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**MODEL 2716
CITIZENS TWO-WAY RADIO**

Remote Mobile

**Manufactured and Distributed by
Hy-Gain de Puerto Rico, Inc.
P.O. Box 68 State Hwy. 31, Km. 4.0
Naguabo, Puerto Rico 00718**



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CHAPTER 1 — GENERAL INFORMATION

Introduction

This service manual contains all the information needed to service and repair the Hy-Gain 16 transceiver (Model 2716). It includes an explanation of the theory of operation and alignment procedures. Revision, addendum and errata sheets will be published as needed. Insert them as required in the manual.

The Hy-Gain 16 is a full 40 channel transceiver designed and type accepted for Class D Citizens Radio Service, as designated by the Federal Communications Commission (FCC).

It is a compact mobile unit which operates by remote control. All the operator controls are built into one unit, the microphone, allowing the transceiver to be mounted out of sight in the vehicle.

The transceiver is completely solid-state, and highly reliable with low power consumption. Its PLL (Phase Locked Loop) frequency synthesizer provides immediate operation on all 40 channels. A built-in automatic noise limiter (ANL) is included to help reduce atmospheric noise. Use the unit with 12 VDC (nominal), either negative or positive ground.

Microphone Operation

PTT Bar

The push-to-talk bar must be depressed to transmit and released to receive.

Receive Light

When the green light is illuminated, the unit is functioning in the receive mode. The light goes out when transmitting.

Transmit Light

When the red light is illuminated, the unit is in the transmit mode. The light is activated when the PTT bar is depressed.

Clock Readout

This light emitting diode (LED) display reads out hours and minutes. When the unit is initially installed or when the microphone is disconnected, the correct time must be set.

To set the clock:

1. Depress the function key, number 1, and then depress key 5 (hrs) until the correct hour is displayed.
2. Depress key 1 again and then key 6 (minutes) to set correct minutes.

If the unit is turned off (switch on the rear of the control unit) but not disconnected, the clock will continue to keep the correct time. The unit will automatically return to the last channel used, when the radio is turned on after being off.

WARNING: If you are going to leave your car for several days, you should disconnect the microphone to prevent draining the car's battery. If you are going to leave for a longer period of time, the fuses should be removed in the power supply cord or the power supply plug should be removed on the back of the radio.

Channel Readout

This LED display reads channels; received signal strength when key 2 is depressed while receiving a signal, and indicates power output in watts when key 2 is depressed while transmitting.

On/Standby Switch

This switch is located on the rear of the microphone unit. The "ON" position energizes the transceiver and illuminates the LED display. When the ignition is switched off the transceiver is turned off but the LED display will not automatically blank out. It is necessary to turn this switch to standby to blank the display and minimize battery drain.

Key Functions

On figure 1-1 the function keys are numbered. In the following instructions these numbers are used to help you correlate the keys and their functions.

1. *Function Switch* - Depress this switch when you want to use the second function of the other keys. EXAMPLE: to activate the PA output on the rear of the radio chassis, first depress the function key and then key 11 (PA on).

2. *S-Meter* - When receiving a signal in the receive mode, depressing and holding key 2 will cause the channel readout to display the signal strength in S-units. In the transmit mode, the same operation will indicate the transmitter relative output. The signal strength reads from 0 - 16 in S-units. EXAMPLE: S-9 is equal to 30 microvolts signal strength. S-16 equals approximately 1000 microvolts. Because of background noise, the S-meter will normally read an S-1 without a received signal. The transmitter's relative output normally reads 4. This should be measured without modulation to get a correct reading.

NOTE: This is measured into a 50 ohm resistive load. If the SWR (Standing Wave Ratio) of your antenna is higher than 1.2 to 1, the reading will be inaccurate. Operation of key 2 must be repeated for each new reading.

3. *Channel Up* - This key increments the channels that the radio is turned to by approximately 4 channels per second. There is an initial delay when the key is depressed to allow single channel stepping.

5. *NB On/Time-Hr* - Depressing key 5 will turn the noise blanker on. Depressing key 1 (Function) and then key 5 and 6 will advance the hours and minutes in the clock readout.

7. *Volume Increase* - Depressing key 7 will raise the audio output level in increments. Key 7 must be depressed again to increase the audio more.

8. *Volume Decrease* - This key lowers the volume in steps. Each key depression lowers the volume.

9. *Emergency-Channel 9* - This key is your emergency channel 9 key. It automatically puts the radio on channel 9. To return to another channel simply depress key 3 or 4 until you are on the channel you want. The channel 9 key overrides the PA function and returns you to channel 9. Transmit on this channel only in a genuine emergency.

10. *Memory* - Depressing key 10 stores the channel which is being displayed in the unit's memory. When the unit is initially turned on, channel 40 is automatically stored in the memory. Therefore the first time the memory key is depressed, channel 40 will be exchanged with the channel displayed. Channel 40 will now be displayed and the channel which was displayed will be stored. EXAMPLE: Using channel 25, depress the memory key. Channel 25 is now stored in the memory. Change channel to 18 by using key 3 or 4.

Depress the memory key and you're on channel 25 again. Depress the memory key again and you're back on channel 18.

11. *Squelch Increase* - Key 11 is used to set the squelch level. Set the volume at a comfortable level and then depress key 11 repeatedly until the speaker quiets. When a signal is received the squelch will break and the signal will be heard.

12. *Squelch Decrease* - If the squelch is set, repeatedly depressing key 12 lowers the squelch level and allows weaker signals and background noise to be heard.

Microphone Control Functions

Power Up Conditions

1. Channel 19
2. Channel 40 stored in memory
3. Volume at medium level
4. Squelch at minimum
5. Clock is random, must be set.

NOTE: The radio can power up in a fault mode. This is caused by the power source not having a sharp enough voltage transient to trigger the logic to the power-up conditions. This is a normal problem with IC logic power-up. The method for getting out of the fault mode is to re-initiate power. The symptoms of the fault mode are: (a) channel 19 is not displayed, or (b) clock runs fast, or (c) volume is not at medium level.

Warranty Service Department

For help with technical problems, for parts information, and information on local and factory repair facilities, contact the National Service Manager. When you write, please include all pertinent information that may be helpful in solving the problem. Address the letter to:

Hy-Gain Warranty Service Department
4900 Superior Street
Lincoln, Nebraska 68504
ATTN: National Service Manager

The Warranty Service Department can repair any unit. Before shipping the unit contact the National Service Manager. Often a problem is field solvable with a little extra help. This can save lost time and shipping costs. Limit factory returns to the difficult problems.

How to Ship Returns

To return a unit, get a return authorization. This is important. Handling of the unit may be delayed if shipped without it. If the unit must be shipped immediately, telephone or telex the National Service Manager for expeditious service.

When you request authorization, notification of repairs may also be requested. The notification will include a copy of the bill. Paying the bill before the return of the unit can save the cost of a COD fee.

For warranty repair, prepare a letter in duplicate containing the following information (for out-of-warranty repair delete items 2 and 3):

1. your name and address
2. purchaser's name and address
3. proof of purchase

Spurious response rejectionall harmonic and spurious suppression better than FCC requirements
 ModulationAM, 90% typical
 Current drain, transmit1.3A @ 13.8 VDC unmodulated

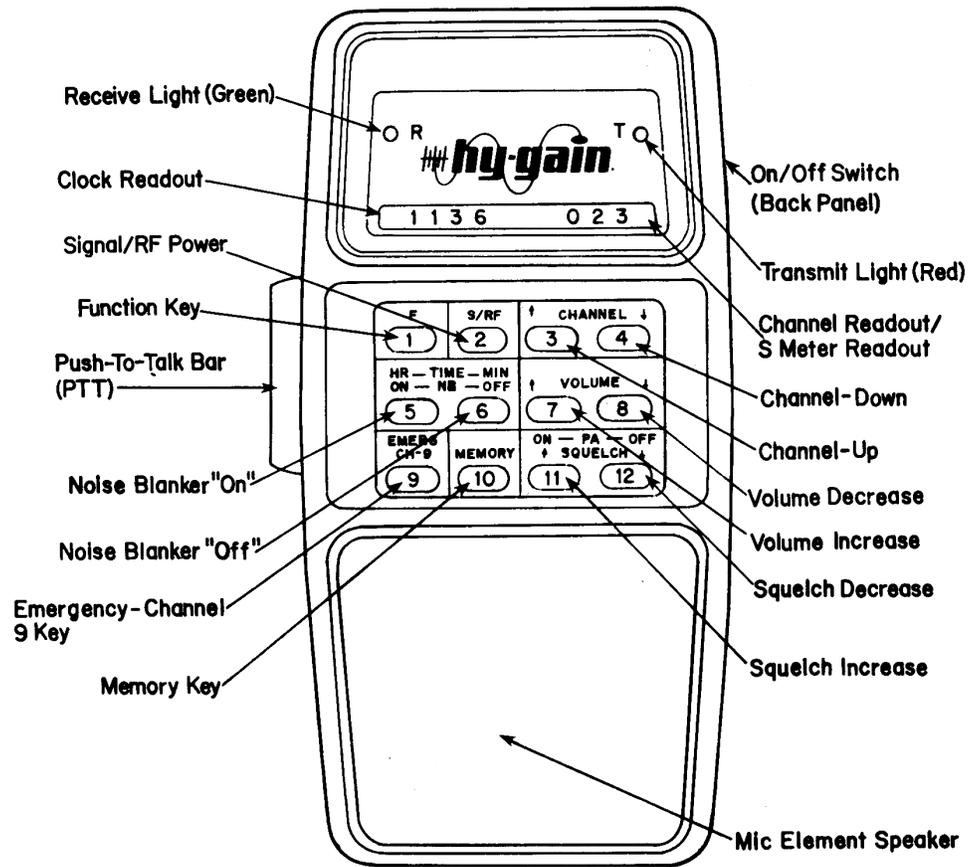


Figure 1-1. Microphone Controls

CHAPTER 2 — THEORY OF OPERATION

General

The theory of operation of the radio is divided into three sections: the Phase Locked Loop frequency synthesizer, the Receiver and the Transmitter. Logic functions will be discussed as they occur within the various circuits. This material covers the functioning of the transceiver with a minimum of technical involvement. We have not attempted to explain the engineering techniques and approaches that arrived at these circuit designs. Refer to the block diagram, figure 2-1 and the schematic diagram, figure 4-4, for visual reference to the theory of operation.

Phase Locked Loop Frequency Synthesizer

The Phase Locked Loop (PLL) frequency synthesizer generates frequencies for use in both the transmitter and receiver sections. Its output determines the channel on which the transceiver is operating. The PLL circuitry incorporates three crystal oscillators to perform its frequency generating functions.

The 11.8066 MHz Oscillator, Q105, has its output tripled and serves as a prescaler for the output of the Voltage Controlled Oscillator (VCO), Q101. The Offset Oscillator, Q109, operates at a frequency of 10.695 MHz, which mixes with the VCO output to provide the transmit frequency. The 10.24 MHz Oscillator, Q117, provides a reference for the PLL and an injection frequency for the Second Receive Mixer.

The PLL circuit generates the operating frequencies needed for the transceiver in accordance with serial data fed to the PLL, IC101, from the Microphone Module. Table A shows the following for each channel: the channel frequency, the VCO frequency and the "N" code.

For example, assume that channel 1 has been selected. The channel frequency is 26.965 MHz, the VCO frequency is 37.660 MHz, and the "N" code is 224. The Microphone Module programs the PLL, IC101, for a division ratio of 224. The 10.24 MHz reference frequency is fed to IC101. It is divided by 1024 within the chip, producing a 10 kHz reference signal. The output of the VCO is mixed in the PLL Mixer, Q102, with the tripled output of Q105, producing a 2.24 MHz signal. The signal is fed to IC101 where it is divided by 224 to produce 10 kHz. The two 10 kHz signals are phase compared in the phase detector within IC101 producing a DC voltage. This DC voltage controls the varactor diode, D101, and holds the VCO frequency at 37.660 MHz.

Assume that the channel is changed to channel 40. The control interface now provides a code that will produce a division ratio of 268. At this instant, the VCO frequency is at 37.660 MHz, which is mixed with the tripled output of Q105. Again, the PLL Mixer, Q102, produces an output of 2.24 MHz. The 2.24 MHz signal is divided by 268 to produce a frequency of 8.35 kHz.

This 8.35 kHz output and the 10 kHz obtained from the reference oscillator are compared in the phase detector within IC101. Since the frequencies are not the same, an error output which is a combined AC-DC voltage is produced.

The low pass filter removes the AC component and allows only the DC voltage to be fed to the VCO varactor. The VCO frequency changes until the output of IC101 is again 10 kHz. When the two frequencies are matched at 10 kHz, the error voltage output of the PLL, IC101, is zero. There is now a new DC voltage which tunes the VCO frequency to 38.100 MHz. When this occurs the loop is considered locked. With the channel selector at 40, the following outputs of the PLL circuitry are produced: the 38.100 MHz VCO output is fed to the First Receiver Mixer and, in the transmit mode, is mixed with the 10.695 MHz output of Q109 to produce a transmit frequency of 27.405 MHz.

Receiver

The receiver is a dual-conversion superheterodyne, receiving AM signals from 26.965 MHz to 27.405 MHz. The operating channel is determined by the PLL frequency synthesizer, which provides the local oscillator frequency to the First Mixer, Q115. A digitally controlled squelch circuit is included to quiet the receiver between transmissions. A noise blanker is also included for noise free reception.

In the receive mode, 13.8 VDC is supplied to IC102, Q114, Q115, Q118, Q119 and to Q106 (the AVR). The AVR supplies regulated voltage to the synthesizer stages and to the Reference Oscillator, Q117. A bias voltage is also applied to the base of the Transmit Switch, Q107. This bias holds the Transmit Switch open, so that the transceiver circuits remain in receive.

Radio signals are received at the antenna and enter the radio at the antenna jack. The filter formed by L109, L110, C153 and C1 matches the antenna impedance to the RF Amplifier, Q114. Signals in the 26.965 MHz to 27.405 MHz range are passed and then amplified by the RF Amplifier, Q114, and its tuned circuits C154, T104 and T105. D107 is a signal overload protector.

The output of the RF Amplifier and buffered VCO signal (the first local oscillator frequency) are applied to the First Receive Mixer, Q115. These two signals are mixed in the First Receive Mixer and produce an output of 10.695 MHz, which is the first IF.

The first IF passes through tuned circuits L112 and T106. It is then applied to the Second Receive Mixer, Q116, along with 10.240 MHz from the Reference Oscillator, Q117. The two signals are mixed in the Second Receive Mixer and produce an output of 455 kHz, which is the second IF. The second IF passes through the Ceramic Filter, CF101, and is amplified by Q118 and Q119. The amplified signal is then fed to the Detector, D110. The Detector establishes an automatic gain control (AGC) voltage and recovers the audio from the modulated signal. The AGC voltage maintains the output volume of the receiver constant under variations in input signal strength.

The Noise Blanker is composed of Q126, Q125 and their associated parts. Fast noise pulses are coupled from the output of the First Mixer, Q115, by C230 to the noise blanker amplifier. The noise pulses are detected by D115 and D116 whose outputs control the Amplifier Switch, Q126. The output of Q126 controls the Noise Blanker Gate, Q125, which is connected across the second IF transformer, T107. When a noise pulse appears, Q126 conducts causing Q125 to conduct and shorts out the primary of T107, preventing the noise pulse from passing through the remainder of the receiver. The squelch functions in the following manner: a detected RF signal level from RF Detector, D109, is fed to the Squelch/S-meter Reference Signal Amplifier, U3a, in the control interface. U3a is a voltage follower. From U3a, the signal, which is now a reference level, goes to the Squelch Comparator, U2b. At the same time, a stepped voltage level (set by the user) from the PLL, IC101, pin 18, is fed to the Squelch Control Voltage Amplifier, U3b. U3b is a voltage follower. From U3b the stepped voltage level is compressed by CR7 and CR8, Step Compressors, on the upper voltage levels only. This voltage level is then fed to U2b. At U2b the reference from U3a and the stepped level from U3b are compared. The resultant high or low data is fed to the Squelch Logic Control, U5c. U5c is a NOR gate. The output of U5c drives the Squelch Switch, Q120. When the squelch data driving Q120 is high, the squelch is closed. When the data is low the squelch is open. R22 on the control interface applies a slight positive voltage to U2b to insure that the squelch opens on the lowest step in absence of any RF signal level. When the PA is operated, low data is felt at U5d, PA/Squelch Control. U5d is a NOR gate wired as an inverter. The inverted output is then applied to pin 9 of U5c. In this case, PA operation, high data is felt by U5c and is inverted and the squelch opens. In the case of normal CB operation, high data is felt by U5d, inverts and low CB data is felt by U5c at pin 9 (in addition to the user operated squelch step level at pin 8 as previously discussed) to open or close the squelch gate.

The Volume Control operates in the following manner: the ANL, D108, feeds detected audio to the Volume Attenuator, U6. At the same time, a stepped voltage level (as set by the user) is received at the Voltage Follower, U1b. The stepped voltage level is fed through the voltage divider, R11 and R12, then to the Summing Amplifier, U1a. The Summing Amplifier has a reference voltage level of approximately 2 volts applied to it from the voltage divider, R15 and R16. The output of the Summing Amplifier will be approximately twice the reference level minus the stepped voltage level. Its output should vary from approximately 4 volts at minimum volume to 2 volts at maximum volume. This 2 to 4 volt level is fed to the Electronic Attenuator, U6, to control its output audio signal level. This controlled signal level is fed to the Audio Amplifier, IC102. It is amplified, then fed to the external speaker jack, back to the microphone unit and to the microphone/speaker.

The 8.7 volt voltage regulator is a saturating regulator. When the 13.8 VDC input drops below a certain level, the voltage regulator follows it down to about 4 volts. A short circuit is limited to 180 mA by Q3, Current Control Amplifier.

Transmitter

Switching to the transmit mode is accomplished in the following manner: when the PTT switch is closed, the base of the DC switch, Q107, is grounded by Q5, Transmit/Receive Switch located in the Control Interface. This establishes forward bias which causes Q107 to conduct. Regulated voltage from the Automatic Voltage Regulator (AVR), Q106, is then supplied through Q107 to Q109 and Q110. RF is now applied to Q111, Q112 and Q113.

The operating channel is determined by the PLL frequency synthesizer. The buffered VCO frequency is mixed in Q110, Transmit Mixer, with the 10.965 MHz Offset Oscillator, Q109, output to yield the transmit frequency. The transmit frequency from Q110 passes through the filter circuit of L103, L104 and T102 and is applied to the Pre-Driver, Q111. The filter circuit partially removes spurious signals from the transmit frequency.

The Pre-Driver, Q111, and the Driver Q112, form two stages of amplification leading to the final stage. The filter circuit of T103 follows Q111, and L106 follows Q112. These two circuits filter out the remaining spurious signals from the transmit frequency.

From the Driver the signal is applied to the final stage, the RF Power Amplifier, Q113. This is a current amplifier that raises the transmit signal to an output of four watts. Its output is applied to a filter, consisting of L109, C151, C152, L110, C2, L1 and C1, and then goes to the antenna jack. The transmit signal is modulated in the following manner: the microphone output is applied through the microphone transformer, T1, to the Audio Amplifier, IC102. The output of IC102 is applied to the collectors of Q112 and Q113 through the audio output transformer, T110. Control voltages for the transmit audio (ALC), Q122, and the Range Boost, Q121, come from detector diode D111. The transmit audio ALC boosts, or lowers the amplifier gain in response to battery voltage fluctuations. This insures full modulation of the carrier despite any changes in battery voltage. The Range Boost reduces AF peaks so that a higher average AF level is supplied to the Audio Amplifier. This gives the desired high average modulation without overmodulation of peaks.

Control and Logic Functions

All operator controls, on/off switch, volume, push-to-talk switch, squelch control, PA on/off switch, plus memory switch, emergency channel 9, noise blanker on/off switch, clock read out and S-meter/channel readout functions are located in the microphone unit. The microphone also includes a speaker for the receiver audio (which doubles as the microphone element).

Channel selection is accomplished with the use of the controller/serial data circuits acting on the PLL, IC101. The Channel Selector switch may be set to channel up or down. With the switch activated, the clock inputs serial data into the PLL which cycles it through the 40 channels.

“N” Code-Frequency Correlation Chart

Table A

Channel No.	Channel Frequency	“N” Code	V.C.O. Frequency
1	26.965 MHz	224	37.660 MHz
2	26.975 MHz	225	37.670 MHz
3	26.985 MHz	226	37.680 MHz
4	27.005 MHz	228	37.700 MHz
5	27.015 MHz	229	37.710 MHz
6	27.025 MHz	230	37.720 MHz
7	27.035 MHz	231	37.730 MHz
8	27.055 MHz	233	37.750 MHz
9	27.065 MHz	234	37.760 MHz
10	27.075 MHz	235	37.770 MHz
11	27.085 MHz	236	37.780 MHz
12	27.105 MHz	238	37.800 MHz
13	27.115 MHz	239	37.810 MHz
14	27.125 MHz	240	37.820 MHz
15	27.135 MHz	241	37.830 MHz
16	27.155 MHz	243	37.850 MHz
17	27.165 MHz	244	37.860 MHz
18	27.175 MHz	245	37.870 MHz
19	27.185 MHz	246	37.880 MHz
20	27.205 MHz	248	37.900 MHz
21	27.215 MHz	249	37.910 MHz
22	27.225 MHz	250	37.920 MHz
23	27.255 MHz	253	37.950 MHz
24	27.235 MHz	251	37.930 MHz
25	27.245 MHz	252	37.940 MHz
26	27.265 MHz	254	37.960 MHz
27	27.275 MHz	255	37.970 MHz
28	27.285 MHz	256	37.980 MHz
29	27.295 MHz	257	37.990 MHz
30	27.305 MHz	258	38.000 MHz
31	27.315 MHz	259	38.010 MHz
32	27.325 MHz	260	38.020 MHz
33	27.335 MHz	261	38.030 MHz
34	27.345 MHz	262	38.040 MHz
35	27.355 MHz	263	38.050 MHz
36	27.365 MHz	264	38.060 MHz
37	27.375 MHz	265	38.070 MHz
38	27.385 MHz	266	38.080 MHz
39	27.395 MHz	267	38.090 MHz
40	27.405 MHz	268	38.100 MHz

CHAPTER 3 — ALIGNMENT PROCEDURES

General

These procedures must be followed to align the transceiver. Alignment should not be undertaken unless the technician has adequate test equipment and a full understanding of the circuitry of the transceiver.

IMPORTANT: Tuning adjustment of this transceiver "shall be made by or under the immediate supervision and responsibility of a person holding a first or second-class commercial radio operator's license," as stipulated in Part 95.97(b) of the FCC Rules and Regulations.

The procedures are divided into two main sections: Transmitter Alignment and Receiver Alignment. See *Equipment* below for a complete list of recommended equipment.

These procedures assume that proper voltages are present at all points in the unit, if not, troubleshoot before continuing.

NOTE: The ferrite cores in the tuning coils are easily chipped or broken. Always use care when inserting an alignment tool in the coil; insert it straight into the core.

Recommended Equipment

The following equipment is recommended for use in aligning the transceiver.

Audio signal generator, 1 kHz

AC VTVM, 1 mV measurable

DC ampere meter, 2A

Variable regulated power supply, 10-15 VDC, 2A or higher

Frequency counter, 0 to 40 MHz, high input impedance type

VTVM with RF probe

Oscilloscope, 30 MHz, high input impedance with a 10:1 attenuator probe

RF wattmeter and 50 ohm, 5W dummy load

Standard RF signal generator, 27 MHz CB band

Speaker dummy resistor, 8 ohm, 5W

All test equipment should be properly calibrated.

NOTE: Test voltage is 13.8 VDC.

Transmitter Alignment Procedure

Equipment Set-up

Refer to figure 3-1 for the connection of test equipment.

Refer to figure 3-4 for the location of components to be adjusted for transmitter alignment.

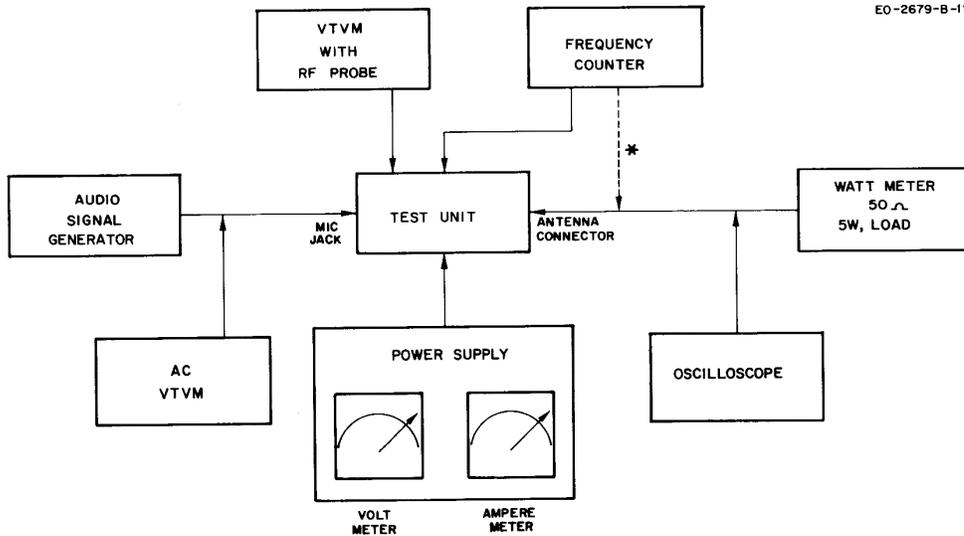


Figure 3-1. Equipment Set-up, Transmitter Alignment

***NOTE:** See figure 3-2 for connection of the frequency counter and the dummy load.

NOTE: For proper operation of the controller IC in the 2716, a fast rise time power source is necessary. If the power supply voltage, when initially applied, comes up too slowly, the controller IC may not function properly. This condition is evident by channel numbers greater than 40 or extremely rapid channeling when the "UP" or "DOWN" button is depressed. This situation can be corrected by removing and then re-inserting the power connector on the 2716 rear panel.

Pre-Alignment Frequency Check

Before alignment, use a 10:1 attenuator oscilloscope probe connected to the frequency counter input probe to check the operating frequencies at the following points:

1. Pin 6 of IC101, reference input, check to read 10.24 MHz.
2. On the emitter end of R110, check to read 11.8066 MHz.

VCO Alignment

1. Connect a VTVM (10 VDC range) across C135 and check to read 5.0V - 5.5V.
2. Connect a VTVM (10 VDC range) on pin 17 of IC101, check to read 8.2V - 9.3V.
3. Place the Channel Selector in the channel 1 position.
4. Connect the VTVM between ground and R114 (TP-8 side).
5. Adjust T101 to obtain $1.5V \pm .1V$.
6. Connect the frequency counter with a 10:1 probe to the collector of Q108 and check for a reading of 37.66 MHz.

RF Output Adjustment

Connect a power-meter to the antenna jack.

1. If the output power initially is under 2 watts, go to step 2. If it is more than 2 watts go to step 6.
2. Place the probe of an oscilloscope on the base of Q111.
3. Turn the transceiver to channel 19 and adjust T111, L103, L104 and T102 for maximum output in transmit.
4. Connect probe to base of Q112 and adjust T103 for maximum output.
5. Adjust L106, L109 and L110 for maximum indication on the wattmeter.
6. Decrease output power to approximately 2 watts by detuning L106 (turning clockwise, in). Also detune L110 by adjusting fully clockwise.
7. Readjust the slug of L106 (yellow) counterclockwise for maximum power output.
8. Readjust T111, L103, L104 and T102 for maximum output in transmit.
9. Adjust the slug of L109 (brown) for maximum power output.
10. Readjust the slug of L106 (yellow) clockwise for a reading of 4.2 watts output.
11. Adjust the slug of L110 (green) counterclockwise for a reading of 3.9 watts output.
12. Check power output on channels 1 through 40.
13. If power roll-off is greater than 0.5 watts, go back to step 6 and channel 19.
14. If power decrease is still around 0.5 watts on channels 1 through 40, adjust T111 on channel 40 for a higher output.
15. Recheck power output of channels 1 through 40. Total transceiver current at this setting should not exceed 1.4A.

Transmitter Frequency Check

1. Unkey the transmitter.
2. Connect the dummy load and frequency counter to the antenna jack as shown in figure 3-2.

EO-0672-A-010

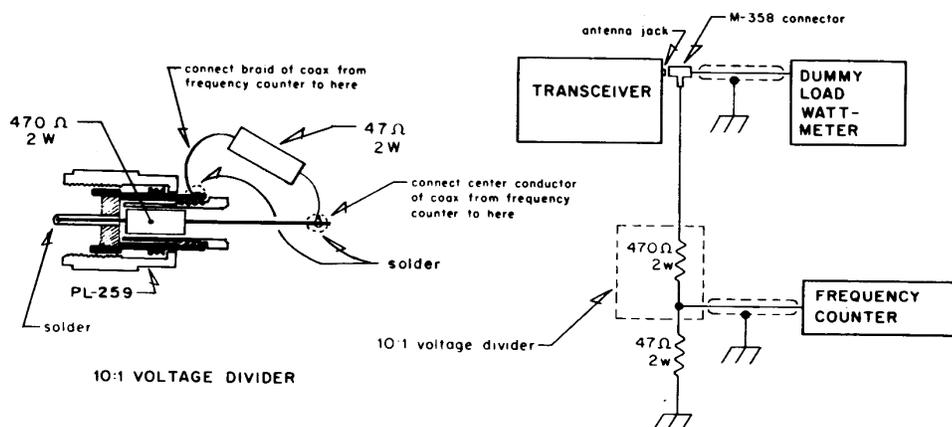


Figure 3-2. Connection of Frequency Counter and Dummy Load to Antenna Jack

3. Key the transmitter with the microphone PTT button.

4. Check the frequency of each channel with the chart below. Frequencies should be within $\pm 800\text{Hz}$ at 25° centigrade.

CHANNEL FREQUENCY

Channel	MHz	Channel	MHz
1	26.965	21	27.215
2	26.975	22	27.225
3	26.985	23	27.255
4	27.005	24	27.235
5	27.015	25	27.245
6	27.025	26	27.265
7	27.035	27	27.275
8	27.055	28	27.285
9	27.065	29	27.295
10	27.075	30	27.305
11	27.085	31	27.315
12	27.105	32	27.325
13	27.115	33	27.335
14	27.125	34	27.345
15	27.135	35	27.355
16	27.155	36	27.365
17	27.165	37	27.375
18	27.175	38	27.385
19	27.185	39	27.395
20	27.205	40	27.405

Adjustment of RF Indicator

1. Channel the transceiver to channel 20.
2. Key the transmitter.
3. Repeatedly depress and then hold the S/RF key on the microphone while adjusting RV104. RV104 should be set to give an RF indication of 5.

Modulation Sensitivity Adjustment

1. Place the unit in the transmit mode and apply a 20 mV, 1 kHz signal to pad 22 on the radio PC board.
2. Adjust RV102 to obtain 90% modulation as observed on the oscilloscope.
3. Decrease the signal input to 6 mV. Modulation should not fall below 80%.
4. Increase the signal input to 40 mV. Connect an oscilloscope to the antenna connector at the C1, L1 point. Check that the modulation envelope is sinusoidal, without any distortion. If any distortion is noted, realign the transmitter starting with step 6 of the RF Output Adjustment procedure.
5. Check the power output with, and without modulation on channels 1, 19 and 40. If downward modulating (power appears to decrease with modulation) occurs, the level should not decrease more than 0.6 watts.

Receiver Alignment Procedure

Equipment Set-up

Refer to figure 3-5 for the location of components to be adjusted for receiver alignment.

Refer to figure 3-3 for test equipment connection.

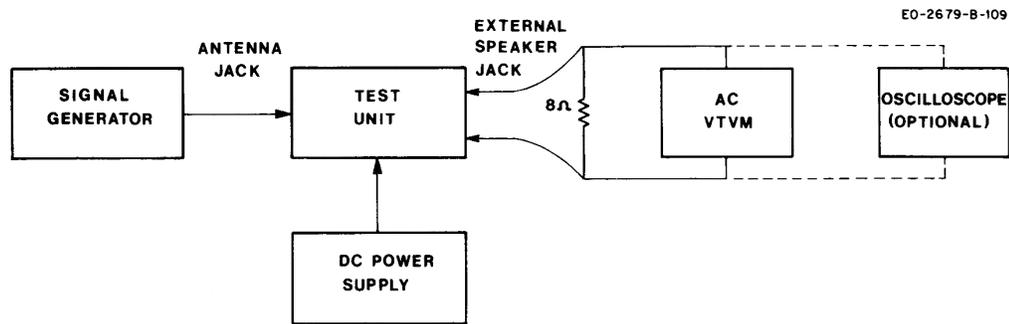


Figure 3-3. Equipment Set-up, Receiver Alignment

Receiver Alignment

1. Set the signal generator to 27.205 MHz, 30%, 1 kHz modulation and set the transceiver to channel 20, squelch open.

NOTE: This alignment should be performed with an extremely small signal input from the signal generator to avoid inaccurate alignment due to AGC action.

2. Adjust T104, T105, L112, T106, T107, T108 and T109 for maximum audio output as indicated on the AC VTVM (or oscilloscope if used).

S-Meter Adjustment

1. Set the signal generator to provide an RF input signal level of 30 μ V.
2. Repeatedly depress and then hold the S/RF key on the microphone while adjusting RV103. RV103 should be set to give an indication of 9.

Tight Squelch Adjustment

1. Set the signal generator to provide an RF input signal level of 50 μ V.
2. Depress the Squelch Up key on the microphone a minimum of 17 times.
3. Adjust RV1 on the control interface board so that the squelch is open.
4. Adjust RV1 so that the squelch just closes (this provides a squelch set such that tight squelch opens at approximately 100 μ V to 200 μ V).

Memory Battery Connection

On rare occasions, due to low line voltage (less than 7 VDC) in an automobile electrical system, the microphone memory will be erased.

These symptoms will be present.

1. Display not lit.
2. Push button functions inoperative.
3. The green light remains on (receive light).

To avoid recurrence:

1. Check your auto battery to determine if it is weak. If it is weak, take steps to repair or replace the battery

2. Connect a 9 volt battery (*Eveready #522 or equivalent alkaline battery*) by following these steps:

- a. Disconnect the microphone from the radio.
- b. Remove the four screws and remove the cover from the transceiver unit (the unit under the seat or in the trunk-NOT THE MICROPHONE.) (See drawing)
- c. Attach the battery to the side of the case by removing the paper from the piece of tape mounted on the case in the radio. (See drawing)
- d. Locate the wires with the battery connector clip, which are tied to the wire bundle in the center of the radio.
- e. Carefully release the battery clip from the wire bundle.
- f. Connect the clip to the battery terminals, ensuring that the clip is being connected to the correct terminals.
- g. Re-install cover. Ensure that the short screw is replaced in the hole from which it was removed. (See drawing)
- h. Connect the transceiver power leads and reconnect the microphone.

NOTE: Under normal usage the battery has an expected life of 1 to 3 years.

The battery should be replaced as necessary or after repeated use with an *Eveready #522 (or equivalent) alkaline battery*. Attach it to the side of the case in the same location and in the same manner as the previously installed battery.

IMPORTANT: If the complete radio is removed from the auto or if the orange memory power lead is disconnected, the 9 volt battery must be disconnected in the unit to prevent it from being discharged.

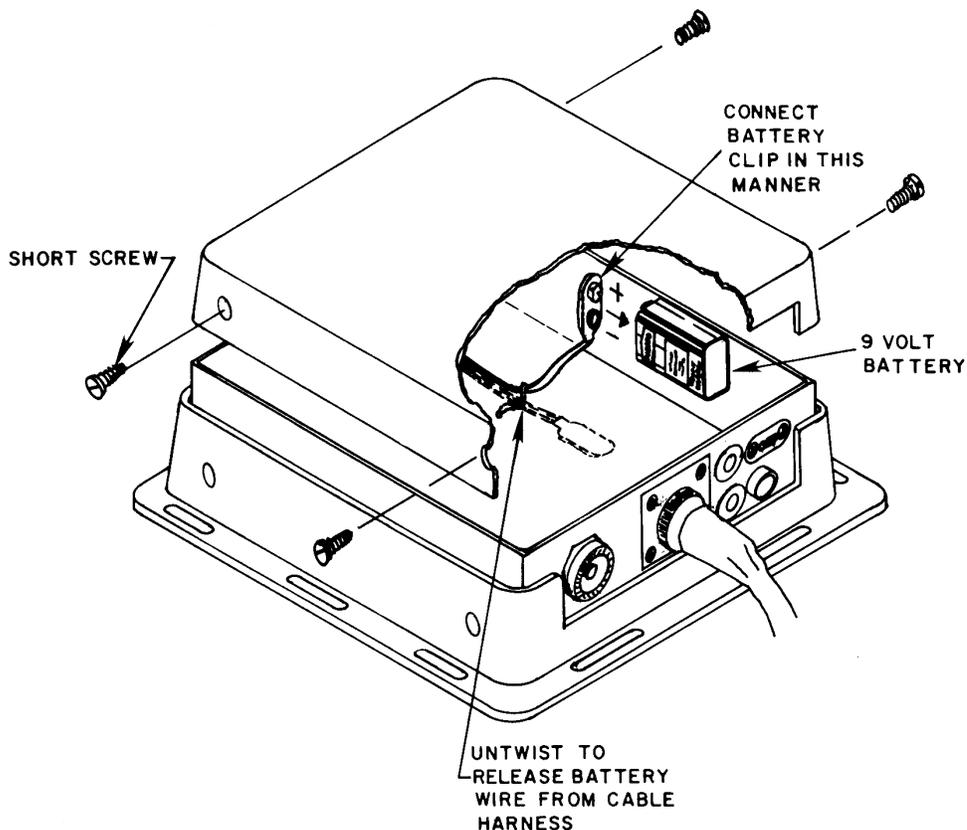


Figure 3-4. Connection of Memory Battery

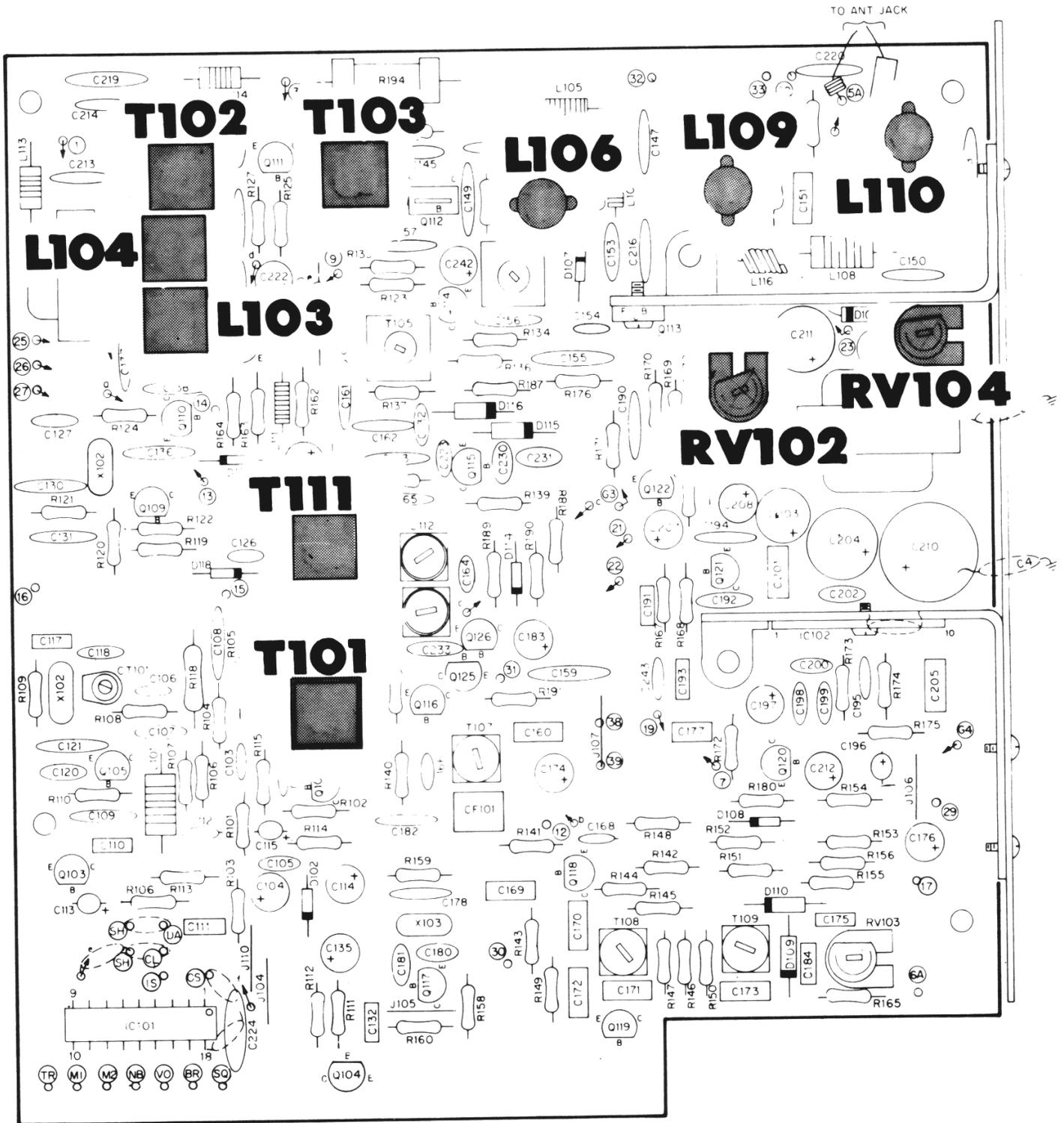


Figure 3-5. Components Adjusted for Transmitter Alignment

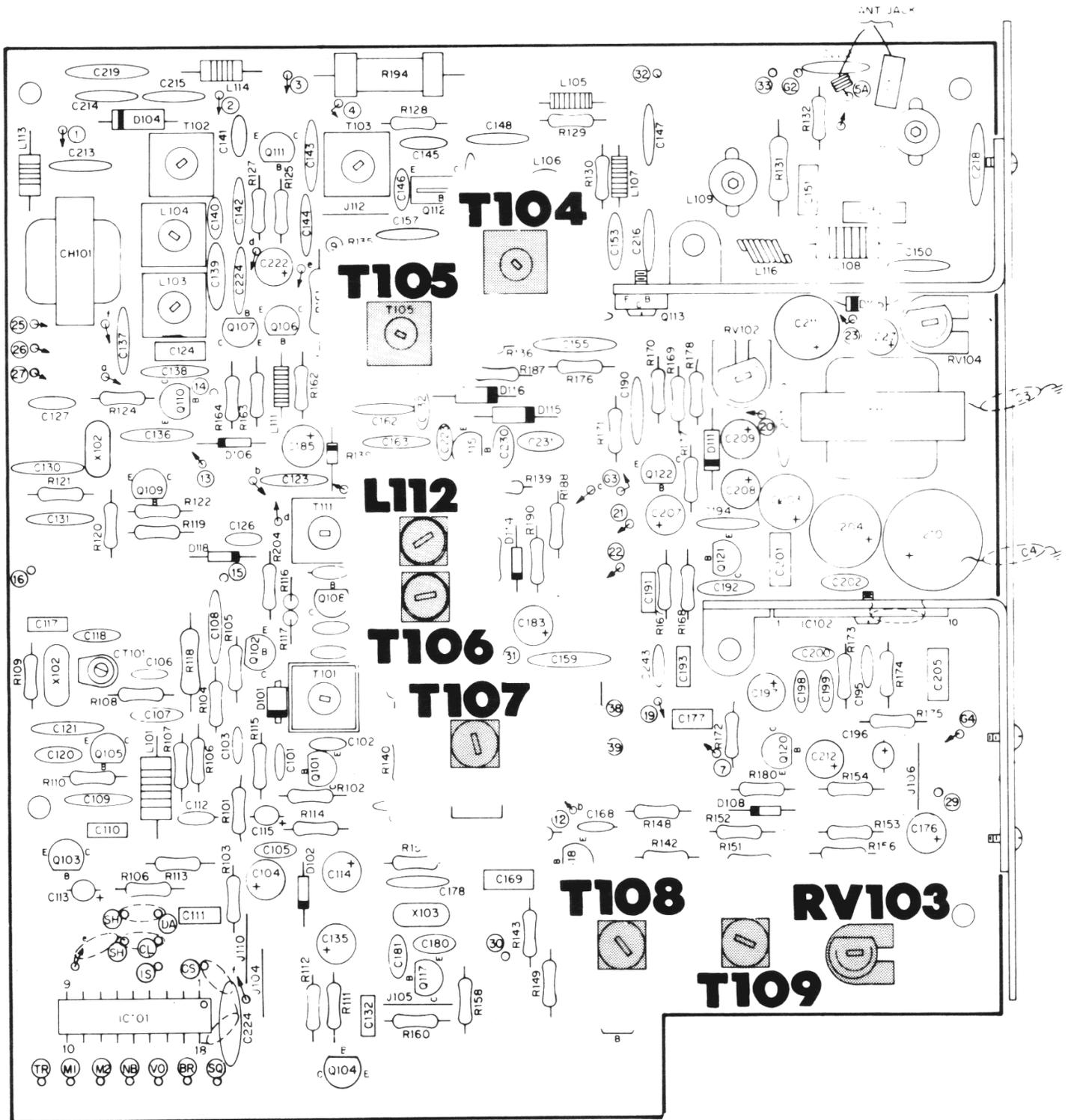


Figure 3-6. Components Adjusted for Receiver Alignment

CHAPTER 4 — CHARTS AND DRAWINGS



Voltage Charts

VOLTAGE MEASUREMENT CHARTS

Main P.C. Board

Reference Designator		E	B	C
Q101	RX	0.0	0.56	2.28
Q102	RX	0.0	0.55	2.55
Q103	RX	0.0	0.65	1.94
Q104	RX	0.0	0.64	2.36
Q105	RX	2.33	2.96	3.86
Q106	RX	8.50	9.17	12.52
Q107	RX	8.50	12.27	0.0
Q108	RX	0.0	0.74	3.78
Q109	RX	0.0	0.0	0.0
	TX	2.27	2.87	4.95
Q110	RX	0.0	0.0	0.0
	TX	1.62	2.22	8.43
Q111	RX	1.61	2.35	13.58
	TX	0.99	1.47	13.24
Q112	RX	0.0	0.0	13.28
	TX	0.0	0.18	10.21
Q113	RX	0.0	0.0	13.28
	TX	0.0	.008	11.43
Q114	RX	1.78	1.08	12.72
	TX	0.50	0.55	12.95
Q115	RX	1.81	2.49	11.98
	TX	0.05	0.54	12.95
Q116	RX	0.0	0.53	0.0
	TX	0.0	0.52	0.0
Q117	RX	1.92	2.49	3.63
	TX	1.92	2.49	3.63
Q118	RX	1.75	2.43	11.99
	TX	0.0	0.54	12.99
Q119	RX	0.56	1.24	12.69
	TX	0.0	0.22	13.01
Q120	squelched	0.0	0.65	0.01
	unsquelched	0.0	0.02	6.67
Q121	RX	0.0	0.01	0.0
Q122	RX	0.0	0.60	0.0

IC 102 (TA 7205P)

Pin No.	1	2	3	4	5	6	7	8	9	10
RX Voltage	6.76	0.0	1.24	6.72	6.63	6.66	0.94	8.0	13.25	13.58
TX Voltage	6.48	0.0	0.0	6.44	6.35	6.38	0.93	7.72	12.68	13.01

2716 Interface Board

Pin	U1	U2	U4	U5	U6						
1	Chart A 2V 2.1V	Chart H Note 3	12.2V .04V .04V	Hi-9V, Lo 0V Rx-0V, TX-8.4V Hi- 6V, Lo-0V RX-0V, TX-8.4V RX-7V, TX-0V RX-7V, TX-0V	1.4V Chart A 0V 0V						
2						NC					
3						NC					
4						4.5V					
5	Chart C Chart E Chart B		Chart H Note 3		12.2V .04V .04V	Hi-9V, Lo 0V Rx-0V, TX-8.4V Hi- 6V, Lo-0V RX-0V, TX-8.4V RX-7V, TX-0V RX-7V, TX-0V	3.8V				
6							10V				
7											
8					Chart H Note 3		12.2V .04V .04V	Hi-9V, Lo 0V Rx-0V, TX-8.4V Hi- 6V, Lo-0V RX-0V, TX-8.4V RX-7V, TX-0V RX-7V, TX-0V			
9											
10											
11							Chart H Note 3		12.2V .04V .04V	Hi-9V, Lo 0V Rx-0V, TX-8.4V Hi- 6V, Lo-0V RX-0V, TX-8.4V RX-7V, TX-0V RX-7V, TX-0V	
12											
13											

Reference Designator		E	B	C
Q1	CB PA	0 0	0 1.4	13.8V .7
Q2	Radio on Radio off	0 0	.8 0	.1 13.8V
Q3		13.1	12.8	0
Q4		12.8V	12.2V	8.4V
Q5	RX TX	0 0	0 .8	8 .2

TR Line - RX 0V, TX 8V
 M1 Line - CB 0V, PA 8V
 V0 Line - See chart D
 OS and IS Line - See note 1
 6B Line - Pin 2, Pin 1 and Pin 5 of U2b, and Pin 3 of U2a- See note 2
 SQ Line - Pins 5, 6 and 7 of U3 - See chart G
 UB Line - 13.8V
 J5 - MIC pin connector 5 - 8.4V
 J5 - MIC pin connector 2 - 8.4V
 Line 9 - CB, 13.8V, PA 0V
 Line 20 - 13.8V, radio on
 Line 25 - 13.8V
 Line 27 - PA 13.8V, CB 0V

NOTES:

- OS - is in operation when the S-Meter is in use. When the S-Meter is pushed, the voltage drops to zero and increases in steps until the voltage on pin 2 of U2a is greater than or equal to the voltage on pin 3 of U2a. This causes the comparator, U2a, to go low and stops the counter and reads what voltage step the counter stopped at (function of IS).
- 6B - this voltage will change depending on the amplitude of the receive signal and the setting of RV103 in receive, RV104 in transmit.
- Pin 7, U2b - this voltage will go low when the voltage on pin 6 is greater than or equal to the voltage on pin 5.

Chart A	
Step	Voltage
0	3.9
1	3.4
2	3.2
3	3.1
4	3.05
5	3
6	2.9
7	2.8
8	2.7
9	2.6
10	2.5
11	2.45
12	2.4
13	2.3
14	2.25
15	2.2

Chart B	
Step	Voltage
0	.2
1	3
3	4.2
4	4.6
5	5
6	5.5
7	5.9
8	6.5
9	6.9
10	7.3
11	7.7
12	8
13	8.3
14	8.7
15	9.1

Chart C	
Step	Voltage
0	0
1	.4
2	.8
3	1.2
4	1.5
5	1.8
6	2.2
7	2.5
8	3
9	3.4
10	3.7
11	4.1
12	4.3
13	4.7
14	5.1
15	5.4

Chart D	
Step	Voltage
0	.1
1	.6
2	1.2
3	1.7
4	2.1
5	2.7
6	3.2
7	3.8
8	4.5
9	5
10	5.6
11	6.1
12	6.5
13	7
14	7.5
15	8

Chart E	
Step	Voltage
0	0
1	.4
2	.8
3	1.1
4	1.4
5	1.7
6	2.1
7	2.5
8	3
9	3.3
10	3.7
11	4.1
12	4.4
13	4.7
14	5.1
15	5.4

NOTES:

All voltage steps controlled by volume control in charts A - E.

Chart G	
Step	Voltage
0	0
1	.5
2	1.1
3	1.7
4	2.1
5	2.7
6	3.3
7	3.8
8	4.6
9	5.1
10	5.7
11	6.2
12	6.7
13	7.2
14	7.8
15	8.3

Chart H	
Step	Voltage
0	0
1	.19
2	.36
3	.51
4	.62
5	.76
6	.87
7	.95
8	1.05
9	1.1
10	1.15
11	1.21
12	1.25
13	1.30
14	1.35
15	1.39

NOTES:

All voltage steps controlled by squelch control in charts G and H.