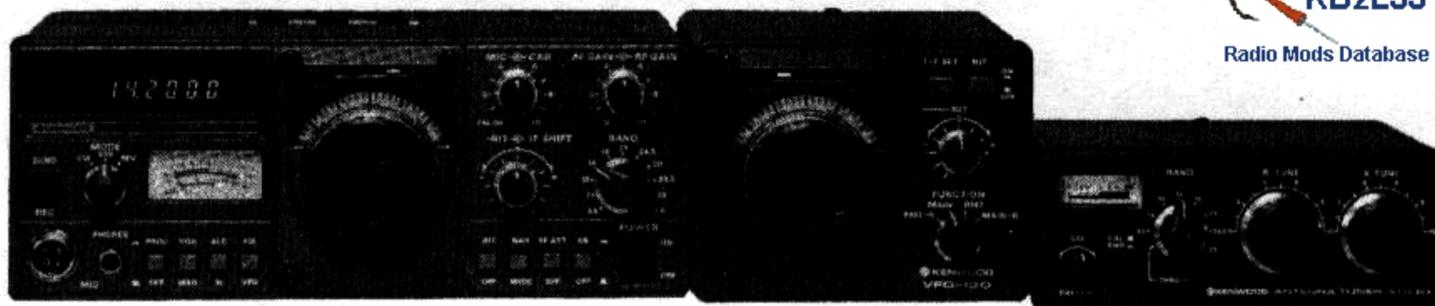




SERVICE MANUAL

TS-130S,V/VFO-120/AT-130

HF SSB TRANSCEIVER



TS-130 S

VFO-120

AT-130

KB2LJJ
Radio Mods Database

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A product of
TRIO-KENWOOD CORPORATION
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SPECIFICATIONS

[GENERAL]

Frequency Range:

80 meter band	3.5 ~ 4.0 MHz
40 meter band	7.0 ~ 7.3 MHz
*30 meter band	10.1 ~ 10.15 MHz (10.0 MHz Receiving only)
20 meter band	14.0 ~ 14.35 MHz
*17 meter band	18.068 ~ 18.168 MHz
15 meter band	21.0 ~ 21.45 MHz
*12 meter band	24.89 ~ 24.99 MHz
10 meter band	28.0 ~ 29.7 MHz

Mode: SSB/CW

Power Requirement:

TS-130S	TS-130V
RX: 0.7A 13.8V DC TX: 18A 13.8V DC	RX: 0.7A 13.8V DC TX: 4A 13.8V DC

Dimensions:

TS-130S	TS-130V
241 (9.6) W x 94 (3.8) H x 293 (11.7) D mm (inch)	241 (9.6) W x 94 (3.8) H x 235 (9.4) D mm (inch)

Weight:

TS-130S	TS-130V
5.6 kg (12.4 lbs)	4.9 kg (10.8 lbs)

[TRANSMITTER]

Final Power Input:

TS-130S	TS-130V
80 – 15 meter band 200 W PEP for SSB operation 160 W DC for CW operation	25W PEP for SSB operation 20W DC for CW operation
10 meter band 160 W PEP for SSB operation 140 W DC for CW operation	25W PEP for SSB operation 20W DC for CW operation

Audio Input Impedance: 500Ω ~ 50 kΩ
RF Output Impedance: 50Ω
Frequency Stability: Within ± 1 kHz during the first hour after 1 minute of warmup
 Within 100 Hz during any 30-minute period after warmup
Carrier Suppression: Better than 40 dB
Sideband Suppression: Better than 50 dB
Spurious Radiation: Better than 40 dB
Harmonic Radiation: Better than 40 dB

[RECEIVER]

Receiver Sensitivity: 0.25μV at 10 dB S + N/N
Image Ratio: Better than 50 dB
IF Rejection: Better than 70 dB
Receiver Selectivity:
 SSB/CW WIDE 2.4 kHz (– 6 dB), 4.2 kHz (– 60 dB)
 SSB NARROW 1.8 kHz (– 6 dB), 3.3 kHz (– 60 dB) with optional YK-88SN filter
 CW NARROW 500 Hz (– 6 dB), 1.5 kHz (– 60 dB) with optional YK-88C filter
 270 Hz (– 6 dB), 1.1 kHz (– 60 dB) with optional YK-88CN filter
Audio Output Impedance: 4 ~ 16Ω
Audio Output: 1.5 W

NOTE: Circuit and ratings may change without notice due to developments in technology.

* Will transmit on the new 30, 17, and 12 meter bands. Diodes installed for preventing accidental transmission before government amateur authorization.

CIRCUIT DESCRIPTION

Features added from former TS-120S,V are as follows;

1. The three new HF bands (receive only).

Band	Receive frequency
10	10.0~10.25MHz
18	18.0~18.5MHz
24.5	24.5~25.0MHz

(Note) Receives WWV on 10MHz.

2. 20dB RF attenuator

3. 2-position selectivity (receive only).

- 1) Optional filters available.

Optional filter	-6dB bandwidth
YK-88SN SSB narrow filter	1.8kHz
YK-88C CW filter	500Hz
YK-88CN CW narrow filter	270Hz

(Note) YK-88S (-6 dB bandwidth:2.4kHz) is installed at the factory.

- 2) -6dB bandwidth with various optional filters.

No.	MODE Filter	CW		SSB	
		WIDE	NARROW	WIDE	NARROW
1)	YK-88S only (installed at factory)	2.4kHz	*	2.4kHz	*
2)	YK-88C or YK-88CN	2.4kHz	500Hz or 270Hz	2.4kHz	*
3)	YK-88SN	2.4kHz	1.8kHz	2.4kHz	1.8kHz
4)	YK-88C or YK-88CN, YK-88SN	2.4kHz	500Hz or 270Hz	2.4kHz	1.8kHz

- (Note) 1. *: No receive.
 2. Jumper wire on the IF unit should be changed in No. 2 and No.4 Position.
 3. YK-88S is always used in transmit.

5. AGC-type speech processor

Item	Rating
Center frequency fo	8830kHz
Center frequency deviation	8830kHz ±150Hz at 6dB
6dB bandwidth	±900Hz or more
60dB bandwidth	±1800Hz or less
Guaranteed attenuation	80dB or more within fo ±2.5kHz to ±1MHz
Ripple	2dB or less
Loss	3dB ±2dB
Input and output impedance	600Ω/15pF

Table 1. SSB crystal filter (L71-0220-05)
YK-88SN (Option)

Item	Rating
Center frequency fo	8830.7kHz
Center frequency deviation	fo ±150Hz at 6dB
6dB bandwidth	±250Hz or more
60dB bandwidth	±900Hz or less
Ripple	2dB or less
Loss	6dB ±2dB
Guaranteed attenuation	80dB or more within fo ±2kHz to ±1MHz
Input and output impedance	600Ω/15pF

Table 2. CW crystal filter (L71-0211-05)
YK-88C (Option)

Item	Rating
Center frequency fo	8830.7kHz
Center frequency deviation	fo ±50Hz at 6dB
6dB bandwidth	±125Hz or more
60dB bandwidth	±600Hz or less
Ripple	2dB or less
Loss	8dB ±2dB
Guaranteed attenuation	80dB or more within fo ±2kHz to ±1MHz
Input and output impedance	600Ω/15pF

Table 3. CW crystal filter (L71-0221-05)
YK-88CN (Option)

CIRCUIT DESCRIPTION

The programmable divider converts the information from the band switch into a BCD signal in the counter. By presetting, the signal is divided at the ratio shown in Table 4. The phase comparator is a Motorola MC4044P. The loop filter amplifier, component transistors, minimizes unwanted spurious signal. If output of the phase comparator unlocks for any reason, VCO output is switched off to prevent out of band emission and, simultaneously the digital display blanks

CAR OSCILLATOR

The CAR oscillator contains one oscillator and two crystals for LSB, USB and CW operation. The oscillator frequency in each mode is listed in Fig. 1. Oscillator frequency can be varied by the IF SHIFT control during reception.

VFO OSCILLATOR

The TS-130 VFO has same circuit and gear ass'y as the VFO-830. An LED indicator for VFO and FIX operation has been added.

DIGITAL COUNTER

The TS-130 digital counter employs a VFO frequency counting system as shown in Fig.3.

The VFO frequency is mixed with a 5MHz signal obtained from the reference oscillator chain by a 3SK73 (Q7) and is converted to a 0.5MHz to 1MHz signal. This signal passes through the LPF, is amplified, buffered and shaped into a square wave, passes through the 0.1 second gate circuit and is applied to the 7-digit counter. The signal is counted from 10Hz to 10MHz.

The 100kHz, 1MHz and 10MHz order digits are preset by diode matrix operating on bandswitch information.

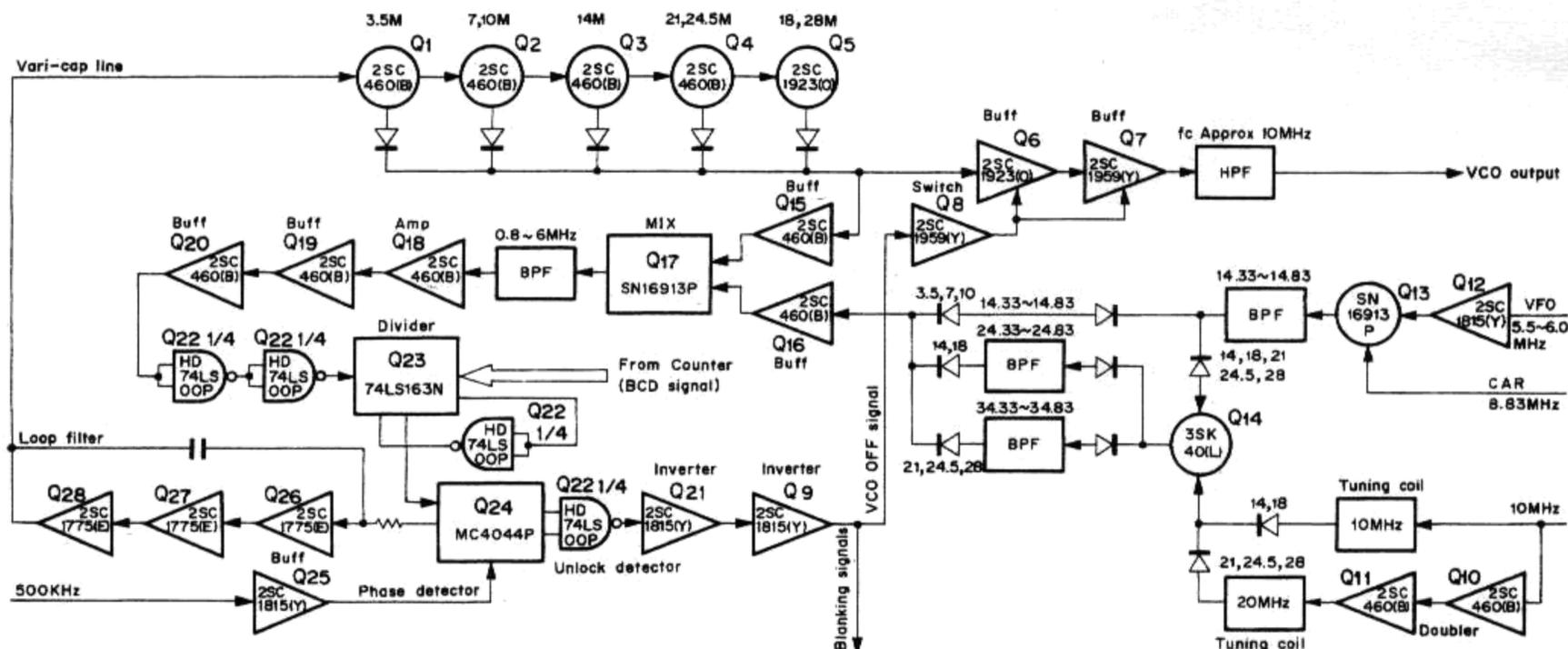


Fig. 2 TS-130 PLL circuit configuration

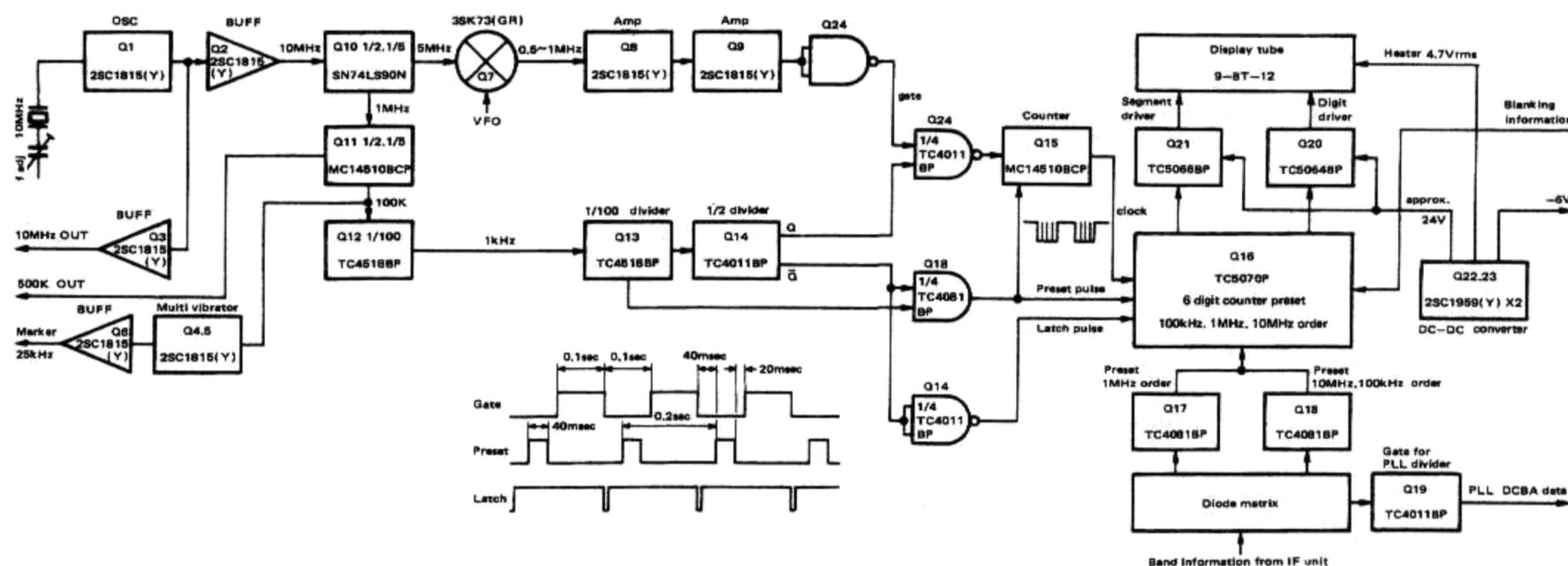


Fig. 3 TS-130 Counter unit block diagram

CIRCUIT DESCRIPTION/SPECIAL COMPONENTS DATA

The 10MHz signal from the time-base reference oscillator is divided to produce gate, latch, and reset pulses which are fed to the counter. The 10 MHz and 500kHz signals are fed to the PLL circuit.

The marker circuit produces a 100kHz signal which synchronizes the 25kHz multivibrator to obtain a marker signal as accurate as the reference frequency. The analog dial can be accurately calibrated to the marker signal.

The 1/10 division at the first-stage count-down chain uses low-power Schottky TTL, while the remaining divisions are made by a CMOS IC for low power consumption and minimum spurious emission.

Because of the IF SHIFT circuit, the CAR frequency is independent of the transmit/receive frequency. Once the VFO frequency is counted, the operating frequency is indicated as accurately as the 10 MHz reference oscillator frequency is calibrated to WWV. Operating frequency is indicated accurate to the 100Hz order, regardless of the band or mode.

PROTECTION CIRCUIT

When the transmit output load varies, the toroid in the final circuit samples reflected power. It is then rectified and amplified, producing a protection voltage to control the 2SK19 (Q12) on the AF-GEN unit, so transmitter output is continuously reduced.

FILTER UNIT

1. ALC: Protection circuit (VSWR)

The protection voltage picked up by L18 (S type), L11 (V type) in the filter unit is amplified by Q1 (S type), Q2 (V type) (2SC1815), then applied to the ALC line to control the output voltage.

2. Fan drive circuit (S type)

The output of the thermistor TH3 detecting the temperature of the final unit is applied to Q6 (2SA562) via Q7 and Q8, so that Q6 is switched to operate the fan. The fan starts to rotate at about 45°C although the operating range shown in specification is 30~60°C. It stops when the temperature drops to a level 5~15°C lower than the start temperature. This circuit operates regardless of transmission or reception because it detects the temperature of the heat sink.

3. AVR circuit

The 11V AVR consists of Q4, Q5 and Q6 (V type), Q4, Q5 and Q10 (S type). The regulated voltage is supplied to every unit except for the fan drive circuit during transmission. The fan drive circuit is always supplied with the regulated voltage regardless of transmission or reception.

4. Filter circuit

The filter is a 2-stage constant K filter (3-stage for 3.5 MHz band). When the processor switch is ON Q1 (V type) or Q11 (S type) is cut off to shorten the ALC time constant.

FINAL UNIT

1. Temperature protection (S type)

1. Core temperature protection

operates when the output transformer temperature exceeds 120°C. It recovers at approx. 80 to 110°C.

2. Operates when the heat sink temperature exceeds 90°C. It recovers at approx. 50 to 80°C.

When either of the above protection systems operate, the RL circuit in the AF-GEN unit is turned OFF and the unit is forcibly placed in the reception mode and transmission is inhibited. The protection circuit automatically recovers when the temperature drops to the normal level (i.e., the temperature drops by about 40°C).

2. Temperature detection by the fan drive circuit (S type)

The heat sink temperature is detected by the thermistor TH3 to control fan operation.

SPECIAL COMPONENTS DATA

• Applications

2SC2290(V03-2290-06) HF power amplifier for S type.

NPN Epitaxial planar Si transistor

• Absolute maximum ratings

Item	Pc	Vcbo	Vces	Vebo	Ic	Ie	Tstg
Value	175(W)	45(V)	45(V)	4.0(V)	20(A)	-20(A)	-65~175(°C)
	(Tc=25°C)						

• Application

2SC2509 (V03-2509-06) HF power amplifier for S,V type.

NPN Epitaxial planar Si transistor

• Absolute maximum ratings

Item	Pc	Vcbo	Vces	Vceo	Vebo	Ic	Ie	Tstg
Value	20(W)	40(V)	40(V)	18(V)	4(V)	5(A)	-5(A)	-55~150(°C)
	(Tc=25°C)							

• Application

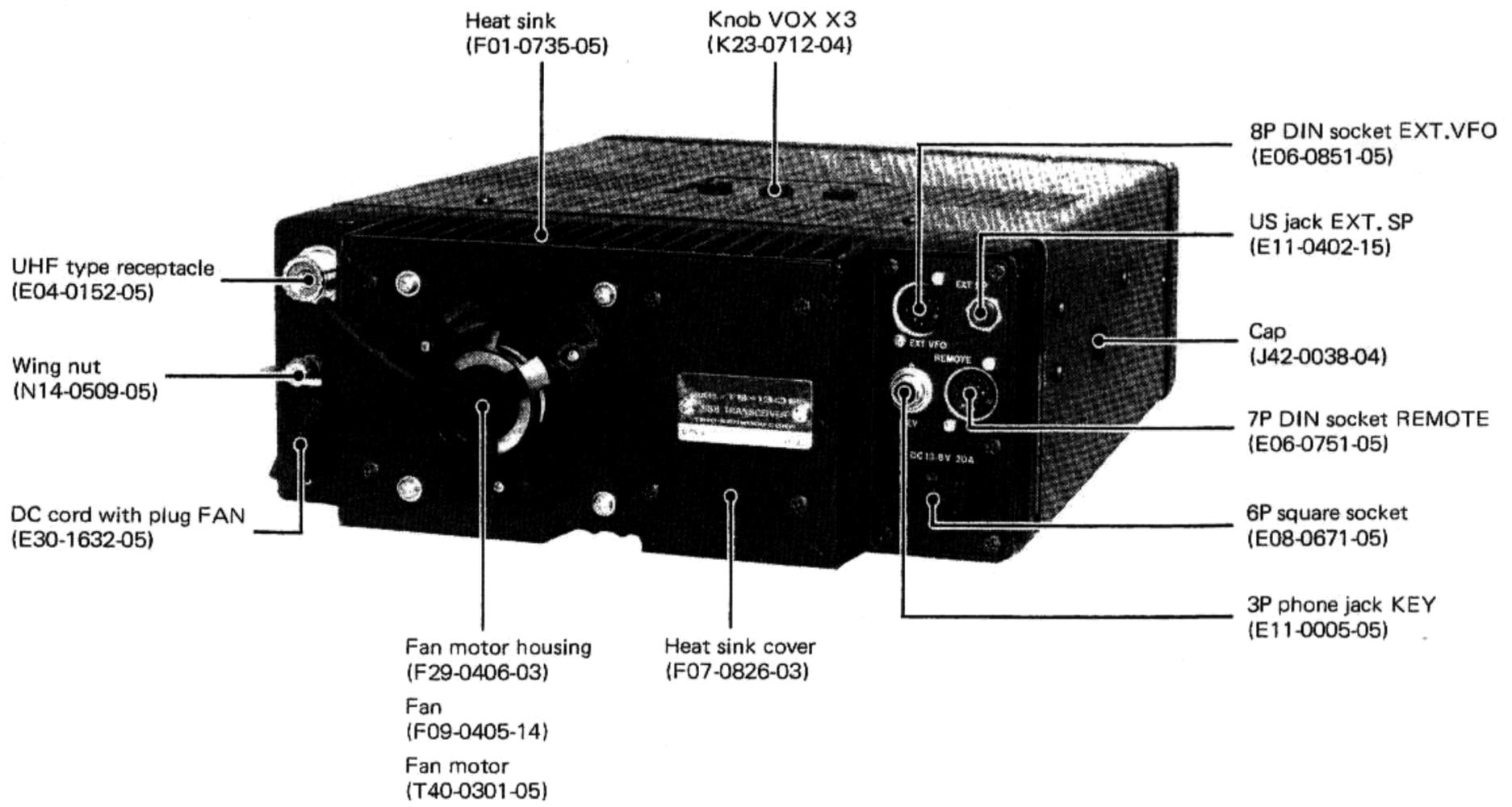
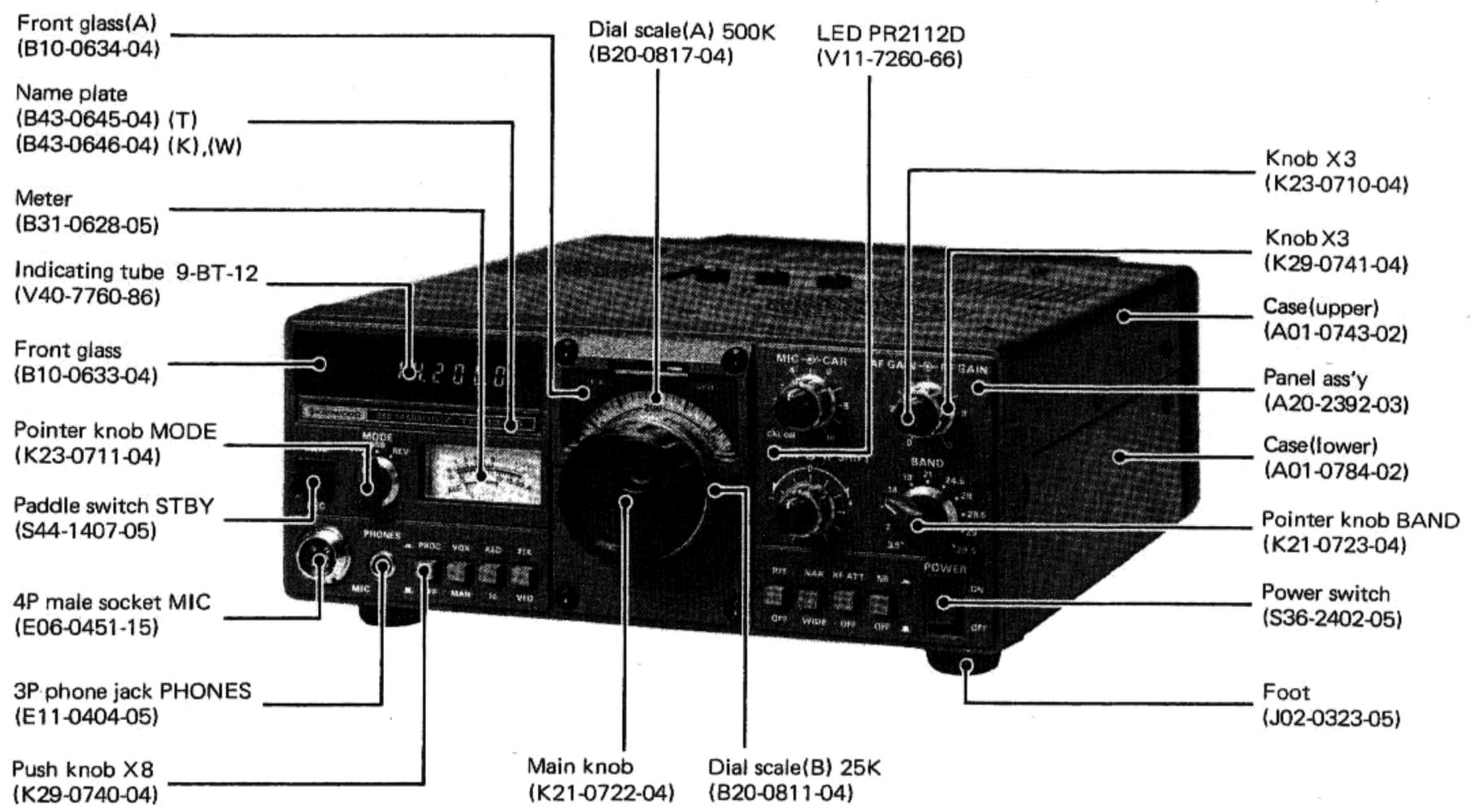
2SC2075(V03-2075-06) HF power amplifier for V type.

NPN Epitaxial planar Si transistor

• Absolute maximum ratings

Item	Pc	Vcbo	Vcer	Vebo	Ic	Ie	Tstg
Value	10(W)	80(V)	80(V)	4.0(V)	4(A)	-4(A)	-55~150(°C)
	(Tc=25°C)						

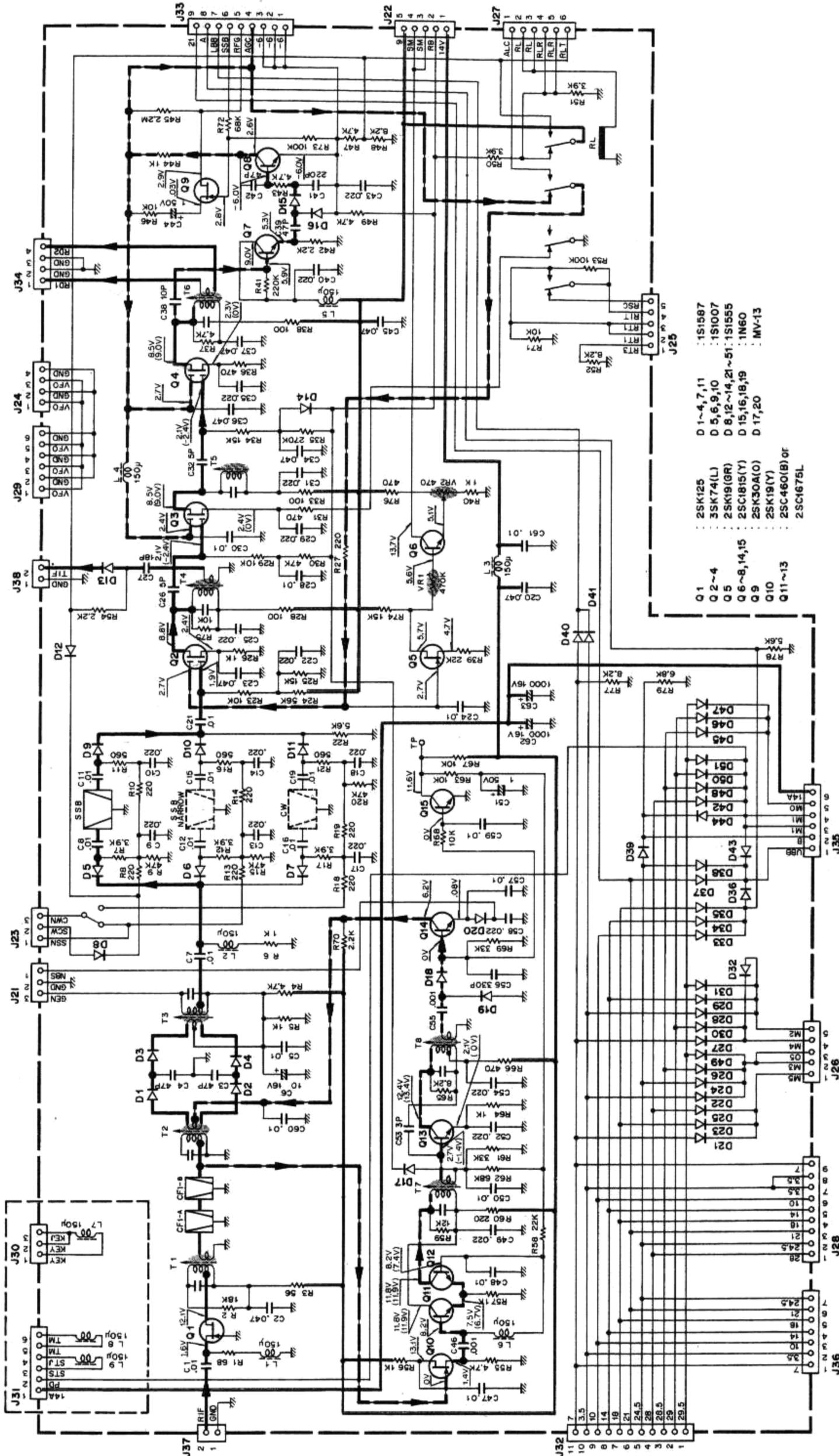
OUTSIDE VIEWS (S TYPE)



CIRCUIT DIAGRAM TS-130S,V

▼ IF UNIT (X48-1300-00,-01) 00:S,01:V

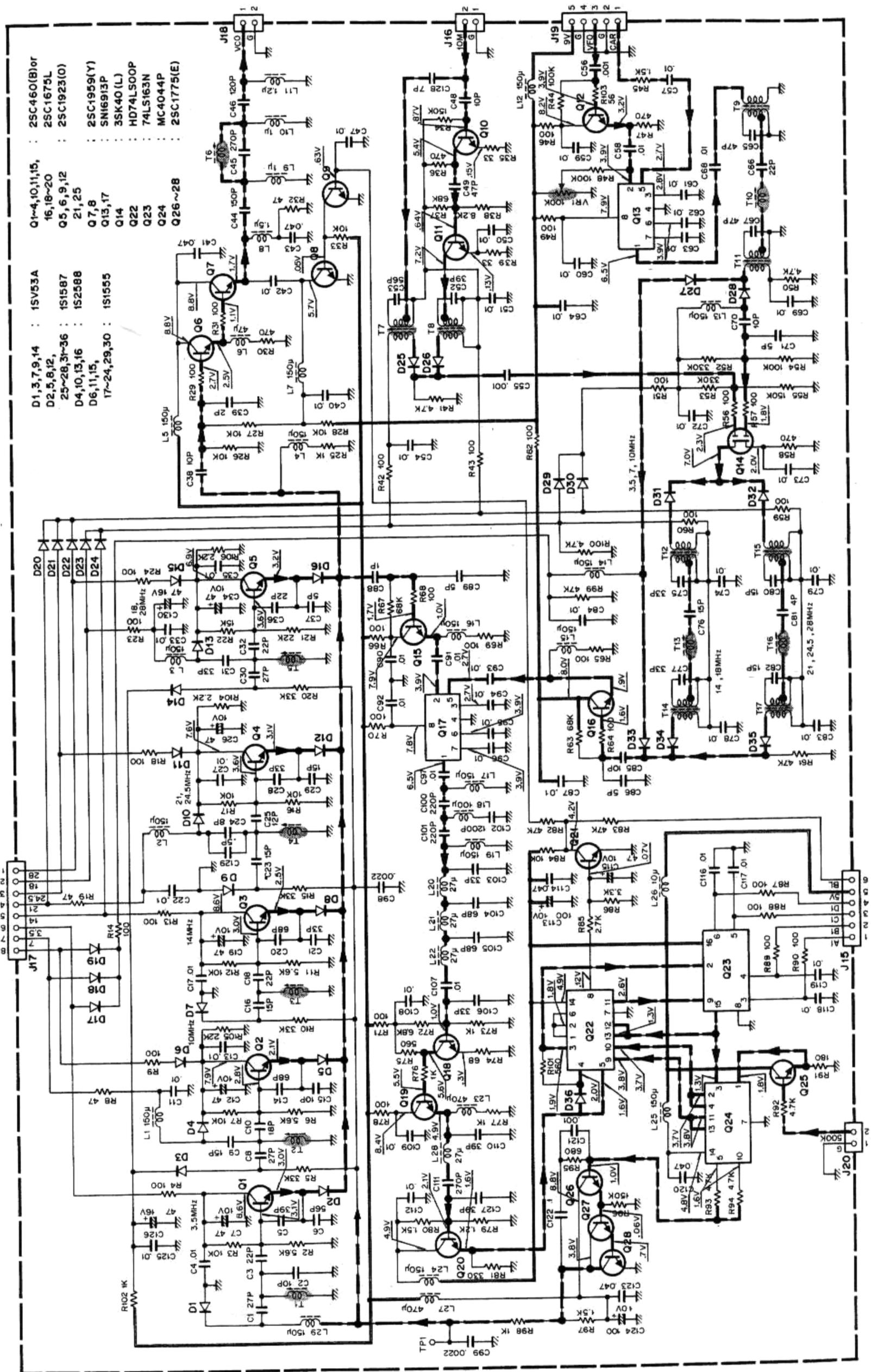
TS-130V does not use J30 and J31.



- Q 1 : 2SK125
- Q 2~4 : 3SK74(L)
- Q 5 : 2SK19(GR)
- Q 6~8,14,15 : 2SC1815(Y)
- Q 9 : 2SK30A(O)
- Q 10 : 2SK19(Y)
- Q 11~13 : 2SC460(B) or 2SC1675L
- D 1~4,7,11 : 1S1587
- D 5,6,9,10 : 1S1007
- D 8,12~14,21~51 : 1S1555
- D 15,16,18,19 : 1N60
- D 17,20 : MV-13

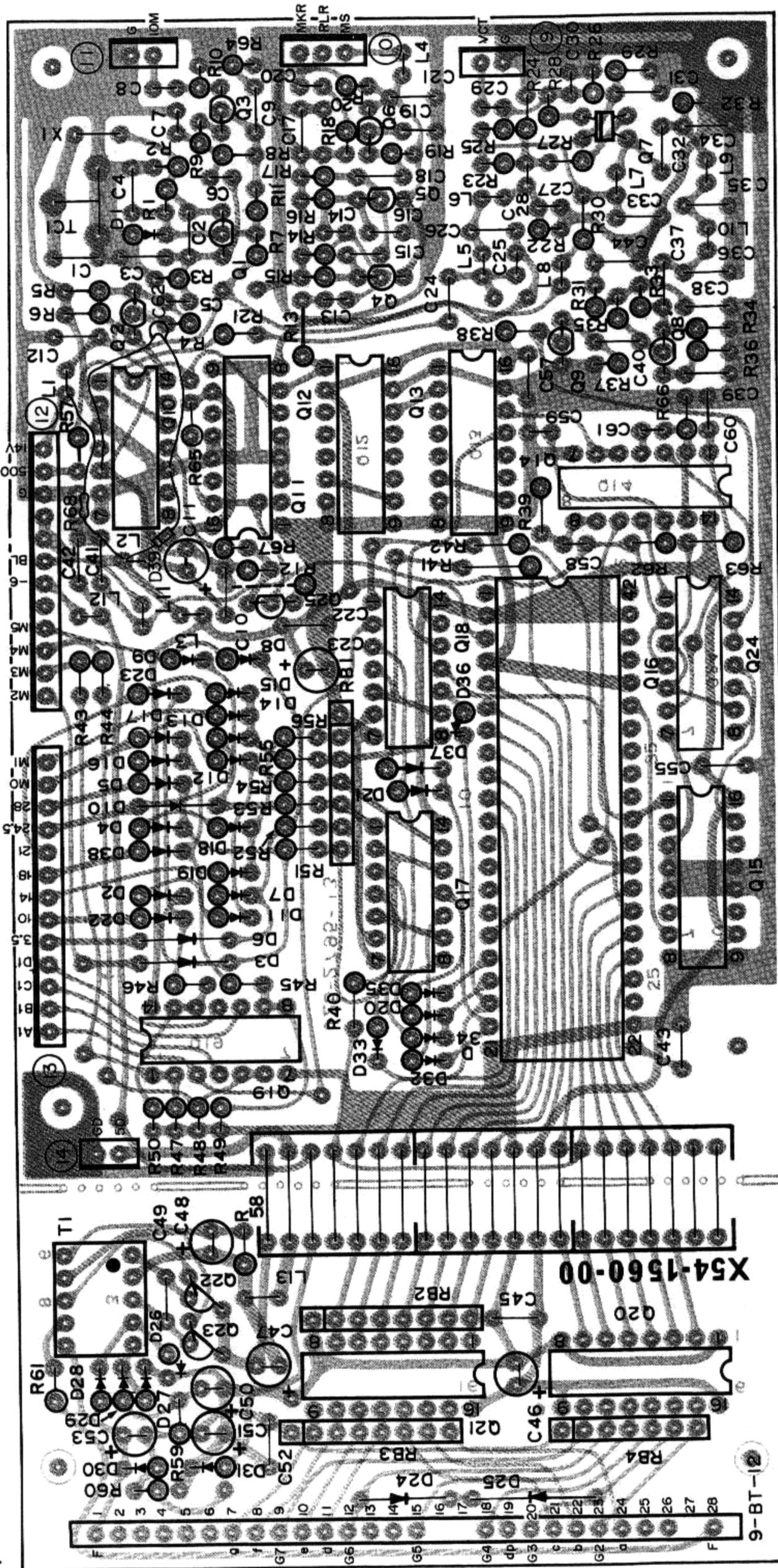
CIRCUIT DIAGRAM TS-130S,V

PLL UNIT (X50-1700-00)

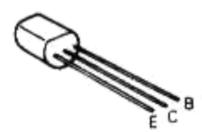


TS-130S,V PC BOARD VIEW

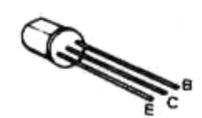
▼ COUNTER UNIT (X54-1560-00) Components side view



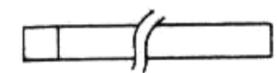
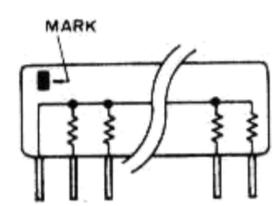
2SC1815(BL)
 2SC1815(Y)
 2SC1959(Y)



2SC785(O)



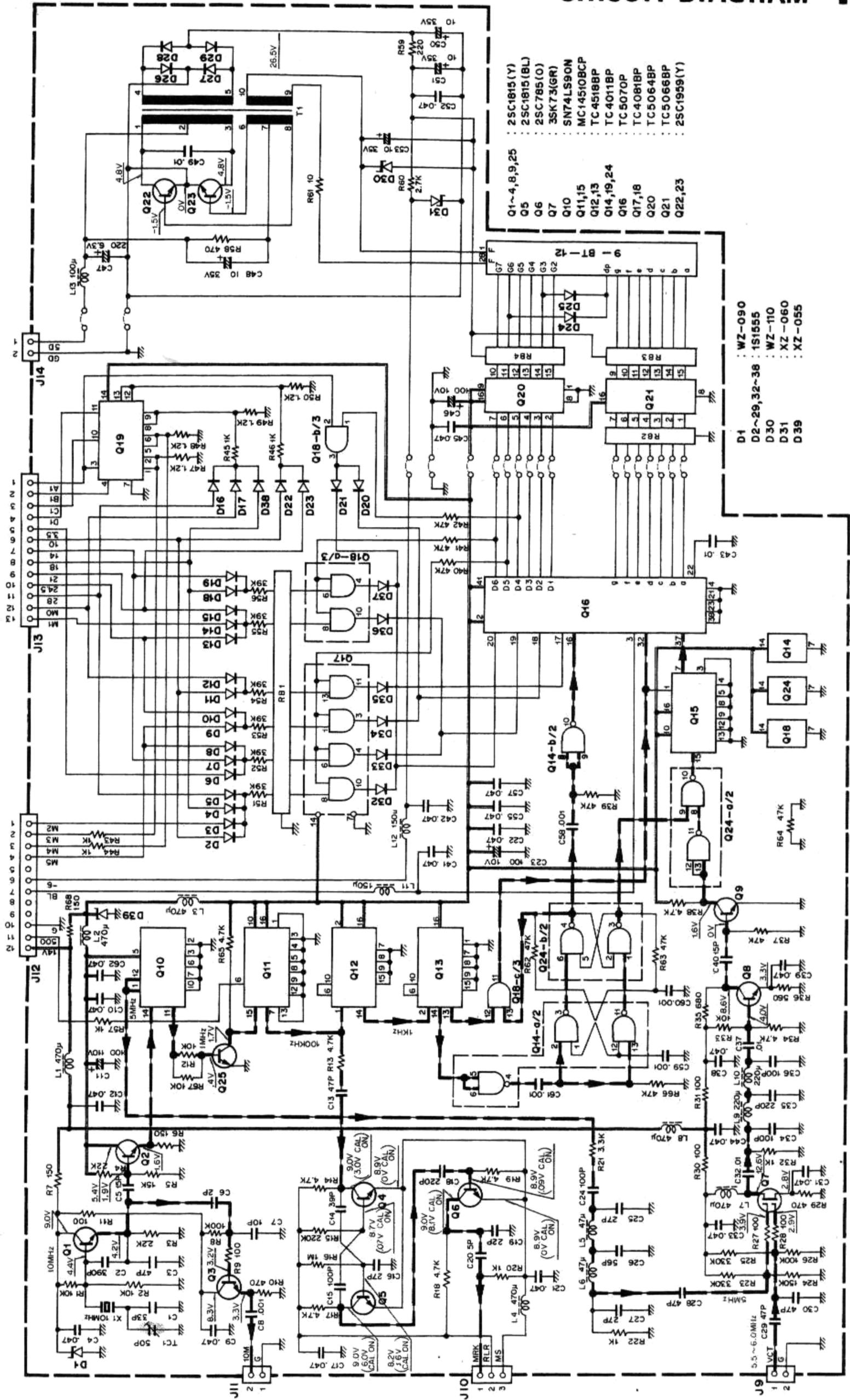
3SK73(GR)



RB1~4

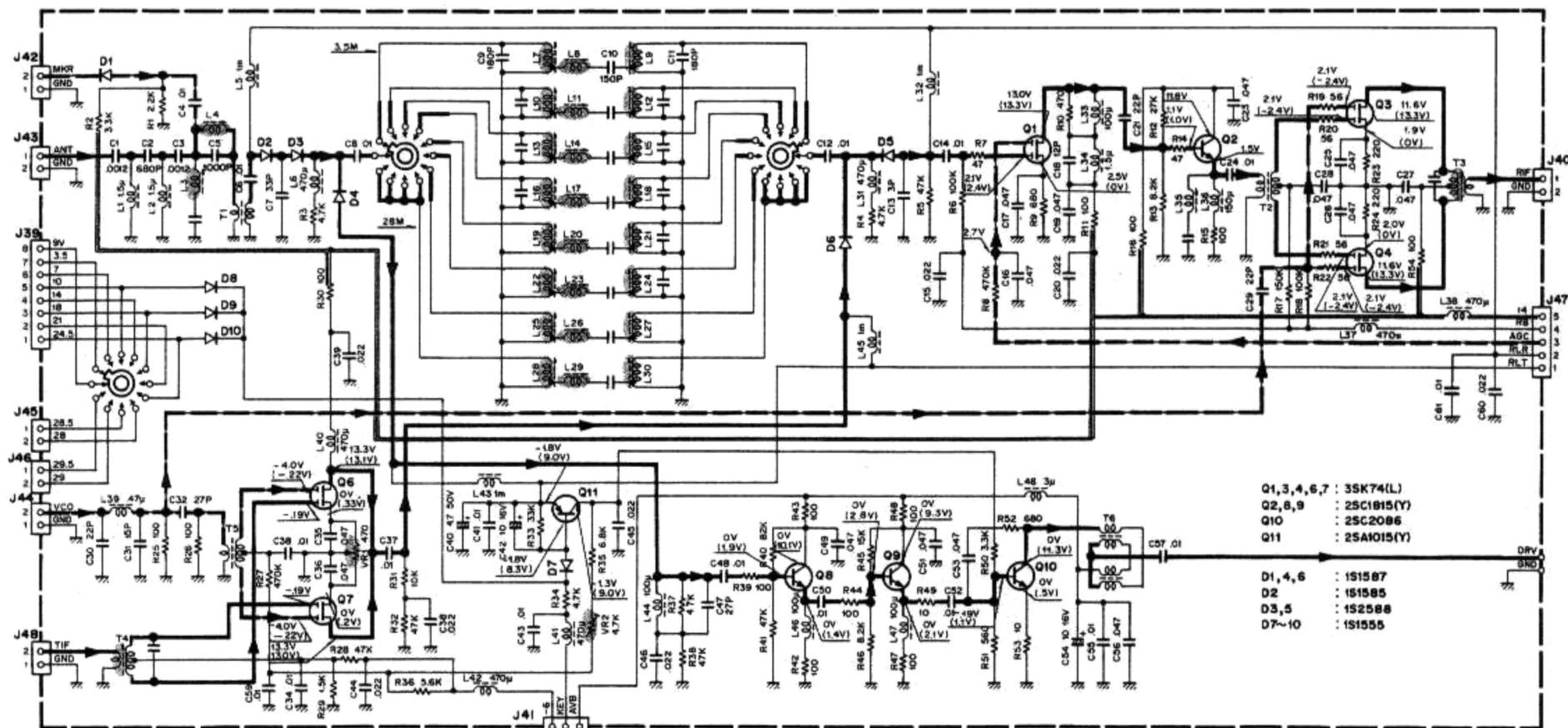
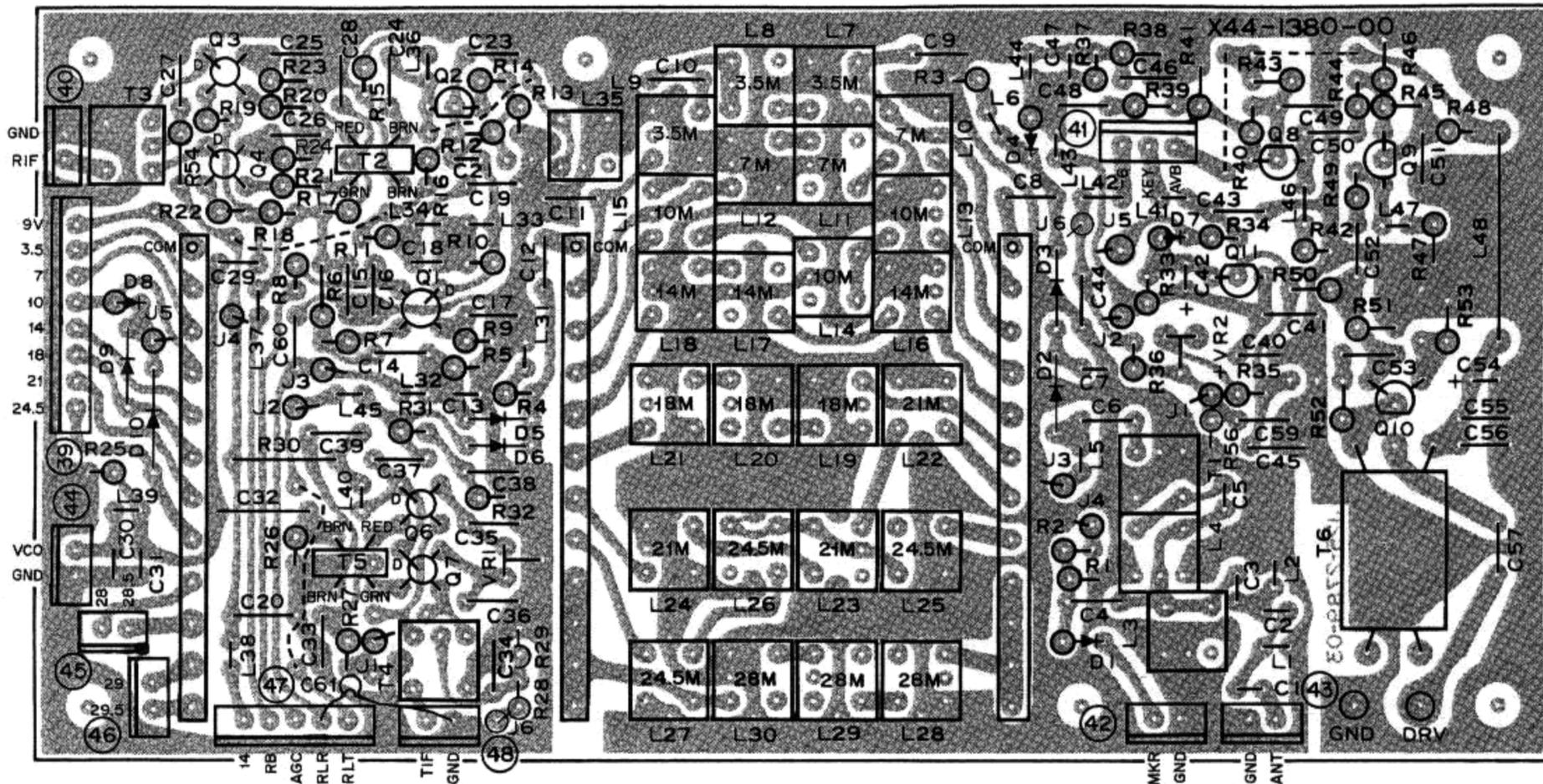
CIRCUIT DIAGRAM TS-130S,V

COUNTER UNIT (X54-1560-00)



TS-130SV PC BOARD VIEW/CIRCUIT DIAGRAM

▼ RF UNIT (X44-1380-00) Components side view



- Q1,3,4,6,7 : 3SK74(L)
- Q2,8,9 : 2SC1815(Y)
- Q10 : 2SC2086
- Q11 : 2SA1015(Y)
- D1,4,6 : 1S1587
- D2,8 : 1S1585
- D3,5 : 1S2588
- D7-10 : 1S1555

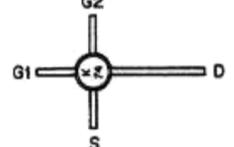
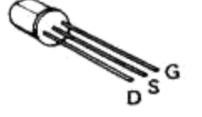
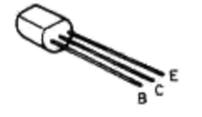
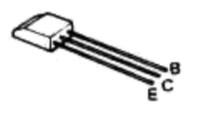
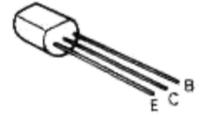
2SC1015(Y)
2SC1675L
2SC1815(Y)
2SC1959(Y)

2SC460(B)

2SC2086

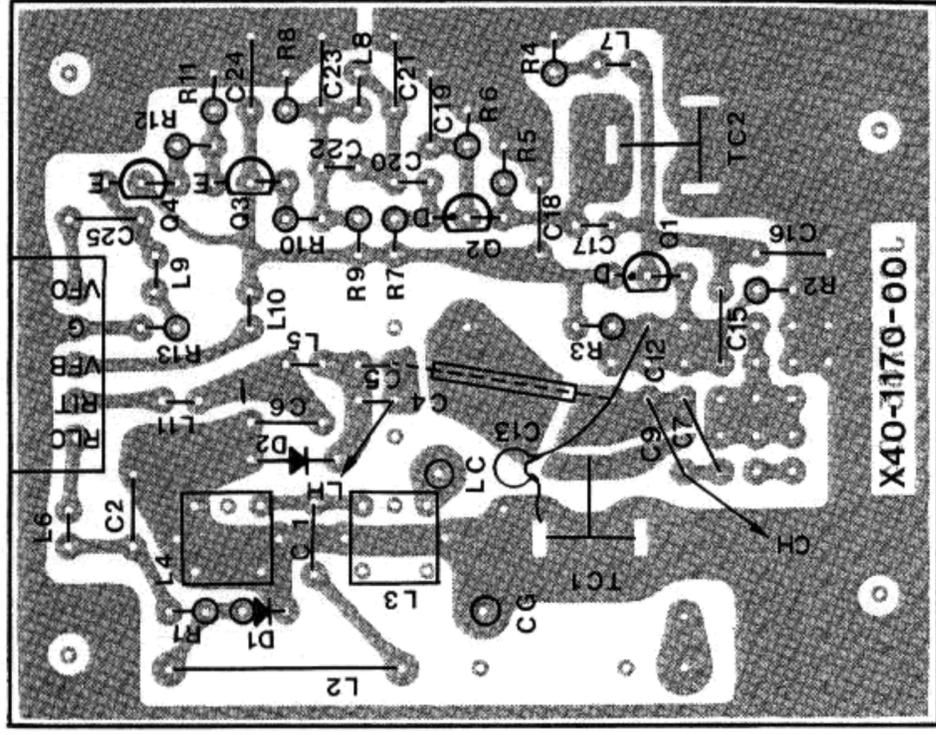
2SK19(Y)

3SK74(L)

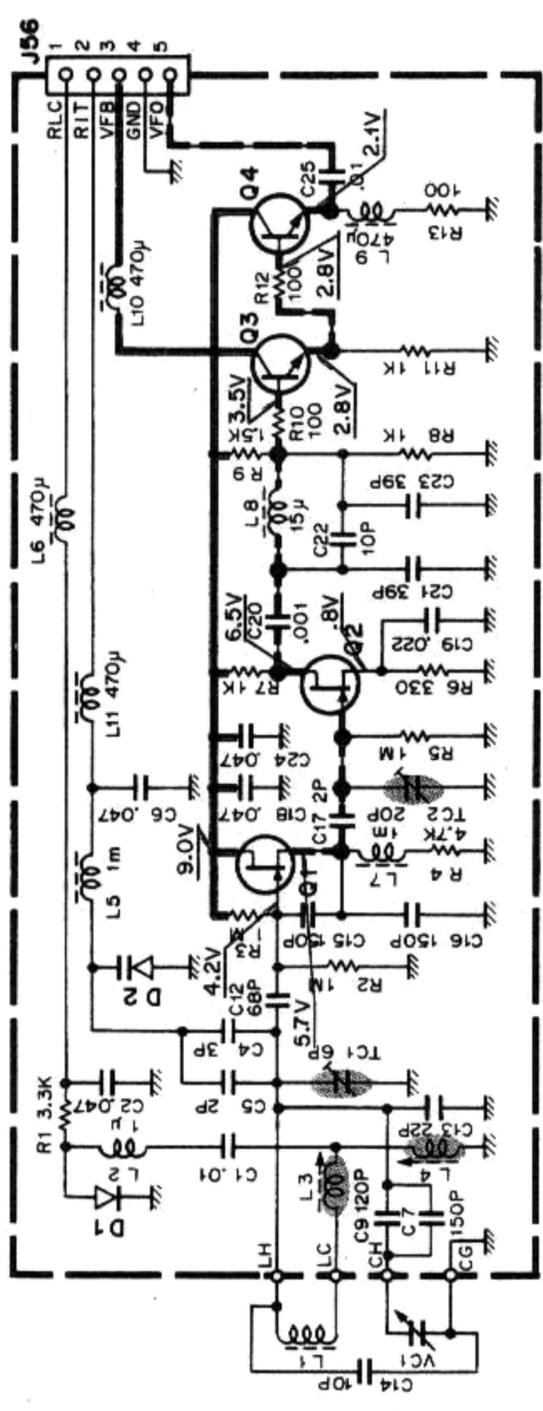
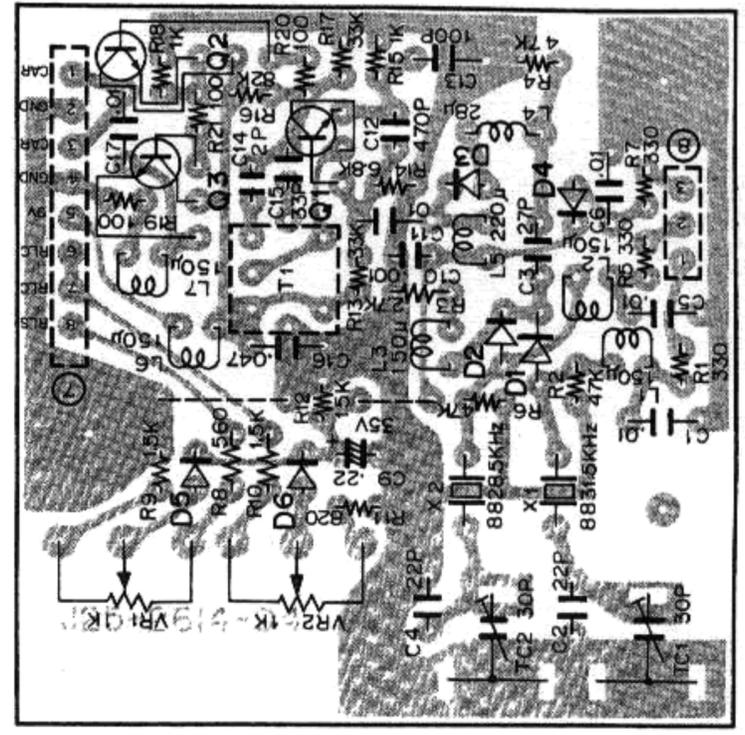


PC BOARD VIEWS/CIRCUIT DIAGRAMS TS-130S

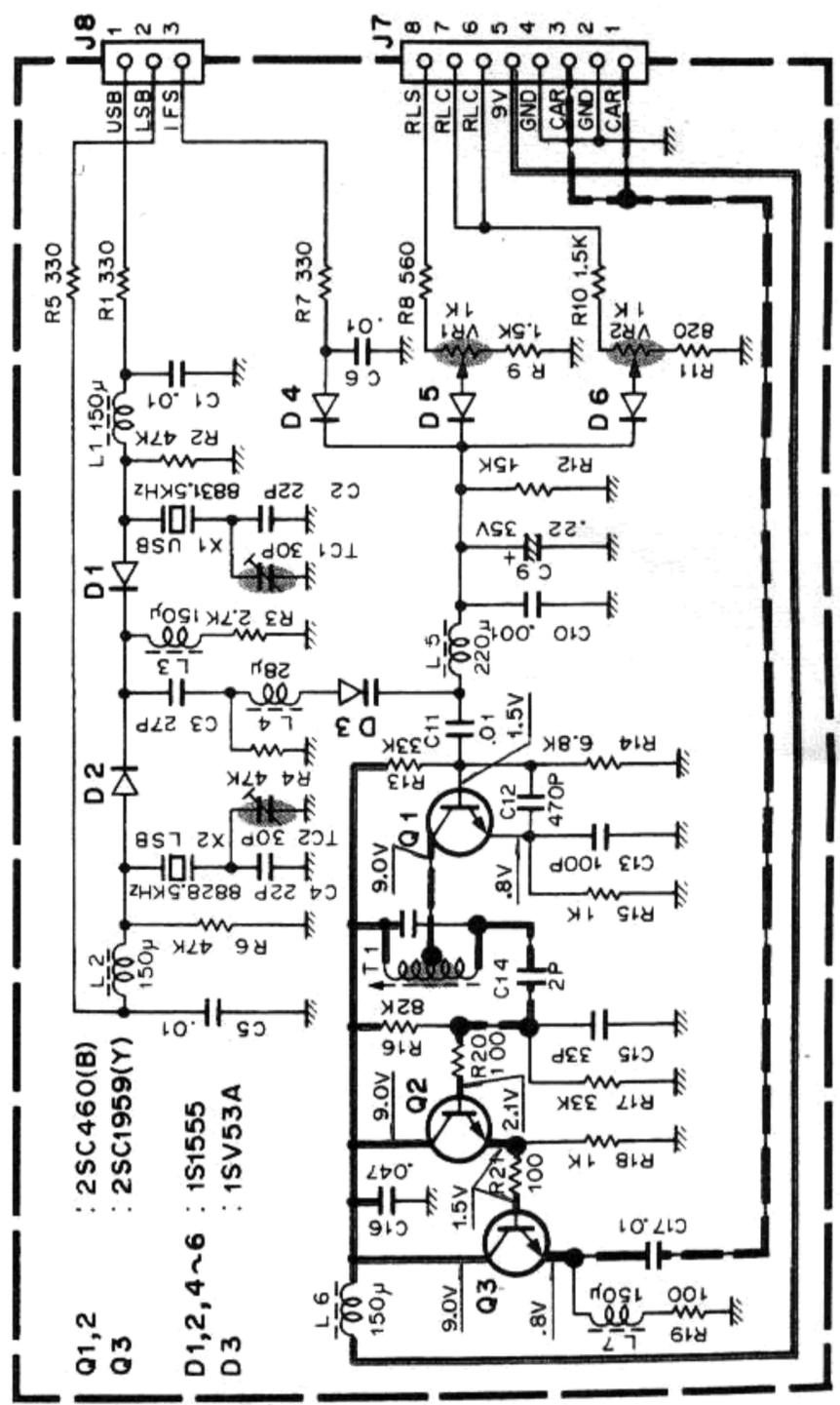
▼ VFO UNIT (X40-1170-00) Components side view



▼ CAR UNIT (X50-1500-00) Foil side view



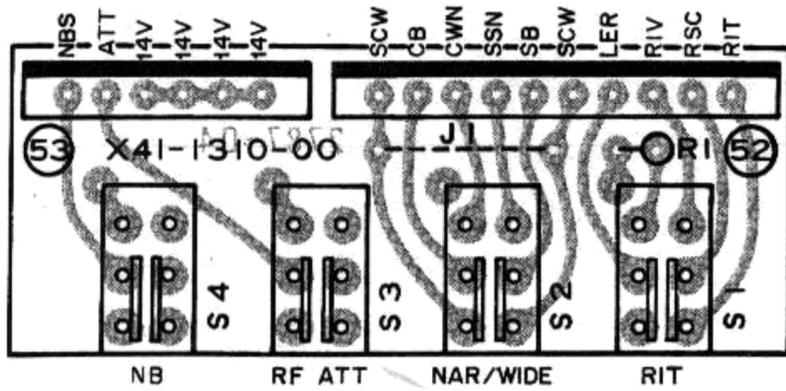
- Q1,2 : 2SK19(Y) D1 : 1S2588
- Q3 : 2SC460(B) or D2 : 1SV53A
- 2SC1675L
- Q4 : 2SC1959(Y)



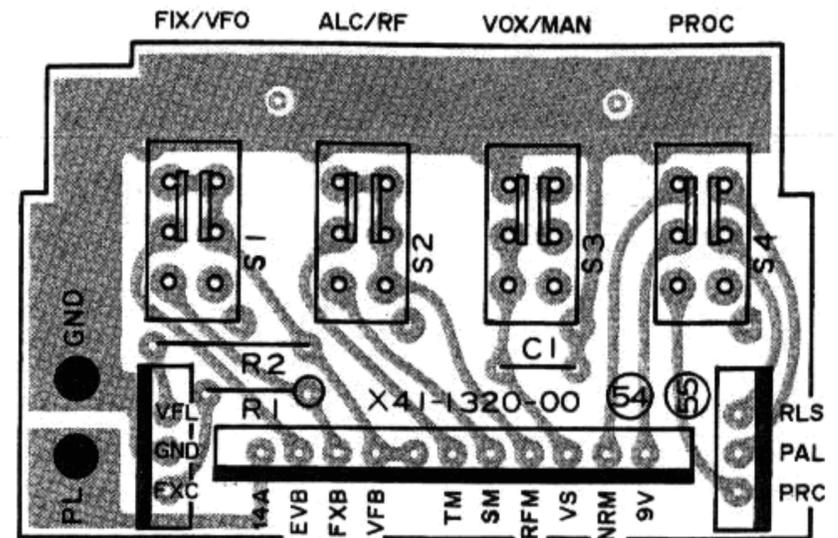
- Q1,2 : 2SC460(B)
- Q3 : 2SC1959(Y)
- D1,2,4~6 : 1S1555
- D3 : 1SV53A

TS-130S,V PC BOARD VIEWS

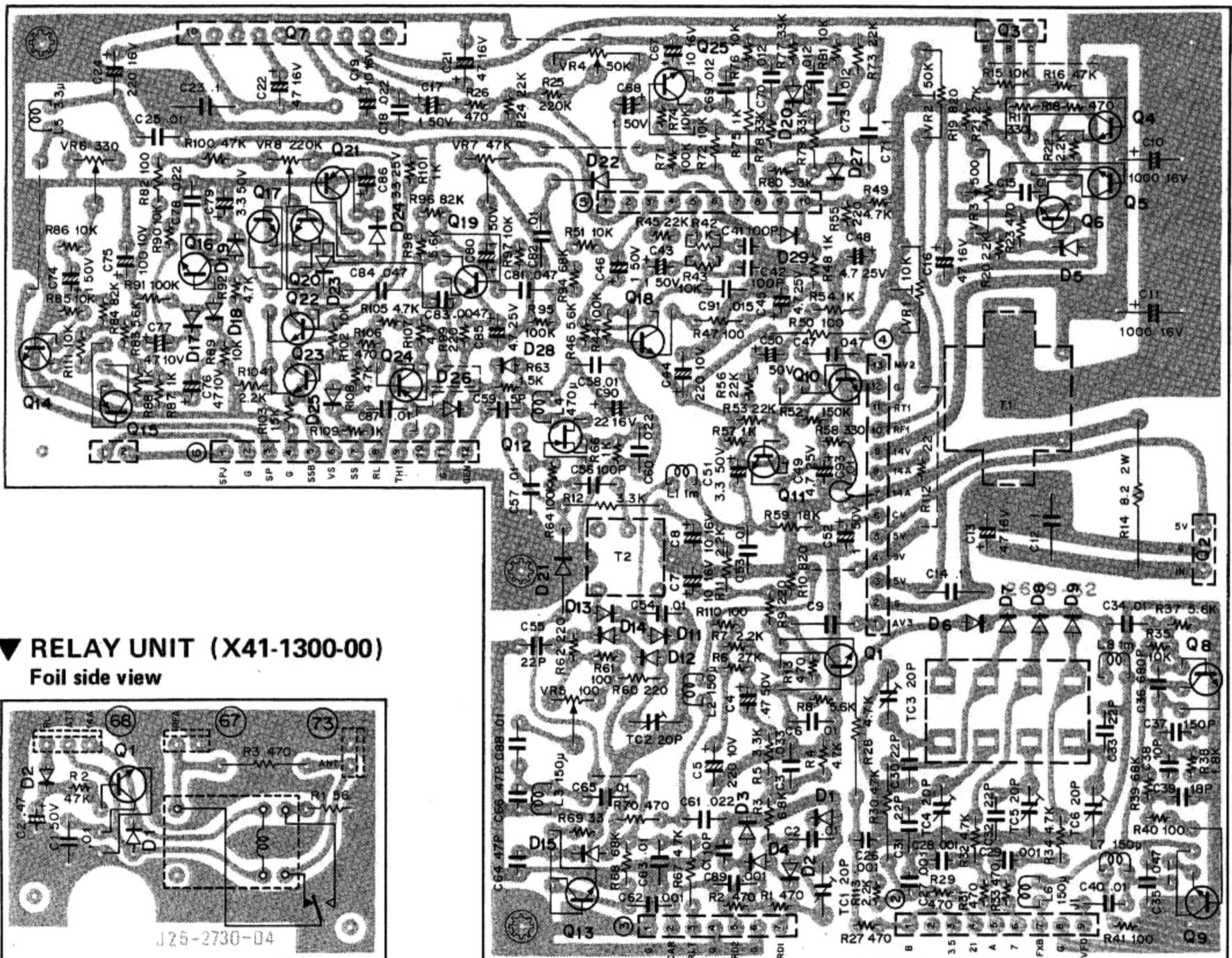
▼ SWITCH (A) UNIT (X41-1310-00) Components side view



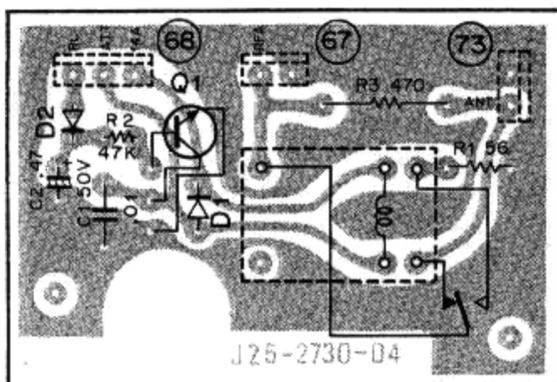
▼ SWITCH (B) UNIT (X41-1320-00) Components side view



▼ AF-GEN UNIT (X49-1110-01) Foil side view



▼ RELAY UNIT (X41-1300-00) Foil side view



Q1: 2SC1959(Y) D1,2: 1S1555

Q1,18: 2SC2240(GR) Q2: μ PC14305H Q3: 2SA473(Y)

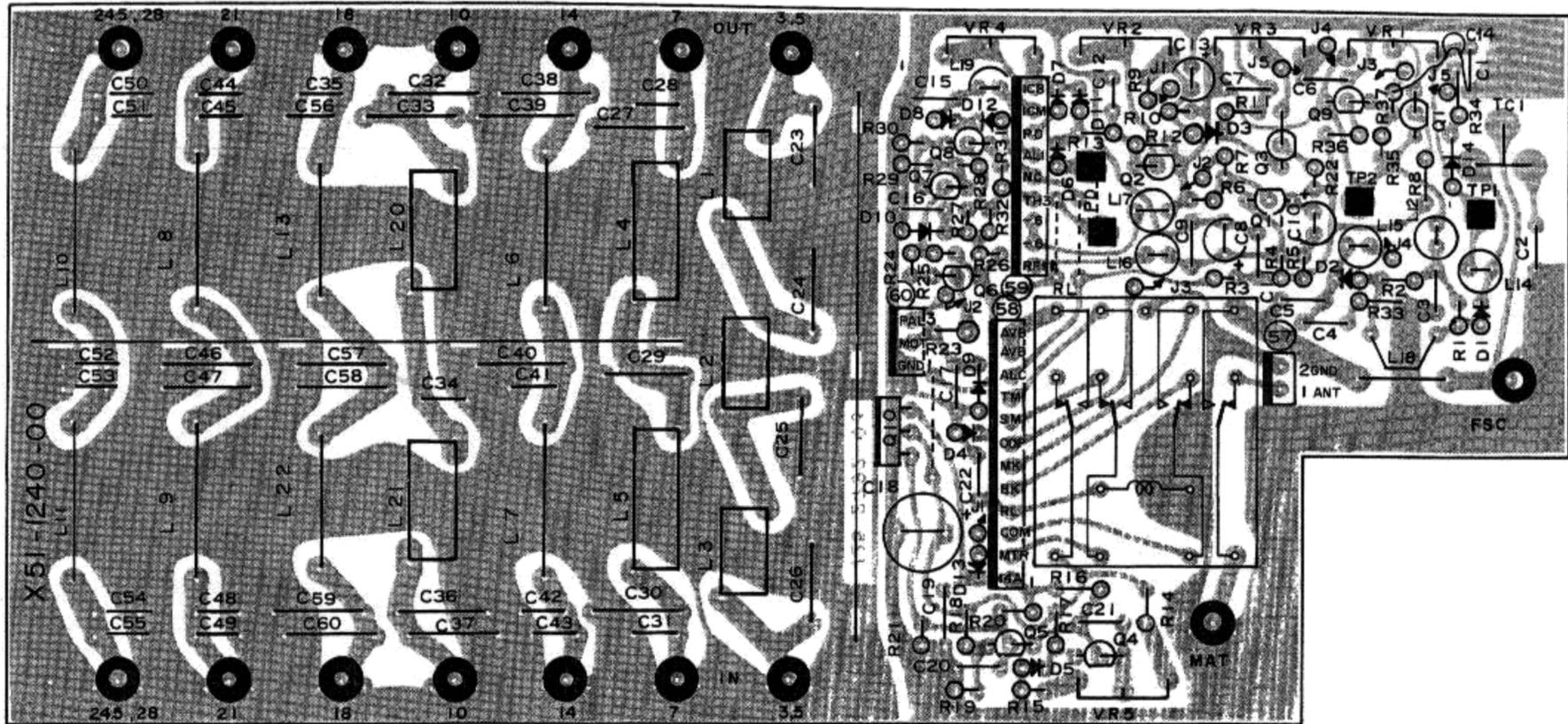
Q4~6,10,11,14,16,17,19,20,23,25: 2SC1815(Y) Q7: HA1366W or HA1366WR

Q8,13: 2SC460(B) or 2SC1675L Q9: 2SC1959(Y) Q12: 2SK19(GR) Q15,21: 2SA1015(Y)

Q22: 2SC1815(GR) Q24: 2SA562(Y) D1~4, 11~14,23,24,26: 1N60 D5: WZ-061

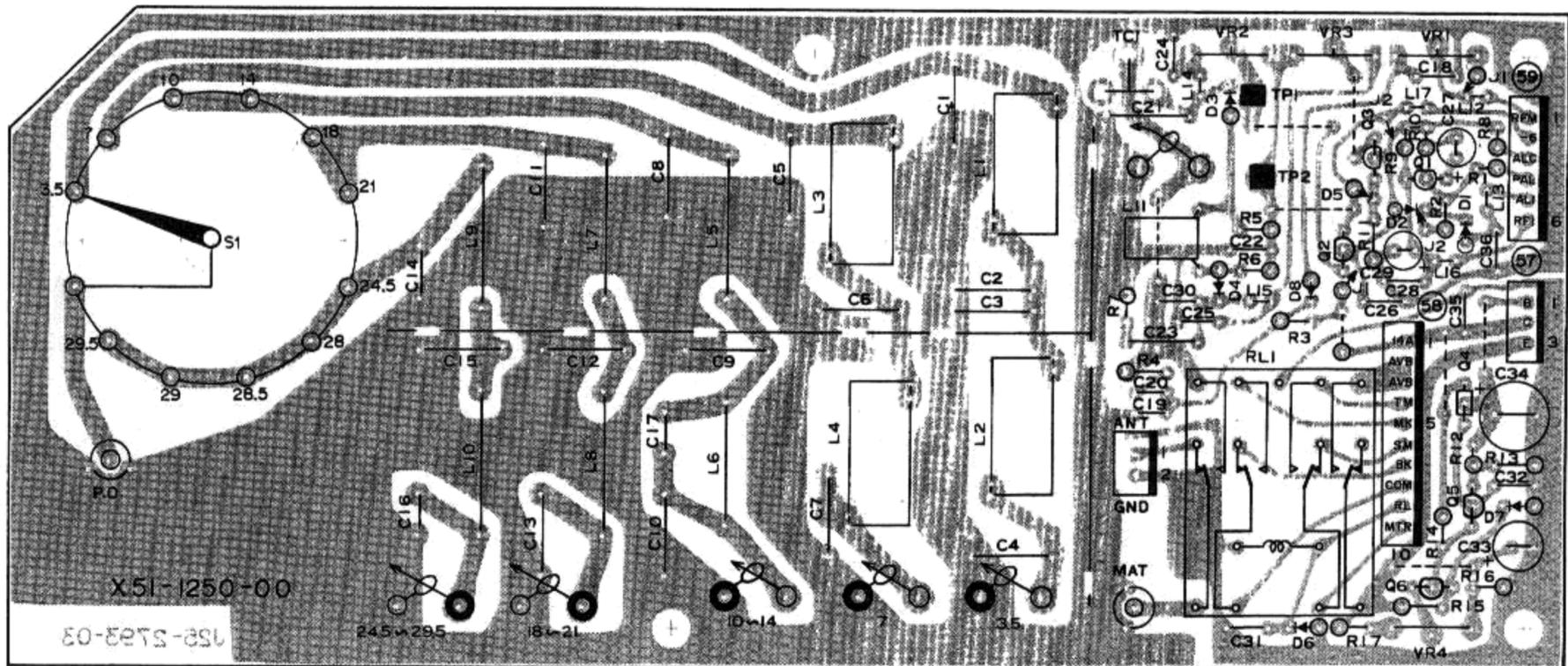
D6~9: 1S2588 D15: 1S1587 D17~22,25,27~29: 1S1555

▼ FILTER UNIT (X51-1240-00) S TYPE Components side view



Q1~5,7~9: 2SC1815(Y) Q6: 2SA562(Y) Q10: 2SA473(Y) Q11: 2SK30A(O) D1,2: 1N60 D3: WZ-044
 D4,6,7,9,12,14: 1S1555 D5,10: WZ-061 D8,11,13: WZ-090

▼ FILTER UNIT (X51-1250-00) V TYPE Components side view



Q1: 2SK30A(O) Q2,3,5,6: 2SC1815(Y) Q4: 2SA496(Y) D1: WZ-090 D2,6: 1S1555 D3,4,8: 1N60 D5: WZ-044 D7: WZ-061

- 2SA1015(Y)
- 2SC1675L
- 2SC1815(GR)
- 2SC1815(Y)
- 2SC1959(Y)
- 2SC2240(GR)

2SC460(B)

2SA496(Y)

2SA473(Y)

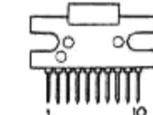
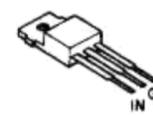
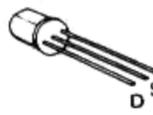
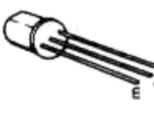
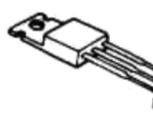
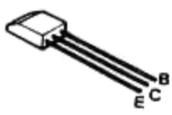
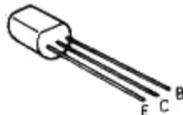
2SA562(Y)

2SK19(GR)

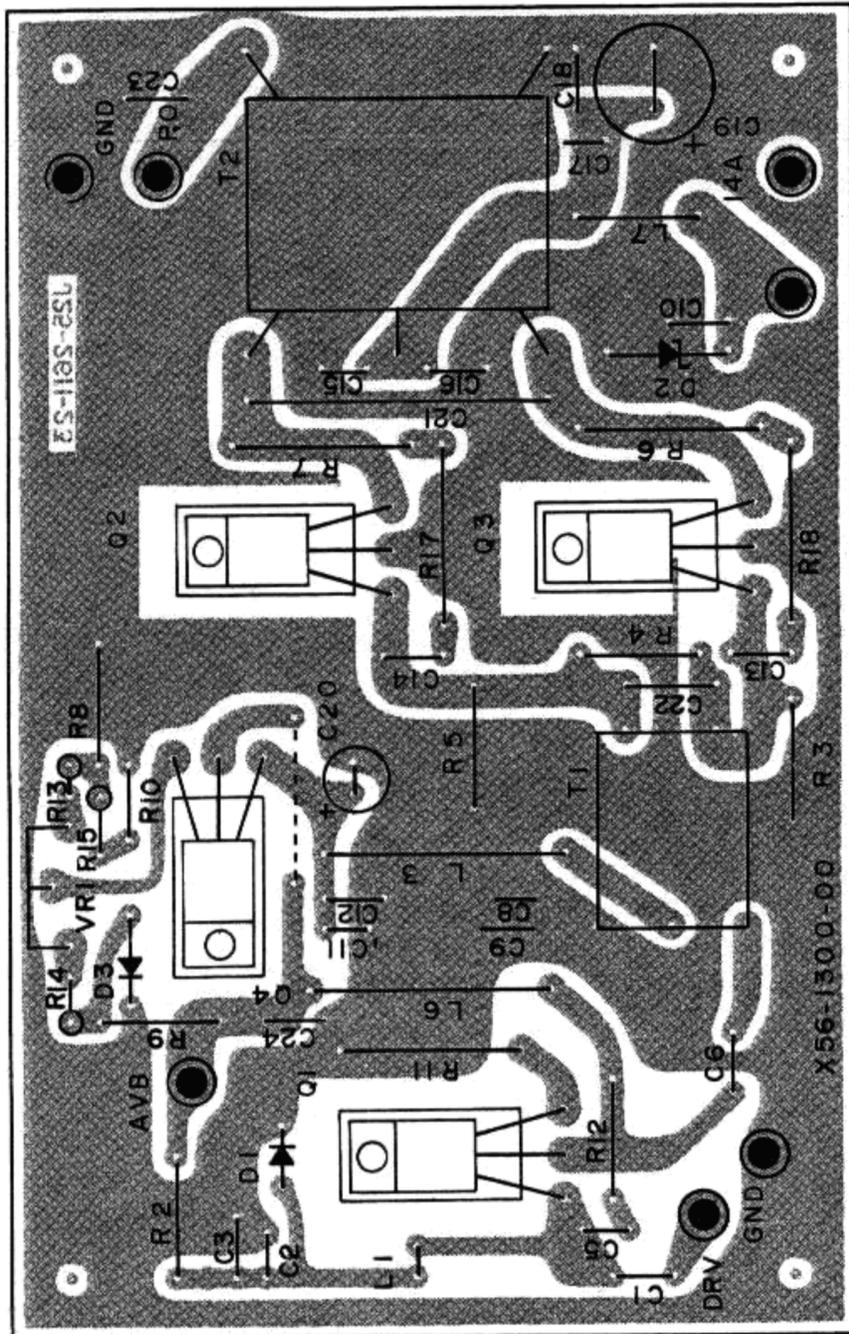
2SK30A(O)

μPC14305H

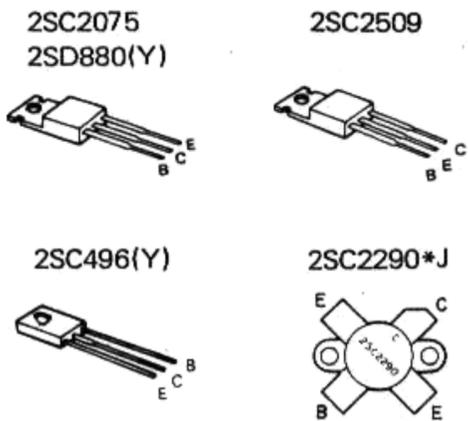
HA1366W
HA1366WR



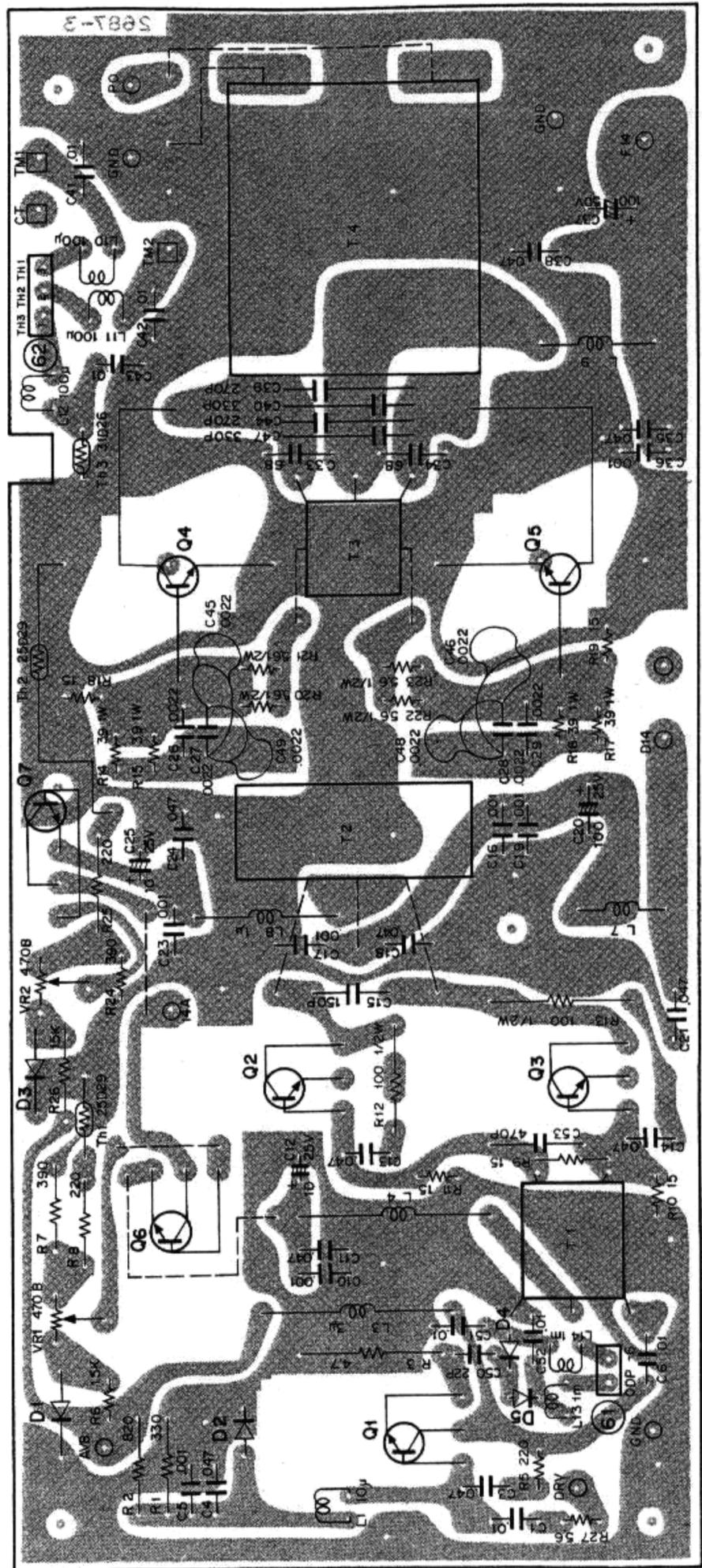
▼ FINAL UNIT (X56-1300-00) V TYPE Components side view



Q1: 2SC2075 Q2,3: 2SC2509 Q4: 2SC496(Y) Q5: 2SD880(Y)
D1: SV-4A D2: BZ-240 D3: SV-03



▼ FINAL UNIT (X56-1350-00) S TYPE Components side view



Q1: 2SC2075 Q2,3: 2SC2509 Q4,5: 2SC2290*J
Q6,7: 2SD880(Y) D1,3: SV-03 D2: SV-4A D4,5: 1N60

PARTS LIST

Note 1:

K. U.S.A T Britain W Europe X Australia

Note 2:

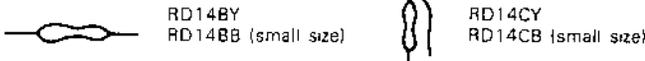
Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components, refer to the schematic diagram of the PC board illustration. Resistors not otherwise detailed are carbon type 1/4W or 1/8W. Order carbon resistors and capacitors according to the following example:

A carbon resistor's part number is RD14BY 2E222J

A ceramic capacitor's number is CK45F1H103Z, CC45TH1H220J

RESISTOR

1. Type of the carbon resistor



2. Wattage

1W → 3A 3W → 3F 5W → 3H
2W → 3D 4W → 3G

3' = CC45 ○ ○ ...

Ceramic capacitor (type I) temperature coeff. capacitor 1' 3'.

1st word (Color)	C (Black)	L (Red)	P (Orange)	R (Yellow)	S (Green)	T (Blue)	U (Violet)
ppm/°C	0	-80	-150	-220	-330	-470	-750

3 = CK45 ○

Ceramic capacitor (type II) 3

Cord	B	D	E	F
Operating temperature °C	-30 +85	-30 +85	-30 +85	-10 +70

6 = Tolerance

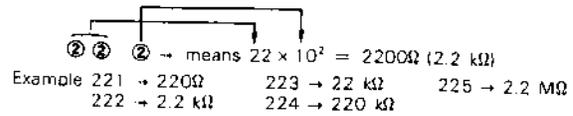
Cord	C	D	G	J	K	M	X	Z	P	No cord
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 -20	+80 -20	+100 -0	More than 10 μF -10 ~ +50 Less than 4.7 μF -10 ~ +75

Less than 10 pF

Cord	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

Abbreviation		Abbreviation	
Cap.	Capacitor	ML	Mylar
C	Ceramic	S	Styren
E	Electrolytic	T	Tantalum
MC	Mica		

3. Resistance value



4. Tolerance

J = ±5% (Gold) K = ±10% (Silver)

CAPACITORS

Type I

CC 45 TH 1H 220 J CK 45 F 1H 103 Z

1' 2 3' 4 5 6 1 2 3 4 5 6

1 = Type ... ceramic, electrolytic, etc 4 = Voltage rating
2 = Shape ... round, square, etc 5 = Value
3 = Temp range 6 = Tolerance
3' = Temp coefficient

Type II

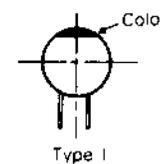
Ex. CC45TH = -470 ±60 ppm/°C

2nd Word	G	H	J	K	L
ppm/°C	±30	±60	±120	±250	±500

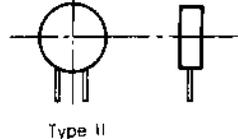
5 = Capacitor value

Example 010 → 1 pF
100 → 10 pF
101 → 100 pF
102 → 1000 pF = 0.001 μF
103 → 0.01 μF

CC45



CK45



TS-130 SEMICONDUCTOR

☆: New parts

Item	Name	Parts No.	Re- marks	Item	Name	Parts No.	Re- marks
Diode	1N60	V11-0051-05		Thermistor	25D29	V11-3360-16	500Ω at 25°C
	1S1007	V11-4160-66			31D26	V11-7762-16	1kΩ at 25°C
	1S1555	V11-0076-05		LED	PR2112D	V11-7260-66	
	1S1585	V11-3172-76			TLY-205	V11-3163-16	
	1S1587	V11-0370-05		Zener diode	BZ-240	V11-4160-98	
	1S2588	V11-0414-05			XZ-055	V11-4105-50	
	S31C	V11-2163-86			XZ-060	V11-4101-20	
	U05B	V11-0270-05			WZ-044	V11-4161-06	
			WZ-061		V11-0243-05		
Varistor	MV-13	V21-0004-05		WZ-090	V11-0240-05		
	SV-03	V21-0007-05		WZ-110	V11-4161-48		
	SV-4A	V11-4363-36	☆	Indicating tube	9-BT-12	V40-7760-86	
Vari-cap diode	1SV53A	V11-4161-36					

PARTS LIST

Item	Name	Parts No.	Re- marks	Ref.No.	Parts No.	Description	Re- marks
TR	2SA473 (Y)	V01-0473-06			B05-0701-04	SP grill cloth	
	2SA496(Y)	V01-0113-05			B10-0633-04	Front glass	☆
	2SA562(Y)	V01-0032-05			B30-0818-05	Pilot lamp 12V,40mA	☆
	2SA1015(Y)	V01-1015-06			B31-0628-05	Meter	S ☆
					B31-0629-05	Meter	V ☆
					B39-0407-04	Spacer	
	2SC460 (B)	V03-0079-05			B42-1644-04	Seal (VOX)	
	2SC496(Y)	V03-0336-05			B42-1693-04	Seal (Adj.)	☆
	2SC785(O)	V03-0473-05			B43-0645-04	Name plate	S(T) ☆
	2SC1675L	V03-1675-10			B43-0646-04	Name plate	S(K),S(W) ☆
	2SC1775(E)	V03-1775-06			B43-0647-04	Name plate	V(T) ☆
	2SC1815(BL)	V03-1815-26			B43-0648-04	Name plate	V(K),V(W) ☆
	2SC1815(GR)	V03-1815-16			B46-0058-00	Warranty card	(K) ☆
	2SC1815(Y)	V03-1815-06			B50-2750-00	Operating manual	(K),(W) ☆
	2SC1923(O)	V03-1923-06			B50-2751-00	Operating manual	(T) ☆
	2SC1959(Y)	V03-1959-06					
	2SC2075	V03-2075-06					
	2SC2086	V03-2086-06			D21-0807-05	Band shaft	
	2SC2240(GR)	V03-2240-06			D22-0404-05	Universal joint	
	2SC2290*J	V03-2290-16			D40-0615-04	Gear ass'y	☆
	2SC2509	V03-2509-06					
					E04-0152-05	UHF type receptacle ANT	V
					E06-0252-05	2P male socket POWER	V
					E06-0451-15	4P male socket MIC	
					E06-0751-05	7P DIN socket REMOTE	
				E06-0851-05	8P DIN socket EXT.VFO		
				E07-0252-05	2P metal plug POWER	V	
				E07-0403-05	4P MIC plug (W),(T)		
				E07-0751-05	7P DIN plug REMOTE		
				E08-0671-05	6P square socket POWER	S	
				E09-0671-05	6P plug POWER	S	
				E11-0005-15	3P phone jack KEY	V	
				E11-0402-15	US jack EXT. SP		
				E11-0404-05	3P phone jack PHONES	V	
				E11-0404-05	3P phone jack KEY,PHONES	S	
				E12-0001-05	phone plug EXT. SP		
				E23-0015-04	Lug terminal	S	
				E23-0417-05	Pin for 6P square socket POWER	S	
				E23-0418-05	Pin for 6P plug POWER	S	
				E23-0420-05	Lug terminal	S	
				E29-0407-05	Bridge connector		
				E30-1632-05	DC cord with plug FAN	S	
				E30-1638-05	DC cord ass'y	S	
				E30-1675-05	DC cord ass'y	V ☆	
				E31-0431-05	Speaker cord with 2P plug		
				F06-2034-05	Fuse (20A)	S	
				F05-4022-05	Fuse (4A)	V	
				F07-0826-03	Heat sink cover	S	
				F09-0405-14	Fan	S	
				F29-0406-03	Fan motor housing	S	
				G01-0801-04	Gnd spring BAND		
				G02-0505-05	Knob spring		
				H01-2705-04	Carton case (inside) S(K),S(W)	☆	
				H01-2706-04	Carton case (inside) S(T)	☆	
				H01-2708-04	Carton case (inside) V(K),V(W)	☆	
				H01-2709-04	Carton case (inside) V(T)	☆	
				H03-1769-04	Carton case (outside) S	☆	
				H03-1770-04	Carton case (outside) V	☆	

Ref.No.	Parts No.	Description	Re- marks
TS-130 S,V GENERAL			
	A01-0725-02	Case (upper)	V
	A01-0743-02	Case (upper)	S
	A01-0784-02	Case (lower)	S ☆
	A01-0785-02	Case (lower)	V ☆
	A20-2392-03	Panel ass'y	S ☆
	A20-2393-03	Panel ass'y	V ☆

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
	H10-2509-02	Packing fixture (F)			X56-1300-00	Final unit	V
	H10-2510-02	Packing fixture (R)	V		X56-1350-00	Final unit	S
	H10-2520-02	Packing fixture (R)	S	RELAY UNIT (X41-1300-00)			
	H12-0441-04	Cushion	V				
	H12-0462-04	Cushion	S				
	H20-1405-03	Protective cover	V				
	H20-1410-03	Protective cover	S				
	H21-0701-04	Protective sheet	VOX				
	H25-0112-04	Protective bag					
	H25-0116-04	Protective bag					
	J02-0323-05	Foot					
	J02-0407-04	Assistant foot					
	J13-0404-05	Fuse holder	S	SWITCH (A) UNIT (X41-1310-00)			
	J19-1301-04	Diode holder					
	J21-2504-04	SP mounting hardware					
	J21-2573-04	Foot mounting hardware					
	J21-2631-04	Motor mounting hardware	S				
	J31-0141-04	Spacer ring	MIC				
	J42-0038-04	Cap	Case (lower)				
	J42-0423-04	Knob bush	☆				
	J61-0019-05	Vinyle tie					
	J61-0401-05	Nylon band					
	K21-0723-04	Pointer knob	BAND	SWITCH (B) UNIT (X41-1320-00)			
	K23-0710-04	Knob					
	K23-0711-04	Pointer knob	MODE				
	K23-0712-04	Knob	VOX				
	K29-0740-04	Push knob	☆				
	K29-0741-04	Knob	☆				
	L40-1511-03	Ferri-inductor	150μH				
	L40-4711-03	Ferri-inductor	470μH				
	N14-0508-04	Spanner nut M9	BAND				
	N14-0518-04	Spanner nut M7	MODE				
	N19-0607-04	Nylon washer	☆	RF UNIT (X44-1380-00)			
VR1	R19-3409-05	Pot. 10kΩ(A)/10kΩ(B) RF/AF	☆				
VR2	R19-9405-05	Pot. 10kΩ(F)/5kΩ(B) RIT/IF	☆				
R7	R92-0620-05	Cement resistor 15mΩ					
	S01-2422-05	Rotary switch	MODE				
	S01-2423-05	Rotary switch	BAND				
	S36-2402-05	Power switch	S				
	S44-1407-05	Paddle switch	STBY				
	T03-0027-15	Speaker					
	T40-0301-05	Fan motor	S				
	X40-1170-00	VFO unit		C5	CQ09S1H102J	S	0.001μF
	X41-1300-00	Relay unit		C7	CC45RH1H330J	C	33pF
	X41-1310-00	Switch (A) unit	power side	C9	CC45RH1H181J	C	180pF
	X41-1320-00	Switch (B) unit	MIC side	C10	CC45RH1H151J	C	150pF
	X44-1380-00	RF unit		C11	CC45RH1H181J	C	180pF
	X48-1300-00	IF unit	S	C13	CC45RH1H030C	C	3pF ±0.25pF
	X48-1300-01	IF unit	V	C16,17	C91-0456-05	C	0.047μF 25V
	X49-1110-01	AF-GEN unit		C18	CC45RH1H120J	C	12pF
	X50-1500-00	CAR unit		C19	C91-0456-05	C	0.047μF 25V
	X50-1700-00	PLL unit		C21	CC45SL1H220J	C	22pF
	X51-1240-00	Filter unit	S	C23	C91-0456-05	C	0.047μF 25V
	X51-1250-00	Filter unit	V	C25~28	C91-0456-05	C	0.047μF 25V
	X54-1450-01	Indicator unit	VFO	C29,30	CC45SL1H220J	C	22pF
	X54-1550-00	Processor unit		C31	CC45SL1H150J	C	15pF
	X54-1560-00	Counter unit		C32	CC45SL1H270J	C	27pF
				C33,34	C91-0455-05	C	0.01μF 25V
				C35,36	C91-0456-05	C	0.047μF 25V
				C40	CE04W1H4R7Q	E	4.7μF 50V
				C42	CE04W1C100Q	E	10μF 16V
				C47	CC45RH1H270J	C	27pF
				C49	C91-0456-05	C	0.047μF 25V
				C51,53	C91-0456-05	C	0.047μF 25V
				C54	CE04W1C100Q	E	10μF 16V
				C56	C91-0456-05	C	0.047μF 25V
					E23-0401-05	Round terminal	
					E40-0273-05	Mini connect wafer	2P
					E40-0373-05	Mini connect wafer	3P
					E40-0573-05	Mini connect wafer	5P
					E40-0873-05	Mini connect wafer	8P

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
	J31-0502-04 J42-0404-05	PC Board collar PC Board bush		IF UNIT (X48-1380-00,-01) 00 : S, 01 : V			
L1,2	L40-1592-02	Ferri-inductor 1.5μH		C3,4	CC45SL1H470J	C 47pF	
L3	L34-0966-05	Trap coil 8.83M	☆	C6	CE04W1C100	E 10μF 16V	
L4	L34-0558-05	Trap coil		C23	C91-0456-05	C 0.047μF 25V	
L5	L40-1021-03	Ferri-inductor 1mH		C26	CC45SL1H050C	C 5pF ±0.25pF	
L6	L40-4711-03	Ferri-inductor 470μH		C27	CC45SL1H180J	C 18pF	
L7	L34-0967-05	BPF coil 3.5A	☆	C32	CC45SL1H050C	C 5pF ±0.25pF	
L8	L34-0968-05	BPF coil 3.5B	☆	C34,36	C91-0456-05	C 0.047μF 25V	
L9	L34-0967-05	BPF coil 3.5A	☆	C38	CC45SL1H100D	C 10pF ±0.5pF	
L10	L34-0969-05	BPF coil 7A	☆	C39,42	CC45SL1H470J	C 47pF	
L11	L34-0970-05	BPF coil 7B	☆	C44,51	CE04W1H010	E 1μF 50V	
L12	L34-0971-05	BPF coil 7C	☆	C53	CC45SL1H030C	C 3pF ±0.25pF	
L13	L34-0972-05	BPF coil 10A	☆	C62,63	C90-0817-05	E 1000μF 16V	
L14	L34-0973-05	BPF coil 10B	☆		E23-0046-04	Square terminal	
L15	L34-0974-05	BPF coil 10C	☆		E23-0401-05	Round terminal	
L16	L34-0975-05	BPF coil 14A	☆		E40-0273-05	Mini connect wafer 2P	
L17	L34-0976-05	BPF coil 14B	☆		E40-0373-05	Mini connect wafer 3P	
L18	L34-0977-05	BPF coil 14C	☆		E40-0473-05	Mini connect wafer 4P	
L19	L34-0978-05	BPF coil 18A	☆		E40-0573-05	Mini connect wafer 5P	
L20	L34-0979-05	BPF coil 18B	☆		E40-0673-05	Mini connect wafer 6P	
L21	L34-0980-05	BPF coil 18C	☆		E40-0773-05	Mini connect wafer 7P	
L22	L34-0981-05	BPF coil 21A	☆		E40-0973-05	Mini connect wafer 9P	
L23	L34-0982-05	BPF coil 21B	☆		E40-1173-05	Mini connect wafer 11P	
L24	L34-0983-05	BPF coil 21C	☆		J31-0502-04	PC Board collar	
L25	L34-0984-05	BPF coil 24.5A	☆		J42-0404-05	PC Board bush	
L26	L34-0985-05	BPF coil 24.5B	☆	L1~9	L40-1511-03	Ferri-inductor 150μH	S
L27	L34-0986-05	BPF coil 24.5C	☆	L1~6	L40-1511-03	Ferri-inductor 150μH	V
L28	L34-0707-05	BPF coil 28A					
L29	L34-0987-05	BPF coil 28B	☆	T1	L34-0967-05	Tuning coil	☆
L30	L34-0738-05	BPF coil 28C		T2	L34-0942-05	Tuning coil	
L31	L40-4711-03	Ferri-inductor 470μH		T3	L34-0538-05	Tuning coil	
L32	L40-1021-03	Ferri-inductor 1mH		T4,5	L34-0535-05	Tuning coil	
L33	L40-1011-03	Ferri-inductor 100μH		T6	L34-0536-05	Tuning coil	
L34	L40-1592-02	Ferri-inductor 1.5μH		T7	L34-0535-05	Tuning coil	
L35	L34-0966-05	Trap coil 8.83M	☆	T8	L34-0536-05	Tuning coil	
L36	L40-1511-03	Ferri-inductor 150μH		CF1	L72-0310-05	Ceramic filter 8.83MHz	
L37,38	L40-4711-03	Ferri-inductor 470μH		XF1	L71-0208-05	MCF 8.83MHz	
L39	L40-4782-02	Ferri-inductor 0.47μH		VR1	R12-6405-05	Trim. pot 470kΩ	☆
L40~42	L40-4711-03	Ferri-inductor 470μH		VR2	R12-0416-05	Trim. pot 470Ω	
L43	L40-1021-03	Ferri-inductor 1mH			R92-0150-05	Short jumper	
L44	L40-1011-03	Ferri-inductor 100μH			S51-4401-05	Relay (LZN-4)	
L45	L40-1021-03	Ferri-inductor 1mH		AF-GEN UNIT (X49-1110-01)			
L46,47	L40-1011-03	Ferri-inductor 100μH		C1	CC45CH1H100D	C 10pF ±0.5pF	
L48	L33-0032-05	Choke coil 3μH		C3	CQ92M1H333K	ML 0.033μF	
T1	L34-0696-35	Input coil	☆	C4	CE04W1HR47	E 0.47μF 50V	
T2	L19-0303-05	Wide bandwidth trans		C5	CE04W1A221	E 220μF 10V	
T3	L30-0506-05	IFT		C7,8	CE04W1C100	E 10μF 16V	
T4	L34-0697-05	Output coil		C9	CQ92M1H104K	ML 0.1μF	
T5	L19-0303-05	Wide bandwidth trans		C10,11	C90-0817-05	E 1000μF 16V	☆
T6	L19-0302-05	Wide bandwidth trans		C12	CQ92M1H104K	ML 0.1μF	
VR1	R12-0416-05	Trim. pot 470Ω		C13	CE04W1C470	E 47μF 16V	
VR2	R12-1408-05	Trim. pot 4.7kΩ	☆				
	R92-0150-05	Short jumper					
	S29-3406-05	Rotary wafer ass'y	☆				

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
C14	CQ92M1H104K	ML 0.1μF		T1	L15-0016-05	Choke	
C16	CE04W1C470	E 47μF 16V		T2	L34-0567-05	Tuning coil	
C17	CE04W1H010	E 1μF 50V		R14	RS14GB3D8R2J	Metal film 8.2Ω 2W	
C18	CQ92M1H223K	ML 0.022μF		VR1	R12-3025-05	Trim.pot 10kΩ(B) RIT	
C19	CE04W1C100	E 10μF 16V		VR2	R12-4016-05	Trim.pot 50kΩ(B) RF	
C21,22	CE04W1C470	E 47μF 16V		VR3	R12-0042-05	Trim.pot 500Ω(B) 9V	
C23	CQ92M1H104K	ML 0.1μF		VR4	R12-4016-05	Trim.pot 50kΩ(B) SIDE TONE	
C24	CE04W1C221	E 220μF 16V		VR5	R12-0401-05	Trim.pot 100Ω(B) BM	
C30~33	CC45CH1H220J	C 22pF		VR6	R12-0405-05	Trim.pot 330Ω(B) ANT1.V	☆
C37	CC45SL1H151J	C 150pF		VR7	R12-3408-05	Trim.pot 47kΩ(B) V.GAIN	☆
C38	CC45CH1H100D	C 10pF ±0.5pF		VR8	R12-5402-05	Trim.pot 220kΩ(B) DELAY	☆
C39	CC45SL1H180J	C 18pF			R92-0150-05	Short jumper	
C41,42	CC45SL1H101J	C 100pF		CAR UNIT (X50-1500-00)			
C43	CE04W1H010	E 1μF 50V		C2	CC45UJ1H220J	C 22pF	
C44	CE04W1A221	E 220μF 10V		C3	CC45UJ1H270J	C 27pF	
C45	CE04W1E4R7	E 4.7μF 25V		C4	CC45UJ1H220J	C 22pF	
C46	CE04W1H010	E 1μF 50V		C9	CS15E1VR22M	T 0.22μF 35V	
C47	CQ92M1H473K	ML 0.047μF		C13	CC45SL1H101J	C 100pF	
C48,49	CE04W1E4R7	E 4.7μF 25V		C14	CC45CH1H020C	C 2pF ±0.25pF	
C50	CE04W1H010	E 1μF 50V		C15	CC45CH1H330J	C 33pF	
C51	CE04W1H3R3	E 3.3μF 50V		C16	C91-0456-05	C 0.047μF 25V	
C52	CE04W1H010	E 1μF 50V		TC1,2	C05-0056-05	Ceramic trimmer 30pF	
C55	CC45UJ1H220J	C 22pF			E40-0373-05	Mini connect wafer 3P	
C56	CC45SL1H101J	C 100pF			E40-0873-05	Mini connect wafer 8P	
C59	CC45CH1H050C	C 5pF ±0.25pF			J31-0502-04	PC Board collar	
C64,66	CC45SL1H470J	C 47pF			J42-0404-05	PC Board bush	
C67	CE04W1C100	E 10μF 16V		L1~3	L40-1511-03	Ferri-inductor 150μH	
C68	CE04W1H010	E 1μF 50V		L4	L33-0266-05	Choke coil 28μH	
C69,70	CQ92M1H123K	ML 0.012μF		L5	L40-2211-03	Ferri-inductor 220μH	
C71	CQ92M1H104K	ML 0.1μF		L6,7	L40-1511-03	Ferri-inductor 150μH	
C72,73	CQ92M1H123K	ML 0.012μF		T1	L32-0201-05	OSC coil	
C74	CE04W1H010	E 1μF 50V		X1	L77-0485-05	Crystal 8831.5kHz	
C75	CE04W1A101	E 100μF 10V		X2	L77-0486-05	Crystal 8828.5kHz	
C76,77	CE04W1A470	E 47μF 10V		VR1,2	R12-1012-05	Trim. pot 1kΩ(B)	
C78	CQ92M1H223K	ML 0.022μF			R92-0150-05	Short jumper	
C79	CE04W1H3R3	E 3.3μF 50V		PLL UNIT (X50-1700-00)			
C80	CE04W1H010	E 1μF 50V		C1	CC45TH1H270J	C 27pF	
C81	CQ92M1H473K	ML 0.047μF		C2	CC45TH1H100D	C 10pF ±0.5pF	
C83	CQ92M1H472K	ML 0.0047μF		C3	CC45TH1H220J	C 22pF	
C84	CQ92M1H473K	ML 0.047μF		C5	CC45RH1H390J	C 39pF	
C85	CE04W1E4R7	E 4.7μF 25V		C6	CC45SH1H560J	C 56pF	
C86	CE04W1E3R3	E 3.3μF 25V		C7	CE04W1A470Q	E 47μF 10V	
C90	CE04W1C220	E 22μF 16V		C8	CC45TH1H270J	C 27pF	
C91	CQ92M1H153K	ML 0.015μF					
C92	CC45SL1H050C	C 5pF ±0.25pF					
TC1~6	C05-0030-15	Ceramic trimmer 20pF					
	E18-0401-05	Crystal socket 4P					
	E40-0273-05	Mini connect wafer 2P					
	E40-0773-05	Mini connect wafer 7P					
	E40-0911-05	Mini connect wafer 9P	☆				
	E40-1073-05	Mini connect wafer 10P					
	E40-1273-05	Mini connect wafer 12P					
	E40-1373-05	Mini connect wafer 13P	☆				
	F20-0078-05	Insulating board					
	F29-0014-05	Shoulder washer					
L1	L40-1021-03	Ferri-inductor 1mH					
L2,3	L40-1511-03	Ferri-inductor 150μH					
L4	L40-4711-03	Ferri-inductor 470μH					
L5	L40-3392-02	Ferri-inductor 3.3μH					
L6,7	L40-1511-03	Ferri-inductor 150μH					
L8	L40-1021-03	Ferri-inductor 1mH					

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
C9	CC45TH1H150J	C 15pF		C126	CE04W1A470Q	E 47μF 10V	
C10	CC45TH1H180J	C 18pF		C127	CC45SL1H390J	C 39pF	
C12	CE04W1A470Q	E 47μF 10V		C128	CC45SL1H070D	C 7pF ±0.5pF	
C14	CC45UJ1H680J	C 68pF		C129	CC45CH1H0R5C	C 0.5pF ±0.25pF	
C15	CC45UJ1H100D	C 10pF ±0.5pF		C130	CE04W1C470M	E 47μF 16V	
C16	CC45TH1H150J	C 15pF			E23-0046-04	Square terminal	
C18	CC45TH1H220J	C 22pF			E40-0273-05	Mini connect wafer 2P	
C19	CE04W1A470Q	E 47μF 10V			E40-0573-05	Mini connect wafer 5P	
C20	CC45UJ1H680J	C 68pF			E40-0673-05	Mini connect wafer 6P	
C21	CC45UJ1H330J	C 33pF			E40-0873-05	Mini connect wafer 8P	
C23	CC45TH1H150J	C 15pF			J31-0502-04	PC Board collar	
C24	CC45TH1H080D	C 8pF ±0.5pF			J42-0404-05	PC Board bush	
C25	CC45TH1H120J	C 12pF		L1~5	L40-1511-03	Ferri-inductor 150μH	
C26	CE04W1A470Q	E 47μF 10V		L6	L40-4701-03	Ferri-inductor 47μH	
C28	CC45TH1H330J	C 33pF		L7	L40-1511-03	Ferri-inductor 150μH	
C29	CC45TH1H150J	C 15pF		L8	L40-1592-02	Ferri-inductor 1.5μH	
C30	CC45TH1H270J	C 27pF		L9,10	L40-1092-02	Ferri-inductor 1.0μH	
C31	CC45TH1H330J	C 33pF		L11	L40-1292-02	Ferri-inductor 1.2μH	
C32	CC45UJ1H220J	C 22pF		L12~17	L40-1511-03	Ferri-inductor 150μH	
C34	CE04W1A470Q	E 47μF 10V		L18	L40-1011-03	Ferri-inductor 100μH	
C36	CC45UJ1H220J	C 22pF		L19	L40-1511-03	Ferri-inductor 150μH	
C37	CC45UJ1H050C	C 5pF ±0.25pF		L20~22	L40-2701-03	Ferri-inductor 27μH	
C38	CC45CH1H100D	C 10pF ±0.5pF		L23	L40-4711-03	Ferri-inductor 470μH	
C39	CC45CH1H020C	C 2pF ±0.25pF		L24,25	L40-1511-03	Ferri-inductor 150μH	
C41,43	C91-0456-05	C 0.047μF 25V		L26	L40-1001-03	Ferri-inductor 10μH	
C44	CC45SL1H151J	C 150pF		L27	L40-4711-03	Ferri-inductor 470μH	
C45	CC45SL1H271J	C 270pF		L28	L40-2701-03	Ferri-inductor 27μH	
C46	CC45SL1H121J	C 120pF		L29	L40-1511-03	Ferri-inductor 150μH	
C48	CC45CH1H100D	C 10pF ±0.5pF		T1	L32-0193-05	OSC coil	
C49	CC45SL1H470J	C 47pF		T2	L32-0195-05	OSC coil	
C52	CC45RH1H390J	C 39pF		T3	L32-0196-05	OSC coil	
C53	CC45RH1H560J	C 56pF		T4	L32-0197-05	OSC coil	
C65	CC45RH1H470J	C 47pF		T5	L32-0198-05	OSC coil	
C66	CC45RH1H220J	C 22pF		T6	L34-0529-05	Trap coil 8.83M	
C67	CC45RH1H470J	C 47pF		T7	L34-0709-05	Tuning coil 10M	
C70	CC45RH1H100D	C 10pF ±0.5pF		T8	L34-0710-05	Tuning coil 20M	
C71	CC45SL1H050D	C 5pF ±0.5pF		T9	L34-0712-05	Tuning coil	
C75	CC45RH1H330J	C 33pF		T10	L34-0713-05	Tuning coil	
C76	CC45RH1H150J	C 15pF		T11	L34-0711-05	Tuning coil	
C77	CC45RH1H330J	C 33pF		T12	L34-0716-05	Tuning coil	
C80	CC45RH1H150J	C 15pF		T13	L34-0715-05	Tuning coil	
C81	CC45RH1H040C	C 4pF ±0.25pF		T14	L34-0714-05	Tuning coil	
C82	CC45RH1H150J	C 15pF		T15	L34-0757-05	Tuning coil	
C85	CC45RH1H100D	C 10pF ±0.5pF		T16	L34-0718-05	Tuning coil	
C86	CC45SL1H050D	C 5pF ±0.5pF		T17	L34-0717-05	Tuning coil	
C88	CC45CH1H010C	C 1pF ±0.25pF		VR1	R12-5014-05	Trim. pot 100kΩ	
C89	CC45CH1H050C	C 5pF ±0.25pF			R92-0150-05	Short jumper	
C100,101	CC45SL1H221J	C 220pF					
C102	CQ92M1H122K	ML 0.0012μF					
C103	CC45SL1H330J	C 33pF					
C104,105	CC45SL1H680J	C 68pF					
C106	CC45SL1H330J	C 33pF					
C108,109	C91-0456-05	C 0.047μF 25V					
C110	CC45SL1H390J	C 39pF					
C111	CC45SL1H271J	C 270pF					
C112	C91-0456-05	C 0.047μF 25V					
C113	CE04W1A101Q	E 100μF 10V					
C114	C91-0456-05	C 0.047μF 25V					
C115	CE04W1A470Q	E 47μF 10V					
C120	C91-0456-05	C 0.047μF 25V					
C121	CQ92M1H102K	ML 0.001μF					
C122	CQ92M1H104K	ML 0.1μF					
C123	C91-0456-05	C 0.047μF 25V					
C124	CE04W1A101Q	E 100μF 10V					

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks
FILTER UNIT (X51-1240-00) S TYPE			
C2	CC45SL2H221J	C 220pF 500V	
C3	C91-0456-05	C 0.047μF 25V	
C4	CC45CH1H680J	C 68pF	
C5	CC45CH2H030C	C 3pF ±0.25pF 500V	
C7	C91-0456-05	C 0.047μF 25V	
C8	CE04W1H010	E 1μF 50V	
C10	CE04W1HR47	E 0.47μF 50V	
C11	C91-0456-05	C 0.047μF 25V	
C13	CE04W1C100	E 10μF 16V	
C18	CE04W1C221	E 220μF 16V	
C19	C91-0456-05	C 0.047μF 25V	
C23	CM93D2H561J	MC 560pF 500V	
C24,25	CM93D2H122J	MC 0.0012μF 500V	
C26	CM93D2H821J	MC 820pF 500V	
C27	CC45CH2H151J	C 150pF 500V	
C28	CC45SL2H181J	C 180pF 500V	
C29	CM93D2H621J	MC 620pF 500V	
C30	CC45CH2H151J	C 150pF 500V	
C31	CC45SL2H181J	C 180pF 500V	
C32,33	CC45CH2H121J	C 120pF 500V	
C34	CM93D2H471J	MC 470pF 500V	
C35	CC45CH2H680J	C 68pF 500V	
C36	CC45CH2H151J	C 150pF 500V	
C37	CC45SL2H221J	C 220pF 500V	
C38	CC45CH2H121J	C 120pF 500V	
C39	CC45CH2H101J	C 100pF 500V	
C40	CC45CH2H151J	C 150pF 500V	
C41	CC45SL2H181J	C 180pF 500V	
C42	CC45CH2H680J	C 68pF 500V	
C43	CC45CH2H820J	C 82pF 500V	
C44	CC45CH2H560J	C 56pF 500V	
C45	CC45CH2H680J	C 68pF 500V	
C46	CC45CH2H101J	C 100pF 500V	
C47	CC45CH2H121J	C 120pF 500V	
C48	CC45CH2H560J	C 56pF 500V	
C49	CC45CH2H680J	C 68pF 500V	
C50	CC45CH2H470J	C 47pF 500V	
C51	CC45CH2H390J	C 39pF 500V	
C52,53	CC45CH2H820J	C 82pF 500V	
C54,55	CC45CH2H680J	C 68pF 500V	
C56	CC45CH2H820J	C 82pF 500V	
C57,58	CC45CH2H151J	C 150pF 500V	
C59,60	CC45CH2H101J	C 100pF 500V	
TC1	C05-0043-05	Ceramic trimmer 20pF	
	E04-0154-05	Coax. connector	
	E23-0046-04	Square terminal	
	E40-0273-05	Mini connect wafer 2P	
	E40-0373-05	Mini connect wafer 3P	
	E40-0973-05	Mini connect wafer 9P	
	E40-1273-05	Mini connect wafer 12P	
	F20-0078-05	Insulating board	
	F29-0014-05	Shoulder washer	
	J31-0502-04	PC Board collar	
	J42-0404-05	PC Board bush	
L1~3	L34-0826-05	Filter coil (A)	
L4,5	L34-0827-05	Filter coil (B)	
L6,7	L34-0828-05	Filter coil (C)	

Ref.No.	Parts No.	Description	Re- marks
L8,9	L34-3001-15	Filter coil (D)	
L10,11	L34-0830-05	Filter coil (E)	
L12	L40-1021-03	Ferri-inductor 1mH	
L13	L34-0989-05	Filter coil (G)	☆
L14,15	L40-1021-03	Ferri-inductor 1mH	
L16,17	L40-1511-03	Ferri-inductor 150μH	
L18	L39-0406-05	Detector coil	
L19	L40-1511-03	Ferri-inductor 150μH	
L20,21	L34-0988-05	Filter coil (F)	☆
L22	L34-0989-05	Filter coil (G)	☆
R23	RC05GF2H151J	Solid 150Ω 1/2W	
VR1	R12-4016-05	Trim. pot 50kΩ(B)	
VR2	R12-3025-05	Trim. pot 10kΩ(B)	
VR3	R12-4016-05	Trim. pot 50kΩ(B)	
VR4	R12-0042-05	Trim. pot 500Ω(B)	
VR5	R12-1020-05	Trim. pot 1kΩ(B)	
	R92-0150-05	Short jumper	
RL1	S51-4402-05	Relay (LZN403)	

FILTER UNIT (X51-1250-00) V TYPE			
C1	CC45SL2H102JTD	C 0.001μF 500V	
C2	CC45SL2H821JTD	C 820pF 500V	
C3	CC45SL2H331J	C 330pF 500V	
C4	CC45SL2H561JTD	C 560pF 500V	
C5	CC45SL2H331J	C 330pF 500V	
C6	CC45SL2H561JTD	C 560pF 500V	
C7	CC45SL2H331J	C 330pF 500V	
C8	CC45CH2H131J	C 130pF 500V	
C9	CC45SL2H331J	C 330pF 500V	
C10	CC45SL2H161J	C 160pF 500V	
C11	CC45SL2H151J	C 150pF 500V	
C12	CC45SL2H241J	C 240pF 500V	
C13	CC45CH2H121J	C 120pF 500V	
C14	CC45CH2H820J	C 82pF 500V	
C15	CC45SL2H161J	C 160pF 500V	
C16	CC45CH2H820J	C 82pF 500V	
C17	CC45CH2H750J	C 75pF 500V	
C19	CC45CH1H100D	C 10pF ±0.5pF	
C20	CC45CH1H101J	C 100pF 500V	
C21	CC45SL2H221J	C 220pF 500V	
C22	C91-0456-05	C 0.047μF 25V	
C23	CC45SL2H151J	C 150pF 500V	
C26	C91-0456-05	C 0.047μF 25V	
C27	CE04W1HR47	E 0.47μF 50V	
C29	CE04W1H010	E 1μF 50V	
C30	CC45CH2H150J	C 15pF 500V	
C33	CE04W1C470Q	E 47μF 16V	
C34	CE04W1C221Q	E 220μF 16V	
C35	C91-0456-05	C 0.047μF 25V	
TC1	C05-0043-05	Ceramic trimmer 20pF	
	E04-0154-05	Coax. connector	
	E23-0046-04	Square terminal	
	E40-0273-05	Mini connect wafer 2P	
	E40-0373-05	Mini connect wafer 3P	

PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks	
	E40-0673-05	Mini connect wafer 6P		C11	CE04W1A101Q	E 100µF 10V		
	E40-1073-05	Mini connect wafer 10P		C12	C91-0456-05	C 0.047µF 25V		
	J31-0502-04	PC Board collar		C13	CC45SL1H470J	C 47pF		
	J42-0404-05	PC Board bush		C14	CC45CH1H390J	C 39pF		
	J61-0019-05	Vinyle tie		C15	CC45CH1H101J	C 100pF		
L1,2	L34-0826-05	Filter coil		C16	CC45CH1H270J	C 27pF		
L3,4	L34-0827-05	Filter coil		C17	C91-0456-05	C 0.047µF 25V		
L5	L34-0828-05	Filter coil		C18	CC45SL1H221J	C 220pF		
L6	L34-0724-05	Filter coil		C19	CC45SL1H220J	C 22pF		
L7,8	L34-0829-05	Filter coil		C20	CC45SL1H050C	C 5pF ±0.25pF		
L9,10	L34-0830-05	Filter coil		C21,22	C91-0456-05	C 0.047µF 25V		
L11	L39-0404-05	Detector coil		C23	CE04W1A101Q	E 100µF 10V		
L12,13	L40-1511-03	Ferri-inductor 150µH		C24	CC45SL1H101J	C 100pF		
L14,15	L40-1021-03	Ferri-inductor 1mH		C25	CC45SL1H270J	C 27pF		
L16,17	L40-1511-03	Ferri-inductor 150µH		C26	CC45SL1H560J	C 56pF		
				C27	CC45SL1H270J	C 27pF		
R4	RC05GF2H103K	Solid 10kΩ 1/2W		C28~30	CC45SL1H470J	C 47pF		
VR1	R12-3025-05	Trim. pot 10kΩ(B)		C31,33	C91-0456-05	C 0.047µF 25V		
VR2,3	R12-4016-05	Trim. pot 50kΩ(B)		C34	CC45SL1H101J	C 100pF		
VR4	R12-1020-05	Trim. pot 1kΩ(B)		C35	CC45SL1H221J	C 220pF		
	R92-0150-05	Short jumper		C36	CC45SL1H101J	C 100pF		
	S01-2424-05	Rotary switch	☆	C38,39	C91-0456-05	C 0.047µF 25V		
	S51-4402-05	Relay (LZN403)		C40	CC45SL1H150J	C 15pF		
PROCESSOR UNIT (X54-1550-00)								
C1~4	CE04W1H010Q	E 1µF 50V		C41,42	C91-0456-05	C 0.047µF 25V		
C5	CE04W1H3R3Q	E 3.3µF 50V		C43	CQ92M1H103K	ML 0.01µF		
C6,7	CE04W1H010Q	E 1µF 50V		C44,45	C91-0456-05	C 0.047µF 25V		
C8	CE04W1H4R7Q	E 4.7µF 50V		C46	CE04W1A101Q	E 100µF 10V		
C9	CE04W1C100Q	E 10µF 16V		C47	CE04W0J221Q	E 220µF 6.3V		
C10	CE04W1H4R7Q	E 4.7µF 50V		C48	CE04W1V100Q	E 10µF 35V		
C11	CE04W1C470Q	E 47µF 16V		C49	CQ92M1H103K	ML 0.01µF		
	E23-0047-04	Square terminal		C50,51	CE04W1V100Q	E 10µF 35V		
	E40-0273-05	Mini connect wafer 2P		C52	C91-0456-05	C 0.047µF 25V		
	E40-0473-05	Mini connect wafer 4P		C53	CE04W1V100Q	E 10µF 35V		
	E40-0873-05	Mini connect wafer 8P		C55,57,62	C91-0456-05	C 0.047µF 25V		
VR1,S1	R19-3408-05	Pot. with SW 10kΩ(A),10kΩ(B)	☆	TC1	C05-0035-05	Ceramic trimmer 50pF		
VR2	R12-5406-05	Pot. 100kΩ	☆		E31-0466-05	Tape cable		
	R92-0150-05	Short jumper			E40-0273-05	Mini connect wafer 2P		
COUNTER UNIT (X54-1560-00)						E40-0373-05	Mini connect wafer 3P	
C1	CC45CH1H390J	C 33pF			E40-1273-05	Mini connect wafer 12P		
C2	CC45SL1H391J	C 390pF			E40-1373-05	Mini connect wafer 13P		
C3	CC45CH1H470J	C 47pF			J31-0502-04	PC Board collar		
C4	C91-0456-05	C 0.047µF 25V			J42-0404-05	PC Board bush		
C5	CC45SL1H150J	C 15pF		L1~4	L40-4711-03	Ferri-inductor 470µH		
C6	CC45SL1H020C	C 2pF ±0.25pF		L5,6	L40-4701-03	Ferri-inductor 47µH		
C7	CC45SL1H100D	C 10pF ±0.5pF		L7,8	L40-4711-03	Ferri-inductor 470µH		
C9,10	C91-0456-05	C 0.047µF 25V		L9,10	L40-2211-03	Ferri-inductor 220µH		
				L11,12	L40-1511-03	Ferri-inductor 150µH		
				L13	L40-1011-04	Ferri-inductor 100µH		
				T1	L19-0305-05	OSC trans		
				X1	L77-0482-05	Crystal 10MHz		
				R68	RC05GF2H151K	Solid 150Ω 1/2W		
				RB1	R90-0522-05	Resistor block 47kΩ X6		
				RB2,3	R90-0521-05	Resistor block 47kΩ X7		
				RB4	R90-0522-05	Resistor block 47kΩ X6		
					R92-0150-05	Short jumper		

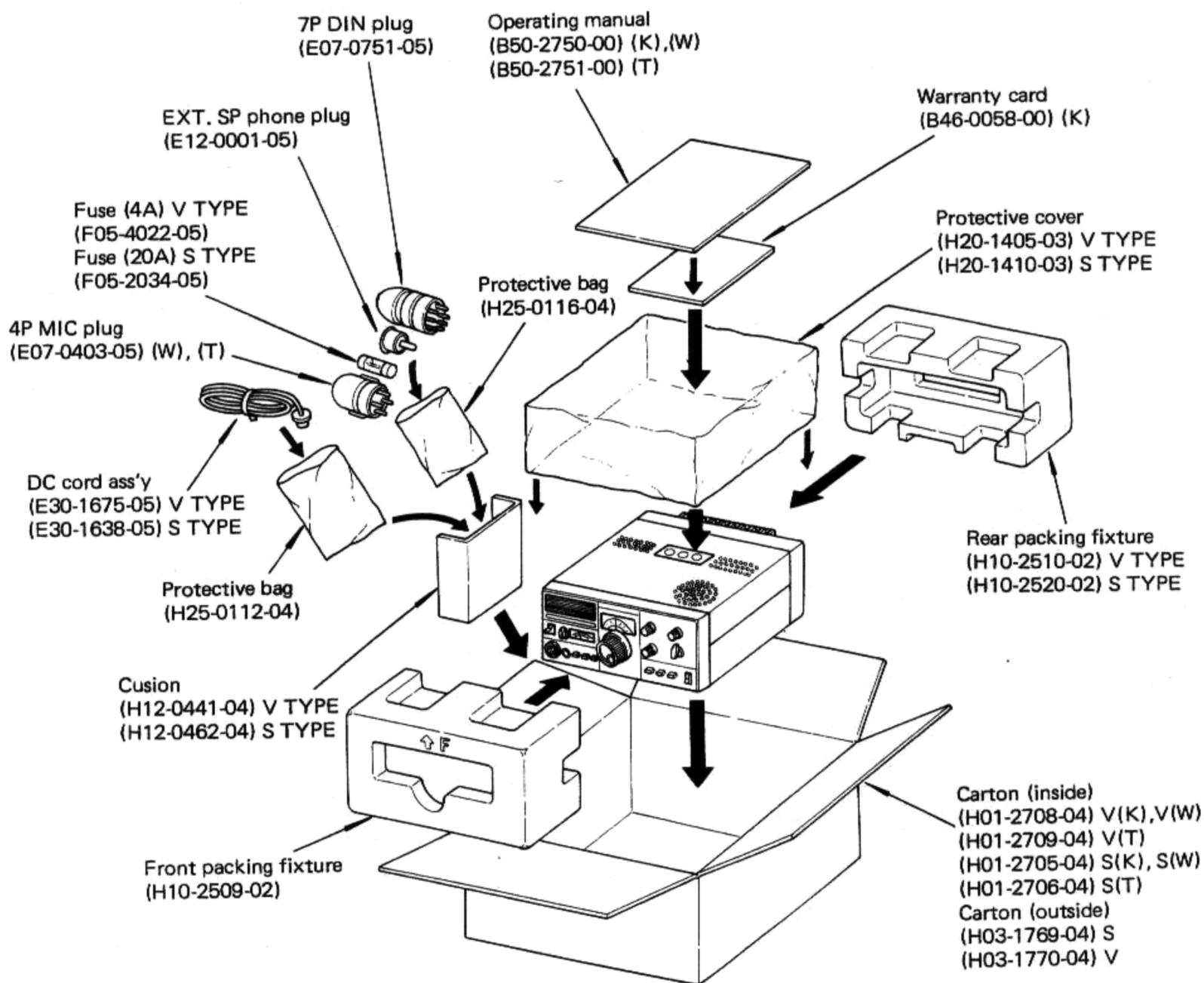
PARTS LIST

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
FINAL UNIT (X-56-1300-00) V TYPE							
C1,3	C91-0456-05	C 0.047μF 25V		E23-0043-04	Antenna earth lug		
C5,6,10	C91-0456-05	C 0.047μF 25V		E23-0046-04	Square terminal		
C12~14	C91-0456-05	C 0.047μF 25V		E23-0401-05	Round terminal		
C16,18	C91-0456-05	C 0.047μF 25V		E23-0420-05	Earth lug		
C19	CE04W1C101	E 100μF 16V		E40-0273-05	Mini connect wafer 2P		
C20	CE04W1C100	E 10μF 16V		E40-0373-05	Mini connect wafer 3P		
C21	CC45SL2H151J	C 150pF 500V		F01-0735-05	Heat sink		
C22	CC45SL1H471J	C 470pF		F20-0078-05	Insulating board		
C23	CC45SL2H680J	C 68pF 500V		F29-0014-05	Shoulder washer		
C24	C91-0456-05	C 0.047μF 25V		J31-0503-05	Bees		
	E23-0401-05	Round terminal		J32-0730-04	Hex. boss		☆
	F01-0717-13	Heat sink A	☆	L1	L40-1001-04	Ferri-inductor 10μH	
	F20-0078-05	Insulating board		L3,4	L33-0032-05	RFC	
	F29-0014-05	Shoulder washer		L7	L33-0617-05	RFC	
L1	L40-4701-03	Ferri-inductor 47μH		L8	L33-0025-05	RFC	
L3,6	L33-0032-05	RFC 3μH		L9	L33-0625-15	RFC	☆
L7	L33-0617-05	RFC	☆	L10~12	L40-1011-04	Ferri-inductor 100μH	
T1	L19-0315-15	Wide bandwidth trans		L13,14	L40-1021-03	Ferri-inductor 1mH	
T2	L19-0306-15	Output trans	☆	T1	L19-0315-25	Wide bandwidth trans	
R6,7	RC05GF2H560J	Solid 56Ω 1/2W		T2	L19-0311-05	Input trans	☆
R11	RC05GF2H4R7J	Solid 4.7Ω 1/2W		T3	L19-0313-15	NF trans	☆
R17,18	RC05GF2H560J	Solid 56Ω 1/2W		T4	L19-0312-05	Output trans	☆
VR1	R12-0412-05	Trim. pot 200Ω(B)		N19-0611-04	Washer		☆
	R92-0150-05	Short jumper		R3	RC05GF2H4R7J	Solid 4.7Ω 1/2W	
FINAL UNIT (X56-1350-00) S TYPE							
C1	C91-0455-05	C 0.01μF 25V		R12,13	RC05GF2H101J	Solid 100Ω 1/2W	
C3,4	C91-0456-05	C 0.047μF 25V		R14~17	RS14A83A3R9J	Metal film 3.9Ω 1W	
C6	C91-0455-05	C 0.01μF 25V		R18,19	RC05GF2H150J	Solid 15Ω 1/2W	
C11	C91-0456-05	C 0.047μF 25V		R20~23	RC05GF2H5R6J	Solid 5.6Ω 1/2W	
C12	CE04W1E100	E 10μF 25V		VR1,2	R12-0058-05	Trim. pot 470Ω(B)	
C13,14	C91-0456-05	C 0.047μF 25V			R92-0150-05	Short jumper	
C15	CM93AD2H151J	MC 150pF 500V		TM1	S59-1404-05	Thermostat Heat sink	
C18,19	C91-0456-05	C 0.047μF 25V		TM2	S59-1403-05	Thermostat core	
C20	CE04W1E101	E 100μF 25V		VFO ASS'Y UNIT (X60-1160-00)			
C21,24	C91-0456-05	C 0.047μF 25V		B01-0621-04	Dial escutcheon		☆
C25	CE04W1E100	E 10μF 25V		B08-4301-04	Dial back board		☆
C33,34	C91-0448-05	Laminated cap. 0.68μF	☆	B10-0634-04	Front glass (A)		
C35	C91-0456-05	C 0.047μF 25V		B20-0811-04	Dial scale (B) 25K		☆
C37	CE04W1H101Q	E 100μF 50V		B20-0817-04	Dial scale (A) 500K		
C38	C91-0456-05	C 0.047μF 25V		B42-1645-04	Seal Bottom		
C39	CM93AD2H271J	MC 270pF 500V		B42-1671-04	Seal Top		
C40	CM93AD2H331J	MC 330pF 500V		G01-0804-04	Coil spring		
C41~43	C91-0455-05	C 0.01μF 25V		J19-1317-04	Diode holder		
C44	CM93AD2H271J	MC 270pF 500V		K21-0722-04	Main knob		
C47	CM93AD2H331J	MC 330pF 500V		N19-0613-04	washer B		
C50	CC45SL1H220J	C 22pF		X40-1170-00	VFO unit		☆
C51,52	C91-0455-05	C 0.01μF 25V		X54-1450-01	INDICATOR unit		
C53	CC45SL1H471J	C 470pF					
	E04-0152-05	UHF type receptacle					
	E08-0271-05	DC socket FAN					

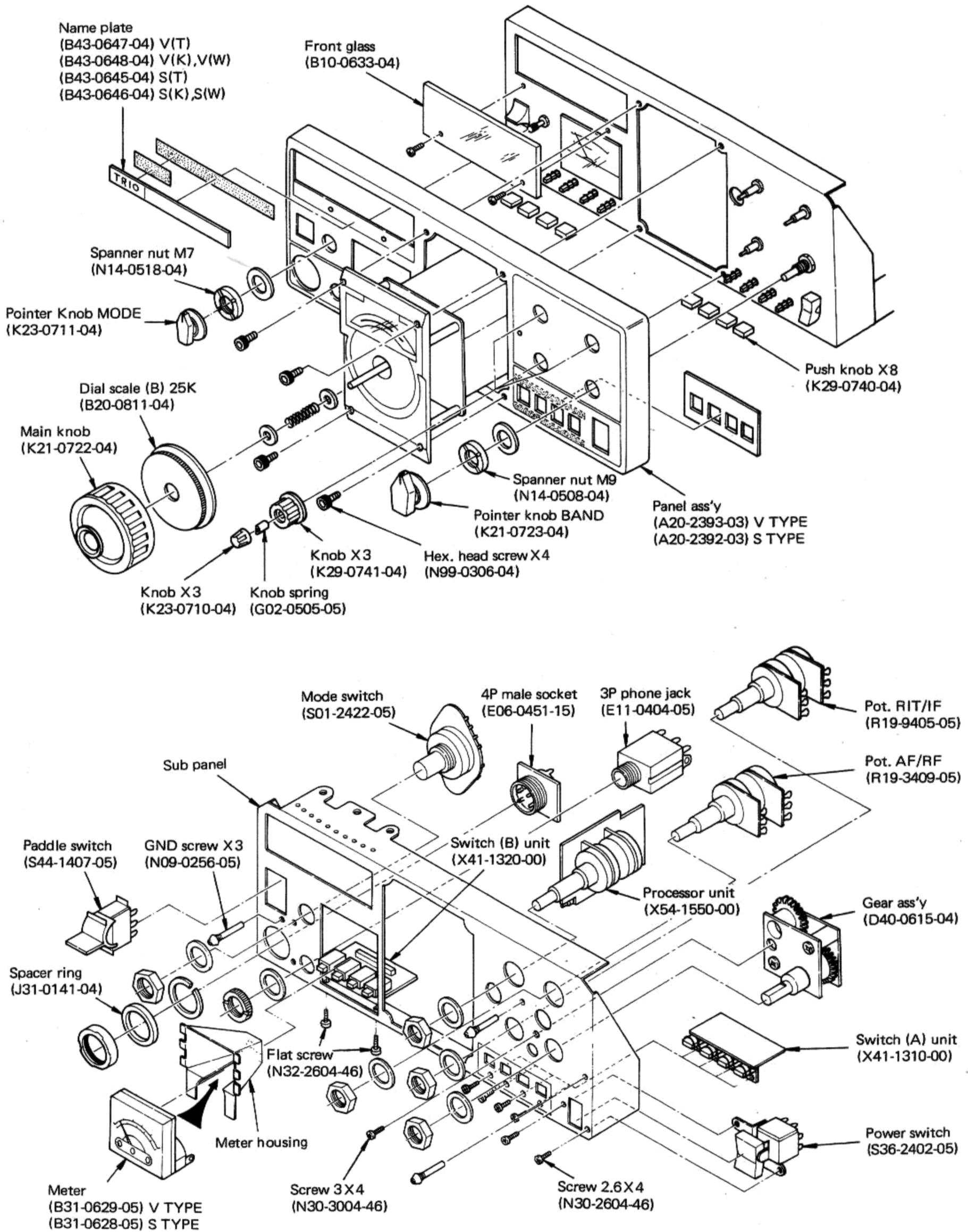
PARTS LIST/PACKING

Ref.No.	Parts No.	Description	Re-remarks	Ref. No.	Parts No.	Description	Re-remarks
VFO UNIT (X40-1170-00)				TC1	C05-0009-15	Ceramic trimmer 6pF	
C2	C91-0456-05	C 0.047 μ F 25V		TC2	C05-0013-15	Ceramic trimmer 20pF	
C4	CC45RG1H030C	C 3pF \pm 0.25pF			C02-0019-05	Variable cap.	☆
C5	CC45PG1H020C	C 2pF \pm 0.25pF			D40-0614-05	Dial mechanism ass'y	☆
C6	C91-0456-05	C 0.047 μ F 25V			E40-0574-05	Mini connect wafer 5P	
C7	CC45LG1H151J	C 150pF		L1	L32-0628-05	OSC coil	☆
C9	CC45LG1H121J	C 120pF		L2	L33-0025-05	Choke coil 1 μ H	
C12	CC45LG1H680J	C 68pF		L3	L32-0629-05	OSC coil (C)	☆
C13	CC45LG1H220J	C 22pF		L4	L32-0609-05	OSC coil (B)	
C14	CC45CG1H100D	C 10pF \pm 0.5pF		L5	L40-1021-03	Ferri-inductor 1mH	
C15	CC45LG1H151J	C 150pF		L6	L40-4711-03	Ferri-inductor 470 μ H	
C16	CC45LG1H151J	C 150pF		L7	L40-1021-03	Ferri-inductor 1mH	
C17	CC45CH1H020C	C 2pF \pm 0.25pF		L8	L40-1501-03	Ferri-inductor 15 μ H	
C18	C91-0456-05	C 0.047 μ F 25V		L9~11	L40-4711-03	Ferri-inductor 470 μ H	
C21	CC45SL1H390J	C 39pF			R92-0150-05	Short jumper	
C22	CC45CH1H100D	C 10pF \pm 0.5pF					
C23	CC45SL1H390J	C 39pF					
C24	C91-0456-05	C 0.047 μ F 25V					

PACKING



DISASSEMBLY

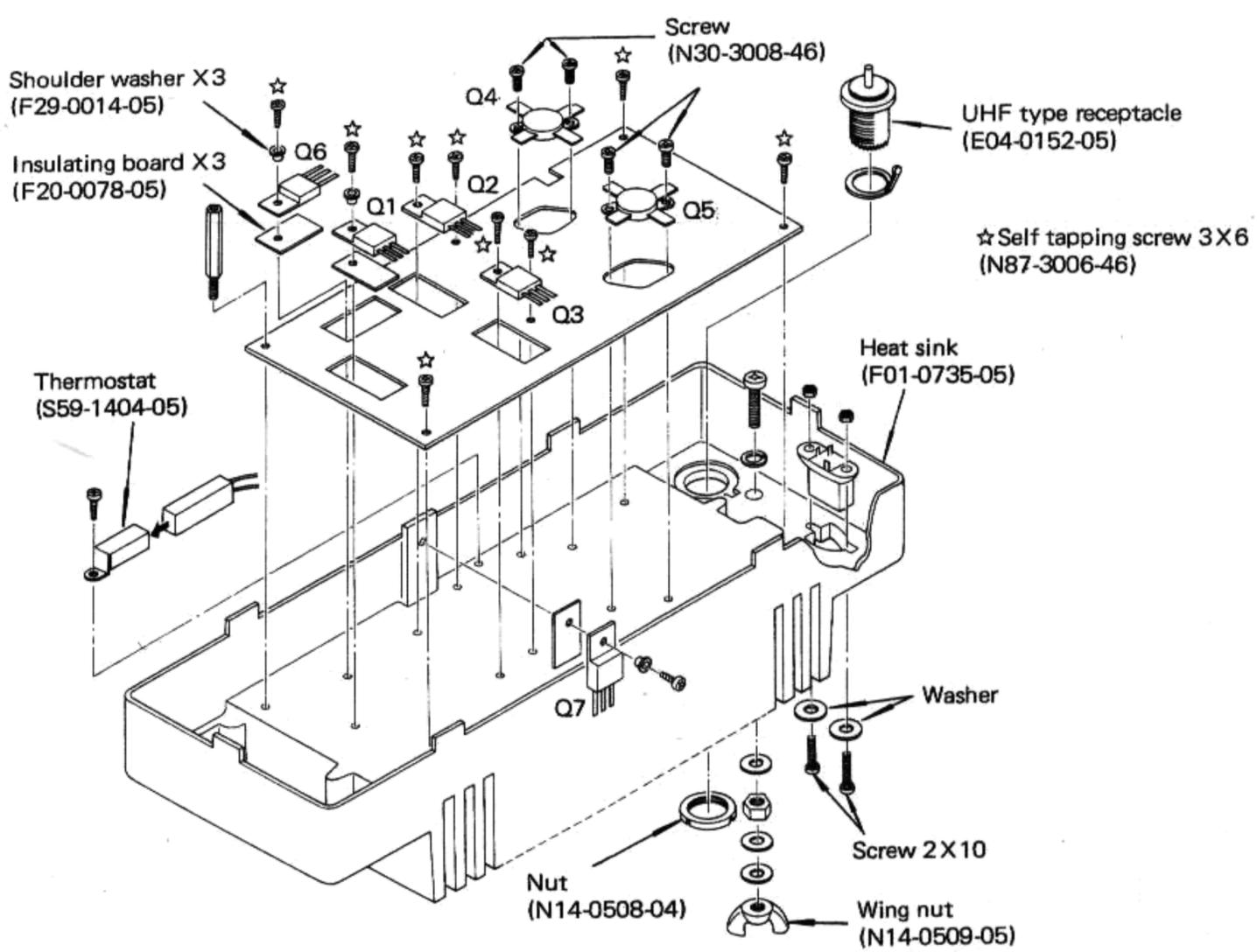


TS-130SV

DISASSEMBLY

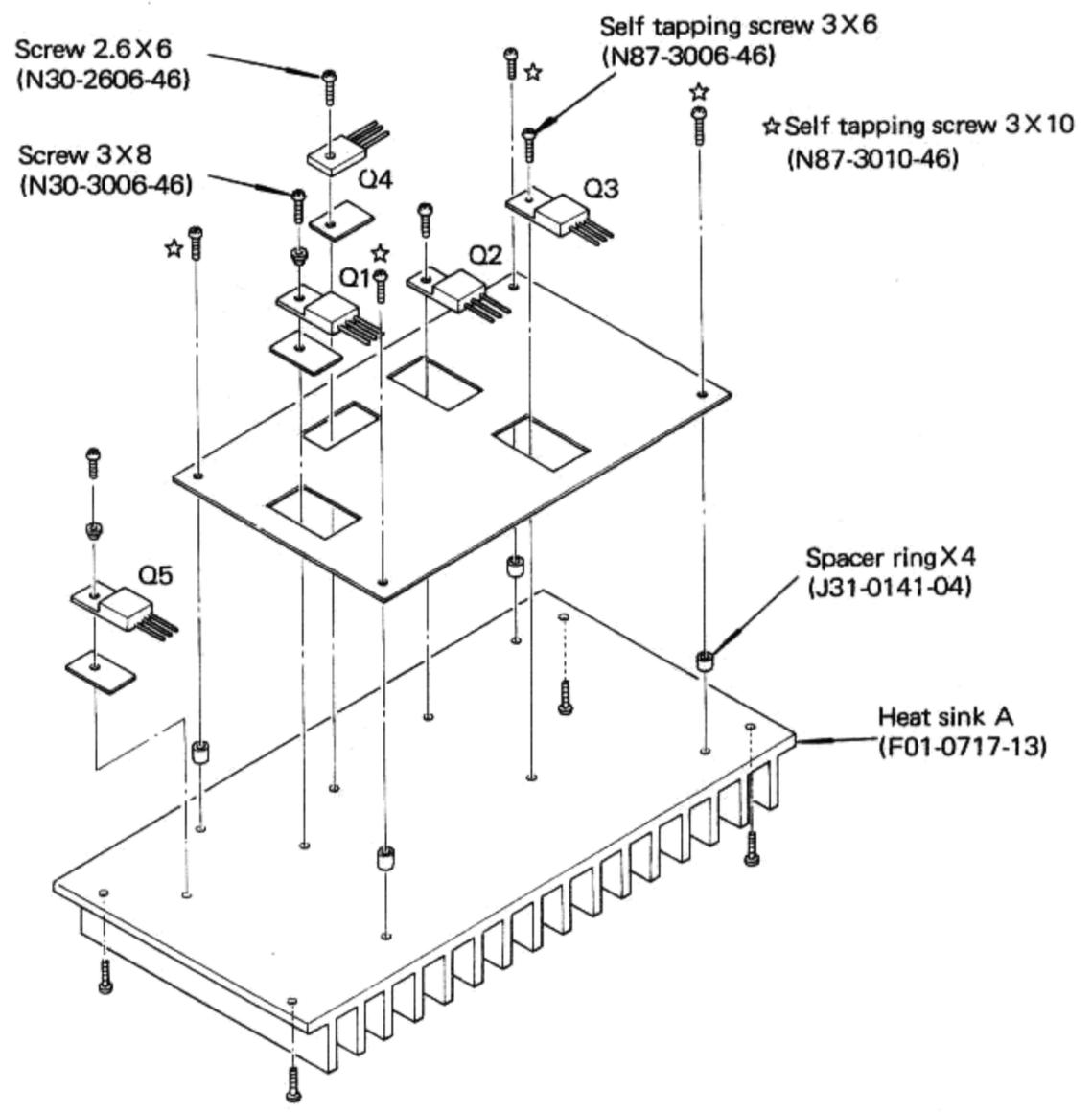
FINAL UNIT (S type)

- Q1: 2SC2075 (V03-2075-06)
- Q2,3: 2SC2509 (V03-2509-06)
- Q4,5: 2SC2290*J (V03-2290-16)
- Q6,7: 2SD880(Y) (V04-0880-16)

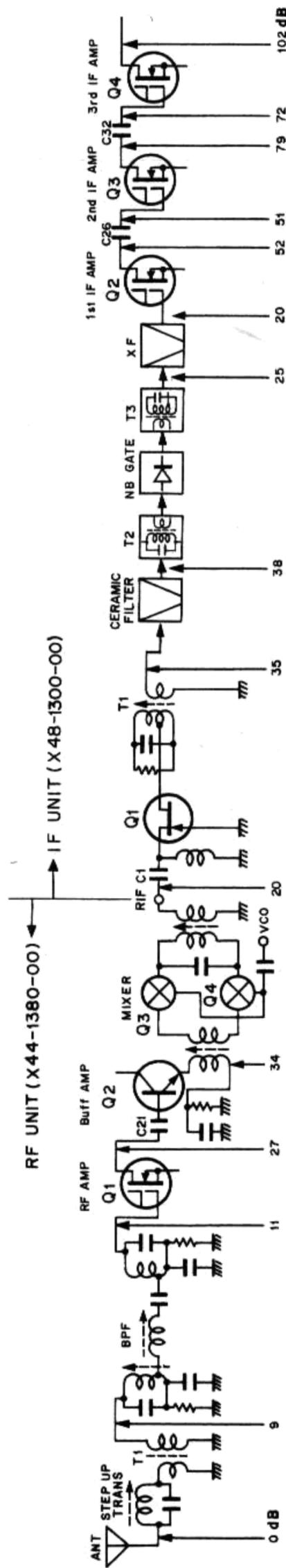


FINAL UNIT (V type)

- Q1 : 2SC2075 (V03-2075-06)
- Q2,3: 2SC2509 (V03-2509-06)
- Q4 : 2SC496(Y) (V03-0336-05)
- Q5 : 2SD880(Y) (V04-0880-16)

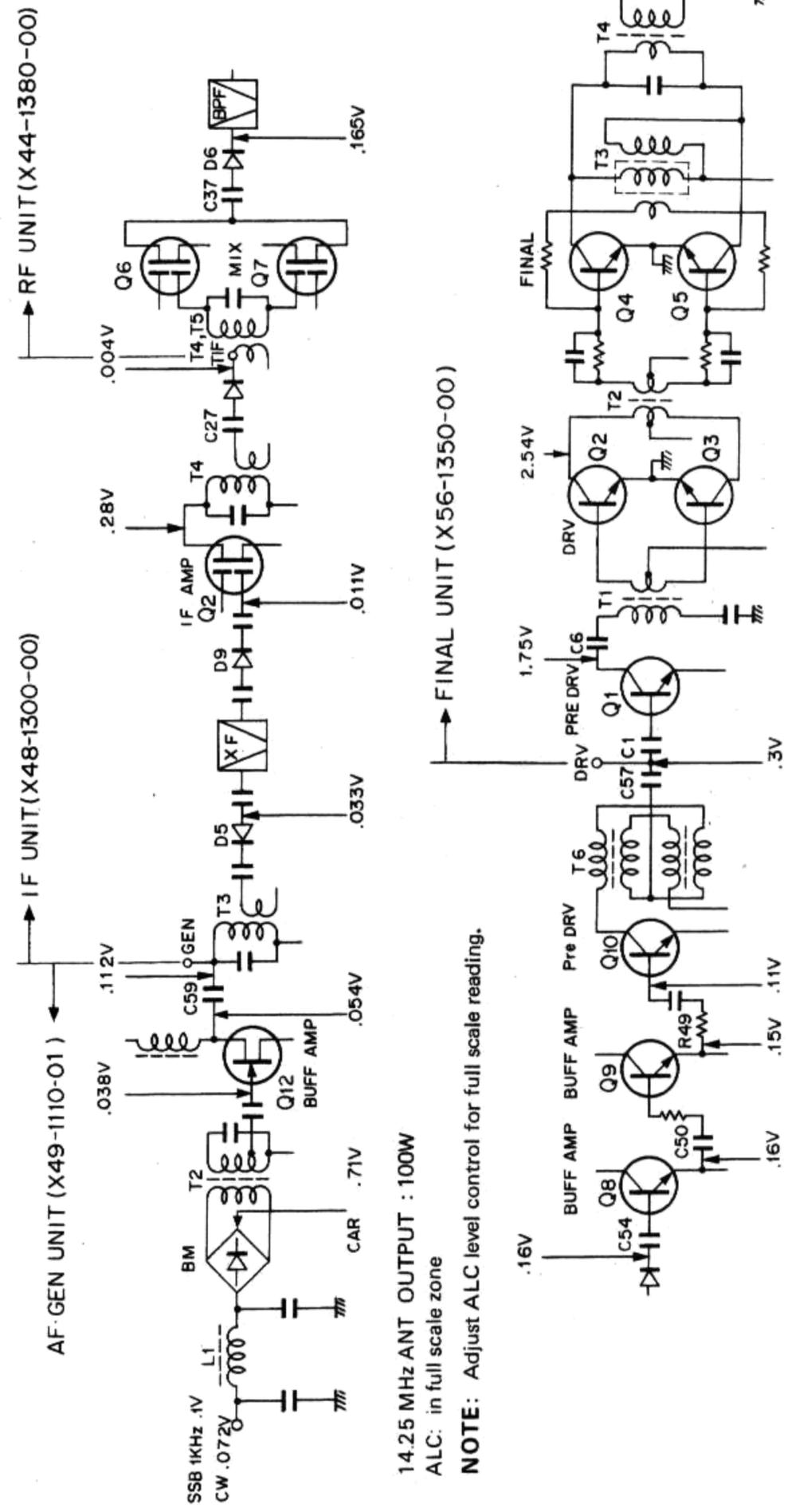


RECEIVER SECTION



NOTES:
 1) The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF gain control for 0.63V/8Ω (50 mW) audio output at 0 dB signal generator input at 14.250 MHz.
 2) All voltage measurements are read from an RF VTVM.
 3) To measure signal generator output connect a 0.01 μF 500 WV capacitor between the signal generator and the check point.

TRANSMITTER SECTION (S TYPE)



NOTE: Adjust ALC level control for full scale reading.

ADJUSTMENTS

GENERAL

Adjustment procedures for this transceiver are classified into formal adjustments requiring a full service bench and simplified adjustment using a VTVM, AF and RF VTVM, AG, and AF and RF dummy load. Complete adjustment also requires a frequency counter, SSG, sweep generator, etc.

TEST EQUIPMENT REQUIRED

1. VTVM or DVM

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

NOTE : A high-precision voltmeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2. DC current meter

- 1) Current range: 100mA, 200mA, 2A, 10A, High-precision current meter may be used.

3. RF VTVM

- 1) Input impedance: 1MΩ and less than 3 pF, min.
- 2) Voltage range: 10mV to 300V
- 3) Frequency range: 50MHz or greater

NOTE: During adjustment special accuracy is not required (such as input level or PLL circuit carrier oscillator output), a VTVM or VOM may substitute for an RF VTVM by measuring through the output of a detector as shown in item 14.

4. AF VTVM

- 1) Frequency range: 50Hz to 10kHz
- 2) Input resistance: 1MΩ or greater
- 3) Voltage range: 10mV to 30V

5. AF GENERATOR (AG)

- 1) Frequency range: 200Hz to 5kHz
- 2) Output: 2mV~1V, low distortion

6. AF DUMMY LOAD

- 1) Impedance: 8Ω
- 2) Dissipation: 3W or greater

7. RF DUMMY LOAD

- 1) Impedance: 50Ω, 150Ω
- 2) Dissipation: 100W continuous or greater
- 3) Frequency limits: 1.8 to 30MHz

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

8. OSCILLOSCOPE

Requires high sensitivity, and external synchronization capability.

9. SWEEP GENERATOR

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

10. Standard Signal Generator (SSG)

- 1) Frequency range: 1.8 to 30MHz
- 2) Output: -20dB/0.1μV~120dB/1V

NOTE: Generator must be frequency stable.

11. FREQUENCY COUNTER

- 1) Minimum input voltage: 50mV
- 2) Frequency range: Greater than 40MHz

12. NOISE GENERATOR

Must generate ignition noise containing harmonics beyond 30MHz.

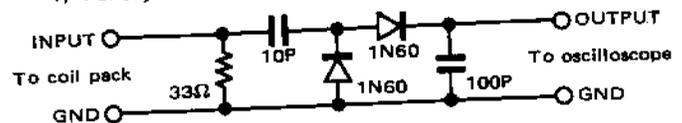
13. Spectrum analyzer

- 1) Frequency range: 100K to 110MHz
- 2) Bandwidth: 1kHz to 3MHz

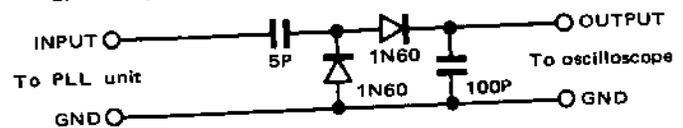
NOTE: R-1000 receiver may be used.

14. Detector

- 1) For adjustment of TX BPF



- 2) For adjustment of PLL unit BPF



15. Directional coupler

16. FIX-CH adjusting crystal element

- 1) 5.750MHz (center: 250kHz)

REFERENCE

Japanese "SSG"	American "SG"
-6dB	.025μV
0dB	.05μV
6dB	.1μV
12dB	.2μV
24dB	.8μV
30dB	.15.8μV
40dB	.50μV
50dB	.158μV
60dB	.500μV
70dB	.1.58mV
80dB	.5mV
90dB	.15.8mV
100dB	.50mV
120dB	.0.5V

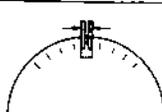
ADJUSTMENTS

PREPARATION

Unless otherwise specified, set the controls as follows.

POWERON	SEND/RECREC
AF GAINCOUNTERCLOCKWISE	NBOFF
RF GAINFULL CLOCKWISE	FIX./VFOVFO
RIT SW.OFF	VOX/MAN.MAN
IF SHIFTCENTERED	PROC.OFF
NODESSB	WIDE/NARWIDE

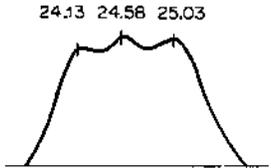
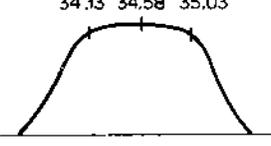
(V): TS-130 V type
(S): TS-130 S type

Item	Condition	Measuring point			Adjust			Specifications/Remarks	
		Test equipment	Unit	Terminal	Unit	Parts	Reference		
1. Power Supply voltage		DC VTVM	AF-GEN	J4,7P	AF-GEN		3.8V		
				J4,4P		VR3	9V		
				J4,5P			50V		
				J4,10P		AF-GEN	VR2		2.8V
	STBY:SEND		Filter	AVB	Filter	VR4(V) VR5(S)	11.0V		
2. CAR 1) CAR output 2) Freq. RX	BAND:3.5 STBY:REC IF SHIFT: Centered MODE:SSB MODE:REV MODE:CW STBY:SEND	RF VTVM Frequency counter	AF-GEN	J3,2P	CAR	T1	0.3Vrms	0.3V±1dB	
						TC2	8.82850MHz		
						TC1	8.83150MHz		
		Frequency counter	AF-GEN	J3,2P	CAR	VR2	8.83070MHz		
3. IF SHIFT	MODE:SSB STBY:Alternate SEND/REC	Frequency counter	AF-GEN	J3,2P	CAR	VR1	8.82850MHz	RX and TX frequency no change.	
4. VFO 1) Output 2) 800Hz shift 3) Frequency tracking and check	VFO scale:250 MODE:CW STBY:SEND	RF VTVM Frequency counter	AF-GEN	J1,6P	VFO	TC2	0.2Vrms Adjust for 800Hz higher than receive state.	0.2V±1dB rms 800±50Hz	
						L4			
	VFO:50 Set the CAL control to the index. VFO scale: Approx. 450 Set the CAL control calibrated under this VFO setting exactly to the index.						L3	5550.00 kHz ±200 Hz	Repeat this adjustment several times until the frequency is within specification.
							TC1	5950.00 kHz ±200 Hz	
Set the VFO main tuning to 5750.000 kHz.								The 50 kHz point on the dial scale must be aligned to the index.	
Under the above condition, set the CAL control to the index. Turn the main tuning, and set the calibrated CAL control to the index in the order of 0, 100, 200, 300, 400, and 500 to check frequency deviation at each 100 kHz point.							0 5.5MHz 100 5.6 200 5.7 300 5.8 400 5.9 500 6.0	Within ±2kHz	
Set the CAL control back to 250 under the above condition (do not turn excessively.), then further set back the CAL control to 0 with respect to the frequency at 250 to check The difference from the reference frequency.							Less than 400Hz	Backlash	

ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specification/Remarks																																																				
		Instruments	Unit	Terminal	Unit	Parts	Reference																																																					
5. RIT	1) Adjust VFO frequency to 5.75MHz 2) RIT control: Centered	Frequency counter	AF-GEN	J1,6P	AF-GEN	VR1	Alternate RIT ON and OFF	1) No frequency change between RIT ON and OFF 2) More than ±1.5kHz variable RIT range																																																				
6. VCO	VFO BAND 250 3.5 250 7 250 14 250 18 250 21 500 29.0	DCVTVM Frequency counter	PLL	TP1	PLL	T1 T2 T3 T5 T4 -	3.5V 5.0V 4.0V 6.1V 3.75V 4.75V(check)	Oscillator level 1V+3dB, -1dB at J18, 1P on PLL unit																																																				
								<table border="1"> <thead> <tr> <th>VFO BAND</th> <th>0</th> <th>250</th> <th>500</th> <th></th> </tr> </thead> <tbody> <tr> <td>3.5</td> <td>12.33M</td> <td>(3.5V) 12.58M</td> <td>12.83M</td> <td></td> </tr> <tr> <td>7.0</td> <td>15.83M</td> <td>(5.0V) 16.08M</td> <td>16.33M</td> <td>VCO Common</td> </tr> <tr> <td>10.0</td> <td>18.33M</td> <td>19.08M</td> <td>19.33M</td> <td></td> </tr> <tr> <td>14.0</td> <td>22.83M</td> <td>(4V) 23.08M</td> <td>23.33M</td> <td></td> </tr> <tr> <td>21.0</td> <td>29.83M</td> <td>(3.75V) 30.08M</td> <td>30.33M</td> <td>VCO Common</td> </tr> <tr> <td>24.5</td> <td>33.33M</td> <td>33.58M</td> <td>33.83M</td> <td></td> </tr> <tr> <td>18.0</td> <td>26.83M</td> <td>(6.1V) 27.08M</td> <td>27.33M</td> <td>VCO Common</td> </tr> <tr> <td>28.0</td> <td>36.83M</td> <td>37.08M</td> <td>37.33M</td> <td></td> </tr> <tr> <td>28.5</td> <td>37.33M</td> <td>37.58M</td> <td>37.83M</td> <td></td> </tr> <tr> <td>29.0</td> <td>37.83M</td> <td>38.08M</td> <td>38.33M</td> <td></td> </tr> <tr> <td>29.5</td> <td>38.33M</td> <td>38.58M</td> <td>38.83M</td> <td></td> </tr> </tbody> </table>	VFO BAND	0	250	500		3.5	12.33M	(3.5V) 12.58M	12.83M		7.0	15.83M	(5.0V) 16.08M	16.33M	VCO Common	10.0	18.33M	19.08M	19.33M		14.0	22.83M	(4V) 23.08M	23.33M		21.0	29.83M	(3.75V) 30.08M	30.33M	VCO Common	24.5	33.33M	33.58M	33.83M		18.0	26.83M	(6.1V) 27.08M	27.33M	VCO Common	28.0	36.83M	37.08M	37.33M		28.5	37.33M	37.58M	37.83M		29.0	37.83M
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29.5	38.33M	38.58M	38.83M																																																									
Note (): control voltage																																																												
7. TX BPF (RX BPF)	MODE:SSB STBY:SEND Make adjustments in the following sequence: 3.5→7→10→14→18→21→24.5→28MHz. Disconnect connector J18 on the PLL unit and connect the sweep generator RF output to it. Connect the detector input to the DRV terminal on the RF unit.	Sweep generator, Oscilloscope, Detector	PLL RF	J18 DRV	RF	L7~30	Adjust coils for waveform as shown.	<p>3.5M: 3.5, 3.75, 4.0. Ripple less than 5dB. L7,8,9</p> <p>7M: 7.0, 7.15, 7.3. Ripple less than 2dB. L10,11,12</p> <p>10M: 9.875, 10.125, 10.375. Ripple less than 2dB. L13,14,15</p> <p>14M: 14.0, 14.2, 14.4. Ripple less than 2dB. L16,17,18</p> <p>18M: 17.875, 18.125, 18.375. Ripple less than 2dB. L19,20,21</p> <p>21M: 21, 21.25, 21.5. Ripple less than 1dB. L22, 23, 24</p> <p>24.5M: 24.5, 24.95, 25.35. Ripple less than 1dB. L25, 26, 27</p> <p>28M: 28.0, 29.0, 30.0. Ripple less than 2dB. L28, 29, 30</p>																																																				
8. PLL BPF 1) BPF-A	STBY:REC Disconnect connectors J17 and J19 on the PLL unit. Connect the cathode of D17 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit with a lead. Connect the sweep generator RF output to the J19, 3P (VFO) on the PLL unit. Connect the detector input to Q16 emitter on the PLL unit.	Detector, Oscilloscope, Sweep generator	PLL	Q16(E)	PLL	T9 T10 T11	Adjust T9~T11 for waveform as shown at right.	<p>14.23 14.58 14.93</p>																																																				

ADJUSTMENTS

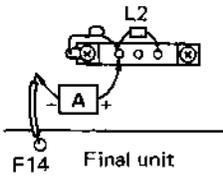
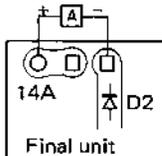
Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
2) BPF-B	Disconnect connectors J17 and J19 on the PLL unit. Connect the cathode of D24 and D27 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit with a lead. Connect the sweep generator RF output to the anode of D28 on the PLL unit via a 15pF capacitor. Detector input: Same as above	Detector, Oscilloscope, Sweep generator	PLL	Q16 (E)	PLL	T12 T13 T14 T7	Adjust T12~T14 for waveform as shown at right. Adjust T7 for maximum output.	
3) BPF-C	Disconnect connectors J17 and J19 on the PLL unit. Connect the cathode of D20 and D27 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit. Sweep generator RF output: Same as above Detector input: Same as above					T15 T16 T17 T8	Adjust T15~T17 for waveform as shown at right. Adjust T8 for maximum output	
9. VFO, MIX spurious	Disconnect connector J17 on the PLL unit. Connect the cathode of D17 on the PLL unit to the jumper wire next to the D22 on the AF-GEN unit. VFO scale: 250 MODE: CW	Spectrum analyzer or monitor receiver	PLL	Q16 (E)	PLL	VR1	Adjust for minimum output at 14.99MHz.	Less than -55dB
10. PLL-IF trap	Disconnect connector J17 on the PLL unit. Connect the SSG output 8.83MHz, 60dB to Q7 emitter on the PLL unit via a 0.01μF capacitor.	SSG, RF VTVM	PLL	Q7 (E) J18,1P	PLL	T6	Adjust for minimum output.	

TS-130SV

ADJUSTMENTS

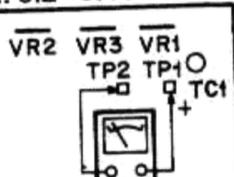
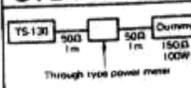
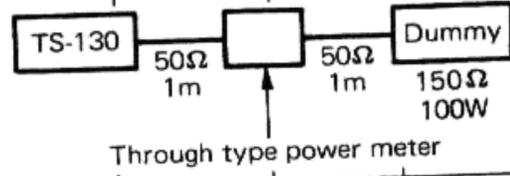
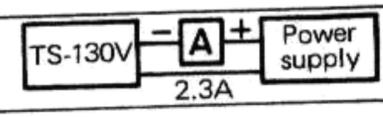
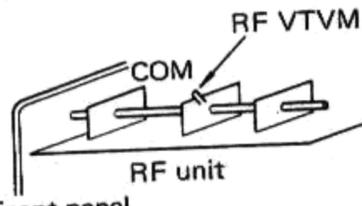
Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
11. IF AMP	VFO:250 IF SHIFT: Centered VFO/FIX: VFO MODE:SSB BAND:14 AF GAIN:10 o'clock RF GAIN: Fully clock- wise Connect the SSG output 14.25MHz, -6dB to the ANT terminal.	SSG, Oscillo- scope, AF VTVM, AF Dum- my load		SP	RF	T3 IF T1 T2 T3 T4 T5 T6	The slug of T3 should be turned counter- clockwise from the peak point to reduce audio output by 2dB. Adjust T1~T6 for maximum audio output.	
12. IF trap	1) BAND: 10MHz VFO: any fre- quency SSG: 8.83 MHz, 80dB	SSG, AF VTVM		SP	RF	L3 L4 L35	Adjust for minimum S-meter reading and AF output level. Repeat the procedure two or three times.	L3 and L4 should be adjusted while they are turned counterclockwise.
13. NB	BAND:10 VFO:250 NB SW:ON Connect the SSG output 10.25 MHz, 60dB to the ANT terminal.	DC VTVM, SSG	IF	TP (Q15 ©)	IF	T7 T8	Adjust for mini- mum DC voltage.	
	Disconnect the SSG output. Connect the noise genera- tor output to the ANT ter- minal. Set the noise ge- nerator output level to S5~7.	Noise generator			IF	T2	Turned counter- clockwise 90 de- gree from the peak point. If adequate effect is not obtained, repeat the adjust- ment several times.	T2 has been adjusted for the peak point in item 11. The NB must provide adequate effect.
14. Carrier balance (IF SHIFT)	IF SHIFT: Centered RF GAIN: Counterclock- wise	RF VTVM	IF	Q7 (E)	AF-GEN	TC1	Adjust for mini- mum.	
15. S meter 1) Starting level 2) S1 3) S9	RF GAIN: Fully counter- clockwise				IF	VR2	Set to starting level.	
	BAND:14 VFO:175 MODE:CW SSG:14.175M, 8dB					T5	Set to S1.	T5 should be adjusted while it is turned counterclockwise.
	SSG:14.175M, 40dB					VR2	Set to S9.	
16. Counter standard Oscillator	BAND:10 VFO:0 Receive WWV signal.				Counter	TC1	Set to zero beat.	

ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
17. Base current 1) S type	MODE:SSB MIC GAIN: Full counter-clockwise DC current meter: Connect ⊕ to D14 lead, ⊖ to D14 terminal. STBY:SEND STBY:REC	DC current meter	Final	D14	Final	VR1	150mA	
				F14 3P terminal				
	2) V type	DC current meter: Connect ⊕ to red wire from F14 terminal, ⊖ to 3P terminal. STBY:SEND STBY:REC						
18. Carrier level	BAND:14 MODE:CW STBY:SEND Reduce RF power(S type) to 30W, RF meter(V type) to 3 by CAR level control. STBY:REC	DC current meter	Final	14A	Final	VR1	100mA	
19. ALC (RF power) 1) S type	BAND:14 CAR LEVEL: Centered VFO:200 MODE:CW STBY:SEND Filter unit, VR2:Counter-clockwise BAND:28.5	Power meter			AF-GEN RF	T2 T4	Adjust for maximum RF output.	
2) V type	Same as above.					Filter		
20. RF meter (V type only)	BAND:14 MODE:CW Meter: RF(IC) STBY:SEND STBY:REC	Power meter			Filter	VR2	Set to 75W.	
						VR3	Set to 11W.	
21. IC meter (S type only)	MODE:CW DC current meter: Connect ⊖ to red wire from F14 terminal ⊕ to 3P terminal. STBY:SEND STBY:REC	Power meter, DC current meter			Filter	VR1	Set to 8W.	
						VR4	Set to 11A on IC meter.	

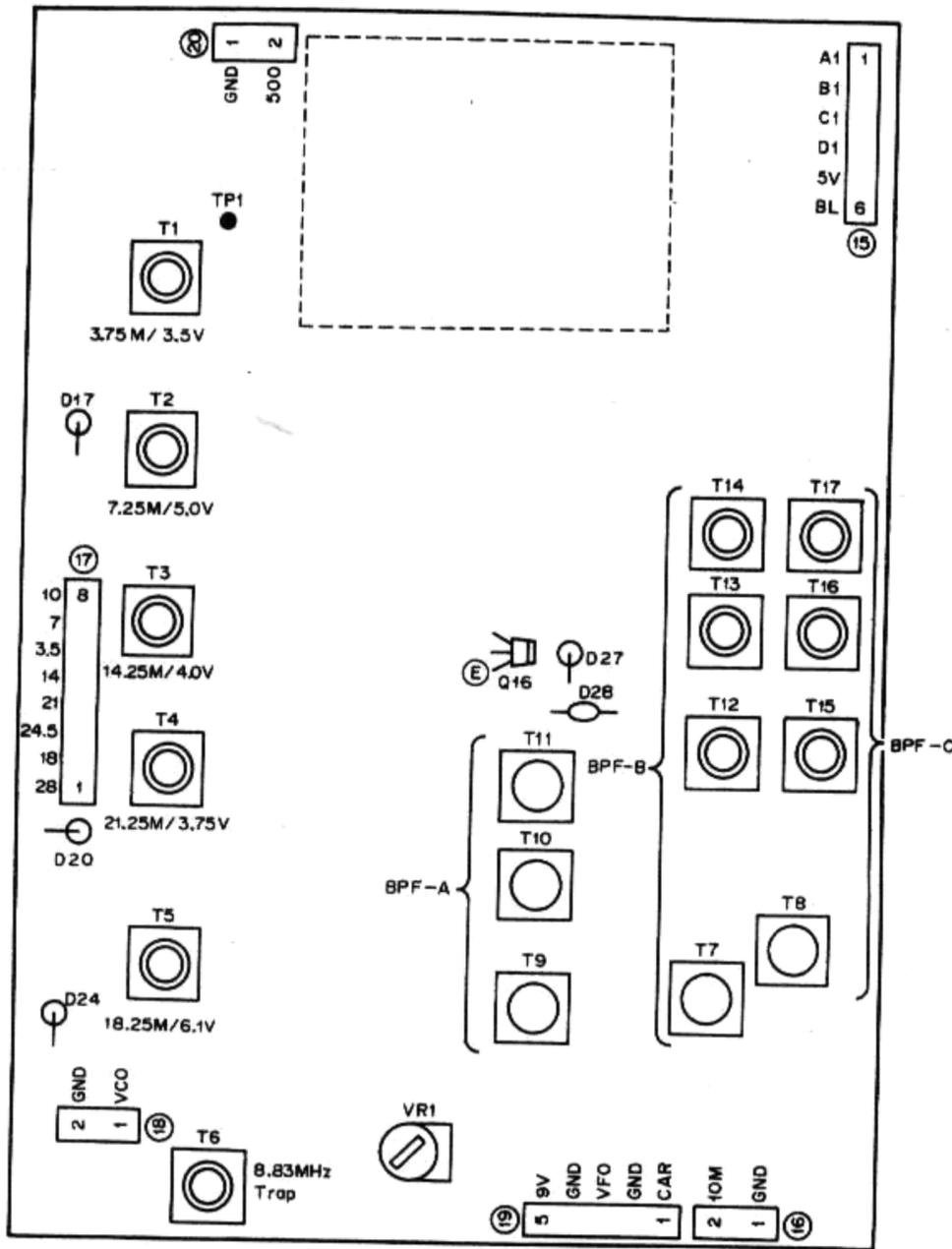
TS-130SV

ADJUSTMENTS

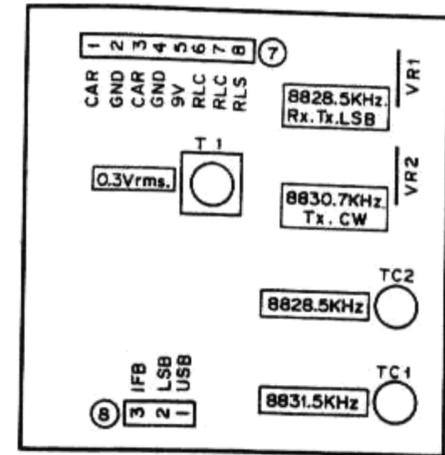
Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
22. Protection 1) S type	Filter unit, VR1: Fully clockwise BAND: 14 MODE: CW ANT: Power meter (50Ω) STBY: SEND	DVM, power meter (50Ω)	Filter	TP1 TP2	Filter	TC1	Adjust for minimum.	
							Approx. 0.2~0.4V	
	2) V type	Filter unit, VR1: Fully clockwise BAND: 14 MODE: CW ANT: 50Ω Dummy STBY: SEND STBY: REC	150Ω, 100W Dummy load 	Filter	TP1 TP2	Filter	TC1	Adjust VR1 to obtain 39W RF power.
ANT: Shorted STBY: SEND STBY: REC								
		DC current meter			Filter	VR2	Set to 2.3A.	
23. TX spurious	BAND: 21 VFO: 250 MODE: SSB MIC, CAR level: Fully counter-clockwise STBY: SEND STBY: REC	RF VTVM	RF	Common terminal of rotary switch	RF	VR1	Adjust for minimum.	
24. SSB carrier point	BAND: 14 MIC input: AG 1.5kHz, 7mV MODE: SSB STBY: SEND 1) Adjust MIC GAIN control until RF power becomes 50W (S type), 5W (V type). 2) Change AG frequency to 300Hz and 2.7kHz alternately. MODE: SSB and REV	Power meter, Synchroscope, AG			CAR	TC1 (SSB) TC2 (REV)	Adjust TC1 and TC2 so that RF power is equal at AG frequency 300Hz and 2.7 kHz.	Within -6dB at AG frequency 400Hz and 2.6kHz respect to 1.5kHz signal level.
25. Carrier suppression Note: This adjustment should be done after completing the SSB carrier point adjustment (or check) in item 24.	BAND: 14 MODE: CW ↔ SSB, REV STBY: SEND MIC: No input STBY: REC	Power meter, Oscilloscope		ANT	AF-GEN	VR5 TC2	Adjust VR5 and TC2 alternately for minimum output.	Carrier better than 40dB down from output signal.
26. Speech processor	MODE: SSB MIC input: AG 1kHz, 10mV PROC: ON ↔ OFF	AF VTVM	Processor	TP1	Processor	VR2	Adjust for equal level.	Approx. 150mV
27. Side tone	MODE: CW AF GAIN: 12:00 KEY: Plug a key and operate.	AF VTVM, KEY		SP	AF-GEN	VR4	Set to 0.63V/8Ω.	

ADJUSTMENTS

▼ PLL UNIT (X50-1700-00)



▼ CAR UNIT (X50-1500-00)



TEST AND ALIGNMENT SET-UP

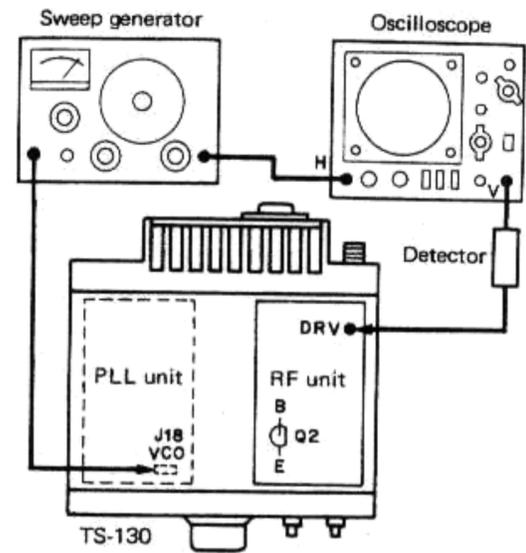


Fig. 4 7. TX BPF (RX BPF)

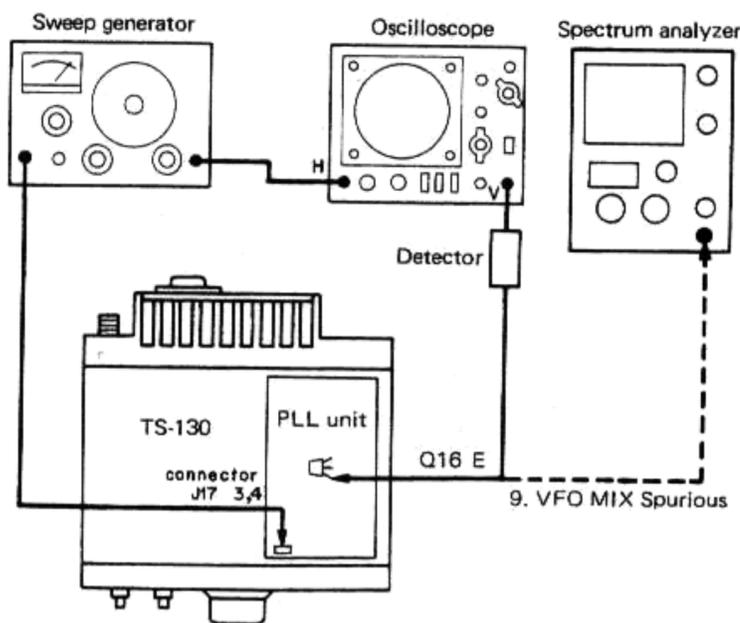


Fig. 5 8. PLL BPF-A,B,C
9. VFO MIX spurious (Disconnect Sweep generator and Oscilloscope)

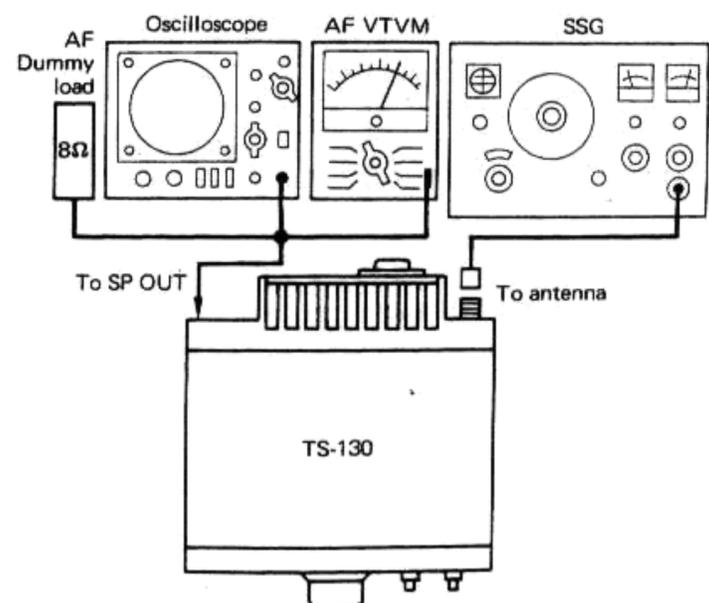
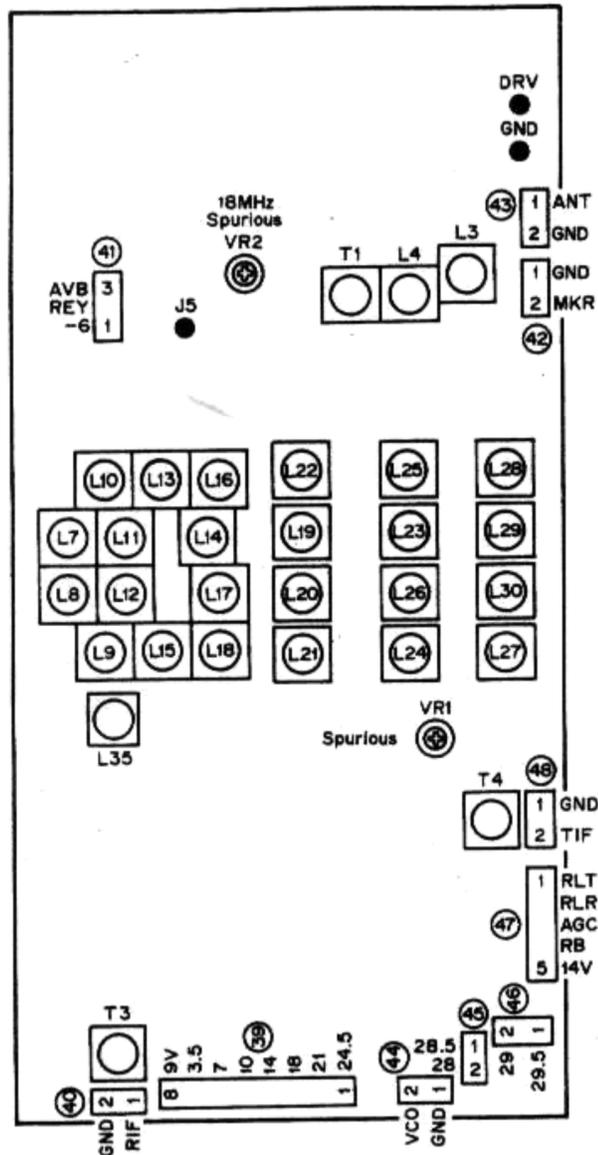


Fig. 6 11. IF AMP, 12. IF trap

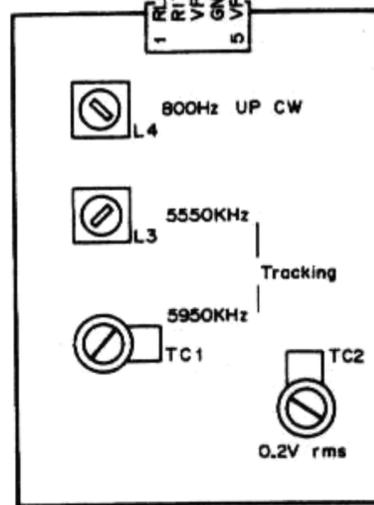
ADJUSTMENTS

PC BOARD ALIGNMENT

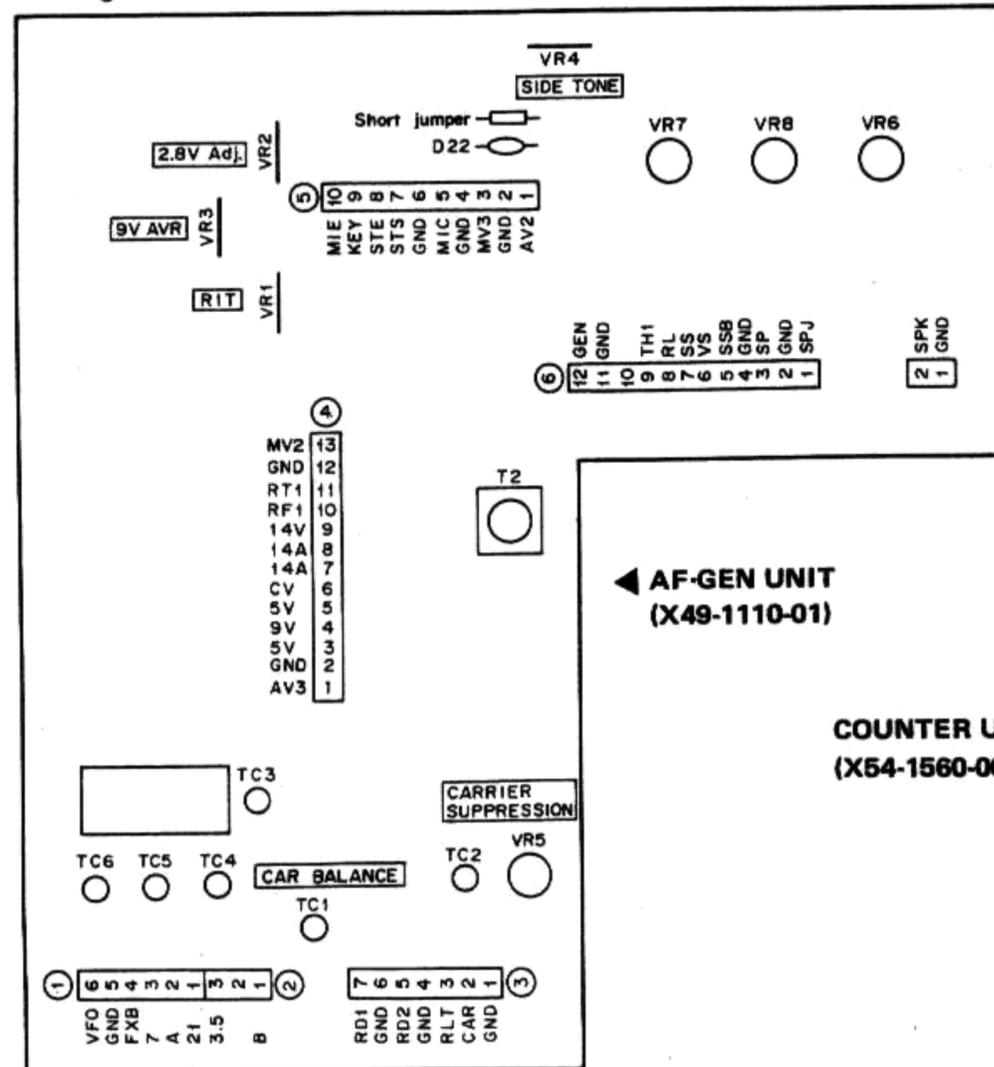
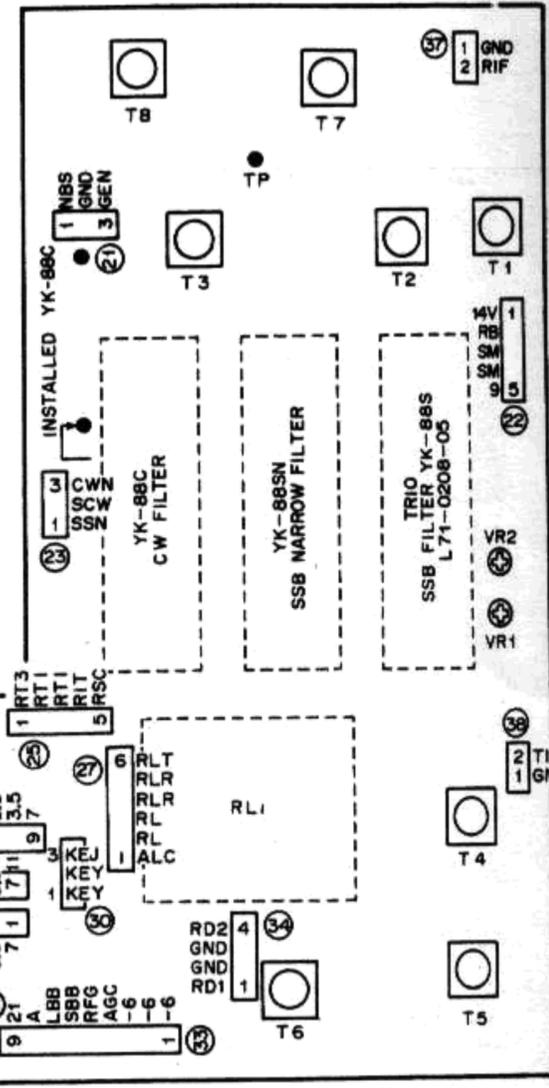
▼ RF UNIT (X44-1380-00)



▼ VFO UNIT (X40-1170-00)

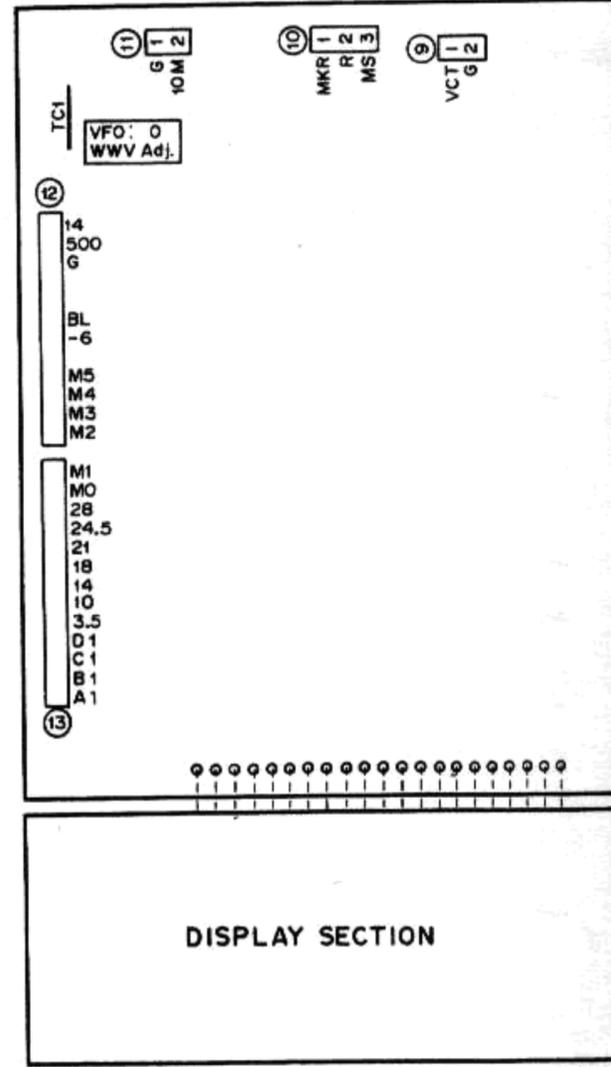


▼ IF UNIT (X48-1300-00)



◀ AF-GEN UNIT (X49-1110-01)

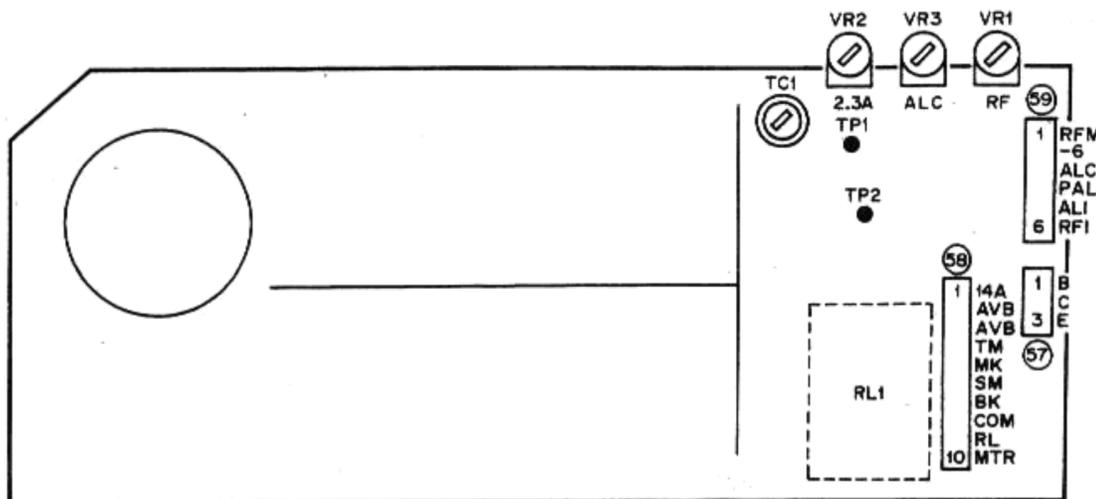
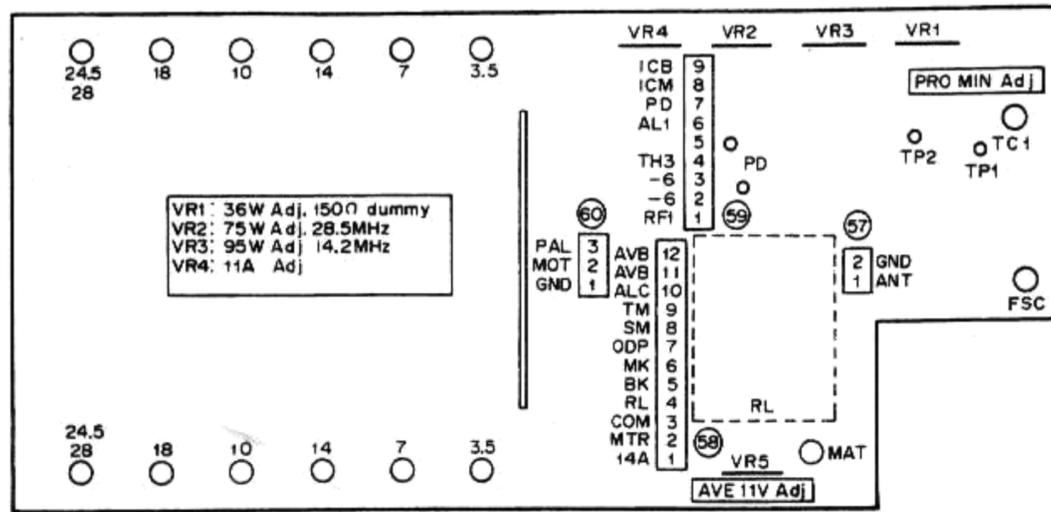
COUNTER UNIT ▶ (X54-1560-00)



DISPLAY SECTION

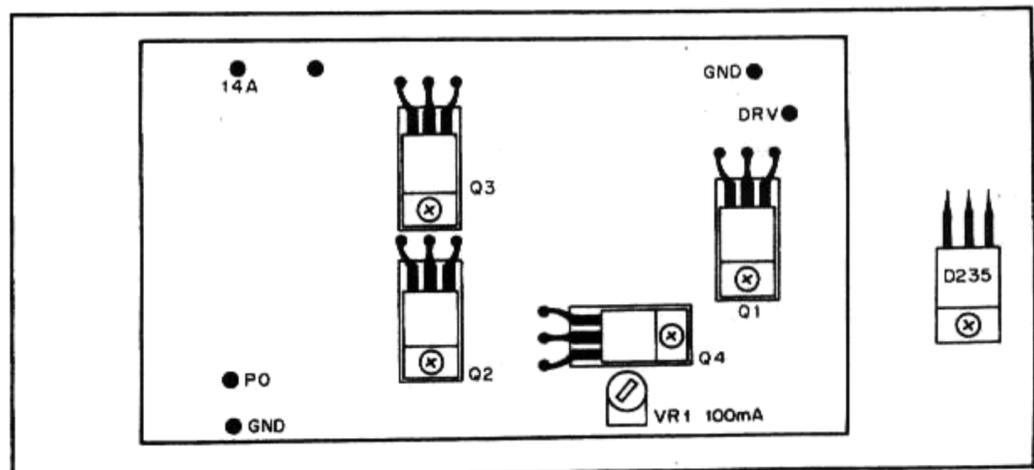
ADJUSTMENTS

▼ FILTER UNIT (X51-1240-00) S TYPE

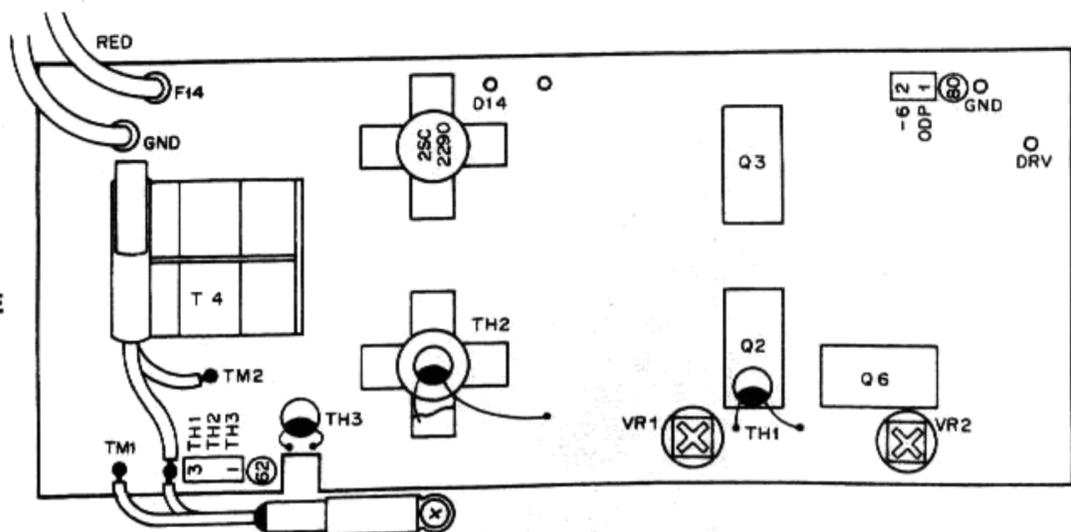


◀ FILTER UNIT (X51-1250-00) V TYPE

FINAL UNIT ▶ (X56-1300-00) V TYPE

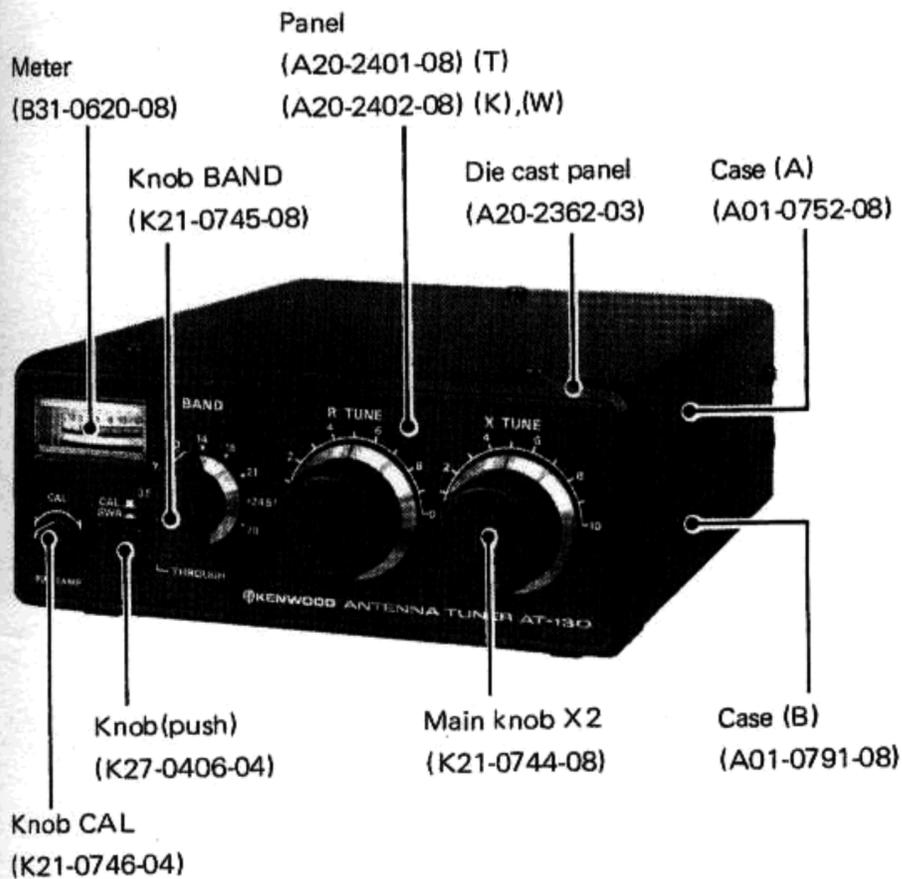


FINAL UNIT ▶ (X56-1350-00) S TYPE



AT-130

OUTSIDE VIEW

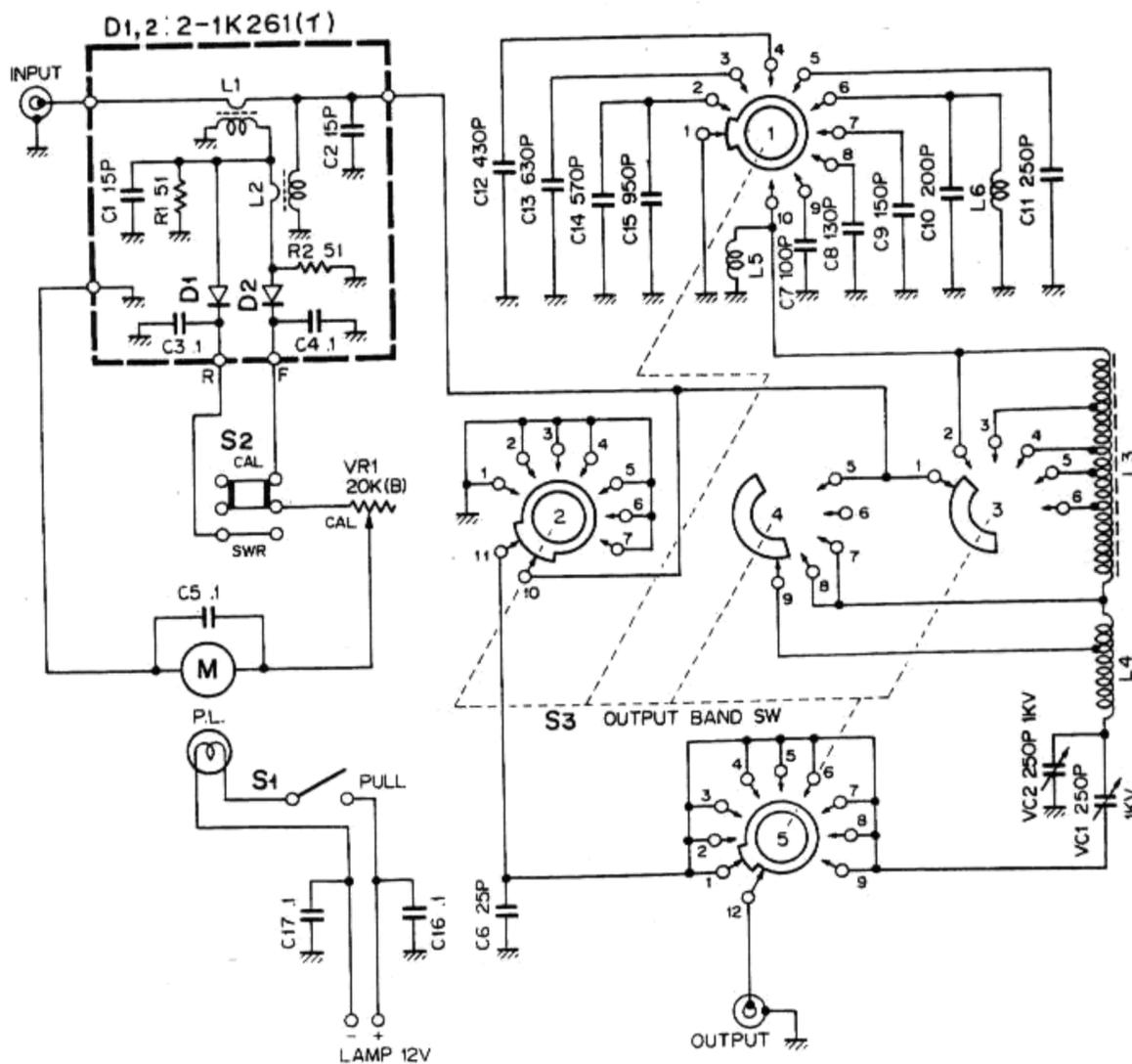


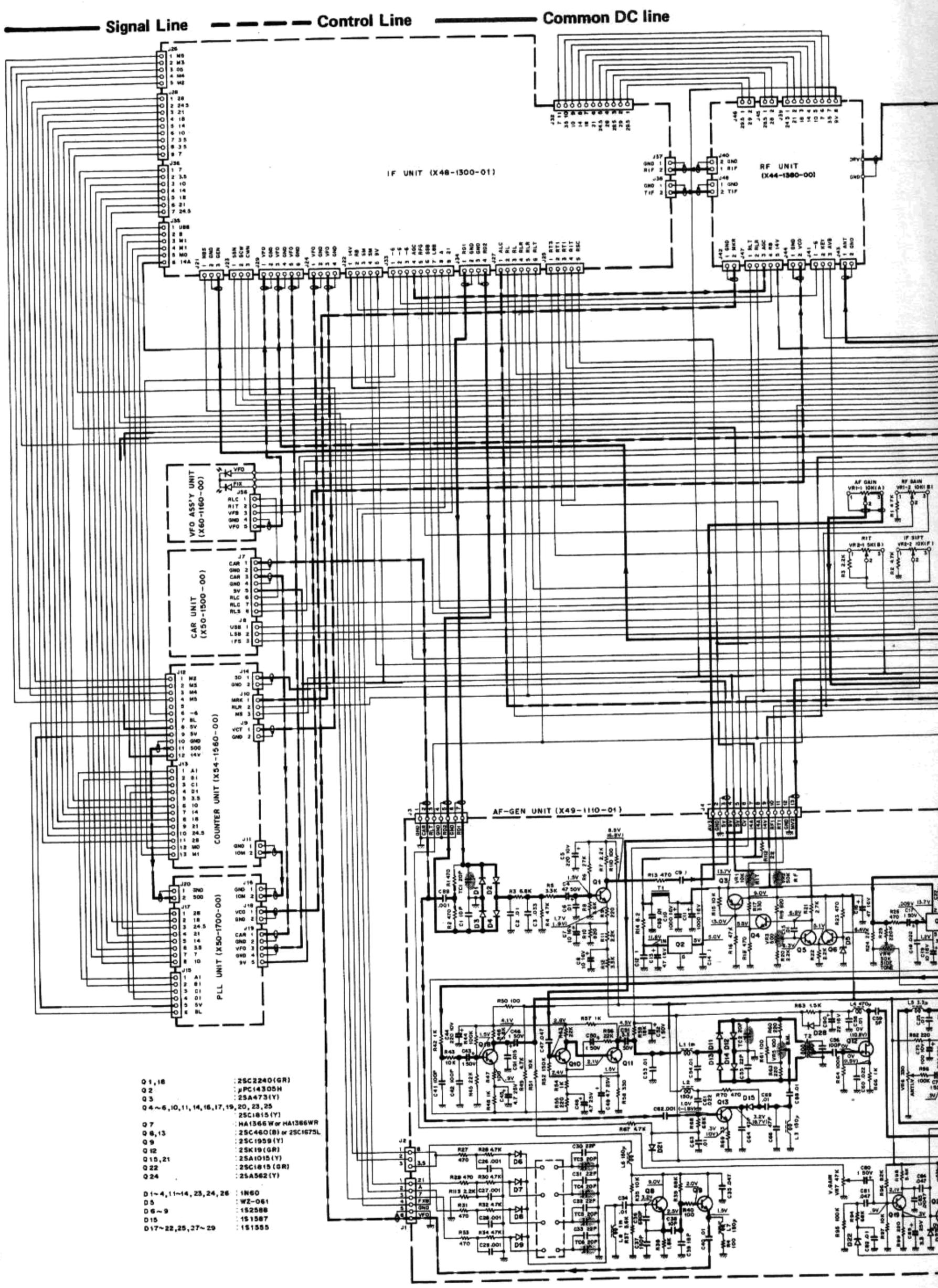
SPECIFICATIONS

- 1. Antenna Coupler**
 Frequency range 8 amateur bands from 3.5 to 29.7 MHz
 Input impedance 50Ω
 Output impedance 20 to 300Ω, unbalanced.
 Through power 150W max. (3.5 MHz band, 120W)
 Insertion loss Less than 0.5dB at optimum match.
- 2. SWR Meter**
 Frequency range 3.5 to 29.7MHz
 Max. power 150W
 Measurable range 1.0:1 to 10:1
 Min. power required2W
- 3. General**
 INPUT Connector UHF type (50Ω)
 ANT Connector UHF type (50Ω)
 GND Wing nut and STUD.
 Dimensions H. 60mm (2-3/8")
 W. 152mm (6")
 D. 159mm (6-1/4")
 Weight 1.6kg (3.5 lbs) approx.

NOTE: The circuit and ratings may change without notice due to developments in technology.

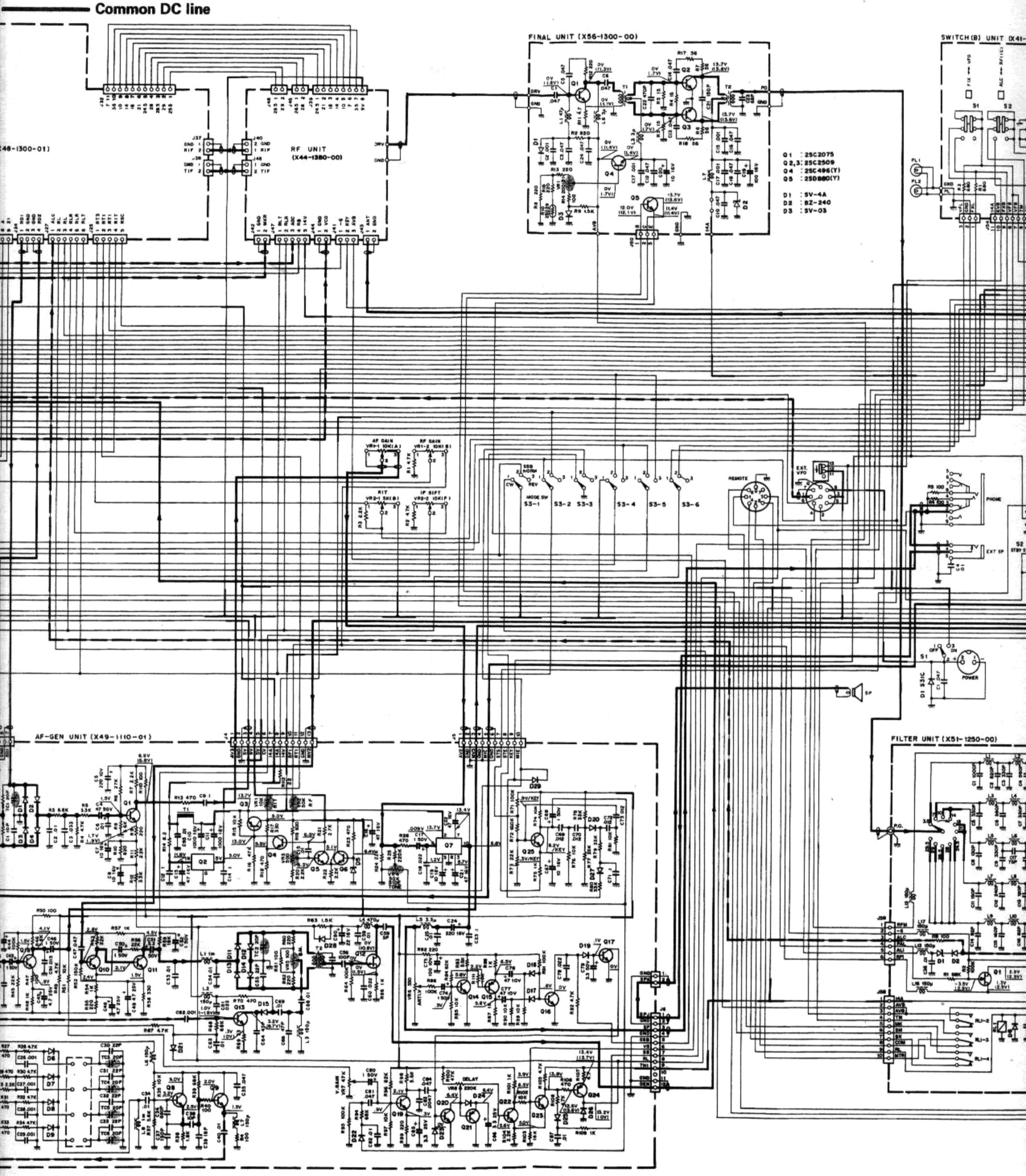
SCHEMATIC DIAGRAM





- Q1, 18 : 2SC2240(IGR)
- Q2 : JPC14305H
- Q3 : 2SA473(Y)
- Q4-6, 10, 11, 14, 16, 17, 19, 20, 23, 25 : 2SC1815(Y)
- Q7 : HA1366 W or HA1366WR
- Q8, 13 : 2SC460(B) or 2SC1673L
- Q9 : 2SC1959(Y)
- Q12 : 2SK19(IGR)
- Q15, 21 : 2SA1015(Y)
- Q22 : 2SC1815(IGR)
- Q24 : 2SA562(Y)
- D1-4, 11-14, 23, 24, 26 : 1N60
- D5 : WZ-061
- D6-9 : 1S2588
- D15 : 1S1587
- D17-22, 25, 27-29 : 1S1555

SCHEMATIC DIAGRAM (V) TYPE



- Q1 : 25C2075
- Q2,3 : 25C2509
- Q4 : 25C496(Y)
- Q5 : 25B80(Y)
- D1 : 5V-4A
- D2 : 8Z-240
- D3 : 5V-03

FILTER UNIT (X51-1250-00)

FINAL UNIT (X55-1300-00)

SWITCH(B) UNIT (X41-1300-01)

(46-1300-01)

RF UNIT (X44-1380-00)

Common DC line

AF-GEN UNIT (X49-1110-01)

PHOME

EXT SP

POWER

D1 531C

EXT VFO

MODE SW

53-1 53-2 53-3 53-4 53-5 53-6

VR1-1 10K1A1

VR1-2 50K1B1

VR2-1 5K1C1

VR2-2 10K1F1

VR3 2.2K

VR4 4.7K

VR5 10K

VR6 10K

VR7 10K

VR8 10K

VR9 10K

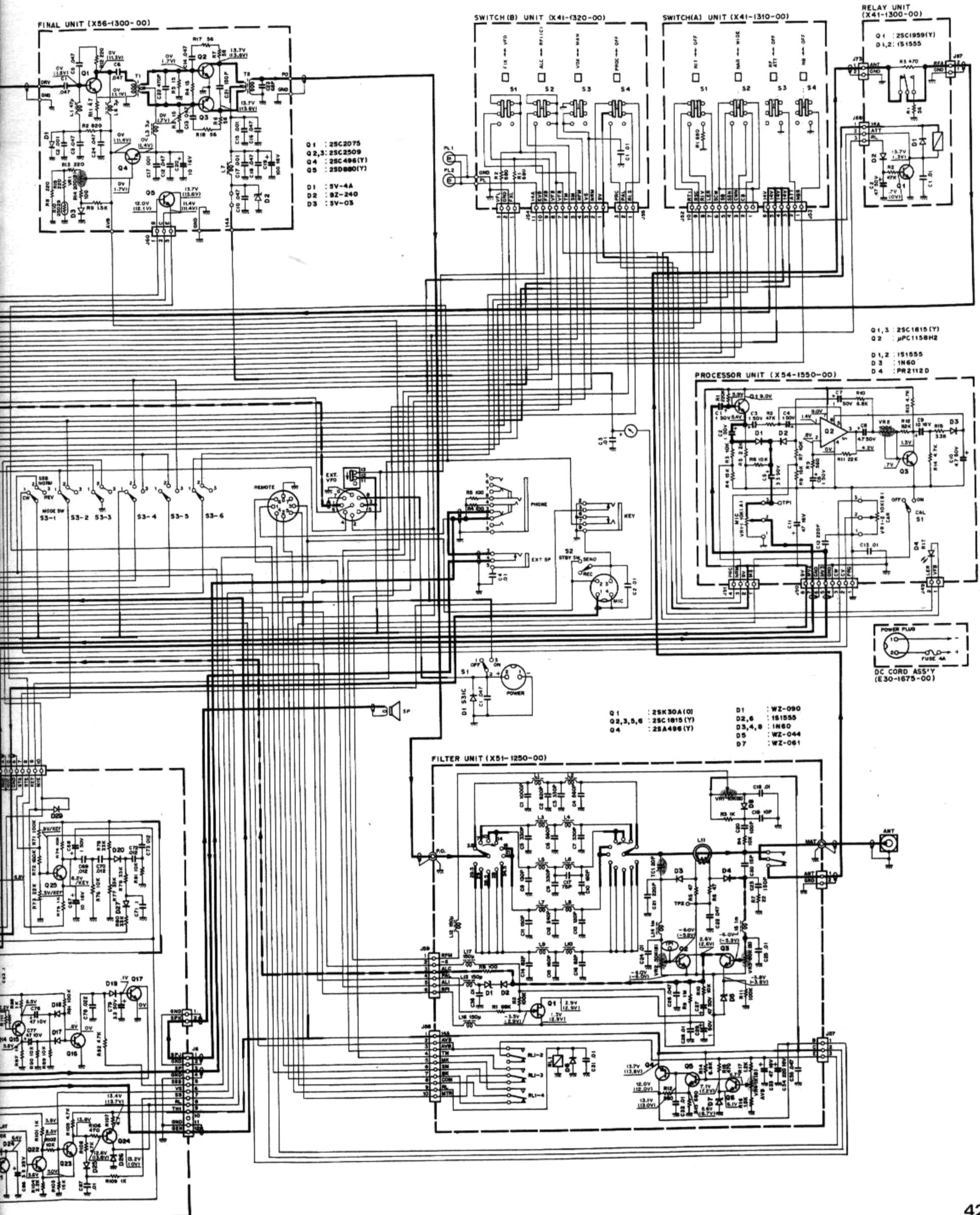
VR10 10K

VR11 10K

VR12 10K

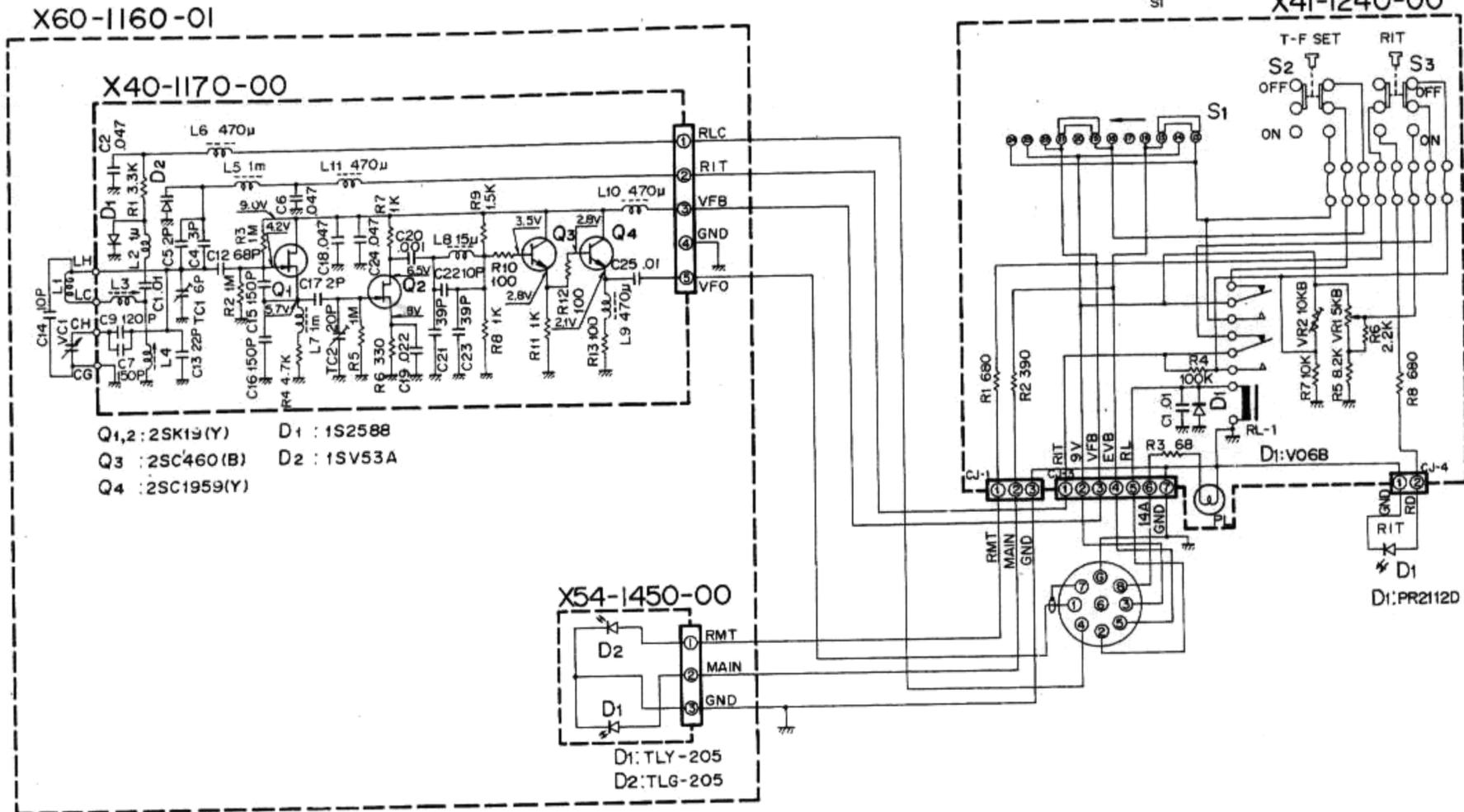
C DIAGRAM (V) TYPE

Voltage measurement conditions
 f = 14.25MHz, MODE SSB, RX no signal, () in TX

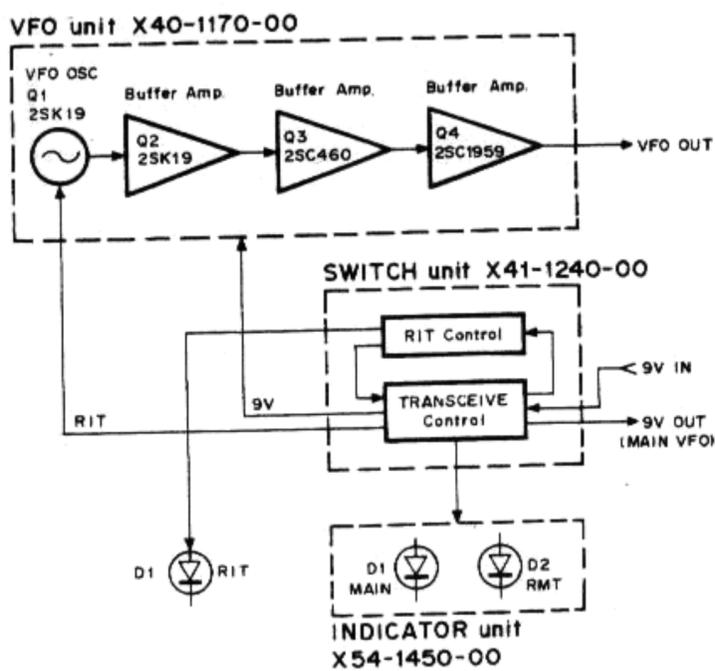


VFO-120

SCHEMATIC DIAGRAM



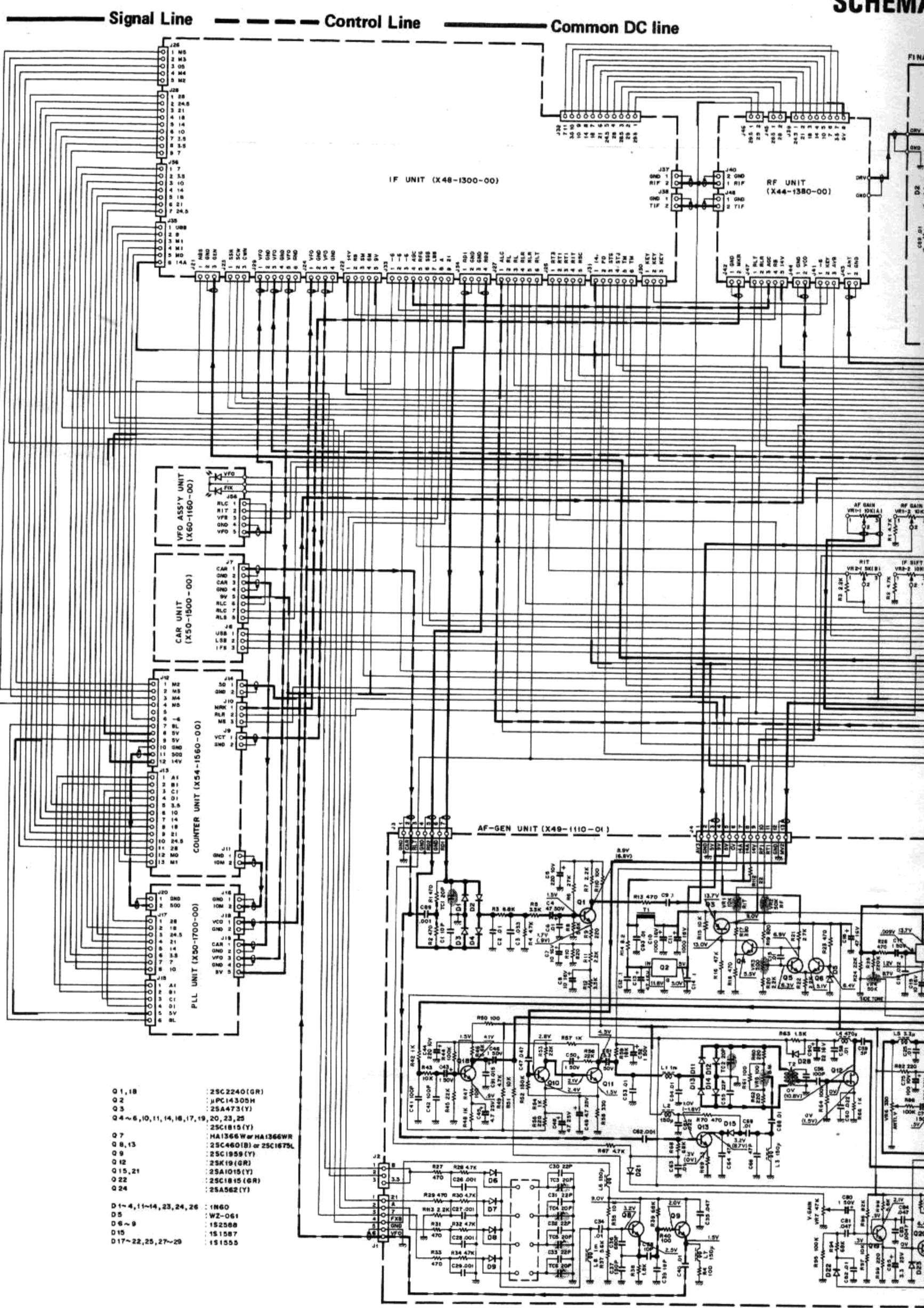
BLOCK DIAGRAM



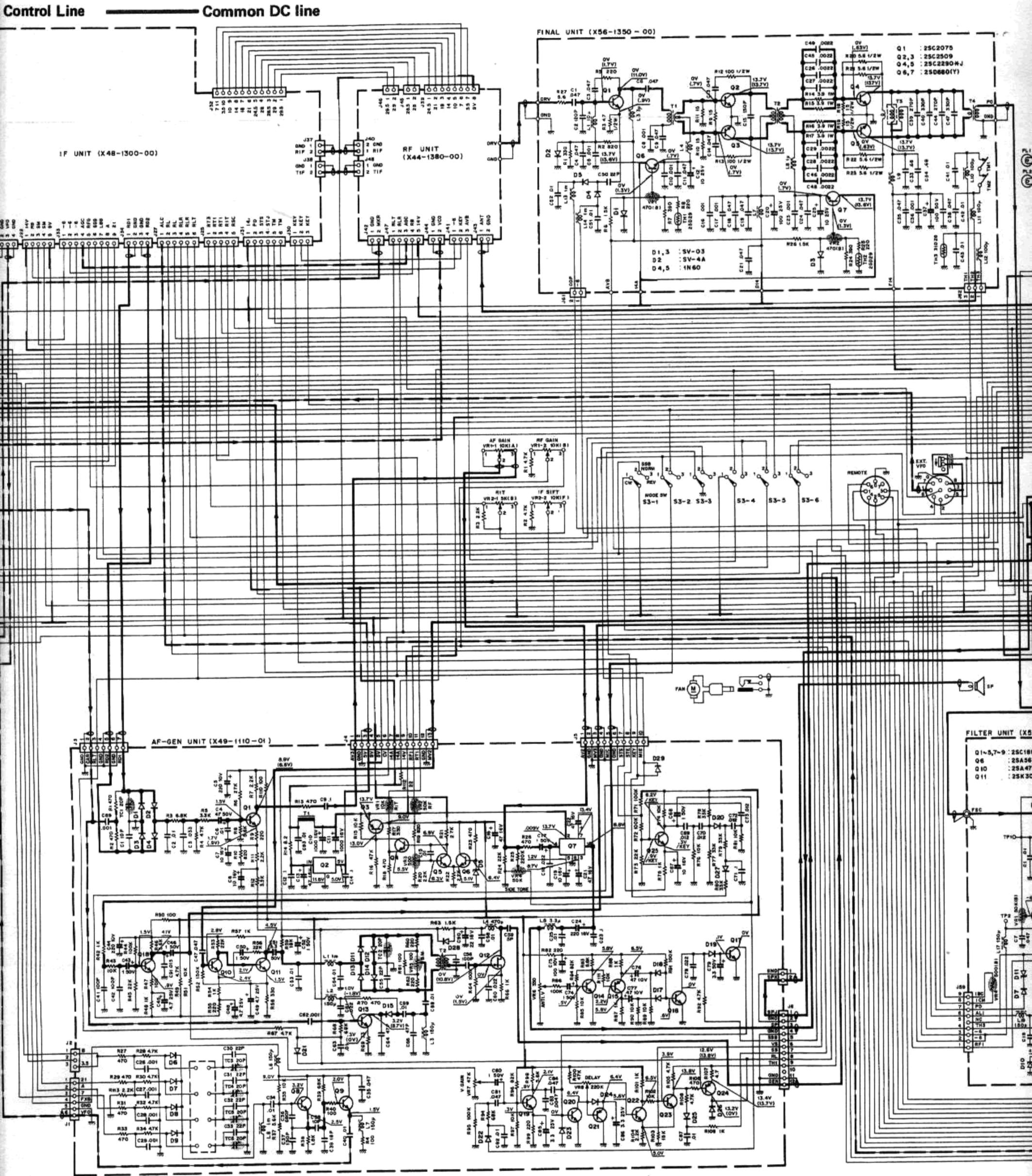
PARTS LIST

☆: New parts

Ref.No.	Parts No.	Description	Re- marks
GENERAL			
	A01-0739-03	Case(A) upper	
	A01-0740-03	Case(B) lower	
	A20-2341-04	Panel	(T)
	A20-2342-04	Panel	(K),(W)
	B39-0407-04	Spacer for foot	
	B46-0058-00	Warranty card	(K)
	B50-2633-10	Operating manual	(K),(W) ☆
	B50-2634-10	Operating manual	(T) ☆
	E02-0107-05	Diode socket	
	E06-0852-05	8P DIN socket	
	E30-1623-05	Earth cable	
	E30-1628-15	VFO cable	☆
	E31-0482-15	Connector with lead	
	G09-0405-05	Spring	
	H01-2609-04	Carton case (inside)	(K),(W)
	H01-2610-04	Carton case (inside)	(T)
	H10-2513-02	Packing fixture (F)	
	H10-2514-02	Packing fixture (R)	
	H12-0445-04	Cushion	
	H20-1407-03	Protective cover	
	H25-0117-04	Accessories bag 80 X 250	



SCHEMATIC DIAGRAM (S) TYPE



FILTER UNIT (X51-1350-00)

- Q1-5,7-9 : 25C181
- Q6 : 25A56
- Q10 : 25A47
- Q11 : 25K30

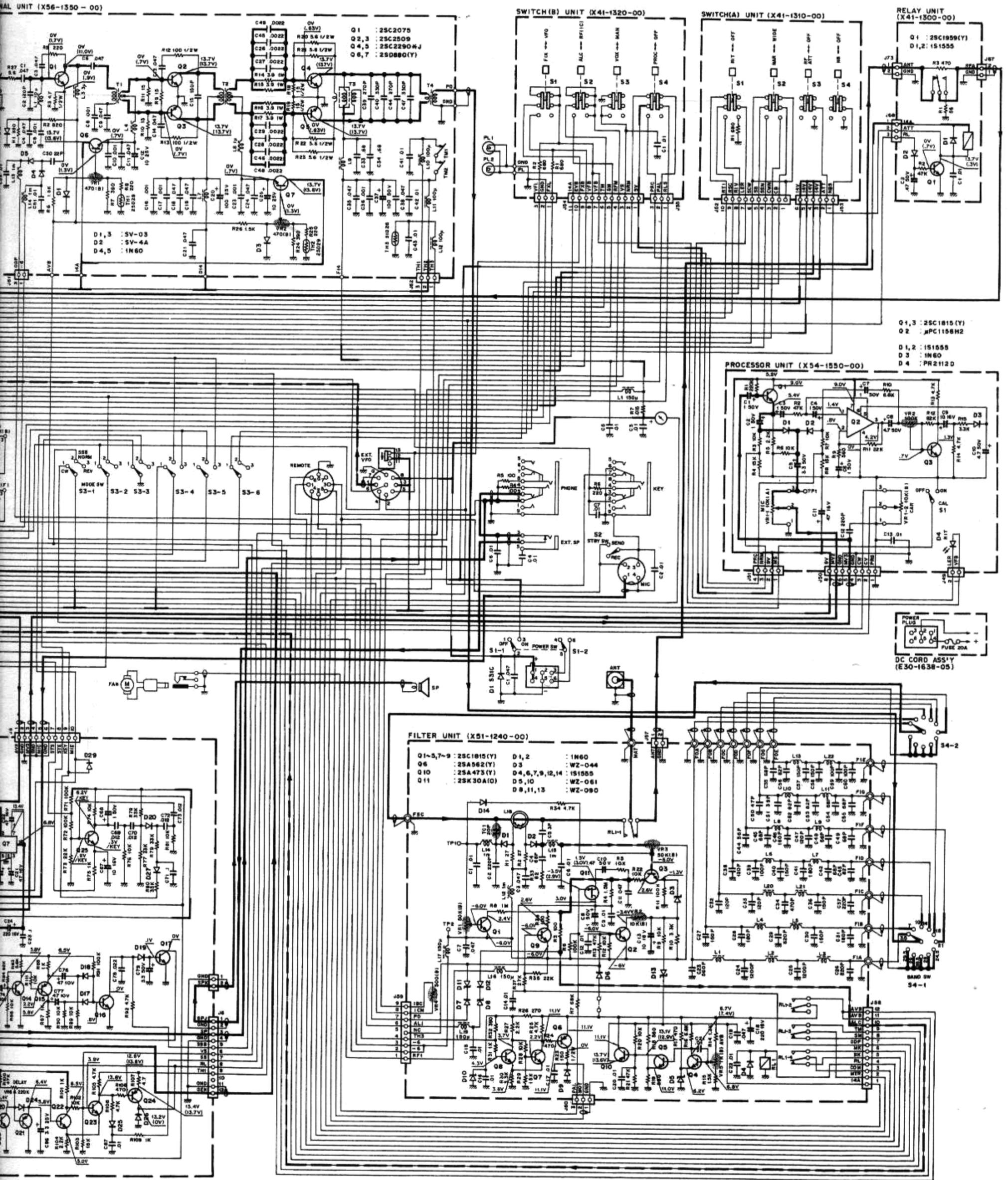
- Q1 : 25C2075
- Q2,3 : 25C2509
- Q4,5 : 25C2290-N
- Q6,7 : 25D680(Y)

- D1,3 : 5V-03
- D2 : 5V-4A
- D4,5 : 1N60

TS-130SV

CIRCUIT DIAGRAM (S) TYPE

Voltage measurement conditions
f = 14.25MHz, MODE SSB, RX no signal, () : in TX

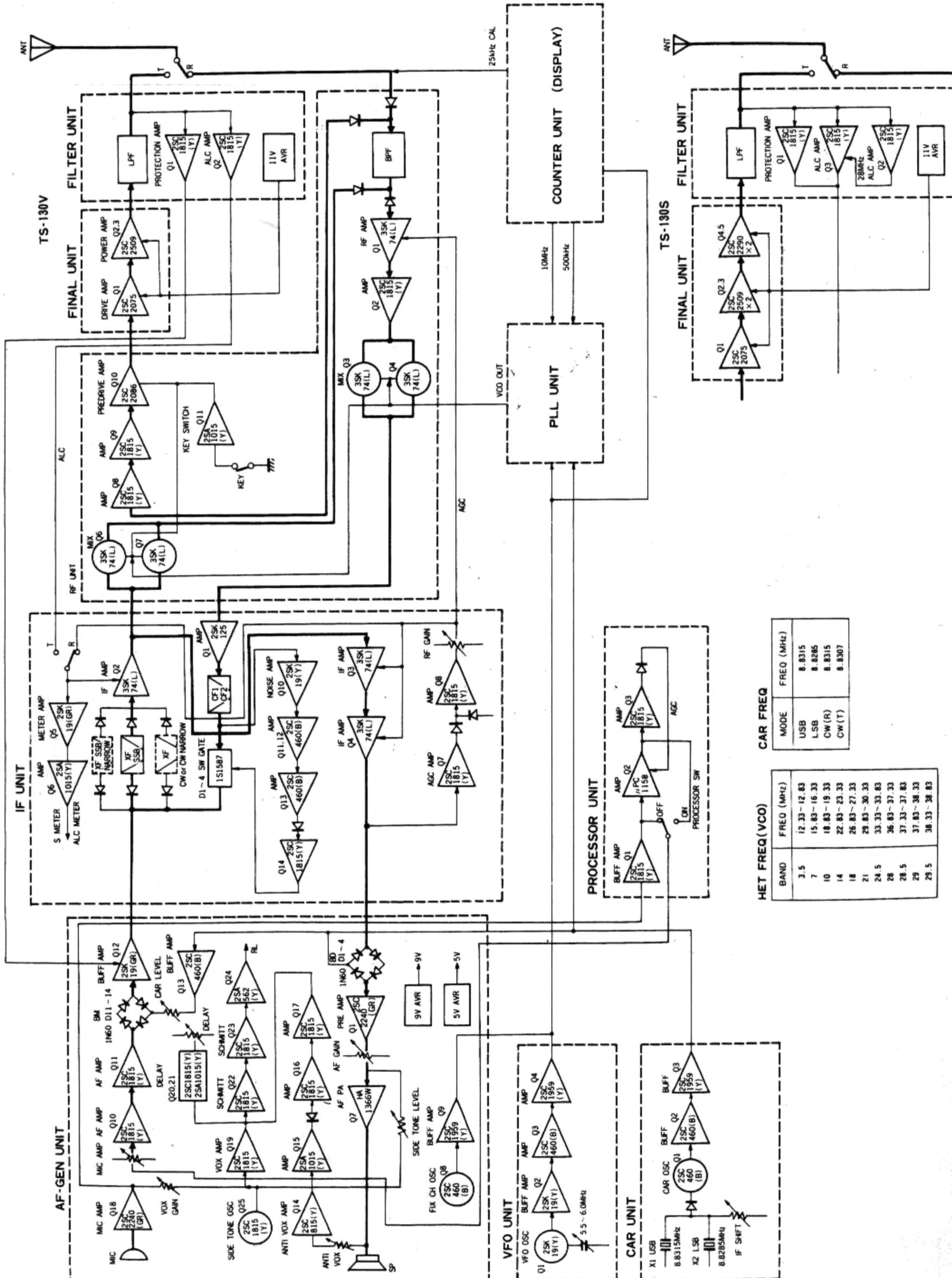


TS-130S.V

VFO-120

Ref.No.	Parts No.	Description	Re- marks	Ref.No.	Parts No.	Description	Re- marks
D1	J02-0323-05	Foot		VFO UNIT (X40-1170-00)			
	J02-0409-04	Assistance foot		C2	C91-0456-05	C 0.047 μ F 25V	
	J61-0019-05	Vinyle tie		C4	CC45RG1H030C	C 3pF \pm 0.25pF	
	K23-0721-04	Knob RIT		C5	CC45PG1H020C	C 2pF \pm 0.25pF	
	K29-0709-04	Push knob (square)		C6	C91-0456-05	C 0.047 μ F 25V	
	K29-0715-04	Pointer knob FUNCTION		C7	CC45LG1H151J	C 150pF	
	N14-0509-05	Wing nut		C9	CC45LG1H121J	C 120pF	
	N99-0306-04	Hex. head screw (VFO M4X10)		C12	CC45LG1H680J	C 68pF	
	V11-7260-66	LED PR2112D RIT		C13	CC45LG1H220J	C 22pF	
	X41-1240-00	Switch unit	☆	C14	CC45CG1H100D	C 10pF \pm 0.5pF	
X60-1160-01	VFO ass'y unit	☆	C15,16	CC45LG1H151J	C 150pF		
SWITCH UNIT (X41-1240-00)				C17	CC45CH1H020C	C 2pF \pm 0.25pF	
CJ-1 CJ-3 CJ-4 VR1 VR2 S1 S2 S3 RL1 D1	B30-0818-05	Pilot lamp		C18	C91-0456-05	C 0.047 μ F 25V	
	E40-0373-05	Mini connect wafer 3P		C21	CC45SL1H390J	C 39pF	
	E40-0774-05	Mini connect wafer 7P		C22	CC45CH1H100D	C 10pF \pm 0.5pF	
	E40-0274-05	Mini connect wafer 2P		C23	CC45SL1H390J	C 39pF	
	R01-2404-05	Pot. 5k Ω (B) RIT		C24	C91-0456-05	C 0.047 μ F 25V	
	R12-3025-05	Pot. 10k Ω (B)		C02-0019-05		Variable capacitor	☆
	S29-1410-05	Slide rotary switch		TC1	C05-0009-15	Ceramic trimmer 6pF	
	S40-2409-15	Push switch T-F SET		TC2	C05-0013-15	Ceramic trimmer 20pF	
	S40-2404-05	Push switch RIT		D40-0614-05		Dial mechanism ass'y	☆
	S51-2408-05	Relay G2V-2		E40-0574-05		Mini connect wafer 5P	
V11-0219-05	Diode V06B		L1	L32-0628-05	OSC coil	☆	
VFO ASS'Y UNIT (X60-1160-01)				L2	L33-0025-05	Choke coil 1 μ H	
B01-0621-04	Dial escutcheon		L3	L32-0629-05	OSC coil (C)	☆	
B08-4301-04	Dial back board	☆	L4	L32-0609-05	OSC coil (B)		
B10-0620-04	Front glass (A) MAIN-RMT		L5	L40-1021-03	Ferri-inductor 1mH		
B20-0811-04	Dial scale (B) 25K		L6	L40-4711-03	Ferri-inductor 470 μ H		
B20-0817-04	Dial scale (A) 500K	☆	L7	L40-1021-03	Ferri-inductor 1mH		
B42-1645-04	Seal bottom		L8	L40-1501-03	Ferri-inductor 15 μ H		
B42-1671-04	Seal top		L9~11	L40-4711-03	Ferri-inductor 470 μ H		
G01-0840-04	Coil spring		R92-0150-05		Short jumper		
K21-0722-04	Main knob		Q1,2	V09-0011-05	FET 2SK19(Y)		
N19-0608-04	Washer Main knob		Q3	V03-0079-05	TR 2SC460(B)		
X40-1170-00	VFO unit		Q4	V03-1959-06	TR 2SC1959(Y)		
X54-1450-00	Indicator unit		D1	V11-0414-05	Diode 1S2588		
				D2	V11-4161-36	Varicap diode 1SV53A	
				INDICATOR UNIT (X54-1450-00)			
				D1	V11-3163-16	LED TLY-205 MAIN	
				D2	V11-3162-86	LED TLG-205 RMT	

BLOCK DIAGRAM



CAR FREQ

MODE	FREQ (MHz)
USB	8.8315
LSB	8.8285
CW(R)	8.8315
CW(T)	8.8307

HET FREQ (VCO)

BAND	FREQ (MHz)
3.5	12.33-12.83
7	15.83-16.33
10	18.83-19.33
14	22.83-23.33
18	26.83-27.33
21	29.83-30.33
24.5	33.33-33.83
28	36.83-37.33
28.5	37.33-37.83
29	37.83-38.33
29.5	38.33-38.83