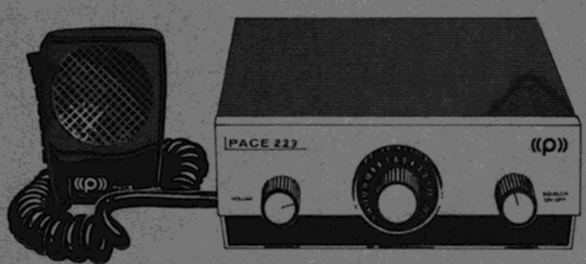
Pace 223 2376A Service Manual

PRICE $2.50

SERVICE MANUAL

223-2376A



PATHCOM INC.

PACE TWO-WAY RADIO PRODUCTS

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

I. GENERAL INFORMATION

The following procedures contain the necessary information to perform a detailed trouble-shooting analysis and complete alignment of the CB 223 and CB 2376A.

The procedures given in this manual assume a general knowledge of communications - type transmitters and receivers and a familiarization with transistors.

Every effort has been made to keep the required instruments necessary to align and service as simple as possible. It must be realized that the degree of accuracy attained in measurement is directly related to the quality of instruments used. Where a lower quality instrument than the one suggested is used, allowance must be made for possible error in readings.

CHASSIS REMOVAL:

Remove the four screws from each side of the radio and remove top and bottom cover.

SPEAKER REMOVAL:

It may be more convenient to perform service work with the speaker removed if there is a squelch or audio problem. The speaker can then temporarily be plugged into the EXT SPKR (External Speaker) Jack. (CB 2376A only) If the problem is in the receiver or transmitter, speaker removal is probably unnecessary.

TEST EQUIPMENT REQUIRED:

Power source of 13.8 V DC capable of 2 amps, either well regulated or semi-regulated and adjustable with an ammeter. (Or use external ammeter of 0-2.5 amps.)

RECEIVER ALIGNMENT

R. F. Signal Generator, capable of tuning 455 KHz and 27 MHz CB frequencies, 20,000 ohm/v multimeter (with AC output function).

TRANSMITTER ALIGNMENT

Audio Generator (optional)
Oscilloscope 30 MHz bandpass or DC coupled scope with detector
Wattmeter 50 ohm, 5 watts

II. TRANSMIT - RECEIVER SWITCHING SYSTEM

The transmit-receive switching system is semi-electronic. The antenna and speaker circuits are switched by a SPDT relay. The transmitter oscillator and receiver are switched by the same microphone contacts that operate the relay. The antenna circuit is switched in the conventional manner; the speaker is also switched with the antenna relay contacts. Shunting of the RF circuit to ground through the audio system is prevented by a pair of isolation RF chokes, RFC7 and RFC8 (see Fig. 1).

When the push-to-talk is in the normal or receive position, the antenna is connected through C1 and C85 to the receiver RF stage, while RFC7 and RFC8 present a high RF impedance so that no antenna currents will flow into the audio circuit. The speaker is connected across T11 because the RF chokes are essentially zero impedance at audio frequencies. Loss of audio through the antenna or RF stage is prevented by C1 and C85 which are very high impedance at audio frequencies.

When the push-to-talk switch is depressed, the ground side of the receiver is opened, thereby disabling it. The relay coil, synthesizer mixer Q16, oscillator Q14, and pre-driver Q18 are energized by completing their ground returns, the speaker is disconnected and the transmitter is connected to the antenna.

Note that +12v is applied to the transmitter I.P.A. and P.A. stages at all times (through T11). This is possible because these stages draw no current when drive is removed, i.e., the synthesizer is off. Receiver audio also appears on their collectors, but since they are drawing no current, they appear as a small capacity shunting T11.

A. RECEIVER DESCRIPTION:

The receiver is a double conversion superheterodyne. Both oscillators are crystal controlled and both are changed in frequency steps to obtain 23 channel operation. The first mixer (Q2) uses high side injection obtained from oscillator Q15. (Oscillator Q15 works during both transmit and receive operation.) The second mixer Q3 obtains injection from oscillator Q4. The output of Q3 is at 455 KHz and passes through the six stage filter T2 through T7. The signal is further amplified by Q5 and Q6 which drives the detector consisting of CR2 - CR3.

In the CB 2376A only, the low side of the secondary of T1 is connected to a panel switch and 470 ohm resistor. In the LOCAL position the DC base current of Q3 is shunted off to reduce its gain. A drop of 15 dB occurs in this position.

The output of the detector contains the rectified audio and a DC component proportional to the carrier. The DC component is applied through filter network R23-C40 to the AGC amplifier Q7. This positive going voltage turns Q7 on, causing its collector to go toward ground. Q1, Q2, Q3, and Q5 receive their base bias from the network in the collector of Q7, and the negative going voltage reduces their bias and consequently their gains. At maximum signal level, they will be turned completely off.

The DC bias from the detector is also applied to a divider consisting of R24 and R26. R27-R28 connects the positive end of the divider string to the anode of CR4 thereby forward biasing CR4, but audio is bypassed by C35. Whenever a positive signal greater than the amount of voltage across R24 or R26 appears, CR4 is gated off.

Noise pulses are usually equal to three or four times the normal 100% modulated audio level and they will gate CR4 off. Clipping is fixed at about 65%.

B. TRANSMITTER DESCRIPTION:

The transmitter is comprised of two basic sections, the low level frequency generation section contained in the synthesizer output board (S.O.B.); the Driver, Intermediate Power Amplifier (I.P.A.) and Power Amplifier (P.A.) located on the main printed circuit board. The S.O.B. is connected to the main circuit board with a small coaxial cable and, therefore may be checked and serviced as a separate unit quite readily.

The S.O.B. comprises two oscillators, Q14 and Q15. Q14 operates at approximately 8.0 MHz and Q15 at 35. The difference of the two oscillators is obtained from mixer Q16 and passed through a bandpass filter L7 and L8. The output is coupled by coaxial cable to Driver Q18. Driver Q18 operates class AB, i.e., a small forward bias exists with no signal and increases with drive power. The I.P.A. (Q19) and P.A. (Q20) are operated class C, the more drive applied, the more reverse biased their base emitter becomes. There is no current flow in the Q19 or Q20 without drive applied. The transmitter output network is a three section pi for maximum efficiency and harmonic rejection.

III. RECEIVER SERVICING

A. GENERAL:

There is little reason why a receiver will become badly mistuned and it is therefore seldom necessary to perform a complete realignment except after major service work.

Certain steps and careful observation can help pin point trouble before wasteful trouble-shooting effort is expended. In case of a dead receiver the following should be checked.

1. If the "S" Meter (CB2376A only) is working in a normal manner, i.e., it varies as channels are changed and is moving over the scale, then the receiver is probably OK. Trouble points could be in the audio, speaker, or speaker switching circuit.

2. If the "S" Meter is not working the receiver oscillators will be checked as a normal part of the checkout procedure. If the transmitter is working properly, oscillator Q15 is OK. If both transmitter and receiver are inoperative (or off frequency) it is probable that Q15 is defective.

3. The audio may be checked in the P.A. position (CB2376A only). Press the mike key with panel switch in P.A. position. The internal speaker should produce output.

4. In case of a dead audio, check the radio current in unsquelched condition (squelch control ccw), current should be about 850 ma at 13.8 volts. If not, radio is being held squelched or there is a defect in audio biasing.

B. OSCILLATOR CHECKS:

Place voltmeter probe at Junction R14-C16 (0.5-3.0V). Momentarily ground collector of Q4 with a .005 or larger capacitor, if voltage at Junction increases Q4 is oscillating. Check operation on four successive channels to determine if crystals Y5 to Y8 are all operating. The synthesizer mixer oscillator may be checked in a similar manner. Place voltmeter across R71 and ground Q15 collector with a capacitor. An increase in voltage indicates proper oscillation. If Q15 is suspected of being mistuned, check transmitter troubleshooting section for correct modification and tuning porcedure.

C. AGC SERVICING:

Severe overload distortion, failure of the squelch system or "S" Meter operation may be caused by an inoperative AGC system.

Bias for Q1, Q2, and Q5 is obtained from a voltage divider (R35-R36). The collector of Q7 is tapped into the top of the voltage divider between R33-R34, and increasing collector current reduces the base bias on Q1, Q2, and Q5. Positive going voltage from the detector is applied to Q7 base through a filter divider consisting of R23, R7, and C40.

AGC for the second mixer Q3 is derived from the emitter of Q2. Since Q2 emitter goes toward ground this cuts off Q3. In this manner Q3 is the first amplifier to be cut off thereby reducing mixer noise more quickly with small increases in signal. AGC troubleshooting is simplified by using the voltage Chart (Table 1). Each stage voltage is given for 100 and 10,000 micro-volts signal input.

D. DETECTOR CHECK:

Detector diodes CR2-CR3 can be checked easily with an ohmmeter. Using low ohms scale, connect ohmmeter to the junction of CR3-R23 and ground. A reading of several hundred ohms should result; if it is much higher, reverse the ohmmeter leads. If very low (less than 100 ohms) or greater than 1000 ohms, check the diodes individually.

E. HIGH FREQUENCY CIRCUIT ALIGNMENT:

1. Connect 20,000 ohm/volt V-O-M to Q7 collector. Use 10V scale.

2. Apply 27 MHz signal to ANTENNA jack and tune for minimum voltage at Q7. Adjust generator for a reading of about 6.5 volts.

3. Adjust T2, T1, L2, and L1 for minimum reading at Q7. Reduce generator output as necessary to keep Q7 collector at about 6.5 to 7.5 V.

4. Set generator for 0.4 uV and touch-up L2, L1, T8, and T7 for minimum reading at Q7. If Q7 is not 7 volts or less at 0.5 uV, turn signal generator off. Rotate squelch control clockwise until receiver just squelches, and slowly bring generator output up. If the receiver breaks the squelch at 0.35 uV or less, continue with step 5. If it does not, proceed to step 6.

5. Set signal generator to 40% modulation and 0.4 uV output. Connect an AC voltmeter (with dB scale) across speaker terminals and adjust to about 1 volt audio output using volume control. Use convenient reference such as 0 to +2 on the dB scale. Turn signal generator modulation "off" (do not disturb RF output). The voltmeter must drop at least 10 dB.

6. If IF alignment is necessary, it should only be attempted when an accurate 455 KHz signal source is available. Alignment on other than 455 KHz will cause the radio to be off channel at 27 MHz. If a crystal controlled 27 MHz generator is available, the receiver may be aligned on channel. But this is a less accurate method unless the generator crystal frequency is known to be within 0.001%. Connect the 455 KHz generator at the collector of Q3 through a 0.01 or larger blocking capacitor and connect a V-O-M to Q7. Bring the generator level up until the voltage Q7 begins to drop. Peak up T8, through T3 and reverse order. Disconnect generator and apply 27 MHz to ANTENNA jack and perform step 5.

7. Connect a signal generator to ANTENNA jack, and turn generator output to zero (or tune off channel) with volume at center position, rotate the Squelch Control clockwise to the point that just silences the audio output completely. Bring up signal generator output slowly, and observe that the squelch breaks at 0.34 uV or less.

   If the squelch does not break, check the DC voltage at CR3-R23. The squelch requires 2.0-2.5 volts (measure with VTVM) to operate. If this voltage is less, gain is too low.

   If the voltage at CR3-R23 is adequate, check that the collector voltage at Q7 will vary at 0.4 volts while varying signal generator from zero to 0.35 uV. If it does not, check Q7 and its associated circuitry. If Q7 checks OK, check voltage at R4-C9. This voltage varies only slightly, about 0.1V for a 2 to 1 signal input change, i.e., going from 0.5 uV to 1.0uV. If R4-C9 voltage appears correct, check voltage at Q8 collector by adjusting R38. The proper values are shown on the voltage chart (Table IV). Continue voltage tracing at Q9 and Q12; see section IV. B. Use schematic and voltage chart for reference.

F. NOISE LIMITER CHECK:

If noise limiter diode is suspected of being faulty, short it out momentarily. If Audio comes through, replace the diode and/or check R24, C28, and R23. To check limiter operation, observe the audio between CR 4 anode and ground on an oscilloscope. Limiting should occur at about 65% modulation.

IV. AUDIO SYSTEM DESCRIPTION

The audio system is an all direct coupled single ended amplifier. The input stage Q10 is an emitter follower giving high input impedance. This high input impedance allows use of a standard ceramic microphone. The standard high impedance ceramic unit possesses better speech characteristics than the so called low impedance types. Q10 is biased by a divider string in the collector of Q11 thus providing negative DC feedback around Q10 and Q11. This stabilized DC voltage drives Q12. Resistor R53 in the emitter of Q12 is adjusted to compensate for the difference in beta of Q13. R53 is adjusted to provide about 1 amp current in Q13 during transmit and/or public address functions. R54 is then adjusted to produce 600-700 ma. in Q13 during receive condition.

Squelch operation is obtained by "starving" the divider string in the collector of Q11. The squelch transistor Q9 draws current through a 10K resistor R49. This prevents any base current from reaching Q10, turning it off. This in turn shuts off Q11 and the only current then flowing through R50, 51, and 52 is the small amount flowing through R49 to Q9. This is insufficient to turn Q12 on and Q13 will also be off.

A. AUDIO TROUBLE SHOOTING:

Audio and squelch trouble shooting can be effectively carried out by careful use of the voltage chart, (Table 3). If all voltages are satisfactory but the audio is weak or distorted, all capacitors should be paralleled by good ones particularly C44 and C46.

About 25 millivolts of audio applied to the audio input should produce 80-100% modulation. If this is satisfactory but modulation is still poor, check the output from the microphone. Normal close talking should produce 15-30 millivolts on a 1 megohm input audio voltmeter. It should be possible to obtain 150-300 millivolts when whistling loudly into a good microphone.

B. SQUELCH AMPLIFIERS:

The squelch sensing voltage is taken from the collector of the RF amplifier Q1. With increasing signal strength the base of Q1 moves toward ground cutting off Q1. Because of DC load resistor R4 the voltage at the collector of Q1 increases in a positive direction. Since Q8 is a PNP transistor this positive going voltage cuts it off. The cut off or squelch point is determined by R38, the squelch control. As the control is moved toward the +10 volt supply, Q1 must be more nearly cut-off (requiring a stronger signal) to cut off Q8. With Q8 cut off no current flows in R41-R42 and this in turn cuts off Q9. See section 4.0 for explanation of the squelch function in the audio amplifier. Squelch troubleshooting will be simplified by using Table 4.

V. "S" METER (2376A only):

The "S" Meter is in a bridge circuit in the collector of Q7, the AGC amplifier. With no signal, the voltage across the "S" Meter is nearly zero. With increasing signal strength, Q7 conducts causing the voltage at its collector to go negative (towards ground) with respect to the junction of R31-R32, causing current flow through the "S" Meter.

"S" METER ADJUSTMENT:

With the power off, adjust the "S" Meter zero so that the pointer is approximately 3 pointer widths below the lower calibration mark. Turn power on and apply an RF signal of 100 u volts. Adjust the calibration control (R32) so that the "S" Meter reads S-9. The transceiver shall not be tilted more than 15^{o} from normal position during this adjustment and test.

VI. TRANSMITTER TEST AND ALIGNMENT

A. GENERAL:

To properly align and test the transmitter, a good modulation indicator is more important than any other instrument. 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 ANT 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 scope. This is probably the easiest to use, and the most accurate, unless a high frequency scope is available. A suitable detector is shown in Figure 2.

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.

If a high frequency scope is used, connect the probe to the ANT 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. (See Figure 3).

Apply modulation, and observe the maximum height of the modulated waveform. For 100% modulation, EP=2EM, 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 2A, 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 2B.) 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 2C.) 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 80-90% modulation.

B. TRANSMITTER SERVICING:

CAUTION: Do not attempt any adjustments on the S.O.B. (Synthesizer Output Board), without following this procedure carefully. If the transmitter is inoperative, check as follows:

1. Blows Fuses - Check for shorted Q19 or Q20. Check Base of Q19 (-0.5 to -0.6 volts) if OK, check for trouble between Q19 and antenna. Use VTVM, or VOM with 10-20 uhy choke in series with probe and check for -10 to -15 volts at base of Q20. If OK, trouble is in output circuit or Q20 has open collector.

2. No Voltage at base of Q19 - Check RF output (0.3 to 0.5 V) on S.O.B. If OK, trouble is in coax cable connecting S.O.B. to main PC board, or in Q18 stage. Note that Q18 emitter is at about 1.6-1.9 volts during transmit but jumps to about 3.5 V when key is released.

3. No Voltage or Incorrect Voltage at Output - If no voltage at output, check junction of C59-C60 (3 to 4 V RF). If all are 0 volts, either 8 MHz oscillator Q14 or 35 MHz oscillator Q15 is dead.

To check Q15 oscillator, place VOM probe in series with choke at emitter of Q15. Meter should indicate 1.4-2.5 volts. Touch a .01 uf or larger capacitor from base of Q15 to ground; voltage should jump up. If there is no voltage jump, Q15 is not oscillating. Try other channels to determine if a crystal is bad. See Synthesizer Crystal Frequency Chart to locate crystals in use.

Q15 oscillator is properly tuned by measuring the RF voltage at its emitter using an RF adapter probe with a VOM or VTVM. If no probe is available, one may be fabricated as in Figure 4.

NOTE: Q15 is checked without keying transmitter.

Place probe across R71 and turn core in L6 out (ccw) so there is no reading on the meter. Place channel switch on channel 13 and rotate L6 cw. The meter should suddenly jump up to approximately 1.3-2.0 volts and begin to drop with continued cw rotation until a small "dip" is passed. Continuing past the dip will result in a decreasing reading until the meter drops to zero. The core should be adjusted to the center of the small dip. Check all channels for oscillation.

The same probe may be used to check Q14 for oscillation. With the transmitter keyed several volts of RF should appear at the emitter of Q14, (Q14 emitter will be at about 1.2 V DC (TX keyed) and Q15 emitter at about 2.5-3.0 V DC).

If both Q14 and Q15 are oscillating OK but voltage at Junction C59-C60 is low or zero, check voltage at Section of L6 (2.5-3.0 V) to determine if Q16 is mixing properly. Test voltage at Sec. of L6 will increase slightly when transmit key is depressed.

CAUTION: Alignment of L7 and L8 should not be attempted until it has been determined that there are no component or transistor failures. If Q16 or Q17 are replaced only slight touch up may be needed, but if L7 or L8 are replaced, alignment must be carried out in accordance with Mixer Alignment.

Mixer Alignment: Since it is possible to align the output of the mixer transistor Q16 to frequencies other than 27 MHz, a frequency counter, tuneable receiver or signal generator must be used to obtain correct tuning.

Signal Generator Method: Disable oscillator Q15 by rotating the core of L6 clockwise until almost all the way out of L6.

Connect 27 MHz generator through .002 or larger capacitor to base of Q16. Connect VTVM (+ volts) to output, set generator for maximum output. Starting with core in L7 at maximum clockwise (in) position rotate counter clockwise until a peak is noted in output (C62) reading.

Tune up oscillators Q14 and Q15 in accordance with step and check voltage at output with transmitter keyed. Readjust L9 slightly to obtain maximum reading at output.

Receiver Method: If a well calibrated communications receiver with an "S" Meter is available, it may be used to tune up the S.O.B. Disconnect the shielded S.O.B. output cable from the main printed circuit board and place it near the antenna terminals of the receiver. Ascertain that both the 8 MHz and 35 MHz oscillators are operating (See VI 3). Place the channel selector in Channel 9, 10, or 11, and then key the transmitter mike button. Tuning around the correct frequency on the receiver should be possible to pick up a strong signal. Other signals may be heard at approximately 25, 29, and 32 MHz. Ensure that it is the 27 MHz signal that is tuned in.

After peaking the coil in this manner, a VTVM probe may be placed at output and L7, L8 trimmed up for peak reading. Reconnect shield cable to main board and key transmitter, L9 may have to be repeaked slightly for maximum output at output (C62).

Frequency Counter Method: Disconnect shielded S.O.B. output cable from main printed curcuit board and terminate it with a 50 ohm resistor. Connect counter across the 50 ohm resistor. Connect VTVM to C62 and check counter frequency. If frequency is correct, repeak L8 for maximum at C62. If new coils have been installed at L8 set the core about 1/16" in from the top of the coil form and adjust L7 for proper frequency.

If difficulty is encountered in obtaining a counter reading, place VTVM probe at TP3 and rotate core in L7 full cw, then slowly back off ccw until a peak occurs at TP3, then adjust L8 and L9 for maximum at TP5. If counter reading is too low, repeat the procedure until L7 is at the correct output frequency.

Reconnect the shield cable to the main printed circuit board and key the transmitter. L9 may have to be repeaked to obtain maximum voltage at TP5.

C. TRANSMITTER ALIGNMENT, GENERAL:

Transmitter adjustment should not be attempted unless very low power, instability or audio distortion is present. Follow the tuning procedure CAREFULLY. Failure to do so may result in excessive dissipation with resultant loss of a driver output unit. Remember that when a battery or battery eliminator is used, the current supply is nearly unlimited, and it is therefore inadvisable to operate the transceiver without the fused power cord.

D. TRANSMITTER ALIGNMENT PROCEDURE:

NOTE: S.O.B. must be properly aligned as per VI. A. Preset the tuning adjustment as follows:

L10 Slug in approximately 1/8 inch
L11 Slug in approximately flush
L12 Slug in approximately flush
L13 Slug in approximately flush

Driver - Key the transmitter and adjust L10 for maximum voltage at base of Q19. Voltage shall be no less than -0.5 volts DC. (Use 1K ohm in series with meter.)

I.P.A. - Adjust L11 to obtain maximum RF output.

P.A. - Adjust L12 and L13 for maximum RF output. If maximum output exceeds 4.0 watts, rotate driver tuning L11, clockwise to reduce power. Repeak L12 and L13 for maximum output and further reduce power by rotating L11 clockwise and repeaking L12 and L13 to obtain approximately 3.7 watts output. L12 and L13 must always be repeaked after adjustment of L11. After obtaining about 3.7 watts rotate L12 clockwise to reduce power about 100MW; rotate L13 counter-clockwise to reduce power an additional 100 MW.

Check modulation (see Section 6.1). Steady tone modulation should be at least 80% and speech peaks must "hit" 90% or greater. If modulation is inadequate, L13 may be rotated counter-clockwise slightly to improve it, but in no case greater than 1/2 turn. Maximum input current at final adjustment shall not exceed 2.1 amperes and pwer output shall not be less than 3.3 watts.

E. TRANSMITTER FAILURE ANALYSIS:

In the event that an I.P.A. (Q19) or P.A. (Q20) has failed, it should be determined that:

1. CR9, CR10, and CR11 are not defective.

2. The S.O.B. is properly tuned.

3. The antenna in the normal installation is no more than 2 to 1 VSWR.

4. Input voltage does not exceed 16.8 V.

5. The transmitter is properly tuned, particularly L11, L12, and L13.

6. The transmitter operates on frequency and without parasitics down to at least 10.5 input.

7. The relay is not affected by vibration.

ORDERING INFORMATION

When ordering replacement parts, state radio model number, schematic circuit symbol, part description and part number when known. For example:

CR4, Silicon diode, PN 13-0003
Q1, RF Amp. Transistor, PN 13-0065

Do not use numbers stamped on parts, as these are often date codes, process codes, etc., and may vary from time to time making it extremely difficult for the department to trace.

CB 223 & CB 2376A PARTS LIST

All Resistors are 1/2 watt, 10% unless otherwise noted.
Capacitors with values to 620 pF are Type DM-15 mica (or equivalent) ± 10% unless otherwise noted.
Capacitors with values from 0.001 to 0.005 uF are general purpose ceramic ± 20%.
Capacitors with values from 0.01 to 0.22 uF are mylar or polyester ± 20%.
All electrolytics are 15V unless otherwise noted.

Ref. Desig.	Part No.	Description
TRANSISTORS		
Q1, Q16	13-0065	MPS 6511
Q2, Q6	13-0062-1	F 062A
Q3, Q5, Q9, Q14, Q15	13-0062	MPS 3693
Q4, Q8, Q12	13-0061	MPS 6534
Q6, Q18	13-0064	MPS 3646
Q7, Q10	13-0022	MPS 6514
Q11	13-0063	MPS 3694
Q13	13-0014	SJ 2095, 2N 3054
Q17	Not Used	
Q19, Q20	13-0079	MRF 8004
DIODES		
CR1, CR2, CR3, CR12*	13-0004	Germanium, 1N 295X
CR4, CR10, CR12**, CR13, CR14, CR15	13-0003	Silicon, 1N 3600
CR5	13-0002	Zener, 10V 2W
CR6, CR7, CR8	Not Used	
CR9	13-0017	Zener, 36V 2W
CR11	13-0106	Zener, 68V 1W
INDUCTORS		
L1	17-0019	RX Antenna Coil
L2	17-0018	RX RF AMP Coil
L3, L9	Not Used	
L4	17-0017	6MHz Osc. Coil
L5	17-0017	8MHz Bandpass Coil
L6	17-0028	35MHz Osc. Coil
L7	17-0032	27MHz Mixer Coil
L8	17-0025	27MHz Bandpass Coil

Ref. Desig.	Part No.	Description
INDUCTORS (Cont.)		
L10	17-0028	Driver Tuning Coil
L11, L13	17-0021	IPA Tuning & PA Loading Coil
L12	17-0020	Pa Tuning Coil
L14	17-0015	TX Filter Coil
RFC1, RFC2	17-0016	22 uH Choke
RFC 3	17-0041	4.7 uH Choke
RFC 4	Not Used	
RFC 5 thru RFC 9	17-0026	3.3 uH Choke
T1, T9	16-0007	7MHz IF & 8MHz Osc. Xfmr.
T2	16-0005	IF Filter Input Xfmr.
T3 thru T6	16-0003	If Filter Xfmr.
T7	16-0006	IF Filter Output Xfmr.
T8	16-0013	IF Output Xfmr.
T10*	16-0021	Filter Choke
T11	16-0016	Audio Mod. Xfmr.
MISCELLANEOUS		
DS1	13-0019	Pilot Lamp
DS2*	13-0019	"S" Meter Lamp
J1	27-0060	Antenna Jack
J2*, J3*	27-0037	PA & Ext. Spkr. Jack
M1	22-0016	Microphone Assy.
R32*	14-0007	5k ohm Trimpot
R38	15-0034	Squelch Control
R43*	15-0055	Volume/PA Control
R43**	15-0033	Volume Control
RY1	21-0008	Relay (SPST)
SP1	22-0007	Speaker (3.2 ohm)
SW1*, SW2*	15-0058	Slide Switch(DPDT)
SW3	Not Used	
SW4	15-0035	Channel Selector Switch
	24-0027	Control Knob
	24-0031A-2*	Channel Selector Knob
	24-0031-2**	Channel Selector Knob
	36-0027*	"S" Meter

*Used in CB 2376A only.
**Used in CB 223 only.

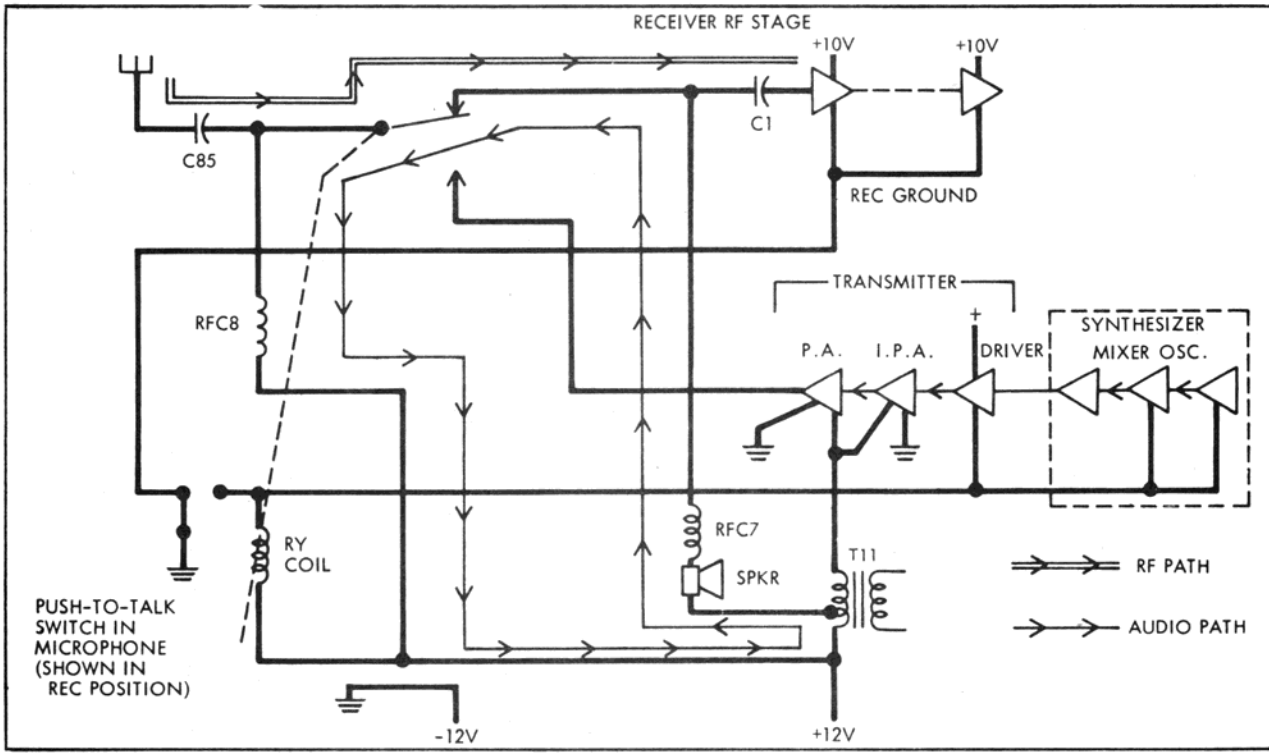


Fig. 1 RECEIVE-TRANSMIT SWITCHING SCHEMATIC

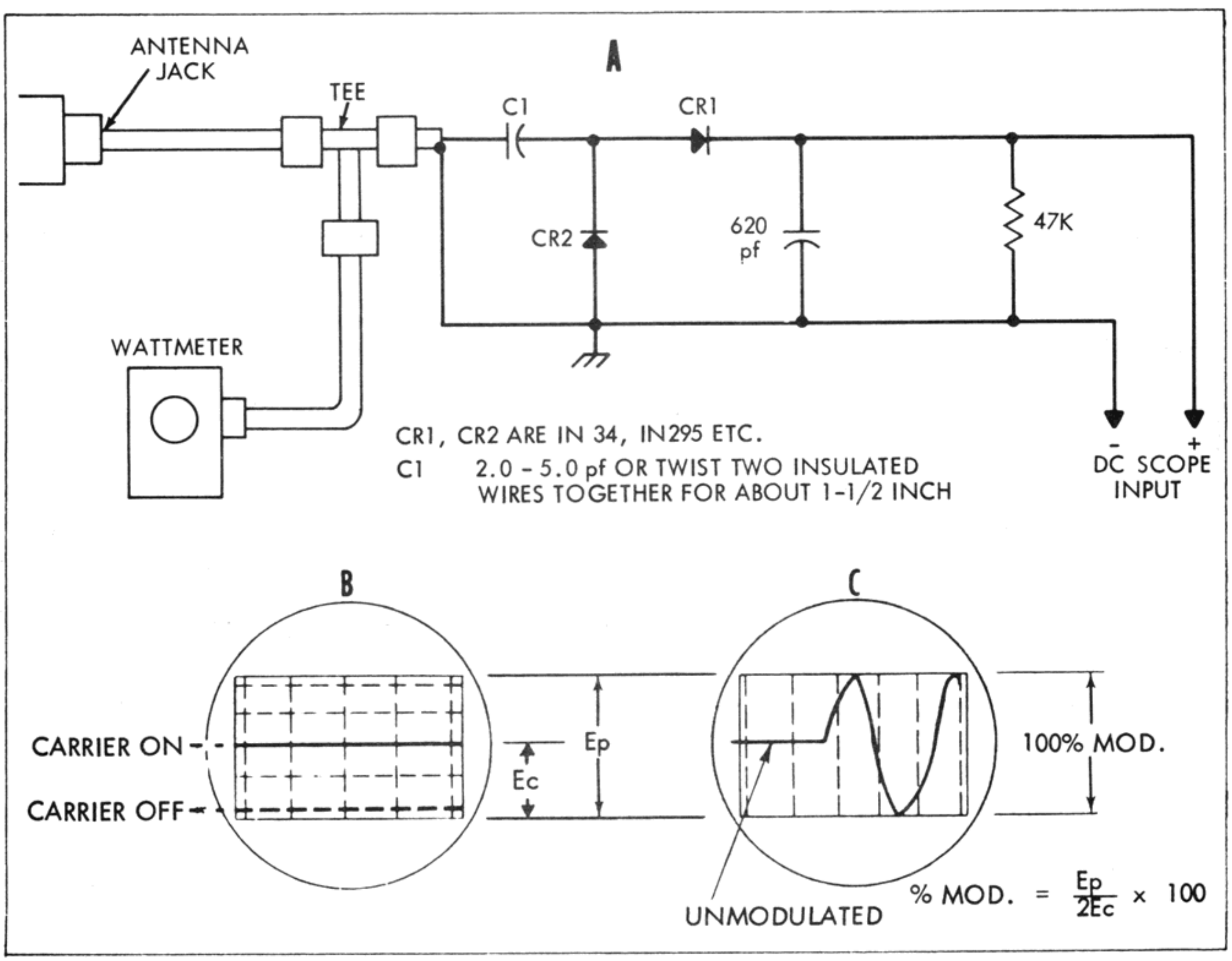


Fig. 2 MODULATION DETECTOR

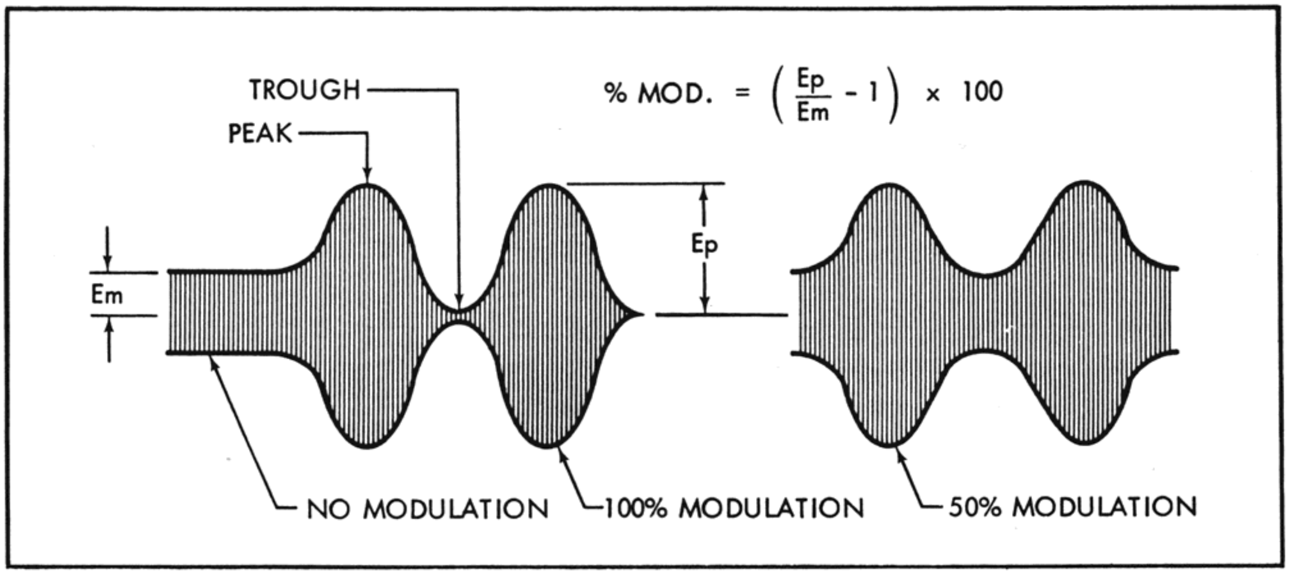


Fig. 3 DIRECT MODULATION MONITOR

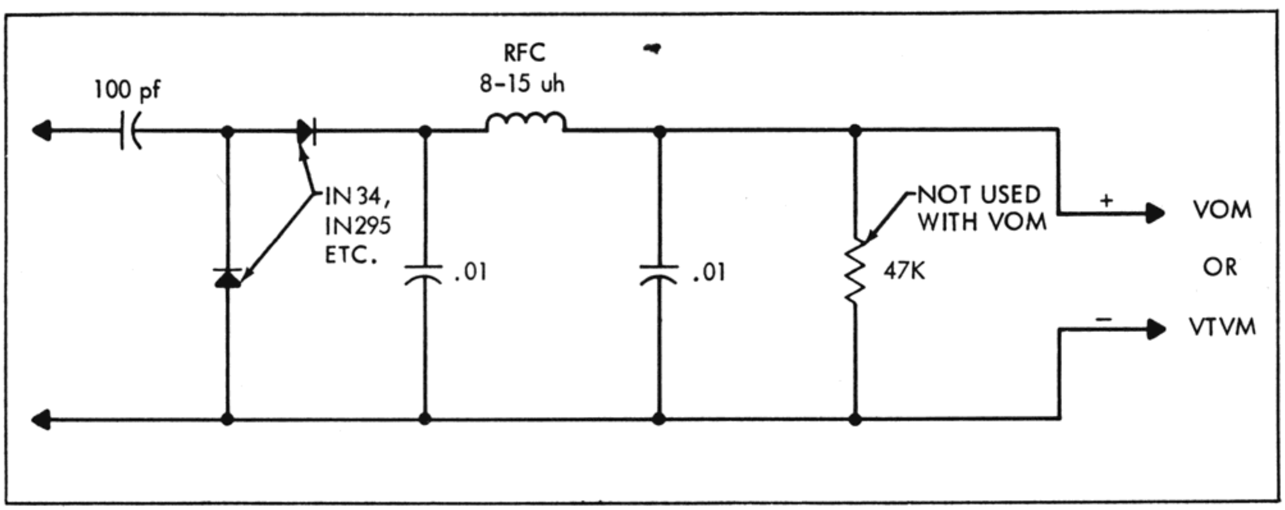


Fig. 4 RF PROBE

TABLE I
RECEIVER DC VOLTAGES

Transistor Stage		Input Signal, uV		
		0	100	10K
Q 1	C	7.6	9.0	9.5
	B	4.5	1.7	1.25
	E	3.9	1.0	0.7
Q 2	C	5.4	8.3	9.4
	B	1.8	0.6	0.5
	E	1.3	0.3	0.2
Q 3	C	9.7	10.	10.
	B	1.3	0.4	0.3
	E	0.7	0.15	0.1
Q 4	C	2.7	2.7	2.7
	B	9.5	9.5	9.5
	E	10.	10.	10.
Q 5	C	4.8	8.8	9.7
	B	1.8	0.7	0.6
	E	1.2	0.2	.05
Q 6	C	9.2	9.2	9.2
	B	2.5	2.6	2.6
	E	2.0	2.0	2.0
Q 7	C	9.2	3.9	2.2
	B	0.1	0.7	0.6
	E	0	0	0

All voltages measured with VTVM (10 megohm input impedance) values may vary as much as 20%.

TABLE II
RECEIVER INJECTION VOLTAGES

Location	Frequency	Level
Ant Jack	27 MHz	0.4 uV
Q 1 Base	27 MHz	6-9 uV
Q 3 Base	8.5 MHz	12-18 uV
Q 3 Collector	455 KHz	2500 uV
Q 5 Base	455 KHz	300 uV
Q 6 Base	455 KHz	2000 uV

Note: All values to produce 2.2 volts or greater at junction of CR 3, and R 24

TABLE III
OSCILLATOR INJECTION VOLTAGE (RMS RF Volts)

Stage	Loc.	Volts
Q 4	emitter	0.6 - 1.3
L 3	Tap	.08 - .14
L 4	Tap	0.1 - 0.25

TABLE IV
DETECTOR OUTPUT VOLTAGE
(at junction of CR 3, C 32)

Signal Input	Det Volts
0	0.1 - 0.3
100 uV	4.8
10,000 uV	5.2

TABLE V
AUDIO DC VOLTAGES

		unsquelched	squelched
Q 10	C	9.2	12
	B	1.2	0.5
	E	0.6	0.3
Q 11	C	5.0	9.5
	B	0.6	0.3
	E	0	0
Q 12	C	1.0	0.3
	B	7.5	11.0
	E	8.0	9.0
Q 13	C	13.2	13.7
	B	1.0	0.3
	E	0.4	0

TABLE VI
SQUELCH AMPLIFIER VOLTAGES

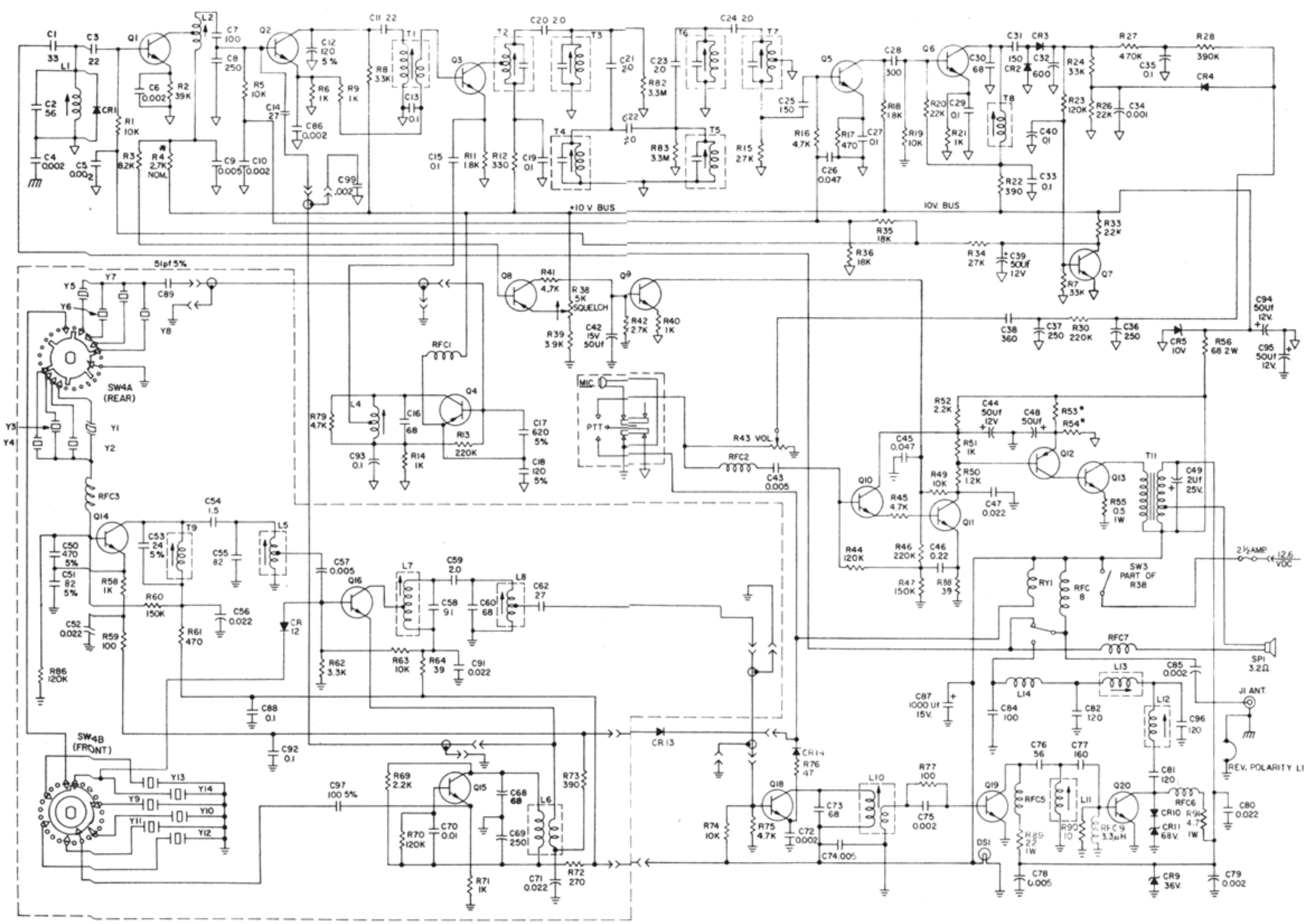
		full squelch	unsquelched
Q 8	C	9.5	0
	B	8.8	8.0
	E	10.0	4.4
Q 9	C	1.6	5.0
	B	2.2	0
	E	1.6	0

	CRYSTAL NUMBER													
Channel No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	T				R				B					
2		T				R			B					
3			T				R		B					
4				T				R	B					
5	T				R					B				
6		T				R				B				
7			T				R			B				
8				T				R		B				
9	T				R						B			
10		T				R					B			
11			T				R				B			
12				T				R			B			
13	T				R							B		
14		T				R						B		
15			T				R					B		
16				T				R				B		
17	T				R								B	
18		T				R							B	
19			T				R						B	
20				T				R					B	
21	T				R									B
22		T				R								B
23				T				R						B

T – Transmit
R – Receive
B – Transmit & Receive

See schematic for crystal frequency.

Fig. 5 – Crystal vs. Channel Identifier

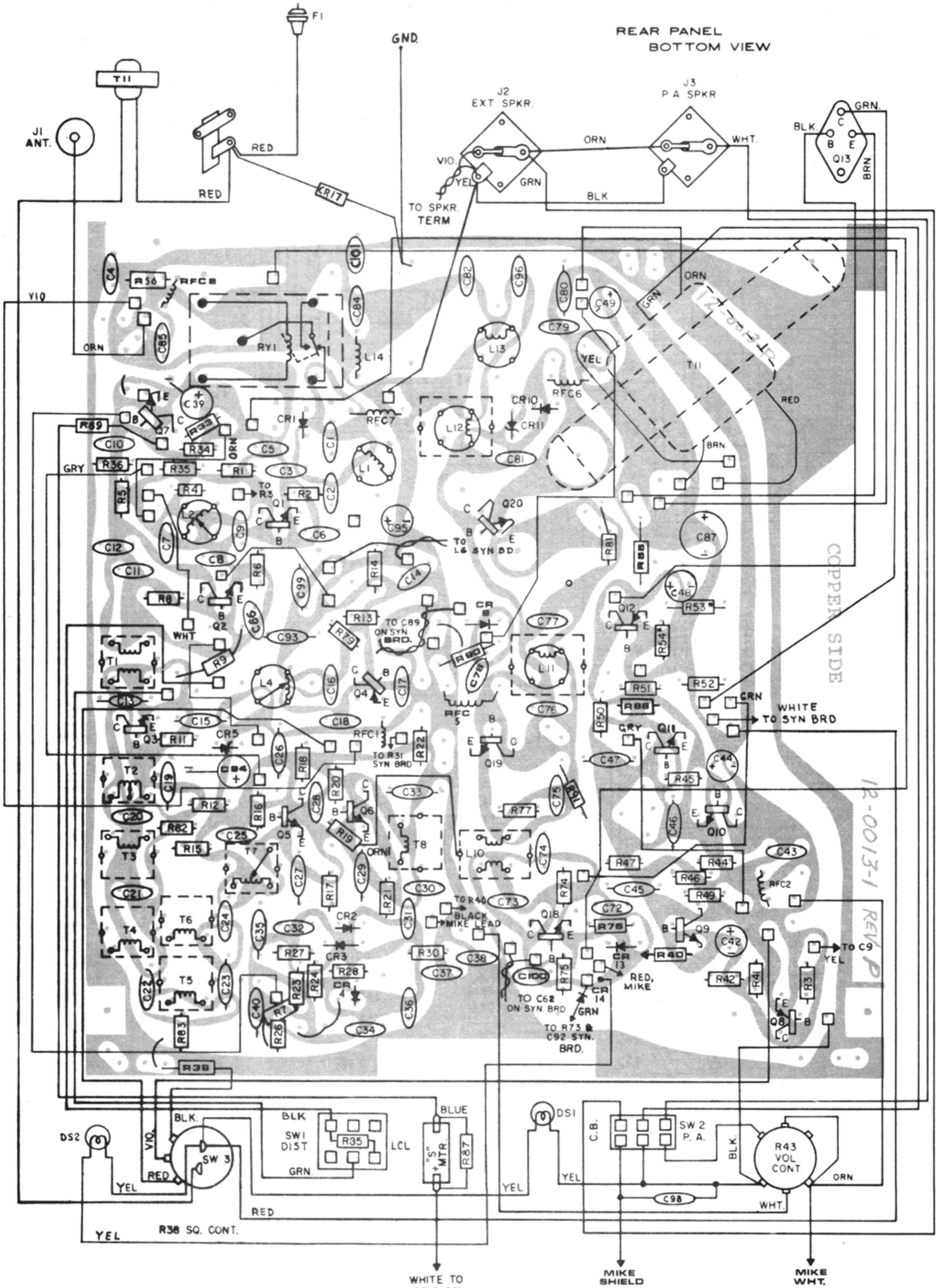


NOTES:

1. ⏚ DENOTES AUDIO, SYNTHESIZER AND XMTR GROUND.
2. ▽ DENOTES RCVR GROUND.
3. ⫫ DENOTES CHASSIS GROUND.
4. DECIMAL CAPACITOR VALUES IN UFD. ALL OTHERS IN PF UNLESS OTHERWISE SPECIFIED. ALL RESISTOR VALUES IN OHMS.
5. SW4 SHOWN IN CHANNEL 23 POSITION.
6. * SELECTED VALUES, SEE SERVICE INFO.
7. AREA ENCLOSED IN DASHED LINES ARE COMPONENTS LOCATED ON FREQUENCY SYNTHESIZER P.C. BOARD.
8. FREQUENCY SYNTHESIZER CRYSTAL FREQUENCIES ARE AS FOLLOWS:

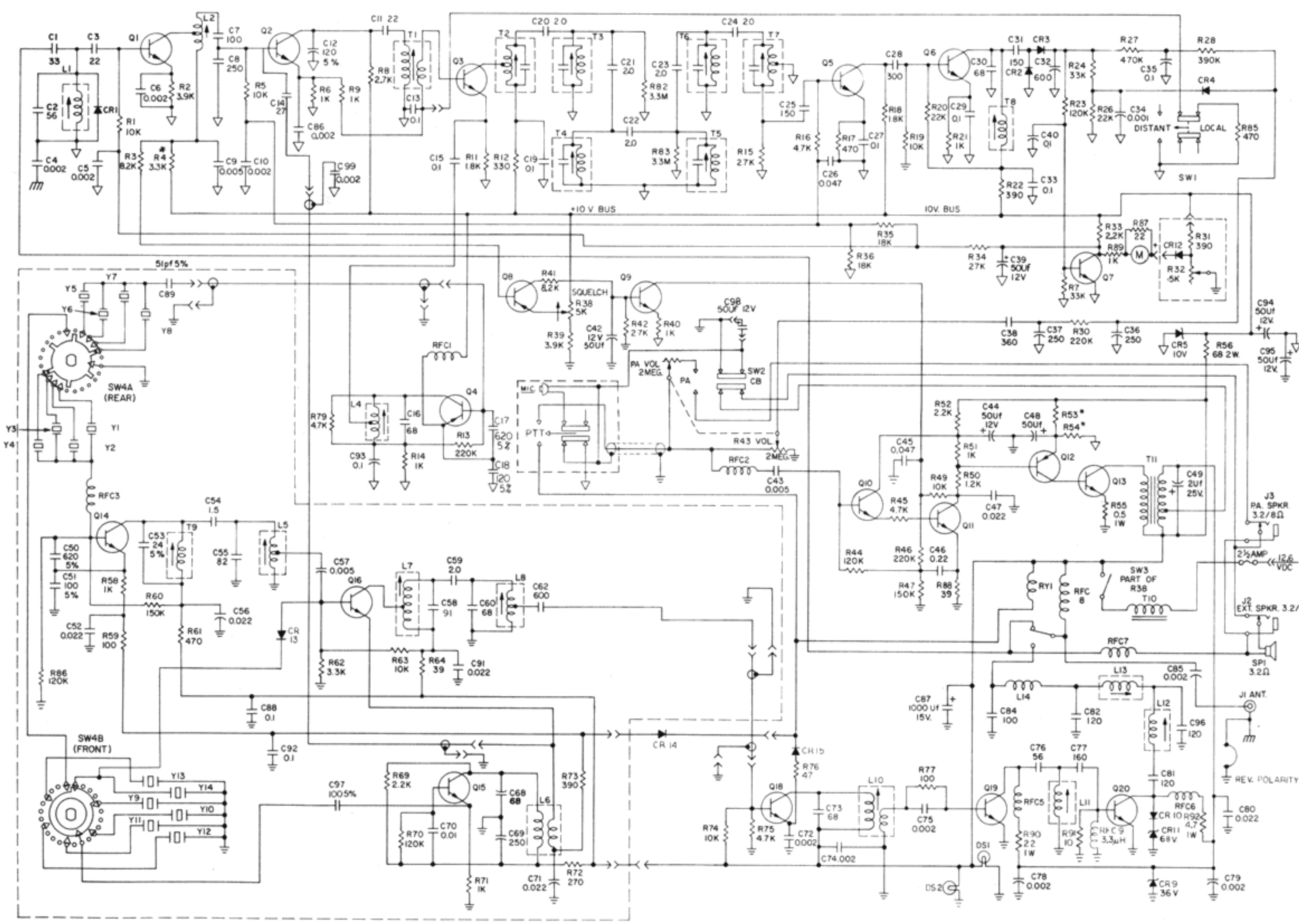
Y1 – 8.006 MHz	Y8 – 8.421 MHz
Y2 – 7.996 MHz	Y9 – 34.971 MHz
Y3 – 7.986 MHz	Y10 – 35.021 MHz
Y4 – 7.966 MHz	Y11 – 35.071 MHz
Y5 – 8.461 MHz	Y12 – 35.121 MHz
Y6 – 8.451 MHz	Y13 – 35.171 MHz
Y7 – 8.441 MHz	Y14 – 35.221 MHz

SCHEMATIC DIAGRAM MODEL 223
PATHCOM INC. 11-0036 D
REDRAWN BY JK



FRONT PANEL
BOTTOM VIEW

10-5005-575



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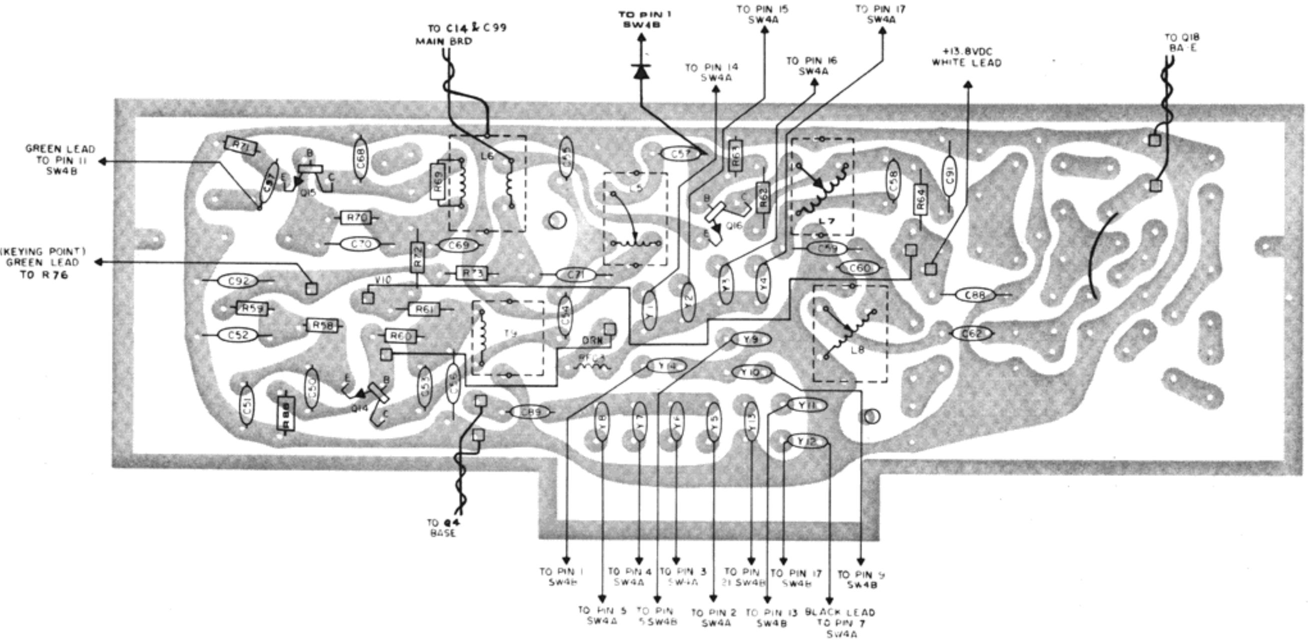
SCHEMATIC DIAGRAM MODEL 2376 A
PATHCOM INC. PACE DIVISION
11-0038 C

MODEL 223

SYNTHESIZER OUTPUT BOARD
BOTTOM VIEW
(COPPER SIDE)



2376 B

SYNTHESIZER OUTPUT BOARD
BOTTOM VIEW
(COPPER SIDE)