Royce 1-601 Series 1 and 3 Service Manual

Royce

Model 1-601

SERVICE MANUAL

1-601 CIRCUIT DESCRIPTION

GENERAL

The 1-601 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 is one "modular" board, the oscillator synthesizer circuit. There are two basic versions of the 1-601. Early models utilized a crystal oscillator module for synthesis, later versions incorporated the Gyro-Lock (PLL) module. For purposes of this manual the models will be identified as series 1 and series 3 respectively.

RF SECTION

Incoming r.f. signals from the antenna jack are applied through T101 to the base of Q101 (2SC382 series 1, 2SC674 series 2). 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 oscillator unit (pin 24 series 1, pin 19 series 3). 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 oscillator unit also provides an output at 10.2 MHz to the input of Q103 (pin 8 series 1, pin 2 series 3). 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 Q109 (2SC372 series 1, 2SC536 series 3). The output of Q109 is applied to a second audio preamp Q301 (2SC735 series 1, 2SD467 series 3), providing the squelch is "off." 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 Q303, 304 (2SC1173 series 1, 2SD330 series 3), 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 (RL1-2).

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 Q205 (2SC372 series 1, 2SC536 series 3). 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 aduio 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 Q204 (2SA562 series 1, 2SB561 series 3) to conduct, thus limiting the audio input level. Threshold of the circuit is controlled by the 10K ohm mini-potentiometer VR201.

TRANSMITTER SECTION

The transmitter section is conventional and straightforward in design. The oscillator unit provides a 27 MHz signal (pin 10 series 1, pin 23 series 3) 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. 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 (Q206).

SQUELCH — AGC

The A.G.C. amplifier Q108 (2SC372 series 1, 2SC536 series 3) 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 Q107 (2SC372 series 1, 2SC536 series 3) which, when operational, biases Q109 off.

1-601 (Series 1)

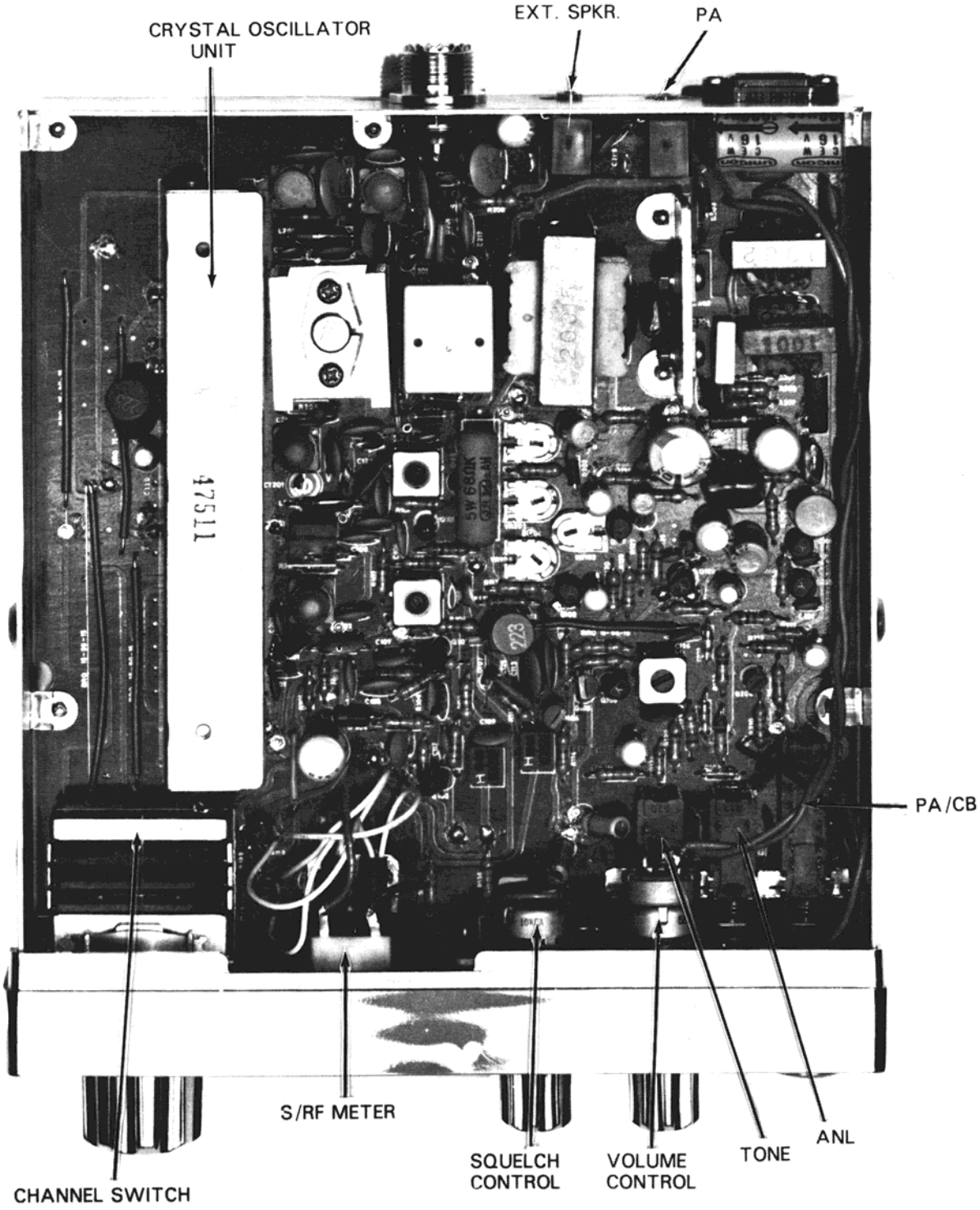


FIG 1

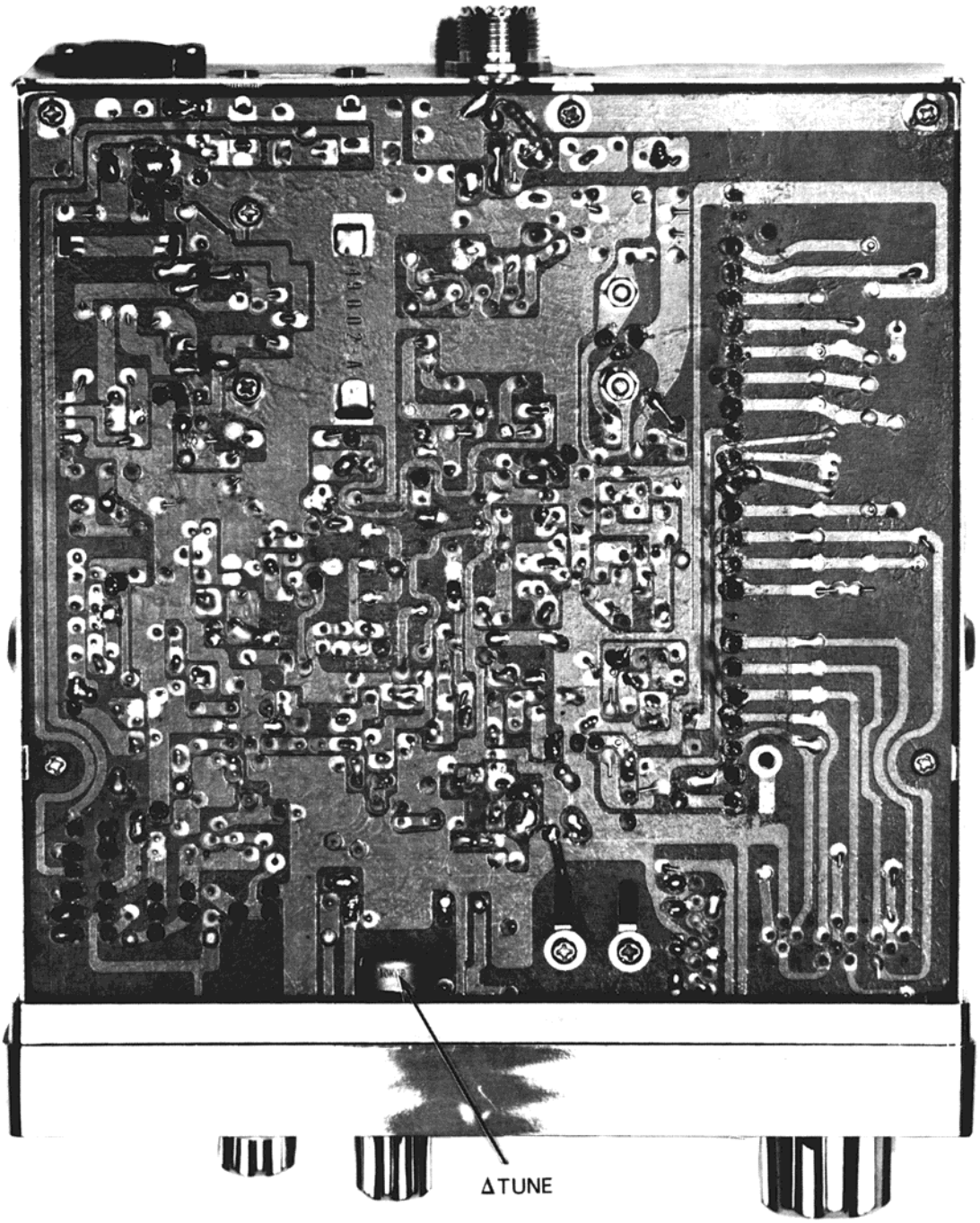


FIG. 2

1-601 (Series 3)

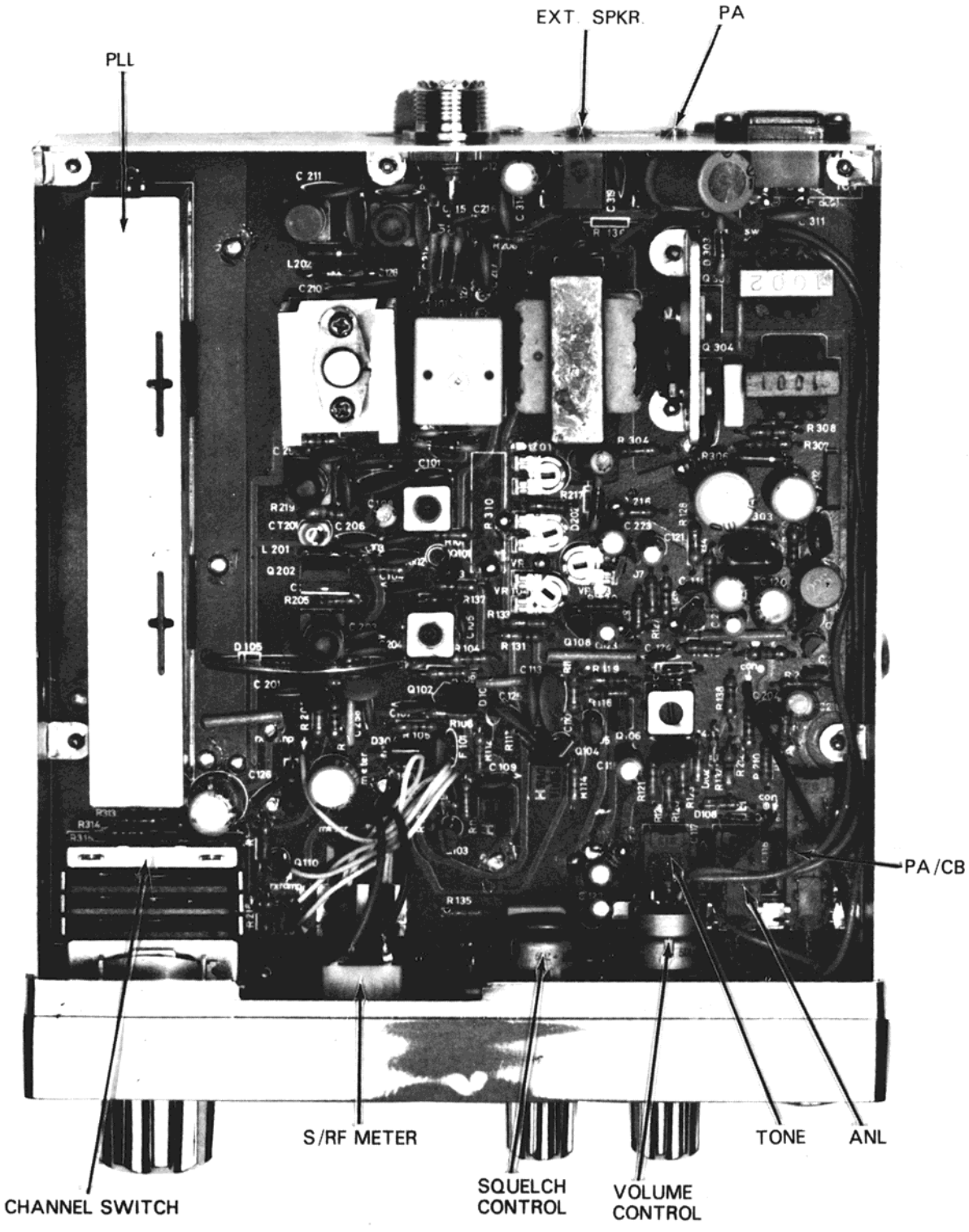


FIG. 3

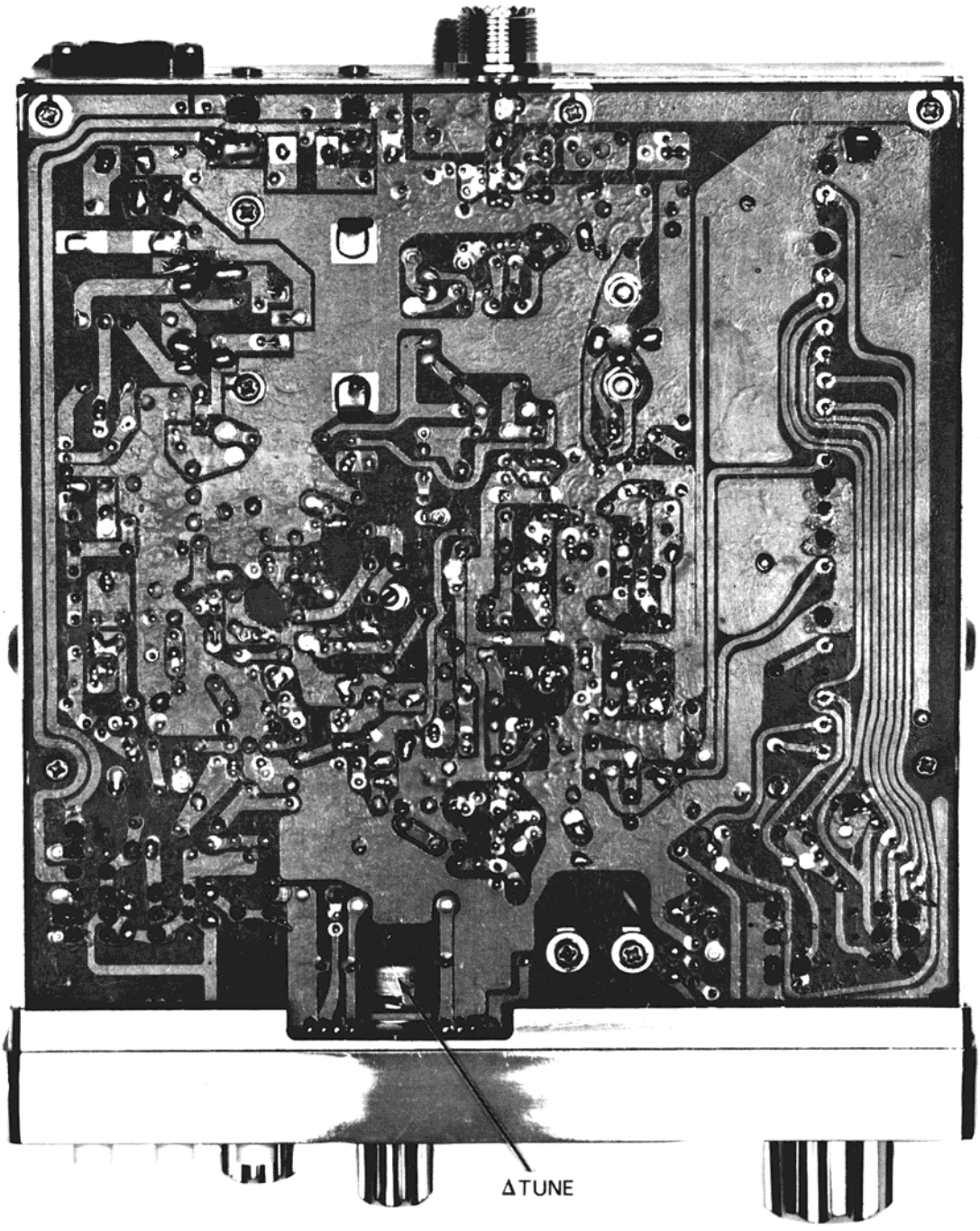
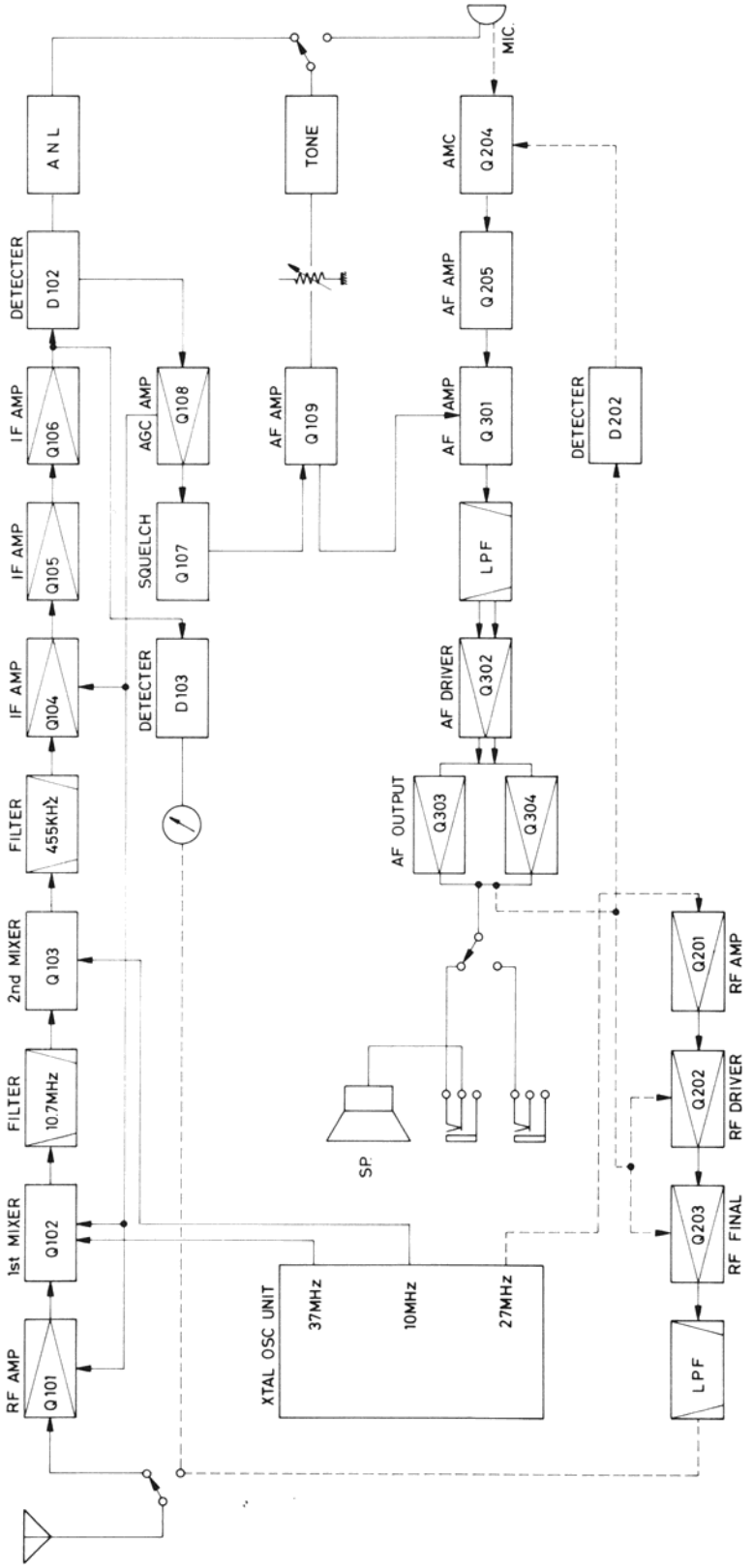


FIG. 4

1-601 Series 1

BLOCK DIAGRAM



I-601 Voltage Chart **Series 1**

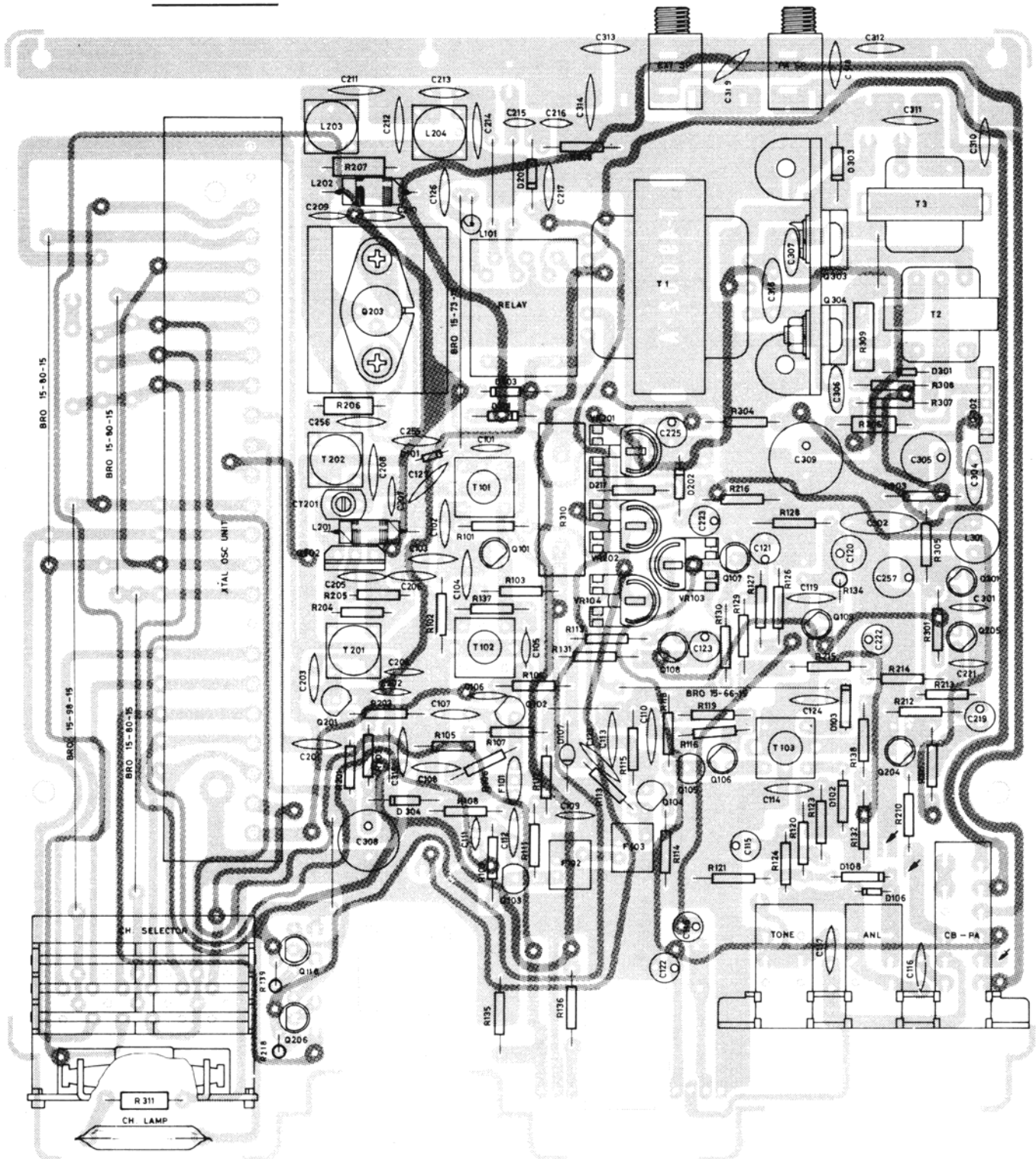
				RX	TX
Q101	2SC382GR	Vb		2.2V	
		Vc		7.4V	
		Ve		1.5V	
Q102	2SC710C	Vb		1.2V	
		Vc		8.3V	
		Ve		0.8V	
Q103	2SC711E	Vb		0.7V	
		Vc		4.5V	
		Ve		0V	
Q104	2SC711E	Vb		1.2V	
		Vc		2.6V	
		Ve		0.6V	
Q105	2SC711D	Vb		0.7V	
		Vc		4.6V	
		Ve		0V	
Q106	2SA562Y	Vb		4.6V	
		Vc		0V	
		Ve		5.3V	
Q107	2SC372Y	Vb	(NO SQUELCH)	0V	
			(SQUELCH)	0.7V	
		Vc	(NO SQUELCH)	7.0V	
			(SQUELCH)	0.1V	
		Ve	(NO SQUELCH)	0V	
			(SQUELCH)	0V	
Q108	2SC372Y	Vb		2.6V	
		Vc		9.0V	
		Ve		2.0V	
Q109	2SC372Y	Vb	(NO SQUELCH)	1.0V	
			(SQUELCH)	0V	
		Vc	(NO SQUELCH)	6.0V	5.0V
			(SQUELCH)	8.8V	
		Ve	(NO SQUELCH)	0.4V	
			(SQUELCH)	0V	
Q110	2SC735Y	Vb		0.8V	
		Vc		0.3V	
		Ve		0V	

			RX	TX
Q201	2SC710C	Vb		1.8V
		Vc		13.6V
		Ve		1.4V
Q202	2SC1018	Vb		
		Vc		12.4V
		Ve		
Q203	2SC756A	Vb		
		Vc		12.4V
		Ve		
Q204	2SA562Y	Vb		
		Vc		
		Ve		0V
Q205	2SC372Y	Vb	4.4V	4.4V
		Vc	6.0V	5.0V
		Ve	9.0V	3.9V
Q206	2SC735Y	Vb		2.0V
		Vc		
		Ve		0V
Q301	2SC735Y	Vb	6.0V	5.0V
		Vc	11.0V	11.0V
		Ve	4.7V	3.9V
Q302	TA7062P	(1)	0.8V	0.8V
		(2)	0.2V	0.2V
		(3)	0V	0V
		(4)	12.2V	12.2V
		(5)	11.8V	11.8V
Q303	2SC1173	Vb	0.7V	0.7V
Q304		Vc	13.7V	13.7V
		Ve	0.1V	0.1V

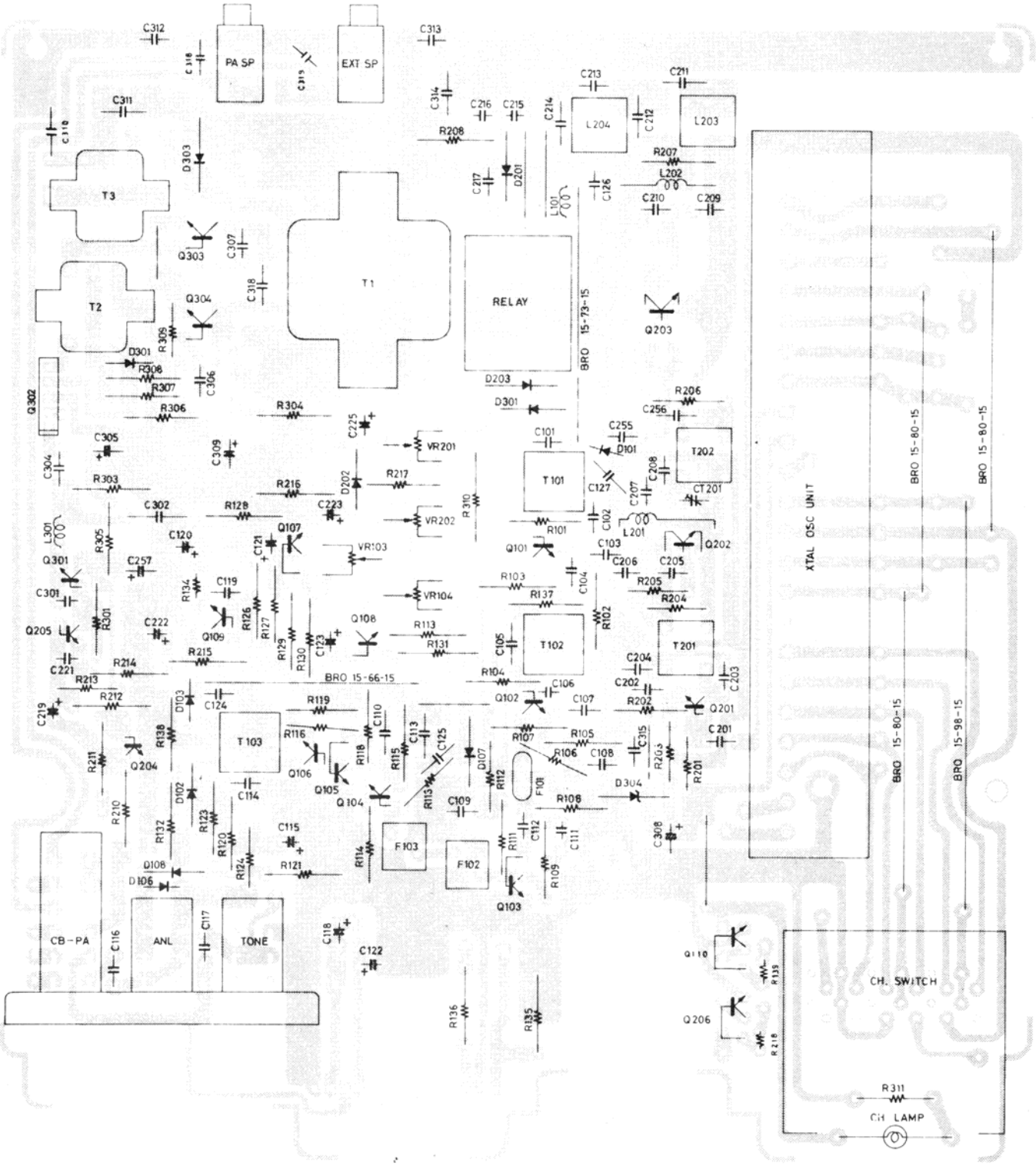
PARTS LAYOUT

1-601 (Series 1)

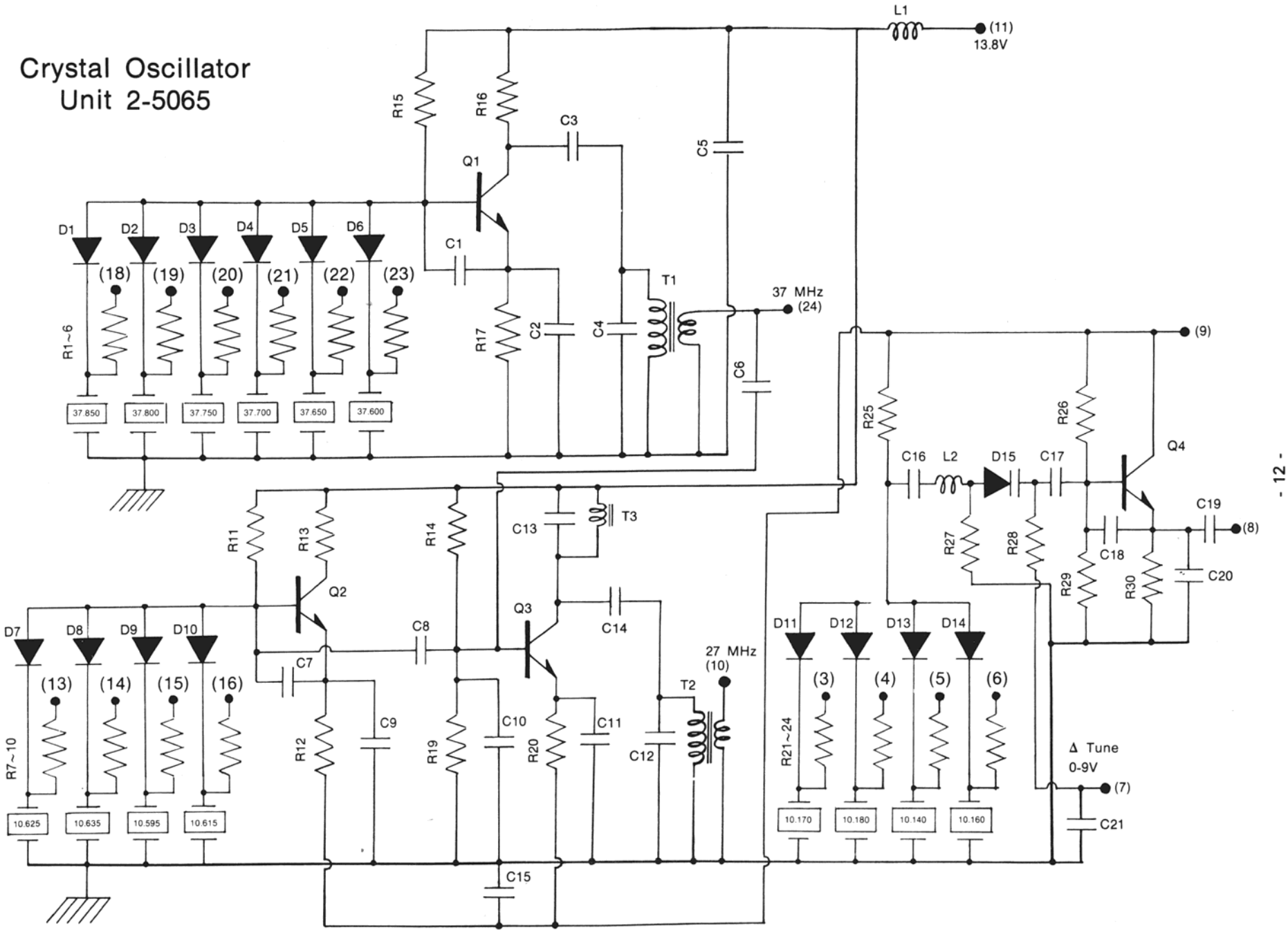
TOP VIEW

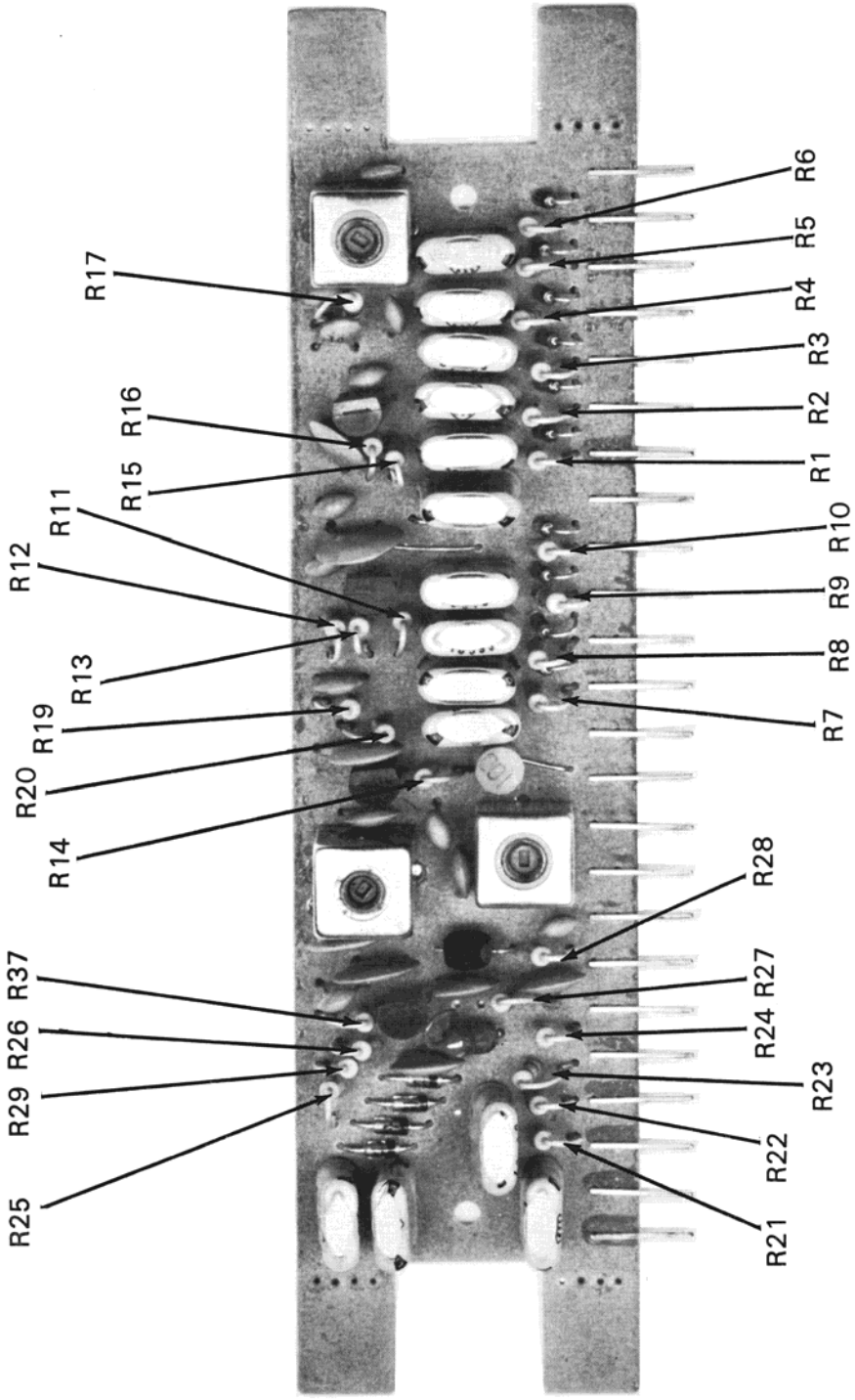


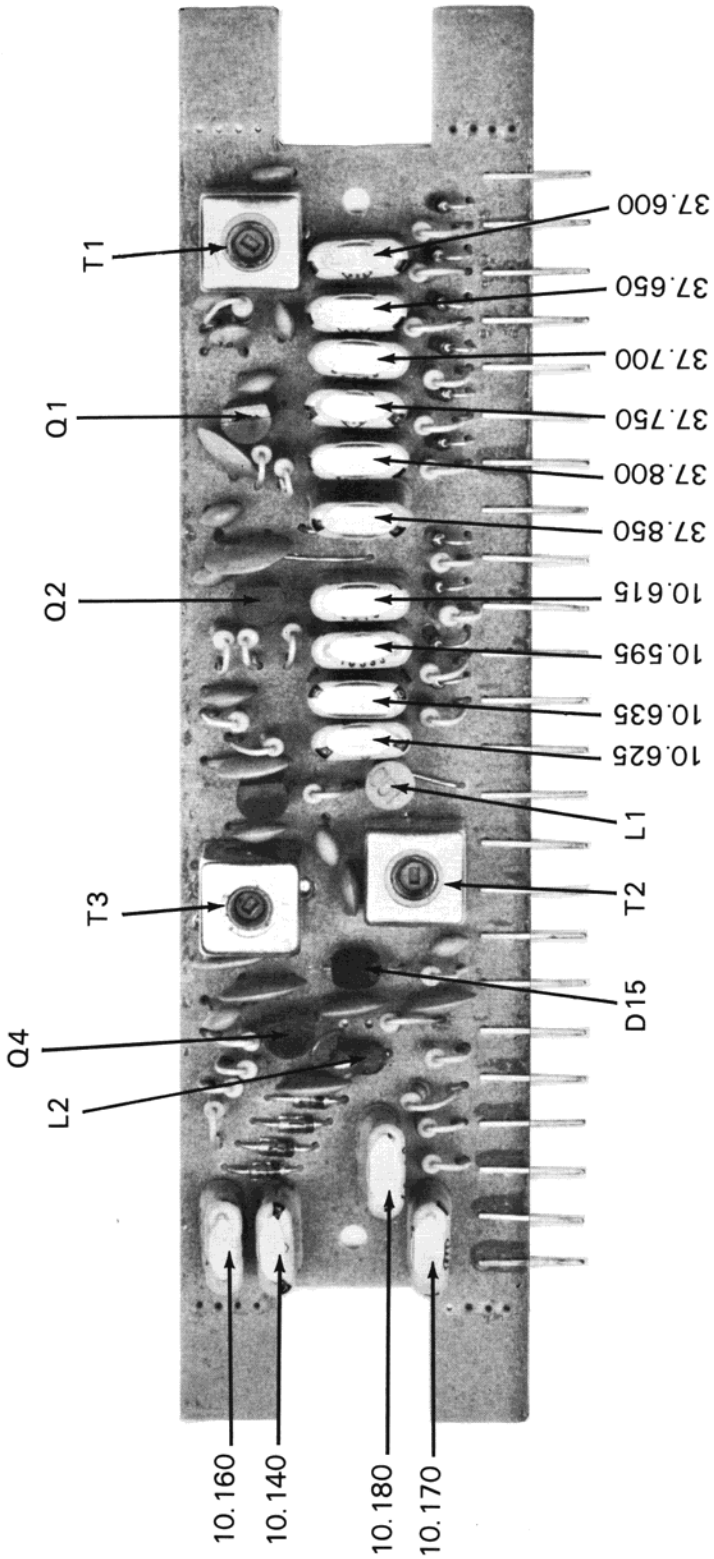
PARTS LAYOUT
BACKVIEW 1-601 (Series 1)

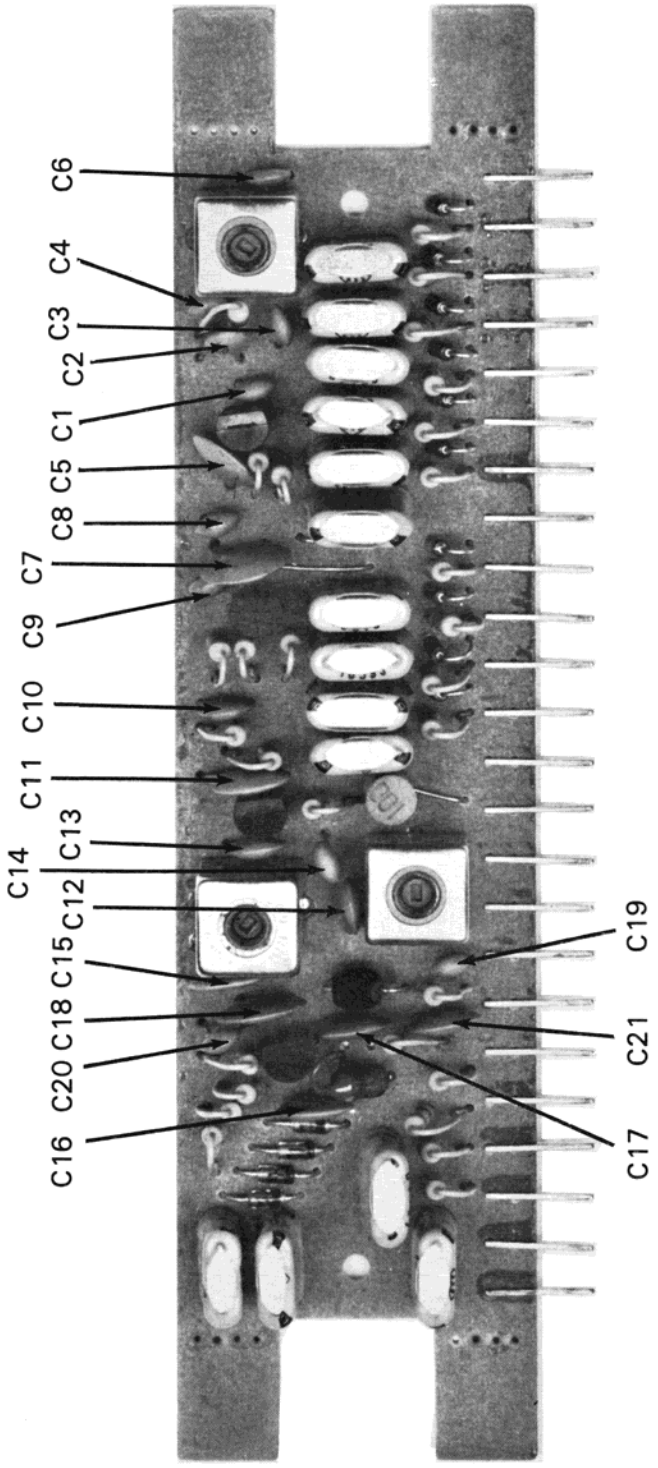


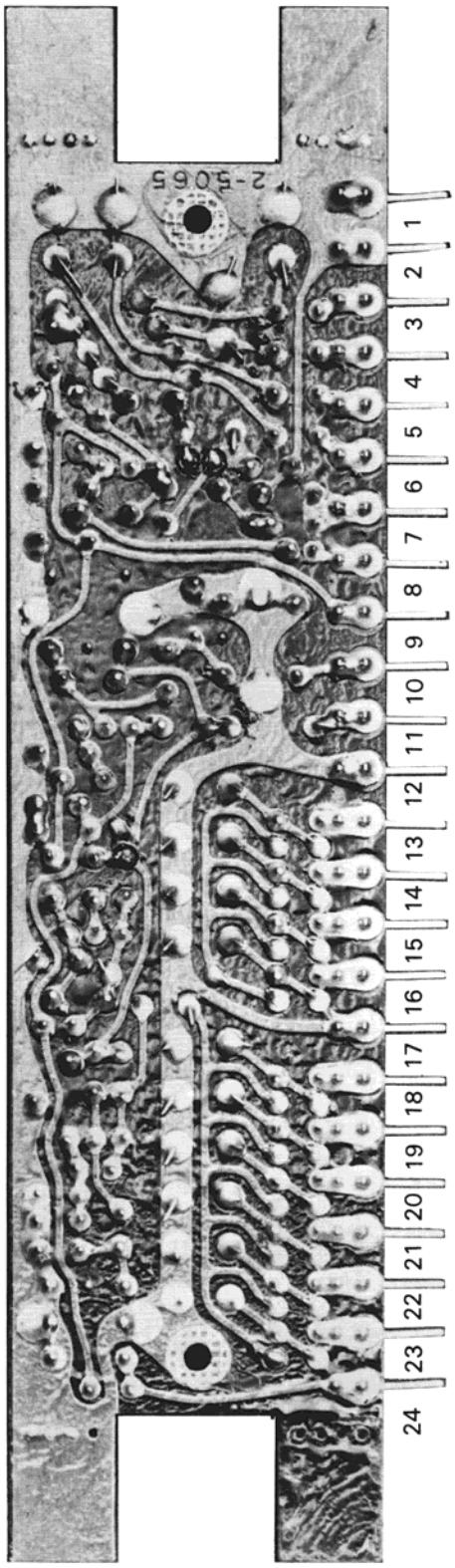
Crystal Oscillator Unit 2-5065




R17
R16
R15
R11
R12
R13
R19
R20
R14
R37
R26
R29
R25
R28
R27
R24
R23
R22
R21
R6
R5
R4
R3
R2
R1
R10
R9
R8
R7


T1
Q1
Q2
T3
Q4
L2
10.160
10.140
10.180
10.170
37.600
37.650
37.700
37.750
37.800
37.850
10.615
10.595
10.635
10.625
L1
T2
D15


C6
C4
C3
C2
C1
C5
C8
C7
C9
C10
C11
C13
C14
C12
C15
C18
C20
C16
C19
C21
C17


2-5065
1
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1-601 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 μF	
C6	39pF	
C7	300pF	
C8	15pF	
C9	39pF	
C10	100pF	
C11	.001μF	
C12	120pF	
C13	120pF	
C14	3pF	
C15	.001μF	
C16	.001μF	
C17	.001μF	
C18	300pF	
C19	10pF	
C20	51pF	
C21	.001μF	
	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	510Ω	
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.

X^1 37.60 MHz
X^2 37.65 MHz
X^3 37.70 MHz
X^4 37.75 MHz
X^5 37.80 MHz
X^6 37.85 MHz

(B) Group 4 pcs. (Transmittig)

X^7 10.635 MHz
X^8 10.625 MHz
X^9 10.615 MHz
X^{10} 10.595 MHz

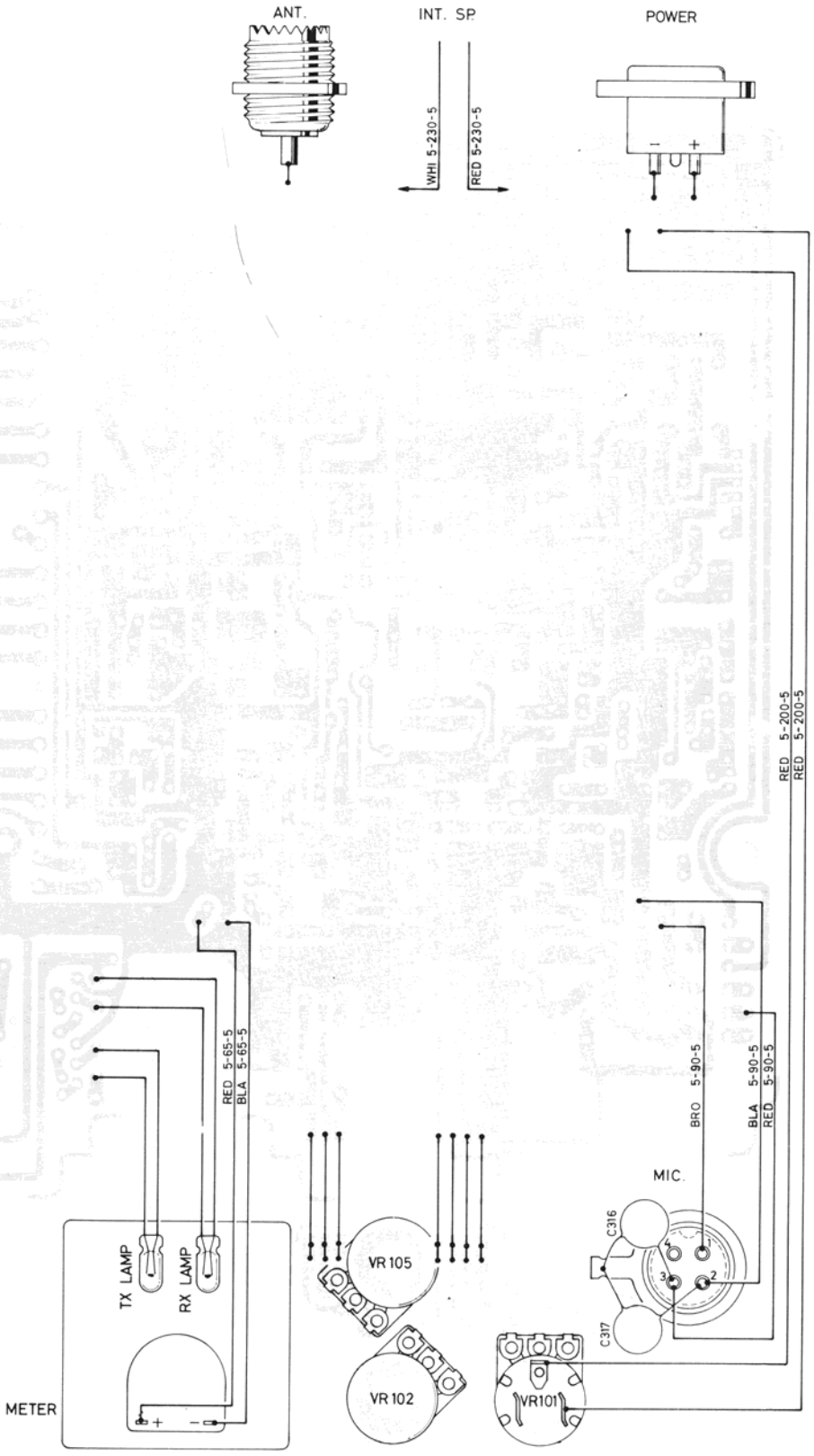
(C) Group 4 pcs. (Receiving)

X^{11} 10.18 MHz
X^{12} 10.17 MHz
X^{13} 10.16 MHz
X^{14} 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}

WIRING DIAGRAM

1-601 (Series 1)



I-601 Alignment Instruction

RECEIVER

A. Inject at the ant. jack a 27.115MHz signal (±.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 (2.0v/8 ohm) 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 50000uV and adjust the volume control so that the voltmeter output is 500mW (2.0v/8 ohms). 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".

DELTA TUNE

A. Set the output voltage of a signal generator at 1uV.
B. Set the Delta Tune control at the center and the squclch control at minimum.
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 ± 1KHz 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/8 ohm) at maximum position of volume control.

TRANSMITTER

A. Power Supply −13.8VDC.

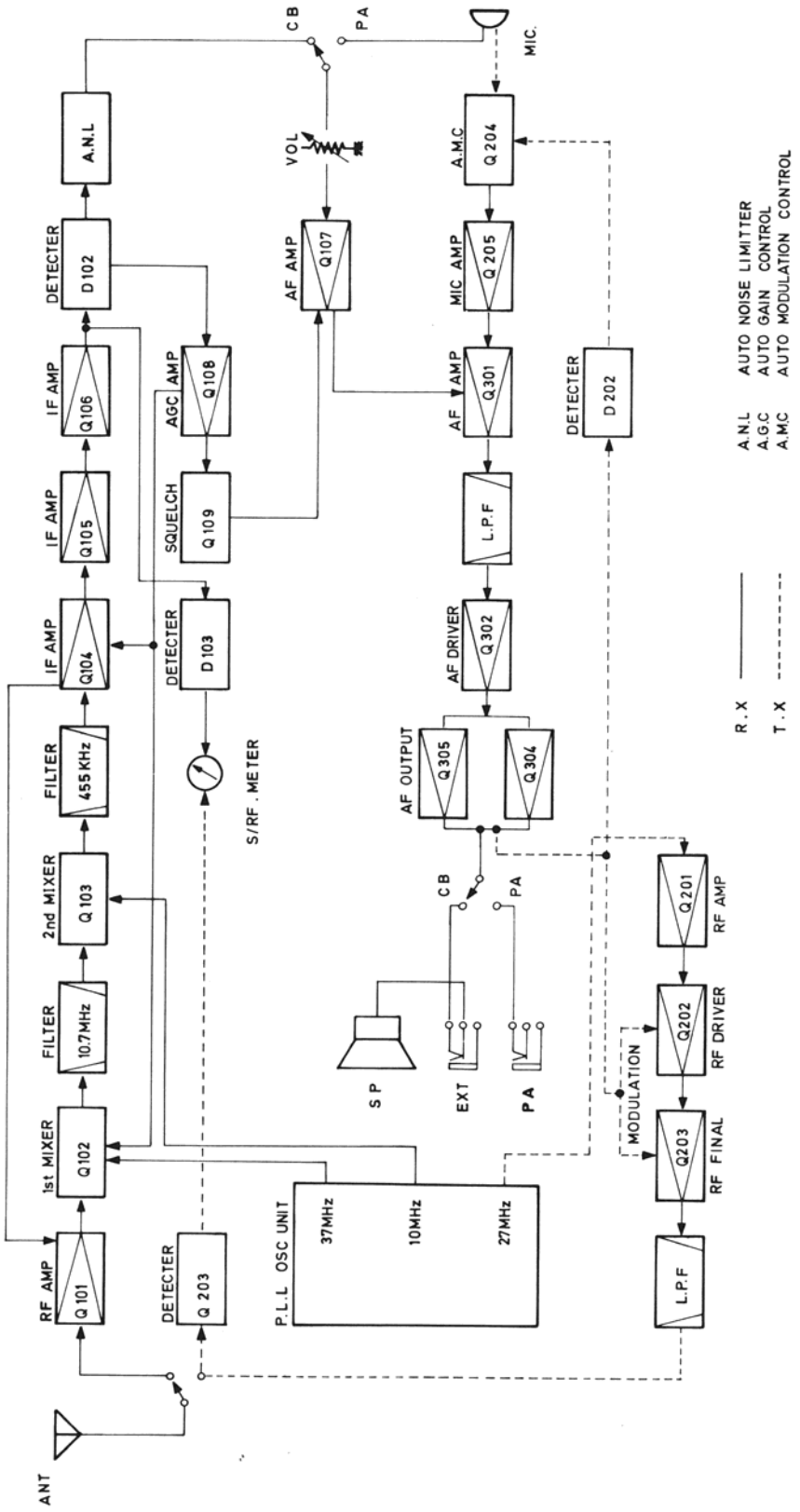
B. Use a suitable power meter, non-inductive dummy load and oscilloscope connected to antenna jack.

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 ± 800Hz
3. A.F. Oscillator with AF voltmeter in shunt (1KHz 10mV)	Inject at mic input	VR-201	−90% modulation on oscilloscope
		———	Reduce AF oscillator output to 5mV; modulation ≥ 50%

C. With 0% modulation and carrier power 3.5 to 4 Watts, adjust VR202 until meter reads between S9 and S10.

1-601 Series 3

BLOCK DIAGRAM

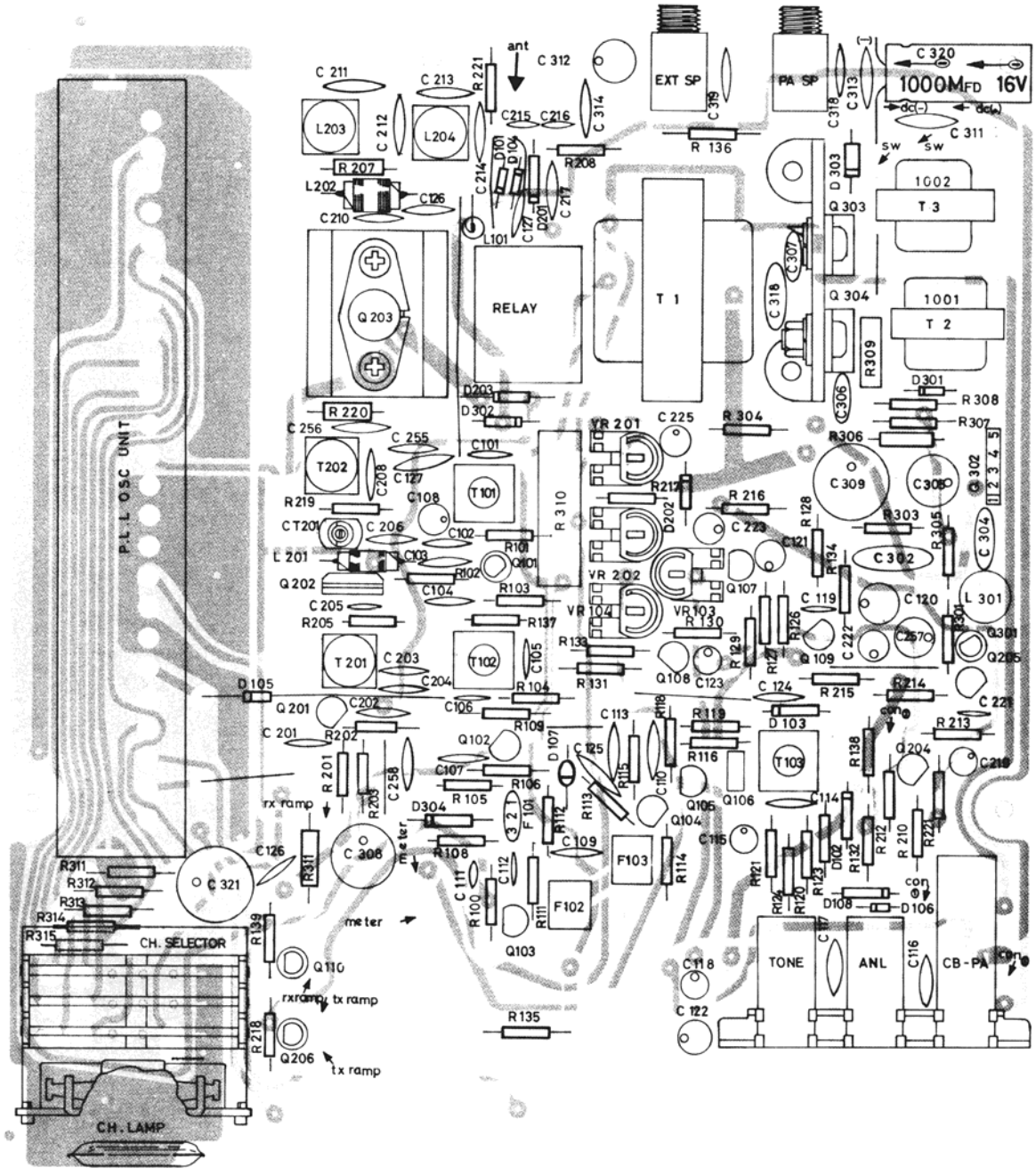


1-601 Voltage Chart (Series 3)

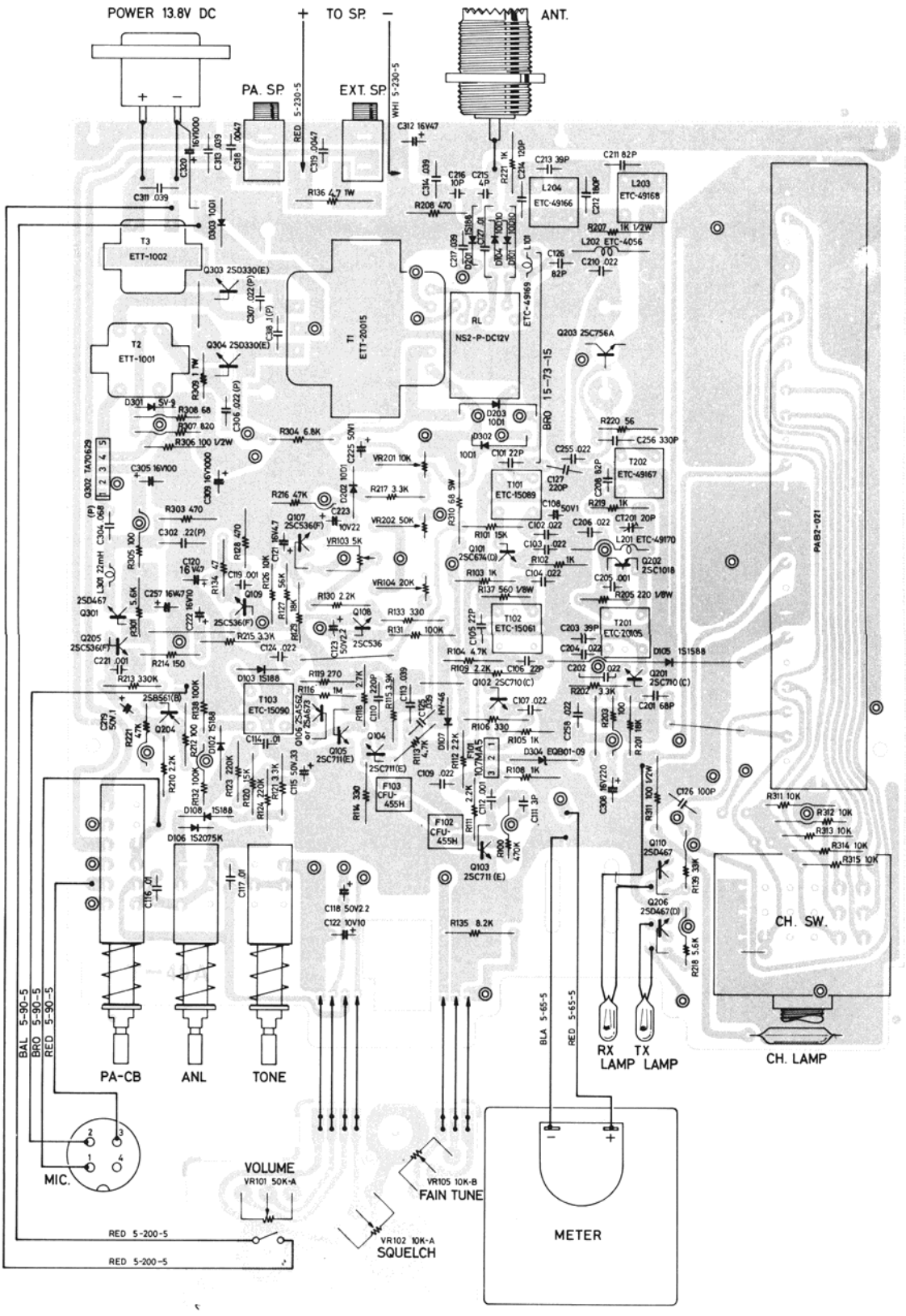
			RX	TX
Q101	2SC674	Vb	1.0V	
		Vc	6.6V	
		Ve	1.6V	
Q102	2SC710C	Vb	0.8V	
		Vc	8.3V	
		Ve	0.6V	
Q103	2SC711E	Vb	0.2V	
		Vc	3.7V	
		Ve	0V	
Q104	2SC711E	Vb	0.8V	
		Vc	2.0V	
		Ve	0.6V	
Q105	2SC711E	Vb	0.7V	
		Vc	5.0V	
		Ve	0V	
Q106	2SA562Y	Vb	5.0V	
		Vc	0V	
		Ve	6.4V	
Q107	2SC536	Vb(NO SQUELCH)	0V	
		(SQUELCH)	0.7V	
		Vc(NO SQUELCH)	3.3V	
		(SQUELCH)	0.7V	
		Ve(NO SQUELCH)	0V	
		(SQUELCH)	0V	
Q108	2SC536	Vb	0.7V	
		Vc	8.8V	
		Ve	2.1V	
Q109	2SC372Y	Vb(NO SQUELCH)	0.6V	
		(SQUELCH)	0V	
		Vc(NO SQUELCH)	3.9V	4.3V
		(SQUELCH)	6.1V	4.3V
		Ve(NO SQUELCH)	0.4V	
		(SQUELCH)	0V	
Q110	2SD467	Vb	0.7V	
		Vc	0.5V	
		Ve	0V	

			RX	TX
Q201	2SC710C	Vb		1.4V
		Vc		13.4V
		Ve		1.2V
Q202	2SC1018	Vb		
		Vc		12.0V
		Ve		
Q203	2SC756A	Vb		
		Vc		12.0V
		Ve		
Q204	2SA562Y	Vb		
		Vc		
		Ve		0V
Q205	2SC536	Vb	0.8V	0.4V
		Vc	3.9V	4.3V
		Ve	6.6V	2.5V
Q206	2SC735Y	Vb		0.7V
		Vc		0.9V
		Ve		0V
Q301	2SD467	Vb	5.0V	4.6V
		Vc	11.0V	11.0V
		Ve	4.8V	4.6V
Q302	TA7062P	(1)	0.7V	0.7V
		(2)	0.1V	0.1V
		(3)	0V	0V
		(4)	11.8V	11.8V
		(5)	11.4V	11.4V
Q303	2SC1173	Vb	0.7V	0.7V
Q304		Vc	13.1V	13.1V
		Ve	0.1V	0.1V

PARTS LAYOUT (TOP VIEW)



PARTS LAYOUT (BACK VIEW)



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AGC RESPONSE

Set the output voltage of a signal generator at 50000uV and adjust the volume control so that the voltmeter output is 500mW (2.0v/8 ohms). 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".

DELTA TUNE

A. Set the output voltage of a signal generator at 1uV.
B. Set the Delta Tune control at the center and the squclch control at minimum.
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 ± 1KHz 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/8 ohm) 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 ± 800Hz
3. A.F. Oscillator with AF voltmeter in shunt (1KHz 10mV)	Inject at mic input	VR-201	−90% modulation on oscilloscope
		———	Reduce AF oscillator output to 5mV; modulation ≥ 50%

C. With 0% modulation and carrier power 3.5 to 4 Watts, adjust VR202 until meter reads between S9 and S10.

SPECIFICATIONS 1-601

GENERAL

1.	Semiconductors	: 21 Transistors, 13 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
		: Delta Tune Control
		: Channel Selector Switch
		: CB-PA Switch
		: ANL Switch
		: TONE 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	: 7-1/16" (W) x 2-5/32" (H) x 8-1/32" (D)
10.	Weight	: 3 LBS. 13 OZ.

RECEIVER

1.	Sensitivity at S/N 10 dB	: 0.5 uV Typical
2.	Adjacent Channel Selectivity	: More than 80dB
3.	AGC Figure of Range	: 80 dB
4.	Squelch Range	: 0.5 uV - 500 uV
5.	Audio Output Power	: 4 Watts
6.	Distortion at input 100 uV	: 6 %
7.	Audio Freqency Response	: 400 - 2000 Hz
8.	Supurious Response	: More than 45 dB supurious 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

1-601 PARTS LIST

REF. #	DESCRIPTION	PART # Where Part Numbers not given, order by MODEL and DESCRIPTION
Q101	2SC382/2SC674 transistor	
Q102	2SC710 transistor	
Q103	2SC711 transistor	
Q104	2SC711 transistor	
Q105	2SC711 transistor	
Q106	2SA562/2SA673 transistor	
Q107	2SC372/2SC536 transistor	
Q108	2SC372/2SC536 transistor	
Q109	2SC372/2SC536 transistor	
Q110	2SC735/2SD467 transistor	
Q201	2SC710 transistor	
Q202	2SC1018 transistor	
Q203	2SC756 transistor	
Q204	2SA562/2SB561 transistor	
Q205	2SC372/2SC536 transistor	
Q206	2SC735/2SD467 transistor	
Q301	2SC735/2SD467 transistor	
Q302	TA7062P I.C.	
Q303, 304	2SC1173/2SD330 transistor	
D101	WG713/10D-1 diode	
D102	1S188 diode	
D103	1S188 diode	
D104	10D-1 diode (Series 3)	
D105	1S1588 diode (Series 3)	
D106	1S2075K diode	
D107	HV-46 diode	
D108	1S188 diode	
D201	1S188 diode	
D202	SR1K-2/10D-1 diode	
D203	SR1K-2/10D-1 diode	
D301	SV-9 diode	
D302	SR1K-2/10D-1 diode	
D303	SR1K-2/10D-1 diode	
D304	EQB01-09 diode (zener)	
	COILS — INDUCTORS	
L101	r.f. coil (49169)	2-0162
L201	r.f. coil (49170)	2-0166
L202	r.f. coil (4056)	2-0169
L203	r.f. coil (49168)	2-0163
L204	r.f. coil (49166)	2-0164
L301	choke (LF5-223K)	2-0165
T101	r.f. transformer (15089)	2-0049
T102	r.f. transformer (15061)	2-0045
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)	2-0032
T2	driver transformer (1001)	2-0033
T3	choke (1002)	2-0030

REF. #	DESCRIPTION	PART #
	CONTROLS	
VR101	volume control (50K)	
VR102	squelch control (10K)	
VR103	semi-fixed resistor (5K)	
VR104	semi-fixed resistor (20K)	
VR105	delta-tune control (10K)	
VR201	semi-fixed resistor (10K)	
VR202	semi-fixed resistor (50K)	
	channel switch (Series 1)	
	channel switch (Series 3)	
	ANL/TONE switch	
	PA/CB switch	
	CASE PARTS	
	case, top	15-12101
	case, bottom	15-12102
	front panel	15-12301
	channel knob w/disc	15-12701
	volume knob	15-12702
	push knob (white)	15-12703
	RESISTORS/CAPACITORS	
	Refer to schematic for specific values	
	MISCELLANEOUS	
	D.C. jack	
	D.C. cord	
	S/RF meter	
	relay	
	x-tol oscillator unit	
	PLL oscillator unit	
	speaker	
	external spkr/PA jack	
	10.7 MHz i.f. filter (10.7 MF-B)	
	455 KHz i.f. filter (CFU 455H)	
	mounting bracket	
	mic hanger	
	microphone (complete)	

1-601 Service Notes:

1. Engineering evaluation indicates many failures are due to poor eyelet contact. It is suggested that jumper wires be utilized through the eyelet contacts and soldered to both sides as opposed to only resoldering.

2. The PLL oscillator unit in the series 3 models is not designed as a field-serviceable unit, so please do not attempt repair as parts will not be made available. Please return defective modules for replacement.