KENWOOD

SERVICE MANUAL

TS-520S

SSB TRANSCEIVER

Scanned 24 July 2002 • Ward Willats • KG6HAF • Felton, California

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SPECIFICATIONS

GENERAL

Frequency Range

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

Mode
SSB (USB, LSB) or CW

Antenna Impedance
50 ~ 75 ohms

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

Tubes and Semiconductors

Tubes	3
Transistors	52
FETs	19
Diodes	100

Power Requirements

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

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

Weight
16 kg (37.4 lbs.)

TRANSMITTER

RF Input Power

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

Carrier Suppression
Better than 40 dB

Sideband Suppression
Better than 50 dB

Spurious Radiation
Better than 40 dB

Microphone
High impedance microphone (50 k ohms)

AF Response
400 to 2,600 Hz, within –6 dB

RECEIVER

Sensitivity
0.25 μV S+N/N 10 dB or more

Selectivity
SSB – 2.4 kHz (–6 dB)
– 4.4 kHz (–60 dB)
CW* – 0.5 kHz (–6 dB)
– 1.5 kHz (–60 dB)
* (with optional CW filter installed)

Image Ratio
Better than 50 dB

IF Rejection
Better than 50 dB

AF Output Power
1 watt (8 ohms load, with less than 10% distortion)

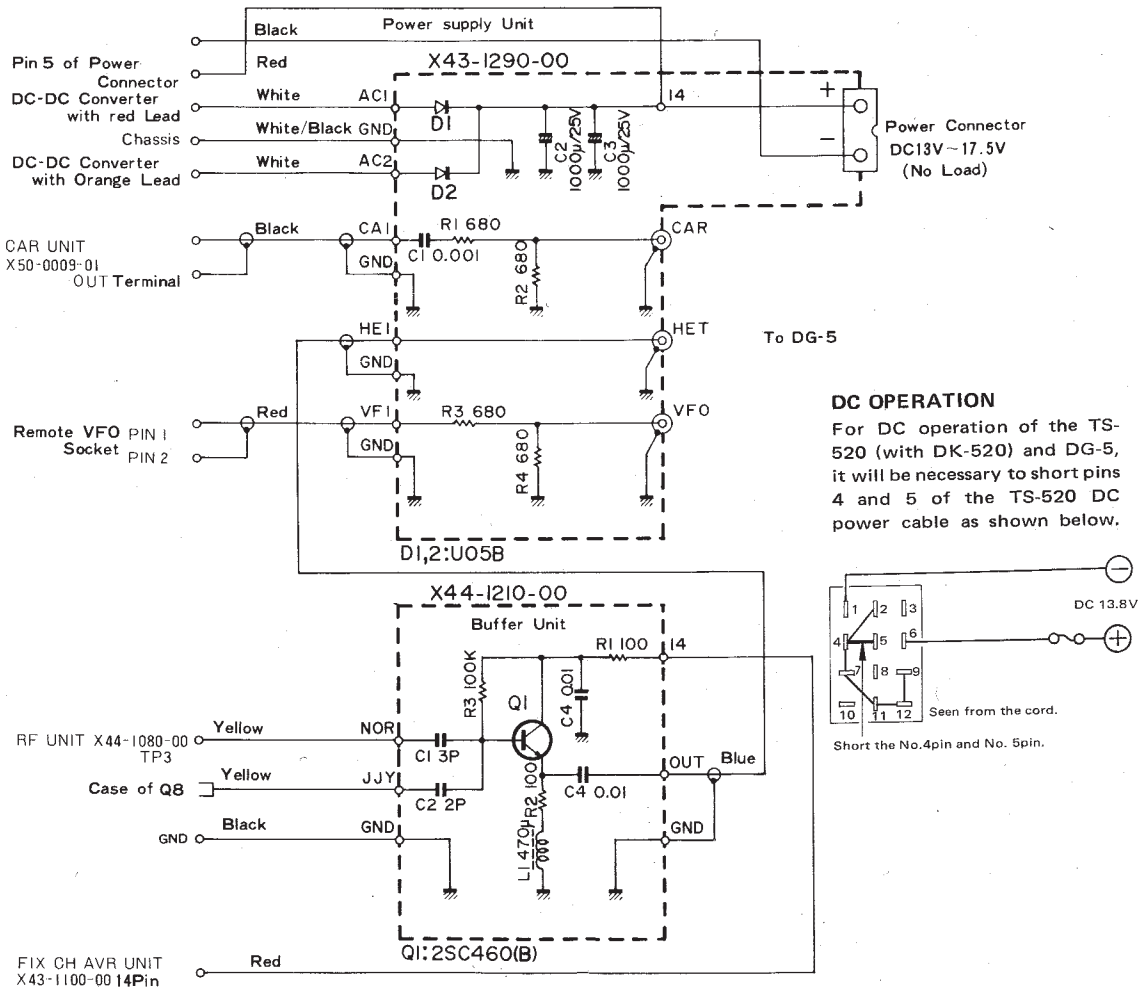
AF Output Impedance
40 to 16 ohms

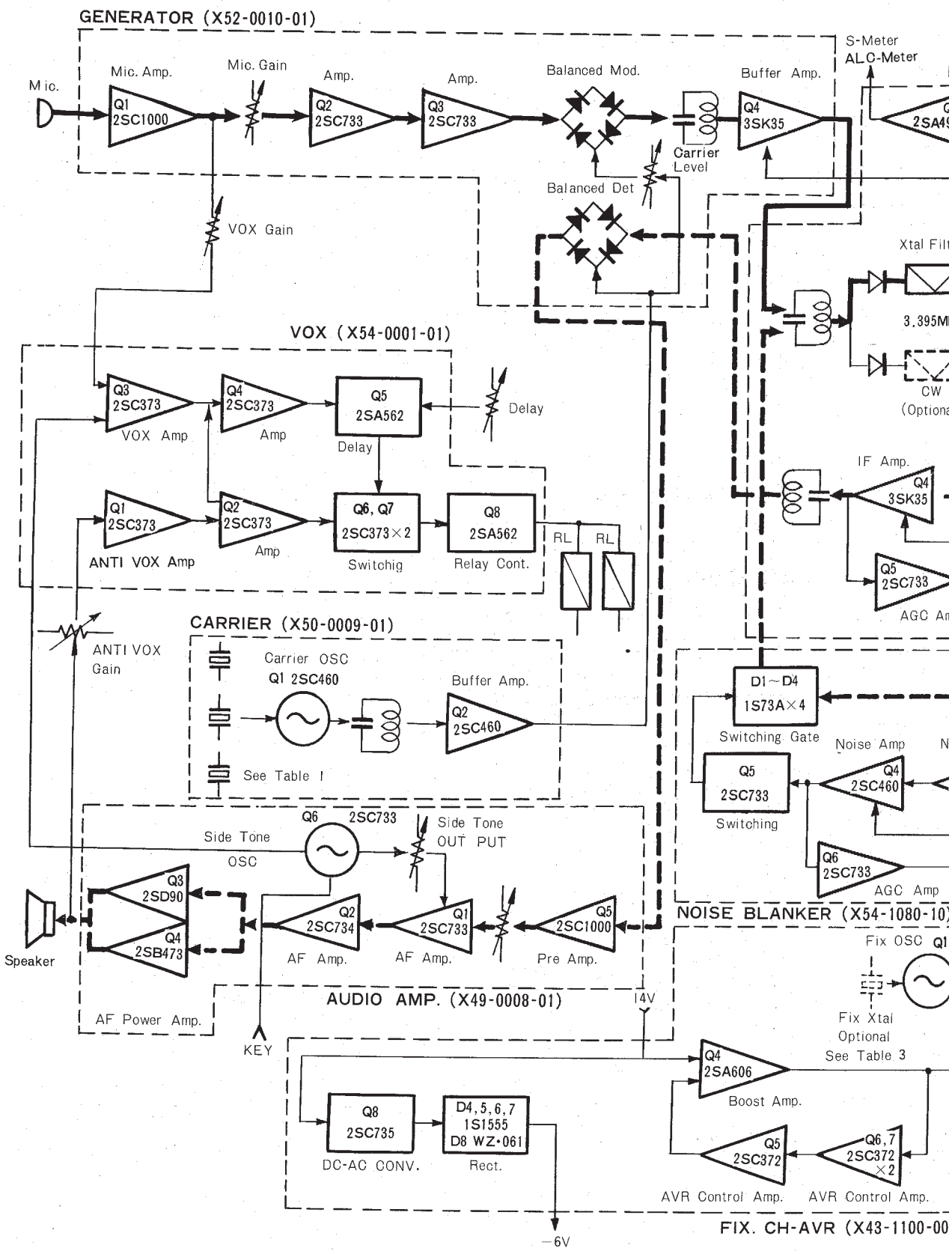
TS-520 SERIES COMPARATIVE TABLE

Item \ Type	520	520S
Final unit	Hand wired	P.C.B. (X56-1200-00)
Digital display termination	By installing DK-520, DG-5 (Option) can be connected.	Built-in
1.8 MHz, AUX band	–	Built-in
RF ATT	–	Built-in
Speech processor	–	Built-in
Phone patch termination	–	Built-in
EXT REC ANT JACK	–	Built-in

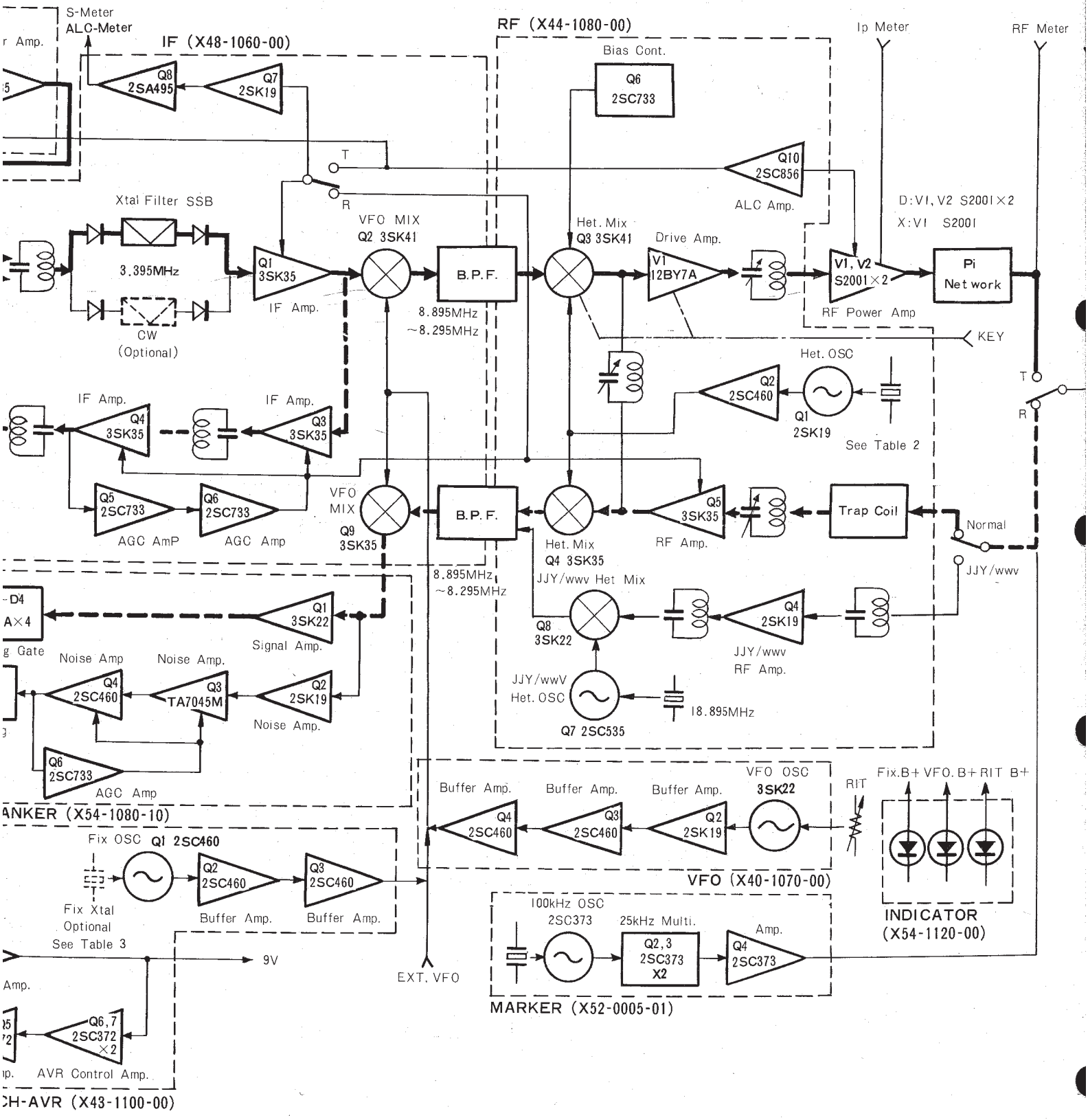
er ANT

DK-520 OPTION TO TS-520




GENERATOR (X52-0010-01)
Mic.
Mic. Amp.
Q1 2SC1000
Mic. Gain
Amp.
Q2 2SC733
Amp.
Q3 2SC733
Balanced Mod.
Balanced Det
Carrier Level
Buffer Amp.
Q4 3SK35
S-Meter
ALC-Meter
VOX Gain
VOX (X54-0001-01)
Q3 2SC373
VOX Amp
Q4 2SC373
Amp
Q5 2SA562
Delay
Delay
Q1 2SC373
ANTI VOX Amp
Q2 2SC373
Amp
Q6, Q7 2SC373×2
Switchig
Q8 2SA562
Relay Cont.
RL
RL
ANTI VOX Gain
CARRIER (X50-0009-01)
Carrier OSC
Q1 2SC460
Buffer Amp.
Q2 2SC460
See Table 1
Xtal Fil
3.395M
CW
(Optiona
IF Amp.
Q4 3SK35
Q5 2SC733
AGC Am
D1~D4 1S73A×4
Switching Gate
Noise Amp
Q5 2SC733
Switching
Q4 2SC460
Q6 2SC733
AGC Amp
NOISE BLANKER (X54-1080-10)
Fix OSC Q1
Fix Xtal
Optional
See Table 3
Q6 2SC733
Side Tone OSC
Side Tone OUT PUT
Q3 2SD90
Q4 2SB473
Speaker
Q2 2SC734
AF Amp.
Q1 2SC733
AF Amp.
Q5 2SC1000
Pre Amp.
AUDIO AMP. (X49-0008-01)
AF Power Amp.
KEY
14V
Q4 2SA606
Boost Amp.
Q8 2SC735
DC-AC CONV.
D4,5,6,7 1S1555 D8 WZ-061
Rect.
Q5 2SC372
AVR Control Amp.
Q6,7 2SC372 ×2
AVR Control Amp.
FIX. CH-AVR (X43-1100-00
−6V

BLOCK DIAGRAM



GENERAL/CIRCUIT DESCRIPTION

General

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

Circuit Description

Transmitter Section

The microphone signal is fed to the generator unit (refer to paragraph "Generator Unit" for operation of generator unit) and is amplified by the MIC amplifier. The signal is then converted to a DSB (Double Side Band) signal of 3.395 MHz and fed to the IF unit. The signal passes through the crystal filter and becomes a SSB signal.
The IF signal is mixed with the VFO signal by the 1st mixer and becomes the 2nd IF frequency of 8.895~8.295 MHz. This signal passes through the BPF and is fed to the RF unit. The signal is then converted to the transmit frequency, 1.8~28 MHz by Q1 3SK41(L) and is voltage amplified by the driver tube V1 12BY7A to drive the final tubes S2001A which deliver RF power to the ANT circuit.

Receiver Section

The receive signal of 1.8~28 MHz from the ANT terminal is converted to a 1st IF of 8.895~8.295 MHz through the RF unit and is fed to the IF unit. The signal passes through the BPF of the IF and is mixed with the VFO signal by Q9 that it becoming the 2nd IF frequency of 3.395 MHz. The signal then passes through the NB, returns to the IF, passing through the crystal filter, and is amplified before being fed to the generator unit. Finally, the signal is fed to the BD (balance detector) where it is converted to an AF signal. The AF signal is fed to the AF unit where it is amplified by Q1~4 to drive the speaker.

1. Carrier Unit (X50-0009-01)

This circuit functions as a carrier oscillator for the generator during transmission, and as a BFO for the ring detector during reception. The oscillator circuit Q1 (2SC460B) is of the Pierce B-E type; Q2 (2SC460B) functions as a buffer amplifier to provide stabilized output. Selection of oscillation frequency is accomplished by diode switch D1-D4 (1S1555 X 4).
When forward biased the diode internal resistance become low and an oscillator circuit is completed. Without forward bias, the diode resistance becomes high, and the crystal is disconnected, stopping oscillation. Frequencies are 3396.5 kHz for USB, 3393.5 kHz for LSB, and 3394.3 kHz (receive) and 3395.0 kHz (transmit) for CW.

2. Generator Unit (X52-1090-00)

This is the heart of the SSB transmitter, generating DSB signals during transmission. Voice signals fed to microphone are amplified by Q3 (2SC1000GR), Q5 (2SC733Y) and Q6 (2SC733Y) and then fed to the ring modulator (D1-D4), which suppresses the carrier component, passing only the DSB signal. The signal is amplified by the FET buffer amplifier Q1 and applied to the IF. The unwanted side band and carrier contained in DSB signals are further suppressed by the crystal filter in the IF unit to obtain a SSB signal. During CW operation, a DC voltage unbalances the ring modulator to obtain carrier output.
The processor is controlled by a switch on the front panel. Operating as a compressor circuit, the output of Q3 is further amplified by Q4 (2SC1000GR), Q8 (2SC30-0), Q9 (2SC-733Y) and Q10 (2SC733Y) and is fed to Q5 through the diode switch controlled by the processor switch. The output of Q10 is phase inverted by Q11 (2SC945A) and rectified by a bridge rectifier consisting of 4 diodes. This signal is DC amplified by Q12 (2SC945R) to control the FET attenuator Q7 (2SK30-0) which utilizes pinch-off voltage. The required time constant is obtained at the output of Q12; in practice, 14 dB compression is obtained at 10 mV MIC input.
The MIC gain control is provided on the input side of Q5, so MIC gain can be set as desired independent of the processor switch position.
The unit also includes a receive ring demodulator and a transistor switching circuit Q2 (2SC460B) which disconnects carrier to the transmit ring modulator during reception.

CIRCUIT DESCRIPTION

3. RF Unit (X44-1200-00)

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

WWV Receiving Section

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

ALC System

The ALC amplifier Q10 (2SC1515) features high breakdown voltage between collector, emitter and base. ALC voltage is produced when the grid current flowing into the S2001A's reaches about 30 μA.
By setting the pull switch on the MIC/CAR VR to the NORM position, ALC voltage is fed back to the proceeding stage through the time constant circuit R72 and C59.

Control Section

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

Local Oscillator Circuit

A crystal oscillator circuit generates an oscillation frequency for each band. It functions as a 2nd local oscillator during transmission, and a 1st local oscillator during reception.
Crystals and oscillator coils are included in the OSC coil unit (X44-1160-00). Oscillation is effected by Q6 (2SK-19GR), while Q7 (2SC460B) functions as a buffer amplifier.
Non-adjustment oscillator circuit Q8 (2SC460B) is also included for WWV reception, the output of which is applied to Q4. Local oscillator output for the DG-5 digital display option appears through the buffer amplifier Q9 (2SC460B).
The Drive (X44-1190-00),
MIX (X44-1180-00),
ANT (X44-1170-00), and
OSC Coil Units (X44-1160-00),
function in conjunction with the RF unit. Coils, crystals and rotary switches are neatly arranged on printed circuit boards.

4. IF Unit (X48-1060-01)

This unit functions for both transmission and reception. During transmission, the DSB signal from the generator becomes a SSB signal while the unwanted side band and carrier are suppressed by the SSB crystal filter XF1. The SSB signal is IF amplified by Q1 (3SK35GR), which is common to transmission and reception, and is fed to the transmitter mixer Q2 (3SK35Y).
The local oscillator signal from the VFO unit is applied to G2 of Q2 while the cut-off frequency passes through the 7 MHz low pass filter (T10, T11, T12). The signal is mixed with the SSB signal at G1.
The converted 2nd IF signal is fed to the RF unit through the band pass filter. During transmission, the receiver IF amplifier Q3 (3SK35GR), Q4 (3SK35GR) and the receiver VFO mixer Q9 (3SK41L) are cut off by a nagetive voltage at the RB terminal.
During reception, the 1st IF signal from the RF unit is fed through the band pass filter to the VFO mixer Q9, where the signal is converted to the 2nd IF. This signal is fed through the IFT to the NB, and its output is applied through XF1 to the IF amplifier Q1.
The signal is then amplified by the 2-stage IF amplifier (Q3, Q4) and is fed to the ring detector of the generator. During reception, the transmitter VFO mixer Q2 is cut off by a negative voltage at the TBL terminal. Q5 (2SK19GR) and Q6 (2SK19GR) are AGC amplifiers. Q6 is used to select SLOW, FAST and OFF AGC and control RF GAIN.
A diode switch is provided on the input and output of the crystal filter so that the filter switches with the mode switch when the CW crystal filter YG-3395C (option) is installed.
During transmission, Q7 (2SK19GR) and Q8 (2SA495Y) function as an ALC circuit. They also function as an S meter circuit during reception.

CIRCUIT DESCRIPTION

5. NB (Noise Blanker Unit) (X54-1080-10)

The NB unit is divided into 2 circuits, a signal circuit and a noise amplifier and switch circuit.
In the signal circuit, the signal from the VFO mixer of the IF unit passes through the 3-stage IFT band pass filter and is amplified by Q1 (3SK22GR). The signal is then applied to the NBO terminal of the IF unit through the balanced blanking gate circuit.
In the noise amplifier, the noise signal amplified by Q2 (2SK19GR), Q3 (2SC460B), Q7 (2SC460B) and Q4 (2SC-460B) is applied to the base of Q6 (2SC733Y) through the noise rectifier circuit consisting of D5 and D6 (1N60). The AGC time constant circuit Q6 has no effect on pulse noise; it functions for continuous, short-cycle signals such as SSB. Accordingly, Q3, Q4 and Q7 function in a state close to maximum gain for pulse noise, and function in a state of suppressed gain for continuous signals because of AGC voltage.
With the NB switch ON, the emitter of Q5 (2SC733Y) is grounded and when pulse noise is received, Q5 is turned ON. The blanking gate diodes connected to Q5 are reverse biased by the time constant circuit C7 and R3, thus the signal line is cut off to eliminate pulse noise.

6. AF Unit (X49-0008-01)

The AF unit contains a complementary OTL (Output Transformerless) audio frequency amplifier, semi-break-in circuit for CW operation, side tone oscillator circuit for monitoring and a detector circuit for calibration.
Q5 (2SC733Y) preamplifies the audio signal from the ring detector. High frequency components are cut by C15 and C18.
The signal is further amplified by Q1 and Q2 (2SC733Y) and then power amplified by Q3 (2SD90-0) and Q4 (2SB-473C, D, N).
The side tone circuit functions only when the MODE switch is set to CW and the key connected to the KEY terminal is ON. This circuit uses a phase-shift oscillator at about 750 Hz. During transmission, Q5 is cut off by + voltage at the RL terminal.
When the optional DC-DC unit (DS-1A) is operated from a DC power source, the side tone circuit does not function if the H. SW is OFF, because the converter is also controlled by the heater SW, hence, the bias voltage of Q6 (2SC733Y) and the control voltage for the switching diode D3 (1S1555) are not generated. VR2 sets the output level of side tone.

7. VFO Unit (X40-1070-01)

The VFO frequency range is 5.5 MHz ("0" on the sub dial) to 4.9 MHz ("600" on the sub dial).
Q1 (3SK22Y) is a clapp oscillator, while Q2 (2SK19GR) provides buffered output. The use of a 1-stage RF filter, and Darlington output Q3 and Q4 (2SC460B), provides stabilized operation against changes in load.

8. Marker Unit (X52-0005-01)

The 100 kHz crystal is energized by Q1 (2SC373).
Frequency is precisely adjusted by ceramic trimmer TC1 in the collector circuit.
Output of Q1 is shaped by diode D1 (1N60) to synchronize the multi-vibrator Q2 and Q3 (2SC373). The free running frequency of the multi-vibrator is approximately 25 kHz and is precisely synchronized to 25 kHz by Q1 output.
This signal is buffer amplified by Q4 (2SC373) to obtain the required output.

9. VOX Unit (X54-0001-00)

In SSB operation, voice signal from the MIC amplifier is fed to the MV terminal (side tone output in the case of CW operation). The signal is amplified by Q3 (2SC373), rectified by D6 (1N60) and becomes a DC signal proportional to the input signal.
When DC voltage from D6 is applied to the base of Q4 (2SC373), Q4 turns ON; as a result the voltage at the base of Q6 (2SC373) is decreased.
When Q4 is cut off during no-signal period, the base and emitter voltages of Q5 (2SA562Y) are equal, turning Q5 OFF therefore, C10 is charged through D7, the voltage being set by the DELAY VR. This turns Q4 and Q5 ON, discharging C10 through Q5. This action, repeated, represents VOX hold time.
Q6 and Q7 (2SC373) form a Schmidt circuit; when Q4 is OFF, Q6 is ON and Q7 is OFF. When Q4 is ON, Q6 is OFF and Q7 is ON, which, in turn, sets Q8 (2SA562Y) ON to operate the standby relay.
The ANTI VOX signal from the output of the AF unit is stepped up by T1 through the AV terminal and full-wave rectified by D1-D4 to cut off Q1 (2SC373).
When Q1 is OFF, C5 is charged through R4 and, at the same time, Q2 (2SC373) is turned ON, thus the base of Q4 is grounded; Q4 turns OFF to stop the operation of VOX.

CIRCUIT DESCRIPTION/FUNCTIONAL DESCRIPTION

10. FIX CH, AVR Unit (X43-1100-00)

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

The 9V AVR circuit supplies power to the main oscillator and control circuits. Q4 (2SA606L) is a current regulator, Q5 and Q6 (2SC372) error voltage amplifiers, and Q7 (2SC372) is a temperature compensating transistor. D3 (WZ061) is the zener reference diode.

An oscillator circuit is formed by Q8 (2SC735Y) and T1 operating at approximately 400 Hz, which is rectified by D4-D7 (1S1555 X 4). A stabilized -6V source is obtained through zener diode D8 (WZ-061).

11. Rectifier Unit (X43-1090-02)

This unit contains all the rectifier circuits. In the S type transceiver, a voltage doubler delivers 800V half-wave rectifiers supply 300V, 200V and -C line, and a bridge rectifier 14V.

12. HV Unit (X43-1110-00)

This unit contains a voltage divider for plate voltage indication (HV) of the final amplifiers, a voltage divider to reduce screen voltage in TUNE, and a resistor to step down power to 50W during 28 MHz operation.

13. Indicator Unit (X54-1280-00)

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

14. Final Unit (X56-1200-00)

The power amplifiers and all associated components other than the π match circuit are contained on the final printed circuit board.

FUNCTIONAL DESCRIPTION

Speech Processor Theory

In DX operation, the early model TS-520 changed ALC operation in 2 steps: to delay the rising ALC voltage and to shorten its release time so that the average power during SSB operation was increased. It offered reliable performance.

The TS-520S has a unique circuit which suppresses the spread of side bands and provides reliable function as a processor. In this speech processor, the MIC amplifier circuit has an AGC type compression amplifier. Because the time constant is relatively large, the amplifier has sufficient compression effect with minimum distortion. It also shortens the ALC time constant, which controls overall transmitter gain. This increases the average output power during SSB operation, without deteriorating signal quality. The circuit is designed to provide approximately 6 dB compression (at full scale ALC) at normal time constant, and about 20 dB (at 10 mV of MIC input) through the low frequency speech processor.

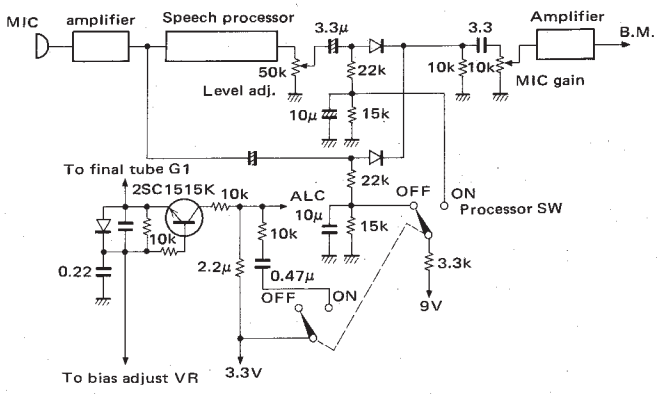


Fig. 1

Speech Processor Operation

Referring to Fig. 2, the MIC AMP input is amplified to 50 mV by the MIC amplifier. Amplifier output will be saturated if the input level exceeds this limit. As shown in Fig. 2, the MIC amplifier output is saturated at approximately 70 mV when the processor is ON. The illustration also shows the output at processor ON and OFF cross at 10 mV input. This means these two outputs are equal at about 70 mV.

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

At processor ON the operating curve shifts toward the left from the OFF position. This shows the compression effect, which is adjustable within the range shown by means of VR2 in the generator unit. That is, MIC input can be amplified to approximately 70 mV by the compression amplifier. If more than 10 mV input is used, the MIC amplifier output

FUNCTIONAL DESCRIPTION

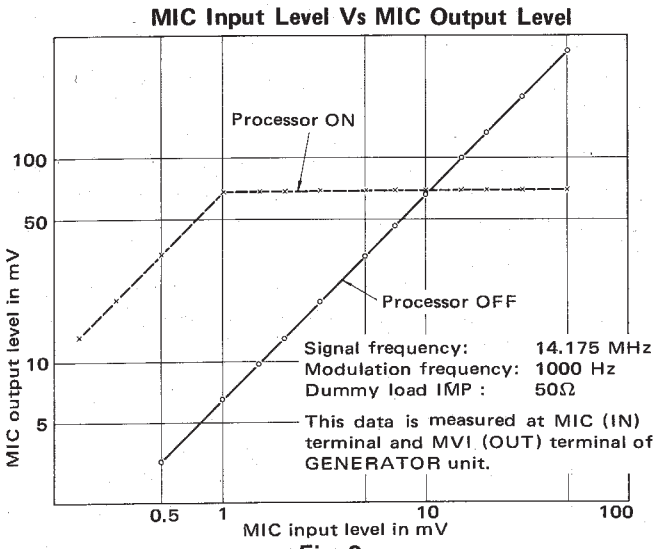


Fig. 2

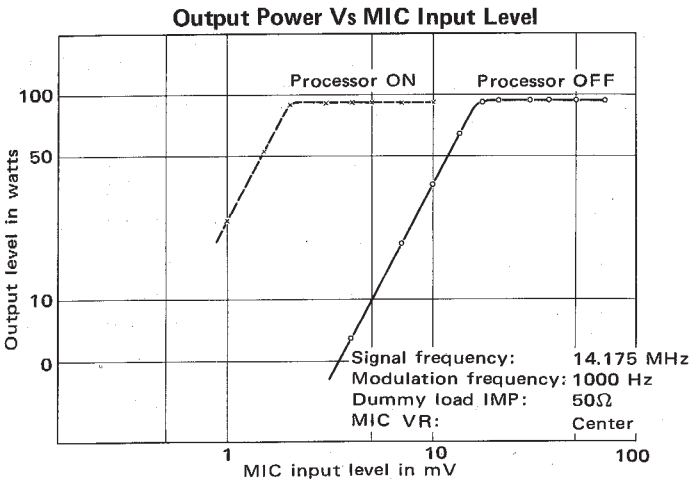


Fig. 3

is decreased at processor ON from the output level at processor OFF, if a microphone rated at less than 10 mV output is used, the MIC amplifier output is increased at processor ON. The relationship between MIC input and transmit output is shown in Fig. 3, that output is not increased at excessive MIC input, nor increased at maximum compression. Since semi-fixed resistors VR2 and VR3 are preadjusted, the MIC gain control is used to adjust the input level within the ALC zone.

In practical operation of the transceiver, sound quality will deteriorate if excessive input is applied, though this can be eliminated by using an attenuator between the microphone and the MIC input.

Excessive MIC input can be checked by the setting of the MIC control. As stated previously, the output level at 10 mV input is unchanged when the processor is turned ON and OFF with the MIC control set at the center (12-o'clock) position, since the circuit is preadjusted.

The MIC input level is normal so long as the control is between 12 and 10 o'clock positions. If the control must be set below 10'oclock, it indicates the MIC input is too high. In this state, the MIC amplifier output is attenuated when the processor is engaged. If the control is shifted toward the right of center, output is increased with the compressor ON.

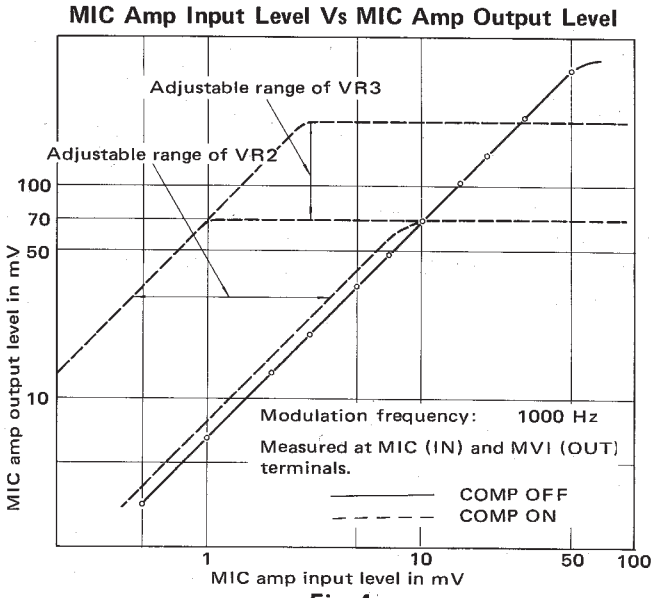


Fig. 4

FUNCTIONAL DESCRIPTION

Intermodulation Characteristics

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

In a double conversion system, if the first mixer input level can be suppressed, the second mixer input can be maintained constant. Therefore, the first mixer input level for 1.9~21 MHz band is decreased by the C devider while the level for 28~29.1 MHz is maintained.

In the TS-520S, switching of the C devider and selection of converter power for WWV reception, and antenna circuits are accomplished by the rotary switch.

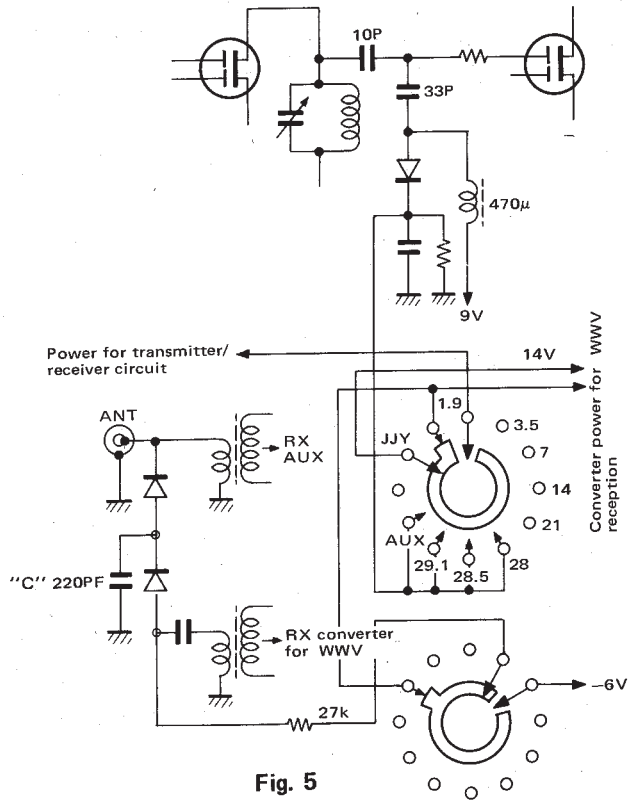


Fig. 5

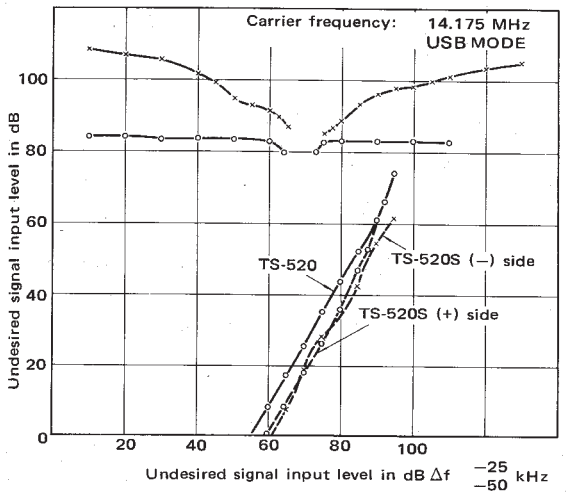


Fig. 6

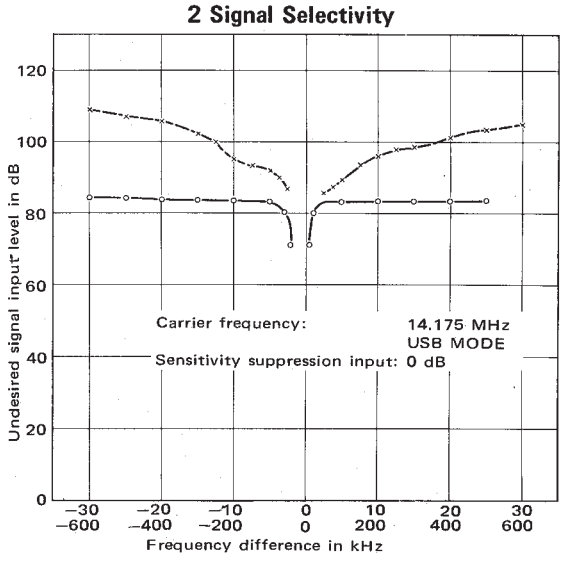


Fig. 7

Antenna Circuit

TS-520S has EXT REC ANT provision (external receiver antenna), and RF ATT. The antenna system is shown in Fig. 8.

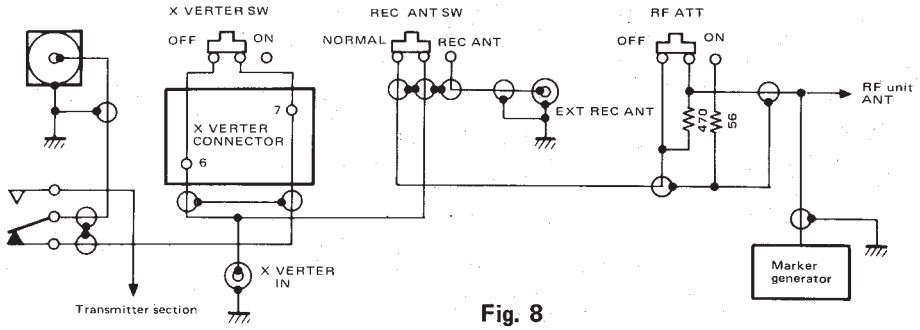
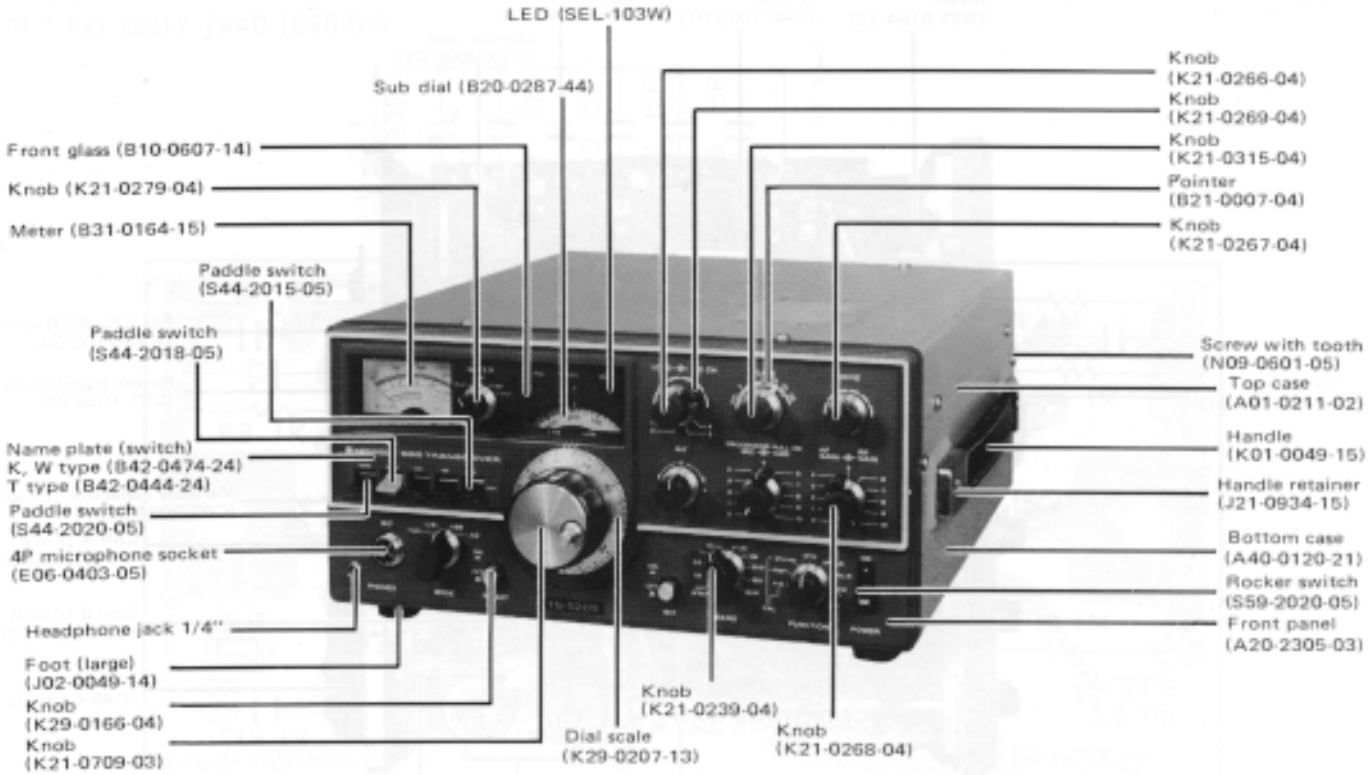
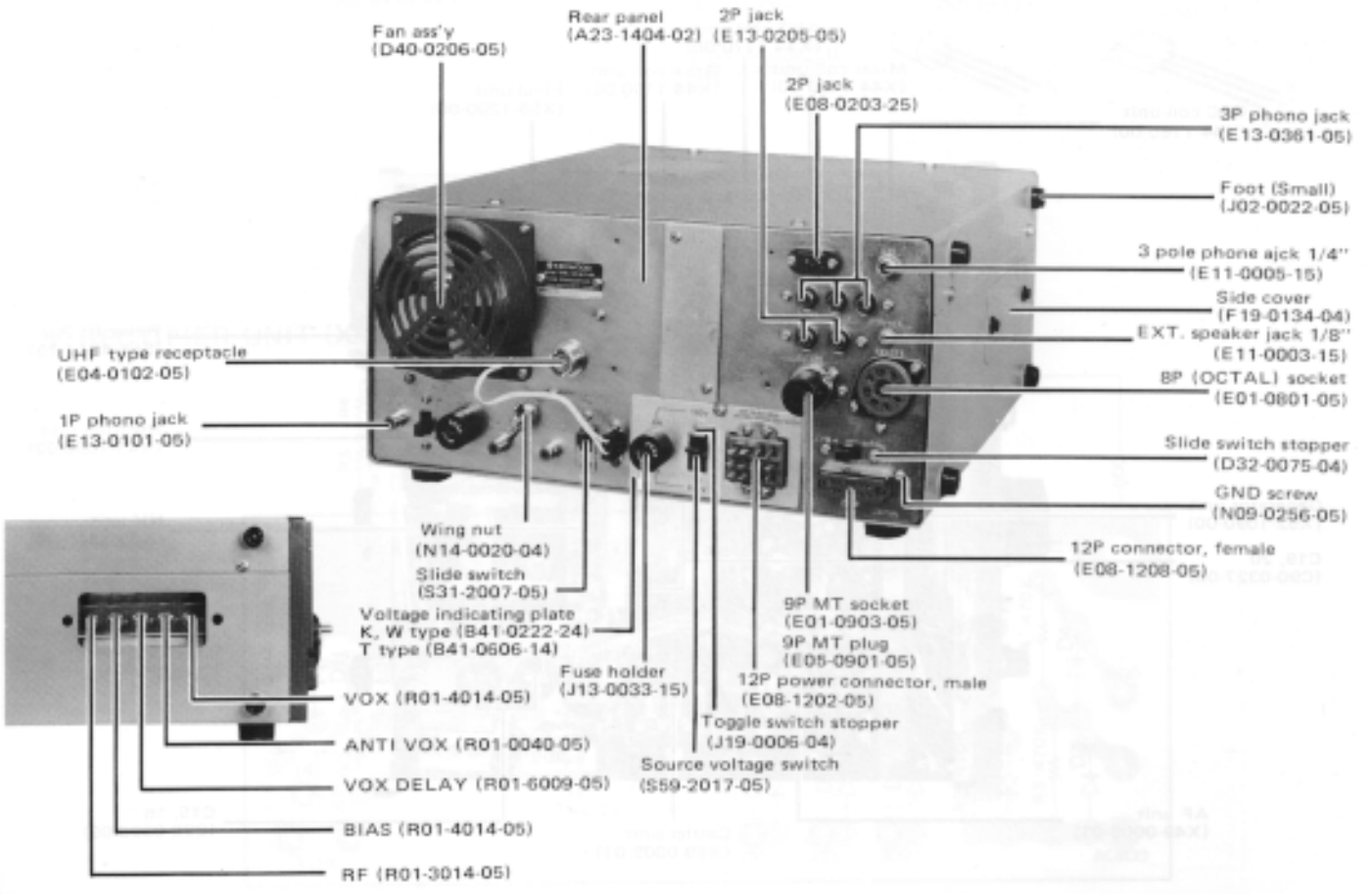


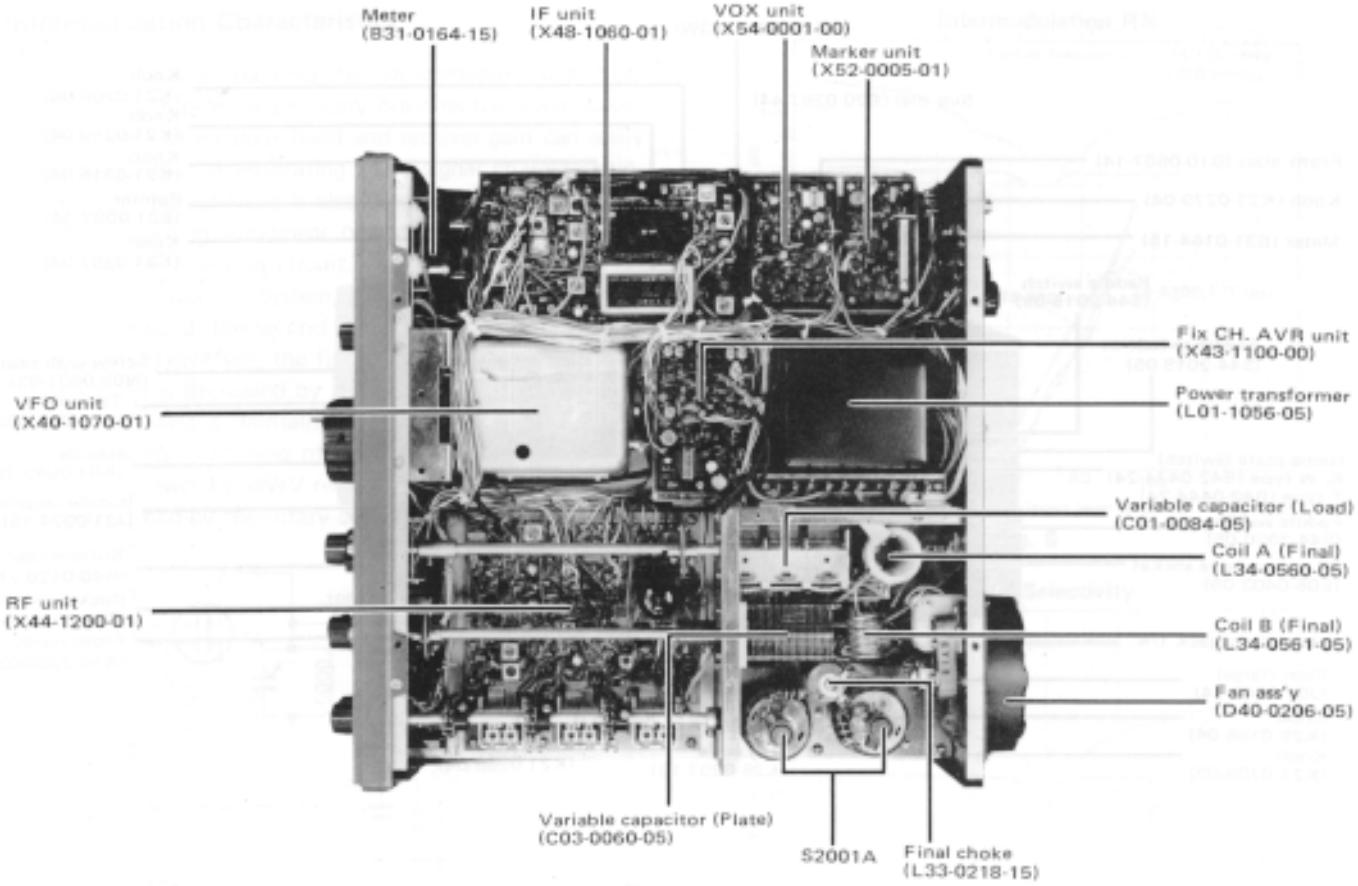
Fig. 8

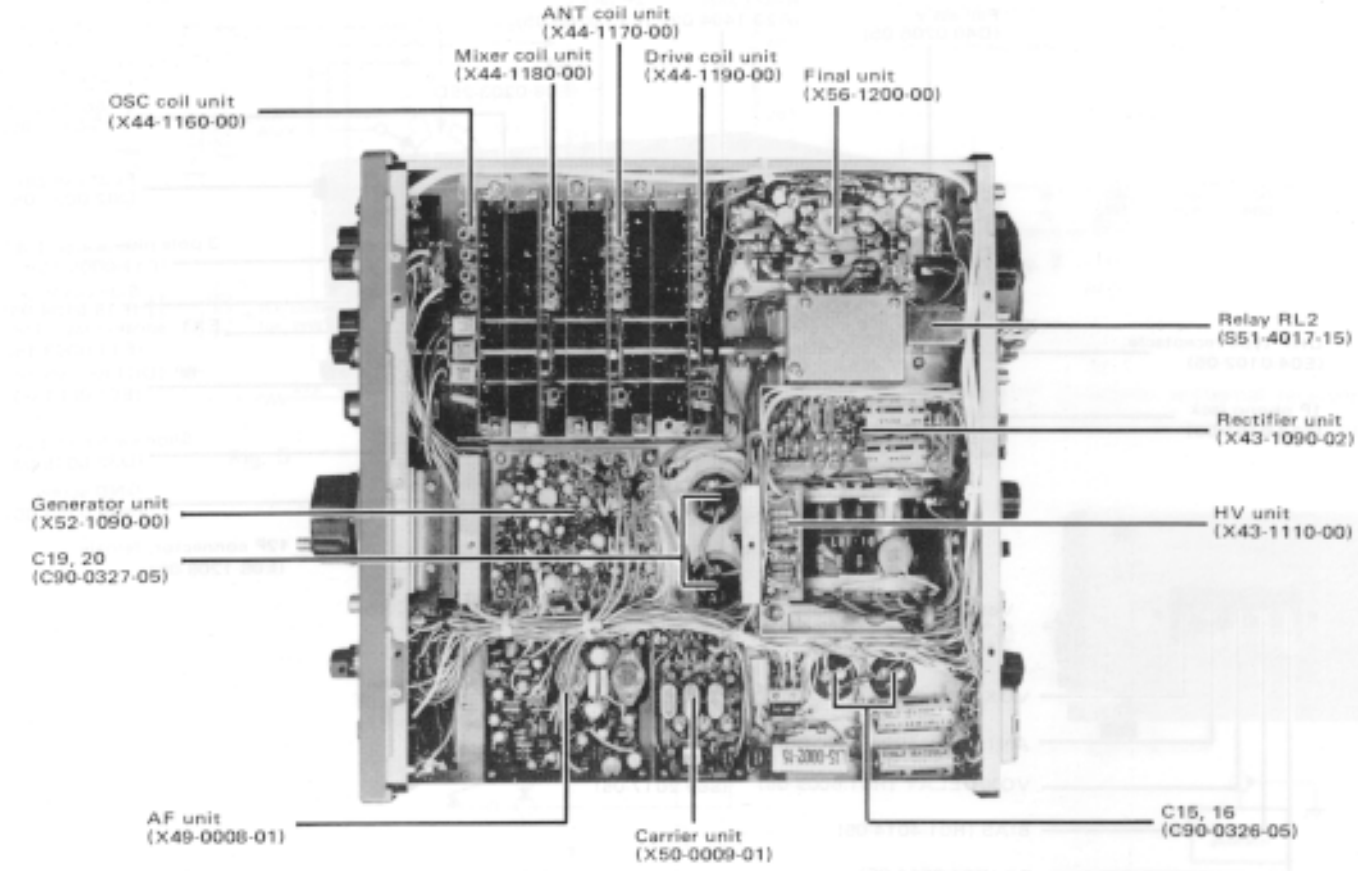
EXTERNAL VIEW





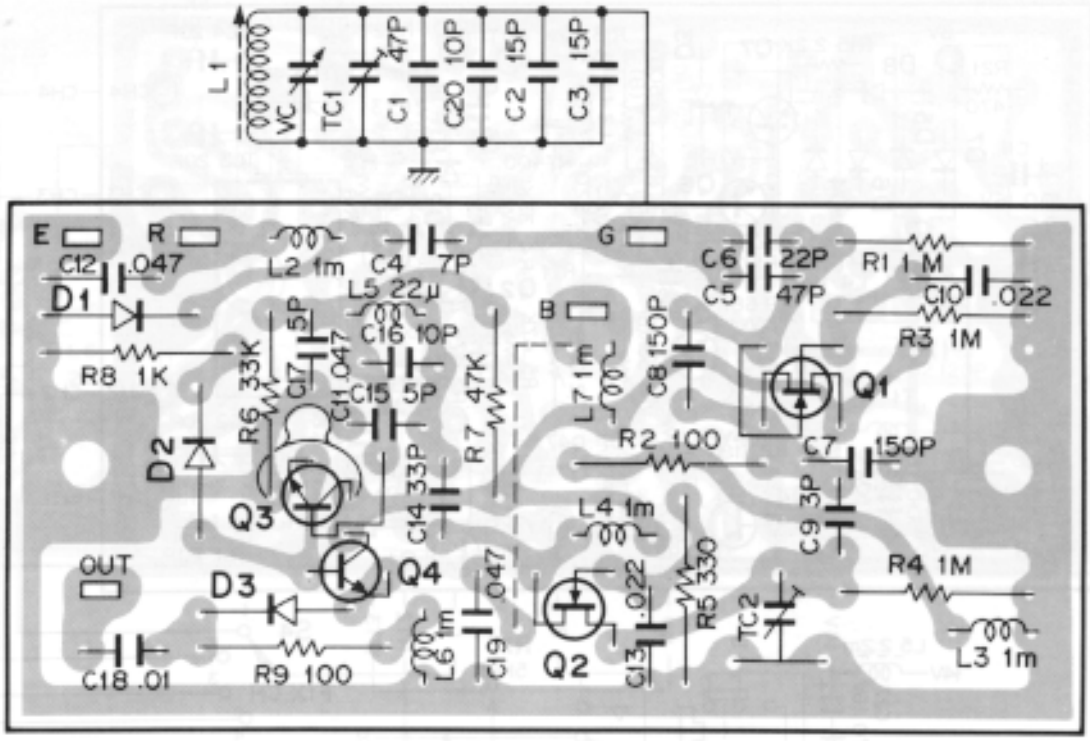
PARTS ALIGNMENT



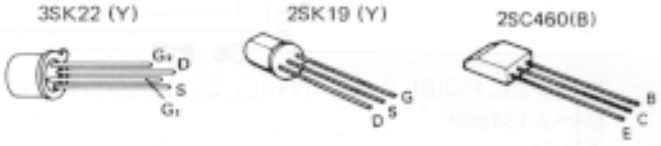


PC BOARD

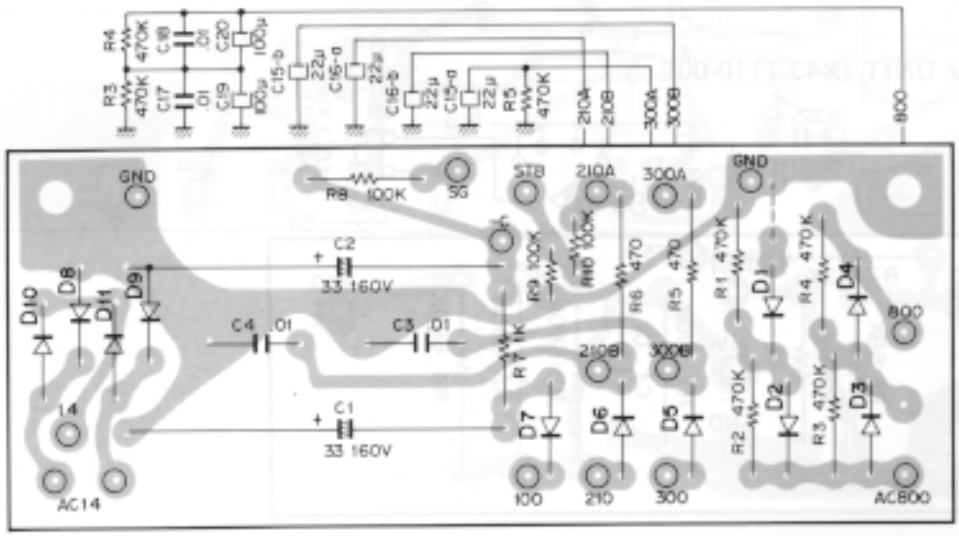
▼ VFO UNIT (X40-1070-01)



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

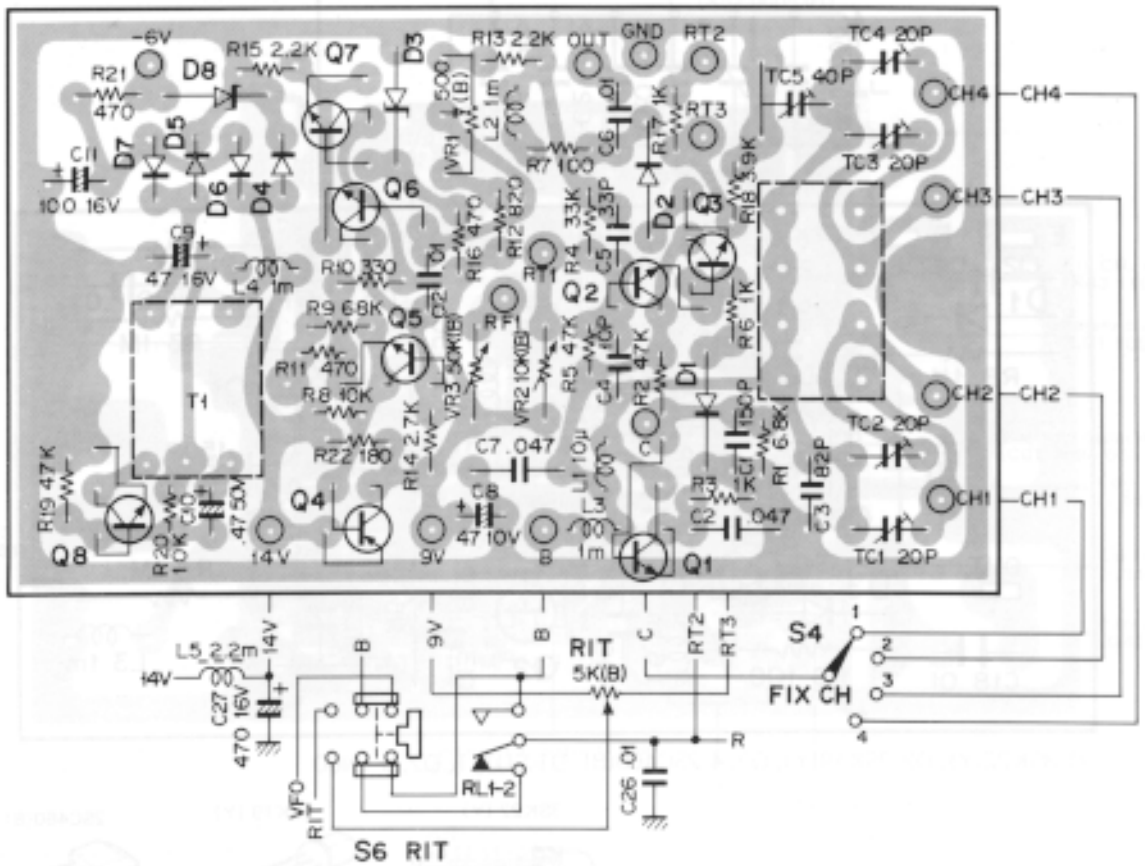


▼ RECTIFIER UNIT (X43-1090-02)

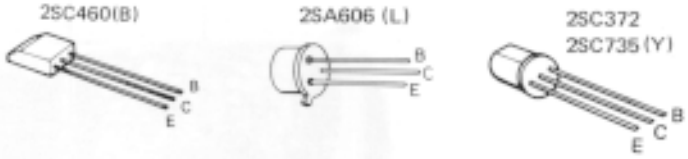


PC BOARD

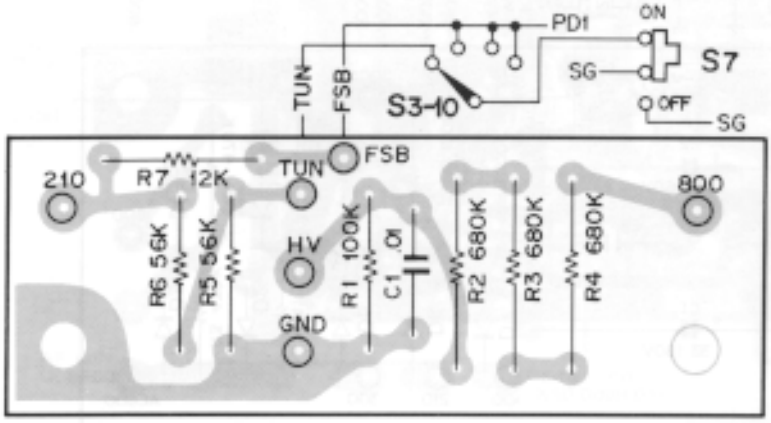
▼ FIX CH. AVR UNIT (X43-1100-00)



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

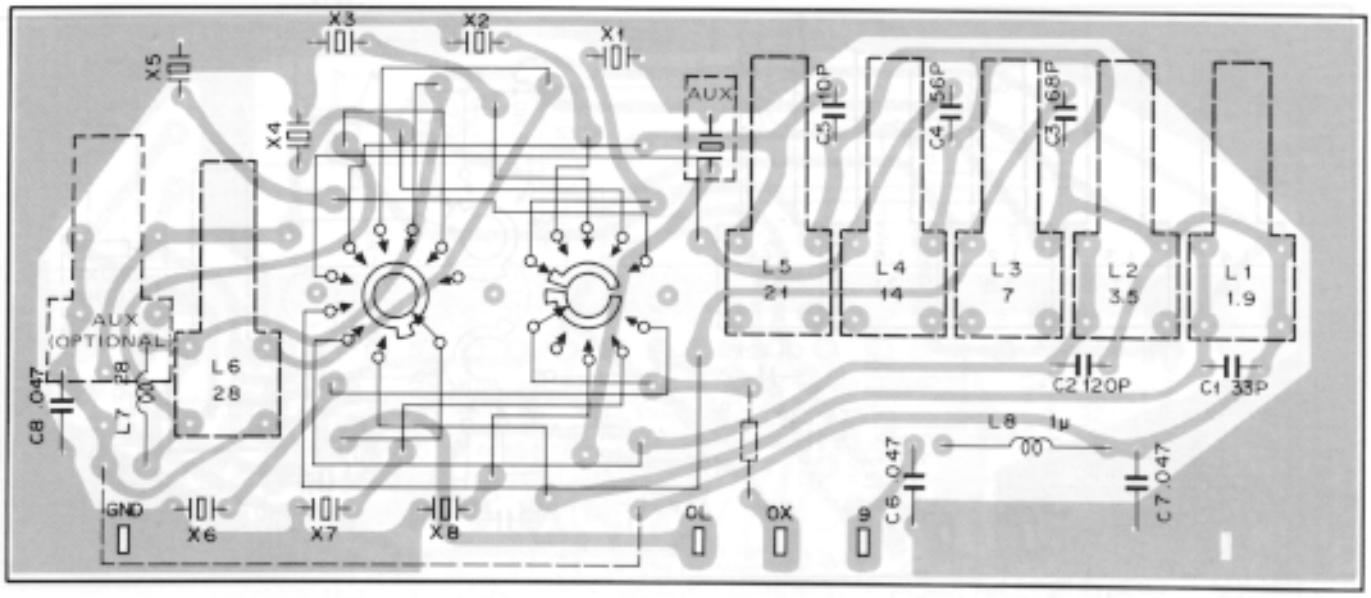


▼ HV UNIT (X43-1110-00)

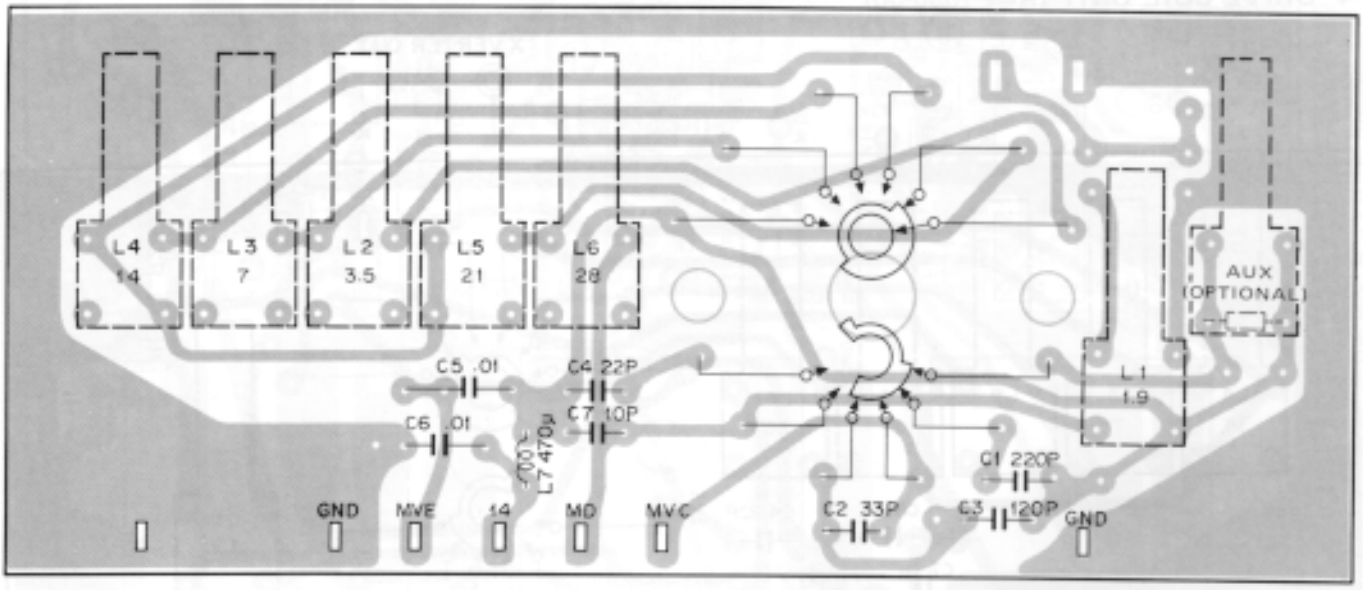


PC BOARD

▼ OSC COIL UNIT (X44-1160-00)

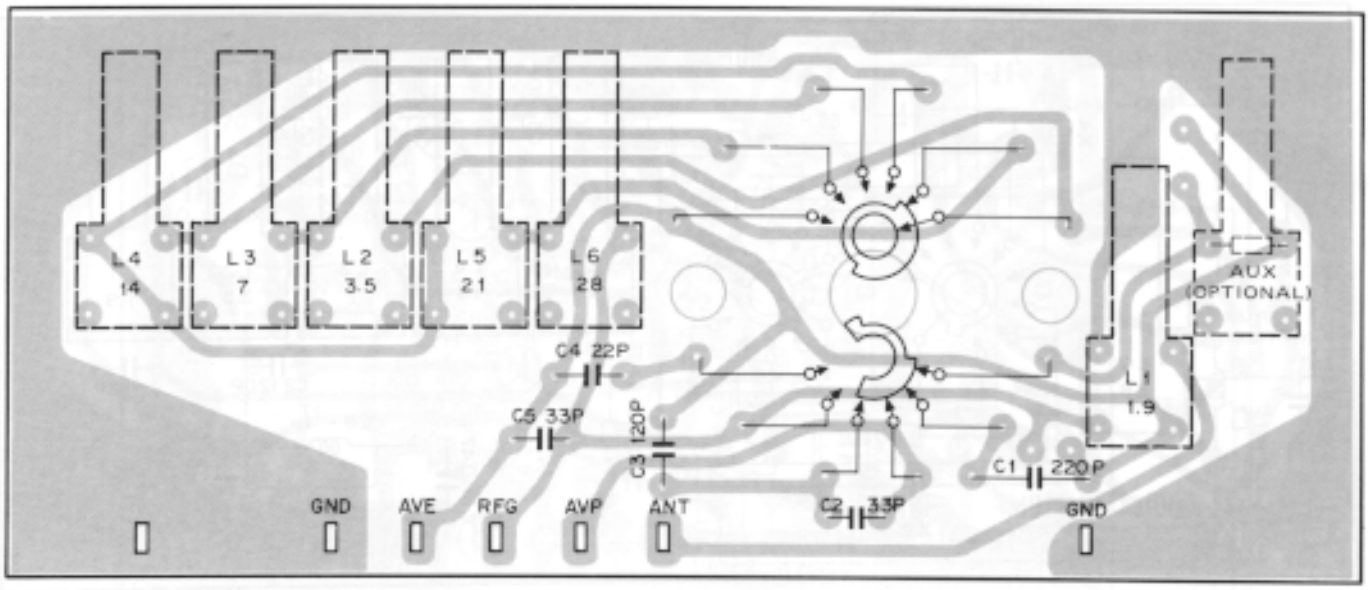


▼ ANT COIL UNIT (X44-1070-00)

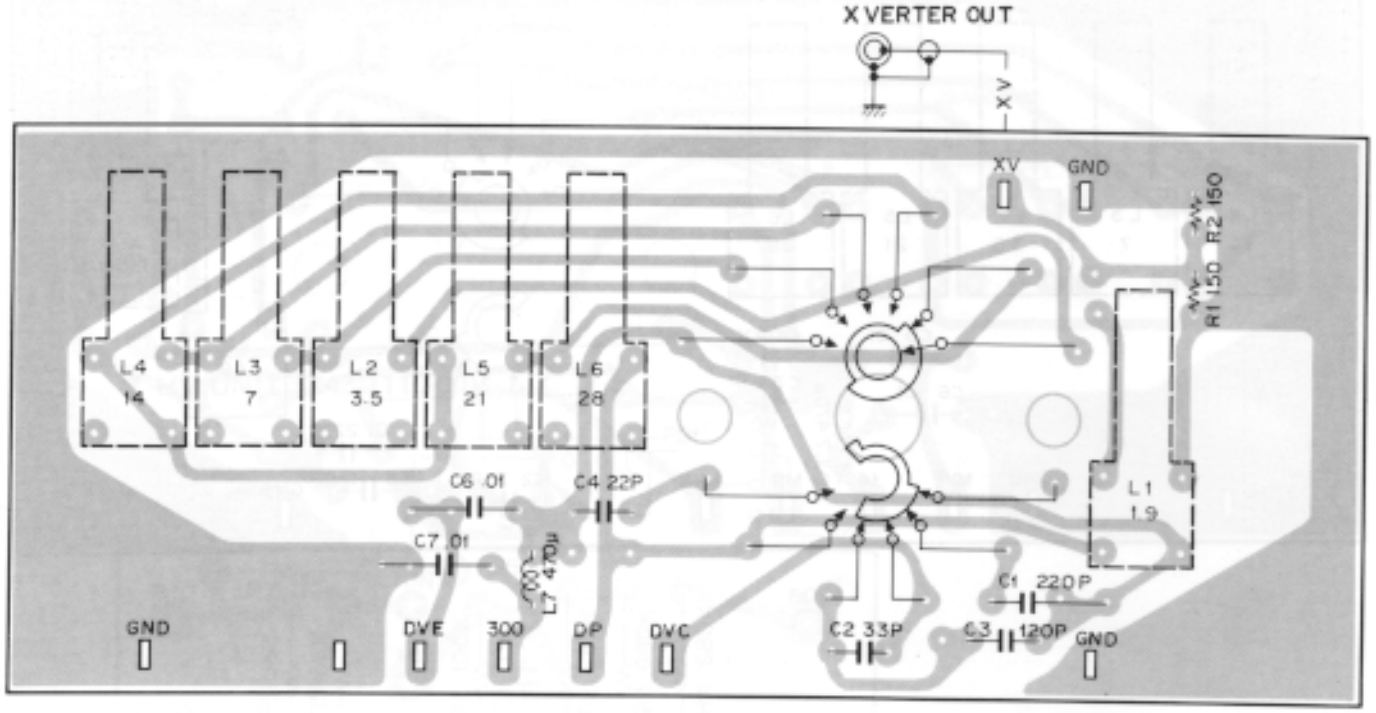


PC BOARD

▼ MIXER COIL UNIT (X44-1080-00)

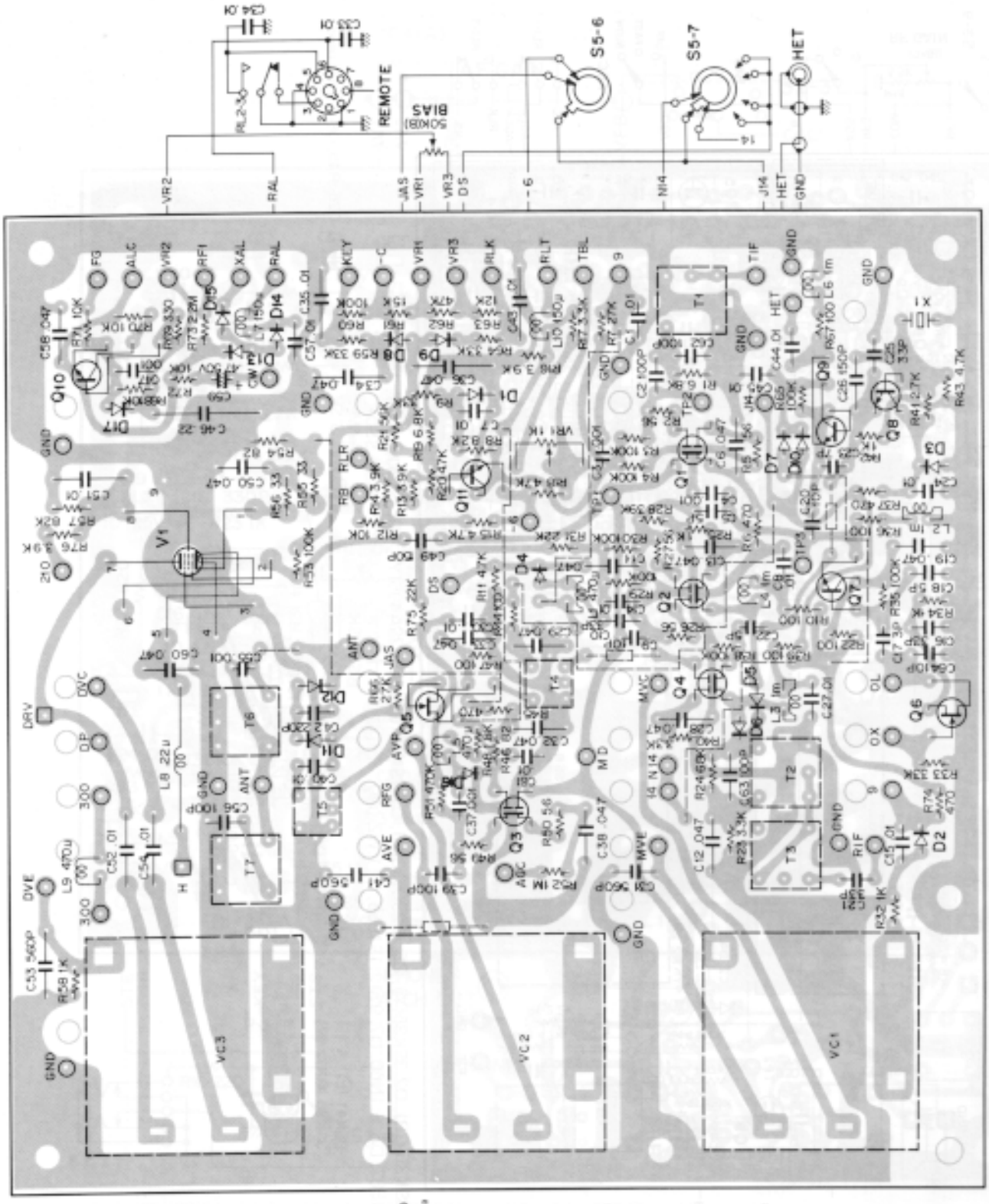


▼ DRIVE COIL UNIT (X44-1090-00)

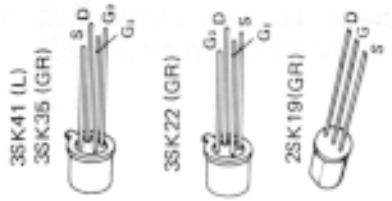


PC BOARD

▼ RF UNIT (X44-1200-00)

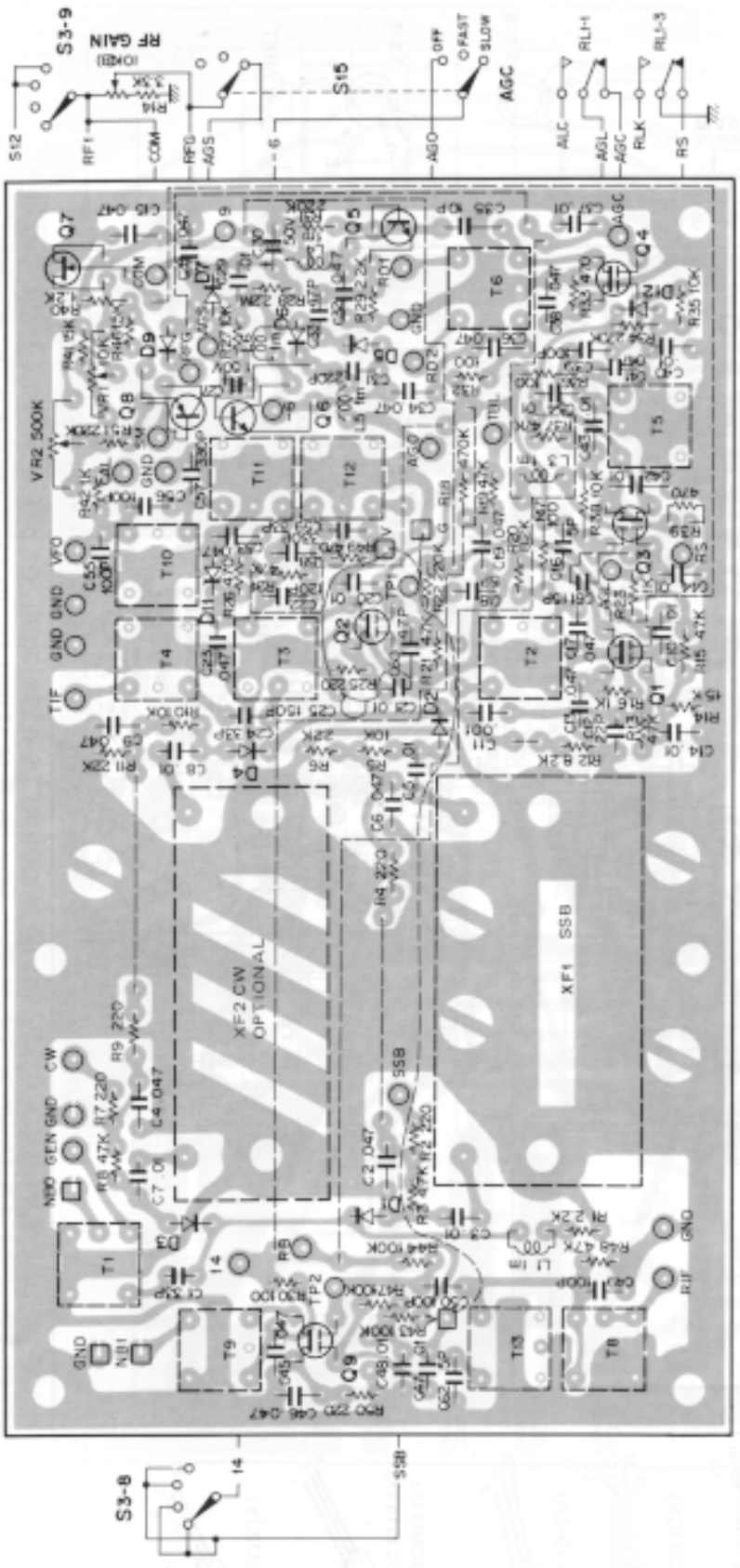


V1:12BY7A, Q1, 2:3SK41(L), Q3:3SK35(GR), Q4:3SK22(GR), Q5, 6:2SK19(GR), Q7, 8, 9:2SC460(B), Q10:2SC1515(K), Q11:2SC733(Y), D1, 2, 3, 13:WZ-090, D4, 11, 12:1S2588, D5, 6, 16:1S1587, D7, 10, 17:1S1555, D8, 9, 14, 15:V06B



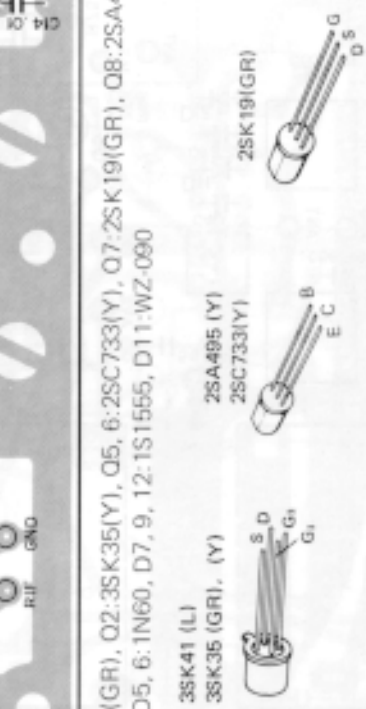
PC BOARD

▼ IF UNIT (X48-1060-01)



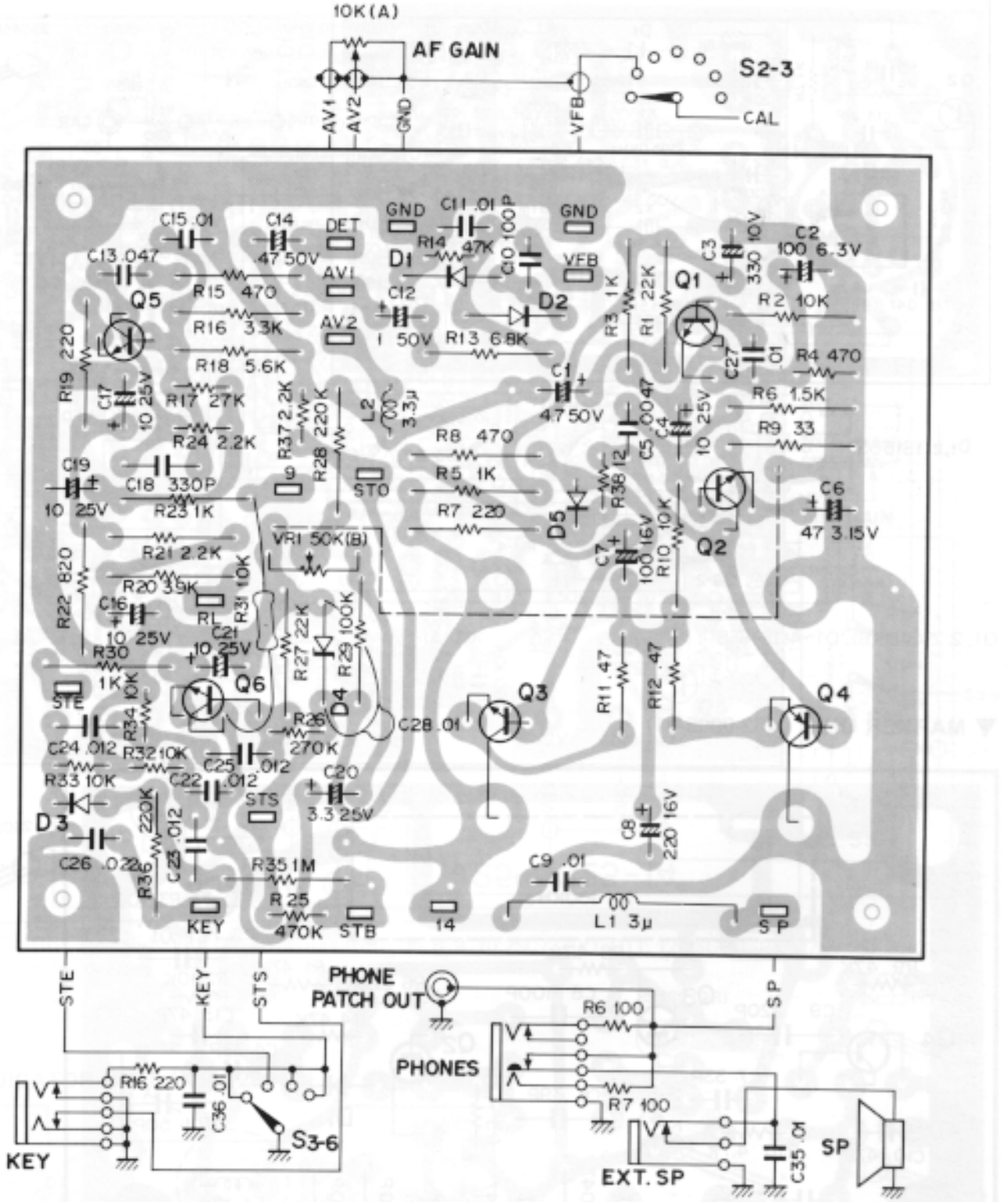
Q1, 3, 4:3SK35(GR), Q2:3SK35(Y), Q5, 6:2SC733(Y), Q7:2SK19(GR), Q8:2SA495(Y), Q9:3SK41(L), D1, 2:1S1007,
D3, 4:1S1587, D5, 6:1N60, D7, 9, 12:1S1555, D11:WZ-090

Note: C26, R45, D8, L2 not used.

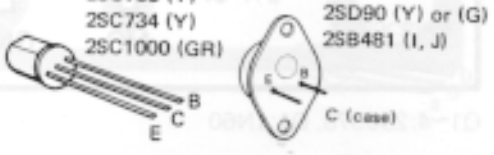


PC BOARD

▼ AF UNIT (X49-0008-01)

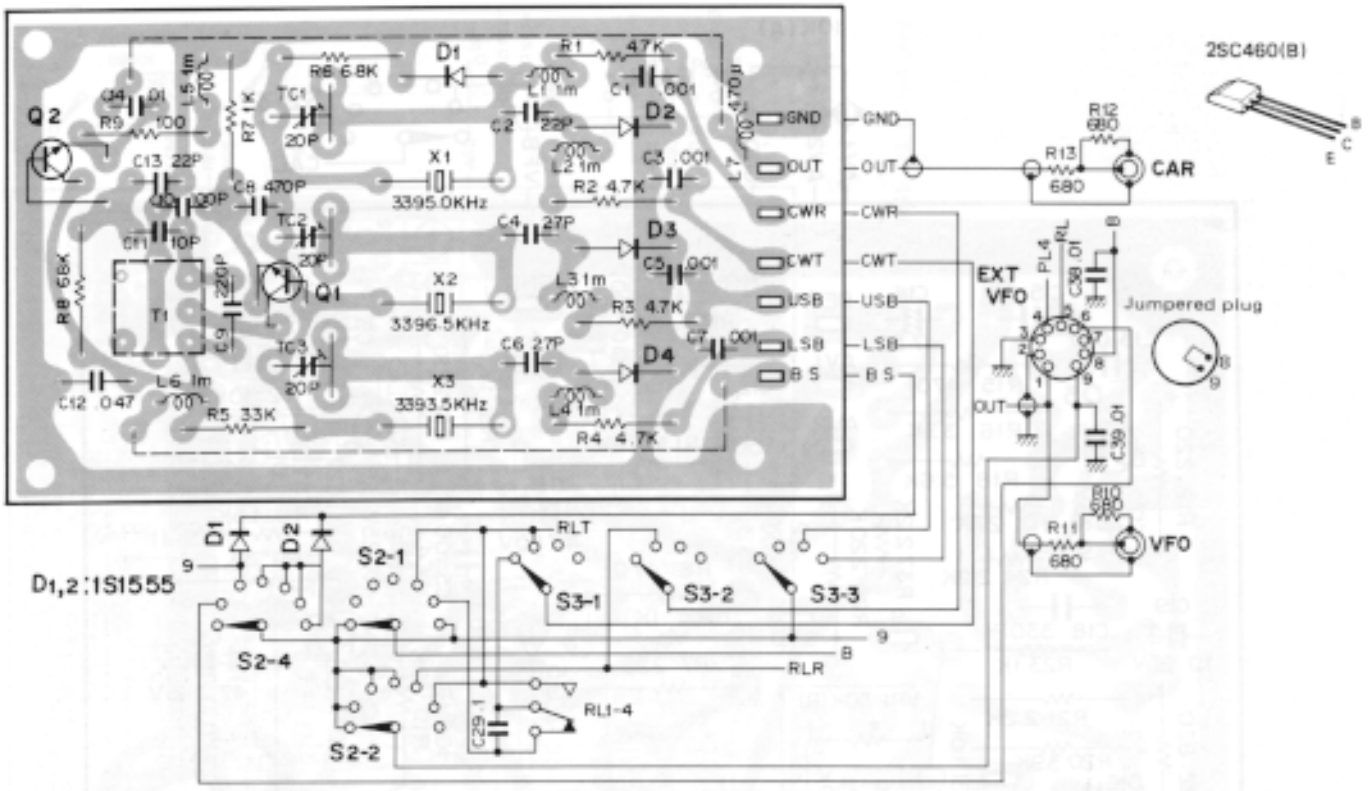


Q1, 6:2SC733(Y), Q2:2SC734(Y), Q3:2SD90(Y) or (G), Q4: 2SB481(I.J.), Q5:2SC1000(GR), D1, 2:1N60, D3:1S1555, D4:WZ130, D5:V06B



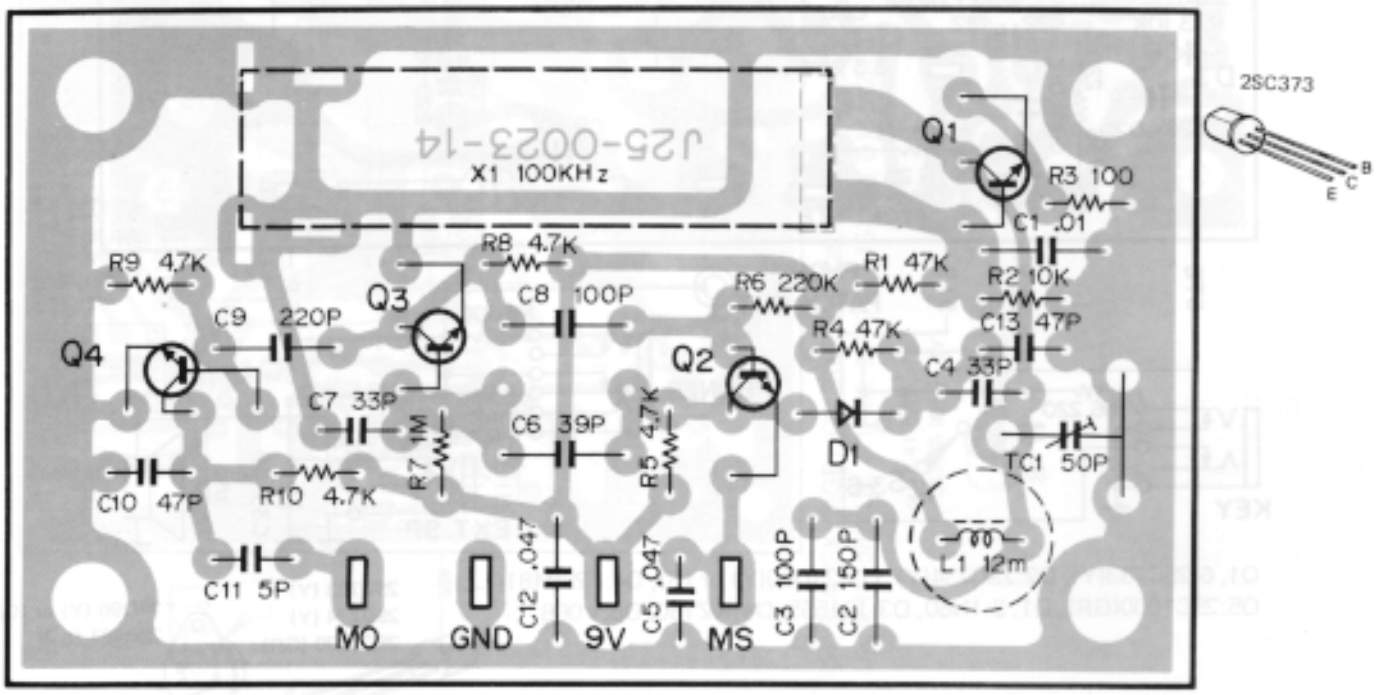
PC BOARD

▼ CARRIER UNIT (X50-0009-01)



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

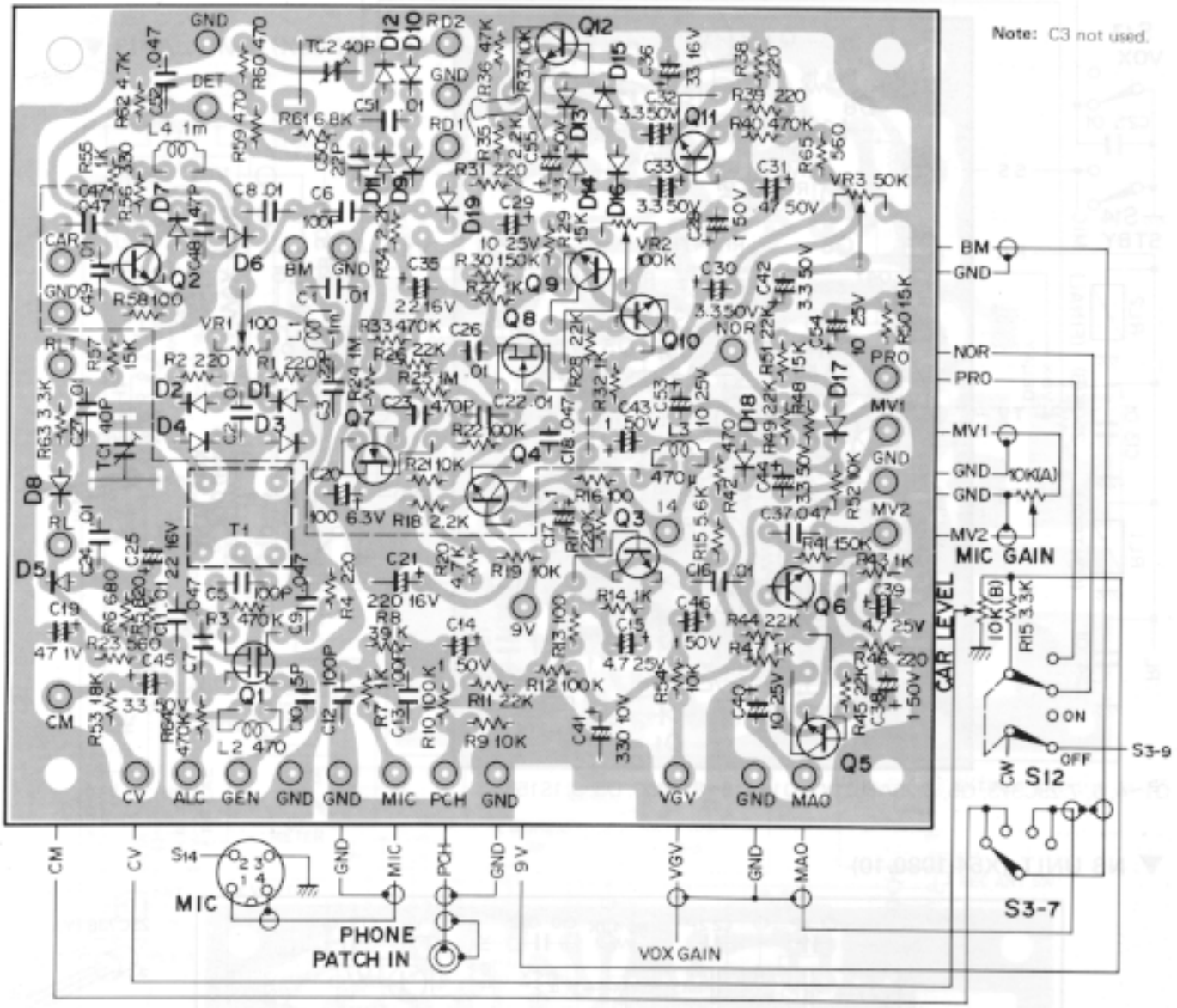
▼ MARKER UNIT (X52-0005-01)



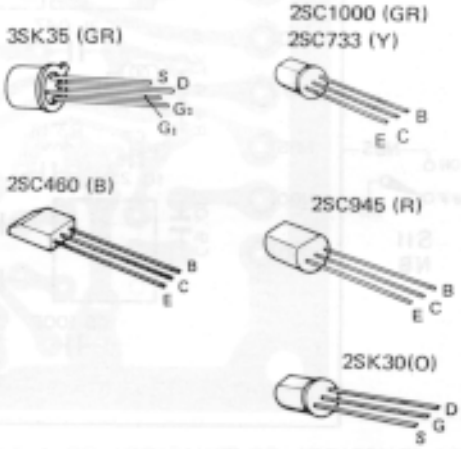
Q1~4:2SC373, D1:1N60

PC BOARD

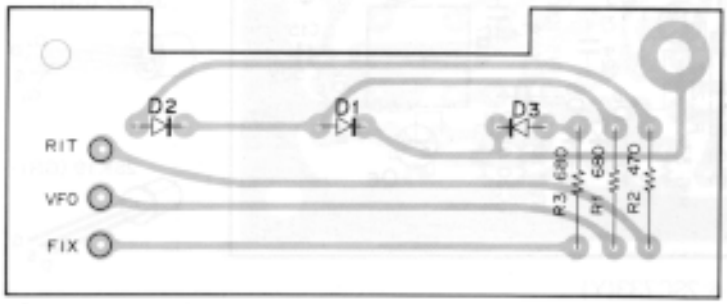
▼ GENERATOR UNIT (X52-1090-00)



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



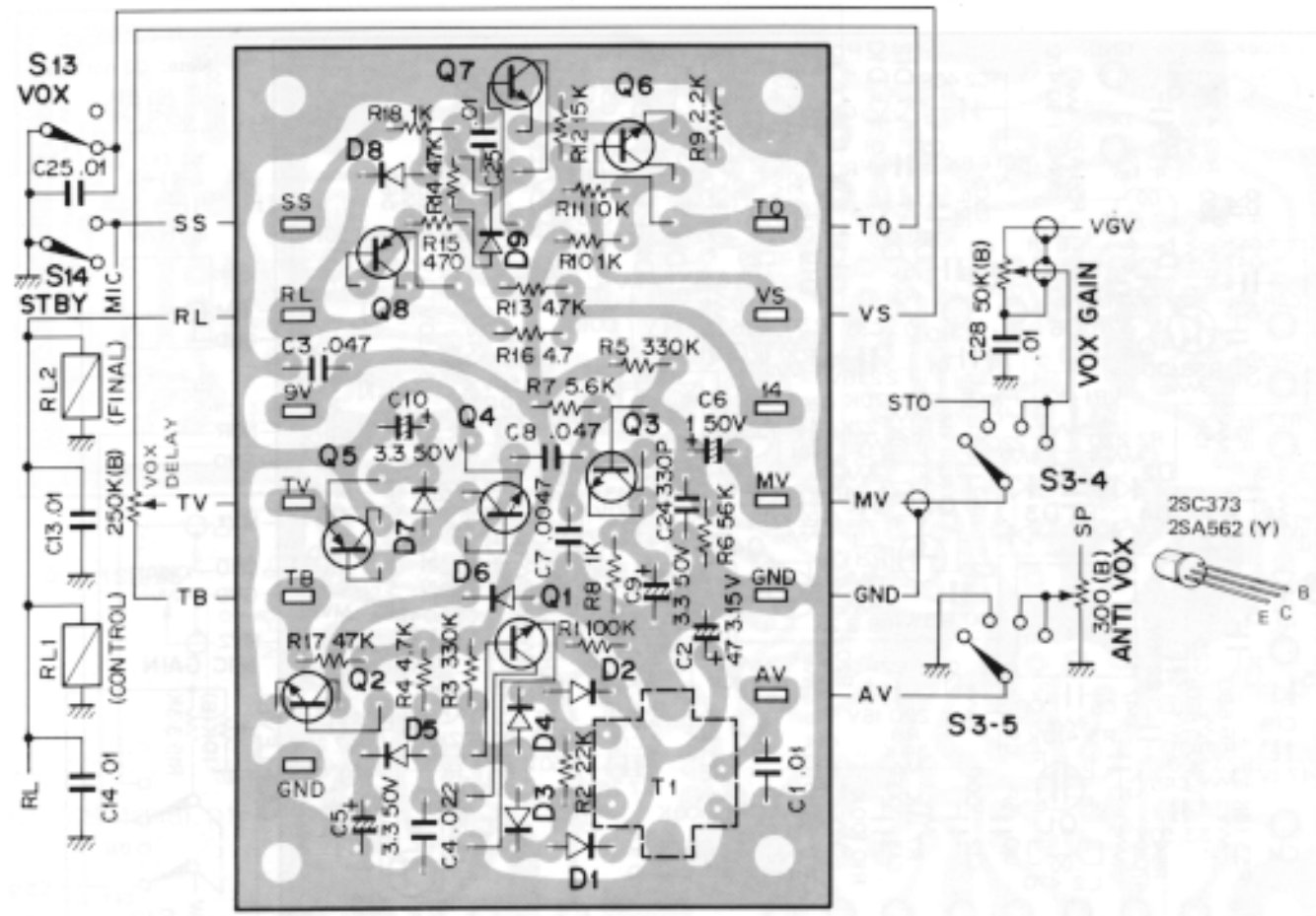
▼ INDICATOR UNIT (X54-1280-00)



D1~3:SEL-103W

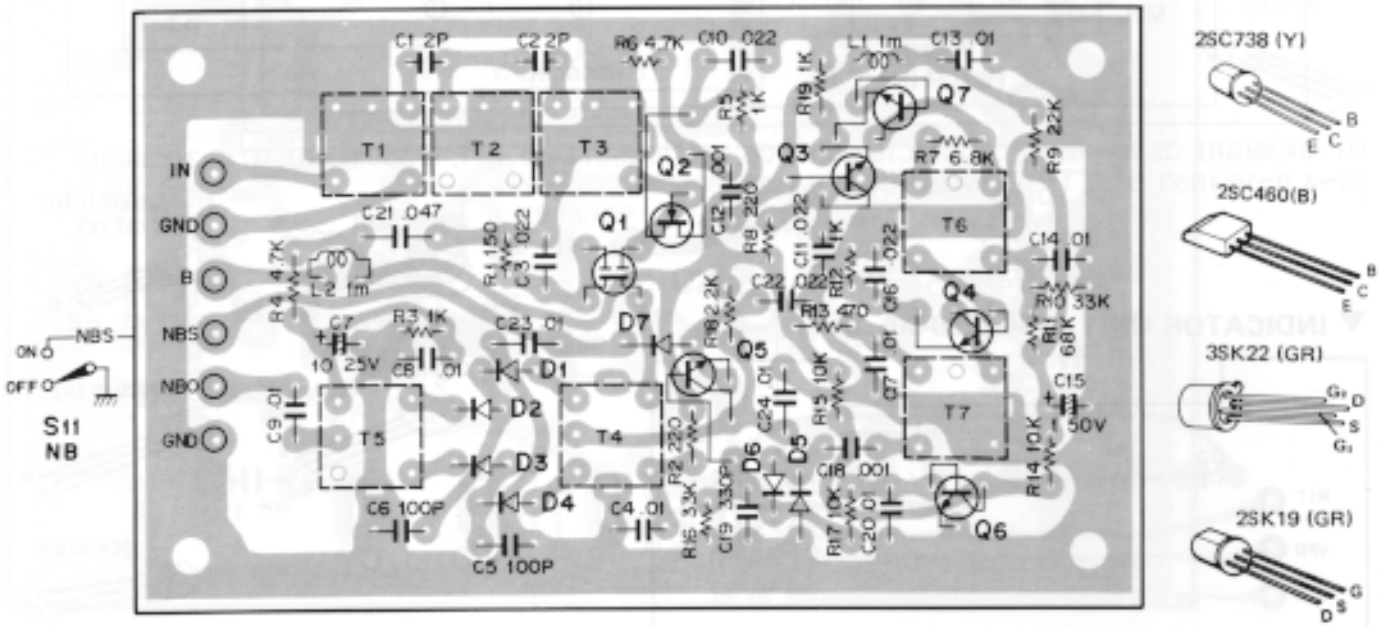
PC BOARD

▼ VOX UNIT (X54-0001-00)



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

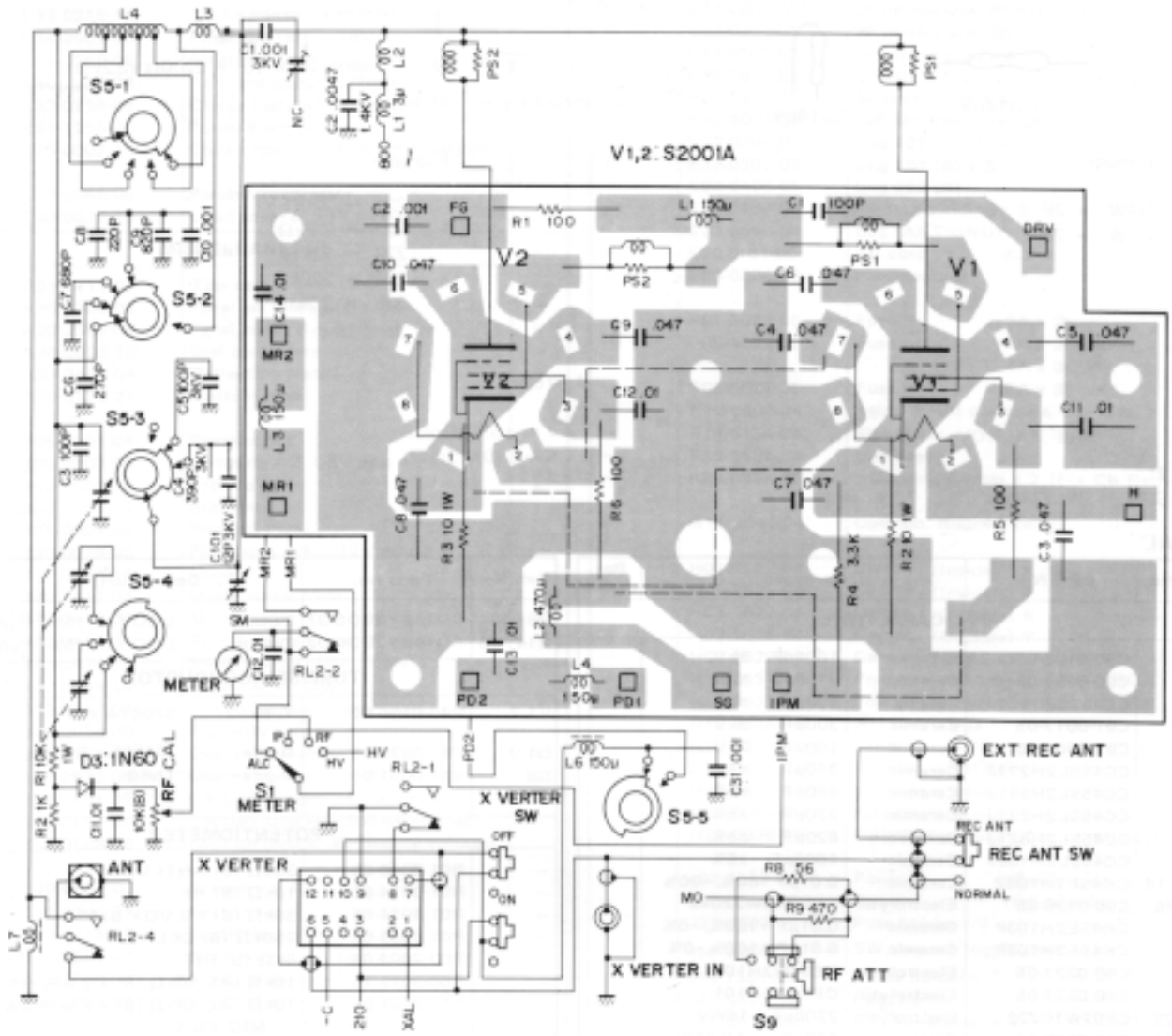
▼ NB UNIT (X54-1080-10)



Q1:3SK22(GR), Q2:2SK19(GR), Q3, 4, 7:2SC460(B), Q5, 6:2SC733(Y)

PC BOARD

▼ FINAL UNIT (X56-1220-00)



PARTS LIST

Note 1:
Except special types (example: cement, metal film, etc.) resistors are not detailed in the PARTS LIST. In regard to value, refer to the schematic diagram or the PC board illustration. Resistors not otherwise detailed are carbon type (1/4 or 1/8W).
Order carbon resistors according to the following example:
A carbon resistor's part number is RD14BY 2E222J.

1. Type of the carbon resistor

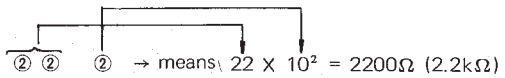
RD14BY

RD14CY

2. Wattage

1/4W → 2E
1/8W → 2B

3. Resistance value



Significant figure Multiplier

Example:

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

4. Tolerance

J = ±5% (Gold)
K = ±10% (Silver)

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

TOTAL

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	C90-0186-05	Ceramic 1000pF 3kV	
C2	C90-0187-05	Ceramic 4700pF 1.4kV	
C3	CC45SL2H101J	Ceramic 100pF ±5%	
C4	C91-0017-05	Ceramic 390pF 3kV	
C5	C91-0401-05	Ceramic 100pF 3kV	
C6	CC45SL2H271J	Ceramic 270pF ±5%	
C7	CC45SL2H681J	Ceramic 680pF ±5%	
C8	CC45SL2H221J	Ceramic 220pF ±5%	
C9	CC45SL2H821J	Ceramic 820pF ±5%	
C10	CC45SL2H102J	Ceramic 1000pF ±5%	
C11~14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C15,16	C90-0326-05	Electrolytic CE64W2W220x2	
C17	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C18	CK45E2H103P	Ceramic 0.01μF +100%,-0%	
C19	C90-0327-05	Electrolytic CE64W2H101	
C20	C90-0327-05	Electrolytic CE64W2H101	
C21,22	CE02W1C222	Electrolytic 2200μF 16WV	
C23,24	C90-0300-05	Ceramic 470pF AC 150V	
C25,26	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C27	CE04W1C471	Electrolytic 470μF 16WV	
C28	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C29	CQ93M1H104K	Mylar 0.1μF ±10%	
C30	C90-0187-05	Ceramic 4700pF 1.4kV	
C31, 32			
C33~35	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C36	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C37	CC45SL2H151J	Ceramic 150pF ±5%	
C38,39	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C40	C90-0172-05	Ceramic 12pF 3kV	
		RESISTOR	
R1	RC05GF3A103K	Carbon 10kΩ ±10% 1W	
R2	RD14BY2E102J	Carbon 1kΩ ±5% ¼W	
R3	RC05GF2H474J	Carbon 470kΩ ±5% ½W	
R4,5	RC05GF2H474J	Carbon 470kΩ ±5% ½W	
R6,7	RC05GF2H474J	Carbon 100Ω ±5% ½W	
R8~13	RD14BY2B000J	Carbon 000 Ω ±5% 1/8W	
R14~16	RD14BY2E000J	Carbon 000 Ω ±5% ¼W	
		TUBE/SEMICONDUCTOR	
V1,2	V40-0150-00	Tube S2001A x 2	
D1,2	V11-0076-05	Diode 1S1555 x 2	
D3	V11-0051-05	Diode 1N60	
		POTENTIOMETER	
—	R01-0040-05	300Ω (B) ANTI VOX	
—	R01-3014-05	10kΩ (B) RF	
—	R01-4014-05	50kΩ (B) x 2 VOX BIAS	
—	R01-6009-05	250kΩ (B) DELAY	
—	R03-2004-05	5kΩ (B) RIT	
—	R08-3012-15	10kΩ (A), 10kΩ (B) x 2 AF, RF	
—	R19-3401-05	10kΩ (A), 10kΩ (B) x 2 with SW, MIC, CAR	☆
		VARIABLE CAPACITOR/TRIMMER	
—	C01-0084-05	Variable capacitor (B) LOAD	
—	C03-0060-05	Variable capacitor (A) FINAL	
—	C03-0002-05	Trimmer	
		SWITCH	
S1	S29-1006-05	Rotary switch METER	
S2	S01-4017-05	Rotary switch FUNCTION	
S3	S04-5016-05	Rotary switch MODE	
S4	S10-1107-05	Rotary switch CHANNEL	
S5	S01-3401-05	Rotary switch FINAL	☆
—	S31-2007-05	Slide switch x 3	
—	S40-2023-05	Push switch x 2 RIT, ATT	
—	S44-2015-05	Paddle switch (Black)	
—	S44-2018-05	Paddle switch (Grey)	
—	S44-2020-05	Paddle switch (Black) x 3	
RL1	S51-4016-15	Relay	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
RL2	S51-4017-15	Relay (Final)	
—	S59-2017-05	Switch (Voltage selecting)	
—	S59-2020-05	Rocker switch (Power)	
		COIL/SPEAKER	
L1	L33-0032-05	Choke coil	
L2	L33-0218-15	Choke coil (Final)	
L3	L34-0561-05	Final coil (B) 28MHz	
L4	L34-0560-05	Final coil (A)	
L5	L40-2225-04	Ferri-inductor 2.2mH	
L7	L33-0259-05	Choke (Safety) 470μH	
—	L01-1056-05	Power transformer	
—	L15-0002-15	Choke coil (Low frequency)	
PS1,2	L39-0046-05	Parastic suppressor	
—	T03-0027-15	Loud speaker 8Ω 1W	
		MISCELLANEOUS	
—	A01-0211-02	Top case	
—	A20-2305-03	Panel ass'y Front T	☆
—	A20-2306-03	Panel ass'y Front K, W	☆
—	A30-0602-13	Dial back plate	☆
—	A33-0401-04	Reflection plate	☆
—	A40-0120-21	Bottom case	
—	B05-0201-04	Speaker net	
—	B09-0003-05	Coupling x 2 Universal	
—	B10-0607-14	Front glass	☆
—	B20-0287-44	Sub-dial	
—	B21-0007-04	Pointer, Plate	
—	B30-0079-05	Pilot lamp x 4 12V 40mA	
—	B31-0164-15	Meter	
—	B40-2411-04	Model name plate T	
—	B40-2413-04	Model name plate K, W	☆
—	B42-0444-24	Switch name plate T	☆
—	B42-0474-24	Switch name plate K, W	
—	B42-0445-14	Panel name plate	
—	B42-0447-04	VR adjustment name plate	
—	B46-0058-00	Warranty card	
—	B50-2531-00	Operating manual K, W	☆
—	B50-2532-00	Operating manual T	☆
—	B58-0181-00	Caution sticker (Final section)	
—	B58-0187-00	Caution card W (Source voltage)	
—	B58-0188-00	Caution card K, W (Source voltage)	
—	D13-0032-03	Sprocket x 3	
—	D21-0326-24	Shaft (A) LOAD	
—	D21-0415-14	Shaft (B) PLATE	
—	D21-0802-04	Shaft (C) DRIVE	☆
—	D22-0004-04	Shaft coupling x 2 6φ-6φ Bakelite	
—	D22-0027-14	Shaft joint	
—	D23-0048-04	Shaft supporter (Metal)	
—	D23-0061-04	Shaft supporter (Mold)	
—	D23-0116-05	Swivel shaft bearing ass'y	
—	D32-0018-04	Shaft stopper x 2	
—	D32-0075-04	Switch stopper x 2 Slide type	
—	D40-0204-05	Vernier mechanism PLATE	
—	D40-0206-05	Fan ass'y	
—			
—	E01-0801-05	8P (OCTAL) socket	
—	E01-0903-05	9P socket (EXT/VFO)	
—	E03-0301-15	AC plug (3P, power source)	
—	E04-0102-05	UHF type receptacle	
—	E05-0901-05	9P plug (EXT/VFO)	
—	E06-0403-05	4P MIC socket	
—	E07-0403-05	4P MIC plug	
—	E08-0203-25	2P polarized jack 14V OUT	
—	E08-0204-05	2P socket x 2	
—	E08-1202-05	12P POWER IN socket	
—	E08-1207-05	12P plug (x VERTER)	
—	E08-1208-05	12P connector (x VERTER)	

Ref. No.	Parts No.	Description	Remarks
—	E09-0204-05	2P plug x 3	
—	E11-0003-15	Ext. speaker jack 1/8"	
—	E11-0005-15	3P phone jack KEY 1/4"	
—	E11-0034-25	Jack with 2P switch PHONES 1/4"	
—	E12-0001-05	Phone plug (Ext. SP) 1/8"	
—	E13-0101-05	1P phono jack x 3 VFO, HET, CAR	
—	E13-0205-05	2P phono jack (Phone patch)	
—	E13-0361-05	3P phono jack (Counter)	☆
—	E14-0101-05	1P phono plug x 4	
—	E14-0801-05	8P OCTAL plug	
—	E20-0512-05	5P terminal strips	
—	E20-1003-05	10P terminal strip DC-DC CONV.	
—	E22-0206-05	Lug 101	
—	E22-0207-05	Lug 101 (B) x 5	
—	E22-0405-05	Lug 202 (B)	
	E23-0037-04	Shaft grounding x 2	
—	E23-0088-04	Lug (ANT-GND)	
—	E30-0181-05	AC cord K	
—	E90-0004-15	Plate cap x 2	
—	F05-2023-05	Fuse 2A x 2	
—	F05-4022-05	Fuse 4A x 2 K	
		4A x 3 W, T	
—	F05-6021-05	Fuse 6A x 3 K	
	F10-0402-04	Relay shield plate 6A x 2 W, T	
—	F19-0134-04	Side cover VOX, RF, BIAS	
—	F20-0504-04	Insulator	☆
—	F29-0014-05	Insulating washer x 2 (Fix Ch Ret.)	
—	G11-0044-04	Cushion Rubber, relay	
—	H01-2522-04	Carton (Inside) K, W	☆
—	H01-2523-04	Carton (Inside) T	
—	H03-1627-04	Carton (Outside) K	
—	H03-1628-04	Carton (Outside) T	
—	H03-1629-04	Carton (Outside) W	
—	H10-0931-12	Polystyrene foam cushion, FRONT	
—	H10-0932-22	Polystyrene foam cushion, REAR	
—	H10-1276-04	Accessory box	
—	H10-1393-04	Cushion SIDE	
—	H12-0405-04	Cushion FRONT	☆
—	H20-0439-03	Protective cover	
—	H25-0016-00	Polyethylene bag	
—	H25-0036-00	Polyethylene bag	
—	J02-0022-05	Foot (Small) x 4	
—	J02-0049-14	Foot (Large) x 6	
—	J13-0033-15	Fuse holder x 2	
	J19-0004-04	SW stopper toggle type	
—	J19-1301-04	Diode holder x 3	
—	J21-0392-04	Lead holder	
—	J21-0934-15	Handle retainer x 2	
	J21-1155-04	Fix ch. retainer	
—	J21-1497-04	Bobbin angle x 2	
—	J32-0074-04	Hex. boss x 6	
—	J32-0182-04	Hex. boss x 4	
—	J32-0220-04	Hex. boss x 6	
—	J32-0709-04	Hex. boss 4 mm	
—	J32-1030-14	Round boss x 2	
—	J41-0020-04	Knob bushing x 2	
—	J41-0024-15	Cord bushing	
—	J59-0001-05	Grommet x 2 (Quick release catch)	
—	J59-0002-05	Plunger x 2 (Quick release catch)	
—	J61-0014-05	Free up belt	
—	K01-0049-15	Handle LEATHER	
—	K21-0239-04	Knob x 2 BAND, MODE	
—	K21-0266-04	Knob LOAD 2, 6φ	
—	K21-0267-04	Knob x 3 DRIVE, RIT, FUNCTION	
—	K21-0268-04	Knob x 2 AF GAIN, MIC	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
–	K21-0269-04	Knob x 3 FIX, ch. CAR, RF GAIN	
–	K21-0279-04	Knob METER	
–	K21-0315-04	Knob PLATE	
–	K21-0709-03	Knob MAIN,	☆
–	K29-0166-04	Knob x 2 PUSH	
–	K29-0207-13	Dial scale	
–	N09-0256-05	Screw (GND) x 16	
–	N09-0601-05	Screw (Case) x 17 4 x 8 mm	☆
–	N14-0020-04	Wing nut, GROUND	
–	W01-0005-04	Tuning tool	
–	X40-1070-01	VFO unit	
–	X43-1090-02	Rectifier unit	
–	X43-1100-00	FIX CH, AVR unit	
–	X43-1110-00	HV unit	
–	X44-1160-00	OSC coil unit	☆
–	X44-1170-00	ANT coil unit	☆
–	X44-1180-00	MIXER coil unit	☆
–	X44-1190-00	DRIVE coil unit	☆
–	X44-1200-00	RF unit	☆
–	X48-1060-01	IF unit	☆
–	X49-0008-01	AF unit	
–	X50-0009-01	CARRIER unit	
–	X52-0005-01	MARKER unit	
–	X52-1090-00	GENERATOR unit	☆
–	X54-0001-00	VOX unit	
–	X54-1080-10	NB unit	
–	X54-1280-00	INDICATOR unit	☆
–	X56-1200-00	FINAL unit	

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

VFO UNIT (X40-1070-01)

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

RECTIFIER UNIT (X43-1090-02)

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

PARTS LIST

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

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45SL1H151J	Ceramic 150pF ±5%	
C2	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C3	CC45CH1H820J	Ceramic 82pF ±5%	
C4	CC35CH1H100D	Ceramic 10pF ±0.5pF	
C5	CC45CH1H330J	Ceramic 33pF ±5%	
C6	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C7	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C8	CE04W1A470	Electrolytic 47μF 10WV	
C9	CE04W1C470	Electrolytic 47μF 16WV	
C10	CE04W1HR47	Electrolytic 0.47μF 50WV	
C11	CE04W1C101	Electrolytic 100μF 16WV	
C12	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
		RESISTOR	
R1~22	RD14CY2E000J	Carbon 000Ω ±5% ¼W	
		SEMICONDUCTOR	
Q1~3	V03-0079-05	Transistor 2SC460(B)	
Q4	V01-0048-05	Transistor 2SA606(L)	
Q5~6	V03-0099-05	Transistor 2SC372	
Q8	V03-0241-05	Transistor 2SC735(Y)	
D1,2	V11-0051-05	Diode 1N60	
D3	V11-0243-05	Zener diode WZ-061 6.1V W	
D4~7	V11-0076-05	Diode 1S1555	
D8	V11-0243-05	Zener diode WZ-061 6.1V W	
		POTENTIOMETER	
VR1	R12-0042-05	SEMI-fixed resistor 500Ω (B)	
VR2	R12-3036-05	Semi-fixed resistor 10kΩ (B)	
VR3	R12-4020-05	Semi-fixed resistor 50kΩ (B)	
		COIL/TRIMMER	
TC1~4	C05-0030-15	Ceramic trimmer 20pF (Blue)	
TC5	C05-0015-15	Ceramic trimmer 40pF (Brown)	
L1	L40-1001-03	Ferri-inductor 10μH	
L2~4	L40-1021-03	Ferri-inductor 1mH	
T1	L12-0013-05	OSC transformer	
		MISCELLANEOUS	
—	E18-0401-05	4 Crystal socket ass'y	
—	E23-0047-04	Wire-wrap terminal x 15	

HV UNIT (X43-1110-00)

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

OSC COIL UNIT (X44-1160-00)

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

ANTENNA COIL UNIT (X44-1170-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45RH1H221J	Ceramic 220pF ±5%	
C2	CC45RH1H330J	Ceramic 33pF ±5%	
C3	CC45RH1H121J	Ceramic 120pF ±5%	
C4	CC45RH1H220J	Ceramic 22pF ±5%	
C5	CC45RH1H330J	Ceramic 33pF ±5%	
		COIL	
L1	L34-0620-05	Tuning coil 1.9MHz	☆
L2	L34-0621-05	Tuning coil 3.5MHz	
L3	L31-0032-05	Tuning coil 7MHz	
L4	L31-0033-05	Tuning coil 14MHz	
L5	L31-0034-05	Tuning coil 21MHz	
L6	L31-0209-05	Tuning coil 28MHz	
		MISCELLANEOUS	
—	S01-1403-05	Rotary switch wafer	
—	S01-1404-05	Rotary switch wafer (for terminal)	☆
—	D21-0801-05	Band switch shaft	☆
—	E23-0006-04	Wire-wrap, Edge x 6 terminal	
—	E23-0015-04	Grand lug x 2	
—	J31-0102-04	Collar (A) x 4 30mm	
—	J31-0103-04	Collar (B) x 2 25mm	
—	J31-0105-04	Collar (D) x 8 10mm	

PARTS LIST

MIXER COIL UNIT (X44-1180-00)

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

DRIVE COIL UNIT (X44-1190-00)

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

RF UNIT (X44-1200-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C2	CC45SL1H101J	Ceramic 100pF ±5%	
C3,4	CK45B1H102K	Ceramic 1000pF ±10%	
C5	CC45CH1H050D	Ceramic 5pF ±0.5pF	
C6	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C7,8	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C9	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C10	CC45SL1H330J	Ceramic 33pF ±5%	
C11~13	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C14,15	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C16	CC45SL1H330J	Ceramic 33pF ±5%	
C17	CC45CH1H030D	Ceramic 3pF ±0.5pF	
C18	CC45CH1H050D	Ceramic 5pF ±0.5pF	
C19	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C20	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C21	CC45CH1H330J	Ceramic 33pF ±5%	
C22	CC35CH1H050D	Ceramic 5pF ±0.5pF	
C23	CC45CH1H070D	Ceramic 7pF ±0.5pF	
C24	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C25	CC45CH1H330J	Ceramic 33pF ±5%	
C26	CC45CH1H151J	Ceramic 150pF ±5%	
C27	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C28,29	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C30	CK45F1H103Z	Ceramic 0.01μF +80%, --20%	
C31	CC45SL1H561J	Ceramic 560pF ±5%	
C32,33	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C34	CQ93M2H473K	Mylar 0.047μF ±10%	
C35	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C36	CQ93M2A473K	Mylar 0.047μF ±10%	
C37	CK45B1H102K	Ceramic 1000pF ±10%	
C38	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C39	CC45SL1H101J	Ceramic 100pF ±5%	
C40	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C41	CC45SL1H561J	Ceramic 560pF ±5%	
C42	CC45SL1H221J	Ceramic 220pF ±5%	
C43	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C44,45	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C46	CQ93M2A224M	Mylar 0.22μF ±20%	
C47	CK45B1H102K	Ceramic 1000pF ±10%	
C48	———		
C49	CC45SL2H151J	Ceramic 150pF ±5%	
C50	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C51,52	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C53	CC45SL1H561J	Ceramic 560pF ±5%	
C54	CK45E2H103P	Ceramic 0.01μF +100%, -0%	
C55	CQ93M1H102K	Mylar 1000pF ±10%	
C56	CC45CH1H101J	Ceramic 100pF ±5%	
C57	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C58	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C59	CE04W1HR47	Electrolytic 0.47μF 50WV	
C60	C90-0262-05	Ceramic 0.047μF DD310BC473K 25V	
C61	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C62,63	CC45CH101J	Ceramic 100pF ±5%	
C64	CC45CH1H100D	Ceramic 10pF ±5pF	
		RESISTOR	
R1~75	RD14CY2EOOOJ	Carbon OOOΩ ±5% ¼W	
R54~57 73, 76	RC05GF2HOOOJ	Carbon OOOΩ ±5% ¼W	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
TUBE/SEMICONDUCTOR			
V1	V40-0114-00	Driver tube 12BY7A	
Q1,2	V09-0057-05	FET 3SK41(L) or 3SK40(L)	
Q3	V09-0036-05	FET 3SK35(GR)	
Q4	V09-0023-05	FET 3SK22(GR)	
Q5,6	V09-0012-05	FET 2SK19(GR)	
Q7~9	V04-0079-05	Transistor 2SC460(B)	
Q10	V03-0450-05	Transistor 2SC1515(K)	
Q11	V03-0123-05	Transistor 2SC733(Y)	
D1~3	V11-0240-05	Zener diode WZ-090 9.0V W	
D4	V11-0414-05	Diode 1S2588	
D5,6	V11-0370-05	Diode 1S1587	
D7	V11-0076-05	Diode 1S1555	
D8,9	V11-0219-05	Diode V06B	
D10	V11-0076-05	Diode 1S1555	
D11,12	V11-0414-05	Diode 1S2588	
D13	V11-0240-05	Zener diode WZ-090 9.0V W	
D14,15	V11-0219-05	Diode V06B	
D16	V11-0370-05	Diode 1S1587	
D17	V11-0076-05	Diode 1S1555	
POTENTIOMETER/VC			
VR1	R12-1012-05	Semi-fixed resistor 1kΩ	
VC1~3	C01-0127-15	Variable capacitor	
COIL/CRYSTAL			
L1	L40-4711-03	Ferri-inductor 470μH	
L2~4	L40-1021-03	Ferri-inductor 1mH	
L5	L40-4711-03	Ferri-inductor 470μH	
L6	L40-1021-03	Ferri-inductor 1mH	
L7	L40-1511-03	Ferri-inductor 150μH	
L8	L33-0074-05	Heater choke 0.22μH	
L9	L40-4711-03	Ferri-inductor 470μH	
L10	L40-1511-03	Ferri-inductor 150μH	
T1,2	L30-0008-05	BPF coil	
T3	L30-0009-05	BPF coil	
T4,5	L34-0622-05	Tuning coil 15MHz WWV	☆
T6	L31-0010-05	Trap coil 8.6MHz	
T7	L31-0011-05	Trap coil 8.6MHz	
X1	L77-0180-05	Crystal 23.895MHz WWV	
MISCELLANEOUS			
—	D13-0032-03	Sprocket x 3	
—	D16-0033-04	Chain ass'y x 3	
—	E06-0406-05	FET socket x 3	
—	E10-1902-05	9P tube socket	
—	E23-0046-04	Wire-wrap short	
—	E23-0047-04	Wire-wrap terminal x 58	

IF UNIT (X48-1060-01)

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

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
X1	L77-0123-05	Crystal, CW T13-98 3395.0kHz	
X2	L77-0122-05	Crystal, USB T13-97 3396.5kHz	
X3	L77-0120-05	Crystal, LSB T13-95 3393.5kHz	
L1~6	L40-1021-03	Ferri-inductor 1mH	
L7	L40-4711-03	Ferri-inductor 470μH	
T1	L32-0003-05	OSC coil	
MISCELLANEOUS			
—	E23-0005-04	Terminal (Twist lock) x 7	

MARKER UNIT (X52-0005-01)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1	CQ93M1H103K	Mylar 0.01μF ±10%	
C2	CC45CH1H151J	Ceramic 150pF ±5%	
C3	CC45TH1H101J	Ceramic 100pF ±5%	
C4	CC45CH1H330J	Ceramic 33pF ±5%	
C5	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C6	CC45CH1H390J	Ceramic 39pF ±5%	
C7	CC45CH1H330J	Ceramic 33pF ±5%	
C8	CC45SL1H101J	Ceramic 100pF ±5%	
C9	CC45SL1H221K	Ceramic 220pF ±10%	
C10	CC45SL1H470K	Ceramic 47pF ±10%	
C11	CC94SL2H050D	Ceramic 5pF ±0.5pF	
C12	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C13	CC45CH1H470J	Ceramic 47pF ±5%	
RESISTOR			
R1~10	RD14CY2EOOOJ	Carbon OOOΩ ±5% ¼W	
SEMICONDUCTOR			
Q1	V03-0042-05	Transistor 2SC373 or 2SC458(B)	
Q2,3	V03-0042-05	Transistor 2SC373	
Q4	V03-0042-05	Transistor 2SC373 or 2SC458(B)	
D1	V11-0051-05	Diode 1N60	
CRYSTAL/TRIMMER/COIL			
X1	L77-0009-05	Crystal 100kHz	
TC1	C05-0029-05	Ceramic trimmer 50 pF	
L1	L40-1235-05	Ferri-inductor 12mH	
MISCELLANEOUS			
—	E23-0005-04	Terminal (Twist lock) x 4	

GENERATOR UNIT (X52-1090-00)

Ref. No.	Parts No.	Description	Remarks
CAPACITOR			
C1,2	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C3	CC45SL1H220J	Ceramic 0.1μF ±5%	
C4	——		
C5,6	CC45SL1H101J	Ceramic 100pF ±5%	
C7	C90-0262-05	Ceramic 0.047μF ±10%	
C8	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C9	C90-0262-05	Ceramic 0.047μF ±10%	
C10	CC45SL1H050D	Ceramic 5pF ±0.5pF	
C11	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C12	CC45SL1H101J	Ceramic 100pF ±5%	
C14	CE04W1H010	Electrolytic 1μF 50WV	
C15	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C16	CQ92M1H103K	Mylar 0.01μF ±10%	
C17	CS15E1VR10M	Tantalum 0.1μF ±20%	
C18	CQ92M1H473K	Mylar 0.047μF ±10%	
C19	CE04W1A470	Electrolytic 47μF 1.0WV	
C20	CE04W0J101	Electrolytic 100μF 6.3WV	
C21	CE04W1C221	Electrolytic 220μF 16WV	
C22	CQ92M1H103K	Mylar 0.01μF ±10%	
C23	CK45B1H471K	Ceramic 470pF ±10%	
C24	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C25	CE04W1C220	Electrolytic 22μF 16WV	
C26	CQ92M1H103K	Mylar 0.01μF ±10%	
C27	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C28	CE04W1H010	Electrolytic 1μF 50WV	
C29	CE04W1E100	Electrolytic 10μF 25WV	
C30	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C31	CE04W1HR47	Electrolytic 0.47μF 50WV	
C32,33	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C34	——		
C35	CE04W1C220	Electrolytic 22μF 16WV	
C36	CE04W1C330	Electrolytic 33μF 16WV	
C37	C90-0262-05	Ceramic 0.047μF ±10%	
C38	CE04W1H010	Electrolytic 1μF 50WV	
C39	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C40	CE04W1E100	Electrolytic 10μF 25WV	
C41	CE04W1A331	Electrolytic 330μF 10WV	
C42	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C43	CE04W1H010	Electrolytic 1μF 50WV	
C44,45	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C46	CE04W1H010	Electrolytic 1μF 50WV	
C47	C90-0262-05	Ceramic 0.047μF ±10%	
C48	CC45SL1H470J	Ceramic 47pF ±5%	
C49	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C50	CC45SL1H220J	Ceramic 22pF ±5%	
C51	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C52	C90-0262-05	Ceramic 0.047μF ±10%	
C53,54	CE04W1E100	Electrolytic 10μF 25WV	
C55	CE04W1H3R3	Electrolytic 3.3μF 50WV	
RESISTOR			
R1~65	RD14CY2BOOOJ	Carbon OOOΩ ±5% 1/8W	
SEMICONDUCTOR			
Q1	V09-0036-05	FET 3SK35(GR)	
Q2	V03-0079-05	Transistor 2SC460(B)	
Q3,4	V03-0355-05	Transistor 2SC1000(GR)	
Q5,6	V03-0123-05	Transistor 2SC733(Y)	
Q7,8	V09-0015-05	FET 2SK30(O)	
Q9,10	V03-0123-05	Transistor 2SC733(Y)	
Q11,12	V03-0270-05	Transistor 2SC745(R)	
D1~4	V11-0051-05	Diode 1N60	
D5	V11-0076-05	Diode 1S1555	
D6,7	V11-0414-05	Diode 1S2588	
D8	V11-0076-05	Diode 1S1555	
D9~16	V11-0051-05	Diode 1N60	
D17~19	V11-0076-05	Diode 1S1555	

PARTS LIST

Ref. No.	Parts No.	Description	Remarks
		POTENTIOMETER	
VR1	R12-0401-05	Semi-fixed resistor 100Ω (B)	
VR2	R12-5401-05	Semi-fixed resistor 100kΩ (B)	☆
VR3	R12-4503-05	Semi-fixed resistor 50kΩ (B)	☆
		TRIMMER/COIL	
TC1,2	C05-0015-15	Ceramic trimmer 40pF	
L1	L40-1021-03	Ferri-inductor 1mH	
L2,3	L40-4711-03	Ferri-inductor 470μH	
L4	L40-1021-03	Ferri-inductor 1mH	
T1	L30-0021-05	IFT 3395kHz	
		MISCELLANEOUS	
—	E23-0047-04	Wire-wrap terminal x 30	

VOX UNIT (X54-0001-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C2	CE04W0F470	Electrolytic 47μF 3.15WV	
C3	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C4	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C5	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C6	CE04W1H010	Electrolytic 1μF 50WV	
C7	CK94YY1H472M	Ceramic 4700pF ±20%	
C8	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C9,10	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C24	CC45SL1H331K	Ceramic 330pF ±10%	
C25	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
		RESISTOR	
R1~17	RD14CY2EOOOJ	Carbon OOOΩ ±5% ¼W	
R14	RD14BY2E472J	Carbon 4.7kΩ ±5% ¼W	
R18	RD14BY2B102J	Carbon 1kΩ ±5% 1/8 W	
		SEMICONDUCTOR	
Q1~4	V03-0042-05	Transistor 2SC373	
Q5	V01-0038-05	Transistor 2SA562(Y)	
Q6,7	V03-0042-05	Transistor 2SC373	
Q8	V01-0038-05	Transistor 2SA562(Y)	
D1~4	V11-0051-05	Diode 1N60	
D5	V11-0076-05	Diode 1S1555	
D6~8	V11-0051-05	Diode 1N60	
D9	V11-0076-05	Diode 1S1555	
		MISCELLANEOUS	
T1	L13-0001-05	Input transformer 500Ω : 20kΩ	
—	E23-0005-04	Terminal twist lock	

NB UNIT (X54-1080-10)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1,2	CC45SL1H020D	Ceramic 2pF ±0.5pF	
C3	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C4	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C5,6	CC45SL1H101J	Ceramic 100pF ±5%	
C7	CE04W1E100	Electrolytic 10μF 25WV	
C8,9	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C10,11	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C12	CK45D1H102M	Ceramic 1000pF ±20%	
C13,14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C15	CE04W1H010	Electrolytic 1μF 50WV	
C16	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C17	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C18	CK45D1H102M	Ceramic 1000pF ±20%	
C19	CC45SL1H331J	Ceramic 330pF ±6% ±5%	
C20	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C21	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C22	CK45F1H223Z	Ceramic 0.022μF +80%, -20%	
C23,24	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
		RESISTOR	
R1~19	RD14CY2EOOOJ	Carbon OOOOΩ ±5% ¼W	
		SEMICONDUCTOR	
Q1	V09-0023-05	FET 3SK22(GR)	
Q2	V09-0012-05	FET 2SK19(GR)	
Q3,4	V03-0079-05	Transistor 2SC460(B)	
Q5,6	V03-0123-05	Transistor 2SC733(Y)	
Q7	V03-0079-05	Transistor 2SC460(B)	
D1~4	V11-0370-05	Diode 1S1587	
D5,6	V11-0051-05	Diode 1N60	
D7	V21-0041-05	Varister MV-13	
		COIL	
L1,2	L40-1021-03	Ferri-inductor 1mH	
T1~3	L30-0010-05	IFT 3395kHz	
T4	L31-0286-05	NB coil (A) 3395kHz	
T5	L31-0287-05	NB coil (B) 3395kHz	
T6	L30-0010-05	IFT 3395kHz	
T7	L30-0021-05	IFT 3395kHz	
		MISCELLANEOUS	
—	E23-0046-04	Wire-wrap short terminal x 6	

INDICATOR UNIT (X54-1280-00)

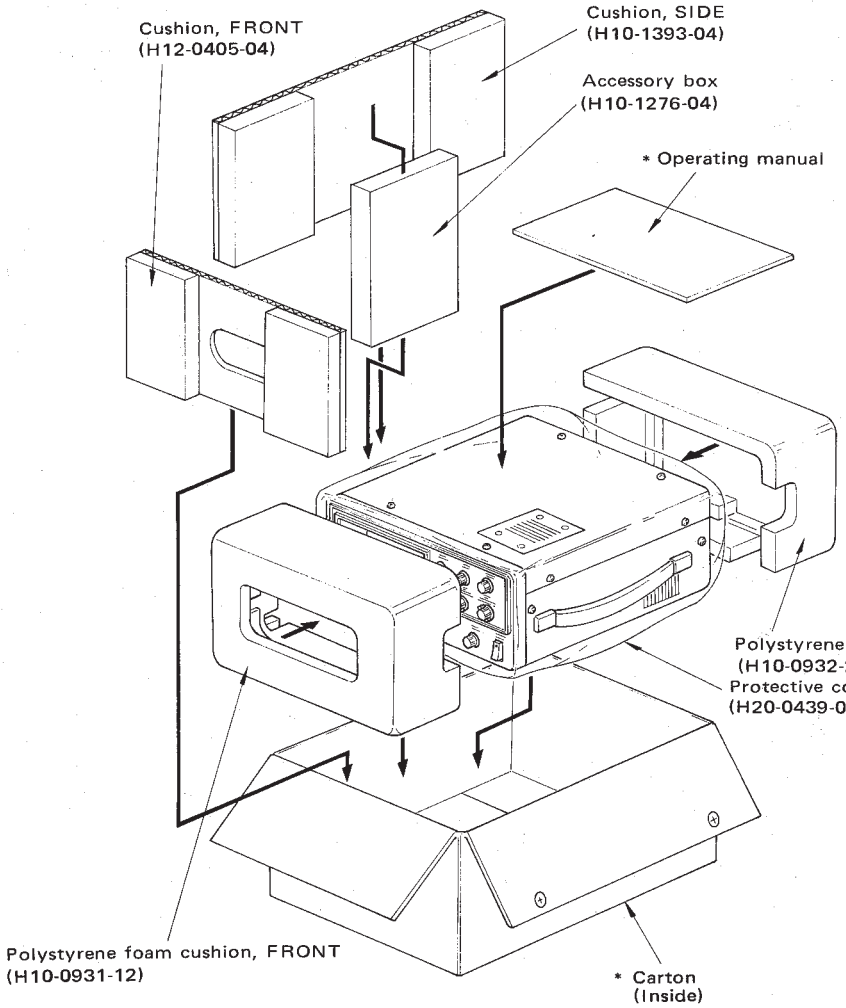
Ref. No.	Parts No.	Description	Remarks
		RESISTOR	
R1	RD14BY2E681J	Carbon 680Ω ±5% ¼W	
R2	RD14BY2E471J	Carbon 470Ω ±5% ¼W	
R3	RD14BY2E681J	Carbon 680Ω ±5% ¼W	
		SEMICONDUCTOR	
D1~3	V11-0304-05	LED SEL-103W	
		MISCELLANEOUS	
—	E23-0047-04	Wire-wrap terminal x 3	
—	F15-0609-04	Shading rubber x 3	
—	F20-0501-04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

PARTS LIST/PACKING

FINAL UNIT (X56-1200-00)

Ref. No.	Parts No.	Description	Remarks
		CAPACITOR	
C1	CC45SL2H101J	Ceramic 100pF ±5%	
C2	CK45E2H102P	Ceramic 1000pF +100%, -0%	
C3~10	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C3, 5~7	CK45F1H473Z	Ceramic 0.047μF +80%, -20%	
C11~13	CK45F1H103P	Ceramic 0.01μF +100%, -0%	
C11,13	CK45F1H103P	Ceramic 0.01μF +100%, -0%	
C14	CK45F1H103Z	Ceramic 0.01μF +80%, -20%	
C15	CC45CH2H150J	Ceramic 15pF ±5%	
		RESISTOR	
R1	RD14BY2E101J	Carbon 100Ω ±5% ¼W	
R2,3	RC05GF3A100J	Carbon 10Ω ±5% 1W	
R4	RD14BY2E332J	Carbon 3.3kΩ ±5% ¼W	
R5	RC05GF2H101J	Carbon 100Ω ±5% ½W	
R6	RC05GF2H101J	Carbon 100Ω ±5% ½W	
R7	RW14AG3K6R2K	Wire wound 6.2Ω ±10% 10W	
		COIL	
L1	L40-1511-03	Ferri-inductor 150μH	
L2	L40-4711-03	Ferri-inductor 470μH	
L3,4	L40-1511-03	Ferri-inductor 150μH	
PS1,2	L33-0110-05	Parastic suppressor	
		MISCELLANEOUS	
V1,2	E01-0801-05	8P (OCTAL) socket	
—	E23-0047-04	Wire-wrap terminal x 9	

PACKING



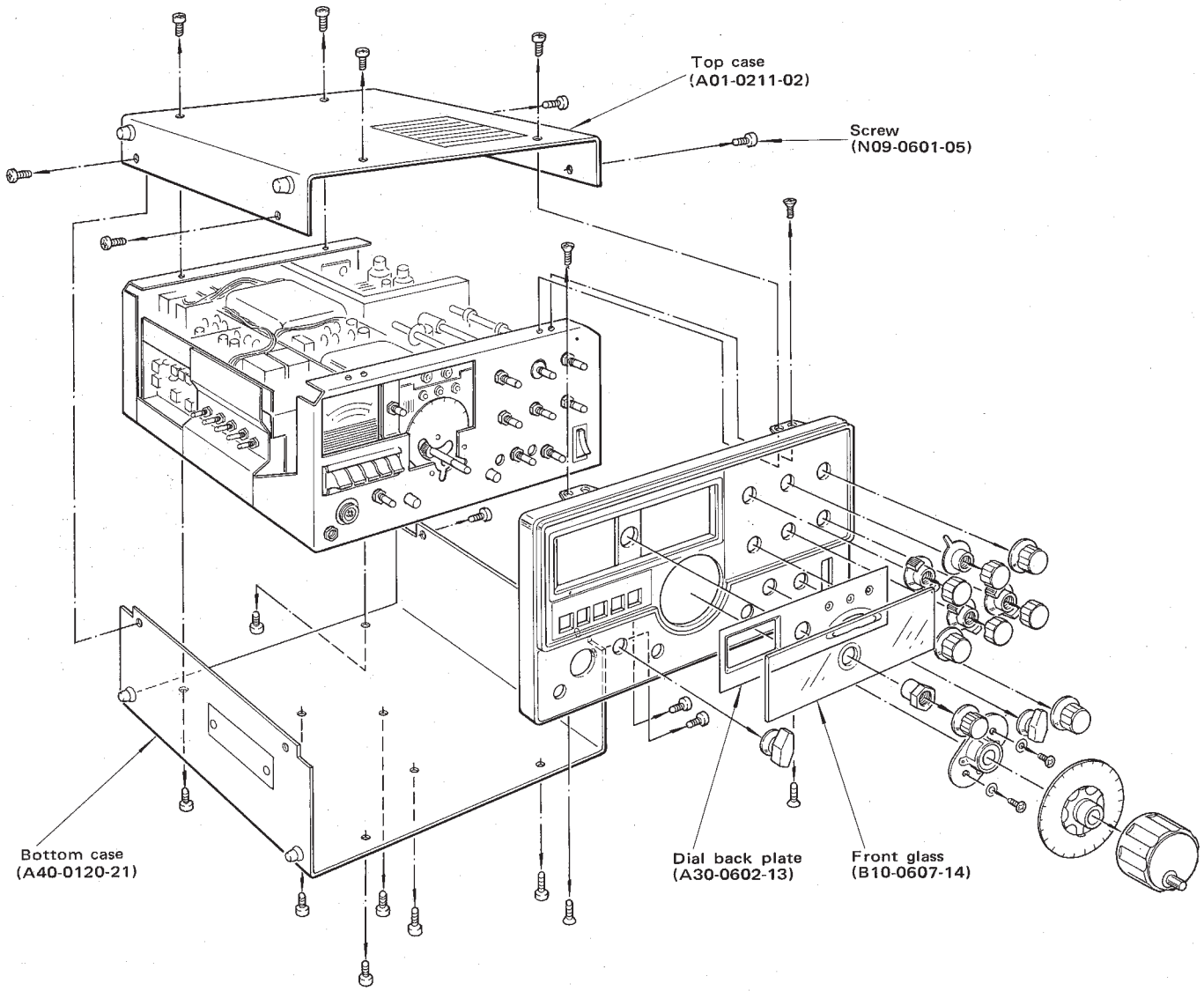
Accessories

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

* Refer to parts list.

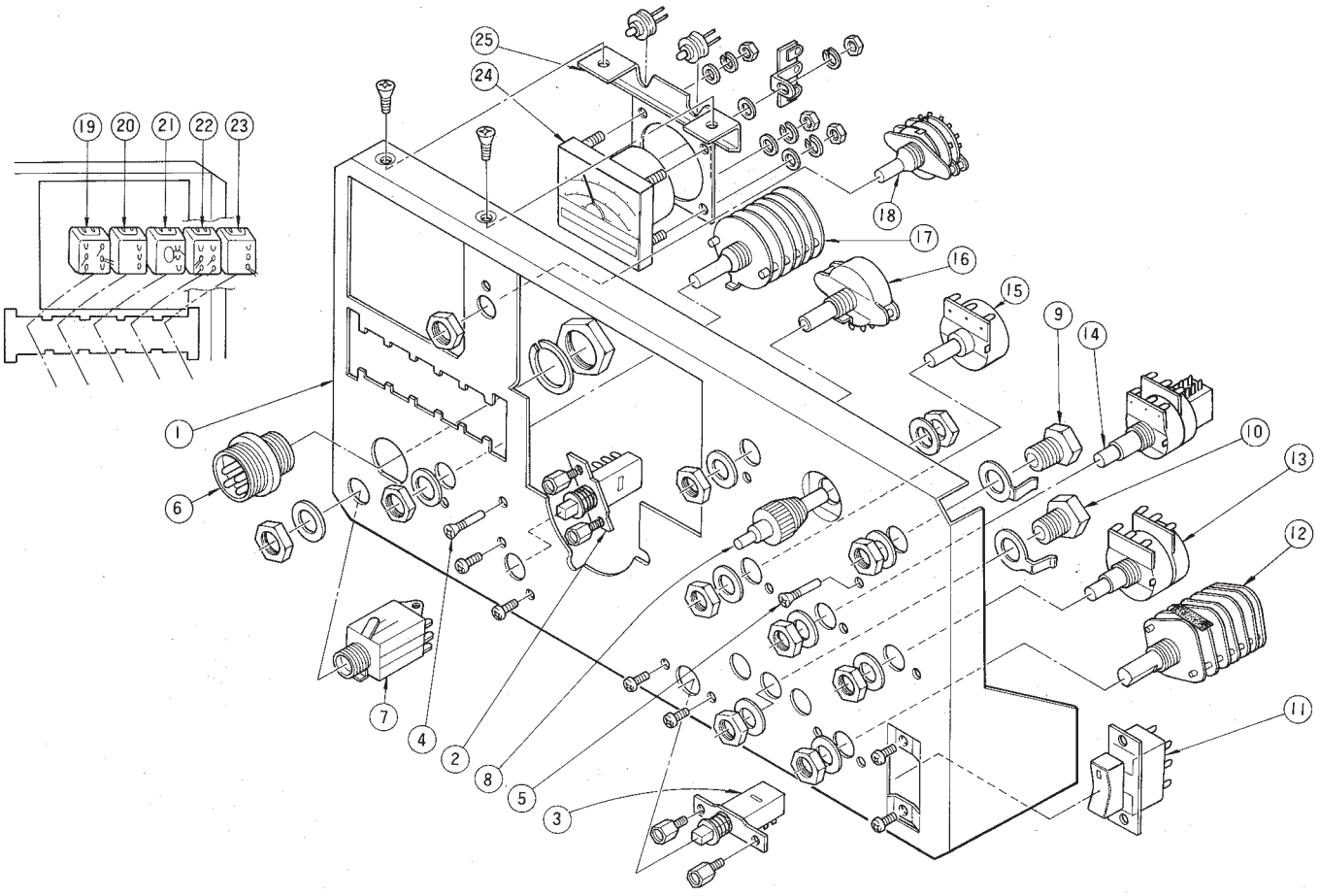
DISASSEMBLY

DISASSEMBLY OF PANEL ASS'Y AND CASE



DISASSEMBLY

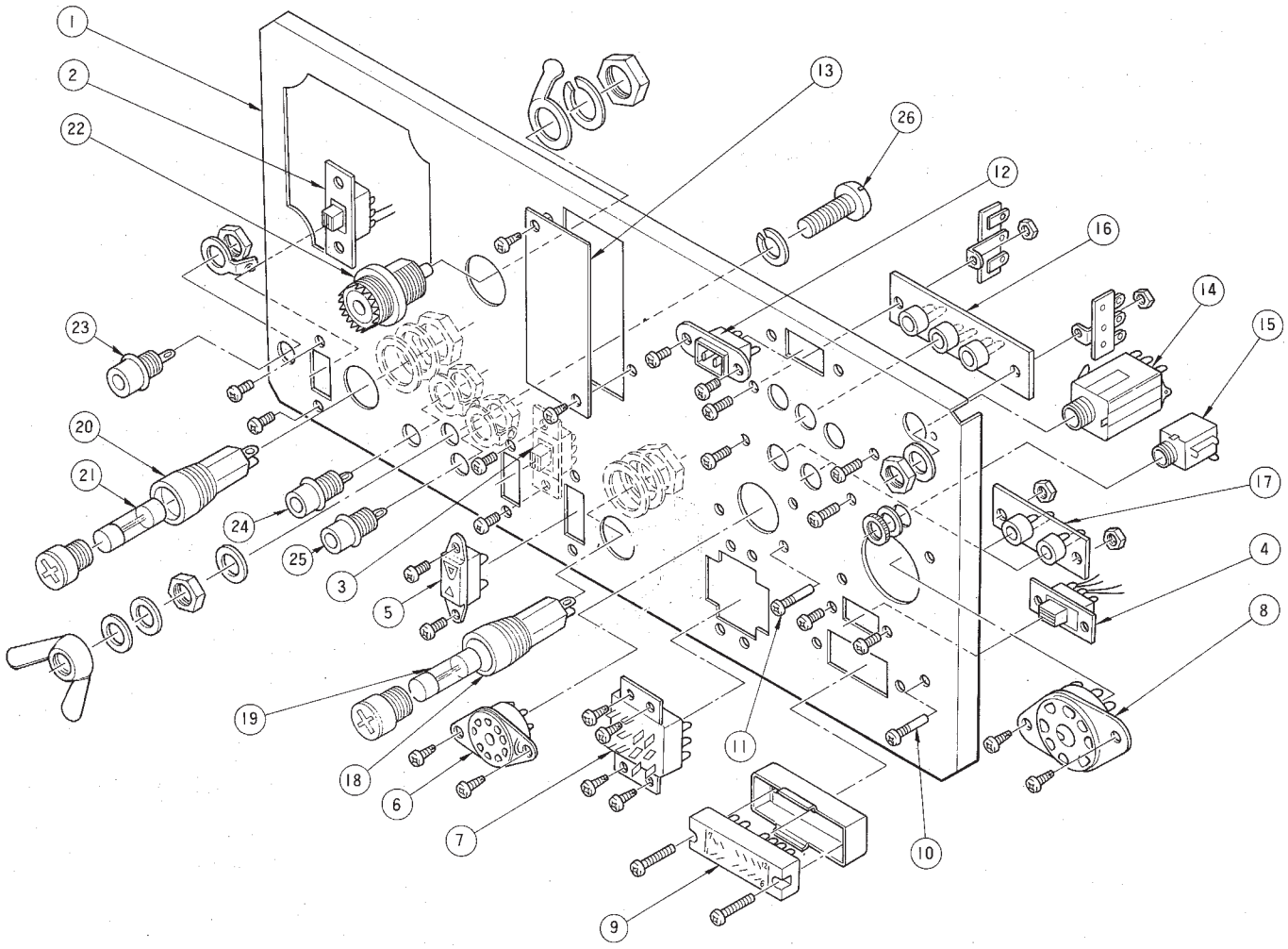
DISASSEMBLY OF SUBPANEL



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

DISASSEMBLY

DISASSEMBLY OF REAR PANEL



No.	Description	Parts No.	Remarks	No.	Description	Parts No.	Remarks
1	Rear panel	A23-1404-02		16	3P pin jack	E13-0361-05	VFO.HET. CAR
2	Slide switch	S31-2007-05	SG	17	2P pin jack	E13-0205-05	PHONE PATCH
3	Slide switch	S31-2007-05	REC. ANT	18	Fuse holder	J13-0033-15	AC FUSE
4	Slide switch	S31-2007-05	X VERTER	19	Fuse *		
5	2P socket	E08-0204-05	FAN PWR	20	Fuse holder	J13-0033-15	DC FUSE
6	9P socket	E01-0903-05	EXT. VFO	21	Fuse *		
7	12P socket	E08-1202-05	POWER	22	UHF receptacle	E04-0102-05	ANT
8	8P OCTAL socket	E01-0801-05	REMOTE	23	1P pin jack	E13-0101-05	X VERTER OUT
9	12P connector,,female	E08-1208-05	X VERTER	24	1P pin jack	E13-0101-05	X VERTER IN
10	Screw (GND)	N09-0256-05		25	1P pin jack	E13-0101-05	EXT. REC. ANT.
11	Screw (GND)	N09-0256-05		26	GND screw	N31-6018-11	
12	2P jack polarized	E08-0203-25	DC 13.8V		Fan ass'y	D40-0206-05	
13	Cover plate	F19-0133-14	DC-DC CONV.		Toggle SW	S59-2017-05	SOURCE VOLTAGE
14	3 pole phone jack	E11-0005-15	KEY 1/4"		SW stopper	J19-0006-04	
15	Phone jack	E11-0003-15	EXT. SP 1/8"				

* See parts list.

DISASSEMBLY

WARNING

LETHAL VOLTAGES ARE PRESENT WITHIN THE TS-520S. EXERCISE EXTREME CAUTION TO AVOID ELECTRIC SHOCK.

1. REPLACING THE RELAYS

(1) ANTENNA RELAY

RL2 is enclosed on the bottom of the final section. Remove the bottom case and then remove the relay shield box cover as shown in Figure 9. This relay has heavy contacts. Be sure to use a genuine replacement.

(2) VOX RELAY

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

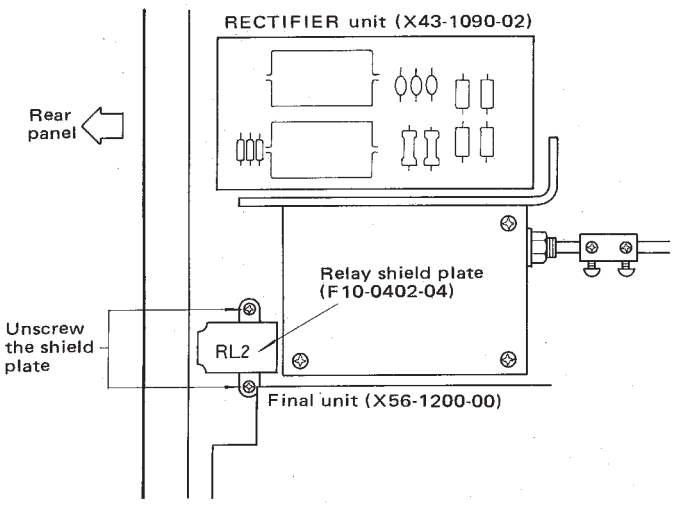


Fig. 9 Replacing RL2

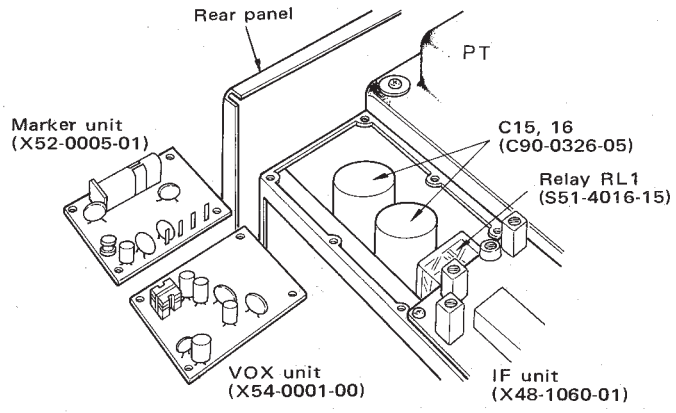


Fig. 10 Replacing RL1, C15 and C16

2. REPLACING THE ELECTROLYTIC POWER SUPPLY CAPACITORS

(Figure 11) C19 and C20 are reached by removing the TS-520S top cover and then the FIXCH · AVR board. C15 and C16 are reached by removing the transceiver's top case and then the MARKER and VOX board (Figure 10).

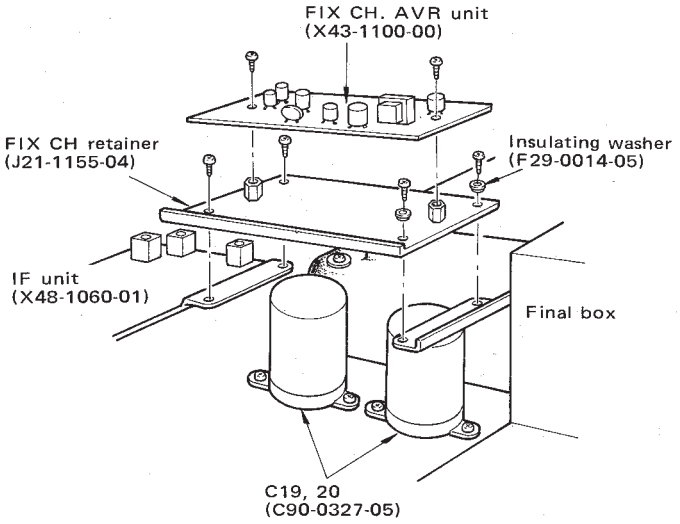
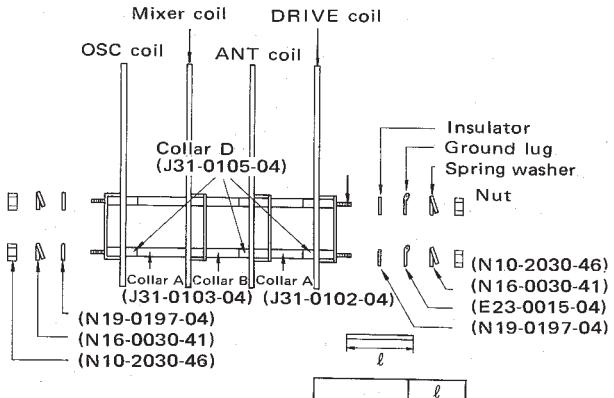


Fig. 11 Replacing C19, 20

3. DISASSEMBLY OF THE COIL PACK

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



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

Fig. 12 Coil Pack Assembly

DISASSEMBLY

1. Remove the top and bottom cover of the transceiver.
2. From the top, disconnect the leads between the wrap-terminals on the RF board and the COIL board to be removed.
3. Remove all of the front panel knobs and the front glass as shown on page 35.
4. Use a small hex nut driver to loosen the nuts at the front and back of the coil pack. The front nuts are reached through two holes in the front sub-panel on either side of the band switch. The front nust must be loosened to remove the OSC or MIX COIL boards. The back nuts must be loosened to remove the ANT or DRIVER coil boards.
5. The OSC COIL board can be removed by pulling the screw bars towards the rear panel. For the other boards, pull the screw bars out towards the front panel.

4. REMOVING THE VFO SECTION

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

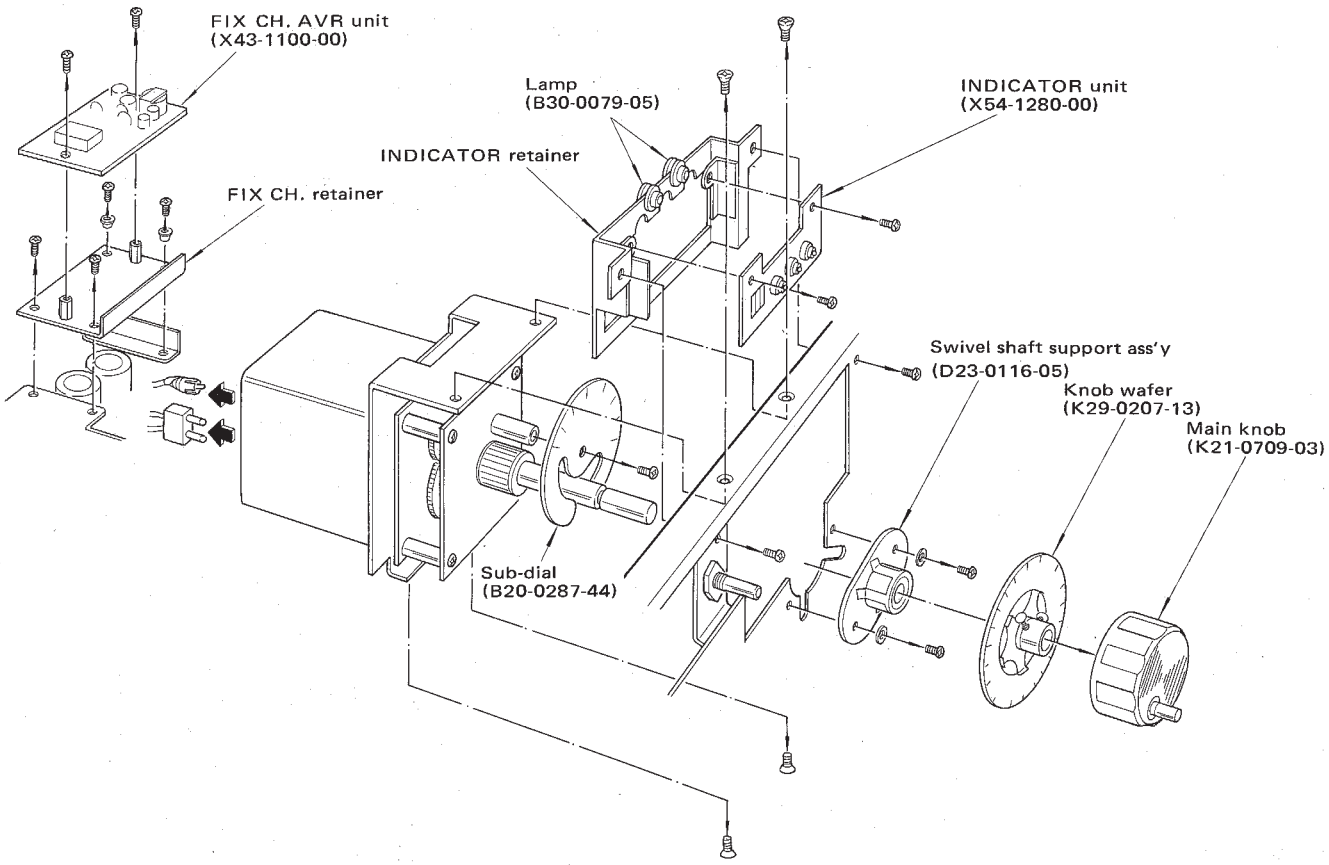


Fig. 13 Exploded View of VFO and INDICATOR Unit

DISASSEMBLY/MODIFICATION

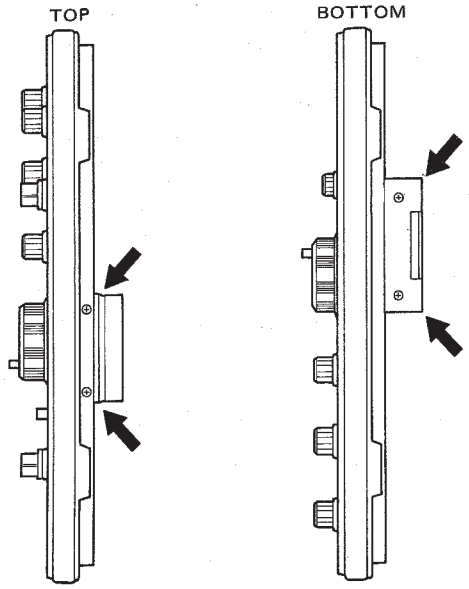


Fig. 14 VFO Retainer

5. REPLACING THE DIAL LIGHTS

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

6. REPLACING THE METER LIGHTS

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

7. REMOVING THE METER

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

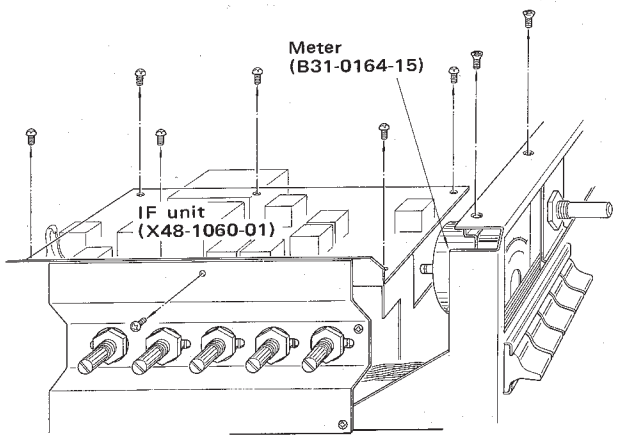


Fig. 15 Removing the Meter

8. CHANGING PADDLE SWITCHES

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

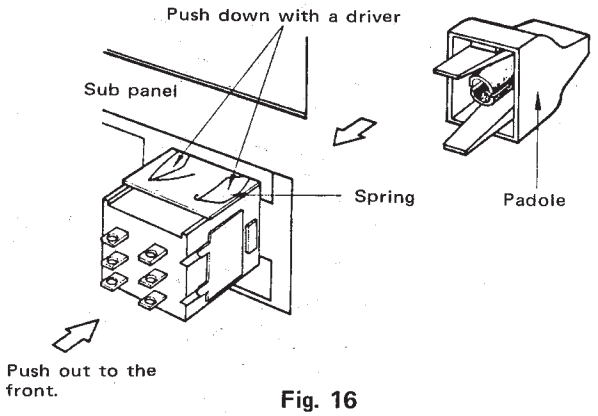


Fig. 16

MODIFICATION TO 50W

- Remove L4 (150 mH) from the FINAL unit. (Figure 17)
- SG terminal is now supplied power from the FSB terminal of the HV unit, all bands and all modes.

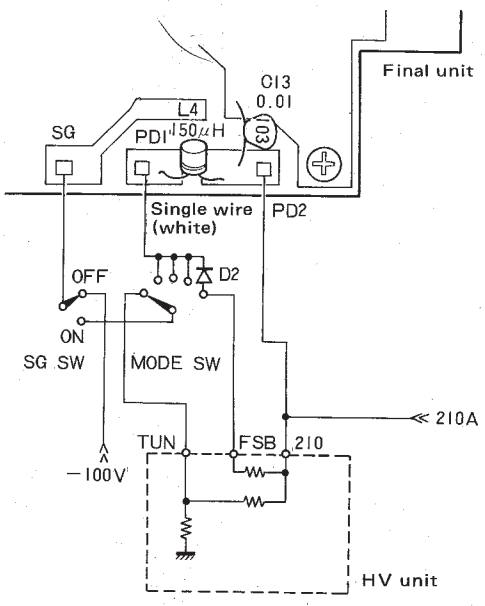
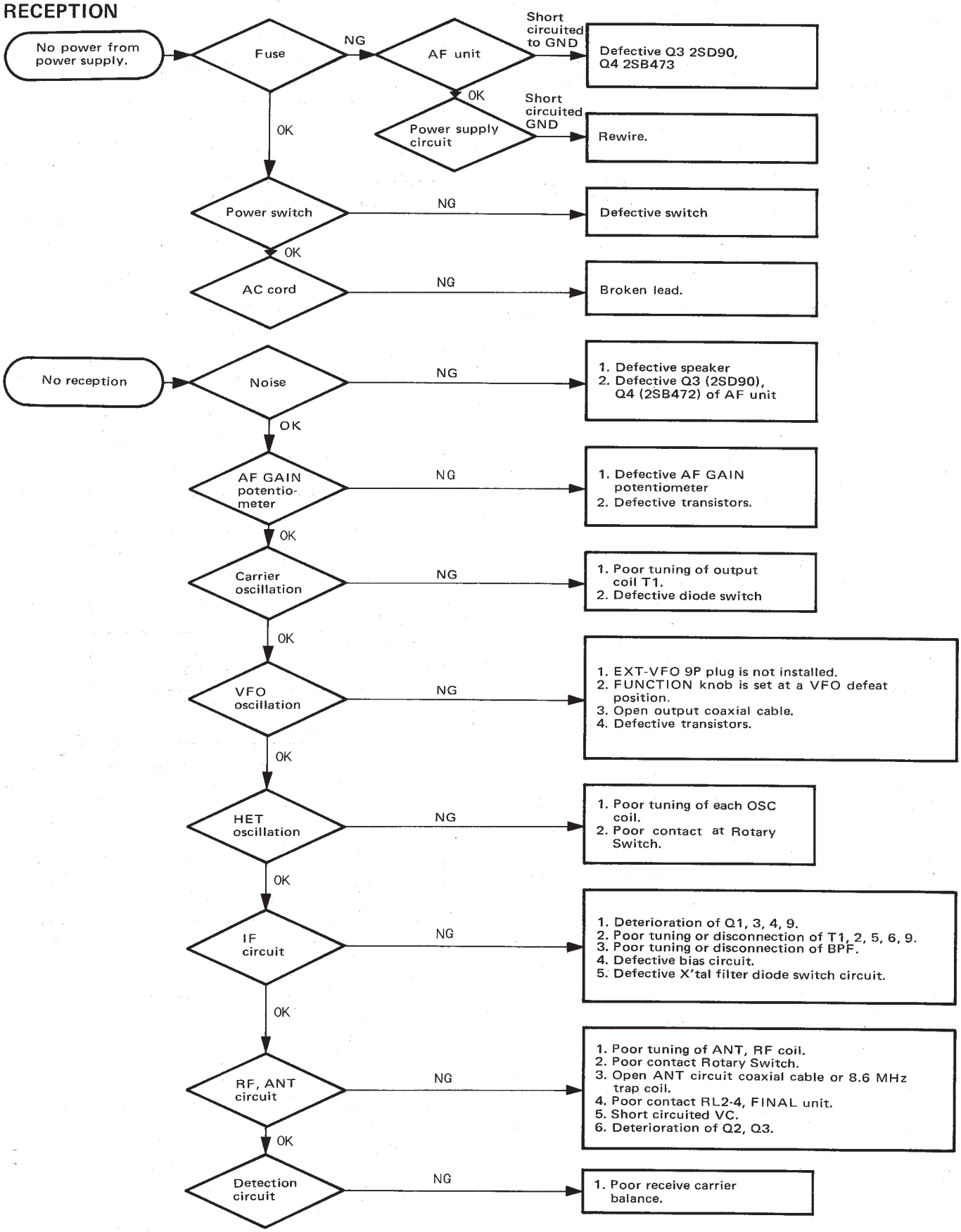


Fig. 17

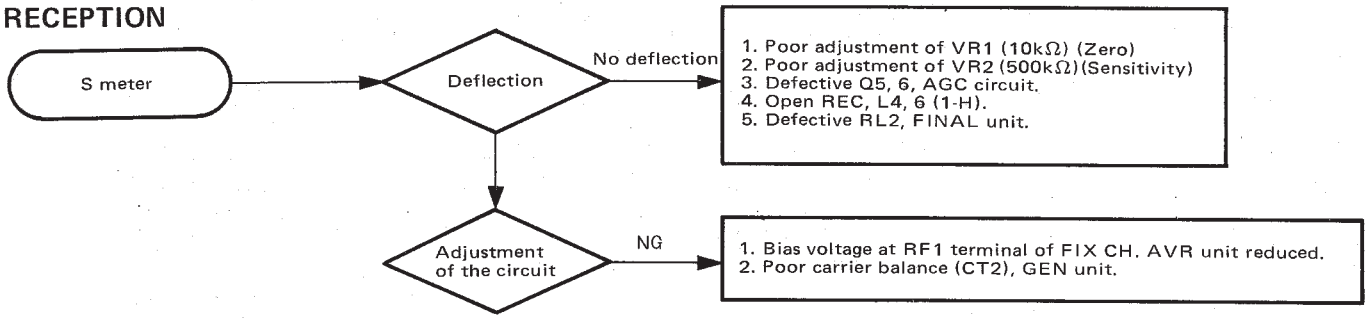
TROUBLESHOOTING

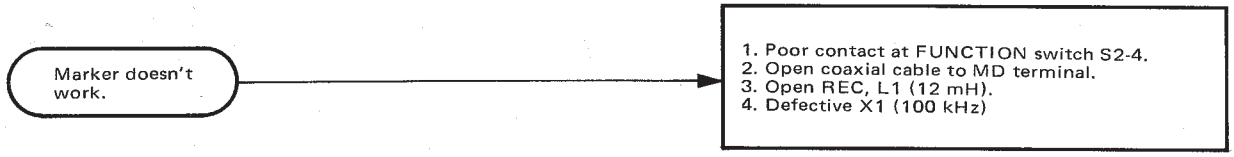
RECEPTION

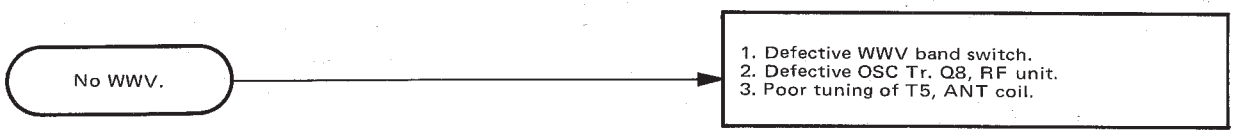


TROUBLESHOOTING

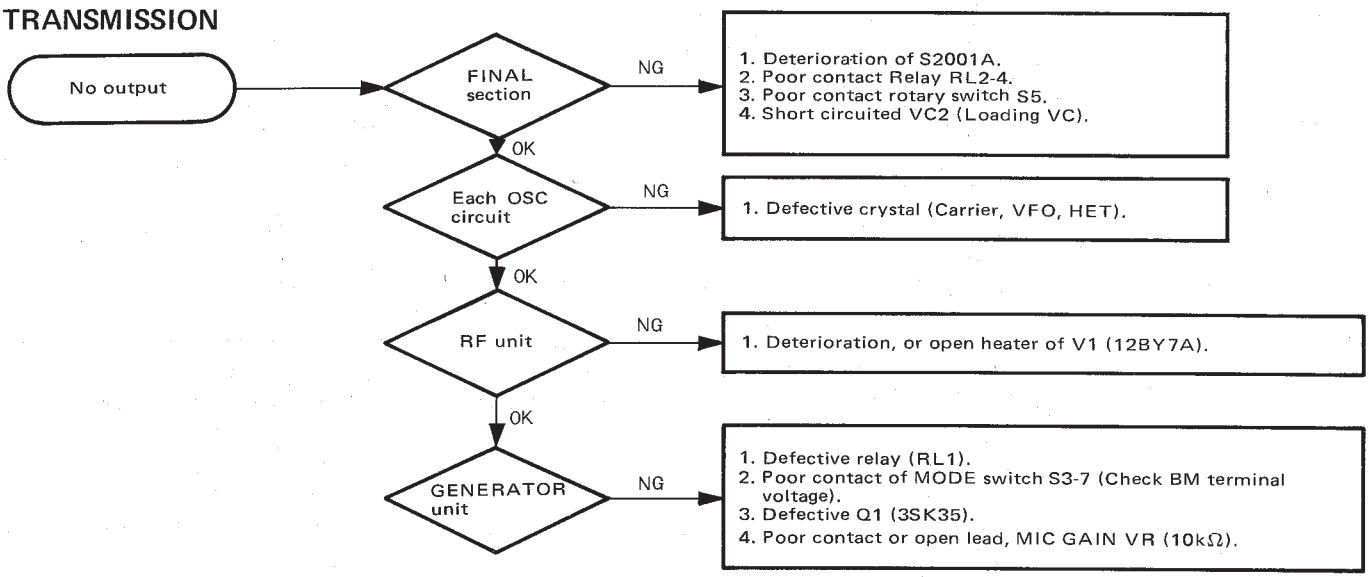
RECEPTION

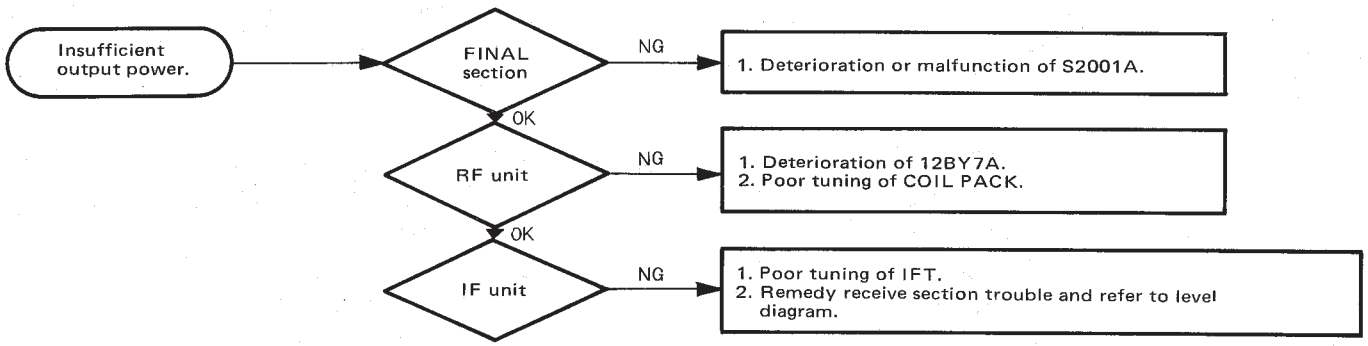






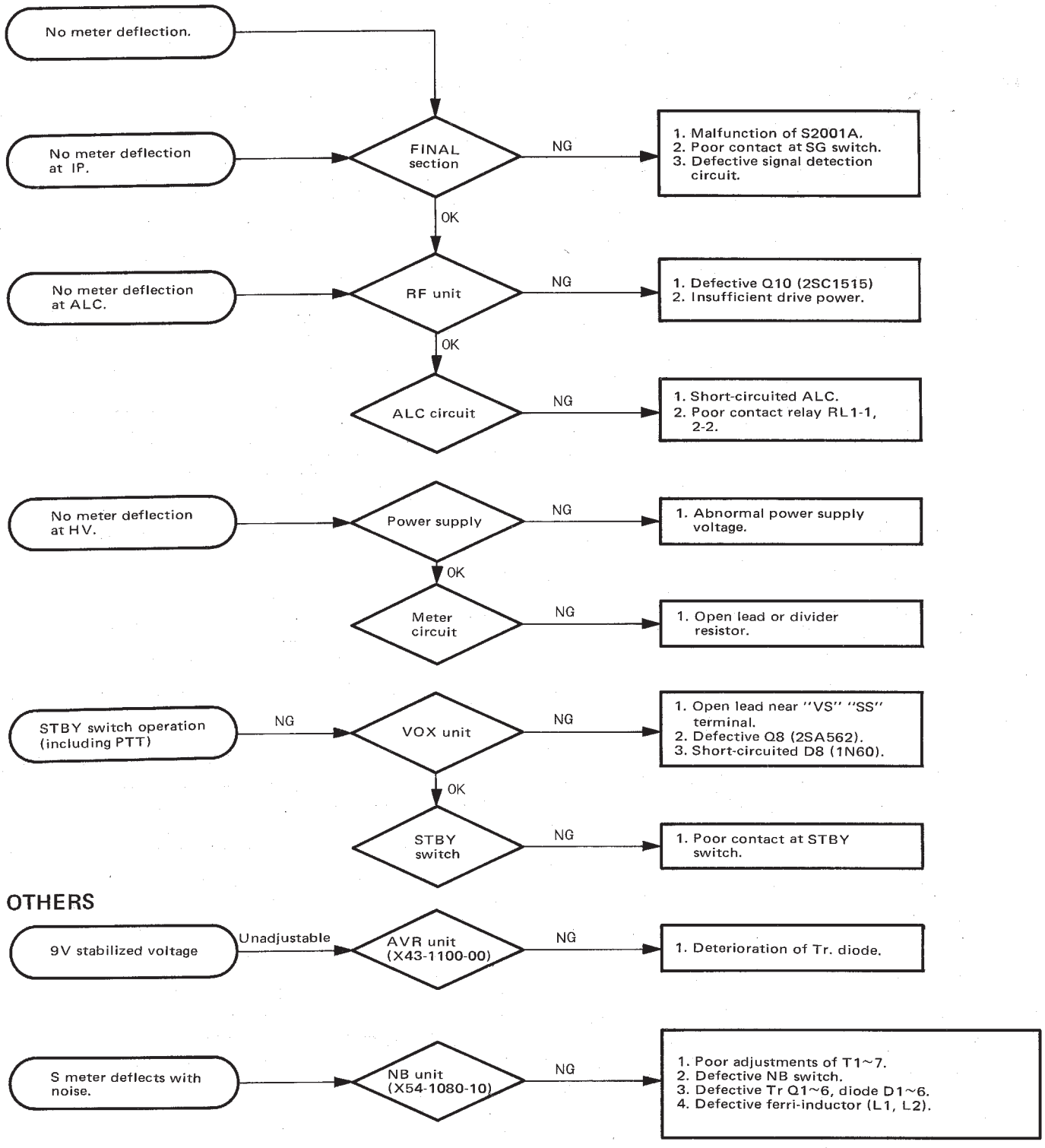
TRANSMISSION





TROUBLESHOOTING

TRANSMISSION

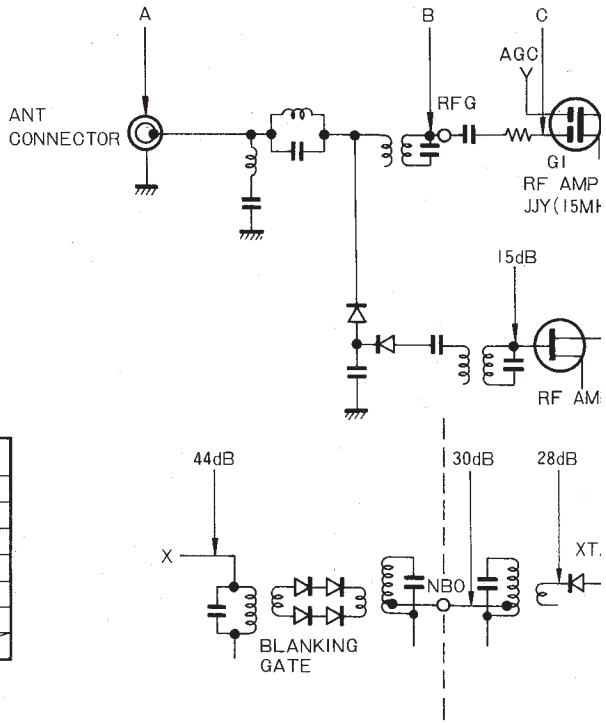


OTHERS

RECEIVER SECTION

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

RF

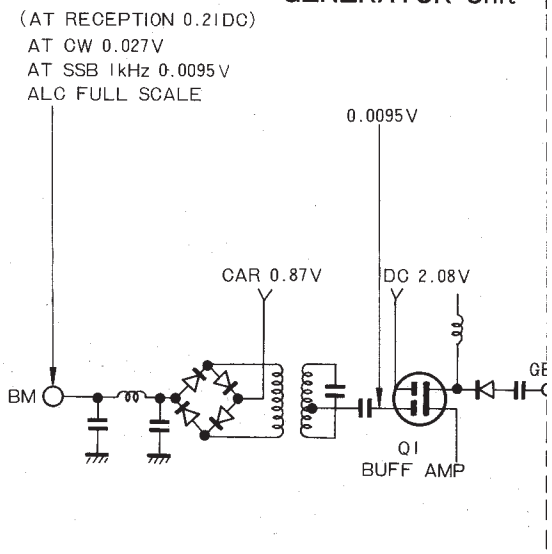


f MHz	A dB	B dB	C dB	D dB	E dB
1.8	-2	13	13	40	28
3.75	0	16	16	42	31
7.15	0	19	18	41	31
14.175	0	18	17	41	30
21.225	1	17	17	40	29
28.8	-1	13	13	34	27
JJY	1				

TRANSMITTER SECTION

1. The levels shown are measured with an RF VTVM having an input capacitance of less than 3 pF.
2. All voltages at and before the first grid of the final tubes are measured with the rear panel SG switch turned off.

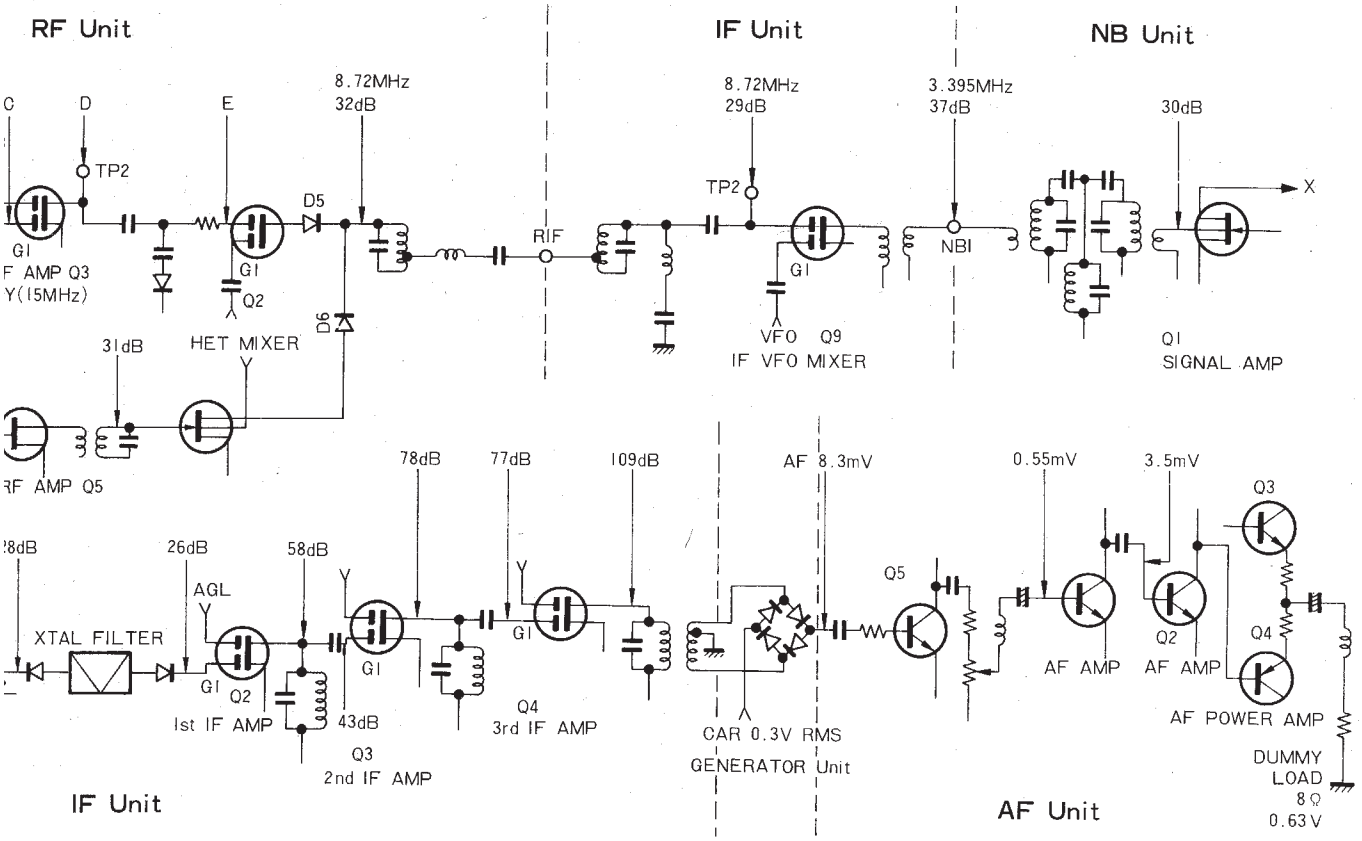
GENERATOR Unit

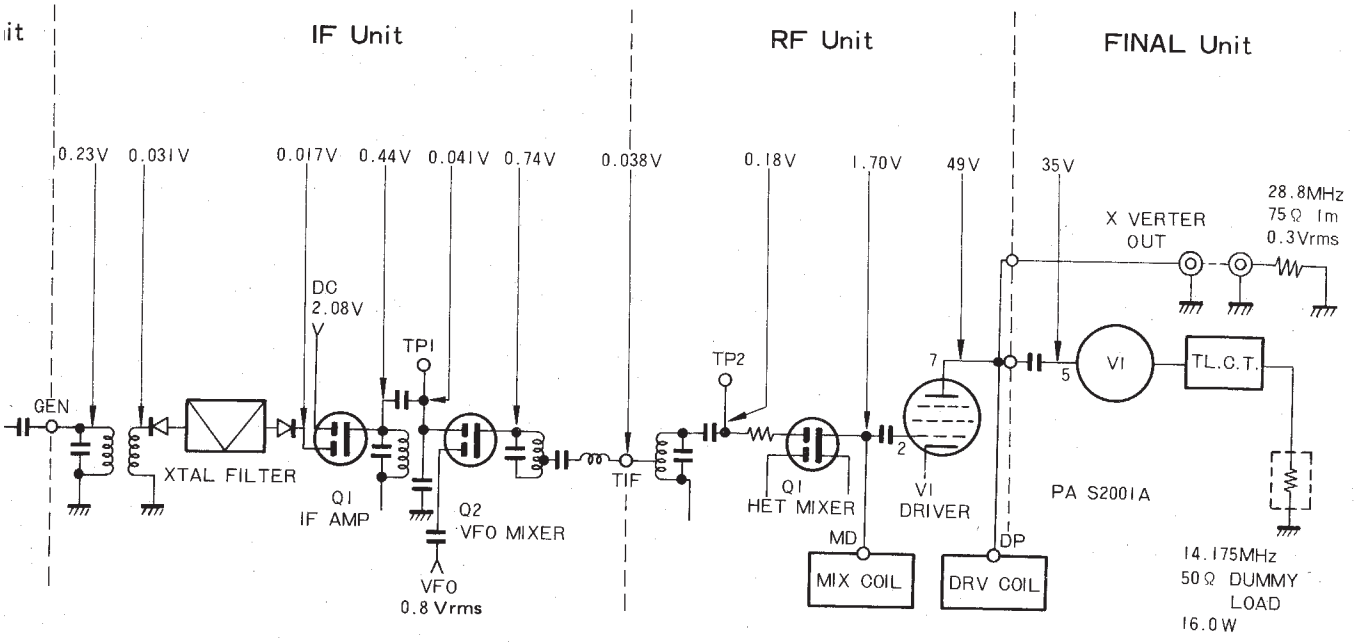


HET LEVEL (TP3)

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

L DIAGRAM


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


IF Unit
RF Unit
FINAL Unit
0.23V
0.031V
0.017V
0.44V
0.041V
0.74V
0.038V
0.18V
1.70V
49V
35V
28.8MHz
75Ω 1m
0.3Vrms
X VERTER
OUT
DC
2.08V
TP1
TP2
GEN
XTAL FILTER
Q1
IF AMP
Q2
VFO MIXER
VFO
0.8Vrms
TIF
Q1
HET MIXER
V1
DRIVER
V1
TL.C.T.
PA S2001A
MD
MIX COIL
DP
DRV COIL
14.175MHz
50Ω DUMMY
LOAD
16.0W

ADJUSTMENTS

TEST EQUIPMENT REQUIRED

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

2. RF Vacuum-tube Voltmeter (RF VTVM)
1) Input impedance: More than 1MΩ, less than 20 pF
2) Voltage range: FS = 10 mV to 300V
3) Frequency range: Greater than 50 MHz

Note:
When special accuracy is not required during adjustment such as input level or oscillation output, a voltmeter or circuit tester may be substituted for RF VTVM by connecting it to the output of detector as shown in Fig. 19.

3. AF Voltmeter
1) Frequency: 50 Hz to 10 kHz
2) Input resistance: More than 1MΩ
3) Voltage range: FS = 10 mV to 30 V

4. AF Generator (AG)
1) Frequency range: 200 Hz to 5 kHz
2) Output: Maximum 1 V

Note:
The AF generator should have low distortion.

5. AF Dummy Load
1) Impedance: 8Ω
2) Power: More than 3 W capability

6. RF Dummy Load
1) Impedance: 50 to 75 Ω
2) Power: Greater than 150 W rating
3) Frequency: 1.8 to 30 MHz

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

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

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

9. SSG (Standard Signal Generator)
1) Frequency: 1.9 to 30 MHz
2) Output: 0 dB/μV ~ 120 dB/μV

Note:
Select equipment that is frequency stable during non-modulation and having a minimum level of frequency modulation.

10. Frequency Counter
1) Minimum input voltage: 50 mV
2) Frequency range: More than 40 MHz

11. Noise Generator
Select equipment that generates ignition-like noise containing high harmonics to 30 MHz or higher.

12. Directional Coupler

RECEIVING SECTION

1. General

Place the unit on its side, with both covers removed, finals up. Be certain that the air supply to the final tubes is not blocked.

(1) Initial Settings
1) Front panel

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

2) Rear panel

SG SW	OFF
REC ANT	NORMAL
X VERTER	OFF

(2) Rear Panel
Connect an 8Ω dummy load to SPEAKER jack.

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

(1) Test Equipment
1) Voltmeter

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

ADJUSTMENTS

3. Band Pass Filter Adjustment

(1) Test Equipment

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

(2) Adjustment

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

Note:
VFO and FIX. CH (If installed) must be off.

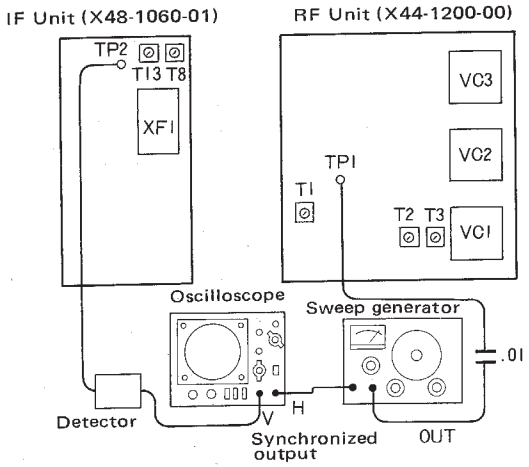


Fig. 18 B.P.F. for Reception

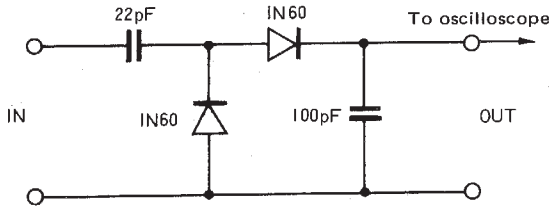


Fig. 19 Detector

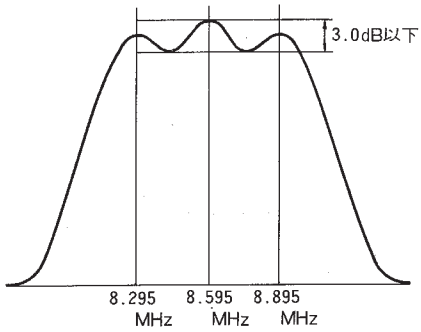


Fig. 20

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

Note:
VFO and FIX. CH (If installed) must be off.

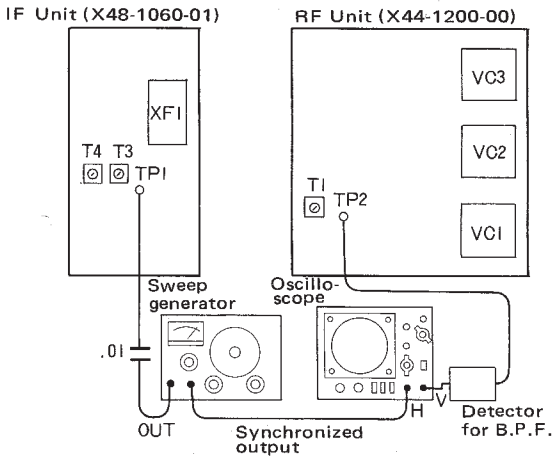


Fig. 21 B.P.F. for TRANSMISSION

4. Carrier Board Adjustment

(1) Test Equipment

1) RF VTVM

(2) Adjustment

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

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

5. Coil Pack Alignment

(1) Test Equipment

1) RF VTVM
2) SSG
3) AF VTVM

(2) Adjustment

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

ADJUSTMENTS

2) ANTENNA AND MIXER COILS

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

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

Table 1

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

3) DRIVE COILS

CAUTION Disconnect SSG.

Turn the H.SW switch ON, MODE switch to CW, set the METER switch to ALC, adjust the CAR control to maximum, and set the standby switch to SEND. Adjust each coil, in order and at the frequencies described in Table 1, for maximum ALC deflection. Reduce the CAR control as necessary. After adjustments, set the STBY SW to REC.

Note 1:
In this adjustments, set SG SW to OFF.
Note 2:
CAUTION
SSG output should not be connected to ANT terminal or damage to the SSG attenuator will occur.
Note 3:
1.8 MHz ANT coil should be tuned at the point the core is deep in the form.
The other coil cores should be tuned at the top positions.

6. WWV Circuit Alignment

(1) Test Equipment
1) SSG

(2) Adjustments

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

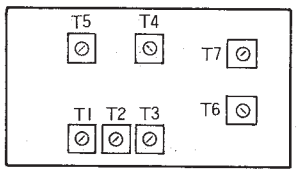
7. IFT Adjustment

(1) Test Equipment
1) SSG
2) Tester

(2) Adjustments

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

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



NB Unit (X54-1080-10)

Fig. 22

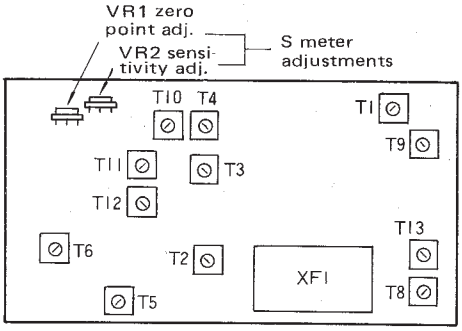


Fig. 23

ADJUSTMENTS

8. Trap Coil Adjustment

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

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

9. Carrier Balance

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

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

10. S-Meter Adjustment

(1) Test Equipment
1) SSG

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

11. RIT Adjustment

(1) Test Equipment
None.

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

12. Calibrator Frequency Adjustment

12-1 Frequency Counter used.

(1) Test Equipment
1) Frequency counter

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

12-2 WWV Circuit used.

(1) Test Equipment
None.

(2) Adjustments
Connect an antenna to the transceiver and receive WWV at 15 MHz. Set the FUNCTION switch to CAL-25 kHz to turn on the calibrator. Adjust TC1 to bring the calibrator and WWV to zero beat.

13. VFO Adjustments

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

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

ADJUSTMENTS

Adjustment of Output Voltage

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

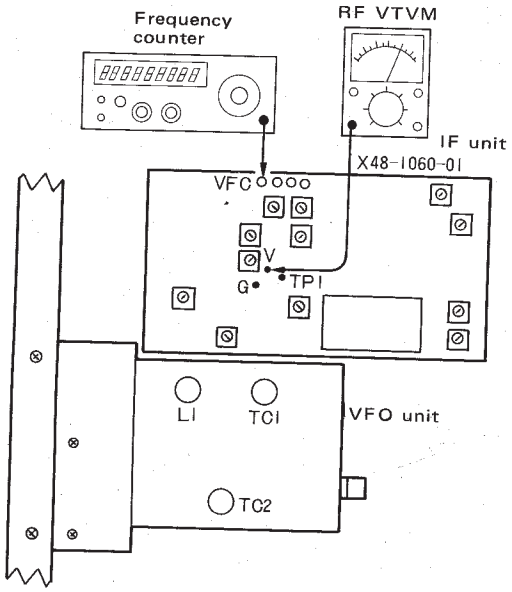


Fig. 24

TRANSMITTER SECTION

14. Final Bias Current Adjustments

(1) Test Equipment

None.

(2) Adjustments

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

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

15. IFT Adjustment

(1) Test Equipment

50Ω dummy load.

(2) Adjustments

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

16. RF Meter, Power Check, and Neutralization Adjustment

(1) Test Equipment

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

(2) Adjustments

RF Meter

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

Neutralization

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

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

Note:

Be sure that the PLATE is dipped, or max. RF is shown, while still in the tune position.

ADJUSTMENTS

17. Balanced Modulator and Carrier Adjustment

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

(2) Adjustments

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

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

Switch the AF input to 2600 Hz and, if necessary, adjust TC3 for output within 5 watts of the output power for 1500 Hz.

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

18. Sidetone Output Adjustment

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

(2) Adjustments

Slide the SG switch off and connect the key to the TS-520S. Set the MODE switch to CW and the AF gain control to 12 o'clock. Connect the AF VTVM to the EXT. SPEAKER jack, the key the transceiver, and adjust VR1 on the AF board for a reading of approximately 50 mW (0.63 V/8 ohms).

19. Processor Adjustments

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

(2) Adjustments

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

With the PROCESSOR SW on, decrease the AG output to 1 mV (−20 dB), and adjust VR2 for −6 dB output at the MAO terminal.

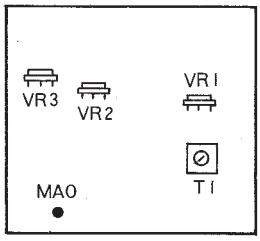
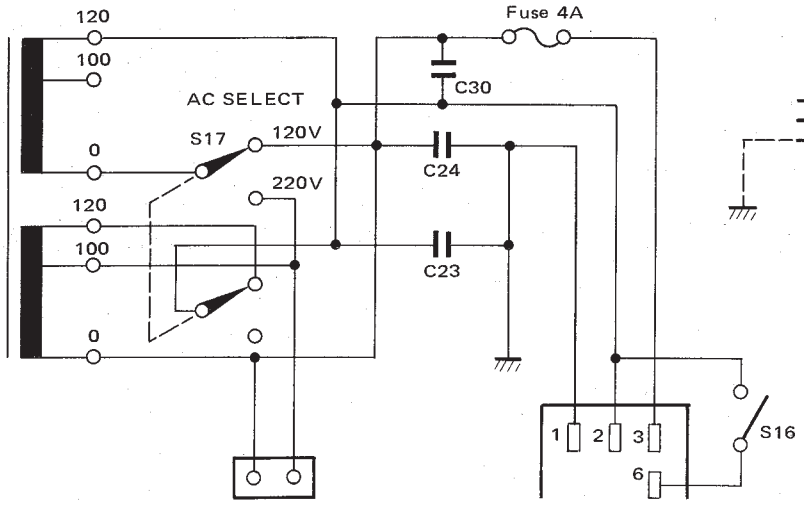


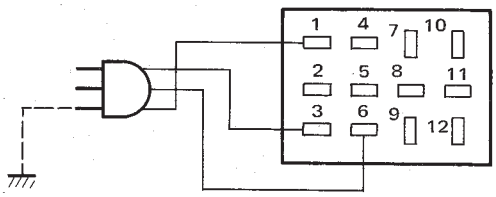
Fig. 25 GENERATOR Unit (X52-1090-00)

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

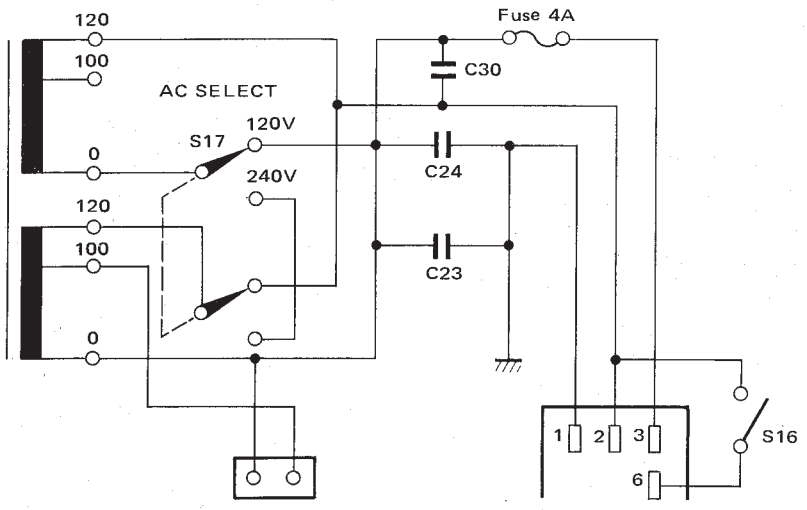
W Type Power Transformer (Y54-1290-61)



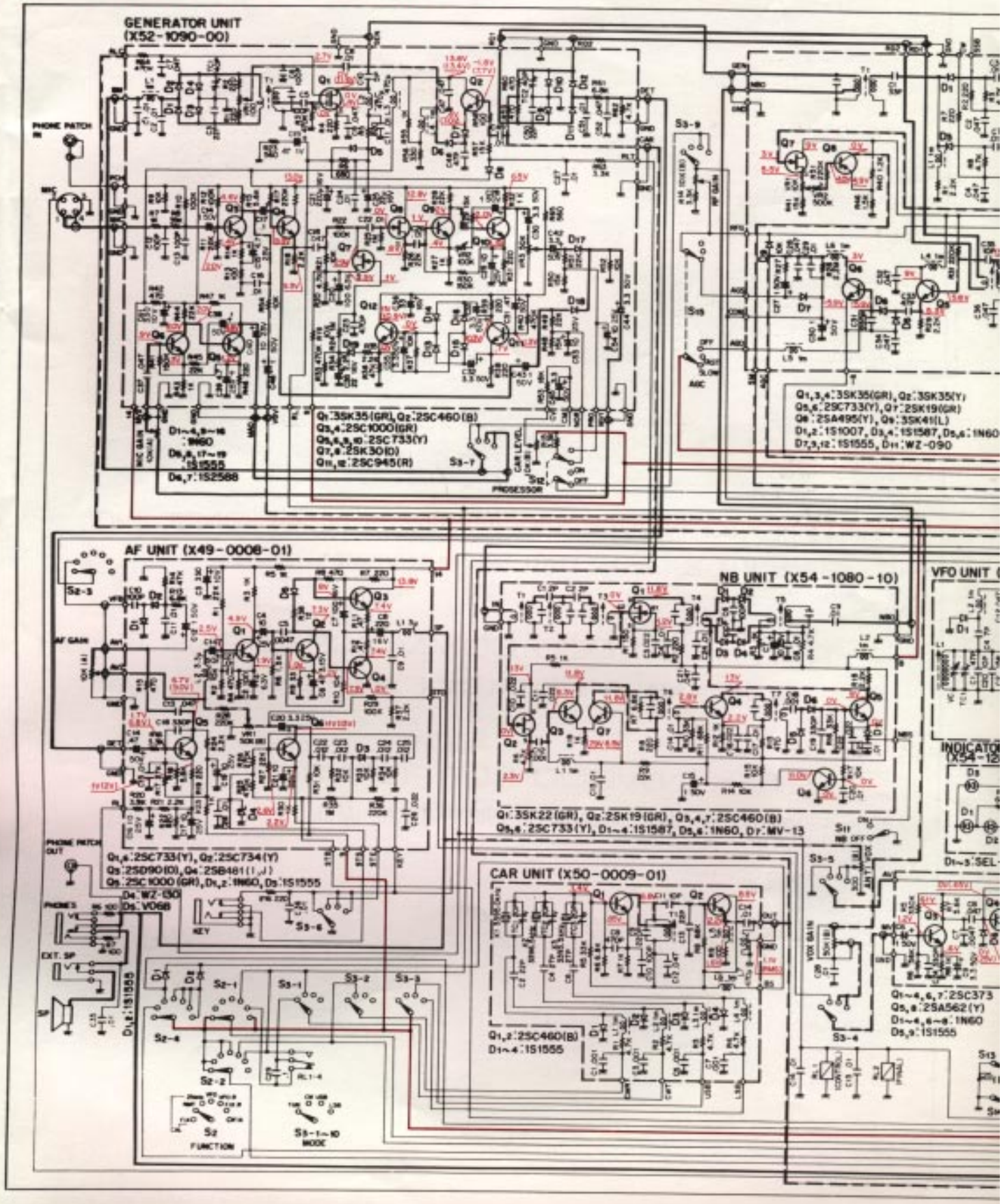
3-phase AC Power Cord



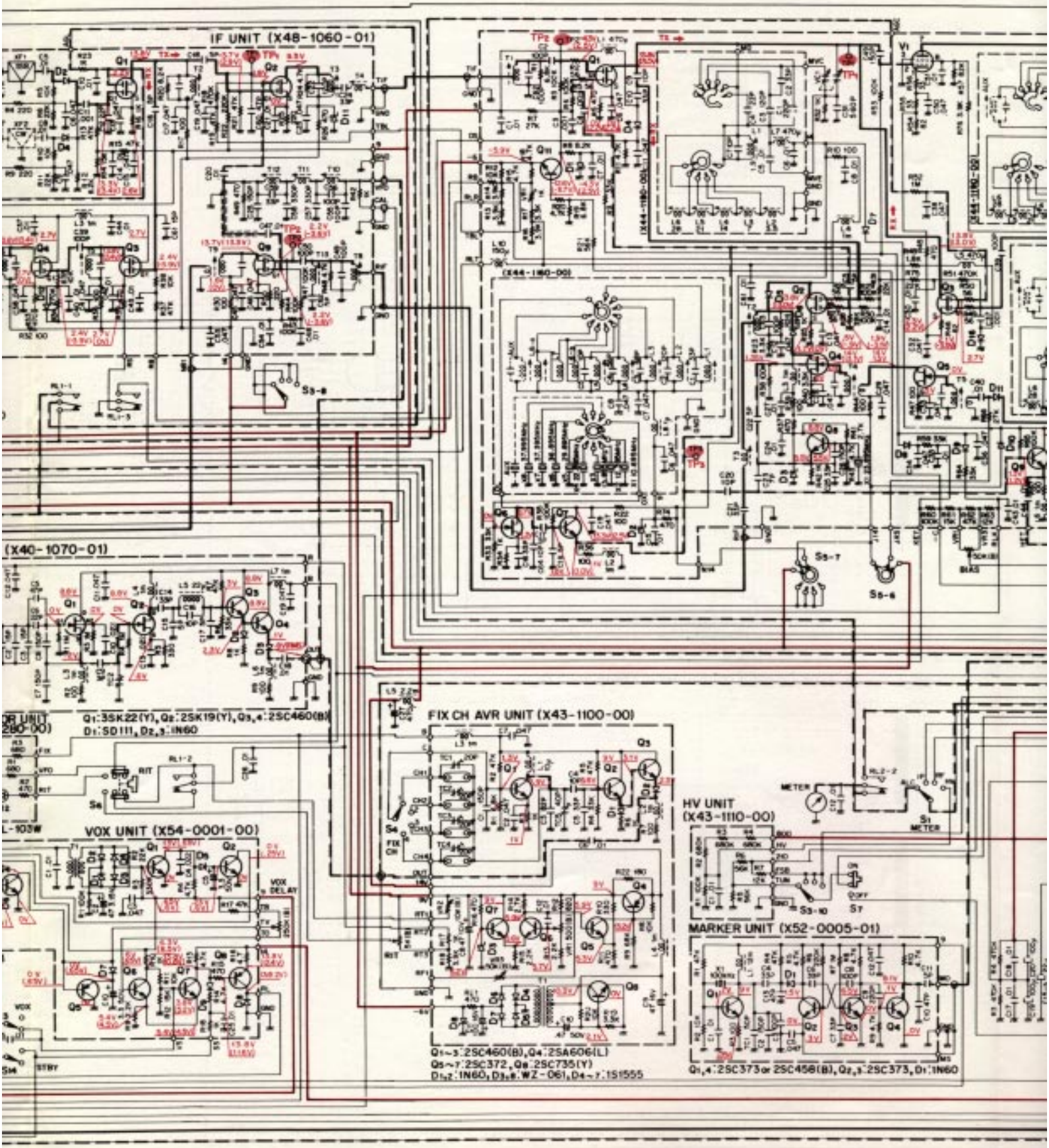
T Type Power Transformer (Y54-1290-51)

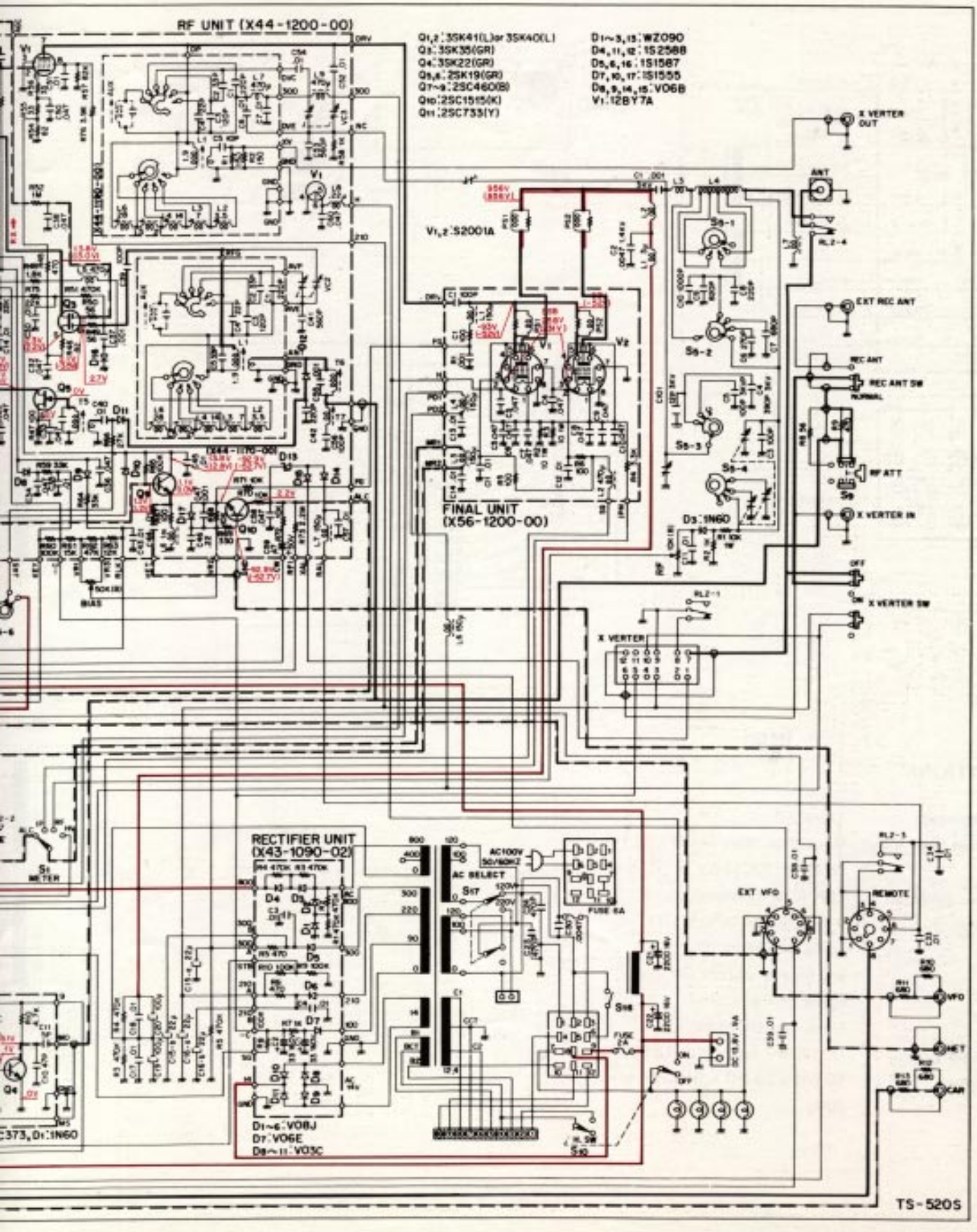


—— Signal line - - - - - - AGC, ALC, OSC control signal line
—— +800V, +14V, +9V, −6V DC Voltage at reception (at transmission)



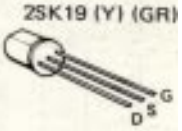
SCHEMATIC DIAGRAM



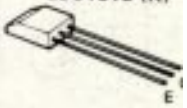


3SK22 (Y) or (GR

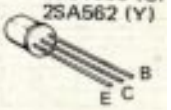
2SK19 (Y) (GR)



2SC460 (B)
2SC458 (B)
2SC1515 (K)

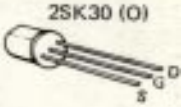


2SC372
2SC373
2SC735
2SC733 (Y)
2SA495 (Y)
2SC734 (Y)
2SC1000 (GR
2SA562 (Y)

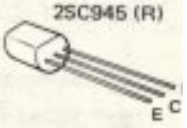


3SK41 (L)
3SK35 (GR)
3SK35 (Y)

2SK30 (O)

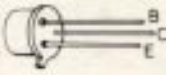


2SC945 (R)



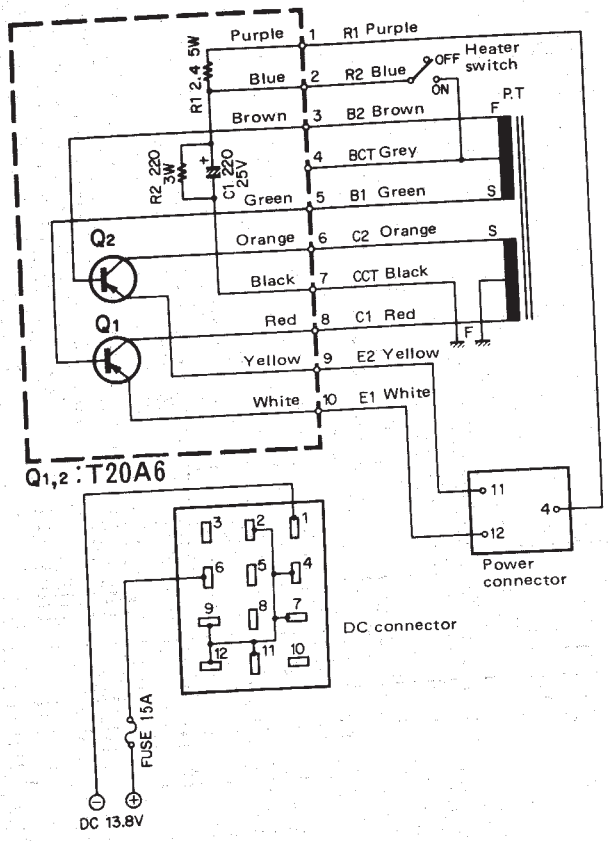
2SB481 (I, J)
2SD90 (Y) or (G

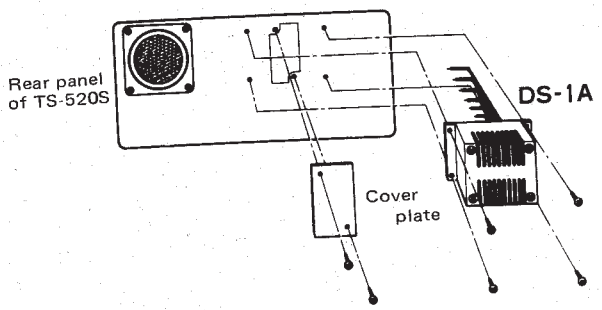
2SA606

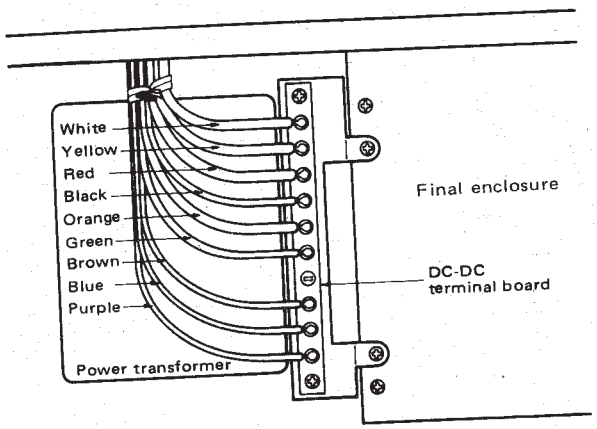


DS-1A

DC-DC CONVERTER (OPTION)







SPECIFICATIONS

1.	**Semiconductors**	T20A6 (2)
2.	**Rated final stage input**	More than 90W at CW (1.8~ 28 MHz), DC13.8V
3.	**Power consumption**	15A (CW transmission) 0.6A (heater switch OFF in signal receive mode) 5A (heater switch ON in no-signal receive mode)
4.	**Power supply**	Note: At DC13.8V DC12-16V (standard: 13.8V)
5.	**Dimensions**	80 (W) x 39 (H) x 94 (D) mm
6.	**Weight**	300g

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TRIO-KENWOOD COMMUNICATIONS, GmbH

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