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Royce 1-603 Service Manual

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Model 1-603

SERVICE MANUAL

1-603 CIRCUIT DESCRIPTION

GENERAL

The 1-603 is designed around a double-sided P. C. board that comprises Royce's "semi-leadless" chassis. The main board circuitry consists of the r. f. and i. f. stages; audio, transmitter modulator and output stages. In addition, there are two "modular" boards; the diode matrix switching circuit for the LED channel readout function, and the crystal oscillator unit. Each of these in turn will be examined further, subsequently.

R. F. SECTION

Incoming r. f. signals from the antenna jack are applied through T101 to the base of the r. f. amplifier 2SC382 (Q101). The input is diode protected against transients. The output of Q101 is applied to the base of the first mixer 2SC710 (Q102) as is the 37 MHz output from the crystal oscillator unit (pin 24). The mixing process provides the first i. f. frequency output (10.7 MHz) which, after passing through the 10.7 MHz filter (F101), is applied to the input of the second mixer 2SC711 (Q103). The crystal oscillator unit also provides an output from pin 8 (10.2 MHz) to the input of Q103. The mixing process then completes conversion to the 455 KHz second i. f. which is then applied to the 455 KHz i. f. filters (F102, F103).

A high degree of selectivity is achieved through the use of the dual i. f. filters, hence no tuned circuits are utilized in the three-stage i. f. strip consisting of 2SC711 (Q104, 105) 2SA562 (Q106). The output of the detector 1S188 (D102) is then applied through a switchable noise gate (ANL function) to provide audio output to the volume control.

AUDIO SECTION

The audio signal from the volume control is applied to the first audio preamp 2SC372 (Q109). Providing the squelch is "off," the output of Q109 is applied to a second audio preamp 2SC735 (Q301). The output of Q301 feeds the audio driver I. C. TA7062P (Q302) which in turn drives the primary of driver transformer ETT-1001 (T2). The output is a push-pull stage consisting of T2 secondary, the audio output (and modulator) transistors 2SC1173 (Q303, Q304), and the modulation and output transformer ETT-20015 (T1). In the receive mode, the audio output secondary of T1 drives the speaker via the switching relay NS2-P-DC12V (RL 1-2).

MODULATOR SECTION

The modulator section begins at the microphone input jack. In the transmit mode (pin 3 grounded at mic jack), the switching relay will be activated. The audio input (pin 1 mic jack) is applied to the base of the mic preamp 2SC372 (Q205). The signal then follows a similar progression from Q301 on through to the output as outlined in the AUDIO SECTION, preceding with two exceptions. The audio output winding is disconnected, and the output of the modulation transformer is applied to the transmitter driver and output stages. A negative feedback signal is developed by the "automatic modulation control" circuit from the modulation stage output. Modulation peaks in the output cause A.M.C. amplifier 2SA562 (Q204) to conduct, thus limiting the audio input level. Threshold of the circuit is controlled by the 10 K ohm mini-potentiometer VR201.

TRANSMITTER SECTION

The transmitter section is conventional and straightforward in design. The crystal oscillator unit provides a 27 MHz signal (from pin 10) to the input of the predriver 2SC710 (Q201). Class A operation is employed in the Q201 drives the r. f. driver 2SC1018 (Q202) which in turn drives the r. f. final 2SC756 (Q203). Both the driver and final are operated class B. The output circuitry comprises a pi-loading, and low pass filter network (54 MHz). Associated circuitry consists of a tap on the r. f. output, rectified by D201 to provide a signal for the r. f. meter, and the transmit/modulation indicator amplifier 2SC735 (Q206).

DIODE MATRIX CIRCUIT MODULE

The D.M.C. unit performs the singular function of providing the necessary switching to display the channel position on the LED readout. Associated circuitry consists of a voltage regulator 2SC1173 (Q401) and brightness switch. The seven-segment LED display devices have 5/16" character heights, and average dissipation of approximately 15 MA per segment. The TLR-302 is common cathode, the TLR-303 is common anode. For additional particulars on the D.M.C. unit, refer to the board layout and pin functional descriptions.

SQUELCH — AGC

The A.G.C. amplifier 2SC372 (Q108) operates on signals supplied by the detector output. The A.G.C. output is applied to the base of Q102 and Q104. The A.G.C. output also serves as a source for the squelch circuit transistor 2SC372 (Q107) which, when operational, biases Q109 off.

1-603

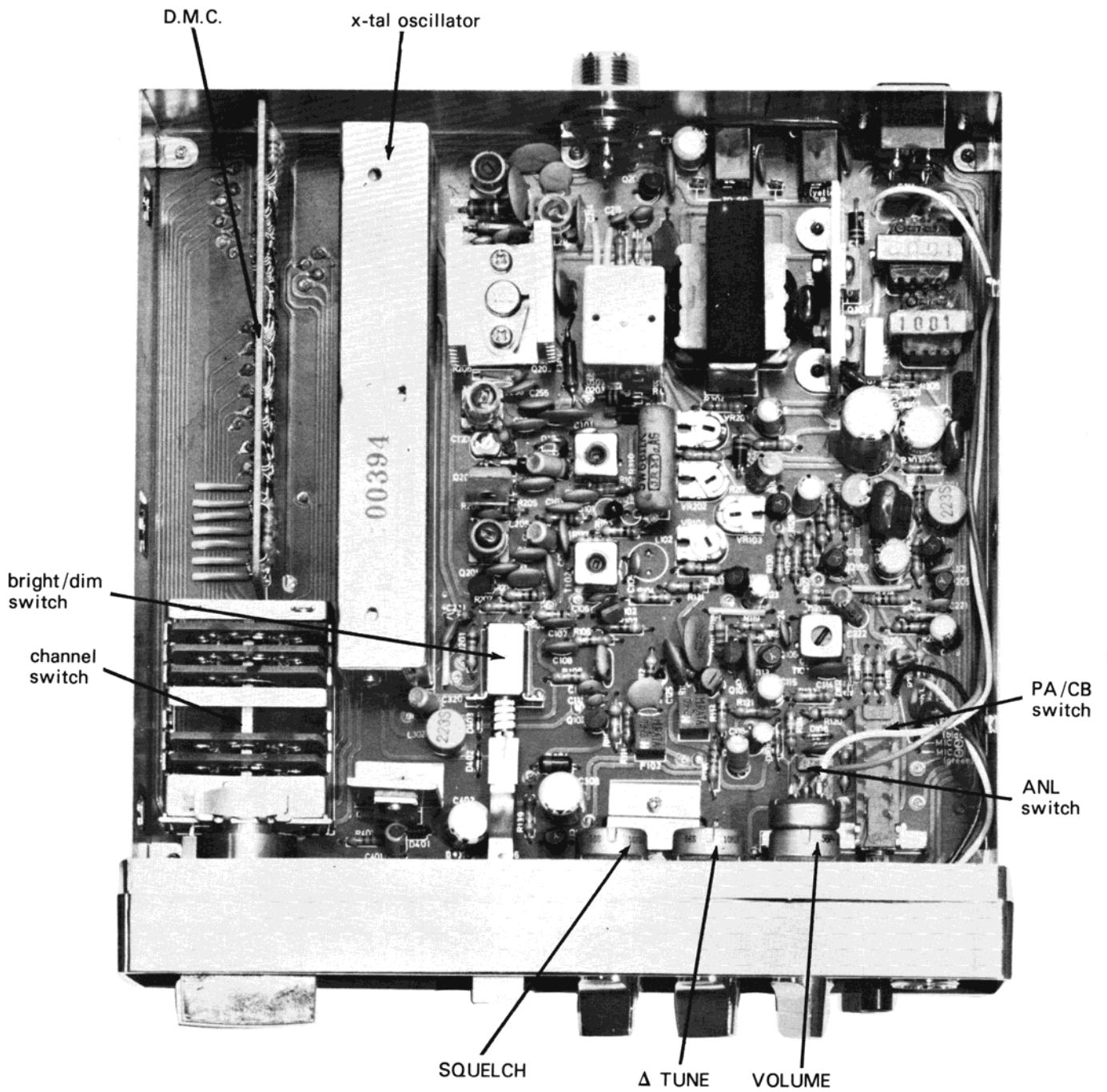


Fig 1

1-603

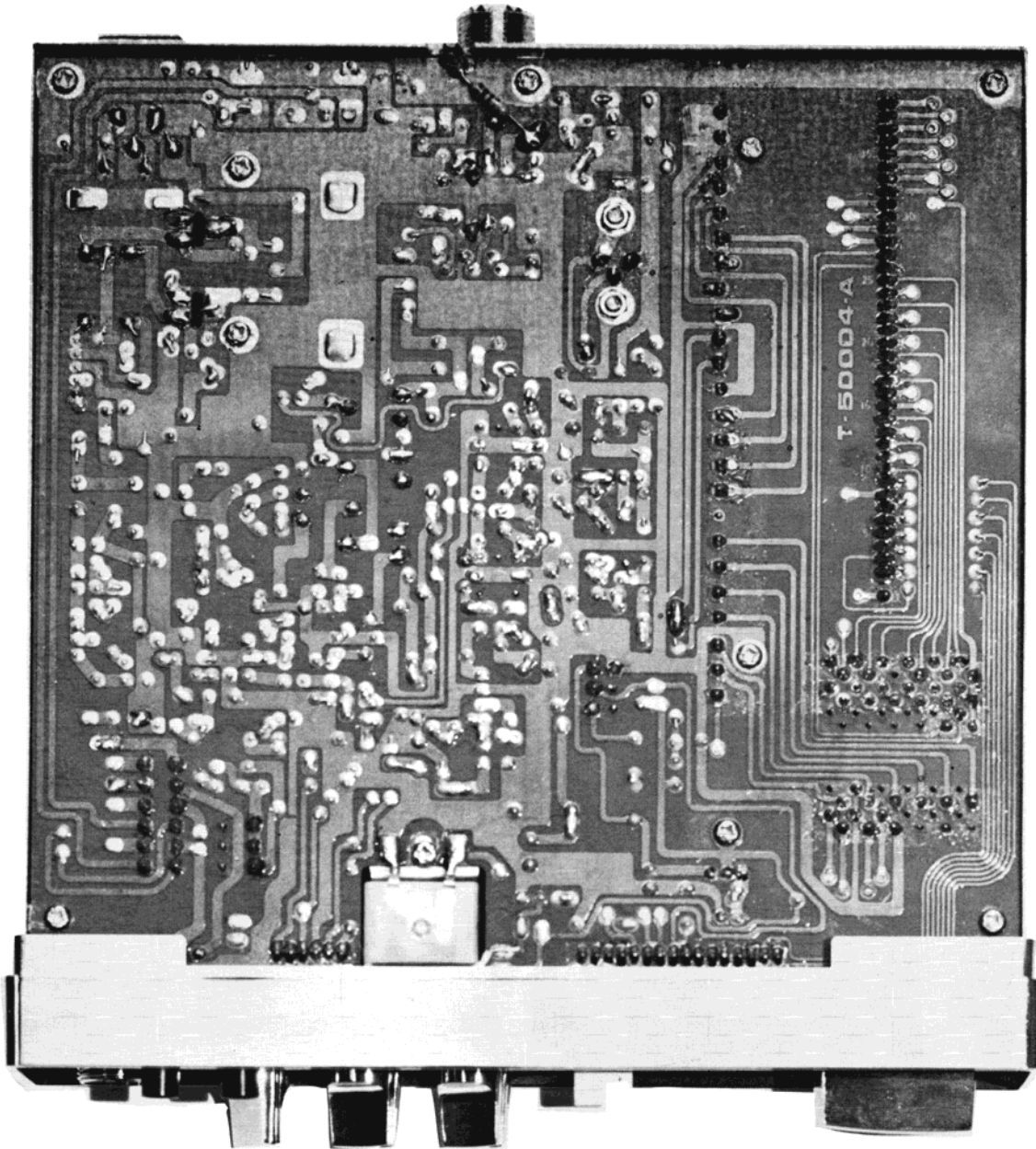
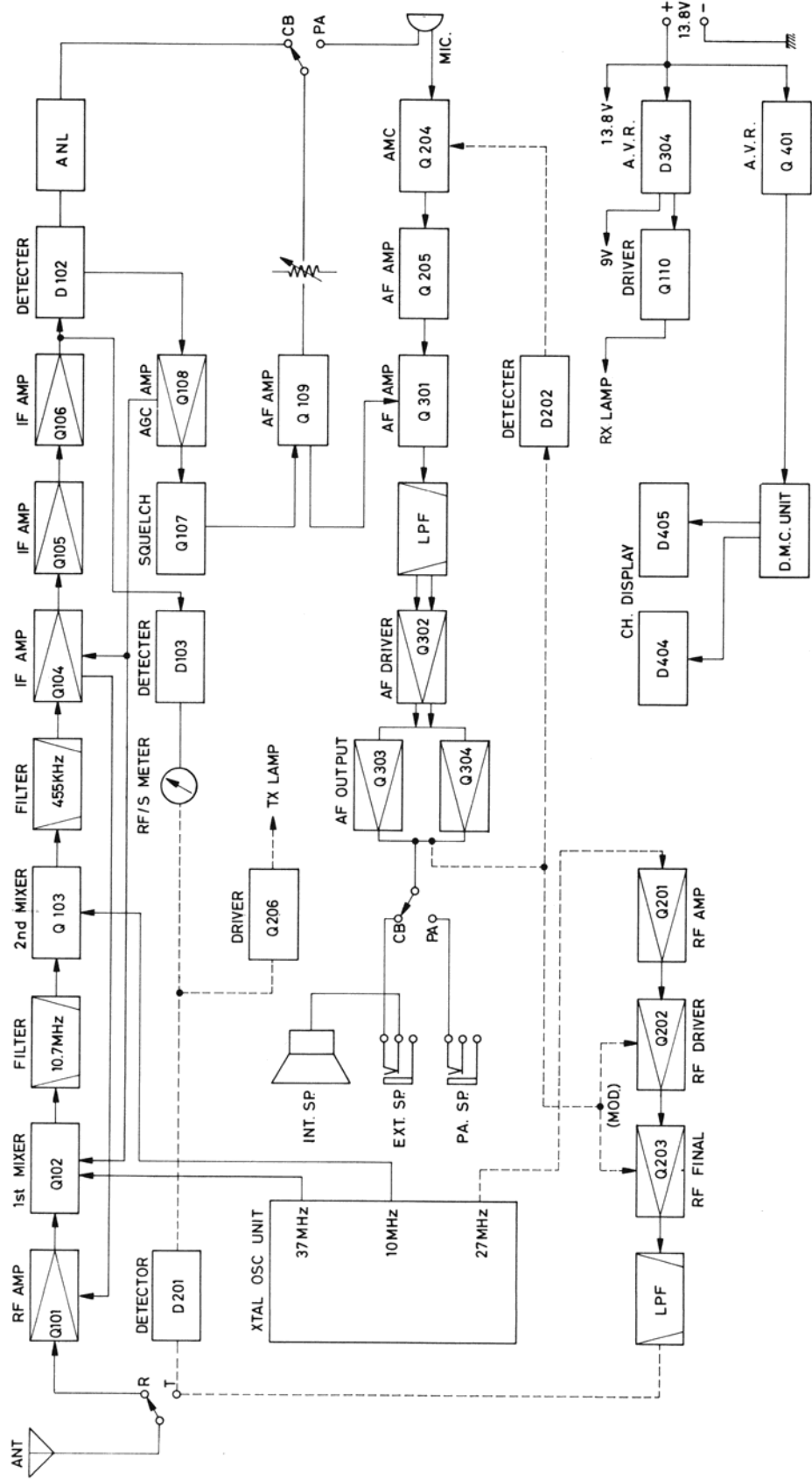


Fig 2

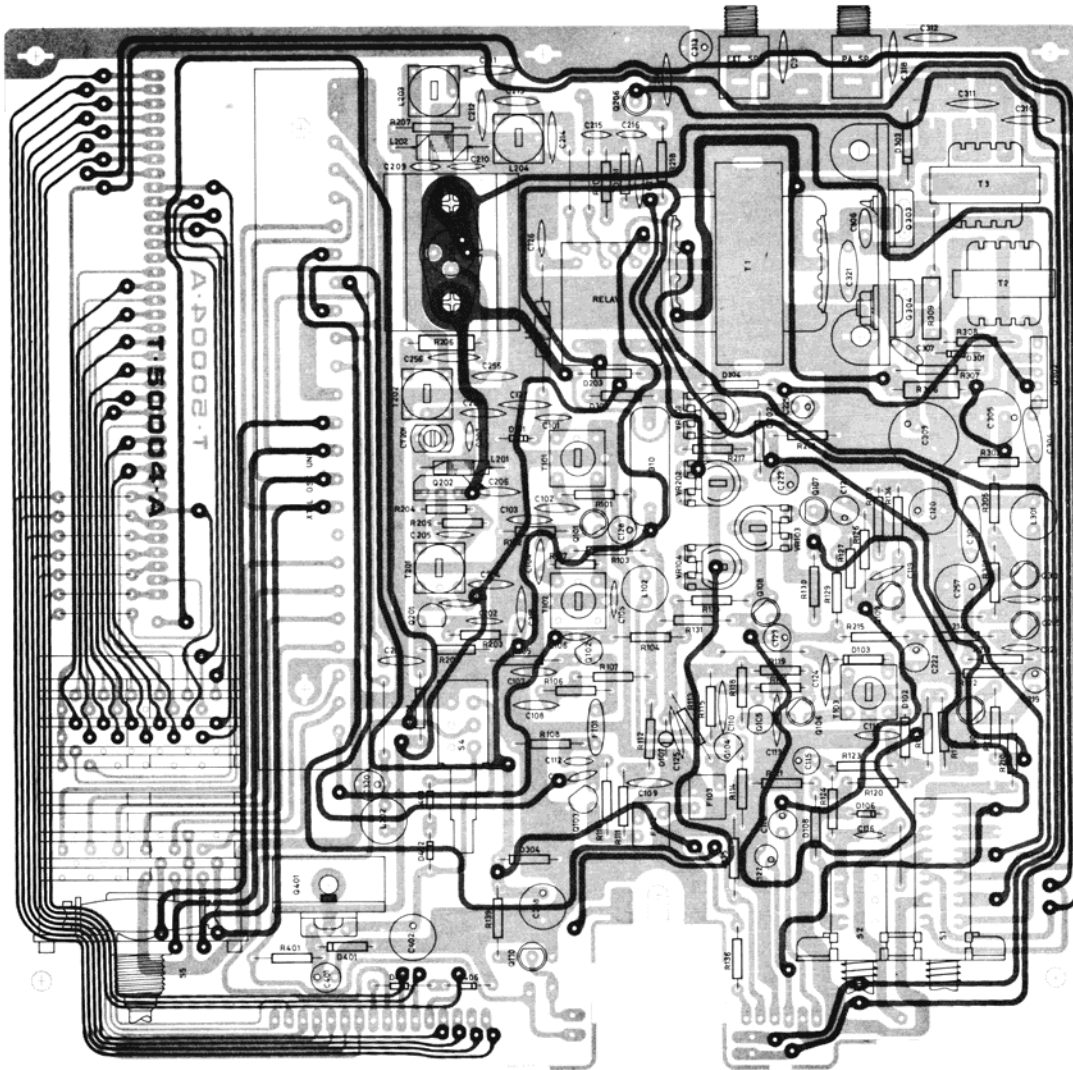
I-603 BLOCK DIAGRAM



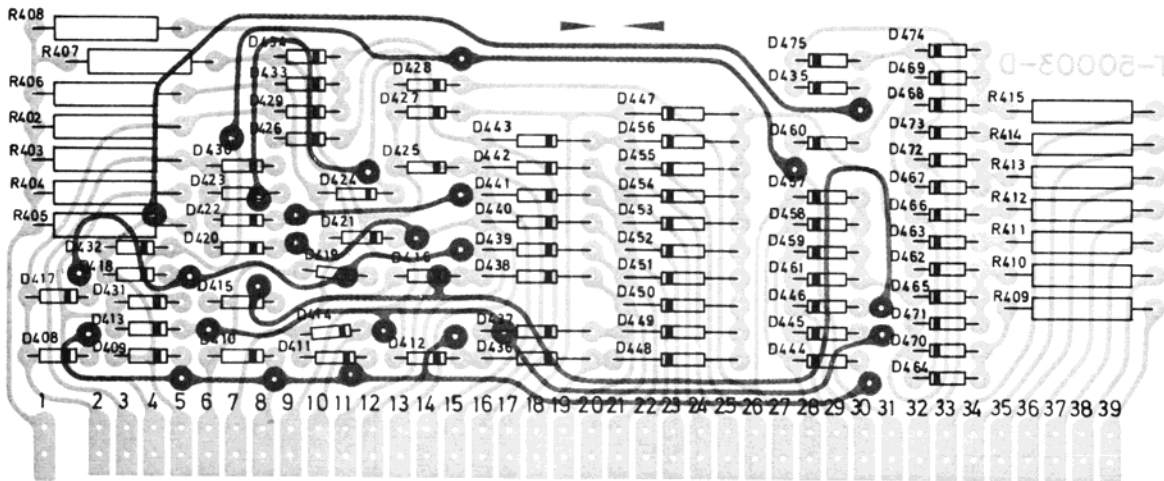
1-603 Voltage Chart

| | | Vb | | Vc | | Ve | |
|-------|-------------|------------|-------|----------------|-----------|------------|------|
| Q-101 | 2SC-382GR | 2.0V | | 7.4V | | 1.5V | |
| Q-102 | 2SC-710C | 1.2V | | 8.3V | | 0.8V | |
| Q-103 | 2SC-711E | 0.7V | | 4.0V | | 0V | |
| Q-104 | 2SC-711E | 1.1V | | 2.5V | | 0.6V | |
| Q-105 | 2SC-711D | 0.6V | | 4.6V | | 0V | |
| Q-106 | 2SA-562Y | 4.6V | | 0V | | 5.2V | |
| Q-107 | 2SC-372Y | SQUELCH | 0.65V | SQUELCH | 0V | SQUELCH | 0V |
| | | NO SQUELCH | 0V | NO SQUELCH | 7V | NO SQUELCH | 0V |
| Q-108 | 2SC-372Y | 2.1V | | 8.9V | | 1.9V | |
| Q-109 | 2SC-377Y | SQUELCH | 0V | SQUELCH(TX) | 6V (4.6V) | SQUELCH | 0V |
| | | NO SQUELCH | 0.95V | NO SQUELCH(TX) | 6V (4.6V) | NO SQUELCH | 0.4V |
| Q-110 | 2SC-735Y | 0.7V | | 0.3V | | 0V | |
| Q-201 | 2SC-710C | RX | 1.5V | RX | 13.8V | RX | 8.9V |
| | | TX | 2.0V | TX | 13.8V | TX | 1.3V |
| Q-202 | 2SC-1018 | - | | 12.2V | | - | |
| Q-203 | 2SC-756A | - | | 12.2V | | - | |
| Q-204 | 2SA-562Y | - | | - | | 0V | |
| Q-205 | 2SC-372Y | RX | 4.1V | RX | 6.0V | RX | 8.8V |
| | | TX | 4.1V | TX | 4.6V | TX | 3.6V |
| Q-206 | 2SC-735Y | 0.7V | | 5.1V | | 0.0V | |
| Q-301 | 2SC-735Y | RX | 6.0V | RX | 10.2V | RX | 5.4V |
| | | TX | 4.6V | TX | 10.4V | TX | 4.0V |
| Q-302 | TA-7062P | PIN NO 1 | 2 | 3 | 4 | 5 | |
| | | 0.8V | 0.2V | 0V | 12V | 11.4V | |
| Q-303 | 2SC-1173(O) | 0.7V | | 13.7V | | 0.1V | |
| Q-304 | 2SC-1173(O) | 0.7V | | 13.7V | | 0.1V | |
| Q-401 | 2SC-1173(O) | 5.8V | | 13.8V | | 5.0V | |

TOP VIEW



D.M.C. Board 1-603 TOP VIEW

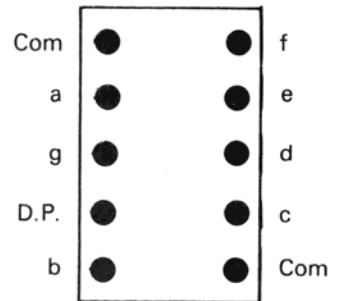
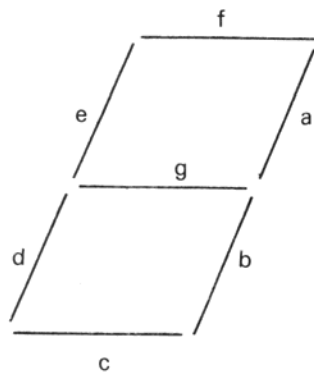


Pin Functions

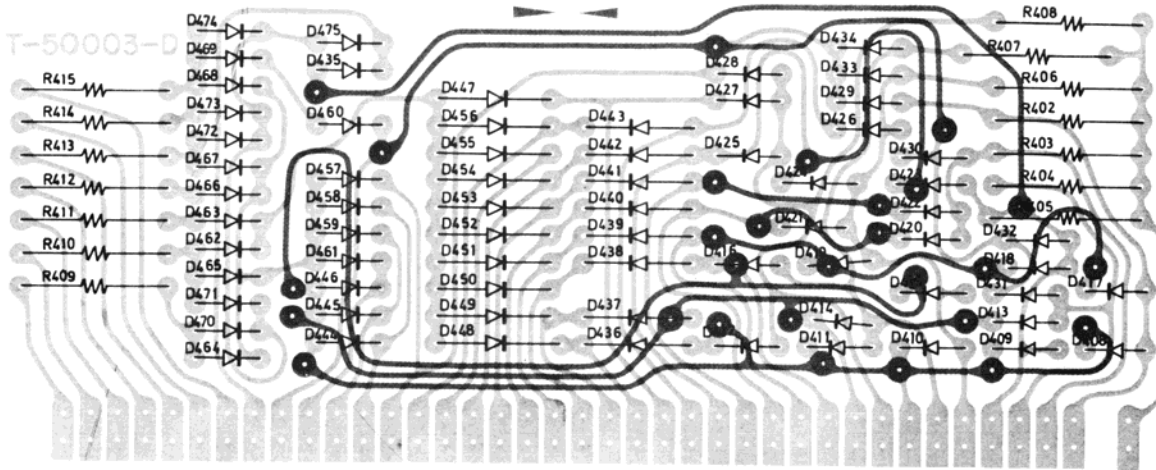
- 1. (f) Bright/Dim Switch
- 2. F2*
- 3. A2
- 4. B2
- 5. C2
- 6. D2
- 7. E2
- 8., 20-31 Channel Switch
- 9. G2
- 32. PA Switch
- 33. G3
- 34. E3
- 35. D3
- 36. C3
- 37. B3
- 38. A3
- 39. F3

*Segment F TLR302

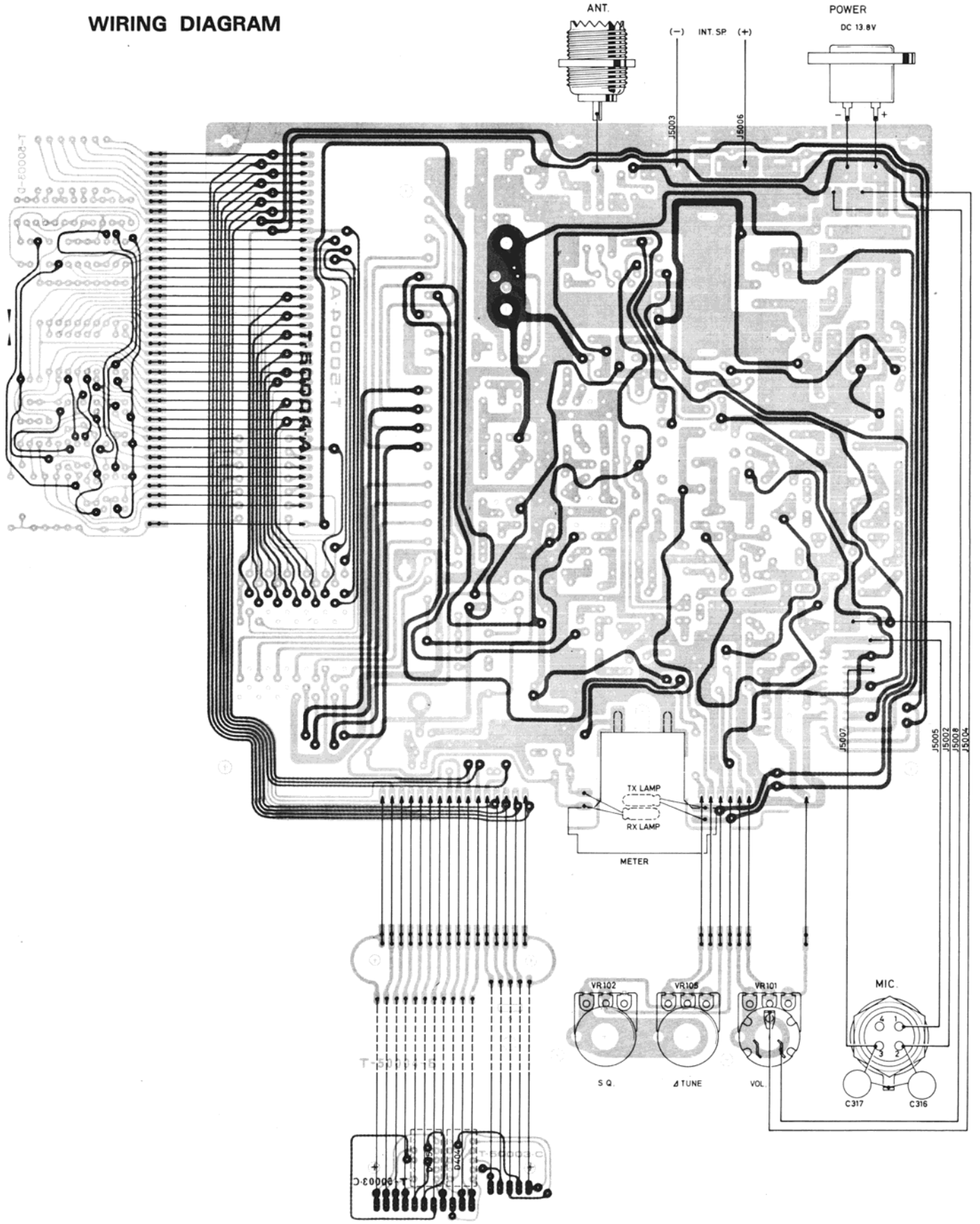
TLR302/303



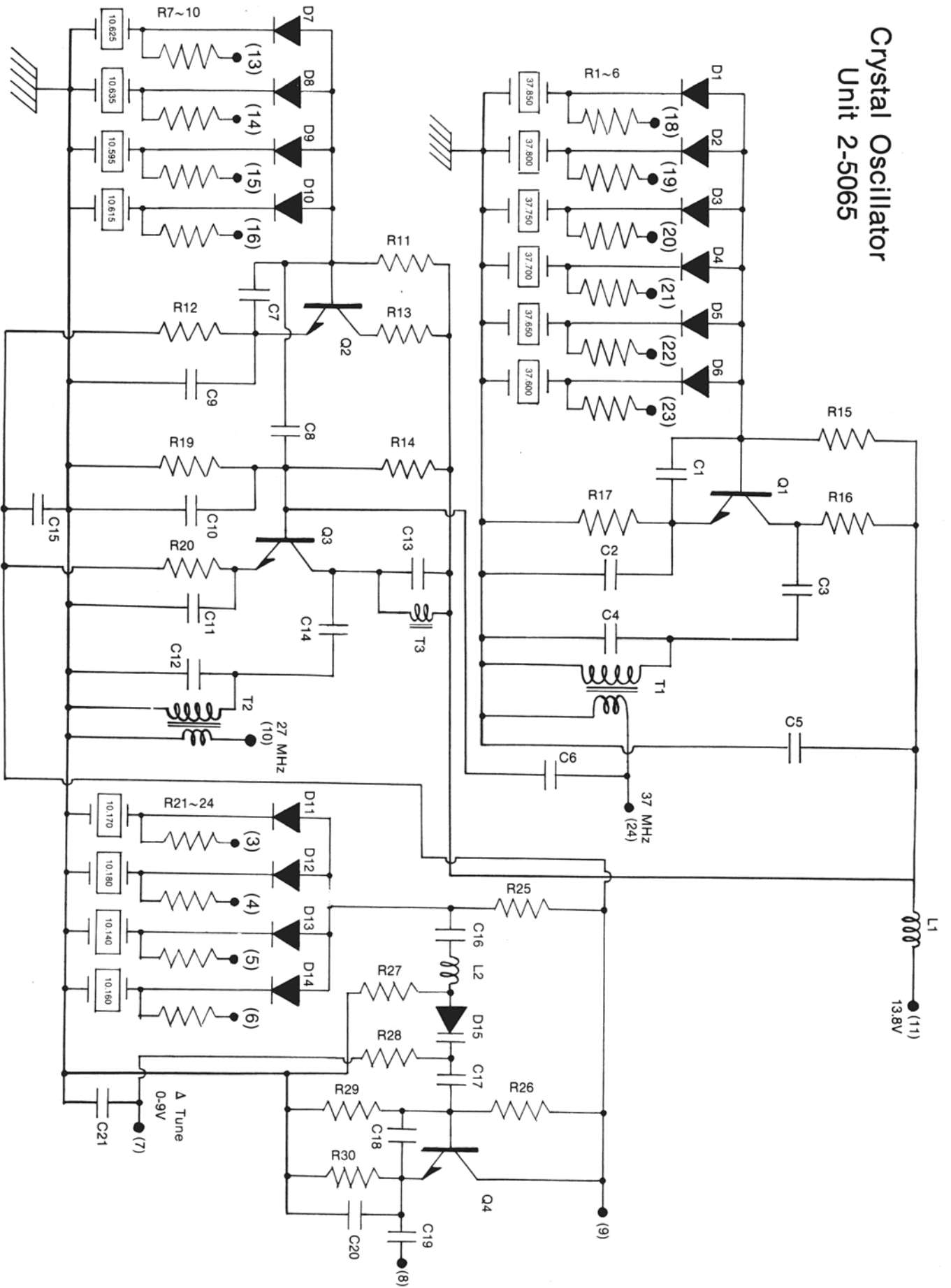
BOTTOM VIEW

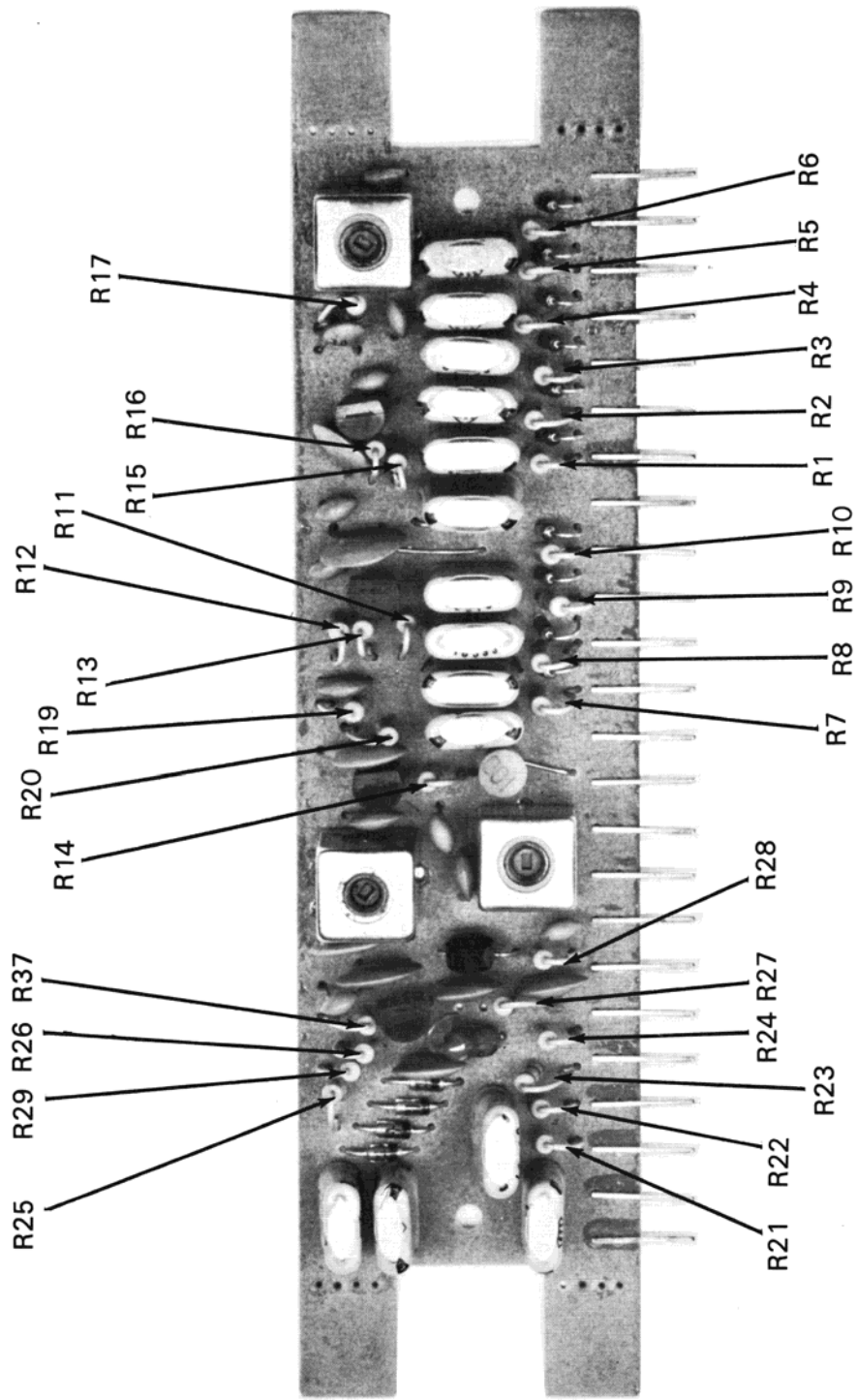


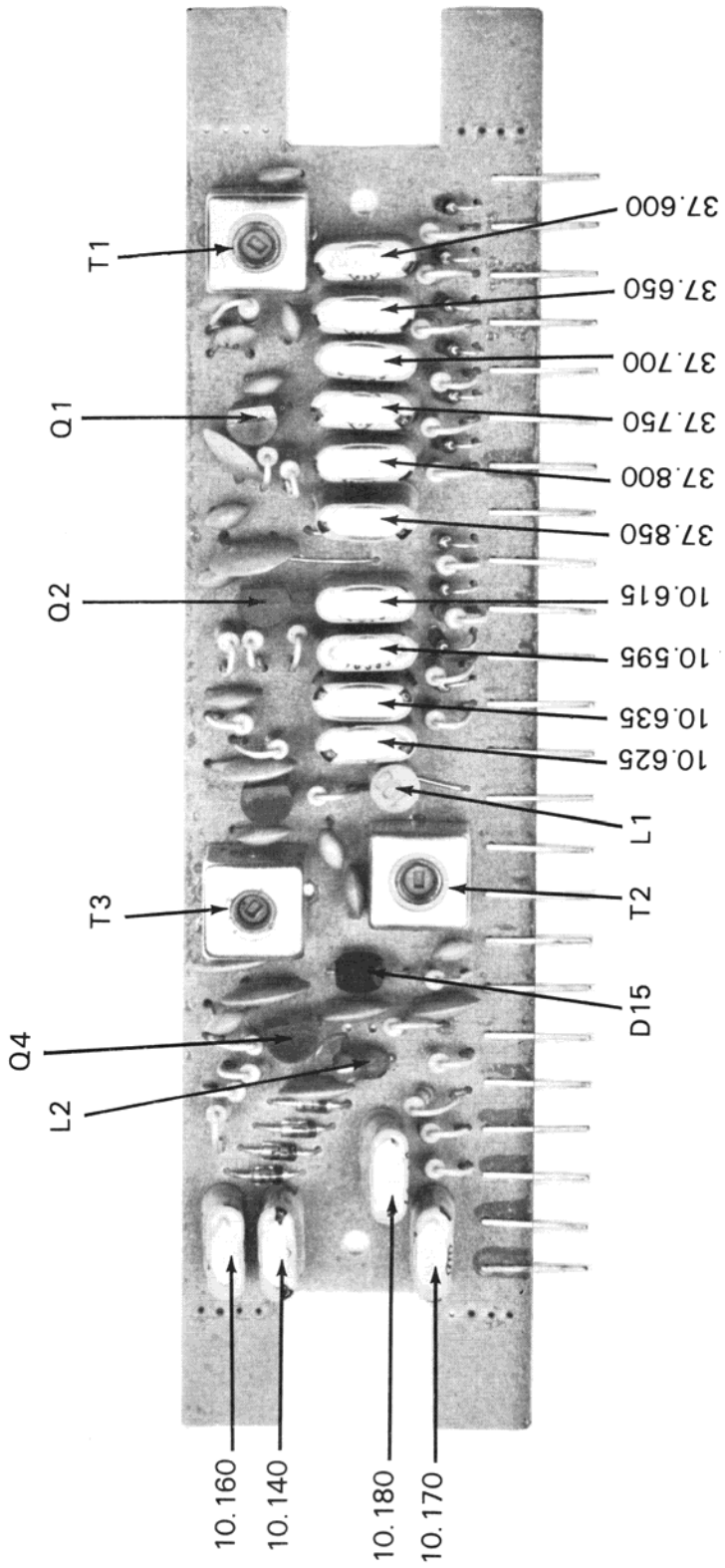
WIRING DIAGRAM

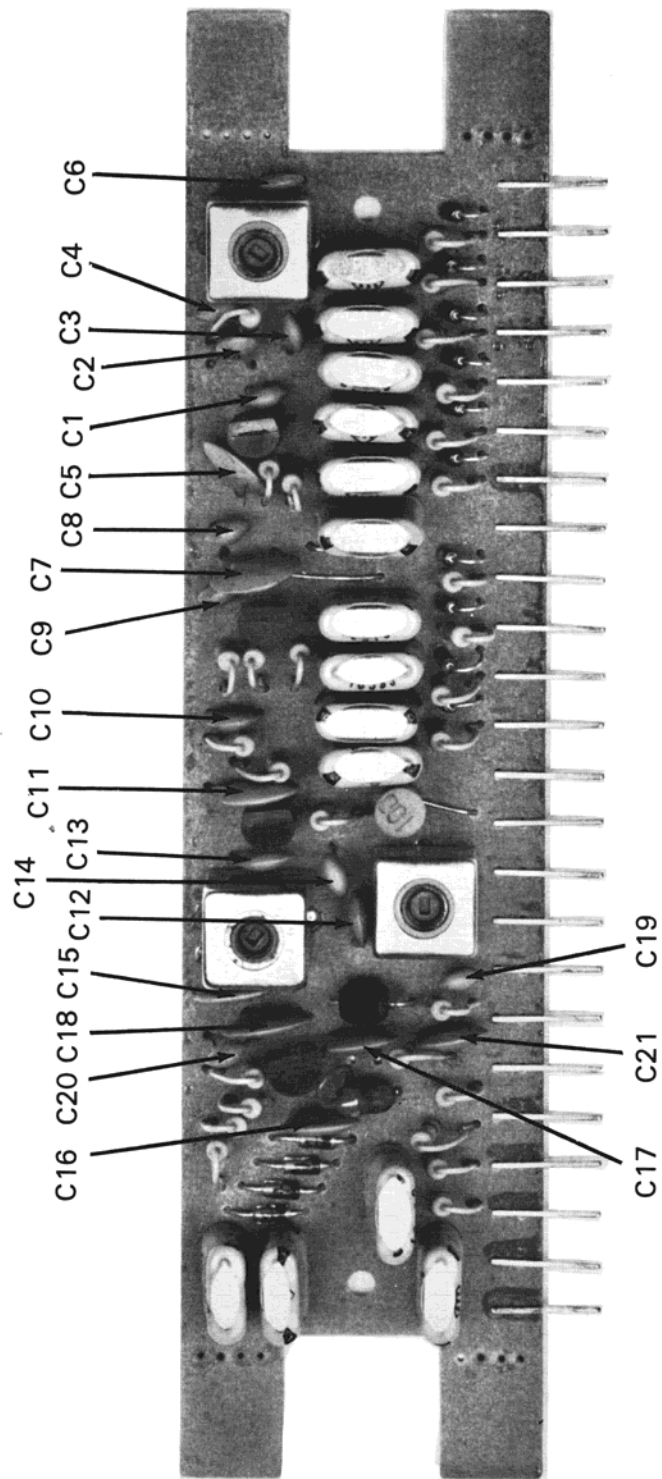


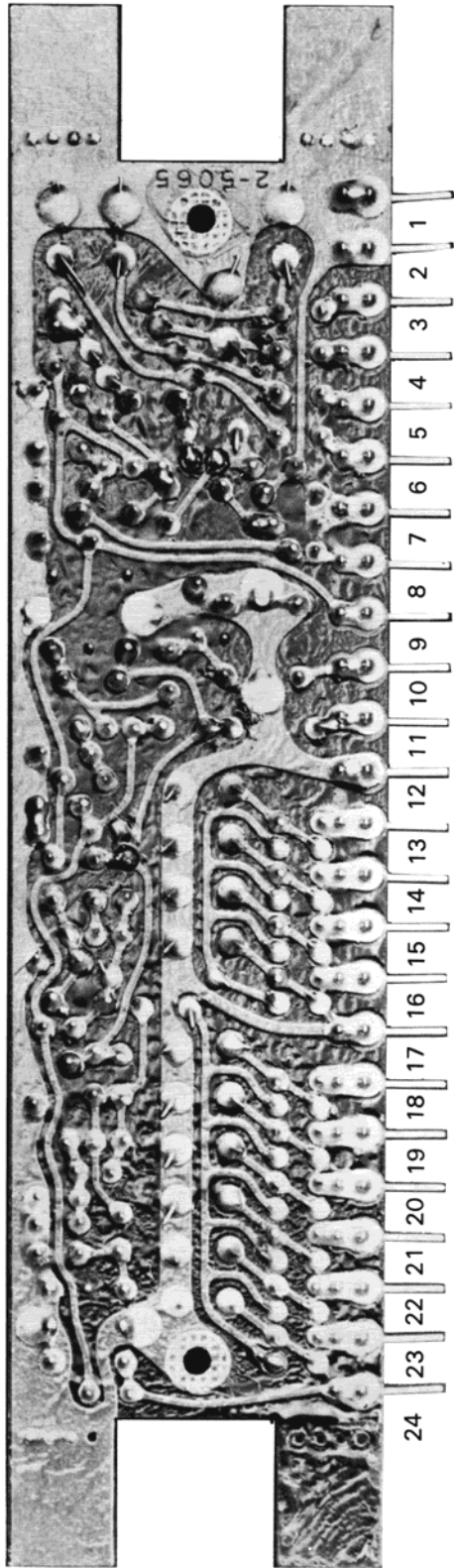
Crystal Oscillator Unit 2-5065











1-603 PARTS LIST

Crystal Oscillator Parts List

| Ref. # | Description | Part # |
|--------|-------------|--------|
|--------|-------------|--------|

Semiconductors

| | | |
|--------|-------------------|--|
| Q1-Q4 | 2SC710 Transistor | |
| D1-D14 | MC301 Diode | |
| D15 | ITT301 Varactor | |

Coils — Inductors

| | | |
|----|--|--------|
| L1 | Choke (LF4-100K) | 2-0074 |
| L2 | Choke (15uH) | 2-0170 |
| T1 | r.f. Transformer (819-50L/23579) | 2-0175 |
| T2 | r.f. Transformer (819-50L/23579) | 2-0175 |
| T3 | r.f. Transformer (820-50L/23578) | 2-0176 |

Capacitors

| | |
|-----|--------------|
| C1 | 15pF |
| C2 | 30pF |
| C3 | 15pF |
| C4 | 51pF |
| C5 | .001 μ F |
| C6 | 39pF |
| C7 | 300pF |
| C8 | 15pF |
| C9 | 39pF |
| C10 | 100pF |
| C11 | .001 μ F |
| C12 | 120pF |
| C13 | 120pF |
| C14 | 3pF |
| C15 | .001 μ F |
| C16 | .001 μ F |
| C17 | .001 μ F |
| C18 | 300pF |
| C19 | 10pF |
| C20 | 51pF |
| C21 | .001 μ F |

Resistors (All 1/4w 5%)

| | |
|--------------|--------------|
| R1-R10 | 5.1K |
| R11 | 5.1K |
| R12 | 2K |
| R13 | 5.1K |
| R14 | 10K |
| R15 | 15K |
| R16 | 5.1K |
| R17 | 1K |
| R19 | 10K |
| R20 | 510 Ω |
| R21,22,24 | 5.1K |
| R23 | 2.7K |
| R25 | 5.1K |
| R26,27,28,29 | 51K |
| R30 | 1K |

Crystals (in MHz)

| | | |
|--------|--------|--------|
| 10.140 | 10.595 | 37.600 |
| 10.160 | 10.615 | 37.650 |
| 10.170 | 10.625 | 37.700 |
| 10.180 | 10.635 | 37.750 |
| | | 37.800 |
| | | 37.850 |

CRYSTAL FREQUENCY CHART

(A) Group 6 pcs.

X¹ 37.60 MHz
 X² 37.65 MHz
 X³ 37.70 MHz
 X⁴ 37.75 MHz
 X⁵ 37.80 MHz
 X⁶ 37.85 MHz

(B) Group 4 pcs.
 (Transmitting)

X⁷ 10.635 MHz
 X⁸ 10.625 MHz
 X⁹ 10.615 MHz
 X¹⁰ 10.595 MHz

(C) Group 4 pcs.
 (Receiving)

X¹¹ 10.18 MHz
 X¹² 10.17 MHz
 X¹³ 10.16 MHz
 X¹⁴ 10.14 MHz

| CHANNEL | FREQUENCY (MHz) | COMBINATION (Transmit) | COMBINATION (Receive) |
|---------|-----------------|----------------------------------|----------------------------------|
| 1. | 26.965 | X ¹ - X ⁷ | X ¹ - X ¹¹ |
| 2. | 26.975 | X ¹ - X ⁸ | X ¹ - X ¹² |
| 3. | 26.985 | X ¹ - X ⁹ | X ¹ - X ¹³ |
| 4. | 27.005 | X ¹ - X ¹⁰ | X ¹ - X ¹⁴ |
| 5. | 27.015 | X ² - X ⁷ | X ² - X ¹¹ |
| 6. | 27.025 | X ² - X ⁸ | X ² - X ¹² |
| 7. | 27.035 | X ² - X ⁹ | X ² - X ¹³ |
| 8. | 27.055 | X ² - X ¹⁰ | X ² - X ¹⁴ |
| 9. | 27.065 | X ³ - X ⁷ | X ³ - X ¹¹ |
| 10. | 27.075 | X ³ - X ⁸ | X ³ - X ¹² |
| 11. | 27.085 | X ³ - X ⁹ | X ³ - X ¹³ |
| 12. | 27.105 | X ³ - X ¹⁰ | X ³ - X ¹⁴ |
| 13. | 27.115 | X ⁴ - X ⁷ | X ⁴ - X ¹¹ |
| 14. | 27.125 | X ⁴ - X ⁸ | X ⁴ - X ¹² |
| 15. | 27.135 | X ⁴ - X ⁹ | X ⁴ - X ¹³ |
| 16. | 27.155 | X ⁴ - X ¹⁰ | X ⁴ - X ¹⁴ |
| 17. | 27.165 | X ⁵ - X ⁷ | X ⁵ - X ¹¹ |
| 18. | 27.175 | X ⁵ - X ⁸ | X ⁵ - X ¹² |
| 19. | 27.185 | X ⁵ - X ⁹ | X ⁵ - X ¹³ |
| 20. | 27.205 | X ⁵ - X ¹⁰ | X ⁵ - X ¹⁴ |
| 21. | 27.215 | X ⁶ - X ⁷ | X ⁶ - X ¹¹ |
| 22. | 27.225 | X ⁶ - X ⁸ | X ⁶ - X ¹² |
| 23. | 27.255 | X ⁶ - X ¹⁰ | X ⁶ - X ¹⁴ |

1-603 Alignment Instruction

RECEIVER

- A. Inject at the ant. jack a 27.115MHz signal ($\pm .002\%$; 30% modulation at 1KHz).
- B. Connect an audio voltmeter and oscilloscope across on 8 ohm load and plug into external speaker jack.

| Test Equipment | Test Point | Adjust | Remarks |
|---|---------------------|---------------------------|--|
| 1. RF. signal generator (low range to avoid audio saturation) | Inject at ant. jack | channel sel to 13 | |
| | | T-101, T-102, T-103 | Max. output with vol. control at max, squelch control at min. output should be more than 500mw (2v/8ohm) with gen. voltage at 1uV; S & N/N=more than 10dB on all channels. |

AGC RESPONSE

Set the output voltage of a signal generator at 50,000uV and adjust the volume control so that the voltmeter output is 500mW (2.0v/8ohms). Then, lower the output voltage of the generator so that the voltmeter output is 10dB down. The output voltage of the signal generator should be under 5uV at this time.

SQUELCH

Set squelch control to maximum. Set signal generator to 500uV, and adjust VR103 so that squelch opens at 500uV signal level.

S-METER ADJUSTMENT

- A. Set RF. signal generator to 100uV. Adjust VR104 until meter indicates "S-9"
- B. With 0% modulation and carrier power 3.5 to 4 Watts, adjust VR202 until meter reads between S9 and S10.

DELTA TUNE

- A. Set the output voltage of a signal generator at 1uV.
- B. Set the Delta Tune Control at the center, and the Squelch Control at minimum. Set the ANL switch to the "OFF" position.
- C. Set the Volume Control so that 500mW may be attained on the voltmeter output. Then, with the Delta Tune control at the "+" side, vary the frequencies of the signal generator until the maximum voltmeter output is attained. Read the frequency variance of the signal generator. Do the same thing for the "-" side. Ascertain that the frequency variation is within $\pm 1\text{KHz}$ to 2KHz.

AUDIO POWER CHECK

With a generator output of 1mV and squelch control at minimum, audio output should be more than 4w (5.7v/8ohm) at maximum position of volume control.

TRANSMITTER

A. Power Supply – 13.8VDC.

B. Use a suitable power meter, non-inductive dummy load and oscilloscope connected to antenna jack.

| Test Equipment | Test Point | Adjust | Remarks |
|---|---------------------|-------------------------------------|---|
| 1. Power Meter | antenna jack | T-201, T-202, L-203, L-204 | Adjust for maximum output power. |
| 2. Freq. Counter | across dummy load | ————— | Check all channels \pm 800Hz |
| 3. A.F. Oscillator with AF voltmeter in shunt (1KHz 20mV) | Inject at mic input | VR-201 | – 90% modulation on oscilloscope. |
| | | ————— | Reduce AF oscillator output to 5mV; modulation \geq 50% |

SPECIFICATIONS

GENERAL

| | |
|-------------------------|--|
| 1. Semiconductors | : 24 Transistors, 103 Diodes and 1 IC |
| 2. Frequency Range | : 26.965 MHZ – 27.255 MHZ |
| 3. Mode of Operation | : AM |
| 4. Controls | : Volume Control with power on-off switch : Variable Squelch Control : Fine Tune Control : Digital Readout Channel Selector Switch : CB-PA Switch : ANL Switch : Bright-Dim Switch |
| 5. Connectors and Jacks | : Microphone Connector : Coaxial type Antenna Connector : Public Address Speaker Jack 3.5 MM : External Speaker Jack 3.5 MM |
| 6. Speaker | : 3-1/2 inches, 8 ohms |
| 7. Microphone | : Dynamic Microphone (500 ohms) |
| 8. Power Supply | : 13.8 VDC Positive or Negative Ground |
| 9. Dimensions | : 8" (W) x 2-1/8" (H) x 8-1/16" (D) |
| 10. Weight | : 4 LBS. 13 OZ. |

RECEIVER

| | |
|------------------------------------|---|
| 1. Sensitivity at S/N 10 dB | : 0.5 μ V |
| 2. Selectivity | : 5 KHZ |
| 3. AGC Figure of Range | : 80 dB |
| 4. Squelch Range | : 0.5 μ V – 500 μ V |
| 5. Audio Output Power | : 4 Watts |
| 6. Distortion at input 100 μ V | : 6% |
| 7. Audio Frequency Response | : 400 – 2000 HZ |
| 8. Spurious Response | : More than 45 dB spurious signal is required to produce the same amount of audio output as the desired receive signal. |
| 9. IF Frequency | : 1st . . . 10.595 . . . 10.635 MHZ 2nd . . . 455 KHZ |
| 10. Current Drain no audio | : 250 mA |

TRANSMITTER

| | |
|--------------------------|-------------------|
| 1. RF Output Power | : 4 Watts |
| 2. Modulation Capability | : Up to 98% |
| 3. Harmonic Suppression | : More than 50 dB |
| 4. Current Drain | : 1200 mA |

1-603 PARTS LIST

| REF. # | DESCRIPTION Semiconductors | PART # |
|--------------------------|--------------------------------|--------|
| Q 101 | 2SC382 Transistor | |
| Q 102 | 2SC710 Transistor | |
| Q 103 | 2SC711 Transistor | |
| Q 104 | 2SC711 Transistor | |
| Q 105 | 2SC711 Transistor | |
| Q 106 | 2SA562 Transistor | |
| Q 107 | 2SC372 Transistor | |
| Q 108 | 2SC372 Transistor | |
| Q 109 | 2SC372 Transistor | |
| Q 110 | 2SC735 Transistor | |
| Q 201 | 2SC710 Transistor | |
| Q 202 | 2SC1018 Transistor | |
| Q 203 | 2SC756 Transistor | |
| Q 204 | 2SA562 Transistor | |
| Q 205 | 2SC372 Transistor | |
| Q 206 | 2SC735 Transistor | |
| Q 301 | 2SC735 Transistor | |
| Q 302 | TA 7062P I. C. | |
| Q 303, 304 | 2SC1173 Transistor | |
| Q 401 | 2SC1173 Transistor | |
| D 101 | WG713 (or) 10 D-1 Diode | |
| D 102 | 1S188 Diode | |
| D 103 | 1S188 Diode | |
| D 106 | 1S2075K Diode | |
| D 107 | HV-46 Diode | |
| D 108 | 1S188 Diode | |
| D 201 | 1S188 Diode | |
| D 202 | SR1K-2 Diode | |
| D 203 | SR1K-2 Diode | |
| D 301 | SV-9 Diode | |
| D 302 | SR1K-2 Diode | |
| D 303 | SR1K-2 Diode | |
| D 304 | EQB01-09 Diode (Zener) | |
| D 401 | EQA01-06R Diode (Zener) | |
| D 402 | WG713 Diode | |
| D 403 | WG713 Diode | |
| D 404 | TLR303 L.E.D. (Common Anode) | |
| D 405 | TLR302 L.E.D. (Common Cathode) | |
| D 406 | WG713 Diode | |
| D 407 | WG713 Diode | |
| D 408-475 | WG713 Diode | |
| Coils — Inductors | | |
| L 101 | r.f. coil (49169)..... | 2-0162 |
| L 102 | choke (LF5-223K) | 2-0165 |
| L 201 | r.f. coil (49170)..... | 2-0166 |
| L 202 | r.f. coil (4056)..... | 2-0169 |
| L 203 | r.f. coil (49168)..... | 2-0163 |
| L 204 | r.f. coil (49166)..... | 2-0164 |
| L 301, L 302 | choke (LF5-223K) | 2-0165 |
| T 101 | r.f. Transformer (15089) | 2-0049 |
| T 102 | r.f. Transformer (15061) | 2-0045 |

1-603 PARTS LIST

| REF. # | DESCRIPTION | PART # |
|--------|--------------------------------------|--------|
| | Coils — Inductors | |
| T103 | r.f. Transformer (15090) | 2-0050 |
| T201 | r.f. Transformer (20105) | 2-0062 |
| T202 | r.f. Transformer (49167) | 2-0161 |
| T1 | Modulation Transformer (20015) | 2-0156 |
| T2 | Driver Transformer (1001) | 2-0033 |
| T3 | Choke (1002) | 2-0030 |

Case Parts

| | |
|----------------------------|-------|
| Case, Top | |
| Case, Bottom | |
| Front Panel | |
| Channel Knob | |
| Volume/Squelch Knob | |
| Bright-dim Knob | |
| PA/CB Knob | |
| Meter Fixing Metal | |
| D.C. Input Jack | 5-505 |
| Ext. Spkr./P.A. Jack | 5-503 |
| Ant. Jack | 5-502 |
| Mic Jack | 5-501 |
| Mounting Bracket | |
| Wingbolt | 3-437 |
| Mic Hanger | 3-428 |

Controls

| | |
|-------|-------------------------------------|
| S1 | PA/CB Switch |
| S2 | ANL Switch |
| S4 | Bright-dim Switch |
| S5 | Channel Switch |
| VR101 | Volume Control (50K Ω) |
| VR102 | Squelch Control (10K Ω) |
| VR103 | Semi-Fixed Resistor (5K Ω) |
| VR104 | Semi-Fixed Resistor (20K Ω) |
| VR105 | Delta-Tune (10K Ω) |
| VR201 | Semi-Fixed Resistor (10K Ω) |
| VR202 | Semi-Fixed Resistor (20K Ω) |

Miscellaneous

| | |
|-----------|------------------------------|
| | Relay (NS2-P-DC12v) |
| | Speaker |
| | Heatsink (2SC1173) |
| | Heatsink (2SD 330) |
| | Heatsink (2SC756) |
| | D.C. Cord |
| F102, 103 | i.f. Filter (CFU-455H) |
| F101 | i.f. filter (SFE — 10.7 MA5) |
| | RX Pilot Lamp |
| | TX Pilot Lamp |
| | S/RF Meter |

Resistor/Capacitors

Consult schematic for specific values.