IC-202E

2 METER BAND SSB TRANSCEIVER

INSTRUCTION MANUAL

ICOM

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SECTION I INTRODUCTION

Congratulations on the purchase of the IC-202E portable 2 meter SSB transceiver. The IC-202E was designed to be operable anywhere like most portables, but we also included features like a very effective noise blanker, RIT, S&RF meter, and a full 3 watts output. Two built-in crystals in the stable VXO allow operation between 144.00 and 144.40MHz. If you wish to expand the range of the IC-202E, we have also provided 2 spare crystal sockets for your convenience. With a slight retuning of the IC-202E, and installation of a special crystal, you may also work through OSCAR in USB.

The aluminum die cast frame provides a very strong yet light housing for the 2 circuit boards, and the aluminum sides snap off easily if service is ever necessary or to change batteries.

The IC-202E operates on 9 inexpensive C cell batteries, or an external 13.8V DC source. The IC-202E will also operate on nicad batteries, contained in the BC-20 nicad battery/charger kit. For AC operation, we recommend the IC-3PS which not only provides power for the IC-202E, but also doubles as a stand and holder for the IC-20L 10 watt linear amplifier.

You can use the built-in whip antenna for portable use, or a flexible antenna such as the IC-FA1. An external antenna connects to the antenna connector on the back of the IC-202E.

We are sure that you will have years of lasting enjoyment from your IC-202E, manufactured by the leader in communication equipment: Inoue Communication Equipment Corporation.

SECTION II SPECIFICATIONS

General:

Number of Semi-conductors	Transistors 19 FET 7 IC 7 Diodes 33
Frequency Coverage	144–146MHz
Frequency Stability	Less than 200Hz per hour at +25°C
Antenna Impedance	50 ohms unbalanced
Power Supply Requirements	DC 13.8V±15% Negative Ground 800mA max
Current Drain	Transmitting: A3J Approx. 540mA A1 Approx. 750mA Receiving: At max audio approx 250mA With no signal approx 90mA Dial Light: Approx 40mA
Dimensions	183mm(H) x 61mm(W) x 162mm(D)
Net Weight	2.0KGs including batteries.

Transmitter:

Emission Mode	A3J (USB) and A1
RF Power Output	A3J 3W (PEP) A1 3W
Carrier Suppression	More than 40dB down
Unwanted Sideband Suppression	More than 40dB down at 1000Hz AF input
Spurious Radiation	More than 60dB below peak power
Microphone	Impedance: 600 ohms Input level: 10mV typical Dynamic or optional Electret condenser microphone

Receiver:

Receiving System	Single Conversion Super Heterodyne
Intermediate Frequency	10.7MHz
Receiving Mode	A3J (USB) and A1
Spurious Response Rejection Ratio	More than 60dB
Sensitivity	Less than 0.5μV for 10dB S+N/N
Selectivity	±1.2KHz at –6dB ±2.4KHz at –60dB
Audio Output	More than 1W
Audio Output Impedance	8 ohms

144.00–144.40MHz built-in (2 Crystals). Each crystal gives 200KHz continuous coverage. Two spare crystal sockets are provided for additional frequency ranges between 144.40–146.00MHz. An external VFO connection is also provided.

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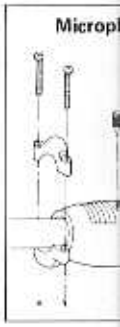
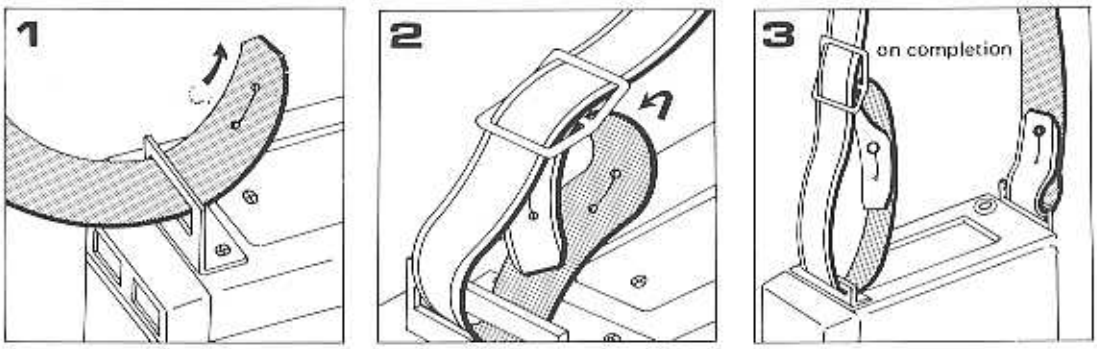


SECTION III ACCESSORIES

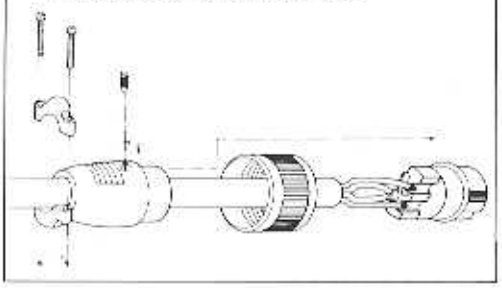
Various accessories are packed with your transceiver. Be sure not to overlook anything. Also it's a good idea to keep packing cartons in case of moving or if return for service is necessary.

1.	Dynamic Microphone	1	5.	Ext. Speaker Plug, Key Plug	2
2.	Microphone Case	1	6.	Earphone	1
3.	Shoulder Strap	1	7.	Dry Cells Type "C"	9
4.	Power Supply Plug	1	8.	Battery Tubes	2

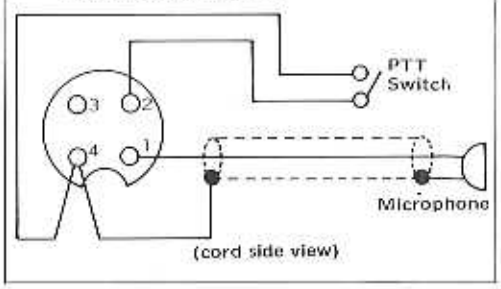
How to fit the shoulder strap



Microphone plug exploded view



Microphone connection



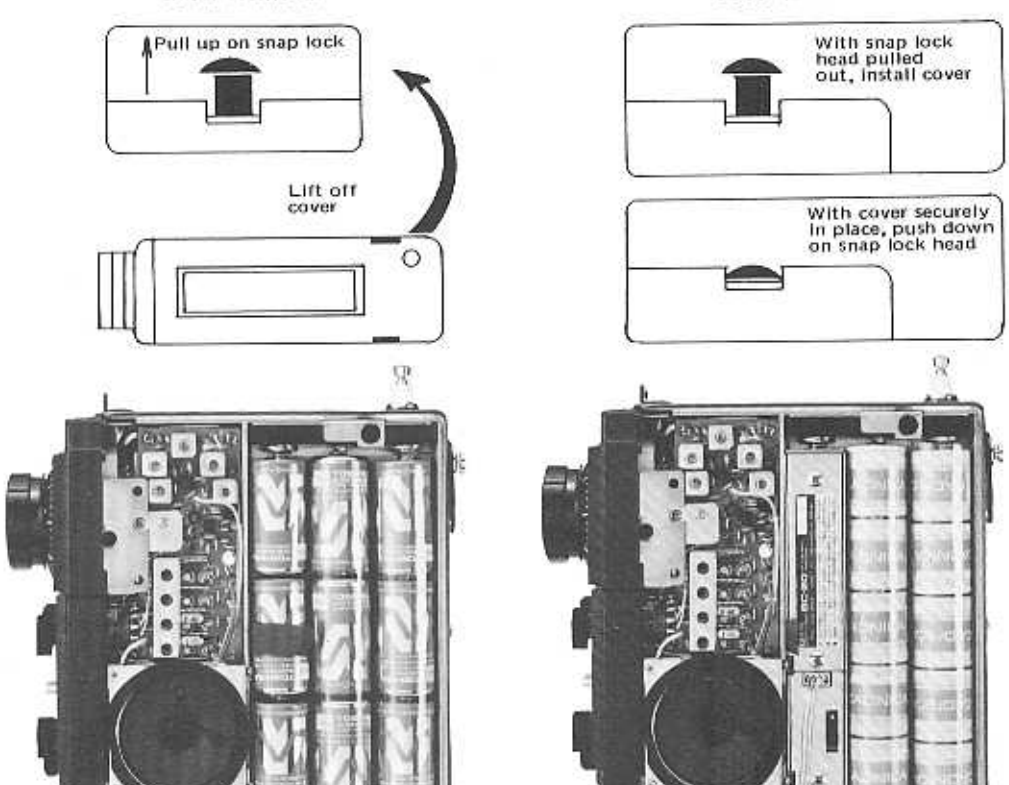
SECTION IV PRE-OPERATION

BATTERY INSTALLATION

Dry Battery:

Place the function switch in the OFF position. Remove the side that covers the battery case and speaker. Install the batteries into the battery tubes (three in each) taking care to observe the same direction (polarity).

Carefully install the battery tubes in the manner shown in photograph 1, placing the last three batteries in the inner column. Again take care to observe polarity, and place the battery tubes on top of the ribbon so when the batteries need to be removed, a simple pull on the ribbon will make removal easier. With the batteries properly in place, carefully replace the side cover.



Photograph 1
Dry Battery Installation

Photograph 2
Nickel-Cadmium Batteries and Charger Installation

Nickel-Cadmium Batteries and Charger:

First, install the charger in the battery case (the speaker side) of the transceiver housing as shown in photograph 2. The polarity of the switch end of the charger must be positive and on the case side, negative. Accordingly the negative polarity must be connected to the spring side of the battery case.

Next, install five nickel-cadmium batteries in the battery tubes in the same direction. Make certain the (-) minus side is next to the spring. After installation of the charger and batteries in the case, connect the connector to the socket of the charger (i.e., the connector from the transceiver housing). Make sure the switch of the charger is on, then install the cover housing as before.

WHEN TO REPLACE BATTERIES

When the power pilot lamp does not light up with the power switch on, or when it lights up during reception and goes out during transmission, the batteries are exhausted. Use batteries of the same type, for mixed types might cause leakage. Replace worn batteries with a complete new set of nine. If used with old batteries, the life of new ones might be shortened. Battery life is shortened more by transmitting than by receiving, since several times more current is drawn in transmit. To prolong battery life, therefore, practice as follows:

* Try to minimize the transmit period.
* Keep the transmission output on LOW as much as possible.
* Reduce volume during reception.
* Be sure to cut off power source when set is not used.

More working hours are available if high-performance batteries such as Alkaline type are employed.

EXTERNAL POWER PLUG CONNECTION

External Power Source

For use at home or in the car, please use the external power source which assures you of stable communication without concern about battery consumption.

1. Use either a regulated power supply or car battery of 13.8V DC and of over 1A current capability. (Though this transceiver may work at 11 to 15 VDC, use it preferably at the rated voltage.)
2. Correctly connect the external supply plug, as shown in the figure. If polarity is reversed, source power is cut off by the protection circuit and the unit will not operate.
3. When the transceiver is kept out of use for a prolonged period, the unit is operated for extended periods by external power only, or when the batteries are exhausted etc., remove the batteries to protect the unit from possible damage by battery leakage.
4. The outside electrode of the power plug is + (Positive). Be careful not to short the plug to the chassis frame, etc. When used in the car, don't short the plug to the car body or to the transceiver body itself, but connect it to the car battery through its fuse (1A-2A).

External DC Plug Wiring Diagram

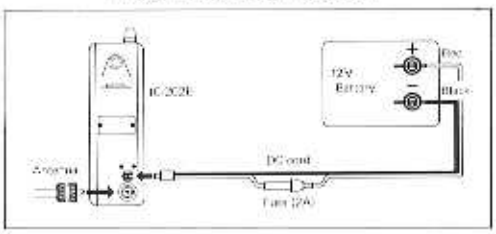
FOR OUTDOOR USE

1. Insert the supplied batteries. (Refer to "How to insert batteries").
2. Attach the supplied shoulder strap through the fixture of the body (as shown in the drawings on page 3).
3. Fully extend the whip antenna for operation, or install the flexible antenna. Keep the collapsible antenna depressed when the set is not in use so that it will not be damaged.

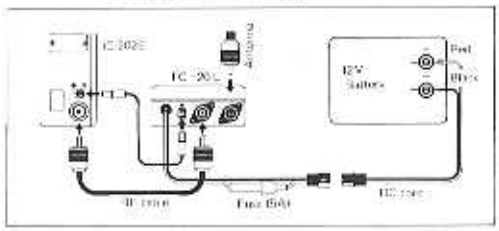
FOR USE IN THE CAR

1. Don't place the unit near the outlet of heaters, air-conditioners, etc.
2. Install the unit in a convenient place to avoid disrupting safe driving.
3. For the best power source, connect to the car battery through the fuse (1A-2A).
4. Firmly ground to the car body a mobile antenna (e.g. whip antenna) that requires grounding.

Mobile cable connection



Connection using IC-20L



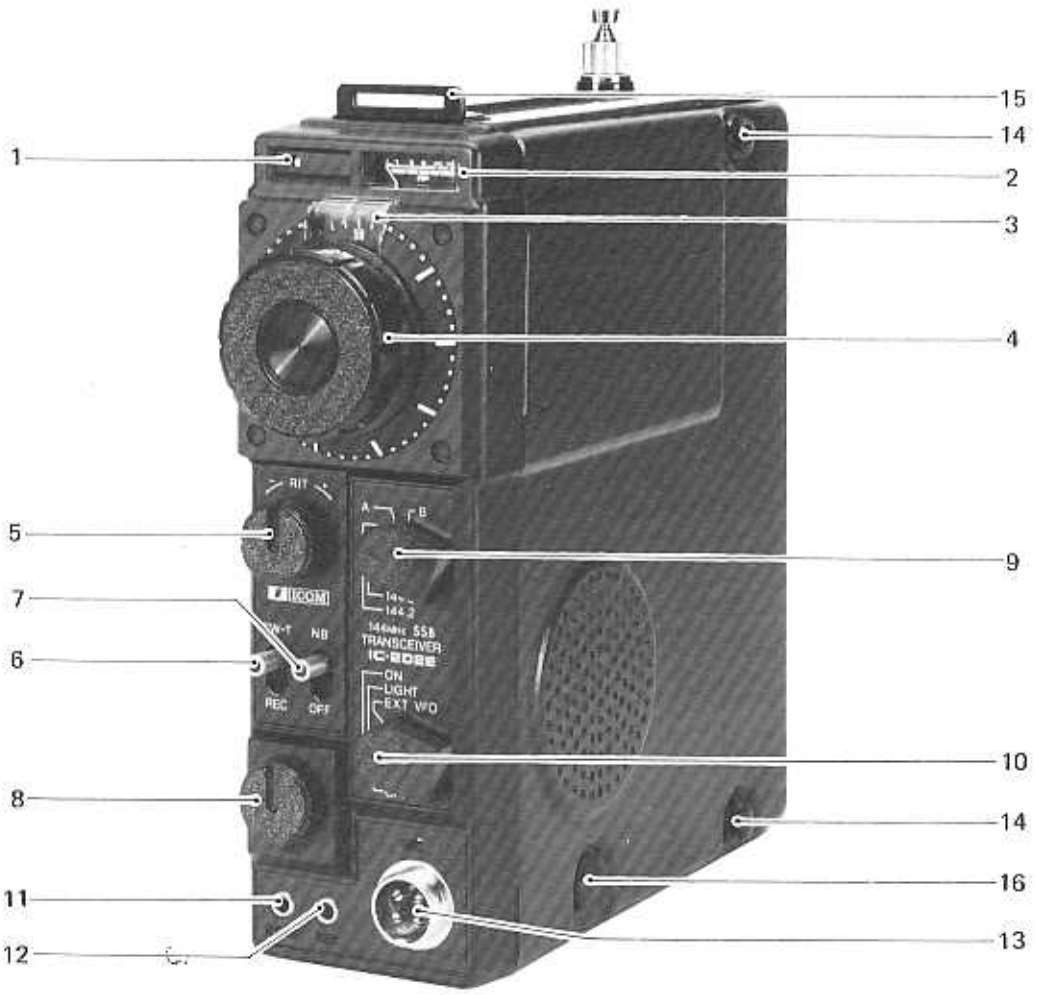
FOR FIXED USE

1. Don't install the unit in places exposed to rain, water splash, direct sunshine, dust, vibration, or heat.
2. Use a high performance external antenna as recommended. When doing this, be sure to depress the whip antenna into the body.
3. For fixed use, an external power supply is more economical than batteries.
4. Use of the linear amplifier IC-20L and AC power supply IC-3PS give excellent performance for fixed use.

HOW TO USE EXTERNAL ANTENNA

1. Select a high performance antenna (a multi-element beam or gain antenna) and set it up in the highest possible position. Tightly connect the antenna so that performance will not be affected by weather or vibration. The matching impedance is designed to be 50Ω.

SECTION V DESCRIPTION OF CONTROLS AND CONNECTIONS



1. POWER INDICATOR LED
   Shows when power is applied to the IC-202E.

2. S & RF METER
   Indicates the relative signal strength of incoming signals and output power of transmitted signals.

3. DIAL SCALE
The dial is divided into 10KHz increments with a total coverage of 200KHz. The operating frequency is read by adding the frequency shown on the dial to that shown on the crystal switch, or in the case of the spare crystals, by adding the dial reading to the frequency of the crystal installed.

4. TUNING KNOB
Selects the Frequency.

5. RIT
Independently swings the receiver frequency ±3KHz so that signals that are slightly off frequency may be tuned for clarity without affecting the transmitting frequency.

6. MODE SWITCH
In the CW-T position the transmitter will transmit when the CW key makes contact. In the REC position both SSB and CW signals can be received. In the CW-T position, the microphone is disconnected from the circuit.

7. NOISE BLANKER SWITCH
In the NB position, the noise blanker is put into the circuit and noise pulses will be reduced.

8. VOLUME CONTROL
Controls the audio output level.

9. CRYSTAL SWITCH
Selects the crystal to be used in the VXO.

10. FUNCTION SWITCH
Turns the power on and off and in the light position, turns on the meter light. In EXT VFO position, the frequency of the IC-202E can be controlled by an external VFO. (see page 10).

11. EXTERNAL SPEAKER JACK
An external speaker can be connected here. The impedance of the speaker should be 8 ohms. With the external speaker connected, the built-in speaker will be disabled.

12. KEY JACK
Accepts a CW key for CW operation.

13. MICROPHONE CONNECTOR
A 600 ohm microphone is connected here.

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14. SNAP LOCKS
Convenient snap-locks hold the sides in place. To remove them for any service or to replace the batteries, simply pull out on the center of the snap-locks and the cover can easily be removed. When replacing the covers be sure that you have placed the covers properly in the grooves provided, then push down on the center of the snap-lock (see page 4).
Note: when the sides are placed in the grooves, the snap-lock center must be pulled out.

15. SHOULDER STRAP BRACKET
Connect the shoulder strap here for easy carrying (see page 3).

16. EXTERNAL VFO SOCKET
Accepts plug from an external frequency source.

17. WHIP ANTENNA
When not in use, the antenna should be fully collapsed. Extend completely for operation. Use care when expanding or compressing the antenna.

FLEXIBLE ANTENNA (see page 26).
A flexible antenna, such as the IC-FA1, can be used. Unscrew the whip antenna from the set and screw the flexible antenna in its place.

18. MICROPHONE HANGER
When not in use, the mike can be hung out of the way.

19. EXTERNAL POWER SUPPLY JACK
Any well regulated power supply with an output of 13.8 volts can be connected here, instead of using the batteries installed. Inserting the power plug into the jack disables the internal battery source. When the BC-20 nicad battery pack is used, the external power source will charge the batteries.

20. EXTERNAL ANTENNA RECEPTACLE
An external antenna of 50 ohms impedance can be connected here. If an external antenna is used, the built-in whip should be completely collapsed.

21. IDENTIFICATION PLATE
States model number and serial number.

SECTION VI OPERATION

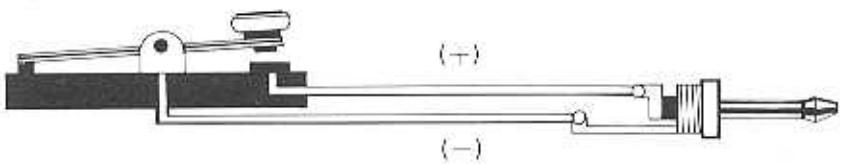
1. After the batteries have been installed, or the IC-202E is connected to an external power source, turn the function switch on. If the surrounding light is too dim to see the S & RF meter, turn the switch to the LIGHT position, and the meter will be illuminated.

2. Extend the whip antenna its full length, or if you wish to use an external antenna, connect the cable to the EXT antenna connector on the back of the IC-202E.

3. Connect the microphone to the MIC jack on the front panel.

4. If you wish to use the CW mode of transmission, connect a key to the KEY jack on the front panel. You do not have to disconnect the microphone for CW operation.

Key Wiring Diagram



5. Place the mode switch in the proper position for the portion of the 2 meter band you wish to operate in, whether it be CW or SSB. If you wish to operate outside of the 144.00 – 144.40MHz portion of the band, it will be necessary for you to install an additional crystal in one of the spare crystal sockets provided for this purpose. See page 11 for an explanation of how this is done. Crystals can be ordered from your authorized ICOM distributor or wholesaler.

6. Turn the tuning knob until you reach the desired frequency or a signal is heard. Adjust the volume control for a comfortable level of listening. If operating SSB, you may wish to place the Noise Blanking switch in the NB position. This activates the noise blanking circuit which will suppress noise pulses. After selecting the operating frequency, if the received signal seems to drift, adjust the RIT control until the signal is again clear.

7. For SSB operation, hold the microphone close to your mouth, push the PTT switch on the microphone, and speak in a clear, normal tone of voice. For CW operation, after connection of your KEY, place the CW-T switch in the CW-T position and the IC-202E will transmit when the KEY contacts are closed. To receive, place the switch back in the REC position.

8. For operation with an external VFO, remove the rubber plug in the side of the IC-202E, and place the function switch in the EXT VFO position. The input frequency should be – 133.3MHz – 135.3MHz, 50 Ω, 300MV for 144.00 – 146.00 MHz.

A/B POSITION SPARE CRYSTALS

The IC-202E comes with 2 crystals installed in the VXO for operation between 144.00–144.40MHz with each crystal covering 200KHz. If you wish to work another part of the band, all that is needed is to install the proper frequency crystal in either the A or B spare crystal socket, tweak it, and you are ready for operation. Also a crystal can be installed to work the 145.80–146.00MHz portion of the band if you want to use OSCAR.

INSTRUCTIONS FOR INSTALLATION

Crystals 36-1 and 36-2 are already installed in the crystal sockets. These are for 144.00–144.20 (36-1) and 144.20–144.40MHz (36-2). Installing additional crystals in the spare crystal sockets in some positions and / or combinations may cause the output level of the operating crystal to decrease. This is due to absorption of some of the energy by the adjacent crystal.

BE SURE TO FOLLOW THE CHART EXACTLY AS TO POSITION AND COMBINATION OF THE SPARE CRYSTALS TO OBTAIN THE OPTIMUM PERFORMANCE.

	SPARE SOCKET	
	A	B
COMBINATION OF CRYSTALS	36–3	X
	36–5	X
	36–6	X
	X	36–4
	X	36–5
	X	36–6
	36–3	36–4
	36–3	36–6
	36–5	36–4
	36–6	36–4

For other combination of crystals than those listed, a slight modification or realignment will probably be required. For communication through OSCAR (145.80–146.00MHz) realignment of various parts besides the readjustment of the oscillator frequency will be necessary.

Xtal No.	Center Freq.	Range	Type	Basic Freq.
36-1	144.100MHz	144.000–144.200MHz	HC-18/U	14848.83KHz*
36-2	144.300	144.200–144.400	HC-18/U	14871.06 *
36-3	144.500	144.400–144.600	HC-25/U	14893.28
36-4	144.700	144.600–144.800	HC-25/U	14915.50
36-5	144.900	144.800–145.000	HC-25/U	14937.72
36-6	145.900MHz	145.800–146.000MHz	HC-25/U	15048.83KHz**

* Supplied in the transceiver

** For OSCAR use.

Note: a. CL is 20 PF, with regard to the crystal load capacitance.

b. The frequency of the crystal oscillator (basic frequency) does not correspond to the oscillation frequency in the circuit.

SECTION VII THEORY

CIRCUITS

Section IX shows a block diagram of the IC-202E.

The receiving section is a single conversion super heterodyne, employing a wide band variable crystal oscillator (VXO) as the local oscillator. The transmitting section is a single conversion system which employs a filter-type SSB generator using a 10.7MHz crystal filter and the same local oscillator as the receiving section. A double-balanced mixer is used for the transmitting mixer to minimize spurious radiation. Although a portable unit, the IC-202E also features built-in circuits such as RIT, AGC, ALC, and a noise blanker.

This transceiver can be used with ease outdoors, in the car, or as a fixed station since it may be powered either with its batteries or with 13.8V external power source.

RECEIVING CIRCUIT

The signal from the whip antenna or antenna terminal passes through the harmonic filter, through the T/R switching diode D25 (MI301) amplified by RF amplifier Q2 (3SK40) and is then fed to the gate of mixer Q3 (2SK49). The switching diode is turned on by T/R control Q1 (2SA750), and D25 is turned on with forward voltage bias thus directing the input signal to Q2.

During transmission, the Receiver section +9V goes to zero to turn off Q1, and forward voltage bias is not applied to D25. At the same time, the transmit output is switched around Q2 to the antenna system. D25 is turned off as reverse bias is generated when the transmit signal is present. The 133MHz local oscillator output from the VXO is injected to mixer Q3 source. The resultant conversion is an IF Frequency of 10.7MHz.

The IF signal passes through the diode switch D1 (1SS53), which serves as both transmit-receive switch and noise blanker gate, the IF selectivity is obtained by the 10.7MHz crystal filter, then passes the switching diode D3 (1SS53) and is amplified up to a suitable level by the IF amplifiers consisting of Q6 (MEM616), Q7 (MEM616) and IC1 (LA1221). The output of IC1 is applied to the demodulation and AGC circuits.

The demodulation circuit is a ring demodulator composed of D6 to D9 (1N60's) which uses the 10.6985MHz from the BFO to generate the resultant audio signal. Higher audio frequencies of the demodulated signal are cut off by a low-pass filter consisting of C39, L11 and C40. The volume control (R–1) adjusts this output level which is fed to AF amplifier IC2 (μPC575C2) providing 1 watt of audio.

The network R32 and D29 (1S1555) provides positive bias to IC2 for muting audio during transmit and silent transmit-receive switching.

NOISE BLANKER

A part of the IF signal is picked up at the drain of mixer Q3, amplified by IC3 and IC4 (LA1221's), and detected by D11(1N60). This detected output is separated into signal audio components, and pulse components (noise). The signal component is amplified by Q5 (2SC945) and provides AGC control to IC3.

The noise pulse component turns on Q5 (2SC945), and as long as noise exists, turns off

D1 by grounding the anode of the noise blanker gate diode D1, thus the noise is not transferred to the crystal filter.

AGC CIRCUIT

A part of the IF signal is picked up from the IF amplifier IC1 and passes through C73 and R39 to be detected by D13 (1N60), D14 and D15 (1S2473's). When no signal is received, bias voltage is applied to the base of AGC control Q11 (2SC945) through R51, D14 and D13, and the potential at the emitter of Q11 goes to nearly zero.

In the presence of a signal, C69 which is connected to Q11 base is first negatively charged because D14 is turned on, and so Q11 is turned off. Also, C70 which is connected to Q11 emitter is negatively charged through D15 up to a voltage determined by the loop gain of each amplifier of RF and IF, and C70 is kept at the achieved voltage due to the absence of a discharge circuit.

When the signal diminishes, the negative voltage charged in C69 is gradually discharged through R51 and drops down to a voltage where Q11 is turned on. Then the negative voltage charged in C70 is rapidly discharged through Q11, thus the AGC time constant of fast attack and slow release is effected.

TRANSMITTING CIRCUIT

The small signal from the microphone is adjusted by the mike gain adjustment R61. Higher or lower frequencies outside desirable communication frequency range are attenuated by R65, C80 and C79, and the remaining frequencies are amplified by AF amplifier IC5 (μPC566H).

This AF signal and BFO output (10.6985MHz) are fed to the balanced modulator IC6 (SN76514N). The resulting carrier suppressed double sideband signal is amplified by IF amplifier Q16 (2SK19). The unwanted side band is then removed by the 10.7MHz crystal filter where it passes through the diode switch D2 (1SS53) to become a 10.7MHz SSB (USB) signal.

This 10.7MHz signal passes the diode switch D4(1SS53) to the transmit mixer IC7 (SN76514N). The L.O. of 133MHz from VXO unit is then combined to become the SSB (USB) signal of 144MHz. The transmit mixer IC7 is a double-balanced mixer, which minimizes spurious radiation.

In addition, the output circuits of IC7 and the 144MHz amplifier Q17 (3SK37) provides a band-pass filtering which further minimizes spurious radiation. This 144MHz SSB signal is linearly amplified by Q18 (2SC383), Q19 (2SC998), and Q20 (2SC1947) respectively. Higher harmonics are suppressed by the low-pass filter composed of L27, L28 and C140 to C144. The resultant output power is 3 Watts PEP. PA Q20 idling current is adjusted by R90. It is preset at 30mA.

ALC CIRCUIT

The ALC (Automatic Level Control) circuit picks out a part of the drive stage Q19 output, rectifies it by D20 (1S2473) and D21 (1N60), and applies the obtained negative voltage to the transmit IF amplifier Q16 gate to control circuit gain.

CW TRANSMISSION

For CW transmission, the voltage exerted on AF amplifier IC5 is reduced. At the same time the voltage to BFO frequency shift switch Q8's (2SC945) base is also reduced to turn it off so that C62 is in series as a part of the BFO crystal oscillator to shift the frequency about 1 KHz upward, which is within the crystal filter passband. Also, at the same time, the 5th Pin of the balanced modulator, IC6, is supplied with a voltage, which makes the modulator unbalanced, so that the BFO frequency appears unsuppressed at the output. Consequently, these signals are amplified by the transmit IF amplifier Q16 and pass through the crystal filter, transmit mixer IC7 and forward as in the SSB mode. Keying is done by Q17 source and Q18 emitter.

COMMON CIRCUIT

BFO

The BFO is a non-adjustable oscillator Q9 (2SC945). The crystal unit X1 has a load capacity of 25pF and operate at 10.6985MHz in the SSB mode. The change in BFO Frequency is explained under "CW transmission". The BFO output buffer is Q10 (2SC945).

METER CIRCUIT

This circuit permits use of single meter as an S-meter during reception and as an output level meter during transmission.

A bridge circuit composed of R49 and R48 is connected to the power source, stabilized by Zener diode D28 (WZ056), and the IF amplifier Q7 source. AGC voltage is generated by input signals reducing Q7's source voltage, thus unbalancing the bridge causing an upscale meter reading.

The S-meter is adjusted for its zero point by R48, and for its full scale point by R50.

For the output level meter, the output detection diode D22 (1N60) is coupled with L26 to partly rectify the RF output, thus giving an upscale relative output indication.

The extent of the meter indication can be adjusted by changing the degree of coupling of D22 and L26.

POWER SOURCE AND TRANSMIT/RECEIVE CHANGE-OVER CIRCUIT

The power source voltage (13.8V) supplied from either built-in batteries or external power connected to J10.

This voltage is directly applied to the AF power amplifier IC2 in the receiver section as well as to the collector of Q18, Q19 and Q20 in the power amplifier section.

Other circuits are fed with voltage from the voltage regulator circuits. The voltage regulator circuit for the VFO unit BFO and AGC circuits is derived from 13.8V to the Zener diode D19 (XZ076) and power-source indicating lamp D-2 (light-emitting diode TLR-102), resulting in stabilized voltage of about 9.6V which becomes a reference level at D19's cathode. This voltage is applied to Q15's (2SC1209) base, and a regulated voltage of about 9V is available at its emitter.

The brightness of power-indicating lamp varies according to the power voltage. When the power voltage drops to a level under about 10V, the current to D19 and D-2 stops, turning off D-2. Thus the power voltage fluctuation and battery condition can be judged from the D-2 Display. For the receiving section's regulated voltage supply the reference voltage of D19's cathode is applied to Q12's (2SCD355) base through D16 (1S2473), and a regulated voltage of about 9.5V is obtained at its emitter.

When transmitting, R54 is grounded by the microphone PTT switch or mode change-over switch (in the case of CW-T), to make Q12's base voltage zero and output voltage also zero.

Likewise, for the transmit section regulated voltage, the reference voltage of D19 cathode is applied to Q14's (2SD355) base through D18 (1S2473), and a regulated voltage of about 9.5V is obtained at its emitter.

During reception, since the PTT switch is not grounded, positive voltage is applied on the transmit/receive change-over control Q13's (2SC945) base through R55 to turn on Q13, while the Q14's base is grounded through R56 and Q13, thus making the power voltage zero. When transmitting, the PTT switch is grounded and Q13's base is also grounded through D17 (1N60) to turn off Q13 and apply the reference voltage to Q14's base, and so a proper voltage is obtained. Also, the rise time for transmit/receive change-over is delayed by C74 and C75 respectively to prevent transmission signals from entering the receiving section during the change-over operation.

RIT CIRCUIT

During reception, positive voltage is applied to Q22's (2SC945) base through R95 to turn on Q22, and current flows through R18 in VXO unit, RIT control R-2, R97 and Q22. The voltage applied to D1 (MV201) of the VXO unit is varied by adjusting the RIT control R-2, and D1's capacity varies accordingly, thus enabling the local oscillator frequency (receiving frequency) to be changed.

In the case of transmission, since the voltage on Q22's base becomes zero to turn off Q22 while positive voltage is applied to Q23's (2SC945) base at the same time through R96 to turn on Q23, current flows through R18, R98, and Q23 all within the VXO unit. The voltage divided by R18 and R98 is applied to D1, and so transmission can be made at dial-set frequencies irrespective of the position of RIT control R-2. The receiving frequency at the RIT zero point can be corrected by adjusting R98.

VXO UNIT

The oscillator Q1(2SC373) in series with a crystal and variable capacitor, varies its frequency by changing the capacity of the variable capacitor.

Resistors R1 to R4 are damping resistors to prevent abnormal oscillation. Capacitors C31 to C34 are linearity-adjusted for non-linearity of frequency changes caused by the errors of the crystal unit and variable capacitor. L1 to L4 and C1 to C4 adjust the oscillation frequency and band width.

In this oscillator, a 14MHz signal is oscillated fundamentally, tripled by Q2 (2SC373), tripled again by Q3 (2SC763) to a 133MHz signal with the level of 300mV as the first local oscillator. The band-pass filter composed of L7 to L9 minimizes spurious radiation.

Though the regulated voltage for the oscillator is supplied at a level of about 9 volts from Q15 of the main unit, it is further stabilized by the constant current circuit using Q4 (2SK19) and Zener diode D2 (WZ061). This voltage is supplied to Q1, Q2 and RIT circuit to further ensure sufficient frequency stability.

In the RIT circuit, the capacity of D1 to which a signal from R-2, RIT control, is given through R5, is changed. C6 and C30 are connected in series, which keeps the RIT shift to 3KHz.

ADJUSTMENT OF VARIOUS SECTIONS

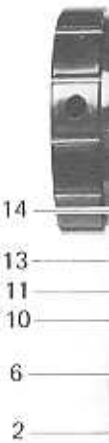
This set is completely adjusted and checked so that it functions correctly. During prolonged use, however, the preadjusted condition might be affected by wear of parts, etc. If it is necessary to make adjustments at some time to regain specified performance, the following procedure may be followed.

Remember that changes in capacitor or coils will be very small, if any. Adjustments should not be attempted without adequate test equipment.

VXO UNIT ADJUSTMENT

1. Measuring Instruments for Adjustment:
   * RF voltmeter (with above 1V full scale capability at 150MHz)
   * Frequency counter (capable of measuring 150MHz)
   * Multimeter (20Kohm per volt).
2. Frequency Adjustment:
   a. Connect the frequency counter to J3 of the VXO unit, with ground connected to J2.
   b. Place the RIT in the center position. Set the crystal switch to the position of the crystal to be aligned.
   c. Set the tuning dial to "100", and adjust the appropriate coil until the frequency shown in the chart is obtained.
   d. Next set the dial to 200 and adjust trimmer (a) for the proper frequency according to the chart.
   e. Set the dial now to "0" and adjust trimmer (b) for the proper frequency.
   f. Repeat the adjustment above till no further adjustment is necessary to get the proper frequencies at all three points.

Crystal No.	Dial		
	0	100	200
36-1	133.3015 MHz	133.4015 MHz	133.5015 MHz
36-2	133.5015	133.6015	133.7015
36-3	133.7015	133.8015	133.9015
36-4	133.9015	134.0015	134.1015
36-5	134.1015	134.2015	134.3015
36-6	135.1015	135.2015	135.3015



1. Crystal
2. Coil for
3. Trimme
4. Trimme
5. Crystal
6. Coil for
7. Trimme
8. Trimme

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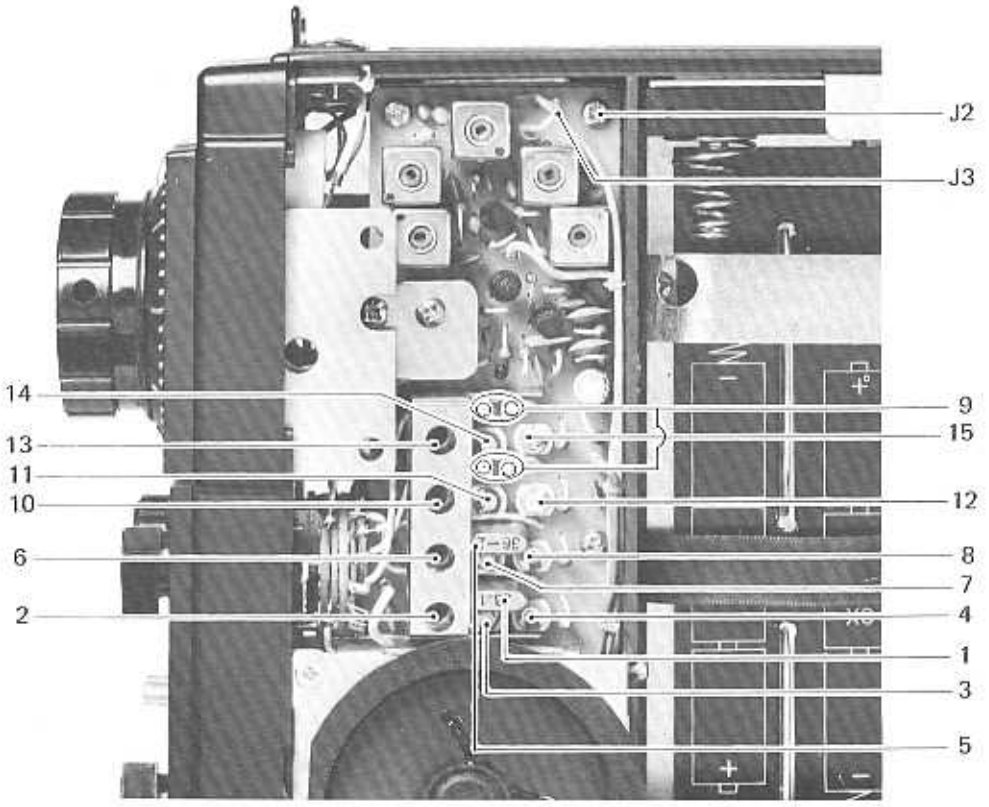

1. Crystal for 144.0MHz band
2. Coil for 144.0MHz band
3. Trimmer (a) for 144.0MHz band
4. Trimmer (b) for 144.0MHz band
5. Crystal for 144.2MHz band
6. Coil for 144.2MHz band
7. Trimmer (a) for 144.2MHz band
8. Trimmer (b) for 144.2MHz band
9. Additional Crystal Sockets "A" and "B"
10. Coil for the "A" band
11. Trimmer (a) for "A" band
12. Trimmer (b) for the "A" band
13. Coil for the "B" band
14. Trimmer (a) for the "B" band
15. Trimmer (b) for the "B" band

ADJUSTMENTS ON MULTIPLIER STAGES

For receiving, set the crystal selector to "144.2" and the tuning knob to the "200" position (the receiving frequency is 144.4MHz), connect a multimeter (for 3 volt range) to the check point R15 and tune L5 and L6 to maximum indication. Connect the probe of a RF voltmeter to the output terminal J3 of VXO and tune L7 and L9 to maximum indication. Further, readjust L5 and L6 and repeat this procedure to obtain the maximum indication of the RF voltmeter (250 – 300 mV).

RIT ADJUSTMENT

In the receive mode connect the frequency counter to J3, set the RIT knob to the center (detent) then record the frequency (the dial scale may be set at any position but do not change it during the adjustment).

Next, turn the MODE change-over switch to "CW-T" without connecting the key to the key jack, then read out the frequency. If it differs from the previously recorded frequency, adjust R98 on the main board to equalize both frequencies.

Repeat above adjustments to reduce the frequency difference between reception and transmission to under 10Hz.

TRANSMITTING SECTION ADJUSTMENT

a. **Measuring Instruments for Adjustment**
   * Terminal wattmeter (for about 10W full scale with 50 ohm impedance)
   * Frequency counter
   * RF voltmeter
   * AF oscillator
   * AF millivoltmeter
   * Multimeter (20Kohm per volt).

b. **Final Stage Idle Current Adjustment**
   Turn the MODE change-over switch to "CW-T" without connecting the key to the key jack. Remove the solder of C136 and W22, and connect the multimeter, which is set at 100mA range, between these points. Adjust R90 so that the current becomes 30mA. After the adjustment, resolder the leads of C136 and W22.

c. **Coil Adjustment**
   Connect the wattmeter to the external antenna socket, and set the transmit/receive frequency at "144.4MHz". With the MODE change-over switch turned to "CW-T", connect the key to the key jack and hold down the key, connect the RF voltmeter probe to the check point of R81 and adjust the cores of L14 to L19 alternately for a maximum voltmeter reading.

d. **Driving and Final Stage Adjustments**
   Make sure that the power voltage is 13.8V under the same condition as in c. Turn the R92 rotor toward ground (to panel face) and adjust C120, C121, C127, C128, C137 and C138 so that the wattmeter indicates maximum (over 3W). After this, adjust R92 so that the wattmeter indicates exactly 3W. Set multimeter to volt range and connect to check point R105. Readjust L14 to L19 for maximum indication.

e. **RF Meter Adjustment**
   Move D22 with respect to L26 (coupling) so that the meter indicates about 90% of full scale when the output is 3W at the completion of adjustment (d).

f. **Carrier Frequency Adjustment**
   In receive, connect a frequency counter to check-point R28 and adjust C61 for 10.6985MHz. At this time, make sure that if the MODE change-over switch is turned to "CW-T," the frequency shifts about 1KHz upward. Then turn the MODE change-over switch to "REC" and connect the AF oscillator to the check point, R68. Ground the mike plug socket pin No.2 for SSB transmission, and set the AF oscillator oscillation frequency at 1.5KHz. Adjust the output level to 2.5W. Keeping the output level unchanged, alternately change the audio oscillator frequency from 300Hz to 3KHz, and fine adjust C61 to balance the output.

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g. **Mike Gain Adjustment**

Connect the AF oscillator between the mike plug socket pins No.1 and No.4 (ground). Set its frequency at 1.5KHz and output level at 6mV.

Ground the mike plug socket pin No.2 and connect the AF millivoltmeter (300mV range) to the R68 check point and adjust R61 so that the meter reads 150mV. This adjustment can be slightly changed according to the use of microphone, strength of voice, condition, etc. Observation of the output carrier on a high frequency oscilloscope would be helpful while using normal microphone procedures in order to achieve optimum waveform and quality.

RECEIVING SECTION ADJUSTMENT

a. **Measuring Instruments for Adjustment**

* Standard signal generator (for 144MHz band)
* AF millivoltmeter
* Multimeter

b. **Sensitivity Adjustment**

With the receiving frequency set at 144.4MHz and the volume knob in a reasonable volume position, connect the standard signal generator to the antenna connector and the AF millivoltmeter (1V range) to the AF output terminals J4 and J5 (ground).

(Never transmit during this adjustment because it may damage the signal generator attenuators).

Keeping the signal generator unmodulated, set the output level at about 30dB (μV) and adjust the generator frequency to the receiving frequency. As a beat is heard from the speaker, fine-adjust the signal generator frequency or receiving frequency so that the beat becomes about 1000Hz. Try to keep the beat at this frequency during the adjustment.
Next, adjust L1-L10 cores successively to maximize the AF millivoltmeter indication, and if the AF millivoltmeter becomes full-scale, lower the signal generator output level without converting the meter range or turning the volume knob, etc. Repeat the adjustment until the AF millivoltmeter indicates over 800mV with the volume knob at maximum and S+N/N becomes over 10dB when the signal generator output level is -10dB (μV).

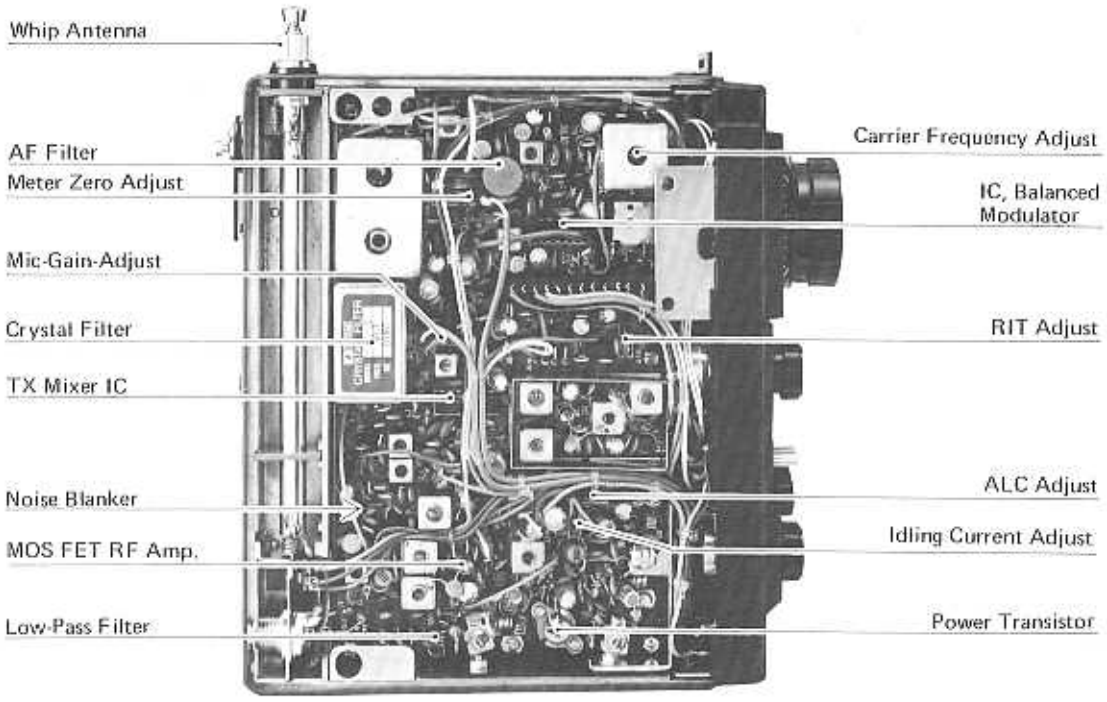
c. **S Meter Adjustment**

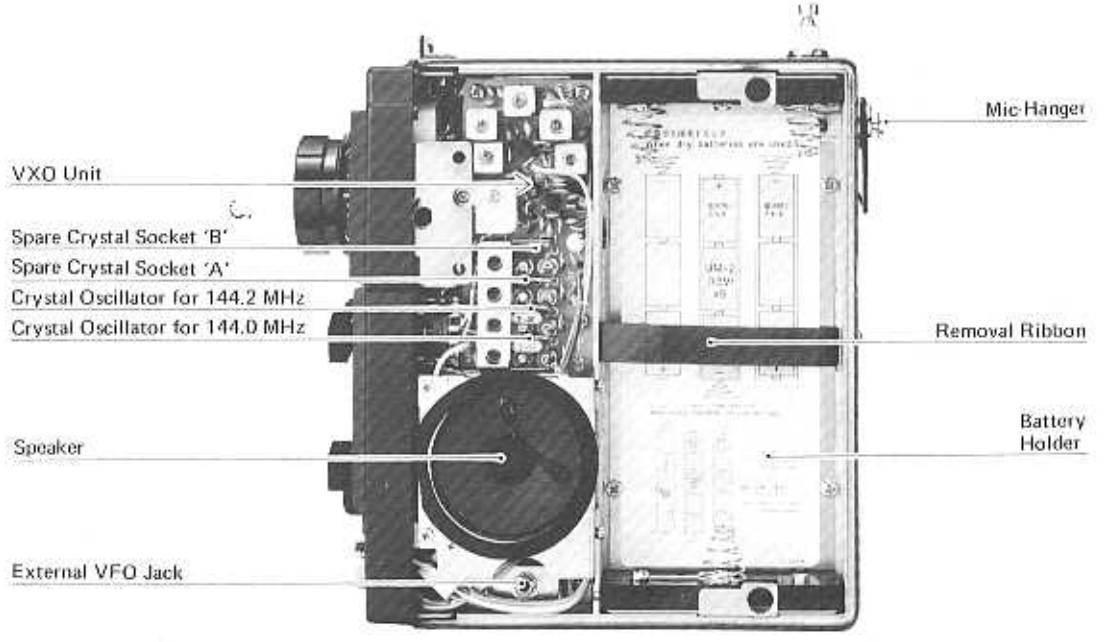
Adjust R48 so that the S meter indicates zero with no signal. Next, with the signal generator output level set at 90dB (μV), adjust the frequency to the receiving frequency, and adjust R50 so that the S meter indicates full scale. After this adjustment is finished, lower the signal generator output level, and make sure that the signal generator output is within a range of 0dB ± 3dB when the S meter indicates S5.

d. **Noise Blanker Adjustment**

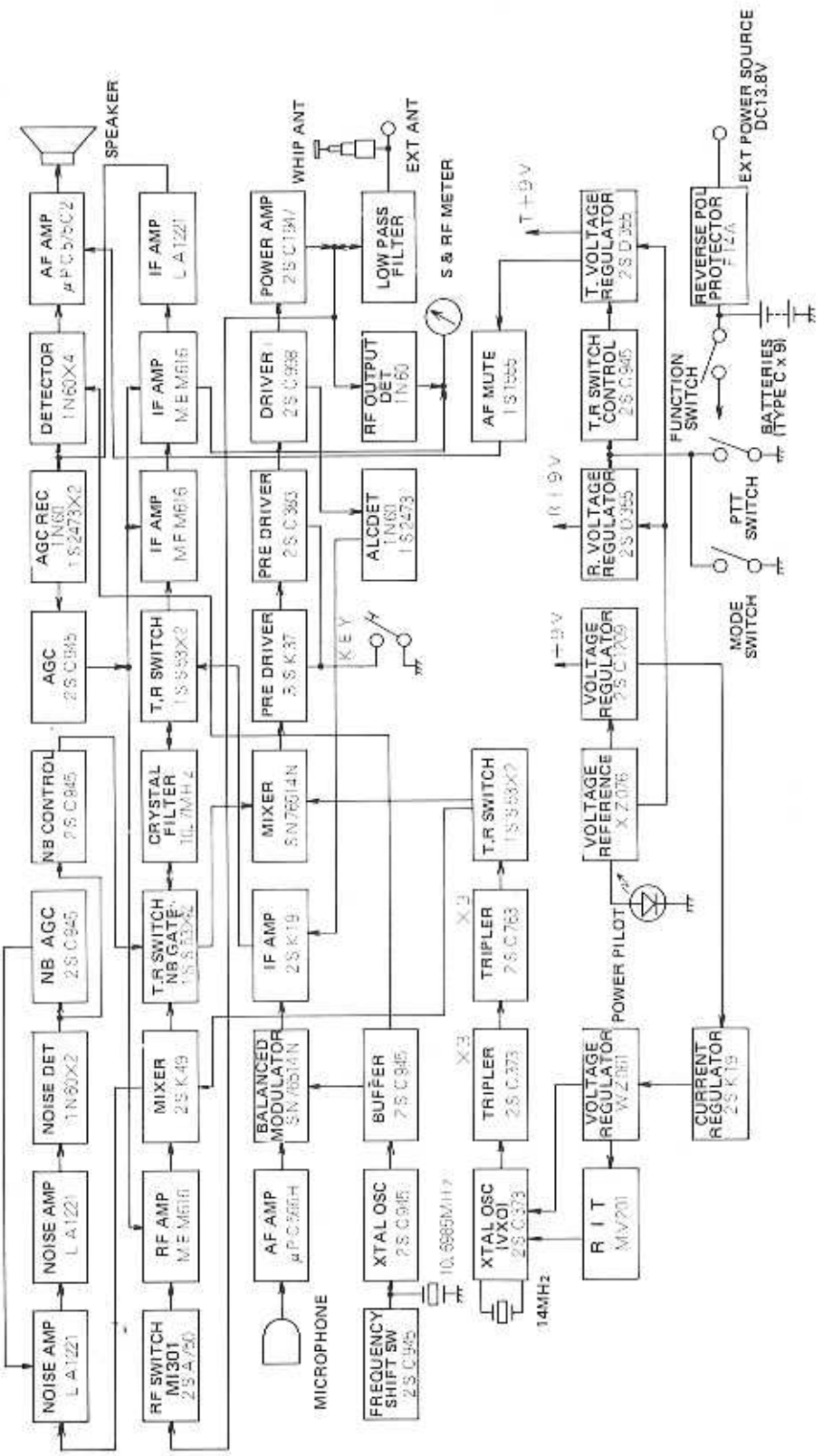
Set the signal generator output level at about 30dB (μV), and adjust to the receiving frequency. Making sure that the beat is generated from the speaker, connect the multimeter (0.3V range) to the R39 check-point, and gradually lower the signal generator output level and adjust the L12 to a point where the indication is maximum.

SECTION VIII INSIDE VIEW





SECTION IX BLOCK DIAGRAM



SECTION X PARTS LIST

MAIN UNIT

Ref. No.	Description	Part No.	Board Location
Q1	Transistor	2SA750 (1)	I4
Q2	FET	3SK40-M	I3
Q3	FET	2SK49-H2	H2
Q4	Transistor	2SC945-P	G1
Q5	Transistor	2SC945-P	F1
Q6	FET	MEM616-Y	C1
Q7	FET	MEM616-B	B2
Q8	Transistor	2SC945-P	A6
Q9	Transistor	2SC945-P	B6
Q10	Transistor	2SC945-P	B6
Q11	Transistor	2SC945-P	A5
Q12	Transistor	2SD355-E	E5
Q13	Transistor	2SC945-P	D5
Q14	Transistor	2SD355-E	D3
Q15	Transistor	2SC1209-E	E5
Q16	FET	2SK19-GR	C3
Q17	FET	3SK37-3	F5
Q18	Transistor	2SC383	G6
Q19	Transistor	2SC998	I6
Q20	Transistor	2SC1947	J4
Q21	—	—	
Q22	Transistor	2SC945-S	D6
Q23	Transistor	2SC945-S	E6
IC1	IC	LA1221	B3
IC2	IC	μPC575 C2	G3
IC3	IC	LA1221	H1
IC4	IC	LA1221	H1
IC5	IC	μPC566H	D2
IC6	IC	SN76514N	C5
IC7	IC	SN76514N	F3
D1	Diode	1SS53	F2
D2	Diode	1SS53	F2
D3	Diode	1SS53	C2
D4	Diode	1SS53	C2
D5	Diode	1N60	C2
D6	Diode	1N60	B4
D7	Diode	1N60	B4
D8	Diode	1N60	B4
D9	Diode	1N60	B4
D11	Diode	1N60	I1
D12	Diode	1S2473	A5
D13	Diode	1N60	A4
D14	Diode	1S2473	A5
D15	Diode	1S2473	A5
D16	Diode	1S2473	E4
D17	Diode	1N60	D5
D18	Diode	1S2473	E4
D19	Diode	XZ-076	E4
D20	Diode	1S2473	I5
D21	Diode	1N60	I5
D22	Diode	1N60	J3
D23	Diode	1S1555	H6
D24	Diode	1S1555	J5
D25	Diode	M1301	J3
D26	Diode	1SS53	G2
D27	Diode	1SS53	G3
D28	Diode	WZ-056	B1
D29	Diode	1S1555	D3

MAIN UNIT

Ref. No.	Description	Part No.		Board Location
FL1	Xtal Filter	FEC-103-1	10.7MHz	E1
X1	Xtal	HC-18/U	10.6985MHz	A6
L1	Coil	LS-4		I4
L2	Coil	LS-3A		I2
L3	Coil	LS-3A		I2
L4	Coil	LS-3A		H2
L5	Coil	LS-7		G2
L6	Coil	LS-7		G2
L7	Coil	LS-66A		C1
L8	Coil	LS-66A		B1
L9	Coil	LS-66A		A2
L10	Coil	LS-68		B4
L11	Coil	L104 Choke		B3
L12	Coil	LS-7		I1
L13	Coil	L101 Choke		I1
L14	Coil	LS-67		C3
L15	Coil	LS-67		E2
L16	Coil	LS-3A		F4
L17	Coil	LS-3A		G4
L18	Coil	LS-3A		F5
L19	Coil	LS-3A		F6
L20	Coil	LA-96		G6
L21	Coil	LA-71		H6
L22	Coil	LA-2		I6
L23	Coil	LA-9		J6
L24	Coil	LA-97		J5
L25	Coil	LA-9		J4
L26	Coil	LA-2		J3
L27	Coil	LA-71		J2
L28	Coil	LA-71		J1
L29	Coil	L100 Choke		I5
L30	Coil	L101 Choke		A3
L31	Coil	L101 Choke		A4
L32	Coil	L101 Choke		I1
R1	Resistor	470 ohm	ELR25	I3
R2	Resistor	4.7K ohm	ELR25	I4
R3	Resistor	100K ohm	ELR25	I3
R4	Resistor	100K ohm	ELR25	H3
R5	Resistor	100K ohm	ELR25	I3
R6	Resistor	47 ohm	ELR25	H3
R7	Resistor	22 ohm	ELR25	I2
R8	Resistor	1K ohm	ELR25	H2
R9	Resistor	220 ohm	ELR25	G1
R10	Resistor	4.7K ohm	ELR25	G1
R11	Resistor	10K ohm	ELR25	F1
R12	Resistor	12K ohm	ELR25	F2
R13	Resistor	39K ohm	ELR25	F2
R14	Resistor	10K ohm	ELR25	D2
R15	Resistor	10K ohm	ELR25	D1
R16	Resistor	22K ohm	ELR25	C1
R17	Resistor	100K ohm	ELR25	C1
R18	Resistor	100K ohm	ELR25	C1
R19	Resistor	100 ohm	ELR25	B2
R20	Resistor	220 ohm	ELR25	B1
R21	Resistor	6.8K ohm	ELR25	B1
R22	Resistor	10K ohm	R25	C1
R23	Resistor	470 ohm	ELR25	A1

Ref. No.	De
R24	Resist
R25	Resist
R26	Resist
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R28	Resist
R29	Resist
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R31	Resist
R32	Resist
R33	Resist
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R36	Resist
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R38	Resist
R39	Resist
R40	Resist
R41	Resist
R42	Resist
R43	Resist
R44	Resist
R45	Resist
R46	Resist
R47	Resist
R48	Trimr
R49	Resist
R50	Trimr
R51	Resist
R52	Resist
R53	Resist
R54	Resist
R55	Resist
R56	Resist
R57	Resist
R58	Resist
R59	Resist
R60	Resist
R61	Trimr
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R64	Resist
R65	Resist
R66	Resist
R67	Resist
R68	Resist
R69	Resist
R70	Resist
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R72	Resist
R73	Resist
R74	Resist
R75	—
R76	Resist
R77	Resist
R78	Resist
R79	Resist
R80	Resist
R81	Resist
R82	Resist

MAIN UNIT				
Ref. No.	Description	Part No.	Board Location	
R24	Resistor	220 ohm	ELR25	B2
R25	Resistor	4.7K ohm	ELR25	A2
R26	Resistor	220 ohm	ELR25	A2
R27	Resistor	4.7K ohm	ELR25	H2
R28	Resistor	470 ohm	R25	B4
R29	Resistor	470 ohm	ELR25	B4
R30	Resistor	820 ohm	ELR25	B4
R31	Resistor	39K ohm	ELR25	B3
R32	Resistor	4.7K ohm	ELR25	E3
R33	Resistor	270 ohm	ELR25	G3
R34	Resistor	100 ohm	ELR25	A4
R35	Resistor	120K ohm	ELR25	H4
R36	Resistor	2.2K ohm	ELR25	G1
R37	Resistor	1K ohm	ELR25	H1
R38	Resistor	10K ohm	ELR25	G1
R39	Resistor	22K ohm	R25	F1
R40	Resistor	27K ohm	ELR25	F2
R41	Resistor	4.7K ohm	ELR25	A6
R42	Resistor	4.7K ohm	ELR25	A5
R43	Resistor	22K ohm	ELR25	B6
R44	Resistor	22K ohm	ELR25	A6
R45	Resistor	3.3K ohm	ELR25	B6
R46	Resistor	4.7K ohm	ELR25	B5
R47	Resistor	1K ohm	ELR25	B5
R48	Trimmer	1K ohm	FR10B	C3
R49	Resistor	2.2K ohm	ELR25	B2
R50	Trimmer	5K ohm	FR10B	B3
R51	Resistor	1.8K ohm	ELR25	A5
R52	Resistor	10 ohm	ELR25	E4
R53	Resistor	4.7K ohm	ELR25	E4
R54	Resistor	22 ohm	ELR25	E5
R55	Resistor	22K ohm	ELR25	D4
R56	Resistor	22 ohm	ELR25	D4
R57	Resistor	4.7K ohm	ELR25	D4
R58	Resistor	22 ohm	ELR25	D4
R59	Resistor	470 ohm	ELR25	E5
R60	Resistor	22 ohm	ELR25	E5
R61	Trimmer	500 ohm	FR10B	E2
R62	Resistor	15K ohm	ELR25	E3
R63	Resistor	150K ohm	ELR25	D2
R64	Resistor	56K ohm	ELR25	D3
R65	Resistor	2.2K ohm	ELR25	E2
R66	Resistor	560 ohm	ELR25	D3
R67	Resistor	330 ohm	ELR25	D3
R68	Resistor	2.7K ohm	R25	D5
R69	Resistor	100 ohm	ELR25	D4
R70	Resistor	47K ohm	ELR25	H3
R71	Resistor	100 ohm	ELR25	C2
R72	Resistor	150 ohm	ELR25	C2
R73	Resistor	220 ohm	ELR25	C3
R74	Resistor	10K ohm	ELR25	E3
R75	–	–		
R76	Resistor	47 ohm	ELR25	E3
R77	Resistor	100K ohm	ELR25	F4
R78	Resistor	100K ohm	ELR25	F5
R79	Resistor	100 ohm	ELR25	F5
R80	Resistor	100 ohm	ELR25	G5
R81	Resistor	470 ohm	R25	F6
R82	Resistor	47 ohm	R25	F6

MAIN UNIT				
Ref. No.	Description	Part No.	Board Location	
R83	Resistor	47 ohm	ELR25	G6
R84	Resistor	1.8K ohm	ELR25	H6
R85	Resistor	10 ohm	R25	H6
R86	Resistor	680 ohm	ELR25	H5
R87	Resistor	150K ohm	ELR25	H3
R88	Resistor	47 ohm	R25	J5
R89	Resistor	220 ohm	ELR25	I5
R90	Trimmer	500 ohm	FR10P	H5
R91	Resistor	220 ohm	ELR25	G5
R92	Trimmer	5K ohm	ELR25	H5
R93	Resistor	470 ohm	R½	J3
R94	Resistor	220 ohm	ELR25	J5
R95	Resistor	10K ohm	ELR25	D6
R96	Resistor	10K ohm	ELR25	E5
R97	Resistor	8.2K ohm	ELR25	D6
R98	Trimmer	10K ohm	FR10B	E6
R99	Resistor	4.7K ohm	ELR25	G2
R100	Resistor	68 ohm	ELR25	G3
R101	Resistor	10K ohm	ELR25	G4
R102	Resistor	4.7K ohm	ELR25	G3
R103	Resistor	2.7K ohm	ELR25	G6
R104	Resistor	2.2K ohm	R25	G6
R105	Resistor	47K ohm	R25	C3
R106	Resistor	2.2K ohm	ELR25	B3
C1	Ceramic	0.01μF	50V	I4
C2	Ceramic	10pF	50V	H4
C3	Ceramic	0.01μF	50V	I3
C4	Ceramic	0.01μF	50V	H3
C5	Ceramic	0.01μF	50V	I3
C6	Ceramic	7pF	50V	I2
C7	Ceramic	0.01μF	50V	I3
C8	Ceramic	0.35pF	50V	I2
C9	Ceramic	6pF	50V	I2
C10	Ceramic	0.35pF	50V	H2
C11	Ceramic	7pF	50V	H2
C12	Ceramic	0.01μF	50V	H2
C13	Ceramic	1pF	50V	H1
C14	Ceramic	0.01μF	50V	G2
C15	Ceramic	4pF	50V	G1
C16	Ceramic	500pF	50V	F2
C17	Ceramic	0.01μF	50V	H1
C18	Ceramic	0.01μF	50V	F2
C19	Ceramic	0.01μF	50V	D2
C20	Ceramic	0.01μF	50V	D1
C21	Ceramic	0.01μF	50V	C1
C22	Ceramic	0.01μF	50V	C2
C23	–	–		
C24	Ceramic	0.001μF	50V	C1
C25	Ceramic	0.01μF	50V	C1
C26	Ceramic	0.01μF	50V	C2
C27	–	–		
C28	Ceramic	0.001μF	50V	B2
C29	Ceramic	0.01μF	50V	B1
C30	Ceramic	0.01μF	50V	B2
C31	Ceramic	0.01μF	50V	B2
C32	–	–		
C33	Ceramic	0.01μF	50V	A2

MAIN UNIT				
Ref. No.	Description	Part No.		Board Location
C34	Ceramic	10pF	50V	B3
C35	Ceramic	0.01μF	50V	B3
C36	Ceramic	120pF	50V	B4
C37	Ceramic	0.01μF	50V	B4
C38	Semiconductive	0.2μF	12V	B4
C39	Mylar	0.056μF	50V	C4
C40	Mylar	0.056μF	50V	C4
C41	Electrolytic	1μF	50V	H3
C42	Ceramic	0.01μF	50V	D6
C43	Electrolytic	10μF	16V	G3
C44	Ceramic	0.01μF	50V	E6
C45	Ceramic	0.001μF	50V	H3
C46	Electrolytic	47μF	16V	G3
C47	Electrolytic	47μF	16V	H4
C48	Electrolytic	100μF	10V	G4
C49	Semiconductive	0.2μF	12V	G4
C50	Ceramic	0.01μF	50V	G1
C51	Electrolytic	1μF	50V	G1
C52	Ceramic	0.001μF	50V	H1
C53	Ceramic	0.01μF	50V	H1
C54	Ceramic	0.01μF	50V	H1
C55	Ceramic	0.001μF	50V	I1
C56	Ceramic	50pF	50V	I1
C57	Ceramic	50pF	50V	I2
C58	Ceramic	0.001μF	50V	F1
C59	Ceramic	0.01μF	50V	G1
C60	Ceramic	0.01μF	50V	A5
C61	Trimmer	CV05E300 (30pF)		B6
C62	Ceramic	68pF	50V	B5
C63	Ceramic	30pF	50V	A6
C64	Styrene	200pF	50V	B6
C65	Styrene	100pF	50V	B5
C66	Ceramic	0.01μF	50V	B5
C67	Ceramic	60pF	50V	B5
C68	Ceramic	50pF	50V	B5
C69	Bi Polar	4.7 μP	25V	A5
C70	Electrolytic	1μF	50V	A4
C71	Ceramic	0.01μF	50V	B4
C72	Ceramic	0.01μF	50V	B5
C73	Ceramic	0.001μF	50V	A4
C74	Electrolytic	10μF	16V	E5
C75	Electrolytic	10μF	16V	E3
C76	Ceramic	0.01μF	50V	E4
C77	Electrolytic	10μF	16V	E5
C78	Ceramic	0.01μF	50V	E5
C79	Mylar	0.002μF	50V	D2
C80	Ceramic	0.01μF	50V	E2
C81	Ceramic	500pF	50V	D3
C82	Electrolytic	47μF	6.3V	D2
C83	Ceramic	0.01μF	50V	D3
C84	Electrolytic	10μF	16V	D2
C85	Bi Polor	4.7μF	25V	C3
C86	Electrolytic	10μF	16V	C5
C87	Ceramic	0.01μF	50V	B5
C88	Ceramic	0.01μF	50V	C5
C89	Ceramic	0.01μF	50V	C5
C90	Ceramic	45pF	50V	C4
C91	Ceramic	0.01μF	50V	C3
C92	Ceramic	0.01μF	50V	D4
C93	Electrolytic	10μF	16V	C4

MAIN UNIT				
Ref. No.	Description	Part No.		Board Location
C94	Electrolytic	10μF	16V	D4
C95	Ceramic	0.01μF	50V	C2
C96	Ceramic	0.01μF	50V	C3
C97	Ceramic	45pF	50V	F2
C98	Ceramic	0.01μF	50V	E3
C99	Ceramic	0.01μF	50V	F3
C100	Ceramic	0.01μF	50V	F2
C101	Ceramic	0.01μF	50V	F3
C102	Ceramic	0.01μF	50V	F3
C103	Ceramic	0.01μF	50V	F3
C105	Electrolytic	10μF	16V	F3
C106	Ceramic	8pF	50V	F4
C107	Ceramic	0.01μF	50V	G5
C108	Ceramic	6pF	50V	G4
C109	Electrolytic	10μF	16V	F5
C110	Ceramic	0.01μF	50V	E5
C111	Ceramic	0.01μF	50V	G5
C112	Ceramic	0.01μF	50V	G5
C113	Ceramic	6pF	50V	F5
C114	Ceramic	6pF	50V	F6
C115	Ceramic	8pF	50V	F6
C116	Ceramic	120pF	50V	F6
C117	Electrolytic	10μF	16V	G5
C118	Ceramic	0.01μF	50V	G6
C119	Ceramic	0.01μF	50V	G6
C120	Trimmer	CV05C120 (12pF)		H6
C121	Trimmer	CV05D180 (18pF)		H6
C122	Electrolytic	10μF	16V	H6
C123	Ceramic	0.01μF	50V	H5
C124	Ceramic	0.01μF	50V	I5
C125	Electrolytic	10μF	16V	I6
C126	Feed Through	1000pF	50V	I6
C127	Trimmer	CV05D120 (12pF)		I6
C128	Trimmer	CVE50-11 (50pF)		J6
C129	Ceramic	15pF	50V	I5
C130	Ceramic	0.01μF	50V	H5
C131	Electrolytic	4.7μF	16V	H5
C132	Electrolytic	10μF	16V	I5
C133	Ceramic	0.01μF	50V	I5
C134	Ceramic	0.01μF	50V	I4
C135	Electrolytic	10μF	16V	J4
C136	Feed Through	1000pF	50V	I4
C137	Trimmer	CV05D180 (18pF)		J4
C138	Trimmer	CVE50-11 (50pF)		J3
C139	Ceramic	0.01μF	50V	J3
C140	Ceramic	15pF	50V	J2
C141	Ceramic	6pF	50V	J2
C142	Ceramic	30pF	50V	J2
C143	Ceramic	2pF	50V	J2
C144	Ceramic	20pF	50V	J1
C145	Ceramic	0.01μF	50V	I5
C146	Ceramic	0.01μF	50V	G5
C147	Ceramic	0.01μF	50V	G2
C148	Ceramic	0.01μF	50V	G3
C149	Ceramic	0.001μF	50V	I3
C150	Ceramic	0.04μF	50V	E4
C151	Ceramic	7pF	50V	F4
C152	Ceramic	0.01μF	50V	G2
C153	Ceramic	10pF	50V	I5
C154	Ceramic	0.01μF	50V	I5

C155	Electrolytic
C156	Electrolytic
C157	Ceramic
C158	Ceramic
C159	Ceramic
C160	Ceramic
C161	Ceramic

Ref. No.	VX Description
J1	Pin Contact
J2	Pin Contact
J3	Pin Contact
J4	Pin Contact
J5	Pin Contact
J6	Pin Contact
Q1	Transistor
Q2	Transistor
Q3	Transistor
Q4	FET
D1	Diode
D2	Diode
X1	Xtal
X2	Xtal
L1	Coil
L2	Coil
L3	Coil
L4	Coil
L5	Coil
L6	Coil
L7	Coil
L8	Coil
L9	Coil
R1	Resistor
R2	Resistor
R3	Resistor
R4	Resistor
R5	Resistor
R6	Resistor
R7	Resistor
R8	Resistor
R9	Resistor
R10	Resistor
R11	Resistor
R12	Resistor
R13	Resistor
R14	Resistor
R15	Resistor
R16	Resistor
R17	—
R18	Resistor
C1	Trimmer
C2	Trimmer
C3	Trimmer
C4	Trimmer
C5	Variable

C155	Electrolytic	33μF	10V	I3
C156	Electrolytic	4.7μF	10V	H4
C157	Ceramic	10pF	50V	J4
C158	Ceramic	0.01μF	50V	I3
C159	Ceramic	0.01μF	50V	B1
C160	Ceramic	0.01μF	50V	F5
C161	Ceramic	0.01μF	50V	I4

VXO UNIT

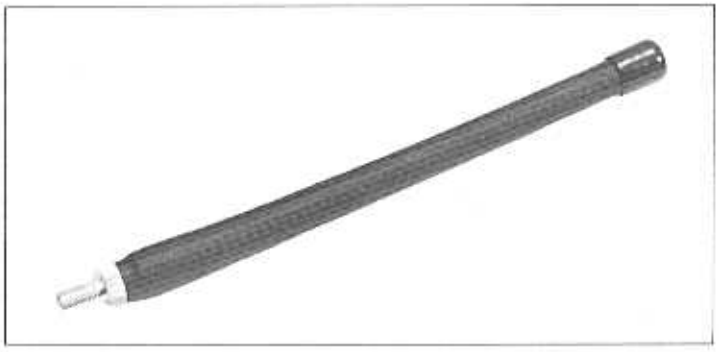
Ref. No.	Description	Part No.	Board Location
J1	Pin Contact	60809-1	
J2	Pin Contact	60809-1	
J3	Pin Contact	60809-1	
J4	Pin Contact	60809-1	
J5	Pin Contact	60809-1	
J6	Pin Contact	60809-1	
Q1	Transistor	2SC373	C2
Q2	Transistor	2SC373	C3
Q3	Transistor	2SC763-C	B2
Q4	FET	2SK19Gr	C2
D1	Diode	MV-201	E1
D2	Diode	WZ-061	C2
X1	Xtal	HC-18/U 36-1	F2
X2	Xtal	HC-18/U 36-2	F2
L1	Coil	LB-28B	F1
L2	Coil	LB-28B	F1
L3	Coil	LB-28B	E1
L4	Coil	LB-28B	D1
L5	Coil	LS-2	B3
L6	Coil	LS-2	B3
L7	Coil	LS-3A	B1
L8	Coil	LS-3A	B1
L9	Coil	LS-3A	A2
R1	Resistor	100K ohm ELR25	G3
R2	Resistor	100K ohm ELR25	F2
R3	Resistor	100K ohm ELR25	E3
R4	Resistor	100K ohm ELR25	E3
R5	Resistor	220K ohm R25	F1
R6	Resistor	10K ohm ELR25	D2
R7	Resistor	22K ohm ELR25	C2
R8	Resistor	470 ohm ELR25	D3
R9	Resistor	10K ohm ELR25	C3
R10	Resistor	22K ohm ELR25	D3
R11	Resistor	330 ohm ELR25	C3
R12	Resistor	220 ohm ELR25	B2
R13	Resistor	3.9K ohm ELR25	B2
R14	Resistor	15K ohm ELR25	B2
R15	Resistor	330 ohm R25	B2
R16	Resistor	220 ohm ELR25	B2
R17	—	—	
R18	Resistor	4.7K ohm ELR25	D3
C1	Trimmer	CV05C120 (12pF)	G2
C2	Trimmer	CV05C120 (12pF)	F2
C3	Trimmer	CV05C120 (12pF)	E2
C4	Trimmer	CV05C120 (12pF)	E2
C5	Variable	C321A(Ganged)	C1

MAIN UNIT

Ref. No.	Description	Part No.	Board Location
C6	Ceramic	10pF CH 50V	D1
C7	Ceramic	0.01μF 50V	G1
C8	Ceramic	100pF YL 50V	C2
C9	Ceramic	10pF CH 50V	D2
C10	Ceramic	200pF XL 50V	C2
C11	Ceramic	200pF XL 50V	D3
C12	Ceramic	200pF XL 50V	C3
C13	Ceramic	0.01μF 50V	C3
C14	Ceramic	40pF PH 50V	C3
C15	Ceramic	0.01μF 50V	C3
C16	Ceramic	1pF 50V	B3
C17	Ceramic	45pF PH 50V	B3
C18	Ceramic	45pF 50V	B2
C19	Ceramic	0.01μF 50V	B2
C20	Ceramic	0.01μF 50V	B2
C21	Ceramic	8pF 50V	B2
C22	Ceramic	6pF 50V	B1
C23	Ceramic	8pF 50V	A1
C24	Ceramic	8pF 50V	A1
C25	Ceramic	0.35pF 50V	A1
C26	Ceramic	0.01μF 50V	A2
C27	Electrolytic	33μF 10V	D3
C28	Ceramic	0.01μF 50V	E3
C29	Ceramic	0.01μF 50V	C2
C30	Ceramic	5pF CH 50V	E1
C31	Trimmer	CV05A050 (5pF)	G2
C32	Trimmer	CV05A050 (5pF)	F2
C33	Trimmer	CV05A050 (5pF)	E2
C34	Trimmer	CV05A050 (5pF)	E2
C35	Ceramic	5pF CH 50V	D1
C36	Ceramic	0.01μF 50V	D2
C37	Ceramic	0.001μF 50V	C2
S1	Switch	ESR-E134K20Z	
J1	Pin Contact	60809-1	E3
J2	Pin Contact	60809-1	A2
J3	Pin Contact	60809-1	A3
J4	Pin Contact	60809-1	B2
J5	Pin Contact	60809-1	F1
SO1	Xtal Socket	380-598-2	D2
SO2	Xtal Socket	380-598-2	D2
SO3	Xtal Socket	380-598-2	E2
SO4	Xtal Socket	380-598-2	E2

SECTION XI OPTIONS

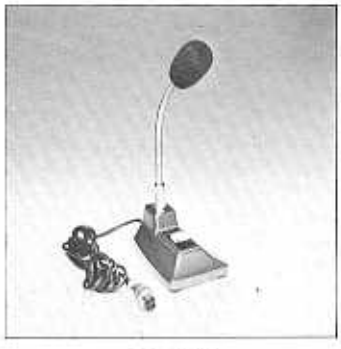
We have prepared a variety of options for the portable transceiver IC-202E in order to enlarge its use as a portable, mobile and fixed set.



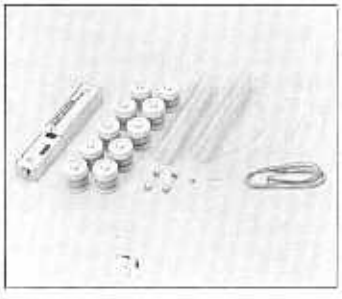
IC–FA1
FLEXIBLE
ANTENNA

IC–20L
LINEAR AMPLIFIER
144MHz 10W

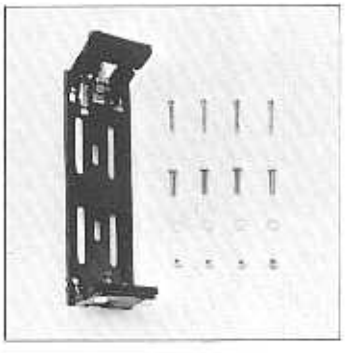
IC–3PS
POWER SUPPLY
13.8V 3A



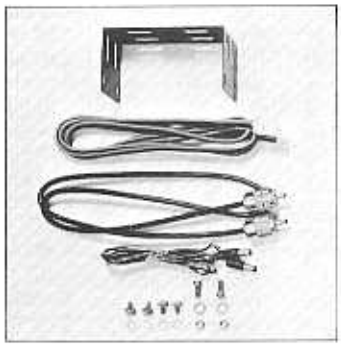
IC–SM2
DESK MICROPHONE
ELECTRET CONDENSER
TYPE



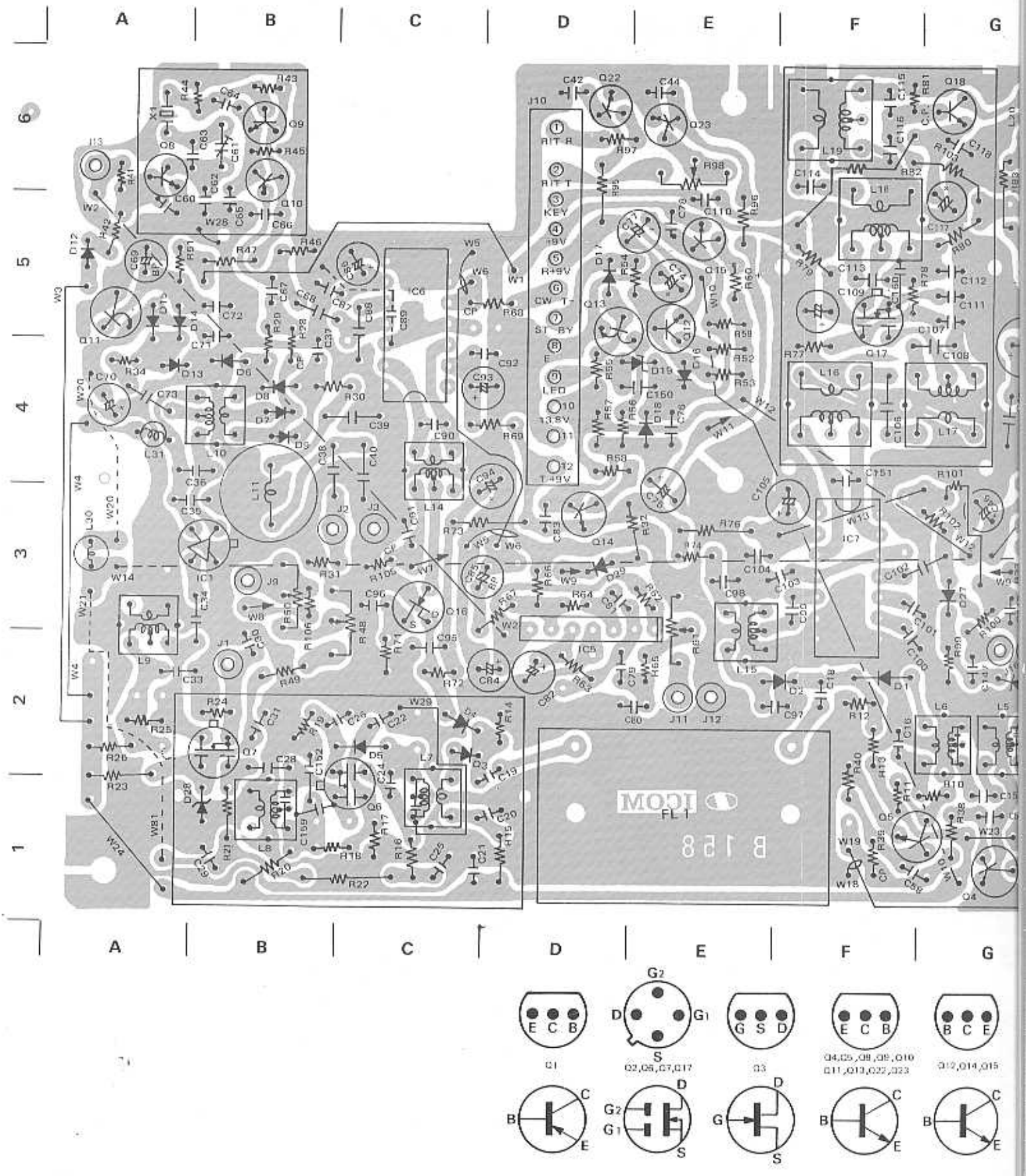
RECHARGEABLE
BATTERY PACK
BATTERY CHARGER BC-20
BATTERY N-900C x 10
(900 mAh)



MOBILE MOUNTING
BRACKET (B)
FOR IC-202E



MOBILE MOUNTING
KIT FOR IC-20L


A
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J10
RIT R
RIT T
KEY
+8V
R+8V
CW T
ST BY
E
LED
13.8V
T+8V
IC6
IC1
IC7
IC5
FL1
ICOM
J1
J2
J3
J9
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J12
J13
L10
L11
L14
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L15
L7
L8
L6
L5
Q1
Q2,Q6,Q7,Q17
Q3
Q4,Q5,Q8,Q9,Q10
Q11,Q13,Q22,Q23
Q12,Q14,Q15
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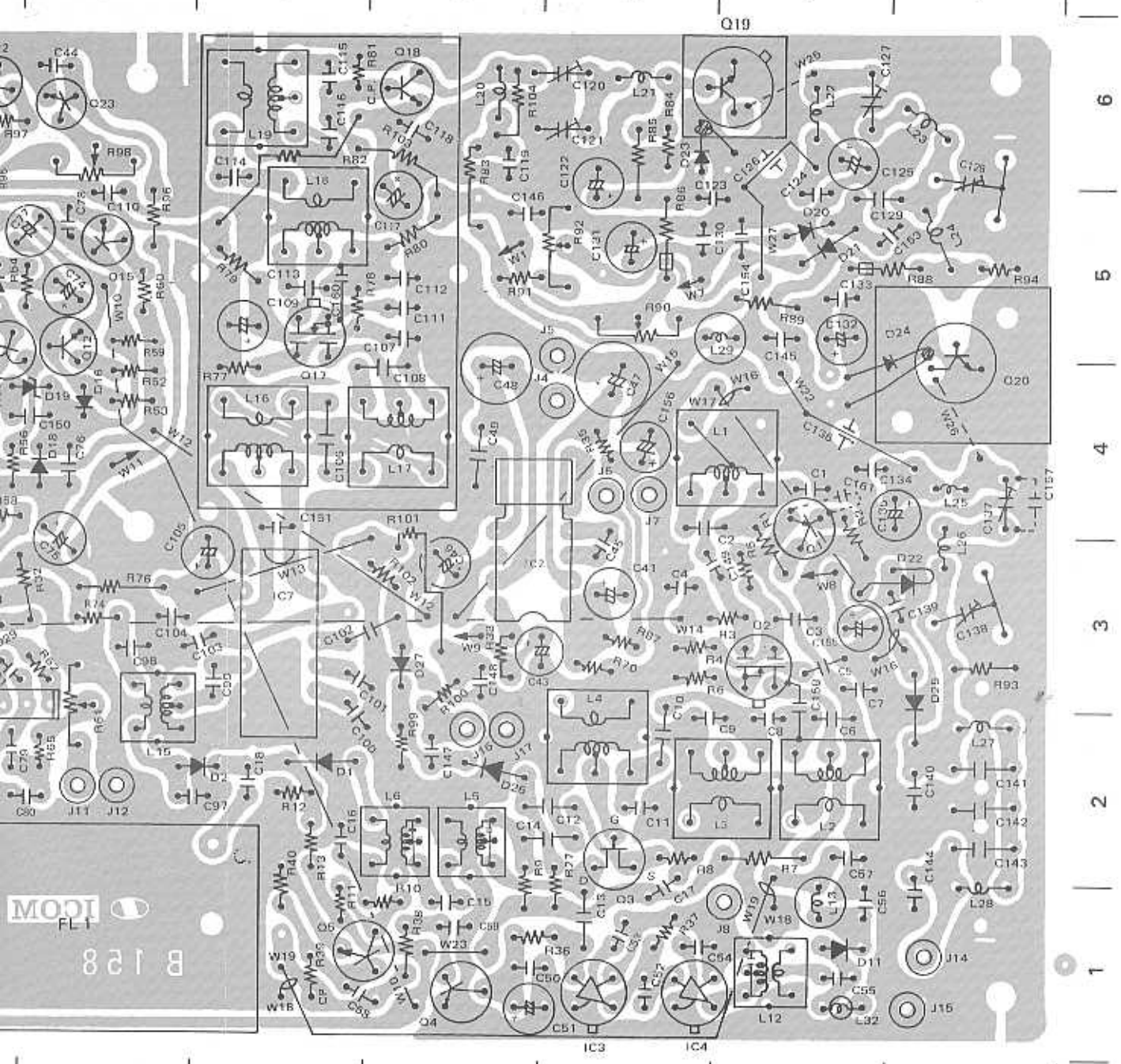
E
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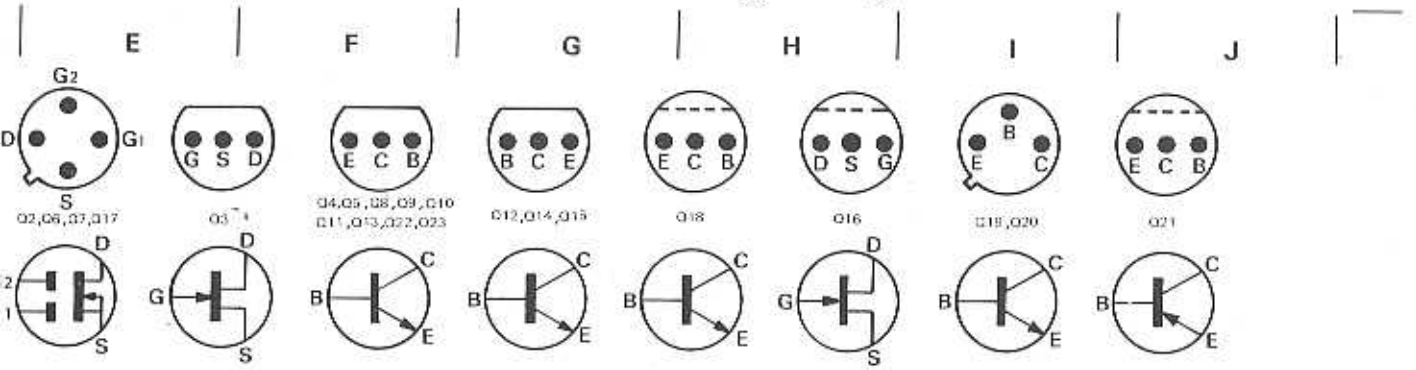
E
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J
G2
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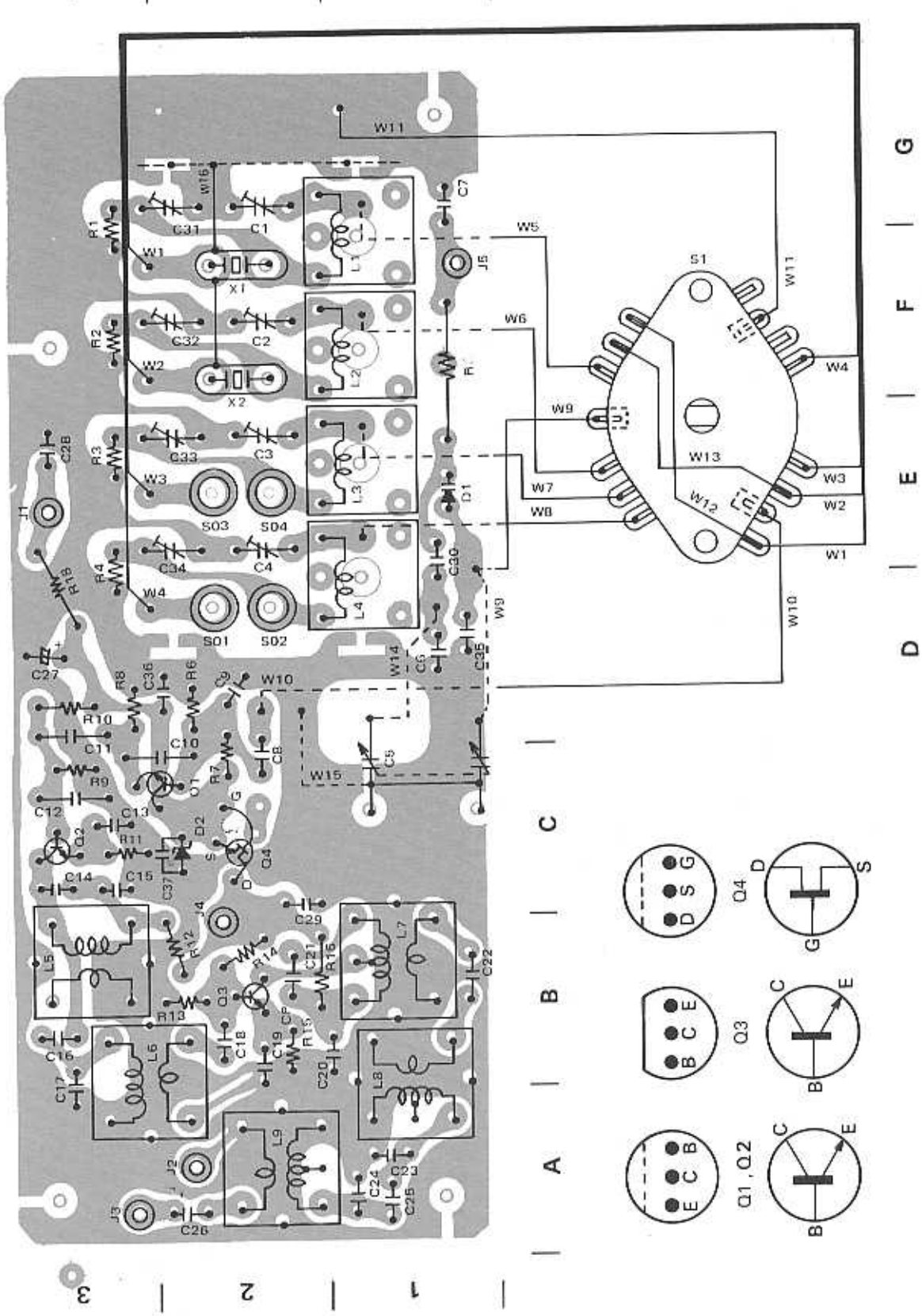
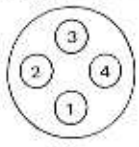
G1
S
Q2,Q6,Q7,Q17
G S D
Q3
E C B
Q4,Q5,Q8,Q9,Q10
Q11,Q13,Q22,Q23
B C E
Q12,Q14,Q15
E C B
Q18
D S G
Q16
B
E C
Q19,Q20
E C B
Q21



Unit	Q No.
Main Unit	Q1
	Q1
	Q2
	Q3
	Q4
	Q5
	Q6
	Q7
	Q8
	Q8
	Q9
	Q10
	Q11
	Q11
	Q12
	Q12
	Q13
	Q13
	Q14
	Q14
	Q15
	Q16
	Q17
	Q18
	Q18
	Q19
	Q19
	Q20
	Q20
	Q21
	Q21
	Q22
	Q22
	Q23
	Q23
VXO Unit	Q1
	Q2
	Q3
	Q4

Bottom View

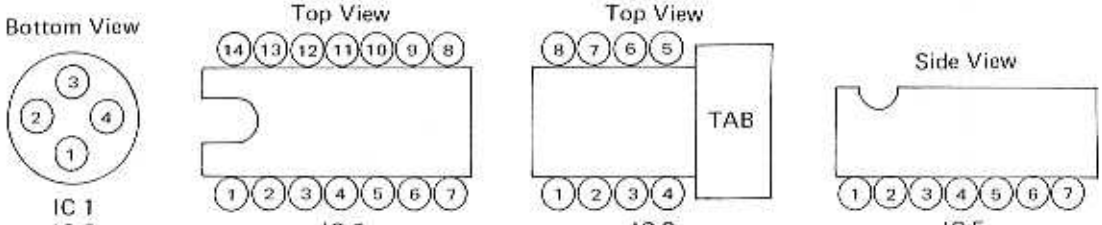


IC 1
IC 3
IC 4

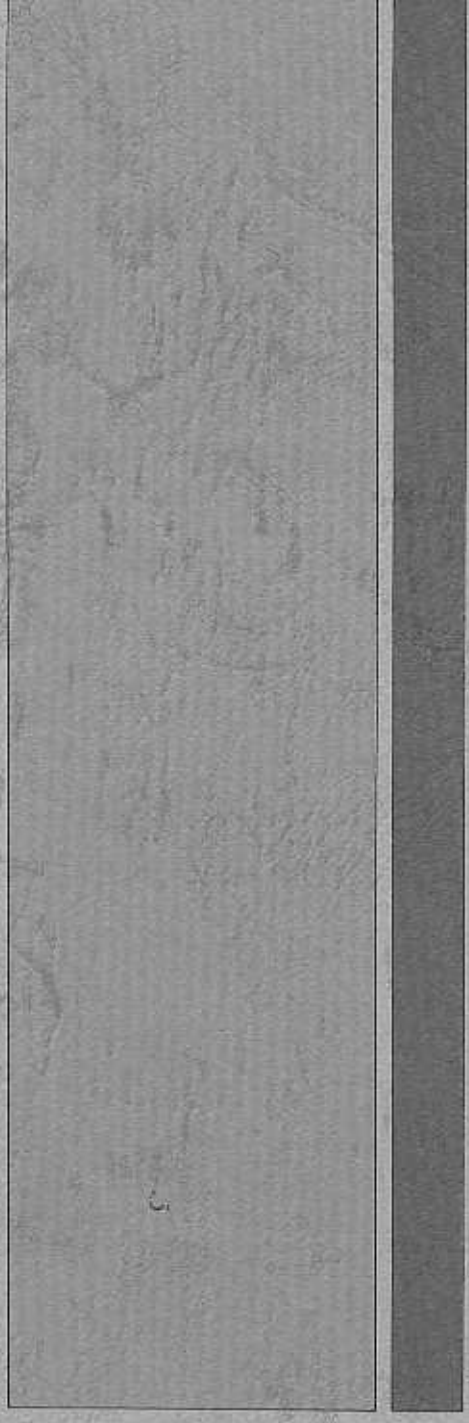
Unit	IC No.
Main	IC1
	IC2
	IC2
	IC3
	IC4
	IC5
	IC6
	IC6
	IC7

VOLTAGE CHART

Unit	Q No.	Mode	Transistor (B)	Transistor (C)	Transistor (E)	FET (G1)	FET (G2)	FET (D)	FET (S)	Remarks
	Q1	R	8.2	8.9	8.9					
	Q1	T	0	0	0					
	Q2	R				0	4.2	9.0	0.23	
	Q3	R				0		9.0	0.86	
	Q4	R	0	2.1	E					NB–ON
	Q5	R	0	6.7	E					NB–ON
	Q6	R				0	4.2	8.8	0.35	
	Q7	R				0	5.4	8.8	0.65	
	Q8	R	0.7	0	E					
	Q8	T	0	0	E					CW–T
	Q9	R	5.0	7.0	4.4					
	Q10	R	4.4	7.0	3.8					
	Q11	R	0.05	E	0					
	Q11	T	0.05	E	0					
	Q12	R	9.9	12.2	9.2					
	Q12	T	0	13.0	0					
	Q13	R	0.65	0	E					
Main	Q13	T	0.23	9.8	E					
Unit	Q14	R	0	13.2	0					
	Q14	T	9.8	11.3	9.2					
	Q15	R	9.3	12.2	8.7					
	Q16	T				0		6.4	0.7	
	Q17	T				0	4.1	8.8	0.45	
	Q18	R	0	13.2	0					
	Q18	T	1.3	12.6	0.6					
	Q19	R	0	13.2	E					
	Q19	T	0.72	13.2	E					
	Q20	R	0	13.2	E					
	Q20	T	0.75	13.2	E					
	Q21	R								
	Q21	T								
	Q22	R	0.67	0	E					
	Q22	T	0	3.7	E					
	Q23	R	0	4.8	E					
	Q23	T	0.67	0	E					
	Q1	R&T	1.8	6.1	1.3					
VXO	Q2	R&T	1.7	7.8	1.3					
Unit	Q3	R&T	1.6	7.7	1.55					
	Q4					6.1	8.7	6.1		

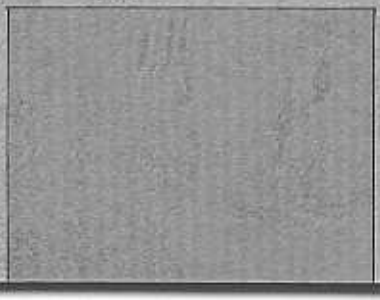


Unit	IC No.	Mode	Pin No. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	IC1	R	9.3	9.3	2.05	E											
	IC2	R	1.4	13.0	12.3	7.3	6.1	13.0	0.21	1.7							
	IC2	T	1.5	13.0	12.8	0	0.55	13.0	0	4.8							
	IC3	R	6.6	9.3	2.05	E											
Main	IC4	R	9.3	9.3	2.05	E											
	IC5	T	1.5	0.7	0.1	E	0.85	1.3	9.2								
	IC6	T	0	8.8	7.8	4.5	2.9	E	E	E	2.9	4.5	4.5	4.5	7.8	E	
	IC6	T	0	8.4	6.0	5.5	4.9	E	E	E	4.7	5.4	5.5	5.5	6.0	E	CW-T
	IC7	T	E	8.8	7.8	4.5	2.9	E	E	E	2.9	4.5	4.5	4.5	7.8	E	



NOUE COMMUNICATION EQUIPMENT CORPORATION

-6-19, KAMI KURATSUKURI, HIRANO-KU,
OSAKA JAPAN



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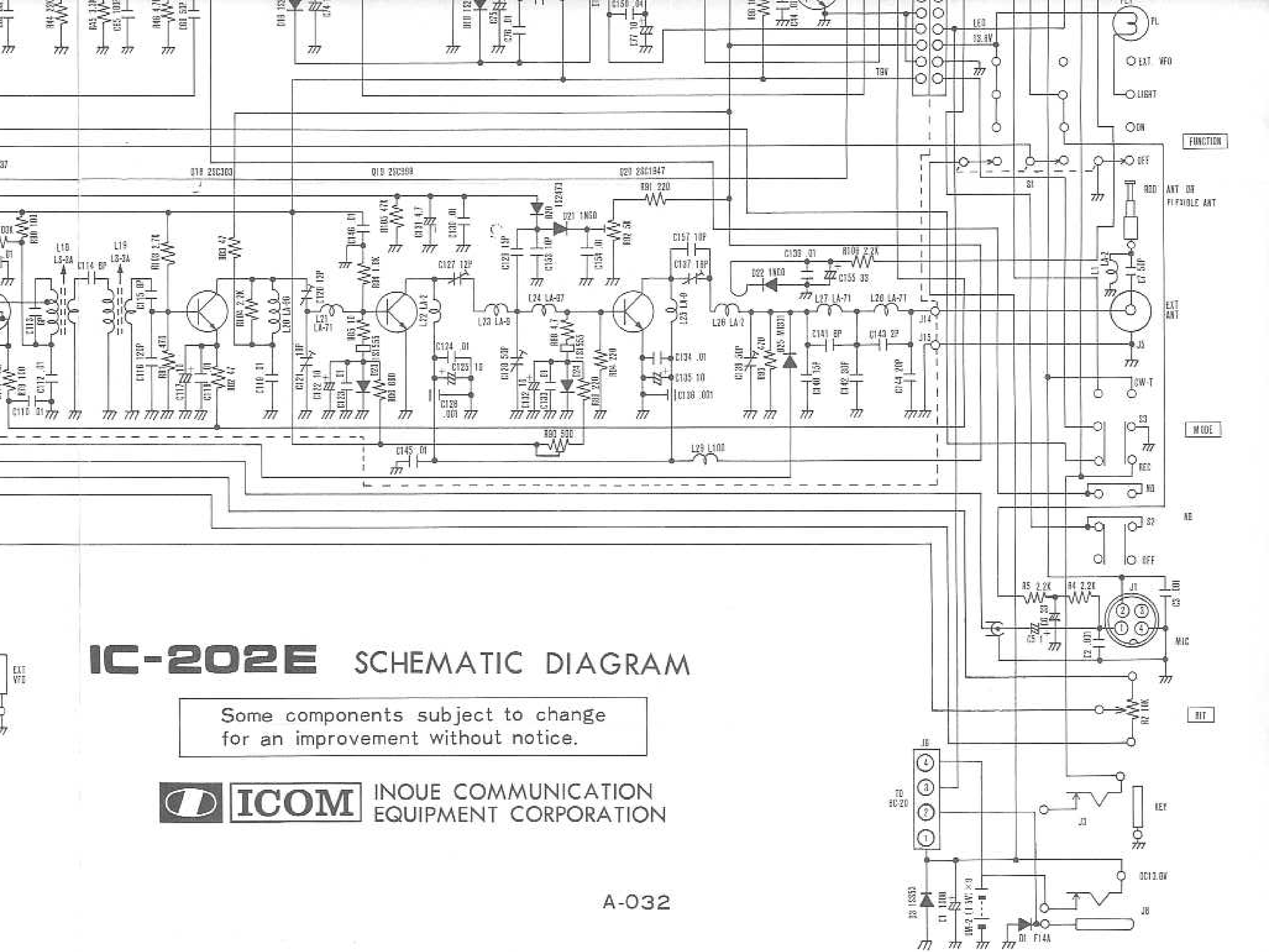
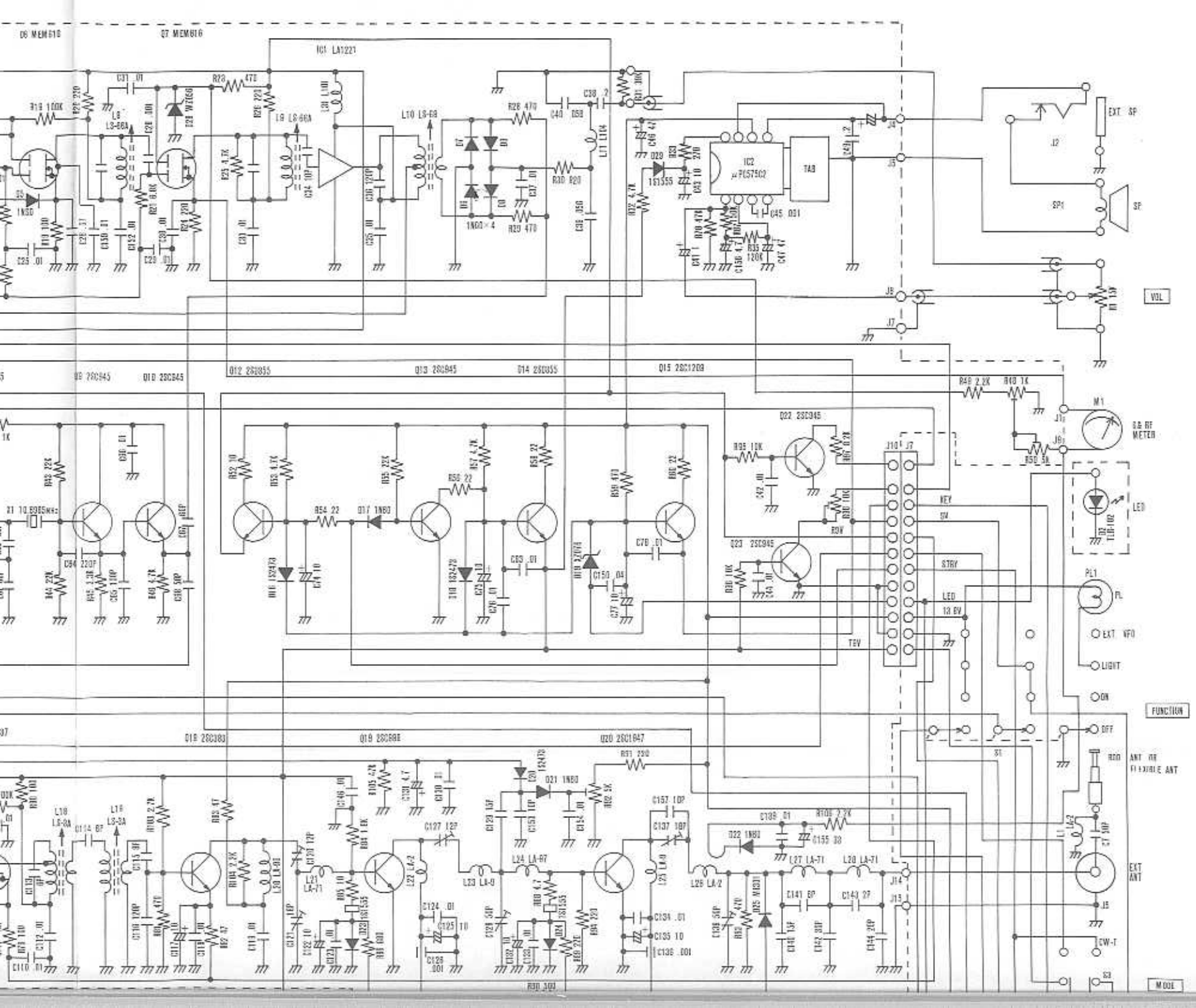


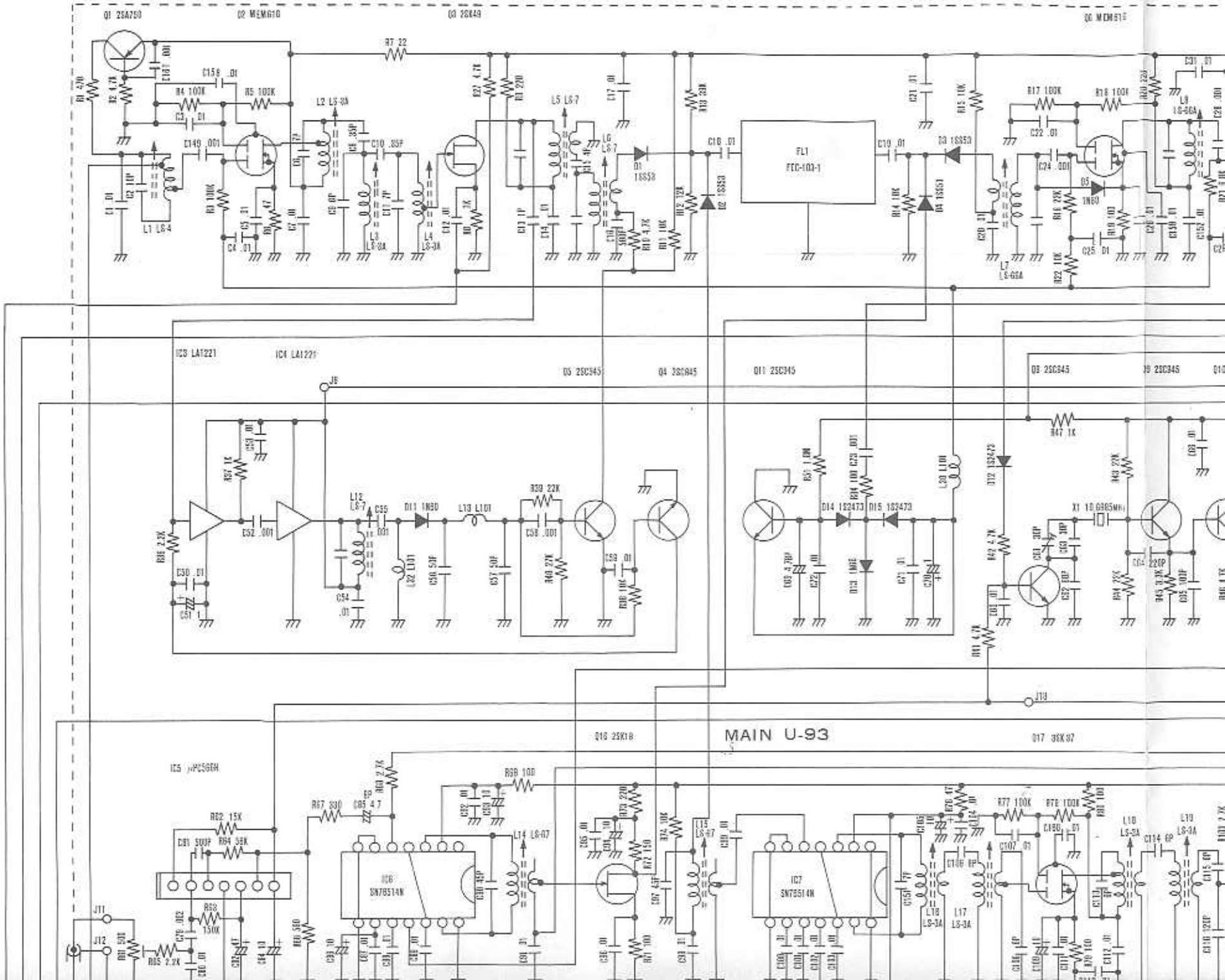
IC-202E SCHEMATIC DIAGRAM

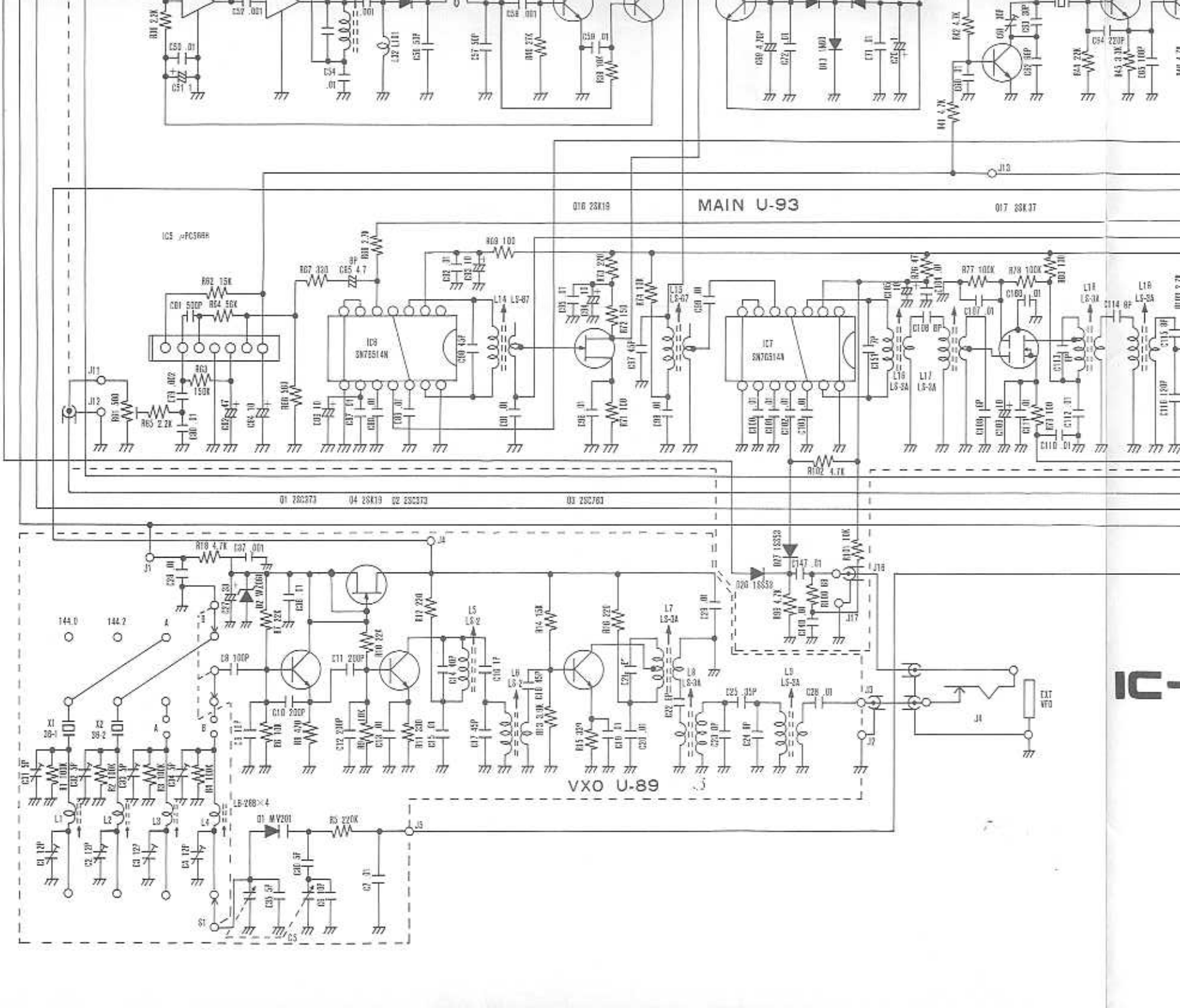
Some components subject to change for an improvement without notice.

ICOM INOUE COMMUNICATION EQUIPMENT CORPORATION

A-032


Q6 MEM616
Q7 MEM616
IC1 LA1221
IC2 μPC575C2
TAB
1SS355
1N60×4
EXT SP
SP1
SP
VOL
Q12 2SC855
Q13 2SC945
Q14 2SC855
Q15 2SC1209
Q22 2SC945
Q23 2SC945
M1
S METER
RF METER
LED
KEY
STBY
LED 13.8V
TEV
PL1
PL
EXT VFO
LIGHT
ON
OFF
FUNCTION
ANT OR FLEXIBLE ANT
EXT ANT
CW-T
MODE
Q18 2SC383
Q19 2SC898
Q20 2SC1847
Q21 1N60
D22 1N60


MAIN U-93
Q1 2SA750
Q2 MEM616
Q3 2SK49
Q4 2SC945
Q5 2SC945
Q6 MEM616
Q9 2SC945
Q11 2SC945
Q16 2SK18
Q17 2SK97
IC3 LA1221
IC4 LA1221
IC5 μPC5GGH
IC6 SN76514N
IC7 SN76514N
FL1
FCC-103-1
X1 10.6965MHz
J6
J11
J12
J13


MAIN U-93
VXO U-89
IC5 μPC566B
IC9 SN76514N
IC7 SN76514N
Q16 2SK19
Q17 2SK37
Q1 2SC373
Q4 2SK19
Q2 2SC373
Q3 2SC763
D20 1S53B
D7 1S53B
D1 MV201
144.0
144.2
EXT VFO
IC-