Cobra HC-200 Service Manual

SERVICE MANUAL

SERVICE MANUAL HC-200

Cobra Model HC-200
"Command Call" 2-Way FM Communicator

Cobra®
Conversation Loud and Clear

Cobra Communications Product Group
DYNASCAN CORPORATION
6460 W. Cortland St.
Chicago, Illinois 60635

TABLE OF CONTENTS

SPECIFICATIONS

GENERAL

Frequency Range	49.830 to 49.890 MHz
Number of Channels	1
Input Voltage	9 volts DC
Current Drain	
Standby	13.5 mA maximum
Receive	40 mA maximum
Transmit	50 mA maximum
Dimensions	4-9/16"H x 2-1/2"W x 1-7/64"D (115 mm x 64 mm x 28 mm)
Weight	9 oz. (225 grams)
Power Source	9-volt battery (Eveready 216 or equivalent)

RECEIVER

Sensitivity (20 dB quieting)	0.5 uV minimum
Squelch Sensitivity (Threshold)	0.5 uV minimum
Modulation Acceptance Bandwidth	+/- 7 kHz minimum
Spurious and Image Rejection	20 dB minimum
Frequency Stability (0° to +40° C.)	+/- 2kHz minimum

HC-200 THEORY OF OPERATION

TRANSMITTER

General:

The transmitter consists of a varacter frequency modulated crystal controlled oscillator, tripler and power amplifier.

Signal Generation:

Audio from the electect microphone is amplified and gain limited by IC 3/4 (LM-324N). Diodes D9 and D10 limit the output to a maximum level determined by their forward conduction resistance. This gain limited audio is further amplified by IC-3/3 and applied to varacter diode D8 through RV-1, which is used to set the maximum frequency deviation of the transmitter, Q9 is a fundamental oscillator operating at 16 MHz. The output from Q9 is tripled to the output frequency by Q8. The 49 MHz signal is further amplified and coupled to antenna by Q7. Both L7 and L8 are tuned for maximum output at the operating frequency.

RECEIVER

General:

The receiver is a crystal controlled, dual conversion superheterdyne design with 10.7 MHz and 455 KHz intermediate frequency and quadature detector.

Signal Reception:

The Emitter of Q1, RF Amplifier, is connected to the secondary of L6, transmit output tuning. L6 is the receiver input selectivity element. Q1 is connected for common base usage. The collector output of Q1 is tuned to the 49MHz incoming signal frquency by L1. The secondary of L1 matches the collector impedance of Q7 to the input of Q2, first mixer. The first local oscillator output at Q3 is also fed to the base of Q2 through C23.

The collector of the mixer, Q2, is tuned to 10.7 MHz by L2, which provides rejection of undesired mixing products and inpedance matches the output of Q2 to the IC-1, MC-3357. IC-1 contains the second mixer, 455 KHz IF Amplifier/Limiter detector. The quandrature detector is tuned by L4. The detected audio output exits thru Pin 9 and is applied to the audio output amplifier, IC-2, LM-386 the squelch noise amplifier contained in IC-1. Audio noise frequency components are selected and amplified by the OP-AMP in IC-1. The center frequency of the noise OP-AMP is determined by R15 and C17.

The output of the noise amplifier is rectified by D4 and D5 and applied to the level detector amplifier input on IC-1. The detected switched output is taken from Pin 14 and is used to control Q6 which controls VCC applied to Pin 6 of IC-2. During no signal reception Q6 is biased "OFF" and operating voltage does not reach IC-2. Switching signal reception or transmission Q6 is turned "ON" and VCC is switched to IC-2. In this manner, audio reaching the speaker is switched ON/OFF to match signal reception.

VOICE CONTROL (VOX)

The gain controlled transmit audio from Pin 1 to IC-3/3 is further amplified by IC 3/1 and recitified by D6/D7. IC-3/2 is used as a level detector to drive DC switching transistors Q4 and Q5 which control VCC to Q1, Q2, Q3, IC-1 in the receiver and Q7, Q8, and Q9 in the transmitter, during transmit, VCC is removed from the receiver.

PUSH-TO-TALK

In the PTT mode, the differential input IC-3/2 is grouded to the PTT switch and causes it to toggle and switch Q4/Q5. Input of IC-3/1 is grounded to prevent audio signals from switching the level detector, IC-3/2.

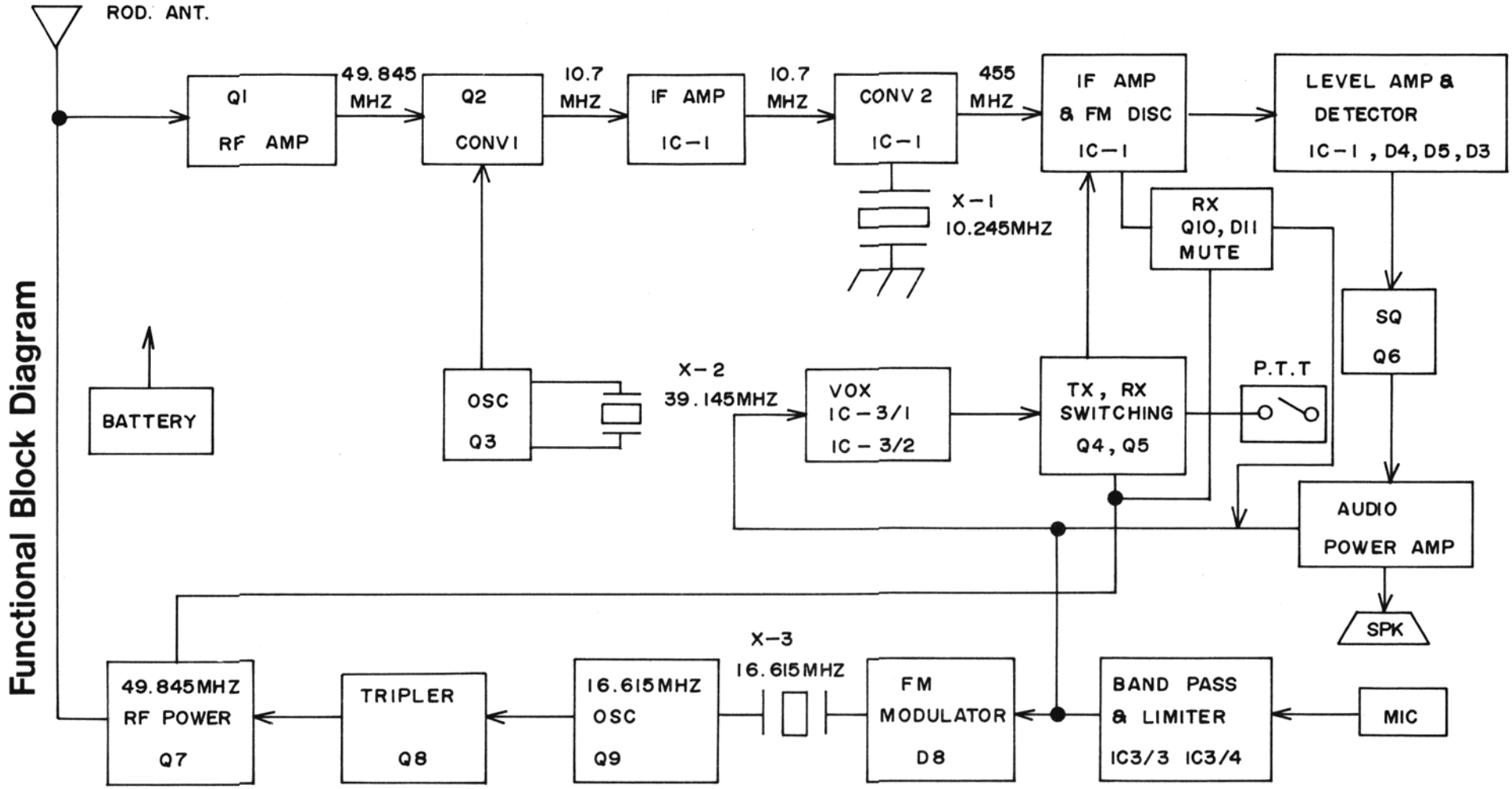
Q10 is used to minimize white noise reaching the audio amplified earphone and reduce switching noise in the earphone.

Tuning test alignment procedure on 49 MHz VOX units--please refer to service outlines for componet locations.

Since the unit is not 50 ohm INPUT/OUTPUT, it is not possible to make direct electrical connections for receive/transmit test.

At the factory special calibrated test fixtures are used during manufacture for alignment purposes.

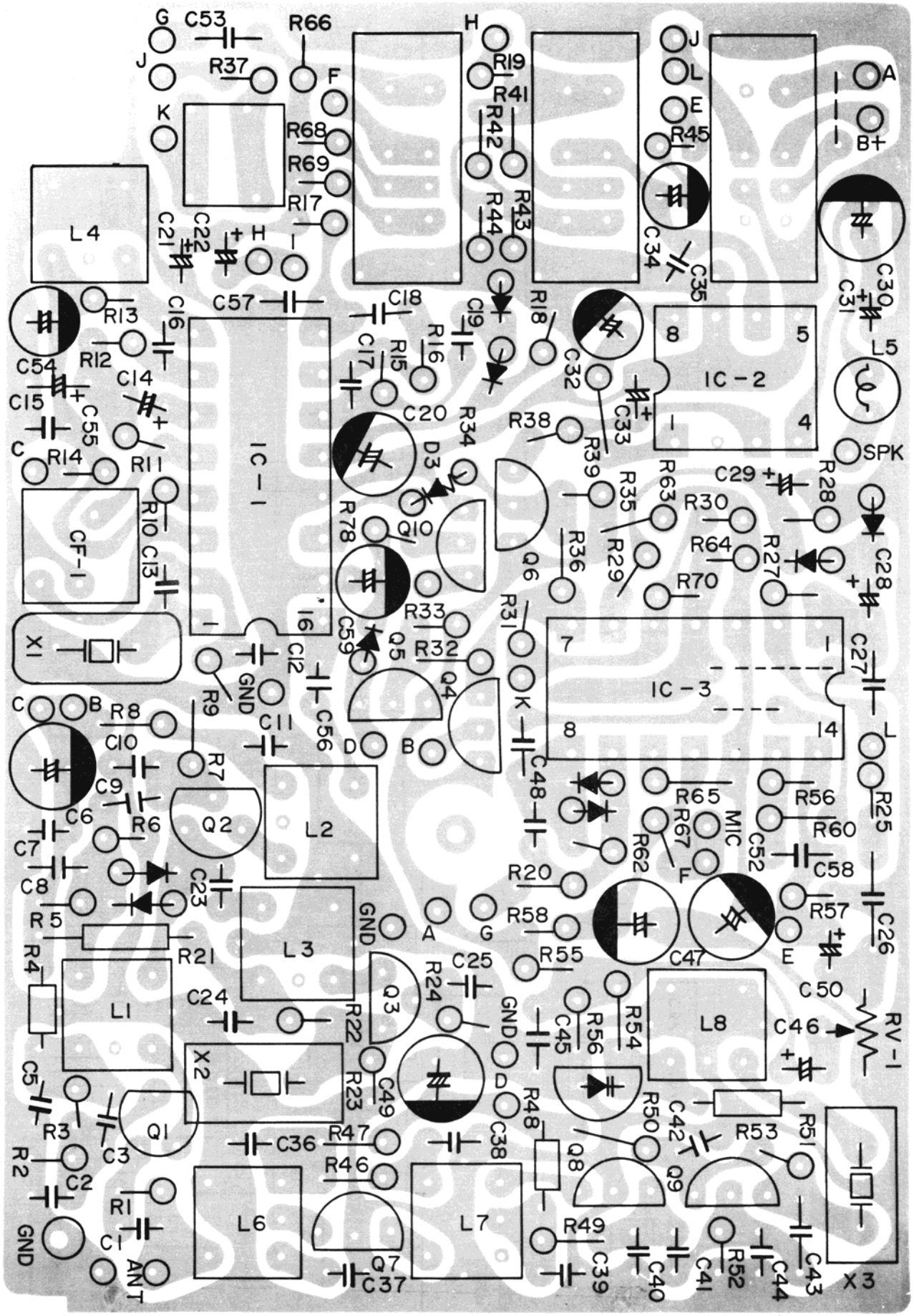
Functional Block Diagram



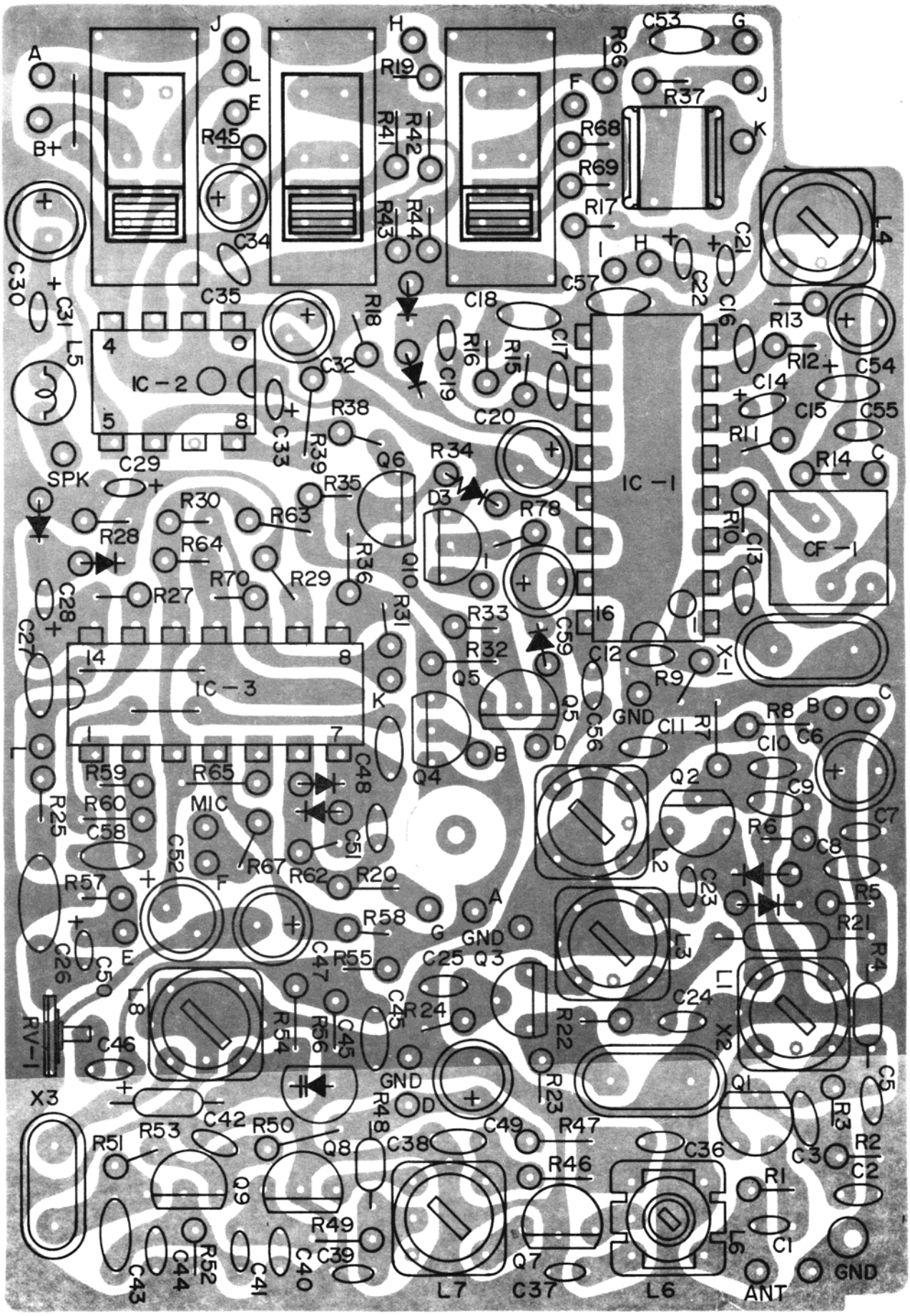
MODEL : MX-49S

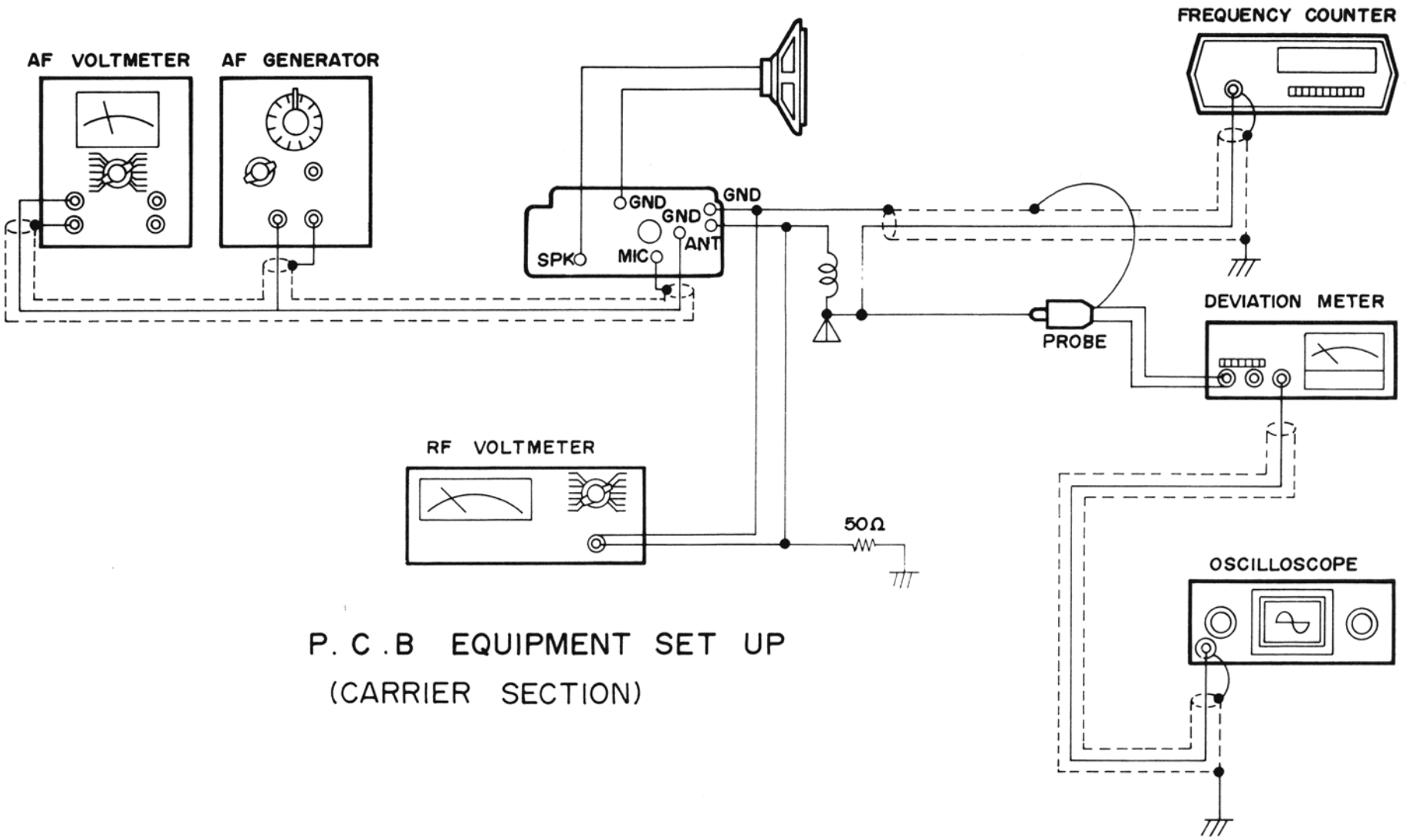
CHANNEL	FREQ	X-2	X-3
A	49.830MHZ	39.130MHZ	16.610MHZ
B	49.845MHZ	39.145MHZ	16.615MHZ
C	49.860MHZ	39.160MHZ	16.620MHZ
D	49.875MHZ	39.175MHZ	16.625MHZ
E	49.890MHZ	39.190MHZ	16.630MHZ

Parts Layout.



Parts Layout.



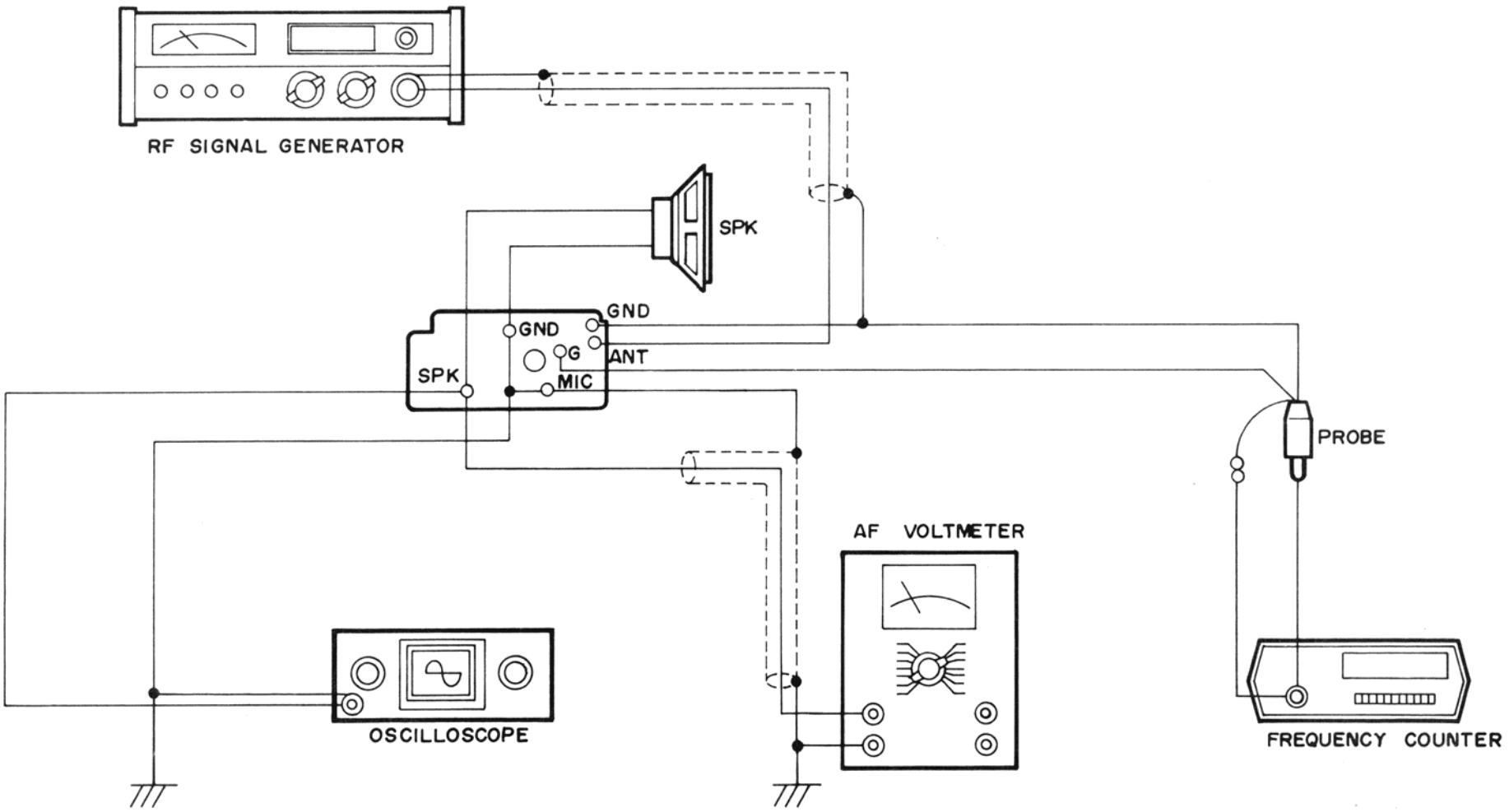


P. C. B EQUIPMENT SET UP

(CARRIER SECTION)

P.C.B EQUIPMENTS SET UP

(Receiver Section)



ALIGNMENT PROCEDURE

For field service procedures, the following system has proven to yeild very good results. Again, transmitter output or receiver sensitivity cannot be measured by direct electrical connection to the unit under test. Indirect methods must be used.

1. Half-way dipole antennas can be used for test. Two 300 ohm dipoles 9.4ft long can be easily constructed using TV twin lead. Low cost 300 to 75 ohm TV Balums should be used at the center to de-couple the antenna from coax feed line. The antenna can be fed using RG-68/U coax. The 50 ohm to 75 ohm mis-match will not cause any significant errors.

2. Position one dipole antenna vertically six feet directly to the left of the bench. The other should be vertically positioned ten feet to the right of the bench. The bottom of each antenna should be about 3 feet above ground.

3. Connect the closer antenna to the signal generator. The antenna 10 feet away should be connected to a field strength meter or electronic milli-volt meter. Place the headset on a foam wig holder (Head) and extend the antenna fully.

4. Since transmitter tuning interacts with receiver sensitivity, it should be tuned first.

   a. In PTT mode, adjust L8 for correct frequency on a counter with a sensing antenna. Correct frequency is channel frequency plus one KHz at 9.0 volts.

   b. L7 and L6 are adjusted for maximum field strength, minimum acceptable at 10 feet is five millivolts or 5000UV as indicated on field strength meter. NOTE: You can use a TV field strength meter, like Jerold 747, because it has enough over lap in tuning to be useful. Unless a relatively clear area is available, considerable S.W.R. due to reflection/absorbtion by surrounding can be experienced.

   c. RV-1 is set to 4.0 to 4.5 KHz maximum deviation with mike sensitivity at maximum use small whip on deviation monitor.

   d. The earphone has an antenna loading coil under the logo label. This should be set for maximum field strength. Setting of L6 and the antenna will inter-act slightly. The 70 cm cord to the headphone should not be coiled but reasonably straight because it acts as the antenna counter poise. This completes the transmitter tuning.

5. Receiver tuning starts at the 1st local oscillator, L3.

   a. Attach counter to TP-1 and back slug of L3 our to top of can turn slug down until Q3 starts to oscillate, then turn 1/3 to 1/2 turn more to insure the oscillator will start each time the unit is turned on. Check the counter to insure the frequency is within plus/minus 2 KHz of frequency on xtal. Disconnect counter. Do not turn slug any further or oscillator spurious will go up and cause poor receiver performance.

   b. Apply one milli-volt signal with audio modulation 1 KHz and 2 KHz deviation to the antenna at 6 feet. The squelch should break on the receiver.

c. Reduce signal level to a few DB above squelch threshold. Tune L2 and L1 for best sinad, or note point that squelch closes as you rotate each slug and set to mid-range. Repeat L1-L2 until no further improvement. L-2 setting is most critical. L-1 setting is rather broad.

d. L4 is adjusted for maximum audio output with 1 milli-volt applied to test antenna.

e. Vary frequency of generator +/- 15 KHz and make sure audio output is maximum at center channel. This checks the 10.245 xtal frequency and CF-1 to insure thay are OK.

f. Minimum acceptable squelch threshold is 300 uv into test antenna at six feet. Most units are 50-100 uv.

6. Check balance of functions to insure no problem at volume/mic-sens/PWR/PTT/VOX/ switches.

SPECIAL NOTES:

7. Check to insure squelch does not open at 7.0 volts without signal. Squelch is noise operated and defective D4, D5, C20, C19, 418 or poor alignment of L2 and L4 can cause mis-operation of low volts. Unit should operate OK to 7.0 volts. Receiver squelch usually fails about 6.5 to 7.0 volts. This is normal and indicates low battery. Akaline battery highly recommended.

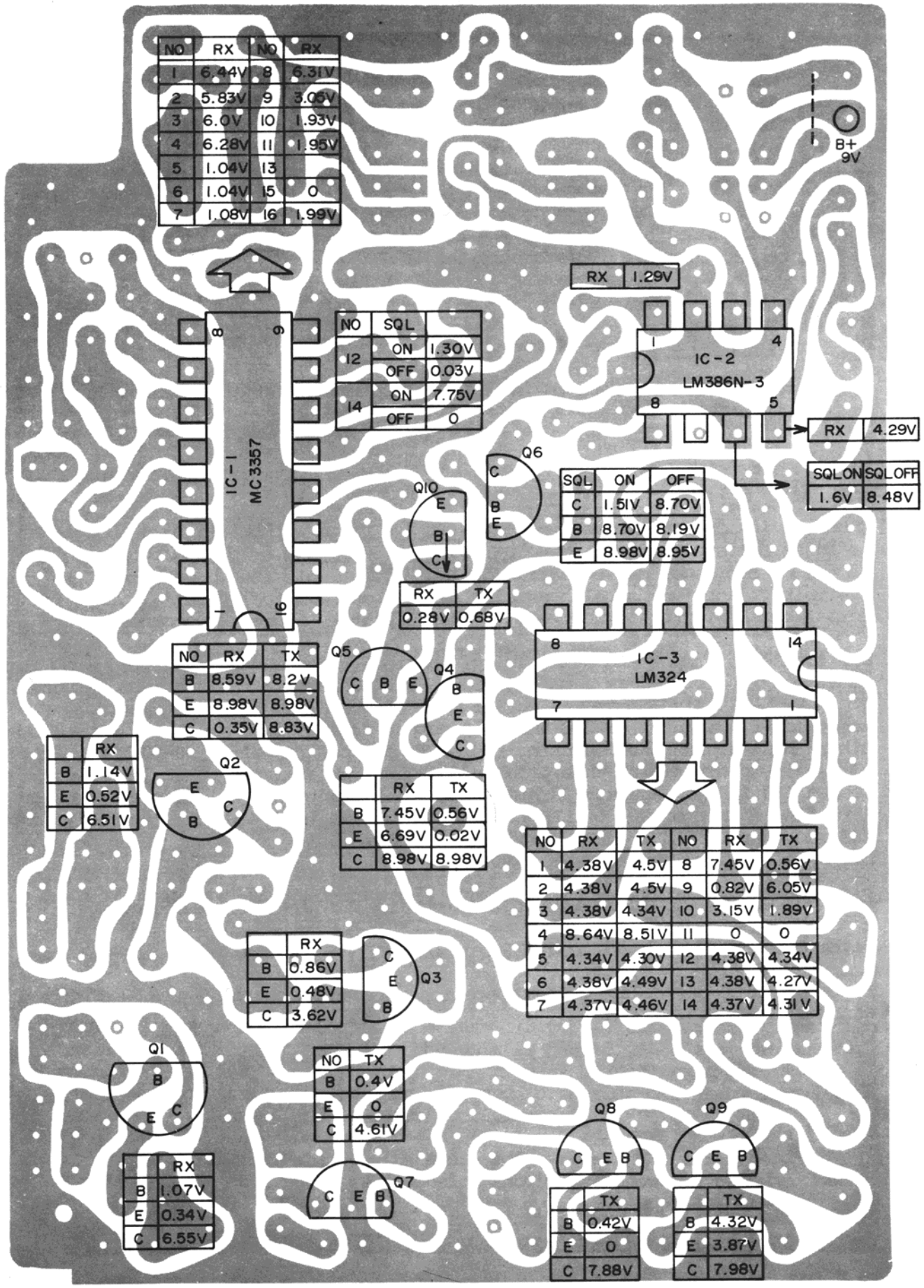
8. Due to lack of front end selectivity, spurious responses and overload are sometimes interpreted as a malfunction. EX: Channel 3 has spurious response at 88.89 MHz. Also, image in 28.455 MHz. Since X2 is 3rd overtone type, sometimes fundamental or 2nd harmonic output from L3 into miser can cause some other unususal response occuring in low TV channel ranges of 50-80 MHz. Re-tuning L3 usually can minimize this problem. A spectrum analyzer on TP-1 is useful to set L-3 for min spurs. Turning slug too far into L-3 will cause a problem. A running change of C23 to 1PF from 22PF was made in November to series resonate the secondary of L3 at 39 MHz and reduce spurious outputs about 40-50 D8. All COBRA uniits incorporated this change.

9. Poor VOX/NO MOD/ETC is usually a problem with IC3, LM-324, or microphone.

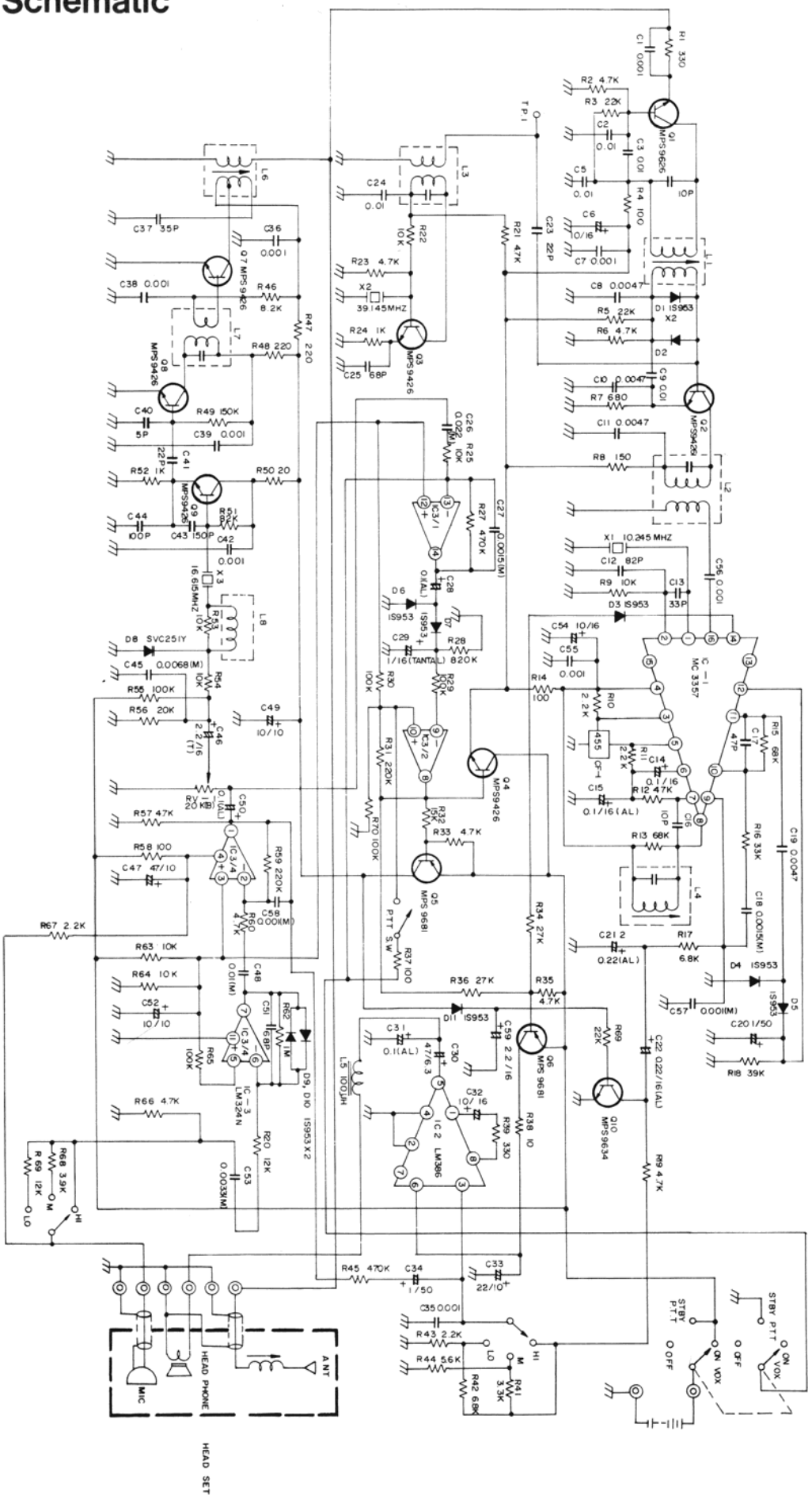
10. We have seen few problems with IC-1 or LC-2.

11. To reduce drop out delay on VOX operation, a running charge 0.47 UFD of C29 was made.

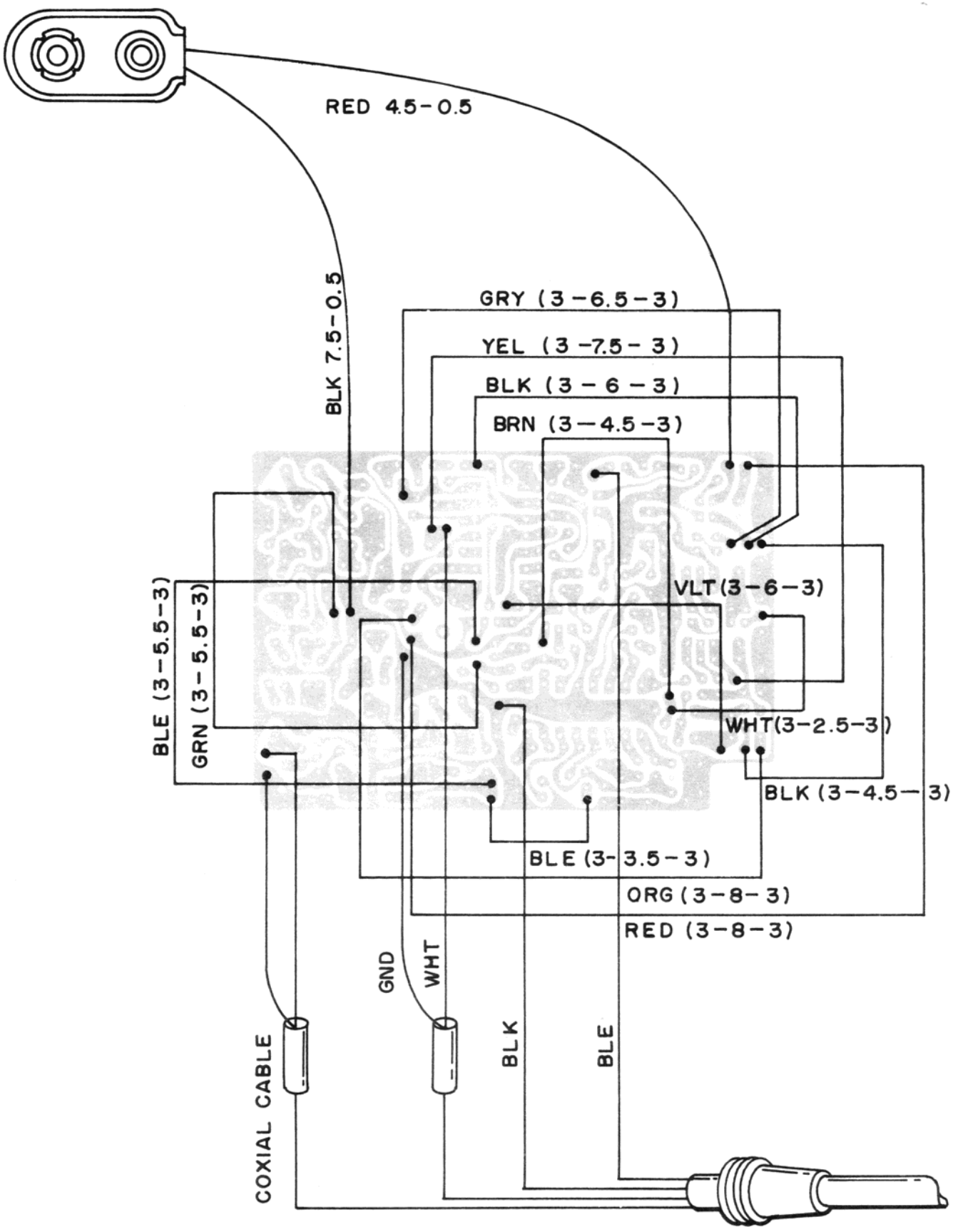
Voltage Chart

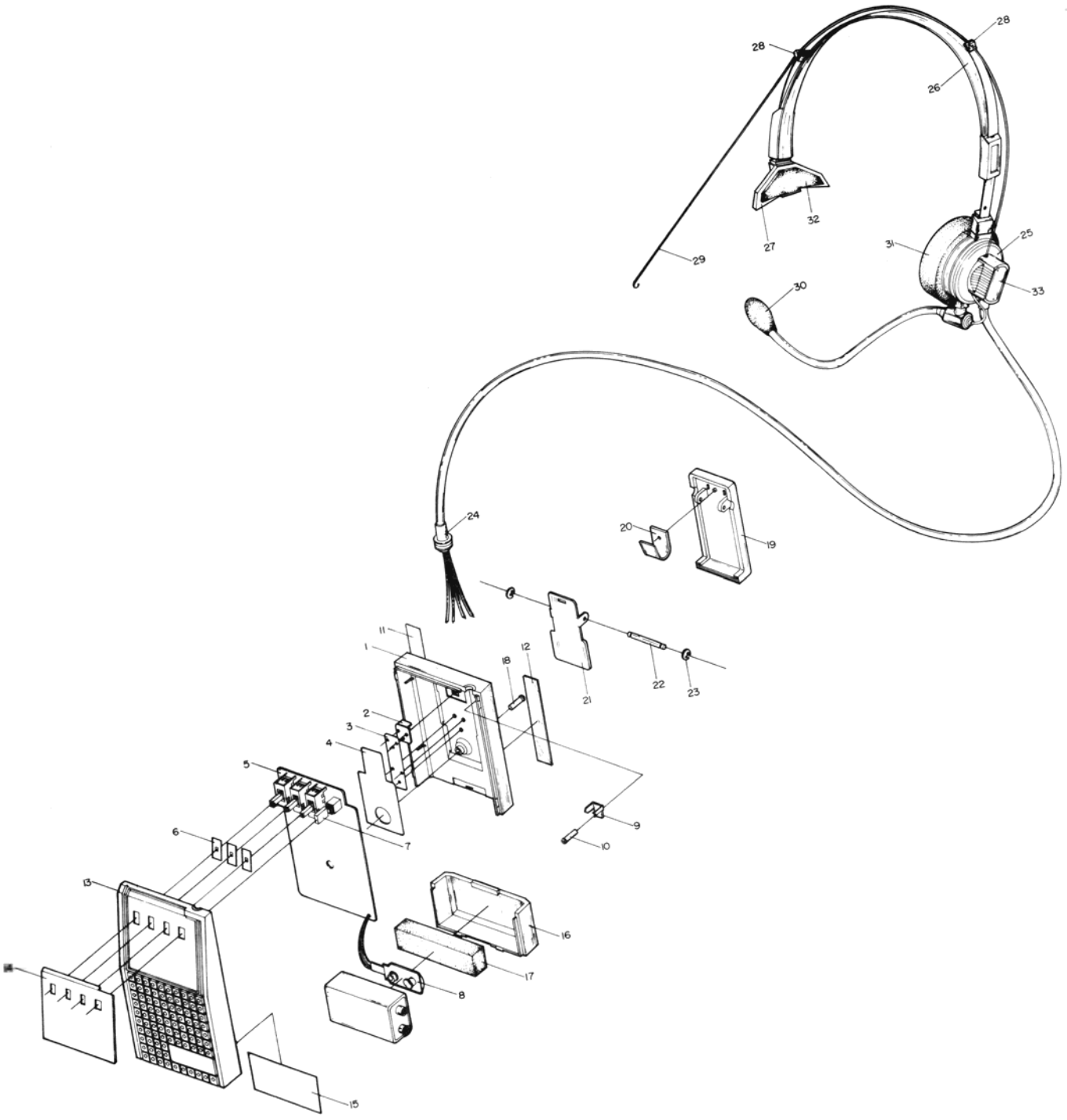


Schematic


R1 330
C1 0.0001
R2 4.7K
R3 22K
C2 0.01
C3 0.001
Q1 MPS9626
C5 0.01
R4 100
10P
C6 0/16
C7 0.001
L1
C8 0.0047
D1 IS953
X2
R5 22K
R6 4.7K
D2
C9 0.001
C10 0.0047
R7 680
Q2 MPS9426
C11 0.0047
R8 150
L2
X1 10.245 MHZ
C12 82P
R9 10K
C13 33P
D3 IS953
C56 0.001
TP1
L3
C24 0.01
R21 4.7K
C23 22P
R22 10K
R23 4.7K
X2 39.145MHZ
R24 1K
Q3 MPS9426
C25 68P
L6
C37 35P
C36 0.001
Q7 MPS9426
C38 0.001
R46 8.2K
L7
R47 220
R48 220
Q8 MPS9426
C40 5P
R49 150K
C39 0.001
C41 22P
R52 1K
R50 20
Q9 MPS9426
C44 100P
C43 150P
R51 22K
C42 0.001
X3 16.65MHz
L8
R53 10K
D8 SVC251Y
C45 0.0068(M)
R54 10K
R55 100K
R56 20K
C46 2.2/16 (T)
C49 10/10
RV 20 KΩ
C50 0.1(AL)
R57 47K
R58 100
C47 47/10
IC 3/4
R59 220K
C58 0.001(M)
R60 47K
R67 2.2K
R63 10K
R64 10K
C52 10/10
C48 0.01(M)
C51 68P
R62 1M
R65 100K
IC-3 LM324N
D9, D10 IS953 X2
R66 4.7K
R68 3.9K
R69 12K
M
LO
HI
R20 12K
C53 0.0033(M)
C26 0.022 R25 10K
IC 3/1
R27 470K
C27 0.001(M)
C28 0.1(AL)
D6 IS953
D7 IS953
C29 1/16 (TANTAL)
R28 820K
R29 100K
R30 100K
R31 220K
IC 3/2
R32 15K
R33 4.7K
R70 100K
Q4 MPS9426
Q5 MPS 9681
PTT S.W
R37 100
R34 27K
R36 27K
R35 4.7K
D11 IS953
C31 0.1(AL)
C30 47/6.3
C59 2.2/16
Q6 MPS 9681
L5 100μH
C32 10/16
IC 2 LM386
R39 330
R38 10
R45 470K
C34 1/50
C33 22/10
C35 0.001
R43 2.2K
R44 5.6K
R42 6.8K
R41 3.3K
LO
M
HI
MIC
HEAD PHONE
ANT
HEAD SET
C-1 MC 3357
R14 100
C54 10/16
C55 0.001
R10 2.2K
455 CF-1
R11 2.2K
C14 0.1/16
R12 4.7K
C15 0.1/16 (AL)
C16 10P
R13 68K
L4
C17 47P
R15 68K
R16 33K
C18 0.001(M)
C19 0.0047
C21 2
R17 6.8K
0.22(AL)
D4 IS953
D5 IS953
C57 0.001(M)
C20 1/50
R18 39K
R69 22K
C22 0.22/16(AL)
Q10 MPS9634
R9 4.7K
STBY PTT
ON VOX
OFF
STBY P.T.T
ON VOX
OFF

Wiring Diagram




28
28
26
32
27
29
31
25
33
30
24
20
19
11
1
18
12
21
22
23
2
3
4
5
6
7
9
10
13
16
17
8
15

EXPLODED VIEW PARTS LIST

No.	Parts Name	Part #
1	Cover (Bottom)	
2	Stopper	
3	Spring Stopper Mtg.	
4	Insulation Plate	
5	P.C.B. Main	
6	Felt	
7	Knob	
8	Snap Jack Battery	771-044-9-001
9	Clip Cord MTG	741-162-9-001
10	(+) Tapping Screw (B.H)	
11	Name Plate CH. E (HC-200)	
12	Label FCC Sticker	
13	Cover (Upper)	
14	Overlay	
15	Caution Label Battery	
16	Cover Battery	
17	Cushion Battery	
18	(+) Tapping Screw (B.H)	
19	Clip	380-467-9-002
20	Spring Clip Mtg	767-128-9-002
21	Holder Clip Mtg	250-110-9-001
22	Shaft Clip Mtg	763-189-9-001
23	E-Ring	
24	Bushing Cord Mtg	
25	Ear Cup Ass'y (Head Set)	
26	Head Band (Head Set)	
27	Pressure (Head Set)	
28	Clip Ant (Head Set)	
29	Antenna (Head Set)	
30	MIC Cushion (Head Set)	
31	Ear Cushion (Head Set)	
32	PAD Pressure (Head Set)	
33	Name Plate (Head Set)	

MECHANICAL PARTS LIST

Parts Name	Part #
Headset Ass'y	523-523-9-001
MIC Cushion (Head Set) BLK Sponge	388-065-9-001
Ear Cushion (Head Set) BLK Sponge	388-065-9-002
Holder Clip MTG SPC 40x5lxl.0T Nl-Plat	250-110-9-001
Clip ABS COL RED	380-467-9-002
Shaft Clip MTG BSBM &2.5x30 Nl-Plat	763-189-9-001
Spring Clip MTG SUS 34xl4xo.5T	767-128-9-002
(+) Tapping Screw (B.H) 2.6x6 2S ZN Plat	710-068-9-004
(+) Tapping Screw (B.H) 3xl6 2S SN Plat	710-081-9-001
Cover (Upper) ABS BLK SLK PRNT COL RED	271-173-9-001
Cover Battery ABS COL RED	271-174-9-001
Cover (Bottom) ABS COL RED	271-175-9-001
Clip Cord MTG SPC 25xl2x0.8T ZN Plat	741-162-9-001
Stopper ABS COL RED	380-467-9-001
Overlay ALP 52x50x0.4T	260-345-9-001
Name Plate CH E (HC-200) ALP 70xl3x0.4T	
Snap Jack Battery	771-044-9-001
Slide S.W. 2P-3T SS-23D03	084-119-9-001
Touch S.W. EVQ-08Bl1K	091-016-9-001
Spring Stopper MTG SUS 13x40x0.3T	767-128-9-001
Cushion Battery GRY Sponge 24-57-10T	388-063-9-001
Insulation Plate Fiber 30x60x0.25T	342-105-9-001
Felt 20xl0x0.3t	351-020-9-001
Out Box (HC-200) 504(W)x215(D)x415(H)	
Instruction Manual (HC-200)	480-368-9-001
Schematic (HC-200)	499-258-9-001

ELECTRICAL PARTS LIST

Transistor MPS9634 (C)	176-128-9-001
Transistor MPS9426 (C)	176-115-9-001
Transistor MPS9681 (T)	177-049-9-001
Transistor MPS9626 (F)	176-141-9-001
I.C. MC3357P	307-247-9-001
I.C. LM324N	307-306-9-002
I.C. LM386 (803-N-3)	307-078-9-001
Diode Sl KDS1555	151-028-9-007
Diode lS2473	151-035-9-001
Diode Sl lS953	151-093-9-001
Diode Sl MA150	151-108-9-001
Diode Varicap SVC251Y	154-008-9-001
Diode Varicap MV2209	154-009-9-001
Crystal Unit 10.245	132-037-9-002
Crystal 16.630MHz	135-040-9-015
Crystal 39.190MHz	135-040-9-020
Filter Ceramic CFU 45502 (455 D2)	140-030-9-001

Part Name	Part #
Resistor Semifixed 20K ohm 8 Dia	008-462-9-001
Transistor MPS9681 (U)	177-061-9-001
Coil 48MHz Tune 7MM	047-009-9-001
Choke Coil 100uH Mo Type (PC)	047-009-9-002
39MHz RF Tune	047-001-9-020
16MHz OSC	047-001-9-017
49NHz RF AMP	047-009-9-003
1FT 10.7MHz M1X	047-009-9-004
49MHz ANT Loading	047-009-9-005
1FT 455KHz DET	047-009-9-006
49MHz TX ANT	047-009-9-007