Typical Specifications

GENERAL

Operating Frequency Range ....26.965 to 27.405 MHz
Channel Coverage ....Ch. 1 to Ch. 40 incl.
Frequency Control ....Crystal-controlled phase-lock loop
Operating Temperature Range ....−30 to 50°C. (−22 to 112°F)
Power Requirements (Automotive-type electrical system):
Voltage .... 10-15 Vdc
Current (Typical Average)........ 0.7A (Rec); 1.2A (Xmtr)

TRANSMITTER SECTION

Emission Classification (FCC) 6A3
Power Output 4W
Maximum Modulation (FCC Limit) 100%
Harmonic & Spurious Suppression ....60 dB min.
Output Impedance (Antenna Load) ....50 Ohms

RECEIVER SECTION

Sensitivity (10 dB s/n) .... 0.7 µV
Adjacent Channel Rejection ....40 dB min.
Image Rejection (First IF frequency) ....60 dB min.
Spurious Rejection ....40 dB min.
Intermediate Frequencies .... 10.695 MHz; 455 kHz
Squelch Sensitivity (Adjustable) ....1.5 µV to 100 µV
Audio Power Output (Less than 10% THD) .... 3W min.

NOTE: The Model 14T275 meets all applicable requirements for Class D Citizens Band Radio under Part 95 of the Federal Communications Commission Rules and Regulations in effect as of the date of unit manufacture.

Important Notice

Under law, the transmitter portion of the transceiver described in this manual may be serviced by (or only under the direct supervision of) a technician having a First Class or a Second Class FCC Radiotelephone License.

Servicing includes internal adjustments or replacement of crystals, transistors and any other components which affect transmitter performance.

Description

GENERAL

The model 14T275 is a solid-state, precision-engineered CB transceiver for two-way radio communication on all 40 channels of the Class D Citizens Band. It uses a special, detachable, hand-held unit that contains all operating controls, a dynamic microphone and speaker.

The Model 14T275 operates in any vehicle equipped with an automotive-type 12-volt, positive- or negative-ground electrical system. There are three major assemblies: the mic./speaker/control unit, a switch box that doubles as a mic. bracket and the main chassis. A 6.5 foot (2m) cable (included) interconnects the switch box with the main chassis.

The chassis is packaged for mounting in a concealed location such as beneath the instrument panel on the cowl or under the front seat in automobiles, trucks, recreational vehicles and the like. Equipped with an optional extension cable (Model 14T818, 13 ft. or 3.9m length), the chassis unit can be mounted in the trunk or under the rear seat of most automobiles. The out-of-sight chassis mount and the easily concealed, detachable mic./speaker/control unit minimizes theft risk and allows installation in vehicles with insufficient space for an underdash CB set.

CAUTION: Closed car-trunk temperatures in some regions of the country exceed maximum operating temperatures for the chassis. In such cases, we recommend that the chassis be located beneath the front seat instead of in the trunk.

The transceiver uses electronic channel selection, digital channel indication and separate elements for microphone and speakers. A chassis-mounted speaker, activated with a switch on the mic. bracket, provides improved sound quality in some situations. The chassis includes a jack for connection of an external speaker.

CIRCUIT DESCRIPTION

Phase-Lock Loop Circuitry

The Model 14T275 uses a phase-lock loop (PLL) system of frequency synthesis to generate highly precise carrier and local-oscillator signals for the transmitter and receiver sections of the transceiver.

The PLL employs a free-running, voltage-controlled oscillator (VCO, part of IC-2, Location 5B in Fig. 1), a phase detector, a crystal-controlled reference oscillator (Loc. 8D in Fig. 1) and a programmable frequency divider IC1. (Loc. 2-6D Fig. 1)

The VCO operates at a frequency of 17.18 to 17.62 MHz, depending on channel selector setting, and produces two outputs: one at 37.66 to 38.1 MHz and another at 2.86 to 3.3 MHz. The crystal controlled reference oscillator (Loc. 8D in Fig. 1) operates at 10.24 MHz and feeds a bandpass filter/doubler (BPF/DBLR Loc. 7C in Fig. 1). The 20.48 MHz output of the BPF/DBLR beats with the 17.18-17.62 MHz VCO signal to produce a 37.66-38.1 MHz result. This signal feeds two loads: the receiver first mixer and the transmitter oscillator/mixer/buffer stage (IC3, Loc. 7B in Fig. 1). The second mixer output signal, at 2.86-3.3 MHz, feeds the programmable divider in IC1, (Loc. 3D in Fig. 1).

Simultaneously, the 10.24 MHz output of the reference oscillator through a buffer amplifier (Loc. 7D in Fig. 1) goes to the 1/1024 divider in IC1. This produces a highly precise 10 kHz signal for VCO control via the phase detector (Loc. 4D in Fig. 1). The programmable divider (Loc. 3D, Fig. 1) divides the 2.86 to 3.3 MHz signal in 10 kHz steps, according to the program developed in the channel selector circuit to arrive at a signal in the 10 kHz region, harmonically related to the VCO frequency.

The phase detector develops a d-c voltage in proportion to the phase difference between the two 10 kHz signals. This alters the frequency of the VCO until the divided down signal matches the divided down reference oscillator signal. Once the VCO arrives at the proper frequency, it locks to the reference oscillator. Thus, at Ch. 20, the VCO operates at 17.42 MHz (17.42 + 20.48 − 10.695 MHz) for a carrier frequency of 27.205 MHz. See chart of Fig. 2 for the VCO, carrier and receiver local oscillator frequency for all 40 channels.

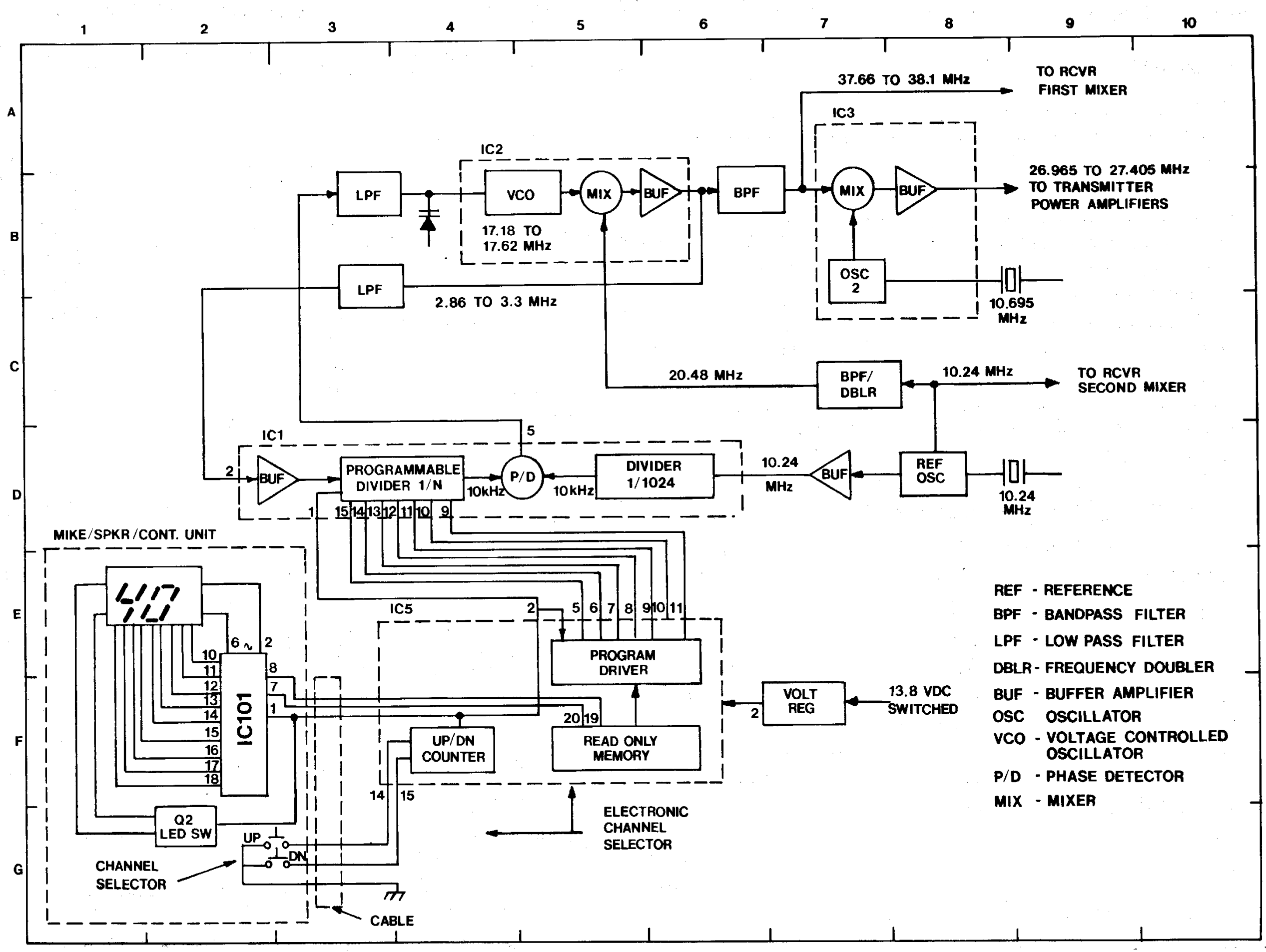


Figure 1. Block Diagram, Phase Locked Loop (PLL) and Electronic Channel Selector

ELECTRONIC CHANNEL SELECTOR

Since the operating controls are in the mic./speaker unit, the 14T275 uses a system of pushbutton electronic channel selection instead of the familiar rotary channel selection switch. Referring to Fig. 1, actual channel selection is the function of chip IC5 (Loc. 4 & 5E, Fig. 1). This chip includes three sub-functions: one, a read-only memory (ROM); two, a program driver, and three, an up/down counter. A driver for the LED channel number indicator is part of the hand-held control unit (IC101 in the control unit).

The ROM is programmed with the digital "N" codes (see chart of Fig. 2). When either the "UP" or "DN" pushbutton switches are closed, the UP/DN counter shifts operating channel at a one-per-second rate. If the pushbutton switch (either "UP" or "DOWN") is still closed after the one channel shift, the rate increases to about six channels per second. As the channel change takes place, the LED driver switches the sections of the display accordingly. When the pushbutton switch opens, the counter operation ceases. At this point, the proper "N" code goes to the programmable divider in IC1. The PLL then goes to work in adjusting VCO frequency to the needs of the system.

While a channel change takes place, both the receiver and the transmitter become inoperative. In the receiver, the bias in the 455 kHz IF amplifier (Q11, Q12) is lifted; removing the bias from the DC switch (Q22) renders the transmitter temporarily inoperative.

TRANSMITTER RF SYSTEM

Carrier frequency generation starts with a crystal controlled oscillator (in IC3, see Fig. 3) operating at 10.695 MHz. This signal, beat against the PLL generated 37 MHz signal in the mixer section of IC3, generates a 27 MHz carrier. This carrier signal goes through a buffer stage in the chip before going on to the first carrier amplifier (Q3) in the transmitter amplifier chain. This amplifier increases the power level slightly and isolates the modulated amplifiers that follow from the mixer stage. Through a shift in bias, this stage also serves as the on/off control of the transmitter. Transistors Q4 and Q5 are modulated amplifiers that raise carrier to the 4-watt output level. A low pass filter, in the output circuit attenuates out-of-band signals and matches antenna impedance to that of the final amplifier.

AUDIO AND MODULATOR SYSTEM

A preamplifier, built into the mic./speaker unit, raises the level of mike audio to offset the attenuation of the cable to the main chassis. In the main chassis, IC4 prepares the audio for modulating the collector power of the two modulated amplifiers in the RF chain (Q4 and Q5). An ALC circuit (Q14, 15) controls audio gain to prevent overmodulation.

RECEIVER SYSTEM

The receiver is a double conversion system with a grounded base RF amplifier and a two-stage 455 kHz IF amplifier. The first mixer (Q9) beats incoming RF against the 37 MHz signal generated in the PLL. This produces a 10.695 MHz result which feeds the second mixer (Q10). The second mixer beats the 10.695 MHz signal against that of the reference oscillator (Q1) operating at 10.24 MHz. This results in a 455 kHz intermediate frequency. Cascaded, grounded emitter amplifiers (Q11, Q12) amplify the 455 kHz signal for the detector circuit. A three-pole ceramic filter (CF1), in the input circuit of the first 455 Khz IF amplifier (Q11) achieves amplifier selectivity.

A 1N60 diode (D9), demodulates the IF signal. The resulting audio goes through the volume control to the audio amplifier chip (IC4) and then to either the speaker in the mike/speaker unit or the chassis-mounted speaker, as determined by the position of a slide switch in the mike connector box.

Audio amplifier squelch voltage is developed in the Q13 circuit. At low or no signal RF levels, Q13 conducts heavily which, in turn, blocks the audio amplifier (IC4). As incoming RF level increases, Q13 unsaturates and opens the audio amplifier. The adjustment of the squelch control determines the signal level required to open the audio amplifier.

The receiver includes no Noise Blanker, PA or Delta-Tune features.

CH. NO.	CHAN. FREQ. MHz	"N" CODE	VCO FREQ.	SELECTOR SWITCH OUTPUT							RECR. LOC. OSC.
				A	B	C	D	A	B	C	
1	26.965	330	17.18	0	1	0	1	0	0	1	37.66
2	26.975	329	17.19	1	0	0	1	0	0	1	37.67
3	26.985	328	17.20	0	0	0	1	0	0	1	37.68
4	27.005	326	17.22	0	1	1	0	0	0	1	37.70
5	27.015	325	17.23	1	0	1	0	0	0	1	37.71
6	27.025	324	17.24	0	0	1	0	0	0	1	37.72
7	27.035	323	17.25	1	1	0	0	0	0	1	37.73
8	27.055	321	17.27	1	0	0	0	0	0	1	37.75
9	27.065	320	17.28	0	0	0	0	0	0	1	37.76
10	27.075	319	17.29	1	1	1	1	1	1	0	37.77
11	27.085	318	17.30	0	1	1	1	1	1	0	37.78
12	27.105	316	17.32	0	0	1	1	1	1	0	37.80
13	27.115	315	17.33	1	1	0	1	1	1	0	37.81
14	27.125	314	17.34	0	1	0	1	1	1	0	37.82
15	27.135	313	17.35	1	0	0	1	1	1	0	37.83
16	27.155	311	17.37	1	1	1	0	1	1	0	37.85
17	27.165	310	17.38	0	1	1	0	1	1	0	37.86
18	27.175	309	17.39	1	0	1	0	1	1	0	37.87
19	27.185	308	17.40	0	0	1	0	1	1	0	37.88
20	27.205	306	17.42	0	1	0	0	1	1	0	37.90
21	27.215	305	17.43	1	0	0	0	1	1	0	37.91
22	27.225	304	17.44	0	0	0	0	1	1	0	37.92
23	27.255	301	17.47	1	0	1	1	0	1	0	37.95
24	27.235	303	17.45	1	1	1	1	0	1	0	37.93
25	27.245	302	17.46	0	1	1	1	0	1	0	37.94
26	27.265	300	17.48	0	0	1	1	0	1	0	37.96
27	27.275	299	17.49	1	1	0	1	0	1	0	37.97
28	27.285	298	17.50	0	1	0	1	0	1	0	37.98
29	27.295	297	17.51	1	0	0	1	0	1	0	37.99
30	27.305	296	17.52	0	0	0	1	0	1	0	38.00
31	27.315	295	17.53	1	1	1	0	0	1	0	38.01
32	27.325	294	17.54	0	1	1	0	0	1	0	38.02
33	27.335	293	17.55	1	0	1	0	0	1	0	38.03
34	27.345	292	17.56	0	0	1	0	0	1	0	38.04
35	27.355	291	17.57	1	1	0	0	0	1	0	38.05
36	27.365	290	17.58	0	1	0	0	0	1	0	38.06
37	27.375	289	17.59	1	0	0	0	0	1	0	38.07
38	27.385	288	17.60	0	0	0	0	0	1	0	38.08
39	27.395	287	17.61	1	1	1	1	1	0	0	38.09
40	27.405	286	17.62	0	1	1	1	1	0	0	38.10

Figure 2. Channel Number vs. Frequency, "N" Code, VCO and Receiver Local Oscillator Frequency

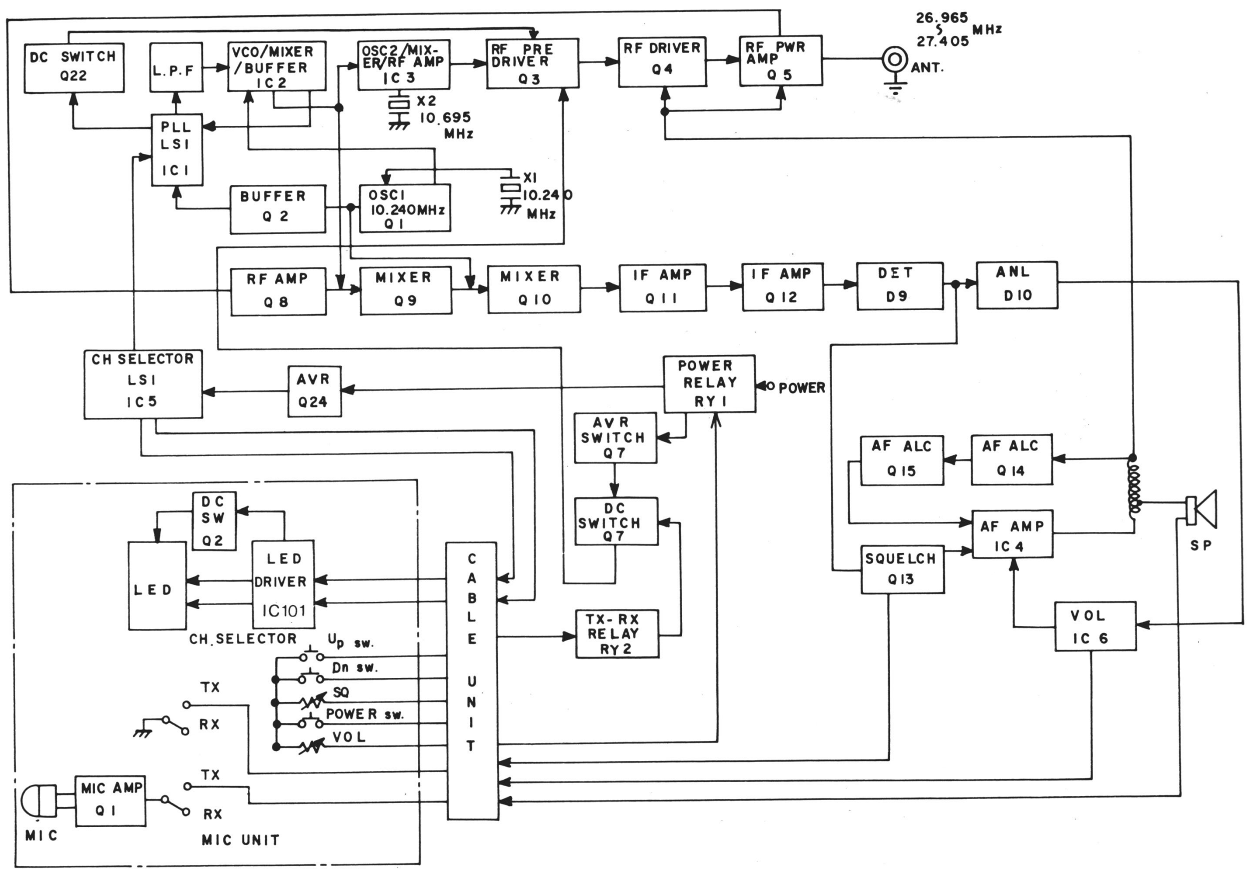
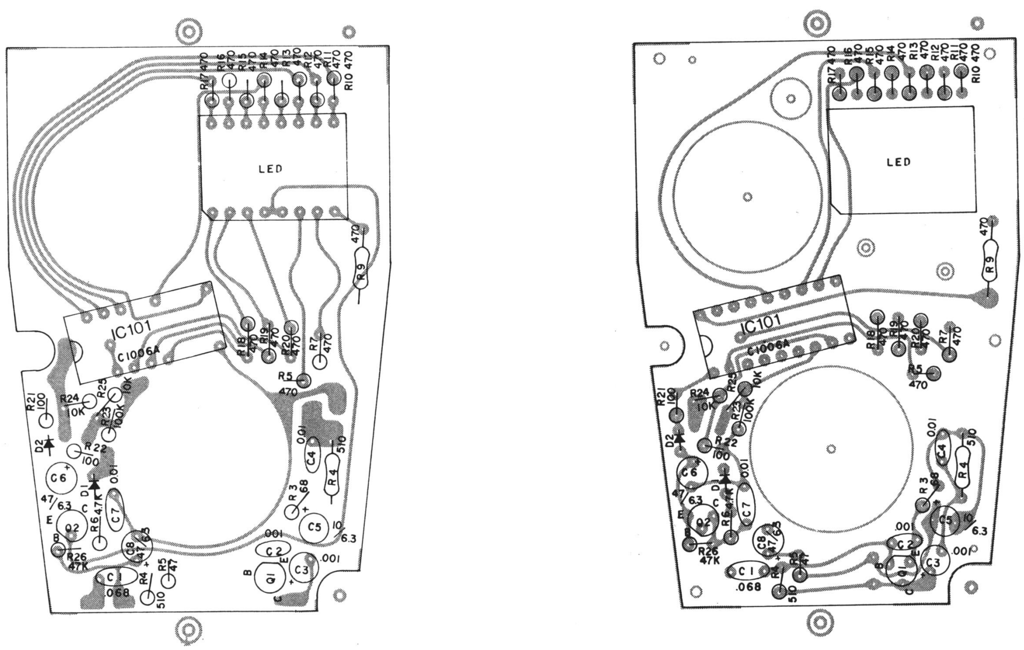


Figure 3. Overall Block Diagram, 14T275 CB Transceiver



VIEW OF WIRING AND COMPONENTS
ON COMPONENT SIDE OF BOARD

VIEW THROUGH BOARD
OF WIRING ON OPPOSITE SIDE OF COMPONENTS

Figure 4. Mic/Speaker/Control Board (Foil on Both Sides)

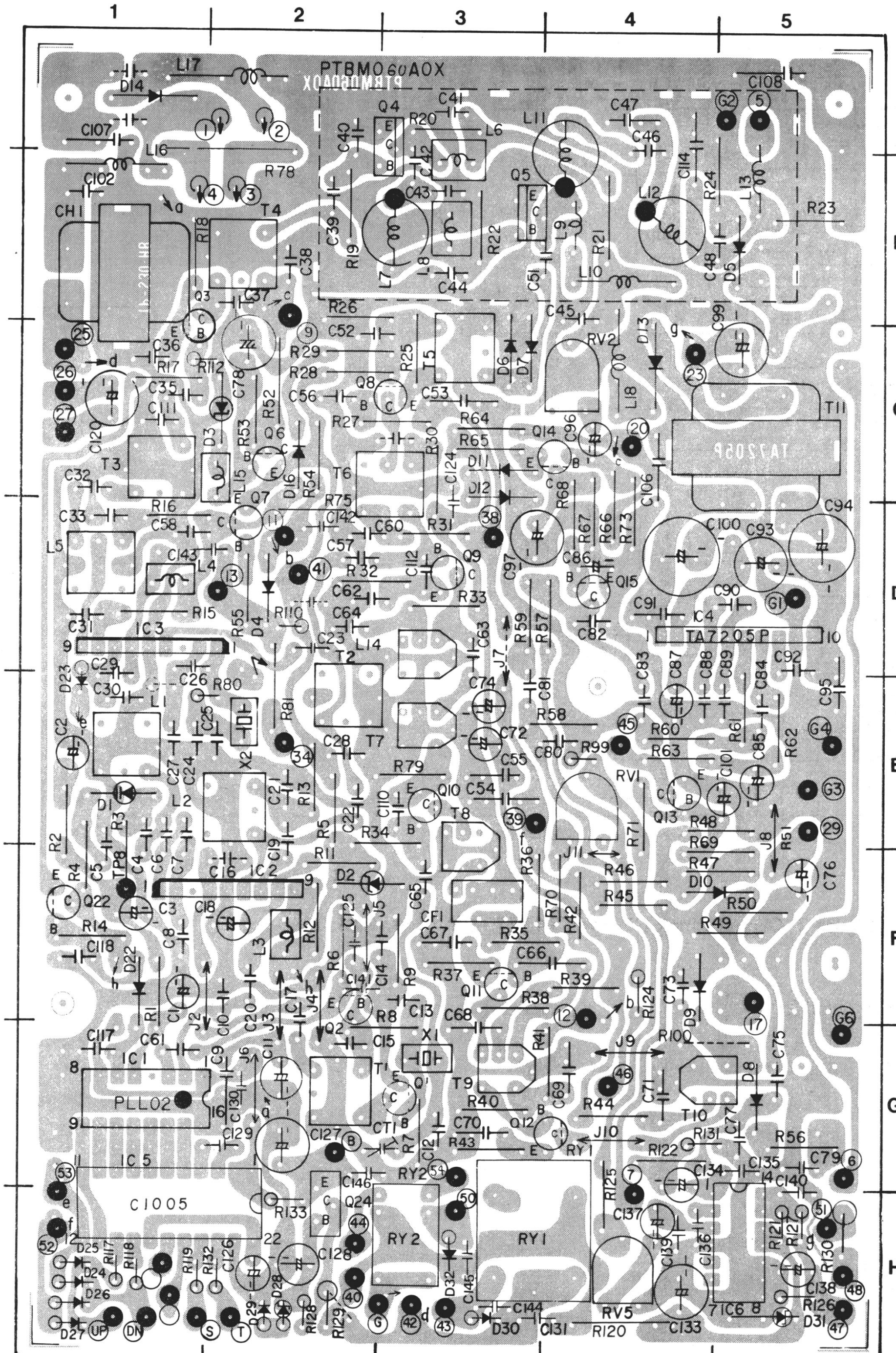


Figure 5. Main Board, Component Side

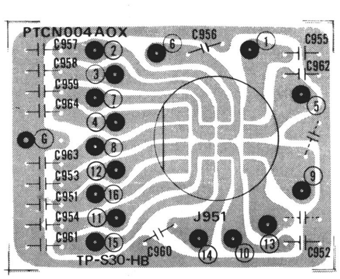


Figure 6. Connector Board, Component Side

MAIN BOARD COMPONENT LOCATIONS

C

C1	1F
C2	1E
C3	1F
C4	1F
C5	1F
C6	1F
C7	1F
C8	1F
C9	2G
C10	2F
C11	2G
C12	3G
C13	3F
C14	3F
C15	2G
C16	2F
C17	2F
C18	2F
C19	2F
C20	2F
C21	2E
C22	2E
C23	2D
C24	1E
C25	2E
C26	1E
C27	1E
C28	2E
C29	1E
C30	1E
C31	1D
C32	1C
C33	1D
C35	1C
C36	1C
C37	2B
C38	2B
C39	2B
C40	2A
C41	3A
C42	3B
C43	3B
C44	3B
C45	4B
C46	4A
C47	4A
C48	5B
C49	5B
C50	5B
C51	3B
C52	2C
C53	3C
C54	3E
C55	3E
C56	2C
C57	2D
C58	1D
C60	2D
C61	1G
C62	2D
C63	3D
C64	2D
C65	3F
C66	4F
C67	3F
C68	3G
C69	4G
C70	3G
C71	4G
C72	3E
C73	4F
C74	3E
C75	5G
C76	5F
C77	5G
C78	2C
C79	5G
C80	4E
C81	3E
C82	4D
C83	4E
C84	5E
C85	5E
C86	4E
C87	4E
C88	4E
C89	5E
C90	5D
C91	4D
C92	5D
C93	5D
C94	5D
C95	5E
C96	4C
C97	3D
C99	5C
C100	4D
C101	5E
C102	1B
C106	4C
C107	5A
C108	5A
C110	3E
C111	1C
C112	3D
C114	4B
C117	1G
C118	1F
C120	1C
C124	3C
C125	2F
C126	2H
C127	2G
C128	2H
C129	2G
C131	4H
C133	4H
C134	4G
C135	5G
C136	4H
C137	4H
C138	5H
C139	4H
C140	5G
C141	2F
C142	2D
C143	1D
C144	4H
C145	3H
C146	2G

R

R1	1F
R2	1E
R3	1E
R4	1F
R5	2E
R6	2F
R7	3G
R8	3G
R9	3F
R11	2F
R12	2F
R13	2E
R14	1F
R15	1D
R16	1D
R17	1C
R18	1B
R19	2B
R20	3A
R21	4B
R22	3B
R23	5B
R24	5B
R25	3C
R26	2B
R27	2C
R28	2C
R29	2C
R30	3C
R31	3D
R32	2D
R33	3D
R34	3E
R35	3F
R36	3F
R37	3F
R38	3F
R39	4F
R40	3G
R41	4G
R42	4F
R43	3G
R44	4G
R45	4F
R46	4F
R47	4F
R48	4E
R49	4F
R50	5F
R51	5E
R52	2C
R53	2C
R54	2C
R55	2D
R56	5G
R58	4E
R59	3D
R60	4E
R61	5E
R62	5E
R63	4E
R64	3C
R65	3C
R66	4D
R67	4D
R68	4C
R69	4E
R70	4F
R71	4E
R73	4D
R75	2D
R78	2B
R79	3E
R80	1E
R81	2E
R99	4E
R100	4G
R110	2D
R112	1C
R117	1H
R118	1H
R119	1H
R120	4H
R121	5H
R122	4G
R124	4F
R125	4G
R126	5H
R127	5H
R128	2H
R129	2H
R130	5H
R131	4G
R132	2H
R133	2H

D

D1	1E
D2	2F
D3	2C
D4	2D
D5	5B
D6	3C
D7	3C
D8	5G
D9	4F
D10	4F
D11	3C
D12	3C
D13	4C
D14	1A
D16	2C
D22	1F
D23	1E
D24	1H
D25	1H
D26	1H
D27	1H
D28	2H
D29	2H
D30	4H
D31	5H
D32	3H

T

T1	2G
T2	2D
T3	1C
T4	2B
T5	3C
T6	2C
T7	3E
T8	3E
T9	3G
T10	4G
T11	5C

Q

Q1	2G
Q2	2G
Q3	1C
Q4	3A
Q5	3B
Q6	2C
Q7	2D
Q8	2C
Q9	3D
Q10	3E
Q11	3F
Q12	4G
Q13	4E
Q14	4C
Q15	4D
Q22	1F
Q24	2H

IC

IC1	1G
IC2	2F
IC3	1D
IC4	5D
IC5	1G
IC6	5H

J

J1	5A
J2	1A
J3	1A

L

L1	1E
L2	1E
L3	2F
L4	1D
L5	1D
L6	3A
L7	3B
L8	3B
L9	4B
L10	4B
L11	4A
L12	4B
L13	5B
L14	2D
L15	2C
L16	1B
L17	1A
L18	4C

RV

RV1	4E
RV2	4C
RV3	5G
RV4	5B
RV5	4H

RY

RY1	4H
RY2	3H

X

X1	3G
X2	2E

CH

CH1	1B

CF

CF1	3F

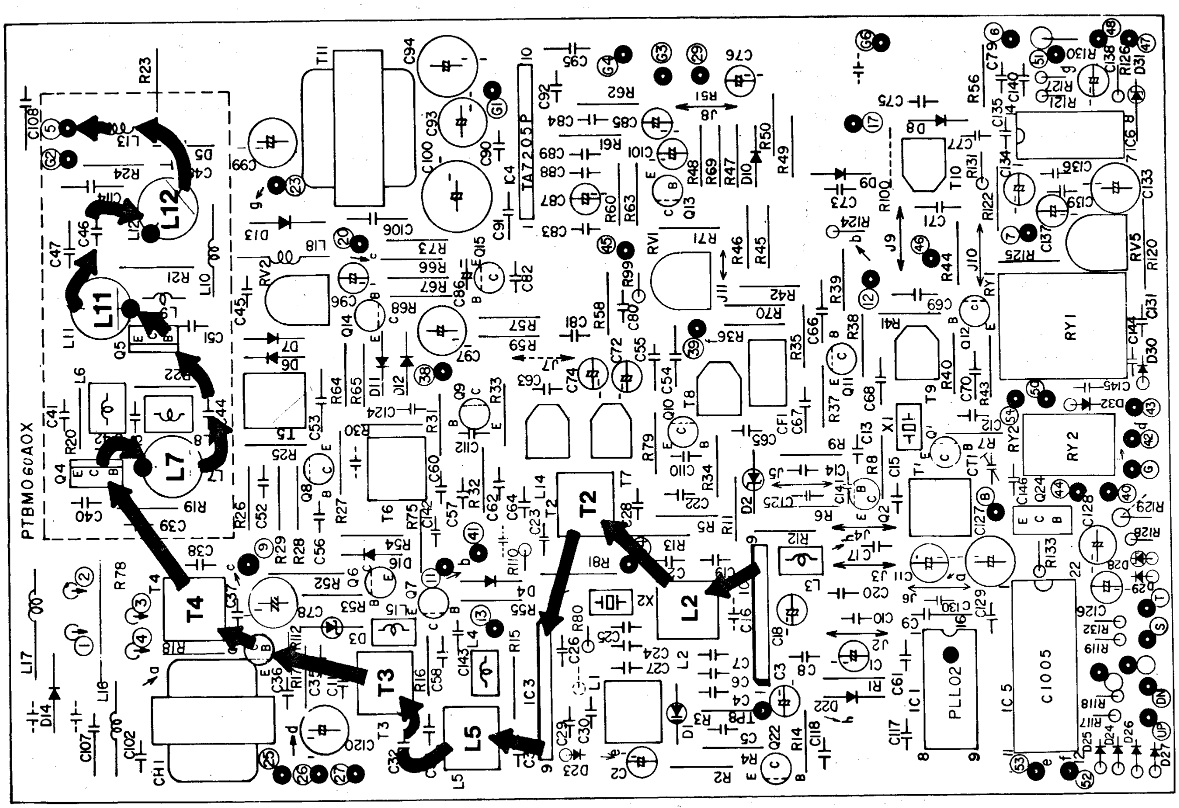


Figure 7. Transmitter Signal Path, Main Board

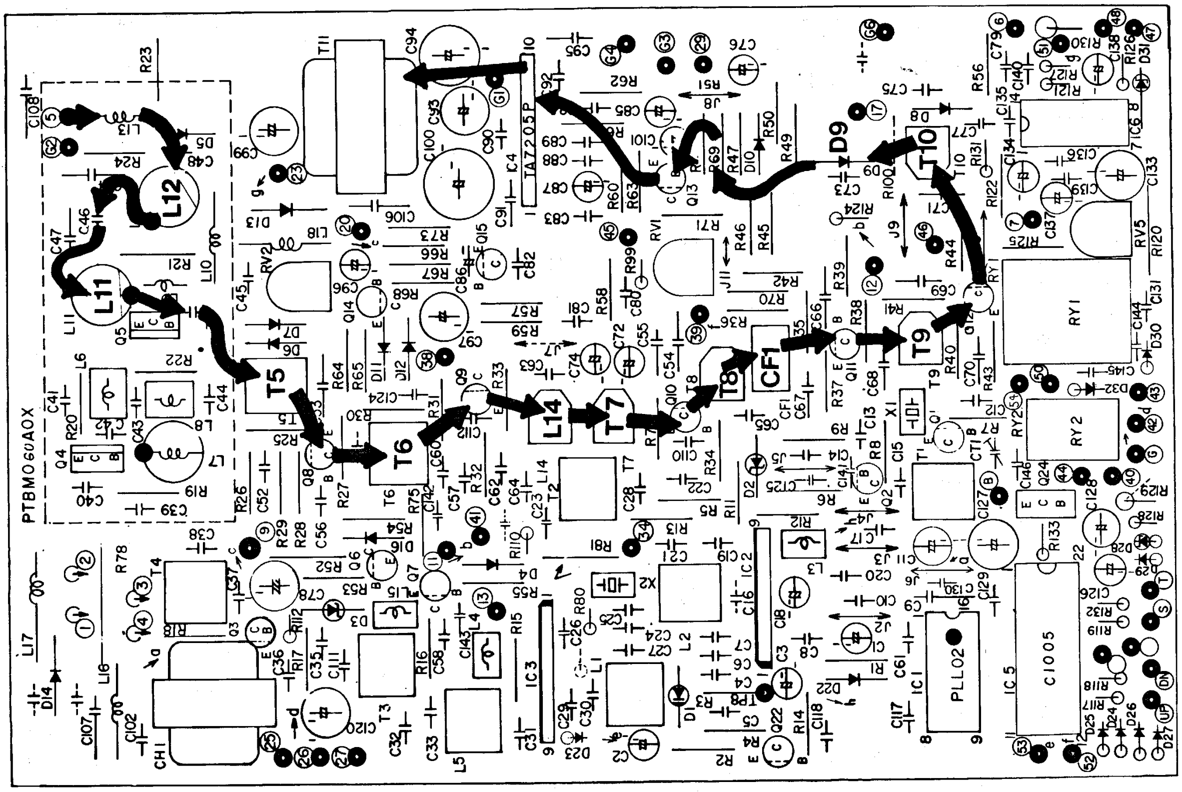
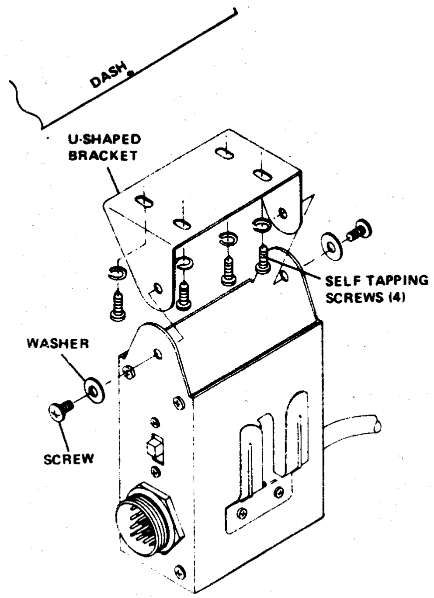
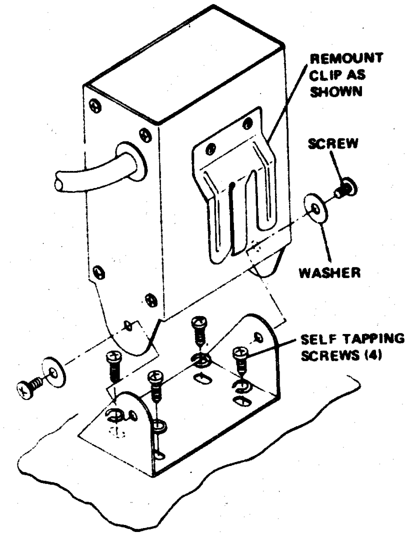


Figure 8. Receiver Signal Path, Main Board

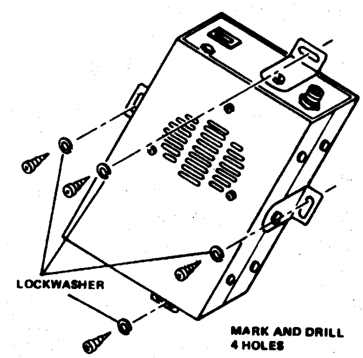
Installation



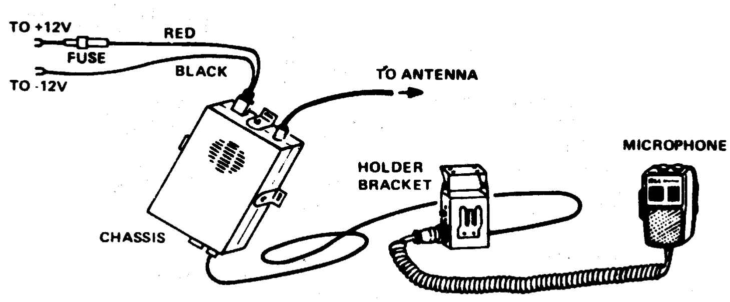
Installing Bracket Under Dash



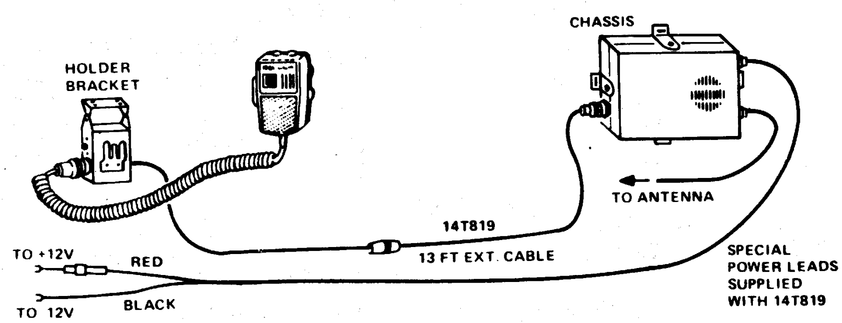
Installing Bracket On Console



Installing Chassis



Front Installation



Rear Installation

Figure 9. 14T275 Cable Interconnections

Service Notes

REPAIR OF UNIT

RCA Co-Pilot CB Transceivers are designed for high performance. This performance is strongly dependent on the high quality of the components used in fabrication. When you repair or otherwise service these transceivers, the way you perform the repair and the quality of the replacement part or parts you select has a definite bearing on transceiver performance. Consequently, you should use components of superior quality. The parts included in the lists printed at the rear of this manual are superior replacements.

RETUNING AND REALIGNMENT

The transceiver is carefully aligned during manufacture. Before readjusting the unit, visually recheck all external connections for looseness or broken wires. A check of operating voltages (see schematic and Fig. 11) often isolates a malfunction. If realignment is in order, use procedure starting on page 11.

CRYSTALS SOLDERED IN PLACE

Frequency crystals are *not* plug-in units. What appears to be a crystal socket is a thermal isolator; crystals are soldered into the circuit.

EQUIPMENT REMOVAL

When removing unit from vehicle, it is unnecessary to remove either the dash unit or the extension cable connecting a trunk mounted unit to the dash unit. The mic. connector connects directly to the chassis receptacle for operation out-of-car. However, this arrangement disables the speaker in the hand-held mic. unit. (The slide switch in the connector box controls the speakers).

Caution

Since the operating controls are in the hand-held mic./speaker unit, operation of the transceiver with the hand-held unit disconnected is impossible. As a result, a dummy mic. connector cannot be used. This presents a serious danger to test equipment used in troubleshooting receiver circuitry in that inadvertent keying of the transmitter could damage the test gear. *As a result, we recommend that you disable the push-to-talk switch while troubleshooting and/or aligning receiver circuits.* The easiest way is to remove, temporarily, the push-to-talk lever from the hand-held unit. See Fig. 21 (page 18) for assembly drawing of hand-held unit.

Recommended Test Equipment

1. *Antenna Dummy Load* – Power rating of at least 5 watts. Bird Model 8053 Coaxial Load Resistor or equivalent.
2. *RF Wattmeter* – Bird Model 43 "Thru-Line" Wattmeter with Bird Model 5A Element or equivalent.
3. *Frequency Counter* – Hewlett-Packard Model HP-5283A or equivalent (requires attennator for connection to antenna output).
4. *High-Frequency Signal Generator* – Hewlett-Packard Model HP-606B, Wavetek Model 3000 or equivalent with a frequency range of 50 kHz to 65 MHz and accurate to within 1 percent.
5. *Oscilloscope* – Suitable instrument with vertical axis response to 30 MHz or higher for monitoring modulation envelope.
6. *Electronic Voltmeter* – RCA Model WV-500B or equivalent with high input impedance.
7. *Speaker Dummy Load* – Five watt, 8-ohm resistive load.
8. *Audio Signal Generator* – Range 10 Hz to 20 kHz with output level calibration.
9. *RF Voltmeter* – High input impedance with response to 30 MHz or higher (RCA WV-500B above plus WG-301A RF Probe or equivalent).
10. *Power Supply* – Regulated, 0-20 Vdc, 2A current capability.
11. *Ammeter* – 2A full scale.
12. *Multimeter* – 20,000 ohms/volt or greater sensitivity.

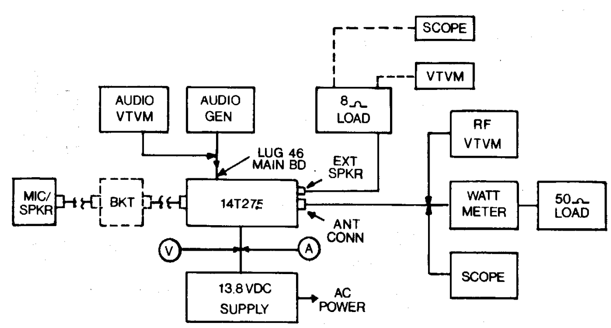


Figure 10. Test Equipment Relationships