KENWOOD

AMATEUR SSB TRANSMITTER

Model T-599

OPERATING MANUAL

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

KENWOOD T-599 SPECIFICATIONS

TRANSMITTING FREQUENCY RANGE:	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
TYPE OF EMISSION:	SSB (A3J), CW (A1), and AM (A3)
RATED INPUT TO FINAL STAGE:	SSB and CW 3.5 through 21.0 MHz 200 W 28.0 MHz 160 W AM 3.5 through 28.0 MHz 80 W
CARRIER SUPPRESSION:	−40 dB or less
UNWANTED SIDEBAND SUPPRESSION:	−40 dB or less
HARMONICS RADIATION:	−40 dB or less (under CW Operation)
OUTPUT IMPEDANCE:	50 ohms
MICROPHONE INPUT IMPEDANCE:	600 ohms or 50 K ohms (as selected)
MODULATION SYSTEM:	Balanced modulation for SSB and low-power modulation for AM.
SSB GENERATION SYSTEM:	Filter system
TRANSMITTING FREQUENCY CHARACTERISTIC:	300 Hz to 2700 Hz (±6 dB)
KEYING:	Block bias keying
FREQUENCY STABILITY:	Within ±2 kHz from one minute after switching on the set to 60 minutes, and later within ±100 Hz per fifteen minutes.
TUBES AND SEMICONDUCTORS EMPLOYED:	3 Vacuum Tubes 4 FET 1 IC 29 Transistors 33 Diodes 3 Zener Diodes 1 Varicap
POWER CONSUMPTION:	350 Watts maximum
DIMENSIONS:	10-5/8″ wide 5-1/2″ high 12-3/16″ deep
WEIGHT:	26.4 lbs

SECTION ONE INSTALLATION

1 - 1 UNPACKING

Carefully lift the transmitter out of the packing material and examine it for visible damage. If the transmitter has been damaged, notify the shipping company. Check the tuning controls and switches for freedom of movement. Check that the following accessories have been included with the transmitter.

- 1 Microphone plug
- 1 Remote cable (for connection to R-599)
- 1 Remote plug
- 2 Phono plugs
- 2 Leg extenders
- 1 Tuning tool

1 - 2 EQUIPMENT INSTALLATION

GENERAL

Install the transmitter in a cool dry place, out of the direct rays of the sun. Insure that ample space is provided above and on each side of the unit to allow free air flow over the chassis.

POWER SOURCE

The input power requirement for this transmitter is 115 V AC, with 50/60 Hz. In the areas where the input voltage deviation exceeds ±10% of the rated value, it is recommended that a line voltage regulator unit, with a current capacity of three amps minimum, be used.

ANTENNA

The pi-network of this transmitter is designed to match a 50 ohm load, with an SWR not exceeding 2:1. If operation with an antenna having an input impedance greater than 75 ohms or SWR in excess of 2:1 is anticipated, it is recommended that an appropriate antenna coupling unit be used between the transmitter and the antenna.

MICROPHONE

The quality of the transmitted SSB or AM signal depends to a great extent on the type and characteristics of the microphone used.

The input impedance to the microphone amplifier is 600 ohms or 50 K ohms, depending on the position of the microphone impedance selector switch, found on the bottom of the transmitter. (See Figure 8, Page 13.)

The microphone circuits were designed under the assumption that microphones with an output impedance of 600 ohms will have a standard sensitivity of −70 to −80 dB and those having an impedance of 50 K ohms, a standard sensitivity of −40 to −50 dB. Accordingly, the transmitter is operable with a wide variety of microphones. To connect the microphone connector to the mirophone, proceed as illustrated in Figure 11, using the connector provided with the transmitter.

EQUIPMENT INTERCONNECTIONS

Operation with the R-599 Receiver — When operation is in conjunction with the R-599, the remote connector terminal of the T-599 transmitter provides all necessary connections and switching functions for transceive or separate operation. To connect the T-599 transmitter to the R-599 receiver proceed as illustrated in Figure 1.

Operation with Other Receivers — When operating the T-599 with a receiver other than the R-599 it will be necessary to wire the remote connector socket to provide the switching functions required by the particular receiver in use. Table 4 lists the remote connector pins and their functions. See Figure 2 for connections.

Operation with a Linear Amplifier — The T-599 provides an output power of 100 watts PEP (nominal) and therefore provides sufficient drive for most amplifier configurations. To connect the T-599 to an amplifier refer to Table 4 for switching functions and proceed as illustrated in Figure 3.

SECTION TWO OPERATION

2 - 1 OPERATING CONTROLS & THEIR FUNCTIONS

Table 1 provides information on all operating controls and their functions. It is recommended that you thoroughly familiarize yourself with the table before operation of the transmitter.

2 - 2 PRELIMINARY SETTINGS

Pre-set the front and rear panel controls to the following positions: (Refer to Figure 4, 5.)

Switch	Position
Front Panel	
(1) MODE	TUN
(2) METER	ALC
(4) FUNCTION	MAN
(9) BAND	Desired Band
(10) POWER	OFF
(11) STBY/SEND	STBY
(12) DRIVE	Center of Scale
(13) PLATE	On Band Selected
(14) LOAD	Extreme Counter-clockwise
Rear Panel	
(12) SEP/TRCV	SEP
(13) TRANSVERTER	OFF

2 - 3 TRANSMITTER TUNING

Set the POWER switch to ON. Observe that the dial and meter are illuminated. Wait two to three minutes until the vacuum tubes reach operating temperature.

Turn the STBY/SEND switch from STBY to SEND and adjust the DRIVE control for maximum ALC indication as read on the panel meter.

Set the MODE switch to LSB of USB and the METER switch to IP. Check to see that the meter reads an Ip of 60 ma. If the meter does not read 60 ma, adjust the bias control, located inside the transmitter, for a reading of 60 ma.

Turn the MODE switch from either LSB to the CW position and quickly adjust the plate control for **minimum** plate current.

Set the METER switch to the RF position and adjust the DRIVE control for a maximum as indicated on the panel meter. Adjust the LOAD control and the PLATE control alternately for a maximum meter reading. When the reading fails to increase, the transmitter is properly tuned and transmitting maximum power.

Set the STBY/SEND switch to STBY. This completes adjustment of the transmitter.

NOTE: When operating on the 28 MHz Band, it may not be possible to get any ALC indication during tune-up. Should this occur, turn the METER switch to IP and the MODE switch to CW. Adjust the DRIVE control for a maximum Ip indication, quickly adjust the PLATE control for minimum Ip, then proceed with paragraph 5.

2 - 4 OPERATION

CW OPERATION

Set up the transmitter according to Section 2.2. Set the MODE switch to CW and the STBY/SEND switch to SEND; press the key and adjust the CAR control, located inside the top chassis, for an Ip of 200/ma or less. This completes the adjustments for manual CW operation.

For semi-break-in CW operation, set the STBY/SEND switch to STBY and the FUNCTION switch to VOX. Press the key and adjust VOX gain until the transmitter activates. If desired, to increase the VOX release time adjust the VOX delay clockwise to increase hold time. Set the Antivox clockwise until the VOX does not activate on receiver output, and, if the sidetone output is used adjust it for a comfortable level. The transmitter is now adjusted for semi-break-in operation.

AM OPERATION

Set up the transmitter according to section 2.2. Set the MODE switch to AM. Adjust the CAR control for a maximum Ip of 120 ma. Set the METER switch to the ALC position and adjust the microphone gain control (mic), inside the transmitter, until the panel meter just moves. Decrease microphone gain until the meter ceases to move. The transmitter is now properly adjusted for AM operation.

2 - 5 SSB OPERATION

Set up the transmitter according to section 2.2. Set the MODE switch to the desired sideband. Activate the transmitter by placing the STBY/SEND switch to SEND or by depressing the PTT switch if used. While speaking into the microphone, adjust the MIC gain, inside the transmitter, until the meter set to the ALC range gives a peak indication of slightly less than half scale.

If VOX operation is desired, set the FUNCTION switch to VOX. While speaking into the microphone, adjust the VOX gain, inside the transmitter, until the VOX relay is activated. Adjust the VOX delay for the desired hold time, and adjust the ANTIVOX clockwise until the VOX is not activated by the receiver output.

2 - 6 CALIBRATING TRANSMITTER TO RECEIVE FREQUENCY

Set the FUNCTION switch to CAL, this activates all circuits of the transmitter except the PA and microphone amplifier. Turn the main tuning dial until the calibrate signal is in zero beat with the received frequency.

2 - 7 READING TRANSMIT FREQUENCY

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 transmit 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 were 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.

2 - 8 COMBINED OPERATION WITH R-599 RECEIVER

When operated as directed in Section 1, selection between transmitter and receiver VFO operation may be accomplished by means of the VFO SELECT switch on the front panel of the receiver. The VFO SELECT switch functions as follows:

Position	Function
NORM	With the transmitter SEP/TRCV switch set to SEP or TRCV, the transmitter and receiver VFO operate independently of each other.
RX	With the transmitter SEP/TRCV switch set to TRCV, the transmit and receive frequency are controlled by the receiver VFO.
TX	With the transmitter SEP/TRCV switch set to TRCV, the transmit and receive frequency are controlled by the transmitter VFO.
REV	With the transmitter SEP/TRCV switch set to TRCV, the transmitter VFO controls the receive frequency and the receiver VFO controls the transmit frequency.

SECTION THREE PRINCIPLES OF OPERATION

3 - 1 GENERAL DESCRIPTION

(Refer to the block diagram, Figure 12, page 14)

The T-599 is a high frequency SSB, AM, or CW transmitter that provides full coverage of all amateur bands between 3.5 MHz and 29.7 MHz. Employing printed curcuit construction and solid state components (with the exception of the driver and power amplifier), a significant reduction in the physical size has been achieved with increased reliability and uniform performance.

All units of the T-599 transmitter are marked with their identification numbers which are used not only in the text of this manual, but in the block and schematic diagram as well. Refer to the schematic diagram, Figure 13, page 15, for circuit analysis.

3 - 2 MICROPHONE AMPLIFIER (UC2901J)

The AF signal from the microphone amplifier is applied to the MIC input terminal of the UC2901J unit through a two-position input impedance selector switch, which selects either 600 ohms or 50 K ohms input impedance. The signal is then coupled to the microphone amplifier, which is comprised of Q1, Q2, and Q3.

Initial stage amplifier Q1, also functioning as a VOX amplifier, provides a gain of approximately 25 dB. The output of amplifier Q1 is directly coupled through the microphone gain control to the second and third stage amplifiers Q2 and Q3.

The second and third stage amplifiers each use output-to-input negative feedback which provides not only high gain with a minimum of distortion, but also reduces the output impedance, thereby matching the output to the balanced modulator.

3 - 3 BALANCED MODULATOR (UC2901J)

During SSB operation, the audio signal, from microphone amplifier Q3, and the RF signal of 3393.5 or 3396.5 (depending on the sideband selected) are coupled to the ring balanced modulator consisting of iodes D1 through D4. AF to RF translation is accomplished; and the output, a double sideband suppressed carrier signal, is directly coupled to the input of crystal filter XF1.

For the AM or CW mode of operation a DC voltage is applied to the balanced modulator, switching it to an unbalanced condition. This allows the AM or CW carrier frequency of 3395.0 kHz to pass through the balanced modulator to the crystal filter. The amplitude of the carrier to be supplied is controlled by CAR (VR2).

3 - 4 CARRIER OSCILLATOR (UC1214J)

The carrier oscillator frequencies are 3393.5 kHz for LSB, 3396.5 kHz for USB and 3395.0 kHz for AM or CW transmission.

Oscillator transistor Q1 is operated in a Pierce configuration, with diodes D1 through D4 inserted in series with the USB, LSB, CW, or AM crystal respectively. The oscillator frequency is selected by appliation of a forward bias to these diodes.

When not switched on, these diodes present a high resistance to ground, opening the oscillator circuit. Application of a forward bias causes the diodes to go into conduction, lowering their resistance to approximately 10 ohms which completes the oscillator circuit to ground, allowing oscillator Q1 to start in oscillation. Trimmer capacitors connected in parallel with the crystals provide a means of fine adjustment to the oscillator frequency.

The output of oscillator Q1 is coupled through a capacitive voltage divider, formed by capacitors C11 and C13, to the base of emitter follower Q2. The emitter follower configuration of Q2 presents a low output impedance (approximately 100 ohms), minimizing the fluctuation of oscillator output voltage and frequency due to load variation.

3 - 5 FILTER AND IF AMPLIFIER (UC2901J)

During SSB operation, upper and lower sideband information from the balanced modulator is applied to crystal filter XF1. The pass band of XF1 is centered on 3395.0 kHz, and passes either the LSB signal of 3393.5 kHz or the USB signal of 3396.5 kHz, depending upon the sideband selected.

The selected sideband is then applied to integrated circuit (IC) amplifier Q4 (TS 7045M) which has a circuit configuration as shown in figure 13. Transistors Q1 and Q2 form a differential pair and Q3 is a constant current source. Operating in this arrangement they provide a high gain amplifier that is virtually insensitive to temperature and voltage changes.

During SSB or CW operation, ALC voltage is applied to the base of the emitter follower Q6, effectively varying its conduction. The varying output of Q6 is coupled through resistor R23 to the base of the differential amplifier, Q1 and Q2, increasing or decreasing their gain. This provides a constant signal to the final amplifiers, assuring a high level of output power without excessive distortion at the peaks.

When operating in the AM mode, the RF carrier frequency of 3395.0 kHz is applied through crystal filter XF1 to the base of Q1 of the differential pair. The modulating signal is coupled from the output of microphone amplifier Q3, through the emitter follower Q6, to the base of Q1 and Q2 of the differential pair.

Algebraic addition of the AF and RF signal takes place in the common emitter source, Q1 and Q2. This amplitude modulated RF signal is then coupled through transformer T2 and the 1st mixer Q5.

3 - 6 1st MIXER & BAND PASS FILTER (UC2901J)

The IF signal from TA 7045M (IF amplifier Q4) is coupled to the 1st mixer Q5, where it is heterodyned with the output signal of the VFO operating in the frequency range 4.9 to 5.5 MHz. This produces the 2nd IF signal between 8.295 and 8.895 MHz.

Mixer Q5, a field effect transistor, provides a wide square Eg-Id characteristic curve which makes it particularly suitable for a mixer.

VFO isolation is provided by the emitter follower Q7, and prevents the transmitter and receiver circuits from interfering with each other when the T-599 is operated with its companion receiver R-599 in the transceive mode.

The AM, CW, or SSB signal in the range of 8.295 to 8.895 MHz is coupled to the band pass-filter (BPF). The filter consists of three tuned LC circuits with a center frequency of 8.595 kHz and is essentially flat (within ±1 dB) for 300 kHz on each side of center.

It rejects spurious signals outside its bandpass and the output is delivered to the 2nd mixer (UC2402J).

3 - 7 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 FET.

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

The BFO unit is of the enclosed type and completely adjusted. It should never be removed from its case or modified in any way.

3 - 8 2nd MIXER (UC2402J, UC0118J)

The output of the bandpass filter is coupled to the 2nd mixer, where it is mixed with the output of the heterodyne crystal oscillator of the selected band. This mixer operates in the subtractive mode, therefore the output frequency is the difference between the two input frequencies.

The plate tuning circuit (UC0118J) is composed of a variable capacitor and a fixed coil, parallel resonant to 3.5 MHz. Band switching for the 7, 14, 21, and 28 MHz bands is accomplished by connecting the coil of the selected band in parallel with the basic 3.5 MHz resonant circuit. This effectively decreases the total inductance of the circuit, increasing the resonant frequency.

3 - 9 HETERODYNE CRYSTAL OSCILLATOR (UC2402J, UC0119J)

Transistor Q2 and its associated crystal form a 3rd ovetone crystal oscillator. The crystals and tuning coil are mounted on a separate unit (UC0119J), so designed that the appropriate circuit is automatically selected by the band switch for the band in use.

Because of the large bandwidth of the 10 meter band, individual coil and crystal combinations are used to cover the band segments of 28, 28.5 and 29.1 MHz respectively. This assures uniform performance over the entire band.

During separate operation, the DPDT SEP/TRCV switch places a ground on the emitter of Q2 and the base of Q3. Under these conditions, input amplifier Q3 is cut off and oscillator Q2 supplies the injection voltage for the 2nd mixer.

When the transceive mode of operation is selected, the output of the R-599 receiver heterodyne oscillator is applied to the base of input amplifier Q3 through one contact of the DPDT SEP/TRCV switch.

The other contact of the switch breaks the ground to the emitter of Q2, grounding the emitter of Q3 and the cathode of diode D1. The injection signal for the 2nd mixer is now taken from input amplifier Q3. Application of ground to diode D1 cause it to be forward biased by the pullup action of R2 to the 9 volt source; this grounds the base of Q2, insuring its inactivity.

3 - 10 DRIVER AMPLIFIER (UC2402J, UC0117J)

The output of the 2nd mixer is capacity coupled to the grid of the driver amplifier V1. Operating as a class A amplifier, this stage provides sufficient gain to drive the parallel class AB1 final amplifier, V2 and V3.

The plate tuning circuit is identical to that of the 2nd mixer with the exception of a link coupling added to the 3.5 MHz coil. This derives an output sufficient to drive a VHF transverter or similar device requiring a low level driving signal.

Turning the TRANSVERTER switch to ON connects the link coil to the transverter output connector and applies a negative voltage to the screen grid of the final amplifier tubes causing them to cut off.

3 - 11 POWER AMPLIFIER STAGE

The power amplifier stage consists of two 6146 beam power tubes connected in parallel and operated in class AB1 with a rated power input of 200 watts PEP. Neutralization of this stage assures optimum stability for operation on all bands.

Output from the parallel power amplifier is tuned by a pi-network and coupled to the antenna through contacts of the TX/RX relay, RL2.

3 - 12 ALC & BIAS CONTROL (UC3001J)

This unit controls the operating and blocking bias to the 1st mixer, 2nd mixer, driver and power amplifier for the AM, CW, and SSB mode of operation.

During the SSB or AM mode of operation, the junction of resistor R1 and diode D1 is forceably grounded by the MODE switch. This removes the blocking bias from the driver (terminal DG) and the 1st and 2nd mixer (terminal MG).

Under standby conditions, terminal RS is grounded through contacts of the VOX relay. This establishes a bias on the base of transistor Q1, turning it on, which places −94 volts on terminal PG through diode D2 and variable resistor VR1. This negative voltage keeps power amplifier, V2 and V3 in a cutoff condition.

Activation of the VOX relay by voice signal or manual switch removes the ground from terminal RS, removing the bias from the base of Q1, turning it off. Operating bias of about −50 volts (derived through terminal PG, from the −94 volt source, and voltage divider network RS, RG, and VRS) is now applied to the power amplifier.

When the CW mode of operation is selected and the transmitter is in standby, the ground from the junction of resistor R1 and diode D1 is removed. Blocking bias is now developed across voltage divider R1, R9 and R10 and applied to terminal DG and MG, biasing the first mixer, 2nd mixer and driver stage into cutoff. Terminal RS is grounded through contacts of the VOX relay which turns on transistor Q1 and applies −94 volts bias to the power amplifier through teminal PG, cutting them off.

Closing the key grounds the junction of resistor R1 and diode D1 and activates the VOX relay. The ground at the junction of R1 and D1 removes the blocking bias to the 1st mixer, 2nd mixer, and driver through terminal DG and MG. Activation of the VOX relay removes the ground at terminal RS which cuts off transistor Q1 and applies operating bias to the power amplifier through voltage divider R5, R6 and VR5.

This form of block bias keying assures smooth CW operation without backwave radiation.

Transistor Q2 functions as an ALC amplifier during CW and SSB operation. When the power amplifier is driven into grid current region, a voltage change is felt across variable resistor VR1; this change is detected and amplified by transistor Q2 and applied to the ALC terminal of the board where it is coupled to IF amplifier Q4, effectively controlling the gain of the IF stage.

This circuit has a fast attack time and a slow release time assuring optimum drive to the power amplifier at all times without excessive distortion.

3 - 13 POWER SUPPLY CIRCUIT (UC1011J AND CABINET)

Operating voltages for the transmitter are derived from a single transformer with multiple secondary windings. The power supply delivers the following voltages: high voltage B+ — 850 VDC, low voltage B+ — 210 VDC and 300 VDC, Bias — −90 VDC, low voltage — +14 VDC.

The power supply operates from 115 V AC, 50 or 60 Hz and is protected against overload by a 6 amp fused primary. Television interference is reduced by the incorporation of an internal brute force line filter.

3 - 14 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 spply (Derived from +14 V DC 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:

Transistor 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 estblished 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 0.6 volt) and places the emitter of Q3 approximately 0.2 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 increase in Q3 collector voltage is directly coupled to the base of error amplifier Q2; this icreasing positive potential on the base causes the collector current to increase, decreasing the collector voltage. The decrease in collector voltage of Q2 is felt on the base of series regulator Q1, a silicon PNP transistor. The decrease in base voltage causes an increase in current through Q1 decreasing the collector-to-emitter voltage drop, stabilizing the output voltage at +9 volts.

3 - 15 VOX AMPLIFIER & ANTIVOX CIRCUIT (UC3101J)

VOX AMPLIFIER

Under standby condition this circuit is quiescent; transistors Q4, Q5, Q7, and Q8 are turned off and transistor Q1 is turned on. VOX amplifier holding capacitor C10 is charged from the +9 volt supply through the VOX relay resistor VR8.

The output of amplifier Q3 is rectified by half-wave rectifier D6 and produces a −DC output voltage proportional to the AF input to Q3. Application of an AF signal to Q3, and subsequent rectification by D6, forward biases Q4 turning it on. With Q4 on, the base potential of Q5 is lowered, turning it on and allowing the VOX amplifier holding capacitor C10 to discharge through the low collector-to-emitter resistance of Q5.

Since the discharge current of C10 is Hfe times as large as the base current of Q5, capacitor C10 will completely discharge through Q5 with the slightest amount of current flow through the collector of Q4. For this reason, the time constant circuit is capable of providing an almost constant VOX hold time for a variable level at the input.

ANTIVOX CIRCUIT (UC3101J)

The ANTIVOX signal is coupled through step-up transformer T1 to a full-wave bridge rectifier comprised of diodes D1 through D4. The positive DC voltage from the rectifier circuit is applied to the base of Q1, turning off the transistor.

When transistor Q1 turns off, the increase in collector voltage is coupled through diode D2 to the base of Q2 turning it on, simultaneously charging time-constant capacitor C5. With Q2 turned on, a ground is placed on the base of transistor Q4 of the VOX circuit, preventing the VOX circuit from being activated by extraneous noise.

3 - 16 SIDE TONE OSCILLATOR (UC3102J)

The side tone oscillator activates the VOX amplifier for semi-break-in keying and provides monitoring facilities during CW operation.

The circuit consists of transistors Q1, Q2, Q3 and Q4. Transistor Q1 is a phase shift oscillator operating at approximately 750 Hz. Transistor Q2 and complementary pair Q3 and Q4 provide sufficient amplification to operate an 8 ohm speaker. The output power is approximately 100 mW.

Insertion of the key in the key jack forward biases oscillator Q1, activating it for subsequent CW operation.

The CW sidetone volume and VOX actuating signal is controlled by VR1, located just inside the top cover on UC3102J. This position is shown in Figure 6. The transmitter will not function in semiautomatic CW mode unless VR1 is advanced sufficiently to the clockwise position.

SECTION FOUR MAINTENANCE

4 - 1 GENERAL

Included in this section are alignment, neutralization procedures and voltage measurements. Should it become necessary to remove any of the solid state devices, be sure to attach an appropriate heat sink to the device leads prior to application of the soldering iron.

To remove the transmitter chassis from the cabinet, remove two screws from the top plate and three screws from each side, then lift the cabinet up and away from the chassis.

To remove the bottom plate, remove seven screws and lift the plate off. DO NOT REMOVE SCREWS HOLDING THE FEET TO THE BOTTOM PLATE.

4 - 2 CARRIER OSCILLATOR ADJUSTMENT

Accurate adjustment of the carrier oscillator requires a frequency counter or other accurate frequency determining device and an RF VTVM. In the absence of these items of test equipment, an approximate adjustment can be made using the following procedure:

Lightly couple a calibrated communications receiver to the output of the carrier oscillator. Set the receiver to receive a frequency of 3393.5 kHz.

With the MODE switch in the LSB position, adjust the core of transformer T1 in a clockwise direction until oscillation stops. Now turn the core counterclockwise until oscillation just starts. Check to see that the oscillator functions in USB and CW positions of the FUNCTION switch.

4 - 3 CARRIER BALANCE ADJUSTMENT

Connect the transmitter output to a dummy load. Tune and load the transmitter for CW operation on the 7 MHz or 14 MHz band. Set the carrier level to 200 ma as indicated on the panel meter.

Set the FUNCTION switch to LSB and MIC gain to the extreme counter-clockwise position. Alternately adjust trimmer TC1 and resistor VR1 on the generator unit (UC2901J) for minimum indication, as read on the panel meter. (The METER switch is in the IP position.)

4 - 4 GENERATOR UNIT ADJUSTMENT (UC2901J)

With the transmitter tuned to operate in the CW mode, adjust the cores of transformers T1 and T2 on the generator unit for maximum indication as read on the panel meter. (The METER switch is in the RF position.)

DO NOT attempt adjustment of transformers T3, T4, and T5 unless a sweep and marker generator is used. Adjustment of these transformers affects the bandpass of this transmitter.

4 - 5 HETERODYNE CRYSTAL OSCILLATOR ADJUSTMENT (UC0119J)

To adjust the heterodyne crystal oscillator frequency, locate the crystal oscillator coil in the coil pack behind the front panel, and adjust it as follows:

Slowly turn the core clockwise until oscillator stops. Then turn the core ½ to 1 turn counter-clockwise until the oscillator goes into oscillation.

The output of the heterodyne oscillator may be checked with a communications receiver tuned to the appropriate frequency, or by watching the RF indication on the panel meter as the oscillator coil is adjusted.

4 - 6 DRIVER TUNING (UC0118J , UC0117J)

(See Figure 8, page 13)

Locate the mixer tuning coils at the center of the coil pack, and the driver plate tuning coils at the end near the PA. Set the MODE switch to CW and the DRIVE control to center scale.

With the transmitter in the transmit condition, adjust the cores of the mixer and driver tuning coils for maximum output as indicated on the panel meter set to the RF position.

During this procedure adjust the bands in the following order: 3.5, then 28.5, then 21, then 14, and then 7 MHz with the VFO set at 3.75, 28.8, 21.225, 14.175 and 7.15 MHz respectively.

The coils of this unit are switched in series and paralleled for the different bands. It is therefore essential that the coils be adjusted in the order given.

4 - 7 NEUTRALIZATION OF THE PA

(Refer to Figure 7, page 13)

Turn the transmitter for CW operation at 21.225 MHz; then disable the power amplifier by setting the TRANSVERTER switch to ON.

With a sensitive VTVM connected to the screen grids of the PA, adjust neutralizing capacitor TC1 for minimum indication on the VTVM. This capacitor is located on the top of the PA compartment.

4 - 8 AM SET

(Refer to Figure 8, page 13)

Set the bandswitch to the 14 MHz band, and adjust the transmitter for maximum output in the CW mode.

With the panel meter set to ALC, adjust the CAR control on the top of the chassis for a meter reading of 200 ma.

Turn the MODE switch to AM and adjust AM-set control VR3 on the bottom of the chassis for a meter reading of 120 ma. (The meter is set to IP.)

4 - 9 LUBRICATION AND CLEANING

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

The knobs and front panel may be cleaned with any neutral cleaner.

4 - 10 PILOT LAMP REPLACEMENT

Should the pilot lamps require replacement, replace them only with a tubular type, having a current rating of 300 ma at 8 volts. These are available from your local dealer.

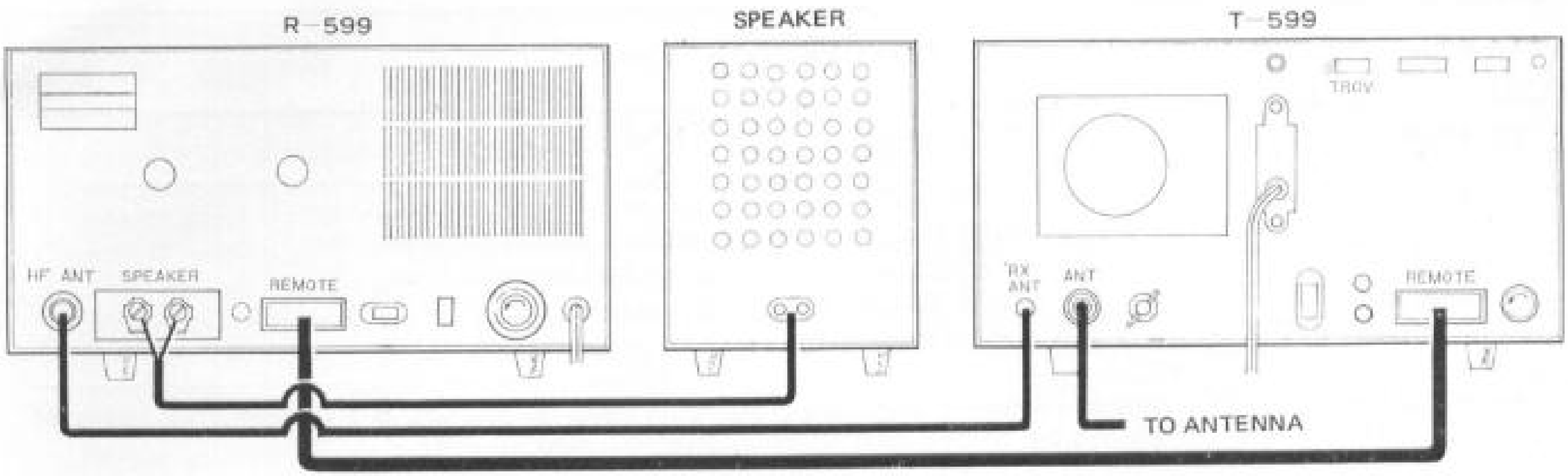


Figure 1 Interconnection of T-599 and R-599 receiver

An example in which switchover between the transmitter and the receiver is performed by tuning on and off the mute bias
One contact of switching relay is repeated to terminals No. 12, No. 13 and No. 14 respectively. Use these terminals after making reference to the use of the terminals in the text.
Solder lead wires to pins No. 13 and No. 14 of 16-pin.

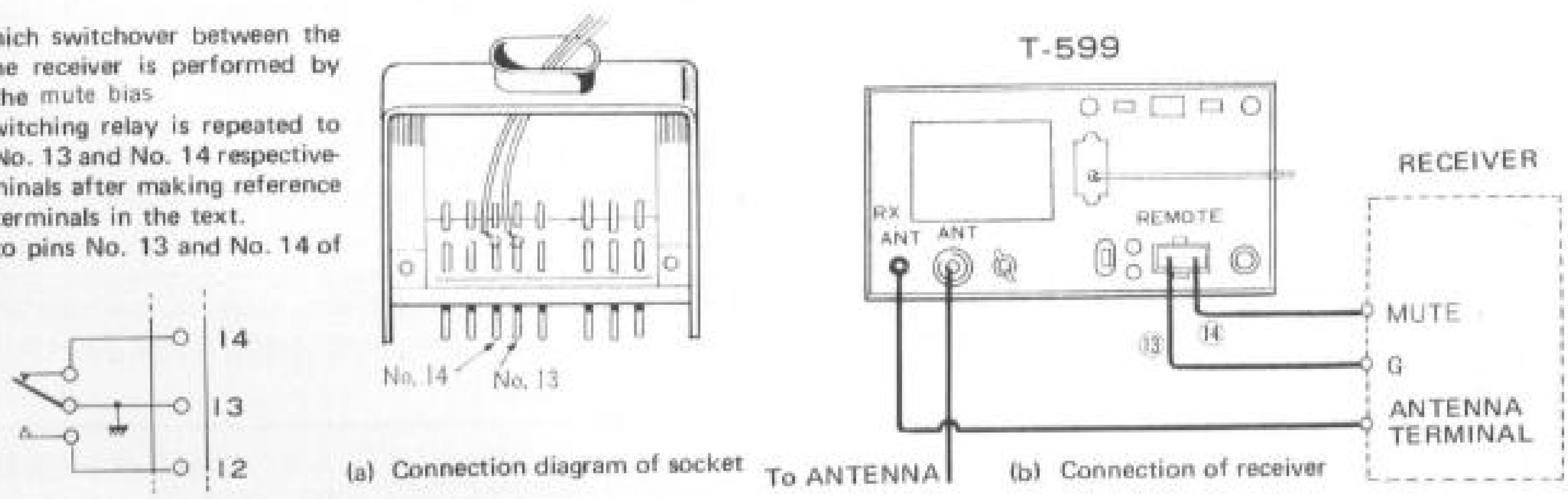


Figure 2 Interconnection of T-599 with receiver other than R-599

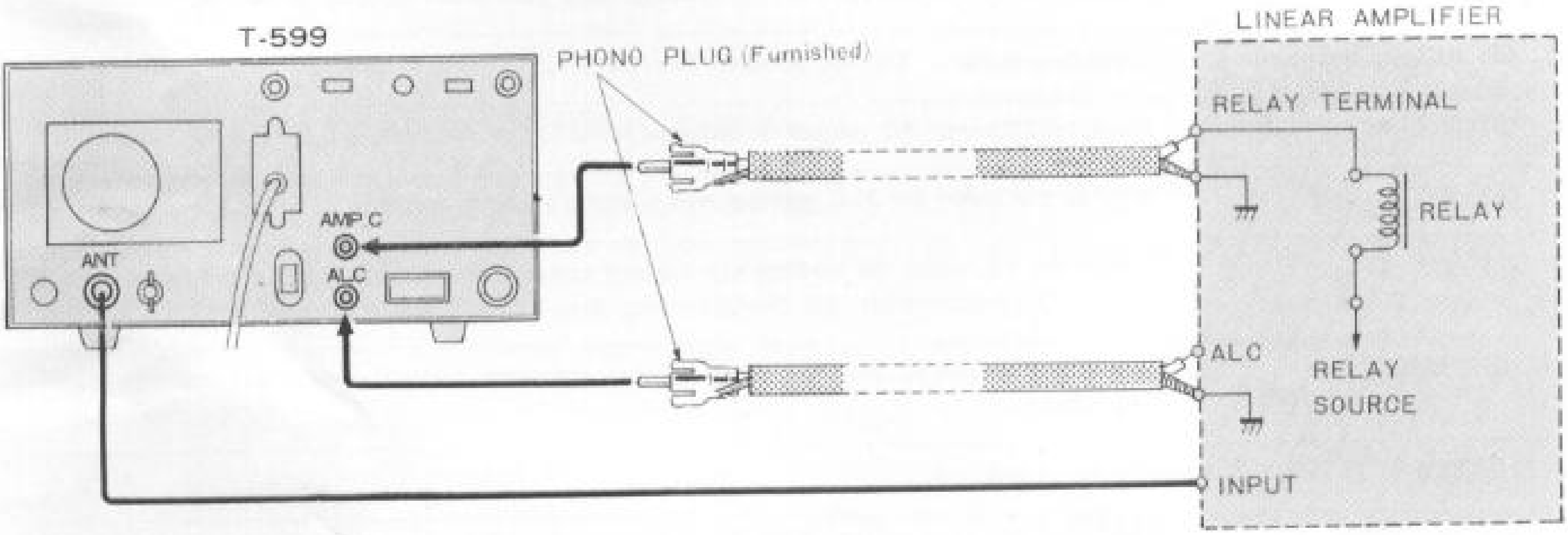


Figure 3 Interconnection of T-599 with linear amplifier

REF. NO.	FRONT PANEL (See Figure 4)
(1) MODE	Selects mode of operation. Tune, CW, LSB, USB or AM.
(2) METER	
(1) ALC	Provides relative indication of ALC voltage feedback to IF amp. Q4.
(2) Ip	Indicates PA plate current by measuring PA cathode voltage.
(3) RF	Provides relative indication of PA, RF output voltage.
(4) HV	Indicates plate voltage of PA.
(4) FUNCTION	Selects manual or VOX keying or, in the calibrate position, activates low level stages of transmitter for zero beat to the receive frequency.
(9) BAND	Selects appropriate circuits for operation in 600 kHz segment of the 3.5, 7, 14, 21 or 28 MHz band.
(10) POWER	Applies input power to all circuits of the transmitter.
(11) SEND/STBY	Manually keys transmitter when set to the send position.
(12) DRIVE	Tunes all ganged circuits of the PA driver.
(13) PLATE	The inner knob of a composite control resonates PA plate circuit to desired frequency. Before operating, pre-position this control to the band in use. Read band on the outer scale marked on the panel.
(14) LOAD	The outer knob of a composite control adjusts the antenna load variable capacitor. Approximate load impedance is read on the inner scale. The impedance increases clockwise on the scale.

	REAR PANEL CONTROLS AND CONNECTORS (See Figure 5)
(1) RX ANT	Common antenna to receiver. Switching of the antenna is accomplished by an internal TR relay.
(2) ANT	Transmitter output to the antenna, linear amplifier, or dummy load. Do not operate this transmitter without a 50 to 75 ohm load connected to this connector.
(3) GND	Ground terminal. Do not operate this transmitter without a good earth ground.
(5) EXT. AC	Provides 300 watt AC output to external unit.
(6) ALC	This is the input for ALC voltage when using a linear amplifier.
(7) AMP. C	These are terminals for making the control connections for a linear amplifier when it is used. These terminals are shorted when the T-599 is switched to transmitting mode.
(8) REMOTE	Provides interconnection for R-599 receiver or relay control contacts for linear amplifier.
(11) KEY	CW key input.
(12) SEP/TRCV	Selects separate or transceive operation when operated in conjunction with the R-599 receiver.

(13) **TRANSVERTER ON-OFF**	When switch is set to the OFF position, the PA is disabled and the driver output is link coupled to the transverter output terminal.
(14) **TRANSVERTER OUT**	Output connector to a transverter.

TOP CHASSIS CONTROLS (See Figure 6)

(1) **CAR**	Variable resistor that adjusts the output carrier level during CW or AM operation.
(2) **MIC**	Microphone gain control.
(3) **VOX**	VOX sensitivity control.
(4) **ANTI-VOX**	Adjust level of anti-vox voltage.
(5) **DELAY**	Adjust VOX drop-out delay.
(6) **BIAS**	Adjust static PA plate current.
SIDETONE	Adjust sidetone gain (Located inside the UC3102J Sidetone Unit. See Figure 7.)

BOTTOM CONTROL (See Figure 8)

MIC IMP	Select 600 ohm or 50 K ohm input impedance to the microphone amplifier.

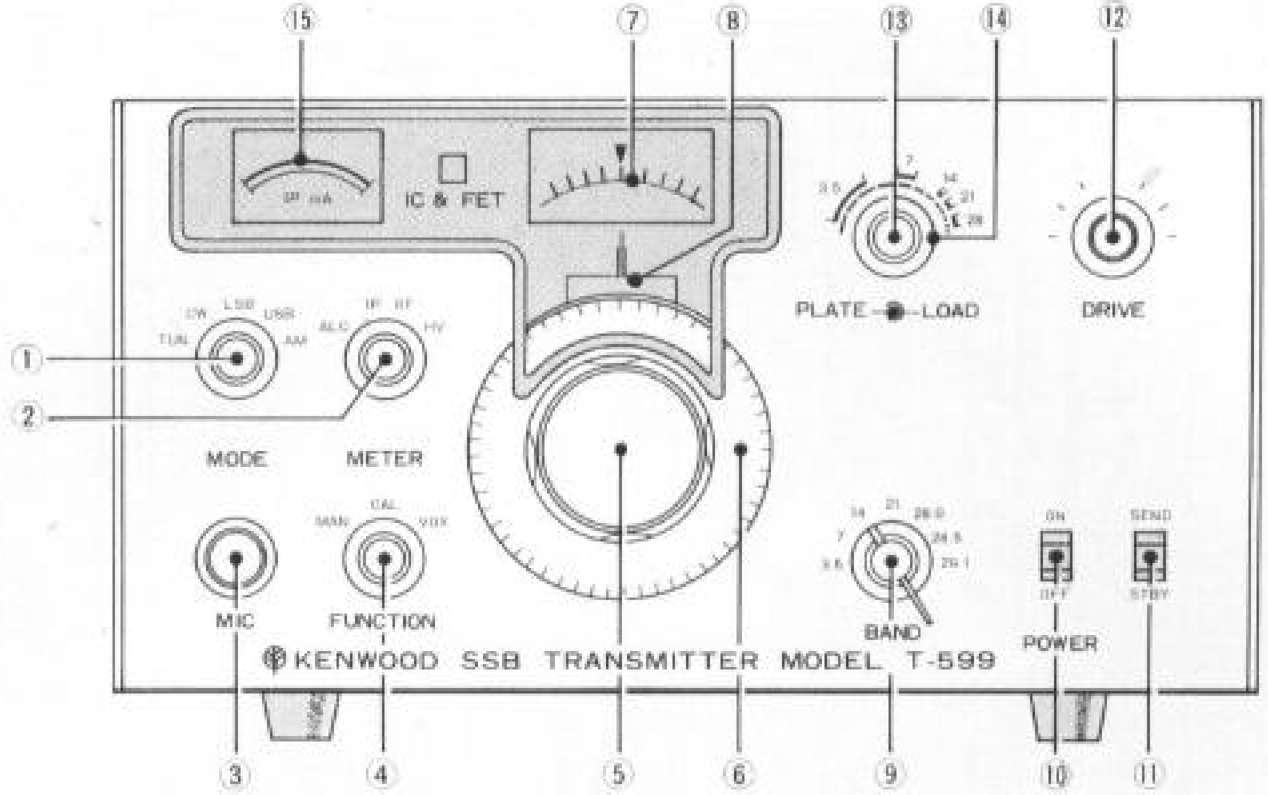


Figure 4 Front panel view

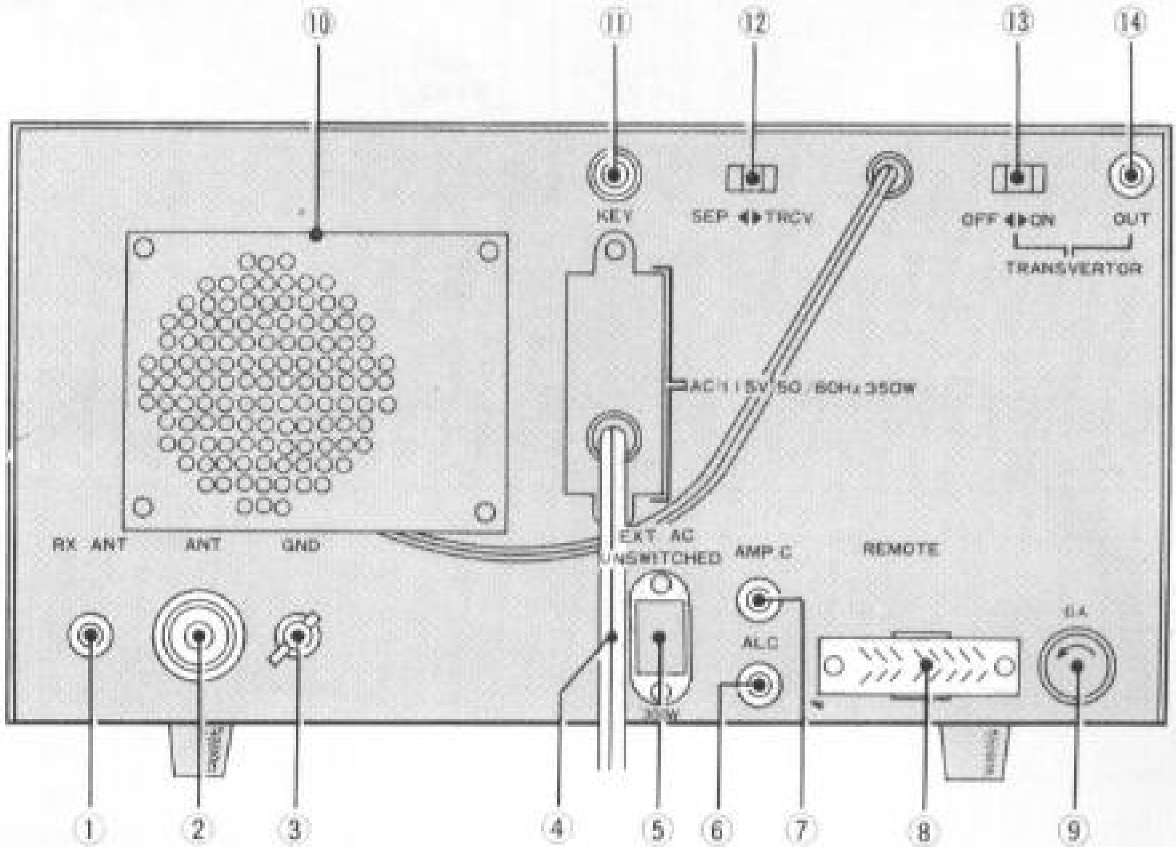


Figure 5 Rear panel view

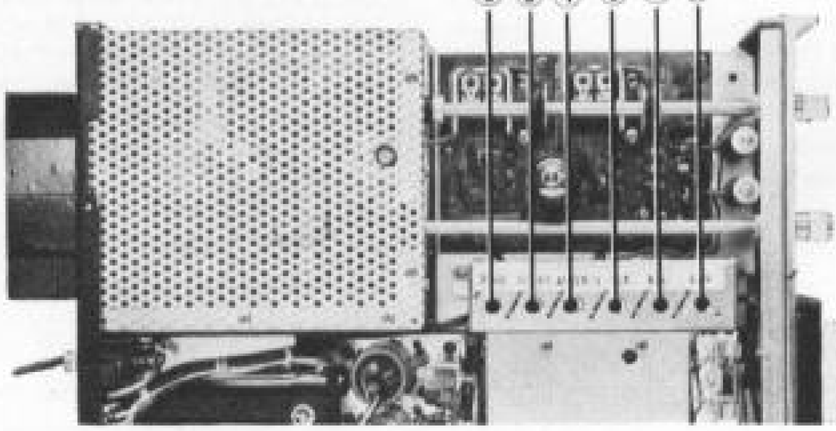


Figure 6
Chassis controls view

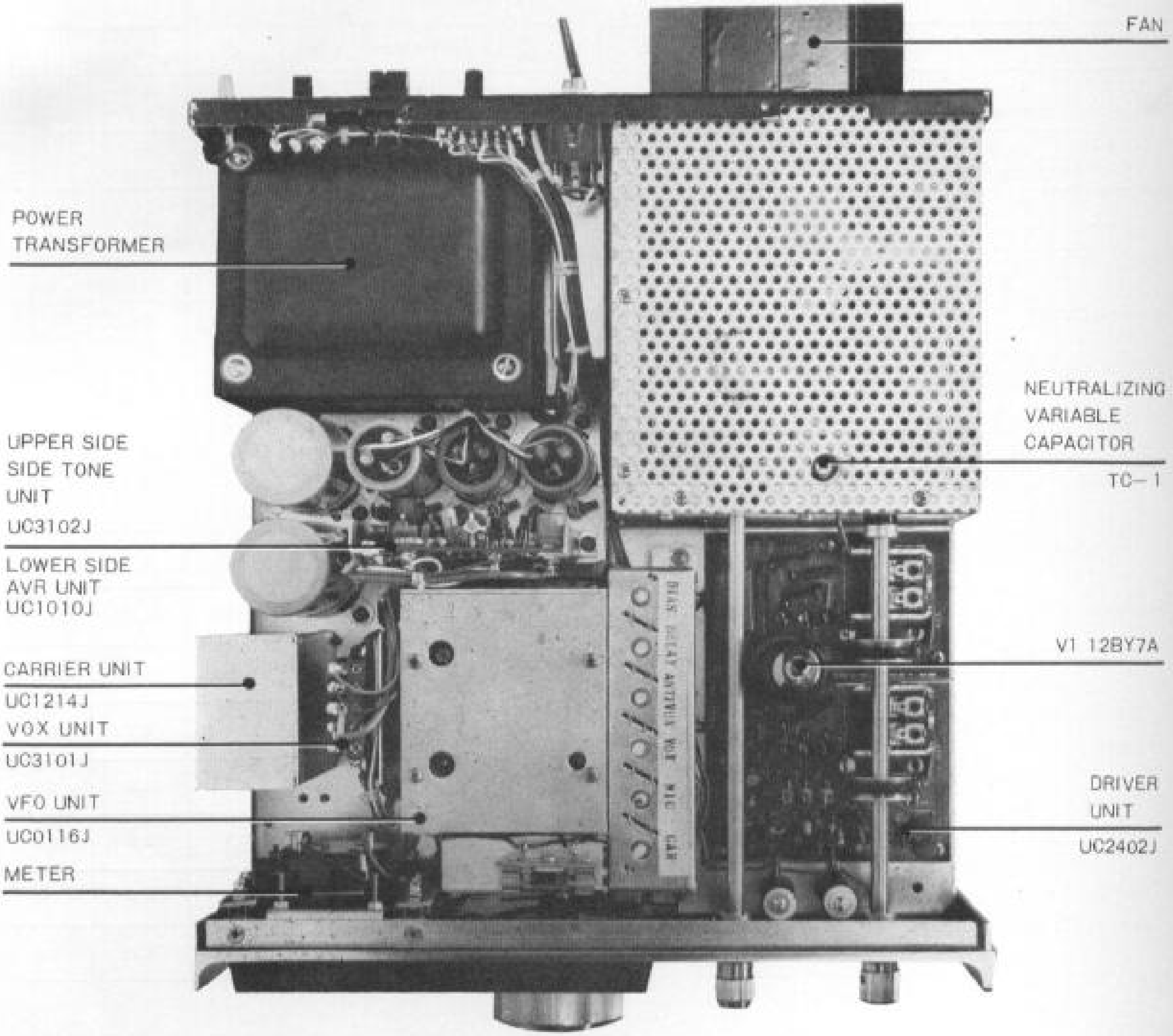


Figure 7 Top chassis view

VR4 RF MET

V2 S2001

CONTROL UNI

UC3001J

V1 S2001

DRIVER COIL PACK UNIT

UC0117J

MIX COIL PACK UNIT

UC0118J

OSC COIL PACK UNIT

UC0119J

Figure 9 generator unit

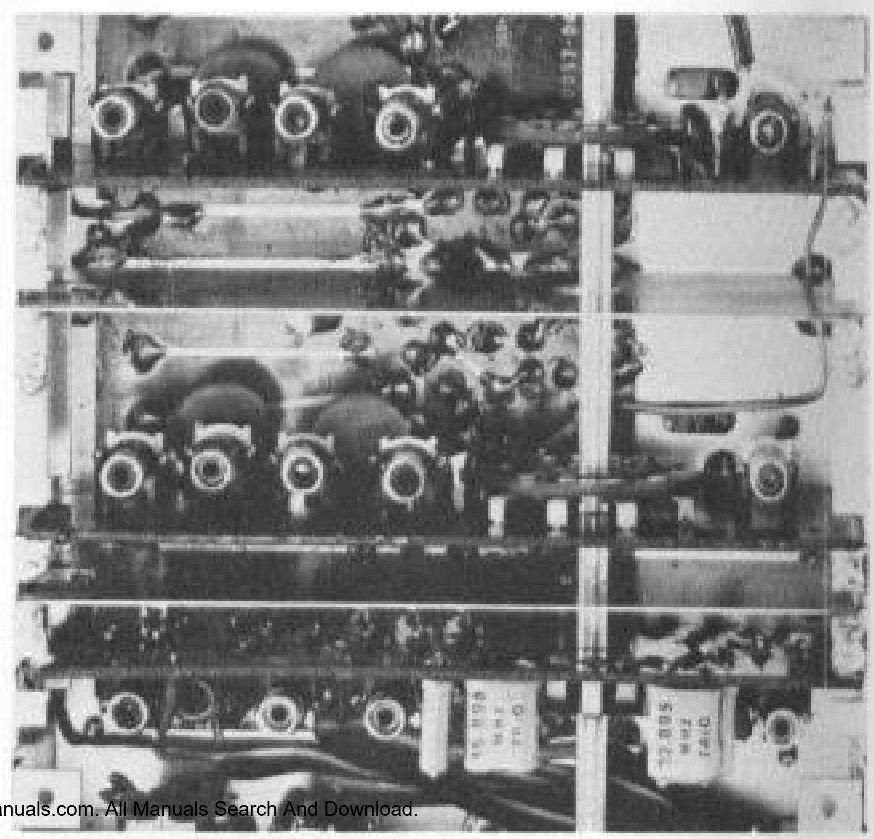


Figure 10 Coil pack

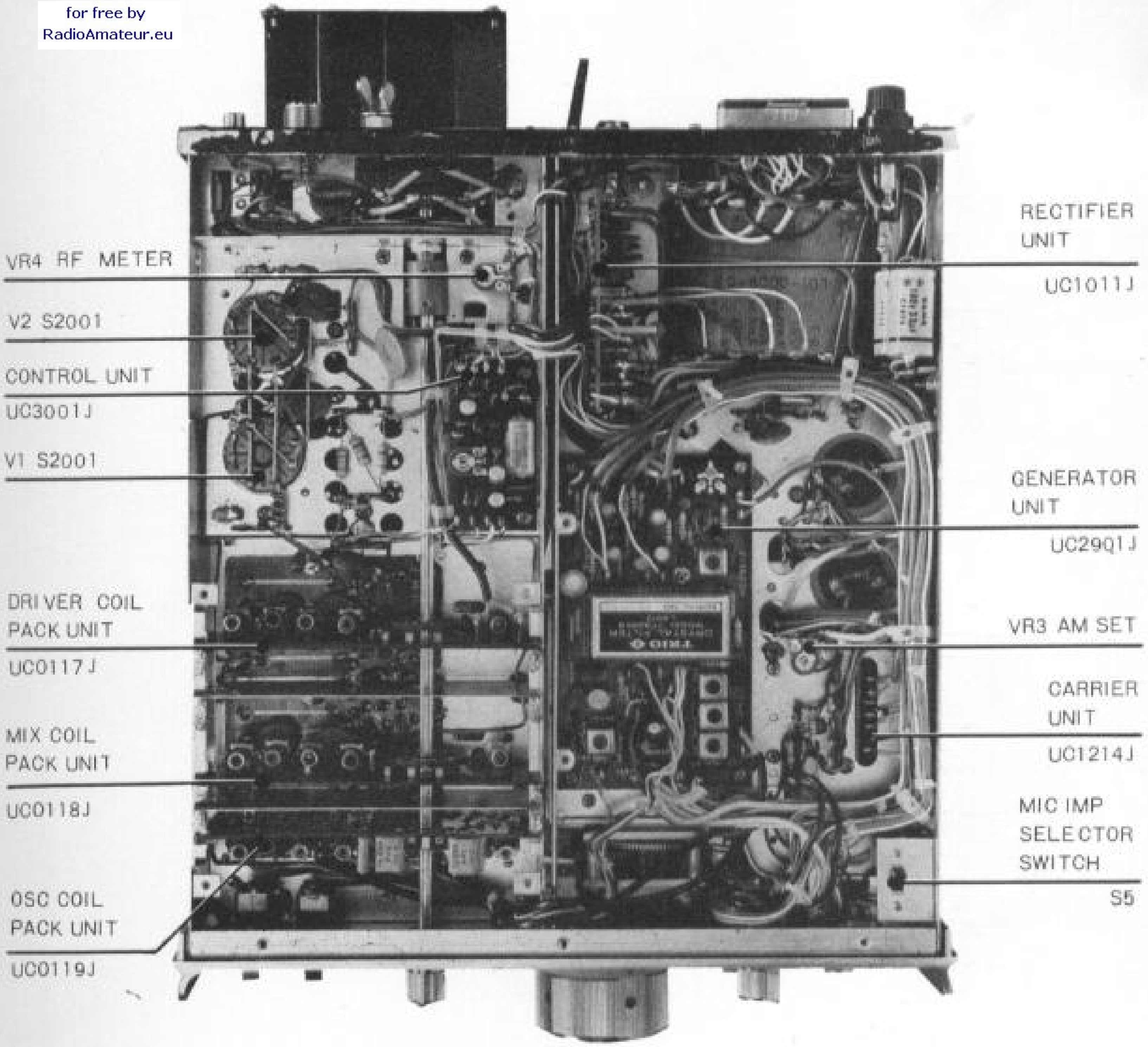


Figure 8 Bottom chassis view

Figure 10
Coil pack

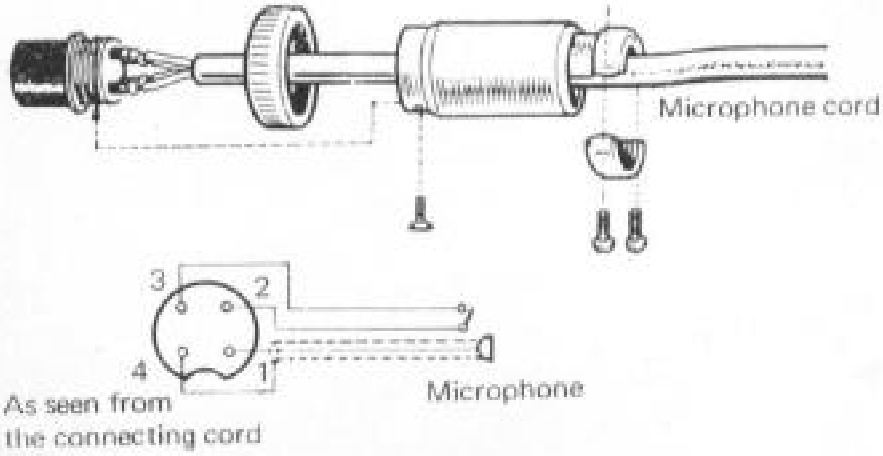


Figure 11 Microphone connection

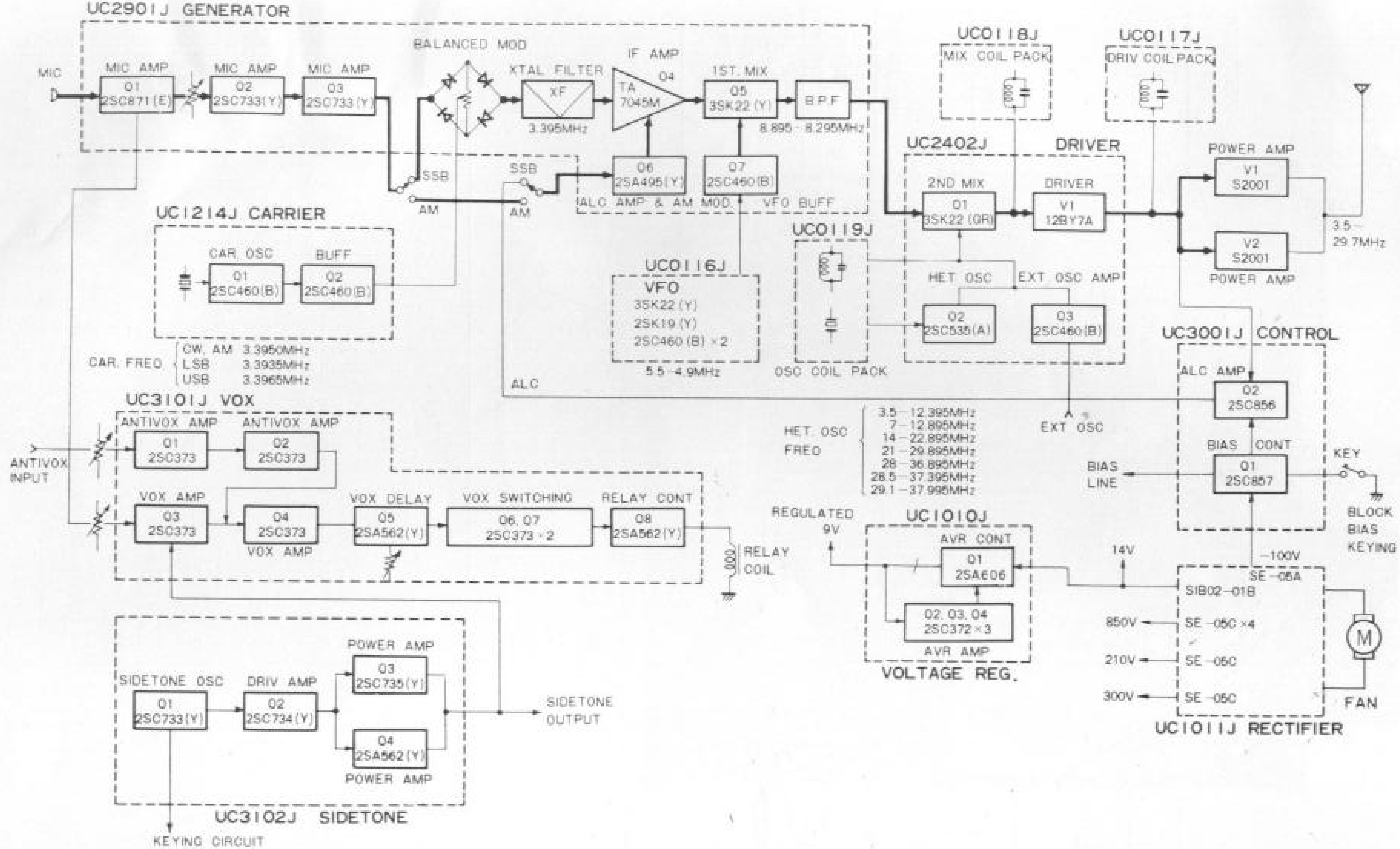


Figure 12 Block diagram

Table 2 Voltage measurements

UNIT NO.	TRANSISTOR	NOTE 1	E	B	C
UC 1214J	Q1 2SC460		0.85	1.4	9.0
	Q2 2SC460		1.55	2.2	9.0
UC 2901J	Q1 2SC871		1.2	1.9	4.5
	Q2 2SC733		0.35	0.9	2.1
	Q3 2SC733		1.50	2.1	3.8
	Q4 TA7045M	Refer next page "C" Table			
	Q5 3SK22	R S	Note2 0 0.95	−4.8 0	−2.0 0
	Q6 2SA495	R S	6.8 Note3 2.2	6.2 1.5	0
	Q7 2SC460	R S	2.6 3.1	3.3 3.8	14.5 13.5
UC 2402J	Q1 3SK22	R S	Note2 0 0.75	−3.75 0	−2.8 −0.5
	Q2 2SC535	SEP TRCV	1.7 0	1.25 0.2	7.5 8.0
	Q3 2SC460	SEP TRCV	2.7 0.87	1.55 1.48	7.5 8.0
	V1 12BY7A	Refer next page "C" Table			
UC 3001J	Q1 2SC857	R S	−94 −95	−94 −95	−94 0
	Q2 2SC856	R S	−94 −50	−94 −50	6.3 Note3 1.5

UNIT NO.	TRANSISTOR	NOTE 1	E	B	C
UC 3101J	Q1 2SC373	R A	0	0.65 0.6	0.13 0.65
	Q2 2SC373	R A	0	0.23 0.67	0 0
	Q3 2SC373		0.6	1.2	6.1
	Q4 2SC373	R V	0	0 0.25	8.5 0.65
	Q5 2SA562	R V	8.5 0.65	8.5 0.65	0
	Q6 2SC373	R V	5.4 4.5	6.0 0.65	6.3 8.6
	Q7 2SC373	R V	5.4 4.5	3.8 5.2	14.5 11.7
	Q8 2SA562	R V	14.5 13.3	14.5 12.5	0 13.2
UC 3102J	Q1 2SC733		0.55	1.10	8.9
	Q2 2SC734		0.68	1.33	6.3
	Q3 2SC735		7.0	7.6	14.5
	Q4 2SA562		7.0	6.3	0
UC 1010J	Q1 2SA606		14.5	13.8	9.0
	Q2 2SC372		·5.3	5.9	13.8
	Q3 2SC372		5.5	5.7	5.9
	Q4 2SC372		5.5	6.15	9.0

Figure 12 Block diagram

Table 3 Voltage measurements

UNIT NO.	TER-MINAL	NOTE 1	VOLTAGE
UC 2901J	AF5	Note 4	1.4
	AF6	Note 5	0.4
	CAR		[1.0]
	MG	R	−7.0
		S	0
	B1	R	14.5
		S	13.5
	B2	R	0
		S	13.5
	SM		0
	ALC	R	6.2
		S	Note3 1.5
	BS		9.0
	VFO		[1.0]
	OUT	R	[0]
		S	Note6 [0.5]
UC 1214J	BS		9.0
	LSB		−0.4
	USB		−0.7
	CWT	R	14.5
		S	13.5
	OUT		[1.0]
UC 0116J	R		5.4
	B		9.0
	OUT		[1.0]
UC 2402J	14	R	14.5
		S	13.5
	9		9.0
	AS	SEP	3.0
		TRCV	0

UNIT NO.	TER-MINAL	NOTE 1	VOLTAGE
UC 2402J	OS	SEP	0
		TRCV	0.17
	MG	R	−7.1
		S	0
	OX	SEP	1.25
		TRCV	0.5
	OL		7.5
	MD	R	14.5
		S	13.5
	MVC	Note7	14.5
	DG	R	−46.0
		S	0
	H		(6.3)
	DP	R	318
	300	R	318
		S	290
	DVC	Note7	330
UC 3001J	MG	R	−7.0
		S	0
	DG	R	−46.0
		S	0
	RS	R	0
		S	−94
	KEY	R	0
		C	−60
	−C		−94
	PG	R	−94
		S	−50
	ALC	R	6.2
		S	Note3 2.1

UNIT NO.	TER-MINAL	NOTE 1	VOLTAGE
UC 3C01J	VR	R	−37
		S	−20
UC 3101J	SS	R	14.8
		V	12.0
	RL	R	0
		V	13.2
	9V		9.0
	TV	Note8	8.5
	TB	R	8.5
		V	0.65
	TO	R	8.5
		V	0.65
	VS	R	3.8
		V	5.2
	14	R	14.8
		V	14.0
UC 3102J	KY1	K	13.6
		C	12.8
	KY2	K	−60
		C	0
	OE	K	0
		Note8	1.6
	B	K	14.5
		C	13.5
UC 1010J	IN	R	14.5
		S	13.5
	OUT		9.0
	RTI		5.4

UNIT NO.	TER-MINAL	NOTE 1	VOLTAGE
UC 1011J	HV	R	(338)
		S	(310)
	850	R	910
		S	815
	300	R	315
		S	290
	C25	R	335
		S	315
	210	R	235
		S	215
	C26	R	242
		S	228
	−C	R	−94
		S	−97
	C28	R	−102
		S	−100
	14	R	14.8
		S	14.0
	14B	R	(6.8)
		S	(6.6)
	14A	R	(5.7)
		S	(5.5)
	100	R	(75)
		S	(72)
	230	R	(187)
		S	(178)
	320	R	(260)
		S	(255)

PIN	NOTE 1	Q_4 TA7045M	V_1 12BY7A	V_1 S2001	V_2 S2001
1	R	6.8	0	0	0
	S	Note3 1.7	2.6	1.1	1.1
2	R		−46	(6.3)	(6.3)
	S		0		
3	R	0	0	235	235
	S			215	215
4	R		0	0	0
	S			1.1	1.1
5	R	6.8	0	−94	−94
	S	Note3 1.7		−50	−50

PIN	NOTE 1	Q_4 TA7045M	V_1 12BY7A	V_1 S2001	V_2 S2001
6	R	14.5	(6.3)	0	0
	S	13.5		1.1	1.1
7	R	0	318	0	0
	S	13.5	290		
8	R	14.5	200	0	0
	S	13.5	150		
9	R		0		
	S				
P	R			910	910
	S			815	815

Note 1
- R: Under stand-by condition.
- S: Under maximum CW transmitting output.
- SEP: SEP TRCV switch at SEP Position.
- TRCV: SEP TRCV Switch at TRCV Position.
- A: 0.5 V ANTI-VOX input Signal.
- V: VOX and CW side tone Operations.
- K: CW operation with Stand-by Key inserted.
- C: CW operation with Key downed.

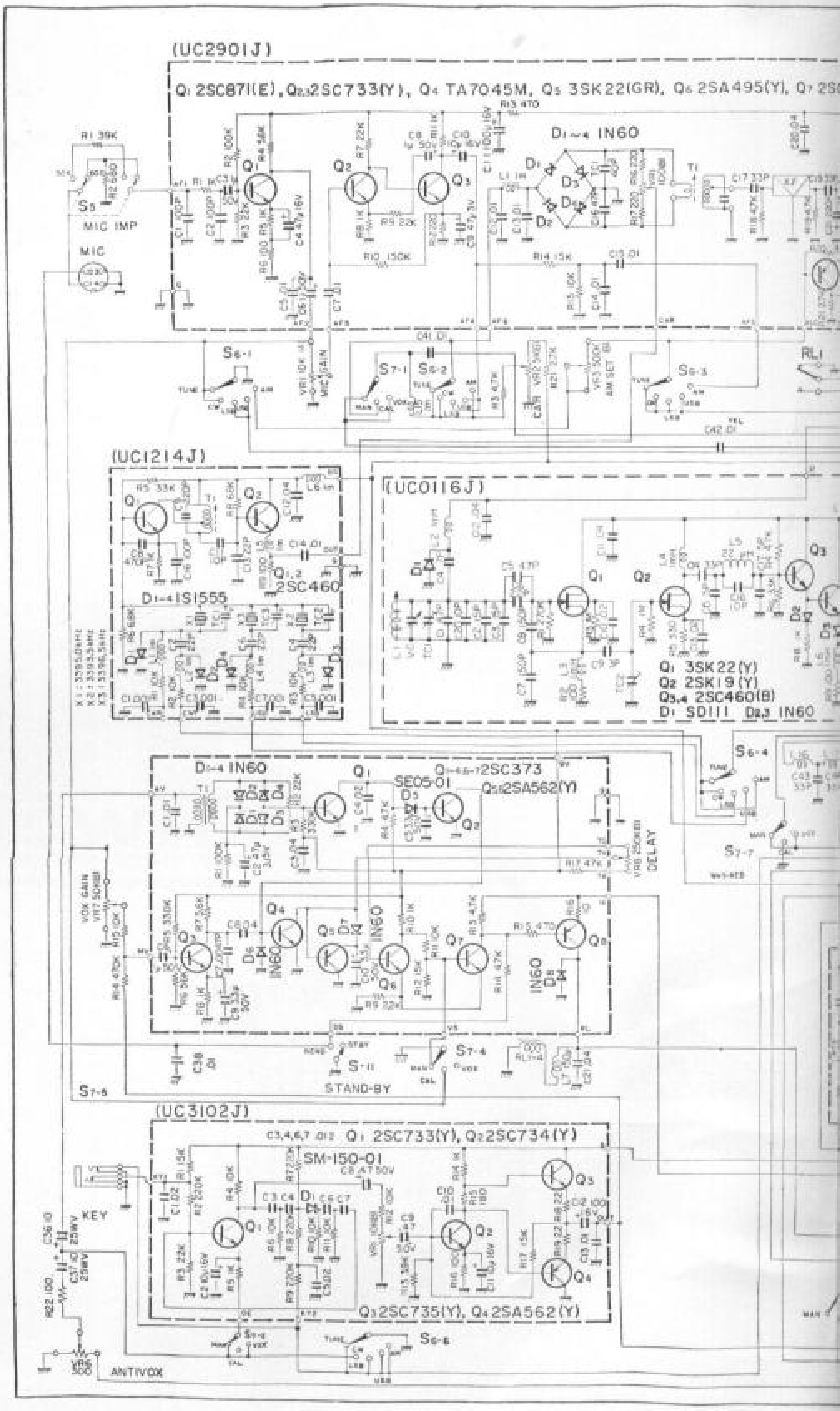
Note 2 Read E, B and C as S, G1 and G2 respectively. D is same as 14 V Supply line.

Note 3 Approx. 5.5 V if meter set at ALC range does not deflect.
Note 4 MODE Switch set at AM. O at positions other than AM.
Note 5 MODE Switch set at Position TUN, CW and AM. O at Position other than TUN, CW and AM.
Note 6 Value varies depending on how ALC circuit functions.
Note 7 3.5 MHz band. O for the band other than 3.5 MHz band.
Note 8 DELAY VR control placed in the extreme counterclockwise position.
Note 9 Operations other than CW operation.

*** Measurement is made using a vacume tube voltmeter. The value shows the voltage to the chassis. The value in ( ) denotes the AC voltage and that in [ ] the RF voltage.**

Table 4 Remote Connector

PIN NO.	FUNCTION
1	VFO input/output during transceive operation.
2	Not used.
3	Calibrate signal to R-599 during combined operation.
4	Relay voltage to R-599 during combined operation.
5	Not used.
6	ALC input from linear amplifier.
7	Not used.
8	Heterodyne oscillator input from R-599 receiver during transceive operation.
9	Ground.
10	Anti-Vox input.
11	B + input to TX VFO during transceive operation when using the TX VFO for frequency control.
12, 13, 14	Pins 12, 13, and 14 are parallel with a single-pole double-throw contact of the VOX relay. During standby operation Pin 13 becomes a grounded common contact with Pin 14. During transmit, it becomes a grounded common contact with Pin 12 which is connected to AMP C.
15	Sidetone output.
16	Ground.



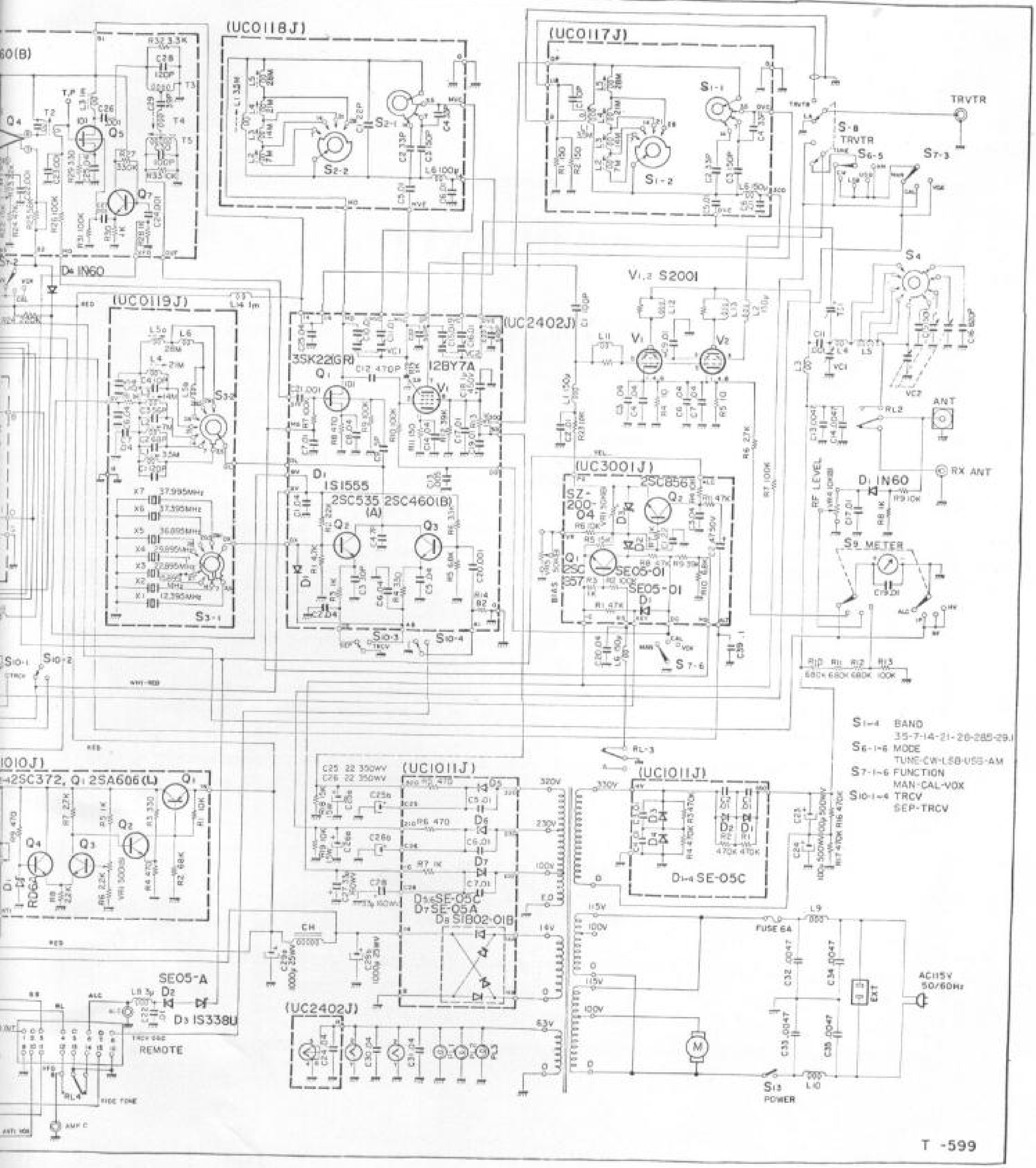


Figure 13 Schematic diagram

KENWOOD®

Manufactured by TRIO ELECTRONICS, INC., Tokyo, Japan

for HENRY RADIO Los Angeles, California

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Service bulletin no. 7 (2-11-1977)

No ALC - Drive 10 meters: Check for loose contact at oscillator wafer on coil pack.

No TX any band: Check the T1 on generator board (X52-0009-00).

No TX: Bad driver FET Q1 3SK22(GR) on X47-0004-00).

No relay action when TX: Bad Q8 2SA562(Y). When replacing Q8 change resistor R16 to 4.7 ohm.

Rubber belt sliping on drive and load: TKC has Chain Modification Kit.

No drive when shock: Check for loose output terminals af final rotary switch (S10-1002-05).

No output on any band: Check T2 GEN unit (X42-0009-00).

No TX: Check final relay for burned contacts. (S51-4017-15).

Bias current too high and blows fuse: Check for bad 6-7001A and shorted cathode resistors 10 ohm.

Cannot neutralize: Make sure shield is properly installed on driver 12BY7.

No output from generator unit (X52-0009-00): Bad Q4 TA7045.

No 9 Volt out at AVR (X43-0010-00): CHeck Q1 2SA606(L).

Low output power: If American 12BY7 is used in driver circuit, this can cause parasitic oscillation. Please use standard Kenwood replacement tubes.

Blows fuse: Check for shorted electrlytics at power supply (X43-0011-00).

AC hum on SSB transmission: Send for TKC bulletin.