



KENWOOD

# SERVICE MANUAL

**Model TV-502S**



**2m TRANSVERTER**

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## FEATURES

1. TV-502S is designed to be used in combination with TS-820S, TS-520S for 144 MHz operation.
2. Frequency range 144.0 MHz to 146.0 MHz.
3. Amplified ALC system is employed. ALC voltage fed back to transceiver minimizes distortion caused by over-driving, assuring quality transmission.
4. All-solid-state configuration with FET's employed in major circuits.
5. TV-502S provides of 145 MHz SSB mobile operation, when connecting TS-520 with DS-1.
6. Enjoyable excellent operation performance of TS-520 on 144 MHz band by connecting to TS-520.
7. Receiving antenna circuit incorporates highly sensitive tuning circuit to minimize radio interference.
8. Unique, functional design perfectly matches the styling of TS-520, VFO-520 and SP-520.
9. With minor modification of wiring, changeover between HF and VHF is effected by simply manipulating the Power Switch of TV-502.

# SPECIFICATIONS

|                                  |                                                                                                                     |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------|
| TRANSMITTING/RECEIVING FREQUENCY | 144 ~ 145.7 MHz<br>145.0 ~ 146.0 MHz                                                                                |
| INPUT/OUTPUT IF FREQUENCY        | 28.0 ~ 29.7 MHz                                                                                                     |
| TYPE OF EMISSION                 | SSB (A3J)<br>CW (A1)                                                                                                |
| RATED OUTPUT                     | 8W (AC operation)                                                                                                   |
| ANTENNA INPUT/OUTPUT IMPEDANCE   | 50Ω                                                                                                                 |
| UNWANTED RADIATION               | More than -60 dB                                                                                                    |
| RECEIVING SENSITIVITY            | More than 1μV at S/N 10 dB                                                                                          |
| IMAGE RATIO                      | More than 60 dB                                                                                                     |
| IF REJECTION                     | More than 60 dB                                                                                                     |
| FREQUENCY STABILITY              | Less than ± 2.5 kHz during 1 ~ 60 min after power<br>ON within 150 Hz (per 30 min) thereafter.                      |
| POWER CONSUMPTION                | AC 220/120 V<br>Transmission 50W max<br>Reception 12W max<br>DC 13.8 V<br>Transmission 2A max<br>Reception 0.4A max |
| POWER REQUIREMENT                | AC 220/120 V<br>DC 12 ~ 16 V (standard voltage 13.8 V)                                                              |
| SEMICONDUCTOR                    | FET 5<br>Transistor 15<br>Diode 19                                                                                  |
| DIMENSIONS                       | 6-9/16" (168 mm) wide x 5-15/16" (153 mm) high x 13-1/8" (336 mm) deep                                              |
| WEIGHT                           | 11.5 lbs. (5.2 kg)                                                                                                  |

## FINAL TRANSISTOR SPECIFICATION

(2SC1242A ABSOLUTE MAX. RATINGS)

|                    |                               |
|--------------------|-------------------------------|
| V <sub>CBO</sub> : | 35 V                          |
| V <sub>CEO</sub> : | 18 V                          |
| V <sub>EBO</sub> : | 3.5 V                         |
| I <sub>C</sub> :   | 4.5 A                         |
| P <sub>C</sub> :   | 30 W (T <sub>C</sub> = 25° C) |
| T <sub>j</sub> :   | 175° C                        |
| T <sub>stg</sub> : | -65 ~ 175° C                  |

# CIRCUIT DESCRIPTION

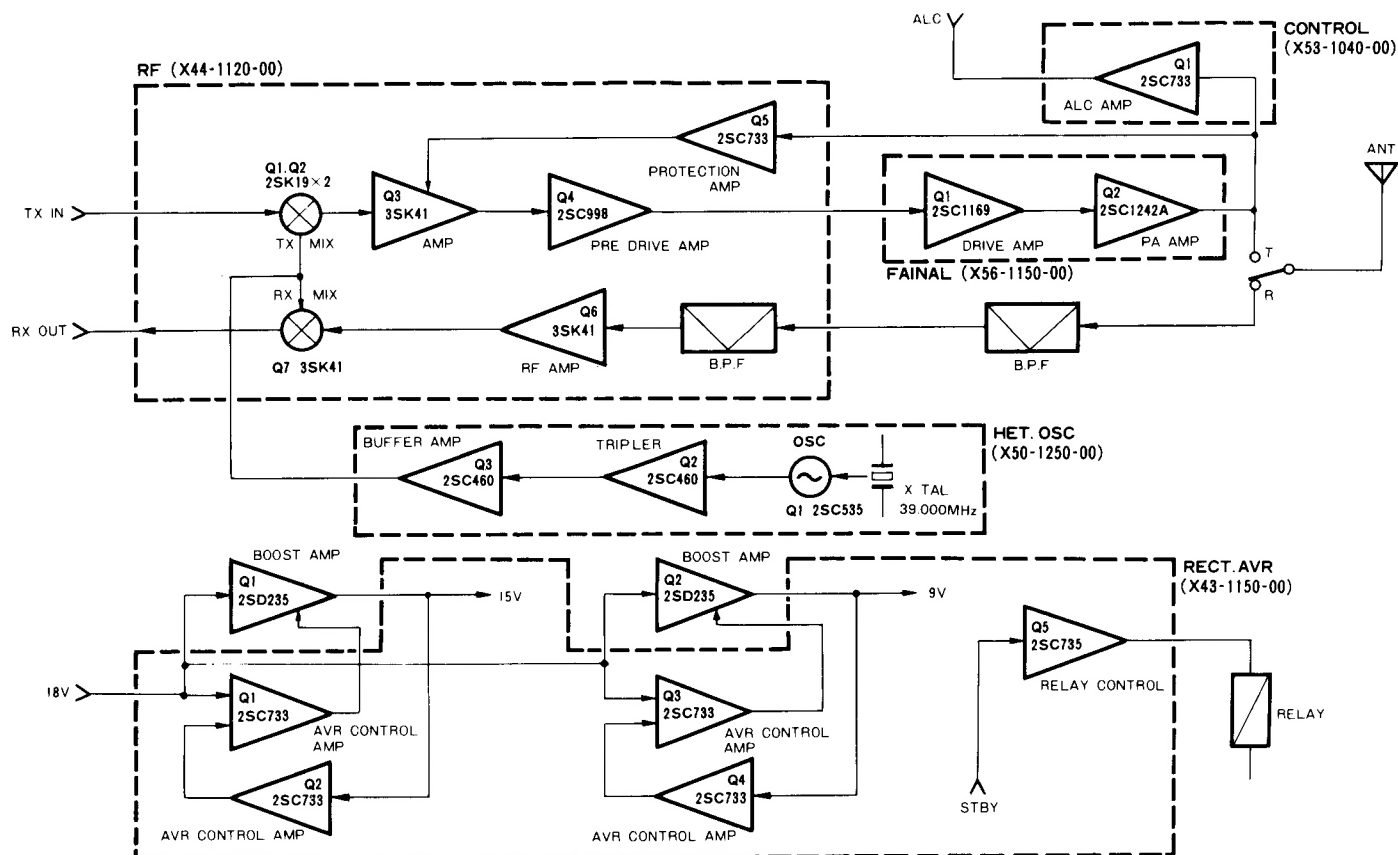


Fig. 1 TV-502 Block Diagram

Fig. 1 shows the block diagram of TV-502.

## RF UNIT (X44-1120-00)

This unit is composed of an RF amplifier and mixer for reception, a balanced type mixer (2SK19 x 2) and 2-stages RF amplifier for transmission, and a final protection control circuit.

### Receiving section

The 144 MHz signal from the antenna passes through the helical filter (T9) and is then applied to the 1st gate of RF amplifier FET (Q6: 3SK41). The signal thus amplified is fed to the 1st gate of the mixer (Q7: 3SK41) through the band pass filter consisting of T8 and T7, where the signal is converted into the 1st IF signal of 28 MHz band. After lowering the impedance by T6, it is picked up as transverter signal.

### Transmitting section

The 28 MHz band signal fed from TS-520 is converted into 144 MHz band signal through the balanced mixer consisting of Q1 and Q2 (2SK19). The signal thus converted passes through the filter circuit (T2 ~ 5). It is amplified by Q3 (3SK41) and fed to the pre-driver Q4

(2SC998), resulting to the input signal for the final unit. The transistor Q5 (2SC733) is used to control the 2nd gate voltage of Q3 (3SK41) using the protection voltage supplied from the control unit (X53-1040-00).

## FINAL UNIT (X56-1150-00)

This unit amplifies the signal, from the RF unit, up to the level of the rated output power. The output of the pre-driver (Q4: 2SC998) of the RF unit passes through the tuning circuit and is power-amplified by the driver (Q1: 2SC1169), and furthermore amplified to the rated power level through the final stage power transistor (Q2: 2SC1242A). The amplified signal passes through the low pass filter (LPF) composed of L7, C12, L8 and C13 to remove the higher harmonics component, and becomes output signal.

The diodes D1 and D2 (1S1555) are used to provide each transistor with a proper bias, utilizing forward voltage to keep bias variations minimum in regard to temperature.

# CIRCUIT DESCRIPTION/MODIFICATION

## HET OSCILLATOR UNIT (X50-1250-00)

This is a local oscillator unit for frequency conversion. The fundamental oscillation frequency (38.666 MHz, 39.000 MHz) is oscillated by Q1 (2SC535) and tripled by Q2 (2SC460) up to 116.0 MHz and 117 MHz of local oscillation frequency. It passes through the spurious rejection filter circuit consisting of T2 and T3 and is fed to the buffer amplifier Q3 (2SC460) where the impedance is lowered to obtain necessary output.

This unit has a built-in crystal for 38.666 MHz, 39.000 MHz as a standard, and is designed to obtain 117 MHz of local oscillation frequency by inserting a crystal for 39.000 MHz. Switching the band selector, this changeover is accomplished by the diode switch consisting of D1 and D2 (1N60).

## CONTROL UNIT (X53-1040-00)

This unit incorporates an ALC detector circuit, protection detector circuit and RF meter circuit.

In the ALC detector circuit, the output voltage is divided by C5 (1pF) and C4 (22pF) and rectified by D2 and D3 (1N60). It is then amplified by Q1 (2SC733) to obtain ALC voltage which is feedbacked to TS-520 to control the drive voltage.

In the protection detector circuit, the reflected wave power obtained from the circuit line in parallel with the signal line and from the detector coil (L5) is rectified through D4 (1N60) for necessary output.

And in the meter circuit, the output voltage is divided and rectified by C12 (1pF) and C11 (5pF). The meter sensitivity can be adjusted by the 100 k $\Omega$  PC trimmer potentiometer (VR1).

## RECTIFIER/AVR UNIT (X43-1150-00)

Included in this unit are a rectifier circuit, 9 V power stabilizer circuit, 15 V power stabilizer circuit, and a relay drive circuit. The transistors Q1 and Q2 (2SD235), used to control the 9 V and 15 V stabilized power, are mounted on the heat sink of the final unit, while the transistors Q1 and Q3 (2SC733) are Darlington connected to the 9 V and 15 V stabilized power control transistors (Q1, Q2) for driving.

The transistors Q2 and Q4 (2SC733) are the error voltage detector transistors for 9 V and 15 V of power voltages, and are used for comparison with the reference voltages from D5 (WZ-090) and D6 (WZ-061). The transistor Q5 (2SC735) is the relay drive transistor and D7 (V06B) is the diode to erase the spike voltage caused by the relay.

The rectifier circuit is the bridge connected circuit using D1 ~ 4 (U05B).

Care should be used not to short the 9 V/15 V lines to the chassis, since the power stabilizer circuits are not provided with protection circuits.

## CIRCUIT CHANGE

Although TS-520 works satisfactorily when only connected to TV-502, it is also designed to permit simple changes in the circuit to offer the following operating advantages:

1. The operating band of VHF or HF can be selected with the POWER switch on TV-502.
2. As the final (S2001) screen voltage of TS-520 is automatically switched, the SG switch of TS-520 may be left ON (up) position at all times.

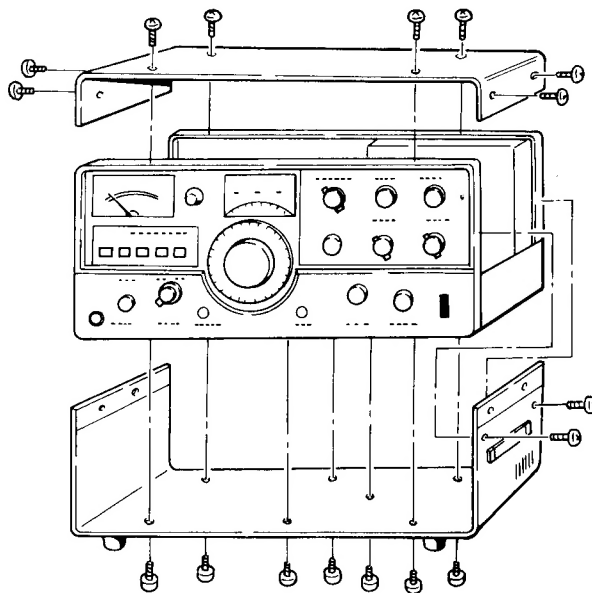


Fig. 2

## Preparation and Precaution for Circuit Change:

1. Disconnect the power cord of TS-520.
2. Remove the case from the unit (see Fig. 2).
3. Short the high voltage circuit to the chassis for a short period of time using a screwdriver in order to prevent electric shock.

## Method of Circuit Change:

Only the X VERTOR connector circuit may be changed. Do not touch any other circuits. To change, remove the lead wire connected between the pins 6-7 and the other lead wire connected between the pins 3-10 by referring to Fig. 4.

Be very sure that other lead wires remain as they are.

**NOTE:** On earlier produced TS-520, solder both the earth line of coaxial cable (A) and (B) to twelfth terminal (see Fig. 4), which are open.

After the change of the connector circuit, replace the upper lid and the bottom plate.

If TS-520 is to be operated without connecting TV-502, make sure to insert the supplied 12P shorting plug into the X VERTOR connector. Fig. 5 shows the internal connection of the 12P shorting plug.

# CIRCUIT MODIFICATION

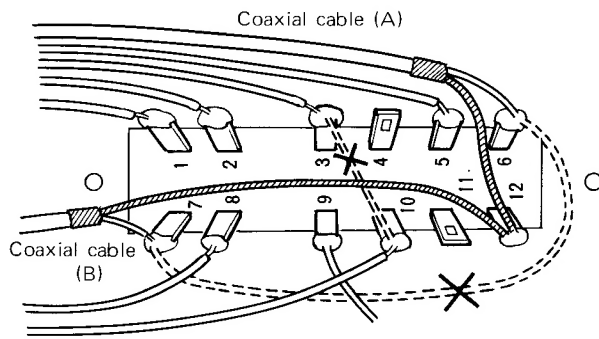


Fig. 4 Change of TS-520 X VERTOR Connector Circuit

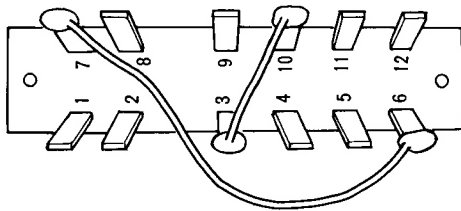


Fig. 5 Internal View of 12P Shorting Plug

## DC Power Operation:

TV-502 can be operated on DC power. In this case, TS-520 must be equipped with DS-1. When the supplied DC power 2P plug is used, the AC-DC selector switch on the rear panel should be set to the DC position (this switch is set to "AC" when shipment) and a fuse (3A) should be provided along the DC cord.

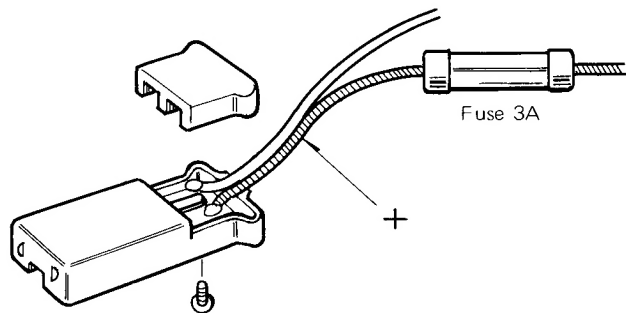
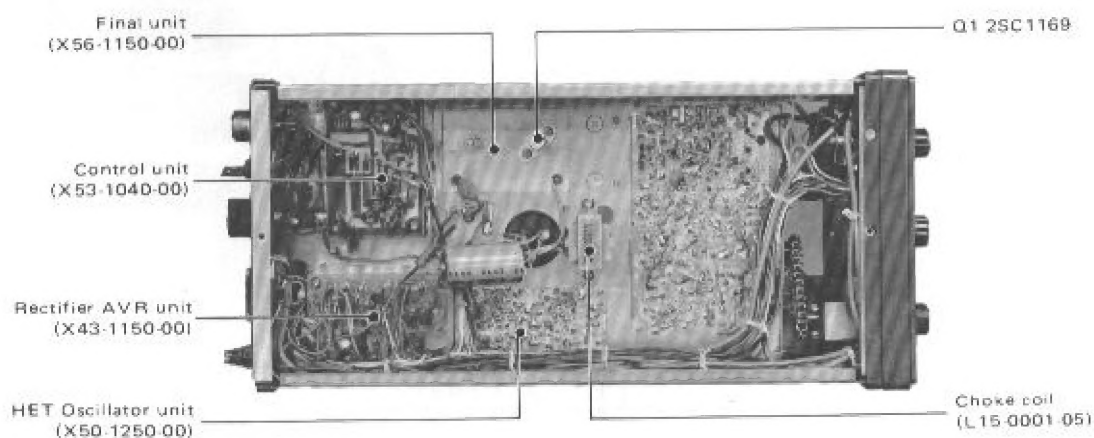
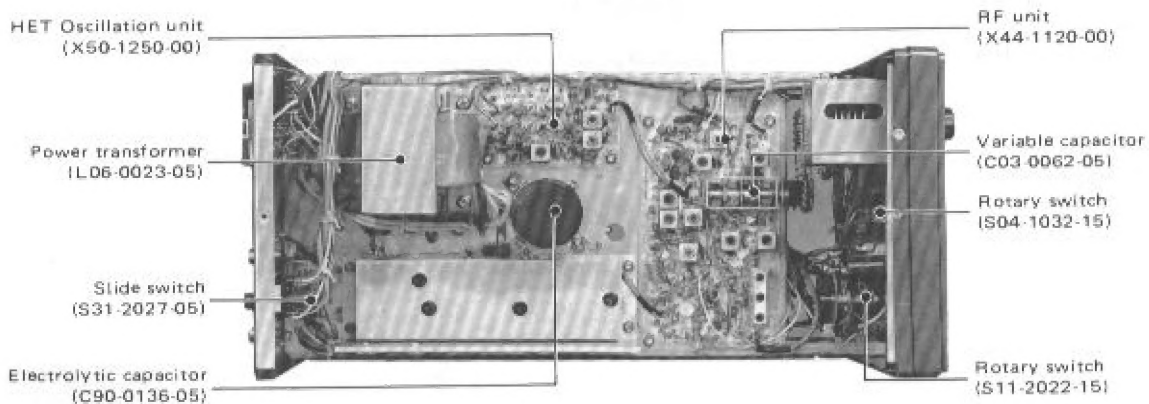
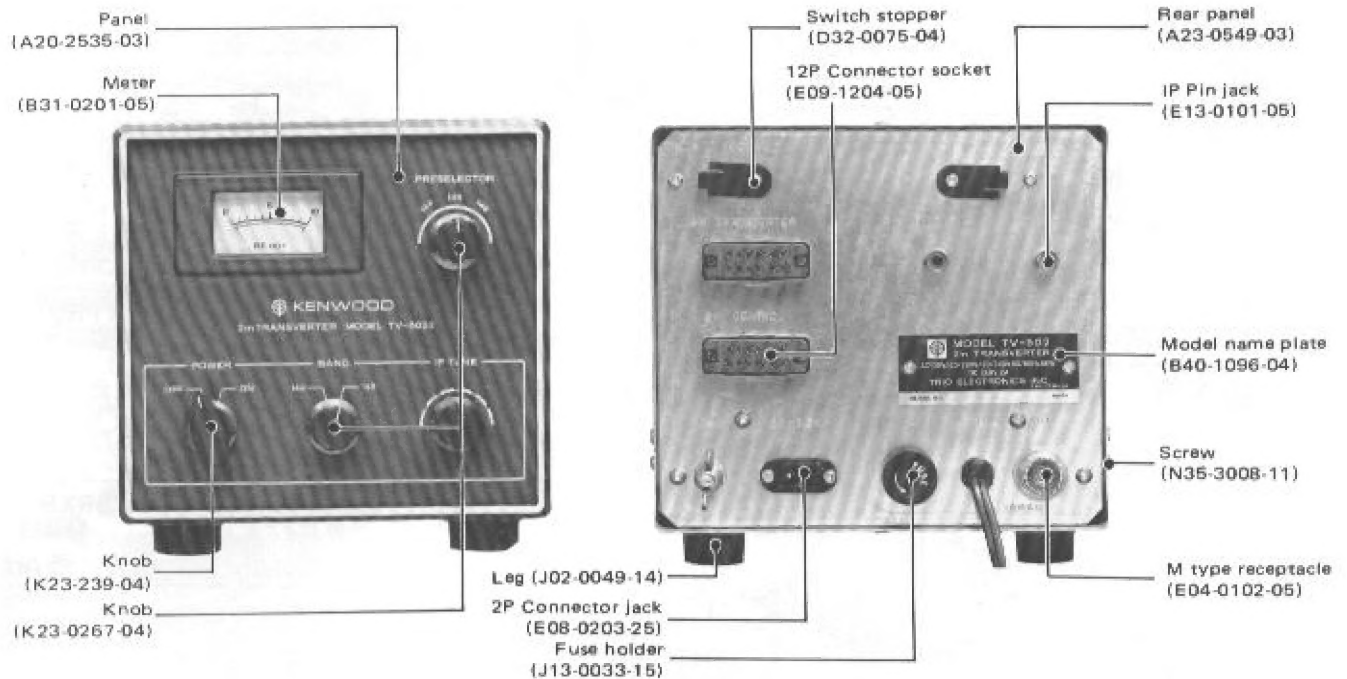


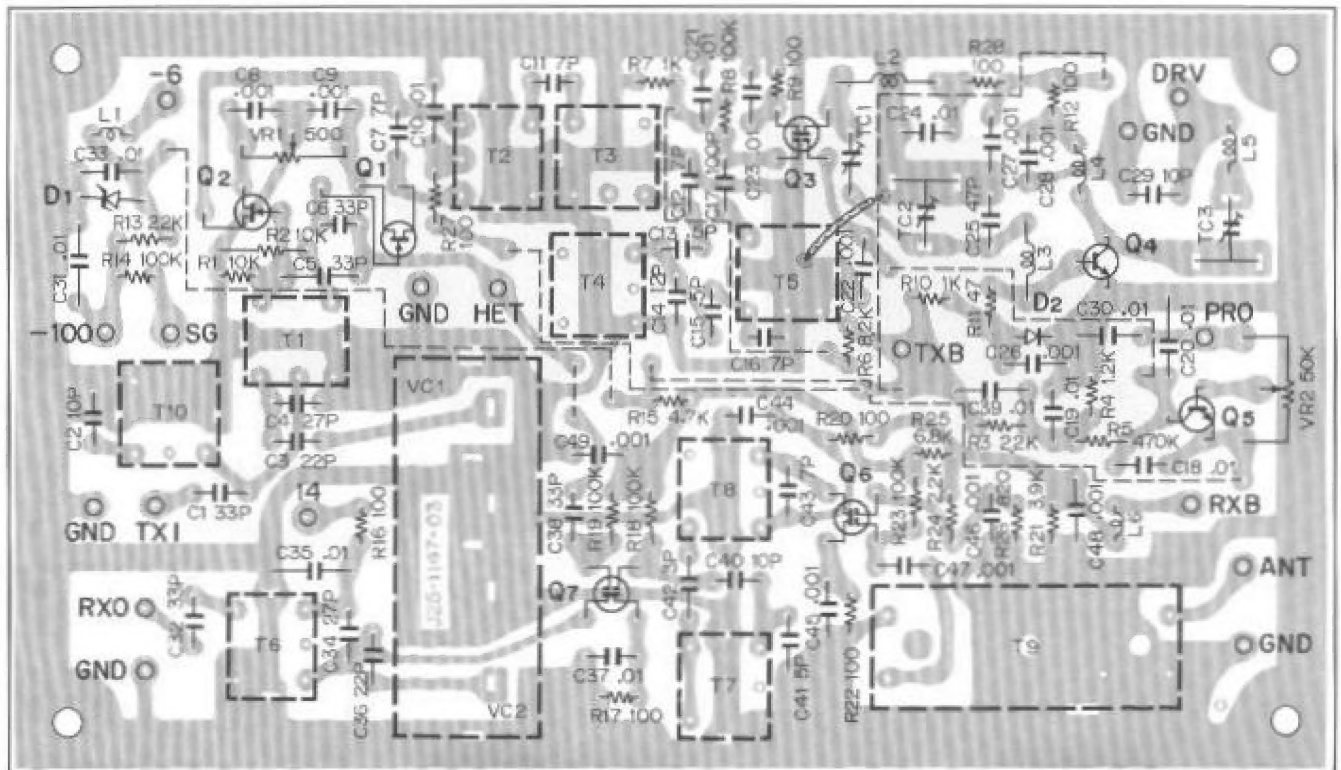
Fig. 6 Connection of DC Plug

# PARTS ALIGNMENT



# PC BOARD

▼ RF (X44-1120-00)

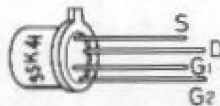


Q1,2: 2SK19 (GR), Q3,6,7: 3SK41 (L), Q4: 2SC998, Q5: 2SC733 (Y), D1: WZ-061, D2: IS 1555

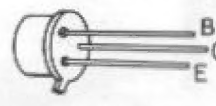
2SK19 (GR)



3SK41 (L)



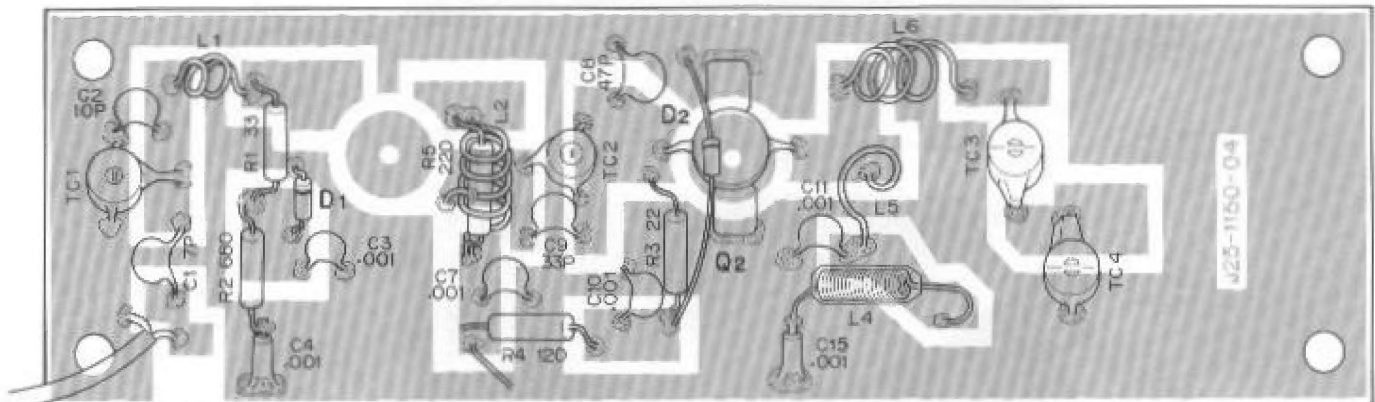
2SC998



2SC733 (Y)

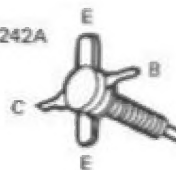


▼ FINAL (X56-1150-00)



Q2: 2SC1242A, D1,2: IS1555

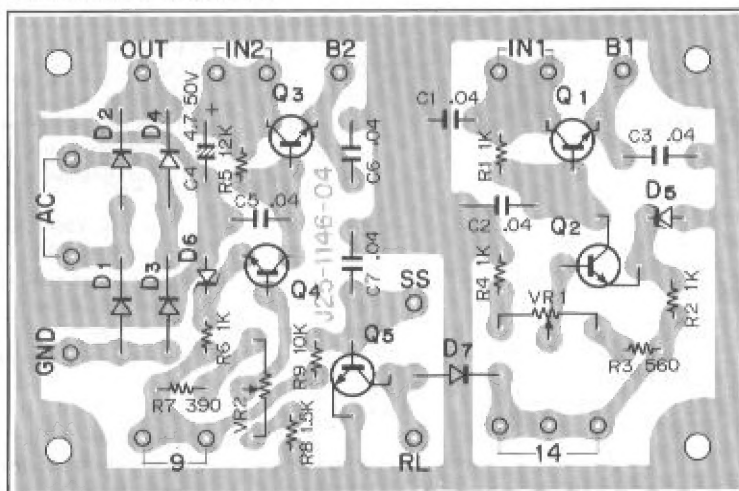
2SC1242A





## PC BOARD

▼ RECTIFIER AVR (X43-1150-00)

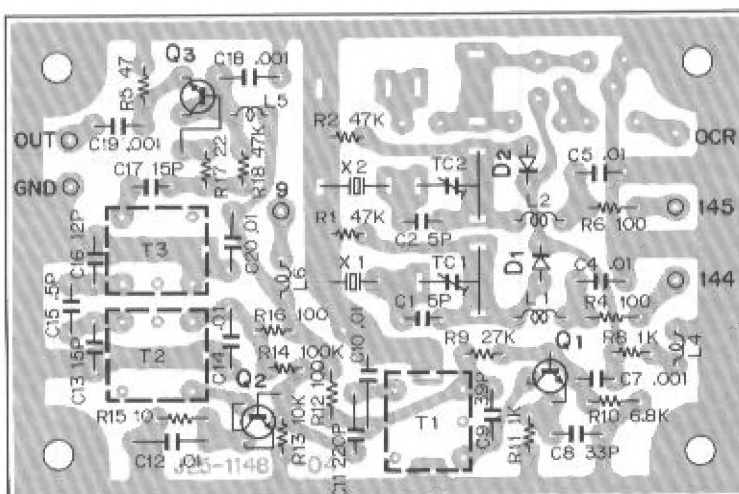


Q1~4: 2SC733(Y), D1~4: U05B, D5: WZ090, D6: WZ061  
Q5: 2SC735(Y) D7: V06B

2SC733 (Y)  
2SC735 (Y)

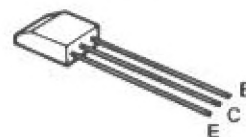


▼ CONTROL (X53-1040-00)

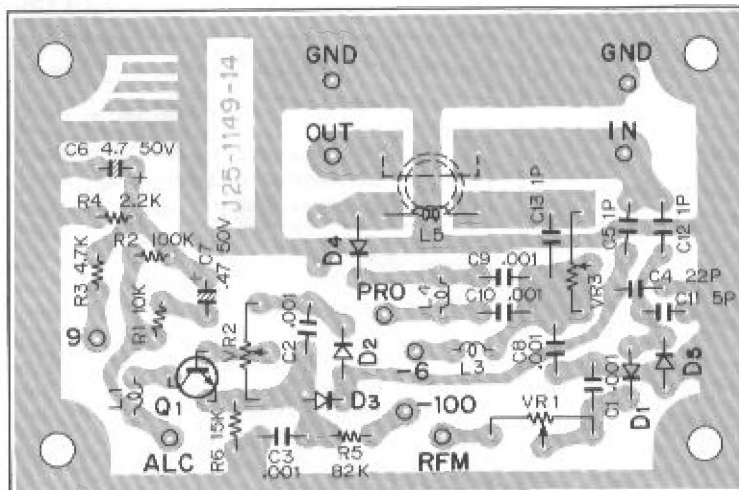


Q<sub>1</sub>: 2SC535(A), Q<sub>2,3</sub>: 2SC460(B), D<sub>1,2</sub>: 1N60

2SC535 (A)  
2SC460 (B)



▼ HET. OSC. (X50-1250-00)



Q<sub>1</sub>: 2SC733 (Y), D<sub>1~5</sub>: 1N60

25C733 (Y)



# PARTS LIST

## TV-502 TRANSVERTER (Overall parts list)

| Ref. No.                  | Parts No.    | Description                                  | Re-<br>marks |
|---------------------------|--------------|----------------------------------------------|--------------|
| <b>CAPACITOR</b>          |              |                                              |              |
| C1                        | CK45F1H103Z  | Ceramic 0.01 $\mu$ F +80%, -20%              |              |
| C2, 3                     | CK45F1E403Z  | Ceramic 0.04 $\mu$ F +80%, -20%              |              |
| C4                        | CE02W1E222   | Electrolytic 2200 $\mu$ F 25WV               |              |
| C5, 6                     | CK45F1E403Z  | Ceramic 0.04 $\mu$ F +80%, -20%              |              |
| C7                        | C90-0136-05  | Electrolytic 6800 $\mu$ F 35WV               |              |
| C8                        | CK45F1H103Z  | Ceramic 0.01 $\mu$ F +80%, -20%              |              |
| C9                        | CC45SL2H020C | Ceramic 2pF $\pm$ 0.25pF                     |              |
| C10                       | CK45F1E403Z  | Ceramic 0.04 $\mu$ F +80%, -20%              |              |
| <b>RESISTER</b>           |              |                                              |              |
| R1                        | RN14AB3D100J | Metal film 10 $\Omega$ $\pm$ 5% 2W           |              |
| <b>SEMICONDUCTOR</b>      |              |                                              |              |
| D1                        | V11-0270-05  | Diode U05B                                   |              |
| <b>TRANSFORMER / COIL</b> |              |                                              |              |
| T1                        | L06-0032-05  | Power transformer                            |              |
| CH1                       | L15-0001-15  | Choke coil (low frequency)                   |              |
| L1                        | L33-0074-05  | Choke coil (heater) (0.3 $\mu$ H)            |              |
| L2, 3                     | L40-1011-03  | Ferri-inductor x 2 (100 $\mu$ H)             |              |
| —                         | L34-0475-05  | VHF coil                                     |              |
| —                         | L34-0476-05  | VHF coil                                     |              |
| <b>SWITCH</b>             |              |                                              |              |
| S1                        | S11-2022-15  | Rotary switch                                |              |
| S3                        | S04-1032-15  | Rotary switch                                |              |
| S4, 5                     | S31-2027-05  | Slide switch x 2                             |              |
| <b>MISCELLANEOUS</b>      |              |                                              |              |
| —                         | A01-0255-02  | Case (A)                                     |              |
| —                         | A01-0256-02  | Case (B)                                     |              |
| —                         | A10-0413-11  | Chassis                                      |              |
| —                         | A20-2535-03  | Panel                                        |              |
| —                         | A22-0166-13  | Sub-panel                                    |              |
| —                         | A23-0549-03  | Rear panel                                   |              |
| —                         | B01-0078-23  | Escutcheon                                   |              |
| —                         | B30-0002-05  | Pilot lamp (12V, 3W)                         |              |
| M                         | B31-0201-05  | Meter                                        |              |
| —                         | B40-1096-04  | Model name plate                             |              |
| —                         | B42-0545-04  | Sticker (fuse)                               |              |
| —                         | B58-0194-00  | Caution card                                 |              |
| —                         | B50-1300-00  | Operation manual                             |              |
| —                         | B58-0190-00  | Caution card<br>(Power supply voltage) (TAG) |              |
| —                         | B58-0191-00  | Caution card<br>(Power supply voltage)       |              |
| —                         | D13-0032-03  | Sprocket                                     |              |
| —                         | D16-0050-04  | Chain assembly                               |              |
| —                         | D20-0108-04  | Dial shaft                                   |              |
| —                         | D32-0075-04  | Switch stopper x 3                           |              |
| —                         | E03-0301-05  | Plug                                         |              |
| J5                        | E04-0102-05  | M type receptacle                            |              |
| J6                        | E08-0203-25  | 2P connector jack                            |              |
| J3, 4                     | E08-1208-05  | 12P connector socket x 2                     |              |
| —                         | E09-0203-15  | 2P connector plug                            |              |
| —                         | E09-1204-05  | 12P connector plug x 3                       |              |
| J1, 2                     | E13-0101-05  | 1P jack x 2                                  |              |
| —                         | E14-0115-05  | 1P plug x 3                                  |              |
| —                         | E15-0038-05  | Pilot socket                                 |              |
| —                         | E19-0207-05  | Plug (interchangeable)                       |              |

| Ref. No. | Parts No.   | Description                    | Re-<br>marks |
|----------|-------------|--------------------------------|--------------|
| —        | E22-0216-05 | Lug x 3                        |              |
| —        | E22-0415-05 | Lug                            |              |
| —        | E23-0055-05 | Hermetic seal                  |              |
| —        | E23-0069-05 | Terminal (for grand cable) x 2 |              |
| —        | E23-0071-04 | Lug (antenna earth)            |              |
| —        | E30-0019-05 | Connecting cable               |              |
| —        | F05-1023-05 | Fuse (1A, 100V) x 2            |              |
| —        | F05-5013-05 | Fuse (0.5A, 220V) x 2          |              |
| —        | F07-0365-04 | Cover (filter case)            |              |
| —        | F07-0366-04 | Cover (filter case)            |              |
| —        | F11-0211-04 | Filter case                    |              |
| —        | F19-0184-04 | Meter stopping plate           |              |
| —        | J02-0049-14 | Leg x 6                        |              |
| —        | J13-0033-15 | Fuse holder                    |              |
| —        | J19-0452-04 | Transformer retainer x 2       |              |
| —        | J21-0392-04 | Lead holder                    |              |
| —        | J32-1030-14 | Round boss x 2                 |              |
| —        | J41-0024-15 | Cord bushing                   |              |
| —        | J61-0014-05 | Free up belt                   |              |
| —        | J61-0019-05 | Cable wrapping band x 7        |              |
| —        | K21-0267-04 | Knob x 3                       |              |
| —        | K23-0239-04 | Knob                           |              |
| —        | N35-3008-11 | Screw x 16                     |              |
| RL1      | S51-4017-25 | Relay                          |              |
| —        | H01-1275-04 | Carton case                    |              |
| —        | H03-0387-04 | Carton case (external)         |              |
| —        | H10-1200-02 | Buffer fixture x 2             |              |
| —        | H10-1201-04 | Buffer fixture                 |              |
| —        | H20-0276-03 | Protection bag                 |              |
| —        | H25-0016-00 | Polyethylene bag               |              |
| —        | H25-0105-04 | Protection bag                 |              |
| —        | X43-1150-00 | Rectifier AVR unit             |              |
| —        | X44-1120-00 | RF unit                        |              |
| —        | X50-1250-00 | HET oscillator unit            |              |
| —        | X53-1040-00 | Control unit                   |              |
| —        | X56-1150-00 | Final unit                     |              |

## RECTIFIER AVR UNIT (X43-1150-00)

| Ref. No.         | Parts No.      | Description                        | Re-<br>marks |
|------------------|----------------|------------------------------------|--------------|
| <b>CAPACITOR</b> |                |                                    |              |
| C1 ~ 3           | CK45F1E403Z    | Ceramic 0.04 $\mu$ F +80%—20%      |              |
| C4               | CE04W1H4R7(RL) | Electrolytic 4.7 $\mu$ F 50WV      |              |
| C5 ~ 7           | CK45F1E403Z    | Ceramic 0.04 $\mu$ F +80%—20%      |              |
| <b>RESISTOR</b>  |                |                                    |              |
| R1, 2            | PD14CY2E102J   | Carbon 1k $\Omega$ $\pm$ 5% 1/4W   |              |
| R3               | PD14CY2E561J   | Carbon 560 $\Omega$ $\pm$ 5% 1/4W  |              |
| R4               | PD14CY2E102J   | Carbon 1k $\Omega$ $\pm$ 5% 1/4W   |              |
| R5               | PD14CY2E123J   | Carbon 12k $\Omega$ $\pm$ 5% 1/4W  |              |
| R6               | PD14CY2E102J   | Carbon 1k $\Omega$ $\pm$ 5% 1/4W   |              |
| R7               | PD14CY2E391J   | Carbon 390 $\Omega$ $\pm$ 5% 1/4W  |              |
| R8               | PD14CY2E152J   | Carbon 1.5k $\Omega$ $\pm$ 5% 1/4W |              |
| R9               | PD14CY2E103J   | Carbon 10k $\Omega$ $\pm$ 5% 1/4W  |              |

# PARTS LIST

| Ref. No.             | Parts No.   | Description           | Re-<br>marks |
|----------------------|-------------|-----------------------|--------------|
| <b>SEMICONDUCTOR</b> |             |                       |              |
| Q1 ~ 4               | V03-0123-05 | Transistor 2SC733 (Y) |              |
| Q5                   | V03-0241-09 | Transistor 2SC735 (Y) |              |
| D1 ~ 4               | V11-0270-05 | Diode U05B            |              |
| D5                   | V11-0240-05 | Zener diode WZ-090    |              |
| D6                   | V11-0243-05 | Zener diode WZ-061    |              |
| D7                   | V11-0219-05 | Diode V06B            |              |
| <b>POTENTIOMETER</b> |             |                       |              |
| VR1                  | R12-1020-05 | Volume 1k $\Omega$    |              |
| VR2                  | R12-0042-05 | Volume 500 $\Omega$   |              |
| <b>MISCELLANEOUS</b> |             |                       |              |
| —                    | E23-0047-04 | Terminal x 17         |              |
| —                    | J25-1146-04 | PC board              |              |

## RF UNIT (X44-1120-00)

| Ref. No.         | Parts No.     | Description                               | Re-<br>marks |
|------------------|---------------|-------------------------------------------|--------------|
| <b>CAPACITOR</b> |               |                                           |              |
| C1               | CC45SL1H330J  | Ceramic 33pF $\pm 5\%$                    |              |
| C2               | CC45CH1H100J  | Ceramic 10pF $\pm 5\%$                    |              |
| C3               | CC45CH1H220J  | Ceramic 22pF $\pm 5\%$                    |              |
| C4               | CC45CH1H270J  | Ceramic 27pF $\pm 5\%$                    |              |
| C5, 6            | CC45SL1H330J  | Ceramic 33pF $\pm 5\%$                    |              |
| C7               | CC45CH1H070D  | Ceramic 7pF $\pm 0.5\text{pF}$            |              |
| C8, 9            | CC45D1H102M   | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$    |              |
| C10              | CK45F1H103ZTP | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C11              | CC45SL1H070D  | Ceramic 7pF $\pm 0.5\text{pF}$            |              |
| C12              | CC45CH1H070D  | Ceramic 7pF $\pm 0.5\text{pF}$            |              |
| C13              | C90-0231-05   | Ceramic 0.5pF $\pm 0.5\text{pF}$          |              |
| C14              | CC45CH1H120J  | Ceramic 12pF $\pm 5\%$                    |              |
| C15              | C90-0231-05   | Ceramic 0.5pF $\pm 0.5\text{pF}$          |              |
| C16              | CC45CH070D    | Ceramic 7pF $\pm 0.5\text{pF}$            |              |
| C17              | CC45SL1H101J  | Ceramic 100pF $\pm 5\%$                   |              |
| C18~21           | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C22              | CK45D1H102M   | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$    |              |
| C23, 24          | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C25              | CC45SL1H470J  | Ceramic 470pF $\pm 5\%$                   |              |
| C26~28           | CK45D1H102M   | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$    |              |
| C29              | CC45SL1H100D  | Ceramic 10pF $\pm 0.5\text{pF}$           |              |
| C30, 31          | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C32              | CC45SL1H330J  | Ceramic 33pF $\pm 5\%$                    |              |
| C33              | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C34              | CC45CH1H270J  | Ceramic 27pF $\pm 5\%$                    |              |
| C35              | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C36              | CC45CH1H220J  | Ceramic 22pF $\pm 5\%$                    |              |
| C37              | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C38              | CC45SL1H330J  | Ceramic 33pF $\pm 5\%$                    |              |
| C39              | CK45F1H103ZTD | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C40              | CC45SL1H100D  | Ceramic 10pF $\pm 0.5\text{pF}$           |              |
| C41              | CC45CH1H050D  | Ceramic 5pF $\pm 0.5\text{pF}$            |              |
| C42              | CC45SL1H030D  | Ceramic 3pF $\pm 0.5\text{pF}$            |              |
| C43              | CC45CH1H070D  | Ceramic 7pF $\pm 0.5\text{pF}$            |              |
| C44~49           | CK45D1H102M   | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$    |              |
| C50              | CK45F1H103Z   | Ceramic 0.01 $\mu\text{F}$ $+80\%, -20\%$ |              |
| C51              | CK45F1E403Z   | Ceramic 0.04 $\mu\text{F}$ $+80\%, -20\%$ |              |

| Ref. No.                            | Parts No.    | Description                           | Re-<br>marks |
|-------------------------------------|--------------|---------------------------------------|--------------|
| <b>RESISTOR</b>                     |              |                                       |              |
| R1, 2                               | PD14CY2E103J | Carbon 10k $\Omega$ $\pm 5\%$ 1/4W    |              |
| R3                                  | PD14CY2E222J | Carbon 2.2k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R4                                  | PD14CY2E122J | Carbon 1.2k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R5                                  | PD14CY2E474J | Carbon 470k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R6                                  | PD14CY2E822J | Carbon 8.2k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R7                                  | PD14CY2E102J | Carbon 1k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R8                                  | PD14CY2E104J | Carbon 100k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R9                                  | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W    |              |
| R10                                 | PD14CY2E102J | Carbon 1k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R11                                 | PD14CY2E470J | Carbon 47 $\Omega$ $\pm 5\%$ 1/4W     |              |
| R12                                 | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W    |              |
| R13                                 | RC05GF2H223J | Carbon 22k $\Omega$ $\pm 5\%$ 1/2W    |              |
| R14                                 | RN14AB3D104J | Metal film 100k $\Omega$ $\pm 5\%$ 2W |              |
| R15                                 | PD14CY2E472J | Carbon 4.7k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R16, 17                             | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W    |              |
| R18, 19                             | PD14CY2E104J | Carbon 100k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R20                                 | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W    |              |
| R21                                 | PD14CY2E392J | Carbon 3.9k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R22                                 | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W    |              |
| R23                                 | PD14CY2E104J | Carbon 100k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R24                                 | PD14CY2E222J | Carbon 2.2k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R25                                 | PD14CY2E682J | Carbon 6.8k $\Omega$ $\pm 5\%$ 1/4W   |              |
| R26                                 | PD14CY2E821J | Carbon 820 $\Omega$ $\pm 5\%$ 1/4W    |              |
| R27, 28                             | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W    |              |
| <b>SEMICONDUCTOR</b>                |              |                                       |              |
| Q1, 2                               | V09-0012-05  | FET 2SK19 (GR)                        |              |
| Q3                                  | V09-0057-05  | FET 3SK41 (L)                         |              |
| Q4                                  | V03-0168-05  | Transistor 2SC998                     |              |
| Q5                                  | V03-0123-05  | Transistor 3SC733 (Y)                 |              |
| Q6, 7                               | V09-0057-05  | FET 3SK41 (L)                         |              |
| D1                                  | V11-0243-05  | Zener diode WZ-061                    |              |
| D2                                  | V11-0263-05  | Diode 1S1555                          |              |
| <b>COIL</b>                         |              |                                       |              |
| T1                                  | L31-0348-05  | Tuning coil (28 MHz)                  |              |
| T2                                  | L31-0349-05  | Tuning coil (BM)                      |              |
| T3                                  | L31-0350-05  | Tuning coil (144 MHz)                 |              |
| T4                                  | L31-0266-05  | Tuning coil (144 MHz)                 |              |
| T5                                  | L31-0267-05  | Tuning coil (144 MHz)                 |              |
| T6                                  | L31-0348-05  | Tuning coil (28 MHz)                  |              |
| T7, 8                               | L31-0350-05  | Tuning coil (144 MHz)                 |              |
| T9                                  | L79-0022-05  | Helical filter                        |              |
| T10                                 | L31-0266-05  | Tuning coil (144 MHz)                 |              |
| L1                                  | L40-1011-03  | Ferri-inductor (100 $\mu\text{H}$ )   |              |
| L2                                  | L34-0388-05  | VHF coil                              |              |
| L3                                  | L34-0432-05  | VHF coil                              |              |
| L4, 5                               | L34-0430-05  | VHF coil                              |              |
| L6                                  | L34-1511-03  | Ferri-inductor (150 $\mu\text{H}$ )   |              |
| <b>VARIABLE CAPACITOR / TRIMMER</b> |              |                                       |              |
| VC1,2                               | C01-0166-15  | Variable capacitor (29P x 4)          |              |
| TC1                                 | C05-0030-15  | Ceramic trimmer (20PF)                |              |
| TC2,3                               | C05-0015-15  | Ceramic trimmer (40PF)                |              |
| <b>POTENTIOMETER</b>                |              |                                       |              |
| VR1                                 | R12-0042-05  | Volume 500 $\Omega$                   |              |
| VR2                                 | R12-4016-05  | Volume 50k $\Omega$                   |              |
| <b>MISCELLANEOUS</b>                |              |                                       |              |
| —                                   | D13-0032-03  | Sprocket                              |              |
| —                                   | E23-0047-04  | Terminal x 17                         |              |
| —                                   | J25-1147-03  | PC board                              |              |

# PARTS LIST

## HET UNIT (X50-1250-00)

| Ref. No.                      | Parts No.    | Description                            | Re-<br>marks |
|-------------------------------|--------------|----------------------------------------|--------------|
| <b>CAPACITOR</b>              |              |                                        |              |
| C1, 2                         | CC45SL1H050D | Ceramic 5pF $\pm 0.5\text{pF}$         |              |
| C4, 5                         | CK45F1H103Z  | Ceramic 0.01 $\mu\text{F}$ +80%, -20%  |              |
| C7                            | CK45D1H102M  | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$ |              |
| C8                            | CC45SL1H330J | Ceramic 33pF $\pm 5\%$                 |              |
| C9                            | CC45TH1H390J | Ceramic 39pF $\pm 5\%$                 |              |
| C10                           | CK45F1H103Z  | Ceramic 0.01 $\mu\text{F}$ +80%, -20%  |              |
| C11                           | CC45SL1H221J | Ceramic 220pF $\pm 5\%$                |              |
| C12                           | CK45F1H103Z  | Ceramic 0.01 $\mu\text{F}$ +80%, -20%  |              |
| C13                           | CC45CH1H150J | Ceramic 15pF $\pm 5\%$                 |              |
| C14                           | CK45F1H103Z  | Ceramic 0.01 $\mu\text{F}$ +80%, -20%  |              |
| C15                           | C90-0231-05  | Ceramic 0.5pF +80%, -20%               |              |
| C16                           | CC45CH1H120J | Ceramic 12pF $\pm 5\%$                 |              |
| C17                           | CC45SL1H150J | Ceramic 15pF $\pm 5\%$                 |              |
| C18,19                        | CK45D1H102M  | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$ |              |
| C20                           | CK45F1H103Z  | Ceramic 0.01 $\mu\text{F}$ +80%, -20%  |              |
| <b>RESISTOR</b>               |              |                                        |              |
| R1, 2                         | PD14CY2E473J | Carbon 47k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R4                            | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W     |              |
| R5                            | PD14CY2E470J | Carbon 47 $\Omega$ $\pm 5\%$ 1/4W      |              |
| R6                            | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W     |              |
| R8                            | PD14CY2E102J | Carbon 1k $\Omega$ $\pm 5\%$ 1/4W      |              |
| R9                            | PD14CY2E273J | Carbon 27k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R10                           | PD14CY2E682J | Carbon 6.8k $\Omega$ $\pm 5\%$ 1/4W    |              |
| R11                           | PD14CY2E102J | Carbon 1k $\Omega$ $\pm 5\%$ 1/4W      |              |
| R12                           | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W     |              |
| R13                           | PD14CY2E103J | Carbon 10k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R14                           | PD14CY2E104J | Carbon 100k $\Omega$ $\pm 5\%$ 1/4W    |              |
| R15                           | PD14CY2E100J | Carbon 10 $\Omega$ $\pm 5\%$ 1/4W      |              |
| R16                           | PD14CY2E101J | Carbon 100 $\Omega$ $\pm 5\%$ 1/4W     |              |
| R17                           | PD14CY2E220J | Carbon 220 $\Omega$ $\pm 5\%$ 1/4W     |              |
| R18                           | PD14CY2E473J | Carbon 47k $\Omega$ $\pm 5\%$ 1/4W     |              |
| <b>SEMICONDUCTOR</b>          |              |                                        |              |
| Q1                            | V03-0104-05  | Transistor 2SC535 (A)                  |              |
| Q2, 3                         | V03-0079-05  | Transistor 2SC460 (B)                  |              |
| D1, 2                         | V11-0551-05  | Diode 1N60                             |              |
| <b>COIL / X'tal / TRIMMER</b> |              |                                        |              |
| T1                            | L32-0182-05  | Oscillation coil                       |              |
| T2, 3                         | L31-0267-05  | Tuning coil                            |              |
| L1, 2                         | L40-1511-03  | Ferri-inductor (150 $\mu\text{H}$ )    |              |
| L4                            | L40-1511-03  | Ferri-inductor (150 $\mu\text{H}$ )    |              |
| L5, 6                         | L40-1011-03  | Ferri-inductor (100 $\mu\text{H}$ )    |              |
| X1                            | L77-0401-05  | Crystal oscillator (38.666 MHz)        |              |
| X2                            | L77-0409-05  | Crystal oscillator (39 MHz)            |              |
| TC1, 2                        | C05-0029-15  | Ceramic trimmer                        |              |
| <b>MISCELLANEOUS</b>          |              |                                        |              |
| —                             | E18-0201-05  | Crystal socket                         |              |
| —                             | E23-0047-05  | Terminal x 5                           |              |
| —                             | J25-1148-09  | PC board                               |              |

## CONTROL UNIT (X53-1040-00)

| Ref. No.             | Parts No.      | Description                            | Re-<br>marks |
|----------------------|----------------|----------------------------------------|--------------|
| <b>CAPACITOR</b>     |                |                                        |              |
| C1 ~ 3               | CK45D1H102M    | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$ |              |
| C4                   | CC45SL2H220J   | Ceramic 22pF $\pm 5\%$                 |              |
| C5                   | CC45SL2H010C   | Ceramic 1pF $\pm 0.25\text{pF}$        |              |
| C6                   | CE04W1H4R7(RL) | Electrolytic 4.7 $\mu\text{F}$ 50WV    |              |
| C7                   | CE04W1HR47(RL) | Electrolytic 0.47 $\mu\text{F}$ 50W    |              |
| C8 ~ 10              | CK45D1H102M    | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$ |              |
| C11                  | CC45SL2H050C   | Ceramic 5pF $\pm 0.25\text{pF}$        |              |
| C12,13               | CC45SL2H010C   | Ceramic 1pF $\pm 0.25\text{pF}$        |              |
| C14                  | CK45D1H102M    | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$ |              |
| <b>RESISTOR</b>      |                |                                        |              |
| R1                   | PD14CY2E103J   | Carbon 10k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R2                   | PD14CY2E104J   | Carbon 100k $\Omega$ $\pm 5\%$ 1/4W    |              |
| R3                   | PD14CY2E472J   | Carbon 4.7k $\Omega$ $\pm 5\%$ 1/4W    |              |
| R4                   | PD14CY2E222J   | Carbon 2.2k $\Omega$ $\pm 5\%$ 1/4W    |              |
| R5                   | PD14CY2E823J   | Carbon 82k $\Omega$ $\pm 5\%$ 1/4W     |              |
| R6                   | PD14CY2E153J   | Carbon 15k $\Omega$ $\pm 5\%$ 1/4W     |              |
| <b>SEMICONDUCTOR</b> |                |                                        |              |
| Q1                   | V03-0123-05    | Transistor 2SC733 (Y)                  |              |
| D1 ~ 5               | V11-0051-05    | Diode 1N60                             |              |
| <b>COIL</b>          |                |                                        |              |
| L1                   | L40-1011-03    | Ferri-inductor (100 $\mu\text{H}$ )    |              |
| L3                   | L33-0025-05    | Choke coil (1 $\mu\text{H}$ )          |              |
| L4                   | L40-1011-03    | Ferri-inductor (100 $\mu\text{H}$ )    |              |
| L5                   | L39-0052-05    | Detecting coil                         |              |
| <b>POTENTIOMETER</b> |                |                                        |              |
| VR1                  | R12-5014-05    | Volume 100k $\Omega$                   |              |
| VR2                  | R12-4016-05    | Volume 50k $\Omega$                    |              |
| VR3                  | R12-0042-05    | Volume 500 $\Omega$                    |              |
| <b>MISCELLANEOUS</b> |                |                                        |              |
| —                    | E23-0047-04    | Terminal x 10                          |              |
| —                    | J25-1149-14    | PC board                               |              |

## FINAL UNIT (X56-1150-00)

| Ref. No.         | Parts No.    | Description                                    | Re-<br>marks |
|------------------|--------------|------------------------------------------------|--------------|
| <b>CAPACITOR</b> |              |                                                |              |
| C1               | CC45SL2H070D | Ceramic 7pF $\pm 0.5\text{pF}$                 |              |
| C2               | CC45SL2H100J | Ceramic 10pF $\pm 5\%$                         |              |
| C3               | CK45D1H102M  | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$         |              |
| C4               | CK18E2H102P  | Ceramic 0.001 $\mu\text{F}$ +100%, -0%         |              |
| C5, 6            | C90-0117-05  | Ceramic 0.001 $\mu\text{F}$ +100%, -0%         |              |
| C7               | CK45D1H102M  | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$         |              |
| C8               | CC45SL2H470J | Ceramic 47pF $\pm 5\%$                         |              |
| C9               | CC45SL2H330J | Ceramic 33pF $\pm 5\%$                         |              |
| C10,11           | CK45D1H102M  | Ceramic 0.001 $\mu\text{F}$ $\pm 20\%$         |              |
| C12              | CC45SL2H270J | Ceramic 27pF $\pm 5\%$                         |              |
| C13              | CC45SL2H070D | Ceramic 7pF $\pm 0.5\text{pF}$                 |              |
| C14              | C90-0117-05  | Ceramic 0.001 $\mu\text{F}$ $\pm 0.5\text{pF}$ |              |
| C15              | CK18E2H102P  | Ceramic 0.001 $\mu\text{F}$ +100%, -0%         |              |

## PARTS LIST

| Ref. No.              | Parts No.    | Description            | Re-<br>marks |
|-----------------------|--------------|------------------------|--------------|
| <b>RESISTOR</b>       |              |                        |              |
| R1                    | RC05GF2H330J | Carbon 33Ω ±5% 1/2W    |              |
| R2                    | RC05GF2H681J | Carbon 680Ω ±5% 1/2W   |              |
| R3                    | PC05GF2H220J | Carbon 22Ω ±5% 1/2W    |              |
| R4                    | RC05GF2H121J | Carbon 120Ω ±5% 1/2W   |              |
| R5                    | RC05GF2H221J | Carbon 220Ω ±5% 1/2W   |              |
| R6                    | RN14AB3D151J | Carbon 150Ω ±5% 2W     |              |
| <b>SEMICONDUCTOR</b>  |              |                        |              |
| Q1                    | V03-0350-05  | Transistor 2SC1169     |              |
| Q2                    | V03-0349-05  | Transistor 2SC1242A    |              |
| Q3, 4                 | V04-0046-05  | Transistor 2SD235 (Y)  |              |
| D1, 2                 | V11-0076-05  | Diode 1S1555           |              |
| <b>COIL / TRIMMER</b> |              |                        |              |
| L1                    | L34-0426-05  | VHF coil               |              |
| L2                    | L34-0464-05  | VHF coil               |              |
| L4                    | L33-0074-05  | Heater choke (0.3μH)   |              |
| L5                    | L34-0378-05  | VHF coil               |              |
| L6                    | L34-0465-05  | VHF coil               |              |
| L7                    | L34-0466-05  | VHF coil               |              |
| L8                    | L34-0467-05  | VHF coil               |              |
| TC1,2                 | C05-0013-15  | Ceramic trimmer (20PF) |              |
| TC3                   | C05-0057-05  | Ceramic trimmer (20PF) |              |
| TC4                   | C05-0060-05  | Ceramic trimmer (45PF) |              |
| <b>MISCELLANEOUS</b>  |              |                        |              |
| —                     | E23-0001-05  | Hermetic seal x 2      |              |
| —                     | F01-0198-04  | Heat sink              |              |
| —                     | F07-0358-14  | Final cover            |              |
| —                     | F10-0358-04  | Shield plate (final)   |              |
| —                     | F11-0205-04  | Shield case (final)    |              |
| —                     | F20-0078-05  | Insulating plate x 2   |              |
| —                     | J25-1150-04  | PC board               |              |

| Ref. No. | Parts No. | Description | Re-<br>marks |
|----------|-----------|-------------|--------------|
|          |           |             |              |

# TROUBLESHOOTING

## RECEIVING SECTION

| SYMPTOM                          | CAUSE                                                                                                                                                                                                                                                                                                                              | REMEDY                                                                                                                                                                                |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. No power supply is available. | 1) Blown fuse<br>2) Defective power switch<br>3) Disconnection near plug                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>○ Replace</li> <li>○ Check and replace</li> <li>○ Check power cord</li> </ul>                                                                  |
| 2. Blown fuse                    | 1) Defective rectifier diode U05B of Rectifier AVR unit (X43-1150-00)<br>2) 15 Volt B circuit shorted to chassis                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>○ Replace</li> <li>○ Check and rewire</li> </ul>                                                                                               |
| 3. Too low sensitivity           | 1) Disconnection or short circuit of connecting wire<br>2) Defective FET Q6, Q7 of RF unit (X44-1120-00)<br>3) Poor adjustment of tuning circuit of RF unit (X44-1120-00)<br>4) Defective D6 (WZ061) of RF unit (X44-1120-00)<br>5) Poor adjustment of Helical resonator<br>6) Poor contact of relay                               | <ul style="list-style-type: none"> <li>○ Check and replace</li> <li>○ Replace</li> <li>○ Readjust T6, T7, T8, T9</li> <li>○ Replace</li> <li>○ Readjust</li> <li>○ Replace</li> </ul> |
| 4. No receiver noise             | 1) Poor adjustment of oscillating coil of HET oscillator unit (X50-1250-00)<br>2) Defective diode switch of HET oscillator unit (X50-1250-00)<br>3) Poor contact of band-switch of HET oscillator unit (X50-1250-00)<br>4) Disconnection of output coaxial cable<br>5) Disconnection of antenna circuit or IF output coaxial cable | <ul style="list-style-type: none"> <li>○ Readjust</li> <li>○ Replace</li> <li>○ Check contact</li> <li>○ Check contact</li> <li>○ Check and rewire</li> </ul>                         |

## TRANSMITTING SECTION

| SYMPTOM                                                                  | CAUSE                                                                                                                                                                                                                                                                                                                                                                                          | REMEDY                                                                                                                                                                                                            |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. No output                                                             | 1) Defective Q1, Q2 of Final unit (X56-1150-00)<br>2) Defective Q1, Q2, Q3, Q4, Q5 of RF unit (X44-1120-00)<br>3) Poor adjustment of oscillating coil of HET oscillator unit (X50-1250-00)<br>4) Disconnecting of input or output coaxial cable<br>5) Poor adjustment of VR3 of Control unit (X53-1040-00)<br>6) Poor contact of relay<br>7) Disconnecting or short circuit of connecting cord | <ul style="list-style-type: none"> <li>○ Replace</li> <li>○ Replace</li> <li>○ Readjust</li> <li>○ Check contact and rewire</li> <li>○ Readjust</li> <li>○ Replace</li> <li>○ Check and replace</li> </ul>        |
| 2. Low output                                                            | 1) Poor adjustment of trimmer capacitor of Final unit (X56-1150-00)<br>2) Poor tuning of tuning circuit of RF unit (X44-1120-00)<br>3) Poor adjustment of T2, T3 of HET oscillator unit (X50-1250-00)<br>4) Poor adjustment of VR2, VR3 of control unit (X53-1040-00)<br>5) Defective Q1, Q3, D5, D6 of Rectifier AVR unit (X43-1150-00)                                                       | <ul style="list-style-type: none"> <li>○ Readjust</li> <li>○ Readjust</li> <li>○ Readjust</li> <li>○ Readjust</li> <li>○ Replace</li> </ul>                                                                       |
| 3. Too high or too low deflection of RF meter                            | 1) Poor adjustment of VR1 of Control unit (X53-1040-00)                                                                                                                                                                                                                                                                                                                                        | ○ Readjust                                                                                                                                                                                                        |
| 4. No deflection of RF meter                                             | 1) Defective D1, D5 of Control unit (X53-1040-00)                                                                                                                                                                                                                                                                                                                                              | ○ Replace                                                                                                                                                                                                         |
| 5. Too high deflection of ALC meter due to undesirable high power output | 1) Poor adjustment of VR2 of Control unit (X53-1040-00)                                                                                                                                                                                                                                                                                                                                        | ○ Readjust                                                                                                                                                                                                        |
| 6. Too low deflection of ALC meter due to extremely low output           | 1) Disconnection of connecting cable                                                                                                                                                                                                                                                                                                                                                           | ○ Check conduction and refer to 2. Low output                                                                                                                                                                     |
| 7. Stand-by function is inoperative                                      | 1) Relay does not work<br><br>2) Relay keeps working position unnecessarily, although switch is turned off.                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"> <li>○ Check and replace Q5 of Rectifier AVR unit (X43-1150-00), connecting cable and connector.</li> <li>○ Check and replace Q5 of Rectifier AVR unit (X43-1150-00)</li> </ul> |

# ADJUSTMENTS

Adjustments of TV-502 should be performed with TS-520 connected as shown in Fig. 7.

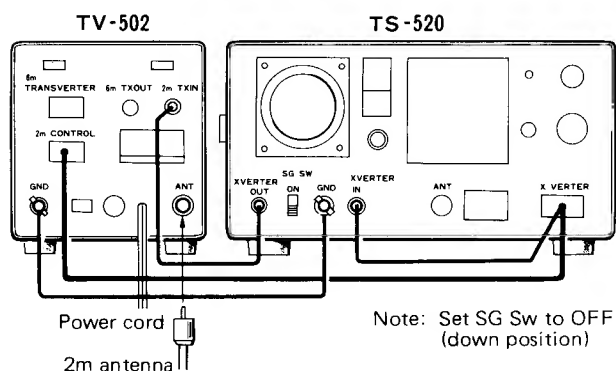


Fig. 7 Connection

## RECEIVING SECTION

Fig. 8 shows the level diagram of reception.

**NOTE 1:** As shown in Fig. 8, the SSG signal of 145.0 MHz 0dB is fed from the ANT terminal and the AF VR is adjusted for the audio output of 0.63 V/8Ω. When the AF VR is properly adjusted for the specified audio level, the SSG signal level indicated at each section should be obtained.

**NOTE 2:** Measurement of SSG output should be made through a ceramic capacitor of 0.01μF (50 WV).

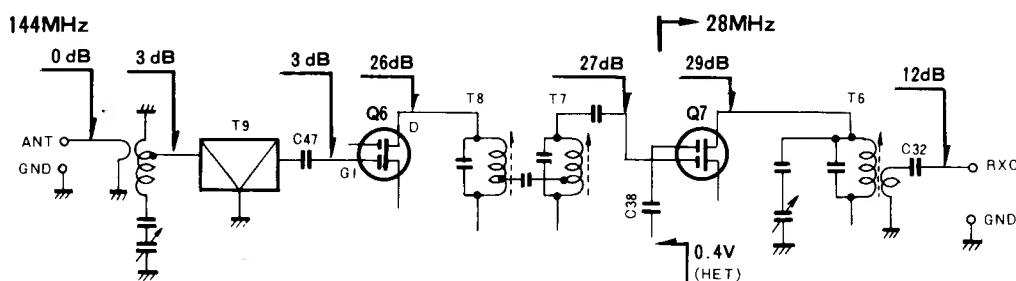


Fig. 8 Level Diagram of Reception

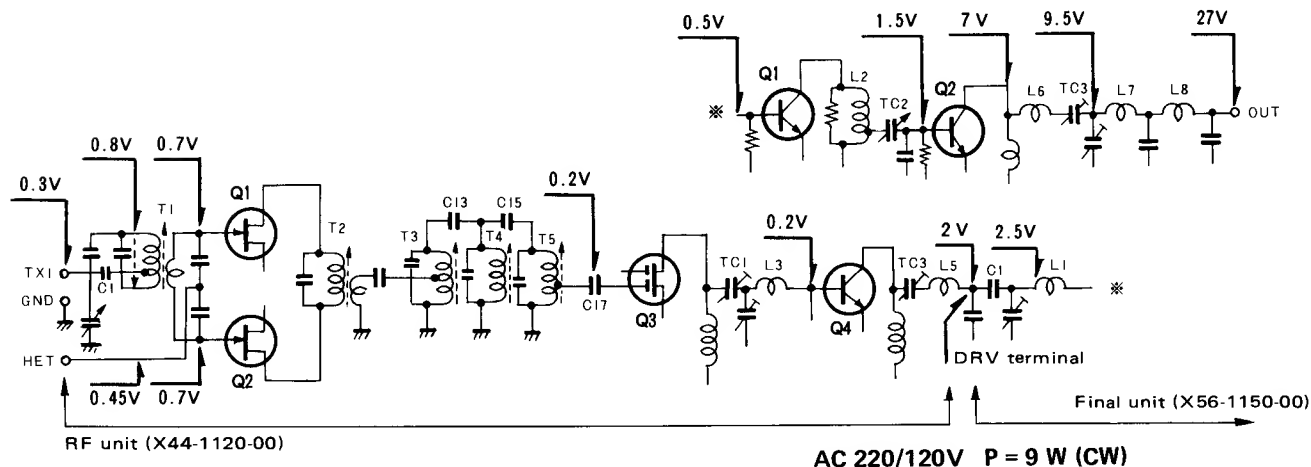


Fig. 9 Level Diagram of Transmission

## 1. Rectifier/AVR Unit (X53-1150-00)

(1) Test equipment

1) Voltmeter (tester)

(2) Adjustments (Fig. 10)

1) 15 V Setting

With the power switch turned to ON, connect a DC voltmeter to the terminal (14) on the AVR unit.

Adjust VR1 for 15 V on the voltmeter.

2) 9 V Setting

Connect the DC voltmeter to the terminal (9) on the AVR unit. Adjust VR2 for 9 V on the voltmeter

## 2. Heterodyne Oscillator Unit (X50-1250-00)

(1) Test equipment

1) RF VTVM (f: 150 MHz or higher)

2) Frequency Counter (f: 150 MHz or higher)

(2) Adjustment (Fig. 10)

1) Adjustment of Oscillating Level

Connect the RF VTVM to the OUT terminal on the heterodyne unit. Turn the core of T1 so that the output is set at 1dB down position from the peak point. This adjustment should be performed using an insulated screwdriver. Next, adjust T2 and T3 for maximum reading on VTVM.

Repeat the above adjustment two or three times.

# ADJUSTMENTS

- 2) Check of Vacant Channel (X2) Output  
Set the BAND switch to "145 MHz" to check that the crystal is oscillating. After checking, remove the crystal and set the BAND switch back to "144 MHz".
- 3) Adjustment of Heterodyne Frequency  
Disconnect the VTVM and connect the frequency counter instead. Adjust TC1 for 116 MHz of frequency. Then set TC2 in the mechanical center position.

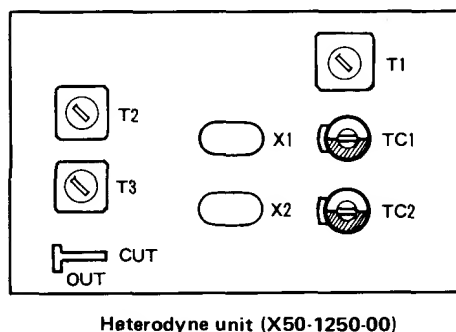
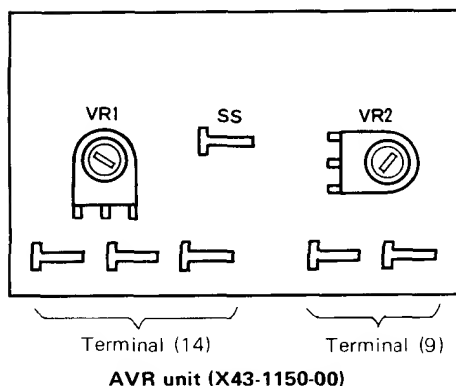


Fig. 10

## 3. RF Unit (X44-1120-00)

- (1) Test equipment
  - 1) SSG (f: 144 ~ 148 MHz, modulation not required)
  - 2) Oscilloscope
  - 3) AF VTVM
- (2) Adjustment  
Before adjustments, set the switches and knobs on TV-502 as follows:

## TV-502

|                                    |                 |
|------------------------------------|-----------------|
| Front Panel:                       |                 |
| POWER switch                       | ON              |
| BAND switch                        | 144             |
| IN TUNE knob                       | Center position |
| PRESELECTOR knob                   | Center position |
| Rear Panel:                        |                 |
| AC-DC selector switch              | AC              |
| 2m ONLY-6m CONNECT selector switch | 2m ONLY         |

- 1) 144.5 MHz Sensitivity Adjustment  
Set the band switch on TS-520 to "28.5 MHz". Then set the VFO dial to "0" and the mode switch to "USB". Apply the signal of 144.5 MHz 60dB from SSG to the antenna terminal on TV-502. Adjust the VFO knob and DRIVE knob for maximum reading on the S meter. Then adjust T6 in the RF unit until the S meter of TS-520 indicates maximum deflection.
- 2) 145 MHz Sensitivity Adjustment  
Set the VFO dial to "0" (29 MHz) and apply the 145 MHz signal of SSG. Adjust the DRIVE knob on TS-520 for maximum sensitivity. Next, adjust the IF TUNE knob on TV-502 for maximum reading on the S meter. Also, adjust T7 and T8 in the RF unit until maximum sensitivity is obtained. The adjustment should be repeated two or three times. Note that the signal level of SSG should be lowered properly according to the increase of the sensitivity. Then obtain a maximum reading on the S meter by adjusting the air-core coil of the helical filter.

**NOTE:** The PRESELECTOR knob should set in its center position.

- 3) 144 MHz Sensitivity Adjustment  
Set the band switch on TS-520 to "28 MHz". Then set the VFO dial to "0" and apply the 144 MHz signal from SSG. Adjust TS-520 for maximum sensitivity. To obtain maximum reading on the S meter, turn the IF TUNE knob on TV-502. The maximum sensitivity can be obtained by adjusting the 3 cores of T9 from the rear of the printed circuit board.



# ADJUSTMENTS

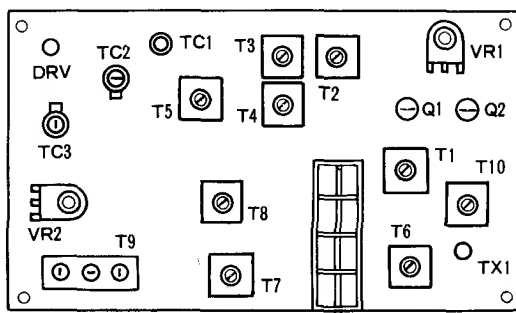


Fig. 11 RF Unit (X44-1120-00)

## TRANSMITTING SECTION:

Fig. 9 shows the transmission level diagram.

**NOTE:** The levels indicated in Fig. 9 were measured with RF VTVM having input capacitance of less than 3pF in the condition CW output of 9 W during AC operation

### 1. Preparation for Adjustment

- (1) Test equipment
  - 1) DC power supply (12-16 V adjustable, 2A min.)
  - 2) RF VTVM
  - 3) 50 $\Omega$  terminated power meter
  - 4) DC voltmeter (tester)
  - 5) SSG
- (2) Adjustment

Before making adjustments, the switches and knobs on TV-502 and TS-520, and the semi-fixed resistors in the RF unit and control unit, should be set as follows:

#### TV-502

| FRONT PANEL                        |                                                    |
|------------------------------------|----------------------------------------------------|
| POWER Switch                       | ON                                                 |
| BAND Switch                        | 144                                                |
| IF TUNE Knob                       | Center position (or maximum receiving sensitivity) |
| PRESELECTOR Knob                   | Center position (or maximum receiving sensitivity) |
| REAR PANEL                         |                                                    |
| AC-DC Selector Switch              | DC                                                 |
| 2m ONLY-6m CONNECT Selector Switch | 2m ONLY                                            |

#### TS-520

| FRONT PANEL |                 |
|-------------|-----------------|
| MODE Switch | CW              |
| H.SW Switch | ON              |
| CAR Knob    | Center position |
| REAR PANEL  |                 |
| SG Switch   | OFF             |

RF unit (X44-1120-00)

VR2 Maximum clockwise

Control unit (X53-1040-00)

VR2 Maximum clockwise

The adjustment of transmitter section should preferably be made with a DC power stabilizer for observing the current consumption (power supply voltage of 12 V).

### 2. Adjustment of RF Unit (X44-1120-00)

- (1) Set the band switch on TS-520 to "28.5" and the VFO dial to "500". Connect the RF VTVM to the DRV terminal on the RF unit and set the standby switch on TS-520 to "SEND".
- (2) Adjust the DRIVE knob on TS-520 and also adjust T1 ~ 5, TC1 and TC2 in the RF unit of TV-520 so that a maximum reading is obtained on the RF VTVM.

### 3. Power Adjustment

- (1) Maintaining power supply voltage of 12 V, disconnect the RF VTVM. Adjust T3 in the RF unit and TC1 and TC2 in the final unit for maximum current (Fig. 14).
- (2) With TC3 and TC4 in the final unit set to the positions shown in Fig. 12(A), fine adjust so that a maximum power is obtained.

**NOTE:** Care should be taken in adjustment because TC3 and TC4 are also tuned in the positions shown in Fig. 12(B).

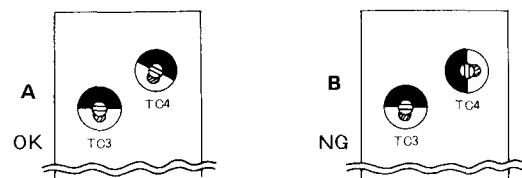


Fig. 12

- (3) Next, set the power voltage to 15 V. Fine adjust TC3 in the RF unit and TC1 and TC2 in the final unit for maximum current.
- (4) Readjust TC3 and TC4 in the final unit to obtain maximum power. This adjustment should be repeated two or three times.

**NOTE:** TC4 should be set in such a position that the current begins to decrease while the output power remains unchanged.

- (5) Set the band switch on TS-520 to "28" and the VFO dial to "500". The IF TUNE knob on TV-502 should be in its center position.
- (6) Adjust the DRIVE knob on TS-520 until the ALC meter causes maximum deflection and then adjust T1 in the RF unit for maximum current.

# ADJUSTMENTS

- (7) Under the above condition, set the AC-DC selector switch on the rear panel to "AC". Then, adjust VR2 of the control unit until the output power reaches 9 W (ALC adjustment) (Fig. 15).
- (8) Turn VR1 of the control unit so that the RF meter indicates the point "8" (RF meter adjustment). Then, set the AC-DC selector switch back to "DC".

## 4. Readjustment of RF Unit

- (1) Set the band switch on TS-520 to "28.5" with the VFO dial remaining in "500" position.
- (2) Turn the DRIVE knob on TS-520 and the IF TUNE knob on TV-502 until the ALC meter on TS-520 causes maximum deflection.
- (3) Fine adjust T2 ~ T5, TC1 and TC2 in the RF unit of TV-502 for maximum reading on the ALC meter. This adjustment should be repeated several times.

**NOTE:** This adjustment must be made carefully because it largely relates to the spurious radiation.

## 5. Protection Adjustment

- (1) Connect the "minus" lead of a voltmeter to the -6 terminal of the control unit (X53-1040-00) and the "plus" lead to the PRO terminal. Adjust VR3 in the control unit for minimum reading on the voltmeter.
- (2) Disconnect the leads of the voltmeter, set VR2 in the RF unit to the center position and remove the cord of the power meter (antenna open circuited). Adjust VR2 in the RF unit so that the current flow reaches 1A.

**NOTE:** This adjustment should be performed quickly.

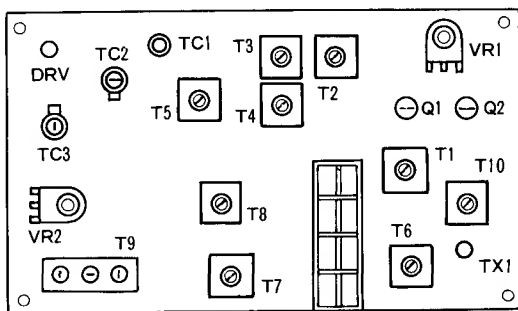


Fig. 13 RF unit (X44-1120-00)

## 6. Trap Adjustment

- (1) Set the band selector switch to "145". Remove the pin cord from the 2m TX IN terminal and connect SSG to feed 148 MHz 100 dB signal.
- (2) Connect RF VTVM to the gate of Q1 in the RF unit and adjust T1 for minimum reading on VTVM.

**NOTE 1:** The series trap consisting of T10 and C2 is used to remove the fourfold harmonics ( $37 \text{ MHz} \times 4 = 148 \text{ MHz}$ ) of the frequency of the 28 MHz heterodyne oscillator in TS-520. It protects TS-520 against the near-by spurious radiation.

**NOTE 2:** If expected effect cannot be attained by adjusting the trap, readjust the heterodyne oscillator coil in TS-520.

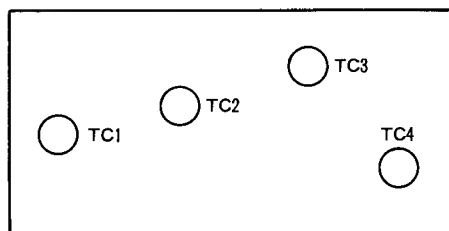


Fig. 14 Final unit (X56-1150-00)

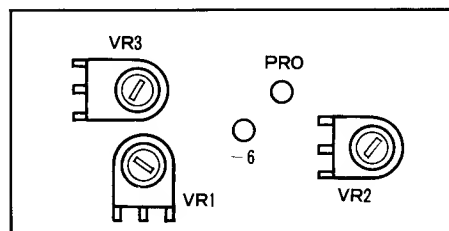


Fig. 15 Control unit (X53-1040-00)

# ADJUSTMENTS/REFERENCE

## Replacement of Transistors in Final Unit:

The final unit uses two transistors. One is Q1 (2SC1169) in the driver circuit and the other is Q2 (2SC1242A) in the power amplifier circuit at the final stage. To replace these transistors, remove the case and follow the procedure shown in the illustration (see Fig. 16).

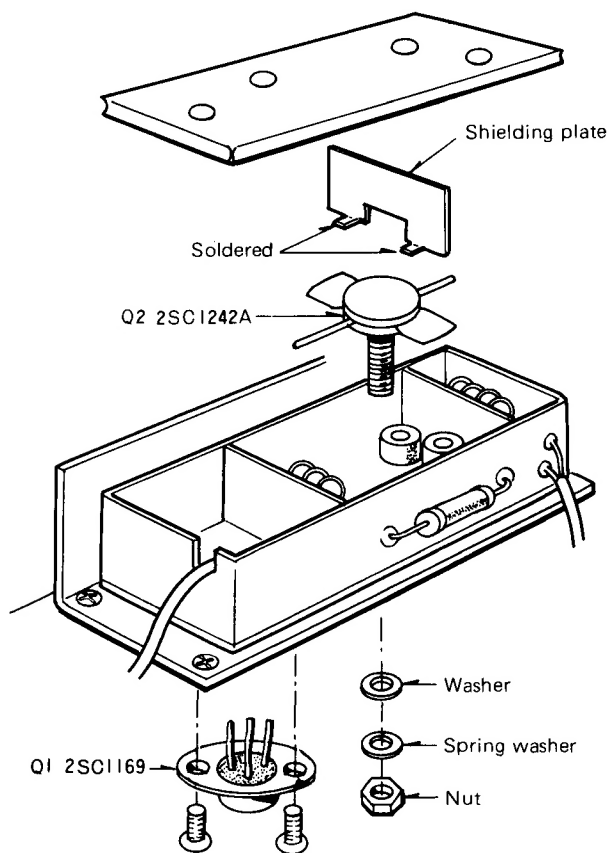


Fig. 16 Replacement of Final Unit Transistors

## \*REFERENCE

### 1. Connection of TV-502 to TS-520 and Precaution for Operation

(1) Fig. 17 shows the method of connecting TV-502 to TS-520.

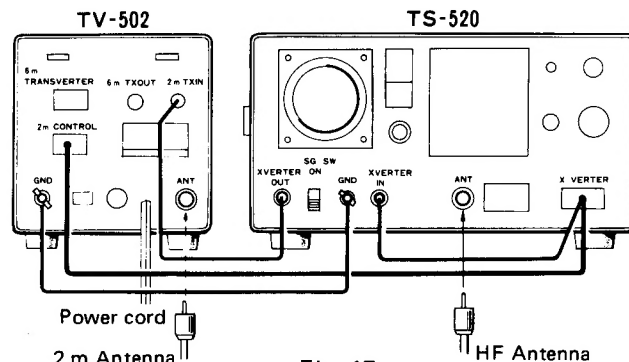


Fig. 17

If the circuit of TS-520 has already been changed as described previously, it is possible to start 2m operation with the SG switch on TS-520 and the HF antenna left as they are. For HF operation, simply set the power switch of TV-502 to OFF.

If the modified TS-520 is to be used alone, be sure to insert the 12P shorting plug supplied with TV-502.

(2) For 2m operation, if TV-502 is connected to TS-520 whose circuit is not changed, make certain that the SG switch is set to OFF and the HF antenna is removed. For HF operation under such a condition, be sure to disconnect the pin cord plug from the X VERTER IN terminal on TS-520 (For decrease of receiving sensitivity might happen.)

### 2. Method of Reducing 2m Band Near-by Suprious radiation (TS-520)

When the transverter is connected for 2m operation, the HF unit (TS-520) may sometimes become a cause of suprious radiation (near-by suprious during transmission). While TS-520 is designed to fully meet with the requirements of HF band, it has been done in the circuit starting with No. 05 production lot that only the 28 MHz band is improved to less than -50 dB to satisfy the requirement (less than -60 dB) of the 2m band specified in the ELECTRIC WAVE LAW.

The suprious radiation in 2m band can be further reduced by making readjustments as follows:

**NOTE:** Refer to the Technical Service Information (Bo-Ho-205) for the above improvement in TS-520.

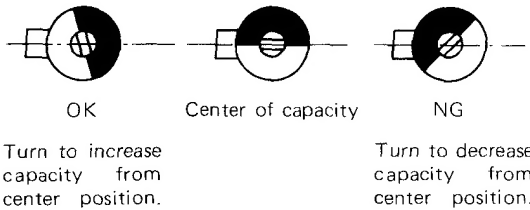
# REFERENCE

## Adjusting Method:

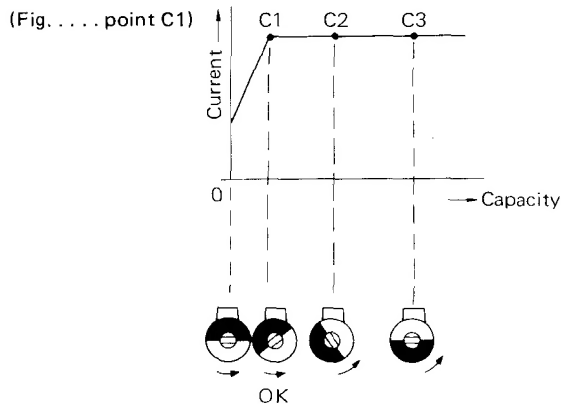
- (1) Adjust each knob on TS-520 and TV-502 for maximum power in 144.8 MHz (28.8 MHz for TS-520) MODE CW.
- (2) Obtain maximum reading on the ALC meter by adjusting the semi-fixed resistor VR11 on the lug in the IF unit of TS-520.
- (3) Receive a signal around 144.585 MHz using another receiver and readjust VR11 (TS-520) for minimum reading on the S meter (another receiver). In the level where the S meter causes no deflection, readjustment should also be made for minimum AF output (TS-520).

## 3. Method of Improving Near-by Suprious radiation and second harmonics (TV-502)

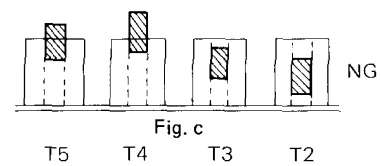
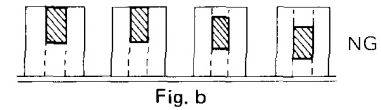
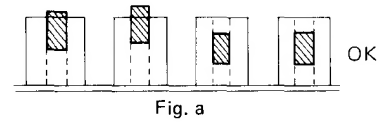
- (1) Final unit  
Position of TC4 (for improving second harmonics)



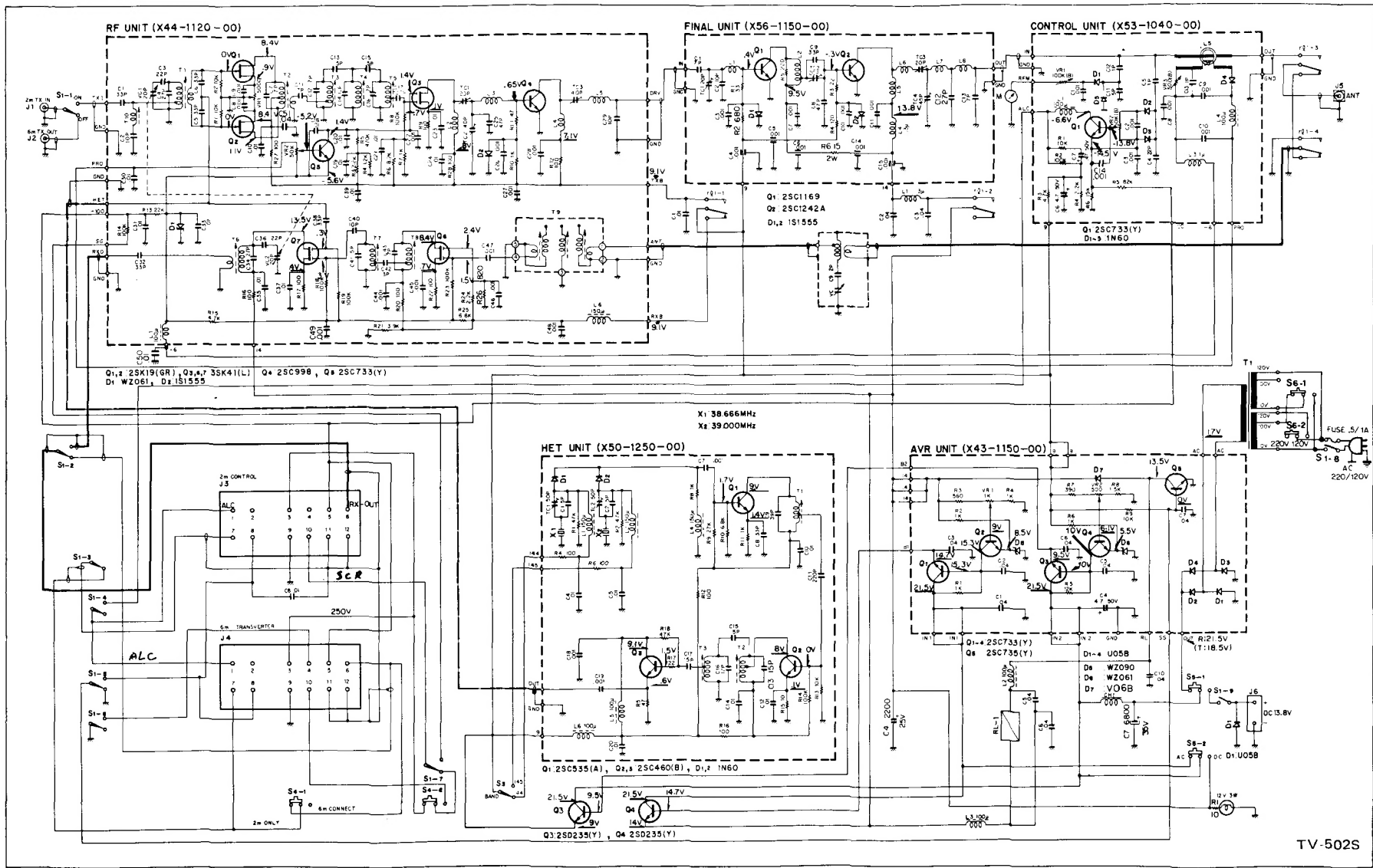
- (2) RF unit
  - 1) Position of TC3 (for improving of suprious of 116 MHz local oscillator)  
Set TC3 to the point C1 on the following figure.



- 2) Core position of T2 ~ T5 (for improving near-by suprious)  
Set T4 so that the core juts out about 1 ~ 2 mm as figure a. Be caution that the core position of T3, T5 varies according to that of T4.



## SCHEMATIC DIAGRAM



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