



# ALL BAND COMMUNICATIONS RECEIVER

## Model R-599



### OPERATING MANUAL



## COMMUNICATIONS RECEIVER

# Model R-599



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# KENWOOD R-599 SPECIFICATIONS

RECEIVING FREQUENCY RANGE: .. 1.8 MHz Band — 1.80 to 2.30 MHz  
 3.5 MHz Band — 3.50 to 4.00 MHz  
 7.0 MHz Band — 7.00 to 7.50 MHz  
 14.0 MHz Band — 14.00 to 14.50 MHz  
 21.0 MHz Band — 21.00 to 21.50 MHz  
 28.0 MHz Band — 28.00 to 28.50 MHz  
 28.5 MHz Band — 28.50 to 29.10 MHz  
 29.1 MHz Band — 29.10 to 29.70 MHz  
 50.0 MHz Band — 50.00 to 53.40 MHz\*  
 144.0 MHz Band — 144.00 to 147.4 MHz\*\*  
 \* with CC-69 \*\* with CC-29  
 WWV 10.00 MHz

TYPE OF RECEPTION: ..... SSB, CW, AM, and FM

ANTENNA INPUT IMPEDANCE: .... 50 to 75 ohms (unbalanced)

SENSITIVITY: ..... SSB: \* or more  
 1.8-21 MHz Bands 0.5  $\mu$ V S/N 10 db\*  
 28 MHz Band 1.5  $\mu$ V S/N 10 db\*  
 50 MHz Band 1.5  $\mu$ V S/N 10 db\*  
 144 MHz Band 2.0  $\mu$ V S/N 10 db\*  
 AM: \* or more  
 1.8-21 MHz Bands 2.0  $\mu$ V S/N 10 db\*  
 28 MHz Band 4.0  $\mu$ V S/N 10 db\*  
 50 MHz Band 2.0  $\mu$ V S/N 10 db\*  
 144 MHz Band 3.0  $\mu$ V S/N 10 db\*

IMAGE RATIO: ..... More than 50 db

IF INTERFERENCE: ..... More than 50 db

SELECTIVITY: ..... SSB: More than  $\pm 1.1$  kHz (at — 6 db)  
 Less than  $\pm 2.5$  kHz (at — 60 db)  
 CW: More than  $\pm 250$  Hz (at — 6 db)  
 Less than  $\pm 750$  Hz (at — 60 db)  
 AM: More than  $\pm 2.5$  kHz (at — 6 db)  
 Less than  $\pm 5.0$  kHz (at — 60 db)  
 FM: More than  $\pm 10$  kHz (at — 6 db)  
 Less than  $\pm 40$  kHz (at — 20 db)

FREQUENCY STABILITY: ..... Within  $\pm 2$  kHz for 60 minutes from one minute after switching on the set.  
 Within 100 Hz after 15 minutes.

AF OUTPUT ..... More than 1 watt (at 10% noise output)

LOAD IMPEDANCE: .... 4 to 16 ohms

SEMICONDUCTOR COMPLEMENT: .. 6 FET  
 1 IC  
 25 Transistors  
 33 Diodes  
 2 Zener Diodes  
 1 Variable Capacitor

POWER CONSUMPTION: ..... AC: Less than 15 W  
 DC: Less than 1A (at 13.8 V)

POWER REQUIREMENT: ..... AC: 100/117/220/240 V, 50/60 Hz  
 DC: 12 to 15 volts

DIMENSIONS: ..... 10-1/8" wide  
 5-1/2" high  
 12-7/32" deep

WEIGHT: ..... 12.54 pounds

# SECTION ONE INSTALLATION

## 1-1 UNPACKING

Carefully lift the receiver out of the packing material and inspect for visible damage. If the receiver has been damaged, notify the shipping company. Check the tuning controls and switches for freedom of movement and verify that the equipment included with the receiver is as listed below:

- |                         |                    |
|-------------------------|--------------------|
| 1 16-pin connector plug | 1 Operating manual |
| 1 2-pin connector plug  | 2 Leg extensions   |

## 1-2 INSTALLATION

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

## POWER

Determine the type and voltage rating of the power available and set the **VOLTAGE SELECTOR**, on the rear panel of the receiver accordingly.

## ANTENNA

Connect any antenna having an impedance of 50 to 75 ohms to the appropriate antenna connector on the rear panel of the receiver.

## SPEAKER

Connect a good quality speaker with an input impedance of 4 to 16 ohms to the **SPEAKER** terminals.

## GROUND

Connect the **GND** terminal to a good earth ground.

## 1-3 INTERCONNECTION OF EQUIPMENT

When the R-599 receiver is to be used with the T-599 transmitter, proceed as illustrated in Figure 1.

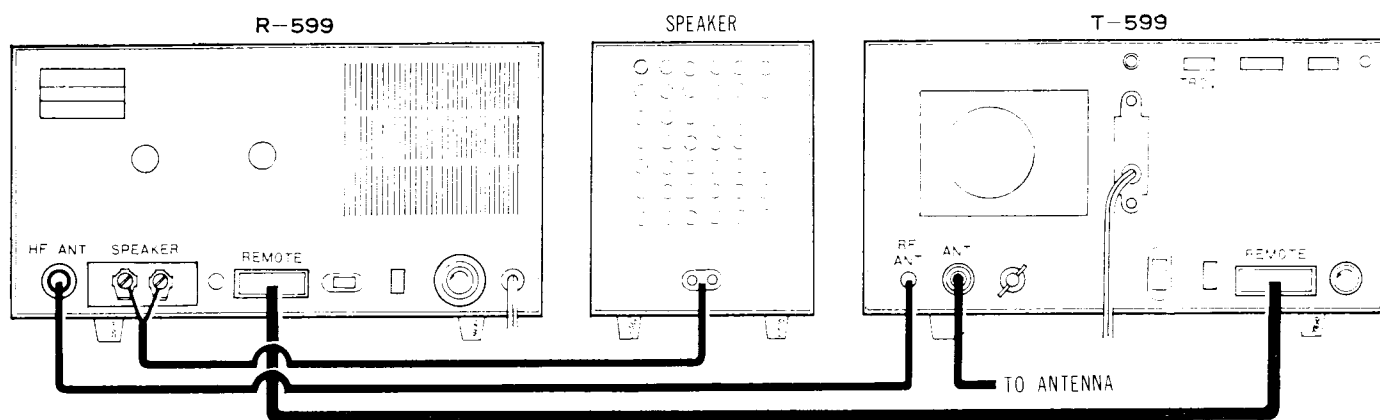
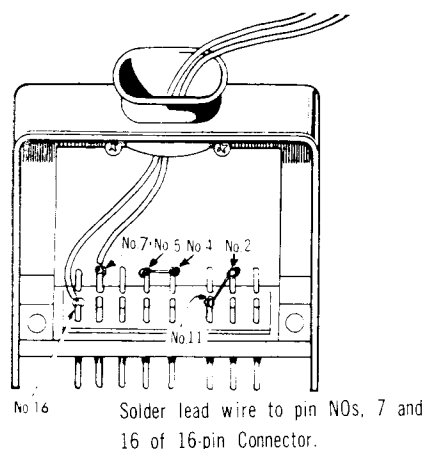
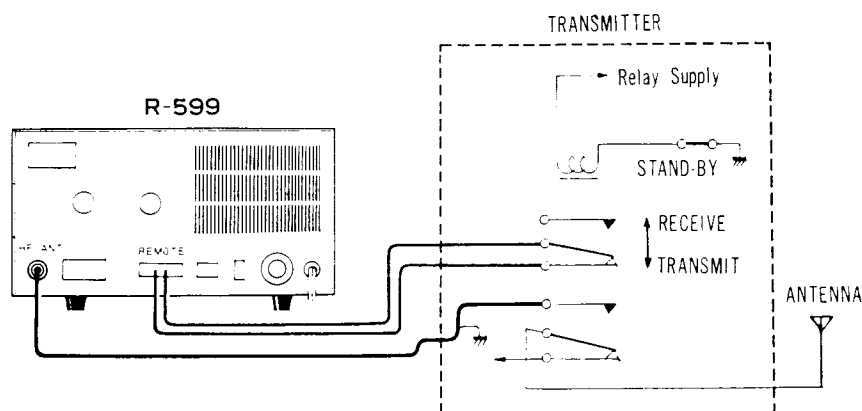


Fig. 1 Connection Diagram for R-599 and T-599



(a) Connection Diagram of Socket



(b) Connection of Transmitter.

Fig. 2 Connection Diagram for R-599 and another Transmitter

## 1-4 INSTALLATION OF FIXED CHANNEL CRYSTALS

Inside the R-599 is a printed circuit board which uses a fixed channel oscillator to control the 1st mixer output. This crystal control permits spot frequency reception.

The fixed channel oscillator has space for 5 channel crystals, one of which can be selected by the CH SELECT switch on the printed circuit board. Therefore the receiver can receive a single, or spot, frequency on the band to which the receiver is switched. The same crystal will have different frequencies, depending on the band selected.

The crystal frequency lies in the range of 4.9 to 5.5 MHz and is determined by an inverse relationship with the receiving frequency.

For instance:

| Receiving Frequency | Crystal Frequency |
|---------------------|-------------------|
| 14.0 MHz            | 5.5 MHz           |
| 14.1 MHz            | 5.4 MHz           |
| 14.2 MHz            | 5.3 MHz           |
| 14.3 MHz            | 5.2 MHz           |
| :                   | :                 |
| :                   | :                 |
| 14.6 MHz            | 4.9 MHz           |
| 7.0 MHz             | 5.5 MHz           |
| 7.1 MHz             | 5.4 MHz           |
| etc.                |                   |

### Crystal Specifications:

Type: HC-25/U or HC-6/U (one socket)  
Oscillation: Fundamental frequency  
Temperature Tolerance:  $\pm 0.002\%$

When the CH SELECT switch is put in the VFO position the receiver VFO is used instead of one of the channel crystals.

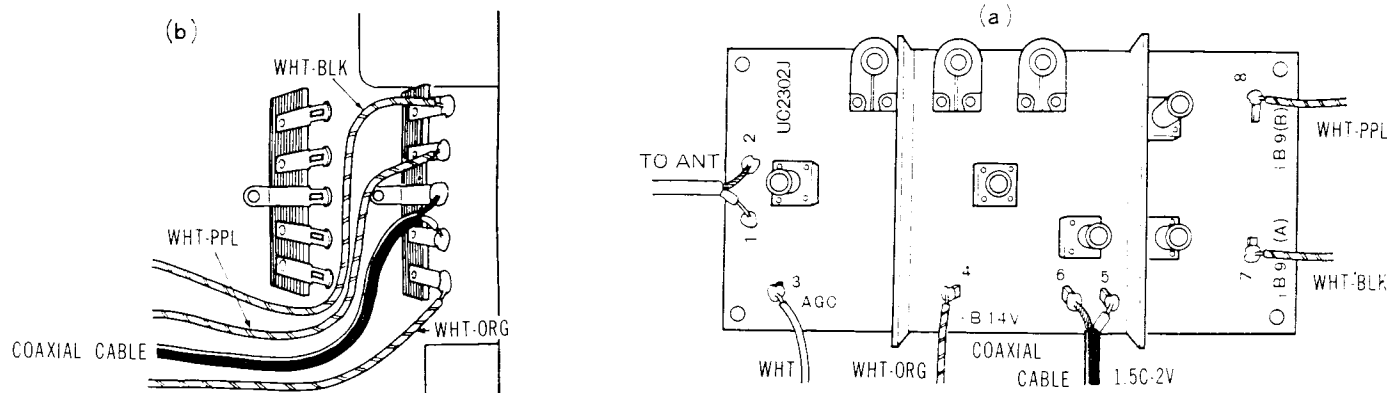


Fig. 3 Mounting of 50 MHz Converter

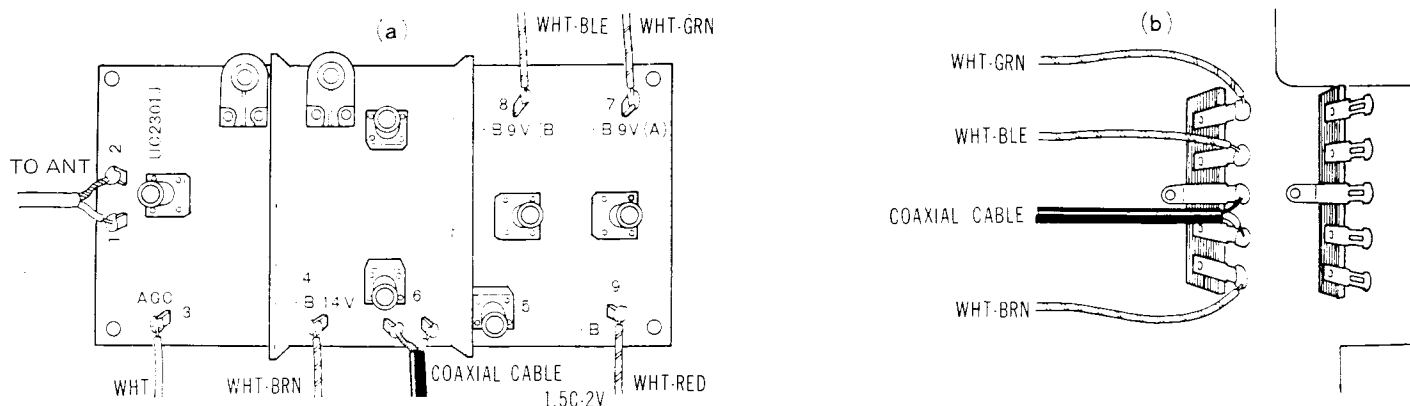


Fig. 4 Mounting of 144 MHz Converter

## 1-5 INSTALLATION OF VHF CONVERTERS

### 50 MHz CONVERTER (MODEL CC-69)

To install the 50 MHz converter in the R-599 receiver, refer to Figure 3 and proceed as follows:

Remove the outer case from the R-599 receiver.

Solder the wires furnished with the converter to the terminals of the printed circuit board as shown in Figure 3.

Locate the designated mounting place for the converter on the chassis of the R-599.

Place the converter on the chassis making sure that the mounting holes are properly aligned and secure it with four hexagon mounting screws.

Remove the patch plate from the rear panel and attach the antenna connector for the 50 MHz band to the rear panel.

Solder the lead wires from the converter to the receiver as illustrated in Figure 3.

Solder the lead from the AGC terminal of the converter to the AGC terminal of the RF unit (UC1120J).

Solder the lead wire from the +9 volt terminal of the converter to the 50 MHz position of the band switch of the R-599. This completes installation of the 50 MHz converter.

### 144 MHz CONVERTER (MODEL CC-29)

To install the 144 MHz converter in the R-599, refer to Figure 4 and proceed as follows:

Remove the outer case from the R-599 receiver.

Solder the lead wires supplied with the converter to the terminals of the printed circuit board of the converter as illustrated in Figure 4.

Locate the designated mounting place for the converter on the chassis of the receiver and screw four hexagon mounting screws, furnished with the converter, into the chassis.

Position the converter on the mounting screws, making sure that the mounting holes are aligned and then secure with the four mounting screws.

Remove the patch plate from the rear panel and install the antenna connector for the 144 MHz antenna.

Solder the leads from the converter to the R-599 as illustrated in Figure 4.

Solder the lead wire from the AGC terminal of the converter to the AGC terminal of the RF unit (UC1102J).

Solder the lead wire from the +9 volt terminal of the converter to the 144 MHz position of the band switch of the receiver. This completes installation.

## SECTION TWO OPERATION

### 2-1 FRONT PANEL CONTROLS AND THEIR FUNCTION

#### MAIN BANDSWITCH (1 on Figure 5.)

The main BAND switch is a 10 position rotary switch that selects the desired band of operation (1.8 to 29.1 MHz, an external band, or WWV at 10 MHz).

#### AUXILIARY BANDSWITCH (2 on Figure 5.)

The auxiliary BAND switch is a 5 position rotary switch that selects either HF or VHF operation. With this switch set to the HF position the desired band of operation is selected by the main BAND switch. When set to the 50A or 50B or 144A or 144B position, 50 or 144 MHz converters (available as optional accessories) are connected to the input of the R-599.

#### POWER (3 on Figure 5.)

When the POWER switch is set to the ON position, operating power is applied to all receiver circuits.

#### RIT (Receiver Incremental Tuning Control) (4 on Figure 5.)

This control provides for fine adjustment of the receiver frequency when the R-599 is operated in the transceive mode with the T-599 transmitter. The RIT circuit is disabled when the switch is pulled out.

#### PRESELECTOR (5 on Figure 5.)

This control adjusts the RF amplifier for maximum gain and selectivity at any desired operating frequency. This control should be adjusted to provide a maximum S-meter reading when the receiver is tuned to the desired frequency.

#### SQUELCH (6 on Figure 5.)

With this control set to the OFF position, maximum counterclockwise, the squelch circuit is disabled. Advancing the control in a clockwise direction activates the circuit and sets the squelch threshold.

#### VFO SELECT — SELECTIVITY (7 and 8 on Figure 5.)

This is a composite control consisting of a VFO selector and a filter selector switch.

The VFO SELECT, a 4 position rotary switch forming the inner knob of this control, selects the desired VFO. When the R-599 is operated in the combined mode with the T-599 transmitter this switch performs the following functions:

| Position | Function                                                                                        |
|----------|-------------------------------------------------------------------------------------------------|
| NORM     | The R-599's and T-599's VFO operates independently.                                             |
| RX       | The R-599 VFO is activated for transmission and reception.                                      |
| TX       | The T-599 VFO is activated for transmission and reception.                                      |
| REV      | The T-599 VFO controls the receive frequency and the R-599 VFO controls the transmit frequency. |

When the R-599 receiver is not operated in the combined configuration this control should be left in the NORM position.

The SELECTIVITY control is a 5 position rotary switch that forms the outer knob. When set to the AUTO position, the appropriate filter for the desired mode of operation is automatically selected. In the other positions it provides the following functions:

| Position | Function                  |
|----------|---------------------------|
| LSB, USB | Selects a 2.5 kHz filter. |
| CW       | Selects a 500 Hz filter.  |
| AM, AM.N | Selects a 5.0 kHz filter. |
| FM       | Selects a 25 kHz filter.  |

#### RF ATT — AF GAIN (9 and 10 on Figure 5.)

This is a composite control that adjusts the level of the AF output or the RF input signal. The AF GAIN is the outer knob, the RF ATT is the inner knob. The RF ATT is a precision step attenuator, selectable in 20 db steps, from 0 to 60 db.

#### PHONES (11 on Figure 5.)

This jack accepts a standard plug for headphone operation.

#### FUNCTION (12 on Figure 5.)

This switch is a 6 position rotary switch that provides the following functions:

| Position | Function                                                                                                                       |
|----------|--------------------------------------------------------------------------------------------------------------------------------|
| STBY     | Places the receiver in the standby mode.                                                                                       |
| MONI     | Provides a low level monitor signal from the transmitter output when operated in the combined mode with the T-599 transmitter. |
| SLOW     | Selects a slow AGC action.                                                                                                     |
| FAST     | Selects a fast AGC action.                                                                                                     |
| 100 kHz  | Selects a 100 kHz marker signal.                                                                                               |
| 25 kHz   | Selects a 25 kHz marker signal.                                                                                                |

#### MODE (13 on Figure 5.)

This control is a 6 position rotary switch that selects the CW, LSB, USB, AM, AM mode with a noise limiter, or the FM mode of operation.

#### S-METER (14 on Figure 5.)

The S-meter indicates the level in db of the received signal. The meter is calibrated so that a 40 microvolt input signal will produce an S-9 reading on the meter.

#### READING THE FREQUENCY INDICATING DIAL

(15 on Figure 5.)

The main dial has black and red graduations and is indexed at 500 Hz intervals over the range 0-25 and 25-50. The subdial has alternate blue and red graduations at 25 kHz intervals over the range of 0-600 kHz. To read the receive frequency, add the band + subdial + main dial. Example: Band — 14 MHz, the subdial is between 200

and the first 25 kHz graduation, and the main dial is at 18. The frequency is then the sum of  $14,000 + 200 + 18$  which equals 14.218 MHz. If the subdial was set between the first and second 25 kHz graduation, the frequency is then read as  $14,000 + 200 +$  the red scale of the main dial. Example:  $14,000 + 200 + 45 = 14.245$  MHz.

#### CALIBRATING THE FREQUENCY INDICATING DIAL

Set the FUNCTION switch to the 100 kHz CAL position. Set the BAND switch to the desired band of operation.

Rotate the tuning knob until zero beat is heard in the receiver speaker.

Depress the main tuning dial and rotate it until the zero graduation is exactly under the indicating mark. This completes the dial calibration to the nearest 100 kHz.

If more precise calibration is desired, proceed as follows:

Tune the main dial to the 25 kHz mark nearest the desired frequency of operation.

Set the FUNCTION switch to the 25kHz CAL position and zero beat the marker signal.

Depress the main tuning dial and rotate it until the zero graduation is exactly under the indicating mark. This completes the dial calibration to the nearest 25 kHz.

## 2-2 REAR PANEL CONTROLS AND TERMINALS

### HF ANT (1 on Figure 6.)

The HF ANT is an input for an antenna having an impedance of 50 to 75 ohms in the frequency range of 1.8 to 29.7 MHz.

### SPEAKER (2 on Figure 6.)

The SPEAKER terminal is a connection for a 4 to 16 ohm speaker.

### REMOTE (3 on Figure 6.)

This connector provides facilities for combined operation of the R-599 receiver and the T-599 transmitter using the cable supplied.

If operation with a transmitter other than the T-599 is desired, the plug supplied with the R-599 must be wired to accomplish muting of the receiver during the time the transmitter is in operation. For this type of operation, proceed as illustrated in Figure 2.

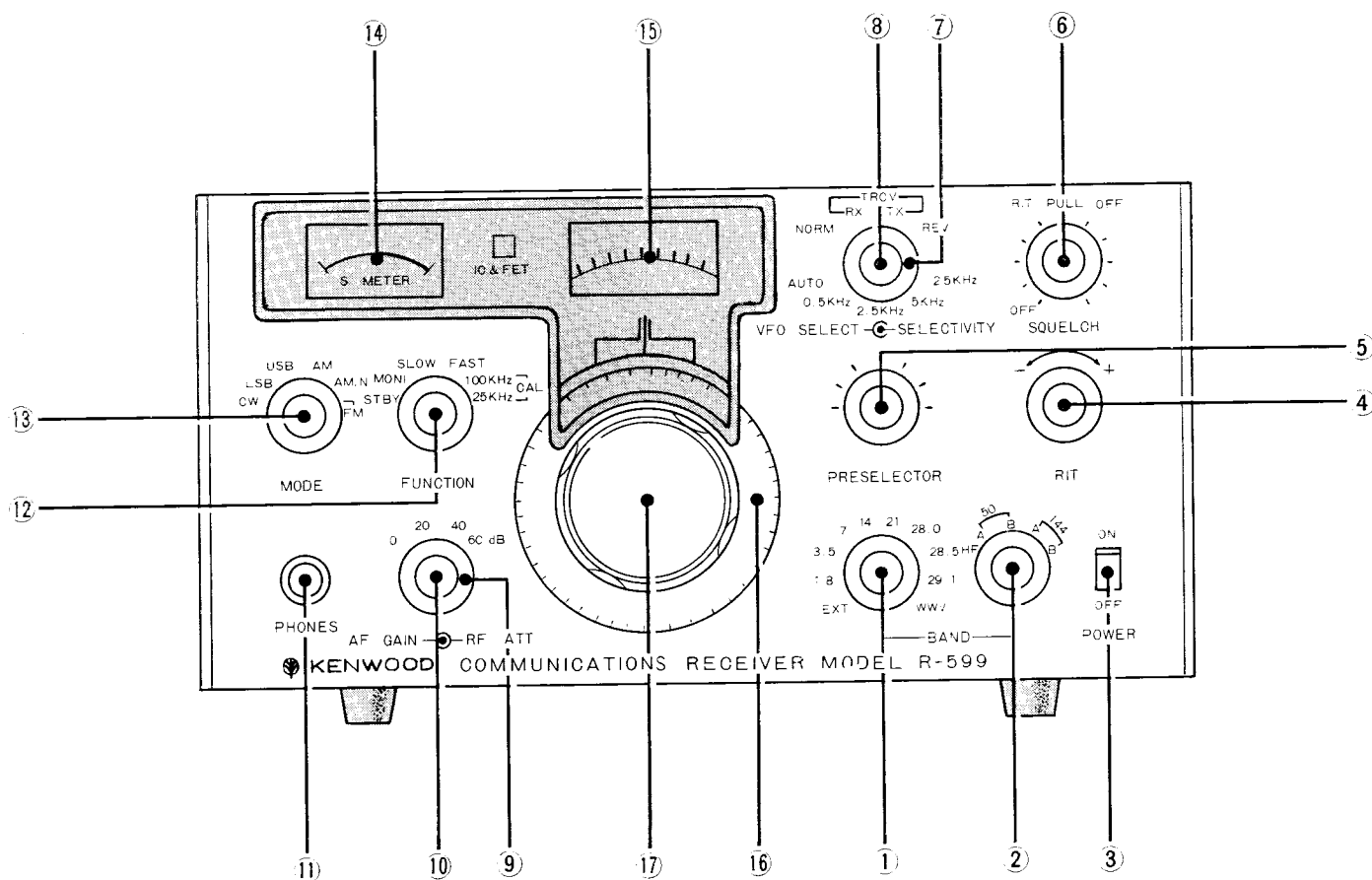


Fig. 5 Front Panel



**DC INPUT TERMINALS** (4 on Figure 6.)

This input terminal is for a 12 VDC source with a 1 amp current capacity.

**AC-DC** (5 on Figure 6.)

This is a 2 position slide switch that selects a DC or AC input.

**VOLTAGE SELECTOR** (6 on Figure 6.)

This switch selects an input voltage of 100, 117, 220 or 240 for the AC source.

**AC POWER CORD** (7 on Figure 6.)

This connects the receiver to the AC source.

**VHF ANTENNA** (8 and 9 on Figure 6.)

These input terminals are for a VHF antenna in the 50 and 144 MHz bands respectively, with an impedance of 50 to 75 ohms. Before operating the receiver, the described controls should be set as described in the next section.

**2-3 PRELIMINARY SETTINGS**

Before operating the R-599, be sure the operating controls are in the following positions:

| Switch         | Position                  |
|----------------|---------------------------|
| POWER          | OFF                       |
| BAND           | Desired Band of Operation |
| RF ATT         | 0 db                      |
| AF GAIN        | Center Scale              |
| MODE           | Desired Mode of Reception |
| FUNCTION       | FAST                      |
| PRESELECTOR    | Center Dial               |
| SELECTIVITY    | AUTO                      |
| SQUELCH        | OFF                       |
| AC-DC SELECTOR | Type of Input Power       |

When the above steps have been completed, proceed as follows to place the receiver into operation:

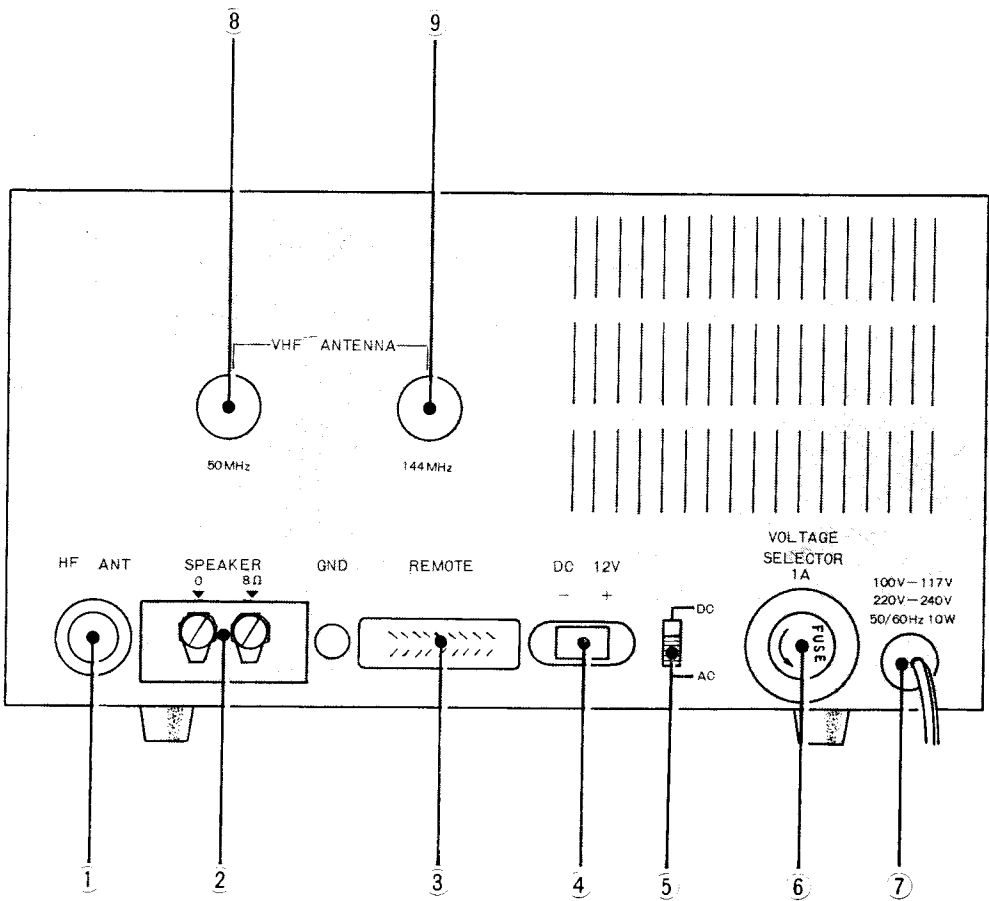
Set the POWER switch to ON and observe that the pilot lamps are lighted.

Rotate the main tuning dial until a signal is heard.

Adjust the PRESELECTOR for a maximum indication on the S-meter.

Set the AF gain to a comfortable level.

This completes the operating procedure for the R-599.



**Fig. 6 Rear Panel**

# SECTION 3 PRINCIPLES OF OPERATION

## 3-1 GENERAL

The model R-599 is a high frequency SSB, CW, AM, or FM solid state receiver that provides full coverage of the amateur bands between 1.8 and 29.7 MHz, as well as WWV's standard signal at 10 MHz. Provisions have been made to extend the coverage of the R-599 to include the 50 and 144 MHz bands by the installation of internally mounted crystal controlled converters available as an optional accessory from your authorized distributor.

The R-599 operates on the double superheterodyne principle for frequencies between 1.8 and 29.7 MHz and on the triple superheterodyne principle for 50 and 144 MHz reception. Employment of this conversion system effectively increases the signal-to-image ratio and provides greater adjacent channel selectivity.

All units of the R-599 are marked with their identification numbers which are used not only in the text of this manual, but also in the block and schematic diagrams. A circuit analysis follows. Refer to the block diagram, Figure 7.

## 3-2 RF UNIT (UC1102J)

The signal from the HF antenna, or the 6 and 2 meter converters, is applied to the RF attenuator which provides precision attenuation of the input RF signal in 20 db steps from 0 to 60 db.

The output of the RF attenuator is sampled by a pair of back-to-back germanium diodes. Any signal applied to these diodes will be limited to a maximum of 400 mV peak-to-peak. This protects the receiver from front-end overload caused by high power transmitters operating in close proximity.

The output of the peak limiting diodes is applied to the RF amplifier Q1, an FET. Because of the better cross modulation characteristics, and higher input and output impedance, the FET is particularly suitable for use as a high gain RF amplifier.

The antenna and RF coil packs associated with RF amplifier Q1 are composed of individually tuned circuits for each of the amateur bands. The appropriate tuned circuit for the band in use is automatically selected by positioning the BAND switch to the desired band of operation.

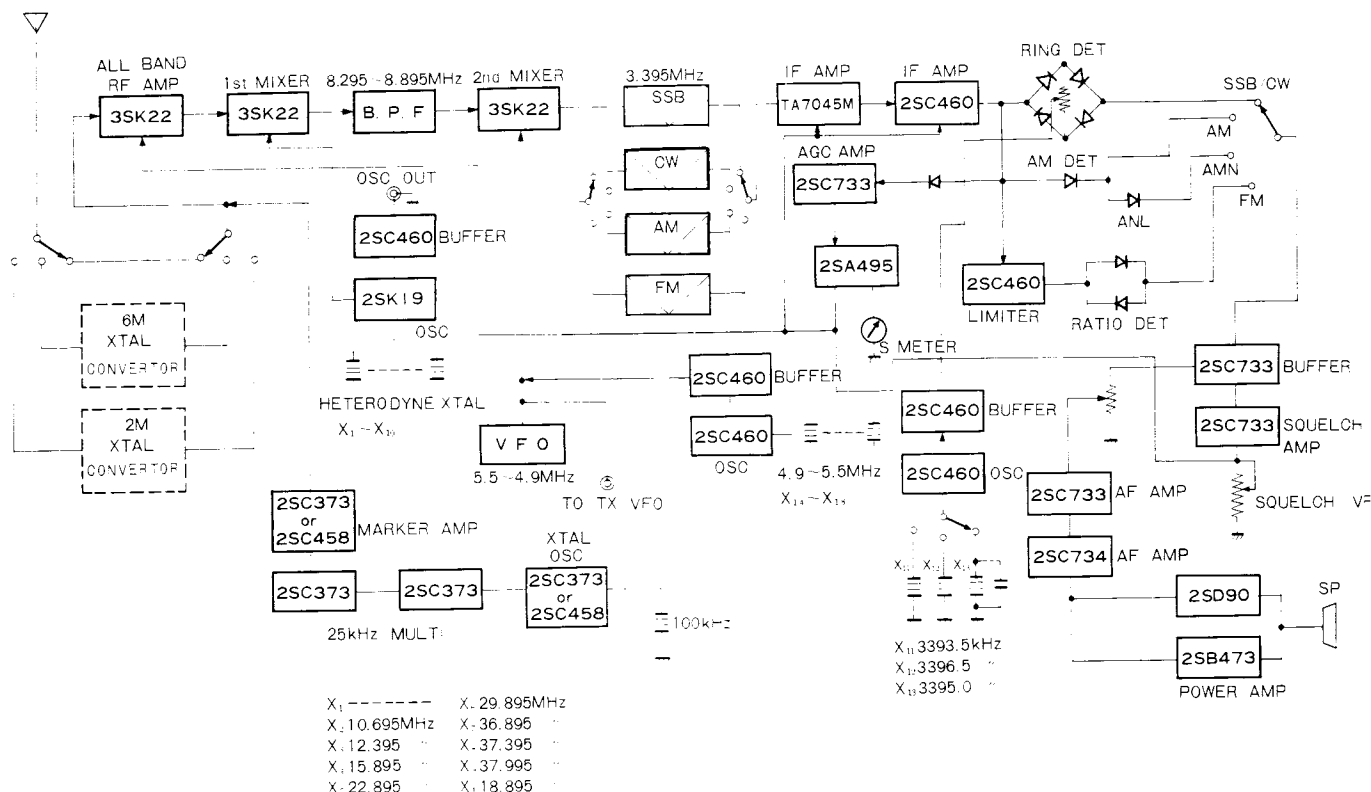


Fig. 7 Block Diagram

Because of the high input and output impedance of the RF amplifier Q1, loading of the tuned circuits is substantially reduced, effectively increasing their Q, providing high selectivity on all bands.

The amplified RF signal between 1.8 and 29.7 MHz is coupled through the selected RF coil to gate 1 of the 1st mixer Q2. The output of the heterodyne crystal oscillator Q3, a third overtone crystal oscillator, is applied to gate 2.

The output of the mixer is a wide-band RF signal consisting of the sum, difference, and the two original input signals.

The output of the heterodyne oscillator Q3 is also coupled through buffer transistor Q4 to the remote terminal of the receiver. Subsequently the output is used as the 2nd mixer injection signal for the T-599 when the transmitter is used in a combined transmitter/receiver configuration.

### 3-3 IF UNIT (UC1212J)

The wide-band RF signal from the 1st mixer is coupled to the IF unit through the band-pass filter (BPF). The BPF has a pass-band of 600 kHz from 8.295 to 8.895 MHz and therefore always selects the difference component of the input signal.

The 1st IF signal, a 600 kHz spectrum between 8.295 and 8.895 MHz, is applied to the 2nd mixer Q2, a subtractive mixer, where it is heterodyned with the 4.9 to 5.5 MHz output of the variable frequency oscillator (VFO). This produces the 2nd IF of 3.395 MHz. This signal is then applied to the appropriate filter unit for SSB, CW, AM or FM, depending on the mode of operation selected.

The 2nd IF output of the selected filter is applied to a two stage IF amplifier (comprised of integrated circuit Q2 (TA7045M) and transistor Q3) where IF amplification is accomplished. The output of the 2nd IF amplifier Q3 is connected to one of three types of detector circuits, depending on the mode of operation selected. These include a ring detector (composed of diodes D4-D7 for SSB and CW operation) and a ratio detector (composed of limiter Q8, transformer T8), and diodes D9-D10 for FM detection.

Part of the 2nd IF signal from amplifier Q3 is coupled through capacitor C13 to an AGC circuit, consisting of diodes D1 and D2. The detected output is applied to AGC amplifier Q4 where it is amplified and applied to transistor Q5, a current amplifier and emitter follower.

Transistor Q5 delivers two outputs. The low impedance output from the emitter is applied to the 1st IF amplifier ICQ2, the 2nd IF amplifier Q3, RF amplifier Q1, and the squelch amplifier Q6.

The collector of Q5 is returned to ground through the

S-meter and therefore causes the S-meter to deflect in direct proportion to the AGC voltage developed. This provides an accurate measurement of the input signal level when used in conjunction with the step attenuator.

The attack and release time of the AGC circuit is determined by the collector-to-emitter resistance of transistor Q4 and series capacitors C3 and C4. With no signal input to the 2nd IF amplifier Q3, AGC amplifier transistor Q4 and AGC output transistor Q5 are cutoff. Capacitors C3 and C4 have charged through the collector resistor of Q4 to the 9 volt source voltage. Application of a signal to the 2nd IF amplifier Q3 causes an output from the AGC detector which forward biases AGC amplifier transistor Q4. Application of the forward bias causes Q4 to go into hard conduction which lowers its collector-to-emitter resistance to approximately 33 ohms, allowing capacitors C3 and C4 to discharge very quickly. The discharge of these capacitors forward biases AGC output transistor Q5 causing it to go into conduction which applies an AGC voltage to the RF amplifier, IF amplifier and 2nd mixer circuits. Removal of the input signal to the 2nd IF amplifier Q3 removes the forward bias from AGC amplifier Q4 causing it to go into cutoff. Under these conditions, C3 and C4 begin to charge very slowly through Q4's emitter resistor R19, thus transistor Q4 and capacitors C3 and C4 provide ideal fast-attack slow-release AGC characteristics. Positioning the AGC selector switch to the slow position shorts out capacitor C4 which increases the total circuit capacity, increasing the attack/release time.

The output of AGC transistor Q5 is coupled through resistor R23 to the base of squelch amplifier Q6, where it is amplified and applied to the base of buffer transistor Q7. This controls the base voltage of Q7 with the input signal. As a result, buffer transistor Q7 controls AF amplifier Q1 (in the AF unit) with its output, performing a squelch operation under control of the input signal. The squelch threshold is set by a front panel SQUELCH control.

### 3-4 FILTER UNIT (UC1213J)

This unit incorporates different filters for the SSB, CW, AM and FM modes of operation. The appropriate filter is selected by a diode switch when the MODE switch is set to the desired type of operation.

With the MODE switch set to the SSB position, 13.8 VDC is applied to the SSB terminal of XF1. This forward biases diodes D1-D2 and reverse biases diodes D3 through D8. Under these conditions only the SSB signal is passed through filter XF1, from the 2nd mixer Q1 to the 1st IF amplifier Q2. The reverse biased diodes D3 through D8 provide 70 db isolation to the unselected filters.

Other filters for the CW, AM and FM mode of operation are selected in the same manner described for filter XF1 when the MODE switch is set to the CW, AM and FM positions respectively.

### 3-5 VFO UNIT (UC0116J)

The variable frequency oscillator operates in the frequency range of 4.9 to 5.5 MHz. The circuit is composed of a field effect transistor (FET) operating in a Clapp configuration followed by three buffer stages, each employing FETs.

The output from the 1st buffer stage is coupled through a harmonic filter to the output stage, consisting of two FETs connected in a Darlington configuration and acting as a low impedance buffer.

The VFO also uses a receive-incremental-tuning (RIT) circuit, operated by the RIT voltage developed in the automatic voltage regulator unit (UC1010J).

The RIT circuit is activated by the receiver relay and varies the receive VFO frequency regardless of the setting of the VFO SELECT dial. The RIT control is located on the front panel.

The VFO is of the enclosed type and completely adjusted. IT SHOULD NEVER BE REMOVED FROM ITS CASE OR MODIFIED IN ANY WAY.

### 3-6 CARRIER BFO UNIT (UC1214J)

The BFO circuit is a crystal controlled oscillator operating in the Pierce configuration. Fine adjustment of the output frequency is accomplished by trimmer capacitors TC1 through TC3 which are connected in parallel with crystals X1, X2, and X3 respectively. The appropriate crystal for the USB, LSB, or CW mode of operation is selected by a diode switch.

When the MODE switch is placed in the LSB position +13.8 VDC is applied to the LSB terminal of the BFO unit. This applies a forward bias through resistor R4 and inductor L4 to diode D4, turning it on. With diode D4 turned on, capacitor C6 is grounded through the low forward resistance of the diode, allowing transistor Q1 to go into oscillation at the crystal frequency of X3 or 3393.5 kHz.

When operating in the USB mode, the BFO operates as previously described except the +13.8 VDC is applied to diode D3 through resistor R3 and inductor L3, thereby selecting crystal X2.

When the MODE switch is placed in the CW position, a +13.8 VDC is applied to the CWR terminal of the BFO unit. This applies a forward bias through resistor R1 and inductor L1 to diode D1, turning the diode on. This grounds crystal X2 through diode D1, without a series capacitor. As a result, oscillator Q2 oscillates at a frequency approximately 700 Hz lower than the crystal frequency. The beat frequency of the received signal may be varied  $\pm 200$  Hz by trimmer capacitor TC1.

The output of the oscillator transistor Q1 is applied to the base of buffer Q2 through a voltage divider composed

of C10 and C13. Buffer transistor Q2, connected in an emitter follower configuration, provides an output impedance of 100 ohms, minimizing frequency variation due to changes in the load.

### 3-7 MARKER UNIT (UC1505J)

The marker unit provides a marker signal at 25 kHz or 100 kHz intervals over the range 3.5 to 29.0 MHz. Selection of the 25 or 100 kHz marker signal is accomplished by means of the FUNCTION switch on the front panel.

Transistor Q1 and crystal X1 form a 100 kHz oscillator. Trimmer capacitor TC1, in the collector circuit of Q1, provides a means for precision adjustment of the oscillator frequency.

The output of oscillator transistor Q1 is coupled by capacitor C4 to diode D1, where the 100 kHz sine wave is shaped into a pulsed waveform with a repetition rate of 25 kHz. The 25 kHz pulse is used to synchronize a free-running 25 kHz multivibrator composed of transistors Q2 and Q3. The output of the multivibrator is coupled to amplifier Q4, where it is shaped into a rectangular waveform and applied to RF amplifier Q1 as a 25 kHz marker signal.

When the FUNCTION switch is placed in the 100 kHz position, the emitter of Q2 is removed from ground by contacts of the FUNCTION switch (S-3A) thereby turning Q2 off. Under these conditions Q3 operates as a straight through amplifier and couples the 100 kHz marker signal to amplifier Q4 where it is further amplified and applied to RF amplifier Q1.

### 3-8 AUTOMATIC VOLTAGE REGULATOR (AVR) (UC1010J)

The AVR unit supplies power to the VFO, carrier oscillator, heterodyne oscillator, and other circuits of the transmitter that require a stable low voltage source. Precision regulation of the +9 volt supply is obtained by the use of an error detection circuit, an error amplifier circuit and a series regulator. Detailed circuit analysis is as follows:

Transistors Q3 and Q4 comprise a differential amplifier. Transistor Q2 is the error amplifier and transistor Q1 is the series regulator. The reference voltage for the differential amplifier is established by resistor R9 and D1, a 6.6 volt zener diode. The emitter voltage of Q4 follows its base voltage (less the base-emitter drop of approximately .6 volts) and places the emitter of Q3 approximately .2 volts negative with respect to the base. Under these conditions error amplifier Q2 and series regulator Q1 are quiescent and the output voltage is stabilized at +9 volts.

Should the output voltage (sensed at the base of transistor Q3) decrease, the collector current will also decrease causing an increase in collector voltage. The

## SECTION FOUR MAINTENANCE

### 4-1 REMOVAL OF CABINET AND BOTTOM PLATE

Remove two screws on the top rear of the cabinet, then remove six screws from the sides and remove the cabinet.

To remove the bottom plate, remove six screws and lift the plate off.

### 4-2 VFO DRIVE GEARS

Thoroughly clean and lubricate the drive gears of the VFO once each year with machine oil.

### 4-3 PILOT LAMPS

Should the pilot lamps require replacement be sure and replace them with an identical lamp with a rating of 14 volts at 200 ma.

### 4-4 ALIGNMENT OF THE MARKER OSCILLATOR (UC1505J)

Should the marker oscillator require adjustment, refer to Figure 8 and proceed as follows:

Set up the receiver to receive WWV at 10 MHz. Adjust TC1 on the marker board (UC1505J) for zero beat as heard on the receiver speaker.

### 4-5 AUTOMATIC VOLTAGE REGULATOR UNIT (AVR) (UC1010J)

Should the AVR unit require adjustment refer to Figure 9 and proceed as follows:

Monitor the +9 VDC output on terminal board UC1010J with a high impedance VTVM. Adjust VR1 until the output reads +9 volts.

To adjust the RIT voltage, precisely set the RIT control to zero. Tune in the 100 kHz marker signal, and while turning the RIT on and off, adjust VR2 until the same beat note is heard with the RIT on as with it off.

### 4-6 AF UNIT (UC1307J)

When the base current to the output amplifier is improperly adjusted the audio output is excessively distorted. To make this adjustment refer to Figure 10 and do as follows: Disconnect the red wire from the B terminal of the circuit board and insert a ma. meter of a minimum 100 ma. capacity in series with the red wire and the B terminal. Adjust VR1 slowly until the indicated current is 40 ma. Remove the ma. meter and reconnect the wire to the B terminal.

### 4-7 MONITOR CIRCUIT

To adjust the output of the monitor circuit for AM or SSB operation refer to CHASSIS BOTTOM VIEW and adjust VR2 (MONITOR) until the output from the speaker is set at the desired level.

### 4-8 SIDETONE CIRCUIT

To adjust the output of the sidetone circuit for CW operation, refer to CHASSIS TOP VIEW. Locate AF Unit UC1307-J. To the right of this unit is an adjustable Sidetone VR (not marked in photo). Adjust this VR for desired level while keying the transmitter.

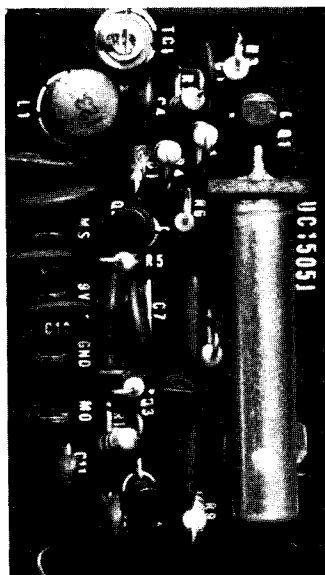


Fig. 8 UC1505J

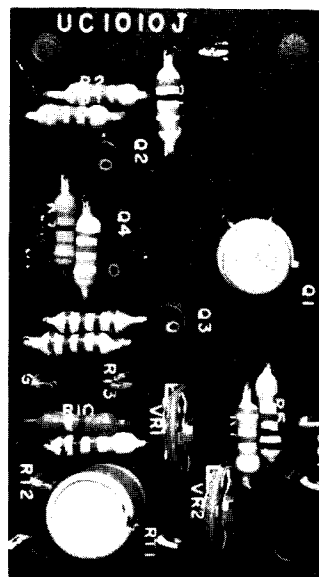


Fig. 9 UC1010J

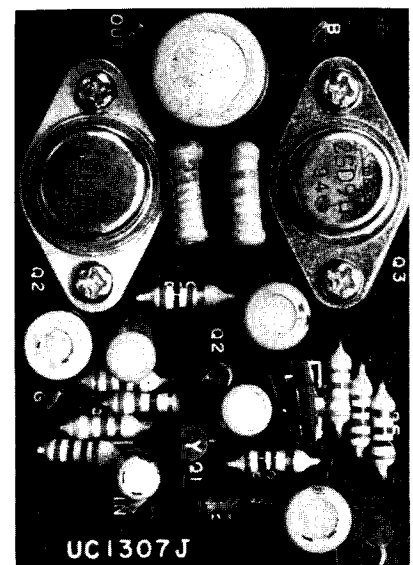
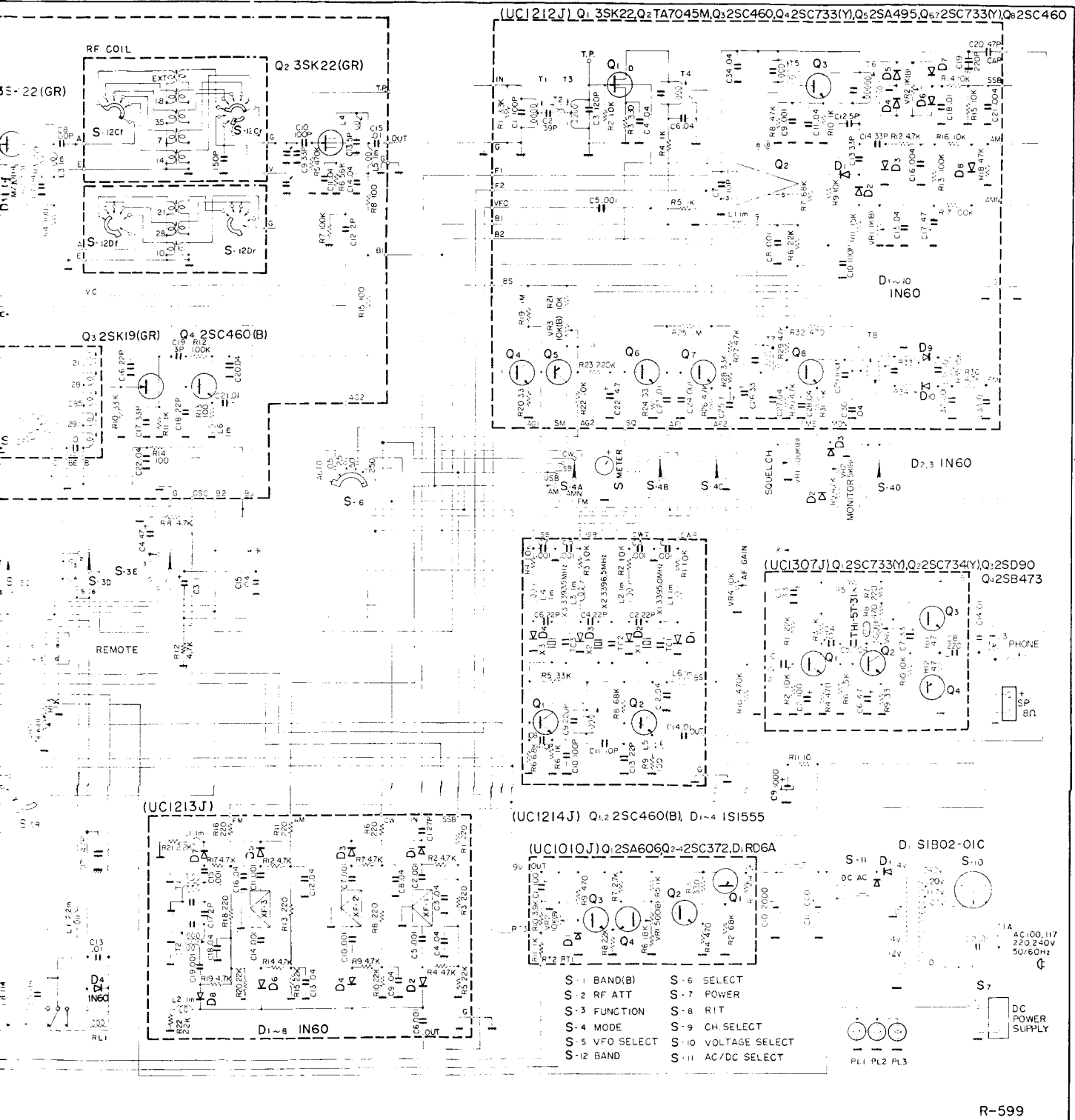
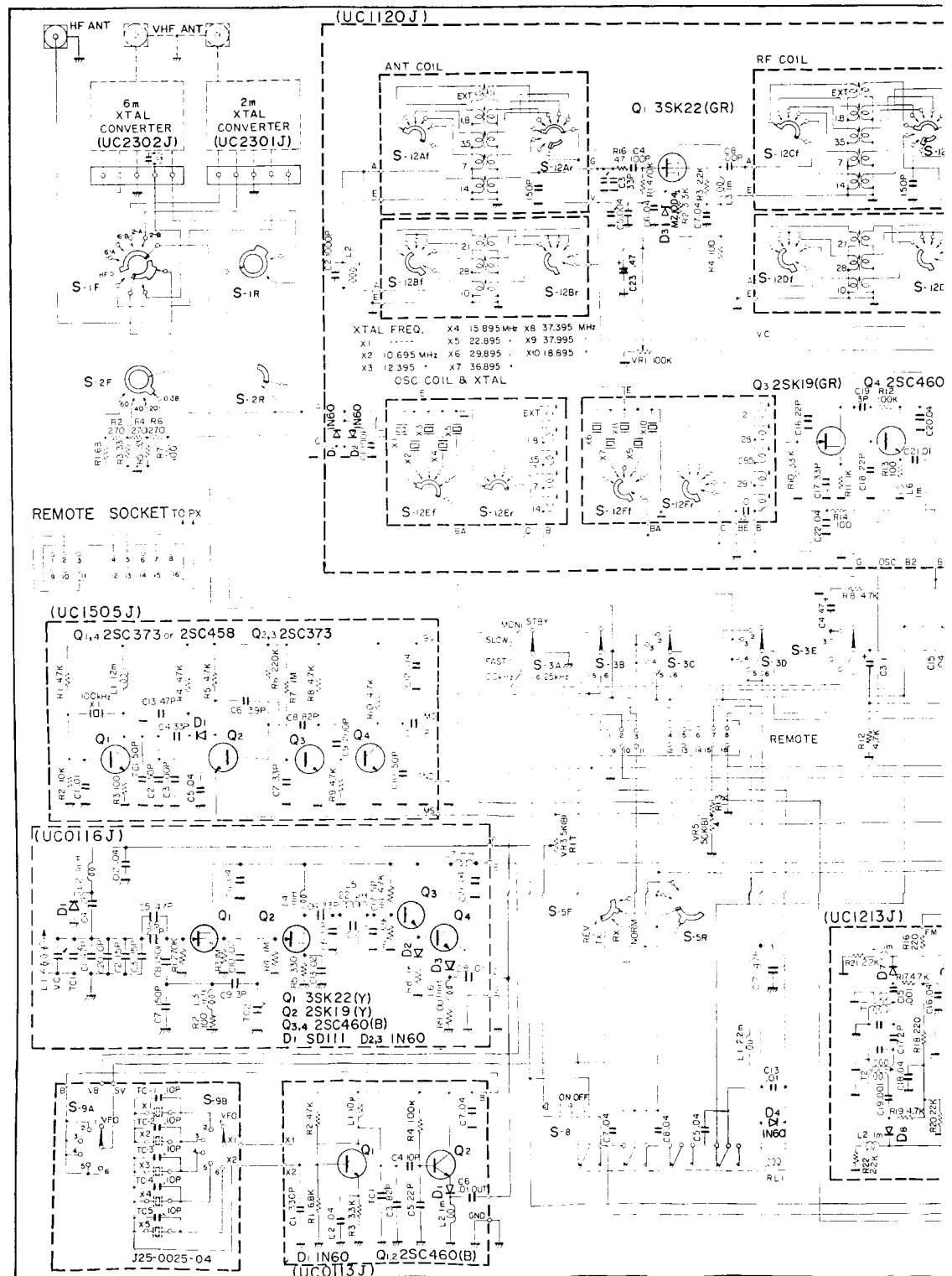


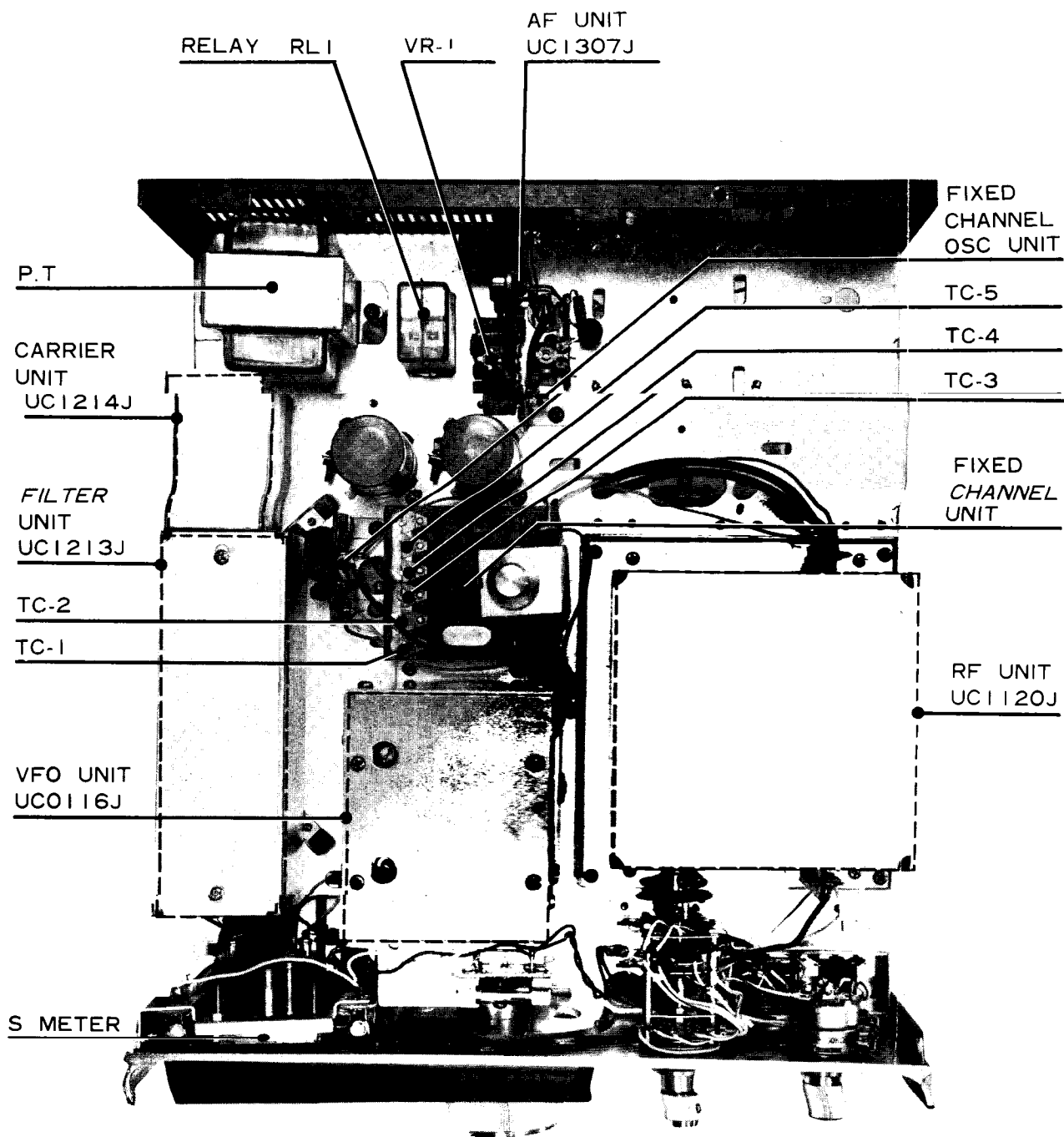
Fig. 10 UC1307J



# SCHEMATIC

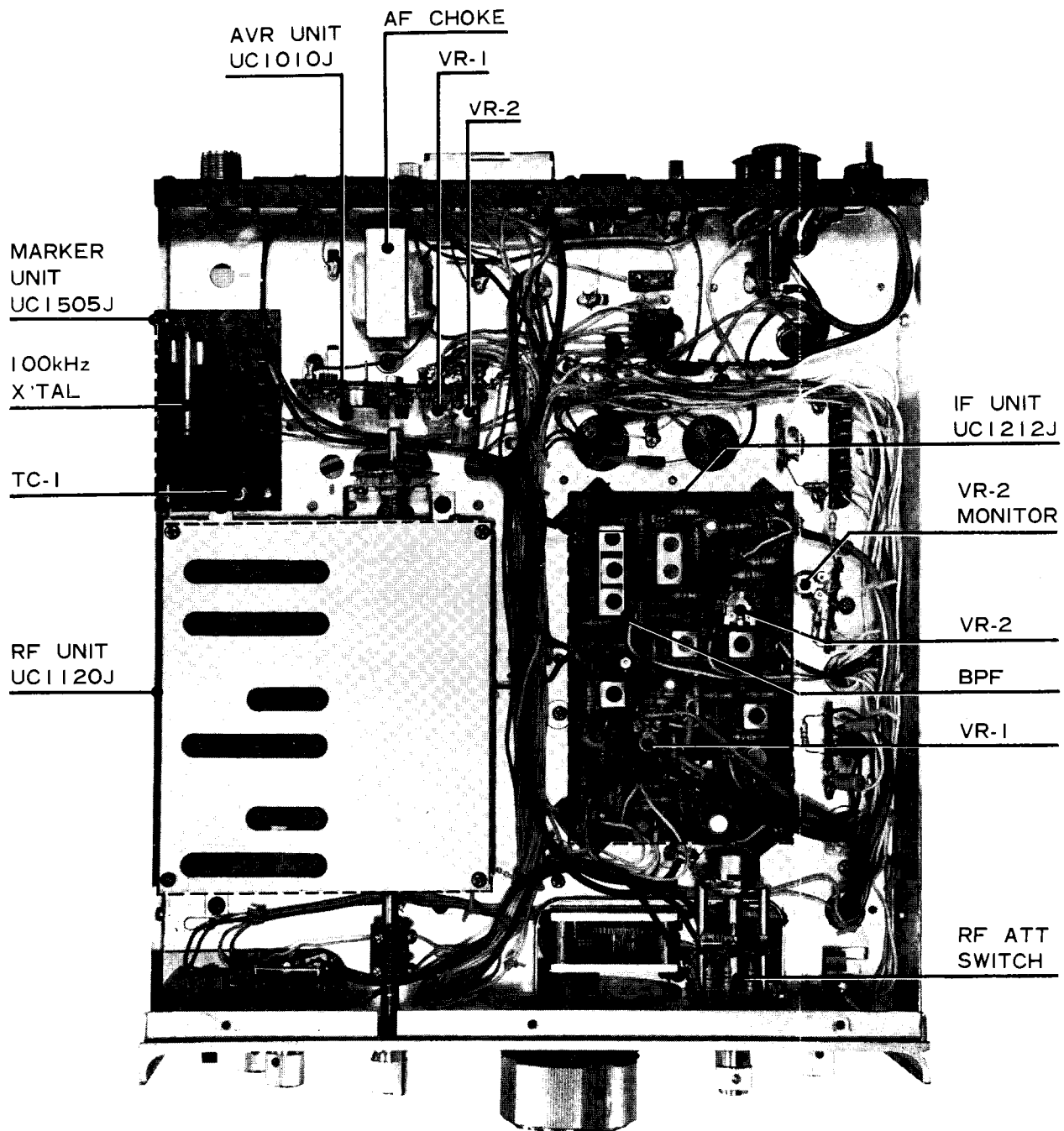


# CHASSIS TOP VIEW





## CHASSIS BOTTOM VIEW



# WARRANTY

Henry Radio warrants this product to be free from defective material and workmanship and agrees to remedy any such defect or to furnish a new part in exchange for any part of any Kenwood unit which under normal installation, use, and service discloses such defect, provided the unit is delivered by the owner to us intact, for our examination, with all transportation charges prepaid to our store, within ninety days from the date of sale to original purchaser and provided that such examination discloses in our judgment that it is thus defective. Should a malfunction be suspected, write in detail to our Service Department for suggestions concerning the operation, repair, or return of your unit if it should prove necessary.

This warranty does not extend to any of our radio products which have been subjected to misuse, neglect, accident, incorrect wiring not our own, improper installation, or to use in violation of instructions furnished by us, nor does it extend to units which have been repaired or altered outside our factory, nor in cases where the serial number thereof has been removed, defaced, or changed, nor to units used with accessories not manufactured or recommended by us.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by Henry Radio without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our radio products.

Henry Radio reserves the right to make any improvements to its products which it may deem desirable without obligation to install such improvements in its previously manufactured products.

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Manufactured by TRIO ELECTRONICS, INC., Tokyo, Japan  
for HENRY RADIO Los Angeles, California