

**REALISTIC<sup>®</sup>**

# Service Manual

## CB 40-CHANNEL TRANSCEIVER TRC-410

Catalog Number: 21-1504



CUSTOM MANUFACTURED FOR RADIO SHACK  A DIVISION OF TANDY CORPORATION

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# 1. 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 (max.)	3.6-4.4 watts
Emission .....	8A3	
Modulation capabilities .....	+90%, —95%	
AMC Range at 1 kHz .....	40 dB	> 30dB
Frequency accuracy .....	0.002%	0.005%
Spurious radiation & Harmonic		
signal radiation ratio from fundamental .....	—65 dB	—60 dB
Current consumption		
unmodulated .....	1050 mA	1400 mA
80% modulated .....	1600 mA	1950 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**

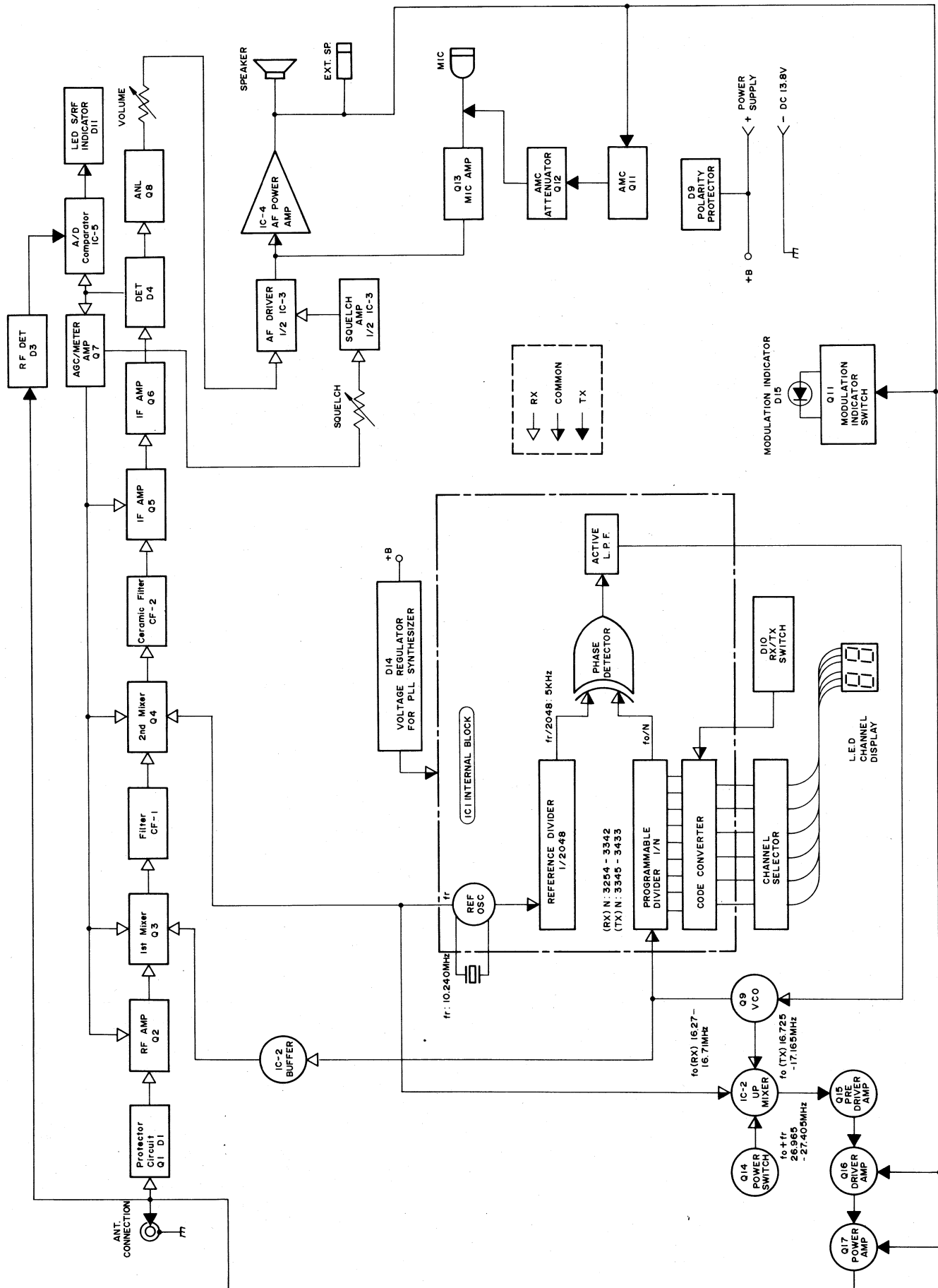
<b>Description</b>	<b>Nominal</b>	<b>Limit</b>
Intermediate frequency		
1st IF .....	10.695 MHz	
2nd IF .....	455 kHz	
Sensitivity for 500 mW output .....	0.25 $\mu$ V	0.5 $\mu$ V
Sensitivity at 10 dB S + N/N .....	0.6 $\mu$ V	1.2 $\mu$ V
Adjacent channel rejection .....	60 dB	56 dB
Image rejection (1st IF/2nd IF) .....	45 dB	35 dB
IF rejection ratio (1st IF/2nd IF) .....	70 dB	60 dB
Signal-to-Noise ratio		
at 1 mV input .....	40 dB	34 dB
Distortion at 1 mV input,		
50% mod. (500 mW out) .....	3%	6%
AGC Figure of merit at 50 mV input .....	90 dB	70 dB
Power output at 500 $\mu$ V Input		
Undistorted (10% THD) .....	3.5 W	3.0 W
Maximum .....	6.0 W	4.0 W
Electrical fidelity compared to 1000 Hz		
450 Hz .....	-5 dB	-6 $\pm$ 3 dB
2500 Hz .....	-5 dB	-6 $\pm$ 3 dB
Cross modulation .....	50 dB	45 dB
Squelch .....	Adjustable from 0.6 $\mu$ V to 1 mV	
Current consumption (no signal) .....	190 mA	280 mA
"S" meter sensitivity to light 4th LED .....	10 $\mu$ V	5 - 20 $\mu$ V

**OTHER ITEMS**

Fuse .....	2 Amp.
General power requirement .....	12 - 16 V DC
Dimensions .....	(H) 1-18/32"(40mm) $\times$ (W) 4-30/32"(125mm) $\times$ (D) 8-5/32"(207mm)
Weight .....	2 lb 2 oz. (1 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.

# 2. BLOCK DIAGRAM



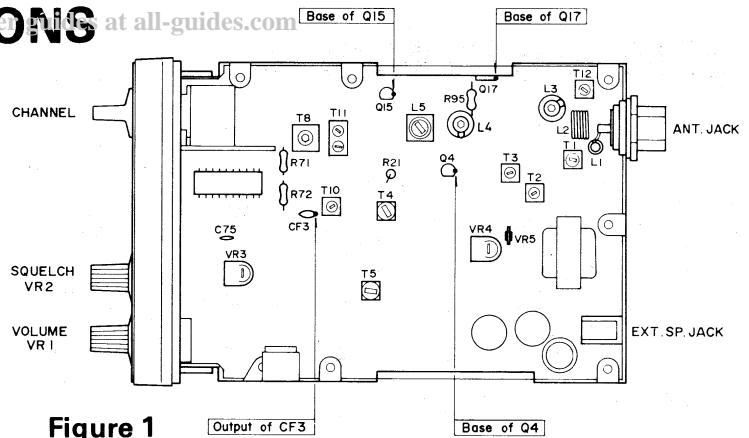
# 3. ALIGNMENT INSTRUCTIONS

## A. PLL SECTION

### 1. Test Equipment Required

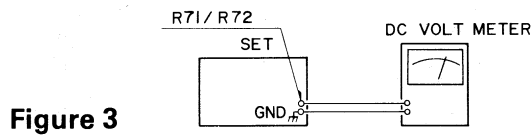
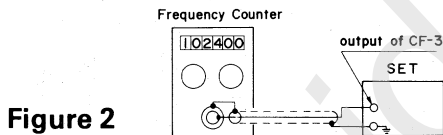
- a. Frequency Counter
- b. DC Power Supply (13.8 Volt, 2.5 Amp.)
- c. DC Volt Meter (above 100 K $\Omega$ /V)

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



### 2. Alignment Procedure

STEP	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
1	MIC: Receive, POWER: "on", VOLUME: Optional, SQUELCH: Optional, Channel Selector: Optional.		
2	Connect Frequency Counter to output of CF-3 (Figure 2).	C75	If the frequency is not 10.240 MHz $\pm$ 400 Hz, change value of C75 (18-39 pF).
3	MIC: Transmit, Channel Selector: Channel 40.		
4	Connect DC Volt Meter to R71/R72 (Figure 3).	T8	Alignment of VCO Adjust for 6.0 Volt indication on DC Volt Meter.
5	MIC: Receive, Channel Selector: Channel 1.		
6	Same as step 5.		Check for indication on DC Volt Meter; must be 2.5-3.5 Volt. If DC Volt Meter does not indicate 2.5-3.5 Volt, readjust T8 (return to step 4).

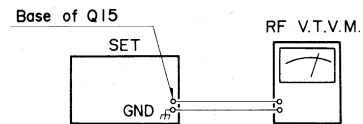


## B. TRANSMITTER SECTION

### 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
- i. Coupler

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



### 2. Alignment Procedure

**Figure 4**

STEP	SIGNAL SOURCE CONNECTION	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
1	Set Channel Selector to Channel 18.			
2	Disconnect R95 (or short base of Q17 to ground with 0.01 $\mu$ F).			
3		Connect RF V.T.V.M. to base of Q15 (Figure 4).	T10	Alignment of Pre-driver Stage
4			T11	Adjust for maximum indication on RF V.T.V.M.

STEP	SIGNAL SOURCE CONNECTION	OUTPUT INDICATOR CONNECTION	ADJUST	ADJUST FOR
5	① Make sure that the level (at base of Q15) of Channel 1 and Channel 40 is above 450 mV on RF V.T.V.M. ② Make sure that the differential level (at base of Q15) of Channel 1 and Channel 40 is below 50 mV on RF V.T.V.M. If the differential level is above 50 mV and /or level is below 450 mV, repeat steps 3 and 4 as necessary to obtain maximum output.			
6	Re-connect R95 (or remove shorting capacitor). (Figure 5).			
7		Connect Dummy Load and Frequency Counter through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT. Jack on Set. (Figure 6).	L5	Alignment of Driver and Final Stage
8			L4	Adjust for maximum indication on RF Power Meter.
9			L3	
10	Repeat steps 7 through 9 as necessary to obtain maximum output.			
11	Adjust the core of L5 up (1/4 turn).			
12		Connect Dummy Load and Frequency Counter through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT. Jack on Set. (Figure 6).		Check that RF output power is 3.7 to 4.3W on all channels with no modulation. If it is not within the above range, go back to steps 3 through 10 and readjust. If still improper, change R95 value (0–15 ohms).
13	Audio Generator (1 kHz) across C115 or to Microphone Connector, pin 4. (Figure 7) Adjust audio signal level to obtain 80-100% modulation level.	Connect Dummy Load and Oscilloscope through Coupler to RF Meter. Connect RF Meter to EXT. ANT. Jack on Set. (Figure 7).		Check scope pattern for proper modulation.
14		Connect Dummy Load and Field Strength Meter through Coupler to RF Power Meter. Connect RF Power Meter to EXT. ANT. Jack on set. (Figure 8) Tune to 2nd harmonic Frequency (54.35 MHz) on Field Strength Meter. or Connect Spectrum Analyzer and RF Attenuator through RF Power Meter to EXT. ANT. Jack on Set. (Figure 9)		Check level of fundamental and 2nd harmonic frequency (54.35 MHz). Check suppression of 2nd harmonic frequency (54.35 MHz) compared to fundamental (must be better than –63 dB). Check all Channels and if necessary, make sure that is more than –63 dB on all channels with no modulation. If it is NG, adjust L2 and L1 (stretch or squeeze).
15		Same as step 12.	Adjustment of Transmitter Frequency Make sure that the transmitter frequency is 27.175 MHz ± 600 Hz indication on Frequency Counter. Change crystal.	
16		Same as step 12.	VR5	Alignment of LED RF Meter Adjust so fourth LED lights at 3.5 watts of RF output power.

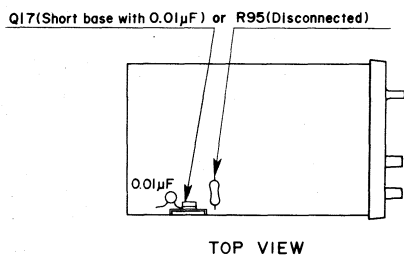


Figure 5

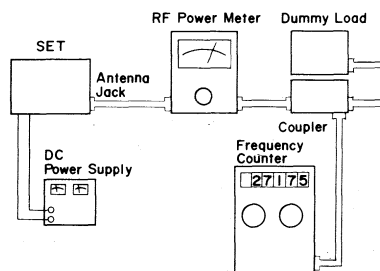


Figure 6

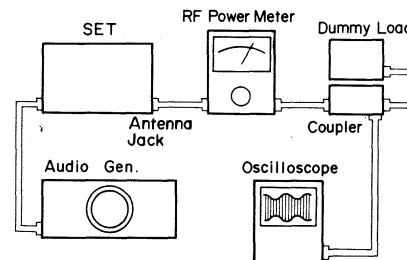


Figure 7

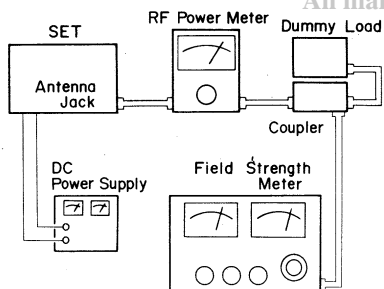


Figure 8

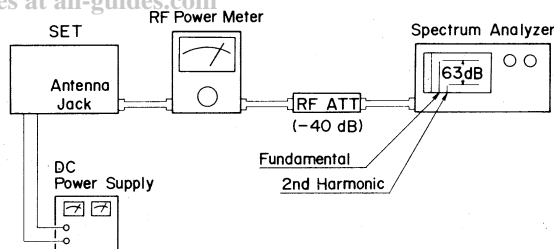


Figure 9

**C. RECEIVER SECTION**

**1. Test Equipment Required**

- a. RF Signal Generator
- b. V.T.V.M.
- c. 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-metallic alignment tool must be used for all adjustments.
- 4. Power supply adjusted for 13.8 V DC, 2A.

**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 18.				
2	Turn VR-2 (SQUELCH) fully counterclockwise.				
3	Turn VR-4 (VOLUME) fully clockwise.				
4	Connect RF Signal Generator (455 kHz, 30%) to base of Q4 through 0.01 $\mu$ F Capacitor.	Connect V.T.V.M. across EXT. Speaker Jack with 8 $\Omega$ Dummy load. (Figure 10)	455 kHz, 1 kHz 30% Modulation. Adjust the output of RF Signal Generator to a minimum level, so the IF circuit is not saturated.	T4	Alignment of 2nd IF Adjust for maximum output.
5				T5	
6	Connect RF Signal Generator to Antenna Connector.	Connect V.T.V.M. and Distortion Meter across Ext. Speaker Jack with 8 $\Omega$ Dummy load. (Figure 11)	27.175 MHz 1 kHz, 30% Mod.	T1	Overall Adjustment Adjust for maximum indication on V.T.V.M. Reduce output from RF SG so that audio output remains about 500 mW (2 V).
7				T2	
8				T3	
9				T4	
10	Repeat steps 6 through 9 as necessary to obtain maximum output.				
11	Same as step 6	Same as step 6.	27.175 MHz 1 kHz, 80% Mod. Set Output of RF SG to 1 mV.	T5	Alignment of T5
					Adjust for minimum indication on Distortion Meter.
12	Same as step 6	Same as step 6.	27.175 MHz 1 kHz, 30% Mod. Set output of RF SG to 0.316 $\mu$ V.	R21	Adjustment of IF Gain
					Confirm 2V indication on V.T.V.M. If not 2V, change value of R21 (330—1K)
13	Same as step 6	Same as step 6.	27.175 MHz 1 kHz, 30% Mod. Set Output of RF SG to 1 mV.	VR3	Adjustment of SQUELCH
					Turn VR-2 (SQUELCH) fully clockwise. Adjust output "on".
14	Same as step 6	Same as step 6.	27.175 MHz 1 kHz, 30% Mod. Set Output of RF SG to 50 $\mu$ V.	VR4	Adjustment of LED S-Meter
					Adjust so fourth LED on S/RF Meter lights.

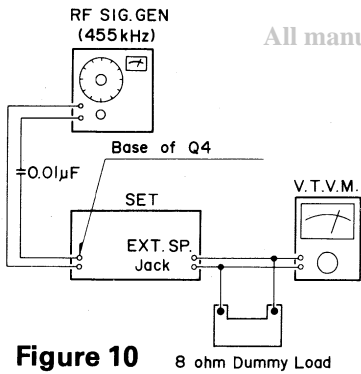


Figure 10 8 ohm Dummy Load

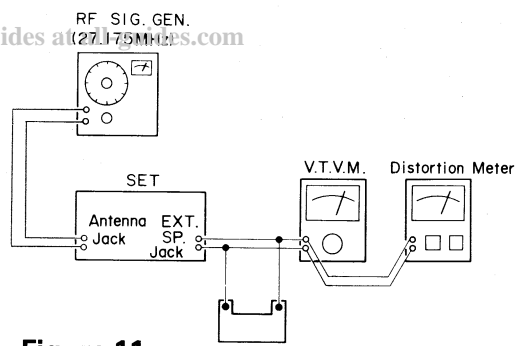


Figure 11 8 ohm Dummy Load

## 4. FREQUENCIES GENERATED AND MIXED TO OBTAIN EACH CHANNEL

### RECEIVE

$$*VCO \text{ FREQUENCY} = ((N/2048) \times (\text{REFERENCE FREQUENCY (10.240 MHz)}))$$

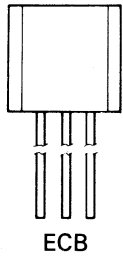
### TRANSMIT

$$*VCO \text{ FREQUENCY} = ((N/2048) \times (\text{REFERENCE FREQUENCY (10.240 MHz)}))$$

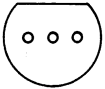
$$*TRANSMIT \text{ FREQUENCY} = VCO \text{ FREQUENCY} + (\text{REFERENCE FREQUENCY (10.240 MHz)})$$

CHANNEL NUMBERS	BCD INPUT TO IC-1		RECEIVE		TRANSMIT				
	IC-1 PIN NUMBERS		N	VCO FREQUENCY (MHz)	N	VCO FREQUENCY (MHz)	TRANSMIT FREQUENCY (MHz)		
	8	7						6	5
1	0	0	0	0	3254	16.270	3345	16.725	26.965
2	0	0	0	0	3256	16.280	3347	16.735	26.975
3	0	0	0	0	3258	16.290	3347	16.745	26.985
4	0	0	0	0	3262	16.310	3353	16.765	27.005
5	0	0	0	0	3264	16.320	3355	16.775	27.015
6	0	0	0	0	3265	16.330	3357	16.785	27.025
7	0	0	0	0	3268	16.340	3359	16.795	27.035
8	0	0	0	0	3272	16.360	3363	16.815	27.055
9	0	0	0	0	3274	16.370	3365	16.825	27.065
10	0	0	0	0	3276	16.380	3367	16.835	27.075
11	0	0	0	0	3278	16.390	3369	16.845	27.085
12	0	0	0	0	3282	16.410	3373	16.865	27.015
13	0	0	0	0	3284	16.420	3375	16.875	27.115
14	0	0	0	0	3286	16.430	3377	16.885	27.125
15	0	0	0	0	3288	16.440	3379	16.895	27.135
16	0	0	0	0	3292	16.460	3383	16.915	27.155
17	0	0	0	0	3294	16.470	3385	16.925	27.165
18	0	0	0	0	3296	16.480	3387	16.935	27.175
19	0	0	0	0	3293	16.490	3389	16.945	27.185
20	0	0	0	1	3302	16.510	3393	16.965	27.205
21	0	0	0	1	3304	16.520	3355	16.975	27.215
22	0	0	0	1	3306	16.530	3397	16.985	27.225
23	0	0	0	1	3312	16.560	3403	17.015	27.255
24	0	0	0	1	3308	16.540	3399	16.995	27.235
25	0	0	0	1	3310	16.550	3401	17.005	27.245
26	0	0	0	1	3314	16.570	3405	17.025	27.265
27	0	0	0	1	3316	16.580	3407	17.035	27.275
28	0	0	0	1	3318	16.590	3409	17.045	27.285
29	0	0	0	1	3320	16.600	3411	17.055	27.295
30	0	0	0	1	3322	16.610	3413	17.065	27.305
31	0	0	0	1	3324	16.620	3415	17.075	27.315
32	0	0	0	1	3326	16.630	3417	17.085	27.325
33	0	0	0	1	3328	16.640	3419	17.095	27.335
34	0	0	0	1	3330	16.650	3421	17.105	27.345
35	0	0	0	1	3332	16.660	3423	17.115	27.355
36	0	0	0	1	3334	16.670	3425	17.125	27.365
37	0	0	0	1	3336	16.680	3427	17.135	27.375
38	0	0	0	1	3338	16.690	3429	17.145	27.385
39	0	0	0	1	3340	16.700	3431	17.155	27.395
40	0	0	0	0	3342	16.710	3433	17.165	27.405

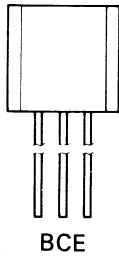
# 5. TRANSISTOR LEAD IDENTIFICATION AND IC INTERNAL CONNECTION



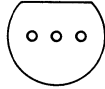
ECB



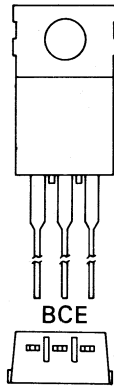
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- 2SC1674



BCE

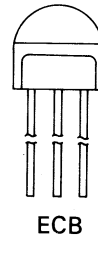


2SC2086



BCE

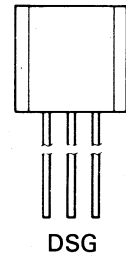
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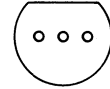
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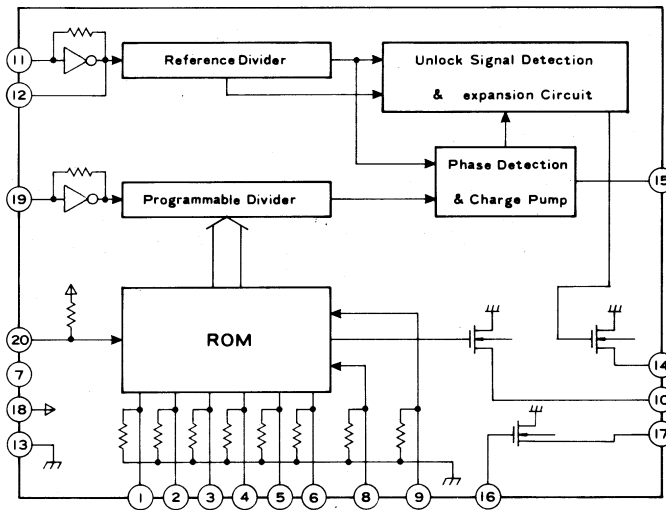
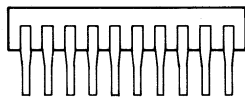
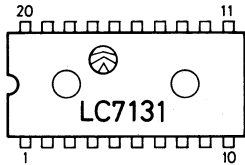


DSG

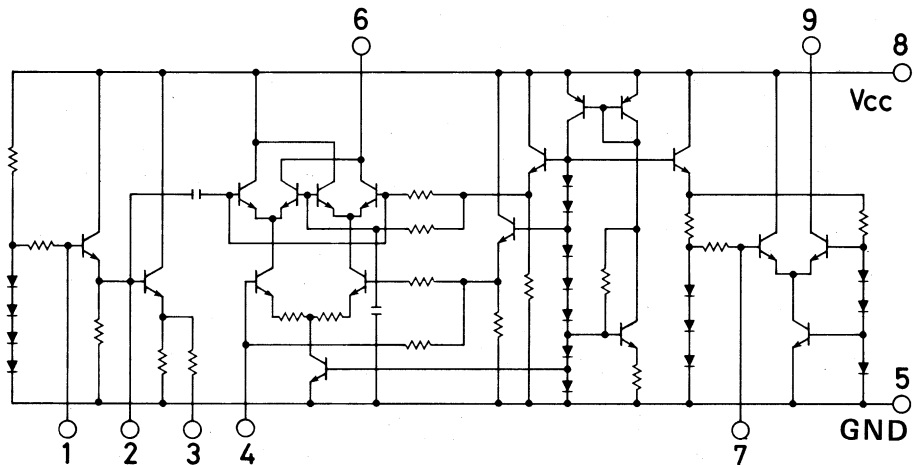
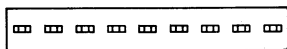
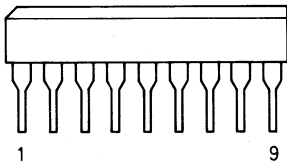


2SK41

## IC-LC7131

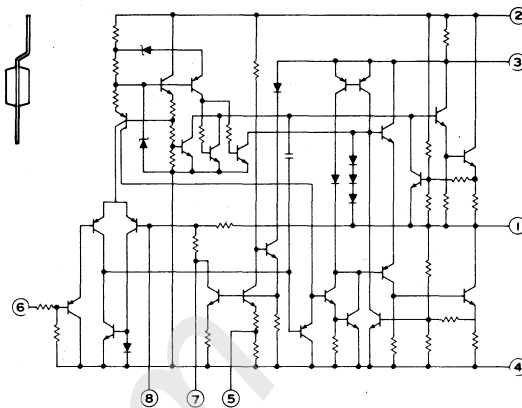
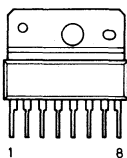
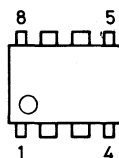


## IC-2 TA7310P

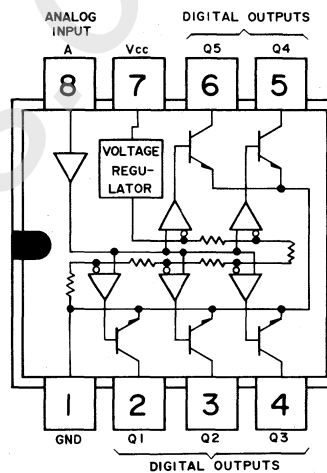
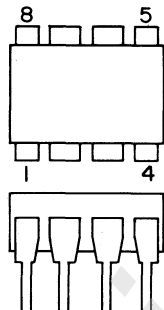


**IC-3 NJM4558D**

**IC-4 MB3712**



**IC-5 TL-489**



## 6. TROUBLESHOOTING

SYMPTOM	CAUSE/REMEDY
A) UNIT WILL NOT TURN ON.	<ol style="list-style-type: none"> <li>1. Defective power switch S3: Replace.</li> <li>2. Fuse blown: Replace.</li> <li>3. Broken DC power cable: Replace.</li> <li>4. Poor solder connection or other open connection in circuit: Repair or replace.</li> <li>5. Defective IC-1: Replace.</li> </ol>
B) NO RECEIVE SOUND.	<ol style="list-style-type: none"> <li>1. Defective external Speaker jack: Repair or replace.</li> <li>2. Poor contact on microphone connector: Repair as required.</li> <li>3. Defective push switch on microphone: Repair or replace MIC.</li> <li>4. Defective internal Speaker: Replace Speaker.</li> <li>5. Defective D4, VR3, VR2, IC-3 or semiconductor in RX circuit: Replace the defective component(s).</li> <li>6. Defective VR-1: Replace.</li> </ol>
C) NO NOISE	<ol style="list-style-type: none"> <li>1. Defective Q7: Replace.</li> <li>2. Measure transistor &amp; IC voltages in all audio states and receiver section. Compare with voltages noted on the IC &amp; TRANSISTOR VOLTAGE CHART.</li> <li>3. Improper local oscillator adjustment: Readjust.</li> <li>4. Defective SQUELCH Circuit (IC-3, VR2, VR3): Replace the defective component(s).</li> </ol>
D) NO TRANSMISSION	<ol style="list-style-type: none"> <li>1. Defective microphone: Repair or replace microphone.</li> <li>2. Defective push switch on microphone: Repair or replace.</li> <li>3. Improper adjustment of carrier oscillator or local oscillator: Readjust.</li> <li>4. If you have checked all channels and obtain no RF output, check V.C.O. and/or signal trace through transmitter circuit.</li> <li>5. Defective Antenna connector: Repair or replace.</li> <li>6. Defective L1: Repair or replace.</li> <li>7. Defective Q14 (E-C short): Replace.</li> </ol>
E) NO MODULATION	<ol style="list-style-type: none"> <li>1. Defective microphone: Repair or replace microphone.</li> <li>2. Poor audio output/Defective modulator: Repair or replace defective component(s).</li> <li>3. Inoperative microphone amplifier (Q13, IC-4): Replace component(s).</li> <li>4. Defective microphone connector: Repair or replace.</li> <li>5. Defective AMC circuit (Q11, D7, Q12): Replace component(s).</li> </ol>
F) NO SQUELCH	<ol style="list-style-type: none"> <li>1. Defective Q7, IC-3 circuit: Replace component(s).</li> <li>2. Improper adjustment of VR-3: Readjust.</li> </ol>
G) LED METER DOES NOT OPERATE BUT CB OPERATES NORMALLY	<ol style="list-style-type: none"> <li>1. Defective LED (D11-1 — D11-5): Replace.</li> <li>2. Defective IC-5: Replace.</li> <li>3. Defective D3, VR-5: Replace.</li> </ol>
H) MODULATION INDICATOR DOES NOT LIGHT	<ol style="list-style-type: none"> <li>1. Defective D15, Q10: Replace.</li> <li>2. Check Modulation: Refer E) NO MODULATION.</li> </ol>

# 7. TRANSISTOR AND IC VOLTAGE CHART

## TRANSISTOR VOLTAGE CHART

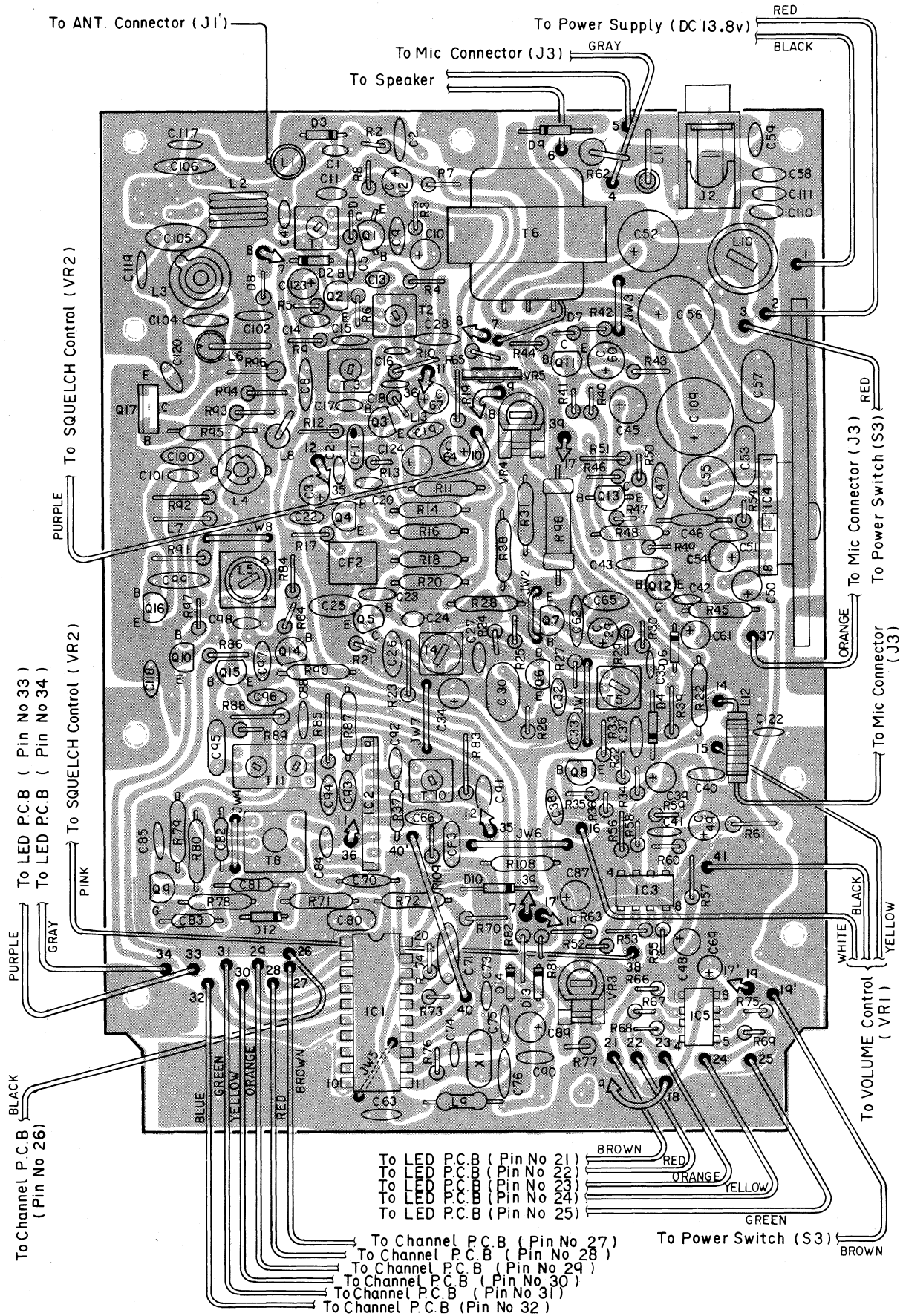
TRANSISTOR NUMBER	EMITTER (SOURCE)		COLLECTOR (DRAIN)		BASE (GATE)	
	RECEIVE	TRANSMIT	RECEIVE	TRANSMIT	RECEIVE	TRANSMIT
Q1	2.0	1.3	2.0	1.3	8.0	0.6
Q2	0.7	0	7.5	0	1.1	0.4
Q3	0.5	0	8.1	0	1.2	0.4
Q4	0.7	0	6.4	0	1.1	0.4
Q5	0.8	0	9.0	0	1.4	0.4
Q6	1.5	0	8.1	0	2.1	0
Q7	0	0	7.9	0.5	0.5	0
Q8	0.1	0	0.1	0.4	0.5	0.5
Q9	8.1	8.0	0.5	0.5	0	0
Q10	2.8	11.6	0	0	13.0	11.0
Q11	3.6	3.6	0.7	0	4.3	4.3
Q12	0	0	0	0	0.7	0
Q13	0.6	0.6	3.5	3.3	1.2	1.2
Q14	13.7	13.5	1.2	13.5	13.3	12.8
Q15	9.4	2.4	13.7	13.8	3.5	2.6
Q16	0	0	13.3	13.8	0	0
Q17	-0.3	0	13.3	13.8	0	0

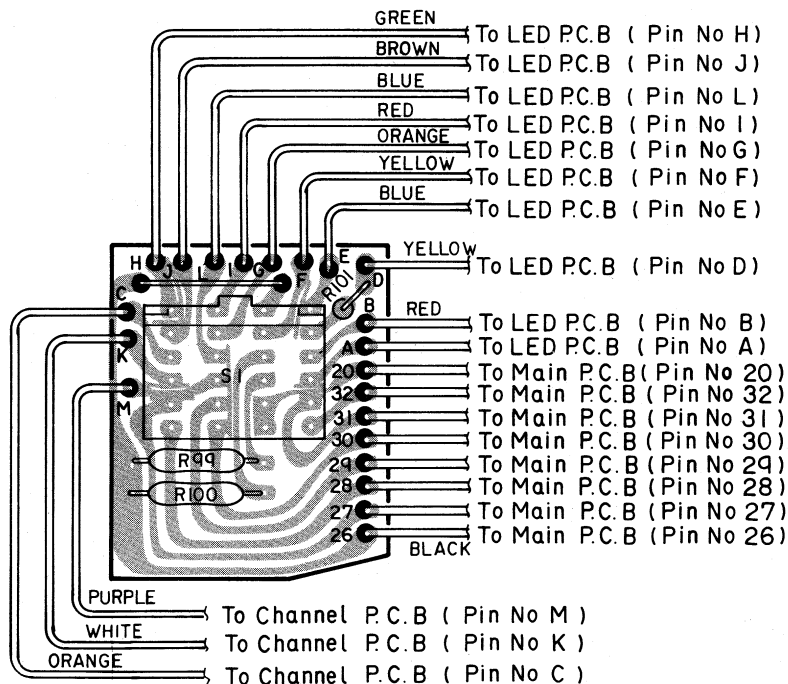
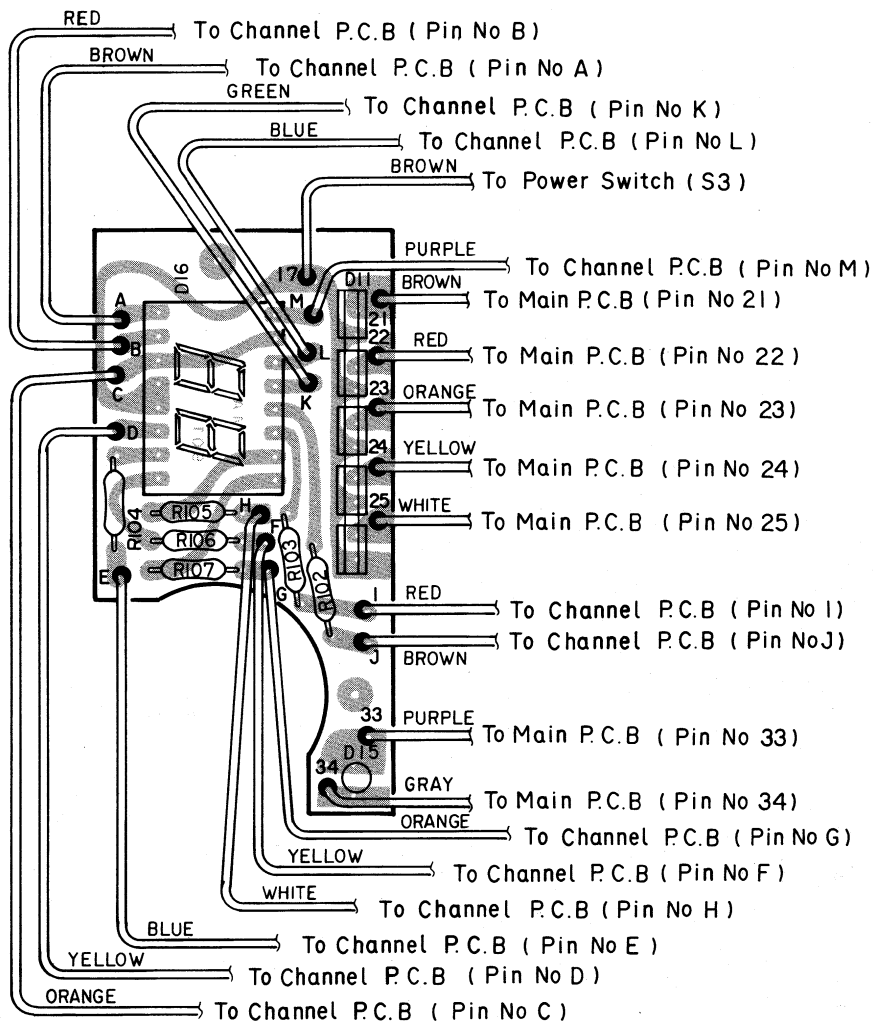
**NOTE:** All voltage values are indicated in volts with no signal measured with V.T.V.M. PLL in locked condition. Channel is 19.

## IC VOLTAGE CHART

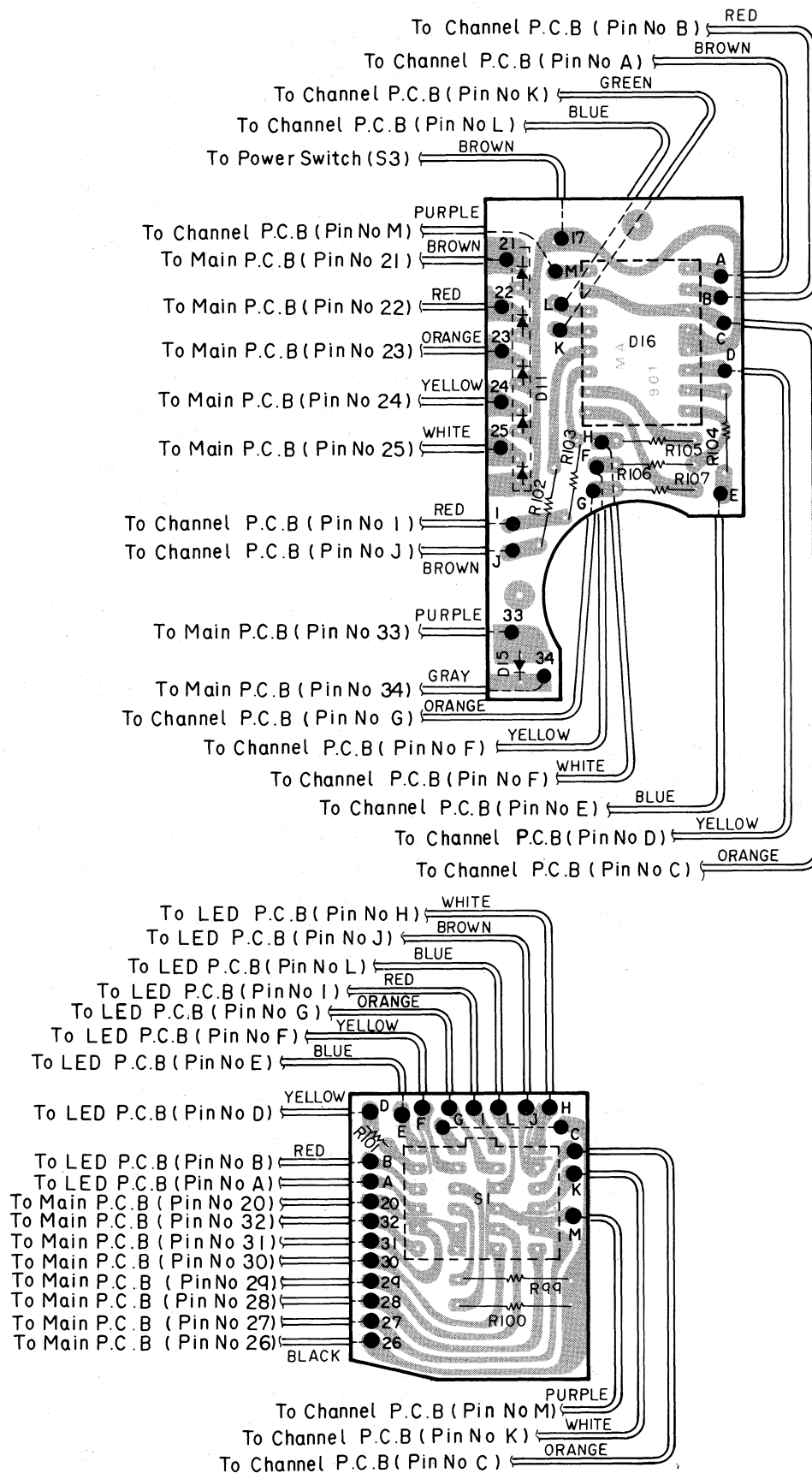
IC-1 LC7131	PIN NO.	1	2	3	4	5	6	7	8	9	10
	RECEIVE	6.4	0	0	6.4	0	0	0	0	0	0
	TRANSMIT	6.4	0	0	6.4	6.4	0	0	0	0	0
	PIN NO.	11	12	13	14	15	16	17	18	19	20
RECEIVE	3.2	3.1	0	2.0	1.5	1.5	3.5	6.4	2.8	6.3	
	TRANSMIT	3.2	3.1	0	1.4	1.4	0	5.1	6.4	2.8	0.7
IC-2 KIA7310	PIN NO.	1	2	3	4	5	6	7	8	9	
	RECEIVE	2.6	1.9	1.2	1.6	0	1.2	2.0	7.2	1.2	
	TRANSMIT	2.5	1.9	1.3	2.4	0	13.2	1.9	8.2	13.2	
IC-3 NJM4558 Squelch (on/off)	PIN NO.	1	2	3	4	5	6	7	8		
	RECEIVE	1.3/4.4	1.3/4.4	1.0/4.4	0/0	1.4/1.4	2.7/0	1.3/7.8	8.5/8.5		
	TRANSMIT	4.4	4.4	4.4	0	1.4	0	7.9	8.5		
IC-4 MB3712HM	PIN NO.	1	2	3	4	5	6	7	8		
	RECEIVE	6.8	13.7	13.0	0	0	0	0.6	0.6		
	TRANSMIT	6.8	13.6	12.9	0	0	0	0.6	0.6		
IC-5 TL489C	PIN NO.	1	2	3	4	5	6	7	8		
	RECEIVE	0	12.3	12.3	12.2	12.3	12.2	13.7	0		
	TRANSMIT ON	0	0	0	0	0	12.1	13.6	0.9		
(LED	0	1.5	12.1	12.1	12.1	12.1	12.1	13.5	0		
(RF/S METER) OFF											

# 8. PRINTED CIRCUIT BOARD (TOP VIEW)

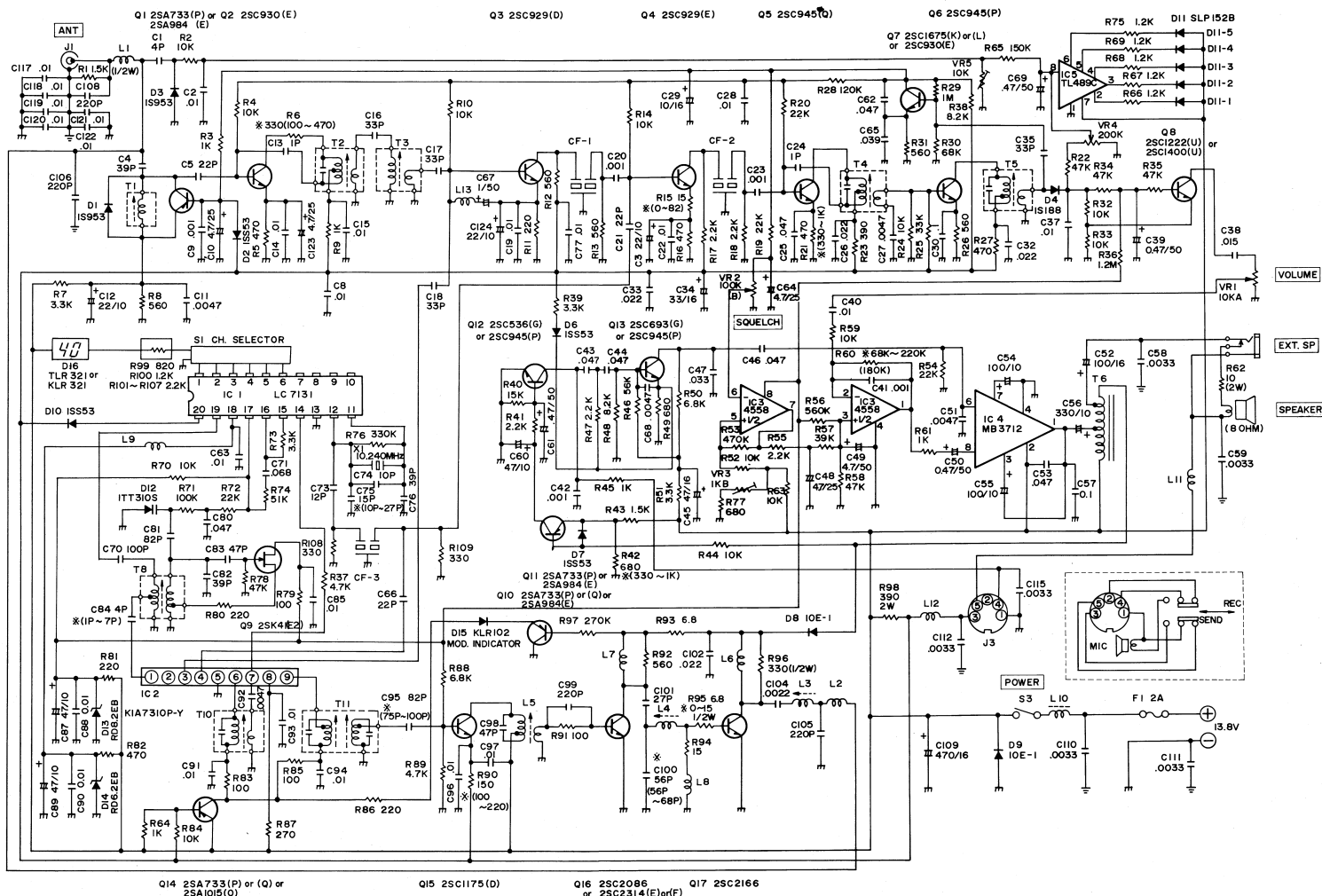








## 12. SCHEMATIC DIAGRAM



RADIO SHACK  A DIVISION OF TANDY CORPORATION

U.S.A.: FORT WORTH, TEXAS 76102  
CANADA: BARRIE, ONTARIO L4M 4W5

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**TANDY CORPORATION**

AUSTRALIA

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280-316 VICTORIA ROAD  
RYDALMERE, N.S.W. 2116

BELGIUM

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PARC INDUSTRIEL DE NANINNE  
5140 NANINNE

U. K.

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BILSTON ROAD, WEDNESBURY  
WEST MIDLANDS WS10 7JN