REALISTIC®

Service Manual

21-1526

CB 40-CHANNEL TRANSCEIVER
TRC-466

Catalog Number : 21-1526

CUSTOM MANUFACTURED FOR RADIO SHACK TC A DIVISION OF TANDY CORPORATION

CONTENTS

SPECIFICATIONS

GENERAL SPECIFICATIONS

Description	
Transmitter	Crystal controlled PLL synthesizer, amplitude modulation
Receiver	Crystal controlled double conversion, superheterodyne system
Communicating frequencies	All 40 CB channels (26.965 to 27.405 MHz)
Voltage operation	12 — 16 V DC (positive or negative ground vehicles)
Temperature and Humidity range	−30°C to +60°C and 10% to 90%
Transmitter/Receiver switching	Electronic

STANDARD TEST CONDITIONS

Battery supply voltage	13.8 V DC
Modulation	1000 Hz, 30%
Receiver output power	500 mW at external SP.
Receiver output impedance	8 ohms, non-inductive
Ant. load impedance of transmitter	50 ohms, non-inductive
Ambient conditions	
temperature	17 to 23°C
humidity	40 to 70%

TRANSMITTER SPECIFICATIONS

Description	Nominal	Limit
RF power output	4.0 watts	3 — 4 watts
Emission	8A3	
Modulation Capabilities	+90%, −100%	
AMC Range at 1 kHz	40 dB	>30 dB
Frequency accuracy	0.002%	0.005%
Spurious radiation & Harmonic signal radiation radio from fundamental	−65 dB	−60 dB
Current consumption		
unmodulated	1200 mA	1800 mA
max. modulated	1800 mA	2000 mA
Envelope distortion	10% max. 1000 Hz, 50% mod.	
Hum and Noise level	40 dB min. below max. mod.	
Stability against variation of antenna impedance	Satisfactory when dummy antenna is varied from 40 ohms to 200 ohms.	

RECEIVER SPECIFICATIONS

Description	Nominal	Limit
Intermediate frequency		
1st IF	10.695 MHz	
2nd IF	455 kHz	
Sensitivity for 500 mW output	0.25 μV	0.5 μV
Sensitivity at 10 dB S+N/N	0.5 μV	1.4 μV
Adjacent Channel Rejection	80 dB	60 dB
Image Rejection (5.7 MHz)	50 dB	>40 dB
Bandwidth (−6 dB)	7.6 kHz	5 − 9 kHz
Signal-to-Noise ratio		
at 1 mV input	40 dB	35 dB
Distortion at 5 mV input	2.5%	<6%
AGC Figure of merit at 50 mV input	105 dB	>90 dB
Power output at 500 μV Input		
Undistorted (10% THD)	3.5 W	>3.0 W
Maximum	5.0 W	>4.0 W
Electrical fidelity compared to 1000 Hz		
400 Hz	−6 dB	− 6 ± 5 dB
2000 Hz	−6 dB	−6 ± 5 dB
Cross Modulation	50 dB	>46 dB
Squelch	Adjustable from 0.5 μV to 1 mV	
Current consumption (no signal)	300 mA	<450 mA

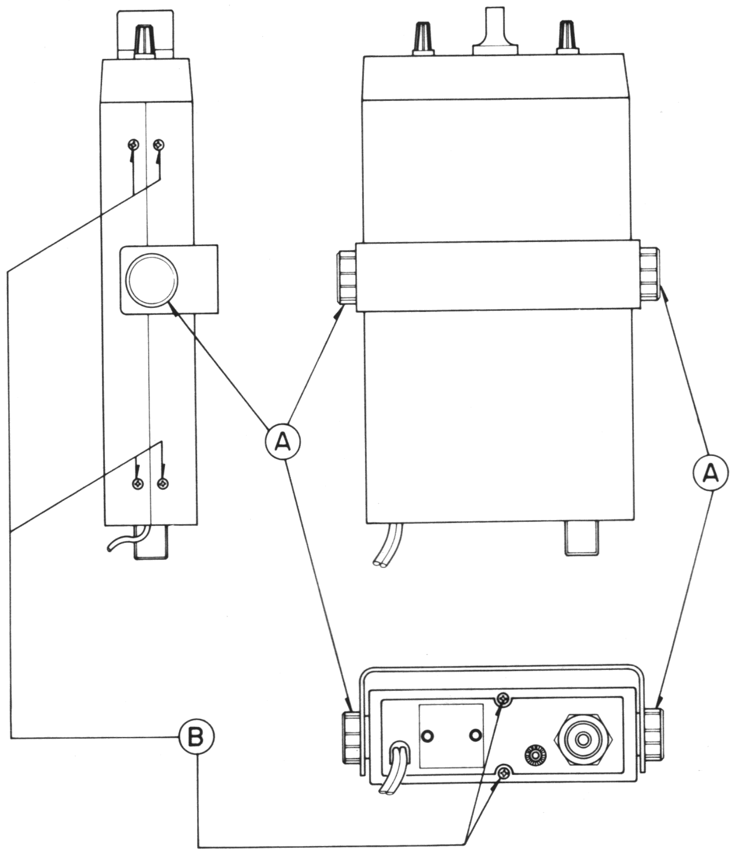
OTHER ITEMS

Fuse	2 Amp.
General power requirement	12 − 16 V DC
Dimensions	(H)1-11/16″(43mm) × (W)5-11/32″(136mm) × (D)9-13/16″(249mm)
Weight	2 Lbs. 14 oz. (1.3 kg)

NOTE: Nominal Specs represent the design specs; all units should be able to approximate these — some will exceed and some may drop slightly below these specs. Limit Specs represent the absolute worst condition which still might be considered acceptable; in no case should a unit perform to less than within any Limit Spec.

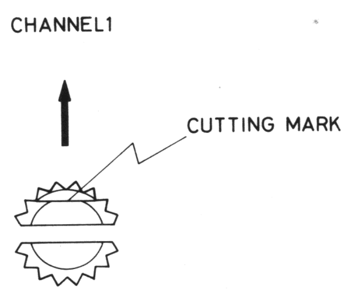
DISASSEMBLY INSTRUCTIONS

1. Remove (2) mounting bracket screws Ⓐ.
2. Remove (10) screws Ⓑ from top and bottom covers.
   (Four screws from each side and two from rear of unit.)
   Caution: Speaker wires are attached to bottom cover.

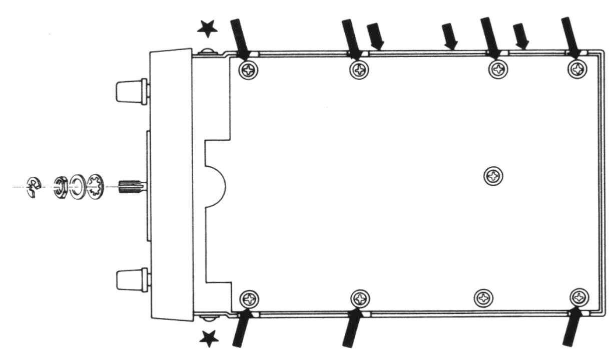


REMOVING PRINTED CIRCUIT BOARD

1. Pull Channel Selector knob off.
2. Remove E Ring, nut, washer and lock washer from Channel Selector shaft.
3. Remove (14) screws from Printed Circuit Board.
   (7 screws marked ⬅, 3 screws marked ⬅ and 4 screws marked ★)
4. Carefully remove P.C.B. from chassis.

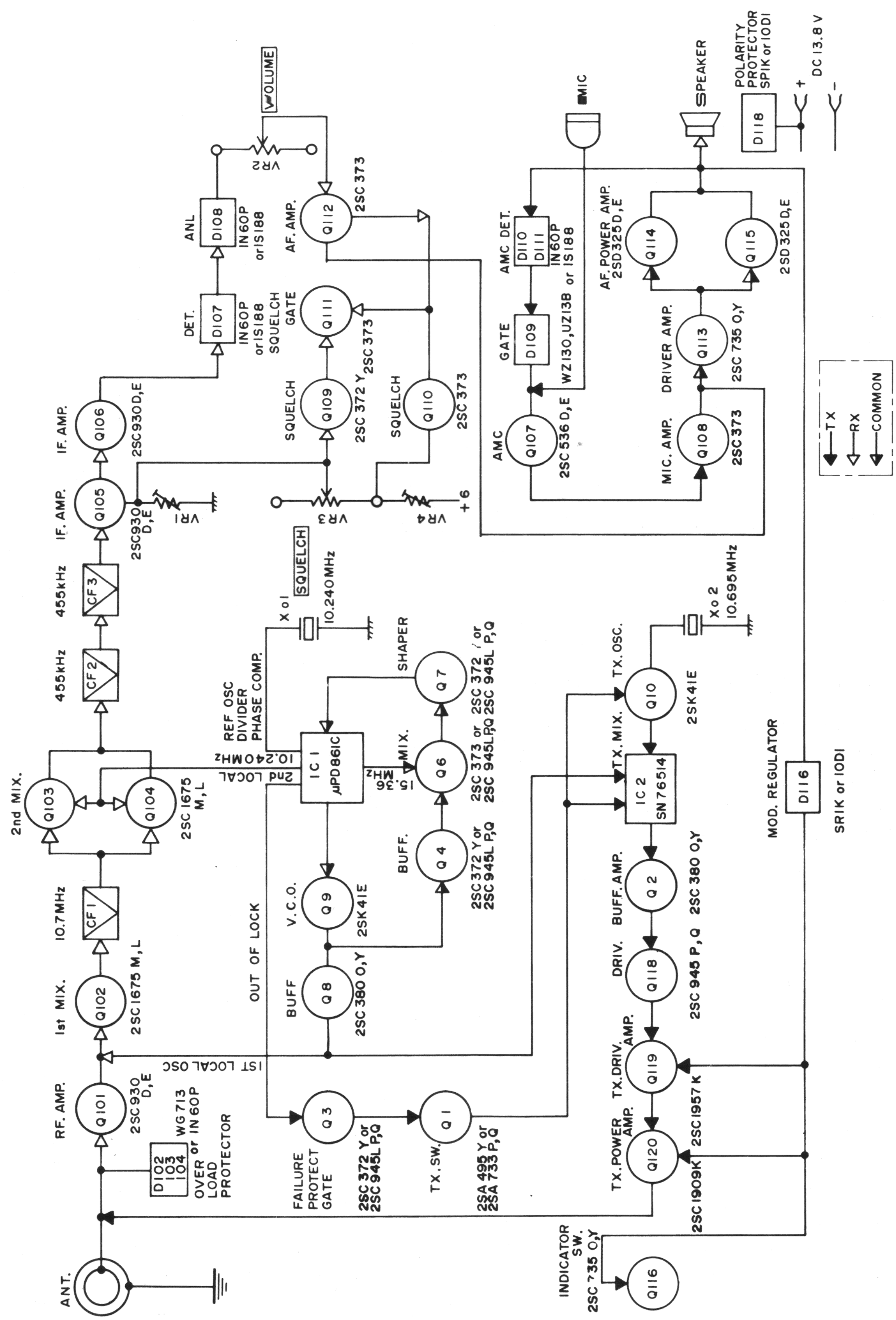


POSITION OF CHANNEL KNOB SHAFT



IMPORTANT NOTE:
When replacing the Channel knob, you must be sure to index it correctly. There is the cutting mark on the switch shaft, rotate the shaft so the cutting mark of the shaft is up and precisely horizontal. Now position the knob to indicate Channel 1 and carefully press the knob in place (don't turn either the knob or shaft while doing this). As a double-check, connect a Frequency Counter to the unit and check Transmit frequency (should be 26.965 MHz).

BLOCK DIAGRAM

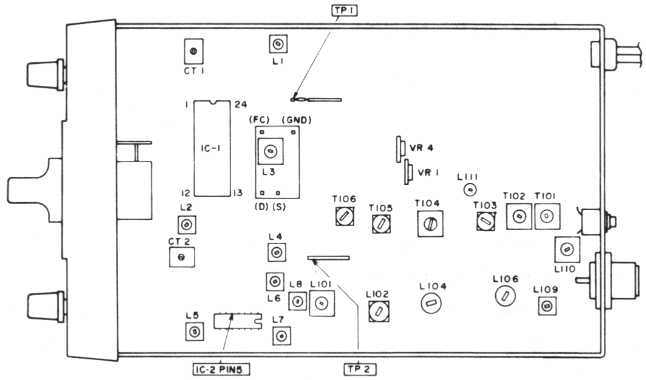


ALIGNMENT INSTRUCTIONS

A. PLL SECTION

1. Test Equipment Required

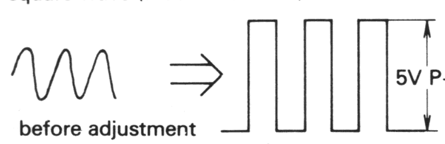
a. V.T.V.M.
b. Frequency Counter
c. DC Power Supply (13.8 Volt, 2.5 Amp.)
d. Oscilloscope
e. RF Output Power Meter
f. DC Volt Meter (above 100 KΩ /V)



NOTE: Figure 1 provides test point and alignment location information.

Figure 1

2. Alignment Procedure

STEP	CONTROL SETTING	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
1	Set Channel Selector to channel 1.			
2	MIC: Receive POWER: "on" VOLUME: Optional SQUELCH: Optional	Connect DC Volt Meter to "FC" on P.C.B. (Figure 2) Also see P.C.B. Bottom View.	L3	Adjust for 1.2 Volt indication on DC Volt Meter.
3	MIC: Receive POWER: "on" VOLUME: Optional SQUELCH: Optional Channel Selector: Channel 40	Same as step 2. (Figure 2)	Check for indication on DC Volt Meter (must be 3 - 3.5 Volt). If DC Volt Meter does not indicate 3 - 3.5 Volt, readjust L3, return to step 2.	
4	Same as step 2. (Return Channel Selector to Channel 1).	Connect Frequency Counter to TP-1. (Figure 3)	CT1	Adjust for 10.240 MHz ± 50 Hz indication on Frequency Counter.
5	Same as step 2.	Connect RF V.T.V.M. to TP-1. (Figure 2)	L1	Adjust for maximum indication on RF V.T.V.M. (reference 160 ± 30 mV)
6	Same as step 2.	Oscilloscope to pin 13 of IC 1 (Figure 4)	L2	Adjust L2 to obtain square wave (must be 5 VP-P). 
7	MIC: Receive POWER: "on" VOLUME: Optional SQUELCH: Optional Channel Selector: Channel 20	Connect RF V.T.V.M. to TP-2. (Figure 4)	L4 L6	Adjust for maximum indication on RF V.T.V.M. (reference 120 mV)
8	Check for indication on DC Volt Meter at Channel 1/Channel 40, it must be 1.2 - 1.5 Volt/3 - 3.5 Volt. (See Figure 2) If DC Volt Meter does not read within these tolerances, readjust L3. If readings are still improper, component(s) may be defective.			

B. RECEIVER SECTION

1. Test Equipment Required

a. RF Signal Generator
b. V.T.V.M.
c. Oscilloscope
d. RF V.T.V.M.
e. Distortion Meter

2. General Alignment Conditions

1. Signal input must be kept as low as possible, to avoid overload and clipping. (Use highest possible sensitivity of output indicator.)
2. Standard modulation is 1000 Hz at 30% amplitude.
3. A non-metalic alignment tool must be used for all adjustments.
4. Connection of test equipment is shown in Figure 5.
5. Power supply adjusted for 13.8 V DC, 2 A.

NOTE: Figure 1 provides alignment location information.

3. Alignment Procedure

STEP	SIGNAL SOURCE CONNECTION	OUTPUT INDICATOR CONNECTION	SET SIGNAL	ADJUST	ADJUST FOR
1	Set Channel Selector to Channel 20				
2	Turn VR-3 (SQUELCH) fully counterclockwise.				
3	Turn VR-2 (VOLUME) fully clockwise.				
4	RF Signal Generator connected to Antenna Connector (Figure 5)	V.T.V.M. connected across Ext. Speaker Jack with 8 Ω load (Figure 5)	27.205 MHz (modulation)	L110	Adjust for maximum output
5				T101	
6				T102	
7				T103	
8				T104	
9				T105	
10				T106	
11				L111	
12	Repeat steps 4 through 11 as necessary to obtain maximum sensitivity.				
13	Same	Same	27.205 MHz (modulated) Signal Input should be set to 0.125 μV	VR-1 Gain Control	Adjust for 2.0 Volts V.T.V.M. indication across 8 ohm resistor.
14	Turn VR-3 (SQUELCH) fully clockwise.				
15	Same	Same	27.205 MHz (modulated) Signal Input should be set to 400 μV	VR-4	Output to be 2 volts

C. TRANSMITTER SECTION

1. Test Equipment Required

a. RF Output Power Meter
b. 50 Ohm Load (non-inductive)
c. RF Attenuator
d. Oscilloscope
e. Audio Generator
f. DC Power Supply (13.8 Volt, 2.5 Amp.)
g. Field Strength Meter (or Spectrum Analyzer)
h. Frequency Counter

NOTE: Figure 1 provides test point and alignment location information.

2. Alignment Procedure

STEP	SIGNAL SOURCE CONNECTION	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
1	Set Channel Selector to Channel 20			
2	Disconnect R179 (or short base of Q119 to ground with 0.01 μF). See Figure 11.			
3		Connect RF V.T.V.M. to pin 5 of IC2 (Figure 6)	L5	Adjust for maximum indication on RF V.T.V.M.
4		Connect RF V.T.V.M. to base of Q118 (Figure 7)	L7	Adjust for maximum indication on RF V.T.V.M.
5			L8	
6			L101	
7			L5	Adjust for 400 mV indication on RF V.T.V.M.
8	Repeat steps 4 through 7 as necessary to obtain maximum output and 400 mV.			
9	Re-connect R179 (or remove shorting capacitor)			
10		Connect Dummy Load and Frequency Counter through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT Jack on Set. (Figure 8)	L102	Adjust for maximum indication on RF Power Meter.
11			L104	
12			L106	
13	Repeat steps 10 through 12 as necessary to obtain maximum output.			
14	Adjust the core of L102 down (1/2 turn).			
15	Adjust the core of L104 up (1/2 turn).			
16		Connect Dummy Load and Frequency Counter through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT Jack on Set. (Figure 8)	Check that RF output power is 3.5 to 4 W on all channels with no modulation. If it is not within the above range, go back to steps 11 through 13 and readjust. If still improper, change R179 value (0 — 10 ohms).	

STEP	SIGNAL SOURCE CONNECTION	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
17	(Return to Channel 20.)	Same as step 17	CT2	Adjust for 27.205 MHz ± 100 Hz indication on Frequency Counter
18	Audio Generator (1 kHz) across C152 or to Microphone Connector, pin 4. (Figure 9) Adjust audio signal level (about 2 mV) to obtain 80-100% modulation level.	Connect Dummy Load and Oscilloscope through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT Jack on Set. (Figure 9)	Check scope pattern for proper modulation	
※ 19		Connect Dummy Load and Field Strength Meter through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT Jack on set. (Figure 12) Tune to 2nd harmonic frequency (54.41 MHz) on Field Strength Meter.	L109	Adjust for min. (54.41 MHz) indication on Field Strength Meter.
20	Check level of fundamental and 2nd harmonic frequency (54.41 MHz).			
21	Check suppression of 2nd harmonic frequency (54.41 MHz) compared to fundamental (must be better than −70 dB).			
22	Check all Channels and if necessary, repeat steps 19 through 21 to obtain more than −50 dB on all channels with no modulation.			

※ : If you have a Spectrum Analyzer, you can obtain more precise readings with it.

STEP	SIGNAL SOURCE CONNECTION	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
A		Connect Spectrum Analyzer and RF Attenuator through RF Power Meter. Connect RF Power Meter to EXT. ANT Jack on Set. (Figure 10)	L109	Adjust for min (54.41 MHz) indication on Spectrum Analyzer.
B	Go to step 20.			

EQUIPMENT CONNECTIONS

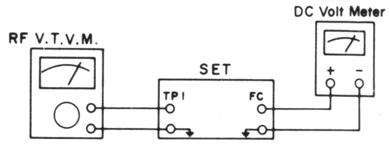


Figure 2

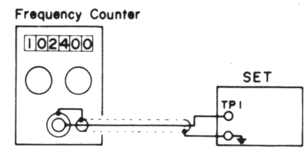


Figure 3

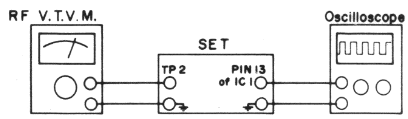


Figure 4

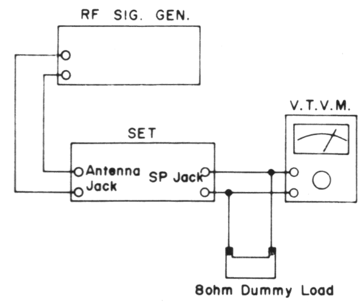


Figure 5

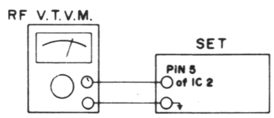


Figure 6

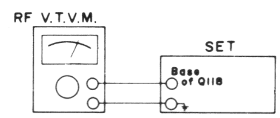


Figure 7

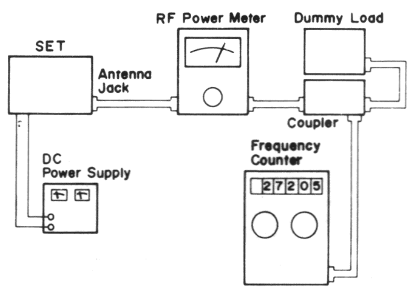


Figure 8

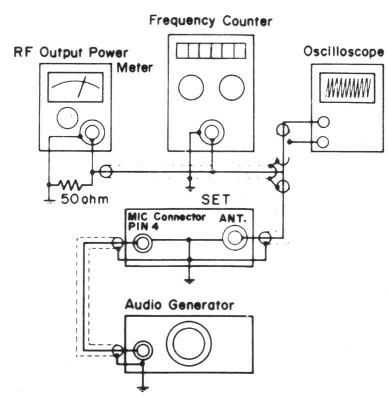


Figure 9

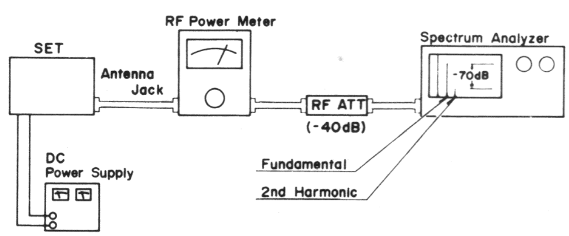


Figure 10

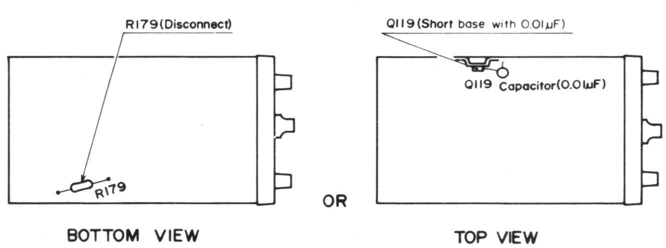


Figure 11

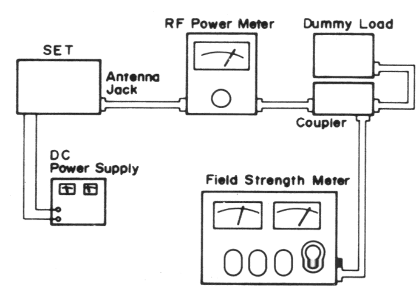


Figure 12

FREQUENCIES GENERATED AND MIXED TO OBTAIN EACH CHANNEL

- VCO FREQUENCY = 〔(N/1024 + 1.5)〕 × 〔REFERENCE FREQUENCY (10.240 MHz)〕
- TRANSMIT FREQUENCY = (VCO FREQUENCY) + 〔1 st IF FREQUENCY (10.695 MHz)〕

CHANNEL NUMBERS	BCD INPUT TO IC-1 IC-1 PIN NUMBERS 8765	 4321	N	VCO FREQUENCY (MHz)	TRANSMIT FREQUENCY (MHz)
1	0000	0001	91	16.270	26.965
2	0000	0010	92	16.280	26.975
3	0000	0011	93	16.290	26.985
4	0000	0100	95	16.310	27.005
5	0000	0101	96	16.320	27.015
6	0000	0110	97	16.330	27.025
7	0000	0111	98	16.340	27.035
8	0000	1000	100	16.360	27.055
9	0000	1001	101	16.370	27.065
10	0001	0000	102	16.380	27.075
11	0001	0001	103	16.390	27.085
12	0001	0010	105	16.410	27.105
13	0001	0011	106	16.420	27.115
14	0001	0100	107	16.430	27.125
15	0001	0101	108	16.440	27.135
16	0001	0110	110	16.460	27.155
17	0001	0111	111	16.470	27.165
18	0001	1000	112	16.480	27.175
19	0001	1001	113	16.490	27.185
20	0010	0000	115	16.510	27.205
21	0010	0001	116	16.520	27.215
22	0010	0010	117	16.530	27.225
23	0010	0011	120	16.560	27.255
24	0010	0100	118	16.540	27.235
25	0010	0101	119	16.550	27.245
26	0010	0110	121	16.570	27.265
27	0010	0111	122	16.580	27.275
28	0010	1000	123	16.590	27.285
29	0010	1001	124	16.600	27.295
30	0011	0000	125	16.610	27.305
31	0011	0001	126	16.620	27.315
32	0011	0010	127	16.630	27.325
33	0011	0011	128	16.640	27.335
34	0011	0100	129	16.650	27.345
35	0011	0101	130	16.660	27.355
36	0011	0110	131	16.670	27.365
37	0011	0111	132	16.680	27.375
38	0011	1000	133	16.690	27.385
39	0011	1001	134	16.700	27.395
40	0000	0000	135	16.710	27.405

ANTENNA SYSTEM

An antenna system can be considered to include the antenna proper, the feed line and any coupling devices used for transferring power from the transmitter to the line and from the line to the antenna. Some simple systems may omit the transmission line or one or both of the coupling devices.

Selecting an Antenna

For mobile operation at 27 MHz, the vertical whip antenna is almost universally used. Since longer whips present mechanical difficulties, the length is usually limited to a dimension that will resonate as a quarter-wave antenna in the CB band; the car body serves as the ground connection. This antenna length is approximately 8.5 feet. With the whip length adjusted to resonance in the CB band, the impedance at the feed point, X, Fig. A, will appear as a pure resistance at the resonant frequency.

Mobile Antenna

Minimizing Losses

There is little that can be done about the nature of the coil. However, poor electrical contact between large surfaces of the car body, and especially between the point where the feed line is grounded and the rest of the body, can add materially to the ground-loss resistance.

For example, the feed line, which should be grounded as close to the base of the antenna as possible, might be connected to the bumper, while the bumper may have poor contact with the rest of the body because of rust or paint.

Feeding the Antenna

It is usually found most convenient to feed the whip antenna with coax line. Unless very low-Q loading coils are used, the feed-point impedance will always be appreciably lower than 52 ohms — the characteristic impedance of the commonly-used coax line, RG-8/U or RG-58/U.

One method of obtaining a match is shown in Fig. B. For detailed information on precise loading and matching of Antennas and Transmission line systems, refer to the lastest edition of the **ARRL Handbook**.

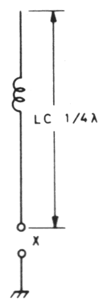


Figure A

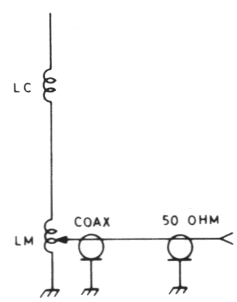


Figure B

TROUBLE SHOOTING HINTS

UNIT WILL NOT TURN ON

1. Defective power switch.
2. Fuse blown.
3. Broken DC power cable.
4. Poor solder connection or other open connection in power circuit.

NO RECEIVE SOUND

1. Defective external speaker jack.
2. Poor contact on microphone connector.
3. Defective push switch on microphone.
4. Defective internal speaker.
5. Defective semiconductor in RX circuit.

NO NOISE

1. Apply audio signal to Q112 base. (signal inject/trace).
2. Measure transistor voltages in all audio stages and receiver section and compare with voltage noted in chart.
3. Improper local oscillator adjustment or main oscillator.

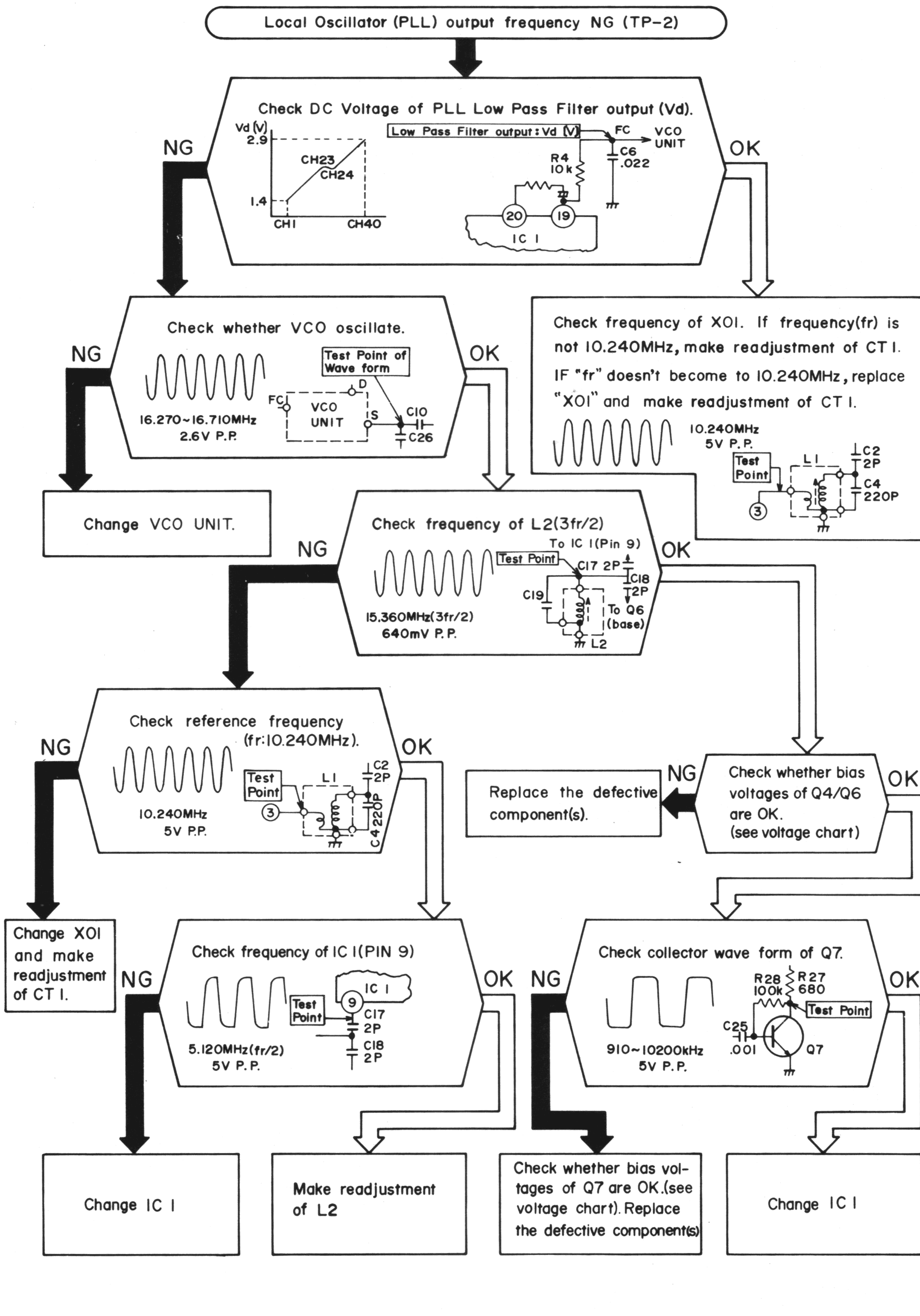
NO TRANSMISSION

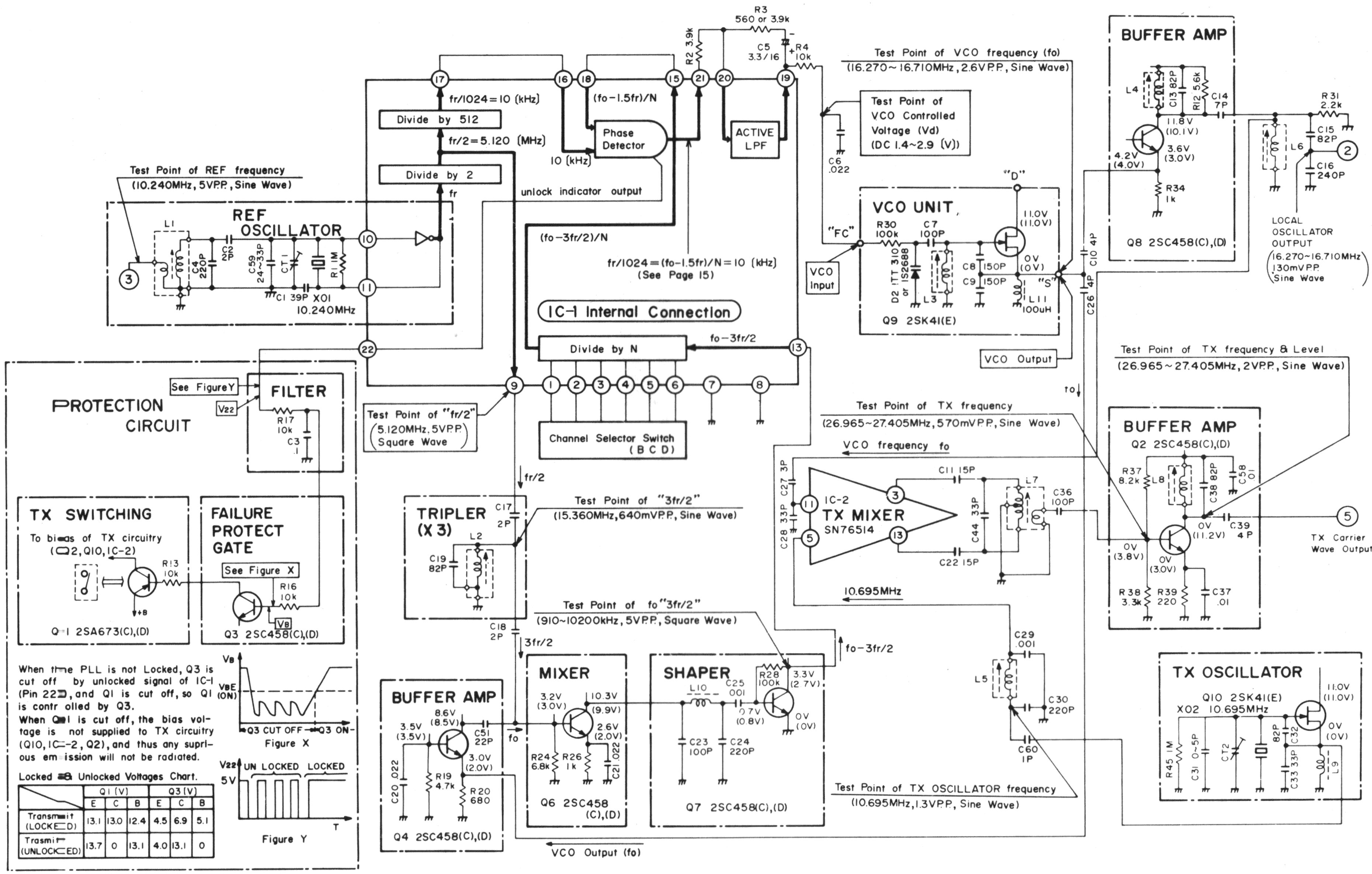
1. Defective microphone connector.
2. Defective push switch on microphone.
3. Improper adjustment of main oscillator or local oscillator.
4. If you have checked all channels and obtain no RF output, check DC Control voltage of VCO and/or signal trace through transmitter circuit.
5. Defect in power supply.
6. Defective antenna connector.

NO MODULATION

1. Defective microphone.
2. Poor audio output/Defective modulator.
3. Inoperative microphone amplifier.
4. Defective microphone connector.
5. Apply audio signal to pin No. 4 of microphone connector and trace to defective stage.

PLL TROUBLE SHOOTING HINTS





Locked [&] Unlocked Voltages Chart.

	Q1 (V) E	Q1 (V) C	Q1 (V) B	Q3 (V) E	Q3 (V) C	Q3 (V) B
Transmit (LOCKED)	13.1	13.0	12.4	4.5	6.9	5.1
Trasmit (UNLOCKED)	13.7	0	13.1	4.0	13.1	0

NOTE
1. ALL VOLTAGE VALUES ARE INDICATED IN VOLTS WITH NO SIGNAL, MEASURED WITH V.T.V.M.
2. ( ): VOLTAGE IN TRANSMIT MODE.

CIRCUIT DESCRIPTION

A. The Basic PLL

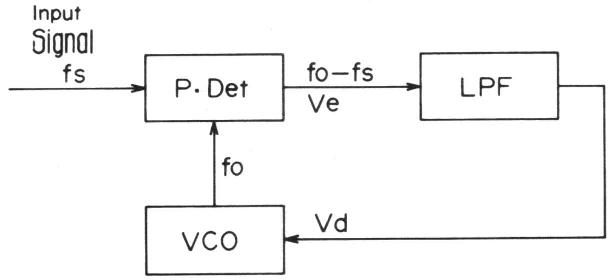


Figure 1A

The Phase Detector (P-Det) detects any phase difference between the Input Signal (f_s) and the output signal from the VCO (f_o). It then generates a voltage proportional to this phase difference.
This proportional-phase-voltage is fed through a Low Pass Filter and is applied to the VCO (Voltage Controlled Oscillator).
The Low Pass Filter (LPF) processes the signal from the Phase Detector and removes any harmonic content which might otherwise produce spurious results from the VCO.

A simple block diagram of the PLL section is shown in Figure 1A.

When there is no input signal (f_s), VCO oscillates at a free-running frequency. When an input signal does not appear, the Phase Detector generates an error voltage (V_e) proportional to the phase difference between the input signal (f_s) and the VCO frequency (f_o). V_e is filtered through the Low Pass Filter and applied to the control terminal of the VCO. As the phase of f_o approaches that of f_s, the error voltage approaches the precise value required for the desired frequency (produced by VCO). This condition is termed "locked".

B. PLL Synthesizer

To accomplish frequency synthesis, a programmable divider is used as shown in Figure 1B.

When the PLL is locked, $f_o = f_r$ (times) N

$$\left(\text{Where } f_r = f_v = \frac{f_o}{N} \rightarrow f_o = Nf_r\right)$$

Thus, we can obtain the desired synthesized frequencies by varying "N" (see Figure 1C)

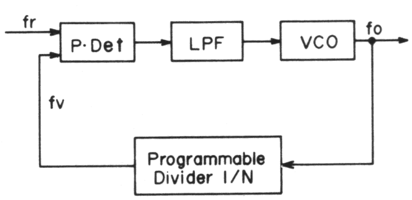


Figure 1B

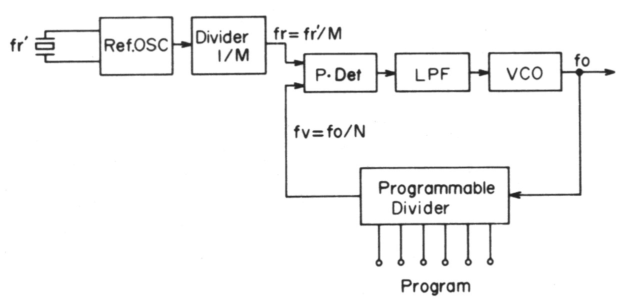


Figure 1C