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Service Manual

SPARTAN SSB+

23 CHANNEL CB TRANSCEIVER
AM-SINGLE SIDE BAND



NOTICE

FCC Rules and Regulations, Part 95, requires that only those persons possessing a valid First or Second Class Radio Telephone Operator's license are permitted to make repairs or adjustments in the transmitter section of any Citizens Band Transceiver.

CERTIFICATION

FANON/COURIER Corporation, Pasadena, California, certifies that this Citizens Band Transceiver meets FCC Rules and Regulations, Part 95, regarding frequency tolerance, stability, power input, modulation, and spurious suppression.

This certification is void if crystals other than those recommended by the manufacturer are installed or if any modification is made to the transmitter circuits, not specified by FANON/COURIER Corporation, or by any personnel not holding the proper FCC license.

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SECTION I

INTRODUCTION

This service manual, together with the owner's instruction manual, provides a complete set of instructions necessary to install, operate and service the Spartan Citizens Band Transceiver.

The service instructions given are intended to be used by service personnel who are familiar with CB (Citizens Band) equipment. Therefore, detailed information on basic electronic circuitry, service procedures and test equipment setups are not included.

Before replacing any parts or making repairs to the Spartan, please read the warranty printed on the back of this manual, under which the unit is warranted.

SERVICE AND FACTORY MAINTENANCE

Should the Spartan require Factory Service, write or call the FANON/COURIER Service department, 990 South Fair Oaks Avenue, Pasadena, California, 91105, and request RETURN AUTHORIZATION. When shipping the unit to the factory, please enclose a full description of the problem with the unit. Pack all articles well enough to withstand rough handling during shipping. Follow the instructions given in the Return Authorization Form which will be sent to you.

FANON/COURIER or equivalent quality parts should always be used when replacing faulty or damaged components, as many of the frequency controlling components have been selected for their temperature, vibration, stability and other characteristics.

GENERAL DESCRIPTION

The Courier Spartan SSB+ is an AM Single Side Band radio receiver and transmitter designed to operate in the 26 to 27 MHz Citizens Band. The set operates from 13.8 VDC for mobile operation.

RECEIVER

The receiver section is a double conversion superhetrodyne type with adjustable squelch, a single side band clarifier, a variable range control and a volume control.

TRANSMITTER

The transmitter section utilizes three crystal controlled oscillators to produce the 23 Citizens Band channel frequencies and their upper and lower side bands, a total of 69 channels. The power output stage is a high gain RF power transistor, conservatively rated to produce the 4 watt output and 12 watt PEP (peak envelope power) output on SSB (single side band) operation.

GENERAL NOMINAL SPECIFICATIONS

Frequency Range-
23 Channels, 26.965 through
27.255 MHz, Crystal Controlled,
AM, Upper and Lower Side bands.

Frequency Control-
Crystal controlled Synthesizer
Technique

Frequency Tolerance-
Channel Frequency ± 500 Hz.

Frequency Stability-
0.005% from -30° to 50° C.

Operating Temperature-
 -20° C to $+50^{\circ}$ C.

Primary Power (Input Voltage)
13.8V DC (EIA Standard).

Antenna-
50 ohm (unbalanced)

Dimensions-
D = $10 \frac{2}{3}$ ", W = 8",
H = $2 \frac{1}{3}$ "

Weight-
5lbs., 7 oz.

RECEIVER SECTION NOMINAL SPECIFICATIONS

Sensitivity-
AM = Less than 0.25uV
for 10db $\frac{S + N}{N}$

SSB = Less than 0.15uV
for 10db $\frac{S + N}{N}$

Selectivity-
AM = ± 3 KHz at 6db
SSB = ± 2.1 KHz at 6db

Spurious Rejection-
More than 60db.

1st IF Frequency-
AM & SSB = 7.8 MHz

2nd IF Frequency-
AM = 455 KHz.

Clarifier Range-
 ± 600 Hz.

Audio Output-
6 Watts.

Squelch Range-
AM & SSB adjustable from
0.15uV to 500uV.

TRANSMITTER SECTION NOMINAL SPECIFICATIONS

Frequency Range-
26.965 to 27.255 MHz

Output Power-
AM = 4 Watts
SSB = 12 Watts PEP.

Modulation Capability-
100%

Output Impedance-
50 ohms Unbalanced.

Frequency Response-
400 Hz to 3 KHz at 3 db.

Spurious Harmonic Suppression-
60db Minimum.

SSB Filter-
Crystal Lattice Type 7.8 KHz
2.1 KHz at 6 db; 5.5 KHz at
60db.

SERVICE INSTRUCTIONS

The Spartan transceiver contains many new circuits not usually found in Citizens Band radio transceivers. Therefore, service personnel should thoroughly familiarize themselves with the theory and operation of SSB radio reception and transmission before attempting to service the Spartan.

Study the Spartan owners manual, the schematic, the functional block diagrams and other illustrations found in this manual before making any repairs or adjustments.

The transceiver has been very carefully adjusted, aligned and tested at the factory with precision test equipment, therefore, do not make any unnecessary adjustments to the internal potentiometers, coils or transformers. Adjustments should be made ONLY when associated parts have been replaced due to failure.

FANON/COURIER (or equivalent) quality parts should always be used when replacing faulty or damaged components, as many of the frequency controlling components have been selected for best temperature, vibration and other characteristics.

When ordering replacement parts, refer to the Replacement Parts List in this manual. Give a brief description of the part and the Courier part number.

PERFORMANCE TESTS

The following tests are designed to verify the performance of the transceiver to the manufacturer's specifications after Service has been performed requiring the replacement of parts, repair of malfunctioning components or adjustment.

The tests are based upon the use of test equipment, whose accuracy has been checked against approved standards (National Bureau of Standards) for frequency and stability.

Service personnel must have a First or Second Class Radio Telephone Operator's License before making any adjustments in the transmitter section of the transceiver.

Details on connecting and disconnecting test equipment are not always mentioned, however, ALWAYS TURN THE POWER OFF before connecting or disconnecting equipment.

Before adjusting RF coils, warm the wax with a small soldering iron. Touch the center of the cores, not the windings.

TEST EQUIPMENT REQUIREMENTS

The following items of test equipment, or EQUIVALENT, are required to properly service the SPARTAN TRANSCEIVER. The signal generators used should be checked against secondary standards which meet the National Bureau of Standards for accuracy and stability.

EQUIPMENT LIST

- * Wattmeter, Bird Model 43.
- * Wattmeter/DB Meter, EICO Model 261.
- * Regulated Power Supply, 0-16V DC, 5 Ampere.
- * Spectrum Analyzer, Hewlett Packard Model 8554/8552A.
- * Millivolt Meter, Ballantine Model 300D.
- * RF Signal Generator, Meguro Model MSG-228S.
- * Frequency Counter, Systron/Donner Model 7015.
- * Oscilloscope, Tektronix Model 453A.
- * (2) Audio Signal Generators, EICO Model 378.
- * AC Voltmeter, Hewlett Packard Model 410B.
- * DC Voltmeter, Simpson Model 260.
- * Decade Attenuator, General Radio Model 1450-TB.
- * Coaxial T Connector, Hewlett Packard Model 11042A.
- * Load, 50 ohms, Non-Inductive.
- * Load, 8 ohms, Non-Inductive.
- * VHF Signal Generator, H. Packard 608E.

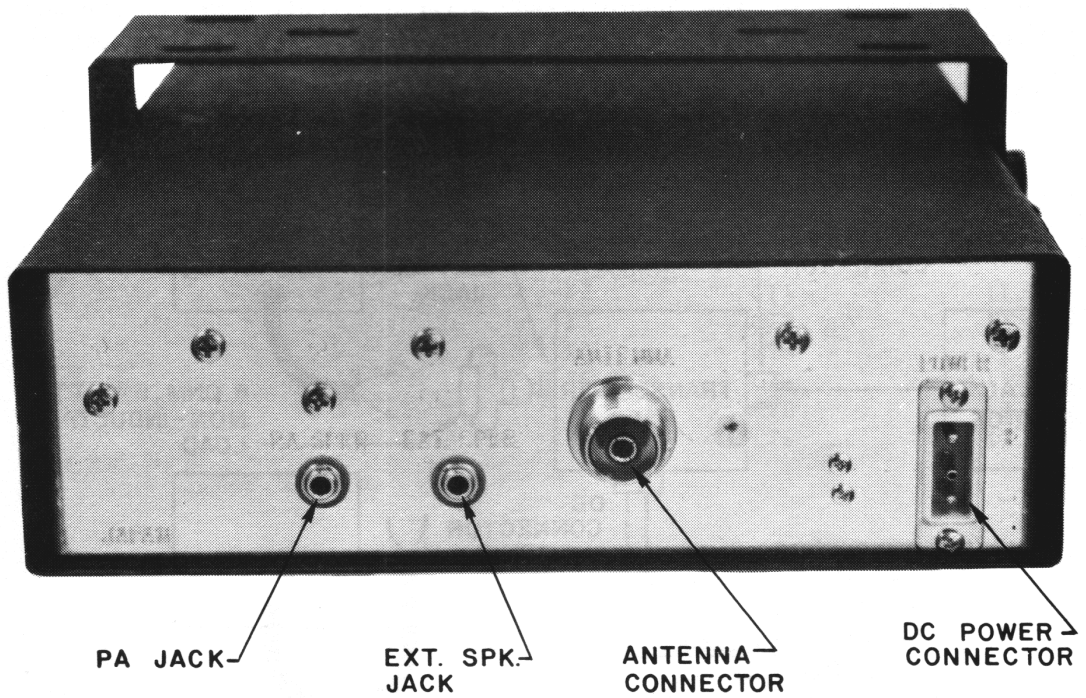
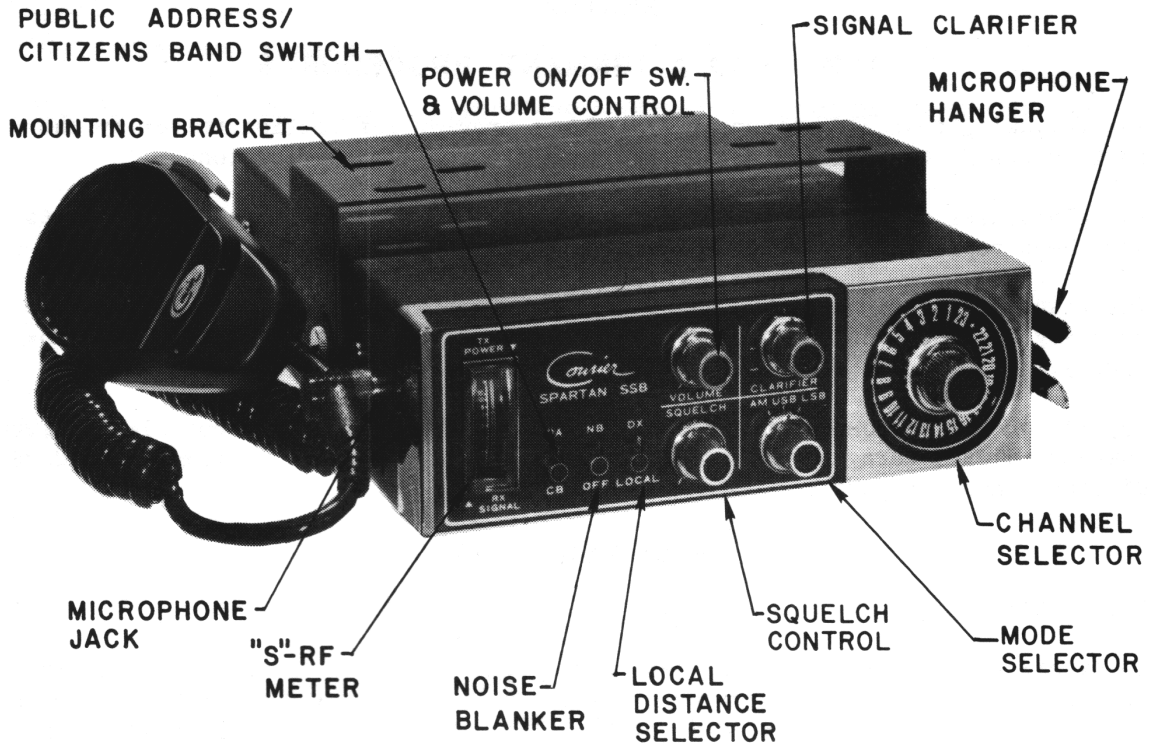


FIGURE 1, CONTROLS, INDICATORS AND CONNECTORS

SECTION II

TEST AND ALIGNMENT PROCEDURES

The following test and alignment procedures provide information to verify the performance of the transceiver to the manufacturer's specifications.

The procedures should be performed, especially, if frequency controlling parts have been repaired, replaced or if adjustments have been made.

The tests are based upon the use of test equipment (see equipment list) whose accuracy has been checked against approved standards (National Bureau of Standards).

Details on how to connect and disconnect the test equipment are not always given, however, always turn the power OFF before replacing crystals or removing and replacing component parts.

RECEIVER TESTS

PRELIMINARY

To expose the circuit board for servicing, remove the two thumb screws holding the mounting bracket. Remove the bracket and the rubber washers then remove the 4 screws holding the speaker-side of the case. Carefully lift and pull to the rear to remove the cover. Loosen the 4 screws holding the speaker bracket and swing the bracket upward.

The "circuit board" side of the case should always be in place before aligning the receiver or transmitter sections of the transceiver.

Always use care when placing the "unprotected" printed circuit board on the workbench. Place a shop towel or other protection on the bench before disassembling the unit.

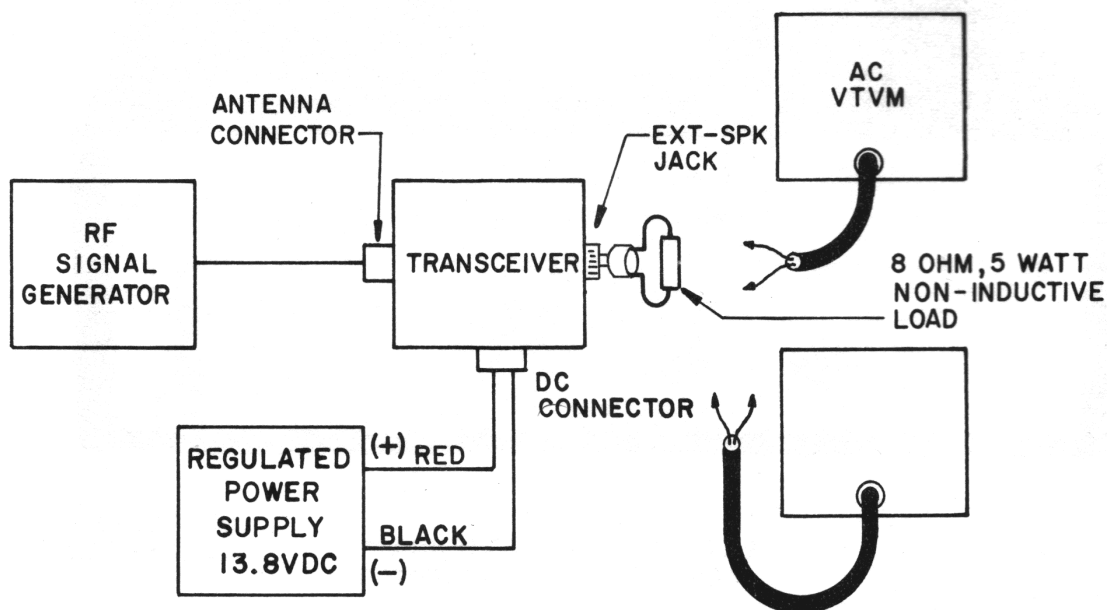


FIGURE 2, TEST SETUP FOR RECEIVER ALIGNMENT

1. Synthesizer Adjustments

CAUTION: TRIMMER CAPACITORS SHOULD NOT REQUIRE ADJUSTMENT
UNLESS A FREQUENCY CONTROLLING COMPONENT HAS BEEN
REPLACED OR REPAIRED.

A. Eleven and Twelve MHz Oscillators

- 1) Set the transceiver front panel controls as follows:

CLARIFIER	to	Center Position
MODE SELECTOR	to	AM Position
PA/CB	to	CB
CHANNEL SELECTOR	to	As required
POWER SWITCH	to	OFF (Set Volume Control to full CCW position)

- 2) Connect the transceiver to the test equipment as shown in the diagram (Figure 3). Adjust the power supply to 13.8V DC \pm 0.2 volts. DO NOT PLUG IN THE MICROPHONE.
- 3) Connect the frequency counter to TP4 and ground (TP2). Volume control 1/2 turn CW.
- 4) Set the CHANNEL SELECTOR switch to the channels shown below and observe the frequency of each channel on the frequency counter. For each observation allow time for the counter to make a regular count. The frequency for each crystal should be within \pm 25 Hz. Adjust the respective trimmer capacitor ONLY IF NECESSARY to correct an OUT-OF-TOLERANCE condition. Replace all defective crystals and check their frequency.

CHANNEL SELECTOR POSITION	CRYSTAL	ADJUST TRIMMER	FREQUENCY IN MHz \pm 25 Hz
1	X2	CT1	11.805000
5	X3	CT2	11.855000
9	X4	CT3	11.905000
13	X5	CT4	11.955000
17	X6	CT5	12.005000
21	X7	CT6	12.055000

1. Synthesizer Adjustments, continued

B. Seven MHz Oscillator (AM/USB)

- 1) Set the MODE selector to the USB position and connect the frequency counter to TP5 and TP2 (ground).
- 2) Set the CHANNEL SELECTOR to the channels shown and observe the frequency of each channel. Frequency should be within ± 5 Hz for each crystal. Adjust the respective trimmer capacitor ONLY IF NECESSARY to correct for an OUT-OF-TOLERANCE condition. Replace all defective crystals with NEW crystals and check their frequency.

CHANNEL SELECTOR POSITION	CRYSTAL	ADJUST TRIMMER	FREQUENCY IN MHz ± 5 Hz
1	X8	CT7	7.361500
2	X9	CT8	7.371500
3	X10	CT9	7.381500
4	X11	CT10	7.401500

C. Seven MHz Oscillator (LSB)

- 1) Set the MODE selector to the LSB position. Connect the frequency counter to TP5 and TP2 (ground).
- 2) Set the CHANNEL SELECTOR to the channels shown and observe the frequency on the counter. Frequency should be within ± 5 Hz of the assigned frequency for each crystal as shown. Adjust the respective trimmer capacitor ONLY IF NECESSARY to correct for an OUT-OF-TOLERANCE condition. Replace all defective crystals with NEW crystals and check their frequency.

CHANNEL SELECTOR POSITION	CRYSTAL	ADJUST TRIMMER	FREQUENCY IN MHz ± 5 Hz
1	X12	CT11	7.358500
2	X13	CT12	7.368500
3	X14	CT13	7.378500
4	X15	CT14	7.398500

D. Mixer and Filter Coil Adjustments

- 1) Connect an RF VTVM to TP3 and TP2 (ground) and set the scale to read 500mV RMS.
- 2) Set the transceiver front panel controls as follows:

CLARIFIER	to	Center position
MODE SELECTOR	to	AM
CHANNEL SELECTOR	to	Ch 15
POWER SWITCH	to	ON
- 3) Adjust T9, T10, T11, T12 and T13 for maximum reading on the VTVM. Reading should be approximately 250 to 290mV RMS.

2. Side Band Oscillators, X16 and X17 Adjustments

A. USB Oscillator X17

- 1) Connect a frequency counter to TP6 and TP2 (ground) and set the transceiver front panel controls as follows:

CLARIFIER	to	Center position
MODE SELECTOR	to	USB
CHANNEL SELECTOR	to	Ch 15
POWER SWITCH	to	ON

- 2) The frequency reading on the counter should be 7.798500 MHz ± 5 , -0 Hz. Adjust CT15 ONLY IF NECESSARY to correct for an OUT-OF-TOLERANCE condition. Replace the crystal if defective and check its frequency.

B. LSB Oscillator X16

Change the MODE SELECTOR to the LSB position and measure the frequency of X16 the same as for the USB X17 crystal. Frequency should be 7.801500 MHz ± 0 , -5 Hz. Replace the crystal, if defective, and check its frequency.

3. AM 2nd Oscillator Frequency Observation (XI)

- A. Connect the frequency counter to TP1 and ground to TP2 and set the MODE SELECTOR to the AM position.
- B. Observe 7.343500 MHz ± 500 Hz on the frequency counter. Replace the crystal with the new unit if defective. Check the frequency of the replaced crystal.

4. AM R.F. and I.F. Alignment

- A. Connect the transceiver to the test equipment as shown on the Test Equipment Setup Diagram. Connect the VTVM across the 8 ohm load resistor and adjust to measure 2 volts. Set the signal generator to 27.115 MHz and modulate 30% with a 1 KHz audio signal. Adjust the RF output to obtain 1 volt on the VTVM.

- B. Set the transceiver front panel controls as follows:

CHANNEL SELECTOR	to	Channel 13
MODE SELECTOR	to	AM
NB (Noise blanker)	to	ON
CLARIFIER	to	Center position
PA/CB Selector	to	CB
SQUELCH CONTROL	to	Minimum (CCW)
DX/LOCAL SELECTOR	to	DX
VOLUME CONTROL	to	Maximum (CW)

- C. Adjust T8, T7, T6, T5, T4, T3, T2 and T1 for MAXIMUM reading on the VTVM. As the coils are peaked reduce the signal generator output to the minimum usable signal. Repeat these adjustments several times to obtain the maximum sensitivity.

5. Sensitivity Adjustments

DX/LOCAL Gain Control Adjustments

- A. Connect the signal generator and the VTVM as in step 4B. Adjust the signal generator output to 0.25uV, 27.115 MHz and 30% modulation at 1 KHz. Set the DX/LOCAL switch to the DX position.
- B. Observe the VTVM and adjust VR1 to obtain 2 volts (500 mW).
- C. Change the DX/LOCAL switch to the LOCAL position. Increase the signal generator output to 50uV (+40db). Adjust VR2 to obtain 2 volts (500 mW) on the VTVM.

6. SSB RF and IF Alignment

A. USB Adjustments

- 1) Connect the test equipment as shown on the Test Equipment Setup Diagram. Set the signal generator frequency to 27.115 MHz (channel 13) and the output voltage to 0.5uV (0db). Throughout these tests 0.5uV = Zero db.

- 2) Set the transceiver front panel controls as follows:

CHANNEL SELECTOR	to	Channel 13
MODE SELECTOR	to	USB
BLANKER	to	ON
PA/CB SELECTOR	to	CB
CLARIFIER	to	Center Position
SQUELCH CONTROL	to	Minimum (CCW)
DX/LOCAL SELECTOR	to	DX
VOLUME CONTROL	to	Maximum (CW)

- 3) Connect an AC VTVM across the 8 ohm load and set the scale to read 2 volts. (Connect an oscilloscope to the same terminals as the VTVM.) Set the controls to observe a 1 KHz, 2 volt audio signal.
- 4) Vary the signal generator frequency with the fine tuning control and locate a frequency (should be approximately 27.116 MHz that produces a 1 KHz audio wave form on the oscilloscope.)

Note: The audio signal observed is the beat signal between the synthesizer and the signal generator signal as follows:

Signal generator frequency = 27.115000 MHz
Synthesizer frequency = 19.306500 MHz

Difference = 7.798500 MHz

USB Carrier Oscillator = 7.798500 MHz

Result = 0.000000 MHz

If the signal generator frequency is changed to 27.116000 MHz, the resultant will be 1 KHz.

- 5) Adjust the signal generator output voltage to the lowest usable level to obtain a .5 to 1.0 volt reading on the VTVM.
- 6) Adjust T15 and T14 for maximum voltage on the VTVM. Repeat these adjustments several times for maximum sensitivity. Reduce the signal generator output as the coils are peaked to maintain the minimum usable signal.
- 7) The signal generator output voltage should be approximately 0.25uV to obtain a 2 volt reading on the VTVM (500 mW).

B. LSB Adjustments

Maintain the same test setup as for the USB adjustments. Change the MODE SELECTOR to the LSB position. Change the signal generator frequency to 27.11400 MHz. The signal generator output voltage should be approximately the same as the reading taken for the USB sensitivity, 0.25uV for 2 volts audio output.

- C. Adjust the volume control to obtain a 2 volt reading on the AC VTVM.
- D. Reduce the signal generator output voltage to obtain 10db drop in the reading on the VTVM. VTVM reading should be approximately 0.63 volts.
- E. The difference in the signal generator reading should be between 70db and 80db.

7. Squelch Adjustments

A. AM Mode

- 1) Set the MODE SELECTOR to the AM position, the SQUELCH CONTROL to the MINIMUM (CCW) position and the DX/LO SELECTOR to DX. NB to ON.
- 2) Connect the signal generator to the antenna connector and adjust the frequency to 27.115 MHz. Modulate 30% with a 1 KHz audio signal. Set the output voltage to 1uV (6db).
- 3) Adjust the transceiver VOLUME CONTROL to obtain 2 volts on the VTVM.
- 4) Readjust the SQUELCH CONTROL to MAXIMUM (CW) position. (DO NOT CHANGE THE VOLUME CONTROL)
- 5) Reset the signal generator output voltage to 500uV (60db).
- 6) Adjust VR4 (AM squelch calibration) to obtain 2 volts on the VTVM.
- 7) Disconnect the signal generator from the antenna connector and remove the miniature phone plug from the EXT SPK jack.
- 8) Turn the VOLUME CONTROL to maximum (CW) and adjust the SQUELCH CONTROL from maximum (CW) position to a point where the "shot noise" stops.
- 9) Reconnect the signal generator to the antenna connector and adjust as in step 2). Increase the generator output to the point where the audio signal is heard in the transceiver speaker. The signal generator output voltage should be approximately 0.15uV (-10db).

B. SSB Mode

- 1) Test setup should be the same as in step A1) through A5) except set the MODE SELECTOR to the USB position.
- 2) Adjust VR5 (SSB squelch calibration) to obtain 2 volts on the VTVM.
- 3) Repeat steps A7) through A9). Signal generator output should be approximately 0.15uV (-10db, or less).

8. "S" - RF Meter Calibration

A. AM Mode

Set the front panel controls as follows:

CHANNEL SELECTOR	to	Channel 13
MODE SELECTOR	to	AM
NOISE BLANKER	to	OFF
PA/CB SELECTOR	to	CB
CLARIFIER	to	Center Position
SQUELCH CONTROL	to	Minimum (CCW)
DX/LO	to	DX
VOLUME CONTROL	to	Maximum (CW)

- 1) Connect the signal generator to the antenna connector as shown on the Test Equipment Diagram and adjust the frequency to 27.115 MHz. Set the level at 100 microvolts.
- 2) Adjust VR3 (AM Meter Calibration Control) to obtain a reading of 9 on the "S" scale.

B. SSB Mode

Maintain the test conditions as in step A. Change the MODE SELECTOR to the USB position. Adjust VR8 (SSB Meter Calibration Control) to obtain a reading of 9 on the "S" scale.

9. Audio Power Output Measurement

- A. Connect the transceiver as shown on the Test Equipment Setup Diagram. Connect the RMS VTVM across the 8 ohm audio load and adjust the meter to measure 10 volts.
- B. Adjust the signal generator frequency to 27.115 MHz and modulate 30% with a 1 KHz audio signal. Set the RF output to 1000uV (66db).
- C. Adjust the transceiver VOLUME CONTROL full CW and the SQUELCH CONTROL full CCW. Rotate the CHANNEL SELECTOR to channel 13.
- D. The reading observed on the RMS VTVM should be approximately 5 volts (3.1 watts).

10. Bandwidth Measurement

A. AM Mode

- 1) Connect an RF signal generator to the antenna connector as shown in the Test Equipment Setup Diagram and adjust the frequency to 27.115 MHz. Set the transceiver front panel controls as in step 7. Connect an audio wattmeter (EICO 261 or equivalent) to the EXT SPK jack and set the meter load to 8 ohms. Set the scale to measure 500 mW.
- 2) Adjust the signal generator output to obtain 500 mW on the wattmeter, then adjust the frequency slightly, and obtain the peak power output point. Readjust the RF output to the 500 mW reading (do not change the frequency). RECORD THE SIGNAL GENERATOR FREQUENCY.
- 3) Turn the transceiver VOLUME control full CCW (OFF) and change the wattmeter scale to read 150 mW. Turn the VOLUME control CW to obtain 100 mW (0db) on the wattmeter.
- 4) Increase the signal generator output 6db and INCREASE the frequency until the wattmeter reads 100 mW (odb).
- 5) The frequency difference in step B and step D should be between 2.5 and 3 KHz. This is the POSITIVE bandwidth.
- 6) Return the signal generator frequency to the frequency recorded in step B, then REDUCE the frequency until 100 mW is again obtained on the wattmeter. The difference in this frequency and that obtained in step B is the NEGATIVE bandwidth and should be between 2.5 and 3 KHz.
- 7) The sum of the frequencies calculated in steps E and F should be $5 \text{ KHz} \pm 1 \text{ KHz}$.

B. SSB Mode

- 1) Change the MODE SELECTOR to the USB position. Adjust the signal generator frequency to 27.116 MHz. Set the wattmeter scale to read 500 mW. Adjust the RF signal generator output to obtain the peak power output and readjust the generator output to 500 mW.
- 2) Turn the transceiver VOLUME control full CCW and change the wattmeter scale to read 150 mW. Readjust the VOLUME control to obtain 100 mW (0db) on the wattmeter.
- 3) Increase the signal generator output 6db and increase the frequency until the wattmeter reads 100 mW.
- 4) The difference in the frequency obtained in step B1) and B2) is the POSITIVE bandwidth and should be between 1.8 and 2.5 KHz.
- 5) Reset the signal generator frequency to 27.116 MHz and adjust the output to obtain 100 mW on the wattmeter.
- 6) Increase the signal generator output 6db and DECREASE the frequency to obtain 100 mW on the wattmeter.

- 7) The difference in the frequency obtained in step B6 and B7 is the negative bandwidth and should be between 1.8 and 2.5 KHz.
- 8) The sum of the frequencies calculated in steps B4) and B8) should be ± 2.1 KHz.

TRANSMITTER TESTS

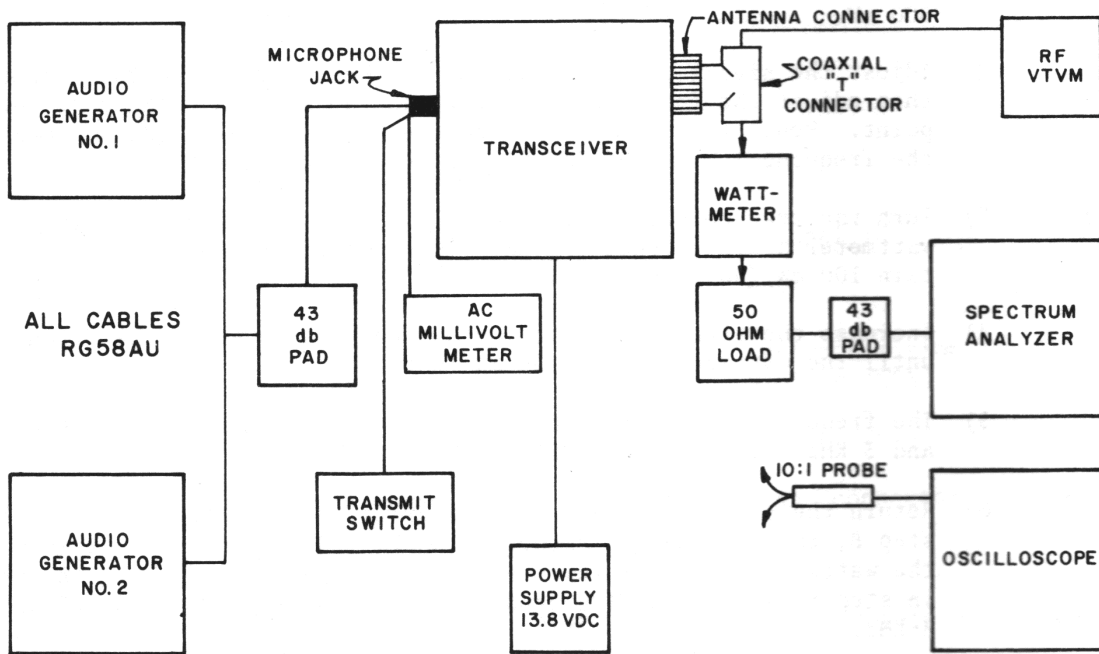


FIGURE 3, TEST SETUP FOR TRANSMITTER ALIGNMENT

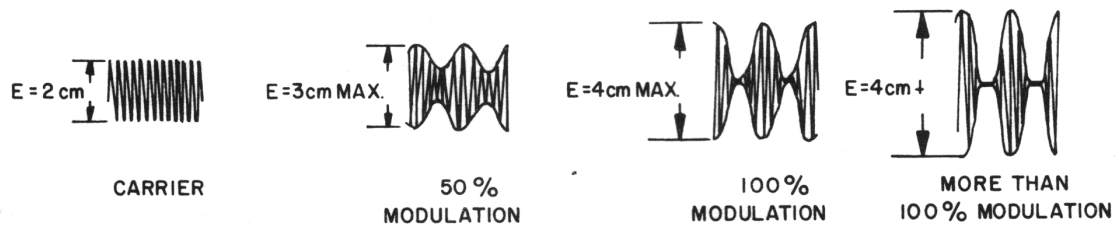
1. RF Coils and Transformer Adjustments
 - A. Remove the top cover (Speaker side) of the transceiver and connect to the test equipment as shown in the Test Equipment Setup Diagram.
 - B. Adjust the transceiver front panel controls as follows:

CHANNEL SELECTOR	to	Channel 13
MODE SELECTOR	to	AM
NOISE BLANKER	to	OFF
PA/CB SELECTOR	to	CB
CLARIFIER	to	Center Position
SQUELCH CONTROL	to	Minimum (CCW)
DX/LO	to	DX
VOLUME CONTROL	to	Minimum (CCW)

- C. Set both audio generator outputs to Zero (assure that the carrier is not being modulated). Turn the Test Transmit Switch to ON.
- D. Adjust T21, T20, T19, T18 and L9 for MAXIMUM reading on the wattmeter. Repeat the adjustments several times to obtain the maximum power output. The UNMODULATED power output should be between 3 and 4 watts. If more than 4 watts is indicated, adjust VR14 to obtain approximately 3.5 watts.

2. AM Modulated Power Output Measurement

- A. Maintain the same test equipment setup and front panel settings as in step 1B. Adjust VR11 (see Figure 8) to approximately 3/4 rotation CW. Turn the VOLUME CONTROL approximately 1/4 CW (POWER SWITCH ON).
- B. Adjust the oscilloscope to observe a 2 cm carrier wave pattern as shown on the diagram below.
- C. Set the No. 1 audio signal generator frequency to 1 KHz and adjust the output to obtain a 50% modulated wave pattern as shown in the diagram below.
- D. Without changing the above settings, change the audio frequency to 2.5 KHz and DECREASE the 43db attenuator 16db (this increases to audio output 16db).
- E. Observe that the modulated wave pattern is approximately 95% modulated. If more than 100% modulation is indicated, replace R138 with a value that will limit the modulation to 95% as shown in the diagram below.



MODULATION PERCENTAGE WAVE PATTERNS

- F. The maximum MODULATED RF POWER OUTPUT should be 4 watts. If more than 4 watts is obtained, adjust VR14 while observing the above wave forms and set to obtain a maximum of 4 watts.
- G. After obtaining 95% modulation and the maximum RF power output, observe that the audio input at the microphone input is approximately 5 mV. If this is not the case, set the audio input to 5 mV at the microphone input and adjust VR11 to obtain the same modulation and power output readings as obtained in step 2F.

3. SSB Mode Adjustments

A. Preliminary Carrier Suppression Adjustment

- 1) Maintain the same test equipment setup as for AM mode testing. Adjust the output of both audio generators to zero. Set the transceiver MODE SELECTOR to the USB position. Connect the oscilloscope probe to the antenna "T" connector (in place of the RF VTVM).

- 2) Key the transmitter and observe the carrier wave pattern as shown in the diagram. Adjust VR10 and CT17 alternately to obtain the MINIMUM carrier amplitude. This adjustment should be rechecked after the maximum power tests have been made.

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CORRECT ADJUSTMENT



INCORRECT ADJUSTMENT

B. Peak Envelope Power (PEP)

- 1) Connect the test equipment as shown on the Test Setup Diagram. Connect the oscilloscope to the same point as the spectrum analyzer and adjust to observe an RF wave pattern as shown in the diagram.
- 2) Set the transceiver MODE SELECTOR to the USB position. Adjust the audio generator outputs to obtain symmetrical oscilloscope patterns, just under limiting, as shown in the SSB waveform patterns, page 21. The two frequencies, F1 and F2 displayed on the spectrum analyzer should be of equal amplitude, as shown in the diagram.
- 3) Adjust the audio generator outputs to obtain approximately 34.7 volts peak (69.4 volts peak-to-peak on the oscilloscope). (Maintain equal amplitudes of the audio generators)
- 4) Decrease the 43db pad 10db and adjust VR9 (ALC) to obtain the maximum rated PEP output as calculated from the following formula:

$$PEP = \frac{(V_{peak})^2}{2R} = \frac{(\text{Oscilloscope reading})^2}{2 \times \text{Antenna Output Impedance}} = \frac{(34.7)^2}{100} = 12.04 \text{ watts}$$

- 5) To maintain the maximum amplitude of the symmetrical wave pattern as described in step 2), it may be necessary to adjust L9. Observe the reading on the RF VTVM which should be approximately 24.5 volts RMS. If this voltage is not obtained, readjustment of T18, T19, T20, T21 and L9 may be necessary. If this adjustment is required, recheck the AM power output in step 2).

C. Final Carrier Suppression Adjustment

- 1) After obtaining the maximum PEP, adjust the spectrum analyzer to indicate zero db for maximum PEP amplitude. See diagram on page 20.
- 2) Readjust VR10 and CT17, if necessary, to reduce the carrier to at least 40db below the PEP amplitude (0db).