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**A and X 40 CHANNEL  
ADDENDUM  
TO  
23 CHANNEL SERVICE MANUALS**

**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

### Application

This service bulletin contains alignment procedures, adjustment drawings, schematics and a parts list. The alignment procedures are valid for the following models:

Chapter 2.....Models 2680A, 2680X, 2682X, 2682B, 2683A, 2701X, 2683X, 3084X, 3084B, 3087A and 3087X

Chapter 3.....Models 2679A, 2679X and 2710X

Chapter 4.....Models 681A, 681X, 682A and 682X

For operating procedures and theory of operation, see the applicable service manual.

**WARNING:** This manual is for use in alignment ONLY! Any attempt to use this manual for conversion of 23 channel models is unlawful.

### 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 completion 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 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

## CHAPTER 2 — REALIGNMENT PROCEDURES FOLLOWING MODIFICATION OF MOST MOBILE MODELS

### General

These procedures must be followed to align the transceivers with the exception of models 2679A, 2679X, 2710X, 681A, 681X, 682A and 682X. Alignment should not be undertaken unless the technician has adequate test equipment and a full understanding of the circuitry of the transceivers.

**IMPORTANT:** Tuning adjustment of these transceivers "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.

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 transceivers.

Audio Signal Generator, 1 kHz

AC VTVM, 1 mV measurable

DC Ampere Meter, 2A

Variable Regulated Power Supply, DC 8-15V, 2A or higher

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 20 kohm/V

All test equipment should be properly calibrated.

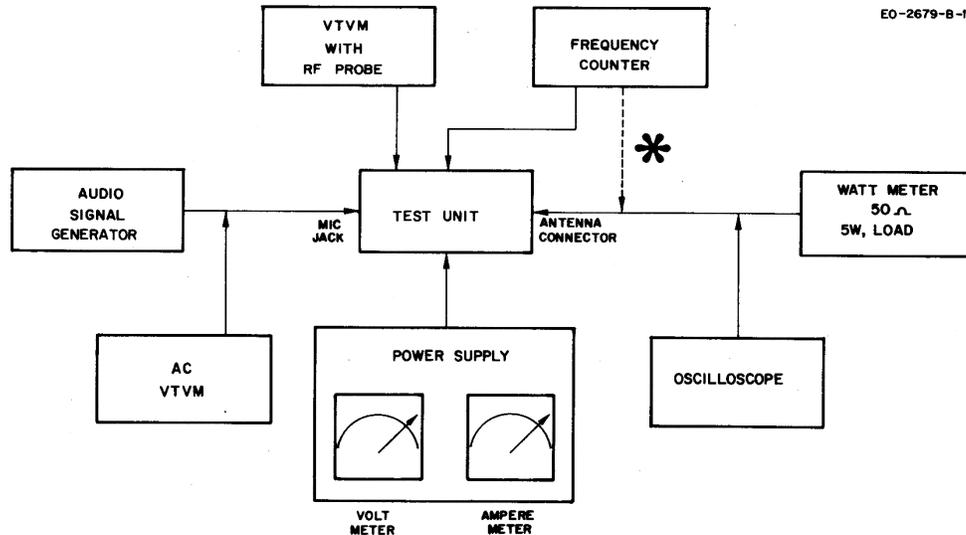
**NOTE:** Test voltage is 13.8 VDC unless otherwise specified.

### Transmitter Alignment Procedure

#### **Equipment Set-Up**

Refer to figure 2-4 for location of components to be adjusted for transmitter alignment.

Connect test equipment as shown in figure 2-1



**Figure 2-1. Equipment Set-Up, Transmitter Alignment**

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

### ***Pre-Alignment Frequency Check***

Before alignment, use a high input impedance frequency counter through a 100 pF capacitor connected in series with the 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.
2. Disconnect C103 from the base of Q102. Check to read 11.8066 MHz at the base of Q102. If necessary, adjust C119 to obtain this frequency. Reconnect C103.
3. Q108 base, transceiver on channel 1, check to read 37.66 MHz.

### ***VCO Alignment***

1. Connect VOM (DC 10V range) 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.
6. The VOM should now read  $4.5V \pm .4V$ .
7. Readjust T101 if needed, and recheck the channel 1 level.

### ***RF Output Adjustment***

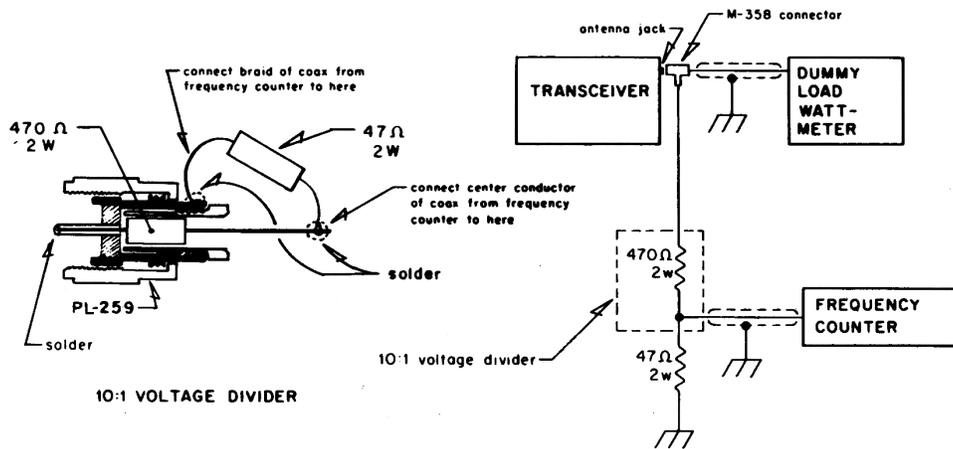
1. Adjust the power supply voltage to 8.0 volts.
2. Connect the VTVM RF probe between the base of Q111 and ground.
3. Set the Transceiver Channel Selector to channel 19. Perform the following procedures on channel 19:

4. Key the transmitter
5. Adjust the slugs of L103, L104, T102 and T111 for a maximum reading on the VTVM.
6. Connect the VTVM RF probe between the base of Q112 and ground.
7. Adjust the slug of T103 for a maximum reading on the VTVM or wattmeter.
8. Adjust L106, L109 and L110 for maximum RF power output as indicated on the wattmeter.
9. Raise the power supply voltage to 13.8V.
10. Repeat steps 2 through 8.
11. Back off L109 (clockwise) for a reading of 4.0 watts RF power output.
12. Readjust L110 for maximum power output.
13. Repeat steps 11 and 12 until the maximum power output is 4.0 watts with L110 peaked for maximum output. Total transceiver current at this setting should not exceed 1.2A.
14. Check power output on channels 1 and 40. Power should not be less than 3.6 watts. If less, repeat alignment procedures.

**Transmitter Frequency Check**

1. Turn the transceiver off.
2. Connect the dummy load and frequency counter to the antenna.

EO-0672-A-010



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

3. Turn transceiver on.
4. Key the transceiver with the microphone PTT button.
5. Check the frequency of each channel with the following chart. Frequencies should be within  $\pm 800\text{Hz}$  at  $25^\circ\text{C}$ .

## 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

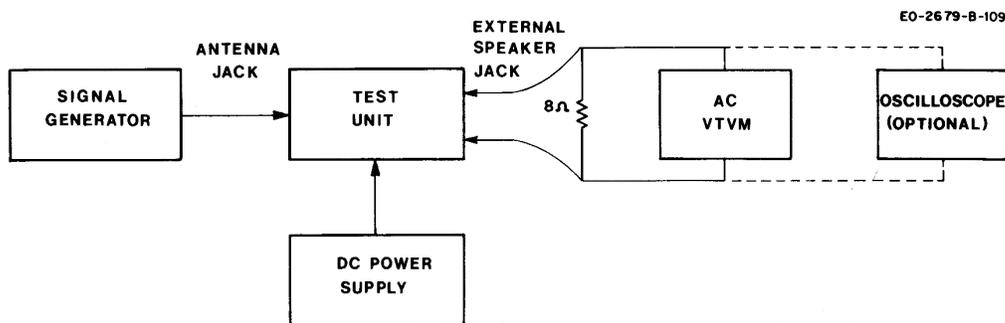
### **Modulation Sensitivity Adjustment**

1. Place the unit in the transmit mode and apply a 20 mV, 1 kHz signal to wire wrap pin 22 on the radio PC board.
2. Adjust RV-102 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 2-5 for the location of components to be adjusted for receiver alignment.



**Figure 2-3. Equipment Set-Up, Receiver Alignment**

#### **Receiver Alignment**

1. Set the signal generator to 27.115 MHz, 1 kHz, 30% modulation and set the transceiver to channel 19.

**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, T108 and T109 for maximum audio output as indicated on the AC VTVM (or oscilloscope if used).

**Tight Squelch Adjustment**

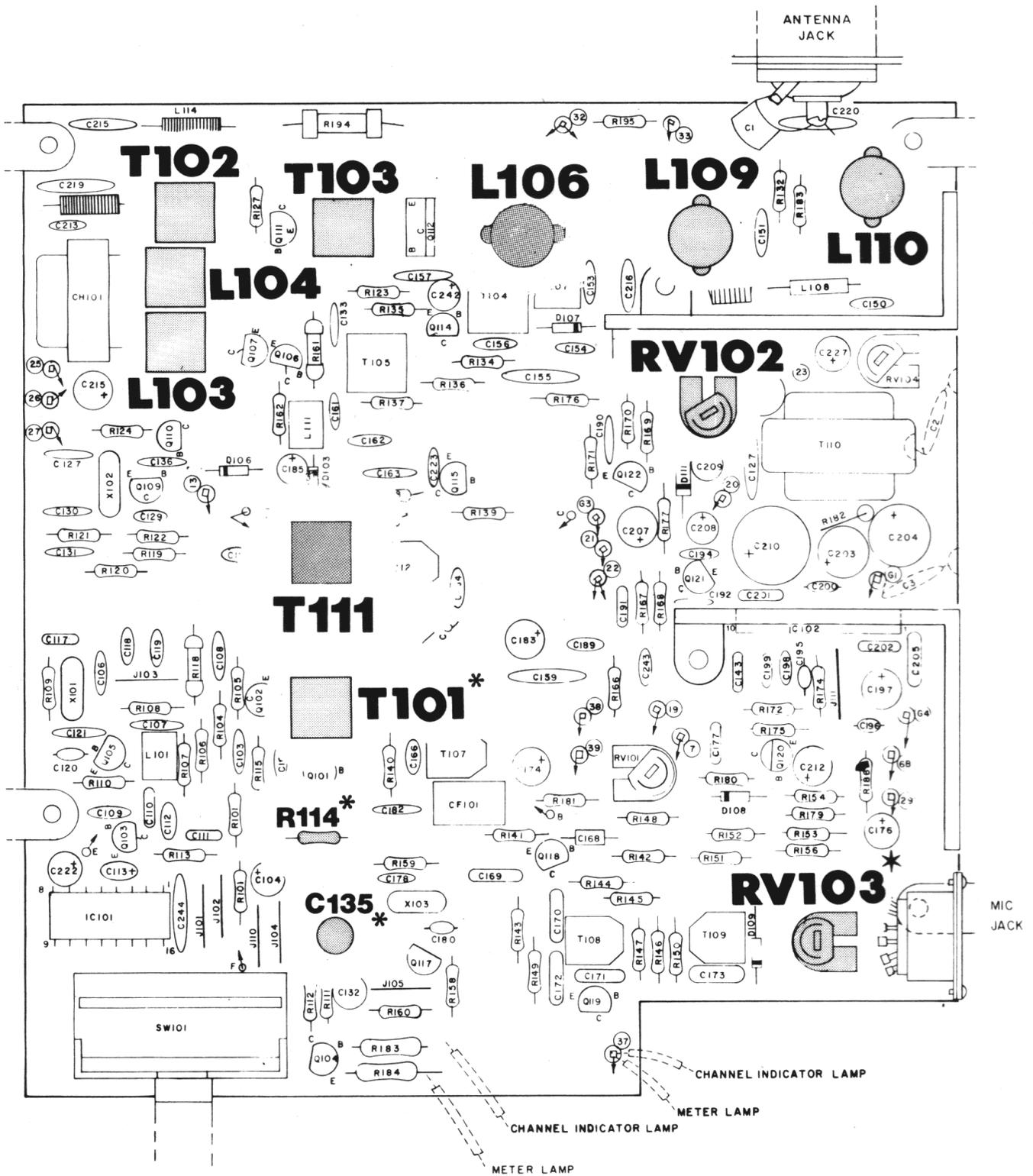
1. Set the signal generator to provide an RF input signal of 50 uV (1 kHz, 30% modulation).

2. Rotate the squelch control fully clockwise.

3. Adjust RV101 so that the squelch just breaks with the 50 uV signal input.

**N — CODE FREQUENCY CORRELATION CHART**

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



**NOTES:**

- ‡ T101 adjusted in VCO Alignment only.
- \*R114 and C135 are connection points for VCO Alignment.
- RV103 not adjusted in these models.

**Figure 2-4. Components Adjusted for Transmitter Alignment**

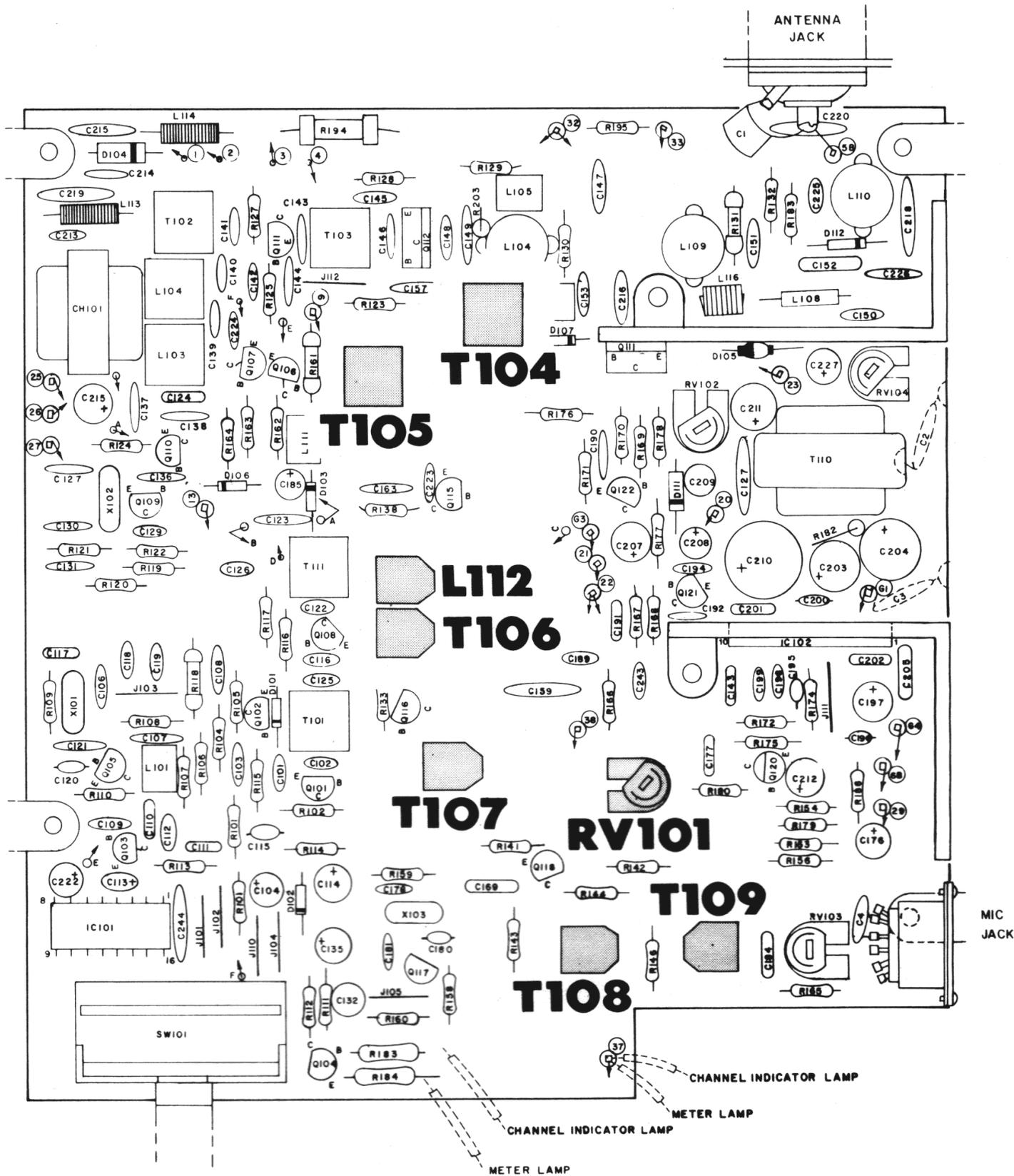


Figure 2-5. Components Adjusted for Receiver Alignment

## CHAPTER 3 — REALIGNMENT PROCEDURES FOR MODELS 2679A, 2679X, and 2710X FOLLOWING MODIFICATION

### General

These procedures must be followed to align the transceivers. 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.

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 measureable

DC Ampere Meter, 2A

Variable Regulated Power Supply, 8-15 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

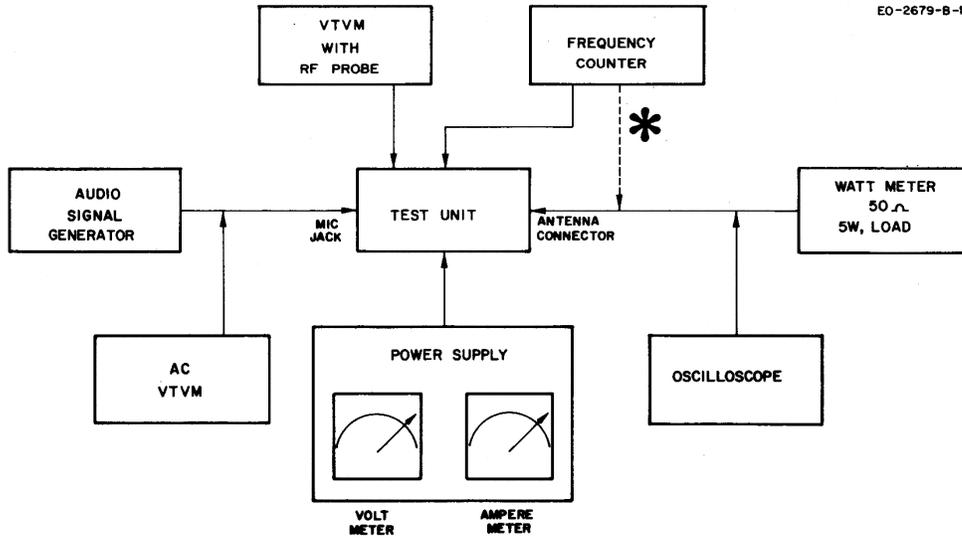
All test equipment should be properly calibrated.

**NOTE:** Test voltage is 13.8 VDC 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.



**Figure 3-1. Equipment Set-Up, Transmitter Alignment**

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

#### ***Pre-Alignment Frequency Check***

Before alignment, use a 10:1 attenuator oscilloscope probe connected to the 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.
2. On the emitter end of R110, check to read 11.8066 MHz.

#### ***VCO Alignment***

1. Connect a VTVM (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 VTVM between ground and R114 (TP-8 side).
4. Adjust T101 to obtain  $1.5V \pm 0.1V$ .
5. 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***

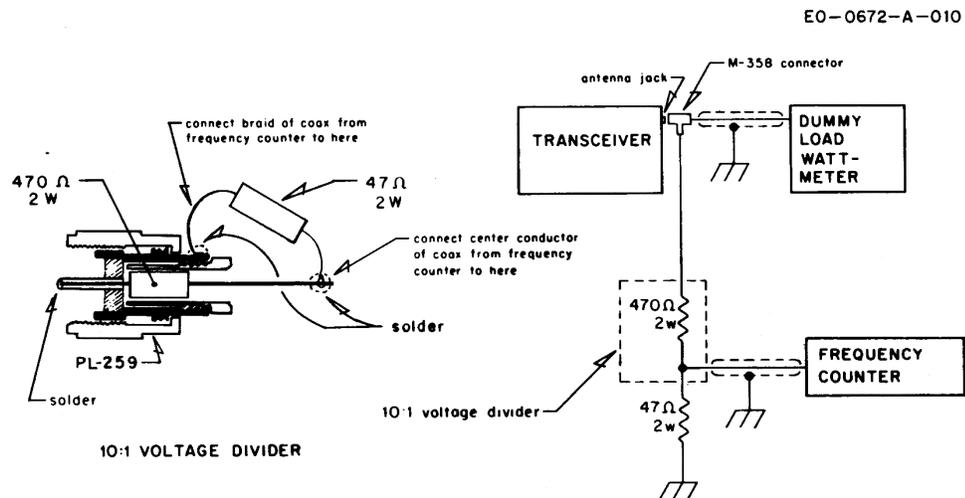
1. Adjust the power supply voltage to 8.0 volts.
2. Connect the VTVM RF probe between the base of Q111 and ground.
3. Set the Transceiver Channel Selector to channel 20. Perform the following procedures on channel 20.
4. Key the transmitter.
5. Adjust the slugs of L103, L104, T102 and T111 for a maximum reading on the VTVM.
6. Connect the VTVM RF probe between the base of Q112 and ground.

7. Adjust the slug of T103 for a maximum reading on the VTVM.
8. Adjust L106 for maximum RF output as indicated on the wattmeter.
9. Adjust L109 and L110 for maximum RF power output as indicated on the wattmeter.
10. Raise the power supply voltage to 13.8V.
11. Repeat steps 2 through 7 only.
12. Back off L110 (counterclockwise) for a reading of 4.0 watts RF power output.
13. Readjust L109 for maximum power output.
14. Repeat steps 12 and 13 until the maximum power output is 4.0 watts with L109 peaked for maximum output.

Total transceiver current at this setting should not exceed 1.2A.

### **Transmitter Frequency Check**

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



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

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

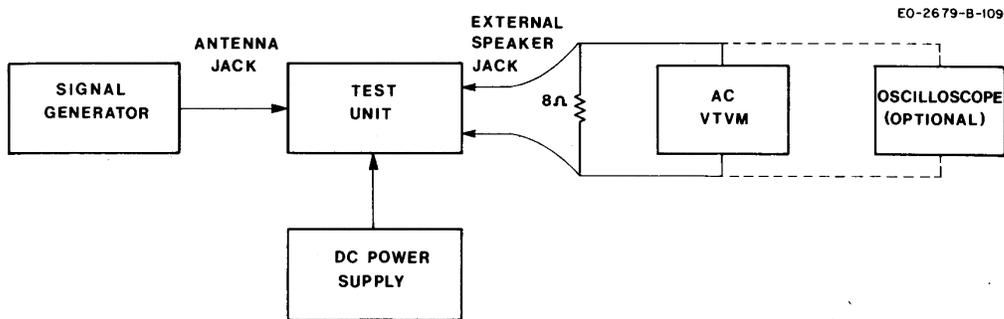
### **Modulation Sensitivity Adjustment**

1. Place the unit in the transmit mode and apply a 20 mV, 1 kHz signal to wire wrap pin 22 on the radio PC board.
2. Adjust RV-102 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, Receiver Alignment**

#### **Receiver Alignment**

1. Set the signal generator to 27.115 MHz, 1 kHz, 30% modulation and set the transceiver to channel 13.

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

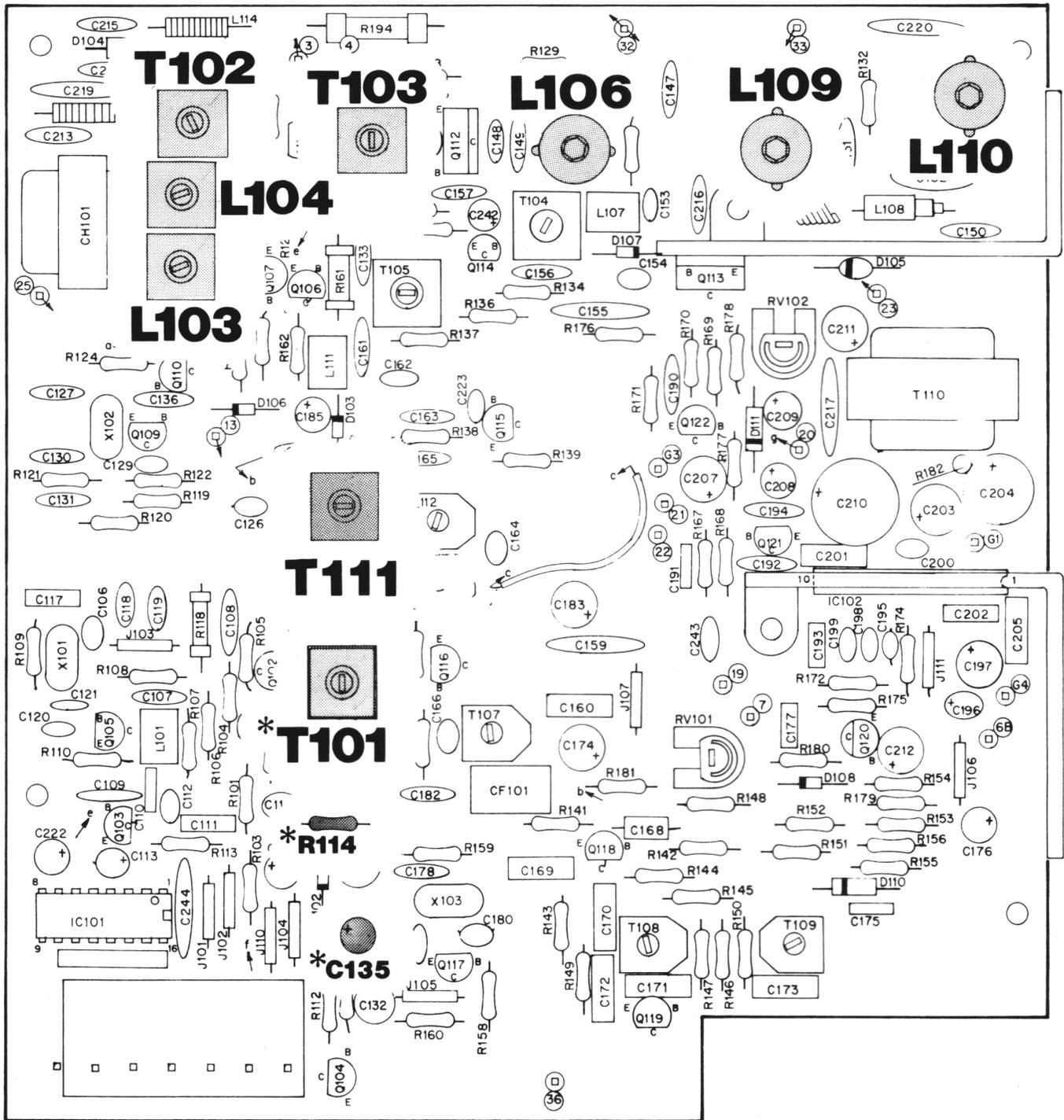
2. Adjust T104, T105, L112, T106, T107, T108 and T109 for maximum audio output as indicated on the AC VTVM (or oscilloscope if used).

**Tight Squelch Adjustment**

1. Set the signal generator to provide an RF input signal of 100 uV (1 kHz, 30% modulation).
2. Rotate the squelch control fully clockwise.
3. Adjust RV-101 so that the squelch just breaks with the 100 uV signal input.

**N-Code Frequency Correlation Chart**

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



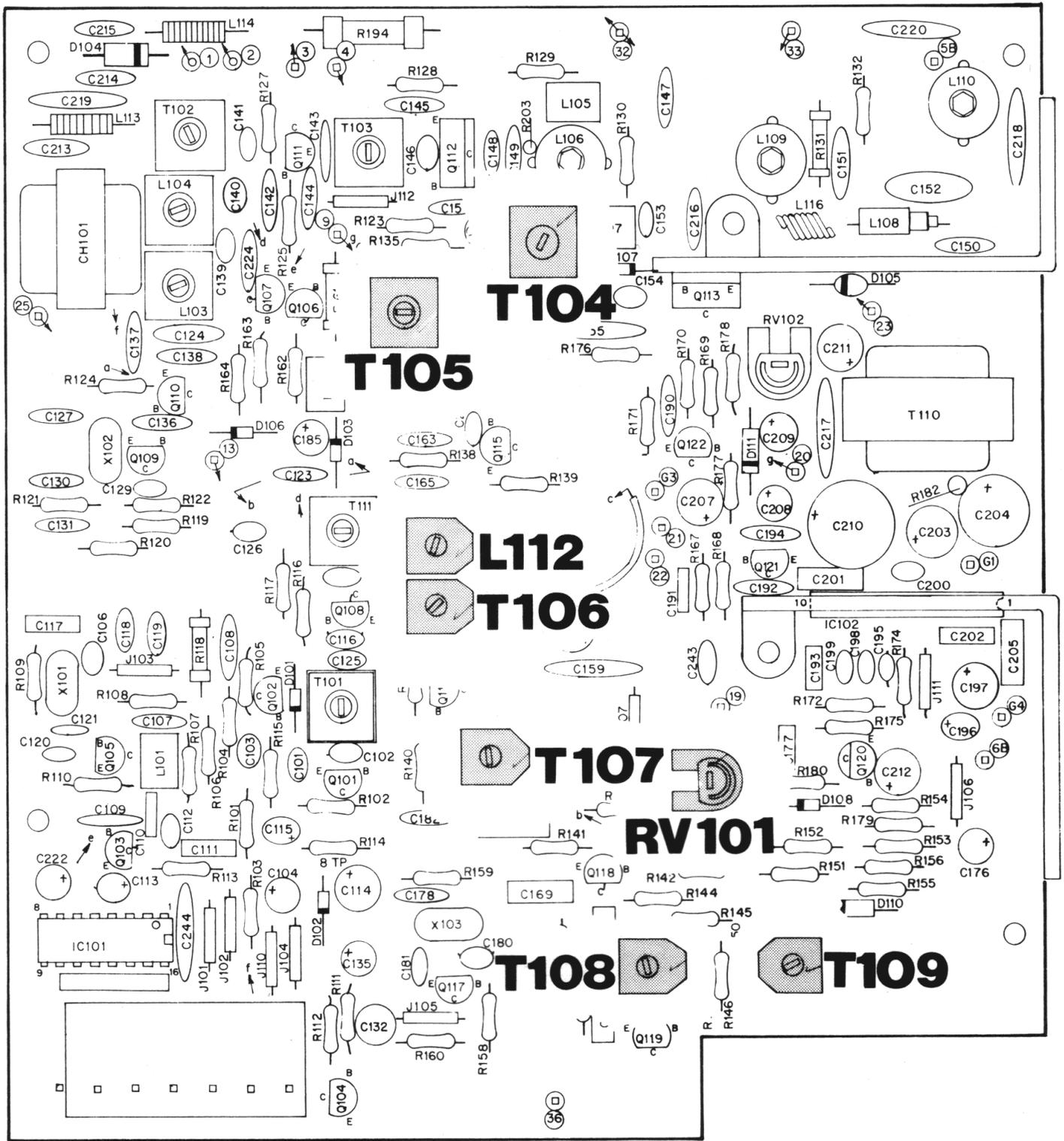
(FRONT PANEL)

**NOTES:**

- \*T101 adjusted in VCO Alignment only.
- \*R114 and C135 are connection points for VCO Alignment.

**Figure 3-4.**

**Components Adjusted for Transmitter Alignment**



(FRONT PANEL)

Figure 3-5.

Components Adjusted for Receiver Alignment