Pace CB145 Service Manual

PRICE $ 2.50

SERVICE MANUAL

PACE CB 145

MOBILE TRANSCEIVER

PATHCOM INC.

PACE TWO-WAY RADIO PRODUCTS

24049 S. Frampton Ave., Harbor City, California 90710

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SECTION 1
GENERAL INFORMATION

1.1 GENERAL DESCRIPTION

This manual contains service and maintenance information for the PACE Model CB 145 Mobile Transceiver manufactured by PATHCOM INC. The Model CB 145 is a 23-channel, crystal controlled HF/AM transceiver. It is a fully solid-state device and may be operated from any standard 13.8 volt DC negative, or positive, ground source. Internal protection is provided to prevent damage in the event that reverse polarity is applied.

Some of the outstanding features of the PACE mobile transceiver are:

*"S"/RF Meter for indication of relative-receive signal strength and transmit power.

*Public Address facility with front panel control and separate speaker jack.

*Delta Tuning to clarify reception of off-frequency signals.

*Automatic Noise Limiter (ANL) circuit clips off "hiss" type noises.

*Noise Blanker blanks out high amplitude "machine gun" type noises.

*Double conversion receiver for optimum performance under all conditions.

1.2 SPECIFICATIONS

Technical specifications for the PACE Model CB 145 are shown in Table 1–1.

1.3 CRYSTAL INFORMATION

Frequency synthesized circuitry is used to obtain all 23 of the Class D Citizens Band channels. Crystal combinations to obtain synthesis are shown for the transmitter and receiver in Table 1–2. The frequency of each crystal is shown in Table 1–3.

1.3.1 WX Crystal Substitution

Crystals may be substituted to convert the weather monitor channels to Public Safety or Business channels in the 151 to 159 MHz range. The two channels selected should be separated by no more than 1 MHz for best results. When these crystals are replaced, the WX receiver section of the transceiver must be realigned. (Refer to Section 4.10.1.)

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When ordering crystals for this purpose, specify the crystal frequency desired and PACE Part Number P5254.

The crystal frequency is determined from the formula:

$$fo = \frac{fc - 10.7 \text{ MHz}}{3}$$

Where fc is the channel frequency and fo is the crystal frequency.

Table 1–1
Technical Specifications

GENERAL	
Number of Channels	23
Operating Voltage	12 V nominal DC, ± ground
Frequency Range	26.965 to 27.255 MHz CB plus 162.400 and 162.550 MHz for weather reception
Microphone	Dynamic, with plug-in connector
Speaker	2-½" oval dynamic, 8 ohms
Antenna Impedance	50 ohms
Size	7-½" X 2-¼" X 10"
Weight	10 lbs. (with accessories)
RECEIVER	
Sensitivity	CB 0.5 μV for 10 dB $\frac{s + n}{n}$
	VHF/WX 2 μV for 20 dB $\frac{s + n}{n}$
Selectivity	60 dB minimum at ± 10 kHz
Image Rejection (Major Image)	50 dB minimum
Squelch Sensitivity (Tight)	500 μV ± 6 dB
Audio Output	3 W
TRANSMITTER	
Compliance	Type Number 42218 Parts 15/95
Power Output	4 W (maximum legal power)
Modulation	85% minimum guaranteed sine wave (typically 95%)
Spurious Attenuation	50 dB minimum below level of carrier radiation

All specifications subject to change without notice.

Table 1–2
Frequency Synthesizing System

		RECEIVER			TRANSMITTER	
Channel Number	Channel Frequency	1st Local Osc Crystal	2nd Local Osc Crystal	2nd IF Frequency	Crystal Combination	Synthesized Frequency
1	26.965 MHz	Y5	Y1	455 kHz	Y5 – Y11	26.965 MHz
2	26.975 MHz	Y5	Y2	455 kHz	Y5 – Y12	26.975 MHz
3	26.985 MHz	Y5	Y3	455 kHz	Y5 – Y13	26.985 MHz
4	27.005 MHz	Y5	Y4	455 kHz	Y5 – Y14	27.005 MHz
5	27.015 MHz	Y6	Y1	455 kHz	Y6 – Y11	27.015 MHz
6	27.025 MHz	Y6	Y2	455 kHz	Y6 – Y12	27.025 MHz
7	27.035 MHz	Y6	Y3	455 kHz	Y6 – Y13	27.035 MHz
8	27.055 MHz	Y6	Y4	455 kHz	Y6 – Y14	27.055 MHz
9	27.065 MHz	Y7	Y1	455 kHz	Y7 – Y11	27.065 MHz
10	27.075 MHz	Y7	Y2	455 kHz	Y7 – Y12	27.075 MHz
11	27.085 MHz	Y7	Y3	455 kHz	Y7 – Y13	27.085 MHz
12	27.105 MHz	Y7	Y4	455 kHz	Y7 – Y14	27.105 MHz
13	27.115 MHz	Y8	Y1	455 kHz	Y8 – Y11	27.115 MHz
14	27.125 MHz	Y8	Y2	455 kHz	Y8 – Y12	27.125 MHz
15	27.135 MHz	Y8	Y3	455 kHz	Y8 – Y13	27.135 MHz
16	27.155 MHz	Y8	Y4	455 kHz	Y8 – Y14	27.155 MHz
17	27.165 MHz	Y9	Y1	455 kHz	Y9 – Y11	27.165 MHz
18	27.175 MHz	Y9	Y2	455 kHz	Y9 – Y12	27.175 MHz
19	27.185 MHz	Y9	Y3	455 kHz	Y9 – Y13	27.185 MHz
20	27.205 MHz	Y9	Y4	455 kHz	Y9 – Y14	27.205 MHz
21	27.215 MHz	Y10	Y1	455 kHz	Y10 – Y11	27.215 MHz
22	27.225 MHz	Y10	Y2	455 kHz	Y10 – Y12	27.225 MHz
23	27.255 MHz	Y10	Y4	455 kHz	Y10 – Y14	27.255 MHz

Table 1–3
Crystal Frequency Chart

Crystal Number	Osc Frequency	Channel in Which Used					
Y5	16.965 MHz	1	2	3	4		
Y6	17.015 MHz	5	6	7	8		
Y7	17.065 MHz	9	10	11	12		
Y8	17.115 MHz	13	14	15	16		
Y9	17.165 MHz	17	18	19	20		
Y10	17.215 MHz	21	22	23			
Y11	10.000 MHz	1	5	9	13	17	21
Y12	10.010 MHz	2	6	10	14	18	22
Y13	10.020 MHz	3	7	11	15	19	
Y14	10.040 MHz	4	8	12	16	20	23
Y1	9.545 MHz	1	5	9	13	17	21
Y2	9.555 MHz	2	6	10	14	18	22
Y3	9.565 MHz	3	7	11	15	19	
Y4	9.585 MHz	4	8	12	16	20	23

1.4 OTHER PERTINENT INFORMATION

The Model CB 145 has been certified for Type Acceptance under FCC Part 95. It also meets Canadian DOC type approved regulations RSS136, and EIA Standards for AM 27 MHz transceivers.

SECTION II
PRINCIPLES OF OPERATION

2.1 GENERAL

This section provides a general description of the Model CB 145 Mobile Transceiver circuitry. Refer to the schematic in Section V.

2.2 TRANSMITTER DESCRIPTION

The transmitter is comprised of two basic sections: (a) the low level frequency generation section (synthesizer) and (b) the Driver, Intermediate Power Amplifier (I.P.A.), and Power Amplifier (P.A.).

The synthesizer comprises two oscillators, Q16 and Q18. Oscillator Q18 operates at approximately 10.0 MHz and Q16 at 17.0 MHz. The sum of the two oscillators is obtained from mixer CR103 and passed through a bandpass-filter/amplifier L107, T103, Q12, and T102. The output (at T102) is coupled to driver Q13. Driver Q13 operates Class AB so that a small forward bias exists with no signal and increases with drive power. The I.P.A. (Q14) and P.A. (Q15) are operated Class C, the more drive applied, the more reverse biased their base-emitters become. There is no current flow in Q14 or Q15 without power applied. The transmitter output network is a three-section pi filter for maximum efficiency and harmonic rejection.

2.3 RECEIVER DESCRIPTION

The receiver is a double conversion superheterodyne. Two crystal controlled oscillators are used, and both are changed in frequency steps to obtain 23-channel operation. The first mixer (Q2) uses low side injection obtained from oscillator Q16 (this oscillator works during both receive and transmit operation). The first IF signal is amplified in Q28 and coupled to second mixer (CR204). Mixer diode CR204 obtains injection from oscillator Q17. Output from CR204 is at 455 kHz and passes through the filter circuit comprised of T206 and ceramic filter LF-201. This signal is amplified in two 2nd-IF stages, Q3 and Q4.

The output from IF amplifier Q4 is coupled from T209 through C226 to AM detector diodes CR206 and CR207. Automatic noise limiting is accomplished by diode CR208 and associated circuitry when the noise blanking switch is in its ON position. After detection, the audio signal is coupled through C232 to the volume control.

2.3.1 Audio Amplifier

The audio amplifier uses AC coupling with a common emitter push-pull output stage. The audio from the collector of pre-driver Q8 is coupled to driver Q9 via C302. R-C combinations in the emitters of Q8 and Q9 boost low frequencies to compensate for losses (at these frequencies) in the transformers.

Transformer coupling is used at the input and output of the push-pull stage. R310, R311, and R302 provide sufficient bias for Q10 and Q11 to prevent crossover distortion. The upper winding in the secondary of T8 couples the audio signal to the speaker (or jacks) during receiver operation. The lower winding couples audio (for modulation) to Q14 and Q15 during transmitter operation.

2.3.2 Squelch

Squelch sensing voltage is coupled from the secondary of T209 to squelch detector CR212 via C228. The detected DC voltage is fed to the base of Q5 which acts as a differential amplifier with Q6.

When there is no incoming RF signal present, Q5 is cut off and Q6 conducts. This puts a positive voltage on the base of Q7 forcing it into saturation. As a result, a positive voltage is placed on the emitter of pre-driver Q8, cutting it off. Thus, no signal is permitted to pass through to the speaker.

Conversely, when an RF signal is present, Q7 is cut off and the audio amplifier operates in a normal manner.

2.3.3 Automatic Gain Control (AGC)

When the received signal level is increased, the signal output voltage (from the secondary of T209) is coupled through C227 to rectifier diodes CR210 and CR211. The resulting negative going voltage is applied through the AGC line, thereby decreasing the receiver gain.

2.3.4 Noise Blanker

The 1st-IF signal (from point A of T204) is coupled to IC201 via L205, C258, C247, T210, and C249. Tuned circuit, L205 and C258, is peaked at 9.0 MHz while T210 acts as a 10 MHz trap. This is done to ensure that only noise pulses pass through the circuit and IF signals are rejected.

Whenever large noise spikes are present in the signal they are amplified in IC201 and Q26. These noise pulses are then rectified by diodes CR216 and CR217. Negative pulses are bypassed by CR218, and only the positive pulses are applied to the gate of Q27. With these positive pulses at the gate, current flows through R250, lowering the drain potential (towards ground). This reverse biases CR219 and receiver IF signals, from the collector of 1st-IF amplifier Q28, are blocked from passing onto diode mixer CR204.

When no noise spikes are present in the signal, CR218 is forward biased and the signal passes through in a normal manner.

2.3.5 RF Gain Control

This is a front panel potentiometer which applies a variable bias to RF amplifier Q1 and 1st-IF amplifier Q28. Thus, the gain of the receiver can be adjusted on weak signals.

It should be noted that the same potential is applied to point (F) in the noise blanking circuit. Thus, the cut-off point of CR219 is adjusted. At higher settings of this control, the cut-off point is increased and some of the noise pulses will be heard in the speaker.

2.4 OSCILLATOR DESCRIPTION

Three separate oscillators are used with a total of 14 crystals. The crystals are combined in a synthesis circuit to obtain all 23 CB channels. Two additional crystals are used for the marine weather channels and are discussed in Section 2.7.2.

Oscillator Q16 is a crystal-controlled modified Colpitts oscillator. Six crystals coupled to the base of this transistor are in the frequency range of 16.965 to 17.215 MHz. A different crystal is selected for each channel as shown in Table 2–1. This oscillator is active in both the transmit and receive modes of operation. The output, taken from the emitter, is coupled to the base of receiver first mixer Q2 via C208 and to the anode of transmitter mixer CR103 via C129.

Oscillator Q17 is a crystal-controlled modified Colpitts oscillator. Four crystals, coupled to the base of this transistor, are in the frequency range of 9.545 to 9.585 MHz. A different crystal is selected for each channel as shown in Table 2–1. The output is taken from the emitter of Q17 and coupled to receiver second mixer CR204. This frequency is then mixed with the output from the 1st-IF amplifier (Q28) to obtain the 455 kHz IF. Q17 is activated in the receive mode only.

Oscillator Q18 is a crystal-controlled modified Colpitts oscillator. Four crystals, coupled to the base of this transistor, are in the frequency range of 10.000 to 10.040 MHz. A different crystal is selected for each channel as shown in Table 2–1. This oscillator is only active in the transmit mode. The output taken from the emitter of Q18 is coupled via C213 to the cathode of mixer diode CR103 where it is mixed with the frequency from Q16.

2.5 TRANSMIT-RECEIVE SWITCHING SYSTEM

The transmit-receive switching system is relay controlled using only one set of contacts. These contacts are energized when the Push-To-Talk (P-T-T) switch is depressed. B+ is continuously applied to the intermediate and power amplifier circuits in the transmitter and to master oscillator Q16. It is also applied to the audio power amplifier so that it may be used in the P.A. mode.

When the P-T-T switch is in the normal (receive) position, the antenna is connected to the receiver RF amplifier via the 10 MHz trap (T201-C201) and C202. At the same time, +9 V is supplied to all other receiver circuits including the second local oscillator, Q17.

Although the antenna is electrically connected to the transmitter output, no current will flow from the output stages since they operate Class C. It is also connected to the VHF weather RF amplifier, which remains inactive when the WX/CB switch is in the CB position. Thus, the CB receiver is operating in a normal manner.

When the P-T-T switch is depressed (PA/CB switch in CB position), the relay is activated and the contact shunts the 9 V zener diode to ground, removing its supply from the receiver circuits. The 9 V potential is also removed from the cathode of CR201 (in the receiver input circuit) forcing it into conduction. This effectively disconnects the antenna from the receiver circuit, since any input signals are shunted to ground through CR201.

At the same time, +12 V is applied to oscillator Q18, pre-driver Q12 and driver Q13. In addition, ground is removed from the upper winding of the audio output transformer, effectively disconnecting the internal speaker.

Now, with drive applied to Q13, audio applied through the lower winding of T302 modulates the RF transmitter.

With the PA/CB switch in the PA position and the P-T-T switch depressed, the +12 V is not applied to Q18, Q12, and Q13. The upper winding of audio output transformer T302 is placed directly across the PA speaker jack which is not dependent on grounding of the secondary winding.

2.6 METER CIRCUITRY

The S/RF Meter provides relative indications of both incoming signal strength and transmitted power.

In receive mode, IF signals from the secondary of T209 are detected by CR205 and filtered by C229. This positive DC voltage is then fed to the meter via limiting potentiometer VR201.

In transmit mode, power output signals are coupled through C103 to CR101 where it is rectified and filtered by C104. This positive DC voltage is then fed to the meter via limiting potentiometer VR101.

2.7 WEATHER FORECAST CIRCUITRY

2.7.1 General Description

The CB 145 is capable of receiving two marine FM weather forecasting channels, WX1 and WX2. These channels operate on frequencies of 162.55 and 162.4 MHz, respectively. To accomplish this, separate circuitry is used for RF amplifier, oscillator, first mixer, 1st-IF amplifier, and second mixer. The 2nd-IF FM signal (10.7 MHz) is then slope detected in T209.

For weather reception, the PA/CB switch must be set to the CB position, and the CB/weather switch set to either WX1 or WX2 position. In either weather position, +9 V is removed from Q1, Q2, and Q17, and the noise blanker in the CB receiver circuitry; and applied to Q24, Q25, Q19, Q22, Q21, and Q20 in the FM receiver circuitry. All other circuits operate normally as described in previous sections.

2.7.2 FM First Oscillator and Tripler Circuits

This oscillator is comprised of transistor Q25 and associated circuitry. It is a crystal-controlled modified Colpitts oscillator. Two crystals are coupled to the base of Q25 via diodes CR401 and CR402. When switched to WX1 position, plus voltage is applied to the anode of CR401. CR401 becomes forward biased, and connects Y13 to the base. CR402, meanwhile, is reverse biased so that Y14 is effectively disconnected. When switched to the WX2 position, the converse is true. Both crystals are third overtone and their frequencies are determined by:

$$fo = \frac{fc - 10.7 \text{ MHz}}{3}$$

Where fo is the crystal frequency and fc is the channel frequency.

The oscillator output is coupled to the base of Q19 where its third harmonic is selected. This multiplied frequency is coupled to the base of FM first mixer Q21 via C414.

2.7.3 RF Amplifier, First Mixer, and First-IF Amplifier

RF signals, from the antenna, are coupled to the FM RF amplifier via C434, T405, and T404. The antenna is effectively disconnected from AM RF amplifier Q1 since this transistor is inoperative. It is also effectively disconnected from the transmitter output as described in Section 2.5. The amplified signal is coupled to the base of first mixer Q21 via T403 where it is mixed with the signal from Q19 to produce a 10.7 MHz signal. The 10.7 MHz signal amplified in Q22 and then coupled to diode mixer CR404.

2.7.4 FM Second Oscillator and Mixer

The second oscillator is comprised of transistor Q24 and associated circuitry. This is a modified Colpitts crystal oscillator with a voltage variable diode in the base. The crystal frequency is 10.245 MHz, but the oscillator frequency can be shifted ±5 kHz by adjusting the Delta Tune potentiometer VR206. This is done to permit slope detection.

Output from the emitter of Q24 is coupled to diode mixer CR404 via C414. This produces a second IF frequency of 455 kHz which is coupled through T206 and C260 to the ceramic filter and on through the second IF to the detector as described in Section 2.3.

2.7.5 RF Gain Control

In either WX1 or WX2 position, this front panel control applies a variable bias to the bases of RF amplifier Q20 and 1st-IF amplifier Q22. The gain of the FM receiver can be controlled in this manner.

NOTES

SECTION III
MAINTENANCE PROCEDURES

3.1 GENERAL

This section contains maintenance instructions for the PACE Model CB 145 Mobile Transceiver. The procedures given in this section assume a general knowledge of AM type communications receivers and a familiarization with transistors and integrated circuits.

It is recommended that maintenance adjustments and repairs be performed only by experienced personnel familiar with the equipment. In some cases, minor changes in voltage levels may be corrected by adjusting potentiometers located in the affected circuits. Standard practices in the electronic industry should be observed in checking and/or replacing system components.

3.1.1 Parts Identification

For printed circuit (PC) board component location, refer to illustrations and schematics in Section V.

3.2 PREVENTIVE MAINTENANCE

The receiver requires minimal maintenance due to the nonmechanical nature of the equipment. However, a preventive maintenance program consisting of electrical checks is recommended as an aid in obtaining maximum operating efficiency from the system.

3.3 CORRECTIVE MAINTENANCE

Corrective maintenance operations entail receiver checks and adjustments which are not part of preventive maintenance procedures. Operational malfunctions which require corrective maintenance may usually be corrected by an adjustment or PC board replacement. If necessary to make repairs at the component level, such repairs should be made by maintenance technicians who are familiar with the equipment and electronic repair techniques. Refer to Section IV for alignment and adjustment procedures.

3.4 TROUBLESHOOTING

It is recommended that a functional analysis approach be used to locate the cause of the receiver malfunction. Troubleshooting can be simplified by reference to the schematic diagrams in Section V.

Standard troubleshooting procedures, such as signal injection and signal tracing, should be used in locating faulty circuits. Once the trouble has been isolated to a particular circuit, the defective component can be localized by voltage and resistance measurements. Refer to voltage charts in Table 3–1.

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Table 3–1
DC Voltage Chart

Transistor and Function			DC Voltage in Volts		
			E	B	C
RECEIVER					
Q1	RF Amplifier		0.6	1.1	8.7
Q2	First Mixer		0.5	1.0	7.5
Q28	First-IF Amplifier (10 MHz)		0.6	1.1	8.5
Q3	Second-IF Amplifier (455 kHz)		0.6	1.1	8.0
Q4	Second-IF Amplifier (455 kHz)		0.7	1.2	8.0
Q5	Squelch Amplifier	SQ	1.0	1.5	9.0
		UNSQ	0.1	0.4	9.0
Q6	Squelch Amplifier	SQ	1.0	1.1	4.5
		UNSQ	0.1	0.9	0.1
Q7	Squelch Switch	SQ	6.5	3.5	9.0
		UNSQ	2.0	0.1	9.0
Q8	AF Amplifier	SQ	6.5	2.0	12.5
		UNSQ	2.0	2.0	7.0
Q9	AF Driver		1.0	1.6	11.0
Q10, Q11	AF Power Amplifier		0.1	0.8	13.5
TRANSMITTER					
Q12	RF Amplifier		0.1	0.7	2.5
Q13	RF Pre-Driver		0.6	1.1	10.5
Q14	RF Driver		0	0	13.0
Q15	RF Power Final		0	0	13.0
SYNTHESIZER					
Q16	17 MHz Synthesizer Oscillator		3.0	4.6	12.0
Q17	9 MHz Synthesizer Oscillator (RX)		3.8	4.0	8.5
Q18	10 MHz Synthesizer Oscillator (TX)		2.2	3.5	9.5
WEATHER FORECAST					
Q19	Frequency Multiplier		2.0	2.5	8.5
Q20	RF Amplifier		0.6	1.1	9.0
Q21	FM First Mixer		0.9	1.2	9.0
Q22	FM First-IF Amplifier		0.6	1.0	8.5
Q24	FM Second Oscillator		2.4	2.9	8.5
Q25	FM First Oscillator		1.2	1.9	8.5
Q23	RX Lamp Switch	RX	0	0.7	1.9
		TX	0	0	13.0
Q29	Mic Switch	RX	13.8	13.8	0
		TX	13.8	6.0	13.0

Table 3–1
(continued)

NOISE BLANKER							
Q26	Noise Amplifier	0		0		7.5	
		S		G		D	
Q27	Noise Blanker Switch	0		0		9.0	
		Pin					
		1	3	4	5	7	8
IC201	Noise Amplifier	8.5	1.2	0	1.3	8.5	8.5

Before proceeding with the troubleshooting procedures, the entire installation should be checked for defective antenna connections and loose or broken supply cables and plugs.

Voltages were measured with an ohmmeter having a 20,000 ohm/volt sensitivity, with 13.8 volts ± 5% DC input. Measurements were made in CB receive mode unless otherwise indicated. All voltages are positive unless otherwise indicated, and have a tolerance of ± 20%.

3.5 MODULATION CHECK

There are three satisfactory methods of checking modulation:

1. A high frequency (30 MHz) oscilloscope, which can be directly coupled by a small capacitor to the antenna jack.

2. A low frequency scope with provisions for direct connection to the deflection plates. A twisted pair, with a 1-1/2 turn link on the end, should be used for coupling. Connect the open end to the deflection plates and then orient the link near the power amplifier coils in the transceiver to obtain a deflection on the screen.

3. A linear detector and a DC oscilloscope would probably be the easiest method to use, and the most accurate, unless a high frequency oscilloscope is available. A suitable detector is shown in Figure 3–1A.

Inexpensive modulation indicators of the meter type have been found to be of irregular accuracy and of no value in checking for parasitics, etc., and, therefore, should not be relied upon.

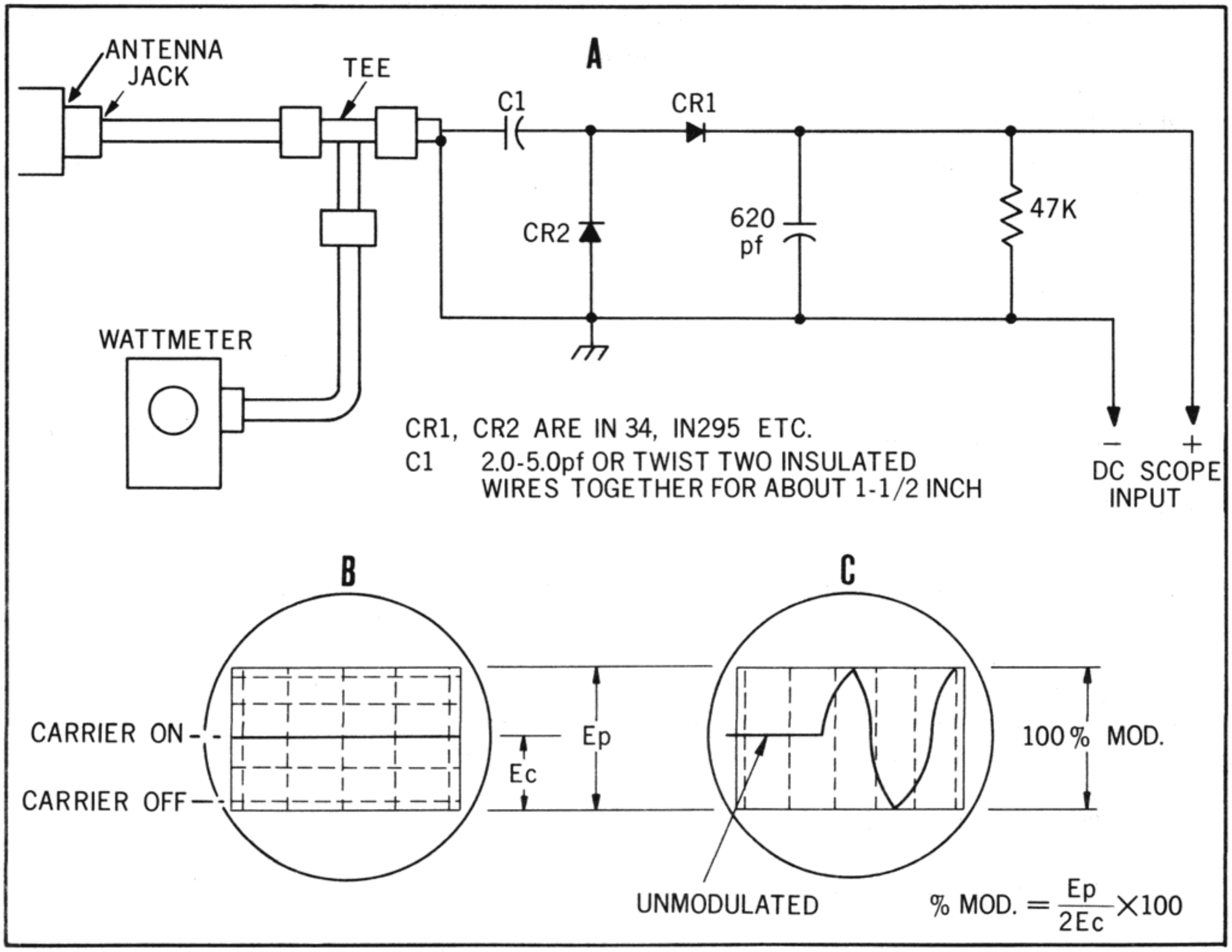

Figure 3-1 Modulation Detector

If a high frequency scope is used, connect the probe to the antenna jack directly through a 20–50 pF capacitor. While transmitting a carrier only, adjust the gain to produce a pattern on the scope of about one-half the usable screen area.

Apply modulation and observe the maximum height of the modulated waveform. For 100% modulation, EP = 2 EM, etc. It is more important that the peak (positive) going portion be analyzed since the "trough" or negative going portion will always perform correctly when the peaks are present.

If a low frequency scope using a direct connection to the plates is employed, the same adjustment procedures apply.

To use the DC scope and detector of Figure 3–1A, adjust the position control with the carrier off to place the trace on a reference line near the bottom of the scope face. See Figure 3–1B. Then feed the unmodulated carrier to the detector and adjust the gain to place the trace in the center of the scope face. It may be necessary to switch the transmitter off and on several times to adjust the trace properly, since on most scopes the position and gain controls will interact.

A 100% modulated transmitter will produce a peak-to-peak envelope equal to twice the shift between the carrier and no carrier traces. See Figure 3-2. When checking modulation, do not over-drive. Whistle into the microphone with increasing loudness so that maximum modulation is reached without clipping.

Talking into the microphone in a normal manner should produce continuous peaks of 80-95% modulation.

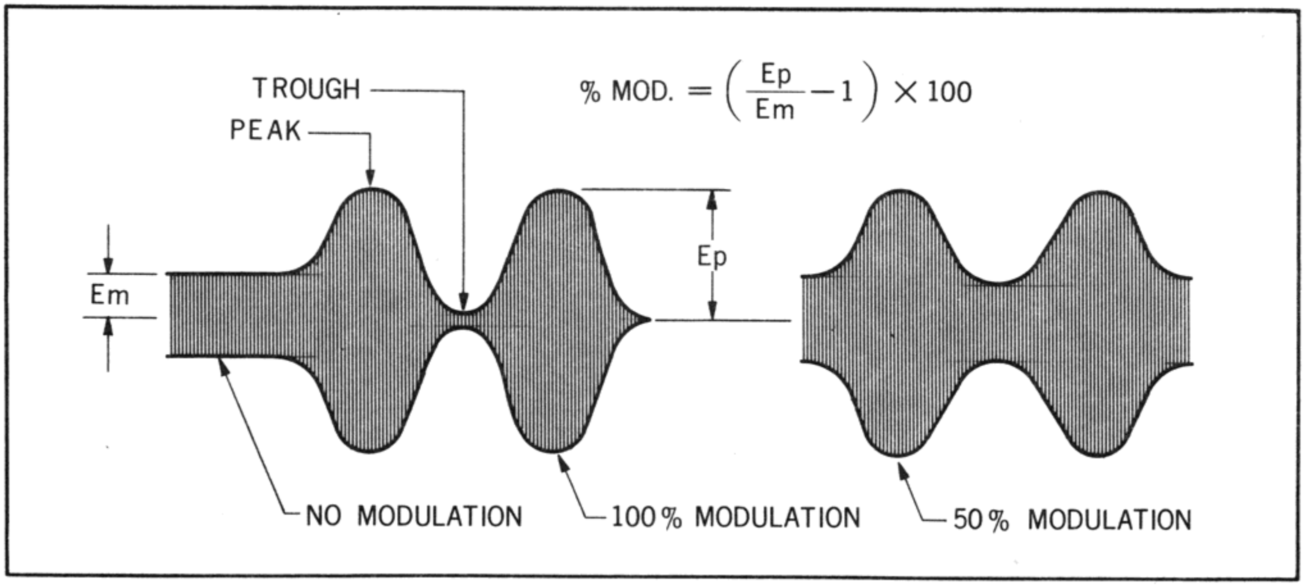

Figure 3-2. Direct Modulation Monitor

NOTES

SECTION IV
ADJUSTMENT AND ALIGNMENT

4.1 GENERAL

The PACE CB 145 Transceiver is factory aligned to provide optimum performance. It will not normally require realignment unless major components have been replaced or if the receiver sensitivity has dropped below the specified 0.5 microvolts for 10 dB S/N or if there is a malfunction of the transmitter.

NOTE

Transmitter tuning adjustments must be made by a technician holding an appropriate FCC license and the results entered in the station radio log.

It is recommended that the transceiver be returned to the factory for realignment. However, correct alignment procedures are given in the following paragraphs where this is not feasible.

4.2 TEST EQUIPMENT

The CB 145 Transceiver alignment should not be undertaken unless precision equipment is available. A list of recommended test equipment and tools are as follows:

1. Power Source of 13.8 V DC: capable of 3 amperes regulated.
2. RF Signal Generator: capable of 455 kHz, 10 MHz, 27 MHz CB frequencies and 162 MHz band.
3. Wattmeter: 50 ohm 10 W (*Bird,* Model 43 or equivalent).
4. Audio Generator.
5. Vacuum Tube Voltmeter: 1 mV to 50 V AC (*Hewlett-Packard,* Model 410B or equivalent).
6. Frequency Counter: DC to 30 MHz (*Hewlett-Packard,* Model 4245L or equivalent).
7. Oscilloscope: 30 MHz (*Tektronix,* Model 545B or equivalent).
8. DC Voltmeter: 0.25 V to 25 V, 20 k ohm/V.
9. RF Millivoltmeter: 3 mV to 3000 mV (*Boonton,* Model 92C or equivalent).
10. Spectrum Analyzer.

4.3 PRELIMINARY SETUP

1. Set the front panel controls as follows:

Control	Setting
Volume ON/OFF	Maximum CCW (Power Off)
Squelch	Maximum CCW
RF Gain	Maximum CW
Delta Tune	Center Position
CB/WX Switch	CB Position
CB/PA Switch	CB Position
NB ON/OFF Switch	OFF Position

2. Connect a regulated DC voltage source of 13.8 volts to the DC power cord (plus to red wire).
3. Connect a 50-ohm dummy load to the antenna jack.
4. Connect a wattmeter across the dummy load.

4.4 TRANSMITTER ADJUSTMENT (See Figure 4–1 for adjustment locations)

1. Set the channel selector switch to Channel 13.
2. Confirm that a dummy load of 50 ohms is connected to the antenna connector of the set.
3. Turn the power switch on, and key the transmitter. The TX lamp should light up.
4. Adjust T104 and T103 for maximum RF output indication on the wattmeter. Then adjust T102, T101, and L105 for maximum output and confirm that no parasitic oscillation is observed when decreasing the DC input voltage to 11.5 volts.
5. Return the DC input to 13.8 volts and adjust L103 and L102 for maximum power output. If the power exceeds 4 watts, turn the slug of L102 counterclockwise slightly to decrease the output to 4 watts.
6. Check the frequency of each channel with the frequency counter connected to the 50-ohm dummy load through an appropriate attenuator. The frequency of each channel should be within ± 0.005% of the frequencies listed in Table 1–2.
7. Adjust R507 so that the reading on the lower scale of the "S"/RF meter matches that on the wattmeter.
8. Using a spectrum analyzer, adjust C130 for minimum second harmonic spurious (54 MHz).
9. Disconnect the wattmeter, frequency counter, and spectrum analyzer.

4.5 MODULATION LIMITER ADJUSTMENT

1. Connect an audio generator, set for 2.5 kHz, to the microphone input.
2. Connect an oscilloscope to the antenna jack (see Section 3.5).
3. Adjust the generator output level to produce 50% modulation.
4. Increase the output level of the generator by 16 dB. Adjust R506 to obtain a maximum of 100% modulation.
5. Disconnect generator and oscilloscope.

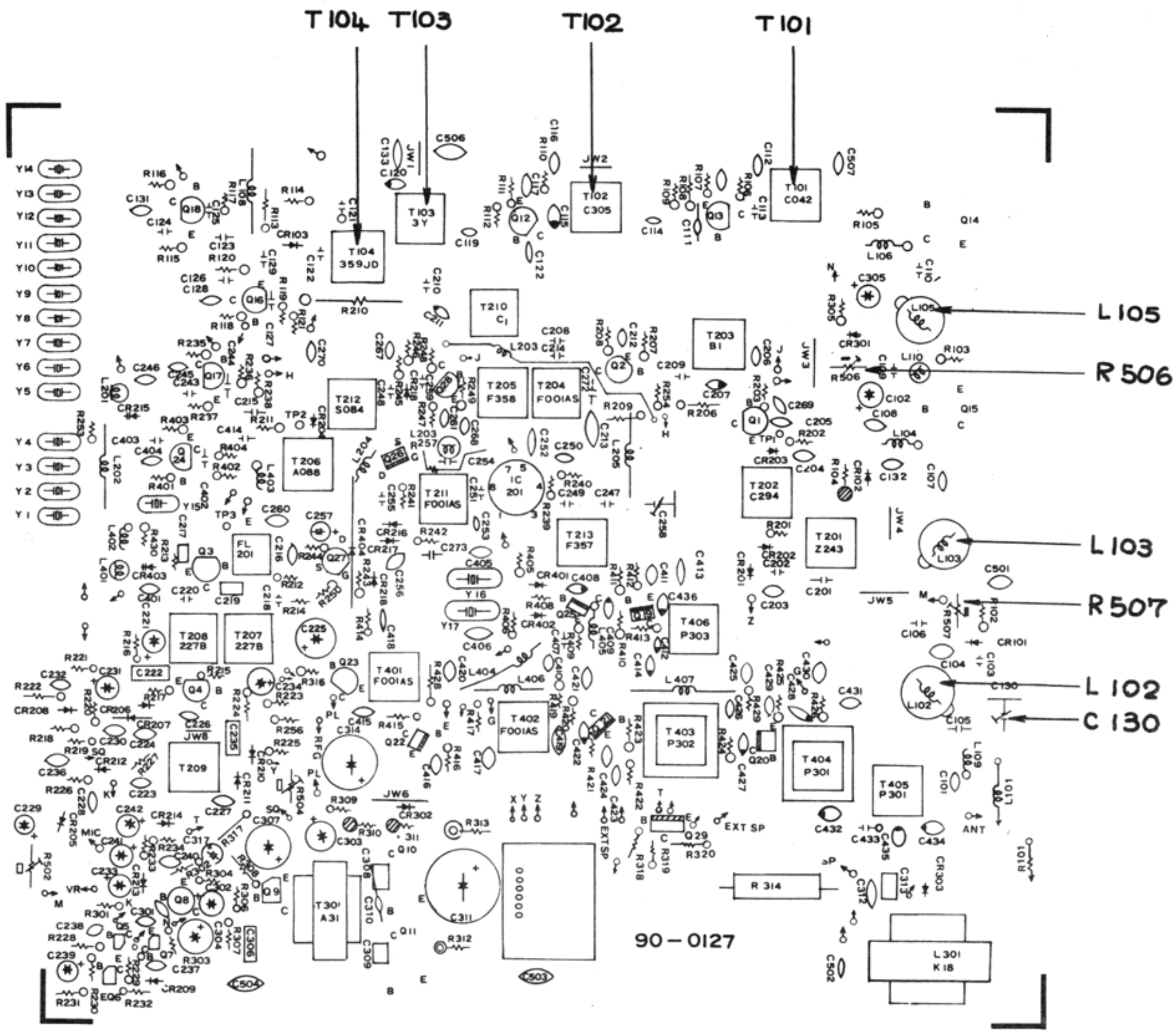

Figure 4–1 Transmitter Adjustment Locations

4.6 CB RECEIVER ALIGNMENT (See Figure 4–2 for receiver adjustment locations)

1. Connect an RF signal generator to the antenna jack.
2. Set the selector switch to Channel 12.
3. Set the signal generator to 27.105 MHz with 30% modulation at 1 kHz.
4. Adjust the generator output for an approximate mid-scale indication (5) on the "S" meter.
5. Adjust T202, T203, T204, T205, T212, T206, T207, T208, and T209 for maximum indication on the "S" meter. Reduce the generator output, as necessary, to keep the "S" meter at its approximate mid-scale (5).
6. Set the output of signal generator to 100 microvolts and adjust R502 for a reading of 9 on the "S" meter.

4.7 10 MHz TRAP ADJUSTMENT

1. Connect an AC VTVM across the speaker terminals.
2. Set the RF generator to 10 MHz with 30% modulation at 1 kHz. Adjust the output level for a minimum of 1000 microvolts.
3. Adjust T201 for a minimum reading on the VTVM.

4.8 TIGHT SQUELCH SENSITIVITY ADJUSTMENT

1. Reset the generator frequency to 27.105 MHz (Channel 12) with 30% modulation at 1 kHz. Adjust the output level to 1000 microvolts.
2. Set R504 to the point where less than 1,000 microvolts does not open squelch.

4.9 NOISE BLANKER ADJUSTMENT

1. Reset the RF signal generator frequency to 26 MHz without modulation. Adjust the output level to more than 10000 microvolts.
2. Connect the RF probe from the oscilloscope to the drain of Q26.
3. Adjust C258 and T211 for a maximum indication on the oscilloscope.
4. Change the frequency of RF signal generator to any desired CB frequency.
5. Adjust T213 for a minimum indication on the oscilloscope.

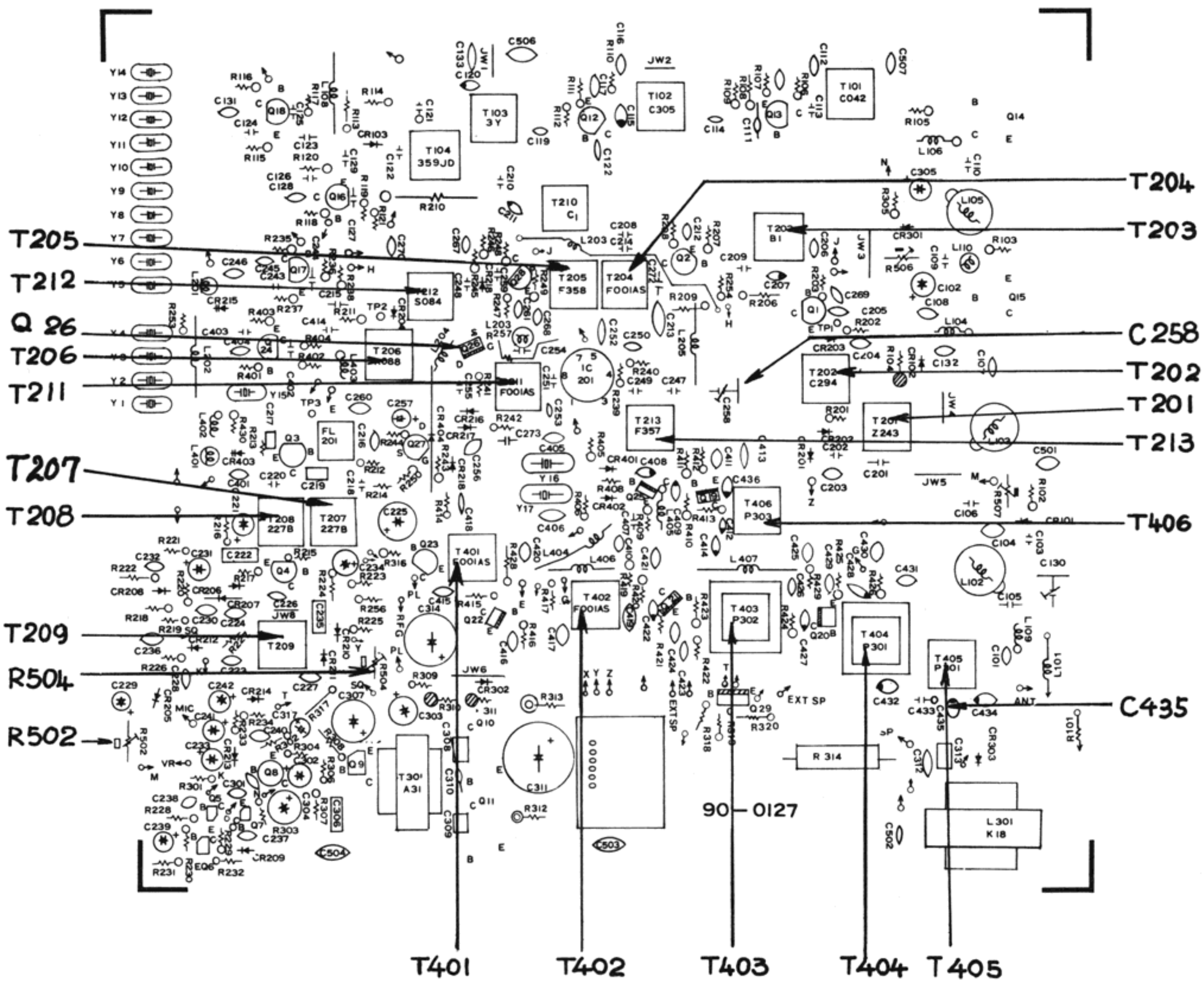

Figure 4–2 Receiver Adjustment Locations

4.10 WX RECEIVER ALIGNMENT

1. Change the WX switch to either the WX1 or WX2 position (whichever one is unavailable in your area).
2. Set the RF signal generator (frequency modulated at ± 2.5 kHz deviation) to 162.550 MHz for WX1 or 162.400 MHz for WX2.
3. Adjust the output level of signal generator to 100 microvolts or more.
4. Adjust T405, T404, T403, T402, T401, T406, and C435 for maximum reading on the "S" meter. Reduce the generator output, as required, to maintain an approximate mid-scale indication.

4.10.1 Alignment for Crystals in 151-159 MHz Band

1. Set the WX switch to the position that corresponds to the new crystal installed.
2. Set the DELTA TUNE control to its center position.
3. Set the RF signal generator (frequency modulated at ± 2.5 kHz deviation) to the selected frequency.
4. Adjust the output level of the signal generator to 100 microvolts or more.
5. Adjust T406, T405, T404, C435, T403, T402, and T401 for a maximum indication on the "S" meter. Reduce the generator output, as required, to maintain an appropriate mid-scale indication.

NOTE

If two crystals have been installed, it will be necessary to repeat above procedure for both channels until the final reading obtained for each is approximately equal.

This completes the alignment procedure.

SECTION V
ILLUSTRATIONS AND PARTS LIST

5.1 GENERAL

The schematic and parts locator in this section are for the PACE Model CB 145 Mobile Transceiver. Part numbers and descriptions are keyed to schematic reference numbers and are listed for these components.

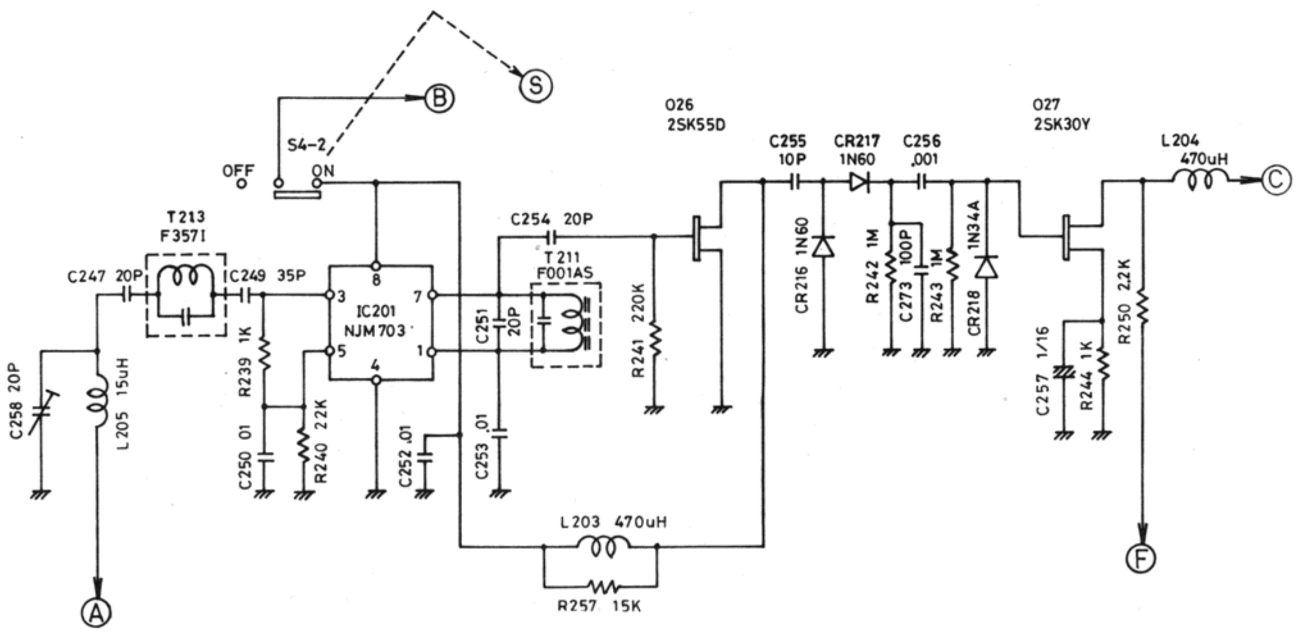

Figure 5—1 Noise Blanking Circuit

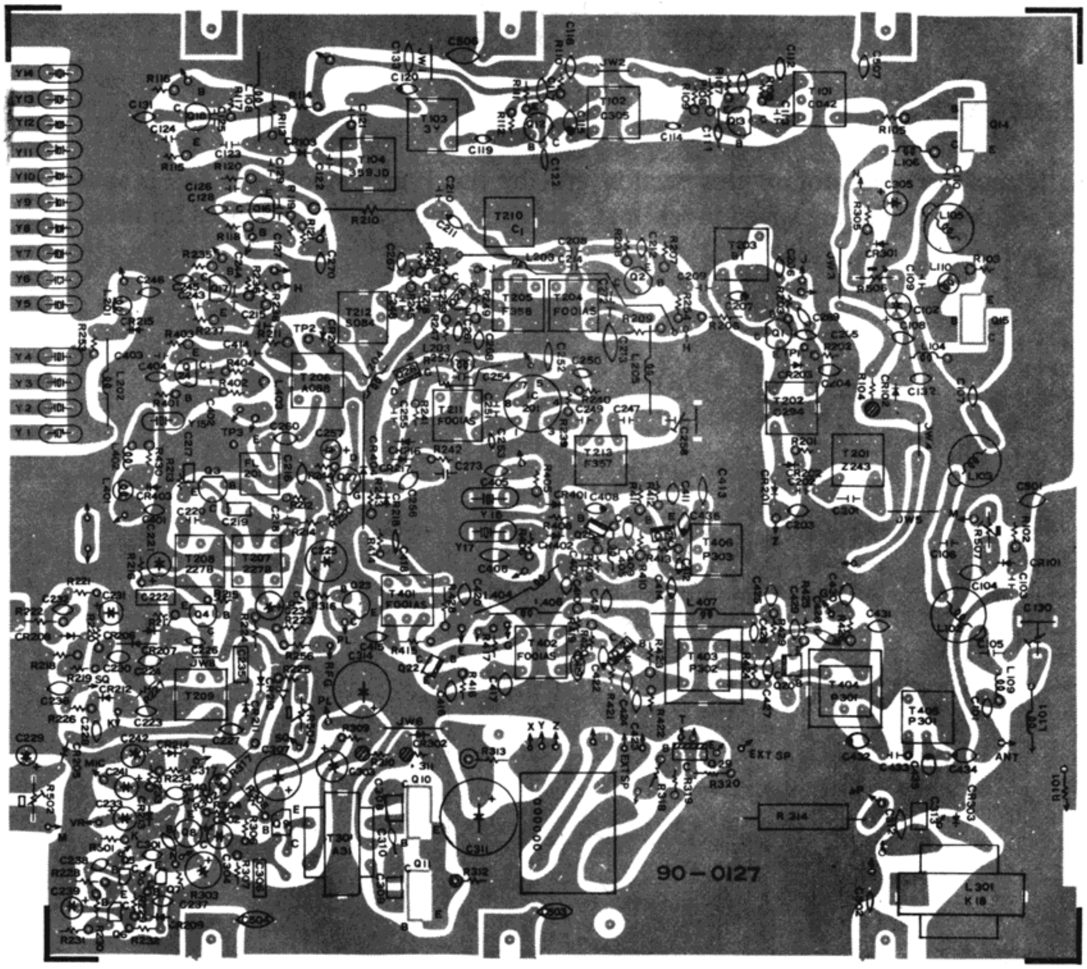

Figure 5–2 Parts Locator (Component Side)

Table 5–1
Parts List

Reference Number	Description	Part Number
CAPACITORS*		
C102, 229, 233, 239, 241, 257, 302	Electrolytic, 1 μF 50 V	IP 22–0001
C130	Variable, 10 pF	IP 22–0045
C217, 219, 313	Mylar, .04 μF	IP 22–0018
C221, 234	Electrolytic, 4.7 μF 25 V	IP 22–0003
C222, 235, 306	Mylar, .1 μF	IP 22–0047
C225, 307	Electrolytic, 220 μF 16 V	IP 22–0009
C231	Aluminum, 0.22 μF 16 V	IP 22–0044
C242, 305, 317	Electrolytic, 10 μF 16 V	IP 22–0004
C258	Variable, 20 pF	IP 22–0020
C303, 304	Electrolytic, 47 μF 16 V	IP 22–0006
C308, 309	Mylar, .01 μF	IP 22–0015
C311	Electrolytic, 1000 μF 16 V	IP 22–0051
C314	Electrolytic, 470 μF 16 V	IP 22–0010
C435	Variable, 6 pF	IP 22–0052
RESISTORS*		
R105	2.2 Ohm 1/4 W	IP 23–0022
R312	1 Ohm 1 W	IP 23–0019
R313	150 Ohm 2 W	IP 23–0020
R314	3.9 Ohm 2 W	IP 23–0021
R501	Potentiometer, RF GAIN, 10 k Ohm B	IP 24–0043
R502, 506	Potentiometer, Trimmer, 10 k Ohm	IP 24–0005
R503, 505	Potentiometer, Concentric, SQUELCH/VOLUME w/Switch, 10 k Ohm B & D	IP 24–0017
R504, 507	Potentiometer, Trimmer, 100 k Ohm	IP 24–0002
R508	Potentiometer, DELTA TUNE	IP 24–0042
DIODES, INTEGRATED CIRCUITS, TRANSISTORS		
CR101, 205, 206, 207, 210, 212, 219, 301	Diode, 1N34A, D	IP 20–0015
CR102, 303	Diode, 1N4002R	IP 20–0120
CR103, 213, 401, 402, 404	Diode, 1S2472SWR	IP 20–0021
CR201, 208, 211, 214	Diode, WG713SWR	IP 20–0145
CR202, 203	Diode, 1S1007SDJ	IP 20–0020
CR204, 216, 217, 218	Diode, 1N60	IP 20–0060
CR209	Diode, BZ090ZJ	IP 20–0019
CR215, 403	Diode, ITT310	IP 20–0151
CR302	Diode, 1S1211VN	IP 20–0023
IC201	Integrated Circuit, ICμA703	IP 20–0174

Table 5–1
(continued)

Q1	Transistor, 2SC710B	IP 20–0001
Q2, 3, 4, 12, 13, 16, 17, 18, 23, 24, 28	Transistor, 2SC710C	IP 20–0002
Q5, 6, 7, 9	Transistor, 2SC403C	IP 20–0170
Q8	Transistor, 2SD187R	IP 20–0076
Q10, 11	Transistor, 2SC1014C–1	IP 20–0172
Q14	Transistor, 2SC1499 (1)	IP 20–0156
Q15	Transistor, 2SC1306 (1)	IP 20–0155
Q19 thru 22, 25	Transistor, 2SC535B	IP 20–0171
Q26	Transistor, 2SK55D	IP 20–0173
Q27	Transistor, 2SK30Y	IP 20–0078
INDUCTORS, CHOKES, AND TRANSFORMERS		
L101	Choke, RF, 0.85 μH	IP 21–0099
L102	Coil, RF, C979NT	IP 21–0181
L103, 105	Coil, RF, C994NT	IP 21–0225
L104	Choke, RF, 0.65 μH	IP 21–0071
L106	Choke, RF, 2.5 μH	IP 21–0227
L108, 206, 402, 403, 404, 406, 407	Choke, RF, 22 μH	IP 21–0072
L109, 408	Choke, RF, 0.1 μH	IP 21–0226
L110	Choke, RF, 2.2 μH	IP 21–0229
L201	Choke, RF, 56 μH	IP 21–0230
L202	Choke, RF, 4.5 μH	IP 21–0070
L203, 204	Choke, RF, 470 μH	IP 21–0195
L205	Choke, RF, 15 μH	IP 21–0228
L301	Choke, Filter, T49262K	IP 21–0112
L401	Choke, RF, 68 μH	IP 21–0231
L405	Choke, RF, 0.4 μH	IP 21–0182
T101	Transformer, RF, C042DD	IP 21–0093
T102	Transformer, RF, C305BD	IP 21–0234
T103	Coil, RF, 507S3–Y	IP 21–0233
T104	Coil, RF, Y–359JD	IP 21–0232
T201	Coil, RF, Z343QD	IP 21–0238
T202	Transformer, RF, C294DD	IP 21–0236
T203	Coil, RF, 508SB–1	IP 21–0237
T204	Transformer, IF, F358K	IP 21–0223
T205, 211, 401, 402	Transformer, IF, F001AS	IP 21–0239
T206	Transformer, IF, A088AT	IP 21–0243
T207, 208	Transformer, IF, EIA227B	IP 21–0244
T209	Transformer, IF, A293AD	IP 21–0221
T210	Coil, RF, 507SC–1	IP 21–0235
T212	Transformer, IF, S084CT	IP 21–0224

Table 5–1
(continued)

T213	Coil, HF, F537I	IP 21–0222
T301	Transformer, Input, T4655K (A–31)	IP 21–0075
T302	Transformer, Output, T9209N (E03)	IP 21–0245
T403	Transformer, Mixer, P302BZ	IP 21–0241
T404, 405	Transformer, RF, P301BZ	IP 21–0240
T406	Transformer, RF, P303NZ	IP 21–0242
MISCELLANEOUS		
	Filter, Ceramic, LF–B8	IP 31–0053
	Jack, Antenna	IP 36–0013
	Jack, Earphone	IP 26–0005
	Jack, Microphone	IP 26–0014
	Lamp, Pilot, 16 V	IP 28–0009
	Relay, HTC, 12 V	IP 32–0007
S2	Switch, WX	IP 25–0038
S3, 4	Switch, CB–PA and NB–OFF	IP 25–0036
S5	Switch, CHANNEL SELECTOR	IP 25–0037
	Knob, CHANNEL SELECTOR	IP 30–0122
	Bezel	IP 30–0119
	Plate, Front	IP 30–0149
	Assembly, Pilot (Red)	IP 30–0123
	Assembly, Pilot (Green)	IP 30–0124
	Assembly, Pilot (Blue)	IP 30–0125
	Assembly, Pilot (White)	IP 30–0127
	Assembly, Pilot (Amber)	IP 30–0126
	Meter, A–36	IP 27–0011
	Knob, VOLUME	IP 30–0092
	Knob, RF GAIN	IP 30–0093
	Knob, SQUELCH, MODE and CLARIFIER	IP 30–0094
	Cabinet, Upper	IP 30–0120
	Cabinet, Lower	IP 30–0121
	Speaker, 8 Ohm 2 W (S–301 A.U)	IP 29–0017
	Bracket, Mounting	IP 30–0117
	Microphone, DM1368LT	IP 29–0016
	Hanger, Microphone	IP 30–0061
Y1	Crystal, 9.5450 MHz	IP 31–0070
Y2	Crystal, 9.5550 MHz	IP 31–0071
Y3	Crystal, 9.5650 MHz	IP 31–0072
Y4	Crystal, 9.5850 MHz	IP 31–0073
Y5	Crystal, 16.965 MHz	IP 31–0074
Y6	Crystal, 17.015 MHz	IP 31–0075
Y7	Crystal, 17.065 MHz	IP 31–0076
Y8	Crystal, 17.115 MHz	IP 31–0077

Table 5–1
(continued)

Y9	Crystal, 17.165 MHz	IP 31–0078
Y10	Crystal, 17.215 MHz	IP 31–0079
Y11	Crystal, 10.000 MHz	IP 31–0080
Y12	Crystal, 10.010 MHz	IP 31–0081
Y13	Crystal, 10.020 MHz	IP 31–0082
Y14	Crystal, 10.040 MHz	IP 31–0083
Y15	Crystal, 10.245 MHz	IP 31–0084
Y16	Crystal, 50.6166 MHz (WX1)	IP P5254**
Y17	Crystal, 50.5666 MHz (WX2)	IP P5254**
	Owners Manual	IP L2031

*Order all unlisted components by description and reference numbers.

**Specify frequency.