INSTRUCTION MANUAL

SOMMERKAMP ELECTRONICS GMBH

GERMANY

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FT-277 SSB TRANSCEIVER
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GENERAL DESCRIPTION

The model FT-277 SSB Transceiver is a precision built, compact, high performance transceiver of advanced design providing SSB (USB, LSB selectable), CW and AM modes of operation. The FT-277 operates at an input of 260 watts SSB, 180 watts CW and 80 watts AM on all bands 80 to 10 meter and 11 meter CB band. An auxiliary band is provided for the use of other frequency than amateur bands.

All circuits, except transmitter linear amplifier, are transistorized and composed of standard computer type built-in modules, permits easy maintenance.

The FT-277 is self-contained, requiring only a microphone and an antenna for operation at home, portable or mobile. The FT-277 operates from either 100/110/117/200/220/234 volts AC or 12 volts DC (negative ground) power source; the two-way solid state power supply is an integral part of the unit. Selection between two power sources is automatically made when the proper line cord is connected.

A separate power switch is provided to turn off tube heaters when in receive, and the FT-277 draws only 0.5 amp less than your auto dash lights.

All accessories, such as built-in VOX, break-in CW with sidetone, 25 and 100 KHz calibrators, noise blanker, 10 MHz WWV are built-in. In addition, dual VFO adaptor, crystal control adaptor, speaker and clarifier is a integral part of the unit. Provision is made for the installation of 600 Hz crystal filter for expert CW operation. CW filter will be selected automatically when the transceiver mode switch is placed in the CW position.

The entire transceiver package is 13 1/2" wide, 6" high, 11 1/2" deep and weighs approximately 30 pounds. Construction of heavy-gauge steel provides an extremely rugged package, virtually immune to the effects of vibration and shock.

For high fidelity listening, external speaker SP-277 will be available from your dealer. The external speaker SP-277P has built-in phone patch net work.

SPECIFICATIONS

Frequency Range	3.5-30 MHz amateur bands, 26.9-27.5 MHz 10-10.5 MHz
Type of Emission	USB or LSB (selectable) CW, AM
Power Input	SSB 260 Watts PEP CW 180 Watts 50% duty cycle AM 80 Watts (slightly lower on 10 meter)
Carrier Suppression	40 db
Sideband Suppression	40 db at 1000 Hz
Spurious Radiation	40 db down at least
Transmitter Frequency Response	300 Hz - 2700 Hz $\pm$ 6 db
Distortion Products	Down at least 10 db
Antenna Output Impedance	50 - 75 ohm unbalanced
Frequency Stability	100 Hz/30 min after warm up
Sensitivity	0.5 uV S/N 10 db
Selectivity	2.4 KH at 6 db 4.5 KH at 60 db * 600 Hz at 6 db * 1.2 KH at 60 db
Image Rejection	50 db at least
Audio Output	3 Watts 4 ohm at 10% distortion
Power Consumption	AC Receive 35 Watts Transmit 300 Watts Max. DC 12V Standby 0.5 Amp. Transmit 21 Amp.
Dimensions	13 1/2" wide, 6" high, 11 1/2" deep
Weight	Approx. 30 Pounds

* Option

INSTALLATION

General;

The **FT-277** Transceiver is designed to provide a complete single-unit installation for fixed, portable, or mobile operation. It is recommended to avoid excessively warm location, such as car heater outlet, however, no special precaution be observed in the choice of location, provided adequate ventilation space is available. A minimum of two inches of air space above the cabinet top and on all sides is recommended to allow proper air flow around the cabinet. Never stack other units above or below the cabinet since the accumulated heat from both units could cause permanent damage.

Home Station;

Plugging the AC power cord into the receptacle at the rear of the transceiver, connect all power circuits for AC operation. Prior to connecting AC cord to power outlet, be sure the voltage marked on the rear of the transceiver should be same as your line voltage. The different line voltage will cause permanent damage of the transceiver. The transceiver has been designed for 100/110/117/200/220/234 Volts, 50/60 cps AC operation, and wired for one of these voltage at factory. If the line voltage is different from your transceiver voltage, the rewiring of the transformer is necessary prior to connecting AC code to power line.

The transceiver should be connected to a good water pipe ground. It is not recommended to use gas or electrical conduit pipes. The grounding lead should be kept as short as possible.

The ground may be connected to the terminal marked GND.

Mobile Installation;

The **FT-277** Transceiver will operate satisfactorily from any 12 volts negative-ground battery source by connecting the DC power cord to the rear panel receptacle. For under-dash mounting, a special mounting bracket is available from your dealer. The transceiver can be used in boat as well as car.

The transceiver requires an average of 14 amps at transmit and 25 amps on voice peaks. The fuse in the DC power cable should be 20 amps. When making connections to the car battery, be certain that the RED lead is connected to the positive (+) terminal and the BLACK lead to the negative (-) terminal of the battery; reversed connections could permanently damage the transceiver. The BLACK lead should have been run directly to the negative terminal of the battery. Using the car frame as a negative connection or connecting the positive lead at a point such as the ignition switch places the devices

creating the noise in the same current path as the transceiver and fails to take advantage of the filtering action of the battery. The power cable should be kept away from ignition wires and be as short as possible to minimize voltage drop and to provide a low impedance path from the transceiver to the battery which acts as filter.

Prior to operating the transceiver in a mobile or marine installation, the automobile voltage regulator setting should be checked. In many vehicles, the voltage regulation is very poor and in many cases, the regulator is adjusted for an excessively high charging voltage. At the battery and regulator age, the maximum voltage while charging can increase to a very surprising level which is injurious to the battery and also this high voltage could cause heavy damage to the transceiver.

The transceiver will operate from a source voltage of 11 volts to 14 volts. It is necessary to carefully set the charging system so that the limit of 14 volts is not exceeded.

Under no circumstances, should the transceiver ever be operated from a vehicle electrical system that cannot regulate the voltage well below 15 volts.

The same precaution should be taken for not only the transceiver but also any other radio equipment used in a vehicle.

W A R N I N G

Lethal voltages are present in several areas of the transceiver whenever the set is on. Do not attempt to work inside the set with power applied.

C A U T I O N

Never transmit without having proper antenna or dummy load connected to the transceiver.

Antenna;

The transceiver is designed for use with resonant antenna having the impedance of 50 - 100 ohm resistive.

The antenna is usually the most critical part of a station installation. Results both in receiving and transmitting will depend on how well an antenna is installed and adjusted. Any of the common antenna systems designed for use on the high frequency amateur bands may be used with

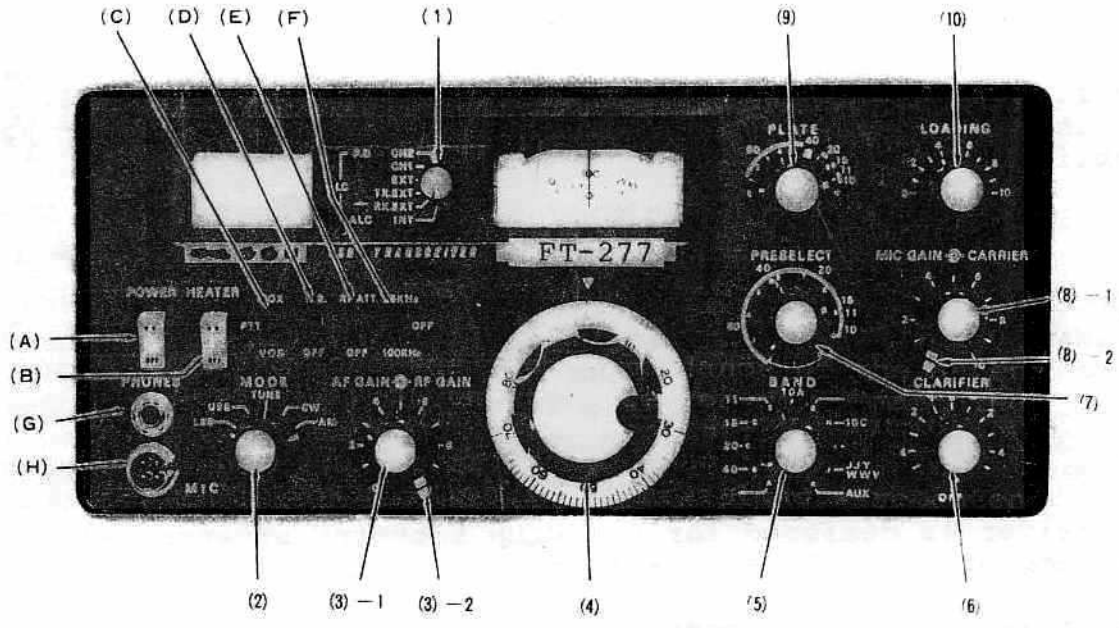
the transceiver, provided the input impedance of the antenna system is within the capability of the transceiver pi matching network (50 - 100 ohms).

If tuned open wire transmission line, or a long wire antenna is used, a suitable antenna tuner must be used between the antenna and the transceiver to provide an impedance match between the unbalanced coaxial output of the transceiver and the balanced open-wire feeder or long wire.

For mobile operation, most of the commonly used mobile antennas in the market will give good results with the transceiver. Make certain that the outer braid of coaxial cable is securely grounded to the chassis of the vehicle at the antenna mount. The length of such a mobile antenna will effect highly on SWR of the transmission output. It is recommended to adjust the antenna length carefully for minimum SWR after installation.

OPERATION

The FT-277 Transceiver has been specifically designed to provide the ease of operation and versatility. All controls have been thoroughly tested before shipment from the factory. Several of the controls are unusual in operation, however, improper adjustment may result in signals of poor quality in both transmit and receive. The various front panel controls and their functions are described in the following section. Be certain that you understand thoroughly the function of each control before operating the transceiver.



CONTROLS & SWITCHES

(1) VFO Select Switch;

This switch sets the transceiver to receive or transmit on either internal VFO or external VFO. The companion FV-101 external VFO allows cross-frequency DX operation and has the effect of providing the operator with spirit frequency, separate receiver-transmitter operation controlled by VFO or crystal.

(2) Mode Switch; (LSB-USB-TUNE-CW-AM)

The mode switch is a five-position switch. This switch is used to select the mode of operation; LSB, USB, AM, CW or TUNE position. At AM, CW and TUNE positions, a separate crystal is used to shift carrier frequency into the filter passband.

(3) RF GAIN/AF GAIN:

The RF GAIN and AF GAIN controls are two controls mounted on concentric shafts. RF GAIN control (lever control) varies the gain of the receiver RF and IF amplifier. Maximum sensitivity is obtained with the control set at 10 (fully clockwise).

The AF GAIN control (round knob) adjusts the audio output level at the speaker and phone jack. Clockwise rotation increases the audio output.

(4) Tuning Knob;

The large knob directly below the dial window controls the actual frequency of operation after the desired band has been selected. A precise double gear and ball driver mechanisms are incorporated to provide a slow tuning rate and, at the same time, to read out 1 KHz on 100 KHz dial. Since the tuning rate is 14 KHz per revolution. There is no critical tuning on SSB signal. An addition feature of this mechanism is that the dial is positively locked to prevent mechanical frequency drift under vibration. As an additional feature, the 100 KHz skirt vernier dial may be adjusted for the calibration.

(5) BAND Switch;

The band switch is an eleven-position switch used to select the desired band for receiving or transmitting. The band indication is made black or red to read on the dial for direct frequency determination.

(6) CLARIFIER;

The clarifier control provides a means for tuning the receiver frequency ±5 KHz to either side of the transmitting frequency. Thus, it is possible to set the pitch of the voice you are receiving to the most readable point without affecting your transmitting frequency. Its use if particularly valuable in "net" operation where several participants may be transmitting slightly off frequency. The clarifier control may be switched off and the receiver locked to the transmitting frequency by setting the clarifier control to the

OFF position. Normally, you will want to keep the clarifier turned off until the initial contact is made. After the contact is made, the clarifier control may be used to zero-in for any drift at the other end of contact.

(7) PRESELECT;

This pretunes signal circuits for both transmit and receive condition. New slug tuned mechanism is used to cover all bands even outside of amateur bands except IF and VFO frequencies.

(8) MIC GAIN/CARRIER;

The MIC GAIN/CARRIER control is two controls mounted on concentric shafts. The carrier control (lever control) varies the amount of the carrier in the CW, AM and TUNE modes of operation.

The MIC GAIN control (round knob) varies the audio level from the microphone amplifier stage. The control has sufficient range to permit adjustment of any high level crystal microphone or low level dynamic microphone normally used for voice communication. Both controls have maximum value with the control set at 10 (fully clockwise).

(9) PLATE;

Tunes plate circuit of PA tubes.

(10) LOADING;

Tunes output circuit of pi network to match output impedance to antenna or feeder impedance.

(A) POWER

Main switch turns transceiver on in both AC and DC operation.

(B) HEATER

With this switch in the down position, the transmitter tube heaters and the high-voltage supply are turned off when the transceiver is in receive only. This reduces battery drain to 0.5 amps and thus permits long period of listening without fear of excessive battery drain. Pushing the rocker switch to the upper position actuates the high-voltage supply and the tube heaters. After 30 seconds warm-up period, the transmitter is ready for operation. This switch operates both DC and AC operation.

(C) MOX/PTT/VOX

In the MOX position (upper position), the transmitter portion of the transceiver is in operation and all circuits common to both transmitter and receiver are in the transmit condition. In the PTT position (mid position), the receiver portion of the transceiver is in operation, the transmitter is operated by a Push-To-Talk switch on the microphone pushed. In the VOX position (lower position), the transmitter is energized by voice or part of the first character of CW transmission and in the absence of voice or keying the transceiver is automatically placed in the receive mode.

(D) NB (NOISE BLANKER)

In upper position, the noise blanker is placed in the circuit and shuts off ignition noise pulse.

(E) RF ATT (RF Attenuator)

20 db attenuator is inserted in the incoming signal path. This may be used to minimize cross modulation.

(F) 25 KHz/100 KHz (CALIBRATOR)

The 100 KHz crystal oscillator is used to calibrate the receiver. In the 25 KHz position, 25 KHz multivibrator generates a maker signal every 25 KHz.

(G) PHONE

The PHONE Jack for headphone. The internal speaker will be disconnected with headphone plug inserted.

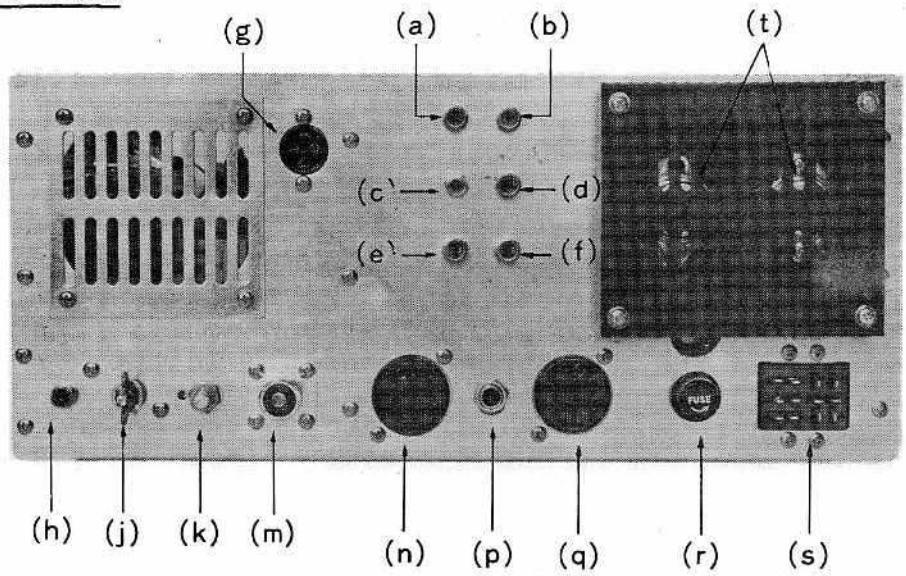
(H) MIC

The Microphone Jack. Three pole plug is used for microphone input, push-to-talk and ground.

(I) METER

Select the meter to read PA cathode current, relative power output, or plate current of ALC controlled stage.

CONNECTORS ON REAR



REAR VIEW

(a) AF-IN;

Audio input from the other optional equipments, such as FM detector unit.

(b) IF OUT;

3180 KHz IF signal may be taken from the jack for the use of panoramic adaptor.

(c) SP;

Audio output jack for an external speaker. Output impedance is 4 ohms and the internal speaker will be disabled with a plug inserted

(d) PTT;

Push-to-talk jack. The transceiver may be controlled with the external circuit. When this termainal is grounded, the transceiver activates into transmitting condition.

(e) PATCH;

Speech input terminal for phone patch connection. Impedance is 50 kilo ohms.

(f) AUX;

This jack is connected to receiver output (4 ohms) to be used for phone patch.

(h) RF OUT;

Output from driver stage may be obtained for the use of optional equi ments, such as our FTV-650 transverter.

(j) GND;

Ground connection.

(m) ANT;

Coaxial connector for antenna.

(n) A.C.C.;

Accessory socket.

(p) KEY;

Key jack for code operation.

(q) EXT VFO;

Input jack for external VFO.

(r) FUSE;

Fuse holder 3 amps for 115 volts, 2 amps for 220 volts operation.

(s) POWER;

Power receptable. AC and DC cord with plug is supplied.

TUNING PROCEDURE

The tuning procedure of the FT-277 Transceiver is not complicated, however, care should be exercised when tuning to insure peak performance of the equipment. The following paragraphs describe the procedure for receiver and transmitter tuning.

INITIAL CHECK

To ensure against improper operation or damage to the equipment, the following initial check by the owner is recommended, although the unit has been thoroughly pre-tested before shipment from factory.

Before connecting to an AC power outlet or 12 volts DC source, carefully examine the unit for any visible damage; check that all printed modules and crystals are firmly in place and that all controls and switches are operating normally. Ensure that voltage specifications marked on rear apron match the supply voltage.

Receiver Calibration;

Preset the controls and switches as indicated;

VFO Selector ---------- INT (internal)
MOX/PTT/VOX ---------- PTT or VOX
POWER ---------- ON (upper position)
RF GAIN ---------- Maximum
AF GAIN ---------- As required
BAND ---------- Desired band
MODE ---------- Desired mode
TUNING ---------- 100 KHz point nearest desired frequency
PRESELECTOR ---------- Desired band segment
CLARIFIER ---------- OFF
RF ATT ---------- OFF
CALIBRATOR ---------- 100 KHz

To calibrate, set the TUNING control to the 100 KHz point on the dial nearest the desired frequency. Tune the receiver to the 100 KHz calibrator signal for zero beat. Two calibrator signals may be heard near the 100 KHz point. One of them is a signal through IF stage. Zero beat against the stranger signal. To calibrate, hold tuning knob firmly at zero beat point and rotate skirt vernier dial to zero position. The skirt vernier dial surrounds the tuning knob and is held in position by a friction locking device. This dial is easily movable by hand but will retain its position after calibration. The transceiver must be calibrated when changing mode of operation to LSB, USB, AM or CW.

Peak the preselector control for maximum S meter reading. In calibrati switch 25 KHz position, calibrator signal can be heard at every 25 KHz point. The calibration switch should be in the OFF position in normal use of the receiver.

Basic Tune-Up;

Connect dummy load to the coaxial antenna output, and preset the controls as follows:

POWER ---------- OFF
HEATER ---------- ON
MODE ---------- TUNE
CARRIER ---------- 0 (fully counter-clockwise)
BAND ---------- Desired band
TUNING ---------- Desired frequency
PRESELECTOR ---------- Desired band segment
PLATE ---------- " " "
LOADING ---------- 0 (9 o'clock position)
METER ---------- IC
VFO SELECT ---------- INT
MOX/PTT/VOX ---------- PTT or VOX

With the transceiver turned on, allow 60 seconds for warm-up of the transmitter tube. Be certain that accessory plug is in the accessory

socket. The heater voltage to the final tubes is supplied through pin 1 and pin 2 of the accessory plug.

Set the MOX/PTT/VOX switch to MOX position. Meter will now read Final Amplifier resting cathode current. This should be set at 70 mA with the BIAS control located under the top cover. Switch the meter to ALC position and adjust ALC control under the top cover for full scale deflection of the meter. Return meter switch to IC position.

C A U T I O N

The importance of short "ON" cycles and limiting IC current to the lowest level consistent with positive tuning indications in the following sequence cannot be overemphasized. An indicated current of 100 mA is usually sufficient to provide positive indication of drive maximums and final plate dips. Excessive "OFF-Resonance" currents for extended periods of time will result in destination of the final amplifier tubes.

Advance CARRIER control until the cathod current starts to increase. Peak the PRESELECTOR for maximum IC reading. Advance CARRIER control until meter reading indicates 100 mA, and quickly tune PLATE for dip. Advance LOADING in small increments and re-dip with the PLATE control until the dip is broad and IC current becomes about 80% of maximum non-resonance current, i.e. 80 mA.

Momentarily advance CARRIER control until the meter shows approximately 400 mA. Momentarily advance the CARRIER control for maximum output (ten seconds maximum), and re-adjust PLATE and LOADING for IC dip at maximum output. At dip the cathode current will be approximately 300 mA. (slightly lower on 10 meter band). Return MOX/PTT/VOX switch to PTT or VOX position.

C A U T I O N

EXCEEDING THE TIME LIMITS NOTED FOR MAXIMUM POWER INPUT DURING FINAL TUNING MAY RESULT IN DESTRUCTION OF THE FINAL OUTPUT TUBES.

NOTE

Insertion of key plug automatically disconnects bias supply to PA tubes, therefore, with key plug installed idling current will not be indicated on meter.

SSB OPERATION

After completion of tuning, set MODE switch to LSB or USB. Set the METER swtich to ALC position. Set the MOX/PTT/VOX switch to MOX position and advance the MIC GAIN control the meter kicks up to mid scale of green colored portion when speaking into the microphone normally.

Set the MOX/PTT/VOX switch to VOX position. For VOX operation, adjust VOX GAIN potentiometer under the top cover until voice actuates the transceiver. Set the ANTITRIP potentiometer to the minimum point to prevent the speaker output from tripping the VOX. Do not use more VOX gain or ANTITRIP gain than necessary.

Adjust the DELAY potentiometer under the top cover for suitable release time.

NOTE

When meter is set to IC, voice modulation peaks will indicate 150 - 200 mA. Actual peak current, however, is approximately 2 times the indicated value.

ADJUSTMENT FOR THE CONTROLS

(1) S METER CONTROL;

This control VR3 marked SM is located on the printed board PB-1080A Adjust the control for S9 reading when 100 uV signal is applied to the antenna terminal from signal generator.

(2) NOISE BLANKER THRESHOLD;

The VR3 marked NB on the PB-1080A determines threshold voltage of noise blanker. Clockwise rotation of the control increases the effect of noise reduction. However, extreme usage of the control reduces the receiver gain. Improper setting of the control sometimes produces distortion on the receive signal.

For proper setting of the control, tune in signal of approximately S6 strength while noise blanker is out. With the noise blanker on adjust the control to a point where the signal strength decreases to S5.

(3) VOX CONTROLS;

The VOX controls are located on PB-1081B VR1 for VOX GAIN control,

VR2 for DELAY control, VR3 for RELAY sensitivity and VR5 for ANTITRIP control.

For proper setting, set MOX/PTT/VOX switch to VOX position, and set AF GAIN and MIC GAIN controls to a minimum position. Advance the RELAY controls until a relay starts to activate, then decrease the control small current until the relay returns to receive position.

Advance MIC GAIN to position 4. Adjust VOX GAIN to just activate VOX relay when speaking into the microphone normally. Set the ANTITRIP control to the minimum point to prevent the loud speaker output from tripping the VOX when AUDIO gain control is advanced for listening. Do not use more VOX GAIN or more ANTITRIP gain than necessary Adjust the DELAY control for suitable release time.

(4) CW SIDETONE LEVEL CONTROL;

CW sidetone level may be adjusted by rotating the tone level potentiometer VR5 located on PB-1081B

(5) ALC METER SETTING;

When METER switch on the front panel is set to ALC position, the meter will indicate limiting action. To adjust meter, set controls as follows:

MODE	:	USB
MIC GAIN	:	Fully counter-clockwise
MOX/PTT/VOX	:	MOX

If meter reads other than full scale, adjust ALC control VR2 on PB-1078A. Return MOX/PTT/VOX switch to PTT or VOX position.

(6) BIAS SETTING;

After warm-up, set MODE switch to USB, METER switch to IC and MOX/PTT/VOX : switch to MOX for transmit condition. The meter will indicate PA cathode current. The needle of the meter should show 70 mA. If the reading is other than 70 mA, adjust BIAS control VR2 on PB-1079A

PRINCIPLES OF OPERATION

The block diagram and the circuit descrption provide you with a better understanding of this transceiver.

The transceiver consists of a double conversion receiver and a double conversion exciter-transmitter. Receiver and transmitter circuits use common oscillator, crystal filter and IF stages. The low frequency IF is 3.180 KHz. The high frequency IF is passband tuned to cover 5520 KHz to 6020 KHz.

All circuits, except driver and final amplifier stages, are assembled in the computor type printed board modules.

MAIN SIGNAL FLOW

In receive, the HF signal from the antenna is routed through the antenna relay to the RF cathcode amplifier stage. Front end selectivity is provided by slug tuned circuits at the input and output of the RF stage. The signal is then converted from the HF frequency to the IF frequency of 5520 - 6020 KHz in mixer stage. The IF frequency is the mixer product resulting from injection from heterodyne oscillator stage of a signal 6020 KHz higher in frequency than lower end frequency of the band. The high frequency IF signal from receiver 1st mixer is applied to the high IF passband network. Output from this network is applied to receiver 2nd mixer Q2. When the signal is applied to 2nd mixer, the VFO injection signal from VFO unit produces the 3180 KHz difference produ ct. Output from the 2nd mixer is fed to the crystal filter through noise blanker. Output from the crystal filter is coupled to integrated circuit IF amplifier chain and then fed to the AM detector, the product detector and the AGC and S meter circuit. The output of a crystal controlled BFO is also fed to the product detector. The front panel MODE switch then selects between AM or product detector as desired by the operator. The signal is finally processed through the audio amplifier and into a built-in speaker or external speaker.

In transmit, audio developed in the microphone amplifier circuit is applied to the balanced modulator stage along with injection from the carrier oscillator stage. A diode-ring modulator, when balanced properly, provides modulated output with sidebands above and below the carrier frequency; the carrier is suppressed. The desired sideband is selected by a crystal filter of which passband is centered at 3.180 KHz. This passes either the upper or lower sideband, depending upon the sideband selected when the MODE switch is set to sideband carrier crystal 3178.5 KHz or 3181.5 KHz.

For AM and CW, a separate crystal 3179.3 KHz is used. The AM signal is generated by a separate AM modulator which works as buffer stage for CW. The output from crystal filter or AM modulator/CW buffer is coupled to transmitter first mixer together with the output of the VFO oscillator. The sum of two signals produce the higher frequency IF signal of 5520 to 6020 KHz. This IF signal is fed to the transmitter second mixer through bandpass network which is so designed that it provides excellent spurious reduction. With the signal from

the heterodyne oscillator, the mixer converts the high frequency IF signal to the desired transmitting frequency.

Output from the transmitter second mixer is amplified by the driver tube to a level sufficient to drive the final linear amplifier tubes.

Final output from amplifier tubes is fed to a pi-section network consisting of coil and PLATE and LOADING capacitors. A section of band switch adjusts the inductance of coil to the correct value for each band, and adds fixed amount of capacity to the PLATE and LOADING capacitors on the lower bands. Output from the pi-network is fed to the antenna through the contacts of the antenna relay.

The ALC circuit is placed in the grid circuit of the final tubes. When RF driving voltage to the final tubes becomes sufficient to drive the grid positive, the grid begins to draw current and the signal is detected. This produces an audio envelope and then rectified to DC voltage which controls gain of younger stages to prevent distortion caused by over drive.

A part of the output from the microphone amplifier is coupled to the VOX amplifier. Amplifier signal is then rectified and applied to the relay control transistor which activates the transceiver.

METERING

The meter circuit is designed to measure signal strength in receive and cathode current, relative Power Output, and the level of automatic level control in transmit. Switching of the meter is automatically made by means of relay contacts for transmit and receive.

The Multipurpose Meter M, in the transceiver has a three position selector switch S8 which provides for metering the system in transmit.

When the transceiver is in the transmit mode, switch position ALC connects the meter to the sauces of ALC controlled IF amplifier MK-10 in PB-1078A.

The meter then measures current of MK-10 which decreases when the ALC controlled voltage is applied to its gate. This control voltage is developed when the final amplifier stage is driven into the grid current levels during SSB operation.

In switch position IC, the meter is connected to the cathodes of final tubes in parallels with shunt resistor, and measures total cathode current of the tubes. This current includes Screen Grid current of the tubes which is neglisible against plate current.

The meter is connected in the cathode circuit to avoid an operational shock hazard which is often experienced when the meter is placed in the high potential point such as plate circuit.

The meter scale carries a 0 - 0.5 amp calibration to monitor the cathode current of the final tubes.

In switch position PO, the relative power output is measured by reading the rectified DC current at the pi output circuit.

When the transceiver is in the receive mode, the AGC voltage developed on signal is fed to the meter amplifiers Q4 and Q5 to provide a long scale deflection for metering antenna signal strength. The meter is calibrated in the customary "S" units up to S-9 and in DB over S-9 representing approximately 100 microvolts at the antenna terminals.

WARNING

ALIGNMENT

DANGEROUS VOLTAGES ARE PRESENT, THEREFORE EXTREME CARE IS ESSENTIAL. BE SURE THAT ALL POWER IS DISCONNECTED BEFORE WORKING ON THE CHASSIS. CHECK THE HIGH VOLTAGES IN THE CAPACITORS BY SHORTING THE HIGH VOLTAGE LINE TO GROUND WITH AN INSULATED SCREW DRIVER.

C A U T I O N

Never operate the transceiver as a transmitter without a matched antenna or adequate dummy load termination. The power amplifier tubes and PI network components can be damaged if the transceiver is operated as a transmitter unloaded.

GENERAL

The transceiver has been carefully aligned and tested at the factory and, with normal usage, should not require other than the usual attention given to electronic equipment. Service or replacement of a major component may require subsequent realignment, but under no circumstance should realignment be attempted unless the operation of the transceiver is fully understood, the malfunction has been analized and definitely traced to misalignment.

Service work should only be performed by persons experienced in this work, using the proper test equipment.

EQUIPMENT REQUIRED

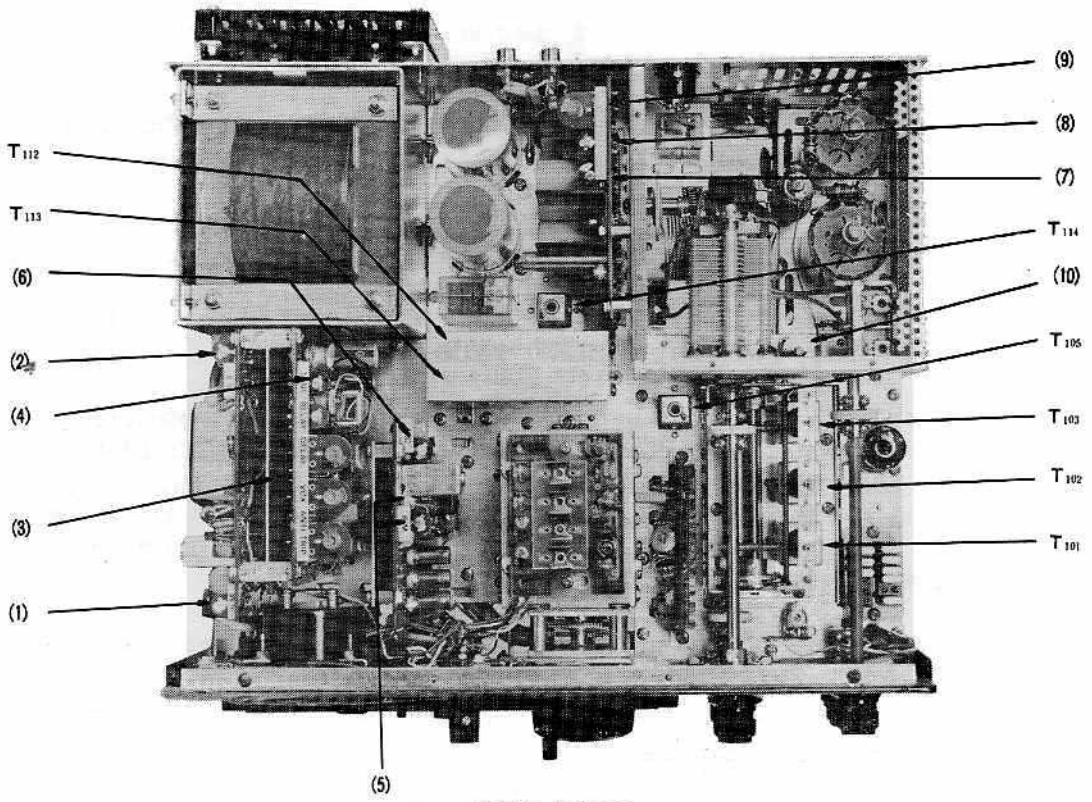
(1) RF Signal Generator; Hewlett-Packard Model 606A, or an equivalent signal generator having up to one volt output at an impedance of 50 to 70 ohms and a frequency coverage to 30 MHz.

(2) A Vacume Tube Voltmeter (VTVM); Hewlett-Packard Model 410B, or equivalent VTVM with an RF probe good to 40 MHz.

(3) A dummy Load; Waters Model 334A or equivalent 50 ohms non-reactive rated 300 watts average power.

(4) AF Signal Generator; Hewlett-Packard Model 200 AB, or equivalent.

(5) A general coverage receiver covering the frequency range from 3 to 30 MHz with a 100 KHz calibrator.



TOP VIEW

1. S-METER SENSITIVITY ADJUSTMENT

The S-meter will require a sensitivity adjustment if it does not indicate signal strength properly. Place the transceiver in the receive mode and connect the signal generator to pin 15 of MJ-3. Set the signal generator at 3180 KHz, 30% modulated and adjust the generator signal level for 93 db. The S-meter should read S-9. If not, adjust S-meter control VR2 on PB-1080 for a S-meter reading just S-9.

2. NOISE BLANKER THRESHOLD

The operating level of the noise blanker is determined by the THRESHOLD control VR3 on PB-1080A. Counterclockwise rotation of the control increases the effectiveness of the blanker, however extreme setting of this control reduces a receiver sensitivity. Receive a proper signal of S-6 or 8 S-meter reading.

Adjust the control for one S-unit decrease with the Noise Blanker switch on.

Extremely strong signals may cause distortion on the derived signal due to mixing at the switching diode. This effect can be reduced by decreasing the threshold control or by switching the Noise Blanker to OFF.

3. VOX ADJUSTMENT

VOX controls are located on PB-1081B, VR1 VOX Gain, VR2 Delay, VR3 Relay Sensitivity and VR5 Antitrip Gain.

Set the operation switch to VOX position and turn AF GAIN and MIC GAIN controls fully counterclockwise. Slowly advance RELAY control (VR3) clockwise until the relay activates, then advance the control carefully counterclockwise until relay release. This released point is proper setting for the RELAY sensitivity.

Set MIC GAIN to center of travel. Speak into the microphone normally, adjust VOX control VR1 to just activate VOX relay.

Receive a proper signal and adjust the AF GAIN control to a comfortable listening level. Set the ANTITRIP control VR5 to the minimum point to prevent the speaker output from tripping the VOX.

Adjust the DELAY control VR2 for suitable release time.

4. CW SIDETONE LEVEL ADJUSTMENT

CW sidetone level may be adjusted by rotating TONE-level potentiometer (VR5) located on PB-1081B.

5. CARRIER BALANCE

The transceiver should be allowed to reach operating temperature before making the carrier balance adjustment.

Tune-up the transceiver for SSB operation using an antenna or dummy load for transmitter. Turn the MIC GAIN control fully counterclockwise to remove all audio from the modulator stage.

With the MODE switch set at either of the LSB/USB positions, turn MOX/PTT/VOX switch to MOX position and adjust the carrier balance controls (VR1 and TC1) on PB-1078A for minimum PO meter reading.

A more exacting balance may be obtained by connecting the VTVM RF probe across the transceiver antenna terminal and observing the RF voltage on the one Volt RMS scale or by tuning a receiver, having an S-meter, to the transmitted frequency. In either case, adjust the balance controls for minimum meter reading while switching the MODE switch back and forth between the two sideband positions to obtain good carrier suppression for both sidebands.

6. ALC LEVEL ADJUSTMENT

The ALC meter will require a zero adjustment when METER switch on the front panel is set to ALC position where the meter will indicate

limiting action. To adjust meter to zero (full scale for this case), set controls as follows;

MODE	USB
MIC GAIN	Fully counterclockwise
OPERATION	MOX

If meter reads other than zero (full scale), adjust ALC control VR2 on PB-1078A for zero indication. Return OPERATION switch to PTT or VOX position.

7. VOLTAGE REGULATOR ADJUSTMENT

Connect VTVM DC probe between pin 13 of MJ-6 (for PB-1079A) and ground. Adjust REG potentiometer VR3 for exactly 6 Volt reading on VTVM.

8. CLARIFIER ADJUSTMENT

The transmitting and the receiving frequency shall be in coincidence at the CLARIFIER control OFF position. If not, adjust the CLARIFIER control VR4 on PB-1079A.

Also both transmit and receive frequencies coincide at CLARIFIER control 0 position. If not, adjust a potentiometer VR3 located near the CLARIFIER control under the main chassis.

9. BIAS ADJUSTMENT

The final amplifier bias must be checked to insure linearity and normal operating plate dissipation for the final tubes. Adjust the BIAS control VR2 on PB-1079A as follows; Set the transceiver at receive mode and allow the transceiver time to reach operating temperature.

Set MODE switch to USB, METER to IC and the OPERATION switch to MOX for transmit condition. The meter will indicate PA plate current (idle or rest current). Idle plate current is 70 MA if the bias is correct. If the idle plate current is other than 70 MA, adjust BIAS control for 70 MA with zero transmitter output.

There is a little difference in the idle current between AC and DC operation. Adjust the idle current to 70 MA for each operation.

10. FINAL AMPLIFIER NEUTRALIZATION

When replacing the final amplifier tubes, it may be necessary to reset the bias to give correct idle current and check neutralization.

Using the procedure outlined below will guarantee maximum output and long tube life.

C A U T I O N

HIGH VOLTAGES ARE PRESENT ON UNDERSIDE OF CHASSIS AND INSIDE OF FINAL COMPARTMENT. USE GREAT CARE WHILE MAKING ADJUSTMENTS WITH WIRING EXPOSED.

(1) Connect a dummy load to antenna, and set meter to IC.

(2) Locate TC-27 the neutralization variable capacitor shaft on the underside of chasis near the driver stage band switch wafer, in the final amplifier section.

(3) Check final amplifier idle current in USB or LSB position and adjust as described before.

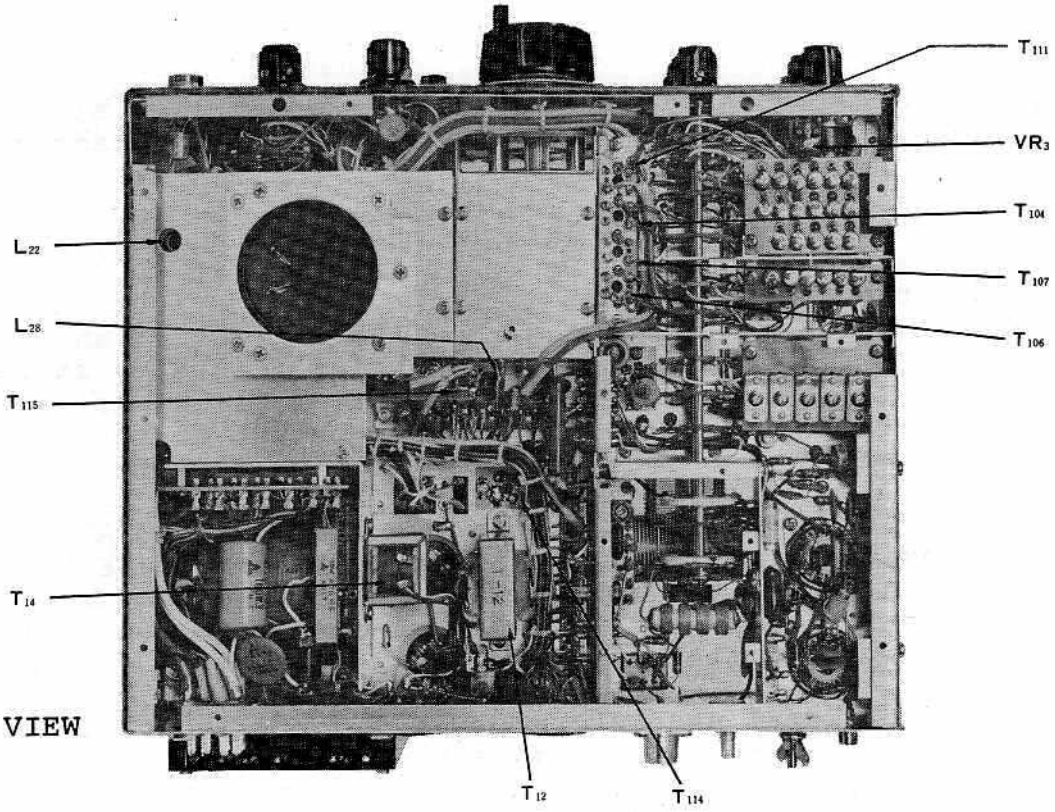
(4) Tune up the transceiver at 29 MHz, 10B or 10C band with MODE switch at TUNE position, and advance MIC GAIN CARRIER until meter IC reads 100 MA.

(5) Rotate PLATE tuning control and observe dip as indicated on the meter. If the dip is not prominent, reduce loading control slightly for better indication. As the PLATE control is rotated the meter should rise equally and smoothly on either side of maximum dip indication.

(6) Determine which side of the dip rises abruptly. Set PLATE control slightly to this side of dip keeping the meter reading below 100 MA.

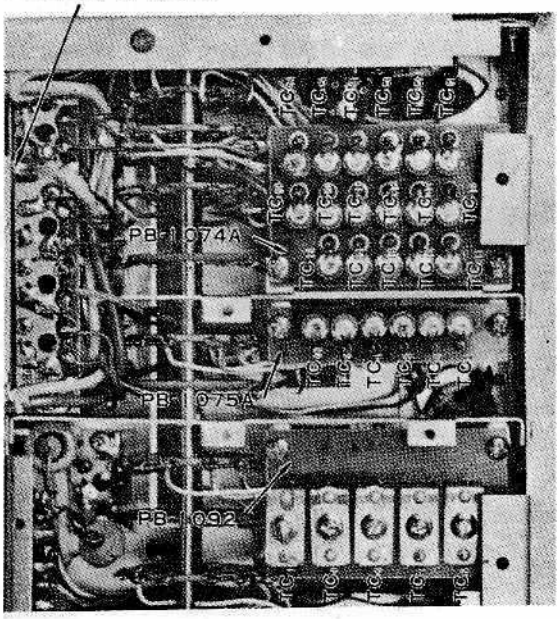
(7) Using no metallic tuning wand, rotate neutralization capacitor shaft very slightly in the direction which reduces the current shown on the meter. Repeat steps 6 and 7 until the meter indicates a smooth and equal rise on either side of the maximum dip point.

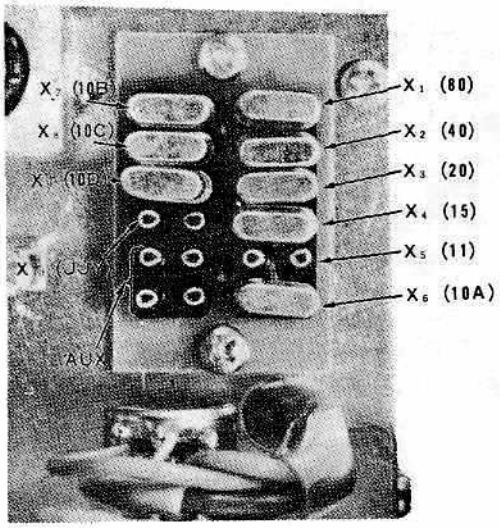
The final compartment cover must be in place to supply the RF shielding required during the neutralization procedure.



BOTTOM VIEW

CHECK POINT





11. ALIGNMENT OF TRANSMITTER MIXER/DRIVER AND RECEIVER FRONT END STAGES

The final amplifier bias adjustment must be properly set per paragraph 9 before extensive operation of the transmitter is attempted. It is assumed that the signal generating stages of the transceiver are functioning properly. Use the internally generated signal of the

transceiver to align the transmitter mixer and driver stages and RF signal generator to align the receiver front end stage.

(1) Connect the 50-ohm dummy load to the antenna Jack. Tune up the transceiver at 30,000 KHz (BAND 10D, VFO at 30,000 KHz) as follows; Set the BAND switch at 10D, the VFO at 000 KHz and the OPERATION switch at MOX. Advance the CARRIER control and tune the final amplifier. Maintain the meter reading IC 100 MA at resonance with the CARRIER control. Set trimmer TC5 at mid-capacitance position adjust slugs of T102 and T103 for maximum output at the dummy load. Reduce the transmitter output to zero with the CARRIER control.

(2) Set the OPERATION switch at receive mode, RF and AF GAIN control at maximum, CLARIFIER control at OFF, and NOISE BLANKER at OFF. Do not change VFO setting and PRESELECTOR control setting set up in step 2. Tune the RF signal generator to 30,000 KHz and adjust it for approximately 1,000 Hz beat note.

Use just enough signal generator output (approximately 1 microvolt for an aligned unit) to keep from developing AGC voltage (no S-meter indication). Set trimmer TC15 at mid capacitance position. Adjust a slug of T-101 for maximum audio output without developing AGC voltage.

(3) Set the BAND switch at 10A, the VFO at 28,000 KHz and the OPERATION switch at MOX. Advance the CARRIER control and tune the final amplifier. Maintain the meter reading 100 MA with the CARRIER control as described in step 1.

Set the PRESELECTOR control at the lower end of 10 and 11 meter segment and adjust trimmer TC5 for maximum output at the dummy load. Reduce the transmitter output to zero with the CARRIER control.

(4) Set the OPERATION switch at receive mode and without changing the VFO or PRESELECTOR control settings, tune the RF signal generator to 28,000 KHz and obtain 1,000 Hz beat note.

Control the signal generator output and adjust trimmer TC15 for maximum audio output as described in step 2.

(5) Repeat step 1, 2, 3 and 4 to peak out the coil adjustments for the 10 meter band.

(6) Set the BAND switch at 15, the VFO at 21,000 KHz and the PRESELECTOR at lower edge of 15 meter segment. Tune up the transceiver at 21,000 KHz as described above. Adjust trimmer TC4 and TC9 for maximum transmitter output at dummy load.

(7) Set the OPERATION switch at receive mode, and without changing the VFO or PRESELECTOR settings, tune the RF signal generator at

21,000 KHz and obtain the 1,000 Hz beat note, and adjust trimmer TC14 for maximum audio output as described in step 2.

(8) Repeat the procedures given in step 6 and 7 at 20 meter band. The trimmer TC3 and TC8 are used for maximum transmitter output and TC13 for maximum audio output in receive.

(9) Set the BAND switch at 80, VFO at 4,000 KHz, and the PRESELECTOR at 12 o'clock position. Set TC1 and TC6 at mid-capacitance point. Tune the transceiver at 4,000 KHz and adjust T105 and T106 for maximum transmitter power output at dummy load.

(10) Set the OPERATION switch at receive mode, and without changing the VFO or PRESELECTOR settings, tune the RF signal generator at 4,000 KHz and obtain the 1,000 Hz beat note, and set TC11 at mid-capacitance point. Adjust T104 for maximum audio output as described in step 2.

(11) Set the PRESELECTOR at the lower edge of 80 meter segment, VFO at 3,500 KHz, and adjust TC1 and TC6 for maximum transmitter power output at dummy load.

(12) Set the OPERATION switch at receive mode, and without changing the VFO or PRESELECTOR settings, tune the RF signal generator at 3,500 KHz and obtain 1,000 Hz beat note. Adjust TC11 for maximum audio output as described in step 2.

(13) Repeat step 9, 10, 11 and 12 to peak out the coil adjustments for 80 meter bands.

(14) Set the BAND switch at 40, VFO at 7,000 KHz and the PRESELECTOR at lower edge of 40 meter segment. Adjust TC2 and TC7 for maximum transmitter power output at dummy load.

(15) Set the OPERATION switch to receive mode, and without changing the VFO or PRESELECTOR settings, tune the RF signal generator at 7,000 KHz and obtain 1,000 Hz beat note. Adjust TC12 for maximum audio output.

12. HETERODYNE CRYSTAL OSCILLATOR ALIGNMENT

The heterodyne crystal oscillation injection may be checked in the following manner. Connect the VTVM RF probe to test point. Injection is normal if the injection voltage measures 0.3 Volt RMS on all bands.

If not, the alignment is required. Set the BAND switch at 10D, TC24 at 1/3 capacitance position, and adjust T111 for 0.3 Volt RMS reading on VTVM. Then adjust TC23, TC22, TC21,.....,TC17 and TC16 for each of the bands to read 0.3 Volt RMS on VTVM. Refer to the heterodyne oscillator alignment chart.

13. TRAP COIL ALIGNMENT

T107 is used to eliminate the direct-through interference by IF frequency signal and tuned to 5,920 KHz.

Set the transceiver at 7,100 KHz LSB in receive mode. Set the RF signal generator at 5,920 KHz and increase the signal generator output until audio beat note is heard. Adjust T107 for minimum audio output.

T113 in PB-1082 is used to eliminate spurious radiation on 20 meter band. For alignment, tune the transceiver to maximum output at 14,350 KHz. To measure spurious radiation, use the S-meter of another receiver and tune it to 14,520 KHz where a spurious signal can be heard. Adjust T113 for minimum S-meter reading without decreasing power output of the transceiver. However, exceeding a continuous full output time of more than 20 seconds may result in destruction of the final output tubes.