hy-gain II and III by hy-gain

MODELS 2702 and 2703
CITIZENS TWO—WAY RADIO
40 channel 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

PN 820189

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CHAPTER 1 — GENERAL INFORMATION

Introduction

This service manual contains all the information needed to service and repair the Hy-Gain II and Hy-Gain III (Models 2702 and 2703). 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 II and III radios are full 40 channel transceivers transmitter type accepted and receiver certified for Class D Citizens Radio Service as designated by the Federal Communications Commission (FCC).

They are compact mobile units, completely solid-state and highly reliable with low power consumption. The PLL (Phase Locked Loop) synthesizer provides immediate operation on all 40 channels. Features include an Automatic Noise Limiter (ANL), an RF Gain Control, and Public Address capabilities. In addition, Model 2703 includes a Noise Blanker circuit and an SWR meter. Output jacks for an optional telephone-style handset and an external speaker are included. Use the units with 12 VDC (nominal), either negative or positive ground.

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 C.O.D. 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 - 27.405 MHz)
Antenna impedance .... 50 ohms nominal
Power requirements.................. 11.5 to 14.5 VDC negative or positive ground
Compliance .... type accepted under the FCC Rules and Regulations, Part 95

Receiver Section

Circuitry .... dual conversion superheterodyne with RF amplifier stage and 455 kHz ceramic filter
Sensitivity........................... 0.7 uV for 10 dB S/N ratio
Intermediate frequency .... 1st IF - 10.695 MHz
2nd IF - 455 kHz
Audio output .... 3 watts maximum
Current drain, rèceive .... 200 mA (no signal)

Transmitter Section

RF power output..................... 4 watts
Emission 6A3
Spurious response rejection .... all harmonic and spurious suppression better than FCC requirements
Modulation.......................... AM 90% typical
Current drain, transmit .... less than 1.1 amp at 13.8 VDC

CHAPTER 2 - THEORY OF OPERATION

General

The theory of operation of the Hy-Gain II and Hy-Gain III (Models 2702 and 2703) transceivers is divided into three sections: the Phase Locked Loop frequency synthesizer, the Receiver, and the Transmitter. This material covers the functioning of the transceivers 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 diagrams. Figure 2-2 and 2-3, for visual reference to the theory of operation.

Phase Locked Loop Frequency Synthesizer

Refer to the PLL circuit block diagram, Figure 2-1, for visual reference to the 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 two crystal oscillators to perform its frequency generating function.

The 10.24 MHz Oscillator, Q1, provides a reference for the PLL and an injection frequency for the Second Receiver Mixer, Q10.

The PLL circuit generates the operating frequencies needed for the transceiver in accordance with the code fed to the programmable divider, a portion of IC1, from the Channel Selector switch, SW-1a. Table A shows the following for each channel: the channel number, channel frequency, "N" digital code, VCO frequency, channel switch output, and the Receiver first local oscillator frequency.

For example, assume that channel 1 has been selected. The channel frequency is 26.965 MHz, the VCO frequency is 17.18 MHz, and the "N" code is 330. The Channel Selector switch programs the programmable divider for a division ratio of 330. The 10.24 MHz reference frequency is fed to the PLL IC, IC1. It is divided internally by 1024, producing a 10 kHz reference signal. The output of the VCO, D1, is mixed in the PLL Mixer portion of IC2 with the doubled output of the Reference Oscillator, Q1. The mixed and converted output difference frequency, 3.30 MHz, is then fed back to the PLL IC, IC1, through a buffer circuit in the VCO/Mixer IC, IC2, and a Low Pass Filter circuit. In the PLL IC, IC1, the output difference frequency goes through a buffer circuit to the programmable divider, and is divided into a low frequency by the predetermined "N" code. The low frequency is fed to the phase detector and compared with the reference frequency.

The phase detector, which is internally located in the PLL IC, IC1, generates a DC output voltage corresponding to the phase difference between the two signals applied. The DC output is then applied to the VCO circuit, IC2, through a low pass filter. The VCO frequency will change so that the VCO frequency coincides with the reference frequency. The Phase Locked Loop circuitry will lock when the frequencies coincide with each other. When this happens, the VCO circuit provides stable frequencies over the band of 17.62 MHz (depending upon the "N" code or channel selected).

Assume that the channel is changed to channel 40. The Channel Selector switch now provides a code that will produce a division ratio of 286. At this instant the VCO frequency is at 17.18 MHz, which is mixed with the doubled output of the 10.24 MHz Reference Oscillator, Q1. Again the PLL Mixer produces an output of 3.30 MHz. The 3.30 MHz signal is divided by 286 to produce a frequency of 11.54 kHz.

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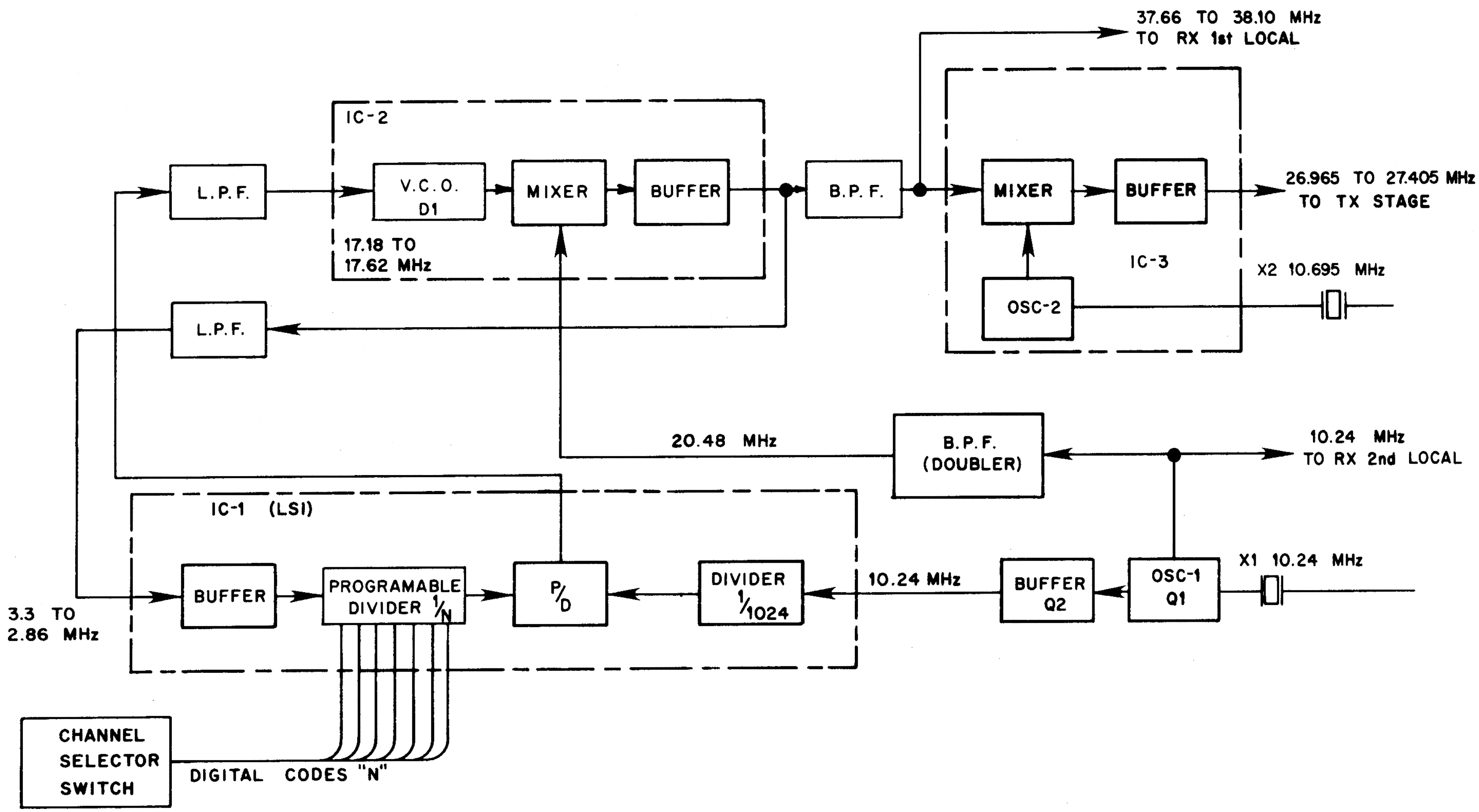

Figure 2-1. PLL Circuitry, Model 2702 and 2703

The 11.54 kHz output, along with the 10 kHz obtained from the Reference Oscillator, Q1, 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.

There is now a new DC voltage set up to tune the VCO frequency to 17.62 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 17.62 MHz VCO output is mixed with 20.48 MHz doubled output from the Reference Oscillator output to produce 38.10 MHz, which is fed to the First Receiver Local Mixer, Q9; and in the transmit mode, the 38.10 MHz is mixed with the 10.695 MHz output of the second oscillator portion of IC3 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. A variable squelch circuit is included to quiet the receiver between transmissions.

In the receive mode 13.8 VDC is supplied to IC4, Q8, Q9, Q11, Q12 and Q6, the AVR. The AVR supplies regulated voltage to the synthesizer stages and to the Reference Oscillator, Q1. A bias voltage is also applied to the base of the Transmit switch, Q7, 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 L11, L12, L13, C46, and C47 matches the antenna impedance to the RF Amplifier, Q8, and its tuned circuit, C51 and T5. D7 and D6 are a signal overload protective circuit.

The output of the RF Amplifier, Q8, and the buffered mixer in IC2 (which in this case could be called the "first oscillator frequency") is applied to the First Receiver Mixer, Q9, and produce an output of 10.695 MHz, which is the first IF.

The first IF passes through tuned circuits, L14 and T7. It is then applied to the Second Receiver Mixer, Q10, which has a second input of 10.24 MHz from the Reference Oscillator, Q1. The output of Q10 is 455 kHz, which is the second IF.

The second IF passes through the Ceramic Filter, CF1, and is amplified by the First and Second IF Amplifiers, Q11 and Q12. The amplified signal is then fed to the Detector, D9. The Detector, D9, establishes an automatic gain control, AGC, voltage and recovers the audio from the modulated signal.

The AGC voltage keeps the output volume of the receiver at a constant level under variations in input signal and also controls the Squelch Switch, Q13.

The squelch functions in the following manner: in the receive mode, a bias voltage from Q6 is applied to the base of Q13, as determined by VR2. In the absence of a signal the base of Q13 is positively biased and is on. This biases the squelch circuit inside the Audio Amplifier, IC4, which turns off the audio portion and quiets the receiver. When a signal is received, the AGC voltage developed by D9 biases Q13 off. This biases the squelch circuit inside IC4 so that the audio portion is turned on and the signal is heard.

The recovered audio from the Detector, D9, passes through a series Automatic Noise Limiter (ANL), D10. The output of the ANL goes through the Volume Control, VR1, and is RC coupled to the Audio Amplifier, IC4. The amplified AF output from IC4 passes through the audio transformer, T11, to be applied to the speaker jacks and the speaker.

Transmitter

Switching to the transmit mode is accomplished in the following manner: when the PTT switch is closed, the base of the DC switch, Q7, is grounded. This establishes forward bias which causes Q7 to conduct. Regulated voltage from the Automatic Voltage Regulator, Q6, is then supplied through Q7 to the Transmit Oscillator Mixer, IC3. When the PLL IC, IC1, is locked and IC3 operates in the transmit mode, a control voltage actuates the DC switch, Q22, and allows RF drive to go to Q3, the RF Pre-driver, the RF Driver, Q4, and the RF Power Amplifier, Q5.

The operating channel is determined by the PLL frequency synthesizer, IC1. The VCO frequency is mixed in IC2 with the 20.48 MHz signal to yield a 37.66 to 38.10 MHz signal which is applied to IC3. In IC3 the signal is mixed with a 10.695 MHz signal from the crystal, X2, and an internal oscillator to provide the 26.965 to 27.405 MHz transmit frequency. The transmit frequency from IC3 passes through the filter circuit of L5 and T3 and is applied to the RF Pre-driver, Q3. The filter circuit partially removes spurious signals from the transmit frequency. The Pre-driver, Q3, and the RF Driver, Q4, form two stages of amplification leading to the final stage. The filter circuit of T4 follows Q3, and L7 follows Q4. These two circuits filter out the remaining spurious signals from the transmit frequency.

From the RF Driver, Q4, the signal is applied to the final stage, the RF Power Amplifier, Q5. 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 L11, C46, C47, L12, C14 and L13, and then to the antenna jack.

The transmit signal is modulated in the following manner: the microphone output is applied to the Audio Amplifier, IC4. The output of IC4 is applied to the collectors of the RF Driver, Q4, and the RF Power Amplifier, Q5, through the audio output transformer, T11. Control voltages for the Automatic Level Compensation circuit (ALC) composed of Q15 and Q14, come from the Detector Diodes, D11 and D12. 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. Q14 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.

Noise Blanking Circuit (2703 only)

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 ANL-NB switch, S2, is in the NB position, noise impulses will be picked up through capacitor C134 and applied to the base of the Noise Amplifier, Q18. Q18 will amplify the impulse which is then applied to Voltage Detectors, D18 and D19. D18 and D19 rectify the amplified impulses, and the resultant DC voltage is applied to the Noise Blanker switch, Q19. Q19 then turns on the Noise Blanker, Q20. When Q20 operates, it causes T8 to short circuit to ground, thereby inactivating the receiver circuit for a short time. The noise impulse duration determines the cut-off time the receiver will be silenced during reception of noise impulses.

Meter Function in Transmit (2703 only)

A fraction of the RF power output is applied to diode D5 through the junction of L12 and C48. D5 rectifies the RF signal into a DC voltage. The DC voltage is then applied to the meter terminals through the meter adjustment trimmer, RV4, when the Meter Mode switch, S3, is placed in the CB position. In this way, the RF output will be indicated on the meter. When S3 is placed in the CAL position, the RF signal is inductive/capacitive coupled in the p.c. board, PTSR006AOX. This signal is rectified by D502 into a DC voltage. The DC voltage goes through R503 on the p.c. board to the calibration variable resistor, VR4, on the front panel. Placing the meter pointer in the "SET" position on the meter scale by adjusting VR4, is to predetermine the standard reference level in terms of forward traveling RF power. When S3 is placed in the SWR position, another DC voltage is produced by rectifying the reflected antenna energy applied to diode D501. The inductive/capacitive coupling circuit is switched to the SWR indication circuit, consisting of RV501, VR4 and the meter, thus giving the SWR of the antenna system.

TX Lamp Circuit (2703 only)

When the Switching transistor, Q7, supplies DC voltage to the transmit circuit, the voltage is also applied to terminal 3 on EPO-0649. This makes Q2 (on EPO-0649)activate. The TX lamp, PL4, will light indicating a transmit condition. At the same time, when the PTT switch on the microphone is pushed, power is supplied through the modulation circuit to PL3, modulation lamp, thus varying the brightness of the lamp during transmission as a visual indication of modulation.

RX Lamp Circuit (2703 only)

When the AVR transistor, Q6, supplies DC voltage to the receive circuit, voltage is applied to terminal 1 on EP0-0649. This makes Q1 conduct and lights the Receiver Lamp, PL2.

PA Amplifier and Switch

When the PA mode is selected by placing S3 in the PA position, the PA Gate Switch, Q4, is grounded. With Q4 grounded all other functions of the unit except the PA are inoperative.

The PA Audio Gate, Q3, functions as an amplifier for the microphone when it is not clamped to AC ground by Q4. The audio signal from the microphone is amplified by Q3 and is then applied to the Audio Amplifier, IC4. The audio signal is amplified by IC4 and is then applied to the PA jack, J4.

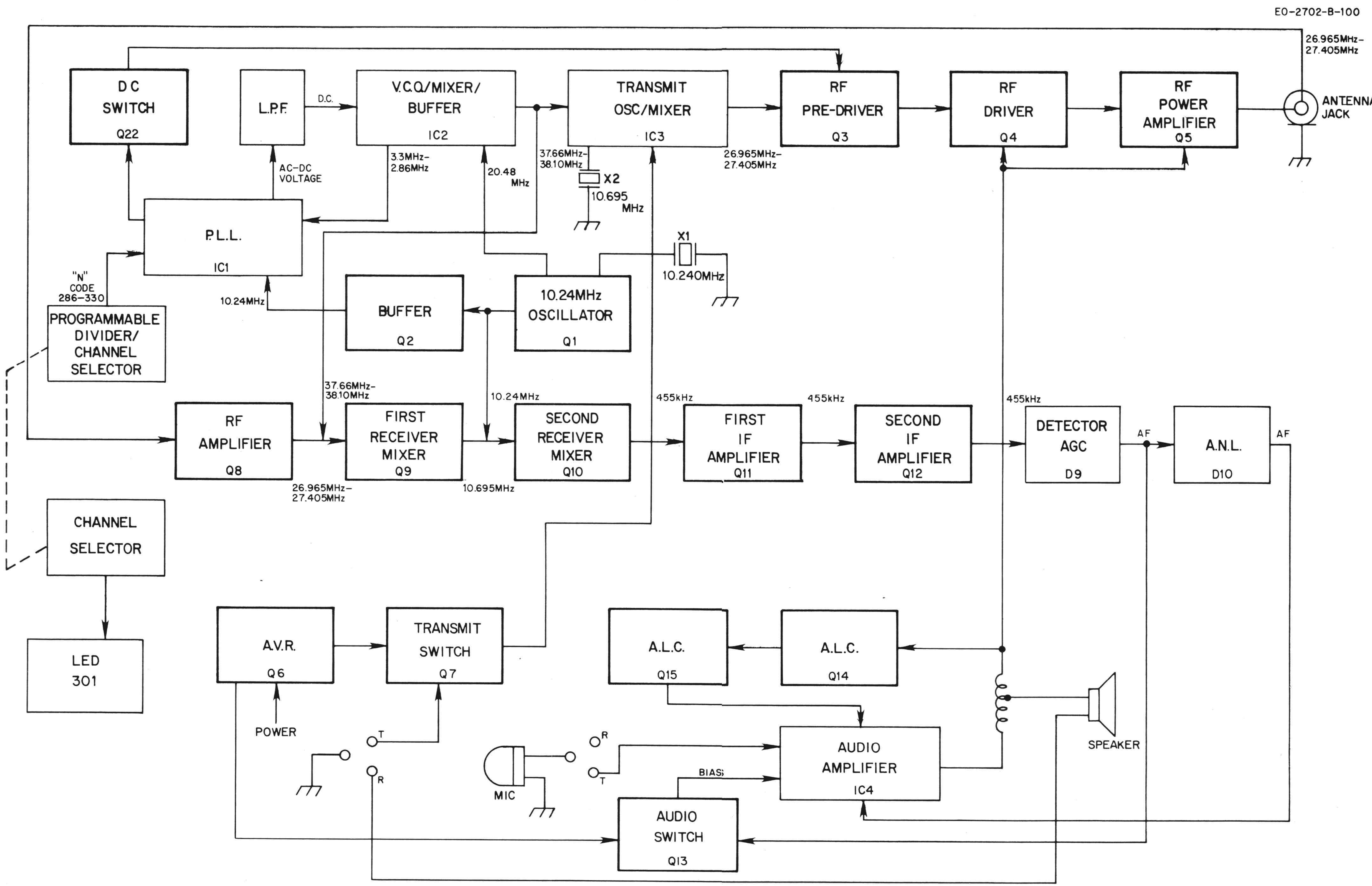

Figure 2-2. Block Diagram, Model 2702

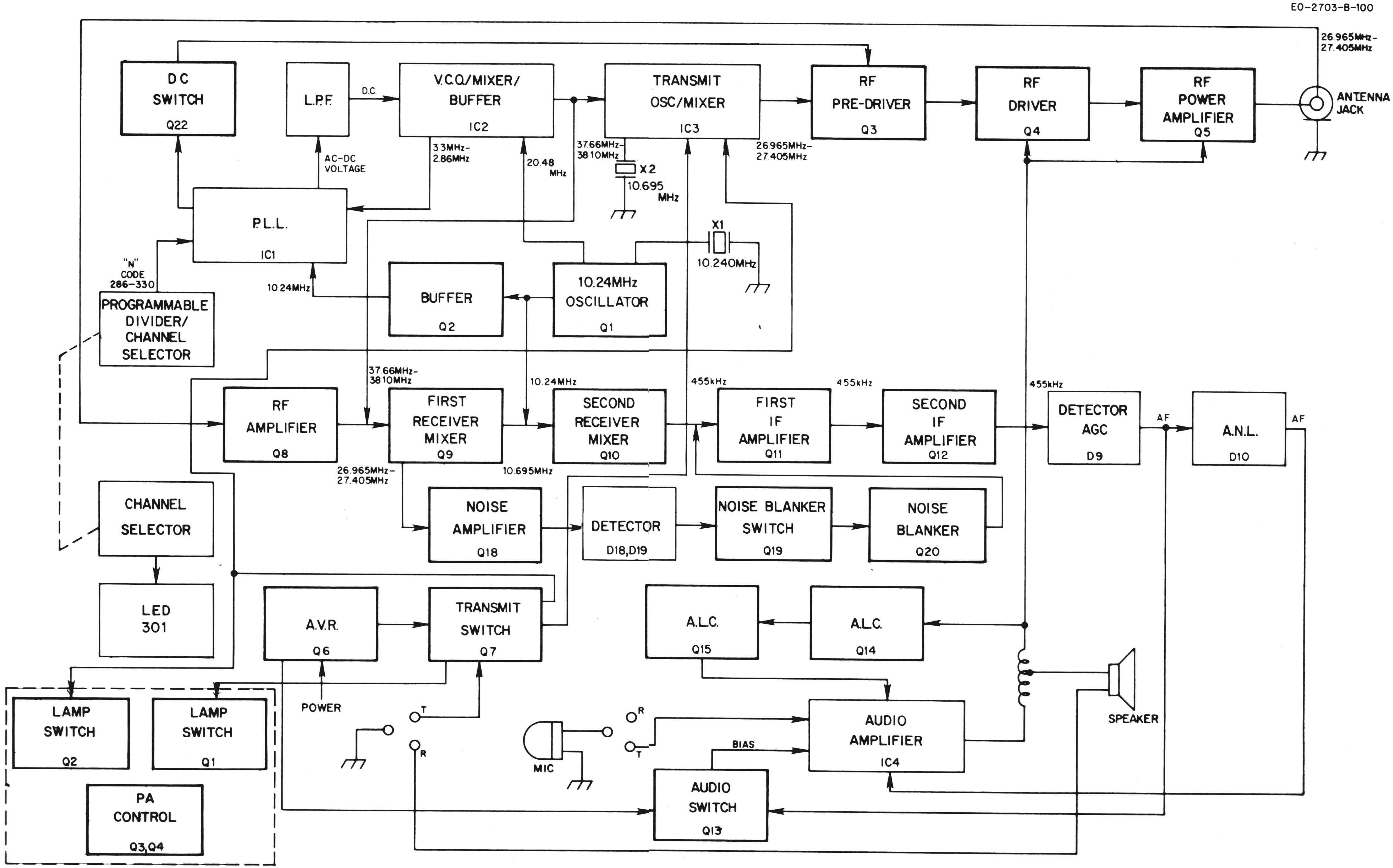

Figure 2-3. Block Diagram, Model 2703

Table A

Channel Frequency and "N" Code Chart

Channel No.	Channel Freq. (MHz)	"N" Digital Codes	VCO Freq. (MHz)	Channel SW. Output A	B	C	D	A	B'	C'	RX 1st Local Freq. (MHz)
1	26.965	330	17.18	0	1	0	1	0	0	1	37.66
2	26.975	329	17.19	1	0	0	1	0	0	1	37.67
3	26.985	328	17.20	0	0	0	1	0	0	1	37.68
4	27.005	326	17.22	0	1	1	0	0	0	1	37.70
5	27.015	325	17.23	1	0	1	0	0	0	1	37.71
6	27.025	324	17.24	0	0	1	0	0	0	1	37.72
7	27.035	323	17.25	1	1	0	0	0	0	1	37.73
8	27.055	321	17.27	1	0	0	0	0	0	1	37.75
9	27.065	320	17.28	0	0	0	0	0	0	1	37.76
10	27.075	319	17.29	1	1	1	1	1	1	0	37.77
11	27.085	318	17.30	0	1	1	1	1	1	0	37.78
12	27.105	316	17.32	0	0	1	1	1	1	0	37.80
13	27.115	315	17.33	1	1	0	1	1	1	0	37.81
14	27.125	314	17.34	0	1	0	1	1	1	0	37.82
15	27.135	313	17.35	1	0	0	1	1	1	0	37.83
16	27.155	311	17.37	1	1	1	0	1	1	0	37.85
17	27.165	310	17.83	0	1	1	0	1	1	0	37.86
18	27.175	309	17.39	1	0	1	0	1	1	0	37.87
19	27.185	308	17.40	0	0	1	0	1	1	0	37.88
20	27.205	306	17.42	0	1	0	0	1	1	0	37.90
21	27.215	305	17.43	1	0	0	0	1	1	0	37.91
22	27.225	304	17.44	0	0	0	0	1	1	0	37.92
23	27.255	301	17.47	1	0	1	1	0	1	0	37.95
24	27.235	303	17.45	1	1	1	1	0	1	0	37.93
25	27.245	302	17.46	0	1	1	1	0	1	0	37.94
26	27.265	300	17.48	0	0	1	1	0	1	0	37.96
27	27.275	299	17.49	1	1	0	1	0	1	0	37.97
28	27.285	298	17.50	0	1	0	1	0	1	0	37.98
29	27.295	297	17.51	1	0	0	1	0	1	0	37.99
30	27.305	296	17.52	0	0	0	1	0	1	0	38.00
31	27.315	295	17.53	1	1	1	0	0	1	0	38.01
32	27.325	294	17.54	0	1	1	0	0	1	0	38.02
33	27.335	293	17.55	1	0	1	0	0	1	0	38.03
34	27.345	292	17.56	0	0	1	0	0	1	0	38.04
35	27.355	291	17.57	1	1	0	0	0	1	0	38.05
36	27.365	290	17.58	0	1	0	0	0	1	0	38.06
37	27.375	289	17.59	1	0	0	0	0	1	0	38.07
38	27.385	288	17.60	0	0	0	0	0	1	0	38.08
39	27.395	287	17.61	1	1	1	1	1	0	0	38.09
40	27.405	286	17.62	0	1	1	1	1	0	0	38.10

CHAPTER 3 - ALIGNMENT

General

These procedures must be followed to align the Hy-Gain II and III transceivers, (Models 2702 and 2703). 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 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'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 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 II and III transceivers.

Audio Signal Generator, 1 kHz
AC VTVM, 1 mV measurable
DC Ampere Meter, 2A
Variable Regulated Power Supply, 8-15 VDC, 2A
Frequency Counter, 0 to 40 MHz, high input impedance type
VTVM with RF probe
Oscilloscope, 30 MHz, high input impedance
Low capacitance RF probe, capacitance not to exceed 7 pF
RF wattmeter and 50 ohm, 5W dummy load
Standard RF signal generator, 27 MHz CB band
Speaker dummy resistor, 8 ohm, 5W
VOM 20k ohm/V

All test equipment should be properly calibrated.

NOTE: Test voltage is 13.8 VDC unless otherwise specified.

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

Transmitter Alignment Procedure

Pre-Alignment Frequency Check

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

Emitter of Q2, reference input, check to read 10.24 MHz accurate to four significant digits.

Pin 6 of IC2, transceiver on channel 1, check to read 37.66 MHz accurate to four significant digits.

Equipment Set-up

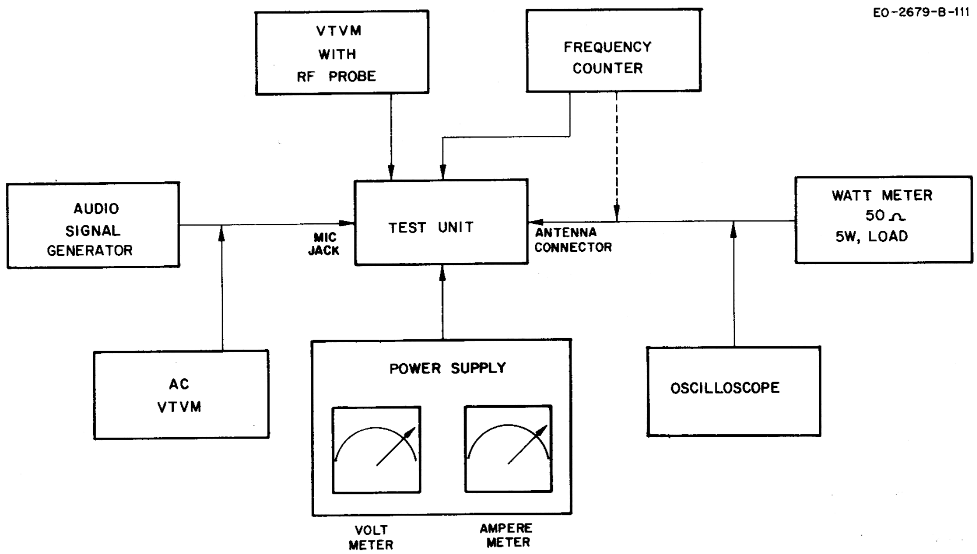

Figure 3-1. Equipment Set-up, Transmitter Alignment

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

VCO Circuit Alignment

1. Place the Channel Selector in the channel 1 position.
2. Connect the VOM (12 VDC range) between ground and TP8.
3. Adjust the L1 core to obtain a reading no lower than 1.5V.
4. Place the Channel Selector in channel 40 position. The reading should be within 3.6V ± .1V.

RF Driver Stage Alignment

NOTE: An RF VTVM is the preferred test equipment for this alignment. In part 3, T1 *must* be adjusted with an RF VTVM to prevent detuning of the circuit. If an oscilloscope is used for the rest of the alignment procedures, use a low capacity (less than 1 pF) high impedance probe.

1. Place the Channel Selector in channel 19 position.
2. Connect the RF VTVM to the base of Q3 and ground.
3. Adjust T1, L2, T2, L5 and T3 in this order, for maximum amplitude on the RF VTVM.
4. Reduce the power supply voltage from 13.8 to 7V and connect the RF VTVM between the base of Q4 and ground.
5. Adjust T3 and T4 for maximum amplitude on the RF VTVM.

RF Power Amplifier Alignment

1. Set the power supply voltage to 13.8 VDC. Place the Channel Selector switch in the channel 19 position.
2. Connect the RF wattmeter to the antenna connector of the transceiver.
3. Adjust L7 for maximum reading on the RF wattmeter.
4. Adjust L11 for maximum reading on the RF wattmeter.
5. Adjust L12 for maximum reading on the RF wattmeter.
6. Readjust L11 for maximum reading.
7. Turn the core of L7 clockwise so that the RF wattmeter indicates 4.4 watts.
8. Turn the core of L12 counterclockwise until the power reading is 3.8 watts.

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.

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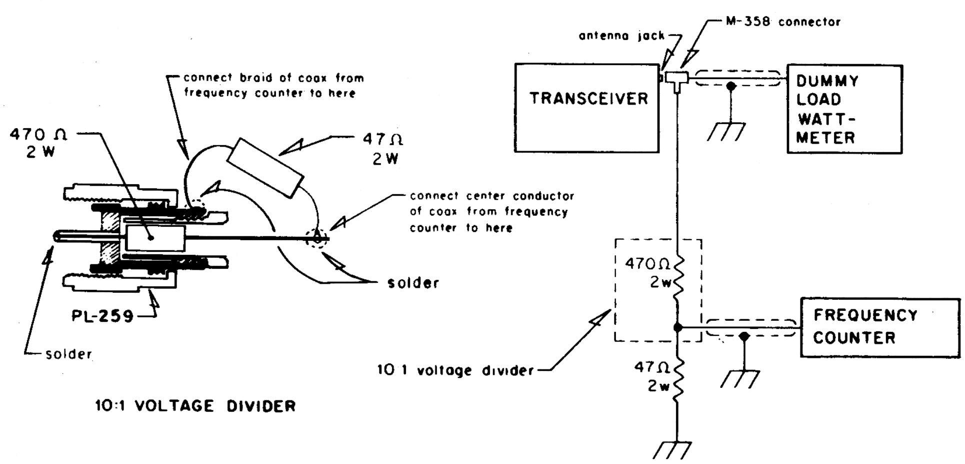


Figure 3-2. Connection of Frequency Counter and Dummy Load.

3. Turn the transceiver on.
4. Key the transmitter with the microphone PTT button.
5. Check the frequency of each channel with the following chart. Frequencies should be within 800Hz 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 Alignment

1. Place the unit in the transmit mode and apply a 20 mA, 1 kHz signal to the junction of C80, R58, and C81, on the radio p.c board.
2. Adjust RV2 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

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

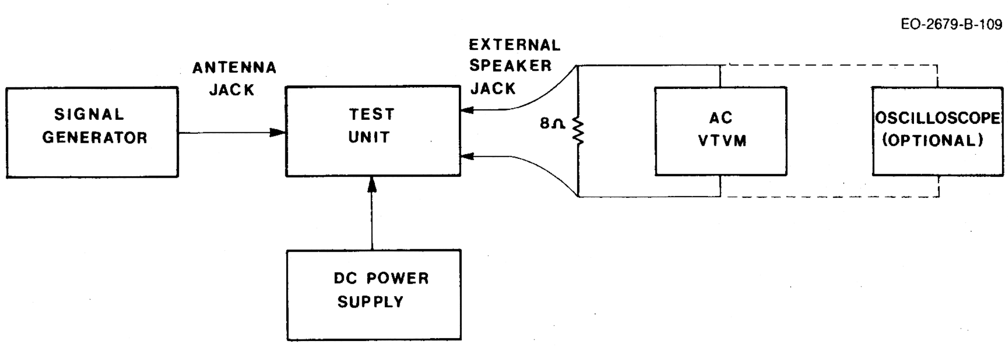


Figure 3-3. Equipment Set-up Receiver Alignment

RF Meter Alignment

Adjust RV4 so that the meter pointer indicates the same wattage as the reading obtained on the wattmeter.

Lock Out Circuit Check

Position the Channel Selector switch in the open channel position. Check the voltage at the base of Q3. The voltage should be between 0.05 to 0.4V.

SWR Meter Circuit Adjustment (Model 2703 only)

Connect a non-inductive resistor of 100 ohms to the antenna connector on the rear of the transceiver. Place the transceiver in transmit mode and turn the SWR CAL switch in the CAL position. Adjust VR4 until the meter pointer is exactly on the SET mark on the meter scale.

Turn the SWR CAL switch in the SWR position and adjust RV501 on p.c. board PTSR006AOX until the meter pointer indicates "2" on the SWR scale.

Receiver Alignment

Place the ANL switch in the "ON" position. To put the transceiver into the receive mode, short pins 5 and 3 of the MIC jack, on the front panel, together.

1. Set the signal generator to 27.185, 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 AFC action.

2. Adjust T5, T6, L14, T7, T8, T9 and T10 for maximum audio output as indicated on the AC VTVM (or oscilloscope if used).
3. Turn the core of T5 one turn clockwise.

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 RV1 so that the squelch just breaks with the 50 uV signal input.

S-Meter Adjustment

1. Set the signal generator to provide a 30 uV signal output.
2. Adjust RV3 so that the S-Meter indicates "9".

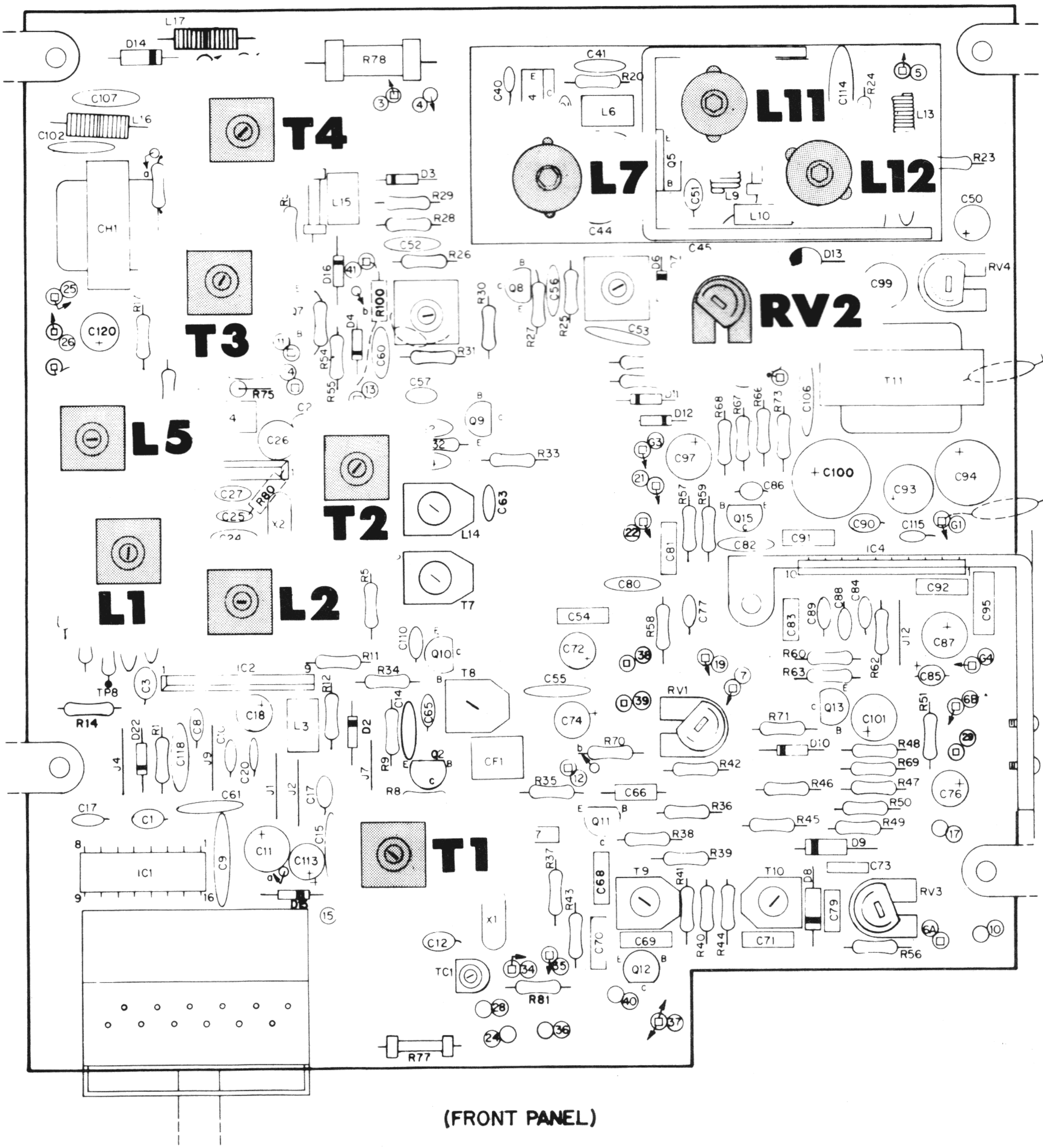


Figure 3-4. Components Adjusted for Transmitter Alignment

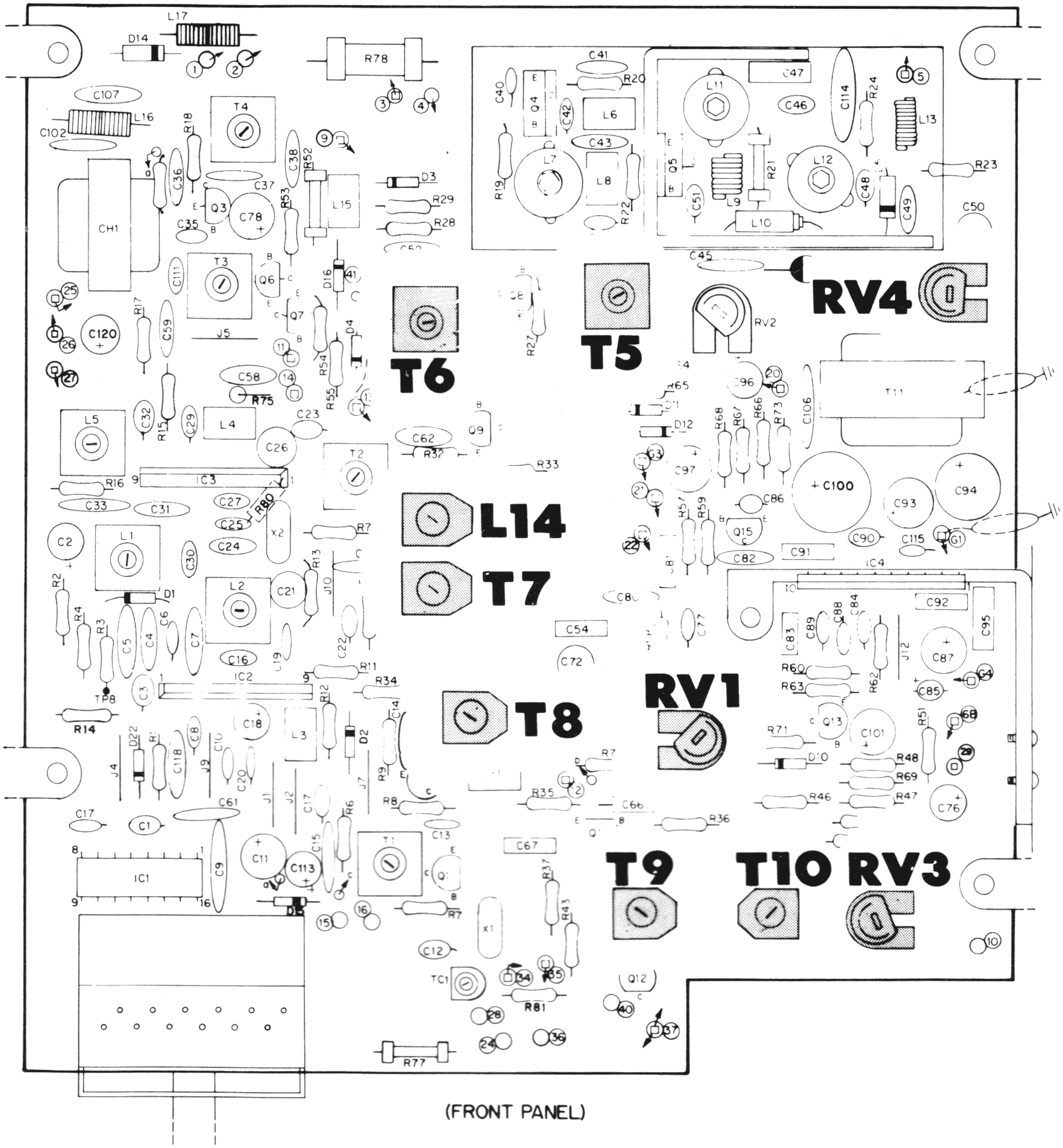


Figure 3-5. Components Adjusted for Receiver Alignment

CHAPTER 4—CHARTS AND DRAWINGS

Voltage Charts

VOLTAGE MEASUREMENT CHART

Reference Designator	Mode	E	B	C
Q1	RX	2.8V	3.3V	5.6V
	TX	2.8V	3.3V	5.6V
Q2	RX	2.8V	2.9V	5.6V
	TX	2.8V	2.9V	5.6V
Q3	RX	1.8V	2.6V	13.8V
	TX	1V	1.7V	13.8V
Q4	RX	0	0	13.8V
	TX	0	0	10.5V
Q5	RX	0	0	13.8V
	TX	0	0	10.5V
Q6	RX	8.8V	9.4V	13.8V
	TX	8.8V	9.4V	12.5V
Q7	RX	8.8V	8.3V	0
	TX	8.8V	8V	8.7V
Q8	RX	1.5V	2.2V	13V
	TX	1.95V	.25V	13V
Q9	RX	1.6V	2.15V	11.5V
	TX	0	.25V	13V
Q10	RX	0	.6V	0
	TX	0	0	0
Q11	RX	1.5V	1.75V	12.2V
	TX	0	.25V	13V
Q12	RX	.85V	1.5V	12.8V
	TX	0	.15V	13V
Q13	RX	0	0	6.6V
	TX	0	.65V	0
Q14	RX	1.5V	7.1V	0
	TX	1.5V	6.8V	0
Q15	RX	0	0	0
	TX	0	0	0
Q18	RX	0	.7V	4V
	TX	0	.7V	4V
Q19	RX	0	0	0
	TX	0	0	0
Q20	RX	0	0	0
	TX	0	0	0
Q22	RX	4.5V	.9V	5.6V
	TX	4.2V	.9V	5.6V
Model 2703 only, with Noise Blanker on.				
Q18	RX	0	.7V	4V
Q19	RX	8.8V	8.2V	0
Q20	RX	0	0	0

IC 2 VCO/MIXER

Pin No.	1	2	3	4	5	6	7	8	9
Measured in receive	2.5V	2V	1.3V	2.35V	0	8.5V	2.1V	4.4V	1.6V

IC 3 OSC 2/MIXER

Pin No.	1	2	3	4	5	6	7	8	9
Measured in transmit	3.6V	2.1V	1.4V	2.7V	0	8.6V	2.1V	7.8V	8.2V

IC 4 (BA 521)

Pin No.	1	2	3	4	5	6	7	8	9	10
Squelched	12.69V	0	0	6.76V	5.8V	2.9V	.10V	13.61V	13.64V	13.71V
Unsquelched	6.82V		1.28V	6.76V	6V	6.70V	.98V	8.06V	13.39V	13.70V

IC 1 (P.L.L. 02A)

Pin No	Voltage	Channels Selected
1	5.6V	N/A
2	.2V	N/A
3	.8V	N/A
4	5.4V	N/A
5	2 - 3.6V	40 - 1
6	5.6V	N/A
7	5.6V	N/A
8	0	N/A
9	5.6V	1, 2, 3, 4, 5, 6, 7, 8, 9
10	5.6V	10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38
11	5.6V	10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 39, 40
12	5.6V	1, 2, 3, 10, 11, 12, 13, 14, 15, 23, 24, 25, 26, 27, 28, 29, 30, 39, 40
13	5.6V	4, 5, 6, 10, 11, 12, 16, 17, 18, 19, 23, 24, 25, 26, 31, 32, 33, 34, 39, 40
14	5.6V	1, 4, 7, 10, 11, 13, 14, 16, 17, 20, 24, 25, 27, 28, 31, 32, 35, 36, 39, 40
15	5.6V	2, 5, 7, 8, 10, 13, 15, 16, 18, 21, 23, 24, 27, 29, 31, 33, 35, 37, 39
16	0V	N/A

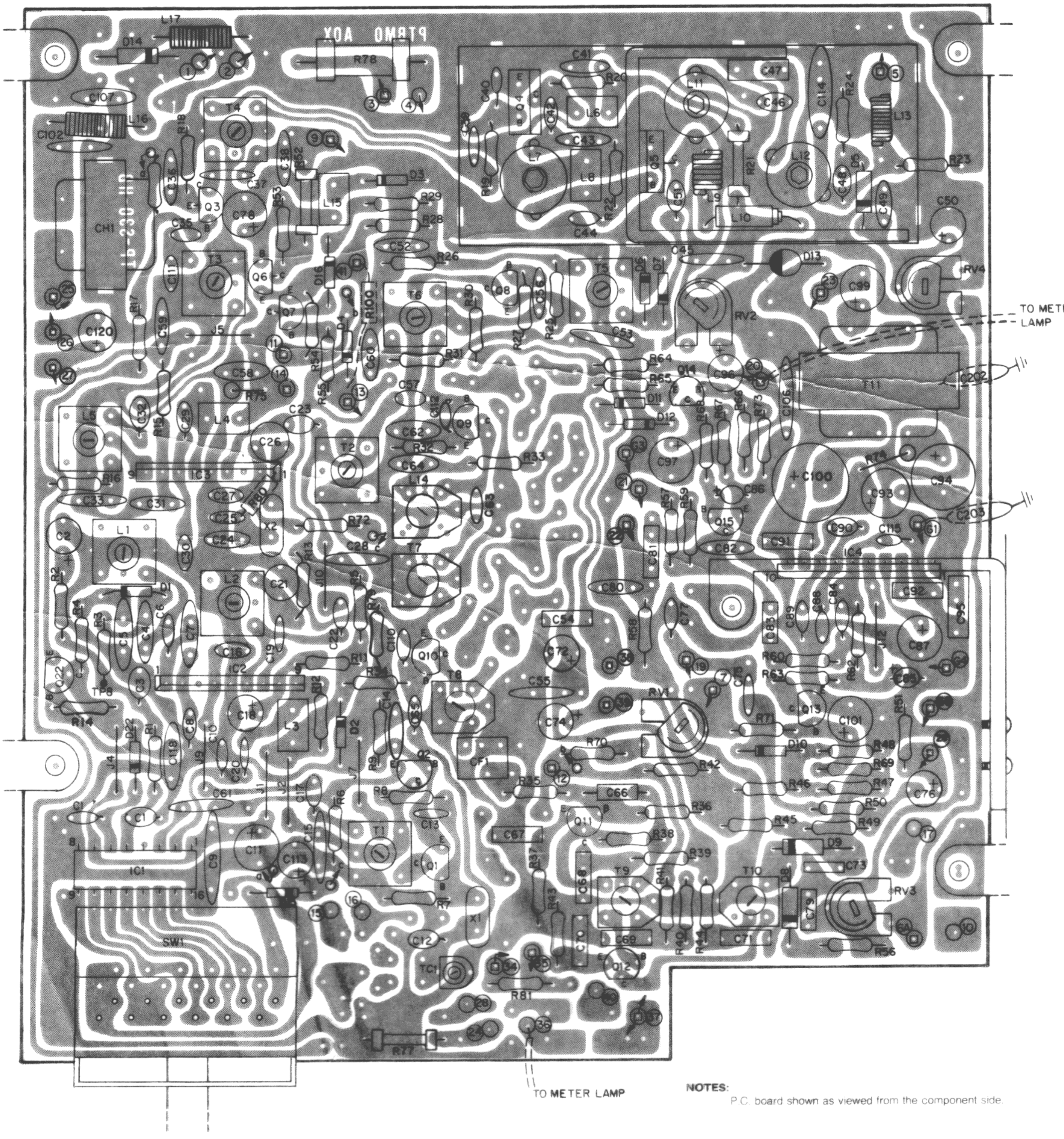
Front Panel Lamp Controller
Q1 - Q4 (2SC945)

Reference Designator	Mode	E	B	C				
Q1	RX	0	.7V	0				
	TX	0	.7V	12.8V				
Q2	RX	0	0	12.8V				
	TX	0	.7V	0				
						E	B	C
Q3	RX	0	0	0	PA	.1V	.6V	.1V
	TX	0	0	0				
Q4	RX	0	.6V	0	PA	0	.1V	.6V
	TX	0	.6V	0				

NOTE: All voltage measurements are taken with the external power supply set at exactly 13.8 VDC.

Main P.C. Board
Component Outline, Model 2702

EO-2702-C-104

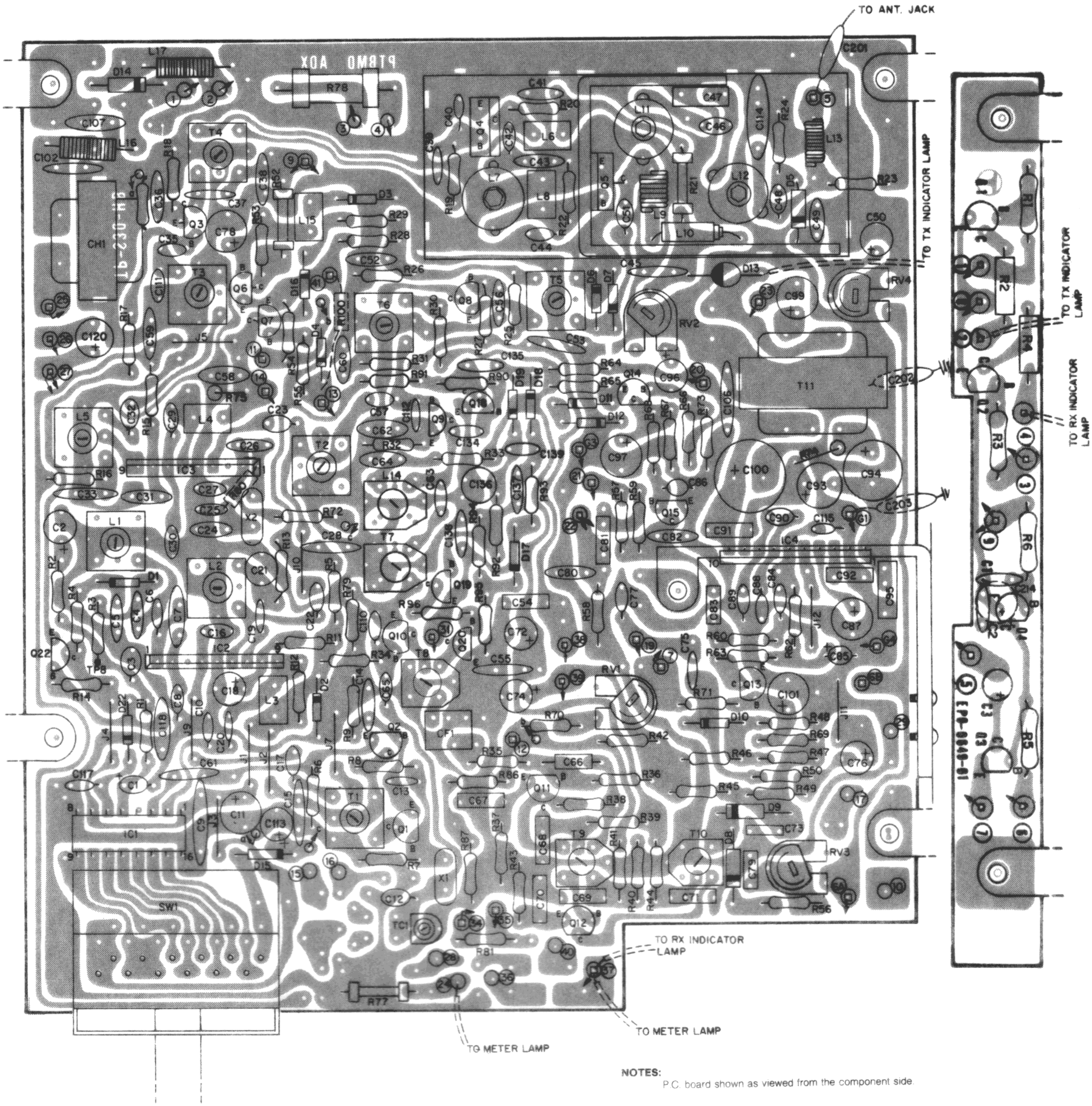


NOTES:
P.C. board shown as viewed from the component side.

Figure 4-1. Main P.C. Board Component Outline, Model 2702

Main P.C. Board
Component Outline, Model 2703

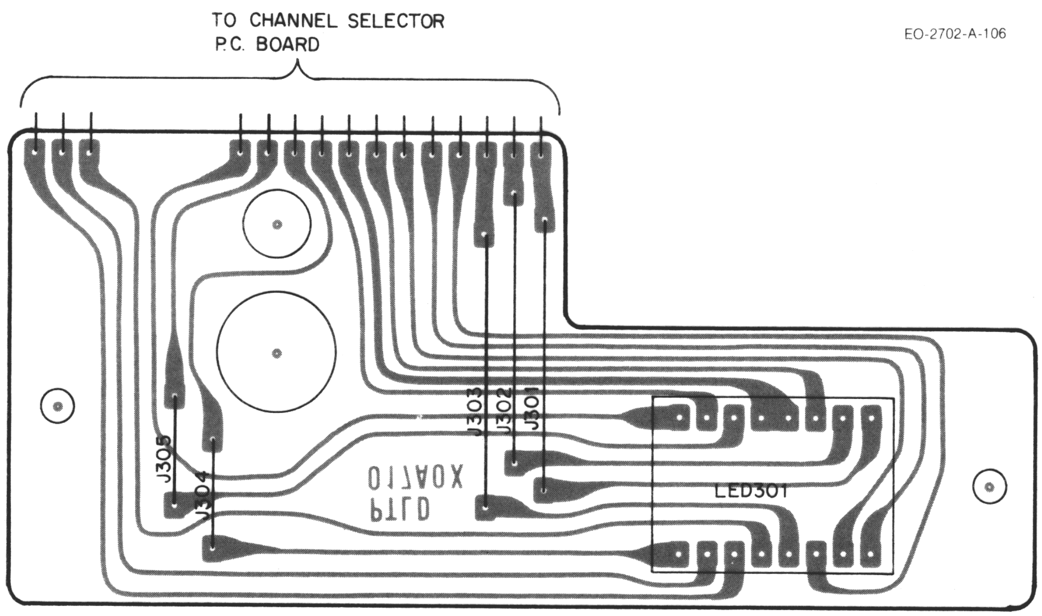
EO-2703-C-1



NOTES:
P.C. board shown as viewed from the component side.

Figure 4-2. Main P.C. Board Component Outline, Model 2703

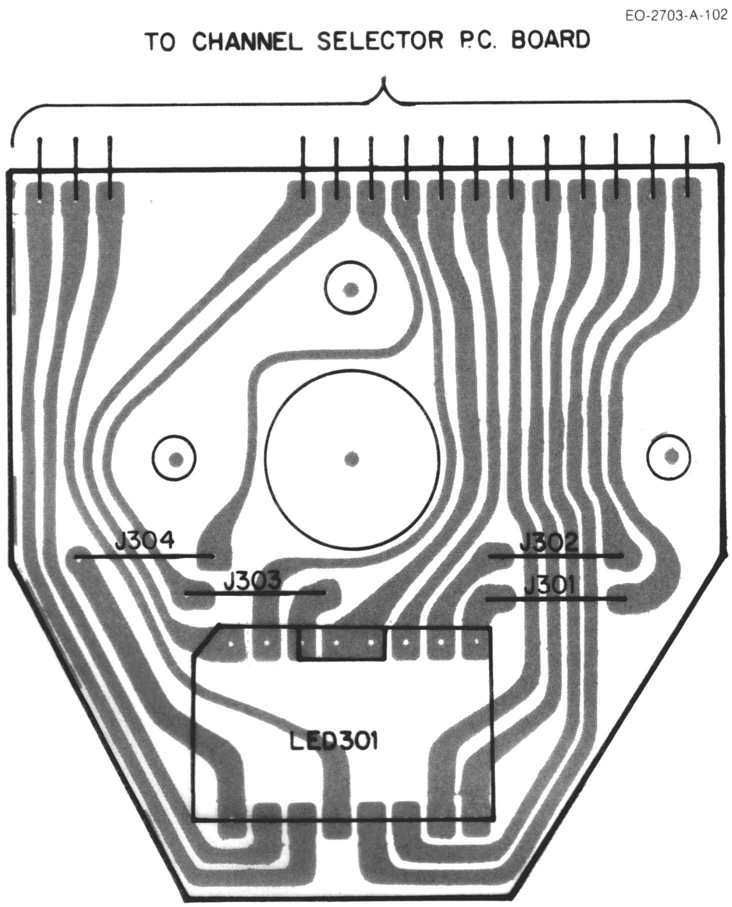
LED P.C. Board
Component Outline, Model 2702



NOTES:
P.C. board shown as viewed from component side.

Figure 4-3. LED P.C. Board Component Outline, Model 2702

LED P.C. Board
Component Outine, Model 2703

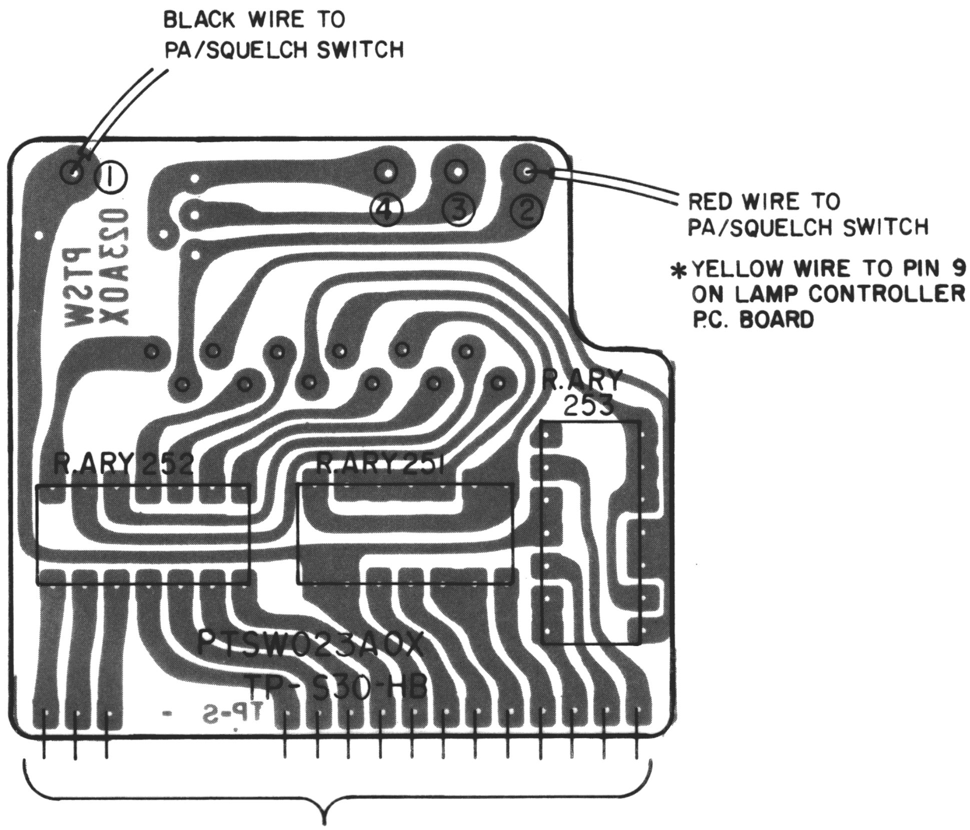


NOTES:
P.C. board shown as viewed from the component side.

Figure 4-4. Led P.C. Board Component Outline, Model 2703

Switch P.C. Board
Component Outline

EO-2702-A-105



NOTES:

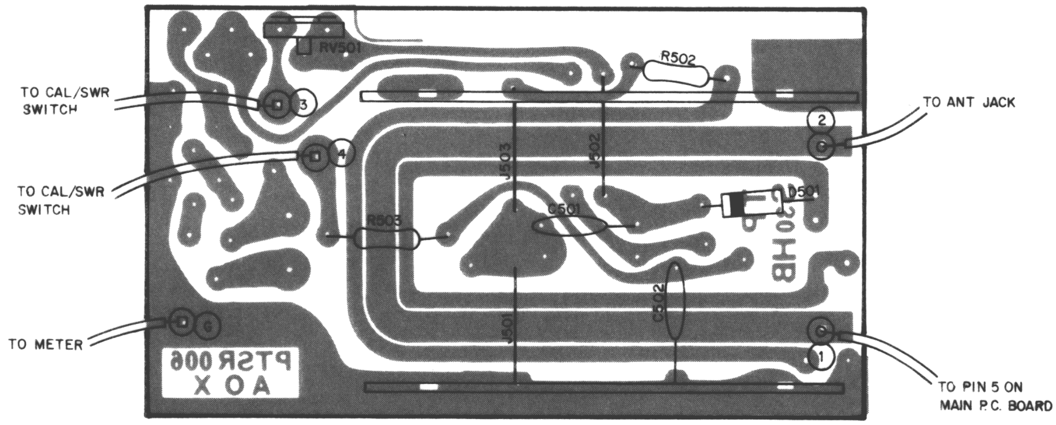
P.C. board shown as viewed from component side.

* Refers to 2703 only

Figure 4-5. Switch P.C. Board Component Outline

SWR P.C. Board
Component Outline, Model 2703

EO-2703-A-103



NOTES:
P.C. board shown as viewed from the component side.

Figure 4-6. SWR P.C. Board Component Outline, Model 2703

Parts List

Main P.C. Board

□ - model 2702 only

■ - model 2703 only

Unmarked components are common to both models.

Reference Designator	Description	Part No.
	□ main p.c. board, complete	AP-TBM051CT
	■ main p.c. board, complete	AP-TBM051FT
	main p.c. board, plated and drilled	PT-BM051AOX
C1	.1uF, 10V, arox	CD-A1A0R1ME
C2	10uF, 16V, electrolytic	CE-ED100ZMN
C3	.22uF, 10V, arox	CD-A1AR22ME
C4	68pF, 50V, ceramic	CC-CB680KPM
C5	.01uF, 50V, ceramic	CK-CB103PEM
C6	22pF, 50V, ceramic	CC-CB220KPM
C7	330pF, 50V, ceramic	CC-CB331KOM
C8	150pF, 50V, ceramic	CC-CB151KOM
C9	.047uF, 50V, ceramic	CK-CB473ZFM
C10	47pF, 50V, ceramic	CC-CB470KOM
C11	47uF, 10V, electrolytic	CE-EC470ALN
C12	18pF, 50V, ceramic	CC-CB180KPM
C13	1000pF, 50V, mylar	CQ-MB102KCH
C14	68pF, 50V, ceramic	CC-CB680KOM
C15	.01uF, 50V, ceramic	CK-CB103PEM
C16	not used	
C17	47pF, 50V, ceramic	CC-CB470KPM
C18	1uF, 50V, electrolytic	CE-EG010ALN
C19	1000pF, 50V, mylar	CQ-MB102KCH
C20	1000pF, 50V, mylar	CQ-MB102KCH
C21	1000pF, 100V, styroflex	CQ-SC102KEF
C22	2pF, 50V, ceramic	CC-CB020COM
C23	7pF, 50V, ceramic	CC-CB070DOM
C24	33pF,50V, ceramic	CC-CB330KPM
C25	4pF, 50V, ceramic	CC-CB040CPM
C26	330F, 100V, styroflex	CQ-SC331KEF
C27	390pF, 50V, ceramic	CK-CB391KBM
C28	.01uF, 50V, ceramic	CK-CB103PEM
C29	68pF, 50V, ceramic	CC-CB680KOM
C30	56pF, 50V, ceramic	CC-CB560KOM
C31	.01uF, 50V, ceramic	CK-CB103PEM
C32	2pF, 50V, ceramic	CC-CB020COM
C33	.01uF, 50V, ceramic	CK-CB103PEM
C34	not used	
C35	68pF, 50V, ceramic	CC-CB680KOM
C36	.01uF, 50V, ceramic	CK-CB103PEM
C37	100pF, 50V, ceramic	CC-CB101KPM
C38	.01uF, 50V, ceramic	CK-CB103PEM
C39	.01uF, 50V, mylar	CQ-MB103KCH
C40	330pF, 50V, ceramic	CK-CB331KBM
C41	.01uF, 50V, ceramic	CK-CB103PEM
C42	120pF, 50V, ceramic	CC-CB121KOM
C43	220pF, 50V, ceramic	CC-CB221KOM
C44	120pF, 50V, ceramic	CC-CB121KOM
C45	.01uF, 50V, ceramic	CK-CB103PEM
C46	120pF, 50V, ceramic	CC-CB121KOM
C47	270pF, 500V, mica	CM-SD271KCS
C48	2pF, 500V, ceramic	CC-CE020COM
C49	.0047uF, 50V, ceramic	CK-CB472PEM
C50	1uF, 50V, electrolytic	CE-EG010ALN
C51	27pF, 50V, ceramic	CC-CB270KOM
C52	.01uF, 50V, ceramic	CK-CB103PEM
C53	.047uF, 50V, ceramic	CK-CB473ZFM
C54	.047uF, 50V, mylar	CQ-MB473KCH
C55	.047uF, 50V, ceramic	CK-CB473ZFM

Reference Designator	Description	Part No.
C56	.01uF, 50V, ceramic	CK-CB103PEM
C57	10pF, 50V, ceramic	CC-CB100DOM
C58	.01uF, 50V, ceramic	CK-CB103PEM
C59	.01uF, 50V, ceramic	CK-CB103PEM
C60	.01uF, 50V, ceramic	CK-CB103PEM
C61	.01uF, 50V, ceramic	CK-CB103PEM
C62	.01uF, 50V, ceramic	CK-CB103PEM
C63	1pF, 50V, ceramic	CC-CB020COM
C64	.01uF, 50V, ceramic	CK-CB103PEM
C65	18pF, 50V, ceramic	CC-CB180KPM
C66	2.2pF, 500V, minic	CG-2H2R2KNN
C67	.047uF, 50V, mylar	CQ-MB473KCH
C68	.047uF, 50V, mylar	CQ-MB473KCH
C69	.047uF, 50V, mylar	CQ-MB473KCH
C70	.047uF, 50V, mylar	CQ-MB473KCH
C71	.047uF, 50V, mylar	CQ-MB473KCH
C72	10uF, 16V, electrolytic	CE-ED100ALN
C73	6800pF, 50V, mylar	CQ-MB682KCH
C74	3.3uF, 25V, electrolytic	CE-EE3R3ALN
C75	4700pF, 50V, mylar	CQ-MB472KCH
C76	1uF, 50V, electrolytic	CE-EG010ALN
C77	100pF, 50V, ceramic	CC-CB101KOM
C78	47uF, 16V, electrolytic	CE-ED470ALN
C79	.022uF, 50V, mylar	CQ-MB223KCH
C80	2200pF, 50V, ceramic	CC-CB222KBM
C81	.022uF, 50V, mylar	CQ-MB223KCH
C82	220pF, 50V, ceramic	CC-CB221KOM
C83	.01uF, 50V, mylar	CQ-MB103KCH
C84	390pF, 50V, ceramic	CK-CB391KBM
C85	5.6uF, 25V, tantalum	CS-SE5R6MDN
C86	.47uF, 10V, arox	CD-A1AR47ME
C87	33uF, 6.3V, electrolytic	CE-EB330ALN
C88	68pF,50V, ceramic	CC-CB680KOM
C89	68pF, 50V, ceramic	CC-CB680KOM
C90	470pF, 50V, ceramic	CK-CB471KBM
C91	.068uF, 50V, mylar	CQ-MB683KCH
C92	.022uF, 50V, ceramic	CK-CB223ZFM
C93	47uF, 16V, electrolytic	CE-ED470ALN
C94	220uF, 16V, electrolytic	CE-AD221ZLS
C95	.068uF, 50V, mylar	CQ-MB683KCH
C96	3.3uF, 25V, electrolytic	CE-EE3R3ALN
C97	47uF, 10V, electrolytic	CE-EC470ALN
C98	not used	
C99	47uF, 25V, electrolytic	CE-AE470ZLS
C100	1000uF, 16V, electrolytic	CE-ED102ZUN
C101	33uF, 6.3V, electrolytic	CE-EB330ALN
C102	.01uF, 50V, ceramic	CK-CB103PEM
C103 thru C105	not used	
C106	.047uF, 50V, ceramic	CK-CB473ZFM
C107	.047uF, 50V, ceramic	CK-CB473ZFM
C108 thru C109	not used	
C110	18pF, 50V, ceramic	CC-CB180KOM
C111	82pF, 50V, ceramic	CC-CB820KOM
C112	not used	
C113	.01uF, 50V, ceramic	CK-CB103PEM
C114	390 pF, 500V, ceramic	CC-CE391KOM
C115	18pF, 50V, ceramic	CC-CB180KOM
C116	not used	
C117	4700pF, 50V, ceramic	CK-CB472KBM
C118	.022uF, 50V, ceramic	CK-CB223ZFM
C119	not used	
C120	33uF, 16V, electrolytic	CE-ED330ALN
C121 thru C133	not used	

Reference Designator	Description	Part No.
C134	■ 3pF, 50V, ceramic	CC-CB030DOM
C135	■ 220pF, 50V, ceramic	CC-CB221KOM
C136	■ .0033uF, 100V, styroflex	CQ-SC332KEF
C137	■ .01uF, 50V, ceramic	CK-CB103PEM
C138	■ 220pF, 50V, ceramic	CC-CB221KOM
CF1	4 element ceramic filter	FB-R455A08M
CH1	choke coil	LJ-119H001Y
CT1	20pF, trimmer capacitor	CT-Z7200H01
D1	ITT410, silicon	QD-CTT410XQ
D2	MZ205, silicon, zener	QD-ZMZ205XE
D3	RD9.1E, silicon, zener	QD-ZRD9EXAA
D4	1S1555, silicon	QD-SS1555XT
D5	1N60, germanium	QD-G1N60XXT
D6	1S1555, silicon	QD-SS1555XT
D7	1S1555, silicon	QD-SS1555XT
D8	1N60, germanium	QD-G1N60XXT
D9	1N60, germanium	QD-G1N60XXT
D10	1S1555, silicon	QD-SS1555XT
D11	1S1555, silicon	QD-SS1555XT
D12	1S1555, silicon	QD-SS1555XT
D13	V06C, silicon	QD-SV06CXXB
D14	1S1885, silicon	QD-SS1885XT
D15	1S1555, silicon	QD-SS1555XT
D16	1S1555, silicon	QD-SS1555XT
D17	■ 1S1555, silicon	QD-SS1555XT
D18	■ 1N60, germanium	QD-G1N60XXT
D19	■ 1N60, germanium	QD-G1N60XXT
D20 thru D21	not used	
D22	■ 1S1555, silicon	QD-SS1555XT
IC1	PLL02A	QQ-OPLL02A0
IC2	TA7310P	QQ-MC3001AT
IC3	TA7310P	QQ-MC3001AT
IC4	BA521A	QQ-MB521AX
L1	rf coil, 18MHz	TR-10DD003S
L2	rf coil, 37MHz	TR-10MB003T
L3	rf coil, 68 uH, peaking	LF-680KD01N
L4	rf coil, 1 uH	LF-1R0KD01N
L5	□ rf coil, 27MHz	TR-10CB001M
L5	■ rf coil, 27MHz	TR-10CB002M
L6	rf coil, 2.2 uH, peaking	LF-2R2KD01N
L7	rf coil, 27MHz	TR-A5CZ001M
L8	rf coil, 68 uH, peaking	LF-680KD01N
L9	rf coil, .55 uH	LA-1KE1011A
L10	rf coil, 1.0 uH	LD-ADX3825M
L11	rf coil, 27MHz	TR-A5CZ002M
L12	rf coil, 27MHz	TR-A5CZ003M
L13	rf coil, .40 uH	LA-1JG1010A
L14	rf coil, 10.7MHz	TR-07MB008N
L15	rf coil, 68 uH, peaking	LF-680KD01N
L16	rf coil, .75 uH	LD-ADB4024B
L17	rf coil, .75 uH	LD-ADB4024B
Q1	2SC710DE	QT-C0710XEE
Q2	2SC710DE	QT-C0710XEE
Q3	2SC1687	QT-C1687XAN
Q4	2SC1846QRS	QT-C1846XAN
Q5	2SC1306	QT-C1306XZA
Q6	2SC1318QR	QT-C1318XDN
Q7	2SA719PQR	QT-A0719XHN

Reference Designator	Description	Part No.
Q8	2SC1047BC	QT-C1047XBN
Q9	2SC1359BC	QT-C1359XBN
Q10	2SC710D	QT-C0710XBE
Q11	2SC710D	QT-C0710XBE
Q12	2SC829BC	QT-C0829XEN
Q13	2SC828P	QT-C0828XAN
Q14	2SA7190	QT-A0719XAN
Q15	2SC945(L)PQ	QT-C0945LAA
Q16 thru Q21	not used in 2702	
Q16 thru Q17	not used in 2703	
Q18	■ 2SC829C	QT-C0829XBN
Q19	■ 2SA733PQ	QT-A0733XDA
Q20	■ 2SC1327TU	QT-C1327XAN
Q21	not used	
Q22	2SC900UE	QT-C0900XEA
R1	3.3k, 5%, ¼, carbon film	RD-25RJ332N
R2	470, 5%, ¼, carbon film	RD-25RJ471N
R3	22k, 5%, ¼, carbon film	RD-25RJ223N
R4	47k, 5%, ¼, carbon film	RD-25RJ473N
R5	68, 5%, ¼, carbon film	RD-25RJ680N
R6	680, 5%, ¼, carbon film	RD-25RJ681N
R7	27k, 5%, ¼, carbon film	RD-25RJ273N
R8	15k, 5%, ¼, carbon film	RD-25RJ153N
R9	1.5k, 5%, ¼, carbon film	RD-25RJ152N
R10	not used	
R11	82, 5%, ¼, carbon film	RD-25RJ820N
R12	2.2k, 5%, ¼, carbon film	RD-25RJ222N
R13	150, 5%, ¼, carbon film	RD-25RJ151N
R14	1M, 5%, ¼, carbon film	RD-25RJ105N
R15	47, 5%, ¼, carbon film	RD-25RJ470N
R16	100, 5%, ¼, carbon film	RD-25RJ101N
R17	5.6k, 5%, ¼, carbon film	RD-25RJ562N
R18	68, 5%, ¼, carbon film	RD-25RJ680N
R19	100, 5%, ¼, carbon film	RD-25RJ101N
R20	220, 5%, ¼, carbon film	RD-25RJ221N
R21	10, 5%, ½w, metal oxide film	RX-HAPJ100B
R22	68, 5%, ¼, carbon film	RD-25RJ680N
R23	47k, 5%, ¼, carbon film	RD-25RJ473N
R24	680, 5%, ¼, carbon film	RD-25RJ681N
R25	330, 5%, ¼, carbon film	RD-25RJ331N
R26	1k, 5%, ¼, carbon film	RD-25RJ102N
R27	680, 5%, ¼, carbon film	RD-25RJ681N
R28	47k, 5%, ¼, carbon film	RD-25RJ473N
R29	3.3k, 5%, ¼, carbon film	RD-25RJ332N
R30	100, 5%, ¼, carbon film	RD-25RJ101N
R31	1.8k, 5%, ¼w, carbon film	RD-25RJ182N
R32	560, 5%, ¼, carbon film	RD-25RJ561N
R33	470, 5%, ¼, carbon film	RD-25RJ471N
R34	470k, 5%, ¼, carbon film	RD-25RJ474N
R35	1k, 5%, ¼, carbon film	RD-25RJ102N
R36	4.7k, 5%, ¼, carbon film	RD-25RJ472N
R37	470, 5%, ¼, carbon film	RD-25RJ471N
R38	47k, 5%, ¼, carbon film	RD-25RJ473N
R39	220, 5%, ¼, carbon film	RD-25RJ221N
R40	3.9k, 5%, ¼, carbon film	RD-25RJ392N
R41	15k, 5%, ¼, carbon film	RD-25RJ153N
R42	33k, 5%, ¼, carbon film	RD-25RJ333N
R43	220, 5%, ¼, carbon film	RD-25RJ221N
R44	47, 5%, ¼, carbon film	RD-25RJ470N
R45	22k, 5%, ¼, carbon film	RD-25RJ223N
R46	270k, 5%, ¼, carbon film	RD-25RJ274N
R47	47k, 5%, ¼, carbon film	RD-25RJ473N

Reference Designator	Description	Part No.
R48	68k, 5%, ¼, carbon film	RD-25RJ683N
R49	33k, 5%, ¼, carbon film	RD-25RJ333N
R50	47k, 5%, ¼, carbon film	RD-25RJ473N
R51	10k, 5%, ¼, carbon film	RD-25RJ103N
R52	10, 5%, ½w, metal oxide film	RX-HAPJ100B
R53	1k, 5%, ¼, carbon film	RD-25RJ102N
R54	390, 5%, ¼, carbon film	RD-25RJ391N
R55	10k, 5%, ¼, carbon film	RD-25RJ103N
R56	820, 5%, ¼, carbon film	RD-25RJ821N
R57	27k, 5%, ¼, carbon film	RD-25RJ273N
R58	3.3k, 5%, ¼, carbon film	RD-25RJ332N
R59	3.3k, 5%, ¼, carbon film	RD-25RJ332N
R60	2.2k, 5%, ¼, carbon film	RD-25RJ222N
R61	not used	
R62	10, 5%, ¼, carbon film	RD-25RJ100N
R63	10k, 5%, ¼, carbon film	RD-25RJ103N
R64	47, 5%, ¼, carbon film	RD-25RJ470N
R65	1k, 5%, ¼, carbon film	RD-25RJ102N
R66	4.7k, 5%, ¼, carbon film	RD-25RJ472N
R67	18k, 5%, ¼, carbon film	RD-25RJ183N
R68	1k, 5%, ¼, carbon film	RD-25RJ102N
R69	22k, 5%, ¼, carbon film	RD-25RJ223N
R70	22k, 5%, ¼, carbon film	RD-25RJ223N
R71	1.8k, 5%, ¼, carbon film	RD-25RJ182N
R72	not used	
R73	4.7k, 5%, ¼, carbon film	RD-25RJ472N
R74	100, 5%, ¼, carbon film	RD-25RJ101N
R75	4.7k, 5%, ¼, carbon film	RD-25RJ472N
R76	not used	
R77	270, 5%, ½w, metal oxide film	RG-HANJ271B
R78	15, 5%, 2w, metal oxide film	RX-2ANJ150B
R79	1k, 5%, ¼, carbon film	RD-25RJ102N
R80	6.8k, 5%, ¼w, solid	RC-14GK682N
R81	1.5k, 5%, ¼, carbon film	RD-25RJ152N
R82	4.7k, 5%, ¼, carbon film	RD-25RJ472N
R83 thru R99	not used in model 2702	
R83 thru R89	not used in model 2703	
R90	■ 100k, 5%, ¼, carbon film	RD-25RJ104N
R91	■ 1k, 5%, ¼, carbon film	RD-25RJ102N
R92	■ 560k, 5%, ¼, carbon film	RD-25RJ561N
R93	■ 100k, 5%, ¼, carbon film	RD-25RJ104N
R94	■ 820k, 5%, ¼, carbon film	RD-25RJ824N
R95	■ 4.7k, 5%, ¼, carbon film	RD-25RJ472N
R96	■ 22k, 5%, ¼, carbon film	RD-25RJ223N
R97 thru R99	not used	
R100	3.3k, 5%, ¼w, solid	RC-14GK332N
R101 thru R110	not used	
R111	2.7k, 5%, ¼, carbon film	RD-25RJ272N
RV1	10k semi-fixed resistor	RP-GNB10301
RV2	5k semi-fixed resistor	RP-GNB50202
RV3	20k semi-fixed resistor	RP-GNB20301
RV4	20k semi-fixed resistor	RP-GNB20301
SW1	switch, rotary	SR-1940202W
T1	rf transformer	TR-10DB002S
T2	rf transformer	TR-10MB005S
T3	rf transformer	TR-10CB001S
T4	rf transformer	TR-10CP005S
T5	rf transformer	TR-10MP003T
T6	rf transformer	TR-10CA003T

Reference Designator	Description	Part No.
T7	rf transformer	TR-07MB008N
T8	if transformer	TR-07LA004N
T9	if transformer	TR-07LA005N
T10	if transformer	TR-07LA023N
T11	audio output transformer	TB-G25B001W
X1	crystal oscillator 10.24000MHz	XA-S1B9001T
X2	crystal oscillator 10.69500MHz	XA-S1B9002T

Quantity	Description	Part No.
2	crystal spacer	VK-111SC001
1	heat sink, IC4	ML-454AD002
1	heat sink, IC4	MS-327AD005

Led P.C. Board

Reference Designator	Description	Part No.
	□ LED p.c. board, complete	AP-TLD017AA
	■ LED p.c. board, complete	AP-TLD015AA
	□ LED p.c. board, drilled and plated	PT-LD017AOX
	■ LED p.c. board, drilled and plated	PT-LD015AOX
LED	SL122	QL-#SL1222C

SWR P.C. Board

Reference Designator	Description	Part No.
	■ SWR p.c. board, complete	AP-TSR006BA
	■ SWR p.c. board, drilled and plated	PT-SR006AOX
C501	■ 01uF, 50V, ceramic	CK-UB103NXY
C502	■ .01uF, 50V, ceramic	CK-UB103NXY
D501	■ 1N60, germanium	QD-G1N60XXT
D502	■ 1N60, germanium	QD-G1N60XXT
R501	■ 82, 5%, ¼, carbon film	RD-25TJ820N
R502	■ 82, 5%, ¼, carbon film	RD-25RJ820N
R503	■ 1.8k, 5%, ¼, carbon film	RD-14RF182N
RV501	■ 5k, semi-fixed resistor	RP-FNB50201
	■ bracket, A	MU-411SX001
	■ bracket, C	ML-621SX001

Lamp Control P.C. Board

Reference Designator	Description	Part No.
	■ lamp control p.c. board, complete	AP-TZZ005AA
	■ lamp control p.c. board, drilled and plated	PT-ZZ005A0X
C1	■ .01uF, 50V, ceramic	CK-CB103PEM
C2	■ .01uF, 50V, ceramic	CK-CB103PEM
C3	■ 10uF, 16V, electrolytic	CE-ED100ALN

Reference Designator	Description	Part No.
Q1	■ 2SC945ARQ	QT-C0945ADA
Q2	■ 2SC945ARQ	QT-C0945ADA
Q3	■ 2SC945AR	QT-C0945ACA
Q4	■ 2SC945ARQ	QT-C0945ADA
R1	■ 10k, 5%, ¼w, carbon film	RD-14TJ103N
R2	■ 270, 5%, ½w, solid	RC-12GK271N
R3	■ 15k, 5%, ¼w, carbon film	RD-14TJ153N
R4	■ 330, 5%, ½w, solid	RC-12GK331N
R5	■ 330k, 5%, ¼w, carbon film	RD-14TJ334N
R6	■ 100k, 5%, ¼w, carbon film	RD-14TJ104N

Switch P.C. Board

Reference Designator	Description	Part No.
	switch p.c. board, complete	AP-TSW023AA
	switch p.c. board, drilled and plated	PT-SW023AOX
	1.8k, 1%, ¼w, resistor array	RA-C182M07N

Chassis Mounted Components

Reference Designator	Description	Part No.
C201	180pF, 500V, mica	CM-SD181KCS
C201B	7pF, 500V, ceramic	CC-DE070DOM
C202	.01uF, 50V, ceramic	CK-DB103PEM
C203	.01uF, 50V, ceramic	CK-DB103PEM
C204	.01uF, 50V, ceramic	CK-DB103PEM
C205	.047uF, 50V, ceramic	CK-DB473ZFM
C206	.01uF, 50V, ceramic	CK-DB103PEM
C207	.01uF, 50V, ceramic	CK-DB103PEM
C208	.0047uF, 50V, ceramic	CK-DB472PEM
C209	.0047uF, 50V, ceramic	CK-DB472PEM
C210	.0047uF, 50V, ceramic	CK-DB472PEM
C211	.0047uF, 50V, ceramic	CK-DB472PEM
C212	.0047uF, 50V, ceramic	CK-DB472PEM
C213	.0047uF, 50V, ceramic	CK-DB472PEM
C214	■ 1uF, 50V, electrolytic	CE-AG010ALN
J1	□ jack, 2-pin, antenna	YJ-C02S009Z
J1	■ jack, 2-pin, antenna	YJ-C02S002Z
J2	jack, 5-pin, DIN, microphone	YJ-D05S001Z
J3	jack, 3-pin, PA	YJ-T03S003Z
J4	jack, 3-pin, eternal speaker	YJ-T03S003Z
J5	jack, 2-pin, DC	JY-B02S001U
M	meter	ZM-J2017M03
M	meter	ZM-J2030N07
PL1	lamp, pilot	ZP-A064105U
PL1	■ lamp, REC	ZP-A064118U
PL2	■ lamp, MOD	ZP-A064119U
R201	100k, 5%, ¼w, carbon film	RD-14TJ104N
S2	switch toggle	ST-020201ZM
S3	switch, rotary	SR-0304103E

Reference Designator	Description	Part No.
VR1/S1	□ 50k, potentiometer (volume)	RV-NB403A11
VR1, VR3/S1	■ 50k, 100k, potentiometer, ganged (volume, RF gain)	RV-PB104B01
VR2, VR3/S3	□ 10k, 100k, potentiometer, ganged (squelch, RF gain CB-PA select)	RV-PE103B01
VR2, VR4	■ 10k, 10k, potentiometer, ganged (squelch, CAL)	RV-PA103B02
	□ speaker	ZQ-A0770802
	■ speaker	ZQ-A0920801

Mechanical Parts

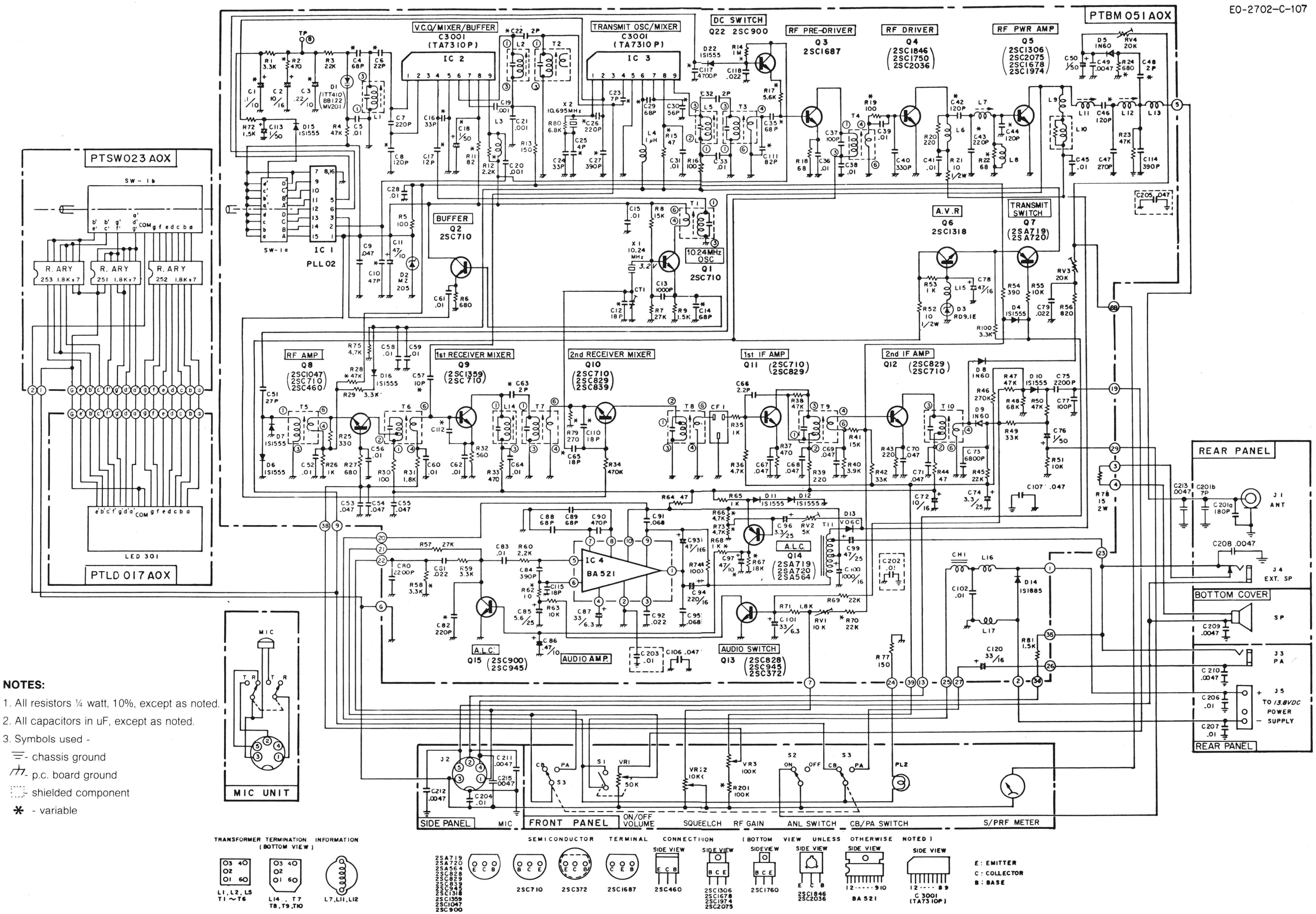
Part Number	Description	Qty
MZ-121SZ003	□ bracket, meter	1
MZ-421SZ003	■ bracket, meter	1
ML-121SZ007	bracket, speaker	4
MU-276SW001	□ bracket, mobile mounting	1
MU-276SW002	■ bracket, mobile mounting	1
MC-473SZ002	■ bracket, p.c. board	1
MU-773SM022	□ case, top	1
MU-773SM053	■ case, top	1
MU-773SM023	□ case, bottom	1
MU-773SM054	■ case, bottom	1
MU-677SZ050	□ chassis	1
MU-677SZ049	■ chassis	1
MX-315SZ001	■ clamp	1
AC-DC038GEA	□ cord, power	1
AC-DC036GEA	■ cord, power	1
AM-2702##01	□ escutcheon	1
AM-2703##01	■ escutcheon	1
AM-2683B#01	■ frame	1
MB-762SZ057	□ front panel	1
MB-762SZ053	■ front panel	1
MZ-331SZ002	hanger, mike	1
VN-176SB006	knob, channel selector	1
VN-274SM001	■ knob, volume and squelch	2
VN-276SM001	□ knob, volume	1
VN-176SB002	knob, RF gain, switch	2
VN-276SB008	■ knob, CB-PA	1
ML-423SN001	□ L shape terminal, DC jack	1

Accessory Parts

Part No.	Description	Qty
BT-PT5013AN	screw, truss head tapping, unit mtg. M5 x 13	4
BT-PP4010BZ	screw, pan head tapping, M4 x 10, unit mtg.	2
MF-284SN001	thumb screw	2

Schematic Diagram, Model 2702

E0-2702-C-107

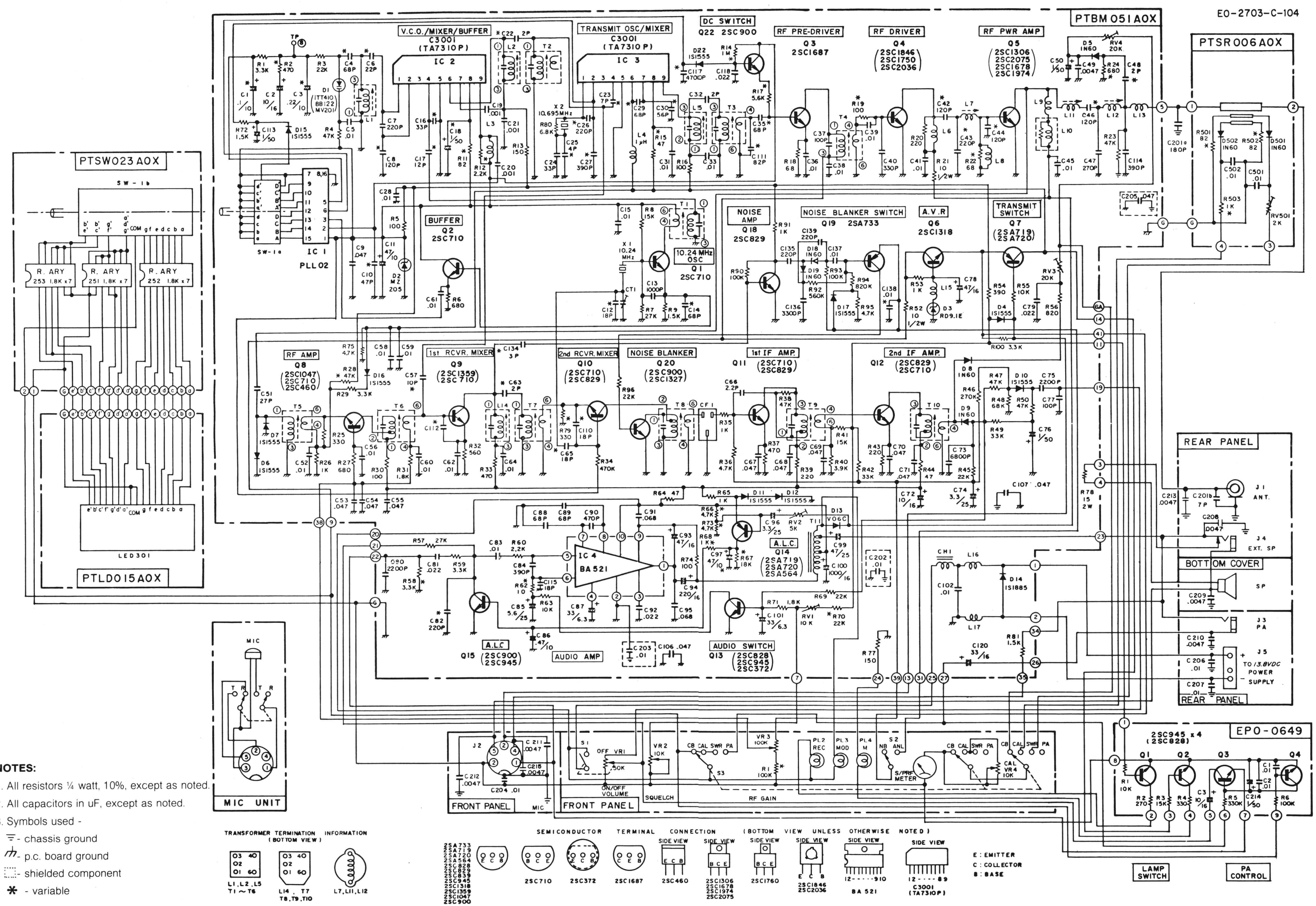


NOTES:

1. All resistors ¼ watt, 10%, except as noted.
2. All capacitors in uF, except as noted.
3. Symbols used -
   - chassis ground
   - p.c. board ground
   - shielded component
   - * - variable

Figure 4-7. Schematic Diagram, Model 2702

Schematic Diagram, Model 2703



NOTES:

1. All resistors ¼ watt, 10%, except as noted.
2. All capacitors in uF, except as noted.
3. Symbols used -
   - chassis ground
   - p.c. board ground
   - shielded component
   - * - variable

Figure 4-8. Schematic Diagram, Model 2703