INSTRUCTION MANUAL FTV-250

YAESU MUSEN CO., LTD.

TOKYO JAPAN

FTV-250

TWO METER TRANSVERTER

The Model FTV-250 is an all solid-state two meter transverter designed for two meter operation in conjunction with the FT-101/277, FL-101/FR-101 or FT-201 series HF transceiver.

Advanced solid-state circuit offers unsurpassed stability and clean signals at an input of 20 watts on 144 through 148 MHz. The spurious radiations are extremely reduced or eliminated by the use of dual balanced mixer in the exciter stage.

The low noise and high gain dual-gates MOS FET provides superior receiver front end.
The entire two meter band is devided into two segments which are selected by a switch on the front panel. The switch also selects HF and VHF antenna automatically.

The transverter is self-contained. It may be operated from 100/110/117/200/220 or 234 volt 50/60 Hz AC when the power transformer is appropriately wired. The FTV-250 is normally supplied for 117 volt AC and 12 volt DC operation.

The transverter weighs approximately 6 kg and is 210 m/m wide, 150 m/m high and 290 m/m deep.

SPECIFICATIONS

TRANSMITTER

Input Frequency	28 - 30 MHz
Input Voltage	3 Volts RMS
Input Impedance	Approximately 8 kilo ohms
PA Input	20 watts DC
Output Frequency	144 - 148 MHz
Output Impedance	50 ohm unbalanced
Spurious Radiation	Better than -60 dB

RECEIVER

Input Frequency	144 - 148 MHz
Antenna Impedance	50 ohm unbalanced
Sensitivity	SSB/CW: Better than S/N 20 dB at 0.5 u Volt antenna input signal AM: Better than S/N 10 dB at 1 u Volt antenna input signal
Internal Spurious	Better than 0 dB
Output Frequency	28 - 30 MHz
Output Impedance	50 ohms
Power Requirements	100/110/117/200/220/234 Volt 50/60 Hz AC or 13.5 Volt DC negative ground
Power Consumption	AC 0.75 VA DC 2.6 A at 10 watts antenna output
Size	210 (W), 150 (H), 290 (D) m/m
Weight	Approximately 6 kg

*The above values are in conjunction with FT-101E.

SEMICONDUCTORS

FET

2SK19GR	3	2SK19Y	1
3SK40M	1		

SI TRANSISTOR

2SC372Y	2	2SC373	1
2SC730	1	2SC735Y	1
2SC741	1	2SC784R	3
2SD313D	2	2N3055	1
2N5591	1	MRF208	1

GE DIODE

1N60AM	2	1S188FM	1

SI DIODE

1S1555	5	1S1941	3
10D-1	3	DS-130YD	1
M4B-5	1		

ZENER DIODE

1N4740	1	WZ061	1
WZ090	1	WZ110	1

VARACTOR DIODE

1S1658	2	BB105GM	7

LED

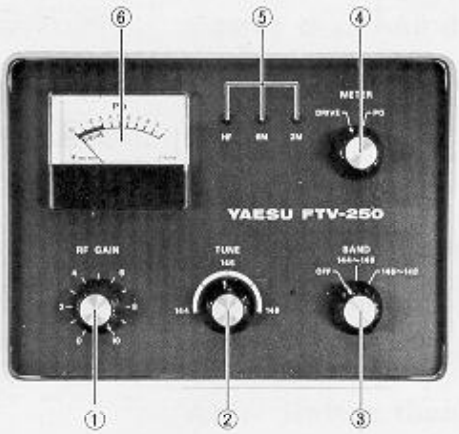
SL103	3

ACCESSORIES

AC Power Cord	1	Coaxial Plug MP-7	1
Coax. Cable (A)	1	Fuse 2A	1
Coax. Cable (B)	1	DC Cord is optional.	
Coax. Cable (C)	1		

CONTROLS AND SWITCHES

FRONT PANEL



(1) RF GAIN — The RF GAIN controls the gain of RF amplifier stage.

(2) TUNE — This control tunes the signal circuit for both transmitter and receiver for optimum performance.

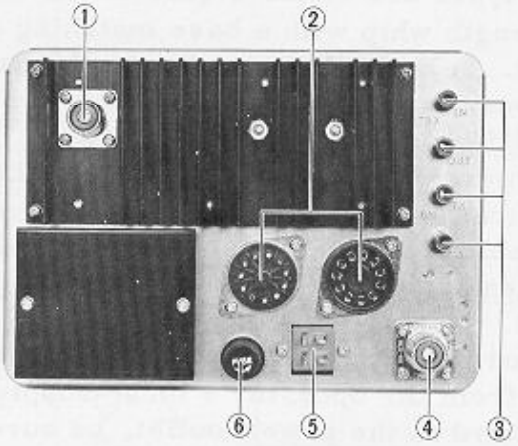
(3) BAND — The BAND switch is a three position switch that selects the two meter amateur band. In the OFF position, the FTV-250 transverter is inoperative and the HF or six meter transverter, if used, will become operational. If the BAND switch of six meter transverter, when connected, is also in the OFF position, the HF antenna is automatically connected to the HF equipment.

(4) METER — This switch selects the meter mode to read exciter drive level and a relative power output.

(5) HF 6M 2M — The lamp shows the band in use.

(6) METER — The METER indicates the relative power output and drive level.

REAR PANEL



(1) 2M ANT — Two meter antenna is connected here.

(2) 2M 6M — Refer to the interconnection diagram.

(3) TRX (IN-OUT), 6M (TX-RX)
RF input and output connectors. Refer to the interconnection diagram.

(4) HF ANT — HF antenna is connected here. If FTV-650B is also connected, the HF antenna is connected to the FTV-650B as illustrated in the interconnection diagram.

(5) POWER — Power receptacle. AC power cord is supplied with the transverter.

(6) FUSE — Fuse holder. For AC operation, a 1 amp fuse is used for 100/117 volt and 0.5 amp fuse on 200/234 volt operation.

INSTALLATION

The FTV-250 Transverter has been primarily designed for combination use with our FT-101/FT-201 transceivers and FL-101/FR-101 transmitter/receiver. The power supply is selfcontained.

The transverter should be placed in a location that has adequate space to permit free air circulation around the heat sink on the back panel.

The antenna and its location are the most important consideration. The antenna should always be as high and in the clear as possible, and a minimum distance of 10 feet should be maintained between the VHF and other antennas.

The most popular antenna types are either a quarter wave length whip with unity gain or a 5/8 wave length whip with a base matching device affording approximately 3.5 dB gain. A multi-element Yagi antenna is also widely used for DX communications.

To minimize loss in the antenna system, the use of the shortest length of the coaxial cable that is practical is recommended, avoiding any sharp angles or kinks. Use type RG-8U cable if the cable length exceeds 25 feet, while RG-58/U may be used for shorter lengths.

The transverter is designed for use in many areas of the world where the supply voltage may differ from the operator's local supply voltage. Therefore, before connecting the AC cord to the power outlet, be sure that the transformer windings agree with the local supply voltage. If not, please refer to Figure 1 for rewiring of the transformer primary connections.

CAUTION

PERMANENT DAMAGE WILL RESULT IF IMPROPER AC SUPPLY VOLTAGE IS APPLIED TO THE TRANSVERTER. OUR WARRANTY DOES NOT COVER DAMAGES CAUSED BY SUCH IMPROPER SUPPLY VOLTAGE.

Be sure proper fuse is used according to the local supply voltage; 1 amp for 100 - 117 volts and 0.5 amp for 200 - 234 volts.

For DC operation, use the DC power cord which may be available through your dealer.

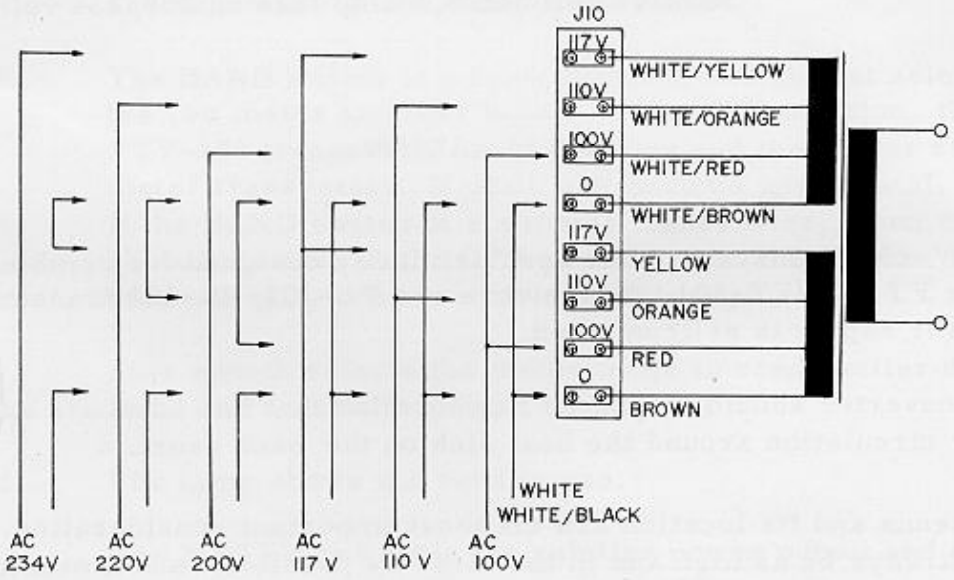


Figure 1 Transformer Primary Wiring

INTERCONNECTIONS

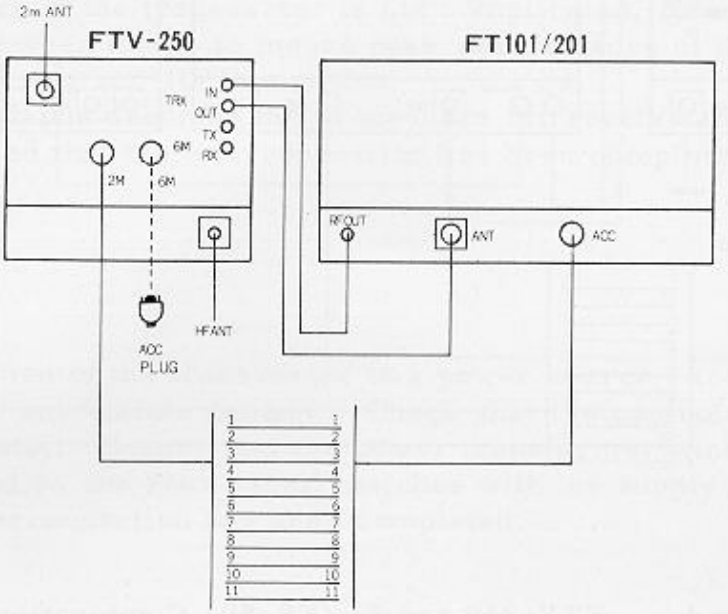


Figure 2 FTV-250 and TRANSCEIVER Combination

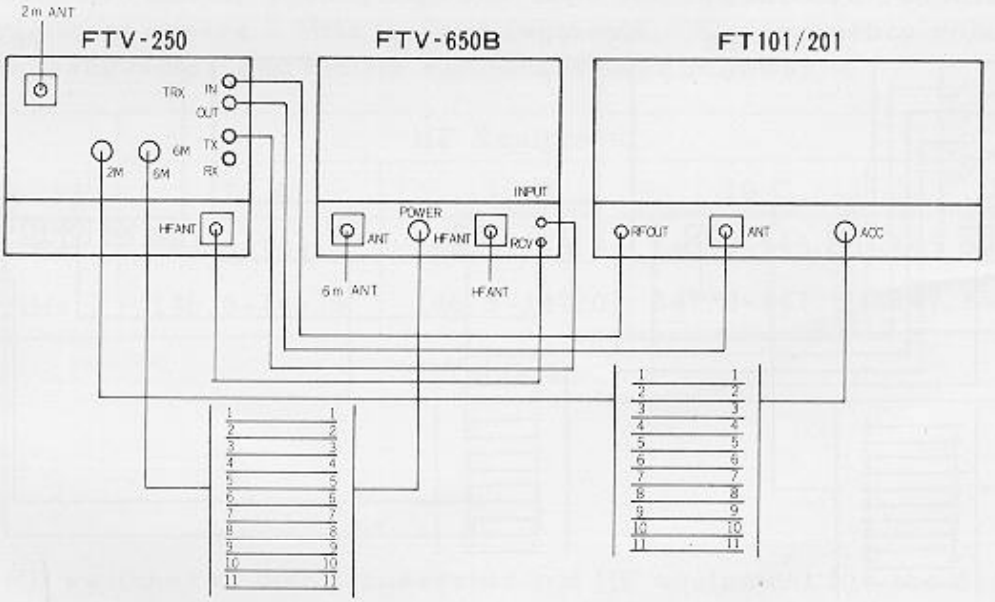


Figure 3 FTV-250, FTV-650B and TRANSCEIVER Combination

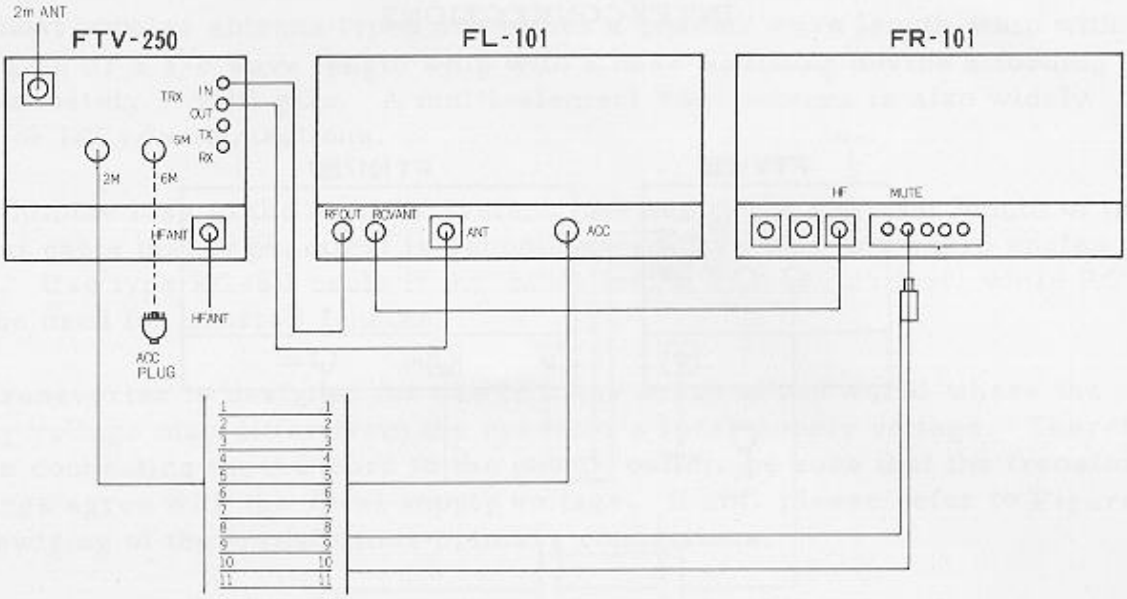


Figure 4 FTV-250 and FL/FR-101 Combination

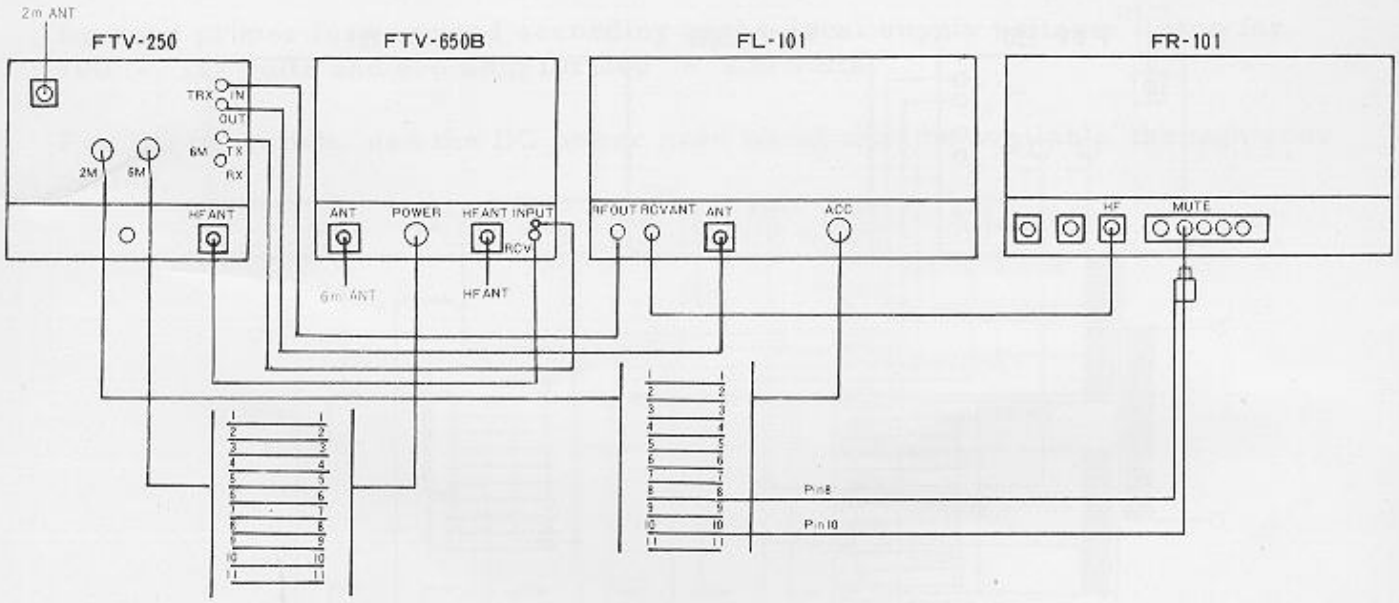


Figure 5 FTV-250, FTV-650B and FL/FR-101 Combination

OPERATION

The tuning procedure of the transverter is not complicated, however, care should be exercised when tuning to insure peak performance of the two combined equipments, transverter and HF equipment.
The following paragraphs describe the procedures for receive and transmit tuning. It is assumed that the interconnection has been completed as shown on page 7 and 8.

INITIAL CHECK

Refer to the connection of the transverter to a power source, and carefully examine the unit for any visible damage. Check that the controls and switches are operating normally. Ensure that the power transformer winding (voltage specification marked on the rear panel) matches with the supply voltage. Ensure that the interconnection has been completed.

FREQUENCY SELECTION

The frequency is determined by the main tuning dial of the HF equipment in conjunction with the transverter BAND switch setting. The transverter BAND switch selects two bands, 144 through 146 MHz and 146 through 148 MHz. The HF equipment covers 2 MHz in four segments. The frequency relation between the transverter and the HF equipment is as follows;

	HF Equipment			
TRANSVERTER	10 A	10 B	10 C	10 D
144 - 146 MHz	144.0-144.5	144.5-145.0	145.0-145.5	145.5-146.0
146 - 148 MHz	146.0-146.5	146.5-147.0	147.0-147.5	147.5-148.0

Table 1

RECEIVE

Set the BAND switches of both transverter and HF equipment for the desired band and tune to the signal by the main tuning dial of the HF equipment. Peak the TUNE control for maximum S-meter reading on the HF equipment. Adjust the RF GAIN of the transverter to reduce interferences from strong signals.

TRANSMIT

CAUTION:

A DUMMY LOAD OR ANTENNA SHOULD BE CONNECTED TO THE ANTENNA TERMINAL FOR TUNE UP OF THE TRANSVERTER OR THE HF EQUIPMENT.

Set the transverter BAND switch to OFF position. Prior to tuning the transverter, the HF equipment must be tuned to 10 meter band with a dummy load connected to the HF antenna terminal of the transverter. Tune up the HF equipment into the dummy load at the desired frequency given from Table 1.

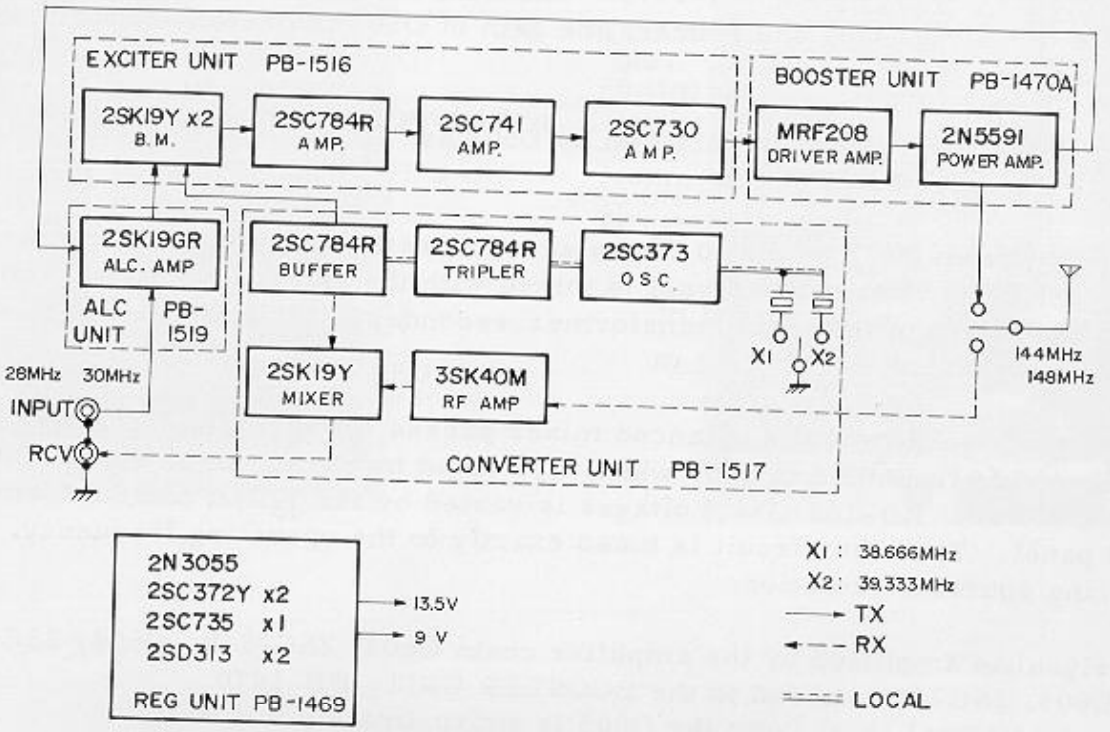
After completion of the HF equipment tune up, set the MIC GAIN and CARRIER controls to fully counterclockwise position, O mark. Set the transverter BAND switch to the desired band and the METER switch to DRIVE position.

Set the HF equipment to TUNE position and set the HF equipment to the transmit mode by the PTT switch. Increase the CARRIER control until the transverter meter reading starts to increase. Peak the PRESELECTOR of the HF equipment and the DRIVE control of the transverter for maximum meter reading. Adjust the CARRIER control until the meter indication stays in the top of the green portion of the meter scale at maximum drive. Set the MODE switch to SSB mode. (Usually the USB mode is used in 2 meter band.)
Advance MIC GAIN until the meter indication goes up to the upper limit of the green portion on voice peaks when speaking normally into the microphone.
On AM mode, the CARRIER LEVEL should be set to the 20% of PO indication on CW mode with the METER switch at PO position.
The MIC GAIN should be set at a level where the meter indication kicks up slightly, with voice peaks.

It is recommended to set the METER switch to the DRIVE position and observe the meter indication so as not to exceed the green portion during operation. Excessive drive may cause the distortion and splatter.

CIRCUIT DESCRIPTION

The following block diagram and circuit description will provide you with better understanding of the transverter.



FTV-250 BLOCK DIAGRAM

RECEIVER

The 144 MHz input signal from the antenna is fed through an antenna relay, RL1201 to pin 5 of the CONVERTER UNIT, PB-1517. The signal is amplified by the RF amplifier Q401, 3SK40M, dual gate MOS FET, and then fed to the gate of the mixer Q402, 2SK19Y, where the input signal is heterodyned with a local signal into 28 MHz IF signal.

The input and output circuits of the RF amplifier utilize a double tuned circuit, which is sharply tuned to the frequency of the received signal with the varactor diodes D401 through D404. Voltage to BB-105-GM is controlled by the TUNE control on the front panel, thus reducing cross and intermodulation.

The heterodyne crystal oscillator Q403, 2SC373, oscillates at 38.66 MHz for 144 - 146 MHz or 39.33 MHz for 146 - 148 MHz depending upon the BAND switch position. This signal is fed to the trippler Q404, 2SC784R, producing 116 or 118 MHz heterodyne signal. The heterodyne signal is fed through the buffer amplifier Q405, 2SC784R, to the receiver mixer 2SK19Y and the exciter mixer 2SK19Y. The converted 28 through 30 MHz IF signal is tuned by T401 and a varactor diode 1S1658 and then fed through the antenna change-over relay to the output terminal J5.

TRANSMITTER

The 28 MHz signal from the RF output of the HF transmitter is fed through the antenna relay to pin 6 of ALC AMP UNIT, PB-1519. The 28 MHz signal is amplified by the ALC (Automatic Level Control) amplifier Q501, 2SK19GR, and fed to the EXCITER UNIT, PB-1516. The ALC voltage is fed through pin 7 to the gate circuit of Q501 and reduces the gain of Q501 to prevent distortion caused by over drive.

A part of the input signal is rectified by D501 and D502, 1S1555, and used to indicate the drive level on the meter.

The output from Q501 is fed to the balanced mixer, consisting of Q601 and Q602, 2SK19GR, where the signal is mixed with the heterodyne signal delivered to the center tap of the input transformer secondary, producing a 144 through 148 MHz signal.

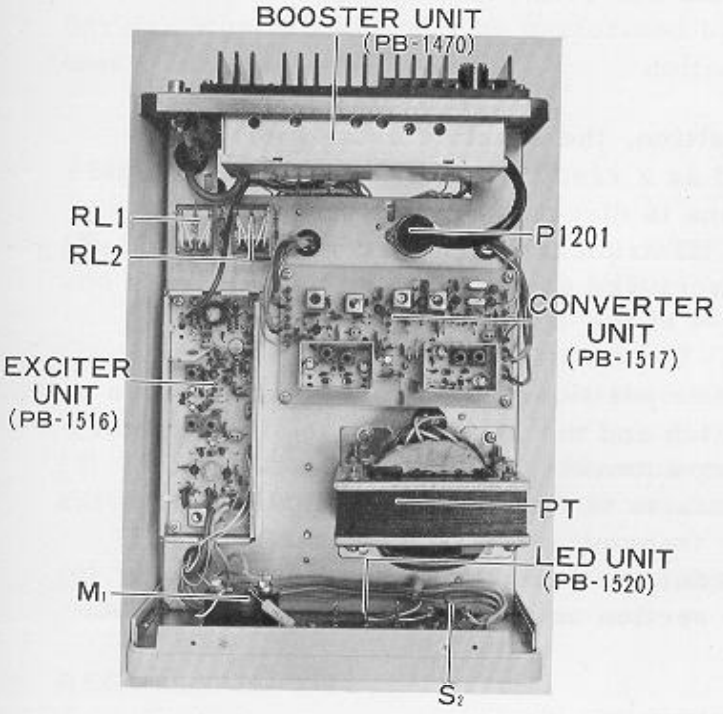
The output signal from the balanced mixer passes through tuned circuits consisting of L601, L602 and L603 which are tuned by the varactor diodes D602, D603 and D604, BB-105-GM Voltages is varied by the TUNE control from the front panel. Thus the circuit is tuned exactly to the operating frequency, reducing spurious radiation.

The signal is amplified by the amplifier chain Q603, 2SC784R, Q604, 2SC741 and Q605, 2SC730, and fed to the BOOSTER UNIT, PB-1470.
The output signal level from the Q605 is approximately 0.1 watt.

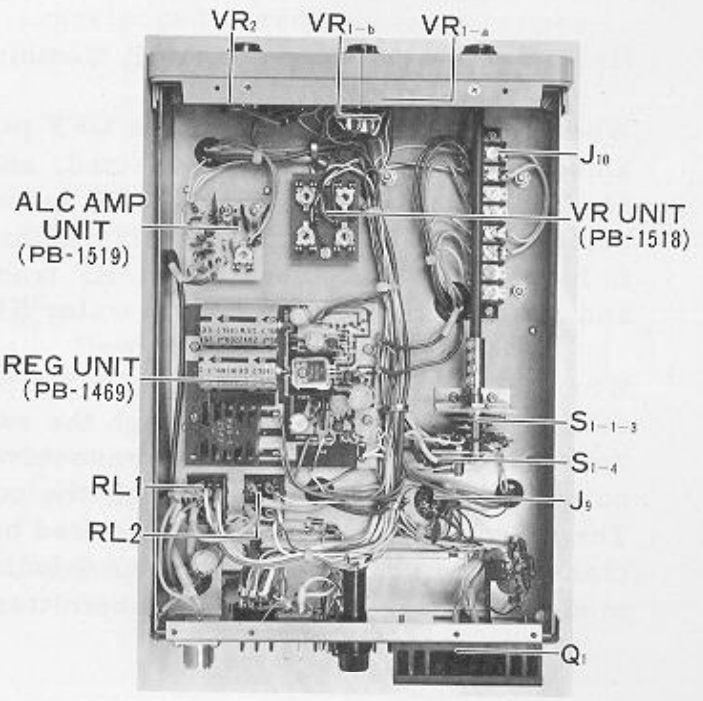
The signal from the EXCITER UNIT is fed to the BOOSTER UNIT and amplified by the driver amplifier Q1201, MRF208, and the final amplifier Q1202, 2N5591, which delivers 10 watts of RF power to the antenna through two stage lowpass filter and the antenna relay.

The bias voltage isstabilized at 9 volts by a zener diode D1209, 1N4740. Two diodes D1201 and D1202, 10D1, are used to protect the power transistors from damage due to heating. A small portion of the RF output is rectified by a diode D1203, 1S188FM, which delivers a resulting DC voltage to the meter where it provides an indication of the relative power output.

The DC voltage obtained from rectifying a small portion of the RF output by the ALC diode D1204, 1S-1555, which is biased by the ALC threshold control VR-1201, is applied to the gate of Q501 in the ALC AMP unit.



Top View



Bottom View

POWER SUPPLY

The power supply has been designed to operate from 100/110/117/200/220 or 234 volts AC 50/60 Hz or 12 volts DC negative ground.
Inserting the appropriate power plug into the rear panel receptacle makes the necessary connections to operate the supply in either AC or DC mode.

For AC operation, the DC voltage is supplied from the bridge connected rectifier unit D1501, M4B-5, which is connected to 17.5 volt secondary winding of the power transformer. The DC voltage is regulated at 13.5 volts by the voltage regulator circuit consisting of Q1501, 2SD313D, Q1, 2N3055 and Q1502, 2SC372Y.

The 13.5 volt voltage is further stabilized at 9 volts by the voltage regulator circuit consisting of Q1503, 2SC372Y, Q1504, 2SD313D and Q1505, 2SC372Y and supplied to the receiver circuit and the heterodyne oscillator circuit.

For DC operation, the positive voltage is connected to pin 3 and the negative voltage to pin 4 of the power receptacle. To protect the circuit from reverse connection of the DC voltage, D2, DS130YD, conducts heavily with reverse polarity connection to blow the line fuse in the DC cord.

CONTROL CIRCUITS

(1) FTV-250 and TRANSCEIVER Combination

When the BAND switch is in the OFF position, the supply voltage for the antenna relay RL-1 is disconnected, and as a result, DC or AC supply voltage for FTV-250 is disconnected. HF antenna is directly coupled through the relay contacts and J5 (TRX OUT) to the HF transceiver. 12.6 volts is supplied to heat up the final tubes of the HF transceiver, connecting pin 2 of J2 (2M) and J3 (6M) through the fourth wafer S1-4 of the BAND switch.

When the BAND switch is at 144 - 148 MHz positions (2 meter operation) the relay voltage is supplied through the switch and the relay activates for 2 meter operation, connecting the HF transceiver antenna jack, J5 to the 28 MHz IF output of the transverter through the contacts of the antenna relay RL-2.
The antenna relay RL-2 is controlled by transmit-receive operation of the HF transceiver. The RL-2 supplies 9 volts for the receiver section on receiver mode and 13.5 volts for the transmitter section on transmit mode.

(2) FTV-250, FTV-650B and TRANSCEIVER Combination

In this combination, the HF antenna is connected to the 6 meter transverter and HF antenna terminal of the FTV-250 is connected to RCV jack of the FTV-650B as illustrated in the interconnection diagram.
With the BAND switch at OFF position, the HF transceiver can be operated as described above and, in addition, 6 meter transverter can be operated as follows:

Signal from the HF antenna is fed to the HF transceiver through RCV jack of FTV-650B, J8 (HF ANT), RL-1 and J5 (TRX OUT). On transmit, on 6 meter band, 28 MHz signal from the HF transceiver is fed through J4 (TRX IN), RL-1 and J6 (6M TX) to the input terminal of the FTV-650B.

When the BAND switch of FTV-650B is OFF, the FTV-250 operates as described in the above paragraph.

MAINTENACE & ALIGNMENT

The FTV-250 transverter has been carefully aligned and tested at factory prior to shipment. With normal usage, it should not require other than the usual attention given to electronic equipment. Service or replacement of major parts may require subsequent realignment, but under no circumstances should realignment be attempted unless the operation of the transverter is fully understood,

the malfunction has been analized and definitely traced to misalignment. Service work should only be performed by experienced personnel using proper test equipment.

TEST EQUIPMENT REQUIRED

(1) RF Signal Generator with 1 volt output at an output impedance of 50 ohms and a frequency coverage to 150 MHz.

(2) Vacuum Tube Volt-Ohm-Meter (VTVM). Hewlett-Packard Model 401B, or equivalent with an RF probe workable up to 150 MHz.

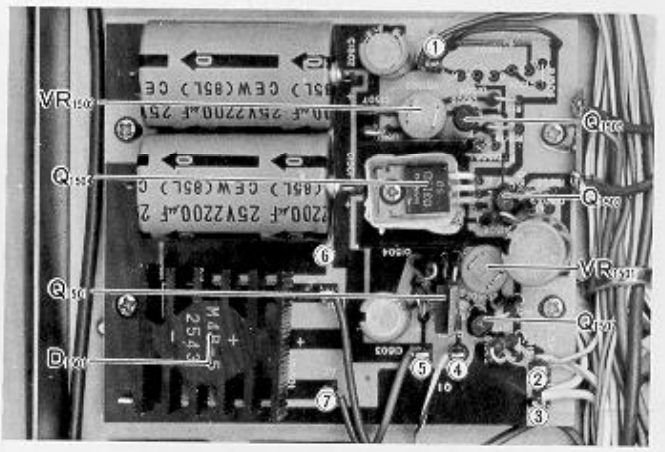
(3) Dummy Load, Yaesu YP-150, or equivalent with 50 ohm nonreactive load rated at 20 watt average power.

(4) Frequency Counter, YC-355D, or equivalent workable up to 200 MHz.

REGULATOR UNIT, PB-1469

The voltage adjustment should be done with AC power supply.
13.5 volts; Connect a VTVM DC probe between the 13.5 volt terminal (positive) and ground (negative). Adjust VR1501 for exact 13.5 volt reading on the VTVM.

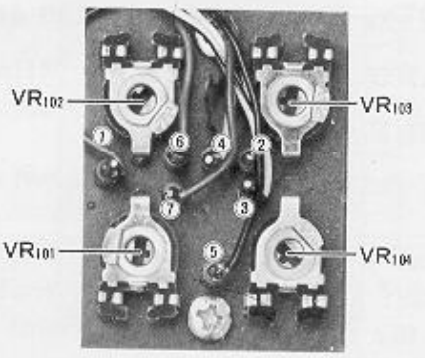
9 volts: Connect a VTVM DC probe between the 9 volt terminal (positive) and ground (negative) and adjust VR1502 for exact 9 volt reading on the VTVM.



REG UNIT

VR UNIT, PB-1518

Set the TUNE control to 148 MHz setting. Connect the positive probe of VTVM to the center arm of forward potentiometer VR1a (TUNE control pot) located on front panel, and adjust VR104 for 5.5 volt reading on the VTVM. Set the TUNE control to 144 MHz setting and make sure that the voltage drops to 3 volts. Disconnect the VTVM positive probe and connect it to the center arm of rear potentiometer VR1b (TUNE control pot). Set the BAND switch to 146 - 148 MHz segment and the TUNE control to



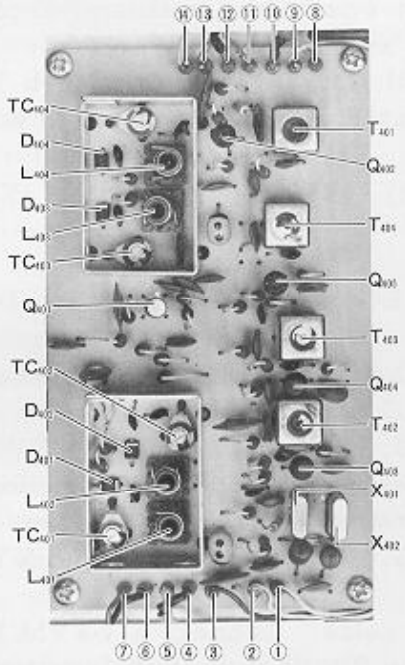
VR UNIT

148 MHz setting. Adjust VR101 for 4.3 volt on the VTVM. Set the TUNE control to 146 MHz and read the VTVM reading.
Set the BAND switch to 144 - 146 MHz segment and the TUNE control to 144 MHz. The VTVM reading should be same as the value measured at 146 MHz with the BAND switch setting of 146 - 148 MHz. Set the TUNE control to 146 MHz. The VTVM should read 4.3 volt.
If these values are not the same, adjust VR102 and VR103 alternately until the VTVM shows the same value at both high and low ends of both band segments.

CONVERTER UNIT, PB-1517

(1) Heterodyne Oscillator

Connect the VTVM RF probe to the base of Q404 and peak T402 for maximum VTVM reading, and set the T402 where the VTVM shows 80% of maximum reading.
Connect the VTVM RF probe and frequency counter to the base of Q405 and peak T403 for maximum VTVM reading.
Connect the VTVM RF probe to pin 8 and peak T403 for maximum VTVM reading.
The coils should be adjusted until the VTVM reading shows the same value with the BAND switch setting of 144 - 146 MHz and 146 - 148 MHz. The output frequency should be 116 MHz for 144 - 146 MHz and 118 MHz for 146 - 148 MHz band.



CONVERTER UNIT

(2) Receiver Front End

Prior to this alignment, the VR unit should be realigned as described in the preceding paragraph. Connect the output of the signal generator set at 146 MHz to the antenna connector.
Set the controls and switch as follows.

BAND	144 - 146 MHz
TUNE	146 MHz
RF GAIN	Fully clockwise position

Peak TC401, TC402, TC403, TC404 and T401 for maximum S-meter reading.
After above procedures, make sure that the TUNE control indication matches to the frequency on the front panel when the receiver is tuned to 144 MHz and 146 MHz respectively.

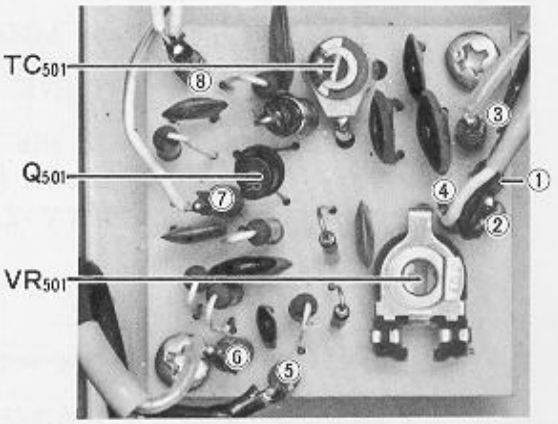
Set the BAND switch to 146 - 148 MHz segment, and make sure that the TUNE control indicates 146 MHz, 147 MHz and 148 MHz when the receiver is tuned to these frequency respectively.

ALC AMP UNIT, PB-1519

Set the METER switch of FTV-250 to DRIVE position and the controls of the HF transceiver as follows.

BAND	10B
FREQUENCY	29 MHz
MODE	TUNE
CARRIER	0

Tune up the HF transceiver at 29 MHz and connect the VTVM RF probe to pin 6 of PB-1519. Increase the CARRIER control until the VTVM indicates 3 volt RMS. Connect the VTVM RF probe to pin 3 and peak TC501 for maximum VTVM reading.
Adjust VR501 until the meter shows 0.3 in the green scale.

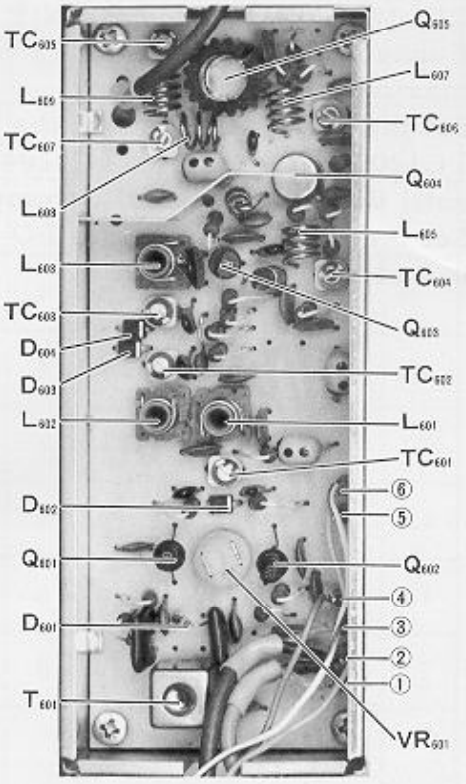


ALC AMP UNIT

EXCITER UNIT, PB-1516

Set the HF transceiver to the same condition as ALC AMP alignment. Set the TUNE control to 145 MHz and the BAND to 144 - 146 MHz. Connect the RF probe of VTVM to the RF input terminal of the BOOSTER UNIT. Peak TC601 through TC607 and T601 for maximum VTVM reading. Connect the VTVM RF probe to the hot end of L602 (junction point between L602 and C614). Adjust VR601 for minimum VTVM reading.

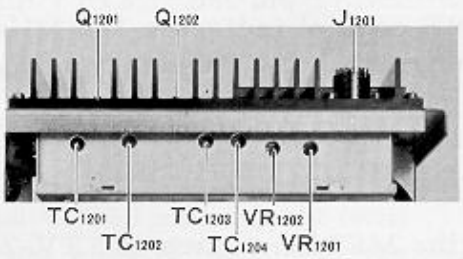
TC601 through TC607 should be realigned for maximum power output at 146 MHz after the completion of the BOOSTER UNIT realignment.



EXCITER UNIT

BOOSTER UNIT, PB-1470

Set the controls and switches as follows:



BOOSTER UNIT

HF Transceiver

BAND	10 D
FREQUENCY	30 MHz
MODE	TUNE
CARRIER	At the level which gives 3 volt (RMS) RF input at FTV-250 RF input.

FTV-250

BAND	144 - 146 MHz
TUNE	146 MHz (12 o'clock position)

It is assumed that the FTV-250 alignment is completed,except the BOOSTER UNIT. Set the VR1201 and VR1202 to fully counterclockwise position. Connect the RF probe of VTVM to the base of Q1201 and peak TC1201, and TC605 and TC607 in the EXCITER UNIT for maximum VTVM reading.
Connect the RF probe of VTVM to the base of Q1202 and peak TC1202 for maximum VTVM reading.
Set the METER switch of the FTV-250 to PO position and peak TC1201, TC1202, TC1203 and TC1204 for maximum meter indication. Adjust VR1201 until the power meter (dummy) shows exactly 10 watts.
Set the METER switch to PO position and adjust VR1202 until the meter indicates 0.8 at 10 watts output.

CONNECTOR RESISTANCE CHART

UNIT	PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14
MAIN CHASSIS	J_1	∞	∞	∞	E	—	—	—	—	—	—	—	—	—	—
	J_2	550K	∞	∞	∞	∞	∞	∞	E	4.6K	∞	∞	—	—	—
	J_3	600K	∞	∞	∞	∞	∞	∞	E	10K	∞	130K	—	—	—
REG		82	95	95	50	28	10	10	—	—	—	—	—	—	—
CONVER-TER		500K	500K	82	E	0	E	82	0	82	E	0	E	※ 3K	※ 18K
ALC AMP		E	E	∞	※ 1.2K	E	22K	180K	13	—	—	—	—	—	—
EXCITER		∞	E	0	※ 3K	※ 18K	13	—	—	—	—	—	—	—	—
BOOSTER	J_9	E	0	※ 3K	※ 1.7K	82	13	13	—	—	—	—	—	—	—

POWER ·····OFF
BAND ·····OFF
RF GAIN ·····MAX
METER SWITCH·····PO

Measured with 20 k ohm/V.
Values are in OHM.

VOLTAGE CHART

UNIT		E (S)		C (D)		B (G)		UNIT		E (S)		C (D)		B (G)	
		R	T	R	T	R	T			R	T	R	T	R	T
MAIN CHASSIS	Q_1	13.5	13.5	18.0	18.0	14.0	14.0	ALC AMP	Q_{501}	0	0.95	0	13.0	0	0
REG	Q_{1501}	14.0	14.0	18.0	18.0	14.6	14.6	EXCI-TER	Q_{601}	0	1.75	0	12.5	0	0
	Q_{1502}	9.0	9.0	14.6	14.6	9.6	9.6		Q_{502}	0	1.75	0	12.5	0	0
	Q_{1503}	9.6	9.6	13.5	13.5	10.2	10.2		Q_{603}	0	1.25	0	13.0	0	1.9
	Q_{1504}	9.0	9.0	13.5	13.5	10.2	10.2		Q_{604}	0	0.75	0	13.0	0	1.65
	Q_{1505}	6.0	6.0	10.2	10.2	6.4	6.4		Q_{605}	0	0	0	13.0	0	0.6
CONVER-TER	Q_{401}	2.9	0	9.0	0	G_1 0.8 G_2 4.4	0.	BOOS-TER	Q_{1201}	0	0	0	13.0	0	0.7
	Q_{402}	1.7	0	9.0	0	0	0.		Q_{1202}	0	0	0	13.0	0	0.7
	Q_{403}	1.5	1.5	8.3	8.3	1.54	1.54								
	Q_{404}	0.85	0.85	8.5	8.5	0.24	0.24								
	Q_{405}	0.8	0.8	8.5	8.5	1.2	1.2								

Measured with VTVM.
Values are in VOLT DC.

FTV-250 PARTS LIST

MAIN CHASSIS

Q TRANSISTOR			
1		2N3055	
D DIODE			
3, 6	Si	1S1555	
1, 4, 5		1S1941	
2		DS-130YD	
R RESISTOR			
	CARBON COMPOSITION		
1		½W	1KΩ
4		½W	470KΩ
2, 3		½W	1MΩ
	WIRE WOUND		
5		2W	150Ω
VR POTENTIOMETER			
1		EVL-BOAS 15B53	5KB
2		EWF-POAS 15O98	5KB/50KB
C CAPACITOR			
	CERAMIC DISC		
3, 6, 7		50WV	0.01μF
2, 4, 9～11		50WV	0.047μF
8, 12		1.5KV	0.0047μF
	MYLAR		
5		50WV	0.1μF
	ELECTROLYTIC		
1		25WV	220μF
PT POWER TRANSFORMER			
1		52-45	
M METER			
1		47820C1	
RL RELAY			
1, 2		AP3241	
RLS RELAY SOCKET			
1, 2		AP3844	
S SWITCH			
1		RS32-1-4-3	
2		ESR-E132R15A	
3		AH-71507	
J CONNECTOR			
1		QMS-AB4M	
2		SA-602B	
3		PA-603B	
4～7		CN-7017	
8		JSO-239	
9		S9-241Y	
10		ML-3161	
FH FUSE HOLDER			
1		SN-1001	

CONVERTER UNIT

PB PRINTED CIRCUIT BOARD			
1517(A～Z)			
Q FET & TRANSISTOR			
401	FET	3SK40M	
402	FET	2SK19Y	
403	Tr	2SC373	
404, 405	Tr	2SC784R	
D DIODE			
406, 407	Ge	1N60AM	
405	Varactor	1S1658	
401～404	Varactor	BB105GM	
X CRYSTAL			
401	HC25/U		38.6666MHz
402	HC25/U		39.3333MHz
R RESISTOR			
	CARBON FILM		
415, 418, 422, 426		¼W	100Ω
425, 429		¼W	220Ω
408, 421		¼W	270Ω
413, 430		¼W	1.5KΩ
409, 417, 424		¼W	2.2KΩ
420		¼W	3.3KΩ
428		¼W	4.7KΩ
416, 419		¼W	10KΩ
427		¼W	22KΩ
404		¼W	33KΩ
423		¼W	47KΩ
405, 406		¼W	68KΩ
403, 407, 412		¼W	100KΩ
401, 402, 410, 411, 414		¼W	1MΩ
C CAPACITOR			
	CERAMIC DISC		
437, 438		50WV	3PF(CH)
401, 402, 411, 413		50WV	5PF(CH)
427, 432		50WV	12PF(CH)
429		50WV	15PF(CH)
403, 414, 421		50WV	20PF(CH)
423		50WV	24PF(CH)
417		50WV	150PF(CH)
415, 420, 425		50WV	0.001μF
404, 406～410, 412, 416 418, 419, 422, 424, 426, 428 430, 431, 436		50WV	0.01μF
405, 433～435		50WV	0.047μF
TC TRIMMER CAPACITOR			
401～404	ECV-1ZW	10×32	10PF
L INDUCTOR			
401	Antenna A	#221003	
402	Antenna B	#221004	
403	RF A	#221005	
404	RF B	#221006	
405	RFC		10μH
410	RFC		250μH
406, 407	RFC		1mH
T TRANSFORMER			
401		R12-4423	
402		R12-4425	
403, 404		R12-4862	

ALC AMP UNIT

PB PRINTED CIRCUIT BOARD

1519 (A~Z)		

Q FET

501	2SK19GR	

D DIODE

501, 502	Si	1S1555

R RESISTOR

CARBON FILM

503, 507	¼W	100Ω
505	¼W	220Ω
501	¼W	10KΩ
502	¼W	22KΩ
504	¼W	100KΩ

VR POTENTIOMETER

501	EVL-S3AA0014	10KB

C CAPACITOR

CERAMIC DISC

501	50WV	10PF (CH)
506, 507	50WV	82PF (CH)
504, 508	50WV	100PF (CH)
502, 503, 505	50WV	0.01μF
509	50WV	0.047μF

TC TRIMMER CAPACITOR

501	ECV-1ZW 40×32	40PF

L INDUCTOR

501	RFC	#220044

EXCITER UNIT

PB PRINTED CIRCUIT BOARD

1516 (A~Z)		

Q FET & TRANSISTOR

601, 602	FET	2SK19GR
605	Tr	2SC730
604	Tr	2SC741
603	Tr	2SC784R

D DIODE

605	Si	10D-1
601	Varactor	1S1658
602~604	Varactor	BB105GM

R RESISTOR

CARBON FILM

619, 621	¼W	22Ω
618	¼W	56Ω
608, 614	¼W	100Ω
613	¼W	220Ω
616	¼W	330Ω
617	¼W	2.7KΩ
612	¼W	3.3KΩ
622	¼W	4.7KΩ
611	¼W	15KΩ
604, 605	¼W	56KΩ
602, 603, 606, 607, 609, 610	¼W	1MΩ

VR POTENTIOMETER

601	SR19R	1KB

C CAPACITOR

DIPPED MICA

604, 605	50WV	390PF

CERAMIC DISC

615	50WV	0.5PF
614, 616	50WV	5PF (CH)
611, 612, 622, 626	50WV	10PF (CH)
618	50WV	56PF (CH)
601, 606, 607, 623, 624	50WV	0.001μF
628, 629	50WV	
602, 608~610, 613	50WV	0.01μF
617, 619~621, 625		
627, 630		

TC TRIMMER CAPACITOR

601~603, 605	ECV-1ZW 10×50	10PF
604, 606, 607	ECV-1ZW 20×50	20PF

L INDUCTOR

601		#221007
602		#221008
603		#221009
604, 606	RFC	#221017
605, 607, 609		#221018
608		#220045
610~612	RFC	10μH

T TRANSFORMER

601	R12-4423

BOOSTER UNIT

PB PRINTED CIRCUIT BOARD

1470 (A~Z)	

Q TRANSISTOR

1201	MRF-208
1202	2N5591

D DIODE

1203	Ge	1S188FM
1204	Si	1S1555
1201, 1202	Si	10D-1
1209	Zener	1N4740

R RESISTOR

CARBON COMPOSITION

1204	½W	10Ω
1201	½W	22Ω
1203	½W	56Ω
1205	½W	120Ω
1202	½W	330Ω
1206	½W	15KΩ

VR POTENTIOMETER

1202	EVL-SOAA 00B53	5KB
1201	EVL-SOAA 00B14	10KB

C CAPACITOR

CERAMIC DISC

1216	50WV	2PF (CH)
1217, 1223	50WV	5PF (CH)
1201, 1205	50WV	10PF (CH)
1213~1215	50WV	20PF (CH)
1212	50WV	39PF (CH)
1211	50WV	68PF (CH)
1206	50WV	100PF (CH)

1202, 1204, 1208, 1210	50WV	0.001μF
1218～1220	50WV	0.01μF
1222	50WV	0.047μF
ELECTROLYTIC		
1203, 1207, 1209	16WV	10μF
TC TRIMMER CAPACITOR		
1202～1204 P-100DS	20P	20PF
1201 ECV-1ZW	50×40	50PF
L INDUCTOR		
1201, 1207	#221019	
1202, 1203	#221022	
1204～1206, 1208, 1209	#221020	
1211, 1212 RFC	#221021	
1210 RFC		22μH
RL RELAY		
1201 LZ-2G		
CONNECTOR		
J1201 JSO-239		
P1201 SI-8501		

VR UNIT

PB PRINTED CIRCUIT BOARD		
1518(A～Z)		
R RESISTOR		
CARBON FILM		
101	¼W	2.7KΩ
VR POTENTIOMETER		
104	EVL-S3AA0014	10KB
102, 103	EVL-S3AA0054	50KB
101	EVL-S3AA0015	100KB

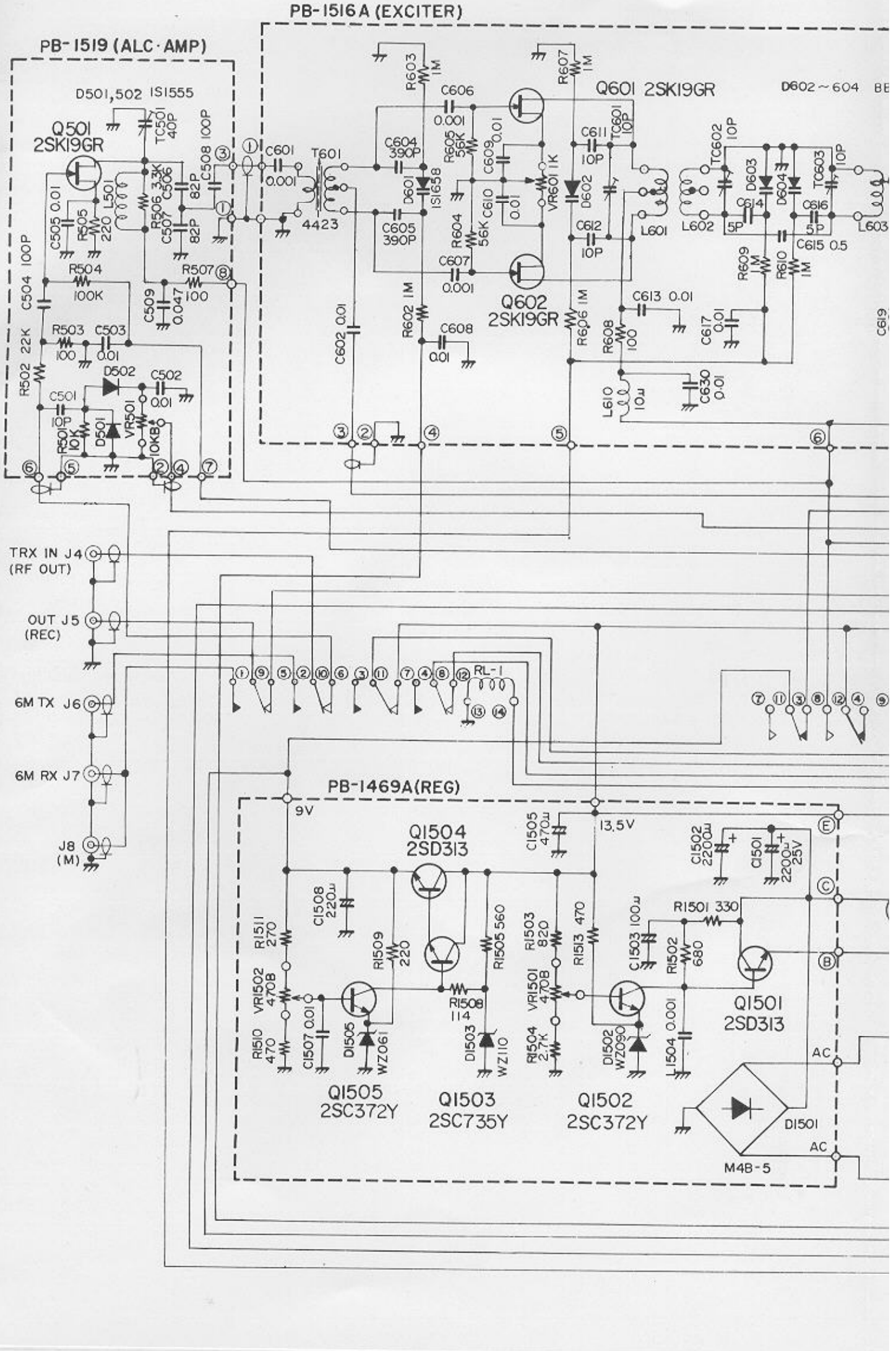
LED UNIT

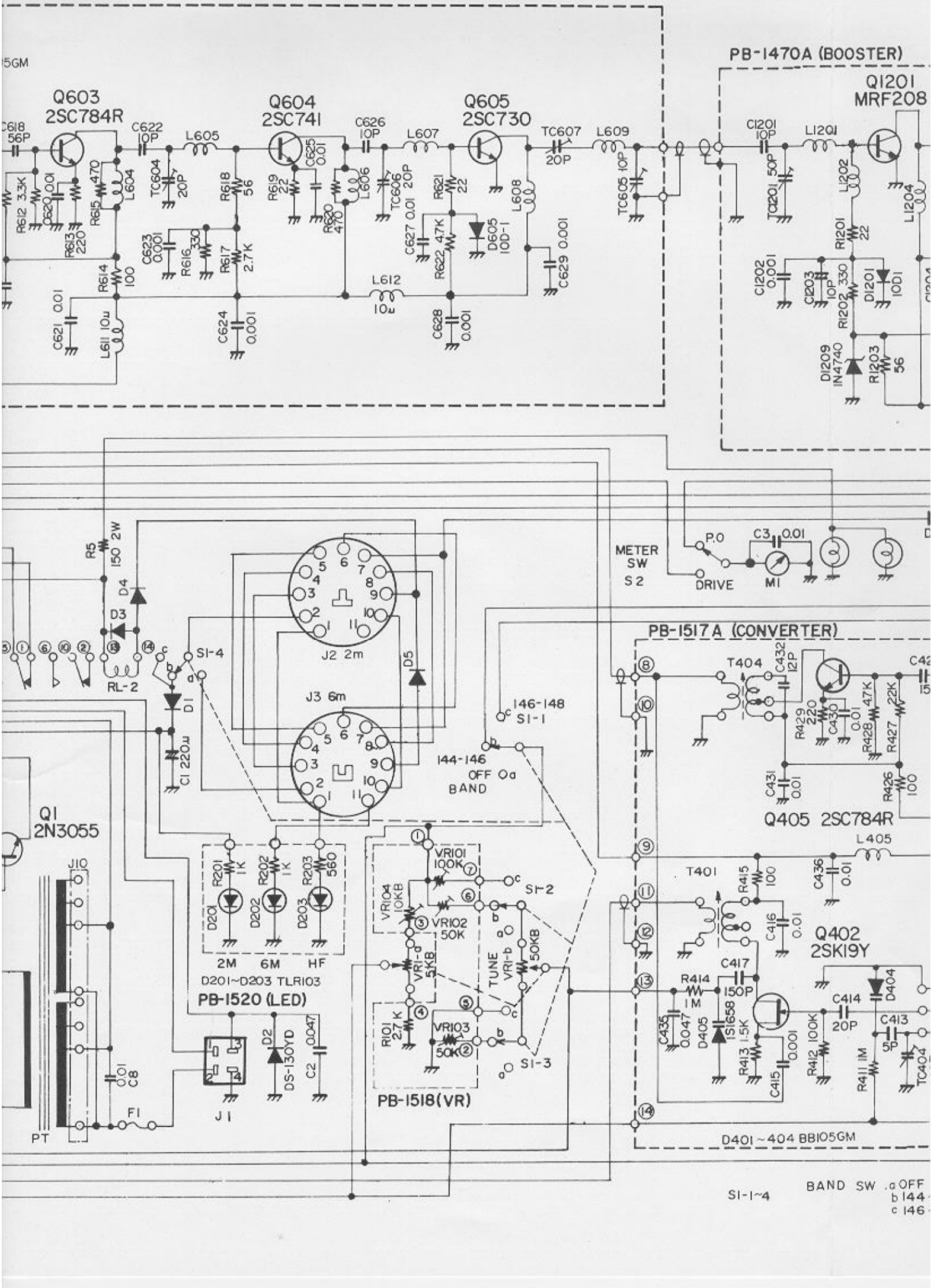
PB PRINTED CIRCUIT BOARD		
1520(A～Z)		
D LIGHT EMITTING DIODE		
201～203 SL-103		
R RESISTOR		
CARBON FILM		
203	¼W	560Ω
201, 202	¼W	1KΩ

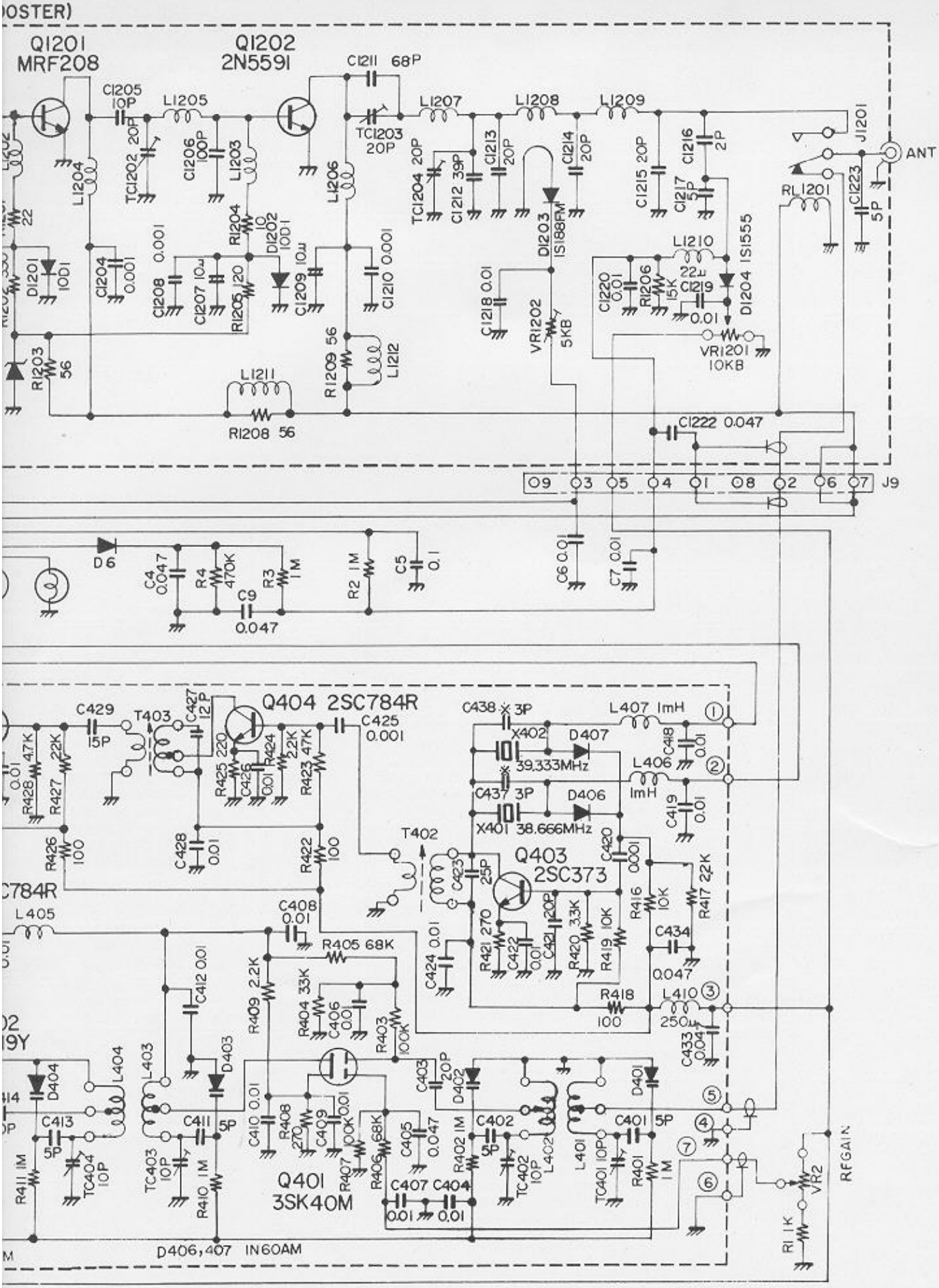
REG UNIT

PB PRINTED CIRCUIT BOARD		
1469(A～Z)		
Q TRANSISTOR		
1502, 1505	2SC372Y	
1503	2SC735Y	
1501, 1504	2SD313D	
D DIODE		
1501 Si	M4B-5	
1505 Zener	WZ061	
1502 Zener	WZ090	
1503 Zener	WZ110	

R RESISTOR		
CARBON FILM		
1509	¼W	220Ω
1511	¼W	270Ω
1501	¼W	330Ω
1510, 1512	¼W	470Ω
1505	¼W	560Ω
1502	¼W	680Ω
1503	¼W	820Ω
1508	¼W	1KΩ
1504	¼W	2.7KΩ
VR POTENTIOMETER		
1501, 1502 SR19R		470B
C CAPACITOR		
CERAMIC DISC		
1507	50WV	0.01μF
MYLAR		
1504	50WV	0.001μF
ELECTROLYTIC		
1503	25WV	100μF
1508	16WV	220μF
1505	16WV	470μF
1501, 1502	25WV	2200μF


PB-1516A (EXCITER)
PB-1519 (ALC·AMP)
D501,502 1S1555
Q501 2SK19GR
Q601 2SK19GR
Q602 2SK19GR
D602~604 BB
T601
4423
TRX IN J4 (RF OUT)
OUT J5 (REC)
6M TX J6
6M RX J7
J8 (M)
RL-1
PB-1469A(REG)
9V
13.5V
Q1504 2SD313
Q1501 2SD313
Q1505 2SC372Y
Q1503 2SC735Y
Q1502 2SC372Y
D1501
M48-5


PB-1470A (BOOSTER)
Q603 2SC784R
Q604 2SC741
Q605 2SC730
Q1201 MRF208
PB-1517A (CONVERTER)
Q405 2SC784R
Q402 2SK19Y
Q1 2N3055
PB-1520 (LED)
PB-1518(VR)
D201~D203 TLR103
D401~404 BB105GM
J2 2m
J3 6m
RL-2
METER SW S2
DRIVE
M1
144-146 OFF Oa BAND
146-148 SI-1
SI-1~4
BAND SW .a OFF
b 144
c 146


)OSTER)
Q1201
MRF208
Q1202
2N5591
C1211 68P
C1205 10P
L1205
L1207
L1208
L1209
TC1203 20P
TC1202 20P
TC1204 20P
C1212 39P
C1213 20P
C1214 20P
C1215 20P
C1216 2P
C1217 5P
J1201
ANT
RL120
C1223 5P
L1204
L1206
C1206 100P
L1203
R1204 10
D1202 1001
D1203 1S188FM
D1204 1S1555
L1210
C1220 0.01
R1206 15K
C1219 22
0.01
VR1201 10KB
VR1202 5KB
C1218 0.01
C1208 0.001
C1207 10P
R1205 120
C1209 10P
C1210 0.001
R1209 56
L1212
L1211
R1208 56
R1203 56
D1201 1001
C1204 0.001
C1222 0.047
J9
D6
C4 0.047
R4 470K
R3 1M
C9 0.047
R2 1M
C5 0.1
C6 0.01
C7 0.01
Q404 2SC784R
C429 15P
T403
C427 12P
C425 0.001
C438 3P
X402
39.333MHz
D407
L407 1mH
C437 3P
X401 38.666MHz
D406
L406 1mH
C448 0.01
C419 0.01
R428 4.7K
R427 22K
R425 220
C426 0.001
R424 2.2K
R423 47K
R426 100
C428 0.01
R422 100
T402
Q403
2SC373
C423 25P
C420 0.001
R416 10K
R417 22K
C421 20P
R420 33K
R419 10K
C434 0.047
R421 270
C422 0.01
C424 0.01
R418 100
L410 250
C433 0.047
L405
C408 0.01
R405 68K
C412 0.01
R409 2.2K
R404 33K
C406 0.01
R403 100K
L403
D403
L404
D404
C413 5P
C411 5P
C410 0.01
R408 270
C409 0.01
C403 20P
D402
D401
C402 5P
C401 5P
R402 1M
TC403 10P
TC404 10P
R411 1M
R410 1M
Q401
3SK40M
C407 C404
0.01 0.01
C405 0.047
R407 100K
R406 68K
TC402 10P
L402
L401
TC401 10P
R401 1M
RFGAIN
VR2
R1 1K
D406,407 IN60AM
SW a OFF
b 144~146
c 146~148
FTV-250
CIRCUIT DIAGRAM

602-F