



# SERVICE MANUAL

## TS-530S/SP/D\* (\*: KOREA MARKET ONLY) SP-230, VFO-240, AT-230, PK-3\*

### HF TRANSCEIVER



SP-230

TS-530S

VFO-240

AT-230

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## SPECIFICATIONS

### [GENERAL]

Frequency Range.....	160 m Band 1.8 ~ 2.0 MHz 80 m Band 3.5 ~ 4.0 MHz 40 m Band 7.0 ~ 7.3 MHz 30 m Band 10.1 ~ 10.15 MHz (10.0 MHz WWV) 20 m Band 14.0 ~ 14.35 MHz * 17 m Band 18.068 ~ 18.168 MHz 15 m Band 21.0 ~ 21.45 MHz * 12 m Band 24.89 ~ 24.99 MHz 10 m Band 28.0 ~ 29.7 MHz
Modes.....	SSB/CW
Frequency Stability .....	Within 1 kHz during the first hour after 1 minute of warmup. Within 100 Hz during any 30 minute period thereafter.
Power Requirement .....	110VAC/120VAC/240VAC, 50/60 Hz
Power Consumption .....	Transmit: 295 watts Receive: 27 watts (with heaters off)
Dimensions .....	333 (13.3) × 133 (5.3) × 333 (13.3) mm (inch)
Weight.....	12.8 kg (28.2 lbs)

### [TRANSMITTER]

	TS-530S/SP	TS-530D
* Final Power Input .....	220W PEP for SSB operation 180W DC for CW operation	160W PEP for SSB operation 130W DC for CW operation
Audio Input Impedance .....	500 $\Omega$ ~ 50 k $\Omega$	
RF Output Impedance.....	50 $\Omega$ ~ 75 $\Omega$	
Carrier Suppression .....	Better than 40 dB	
Sideband Suppression .....	Better than 50 dB	
Spurious Radiation .....	Better than 60 dB	
Harmonic Radiation .....	Better than 40 dB	
Audio Freq. Response .....	400 to 2,600 Hz, within -6 dB	
ALC Input .....	-10V DC Max	
Linear Amp Relay Contact Rating.....	100V DC 1A	

### [RECEIVER]

Receiver Sensitivity .....	0.25 $\mu$ V at 10 dB S + N/N
Image Ratio.....	Better than 60 dB
IF Rejection .....	Better than 70 dB
Receiver Selectivity	
SSB/CW.....	2.4 kHz (-6 dB), 4.2 kHz (-60 dB) CW Optional Filter YK-88C 500 Hz (-6 dB), 1.5 kHz (-60 dB) YK-88CN 270 Hz (-6 dB), 1.1 kHz (-60 dB) SSB Optional Filter YK-88SN 1.8 kHz (-6 dB), 3.3 kHz (-60 dB)
Notch-filter Attenuation .....	Better than 20 dB (1.5 kHz)
Audio Output Impedance .....	8 ~ 16 $\Omega$
Audio Output .....	1.5W (8 $\Omega$ )

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

NOTE: For the TS-530SP shipped to the USA, and for the TS-530D.

\* Will transmit on the 17 and 12 meter bands.

Diodes installed for preventing accidental transmission before government Amateur authorization.

## CIRCUIT DESCRIPTION

### INTRODUCTION

The TS-530 is a single conversion transceiver with an intermediate frequency of 8.83 MHz.

In transmission, an SSB signal generated at 8.83 MHz is mixed with the PLL local oscillator output to produce the final transmission frequency. The circuitry is hybrid with vacuum tubes used only in the driver (12BY7A) and final-stage power amplifier (6146B's).

The PLL circuit generates a heterodyne frequency for each band and a counter reference signal from a single crystal oscillator.

The TS-530 incorporates an IF SHIFT circuit, VOX (also used for CW semi-break-in), side tone circuit, speech processor, noise blanker, XTAL calibrator, and etc.

### RECEIVER CIRCUIT

The signal coming from the antenna is routed through a step-up antenna coil via an RF ATT switch and IF trap. MOS FET Q1, 3SK73 amplifies this signal. Approximately 9 dB of negative feedback is applied to the RF amplifier to reduce noise and expanded dynamic range. The signal passes through buffer amplifier Q2, 2SK125 and is mixed with the PLL VCO output by a balanced mixer (Q3, Q4 : 2SK125). The DOUBLE SIDE-BAND signal is now converted to the intermediate frequency, 8.83 MHz.

Entering the IF unit, this signal is amplified by Q1 (2SK125), passes through ceramic filter CF1 and the NB gating circuit, and is applied to the crystal filter whose center frequency is 8.83 MHz.

The SINGLE SIDE-BAND signal leaving the crystal filter is amplified by Q2~Q4 (3SK73) and is then demodulated to an audio signal by the product detector consisting of D16~D19 (1N60 x4).

In the AF unit, the audio signal is amplified by Q2 (2SC2240) passes through the AF GAIN control, and after being amplified by the power amplifier Q6 (MB3712), drives the speaker.

Item	Rating
Nominal center frequency ( $f_o$ )	8.830 MHz
3 dB Bandwidth	$f_o \pm 5$ kHz or more, total 25 kHz or more
20 dB Bandwidth	90 kHz or less
Ripple (Within 3 dB bandwidth)	1 dB or less
Spurious response	14 dB or more within $f_o \pm 1.5$ MHz
Input and output impedance	330 $\Omega$

**Table 1 Ceramic filter (L72-0324-05)  
SFE8.83MF (IF unit, CF1)**

Item	Rating
Center frequency	8830 kHz
Center frequency deviation	Within $\pm 150$ Hz at 6 dB
Pass bandwidth	$\pm 1.2$ kHz or more at 6 dB
Attenuation bandwidth	$\pm 1.5$ kHz or less at 20 dB $\pm 2.2$ kHz or less at 60 dB $\pm 3.0$ kHz or less at 80 dB
Ripple	2 dB or less
Loss	6 dB or less
Guaranteed attenuation	80 dB or more within $\pm 3$ kHz to $\pm 1$ MHz
Input and output impedance	monolithic 600 $\Omega$ // 15 pF

**Table 2 Crystal (monolithic) filter (L71-0208-05)  
YK-88S (IF unit, XF1)**

### TRANSMITTER CIRCUIT

Audio input picked up by the microphone comes to the IF unit and is amplified by Q11, 12, 15 and 16. The input circuit adapts to any microphone impedance of from 500 ohms to 50 kohms. This amplified signal is converted into a DSB signal by the balanced modulator D27~D30 (1N60 x4), passes through buffer amplifier Q18 (2SK19) and an 8.83 MHz crystal filter, and the output appears as a SSB signal. The SSB signal is amplified by Q2 (3SK73) and is applied to the transmitter mixer in the RF unit. The transmitter mixer is a double balanced mixer consisting of Q6 and Q7 (3SK73), which mixes the SSB signal with the PLL VCO output to generate the final transmission frequency. The signal is then amplified by the driver (V1 : 12BY7A) and then by the final power amplifier (two 6146B's) and is applied to the antenna via a  $\pi$ -matching network.

### PLL CIRCUIT

The PLL signal is synthesized from the VFO, CAR and VCO outputs. The TS-530S employs a programmable divider in the PLL to synthesize the heterodyne frequency from the standard reference oscillator frequency. This simplifies the PLL circuit by eliminating the need for a separate HET XTAL for each band.

Frequency organization of the PLL circuit is shown in **Fig. 1**, the circuit diagram in **Fig. 2**, and frequency organization in other circuits is summarized in **Table 4**. Please refer to **Fig. 1** when reading the following description of PLL circuit operation. MIX (3), a double balanced mixer, mixes the CAR output with the VFO output. MIX (2), which operates for the 18 MHz band and above, mixes either 10 MHz, in the 14 and 18 MHz bands, or 20 MHz, in the 21, 24.5 and 28 MHz bands, with the output of MIX (3) to generate the appropriate frequency needed for each band, as shown in **Table 4**.

## CIRCUIT DESCRIPTION

This is mixed with the VCO output for each band by MIX (1) to a frequency given in **Table 4**, which is then routed through LPF (1), amplified, and wave-shaped to a digital signal. A programmable divider divides this signal into a 500 kHz output. This programmable divider is preset, as shown in **Table 4**, by the BCD signal which is counter-generated from information coming from the band switch. The phase comparator used is a Motorola MC4044P. The loop filter is made of completely discrete components to minimize VCO spurious content.

Six VCOs cover all bands. If the PLL unlocks for any reason, it will be detected from the phase comparator output. This will turn off the VCO output to prevent spurious radiation and, at the same time, the display will be blanked to inform the operator of unlock status.

BAND	RX, Tx frequency (MHz)	VCO (MHz)	MIX (1) input (MHz)	MIX (1) output (MHz)	Division ratio	DCBA
1.5	1.5 ~2.0	10.33 ~10.83	14.33 ~14.83	4.0	1/8	1 0 0 0
3.5	3.5 ~4.0	12.33 ~12.83	14.33 ~14.83	2.0	1/4	1 1 0 0
7	7.0 ~7.5	15.83 ~16.33	14.33 ~14.83	1.5	1/3	1 1 0 1
10	10.0 ~10.5	18.83 ~19.33	14.33 ~14.83	4.5	1/9	0 1 1 1
14	14.0 ~14.5	22.83 ~23.33	24.33 ~24.83	1.5	1/3	1 1 0 1
18	18.0 ~18.5	26.83 ~27.33	24.33 ~24.83	2.5	1/5	1 0 1 1
21	21.0 ~21.5	29.83 ~30.33	34.33 ~34.83	4.5	1/9	0 1 1 1
24.5	24.5 ~25.0	33.33 ~33.83	34.33 ~34.83	1.0	1/2	1 1 1 0
28	28.0 ~28.5	36.83 ~37.33	"	2.5	1/5	1 0 1 1
28.5	28.5 ~29.0	37.33 ~37.83	"	3.0	1/6	1 0 1 0
29	29.0 ~29.5	37.83 ~38.33	"	3.5	1/7	1 0 0 1
29.5	29.5 ~30.0	38.33 ~38.83	"	4.0	1/8	1 0 0 0

Table 3 Frequency chart

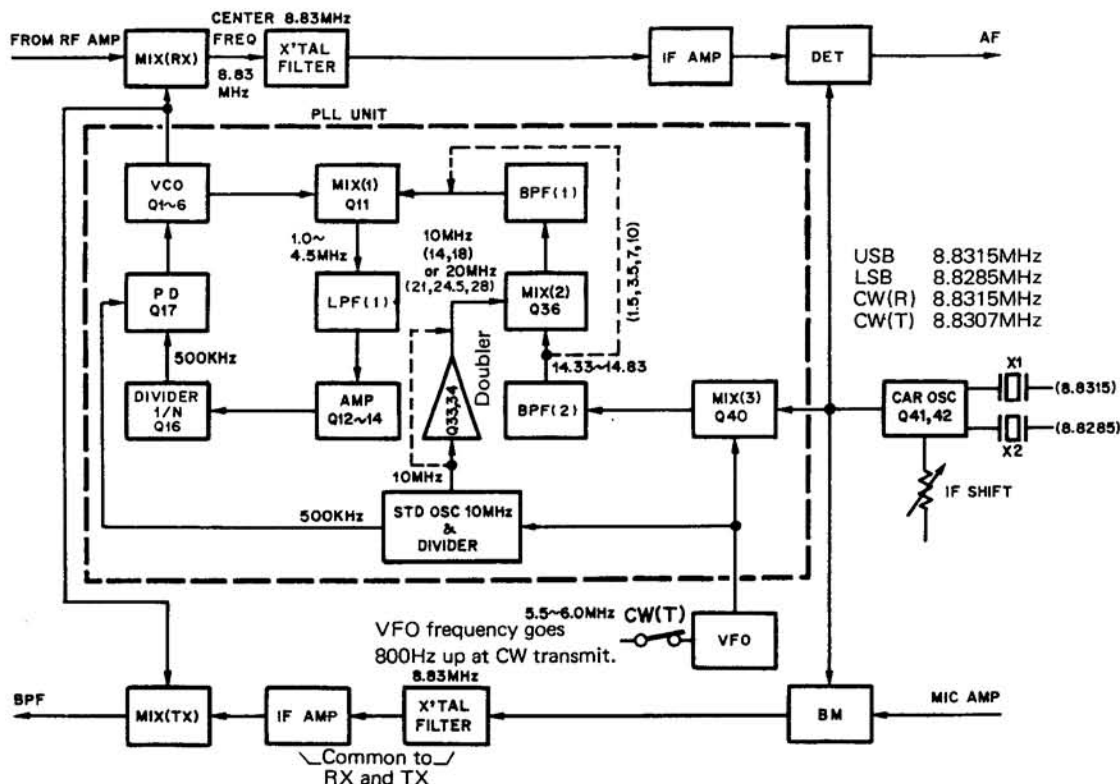


Fig. 1 TS-530 Frequency configuration



## CIRCUIT DESCRIPTION

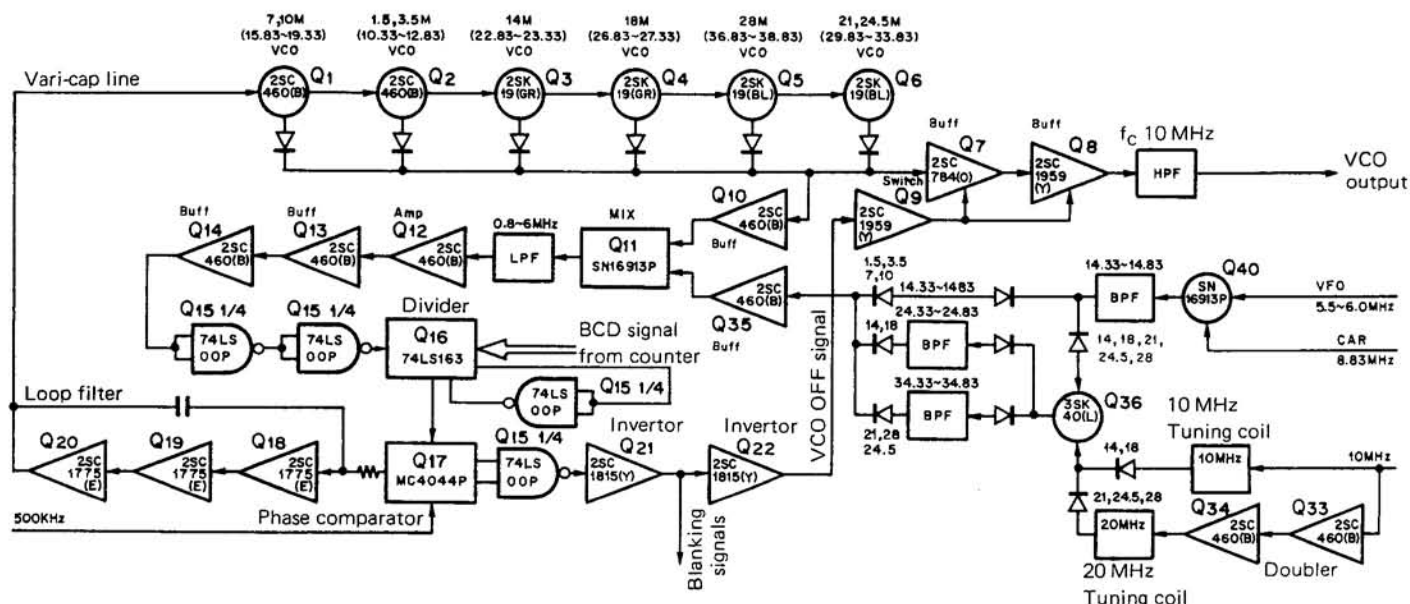


Fig. 2 TS-530 PLL circuit configuration

## COUNTER

This counts the 500 kHz to 1 MHz signal which the PLL unit generates by mixing the VFO output with 5 MHz (halved from the 10 MHz reference frequency). Gate, latch, and preset pulses are generated from a 10 Hz pulse generated by dividing 1 kHz, supplied from the PLL, by 100.

BAND	100K	1 M	10M	DCBA	0.5	BAND	100K	1 M	10M	DCBA	0.5
1.5	0	1	0	1 0 0 0	H	21	5	0	2	0 1 1 1	L
3.5	0	3	0	1 1 0 0	H	24.5	0	4	2	1 1 1 0	H
7	5	6	0	1 1 0 1	L	28	5	7	2	1 0 1 1	L
10	5	9	0	0 1 1 1	L	28.5	0	8	2	1 0 1 0	H
14	5	3	1	1 1 0 1	L	29	5	8	2	1 0 0 1	L
18	5	7	1	1 0 1 1	L	29.5	0	9	2	1 0 0 0	H

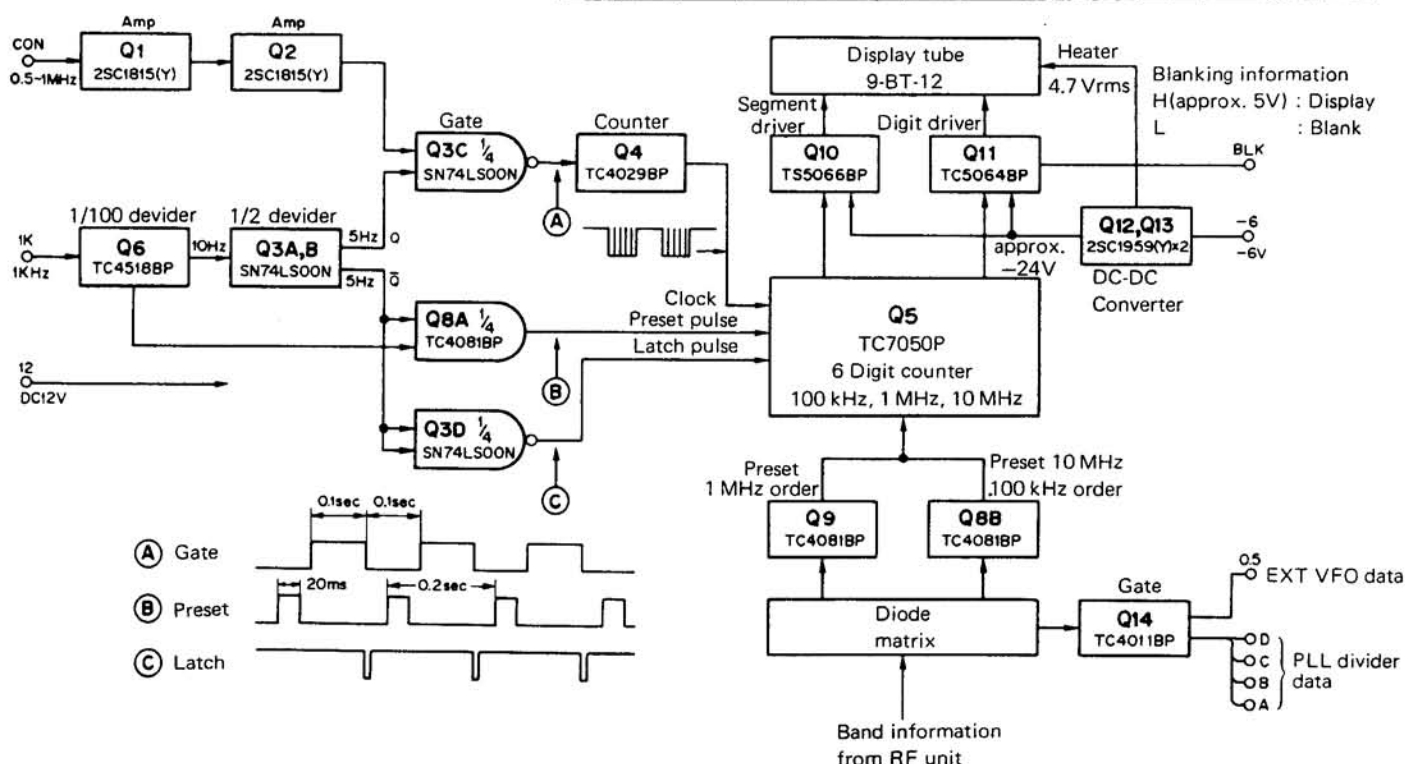


Fig. 3 Counter unit block diagram

CIRCUIT DESCRIPTION

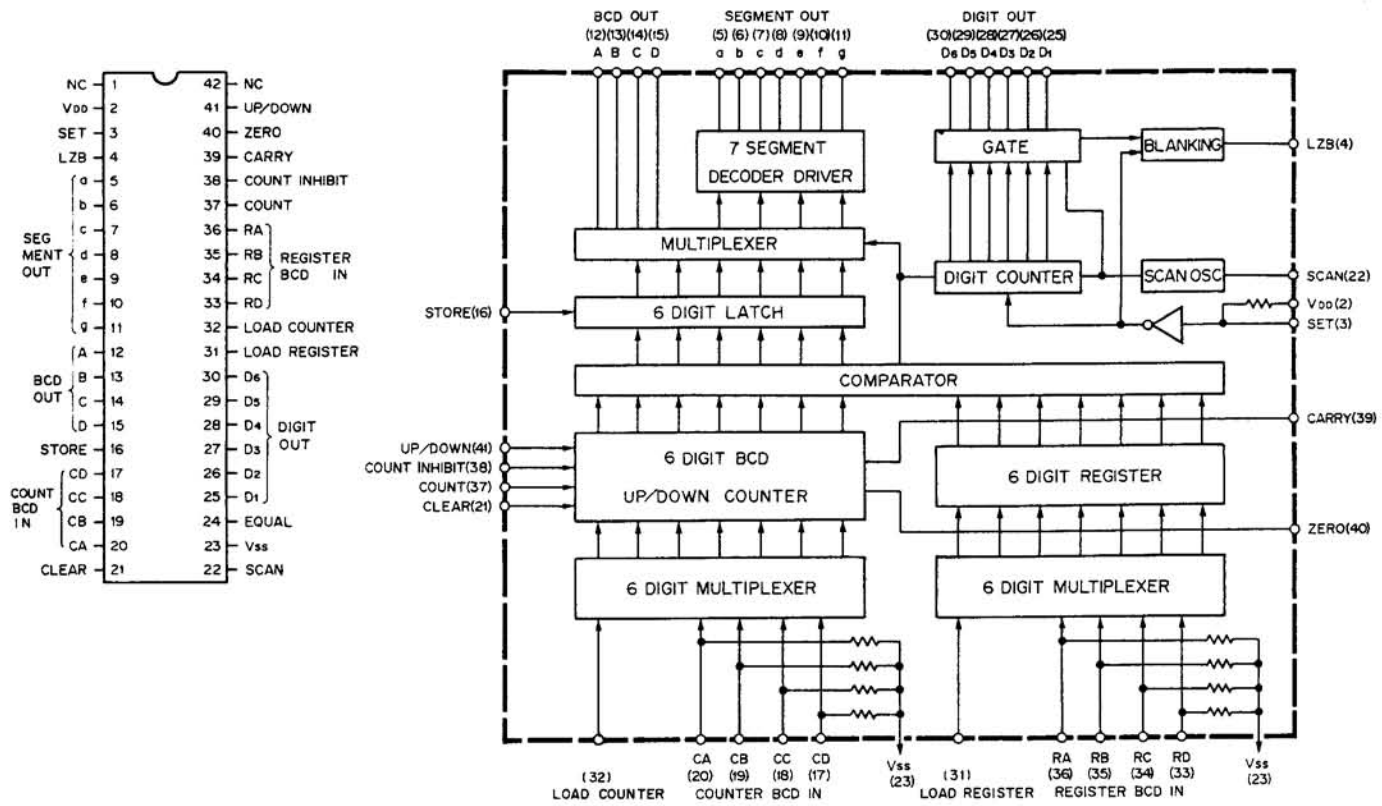


Fig. 4 TS5070P (Counter unit, Q5)

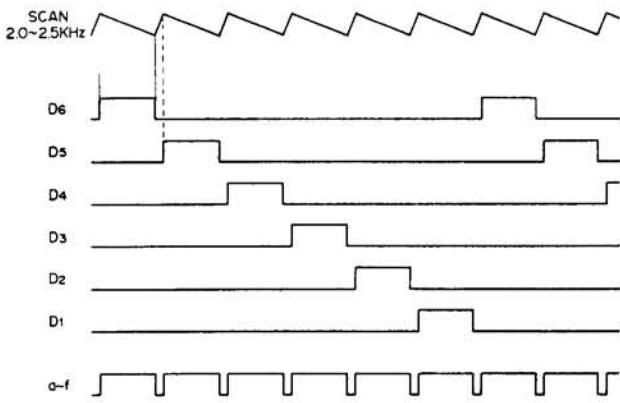
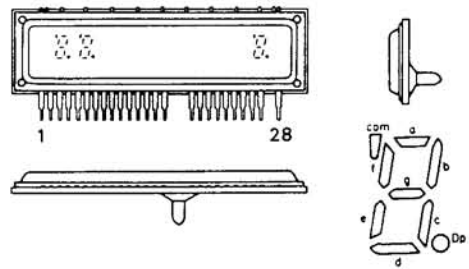


Fig. 5 TC5070P Timing chart

Q5 (TC5070P) is a presettable, 6-digit BCD counter which incorporates a 6-digit latch, 6-digit dynamic drive digital counter, and 7-segment decoder/driver. Band information supplied from the RF unit is applied to a diode matrix to preset the 100 kHz, 1 MHz and 10 MHz digits. Preset values are given in Fig. 3. For instance, to preset 14.000 MHz, with a 500 kHz counter input signal, the 10 MHz value is preset to 1, 1 MHz to 3, and 100 kHz to 5, and the 500 kHz



PIN NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CONNECTION	F	N <sub>C</sub>	G <sub>8</sub>	N <sub>C</sub>	N <sub>C</sub>	G <sub>8</sub>	g	f	G <sub>7</sub>	e	d	G <sub>6</sub>	N <sub>C</sub>	N <sub>C</sub>
	15	16	17	18	19	20	21	22	23	24	25	26	27	28
	G <sub>5</sub>	N <sub>P</sub>	N <sub>P</sub>	G <sub>4</sub>	D <sub>P</sub>	G <sub>3</sub>	c	b	G <sub>2</sub>	a	COM	G <sub>1</sub>	N <sub>P</sub>	F

Fig. 6 Indicating tube 9-BT-12

counter input signal is subtracted from 14.000 MHz. (If no counter input signal were present, 13.500 MHz would be displayed). Q5 supplies the display tube drivers with 7-segment information and dynamic drive control signals to light the fluorescent display tube. In the counter unit, a diode matrix generates frequency division information and supplies the PLL unit with this information. If the PLL unlocks, a BLK (Blanking Low) signal will be applied to the digit driver IC (Q11) to blank the fluorescent display tube.

## CIRCUIT DESCRIPTION

### CAR OSCILLATOR

The CAR oscillator consists of a crystal controlled oscillator which uses two crystals : one for LSB and the other for USB and CW . Frequencies generated are shown in **Fig. 1**. The oscillating frequency can be varied by the IF SHIFT control during reception.

### VFO

The VFO range is 5.5~6.0 MHz. Its oscillating frequency is automatically shifted 800 Hz up during CW transmission so that the actual operating frequency is always displayed.

### CIRCUIT FEATURES

#### 1. Optional filters available

The TS-530 is equipped with an 8.83 MHz IF filter with a bandwidth of 2.4 kHz. Narrow filters are separately available.

#### Installation of optional filters

One or two of the YK88SN, YK88C and YK88CN optional filters can be installed in the TS-530. Jumpers A and B (for filter switching) on the IF unit must be repositioned as shown in the following table.

Install each optional filter in the specified position on the IF unit PC board. To install both a YK88C and YK88CN, install the YK88C in the SSB NARROW FILTER position and the YK88CN in the CW FILTER position.

Option filter YK-88○○	MODE		SSB		CW	
	Jumper destination		NAR SW		NAR SW	
	B	A	OFF	ON	OFF	ON
SN	SSB	SSN	2.4 kHz	1.8 kHz	2.4 kHz	1.8 kHz
C	SSB	CW	2.4 kHz	Reception impossible	2.4 kHz	500 Hz
CN	SSB	CW	2.4 kHz	Reception impossible	2.4 kHz	270 Hz
SN + C	SSB	CW	2.4 kHz	1.8 kHz	2.4 kHz	500 Hz
	SSN	CW	2.4 kHz	1.8 kHz	1.8 kHz	500 Hz
SN + CN	SSB	CW	2.4 kHz	1.8 kHz	2.4 kHz	270 Hz
	SSN	CW	2.4 kHz	1.8 kHz	1.8 kHz	270 Hz
C + CN	SSN	CW	2.4 kHz	500 Hz	500 Hz	270 Hz

Table 4 Installation of optional filters

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

Table 5 SSB crystal filter (L71-0220-05)  
YK-88SN (option)

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

Table 6 CW crystal filter (L71-0211-05)  
YK-88C (Option)

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

Table 7 CW crystal filter (L71-0221-05)  
YK-88CN (Option)

## CIRCUIT DESCRIPTION

## 2. IF SHIFT operation

The IF SHIFT circuit shifts the passband of the IF circuit without changing the receiving frequency. The relative position of the passband of the IF filter to the received signal is shifted when the IF SHIFT control is turned as shown in Fig. 7. The IF SHIFT circuit block diagram is shown in Fig. 8.

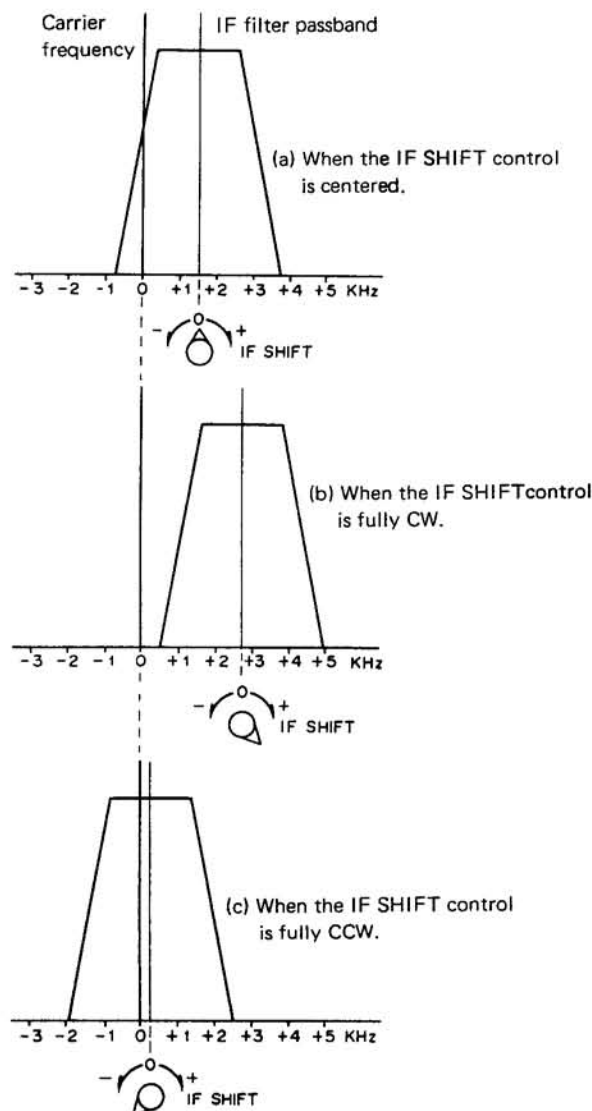


Fig. 7 IF SHIFT operation (for USB mode)

Frequencies within the PLL loop satisfy the following relationship.

$$N \cdot 500 \text{ kHz} = f_{\text{BPF1}} - f_{\text{VCO}} \quad (1)$$

where  $N$  : divisor of programmable divider

500 kHz : phase reference frequency

$f_{\text{BPF1}}$  : input frequency to MIX (1)

$f_{\text{VCO}}$  : VCO frequency

For example, in the case of 14 MHz reception,  $f_{\text{BPF1}}$  is given by eq. (1) as

$$f_{\text{BPF1}} = 10 \text{ MHz} + f_{\text{BPF2}} \quad (2)$$

where 10 MHz : band setting frequency

$$f_{\text{BPF2}} = f_{\text{VFO}} + f_{\text{CAR}} \quad (3)$$

where  $f_{\text{VFO}}$  : VFO frequency

$f_{\text{CAR}}$  : carrier frequency

By substituting eq. (3) into eq. (2) and eq. (2) into eq. (1)

$$f_{\text{VCO}} = 10 \text{ MHz} + f_{\text{VFO}} + f_{\text{CAR}} - N \cdot 500 \text{ kHz}$$

$$\therefore f_{\text{CAR}} = f_{\text{VCO}} + (N \cdot 500 \text{ kHz} - 10 \text{ MHz} - f_{\text{VFO}})$$

Assuming that  $f_{\text{VFO}}$  is constant, when  $f_{\text{CAR}}$  is varied by  $\pm \Delta f$ ,

$$\begin{aligned} f_{\text{CAR}} \pm \Delta f &= [f_{\text{VCO}} + (N \cdot 500 \text{ kHz} - 10 \text{ MHz} - f_{\text{VFO}})] \pm \Delta f \\ &= (f_{\text{VCO}} \pm \Delta f) + (N \cdot 500 \text{ kHz} - 10 \text{ MHz} - f_{\text{VFO}}) \end{aligned}$$

Thus,  $f_{\text{VCO}}$  varies by  $\pm \Delta f$  as  $f_{\text{CAR}}$  is varied by  $\pm \Delta f$ .

The receiving frequency,  $f_{\text{R}}$  is given by

$$f_{\text{R}} = f_{\text{VCO}} - f_{\text{CAR}} \quad (4)$$

Therefore, when  $f_{\text{CAR}}$  is shifted by  $+\Delta f$ , receiving frequency  $f'_{\text{R}}$  is given by

$$\begin{aligned} f'_{\text{R}} &= (f_{\text{VCO}} + \Delta f) - (f_{\text{CAR}} + \Delta f) \\ &= f_{\text{VCO}} - f_{\text{CAR}} \end{aligned} \quad (5)$$

From equations (4) and (5),

$$f_{\text{R}} = f'_{\text{R}}$$

Thus the receiving frequency does not vary even if  $f_{\text{CAR}}$  is varied. However,

$$f_{\text{R}} = f_{\text{VCO}} - \text{IF frequency}$$

so the IF frequency varies as  $f_{\text{VCO}}$  varies.

This means that the relative position of the IF filter passband to the carrier position (of the received signal) is shifted by the same amount as the  $f_{\text{VCO}}$  variation.

# CIRCUIT DESCRIPTION/AC VOLTAGE CONVERSION

## 3. Speech processor [Part of IF unit (X48-1310-00)]

This is an audio compression speech processor. When the processor switch is OFF, the audio signal amplified by Q11 (on the IF unit) passes through buffer amplifier Q12 (2SC1815Y) and is then applied to the MIC pot via diode switch D24 (1S1555).

When the processor switch is ON, the audio signal amplified by Q12 is applied to the AGC-type speech processor consisting of Q13 ( $\mu$ PC1158H2), Q14 (2SC1815Y) and D26 (1N60). The speech processor effectively increases the "talk power" of the audio signal and feeds it to MIC pot via diode switch D25 (1S1555).

When the processor is ON, the ALC time constant is shortened by turning Q30 (2SK30A) in the AF unit OFF to heighten processor effect.

## 4. RIT/XIT operation

Conventional RIT function is provided by the RIT/XIT control. By also turning the XIT switch ON, the transmission frequency is shifted to the same frequency as received under RIT control.

## TS-530(K) AC VOLTAGE CONVERSION

To operate the TS-530S (K) on 240V AC, the power transformer split primaries must be rewired from parallel to series connection.

1. Unplug the AC power cable.
2. Remove the bottom cover.
3. Remove the jumper wires between the two  $\phi$  terminals and two 120 terminals on the bottom of the power transformer.
4. Connect the adjacent 120 and  $\phi$  terminals at the middle of the transformer. This will provide 240V AC operation. For 220V AC operation, change the wires from 120 to 100 winding.
5. Change the AC fuse from 6A to 4A. Tag the power cord at the back of the radio to indicate that the transformer is strapped for 240V AC, and the power fuse should be 4A, and not 6A.
6. Replace the bottom cover and reconnect power to verify your work.

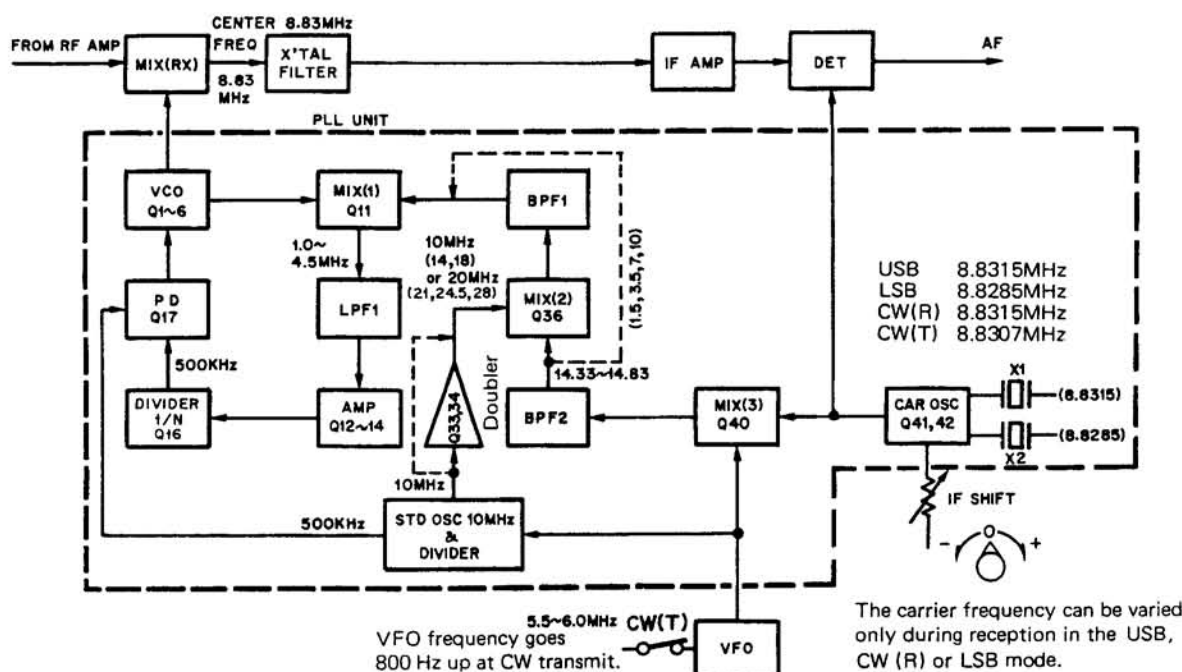
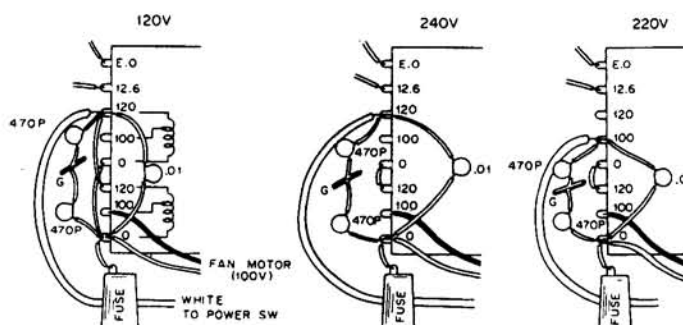
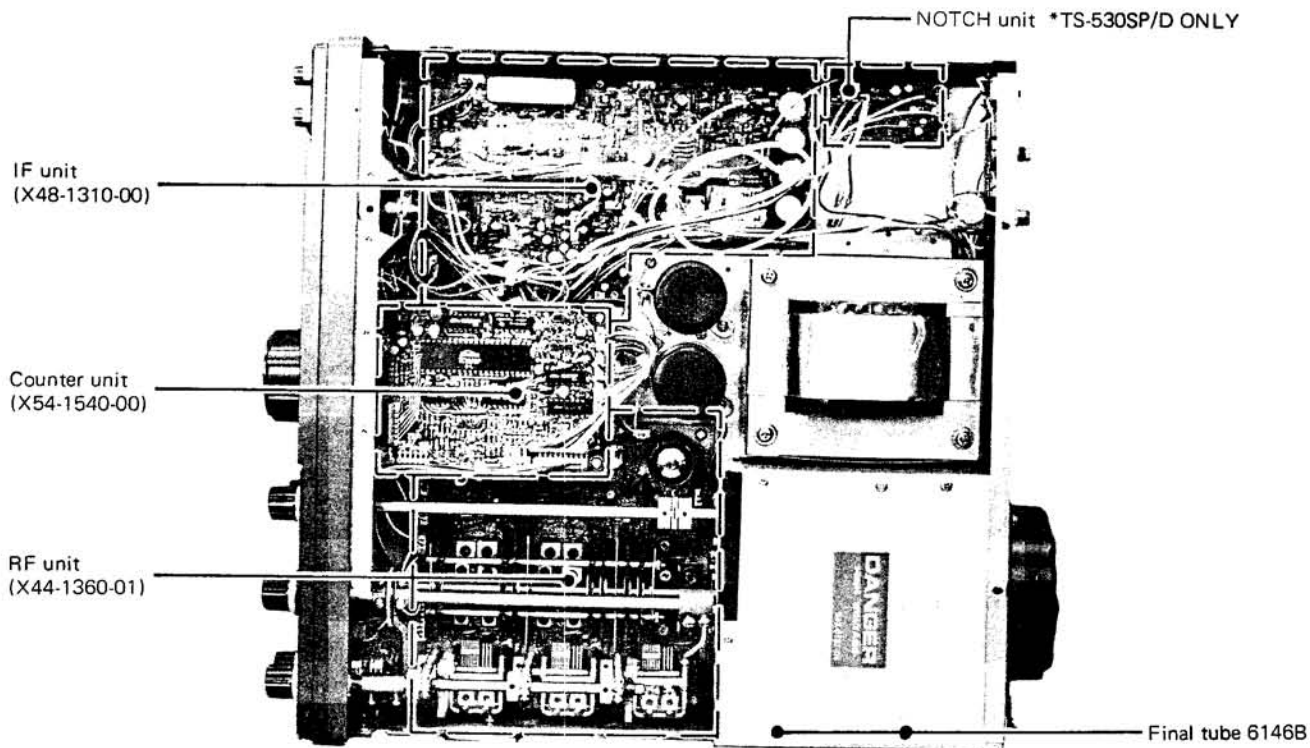


Fig. 8 IF SHIFT Block diagram

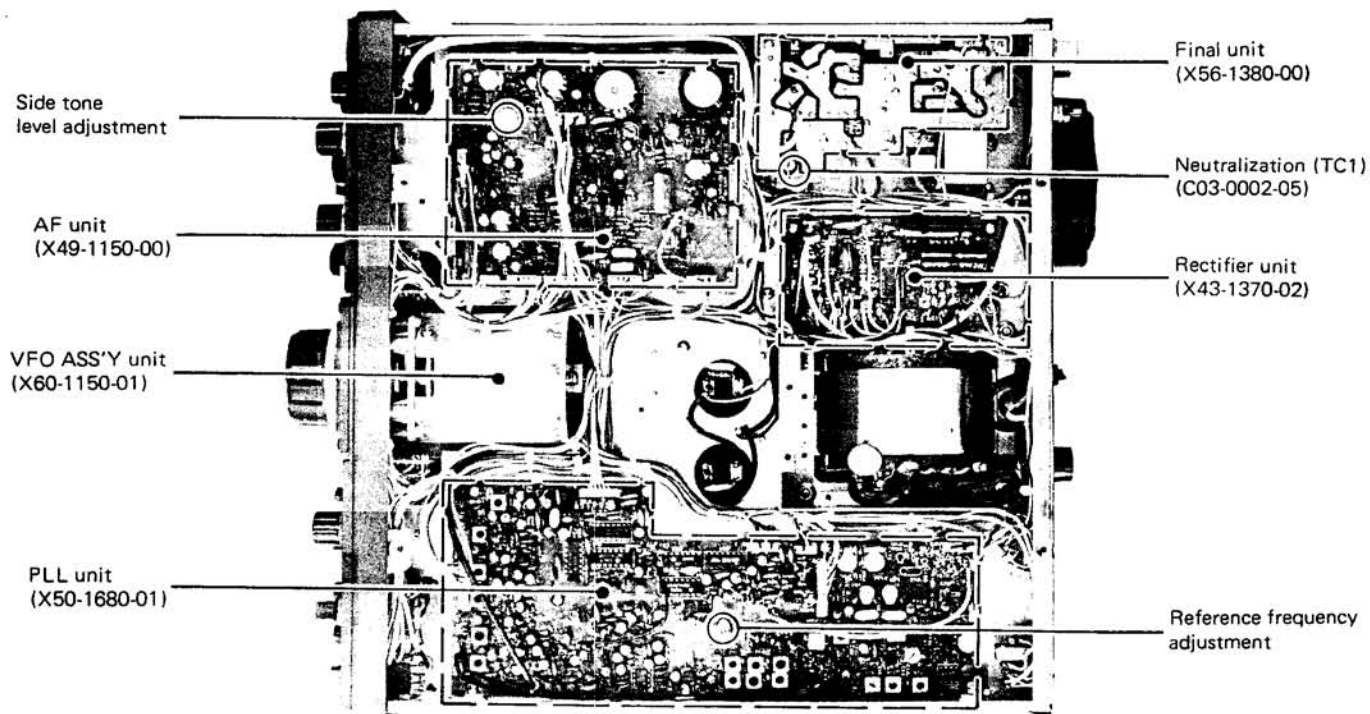


## INSIDE VIEWS

### TOP VIEW

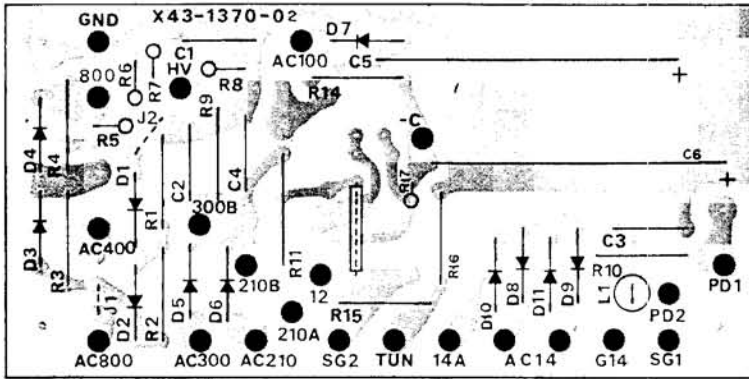


### BOTTOM VIEW



## ▼ RECTIFIER UNIT (X43-1370-02)

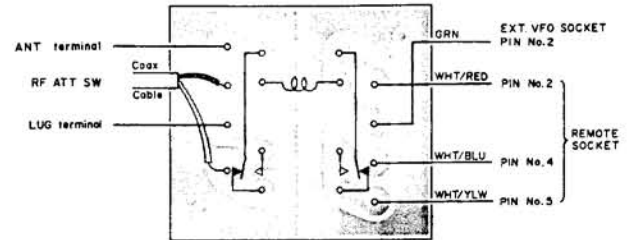
View from component side



D1~6 : V08J D7 : V06E D8~11 : V03C

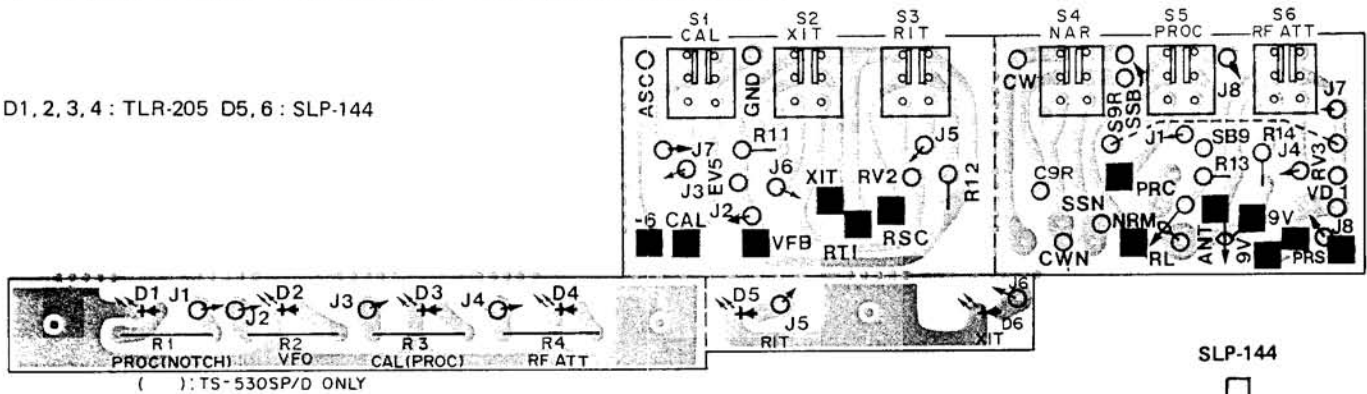
## ▼ ANT RELAY BOARD (J25-3015-04)

View from foil side



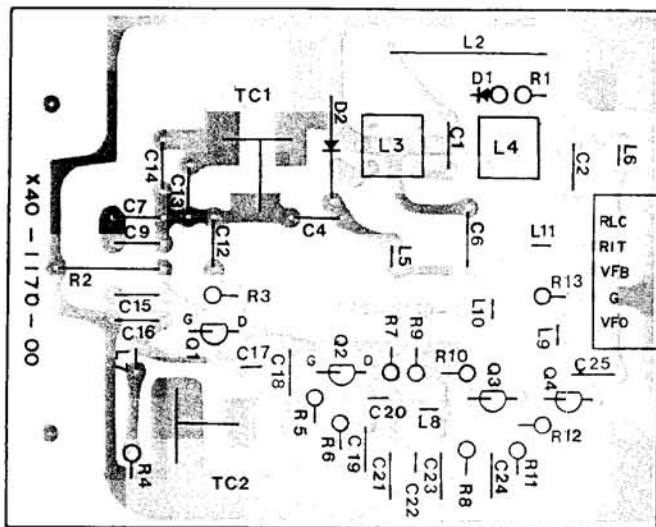
## ▼ SWITCH BOARD (J25-3016-03) View from component side

D1, 2, 3, 4 : TLR-205 D5, 6 : SLP-144



## TS-530S PC BOARD VIEWS

▼ VFO UNIT (X40-1170-00) View from component side



2SA473

2SA562

2SA778A 2SC1815  
2SA1015 2SC1959  
2SC945 2SC2240  
2SC1515

2SC460

2SK19

2SK30A

MB3712

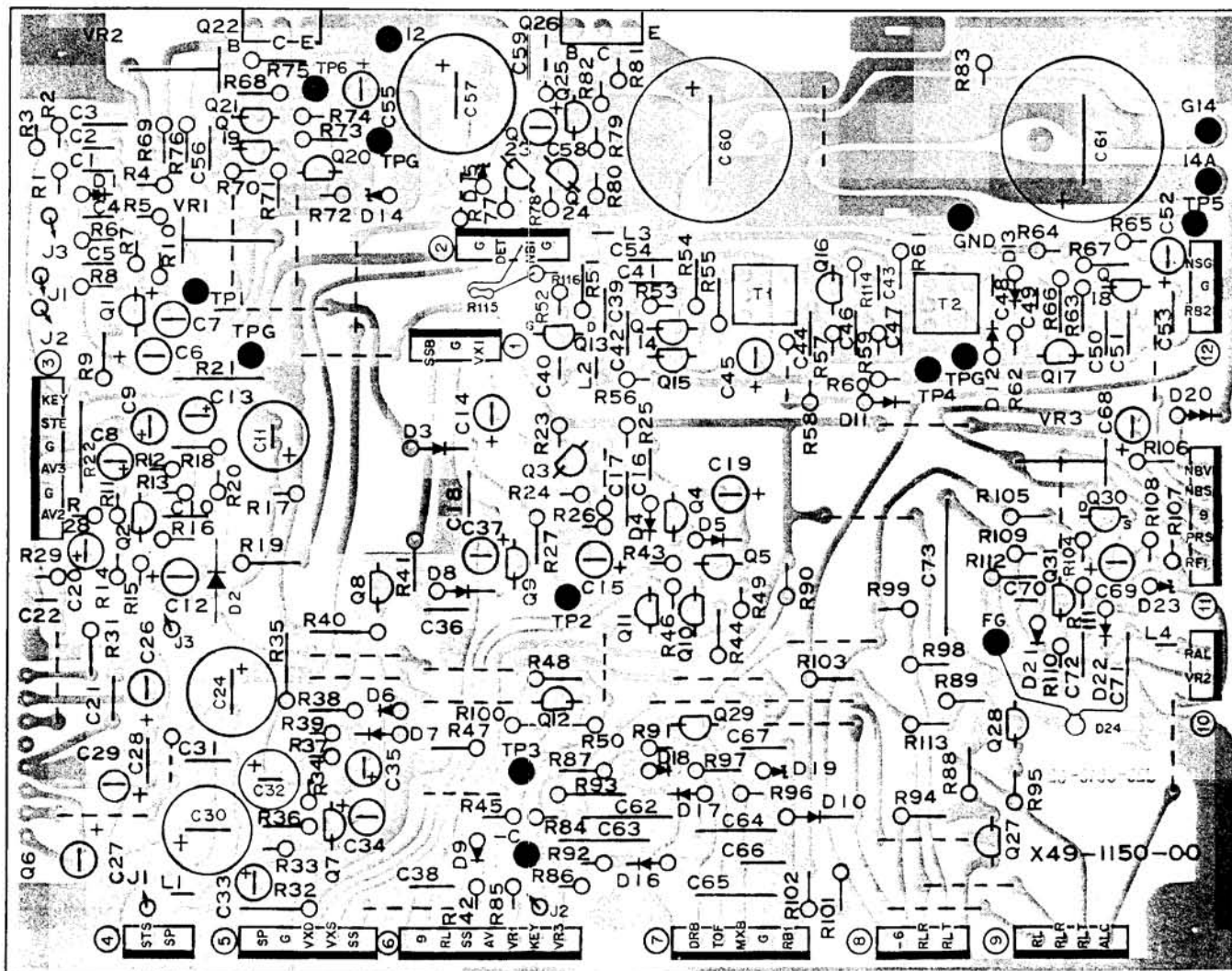
MV-13

MV-203

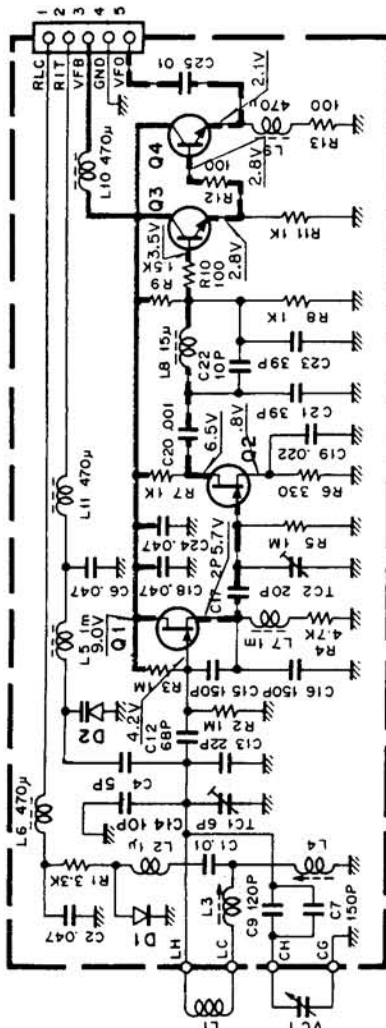
GREEN —  ¥

YELLOW  

**▼ AF UNIT (X49-1150-00)** View from component side

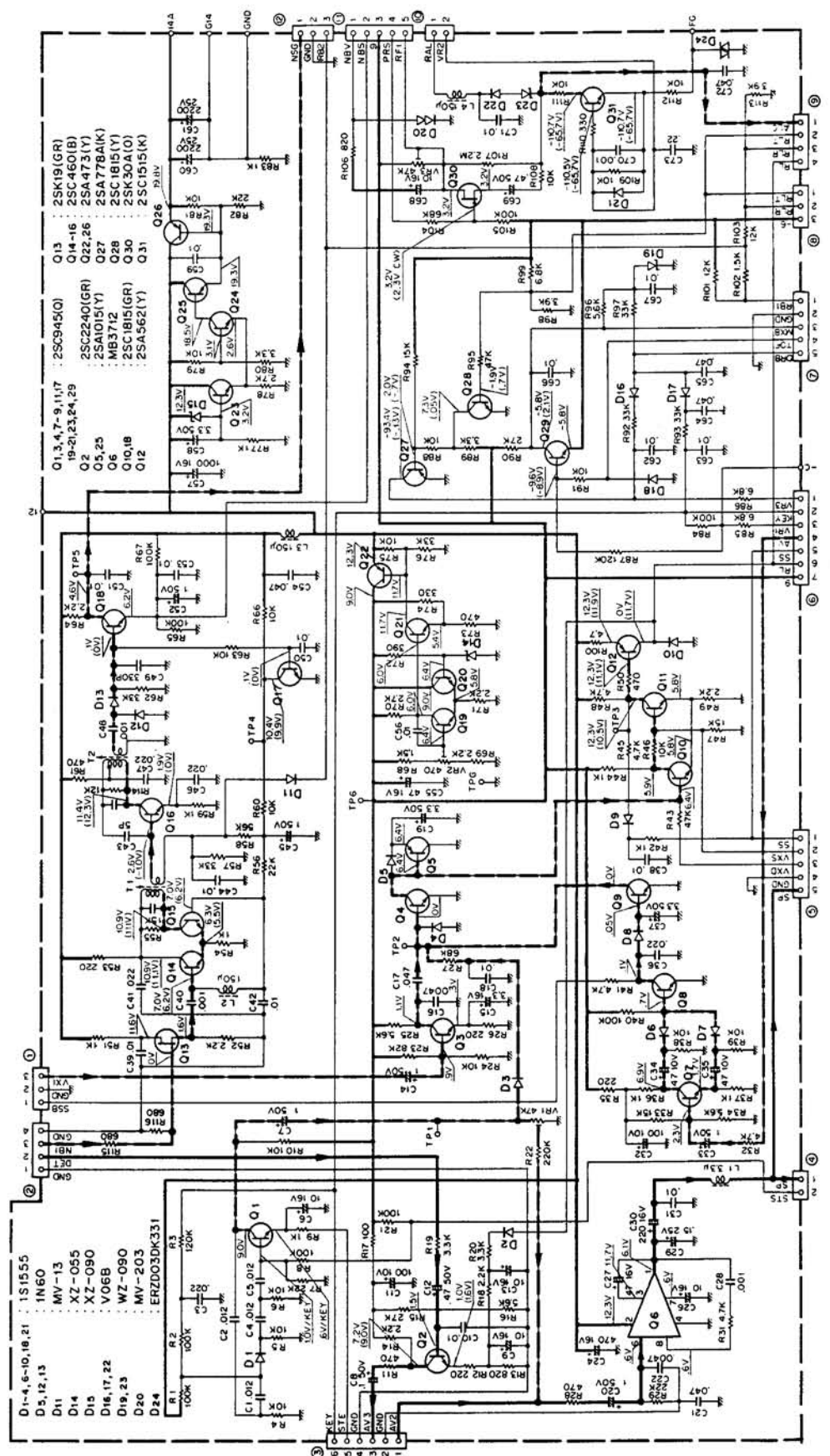


## VFO UNIT (X40-1170-00) ▶



- Q1,2 : 25K19 (Y)  
Q3 : 25C460(B)  
Q4 : 25C1815(Y)
- D1 : 1S2588  
D2 : 1SV53A

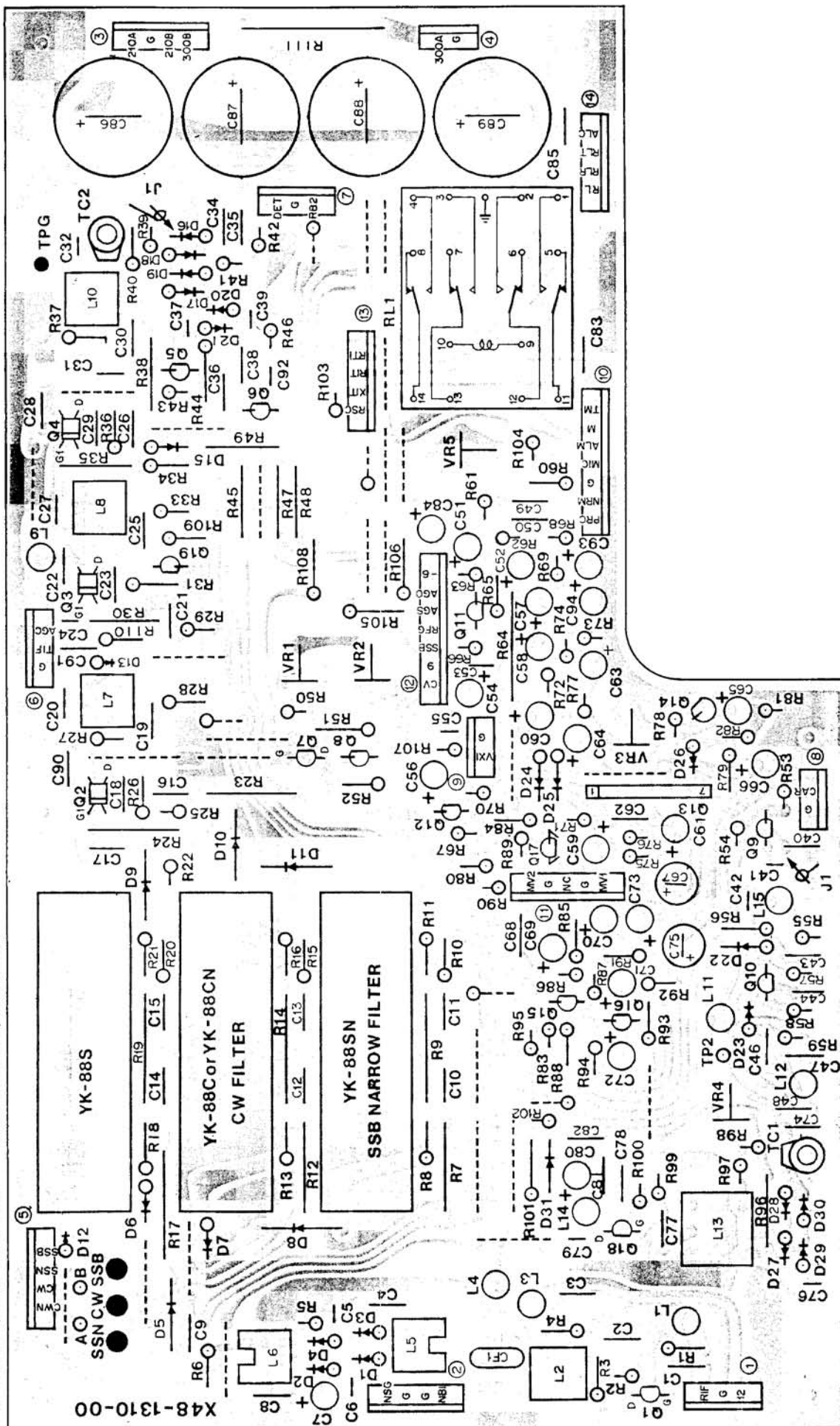
## ▶ AF UNIT (X49-1150-00)





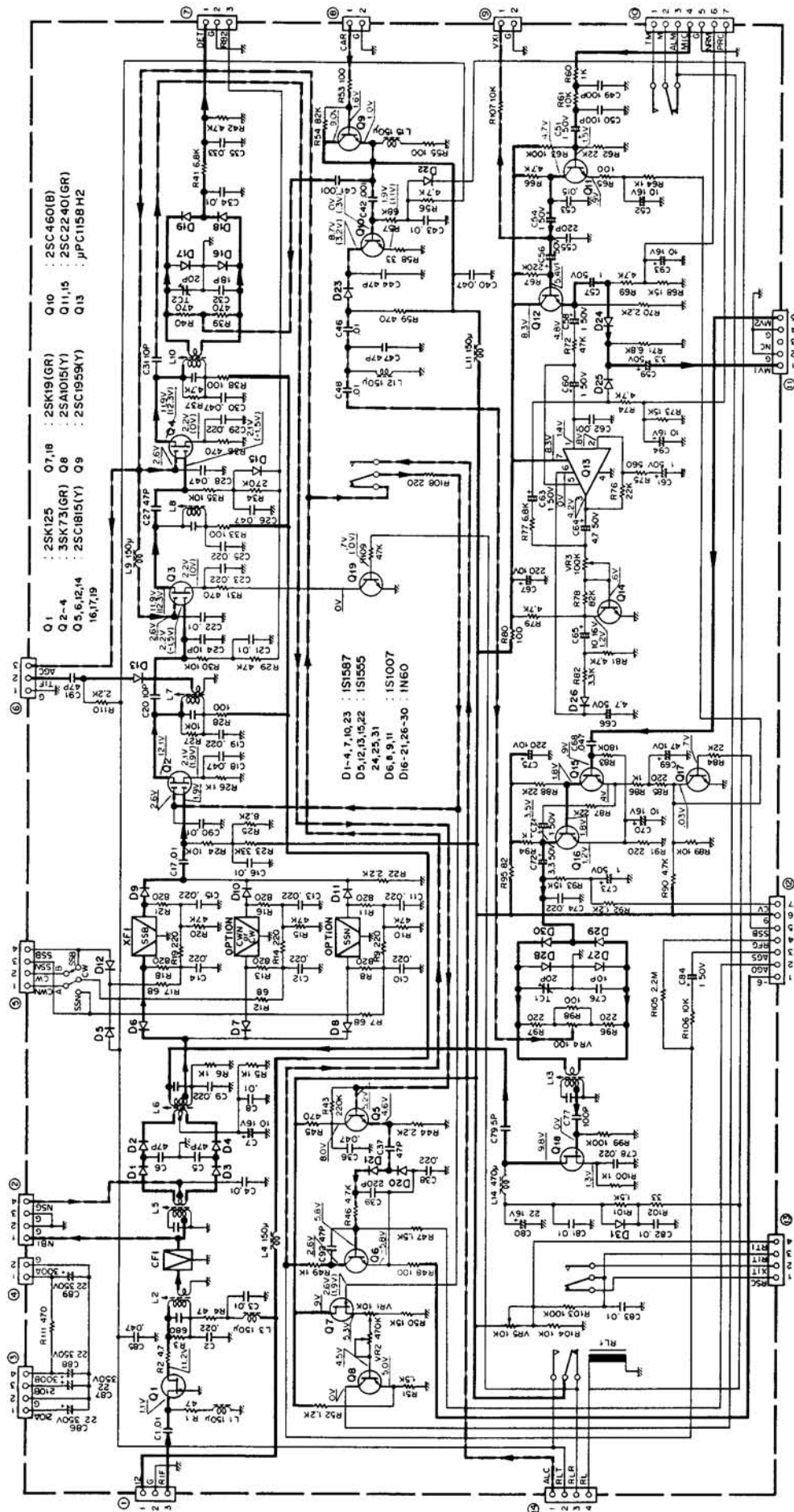
# TS-530S PC BOARD VIEW

▼ IF UNIT (X48-1310-00) View from component side





▼ IF UNIT (X48-1310-00)



2SA1015  
2SC1815  
2SC1959  
2SC2240

**μPC1158H2**

3SK73

2SK125

2SK19

2SC460

2SC1675  
2SC1775  
2SC1885  
2SC1923  
2SC1959



2SC460



2SK19



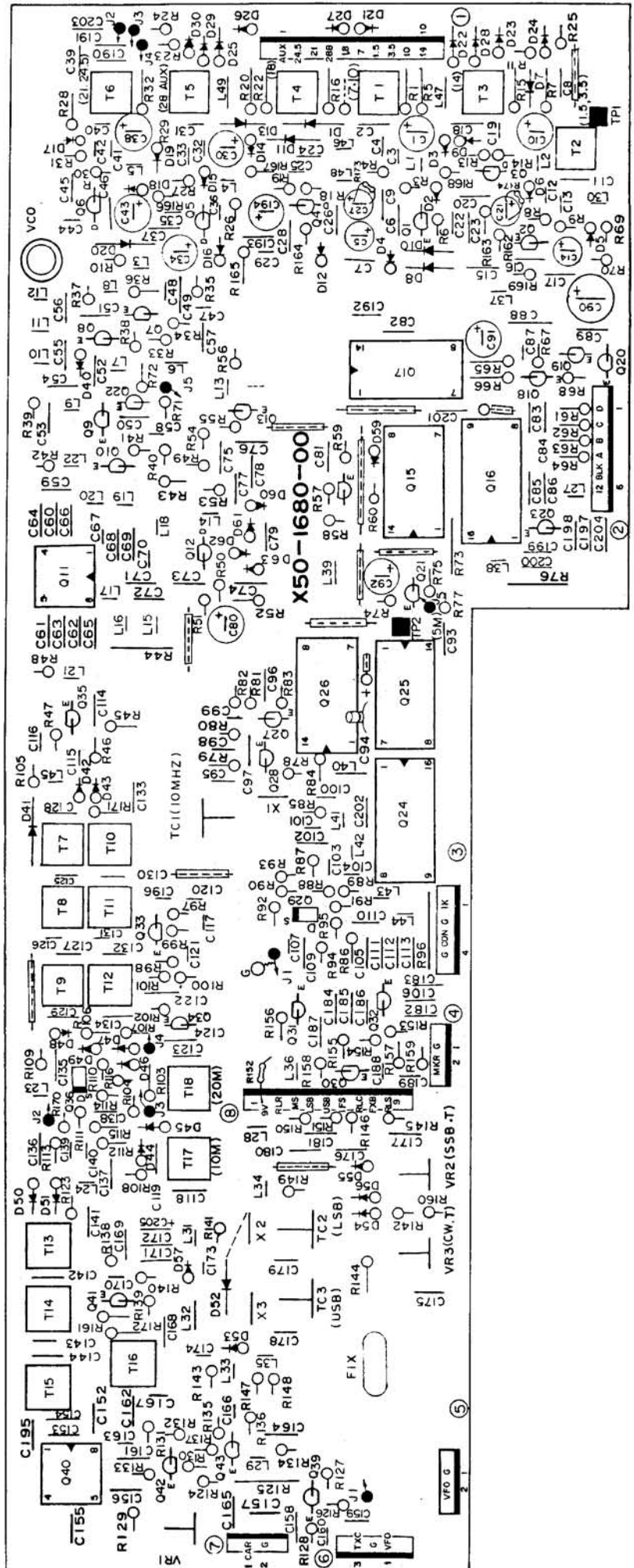
3SK73



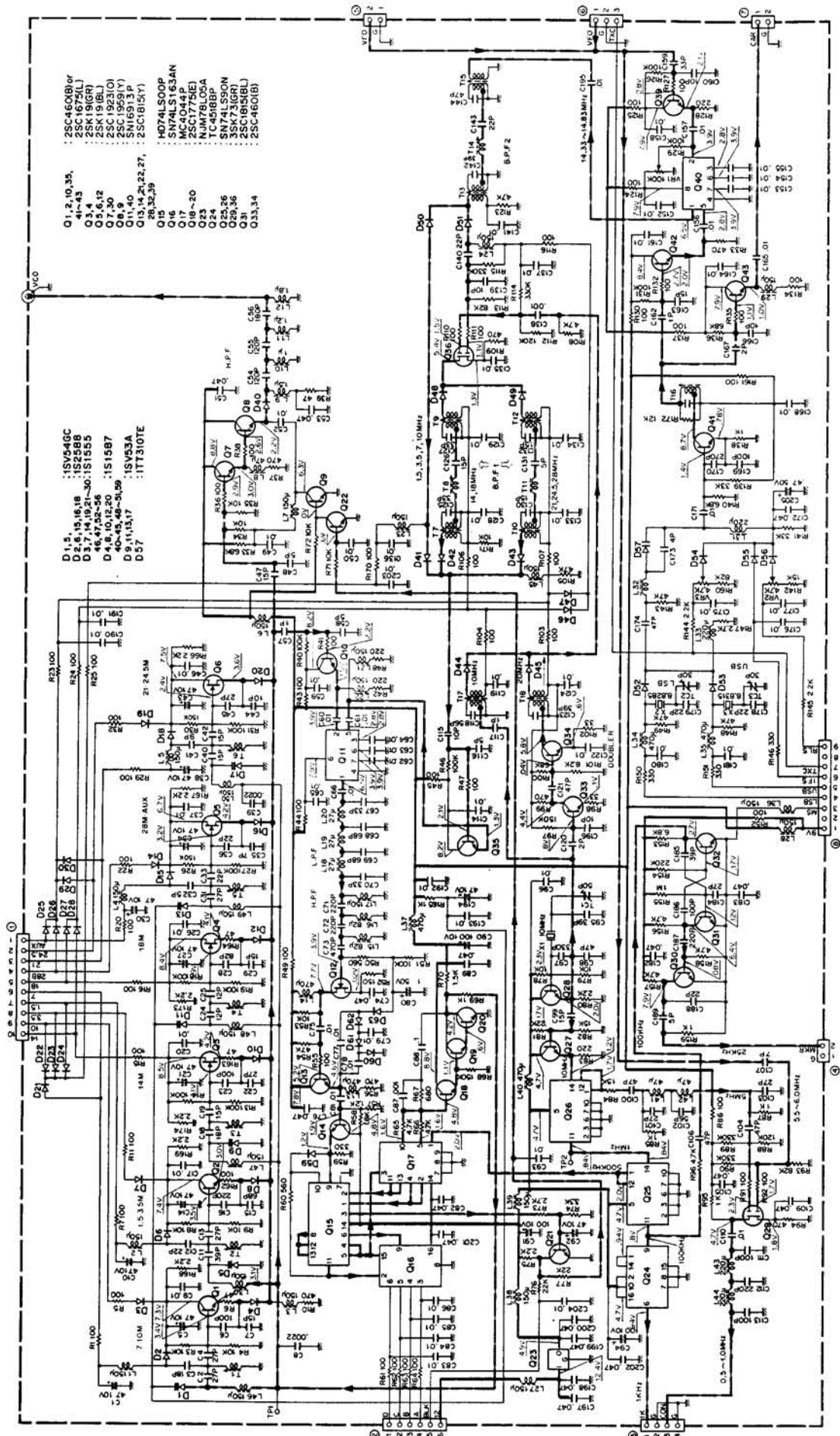
NJM78L05A



▼ PLL UNIT (X50-1680-01) View from component side

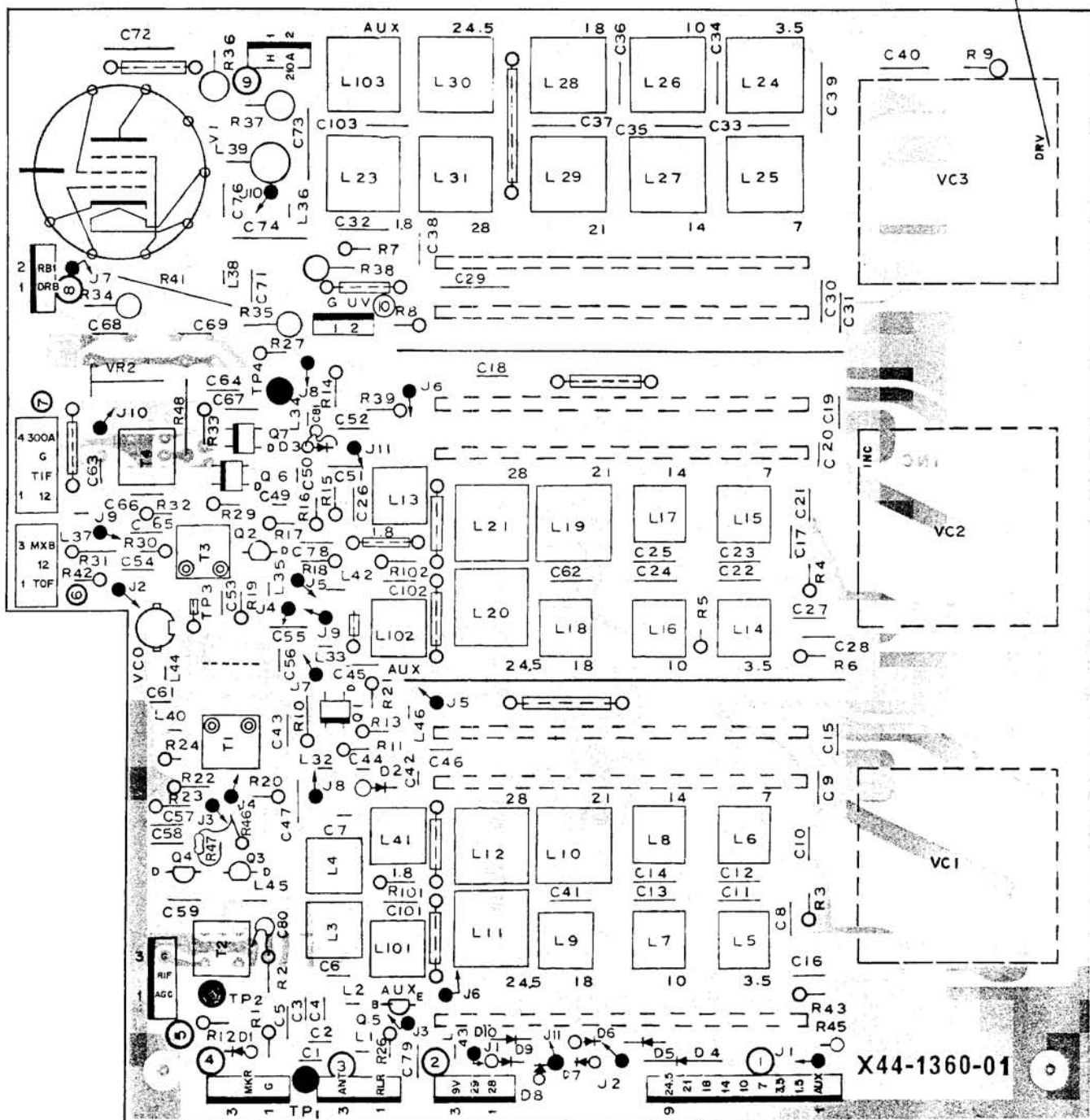


## ▼ PLL UNIT (X50-1680-01)



# TS-530S PC BOARD VIEW

▼ RF UNIT (X44-1360-01) View from component side



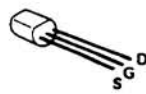
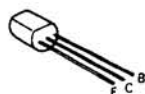
D1, 6, 7 : 3SK73(GR) Q2~4 : 2SK125 Q5 : 2SC1815(Y) D1 : 1S1587 D2, 3 1S2588 D4~10 : 1S1555 V1 : 12BY7A

2SC1815

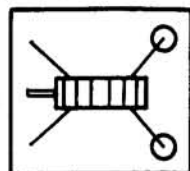
2SK125

3SK73

Attachment method of T1, T2



Twisted wires



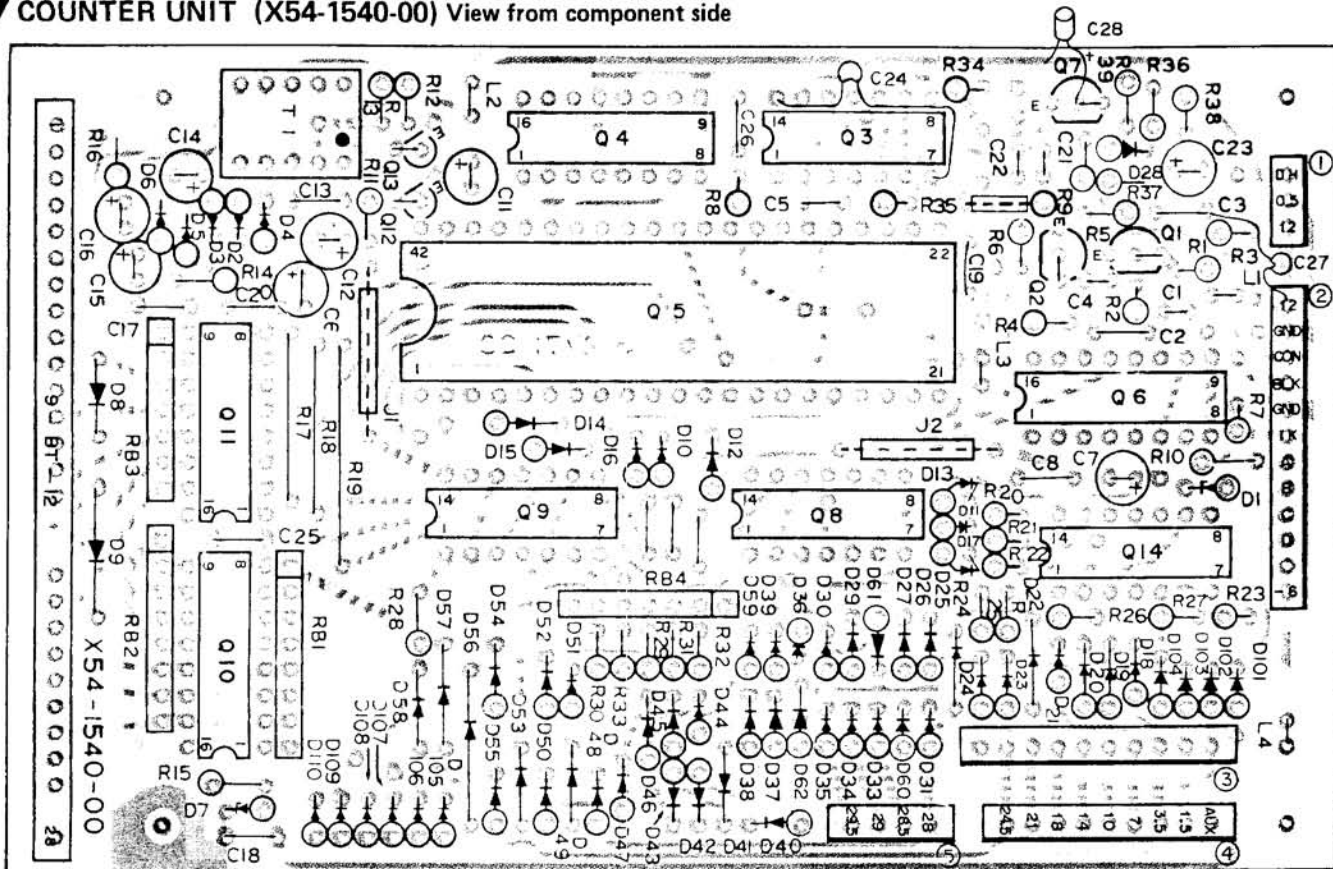
Yellow

Yellow

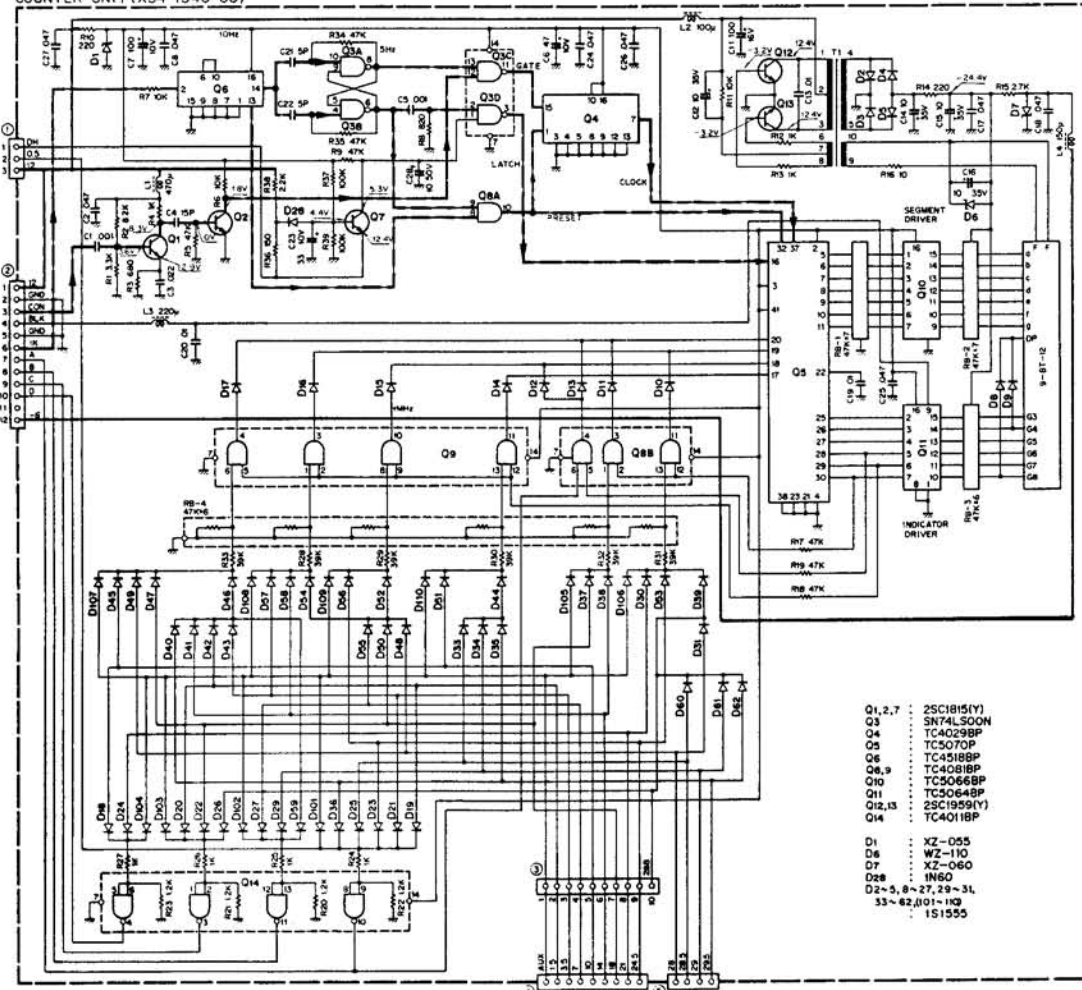


# PC BOARD VIEW/CIRCUIT DIAGRAM TS-530S

## ▼ COUNTER UNIT (X54-1540-00) View from component side

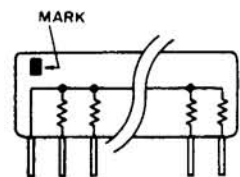


COUNTER UNIT (X54-1540-00)



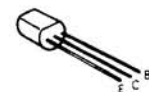
Q1, 2, 7: 2SC1815(V)  
Q3: 2SC1815(V)  
Q4: TC4029BP  
Q5: TC5070P  
Q6: TC4518BP  
Q8, 9: TC4018BP  
Q10: TC5066BP  
Q11: TC5064BP  
Q12, 13: 2SC1959(V)  
Q14: TC4018BP

D1: XZ-D55  
D8: WZ-110  
D7: XZ-O60  
D28: 1N60  
D2~5, 8~27, 29~31, 33~62, 101~110: 1S1555



RB1 ~ 4

2SC1815  
2SC1959





## PARTS LIST

### Note 1:

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

### Note 2:

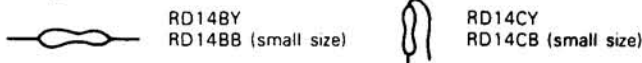
Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. For the value of all common type components, refer to the schematic diagram of the P.C. board illustration. Resistors not 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

② ② ② → means  $22 \times 10^2 = 2200\Omega$  (2.2 kΩ)  
Example 221 → 220Ω      223 → 22 kΩ      225 → 2.2 MΩ  
222 → 2.2 kΩ      224 → 220 kΩ

### 4. Tolerance

J = ±5% (Gold)      K = ±10% (Silver)

### CAPACITORS

#### Type I

CC	45	TH	1H	220	J
1'	2	3'	4	5	6

1 = Type ... ceramic, electrolytic, etc.  
2 = Shape ... round, square, etc.  
3 = Temp range  
3' = Temp coefficient

#### Type II

CK	45	F	1H	103	Z
1	2	3	4	5	6

4 = Voltage rating  
5 = Value  
6 = Tolerance

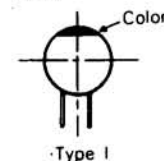
Ex. CC45TH = -470 ±60 ppm/°C

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

#### 5 = Capacitor value

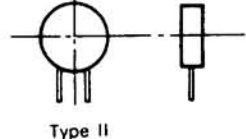
Example: 010 → 1 pF  
100 → 10 pF  
101 → 100 pF  
102 → 1000 pF = 0.001 μF  
103 → 0.01 μF

#### CC45



Type I

#### CK45



Type II

### TS-530 SEMICONDUCTOR

☆: New parts

Item	Name	Parts No.	Re- marks	Item	Name	Parts No.	Re- marks
Diode	1N60	V11-0051-05		Vari-cap diode	1SV53A	V11-4161-36	☆
	1S1007	V11-4160-66			1SV54GC	V11-4173-46	
	1S1555	V11-0076-05		LED	SLP-144	V11-6172-76	
	1S1587	V11-0370-05			TLR-205	V11-3162-96	
	1S2588	V11-0414-05		Zener diode	WZ-061	V11-0243-05	
	V03C	V11-0290-05 200V 1.3A			WZ-090	V11-0240-05	
	V06B	V11-0219-05 100V 1.1A			WZ-110	V11-4161-46	
	V06E	V11-0285-05 400V 1.1A			XZ-055	V11-4105-50	
	V08J	V11-0282-05 800V 1.1A			XZ-060	V11-4101-20	
					XZ-090	V11-4167-06	
Varistor	MV-13	V21-0004-05		Surge absorber	ERZD03DK331		
	MV-203						

## PARTS LIST

Item	Name	Parts No.	Re- marks	Ref. No.	Parts No.	Description	Re- marks
TR	2SA473(Y)	V01-0473-06	☆	TS-530S GENERAL			
	2SA562(Y)	V01-0032-05			A01-0274-05	Fan case	
	2SA778A(K)	V01-0778-16			A01-0778-11	Case (upper)	
	2SA1015(Y)	V01-1015-06			A01-0779-01	Case (lower)	
					A20-2420-03	Panel	☆
	2SC460(B)	V03-0079-05			B03-0519-04	Switch mask Panel	
	2SC945(Q)	V03-0945-06			B03-0520-04	Switch mask Panel	
	2SC1515(K)	V03-0450-05			B05-0708-04	Speaker grill cloth	
	2SC1775(E)	V03-1775-06			B09-0003-05	Coupling Plate	
	2SC1815(BL)	V03-1815-26			B10-0631-04	Front glass (small)	
	2SC1815(GR)	V03-1815-16			B10-0639-04	Front glass (large)	☆
	2SC1815(Y)	V03-1815-06			B21-0501-04	Pointer Plate	
	2SC1923(O)	V03-1923-06			B30-0817-15	Pilot lamp Meter 12V, 80mA	
FET	2SK19(BL)	V09-0111-05	☆		B31-0630-05	Meter	☆
	2SK19(GR)	V09-0012-05			B42-1702-04	Adj. seal	☆
	2SK19(Y)	V09-0011-05			B43-0651-04	Name plate T	☆
	2SK30A(O)	V09-0056-05			B43-0653-04	Name plate K, W, X, M	☆
	2SK125	V09-0136-10			B46-0058-10	Warranty card K	
					B50-2791-00	Operating manual K, W, X, M	☆
IC	3SK73(GR)	V09-1002-46			B50-2792-00	Operating manual T	☆
					B58-0625-00	Transmit warning paper	
	74LS163N	V30-1037-06			B58-0631-00	Warning paper W, T, X, M	
	HD74LS00P	V30-0192-16		C7	C90-0186-05	C 0.001μF 3kV	
	HD74LS90P	V30-1083-06		C8	C91-0079-05	C 0.01μF 2kV	
	HD74LS163P	V30-1047-06		C9	C91-0401-05	C 100pF 3kV	
				C10	C91-0017-05	C 390pF 3kV	
	MB3712	V30-1231-16		C12	CC45SL2H101J	C 100pF 500V	
	MC4044P	V30-0173-05		C13	CC45SL2H271J	C 270pF 500V S/SP	
				C14	CC45SL2H681J	C 680pF 500V S/SP	
	NJM78L05A	V30-1149-06		C15	CC45SL2H121J	C 120pF 500V	
				C16	CC45SL2H821J	C 820pF 500V	
	SN74LS00N	V30-1005-66		C17	CC45SL2H102J	C 0.001μF 500V	
Tube	SN74LS90N	V30-1005-26	☆	C18, 19	C90-0300-05	C 470pF AC150V	
	SN74LS163AN	V30-1154-06		C20	C91-0079-05	C 0.01μF 2kV	
	SN16913P	V30-1048-06		C22, 24	C90-0327-05	E 100μF 500V	
				C26	C91-0467-05	C 22pF 3kV	
	TC4011BP	V30-0301-70		C30	CC45SL1H030C	C 3pF ±0.25pF	
	TC4029BP	V30-1051-06		C31	CC45SL2H101J	C 100pF 500V	
	TC4081BP	V30-0299-10		TC1	C03-0002-05	Trimmer	
	TC4518BP	V30-1039-06		VC1	C03-0060-05	Variable cap. (A) FINAL	
	TC5064BP	V30-1056-06		VC2	C01-0084-05	Variable cap. (B) LOAD	
	TC5066BP	V30-1057-06			D22-0402-05	Universal coupling BAND LOAD	
	TC5070P	V30-1172-06			D22-0405-04	Coupling PLATE	
	μPC1158H2	V11-1177-26			D22-0407-04	Shaft coupling φ6	
	12BY7A	V40-0114-00			D32-0051-04	Shaft stopper M3 x 10	
	6146B	V40-0138-00 K			D32-0075-04	Switch stopper W, T, X, M	
	S2001A	W, T, X, M			D40-0613-05	Vernier mechanism	
					E04-0152-05	UHF type receptacle ANT	
					E06-0451-15	4P male socket MIC	
					E06-0751-05	7P DIN socket REMOTE	
					E06-0851-05	8P DIN socket EXT. VFO	
					E07-0403-05	4P MIC plug (accessory) W, T, X, M	
					E07-0751-05	7P DIN plug (accessory)	
					E07-0851-05	8P DIN plug EXT. VFO	
					E11-0404-05	3P phone jack KEY, PHONE	
					E11-0410-05	Phone jack EXT. SP	
					E12-0001-05	Phone plug (accessory) EXT. SP	

## PARTS LIST

Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
	E22-0207-05	Lug plate			N14-0115-05	Flange nut GND	
	E22-0472-05	Lug plate Final	☆		N14-0509-05	Wing nut GND	
	E23-0046-04	Square terminal Switch, Relay			N14-0517-05	Cap nut BIAS	
	E30-0181-05	AC cord UL/CSA K, M			N30-4012-46	Round screw Foot (large)	
	E30-0185-05	AC cord SAA X			N30-4016-46	Round screw GND	
	E30-0585-05	AC cord CEE W			N30-4025-46	Round screw Foot (accessory)	
	E30-0602-05	AC cord 3P T			N33-3006-41	Round flat screw SP	
	E31-2086-05	Coax cable with plug			N35-3008-45	Bind screw Foot (small)	
	E90-0004-15	Plate cap			N35-4006-41	Bind screw Case	
	F05-4022-05	Fuse 4A W, T, X, M			N87-4012-46	Self tapping screw Foot (large)	
	F05-6021-05	Fuse 6A K, M			N89-3006-46	Bind tapping screw Final cover	
	F09-0041-05	Fan			N99-0306-04	Hex. head screw VFO	
	G01-0801-04	Gnd spring		R22	RC05GF2H221J	Solid 220Ω 1/2W	
	G09-0410-05	D spring φ6		R24	RC05GF3A103K	Solid 10kΩ 1W	
	G13-0633-14	Cushion Meter		R25,26	RC05GF2H474J	Solid 470kΩ 1/2W	
	G13-0639-04	Cushion Indicating tube		R28	RC05GF2H330J	Solid 33Ω 1/2W	
	G53-0502-04	Packing Case side		VR1	R01-3414-05	Pot. 10kΩ(A) AF	☆
	G53-0512-04	Packing Panel		VR2	R01-3415-05	Pot. 10kΩ(B) RF	☆
	H01-2741-04	Carton case (inside) K, W, X, M	☆	VR3	R01-3417-05	Pot. 10kΩ(F) IF SHIFT	☆
	H01-2742-04	Carton case (inside) T	☆	VR4	R01-2405-05	Pot. 5kΩ(B) RIT/XIT	☆
	H03-1797-04	Carton case (outside)	☆	VR5	R01-3414-05	Pot. 10kΩ(A) MIC	☆
	H10-2539-02	Packing fixture (F)		VR6	R01-3416-05	Pot. 10kΩ(B) CAR	☆
	H10-2540-02	Packing fixture (R)		VR7	R01-4408-05	Pot. 50kΩ(B) VOX GAIN	☆
	H20-0439-03	Protective cover		VR8	R01-0404-05	Pot. 300Ω(B) NB	
	H25-0120-04	Protective bag		VR9	R01-6401-05	Pot. 250kΩ(B) DELAY	
	J02-0022-05	Foot (small)		VR10	R01-0405-05	Pot. 300Ω(B) ANTI	☆
	J02-0049-14	Foot (large)		VR11,12	R01-3411-05	Pot. 10kΩ(B) RF OUT, BIAS	
	J13-0033-15	Fuse holder		S1~6	S40-2419-05	Push switch PC board type	
	J25-3015-04	PC board Relay	☆	S7	S40-2403-05	Push switch +0.5 SHIFT	
	J32-0029-04	Hex. boss Relay, PLL		S8,9	S36-1403-05	See saw switch HEATER, POWER	☆
	J32-0159-04	Hex. boss Final		S11	S01-1423-05	Rotary switch AGC	
	J41-0006-05	Cord bushing K, M		S13	S01-1427-05	Rotary switch METER	☆
	J41-0024-15	Cord bushing W, T, X		S14,16	S40-2415-05	Push switch Lead type	
	J42-0409-04	Knob bushing +0.5 SHIFT		S17	S33-2403-05	Paddle switch STBY	☆
	J61-0019-05	Vinyle tie		S18	S01-2429-05	Rotary switch MODE	☆
	J61-0401-05	Nylon band		S20	S31-2007-05	Slide switch SG	
	J61-0402-05	Free up belt W		S22	S01-3406-05	Rotary switch FINAL	
	K01-0406-05	Handle	☆	S23	S31-2027-05	Slide switch AC volt W,T,X,M	
	K21-0723-04	Pointer knob BAND		RL1	S51-2407-05	Relay	
	K23-0738-04	Knob 1 METER, AGC			T07-0215-05	Speaker	☆
	K23-0745-04	Knob VOX, NB, CAR	☆		T40-0022-05	Motor FAN	
	K27-0414-04	Push knob			X43-1370-02	Rectifier unit	☆
	K29-0713-04	Push knob +0.5 SHIFT			X44-1360-01	RF unit	☆
	K29-0715-04	Pointer knob MODE			X48-1310-00	IF unit	☆
	K29-0737-04	Knob 5 PLATE			X49-1150-00	AF unit	☆
	K29-0738-04	Knob 6			X50-1680-01	PLL unit	☆
	K29-0744-04	Paddle knob STBY	☆		X54-1540-00	Counter unit	
L1	L40-6891-13	Choke coil 6.8μH			X56-1380-00	Final unit	
L2	L33-0635-05	Final choke			X60-1150-01	VFO ass'y unit	☆
L3	L34-1004-05	Final coil B 28 MHz					
L4	L34-0560-25	Final coil A					
L5	L33-0259-05	Choke coil 470μH					
T1	L01-8106-15	Power trans					
PS1,2	L39-0046-05	PS coil PLATE					
	N09-0256-05	Gnd screw					

## PARTS LIST

Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
<b>RECTIFIER UNIT (X43-1370-02)</b>							
C5,6	CE02W2C330	E 33 $\mu$ F 160V		C62	CC45RH1H150J	C 15pF	
	E23-0047-04	Square terminal		C63	CC45SL1H151J	C 150pF	
	J31-0502-04	PC board collar		C66,67	C91-0456-05	C 0.047 $\mu$ F	
	J42-0404-05	PC board bushing		C69	CC45SL2H151J	C 150pF 500V	
L1	L40-1511-03	Ferri-inductor 150 $\mu$ H		C78	C91-0456-05	C 0.047 $\mu$ F	
R1~4	RC05GF2H474J	Solid 470k $\Omega$ 1/2W		VC1~3	C01-0127-15	Variable capacitor	
R9	RC05GF2H334J	Solid 330k $\Omega$ 1/2W			D13-0404-04	Sprocket large	
R10	RC05GF2H183J	Solid 18k $\Omega$ 1/2W			D13-0405-04	Sprocket small	
R11	RS14AB3A471J	Metal film 470 $\Omega$ 1W			D16-0403-04	Chain ass'y	
R14	RC05GF2H102J	Solid 1k $\Omega$ 1/2W			E04-0154-05	Coax connector	
R15	RC05GF2H563J	Solid 56k $\Omega$ 1/2W			E10-1902-05	9P tube socket	
R16	RC05GF2H563J	Solid 56k $\Omega$ 1/2W			E23-0047-04	Square terminal	
	R92-0150-05	Short jumper			E40-0273-05	Mini connect wafer 2P	
<b>RF UNIT (X44-1360-01)</b>					E40-0373-05	Mini connect wafer 3P	
C1	CQ92M1H182K	ML 0.0018 $\mu$ F			E40-0374-05	Mini connect wafer 3P L type	
C4	CQ92M1H152K	ML 0.0015 $\mu$ F			E40-0474-05	Mini connect wafer 4P L type	
C6	CC45RH1H101J	C 100pF			E40-0973-05	Mini connect wafer 9P	
C7	CQ09S1H122J	S 0.0012 $\mu$ F			F11-0249-05	Tube shield	
C8	CC45RH1H221J	C 220pF			J31-0502-04	PC board collar	
C9	CC45RH1H330J	C 33pF			J42-0404-05	PC board bushing	
C10	CC45RH1H121J	C 120pF		L1	L40-2792-02	Ferri-inductor 2.7 $\mu$ H	
C11	CC45RH1H560J	C 56pF		L2	L40-4791-02	Ferri-inductor 4.7 $\mu$ H	
C12	CC45RH1H330J	C 33pF		L3	L34-0559-05	Trap coil	
C13	CC45RH1H101J	C 100pF		L4	L34-0558-05	Trap coil	
C14,15	CC45RH1H330J	C 33pF		L5	L34-0930-05	Tuning coil 3.5 MHz	
C16	CC45SL1H561J	C 560pF		L6	L34-0931-05	Tuning coil 7 MHz	
C17	CC45RH1H221J	C 220pF		L7	L34-0932-05	Tuning coil 10 MHz	
C19	CC45RH1H150J	C 15pF		L8	L34-0933-05	Tuning coil 14 MHz	
C20	CC45RH1H330J	C 33pF		L9	L34-0934-05	Tuning coil 18 MHz	
C21	CC45RH1H121J	C 120pF		L10	L34-0990-05	Tuning coil 21 MHz	
C22	CC45RH1H560J	C 56pF		L11	L34-0935-05	Tuning coil 24.5 MHz	
C23	CC45RH1H330J	C 33pF		L12	L34-0995-05	Tuning coil 28 MHz	
C24	CC45RH1H101J	C 100pF		L13	L34-0936-05	Tuning coil MIX 1.5 MHz	
C25	CC45RH1H330J	C 33pF		L14	L34-0930-05	Tuning coil 3.5 MHz	
C26	C91-0456-05	C 0.047 $\mu$ F		L15	L34-0931-05	Tuning coil 7 MHz	
C28	CC45SL1H561J	C 560pF		L16	L34-0932-05	Tuning coil 10 MHz	
C30	CC45RH2H330J	C 33pF 500V		L17	L34-0933-05	Tuning coil 14 MHz	
C31	CC45RH2H121J	C 120pF 500V		L18	L34-0934-05	Tuning coil 18 MHz	
C32	CC45RH2H181J	C 180pF 500V		L19	L34-0990-05	Tuning coil 21 MHz	
C33	CC45RH2H470J	C 47pF 500V		L20	L34-0935-05	Tuning coil 24.5 MHz	
C34	CC45RH2H270J	C 27pF 500V		L21	L34-0995-05	Tuning coil 28 MHz	
C35	CC45RH2H101J	C 100pF 500V		L23	L34-0552-15	Tuning coil 1.5 MHz	
C36	CC45RH2H390J	C 39pF 500V		L24	L34-0553-15	Tuning coil 3.5 MHz	
C37	CC45RH2H180J	C 18pF 500V		L25	L34-0554-05	Tuning coil 7 MHz	
C38	CC45SL2H100D	C 10pF $\pm$ 0.5pF 500V		L26	L34-0937-05	Tuning coil 10 MHz	
C40	CC45SL2H561JTD	C 560pF 500V		L27	L34-0555-05	Tuning coil 14 MHz	
C41	CC45RH1H150J	C 15pF		L28	L34-0938-05	Tuning coil 18 MHz	
C42	CC45SL1H101J	C 100pF		L29	L34-0556-05	Tuning coil 21 MHz	
C45,46	C91-0456-05	C 0.047 $\mu$ F		L30	L34-0939-05	Tuning coil 24.5 MHz	
C49	CC45SL1H050C	C 5pF $\pm$ 0.25pF		L31	L34-0557-05	Tuning coil 28 MHz	
C50	CC45SL1H220J	C 22pF		L32~34	L40-4711-03	Ferri-inductor 470 $\mu$ H	
C55,57,58	C91-0456-05	C 0.047 $\mu$ F		L35	L40-1511-03	Ferri-inductor 150 $\mu$ H	
C61	CC45SL1H470J	C 47pF		L36	L40-4711-03	Ferri-inductor 470 $\mu$ H	
				L37	L40-1511-03	Ferri-inductor 150 $\mu$ H	
				L39	L33-0074-05	Heater choke 0.3 $\mu$ H	
				L40	L40-4782-02	Ferri-inductor 0.47 $\mu$ H	
				L41	L34-2004-05	Tuning coil ANT 1.5 MHz	
				L42	L40-4711-03	Ferri-inductor 470 $\mu$ H	
				L43	L40-1511-03	Ferri-inductor 150 $\mu$ H	

## PARTS LIST

Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
L44	L40-2282-01	Ferri-inductor 0.22μH		C76	CC45UJ1H100D	C 10pF ±0.5pF	
L45,46	L40-1511-03	Ferri-inductor 150μH		C77	CC45SL1H101J	C 100pF	
T1	L19-0303-05	Wide bandwidth trans		C78	C91-0457-05	C 0.022μF	
T2	L30-0509-05	IFT		C79	CC45CH1H050C	C 5pF ±0.25pF	
T3	L19-0303-05	Wide bandwidth trans		C80	CE04W1C220M	E 22μF 16V	
T4	L30-0509-05	IFT		C84	CE04W1H010M	E 1μF 50V	
R34	RC05GF2H104J	Solid 100kΩ 1/2W		C85	C91-0456-05	C 0.047μF	
R35	RC05GF2H151J	Solid 150Ω 1/2W		C86~89	CE04W2V220	E 22μF 350V	
R36	RC05GF2H104J	Solid 100kΩ 1/2W		C91,92	CC45SL1H470J	C 47pF	
R37	RS14AB3A332J	Metal film 3.3kΩ 1W		C93,94	CE04W1C100M	E 10μF 16V	
R38	RC05GF2H474J	Solid 470kΩ 1/2W		TC1,2	C05-0030-15	Ceramic trimmer 20pF	
VR2	R12-6404-05	Trim. pot 470kΩ			E23-0401-05	Round terminal	
	R92-0150-05	Short jumper			E40-0273-05	Mini connect wafer 2P	
	S29-7401-05	Rotary wafer ass'y			E40-0373-05	Mini connect wafer 3P	
IF UNIT (X48-1310-00)					E40-0473-05	Mini connect wafer 4P	
C2	C91-0457-05	C 0.022μF			E40-0573-05	Mini connect wafer 5P	
C5,6	CC45SL1H470J	C 47pF			E40-0773-05	Mini connect wafer 7P	
C7	CE04W1C100M	E 10μF 16V		J31-0502-04	PC board collar		
C9~15	C91-0457-05	C 0.022μF		J42-0404-05	PC board bushing		
C18	C91-0456-05	C 0.047μF		L1	L40-1511-03	Ferri-inductor 150μH	
C19	C91-0457-05	C 0.022μF		L2	L34-0940-05	Tuning coil	
C20	CC45SL1H100D	C 10pF ±0.5pF		L3,4	L40-1511-03	Ferri-inductor 150μH	
C23	C91-0457-05	C 0.022μF		L5	L34-0942-05	Tuning coil	
C24	CC45SL1H100D	C 10pF ±0.5pF		L6	L34-0997-05	Tuning coil	
C25	C91-0457-05	C 0.022μF		L7,8	L34-0535-05	Tuning coil	
C26	C91-0456-05	C 0.047μF		L9	L40-1511-03	Ferri-inductor 150μH	
C27	CC45SL1H470J	C 47pF		L10	L34-0536-05	Tuning coil	
C28	C91-0456-05	C 0.047μF		L11,12	L40-1511-03	Ferri-inductor 150μH	
C29	C91-0457-05	C 0.022μF		L13	L34-0567-05	Tuning coil BM	
C30	C91-0456-05	C 0.047μF		L14	L40-4711-03	Ferri-inductor 470μH	
C31	CC45SL1H100D	C 10pF ±0.5pF		L15	L40-1511-03	Ferri-inductor 150μH	
C32	CC45UJ1H070D	C 7pF ±0.5pF		CF1	L72-0324-05	Ceramic filter 8.83 MHz NB	☆
C35	CQ92M1H333K	ML 0.033μF		XF1	L71-0208-05	MCF YK-88S	
C36	C91-0456-05	C 0.047μF		R111	RS14GB3D471J	Metal film 470Ω 2W	
C37	CC45SL1H470J	C 47pF		VR1	R12-3045-05	Trim. pot 10kΩ	
C38	C91-0457-05	C 0.022μF		VR2	R12-6401-05	Trim. pot 470kΩ	
C40	C91-0456-05	C 0.047μF		VR3	R12-5030-05	Trim. pot 100kΩ	
C44,47	CC45SL1H470J	C 47pF		VR4	R12-0401-05	Trim. pot 100Ω	
C49,50	CC45SL1H101J	C 100pF		VR5	R12-3045-05	Trim. pot 10kΩ	
C51	CE04W1H010M	E 1μF 50V			R92-0150-05	Short jumper	
C52	CE04W1C100M	E 10μF 16V		RL1	S51-4401-05	Relay LZN-4	
C53	CQ92M1H153K	ML 0.015μF		AF UNIT (X49-1150-00)			
C54,56~58	CE04W1H010M	E 1μF 50V		C1,2	CQ92M1H123K	ML 0.012μF	
C59	CE04W1H3R3M	E 3.3μF 50V		C3	CQ92M1H223K	ML 0.022μF	
C60,61,63	CE04W1H010M	E 1μF 50V		C4,5	CQ92M1H123K	ML 0.012μF	
C64	CE04W1H4R7M	E 4.7μF 50V		C6	CE04W1C100M	E 10μF 16V	
C65	CE04W1C100M	E 10μF 16V		C7	CE04W1H010M	E 1μF 50V	
C66	CE04W1H4R7M	E 4.7μF 50V		C8	CE04W1HR10M	E 0.1μF 50V	
C67	CE04W1A221M	E 220μF 10V		C9	CE04W1C100M	E 10μF 16V	
C68	CQ92M1H473K	ML 0.047μF		C10	CQ92M1H103K	ML 0.01μF	
C69	CE04W1A470M	E 47μF 10V		C11	CE04W1A101M	E 100μF 10V	
C70	CE04W1C100M	E 10μF 16V		C12	CE04W1HR47M	E 0.47μF 50V	
C71	CE04W1H010M	E 1μF 50V					
C72	CE04W1H3R3M	E 3.3μF 50V					
C73	CE04W1H010M	E 1μF 50V					
C74	C91-0457-05	C 0.022μF					
C75	CE04W1A221M	E 220μF 10V					



## PARTS LIST

Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
C13	CE04W1C100M	E 10 $\mu$ F 16V		C10	CE04W1A470M	E 47 $\mu$ F 10V	
C14	CE04W1H010M	E 1 $\mu$ F 50V		C11	CC45TH1H390J	C 39pF	
C15	CE04W1C3R3M	E 3.3 $\mu$ F 16V		C12	CC45TH1H220J	C 22pF	
C16	CQ92M1H472K	ML 0.0047 $\mu$ F		C13	CC45TH1H270J	C 27pF	
C17	CQ92M1H473K	ML 0.047 $\mu$ F		C14	CE04W1A470M	E 47 $\mu$ F 10V	
C19	CE04W1H3R3M	E 3.3 $\mu$ F 50V		C15	CC45SH1H680J	C 68pF	
C20	CE04W1H010M	E 1 $\mu$ F 50V		C16	CC45RH1H221J	C 220pF	
C21	C91-0456-05	C 0.047 $\mu$ F 25V		C18	CC45TH1H180J	C 18pF	
C22	CQ92M1H223K	ML 0.022 $\mu$ F		C19	CC45TH1H150J	C 15pF	
C24	CE04W1C471M	E 470 $\mu$ F 16V		C21	CE04W1A470M	E 47 $\mu$ F 10V	
C26	CE04W1C100M	E 10 $\mu$ F 16V		C22	CC45UJ1H270J	C 27pF	
C27	CE04W1C470M	E 47 $\mu$ F 16V		C23	CC45TH1H101J	C 100pF	
C29	C90-0834-05	Cap. 0.15 $\mu$ F 25V	☆	C24,25	CC45UJ1H120J	C 12pF	
C30	CE04W1C221M	E 220 $\mu$ F 16V		C27	CE04W1A470M	E 47 $\mu$ F 10V	
C32	CE04W1A101M	E 100 $\mu$ F 10V		C28	CC45UJ1H820J	C 82pF	
C33	CE04W1H010M	E 1 $\mu$ F 50V		C29	CC45UJ1H150J	C 15pF	
C34,35	CE04W1A470M	E 47 $\mu$ F 10V		C30	CE04W1A470M	E 47 $\mu$ F 10V	
C37	CE04W1H3R3M	E 3.3 $\mu$ F 50V		C31	CC45TH1H270J	C 27pF	
C43	CC45SL1H100D	C 10pF $\pm 0.25$ pF		C32	CC45UJ1H050C	C 5pF $\pm 0.25$ pF	
C45,52	CE04W1H010M	E 1 $\mu$ F 50V		C33	CC45UJ1H220J	C 22pF	
C55	CE04W1C470M	E 47 $\mu$ F 16V		C34	CE04W1A470M	E 47 $\mu$ F 10V	
C57	CE04W1C102M	E 0.001 $\mu$ F 16V		C35	CC45UJ1H070D	C 7pF $\pm 0.5$ pF	
C58	CE04W1H3R3M	E 3.3 $\mu$ F 50V		C36	CC45UJ1H220J	C 22pF	
C60,61	C90-0807-05	E 2200 $\mu$ F 25V		C38	CE04W1A470M	E 47 $\mu$ F 10V	
C64,65	CQ93M2A473K	ML 0.047 $\mu$ F 100V		C40	CC45UJ1J150J	C 15pF	
C68	CE04W1C100M	E 10 $\mu$ F 16V		C41	CC45UJ1H090D	C 9pF $\pm 0.5$ pF	
C69	CE04W1HR47M	E 0.47 $\mu$ F 50V		C42	CC45TH1H150J	C 15pF	
C73	CQ93M2A224M	ML 0.22 $\mu$ F 100V		C43	CE04W1A470M	E 47 $\mu$ F 10V	
	E23-0047-04	Square terminal		C44	CC45UJ1H100D	C 10pF $\pm 0.5$ pF	
	E40-0273-05	Mini connect wafer 2P		C45	CC45UJ1H270J	C 27pF	
	E40-0373-05	Mini connect wafer 3P		C47	CC45TH1H150J	C 15pF	
	E40-0473-05	Mini connect wafer 4P		C48	CC45TH1H050C	C 5pF $\pm 0.25$ pF	
	E40-0573-05	Mini connect wafer 5P		C51,53	C91-0456-05	C 0.047 $\mu$ F	
	E40-0673-05	Mini connect wafer 6P		C54,55	CC45SL1H121J	C 120pF	
	E40-0773-05	Mini connect wafer 7P		C56	CC45SL1H181J	C 180pF	
	F20-0516-05	Insulating sheet		C57	CC45CH1H010C	C 1pF $\pm 0.25$ pF	
	F29-0014-05	Shoulder washer		C58	CC45SL1H050C	C 5pF $\pm 0.25$ pF	
	J31-0502-04	PC board collar		C67	CC45SL1H330J	C 33pF	
	J42-0404-05	PC board bushing		C68,69	CC45SL1H680J	C 68pF	
				C70	CC45SL1H330J	C 33pF	
				C71,72	CC45SL1H221J	C 220pF	
				C74,76	C91-0456-05	C 0.047 $\mu$ F	
L1	L40-3392-02	Ferri-inductor 3.3 $\mu$ H		C80	CE04W1H010M	E 1 $\mu$ F 50V	
L2~4	L40-1511-03	Ferri-inductor 150 $\mu$ H		C82	C91-0456-05	C 0.047 $\mu$ F	
T1	L34-0535-05	Tuning coil red NB		C87	CQ92M1H102K	ML 0.001 $\mu$ F	
T2	L34-0536-05	Tuning coil blue NB		C88	CQ92M1H104K	ML 0.1 $\mu$ F	
				C89	C91-0456-05	C 0.047 $\mu$ F	
VR1	R12-3411-05	Trim. pot 47k $\Omega$		C90,91	CE04W1A101M	E 100 $\mu$ F 10V	
VR2	R12-0413-05	Trim. pot 470 $\Omega$		C92	CE04W1A470M	E 47 $\mu$ F 10V	
VR3	R12-3411-05	Trim. pot 47k $\Omega$		C94	CE04W1A101M	E 100 $\mu$ F 10V	
	R92-0150-05	Short jumper		C95	CC45SL1H390J	C 39pF	
				C97	CC45SL1H331J	C 330pF	
				C98	CC45SL1H470J	C 47pF	
				C99	CC45SL1H150J	C 15pF	
				C100	CC45SL1H470J	C 47pF	
				C101	CC45SL1H270J	C 27pF	
				C102	CC45SL1H560J	C 56pF	
				C103	CC45SL1H270J	C 27pF	
				C104	CC45SL1H470J	C 47pF	
				C105	C91-0456-05	C 0.047 $\mu$ F	
				C106	CC45SL1H470J	C 47pF	
				C107	CC45SL1H070D	C 7pF $\pm 0.5$ pF	
				C109	C91-0456-05	C 0.047 $\mu$ F	
				C111	CC45SL1H101J	C 100pF	
				C112	CC45SL1H221J	C 220pF	
<b>PLL UNIT (X50-1680-01)</b>							
C1	CE04W1A470M	E 47 $\mu$ F 10V					
C2	CC45TH1H270J	C 27pF					
C3	CC45TH1H180J	C 18pF					
C4	CC45TH1H270J	C 27pF					
C5	CE04W1A470M	E 47 $\mu$ F 10V					
C6	CC45UJ1H101J	C 100pF					
C7	CC45UJ1H150J	C 15pF					

## PARTS LIST

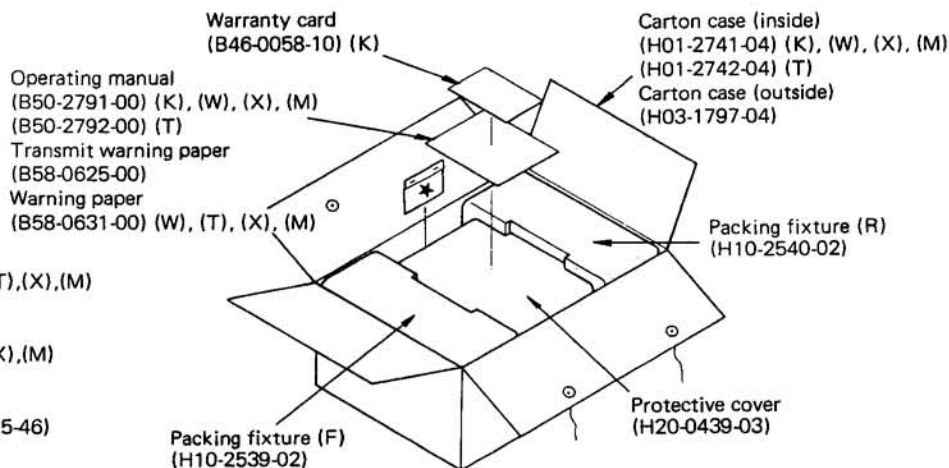
Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
C113	CC45SL1H101J	C 100pF		L31	L40-2211-03	Ferri-inductor 220μH	
C115	CC45RH1H100D	C 10pF ±0.5pF		L32	L33-0636-05	Choke coil 20μH	
C116	CC45TH1H050C	C 5pF ±0.25pF		L33~36	L40-1511-03	Ferri-inductor 150μH	
C117	CC45CH1H010C	C 1pF ±0.25pF		L37	L40-4711-03	Ferri-inductor 470μH	
C118	CC45RH1H560J	C 56pF		L38,39	L40-1511-03	Ferri-inductor 150μH	
C120	CC45CH1H020C	C 2pF ±0.25pF		L40	L40-4711-03	Ferri-inductor 470μH	
C121	CC45SL1H470J	C 47pF		L41,42	L40-4701-03	Ferri-inductor 47μH	
C123	CC45RH1H390J	C 39pF		L43,44	L40-2211-03	Ferri-inductor 220μH	
C125	CC45TH1H330J	C 33pF		L45~50	L40-1511-03	Ferri-inductor 150μH	
C126	CC45TH1H150J	C 15pF					
C127	CC45TH1H330J	C 33pF		T1	L32-0195-05	OSC coil 7, 10 MHz	
C130	CC45UJ1H150J	C 15pF		T2	L32-0193-05	OSC coil 1.5, 3.5 MHz	
C131	CC45UJ1H050C	C 5pF ±0.25pF		T3	L32-0196-05	OSC coil 14 MHz	
C132	CC45UJ1H150J	C 15pF		T4	L32-0199-05	OSC coil 18 MHz	
C139	CC45SL1H100D	C 10pF ±0.5pF		T5	L32-0198-05	OSC coil 28 MHz	
C140	CC45RH1H220J	C 22pF		T6	L32-0197-05	OSC coil 21, 24.5 MHz	
C142	CC45RH1H470J	C 47pF		T7	L34-0714-05	Tuning coil	
C143	CC45RH1H220J	C 22pF		T8	L34-0715-05	Tuning coil	
C144	CC45RH1H470J	C 47pF		T9	L34-0716-05	Tuning coil	
C159	CC45SL1H330J	C 33pF		T10	L34-0717-05	Tuning coil	
C160	CC45SL1H100D	C 10pF ±0.5pF		T11	L34-0718-05	Tuning coil	
C162	CC45CH1H010C	C 1pF ±0.25pF		T12	L34-0757-05	Tuning coil	
C163	CC45SL1H150J	C 15pF		T13	L34-0711-05	Tuning coil	
C166	CC45SL1H100D	C 10pF ±0.5pF		T14	L34-0713-15	Tuning coil	
C167	CC45CH1H020C	C 2pF ±0.25pF		T15	L34-0712-05	Tuning coil	
C169	CC45SL1H101J	C 100pF		T16	L32-0201-05	OSC coil 8.83 MHz	
C172	C91-0456-05	C 0.047μF		T17	L34-0709-05	Tuning coil 10 MHz	
C173	CC45RH1H040C	C 4pF ±0.25pF		T18	L34-0710-05	Tuning coil 20 MHz	
C174	CC45RH1H470J	C 47pF		X1	L77-0482-05	Crystal 10 MHz	
C178,179	CC45RH1H220J	C 22pF		X2	L77-0486-05	Crystal 8.8285 MHz	
C182,183	C91-0456-05	C 0.047μF		X3	L77-0485-05	Crystal 8.8315 MHz	
C184	CC45CH1H270J	C 27pF					
C185	CC45CH1H390J	C 39pF		VR1	R12-5030-05	Trim. pot 100kΩ	
C186	CC45CH1H101J	C 100pF		VR2,3	R12-1040-05	Trim. pot 4.7kΩ	
C187	CC45SL1H221J	C 220pF					
C188	CC45SL1H220J	C 22pF					
C189	CC45SL1H050C	C 5pF ±0.25pF			R92-0150-05	Short jumper	
C194	CE04W1A470M	E 47μF 10V		<b>COUNTER UNIT (X54-1540-00)</b>			
C196	CC45SL1H100D	C 10pF ±0.5pF		C2	C91-0456-05	C 0.047μF	
C197~202	C91-0456-05	C 0.047μF		C3	C91-0457-05	C 0.022μF	
C205	CE04W1HR47M	E 0.47μF 50V		C4	CC45SL1H150J	C 15pF	
TC1	C05-0029-15	Ceramic trimmer 50pF		C6	CE04W1A470Q	E 47μF 10V	
TC2,3	C05-0056-05	Ceramic trimmer 30pF		C7	CE04W1A101Q	E 100μF 10V	
	E04-0154-05	Coax connector		C8,9	C91-0456-05	C 0.047μF	
	E23-0046-04	Square terminal		C11	CE04W1C101M	E 100μF 16V	
	E40-0273-05	Mini connect wafer 2P		C12	CE04W1V100Q	E 10μF 35V	
	E40-0373-05	Mini connect wafer 3P		C13	CQ92M1H103K	ML 0.01μF 50V	
	E40-0473-05	Mini connect wafer 4P		C14~16	CE04W1V100Q	E 10μF 35V	
	E40-0673-05	Mini connect wafer 6P		C17,18	C91-0456-05	C 0.047μF	
	E40-0973-05	Mini connect wafer 9P		C19	CQ92M1H103K	ML 0.01μF 50V	
	E40-1073-05	Mini connect wafer 10P		C21,22	CC45SL1H050C	C 5pF ±0.25pF	
L1~7	L40-1511-03	Ferri-inductor 150μH		C23	CE04W1A330Q	E 33μF 10V	
L8	L40-4701-03	Ferri-inductor 47μH		C24~26	C91-0456-05	C 0.047μF	
L9	L40-1592-02	Ferri-inductor 1.5μH		C28	CE04W1H100M	E 10μF 50V	
L10	L40-1092-02	Ferri-inductor 1μH					
L11	L40-1292-02	Ferri-inductor 1.2μH		J31-0502-04		PC board collar	
L12	L40-1892-02	Ferri-inductor 1.8μH		J42-0404-05		PC board bushing	
L13,14	L40-4711-03	Ferri-inductor 470μH		L1	L40-4711-03	Ferri-inductor 470μH	
L15,16	L40-8201-03	Ferri-inductor 82μH		L2	L40-1011-04	Ferri-inductor 100μH	
L17	L40-1511-03	Ferri-inductor 150μH		L3	L40-2211-03	Ferri-inductor 220μH	
L18~20	L40-2701-03	Ferri-inductor 27μH		L4	L40-1511-03	Ferri-inductor 150μH	
L21~24,27~30	L40-1511-03	Ferri-inductor 150μH					

## PARTS LIST/PACKING

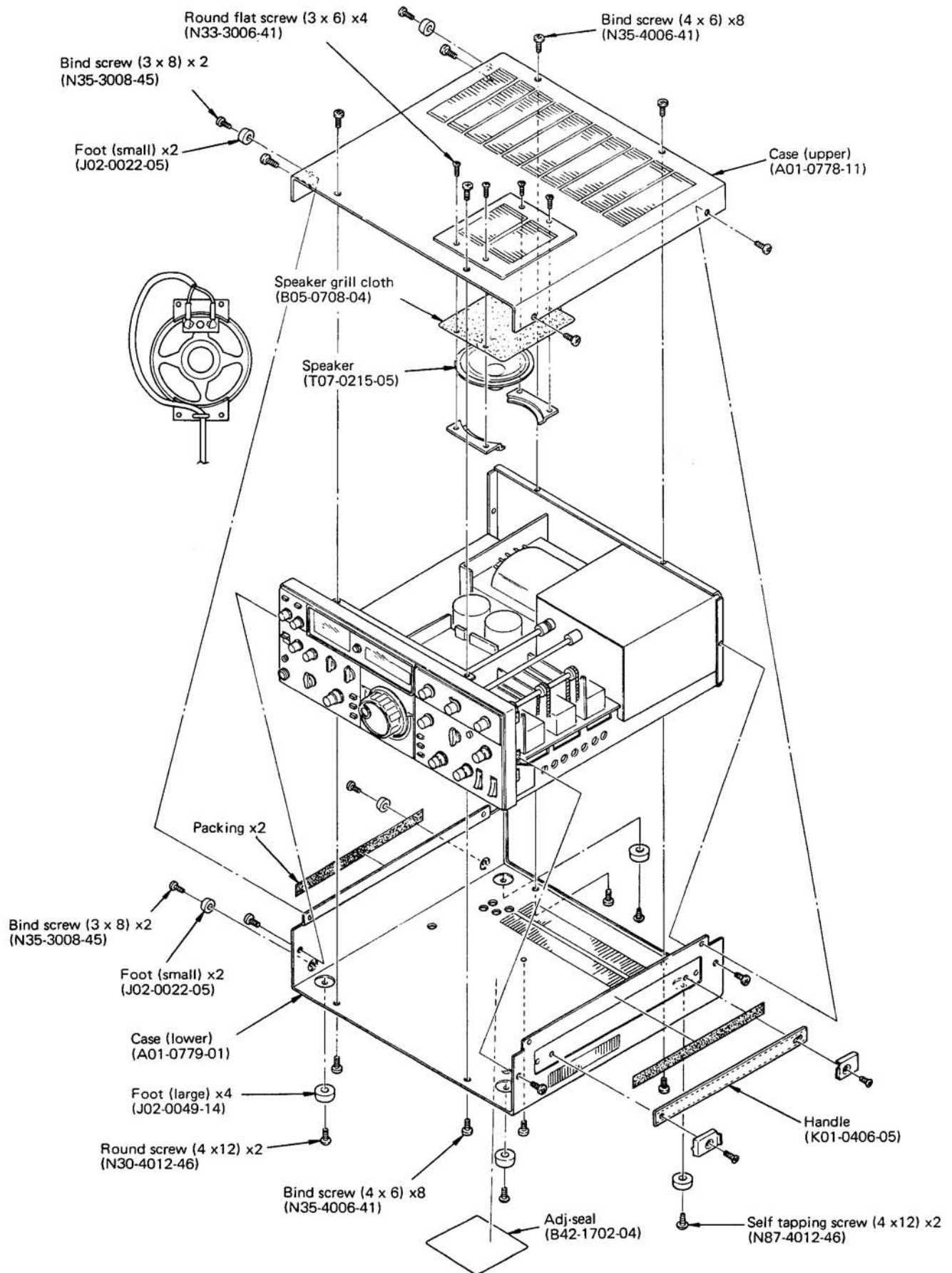
Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
T1	L19-0323-05	OSC trans	☆	<b>VFO UNIT (X40-1170-00)</b>			
R10	RC05GF2H221J	Solid 220Ω 1/2W		C2	C91-0456-05	C 0.047μF 25V	
RB1,2	R90-0521-05	Resistor block 47kΩ X7		C4	CC45CG1H050C	C 5pF ±0.25pF	
RB3,4	R90-0522-05	Resistor block 47kΩ X6		C6	C91-0456-05	C 0.047μF 25V	
	R92-0150-05	Short jumper		C7	CC45LG1H151J	C 150pF	
<b>FINAL UNIT (X56-1380-00)</b>				C9	CC45LG1H121J	C 120pF	
C1	CC45SL2H101J	C 100pF 500V		C12	CC45LG1H680J	C 68pF	
C36	CC45CH2H150J	C 15pF 500V D		C13	CC45CG1H220J	C 22pF	
	E01-0002-05	8P (octal) socket		C14	CC45PG1H100D	C 10pF ±0.5pF	
	E23-0046-04	Square terminal		C15,16	CC45LG1H151J	C 150pF	
L1	L40-1511-03	Ferr-inductor 150μH		C17	CC45CH1H020C	C 2pF ±0.25pF	
L2	L40-4711-03	Ferri-inductor 470μH		C18	C91-0456-05	C 0.047μF 25V	
PS1,2	L33-0010-05	Parastic suppressor GRID		C21	CC45SL1H390J	C 39pF	
R2~5	RC05GF2H200J	Solid 20Ω 1/2W		C22	CC45CH1H100D	C 10pF ±0.5pF	
R7	RC05GF2H101J	Solid 100Ω 1/2W		C23	CC45SL1H390J	C 39pF	
R8	RC05GF2H101J	Solid 100Ω 1/2W		C24	C91-0456-05	C 0.047μF 25V	
R29	R92-0615-05	Cement 6.2Ω 7W D		TC1	C05-0009-15	Ceramic trimmer 6pF	
<b>VFO ASS'Y UNIT (X60-1150-01)</b>				TC2	C05-0013-15	Ceramic trimmer 20pF	
	B07-0630-05	Dial escutcheon		VC1	C02-0019-05	Variable cap.	
	B10-0632-04	Escutcheon glass			D40-0614-05	Dial mechanism ass'y	
	B20-0816-04	Dial scale (B)			E40-0574-05	Mini connect wafer 5P	
	B20-0818-04	Dial scale (A)			F29-0014-05	Insulating washer	
	B30-0819-05	Pilot lamp		L1	L32-0628-05	OSC coil	
	B42-1645-04	Seal Bottom		L2	L33-0025-05	Choke coil 1μH	
	B42-1671-04	Seal Top		L3	L32-0629-05	OSC coil	
	G01-0804-04	Coil spring		L4	L32-0609-05	OSC coil	
	K21-0753-04	Main knob		L5	L40-1021-03	Ferri-inductor 1mH	
	X40-1170-00	VFO unit		L6	L40-4711-03	Ferri-inductor 470μH	
				L7	L40-1021-03	Ferri-inductor 1mH	
				L8	L40-1501-03	Ferri-inductor 15μH	
				L9~11	L40-4711-03	Ferri-inductor 470μH	
					R92-0150-05	Short jumper	

## PACKING

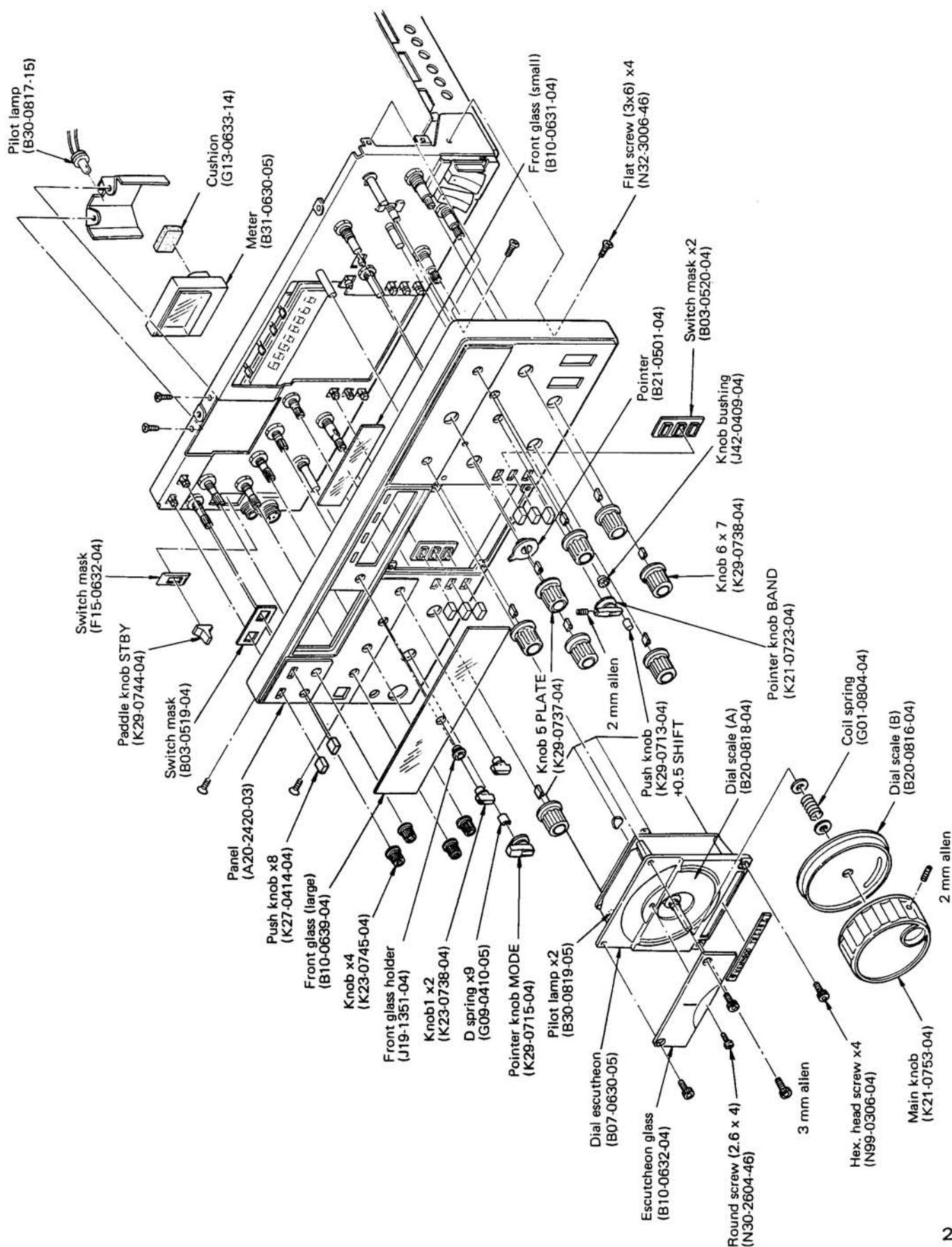
- ★ Protective bag (H25-0120-04)  
 4P MIC plug (E07-0403-05) (W),(T),(X),(M)  
 7P DIN plug (E07-0751-05)  
 Phone plug (E12-0001-05)  
 Fuse 4A (F05-4022-05) (W),(T),(X),(M)  
 Fuse 6A (F05-6021-05) (K),(M)  
 Foot (large) x2 (J02-0049-14)  
 Round crew (4 x25) x2 (N30-4025-46)



## DISASSEMBLY

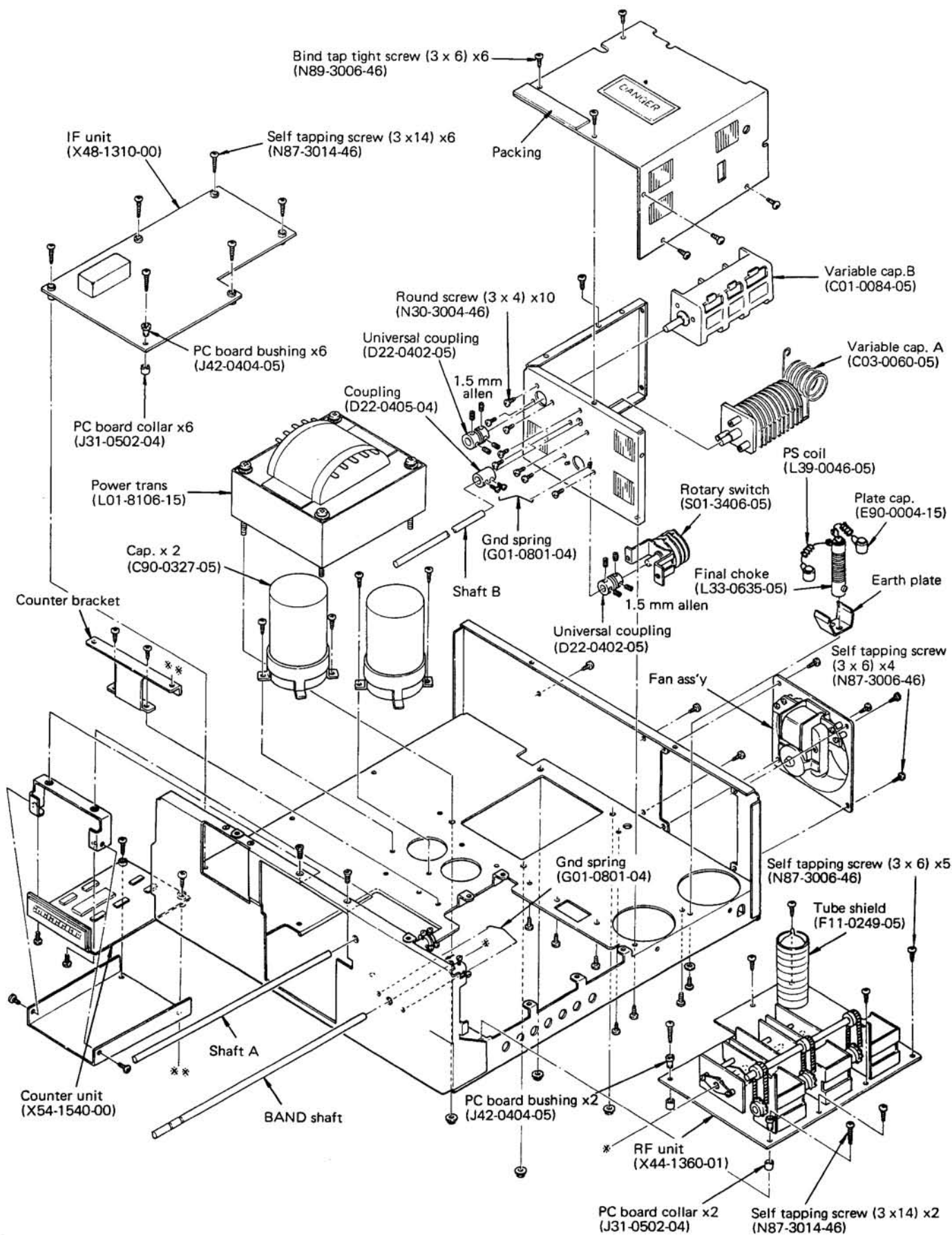


## DISASSEMBLY

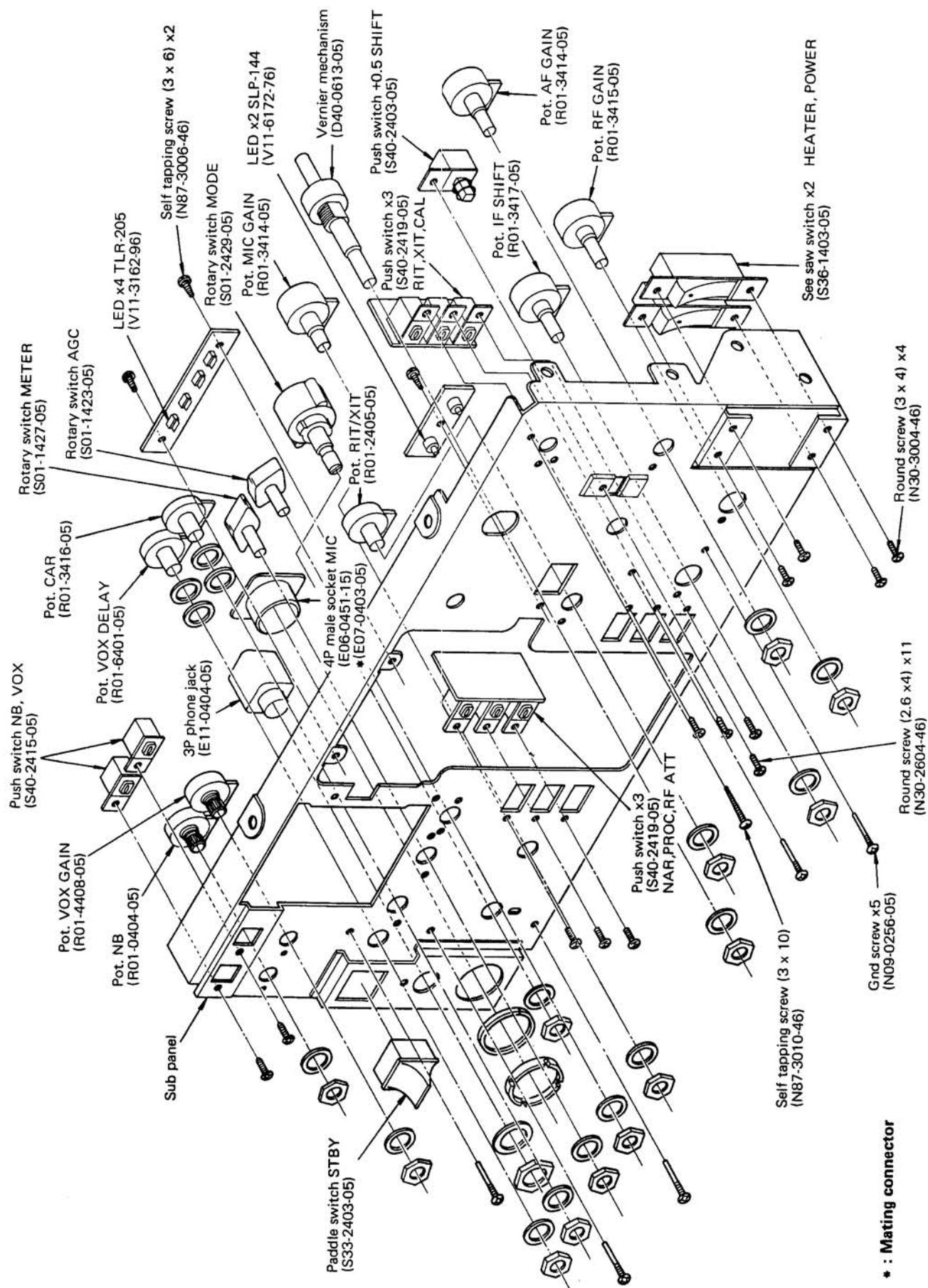




## DISASSEMBLY

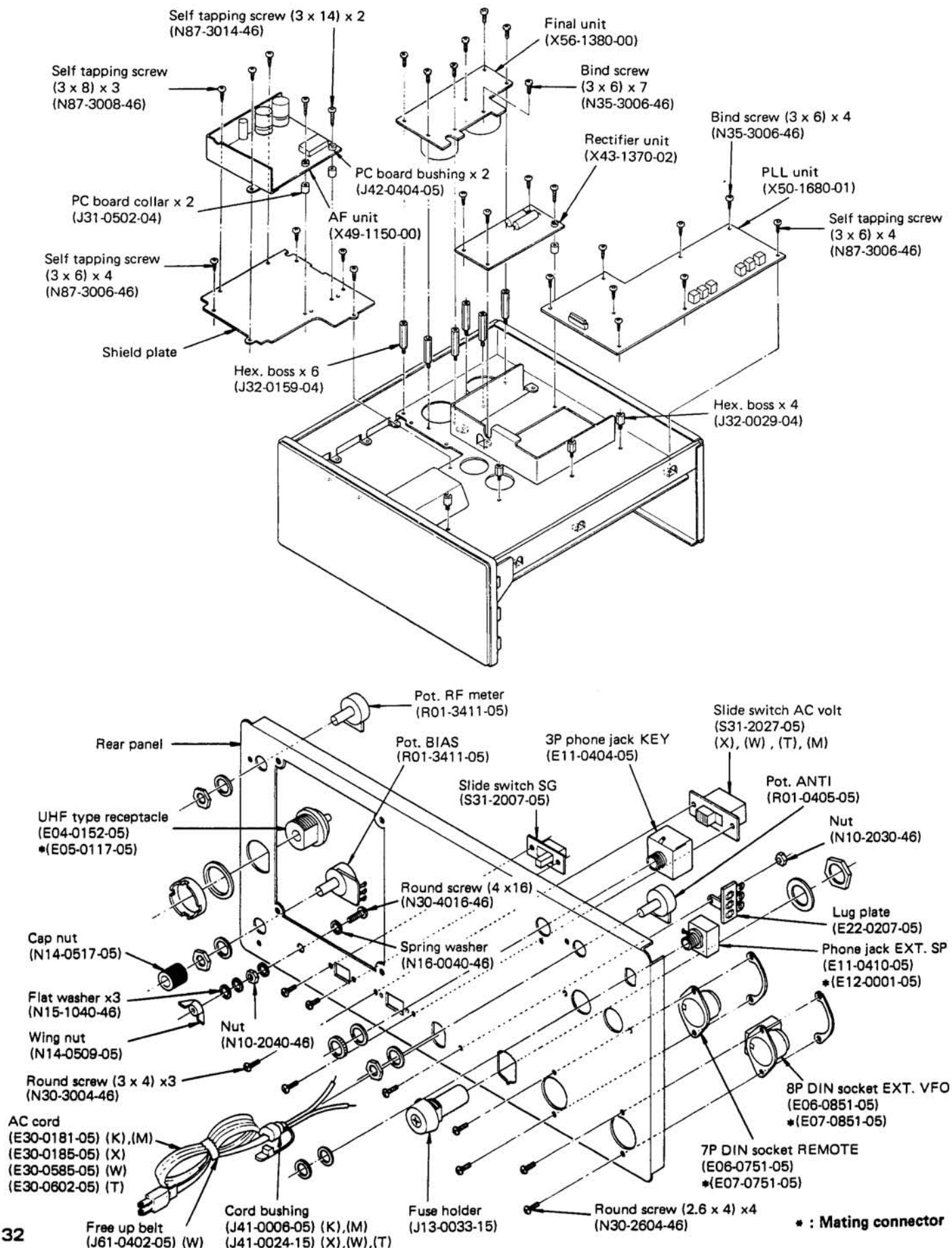


# DISASSEMBLY



\* : Mating connector

## DISASSEMBLY



## ADJUSTMENTS

### TEST EQUIPMENT REQUIRED

#### 1. VTVM or DVM

- 1) Input resistance: More than 1 M $\Omega$
- 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. RF VTVM

- 1) Input impedance: 1 M $\Omega$  and less than 3 pF.
- 2) Voltage range: 10 mV to 300V
- 3) Frequency range: 50 MHz or greater

#### 3. AF VTVM

- 1) Frequency range: 50 Hz to 10 kHz
- 2) Input impedance: 1 M $\Omega$  or greater
- 3) Voltage range: 10 mV to 30V

#### 4. AF GENERATOR (AG)

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

#### 5. AF DUMMY LOAD

- 1) Impedance: 8 $\Omega$
- 2) Dissipation: 3W or greater

#### 6. RF DUMMY LOAD

- 1) Impedance: 50 $\Omega$
- 2) Dissipation: 100W continuous or greater
- 3) Frequency limits: 1.8 to 30 MHz

#### 7. OSCILLOSCOPE

Requires high sensitivity and external synchronization capability.

#### 8. SWEEP GENERATOR

- 1) Center frequency: 8 to 40 MHz
- 2) Sweep bandwidth: Maximum  $\pm 16$  MHz
- 3) Output voltage: More than 0.1V

#### 9. STANDARD SIGNAL GENERATOR (SSG)

- 1) Frequency range: 1.8 to 30 MHz
- 2) Output: -20 dB/0.1  $\mu$ V~120 dB/1V
- 3) Output Z= 50 $\Omega$

Generator must be frequency stable.

#### 10. FREQUENCY COUNTER

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

#### 11. NOISE GENERATOR

Must generate ignition-like noise containing harmonics beyond 30 MHz.

#### 12. Spectrum analyzer

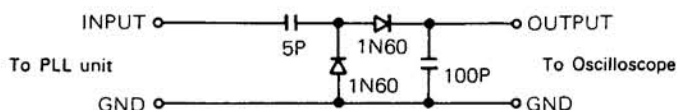
- 1) Frequency range: 100 kHz to 110 MHz
- 2) Bandwidth: 1 kHz to 3 MHz

#### NOTE:

R-1000 receiver may be used.

#### 13. Detector

For adjustment of PLL unit BPF.



#### 14. Directional coupler

#### 15. 8P DIN connector

Refer to Fig. 9 on page 43.

### PREPARATION

Unless otherwise specified, set the controls as follows.

#### Rear panel

SG SW OFF

#### Front panel



MODE	TUNE	MIC GAIN	MIN
CAR	MIN	RF GAIN	MAX
VOX	OFF	PROC	OFF
METER	IP	BAND	1.5
RIT/XIT	CENTERED	AGC	OFF
HEATER	OFF	VOX GAIN	MIN
NB	OFF	RIT	OFF
RF ATT	OFF	CAL	OFF
XIT	OFF	VOX DELAY	MIN
IF SHIFT	CENTERED	AF GAIN	MIN
		NB LEVEL	MIN

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
1. 9V AVR and 3.2V adjustment		DVM	AF	TP-6 Pin-5, connector ⑪	AF	VR2 VR3	9V 3.2V	9V±0.05V 3.2V±0.05V	RF1 (FET bias)
2. Base current adjustment	SG SW : ON MODE : USB METER : IP HEATER : ON DRIVE : Fully clockwise STBY : SEND BIAS pot. : Adjust	1P meter							
	STBY REC, SG SW OFF				Rear panel	Bias pot.		Set to 60mA	Set to 30mA (TS-530D)
3. Carrier adjustment①	IF SHIFT : Centered MODE : USB	RF VTVM	IF	Pin1, connector ⑧	PLL	NOTE : T16	0.3V	0.3V±1 dB	NOTE : The slug of T16 should be turned counter clockwise for this adjustment after the peak point is determined.
	MODE : LSB STBY : REC ↓ SEND	F. counter				VR2	Obtain the same frequency for both transmission and reception	±20 Hz	
	STBY : REC					TC2	8828.50 kHz		
	MODE : USB					TC3	8831.50 kHz		
	MODE : CW					VR3	8830.70 kHz		
	STBY : SEND								
4. IF SHIFT check	MODE : LSB Rotate the IF SHIFT and check the variation.	F. counter	IF	Pin 1, connector ⑧				Set IF SHIFT to center. More than + 1.1 kHz , Less than - 1.1 kHz.	
	MODE : USB Same as above								
	STBY : SEND Regardless of the IF SHIFT setting							8831.50 kHz	USB
	STBY : REC							8828.50 kHz	LSB
5. VFO, RIT check and adjustment	Scale 0~500							Should rotate smoothly and have no abnormal noise.	
	Rear panel SG SW OFF	RF VTVM	PLL	Pin 1, connector ⑧ 2P(GND)	Adjust if the voltage is out of specification.			200 mV±1 dB	
	VFO : 250				VFO	TC2	200mV		
	MODE : CW STBY : SEND	F. counter	Rear panel	EXT VFO 1P, 7P (GND)	Adjust if the frequency is out of specification.		800 Hz UP	800±50 Hz	CW SHIFT



## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	STBY : REC								
	Set the VFO dial to 50. At this time set the CAL control to the index.	F.counter	Rear panel	EXT VFO	VFO	L3		5550.00 kHz ±200 Hz	Repeat the adjustment several times until the frequency is within specification.
	Set the VFO dial to approx. 450. Set the CAL control dial calibrated under this VFO setting exactly to the index.			1P 7P (GND)		TC1		5950.00 kHz ±200 Hz	
	Tune to 5550.00 kHz with the main tuning knob.							The 50 kHz point on the dial scale must be aligned to the index.	
Dial calibration, electrical.	Tune to the CAL signal in order : 0, 100, 200, 300, 400, and 500 to check dial calibration at each 100 kHz point.				0 100 200 300 400 500	5.5 MHz 5.6 5.7 5.8 5.9 6.0		Within ±2.5 kHz	Check the dial scale (Electrically)
Backlash	Calibrate the dial at 0kHz. Tune to 250kHz, then reverse direction and tune back to 0kHz without rocking the dial, and stop.							Less than 400Hz Backlash	Backlash
Dial calibration mechanical	Repeat electrical dial scale check procedure (for mechanical spec).							Calibration should come in contact with the dial pointer.	Check the dial scale (mechanically).
	RIT : Centered				IF	VR5	5750.000 kHz		
	RIT SW : ON Set the VFO main control to 5750.000 kHz								
	Check that the same frequency is obtained when the RIT switch is turned ON and OFF.							Within ±50 Hz	
	RIT SW : ON VFO : 250 RIT control : fully counter-clockwise (⊖ position) RIT control : fully clockwise (⊕ position).							−1.5kHz or less +1.5kHz or more Reference to the center (⌀ position of the RIT control).	

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks										
		Test equipment	Unit	Terminal	Unit	Parts	Method												
	RIT OFF																		
6. Reference oscillator adjustment		F. counter	PLL	TP2	PLL	TC1	1000.000 kHz												
7. VCO adjustment and check	Check the frequencies at the following points and adjust coils until those given in brackets are obtained.	F. counter DVM	PLL PLL	D40 TP1															

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
9. BPF-B adjustment	Disconnect connectors ① and ⑤ on the PLL unit. Connect the cathode of D27 (1S1555) to the jumper wire next to R44 with a clip lead. Connect the cathode of D50 (1S1587) to the jumper wire next to TC1 with a clip lead. Connect the RF output of the sweep generator to R111(100Ω) via a 15pF capacitor.	Sweep generator Oscilloscope	PLL	Q35 ⑥	PLL	T7 T8 T9 T17	Adjust T7~T9 until the response shown at the right is obtained. Then adjust T17 for maximum amplitude.		
10. BPF-C adjustment	Disconnect connectors ① and ⑤ on the PLL unit. Connect the cathode of D26 (1S1555) to the jumper wire next to R44 with a clip lead. Connect the cathode of D50 (1S1587) to the jumper wire next to TC1 with a clip lead.					T10 T11 T12  T18	Adjust T10 through T12 until the band response shown at right is obtained. Then adjust T18 for maximum amplitude.		
11. Carrier balance adjustment	IF SHIFT : Centered RF GAIN : Fully counter-clockwise	RF VTVM	IF	Drain of Q4	IF	TC2	Minimum		Reference approx. 5 mV
12. IF AMP adjustment	BAND : 1.5 VFO : 400 DRIVE : 12 : 00 RF GAIN : fully clockwise IF SHIFT : Centered RF ATT : OFF MODE : USB AGC : OFF NB SW : OFF SG SW : OFF Connect the SSG output (1.9MHz, 40dB) to the antenna terminal. While adjusting, gradually decrease the SSG output level down to -6dB.	AF VTVM Oscilloscope	Rear panel	EXT. SP	RF	ANT coil 1.8	Max. audio output		
						RF coil 1.8			
					IF	T2 L2 L5 L6 L7 L8 L10			

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
13. Coil pack adjustment	Connect the SSG (40dB) to the ANT terminal  DRIVE : 12:00 While adjusting, gradually decrease the SSG output level down to -6 dB. Adjust at the following points:	AF VTVM Oscilloscope	Rear panel	EXT. SP	RF	ANT coil	Max. audio output		
						RF coil			
</									

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	BAND : 14 VFO : 175 STBY : SEND Adjust the CAR control until the ALC meter reads maximum.				IF RF	L13 T4	Max. ALC meter reading		
	STBY : REC Disconnect clip lead from connector ⑦.								
15. IF TRAP adjustment	BAND : Between 1.5 and AUX. Connect the SSG (8.83 MHz, 80dB) to the ANT terminal.	Oscilloscope AF VTVM	Rear panel	EXT. SP	RF	L3 L4	Adjust alternately for minimum		Preset the slugs of L3 and L4 fully clockwise.
16. VFO MIX spurious adjustment	BAND : 3.5 VFO : 388 MODE : LSB Connect the SSG output (3.888 MHz, 60dB) to the ANT terminal. 1) Adjust the SSG frequency to obtain zero beat. 2) Turn the VFO tuning to dial 384 to obtain a spurious beat.	Oscilloscope AF VTVM	Rear panel	EXT. SP	PLL	VR1	minimum beat output		The position of VR1 after adjustment should be approximately centered.
17. S meter adjustment	AGC : OFF				IF	VR1	Set to the deflection starting point.		
	BAND : 14 VFO : 175 AGC : FAST Connect the SSG (14.174 MHz, 8dB) to the ANT terminal.	Oscilloscope AF VTVM	Rear panel	EXT. SP			Adjust the DRIVE control for maximum AF output.		
	SSG output : 40dB				IF	L8	Turn the coil slug counterclockwise until S-1 is obtained.		
						VR2	Set to S-9		Repeat S-1,9 adjustment several times.
18. NB adjustment	NB LEVEL : fully counterclockwise BAND : 14 VFO : 175 Connect the SSG output (14.175 MHz 60dB) to the ANT terminal. SSG output : 20dB Adjust as described above.	DVM	AF	TP4	AF	T1 T2	Minimum		



## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
NB adjustment	AGC : FAST	Speaker	Rear panel	EXT. SP					
	Disconnect the SSG output from the ANT terminal, and connect the noise generator output in its place. Set the noise generator output level to S5~7.								
	NB : ON							The NB must provide adequate effect.	
					If adequate effect is not obtained, repeat the adjustment several times.				
	Reduce the noise generator output level to below the threshold of sensitivity. Turn the NB LEVEL control fully clockwise.							Noise must be blanked.	
	NB : OFF								
19. Neutralization trimmer adjustment	BAND : 28, +0.5 SHIFT : ON	Power meter Sync'ed scope	Rear panel	ANT					Tune-up for MAX RF output.
	VFO : 300 SG SW : ON STBY : SEND Tune the DRIVE, PLATE and LOAD								
	SG SW : OFF							RF output must be 0.	
	METER : ALC Set the ALC to maximum with the DRIVE control. Increase oscilloscope sensitivity.					Neutralization trimmer TC1	Minimum		
	Reduce oscilloscope sensitivity (5V/div.). SG SW : ON							The normal power must be obtained. The signal waveform must be normal.	
20. Side tone, semi-break-in function adjustment	Connect a power meter to the ANT terminal. Plug key into the rear Key jack to transmit in any band. Operate the key.	Oscilloscope AF VTVM	Rear panel	EXT. SP	AF	VR1	0.63V/8Ω		
								The key must control RF output.	
	STBY : REC VOX : ON Operate the key							Semi-break-in operation should be available.	

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
21. Transmission spurious adjustment	Connect pin2 and 4 of connector ⑦ on the AF unit with a clip lead. Set the BAND switch to 18, and VFO to 125. Connect a power meter to the ANT terminal. Set the STBY switch to SEND and tune up.	Spectrum analyzer (receive 17.66MHz with a monitor receiver.)	Rear panel	ANT	RF	VR2	Minimum (Monitor level)	Less than -40dB	
	STBY : REC Disconnect clip lead from connector ⑦								
22. RF meter adjustment	BAND : 14 VFO : 175 METER : RF Connect a power meter to the ANT terminal. Tune up. STBY : REC				Rear panel	RF Meter Pot.	Set the meter to read 250 on the IP scale.		
23. Carrier suppression adjustment	BAND : 14 VFO : 175 MODE : CW Connect power meter to ANT. STBY : SEND	Sync'ro scope	Rear panel	ANT					Tune-up for max RF output.
	MODE : USB				IF	VR4 TC1	Adjust alternately until minimum output is obtained.		
	MODE : LSB ↓ USB						Adjust until no level difference exists between LSB and USB.		
	MODE : CW Sync'ed scope level calibration						Note scope deflection level.		
	MODE : USB, LSB							Less than -50dB	Compared with CW.
	STBY : REC								
24. SSB frequency response adjustment	BAND : 14 VFO : 175 MODE : USB Connect the AG (1500 Hz, 7mV) to the MIC input connector. STBY : SEND Tune up. Set to 50W output with MIC GAIN control.	Power meter Sync'ed scope	Rear panel	ANT					

## ADJUSTMENTS

Item	Condition	Measurement			Adjustment			Specification	Remarks
		Test equipment	Unit	Terminal	Unit	Parts	Method		
	AG : 300Hz ↓ 2700Hz				PLL	TC3	Adjust until the same level is obtained for both 300Hz and 2700Hz (equal audio rolloff).		
	MODE : LSB same as above AG : 400Hz AG : 2600Hz					TC2			
								More than 1/2 with respect to the 1500Hz signal level observed on the scope.	
	After completing the above adjustment, readjust carrier suppression (see item 23.) STBY : REC				IF	VR4 TC1	Minimum	Less than -50dB	
25. Speech processor adjustment	SG SW : OFF MODE : USB PROC : OFF METER : ALC Connect the AG (1500 Hz, 10mV) to the MIC input connector. STBY : SEND Adjust the MIC gain control until the meter indicates the maximum on-scale ALC reading.								
	PROC : ON				IF	VR3	Adjust until the same meter reading is obtained (max on-scale ALC).		
	STBY : REC PROC : OFF								

## ADJUSTMENTS

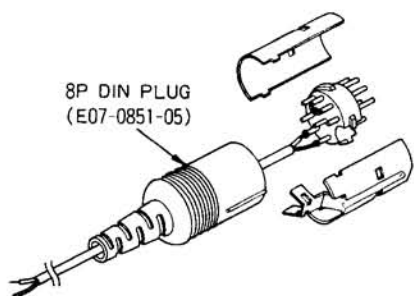


Fig. 9 8P DIN connector

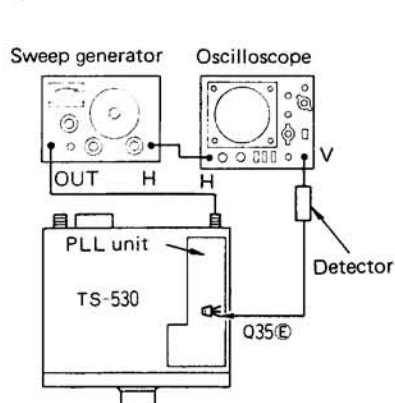


Fig. 10 (8) BPF-A, (9) BPF-B, (10) BPF-C

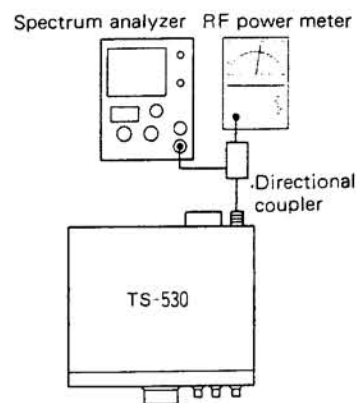
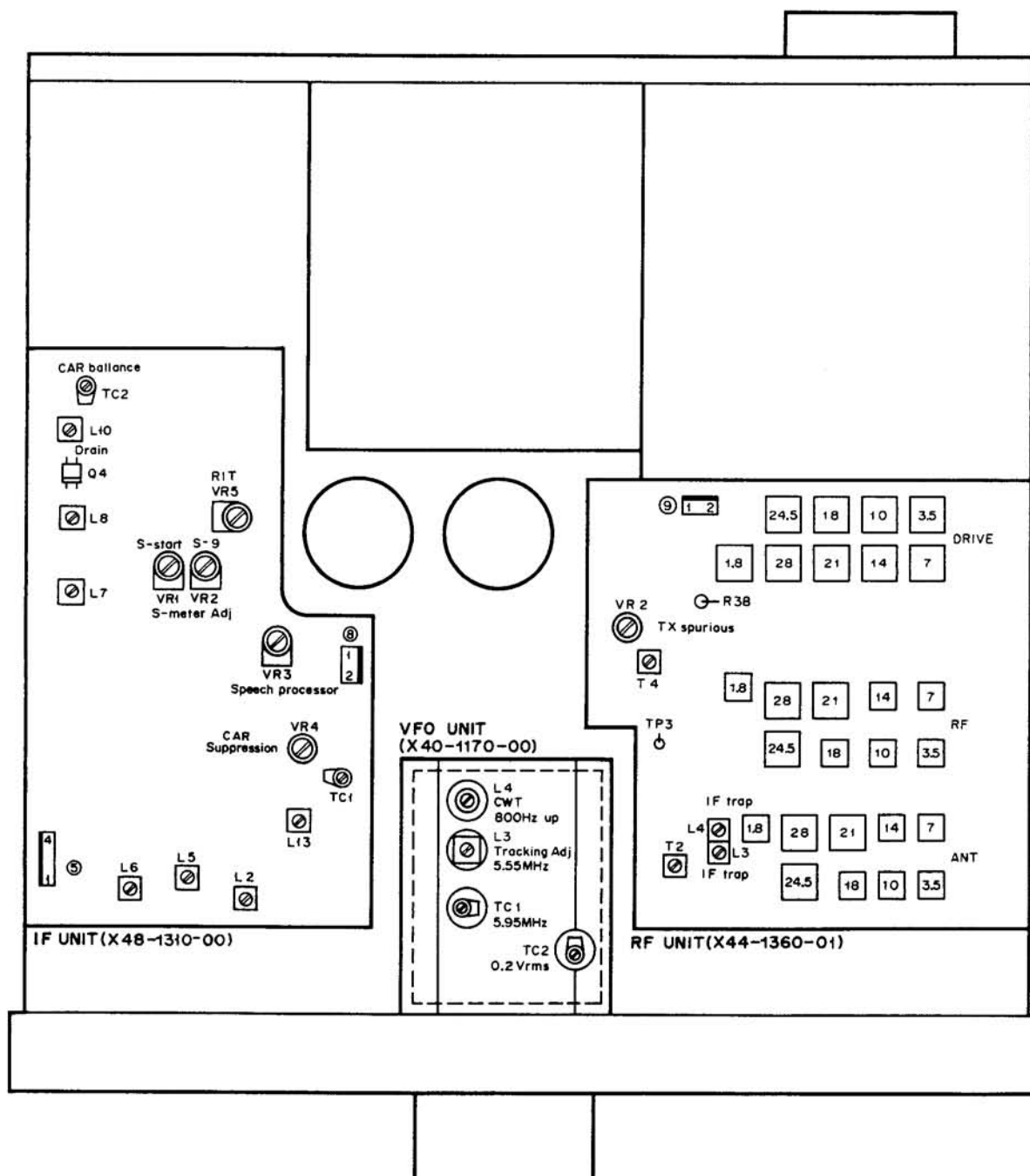


Fig. 11 (21) TX SPURIOUS

### ▼ TOP VIEW



# ADJUSTMENTS

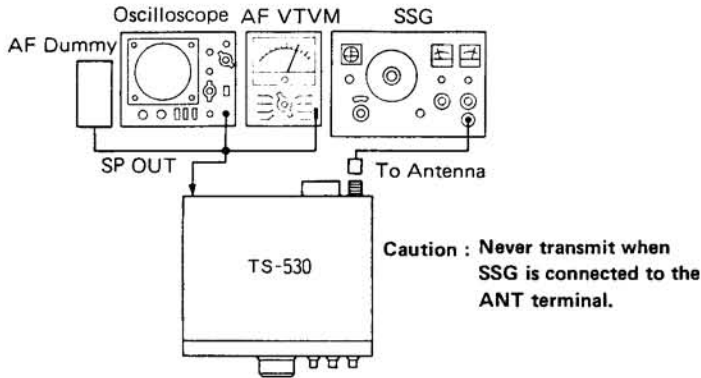
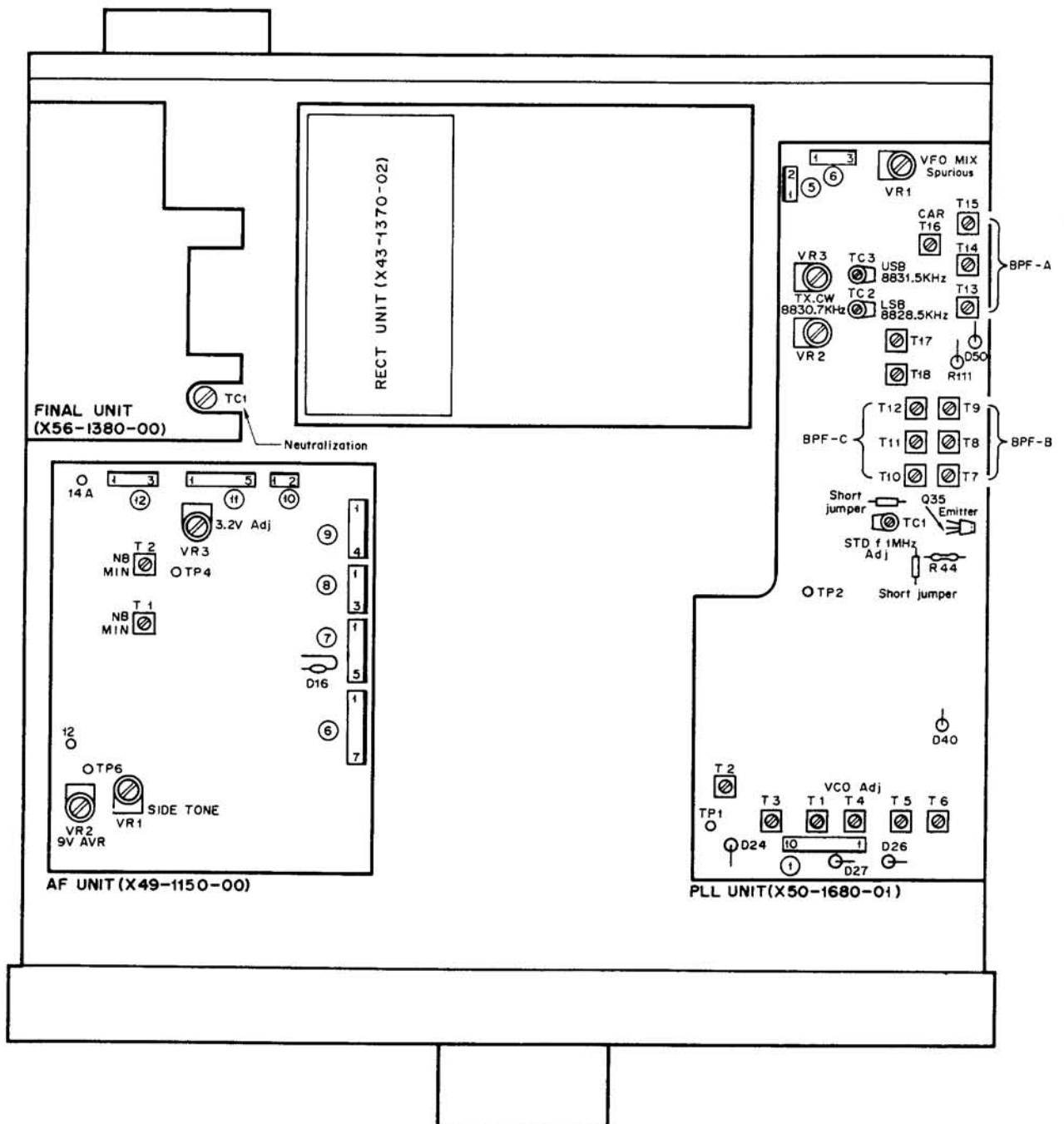


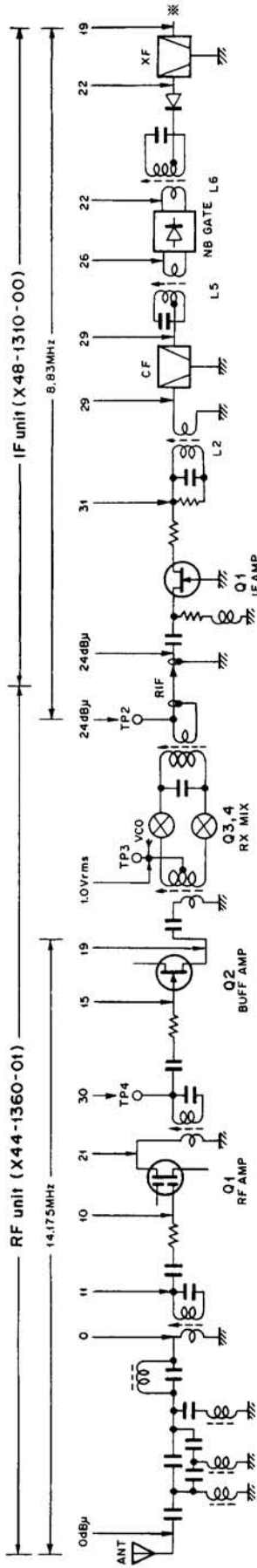
Fig. 12 (12) IF AMP, (13) COIL PACK, (15) IF TRAP

## ▼ BOTTOM VIEW

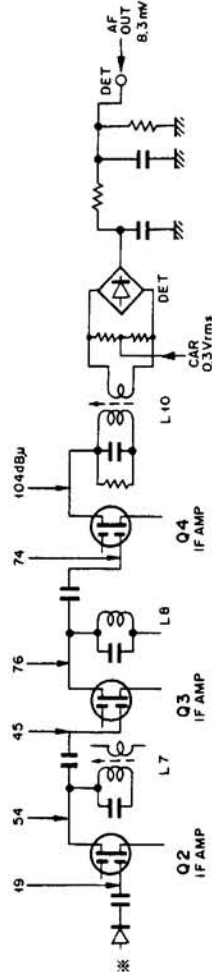




## RECEIVER SECTION



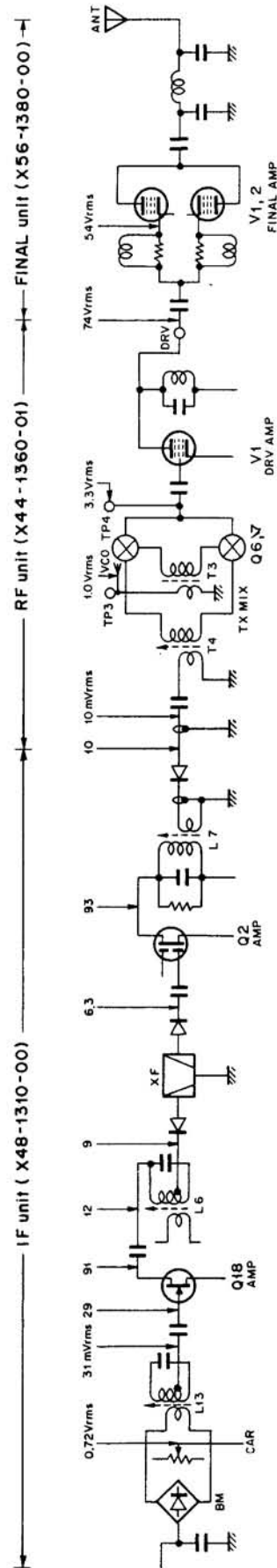
IF unit (X48-1310-00) -



**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  $0.63\text{V}/8\Omega$  ( $50\text{ mW}$ ) audio output  $0\text{ dB}\mu$  signal generator input at  $14.175\text{ MHz}$ .
2. To inject signal generator output connect a  $0.04\mu\text{F}$   $50\text{V}$  capacitor between the signal generator and the check point.

## TRANSMITTER SECTION



**NOTES:**

1. Levels are measured at 14.175 MHz in the CW MODE and SG SW OFF. Carrier level is adjusted until the meter indicates the maximum on-scale ALC reading.
2. All voltage measurements are read from an RF VTVM.
3. A probe with a capacitance of less than 3pF should be used and the ground should be made near the point of measurement.

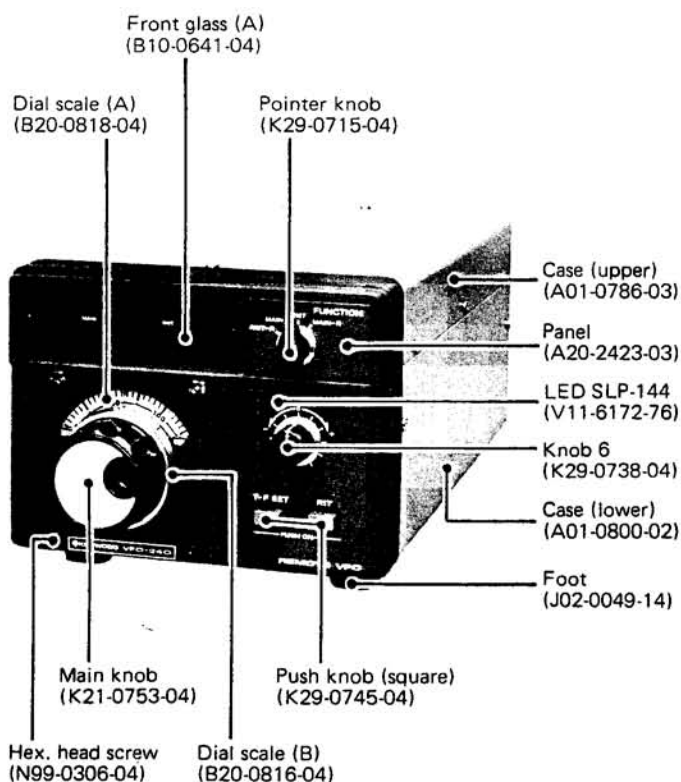
## VFO-240

## SPECIFICATIONS

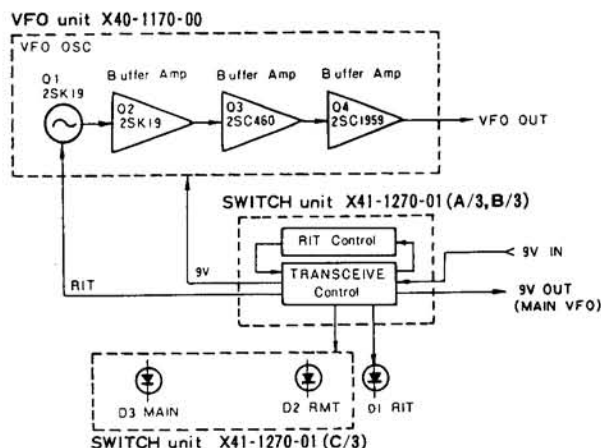
Oscillator frequency .....	5.50 ~ 6.00 MHz
Oscillator circuit.....	Clapp
Output voltage .....	0.2V $\pm$ 1dB (across 470 ohm load)
Frequency stability .....	Within 100 Hz per 30 minutes after 3 minutes warm-up (at room temperature)
Solid-state complement ....	FET: 2 Transistor: 2 Diode: 6
Power source .....	From TS-530S or TS-830S
Dimensions .....	180 (7-1/8") W $\times$ 133 (5-1/4") H $\times$ 288 (11-5/16") D mm (inch)
Weight .....	2.9 kg (6.4 lbs)

\* Specifications are subject to change for improvement without notice.

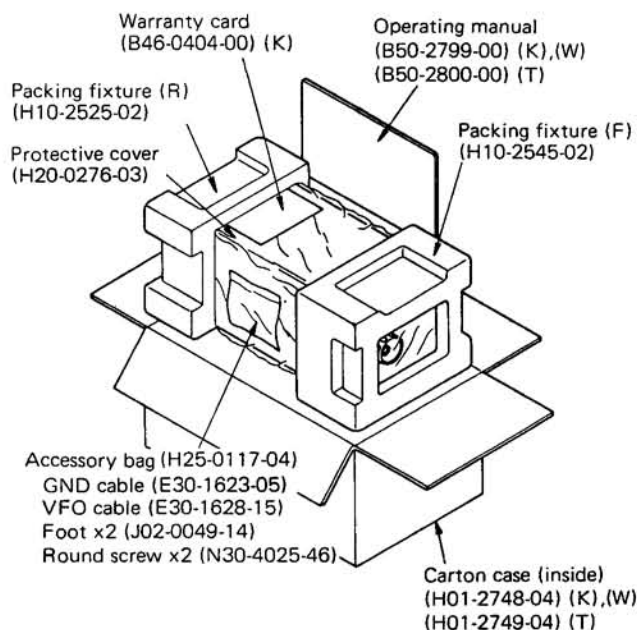
## OUTSIDE VIEW



## BLOCK DIAGRAM



## PACKING



## PARTS LIST

☆: New parts

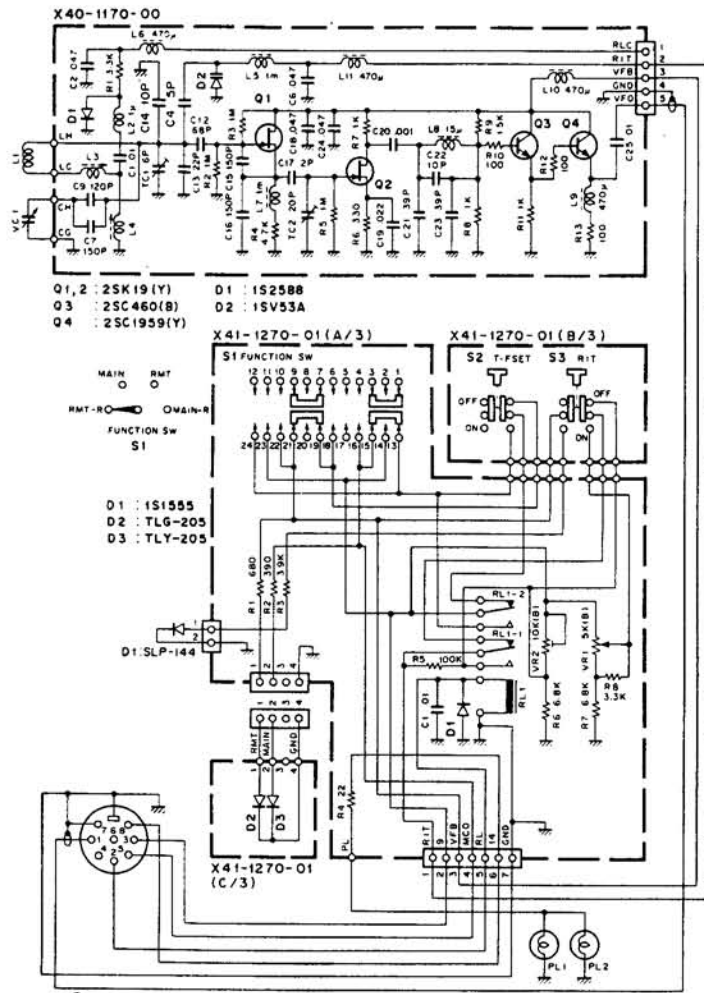
Ref. No.	Parts No.	Description	Re- marks
<b>VFO-240 GENERAL</b>			
	A01-0786-03	Case (upper)	☆
	A01-0800-02	Case (lower)	☆
	A20-2423-03	Panel	☆
	B10-0641-04	Front glass (A)	☆
	B43-0658-04	Name plate	T ☆
	B43-0659-04	Name plate	K,W ☆
	B46-0404-00	Warranty card	K ☆
	B50-2799-00	Operating manual	K,W ☆
	B50-2800-00	Operating manual	T ☆

## VFO-240

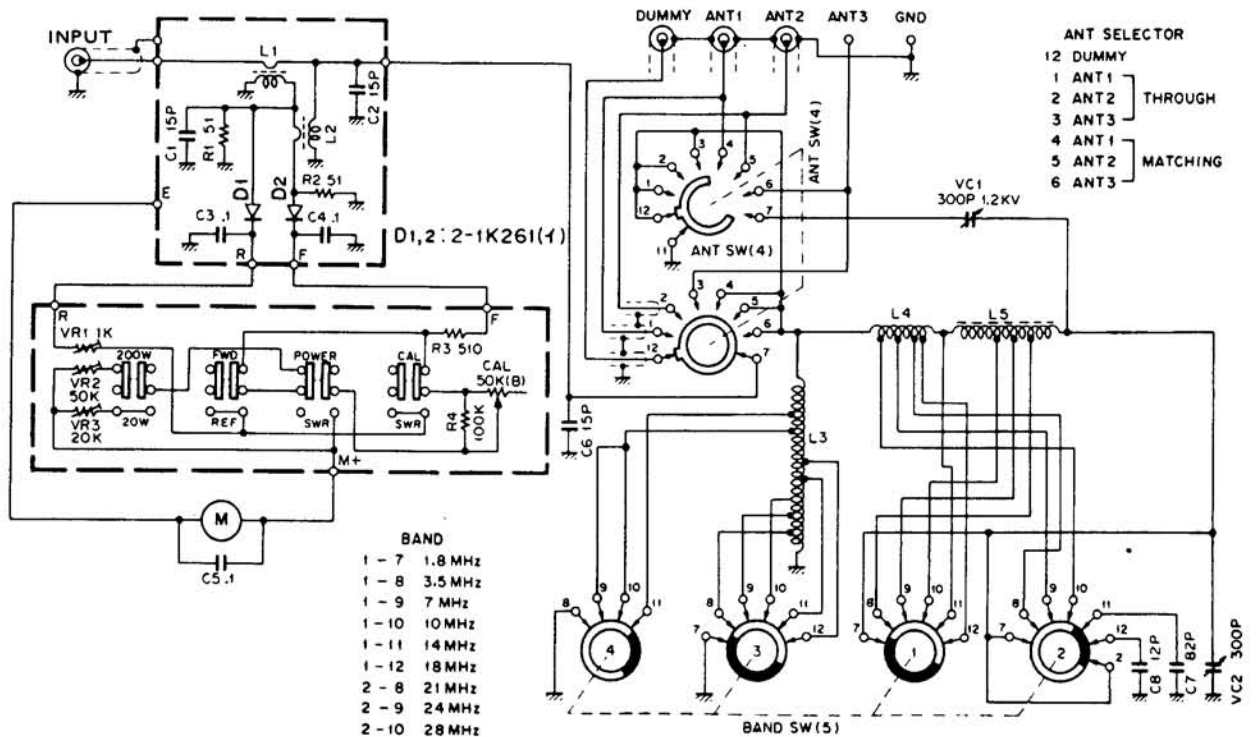
Ref. No.	Parts No.	Description	Re- marks	Ref. No.	Parts No.	Description	Re- marks
D1	E06-0852-05	8P DIN socket VFO OUT		<b>VFO ASS'Y UNIT (X60-1150-01)</b>			
	E30-1623-05	GND cable (accessory)			B07-0630-05	Dial escutcheon	
	E30-1628-15	VFO cable (accessory)			B10-0632-04	Escutcheon glass	
	E31-2091-05	Connector with lead (A)	☆		B20-0816-04	Dial scale (B)	
	E31-2092-05	Connector with lead (B)	☆		B20-0818-04	Dial scale (A)	☆
	G09-0410-05	D spring $\phi 6$ RIT,FUNCTION			B30-0819-05	Pilot lamp	
	H01-2748-04	Carton case (inside) K,W	☆		B42-1645-04	Seal Bottom	
	H01-2749-04	Carton case (inside) T	☆		B42-1671-04	Seal Top	
	H10-2525-02	Packing fixture (R)			G01-0804-04	Coil spring	
	H10-2545-02	Packing fixture (F)			K21-0753-04	Main knob	
	H20-0276-03	Protective cover			X40-1170-00	VFO unit	
	H25-0117-04	Accessory bag		<b>VFO UNIT (X40-1170-00)</b>			
	J02-0049-14	Foot (large)		C2	C91-0456-05	C 0.047 $\mu$ F 25V	
	J61-0019-05	Vinyle tie		C4	CC45CG1H050C	C 5pF $\pm 0.25$ pF	
	K29-0715-04	Pointer knob FUNCTION		C6	C91-0456-05	C 0.047 $\mu$ F 25V	
	K29-0738-04	Knob 6 RIT		C7	CC45LG1H151J	C 150pF	
	K29-0745-04	Push knob (square) RIT, T-F SET	☆	C9	CC45LG1H121J	C 120pF	
	N14-0115-05	Flange nut GND		C12	CC45LG1H680J	C 68pF	
	N14-0509-05	Wing nut GND		C13	CC45CG1H220J	C 22pF	
	N15-1040-46	Washer GND		C14	CC45PG1H100D	C 10pF $\pm 0.5$ pF	
	N16-0040-46	Spring washer GND		C15,16	CC45LG1H151J	C 150pF	
	N30-4012-46	Round screw Foot		C17	CC45CH1H020C	C 2pF $\pm 0.25$ pF	
	N30-4016-46	Round screw GND		C18	C91-0456-05	C 0.047 $\mu$ F 25V	
	N30-4025-46	Round screw Foot (accessory)		C21	CC45SL1H390J	C 39pF	
	N35-3006-41	Bind screw Case		C22	CC45CH1H100D	C 10pF $\pm 0.5$ pF	
	N87-4012-46	Self tapping screw Foot		C23	CC45SL1H390J	C 39pF	
	N99-0306-04	Hex. head screw VFO		C24	C91-0456-05	C 0.047 $\mu$ F 25V	
	N99-0308-04	Hex. head screw Front glass	☆	TC1	C05-0009-15	Ceramic trimmer 6pF	
	V11-6172-76	LED SLP-144		TC2	C05-0013-15	Ceramic trimmer 20pF	
	X41-1270-01	Switch unit	☆	VC1	C02-0019-05	Variable cap.	
	X60-1150-01	VFO ass'y unit			D40-0614-05	Dial mechanism ass'y	
<b>SWITCH UNIT (X41-1270-01)</b>					E40-0574-05	Mini connect wafer 5P	
VR1 VR2	E23-0047-04	Square terminal			F29-0014-05	Insulating washer	
	E23-0401-05	Round terminal		L1	L32-0628-05	OSC coil	
	E40-0216-05	Mini connect wafer 2P		L2	L33-0025-05	Choke coil 1 $\mu$ H	
	E40-0474-05	Mini connect wafer 4P L type		L3	L32-0629-05	OSC coil	
	E40-0774-05	Mini connect wafer 7P L type		L4	L32-0609-05	OSC coil	
	R01-2407-05	Pot. 5k $\Omega$ (B) RIT	☆	L5	L40-1021-03	Ferri-inductor 1mH	
	R12-3025-05	Trim. pot 10k $\Omega$ (B)		L6	L40-4711-03	Ferri-inductor 470 $\mu$ H	
	R92-0150-05	Short jumper		L7	L40-1021-03	Ferri-inductor 1mH	
	S29-1418-05	Slide rotary switch	☆	L8	L40-1501-03	Ferri-inductor 15 $\mu$ H	
	S40-2424-05	Push switch T-F SET	☆	L9~11	L40-4711-03	Ferri-inductor 470 $\mu$ H	
S1	S40-2425-05	Push switch RIT	☆		R92-0150-05	Short jumper	
S3				Q1,2	V09-0011-05	FET 2SK19(Y)	
RL1	S51-2408-05	Relay G2V-2		Q3	V03-0079-05	TR 2SC460(B)	
D1	V11-0076-05	Diode 1S1555		Q4	V03-1959-06	TR 2SC1959(Y)	
D2	V11-3162-86	LED TLG-205		D1	V11-0414-05	Diode 1S2588	
D3	V11-3163-16	LED TLY-205		D2	V11-4161-36	Vari-cap. 1SV53A	

# VFO-240/AT-230

VFO-240  
SCHEMATIC DIAGRAM



AT-230  
SCHEMATIC DIAGRAM



# AT-230

## SPECIFICATIONS

### ANTENNA COUPLER

Frequency Range	9 amateur bands from 1.8 to 29.7 MHz
Input Impedance	50Ω
Output Impedance	10 to 500Ω, unbalanced
Through Power	200W at max.
Insertion Loss	Less than 0.5 dB in matched state
Pi-L	1.8 MHz only
Output Impedance	20 to 500Ω, unbalanced
Through Power	100W at max.

### WATTMETER

Type	Through-line wattmeter
Frequency Range	1.8 to 30 MHz
Measurable RF Power	Up to 20/200W, switched
Kinds of RF Power	Forward or reflected power, switched.
Net weight	3.4 kg (7.5 lbs.) approx.
Impedance	50Ω
Accuracy	Better than ±10% of full scale

### SWR METER

SWR Detection	Toroid core direction coupler
Measurable Range	1.1 to 10
Min. Power Required	4W

### GENERAL

Connectors	
INPUT	UHF type, 50Ω
ANT-1	UHF type
ANT-2	UHF type
ANT-3	Stud and wing nut
Dimensions	W 180 mm (7-3/32")
	H 133 mm (5-15/64")
	D 288 mm (11-11/32")

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

### PARTS LIST

☆, New parts

Ref. No.	Parts No.	Description	Re-marks
<b>AT-230 GENERAL</b>			
	A01-0786-03	Case (upper)	☆
	A01-0788-02	Case (lower)	☆
	A20-2397-02	Panel	☆
	B07-0632-08	Meter escutcheon (T)	☆
	B07-0633-08	Meter escutcheon (K)(W)	☆
	B20-0808-04	Knob skirt	
	B31-0621-08	Meter	
	B46-0058-00	Warranty card (K)	
	B50-2756-08	Operating manual (K)(W)	☆
	B50-2757-08	Operating manual (T)	☆
VC1. 2	C02-0016-08	Variable cap 300pF 1.2kV	
C7	C91-0419-05	C 82pF 3kV	☆
C8	C91-0402-05	C 12pF 3kV	☆
	D23-0061-04	Bearing	

Ref. No.	Parts No.	Description	Re-marks
	E04-0102-05	UHF type receptacle	
	E23-0015-04	Gnd lug φ3	
	E23-0408-05	Terminal	
	F09-0402-05	Insulating cover	
	F29-0402-08	Insulator	
	G13-0621-04	Cushion	
	H01-2714-04	Carton case (inside)(K)(W)	☆
	H01-2715-04	Carton case (inside)(T)	☆
	H10-2525-02	Packing fixture (R)	☆
	H10-2545-02	Packing fixture (F)	☆
	J02-0049-14	Foot (large)	
	J32 1030-04	Round boss	
	K21-0715-04	Main knob R, X Tune	
	K21-0745-08	Knob, BAND, ANT	
	K23-0719-04	Knob, CAL	
	K23-0720-04	Switch paddle	
L3	L34-0992-08	Coil	☆
L4	L34-0993-08	Coil	☆
L5	L34-0994-08	Coil	☆
	N14-0506-08	Wing nut, M5 ANT3, GND	
	S01-2418-08	Rotary switch, ANT	
	S01-5404-08	Rotary switch, BAND	☆
	W02-0302-08	Switch module	
	W02-0303-08	Detector module	

### SWITCH UNIT (W02-0302-08)

VR1	R12-1024-05	Trim. pot 1kΩ (B)	
VR2	R12-4020-05	Trim. pot 50kΩ (B)	
VR3	R12-3420-08	Trim. pot 20kΩ (B)	
VR4	R05-3407-08	Pot. 50kΩ (B) CAL	
R3	RD148B2E511J	Carbon resistor 510Ω ±5% 1/4W	
R4	RD148B2E104J	Carbon resistor 100kΩ ±5% 1/4W	
	S36-2026-15	Paddle switch × 4	

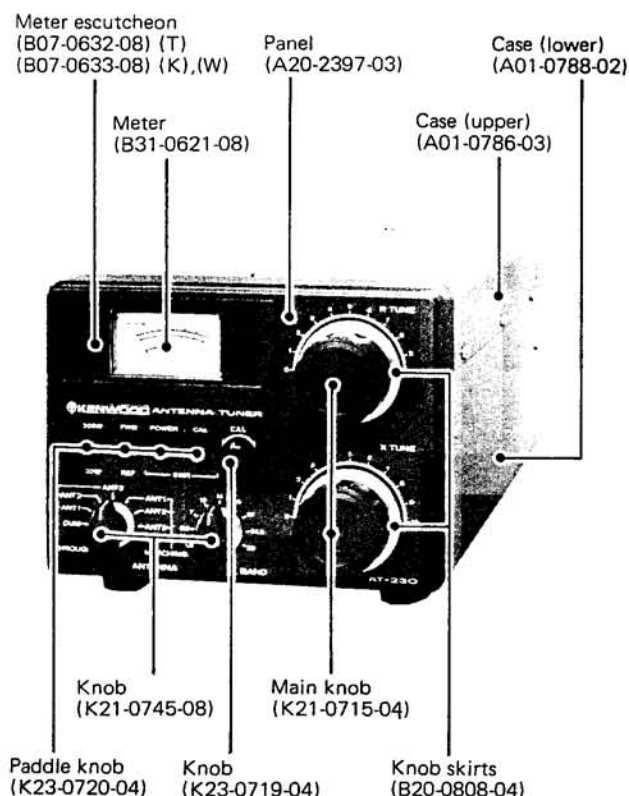
### DETECTOR MODULE (W02-0303-08)

C1. 2	FM05ZC150J5	Mica 15pF 500V	
C6	FM05ZC150J5	Mica 15pF 500V	
R1. 2	RD148B2E510J	Carbon resistor 51Ω ±5% 1/4W	
D1. 2	V11-7763-26	Diode 2-1K261 × 2	
L1. 2	L39-0403-08	Detector coil	



## AT-230

## OUTSIDE VIEW



## ADJUSTMENTS

## 1. INSTRUMENTS

## 1) Terminated Power Meter

1. Frequency range: 50 MHz or more
2. Input impedance:  $50\Omega$
3. Power range: 20W and 200W

## 2) HF Transmitter or Transceiver

- 1) Output: 100W CW  
Variable to 10W.  
Example: TS-530, TS-830S

## 2. POWER METER ADJUSTMENT

## 1) Test Equipment Connection

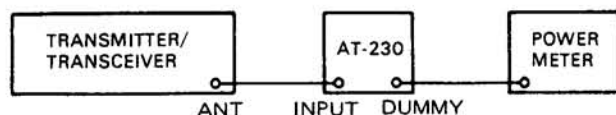


Fig. 1

## 2) Adjustment

1. Connect as in Fig. 1.
2. Unless otherwise specified, controls should be set as follows:

ANT SW	DUMMY
BAND SW	14
200W/20W SW	200W
FWD/REF SW	FWD
POWER/SWR SW	POWER
CAL/SWR SW	SWR

Tune up the transceiver at 14.175 MHz.

3. Adjust the transceiver for 100W output at the power meter (adjusted by the carrier level control).  
Adjust VR2 on the switch unit for a meter reading of 100 on the AT-230.

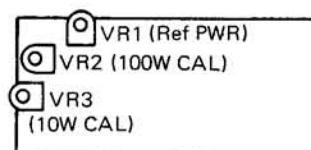


Fig. 2

4. As in step 3, lower transceiver output to 10W and adjust VR3 for a meter indication of 10 on the 20W scale.

## 3. CALIBRATION OF REF POWER

## 1) Connection

As in Fig. 1.

## 2) Adjustment

1. Set controls as described in 2.2.  
Confirm 100W CW output reading
2. Unkey the transceiver and reverse the coaxial cable between the INPUT and DUMMY terminals on the AT-230. Move the FWD/REF switch to the REF position.
3. Transmit and adjust VR1 for previously confirmed 100W reading

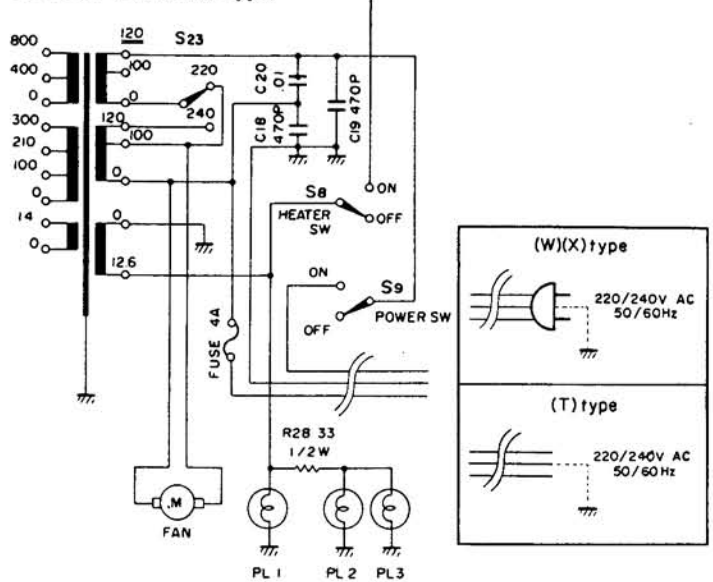
## SCHEMATIC ABBREVIATION

Connector No.	Terminal name		Connector No.	Terminal name	
<b>VFO ass'y unit (X60-1150-01)</b>					
	RLC	From MODE SW S-18-3, 5	⑫	-6	B - 6V input
	RIT	RIT voltage input		AGO	AGC off
	VFB	VFO B + 9V		AGS	AGC slow
	G			RFG	Arm of RF gain control
	VFO	VFO output		SSB	From mode SW S18-4
<b>PLL unit (X50-1680-01)</b>				9	B + 9V
①		BAND SW input information		CV	Arm of carrier level control
②	A,B,C,D	BCD code from counter unit	⑬	RSC	Receiver RIT
	BLK	Blanking signal		XIT	Transmitter RIT
③	12	B + 12V		RIT	RIT voltage to VFO
				RTI	RIT SW S3-1
④	1K	Reference signal from PLL Q24	⑭	ALC	ALC input from AF unit Q31
	CON	To counter unit from PLL Q29		RLT	+ 9V when transmit
⑤	MKR	Marker output		RLR	+ 9V when receive
	VCO	VCO output		RL	Relay voltage
⑤、⑥	VFO	VFO input	<b>RF unit (X44-1360-01)</b>		
⑦	CAR	Carrier output	①	AUX~24.5	To counter unit + 9V on any band
⑧	RLS	MODE SW S18-3	②	28,29 9V	To counter unit + 9V on any band B + 9V
	TXC	MODE SW S18-3	③	ANT	Receiver antenna
	IFS	IF shift arm of VR-3	④	RLR	+ 9V at receive
	USB	From S18-1 + 9V on USB	⑤	MKR	Marker signal input
	LSB	From S18-1 + 9V on LSB	⑥	AGC	AGC input
	MS	Calibrator SW S1-1	⑦	RIF	Receiver IF output
	9	B + 9V	⑧	TOF 12	Transmit stop signal input for WARC B + 12V
<b>Counter unit (X54-1540-00)</b>			⑨	MXB	MIXer B + turn on signal B + 12V
①	0.5 12	0.5 MHz shift signal B + 12V	⑩	TIF 300A	Transmit IF signal input From IF unit + 300V
②	12	B + 12V	⑪	DRB	Control grid bias for 12BY7A
	CON	Counter signal input	⑫	RB1	Receiver bias voltage
	BLK	Blanking signal	⑬	H	Heater voltage
	1K	Reference signal 1 kHz	⑭	210A	B + 210V
③	A~D	BCD input from PLL	⑮	VCO	VCO input
	-6	B - 6V	⑯	DRV	Drive voltage to 6146B
④	AUX~28B	Band information to PLL	⑰	NC	Neutralization
④、⑤	AUX~29.5	Band SW information to + 9V on any band	<b>AF unit (X49-1150-00)</b>		
<b>IF unit (X48-1310-00)</b>			①	SSB VXI	+ 9V on SSB mode VOX amp input
①	12 RIF	B + 12V Receiver IF input	②	DET NBI	Detector signal from IF unit Noise blanker amp input
②	NBI	To noise blanker amp	③	AV2	Arm of AF gain control
	NSG	Noise blanker gate signal		AV3	Top of AF gain control
③	210A	B + 210V		STE	To ground in CW and CW NAR
	210B	B + 210V		KEY	To ground in tune and USB/LSB
④	300B	B + 300V	④	SP	Speaker internal
	300A	B + 300V		STS	Side tone SW
⑤	CWN~SSB	To NAR SW S4-1,2	⑤	SS	Stand by SW
⑥	TIF	Transceiver IF output		VXS	VOX SW to ground when VOX ON
	AGC	Output for AGC		VXD	VOX delay control
⑦	DET	Detector output		SP	Speaker internal
	RB2	Receiver amp bias	⑥	VR3	Final grid bias control
⑧	CAR	Carrier input		KEY	To ground in tune and USB/LSB
	VXI	To VOX circuit		VR1	Final grid bias control
⑩	TM	Meter select SW S-13 arm		AV	Anti VOX signal input
	M	S meter voltage		SS	Stand by SW
	ALM	To ALC meter DC signal		RL	Relay voltage
	MIC	MIC input		9	B + 9V
	NRM	Processor SW OFF	⑦	RB1	Bias for Q1 RF amp on RF unit
PRC	Processor SW ON	MXB		B + to MIXer from Q29 on AF unit	
⑪	MV1	Top of MIC gain control		TOF	TX stop signal for WARC
	MV2	Arm of MIC gain control	DRB	Bias for control grid of 12BY7A	

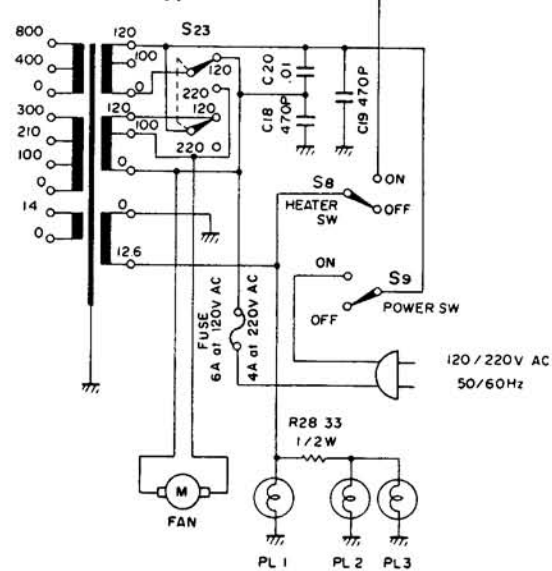
## SCHEMATIC ABBREVIATION

Connector No.	Terminal name	
⑧	RLT RLR -6	+9V on transmit +9V on receive B -6V
⑨	ALC RLT RLR RL	ALC output from Q31 +9V when transmit +9V when receive Relay voltage
⑩	RAL VR2	External ALC input remote socket Arm of TX bias control
⑪	NBV NBS 9 PRS RF1	Top of noise blanker VR Noise blanker SW B + 9V Processor SW Top of RF gain control
⑫	NSG RB2	Noise blanker gate signal Receiver bias for IF unit
	14A	14V input
	G14	14V input (ground)
	FG	Bias for control grid of 6146B
<b>Final unit (X56-1380-00)</b>		
	DRV FG H IPM SG	Drive input Control grid bias Heater voltage AC12.3V IP meter voltage Screen grid voltage
<b>Rectifier unit (X43-1370-02)</b>		
	800 HV 300B 210B 210A -C 12 SG2 TUN	B + 800V High voltage signal to METER B + 300V B + 210V B + 210V Common B— approx. -100V Screen grid cut off voltage Screen grid voltage Screen grid voltage for TUN

TS-530S (T)(W)(X)Type



### TS-530S (M) Type



2SA778A 2SC1775  
2SA1015 2SC1815  
2SC945 2SC1923  
2SC1515 2SC1959  
2SC1675 2SC2240

2SA473

2SA562

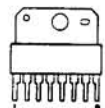
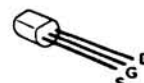
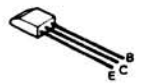
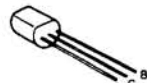
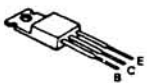
2SC460

2SK19

2SK125  
2SK30A

3SK73

MB3712



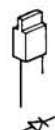
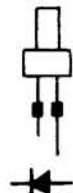
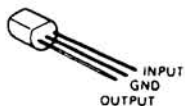
NJM78L05A

**μPC1158H2**

SLP-144

TLR-205

MV-13



A

B

C

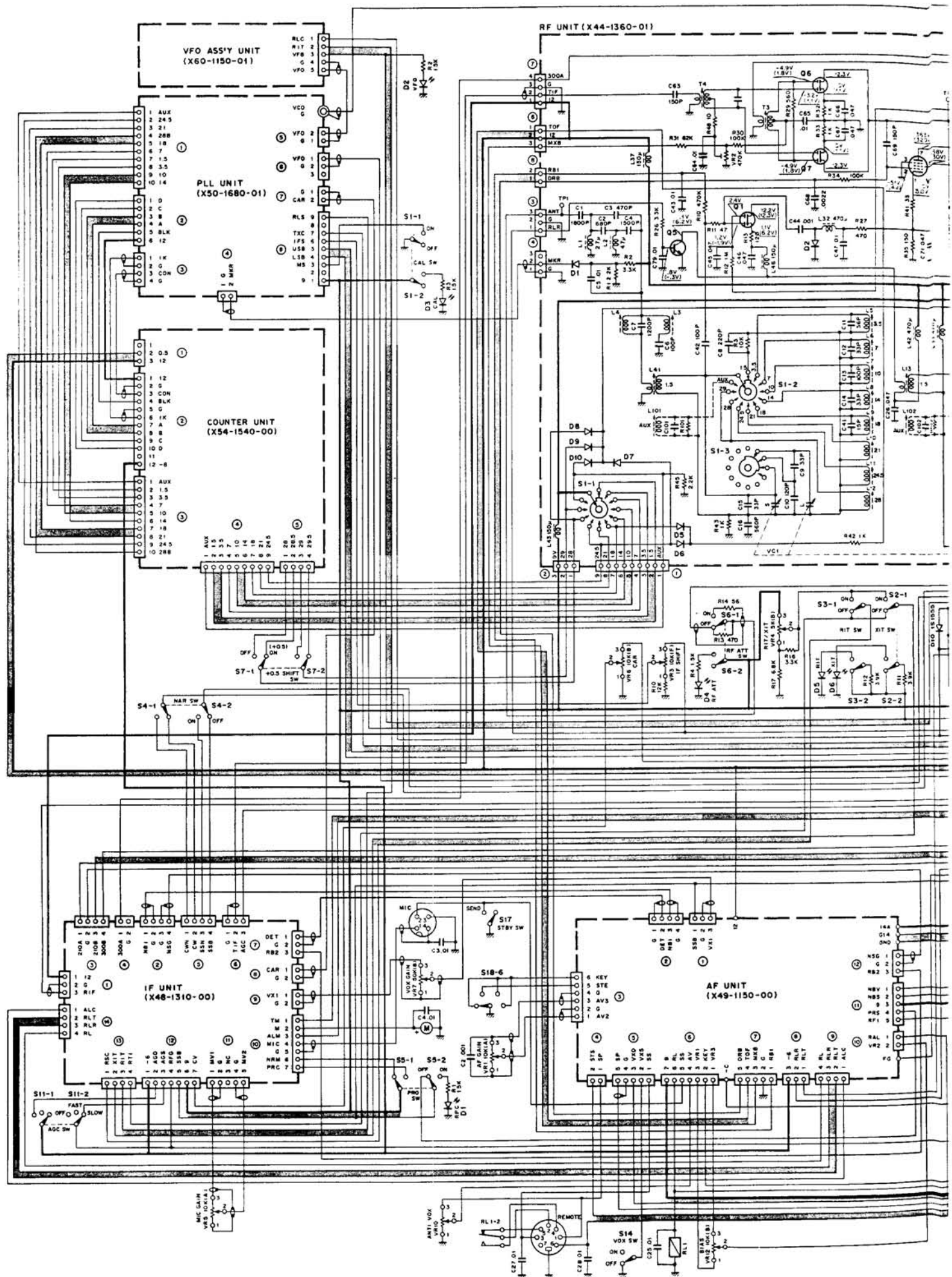
D

Signal Line

Control Line

Common DC Line

## SCHEMATIC DIAG







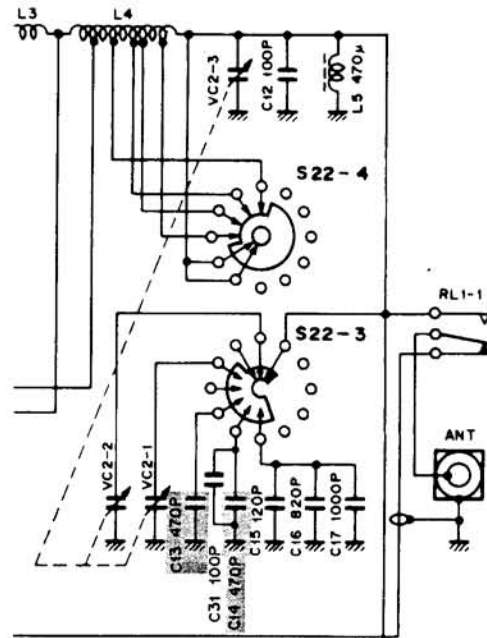
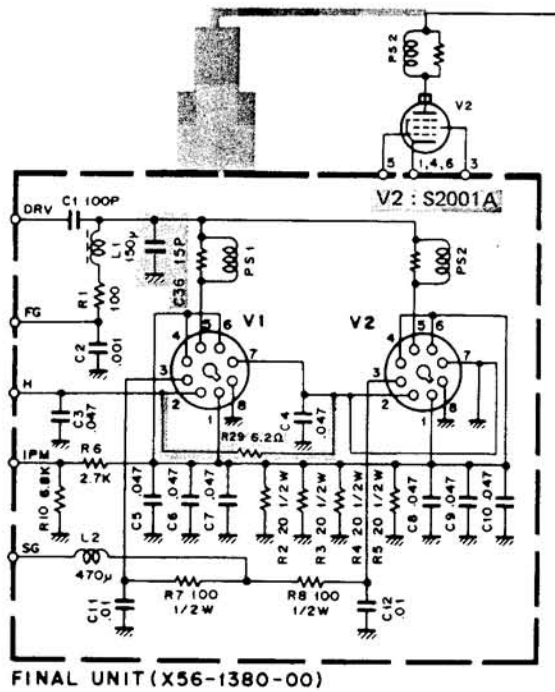


# TS-530S



# TS-530SP/D SCHEMATIC DIAGRAM

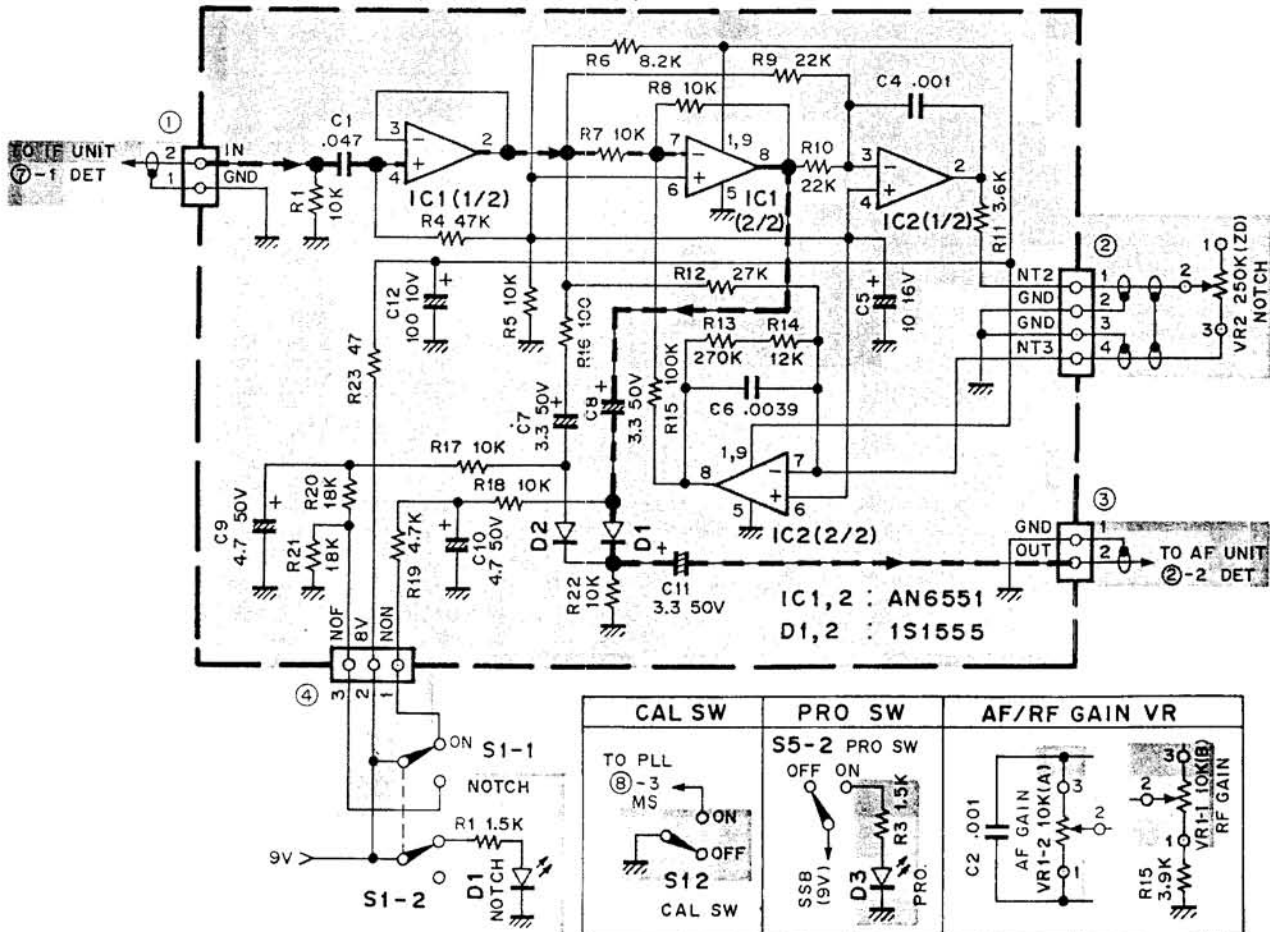
TS-530D ONLY



## ▼NOTCH UNIT

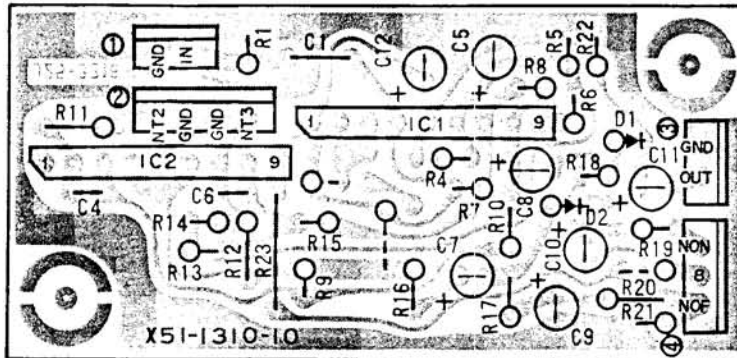
The shaded parts indicate the changed circuit from TS-530S to TS-530SP/D.

### NOTCH UNIT (X51-1310-10)



# TS-530SP/D

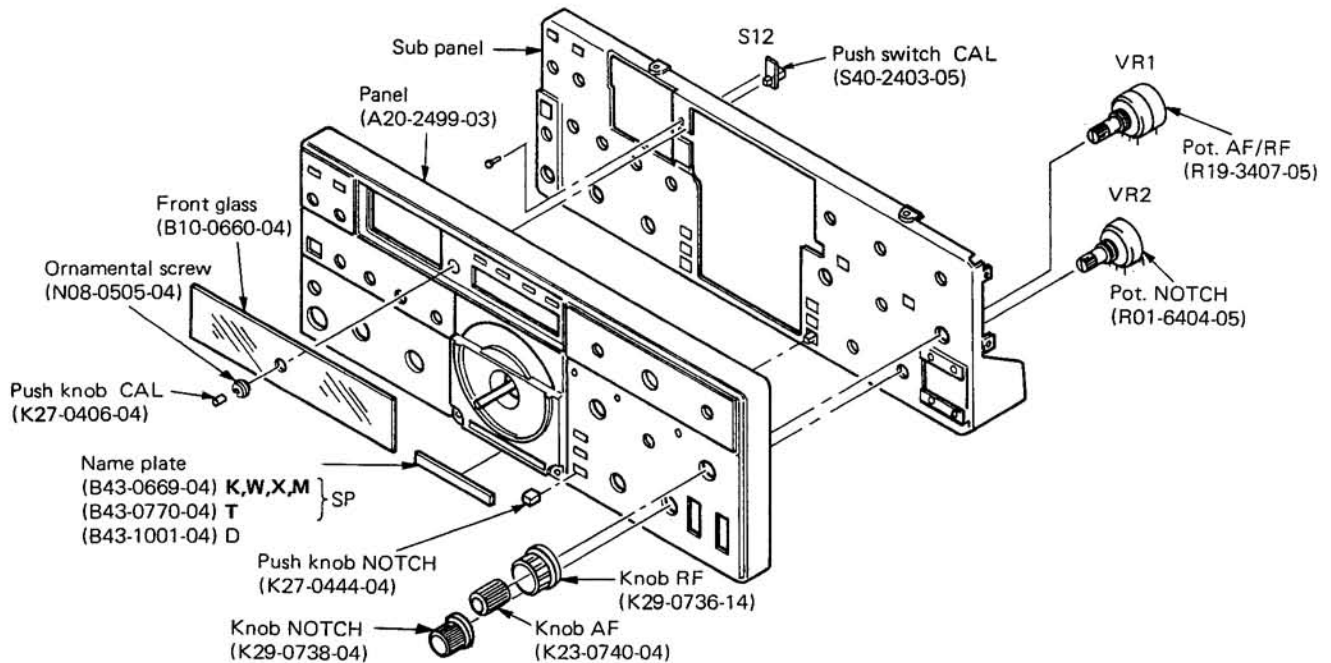
## PC BOARD VIEW



### ◀ NOTCH UNIT (X51-1310-10)

View from component side

## DISASSEMBLY

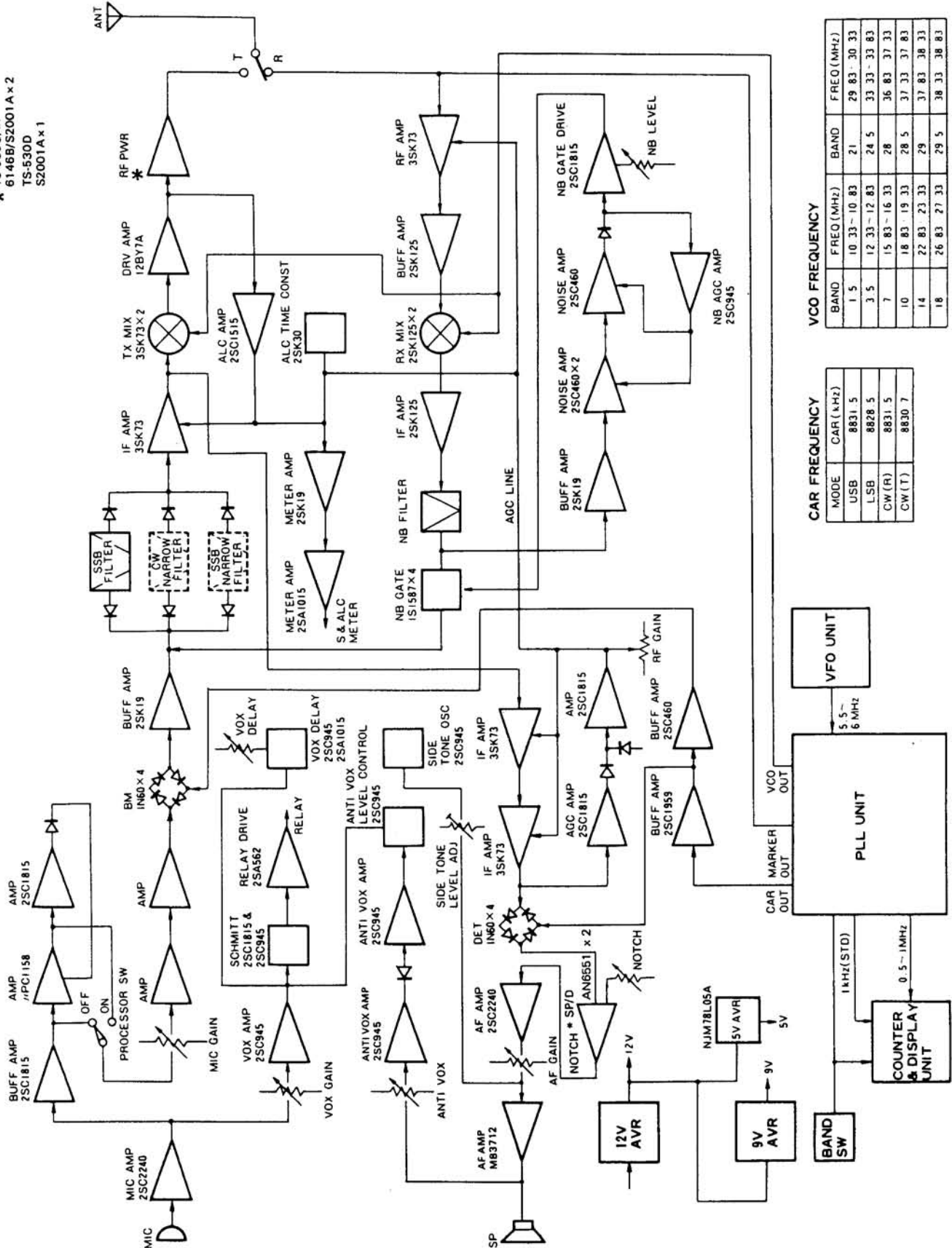


## PARTS LIST

Ref. No.	Parts No.	Description	Re- marks
<b>GENERAL</b>			
	A20-2499-03	Panel	☆
	B10-0660-04	Front glass (large)	☆
	B43-0669-04	Name plate <b>K,W,X,M</b> (SP)	☆
	B43-0770-04	Name plate <b>T</b> (SP)	☆
	B43-1001-04	Name plate (D)	☆
	B50-4075-00	Operating manual <b>K,W,X,M</b> (SP,D)	☆
	B50-4076-00	Operating manual <b>T</b> (SP)	☆
C13,14	CC45SL2H471J	C 470pF 500V (D)	☆
	H01-4520-04	Carton case inside	☆
	H03-2151-04	Carton case outside (SP)	☆
	H03-2152-04	Carton case outside (D)	☆
	K23-0740-04	Knob AF	☆
	K29-0736-14	Knob RF	☆
	L01-8206-05	Power trans (D)	☆
	N08-0505-04	Ornamental screw CAL	☆
VR1	R19-3407-05	Pot. 100kΩ(A)/10kΩ(B) AF/RF	☆
VR2	R01-6404-05	Pot. 250kΩ(ZD) NOTCH	☆
	S12	S40-2403-05 Push switch CAL	☆
	T91-0318-05	Microphone 10kΩ <b>X,M</b>	☆
<b>NOTCH UNIT (X51-1310-10)</b>			
IC1,2		AN6551	
D1,2		1S1555	
C1	CQ92M1H473K	ML 0.047	
C4	CQ92M1H102K	ML 0.001	
C5	CE04W1C100M	E 10 16V	
C6	CQ92M1H392K	ML 0.0039	
C7,8	CE04W1H3R3M	E 3.3 50V	
C9,10	CE04W1H4R7M	E 4.7 50V	
C11	CE04W1H3R3M	E 3.3 50V	
C12	CE04W1A101M	E 100 10V	
	E40-0273-05	Mini connector 2P	
	E40-0373-05	Mini connector 3P	
	E40-0473-05	Mini connector 4P	

# BLOCK DIAGRAM

\* TS-530S/SP  
6146B/S2001A x 2  
TS-530D  
S2001A x 1



CAR FREQUENCY

MODE	CAR (kHz)
USB	8831.5
LSB	8828.5
CW (R)	8831.5
CW (T)	8830.7

VCO FREQUENCY

BAND	FREQ (MHz)	BAND	FREQ (MHz)
1	5	21	29.83 - 30.33
2	10.33 - 10.83	22	33.33 - 33.83
3	12.33 - 12.83	23	36.83 - 37.33
4	15.83 - 16.33	24	37.83 - 38.33
5	18.83 - 19.33	25	38.33 - 38.83
6	22.83 - 23.33	26	38.83 - 39.33
7	26.83 - 27.33	27	39.33 - 39.83
8	29.83 - 30.33	28	39.83 - 40.33
9	32.83 - 33.33	29	40.33 - 40.83
10	35.83 - 36.33	30	40.83 - 41.33
11	38.83 - 39.33	31	41.33 - 41.83
12	41.83 - 42.33	32	42.33 - 42.83
13	44.83 - 45.33	33	45.33 - 45.83
14	47.83 - 48.33	34	48.33 - 48.83
15	50.83 - 51.33	35	51.33 - 51.83
16	53.83 - 54.33	36	54.33 - 54.83
17	56.83 - 57.33	37	57.33 - 57.83
18	59.83 - 60.33	38	60.33 - 60.83
19	62.83 - 63.33	39	63.33 - 63.83
20	65.83 - 66.33	40	66.33 - 66.83

## SP-230/PK-3

### SPECIFICATIONS

<b>Speaker used:</b>	12 cm dia.
<b>Rated Input:</b>	2 Watts
<b>Impedance:</b>	8 $\Omega$
<b>Frequency response:</b>	100Hz to 5kHz.
<b>Filter cut-off frequency,</b>	
<b>LOW:</b>	400Hz, -3dB.
<b>HIGH 1:</b>	3kHz, -3dB.
<b>HIGH 2:</b>	1.5kHz, -3dB.
<b>HIGH 1 + HIGH 2:</b>	1 kHz, -3dB.
<b>Filter attenuation:</b>	-6dB/oct.
<b>Dimensions:</b>	W 180 mm (7-1/16")
	H 133 mm (5-1/4")
	D 287 mm (11-5/16")
<b>Net weight:</b>	1.8 kg. (4.0 lbs.)
<b>Accessories furnished:</b>	Speaker cord, 1 pc. (E14-0101-05)
	Extension foot, 2 pcs. (J02-0049-14)
	Screw, M4 x 12, 2 pcs. (N30-4012-41)
	1 pin plug, 2 pcs. (E20-1610-05)

### PK-3

#### POWER UP KIT for the TS-530D

Ref. No.	Parts No.	Description	Re- marks
	S2001A		
	B50-4103-00	Instruction manual	☆
	E90-0004-15	Plate cap	
	H01-4540-03	Carton case	☆
	H21-0802-04	Protective sheet	☆
	H25-0096-04	Protective bag	☆
	L39-0046-05	PS coil PLATE	

Ref. No.	Parts No.	Description	Re- marks
	A01-0786-03	Case (upper)	
	A01-0789-02	Case (lower)	☆
	A20-2399-05	Panel (T)	☆
	A20-2400-05	Panel (K)(W)	☆
	B46-0058-00	Warranty card (K)	
	B50-2759-00	Operating manual (K)(W)	☆
	B50-2760-00	Operating manual (T)	☆
	E11-0404-05	Phone jack	
	E12-0001-05	Phone plug	
	E13-0361-05	3P Pin jack	
	E14-0101-05	1P Pin plug	
	E30-1610-05	Connector with lead	
	G53-0502-04	Packing	
	H01-2723-04	Carton (inside)(K)(W)	☆
	H01-2724-04	Carton case (inside)(T)	☆
	H10-2523-02	Packing fixture (F)	
	H10-2525-02	Packing fixture (R)	
	H20-0276-03	Protective cover	
	H25-0049-03	Protective bag	
	J02-0049-14	Foot	
	K29-0716-04	Push knob	
	L79-0443-25	Filter	
	RS14A83D8R2J	Solid 8.2 $\Omega$ 2W	
	S40-2414-05	Push switch INPUT	
	S42-3401-05	Push switch LOW, HIGH 1, 2	
	T06-0011-05	Speaker	