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hy-gain 14

by **hy-gain**

MODEL 3114

CITIZEN TWO-WAY RADIO

40 Channel Base Station

**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 14 transceiver (Model 3114). 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 14 is a full 40 channel transceiver, designed, type accepted and receiver certified for Class D Citizens Radio Service as designated by the Federal Communications Commission (FCC).

It is a completely solid state base station, highly reliable with low power consumption. The PLL (Phase Locked Loop) synthesizer provides immediate operation on all 40 channels. Features include switchable ANL (Automatic Noise Limiter), Tone Control, RF Gain Control, Variable Squelch Control, and SWR Bridge, Transmit and Receive Indicator lights, a digital clock, digital channel display, and a switchable Noise Blanker. The unit can also be used for public address with the addition of a PA speaker.

Use the unit with 120 VAC 50-60Hz standard household current.

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
4. serial number
5. complete description of the problem
6. the return authorization

Check the unit to see that all parts and screws are in place and attach an envelope containing a copy of the letter directly to it so this information is not overlooked. Wrap the unit and the envelope in heavy paper or put it in a plastic bag. If the original carton is not

available, place the unit in a strong carton at least *six* inches larger in all three dimensions than the unit. Fill the carton equally around the unit with resilient packing material (shredded paper, excelsior, bubble pack, etc.). Seal the box with gummed paper tape, tie it with a strong cord and ship it by prepaid express, United Parcel Service, or insured parcel post to the address given previously. Mail the original of the letter in a second envelope to that same address.

It is important that the shipment be well packed and fully insured. Damage claims can delay repair and return of the unit. All claims must be settled between you and the carrier.

All shipments must be sent PREPAID. We *do not* accept collect shipments. After the unit has been repaired we will send it back COD unless the bill has been prepaid. Unclaimed or refused COD shipments will not be reshipped until payment is received in full. These items become the property of Hy-Gain 60 days after refusal or return and will be sold for payment of charges due.

Units with unauthorized field modifications cannot be accepted for repair.

Purchase of Parts

Parts can be purchased from any Hy-Gain Service Center or from the factory Warranty Service Department. When ordering, please supply the following information:

1. unit model number
2. unit serial number
3. part description
4. part number

Specifications

General

Channels all 40 channels in the Citizens Band
 (26.965 MHz - 27.405 MHz)
 Antenna impedance 50 ohms, nominal
 Power requirements 120 VAC
 Dimensions (HWD) 4 3/4" x 16" x 11"
 Compliance Type Accepted under FCC Rules,
 Part 95

Receiver Section

Circuitry dual conversion superheterodyne with RF
 amplifier stage and 455 kHz ceramic filter
 Sensitivity 0.7 uV for dB (S+N)/N ratio
 Intermediate frequency 1st IF - 10.695 MHz
 2nd IF - 455 kHz
 Audio output 3 watts, maximum
 Power consumption, receive less than 27 watts (no signal)

Transmitter Section

RF power output 4 watts
 Emission AM, type 6A3
 Spurious response rejection all harmonic and suppression better than FCC
 requirements
 Modulation AM, 90%, typical
 Power consumption, transmit less than 31 watts (no modulation)

CHAPTER 2 - THEORY OF OPERATION

General

The theory of operation of the Hy-Gain 14 is divided into five major sections: the PLL (Phase Locked Loop) frequency synthesizer, the Transmitter, the Receiver, the AVR Power Supply and Operation of Features. The material presented here covers the functioning of the transceiver with a minimum of technical involvement. Although it is intended to be informative, we have not attempted to explain the engineering techniques and approaches that arrived at these circuit designs.

NOTE: For visual reference to the theory of operation refer to figure 2-1, the PLL circuitry block diagram, and the overall block diagram, figure 2-3.

Phase Locked Loop Frequency Synthesizer

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

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 the code fed to the programmable divider, IC101, from the Channel Selector switch. Table A shows the following for each channel: The channel frequency, VCO frequency, binary code and the division ratio of the programmable divider.

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 binary code ("N" code) is 224. The Channel Selector switch programs the programmable divider for a division ratio of 224. The 10.24 MHz reference frequency is fed to the Integrated Circuit PLL Chip, 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. This signal is fed to the programmable divider, which divides it 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, D102, and holds the VCO frequency at 37.660 MHz.

Assume that the channel is changed to channel 23. The Channel Selector switch now provides a code that will produce a division ratio of 253. 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 and the signal is divided by 253 to produce a frequency of 8.73 kHz.

The 8.73 kHz output, along with the 10 kHz obtained from the reference oscillator, is fed to the phase detector. The comparison of the two frequencies in the phase detector produces an error output which is a combined AC-DC voltage. The low pass filter removes the AC component and allows only the DC voltage to be fed to the VCO. The VCO frequency changes until the output of the programmable divider is again 10 kHz. When the two frequencies are matched at 10 kHz, the error voltage output of the phase detector is zero.

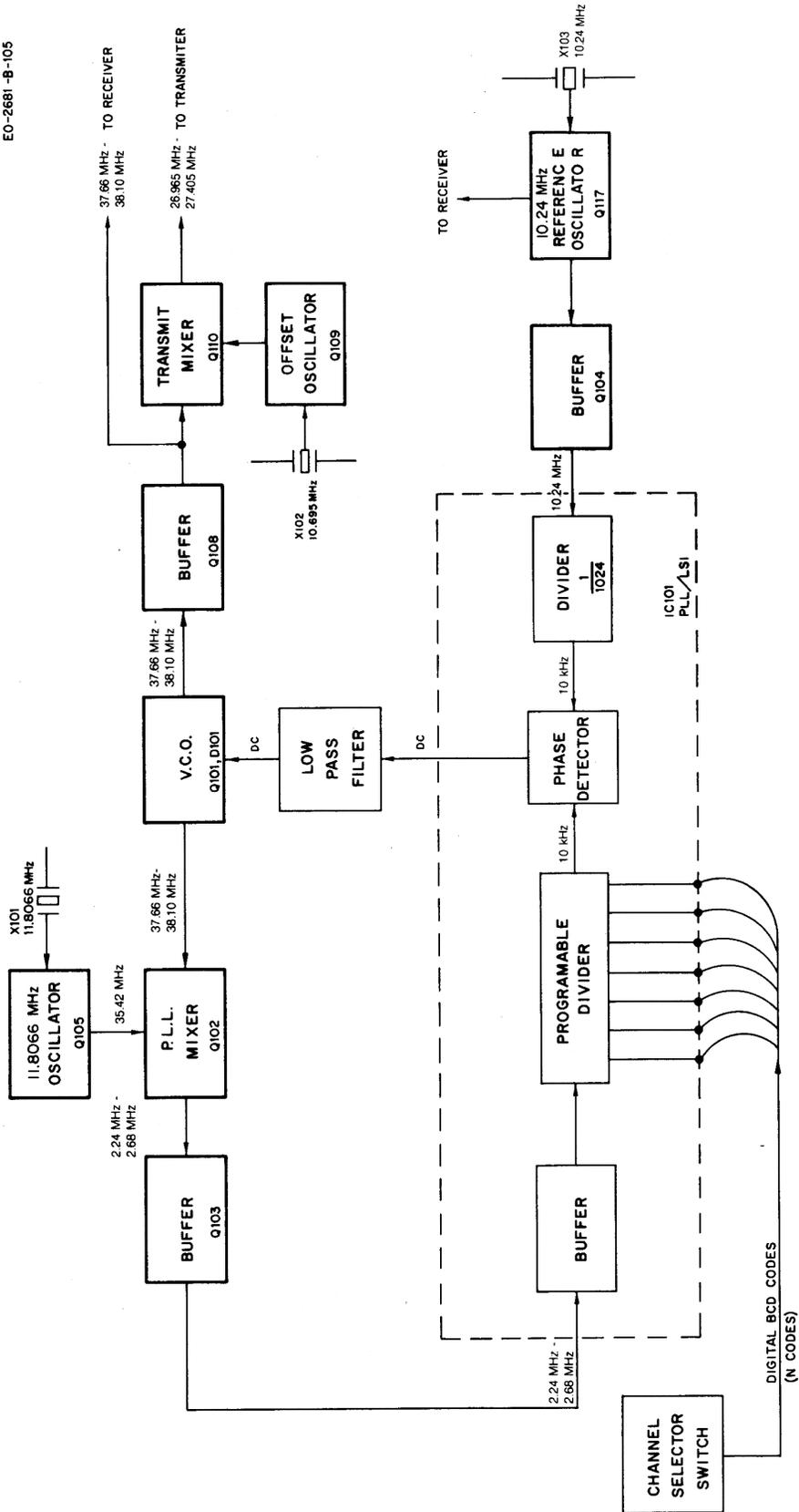


Figure 2-1. Block Diagram PLL Circuitry, Model 3114

There is now a new DC voltage set up to tune 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.

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. 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. Regulated voltage is not applied to Q111, Q112, and Q113.

The operating channel is determined by the PLL frequency synthesizer. The buffered VCO frequency is mixed in Q110 with 10.695 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, C152, L110 and C1, and then to the antenna jack.

The transmit signal is modulated in the following manner: microphone output is applied to the Audio Amplifier, IC102. The output is applied to the collectors of Q112 and Q113 through the audio output transformer, T110. Control voltages for the transmit audio (ALC), Q112, and the Range Boost, Q121, come from the detector diode D111. The transmit audio ALC boosts, or lowers, the amplifier gain in response to line voltage fluctuations. This ensures full modulation of the carrier despite any changes in line 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.

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. A variable squelch circuit is included to quiet the receiver between transmissions.

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 keeping it open so that the transceiver circuits remain in receive.

Radio signals are received by the antenna and enter the radio at the antenna jack. The filter formed by L109, L110, C152 and C1 matches the antenna impedance to the RF Amplifier. Signals in the 26.965 MHz 27.405 MHz range are filtered and amplified by the RF Amplifier Q114, and its tuned circuit C154/T104 and T105. D107 is a signal overload protector.

The output of the RF Amplifier and the buffered VCO signal (which in this case could be called the "first local oscillator frequency") are applied to the First Receiver Mixer and produce an output of 10.965 MHz, which is the first IF.

The first IF passes through tuned circuits L112 and T106. It is then applied to the Second Receiver Mixer, Q116, along with 10.240 MHz from the Reference Oscillator, Q117. The two signals are mixed in the Second Receiver 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 and also controls the Squelch Switch, Q102.

The squelch functions in the following manner: in the receive mode a bias voltage from Q106 is applied to the base of Q120 as determined by RV101. In the absence of the signal the base of Q120 is positively biased and is on. This biases the squelch transistor inside IC102 which turns off the Audio Amplifier and squelches the receiver. When the signal is received, the AGC voltage developed by D110 biases Q120 off. This biases the squelch transistor inside IC102 such that the audio amplifier is turned on and the signal is heard.

The recovered audio from the Detector passes through a series Automatic Noise Limiter (ANL), D108. The output of the ANL goes through the volume control, VR1 and is RC coupled to the Audio Amplifier, IC102. The amplified AF output from IC102 passes through the audio transformer T110, to be applied to the speaker jacks and the speaker.

AVR Power Supply

The AVR, comprised of Q106 and D103, is connected as a series regulator. D103 provides a reference voltage for the base of Q106. Q106 provides a current handling capability for zener diode, D103.

Operation of Features

Channel Display

The selected channel is displayed by a dual 7 segment LED display. The position of the Channel Selector switch determines which LED segment is displayed.

Digital Clock

The digital clock is operated by a monolithic MOS-LSI integrated clock circuit with a 4 digit, 1/2" LED display. The power supply and the other discrete components are all located on a single printed circuit board and comprise a complete electronic clock movement.

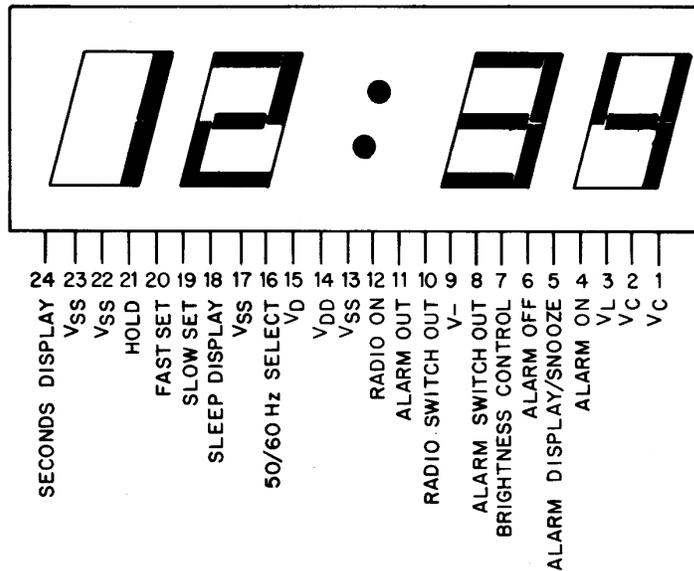


Figure 2-2. Digital Clock LED Module

Delta Tune

The Delta Tune function operates in the following manner. When the switch, SW6, is placed in the negative position Q123 conducts putting C236 in parallel with the 11.8066 Oscillator, Q105, lowering its frequency. With the switch in the positive position no capacitor is in parallel with the oscillator, therefore allowing the frequency to increase slightly. In the center position, C235 is in parallel with Q105, keeping it on frequency.

Noise Blanker

This circuit silences undesirable impulse noises by disabling the receiver circuit for the short time the impulse is applied to the antenna circuit.

When the NB switch is in the "ON" position a fraction of the noise impulse will be applied to D115 and D116 from the Mixer stage, through C286, and rectified into a DC voltage. The voltage is then applied to the base of the Noise Blanker Amplifier, Q126, which operates the Noise Blanker switch.

Q125 will also operate causing T107 to short-circuit to ground thereby inactivating the receiver circuit for a short time. C233 determines the cut-off time the receiver will be silenced during reception of noise impulses.

ANL (Automatic Noise Limiter)

The recovered audio from the Detector passes through a series Automatic Noise Limiter (ANL), D108. The output of the ANL goes through the Volume control, RV6, and is RC coupled to the Audio Amplifier, IC102. The amplified AF output from IC102 passes through the audio transformer, T110, to be applied to the speaker jacks and the speaker.

"N" Code-Frequency Correlation Chart

Table A

Channel No.	Channel Frequency	"N" Code	V.C.O. Frequency	PLL INPUT CODE										
				(256) B8	(128) B7	(64) B6	(32) B5	(16) B4	(8) B3	(4) B2	(2) B1	(1) B0		
1	26.965 MHz	224	37.660 MHz	0	1	1	1	0	0	0	0	0	0	
2	26.975 MHz	225	37.670 MHz	0	1	1	1	0	0	0	0	0	1	
3	26.985 MHz	226	37.680 MHz	0	1	1	1	0	0	0	0	1	0	
4	27.005 MHz	228	37.700 MHz	0	1	1	1	0	0	0	1	0	0	
5	27.015 MHz	229	37.710 MHz	0	1	1	1	0	0	0	1	0	1	
6	27.025 MHz	230	37.720 MHz	0	1	1	1	0	0	0	1	1	0	
7	27.035 MHz	231	37.730 MHz	0	1	1	1	0	0	0	1	1	1	
8	27.055 MHz	233	37.750 MHz	0	1	1	1	0	0	1	0	0	1	
9	27.065 MHz	234	37.760 MHz	0	1	1	1	0	0	1	0	1	0	
10	27.075 MHz	235	37.770 MHz	0	1	1	1	0	0	1	0	1	1	
11	27.085 MHz	236	37.780 MHz	0	1	1	1	0	0	1	1	0	0	
12	27.105 MHz	238	37.800 MHz	0	1	1	1	0	0	1	1	1	0	
13	27.115 MHz	239	37.810 MHz	0	1	1	1	0	0	1	1	1	1	
14	27.125 MHz	240	37.820 MHz	0	1	1	1	1	0	0	0	0	0	
15	27.135 MHz	241	37.830 MHz	0	1	1	1	1	0	0	0	0	1	
16	27.155 MHz	243	37.850 MHz	0	1	1	1	1	0	0	0	1	1	
17	27.165 MHz	244	37.860 MHz	0	1	1	1	1	0	0	1	0	0	
18	27.175 MHz	245	37.870 MHz	0	1	1	1	1	0	0	1	0	1	
19	27.185 MHz	246	37.880 MHz	0	1	1	1	1	0	0	1	1	0	
20	27.205 MHz	248	37.900 MHz	0	1	1	1	1	1	0	0	0	0	
21	27.215 MHz	249	37.910 MHz	0	1	1	1	1	1	0	0	0	1	
22	27.225 MHz	250	37.920 MHz	0	1	1	1	1	1	0	1	0	0	
23	27.255 MHz	253	37.950 MHz	0	1	1	1	1	1	1	0	0	1	
24	27.235 MHz	251	37.930 MHz	0	1	1	1	1	1	0	1	1	1	
25	27.245 MHz	252	37.940 MHz	0	1	1	1	1	1	1	0	0	0	
26	27.265 MHz	254	37.960 MHz	0	1	1	1	1	1	1	1	1	0	
27	27.275 MHz	255	37.970 MHz	0	1	1	1	1	1	1	1	1	1	
28	27.285 MHz	256	37.980 MHz	1	0	0	0	0	0	0	0	0	0	
29	27.295 MHz	257	37.990 MHz	1	0	0	0	0	0	0	0	0	1	
30	27.305 MHz	258	38.000 MHz	1	0	0	0	0	0	0	0	1	0	
31	27.315 MHz	259	38.010 MHz	1	0	0	0	0	0	0	0	1	1	
32	27.325 MHz	260	38.020 MHz	1	0	0	0	0	0	0	1	0	0	
33	27.335 MHz	261	38.030 MHz	1	0	0	0	0	0	0	1	0	1	
34	27.345 MHz	262	38.040 MHz	1	0	0	0	0	0	0	1	1	0	
35	27.355 MHz	263	38.050 MHz	1	0	0	0	0	0	0	1	1	1	
36	27.365 MHz	264	38.060 MHz	1	0	0	0	0	0	1	0	0	0	
37	27.375 MHz	265	38.070 MHz	1	0	0	0	0	0	1	0	0	1	
38	27.385 MHz	266	38.080 MHz	1	0	0	0	0	0	1	0	1	0	
39	27.395 MHz	267	38.090 MHz	1	0	0	0	0	0	1	0	1	1	
40	27.405 MHz	268	38.100 MHz	1	0	0	0	0	0	1	1	0	0	

CHAPTER 3 —ALIGNMENT

General

These procedures must be followed to align the Hy-Gain 14 transceiver (Model 3114). 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 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.

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

Recommended Tools and Equipment

The following equipment is recommended for use in aligning the Hy-Gain 14 transceiver. All test equipment should be properly calibrated.

Audio signal generator, 1 kHz

AC VTVM, 1 mV measurable

DC ampere meter, 2A

Variable regulated power supply, DC 8-15V, 2A

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

VTVM with RF probe

Oscilloscope, 30 MHz, high input impedance

RF wattmeter and 50 ohm, 5W dummy load

Standard RF signal generator, 27 MHz CB band

Speaker dummy resistor, 8 ohm, 5W

VOM 10k ohm/V

All test equipment should be properly calibrated

NOTE: Test voltage is DC 13.8V unless otherwise specified.

Transmitter Alignment Procedure

Equipment Set-up

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

Connect test equipment as shown in figure 3-1.

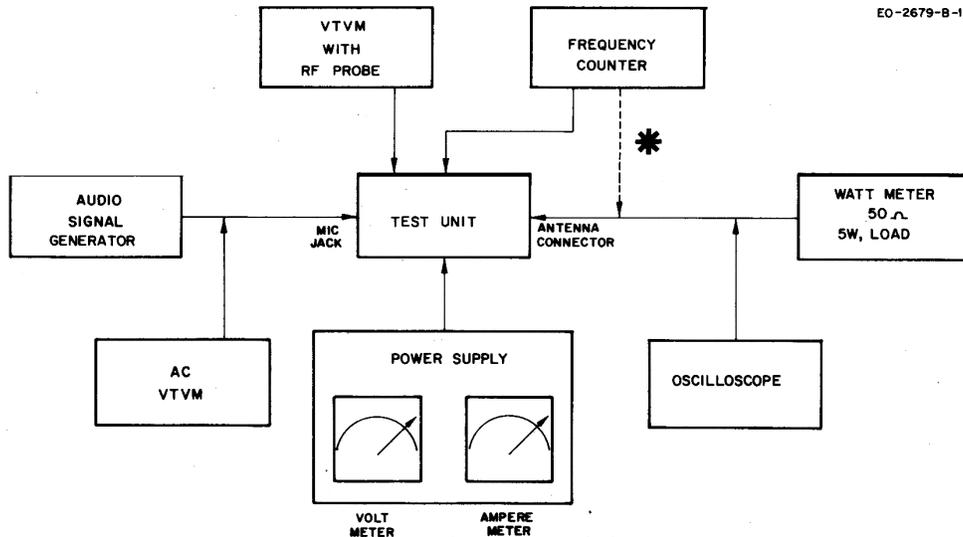


Figure 3-1. Equipment Set-up for Transmitter Alignment

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

Pre-Alignment Frequency Check

Before alignment, use the frequency counter through a 1000 pF coupling capacitor connected in series with a counter input probe to check the operating frequencies at the following points.

1. Pin 3 of IC101, reference input, check to read 10.24 MHz accurate to four significant digits. If not, proceed to VCO alignment.
2. Q108 base, transceiver on CH. 1, check to read 37.66 MHz accurate to four significant digits. If not, proceed to VCO alignment.

VCO Alignment

1. Connect VOM (DC 10V ranged) across C135 and check to read 5.0V - 5.5V.
2. Place the Channel Selector in the channel 1 position.
3. Connect the VOM between ground and R114 (TP-8 side).
4. Adjust T101 to obtain $1.5V \pm .1V$.
5. Place the Channel Selector in the channel 40 position and read the value on the meter. It should be $3.5 \pm .5V$.

Transmitter Alignment Procedure

1. Connect the VTVM RF probe between the base of Q111 and ground.
2. Set the transceiver Channel Selector to channel 19. Perform the following procedure on channel 19.

3. Key the transceiver.
4. Adjust the slugs of L103, L104 and T102 for a maximum reading on the VTVM.
5. Connect the VTVM RF probe between the base of Q112 and ground.
6. Adjust the slug of T103 for a maximum reading on the VTVM.
7. Adjust L109, L106 and L110 for a maximum RF power output as indicated on the wattmeter.
8. Repeat steps 2 through 8.
9. Repeat step 8 until no further improvement is noted.
10. Back off L109 (clockwise) for a reading of 4.0 watts RF power output.
11. Readjust L110 for maximum power out.
12. Repeat steps 12 and 13 until the maximum power output is 4.0 watts with L110 peaked for maximum output.
13. Check power output on channels 1 and 40. Power should not be less than 3.6 watts if less, repeat alignment procedure.

Transmitter Frequency Check

1. Turn the transceiver off.
2. Connect the dummy load and frequency counter to the antenna jack as shown in figure 3-2.

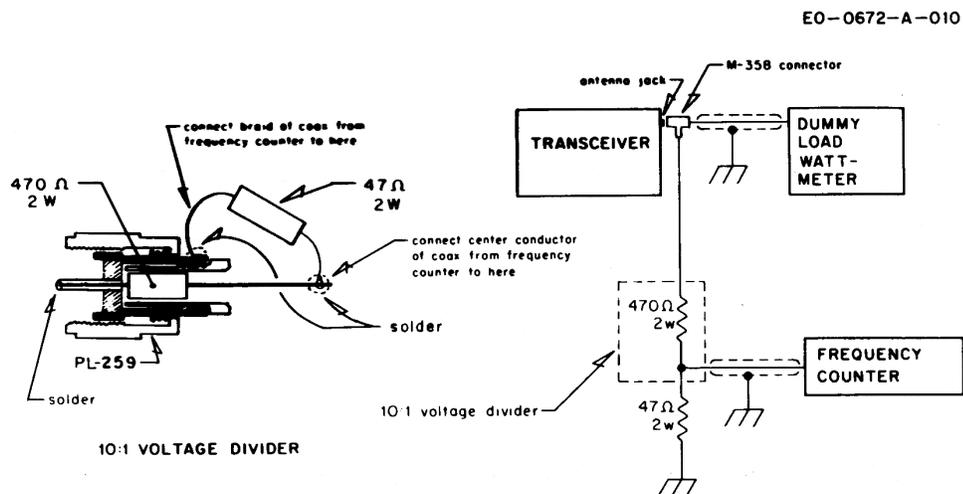


Figure 3-2. Connection of Frequency Counter and Dummy Load

3. Key the transmitter with the microphone PTT button.
4. Check the frequency of each channel with the channel frequency chart. Frequencies should be within $\pm 800\text{Hz}$ at 25°C . (room temperature).

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

Modulation Sensitivity Adjustment

1. Place the unit in the transmit mode and apply a 20 mV, 1 kHz signal to pin 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%.

Receiver Alignment Procedure

Equipment Set-up

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

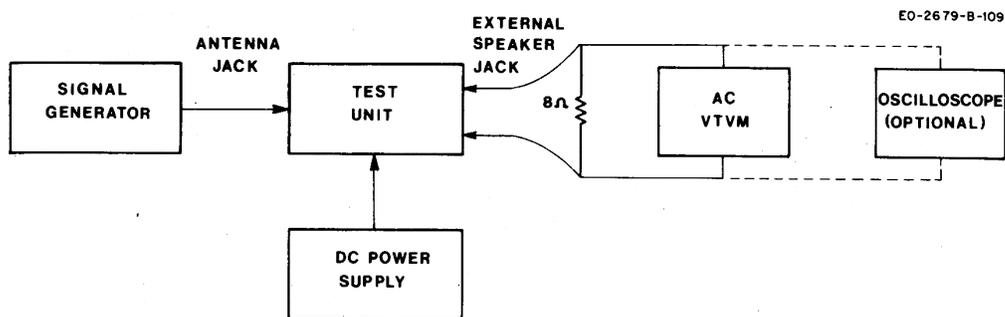


Figure 3-3. Equipment Set-up for Receiver Alignment

Receiver Alignment

1. Set the signal generator to 27.185 MHz, ± 1 kHz, 30% modulation and set the transceiver to channel 19.

NOTE: This alignment should be performed with an extremely small 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).

Tight Squelch Adjustment

1. Set the signal generator to provide an RF input signal of 100 μ V, (1 kHz, 30% modulation).
2. Rotate the squelch control fully clockwise.
3. Adjust RV101 so that the squelch just breaks with the 100 μ V signal input.

Resetting the Digital Clock

1. Step the clock reading to either one or two minutes ahead of the actual current time, using either the FAST or SLOW button. Then immediately hit the STOP button and hold it.
2. Hold the STOP button until actual time synchronizes with the reading on the digital clock. Release the STOP button. The digital clock will now resume normal movement and indicate the correct time.
3. A flashing Display indicates power has been off.

Meter Calibration

RF Power Meter

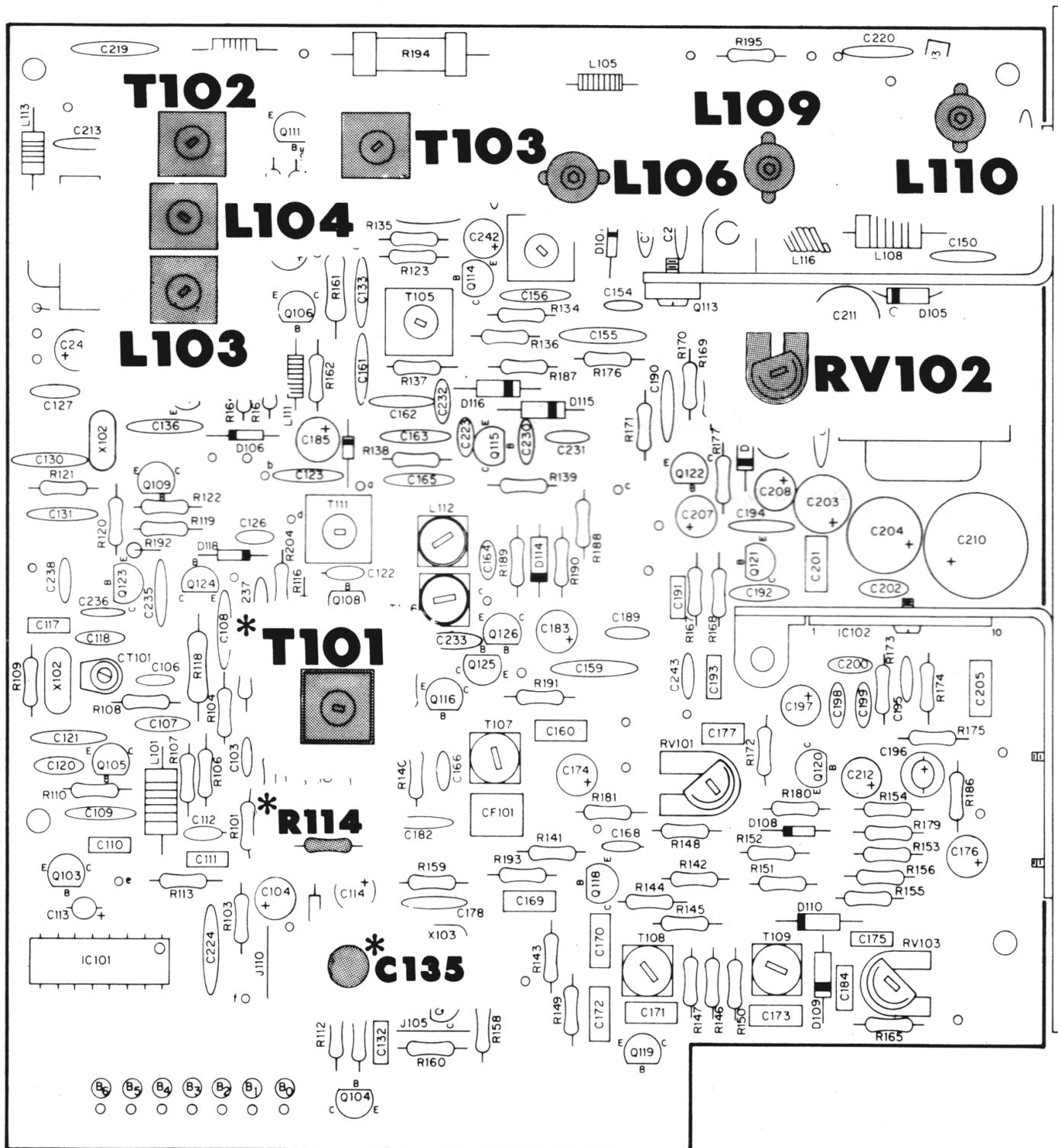
Adjust RV501 until the RF/SWR meter reads the same as the wattmeter.

SWR Meter

1. Fabricate a 100 ohm dummy load using a PL259 connector and a 100 ohm 2W resistor. Attach the 100 ohm load to the antenna connector.
2. Set SWR/CAL switch to CAL.
3. Key the transmitter and adjust the SWR/CAL control on the front panel until the RF/SWR meter reaches the set mark.
4. Return the CAL/SWR switch to SWR.
5. Adjust RV2 until the meter indicates an SWR of "2".

S-Meter Adjustment

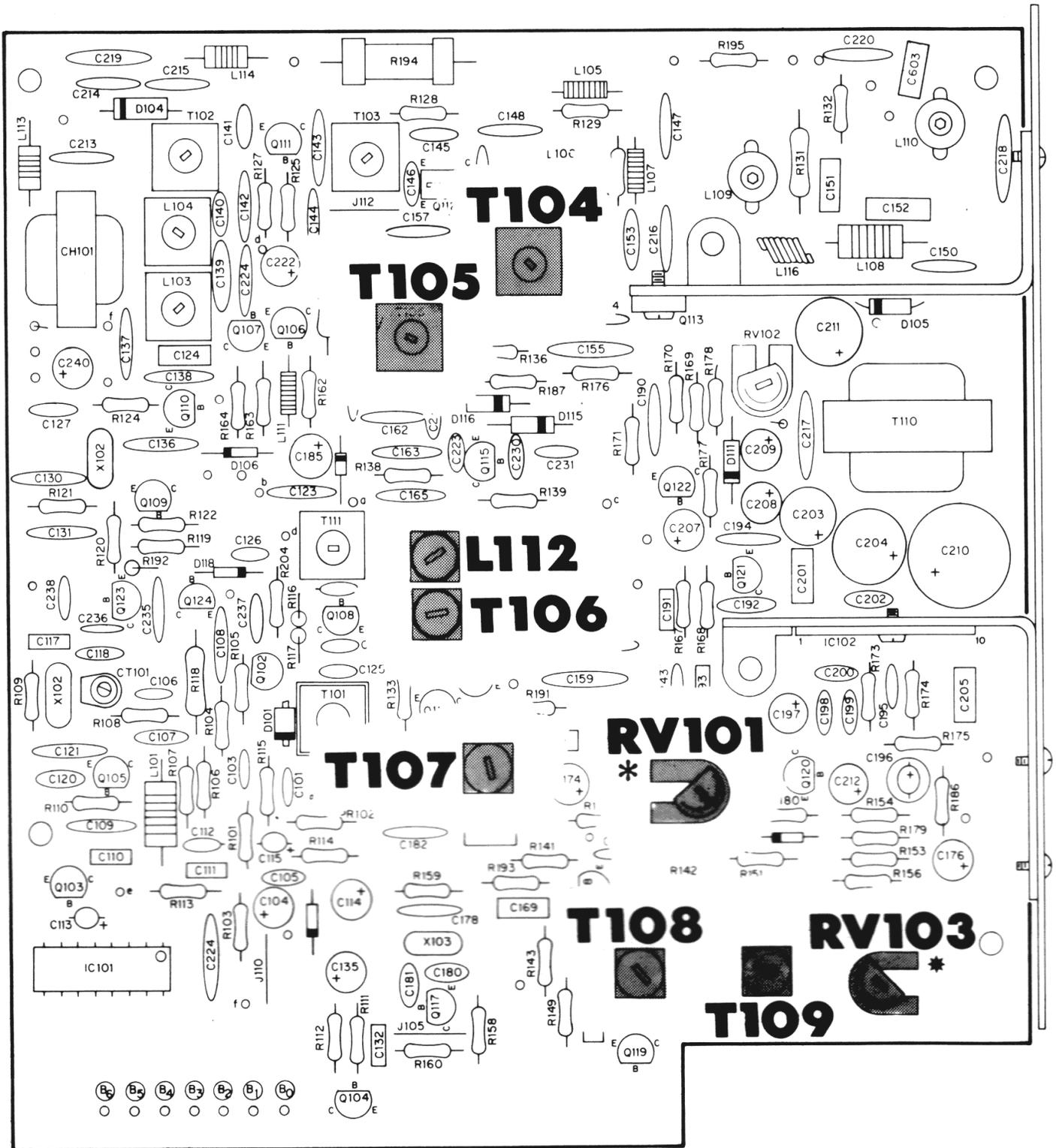
1. Apply a 10 μ V signal to the antenna connector and adjust RV103 so that the S-meter reads between S5 and S6.



NOTE:

*1. Test points and adjustment points for VCO alignment.

Figure 3-4. Components adjusted for Transmitter Alignment



NOTE:

*1. RV101 adjusted for Tight Squelch Alignment.

Figure 3-5. Components adjusted for Receiver Alignment

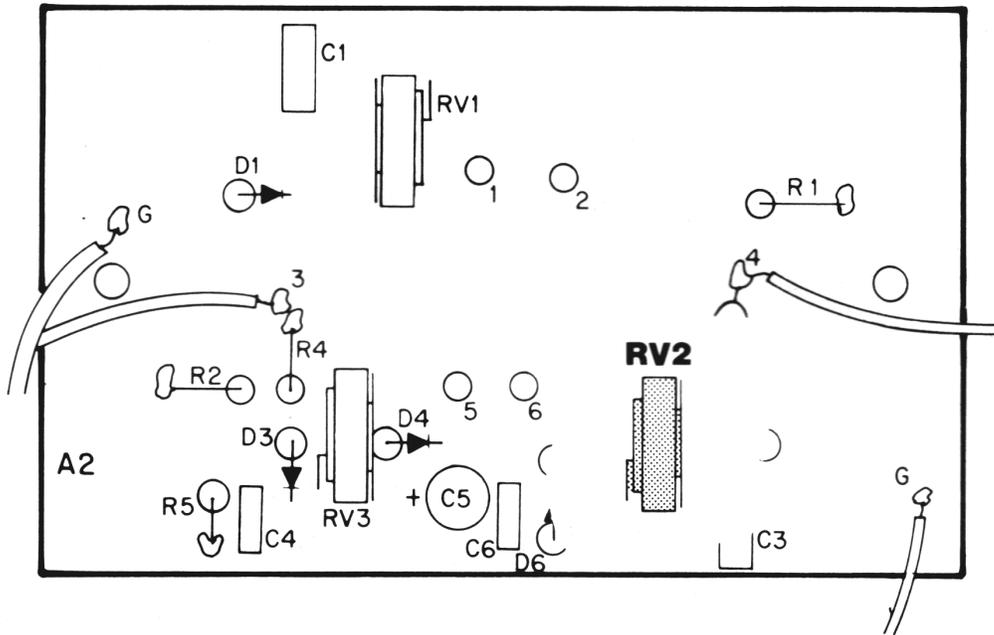


Figure 3-6. Component adjusted for SWR Meter Calibration

CHAPTER 4 — CHARTS AND DRAWINGS



Voltage Charts

**VOLTAGE MEASUREMENT CHART
MAIN P.C. BOARD**

Reference Designator	Mode	E	B	C
Q101	RX	0	.51	1.8
	TX	0	.52	1.8
Q102	RX	0	.37	2.45
	TX	0	.65	2.4
Q103	RX	0	.65	2.65
	TX	0	.65	2.7
Q104	RX	0	.57	3.0
	TX	0	.57	3.0
Q105	RX	2.3	2.8	3.7
	TX	2.2	2.6	3.8
Q106	RX	8.7	9.3	13.5
	TX	8.6	9.3	12.4
Q107	RX	8.7	8.2	1.28
	TX	8.6	7.9	8.6
Q108	RX	0	.54	.67
	TX	0	.72	3.15
Q109	RX	.22	.87	.94
	TX	2.7	3.8	4.4
Q110	RX	0	.67	1.28
	TX	2.0	2.7	8.6
Q111	RX	2.7	3.3	14.7
	TX	2.3	2.9	14.3
Q112	RX	0	0	14.5
	TX	0	-.46	11.1
Q113	RX	0	0	14.5
	TX	0	-.05	12.5
Q114	RX	1.9	2.5	13.5
	TX	3.55	.36	14.1
Q115	RX	1.9	2.5	12.8
	TX	.04	.36	14.1
Q116	RX	0	-.05	0
	TX	0	-.05	0
Q117	RX	1.6	2.1	3.7
	TX	1.6	2.1	3.7
Q118	RX	1.8	2.5	12.8
	TX	0	.36	14.1
Q119	RX	.6	1.27	13.5
	TX	0	.15	14.1
Q121	RX	0	.05	0
	TX	0	.23	0
Q122	RX	0	.59	.05
	TX	.01	.59	.23
Q120	squelched	0	.01	3.7
	unsquelched	0	.65	.01

Delta Tune				
Reference Designator	Mode	E	B	C
(-) Q123	RX	0	.61	.06
	TX	0	.45	30
Q124	RX	0	.59	.9
	TX	0	.7	.01
(0) Q123	RX	0	0	0
	TX	0	0	0
Q124	RX	0	.64	.01
	TX	0	.7	0
(+) Q123	RX	0	0	0
	TX	0	0	0
Q124	RX	0	.59	2.1
	TX	0	.7	.01

Front Panel Lamp Controller				
Reference Designator	Mode	E	B	C
Q1	RX	0.2	.76	.58
	TX	.02	.63	14.2
Q2	RX	.02	.68	13.4
	TX	.02	.78	.19

Power Supply Output	
RX	14.8
TX	14.5

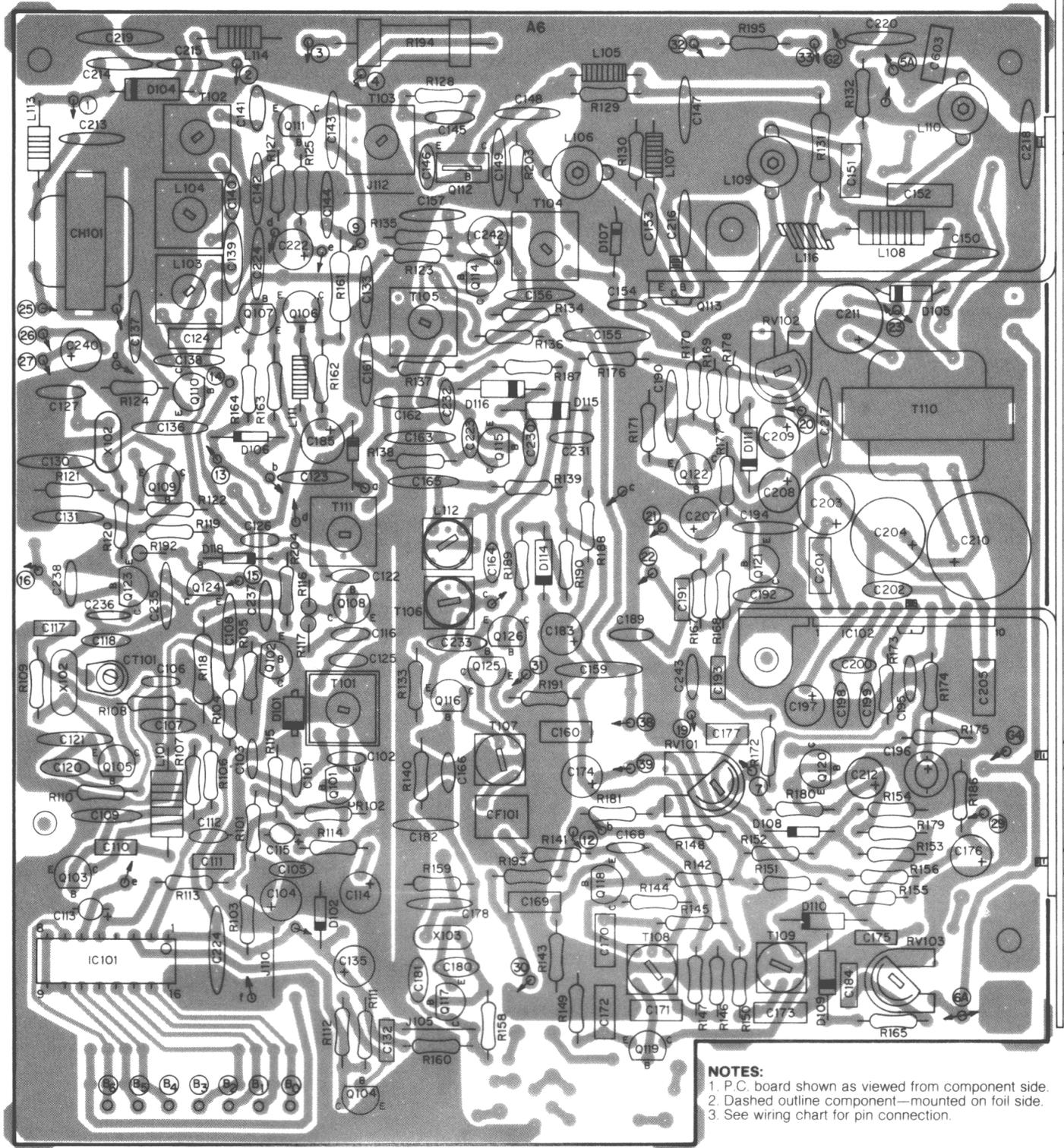
IC102 TA7205P										
Mode	Pin No.									
	1	2	3	4	5	6	7	8	9	10
RX	14.6	13.5	4.2	8.6	1.36	3.6	3.6	1.34	0	7.2
TX	14.2	13.1	4.1	8.4	1.34	3.5	3.5	1.36	0	7

Pin No.	Voltage	Channel Selected
1	5.3	N/A
2	2.5-2.7	1-40
3	3	N/A
4	5.3	N/A
5	4.15-1.45	1-40
6	5.2	N/A
7	5.3	28-40
8	5.3	1-27
9	5.3	1-27
10	5.3	1-27
11	5.3	14-27
12	5.3	20-27 36-40 8-13
13	5.3	4, 5, 6, 7, 11, 12, 13, 17, 18, 19, 23, 25, 32 33, 34, 35, 40
14	5.3	3, 6, 7, 9, 10, 12, 13, 16, 19, 22, 24, 26, 27, 30, 31, 34, 35, 38, 39
15	5.3	2, 5, 7, 8, 10, 13, 15, 16, 18, 21, 23, 24, 27, 29, 31, 33, 35, 37, 39
16	0	N/A

**Component Outline,
Main P.C. Board (A-6)**

**WIRING CHART
MAIN P.C. BOARD**

Pin No.	Wiring Connection
1	red wire to positive side of power regulator p.c. board
2	black to negative side of power regulator p.c. board
3	yellow wire to phone jack
4	yellow wire to speaker
5A	shielded wire/clear portion to pin 3 on swr p.c. board
5B	no wire
6A	two blue wires one to s-meter, one to mod cal switch
6B	no wire
7	white wire to squelch switch
8	T.P.
9	purple wire to pin 5 on edge control p.c. board
10	no wire
11	no wire
12	purple wire to pin 14 on channel selector p.c. board
13	green wire to mic jack
14	gray wire to pin 12 on channel selector p.c. board
15	orange wire to delta tune switch
16	yellow wire to delta tune switch
17	no wire
18	no wire
19	blue wire to volume switch
20	red wire to pin 25 on main p.c. board
21	green wire to volume control switch
22	orange wire to mic gain switch
23	two yellow wires, one to pin 32 on main p.c. board, one to pa jack
24	no wire
25	red wire to pin 20 on main p.c. board blue wire to pin 6 on edge control board
26	orange wire to pa jack
27	green wire to pin 7 on edge control p.c. board
28	no wire
29	gray wire to pin 43 on edge control p.c. board
30	red wire to delta tune
31	white wire to pin 3 on edge control p.c. board
32	yellow wire to pin 23 on main p.c. board
33	orange wire to mic jack
34	through
37	no wire
38	blue wire to rf gain switch
39	green wire to rf gain switch
40 and 41	no wire
G1	no wire
G2	shielded wire/shielded portion to ground on swr p.c. board black wire to mic jack
G3	no wire
G4	black wire to swr meter black wire to squelch switch
B0	black wire to pin 1 on channel selector p.c. board
B1	brown wire to pin 2 on channel selector p.c. board
B2	red wire to pin C on channel selector p.c. board
B3	orange wire to pin 4 on channel selector p.c. board
B4	yellow wire to pin 5 on channel selector p.c. board
B5	green wire to pin 3 on channel selector p.c. board
B6	blue wire to pin 6 on channel selector p.c. board



- NOTES:**
1. P.C. board shown as viewed from component side.
 2. Dashed outline component—mounted on foil side.
 3. See wiring chart for pin connection.

Figure 4-1. Component Outline, Main P.C. Board (A-6)