KENWOOD

SERVICE MANUAL

TS-520S

SSB TRANSCEIVER

CONTENTS

FUNCTIONAL DESCRIPTION

MIC Input Level Vs MIC Output Level

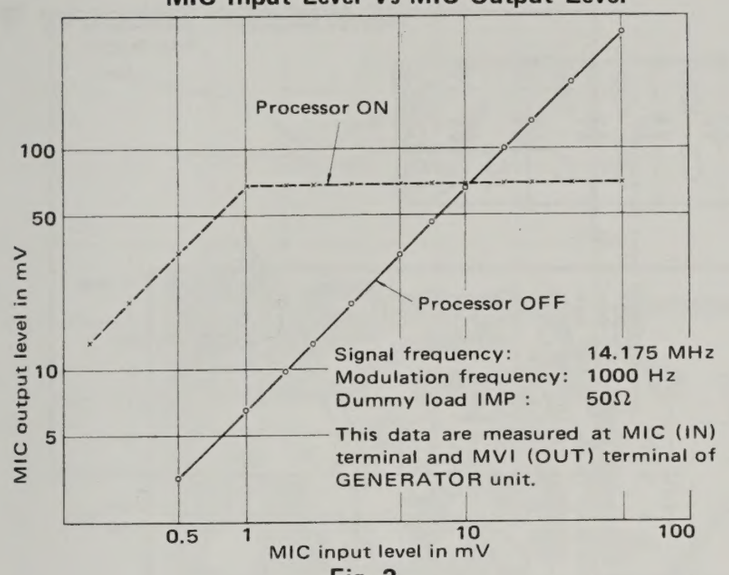


Fig. 2

Output Power Vs MIC Input Level

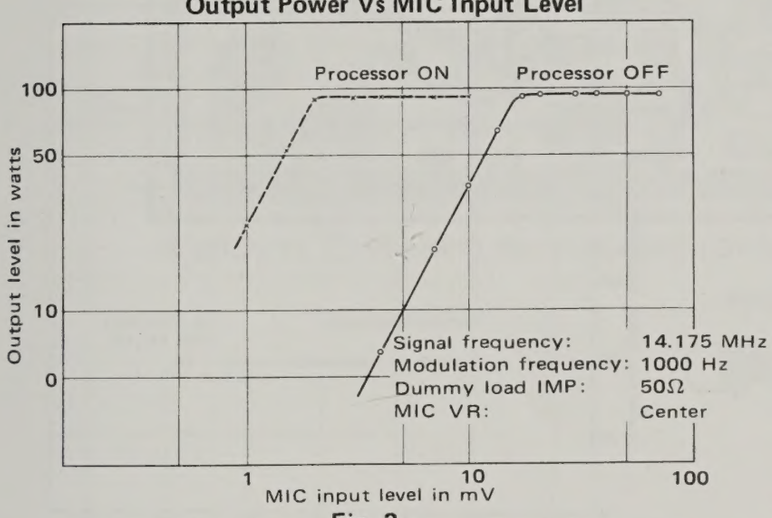


Fig. 3

The MIC AMP input level is adjustable up to about 30mV without excessive distortion by means of VR3 in the generator unit (X52–1090–00).

At processor on the characteristic curve is shifted toward the left from the position at OFF. This shows the compression effect which is adjustable within the range as shown by means of VR2 in the generator unit. That is, MIC input can be amplified stably up to about 70mV by the compression amplifier. As will be understood from the above, if a microphone rated at more than 10mV input is used, the MIC amplifier output is decreased at the processor ON from the output level at processor OFF; on the other hand, if a microphone rated at less than 10mV input is used, the MIC amplifier output is increased at the processor ON. However, there is a relationship between the MIC input and transmitting output as shown in Fig. 3, so that neither the output is increased at MIC input, excessive nor the transmitting output is increased at the processor ON.

Since the semi-fixed resistors VR2 and VR3 are preadjusted as described above, it is stated in item "MIC Knob" of the instruction manual that the MIC gain volume is used to adjust MIC input to a proper level. In other words, the input should be adjusted to a level within the ALC zone.

In practical operation of the transceiver, however, the sound quality is deteriorated if excessively large input is applied to the microphone, though this can be eliminated by using an attenuator in the MIC circuit.

Excessively large MIC input can be checked by the setting point of the MIC volume control. As stated previously, the output level at 10mV input level is unchanged when the processor is set to ON and off since the circuit is so adjusted at the factory prior to shipment, where the MIC volume control is set in the center (12-o'clock) position. The MIC input level is normal as long as the volume control is between 12 and 10 o'clock positions. If the volume control is shifted toward the left (10-o'clock) from the center position (12-o'clock), it is an indication that the MIC input is too large and is attenuated by the volume control. In this state, the MIC amplifier output is attenuated when the processor is set from OFF to ON. Similarly, if the volume control is shifted toward the right (2-o'clock), the output is increased.

MIC Amp Input Level Vs MIC Amp Output Level

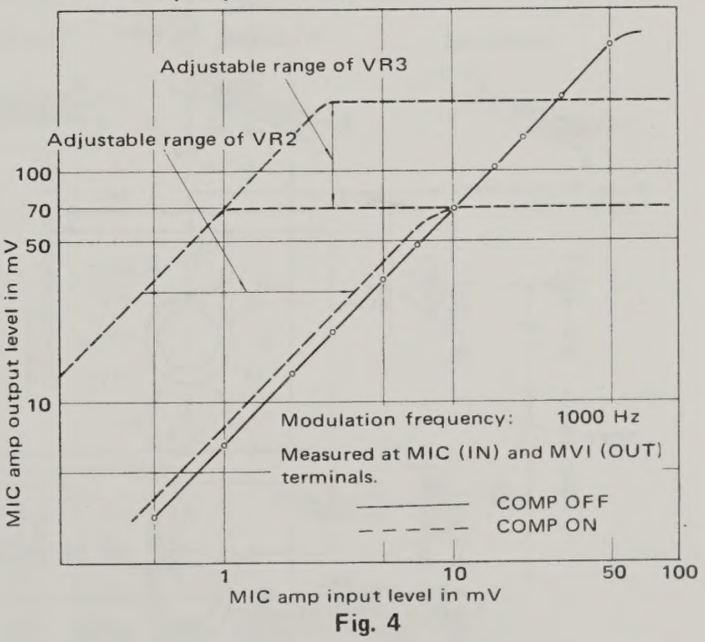


Fig. 4

FUNCTIONAL DESCRIPTION

Low Band 2-signal Characteristic

Low band 2-signal characteristic, as compared with high band, is such that there are many business use signal waves in the vicinity of amateur band and receiver gain can easily be obtained, thus deteriorating the 2-signal characteristic. The 2-signal characteristic is also deteriorated when a large input is present in non-linear operating stage such as the mixer stage of receiving circuit.

In a double conversion system, if the first mixer input level can be suppressed, the second mixer input can be maintained constant. Therefore, the first mixer input level for 1.9-21MHz band is decreased by C division while the level for 28~29.1MHz is maintained the same when the signal is applied to the firs mixer.

This circuit is switched by the band selector switch as found in TS-820 series. In TS-520S, switching of C division and selection of converter power for WWV reception and antenna circuit are accomplished by the same rotary switch.

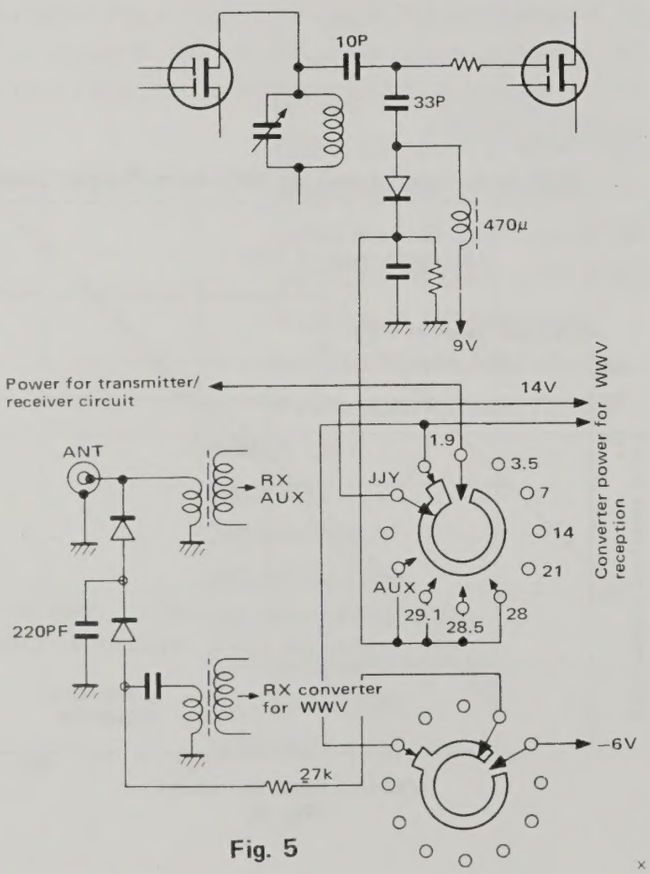


Fig. 5

Intermodulation RX

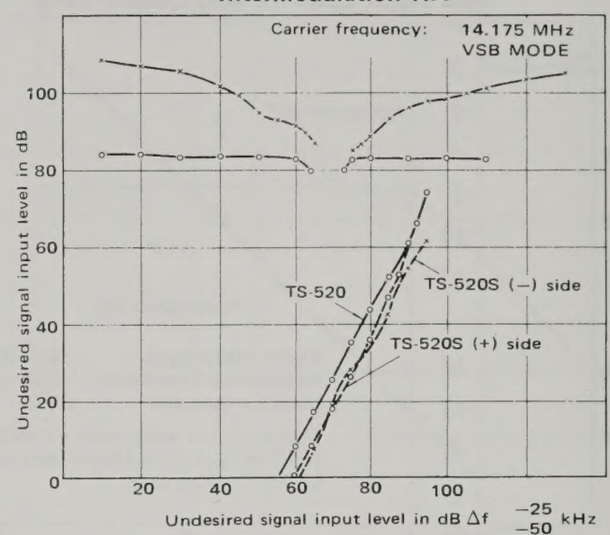


Fig. 6

2 Signal Selectivity

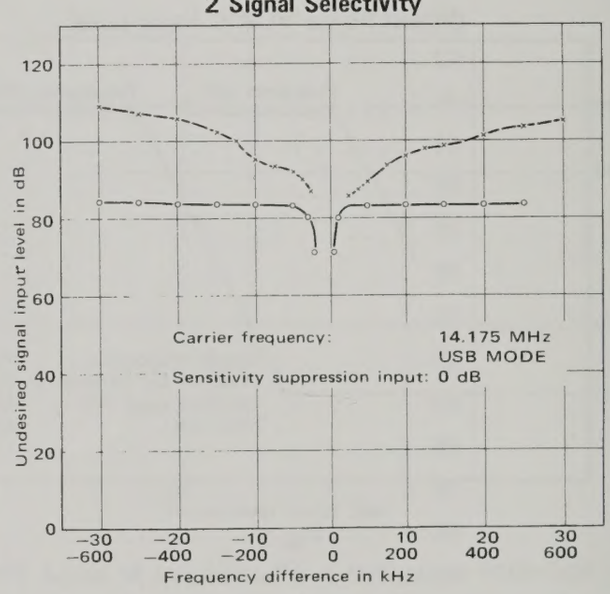


Fig. 7

Antenna Circuit

TS-520S has EXT REC ANT (external receiver antenna) and RF ATT. The antenna system is shown in Fig. 8. A coaxial cable is connected from the rear panel to the RF unit in the ANT circuit. Consideration is given to the circuit so that the circuit cannot be operated when the calbe is in open state.

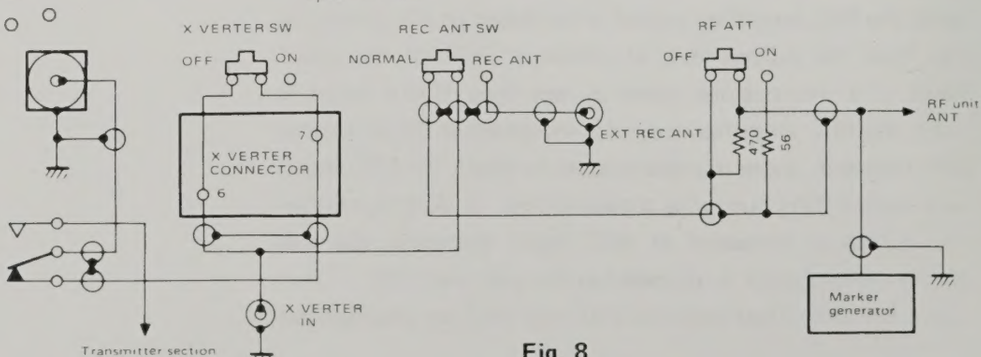
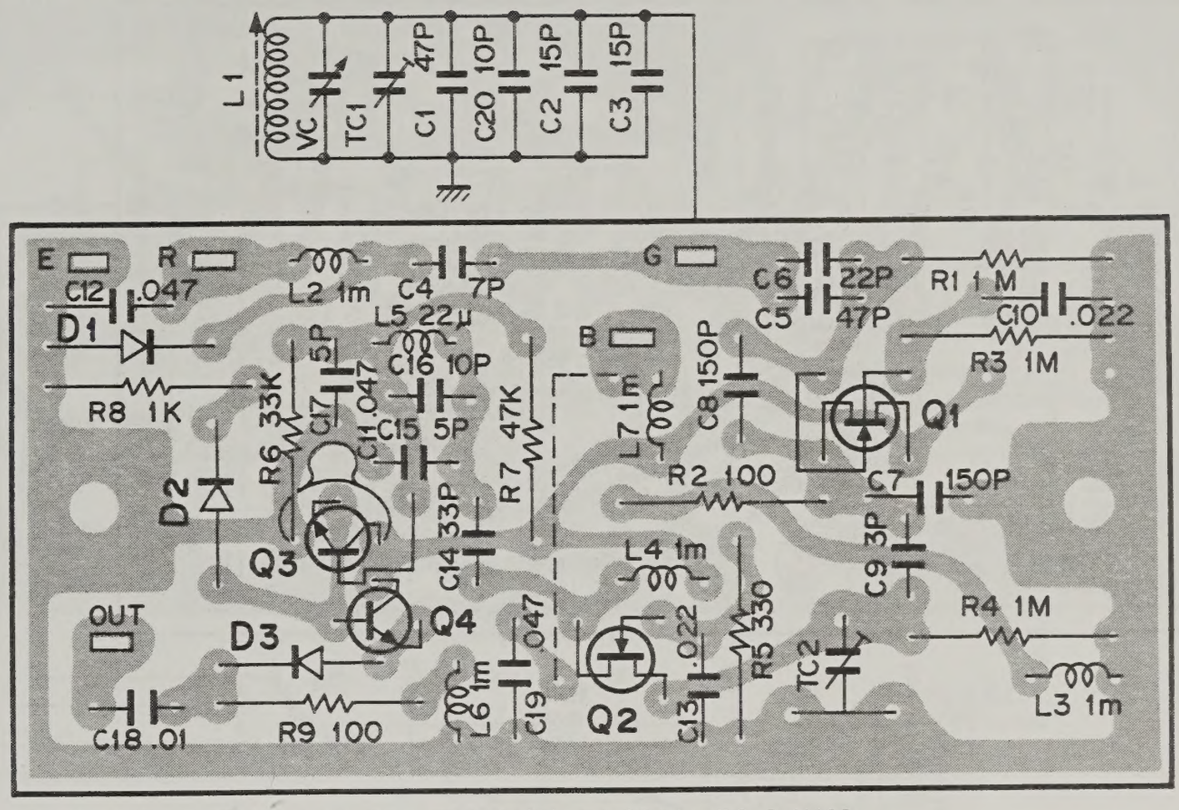


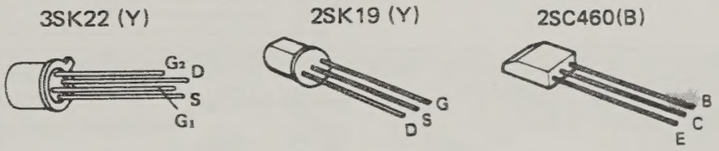
Fig. 8

PC BOARD

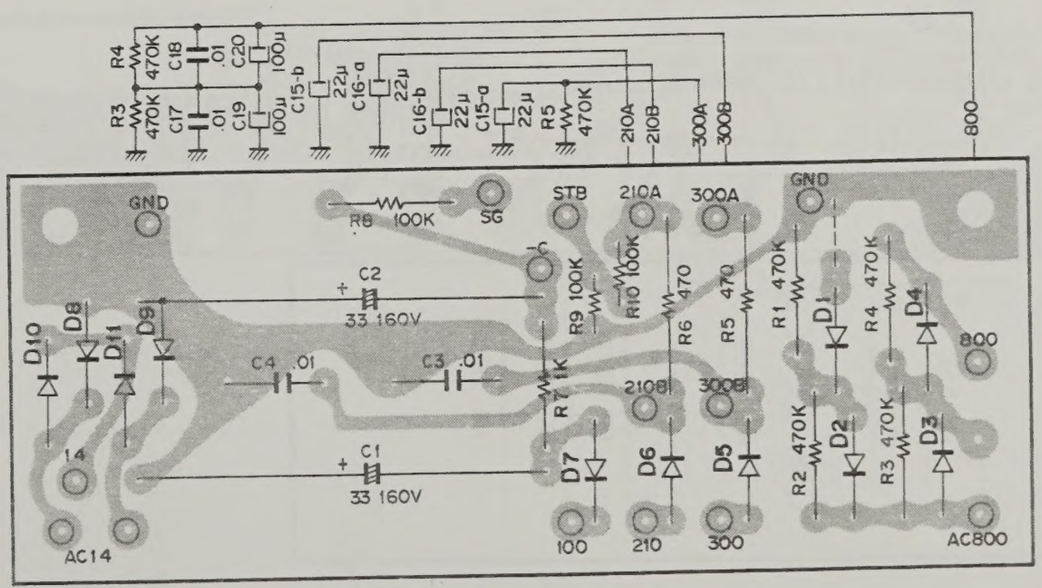
▼ VFO UNIT (X40-1070-01)



Q1:3SK22(Y), Q2:2SK19(Y), Q3, 4:2SC460(B), D1:SD111, D2, 3:1N60

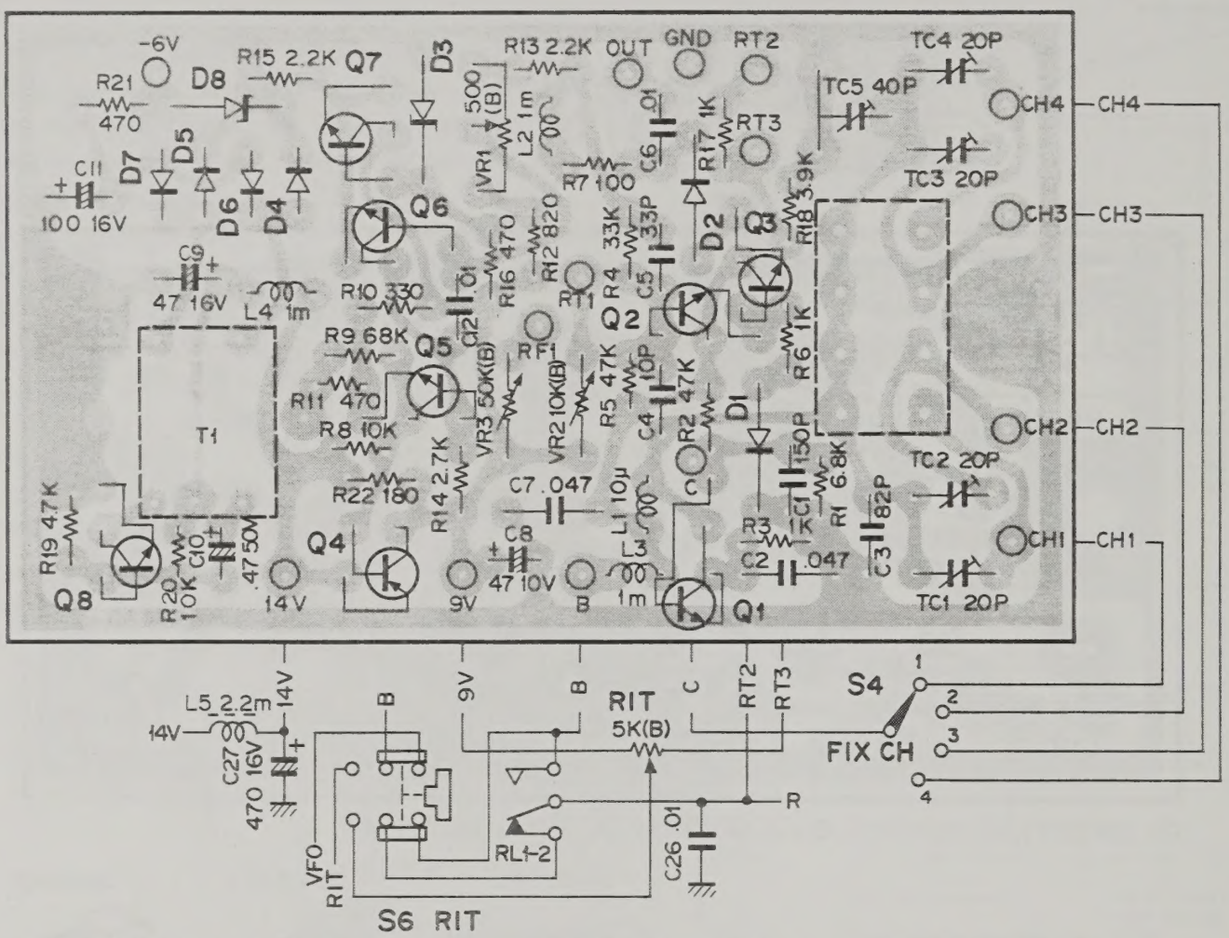


▼ RECTIFIER UNIT (X43-1090-02)

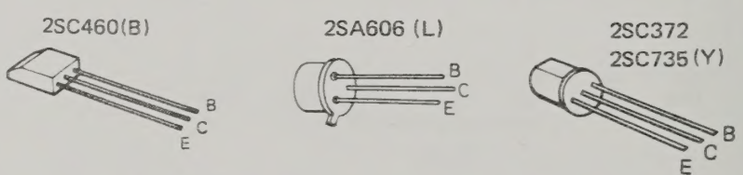


PC BOARD

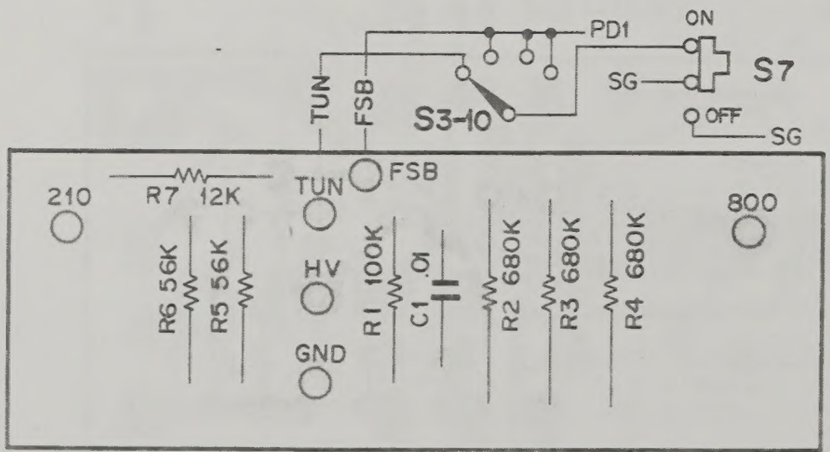
▼ FIX CH. AVR UNIT (X43-1100-00)



Q1~3:2SC460(B), Q4:2SA606(L), Q5 ~7:2SC372, Q8:2SC735(Y), D1, 2:1N60, D3, 8:WZ-061, D4~7:1S1555

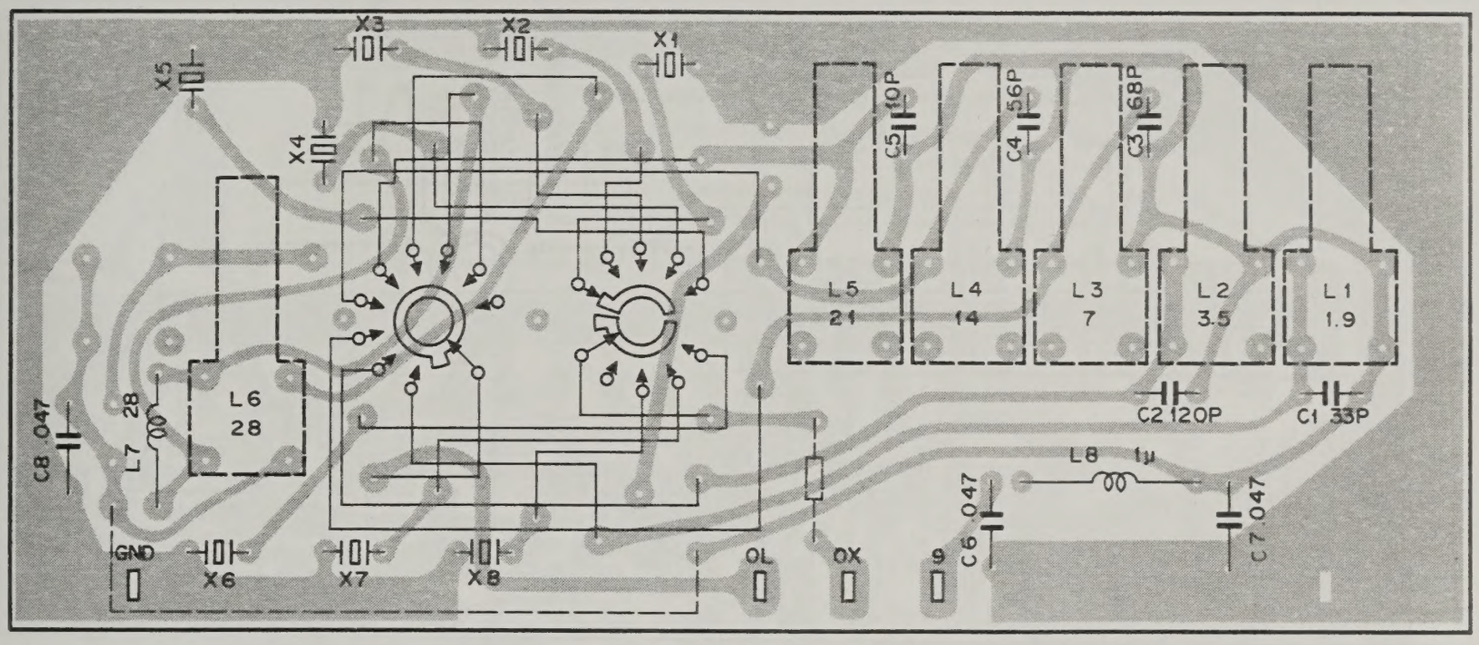


▼ HV UNIT (X43-1110-00)

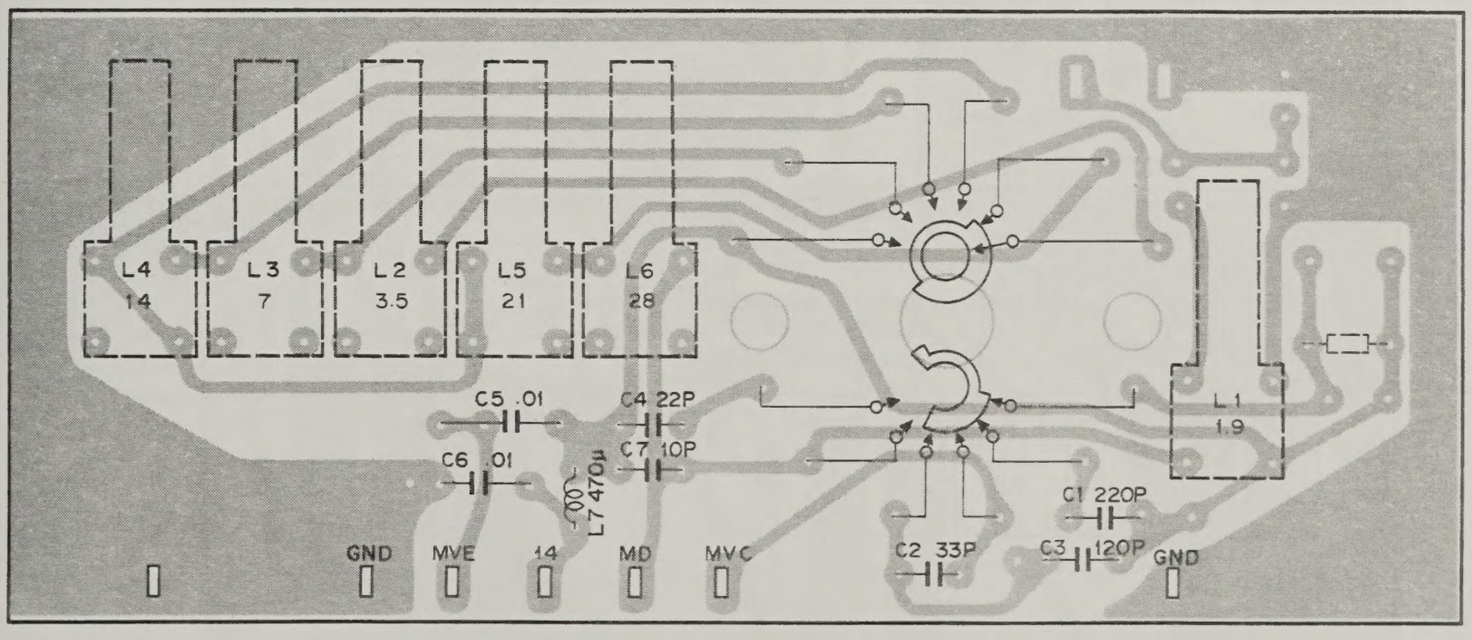


PC BOARD

▼ OSC COIL UNIT (X44-1160-00)

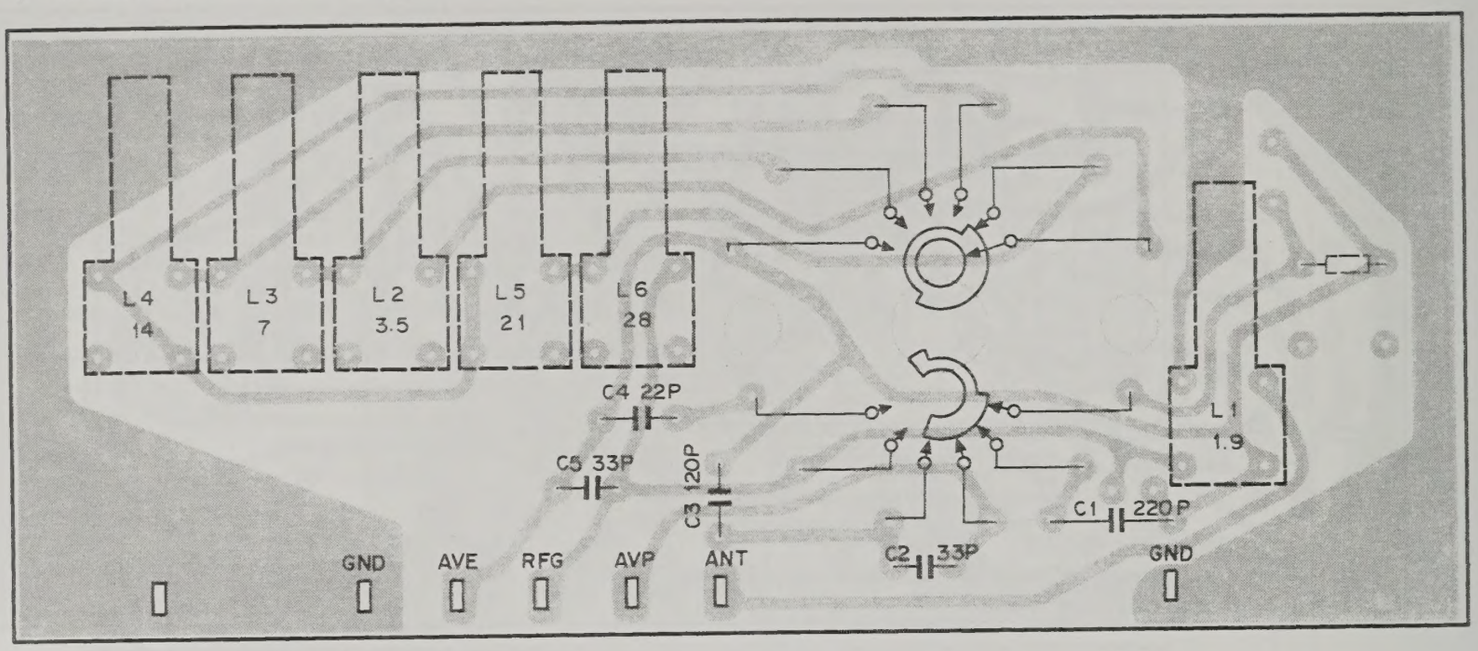


▼ ANT COIL UNIT (X44-1070-00)

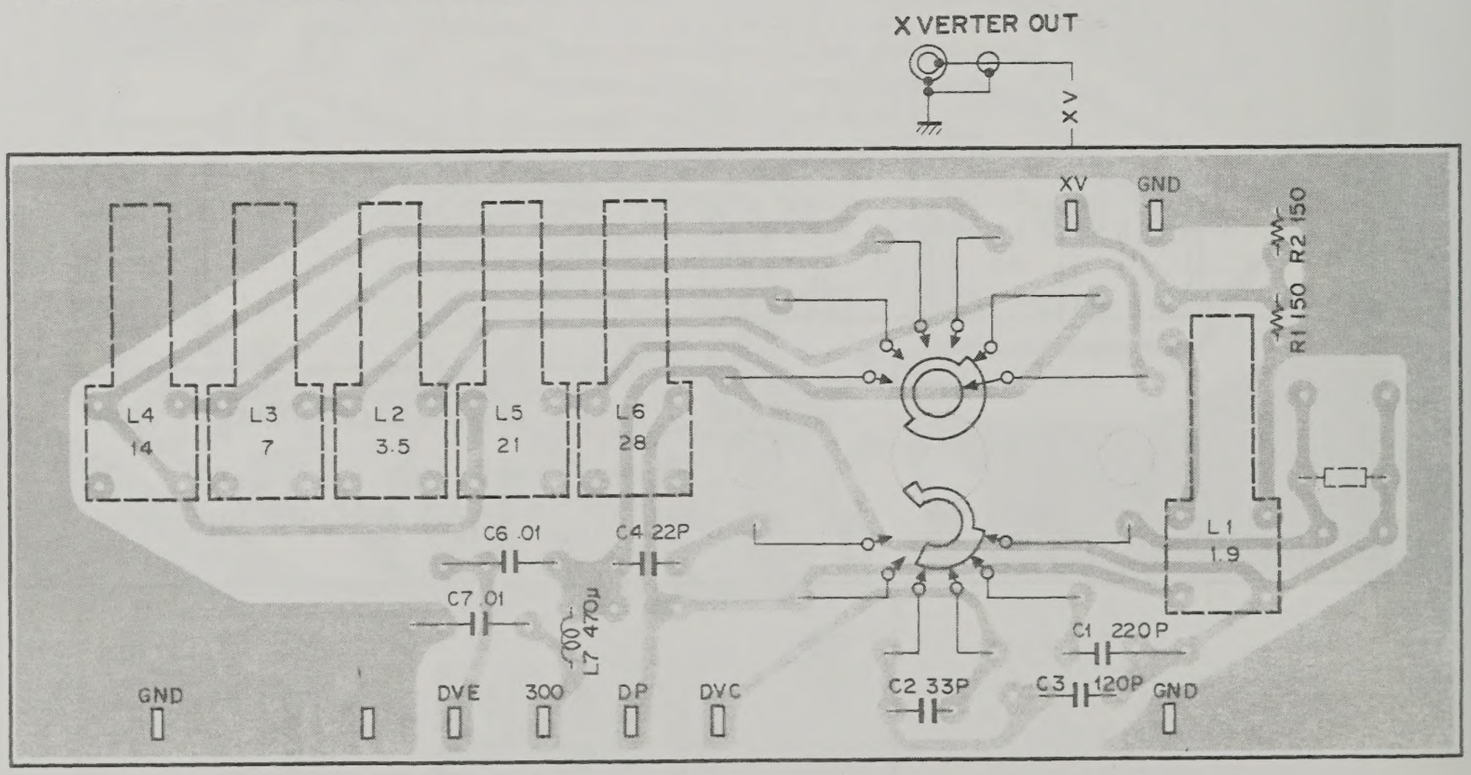


PC BOARD

▼ MIXER COIL UNIT (X44-1080-00)

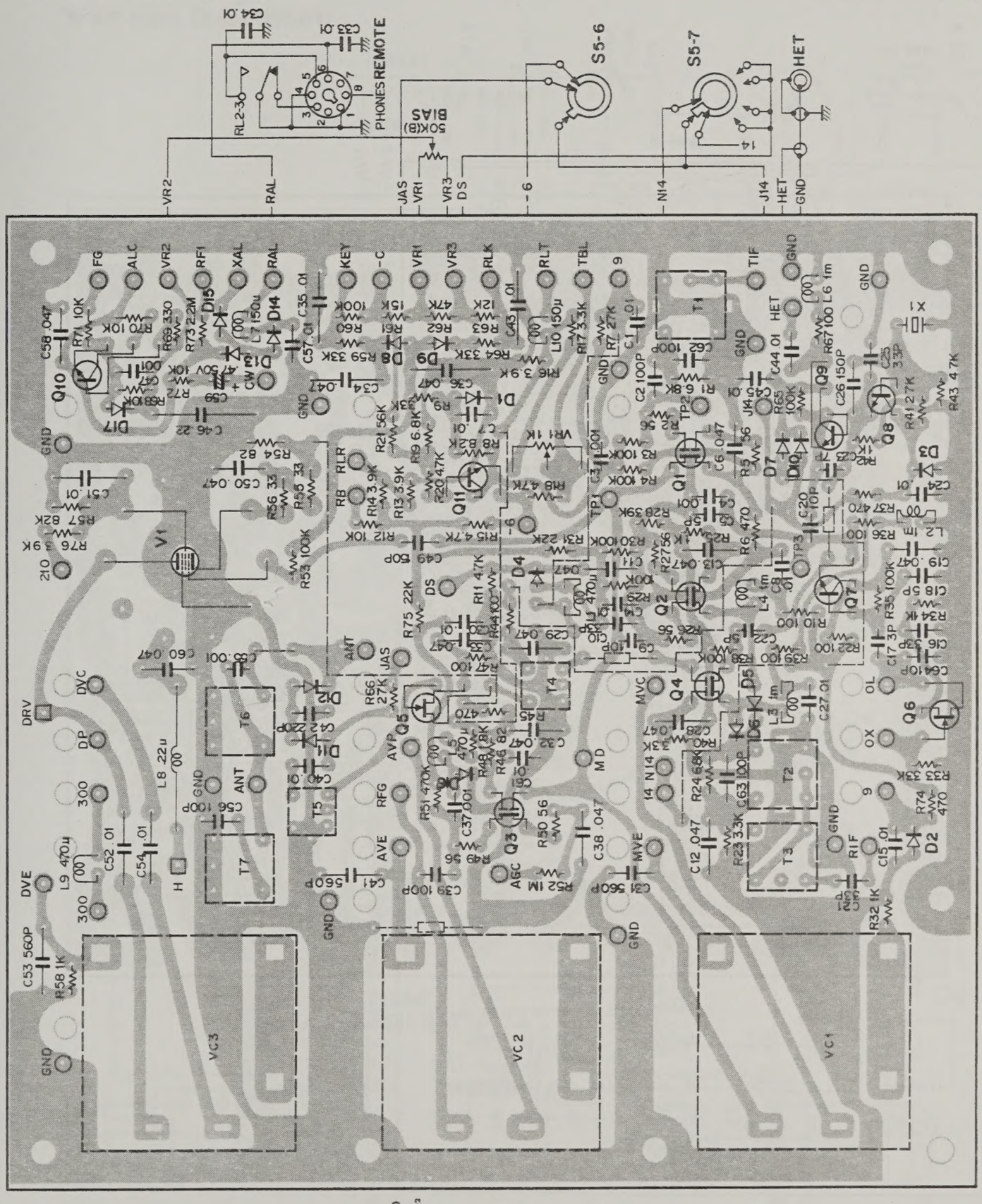


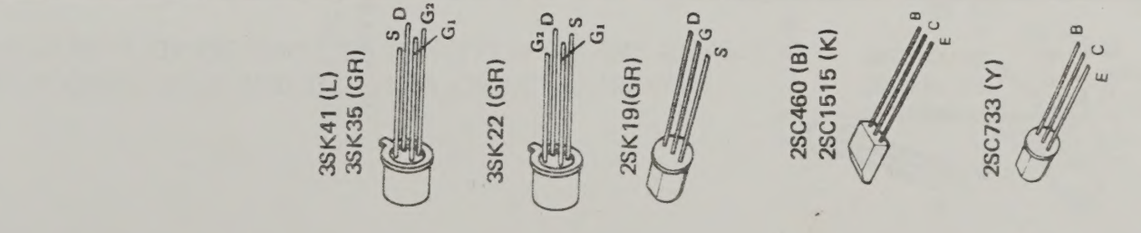
▼ DRIVE COIL UNIT (X44-1090-00)



PC BOARD

▼ RF UNIT (X44-1200-00)

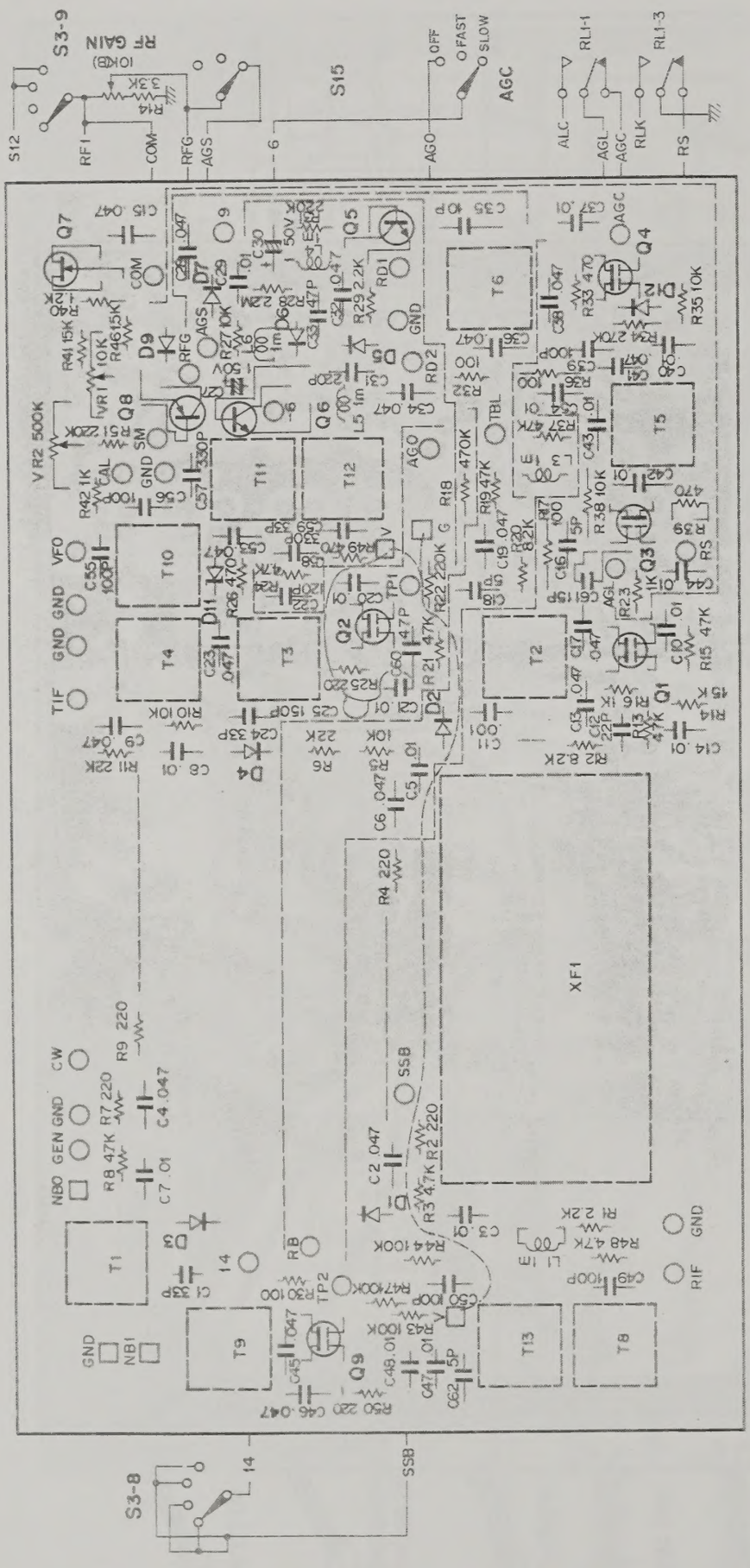




V1:12BY7A, Q1, 2:3SK41(L), Q3:3SK35(GR), Q4:3SK22(GR), Q5, 6:2SK19(GR), Q7, 8, 9:2SC460(B), Q10:2SC1515(K), Q11:2SC733(Y), D1, 2, 3, 13:WZ-090, D4, 11, 12:1S2588, D5, 6, 16:1S1587, D7, 10, 17:1S1555, D8, 9, 14, 15:V06B

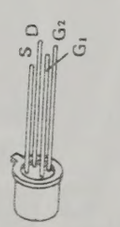
PC BOARD

▼ IF UNIT (X48-1060-01)

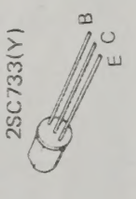


Q1, 3, 4:3SK35(GR), Q2:3SK35(Y), Q5, 6:2SC733(Y), Q7:2SK19(GR), Q8:2SA495(Y), Q9:3SK41(L), D1, 2:1S1007,
D3, 4:1S1587, D5, 6:1N60, D7, 9, 12:1S1555, D11:WZ-090

3SK41 (L)
3SK35 (GR), (Y)



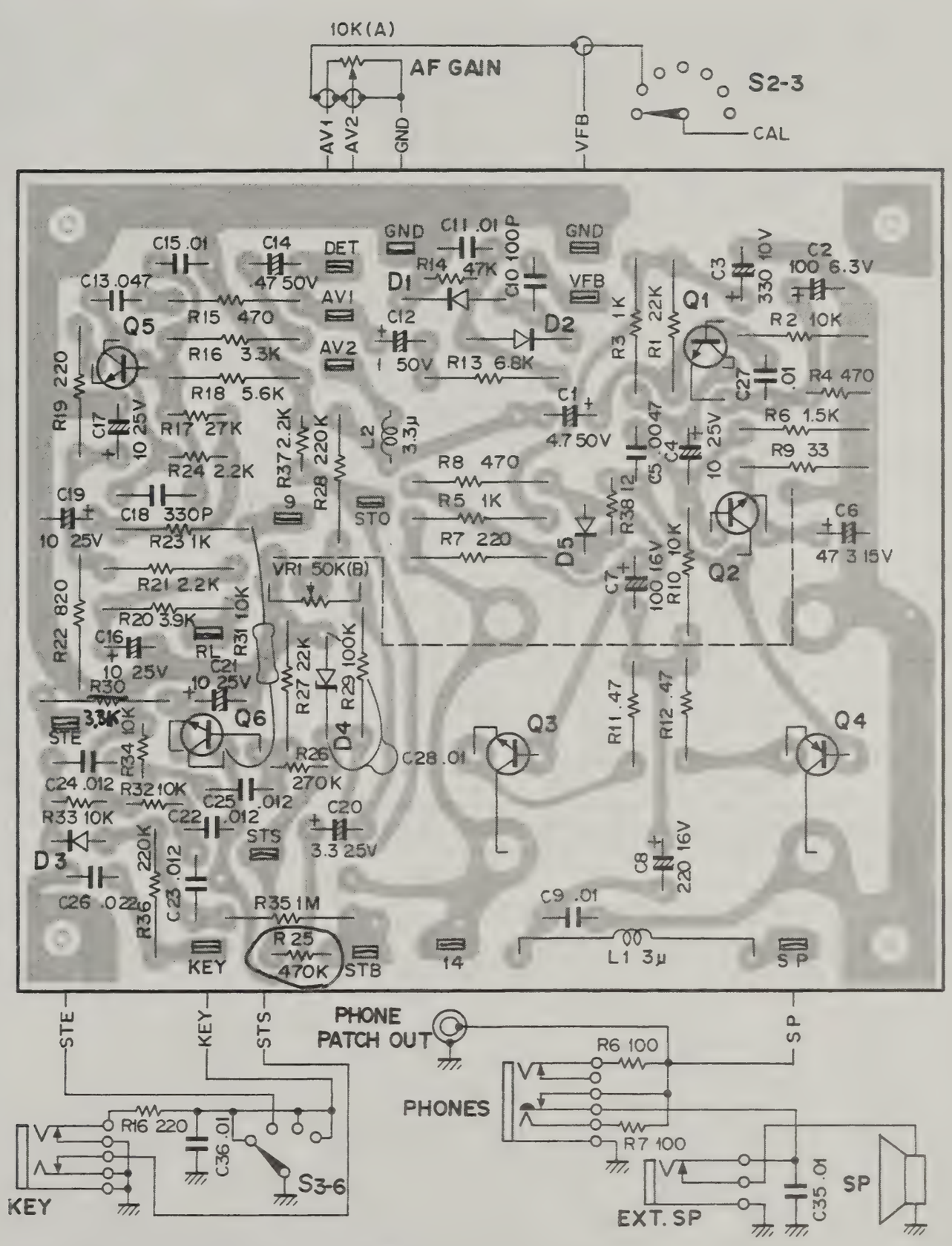
2SA495 (Y)
2SC733(Y)



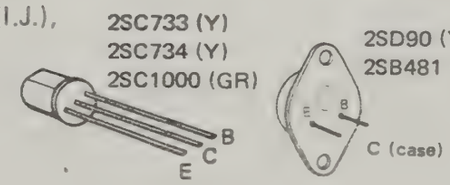
2SK19(GR)

PC BOARD

▼ AF UNIT (X49-0008-01)

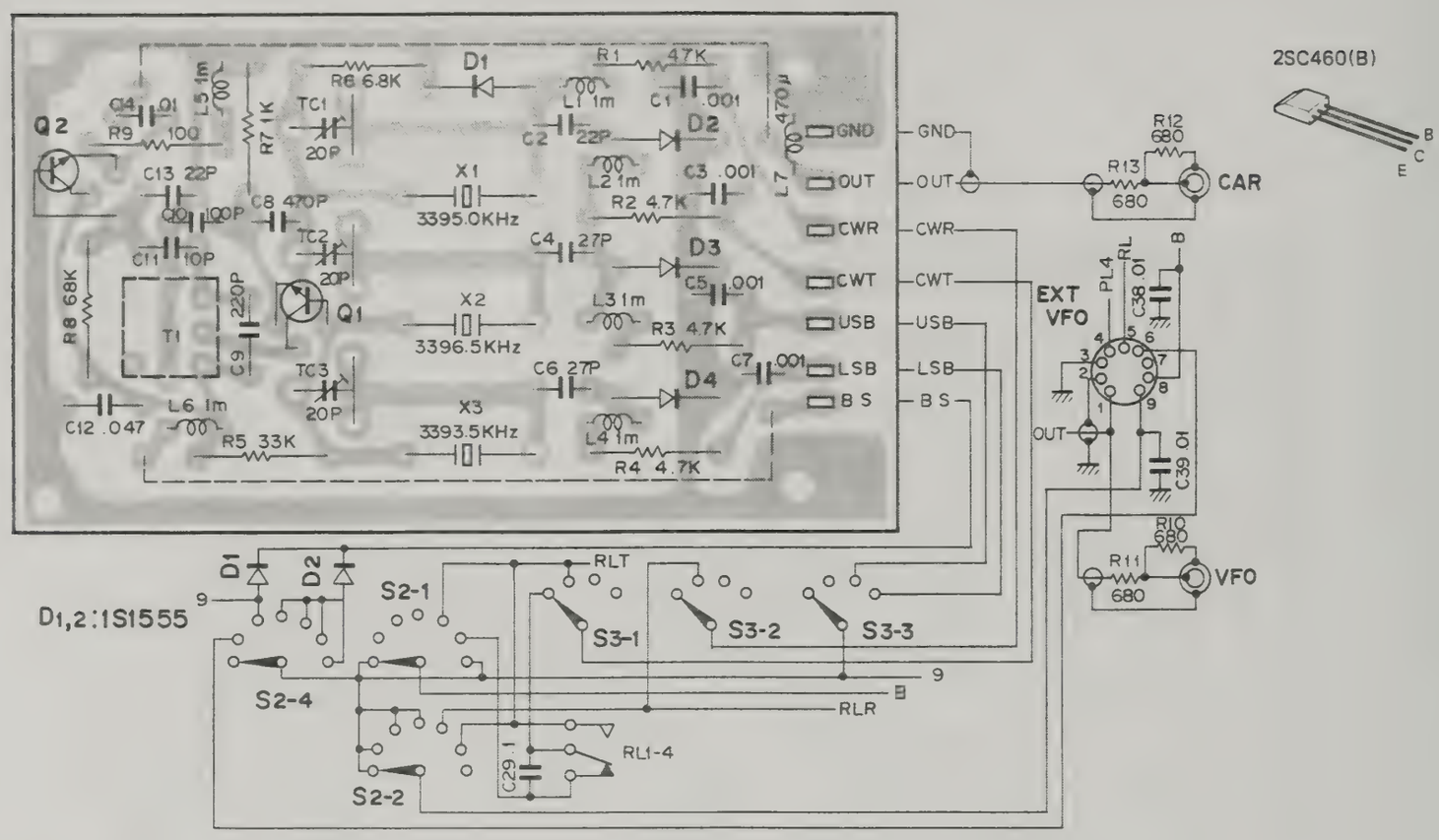


Q1, 6:2SC733(Y), Q2:2SC734(Y), Q3:2SD90(Y) or (G), Q4: 2SB481(I.J.), Q5:2SC1000(GR), D1, 2:1N60, D3:1S1555, D4:WZ130, D5:V06B



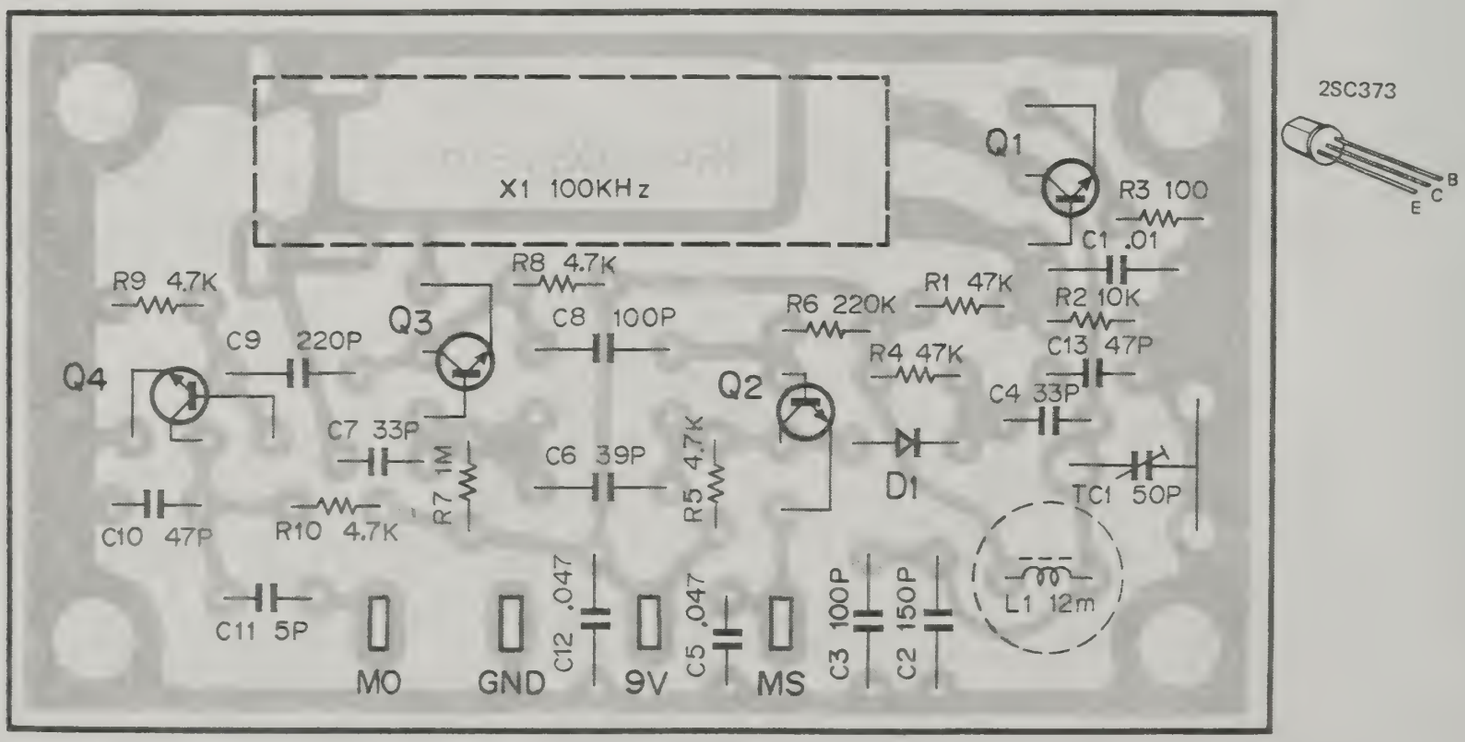
PC BOARD

▼ CARRIER UNIT (X50-0009-01)



Q1, 2:2SC460(B), D1~4:1S1555

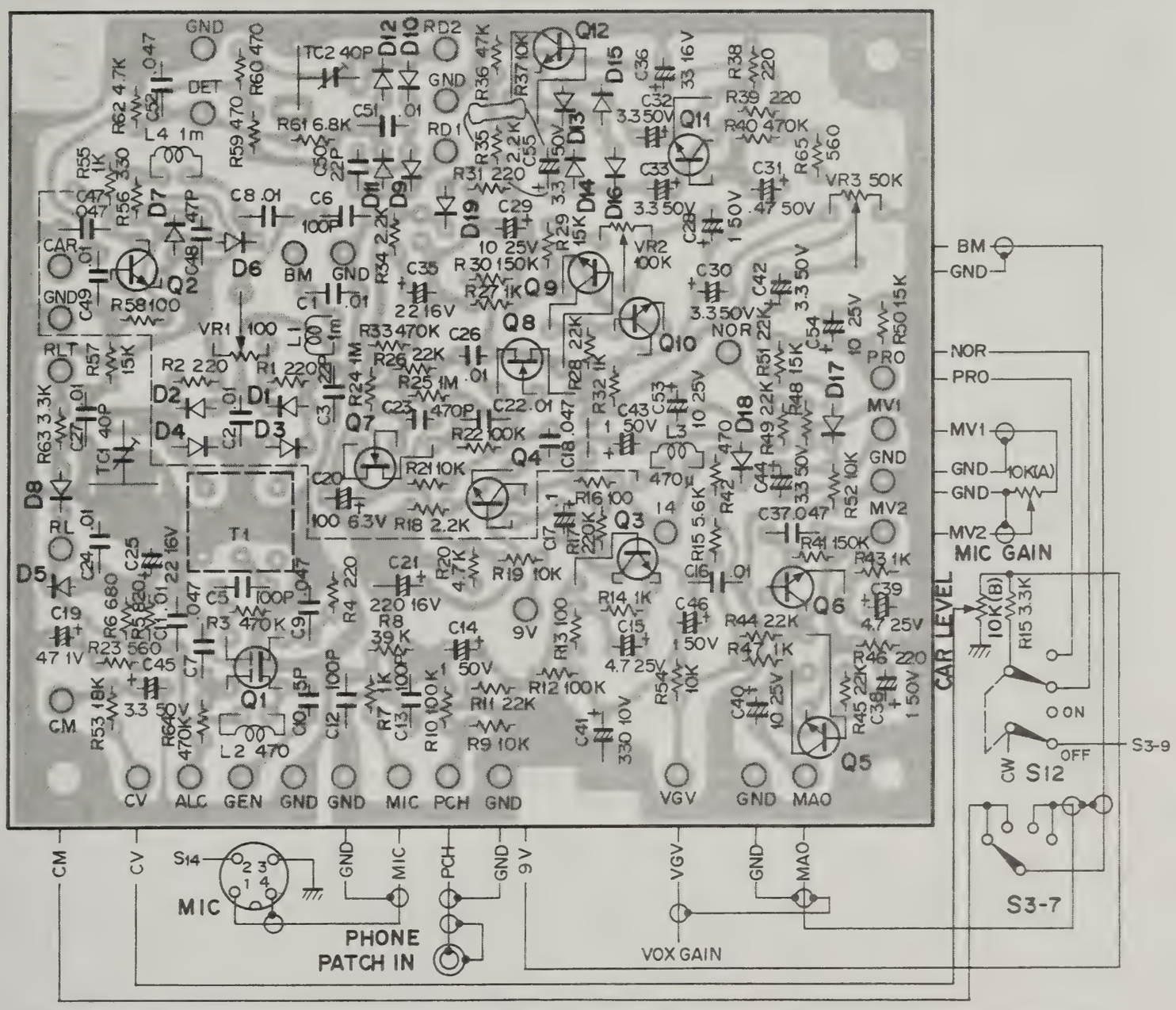
▼ MARKER UNIT (X52-0005-01)



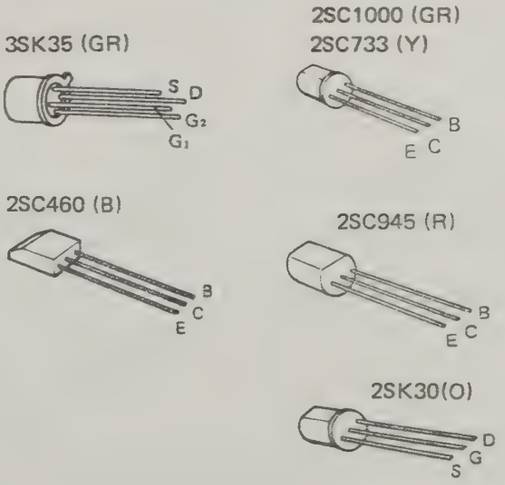
Q1~4:2SC373, D1:1N60

PC BOARD

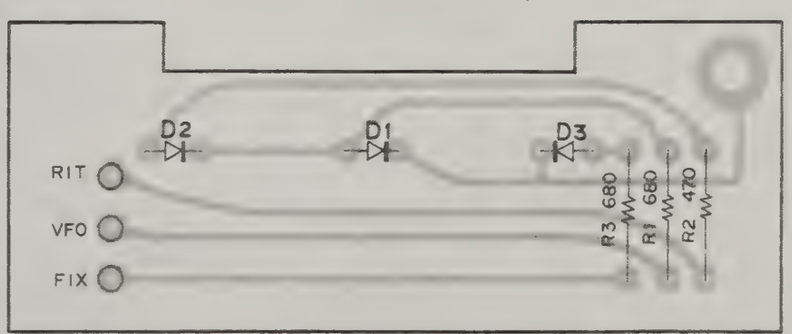
▼ GENERATOR UNIT (X52-1090-00)



Q1:3SK35(GR), Q2:2SC460(B), Q3, 4:2SC1000(GR), Q5, 6, 9, 10:2SC733(Y), Q11, 12:2SC945(R), Q7, 8:2SK30(O), D1~4, 9~16:1N60, D5, 8, 17~19:1S1555, D6, 7:1S2588

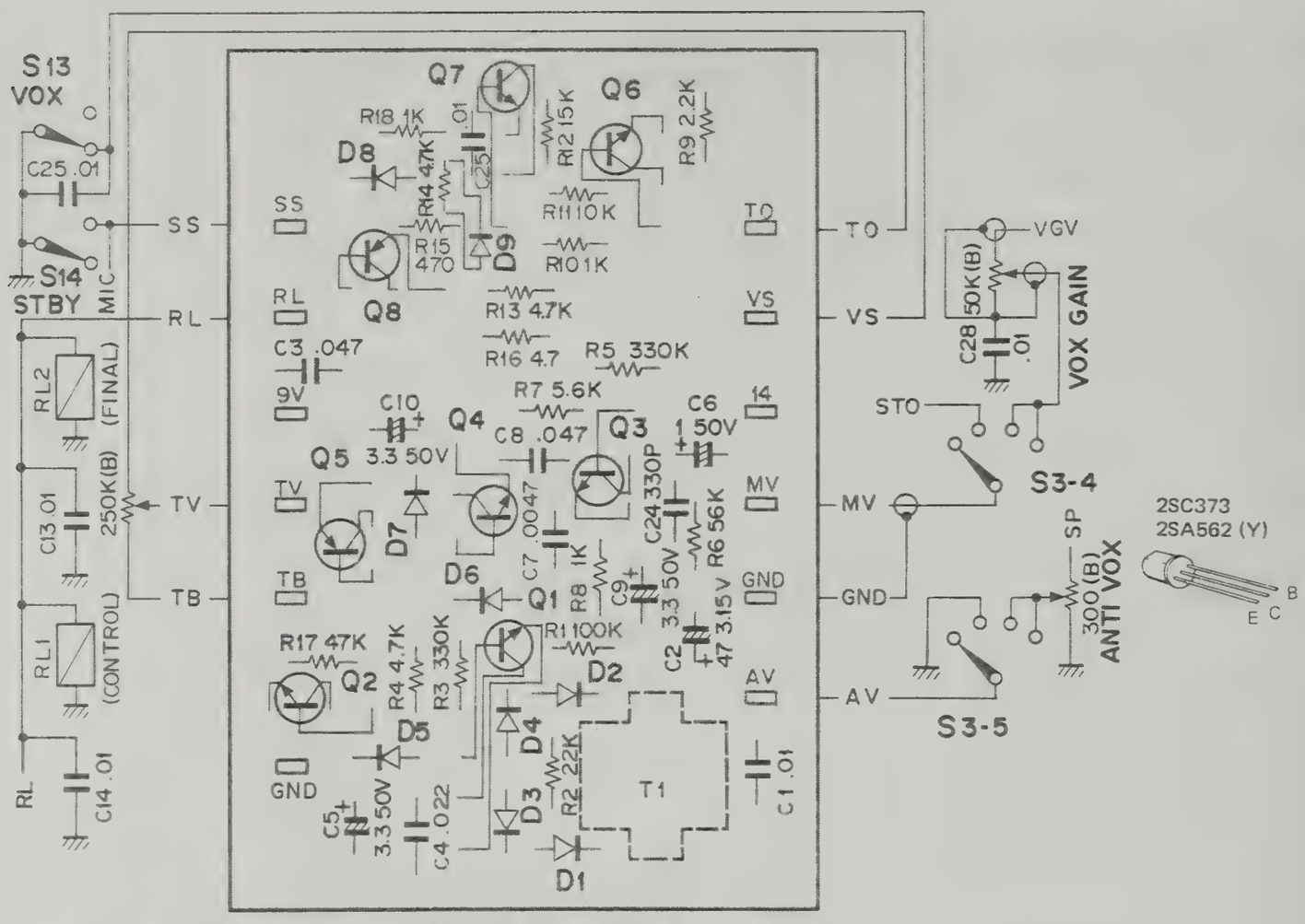


▼ INDICATOR UNIT (X54-1280-00)



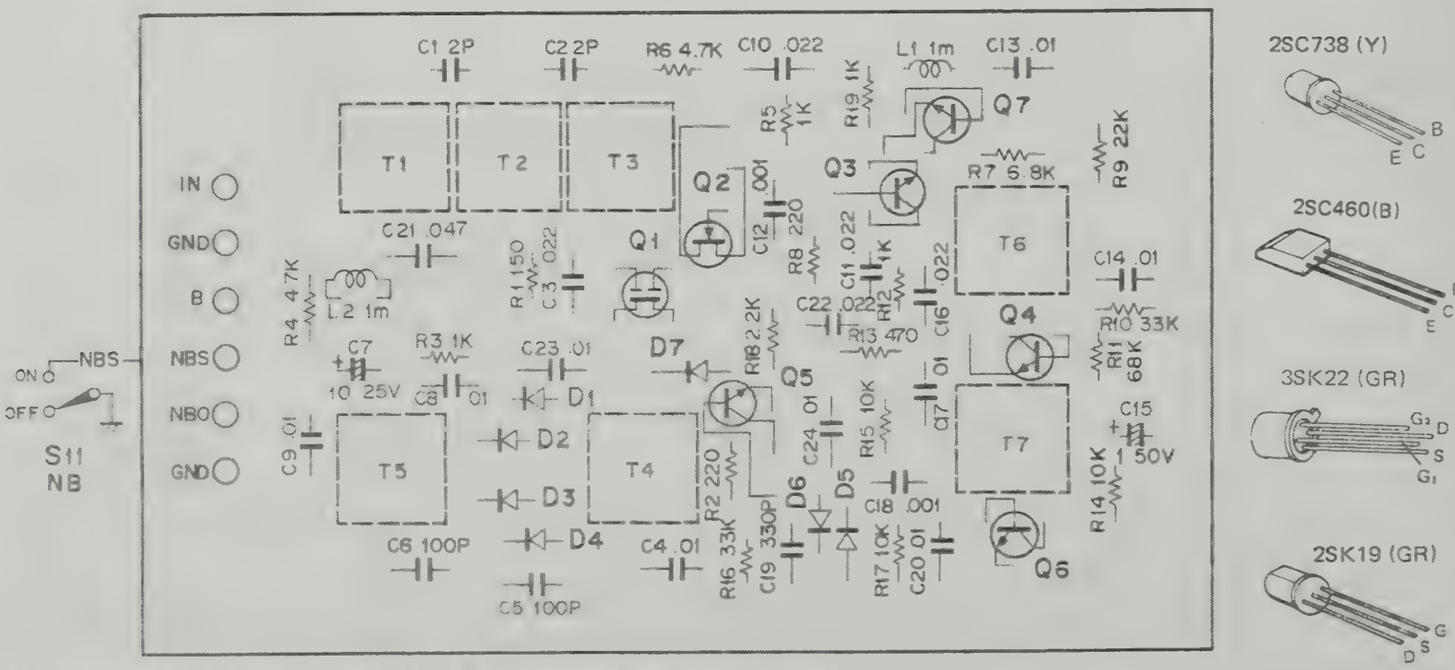
PC BOARD

▼ VOX UNIT (X54-0001-00)



Q1~4, 6, 7:2SC373, Q5, 8:2SA562(Y), D1~4, 6~8:1N60, D5, 9:1S1555

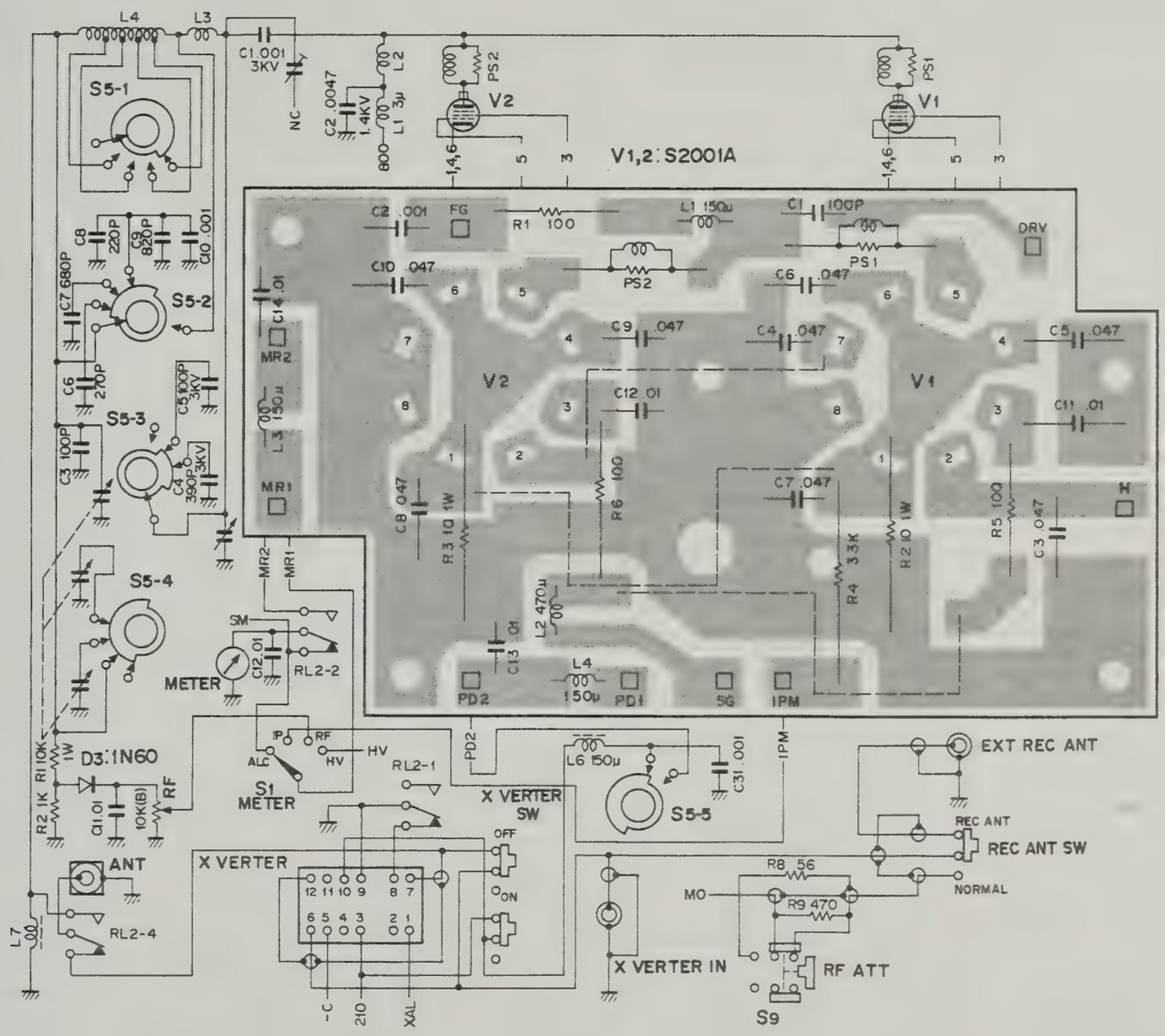
▼ NB UNIT (X54-1080-10)



Q1:3SK22(GR), Q2:2SK19(GR), Q3, 4, 7:2SC460(B), Q5, 6:2SC738(Y)

PC BOARD

▼ FINAL UNIT (X56-1220-00)



PARTS LIST

Note 1:
Resistors except the special type (example: cement, metal film, etc.) are not detailed in PARTS LIST. With regard to the value, refer to the schematic diagram or the PC board illustration. Resistors not detailed are carbon type (1/4 or 1/8W).
You should give an order for the carbon resistors according to the ways described as follows:
A carbon resistor's part number is example RD14BY 2E 222J

1. Kinds of the carbon resistor

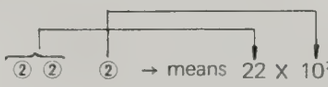

RD14BY


RD14CY

2. Wattage

1/4W → 2E
1/8W → 2B

3. Resistance value



Significant figure Multiplier

Example:

221 → 220Ω
222 → 2.2kΩ
223 → 22kΩ
224 → 220kΩ
225 → 2.2MΩ

4. Tolerance

J = ±5% (Gold color)
K = ±10% (Silver color)

Note 2:
K: U.S.A. W: Europe T: Britain

TOTAL

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	C90-0186-05	Ceramic 1000pF 3kV	
C2	C90-0187-05	Ceramic 4700pF 1.4kV	
C3	CC45SL2H101J	Ceramic 100pF ±5%	
C4	C91-0017-05	Ceramic 390pF 3kV	
C5	C91-0401-05	Ceramic 100pF 3kV	
C6	CC45SL2H271J	Ceramic 270pF ±5%	
C7	CC45SL2H681J	Ceramic 680pF ±5%	
C8	CC45SL2H221J	Ceramic 220pF ±5%	
C9	CC45SL2H821J	Ceramic 820pF ±5%	
C10	CC45SL2H102J	Ceramic 1000pF ±5%	
C11~14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C15,16	C90-0326-05	Electrolytic CE64W2W220x2	
C17	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C18	CK45E2H103P	Ceramic 0.01μF +100%,-0%	
C19	C90-0327-05	Electrolytic CE64W2H101	
C20	C90-0327-05	Electrolytic CE64W2H101	
C21,22	CE02W1C222	Electrolytic 2200μF 16WV	
C23,24	C90-0300-05	Ceramic 470pF AC 150V	
C25,26	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C27	CE04W1C471	Electrolytic 470μF 16WV	
C28	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C29	CQ93M1H104K	Mylar 0.1μF ±10%	
C30	C90-0187-05	Ceramic 4700pF 1.4kV	
C31, 32			
C33~35	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C36	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C37	CC45SL2H151J	Ceramic 150pF ±5%	
C38,39	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
–	C90-0172-05	Ceramic 12pF 3kV	
		RESISTOR	
R1	RC05GF3A103K	Carbon 10kΩ ±10% 1W	
R2	RD14BY2E102J	Carbon 1kΩ ±5% ¼W	
R3	RC05GF2H474J	Carbon 470kΩ ±5% ½W	
R4,5	RC05GF2H474J	Carbon 470kΩ ±5% ½W	
R6,7	RC05GF2H474J	Carbon 100Ω ±5% ½W	

Ref. No.	Parts No.	Description	Remarks
R8~13	RD14BY2B000J	Carbon 000 Ω ±5% 1/8W	
R14~16	RD14BY2E000J	Carbon 000 Ω ±5% ¼W	
		TUBE/SEMICONDUCTOR	
V1,2	V40-0150-00	Tube S2001A x 2	
D1,2	V11-0076-05	Diode 1S555x2	
D3	V11-0051-05	Diode 1N60	
		POTENTIOMETER	
–	R01-0040-05	300Ω (B) ANTI VOX	
–	R01-3014-05	10kΩ (B) RF	
–	R01-4014-05	50kΩ (B) x 2 VOX BIAS	
–	R01-6009-05	250kΩ (B) DELAY	
–	R03-2004-05	5kΩ (B) RIT	
–	R08-3012-15	10kΩ (A), 10kΩ (B) x 2 AF, RF	
–	R19-3401-05	10kΩ (A), 10kΩ (B) x 2 with SW, MIC, CAR	☆
		VARIABLE CAPACITOR/TC	
–	C01-0084-05	Variable capacitor (B) LOAD	
–	C03-0060-05	Variable capacitor (A) FINAL	
–	C03-0002-05	Trimmer	
		SWITCH	
–	S01-3401-05	Rotary switch FINAL	☆
–	S01-4017-05	Rotary switch FUNCTION	
–	S04-5016-05	Rotary switch MODE	
–	S10-1107-05	Rotary switch CHANNEL	
–	S29-1006-05	Rotary switch METER	
–	S31-2007-05	Slide switch x 3	
–	S40-2023-05	Push switch x 2 RIT, ATT	
–	S44-2015-05	Paddle switch	
–	S44-2018-05	Paddle switch (Grey)	
–	S44-2020-05	Paddle switch (Black) x 3	
RL1	S51-4016-15	Relay	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
RL2	S51-4017-15	Relay (Final)	
—	S59-2017-05	Switch (Voltage selecting)	
—	S59-2020-05	Sea-saw switch (Power)	
		COIL/SPEAKER	
L1	L33-0032-05	Choke coil	
L2	L33-0218-15	Choke coil (Final)	
L3	L34-0561-05	Final coil (B) 28MHz	
L4	L34-0560-05	Final coil (A)	
L5	L40-2225-04	Ferri-inductor 2.2mH	
L7	L33-0259-05	Choke (Safety) 470μH	
—	L01-1056-05	Power transformer	
—	L15-0002-15	Choke coil (Low frequency)	
PS1,2	L39-0046-05	Parastic suppressor	
—	T03-0027-15	Loud speaker	
		MISCELLANEOUS	
—	A01-0211-02	Case	
—	A20-2305-03	Panel ass'y T	☆
—	A20-2306-03	Panel ass'y K, W	☆
—	A30-0602-13	Dial back plate	☆
—	A33-0401-04	Reflection plate	☆
—	A40-0120-21	Bottom plate	
—	B05-0201-04	Speaker net	
—	B09-0003-05	Coupling x 2	
—	B10-0607-14	Front glass	☆
—	B20-0287-44	Dial board	
—	B21-0007-04	Pointer Plate	
—	B30-0079-05	Pilot lamp x 4 12V 40mA	
—	B31-0164-15	Meter	
—	B40-2411-04	Model name plate T	
—	B40-2413-04	Model name plate K, W	☆
—	B42-0444-24	Switch name plate T	☆
—	B42-0474-24	Switch name plate K, W	
—	B42-0445-14	Panel name plate	
—	B42-0447-04	VR name plate of adjustment	
—	B46-0058-00	Warranty card	
—	B50-2531-00	Operating manual K, W	☆
—	B50-2532-00	Operating manual T	☆
—	B58-0181-00	Caution sticker (Final section)	
—	B58-0187-00	Caution card W (Source voltage)	
—	B58-0188-00	Caution card K, W (Source voltage)	
—	D13-0032-03	Sprocket x 3	
—	D16-0033-04	Chain ass'y	
—	D21-0326-24	Shaft (A) LOAD	
—	D21-0415-14	Shaft (B) PLATE	
—	D21-0802-04	Shaft (C) DRIVE	☆
—	D22-0004-04	Shaft coupling x 2 6φ-6φ	
—	D22-0027-14	Shaft joint	
—	D23-0048-04	Shaft supporter (Metal)	
—	D23-0061-04	Shaft supporter (Mold)	
—	D23-0116-05	Shaft rotation supporter ass'y	
—	D32-0018-04	Shaft stopper x 2	
—	D32-0075-04	Switch stopper x 2	
—	D40-0204-05	Vernier mechanism	
—	D40-0206-05	Fan ass'y	
—			
—	E01-0801-05	US socket	
—	E01-0903-05	9P MT socket	
—	E03-0301-15	AC plug (3P, power source)	
—	E04-0102-05	M type receptacle	
—	E05-0901-05	9P MT plug	
—	E06-0403-05	4P MIC socket	
—	E07-0403-05	4P MIC plug	
—	E08-0203-25	2P connector jack 14V OUT	
—	E08-0204-05	2P connector socket x 2	
—	E08-1202-05	12P connector socket	
—	E08-1207-05	12P connector socket plug	

Ref. No.	Parts No.	Description	Remarks
—	E08-1208-05	12P connector (up-veter)	
—	E09-0204-05	2P connector socket plug x 3	
—	E11-0003-15	US jack (Ext. SP)	
—	E11-0005-15	3 pole phone jack	
—	E11-0034-25	US jack with 2 pole switch	
—	E12-0001-05	Phone plug (Ext. SP)	
—	E13-0101-05	1P phono jack x 3 VFO, HET, CAR	
—	E13-0205-05	2P phono jack (Phone patch)	
—	E13-0361-05	3P phono jack (Counter)	☆
—	E14-0101-05	1P phono plug x 4	
—	E14-0801-05	US plug	
—	E20-0512-05	5P terminal strips	
—	E20-1003-05	10P terminal strips	
—	E22-0206-05	Lug 101	
—	E22-0207-05	Lug 101 (B) x 5	
—	E22-0405-05	Lug 202 (B)	
	E23-0037-04	Shaft grounding x 2	
—	E23-0088-04	Lug (ANT-GND)	
—	E30-0181-05	AC cord K	
—	E90-0004-15	Plate cap x 2	
—	F05-2023-05	Fuse 2A x 2	
—	F05-4022-05	Fuse 4A x 2 K	
		4A x 3 W, T	
—	F05-6021-05	Fuse 6A x 3 K	
		6A x 2 W, T	
—	F19-0134-04	Side cover	
—	F20-0504-04	Insulator	☆
—	F29-0014-05	Insulating washer x 2	
—	G11-0044-04	Cushion	
—	H01-2522-04	Carton case (Inside) K, W	☆
—	H01-2523-04	Carton case (Inside) T	
—	H03-1627-04	Carton case (Outisde) K	
—	H03-1628-04	Carton case (Outside) T	
—	H03-1629-04	Carton case (Outside) W	
—	H10-0931-12	Polystyrene foam cushion	
—	H10-0932-22	Polystyrene foam cushion	
—	H10-1276-04	Cushion	
—	H10-1393-04	Cushion	
—	H12-0405-04	Cushion	☆
—	H20-0439-03	Protection cover	
—	H25-0016-00	Polyethylene bag	
—	H25-0036-00	Polyethylene bag	
—	J02-0022-05	Foot (Small) x 4	
—	J02-0049-14	Foot (Large) x 6	
—	J13-0033-15	Fuse holder x 2	
—	J19-1301-04	Diode holder x 3	
—	J21-0392-04	Lead holder	
—	J21-0934-15	Handle retainer x 2	
—	J21-1497-04	Bobbin angle x 2	
—	J32-0074-04	Hex. boss x 6	
—	J32-0182-04	Hex. boss x 4	
—	J32-0220-04	Hex. boss x 6	
—	J32-0709-04	Hex. boss 4 mm	
—	J32-1030-14	Round boss x 2	
—	J41-0020-04	Knob bushing x 2	
—	J41-0024-15	Cord bushing	
—	J59-0001-05	Grommet x 2	
—	J59-0002-05	Plunger x 2	
—	J61-0014-05	Free up belt	
—	K01-0049-15	Handle	
—	K21-0239-04	Knob x 2 BAND, MODE	
—	K21-0266-04	Knob LOAD 2, 6φ	
—	K21-0267-04	Knob x 3 DRIVE, RIT, FUNCTION	
—	K21-0268-04	Knob x 2 AF GAIN, MIC	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
–	K21-0269-04	Knob x 3 FIX, ch. CAR, RF GAIN	
–	K21-0279-04	Knob METER	
–	K21-0315-04	Knob PLATE	
–	K21-0709-03	Knob MAIN,	☆
–	K29-0166-04	Knob x 2 PUSH	
–	K29-0207-13	Knob wafer	
–	N09-0256-05	Screw (GND) x 16	
–	N09-0601-05	Screw (Case) x 17	☆
–	W01-0005-04	Stick (for adjustments)	
–	X40-1070-01	VFO unit	
–	X43-1090-02	Rectifier unit	
–	X43-1100-00	FIX CH, AVR unit	
–	X43-1110-00	HV unit	
–	X44-1160-00	OSC coil unit	☆
–	X44-1170-00	ANT coil unit	☆
–	X44-1180-00	MIXER coil unit	☆
–	X44-1190-00	DRIVE coil unit	☆
–	X44-1200-00	RF unit	☆
–	X48-1060-01	IF unit	☆
–	X49-0008-01	AF unit	
–	X50-0009-01	CARRIER unit	
–	X52-0005-01	MARKER unit	
–	X52-1090-00	GENERATOR unit	☆
–	X54-0001-00	VOX unit	
–	X54-1080-10	NB unit	
–	X54-1280-00	INDICATOR unit	☆
–	X56-1200-00	FINAL unit	

Ref. No.	Parts No.	Description	Remarks
VC	C01-0001-25	Variable capacitor	☆
L1	L32-0098-05	OSC coil	
L2~4	L40-1021-03	Ferri-inductor 1mH	
L5	L40-2201-03	Ferri-inductor 22μH	
L6,7	L40-1021-03	Ferriinductor 1mH	
MISCELLANEOUS			
–	D22-0011-05	Shaft coupling	
–	D40-0099-25	Gear mechanism	☆
–	E08-0204-05	2P connector socket	
–	E13-0101-05	1P phono jack	
–	E22-0207-05	Lug strips	
–	E23-0021-04	Terminal x 5	
–	G03-0009-04	Spring	

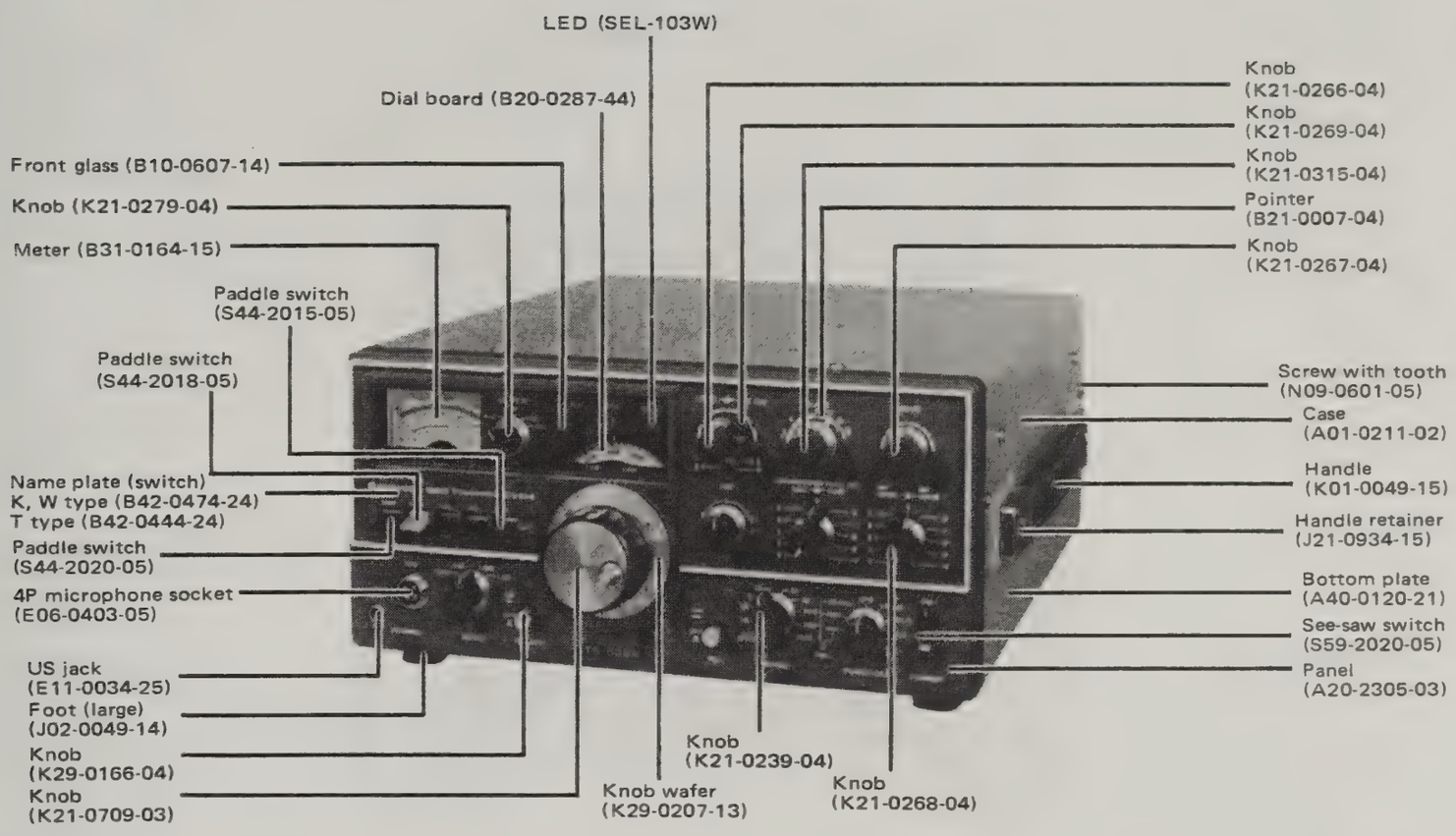
VFO UNIT (X40-1070-01)

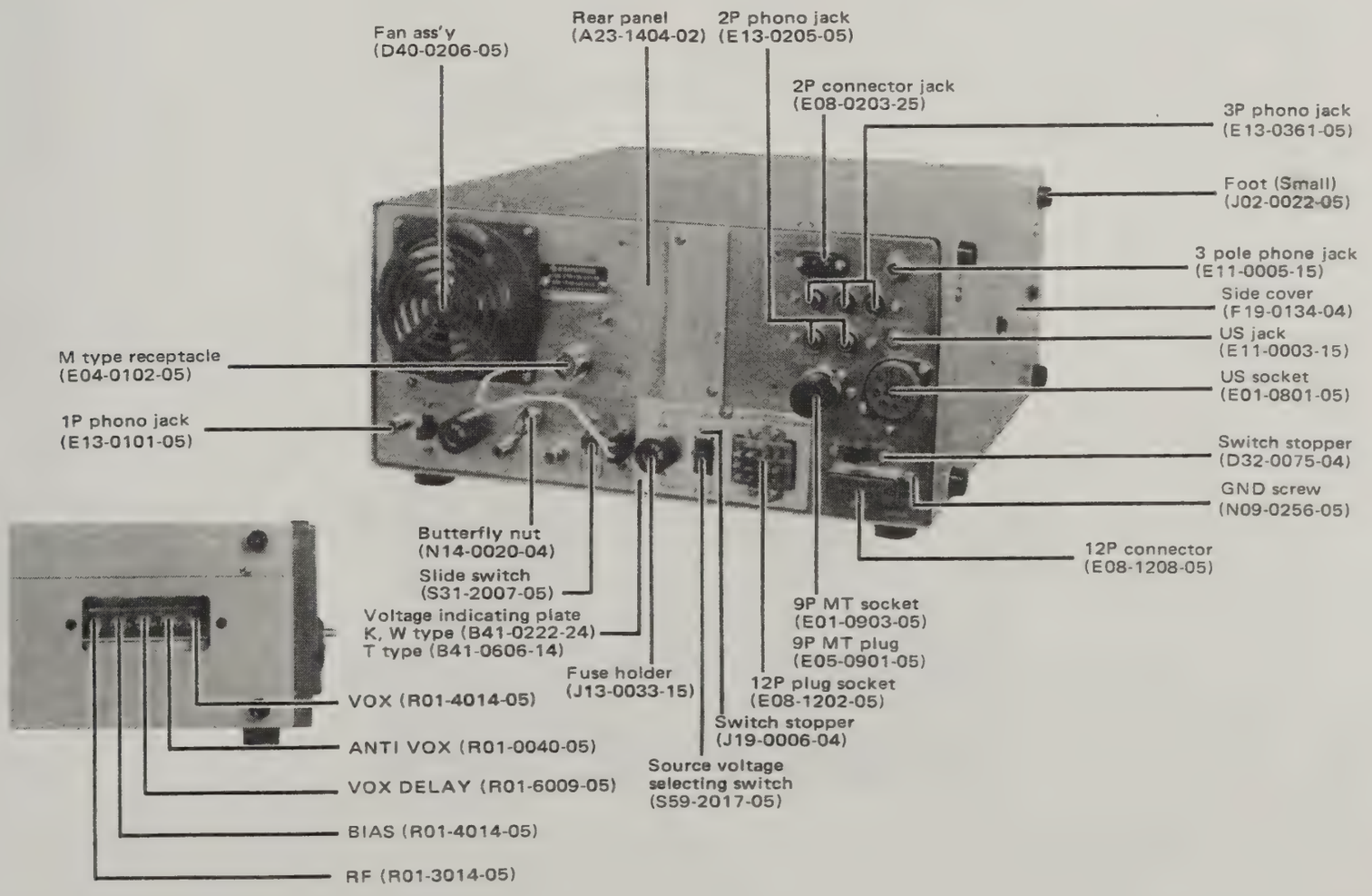
Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45PG1H470J	Ceramic 47pF ±5%	
C2,3	CC45LG1H150J	Ceramic 15pF ±5%	
C4	CC45SG1H070J	Ceramic 7pF ±0.5pF	
C5	CC45LG1H470J	Ceramic 47pF ±5%	
C6	CC45LG1H220J	Ceramic 22pF ±5%	
C7,8	CM93F2A151J	Mica 150pF ±5%	
C9	CC45CH1H030D	Ceramic 3pF ±0.5pF	
C10	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C11,12	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C13	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C14	CC45SL1H330J	Ceramic 33pF ±5%	
C15	CC45SL1H050D	Ceramic 5pF ±0.5pF	
C16	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C17	CC45SL1H050D	Ceramic 5pF ±0.5pF	
C18	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C19	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C20	CC45CG1H100D	Ceramic 10pF ±0.5pF	
RESISTOR			
R1~9	RD14BY2E000J	Carbon 000Ω ±5% ¼W	
SEMICONDUCTOR			
Q1	V09-0020-05	FET 3SK22(Y)	
Q2	V09-0011-05	FET 2SK19(Y)	
Q3,4	V03-0079-05	Transistor 2SC460(B)	
D1	V11-0053-05	Diode SD111	
D2,3	V11-0051-05	Diode 1N60	
VC/COIL			
TC1	C03-0001-05	Variable capacitor (Small)	
TC2	C05-0013-15	Ceramic trimmer	

RECTIFIER UNIT (X43-1090-02)

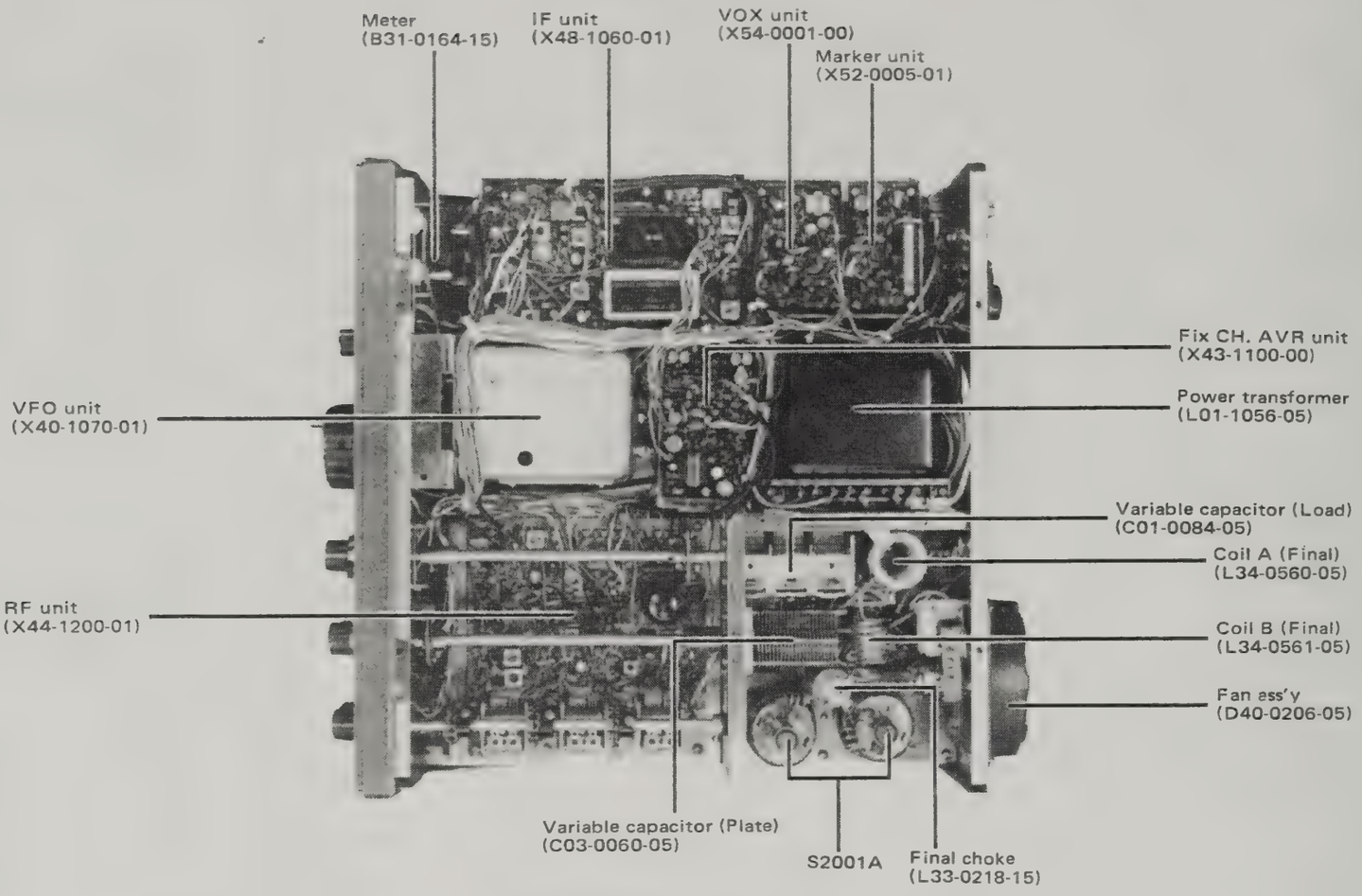
Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1,2	CE02W2C330	Electrolytic 33μF 160WV	
C3,4	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
RESISTOR			
R1~4	RC05GF2H474J	Carbon 470kΩ ±5% ½W	
R5,6	RS14AB3D471J	Metal film 470Ω ±5% 2W	
R7	RC05GF2H102J	Carbon 1kΩ ±5% ½W	
R8	RC05GF2H104J	Carbon 100kΩ ±5% ½W	
R9,10	RD14CY2E104J	Carbon 100kΩ ±5% ¼W	
SEMICONDUCTOR			
D1~6	V11-0282-05	Diode V08J	
D7	V11-0285-05	Diode V06E	
D8~11	V11-0290-05	Diode V03C	
MISCELLANEOUS			
–	E23-0047-04	Terminal x 17	

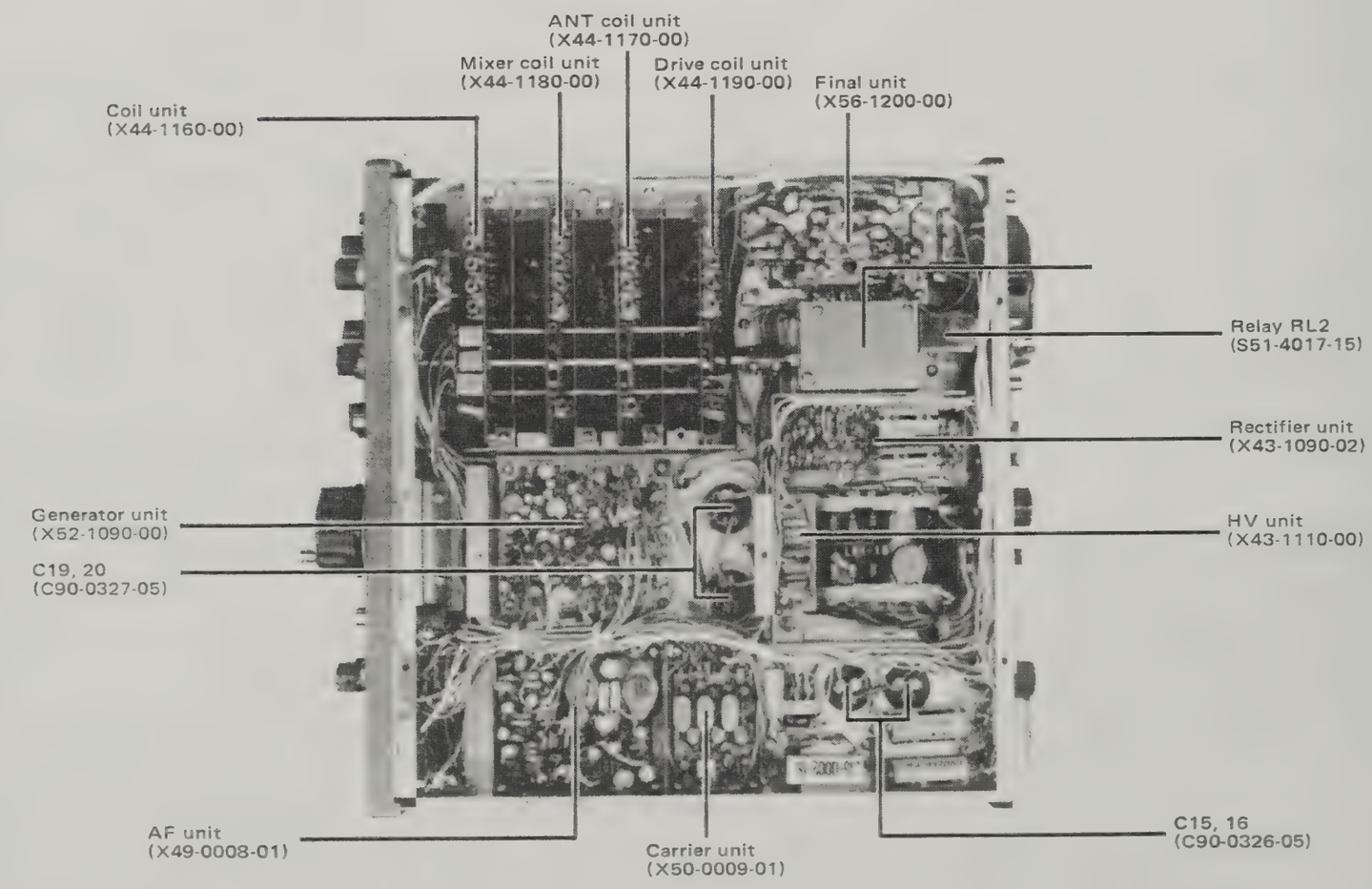
EXTERNAL VIEW





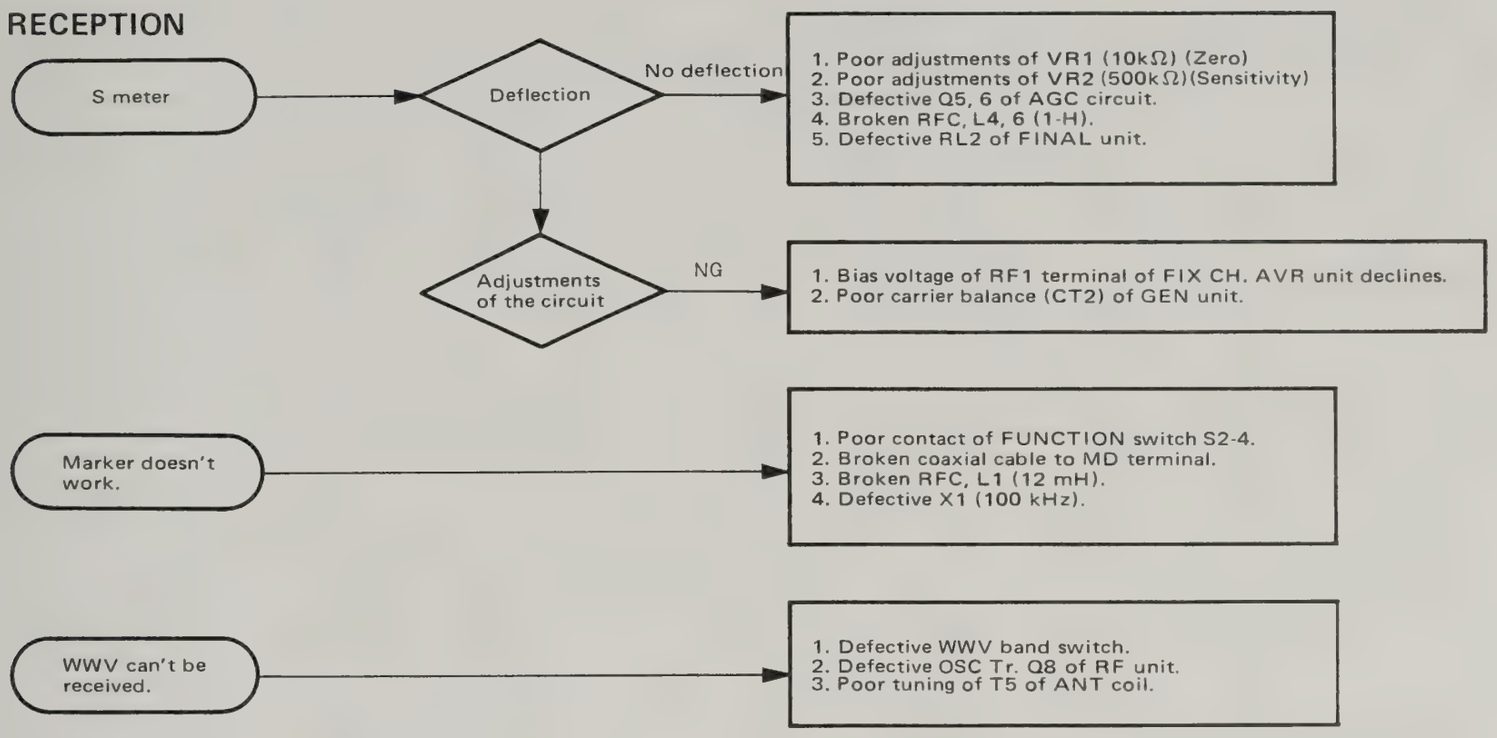
PARTS ALIGNMENT



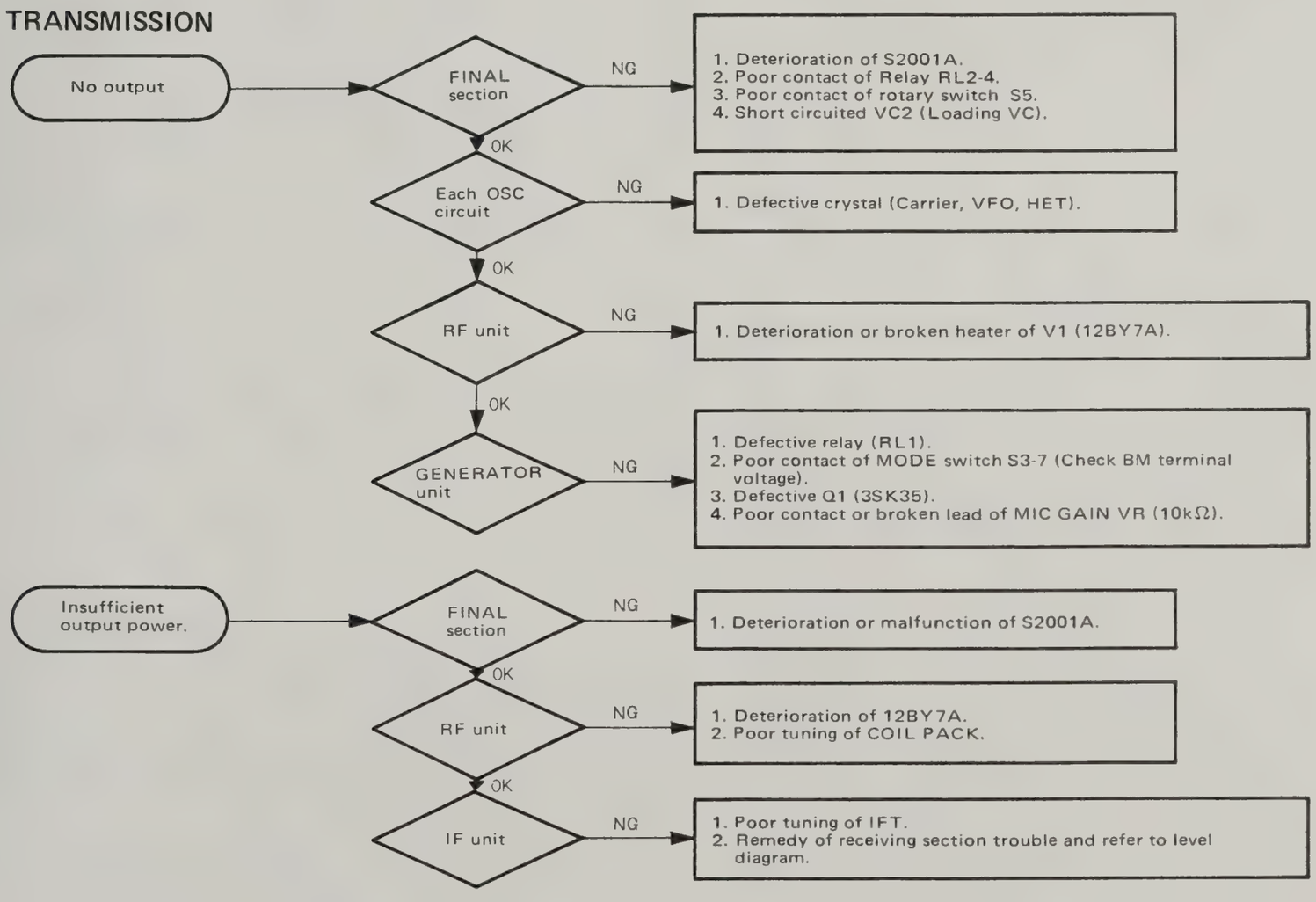


TROUBLESHOOTING

RECEPTION

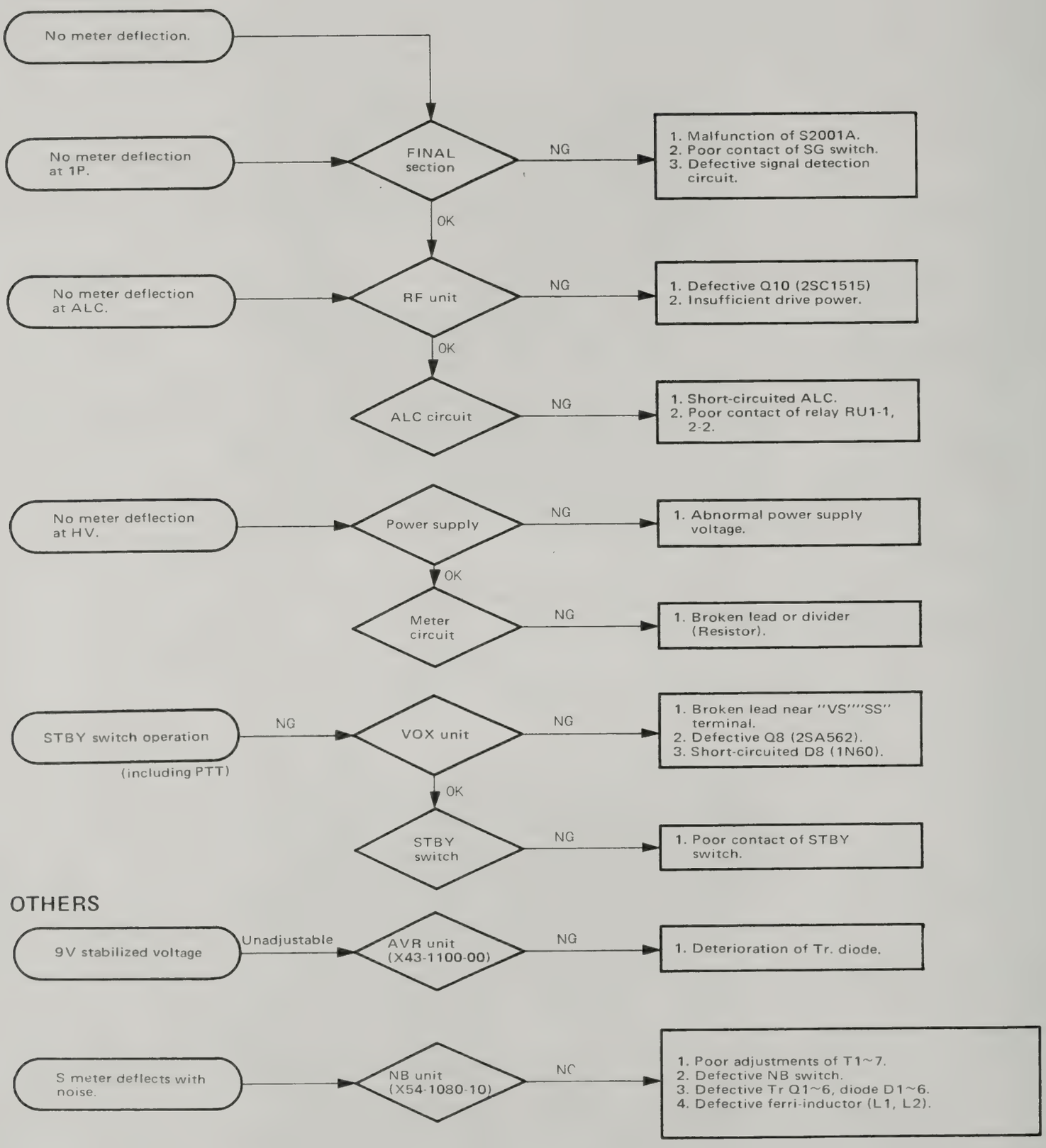


TRANSMISSION



TROUBLE SHOOTING

TRANSMISSION



OTHERS

PARTS LIST

FIX CH, AVR UNIT (X43-1100-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45SL1H151J	Ceramic 150pF ±5%	
C2	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C3	CC45CH1H820J	Ceramic 82pF ±5%	
C4	CC35CH1H100D	Ceramic 10pF ±0.5pF	
C5	CC45CH1H330J	Ceramic 33pF ±5%	
C6	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C7	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C8	CE04W1A470	Electrolytic 47μF 10WV	
C9	CE04W1C470	Electrolytic 47μF 16WV	
C10	CE04W1HR47	Electrolytic 0.47μF 50WV	
C11	CE04W1C101	Electrolytic 100μF 16WV	
C12	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
		RESISTOR	
R1~22	RD14CY2E000J	Carbon 000Ω ±5% ¼W	
		SEMICONDUCTOR	
Q1~3	V03-0079-05	Transistor 2SC460(B)	
Q4	V01-0048-05	Transistor 2SA606(L)	
Q5~6	V03-0099-05	Transistor 2SC372	
Q8	V03-0241-05	Transistor 2SC735(Y)	
D1,2	V11-0051-05	Diode 1N60	
D3	V11-0243-05	Zener diode WZ-061	
D4~7	V11-0076-05	Diode 1S1555	
D8	V11-0243-05	Zener diode WZ-061	
		POTENTIOMETER	
VR1	R12-0042-05	SEMI-fixed resistor 500Ω (B)	
VR2	R12-3036-05	Semi-fixed resistor 10kΩ (B)	
VR3	R12-4020-05	Semi-fixed resistor 50kΩ (B)	
		COIL/TRIMMER	
TC1~4	C05-0030-15	Ceramic trimmer 20pF (Blue)	
TC5	C05-0015-15	Ceramic trimmer 40pF (Brown)	
L1	L40-1001-03	Ferri-inductor 10μH	
L2~4	L40-1021-03	Ferri-inductor 1mH	
T1	L12-0013-05	OSC transformer	
		MISCELLANEOUS	
—	E18-0401-05	Crystal socket	
—	E23-0047-04	Terminal x 15	

HV UNIT (X43-1110-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
		RESISTOR	
R1	RC05GF2H104J	Carbon 100kΩ ±5% ½W	
R2~4	RD14BY2H684J	Carbon 680kΩ ±5% ½W	
R5,6	RC05GF2H563J	Carbon 56kΩ ±5% ½W	
R7	RC05GF2H123J	Carbon 12kΩ ±5% ½W	
		MISCELLANEOUS	
—	E23-0047-04	Terminal x 6	

OSC COIL UNIT (X44-1160-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45RH1H330J	Ceramic 33pF ±5%	
C2	CC45RH1H121J	Ceramic 120pF ±5%	
C3	CC45RH680J	Ceramic 68pF ±5%	
C4	CC45RH1H560J	Ceramic 56pF ±5%	
C5	CC45RH1H100D	Ceramic 10pF ±0.5pF	
C6~8	C90-0262-05	Ceramic 0.047μF ±10%	
		CRYSTAL	
X1	L77-0725-05	Crystal 10.695MHz	☆
X2	L77-0141-15	Crystal 12.395MHz	
X3	L77-0142-15	Crystal 15.895MHz	
X4	L77-0143-15	Crystal 22.895MHz	
X5	L77-0144-15	Crystal 29.895MHz	
X6	L77-0145-15	Crystal 36.895MHz	
X7	L77-0146-15	Crystal 37.395MHz	
X8	L77-0147-15	Crystal 37.995MHz	
		COIL	
L1	L32-0005-05	OSC coil 1.9MHz	
L2,3	L31-0032-05	OSC coil 3.5, 7MHz	
L4	L31-0033-05	OSC coil 14MHz	
L5	L32-0011-05	OSC coil 21MHz	
L6	L32-0138-15	OSC coil 28MHz (A)	
L7	L32-0012-05	OSC coil 28MHz (B)	
L8	L33-0025-05	Choke coil 1μF	
		MISCELLANEOUS	
—	S01-1402-05	Wafer (Rotary)	☆
—	E23-0006-04	Terminal x 4	

ANTENNA COIL UNIT (X44-1170-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45RH1H221J	Ceramic 220pF ±5%	
C2	CC45RH1H330J	Ceramic 33pF ±5%	
C3	CC45RH1H121J	Ceramic 120pF ±5%	
C4	CC45RH1H220J	Ceramic 22pF ±5%	
C5	CC45RH1H330J	Ceramic 33pF ±5%	
		COIL	
L1	L34-0620-05	Tuning coil 1.9MHz	☆
L2	L34-0621-05	Tuning coil 3.5MHz	
L3	L31-0032-05	Tuning coil 7MHz	
L4	L31-0033-05	Tuning coil 14MHz	
L5	L31-0034-05	Tuning coil 21MHz	
L6	L31-0209-05	Tuning coil 28MHz	
		MISCELLANEOUS	
—	S01-1403-05	Wafer (Rotary)	
—	S01-1404-05	Wafer (Rotary) (for terminal)	☆
—	D21-0801-05	Band shaft	☆
—	E23-0006-04	Terminal x 6	
—	E23-0015-04	Earth lug x 2	
—	J31-0102-04	Collar (A) x 4	
—	J31-0103-04	Collar (B) x 2	
—	J31-0105-04	Collar (D) x 8	

PARTS LIST

MIXER COIL UNIT (X44-1180-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45RH1H221J	Ceramic 220pF ±5%	
C2	CC45RH1H330J	Ceramic 33pF ±5%	
C3	CC45RH1H121J	Ceramic 120pF ±5%	
C4	CC45RH1H220J	Ceramic 22pF ±5%	
C5,6	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C7	CC45RH1H100D	Ceramic 10pF ±0.5pF	
		COIL	
L1	L34-0619-05	Tuning coil 1.9MHz	☆
L2	L34-0621-05	Tuning coil 3.5MHz	
L3	L31-0032-05	Tuning coil 7MHz	
L4	L31-0033-05	Tuning coil 14MHz	
L5	L31-0034-05	Tuning coil 21MHz	
L6	L31-0209-05	Tuning coil 28MHz	
L7	L40-4711-03	Ferri-inductor 470μH	
		MISCELLANEOUS	
–	S01-1403-05	Wafer (Rotary)	
–	E23-0006-04	Terminal x 6	

DRIVE COIL UNIT (X44-1190-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45RH2H221J	Ceramic 220pF ±5%	
C2	CC45RH2H330J	Ceramic 33pF ±5%	
C3	CC45RH2H121J	Ceramic 120pF ±5%	
C4	CC45RH2H220J	Ceramic 22pF ±5%	
C5	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C6,7	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
		RESISTOR	
R1,2	RD14CY2E151J	Carbon 150Ω ±5% ¼W	
		COIL	
L1	L34-0625-05	Tuning coil 1.9MHz	☆
L2	L34-0621-05	Tuning coil 3.5MHz	☆
L3	L31-0032-05	Tuning coil 7MHz	
L4	L31-0033-05	Tuning coil 14MHz	
L5	L31-0034-05	Tuning coil 21MHz	
L6	L31-0209-05	Tuning coil 28MHz	
L7	L40-4711-05	Ferri-inductor	
		MISCELLANEOUS	
–	S01-1403-05	Wafer (Rotary)	
–	E23-0006-05	Terminal x 6	
–	E23-0022-05	Terminal x 2	

RF UNIT (X44-1200-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C2	CC45SL1H101J	Ceramic 100pF ±5%	
C3,4	CK45B1H102K	Ceramic 1000pF ±10%	
C5	CC45CH1H050D	Ceramic 5pF ±0.5pF	
C6	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C7,8	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C9	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C10	CC45SL1H330J	Ceramic 33pF ±5%	
C11~13	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C14,15	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C16	CC45SL1H330J	Ceramic 33pF ±5%	
C17	CC45CH1H030D	Ceramic 3pF ±0.5pF	
C18	CC45CH1H050D	Ceramic 5pF ±0.5pF	
C19	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C20	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C21	CC45CH1H330J	Ceramic 33pF ±5%	
C22	CC35CH1H050D	Ceramic 5pF ±0.5pF	
C23	CC45CH1H070D	Ceramic 7pF ±0.5pF	
C24	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C25	CC45CH1H330J	Ceramic 33pF ±5%	
C26	CC45CH1H151J	Ceramic 150pF ±5%	
C27	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C28,29	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C30	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C31	CC45SL1H561J	Ceramic 560pF ±5%	
C32,33	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C34	CQ93M2H473K	Mylar 0.047μF ±10%	
C35	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C36	CQ93M2A473K	Mylar 0.047μF ±10%	
C37	CK45B1H102K	Ceramic 1000pF ±10%	
C38	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C39	CC45SL1H101J	Ceramic 100pF ±5%	
C40	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C41	CC45SL1H561J	Ceramic 560pF ±5%	
C42	CC45SL1H221J	Ceramic 220pF ±5%	
C43	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C44,45	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C46	CQ93M2A224M	Mylar 0.02μF ±20%	
C47	CK45B1H102K	Ceramic 1000pF ±10%	
C48	———		
C49	CC45SL2H151J	Ceramic 150pF ±5%	
C50	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C51,52	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C53	CC45SL1H561J	Ceramic 560pF ±5%	
C54	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C55	CQ93M1H102K	Mylar 1000pF ±10%	
C56	CC45CH1H101J	Ceramic 100pF ±5%	
C57	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C58	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C59	CE04W1HR47	Electrolytic 0.47μF 50WV	
C60	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C61	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C62,63	CC45CH101J	Ceramic 100pF ±5%	
C64	CC45CH1H100D	Ceramic 10pF ±5pF	
		RESISTOR	
R1~75	RD14CY2E000J	Carbon 000Ω ±5% ¼W	
R54~57 73, 76	RC05GF2H000J	Carbon 000Ω ±5% ¼W	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
TUBE/SEMICONDUCTOR			
V1	V40-0114-00	Tube 12BY7A	
Q1,2	V09-0057-05	FET 3SK41(L) or 3SK40(L)	
Q3	V09-0036-05	FET 3SK35(GR)	
Q4	V09-0023-05	FET 3SK22(GR)	
Q5,6	V09-0012-05	FET 2SK19(GR)	
Q7~9	V04-0079-05	Transistor 2SC460(B)	
Q10	V03-0450-05	Transistor 2SC1515(K)	
Q11	V03-0123-05	Transistor 2SC733(Y)	
D1~3	V11-0240-05	Zener diode WZ-090	
D4	V11-0414-05	Diode 1S2588	
D5,6	V11-0370-05	Diode 1S1587	
D7	V11-0076-05	Diode 1S1555	
D8,9	V11-0219-05	Diode V06B	
D10	V11-0076-05	Diode 1S1555	
D11,12	V11-0414-05	Diode 1S2588	
D13	V11-0240-05	Zener diode WZ-090	
D14,15	V11-0219-05	Diode V06B	
D16	V11-0370-05	Diode 1S1587	
D17	V11-0076-05	Diode 1S1555	
POTENTIOMETER/VC			
VR1	R12-1012-05	Semi-fixed resistor 1kΩ	
VC1~3	C01-0127-15	Variable capacitor	
COIL/CRYSTAL			
L1	L40-4711-03	Ferri-inductor 470μH	
L2~4	L40-1021-03	Ferri-inductor 1mH	
L5	L40-4711-03	Ferri-inductor 470μH	
L6	L40-1021-03	Ferri-inductor 1mH	
L7	L40-1511-03	Ferri-inductor 150μH	
L8	L33-0074-05	Heater choke 0.22μH	
L9	L40-4711-03	Ferri-inductor 470μH	
L10	L40-1511-03	Ferri-inductor 150μH	
T1,2	L30-0008-05	BPF coil	
T3	L30-0009-05	BPF coil	
T4,5	L34-0622-05	Tuning coil 15MHz WWV	☆
T6	L31-0010-05	Trap coil 8.6MHz	
T7	L31-0011-05	Trap coil 8.6MHz	
X1	L77-0180-05	Crystal 23.895MHz	
MISCELLANEOUS			
—	D13-0032-03	Sprocket x 3	
—	D16-0033-04	Chain ass'y x 2	
—	E06-0406-05	FET socket x 3	
—	E10-1902-05	Tube socket 9P	
—	E23-0046-04	Terminal x 2	
—	E23-0047-04	Terminal x 58	

IF UNIT (X48-1060-01)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CC45SL1H330J	Ceramic 33pF ±5%	
C2	CQ92M1H473K	Mylar 0.047μF ±10%	
C3	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C4	CQ92M1H473K	Mylar 0.047μF ±10%	
C5	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C6	CQ93M1H473K	Mylar 0.047μF ±10%	
C7,8	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C9	CQ92M1H473K	Mylar 0.047μF ±10%	
C10	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C11	CK45D1H102M	Ceramic 1000pF ±20%	
C12	CC45SL1H220J	Ceramic 22pF ±5%	
C13	CQ92M1H473K	Mylar 0.047μF ±10%	
C14	CK45F1H103Z	Ceramic 0.01μF +80% -20%	
C15	CQ92M1H473K	Mylar 0.047μF ±10%	
C16	CC45CH1H050D	Ceramic 5pF ±0.5pF	
C17	CQ92M1H473K	Mylar 0.047μF ±10%	
C18	CC45CH1H050D	Ceramic 5pF ±0.5pF	
C19	CQ92M1H473K	Mylar 0.047μF ±10%	
C20	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C21	CQ92M1H103K	Mylar 0.01μF ±10%	
C22	CC45CH1H121J	Ceramic 120pF ±5%	
C23	CQ92M1H473K	Mylar 0.047μF ±10%	
C24	CC45CH1H330J	Ceramic 33pF ±5%	
C25	CC45SL1H151J	Ceramic 150pF ±5%	
C26	———		
C27	CE04W1H010	Electrolytic 1μF 50WV	
C28	CQ92M1H473K	Mylar 0.047μF ±10%	
C29	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C30	CE04W1H010	Electrolytic 1μF 50WV	
C31	CC45SL1H221J	Ceramic 220pF ±5%	
C32	CQ92M1H473K	Mylar 0.047μF ±10%	
C33	CC45SL1H470J	Ceramic 47pF ±5%	
C34	CQ92M1H473K	Mylar 0.047μF ±10%	
C35	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C36	CQ92M1H473K	Mylar 0.047μF ±10%	
C37	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C38	CQ92M1H473K	Mylar 0.047μF ±10%	
C39	CC45SL1H101J	Ceramic 100pF ±5%	
C40	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C41	CQ92M1H473K	Mylar 0.047μF ±10%	
C42	CQ92M1H103K	Mylar 0.01μF ±10%	
C43,44	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C45,46	CQ92M1H473K	Mylar 0.047μF ±10%	
C47,48	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C49	CC45CH1H101J	Ceramic 100pF ±5%	
C50	CC45SL1H101J	Ceramic 100pF ±5%	
C51,52			
C53	CQ92M1H473K	Mylar 0.047μF ±10%	
C54	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C55,56	CC45SL1H101J	Ceramic 100pF ±5%	
C57,58	CC45SL1H331J	Ceramic 330pF ±5%	
C59	CC45SL1H330J	Ceramic 33pF ±5%	
C60	CC45SL1H470J	Ceramic 47pF ±5%	
C61	CC45SL1H150J	Ceramic 15pF ±5%	
C62	CC35CH1H050D	Ceramic 5pF ±0.5pF	
RESISTOR			
R1~51	RD14CY2E000J	Carbon 0000Ω ±5% ¼W	
R28	RC05GF2H225J	Carbon 2.2MΩ ±5% ½W	
R45	———		
SEMICONDUCTOR			
Q1	V09-0036-05	FET 3SK35(GR)	
Q2	V09-0066-05	FET 3SK35(Y)	
Q3,4	V09-0036-05	FET 3SK35(GR)	
Q5,6	V03-0123-05	Transistor 2SC733(Y)	
Q7	V09-0012-05	FET 2SK19(GR)	
Q8	V01-0037-05	Transistor 2SA495(Y)	
Q9	V09-0057-05	FET 3SK41(L)	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
D1,2	V11-4160-66	Diode 1S1007	☆
D3,4	V11-0370-05	Diode 1S1587	
D5,6	V11-0051-05	Diode 1N60	
D7	V11-0076-05	Diode 1S1555	
D8	———		
D9	V11-0076-05	Diode 1S1555	
D10			
D11	V11-0240-05	Zener diode WZ-090	
D12	V11-0076-05	Diode 1S1555	
POTENTIOMETER			
VR1	R12-3025-05	Semi-fixed resistor 10kΩ (B)	
VR2	R12-7013-05	Semi-fixed resistor 500kΩ (B)	
FILTER/COIL			
XF1	L71-0018-05	Crystal filter	
L1~6	L40-1021-03	Ferri-inductor	
L2	———		
T1	L30-0263-05	IFT	☆
T2	L30-0010-05	IFT	
T3	L30-0008-05	BPF coil	
T4	L30-0009-05	BPF coil	
T5	L30-0010-05	IFT	
T6	L30-0021-05	IFT	
T7			
T8	L30-0008-05	BPF coil	
T9	L30-0010-05	IFT	
T10	L31-0284-05	Filter coil (Blue)	
T11	L31-0252-05	Filter coil (Green)	
T12	L31-0251-05	Filter coil (White)	
T13	L31-0012-05	Trap coil 12.395MHz	
MISCELLANEOUS			
—	E23-0046-04	Terminal x 6	
—	E23-0047-04	Terminal x 30	
—	E23-0048-04	Terminal	

Ref. No.	Parts No.	Description	Remarks
RESISTOR			
R1~38	RD14BY2E000J	Carbon 000Ω ±5% ¼W	
	RD14CY2E000J	Carbon 000Ω ±5% ¼W	
R11,12	R92-0041-25	Cement 0.47Ω 1W	
SEMICONDUCTOR			
Q1	V03-0123-05	Transistor 2SC733(Y)	
Q2	V03-0126-05	Transistor 2SC734(Y)	
Q3	V04-0008-05	Transistor 2SD90(Y) or (G)	
Q4	V02-0481-16	Transistor 2SB481(I. J)	☆
Q5	V03-0355-05	Transistor 2SC1000(GR)	
Q6	V03-0123-05	Transistor 2SC733(Y)	
D1,2	V11-0051-05	Diode 1N60	
D3	V11-0076-05	Diode 1S1555	
D4	V11-0297-05	Zener diode WZ-130	
D5	V11-0219-05	Diode V06B	
POTENTIOMETER/COIL			
VR1	R12-4015-05	Semi-fixed resistor 50kΩ (B)	
L1	L33-0032-05	Heater choke 3μH	
L2	L40-3391-03	Ferri-inductor 3.3μH	
MISCELLANEOUS			
—	E23-0005-04	Terminal x 16	

AF UNIT (X49-0008-01)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CE04W1H4R7	Electrolytic 4.7μF 50WV	
C2	CE04W0J101	Electrolytic 100μF 6.3WV	
C3	CE04W1A331	Electrolytic 330μF 10WV	
C4	CE04W1E100	Electrolytic 10μF 25WV	
C5	CQ93M1H472K	Mylar 4700pF ±10%	
C6	CE04W0F470	Electrolytic 47μF 3.15WV	
C7	CE04W1C101	Electrolytic 100μF 16WV	
C8	CE04W1C221	Electrolytic 220μF 16WV	
C9	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C10	CC45SL1H101K	Ceramic 100pF ±10%	
C11	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C12	CE04W1H010	Electrolytic 1μF 50WV	
C13	CQ92M1H473K	Mylar 0.047μF ±10%	
C14	CE04W1HR47	Electrolytic 0.47μF 50WV	
C15	CQ92M1H103K	Mylar 0.01μF ±10%	
C16,17	CE04W1E100	Electrolytic 10μF 25WV	
C18	CK45B1H331K	Ceramic 330pF ±10%	
C19	CE04W1E100	Electrolytic 10μF 25WV	
C20	CE04W1E3R3	Electrolytic 3.3μF 25WV	
C21	CE04W1E100	Electrolytic 10μF 25WV	
C22~25	CQ93M1H123K	Mylar 0.012μF ±10%	
C26	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C27,28	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	

CARRIER UNIT (X50-0009-01)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CK45F1H102Z	Ceramic 1000pF +80%, -20%	
C2	CC45CH1H220J	Ceramic 22pF ±5%	
C3	CK45F1H102Z	Ceramic 1000pF +80%, -20%	
C4	CC45CH1H270J	Ceramic 27pF ±5%	
C5	CK45F1H102Z	Ceramic 1000pF +80%, -20%	
C6	CC45CH1H270J	Ceramic 27pF ±5%	
C7	CK45F1H102Z	Ceramic 1000pF +80%, -20%	
C8	CK45B1H471K	Ceramic 470pF ±10%	
C9	CC45TH1H221J	Ceramic 220pF ±5%	
C10	CC45SL1H101K	Ceramic 100pF ±10%	
C11	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C12	CK35F1H473Z	Ceramic 0.047μF +80%, -20%	
C13	CC45CH1H220J	Ceramic 22pF ±5%	
C14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
RESISTOR			
R1~9	RD14BY2E000J	Carbon 000Ω ±5% ¼W	
SEMICONDUCTOR			
Q1,2	V03-0079-05	Transistor 2SC460(B)	
D1~4	V11-0076-05	Diode 1S1555	
TRIMMER/CRYSTAL/COIL			
TC1~3	C05-0013-15	Ceramic trimmer	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
X1	L77-0123-05	Crystal T13-98	
X2	L77-0122-05	Crystal T13-97	
X3	L77-0120-05	Crystal T13-95	
L1~6	L40-1021-03	Ferri-inductor 1mH	
L7	L40-4711-03	Ferri-inductor 470μH	
T1	L32-0003-05	OSC coil	
MISCELLANEOUS			
–	E23-0005-04	Terminal x 7	

MARKER UNIT (X52-0005-01)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CQ93M1H103K	Mylar 0.01μF ±10%	
C2	CC45CH1H151J	Ceramic 150pF ±5%	
C3	CC45TH1H101J	Ceramic 100pF ±5%	
C4	CC45CH1H330J	Ceramic 33pF ±5%	
C5	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C6	CC45CH1H390J	Ceramic 39pF ±5%	
C7	CC45CH1H330J	Ceramic 33pF ±5%	
C8	CC45SL1H101J	Ceramic 100pF ±5%	
C9	CC45SL1H221K	Ceramic 220pF ±10%	
C10	CC45SL1H470K	Ceramic 47pF ±10%	
C11	CC94SL2H050D	Ceramic 5pF ±0.5pF	
C12	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C13	CC45CH1H470J	Ceramic 47pF ±5%	
RESISTOR			
R1~10	RD14CY2E000J	Carbon 000Ω ±5% ¼W	
SEMICONDUCTOR			
Q1	V03-0042-05	Transistor 2SC373 or 2SC458(B)	
Q2,3	V03-0042-05	Transistor 2SC373	
Q4	V03-0042-05	Transistor 2SC373 or 2SC458(B)	
D1	V11-0051-05	Diode 1N60	
CRYSTAL/TRIMMER/COIL			
X1	L77-0009-05	Crystal 100kHz	
TC1	C05-0029-05	Ceramic trimmer	
L1	L40-1235-05	Ferri-inductor	
MISCELLANEOUS			
–	E23-0005-04	Terminal x 6	

GENERATOR UNIT (X52-1090-00)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1,2	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C3	CC45SL1H220J	Ceramic 0.1μF ±5%	
C4	————		
C5,6	CC45SL1H101J	Ceramic 100pF ±5%	
C7	C90-0262-05	Ceramic 0.047μF ±10%	
C8	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C9	C90-0262-05	Ceramic 0.047μF ±10%	
C10	CC45SL1H050D	Ceramic 5pF ±0.5pF	
C11	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C12	CC45SL1H101J	Ceramic 100pF ±5%	
C14	CE04W1H010	Electrolytic 1μF 50WV	
C15	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C16	CQ92M1H103K	Mylar 0.01μF ±10%	
C17	CS15E1VR10M	Tantalum 0.1μF ±20%	
C18	CQ92M1H473K	Mylar 0.047μF ±10%	
C19	CE04W1A470	Electrolytic 47μF 1.0WV	
C20	CE04W0J101	Electrolytic 100μF 6.3WV	
C21	CE04W1C221	Electrolytic 220μF 16WV	
C22	CQ92M1H103K	Mylar 0.01μF ±10%	
C23	CK45B1H471K	Ceramic 470pF ±10%	
C24	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C25	CE04W1C220	Electrolytic 22μF 16WV	
C26	CQ92M1H103K	Mylar 0.01μF ±10%	
C27	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C28	CE04W1H010	Electrolytic 1μF 50WV	
C29	CE04W1E100	Electrolytic 10μF 25WV	
C30	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C31	CE04W1HR47	Electrolytic 0.47μF 50WV	
C32,33	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C34	————		
C35	CE04W1C220	Electrolytic 22μF 16WV	
C36	CE04W1C330	Electrolytic 33μF 16WV	
C37	C90-0262-05	Ceramic 0.047μF ±10%	
C38	CE04W1H010	Electrolytic 1μF 50WV	
C39	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C40	CE04W1E100	Electrolytic 10μF 25WV	
C41	CE04W1A331	Electrolytic 330μF 10WV	
C42	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C43	CE04W1H010	Electrolytic 1μF 50WV	
C44,45	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C46	CE04W1H010	Electrolytic 1μF 50WV	
C47	C90-0262-05	Ceramic 0.047μF ±10%	
C48	CC45SL1H470J	Ceramic 47pF ±5%	
C49	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C50	CC45SL1H220J	Ceramic 22pF ±5%	
C51	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C52	C90-0262-05	Ceramic 0.047μF ±10%	
C53,54	CE04W1E100	Electrolytic 10μF 25WV	
C55	CE04W1H3R3	Electrolytic 3.3μF 50WV	
RESISTOR			
R1~65	RD14CY2B000J	Carbon 000Ω ±5% 1/8W	
SEMICONDUCTOR			
Q1	V09-0036-05	FET	
Q2	V03-0079-05	Transistor	
Q3,4	V03-0355-05	Transistor	
Q5,6	V03-0123-05	Transistor	
Q7,8	V09-0015-05	FET	
Q9,10	V03-0123-05	Transistor	
Q11,12	V03-0270-05	Transistor	
D1~4	V11-0051-05	Diode	
D5	V11-0076-05	Diode	
D6,7	V11-0414-05	Diode	
D8	V11-0076-05	Diode	
D9~16	V11-0051-05	Diode	
D17~19	V11-0076-05	Diode	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
		POTENTIOMETER	
VR1	R12-0401-05	Semi-fixed resistor 100Ω (B)	
VR2	R12-5401-05	Semi-fixed resistor 100kΩ (B)	☆
VR3	R12-4503-05	Semi-fixed resistor 50kΩ (B)	☆
		TRIMMER/COIL	
TC1,2	C05-0015-15	Ceramic trimmer 40pF	
L1	L40-1021-03	Ferri-inductor 1mH	
L2,3	L40-4711-03	Ferri-inductor 470μH	
L4	L40-1021-03	Ferri-inductor 1mH	
T1	L30-0021-05	IFT	
		MISCELLANEOUS	
–	E23-0047-04	Terminal x 30	

VOX UNIT (X54-0001-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C2	CE04W0F470	Electrolytic 47μF 3.15WV	
C3	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C4	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C5	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C6	CE04W1H010	Electrolytic 1μF 50WV	
C7	CK94YY1H472M	Ceramic 4700pF ±20%	
C8	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C9,10	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C24	CC45SL1H331K	Ceramic 330pF ±10%	
C25	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
		RESISTOR	
R1~17	RD14CY2E000J	Carbon 000Ω ±5% ¼W	
R14	RD14BY2E472J	Carbon 4.7kΩ ±5% ¼W	
R18	RD14BY2B102J	Carbon 1kΩ ±5% 1/8W	
		SEMICONDUCTOR	
Q1~4	V03-0042-05	Transistor 2SC373	
Q5	V01-0038-05	Transistor 2SA562(Y)	
Q6,7	V03-0042-05	Transistor 2SC373	
Q8	V01-0038-05	Transistor 2SA562(Y)	
D1~4	V11-0051-05	Diode 1N60	
D5	V11-0076-05	Diode 1S1555	
D6~8	V11-0051-05	Diode 1N60	
D9	V11-0076-05	Diode 1S1555	
		MISCELLANEOUS	
T1	L13-0001-05	Input transformer 500Ω : 20kΩ	
–	E23-0005-04	Terminal	

NB UNIT (X54-1080-10)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1,2	CC45SL1H020D	Ceramic 2pF ±0.5pF	
C3	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C4	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C5,6	CC45SL1H101J	Ceramic 100pF ±5%	
C7	CE04W1E100	Electrolytic 10μF 25WV	
C8,9	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C10,11	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C12	CK45D1H102M	Ceramic 1000pF ±20%	
C13,14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C15	CE04W1H010	Electrolytic 1μF 50WV	
C16	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C17	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C18	CK45D1H102M	Ceramic 1000pF ±20%	
C19	CC45SL1H331J	Ceramic 330pF ±6% ±5%	
C20	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C21	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C22	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C23,24	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
		RESISTOR	
R1~19	RD14CY2E000J	Carbon 0000Ω ±5% ¼W	
		SEMICONDUCTOR	
Q1	V09-0023-05	FET 3SK22(GR)	
Q2	V09-0012-05	FET 2SK19(GR)	
Q3,4	V03-0079-05	Transistor 2SC460(B)	
Q5,6	V03-0123-05	Transistor 2SC733(Y)	
Q7	V03-0079-05	Transistor 2SC460(B)	
D1~4	V11-0370-05	Diode 1S1587	
D5,6	V11-0051-05	Diode 1N60	
D7	V21-0041-05	Varister MV-13	
		COIL	
L1,2	L40-1021-03	Ferri-inductor 1mH	
T1~3	L30-0010-05	IFT 3395kHz	
T4	L31-0286-05	NB coil (A) 3395kHz	
T5	L31-0287-05	NB coil (B) 3395kHz	
T6	L30-0010-05	IFT 3395kHz	
T7	L30-0021-05	IFT 3395kHz	
		MISCELLANEOUS	
–	E23-0046-04	Terminal x 6	

INDICATOR UNIT (X54-1280-00)

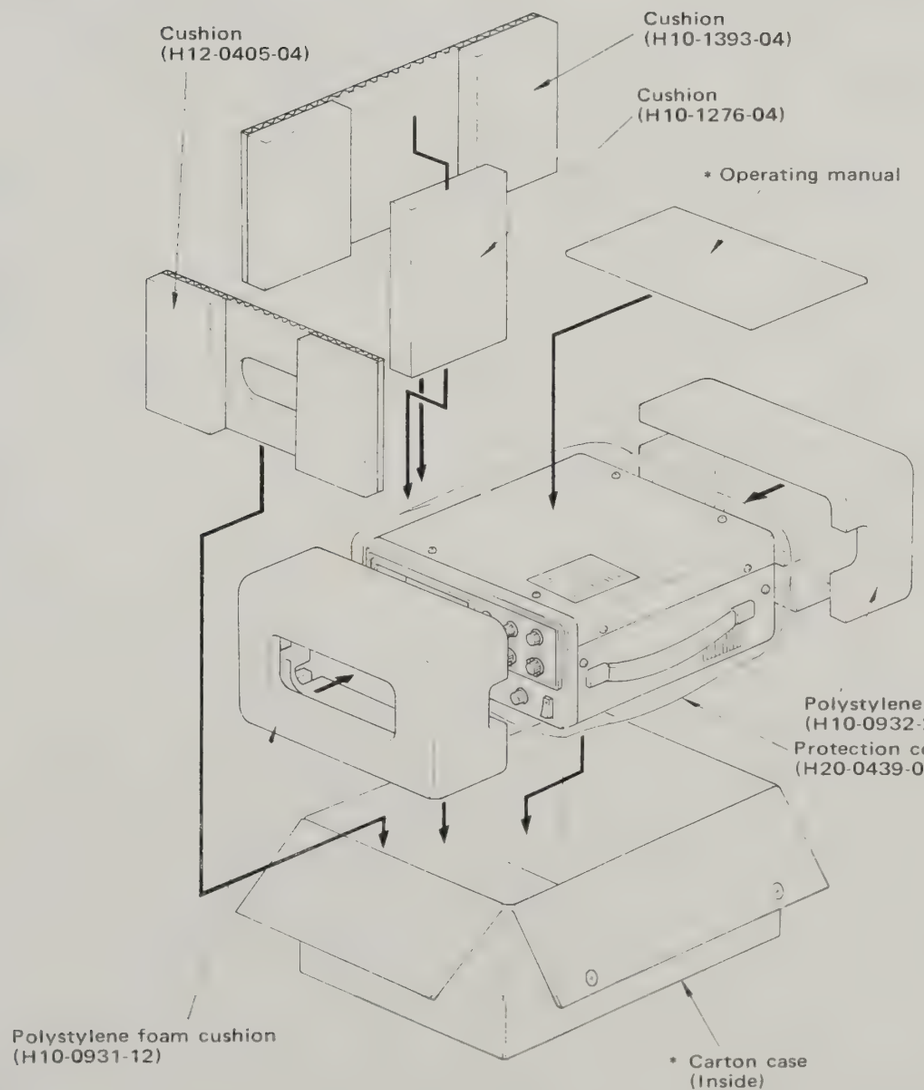
Ref. No.	Parts No.	Description	Remarks
		RESISTOR	
R1	RD14BY2E681J	Carbon 680Ω ±5% ¼W	
R2	RD14BY2E471J	Carbon 470Ω ±5% ¼W	
R3	RD14BY2E681J	Carbon 680Ω ±5% ¼W	
		SEMICONDUCTOR	
D1~3	V11-0304-05	LED SEL-103W	
		MISCELLANEOUS	
–	E23-0047-04	Terminal x 3	
–	F15-0609-04	Shading rubber x 3	
–	F20-0501-04	Insulator x 3	

PARTS LIST/PACKING

FINAL UNIT (X56-1200-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45SL2H101J	Ceramic 100pF ±5%	
C2	CK45E2H102P	Ceramic 1000pF +100%, -0%	
C3~10	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C3, 5~7	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C11~13	CK45F1H103P	Ceramic 0.01μF +100%, -0%	
C11,13	CK45F1H103P	Ceramic 0.01μF +100%, -0%	
C14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C15	CC45CH2H150J	Ceramic 15pF ±5%	
		RESISTOR	
R1	RD14BY2E101J	Carbon 100Ω ±5% ¼W	
R2,3	RC05GF3A100J	Carbon 10Ω ±5% 1W	
R4	RD14BY2E332J	Carbon 3.3kΩ ±5% ¼W	
R5	RC05GF2H101J	Carbon 100Ω ±5% ½W	
R6	RC05GF2H101J	Carbon 100Ω ±5% ½W	
R7	RW14AG3K6R2K	Wire wound 6.2Ω ±10% 10W	
		COIL	
L1	L40-1511-03	Ferri-inductor 150μH	
L2	L40-4711-03	Ferri-inductor 470μH	
L3,4	L40-1511-03	Ferri-inductor 150μH	
PS1,2	L33-0110-05	Parastic suppressor	
		MISCELLANEOUS	
V1,2	E01-0801-05	US socket	
—	E23-0047-04	Terminal x 9	

PACKING



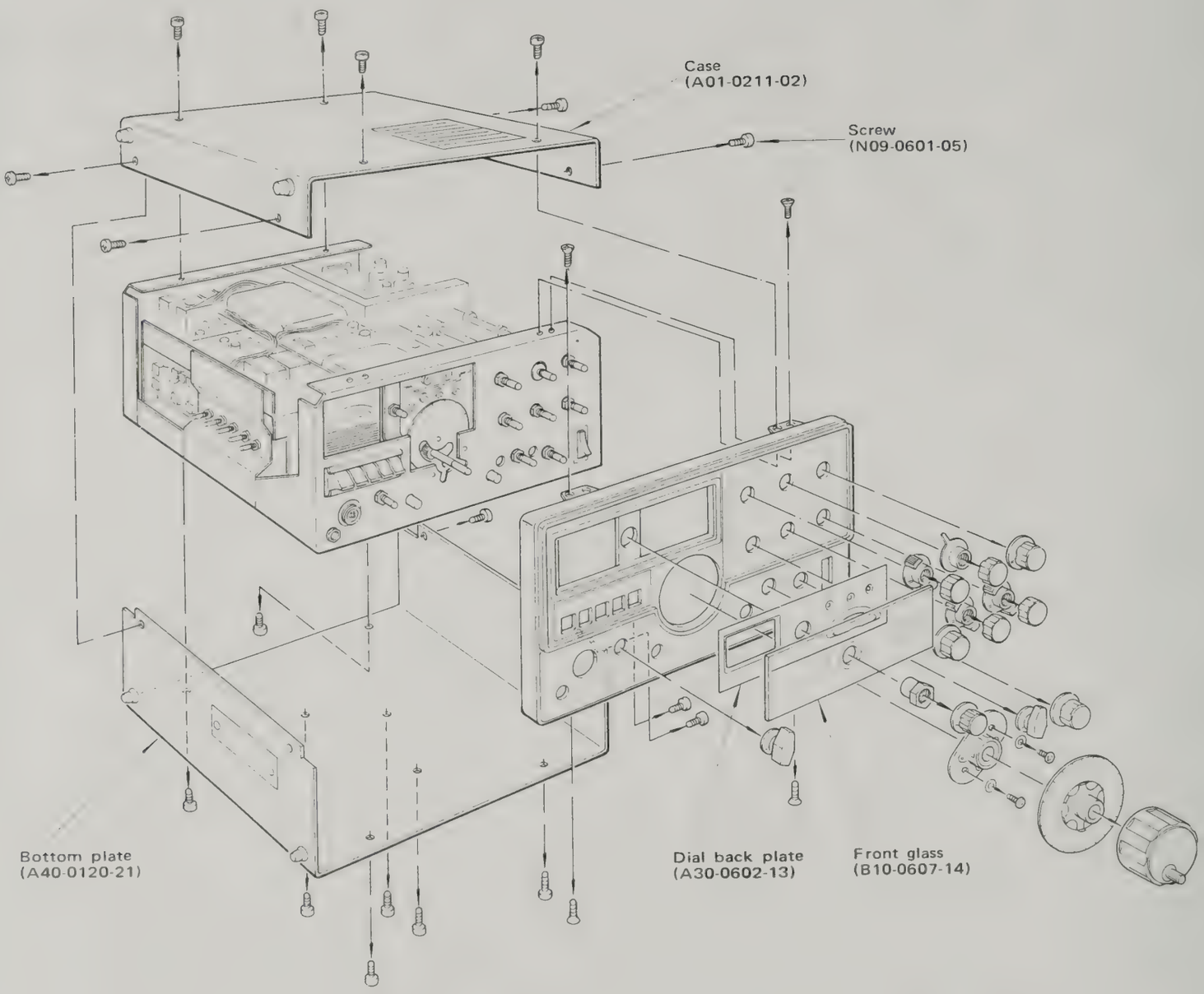
Accessories

- Operating manual
  1P pin plug (E14-0101-05) X 3
  Phone plug (E12-0001-05)
  9P MT plug (E05-0901-05)
  8P US plug (E14-0801-05)
  Screw for foot (N30-4012-46) X 2
  Foot (J02-0049-14)X 2
  AC cord (E30-0181-05)
- Fuse

* Refer to parts list.

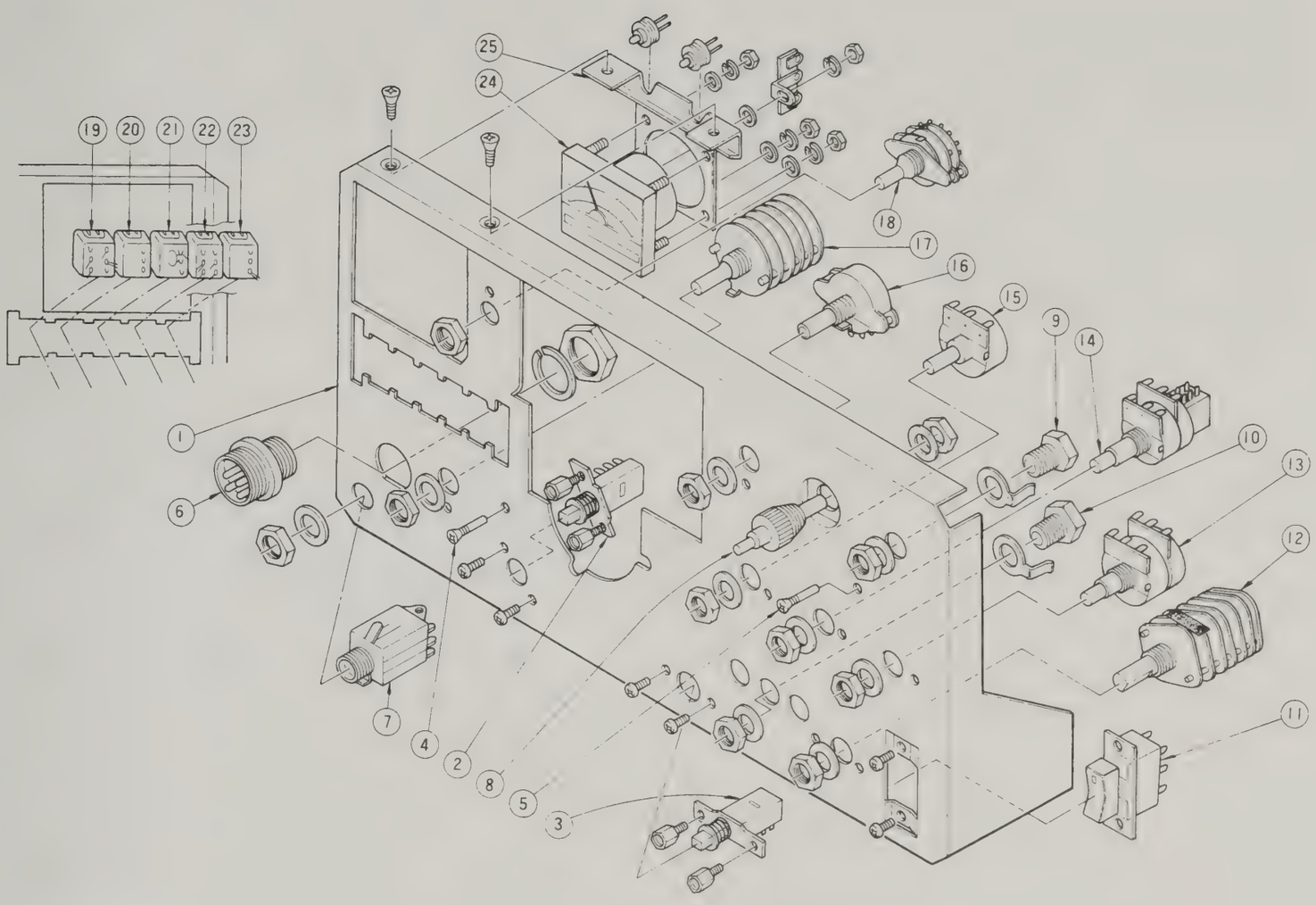
DISASSEMBLY

DISASSEMBLY OF PANEL ASS'Y AND CASE



DISASSEMBLY

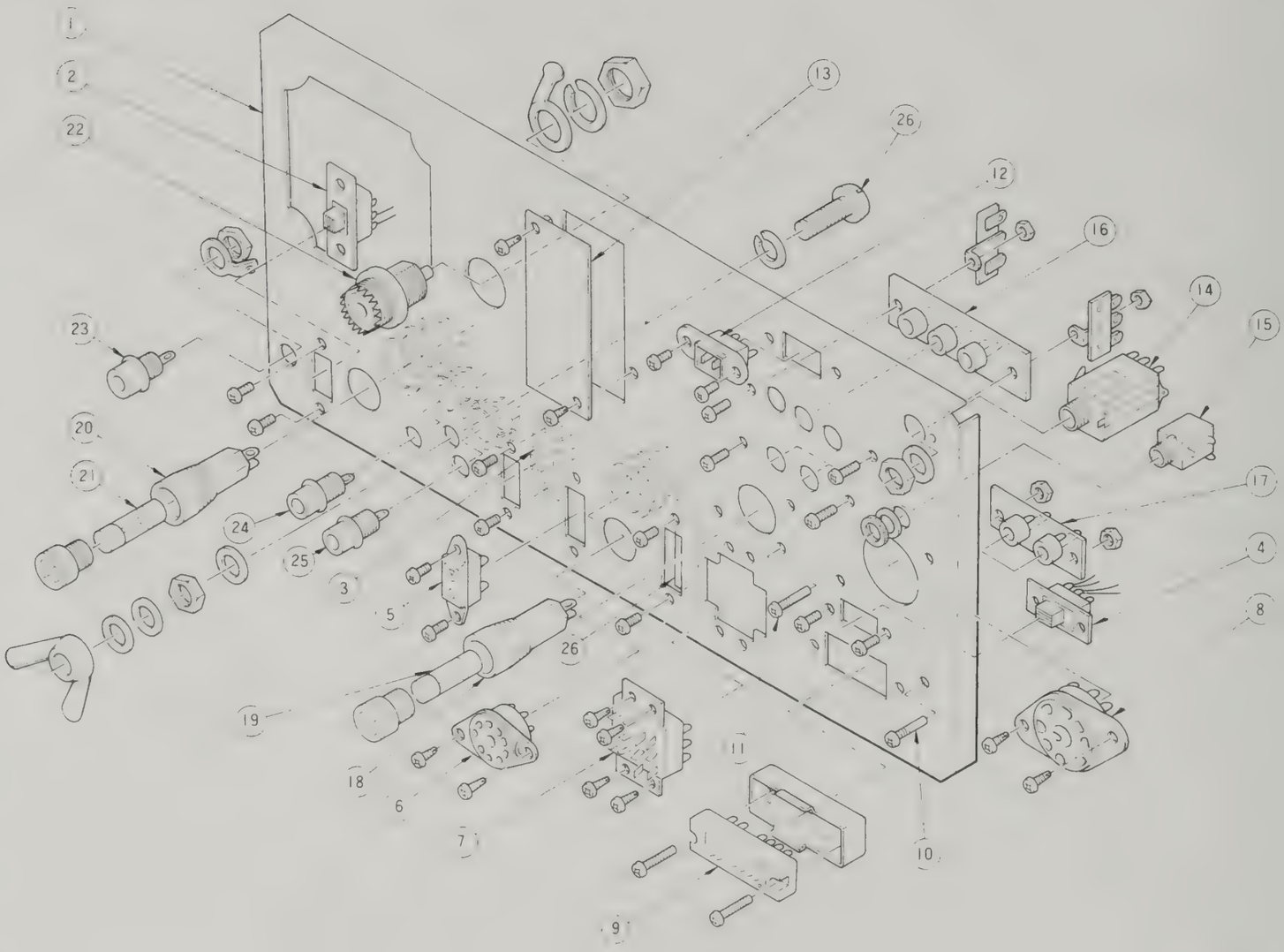
DISASSEMBLY OF SUBPANEL



No.	Description	Parts No.	Remarks	No.	Description	Parts No.	Remarks
1	Subpanel	A22-0135-33	RF ATT	14	Potentiometer	R19-3401-05	MIC/CAR/PRO
2	Push switch	S40-2023-02	RIT	15	Potentiometer	R03-2004-05	RIT
3	Push switch	S40-2023-05		16	Rotary switch	S10-1107-05	FIX. CH
4	Screw (GND)	N09-0256-05		17	Rotary switch	S04-5016-05	MODE
5	Screw (GND)	N09-0256-05		18	Rotary switch	S29-1006-05	METER
6	4P MIC jack	E06-0403-25		19	Paddle switch	S44-2015-05	AGC
7	Phone jack	E11-0034-05		20	Paddle switch	S44-2020-05	NB
8	Vernier mechanism	D40-0204-05		21	Paddle switch	S44-2020-05	VOX
9	Shaft supporter	D23-0048-04		22	Paddle switch	S44-2018-05	H. SW
10	Shaft supporter	D23-0048-04		23	Paddle switch	S44-2020-05	SEND/REC
11	See-saw switch	S59-2020-05	POWER	24	Meter	B31-0164-15	
12	Rotary switch	S01-4017-05	FUNCTION	25	Meter fittings		
13	Potentiometer	R08-3012-15	AF/RF GAIN				

DISASSEMBLY

DISASSEMBLY OF REAR PANEL



No.	Description	Parts No.	Remarks	No.	Description	Parts No.	Remarks
1	Rear panel	A23-1404-02		14	3 pole phone jack	E11-0005-15	KEY
2	Slide switch	S31-2007-05	SG	15	Phone jack	E11-0003-15	EXT. SP
3	Slide switch	S31-2007-05	REC. ANT	16	3P pin jack	E13-0361-05	VFO.HET.
4	Slide switch	S31-2007-05	X VERTER	17	2P pin jack	E13-0205-05	PHONE PATCH
5	2P connector socket	E08-0204-05		18	Fuse holder	J13-0033-15	AC FUSE
6	9P socket	E01-0903-05	EXT. VFO	19	Fuse *		
7	12P connector socket	E08 1202-05	POWER SOURCE CONNECTOR	20	Fuse holder	J13-0033-15	DC FUSE
8	US socket	E01-0801-05	REMOTE	21	Fuse *		
9	12P connector	E08-1208-05	X VERTER	22	M type receptacle	E04-0102-05	ANT X VERTER OUT
10	Screw (GND)	N09-0256-05		23	1P pin jack	E13-0101-05	
11	Screw (GND)	N09-0256-05		24	1P pin jack	E13-0101-05	X VERTER IN
12	2P connector jack	E08-0203-25	DC13.8V	25	1P pin jack	E13-0101-05	EXT. REC. ANT.
13	Cover plate	F19-0133-14		26	GND screw	N31-6018-11	

* See parts list.

DISASSEMBLY

CAUTION: DANGEROUS HIGH VOLTAGES ARE PRESENT WITHIN THE CASE OF THE TS-520S WHEN THE TRANSCEIVER IS TURNED ON. EXERCISE EXTREME CAUTION TO AVOID ELECTRIC SHOCK.

1. REPLACING THE RELAYS

(1) ANTENNA RELAY

RL2 is enclosed on the bottom of the final section. Remove the bottom of the TS-520S case and then remove the cover of the relay shield box as shown in Figure 9. This relay has large contacts and the coil is rated at 300 ohms. Be sure to replace the relay with an exact equivalent.

(2) VOX RELAY

RL1 is located below the VOX board, as shown in Figure 10, next to the power transformer. Remove the top cover of the transceiver and then remove the VOX board. Replace the relay with an exact equivalent.

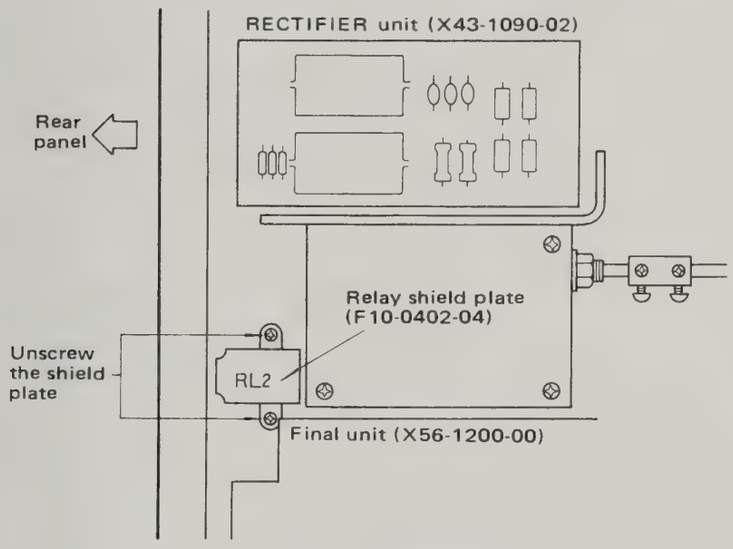


Fig. 9 Replacing RL2

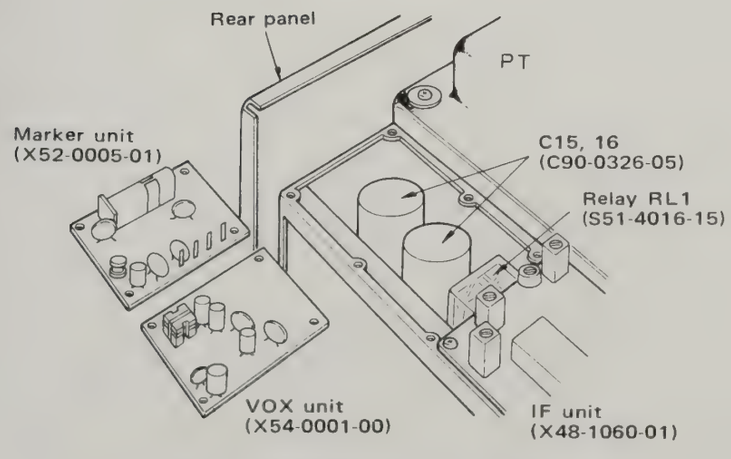


Fig. 10 Replacing RL1, C15 and C16

2. REPLACING THE ELECTROLYTIC POWER SUPPLY CAPACITORS

See Figure 11. C19 and C20 are reached by removing the TS-520S top cover and then the FIXCH-AVR board as shown in Figure 11. C15 and C16 are reached by removing the transceiver's top case and then the MARKER and VOX boards as shown in Figure 10.

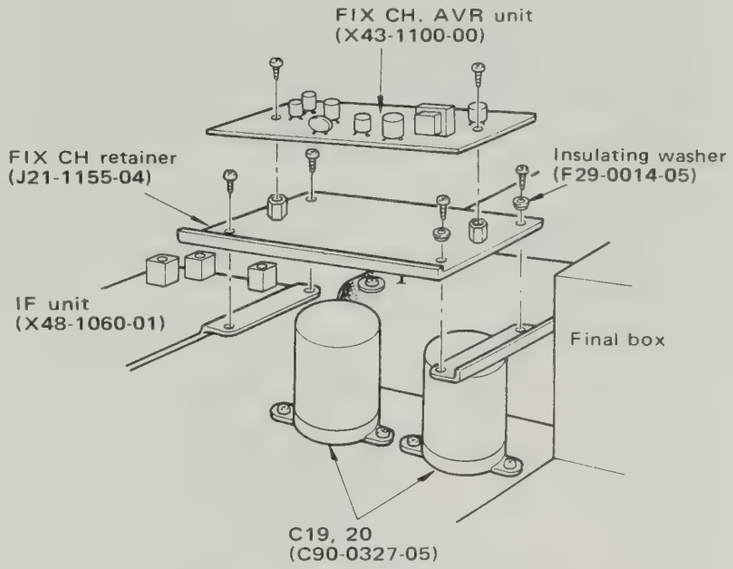
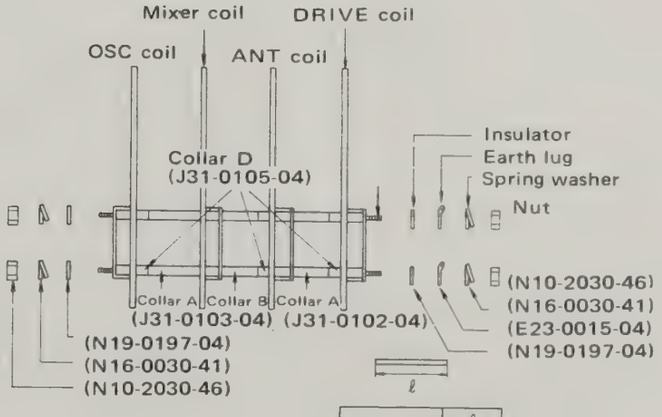


Fig. 11 Replacing C19, 20

3. DISASSEMBLY OF THE COIL PACK

When service is required on the RF board or on any of the coil boards the coil pack must be taken apart as shown in Figure 12. The assembly includes the RF board, the OSCILLATOR COIL board, the MIXER COIL board, the ANTENNA COIL board, and the DRIVER COIL board.



	ℓ
Collar A	30mm
Collar B	25mm
Collar D	10mm

Fig. 12 Coil Pack Assembly

DISASSEMBLY

1. Remove the top and bottom cover of the transceiver.
2. From the top, disconnect the lead between the square wrapping-terminal on the RF board and the COIL board to be removed.
3. Remove all of the front panel knobs and the front glass as shown in page 33.
4. Use a small hex nut driver to loosen the nuts at the front and/or back of the coil pack. The front nuts are reached through two holes in the front sub-panel on either side of the band switch. The front nuts must be loosened to remove the OSCILLATOR or MIXER COIL boards. The back nuts must be loosened to remove the ANTENNA or DRIVER coil boards.
5. The OSCILLATOR COIL board can be removed by pulling the screw bars towards the rear panel. For the other boards, pull the screw bars out towards the front panel.

4. REMOVING THE VFO SECTION

1. Remove the front panel knobs, take off the transceiver's case, remove the front glass and pull off the front panel as shown in Figure 13.
2. Remove the FIXED CHANNEL·AVR board as shown in Figure 11.
3. Unplug the VFO output coax and the 2-pin power plug from the rear of the VFO case.
4. Unscrew the four countersunk screws (two on the top and two on the bottom) which hold the VFO to the front sub-panel (See Figure 14).
5. Gently lift and pull the VFO assembly from the chassis being very careful not to damage the sub-dial. Figure 13 shows the entire assembly.

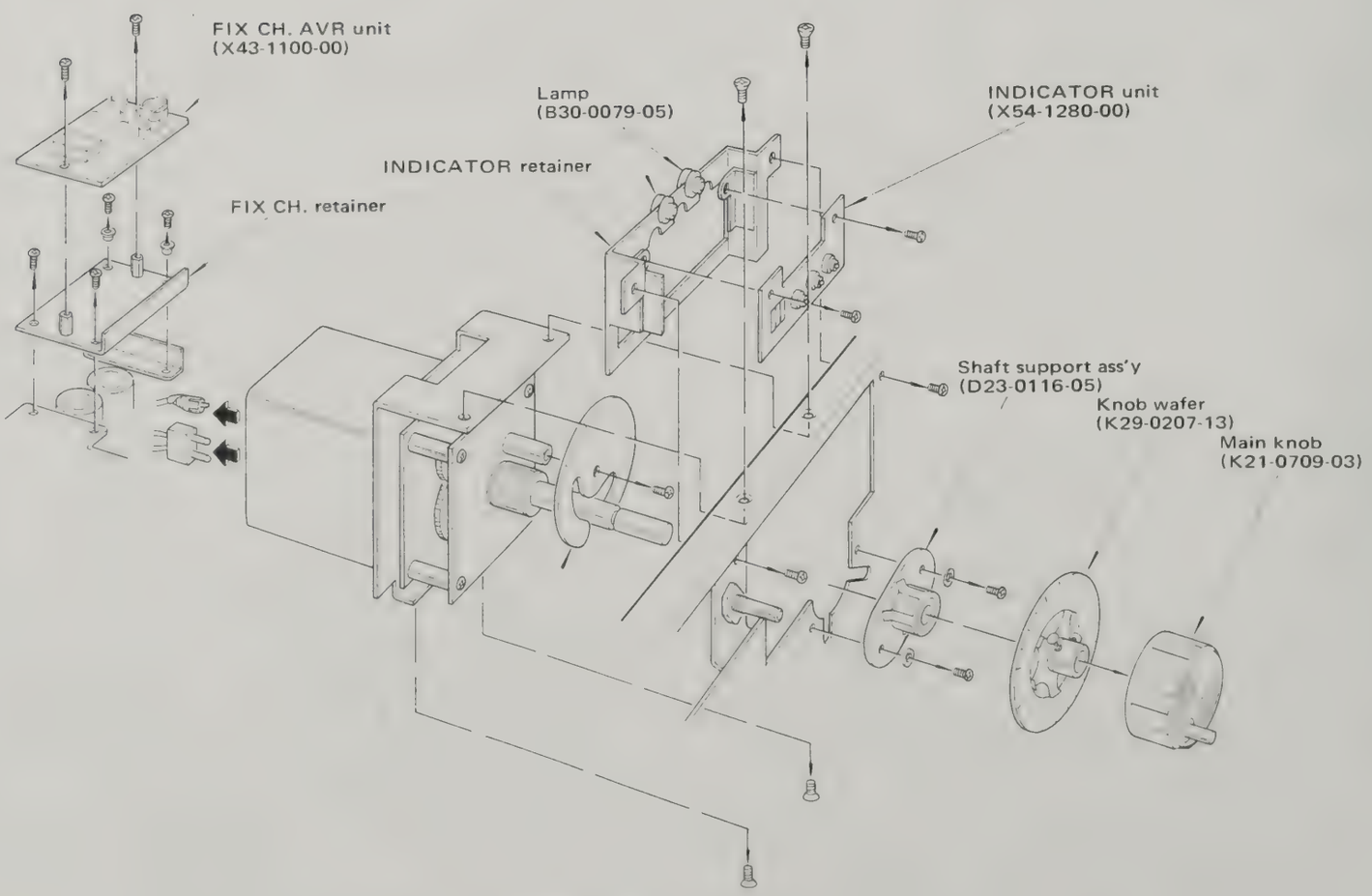


Fig. 13 Exploded View of VFO and INDICATOR Unit

DISASSEMBLY/MODIFICATION

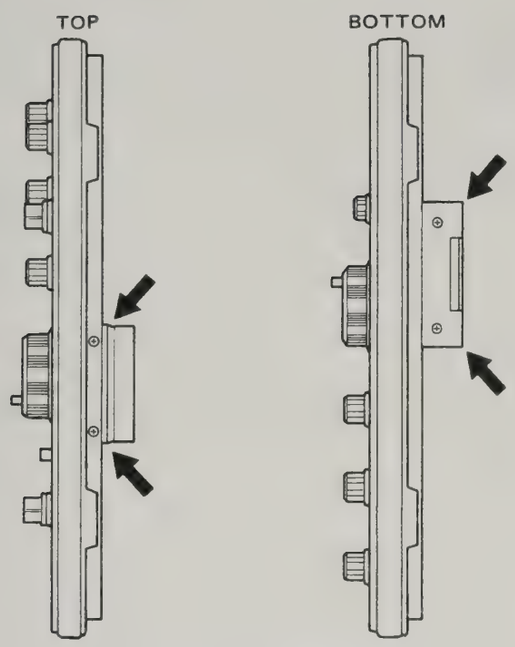


Fig. 14 VFO Retainer

5. REPLACING THE DIAL LIGHTS

1) Remove the front panel.
2) Loosen two screws of the indicator unit and lower it. See Figure 13.

6. REPLACING THE METER LIGHT

1) Loosen two screws of the meter fittings.
2) Tilt the meter backward.

7. REMOVING THE METER

1) Remove two screws of the meter retainer.
2) Remove seven screws of IF unit and tilt IF unit by 60° to VFO.
3) Tilting the meter backward, remove the meter upward.

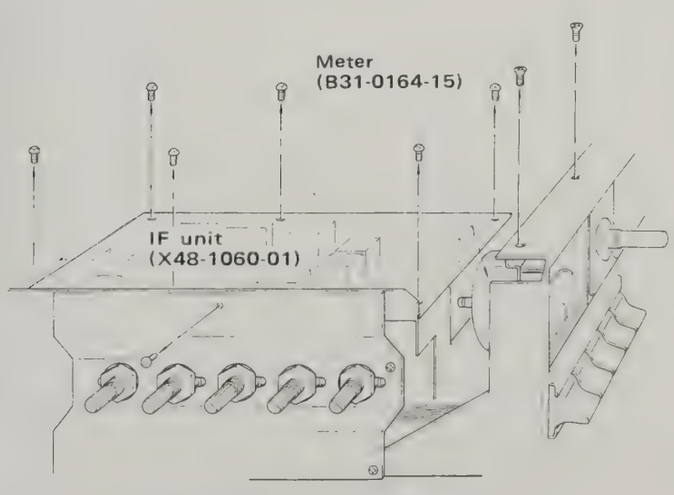


Fig. 15 Removing the Meter

8. CHANGING THE PADDLE SWITCHES

Remove the TS-520S case. Remove all the knobs from the front panel and then remove the front glass and front panel. Take out the meter, as described in Section 7. Pull the switch out towards the front of the transceiver while holding down the securing spring as shown in Figure 16.
Push in a new switch from the front. The switch will secure itself with a leaf spring. The paddle itself can be replaced by levering off the old paddle with a screwdriver. Then push on the new paddle.

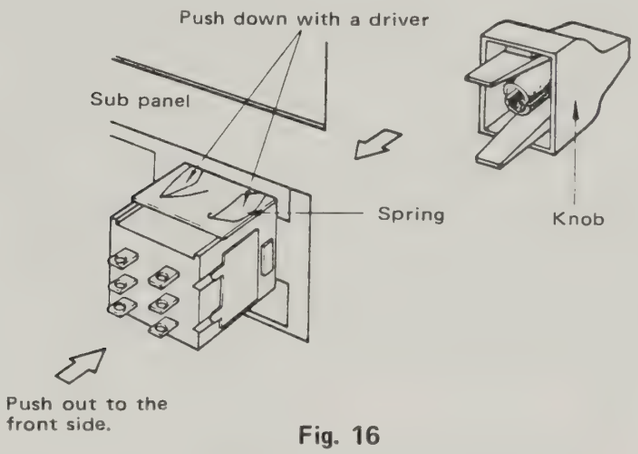


Fig. 16

MODIFICATION TO 50W

- Remove L4 (150 mH) on FINAL unit. (See Figure 17).
- SG terminal is supplied power source from FSB terminal of HV unit in all band and all mode.

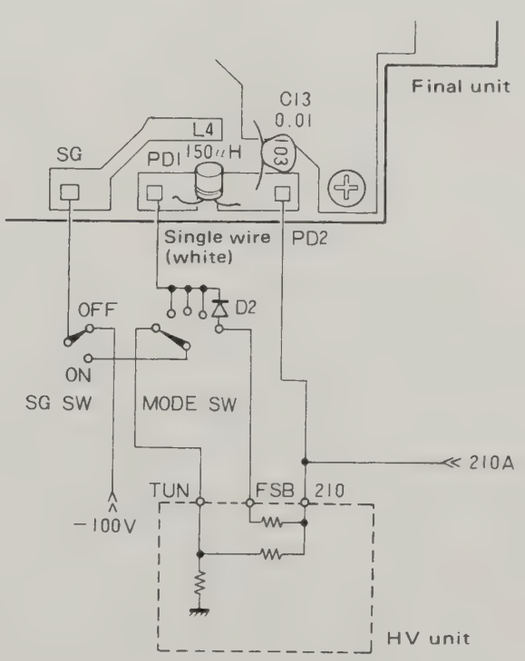
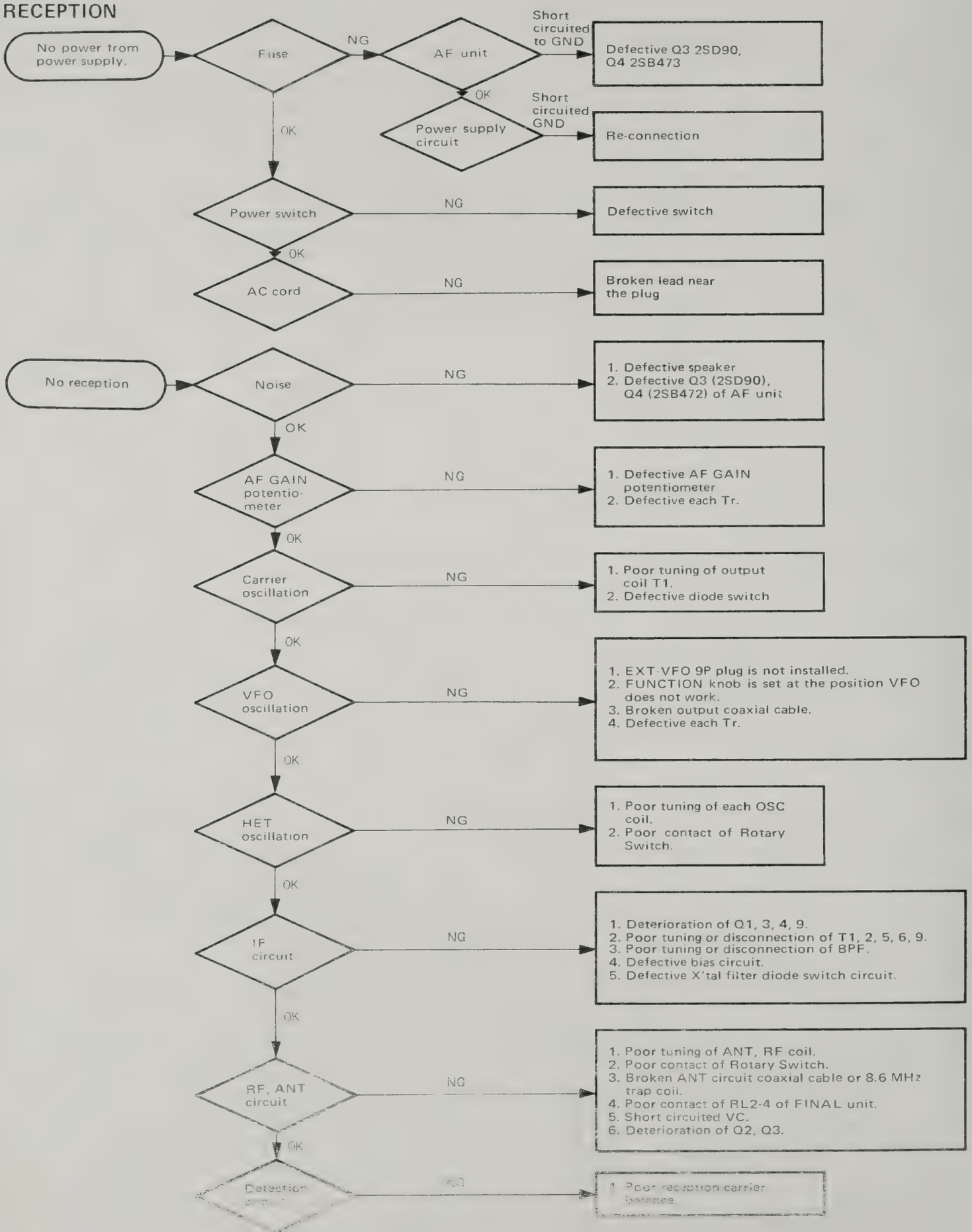


Fig. 17

TROUBLESHOOTING

RECEPTION



ADJUSTMENTS

2) ANTENNA AND MIXER COILS

Set the FUNCTION switch to VFO, remove the VTVM, and connect the signal generator to the ANTENNA connector. Turn the DRIVE control to the 12 o'clock position. Table 1 below describes the adjustment order and frequencies for this alignment. Receive the signal generator output at the designated frequency and carefully adjust the appropriate ANTENNA then MIXER coil for a maximum S-meter reading. The signal generator output should start at 60 dB and be reduced as the circuit sensitivity increases.

Adjusting order	B A N D	Adjusting frequency
1	1.8	1.9 MHz
2	28.5	28.8 MHz
3	21	21.225MHz
4	14	14.175MHz
5	7	7.15 MHz
6	3.5	3.75 MHz

Table 1

Note 1:
ADJUSTMENT order of Table 1 should be keep. If not, adjustment can't be made.
1.8 MHz ANT coil should be tuned at the point the core is placed deeply in the form.
The other coil core should be tuned at the shallow position.
Note 2:
The coil cores are fragile. Tune them carefully from straight above. Be certain to tune the correct coil for each band.

3) DRIVE COILS

Turn the H.SW switch to ON, turn the MODE switch to CW, set the METER switch to ALC, adjust the CAR control to maximum, and set the standby switch to SEND. The SG switch should be OFF whenever the sginal generator is connected to the transceiver. Adjust each coil, in the order of and at the frequencies described in Table 1, for maximum ALC deflection. Reduce the CAR control as necessary. After adjustments, Set STBY SW to REC.

Note 1:
In this adjustments, set SG SW to OFF.
Note 2:
SSG output should not be connected to ANT terminal not to damage SSG attenuator.
Note 3:
1.8 MHz ANT coil should be tuned at the point the core is placed deeply in the form.
The other coil core should be tuned at the shallow position.

6. WWV Circuit Alignment

(1) Test Equipment
1) SSG

(2) Adjustments

Insert a 15 MHz, 60 dB signal into the ANTENNA connector and push the WWV switch on. Set the main tuning dial to zero to receive thes signal. Adjust coils T4 and T5 on the RF board for a maximum S-meter reading. Reduce the signal input as necessary. Adjust coil T3 for a maximum S-meter reading.
Decrease SSG output with a rise of sensitivity.

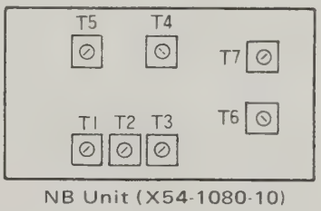
7. IFT Adjustment

(1) Test Equipment
1) SSG
2) Tester

(2) Adjustments

Insert a 40 dB signal into the transceiver and receive it on USB at 14.175 MHz. Tune IF transformers T2, T5, T6, and T9 on the IF board (X48-1060-01) for a maximum S-meter reading. Then adjust IF transformers T1 ~ 5 on the NB board (X54-1080-10) for a maximum S-meter reading. Figure 22, 23 show the coil locations.

Note:
Always repeat the adjustments several times because the coils affect each other.
Set the signal generator to 60 db and connect a voltmeter to the collector of Q6 on the NB board. Adjust NB IF coils T6 and T7 to minimize the voltage at the collector of Q6.



NB Unit (X54-1080-10)

Fig. 22

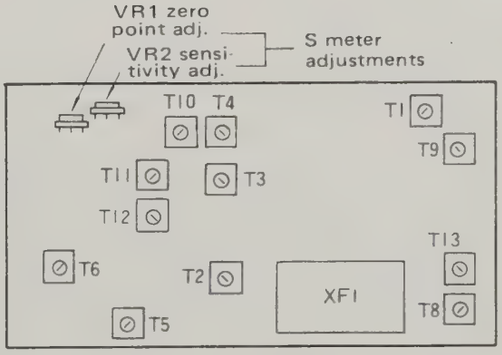


Fig. 23

ADJUSTMENTS

8. Trap Coil Adjustment

(1) Test Equipment
1) SSG
2) AF VTVM

(2) Adjustments
1) 8 MHz IF TRAP
Set the BAND switch to 7 MHz and insert an 8.895 MHz signal (70 dB) at the ANTENNA connector. Tune the receiver to 7.0 MHz and adjust T7 on the RF board (X44-1080-00) for a minimum S-meter reading.
Set the signal generator to 8.395 MHz and receive it at VFO dial "500". Adjust T6 on the RF board to minimize the S-meter reading. Repeat this adjustment two or three times each other.
2) 3.5 MHz TRAP
Turn the BAND switch to 3.5, turn the receiver to 3.7 MHz and adjust the DRIVE control for maximum sensitivity. Connect an AF VTVM and an 8 ohm dummy load to the EXT. SPEAKER jack. Insert a 3.736 MHz signal from the signal generator to the ANTENNA connector, tune it in on the VFO, and adjust trap coil T13 on the IF board for a minimum voltage reading on the AF VTVM.

9. Carrier Balance

(1) Test Equipment
1) SSG
2) AF VTVM

(2) Adjustments
Tune the TS-520S to receive the signal generator input (20 dB) at 14.175 MHz and adjust the DRIVE control for maximum sensitivity. Connect the AF VTVM and an 8 ohm dummy load to the EXT. SPEAKER jack. Adjust TC2 (on the GENERATOR board) for maximum reading on the AF VTVM.

10. S-Meter Adjustment

(1) Test Equipment
1) SSG

(2) Adjustments
Turn the RF gain control fully clockwise, receive the signal generator input at 14.175 MHz (40 dB), and tune the DRIVE control for maximum sensitivity.
With no signal, adjust VR1 on the IF board (X48-1060-01) to zero the S-meter. Then with a 40 dB signal to the ANTENNA connector at 14.175 MHz., adjust VR2 on the IF board for an S9 meter reading.

11. RIT Adjustment

(1) Test Equipment
Not used.

(2) Adjustments
1) Set the RIT control to accurate zero point.
2) Push the RIT switch on.
3) Turn the FUNCTION switch to CAL-25 kHz and receive a calibrator signal with 1 kHz beat tone.
4) Push the RIT switch off and adjust VR2 on the FIX CH. AVR unit for the same 1 kHz beat tone established with the RIT on.
Switch the RIT on and off several times to be certain that the two tones are identical.

12. Calibrator Frequency Adjustment

12-1 Frequency Counter used.

(1) Test Equipment
1) Frequency counter

(2) Adjustments
Connect a frequency counter to terminal MO of the MARKER board. Set the FUNCTION switch to CAL-25 kHz and adjust TC1 on the MARKER board for a frequency counter reading of an even 25 kHz (±2 Hz).

12-2 WWV Circuit used.

(1) Test Equipment
Not used.

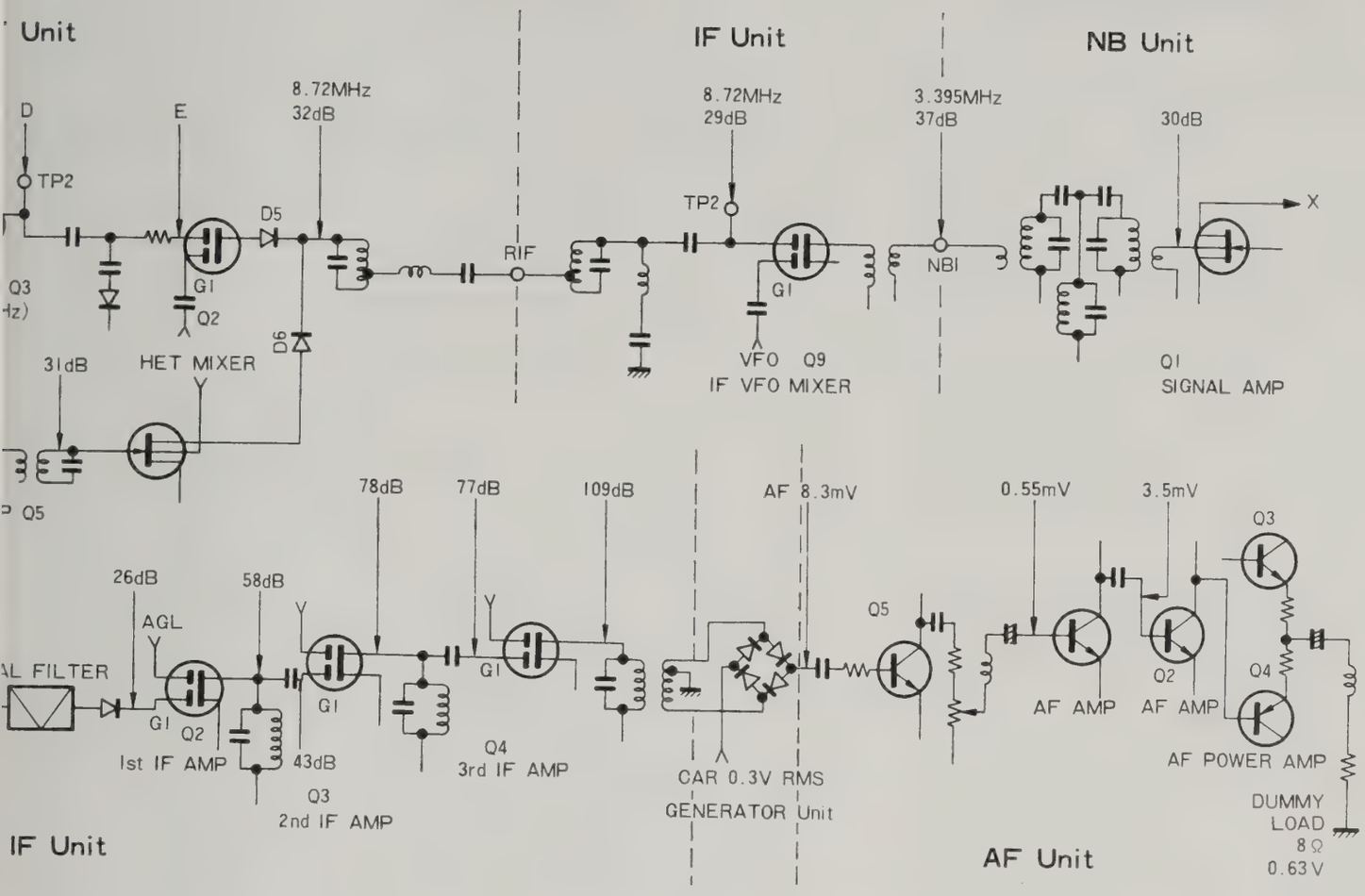
(2) Adjustments
Alternately, connect an antenna to the transceiver and receive WWV at 15 MHz. Set the FUNCTION switch to CAL-25 kHz to turn on the calibrator. Adjust TC1, as above, to bring the calibrator, and WWV into a single beat note.

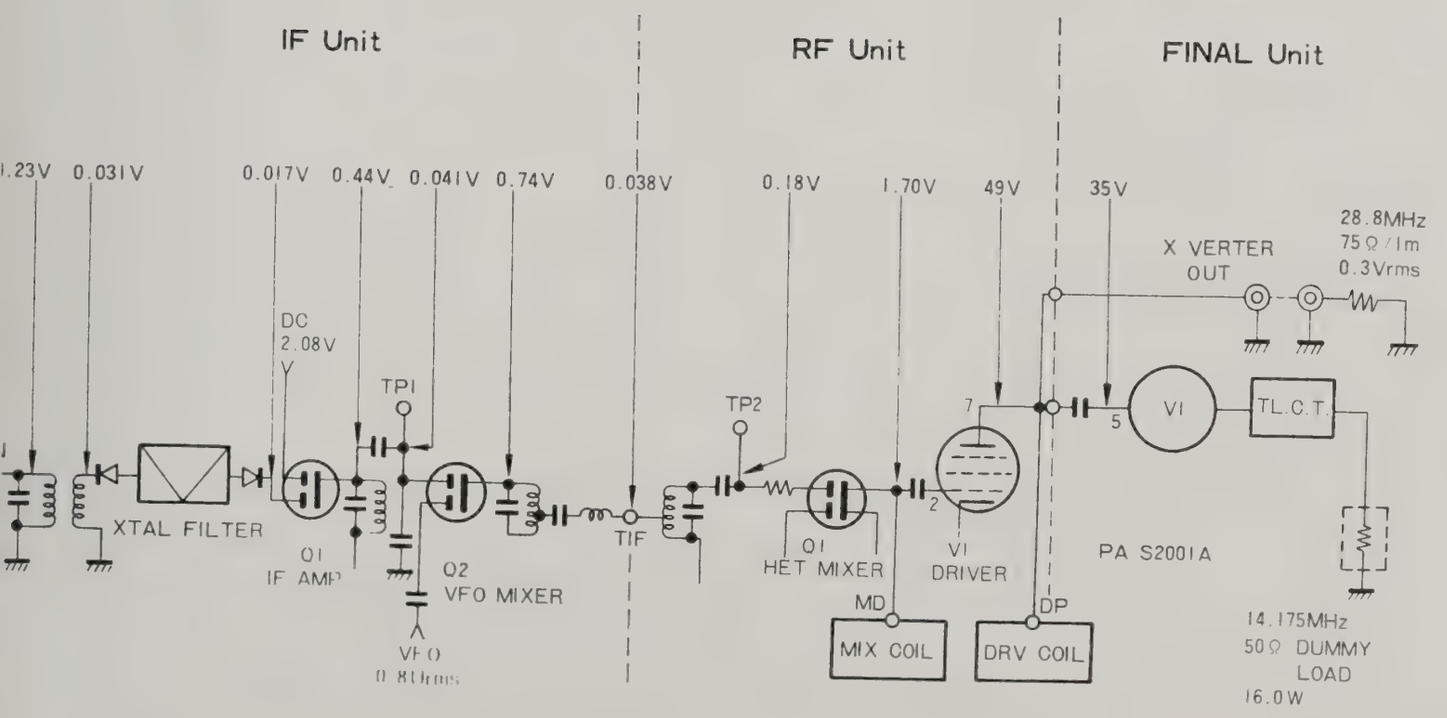
13. VFO Adjustments

(1) Test Equipment
1) RF VTVM
2) Frequency counter

(2) Adjustment
Adjustment of OSC frequency
Set the FUNCTION switch to VFO and connect a frequency counter to terminal VFO on the IF board (X48-1060-01). With the VFO tuned to zero the frequency counter should read 5.5 MHz. If the frequency is not correct, adjust TC1 (inside the VFO section) as shown in Figure 24 for a correct frequency output. Tune the VFO to the 600 marking and check that the frequency counter shows 4.9 MHz. If the frequency is incorrect, adjust L1 in the VFO section for a proper frequency. Repeat the adjustment of TC1 and L1 alternately several times to insure proper operation.

IAGRAM


Unit
IF Unit
NB Unit
D
E
TP2
8.72MHz
32dB
D5
D6
G1
Q2
RIF
8.72MHz
29dB
TP2
G1
VFO Q9
IF VFO MIXER
3.395MHz
37dB
NBI
30dB
X
Q1
SIGNAL AMP
31dB
HET MIXER
Q3
Hz)
P Q5
78dB
77dB
109dB
AF 8.3mV
0.55mV
3.5mV
Q3
26dB
58dB
AGL
AL FILTER
G1
Q2
1st IF AMP
43dB
Q3
2nd IF AMP
G1
G1
Q4
3rd IF AMP
CAR 0.3V RMS
GENERATOR Unit
Q5
AF AMP
Q2
AF AMP
Q4
AF POWER AMP
DUMMY
LOAD
8Ω
0.63V
IF Unit
AF Unit


IF Unit
RF Unit
FINAL Unit
1.23V
0.031V
0.017V
0.44V
0.041V
0.74V
0.038V
0.18V
1.70V
49V
35V
28.8MHz
75Ω/1m
0.3Vrms
X VERTER
OUT
DC
2.08V
TP1
TP2
7
5
VI
TL.C.T.
XTAL FILTER
Q1
IF AMP
Q2
VFO MIXER
VFO
0.8Vrms
TIF
Q1
HET MIXER
2
VI
DRIVER
PA S2001A
MD
MIX COIL
DP
DRV COIL
14.175MHz
50Ω DUMMY
LOAD
16.0W

ADJUSTMENTS

TEST EQUIPMENT REQUIRED

1. Voltmeter

1) Input resistance: More than 1MΩ
2) Voltage range: FS = AC/DC 1.5 to 1000V

Note:
High-precision circuit testers may be used. However, be careful since accurate reading is not obtained in high-impedance circuit measurement.

2. RF Vacuum-tube Voltmeter (RF VTVM)

1) Input impedance: More than 1MΩ , less than 20pF
2) Voltage range: FS = 10 mV to 300V
3) Measurable frequency range: More than 50 MHz

Note:
When special accuracy is not required during adjustment (such as input level or carrier oscillation output in PLL circuit), a voltmeter or circuit tester may be substituted for RF VTVM by connecting it to the output of detector as mentioned later.

3. AF Voltmeter

1) Measurable frequency: 50 Hz to 10 kHz
2) Input resistance: More than 1MΩ
3) Voltage range: FS = 10 mV to 30V

4. AF Generator (AG)

1) Frequency range: 200 Hz to 5 kHz
2) Output: Maximum 1V

Note:
The distortion factor of AF generator should be small.

5. AF Dummy Load

1) Impedance: 8Ω
2) Power: More than 3W

6. RF Dummy Load

1) Impedance: 50 to 75Ω
2) Power: Endurable against power of more than 100W
3) Applicable frequency: 1.8 to 30 MHz

The above-mentioned instruments may be used for simplified adjustment. For the precise adjustment, the following measuring instruments are additionally necessary.

7. Oscilloscope

Select equipment that has as high-sensitivity as possible and permits external synchronization.

8. Slow Sweep Generator

1) Center frequency: 8.83 MHz
2) Frequency deviation: Maximum ±5 kHz
3) Output voltage: More than 0.1V
4) Sweep rate: At least 0.5 sec/cm

9. SSG

1) Oscillation frequency: 1.9 to 30 MHz
2) Output: 0 dB/μV ~ 120 dB/μV

Note:
Select an equipment that the oscillation frequency is stable in non modulation and there are small level of frequency modulation components.

10. Frequency Counter

1) Minimum input voltage: 50 mV
2) Measurable frequency range: More than 40 MHz

11. Noise Generator

Select an equipment that generates ignition-like noise containing high harmonics up to 30 MHz or more.

12. Directional Coupler

RECEIVING SECTION

1. General

Be certain to see the operating manual for directions on removing the transceiver's case and information on the proper service position. Be certain that the air supply to the final tubes is not blocked See page 35.

(1) Initial Settings

1) Front panel

MODE	USB
FUNCTION	FIX
RF GAIN	MAX
H. SW	OFF
VOX	MAN
AGC	FAST
NB	OFF
RIT	OFF
BAND	14
STBY	REC
POWER	ON

2) Rear panel

SG SW	OFF
REC ANT	NORMAL
X VERTER	OFF

(2) Rear Panel

Connect a 8Ω dummy load to SPEAKER jack.

2. Setting of 9V Power Supply and FET Bias Voltage

(1) Test Equipment

1) Voltmeter

(2) Adjustments

Connect the voltmeter to terminal 9 on the FIX. CH-AVR board. Adjust VR1 for a voltage reading of 9 volts ±0.2 volts. Next connect the voltmeter to terminal RF 1 on the FIX. CH-AVR board. Adjust VR3 for a meter reading of 3.3 volts ±0.1 volt.

GENERAL/CIRCUIT DESCRIPTION

General

A block diagram of TS-520S is shown on page 5. The unit is composed of a transmitter and a receiver, each being of a filter type double-conversion system. The receiver has a first IF section (8.895MHz to 8.295MHz) and a second IF section(3.395MHz). The unit contains a number of advanced accessory circuits and devices, such as a speech processor, RF NFB, 1.8MHz and AUX bands, RF ATT, digital display terminal (for connection of DG-5 [option] using a single connecting cable) and phone patch terminal, in addition to other circuits which are found in conventional transceivers.

Circuit Description

Transmitter Section

The microphone signal is fed to the generator unit (refer to paragraph "Generator Unit" for operation of generator unit) and is amplified by the MIC amplifier. The signal is then converted into DSB signal of 3.395MHz and fed to the IF unit. The signal passes through the crystal filter and becomes SSB signal.

Next, the signal is mixed with VFO signal by the 1st mixer and becomes 2nd IF frequency of 8.895~8.295MHz. This signal passes through BPF and is fed to the RF unit.

The signal is then converted into transmit frequency of 1.8~28MHz by Q1 3SK41(L) and is amplified by the driver tube V1 12BY7A to a voltage large enough to drive the final tube S2001A so as to feed the transmitting power to the ANT circuit.

Receiver Section

The receive signal of 1.8~28MHz from the ANT terminal is converted into 1st IF of 8.895~8.295MHz through the RF unit and is fed to the IF unit. The signal passes through BPF of IF and is converted into a VFO frequency by Q9 so that it becomes 2nd IF frequency of 3.395MHz. The signal thus obtained passes through the NB unit and returns to the IF unit. It passes through the crystal filter, and is amplified in IF stage before being fed to the generator unit. Finally, the signal is fed to the BD (balance detect) unit where it is converted into AF signal.

The AF signal is fed to the AF unit where it is amplified by Q1~4 to drive the speaker.

1. Carrier Unit (X50–0009–01)

This circuit functions as a carrier oscillator for the generator during transmission, and as a BFO for the ring detector during reception. The oscillator circuit is of a Pierce B–E type with Q1 (2SC460B); Q2 (2SC460B) functions as a buffer amplifier to provide stabilized output.

Selection of oscillation frequencies is accomplished by a diode switch D1–D4 (1S1555 x 4).

With a forward voltage given to the diode, the internal resistance become low and an oscillator circuit is formed. Without forward voltage, the diode resistance becomes high, thus the circuit is disconnected to stop the oscillation.

The oscillation frequencies are 3396.5KHz for USB, 3393.5KHz for LSB, and 3394.3KHz (receive) and 3395.0KHz (transmit) for CW.

2. Generator Unit (X52–1090–00)

This unit is a heart of SSB transmitter, generating DSB (double side band) signals during transmission. Voice signals fed to microphone are amplified by Q3 (2SC1000GR), Q5 (2SC733Y) and Q6 (2SC733Y) and are then fed to the ring modulator circuit consisting of 4 diodes (D1–D4) so as to become DSB signals the carriers of which component is suppressed.

The signals are amplified by FET buffer amplifier Q1 and applied to the IF unit. The unwanted side band and carrier contained in DSB signals are further suppressed by the crystal filter in the IF unit to obtain SSB signals. During CW operation, DC voltage is given to the ring modulator to obtain necessary carrier output.

This unit is operated by the processor switch on the front panel. Since it has a MIC compressor circuit, the output of Q3 is further amplified by Q4 (2SC1000GR), Q8 (2SC30–0), Q9 (2SC733Y) and Q10 (2SC733Y) and is fed to Q5 through the diode switch operated by the processor switch. The output of Q10 is phase inverted by Q11(2SC945A) and rectified by a bridge rectifier consisting of 4 diodes. This signal is DC amplified by the control amplifier Q12 (2SC945R) to control the FET attenuator Q7 (2SK30–0) which utilizes pinch-off voltage.

The required time constant is obtained at the output of Q12; in practical cases, a compression of 14dB is obtained at 10mV MIC input.

The volume control for MIC gain is provided on the input side of Q5, so MIC gain can be set as desired independent of the processor switch position.

The unit also includes a receive ring demodulator and a transistor switching circuit Q2 (2SC460B) which stops the carrier to the transmit ring modulator during reception.

CIRCUIT DESCRIPTION

3. RF Unit (X44–1200–00)

Among the units contained in TS-520S, this unit has a largest number of functions. It is composed of a transmitter section, receiver section, ALC circuit and a bias control circuit.

WWV Receiving Section

WWV signal of 15MHz passes through the diode switch interlocked with the band switch and is RF amplified by FET Q5 (2SK19GR) after being stepped up by T5. This signal is then converted into the 1st IF signal of 8.895MHz by Q4 so as to be fed to the band pass filter T2. The 1st local oscillator circuit is an overtone circuit consisting of Q8 whose power source voltage is stabilized by D3.
WWV reception is acomplished by the band switch. During WWV reception, power source voltage (14V) is not applied to the transmitter 2nd mixer Q1, receiver 1st mixer Q2 and the 1st local oscillator circuit, thus stopping the transmit and receive functions.

ALC System

The ALC circuit uses 2SC1515 featuring high breakdown voltage between collector, emitter and base. ALC voltage is produced when the grid current flowing into two S2001As reaches about 30μA.
By setting the pull switch in the MIC/CAR VR unit to the NORM SSB position, ALC voltage is fed back to the preceding stage through the time constant circuit consisting of R72 and C59.

Control section

Q11 is a switching transistor to cut off the transmitter 2nd mixer Q1 at the heater switch OFF.
Normally, Q11 is cut off by the negative bias voltage (with respect to emitter) applied from –C line through a shunt resistor; however, when the DC-DC converter stops oscillation at the heater switch OFF, the base voltage of Q11 becomes zero and a forward bias(with respect to emitter) is applied, thereby the transistor turns to ON. The bias resistor of the transmitter 2nd mixer Q2 is connected to the collector of Q11 to provide negative bias to the 1st and 2nd gates, thus Q1 is cut off.
During AC or DC operation, Q1 and V1 are block biased through either D8 or D9 when the heater switch is ON, thus Q1 and V1 are set in cut-off state.

Local Oscillator Circuit

A crystal oscillator circuit generates oscillation frequency for each band. It functions as a 2nd local oscillator during transmission, and a 1st local oscillator during reception.

Crystals and oscillator coils are included in the OSC coil unit (X44–1160–00). Oscillation is effected by Q6 (2SK19GR), while Q7 (2SC460B) functions as a buffer amplifier. Non-adjustment oscillator circuit Q8 (2SC460B) is also included for WWV reception, the output of which is applied to Q4. Each local oscillator output can be taken out as output for the digital display DG-5 (option) through the buffer amplifier Q9 (2SC460B).
Drive coil Unit (X44–1190–00)
MIX Coil Unit (X44–1180–00)
ANT Coil Unit (X44–1170–00)
OSC Coil Unit (X44–1160–00)
These four coil units function in conjunction with the RF unit. Coils, heterodyne crystals and rotary switch are neatly arranged on the printed circuit board.

4. IF Unit (X48–1060–01)

This unit has important functions for both transmission and reception.
During transmission, the DSB signal from the generator unit becomes SSB signal while the unwanted side band and carrier are suppressed by the SSB crystal filter XF1. The SSB signal is amplified by the IF amplifier Q1 (3SK35GR) common to transmission and reception and is fed to the transmitter mixer Q2 (3SK35Y).
The local oscillator signal from the VFO unit is applied to G2 of Q2 while the cut-off frequency passes through the 7MHz low pass filter (T10, T11, T12). The signal is mixed wit h SSB signal at GI.
The signal converted into the 2nd IF signal by this mixer is fed to the RF unit through the band pass filter. During transmission, the receiver IF amplifier Q3 (3SK35GR), Q4(3SK35GR) and the receiver VFO mixer Q9 (3SK41L) are cut off by the negative voltage at the RB terminal.
During reception, the 1st IF signal from the RF unit is fed through the band pass filter to the VFO mixer Q9 where the signal is converted into the 2nd IF signal. This signal is fed through IFT to the NB unit, and its output is applied through XF1 to the IF amplifier Q1 common to transmission and reception, as in the case of transmission.
The signal is then amplified by the next 2-stage IF amplifier (Q3, Q4) and is fed to the ring detector of the generator unit. During reception, the transmitter VFO mixer Q2 is cut off by the negative voltage at the TBL terminal. Q5 (2SK19GR) and Q6 (2SK19GR) represent an AGC amplifier circuit. Q6 is used to select SLOW, FAST and OFF of AGC and control FR GAIN.
A diode switch circuit is provided on each of the input and output sides of the crystal filter so that the crystal filter can be switched in conjunction with the mode swi ch when CW crystal filter YG-3395C (option) is installed. During transmission, Q7 (2SK19GR) and Q8 (2SA495Y) function as an ALC circuit. They also function as an S meter circuit during reception.

CIRCUIT DESCRIPTION

5. NB (noise blanker unit) (X54–1080–10)

The NB unit is divided into 2 circuits; a signal circuit and a noise circuit.
In the signal circuit, the signal from the VFO mixer of the IF unit passes through the 3-stage IFT band pass filter and is amplified by Q1 (3SK22GR). The signal is then applied to the NBO terminal of the IF unit through the balanced type blanking gate circuit.
In the noise circuit, the noise signal amplified by Q2 (2SK19GR), Q3 (2SC460B), Q7 (2SC460B) and Q4 (2SC460B) is applied to the base of Q6 (2SC733Y) through the noise rectifier circuit consisting of D5 (IN60) and D6 (IN60). The AGC time constant circuit Q6 has no effect on pulse noise; it functions for continuous, short-cycle signals such as SSB signals.
Accordingly, Q3, Q4 and Q7 function in a state close to maximum gain for pulse noise, and function in a state of suppressed gain for continuous signals because of AGC voltage.
With the NB switch in ON position, the emitter of Q5 (2SC733Y) is earthed and a pulse noise is produced, thereby Q5 is set on ON while the collector voltage is earthed. The blanking gate diode connected to Q5 is reversely biased for a certain time by the time constant circuit consisting of C7 and R3, thus the signal line is cut off to eliminate signals without pulsive noise can be received just the same as normal signals.

6. AF Unit (X49–0008–01)

The AF unit contains a complementary connected OTL type audio frequency amplifier, semi-break-in circuit for CW operation, side tone oscillator circuit for monitoring and a detector citcuit for calibration.
Q5 (2SC733Y) serves as a preamplifier to amplify the audio signal from the ring detector. It cuts off high frequency component by C15 and C18.
The signal amplified by Q5 is further amplified by Q1 (2SC733Y) and Q2 (2SC733Y) and then power amplified by Q3 (2SD90-0) and Q4 (2SB473C, D, N).
The side tone circuit functionsonly when the MODE switch is set to CW and the key connected to the KEY terminal is pressed to ON. This circuit uses a phase-shifting type oscillator circuit to oscillate about 750Hz. During transmission, Q5 is cut off by + voltage at the RL terminal.
When the optional DC-DC unit (DS-1A) is connected and operated from DC power source, the side tone circuit does not function if the H. SW is in OFF position, because the DC-DC converter stops oscillation and, hence, the bias voltage of Q6 (2SC733Y) and the control voltage for the switching diode D3 (1S1555) are not generated. VR2 is used to set the output level of side tone.

7. VFO Unit (X40–1070–01)

Oscillation frequencies are 5.5 MHz ("0" on sub dial) to 4.9MHz ("600" on sub dial) in 600 MHz band.
The oscillator circuit is of a Clapp type with Q1 (3SK22Y) while the buffer circuit consists of Q2 (2SK19GR) to provide stable oscillation. The use of 1-stage RF filter and a Darlington connected output circuit compose of Q3 (2SC460B) and Q4 (2SC460B) also provides stabilized operation against changes in load.

8. Marker Unit (X52–0005–01)

The 1000KHz crystal oscillating element is energized by Q1 (2SC373 or 2SC458B). The oscillation frequency can be precisely adjusted by the ceramic trimmer TC1 in the collector circuit.
The output of oscillation frequency from Q1 is shaped up in terms of waveform by the diode D1 (1N60) to synchronize the self-run type multi-vibrator composed of Q2 (2SC373) and Q3 (2SC373). the self-run oscillation frequency of the multi-vibrator is about 25KHz and is precisely syncronized to 25KHz by the synchrokous signal of the crystal oscillator output.
This signal is inverted in terms of phase by Q4 (2SC373 or 2SC458B) to obtain the required output.

9. VOX Unit (X54–0001–00)

In SSB operation, voice signal from MIC amplifier is fed to the MV terminal (side tone output in the case of CW operation). The signal amplified by Q3 (2SC373) is rectified by D6 (IN60) and becomes DC signal proportional to the input signal.
When DC voltage from D6 is applied to the base of Q4 (2SC373), Q4 turns ON an; as a result the voltage at the base of Q6 (2SC373) is decreased.
When Q4 is cut off during no-signal time, the base and emitter voltages of Q5 (2SA562Y) are equal, turning Q5 to OFF, therefore, C10 is charged, through D7, with the voltage set by the DELAY VR. This turns Q4 and Q5 to ON, thereby C10 is discharged through Q5. This action is repeated which represents the hold time of VOX.
Q6 and Q7 (2SC373) form a Schmidt circuit; when Q4 is OFF, Q6 is ON and Q7 is OFF. When Q4 is ON, then Q6 is OFF and Q7 is ON, which, in turn, sets Q8 (2SA562Y) to ON to operate the standby relay.
The ANTI VOX signal from the output of AF unit is stepped up by T1 through the AV terminal and full-wave rectified by D1-D4 to cut off Q1 (2SC373).
When Q1 is OFF, C5 is charged through R4 and, at the same time, Q2 (2SC373) is turned ON, thus the base of Q4 is earthed; Q4 turns to OFF to stop the operation of VOX.

CIRCUIT DESCRIPTION/FUNCTIONAL DESCRIPTION

10. FIX CH, AVR Unit (X43–1100–00)

This unit includes a fixed channel crystal oscillator circuit, 9V AVR circuit and -6V DC-DC converter circuit. The crystal oscillator circuit Q1 (2SC460B) is a Pierce C–B circuit and its output is obtained from the Darlington type buffer circuit sonsisting of Q2 (2SC460B) and Q3 (2SC460B). TC1–TC4 are trimmers for fine adjustment of oscillation frequency.

The 9V AVR circuit supplies power to the main oscillator circuit and control circ uit. Q4 (2SA606L) is a current regulating transistor, Q5 (2SC372) and Q6 (2SC372) are error voltage amplifier transistors, and Q7 (2SC372) is a temperature compensating transistor. D3 (WZ061) is a zener diode for referencyvoltage.

A back coupling oscillator circuit is formed by Q8 (2SC735Y) and T1 to oscillate frequency of about 400Hz which is then rectified by D4-D7 (1S1555 x 4), thus a stabilied -6V power source voltage is obtained through a zener diode.

11. Rectifier Unit (X43–1090–02)

This unit contains all the rectifier circuits. In the S type transceivers, the voltage doubler rectifier circuit is for 800V, the half-wave rectifier for 300V, 200V and -C line, and the bridge type rectifier is for 14V line. In the V type transceivers, the high voltage is 400V and a bridge type rectifier is used. Others are the same as those of the S type.

12. HV Unit (X43–1110–00)

This unit contains a voltage dividing circuit for the plate voltage indication (HV) of the final stage power amplifier tube, a voltage dividing circuit to produce screen grid voltage during TUN time, and a resistor to step down (50W) the power during 28MHz band operation.

13. Indicator Unit (X54–1280–00)

Operations of FIX, VFO and RIT are indicated by light emitting diodes above the sub-dial.

14. Final unit (X56–1200–00)

Power amplifier with circuits other than π match circuit on the output side.

Functional Description

Speech Processor

In DX operation, the early model TS-520 changes ALC operation in 2 steps to delay the rising level of ALC and to shorten its release level so that the average power during SSB operation can be increased. It offers reliable operating performance, thus, being preferred by many users.

The model TS-520S has a unique speech processor which suppresses the spread of side band and yet provides reliable functions as a processor. In this speech processor, the MIC amplifier circuit has an AGC type compression amplifier. Because the time constant is relatively large, this amplifier has a sufficient compression effect with minimum distortion. It also shortens the time constant of the ALC circuit which controls the overall gain of the transmitter section. This makes it possible to increase the average power during SSB operation, without deteriorating the quality of signal due to the gain control.

The circuit is so designed that it provides compression of about 6dB (at full scale of ALC meter) at the time constant of ALC and about 20dB (at 10mV of MIC input) through the low frequency speech processor.

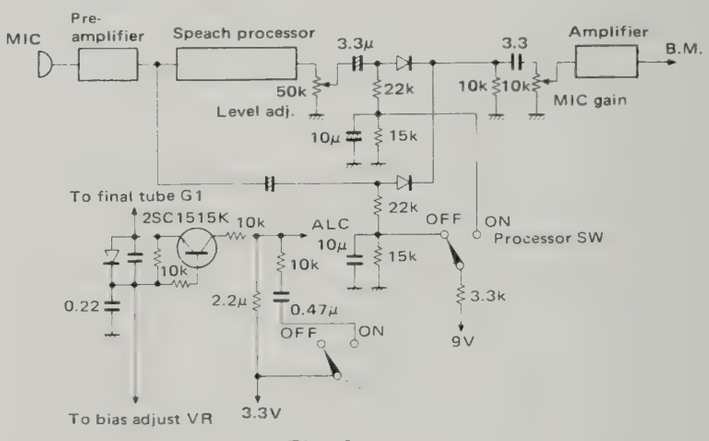


Fig. 1

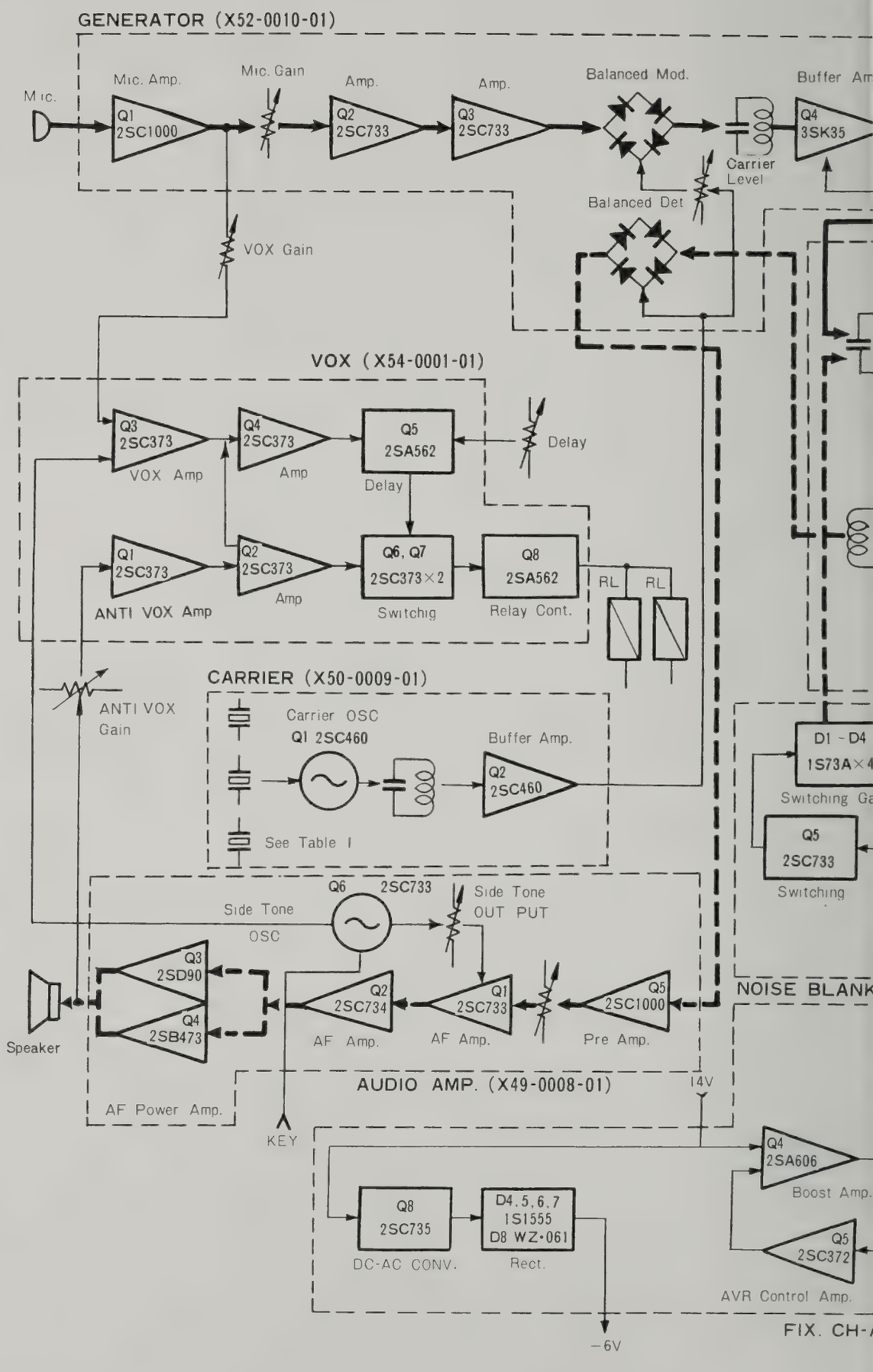
How to Use Speech Processor

Since the operating theory of the circuit is outlined in the previous paragraph, this paragraph is intended to describe operation of the speech processor in detail.

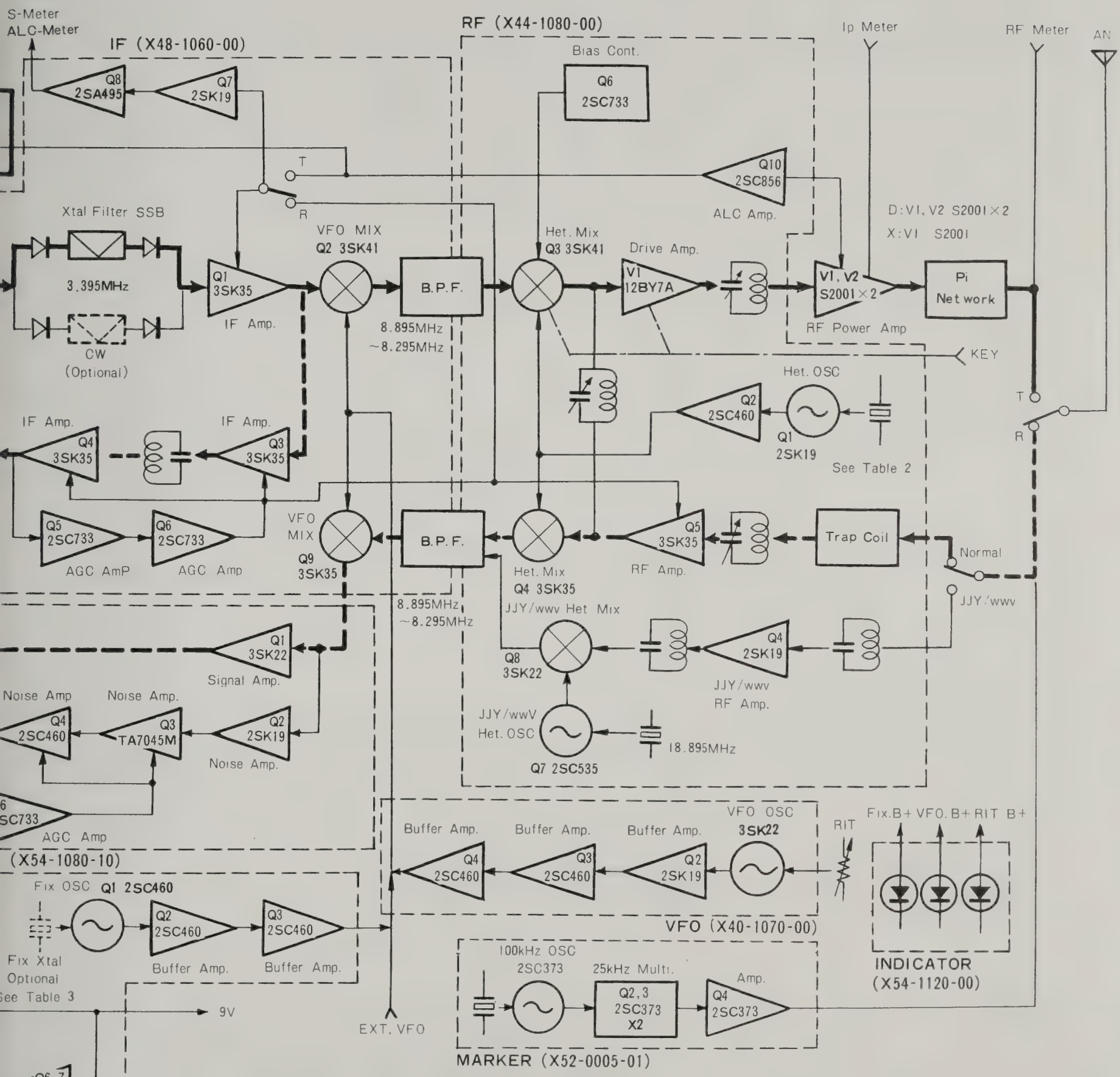
Referring to Fig. 2. , the MIC AMP input is amplified to 50mV by the MIC amplifier. The MIC amplifier output will be saturated if the input is amplified to a level exceeding this limit. As shown in Fig. 2. , the MIC amplifier output is saturated at about 70mV when the processor is set to ON. The illustration also shows that the outpouts at ON and OFF of the processor are crossed each other at 10mV of input. This means that these two outputs are equal to each other at about 70mV.

TS-520 SERIES COMPARATIVE TABLE

Item \ Type	520	520S
Final tube (S2001A) Final unit	2 –	2 (X56-1200-00)
Digital display	By installing DK-520, DG-5 (Option) can be connected.	DG-5 (Option)
1.8 MHz, AUX band	–	Built-in
RF ATT	–	Built-in
Speach processor	–	Built-in
Phone patch terminal	–	Built-in
EXT REC ANT JACK	–	Built-in


GENERATOR (X52-0010-01)
Mic.
Mic. Amp.
Q1 2SC1000
Mic. Gain
Amp.
Q2 2SC733
Amp.
Q3 2SC733
Balanced Mod.
Carrier Level
Balanced Det
Buffer Am
Q4 3SK35
VOX Gain
VOX (X54-0001-01)
Q3 2SC373
VOX Amp
Q4 2SC373
Amp
Q5 2SA562
Delay
Delay
Q1 2SC373
ANTI VOX Amp
Q2 2SC373
Amp
Q6, Q7 2SC373×2
Switchig
Q8 2SA562
Relay Cont.
RL
RL
ANTI VOX Gain
CARRIER (X50-0009-01)
Carrier OSC
Q1 2SC460
Buffer Amp.
Q2 2SC460
See Table I
D1 - D4
1S73A×4
Switching Ga
Q5 2SC733
Switching
Q6 2SC733
Side Tone OSC
Side Tone OUT PUT
Q3 2SD90
Q4 2SB473
Q2 2SC734
Q1 2SC733
Q5 2SC1000
AF Amp.
AF Amp.
Pre Amp.
Speaker
NOISE BLANK
AUDIO AMP. (X49-0008-01)
14V
AF Power Amp.
KEY
Q4 2SA606
Boost Amp.
Q8 2SC735
DC-AC CONV.
D4,5,6,7 1S1555 D8 WZ-061
Rect.
Q5 2SC372
AVR Control Amp.
FIX. CH-A
-6V

BLOCK DIAGRAM



SPECIFICATIONS

GENERAL

Frequency Range

160 meter band – 1.80 to 2.00 MHz
80 meter band – 3.50 to 4.00 MHz
40 meter band – 7.00 to 7.30 MHz
20 meter band – 14.00 to 14.35 MHz
15 meter band – 21.00 to 21.45 MHz
10 meter band – 28.00 to 28.50 MHz (A)
– 28.50 to 29.10 MHz (B)
– 29.10 to 29.70 MHz (C)
WWV – 15.0 MHz (receive only)

Mode SSB (USB, LSB) or CW

Antenna Impedance 50 ~ 75 ohms

Frequency Stability Within 100 Hz during any 30 minute period after warmup
Within ±1 kHz during the first hour after 1 minute of warmup

Tubes and Semiconductors

Tubes	3
Transistors	52
FETs	19
Diodes	100

Power Requirements

	120/220V AC 50/60 Hz operation	13.8V DC operation
Receive	45 watts (heaters on) 26 watts (heaters off)	5A (heaters on) 0.6A (heaters off)
Transmit	280 watts (maximum)	15A (maximum)

Dimensions

333 mm (13.2") wide
153 mm (5.9") high
335 mm (13.2") deep

Weight 16 kg (37.4 lbs.)

TRANSMITTER

RF Input Power

120/220V AC, 50/60 Hz operation	13.8V DC operation
200 watts PEP for SSB operation 160 watts DC for CW operation	120 watts PEP for SSB operation 90 watts DC for CW operation

Carrier Suppression Better than 40 dB
Sideband Suppression Better than 50 dB
Spurious Radiation Better than 40 dB
Microphone High impedance microphone (50 kohms)
AF Response 400 to 2,600 Hz, within –6 dB

RECEIVER

Sensitivity 0.25 μV S+N/N 10 dB or more
Selectivity
SSB – 2.4 kHz (–6 dB)
– 4.4 kHz (–60 dB)
CW* – 0.5 kHz (–6 dB)
– 1.5 kHz (–60 dB)
* (with optional CW filter installed)

Image Ratio Better than 50 dB
IF Rejection Better than 50 dB
AF Output Power 1 watt (8 ohms load, with less than 10% distortion)
AF Output Impedance 40 to 16 ohms

ADJUSTMENTS

Adjustment of Output Voltage

To adjust the VFO output, set the VFO to 300, connect an RF VTVM to terminal V on the IF board, and adjust TC2 in the VFO section for a 1.0 volt reading.

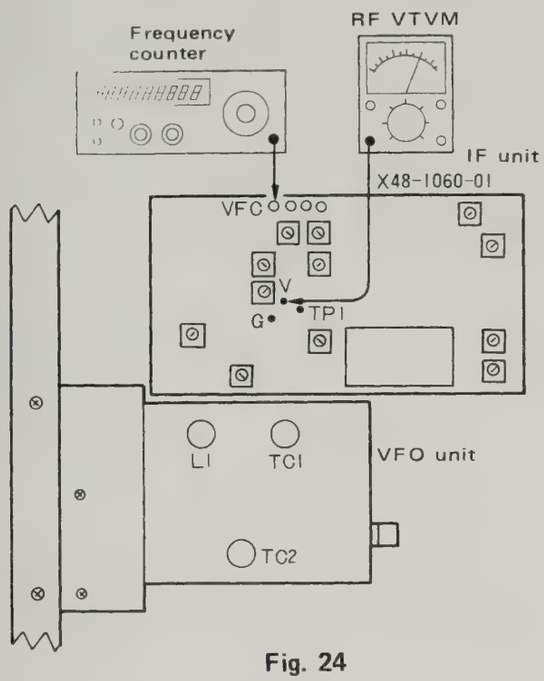


Fig. 24

TRANSMITTING SECTION

14. Final Base Current Adjustments

(1) Test Equipment

Not required.

(2) Adjustments

H · SW:	ON
MODE:	USB or LSB
MIC VR :	Full counter clockwise
Meter SW:	IP
SG. SW	ON

Set STBY SW to SEND and adjust BIAS VR (case side) for 60 mA IP. After adjustments, return STBY SW to REC.

15. IFT on Generator Unit Adjustment

(1) Test Equipment

Dummy load (more than 150W)

(2) Adjustments

Slide the SG switch to off, turn the MODE switch to CW, set the METER switch to ALC, and turn the CAR control fully clockwise. Tune the transmitter section at 14.175 MHz into the dummy load. The DRIVE control should be about 12 o'clock. Set the standby switch to SEND and adjust T1 on the GENERATOR board for a maximum ALC meter reading. Reduce the CAR control as necessary.

16. RF Meter, Power Check, and Neutralization Adjustment

(1) Test Equipment

1) Power meter (more than 150W) or dummy load
2) RF VTVM

(2) Adjustments

RF Meter

Tune the TS-520S for operation at 14.175 MHz into a dummy load through a wattmeter with the SG switch on. Set the meter switch to ALC and the CAR control to about 12 o'clock. With the MODE switch at TUN, transmit at 14.175 MHz and adjust the DRIVE control for a maximum ALC meter reading. Turn the METER switch to IP and tune the PLATE control to minimize the meter reading. Set the MODE switch to CW, turn the METER switch to RF, and tune the PLATE and LOAD controls alternately for maximum output power as indicated on the wattmeter. After the transceiver is tuned, adjust the side panel RF VOLT control for an RF meter reading of about 250 mA (on the IP scale). The RF meter position does not have a separate scale. Return the standby switch to REC.

Neutralization Circuit

Tune the TS-520S for maximum output on CW at 21.3 MHz with the SG switch on. Set the standby switch to REC and slide the SG switch off. Connect the RF VTVM to the ANTENNA connector along with the dummy load, and flip the standby switch to SEND. With an insulated tuning tool, tune TC1 in the final section for a minimum reading on the VTVM.

Tune the TS-520S now for maximum CW output with the SG switch on. Check the power output at 3.75 MHz, 7.15 MHz, 14.175 MHz, 21.225 MHz. Verify with the wattmeter on each band that the output power is more than 80W. And at 28.3 MHz, 28.8 MHz, 29.4 MHz be sure that the output power is more than 50W.

Note:

Be sure in advance that PLATE knob should be adjusted at IP dip point or max. RF meter deflection with TUN position of MODE switch.

ADJUSTMENTS

17. Balanced Modulator and Carrier Adjustment

(1) Test Equipment
1) Power meter
2) AF VTVM
3) AF generator
4) RF VTVM
5) Frequency counter

(2) Adjustments

Tune the TS-520S for maximum CW output at 14.175 MHz through the wattmeter into a dummy load. Set the MODE switch to LSB, connect an RF VTVM to the ANTENNA connector and adjust TC1 and VR1 alternately on the GENERATOR board for a minimum reading on the RF VTVM. Switch the MODE switch to USB and readjust TC1 and VR1 for an RF VTVM reading equal to the reading for LSB.

Disconnect the RF VTVM, set the MODE switch to LSB, and insert a 1500 Hz (5 mV) signal at the MIC connector. Adjust the MIC control for an output power of 50 watts. Switch the AF input to 400 Hz and, if necessary, adjust TC3 (on the CARRIER board) for an output power within 5 watts of the output for 1500 Hz. Switch the AF input to 2600 Hz and, if necessary, adjust TC3 for an output power within 5 watts of the output power for 1500 Hz.

Turn off the rear panel SG switch and connect a frequency counter to terminal OUT on the CARRIER board and set the MODE switch to CW. Set the standby switch to SEND and adjust TC1 on the CARRIER board to obtain an oscillator frequency of 3.395 MHz.

18. Sidetone Output Adjustment

(1) Test Equipment
1) AF VTVM
2) Key

(2) Adjustments

Slide the SG switch off and connect the key to the TS-520S. Set the MODE switch to CW and the AF gain control to about 12 o'clock. Connect the AF VTVM to the EXT. SPEAKER jack, key the transceiver, and adjust VR2 on the AF board for a reading of about 50 mW (0.63 V/8 ohms).

19. Processor Adjustments

(1) Test Equipment
1) AF VTVM
2) AG

(2) Adjustments

Connect AF VTVM to MAO terminal of GENERATOR unit. Apply 10 mV, 1 kHz AG signal to MIC terminal with processor SW off. Turn PROCESSOR SW on and adjust VR3 of GENERATOR unit to obtain same output level with that in PROCESSOR off.

Hold PROCESSOR SW turn on. Decreasing AG output to 1 mV (−20 dB), adjust VR2 for −6 dB output at MAO terminal.

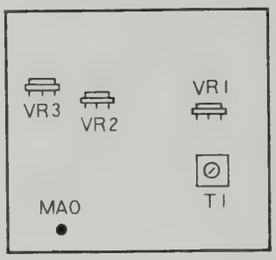


Fig. 25 GENERATOR Unit (X52-1090-00)

ADJUSTMENTS

3. Band Pass Filter Adjustment

(1) Test Equipment

1) Sweep generator (Marker frequency 8.295 MHz, 8.595 MHz, 8.895 MHz required.)
2) Detector (See Fig. 19.)
3) Oscilloscope

(2) Adjustment

1) B.P.F. for reception

See Figure 18 for the test setup. After all of the connections described in Figure 18 have been made for the receiver adjustment, tune T2, T3 on the RF board, and T8 on the IF board for the waveform shown in Figure 20.

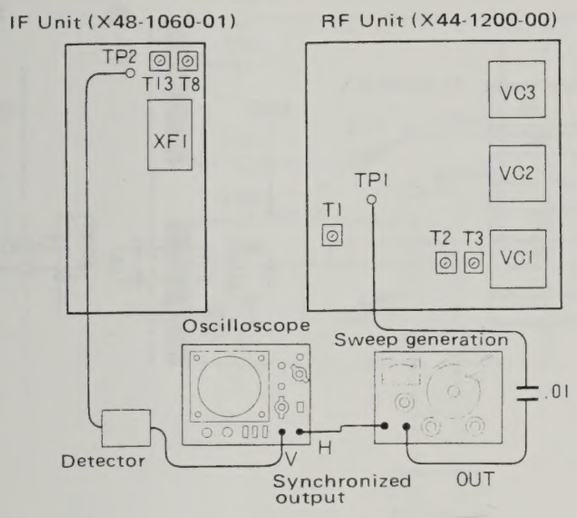


Fig. 18 B.P.F. for Reception

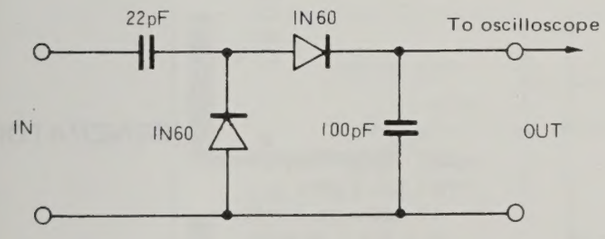


Fig. 19 Detector

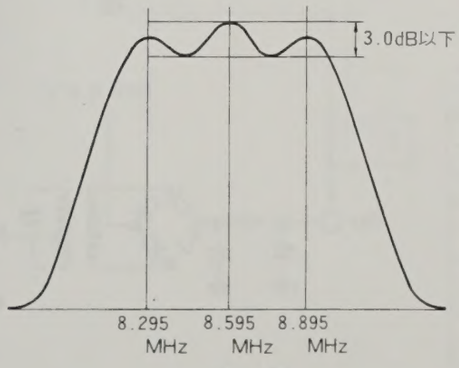


Fig. 20

2) B.P.F. for transmission

Now make the connections for transmission as shown in Figure 21. Set the standby switch to SEND and adjust T3 and T4 on the IF board and T1 on the RF board for the waveform shown in Figure 20. Return the standby switch to REC.

Note:
The FUNCTION switch is set to the FIX position to turn off the VFO. However, if an option crystal is installed in the fixed channel oscillator, the waveform may be disturbed.

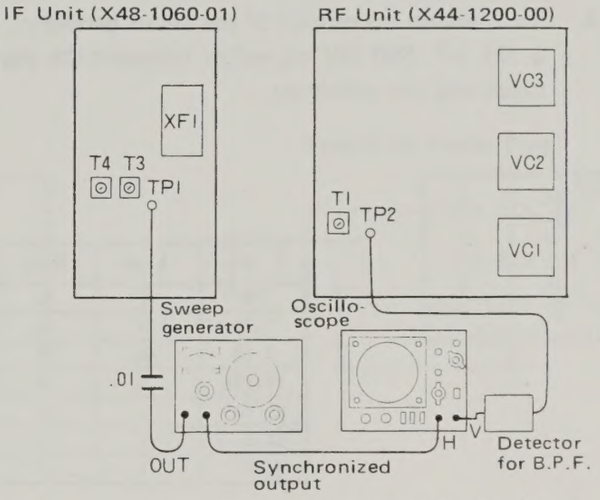


Fig. 21 B.P.F. for TRANSMISSION

4. Carrier Board Adjustment

(1) Test Equipment

1) RF VTVM

(2) Adjustment

Connect the VTVM to terminal OUT on the CARRIER board. Set the FUNCTION switch to VFO and adjust T1 on the CARRIER board for a maximum voltage at the output.

Note:
The carrier can not be adjusted when the FUNCTION switch is turned to CAL-FIX or CAL-RMT.

5. Coil Pack Alignment

(1) Test Equipment

1) RF VTVM
2) SSG
3) AF VTVM

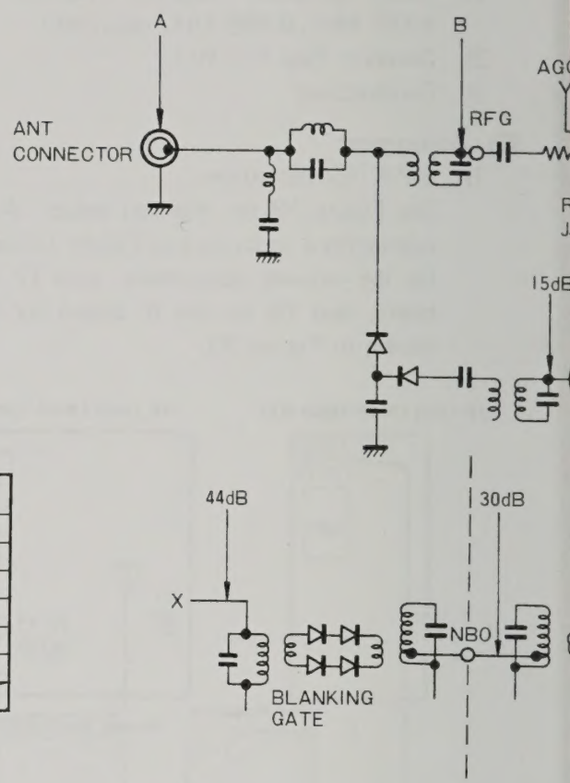
(2) Adjustment

1) HETERODYNE OSCILLATOR COILS

Connect the RF VTVM to terminal TP3 on the RF board. For the 1.8 MHz band adjust the 1.8 MHz oscillator coil for a maximum reading on the VTVM. Then turn the core counterclockwise for a voltage reading 1 db lower than the maximum. Repeat the same procedure for the 3.5, 7, 14, 21, and 28.5 MHz bands.

RECEIVER SECTION

1. The right Figure shows a curve formed by plotting the signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF gain control for a .63v/8 ohm audio output for a 0 db signal generator input at 14.175 MHz.
2. Measure the AF output at the ring detector on the GENERATOR board.
3. All voltage measurements are read from an RF VTVM.
4. To measure the output of the signal generator, connect a .01 μF, 500 WV capacitor between the signal generator and the voltmeter.

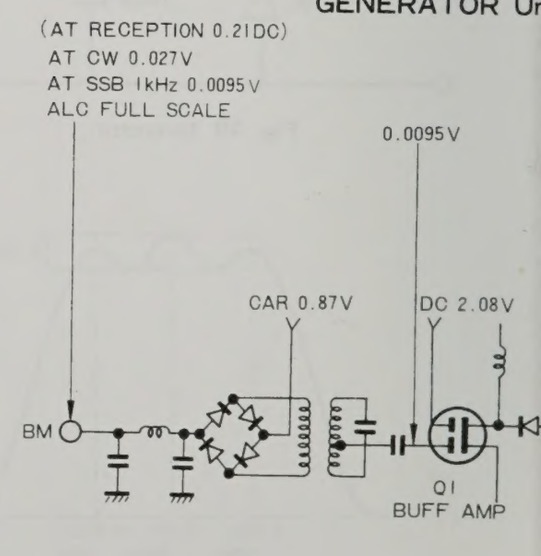


f MHz	A dB	B dB	C dB	D dB	E dB
1.8	-2	13	13	40	28
3.75	0	16	16	42	31
7.15	0	19	18	41	31
14.175	0	18	17	41	30
21.225	1	17	17	40	29
28.8	-1	13	13	34	27
JJY	1				

TRANSMITTER SECTION

1. The voltage measurements in the right figure are measured with an RF VTVM having an input capacitance of less than 3 pF.
2. All the voltages at and before the first gird of the final tubes are measured with the rear panel SG switch turned off.

GENERATOR Ur

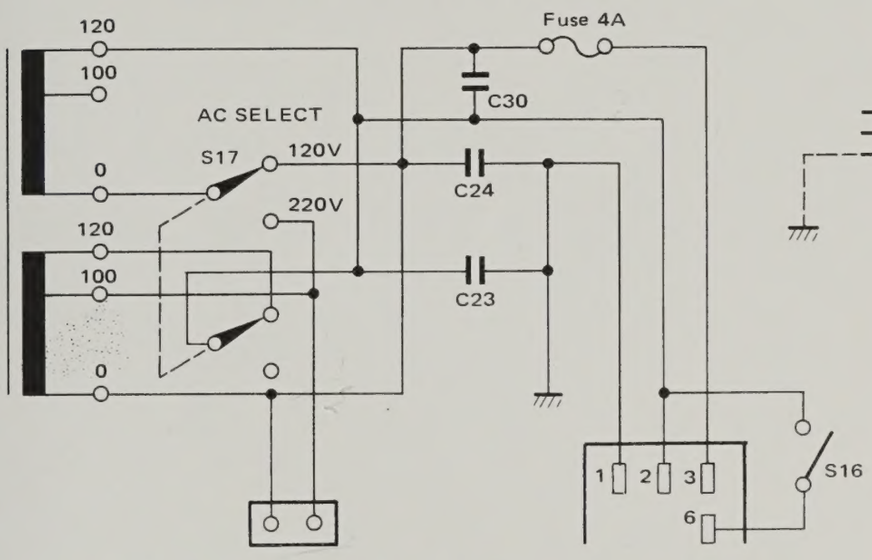


HET LEVEL (TP3)

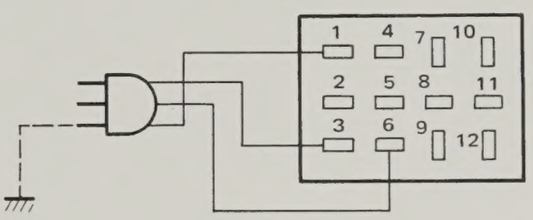
BAND	(V)
1.8	1.65
3.5	1.40
7	1.45
14	1.35
21	1.45
28	1.30
28.5	1.35
29.1	1.40
JJY	0.17

Item \ Destination		K type (U.S.A.)	T type (Britain)	W type (Europe)
Fuse	Installation	6 A	4 A	4 A
	Supplied	4 A	6 A	6 A
Mark on carton case		K mark	T mark	W mark
Factory setting of power source selection		120V	240V	220V
Brand		KENWOOD	TRIO	KENWOOD

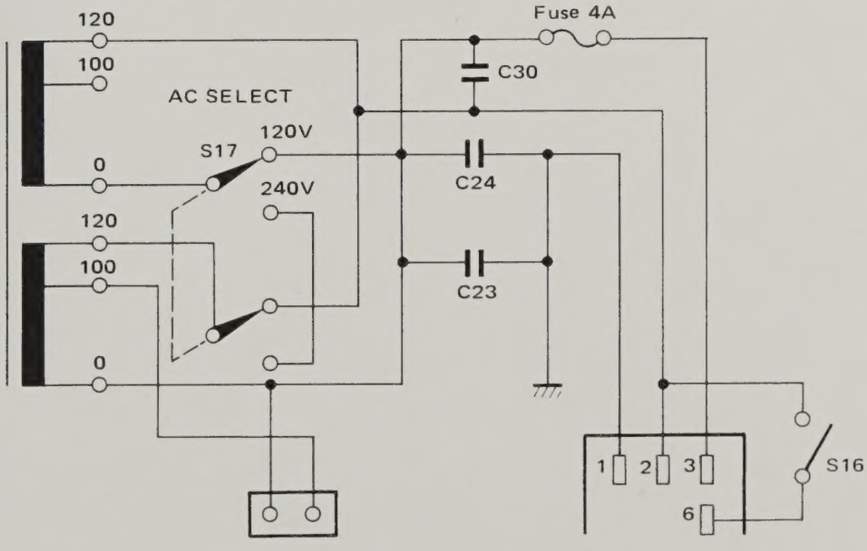
W Type Power Transformer (Y54-1290-61)



3-phase AC Power Cord



T Type Power Transformer (Y54-1290-51)



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