

NEC HF-SSB AMATEUR ALL BAND TRANSCEIVER

MODEL CQ-110E

OPERATING MANUAL



CQ-110E TABLE OF CONTENTS

	<u>Page</u>
I. FEATURES.....	3
II. RATINGS.....	4
III. FRONT PANEL OPERATION.....	5
IV. REAR PANEL CONTROL.....	14
V. OPERATION.....	17
5.1 INSTALLATION.....	17
5.2 POWER SOURCE CONNECTION.....	17
5.3 ANTENNA.....	19
5.4 GROUNDING.....	19
5.5 PREPARATION PRIOR TO STARTING OPERATION.....	20
5.6 PREPARATION FOR OPERATION.....	20
VI. BASIC OPERATIONS FOR TRANSMISSION AND RECEPTION..	21
6.1 WHEN SSB IS RECEIVED.....	21
6.2 WHEN CW IS RECEIVED.....	22
6.3 ADJUSTMENT ON TRANSMISSION.....	22
VII. FREQUENCY CALIBRATION OF DIGITAL FREQUENCY INDICATOR.....	23
7.1 SSB.....	23
7.2 WHEN TRANSMISSION AND RECEPTION ARE MADE WITH CW.	23
7.3 DIGITAL FREQUENCY INDICATION WHEN FINE IS USED...	24
VIII. CIRCUIT AND OPERATION.....	24
8.1 CIRCUITS OF RECEIVER.....	24
8.2 CIRCUITS OF TRANSMITTER.....	28
8.3 ASSOCIATED CIRCUITS.....	29
IX. ADJUSTMENT ON VARIOUS CIRCUITS.....	31
9.1 ADJUSTMENT ON CARRIER BALANCE (RECEIVING).....	31
9.2 ADJUSTMENT ON CARRIER BALANCE (TRANSMITTING).....	32
9.3 S-METER ADJUSTMENT.....	32
9.4 MARKER CALIBRATOR ADJUSTMENT.....	32
9.5 ADJUSTMENT ON VARIOUS COILS.....	32
9.6 ADJUSTMENT ON THE CRYSTAL OSCILLATOR CIRCUIT (HFO) FOR LOCAL OSCILLATOR.....	33
9.7 ADJUSTMENT ON THE PREMIXER OUTPUT BAND PASS COIL (BPF).....	35
9.8 ADJUSTMENT ON VFO OUTPUT COIL.....	36
9.9 ADJUSTMENT OF MIX COIL.....	36

9.10	ADJUSTMENT ON THE TRANSMITTER DRIVER	<u>Page</u>
	STAGE COIL.....	37
9.11	ADJUSTMENT ON IF TRANSFORMERS OF TRANSMITTING.....	38
9.12	ADJUSTMENT ON CARRIER OSCILLATING CIRCUIT.....	38
9.13	ADJUSTMENT ON CW BFO.....	40
9.14	ADJUSTMENT ON OSCILLATOR CIRCUIT OF CARRIER	
	AT TRANSMISSION.....	40
9.15	ADJUSTMENT ON VOX AND (ANTITRIP) CIRCUIT.....	40
9.16	ADJUSTMENT ON CW MONITOR.....	41
9.17	ADJUSTMENT ON NOISE BLANKET CIRCUIT.....	44
9.18	ADJUSTMENT ON IF TRANSFORMERS OF RECEIVING.....	44
9.19	ADJUSTMENT ON NEUTRALIZING CIRCUIT OF TRANSMITTER.....	44
X.	DIGITAL FREQUENCY INDICATOR CIRCUIT.....	45
10.1	FREQUENCY RELATIONSHIP.....	45
10.2	FREQUENCY COUNTER CIRCUIT.....	48
10.3	OFF-RANGE DISPLAY CIRCUIT.....	49
10.4	f-CAL CIRCUIT.....	50
10.5	ADJUSTMENT ON FREQUENCY COUNTER CIRCUIT.....	50

SECTION I - FEATURES

- (a) The CQ-110E unit incorporates a frequency counter with a 7-segment luminous diode which enhances its out-look. If it is deviated from the edge of the band, an off-range indicator will operate to show 'UPPER' or 'LOWER' with LED. This eliminates the possibility of off band operation. When 'FINE' tuning is turned 'ON', receiving and transmitting frequencies must be 'OFF' to enable you to conform the deviation of frequency between your station and the other. IC has been adopted in the circuit. The counter can be calibrated against the 100KHz calibration on zero beat. The adoption of the latch circuit eliminates flickering when changing the tuning frequency.
- (b) A rugged panel which is essential for maintaining high performance, safety and stability is provided together with important parts of related mechanisms such as, VFO. The NEC CQ-110E panel is of die-cast, made from zinc and light metal.
- (c) A hybrid design utilizing features of vacuum tubes and semi-conductors have been incorporated to ensure a high performance circuit.
For perfect reception, a high frequency amplifier tube 6BZ6 which is superior in cross-modulation characteristics compared with FET and can withstand a high antenna input, as well as the low noise beam differential tube 7360 for mixer-stage have been adopted for NEC CQ-110E to assure you of high sensitivity characteristics.
- (d) For VFO circuit, the FET oscillator, the buffer circuit FET and others have been installed in the unit for temperature compensation, designed for C and R to provide high stability. The dial mechanism consists of an assembly of ball-drive and precise double gears.
- (e) Separate crystal filters have been incorporated for USB, LSB and CW to give accurate side band characteristics with regards to operation modes. The incorporation of a special single conversion system in the unit has resulted in extremely low spurious response.
- (f) The NEC CQ-110E can receive and transmit on amateur bands from 1.9MHz to 30MHz on SSB (USB, LSB), CW and AM. Besides, CB band, JJY, WWV(15MHz) can also be received.

Not only SSB(USB, LSB) CW, AM but, also FSK oscillator for RTTY have been incorporated. This will enable you to communicate by teletype if the teletype-writer, converter and printer are connected. You can enjoy all kinds of modes such as FAX(facsimile) and etc. with NEC CQ-110E. For special application on u meters, a crystal must be plugged in to activate the transmitter with receiving possibility.

- (g) 6JS6x2 (with ample allowances) have been built-in for the final stage tube of transmission. When it is being used for a long period as, in the case of contest or similar, the cooling fan can be used together to ensure stability.
- (h) AC/DC power supply and speaker are incorporated in the set. The power supply can be operated on AC as well as DC by using DC/DC converter.

SECTION II - RATINGS

Types of modes	SSB(USB, LSB), (A3j), AM(A3H), CW(A ₁), FSK(F ₁) *****FAX SSTV.
Frequency range	160 m (1.5 - 2.0MHz) 80 m (3.5 - 4.0MHz) 40 m (7.0 - 7.5MHz) 20 m (14.0 - 14.5MHz) 15 m (21.0 - 21.5MHz) 11 m (27.0 - 27.5MHz) 10 mA (28.0 - 28.5MHz) 10 mB (28.5 - 29.0MHz) 10 mC (29.0 - 29.5MHz) 10 mD (29.5 - 30.0MHz) JJY.WWV(15.0 - 15.5MHz)
Frequency Stability	2KHz or below for warming up 100Hz or below/30 min after warming up.
Antenna Impedance	50 - 100 ohm unbalanced.
Maximum Output	SSB CW DC input 280W(240W 28MHz) AM DC input 80W
Carrier suppression ratio	50 dB or more .
Side band wave suppression ratio	50 dB or more (at 1,000KHz)

FIG1 ACCESSORIES



① AC POWER CORD

② DC POWER CORD

③ MICROPHONE

④ KE & SP PLUG

⑤ RCA JACK

⑥ FUSE 5A

⑦ FUSE 1A

⑧ 4^m HEXAGONAL SPANA

⑨ 3^m HEXAGONAL SPANA

Spurious Radiation	-40 dB or less
3rd order distortion	26 dB or more (to one or two signals)
Selectivity	SSB, CW: 0.6KHz (-6dB) 1.6KHz (-60dB) AM: 2.4KHz (-6dB) 4.5KHz (-60dB)
Reception sensitivity	SSB, CW: 0.3uV S/N 10dB or more AM: 1uV S/N 6dB or more
Intermediate frequency interference ratio	-60dB or more
Image frequency interference ratio	-60dB or more
Internal spurious response	1uV or less
Low frequency output	3W (10% distortion)
Low frequency output impedance	8 ohm
Power consumption	receive: 70W or less 50W or less (HEATER OFF) Transmit: 320W or less 120W or less (HEATER OFF)
Dimension	334m/m(W) x 322m/m(D) x 153m/m(H)
Weight	18Kgs

SECTION III - FRONT PANEL OPERATION

3.1 Mode Switch

This switch allows you to select the type of receiving or transmitting modes that you desired. It is in the order of FSK, TUNE, USB, LSB, CW, AM from the left side.

FSK

This is for RTTY. If a teletype-writer and converter is connected to the FSK terminal, teletype communication can be performed.

TUNE position

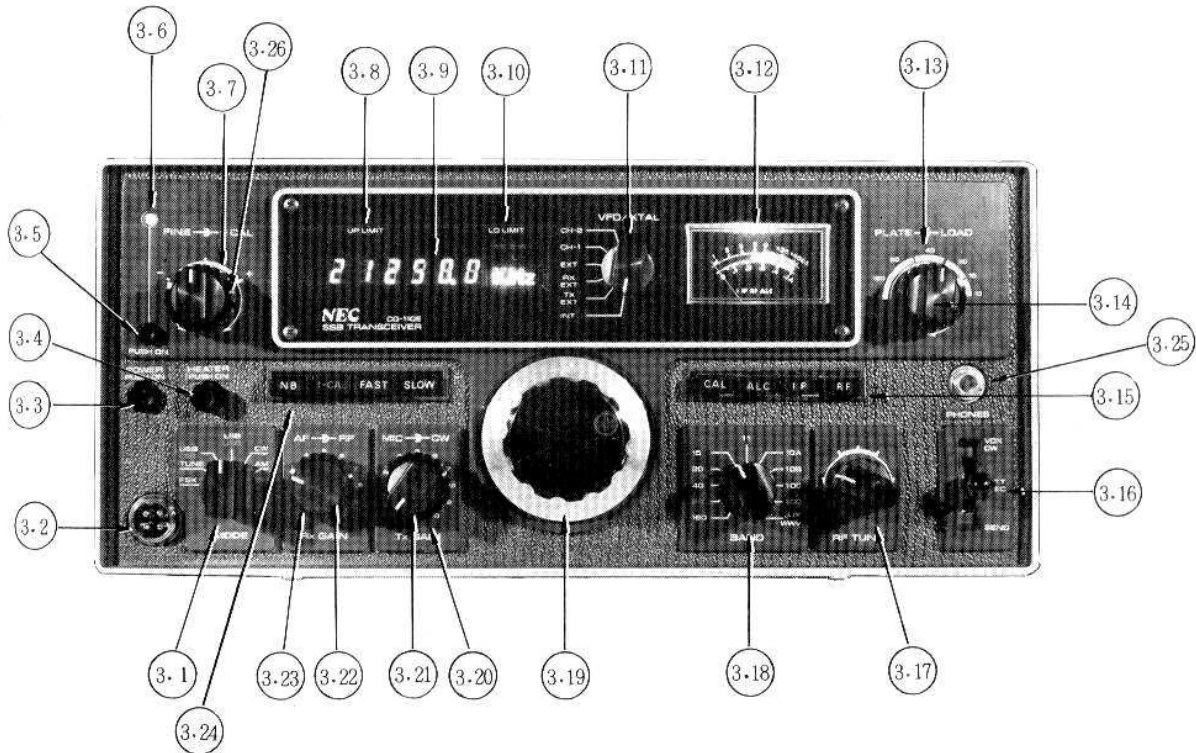
TUNE position is utilized for tuning of RF TUNE, PLATE and LOAD. The maximum power will be found on the meter, with RF position.

Increase the carrier to a level, try the DRIVE TUNE, and PLATE TUNE and LOADING very rapidly.

At the TUNE position, if the unit is set ready for transmission the carrier will be emitted continuously.

Use this position for MIC testing the transmitter. Injection of carrier is made by MIC GAIN (21) control.

FIG.2 - KNOBS AND SWITCHES ON PANEL



USB(LSB in 80m band)/LSB(USB in 80m band)

This is a change-over switch for USB/LSB. It is a general practise to use LSB in 7MHz band or below, and USB in 14MHz band or below, in the case of amateur communication.

CW position

In this switch position, transmission is made on (A1). Injection of carrier is made by TX GAIN CW(20).

AM position

In this switch position, transmission is made on AM(A3H). Adjust the modulation depth by MIC GAIN(21) and the carrier level by TX GAIN(CW) (20); find the adequate levels so that clear speech can be attained.

3.2 MIC(Microphone Connector)

This is a microphone connector. Use a dynamic type with high impedance (20K ohm) microphone or crystal type microphone. 'Press to Talk' switch is provided in the microphone unit. When 'Press to Talk' system is not required, use the STANDBY key (16).

3.3 POWER, PUSH-ON Button

This is a power switch which is of 'PUSH ON', 'PUSH OFF' system.

3.4 HEATER PUSH-ON Button

This is the heater switch which is of 'PUSH ON', 'PUSH OFF' system. The final stage tubes heaters can be switched off, when only 'Receive' is used.

3.5 FINE PUSH-ON Button

This is the switch for FINE tuning. It is also of 'PUSH ON', 'PUSH OFF' system. When turned to 'ON', the FINE tuning indicator (6) will be lit and the FINE tuning knob (7) becomes operable.

3.6 FINE tuning knob

This is the frequency variable knob. For reception, it can be varied by approximately ± 5 KHz, when it is turned clockwise and anti-clockwise. The counter provides direct reading of frequency. The '+' and '-' marks located at the right and left sides of the knob indicate the direction of high and low frequencies.

With the knob at the center position, the receiving and the transmitting frequencies become the same.

3.8 UP LIMIT indicator

This is the upper limit 'Off-range' indicator of VFO. (The VFO coverage is 500KHz on all bands). When this range is exceeded, for instance at 7,500KHz, the upper limit lamp will be illuminated, to indicate off-range.

3.9 DIGITAL FREQUENCY DISPLAY PANEL

This is the digital display with 7-segment LED. Transmitting and receiving frequencies are indicated on this panel. Direct reading can be made down to 100Hz order in the unit of KHz.

3.10 LO LIMIT indicator

This is the lower limit off-range indicator. If VFO is turned beyond the limit range of the counter, for instance, when it is less than 7,000KHz in the 7MKz band, the band edge indication is made by LO LIMIT lamp, as the counting circuit has a reading range of 000.0 - 999.9.

3.11 VFO/X-TAL switch

This is a change-over switch for INTERNAL and EXTERNAL VFO's combination and FIXED CHANNELS.

INTERNAL VFO(INT)	Transmission and reception can be made by incorporating VFO.
TX EXTERNAL VFO(TX EXT)	Reception can be made on incorporating VFO and transmission can be made on external VFO.
RX EXTERNAL VFO(RX EXT)	Transmission can be made by incorporating VFO and reception by external VFO.
EXTERNAL VFO(EXT)	Transmission and reception are made by external VFO.

The grid current of the final stage tube is read from ALC, at the same time, degree of ALC effect must be checked:

3.12 RF

At the time of transmission, the meter (I2) is operated as high frequency output voltmeter; with 50 ohm load, the meter indicates approximately 80% of full scale.

3.13 IP

It indicates the cathode current of 6JS6x2. The scale is 0-500mA. In the case of SSB, adjust BIAS control, so that the idling current is 55 mA. If the idling current has been adjusted properly, the optimum value of grid BIAS voltage can be adjusted automatically when the mode switch changed over to CW position. In CW operation, with the key lifted, the current has to be zero, and the final stage is in cut off condition.

3.14 ALC

When operated in SSB, the meter indicates whether or not the microphone level is correctly adjusted within the range of optimum values.

At the time of non-modulation, the pointer of the meter swings fully to the right end (position of 500mA).

If the pointer of the meter is not at the position, adjust VR103 so that the pointer swings fully to the right end.

When modulation is applied, the pointer of the meter swings down in the direction of the left side but, adjustment must be made on MIC GAIN control so that it does not move more to the left side of 250 mA position corresponding the peak of the voice. The operating range of 250 mA - 500 mA is indicated 'red' in the scale of the meter. If the pointer should swing exceeding the 'red' range at the left side, a large distortion will be caused in output waveform.

3.15 CAL

This is the calibrating (Marker) switch. The ON/OFF switch for supply is to supply the marker oscillating circuit of 100KHz which can be used to calibrate against WWV and for counter adjustment in CW VOICE.

3.16 STANDBY SWITCH 3-WAY KEY

When the switch is at VOX/CW, transmission can be made with automatic brake off. At the positions of PTT/REC, reception can be made or both transmission and reception can be made by 'Press to Talk' (PTT). At the position SEND, transmission will be continued, regardless of the PTT.

PTT

This position is for PTT operation. Transmission and reception can be changed with PTT switch. Actual PTT switch has been incorporated in the microphone body.

VOX

This actually means Voice Operated Transmission. If there is certain voice input at the microphone, the unit will turn to transmitting mode from receiving mode automatically. Even in the case of CW, the low frequency oscillating circuit for monitoring use is utilized for VOX, as the tone signal generator. That is when the key is contacted, it will turn to transmitting mode automatically, and when the transmission has completed, it will return to receiving mode automatically.

SEND

This means manual transmission. The mode of transmission and reception can be changed by STANDBY key. When the key is placed at SEND, transmission can be made, or when the key is placed at REC, reception can be received. This switch turns on or off the power supply of DC 12V, for RL1 and RL2.

3.17 RF TUNE KNOB

This is for tuning of receiving RF stage and transmitting driver stage, At the time of transmission, adjust it in such a way that it becomes maximum.

As transmission and reception are in common on this tuning control, just make one point adjustment on desired frequency.

Note: This is tuning circuits. It can be located at the plate side of the driver tube 6BQ5(V5) at transmitter and frequency mixer tube 6EJ7(V4) at transmitter and grid side of high frequency amplifier tube 6BZ6(V3) at receiver, and the approximate tuning zone scale is provided around the dial.

In the circuit diagram, it is indicated as VC-1a, VC-1b and VC-1c. At the time of reception, the tuning circuit of VC-1b is common tuning tank at plate side of high frequency amplifier tube 6BZ6 (V3).

3.18 BAND switch

This is the band change-over switch. The amateur band of 1.8 - 30.0MHz is divided into 160 m -10 m bands.

RANGE OF FREQUENCIES

160 m	(1.5 - 2.0MHz)	
80 m	(3.5 - 4.0MHz)	* on this band, USB, LSB is reversed Red marking is provided, on the BAND switch and MODE switch.
40 m	(7.0 - 7.5MHz)	
20 m	(14.0-14.5MHz)	
15 m	(21.0-21.5MHz)	
11 m	(27.0-27.5MHz)	
10 mA	(28.0-28.5MHz)	
10 mB	(28.5-29.0MHz)	
10 mC	(29.0-29.5MHz)	
10 mD	(29.5-30.0MHz)	
JJY.WWV	(15.0-15.5MHz)	

3.19 VFO TUNING KNOB

This is the tuning knob for VFO. The mechanism is a combination of ball drive and double gears for smooth and accurate setting. Thus, transmitting and receiving frequencies can be set. When the dial is turned clockwise, the frequency will be higher. The dial frequency is indicated at the frequency display panel (LED) in the unit of KHz. This dial can be turned approximately 35 times for approximately 500KHz variable range. There is an allowance of some 5 turns at both ends. If VFO should deviate from the specified 500KHz variable range, the limit lamps located at the upper part of the display panel will be lighted. When it is deviated towards the upper side, the 'UP' limit lamp will be lighted. Similarly, when it is deviated towards the lower side, 'LO' limit lamp will be lighted, indicating OFF BAND.

3.20 TX GAIN(CW) control knob

This control adjusts the level of carrier at the time of CW. The level of carrier is determined by this control, while reading the meter at the front control. The level of carrier has to be adjusted to the point of just below the grid current runs, as this will make the IP maximum but, ALC, however will not start. At the same time, the RF TUNE must be brought for maximum IP. When grid current runs, the final stage will become class C operation, beyond normal operating class A1, and causes a key-click.

In the case of AM mode transmission, the level of carrier can be adjusted with this control. At the mode of AM, the maximum output power reaches 50W. Please pay attention to the IP, to prevent any over carrier situation. If the carrier level is too high, a minus modulation will develop, and will result in heavy distortion. In the circuit diagram it is symbolized as VR2(100Kohm) Adjust the carrier level to zero by turning it clockwise. As it is turned clockwise, the carrier level will be increased.

3.21 MIC (Microphone gain control)

This is the control for adjusting the gain of the voice amplifier. It is concentric arrangement with TX GAIN(CW)(20).

At the time of transmission, adjust the microphone gain to a position where ALC voltage does not exceed the red range of the meter. (Refer to item ALC).

At AM mode position, balancing between the MIC gain(21) and TX GAIN (CW)(20) is important. If MIC GAIN is set too high, it will be modulated and causing splatter.

3.22 AF GAIN control knob

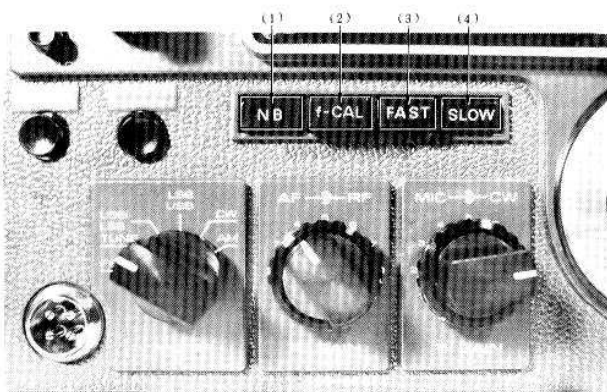
This is for adjusting the volume control at the time of reception. It is inter-connected with the monitor level control during CW.

3.23 RF GAIN control knob

The out-side knob is for adjusting the receiving sensitivity. Usually, it is placed at the position of maximum sensitivity (turned fully clockwise). The S-meter reading should correspond to the RF GAIN setting at the maximum position.

3.24 NB, f-CAL, FAST, SLOW(PUSH ON) button

NB is the noise blanker switch. With push ON, the noise blanker will operate and shut off any pulsive noise such as ignition & etc. f-CAL is the calibration of digital frequency indication switch. With the switch ON, f-CAL dial knob(26) is effective. FAST, SLOW are the AGC time constant change-over switches. At the time of CW, FAST position is recommended.



- (1) NB: Noise Blanker Switch
- (2) f-CAL: Digital Frequency Indicator Calibration Switch.
- (3) FAST: AGC Switch.
- (4) SLOW: AGC Switch.

FIG3 NB, f-CAL AGC SW

NB: When this switch is turned ON, the noise blanker will be operated at the time of reception. If reception is interfered by pulsive noises, such as ignition of automobiles, turn on this switch to shut off the noise.

f-CAL: This is the calibrator switch for adjusting the digital frequency indicator to the right tuning frequency. Whenever the calibration is necessary, turn on this switch.

FAST, SLOW: These switches are for changing the time constant of AGC at the time of reception. When this circuit is turned to SLOW, a capacitor will be inserted, resulting in longer time constant. At the time of SSB reception, if the noise is prominent between words, turn on SLOW switch. If the signal is extremely weak, then the time constant can be shortened by FAST switch position, and it can then be received better.

3.25 PHONES

This is the headphone jack. Insert the plug, when external speaker or headphone is desired. The sound from internal speaker, however, will be shut off.

3.26 f-CAL DIAL knob

When the f-CAL button is depressed, the indication of frequency display can be shifted by means of adjusting f-CAL dial knob, in refernce of standard frequency obtained by 100KHz, or standard radio stations JJY, WWV, etc.

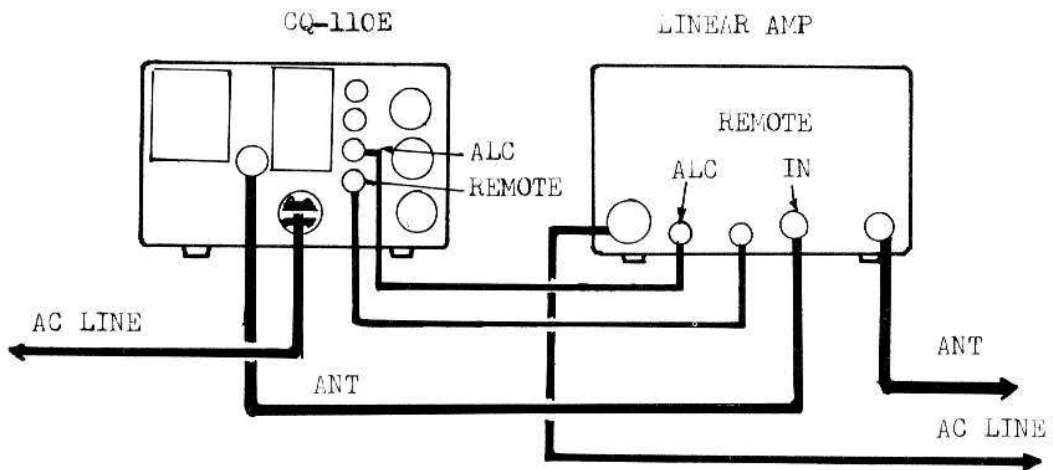


FIG4 CONNECTION OF LINEAR AMP (CQ-301 etc)

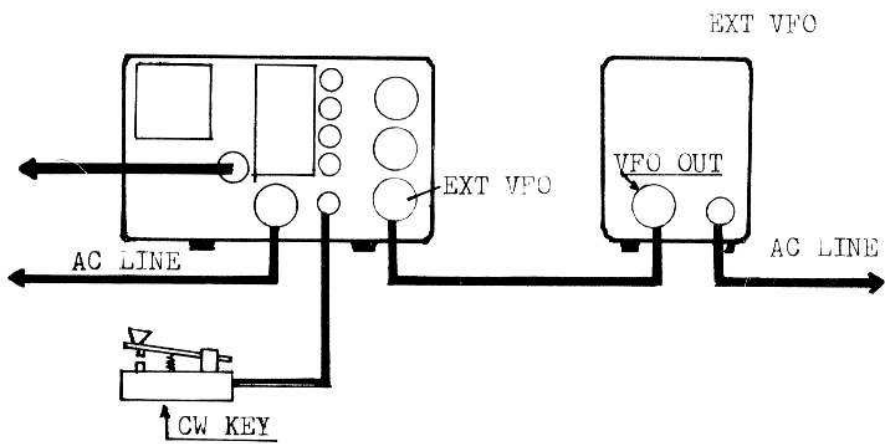


FIG5 CONNECTION OF EXTERNAL VFO

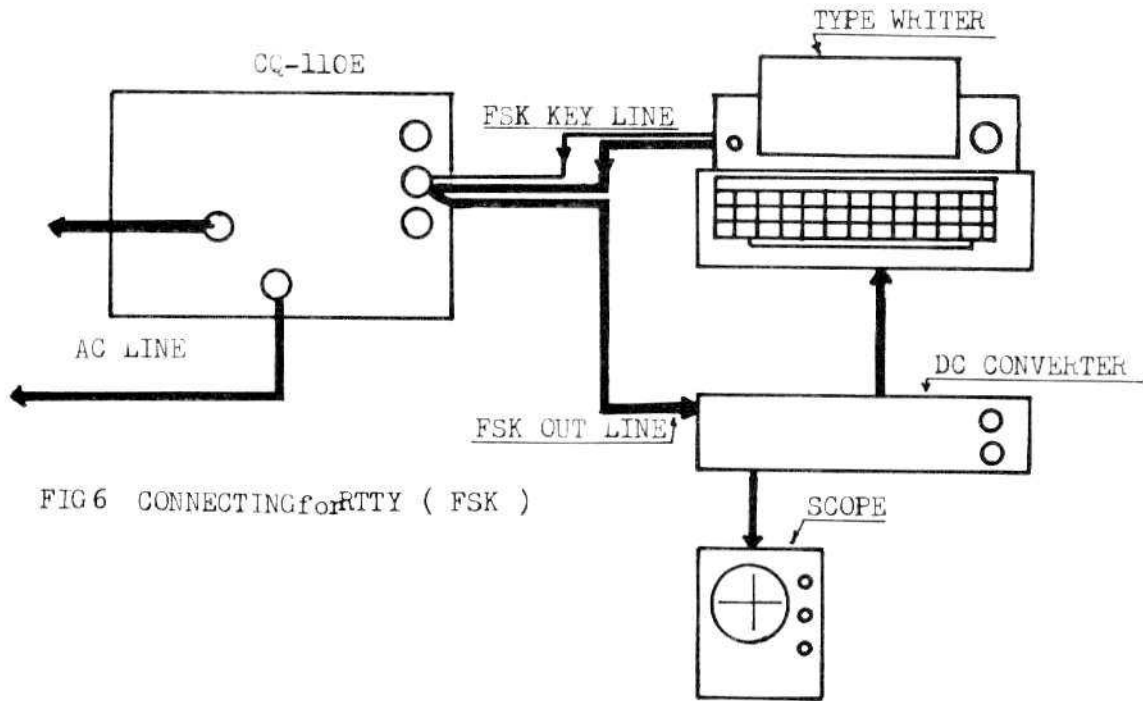


FIG 6 CONNECTING FOR RTTY (FSK)

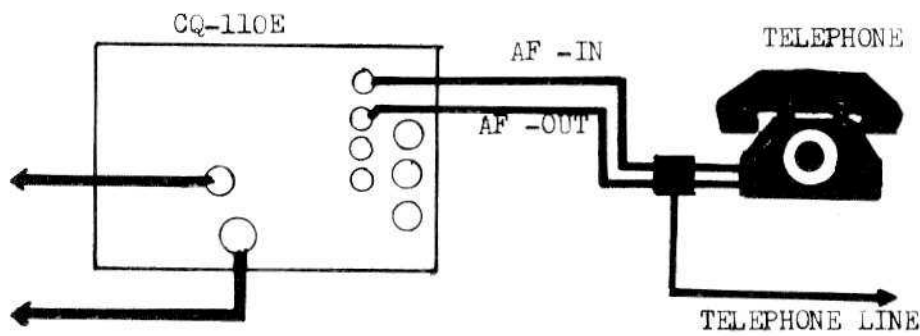


FIG 7 CONNECTING FOR PHONE PATCH

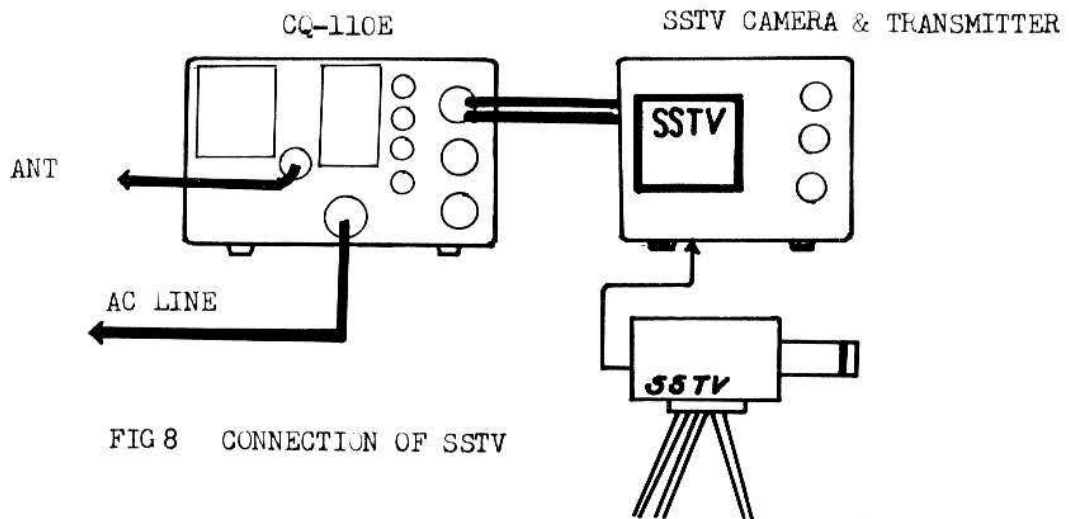
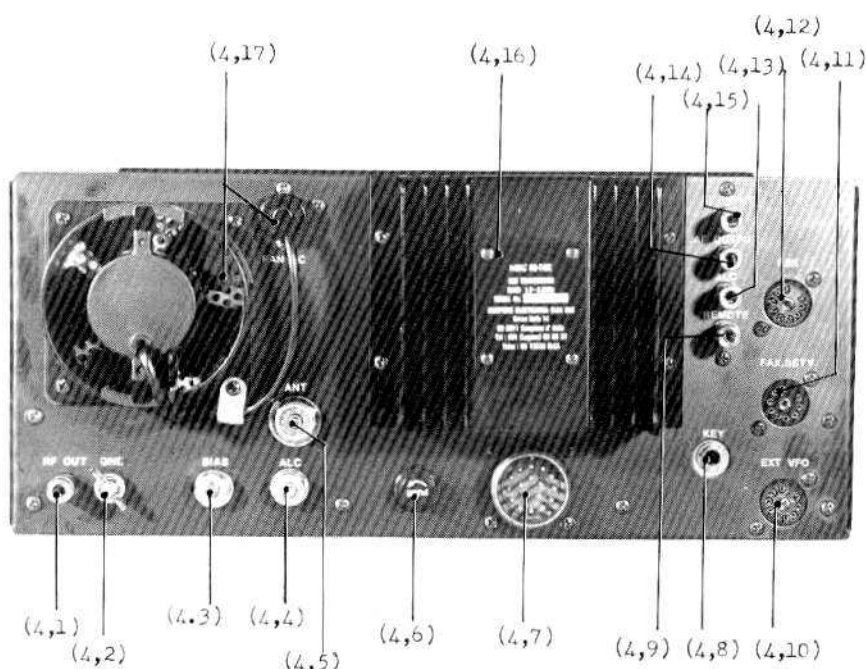


FIG 8 CONNECTION OF SSTV

FIG 9 REAR PANEL CONTROL



SECTION IV - REAR PANEL CONTROL

4.1 RF OUT Terminal

High frequency voltage can be taken out from the plate side of the driver tube 6BQ5(V5) of transmitter. It can be utilized as output to up-verter of 50MHz, 144MHz, etc. The output voltage is approximately 80V p-p(into open load).

4.2 GND Terminal

This is the earth terminal. If the unit is used at base station, effective earthing must be provided.

4.3 BIAS Control

This is for adjustment on grid bias of transmitting final stage tubes. Setting of the IP at the time of transmission (at no signal condition) is 55 mA.

4.4 ALC Control

This is for automatic level control setting, and adjusting loop gain in the ALC link. The feed back amount(DC component) will be set with this control. In the SSB transmitting mode, if the final stage is over driven and resulting in running of grid current, the voice signal will be rectified immediately, and applied to 9MHz FET amplifier to suppress the gain.

4.5 ANT Output Terminal

This is antenna connecting terminal, and the impedance is 50-75 ohm. Before power switch is turned on, be sure to connect suitable antenna or dummy load to this terminal.

4.6 FUSE

This is the fuse holder. Use 5A fuse if replacement is required.

4.7 POWER SOCKET

This is the power plug socket. At the time of AC, connect the power cord into this socket. When it is used on DC 13.5V, special DC power cord must be used.

NOTE: This unit is designed for AC 220V mains supply. If local voltage differs, power transformer connections should be changed. Refer to the connection diagram shown in page

4.8 KEY-JACK

This is the jack for connecting the key. On this terminal, -35V is applied. For CW operation, place the standby key at SEND or CW/VOX position. At VOX position, the break-in operation is possible. A side tone is monitored through speaker.

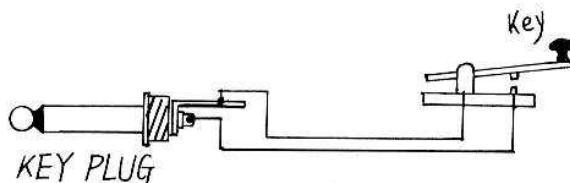


FIG10 KEY PLUG CONNECTION

4.9 REMOTE Control Jack

This is remote terminal of the STANDBY key. Use it as remote control for external VFO, linear amplifier or up-verter, etc. Use only the attached jack.

4.10 VFO Socket

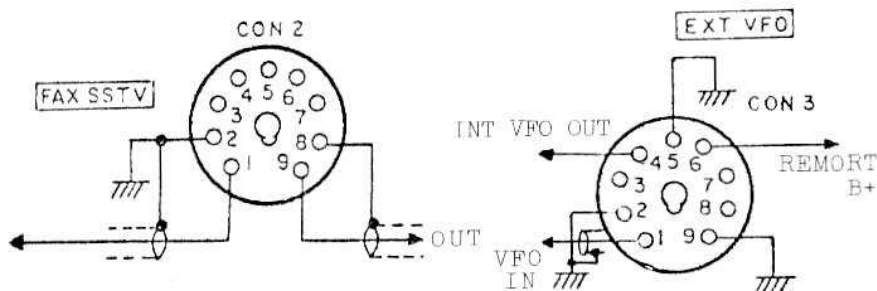
These are the terminals for external VFO connections. They will only accept only specially arranged cable for the purpose.

With these connections, remote operation can be enjoyed. Fig. is the circuit diagram for VFO socket terminal connections.

4.11 FAX, SSTV Socket

These are the input/output terminals of modulator/demodulator for slow scan TV or FAX.

Fig.11 is the circuit diagram of relative connections.



4.12 FSK Socket (Phase Shifted Keying Converter Output Terminal For RTTY)

These are the output terminals to the converter for teletyping (DC converter), and input terminals for keying the mark-space. Relative circuit diagram is shown in Fig.

4.13 ALC Input Terminal

This is the terminal for external ALC input. ALC voltage will be taken in from external linear amplifier.

4.14 AF OUTPUT Jack

This is the output terminal of audio frequency. It can be used for output to phone patch unit, output impedance is 600 ohm.

4.15 AF INPUT Jack

This is the input terminal of audio frequency. Input impedance is 600 ohm.

4.16 DC-DC Converter Unit

This space is for mounting the transistor unit of DC-DC converter.

4.17 FAN Unit

Fan unit is for cooling the transmitting final stage tubes. The motor rating is AC 100V, 50/60Hz. At the time of 50Hz, the motor runs at 2,400RPM, and 3,000RPM on 60Hz. Warm air inside the housing is brought outside.

SECTION V - OPERATION

5.1 INSTALLATION

Select a highly ventilated and dry place where it is not exposed to direct sunlight. As heat is generated, do not place anything on the set or have its side or rear side contacted with the wall. When it is installed as mobile station, select a safe place where no operation is hindered and set in.

The recommended location is the co-driver seat for setting the unit and for safety. When the unit is secured on the dash-board with the special mounting bracket, confirm the strength and air conditioning system and install it in a position where vibration or shock is not transmitted to the unit.

5.2 POWER SOURCE connection

(a) In the fixed Station

When used at fixed station, as the power cord fitted with AC plug is attached, connect it to the power socket of the unit. The rated voltage is 220V, 50/60Hz.

In any case, before the power source is connected with the unit, confirm that the POWER switch on the front panel has been turned OFF (pushed OFF). With the power switch turned 'ON', if power source is interrupted only at the socket, transistors or ICs will be damaged due to transient shock.

Note: When replace the AC power cord, use only current rating of 10A or higher, including power plug.

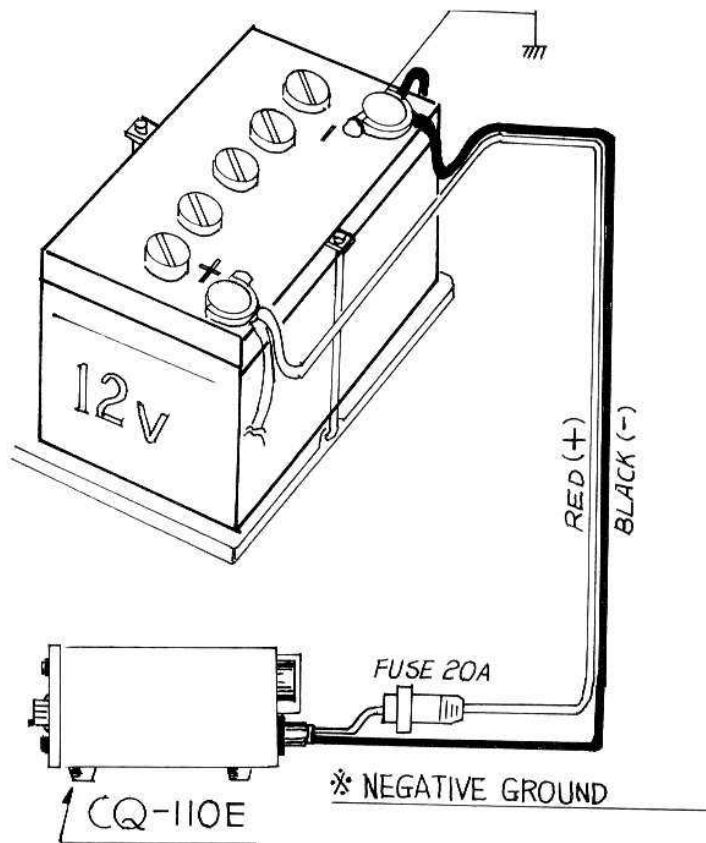
Multiple voltage tap system is provided in the power transformer primary winding. When the internal wiring is changed, it can be suited for 5 different kinds of power sources, as 110V, 117V, 200V, 220V and 234V.

(b) In the Mobile Station

When used as mobile station, connect the DC power cord at the POWER socket, and use the unit on 13.5V DC, with minus grounding battery system.

Connect the red wire with the plus terminal of the battery, and the black wire with minus terminal. Be sure to connect these wires with the battery terminals directly, if the plus side is taken from the cigar-lighter socket or minus side is connected with automobile body, insufficient current capacity makes unexpected accident or noises during operating the unit. If the wire length seems excessively long, cut them to a required length, as a big current (more than 20A) runs, be sure the joints are tight, so that the voltage drop is negligible.

FIG 12 DC OPERATION, FOR MOBIL



5.3 ANTENNA

When used as mobile station, there is a certain limit of antenna size. A vertical type with extension coil is recommended. In a large boat, and ample space is provided for the antenna system, a half wave dipole antenna may be used. However, in most cases, it is used most often in an automobile or small boat. In these cases, be sure to select a high efficient type antenna only. When used as fixed station, any type of antenna may be used. Anyway, the antenna output impedance is designed to be 50-75 ohm unbalanced.

If the matching seems necessary, insert the antenna coupler, etc. Use only loss type co-axial cable for the feeder.

5.4 GROUNDING

In the case of mobile station, the metal chassis is connected with the automobile body or boat hull through the mobile mount and the minus side of power source.

In the case of fixed station, to prevent the spurious radiation from earthing, or to prevent electric shock, be sure to connect the GND terminal of the rear panel with ground wire of heaviest in the shortest pass.

When a grounding type antenna is used, provide earthing to the antenna and the unit chassis separately.

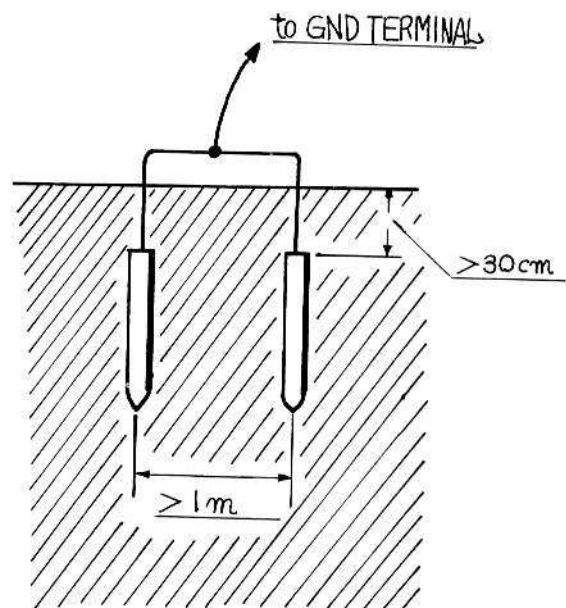
After completion of these connections, of power source, antenna and earthing, QSO comes next.

CONSTRUCTION OF EARTHING SYSTEM

FIG14 SINGLE EARTHING ROD TYPE

Single Earthing Rod Type

When single earthing rod is used, dig a hole as deep as possible, and bury the rod. It is recommended to fill around the rod the charcoal powder.

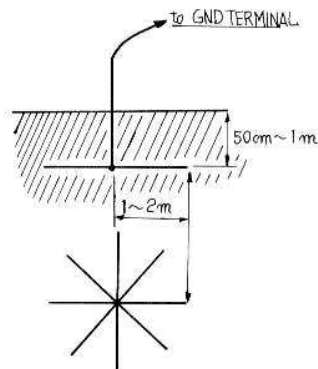


Radial Spreading Type

When the earthing wire is spread radially, more than 6 heavy copper wires must be used. See the details

FIG.15 RADIAL SPREADING TYPE

as shown in the fig.below.
Only heavy duty wire is recommended.



Note: In some cases, the service water pipe may be used as earthing conductor. Do not use the gas pipe, or conduct pipe for electric distribution.

5.5 PREPARATION PRIOR TO STARTING OPERATION

Before the unit is operated, the following preparation is required. Before connecting the power source, make the following preparation:

(a) To begin with, peruse this operating manual, and master the operating procedure. Handling of SSB transceiver is the main subject of the text. Train yourself as if actual transmission were made, and master the transmitting procedure.

(b) Confirm that the POWER switch of the unit has been turned off, then plugg-in the unit to the source.

(c) Connect the antenna with the antenna terminal located at the rear side of the unit. When the transmitter is operated for adjustment of various parts of transmitter, or for testing the the transmission purposes, be sure to connect a suitable dummy load in place of the antenna.

(d) Connect microphone into the socket provided at the front panel.

5.6 PREPARATION FOR OPERATION

Set these knobs and switches provided on the front panel, as follows:

BAND Switch	To desired band
VFO/XTAL Switch	To desired position(or channel)
VFO Tune	To desired frequency
POWER Switch	Off
HEATER Switch	Off

MODE Switch	To desired mode position
AF GAIN Control	At center position
RF GAIN Control	At maximum position(full clockwise)
MIC GAIN Control	At minimum position(full counterclockwise)
METER Switch	At IP position
FINE Switch	Off
RF TUNE	At center
LOAD Control	At center position
PLATE Control	For desired band position(The band indication is shown around the dial).
NB Switch	Off
AGC (FAST, SLOW) switch	To desired position(SLOW in SSB position, OFF or FAST in CW position).
STANDBY KEY	At PTT/REC position.

SECTION VI - BASIC OPERATIONS FOR TRANSMISSION AND RECEPTION

6.1 When SSB is received:

Set these switches on the panel as follows:

- (a) Select the band desired to receive.
- (b) Place the mode switch, at either USB or LSB. In the case of 7MHz or less, use the LSB mode and use USB at higher band. In 3.5MHz band(80m), USB, LSB indication is reversed, and marked in red letters.
- (c) Regarding the meter indication, even if any position of RF, IP, ALC of the meter switch is pushed, S-meter indication takes place at the time of receiving. However, it is recommended that you select the IP position.(If you happend to turn for transmission by mistake, the IP can detect immediately).
- (d) Turn off NB and FINE switches.
- (e) The Standby switch(semens key) position is at PTT/REC.
- (f) Place AGC switch at SLOW, and CAL switch at off position.
- (g) f-CAL switch has to be turned off, until frequency calibration is necessary.
- (h) Place RF Gain control at maximum position, and AF GAIN control at scale division of 3.
- (g) Place RF TUNE control at center of the scale. However, this control must be re-adjusted for maximum receiving sensitivity, depending on the selected band.

Now turn the POWER Switch ON, with the antenna positioned but, with the HEATER Switch 'OFF'.
With the above procedure, preparation for receiving has been completed.

When the power switch is turned on, the front panel will be illuminated by pilot lamp of KHz, meter scale and digital frequency indicator(LED).

The digital frequency indicator indicates receiving frequency. When the fan for cooling the transmission final tubes is turned on, a sound can be heard from the speaker. As vacuum tubes are used in the front end, warming up time of approximately one minute is necessary.

After warming up the front end tubes, try to tune the RF TUNE control for the best sensitivity, judging by the tuning noise. When VFO is tuned, signal will be received. Adjust the frequency to the position where best clarity can be obtained by trimming the VFO.

6.2 When CW(FSK) is received:

Select the MODE switch to CW(FSK) position, and the other procedure is similar to SSB receiving procedure.

6.3 ADJUSTMENT ON TRANSMISSION

To begin with, turn on the HEATER switch on the front panel. It supplies the heater voltage to the transmission final stage tubes.

(a) Set Tx GAIN/CW and MIC GAIN controls for minimum position (full counterclockwise)

(b) Place the STANDBY KEY to SEND position.

(c) Confirm that the IP on the meter indicates 55 mA.

The unit is hence, ready for transmission.

(d) Place the MODE switch position at SSB (USB or LSB).

If the idle current does not indicate 55mA, it is necessary to re-adjust BIAS control provided in the rear panel. By turning the BIAS control counterclockwise direction, the idle current will be increased (i.e final stage tube grid bias will be decreased), or turn it to clockwise direction, the idle current will be decreased.

Note: Do not make this adjustment when the MODE switch is at the TUNE position as incorrect bias setting will be result.

Then, turn the LOAD control knob counterclockwise fully (this means the variable capacitor at maximum capacitance).

Set the PLATE control knob in the vicinity of desired frequency band.

Place the MODE switch to TUNE position, and place the STANDBY key at SEND position.

Turn the MIC GAIN knob slightly in the clockwise direction, therefore the indication of IP is increased (or re-adjust the RF TUNE control and seek for maximum point).

Adjust these LOAD and PLATE controls, and seek for the dip point of IP.

Even if IP is dipped, adjust these LOAD and PLATE controls, so that it is 150mA or so. If the dipped IP value is not sufficient, turn the MIC GAIN knob clockwise furthermore. The current will run further more.

Then, RF power should become maximum.

When this adjustment is completed, the transmitter is operable in any position of desired mode. For SSB, leave as it is, and if the MODE switch is placed at USB or LSB position, radio wave will be emitted.

In the MODE switch position of AM or CW, adjust the carrier level with Tx GAIN(CW) control(approx. 150mA at the time of AM).

In the CW position, push the key, and check the IP value of approx. 400mA(maximum).

SECTION VII - FREQUENCY CALIBRATION OF DIGITAL FREQUENCY INDICATOR

7.1 SSB(When transmission and reception are made on USB and LSB)

When transmission and reception are made with SSB, the same carrier frequency must be used, therefore, the carrier frequency can be read off directly on the digital frequency indicator (dial frequency).

To calibrate the dial frequency, push on the CAL button(100KHz marker), and take zero-beat with the VFO dial.

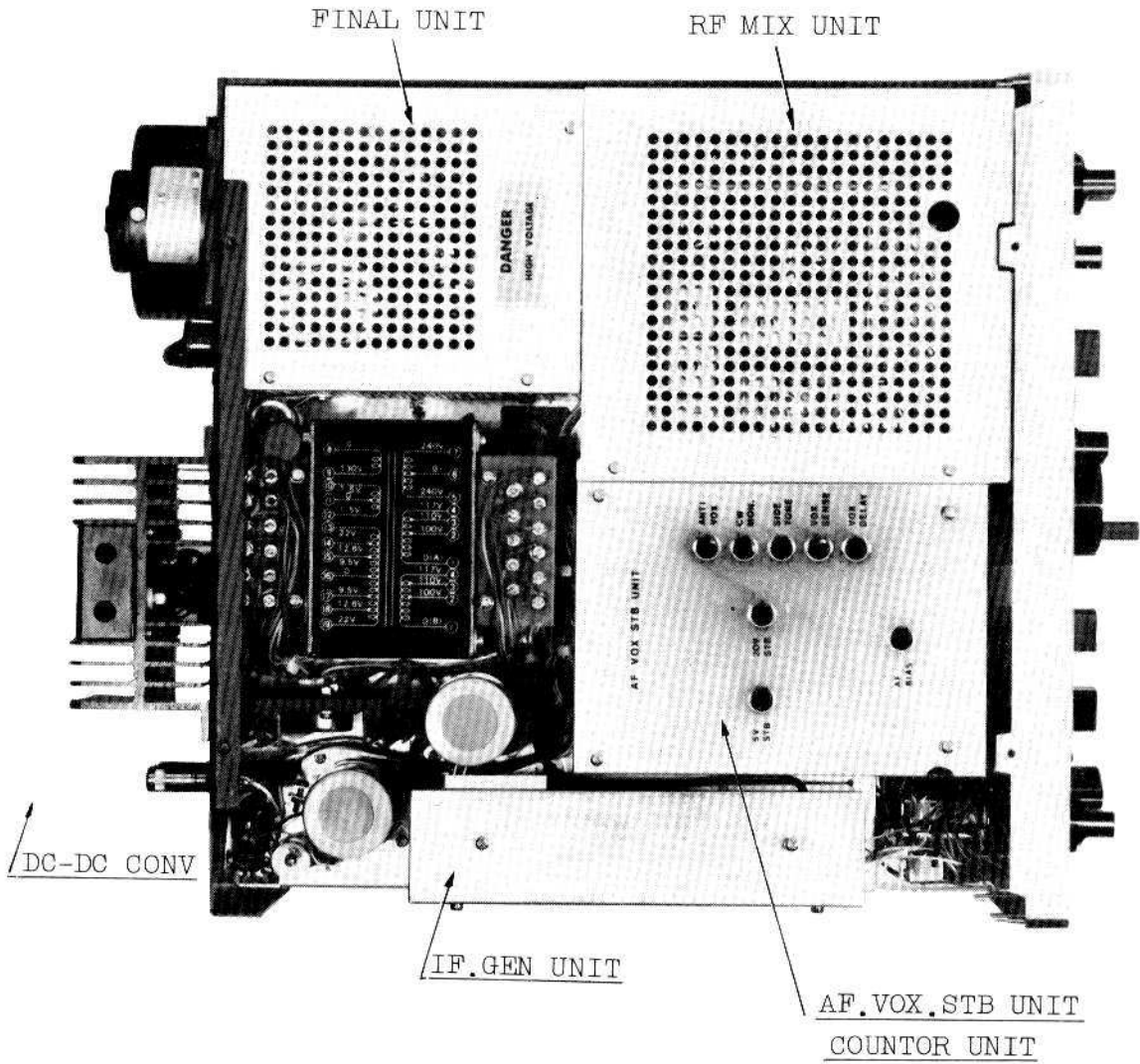
Then push on the f-CAL switch, and adjust f-CAL dial knob, so that the digital frequency indicator indicates the 000.0KHz point. Take for instance, to calibrate on 14,3000KHz, calibrate the VFO dial for zero-beat with the marker on, at this time, the digital frequency indicator would not show exact frequency, but nearly the frequency, for example, 14,301KHz. The error of 1.0KHz can be brought to the correct frequency, by f-CAL dial knob.

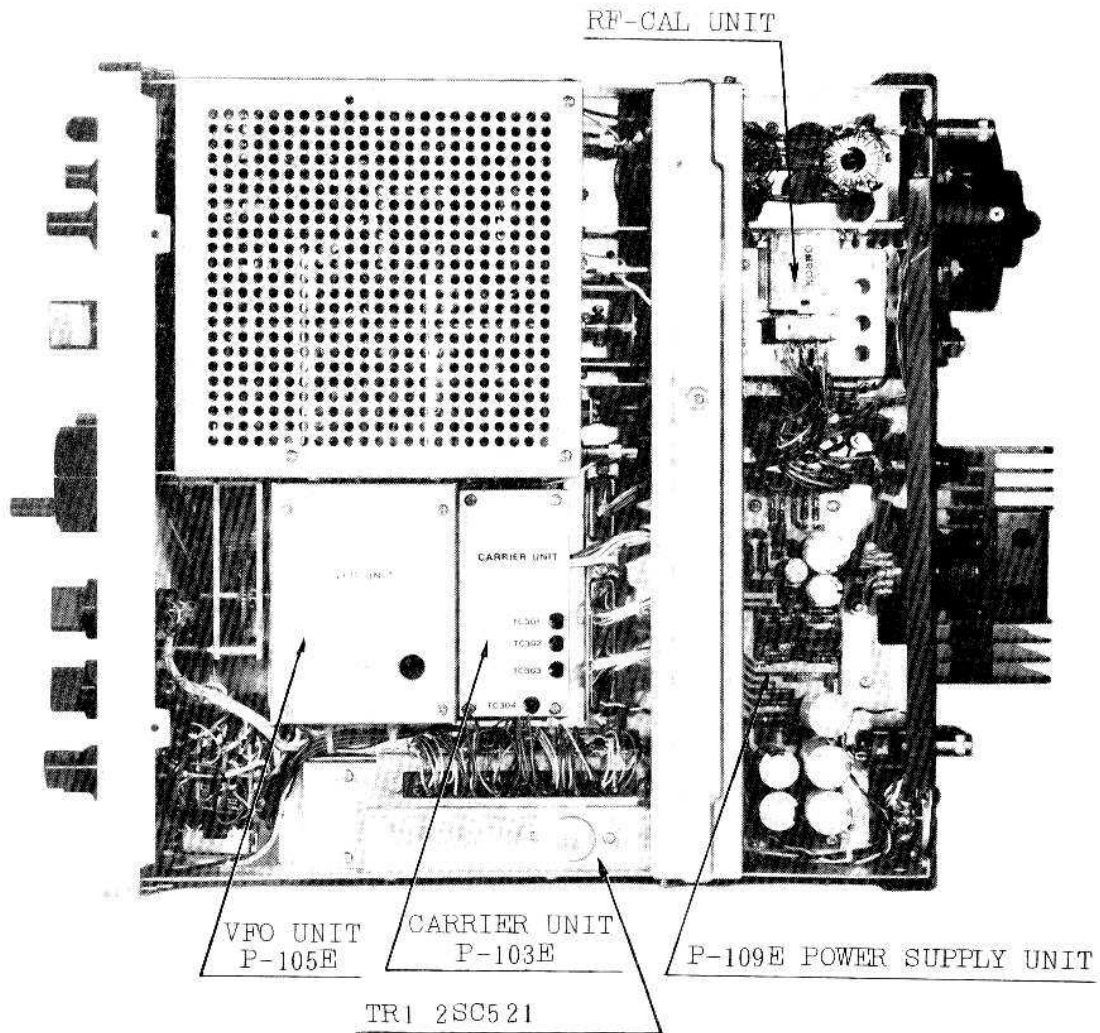
7.2 When transmission and reception are made with CW

At the CW position, the unit is designed to shift the crystal IF frequency from transmitting 9,000KHz to receiving 8,999.2KHz for VFO, so that the difference of 800Hz will be heard as beat note. Important point is that, in the CW mode, the received signal frequency at zero-beat point is processed to lower side(-800hz) in the receiver. Therefore, it is necessary to read the dial, adding approx. 800Hz to know the correct frequency. This occurs only when the MODE switch is placed at CW position, and only during reception.

If the dial frequency is already calibrated in the mode of SSB, the transmitting frequency is the direct reading of the dial, and to receive CW signal, select the MODE switch to CW position, then beat note can be heard, but the dial frequency does not. This is the correct transmitting point.

FIG16 CQ-110E UPPER SIDE VIEW





7.3 DIGITAL FREQUENCY INDICATION when 'FINE' is used

At the time of receiving CW, or different frequency is being used for transmission and reception between partner station, use FINE tuning control (effective only for receiving frequency), with FINE button pushed on.

The dial frequency will be switched during transmission and reception. When the FINE button pushed off, the dial indicates transmitting frequency.

SECTION VIII - CIRCUITS AND OPERATION

Fig. 18 shows the block diagram of CQ-110E.

In the circuit line up, superheterodyne of single conversion system with premixing is employed in the receiver section. Vacuum tubes are used in the front end, i.e. HF amplifier, frequency converter (for receiving, including premixer) to improve cross modulation characteristics (two signal modulation, gain suppression, etc.).

In the transmitter section, 9MHz crystal filter is used to generate SSB signal, and mixed with premixer type local oscillator signal, for obtaining desired frequency.

Besides these basic circuits, the unit is equipped with auxiliary circuits such as VOX, AGC, ALC, NB, digital frequency counter and display, etc.

8.1 CIRCUITS of RECEIVER SECTION

A signal which has entered from the antenna terminal passes through the antenna relay for switching transmission and reception and then, it passes through 9MHz trap filter, and enters the input tuning circuit through band switch (S2, W5) and is added to the grid of HF amplifier tube 6BZ (V5).

9MHz trap (L1250-C1260) has been tuned to intermediate frequency, so that it prevents 9MHz signal to jump into the IF amplifier. The signal amplified in the HF amplifier passes through the band switch S2W3, and is applied to the grid of receiving mixer tube 7360 (V3) through the output tuning circuit.

The mixer is called low noise beam differential tube, designed for superior results in cross modulation characteristics.

Local oscillator signal, which is derived from 6EJ7 (V1) plate and through band pass filter, is applied to the differential plate of 7360. At the plate of 7360, 9MHz intermediate frequency appears.

HF band local oscillator (HFO) is crystal oscillator using transistor 2SC386A as shown in Fig. X, the oscillator frequencies on each band are as shown in the table. The crystal element is 3rd overtone type. In the 80m band, the HFO is eliminated. The oscillator output is injected to premixer tube 6EJ7 (V1) grid.

In the VFO, the oscillator is FET 2SK41E (TR501), and stable output is obtained in the frequency range of 5.0-5.5MHz (500kHz variable range).

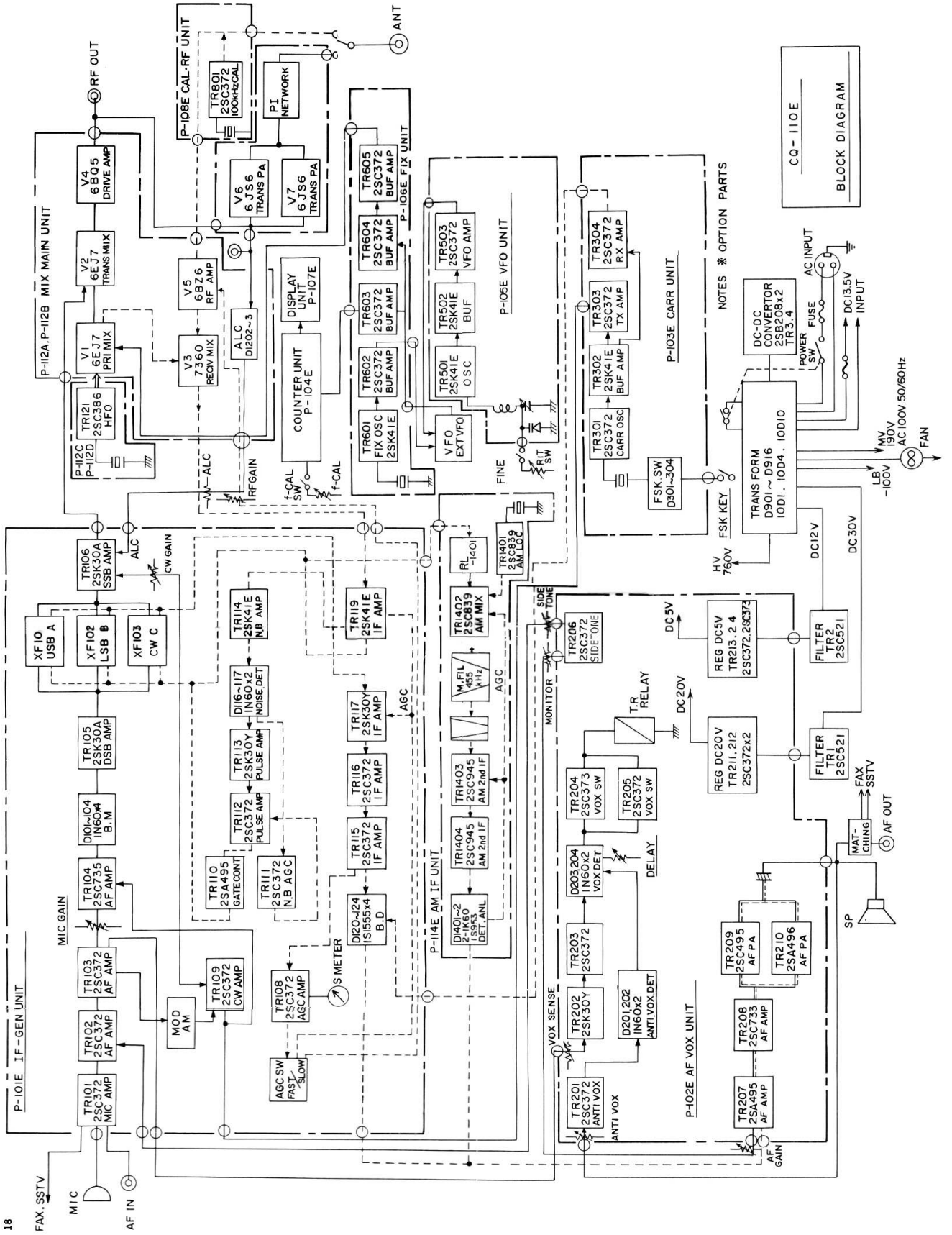
Fig X

$$(\text{BAND OSC Freq HFO}) - (\text{VFO Freq}) - (\text{IF Freq}) = f_{\text{out}}$$

$$f_{\text{out}} = f_{\text{B}} - f_{\text{i}} = 9.0 \text{ MHz}$$

1.9 MHz BAND	=	16.0 - 5.0 - 9.0	
3.5 "	=	9.0 - 5.0	(USB, LSB REV)
7 "	=	21.5 - 5.0 - 9.0	
14.0 "	=	28.5 - 5.0 - 9.0	
21.0 "	=	35.5 - 5.0 - 9.0	
27.0 "	=	41.5 - 5.0 - 9.0	
28.0 "	=	42.5 - 5.0 - 9.0	
28.5 "	=	43.0 - 5.0 - 9.0	
29.0 "	=	43.5 - 5.0 - 9.0	
29.5 "	=	44.0 - 5.0 - 9.0	
JJY.WWV "	=	29.5 - 5.0 - 9.0	

FIG 18



The buffer stage is also FET 2SK41E(TR502), the output is level adjusted with VR501, then goes to the final stage 2SC372(TR503), and the output goes to pre-mixer 6EJ7 grid via VFO/FIX switch. In the grid input of 6EJ7, band pass filter(for VFO frequency) is inserted for the wave from shaping.

The oscillating circuit of VFO consists of oscillating coil L502, variable capacitor VC501 as tuning tank, trimmer capacitor VC502 and associated CR in the circuit are temperature compensated for stable oscillation.

The diode D505(SC-20) coupled to the oscillator circuit through C504 5pF is the circuit for FINE tuning control. When this switch is turned off, a fixed DC voltage will be applied to the diode and it has been so set that it is almost the same as the 'O-Center' position of FINE tuning dial.

When it is turned ON, the LED(LD-P3) is illuminated and the voltage to be added to the diode is changed at VR3A in order to vary the oscillating frequency.

The FINE circuit has been interconnected to the FIXED frequency oscillator unit P-106E. If the VFO/FIX switch is turned to the position "FIX" (CH1 and CH2), it can be handled as in the case of VFO.

The variable range is approx. \pm 4KHz with VFO and \pm 1.5KHz with FIX CHANNELS.

FIX CHANNEL position (CH1 and CH2) is used only for the fixed channel frequency i.e. transmission and reception are made with X-tal. (X-tal of desired frequency will be supplied as option). Oscillation is made at 2SK-41E(TR 601). The output is passing through the volume VR601 for adjustment of level coil of T601, it enters the buffer circuit of TR602.

In this unit, a buffer amplifier for the counter circuit and a buffer amplifier for injection to the premix circuit are provided.

The output from the X-tal oscillator or VFO enters the base of TR603, 2SC-372 and the emitter output becomes the counter input. The same input as TR603 becomes a base input TR604 2SC-372 and forming 2-stage amplifier with TR605 2SC-372, and it becomes an input signal to the premix.

9MHz intermediate frequency signal taken out of the mixer is amplified at 2SK-41E(TR 119) through T112 of P-101E IF board and P-112A IFT(L1207). The signal enters the filter via T111 from the diode switch for changing-over of filters through the gate circuit of noise blanker.

As for the diode switch, 2 pcs. of filters for SSB(USB, LSB) and CW filter are so connected that it is possible to select the respective types of radio wave.

After leaving the filter, the IF signal enters the detecting circuit through IFT T107 - T109 and IF 3-stage amplifier of TR117 2SK-30Y, TR116 2SC-372, TR115 2SC-372.

The detecting circuit is a ring balanced de-modulating circuit and 4 pcs. of diode IN-60 are used.

This part is a special balanced demodulator for reception and injection balancing of carrier is taken at carrier balancer VR 105.

The carrier oscillating frequency is 9,000KHz(in the cases of SSB) and supplied to the ring balanced demodulating circuit. At the time of CW, the frequency is shifted to 8999.2KHz with switching diode located at the carrier oscillator board P-103E. There is unique design in the receiver. When the MODE in AM, IF signal passes through the relay RL 1401 and then, enters TR455KHz. At this time, local oscillator frequency is the 9455KHz at TR 1401 2SC-839. The signal converted to 455KHz passes through the AM-mechanical filter and ceramic filter and enters AM. IF AMP is amplified at TR 1403, TR 1404 2SC-945 x 2, then AM detected.

The detected output passes through ANL(automatic noise limiter) and enters the MODE SWITCH and AF amplifier board P-102E. Thus, the AM IF is exclusive, the resulted sound quality on AM reception is favorable.

The detected output enters AF board P-102 through the volume of AF GAIN through the MODE SWITCH S-1b.

TR207 2SA-495, TR208 2SC-733, TR209 2SC-496, TR210 2SA-496 are for audio frequency amplification.

2SA-495 and 2SC-733 are for pre-amplifier and a complementary OTL circuit is adopted for power stage for lower distortion.

In AGC circuit, part of the IF signal amplified at TR115 2SC-372 is rectified at D112 diode and, further DC amplified with TR108 2SC-372, and applied to the AGC circuit.

AGC voltage is applied over the gate of TR119 2SK-41E and TR117 2SK-30Y.

The reference minus voltage applied through diodes D1201 and D1204 is also controlled by AGC for the grid bias voltage of 6BZ6 (V5).

8.2 CIRCUIT OF TRANSMITTER

The voice signal added to the microphone input terminal is amplified at 2SC-372 (TR101) and 2SC-372 x 2 (TR102, TR103) and then, enters the MIC gain control VR1A (100K ohm).

The signal is further amplified by TR104 2SC-735 and its output is taken out at the emitter.

Through the relay RL102 for transmit/receive, the signal is applied to the balanced modulator circuit.

The microphone amplifier input impedance is designed to approx. 20K ohm.

Carrier frequency is generated at carrier oscillator unit of P-103E. The oscillator is at 2SC-372 (TR301). The oscillating frequency is 9000.0KHz. The oscillator output passes through the buffer amplifier 2SK-41E (TR302), then passes through the transmitter buffer amplifier 2SC-372 (TR303). After passing through RL301 relay, it enters P-101E on IF GEN board and then is applied to the center tap of potentiometer VR102 for the balanced modulator. Here, double side band wave is produced by means of modulating the carrier and voice signal from microphone.

This signal is amplified at 2SK-30 (TR105) and it passes through the side band filter, resulting in providing SSB signal. It is then amplified at 2SK-30 (TR106).

The output signal of IF GEN board enters MIX board P-112. Further, the signal enters the grid G1 of 6EJ7 (V2) of mixer for transmission and at the same time, a local oscillation signal from the pre-mixer is added to this point, then the final desired frequency is obtained at the plate side. In the case of CW or AM, the output from carrier oscillator of P-103E is divided into two directions, one of which goes to the balanced modulator circuit and then, the carrier is supplied to the switching circuit and goes to 2SC-372 (TR109) and is amplified.

The signal further passes through T105 and CW control (VR1B), it becomes an input of TR106 2SK-30A in the SSB amplifier circuit at final stage of filter. At the time of AM, a modulating signal passing through the relay (RL-102) is applied to the base of (TR109) 2SC-372 from the emitter output of 2SC735 (TR104) for low power modulation.

The signal for transmission of the desired frequency is taken out at tuning circuit at plate side of the transmission mixer V2.

This circuit is in common with the tuning circuit at plate side of frequency amplifier 6BZ6 at receiver.

The transmitting signal is amplified to level required for driving the final power amplifier stage at driver tube 6BQ5 (V4). For stable operation of the driver tube, neutralization is made with C1221.

6JS6 x 2 (V6, V7) is used for the final stage. The final stage has been housed in a sturdy case together with the output tuning circuit (tank circuit).

Vc1 is a capacitor for neutralization for operating the final stage output tube.

C1242 - C1245 are used for correction of deviation of neutralization in each band. Thus, all bands can be neutralized. The meter circuit has been inserted in the cathode circuit of the final stage tubes.

Thus, cathode current IP is indicated. The input signal to the final stage can be taken out through the jack of RP OUT via C35. This can be utilized as output to up-verter. Power is supplied to the heater of the final stage tube when the HEATER SWITCH is turned on.

When up-verter is used, turn off the heater and stop the operation of the final stage tube.

In the ALC circuit, control voltage is derived from the final stage tube grid current, by which 2 diodes of 1S33(D1203) conduct and generate minus voltage which is fed back to the base of TR106 on IF-GEN board.

When it is used in combination with the linear amplifier or up-verter, ALC terminal serves to feed ALC voltage.

The output signal at final stage passes through the π -match tuning circuit, the output impedance is 50-75ohm and goes to antenna terminal jack. Divided signal goes to the RF-CAL board of P-108 and rectified by diode D802 and it enters the meter circuit, to indicate output power level of relative value.

8.3 ASSOCIATED CIRCUITS

(a) VOX circuit

A voice signal from the microphone is amplified at 2SC 372 x 3 (TR101, TR102 and TR103) and the output comes out of the emitter follower and then, it is supplied to AF VOX board of P-102. Divided voice signal is taken out through VOX gain adjustment control (VR202). After amplified by VOX amplifier 2SK30 (TR202) and 2SC372 (TR203), control voltage is rectified by D203, D204, and Dc voltage is resulted.

The relay control circuit is a direct coupled circuit with 2SC373 2SC372 (TR204, TR205). When no voice signal is present, TR205 does not conduct and the relay will not be actuated.

When the voice signal is present, rectified voltage at D203, D204 applies to the base of TR204, resulting TR205 to conduct, and the relay is now actuated.

Time constant of VOX circuit depends on R210, C210 and VR203 (DELAY CONT.)

(b) KEYING circuit

When key is connected with the key jack for CW and the contact is opened, TR105, TR106, MIX stage 6EJ7 and Driver stage 6BQ5 (V4) are cut off, resulting in generating no output.

When the key is in contact, they will operate with proper bias and output is generated.

The keying circuit is operable in parallel with SIDE TONE oscillator, and the minitor output appears through low frequency amplifier circuit and speaker. The tone therefore, can be heard while operating the key. The side tone output further enters VOX circuit and it is operated as automatic transmission/reception circuit. It is the so-called semi--break--in keying.

(c) ANTIVOX CIRCUIT

The standby relay is operated with an input from MIC at VOX circuit. If operated with receiving tone i.e. tone from the speaker, it will be meaningless. For this reason, a preventive circuit is provided.

Part of the speaker input is taken out and amplified at ANTIVOX amplifier of TR201 2SC372 after passing through VK201 ANTI VOX CONT and its output is rectified at diodes of D201 and D202 and its negative voltage is applied to the base of the transistor TR204(relay switch) to cut off and to prevent transmission.

(d) MARKER OSCILLATOR

100KHz crystal frequency is oscillated at 2SC-372(TR801) and its output is connected with the antenna circuit via D801 and used as marker for calibration of frequency.

100KHz oscillating frequency can be varied slightly by inserting (TC801) in series with the crystal element.

(e) NOISE BLANKER CIRCUIT

The signal from the receiving mixer enters the I.F. amplifier circuit and part of it, passing through TR119 is amplified at noise amplifier TR114 2SK41E and the amplified signal is rectified at IN60 x 2(D116, D117) and then, it enters VR104 and then, supplied to DC amplifier circuit. Here, the pulse from the noise is amplified and it enters the switching circuit of TR110 2SA495. Threshold level will be controlled by setting the input level of the pulse amplifier of TR113.

Accordingly, if there is a noise input, 2SA495(TR110) will be turned ON and the collector potential of TR110 will drop and no IF input can be added equivalently.

Reverse bias is applied to the base of TR110 through 2SC-372 (TR111) from diode output of D116, D117.

When there is no pulse, TR110 does not conduct, therefore, the intermediate frequency signal can pass to the input of I.F. filters.

(f) POWER SUPPLY P-109E

High voltage B power supply:

The rectifier is the silicon diodes(D905 - D912), and DC voltage is derived from AC 240V x 2 of the power transformer.

47 uF x 2 capacitors are arranged in series in the smoothing circuit for high voltage and center voltage is taken out from center tap of the series capacitors for medium high voltage. High voltage is supplied to the plate of the final stage output tube 6JS6 and medium high voltage of DC300V is supplied to 6BQ5.

Low voltage B power supply:

DC 150V and DC 180V are obtained from the terminal of AC 130V. These DC voltage are for screen grid of the final stage output tubes, and for receiving RF and mixer tube B supply. Negative bias voltage for the transmitting tubes are obtained from this winding by means of rectifier diode D909.

Power Supply for transistors:

Winding taps of AC 22V x 2 and AC 12.5V x 2 are rectified and used for power supply for transistors. The power supply enters the stabilizer circuit of P-102E and the stabilized 20V and 5V DC for the counter are obtained.

Power supply for DC-DC converter:

CQ-110E has been so designed and designed to operate on DC power supply. 2SB-208 x 2 of TR3 TR4 are transistors for oscillation. MS plug for power socket is necessary to replace with DC connection. Power transformer winding tap of 9.5V x 2(AC) are for DC converter, and former tap for converter. 1.5V x 2(AC tap is used for biasing purpose.

Power supply for aircooling fan:

AC 100V tap at the primary side is the power supply for the cooling fan. When the power line voltage of 100-110-117-220-234 taps are used, the wiring for the fan does not need to be modified.

SECTION IX - ADJUSTMENT ON VARIOUS CIRCUITS

Adjustment on the printed circuit boards and various potentiometer to be described hereunder must be made after the temperature inside the cabinet has been stabilized.

Time required for setting the temperature inside the cabinet is different depending on the ambient temperature between winter and summer. However, generally speaking, it takes about 40-60 minutes.

9.1 ADJUSTMENT ON CARRIER BALANCE (TRANSMITTING)

This adjustment is to improve suppression of carrier when operating on SSB. Place the MODE SWITCH at SSB, (USB or LSB) and prepare the unit ready for transmission.

While making the adjustment, the microphone must be pulled out or TX GAIN (CW) and MIC gain controls must be turned to fully counterclockwise to zero position.

With the meter at 'RF' position, if there is any carrier leakage the meter will indicate the amount of leakage. Adjust both VR 102(200 ohm) and TC101(30PF) alternately so that the meter indication becomes minimum. Repeat these steps 2-3 times.

If there is any other receiver set, adjustment can be made by receiving the transmitted signal.

Note: After this adjustment, a kind of hum noise may be heard, but in effect, the noise will not be transmitted over the signal.

9.2 ADJUSTMENT ON CARRIER BALANCE (RECEIVING)

Turn RF GAIN fully clockwise so that maximum gain may be obtained and it is ready for reception. Place the MODE SWITCH at either USB or LSB position, then remove the antenna and check the S-meter reading. Degree of imbalance on the balanced detector appears on the meter. It must be in the area of '0' in either USB or LSB position. Balancing can be adjusted with VR105.

9.3 S-METER ADJUSTMENT

Turn the RF GAIN clockwise fully so that maximum gain can be obtained and adjust it ready for reception on 14MHz band. Turn the MODE SWITCH to either the USB or LSB position. Supply a signal of 40dB to ANT terminal from SSG and adjust the meter to indicate S9(2/3 scale).

This adjustment can be made with VR101.

9.4 MARKER CALIBRATOR ADJUSTMENT

This unit can receive a standard radio wave of 15MHz BAND, the signal will be used to calibrate internal marker calibrator. Upon receiving the standard radio wave of 15MHz, turn on the CAL button and detect the beat note. Adjust the trimmer TC802 of P-108E so that the beat note becomes zero (0).

This calibrator is the standard frequency of this unit and it is extremely important to maintain the correct frequency.

Therefore, adjust the TC802 with utmost care.

In the next step, adjust the digital frequency indication for the correct frequency.

Turn on the CAL button(100KHz), tune the VFO dial knob to an optional 100KHz in the band in order to get zero beating.

(MODE SWITCH is at USB or LSB)

After getting perfect zero beating, push on the f-CAL button, and adjust f-CAL knob to bring the digital frequency indication for -00KHz reading. FINE(tune) button must be kept 'OFF' position during this procedure.

When the f-CAL button is turned OFF, the digital indication recovers to the position of the f-CAL knob zero-center.

In this calibrating mode, if the MODE is switched to CW the zero beating is deviated and the beat note of approx. 800Hz will be heard.

Please refer to paragraph "CALIBRATION OF COUNTER" for details.

9.5 ADJUSTMENT ON VARIOUS COILS

Coils of the equipment have been designed, taking into full consideration the compensation of temperature. Thus, even after the coils are used for a very long period, no remarkable deviation will be caused in the tuning frequency. For this reason,

it is not necessary to turn the cores in more than one turn at the time of adjustment.

Readjustment must be made with utmost care.

9.6 ADJUSTMENT ON THE CRYSTAL OSCILLATOR CIRCUIT(HFO) FOR LOCAL OSCILLATOR.

Turn the VFO/X-TAL knob in the front panel to VFO EXT position. This causes internal VFO to stop.

Then connect the syncroscope or VTVM between the control grid of 6EJ7 V1 (PIN 2) and earth. The range of the syncroscope must be 5V(p-p) ---10V(p-p).

Each oscillator coil must be adjusted in such a manner that the standard voltage is obtained but the core is inserted slightly from max. voltage point. That is, adjust the core in the direction of arrow mark.

After completing it, connect the digital frequency counter at the trimmer capacitor terminal frequency.

If the frequency counter is not available, as the trimmer has been adjusted almost correctly, you are recommended not to touch it. Use VTVM and syncroscope probe, or using a small terminal capacitor is more practical.

Influence will be exerted over adjustment on the oscillating circuit. Return the VFO/X-TAL knob to INT position after completed.

BAND	FREQUENCY	ADJUSTING COIL NO.	TRIMMER NO.	OUTPUT VOLTAGE	PRINTED CIRCUIT BOARD
160	16.0 (MHz)	L1	TC1	3V (p-p)	P-112C
80	-	-	-	-	-
40	21.5 (MHz)	L2	TC2	3V (p-p)	P-112D
20	28.5 (MHz)	L3	TC3	2.5V (p-p)	P-112D
15	35.5	L4	TC4	2.1V (p-p)	P-112D
11	41.5	L5	TC5	1.1V (p-p)	P-112D
10A	42.5	L6	TC6	1.8V (p-p)	P-112C
B	43.0	L7	TC7	1.8V (p-p)	P-112C
C	43.5	L8	TC8	1.8V (p-p)	P-112C
D	44.0	L9	TC9	1.8V (p-p)	P-112C
JJY:WV	29.5	L10	TC10	2.0V (p-p)	P-112C

P-112C HFO UNIT 72201611

P-112D HFO UNIT 72201631

ARRANGEMENT OF PARTS OF HFO UNIT

FIG 19

HFO UNIT ADJUSTING POSITION

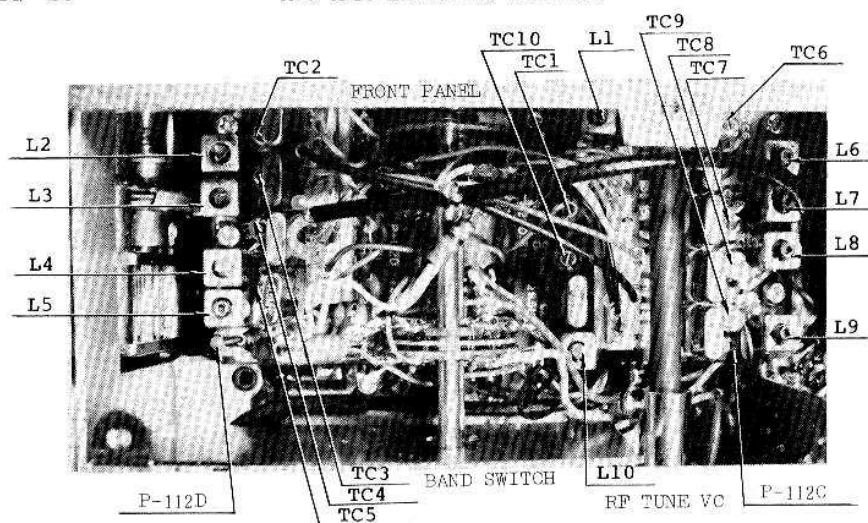
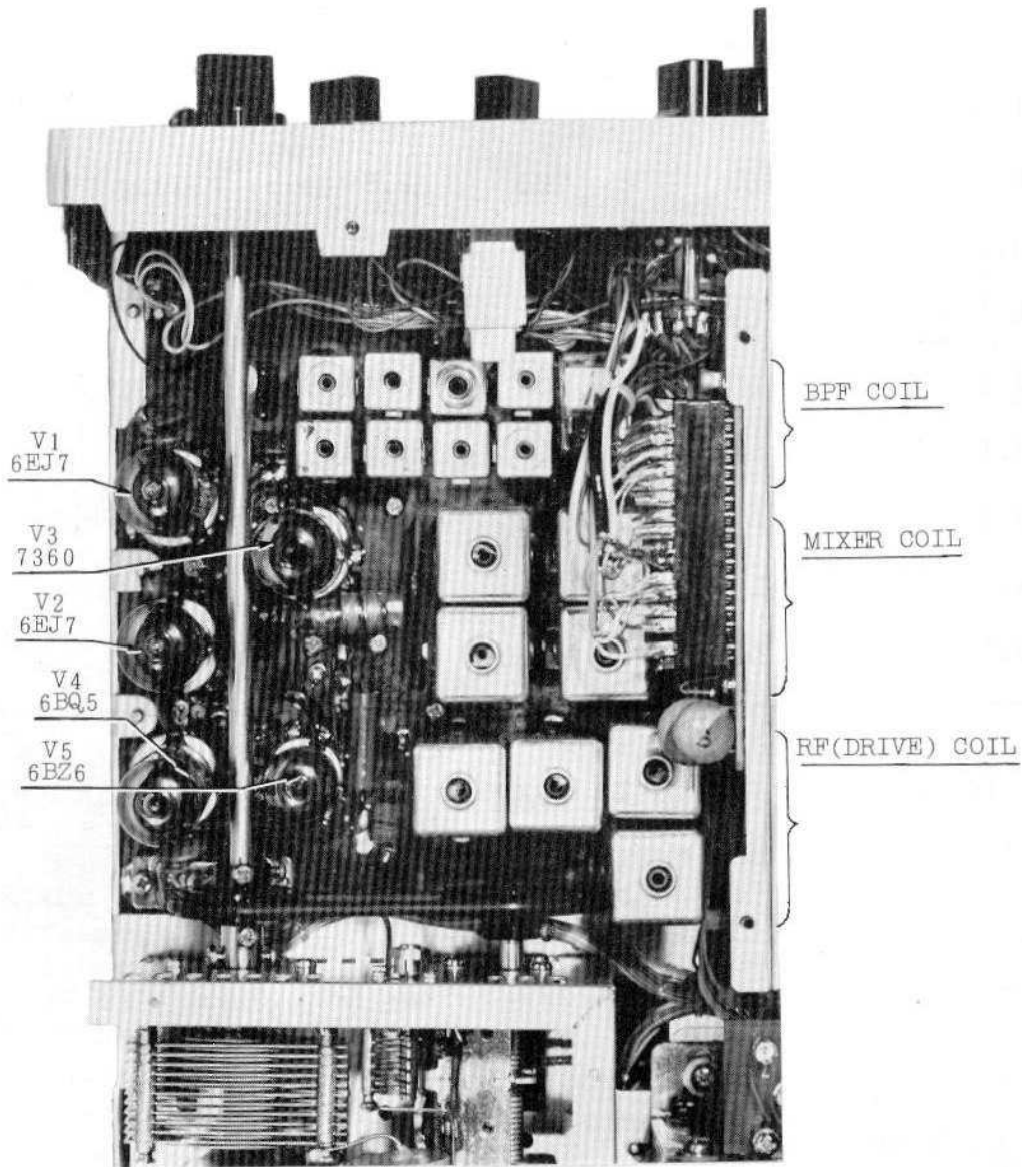


FIG 20 ARRANGEMENT OF PARTS OF BPF COILS

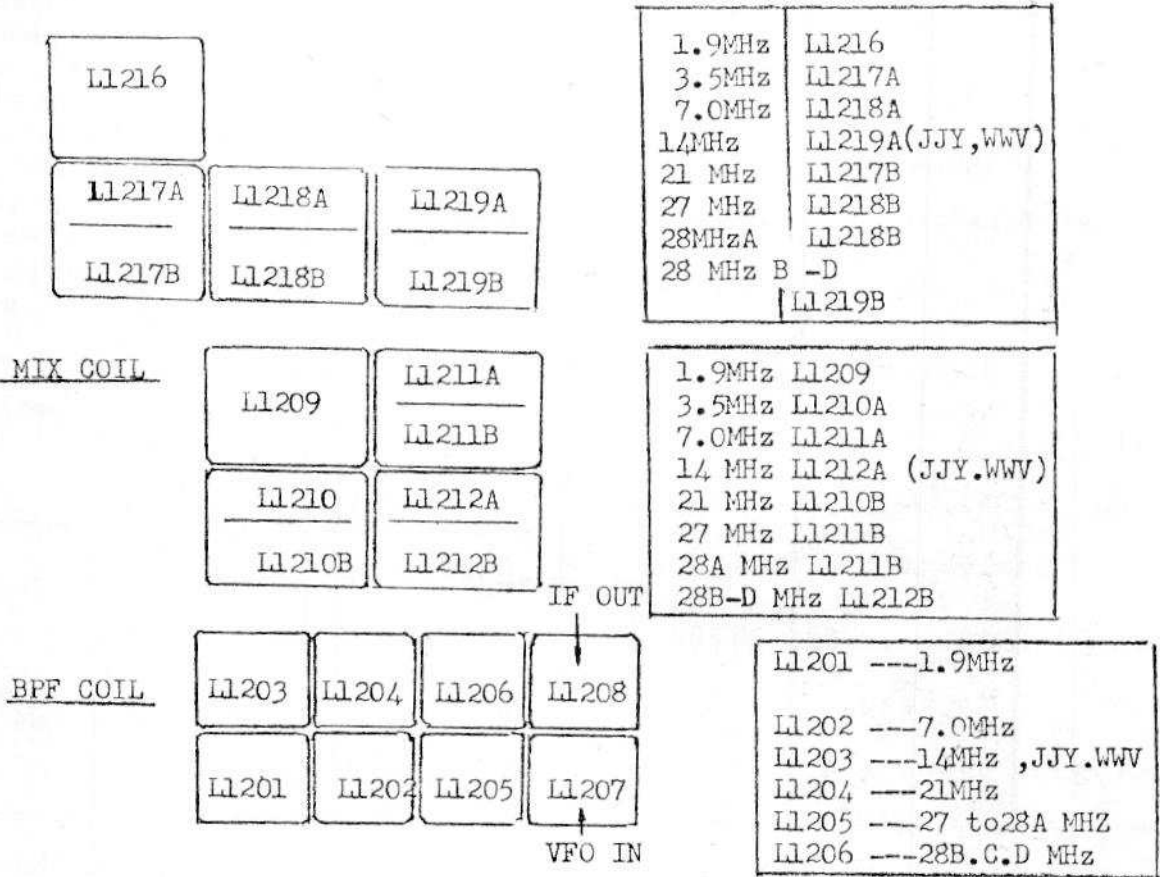
CQ-110E RF. MIX UNIT LAYOUT



9.7 Adjustment on the pre-mixer output band pass coil(BPF)

Couple loosely via small capacitor(1-2PF) the common terminal of W2b of the band switch S2 and connect VTVM or synchroscope. The range must be 0.5 - 2V(p-p).

FIG 21 RF DRIVE COIL



BAND	OUTPUT FREQUENCY	ADJUSTING COIL NO.	OUTPUT VOLTAGE	ADJUSTING FREQ. POINT
160	10.5-11.0	L1201	1.5V(p-p)	1900KHz
80	5.0-5.5	-	1.2V(p-p)	3700KHz
40	16.0-16.5	L1202	0.7V(p-p)	7200KHz
20	23.0-23.5	L1203	0.7V(p-p)	14250KHz
15	30.0-30.5	L1204	0.5V(p-p)	21250KHz
11	36.0-36.5	(L1205)	0.3V(p-p)	
10A	37.0-37.5	L1205	0.3V(p-p)	28.100MHz
10B	37.5-38.0	(L1206)	0.25V(p-p)	
10C	38.0-38.5	L1206	0.4V(p-p)	29.000MHz
10D	38.5-39.0	(L1206)	0.3V(p-p)	
WWY/JJY	24.0-24.5	(L1203)	0.2V(p-p)	

As seen from the above table, if the output voltage of higher than the value indicated in the table is obtained, it is satisfactory. It is necessary to check only the voltage of those mentioned in () as the tuning has been made by other coils.

9.8 Adjustment on VFO output coil

The oscillating frequency of VFO is 5.0MHz-5.5MHz.

Adjust L1207 in such a manner that uniform outputs can be obtained within the range.

Connect the VTVM or synchroscope between the control grid(PIN 2) of 6EJ7(V1) and earth. Turn the BAND switch to 3.5MHz(80m) band and turn the VFO up to 3500KHz - 4000KHz. Then, approx. 0.6-0.8V produced or iV max., adjust L1207 in such a manner that max. value can be obtained near 3.7MHz.

When this adjustment is completed, the 80m band of the premix coil will be perfect.

9.9 Adjustment of MIX coil

Make adjustment with VTVM or synchroscope through the common terminal of band switch W3a. The MODE switch must be placed

at position "TUNE" and the MIC gain must be 7-8.

a) Adjustment on 1.9 MHz coil

Adjust the indication of the digital frequency to 1900 KHz (160m) and the DRIVE knob to the center position. Turn the unit to transmitting mode and make sure the output is maximum. The adjusting coil is L1209 and further adjustment must be made with DRIVE and L1209 so that the noise output becomes maximum at receiving mode. Then, turn the unit to transmitting mode again to confirm that the max. output point coincide with the receiving mode. The same procedure applies to all other bands referring to the following table.

BAND	ADJUSTING COIL	ADJUSTING FREQUENCY	OUTPUT VOLTAGE (p-p)
160	L1209	1900KHz	8V
80	L1210	3600KHz	8V
40	L1211A	7100KHz	8V
20	L1212A	14250KHz	8V
15	L1210B	21250KHz	6V
11	L1211B	corresponding to 10A	5V
10A	L1211B	28100KHz	4V
10B	L1212B		4V
10C	L1212B	29250	4V
10D	L1212B		4V
JJY/WWV	L1211A ?	corresponding to 15m	-

9.10 Adjustment on the transmitter driver stage coil

Couple loosely the VTVM or synchroscope with the common terminal of band switch S2-W4a or the output points going to the grid(G1, PIN2) of 6JS6. Place the DRIVE knob(Variable capacitor) at the center and adjust these coils in such a manner that the receiving noise and output at the time of transmission become maximum, referring to the following table.

BAND	ADJUSTING COIL	OUTPUT VOLTAGE V(p-p)
160	L1216	150V or more
80	L1217A	150V or more
40	L1218A	150V or more
20	L1219A	150V or more
15	L1217B	120V or more
11	L1218B	100V or more
10A	L1218B	80V or more
10B	L1219B	80V or more
10C	L1219B	80V or more
10D	L1219B	80V or more
JJY.WWV	(L1219A)	-

After checking the voltage, turn on the heater switch for final stage. When it has been warmed up fully, connect a dummy load with the antenna and confirm that the transmitting output is normal.

At the same time, confirm that the maximum receiving noise and transmitting output occur on one point on the RF TUNE control. When this occurs, the final stage output circuit has been neutralized completely.

Readjusting of these coils is necessary in the case of 15 m band or above. (Refer to 9-9 ADJUSTMENT ON MIX STAGE COIL for the details.)

9.11 Adjustment on IF transformers of transmitting

Connect the VTVM or synchroscope with the control grid of the mixer 6EJ7(V2) for transmission. Place the MIC GAIN at center and place the MODE switch to the position 'TUNE'.

Adjust these coils of T102, T103 and T104 in such a manner that maximum value can be obtained.

The output voltage must become approx. 8V(p-p) or more.

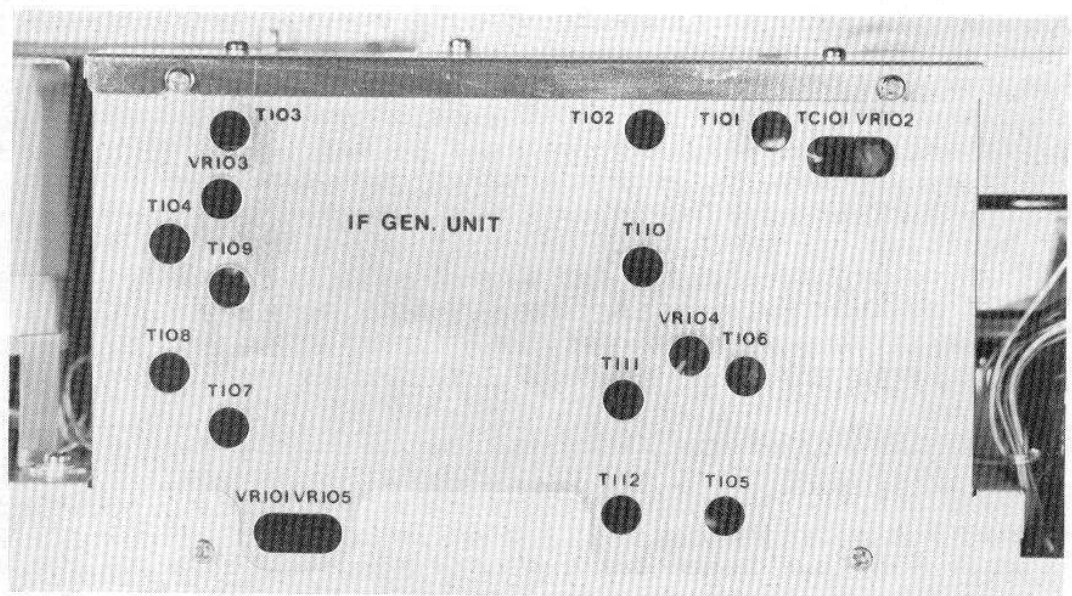
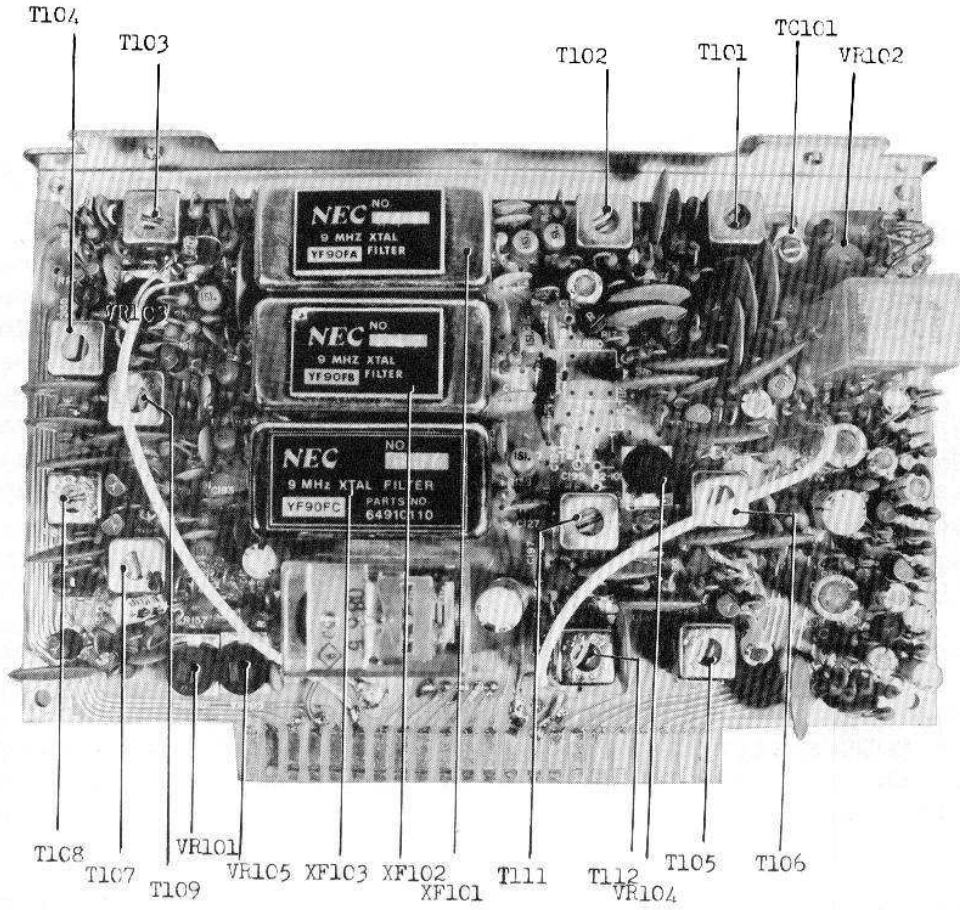
9.12 Adjustment on carrier oscillating circuit

Connect the VTVM or synchroscope to the point of B18 of the IF board P-101E.

Turn the unit to receiving mode, adjust T301 and Z302 of carrier oscillating circuit. Turn these coils for the maximum output point.

On the T301 coil, to prevent the circuit at the max point of output to become unstable sometimes, turn the core further clockwise slightly beyond the output max. point and lock it. The output is approx. 3V p-p.

ARRANGEMENT OF PARTS OF IF UNIT FIG 22



Adjust the carrier frequency oscillator with TC302. If the tuning is made to 9000KHz by digital frequency counter, it will be all right.

If there is no instrument make adjustment by hearing as follows:

First, remove the antenna and hear thr receiving noise only. Then, switch over USB and LSB alternately and adjust TC303 in such a manner in order to obtain almost equal pitch tone of noise.

This adjustment is for bringing the carrier frequency in between each LSB and USB crystal filter frequency in between each LSB and USB crystal filter frequency. If the pitch tone of noise is rather high, a sound of 'shaaa' can be heard. When it is just 1500Hz (balanced point), a sound of 'saa' can be heard. When it is low, a sound of 'shuu' can be heard.

Note: When adjustment is made on the carrier frequency, transmitting balanced modulator may be affected and become imbalanced. For this reason, the balanced modulator for transmission and balanced detector for reception must be checked again.

9.13. Adjustment on CW BFO

BFO function of receiving CW has utilized by the carrier oscillator circuit. When adjustment on the carrier oscillatting circuit is completed, adjust the BFO frequency.

Turn the MODE switch to CW position, and the unit to receiving mode. In the same way as carrier frequency adjustment, connect the digital frequency counter to the point of B18 of P-101E and adjust the frequency to 8999.1 KHz with TC301.

9.14. Adjustment on oscillator circuit of carrier at transmission

This is accomodated in the same unit as carrier oscillator circuit at the time of reception.

The master oscillating circuit is in common and if adjustment is completed on the carrier oscillator circuit, adjustment of transmitting buffer amplifier circuit is sufficient.

For this adjustment, connect the synchroscope or VTVM to the point of A9 of IF board P-101E. Place the MODE switch either 'USB' position or 'LSB' position. Bringing the standby switch to 'SEND' position, the carrier signal will be generated. Adjust T303 coil so that maximum carrier level is obtained.

The carrier frequency must be the same as the receiving mode, check the frequency is at 9000.0KHz.

9.15 Adjustment on VOX (and ANTI TRIP) circuit

Firstly, place the standby switch at the position 'VOX'. When voice is put in the microphone at this mode, the mode turns to transmitting immediately. Popentiometers for adjustment on VOX can be seen when the upper cover is removed.

Turn the DELAY control fully clockwise. Turn the VOX GAIN control clockwise to some extent. When the voice input to the microphone is eliminated, the unit will be returned to receiving mode immediately.

If the mode change is too fast, turn the potentiometer clockwise. Then, place the MIC GAIN at normal position (position where ALC voltage value does not go off the red zone toward the left side on the meter). Introduce voice in the microphone, turn the VOX GAIN clockwise. When it comes to that position, the relay will be actuated on voice and reception will be changed to transmitting mode corresponding the voice input.

Then, turn the ANTI-TRIP control fully counterclockwise. Receive an optional signal and the voice output appears from the speaker. Thus, the voice output from the speaker enters the microphone.

As it has the same effect as that of entry of voice input to the microphone, the unit turns to transmitting mode. To avoid this situation, ANTI-TRIP control should be turned clockwise. There will be a point where the voice from the speaker does not turn to transmitting mode. Secure the control at this position. When ANTI-TRIP control is turned clockwise, sensitivity of the VOX GAIN will drop slightly. Adjust VOX GAIN again to build up the best condition with normal speech level.

For adjustment to return to receiving mode at the end of speech, the speed of recovery time will be set at DELAY control. The setting of the time delay depends on the way of talking of each person. This must be discovered by each individual person.

The delay time can be set approx. one second.

9.16 ADJUSTMENT on CW monitor

In the case of CW, the unit is provided with a low frequency oscillator for monitoring use. The output is utilized not only for monitoring but also drives VOX circuit. When the key is in contact, the tone will turn on the unit to the transmitting mode automatically.

When the key is released, the unit returns to receiving mode automatically. This is called semi-break in CW. Of course, if the standby switch is placed at SEND, normal transmitting mode can be operated.

Adjustment is on the side tone oscillator circuit, apply the probe with synchroscope or the output side of C114 on the P101 IF board. VR204 is located on P102 AF board, and marked SIDE TONE, which can be seen when the upper cover case is removed.

The level is more than 1 V p-p. Set it at approx. 1.5V. This level setting has relations with the modulating level, when the MODE switch is placed "TUNE" position.

As for the monitor of CW, the potentiometer of marked MONITOR is located on the same board, and set the level required. Speaker monitoring level can also be adjusted with AF GAIN control.

FIG 23 CARRIER FREQUENCY DIAGRAM

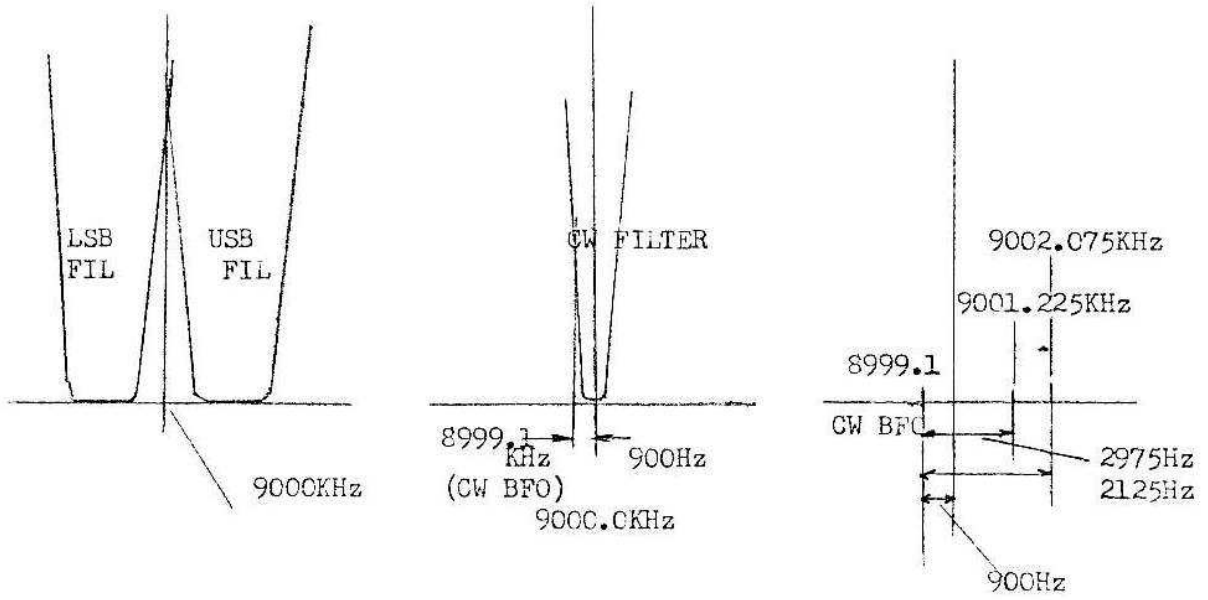


FIG 24 ARRANGEMENT OF PARTS OF CARRIER UNIT

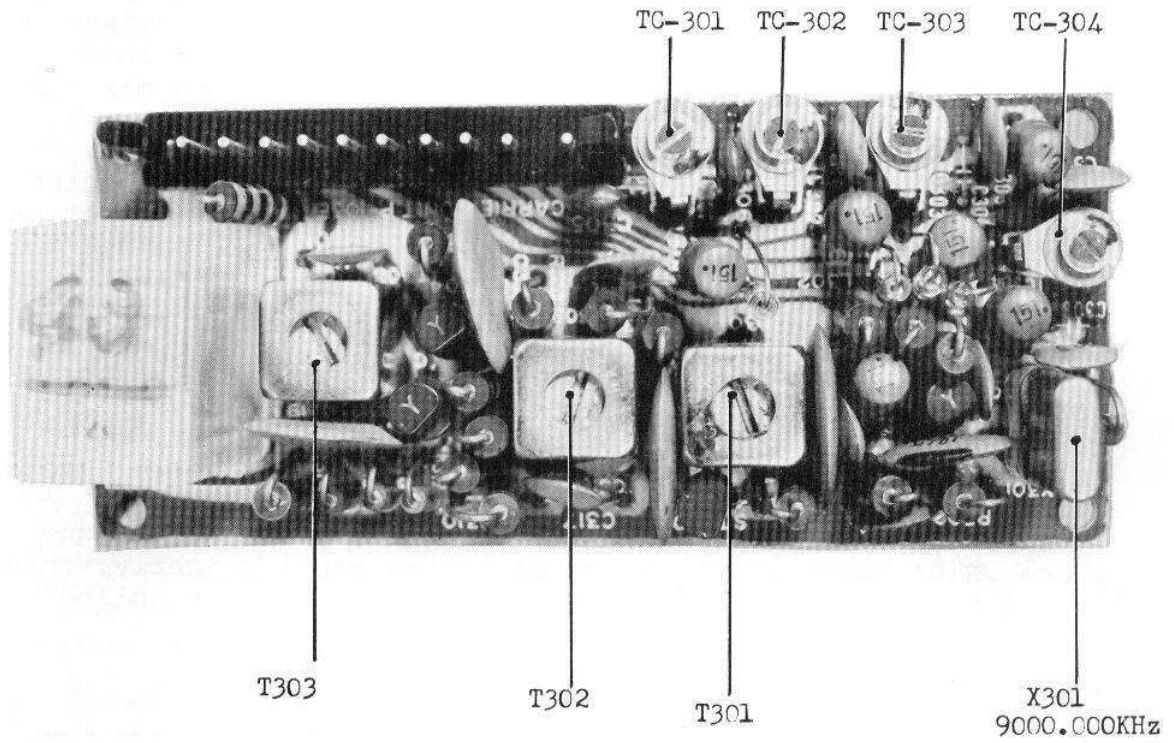
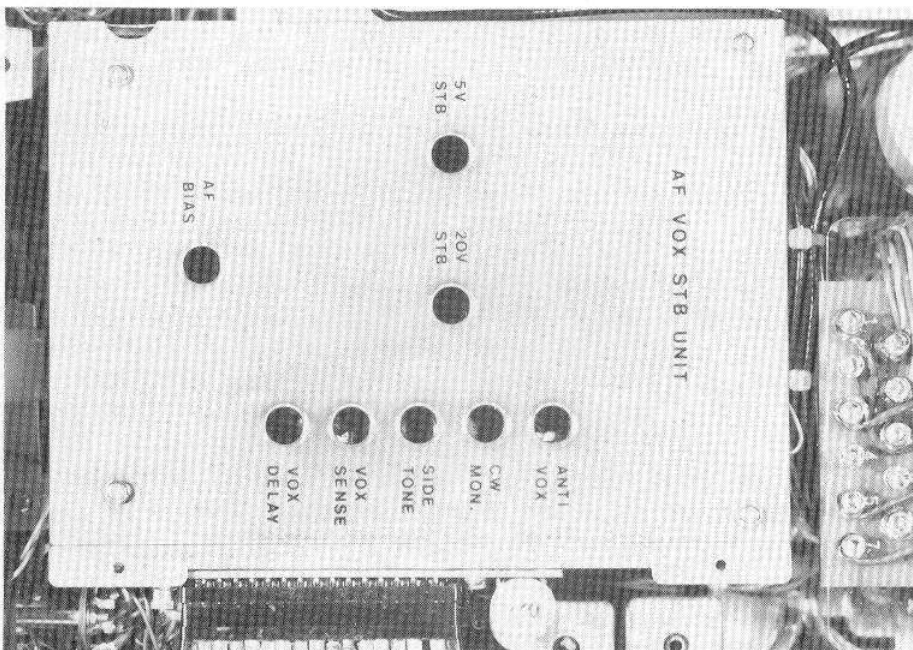


FIG 25 ARRANGEMENT OF P-102E AF VOX UNIT PARTS



9.17 Adjustment on noise blanker circuit

For adjustment on noise blanker, adjust the noise amplifier and threshold level. The circuit is part of IF board P-101E. 8.8MHz of AM-IF signal from S.G. will be supplied similar manner to AM-IF alignment. Adjust the noise amplifier in such a way that the detecting output of NOISE DET becomes maximum. NOISE BLANKER of VR104 is to determine the threshold level. This level will be found in the followings:

With 21MHz band, find the position where the noise generated from the noise generator is clearly suppressed. As the setting exerts influence over cross modulation, it is recommended to set it before the point where it becomes most effective. Alternatively, threshold level can also be adjusted in the following manner.

Receiving a marker signal of 100KHz in an optional frequency (21 MHz is appropriate), adjust the RF TUNE knob in such a manner that S-meter indicates S-9. In this condition, if THRESHOLD VR104 is turned, there will be a point where S-meter starts to fall, secure at this point.

If subjected to cross modulation by adjacent channel frequency, place VR104 backward (increase of 'S' reading) slightly, this should be effective, meanwhile the noise blanker is acting effectively.

9.18 Adjustment on IF transformers of receiving

Supply a signal of 9000KHz to the control grid of the receiving mixer tube 7360(v3) from S.G.

Take the maximum value on S-meter with coil L1208 on P-112AE mixer board, consequently seek for the maximum point on S-meter with coils T112, T111, T109 and T107 of IF board P-101E.

When adjustment is made on T107, it may be necessary to re-adjust balanced detector (for receiving), to recover the best balancing.

9.19 Adjustment on neutralizing circuit at transmitter

Neutralizing circuit is provided from the plate side of the final stage power amplifier tube (6JS6 x 2) at transmitter, to the cold end side of the grid tuning circuit at input side, the trimmer capacitor is located in the final stage block.

After the antenna π -match net work has been adjusted with final stage is ON condition, turn off HEATER of the final stage power amplifier tubes and seek for the minimum output power the antenna terminal by adjusting the (trimmer capacitor) VC1 for neutralization.

Note: Be sure to use an insulated driver for the adjustment.

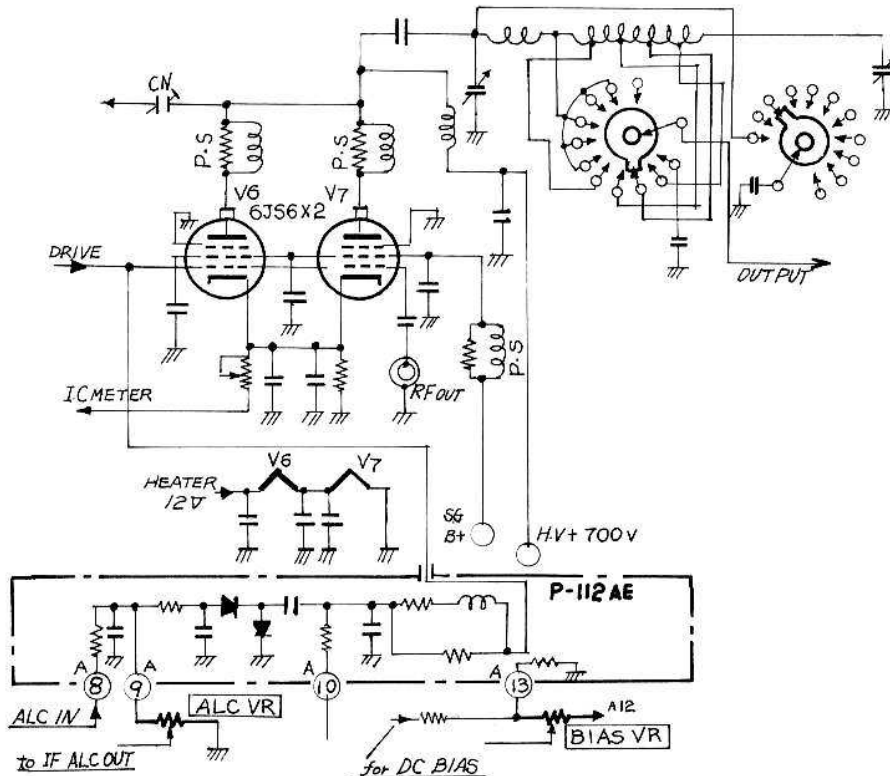
Do not touch the high voltage of the plate side.

After the HEATER is turned off, wait at receiving mode until the final stage tube has cooled down.

It is recommended that all neutral adjustments must be made with utmost care so that no power output can be detected at ANT terminal with HEATER turned off.

To detect the output power, supply suitable power meter or VTVM(with high frequency probe). This adjustment is to be made effectively on 29MHz BAND(29.2MHz is suggested).

FIG 26 FINAL STAGE OF TRANSMITTER



SECTION X - DIGITAL FREQUENCY INDICATOR CIRCUIT

10.1 Frequency relationship

The counter is of frequency direct reading type which counts VFO frequency which is a heterodyne variable element. In all MODES, frequency can be read off directly. The following are the frequencies of related oscillators. Output frequency f-out is given by band oscillating frequency fB and VFO oscillating frequency by fv, and intermediate frequency by fi. (Band oscillating frequency fB) - (VFO oscillating frequency fv) - (Intermediate frequency fi) = Output frequency f-out.
 $f\text{-out} = fB - fv - fi$ (fi = 9.0MHz)
 Frequency is shown in the following table:

FIG 27 ARRANGEMENT OF PARTS OF FINAL STAGE OF TRANSMITTER

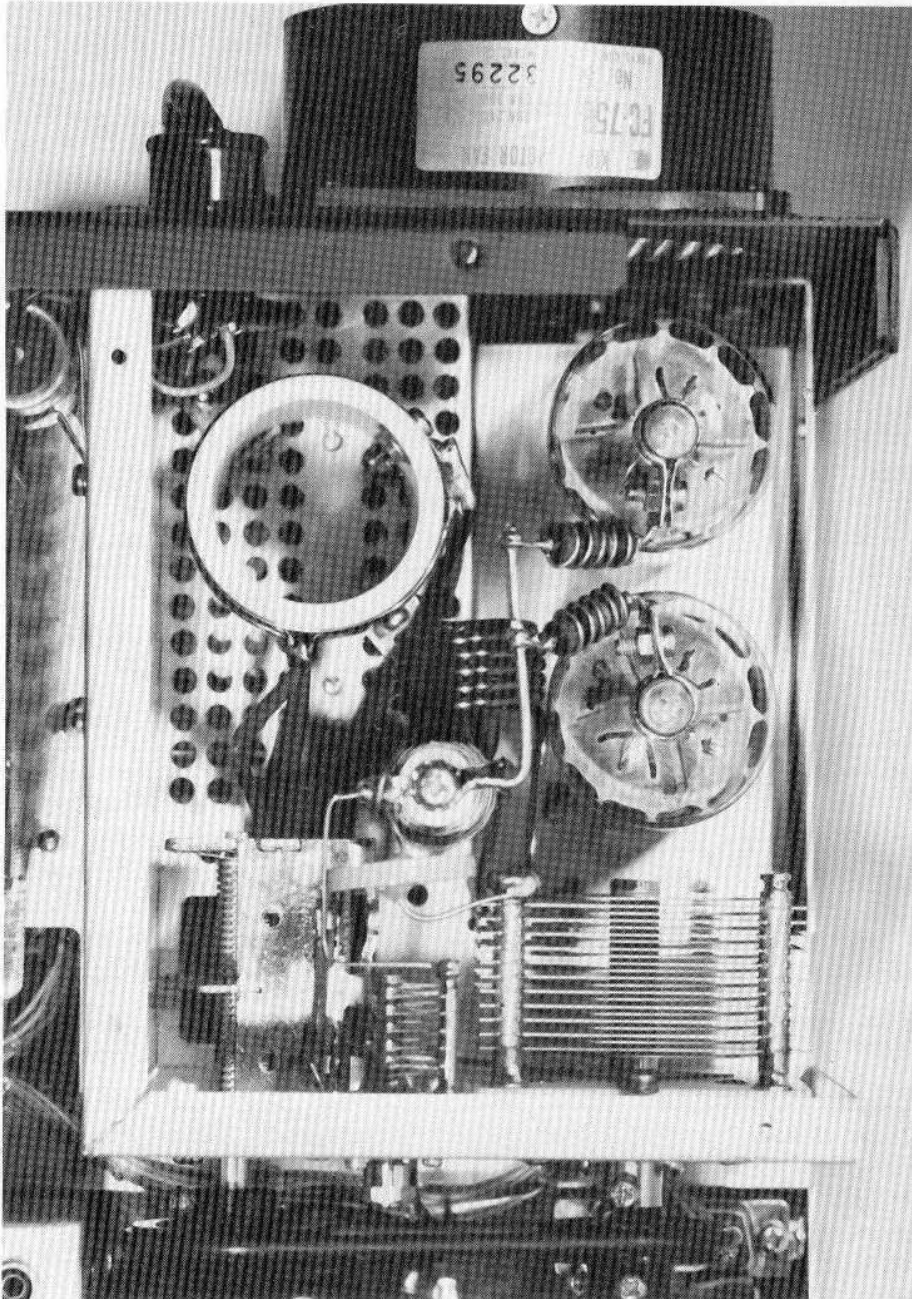
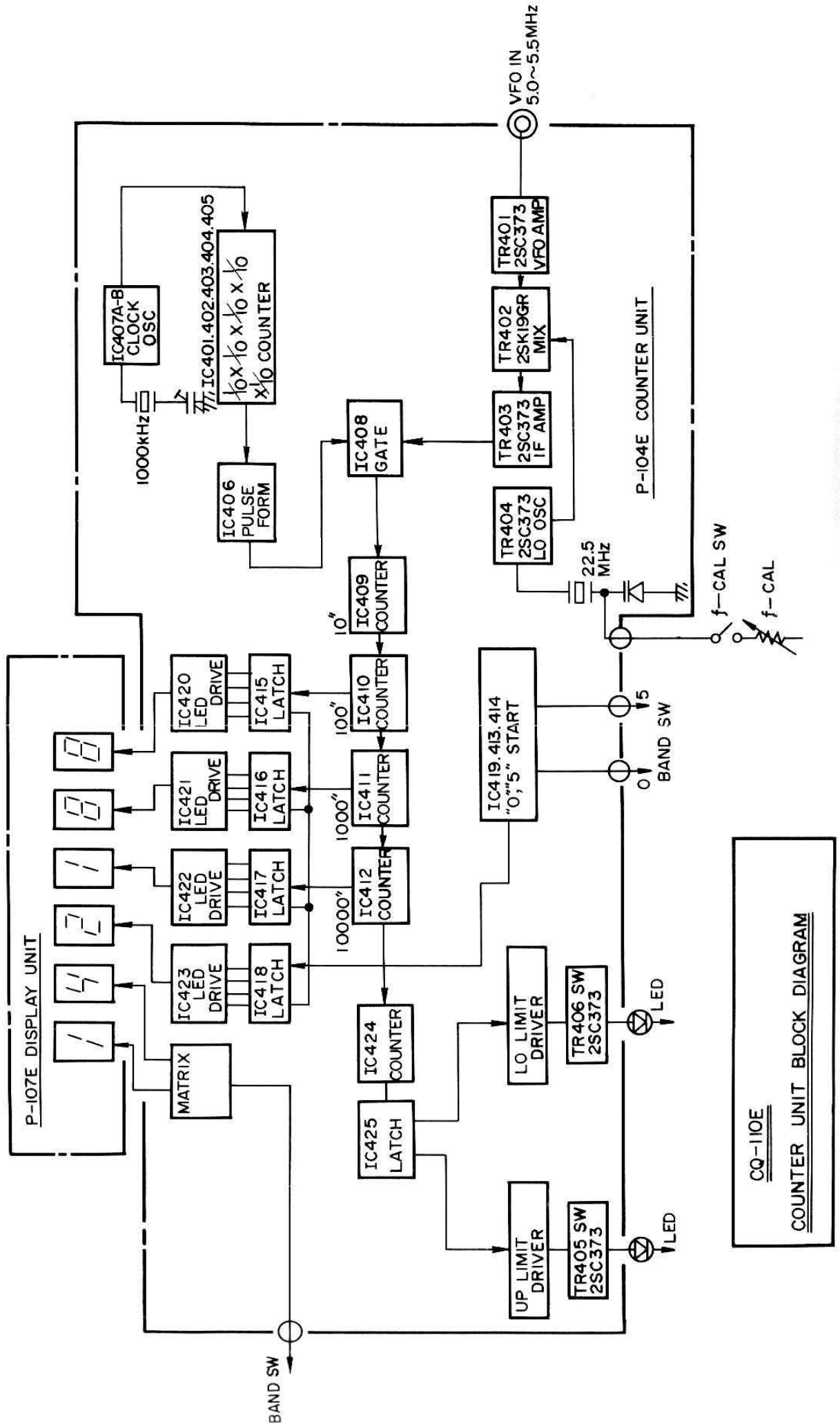


FIG 28



<u>f-out</u>	<u>fB</u>	<u>fv</u>	<u>fi</u>
1.9 MHz BAND	= 16.0	- 5.0	- 9.0
3.5 MHz band	= N.A.	- 5.0	- 9.0 (irregular arrangement, causing USB, LSB reversed)
7.0 MHz band	= 21.5	- 5.0	- 9.0
14.0 MHz band	= 28.5	- 5.0	- 9.0
21.0 MHz band	= 35.5	- 5.0	- 9.0
27.0 MHz band	= 41.5	- 5.0	- 9.0
28.0 MHz band	= 42.5	- 5.0	- 9.0
28.5 MHz band	= 43.0	- 5.0	- 9.0
29.0 MHz band	= 43.5	- 5.0	- 9.0
29.5 MHz band	= 44.0	- 5.0	- 9.0
WY.WWV band	= 29.5	- 5.0	- 9.0

In the 14 MHz (20m) band, considering the intermediate frequency f_i is 9 MHz, the band oscillator circuit (HFO) may be unnecessary, because it can be produced with $9.0(f_i) + 5.0(f_v) = 14.0$ MHz. However, this causes the VFO to dial reversely, resulting in too much troubles. To avoid this reverse VFO, HFO of 28.5 MHz can be adopted. In the 3.5 MHz (80m) band, irregular arrangement is seen. As the result of $-(f_i - f_v)$, the side band will appear reversely, but VFO runs in the normal way.

10.2 Frequency counter circuit

As mention above, the unit has been so designed that the heterodyne process producing SSB is fixed against the variation in oscillating frequency. Therefore, one local oscillator for the prescaler is required to cover 5 MHz - 5.5 MHz range of VFO. In the oscillating circuit, an overtone crystal frequency of 22.500 MHz with TR404 2SC-373 is used and 17,000 MHz - 17,500 MHz which is a difference with VFO frequency is obtained. This frequency is read off at the counter.

TR 402 2SK-19 is the frequency mixer of VFO frequency and 22.5 MHz
TR 401 2SC-373 is the band pass amplifier, and assures within the VFO variable range (500 KHz).

Clock oscillator is the combination of two inverters with IC407 SN-7404, and oscillate 1 MHz. This signal is the frequency divided with IC 401, IC 402, IC 403, IC 404 and IC 405 (SN-7490 x 5). They are counting down the frequency in the step down of 100 KHz, 10 KHz, 1 KHz, 100 Hz, 10 Hz. These output frequencies are supplied to SN-7472 of IC 406 and used as clock pulse.

The VFO output frequency passes through the band pass amplifier, and is frequency converted and through the amplifier circuit of TR 403 2SC-373. After passing the gate circuit of IC 408 SN-7400, it enters the first counter stage IC 409.

Here, the digit of 10 Hz is counted and it goes up to the digit of 100 Hz of next counter stage IC 410 SN-7490. In the same way, the digit is carried over from 100 Hz to 1 KHz, 10 KHz, 100 KHz. The unit indicates the numerals above the digit of 100 Hz.

Actually, 10Hz digit is always counted in the unit to avoid flickering the 100Hz digit.

The BCD output from respective digits enters the latch circuit of IC 415 through IC 418. This type of IC is for sampling hold. It holds the sample output until next signal arrives. Shifting of numeral indication occurs only when the sampling gate is opened, and maintain the display stably.

The display output of BCD enters "BCD to 7 segment decoder driver" IC of driving LED display. These ICs are through IC 420 - IC 423 (SN-7447 x 4).

Frequency display is at the LED.

In the counter, display up to the order of 100KHz is by frequency counting, and MHz order is displayed at MATRIX CIRCUIT combined with the BAND switch.

10.3 OFF-RANGE DISPLAY circuit

An off-range display circuit is included in the counter circuit as an associated circuit. As the indicating frequency band width of 500KHz is the limit, beyond the range. In the indicator, it may shows erroneous frequency. In order to warn the band edge, the UP LIMIT lamp is lighted when it exceeds 500KHz at upper side. LO LIMIT lamp is lighted when it is lower than zero (0)KHz at the lower side.

In the off range region of the band pass amplifier of counter circuit, a flickering may sometimes develop.

In the off range region, the display continues lighting for approx. 50Hz, both UP and LO lamps.

IC 412 is counted more than 500KHz, the signal will be further counted at IC 424 and it goes through the latch circuit of IC 425 SN-7475 and drives switching transistor 2SC-373 TR 405 and the UP lamp is lighted.

When the frequency goes to LO side, LO lamp is lighted by switching the transistor 2SC-373 TR 406.

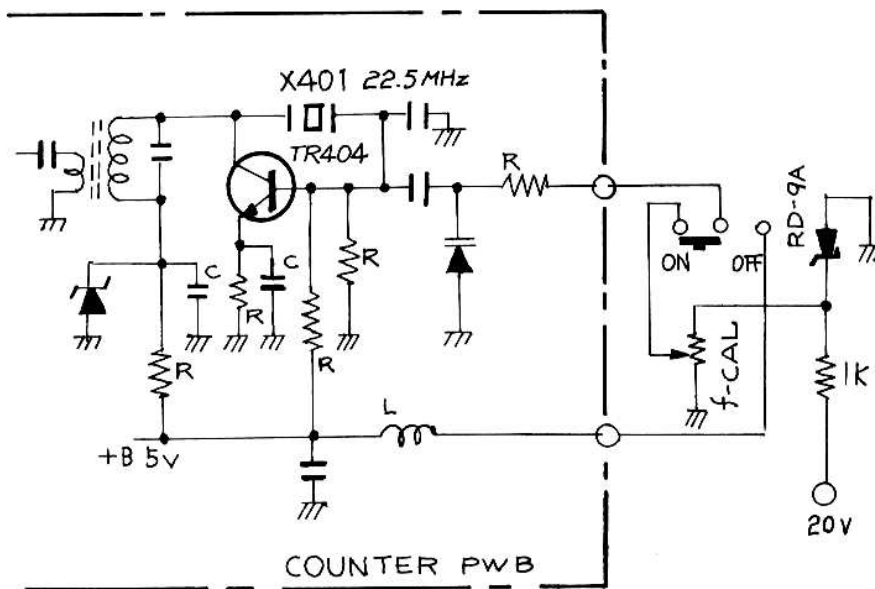
The correct display range of the counter is expressed in the following table.

	Approx. 50KHz		Approx. 50KHz
160 m BAND		1500.0-1999.9 KHz	
80 m BAND		3500.0-3999.9 KHz	
40 m BAND		7000.0-7499.9 KHz	
20 m BAND		14000.0-14499.9KHz	
15 m BAND		21000.0-21499.9KHz	
11 m BAND		27000.0-27499.9KHz	
10Am BAND		28000.0-28499.9KHz	
10Bm BAND		28500.0-28999.9KHz	
10Cm BAND		29000.0-29499.9KHz	
10Dm BAND		29500.0-29999.9KHz	
JJY/WWV BAND		15000.0-15499.9KHz	
	LO LAMP DISPLAY		UP LAMP DISPLAY

10.4 f-CAL circuit

There are various oscillating circuits in the heterodyning process generate SSB. It is not practical to oscillate all of them correct display frequency. Therefore, it is necessary to compensate the error in one of these frequencies, for the calibration. This circuit can be adjusted with variable capacitance diode associated to the crystal oscillating circuit of TR404. When f-CAL is off, control voltage on the vari-cap diode is automatically re-set to the point of f-CAL dial zero-center.

FIG 29 f-CAL CIRCUIT DIAGRAM



10.5 Adjustment on frequency counter circuit

For adjustment on counter unit P-104E, adjust the band pass amplifier, clock pulse oscillating circuit, and local oscillating circuit.

The band pass amplifier should be adjusted in such a manner that 500KHz range of VFO 5.0 - 5.5MHz to become flat level.

Adjust T401 to maximum at 100KHz above the '0'KHz, in an optional BAND switch position.

AT 400KHz, adjust T402 to maximum.

At tuning circuit of TR401, adjust T403 to maximum in 100KHz and

T402 at 400KHz.

In the tuning circuit of TR401, adjust T403 to maximum at 100KHz and T404 in 400KHz.

Then, tune the tuning coils T405 and T406 associated to the frequency converter and the amplifier circuit to maximum at center frequency.

The measuring point is at base of TR402 with VTVM or syncroscope or T406 secondary winding for T405/T406 tuning.

The local oscillator of 22.5MHz is to be adjusted while stopping the oscillation of VFO with VFO/XTAL switch to EXT/position and apply the syncroscope or VTVM to the source of TR402.

Adjust T407, the core to maximum point while the oscillation is stable.

For adjustment of the frequency, turn off the f-CAL switch and adjust T407 for 22,500KHz.

For clock oscillation, connect digital frequency counter with NO.1 PIN of IC401 and adjust the frequency be means of adjusting trimmer capacitor TC401 70pF for correct 1,000KHz.

FIG 30 CQ-110E COUNTER and DISPLAY UNIT LAYOUT

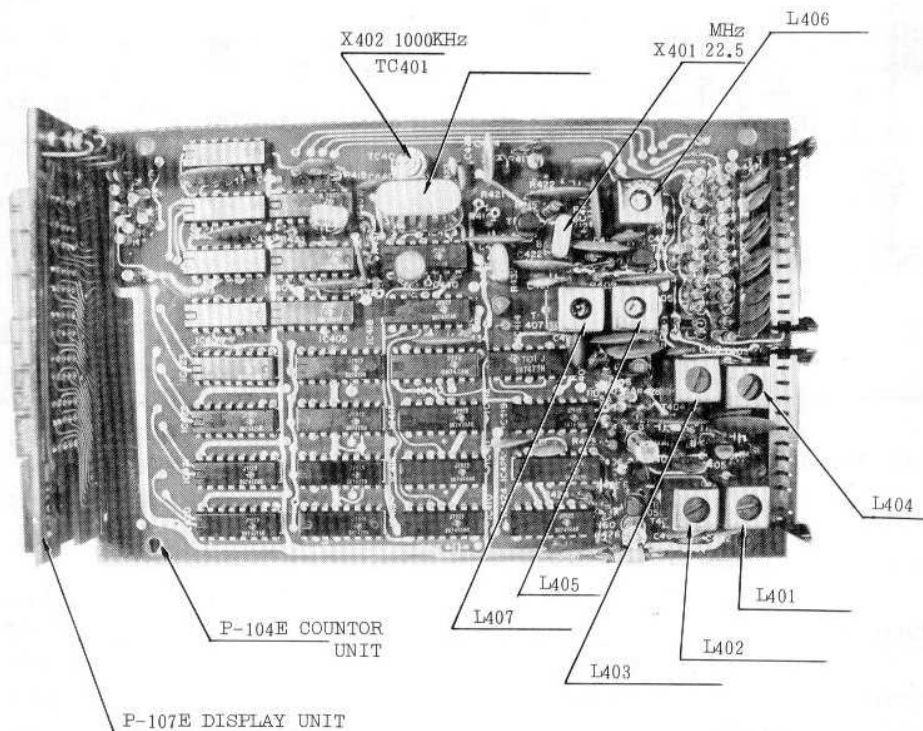
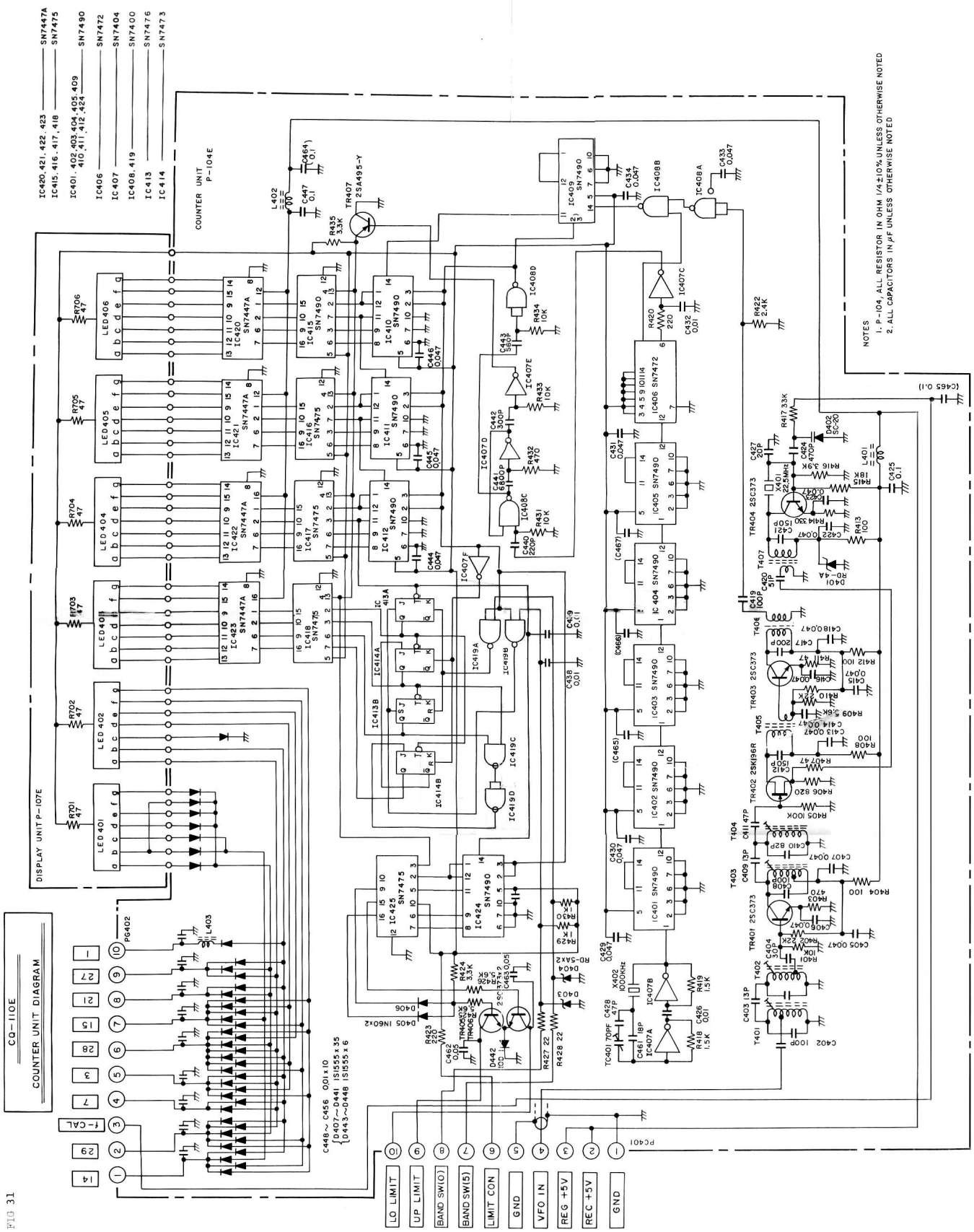


FIG 31



PARTS LIST

CORD NO	NAME	CIRCUIT MARK
30907001	RECEIVING TUBE,6JS6	V6 V7
30907002	RECEIVING TUBE,6BQ5	V4
30907003	RECEIVING TUBE,6BZ6	V5
30909001	VT.7360	V3
30910001	VT.6EJ7	V1 V2
35003018	TR,2SA-495 R	TR110 TR207
35045808	TR,2SC-839H	TR1401 TR1402
35047218	TR,2SC945 R	TR1403 TR1404
35120525		TR105 TR106 TR113 TR117 TR202
35900200	TR.2SA496	TR210
35920501	TR.2SB208	TR3 TR4
35941600	TR.2SC372	TR101 TR102 TR103 TR108 TR109 TR111 TR112 TR115 TR116 TR201 TR203 TR205 TR206 TR211 TR212 TR213 TR301 TR303 TR304 TR503 TR602 TR603 TR604 TR605 TR801
35941700	TR.2SC373	TR204 TR214
35941800	TR.2SC495	TR209
35941900	TR.2SC733	TR208
35942001	TR.2SC386A	TR1
35942200	TR.2SC-521	TR1 TR2
35942300	TR,2SC-735	TR104
35990305	FET.2SK41E	TR114 TR119 TR302 TR501 TR502 TR601
36001005	DIODE,SI.1S1555	D105 D106 D107 D108 D109 D110 D1201 D1204 D124 D125 D205
36001522	DIODE 1S-953	D1402
36002012	DIODE,GE. 1N60	D101 D102 D103 D104 D112 D113 D114 D115 D116 D117 D120 D121 D122 D123 D1 D201 D202 D203 D204 D301 D302 D303 D304 D501 D502 D506 D507 D602 D603 D801 D802
36002515	DIODE,GE 2-1K60	D1401
36003018	DIODE,ZENER,RD-5AL	D207

CORD NO	NAME	CIRCUIT MARK
36003028	DIODE,ZENER RD9AM	D6
36003513		D206 D210 D503 D504
36107011	SI,RECTIFIER 10D-1	D111 D118 D208 D209 D2 D305 D306 D3 D4 D5 D911 D912 D913 D914 D915 D916
36801003	DIODE,LIGHT-E TLR-303-C	LED701 LED702 LED703 LED704 LED705 LED706
36901001	DIODE 1S-33	D1202 D1203
36902003	DIODE RD9.1FB	D1403
36902006	DIODE 10D-10	D901 D902 D903 D904 D905 D906 D907 D908 D909 D910
36904006	DIODE,LIGHT-E TLR-101R	LD-P1 LD-P2 LD-P3
36904007	DIODE SC-20	D505 D601
40003507	R,SOLID 3.3H 10% 1/2W	R226 R235 R236
40003515	R,SOLID 15H 10% 1/2W	R1205
40003517	R,SOLID 22H 10% 1/2W	R37
40003521	R,SOLID 47H 10% 1/2W	LR1201 R208 R213 R36 R701 R702 R703 R704 R705 R706 R707
40003525	R,SOLID 100H 10% 1/2W	R1222 R239 R245 R611
40003526	R,SOLID 120H 10% 1/2W	R621
40003527	R,SOLID 150H 10% 1/2W	R316
40003529	R,SOLID 220H 10% 1/2W	R1202 R1208 R1214 R1215 R232 R233 R234 R314 R616
40003531	R,SOLID 330H 10% 1/2W	R223 R248 R502 R508
40003533	R,SOLID 470H 10% 1/2W	R1240 R251 R304 R307 R309 R315 R320 R509 R516 R610 R619 R620 R803 R906 R907 R910 R911
40003534	R,SOLID 560H 10% 1/2W	R1235 R238 R319
40003535	R,SOLID 680H 10% 1/2W	R308
40003536	R,SOLID 820H 10% 1/2W	R243
40003537	R,SOLID 1K 10% 1/2W	R1218 R201 R204 R209 R212 R250 R310 R514 R605 R609 R612
40003539	R,SOLID 1.5K 10% 1/2W	R1239 R217 R225 R230 R249 R305 R506 R622 R623 R805

CORD NO	NAME	CIRCUIT MARK				
40003541	R,SOLID 2.2K 10% 1/2W	R244 R807	R301	R501	R503	R515
40003543	R,SOLID 3.3K 10% 1/2W	R1219	R240	R311	R507	R613
40003545	R,SOLID 4.7K 10% 1/2W	R1243	R231	R247		
40003546	R,SOLID 5.6K 10% 1/2W	R1225 R210 R306	R1226 R218 R606	R202 R219 R802	R205 R220	R207 R253
40003547	R,SOLID 6.8K 10% 1/2W	R617	R618			
40003549	R,SOLID 10K 10% 1/2W	R1204 R222 R608	R1209 R302	R1234 R512	R211 R513	R221 R607
40003550	R,SOLID 12K 10% 1/2W	R1233	R1237			
40003551	R,SOLID 15K 10% 1/2W	R317	R318	R39	R614	R615
40003553	R,SOLID 22K 10% 1/2W	R1212 R252	R1213 R303	R1217 R40	R1242 R801	R215 R804
40003555	R,SOLID 33K 10% 1/2W	R1221	R1224	R1236	R203	R224
40003557	R,SOLID 47K 10% 1/2W	R1210 R312	R1216	R1220	R1230	R1231
40003558	R,SOLID 56K 10% 1/2W	R229				
40003561	R,SOLID 100K 10% 1/2W	R1201 R1237 R504	R1206 R214 R601	R1227 R216 R604	R1228 R227	R1229 R313
40003563	R,SOLID 150K 10% 1/2W	R206	R228			
40003567	R,SOLID 330K 10% 1/2W	R2-111				
40003569	R,SOLID 470K 10% 1/2W	R1211 R903	R33 R904	R34	R901	R902
40003573	R,SOLID 1M 10% 1/2W	R1207	R1223	R505	R510	R602
40003581	R,SOLID 4.7M 10% 1/2W	R511				
40003641	R,SOLID 47H 5% 1/2W					
40003646	R,SOLID 75H 5% 1/2W	R603				
40005525	R,SOLID 100H 10% 1W					
40005537	R,SOLID 1K 10% 1W	R905				
40005555	R,SOLID 33K 10% 1W	R806				
40102649	R,CARBON 100H 5% 1/4W	R1				
40102665	R,CARBON 470H 5% 1/4W	R2				
40102673	R,CARBON 1K 5% 1/4W	R35				

CORD NO	NAME	CIRCUIT MARK
40112141	R,CARBON 47H 5% 1/4W	R2-110 R2-112
40112147	R,CARBON 82H 5% 1/4W	R122
40112149	R,CARBON 100H 5% 1/4W	R127 R132 R133 R1409 R177 R185 R186
40112151	R,CARBON 120H 5% 1/4W	R121
40112155	R,CARBON 180H 5% 1/4W	R183
40112157	R,CARBON 220H 5% 1/4W	R107 R114 R120 R124 R125 R126 R135 R137 R139 R1418 R141 R1421 R1423 R142 R143 R160
40112159	R,CARBON 270H 5% 1/4W	R2-116
40112161	R,CARBON 330H 5% 1/4W	R2-102
40112165	R,CARBON 470H 5% 1/4W	R110 R119 R155 R168 R175 R181 R187 R190 R194 R196 R2-109
40112167	R,CARBON 560H 5% 1/4W	R101 R2-104 R5
40112169	R,CARBON 680H 5% 1/4W	R1430
40112171	R,CARBON 820H 5% 1/4W	R1407 R1410
40112173	R,CARBON 1K 5% 1/4W	R116 R134 R1403 R150 R166 R172 R179 R191 R2-106
40112177	R,CARBON 1.5K 5% 1/4W	R106 R113 R1416 R195 R6
40112179	R,CARBON 1.8K 5% 1/4W	R1431 R2-117
40112181	R,CARBON 2.2K 5% 1/4W	R130 R1404 R1411 R1414 R152 R158 R159 R161 R162 R163 R7
40112185	R,CARBON 3.3K 5% 1/4W	R157 R176 R184
40112189	R,CARBON 4.7K 5% 1/4W	R1402 R164 R38
40112191	R,CARBON 5.6K 5% 1/4W	R108 R115 R1419 R1427 R1429 R170 R188 R192 R2-114
40112193	R,CARBON 6.8K 5% 1/4W	R4
40112197	R,CARBON 10K 5% 1/4W	R102 R109 R117 R118 R1401 R154 R169 R173 R174 R189 R193 R2-115
40112199	R,CARBON 12K 5% 1/4W	R3
40112201	R,CARBON 15K 5% 1/4W	R1420 R178
40112205	R,CARBON 22K 5% 1/4W	R104 R111 R144 R146 R148 R171 R2-105 R2-118
40112209	R,CARBON 33K 5% 1/4W	R1422 R2-113

CORD NO	NAME	CIRCUIT MARK
40112213	R,CARBON 47K 5% 1/4W	R153
40112217	R,CARBON 68K 5% 1/4W	R1405 R1425
40112219	R,CARBON 82K 5% 1/4W	R1408
40112221	R,CARBON 100K 5% 1/4W	R103 R105 R112 R123 R129 R1426 R1428 R156 R180 R197 R199
40112223	R,CARBON 120K 5% 1/4W	R1417
40112225	R,CARBON 150K 5% 1/4W	R1424
40112229	R,CARBON 220K 5% 1/4W	R1413 R2-108
40112231	R,CARBON 270K 5% 1/4W	R1406
40112233	R,CARBON 330K 5% 1/4W	R128
40112235	R,CARBON 390K 5% 1/4W	R1415
40112237	R,CARBON 470K 5% 1/4W	R1432
40112243	R,CARBON 820K 5% 1/4W	R1412 R198
40112245	R,CARBON 1M 5% 1/4W	R2-103 R2-107
40215028	R,WIRE 0.47H 10% 2W	R246
40302022	R,METAL 56H 10% 2W	R1238
40302543	R,METAL 3.3K 10% 2W	R1203
40303055	R,METAL 33K 10% 3W	R241
40404507	R,METAL 3.3H 10% 1W	R908 R909
40920006	R,VARIABLE 5KH	R31
40920010	RW1P1HK	R242 R32
40920011	RW2PG2.2HK	R237
41920003	R,VARIABLE 10KB	VR3
41920004	R,VARIABLE 100KB	VR1 VR2
41920005	R,VARIABLE 10KB LOCKTYPE	VR5
41920006	R,VARIABLE 1MB LOCK TYPE	VR4
41950076	R,VARIABLE 100H 0.5W	VR102
41950077	R,VARIABLE 500H 0.2W	VR206
41950078	R,VARIABLE 1K 0.2W	VR105 VR207 VR208
41950079	R,VARIABLE 3K 0.2W	VR501 VR601
41950080	R,VARIABLE 10K 0.2W	VR103 VR201

CORD NO	NAME	CIRCUIT MARK
41950081	R,VARIABLE 50K 0.2W	VR104 VR203
41950082	R,VARIABLE 100K 0.2W	VR101 VR202 VR204 VR205
41950101	R,VARIABLE 5KB	VR6
41950102	R,VARIABLE 10KB	VR801
42011025	C,CERAMIC 500V 0.01UF	C614
42011521	C,CERAMIC 500V 4700PF	C1206 C1215 C1219 C1225 C1227 C1235 C1236 C1246 C1247 C1251 C1284 C1285 C1293
42011525	C,CERAMIC 500V 0.01UF	C1205 C1211 C1213 C1214 C1218 C1220 C1224 C1226 C1228 C1229 C1230 C1232 C1233 C1241 C1252 C1253 C1254 C1255 C1256 C1257 C1258 C1286 C1287 C1288 C1289 C1290 C1291 C1292 C30 C31 C32 C33 C34 C37 C38 C39 C45 C46 C47 C901 C902 C903 C904
42012513	C,CERAMIC 1KV 1000PF	C1237 C1238 C1239 C1240
42058525	C,CERAMIC 1.4KV 0.01UF	C40
42068601	C,CERAMIC 1.4KV 100PF	C1259
42068609	C,CERAMIC 1.4KV 470PF	C43
42110913	C,CERAMIC 50V 1000PF	C116 C145 C150 C159 C162 C186 C24 C806
42110921	C,CERAMIC 50V 4700PF	C1280 C183 C185 C234 C2-105 C315 C503 C52 C601
42110925	C,CERAMIC 50V 0.01UF	C101 C109 C111 C115 C117 C119 C120 C122 C123 C124 C125 C126 C127 C128 C129 C130 C131 C132 C133 C134 C136 C140 C141 C146 C147 C148 C151 C155 C160 C173 C180 C184 C184A C187 C188 C189 C190 C197 C198 C201 C211 C212 C217 C218 C21 C223 C224 C22 C230 C231 C238 C242 C2-101 C2-104 C2-108 C301 C302 C303 C304 C309 C310 C317 C318 C323 C48 C501 C502 C511 C513 C602 C607 C608 C609 C610 C613 C616 C803
42110929	C,CERAMIC 50V 0.02UF	C1404 C51
42110933	C,CERAMIC 50V 0.047UF	C1406 C1407 C1409 C1410 C1412 C1413 C1421 C1424

CORD NO	NAME	CIRCUIT MARK				
42110937	C,CERAMIC 50V 0.01UF	C104	C121	C137	C1414	C1415
		C142	C143	C144	C149	C154
		C163	C164	C166	C168	C170
		C171	C172	C174	C176	C179
		C183A	C191	C192	C199	C204
		C206	C208	C219	C220	C227
		C236	C237	C243	C2-102	C2-103
		C311	C316	C319	C321	C505
		C509	C512	C606	C611	C612
		C615	C804	C808		
42130707	C,CERAMIC 50V 330PF 10%	C244				
42130709	C,CERAMIC 50V 470PF	C1408				
42130713	C,CERAMIC 50V 1000PF	C1212	C1217	C1405		
42203007	C,CERAMIC 500V 10PF	C35				
42210207	C,CERAMIC 500V 1.5PF	C1221				
42331001	C,CERAMIC 50V 1PF	C1250				
42331002	C,CERAMIC 50V 2PF	C165				
42331021	C,CERAMIC 50V 10PF	C158				
42331052		C314				
42331057	C,CERAMIC 50V 330PF J,A	C805				
42332005	C,CERAMIC 50V 5PF	C14				
42332010	C,CERAMIC 50V 5PF	C504				
42332012	C,CERAMIC 50V 7PF	C10	C1	C2	C3	C4
		C5	C6	C7	C8	C9
42332015	C,CERAMIC 50V 10PF	C138	C215			
42332021	C,CERAMIC 50V 9PF	C25				
42332023	C,CERAMIC 50V 12PF	C12	C13	C20		
42332029	C,CERAMIC 50V 22PF	C1402				
42332031	C,CERAMIC 50V 27PF	C11				
42332037	C,CERAMIC 50V 47PF	C510				
42332045	C,CERAMIC 50V 100PF	C1403				
42332057	C,CERAMIC 50V 100PF	C175	C313			
42333031	C,CERAMIC 50V 22PF	C178	C181			
42333034		C135	C603			
42333035	C,CERAMIC 50V 33PF	C193	C807			
42333047	C,CERAMIC 50V 100PF 5%	C175				

CORD NO	NAME	CIRCUIT MARK
42407017		C23
42407020	C,MICA 50V 39PF	C801
42407025	C,MICA 50V 100PF	C604 C605
42407124	C,MICA 50V 10PF	C308
42407131		C118 C307
42407139	C,MICA 50V 47PF	C305 C306
42407140	C,MICA 50V 51PF	C508
42407149	C,MICA 50V 300PF	C1401
42407160	C,MICA 50V 330PF	C507
42408012	C,MICA 500V 18PF	C1203
42408125	C,MICA 500V 10PF	C1207 C1276
42408129	C,MICA 500V 15PF	C1210 C1223 C1272 C1281 C1282
42408137	C,MICA 500V 33PF 5%	C1202 C1209 C1245 C1271A C1275 C127 C1283
42408141	C,MICA 500V 47PF	C1231 C1270
42408147	C,MICA 500V 82PF	C1244
42408149	C,MICA 500V 100PF	C1201 C1208 C1216 C1274 C1278
42408153	C,MICA 500V 150PF	C1273 C1277
42408155	C,MICA 500V 180P	C1243
42408157	C,MICA 500V 220PF	C1271
42408161	C,MICA 500V 330PF	C1222 C1242
42408165	C,MICA 500V 470PF	C1204
42701019	C,MYLAR 50V 0.01UF	C1416 C1418
42701021	C,MYLAR 50V 0.022UF	C1419
42701115	C,MYLAR 50V 2200PF	C213
42739005	C,MYLAR 250V 0.047UF	C1234
42940001	C,CERAMIC 5000PF 3KV 10%	C36
42940002	C,CERAMIC 150PF 3KV 10%	C44
42970022	C,POLY 50V 2200PF 5%	C802
42970134	C,POLY 50V 200PF 5%	C506
43011024	C,ELEC.16V 1UF	C1411 C1420 C1422 C152 C153 C161 C167 C198A C2-107

CORD NO	NAME	CIRCUIT MARK				
43011027	C,ELEC.16V 4.7UF	C103	C105	C110	C112	C221
43011028	C,ELEC.16V 10UF	C106 C205 C235	C108 C209 C240	C114 C214 C246	C202 C226	C203 C232
43011030	C,ELEC.16V 33UF	C210				
43011031	C,ELEC.16V 47UF	C139	C228			
43011032	C,ELEC.16V 100UF	C239	C905			
43011033	C,ELEC.16V 220UF	C1423	C229			
43011035	C,ELEC.16V 470UF	C906				
43011036	C,ELEC.16V 1000UF	C907				
43011038	C,ELEC.25V 0.47UF	C49				
43011042	C,ELEC.25V 4.7UF	C50				
43011043	C,ELEC.25V 10UF	C169	C182	C216		
43011044	C,ELEC.25V 22UF	C107	C113			
43011046	C,ELEC.25V 47UF	C102	C207	C222	C225	
43021048	C,ELEC.25V 220UF	C233	C245			
43515072	C,TANTALUM 35V 0.1UF	C1417				
43970030	C,ELEC.25V 47UF	C911				
43970031	C,ELEC.250V 33UF	C912				
43970032	C,ELEC.35V 1000UF	C908	C909	C910		
43970033	C,ELEC.500V 47-47UF	C41	C42			
44025001	TUNING C,AIR 30PF	VC502				
44208004	C,TRIMMER 30PF	TC101 TC304	TC301 TC801	TC302 TC802	TC303	
44209002	C,TRIMMER 20PF	TC10 TC5	TC1 TC6	TC2 TC7	TC3 TC8	TC4 TC9
44950006	TUNING C,AIR	VC1				
44950012	TUNING C,AIR	VC2				
44950013	TUNING C,AIR 3	VC501				
44950014	TUNING C,AIR G-624A	VC3				
44950015	TUNING C,AIR	VC1201				
45910013	TRAMS	PT1				
60809005	M.FILTER MFH-535	T1401				

CORD NO	NAME	CIRCUIT MARK				
60809006	FILTER LFB-8	CF-1				
61052026		L1231				
61052031		L101	L102	L103	L104	L105
		L106	L107	L108	L109	L110
		L111	L112	L113	L114	L115
		L301	L302	L303	L304	L305
		L306	L501	L503	L504	L601
		L603				
61902010	IFT YLC -15430	T1402				
61902011	IFT YLC -20400N	T1403				
61904140	IFT 9MHZ	T101	T102	T105	T106	T107
		T108	T109	T111	T112	T301
		T302	T303			
61904141	IF COIL 9MHZ	T103	T104			
61904142	IF COIL 5.3MHZ	T601				
61904197	VFO 6MHZ COIL	L502				
61904198	COIL FILTER	L1224	L602			
61904199	COIL 3T	L801				
61904203	COIL HFO	L10	L1	L2	L3	L4
		L5	L6	L7	L8	L9
61904205	COIL P.DRIVE 80-15	L1210				
61904206	COIL P.DRIVE 40-11-10AB	L1211				
61904207	COIL P.DRIVE 20-10CD	L1212				
61904208	COIL P.DRIVE 160	L1209				
61904209	COIL DRIVE 80-15	L1217				
61904210	COIL DRIVE 40-11-10AB	L1218				
61904211	COIL DRIVE 20-10CD	L1219				
61904212	COIL DRIVE 160	L1216				
61904213	COIL BPF 160	L1201				
61904214	COIL BPF 80	L1202				
61904215	BPF COIL 20	L1203				
61904216	COIL BPF 15	L1204				
61904217	COIL BPF 11-10	L1205				
61904218	COIL BPF 10CD	L1206				
61904219	COIL MIX	L1208				

CORD NO	NAME	CIRCUIT MARK
61904220	COIL P.MIX	L1207
61904221	COIL 9MHZ	L1230
61904228	COIL	L1223 L1225 L1226 L1227 L1228 L122
61904234	COIL DET 9MHZ	T107
61911018	COIL PLATE-CHOKE	L12
61911019	COIL	L13
61911020	COIL 28MHZ	L14
63906017	SPEAKER	SP
63971025	MICROPHONE 10K	
64910108	X,TAL-FILTER YF-90FAE	XF101
64910109	X,TAL FILTER YF 90FBE	XF102
64910110	X,TAL FILTER YF-90FCE	XF103
64920512	X,TAL HC -25U 9.0MHZ	X301
64920513	X,TAL HC -25U 16MHZ	X1
64920514	X,TAL HC -25U 21.5MHZ	X2
64920515	X,TAL HC -25U 28.5MHZ	X3
64920516	X,TAL HC -25U 35.5MHZ	X4
64920517	X,TAL HC -25U 42.5MHZ	X6
64920518	X,TAL HC -25U 43.0MHZ	X7
64920519	X,TAL HC -25U 43.5MHZ	X8
64920520	X,TAL HC -25U 44.0MHZ	X9
64920535	X,TAL 100KHZ	X801
64920536	X,TAL 29.5MHZ	X10
64920537	X,TAL 41.5MHZ	X5
64920540	X,TAL 9.455MHZ	X1401
65901014	SWITCH,ROTARY 2-4-6	S3
65901015	SWITCH ROTARY 4-8-6	S1
65901016	BAND SWITCH	SW-1
65904020	SWITCH,PUSH BUTTON UEG42	S7
65904021	SWITCH,PUSH BUTTON	S5 S6

CORD NO	NAME	CIRCUIT MARK
65904030	SWITCH,PUSH (1-3)	S8
65904031	SWITCH,PUSH (1-1-2)	S9
65906002	SWITCH	S4
65910012	RELAY MH-4PO DC12V	RL101
65910013	RELAY MH-2P DC12V	RL1201
65910015	RELAY LC-1C DC12V	RL102 RL301
65910020	RELAY MY-4F/DC-12	RL-1
65910024	RELAY LABI DC12V	RL1401
66601006	FUSE,1A	F-201
66601009	FUSE,5A	
66601017	FUSE 20A	
67901108	PILOT LAMP	
67950125	METTER,TUNING	
72201481	PWB 1F P-101E	
72201491	PWB AF P-102E	
72201501	PWB CARRIER P-103E	
72201521	PWB VFO P-105E	
72201531	PWB VFO P-106E	
72201541	PWB DISPLAY P-107E	
72201551	PWB CAL RF P-108E	
72201561	PWB SUP FILTER P-109E	
72201581	PWB LED P-111E	
72201591	PWB MAIN P-112A	
72201601	PWB SVB P-112B	
72201611	PWB HFO P-112C	
72201631	PWB HFO P-112D	
72201641	PWB CRYSTAL P-113E	
72201651	AM IF PWB P-114E	

NEC NIPPON ELECTRIC COMPANY LTD