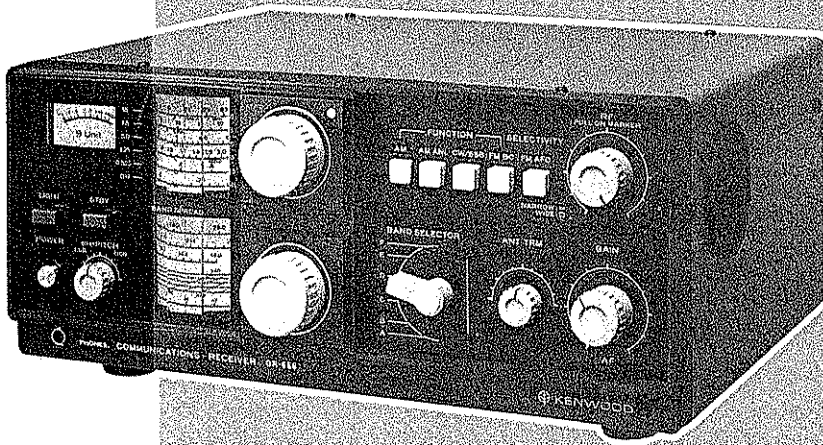




COMMUNICATIONS RECEIVER

Model QR-666



OPERATING MANUAL

QR-666 OPERATING MANUAL

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QR-666 SPECIFICATIONS

1. Frequency range

Band A	170 ~ 410 kHz	5.0 MHz	2.0 μ V	1.4 μ V
B	525 ~ 1,250 kHz	7.0 MHz	2.0 μ V	1.4 μ V
C	1.25 ~ 3.0 MHz	8.0 MHz	5.0 μ V	3.0 μ V
D	3.0 ~ 7.5 MHz	12.0 MHz	3.0 μ V	2.0 μ V
E	7.5 ~ 18 MHz	17.0 MHz	3.0 μ V	2.0 μ V
F	18 ~ 30 MHz	19.0 MHz	5.0 μ V	3.0 μ V
FM.BC	87.5 ~ 108 MHz (option)	24.0 MHz	3.0 μ V	2.0 μ V
		29.0 MHz	2.0 μ V	1.6 μ V

FM... Deviation: 22.5 kHz/1 kHz

S/N ratio: 20 dB at 50 mw output/8 Ω

(option)	88.0 MHz	3.0 μ V
	98.0 MHz	3.0 μ V
	108.0 MHz	3.0 μ V

2. Band spread

Ham bands

80 and 75 m	3.5 ~ 4.0 MHz
40 m	7 ~ 7.5 MHz
20 m	14 ~ 14.6 MHz
15 m	21 ~ 21.5 MHz
10 m	28 ~ 30 MHz

Shortwave bands (option)

75 m	3.82 ~ 4.0 MHz
60 m	4.75 ~ 5.1 MHz
49 m	5.9 ~ 6.2 MHz
41 m	7.0 ~ 7.5 MHz
31 m	9.4 ~ 9.8 MHz
25 m	11.7 ~ 12.0 MHz
19 m	15.0 ~ 15.5 MHz
16 m	17.6 ~ 18.0 MHz
13 m	21.4 ~ 21.8 MHz
11 m	25.6 ~ 26.2 MHz

3. Receivable radio waves

AM, SSB, CW, FM (option)

4. Intermediate frequencies

Band A ~ E	455 kHz
Band F (Double Conversion) 1st IF	4.034 MHz
2nd IF	455 kHz
FM. BC(option)	10.7 MHz

5. Sensitivity

S/N RATIO: 10dB at 50 mW output/8 Ω

		AM	SSB/CW
Band A	190 kHz	3.0 μ V	2.0 μ V
	280 kHz	2.0 μ V	1.6 μ V
	380 kHz	2.0 μ V	1.6 μ V
Band B	600 kHz	3.0 μ V	2.0 μ V
	900 kHz	1.6 μ V	1.0 μ V
	1200 kHz	1.6 μ V	1.0 μ V
Band C	1.3 MHz	3.0 μ V	2.0 μ V
	2.0 MHz	1.6 μ V	1.0 μ V
	2.8 MHz	1.6 μ V	1.0 μ V
Band D	3.4 MHz	3.0 μ V	2.0 μ V

6. Image ratio

Band A	280 kHz	More than 65 dB
Band B	900 kHz	More than 50 dB
Band C	2.0 MHz	More than 50 dB
Band D	5.0 MHz	More than 40 dB
Band E	12.0 MHz	More than 25 dB
Band F	24.0 MHz	More than 40 dB
FM (option)	98.0 MHz	More than 60 dB

7. If rejection

Band A	280 kHz	More than 50 dB
Band B	900 kHz	More than 60 dB
Band C	2.0 MHz	More than 70 dB
Band D	5.0 MHz	More than 70 dB
Band E	12.0 MHz	More than 70 dB
Band F	24.0 MHz	More than 50 dB
FM. BC	98.0 MHz	More than 70 dB

8. Selectivity (IF band width)

	-6 dB	-50 dB	-60 dB
AM WIDE	Over 5 kHz	Below 15 kHz	—
AM NARROW	Over 3 kHz		Below 15 kHz
FM	Over 160 kHz	Below 750 kHz	—

9. Frequency stability

(1 to 60 minutes after switch-on at normal temperature)

Band A	280 kHz	Less than 1 kHz
Band B	900 kHz	Less than 2 kHz
Band C	2.0 MHz	Less than 10 kHz
Band D	5.0 MHz	Less than 15 kHz
Band E	12.0 MHz	Less than 20 kHz
Band F	24.0 MHz	Less than 25 kHz
FM. BC	98.0 MHz	Less than 80 kHz

10. BFO variable range

More than ± 2.5 kHz

11. Audio frequency output

Over 1.5 W/8 Ω (with 10% distortion/1 kHz)

12. Power supply and consumption

(with AF output at 1.5W/8 Ω)

AC 100 /117/220/240 V Below 15 W

DC 12V from batteries (UM-1 \times 8) Below 13W

DC 13V from external power source

(allowed variable range: 12 to 15V)

Below 13 W

13. Transistors and diodes used

4 FETs, 16 transistors and 22 diodes

14. Outer dimensions

362(W) \times 163(H) \times 322(D) (mm),

(14-1/4(W) \times 6-27/64(H) \times 12-11/16(D) inch)

380(W) \times 163(H) \times 322(D) (with FM option) (mm),

(14-31/32(W) \times 6-27/64(H) \times 12-11/16(D) inch)

15. Weight

7.3 kg, 16.1 lbs (QR-666 only)

16. Accessories

Rod antenna

Remote plug

Operating manual

AC Line cord

DC Line cord with fuse

Alignment tool 2

* Any of the specifications given here may be changed or modified without notice.

SECTION 1. INSTALLATION

1-1. UNPACKING

Remove the QR-666 from its shipping box and packing material and examine it for visible damage. If the equipment has been damaged in shipment, save the boxes and packing material and notify the transportation company immediately. It is a good idea to save the boxes and packing material in any case because they are very useful for shipping or moving the equipment.

The following accessories should be included with the receiver.

Operating Manual	1
AC Power Cord	1
(not included with receiver of SEV specification)	
DC Power Cord	1
Alignment Tool	2

1-2. INSTALLATION

Select a place of installation where is out of the direct rays of the sun. Insure that there is ample space above and both sides of the receiver to allow free air circulation.

POWER CONNECTION

Make sure that your AC line voltage corresponds to the voltage marked on the name plate on the rear panel.

Connect the AC POWER cord to an appropriate external power source.

1-3. ANTENNA AND GROUNDING

Installation of antenna and grounding is important for optimum reception of short-wave broadcast or amateur radio signals. A good outdoor antenna will provide best results in reception of a variety of remote stations which cannot be attained with the rod antenna. It should be noted, however, that the rod antenna is effective for reception of middle-wave or local FM broadcast.

The outdoor antenna may be a simple vinyl insulated wire installed outside of house, a beam antenna designed for transmission of amateur radio signals etc. For short-wave broadcast reception, it is recommended that a best possible antenna be installed.

The following describes various types of antennas to be used and their installation:

LONG-WIRE ANTENNA

This is the most simplified antenna. Use an antenna wire of about 30 ~ 100 feet (10 ~ 30 m) and install it on poles, trees or any other convenient location. The antenna wire may be a large sized, vinyl insulated, stranded wire (about 30 strands) or a copper wire of 1/16 ~ 5/64 in. (1.6 ~ 2 mm) diameter.

These type of antenna must be installed horizontally over a length of more than 60 feet (20 m) and positioned as high as possible. Note that it should be as far away as possible from buildings, AC power lines, trees and other objects.

The picture shows an inverted L-type antenna. Other types of antennas such as slant type, vertical type, etc. are also available.

The long-wire antenna, when installed in a open area, is available for all bands.

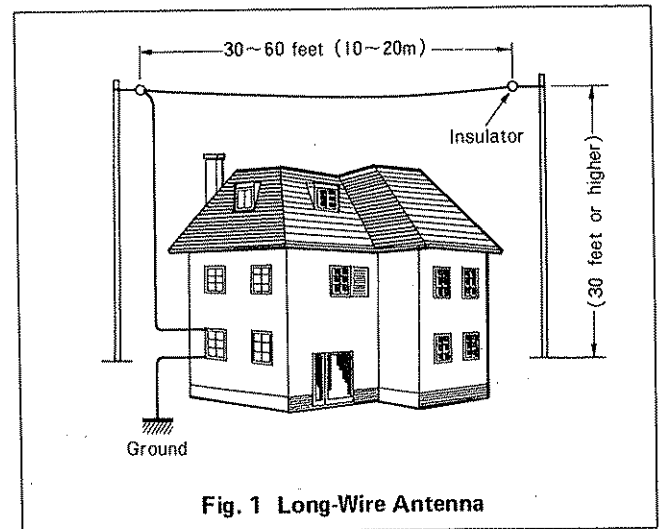


Fig. 1 Long-Wire Antenna

DOUBLET ANTENNA

This type of antenna is suitable for reception of a specific band. The relation between the overall length "L" and tuned frequency is as follows:

$$L \text{ (m)} = \frac{143}{\text{Freq (MHz)}} \quad L \text{ (feet)} = \frac{468}{\text{Freq (MHz)}}$$

This antenna has a directivity so that the gain is increased and noise is minimized in the right angle direction from the antenna at a tuned frequency of specific receiving band. It must be used with a 75Ω coaxial feeder.

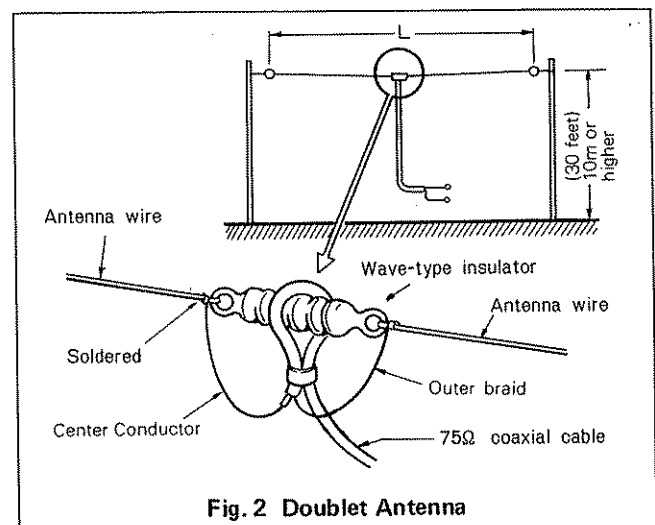
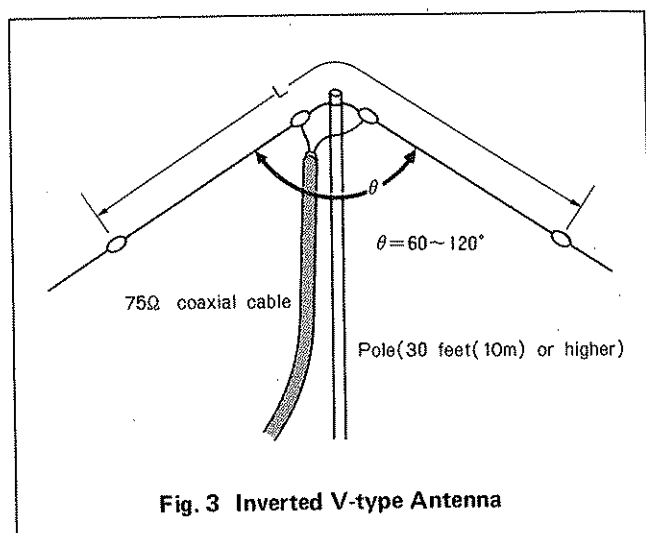


Fig. 2 Doublet Antenna

INVERTED V-TYPE ANTENNA

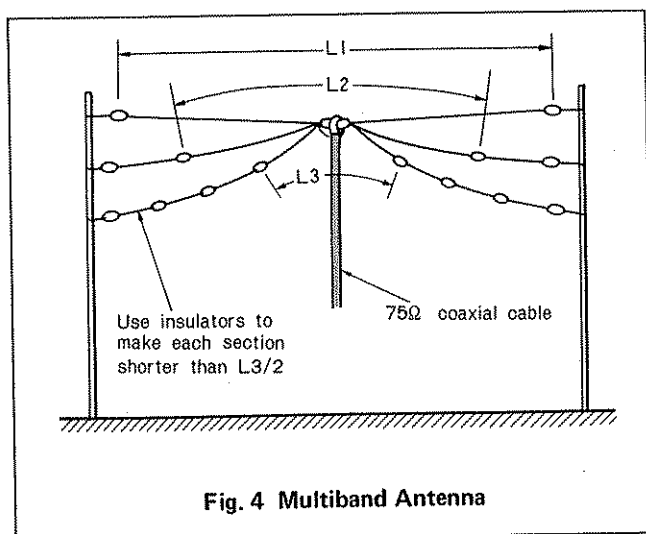
This is a modification of doublet antenna, designed to be installed on a single pole. The characteristics of this antenna are almost the same as those of doublet antennas. The overall length "L" is a little larger than that of doublet antennas, and is obtained by the following:

$$L \text{ (m)} = \frac{148}{\text{Freq (MHz)}} \quad L \text{ (feet)} = \frac{486}{\text{Freq (MHz)}}$$



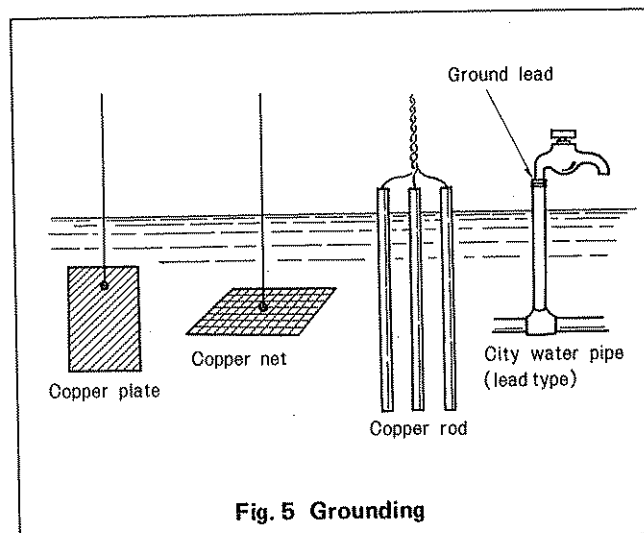
MULTIBAND ANTENNA

This antenna uses more than one doublet antennas for multiband reception. The overall length "L" is the same as that of doublet antennas. If the lengths L1, L2 and L3 are set to the frequencies 7 MHz, 14 MHz and 28 MHz, respectively, then L1 is tuned to 21 MHz (3 x 7 MHz), permitting both the reception and transmission of signals of 4 amateur bands of 7 ~ 28 MHz. If the antenna is used for only reception, it covers a wide 6 ~ 30 MHz broadcast band.

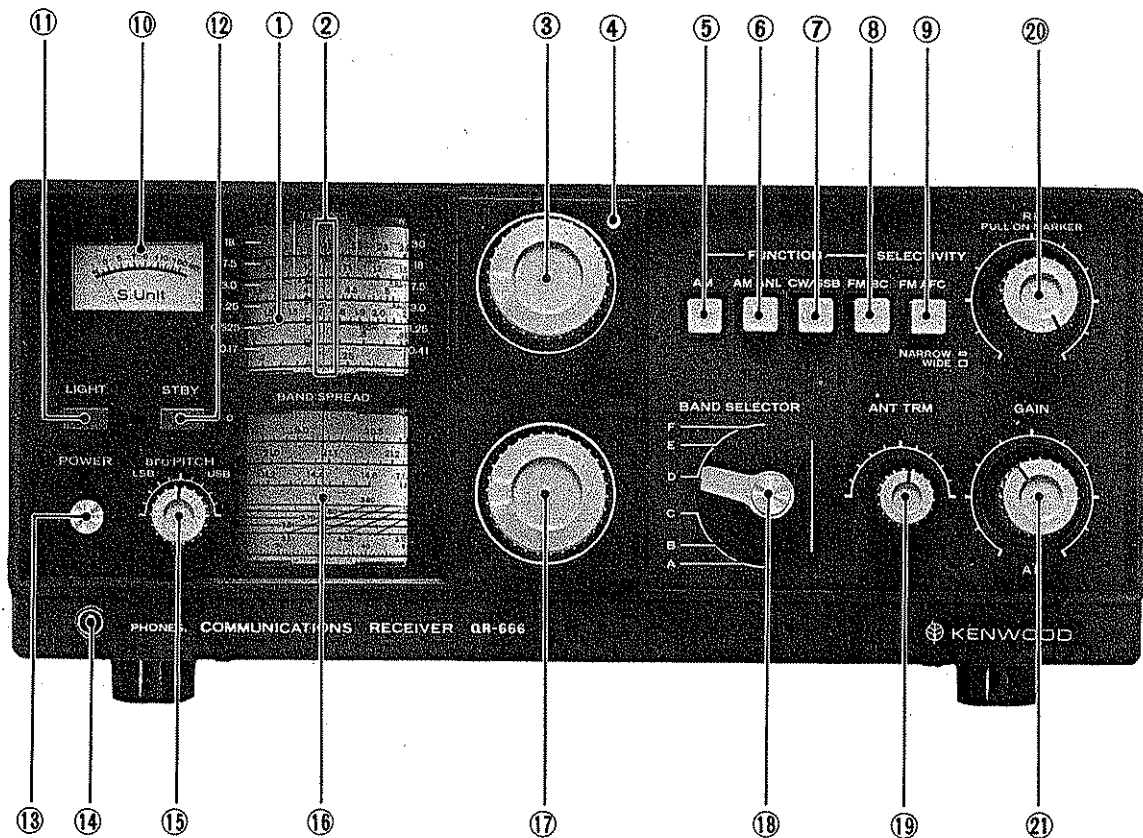


GROUNDING

Normally, the receiver operates without being grounded. However, grounding improves the efficiency of antenna such as a long-wire antenna. It is also effective because it eliminates inductive noise and protects the operator from electric shocks through AC line. To ground the receiver, use a copper or brass plate (or net or rod) connected to a copper wire and bury it in the ground about 1 ~ 7 feet (0.3 ~ 2.0 m) deep. A city water pipe (not vinyl type) may also be used for grounding. Never use a gas pipe for grounding purpose.



SECTION 2. OPERATING CONTROLS



- | | |
|--------------------------|---|
| (1) TUNING | (12) STBY |
| (2) Dial Gauge | (13) POWER |
| (3) Main Tuning Knob | (14) PHONES |
| (4) AC/STBY Lamp | (15) BFO PITCH |
| (5) AM | (16) BAND SPREAD |
| (6) AM ANL | (17) Spread Dial Knob |
| (7) CW/SSB | (18) BAND SELECTOR |
| (8) FM BC | (19) ANT TRM |
| (9) SELECTIVITY (FM AFC) | (20) RF GAIN (PULL ON MARKER: optional) |
| (10) Meter | (21) AF GAIN |
| (11) LIGHT | |

2-1. FRONT PANEL CONTROLS

(1) TUNING

Frequencies in A ~ F bands are indicated on MAIN TUNING dial.

(2) Dial Gauge

This gauge indicates correct frequencies.

(3) Main Tuning Knob

Turn this knob to tune in the desired frequency on the main tuning dial.

(4) AC/STBY Lamp

Pilot lamp for AC operation and STBY. It lights at AC operation and when STBY switch is ON during battery or external power operation.

(5) AM

Push this button for reception of AM wave.

(6) AM ANL

Noise limiter for AM. It is used to eliminate pulse noise.

(7) CW/SSB

Push this button for reception of CW or SSB signals. BFO will be set to ON.

(8) FM BC

Push this button when the receiver is used with the optional FM tuner.

(9) SELECTIVITY (FM AFC)

This switch is used to eliminate radio interference. IF bandwidth is narrowed at NARROW position. It also functions as AFC switch during FM reception.

(10) Meter

The pointer swings in response to the received signal strength.

(11) LIGHT

This is a dial light switch during battery or external power operation. Push the switch to light the dial lamp. When the receiver operates on the built-in battery, the dial lamp glows dim to prevent unnecessary consumption of battery power (the lamp also glows dim during AC operation, but this is in no way an indication that the receiver is in trouble).

(12) STBY

Push this switch to stop the operation of the receiver for a brief period of time. AC/STBY lamp will be lit and the power to RF and IF circuits are cut off.

(13) POWER

Power ON/OFF switch for the receiver.

(14) PHONES

Connect a headphone (8 Ω) and the speaker circuit will be disconnected.

(15) BFO PITCH

Turn this knob to deviate BFO frequency about ± 3 kHz from the center frequency. During CW operation, adjust it for the tone suited to the listening taste. In SSB operation, set it to "LSB" or "USB" and then adjust the dial.

(16) BAND SPREAD

This dial indicates the spread frequency of broadcast band or amateur band.

(17) Spread Dial Knob

Adjust this knob for the frequency indicated on the band spread dial.

(18) BAND SELECTOR

This selects the desired listening band among A ~ F bands.

(19) ANT TRM

Adjust this antenna trimmer for maximum deflection on S meter while receiving a signal.

(20) RF GAIN (PULL ON MARKER: optional)

Turn this knob fully clockwise when the signal strength is normal. Turn it counterclockwise when the signal is too strong; the signal input will be reduced.

OPTIONAL

Pull the knob toward you and the power to the 500 kHz marker generator will be turned to ON.

(21) AF GAIN

Turn this knob clockwise to increase sound volume.

2-2. REAR PANEL CONTROLS

(1) Whip Antenna

A whip antenna of 2.5 feet (0.75 m) long. It provides optimum reception of signals from nearby stations.

(2) Whip Antenna Lead

Connect this lead to AM or FM antenna terminal, whichever is desired.

(3) FM

Connect FM antenna of 50 ~ 300 Ω impedance to this terminal.

(4) GND

Connect an earth lead to this terminal.

(5) AM

Screw terminal and M-type connector are arranged in parallel. Connect an antenna of 50 ~ 75 Ω impedance.

(6) REMOTE

When QR-666 is to be operated alone, be sure to insert the shorting plug. Speaker output, power supply and STBY circuits can be connected to external devices.

(7) S METER ZERO ADJUST

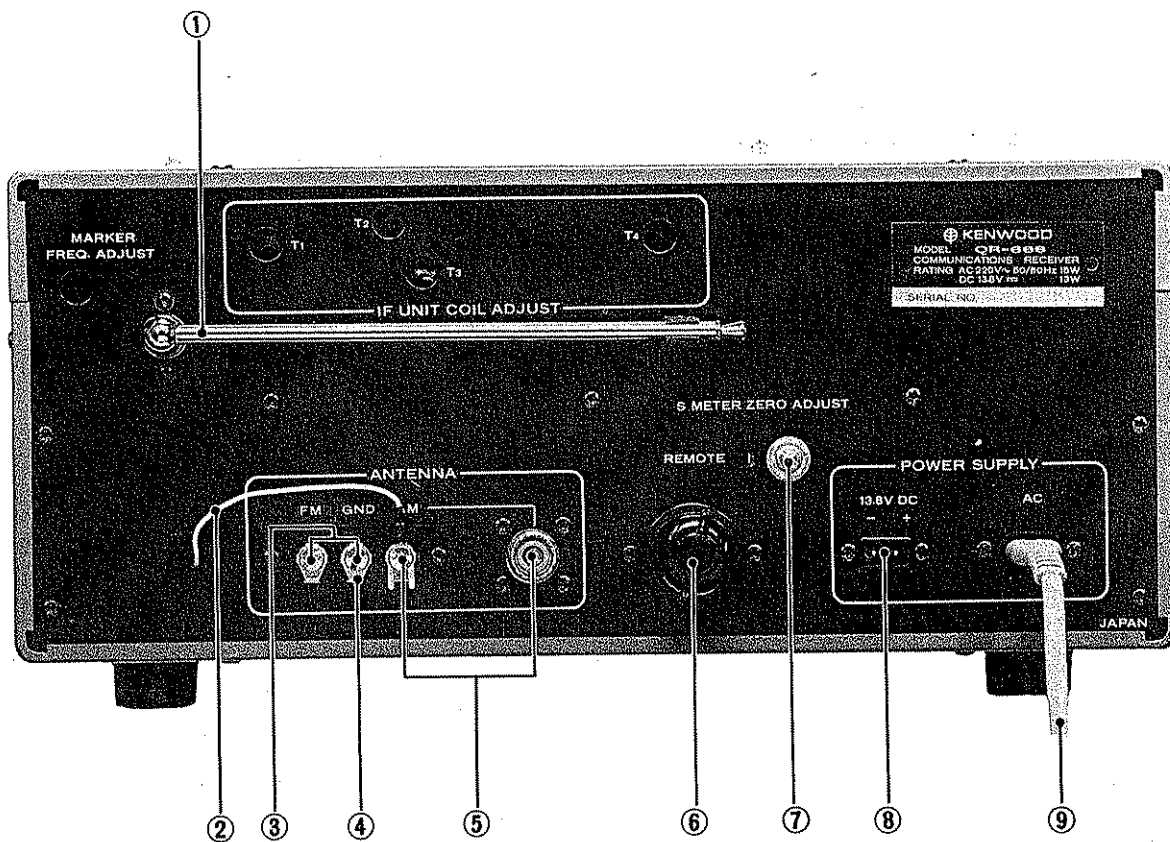
Turn this knob to set the S meter to the "0" position.

(8) 13.8V DC

An input terminal for external power supply of 12 ~ 15V, 0.5A or higher.

(9) AC

This is an AC power input terminal.



- (1) Whip Antenna
- (2) Whip Antenna Lead
- (3) FM
- (4) GND
- (5) AM

- (6) REMOTE
- (7) S METER ZERO ADJUST
- (8) 13.8V DC
- (9) AC

SECTION 3. OPERATING INSTRUCTIONS

3-1. READING THE RECEIVING FREQUENCY

The receiver is provided with a main tuning dial and a band spread dial. The main tuning dial is calibrated with frequencies of 170 kHz to 30 MHz in 6 bands (A ~ F) and is designed to indicate a correct frequency when the band spread dial is in the fully clockwise position or the 100 degree position. Normally, the band spread dial should be set to this position.

The band spread dial indicates the frequency of broadcast band or amateur band more precisely for easy tuning of each meter band. The pointer of the main tuning dial should be set to the desired meter band ▲ mark.

3-2. RECEIVING OF AM SIGNALS

Signals of middle-wave and short-wave international broadcast are transmitted by AM (amplitude modulation) waves.

1. Set the controls of the receiver as follows:
 BAND SELECTOR: Desired band
 FUNCTION: AM
 RF GAIN: Fully clockwise
 AF GAIN: Turn clockwise until receiver noise is heard.
 STBY: OFF
2. Turn the TUNING dial knob to receive signal. Adjust the dial and ANT TRM knob for maximum deflection on the S meter. Then adjust the AF GAIN knob for suitable sound volume.
3. If the signal is too strong and the sound is distorted, turn the RF GAIN knob counterclockwise. If static noise (such as noise due to thunder) or ignition noise from cars are heard, set the FUNCTION knob to AM ANL; the noise limiter is on to reduce noise.
 When radio interference is observed, set the SELECTIVITY switch to NARROW position; the receiving bandwidth is narrowed and the clarity of sound is improved.

3-3. RECEIVING OF SSB SIGNALS AND CW SIGNALS

* SSB signal can be received in amateur band.

With the receiver set in AM mode, this signal cannot be heard clear where the S meter causes intermittent deflection.

CW signal is received in amateur band or any other band. It is intermittent carrier signal (Morse code) without audio frequencies modulation.

1. Set the controls of the receiver as follows:
 BAND SELECTOR: Desired band
 FUNCTION: CW/SSB
 RF GAIN: Fully clockwise

AF GAIN: Set for suitable sound volume.
 BFO PITCH: CW — Center position
 SSB — LSB for 10 MHz or less
 USB for more than 10 MHz

2. To receive SSB signal, turn the TUNING knob slowly and tune in the signal until the sound is heard clearly. Use the band spread knob for easy tuning.
 If the sound cannot be heard clearly, reverse the position of the BFO PITCH knob to LSB or USB and readjust.
3. To receive CW signal, turn the BFO PITCH knob for the comfortable sound.
4. If radio interference or key click noise is observed due to a strong signal near the desired signal, turn the RF GAIN knob counterclockwise to reduce.

3-4. BUILT-IN BATTERY AND EXTERNAL POWER SUPPLY

1. QR-666 operates on AC, built-in battery or external DC power. AC power is normally used for operation of the receiver. If AC power is interrupted during operation, it is automatically switched to the built-in battery where the dial lamp and AC/STBY lamp go off indicating that AC power is switched to the built-in battery.
2. When the receiver is operated on the built-in battery or external DC power, the dial lamp and the S meter lamp are lit by pushing the LIGHT switch and go off by releasing it, thus saving the battery power.
3. Use 8 dry-batteries (UM-1) in series connection for built-in battery. Install the batteries making sure that the battery polarity is correct by referring to the instructions on the bottom of the battery case. To load the batteries, see Fig. 6.

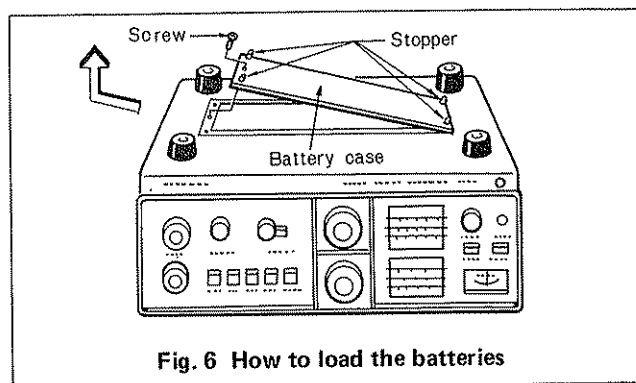


Fig. 6 How to load the batteries

4. For external power supply, use a car battery of 13.8V as a standard. The receiver should be used between 12V and 15V.

3-5. HOW TO USE REMOTE SOCKET

1. The following outputs are connected to the REMOTE socket on the rear panel:

Pin No. 1 Ground

Pin No. 2 9VDC (regulated) output

Pin No. 3 9VDC (regulated) output from STBY switch

Pin No. 4 9VDC regulated input for IF and RF

Pin No. 8 Speaker output

2. When QR-666 is used alone, the pins 3 and 4 are shorted with the REMOTE plug. If the receiver is used as an amateur radio station, remove the short circuit and it can be turned on and off by the relay of external transmitter.

3. A regulated 9VDC power from the pin 2 or 3 of the REMOTE socket can be connected to an external device. A maximum of 100mA of current can be obtained during the operation of the receiver. If the short circuit to the pin 4 of the REMOTE SOCKET is removed, and the AF GAIN is turned fully counterclockwise, the current is increased up to 200mA.

4. An external speaker can be connected to the REMOTE socket between the pins 8 and 1. Both the built-in speaker and the external speaker will operate. To shut out the built-in speaker, insert a headphone or an empty plug.

12

4-2. RF AMPLIFIER (RF UNIT, COIL PACK)

The signal from antenna is applied through RF GAIN volume to the tap of antenna coil. The antenna tuning circuit divides the coil into 6 bands and the signal is tuned by the main tuning variable capacitor, spread variable capacitor and antenna trimmer. The input impedance is rated at $50 \sim 75\Omega$. The signal is then fed to the 1st gate of MOS type dual gate field effect transistor (FET) 3SK35 where the signal is RF amplified. Because of the small feedback capacitance (0.02pF) of 3SK35 and the effects of the resistors R2, R6 and R8, the signal is amplified stably before it is fed to the RF coil. AGC voltage taken from the IF detector is applied to the 2nd gate of 3SK35 for gain control.

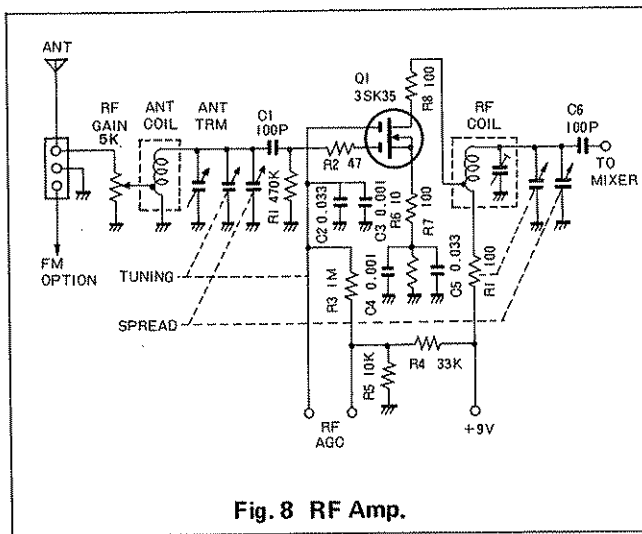


Fig. 8 RF Amp.

4-3. MIXER (RF UNIT)

The RF amplified signal is applied to the 1st gate of 3SK35 and is then mixed with the local oscillator signal at the 2nd gate. The mixer output is converted into 455 kHz IF signal for A ~ E bands and 4.034 MHz IF signal for F band. MOS type dual gate FET is ideal device for mixer circuit because it provides outstanding characteristics against cross modulation due to over-input and frequency pulling effect from local oscillator signal.

Changeover between the outputs of 455 kHz IFT and 4.034 MHz IFT is accomplished by the diode switches D1 ~ D4 interlocked with the band switch.

In the case of 455 kHz IF signal for A ~ E bands, the current from the 9V power supply flows through two different routes; one route is R15 → T1 → D1 → 3SK35 and the other is R15 → T1 → D3 → L1 → R17.

This causes the diodes D1 and D3 to be energized and thus the output of 455 kHz IF signal is obtained through the route of 3SK35 → D1 → T1 → D3 → C11.

Similarly, the output of 4.034 MHz IF signal for F band is obtained through the route of 3SK35 → D2 → T2 → C11 with the aid of the diodes D2 and D4.

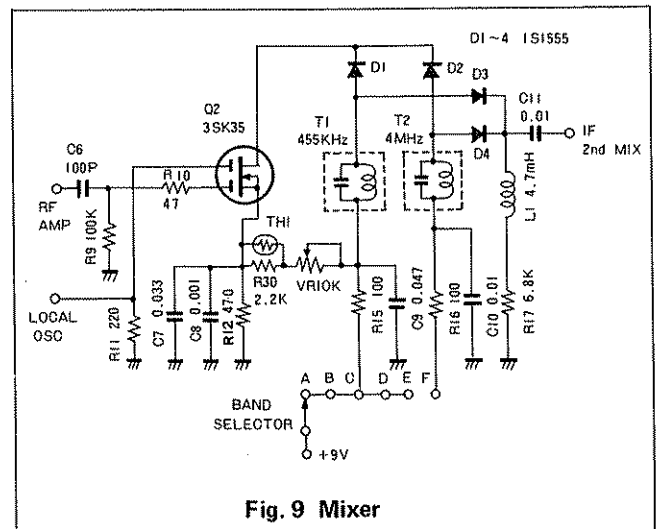


Fig. 9 Mixer

4-4. LOCAL OSCILLATOR CIRCUIT (COIL PACK)

For stabilized oscillation in the wide frequency range extending from 625 kHz to 34.034 MHz, a drain-ground type Hartley oscillator with a field effect transistor 2SK19 is employed as the local oscillator circuit which is built in a coil pack so that the high frequencies of F band can be stably oscillated. The circuit includes a 2SC460 emitter follower for a buffer to eliminate the frequency pulling effect caused by the mixer circuit. The oscillation frequencies are higher than the receiving frequencies by 455 kHz in A ~ E bands and by 4.034 MHz in F band as shown in the following:

- A 0.625 ~ 0.865 MHz
- B 0.98 ~ 1.705 MHz
- C 1.705 ~ 3.455 MHz
- D 3.455 ~ 7.955 MHz
- E 7.955 ~ 18.455 MHz
- F 22.034 ~ 34.034 MHz

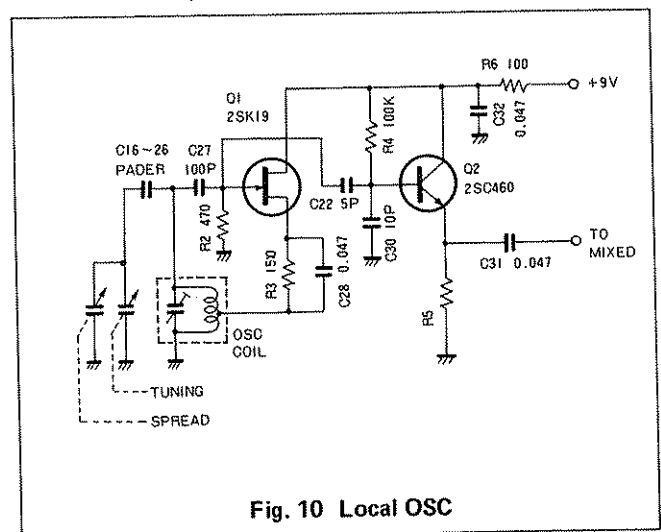


Fig. 10 Local OSC

4-5. 2ND MIXER/IF AMPLIFIER AND F BAND CONVERSION CRYSTAL OSCILLATOR CIRCUIT (RF UNIT)

The signal converted into 455 kHz or 4.034 MHz is applied to the 1st gate of Q3 3SK35 which acts as a 455 kHz IF amplifier for A ~ E bands or as a 455 kHz mixer to mix 4.034 MHz signal with 3.579 MHz conversion signal at the 2nd gate, for F band. A mechanical filter is used at the output side of the tuning circuit to improve the selectivity. Since the bias setting of 455 kHz IF amplifier differs from that of the 2nd mixer, a diode switch (D5, D6) interlocked with the band switch is used for switching. In the mode of IF amplifier, the diode D5 is in OFF state (0V) while AGC voltage is applied to the amplifier through the diode D6 for gain control. In the mode of 2nd mixer, a voltage higher than the AGC voltage is applied through the diode D5 to FET as a fixed bias voltage where the diode D6 is in OFF state, thus the AGC voltage is not fed to the mixer. The transistor Q4 2SC460 is used as 2nd local oscillator with 3.579 MHz crystal to doubly convert the signal for F band. The output of the output coil shunted by the capacitors C18 and C19 is supplied to the 2nd gate of the 2nd mixer.

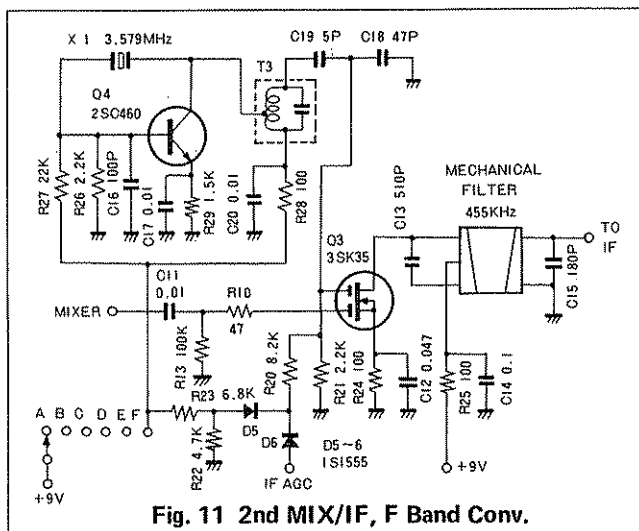


Fig. 11 2nd MIX/IF, F Band Conv.

4-6. IF AMPLIFIER (IF UNIT)

The 455 kHz IF amplifier is a 2-stage amplifier using 2SC941. The gain is controlled by feeding AGC voltage to the 1st stage. The one-signal selectivity of the receiver is determined almost by the IF circuit. To obtain necessary selectivity, the receiver employs a ceramic filter and 2-stage mechanical filter. The ceramic filter is turned to ON and OFF by a switch so that the selectivities (6 dB band-width) of 5 kHz and 3 kHz are obtained at the WIDE and NARROW, respectively.

The ceramic filter at the emitter of Q2 is similar to a bypass capacitor having frequency selectivity characteristic, thus it functions to reduce the gain of Q2 as the signal goes away from 455 kHz.

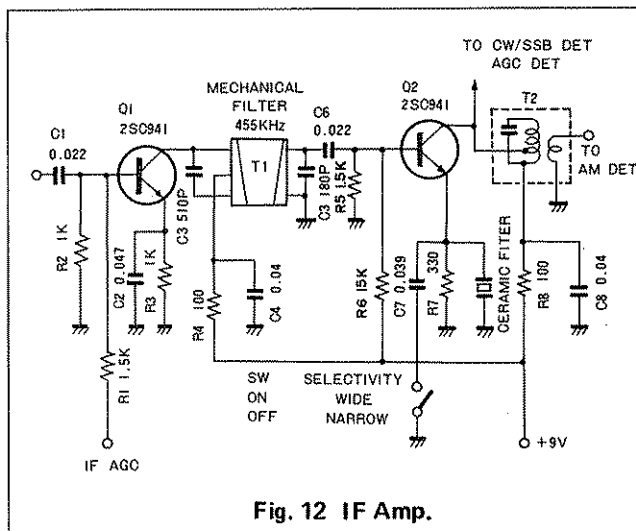


Fig. 12 IF Amp.

4-7. AGC AMPLIFIER (IF UNIT) AND S METER CIRCUIT

The IF signal from the collector of Q2 (IF amplifier) is applied through C12 to the multiplied voltage detector circuit D3 and D4. This signal is amplified by Q3 2SC733 and Q4 2SA495 and is then fed to the IF amplifier as AGC (automatic gain control) voltage.

Similarly, the signal from the collector of Q2 (IF amplifier) is applied through C13 to the multiplied voltage detector circuit D5 and D6 and the output is fed to the RF amplifier as AGC voltage, thereby the amplifier gain is controlled according to the signal strength.

Here, the operation of IF AGC is explained. When the IF signal is detected by D3 and D4, the resulting "+" voltage is applied to the base of Q3. Since a corrector current flows according to base voltage, the voltage at the collector of Q3 (and also the voltage at the base of Q4) is decreased because of R18 provided, while a current flows into Q4. This causes the voltage at the emitter of Q4. This is AGC voltage of bias voltage for IF amplifier and thus the gain of the IF amplifier is decreased.

The operation of RF AGC is such that the "-" voltage obtained by detecting the IF signal through D5 and D6 is applied across R3 connected in series with the 2nd gate bias circuit of RF amplifier; this reduces the voltage at the 2nd gate and, therefore, the gain is controlled. The S meter indicates signal strength utilizing the IF AGC voltage.

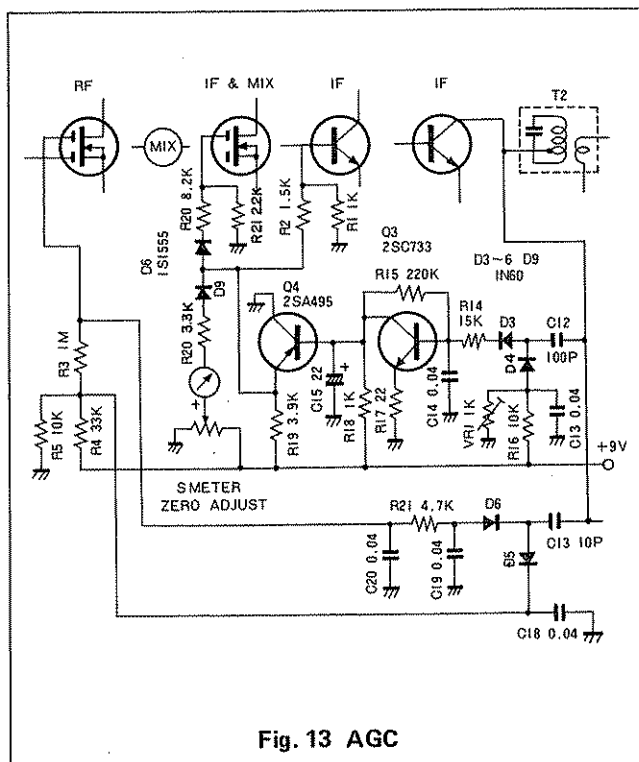


Fig. 13 AGC

4-8. DETECTOR CIRCUIT AND ANL (IF UNIT)

AM signal is detected by the diode linear detector circuit. The signal from the secondary side of T2 at the final IF stage passes through D1 where the "+" carrier is eliminated. The detected signal is fed to the filter consisting of R12 and C10 which produces envelopes for AF signal.

The ANL (automatic noise limiter) is a circuit using a diode connected in series between the detector output and the AF amplifier. This circuit is turned to ON and OFF by noise output for suppressing noise.

CW and SSB signals are detected by the balanced detector circuit. The CW/SSB signal from the final IF stage is fed through C16 to T3 and mixed with BFO signal at the balanced detector circuit consisting of T3, D7, D8, R22 and R23 and thereby the signal is converted into AF signal. The balanced detector circuit is simple in design but provides high efficiency; it is not saturated with a weak or strong signal.

BFO circuit is a Colpitts oscillator circuit of grounded base type. Since it is of Hi-C and Low-L configuration, it provides excellent temperature and drifting characteristics for SSB reception.

An emitter follower buffer is inserted between the BFO circuit and the detector circuit for impedance matching and for preventing frequency pulling effects.

The BFO frequency can be varied to $455 \text{ kHz} \pm 3 \text{ kHz}$ by the BFO PITCH control.

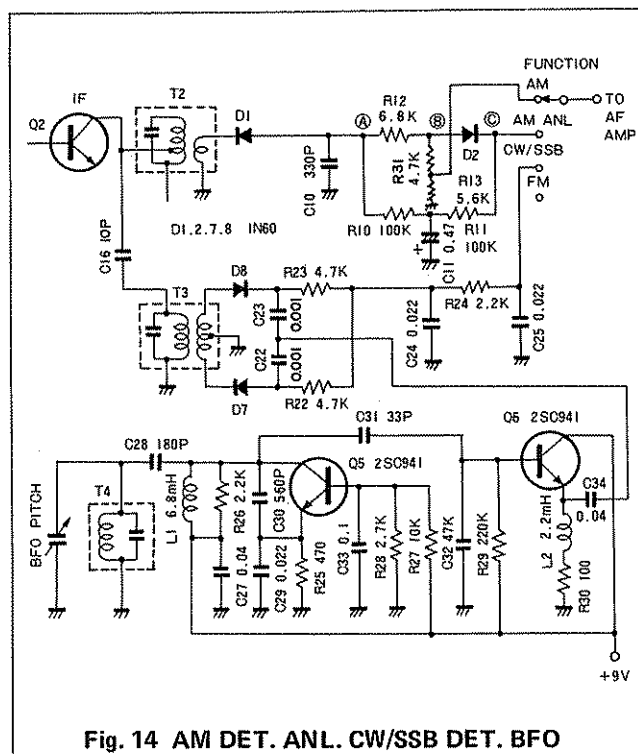
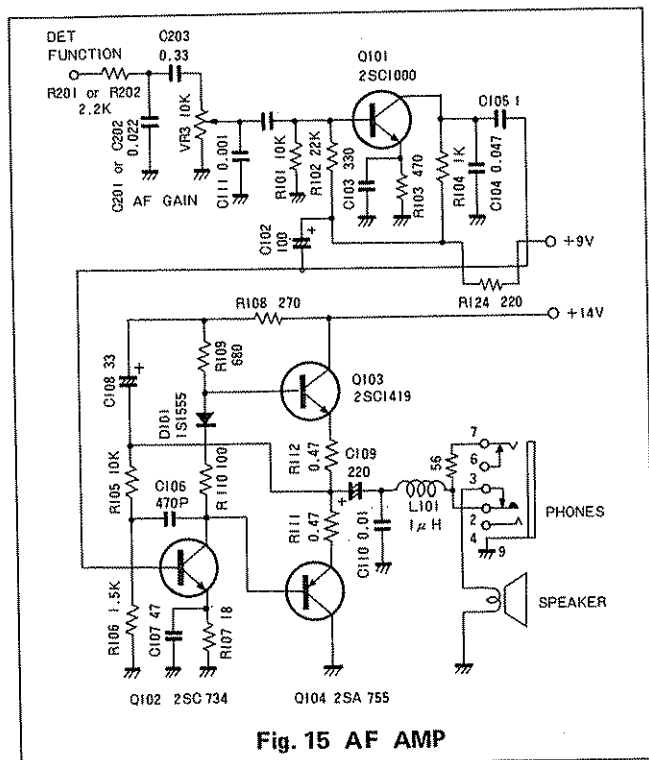


Fig. 14 AM DET. ANL. CW/SSB DET. BFO

4-9. AF AMPLIFIER (AF/PS UNIT)

The detected AF signal passes through AF GAIN volume and is amplified by the AF pre-amplifier Q101 2SC1000. The signal is then fed to the AF driver amplifier Q102 2SC734. To drive the push-pull power amplifier, the collector side of Q102 is rather complicated in design. The resistor R110 and the diode D101 are used to offer proper bias for Q103 and Q104, and the resistor R109 is used as a load resistor for Q102. The resistor R108 and the capacitor C108 are used to increase the load resistance to an equivalent level so that the gain of Q102 is raised.

The power amplifier is complementary OTL type; the arrangement of NPN and PNP transistors provides series operation for DC and parallel operation for AC. AF signal of the same phase is applied to the bases of Q103 and Q104, however, only Q103 operates with "+" signal and only Q104 with "-" signal. This is what is called the push-pull operation.

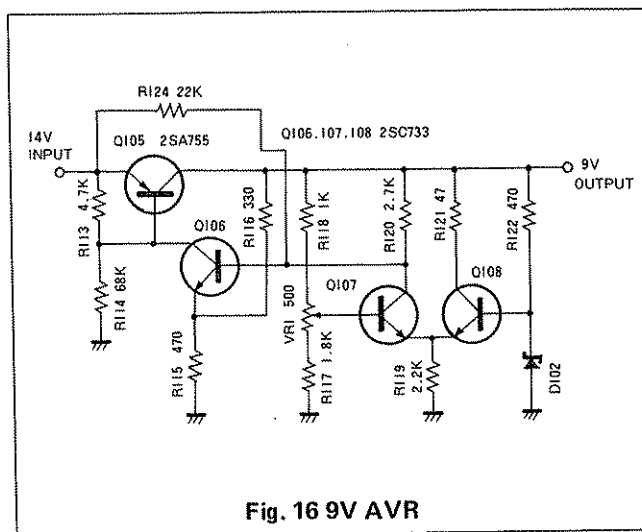


4-10. 9V POWER REGULATOR CIRCUIT (AF/PS UNIT)

For stabilized operation of the receiver, all the units are operated with 9V regulated power, except for AF power amplifier.

When a voltage of 10 ~ 15V is applied to the emitter of Q105, an output voltage of 9V is taken from the collector. If the output voltage is varied from 9V for any reason, the voltage variation is detected by the error voltage detector circuit (differential amplifier) composed of a 6V zener diode, Q107 and Q108. The detected voltage is amplified by Q106 and then applied to the base of Q105 so as to cancel the voltage variation, thereby the voltage is maintained at 9V.

The variable resistor VR1 is used to set the output voltage to 9V. This circuit also functions to protect the receiver against over-current due to shorting of 9V output power.



4-11. POWER CIRCUIT AND PILOT LAMP CIRCUIT

The power of AC 100V is stepped down by the power transformer and is applied to D103 and D104 so that full wave rectified voltage (B voltage) of 14 ~ 14.5V is obtained to operate the AF power amplifier and the power stabilizer circuit.

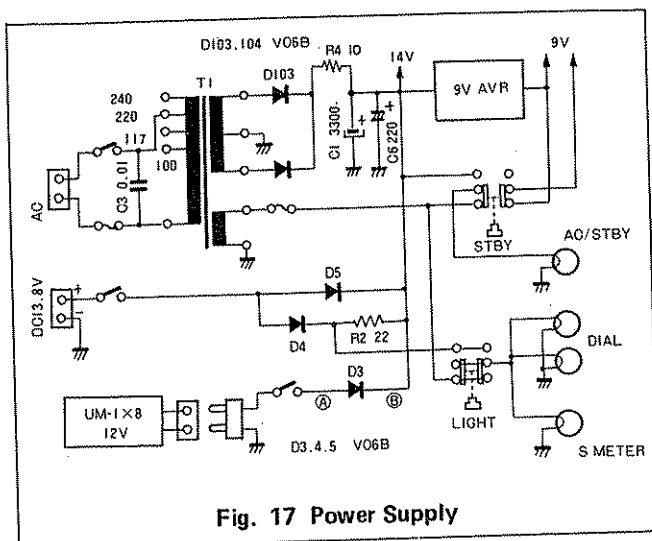
The diodes D3 and D5 at the built-in battery circuit and the external DC power circuit, both connected to the B voltage line, are used for protection against shorting of the B voltage line; also, it is used as automatic changeover switch for AC and DC power.

If the receiver is operated on AC power while the built-in batteries are connected, a voltage of 14V is impressed on the B side of D3 and a voltage of 12V on the A side, thus D3 is reversely biased and therefore it is turned to OFF and the current from the built-in batteries is shut off.

If, under such a condition, the AC cord is disconnected or the AC power is interrupted, the B side becomes 0V and D3 is turned to ON accordingly, allowing the receiver to operate on 12V of built-in battery voltage.

Pilot lamps are used for two different purposes; for illumination of the S meter and the dial and for indication of AC/STBY. Since the receiver is so designed that the current flowing into the lamps is larger than that flowing into the circuits, all the lamps are turned on only when necessary by means of respective switches. When the receiver is operated on an external power, the lamps are lit at normal voltage through D4, but when it is operated on the built-in batteries the current flowing into the lamps is reduced to the smallest possible level to save the battery power.

The AC/STBY lamp is lit when AC power is used and the receiver is in the standby mode.



SECTION 5. MAINTENANCE AND ALIGNMENT

5-1. REMOVING THE CABINET

Figure 18 shows how to remove the QR-666's cabinet. Remove the eight top cover screws and the twelve bottom cover screws and lift away the top cover and bottom cover. The battery leads will still be attached to the chassis, so be careful when removing the bottom cover. The battery leads can be unplugged, if necessary.

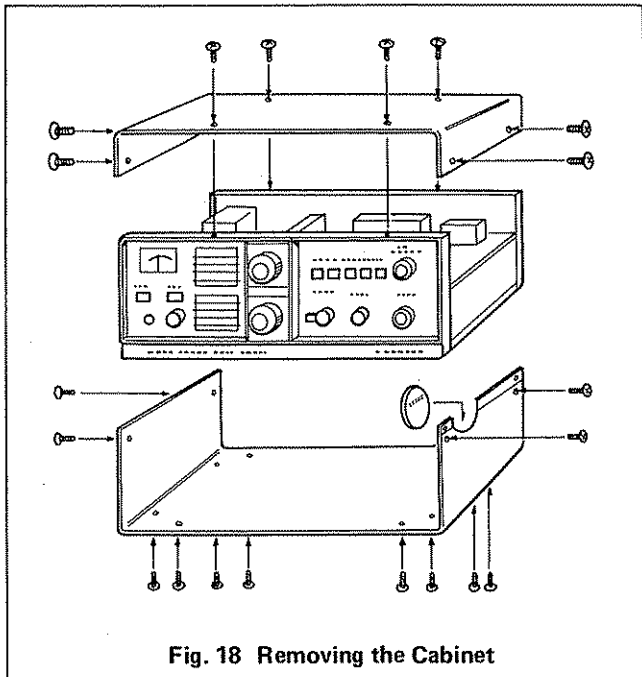


Fig. 18 Removing the Cabinet

5-2. SERVICE POSITION (see Fig. 19)

When adjusting coils and dial tracking of QR-666, place a stand under the receiver (or equipment) as shown in Fig. 19 for facilitated work. For adjustment of the coil pack, fully retract the rod antenna and remove the battery case. The IF unit can be adjusted through the adjusting hole on the rear panel.

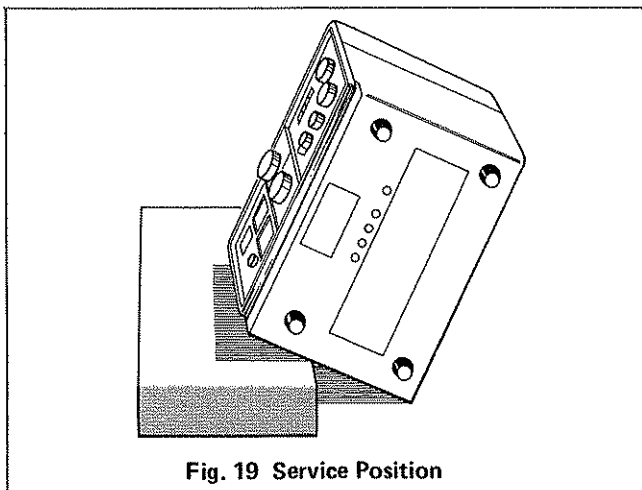


Fig. 19 Service Position

5-3. PRELIMINARY SETTINGS FOR ADJUSTMENT

- For accurate adjustments, use a test oscillator or signal generator capable of amplitude modulation in 170 kHz \sim 30 MHz. The adjustments can also be made with the 500 kHz marker generator (option), a dip meter or broadcast signal of known frequency.
- Control Settings:

BAND SPREAD:	Fully clockwise ("100" position on 100° scale)
RF GAIN:	Fully clockwise
AF GAIN:	Fully counterclockwise
ANT TRM:	Extreme right
BAND SELECTOR:	A
FUNCTION:	AM PUSH ON
SELECTIVITY:	PUSH NARROW
STBY:	OFF
BFO PITCH:	Center position
POWER:	OFF
- Connect AC cord and turn on POWER switches of the receiver and signal generator. Warm up the equipment for about 5 \sim 30 minutes.
- Prepare alignment tool and a small, flat blade screwdriver.

5-4. ADJUSTMENT WITH SIGNAL GENERATOR

- Set the signal generator in 400 Hz or 1,000 Hz, 30% amplitude modulation (modulation frequency and modulation degree may not necessarily be accurate).
- Turn AF GAIN knob clockwise until noise is heard from the receiver, then proceed to adjustments in the following table:
- For adjustment, use the S meter and obtain a peak point of received signal. Set the output of the signal generator so that the S meter indicates about "S9", making sure that the receiver is not overloaded.
- Do not move or turn the coils, trimmers and capacitor excessively. If a tuning point can not be obtained by slightly moving of these adjusting parts, it is an indication that something is wrong with the receiver.

Frequency signal generator	Band selector	Tuning dial frequency	Position of ANT TRM	Process	Location to be adjusted (A method of obtaining a peak point of S-meter)	Remarks
190 kHz	A	190 kHz	Full rightward	1	Rotate the core of A-band OSC coil until any signal can be heard. (L13)	When the output of a signal gener- ator (hereinafter referred to as SG) is required to be reduced any more, turn the RF GAIN knob counterclockwise.
				2	Core of A-band ANT coil (L1)	455 kHz IFT 455 kHz mechanical filter Adjust from the rear panel side.
				3	Core of A-band RF coil (L7)	
				4	Core of RF unit T1	
				5	Core of RF unit MF	
				6	Core of IF unit T1	
				7	Core of IF unit T2	
				8	Adjust the core of IF unit T3 and obtain the minimum deflection of S-meter.	
380 kHz	A	380 kHz	Full rightward	9	Rotate the trimmer capacitor of A-band OSC until any signal can be heard. (TC7)	
				10	Trimmer capacitor of A-band RF (TC1)	
190 kHz and 380 kHz	A	190 kHz and 380 kHz	Full rightward	11	Repeat the processes 1 ~ 3, 9 and 10 until the frequency of SG coincides with that of dial and the maximum signal can be obtained.	
600 kHz	B	600 kHz	Full rightward	12	Rotate the core of B-band OSC coil until any signal can be heard. (L14)	
				13	Core of B-band ANT coil (L2)	
				14	Core of B-band RF coil (L8)	
1,200 kHz	B	1,200 kHz	Full rightward	15	Rotate the trimmer capacitor of B-band OSC until any signal can be heard. (TC8)	
				16	Trimmer capacitor of B-band RF (TC2)	
600 kHz and 1,200 kHz	B	600 kHz and 1,200 kHz	Full rightward	17	Repeat the processes 12 ~ 16 in this order until the frequency of SG coincides with that of dial and the maximum signals can be obtained.	
1.3 MHz	C	1.3 MHz	Center	18	Rotate the core of C-band OSC coil until any signal can be heard. (L15)	
				19	Core of C-band ANT coil (L3)	
				20	Core of C-band RF coil (L9)	
2.8 MHz	C	2.8 MHz	Center	21	Rotate the trimmer capacitor of C-band OSC until any signal can be heard. (TC9)	
				22	C-band RF trimmer capacitor (TC3)	
			Refer to right column	23	It should be understood to be normal if the peak of S-meter can be obtained within the range of scale by rotating the ANT TRM.	When any peak can not be ob- tained, repeat the same adjust- ment after shifting the ANT TRM leftward by one of two scales from the center in the process 19.*

Frequency signal generator	Band selector	Tuning dial frequency	Position of ANT TRM	Process	Location to be adjusted (A method of obtaining a peak point of S-meter)	Remarks
1.3 MHz and 2.8 MHz	C	1.3 MHz and 2.8 MHz		24	Repeat the processes 18 ~ 23 in the ascending order until the frequency of SG coincides with that of dial and the maximum signal can be obtained.	
3.4 MHz	D	3.4 MHz	2nd scale from the center (Leftward)	25	Rotate the core of D-band OSC coil until any signal can be heard. (L16)	
				26	Core of D-band ANT coil (L4)	
				27	Core of D-band RF coil (L10)	
7.0 MHz	D	7.0 MHz	2nd scale from the center (Leftward)	28	Rotate the trimmer capacitor of D-band OSC until any signal can be heard. (TC10)	
				29	D-band RF trimmer capacitor. (TC4)	
			Refer to right column	30	It should be understood to be normal if the peak of S-meter can be obtained by rotating the ANT TRM within the range of scale.	When any peak can not be obtained, repeat the same adjustment after shifting the ANT TRM leftward further more in the process 26.
3.4 MHz and 7.0 MHz	D	3.4 MHz and 7.0 MHz		31	Repeat the processes 25 ~ 30 in the ascending order until the frequency of SG coincides with that of dial and the maximum signal can be obtained.	
8.0 MHz	E	8.0 MHz	Center	32	Rotate the core of E-band OSC coil until any signal can be heard. (L17)	When the dial of receiver is adjusted to the SG signal of 17 MHz, the dial may be tuned at two points. It should be noted that the higher point is resulted from the real signal, but the lower point is resulted from an image signal.
				33	Core of E-band ANT coil (L5)	
				34	Core of E-band RF coil (L11)	
17.0 MHz	E	17.0 MHz	Center	35	Rotate the trimmer capacitor of E-band OSC until any signal can be heard. (TC11)	
				36	E-band RF trimmer capacitor (TC5)	
17.0 MHz	E	17.0 MHz	Refer to right column	37	It should be understood to be normal if the peak of S-meter can be obtained within the range of scale.	When any peak can not be obtained, repeat the same adjustment after shifting the ANT TRM leftward further more in the process 33.
8.0 MHz and 17.0 MHz	E	8.0 MHz and 17.0 MHz		38	Repeat the processes 32 ~ 38 in the ascending order until the frequency of SG coincides with that of dial and the maximum signal can be obtained.	
19 MHz	F	19 MHz	Center	39	Rotate the core of F-band OSC coil until any signal can be heard. (L18)	When the dial of receiver is adjusted to the SG signal of 29 MHz, the dial may be tuned at two points if the SG signal is too strong. It should be noted that the higher point is resulted from the real signal, but the lower point is resulted from an image signal.
				40	Core of F-band ANT coil (L6)	
				41	Core of F-band RF coil (L12)	
				42	Core of RF unit T2 (4.034 MHz IFT)	
29 MHz	F	29 MHz	Center	43	Rotate the trimmer capacitor of F-band OSC until any signal can be heard. (TC12)	
				44	F-band RF trimmer capacitor (TC6)	

Frequency signal generator	Band selector	Tuning dial frequency	Position of ANT TRM	Process	Location to be adjusted (A method of obtaining a peak point to S-meter)	Remarks
29 MHz	F	29 MHz	Refer to right column	45	It should be understood to be normal if the peak of S-meter can be obtained within the range of scale.	When any peak can not be obtained, repeat the same adjustment after shifting the ANT TRM leftward further more in the process 42.
19 MHz and 29 MHz	F	19 MHz and 29 MHz		46	Repeat the processes 39 ~ 41, 43 ~ 45 in the ascending order until the frequency of SG coincides with that of dial and the maximum signal can be obtained.	

5-5. ADJUSTMENT WITH MARKER GENERATOR OR BROADCAST SIGNAL

For adjustment, the 500 kHz marker generator (option) may be used instead of SG. The generator may be calibrated using standard frequencies (2.5 MHz, 5 MHz, 10 MHz, 15 MHz, etc.) of WWV or the like to ensure accurate adjustments.

Adjustments with broadcast signals are also possible. In this case, receive a broadcast of known frequency and adjust the dial setting to the frequency.

5-7. DIAL CORD STRINGING

For replacement of the dial cord, refer to Fig. 20.

When the dial cord is to be replaced, be sure to use the specified dial cord to prevent slipping or back-lash.

1. Cut a dial cord of 3.54 feet (1.08 m) for the main dial, and 3.87 feet (1.18 m) for the spread dial. The dial cord must be free of kinks.
2. With the dial pulley turned fully clockwise, tie the end of the dial cord to the spring (see illustration "A"). Pull the spring and hook it on the boss of the pulley.

5-6. BFO ADJUSTMENT

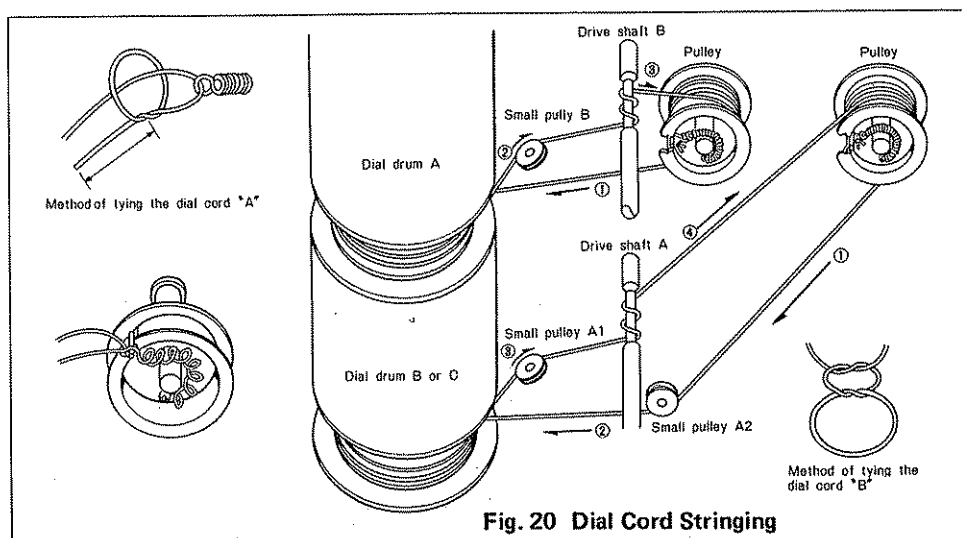
Adjustment of BFO frequency can be made in the following manner:

1. Receive a signal and set the S meter to maximum deflection.
2. Set FUNCTION to CW/SSB and BFO PITCH knob to the center position.
3. Adjust the core of T4 "IF UNIT COIL ADJUST" until zero-beat is obtained.
4. Turn BFO PITCH knob clockwise and counterclockwise to check that a beat of the same tone is heard. Now the adjustment is completed.

3. Wind the longer end of the dial cord a half turn in the clockwise direction around the pulley. Then wind the cord 2 turns around the dial drum and as many turns around the pulley according to the numerical order (see Fig. 20).

Tie the shorter end of the dial cord to the other end. (see illustration "B").

4. Remove the spring from the boss of the pulley, correct the tension of the cord and adjust the scale of the dial drum for correct setting.



5-8. FUSE AND PILOT LAMP REPLACEMENT

The fuse and pilot lamp can be replaced by removing the cover on the top of the cabinet.

When the fuse blows, there is something wrong. Be sure to find the cause before attempting operation. *Use a 200mA fuse for 117VAC operation, and a 80mA fuse for 220/240VAC operation.*

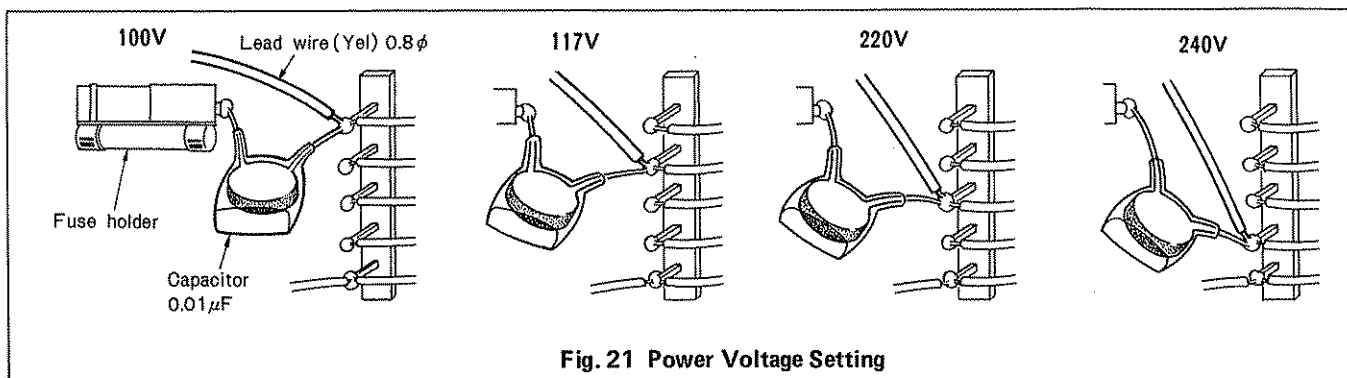
Replace the pilot lamp with a new one of the same rating; the dial lamp is rated at 12V 1.5A, AC/STBY lamp at 8V 50mA and S meter lamp at 12V 1.5A.

The replacement of pilot lamps are available from your dealer.

5-9. POWER VOLTAGE SETTING

Your QR-666 is preset to operate on 117V or 220V AC power before shipment. If the receiver is to be operated on any

other line voltage, change the connection of the wiring according to the instructions given in Fig. 21.



5-10. REPLACEMENT PARTS

The transistors in QR-666 can easily be damaged by being shorted or shocked by metallic tools. Be very careful during service operations, and when possible, use insulated tools. Be sure to use replacement parts of equal or better ratings when servicing the receiver.

When ordering replacement or spare parts for your equipment, be sure to specify the following information: Model number and serial number of the equipment—Schematic number of the part—and the printed circuit board number on which the part is located.

Should it ever be necessary to return the equipment for repair, be sure to pack it very care fully and include a full description of the problems involved.

MHz FM broadcast band and a 10.7 MHz IF circuit. It provides high quality FM reception when installed in QR-666. The detailed information of QR-6MK and QR-6FM can be obtained from your dealer.

5-11. INSTALLATION OF MARKER UNIT (QR-6MK) AND FM UNIT (QR-6FM)

QR-666 is designed to be used with the 500 kHz marker generator (QR-6MK) and the 87.5 ~ 108 MHz FM tuner (QR-6FM), both prepared as optional accessories.

QR-6MK is a 500 kHz crystal oscillator, permitting reading of accurate frequency on the dial by the use of higher harmonics signals.

It offers a great convenience as a signal source of accurate frequency at readjustment.

QR-6FM includes a front end circuit covering 87.5 ~ 108

SECTION 6. TROUBLESHOOTING

6-1. GENERAL INFORMATION

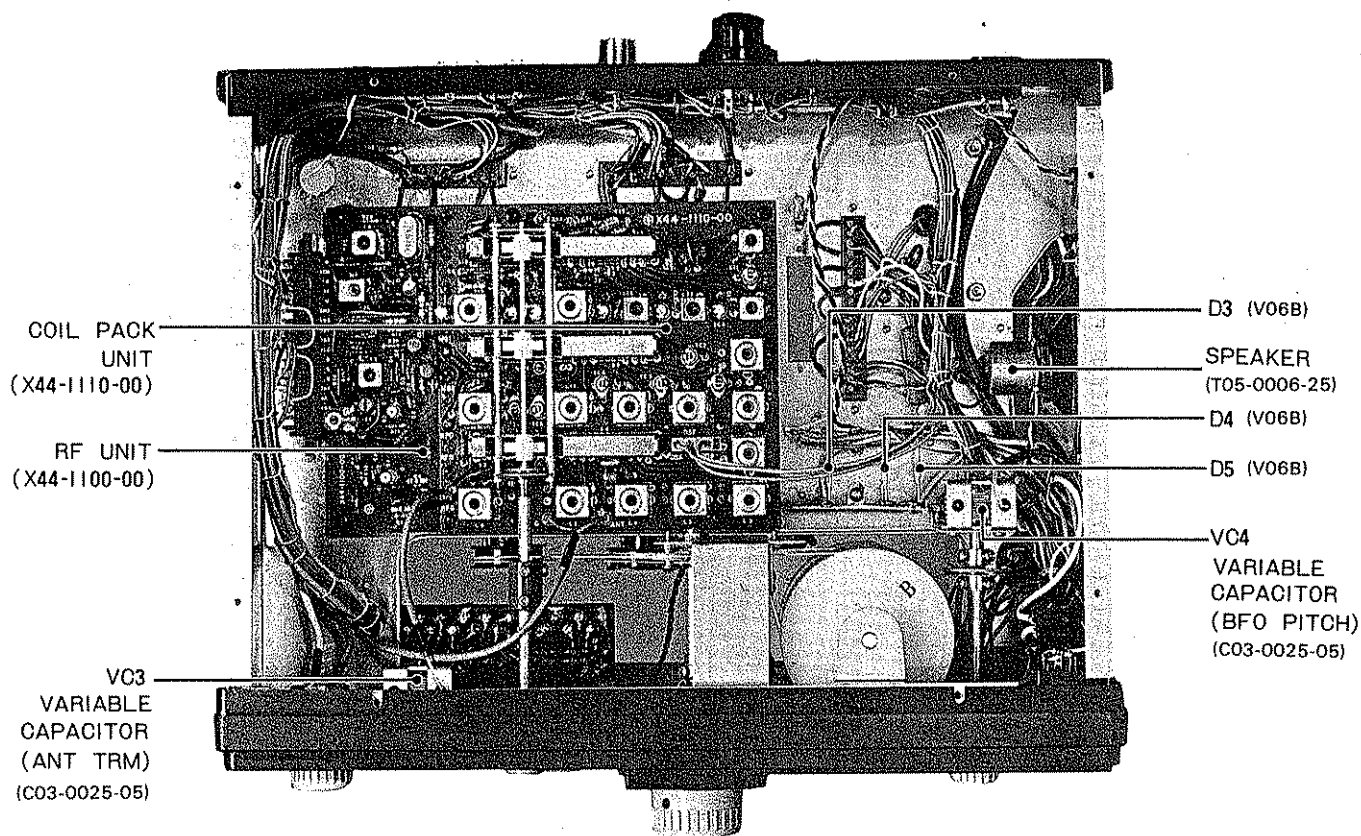
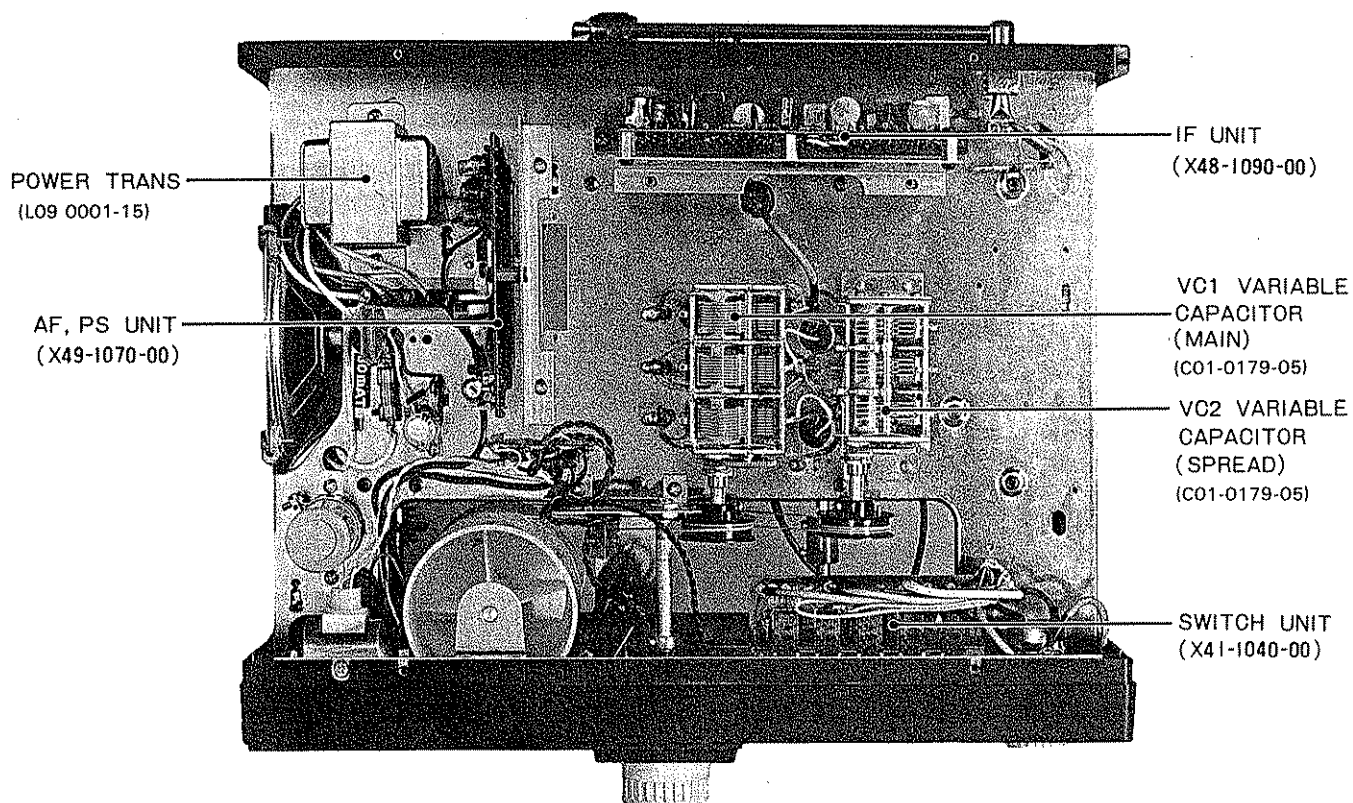
The problems described in this table are failures caused in general by improper operation or connection of the receiver, not by defective components. There is separate service manual for repair of the QR-666.

SYMPTOMS	CAUSE	REMEDY
Pilot lights do not light and there is no receiver noise when the Power switch is turned on.	1. Bad power cable or connections. 2. Blown power supply fuse. 3. Wrong polarity connection for DC operation.	1. Check cables and connections. 2. Replace the fuse 3. Check for a negative ground power connection.
Pilot lights is lighted and there is no receiver noise when the Power switch is turned on.	1. STBY switch is on. 2. Plug is disconnected from REMOTE socket. 3. FUNCTION switch is OFF or in FM BC position (QR-6MK is not installed)	1. Set STBY switch to OFF. 2. Insert plug into REMOTE socket. 3. Set FUNCTION switch to AM, AM-ANL or CW/SSB.
Receiver noise is heard but no signal is received.	1. RF GAIN is in low position. 2. Antenna is incorrectly connected.	1. Turn RF GAIN to it's fully clockwise position. 2. Connect antenna correctly.

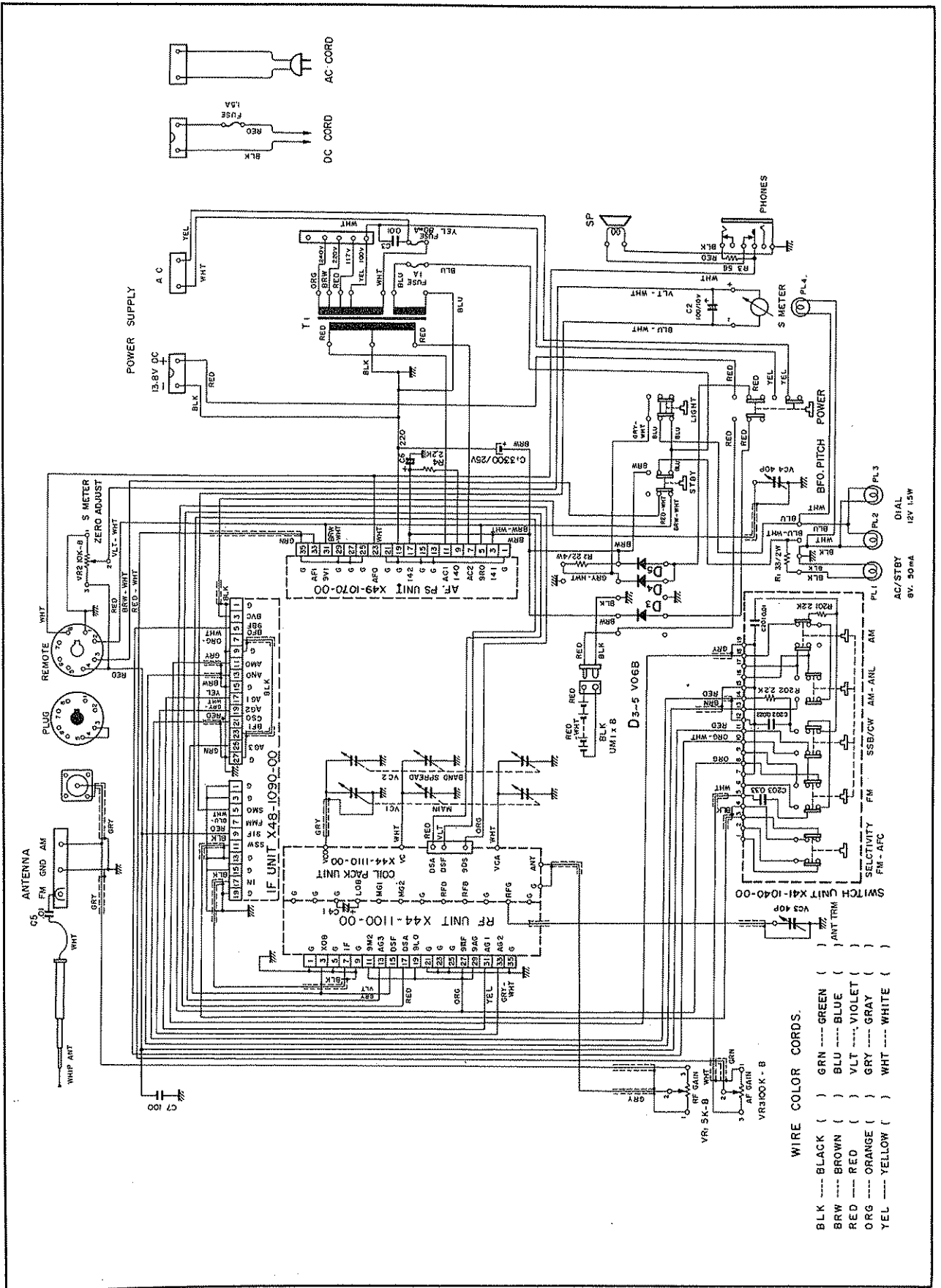
6-2. OPERATING VOLTAGE OF TRANSISTOR AND FIELD EFFECT TRANSISTOR (AT NO SIGNAL)

No.	Electrode	E	C	B	G2	REMARKS
	Transistor	S	D	G1		
RF UNIT (X44-1100-00)						
Q1	3SK35	0.9	8.2	0	0.35	BAND A~E BAND F
Q2	3SK35	1.0	8.3	0	0	
		0.75	8.3	0	0	
Q3	3SK35	0.35	8.7	0	0.55	BAND F
Q4	2SC460	2.7	8.8	0.7		
COIL PACK UNIT (X44-1110-00)						
Q1	2SK19	0.9	8.2	-0.85		
Q2	2SC460	2.3	8.2	2.5		
IF NUIT (X48-1090-00)						
Q1	2SC941	0.6	9.0	1.2		
Q2	2SC941	0.2	8.9	0.8		
Q3	2SC733	0.9	5.2	0.7		
Q4	2SA495	3.1	0	5.2		
Q5	2SC941	1.2	8.9	1.8		
Q6	2SC941	0.4	9.0	0.95		
AP/PS UNIT (X49-1070-00)						
Q101	2SC1000	1.8	4.2	2.4		
Q102	2SC734	0.15	5.9	0.75		
Q103	2SC1419	6.5	13.8	7.1		
Q104	2SA755	6.5	0	5.9		
Q105	2SA755	13.8	9.0	12.8		
Q106	2SC733	5.3	12.8	5.8		
Q107	2SC733	5.2	5.8	5.2		
Q108	2SC733	5.2	9.0	5.8		

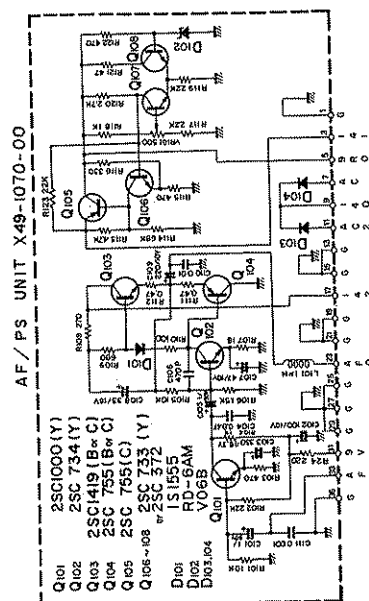
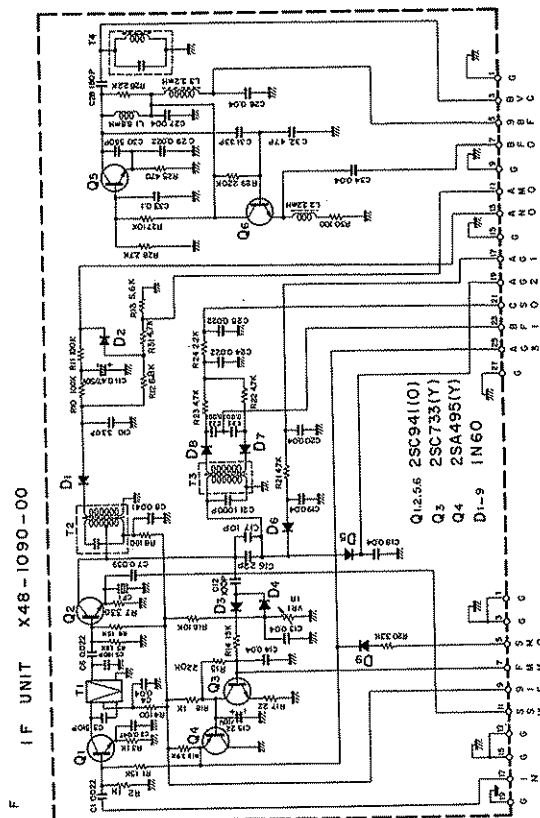
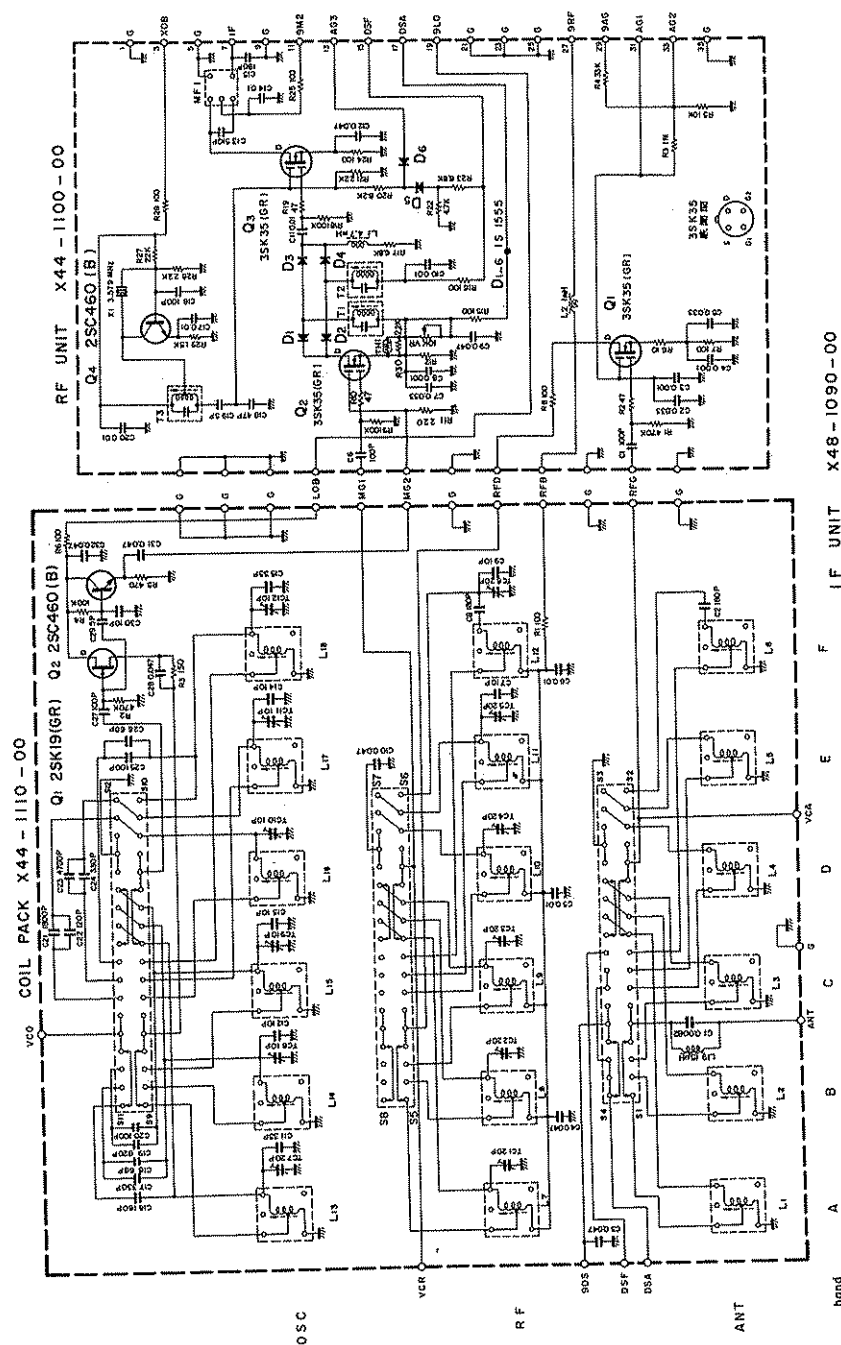
TOP & BOTTOM VIEW OF THE QR-666



QR-666 SCHEMATIC DIAGRAM



QR-666 PRINTED BOARD SCHEMATIC DIAGRAM





Manufactured by TRIO ELECTRONICS, INC., Tokyo, Japan