J_{3001} on the AF unit. The speech signal is amplified by Q_{3001} (2SC732BL) and delivered through microphone gain control potentiometer VR_{3001} to two stages of AF amplifier, Q_{3003} (2SC732GR) and Q_{3004} (2SC1815Y). The output from the emitter of Q_{3004} is applied to double balanced modulator Q_{3006} (MC1496P), where the amplified speech signal and applied carrier signal produce a DSB signal at the IF frequency (10.7 MHz). The balanced modulator provides high carrier suppression stability corresponding to various temperature changes. The signal is then fed to J_{3002} for delivery to the IF unit.

The IF signal appearing at pin 2 of J_{2001} is fed through buffer Q_{2001} (3SK73GR) to the appropriate crystal filter for the mode in use (LSB, USB, A3h) according to the instructions from the mode selector. The resulting SSB signal is amplified by Q_{2002} (3SK73GR) and then delivered to single balanced mixer Q_{1008} and Q_{1009} (3SK73GR) on the RF unit. Here the IF signal is mixed with the local signal from the local signal oscillator/buffer. Finally, the RF signal is amplified by Q_{1002} (3SK73GR) and Q_{1003} (2SC2407) in the RF unit.

A3h

The USB signal at Q_{2002} from the USB filter is joined by a 10.7 MHz carrier signal from the carrier oscillator, resulting in an A3h signal. The carrier level is determined by VR_{2001} on the IF unit, sending the A3h signal on the same path followed for SSB.

100/50W POWER AMPLIFIER

The input signal is amplified by pre-driver $Q_{8001}/_{9001}$ (2SC1589), push-pull drivers $Q_{8002}/_{9002}$, $Q_{8003}/_{9003}$ (2SC2395), and then further amplified by the push-pull final amplifier $Q_{8004}/_{9004}$, $Q_{8005}/_{9005}$ (2SC2290), which supplies approximately 100/50 watts of RF output. This RF signal is then fed to the LPF unit.

NOTE:

Parts with numbers of the form 8XXX are used in the 50W model, while those with numbers of the form 9XXX are used in the 100W model.

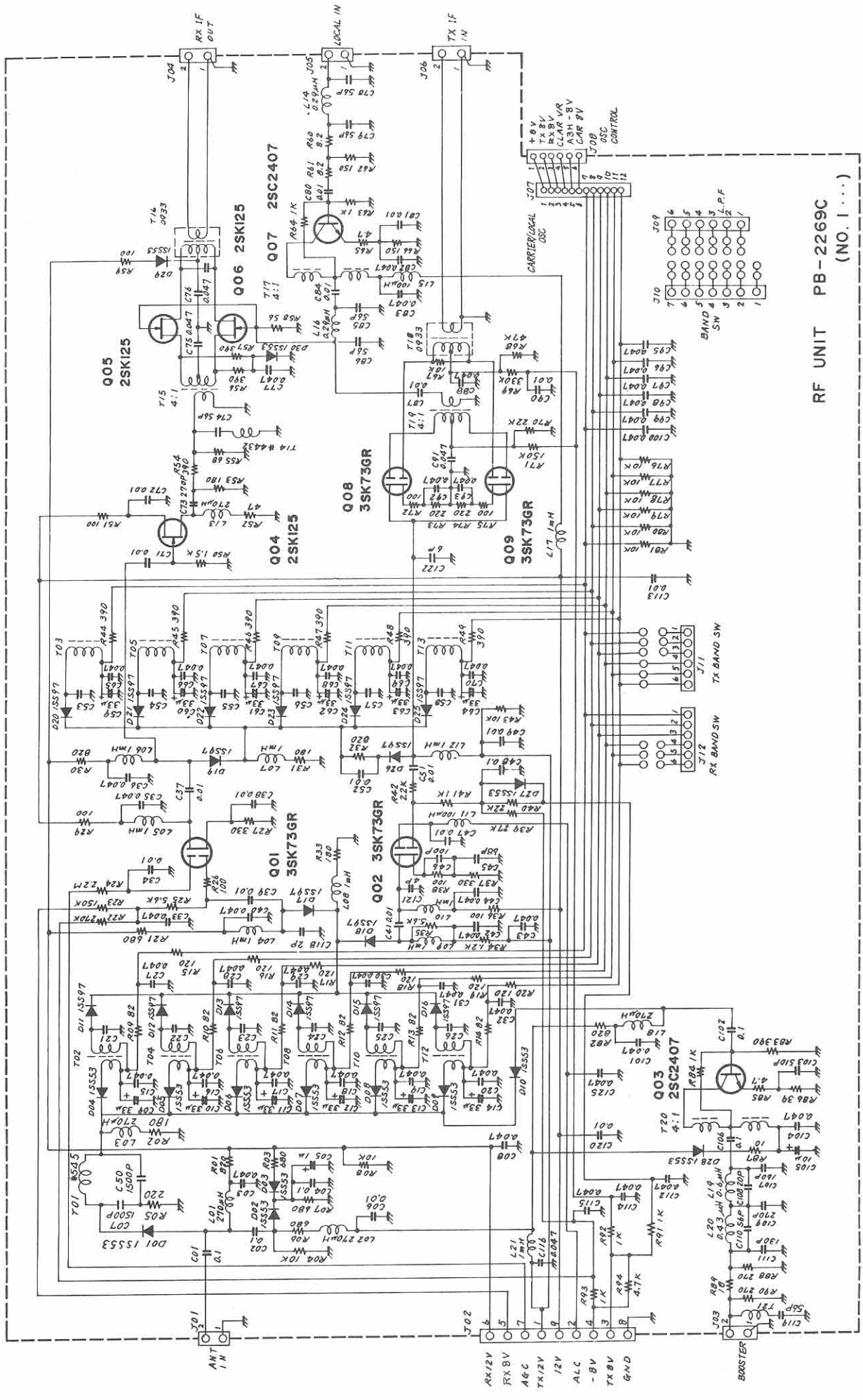
10W POWER AMPLIFIER

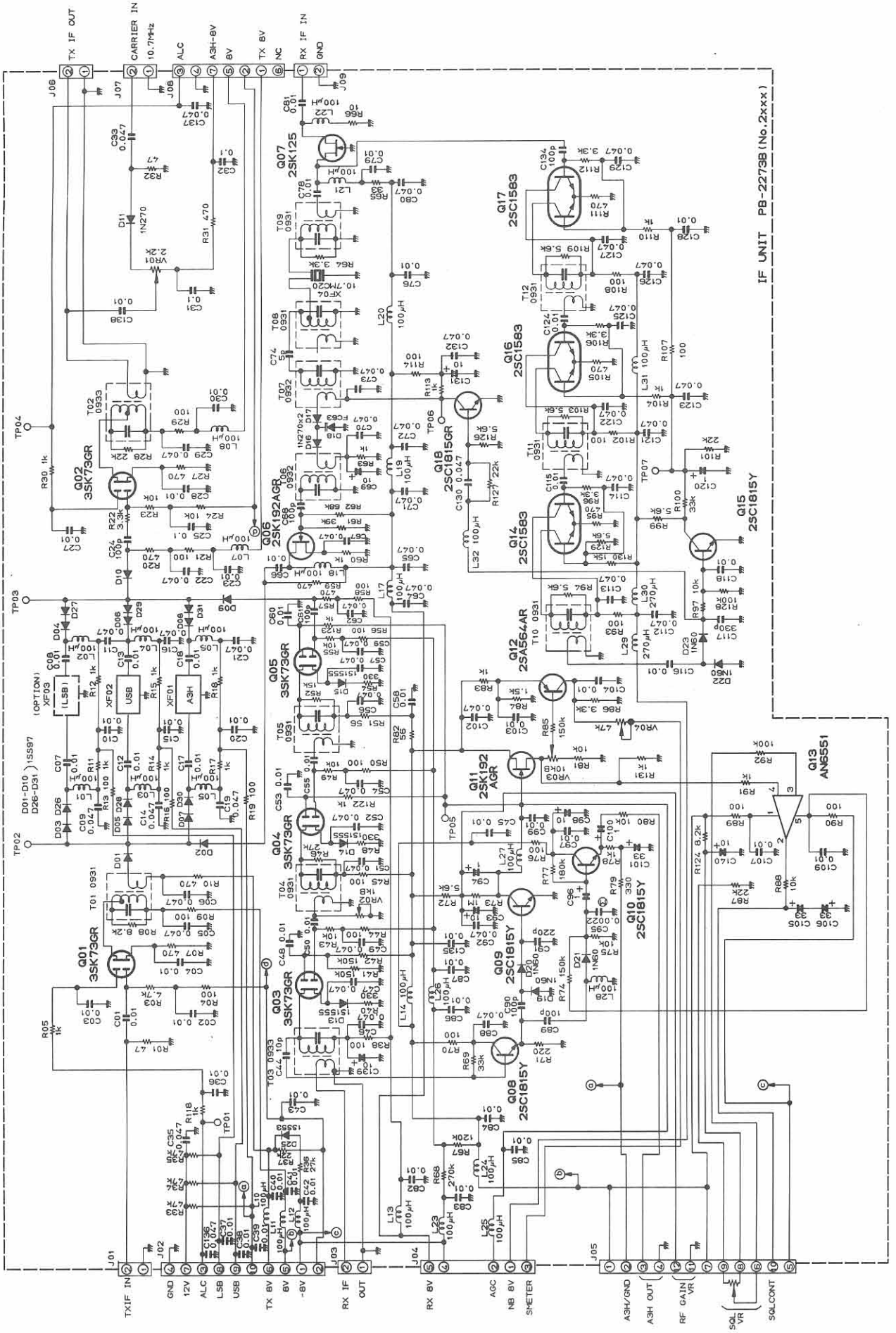
The input signal is amplified by driver Q_{7001} (2SC2166) and delivered to the push-pull final amplifier, consisting of Q_{7002} and Q_{7003} (2SC2509). This RF signal is then delivered to the LPF unit.

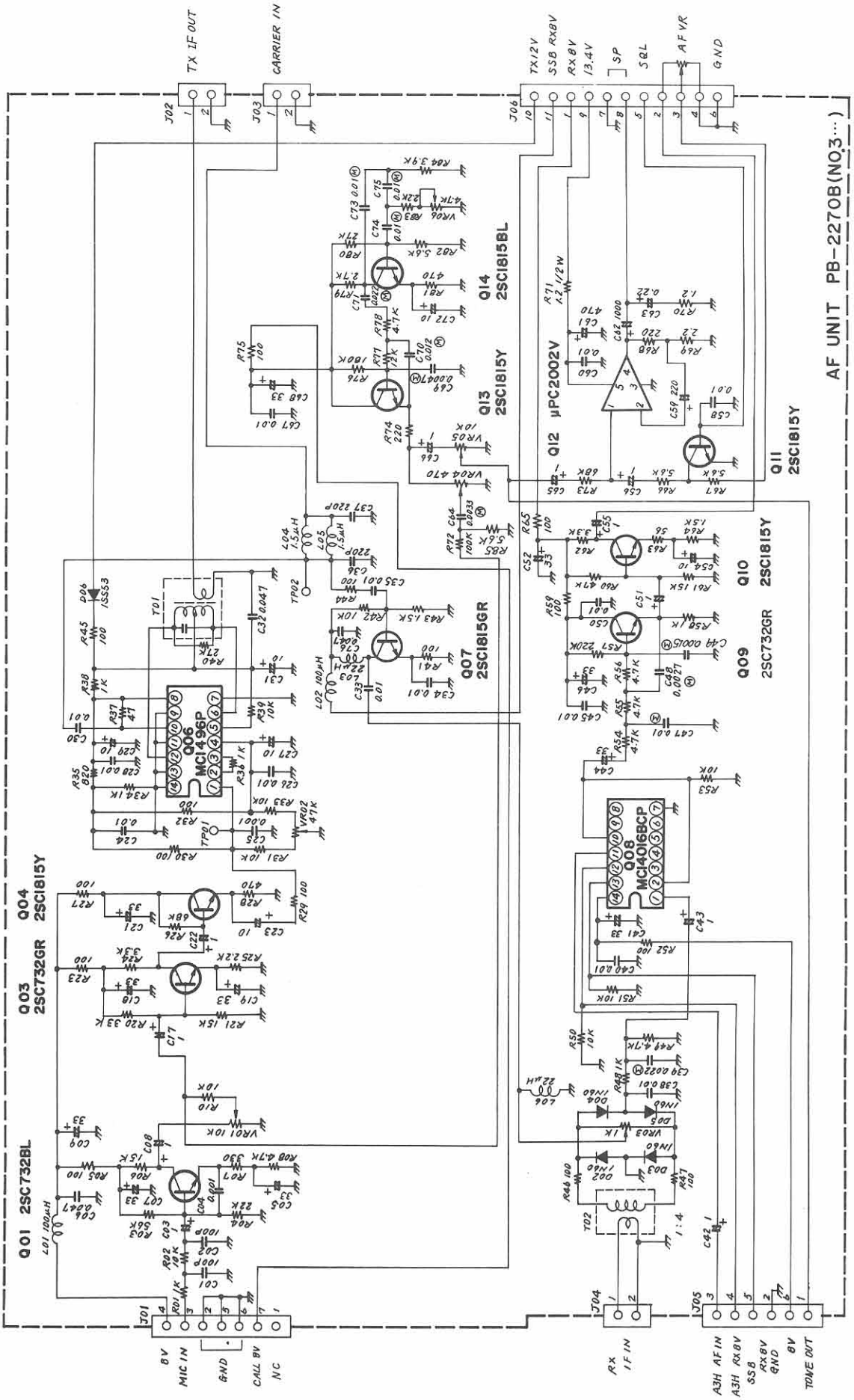
ALC Circuit

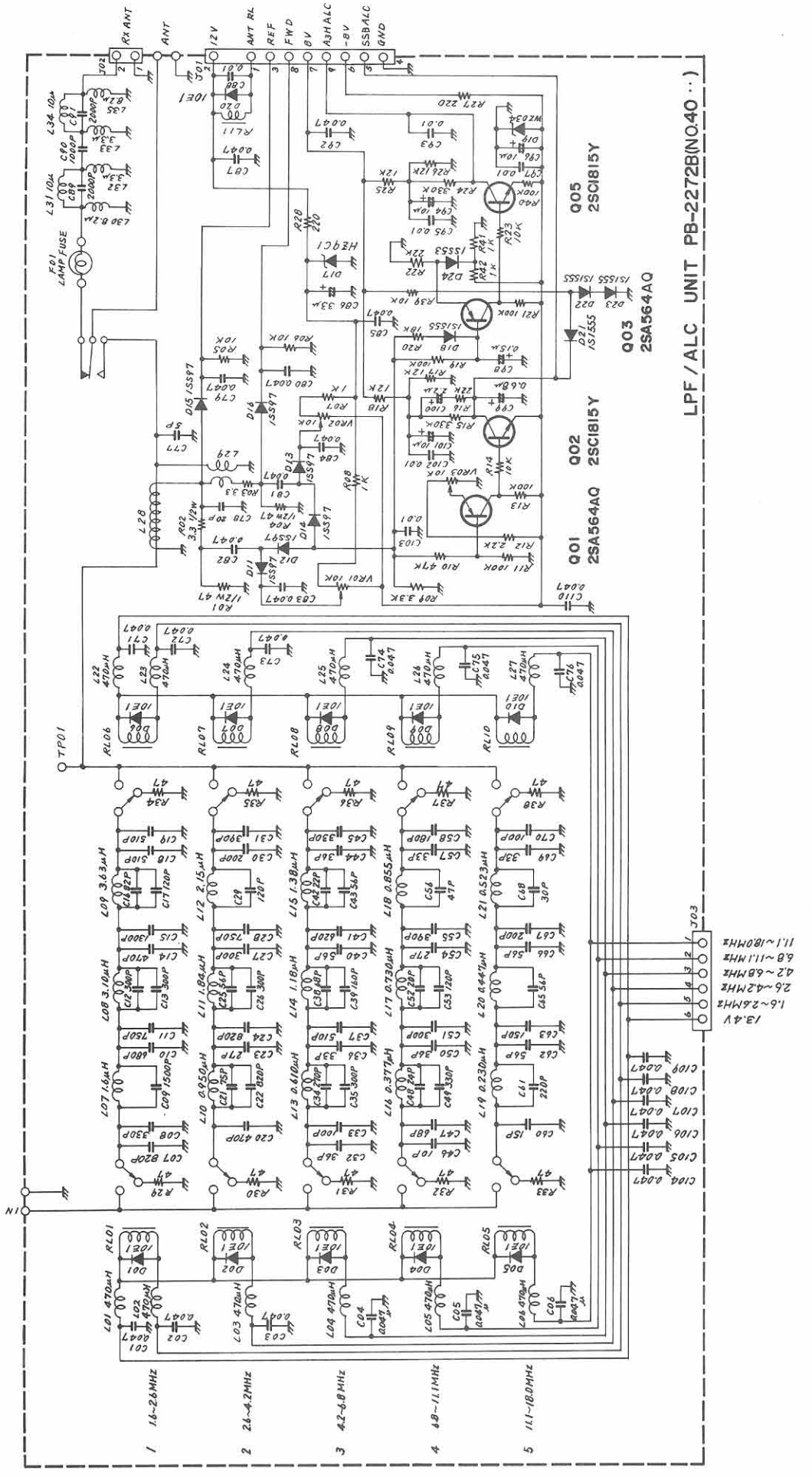
A variety of level control systems are included in the FT-180 for protection against overdrive and high SWR.

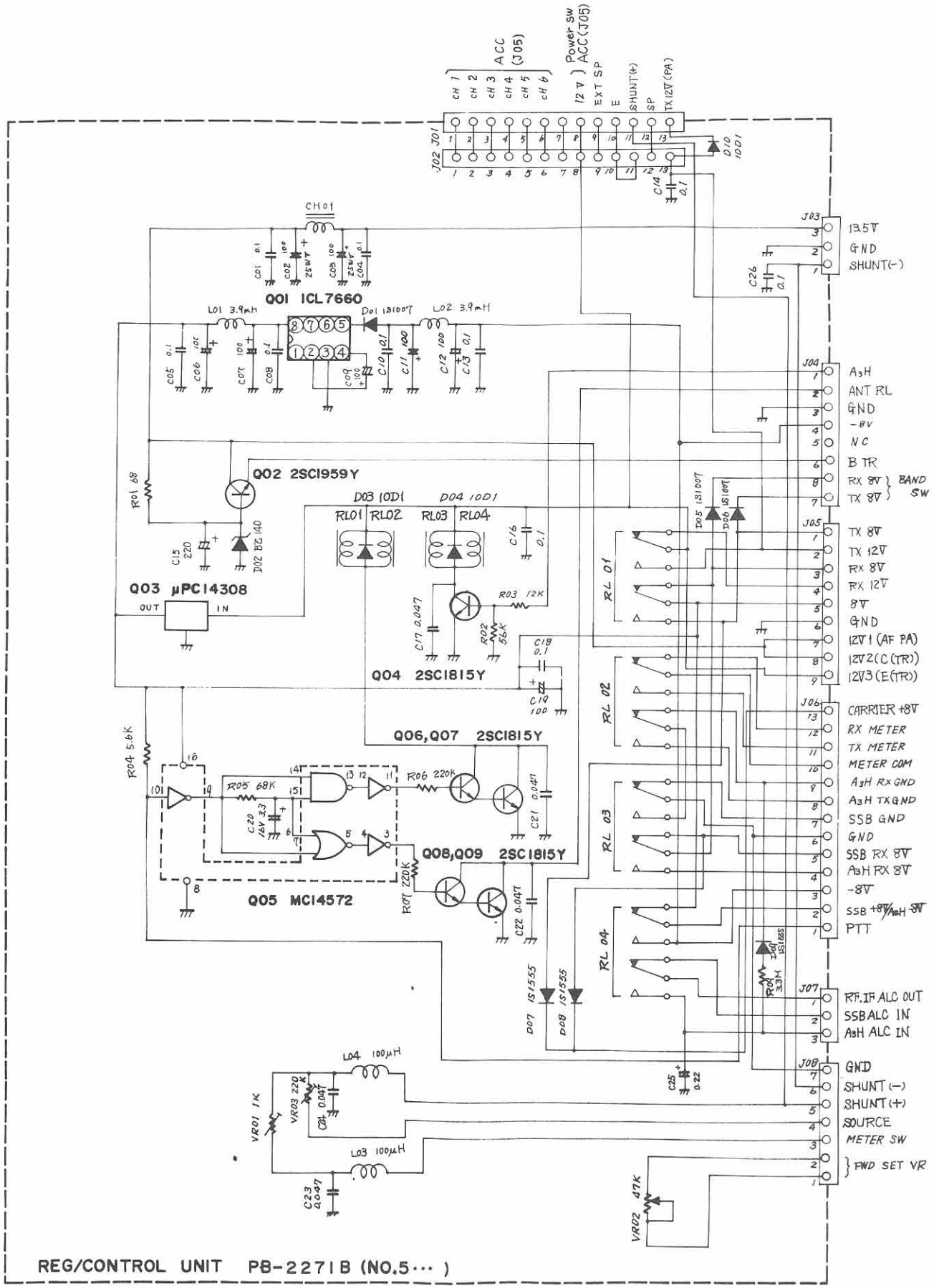
At the directional coupler the output voltage is sensed, and when a high SWR condition exists the voltage is detected by D_{4011}, D_{4012} (1SS97), and the overdrive ALC voltage is detected by D_{4013}, D_{4014} (1SS97). These rectified ALC control voltages are amplified together by Q_{4001} (2SA564Q) and Q_{4002} (2SC1815Y) (A3h: Q_{4003} – Q_{4005}), for the control of TX IF stage.


RF UNIT PB-2269C (NO. 1 ...)
Q01 3SK73GR
Q02 3SK73GR
Q03 2SC2407
Q04 2SK125
Q05 2SK125
Q06 2SK125
Q07 2SC2407
Q08 3SK73GR
Q09 3SK73GR
RX IF OUT
LOCAL IN
TX IF IN
CARRIER/LOCAL OSC
OSC CONTROL
BAND SW
L.P.F
TX BAND SW
RX BAND SW
ANT IN
BOOSTER
RX 12V
RX 8V
AGC
TX 12V
12V
ALC
- 8V
TX 8V
GND

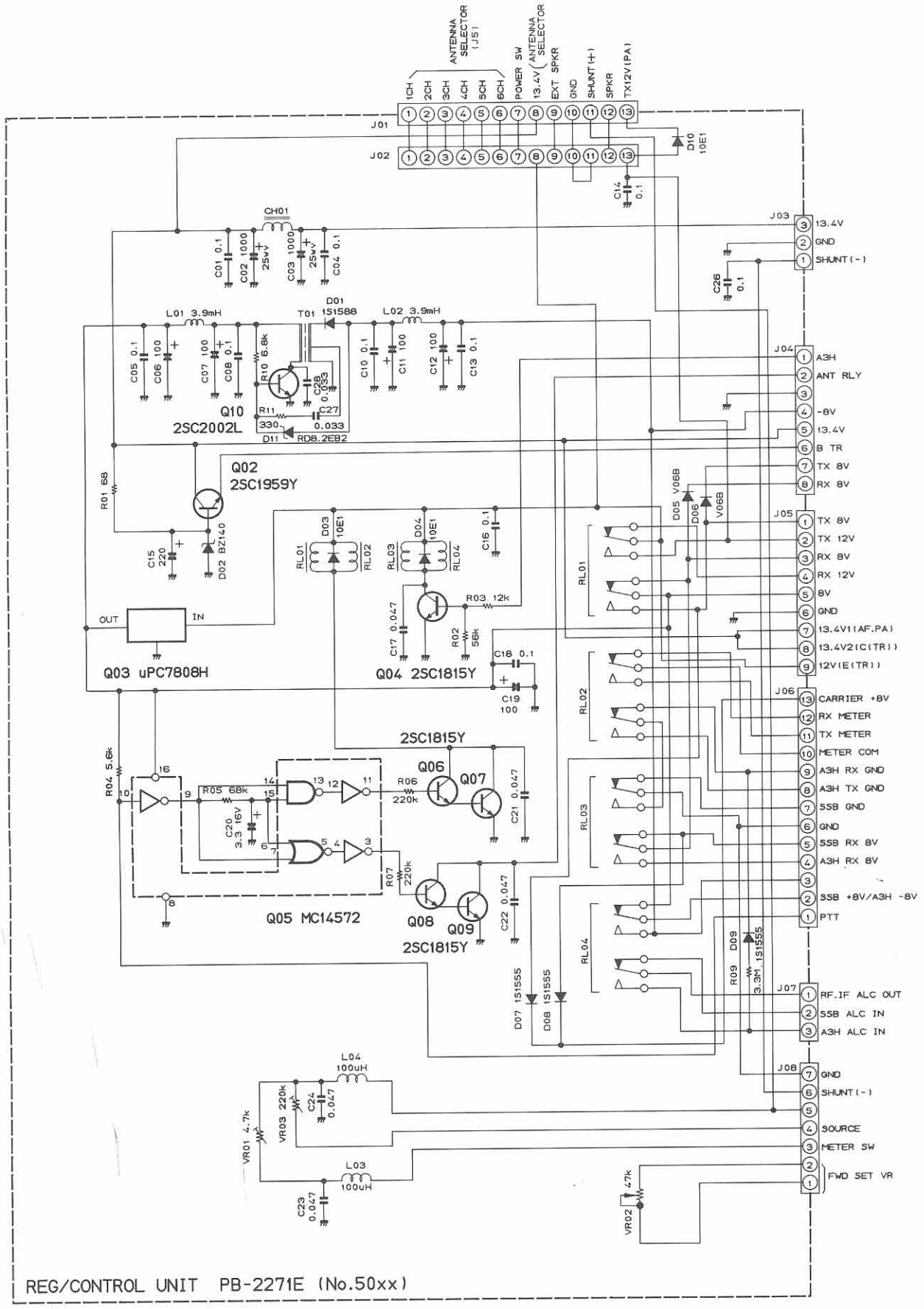

IF UNIT PB-2273B (No.2xxx)
TX IF OUT
CARRIER IN
10.7MHz
ALC
A3H-8V
8V
TX 8V
NC
RX IF IN
GND
Q01 3SK73GR
Q02 3SK73GR
Q03 3SK73GR
Q04 3SK73GR
Q05 3SK73GR
Q06 2SK192AGR
Q07 2SK125
Q08 2SC1815Y
Q09 2SC1815Y
Q10 2SC1815Y
Q11 2SK192AGR
Q12 2SA564AR
Q13 AN6551
Q14 2SC1583
Q15 2SC1815Y
Q16 2SC1583
Q17 2SC1583
Q18 2SC1815GR
(OPTION)
(LSB)
USB
A3H
D01-D10)1SS97
D26-D31
TXIF IN
GND
12V
ALC
LSB
USB
TX 8V
8V
-8V
RX IF OUT
RX 8V
AGC
NB 8V
SMETER
A3H/GND
A3H OUT
RF GAIN VR
SQL VR
SQLCONT


AF UNIT PB-2270B(NO3···)
TX IF OUT
CARRIER IN
TX 12V
SSB RX 8V
RX 8V
13.4V
SP
SQL
AF VR
GND
J02
J03
J06
Q01 2SC732BL
Q02 2SC1815Y
Q03 2SC732GR
Q04 2SC1815Y
Q05 2SC1815GR
Q06 MC1496P
Q07 2SC1815GR
Q08 MC14016BCP
Q09 2SC732GR
Q10 2SC1815Y
Q11 2SC1815Y
Q12 μPC2002V
Q13 2SC1815Y
Q14 2SC1815BL
8V
MIC IN
GND
CALL 8V
NC
J01
J04
J05
RX IF IN
A3H AF IN
A3H RX 8V
SSB RX 8V GND
8V
TONE OUT

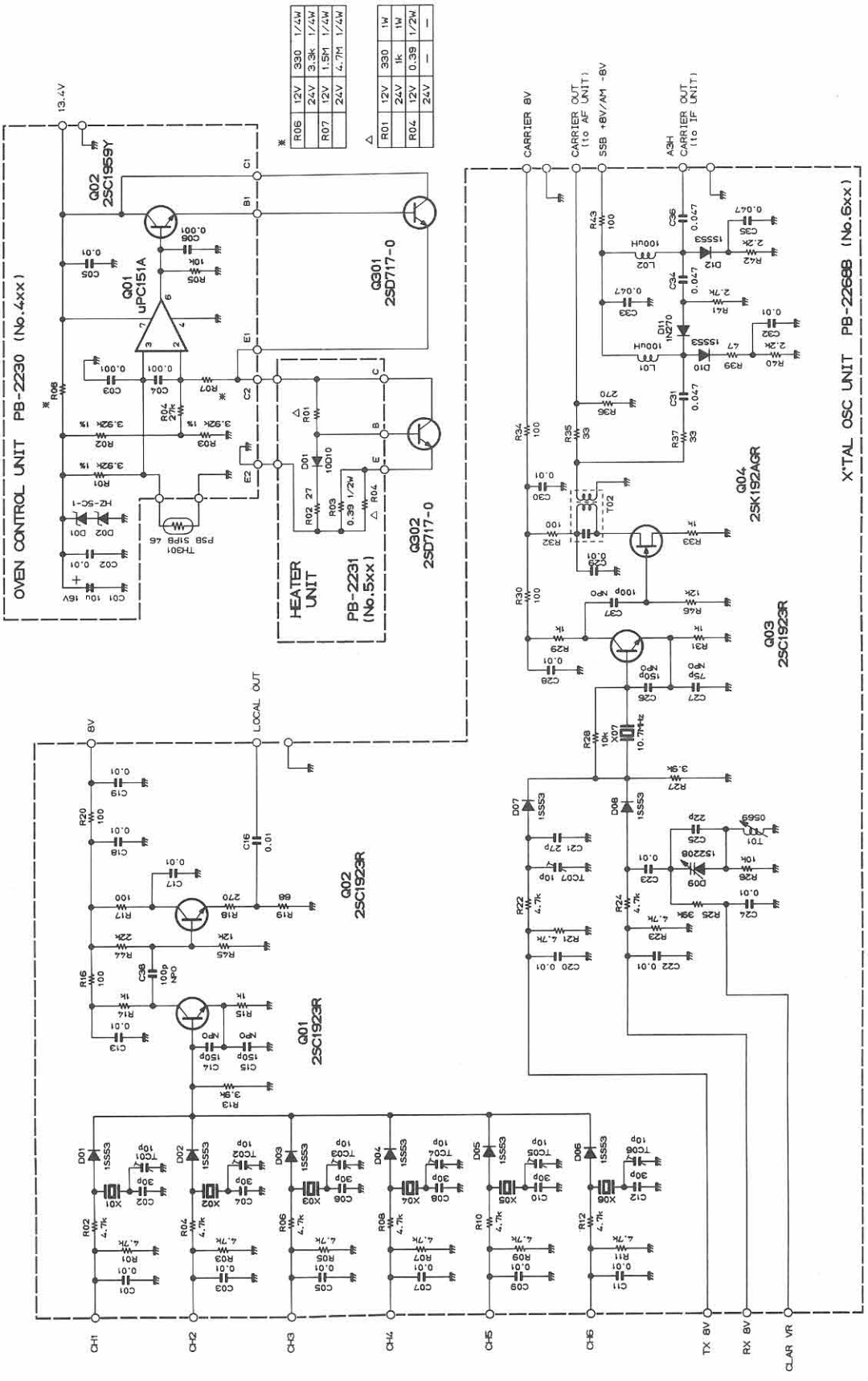

LPF / ALC UNIT PB-2272B(NO.40 ··)
Q01 2SA564AQ
Q02 2SC1815Y
Q03 2SA564AQ
Q05 2SC1815Y
1 1.6~2.6MHz
2 2.6~4.2MHz
3 4.2~6.8 MHz
4 6.8~11.1MHz
5 11.1~18.0MHz
J01
J02
J03
TP01
F01 LAMP FUSE
RX ANT
ANT
12V
ANT RL
REF
FWD
8V
A3J ALC
-8V
SSB ALC
GND



Q5001 IC type –8V Supply

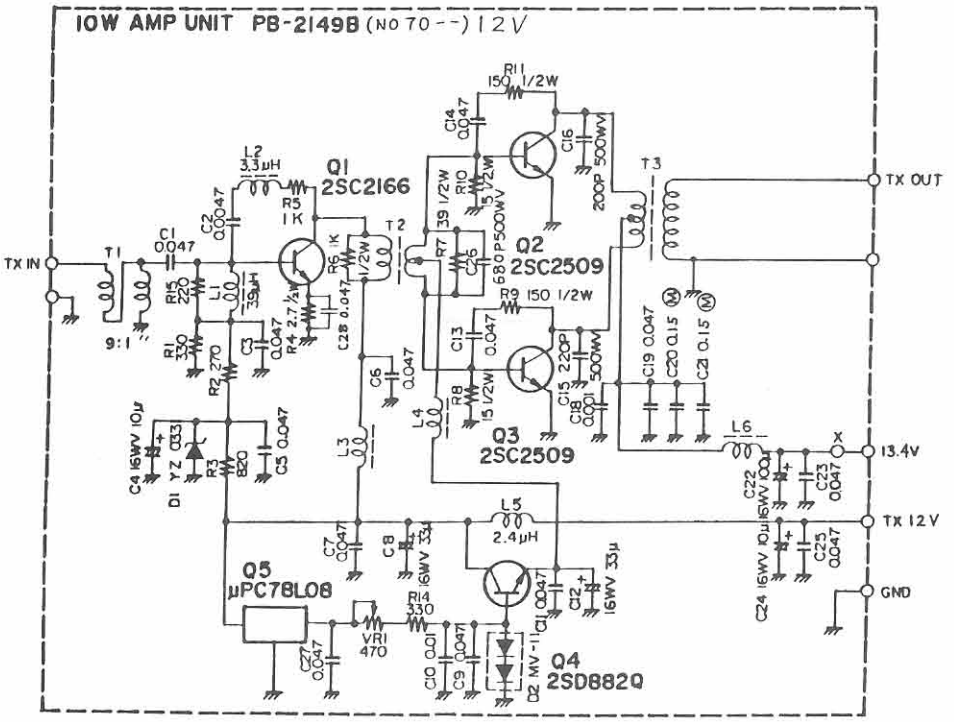


Q5010 discrete type –8V Supply

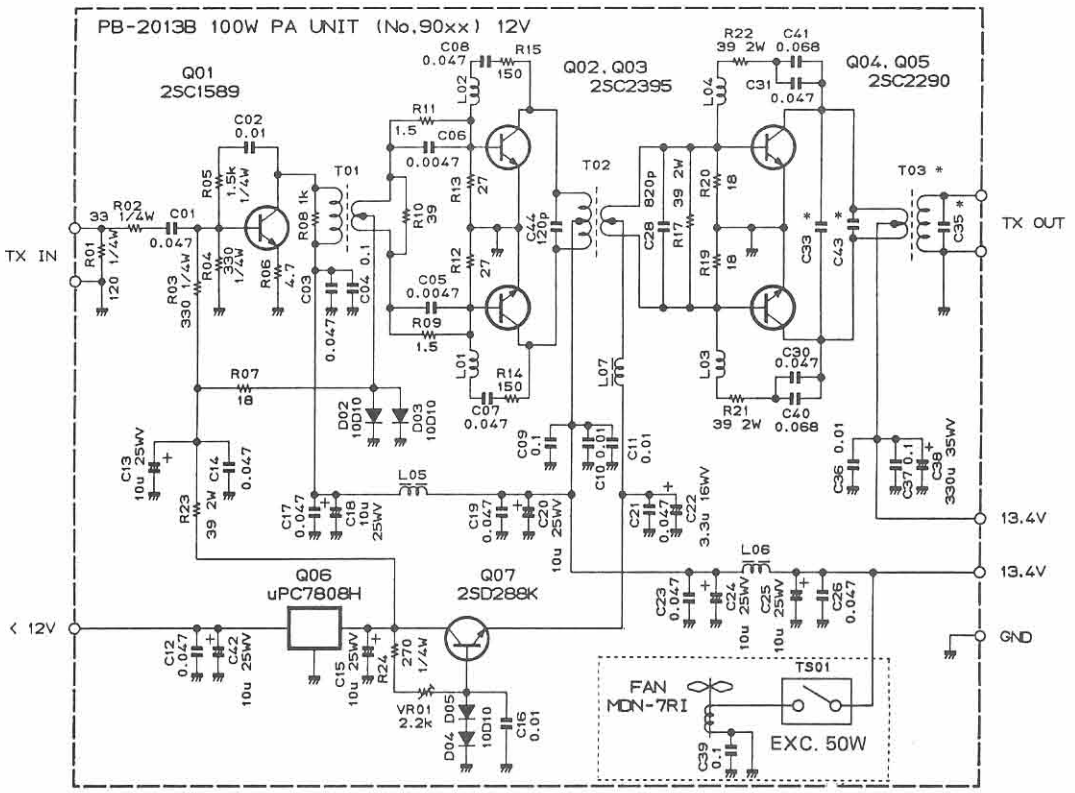


*			
R06	12V	330	1/4W
	24V	3.3k	1/4W
R07	12V	1.5M	1/4W
	24V	4.7M	1/4W

△			
R01	12V	330	1W
	24V	1k	1W
R04	12V	0.39	1/2W
	24V	—	—

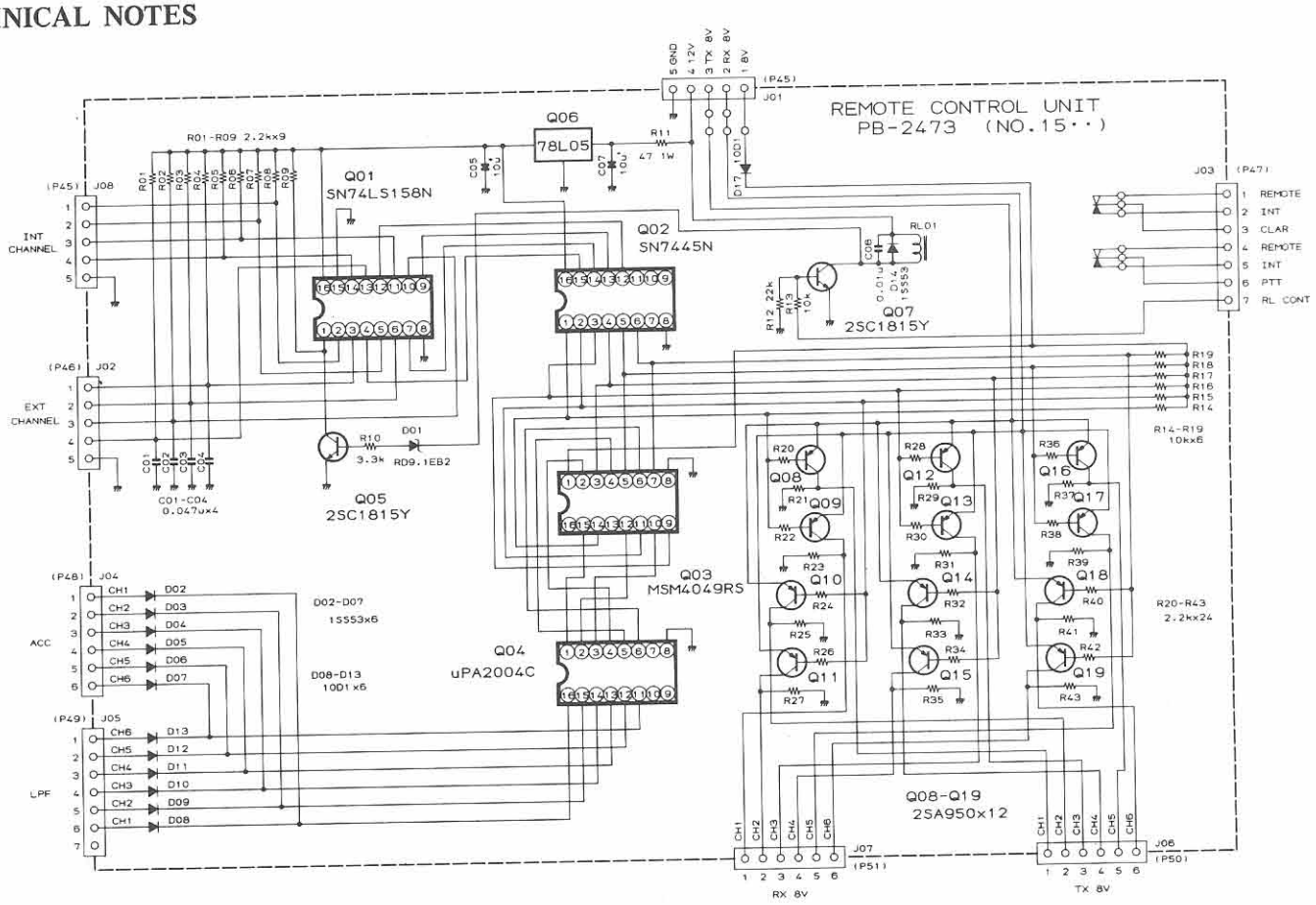


10W PA UNIT

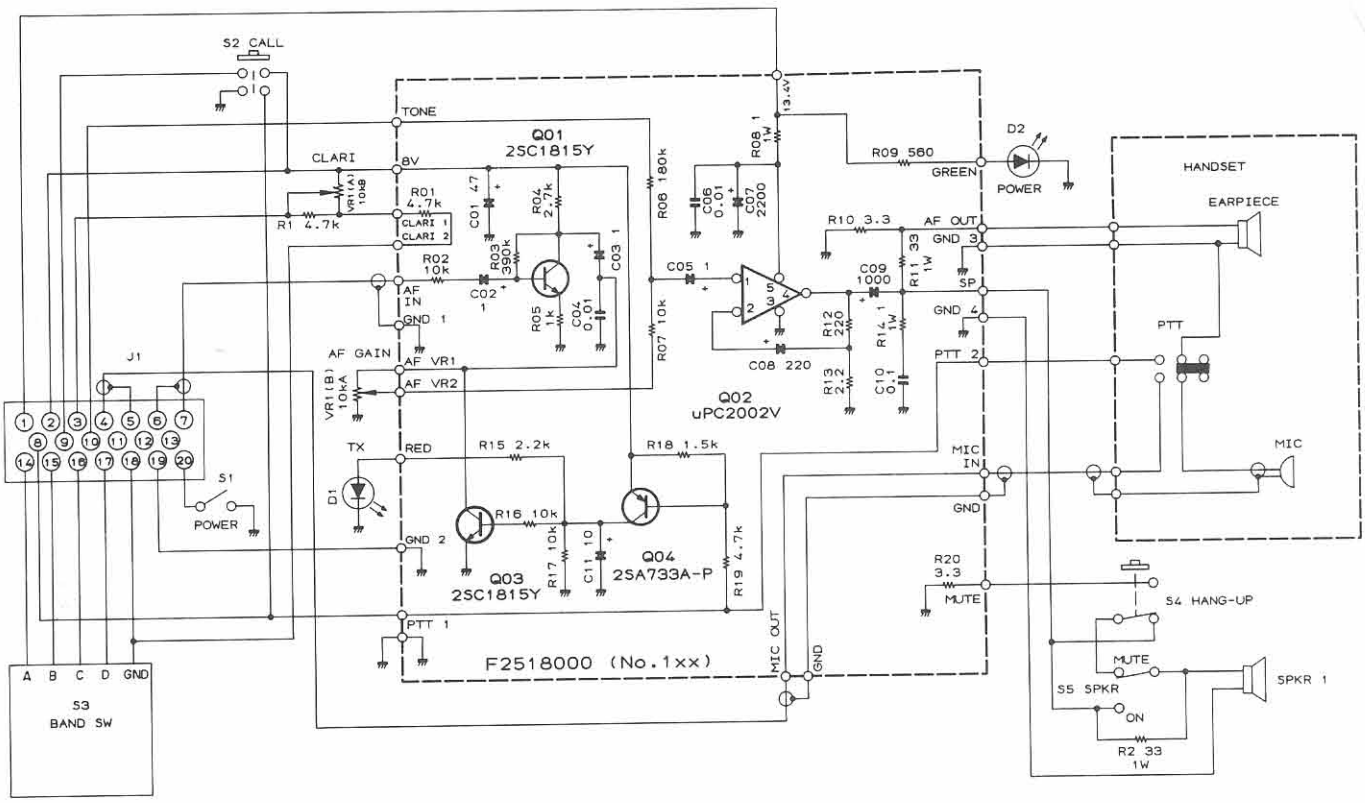


50W/100W PA UNIT

		100W	50W
*	C33	1200 pF	820 pF
	C43	1000 pF	470 pF
	C35	22 pF	Not used
	T03	L0020632	L0021284

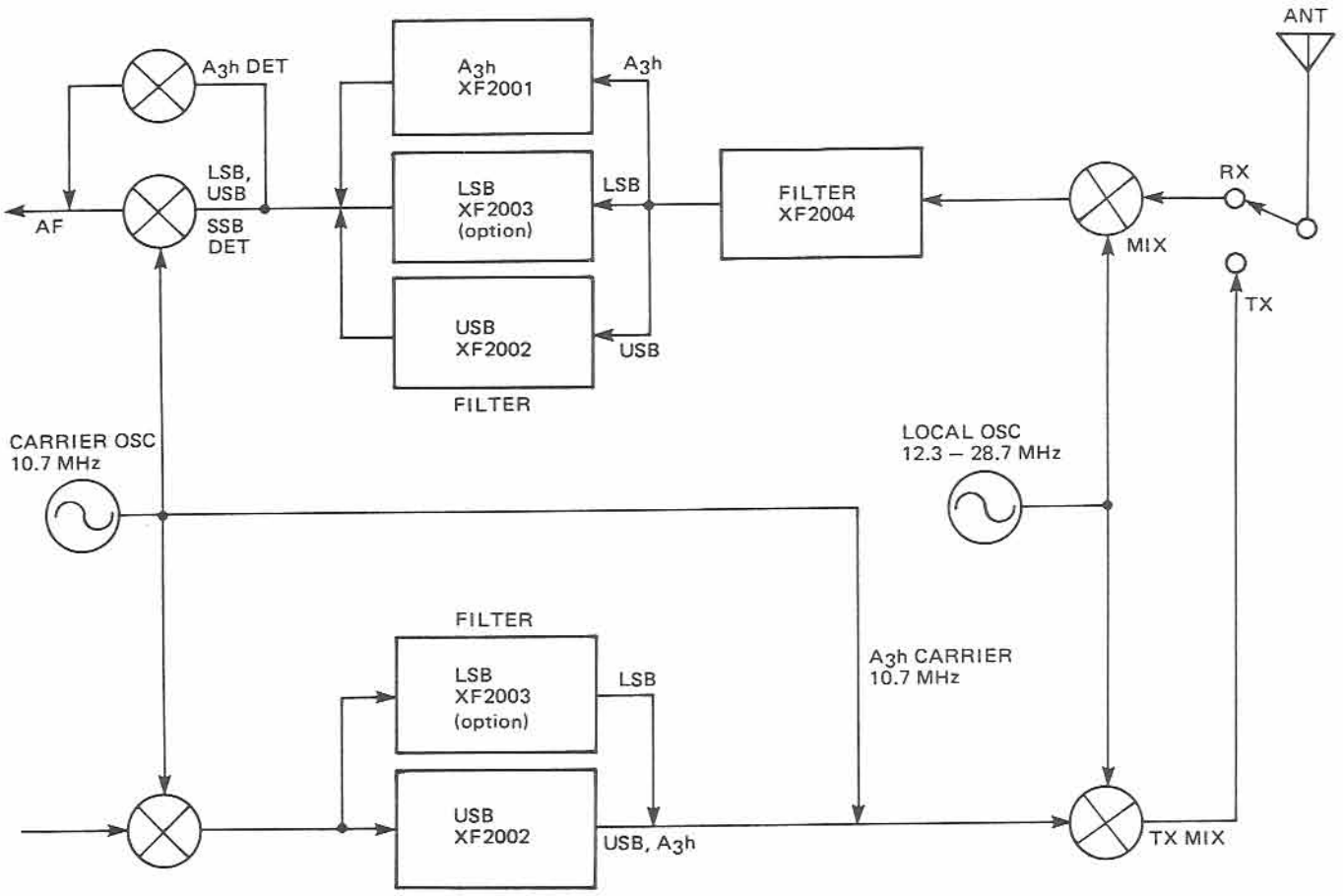


REMOTE CONTROL UNIT (FT-180A option)



FH-180
CIRCUIT DIAGRAM

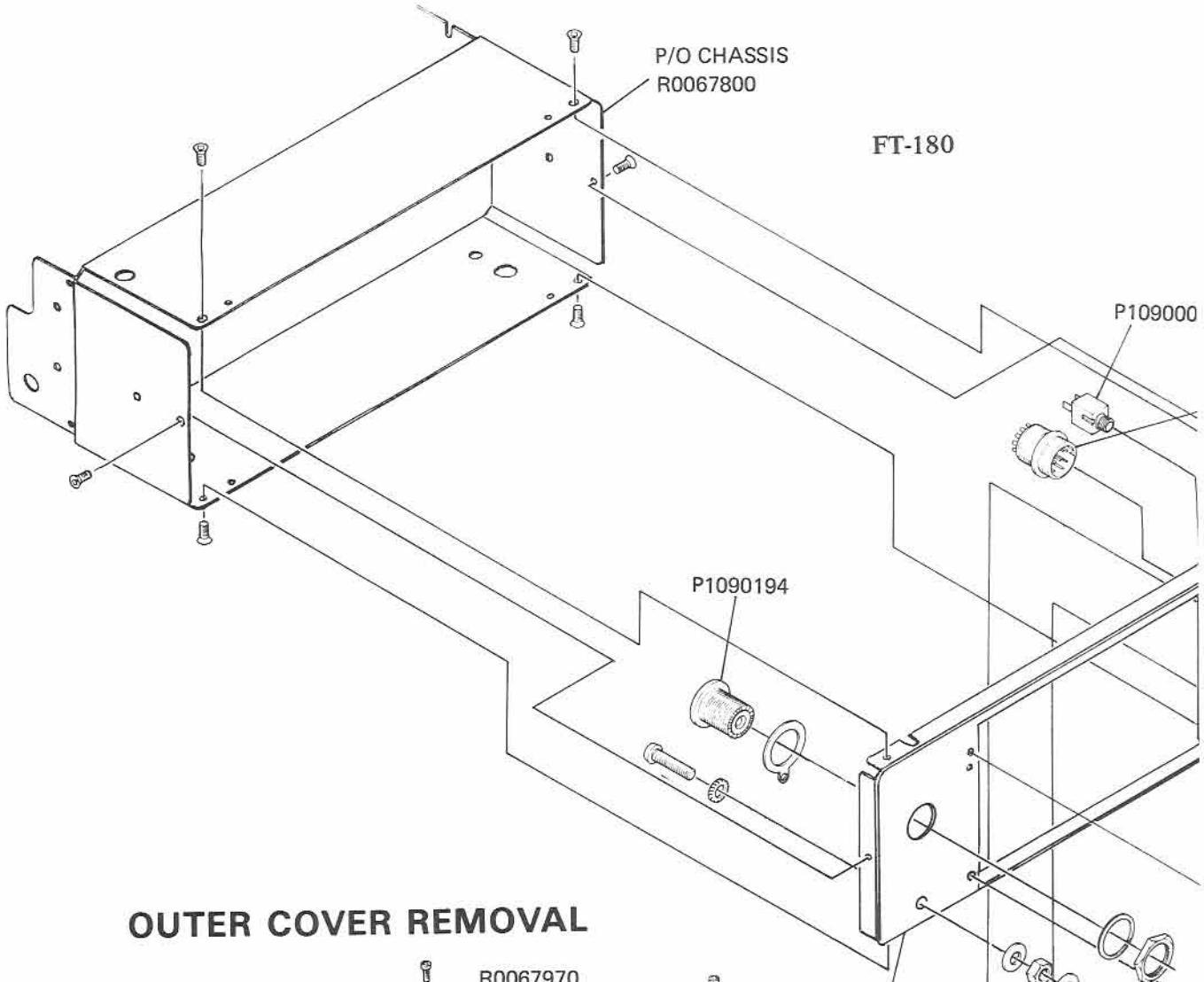
FREQUENCY RELATIONSHIPS



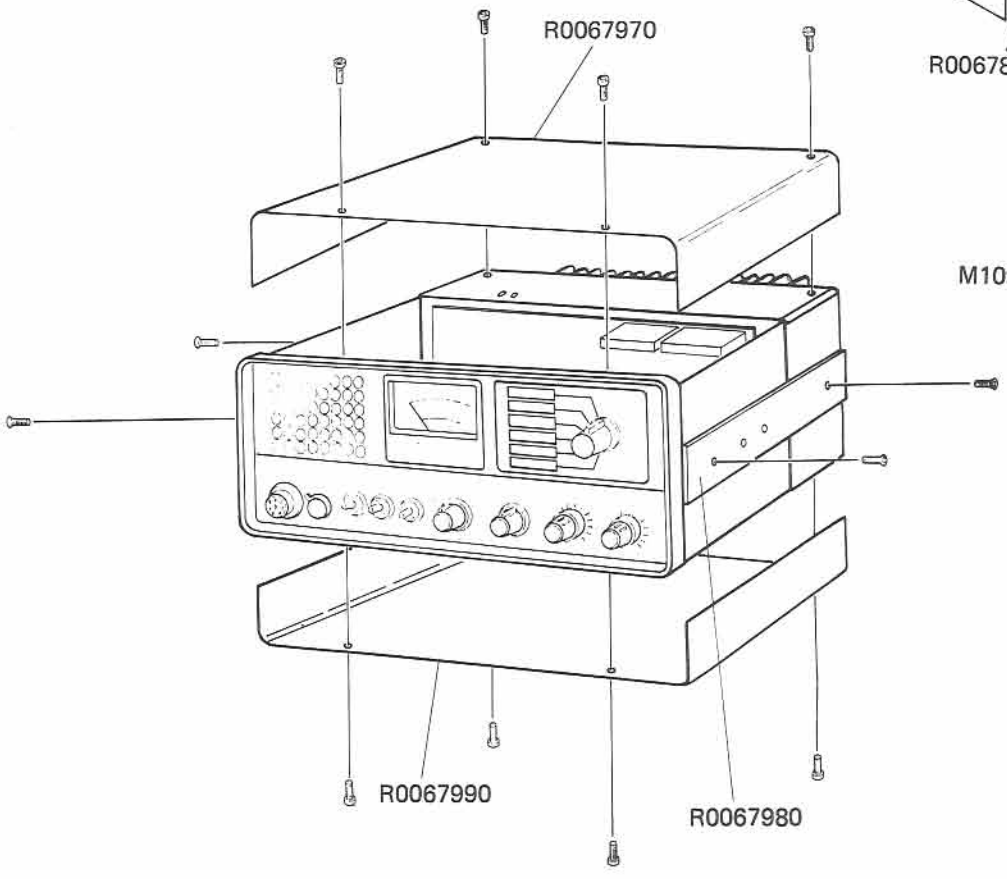
CRYSTAL FILTER

Part Number	Symbol Number	Center Frequency	Description	
H1102250	XF2001	10.700000MHz	XF-10.7HA	AM FILTER
H1102030	XF2002	10.698475MHz	XF-10.7HUA	USB FILTER
H1102031	XF2003	10.701525MHz	XF-10.7HLA	LSB FILTER (OPTION)
H1102032	XF2004	10.700000MHz	10.7MC20	B.P.F (20kHz)

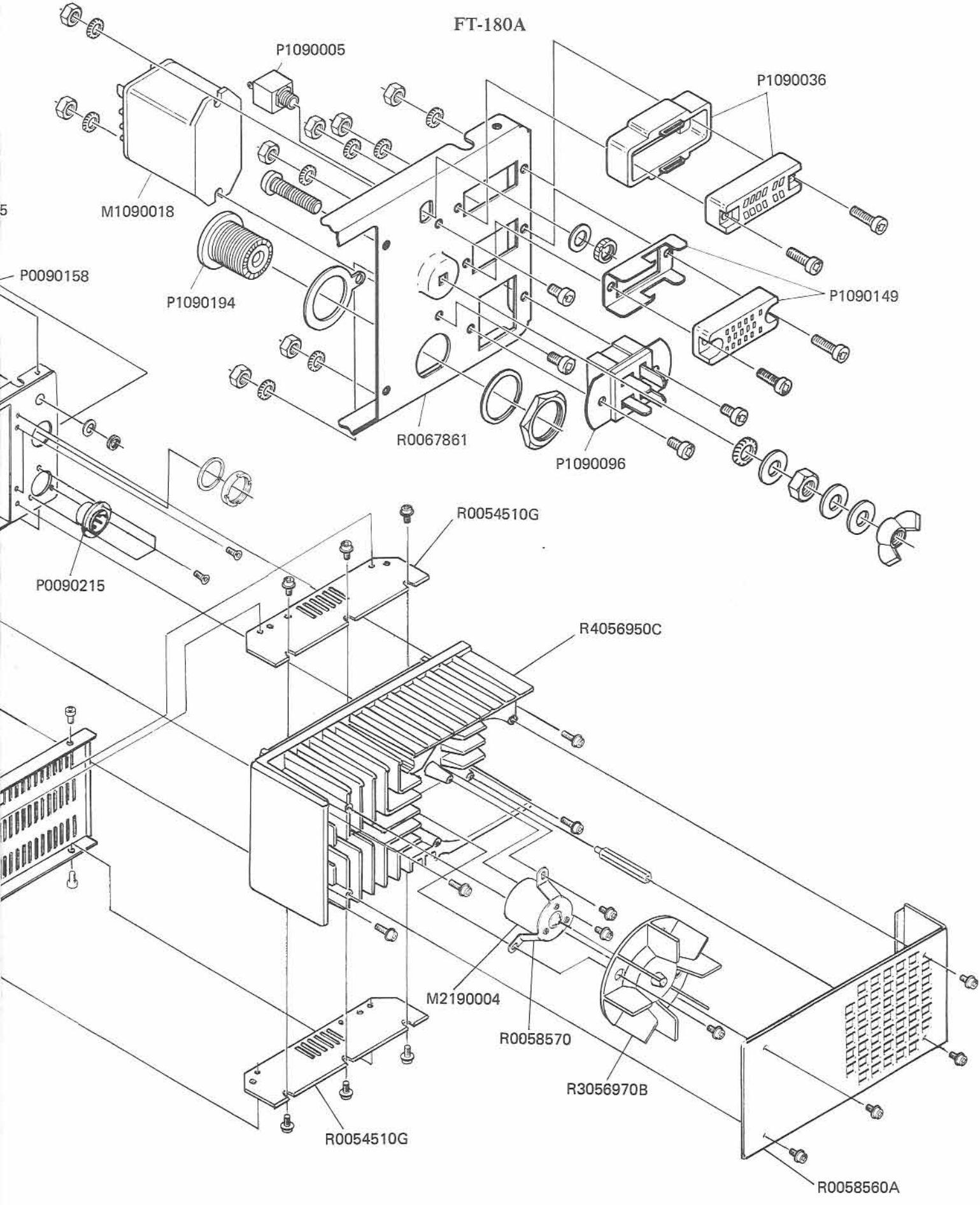
MEMO



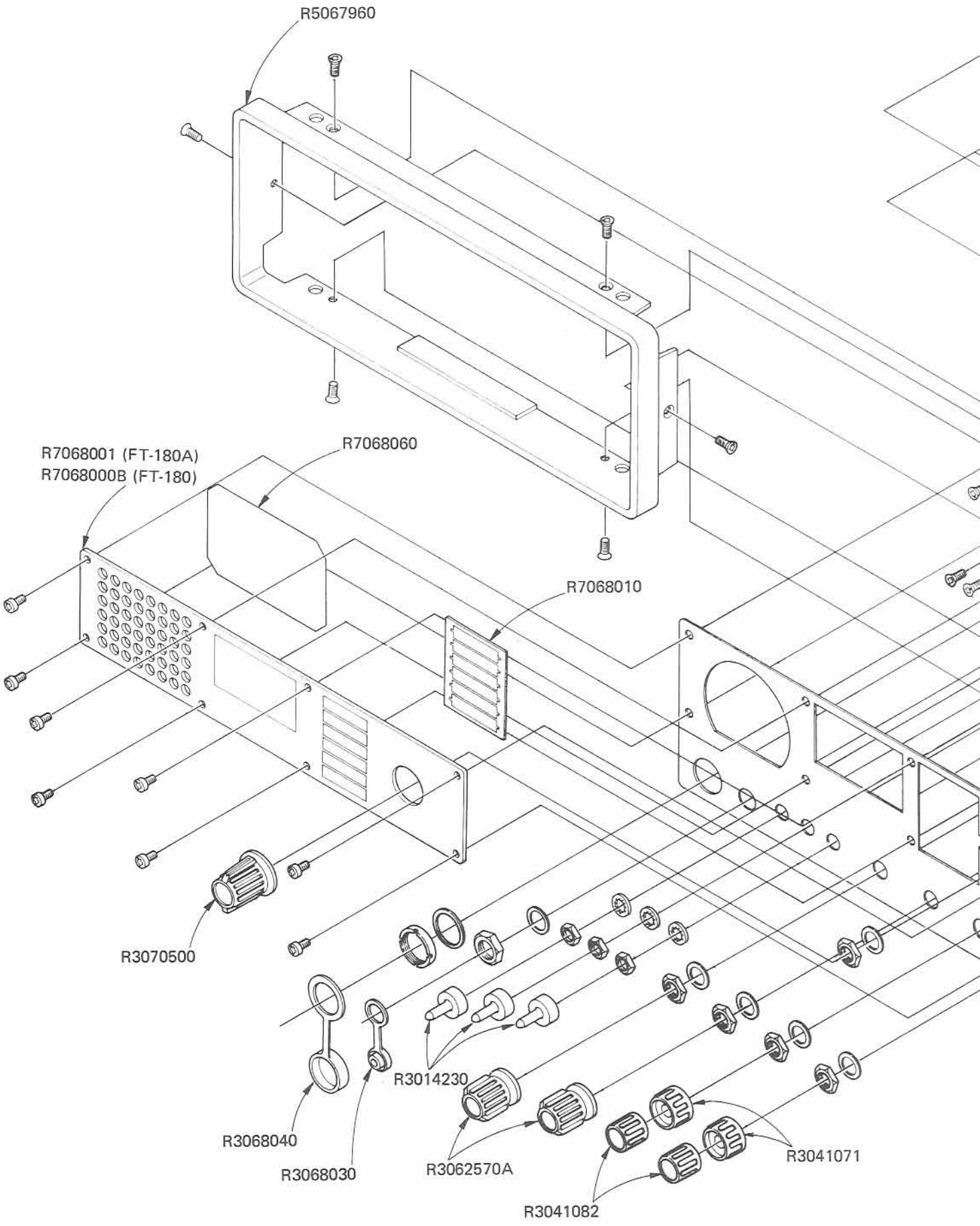
OUTER COVER REMOVAL



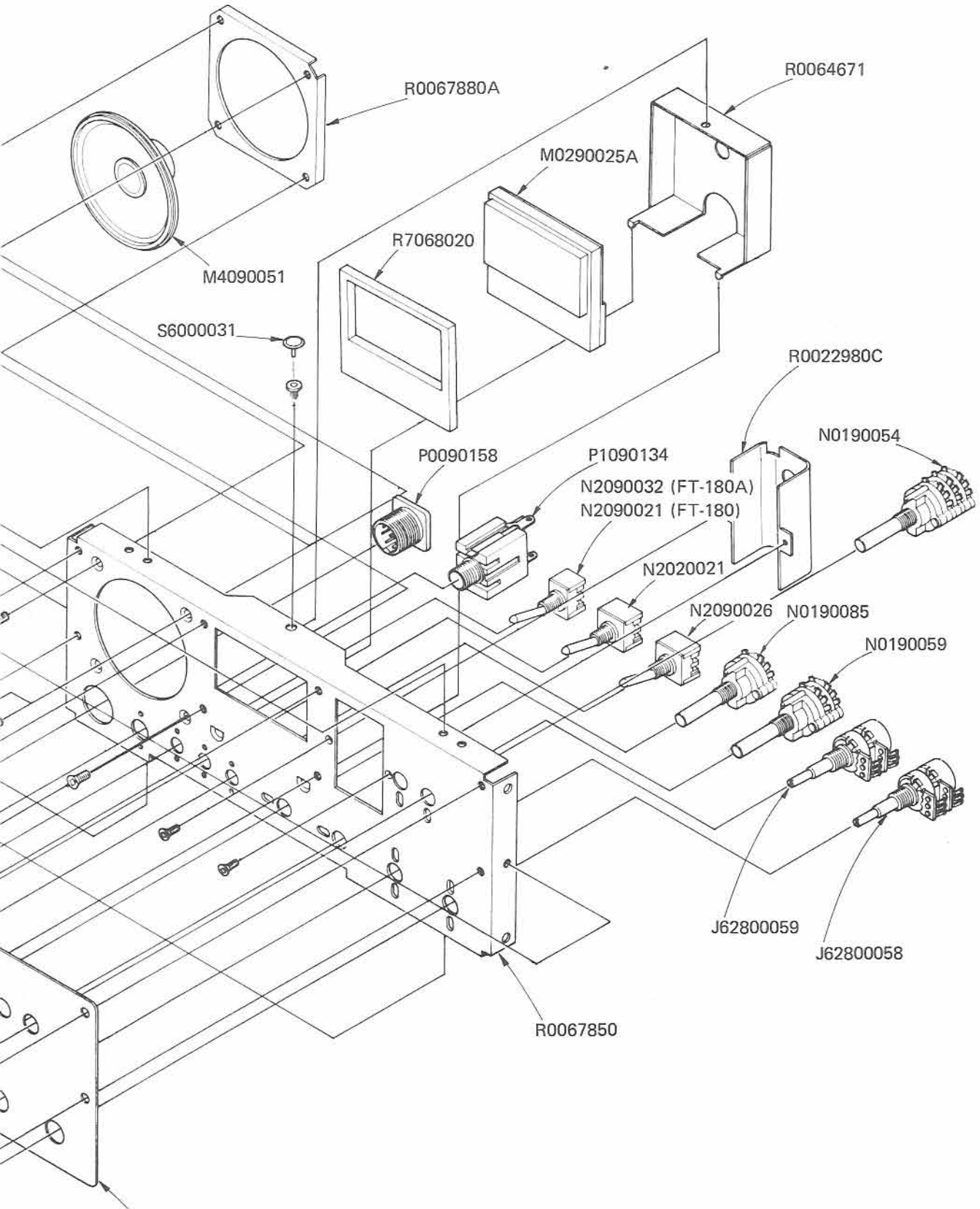
PANEL REMOVAL



FRONT PANEL R



EMOVAL



Wire Stand	R0037861B
Stand Holder	R0037850C
Stand Spacer	R0043050
Foot	R3018980

MAINTENANCE AND ALIGNMENT

This transceiver has been carefully aligned and tested at the factory. With normal use, it should not require other than the usual attention given to electronic equipment.

Service or replacement of a major component may require substantial adjustment. Under no circumstances, though, should realignment be attempted unless the operation of the transceiver is fully understood, the malfunction has been carefully analyzed, and the fault has definitely been traced to misalignment. Sudden difficulties are almost always caused by component failure, rather than misalignment.

Service must be performed only by experienced personnel, using the proper test equipment.

EQUIPMENT REQUIRED

(1) RF Signal Generator: Hewlett-Packard Model 606A or equivalent, with one volt output at 50 ohms, and frequency coverage to 30 MHz.

(2) Vacuum Tube Voltmeter (VTVM): Hewlett-Packard Model 410B or equivalent, with an RF probe good to 40 MHz.

(3) Dummy load/wattmeter: Yaesu Model YP-150Z or equivalent, with 50-ohm non-reactive load impedance, rated at 150 watts average power.

(4) Two additional 50-ohm dummy loads with provision to connect all three in parallel, or one 17 ohm dummy load.

(5) AF Signal Generator: Hewlett-Packard Model 200AB or equivalent.

(6) A general coverage receiver covering 3 to 30 MHz, with a 100 kHz crystal calibrator.

(7) Frequency Counter: Yaesu Model YC-500 or equivalent, with resolution to 0.01 kHz and frequency coverage to 50 MHz.

(8) Oscilloscope: Hewlett-Packard Model 1740A or equivalent.

NOTE: Regarding Measurement Levels

When decibel levels are quoted in the following section (e.g. "Apply a 90 dB signal . . ."), the reference used is 0 dB = 1 μV. At 50 ohms, this level is equivalent to −107 dBm.

RECEIVER ALIGNMENT

1. Antenna Coil/RF Coil Alignment

a) Set the CHANNEL selector to the channel to be aligned, and the RF GAIN control fully clockwise.

b) Connect the signal generator to the antenna jack, and tune its output to the channel frequency. Now set the output level to 90 dB.

c) Adjust the coils shown below for maximum deflection on the S-meter.

CH1: T_{1002}, T_{1003}
CH2: T_{1004}, T_{1005}
CH3: T_{1006}, T_{1007}
CH4: T_{1008}, T_{1009}
CH5: T_{1010}, T_{1011}
CH6: T_{1012}, T_{1013}

NOTE: All channels are simplex. For duplex channel alignment, see page 3-15, step 2.

2. RX Mixer Coil Alignment

a) Set the CHANNEL selector to any installed channel, and the RF GAIN control fully clockwise.

b) Set the signal generator exactly to the channel frequency, and apply a 90 dB signal.

c) Now adjust T_{1016} for maximum deflection on the S-meter.

3. RX Trap Coil Alignment

a) Set the CHANNEL selector to any installed channel, and connect the audio voltmeter to the speaker jack.

b) Connect the signal generator to the antenna jack, and apply a 100 dB signal at 10.7 MHz. Adjust T_{1001} and T_{1014} a few times for minimum indication on the audio voltmeter and S-meter.

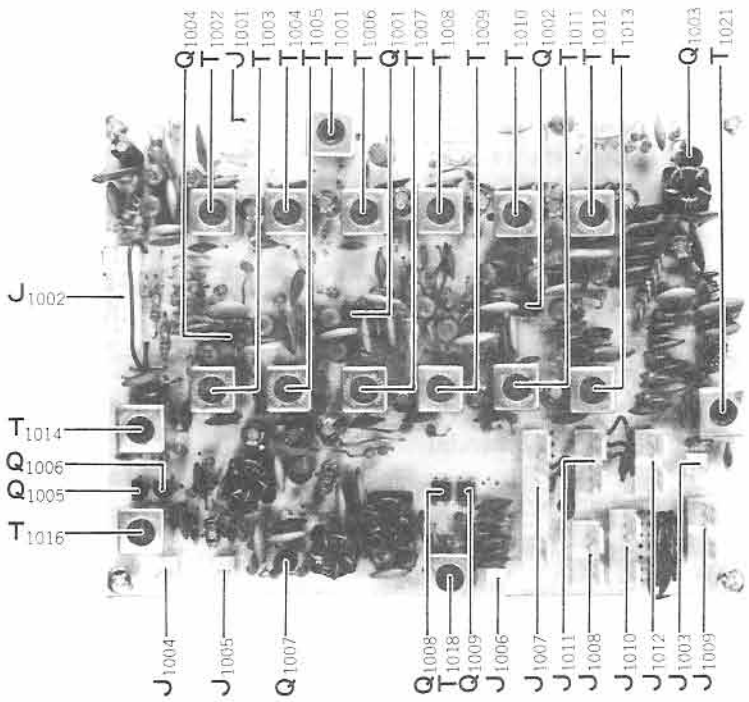
4. IF Coil Adjustment

a) Set the CHANNEL selector to any installed channel, and rotate the RF GAIN control fully clockwise.

b) Apply an 80 dB signal from the signal generator to the ANT jack. Adjust the following coils on the IF unit for a maximum reading on the S-meter. These coils should be aligned in the following order, or the correct peak may not be obtained. This procedure should also be repeated a few times to obtain a correct alignment.

$T_{2006} - T_{2007} - T_{2008} - T_{2009} - T_{2005} - T_{2004} - T_{2003}$

Repeat from T_{2006}.



RF UNIT

5. NB Coil Adjustment

a) Set the CHANNEL selector to any installed channel, and connect the signal generator to the ANT jack.

b) Connect the DC voltmeter to TP_{07} on the IF unit, and adjust the signal generator output to 40 dB on the channel frequency.

c) Now adjust T_{2012}, T_{2011} and T_{2010} for minimum deflection on the DC voltmeter.

6. S-Meter Alignment

a) Without applying any signal to the ANT jack, and with the RF GAIN control fully clockwise, adjust VR_{2003} to the point where the S-meter just starts to deflect.

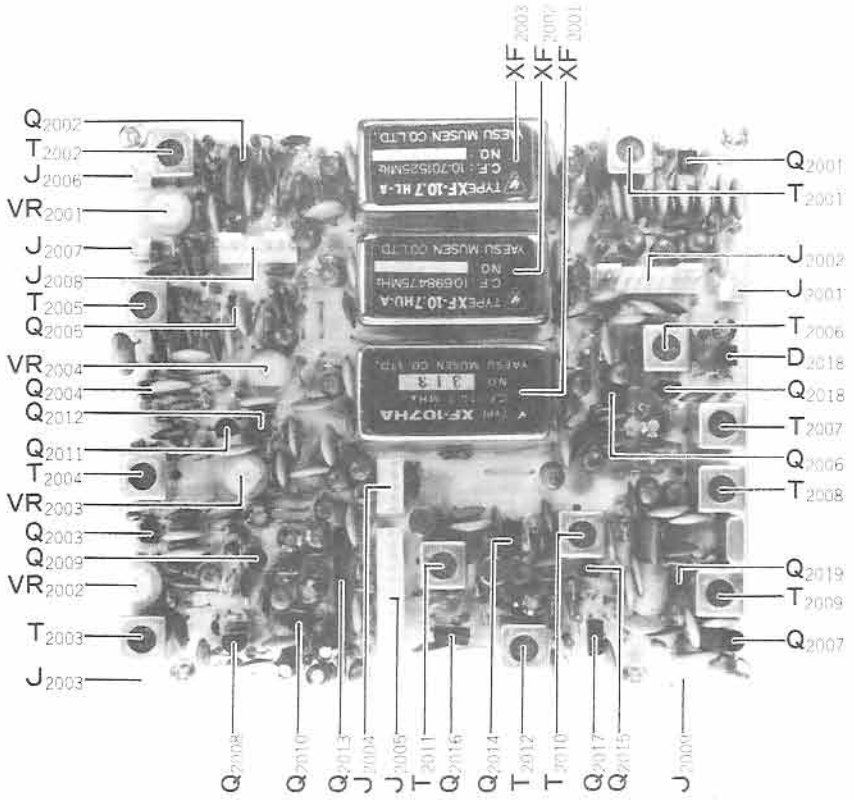
b) Apply a 90 dB signal from the signal generator to the ANT jack, and adjust VR_{2004} for a deflection of S9+60 dB.

c) Reduce the amplitude of the signal generator to 10 dB, and adjust VR_{2002} to the point where the S-meter just starts to deflect.

d) Repeat Steps b and c until the proper deflection is obtained.

7. Product Detector Alignment

Without applying any signal to the receiver, adjust VR_{3003} for a minimum reading on the S-meter.



IF UNIT

TRANSMITTER ALIGNMENT

While performing transmitter alignments, the ANT jack must be terminated by a 50 ohm load, unless otherwise specified in the steps. Failure to follow this precaution will void the warranty of this equipment.

1. Balanced Modulator Coil Alignment

a) Disconnect plug P_{13} from its jack (J_{2001}) on the IF unit, and terminate P_{13} with a 50 ohms resistor. Connect the RF probe of the VTVM to P_{13}.

b) Turn the CALIB/CALL switch to CALL, and adjust T_{3001} for a maximum reading on the VTVM.

2. Carrier Null Alignment

a) Set the MODE switch to USB, VR_{3001} fully counterclockwise, and set the CHANNEL selector to an installed channel.

b) With an external receiver tuned to the channel frequency, close the PTT switch on the microphone. Now adjust VR_{3002} for minimum signal indication on the external receiver.

3. TX Mixer Coil Alignment

a) Set the CHANNEL selector to any installed channel, and disconnect P_{03} from its jack (J_{1003}) on the RF unit. Connect the RF probe of the VTVM to J_{1003}.

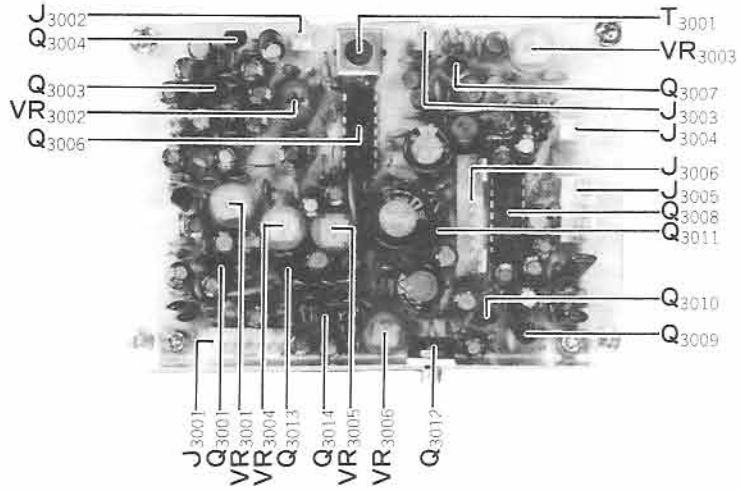
b) Now adjust T_{1018} on the RF unit for a maximum reading on the VTVM.

4. TX IF Trap Coil Alignment

Note: If a spectrum analyzer is not available, do not proceed with this alignment, as the spurious on 10.7 MHz that may result cannot be properly observed.

a) Set the CHANNEL selector to the closest frequency to 10.7 MHz of the installed frequencies, and the MODE switch to A3h. Connect the spectrum analyzer to J_{1003} on the RF unit.

b) Now close the PTT switch, and adjust T_{1021} for a minimum spurious level at 10.7 MHz on the spectrum analyzer.



AF UNIT

5. TX IF Coil Alignment

a) Disconnect P_{06} from its jack (J_{1006}) on the RF unit, and terminate P_{06} with a 50 ohm resistor. Connect the RF probe of the VTVM to P_{06}.

b) Adjust T_{2001} and T_{2002} for maximum deflection on the VTVM.

6. IC Meter and Idling Current Alignment

a) Disconnect the +13.5 volt line to the PA unit, and connect an ammeter in series with the line. Turn the CALIB/CALL switch to CALL.

b) Adjust VR_{5001} so that the reading on the IC meter will show the same value as that on the ammeter.

c) Now release the CALIB/CALL switch, and set the MIC control fully counterclockwise. Press the PTT switch, and adjust VR_{9001} (100W PA), VR_{8001} (50W PA), or VR_{7001} (10W PA) for a reading of 100 mA on the ammeter.

7. FWD Meter Setting

Turn the CALIB/CALL switch to CALL, and adjust VR_{5002} to 80% of full scale on the S/FWD meter.

8. ALC Alignment

Note: Do not switch channels or modes during transmission.

a) Preset the potentiometers and MODE switch, as follows:

VR_{3001}	AF Unit	Fully counterclockwise
VR_{2001}	IF Unit	Fully clockwise
VR_{4003}	LPF Unit	Fully clockwise
VR_{4002}	LPF Unit	Fully counterclockwise
VR_{4001}	LPF Unit	Fully counterclockwise
MODE switch		A3h

b) On any channel, close the PTT switch and adjust VR_{2001} for a power output of 50 watts on the dummy load/wattmeter. (50W PA: 25 watts; 10W PA: 4 watts)

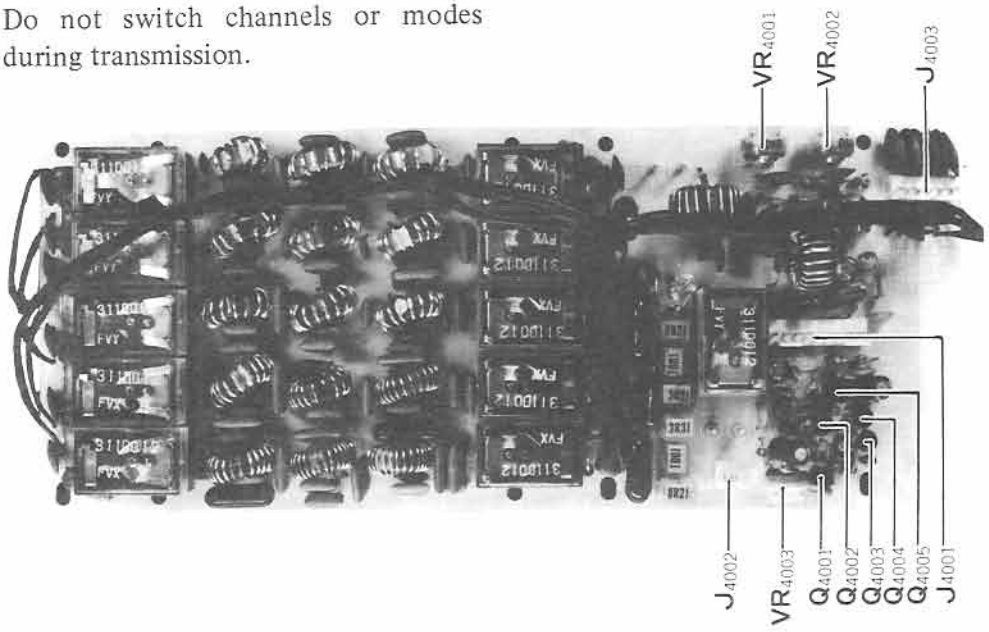
c) Check the power output for each frequency and set the CHANNEL selector to the channel at which minimum power is obtained.

d) Again adjust VR_{2001} for a power output of 67 watts on the dummy load/wattmeter (50W PA: 33 watts; 10W PA: 7 watts).

e) Adjust VR_{4002} for 35 watts on the wattmeter (50W PA: 18 watts; 10W PA: 4 watts).

f) Now set the MODE switch to USB, the CALIB/CALL switch to CALL, and adjust VR_{4003} for a reading of 100 watts on the dummy load/wattmeter (50W PA: 50 watts; 10W PA: 10 watts).

g) Release the CALIB/CALL switch, and apply a 2 mV 1000 Hz signal from the AF generator to the MIC connector. Set the MODE switch to SSB (USB or LSB).

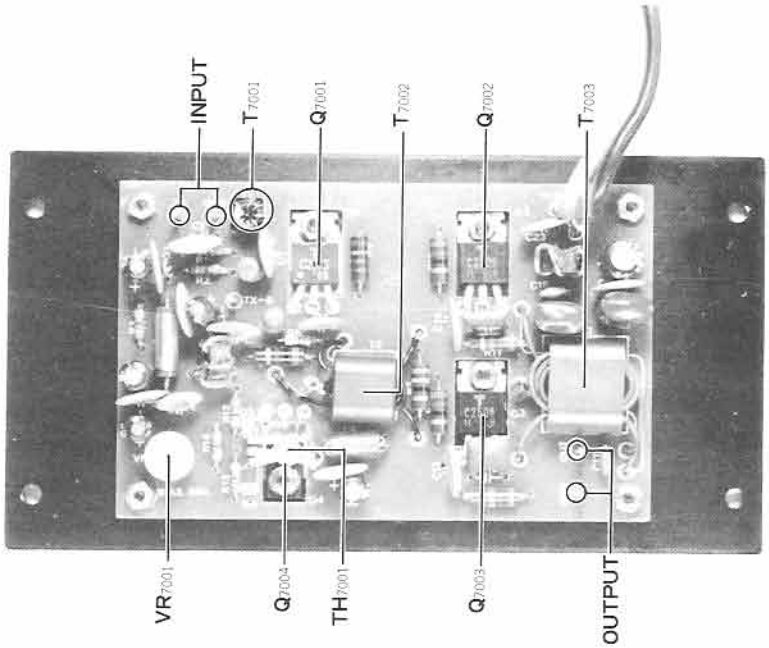


LPF/ALC UNIT

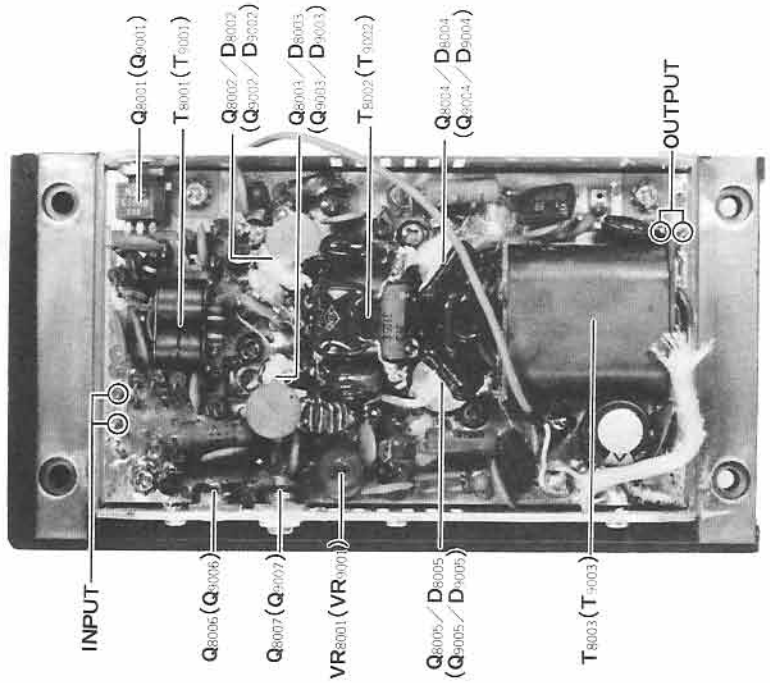
h) Adjust VR_{3001} to the point where the specified power output is obtained on the dummy load/wattmeter.

i) Connect three 50 ohm dummy loads in a parallel fashion, so as to present a 17 ohm load to the amplifier (1:3 SWR with reference to 50 ohms). Turn the CALIB/CALL switch to CALL, and adjust VR_{4001} for 75 watts power output, as indicated on the wattmeter (50W PA: 37.5 watts; 10W PA: 7.5 watts).

Note for 50W Model:
Never attempt to adjust VR_{2001} or VR_{4003} without performing the entire ALC alignment procedure, as this may cause the final transistors to exceed the specified power output, leading to damage by overheating.



10W PA UNIT



50W/100W PA UNIT

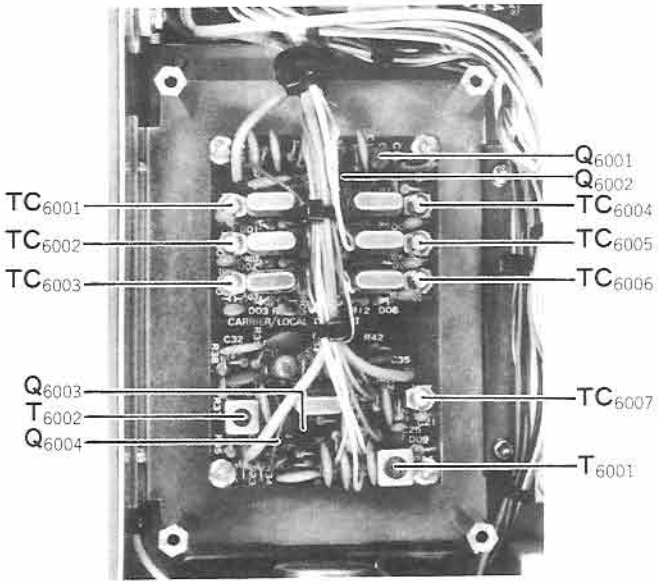
COMMON CIRCUITS

1. Carrier/Local Oscillator Alignment

> Note: When the optional crystal oven is installed, there is a difference in the part numbers used in the FT-180/180A. Part numbers of the form 60XX should be read as 6XX (e.g., $D_{6006} \rightarrow D_{606}$).

a) Disconnect P_{6024} from its jack (J_{3003}) on the AF unit, and connect the RF probe of the VTVM to P_{6024}.

b) Adjust T_{6002} for maximum deflection on the VTVM. The nominal value is approximately 0.2 volts.



CARRIER/LOCAL UNIT

c) Remove the VTVM from P_{6024} and connect the frequency counter to the plug.

d) Set the CLARIFIER control to the center position, and adjust the core of T_{6001} for a reading of 10.700 MHz.

e) Now close the PTT switch and adjust TC_{6007} for a reading of exactly 10.700 MHz.

f) Next, remove the counter from P_{6024} and connect the frequency counter to J_{1005} on the RF unit.

g) The local oscillator frequency must be adjusted by the appropriate trimmer capacitor, corresponding to the CHANNEL selector. Adjust the trimmer capacitors on the CARRIER/LOCAL OSC Unit as shown below to the exact crystal frequencies.

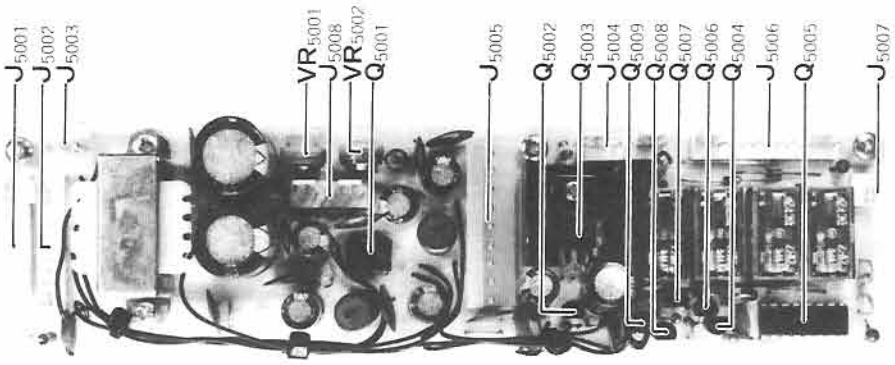
CH1: TC_{6001}
CH2: TC_{6002}
CH3: TC_{6003}
CH4: TC_{6004}
CH5: TC_{6005}
CH6: TC_{6006}

2. Tone Oscillator Alignment

a) Connect the frequency counter to TP_{3001} on the AF unit, turn the CALIB/CALL switch to CALL, and adjust VR_{3006} for a frequency of 1500 Hz ±20 Hz.

b) Connect the AF voltmeter to the internal speaker terminals, and turn the CALIB/CALL switch to CALIB. Adjust VR_{3005} on the AF unit for a reading of 0.45 volts on the AF voltmeter.

c) Connect the AF voltmeter to TP_{3001}, turn the CALIB/CALL switch to CALL, and adjust VR_{3004} for a reading of 80 mV on the AF voltmeter.



REGULATOR/CONTROL UNIT

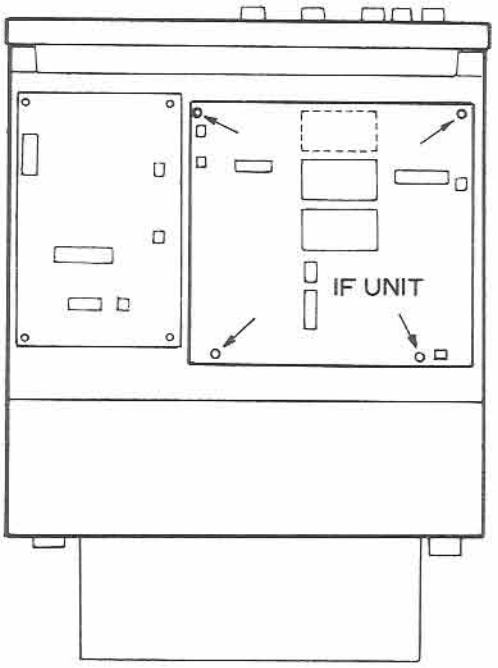
MODIFICATIONS

LSB FILTER INSTALLATION

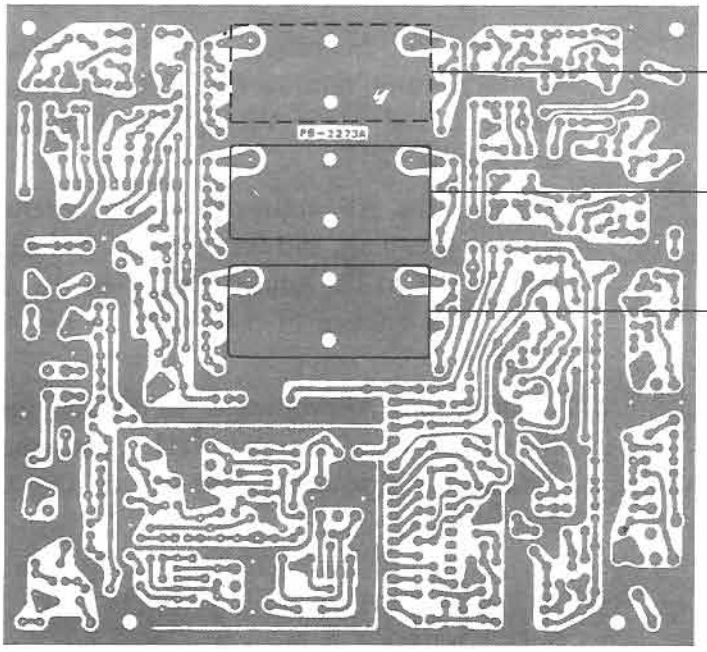
1) Remove the bottom cover of the transceiver, and carefully disconnect all connectors on the IF unit. Then, unscrew the four IF unit mounting screws on the corners of the unit.

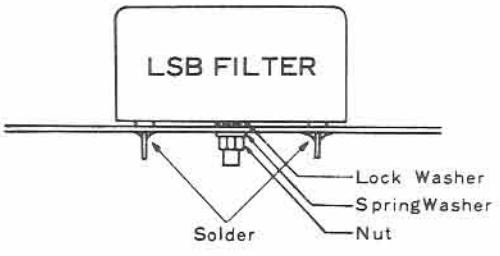
2) Install the LSB Filter on the IF unit using the nuts provided, in the space beside the existing IF filters. Solder the pins of the filter to the circuit board.

3) Install the IF Unit in exactly the same configuration as before, and secure it with the mounting screws. Connect all plugs to their jacks, and close the transceiver.



BOTTOM VIEW





OPTIONAL CRYSTAL OVEN INSTALLATION

1) Remove the bottom and top covers from the chassis.

2) On the bottom side of the transceiver, disconnect P_{19} on the IF unit, and P_{24} on the AF unit. On the top side, disconnect P_{05} and P_{07} on the RF unit. (Refer to Figures 1 and 2.)

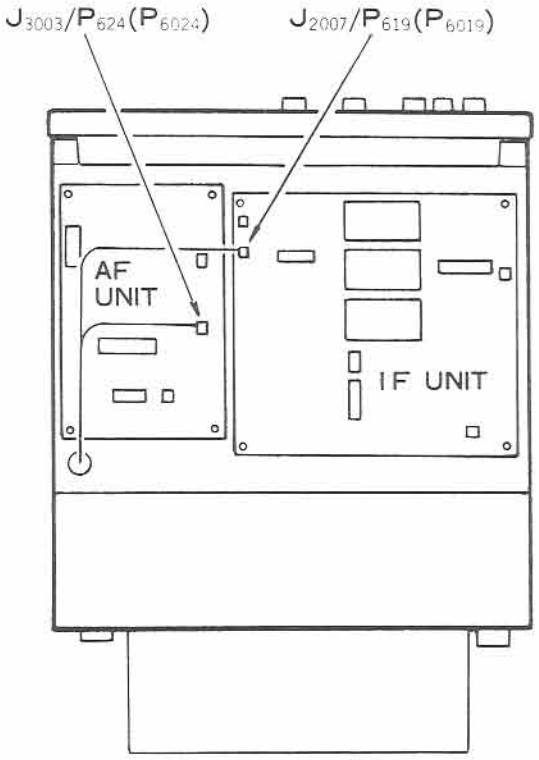
3) Unscrew the four CARRIER/LOCAL OSC Unit mounting screws marked A on Figure 2. Then remove the CARRIER/LOCAL OSC Unit mounting plate from the unit.

4) Affix the mounting plate to the crystal oven with the screws removed in step 3.

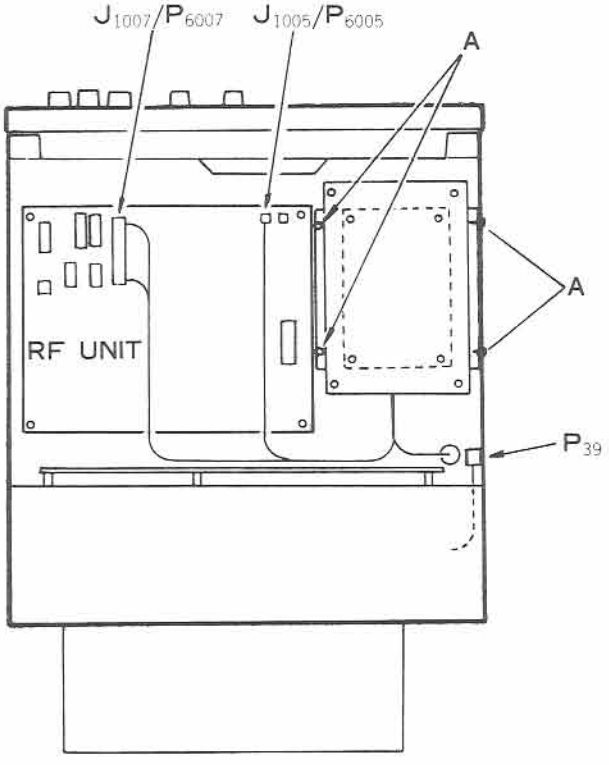
5) Secure the crystal oven with the mounting plate, in exactly the same configuration as the CARRIER/LOCAL OSC Unit was previously.

6) Connect all plugs to their appropriate jacks. (P_{605} to J_{1005}, P_{607} to J_{1007}, P_{619} to J_{2007} and P_{624} to J_{3003}). The heater cable (P_{640}) should be connected to P_{39}. This connector had previously remained loose, near the CARRIER/LOCAL OSC Unit. (Refer to Figures 2 and 3.)

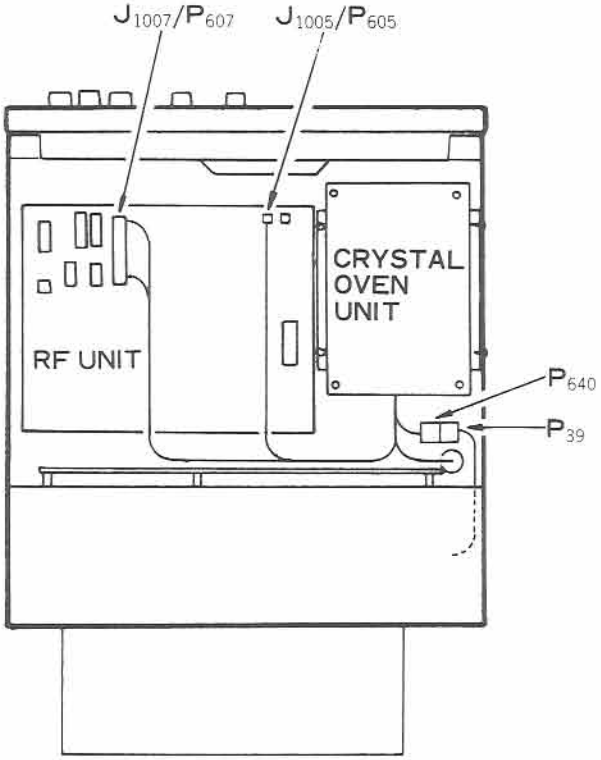
7) Crystals used in the oven differ from those used without, and so new crystals must be installed when the oven is added. See the procedure on the following page.



BOTTOM VIEW
Figure 1



TOP VIEW
Figure 2



TOP VIEW
Figure 3

CHANNEL INSTALLATION PROCEDURE

The channel installation requires a channel crystal, capacitors, coils, and some jumper wires. The exact value of these parts should be determined in accordance with the following instructions.

The formula below is used to determine the exact crystal frequencies:

Crystal = Channel frequency + 10.7 MHz

NOTE:

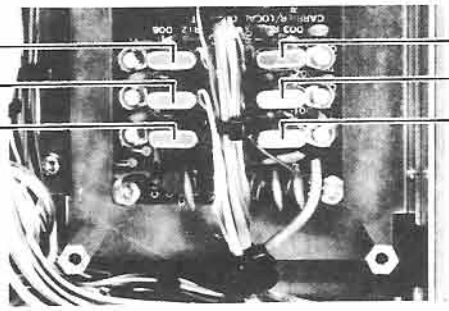
The specifications for crystals used with the oven differ from those used without the oven, so when ordering crystals, please state clearly the 8-digit part number (H...) given in the Table below, along with the channel frequency.

SIMPLEX CHANNELS

1. Referring to Figure 4, install the crystals into the sockets on the CARRIER/LOCAL Unit. Be sure to install the correct crystal in each socket, according to the channel number. If the FT-180A is equipped with a crystal oven, the CARRIER/LOCAL Unit is located within the oven.

2. Unplug all connectors on the RF unit, unscrew the four mounting screws, and remove the RF Unit from the chassis.

3. Referring to Figures 5 and 6, notice that each of the six channels has two transformers, together with their associated capacitors, which must be selected to correspond with the desired channel frequency. Obtain the correct values for these transformers and capacitors from the BAND TABLE on page 44, and install in the correct locations on the RF Unit.



CRYSTAL LOCATIONS
Figure 4

CRYSTAL DATA

	w/o OVEN		w/OVEN	
Location number	X6007	X6001–X6006	X607	X601–X606
Part number	H0102387	H0102391	H0102730	H0102390
Function	Carrier	Local	Carrier	Local
Holder	HC-42/U	HC-42/U	HC-42/U	HC-42/U
Frequency	10.7 MHz	CH + 10.7 (MHz) (12.3 MHz to 28.7 MHz)	10.7 MHz	CH + 10.7 (MHz) (12.3 MHz to 28.7 MHz)
Mode	Fundamental	Fundamental	Fundamental	Fundamental
Load capacitance	24 pF	28 pF	24 pF	28 pF
Parallel capacitance	3.4 pF ± 0.3 pF	5 pF ± 0.5 pF	3.4 pF ± 0.3 pF	5 pF ± 0.5 pF
Effective resistance	less than 40Ω	less than 40Ω	less than 40Ω	less than 40Ω
Drive level	1 mW	1 mW	1 mW	1 mW
Frequency tolerance	±50 Hz	±10 ppm	±50 Hz	±10 ppm
Frequency stability	±10 ppm (−10°C to 50°C)		±0.15 ppm/°C (70°C to 80°C)	
Oven temperature	–		75°C ± 3°C	

For example; to install 2182 kHz into channel 1, find the values for 2.0–2.5 MHz in the BAND TABLE. There we find that the transformers should be part no. L0020973, and the capacitors, 100 pF. From Figures 5 and 6 we see that the transformers should be installed in locations T_{1002} and T_{1003}, and the capacitors in locations C_{1021} and C_{1053} (for CH 1).

4. Part A in Figures 7 and 8 illustrates the jumper wires that must be connected between J_{07} and J_{11} or J_{12} on the RF Unit (if all six channels are to be simplex). If some channels are to be semi-duplex, install only those jumpers corresponding to the simplex channel(s).

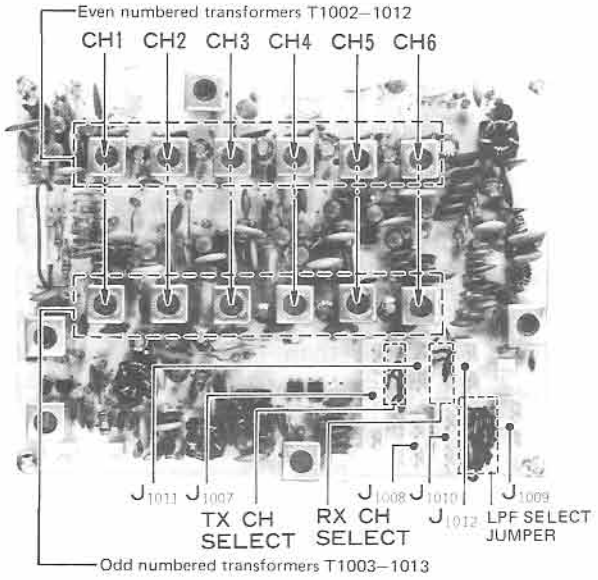
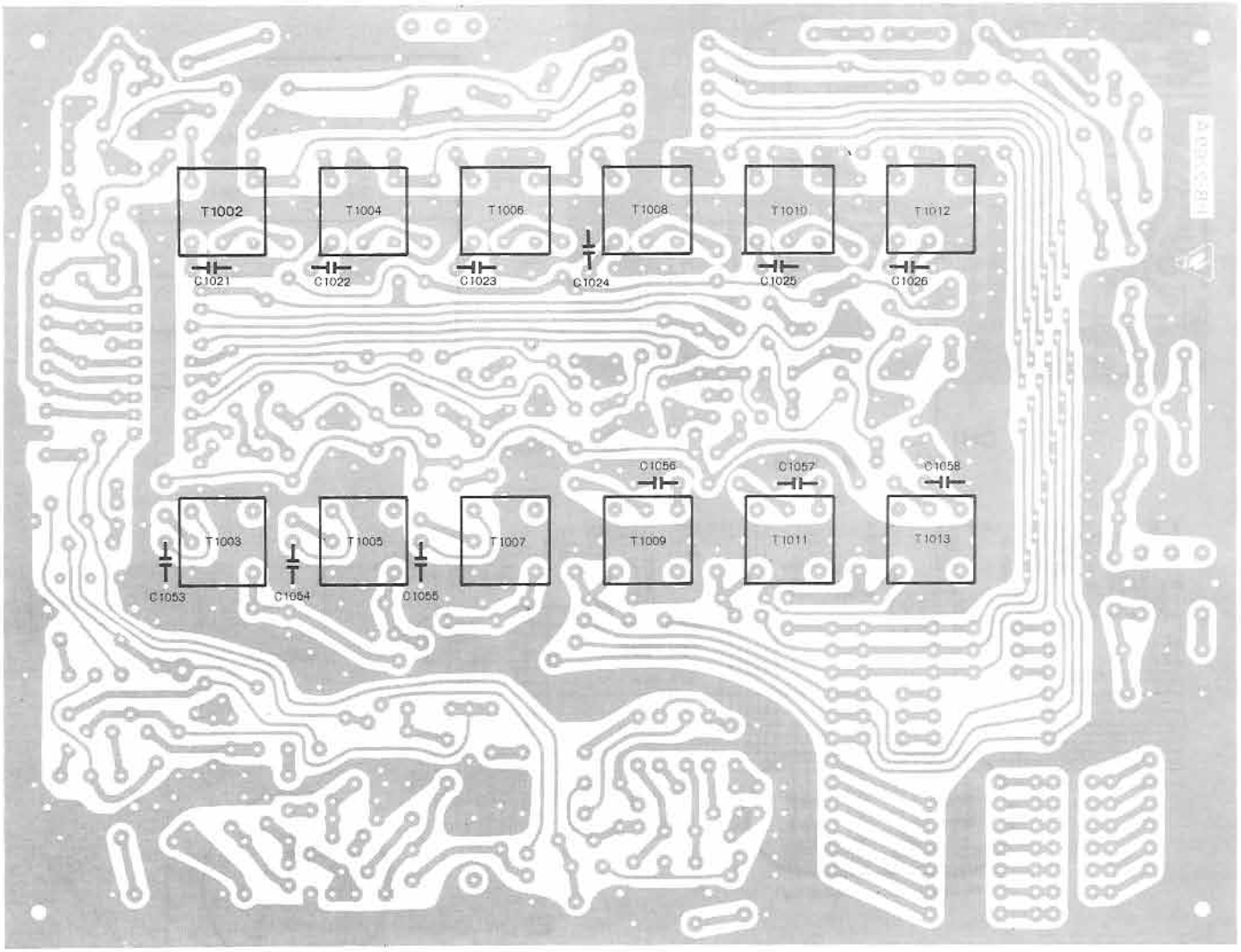


Figure 5 RF Unit



RF Unit – component side

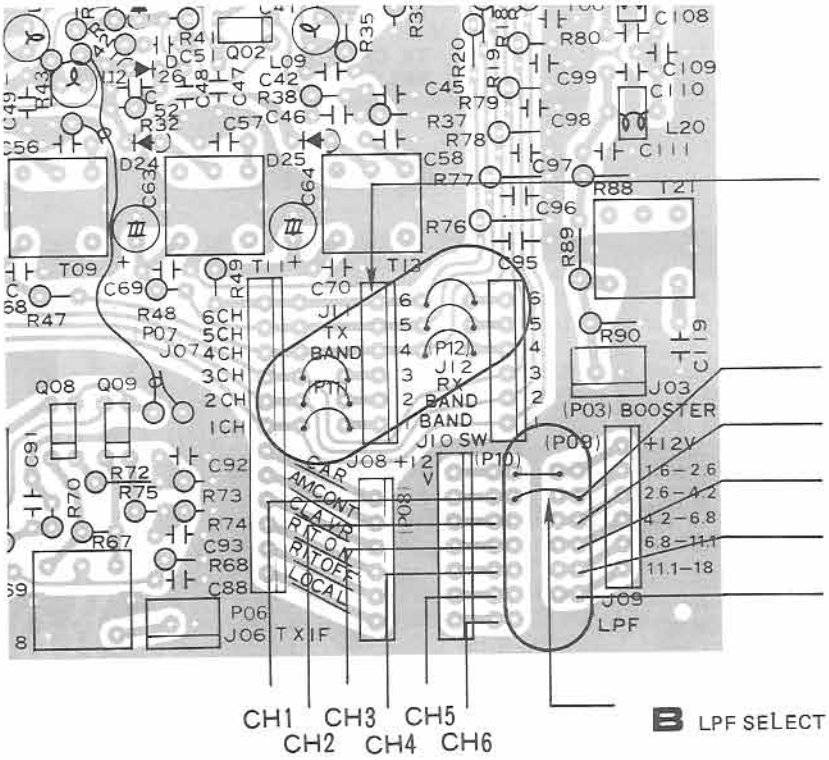
Figure 6

5. Referring to Part B in Figures 7 and 8, install a jumper from the point adjacent to the pin of J_{10} corresponding to the channel being installed to the point connected to the pin of J_{09} corresponding to the LPF whose frequency range includes the channel frequency. For example, if Channel 1 is to be 2182 kHz, connect the jumper from the point next to pin 2 of J_{10} to the 1.6–2.6 MHz point next to J_{09}. If more than one channel is in the same LPF band, simply make multiple connections to the point adjacent to J_{09}.

> **Note:**
>
> Improper jumper connections may damage the lowpass filters and final transistors.

6. When all desired channels have been installed, return the RF Unit to its original position and replace the mounting screws and connectors.

Figure 7



	LPF FREQUENCY RANGE
A	1.6 MHz – 2.6 MHz
B	2.6 MHz – 4.2 MHz
C	4.2 MHz – 6.8 MHz
D	6.8 MHz – 11.1 MHz
E	11.1 MHz – 18.0 MHz

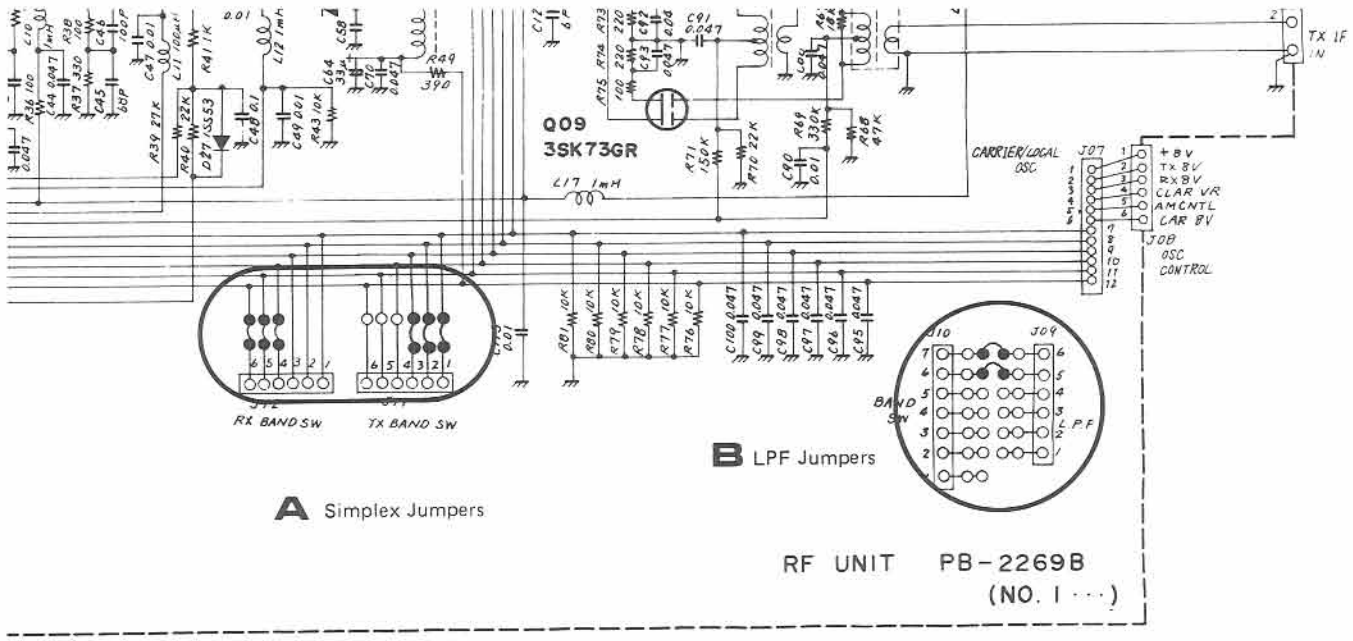


Figure 8

SEMI-DUPLEX CHANNELS

1. Referring to Figure 4, on the CARRIER/LOCAL Unit, install the RX crystal for the semi-duplex channel into location 1, 2 or 3; and the TX crystal into location 4, 5 or 6, respectively. That is, if CH 1 is to be semi-duplex, the TX crystal goes in the CH 4 position; CH 2 semi-duplex TX crystal in CH 5; and CH 3 semi-duplex TX crystal into CH 6.

2. Referring to the BAND TABLE on page 3-40, determine the values of the transformers and capacitors needed for the RX and TX frequencies. Install these parts in the locations listed below and shown in Figures 5 and 6.

CHANNEL 1:
CH 1 (RX) T_{1002}, T_{1003}, C_{1021}, C_{1053}
CH 4 (TX) T_{1008}, T_{1009}, C_{1024}, C_{1056}
CHANNEL 2:
CH 2 (RX) T_{1004}, T_{1005}, C_{1022}, C_{1054}
CH 5 (TX) T_{1010}, T_{1011}, C_{1025}, C_{1057}
CHANNEL 3:
CH 3 (RX) T_{1006}, T_{1007}, C_{1023}, C_{1055}
CH 6 (TX) T_{1012}, T_{1013}, C_{1026}, C_{1058}

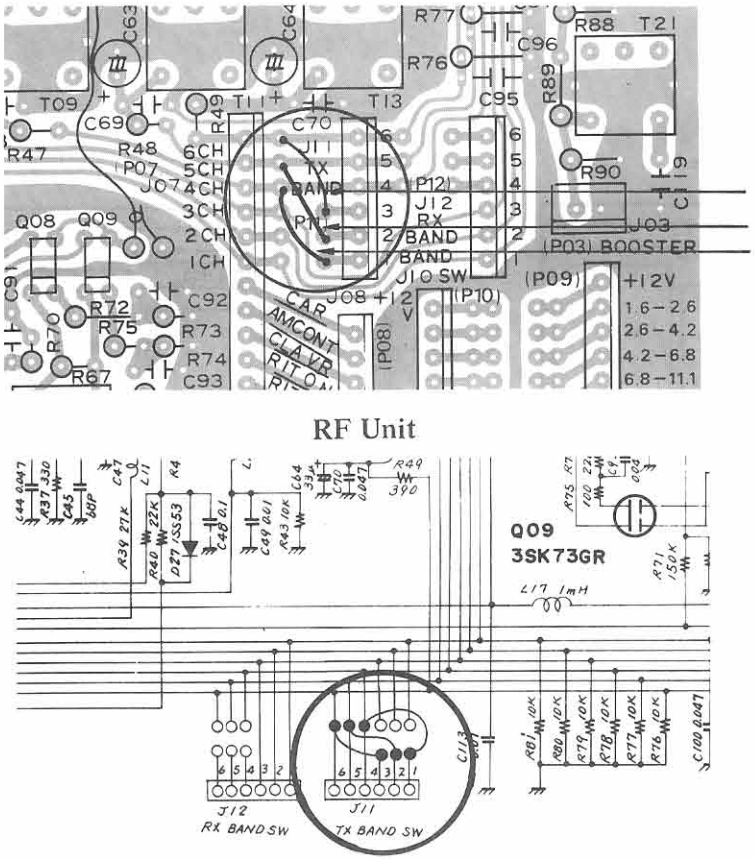
3. Install the Channel Select Jumper(s) from the point adjacent to J_{07} to the point adjacent to J_{11} for the semi-duplex channel(s) being installed, as shown in Figure 9.

4. Referring to step 5 and Part B of Figures 7 and 8 in the Simplex Channel procedure, install the LPF jumper(s) for the TRANSMIT frequency in the CH1, CH2 or CH3 positions (points in common with pins 4, 5 and 6 of J_{10}, respectively). Do not install any LPF jumper for semi-duplex channels in the CH4, CH5 or CH6 positions.

5. Referring to Figure 10, cut the wire to connector P_{11} that corresponds with the CH location that is being used as the transmit frequency for the semi-duplex channel. That is, if CH1 is to be semi-duplex, cut the wire to pin 4 (designated CH4 in Figure 10). For CH2 semi-duplex, cut the wire to pin 5 (CH5); and for CH3 semi-duplex, the wire to pin 6 (CH6).

Figure 9

SEMI-DUPLEX JUMPER CONNECTIONS



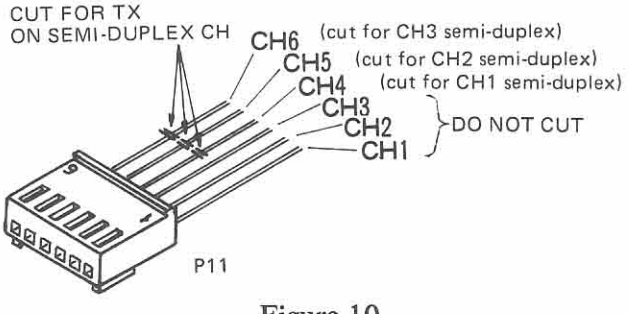


Figure 10

FT-180A
MODIFICATION PROCEDURE
FOR USE WITH THE FH-180

Kit required: Part number D3000266

1. Disconnect the FT-180A from the power source, and remove the 4 screws affixing the top cover. Loosen the side plate screws, and remove the cover.

2. Referring to Figure 11, locate the two screws affixing the Connector Unit. Remove these screws, but do not remove the connectors from the Unit yet.

3. Carefully disconnect plugs P_{10}, P_{11} and P_{12} from RF Unit (previously beneath the Connector Unit). Also disconnect plugs P_{43} and P_{44} from the Connector Unit.

4. Remove the CHANNEL selector knob, mounting nut and washer, and remove this switch and its wires disconnected in the previous step.

5. Install the new BCD switch supplied with the kit, with wires and plug P_{52}.

6. Connect one end of each of the supplied connection cables to the RF Unit: P_{10} to J_{1010}, P_{11} to J_{1011}, and P_{12} to J_{1012}.

7. Referring to Figure 12, install the Remote Control Unit (supplied with the kit) using the the supplied mounting screws. Make sure that no wires or connectors are pinched or trapped beneath the Unit.

8. Connect the other ends of the new connection cables to the Remote Control Unit: P_{49} to J_{705}, P_{50} to J_{706}, and P_{51} to J_{707}.

9. Disconnect the following plugs one at a time from the Connector Unit, and connect them to the jacks on the Remote Control Unit: P_{45} to J_{701}, P_{46} to J_{702}, P_{47} to J_{703} and P_{48} to J_{704}.

10. Connect P_{52} from the new CHANNEL selector switch to J_{708} on the Remote Control Unit.

11. Replace the top cover and its 4 screws. This completes the modification.

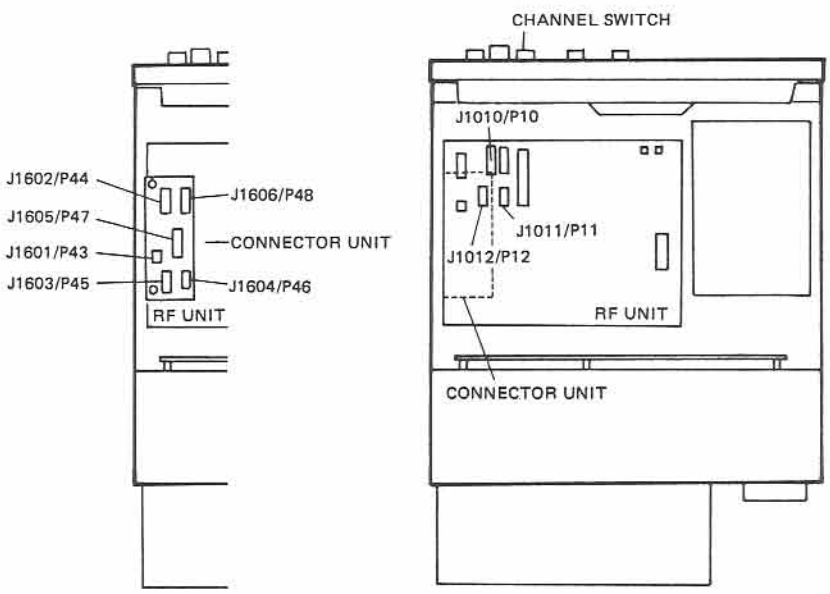


Fig. 11

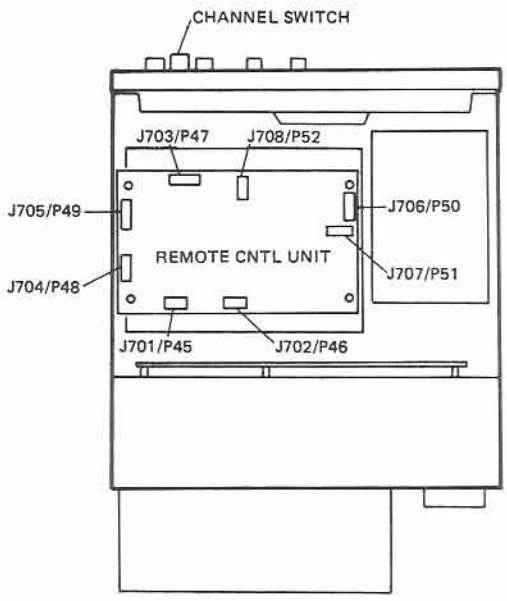
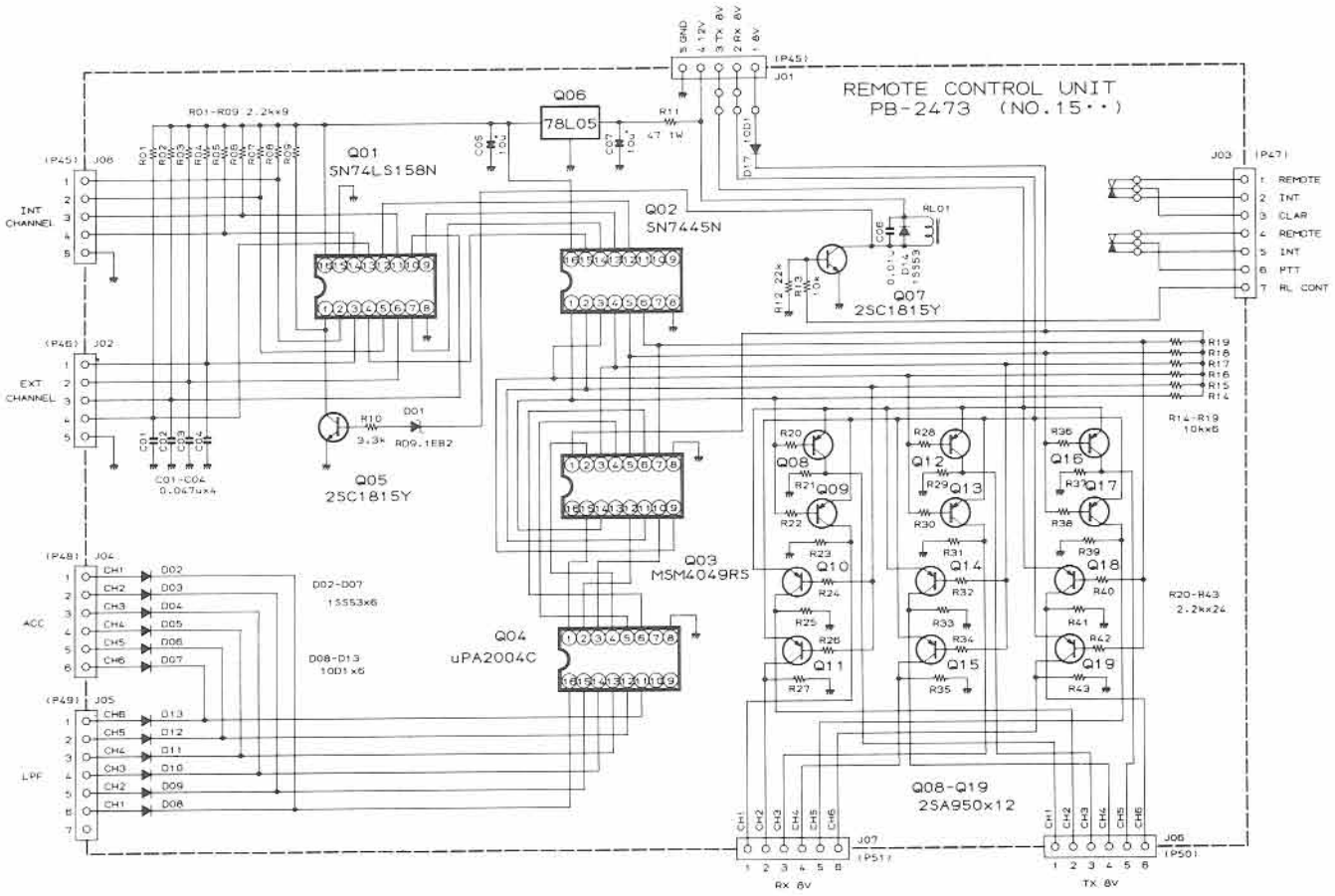
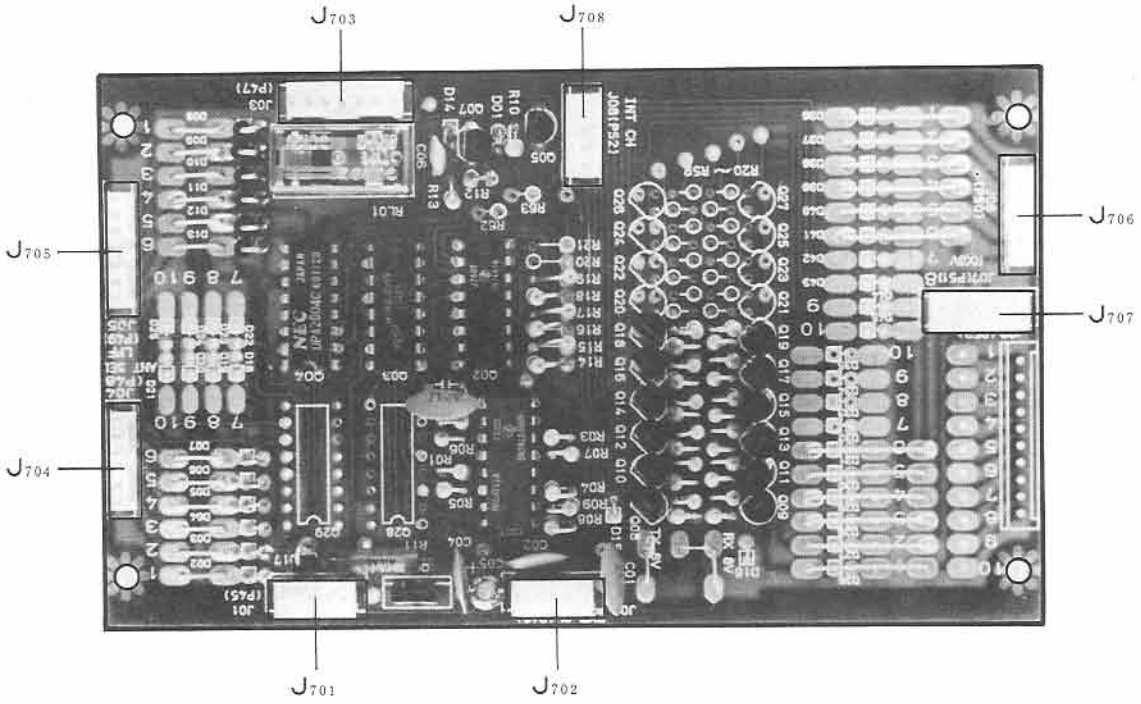


Fig. 12

TOP VIEW





REMOTE CONTROL UNIT

(Optional Accessory for FT-180A)

SOLDERING TECHNIQUE

SOLDERING AND DESOLDERING TECHNIQUE ON PRINTED CIRCUIT BOARDS

The FT-180/180A circuit boards are tough, but mishandling during soldering can cause circuit traces to "lift." While this does not cause 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 IC'S:

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

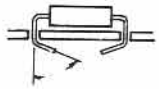
In storage, use only sponge specially designed for CMOS components.

When installing a CMOS IC 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 potential as the chassis (better to discharge small amounts of static electricity through your fingers than through a $5 IC!).

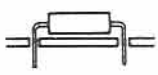
When soldering a CMOS IC onto a circuit board, use a low wattage iron, and be sure to ground the tip with a clip lead, if the tip is not grounded through a three-wire power cord.

INSERTION OF PARTS ON CIRCUIT BOARDS

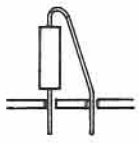
All of the below are acceptable ways of inserting components into circuit board mounting holes.



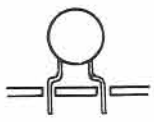
(a) Bend leads slightly



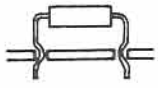
(b) Straight-in mounting



(c) Vertical mounting

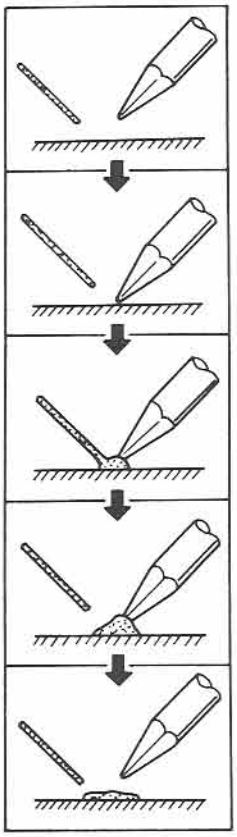


(d) Preformed disc ceramic capacitor



(e) Preformed resistor, diode, etc.

BASIC SOLDERING PRACTICE



(1) Prepare soldering iron and solder.

(2) Apply soldering iron to surface to be soldered.

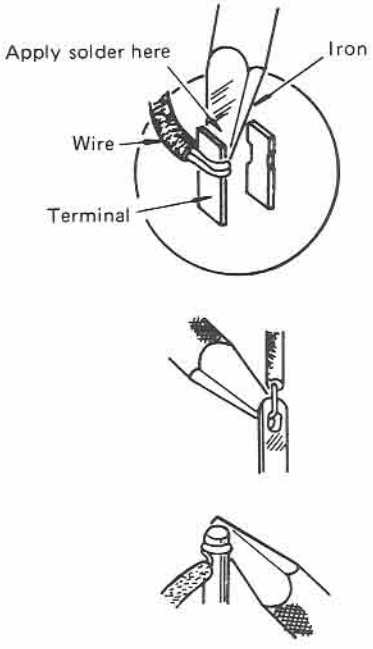
(3) Apply solder to heated surface.

(4) When enough solder is applied, remove solder. Continue to apply heat until solder flows cleanly.

(5) Remove iron from work. Do not apply more heat than necessary for good solder flow.

Soldering to terminal posts:

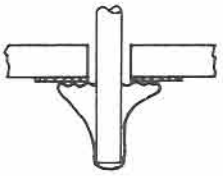
(Be certain to apply heat to both post and wire.)



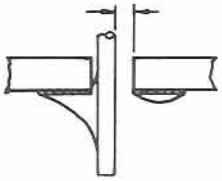
EXAMPLES OF POOR SOLDERING PRACTICE

Solder bridge (caused by use of too much solder)

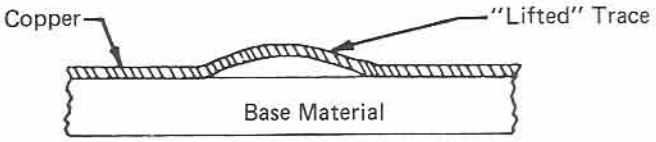
"Cold joint" (caused by insufficient heat to part of work, resulting in poor solder flow)

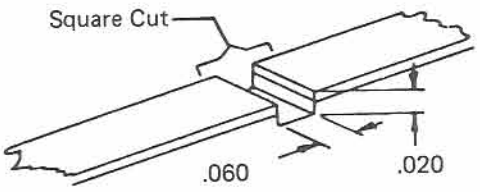


Unstable joint (caused by insufficient heat or solder)



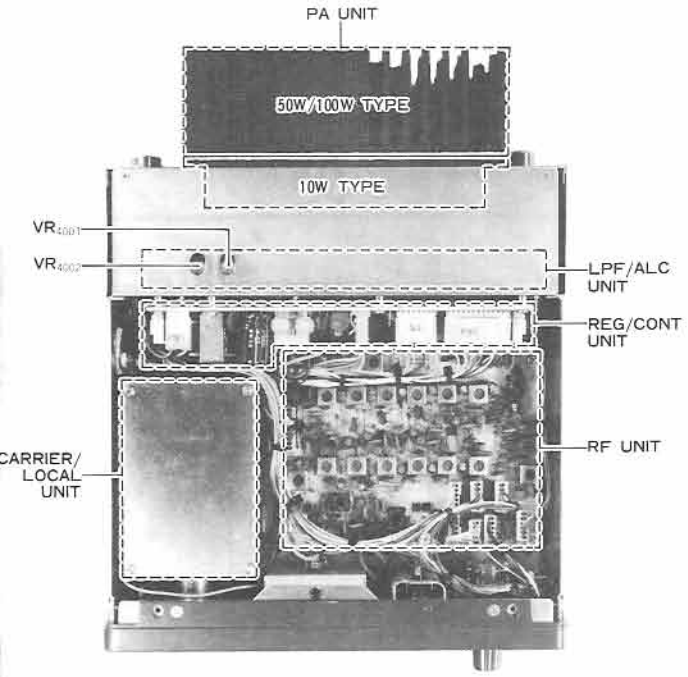
If you have previously lifted a trace, make an etch cut on each side of the lifted trace as shown in the drawing, and install a wire bridge.



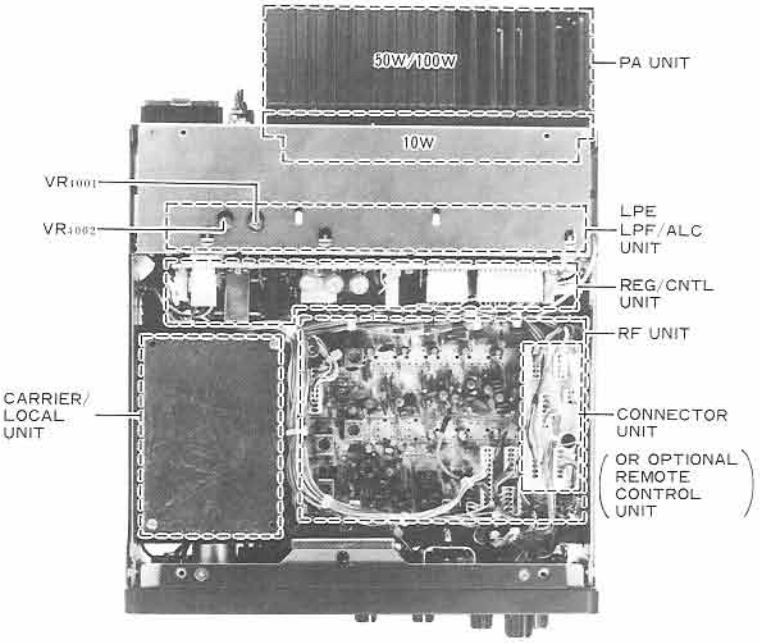


Coat Cut Area With Eastman 910

BOARD LAYOUT

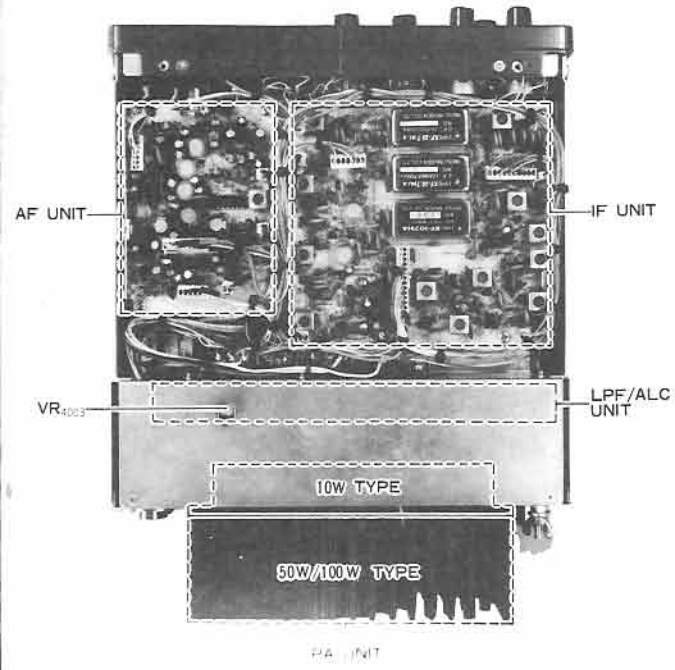


(FT-180)

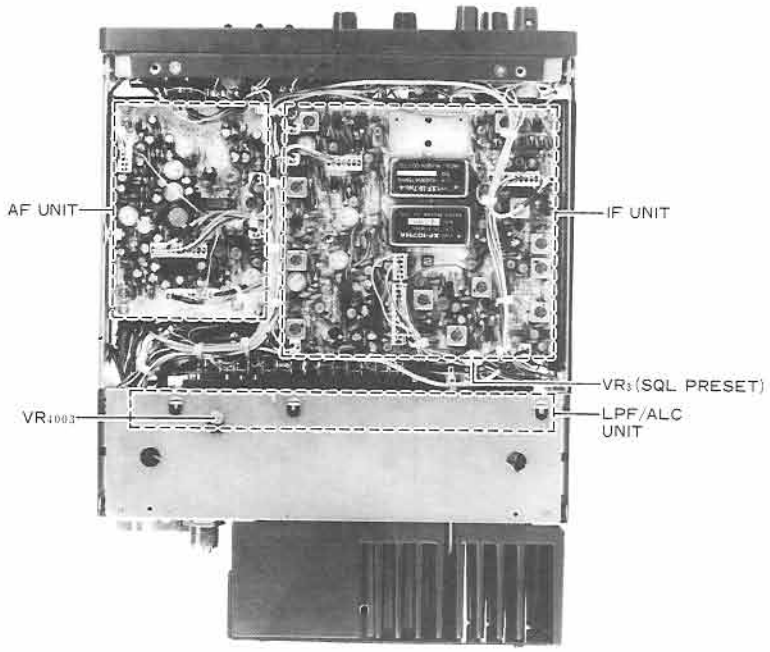


(FT-180A)

TOP VIEW

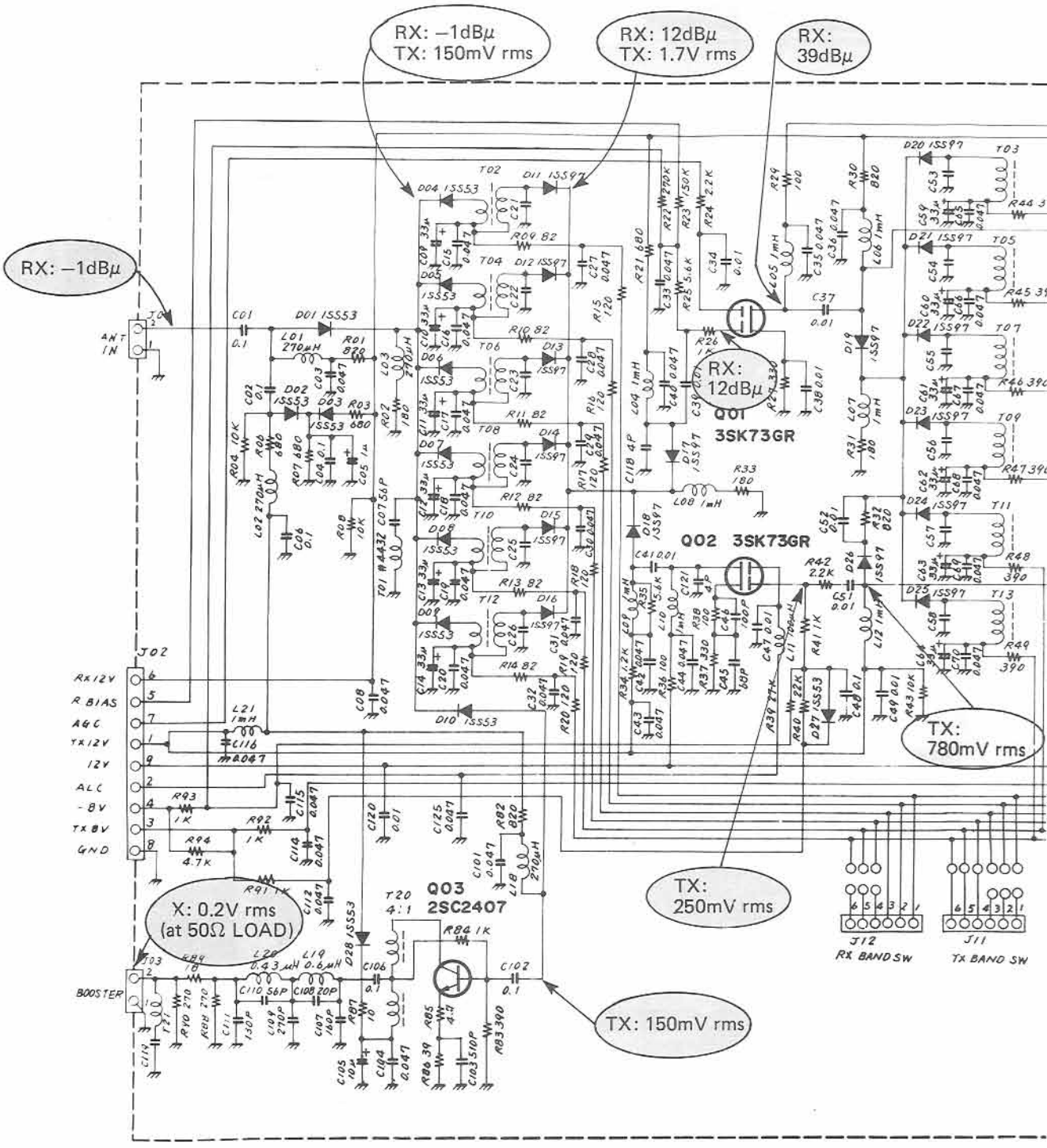


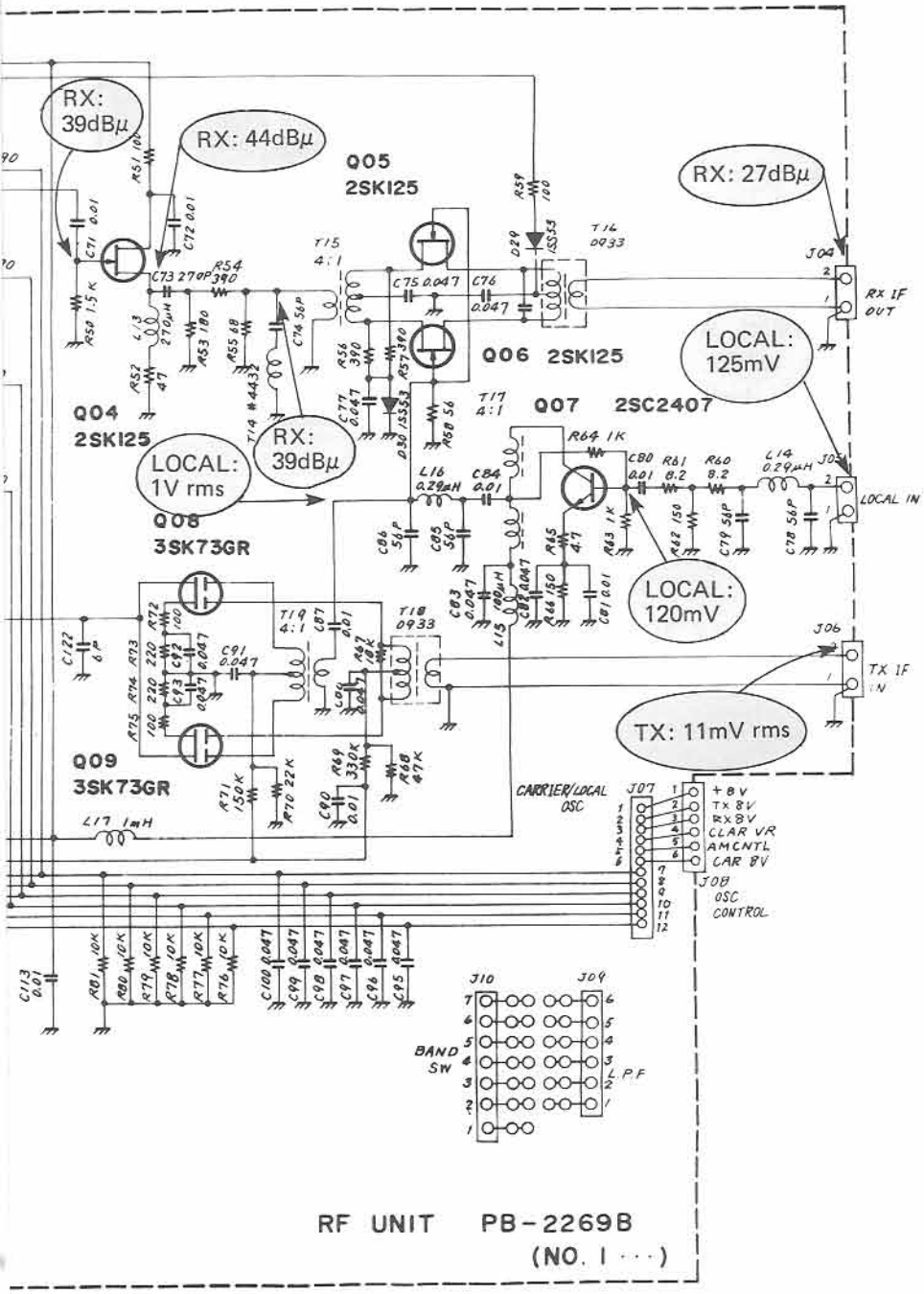
(FT-180)



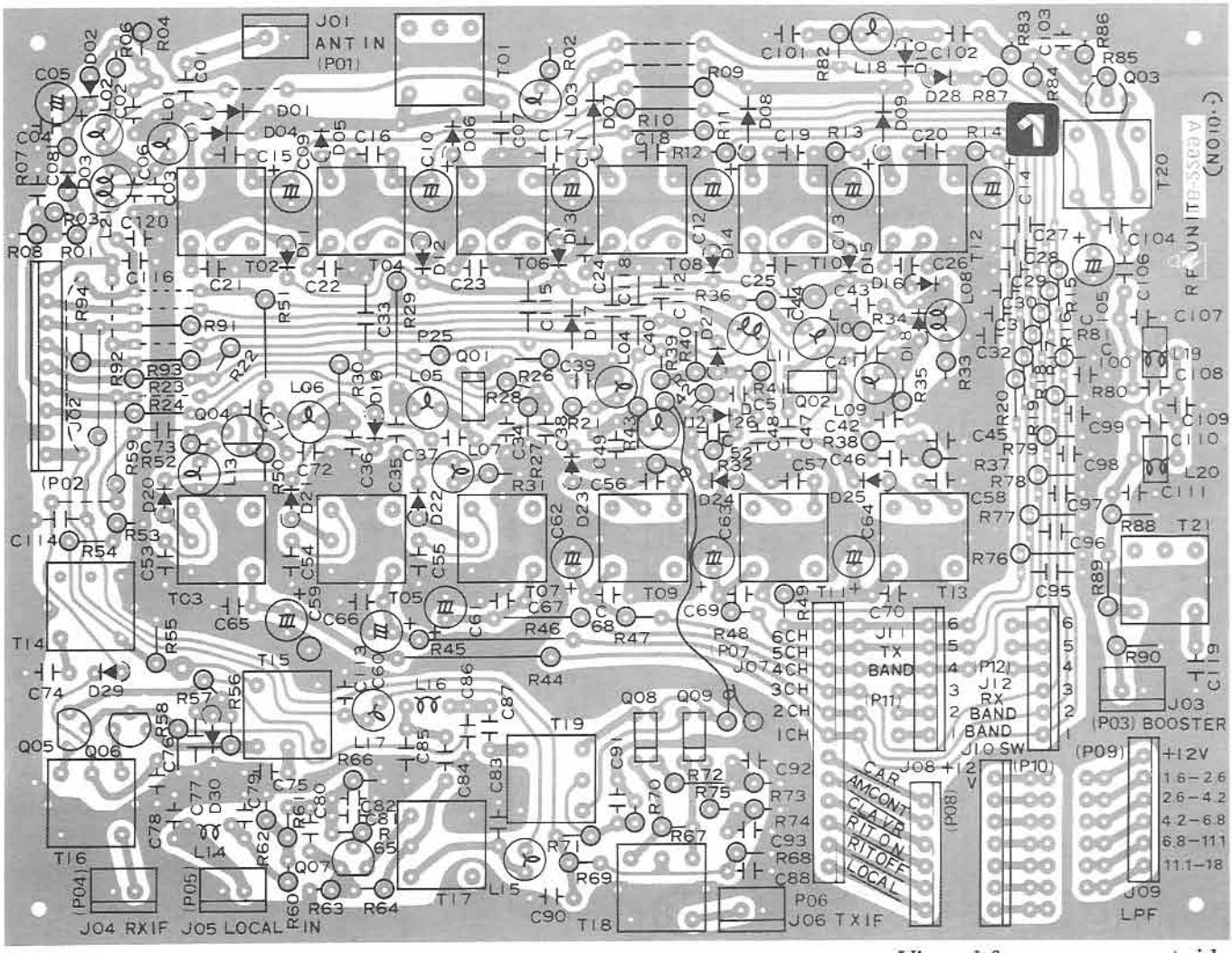
(FT-180A)

BOTTOM VIEW


RX: −1dBμ
TX: 150mV rms
RX: 12dBμ
TX: 1.7V rms
RX:
39dBμ
RX: −1dBμ
RX:
12dBμ
Q01
3SK73GR
Q02 3SK73GR
TX:
780mV rms
TX:
250mV rms
X: 0.2V rms
(at 50Ω LOAD)
Q03
2SC2407
TX: 150mV rms
ANT
IN
BOOSTER
RX BAND SW
TX BAND SW



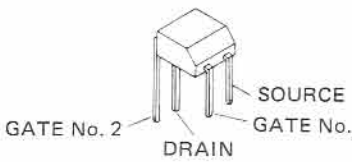
* f: 2182 kHz
MODE: USB
RX: ANT INPUT LEVEL 0 dBμ
TX: OUTPUT POWER 100 Watts
AF: MIC INPUT LEVEL 1 mV



Viewed from component side

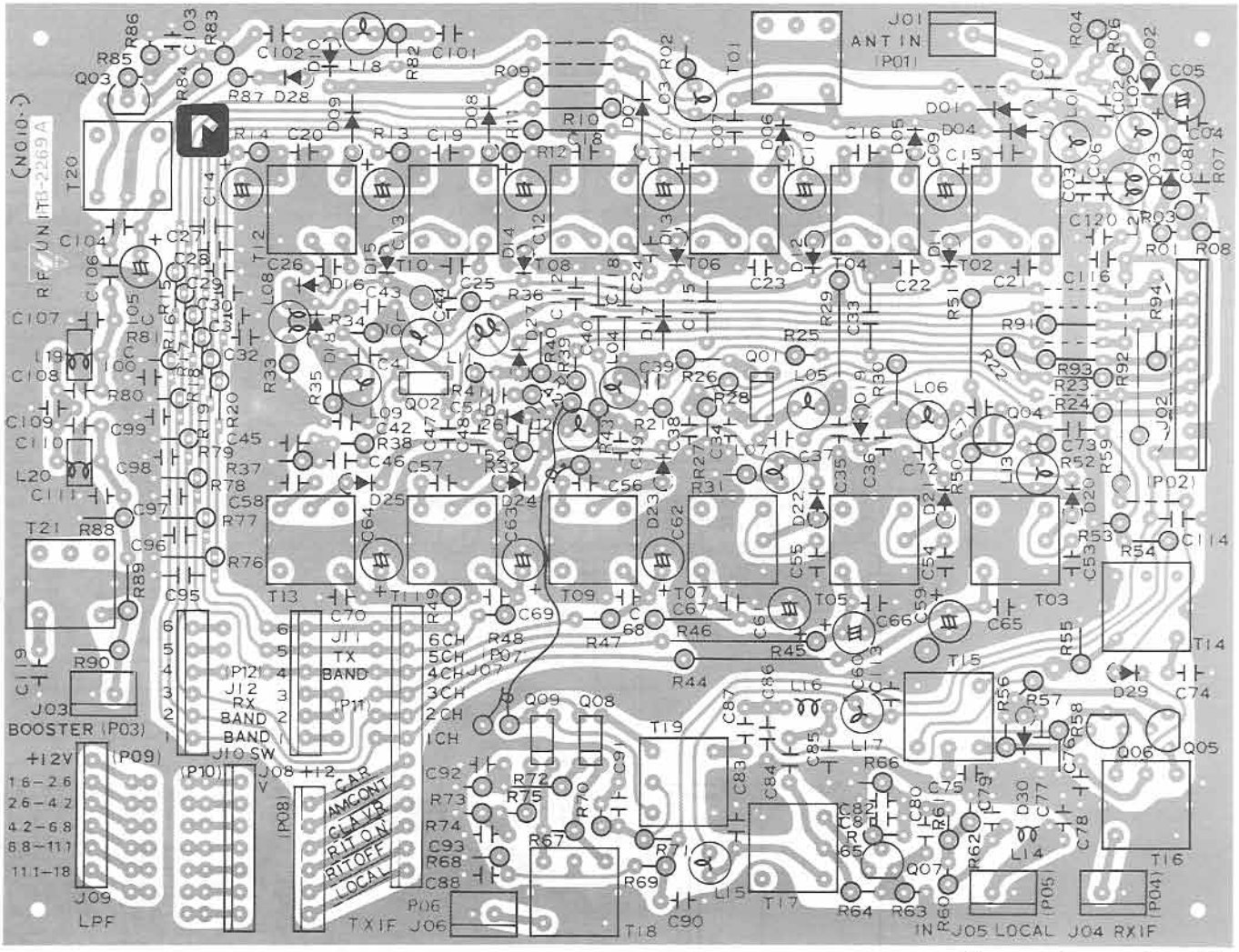
RF UNIT VOLTAGE CHART (DC VOLTS)

	C(D)	E(S)	B(G1)	G2	REMARKS
Q101	10.8	2.9	2.8	4.6	RX
Q102	10.6	1.6	1.5	3.9	TX
Q103	9.7	1.9	2.6		TX
Q104	9.4	1.2	0		RX
Q105	9.8	3.1	0		RX
Q106	9.8	3.1	0		RX
Q107	11.2	4.7	5.4		RX
Q108	11.4	1.0	1.0	1.0	TX
Q109	11.4	1.0	1.0	1.0	TX

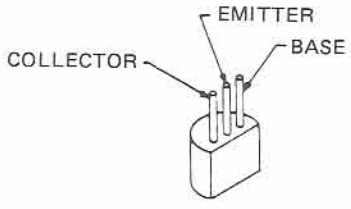


3SK73GR

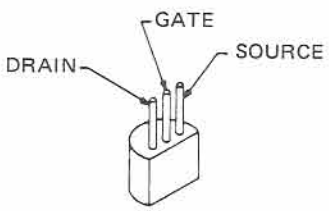
TS LAYOUT



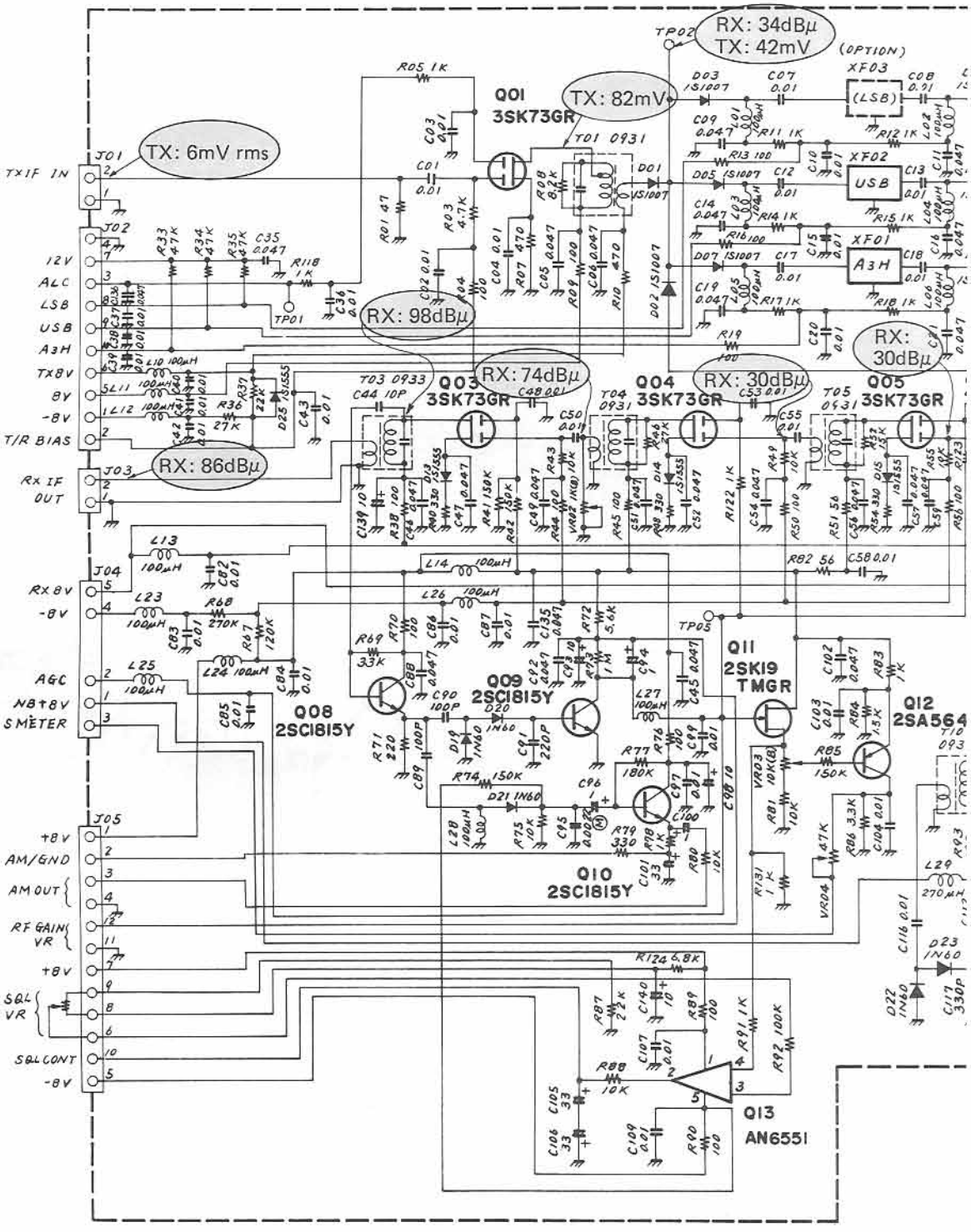
Viewed from solder side

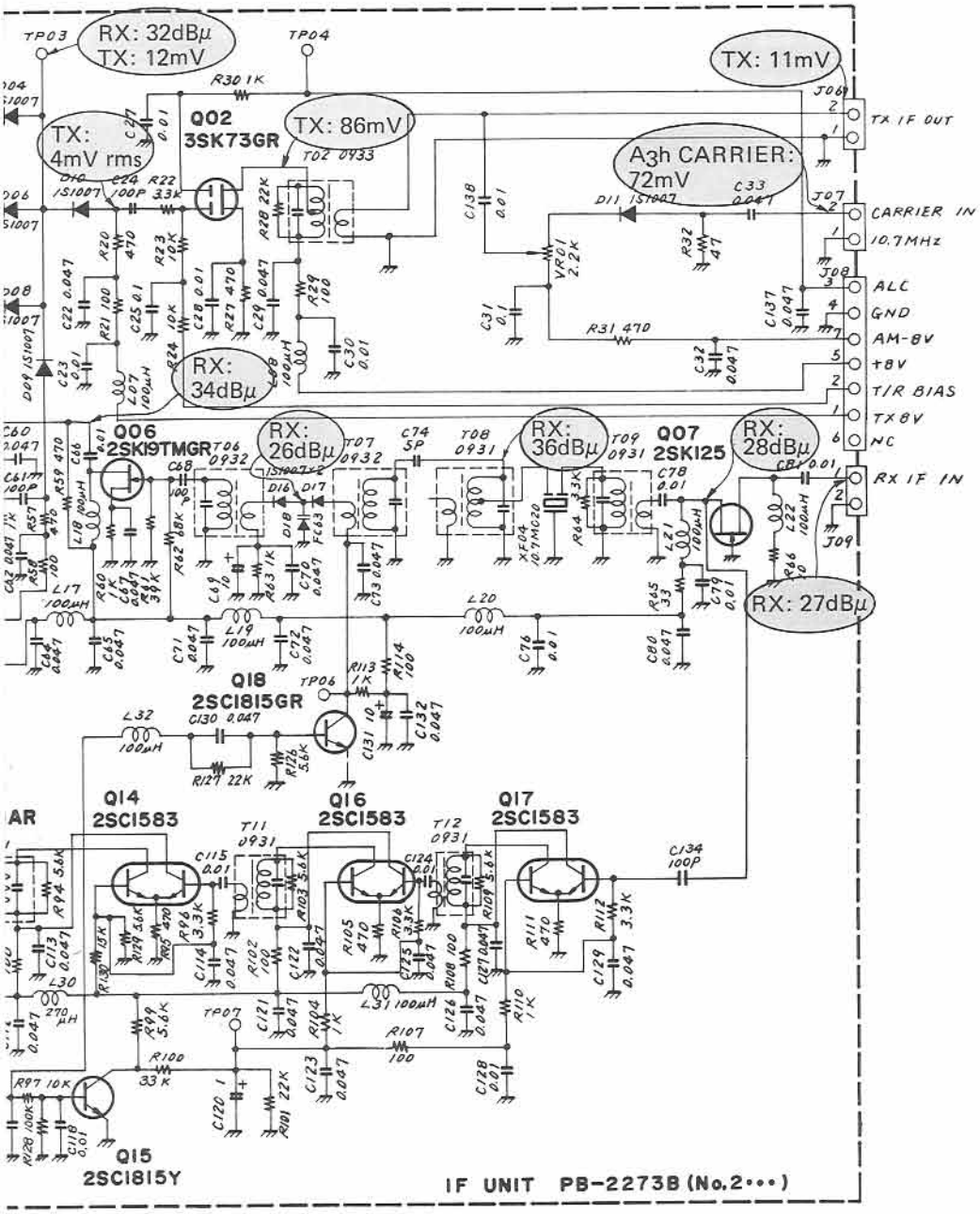


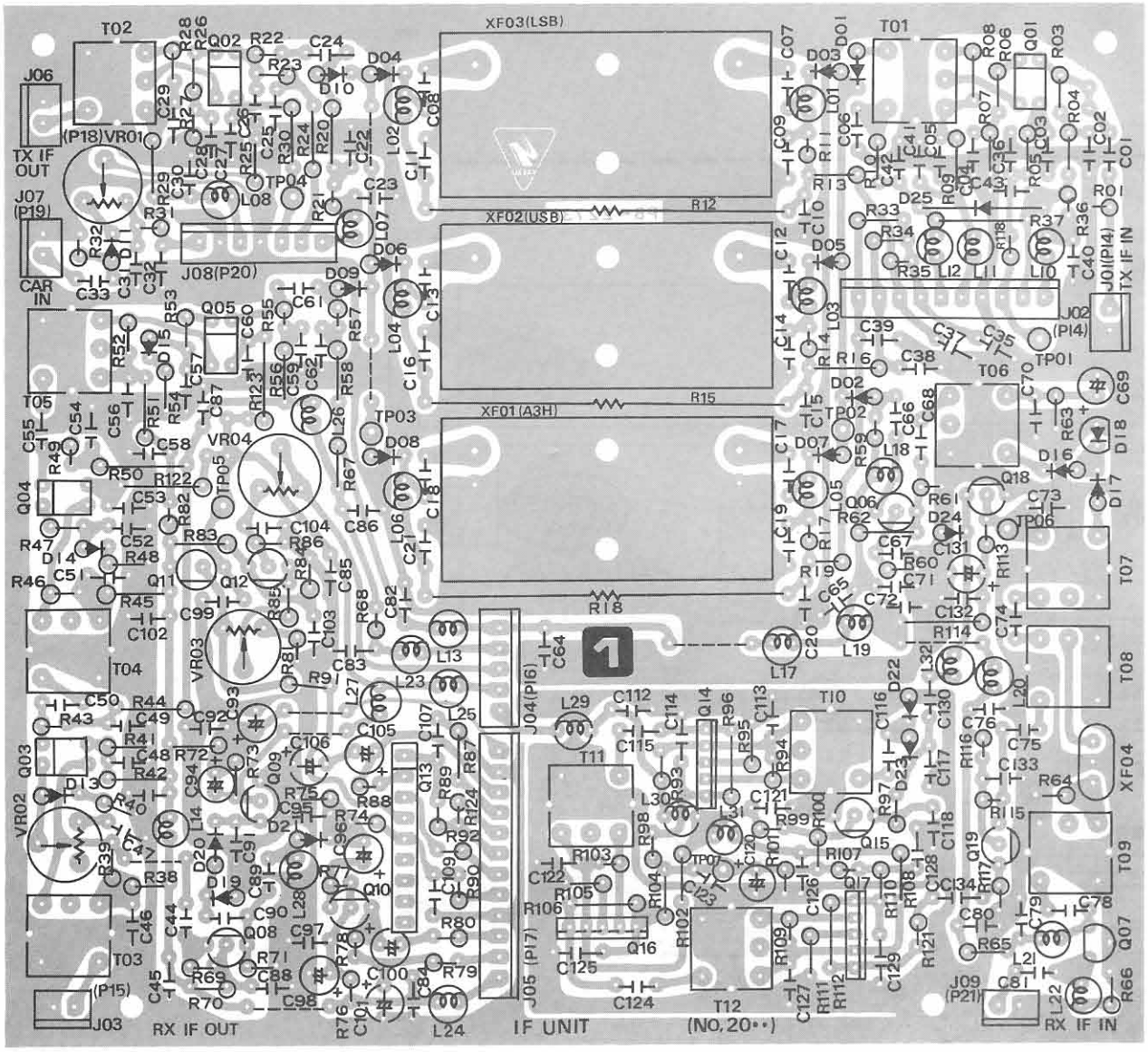
2SC2407



2SK125


TX: 6mV rms
RX: 86dBμ
RX: 98dBμ
RX: 74dBμ
TX: 82mV
RX: 34dBμ
TX: 42mV
RX: 30dBμ
RX: 30dBμ
(OPTION)
Q01 3SK73GR
Q03 3SK73GR
Q04 3SK73GR
Q05 3SK73GR
Q08 2SC1815Y
Q09 2SC1815Y
Q10 2SC1815Y
Q11 2SK19 TMGR
Q12 2SA564
Q13 AN6551
TX IF IN
12V
ALC
LSB
USB
A3H
TX8V
8V
-8V
T/R BIAS
RX IF OUT
RX 8V
-8V
AGC
NB+8V
S METER
+8V
AM/GND
AM OUT
RF GAIN VR
+8V
SQL VR
SQL CONT
-8V
(LSB)
USB
A3H


RX: 32dBμ
TX: 12mV
TP03
TP04
TX: 11mV
TX IF OUT
TX: 4mV rms
Q02 3SK73GR
TX: 86mV
T02 0933
A3h CARRIER: 72mV
CARRIER IN
10.7MHz
ALC
GND
AM-8V
+8V
T/R BIAS
TX 8V
NC
RX IF IN
RX: 34dBμ
RX: 26dBμ
RX: 36dBμ
RX: 28dBμ
RX: 27dBμ
Q06 2SK19TMGR
Q07 2SK125
Q18 2SC1815GR
Q14 2SC1583
Q16 2SC1583
Q17 2SC1583
Q15 2SC1815Y
IF UNIT PB-2273B (No.2•••)



Viewed from component side

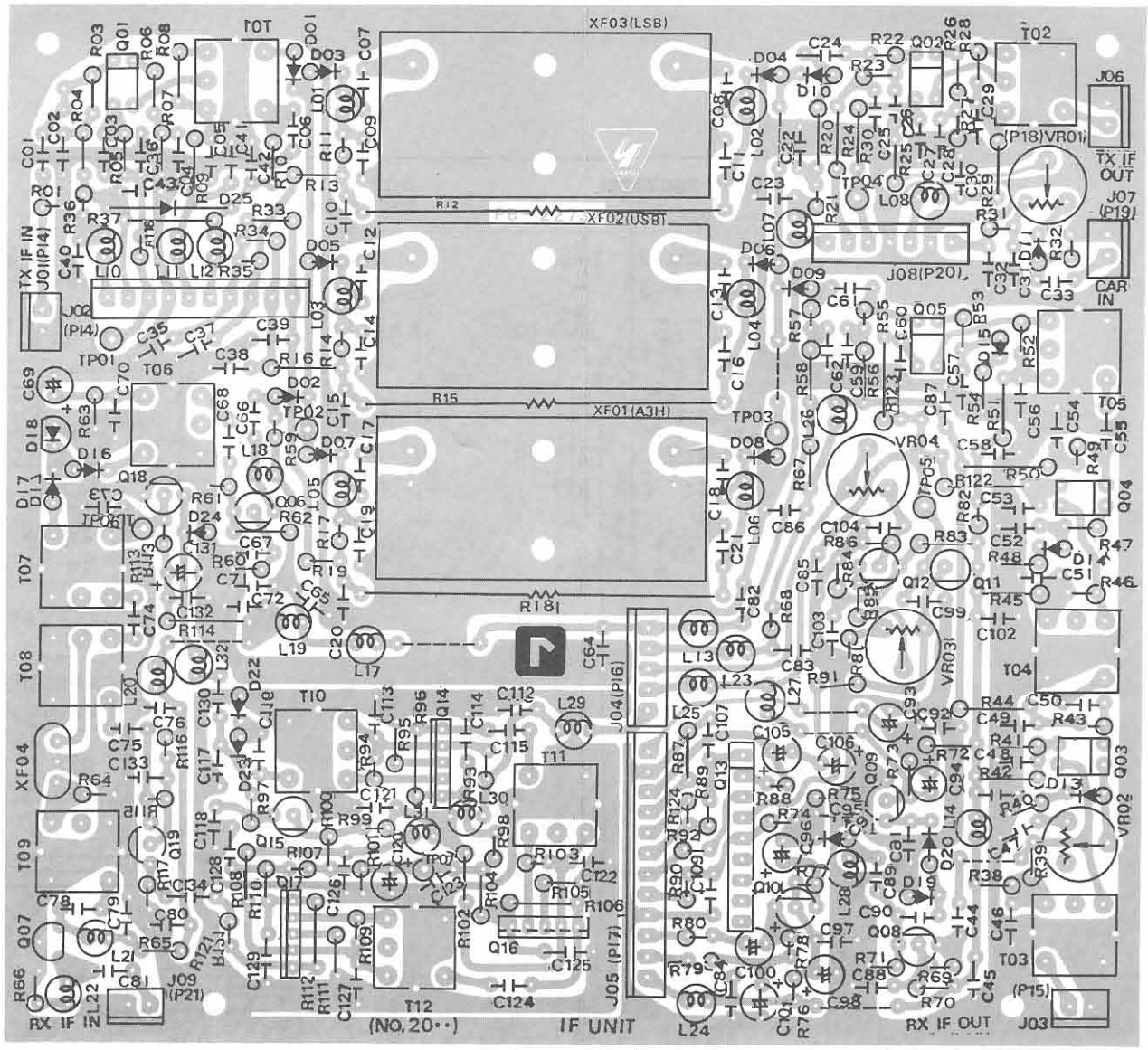
IF UNIT VOLTAGE CHART (DC VOLTS)

	C(D)	E(S)	B(G1)	G2	REMARKS
Q201	7.6	1.7	1.5	3.9	TX
Q202	7.6	1.8	1.5	3.9	TX
Q203	7.2	3.2	3.4	4.0	RX
Q204	7.1	3.3	3.4	4.6	〃
Q205	7.0	3.4	3.4	4.6	〃
Q206	7.9	3.5	2.9		〃
Q207	6.5	0.4	0		〃
Q208	6.6	3.0	3.7		〃
Q209	4.6	0	0		〃
Q210	7.6	3.5	4.2		〃 A3H

	C(D)	E(S)	B(G)	
Q211	7.9	5.3	4.6	
Q212	0.03	4.8	4.2	
Q214	7.6/7.6	1.5	2.1/2.1	
Q215	7.4	0	0.2	
Q216	7.5/7.5	1.9	2.5/2.5	
Q217	7.5/7.5	1.9	2.5/2.5	
Q218	4.1	0	0	

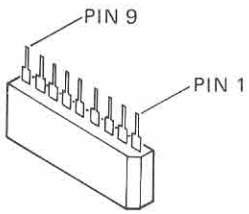
	1	2	3	4	5	6
Q213	7.8	0	5.7	5.3	−6.3	3.1

ARTS LAYOUT

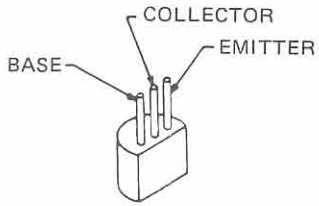


Viewed from solder side

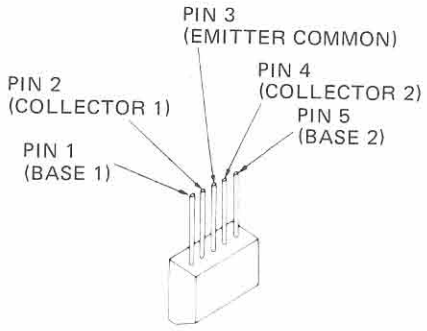
REMARKS
〃
〃
〃 NB ON C1/C2 B1/B2
〃 〃
〃 〃 C1/C2 B1/B2
〃 〃 〃
〃



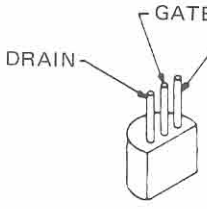
AN6551



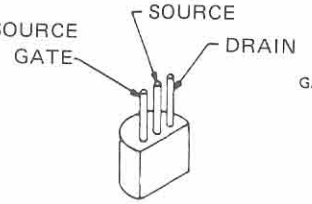
2SC1815Y/GR
2SA564AR



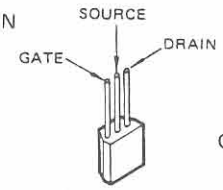
2SC1583



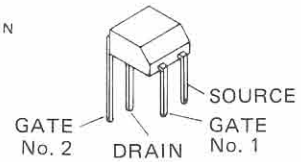
2SK125



2SK19TMGR

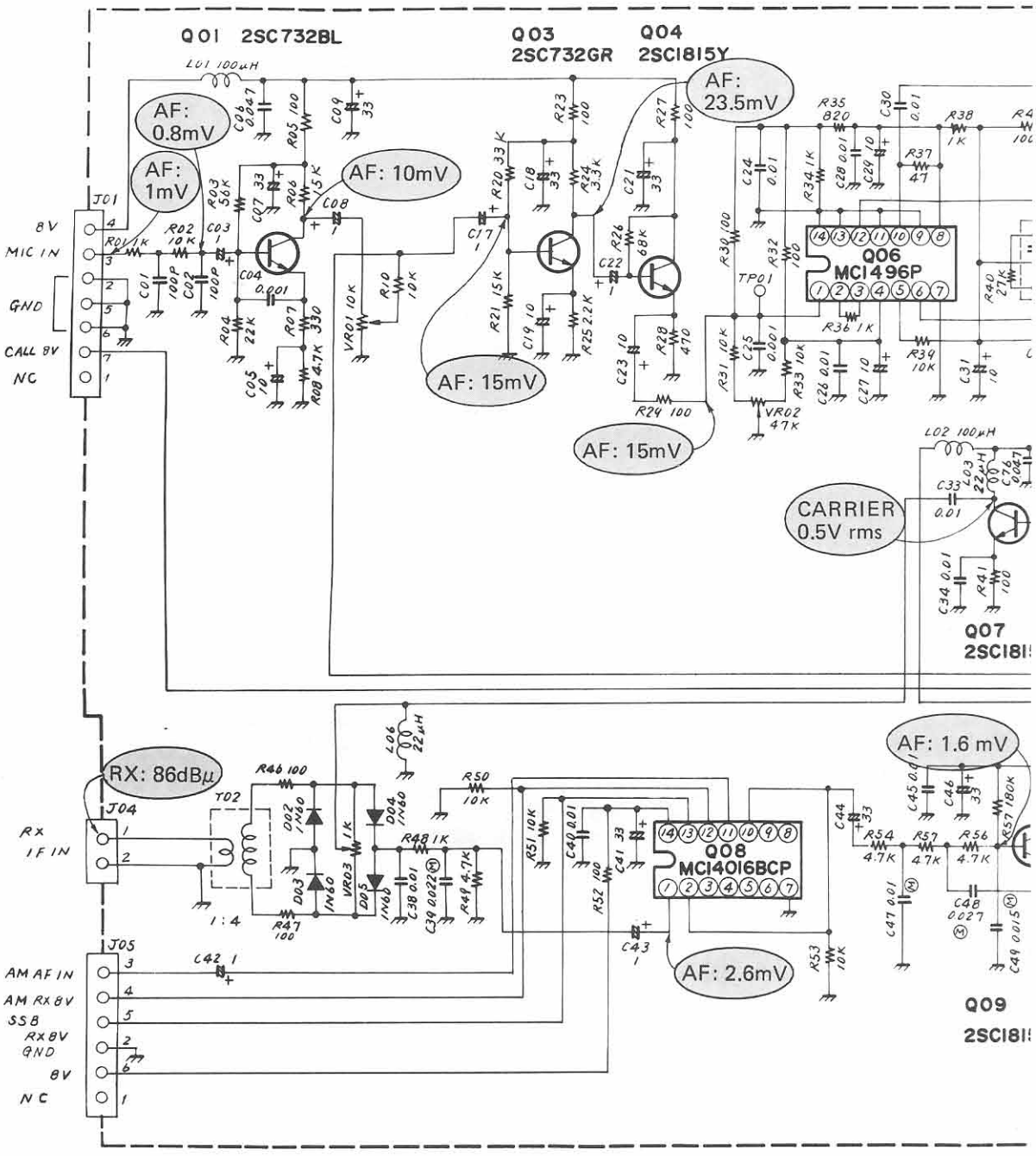


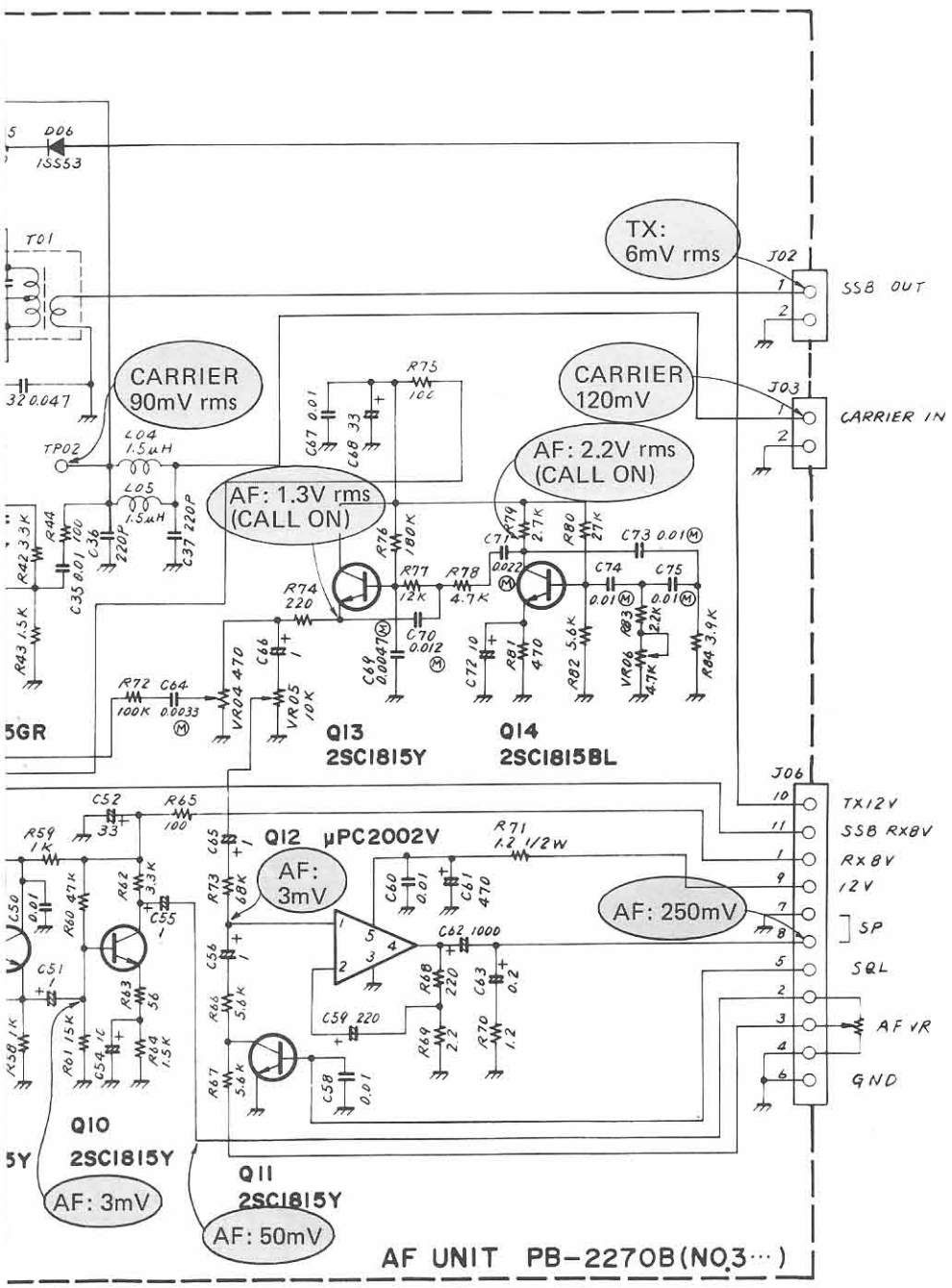
2SK192AY

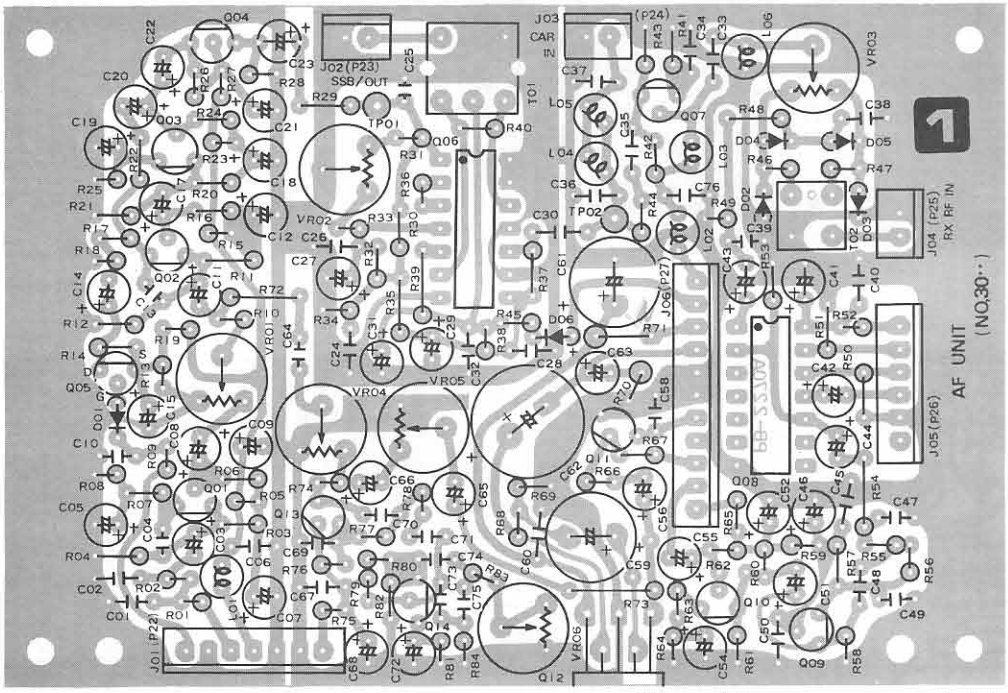


3SK73GR

7	8	9	REMARKS
3.2	7.2	0	RX


Q01 2SC732BL
Q03 2SC732GR
Q04 2SC1815Y
AF: 0.8mV
AF: 1mV
AF: 10mV
AF: 23.5mV
AF: 15mV
AF: 15mV
CARRIER 0.5V rms
AF: 1.6 mV
AF: 2.6mV
RX: 86dBμ
Q06 MC1496P
Q07 2SC181
Q08 MC14016BCP
Q09 2SC181
8V
MIC IN
GND
CALL 8V
NC
RX IF IN
AM AF IN
AM RX 8V
SSB RX 8V
GND
8V
NC
1:4


TX:
6mV rms
J02
SSB OUT
CARRIER
90mV rms
CARRIER
120mV
J03
CARRIER IN
AF: 2.2V rms
(CALL ON)
AF: 1.3V rms
(CALL ON)
Q13
2SC1815Y
Q14
2SC1815BL
J06
TX12V
SSB RX8V
RX8V
12V
SP
SQL
AF VR
GND
Q12 µPC2002V
AF:
3mV
AF: 250mV
Q10
2SC1815Y
AF: 3mV
Q11
2SC1815Y
AF: 50mV
AF UNIT PB-2270B(NO.3···)



Viewed from component side

No used Q3002, Q3005

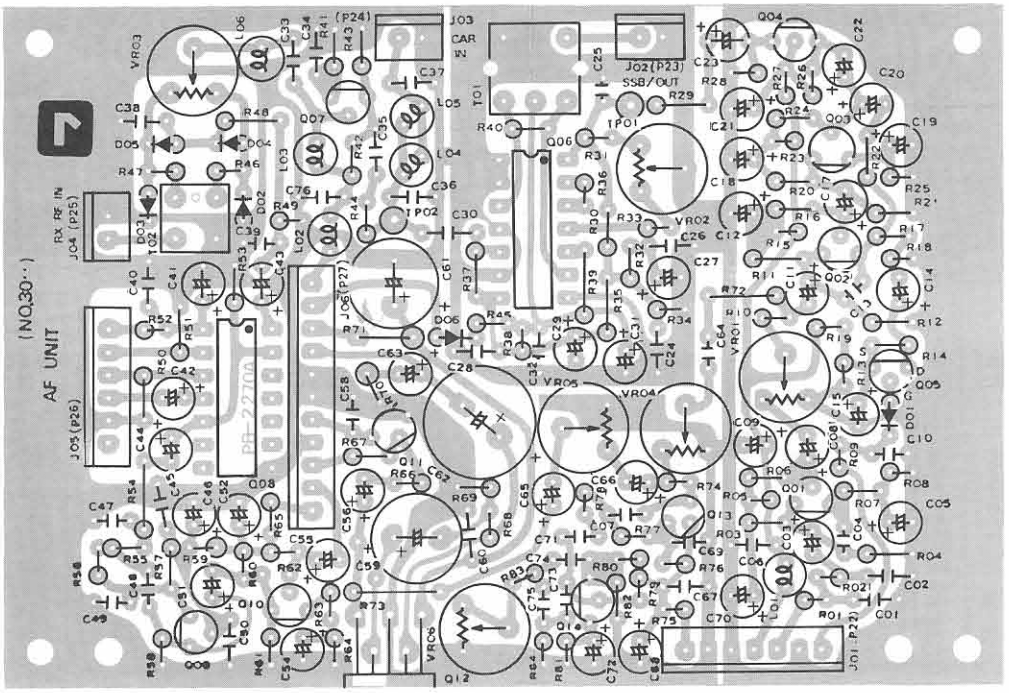
AF UNIT VOLTAGE CHART (DC VOLTS)

	C	E	B	REMARKS
Q3001	3.0	1.6	2.2	TX
Q3003	5.2	1.8	2.4	TX
Q3004	7.1	3.8	4.4	TX
Q3007	7.9	1.7	2.4	RX (SSB)
Q3009	7.2	3.1	3.8	RX
Q3010	5.0	1.2	1.8	RX
Q3011	0	0	0	RX SQL: ϕ
Q3013	7.4	2.7	3.3	CALL ON
Q3014	3.8	1.1	1.2	CALL ON

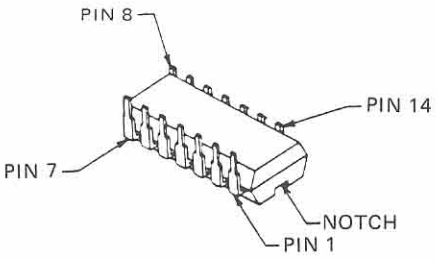
	1	2	3	4	5	REMARKS
Q3012	0.71	0.71	0	6.3	13.0	RX

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	REMARKS
Q3006	3.5	2.8	2.8	3.5	0	10.2	0	6.5	0	6.5	0	10.2	0	0	TX
Q3008	0	0	NC	NC	NC	NC	0	NC	NC	0	0	7.8/0	0/7.8	7.6	RX SSB/A3H

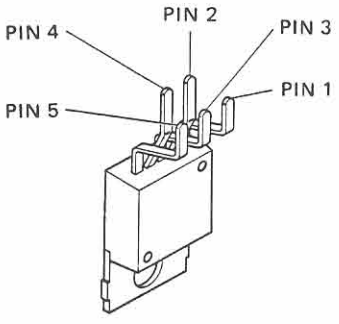
ARTS LAYOUT



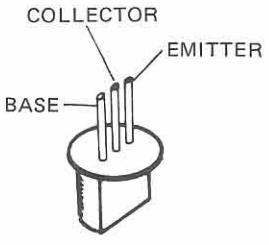
Viewed from solder side



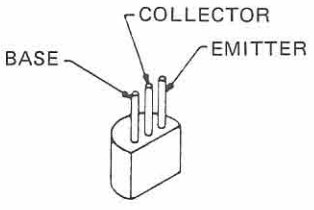
MC1496P
MC14016BCP



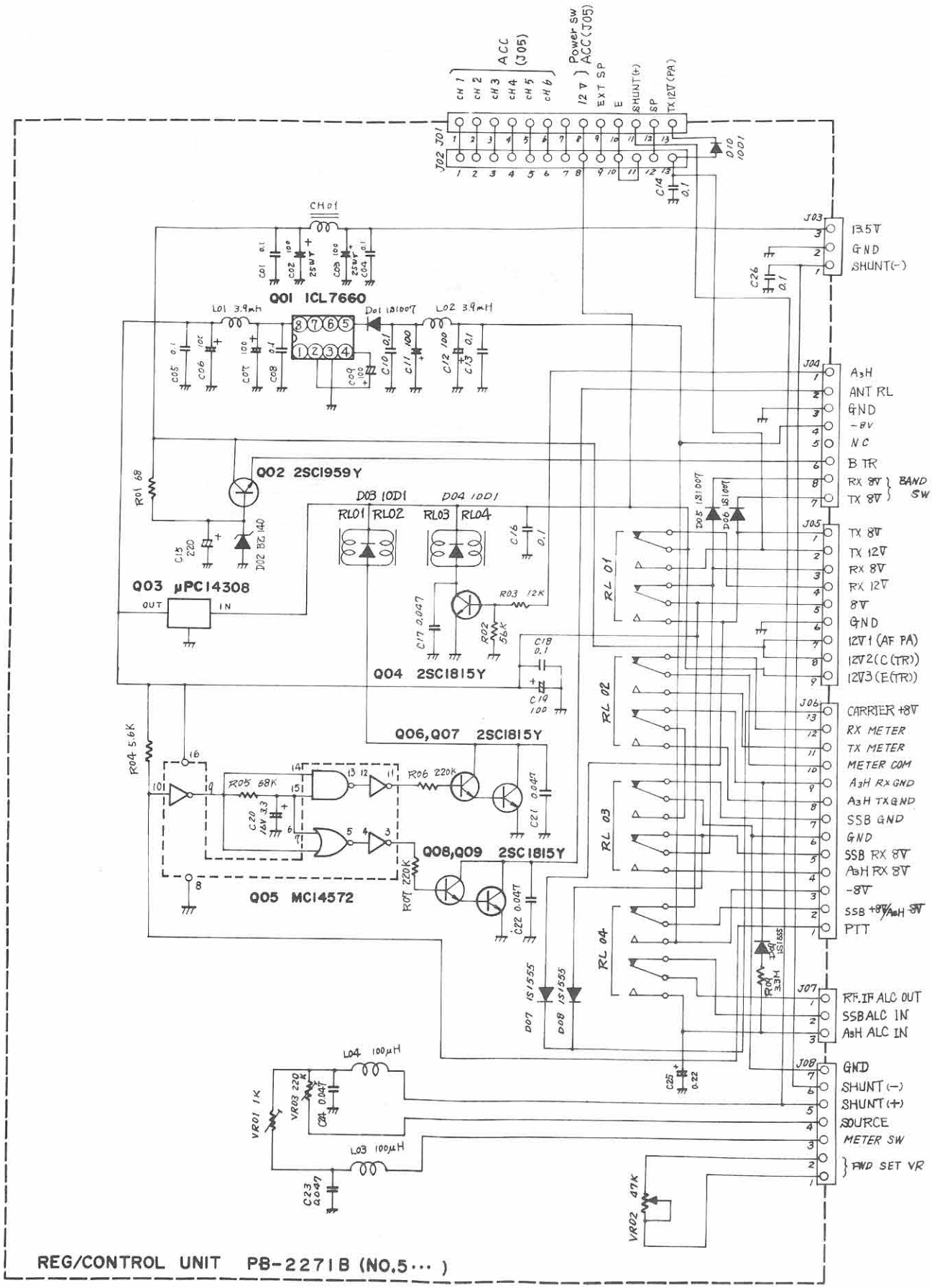
μPC2002V



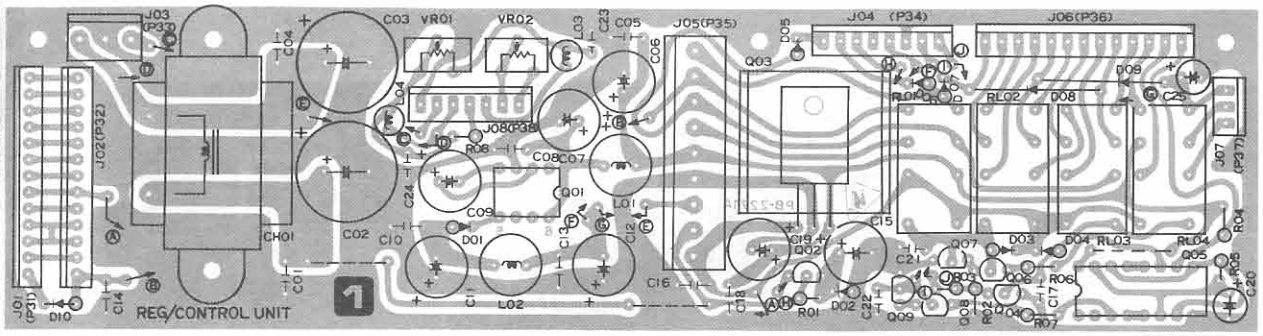
2SC732BL/GR



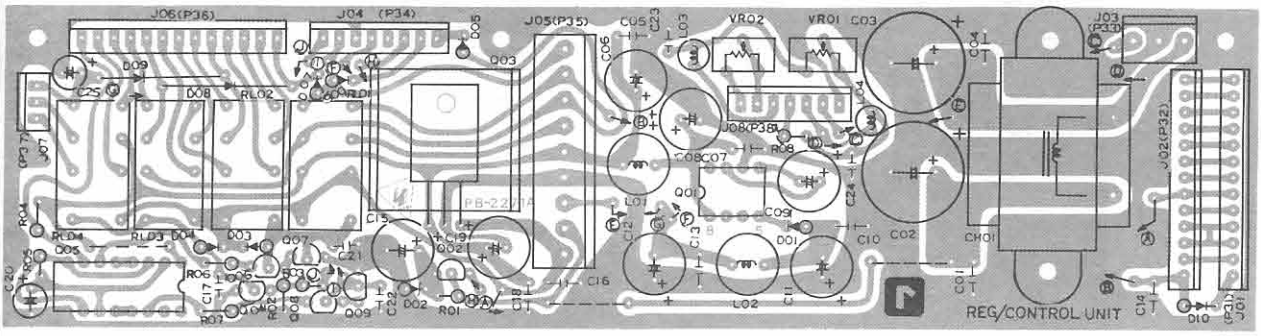
2SC1815Y/GR/BL



Q5001 IC type –8V Supply



Viewed from component side



Viewed from solder side

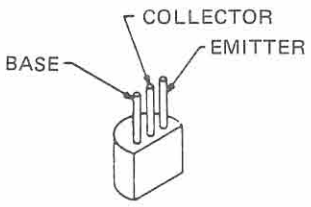
REG/CONTROL UNIT VOLTAGE CHART (DC VOLTS)

	C	E	B	REMARKS
Q5002	13.1	12.4	13.1	
Q5004	11.7/1.5	0/0	0/0.8	SSB/A_3H
Q5006	11.7/0.9	0/0.8	0/1.4	RX/TX
Q5007	11.7/0.9	0/0	0/0.8	〃
Q5008	11.7/0.8	0/0.7	0/1.3	〃
Q5009	11.7/0.8	0/0	0/0.7	〃

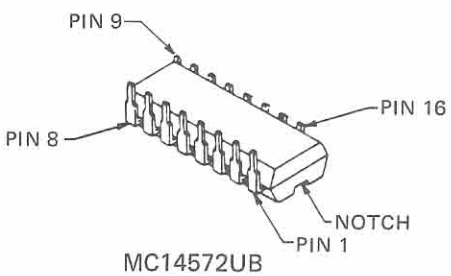
	IN	OUT
Q5003	11.8	8.0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	REMARKS
Q5005	N.C	N.C	0/7.9	8.0/0	8.0/0	0/7.9	0/8.0	0/0	0/7.9	7.9/0	0/7.9	8.0/0	8.0/0	0/8.0	0/7.9	8.0/8.0	RX/TX

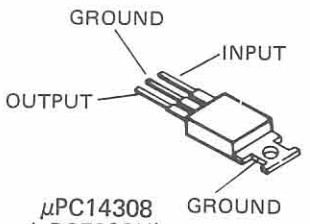
	1	2	3	4	5	6	7	8
Q5001	N.C	4.0	0	−3.3	−3.8	2.9	3.8	7.9



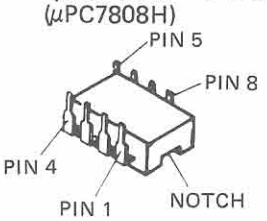
2SC1815Y
2SC1959Y



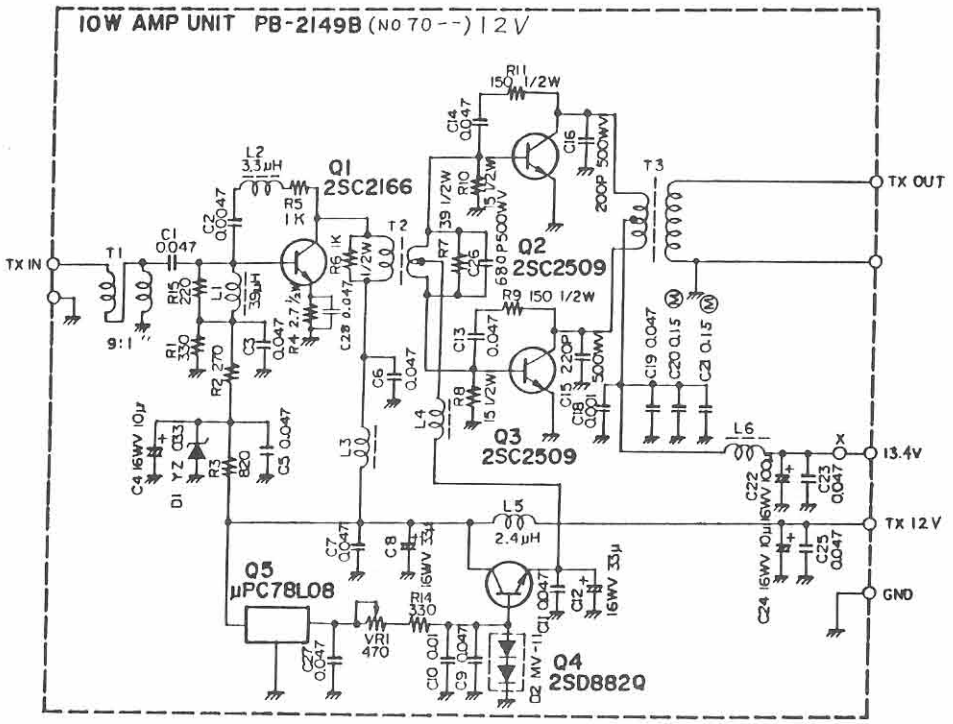
MC14572UB



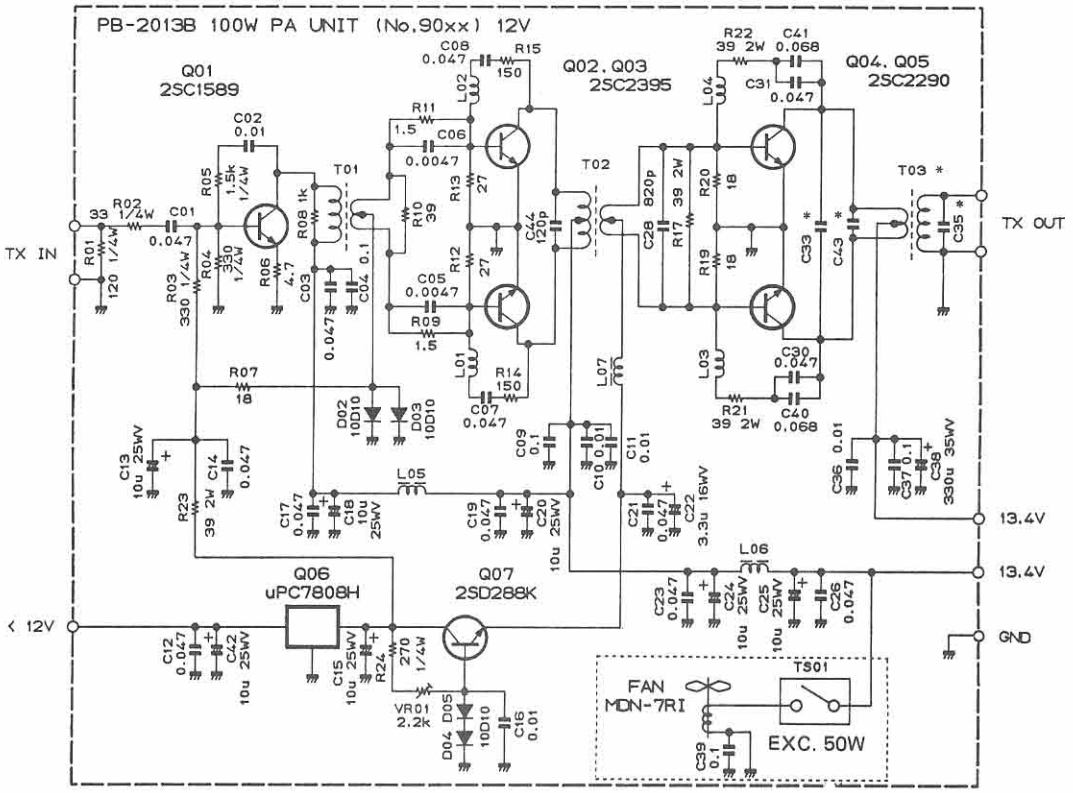
μPC14308
(μPC7808H)



ICL7660CPA



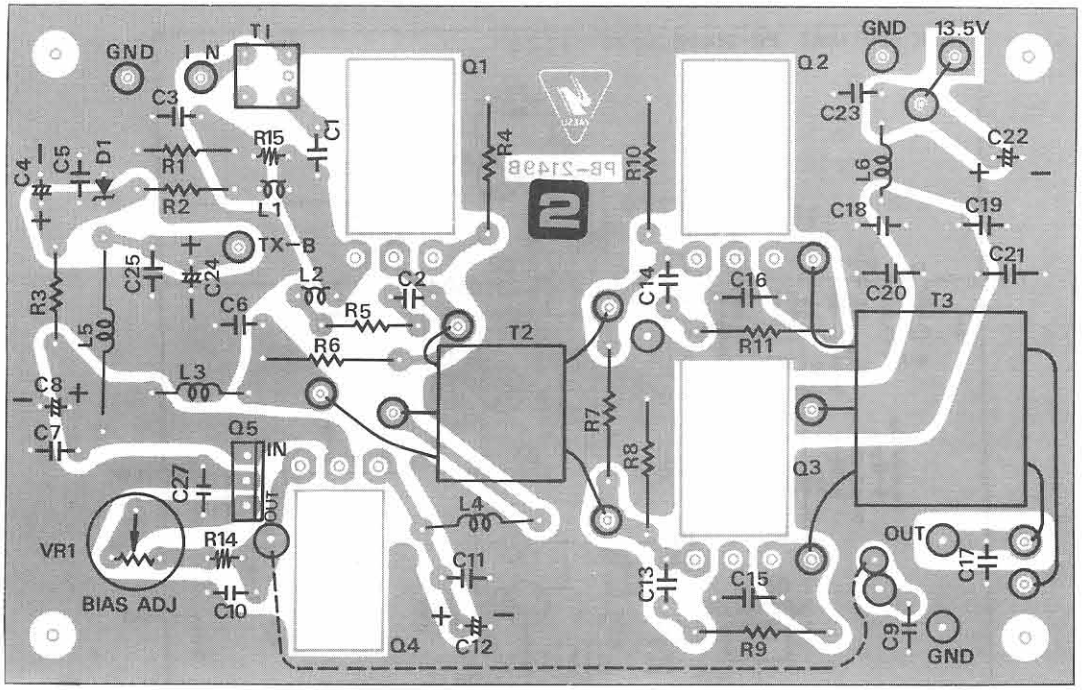
10W PA UNIT



50W/100W PA UNIT

		100W	50W
*	C33	1200 pF	820 pF
	C43	1000 pF	470 pF
	C35	22 pF	Not used
	T03	L0020632	L0021284

10W PA UNIT PARTS LAYOUT

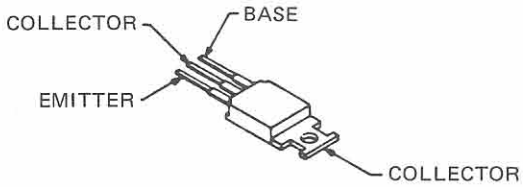


10W MODEL Viewed from component side

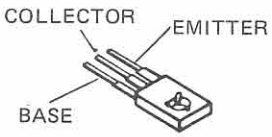
PA UNIT VOLTAGE CHART (10W MODEL)

(DC VOLTS)

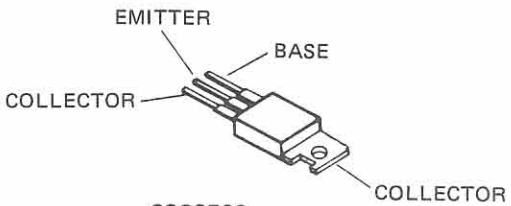
	C	E	B	REMARKS
Q7001	13.5	1.0	1.7	TX
Q7008	13.5	0	0.7	TX
Q7003	13.5	0	0.7	TX
Q7004	13.5	0.7	1.3	TX



2SC2166

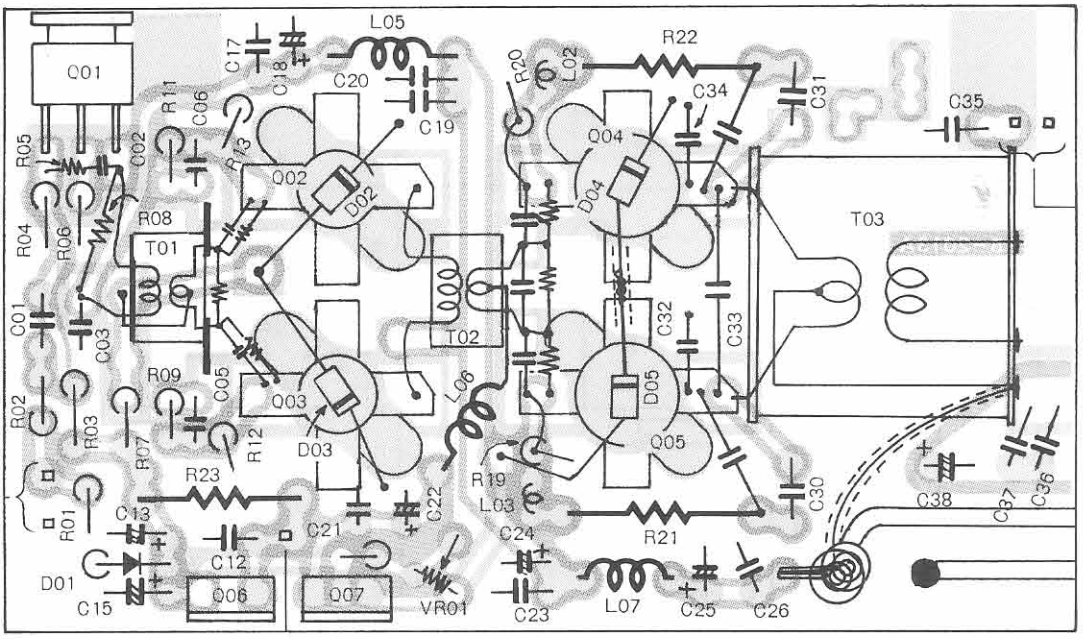


2SC496Y



2SC2509

(Q14..) → (Q90..) or (Q80..)

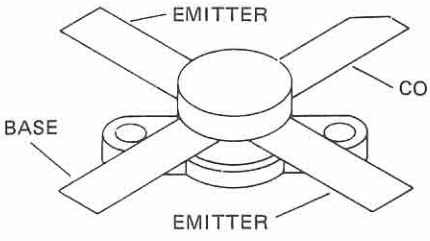


50W/100W MODEL Viewed from component side

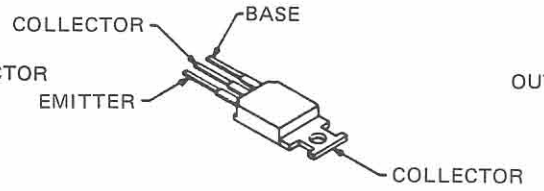
PA UNIT VOLTAGE CHART (50W/100W MODEL) (DC VOLTS)

	C	E	B	REMARKS
Q8001/Q9001	13.5/13.5	0.5/0.5	1.3/1.3	50W/100W TX
Q8002/Q9002	13.5/13.5	0/0	0.7/0.7	"
Q8003/Q9003	13.5/13.5	0/0	0.7/0.7	"
Q8004/Q9004	13.5/13.5	0/0	0.7/0.7	"
Q8005/Q9005	13.5/13.5	0/0	0.7/0.7	"
Q8007/Q9007	8.0/8.0	0.7/0.7	1.3/1.3	"

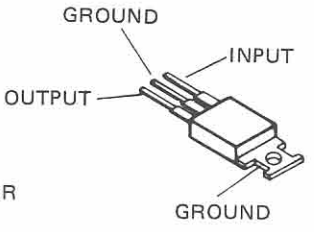
	IN	OUT	REMARKS
Q8006/Q9006	13.5/13.5	8.0/8.0	50W/100W



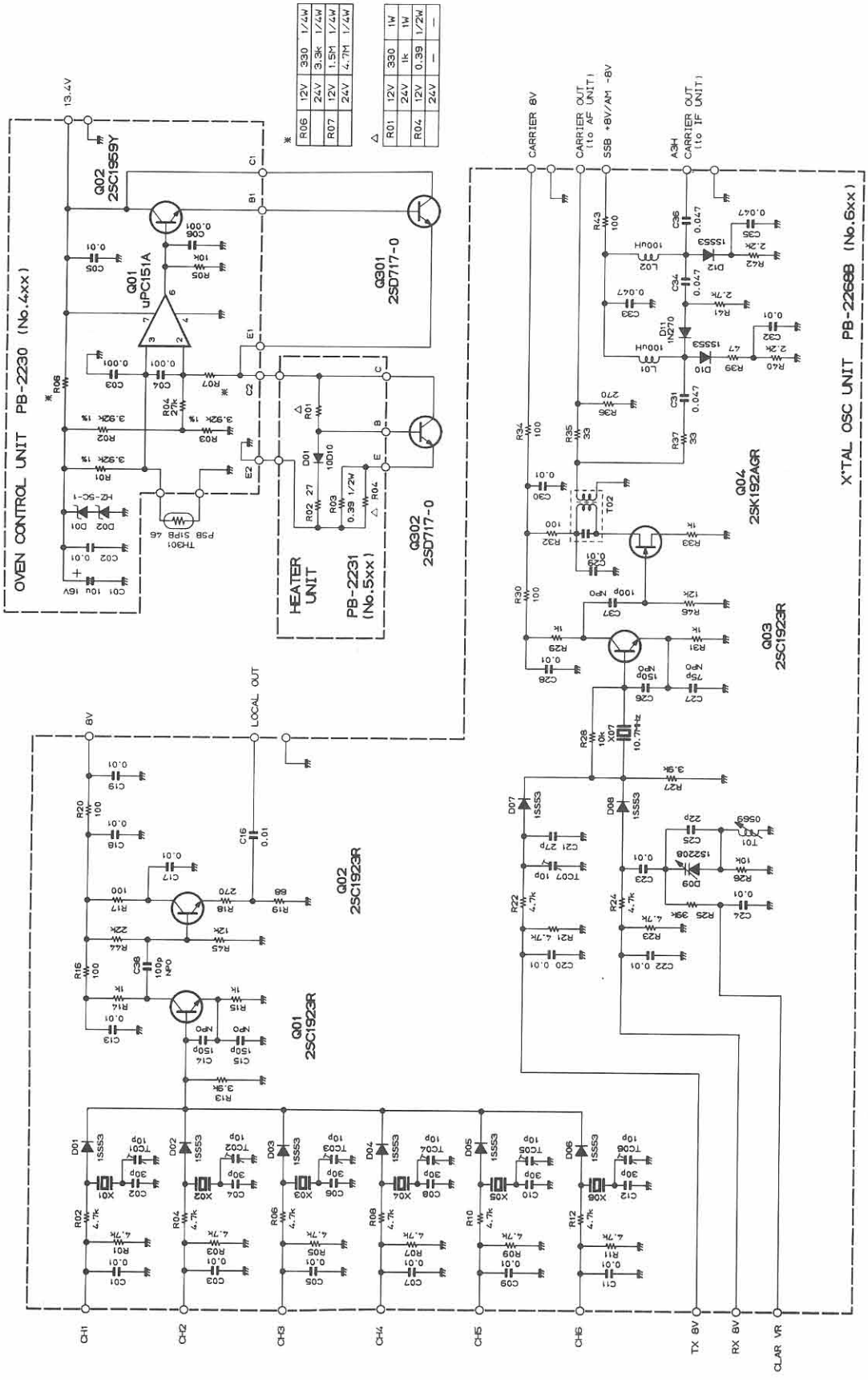
2SC2290
2SC2395



2SC1589
2SD288K



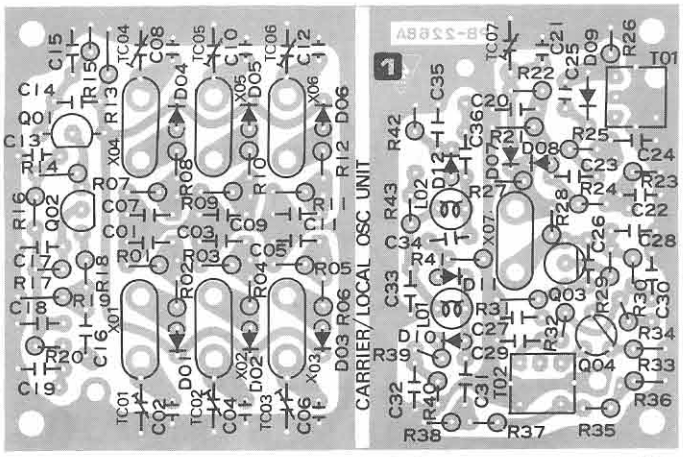
μPC14308
(μPC7808H)



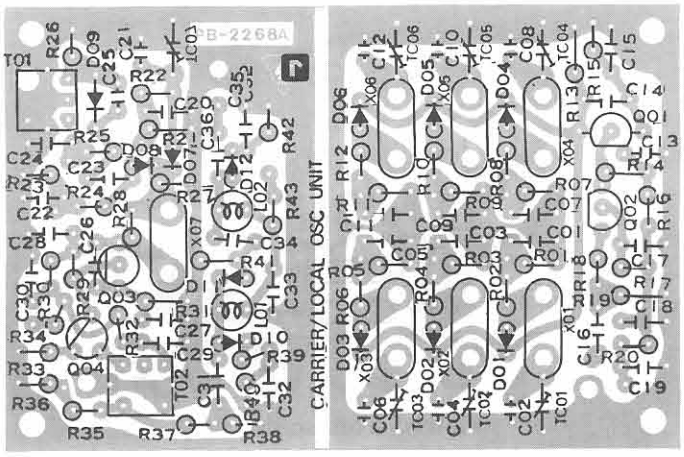
*			
R06	12V	330	1/4W
	24V	3.3K	1/4W
R07	12V	1.5M	1/4W
	24V	4.7M	1/4W

△			
R01	12V	330	1W
	24V	1K	1W
R04	12V	0.39	1/2W
	24V	—	—

CRYSTAL OSCILLATOR UNIT PARTS LAYOUT



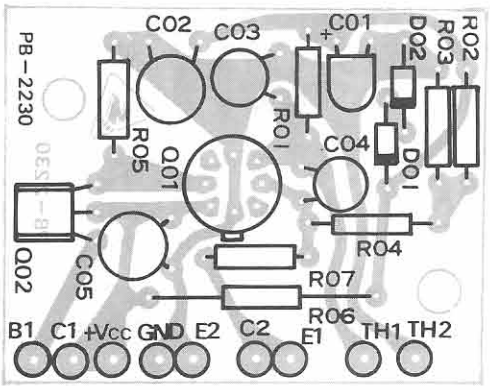
Viewed from component side



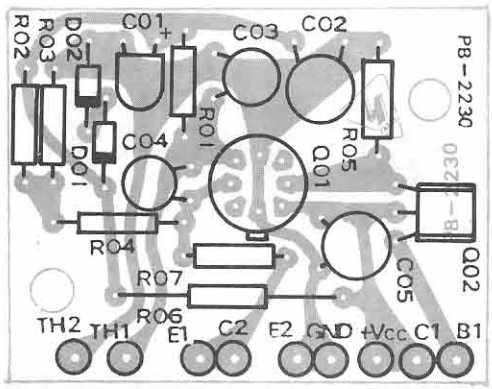
Viewed from solder side

	C(D)	B(G)	E(S)	REMARKS
Q601	4.2	2.1	2.9	Remove crystal from the crystal socket
Q602	5.7	3.4	4.2	"
Q603	5.6	2.0	2.7	"
Q604	7.3	6.1	5.6	"

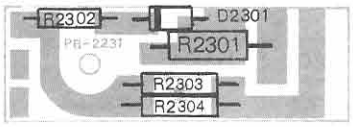
OVEN CONTROL/HEATER UNIT PARTS LAYOUT



Viewed from component side



Viewed from solder side



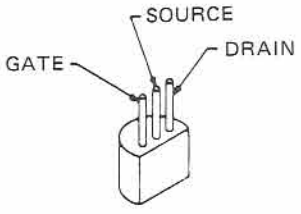
Viewed from component and solder side

OVEN CONTROL UNIT/HEATER UNIT VOLTAGE CHART

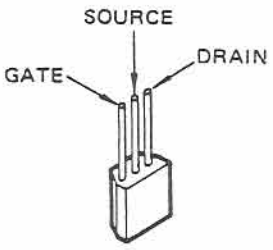
(DC VOLTS)

	C(D)	E(S)	B(G)	REMARKS
Q301	13.5	10.5	11.1	
Q302	10.5	0.5	1.1	
Q402	13.5	11.2	11.8	

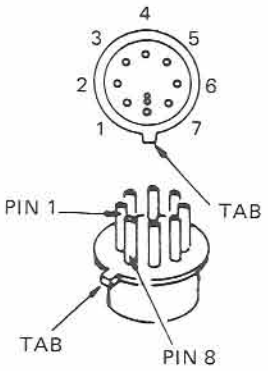
	1	2	3	4	5	6	7	8	REMARKS
Q401	0	5.0	9.0	0	0	11.8	13.5	0	



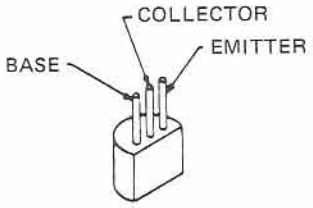
2SK19TMGR



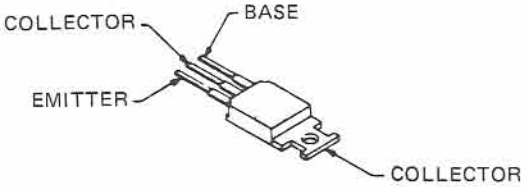
2SK192AY



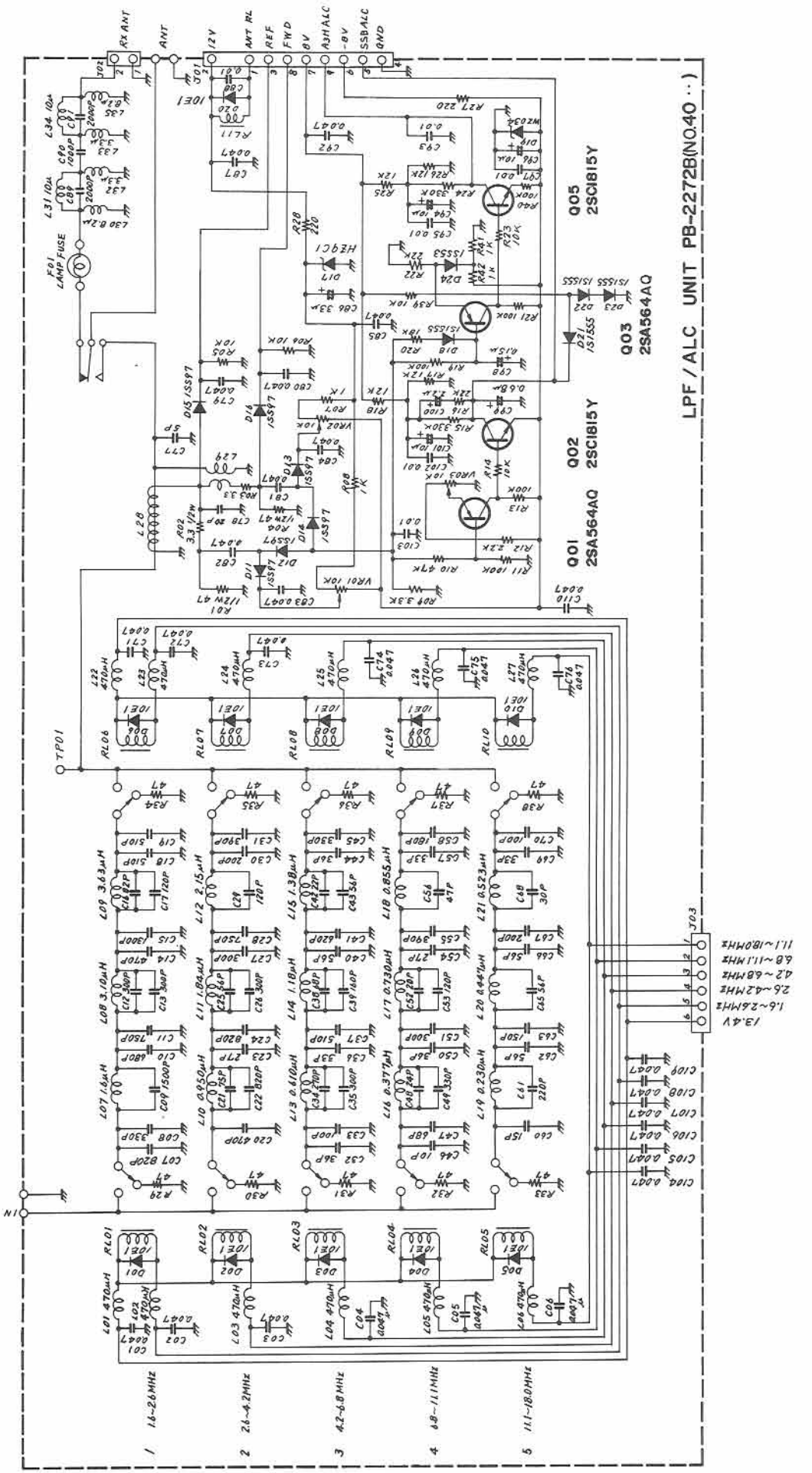
μPC151A

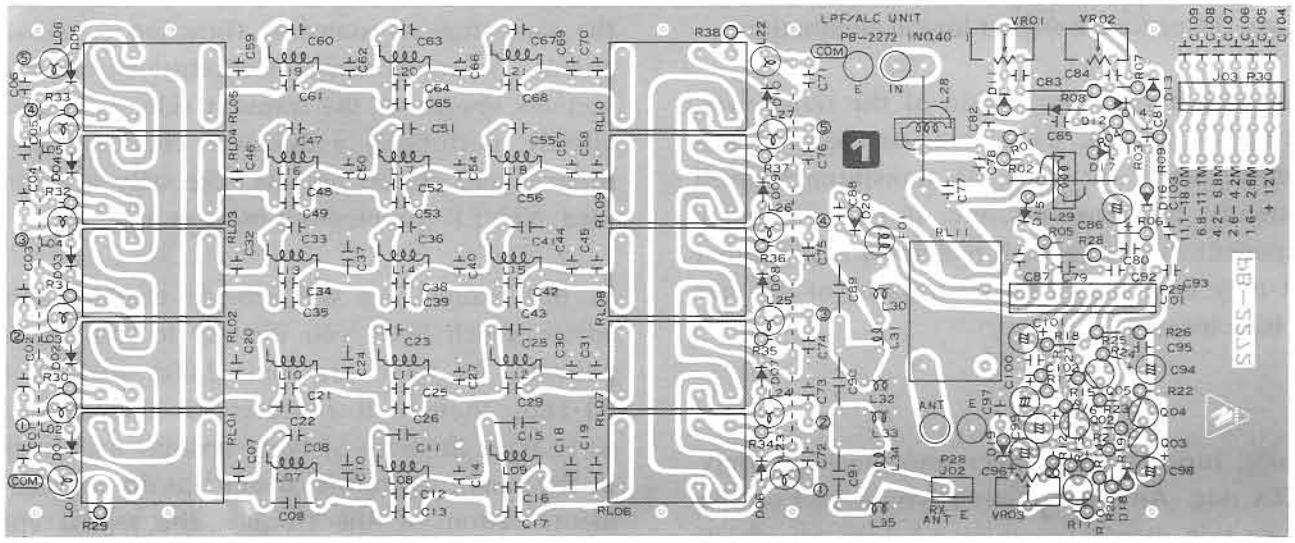


2SC1923R

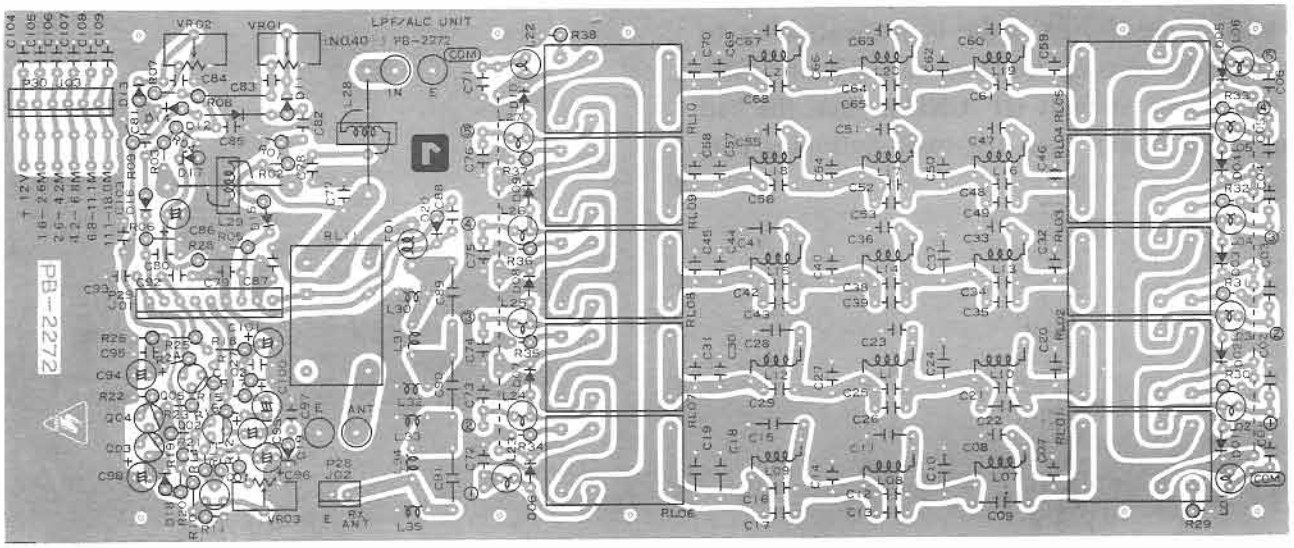


2SD717-O
(2SD1064Q/R)


LPF / ALC UNIT PB-2272B(NO.40 ··)
Q01 2SA564AQ
Q02 2SC1815Y
Q03 2SA564AQ
Q05 2SC1815Y
1.6~2.6MHz
2.6~4.2MHz
4.2~6.8MHz
6.8~11.1MHz
11.1~18.0MHz
13.4V
ANT
RX ANT
12V
ANT RL
REF
FWD
8V
AJH ALC
-8V
SSB ALC
GND



Viewed from component side

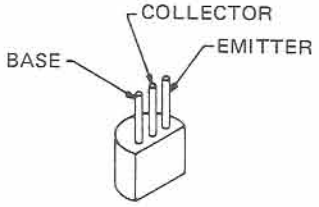


Viewed from solder side

LPF/ALC UNIT VOLTAGE CHART

(DC VOLTS)

	C	E	B	REMARKS
Q4001	−3.3	−0.6	−0.7	TX
Q4002	3.9	−3.4	−3.3	〃
Q4003	−2.9	−0.6	−1.0	〃
Q4004	−2.9	−0.1	−0.6	〃
Q4005	−3.8	−3.3	−2.9	〃



2SC1815Y
2SA564Q

FAULT IDENTIFICATION AND LOCALIZATION

The process of troubleshooting any electronic equipment is highly individualistic. Fundamentally, though, the process is one of logical elimination.

Begin with a visual inspection of the transceiver, looking for broken, discolored, or charred components. Smell the unit, as transformers smell differently than resistors, etc. If you do find a component that is cooked, remember that another fault may have caused the destruction of the part you have located.

Initially, turn on the receiver, and check out only the RX side. Any malfunctions you detect on the receiver side should be repaired before you check out the transmitter. In doing this, you may well cure the entire problem, as much circuitry is shared on TX and RX.

The logical process of fault identification is to determine the missing function (no RX on USB), then the board at fault (IF UNIT), then the bad circuit (USB filter), then the malfunctioning part (Q_{3007}).

If, after the receiver inspection is completed, all appears OK, switch to the transmit side, following the same logical procedure (function – board – circuit – component). Concentrate on those sections unique to the transmit side, as you have already performed a thorough checkout of all receiver and shared circuits. Use only a dummy load. NEVER troubleshoot using an antenna.

In this manual, we will provide troubleshooting advice which leads you directly to suspect components. As there are some 2,000 parts in the FT-180, though, it obviously is impossible for us to trace the path of every possible malfunction in the radio. Therefore, if our tips do not lead to identification of the trouble, the logical elimination process is the way to go.

TROUBLESHOOTING

A FUNDAMENTAL ANALYSIS OF THE TROUBLE

The failure may be caused by one of the following:

1) Mechanical defect
2) Electrical defect
3) Others (Murphy's Law, etc.)

1. MECHANICAL DEFECTS

Typical examples of mechanical defects encountered by the technician are:

a) Damage from shock during transportation (remember the unit was probably subjected both to sea and truck shipment).
b) Damage caused by vibration in service.
c) Damage caused by forcing stubborn knobs or switches. This difficulty is usually preceded by one of the two above defects.

2. ELECTRICAL DEFECTS

Typical electrical defects encountered are:

a) Part(s) failure caused by aging;
b) Failures caused by improper application of supply voltage or by voltage spikes;
c) Improper operation (e.g. transistors without load – this usually points to a failure elsewhere, in addition to the damaged transistor or IC).
d) Loose connections, at the power receptacle, caused by cold solder joints, etc.

3. OTHERS

Among the miscellaneous types of failures or difficulties encountered are:

a) Antenna troubles – be on the alert for antenna problems when the owner of the just-aligned transceiver complains of difficulty "when I switch to the antenna."
b) Poor power source – extremely high or low voltage, insufficient capacity, poor regulation, etc.
c) Murphy's Law – use of a non-Yaesu microphone with different connections, for example. (See page 1-6.)

RECEIVE

Problem	Condition	Probable cause(s)
(1) Nothing happens when switched on	(a) Fuse OK	* Defective power switch * Defective D01 * Defective J5001, J5002 * Defective RL01 * Loose contact at Power Jack J04
	(b) Fuse blows	* Defective C03, 04 or 05 * Defective Power Connector J04 * +13.5V line shorted
(2) No reception	(a) S-meter OK, no audio output from speaker	* Defective speaker * Defective EXT SP Jack J03 * Defective J5001, J5002 * Defective PHONE Jack J02 * Defective J3006 * Defective audio circuit around Q3011, Q3012 and associated circuit
	(b) No audio output on SSB	* Defective Q3008 * Defective J3005 * SSB RX 8V line shorted * Low carrier level * Defective Q3007 * Defective J3004 * Defective T3002
	(c) No audio output on AM	* Defective Q3008 (PB2270B) * Defective J3005
(3) Squelch inoperative	(a) SQL control does not function	* Defective Q2013 and associated circuit * Defective Q3011 and associated circuit * Defective VR02

TRANSMIT

Problem	Condition	Probable cause(s)
(1) No power output	(a) No power output	* Loose contact at J1003 * Loose contact at J1006 * Defective Q1003 and associated circuit * Defective Q1002 and associated circuit * Defective Q1008, 1009 and associated circuit * Defective RL4011 * Defective Q7001, 7002, 7003 and associated circuit * Defective Q8001, Q8002, Q8003, Q8004, Q8005 and associated circuit
	(b) No power output one or more channels	* Defective RL4001–RL4010 * Defective LPF circuit * Defective J4003 * Defective T1002–T1013 * Low local signal level
(2) Poor TX performance	(a) No power output on LSB/USB and no modulation on AM mode	* Defective microphone * Loose contact at microphone connector J01 * Defective J3001 * Defective Q3001, Q3003, Q3004, Q3006 and associated circuit * Defective VR3001 * Defective J3006 * TX 12V line shorted
(3) No change over from RX to TX	(a) TX OK in CALL position	* Failure in PTT line * Defective MIC PTT switch * Defective J01 MIC JACK * Loose J5006 connection
	(b) No TX in CALL position	* Defective Q5005, Q5006, Q5007 * Defective RL5001, RL5002 * Loose J5001, J5002 connection
(4) Inoperative on AM mode	(a) No power output	* Defective Q5005, Q5008, Q5009 * Defective J5004 * Defective S05 (MODE) * Defective RL5003, RL5004 * Defective J2007, D2011 * –8V line shorted
(5) Fuse blows on transmit	(a) OK on RX	* TX 13.5V line grounded * Defective 10W AMP unit * Defective PA unit

(6) Abnormal meter operation	(a) Meter does not deflect at all	* Defective M01 * Defective S04 * Defective J08 * Defective J06 * Defective RL5002
	(b) S-meter does not function	* Defective Q2011, Q2022 * Defective J2004 * Defective J5006 * Defective RL5002
	(c) FWD. REF meter does not function	* Defective S04 * Defective J5008 * Defective J4001 * Defective D4015, D4016
	(d) Source meter does not function	* Defective J5008 * Defective VR5001 and associated circuit

COMMON CIRCUITS

Problem	Condition	Probable cause(s)
(1) XTAL OSC Unit	(a) Crystal oscillator does not oscillate	* Defective D6001–D6006 * Defective channel Xtal * Cold solder joint between Xtal unit and J1007 * Defective Q6001, Q6002
	(b) No carrier output	* Defective X6007 * Defective Q6003, Q6004 * Defective T6002 * Loose connection at J1007
(2) REG/CONTROL Unit	(a) No DC +8 Volt output	* Defective Q5003 * +8V line shorted
	(b) No DC –8 Volt output	* Defective Q5001 (or Q5010) and associated circuit * –8V line shorted
	(c) No TX/RX 12 volt	* Defective RL5001 * TX/RX 12 volt line shorted
	(d) No TX/RX 8 volt	* Defective RL5001 * TX/RX 8V line shorted * AM RX 8V line shorted * Defective J3004 * Defective Q2010, D2021
	(e) AF circuit appears OK, no S-meter deflection	* Defective T3002 * Defective T2003–T2009 * Defective Q2003–Q2009, Q2011, Q2012 and associated circuit * Defective XF2001–XF2003 and associated circuit * Detuned T2003–T2009 * Defective J2004 (RX 8V line) * Defective L2013, L2017, L2019, L2020 and L2021 * Defective J2009 * Defective Q1001, 1004, Q1005 and Q1006 * Defective T1015, T1016 * No local signal * Defective Q1007 * Defective T1017
(3) Partial reception	(a) Poor reception on one or more channel (some channels OK)	* Detuned T1002–T1013 * Defective T1002–T1013 * Channel switched control line open or shorted * Low local signal level

BAND TABLE

FREQ. RANGE MODIFICATION KIT NO.	FREQUENCY RANGE	TRANSFORMERS T_{1002}–T_{1013}	Qty	CERAMIC CAPACITORS (C_{1021}–$_{1026}$, C_{1053}–$_{1058}$)	Qty
D3000116	1.6 – 2.0 MHz	L0020973	2	50WV 180pF CH (K02175181)	2
D3000117	2.0 – 2.5 MHz	L0020973	2	2.0 – 2.25 MHz 50WV 120pF CH (K02175121)	2
				2.25 – 2.5 MHz 50WV 100pF CH (K02175101)	2
D3000118	2.5 – 3.0 MHz	L0020973	2	2.5 – 2.75 MHz 50WV 82pF CH (K02175820)	2
				2.75 – 3.0 MHz 50WV 56pF CH (K02175560)	2
D3000119	3.0 – 3.5 MHz	L0020974	2	3.0 – 3.25 MHz 50WV 150pF CH (K02175151)	2
				3.25 – 3.5 MHz 50WV 120pF CH (K02175121)	2
D3000120	3.5 – 4.5 MHz	L0020974	2	3.5 – 4.0 MHz 50WV 100pF CH (K02175101)	2
				4.0 – 4.5 MHz 50WV 75pF CH (K02179018)	2
D3000121	4.5 – 5.0 MHz	L0020974	2	50WV 56pF CH (K02175560)	2
D3000122	5.0 – 6.0 MHz	L0020975	2	5.0 – 5.5 MHz 50WV 62pF CH (K02179017)	2
				5.5 – 6.0 MHz 50WV 47pF CH (K02175470)	2
D3000123	6.0 – 7.0 MHz	L0020975	2	6.0 – 6.5 MHz 50WV 39pF CH (K02175390)	2
				6.5 – 7.0 MHz 50WV 33pF CH (K02175330)	2
D3000124	7.0 – 8.0 MHz	L0020976	2	50WV 51pF CH (K02179016)	2
D3000125	8.0 – 9.0 MHz	L0020976	2	50WV 39pF CH (K02175390)	2
*D3000126	9.0 – 10.2 MHz	L0020977	2	50WV 39pF CH (K02175390)	2
**D3000401	10.2 – 11.7 MHz	L0020977	2	50WV 27pF CH (K02175270)	2
D3000127	11.7 – 14.0 MHz	L0020977	2	50WV 15pF CH (K02175150)	2
D3000128	14.0 – 17.0 MHz	L0020977	2	50WV 6pF CH (K02173060)	2
D3000129	17.0 – 18.0 MHz	L0020977	2	50WV 3pF CH (K02172030)	2

* Channel frequencies in this range cannot be installed in the special 9.1 MHz IF version.

** Channel frequencies in this range can only be installed in the special 9.1 MHz IF version.

PARTS LIST

MAIN CHASSIS

Symbol No.	Part No.	Description
		TRANSISTOR
Q1	G3408440Y	2SD844Y
		DIODE
D1,2	G2090306	Si 10E1 (AM)
D3–8	G2015550	" 1S1555
D9	G2090027	" 1SS53
		RESISTOR
R1	J10276100	Carbon Composition 1/2W GJ 10Ω
R2	J10276101	" " " " 100Ω
R3,5	J01245472	Carbon film 1/4W TJ 4.7kΩ
R4 (10W model)	J32009003	Meter Shunt 0.125Ω
R4 (50W model)	J32009004	" " 0.025Ω
R4 (100W model)	J32009004	" " 0.025Ω
		POTENTIOMETER
VR1	J62800059	DM10A679A 10kΩA·10kΩB
VR2	J62800058	DM10A679A - 10kΩBx2
VR3	J50710502	V10K-8-1-2 5KB
		CAPACITOR
C6–12,14	K13179008	Ceramic disc 50WV 0.01μF (DD106F103Z50V)
C1,2,13	K13179009	" " " 0.047μF (DD110F473Z50V)
C3,4	K19149025	" " 25WV 0.1μF (UAT13X104K-L46AE)
C5	K40149006	Electrolytic " 2200μF (25RE2200)
		METER
M1	M0290025	AP-170
		SPEAKER
SP1	M4090055	SM-57P 4Ω
		RELAY
RL1	M1090018	G4W-11123A-B 12VDC
		SWITCH
S2	N2090021	8A-1011
S3	N2090026	8A-2041
S4	N0190085	SRN2044
S5	N0190059	SRN1043
S6	N0190038	SRN3066
S6 (Remote)	N0190122	1-1-6 GS (BCD)
S1 (FT-180)	N2090021	8A-1011
S1 (FT-180A)	N2090032	8A-3021
		RECEPTACLE
J1	P0090158	FM214-8SS
J2	P1090134	SG7627
J3	P1090005	SG8050
J4 (FT-180)	P0090215	RB19R4M
J6	P1090194	MBR-06B
J4 (FT-180A)	P1090036	QS-AB4M
J5 (FT-180)	P0090158	FM214-8SS
J5 (FT-180A)	P1090096	SC-12HF
J7 (FT-180A)	P1090149	S-1620A-STA

		MINI CONNECTOR
P1 (with wire)	T9204200	5251-02
P2 (")	T9204201	5251-09
P3 (")	T9204202A	5251-02
P4 (")	T9204203	5251-02
P6 (")	T9204205	5251-02
P8 (")	T9204207	5251-06
P9 (")	T9204208	5251-06
P10 (")	T9204209B	5251-07
P11 (")	T9204210B	5251-06
P12 (")	T9204211B	5251-06
P13 (")	T9204212	5251-02
P14 (")	T9204213A	5251-10
P15 (")	T9204214	5251-02
P16 (")	T9204215	5251-05
P17 (")	T9204216A	5251-12
P20 (")	T9204218A	5251-07
P22 (")	T9204219B	5251-07
P26 (")	T9204221	5251-06
P27 (")	T9204222	5251-11
P29 (")	T9204223	5251-09
P31 (")	T9204224	5251-13
P32 (")	T9204225A	5251-13
P33 (")	T9204226	5239-03
P34 (")	T9204227	5251-08
P35 (")	T9204228	5239-09
P36 (")	T9204229A	5251-13
P37 (")	T9204230	5251-03
P38 (")	T9204231	5251-07
P39 (")	T9204252A	SMR-03V-B
		LAMP
PL1	Q1000045	12V 15mA K0,303,60
PL2	Q1000039	14V 0.12A M1041-5-9
		FUSE HOLDER
FH1	P2000004	F-3294
		TERMINAL BLOCK
	Q6000061	ML3182-15P

RF UNIT

Symbol No.	Part No.	Description
PB-2269C	F0002269C	Printed Circuit Board
(FT-180)	C022690A	P C Board with Components
(FT-180A 10.7MHz)	C022690B	
(FT-180A 9.1MHz)	C022690C	
		FET
Q1004–1006	G3801250	2SK125
Q1001,1002,1008, 1009	G4800730G	3SK73GR
		TRANSISTOR
Q1003,1007	G3324070	2SC2407

		DIODE
D1001–1010, 1027–1030	G2090027	Si 1SS53
D1011–1026	G2090118	Schottky barrier 1SS97
		RESISTOR
R1065,1085	J02245479	Carbon film 1/4W SJ 4.7Ω
R1060,1061	J02245829	" " " " 8.2Ω
R1087	J02245100	" " " " 10Ω
R1089	J02245180	" " " " 18Ω
R1086	J02245390	" " " " 39Ω
R1052	J02245470	" " " " 47Ω
R1058	J02245560	" " " " 56Ω
R1055	J02245680	" " " " 68Ω
R1009	J02245820	" " " " 82Ω
R1026,1029,1036, 1038	J02245101	" " " " 100Ω
R1015–1021	J02245121	" " " " 120Ω
R1062	J02245151	" " " " 150Ω
R1002,1031,1033, 1053	J02245181	" " " " 180Ω
R1073	J02245221	" " " " 220Ω
R1088,1090	J02245271	" " " " 270Ω
R1027,1037	J02245331	" " " " 330Ω
R1044–1049,1054, 1056,1057,1083	J02245391	" " " " 390Ω
R1003,1006,1007, 1021	J02245681	" " " " 680Ω
R1001,1030,1032, 1082	J02245821	" " " " 820Ω
R1041,1063,1064, 1084,1091–1093	J02245102	" " " " 1kΩ
R1034	J02245122	" " " " 1.2kΩ
R1050	J02245152	" " " " 1.5kΩ
R1042	J02245222	" " " " 2.2kΩ
R1094	J02245472	" " " " 4.7kΩ
R1025	J02245562	" " " " 5.6kΩ
R1004,1008,1043, 1076,1077–1081	J02245103	" " " " 10kΩ
R1067	J02245183	" " " " 18kΩ
R1040,1070	J02245223	" " " " 22kΩ
R1039	J02245273	" " " " 27kΩ
R1068	J02245473	" " " " 47kΩ
R1023,1071	J02245154	" " " " 150kΩ
	J02245224	" " " " 220kΩ
R1022	J02245274	" " " " 270kΩ
R1069	J02245334	" " " " 330kΩ
R1024	J02245225	" " " " 2.2MΩ
		CAPACITOR
C1109	K30176271	Dipped mica 50WV 270pF (Z17D271K05)
C1103	K30176511	" " " 510pF (Z18D511K05)
C1007	K30279092	" " 500WV 750pF (DM19D751J5)
C1118,1121	K02172040	Ceramic disc " 4pF (DD104CH040C50V)
C1122	K02173060	" " " 6pF (DD104CH060D50V)
C1108	K02179009	" " " 22pF (DD104CH220J50V)
C1007,1074,1078, 1079,1085,1086, 1110,1119	K02175560	" " " 56pF (DD106CH560J50V)
C1045	K02175680	Ceramic disc 50WV 68pF (DD107CH680J50V)
C1046	K02175101	" " " 100pF (DD107CH101J50V)
C1111	K02179021	" " " 130pF (DD109CH131J50V)
C1107	K02179022	" " " 160pF (DD109CH161J50V)
C1073	K02179027	" " " 270pF (DD112CH271J50V)
C1006,1034, 1037–1039,1041, 1047,1049,1051, 1052,1071,1072, 1080,1081,1084, 1087,1090,1100, 1113,1120	K10179024	" " " 0.01μF (CDS080XB103K50)
C1003,1008, 1015–1020, 1027–1033,1035, 1036,1040,1042, 1044,1065–1070, 1075,1076,1077, 1082,1083,1088, 1091–1093, 1095–1099,1101, 1103,1104,1112, 1114–1116	K19149021	" " 25WV 0.047μF (UAT08X473K-L45AE)
C1001,1002,1004, 1048,1073,1102, 1106	K19149025	" " " 0.1μF (UAT13X104K-L46AE)
C1005	K40170105	Electrolytic 50WV 1μF (50RL1)
C1105	K40120106	" 16WV 10μF (16RL10)
C1009–1014, 1059–1064	K40129008	" " 33μF (16RE33)
C1021–1026, 1053–1058	–	See BAND TABLE (page 3-42)
		INDUCTOR
L1011,1015	L1190016	FL5H-101K 100μH
L1001–1003,1013, 1018	L1190038	FL5H-271K 270μH
L1004–1010,1012, 1017,1021	L1190017	FL5H-102K 1mH
L1014,1016	L0020952	0.29μH
L1019	L0020953	0.60μH
L1020	L0020954	0.43μH
		TRANSFORMER
T1014,1021	L0020178	
T1015,1017,1019, 1020	L0020209	
T1016,1018	L0020957	
T1002–1013	–	See BAND TABLE (page 3-42)
T1001	L0020545	
		MINI CONNECTOR
J1001,1003–1006	P0090218	5045-02A
J1002	P0090225	5045-09A
J1007	P0090228	5045-12A
J1008,1009,1011, 1012	P0090222	5045-06A
J1010	P0090223	5045-07A
	Q5000011	Wrapping terminal C

IF UNIT

Symbol No.	Part No.	Description
PB-2273B	F0002273B	Printed circuit board
(10.7MHz)	C022730A	P C Board with Components
(9.1MHz)	C022732A	
		IC
Q2013	G1090248	AN6551
		FET
Q2006,2011	G3801921G	2SK192AGR
Q2007	G3801250	2SK125
Q2001–2005	G4800730G	3SK73GR
		TRANSISTOR
Q2012	G3105641R	2SA564AR
Q2014,2016,2017	G3315830	2SC1583
Q2008–2010,2015, 2019	G3318150Y	2SC1815Y
Q2018	G3318150G	2SC1815GR
		DIODE
D2011,2016,2017	G2090093	Ge 1N270
D2001–2010, 2026–2031	G2090118	Schottky barrier 1SS97
D2019–2023	G2090029	Ge 1N60
D2013–2015,2025	G2015550	Si 1S1555
	G2090027	Si 1SS53
D2018	G2090040	Varactor FC-63
		CRYSTAL FILTER
XF2001	H1102250	XF-10.7HA 10.7AM
XF2002	H1102030	XF-10.7HUA 10.7USB
XF2003 (OPTION)	H1102031	XF-10.7HLA 10.7LSB
		MONOLITHIC FILTER
XF2004	H1102032	10.7MC20
		RESISTOR
R2066	J02245100	Carbon film 1/4W SJ 10Ω
R2065	J02245330	" " " " 33Ω
R2001,2032	J02245470	" " " " 47Ω
R2051	J02245560	" " " " 56Ω
R2004,2038	J02245101	" " " " 100Ω
	J02245121	" " " " 120Ω
R2071,2117	J02245221	" " " " 220Ω
R2040,2054	J02245331	" " " " 330Ω
R2007,2010,2020, 2027,2031,2057, 2059,2095,2105, 2111	J02245471	" " " " 470Ω
R2005,2011,2014, 2017,2030,2060, 2063,2078,2083, 2091,2104,2110, 2113,2118,2122, 2123,2131	J02245102	" " " " 1kΩ
R2012,2015,2018	J01245102	" " " TJ 1kΩ
R2084,2050	J02245152	" " " SJ 1.5kΩ
	J02245182	" " " " 1.8kΩ
R2022,2064,2086	J02245332	" " " " 3.3kΩ
R2096,2106,2112,	J02245332	Carbon film 1/4W SJ 3.3kΩ
R2003	J02245472	" " " " 4.7kΩ
R2094,2099,2103, 2019,2126,2129	J02245562	" " " " 5.6kΩ
R2008,2072,2124	J02245822	" " " " 8.2kΩ
R2023,2024,2043, 2049,2055,2075, 2080,2081,2088, 2097,2100,2125	J02245103	" " " " 10kΩ
R2052,2130	J02245153	" " " " 15kΩ
R2028,2037,2087, 2101,2127	J02245223	" " " " 22kΩ
R2036,2046	J02245273	" " " " 27kΩ
R2069,2100	J02245333	" " " " 33kΩ
R2061	J02245393	" " " " 39kΩ
R2033	J02245473	" " " " 47kΩ
R2062	J02245683	" " " " 68kΩ
R2092,2128	J02245104	" " " " 100kΩ
R2067	J02245124	" " " " 120kΩ
R2041	J02245154	" " " " 150kΩ
R2077	J02245184	" " " " 180kΩ
	J02245224	" " " " 220kΩ
	J02245274	" " " " 270kΩ
R2073	J02245105	" " " " 1MΩ
		POTENTIOMETER
VR2001	J51723222	H1051A009-2.2KB 2.2kΩB
VR2002	J51723102	H1051A007-1KB 1kΩB
VR2003	J51723103	H1051A013-10KB 10kΩB
VR2004	J51723473	H1051A017-47KB 47kΩB
		CAPACITOR
C2074	K02172050	Ceramic disc 50WV CH 5pF (DD104CH050C50V)
C2044	K02173100	" " " " 10pF (DD104CH100D50V)
C2024,2061,2068, 2089,2090,2134	K02175101	" " " " 100pF (DD107CH101J50V)
C2091	K02179025	" " " " 220pF (DD111CH221J50V)
C2001–2004,2007, 2008,2010,2012, 2013,2015,2017, 2018,2020,2023, 2027,2028,2030, 2036–2043,2045, 2048,2050,2053, 2055,2058,2060, 2066,2075,2076, 2078,2079, 2081–2087,2097, 2099,2107,2109, 2115,2116,2118, 2124,2128,2134, 2135,2138	K01079024	" " " 0.01μF (CDS080XB103K50)
C2005,2006,2011, 2014,2016,2019, 2021,2022,2025, 2029,2035,2046, 2047,2049,2051, 2052,2054,2056, 2057,2059,2062, 2064,2065,2067, 2070–2073,2080, 2088,2092,2102, 2112,2113,2114, 2121–2113, 2125–2127,2129, 2130,2132,2133	K19149021	" " 25WV 0.047μF (UAT08X473K-L45AE)

C2136,2137	K19149021	Ceramic disc 25WV 0.047μF (UAT08X473K-L45AE)
C2025,2031.2032	K19149025	" " " 0.1μF (UAT13X104K-L46AE)
C2117	K30176331	Dipped mica 50WV 330pF (Z17D331K05)
	K30176471	" " " 470pF (Z18D471K05)
C2095	K50177222	Myler " 0.0022μF (50F2U222M)
C2094	K70167105	Tantalum 35WV 1μF (CS15E1V010M)
C2139,2140	K70120002	" 16WV 10μF (489D106X0016C1)
C2096	K40170105	Electrolytic 50WV 1μF (50RL1)
C2069,2093,2098, 2131	K40120106	" 16WV 10μF (16RL10)
C2101,2105,2106	K40129008	" " 33μF (25RE10)
		INDUCTOR
L2001–2008, 2010–2014, 2017–2028,2031, 2032	L1190016	FL5H-101K 100μH
L2029,2030	L1190088	S4-271K 270μH
		TRANSFORMER
T2001	L0020955	
T2002	L0020957	
T2006,2007	L0020956.	
		MINI CONNECTOR
J2001,2003,2006, 2007,2009	P0090218	5045-02A
J2002	P0090226	5045-10A
J2004	P0090221	5045-05A
J2005	P0090228	5045-12A
J2008	P0090223	5045-07A
	Q5000011	Wrapping terminal C

AF UNIT

Symbol No.	Part No.	Description
PB-2270B	F0002270B	Printed Circuit Board
(FT-180)	C022700A	P C Board with components
(FT-180A 10.7MHz)	C022700B	
(FT-180A 9.1MHz)	C022700C	
		IC
Q3006	G1090340	MC1496P
Q3008	G1090124	MC14016BCP
Q3012	G1090284	μPC2002V
		TRANSISTOR
Q3003	G3307320G	2SC732GR
Q3001	G3307320B	2SC732BL
Q3004,3009–3011, 3013	G3318150Y	2SC1815Y
Q3007	G3318150G	2SC1815GR
Q3014	G3318150B	2SC1815BL
		DIODE
D3006	G2090027	Si 1SS53
D3002–3005	G2090029	Ge 1N60
		RESISTOR
R3070,3071	J10276129	Carbon composition 1/2W GK 1.2Ω
R3069	J10276229	" " " " 2.2Ω
R3037	J02245470	Carbon film 1/4W SJ 47Ω
R3063	J02245560	" " " " 56Ω
R3005	J02245101	" " " " 100Ω
	J02245151	" " " " 150Ω
R3068,3074	J02245221	" " " " 220Ω
R3007	J02245331	" " " " 330Ω
R3028,3081	J02245471	" " " " 470Ω
	J02245681	" " " " 680Ω
R3035	J02245821	" " " " 820Ω
R3001	J02245102	" " " " 1kΩ
	J02245152	" " " " 1.5kΩ
R3025,3083	J02245222	" " " " 2.2kΩ
R3079	J02245272	" " " " 2.7kΩ
R3024,3062	J02245332	" " " " 3.3kΩ
R3084	J02245392	" " " " 3.9kΩ
R3008,3049,3054, 3055,3056,3078	J02245472	" " " " 4.7kΩ
R3066,3067,3082	J02245562	" " " " 5.6kΩ
R3002,3010,3031, 3033,3039,3042, 3050,3051,3053	J02245103	" " " " 10kΩ
R3077	J02245123	" " " " 12kΩ
R3006,3021,3061	J02245153	" " " " 15kΩ
R3004	J02245223	" " " " 22kΩ
R3040,3080	J02245273	" " " " 27kΩ
R3020	J02245333	" " " " 33kΩ
	J02245393	" " " " 39kΩ
	J02245473	" " " " 47kΩ
R3003	J02245563	" " " " 56kΩ
R3026,3027	J02245683	" " " " 68kΩ
R3072	J02245104	" " " " 100kΩ
R3057,3076	J02245184	" " " " 180kΩ
		POTENTIOMETER
VR3004	J51723471	H1051A005-470B 470ΩB
VR3003	J51723102	H1051A007-1KB 1kΩB
VR3006	J51723472	H1051A011-4.7KB 4.7kΩB
VR3001,3005	J51723103	H1051A013-10KB 10kΩB
VR3002	J51727473	H1021A317-47KB 47kΩB
		CAPACITOR
C3001,3002	K02175101	Ceramic disc 50WV CH 100pF (DD107CH101J50V)
C3036,3037	K02179025	" " " " 220pF (DD111CH221J50V)
C3004,3025	K12171102	" " " " 0.001μF (DD104E102P50V)

C3024–3035,3038, 3040	K13179008	Ceramic disc 50WV 0.01μF (DD106F103Z50V)
C3006,3032,3076	K13179009	" " " 0.047μF (D110F473Z50V)
C3049	K50177152	Mylar " 0.0015μF (50F2U152M)
C3048	K50177272	" " 0.0027μF (50F2U272M)
C3064	K50177332	" " 0.0033μF (50F2U332M)
C3069	K50177472	" " 0.0047μF (50F2U472M)
C3047,3073–3075	K50177103	" " 0.01μF (50F2U03M)
C3070	K50177123	" " 0.012μF (50F2U123M)
C3039,3071	K50177223	" " 0.022μF (50F2U223M)
C3063	K70167224	Tantalum 35WV 0.22μF (CS15E1VR22MIS)
C3003,3008,3017, 3022,3042,3043, 3051,3055,3056, 3065,3066	K40170105	Electrolytic 50WV 1μF (50RL1)
C3005,3019,3023, 3027,3029,3031, 3054,3072	K40120106	" 16WV 10μF (16RL10)
C3007,3009,3018, 3021,3041,3044, 3046,3052,3068	K40129008	" " 33μF (16RE33)
C3059	K40129009	" " 220μF (16RE220)
C3061	K40129006	" " 470μF (16RE470)
C3062	K40129021	" " 1000μF (16R102S)
		INDUCTOR
L3004	L1190122	FL4H-1R5K 1.5μH
L3006	L1190023	FL5H-220K 22μH
L3003	L1190101	S4-220K 22μH
L3001	L1190016	FL5H-101K 100μH
L3002	L1190121	S4-101K 100μH
		TRANSFORMER
T3001	L0020957	
T3002	L0020788A	
		MINI CONNECTOR
J3001	P0090223	5045-07A
J3002–3004	P0090218	5045-02A
J3005	P0090222	5045-06A
J3006	P0090227	5045-11A
	Q5000011	Wrapping terminal C
		HEAT SINK
	R0067920	for μPC2002V

LPF/ALC UNIT

Symbol No.	Part No.	Description
PB-2272A	F0002272A	Printed Circuit Board
FT-180	C022720A	P C Board with Components
FT-180A	C022720B	
		TRANSISTOR
Q4001,4003,4004	G3105641Q	2SA564Q
Q4002,4005	G3318150Y	2SC1815Y
		DIODE
D4001–4010,4020	G2090001	Si 10D1
D4011–4016	G2090118	Shottky barrier 1SS97
D4018,4021–4023	G2015550	Si 1S1555
D4019	G2090238	Zener HZ3C3
D4017	G2090218	Zener HZ9C1
		RESISTOR
R4002,4003	J10276339	Carbon composition 1/2W GK 3.3Ω
R4001,4004	J10276470	" " " " 47Ω
R4029	J02245470	Carbon film 1/4W SJ 47Ω
R4021	J02245101	" " " " 100Ω
R4027,4028	J02245221	" " " " 220Ω
R4007,4008	J02245102	" " " " 1kΩ
R4012	J02245222	" " " " 2.2kΩ
R4009	J02245332	" " " " 3.3kΩ
R4005,4006,4014, 4023,4039	J02245103	" " " " 10kΩ
R4017,4018,4025, 4026	J02245123	" " " " 12kΩ
R4020	J02245183	" " " " 18kΩ
R4016,4022	J02245223	" " " " 22kΩ
R4010	J02245473	" " " " 47kΩ
R4011,4013,4019, 4021,4040	J02245104	" " " " 100kΩ
R4015,4024	J02245334	" " " " 330kΩ
		POTENTIOMETER
VR4001–4003	J50709103	H1052A013-10KB 10kΩB
		CAPACITOR
C4046	K30275100	Dipped mica 500WV 10pF (LCQ11100J5)
C4069	K30275180	" " " 18pF (LCQ11180J5)
C4052,4059	K30275200	" " " 20pF (LCQ12200J5)
C4042,4060	K30275220	" " " 22pF (LCQ12220J5)
C4048	K30275240	" " " 24pF (LCQ12240J5)
C4023,4054	K30275270	" " " 27pF (LCQ12270J5)
C4064,4068	K30275300	" " " 30pF (LCQ12300J5)
C4036,4057	K30275330	" " " 33pF (LCQ12330J5)
C4032,4044,4050	K30275360	" " " 36pF (LCQ12360J5)

C4056,4077,4078	K30275470	Dipped mica 500WV 47pF (LCQ12470J5)	C4094,4096,4101	K40120106	Electrolytic " 10μF (16RL10)
C4007,4025,4040, 4043,4062,4064, 4066	K30275560	" " " 56pF (LCQ12560J5)	C4086	K40129008	Electrolytic 16WV 33μF (16RE33)
					INDUCTOR
C4038,4047	K30275680	" " " 68pF (LCQ12680J5)	L4032,4033	L1190080	LB4B-3R3J 3.3μH
			L4030,4035	L1190093	LB4B-8R2J 8.2μH
C4021	K30275750	" " " 75pF (LCQ12750J5)	L4031,4034	L1190094	LB4B-100J 10μH
C4016	K30275820	" " " 82pF (LCQ12820J5)	L4001–4006, 4022–4027	L1190120	FL5H-471K 470μH
			L4007	L0020958	1.60μH 1.6–2.6MHz
C4033,4070	K30275101	" " " 100pF (LCQ12101J5)	L4008	L0020959	3.10μH "
			L4009	L0020960	3.63μH "
C4017,4029,4053	K30275121	" " " 120pF (LCQ17121J5)	L4010	L0020961	0.95μH 2.6–4.2MHz
			L4011	L0020962	1.84μH "
C4063	K30275151	" " " 150pF (LCQ17151J5)	L4012	L0020963	2.15μH "
			L4013	L0020964	0.61μH 4.2–6.8MHz
C4039	K30275161	" " " 160pF (LCQ17161J5)	L4014	L0020965	1.18μH "
			L4015	L0020966	1.38μH "
C4058	K30275181	" " " 180pF (LCQ17181J5)	L4016	L0020967	0.377μH 6.8–11.1MHz
			L4017	L0020968	0.730μH "
C4030,4067	K30275201	" " " 200pF (LCQ17201J5)	L4018	L0020969	0.855μH "
			L4019	L0020970	0.230μH 11.1–18.0MHz
C4020,4061	K30275221	" " " 220pF (LCQ17221J5)	L4020	L0020971	0.447μH "
			L4021	L0020972	0.523μH "
C4034	K30275271	" " " 270pF (LCQ17271J5)	L4028,4029	L0020922	
C4012,4013,4026, 4027,4035,4051	K30275301	" " " 300pF (LCQ17301J5)			
					RELAY
C4008,4045,4049	K30275331	" " " 330pF (LCQ17331J5)	RL4001	M1190024	FBR311D012Z 12V
C4031,4055	K30275391	" " " 390pF (LCQ17391J5)			
					LAMP FUSE
C4014	K30275471	" " " 470pF (LCQ17471J5)	F4001	Q1000010	8V 100mA (BQ041-22803A)
C4018,4019,4037	K30275511	" " " 510pF (LCQ18511J5)			
					MINI CONNECTOR
C4041	K30275621	" " " 620pF (LCQ18621J5)	J4001	P0090225	5045-09A
			J4002	P0090218	5045-02A
C4010	K30275681	" " " 680pF (LCQ18681J5)	J4003	P0090222	5045-06A
C4011	K30275751	" " " 750pF (LCQ18751J5)			
					TP TERMINAL
C4022,4024	K30275821	" " " 820pF (LCQ18821J5)		P0090182	RT-01-13B
C4090	K30279051	" " " 1000pF (DM19D102K5)		Q5000011	Wrapping terminal C
C4015	K30279125	" " " 1300pF (DM19D132J5)			
C4089	K30279058	" " " 2000pF (DM19D202K5)			
C4088,4093,4095, 4102,4103	K13179008	Ceramic disc 50WV 0.01μF (DD106F103Z50V)			
			REG/CONTROL UNIT		
C4001–4006, 4071–4076, 4079–4085,4092, 4093,4110 4104–4109	K19149021	" " 25WV 0.047μF (UAT08X473K-L45AE)	Symbol No.	Part No.	Description
			PB-2271E	F0002271E	Printed Circuit Board
				C022710A	P C Board with components
	K19149025	Ceramic " 0.1μF (UAT13X104K-L46AE)			
					IC
C4098	K70167154	Tantalum 35WV 0.15μF (CS15E1VR15M)		G1090350	ICL7660CPA
			Q5003	G1090183	μPC14308
C4099	K70167684	" " 0.68μF (CS15E1VR68M)	Q5005	G1090037	MC14572
C4099,4100	K70127225	" " 2.2μF (CS15E1C2R2M)			

		TRANSISTOR
Q5004,5006–5009	G3318150Y	2SC1815Y
Q5002	G3319590Y	2SC1959Y
Q5010	G3320020L	2SC2002L
		DIODE
D5001	G2015880	Si 1S1588
D5003,5004,5010	G2090306	" 10E1
D5007–5009	G2015550	" 1S1555
D5002	G2090187	Zener BZ140
D5005,5006	G2090003	Si V06B
D5011	G2090221	Zener RD8.2EB2
		RESISTOR
R5001	J02245680	Carbon film 1/4W SJ 68Ω
R5011	J02245331	" " " " 330Ω
R5004	J02245562	" " " " 5.6kΩ
R5010	J02245682	" " " " 6.8kΩ
R5003	J02245123	" " " " 12kΩ
R5002	J02245563	" " " " 56kΩ
R5005	J02245683	" " " " 68kΩ
	J02245823	" " " " 82kΩ
R5006,5007	J02245224	" " " " 220kΩ
R5009	J02245335	" " " " 3.3MΩ
		POTENTIOMETER
VR5001	J50709472	H1052A011-4.7KB 4.7kΩB
VR5002	J50709473	H1052A017-47KB 47kΩB
VR5003	J50709224	H1052A021-220KB 220kΩB
		CAPACITOR
C5017,5021–5024	K19149021	Ceramic 50WV 0.047μF (UAT08X473K-L45AE)
C5001,5004,5005, 5008,5010,5013, 5014,5016,5018, 5026	K19149025	" 25WV 0.1μF (UAT13X104K-L46AE)
C5027,5028	K50177333	Mylar 50WV 0.033μF (50F2U333M)
	K70167224	Tantalum 35WV 0.22μF (CS15E1VR22M)
C5020	K70127335	" 16WV 3.3μF (CS15E1C3R3M)
C5006,5007,5009, 5011,5012,5019	K40129007	Electrolytic " 100μF (16RE100)
C5015	K40149016	" 25WV 220μF (25RE220)
C5002,5003	K40149005	" " 1000μF (25RE1000)
		INDUCTOR
L5001,5002	L1190103	S4-392K 3.9mH
L5003,5004	L1190016	FL5H-101K 100μH
		CHOKE TRANSFORMER
CH5001	L2030069	1.7mH 2.5A
		RELAY
RL5001–5004	M1190015	G2V-2 12V
		MINI CONNECTOR
J5001,5002,5006	P0090229	5045-13A
J5003	P0090237	5273-03A
J5004	P0090224	5045-08A
J5005	P0090238	5273-09A
J5007	P0090219	5045-03A
J5008	P0090223	5045-07A
		DC-DC CONV. TRANSFORMER
T5001	L3030084	MC-102C

CARRIER/LOCAL OSC UNIT–1

Symbol No.	Part No.	Description
PB-2268B	F0002268B	Printed Circuit Board
(10.7MHz)	C022680A	P C Board with components without crystals
(9.1MHz)	C022680B	
		FET
Q6004	G3801921G	2SK192AGR
		TRANSISTOR
Q6001–6003	G3319230	2SC1923R
		DIODE
D6001–6008,6010, 6012	G2090027	Si 1SS53
D6011	G2010093	Ge (GB) 1N270
D6009	G2022080	Varactor 1S2208
		CRYSTAL
X6001–6006	H0102391	HC-42/u LOCAL (25°C)
X6007	H0102387	HC-42/u 10.7MHz(25°C)
		CRYSTAL SOCKET
XS6001–6007	P3090002	SD0105
		RESISTOR
R6035,6037	J02245330	Carbon film 1/4W SJ 33Ω
R6039	J02245470	" " " " 47Ω
R6019	J02245680	" " " " 68Ω
R6016,6017,6020, 6030,6032,6034, 6043	J02245101	" " " " 100Ω
R6018,6036	J02245271	" " " " 270Ω
R6014,6015,6029, 6031,6033	J02245102	" " " " 1kΩ
R6040,6042	J02245222	" " " " 2.2kΩ
R6041	J02245272	" " " " 2.7kΩ
R6013,6027	J02245392	" " " " 3.9kΩ
R6001–6012, 6021–6024	J02245472	" " " " 4.7kΩ
R6026,6028	J02245103	" " " " 10kΩ
R6045,6046	J02245123	" " " " 12kΩ
R6044	J02245223	" " " " 22kΩ
R6025	J02245393	" " " " 39kΩ
		CAPACITOR
C6025	K06179004	Ceramic disc 50WV UJ 20pF (DD104UJ200J50V)
C6021	K06175270	" " " " 27pF (ECC-D1H270JU)

C6002,6004,6006, 6008,6010,6012	K06179006	Ceramic disc 50WV UJ 30pF (DD104UJ300J50V)
C6037,6038	K02175101	" " " CH 100pF (DD107CH101J50V)
C6014,6015,6026	K02175151	" " " " 150pF (DD109CH151J50V)
C6001	K10179024	" " " " 0.01μF (CDS080XB103K50)
C6031,6033–6036	K19149021	" " 25WV 0.047μF (UAT08X473K-45AE)
		TRIMMER CAPACITOR
TC6001–6007	K91000028	ECV1ZW 10x53N 10pF
		INDUCTOR
L6001,6002	L1190016	FL5H-101K 100μH
		TRANSFORMER
T6001	L0020569	
T6002	L0020187	
		MINI CONNECTOR
P6005 (with wire)	T9204204	5251-02
P6007 (")	T9204206	5251-12
P6019 (")	T9204217	5251-02
P6024 (")	T9204220	5251-02

10W PA UNIT

Symbol No.	Part No.	Description
PB-2149A	F0002149B	Printed Circuit Board
	C021492A	P.C. Board with components
		IC
Q7005	G1090080	μPC78L08
		TRANSISTOR
Q7001	G3321660	2SC2166
Q7002,7003	G3325090	2SC2509
Q7004	G3408820Q	2SD882Q
		DIODE
D7001	G2090217	Zener HZ3C1
D7002	G9090017	Varistor MV-11
		RESISTOR
R7004	J10276279	Carbon Composition 1/2W GJ 2.7Ω
R7008,7010	J10276150	" " " " 15Ω
R7007	J10276390	" " " " 39Ω
	J01245151	Carbon film 1/4W TJ 150Ω
R7009,7011	J10276151	" Composition 1/2W GJ 150Ω
R7015	J02245221	" film 1/4W SJ 220Ω
R7002	J01245271	" " " TJ 270Ω
R7001	J01245331	" " " " 330Ω
R7014	J02245331	" " " SJ 330Ω
R7003	J01245821	" " " TJ 820Ω
R7005	J01245102	" " " " 1kΩ
R7006	J10276102	" Composition 1/2W GJ 1kΩ

		THERMISTOR
	G9090008	31D26 1kΩ
		POTENTIOMETER
VR7001	J51727471	H1021A305-470B 470ΩB
		CAPACITOR
	K30276680	Dipped mica 500WV 68pF (LCQ12680K5)
C7015,7016	K30276221	" " " 220pF (LCQ17221K5)
C7026	K30276681	" " " 680pF (LCQ17681K5)
C7018	K10176102	Ceramic disc 50WV 0.001μF (DD104B102K50V)
C7002	K10179038	" " " 0.0047μF (DD108B472K50V)
C7010	K10179024	" " " 0.01μF (CDS080XB103K50)
C7001,7003,7005, 7006,7007,7009, 7011,7013,7014, 7019,7023,7025, 7027,7028	K13179009	" " " 0.047μF (DD110F473Z50V)
C2020,2021	K50177154	Mylar " 0.15μF (50F2U154M)
C7004,7024	K40129004	Electrolytic 16WV 10μF (16RE10)
C7008,7012	K40129008	" " 33μF (16RE33)
C7022	K40129007	" " 100μF (16RE100)
		INDUCTOR
L7002	L1190009	FL4H-3R3M 3.3μH
L7001	L1190027	FL5H-390K 39μH
L7003,7006	L1020032	
L7004	L1020015	
L7005	L1020666	
		TRANSFORMER
T7001	L0020789A	
T7002	L0020833A	
T7003	L0020834A	
	Q5000011	Wrapping terminal C

50W PA UNIT

Symbol No.	Part No.	Description
PB-2013B	F0002013B	Printed Circuit Board
	C020136A	P.C. Board with components
		IC
Q8006	G1090294	μPC7808H
		TRANSISTOR
Q8001	G3315890	2SC1589

Q8004,8005	G3322900O/R	2SC2290-O/R
Q8002,8003	G3323950O/R	2SC2395-O/R
Q8007	G3402880K	2SD288K
		DIODE
D8002–8005	G2090002	Si 10D10
D8001	G2090217	Zener HZ3C1
		RESISTOR
R8009,8011	J10276159	Carbon composition 1/2W GJ 1.5Ω
R8006	J10276479	" " " " 4.7Ω
R8007,8019,8020	J10276180	" " " " 18Ω
R8012,8013	J10276240	" " " " 24Ω
R8002	J02245330	" film 1/4W SJ 33Ω
R8010	J10276390	" composition 1/2W GJ 39Ω
R8001	J02245121	" film 1/4W SJ 120Ω
R8014,8015	J10276151	" composition 1/2W GJ 150Ω
R8024	J02245271	" film 1/4W SJ 270Ω
R8003,8004	J10276331	" composition 1/2W GJ 330Ω
R8008	J10276102	" " " " 1kΩ
R8005	J01245152	" film 1/4W TJ 1.5kΩ
R8017,8021,8022, 8023	J21339001	Metallic film 2W NJ 39Ω
	J21339002	" " " " 68kΩ
		POTENTIOMETER
VR8001	J51727222	H1021A309-2.2KB 2.2kΩB
		CAPACITOR
	K30279024	Dipped mica 500WV 56pF (DM15D560K5)
C8044	K30275121	" " " 120pF (LCQ17121J5)
C8043	K30279122	" " " 470pF (DM15D471J5)
	K30279045	" " " 560pF (DM19D561K5)
	K30279046	" " " 620pF (DM19D621K5)
C8028, 8033	K30279049	" " " 820pF (DM19D821K5)
	K30279118	" " " 5000pF (DM19D502J5)
C8005,8006	K10176472	Ceramic disc 50WV 0.0047μF (DM203YB472K5L5)
C8002,8010,8011, 8016,8036	K10179024	" " " 0.01μF (CDS080XB103K50)
C8001,8003,8007, 8008,8012,8014, 8017,8019,8021, 8023 8026,8030, 8031	K13179009	" " " 0.047μF (DD110F473Z50V)
C8037	K19179001	" " " 0.1μF (RSB305YF104Z6L5)
C8004,8009	K23170002	" chip " 0.1μF (GR43R5V104Z50V09)
C8040,8041	K50177683	Mylar " 0.068μF (50F2U683M)
C8022	K70120006	Tantalum 16WV 3.3μF (489D335X0016B1)
C8013,8015,8019, 8020,8024,8025, 8042	K70120002	Tantalum 16WV 10μF (489D106X0016C1)
C8038	K40169003	Electrolytic 35WV 330μF (35RE330)
		INDUCTOR
L8001–8004	L1020035A	
L8005,8007	L1020015	
L8006	L1020395A	
		TRANSFORMER
T8001	L0020289A	
T8002	L0021490	
T8003	L0021284	
	Q5000011	Wrapping terminal C
	R5067900	HEAT SINK

100W PA UNIT

Symbol No.	Part No.	Description
PB-2013B	F0002013B	Printed Circuit Board
	C020132A	P C Board with components
		IC
Q9006	G1090294	μPC7808H
		TRANSISTOR
Q9001	G3315890	2SC1589
Q9004,9005	G3322900	2SC2290
Q9002,9003	G3323950O/Y	2SC2395
Q9007	G3402880K	2SD288K
		DIODE
D9002–9005	G2090002	Si 10D10
D9001	G2090217	Zener HZ3C1
		RESISTOR
R9009	J10276159	Carbon composition 1/2W GJ 1.5Ω
R9006	J10276479	" " " " 4.7Ω
R9007,9019,9020	J10276180	" " " " 18Ω
R9012,9013	J10276240	" " " " 24Ω
R9002	J02245330	" " " " 33Ω
R9010	J10276390	" " " " 39Ω
R9001	J02245121	" film 1/4W SJ 120Ω
R9014,9015	J10276121	" composition 1/2W GJ 120Ω
R9024	J02245271	" film 1/4W SJ 270Ω
R9003,9004	J10276331	" composition 1/2W GJ 330Ω
R9008	J10276102	" " " " 1kΩ

R9005	J01245152	Carbon film 1/4W TJ 1.5kΩ
R9017,9021,9022	J21339001	Metallic " 2W NJ 39Ω
R9023	J21339002	" " " " 68Ω
		POTENTIOMETER
VR9001	J51727222	CR19R 2.2KB
		CAPACITOR
C9035	K30279024	Dipped mica 500WV 56pF (DM15D560K5)
C9044	K30275910	" " " 91pF (LCQ12910J5)
C9032,9034	K30279122	" " " 470pF (DM15D471J5)
C9043	K30279045	" " " 560pF (DM19D561K5)
C9033	K30279046	" " " 620pF (DM19D621K5)
C9028	K30279092	" " " 720pF (DM19D751J5)
C9027,9029	K30279118	" " " 5000pF (DM19D502J5)
C9005,9006	K10179038	Ceramic disc 50WV 0.0047μF (DD108B472K50V)
C9002,9010,9011, 9016,9036	K10179024	0.01μF (DSX080XB103K50)
C9001,9003,9007, 9008,9012,9014, 9017,9019,9021, 9023,9026,9030, 9031	K13179009	" " " 0.047μF (DD110F473Z50V)
C9037	K19179001	" " " 0.1μF (RSB305YF104Z6L5)
C9004,9009	K23170002	" chip " 0.1μF (GR43Y5V104Z50V09)
C9040,9041	K50177683	Mylar " 0.068μF (50F2U683M)
C9039	K50177104	" " 0.1μF (50F2U104M)
C9022	K70120006	Tantalum 16WV 3.3μF (489D335X0016B1)
C9013,9015,9018, 9020,9024,9025, 9042	K70120002	" " 10μF (489D106X0016C1)
C9038	K40169003	Electrolytic 35WV 330μF (35RE330)
		INDUCTOR
L9001–9004	L1020035A	
L9005,9007	L1020015	
L9006	L1020395A	
		TRANSFORMER
T9001	L0020289A	
T9002	L0020631B	
T9003	L0020632	
	Q5000011	Wrapping terminal C
	R4056950	HEAT SINK

		MOTOR
	M2190004	MDN-7R1 DC13.5V
	R3056970	RADIAL FAN
		THERMAL GUARD
TS9001	N7090025	OHD-60M

CRYSTAL OVEN

★★★★★ CRYSTAL OVEN CHASSIS ★★★★★

Symbol No.	Part No.	Description
		TRANSISTOR
Q301,302	G340717O	2SD717-0
		THERMISTOR
TH301	G9090018	PSB-S1 PB-46

★★★★★ OVEN CONTROL UNIT ★★★★★

Symbol No.	Part No.	Description
PB-2230	F0002230	Printed Circuit Board
	C022301A	P C Board with components
		IC
Q401	G1090353	μPC151A
		TRANSISTOR
Q402	G3319590Y	2SC1959-Y
		DIODE
D401,402	G2090188	Zener HZ-5 C-1
		RESISTOR
R401–403	J20249215	Metallic film 1/4W 3.92kΩ
R406	J01245331	Carbon " " TJ 330Ω
R405	J01245103	" " " " 10kΩ
R404	J01245273	" " " " 27kΩ
R407	J01245155	" " " " 1.5MΩ
		CAPACITOR
C403, 404,406	K12171102	Ceramic disc 50WV 0.001μF (DD104E102P50V)
C402,405	K13179008	" " " 0.01μF (DD106F103Z50V)
C401	K70120002	Tantalum 16WV 10μF (489D106X0016C1)

★★★★★ HEATER UNIT ★★★★★

Symbol No.	Part No.	Description
PB-2231	F0002231	Printed Circuit Board
	C022311A	P C Board with components

		DIODE
D501	G2090002	Si 10D10
		RESISTOR
R503,504	J20279007	Metallic film 1/2W NJ 0.39Ω
R502	J01245180	Carbon " 1/4W TJ 18Ω
R501	J10276391	" Composition 1/2W GK 390Ω

******* CARRIER/LOCAL OSC UNIT–2 *******

Symbol No.	Part No.	Description
PB-2268B	F0002268B	Printed Circuit Board
(9.1MHz)	C022682B	P.C. Board with components without crystals
(10.7MHz)	C022682A	
		FET
Q604	G3801921G	2SK192AGR
		TRANSISTOR
Q601–603	G3319230R	2SC1923R
		DIODE
D601–608,610, 612	G2090027	Si 1SS53
D611	G2010093	Ge (GB) 1N270
D609	G2022080	Varactor 1S2208
		CRYSTAL
X601–606	H0102390	HC-42/u LOCAL (75°C)
X607	H0102730	HC-42/u 10.7MHz (75°C)
		CRYSTAL SOCKET
XS601–607	P3090002	SD0105
		RESISTOR
R635,637	J02245330	Carbon film 1/4W SJ 33Ω
R639	J02245470	" " " " 47Ω
R619	J02245680	" " " " 68Ω
R616,617,620, 630,632,643	J02245101	" " " " 100Ω
R618,636	J02245271	" " " " 270Ω
R614,615,629, 631,633	J02245102	" " " " 1kΩ
R640,642	J02245222	" " " " 2.2kΩ
R641	J02245272	" " " " 2.7kΩ
R613,627	J02245392	" " " " 3.9kΩ
R601–612, 621–624	J02245472	" " " " 4.7kΩ
R626,628	J02245103	" " " " 10kΩ
R645,646	J02245123	" " " " 12kΩ
R644	J02245223	" " " " 22kΩ
R625	J02245393	" " " " 39kΩ

		CAPACITOR
C625	K02179008	Ceramic disc 50WV CH 20pF (DD104CH200J50V)
C621	K02179011	" " " " 27pF (DD104CH27J50V)
C602,604,606, 608,610,612	K02179012	" " " " 30pF (DD105CH300J50V)
C627	K02179018	" " " " 75pF (DD107CH750J50V)
C637,638	K02175101	" " " " 100pF (DD107CH101J50V)
C614,615,626	K02175151	" " " " 150pF (DD109CH151J50V)
C601,603,605, 607,609,611, 613,616–620, 622–624, 628–630,632	K10179024	" " " " 0.01μF (CDS080XB103K50)
C631,633–636	K19149021	" " 25WV 0.047μF (UAT08X473K-L45AE)
		TRIMMER CAPACITOR
TH601–607	K91000028	ECV-1ZW-10x53N 10pF
		INDUCTOR
L601,602	L1190016	FL5H-101K 100μH
		TRANSFORMER
T601	L0020569	
T602	L0020187	
		MINI CONNECTOR
P605 (with wire)	T9204204	5251-02
P607 (")	T9204206	5251-12
P619 (")	T9204217	5251-02
P624 (")	T9204220	5251-02
P640 (")	T9204253	SMP-03V-B

ACCESSORIES

Symbol No.	Part No.	Description
	M3090026	Microphone assembly YM-36
	P1090164	(Microphone plug FM-148P)
	P0090021	Antenna plug MP-5
	P0090007	Phone plug SH-3010
	P0090034	Ext. speaker plug P2240
(FT-180)	P1090164	ACC plug FM-148P
(FT-180A)	P0090078	ACC Plug SC-12CM
(FT-180A)	P0090128	Remote CNTR P-1620BA-CA
		FUSE
	Q0000012	6A (10W TYPE)
	Q0000008	15A (50W TYPE)
	Q0000009	20A (100W TYPE)
		DC POWER CORD
(FT-180)	T9013606A	(10W model)
(FT-180)	T9013615A	(50W model)
(FT-180)	T9013620A	(100W model)
(FT-180)	P1090257	(Power plug RB19P4F)
(FT-180)	Q20000001	(Fuse holder SN-1101)
(FT-180A)	T9006806	10W model
	T9006815	50W model
	T9006820	100W model

CONNECTOR UNIT

Symbol No.	Part No.	Description
PB-2472	F0002472	Printed Circuit Board
	C024720A	PCB with Components
		CONNECTOR
J1601	P0090219	5045-03A
J1602,1606	P0090222	5045-06A
J1603,1604	P0090221	5045-05A
J1605	P0090223	5045-07A

FH-180 REMOTE CONTROL MODIFICATION KIT (Option)

Symbol No.	Part No.	Description
PB-2473	F0002473	Printed Circuit Board
	C0247301	PCB with Components
		IC
Q701	G1090213	SN74LS158N
Q702	G1090004	SN7445N
Q703	G1090133	MSM4049RS
Q704	G1090094	μPA2004C
Q706	G1090084	78L05
		TRANSISTOR
Q705,707	G3318150Y	2SC1815Y
Q708–719	G3109500O	2SA950-O
		DIODE
D702–707,714	G2090027	Si 1SS53
D708–713,717	G2090001	" 10D1
D701	G2090155	Zener RD9.1EB2
		RESISTOR
R711	J20306470	Metallic film 1W 47Ω
R701–709, 720–743	J02245222	Carbon " 1/4W SJ 2.2kΩ
R710	J02245332	" " " " 3.3kΩ
R713–719	J02245103	" " " " 10kΩ
R712	J02245223	" " " " 22kΩ
		CAPACITOR
C706	K13179008	Ceramic 50WV F 0.01μF (DD106F103Z50V)
C701–704	K13179009	" " " 0.047μF (DD110F473Z50V)
C705,707	K40129004	Electrolytic 16WV 10μF (16RE10)
		RELAY
RL701	M1190015	G2V-2

J701,702,708	P0090221	5045-05
J704,706,707	P0090222	5045-06
J703,705	P0090223	5045-07
		CHANNEL SWITCH
	N0190122	1-1-6 GS (BCD) with P52
		CONNECTION CABLE
	T9204645	P49-P10
	T9204646	P50-P11/P51-P12

E3640900(006K-CS)