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Service Manual

Chief 23

CITIZENS BAND TRANSCEIVER

and

VHF / FM MONITOR

Courier

Price $2

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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CHIEF 23 FIGURES

INTRODUCTION

This service manual together with the owner's instruction manual provides a complete set of instructions necessary to install, operate and service the Chief 23 CB transceiver and the VHF/FM monitor. The service instructions given are intended to be used by service personnel familiar with CB (Citizens Band) equipment. Therefore, detailed information on basic electronic circuitry and service procedures as well as test equipment setups are not included.

Please read the warranty printed on the back of this manual, under which the unit is warranteed, before making any repairs or replacing parts.

SERVICE and FACTORY MAINTENANCE

Should the Chief 23 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 and pack all articles well enough to withstand rough handling during shipping. Follow the instructions in the RETURN AUTHORIZATION FORM which will be sent to you.

GENERAL DESCRIPTION

The COURIER Chief 23 is a completely solid-state VHF/FM radio receiver and a CB transceiver. The unit is designed to receive VHF/FM signals from 150 to 175 MHz, and to transmit and receive AM modulated communications in the 26 to 27 MHz (11 meter) Class D Citizens Band.

The CB receiver section is a double conversion superhetrodyne, using a broadband first IF and low noise, high gain RF amplifiers. A mechanical filter is used in the second IF.

The VHF/FM monitor section incorporates a three channel crystal selector, as well as a continuous VHF manual tuning control covering the 150 through 175 MHz frequency range.

The transmitter section, as well as the receiver section, utilizes a 23 channel, crystal controlled frequency synthesizer to produce the crystal controlled transmitted frequencies. Two tuned buffer stages provide maximum isolation between the frequency determining circuits and the final power amplifier. Full 5 watts of modulated RF power is developed at the final RF output amplifier. A two section PI-Network transfers the RF power to the antenna.

SPECIFICATIONS

GENERAL

Transistors: 28

Integrated Circuits: 2

Diodes: 9

Speaker: 3 x 5 inches, 8 ohms

Microphone: Dynamic, Noise Cancelling type, with Press-To-Talk Switch

23 Channel Selector with PA position

Squelch Control with ANL ON/OFF switch

Volume Control with Power ON/OFF switch

CB/VHF switch

VHF Manual Tuning Control

VHF Channel Selector

External and PA speaker jacks

VHF Antenna Connector

RECEIVER - CB

Frequency Range:
26.965 to 27.255 MHz

Sensitivity:
0.5 microvolts for 10 db S/N Ratio
with Noise Limiter ON

Selectivity:
6 db down at 6 KHz

Adjacent Channel Rejection:
10 KHz = 45 db; 20 KHz = 80 db

Squelch Control Range:
At Threshold = .1uV
At Deepest Point = 30uV

Noise Limiter Type:
Series Gate

Audio Output:
3 watts minimum

Audio Distortion:
Less than 10% at 3W

Hum and Noise:
-50 db down

Intermediate Frequencies:
1st IF = 10.625 MHz
2nd IF = 455 KHz

TRANSMITTER - CB

Frequency Range:
26.965 to 27.255 MHz

Power Input to Final Amplifier:
5 watts with 13.8 VDC input

Power Output:
3 watts with 13.8 VDC input

Modulation:
100% with 5 mV at microphone

Emission:
Class D Operation 8A3

Frequency Tolerance:
Better than ±0.005%

Spurious Suppression:
-55 db

Antenna Impedance:
50 ohms (Nominal)

Receive/Transmit Switching:
Enclosed Relay

Harmonic Suppression:
Exceeds 50 db

RECEIVER SECTION - VHF

*	Frequency Range (MHz)	150 to 175
*	Sensitivity for 20 db Quieting	2 uV
*	Image rejection and spurious response	30 db
*	Squelch Sensitivity	1 uV
*	Squelch Stop Sensitivity	2 - 10 uV

SERVICE INSTRUCTIONS

Study the owner's manual and service manual thoroughly before making any adjustments or repairs to the Chief 23.

The transceiver has been very carefully adjusted, aligned and tested at the factory with precision test equipment, therefore, 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.

TEST EQUIPMENT REQUIREMENTS

The following items of test equipment, (or equivalent) are required to properly service the Chief 23. The signal generators used should be checked against secondary standards which meet the National Bureau of Standards for accuracy and stability.

EQUIPMENT LIST

* Wattmeter with 50 ohm load, Bird Model 43
* RMS Volt/Wattmeter, EICO Model 261
* Regulated Power Supply, 0-16VDC, 5 Ampere
* Spectrum Analyzer, Hewlett Packard Model 141T/8554/8552A
* Millivolt Meter, Ballantine Model 300D
* RF Signal Generator, Meguro Model MS6-228S
* Frequency Counter, Systron/Donner Model 7015
* Oscilloscope, Tektronix Model 453A, or Modulation Monitor, Heath Model SB610
* VTVM, Hewlett Packard Model 410B
* Decade Attenuator Load, 600 ohms, 50 db, General Radio Model 1450-TB
* Load, 8 ohms, Non-Inductive
* VHF/FM Signal Generator, Singer FM10C

TROUBLESHOOTING CHART

CB Transceiver

TROUBLE	PROBABLE CAUSE
1. Unit dead: Channel and dial lights do not glow.	a. Power source connections defective. b. Fuse blown. c. Power switch defective. d. L207 or L208 open.
2. Fuse blows after replacement:	a. Power source voltage too high, over 15 volts. b. Power source polarity reversed. c. C259,Q209 shorted. d. L301 shorted to chassis.
3. No audio output on CB or VHF: Dial lights glow. Transmitter operates normally.	a. Speaker defective, voice coil shorted or open. b. Open contact in EXT SPK jack. c. Volume control defective. d. Squelch control set in wrong position. e. Squelch circuit defective (Q203 or Q204). f. Mic not connected or J302 defective.
4. No audio output on CB or VHF: Transmitter keys but no modulation.	a. T203, T202 open or shorted. b. Q205,Q206,Q207 or Q208 defective. c. Relay defective.
5. No audio output on VHF: All CB functions operate normally.	a. Q8 or IC1 defective. b. VHF/CB switch defective. c. VHF channel selector switch defective.
6. Poor reception and weak transmit output:	a. Antenna system defective. b. Relay contacts dirty. c. Power source voltage too low, less than 10 volts.
7. Low background noise on all channels: Transmitter operates normally.	a. Q102 defective. b. T102 or T103 defective. c. C104 shorted.
8. Poor sensitivity:	a. Q101 defective. b. Receiver poorly aligned. c. Diodes D5 or D6 defective.

	TROUBLE	PROBABLE CAUSE
9.	Very low background noise and low transmitter power on all channels: Transmitter keys normally.	a. Q104, Q105 or Q106 defective. b. Channel selector switch defective, contacts dirty. c. Low power source voltage, less than 10 volts.
10.	Squelch function inoperative:	a. Q203 or Q204 shorted. b. C217 or C215 shorted. c. Squelch control defective. d. Diode D203 shorted.
11.	Squelch function inoperative.	a. Q203 or C106 open. b. Diode D203 open. c. Squelch control defective.
12.	Transmitter inoperative: Receiver operates normally.	a. Microphone "Push-To-Talk" switch defective. b. Microphone cord or plug defective. c. Transmit/Receive relay defective. d. Channel selector switch, section "C" contacts defective. e. Q106, Q107, Q207, Q208, Q209, Q210, Q211 defective.
13.	Transmitter does not turn OFF: Receiver inoperative.	a. Microphone "Push-To-Talk" switch defective (closed). b. Microphone cord shield shorted to switching wire. c. Transmit/Receive relay defective.
14.	RF feedback from transmitter to audio producing an audio squeal:	a. Transmit/Receive relay contacts S5-2 defective. b. PA speaker jack shorted to the chassis. c. Broken solder connections at PC board ground lugs.
15.	Low (maximum) modulation percentage: Receiver audio normal.	a. C261 defective. b. Transmitter poorly aligned.
16.	Distorted modulation:	a. Q207 or Q208 defective or weak. b. Defective microphone. c. Transmitter poorly aligned.
17.	Downward modulation:	a. Q210 defective. b. Transmitter poorly aligned. c. Q211 defective.

VHF / FM MONITOR

TROUBLE	PROBABLE CAUSE
1. Poor sensitivity:	a. Q1 or Q2 weak or defective. b. Antenna system defective (poor connections or wrong elements). c. Diodes D3 or D4 defective. d. Poor RF alignment.
2. Receiver inoperative: Background noise present.	a. Q5, Q6 or Q7 defective. b. Channel switch defective. c. VHF/CB switch defective.
3. Squelch function inoperative: CB squelch function operates normally.	a. IC2 defective. b. Diode D1 shorted.
4. Weak audio output:	a. Q8 defective. b. IC1 defective. c. Less than 9 volts being supplied to the VHF circuit board, Zener diode DZ1 defective.
5. Receiver operates on Manual Tuning but not on crystal control:	a. SW1 defective. b. Q5, Q6 or A7 defective. c. L3 & L4 not aligned for the crystals installed.

After repair or replacement of any critical frequency controlling part or circuit, the transmitter and receiver sections should be tested for compliance to the Federal Communications Commission (FCC) frequency and power requirements and the manufacturers specifications.

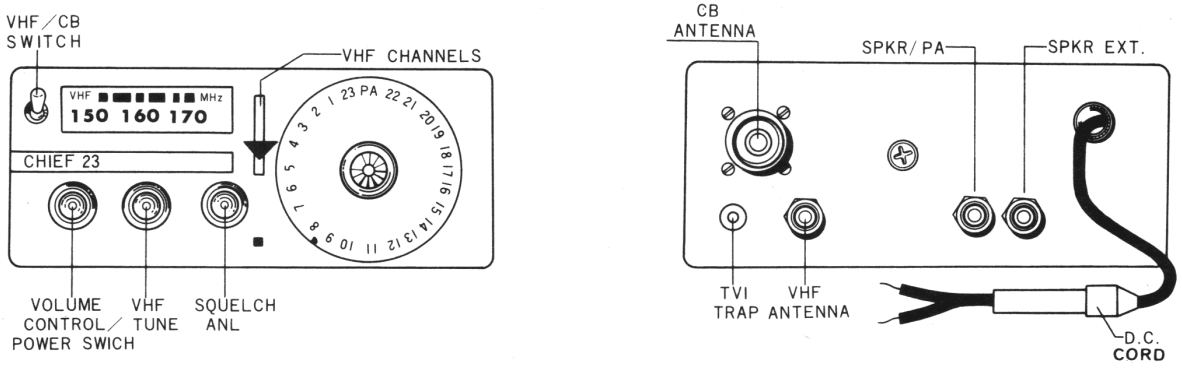

FIGURE 1, FRONT AND BACK PANEL CONTROLS

CRYSTAL SYNTHESIS

Fourteen crystals are used in various combinations to produce the 23 crystal controlled carriers for transmitting and the required IF frequencies for receiving the 23 Citizens Band Channels. The crystals are mounted in individual sockets for ease in removal and replacement (See Figure 6). The table below shows the various combinations required to produce each carrier frequency and the IF frequencies when the transceiver is in the receiving mode. Note that oscillator Q104 functions both in the transmit and receiving modes. Oscillator Q105 functions only in the receiving mode and oscillator Q106 functions only in the transmit mode.

	RECEIVING MODE			TRANSMITTING MODE				
Channel Number	Crystal "A" Frequency (1) [Osc Q104]	Channel Frequency (=)	1st IF Frequency (-) [Mixer Q102]	Crystal "B" Frequency (=) [Osc Q105]	2nd IF Frequency	Crystal "A" Frequency (-) [Osc Q104]	Crystal "C" Frequency (=) [Osc Q106]	Channel Frequency
1	37.600MHz	26.965MHz	10.635MHz	10.180MHz	455KHz	37.600MHz	10.635MHz	26.965MHz
2	"	26.975 "	10.625 "	10.170 "	"	"	10.625 "	26.975 "
3	"	26.985 "	10.615 "	10.160 "	"	"	10.615 "	26.985 "
4	"	27.005 "	10.595 "	10.140 "	"	"	10.595 "	27.005 "
5	37.650	27.015 "	10.635 "	10.180 "	"	37.650MHz	10.635 "	27.015 "
6	"	27.025 "	10.625 "	10.170 "	"	"	10.625 "	27.025 "
7	"	27.035 "	10.615 "	10.160 "	"	"	10.615 "	27.035 "
8	"	27.055 "	10.595 "	10.140 "	"	"	10.595 "	27.055 "
9	37.700	27.065 "	10.635 "	10.180 "	"	37.700MHz	10.635 "	27.065 "
10	"	27.075 "	10.625 "	10.170 "	"	"	10.625 "	27.075 "
11	"	27.085 "	10.615 "	10.160 "	"	"	10.615 "	27.085 "
12	"	27.105 "	10.595 "	10.140 "	"	"	10.595 "	27.105 "
13	37.750MHz	27.115 "	10.635 "	10.180 "	"	37.750MHz	10.635 "	27.115 "
14	"	27.125 "	10.625 "	10.170 "	"	"	10.625 "	27.125 "
15	"	27.135 "	10.615 "	10.160 "	"	"	10.615 "	27.135 "
16	"	27.155 "	10.595 "	10.140 "	"	"	10.595 "	27.155 "
17	37.800MHz	27.165 "	10.635 "	10.180 "	"	37.800MHz	10.635 "	27.165 "
18	"	27.175 "	10.625 "	10.170 "	"	"	10.625 "	27.175 "
19	"	27.185 "	10.615 "	10.160 "	"	"	10.615 "	27.185 "
20	"	27.205 "	10.595 "	10.140 "	"	"	10.595 "	27.205 "
21	37.850MHz	27.215 "	10.635 "	10.180 "	"	37.850MHz	10.635 "	27.215 "
22	"	27.225 "	10.625 "	10.170 "	"	"	10.625 "	27.225 "
23	"	27.255 "	10.595 "	10.140 "	"	"	10.595 "	27.255 "

SECTION I
TRANSCEIVER

1. RECEIVER VERIFICATION AND ALIGNMENT

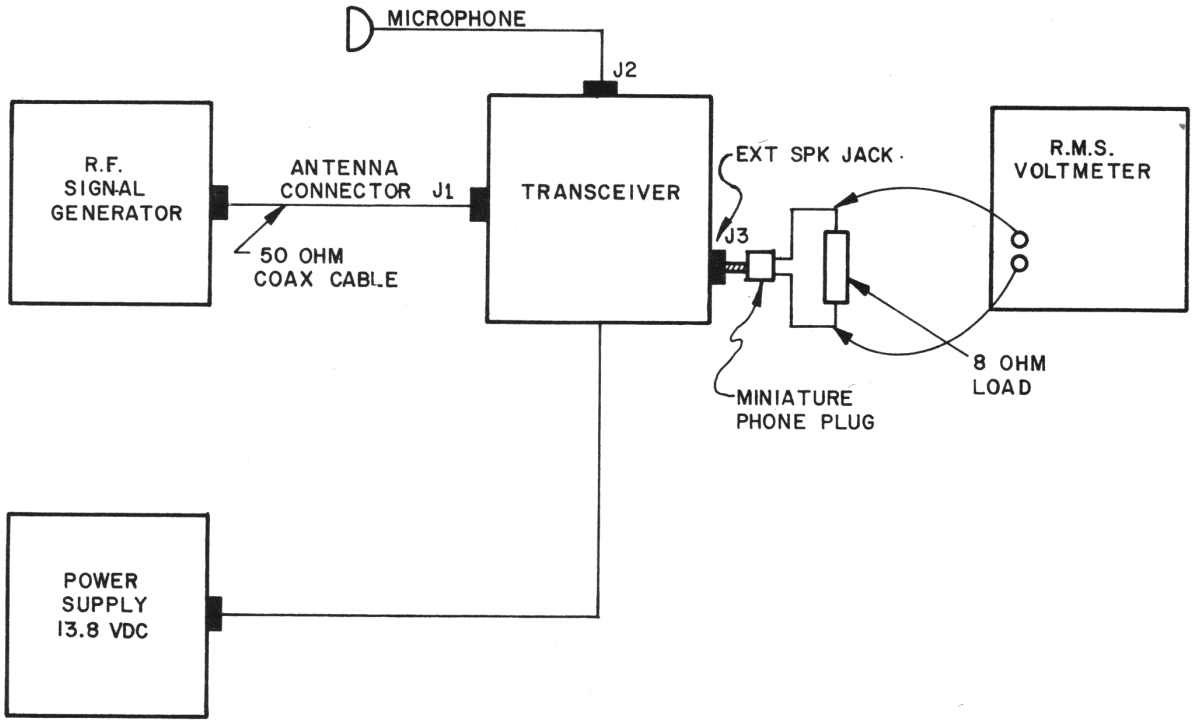

FIGURE 2, TEST SETUP FOR RECEIVER ALIGNMENT

A. Preliminary

1) Remove the speaker side of the case, using care not to break the speaker wires which are soldered to the unit. After removing the 4 screws from the sides, slide the cover toward the rear to relieve the front edge from the front panel, and lift out.

2) Connect the red (+) and black (-) power leads to a DC power source adjusted to 13.8 volts DC ±10%. Insert the microphone plug into the microphone jack located on the left side of the unit and tighten the holding nut firmly.
NOTE: The transceiver will not operate without the microphone being connected.

3) Set the transceiver front panel controls as follows:

POWER SWITCH	to	OFF
VOLUME CONTROL	to	FULL CW POSITION
SQUELCH CONTROL	to	FULL CW POSITION
CHANNEL SELECTOR	to	CHANNEL 13
CB/VHF SELECTOR	to	CB POSITION

4) Connect the transceiver to the test equipment as shown in Figure 2 and set the frequency to 27.115 MHz. Modulate 30% with a 1 KHz audio signal. Adjust the output attenuator to 0 db (0.5 microvolts).

A. Preliminary (continued)

5) Connect an 8 ohm non-inductive load (two 15 ohm 2 watt carbon resistors in parallel) across a miniature phone plug (Herman H. Smith part No. 480 or equivalent) and plug it into the EXT SPK jack; then connect a RMS Volt/Wattmeter set to the 3 volts scale across the 8 ohm load.

6) Turn the transceiver POWER switch to ON (pull out on the Volume Control knob). Observe that the channel indicator pilot glows and that approximately 2.0 volts (500 milliwatts) is indicated on the wattmeter.

B. RF Coil Adjustments

1) If less than 2.0 volts is indicated on the meter, adjust the following coils and RF transformers in the order given for maximum voltage on the meter. As the coils are peaked the voltage output will increase, therefore, reduce the RF signal generator output to maintain 2.0 volts on the meter. Adjust T201, T106, FL101, T105, T104, T103, T102, T101 and T205.

2) Repeat the adjustment of the coils several times to obtain peak sensitivity.

C. Sensitivity Measurement

1) After final adjustments have been made the RF signal generator attenuator should read less than 0 db (0.5 microvolts) to obtain a 2.0 volt (500 milliwatt) reading on the RMS Voltmeter. (Power Output = $\frac{E^2}{R}$) Reseal the wax on the coils.

D. Squelch Sensitivity Measurement

1) Remove the miniature plug from the EXT SPK jack and observe a 1 KHz audio tone from the transceiver speaker. Disconnect the RF signal generator from the Antenna Connector and turn the Squelch Control CCW just to the point where the noise stops. The Squelch Control should be approximately at the center of its rotation.

2) Reconnect the RF signal generator (do not change the setting of any of the transceiver controls) and increase the RF signal generator output until the tone is heard in the transceiver speaker. The signal generator attenuator should read -8 db (0.2 microvolts) or less.

3) Turn the Squelch Control full CCW position. Increase the RF signal generator output to the point where the audio tone is heard again. The generator output should be 30 to 30,000 microvolts.

2. TRANSMITTER ALIGNMENT

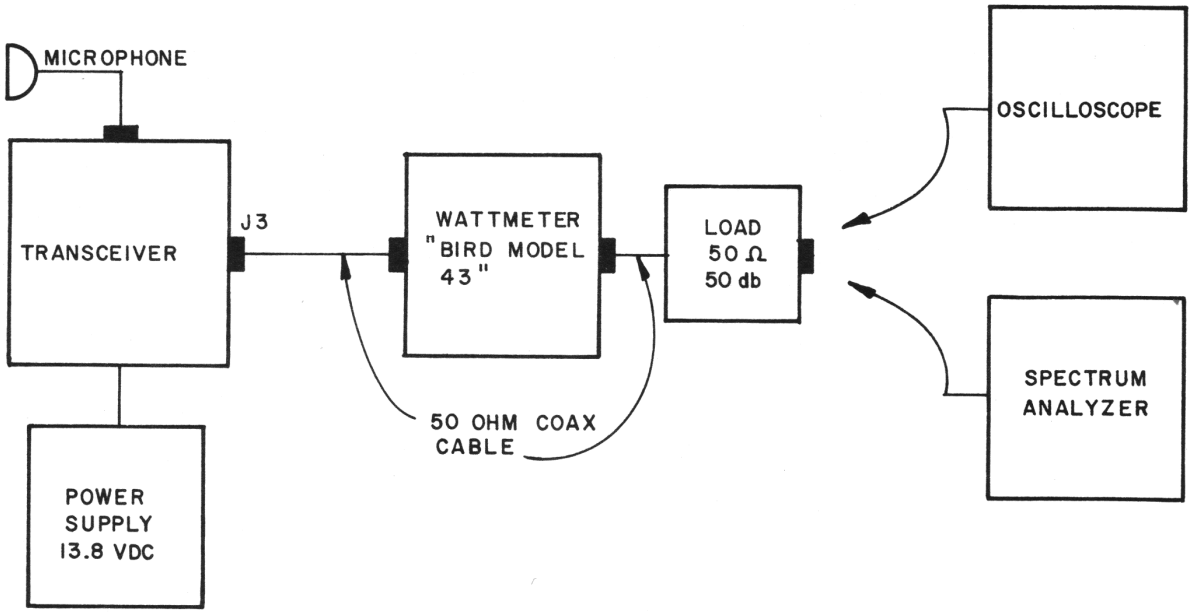

FIGURE 3, TEST SETUP FOR TRANSMITTER ALIGNMENT

WARNING

PERSONNEL POSSESSING A 1ST OR 2ND CLASS RADIO TELEPHONE OPERATOR'S LICENSE ONLY MAY MAKE ADJUSTMENTS IN THE TRANSMITTER SECTION OF THIS TRANSCEIVER.

A. Preliminary (Connect the transceiver to the test equipment as shown in Figure 3).

1) Connect the red (+) and black (-) power leads to a regulated DC power source adjusted to 13.8 volts. Insert the microphone plug into the microphone jack, located on the left side of the chassis, tighten the holding nut firmly.

2) Set the transceiver front panel controls as follows:

POWER SWITCH	to	OFF
VOLUME CONTROL	to	1/4 to 1/2 ROTATION
SQUELCH CONTROL	to	FULL CW POSITION
CHANNEL SELECTOR	to	CHANNEL 13
CB/VHF SELECTOR	to	CB POSITION

B. Oscillator Adjustment

1) Turn the transceiver POWER switch to ON and observe that the Channel Selector dial light glows and that there is atmospheric noise coming from the speaker.

2) Press the microphone transmit switch and observe that the transmit light on the front panel glows. Hold the transmit switch ON long enough to obtain a regular frequency count on the frequency counter. Do not talk into the microphone. The frequency counter should indicate 27.115 MHz ±.005% (1355.75 Hz). Rotate the Channel Selector through the other 22 channels and observe the frequency of each channel.

B. Oscillator Adjustment (continued)

3) If all channels are out of tolerance or are very close to the high or low frequency side, L107 or T108 may require adjusting. However, if only one or two channels are out of tolerance, the crystals should be replaced first.

4) Oscillator Coil L107 Adjustment

a. L107 has a critical effect on the operation of the high frequency oscillator, therefore, follow very carefully the following procedure:
b. Set the Channel Selector switch to channel 13.
c. While holding the transmit switch ON, observe the RF wattmeter and the frequency counter. Slowly adjust L107 to bring the frequency as near to the center frequency (27.115 MHz) as possible. ALLOW TIME FOR THE FREQUENCY COUNTER TO MAKE A REGULAR COUNT. Set the frequency within 5 Hz of 27.115 MHz.
d. Observe the RF wattmeter for a small change in power output. If there is a large change, or if the oscillator stops oscillating (drops out), turn L107 core in the opposite direction to a point where the oscillator is stable again. Rotate the Channel Selector through the other channel positions and observe the frequency and stability of each channel. Repeat this procedure until each channel is within tolerance. If it is not possible to bring some channels within frequency tolerance, replace the crystals.

3. OSCILLATOR COIL T108 ADJUSTMENT

A. After making the 37 MHz oscillator adjustment and the channel frequency is still out of tolerance or very close to the upper or lower frequency limit, adjust T108 as follows:

1) Hold the transmit switch ON, and observe the frequency counter and the wattmeter for the desired frequency change and for a small change in the RF wattage output. If there is a large change in the power output, or if the oscillator "drops-out", turn the core in the opposite direction to maintain stable oscillation. Rotate the Channel Selector through the other 22 channels and observe the frequency and stability of each. All channel frequencies should be within ±.005% of the assigned channel frequency.

4. RF AMPLIFIER ALIGNMENT

A. Turn the transceiver POWER to ON. Press the transmit switch and observe the RF power output on the RF wattmeter. If less than 3 to 3.5 watts is indicated on the wattmeter, without modulation, adjust the following coils and transformers for maximum wattage output (maximum 5 watts): L202, T205, T204, T111, T110 and T109.

NOTE: Some early models have different coil and transistor symbols and L203 and L204 are adjustable (Refer to Issue A, B, C and D schematics in this manual.

B. After making final adjustments, check each channel for at least 3 to 3.5 watts output.