MOTOROLA

PAC•RT
Portable/Mobile Vehicular Repeater System
Model H14TTY3110A

SPECIFICATIONS

GENERAL

Dimensions:	2½"H × 10½"W × 12½"D (64 × 263 × 318 mm)
Weight:	10 lbs. (4.54kg) less cables and charger
Attack Time: (Priority Unit)	300 msec maximum
Temperature Range:	−30°C to +60°C, +25°C reference
Power Input:	13.8Vdc, ±15%
Single-tone Encoder/Decoder:	Plug-in element: 800-1400 Hz
Time-Out Timer:	Two minutes ± 0.5 minute
Channel Capability:	C1R1

RECEIVER

Frequency Range:	450-470 MHz
Frequency Stability:	±0.0015%
Channel Spacing:	25 kHz
Current Drain:	350 mA
Sensitivity	
20 dB Quieting:	1.0 uV
12 dB Sinad:	.80 uV
Squelch Sensitivity:	1.0 uV (adjustable)
Modulation Acceptance:	7 kHz
Intermodulation:	−60 dB
Spurious and Image	
Response:	−50 dB
Selectivity:	−70 dB
PL Decoder:	Plug-in Reed: 67-192.8 Hz
Audio Distortion:	5%
Audio Level:	1.0 V rms (nominal into 100 Ω)
Audio Response:	+1, −3 dB referenced to 6 db/octave pre-emphasis

TRANSMITTER

Frequency Range:	450-470 MHz
RF Power Output:	250 mW minimum
Modulation:	16F3
Frequency Stability:	±0.0005% Standard
Current Drain:	500 mA
Audio Distortion:	5%
Audio Response:	+1, −3 dB referenced to 6 dB/octave pre-emphasis
Conducted Spurious:	−40 dB
Deviation:	Continuously adjustable to ±5 kHz

MOBILE DETECTOR (Optional)

Frequency Range:	30-50 MHz	150.8-174 MHz
Number of Channels:	1 to 4	1 to 4
Modulation Acceptance:	7 kHz	7 kHz
Frequency Stability:	+0.005%	±0.0025%
Selectivity:	−40 dB	−70 dB
Spurious Response:	−40 dB	−50 dB
Squelch Sensitivity:	1 uV	1 uV
Sensitivity: (20 dB Quieting)	1 uV	1 uV

Specifications Subject To Change Without Notice

RELATED PUBLICATIONS AVAILABLE SEPARATELY

Operating Instructions	68P81009C95
Theory/Maintenance Manual	68P81010C05

SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to this equipment. Proper use of this radio will result in exposure below the OSHA limit.

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle in within two feet (0.6 meter) of the antenna.

DO NOT operate the transmitter of any radio unless all rf connectors are secure and any open connectors are properly terminated.

DO NOT hold the transmit (PTT) switch on when not actually desiring to transmit.

DO NOT allow children to play with any radio equipment containing a transmitter.

DO NOT operate a transmitter near unshielded electrical blasting caps or in an explosive atmosphere unless it is a type especially qualified for such use.

EPF-10431-O

Service Manual
68P81010C09-A

INSTALLATION

1. CABLE ROUTING

Determine convenient locations for the PAC•RT vehicular repeater, the vehicular charger or holder, and the antenna. The vehicular repeater may be located in an out-of-the-way place close to the mobile unit (within six feet). The vehicular charger or holder mounts to the dash on a trunnion bracket and the antenna is a trunk lip mount type.

With the vehicular repeater, charger or holder, and antenna in place (not mounted) in their approximate positions, the cable should be routed between them. Allow enough slack cable to permit the plug to be easily connected or disconnected from the vehicular repeater, charger or holder, and antenna.

2. PAC•RT VEHICULAR REPEATER INSTALLATION

Choose a location for the vehicular repeater where the mounting screws are not directly above the gas tank, gas line, brake line, electrical cable, or other vital parts if possible. If the unit must be mounted over a gas tank, gas line, brake line, or electrical cable, care must be taken that the mounting screws will not pierce nor interfere with these parts. NEVER MOUNT ABOVE A MUFFLER, CATALYTIC HEATER, OR OTHER HEAT PRODUCING DEVICE.

Always make a preliminary check to see how far the screws will extend below the vehicle floor. If it appears that they may interfere with parts mounted under the floor, thick spacers may be used.

1 • SET UNIT UPRIGHT ON FIRM SUPPORTING SURFACE.

• INSERT KEY AND TURN CLOCKWISE. HANDLE WILL SPRING OPEN.

• SWING HANDLE OUT TO FULL OPEN POSITION.

2 • HOLDING CASE AND BOTTOM PLATE TOGETHER WITH LIGHT PRESSURE AND SIMULTANEOUSLY PRESSING DOWN ON MOUNTING HOLE BLISTER, PULL UNIT UP BY HANDLE. PLATE IS FREE TO FALL AWAY.

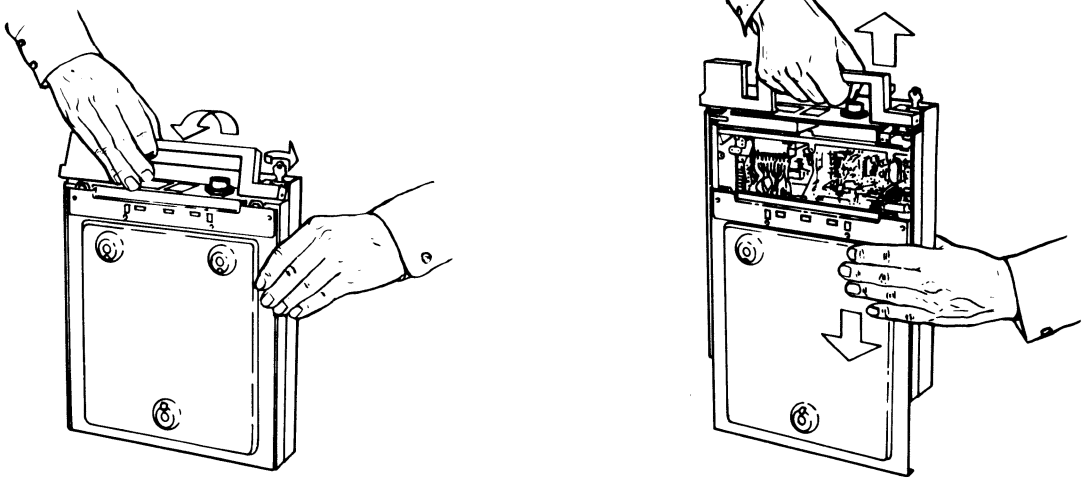

Figure 1. Bottom Plate Removal AEPF-6885-O

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MOTOROLA INC.

MANUAL REVISION

for
Manual No. 68P81010C09-A
Portable / Mobile
Vehicular Repeater System

This revision outlines changes that have occurred since the printing of your manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

NO.	CHANGE AFFECTS	ITEM NO.	SUFFIX
1	GENERAL INFORMATION	NKN6371A	---
		NKN6372A	---
		NKN6374A	---
		NKN6375A	---
2	INTERFACE CABLE KIT ("SYNTOR X")	NKN6314A	__
3	Vehicular Repeater Main Logic Board		

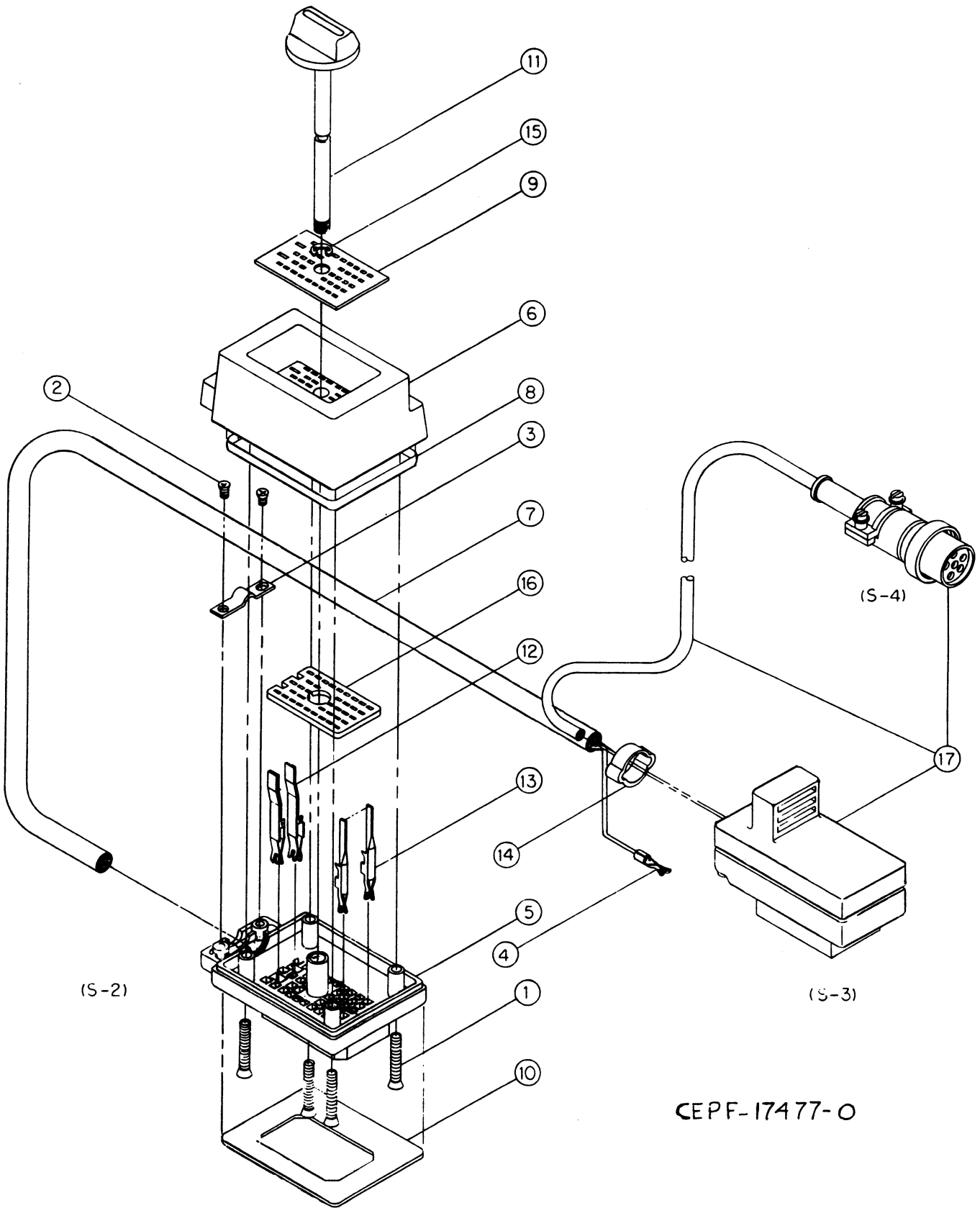
CHANGES
NO.

1 Add the following information to your manual:

NOTE:
KITS NKN6371A, NKN6372A, AND NKN6375A USE EXPLODED VIEW CEPF-17477-0, WHILE KIT NKN6374A USES EXPLODED VIEW CEPF-17494-0.

2 On the NKN6314A INTERFACE KIT FOR " SYNTOR X, " change Motorola Part No. 2883485M01 to 2883485M05.

3 On page 33, VEHICULAR REPEATER PARTS LIST, change Motorola Part No. 0600124D46 10 Meg to 0611009D33 5.6 Meg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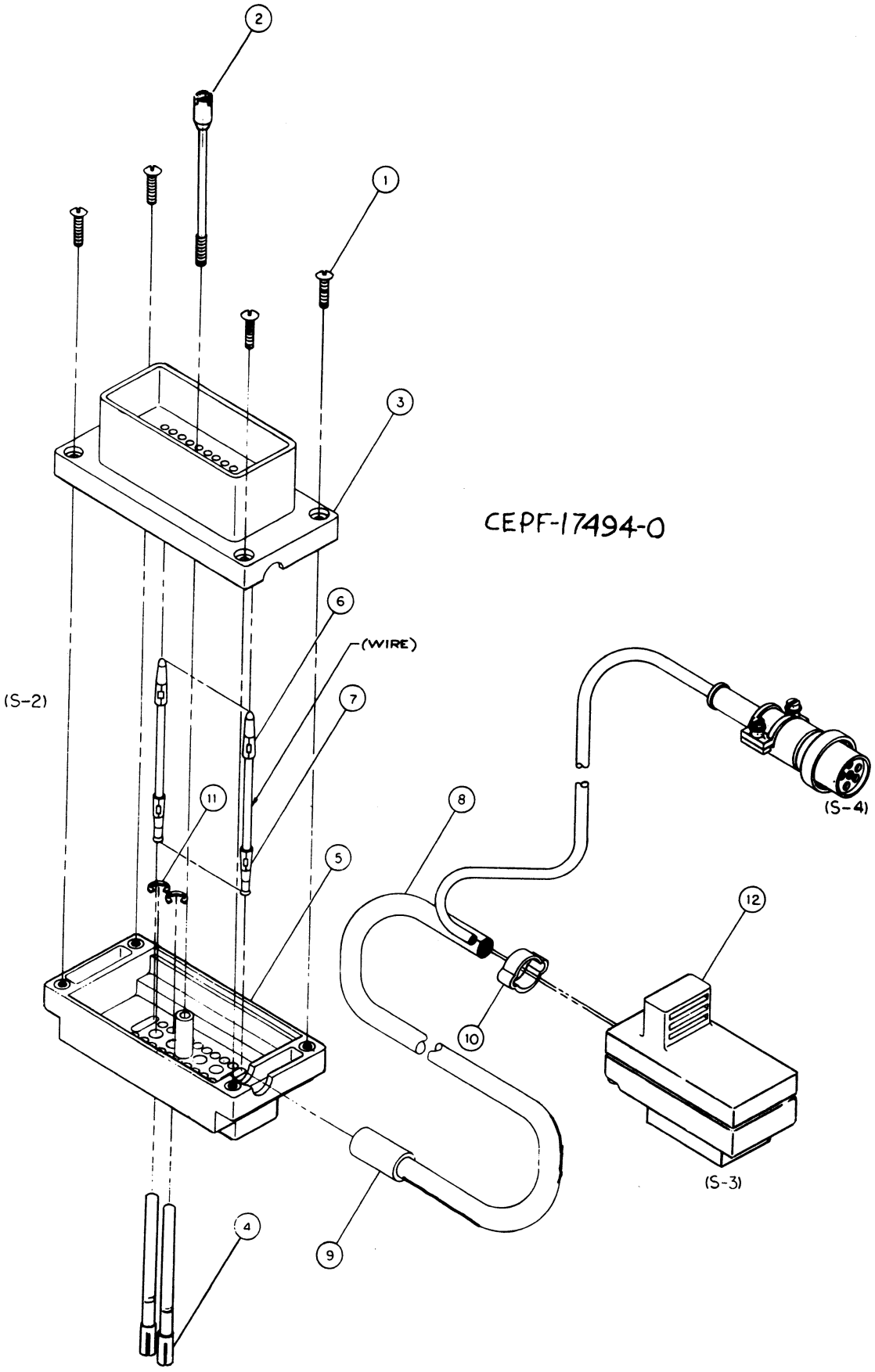
CEPF-17477-O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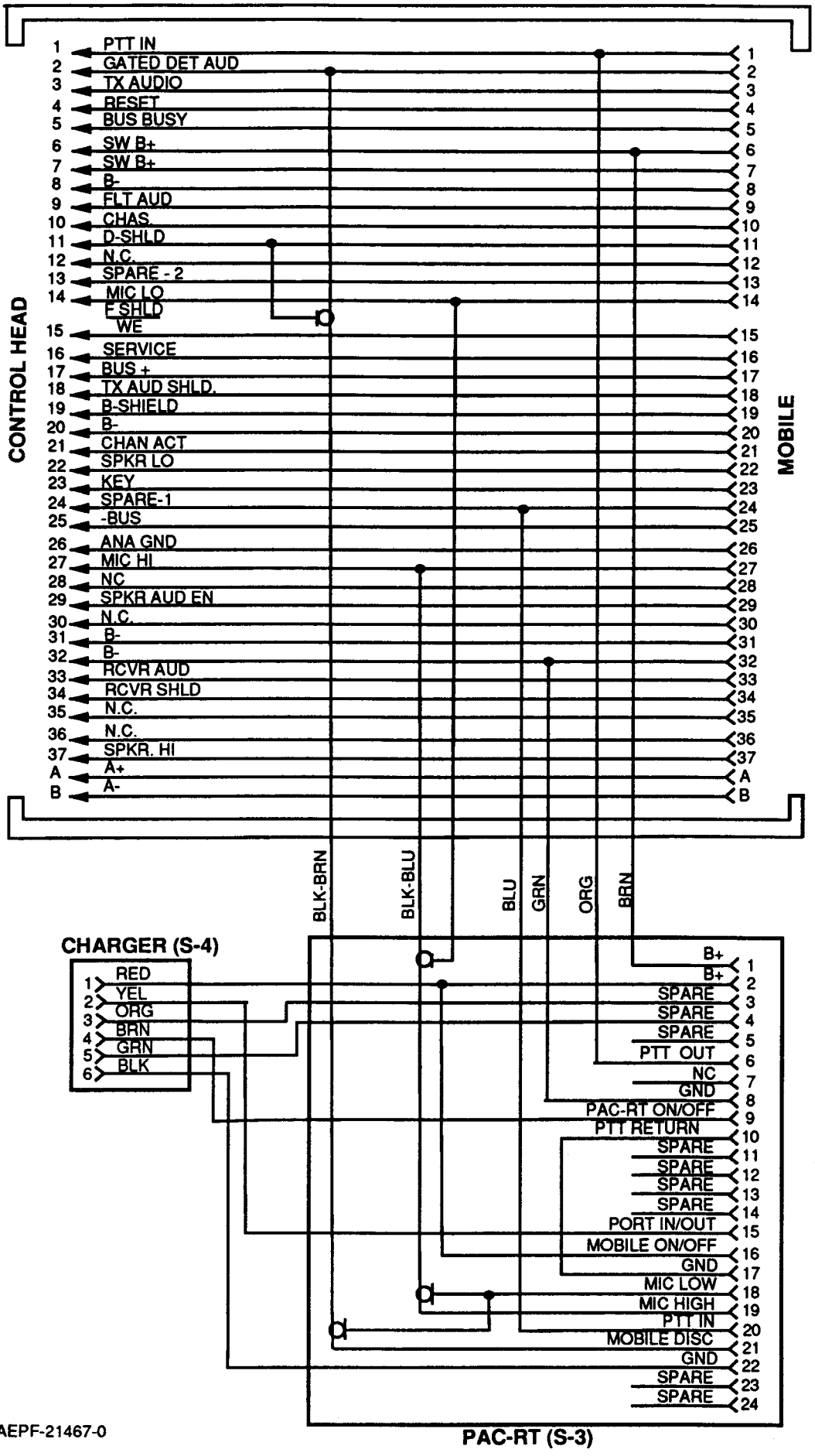
NKN6371A SYNTOR X 9000 Conventional
NKN6372A SYNTOR X 9000 Trunked
NKN6375A SYNTOR X NKN6314A Replacement

REF. NO.	PART NO.	DESCRIPTION
1	0310944B28	Screw (4 req'd)
2	0310945A10	Screw (2 req'd)
3	0780266L01	Strain Relief
4	0984151B03	Receptacle, Contact
5	1580158K03	Housing, T-Connector
6	1580159K03	Cover, T-Connector
7	3005732Q01	Cable, Shielded (6 ft.)
8	3280058H03	Gasket
9	3280072J01	Gasket
10	3280004L02	Gasket
11	3680220B05	Knob, Extended
12	3980161K02	Contact, Power
13	3980162K02	Contact, Signal
14	4205612Q01	Clamp
15	4280156B01	Ring, "C"
16	4680010L01	Guide
17	0105951N11	PAC Connector (Assembly) consisting of:
	0300138901	Screw, #6-32 x5/8 (3 req'd)
	0984086B01	Receptacle, Housing; (37 pin)
	0984151B03	Receptacle, Contact (9 req'd)
	1505572D01	Front Housing
	1505573D01	Rear Housing
	2884510H01	Connector, 6-Pin
	3005635D01	Cable (17 ft.)
	3700842245	Strain Relief
	4200850817	Clamp

NKN6374A GE DELTA SX

REF. NO.	PART NO.	DESCRIPTION
1	0300138729	Screw, #6-32 x 5/8 (4 req'd)
2	0305173R01	Screw, Special
3	0905175R01	Receptacle, Connector
4	2205429E03	Power Pin (2 req'd)
5	2805174R01	Plug, Connector
6	2982335A01	Terminal, Chain Form (36 req'd)
7	2982336A01	Terminal, Chain Form (36 req'd)
8	3005214R01	Cable, 15-Conductor (4 ft.)
9	3700830417	Sleeving
10	4205612Q01	Strain Relief
11	4210219A25	Retainer, E-Ring (2 req'd)
12	0105951N11	PAC Connector (Assembly) consisting of:
	0300138901	Screw, #6-32 x5/8 (3 req'd)
	0984086B01	Receptacle, Housing; (37 pin)
	0984151B03	Receptacle, Contact (9 req'd)
	1505572D01	Front Housing
	1505573D01	Rear Housing
	2884510H01	Connector, 6-Pin
	3005635D01	Cable (17 ft.)
	3700842245	Strain Relief
	4200850817	Clamp

NKN6371A SYNTOR X 9000 CONVENTIONAL (S-2)



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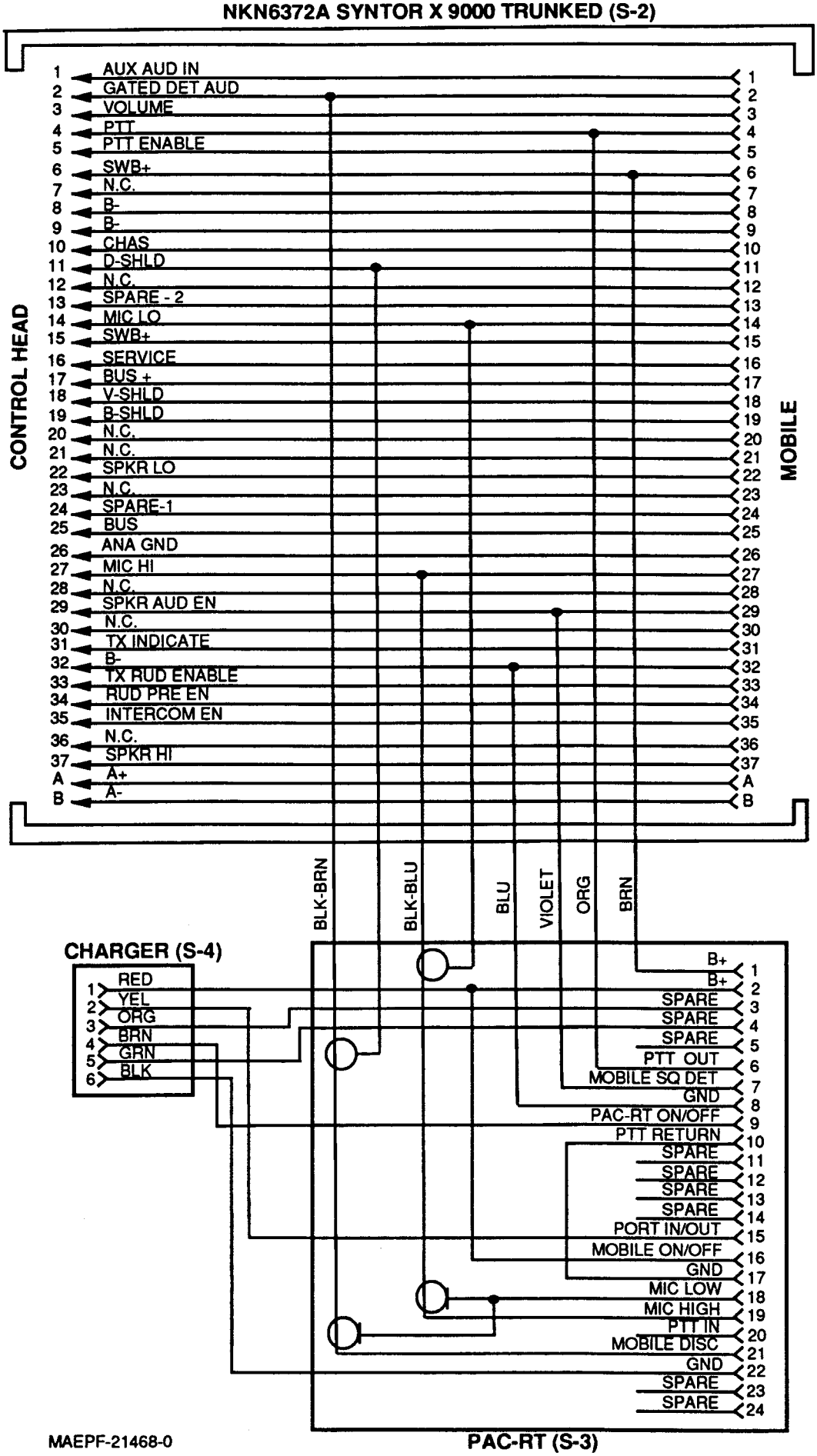
NKN6372A SYNTOR X 9000 TRUNKED (S-2)



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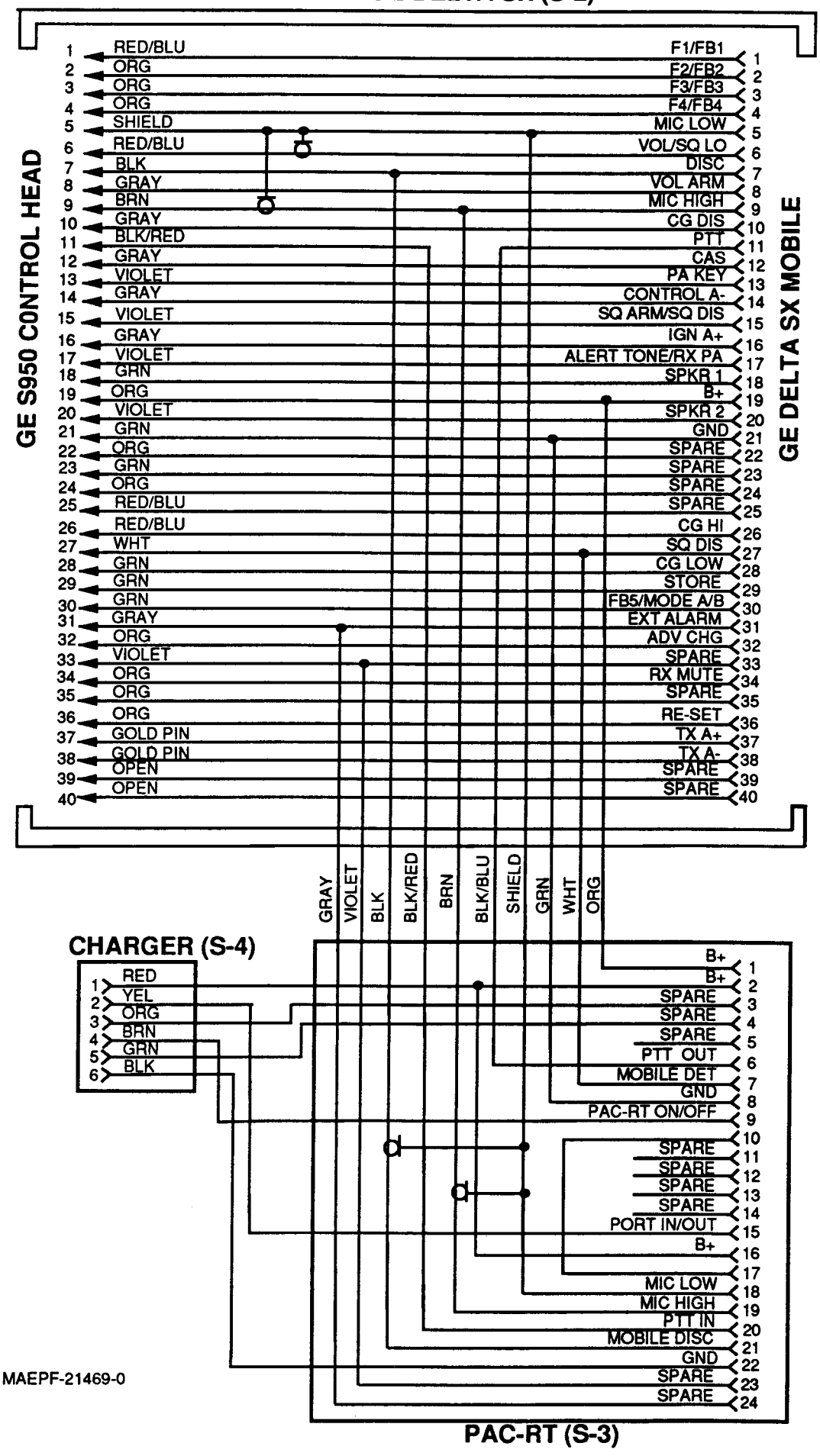
NKN6374A GE DELTA SX (S-2)



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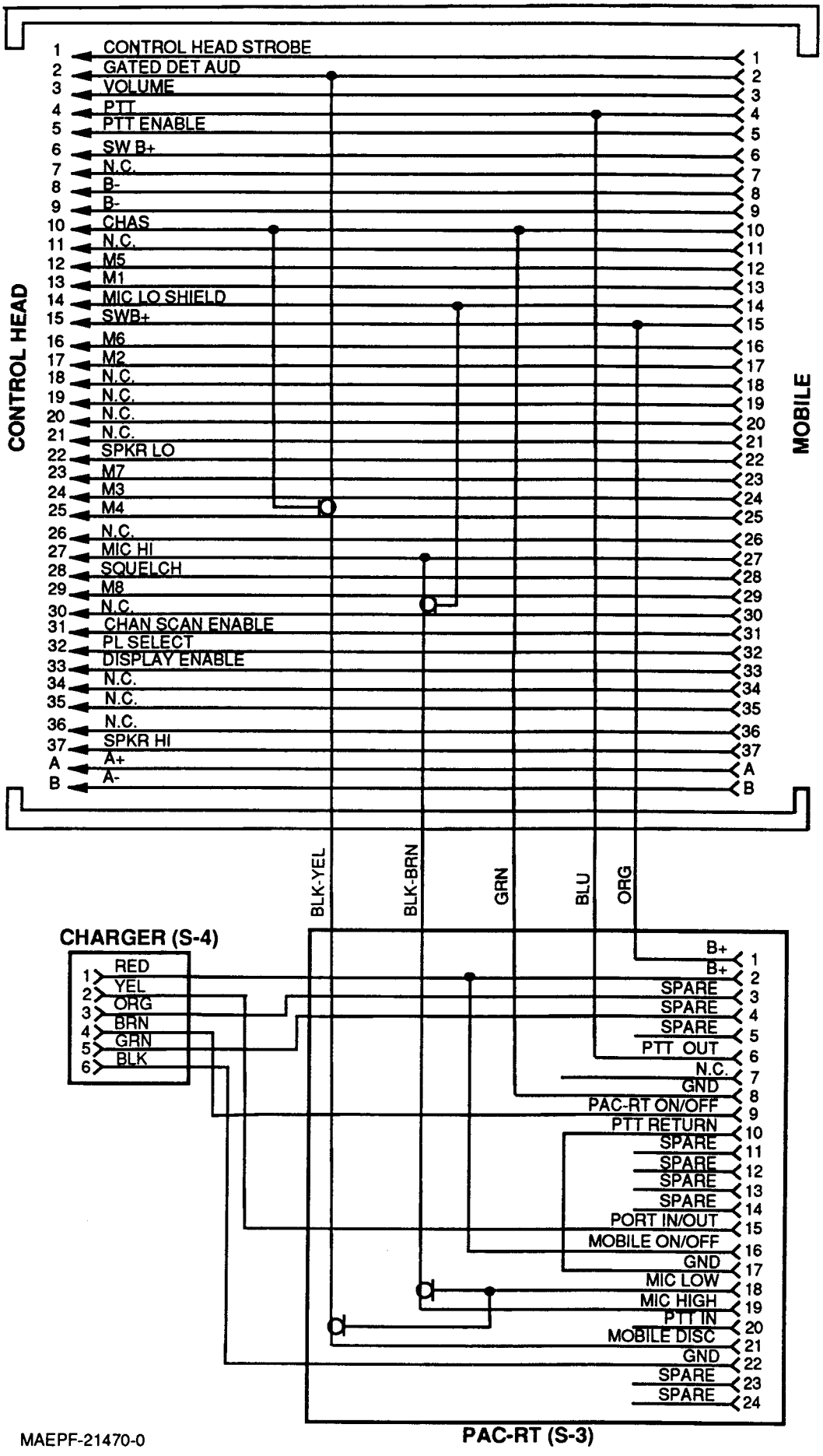
NKN6375A SYNTOR X NKN6314A REPLACEMENT



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MOTOROLA

MANUAL REVISION

for

Manual No. 68P81010C09-A
PACe RT Service Manual

This revision outlines changes that have occurred since the printing of your manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

NO.	CHANGE AFFECTS	ITEM NO.	SUFFIX
1	Parts List	NUE6252A	3
		NUE6252B	8
2	Parts List	NUE6252A	---
		NUE6252B	---
3	Parts List, Schematic Diagram	NLN4358A	11
		NLN8982A	11

CHANGES

NO.	REF. SYM.	ACTION	PART NO.	DESCRIPTION
1	Q108	changed to	4800869728	**TRANSISTOR:** NPN, Type M9728
2	Y2	changed to	NXN6115A	**CRYSTAL:** 2nd Oscillator 17.445MHz
			NXN6116A	2nd Oscillator 18.355MHz
3	R534	changed to	0611009C53	**RESISTOR:** 1.5k±5%;1/4W

In some vehicles, the bottom of the handle will be pressed against the floor or floor cushioning when the unit is securely mounted to the floor. This will prevent opening the handle far enough to release the unit from its mounting. If this is the case, use thick spacers for mounting.

The unit should be mounted to a level surface to prevent the bottom plate from buckling. For uneven trunk or under-seat areas, a sheet of plywood may be used to mount the bottom plate. The raised shelf in some trunk compartments is a good mounting location. Leave at least three inches of clear space in front of the unit so that the handle can be opened and the main assembly can be removed from the bottom plate.

When the final position has been determined, remove the bottom plate from the unit as shown in Figure 1. Be sure to lift the unit straight up at least one inch before separating the plate to avoid bending the guide pins.

Place the plate in the desired position, and use it as a template to mark the location for drilling the three mounting holes. Drill the holes using a 3/16" drill. Mount the bottom plate, with or without thick spacers as desired; see Figure 2.

Once the bottom plate is mounted, replace the unit assembly onto the bottom plate following the procedure in Figure 3. For removing the unit, reverse the procedure.

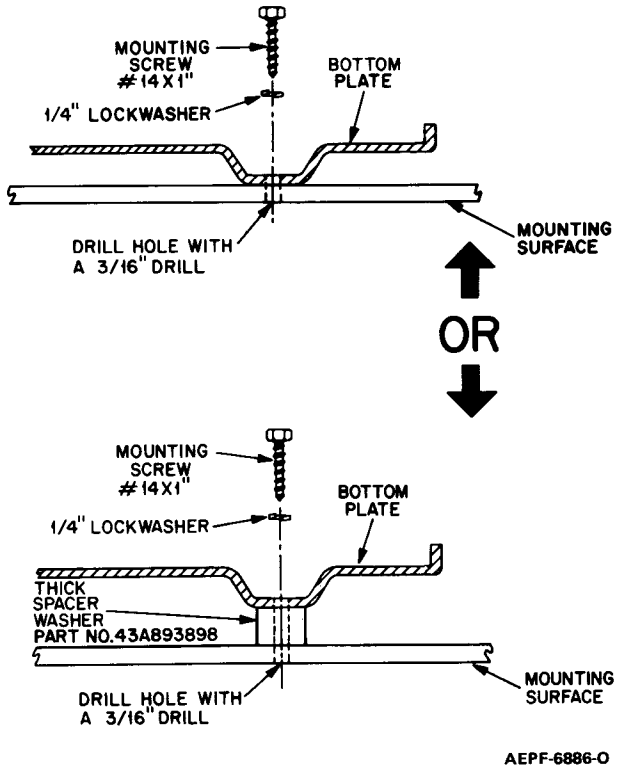
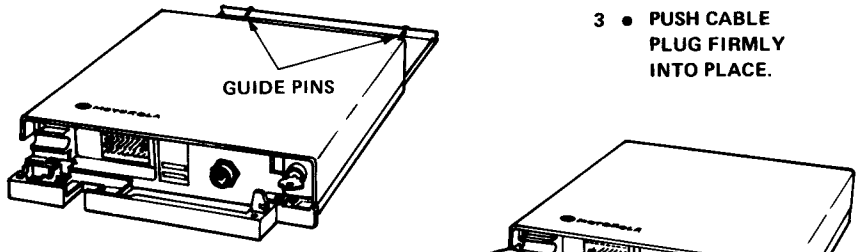


Figure 2. Bottom Plate Installation Detail



1 • SET OR SLIDE UNIT ONTO BOTTOM PLATE. WHEN PROPERLY SEATED, IT WILL SLIDE FREELY.

2 • PUSH UNIT BACK AS FAR AS IT WILL GO. EXTRA PRESSURE WILL BE REQUIRED AS UNIT ENGAGES GUIDE PINS.

3 • PUSH CABLE PLUG FIRMLY INTO PLACE.

4 • TURN KEY COUNTER-CLOCKWISE TO VERTICAL POSITION.

• CLOSE HANDLE. LISTEN FOR LOCKING "CLICK."

• TRY HANDLE TO BE SURE IT IS LOCKED AND UNIT IS LATCHED INTO PLACE.

• REMOVE KEY.

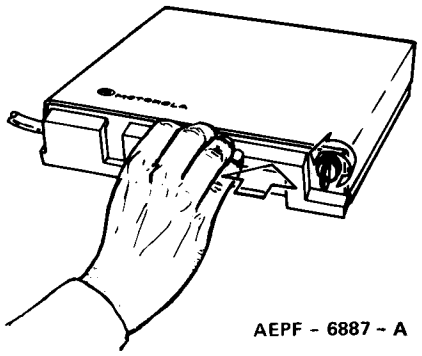


Figure 3. Unit Reassembly

3. ANTENNA INSTALLATION, TRUNK LIP TYPE

Refer to Figure 4 and install the trunk lip mount antenna as follows:

a. Locate and insert two 10-32 UNF-3 x 3/8" set screws into the bracket of the antenna base.

b. Attach the antenna base to the rear lip of the trunk lid and tighten the set screws.

NOTE

Mount the repeater antenna as far from the mobile antenna as possible, never less than three feet.

c. Uncoil the supplied antenna cable and attach the pin plug connector to the antenna connector.

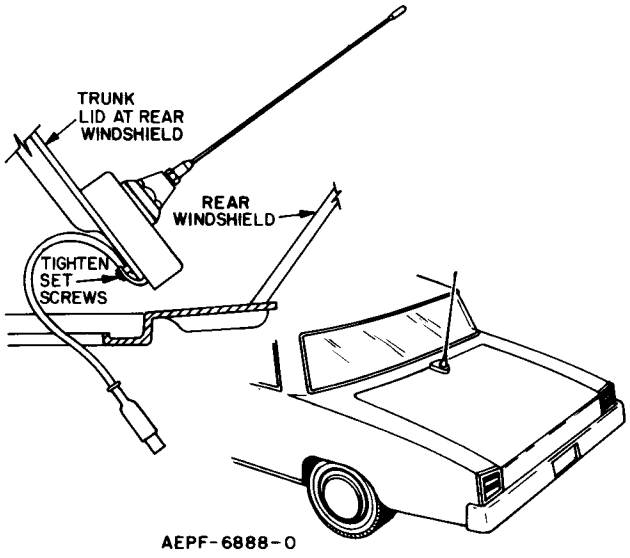


Figure 4. Antenna Installation

d. Connect the antenna cable uhf connector to the PAC•RT vehicular repeater.

e. Cut the antenna to length in accordance with the antenna cutting chart in Figure 5 for the specific frequency of operation.

f. Loosen the antenna clutch nut (topmost nut) on the antenna base. Do not remove the nut (a small sleeve inside could be lost).

g. Insert the cut-to-length antenna rod through the clutch nut and clutch sleeve until it is firmly seated in position in the antenna base. Tighten the clutch nut.

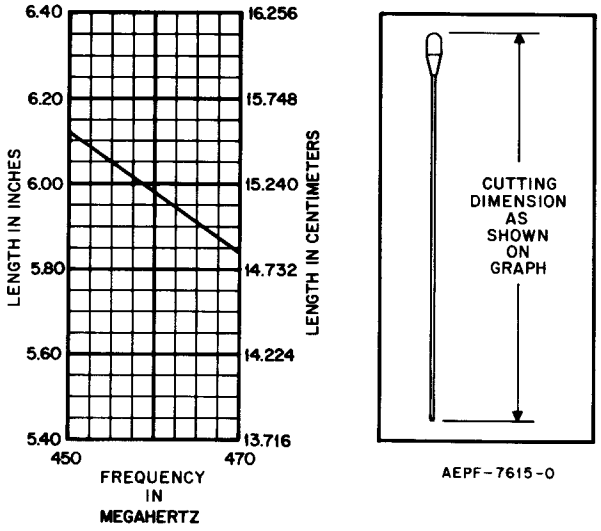


Figure 5. Antenna Cutting Chart

4. CONTROL UNIT INSTALLATION

The PAC•RT vehicular repeater control unit may be a control unit/vehicular charger, a control unit/holder, or a control unit only. Mounting hardware is supplied with each unit for mounting the control unit below the dashboard. Refer to Figure 6 for the control unit/vehicular charger or the control unit/holder mounting details. Refer to Figure 7 for the control unit mounting details.

a. Using the control unit mounting bracket as a template, drill the appropriate size holes in a convenient place on the under side of the dash.

b. Mount the control unit mounting bracket to the dash using the mounting hardware designated in Figure 6 or 7 as applicable.

c. Mount the charger or holder to its bracket using the four 1/4-20 bolts, lockwashers, and flat washers provided. The flat washer MUST be placed between the lockwasher and the bracket to ensure proper locking action of the lockwasher. Do not tighten the four bolts.

d. Rotate the charger or holder to a position that provides about a 45-degree mounting angle. This angle provides operational convenience for the operator and physical security for the portable radio under rough traveling conditions. Tighten the four mounting bolts holding the charger to the bracket.

e. Attach the cable from the repeater to the rear of the control unit.

5. FINAL CABLE INSTALLATION

Refer to Figure 8 or 9 for the interfacing of the cable assembly between the existing mobile radio and control head and the PAC•RT vehicular repeater and charger. Note the different cable lengths of the cable assembly being added; they will be used as a means of identification. Perform the following procedure:

a. Disconnect the plug from the existing mobile radio and connect it to the male plug as shown in Figure 8 or Figure 9 for the specific mobile radio used. In Figure 8, the plug is on a two-foot piece of cable; in Figure 9, it is a feed-through connector.

b. On the same cable or feed-through connector, connect the female plug to the existing mobile radio.

c. Locate the female plug on the end of the six-foot section of cable, and connect it to the vehicular repeater.

d. The charger or holder and antenna cables should already be connected (see paragraphs 3. d. and 4. e.).

e. To minimize pinching or crushing of the cables by boxes or equipment being set upon them, dress the cables in an out-of-the-way place.

6. SPECIAL FEATURES

The digital logic circuitry of the PAC•RT vehicular repeater prevents interference caused by several repeaters being activated at the same time. Even if eight or more repeaters are being used in the same area at the same time, only-one unit repeats the communication in either direction.

A portable priority interrupt feature gives the operator "talk-back" ability from the portable radio. This overcomes the problem of repeater access when the mobile channel is active. Without priority interrupt, the operator could be locked out of the system until the channel is clear, even though it may only be "skip" or some other interference tying up the channel.

The time-out timer circuit prevents prolonged system tie-up. Should the time-out timer turn off the priority PAC•RT vehicular repeater, the logic circuit automatically removes the repeater from the priority state, allowing another unit in the system to assume the repeat function.

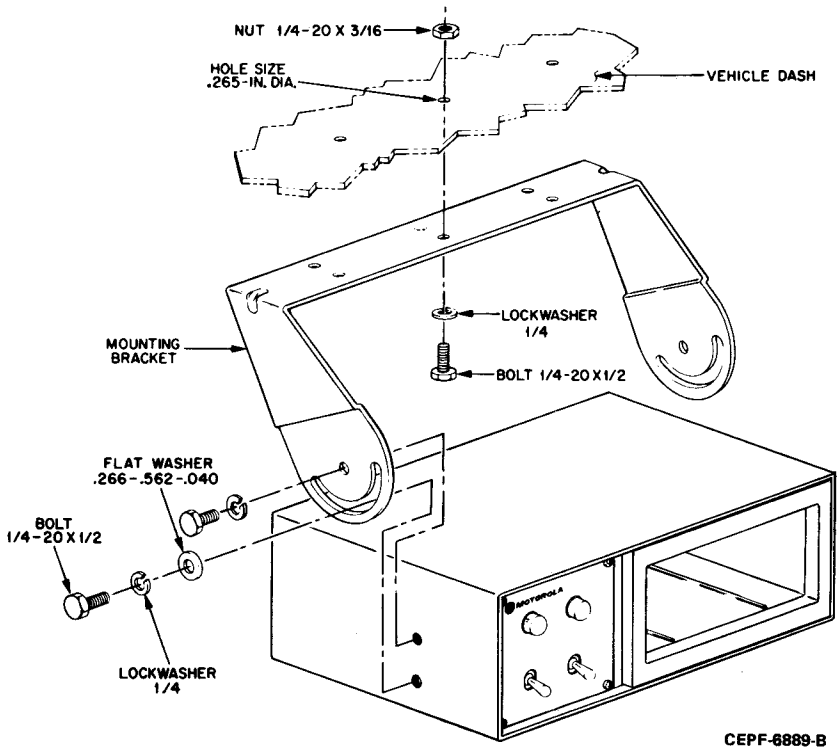


Figure 6. Vehicular Charger or Holder Installation Detail

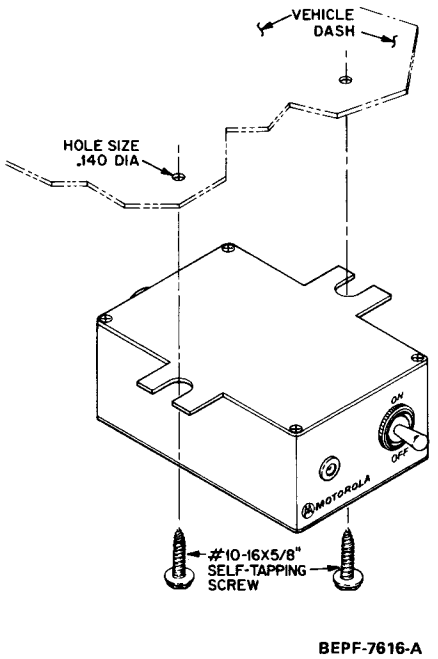


Figure 7. Control Unit Installation Detail

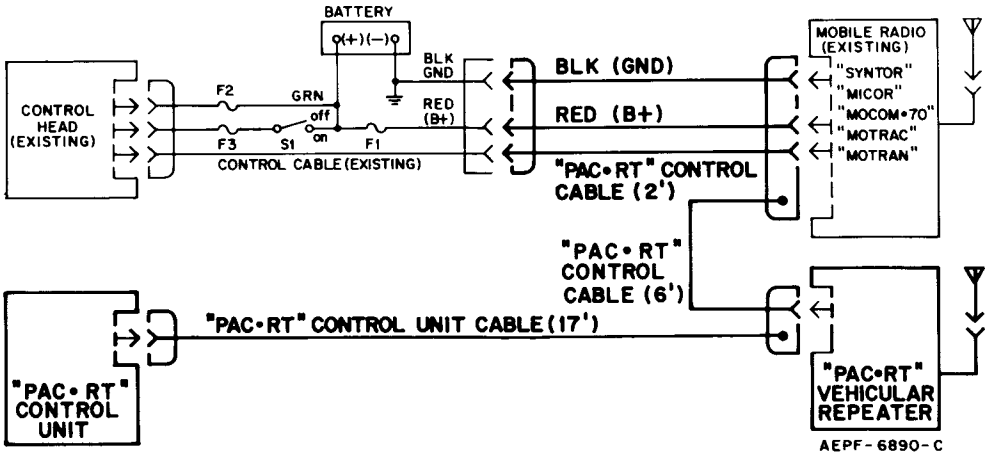


Figure 8
"Syntor," "Micor," "Mocom•70," "Motrac," and "Motran"
Cable Assembly Installation Detail

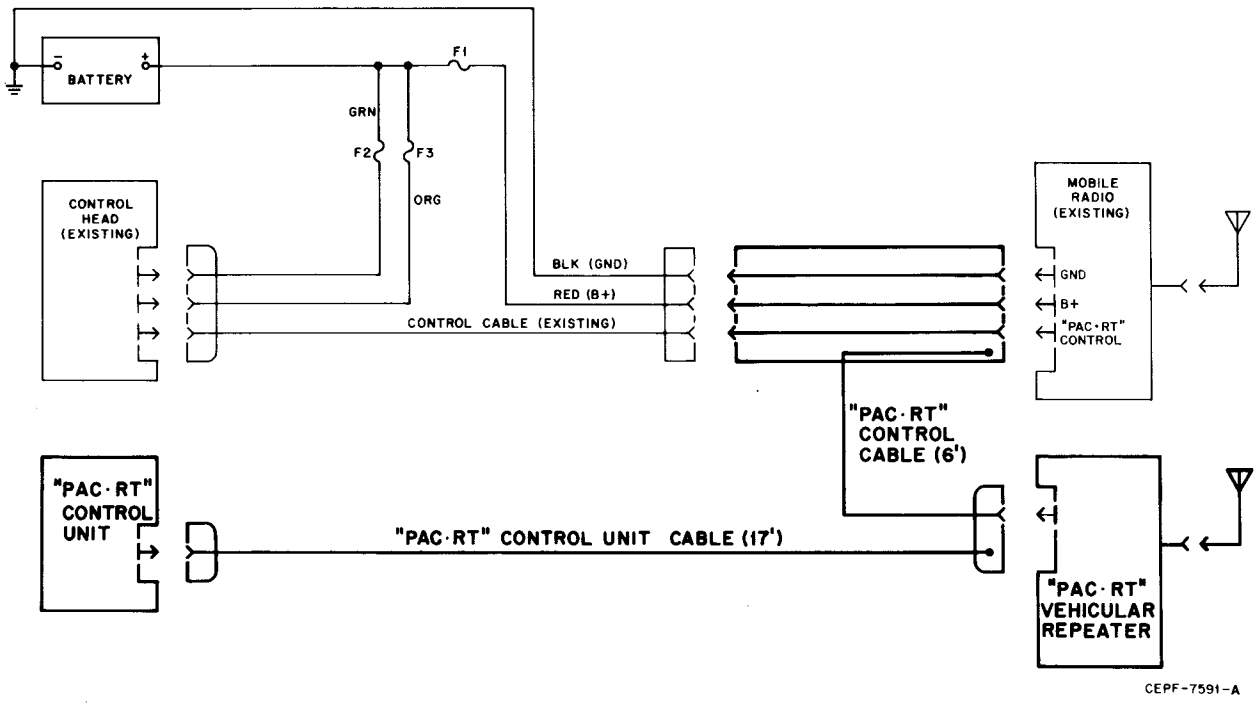


Figure 9.
GE "MASTR Progress Line" and "MASTR II"
Cable Assembly Installation Detail

7. ADJUSTMENTS

NOTE

No adjustments are required to be made to the existing mobile radio.

After the PAC•RT vehicular repeater has been completely wired to the existing mobile radio installation, the repeater requires adjustment. Adjustments necessary are the vehicular repeater deviation adjust, the mobile deviation adjust, and the mobile squelch adjust. For all practical purposes, both deviation adjustments are level adjustments and in no way adjusts transmitter deviation of the mobile or repeater units. If the mobile radio is equipped with PL, there is a mobile PL squelch adjustment that must be made. Perform the following procedures.

CAUTION

Because of the "priority-interrupt," it is possible that the mobile radio can be "keyed" if the repeater receives a properly PL encoded signal. To prevent this from happening and damaging the signal generator, it is essential that PL reed E302 be removed anytime a signal generator is directly connected to the mobile radio.

a. Vehicular Repeater Deviation (Level) Adjust

(1) If the PAC•RT repeater is equipped with the mobile PL option, set the channel selector on the control head to channel 1, and ground the collector of Q313 or set channel selector to a non-PL channel if one exists. Remove PL reed E302 to prevent keying the mobile unit, and to protect the signal generator from damage.

(2) Apply a 1000 uV on-channel signal modulated with a 1 kHz tone at ±3 kHz deviation to the mobile antenna jack.

(3) Adjust REPEATER DEV ADJ R303 to provide ±3 kHz deviation on the portable channel. Remove signal generator from the mobile antenna jack.

(4) DO NOT REINSTALL "PL" REED E302 UNTIL SPECIFICALLY INSTRUCTED.

b. Mobile Deviation (Level) Adjust

(1) Ground Q312 collector (S1 on relay K1).

(2) Apply a 1000 uV, on-channel, portable signal modulated with a 1 kHz tone at ±3 kHz deviation to the PAC•RT antenna jack.

(3) Adjust MOBILE DEV ADJ R481 to provide ±3 kHz deviation on the mobile channel.

(4) Remove the ground from Q312 collector (S1 on relay K1).

c. Mobile Squelch Adjust

(1) Apply a 20 dB quieting signal to the mobile antenna jack.

(2) Adjust MOBILE SQ ADJ R305 until the PAC•RT unit begins to transmit.

(3) Remove the signal and verify that the repeater stops transmitting.

(4) Remove the ground from Q313 collector (grounded in step a.(1)).

d. Mobile PL Squelch Adjust

(1) Set channel selector to a PL position. Apply a 10 dB quieting signal to the mobile antenna jack.

(2) Modulate the signal with the desired PL frequency at ±0.5 kHz deviation.

(3) Adjust MOBILE PL ADJ R304 until the PAC•RT unit begins to transmit.

(4) Remove the signal and verify that the repeater stops transmitting.

e. Disconnect all test equipment, and reinstall PL reed E302. Reassemble the vehicular repeater to its base plate.

8. OPTIONAL FEATURES

An optional mobile detector is available for the mobile radio systems using different transmit and receive frequencies, as when a two-frequency simplex system is in use. Such offset frequencies do not allow the portable radio user to determine if the mobile channel is in use. By using the optional mobile detector, the logic circuit in the PAC •RT vehicular repeater senses the use of other channels and ensures that multiple repeaters in the same general area are not "keyed."

In some systems utilizing base station repeater, the repeater provides the means to monitor the mobile transmit frequency in place of a mobile detector. To do this, the 400 mS count-down clock is increased to 700 mS. This change allows the extra time required for the base station repeater to respond. Refer to Step 4 of the Vehicular Repeater Alignment Procedure.

SYSTEM ALIGNMENT

1. GENERAL

After the vehicular repeater has been completely connected into the existing mobile radio installation, several adjustments must be made in the repeater. The REPEATER DEV ADJ control and the MOBILE DEV ADJ control must be set. Also, the MOBILE PL ADJ control (if applicable) and the MOBILE SQ ADJ control must be set. These controls, located on the "PAC•RT" main circuit board, must be adjusted with the actual mobile radio being used with the repeater due to the variations between mobile radios.

The transmitter - receiver and the optional monitor receiver circuit boards are aligned at the factory and should not need realignment. Realignment may be required if components are replaced or have aged. If necessary, refer to the specific alignment procedures for the transmitter - receiver circuit board and the monitor receiver circuit board.

The vehicular repeater can be aligned more readily on the bench or it can be aligned in the vehicle. The only adjustments that MUST be made in the vehicle are the mobile squelch, mobile deviation, repeater deviation, and the mobile PL in the repeater.

NOTE

No adjustments are required to the existing mobile radio.

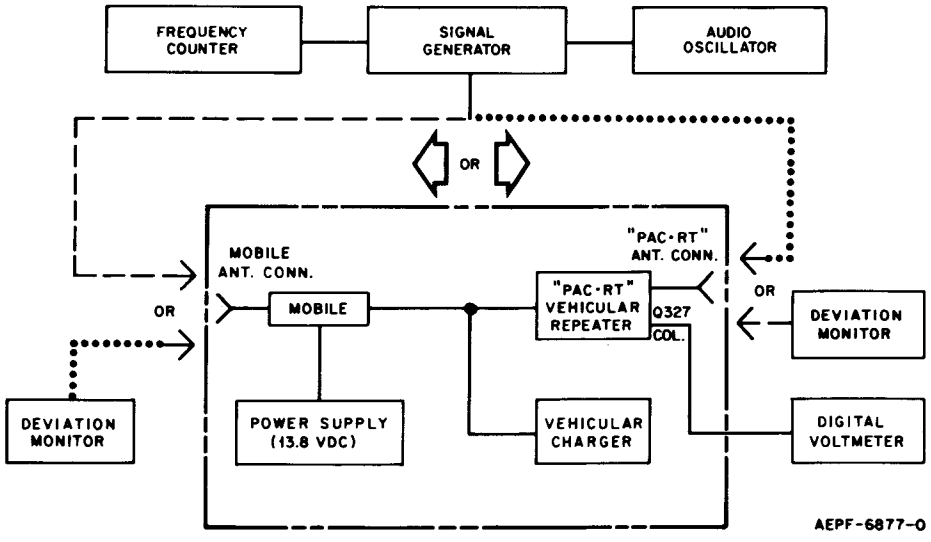
2. VEHICULAR REPEATER ALIGNMENT

a. Remove the vehicular repeater unit from its base; reverse the procedure in Figure 3.

b. If the vehicular repeater is to be aligned in the mobile unit, position the repeater so that the circuit board adjustments are exposed and reconnect the cables. If the vehicular repeater is to be aligned on the bench with a comparable mobile setup, position the repeater so that the circuit board adjustments are exposed and connect the cables to the repeater. Refer to "Alignment Setup."

c. Perform the following alignment procedure:

VEHICULAR REPEATER ALIGNMENT SETUP



VEHICULAR REPEATER ALIGNMENT PROCEDURE

NOTE: Steps 1-4 are not required for installation alignment, and should be performed only if components are replaced or have aged.

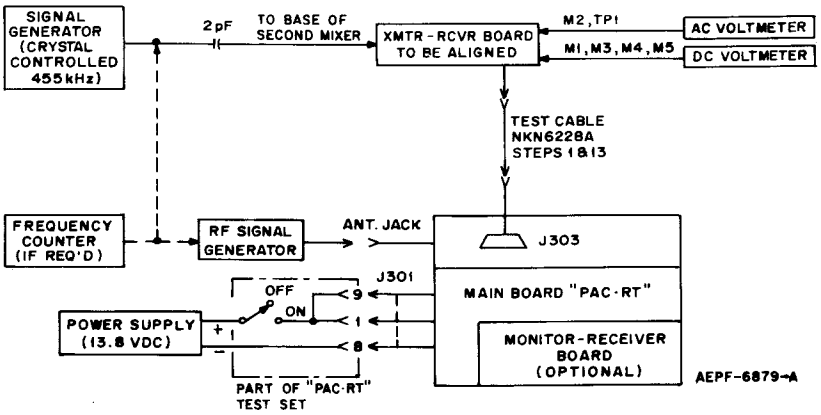
STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	DC Power Supply, Digital Voltmeter	Q327 Collector	R379	REGULATED VOLTAGE--Connect the power supply **positive terminal to pins 1** and 9 of vehicular repeater jack J301 and the power supply negative terminal to pin 8 of J301. Adjust power supply voltage for 13.8 V. Connect the digital voltmeter to Q327 collector. Adjust REG VOLT ADJ R379 for 10.5 V on the digital voltmeter.
2	Deviation Monitor	PAC•RT Antenna Jack	R116	SINGLE-TONE DEVIATION -- Transmit a single-tone burst by depressing and then releasing the switch in the charger or holder pocket or supply regulated B+ to pin 15 of J301. Adjust R116 on the transmitter-receiver circuit board for ±5 kHz deviation at the antenna jack.
3	Frequency Counter, Signal Generator, Digital Voltmeter or VOM	Q416 Collector	R450	VEHICULAR REPEATER SQUELCH -- Apply a 0.75 uV on-channel, unmodulated portable signal to the repeater antenna jack. Adjust REPEATER SQ ADJ R450 until the collector of Q416 switches from 0 V dc to regulated B+ (10.5 V).
4	Frequency Counter, or Oscilloscope	U11E-12	R512	PRIORITY CLOCK -- Ground test points A (U9D-13) and E (U9B-6) on the repeater circuit board. Momentarily depress the mobile PTT switch or momentarily ground pin 20 of J301. Ground test point B (U10A-4). Monitor the 400 msec clock at U11E-12. Adjust CLK ADJ R512 for a 400 msec period.
				NOTE If the preceding steps were performed on the bench, reinstall the vehicular repeater in the mobile unit. Position it to expose the circuit board adjustments. Connect the control cable.
				CAUTION Because of the "priority-interrupt," it is possible that the mobile radio can be "keyed" if the repeater receives a properly PL encoded portable signal. To prevent this from happening and damaging the signal generator, it is essential that PL reed E302 be removed anytime a signal generator is directly connected to the mobile radio.
5	Frequency Counter, Deviation Monitor, Signal Generator, Audio Oscillator, Digital Voltmeter		R303	VEHICULAR REPEATER DEVIATION -- If the PAC•RT repeater is equipped with the mobile PL option, set the channel selector on the control head to channel 1, and ground the base of Q307. Remove PL reed E302 to prevent keying the mobile unit, and to protect the signal generator from damage. Apply a 1000 uV on-channel signal modulated with a 1 kHz tone at ±3 kHz deviation to the mobile antenna jack. Adjust REPEATER DEV ADJ R303 to provide ±3 kHz deviation on the portable channel. Remove signal generator from the mobile antenna jack. DO NOT REINSTALL PL REED E302 UNTIL SPECIFICALLY INSTRUCTED.
6	Frequency Counter, Deviation Monitor, Signal Generator, Audio Generator		R481	MOBILE DEVIATION -- Ground Q312 collector (S1 on relay K1). Apply a 1000 uV, on-channel, portable signal modulated with a 1 kHz tone at ±3 kHz deviation to the PAC•RT antenna jack. Adjust MOBILE DEV ADJ R481 to provide ±3 kHz deviation on the mobile channel. Remove the ground from Q312 collector (S1 on relay K1).
7	Frequency Counter, Signal Generator, Digital Voltmeter or VOM	Q303 Collector	R305	MOBILE SQUELCH -- Apply a 20 dB quieting signal to the mobile antenna jack. Use a voltmeter to monitor the logical mobile squelch line on the collector of Q303. Adjust MOBILE SQ ADJ R305 until the PAC•RT unit begins to transmit (Collector of Q303 switches to 10.5 V). Remove the signal and verify that the repeater stops transmitting. Remove the ground from Q307 base (grounded in step 5).
8	Frequency Counter, Signal Generator, Deviation Monitor, Audio Oscillator, Digital Voltmeter or VOM	Q307 Collector	R304	MOBILE "PL" SQUELCH -- Set channel selector to a "PL" position. Apply a 20 dB quieting signal to the mobile antenna jack. Modulate the signal with the PL frequency at ±0.5 kHz deviation. Monitor the logical mobile PL line with a voltmeter. The collector of Q307 will switch to 10.5 V when mobile PL is detected. Adjust MOBILE PL ADJ R304 until the PAC•RT unit begins to transmit. Remove the signal and verify that the repeater stops transmitting.
9				Disconnect all test equipment, and reinstall PL reed E302. Reassemble the vehicular repeater to its base plate.

EPF-6878-F

3. TRANSMITTER RECEIVER ALIGNMENT

Alignment of the transmitter-receiver circuit board is not necessary unless components are replaced or have aged. If necessary, remove the vehicular repeater unit from its base (reverse the procedure in Figure 3) and perform the following procedures in the transmitter and receiver setup and alignment procedures.

RECEIVER ALIGNMENT SETUP



RECEIVER ALIGNMENT PROCEDURE

STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable NKN6228A			Remove transmitter-receiver circuit board from main circuit board and chassis. Connect test cable between P303 on transmitter-receiver circuit board and J303 on main circuit board. If used, the monitor receiver circuit board must be in position on the main circuit board.
2	AC Voltmeter, Signal Generator (455 kHz crystal-controlled)	M2 -40 dB scale	T1, T2	LOW I-F FREQUENCY -- Connect the 455 kHz signal generator to 2nd mixer base (use a 2 pF isolation capacitor). Increase and maintain a signal level of about -40 dBm on meter point M2. Tune for peak. Peak T2, T1, and repeak T2. Do not repeat.
3	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +3 V dc scale & -40 dB scale	T3	LIMITER -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. (If T3 has been completely misaligned, position T3 slug so that it is 1/16" above the solder side of the board. Adjust T3 for maximum positive voltage (approximately 1.4 V dc) at M5.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.3 V dc scale & -40 dB scale	T4	DISCRIMINATOR -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T4 has been completely misaligned, position T4 slug so that it is 1/16" above the solder side of the board. Adjust T4 for discriminator zero (0 ±.05 V). Adjust for the first zero at M4.
5				Repeak T3 at M5 (step 4). Then rezero T4 at M4 (step 5).
6		TP1	L13, L14	HIGH I-F FILTER -- If the I-F filter has been completely misaligned or the frequency is being changed, position the slugs so that they are 1/16" above the solder side of the board. With no signal input tune L13 & L14 for maximum audio noise at TP1.
7	DC Multimeter	M1 3 Vdc scale	L8	OSCILLATOR OUTPUT -- Tune L8 for minimum dc voltage at M1.
8	AC Voltmeter, Signal Generator	M2 -30 dB scale	L11, L12, FL1 (Z1, Z2, Z3, Z4)	RECEIVER--Connect the signal generator to the PAC•RT antenna jack. Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ±.05 Vdc. Tune L11, L12 (one turn at a time), and FL1 (Z1, Z2, Z3, Z4) for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
9	DC Multimeter	M4 0.3 V dc scale	L7	RECEIVE FREQUENCY -- Use the base station transmitter or a frequency standard as a signal source and adjust L7 for zero at M4 (±.05 V dc).
10	AC Voltmeter, Signal Generator (modulate with 1000 Hz Tone ±5kHz deviation)	M2, -30 dB scale	FL1, L8, L11, L12, L13, L14, T1, T2	RF & HIGH I-F FILTER -- Retune FL1 (Z1, Z2, Z3, Z4), L8, L11, L12, L13, L14, T1 and T2 in that order to ensure a peak at M2. Keep the reading below -30 dBm at M2 and at zero ±.05 Vdc at M4. Start tuning L13 and L14 from the center of the coil and tune for the first peak.
11	AC Voltmeter, Signal Generator (Modulate with 1000 Hz Tone ±5 kHz deviation)	M2, M4 -30 dB scale	L13, L14	Check for ±.05 V dc discriminator zero at M4, then carefully peak L13 and L14 at M2. Do not retune.
12				Remove test cable. Reassemble transmitter-receiver circuit board onto main circuit board.
13				Repeat Step 10.
14	AC Voltmeter Signal Generator	TP1		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity measurement as a check of alignment.

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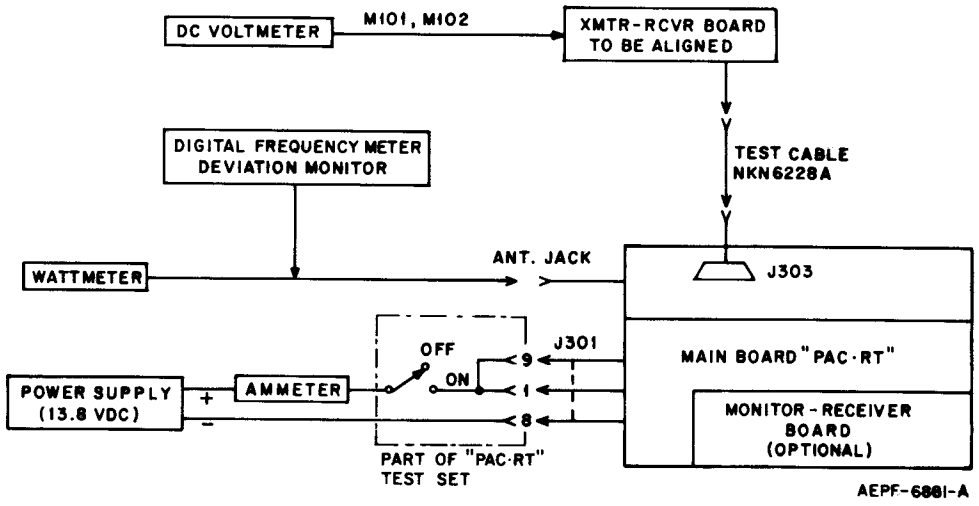
TRANSMITTER ALIGNMENT SETUP



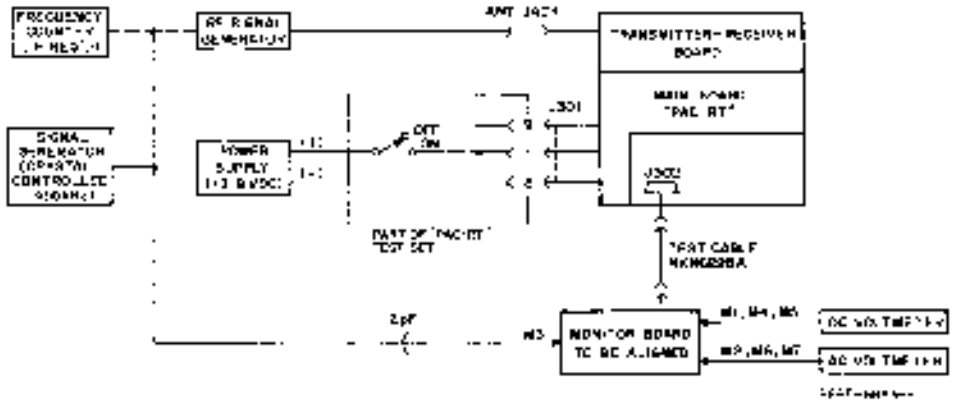
STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1				Adjust power supply voltage for 13.8 V dc.
2				Ground collector of Q309 and Q421.
3				OSCILLATOR -- Y101 is preset to assigned frequency at the factory. Do not readjust unless the crystals are replaced or the setting was accidentally changed. If it is necessary to readjust Y101, (a) Complete steps 4 thru 6. (b) Set up the frequency monitor for frequency measurement and adjust warp coil Y101 to assigned frequency. (c) Complete step 7. **NOTE** If Y101 does not need to be adjusted, continue with steps 4 through 7.
4	DC Multimeter, Ammeter	M101	L102, L103	Tune L102 for maximum current (500 mA range). Tune L102 and L103 for maximum negative voltage on M101 (-0.8 V dc, typical).
5	DC Multimeter, Ammeter	M102	L102, L103, L104, L106	Preset L104 to center of coil. Tune L106 for maximum positive voltage on M102; then, detune L106 to approximately 1 volt dc. Peak L104 at this time; then, repeak L106. Tune L102, L103, L106 in that order for maximum positive voltage on M102. Repeak once to ensure peak (+2.2 Vdc, typical).
6	Ammeter, RF Wattmeter		L109, L110, L112, L115	Preset all coils flush with solder side of board. Tune L109, L110, L112, L115 in that order towards center of coil for maximum current until power can be read on wattmeter; then repeak all coils above for maximum power (0.25 watt minimum).
7				DEVIATION CHECK -- See Single-Tone Deviation adjustment in the "PAC•RT Vehicular Repeater Alignment Procedure" for adjustment of R116.

EPF-7624-O

4. MONITOR RECEIVER ALIGNMENT (OPTIONAL CIRCUIT BOARD)

Alignment of the monitor receiver circuit boards is not necessary unless components are replaced or have aged. If alignment is necessary, remove the vehicular repeater unit from its base; reverse procedure in Figure 3, and perform the following procedures found in the monitor receiver setup and alignment procedures for either the 30-50 MHz monitor receiver or the 450-512 MHz monitor receiver.

30—50 MHz & VHF MOBILE DETECTOR ALIGNMENT SETUP



30—50 MHz MOBILE DETECTOR ALIGNMENT PROCEDURE

STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable 19D902884A			Remove mobile detector circuit board from main circuit board and chassis. Connect test cable between P802 on monitor receiver circuit board and J304 on main circuit board. The transmitter-receiver circuit board must be in position on the main circuit board.
2				Locate TP1, TP2, TP3, TP4, and TP5 on the monitor receiver circuit board. Ground TP1 to activate the PL oscillator. (TP3 for F2. TP5 for F3, etc.)
3	AC Voltmeter, Signal Generator (455kHz crystal-controlled)	M2 -40 dB scale	L2, L3	LOW-FREQUENCY -- Connect the 455 kHz signal generator to 2nd mixer base (use a .1 pF isolation capacitor). Increase and maintain a signal level of about 10 dBm on meter at point M2. Tune for peak. Keep T1, T3, and squelch T3. Do not retest.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +1 V dc scale & -40 dB scale	L4	LIMITER -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T4 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T4 for maximum positive voltage (approximately 2.2 V dc).
5	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.1 V dc scale & -40 dB scale	T3	DISCRIMINATOR -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T3 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T3 for discriminator zero (0 ± 0.05 V). Adjust for the first zero.
6		M4	L7, L8	9 MHz I.F. FILTER -- If the I.F. filter has been completely misaligned or the frequency is being changed, position the slugs so that they are 1/16" above the solder side of the board. With no signal input tune L7 & L8 for maximum audio noise on M4.
7	DC Multimeter, .001 uF Cap.	M1 1 V dc scale	L1	INJECTION -- Tune T1 for a peak at M1. Short oscillator transistor base to ground with a .0082 uF capacitor. The change in voltage at M1 should be greater than .02 V dc.
8	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within 1.05 V dc. Tune L1, L2, and L3 for a peak at M4. Keep the reading below 30 dBm by reducing generator output.
9	DC Multimeter	M4 0.1 V dc scale	T4 (F1), T6, T10, & L16 (if used)	RECEIVE FREQUENCY -- Use the base station transmitter or a frequency standard as a signal source and adjust L16 for zero at M4 (+, 0.1 V dc). MULTIPLE FREQUENCY MODELS -- Remove ground from TP1 and repeat steps 7 through 9 for each of the remaining points noted in step 2. Adjust the appropriate coil for each channel for zero reading at M1: F2-L9, F3-L10, F4-L11, and F5-L16.
10	AC Voltmeter, Signal Generator	M2 -30 dB scale	L4, L5, L6, L7, L8, T2, T3	RF SELECTIVITY & HIGH-FREQUENCY -- Ground TP1, TP2, TP3, TP4, or TP5 that is associated with the lowest frequency channel. Retune L1, L2, L3, T1, L7, L8, T2, and T3 in that order to ensure a peak at M2. Keep the reading below -30 dBm at M2 and at zero ± 0.1 V dc at M4.
11				Remove test cable. Reassemble mobile detector circuit board onto main circuit board.
12	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3	RF SELECTIVITY -- Adjust signal generator output for -77 dBm at M2. Adjust signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L2, and L3 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
13	AC Voltmeter, Signal Generator	M5		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity measurement as a check of alignment (0.79 uV measured at the antenna input corresponds to 1 mV at the RF input to the mobile detector).
14	DC Multimeter, Signal Generator	M7 15 V scale	R18	SQUELCH SETTING -- Set R18 fully counterclockwise. Set signal generator at the level used in step 13. Slowly turn R18 clockwise until M7 just switches to approximately 9.5 volts.

EDS-7486-C

VHF MOBILE DETECTOR ALIGNMENT PROCEDURE

STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable NKN6228A			Remove mobile detector circuit board from main circuit board and chassis. Connect test cable between P302 on mobile detector circuit board and J302 on main circuit board. The transmitter-receiver circuit board must be in position on the main circuit board.
2				Locate TP1, TP2, TP3, TP4, and TP5 on the mobile detector circuit board. Ground TP1 to activate the F1 oscillator. (TP2 for F2, TP3 for F3, etc.)
3	AC Voltmeter, Signal Generator (455 kHz crystal-controlled)	M2 -40 dB scale	T3, T4	LOW I-F FREQUENCY -- Connect the 455 kHz signal generator to 2nd mixer base, M3 (use a 2 pF isolation capacitor). Increase and maintain a signal level of about -40 dBm on meter at point M2. Tune for peak. Peak T4, T3, and repeak T4. Do not repeat.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +3 V dc scale & -40 dB scale	T5	LIMITER -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T5 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T5 for maximum positive voltage (approximately 2.2 V dc).
5	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.3 V dc scale & -40 dB scale	T6	DISCRIMINATOR -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T6 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T6 for discriminator zero (0 ± .05 V). Adjust for the first zero.
6	DC Multimeter	M8	T1, L9	Tune T1 and L9 for a dip at M8.
7	DC Multimeter, .002 uF Cap.	M1	T1, L9, T2	Tune T2 for a peak at M1. Retune T1, L9, and T2 for a peak at M1. Short Oscillator transistor base to ground with a .002 uF capacitor. The change in voltage at M1 should be greater than .02 V dc.
8		M6	L5, L6	HIGH I-F FILTER -- If the I-F filter has been completely misaligned or the frequency is being changed, position the slugs so that they are 1/16" above the solder side of the board. With no signal input tune L5 & L6 for maximum audio noise at M6.
9	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L2, L3 and L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
10	DC Multimeter	M4 0.3 V dc scale	L10(L11, L12, L13, & L14 if used)	RECEIVE FREQUENCY -- Use the base station transmitter or a frequency standard as a signal source and adjust L10 for zero at M4 (±.05 V dc). MULTIPLE FREQUENCY MODELS -- Remove ground from TP1 and repeat steps 2 and 10 for each of the remaining points noted in step 2. Adjust the appropriate coil for each channel for zero reading at M3: F2-L11, F3-L12, F4-L13, and F5-L14.
11	AC Voltmeter, Signal Generator, DC Multimeter	M2 -30 dB scale	L1, L2, L3, L4, T1, T2, L5, L6, T3, and T4	RF SELECTIVITY & HIGH I-F FILTER -- Ground TP1, TP2, TP3, TP4, or TP5 that is associated with the lowest frequency channel. Retune L1, L2, L3, L4, T1, T2, L5, L6, T3 and T4 in that order to ensure a peak at M2. Keep the reading below -30 dBm at M2 and at zero ± .05 V dc at M4.
12				Remove test cable. Reassemble mobile detector circuit board onto main circuit board.
13	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L2, L3, and L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
14	AC Voltmeter, Signal Generator	M6		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity measurement as a check of alignment (13.75 uV maximum at the antenna input corresponds to 1 uV at the rf input to the monitor-receiver).
15	DC Multimeter, Signal Generator	M7 15 V scale	R53	SQUELCH SETTING -- Set R53 fully counterclockwise. Set signal generator at the level set in step 14. Slowly turn R53 clockwise until M7 just switches to approximately 9.5 volts.

EPF-7993-A

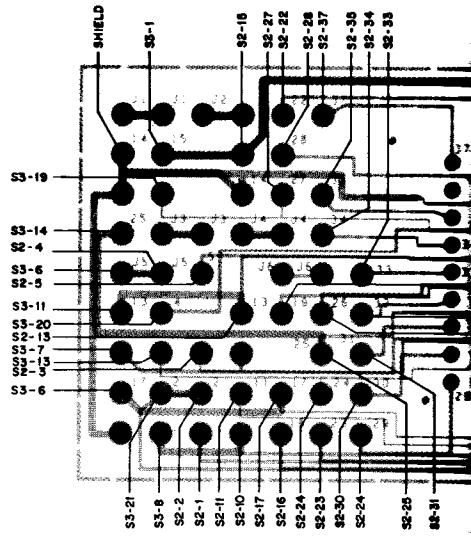
NKN6314A INTERFACE CABLE KIT ("SYNTOR X")

PLF-1934-O

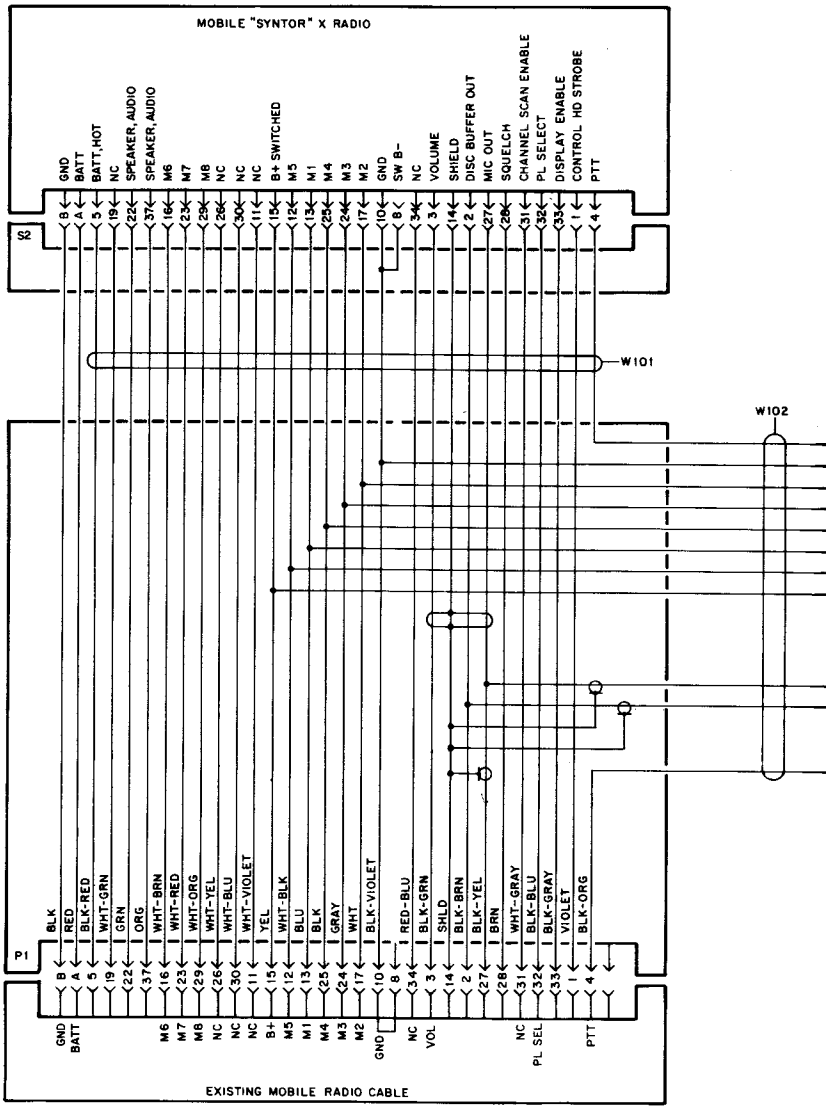
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, Plug:
P1	2883485M01	CONNECTOR, Male, 37 Contact
S2,4		Refer to **NONREFERENCED ITEMS**
S3	0984086B01	RECEPTACLE, Female, 37 Contact
		CABLE:
W101	3084875E01	Control, 2′
W102	3000864650	Control, 3′
W103	3005635D01	Charger, 17′
	3000858552	Ground, 2′
	3000858553	Power, 2′

	MOTOROLA PART NO.	NONREFERENCED ITEMS
	8405291K01	INTERFACE BOARD
	(FOR P1)	
	0300124752	SCREW, Tapping 4-24 x 1/4″
	0300125347	SCREW, Tapping 2-56 x 3/16″
	0300138133	SCREW, Machine 6-32 x 3/4″
	0300140163	SCREW, Machine 6-32 x 1/16″
	0510277A26	GROMMET, Nylon
	0510277A27	GROMMET, Nylon
	1505287K01	HOUSING, Front
	1505288K01	HOUSING, Adapter
	1505289K01	COVER, Adapter
	2905285K01	TERMINAL
	2984028H02	TERMINAL PLUG
	3105286K01	BLOCK, Terminal
	(FOR S2)	
	0300140035	SCREW, Tapping, 6-20 x 1/2″
	0980227B01	CONTACT, Female
	0984151B03	RECEPTACLE, Contact
	1580215B01	HOUSING, Connector, Front
	1580216B01	HOUSING, Connector, Back
	2910134A48	LUG, Connector
	2910134A56	LUG, Connector
	3283859M01	GASKET
	3680220B01	SCREW, Connector
	4280156B01	RING, Retainer
	(FOR S3)	
	0300138901	SCREW, Machine 6-32 x 5/8″
	0984151B03	RECEPTACLE, Contact
	0984151B05	RECEPTACLE, Contact
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	2910134A48	LUG, Connector
	(FOR S4)	
	2884510H01	PLUG, Cable, 6 Pin Female
	3700842245	STRAIN RELIEF
	4200850817	CLAMP, Cable

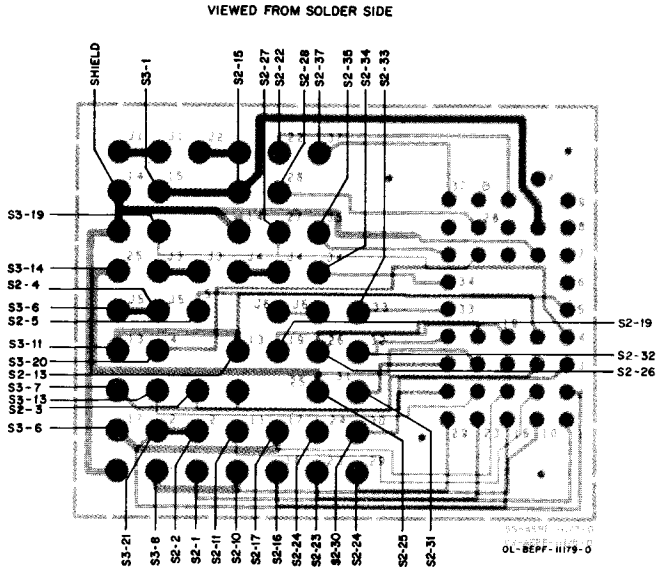
VIEWED FROM SOLDER SIDE



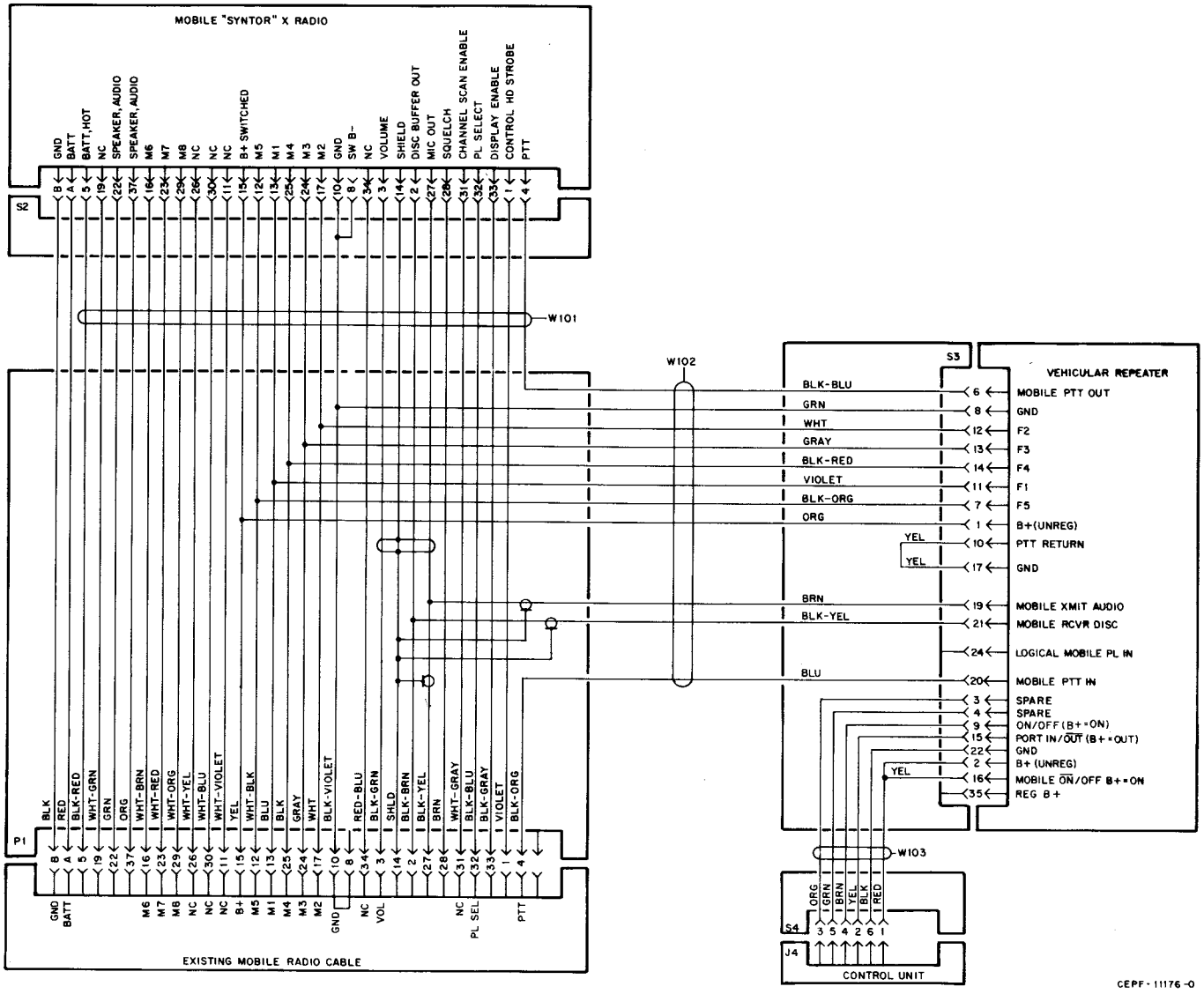
INTERCABLING DIAGR

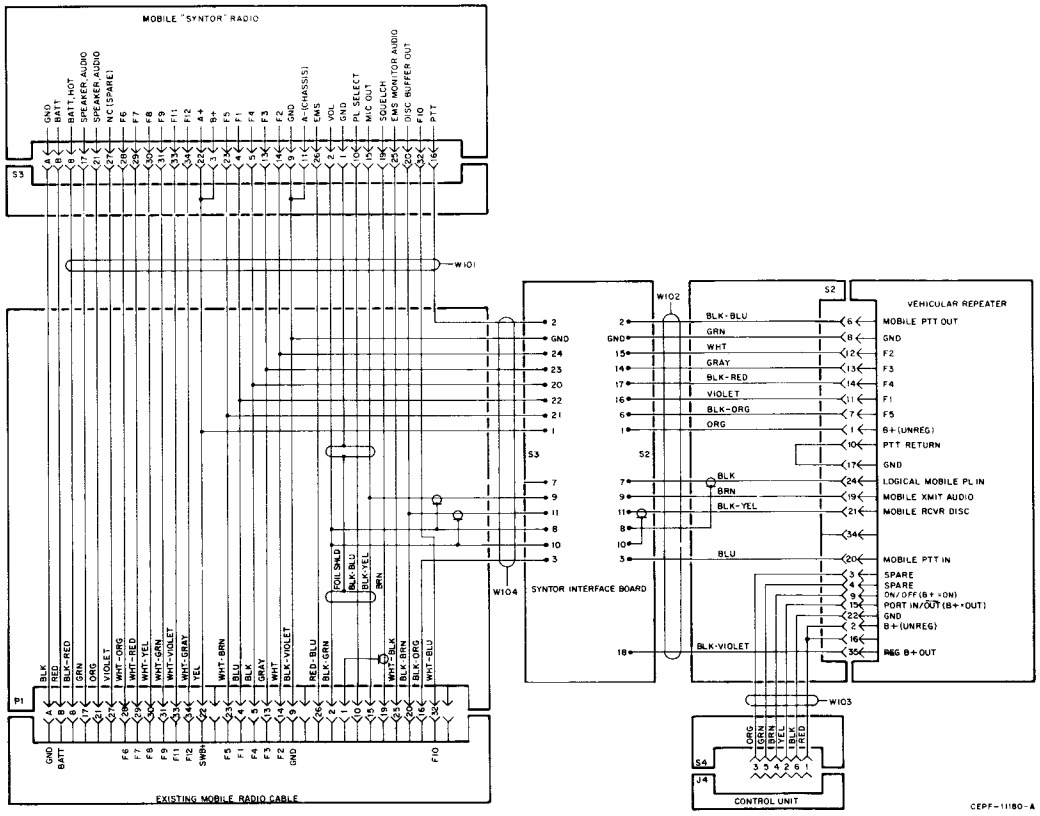


CIRCUIT BOARD DETAIL



INTERCABLING DIAGRAM





NLN6313A INTERFACE CABLE KIT ("SYNTOR")

PLF-1935-O

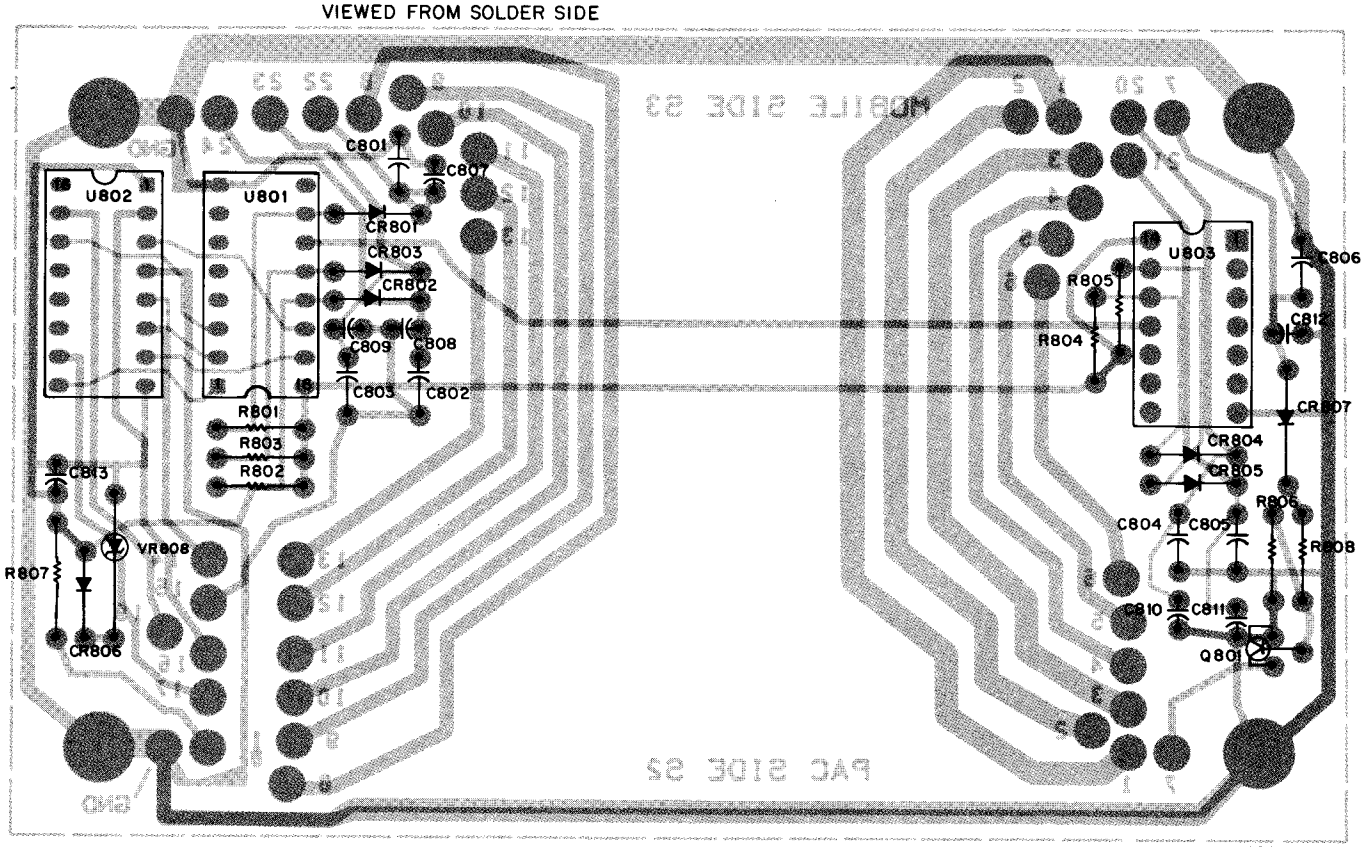
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed:
C801 thru 806	2184511B24	100pF ± 10%; N150
C807 thru 812	2184511B09	15pF ± 10%; N150
C813	2184008H11	.15uF + 80 − 20%; 50V
		DIODE: See Note
CR801-806	4883654H01	Silicon
CR807	4883329G04	3 Pellet
VR808	4882256C15	5.1V Zener
		CONNECTOR, Plug
P1	2805684D01	37-Contact, Male
S2	0984086B01	Receptacle, 37-Contact
S3	0984086B01	Receptacle, 37-Contact
S4	-----	Refer to **NONREFERENCED ITEMS**
		TRANSISTOR: See Note
Q801	4800869642	NPN; Type M9642
		RESISTOR, Fixed: Ω
		± 5%; ⅛W
R801 thru 806	0660075A97	100k
R807	0611009C39	390; ¼W
R808	0660075A89	47k
		MODULE, Encapsulated:
U801	5184887K20	Decoder
U802	5184887K01	Hex Inverter
U803	5182822F43	2 in Or Gate
		CABLE:
W101	3084875E01	Control, 2′
W102	300864650	Control, 2′
W103	3005635D01	Control, 17′
W104	300864650	Control, 2′
	300858552	Ground, 2′
	300858553	Power, 2′

	MOTOROLA PART NO.	NONREFERENCED ITEMS
	8405394K01	INTERFACE BOARD
	(For Interface)	
	0300008022	SCREW, Machine 4-40 x ¼″
	0300124671	SCREW, Tapping 4-24 x ¼″
	0300136756	SCREW, Tapping 10-16 x ⅝″
	0510277A26	GROMMET, Nylon
	1505397K01	HOUSING
	1505398K01	COVER, Housing
	(For P1)	
	0300119947	SCREW, Tapping 6-20 x ⅜″
	0300120622	SCREW, Machine 6-32 x ¼″
	0300135850	SCREW, Machine 2-56 x 9/16″
	0300136756	SCREW, Tapping 10-16 x ⅝″
	0300138045	SCREW, Machine 6-32 x 1¼″
	0300138097	SCREW, Machine 6-32 x ⅞″
	0305614D01	SCREW, Thumb
	0400007650	WASHER, Lock
	0400008406	WASHER, Lock
	0705612D01	BRACKET, Adapter
	1584044C03	HOUSING, Receptacle, Front
	4205777E01	CLAMP, Cable
	4305613D01	SPACER, Connector
	5805611D01	ADAPTER, Connector
	(For S2)	
	0300132127	SCREW, Tapping 6-20 x ¾″
	0300138097	SCREW, Machine 6-32 x ⅞″
	0300138901	SCREW, Machine 6-32 x ⅝″
	0984151B03	RECEPTACLE, Contact
	0984151B06	RECEPTACLE, Contact
	1584044C03	HOUSING, Receptacle, Front
	1584045C01	HOUSING, Receptacle, Rear
	4284933E01	CLAMP, Cable
	(For S3)	
	0300140079	SCREW, Tapping 6-19 x ½″
	0984151B03	RECEPTACLE, Contact
	0984151B05	RECEPTACLE, Contact
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	(For S4)	
	2884510H01	PLUG, Cable, Female
	3700842245	STRAIN RELIEF
	4200850817	CLAMP, Cable

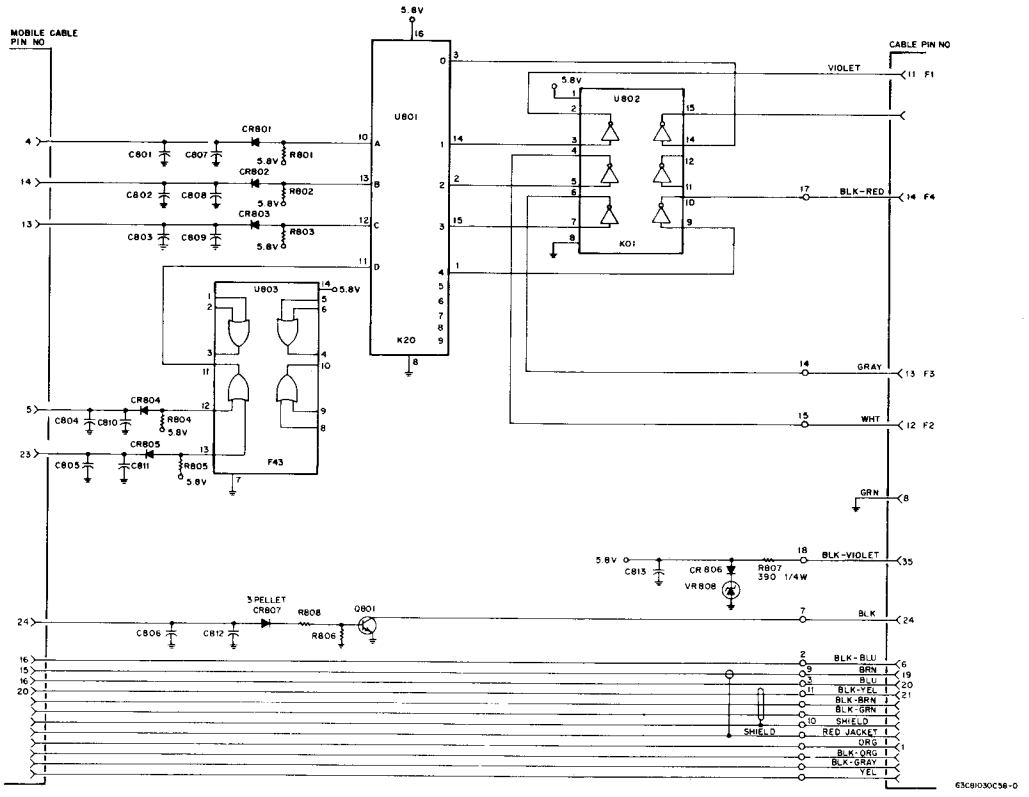
"SYNTOR" INTERCABLING DIAGRAM

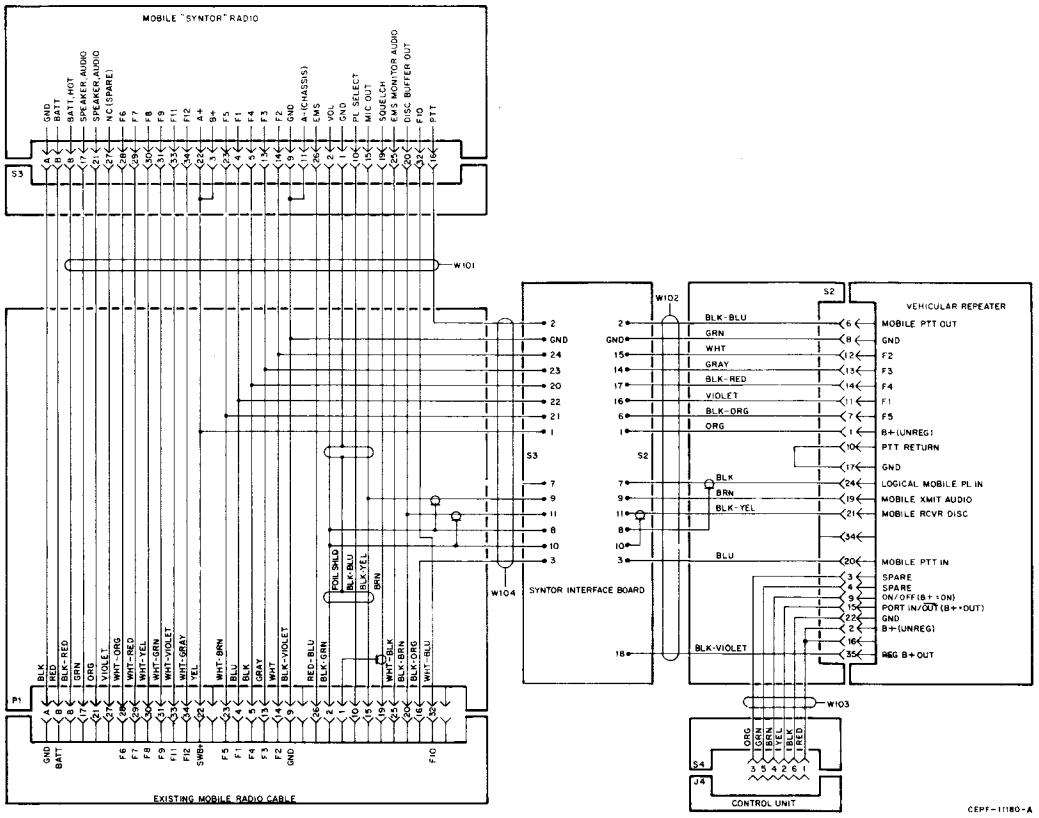
CIRCUIT BOARD DETAIL

VIEWED FROM SOLDER SIDE



SCHEMATIC DIAGRAM





NLN6313A INTERFACE CABLE KIT ("SYNTOR")

PLF-1935-O

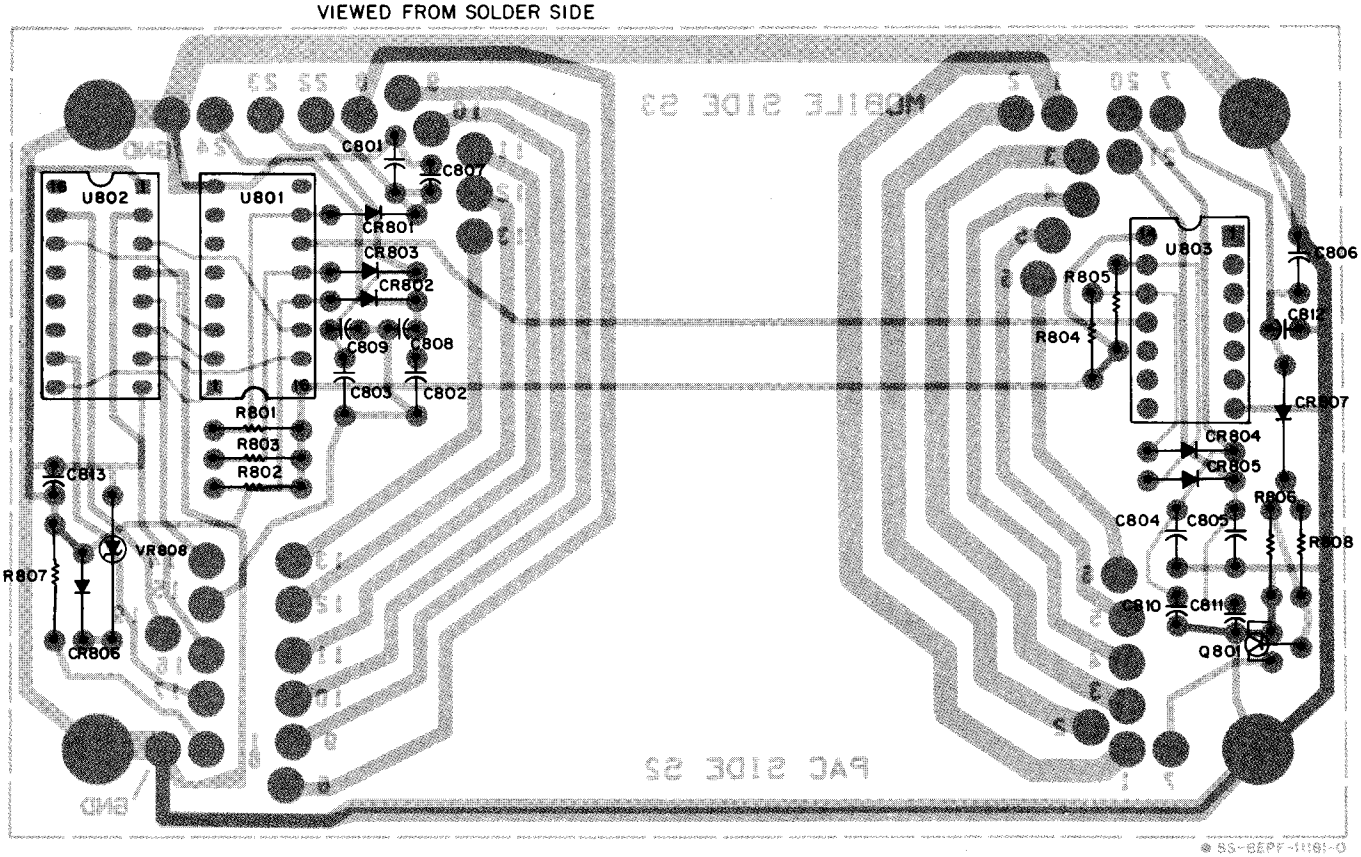
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed:
C801 thru 806	2184511B24	100pF ± 10%; N150
C807 thru 812	2184511B09	15pF ± 10%; N150
C813	2184008H11	.15uF + 80 − 20%; 50V
		DIODE: See Note
CR801-806	4883654H01	Silicon
CR807	4883329G04	3 Pellet
VR808	4882256C15	5.1V Zener
		CONNECTOR, Plug
P1	2805684D01	37-Contact, Male
S2	0984086B01	Receptacle, 37-Contact
S3	0984086B01	Receptacle, 37-Contact
S4	-----	Refer to **NONREFERENCED ITEMS**
		TRANSISTOR: See Note
Q801	4800869642	NPN; Type M9642
		RESISTOR, Fixed: Ω
		± 5%; ⅛W
R801 thru 806	0660075A97	100k
R807	0611009C39	390; ¼W
R808	0660075A89	47k
		MODULE, Encapsulated:
U801	5184887K20	Decoder
U802	5184887K01	Hex Inverter
U803	5182822F43	2 in Or Gate
		CABLE:
W101	3084875E01	Control, 2'
W102	300864650	Control, 2'
W103	3005635D01	Control, 17'
W104	300864650	Control, 2'
	300858552	Ground, 2'
	300858553	Power, 2'

	MOTOROLA PART NO.	NONREFERENCED ITEMS
	8405394K01	INTERFACE BOARD
	(For Interface)	
	0300008022	SCREW, Machine 4-40 x ¼"
	0300124671	SCREW, Tapping 4-24 x ¼"
	0300136756	SCREW, Tapping 10-16 x ⅝"
	0510277A26	GROMMET, Nylon
	1505397K01	HOUSING
	1505398K01	COVER, Housing
	(For P1)	
	0300119947	SCREW, Tapping 6-20 x ⅜"
	0300120622	SCREW, Machine 6-32 x ¼"
	0300135850	SCREW, Machine 2-56 x 9/16"
	0300136756	SCREW, Tapping 10-16 x ⅝"
	0300138045	SCREW, Machine 6-32 x 1¼"
	0300138097	SCREW, Machine 6-32 x ⅞"
	0305614D01	SCREW, Thumb
	0400007650	WASHER, Lock
	0400008406	WASHER, Lock
	0705612D01	BRACKET, Adapter
	1584044C03	HOUSING, Receptacle, Front
	4205777E01	CLAMP, Cable
	4305613D01	SPACER, Connector
	5805611D01	ADAPTER, Connector
	(For S2)	
	0300132127	SCREW, Tapping 6-20 x ¾"
	0300138097	SCREW, Machine 6-32 x ⅞"
	0300138901	SCREW, Machine 6-32 x ⅝"
	0984151B03	RECEPTACLE, Contact
	0984151B06	RECEPTACLE, Contact
	1584044C03	HOUSING, Receptacle, Front
	1584045C01	HOUSING, Receptacle, Rear
	4284933E01	CLAMP, Cable
	(For S3)	
	0300140079	SCREW, Tapping 6-19 x ½"
	0984151B03	RECEPTACLE, Contact
	0984151B05	RECEPTACLE, Contact
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	(For S4)	
	2884510H01	PLUG, Cable, Female
	3700842245	STRAIN RELIEF
	4200850817	CLAMP, Cable

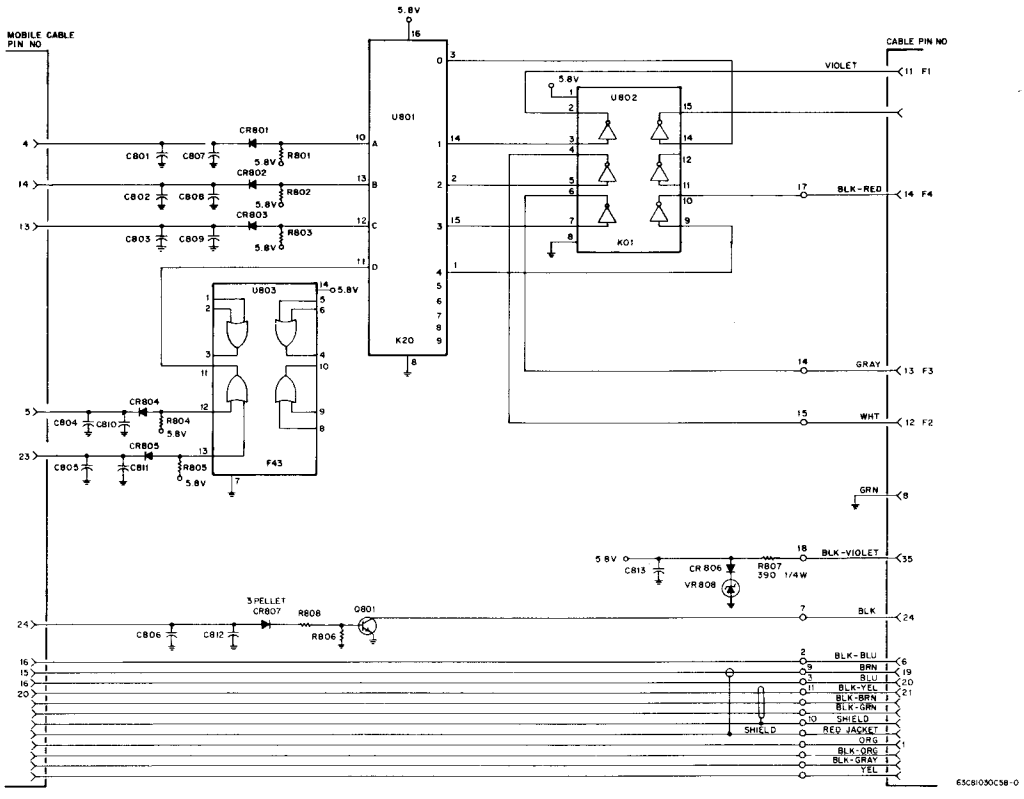
"SYNTOR" INTERCABLING DIAGRAM

CIRCUIT BOARD DETAIL

VIEWED FROM SOLDER SIDE



SCHEMATIC DIAGRAM



MAXAR RADIO INTERCABLING

1. DESCRIPTION

This section describes the NKN6250A Cable Kit which enables the Portable/Mobile Vehicular Repeater System to be used with the Maxar Radio. The kit consists of an interconnect box, wiring, and connectors to provide for the complete interconnection between the Maxar radio (usually dash mounted) and vehicular repeater (usually trunk mounted). The interconnect box contains an amplifier/filter circuit (Q801 on the attached schematic diagram) which functions as an amplifier for the discriminator output signal from the Maxar radio, and as a high-pass filter (f_o = 3 kHz) for squelch boost. The emitter follower output (Q802) then connects to the audio line in the vehicular repeater.

2. INSTALLATION

a. Disconnect the power connector from the back of the Maxar radio.

b. Insert the loose-end pins attached to the gray cable part of the NKN6250A Cable Kit (W102 on the attached schematic diagram) into their respective slots in the Maxar power connector.

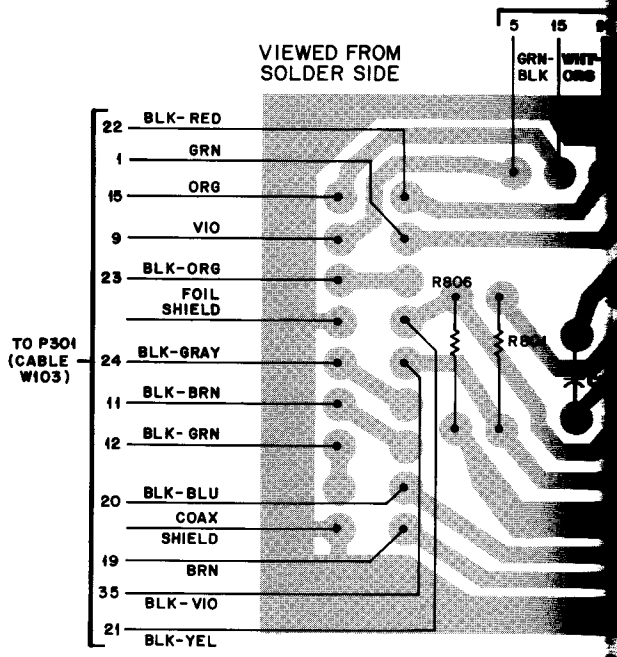
c. Plug the power/control unit connector assembled in the preceding step into the interconnect box connector S4.

d. Mount the interconnect box as shown in Figure 7 of the appropriate service manual; use the two #10-16 x 5/8" screws supplied with the kit.

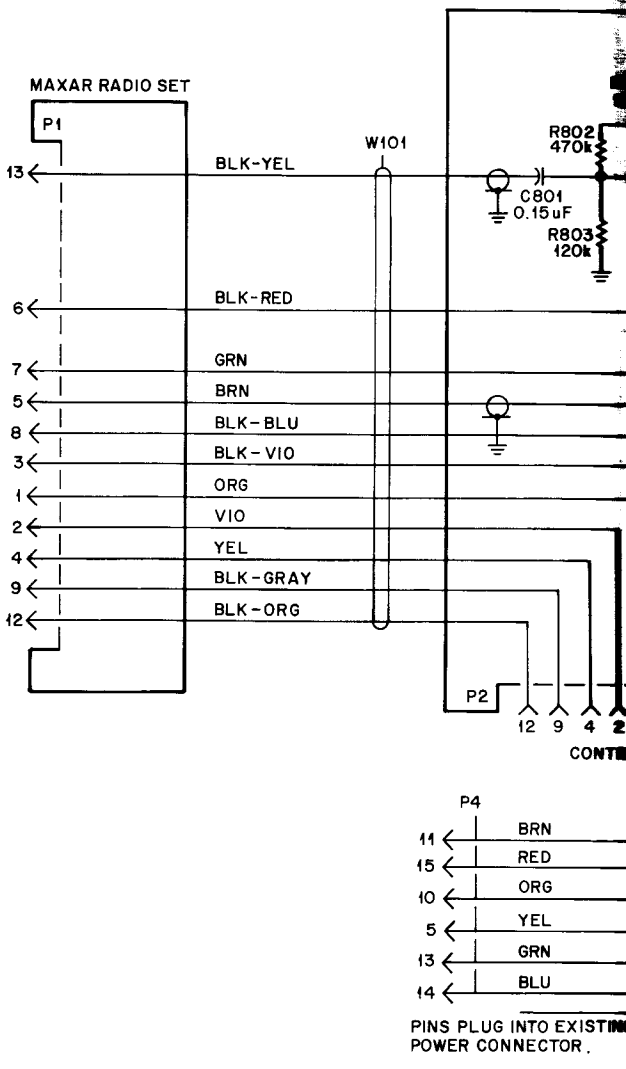
e. Plug the short cable (W101) into the back of the Maxar radio.

f. Route the long wire (W103) to the trunk compartment of the vehicle and plug it into the vehicular repeater.

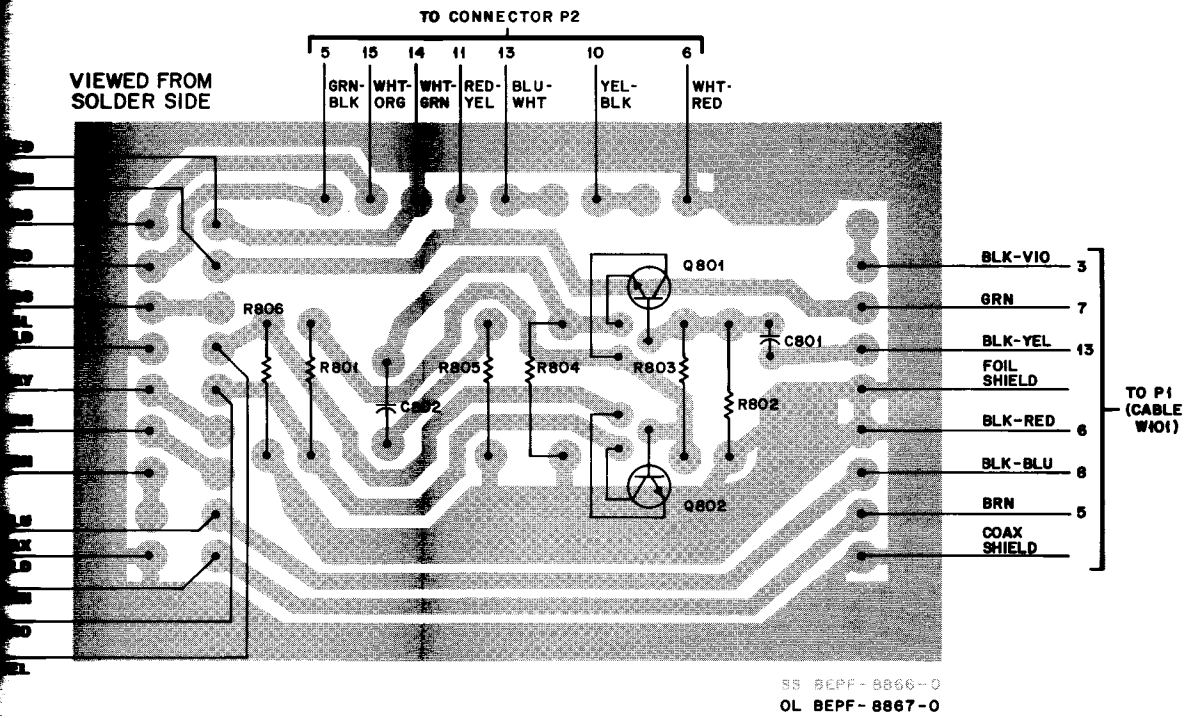
NKN6250A INTERCONNECT B



NKN6250A INTERFA



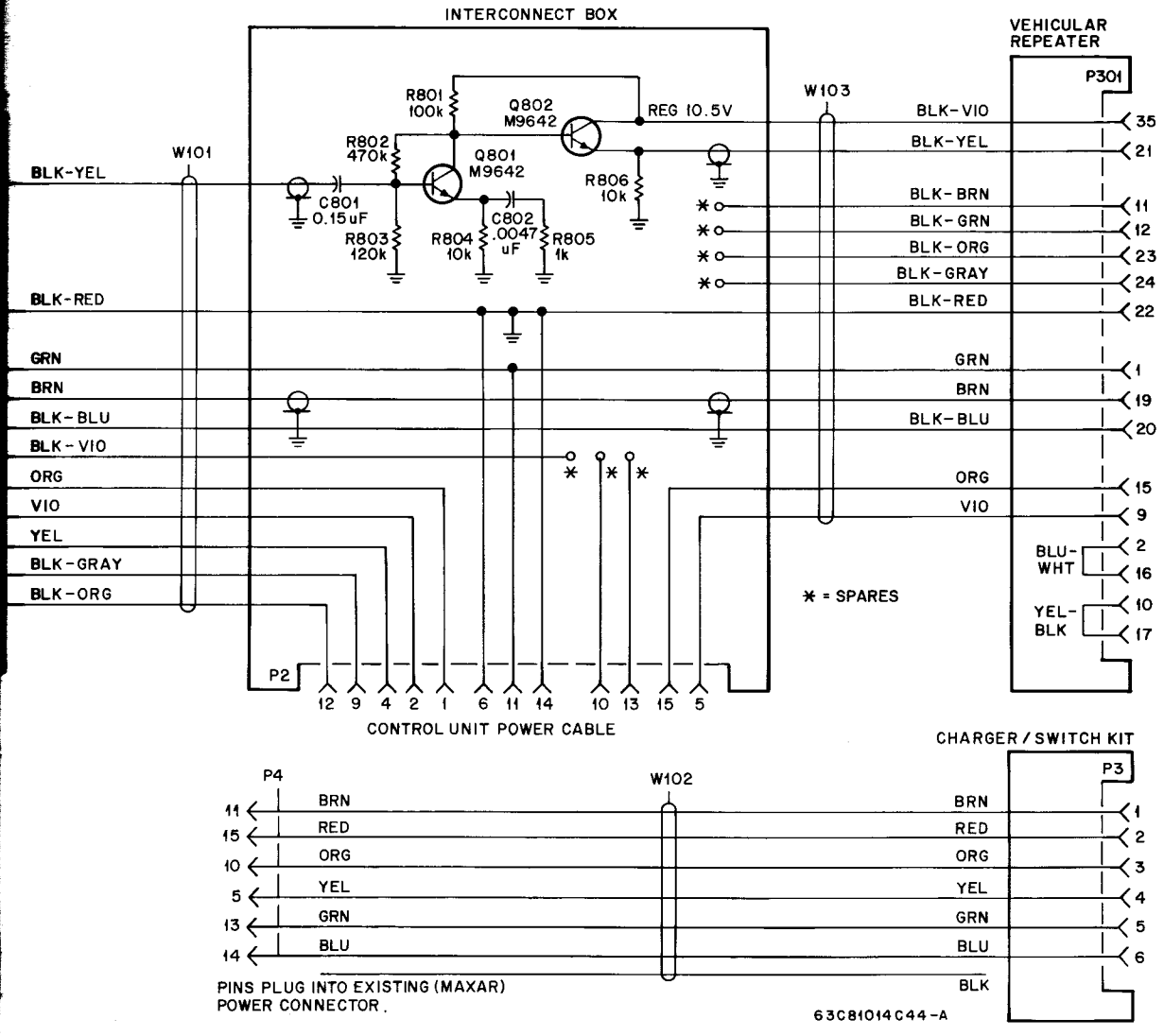
NKN6250A INTERCONNECT BOX CIRCUIT BOARD LAYOUT DIAGRAM



SS BEPF-8866-O

OL BEPF-8867-O

NKN6250A INTERFACE CABLE SCHEMATIC DIAGRAM



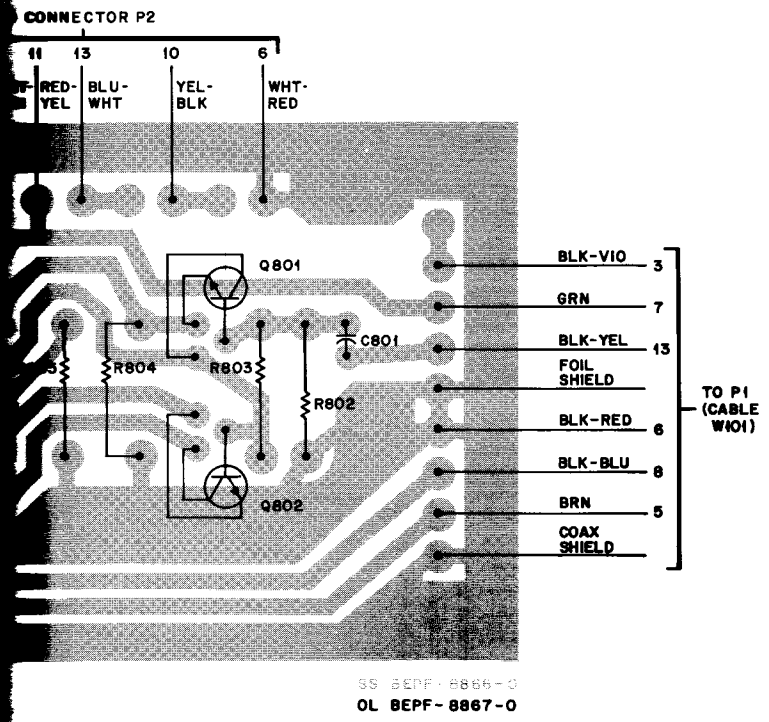
PARTS LIST

NKN6250A Interface Cable Kit ("M

REFERENCE SYMBOL	MOTOROLA PART NO.
C801	2184008H03
C802	2182428B09
P1	----------
P2	1583292K01
P3	2884510H01
P4	2984706E05
P301	0984086B01
Q801, 802	4800869642
R801	0600124C97
R802	0600124D14
R803	0600124C99
R804	0600124C73
R805	0600124C49
R806	0600124C73
W101	3000858513
W102	3005635D01
W103	3000858513
NONREFERENC	
	(For P1)
	1583293K01
	2984706E06
	(For P3)
	3700842245
	4200850817
	(For P301)
	0300138901
	0984151B03
	1505572D01
	1505573D01
	3700012706
	(For PC Board)
	0300136783
	1505680F01
	1505716E02
	1505716E03
	0300136756
	4282018H02
	4384319H03
	8405934F01

NOTE: For optimum performance tors by Motorola part num

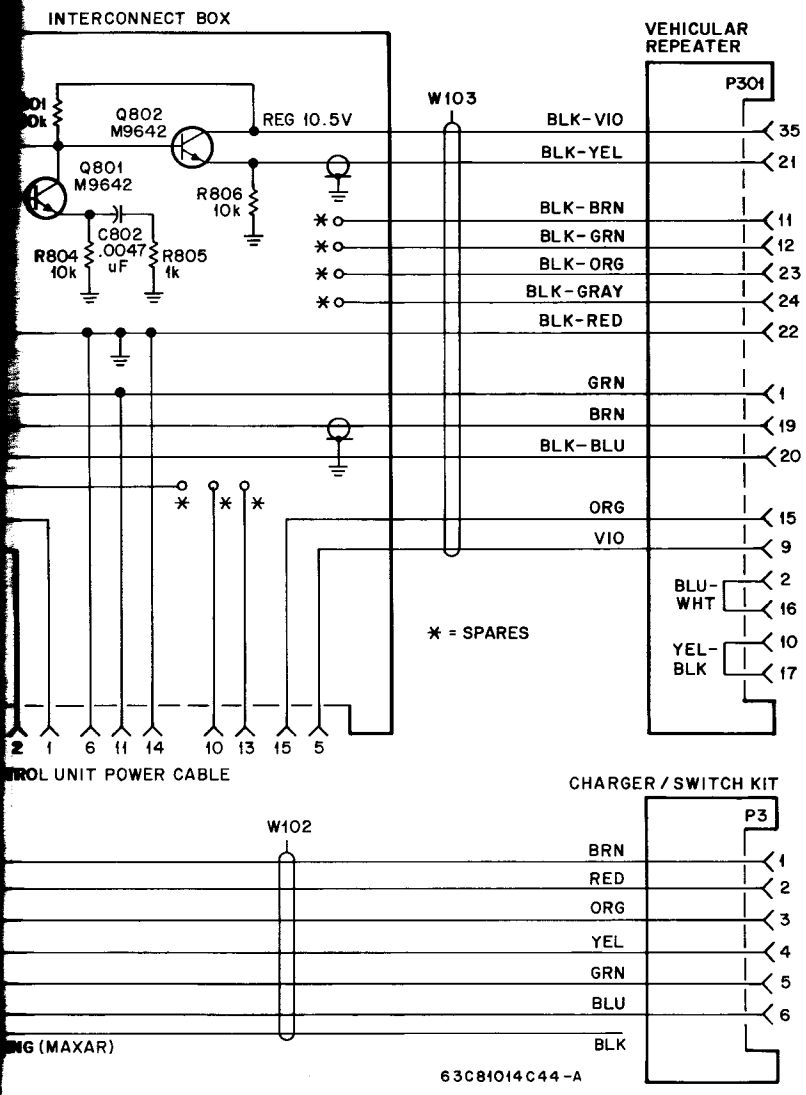
X CIRCUIT BOARD LAYOUT DIAGRAM



SS BEPF-8866-O

OL BEPF-8867-O

E CABLE SCHEMATIC DIAGRAM



63C81014C44-A

PARTS LIST

NKN6250A Interface Cable Kit ("Maxar") PLF-1445-A

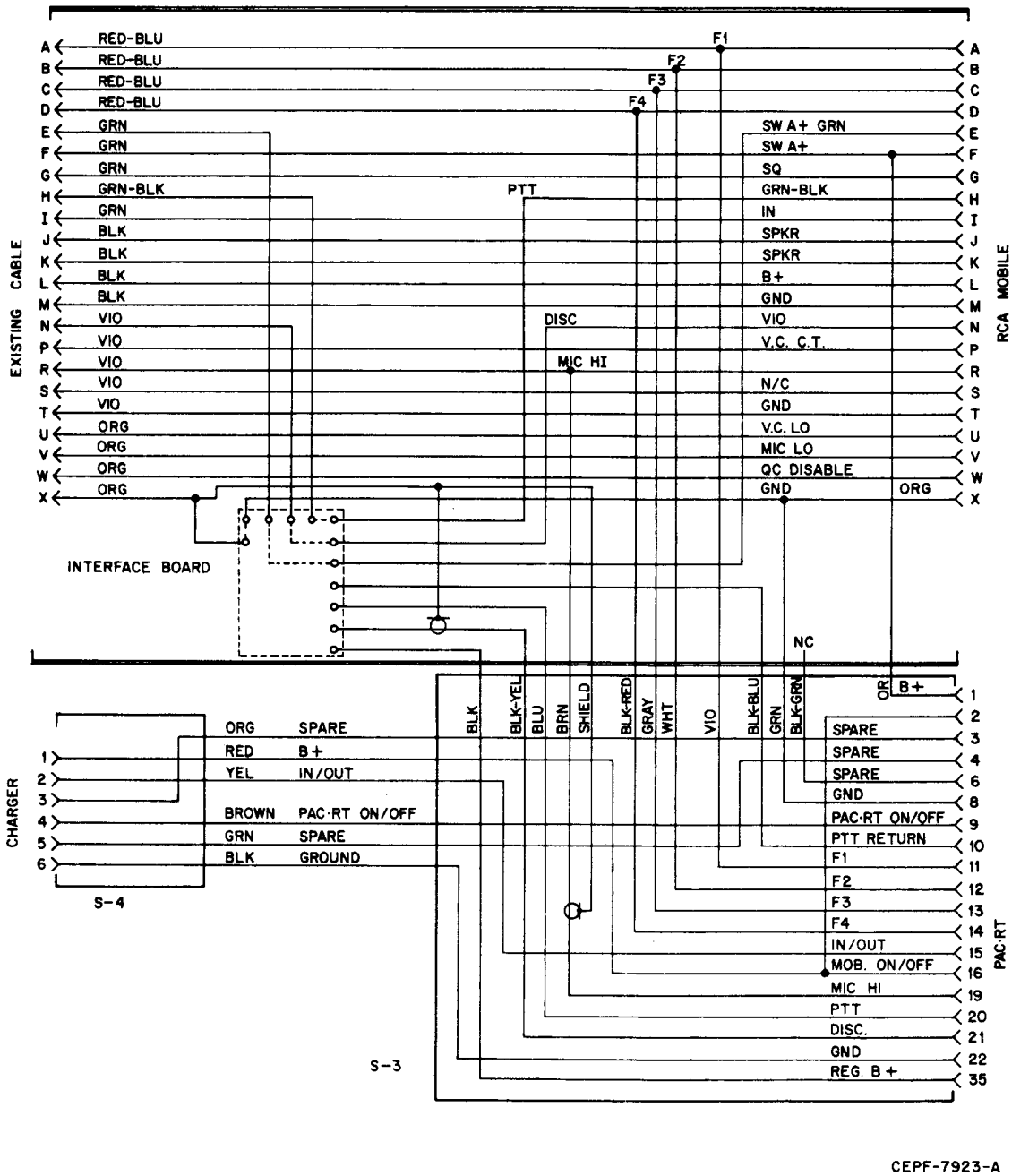
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF
C801	2184008H03	0.15 +80%-20%; 50 V
C802	2182428B09	.0047 ±10%; 100 V
		CONNECTOR, Plug:
P1	----------	Refer to NONREFERENCED ITEMS
P2	1583292K01	Receptacle, 15-Pin
P3	2884510H01	6-Pin, Female
P4	2984706E05	Terminal, Crimp; Single
P301	0984086B01	Receptacle, 37-Contact
		TRANSISTOR: See Note
Q801, 802	4800869642	NPN; type M9642
		RESISTOR, Fixed: Ω ±10%; 1/4 W
R801	0600124C97	100 k
R802	0600124D14	470 k
R803	0600124C99	120 k
R804	0600124C73	10 k
R805	0600124C49	1 k
R806	0600124C73	10 k
		CABLE:
W101	3000858513	13-Conductor
W102	3005635D01	7-Conductor
W103	3000858513	13-Conductor
NONREFERENCED ITEMS		
	(For P1)	
	1583293K01	HOUSING, Plug
	2984706E06	TERMINAL, Crimp
	(For P3)	
	3700842245	SLEEVE, Strain Relief
	4200850817	CLAMP (Includes Screws)
	(For P301)	
	0300138901	SCREW, Phillips; 6-32 x 5/8"
	0984151B03	RECEPTACLE, Female Pin
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	3700012706	GROMMET, Rubber
	(For PC Board)	
	0300136783	SCREW, Phillips; 2-56 x 5/16"
	1505680F01	HOUSING
	1505716E02	COVER, Top
	1505716E03	COVER, Bottom
	0300136756	SCREW, Slotted 10-16 x 38" (For Mounting Interconnect Box)
	4282018H02	RETAINER, For W101
	4384319H03	SPACER, For PC Board
	8405934F01	PC BOARD

NOTE: For optimum performance, order replacement transistors by Motorola part number only.

NKN6232A INTERFA

RCA 1000/700/

INTERCABLING DIAGRAM



CEPF-7923-A

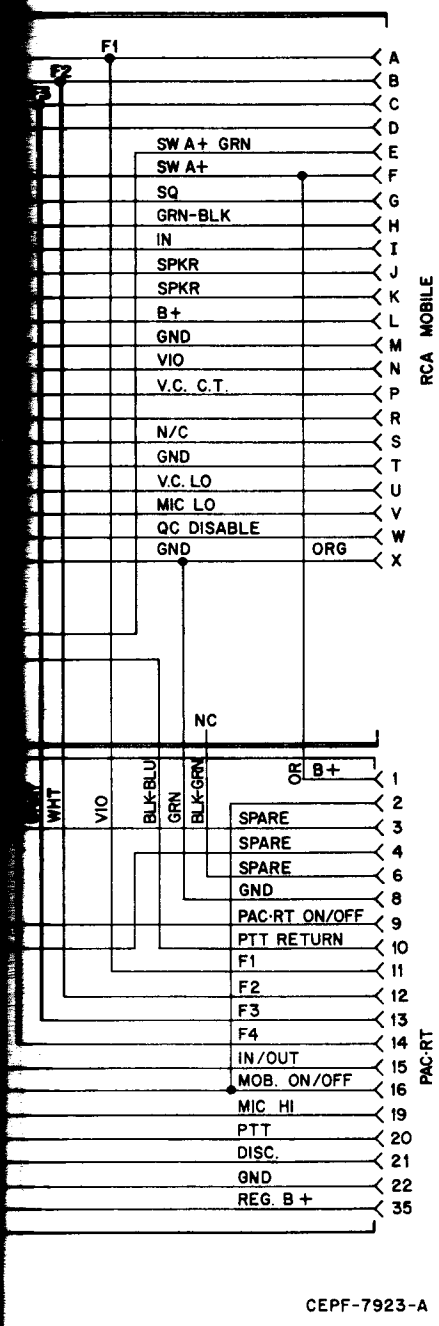
CIRCU

NKN6233A Inter

REFERENCE SYMBOL
C801
C802
C803, 804, 805
C806, 807
CR802, 803, 804
K801
Q801
Q802
Q803, 804
R802
R803
R804
R805
R806
R807
R808
R809
R810
R811

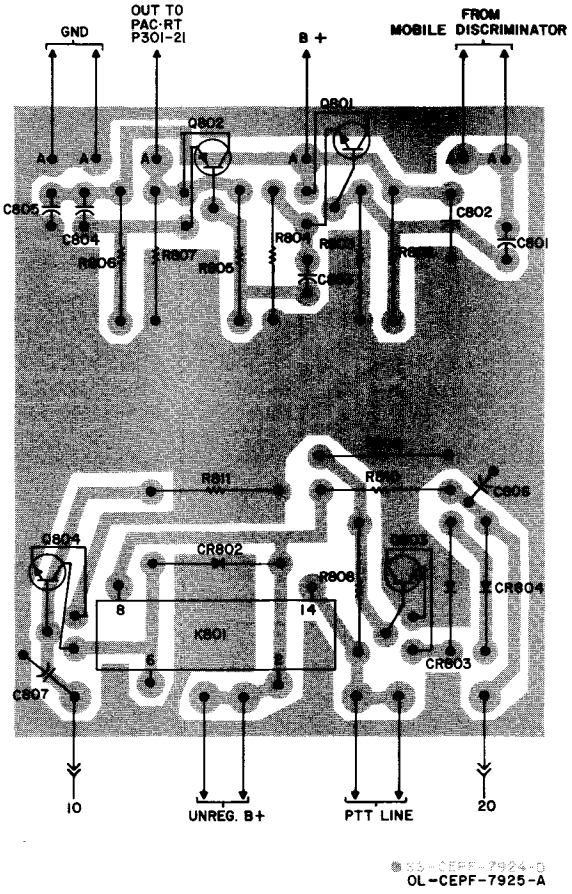
NKN6232A INTERFACE CABLE KIT

RCA 1000/700/500 SERIES



CEPF-7923-A

CIRCUIT BOARD DETAIL



NKN6233A Interface Cable Kit (RCA) PLF-1265-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed:
C801	2184008H13	.05 uF ±20%; 25 V
C802	2383441B19	10 uF ±20%; 20 V
C803, 804, 805	2184008H13	.05 uF ±20%; 25 V
C806, 807	2182213E21	.002 uF ±5%; 100 V
		DIODE: See Note
CR802, 803, 804	4883654H01	Silicon
		RELAY:
K801	8005837E01	Coil voltage: 12 V, res: 500 Ω
		TRANSISTOR:
Q801	4800869642	NPN; type M9642
Q802	4800869643	PNP; type M9643
Q803, 804	4800869642	NPN; type M9642
		RESISTOR, Fixed: Ω ±5% 1/4 W unless stated
R802	0600124D32	2.7 Meg. ±10%
R803	0600124D36	3.9 Meg. ±10%
R804	0600124A97	100 k
R805	0600124B04	180 k
R806	0600124A49	1 k
R807	0600124A65	4.7 k
R808	0600124A71	8.2 k
R809	0600124A47	820
R810	0600124A77	15 k
R811	0600124A79	18 k

REG. B+ S3-35

MOBILE ISCRIMINATOR S2-B P1-B

GROUND S2-X P1-X

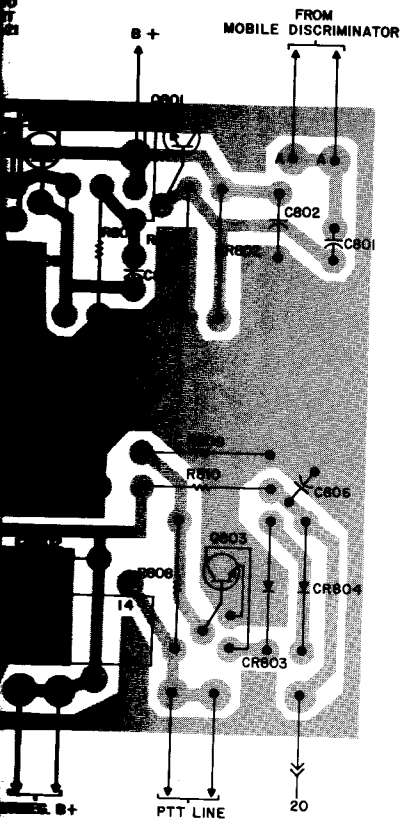
PTT LINE S2-H P1-H

SW. B+ S2-E P1-E

BOARD AND SUFFIX NO.	
NKN6233A-1	

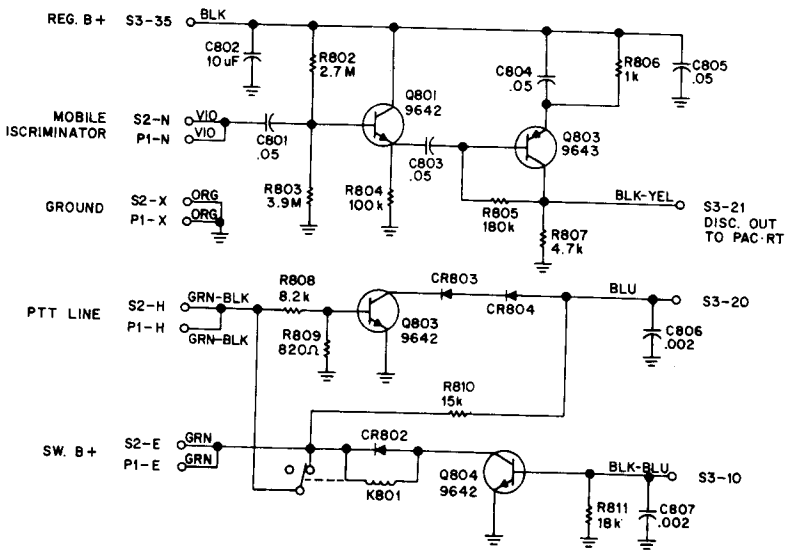
ACE CABLE KIT
V500 SERIES

UIT BOARD DETAIL



OL-CEPF-7925-A

SCHEMATIC DIAGRAM



6388100902-A

REVISIONS

BOARD AND SUFFIX NO.	REFERENCE SYMBOL	CHANGE
NKN6233A-1	C806	Added
	C807	Added

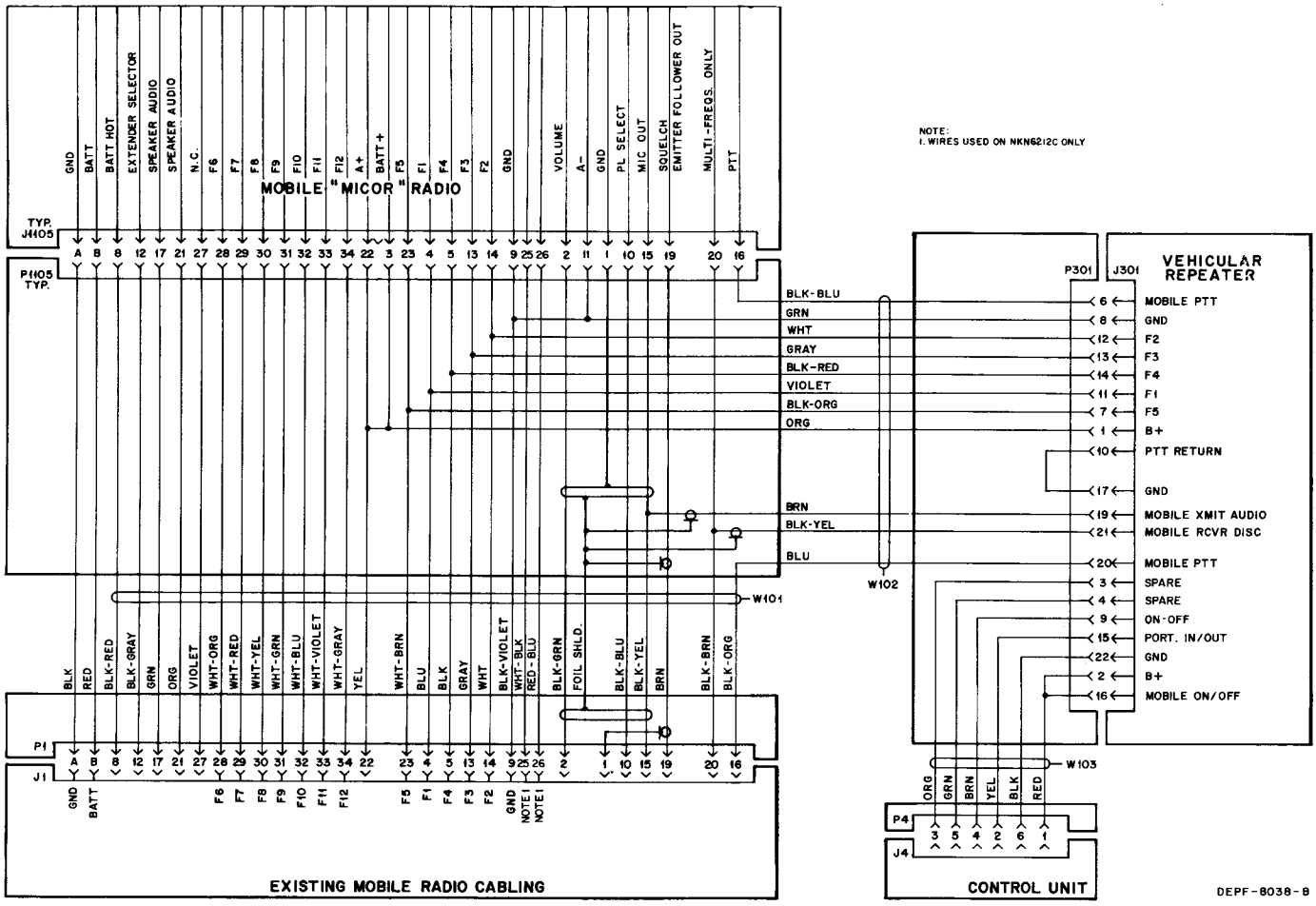
ace Cable Kit (RCA) PLF-1265-B

MOTOROLA PART NO.	DESCRIPTION
	CAPACITOR, Fixed:
2184008H13	.05 uF ±20%; 25 V
2383441B19	10 uF ±20%; 20 V
2184008H13	.05 uF ±20%; 25 V
2182213E21	.002 uF ±5%; 100 V
	DIODE: See Note
4883654H01	Silicon
	RELAY:
8005837E01	Coil voltage: 12 V, res: 500 Ω
	TRANSISTOR:
4800869642	NPN; type M9642
4800869643	PNP; type M9643
4800869642	NPN; type M9642
	RESISTOR, Fixed: Ω ±5%
	1/4 W unless stated
0600124D32	2.7 Meg. ±10%
0600124D36	3.9 Meg. ±10%
0600124A97	100 k
0600124B04	180 k
0600124A49	1 k
0600124A65	4.7 k
0600124A71	8.2 k
0600124A47	820
0600124A77	15 k
0600124A79	18 k

NONREFERENCED ITEMS		
	0300121103	SCREW, Phillips; 6-32 x 3/8"
	0300138901	SCREW, Phillips; 6-32 x 5/8"
	0905601E01	CONNECTOR
	0984086B01	RECEPTACLE, Female; 37-line
	0984151B03	CONTACT, Receptacle
	0984151B05	CONTACT, Receptacle; plated
	0984151B06	CONTACT, Receptacle
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	1505600E01	HOUSING, Connector
	2805602E01	PLUG, Connector
	2884510H01	PLUG, Cable; 6-pin
	3000864650	CABLE, 17-conductor
	3005635D01	CABLE
	3700842245	STRAIN RELIEF
	4200850817	CLAMP, Cable
	8405791E01	PC BOARD

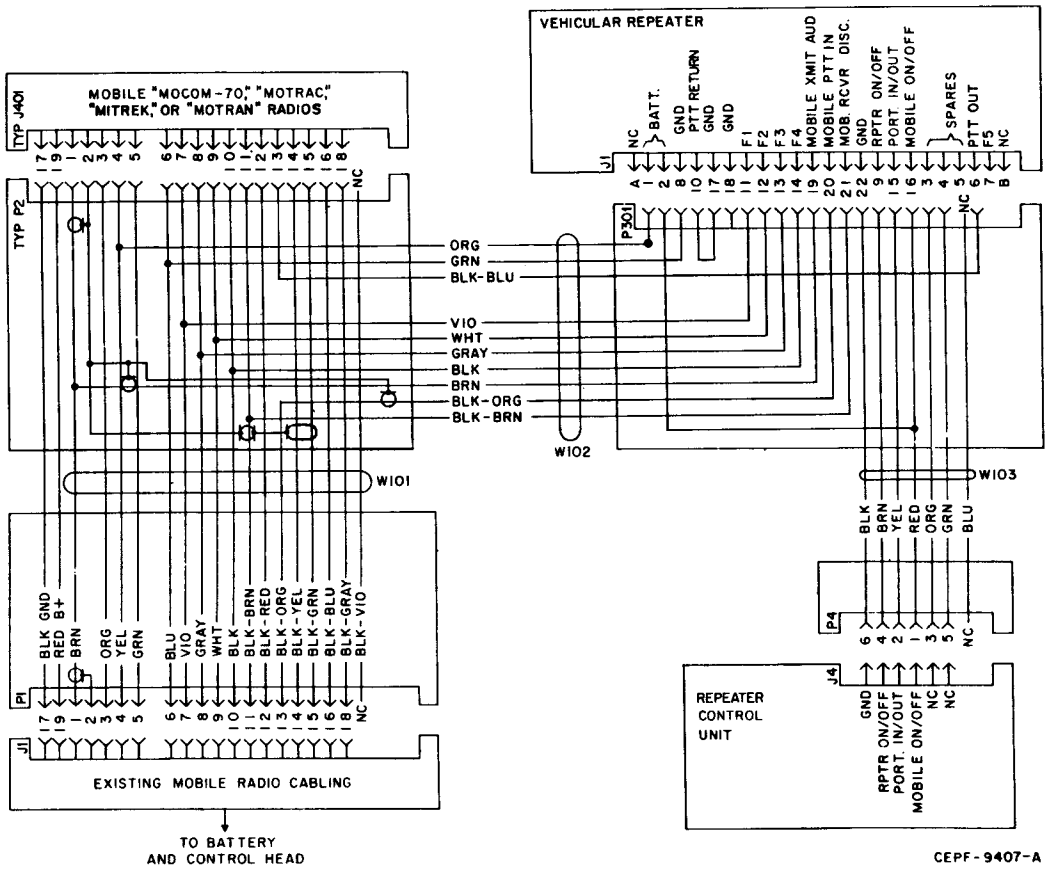
"RCA" INTERCABLING DIAGRAM

INTERCABLING DIAGRAM



NKN6212B/C 12-Freq. Interface Cable Kit ("MICOR") PLF-1302-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, Plug:
P1	2805684D01	37-contact, male
P4	2884510H01	6-pin, female
P301	0984086B01	37-contact, female
P1105 (TYP)	0984086B01	37-contact, female
		CABLE:
W101	3084875E01	Control, 2'
W102	3000864650	Control, 6'
W103	3005635D01	Charger, 17'
NONREFERENCED ITEMS		
	(For P1)	
	3000851875	CABLE, Ground; 2' (from P1 to P1105)
	3000812505	CABLE, Power; 2' (from P1 to P1105)
	5805611D01	HOUSING, Rear
	0705612D01	BRACKET, Rear Housing
	1584044C01	HOUSING, Front
	4305613D01	SPACER, Connector
	4284933E01	CLAMP
	0300120622	SCREW, Phillips; 6-32 x 1/4"
	0300132127	SCREW, Tapping; 6-20 x 3/4"
	0300135850	SCREW, Slotted; 2-56 x 9/16"
	0300138045	SCREW, Phillips; 6-32 x 1-1/4"
	0300138097	SCREW, Phillips; 6-32 x 7/8"
	0305614D01	SCREW, Thumb
	0400008406	LOCKWASHER, Internal #2
	(For P4)	
	4200850817	CLAMP
	3700842245	STRAIN-RELIEF
	(For P301)	
	1505573D01	HOUSING, Rear
	1505572D01	HOUSING, Front
	0300138901	SCREW, Phillips; 6-32 x 5/8"
	(For P1105)	
	1584045C01	HOUSING, Rear
	1584044C01	HOUSING, Front
	4205777E01	CLAMP, Cable
	0300138901	SCREW, Phillips; 6-32 x 5/8"
	0300119947	SCREW, Tapping; 6-20 x 3/8"

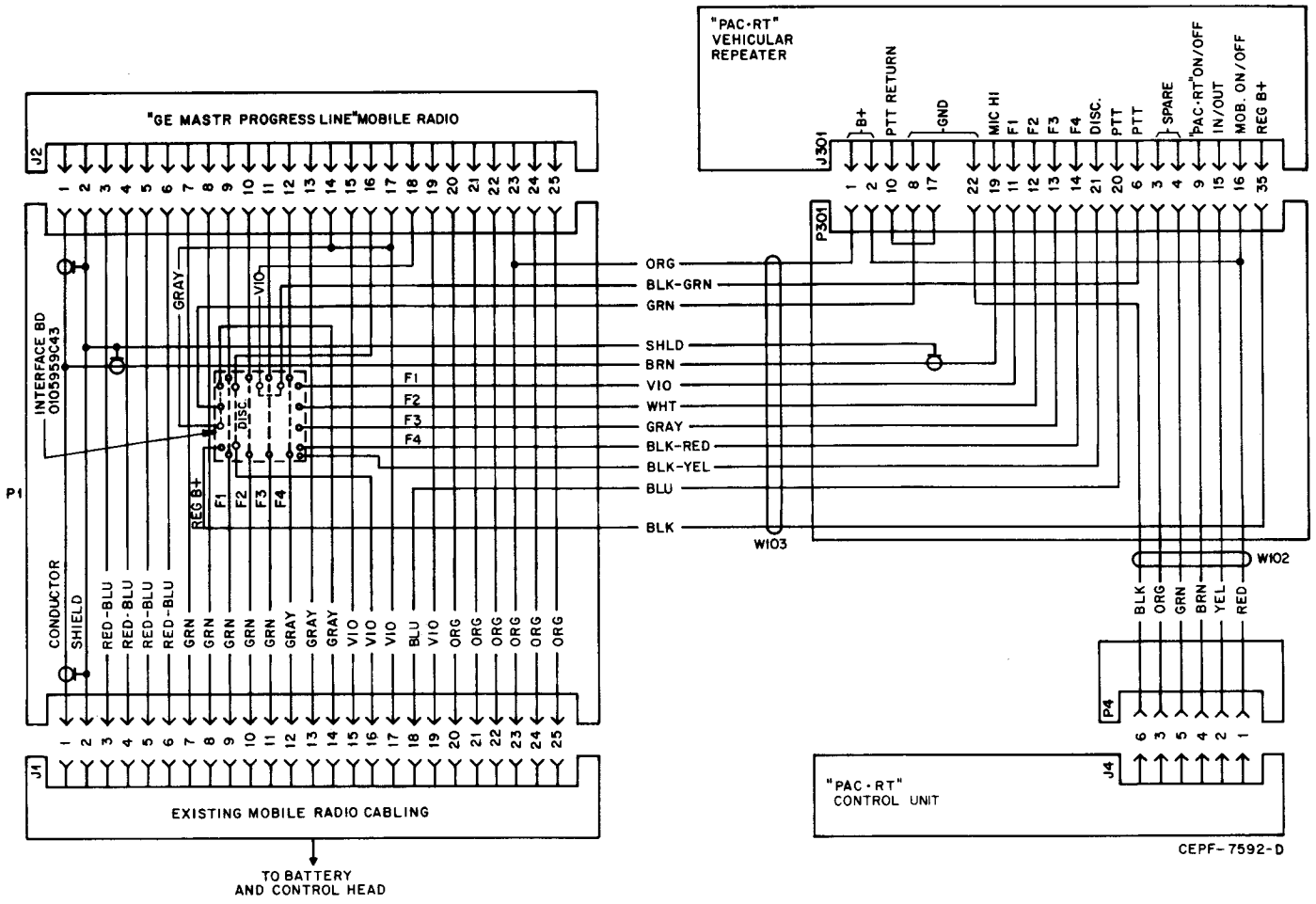


NKN6214B Interface Cable Kit PLF-1570-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, Plug:
P1	2800802820	19-contact, male
P4	2884510H01	6-pin, female
P301	0984086B01	37-contact, female
P402 (TYP)	0900801050	19-contact, female
		CABLE:
W101	3084875E01	Control, 2'
W102	3000864650	Control, 6'
W103	3005635D01	Charger, 17'
	0300851875	Ground, 2'
	0300812505	Power, 2'
NONREFERENCED ITEMS		
	(For P1)	
	0200129924	NUT, Hex; 4-40 x 1/4" x 3/32"
	0300131758	SCREW, Slotted; 4-40 x 1/8"
	0300132127	SCREW, Hex; 6-60 x 3/4"
	1582075D01	HOUSING, Plug (RH)
	1582075D03	HOUSING, Plug (LH)
	4200864148	STRAIN RELIEF
	(For P4)	
	3700842245	SLEEVE, Strain Relief
	4200850817	CLAMP, Cable
	(For P301)	
	0300138901	SCREW, Phillips; 6-32 x 5/8"
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	0984151B05	CONTACT
	0984151B06	CONTACT
	1505298F01	SHIELD
	0300107364	SCREW
	(For P402)	
	0200129924	NUT, Hex; 4-40 x 1/4" x 3/32"
	0300119947	SCREW, Phillips; 6-20 x 3/8"
	0300131758	SCREW, Slotted; 4-40 x 1/8"
	0300867088	SCREW, Cover Retaining
	0400011722	WASHER, "C"
	0400800671	WASHER
	0482113D01	WASHER, Flat
	1582075D01	HOUSING, Plug (RH)
	1582075D03	HOUSING, Plug (LH)
	3600867087	KNOB, Retainer
	4205841D01	CLAMP, Cable

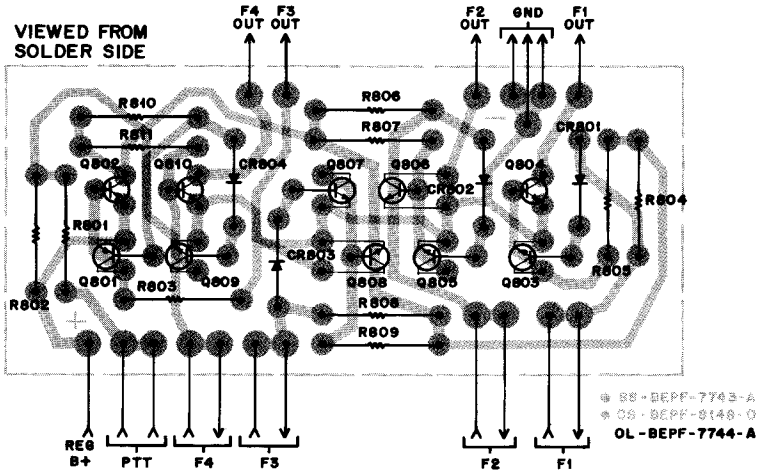
INTERCABLING DIAGRAMS ("MOCOM•70," "MOTRAC," "MITREK," "MOTRAN")

INTERCABLING DIAGRAM

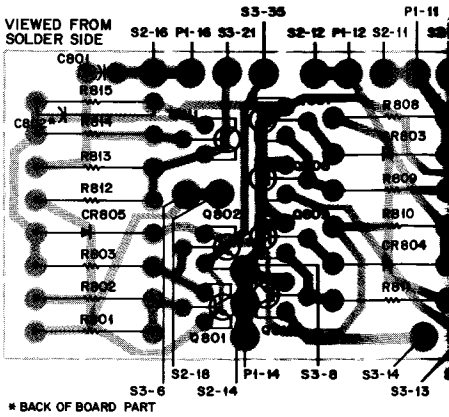


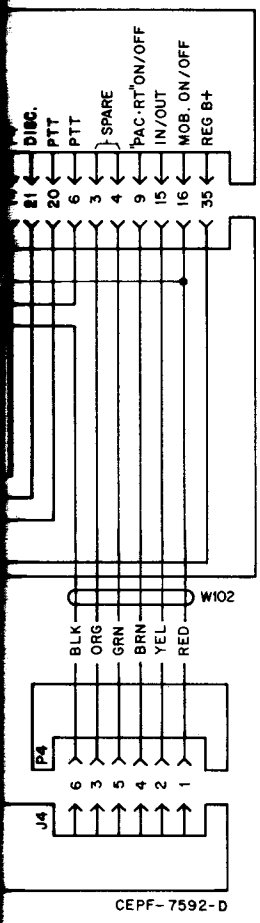
CIRCUIT BOARD DETAIL

NKN6231A

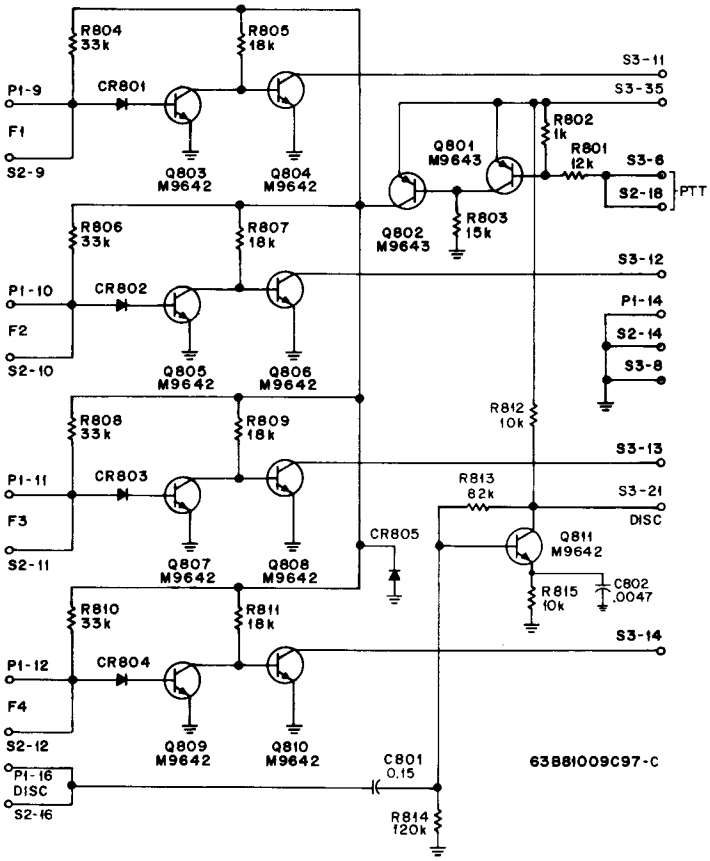


NKN6231-1 & Late





SCHEMATIC DIAGRAM

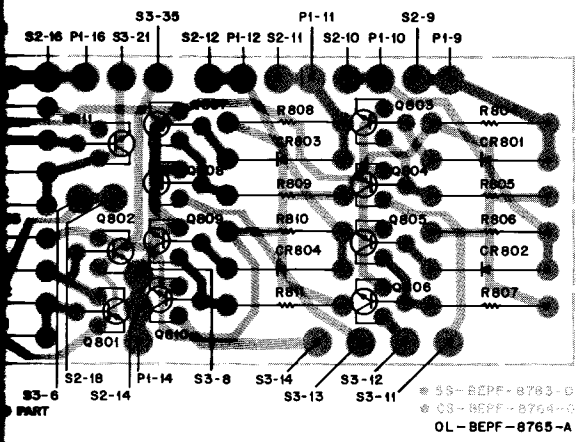


REV

BOARD AND SUFFIX NO.	REFERENCE SYMBOL
NKN6231A	---
NKN6231A-1	C801
	CR805
	Q811
	R812 thru
	R812
	R813
NKN6231A-2	C802

IL

NKN6231 - 1 & Later



NKN6231A Interface Cable Kit ("GE MASTR Progress Line") PLF-1320-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed:
C801	2184008H03	0.15 uF ±20%; 5 V
C802	2182428B27	.0047 uF
		DIODE: See Note
CR801 thru 805	4883654H01	Silicon
		CONNECTOR, Plug:
P1	----------	Refer to NONREFERENCED ITEMS
P4	2884510H01	6-pin, female
P301	0984086B01	Receptacle, 37-contact
		TRANSISTOR: See Note
Q801, 802	4800869643	PNP; type M9643
Q803 thru 810	4800869642	NPN; type M9642
		RESISTOR, Fixed: Ω ±5% 1/4 W
R801	0600124A75	12 k
R802	0600124A49	1 k
R803	0600124A77	15 k
R804	0600124A85	33 k
R805	0600124A79	18 k
R806	0600124A85	33 k
R807	0600124A79	18 k
R808	0600124A85	33 k
R809	0600124A79	18 k
R810	0600124A85	33 k
R811	0600124A79	18 k
R812	0600124A73	10 k
R813	0600124A95	82 k
R814	0600124A99	120 k
R815	0600124A73	10 k
		CABLE:
W102	3000864650	Control, 6'
W103	3005635D01	Charger, 17'
NONREFERENCED ITEMS		
	8405644F01	INTERFACE BOARD
	(For P1)	
	0300131122	SCREW, 6-32 x 1-5/8"
	0305665D01	SCREW, Special
	1405279E03	INSULATOR, Shim
	1405666D01	INSULATOR, (on male side of connector)
	1405666D02	INSULATOR, (on female side of connector)
	1505675D01	COVER, Top
	1505675D02	COVER, Bottom
	2982335A02	TERMIMAL PIN, Male (25)
	2982336A02	TERMINAL PIN, Female (25)
	4282018H17	RETAINER, Cable
	(For P4)	
	3700842245	STRAIN RELIEF
	4200850817	CLAMP
	(For P301)	
	0300138901	SCREW, Phillips; 6-32 x 5/8"
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear

NOTE: For optimum performance, order replacement transistors and diodes by Motorola part number only.

REVISIONS

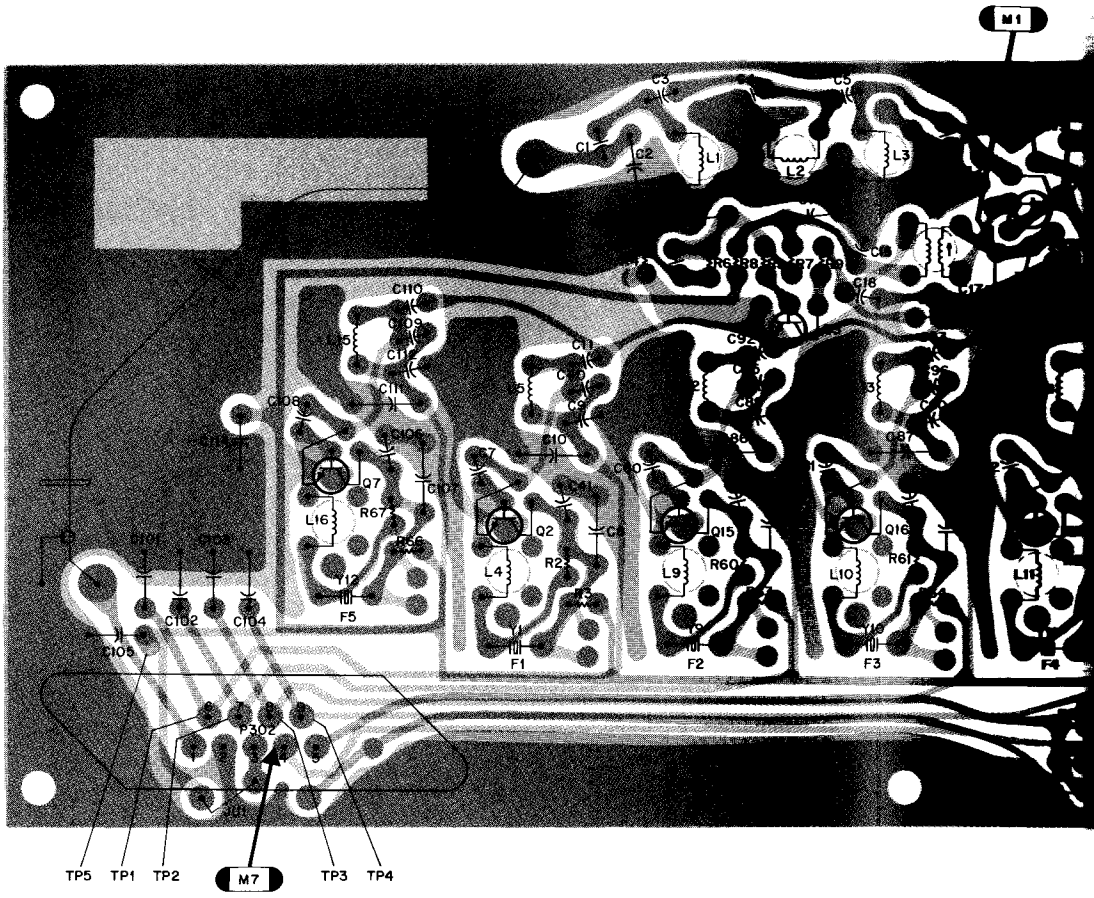
BOARD AND SUFFIX NO.	REFERENCE SYMBOL	CHANGE
NKN6231A	---	Circuit Board, was 8405290F01
NKN6231A-1	C801	Added, was 2184008H13, .05 uF
	CR805	Added
	Q811	Added
	R812 thru 815	Added
	R812	Was 0600124A97, 100 k
	R813	Was 0600124B14, 470 k
NKN6231A-2	C802	Added

Mobile Detector

NRB6252A (30-40 MHz)
NRB6262A (40-50 MHz)

PLF-1085-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ± 10% 50V unless stated
C1	2184511B13	33 (30-40 MHz)
	or 2184511B10	18 (40-50 MHz)
C2	2184511B28	270 (30-40 MHz)
	or 2184511B25	120 (40-50 MHz)
C3	2184511B03	1.5 ± 0.25pF
C4	2184511B12	27 (30-40 MHz)
	or 2184511B09	15 (40-50 MHz)
C5	2184511B03	1.5 ± 0.25pF
C6	2184511B12	27 (30-40 MHz)
	or 2184511B09	15 (40-50 MHz)
C7	2105529B10	40 ± 5%
C8	2182428B62	.01uF – 20 + 80%; 500V
C9	2184511B01	100; N750
C10	2182428B62	.01uF – 20 + 80%; 500V
C11	2182358G22	8 ± 0.25pF
C12	2184511B01	100; N750
C13	2182428B62	.01uF – 20 + 80%; 500V
C14	2182213E09	.002uF
C15, 16	2184511B01	100; N750
C17	2182213E09	.002uF
C18	2184511B24	100 (30-40 MHz)
	or 2184511B20	68 (40-50 MHz)
C19	2182428B62	.01uF – 20 + 80%; 500V
C20, 21	2184511B01	100; N750
C22	2184008H03	0.15uF – 20 + 80%
C23	0882905G05	0.15uF
C24	2184511B01	100; N750
C25	2382256J08	22uF – 10 + 50%; 40V
C26, 27	0882096J06	1500; 250V
C28	2184511B01	100; N750
C29	2384762H08	3.9uF ± 20%; 15V
C30	2382256J08	22uF – 10 + 50%; 40V
C31	2182213E08	1000 ± 5%; 100V
C32	2184511B01	100; N750
C33	2183162H24	650 ± 5%
C34	0882905G01	.01uF
C35	2382256J07	4.7uF – 10 + 50%; 63V
C36, 38	0883514E08	0.22uF
C37	2184511B86	30
C39	2184511B01	100; N750
C40	2182358G03	5.6 ± 0.25pF
C41	2184511B01	100; N750
C42	2382256J03	10uF – 10 + 50%; 25V
C43	2182372C07	.05uF – 20 + 80%; 25V
C44	2100847065	500
C45	2184511B23	91
C46	2184511B26	150
C47	2184511B48	180
C48	2182372C07	.05uF – 20 + 80%; 25V
C49	2184511B33	1.3 ± 0.25pF
C50	2182372C07	.05uF – 20 + 80%; 25V
C51	0882163J06	300 ± 5%; 63V
C52	2182372C07	.05uF – 20 + 80%; 25V
C53	2182877B53	300
C54	2182877B54	500; N750
C55	0882163J07	400 ± 5%; 63V
C56	2182213E08	1000 ± 5%; 100V
C57	2182372C07	.05uF – 20 + 80%; 25V
C58	2184511B25	120
C59	2184511B13	33
C60	2383441B27	10uF ± 20%; 15V
C61	2182213E08	1000 ± 5%; 100V
C62	2383441B29	1uF ± 20%; 20V
C63	2383441B28	22uF ± 20%; 15V
C64	2184008H13	.05uF ± 20%; 25V
C65	2182213E08	1000 ± 5%; 100V
C66	2182372C07	.05uF – 20 + 80%; 25V
C67	2182213E08	1000 ± 5%; 100V
C68	2182372C07	.05uF – 20 + 80%; 25V
C69	2182187B14	1000; 100V
C70	2182372C07	.05uF – 20 + 80%; 25V
C71	2182213E08	1000 ± 5%; 100V
C72	2182372C07	.05uF – 20 + 80%; 25V
C73	2182428B10	3300; 100V
C74	0882163J09	2000 ± 5%; 33V
C75	2182428B36	2000; 200V
C76	0882096J14	.015uF; 250V
C77	2184511B24	100
C78	2323441B28	22uF ± 20%; 15V
C79	2184511B24	100
C80, 81, 82	2105529B10	40 ± 5%
C83 thru 88	2182428B62	.01uF – 20 + 80%; 500V
C89, 90, 91	2184511B01	100; N750
C92, 93, 94	2182358G22	8 ± 0.25pF
C95, 96, 97	2182358G03	5.6
C98, 99, 100	2184511B01	100; N750
C101 thru 105	2182213E09	.002uF
C106	2184511B01	100; N750
C107	2182428B62	.01uF – 20 + 80%; 500V
C108	2105529B10	40 ± 5%
C109	2182358G03	5.6
C110	2182358G22	8 ± 0.25pF
C111	2182428B62	.01uF – 20 + 80%; 500V
C112	2184511B01	100; N750
C113, 114	2182213E09	.002uF
C115	0882096J04	.047uF; 250V
C116	2105529B08	30 (30-33 MHz)
	or 2105529B05	20 ± 5% (40-45 MHz)
C117	2184511B01	100; N750
		DIODE: See Note I
CR1, 2	4882139G01	Germanium
		INTEGRATED CIRCUIT:
IC1	5184267A09	Squelch Detector; Type M6709
		COIL, RF:
L1, 2, 3	2482273J01	Coded CLEAR, 12-¼ turns closewound
L4	2482944J12	Coded ORANGE, 15-¼ turns closewound
L5	2482723H07	10uH choke
L6	2482723H20	0.29uH choke
L7, 8	2482827J08	Coded GREEN, 36-¾ turns closewound
L9, 10, 11	2482944J12	Coded ORANGE, 15-¼ turns closewound
L12 thru 15	2482723H07	10uH choke
L16	2482944J12	Coded ORANGE, 15-¼ turns closewound
		PLUG:
P302	2882846E02	Connector, 9-pin
		TRANSISTOR: See Note I
Q1	4800869726	NPN, Type M9726
Q2	4800869662	NPN, Type M9662
Q3 thru 6	4800869570	NPN, Type M9570
Q7	4800869662	NPN, Type M9662
Q8	4800869494	NPN, Type M9494
Q9, 10	4800869570	NPN, Type M9570
Q11	4800869571	PNP, Type M9571
Q12	4800869570	NPN, Type M9570
Q13	4800865971	PNP, Type M9571
Q14	4800869570	NPN, Type M9570
Q15, 16, 17	4800869662	NPN, Type M9662
		RESISTOR, Fixed: Ω ± 5%; ¼W unless stated
R1	0611009C73	10k
R2	0611009C47	820
R3	0611009C73	10k
R4	0611009C57	2.2k
R5	0600124A09	22
R6	0611009C85	33k
R7	0611009C67	5.6k
R8	0611009C51	1.2k
R9	0600124A25	100
R10	0611009D12	390k
R11	0611009C89	47k
R12	0611009C57	2.2k
R13	0611009C73	10k
R15	0600124A25	100
R16	0611009D12	390k
R17	0611009C89	47k
R18	1884944C03	Pot., 10k
R19	0611009C45	680k
R20	0611009C81	22k
R21	0600124A05	15
R22	0611009C97	100k
R23	0611009D04	180k
R24	0611009C83	27k
R25		
R26		
R27		
R29		
R30		
R31		
R32		
R33		
R34		
R35		
R36		
R37		
R38		
R39		
R40		
R41		
R42		
R43		
R44, 45		
R46, 47		
R48		
R49, 50		
R51		
R52		
R53		
R54		
R55		
R56, 57		
R58		
R59		
R60, 61, 62		
R63 thru 66		
R67		
T1		
T2, 3		
T4		



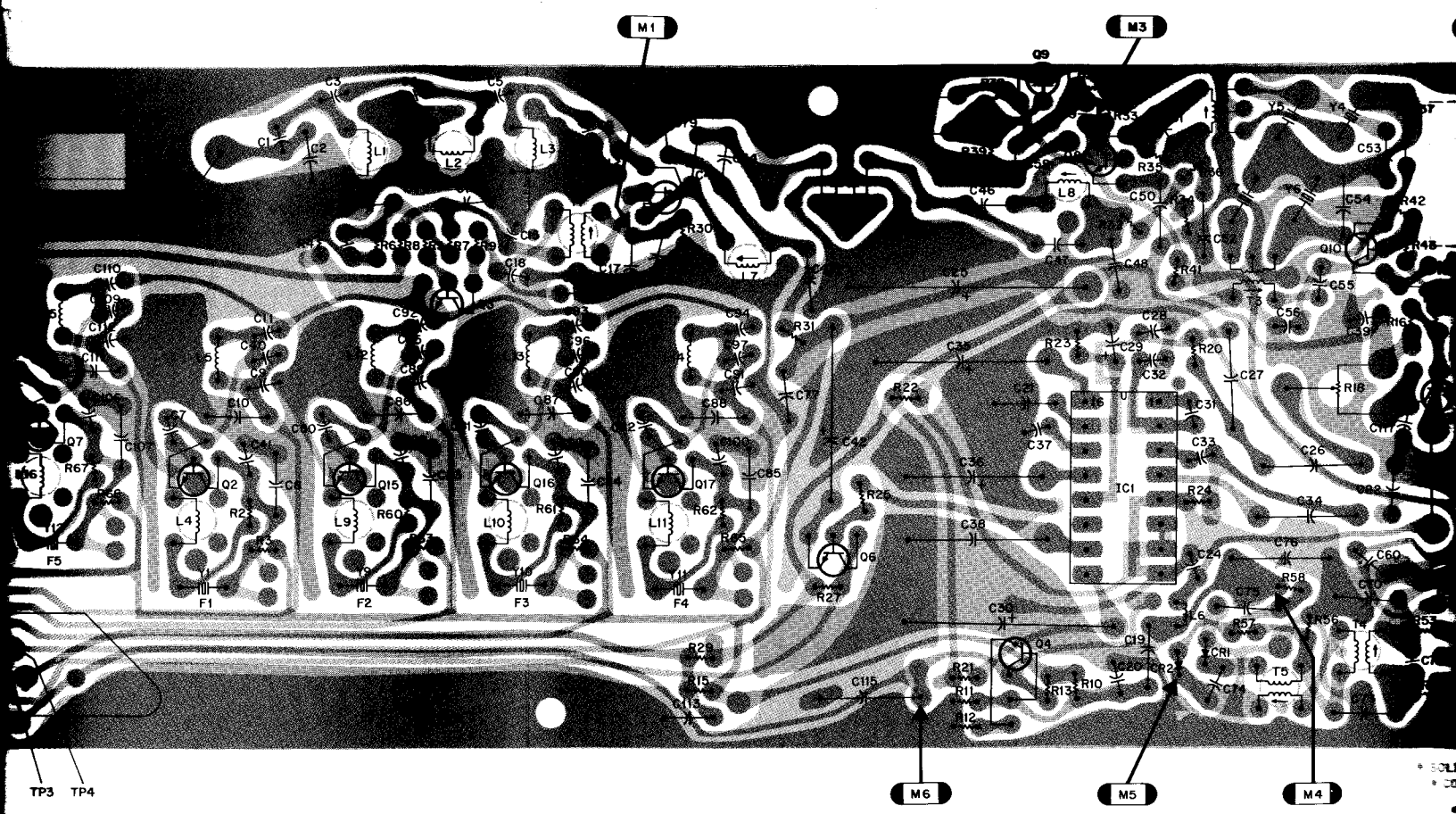
R25	0611009C89	47k
R26	0611009C73	10k
R27	0611009C79	18k
R29	0600124A19	56
R30	0611009C51	1.2k
R31	0600124A31	180
R32	0611009C97	100k
R33	0611009C73	10k
R34	0611009C49	1k
R35	0611009C81	22k
R36	0611009C43	560
R37	0600124A17	47
R38	0611009C75	12k
R39	0611009C69	6.8k
R40	0611009C53	1.5k
R41	0611009C59	2.7k
R42	0611009C83	27k
R43	0611009C95	82k
R44, 45	0611009C65	4.7k
R46, 47	0611009C97	100k
R48	0611009C55	1.8k
R49, 50	0611009C65	4.7k
R51	0611009C97	100k
R52	0611009C49	1k
R53	0611009D04	180k
R54	0611009C37	330
R55	0611009C49	1k
R56, 57	0611009C83	27k
R58	0611009C65	4.7k
R59	0611009C55	1.8k
R60, 61, 62	0611009C47	820
R63 thru 66	0611009C73	10k
R67	0611009C47	820
		TRANSFORMER:
T1	2482827J11	Coded YELLOW; Pri: 5-¼ turns, Sec: 2-¼ turns; Includes 7682451B04 CORE
T2, 3	2482045J07	455 kHz
T4	0105957A62	ASSEMBLY, Includes: COIL 2484235H02, SHIELD 2684800H11, CORE 7682686D06
T5	0105957A64	ASSEMBLY, Includes: COIL 2484235H01, SHIELD 2684800H11, CORE 7682686D06
		FILTER: See Note II
Y1	KXN6126AA	40.7-43.7 MHz
	or KXN6126AB	43.7-57.1 MHz
	or KXN6126AC	57.1-60.7 MHz
Y2	9105898C02	10.7 MHz Ceramic
Y4	4883192C13	Resonator, 450.3 kHz
Y5, 6	4883192C22	Resonator, 459.4 kHz
Y7	4883192C13	Resonator, 450.3 kHz
Y8	4884806C01	10.245 MHz
	or 4884224C02	11.155 MHz
Y9 thru 12	KXN6126AA	40.7-43.7 MHz
	or KXN6126AB	43.7-57.1 MHz
	or KXN6126AC	57.1-60.7 MHz

	MOTOROLA PART NO.	NONREFERENCED ITE
	3083361G01	CABLE, Coax
	2684800H11	SHIELD, Coil; 30-40 MHz (for L4, L9, L10, L11, L16)
	or 2684800H03	SHIELD, Coil; 40-50 MHz (for L4, L9, L10, L11, L16)
	2684800H07	SHIELD, Coil; for L1, L2, L3, L7, L8, & T1
	7682686D06	SLEEVE, Ferrite; for L4, L9, L10, L11, L16 (30-40 MHz models only)
	7682686D09	CORE, Ferrite; for L1, L2, & L3
	1405525D01	PAD, Insulator; for T2, T3
	1483485A01	PAD, Insulator; for Y1, Y8, Y9, Y10, Y11, Y12
	0705121D01	BRACKET, Connector; for P30

NOTES:

I. For optimum performance, order replacement diodes and transistors by Mo number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), type number. Proper oscillator frequency and crystal type will be found s crystal can.



T5	0105957A64	ASSEMBLY, Includes: COIL 2484235H01, SHIELD 2684800H11, CORE 7682686D06
		FILTER: See Note II
Y1	KXN6126AA	40.7-43.7 MHz
	or KXN6126AB	43.7-57.1 MHz
	or KXN6126AC	57.1-60.7 MHz
Y2	9105898C02	10.7 MHz Ceramic
Y4	4883192C13	Resonator, 450.3 kHz
Y5, 6	4883192C22	Resonator, 459.4 kHz
Y7	4883192C13	Resonator, 450.3 kHz
Y8	4884806C01	10.245 MHz
	or 4884224C02	11.155 MHz
Y9 thru 12	KXN6126AA	40.7-43.7 MHz
	or KXN6126AB	43.7-57.1 MHz
	or KXN6126AC	57.1-60.7 MHz

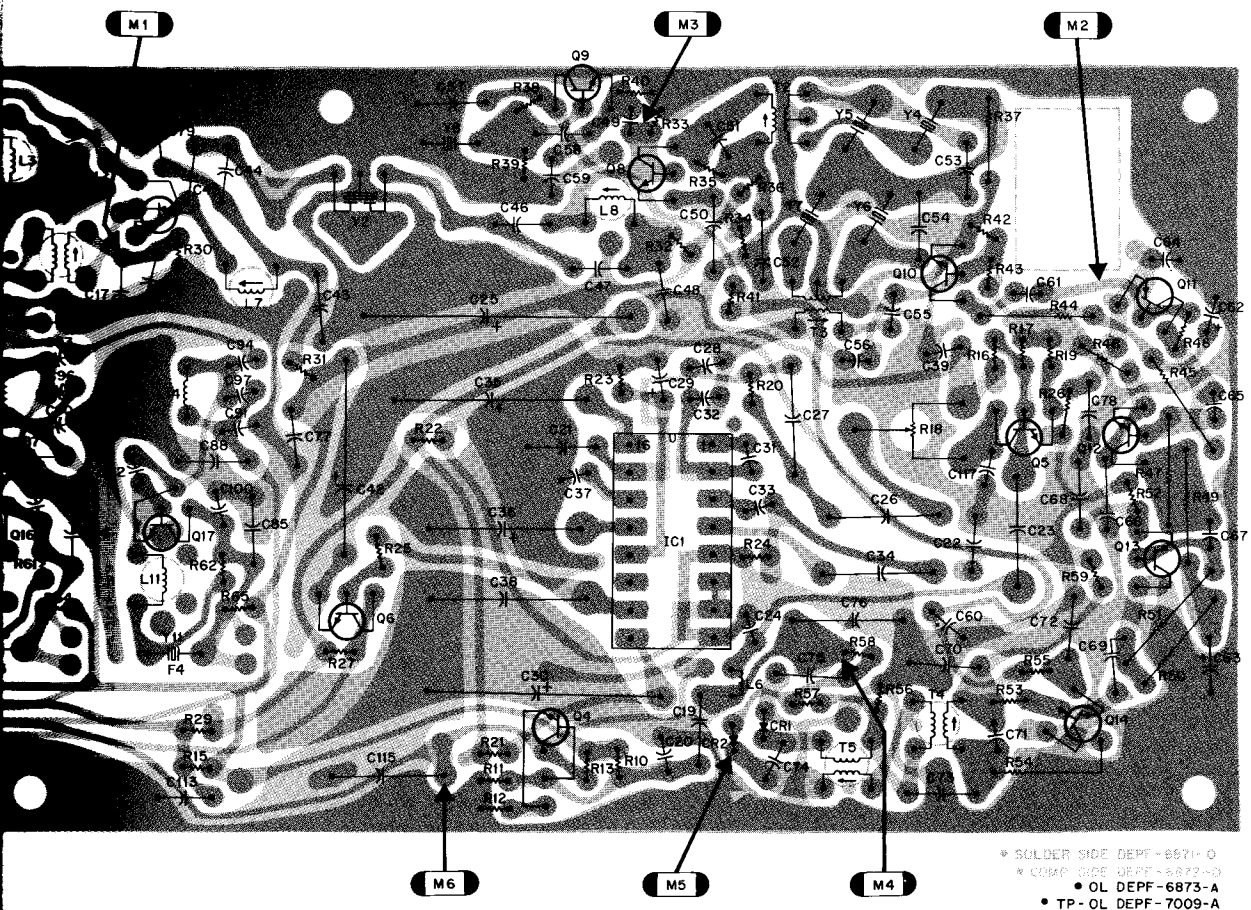
	MOTOROLA PART NO.	NONREFERENCED ITEMS
	3083361G01	CABLE, Coax
	2684800H11	SHIELD, Coil; 30-40 MHz (for L4, L9, L10, L11, L16)
	or 2684800H03	SHIELD, Coil; 40-50 MHz (for L4, L9, L10, L11, L16)
	2684800H07	SHIELD, Coil; for L1, L2, L3, L7, L8, & T1
	7682686D06	SLEEVE, Ferrite; for L4, L9, L10, L11, L16 (30-40 MHz models only)
	7682686D09	CORE, Ferrite; for L1, L2, & L3
	1405525D01	PAD, Insulator; for T2, T3
	1483485A01	PAD, Insulator; for Y1, Y8, Y9, Y10, Y11, Y12
	0705121D01	BRACKET, Connector; for P302

NOTES:

I. For optimum performance, order replacement diodes and transistors by Motorola part number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Proper oscillator frequency and crystal type will be found stamped on crystal can.

(NRB6252A & NRB6262A)
30-50 MHz MOBILE DETECTO
CIRCUIT BOARD DETAIL AN



SEMBLY, Includes:
L 2484235H01,
ELD 2684800H11,
RE 7682686D06

TER: See Note II
7-43.7 MHz
7-57.1 MHz
1-60.7 MHz
7 MHz Ceramic
onator, 450.3 kHz
onator, 459.4 kHz
onator, 450.3 kHz
245 MHz
55 MHz
7-43.7 MHz
7-57.1 MHz
1-60.7 MHz

NONREFERENCED ITEMS

BLE, Coax
ELD, Coil; 30-40 MHz
L4, L9, L10, L11, L16)
ELD, Coil; 40-50 MHz
L4, L9, L10, L11, L16)
ELD, Coil; for L1, L2, L3,
L8, & T1
EVE, Ferrite; for L4, L9,
L11, L16 (30-40 MHz
dels only)
RE, Ferrite; for L1, L2, & L3
D, Insulator; for T2, T3
D, Insulator; for Y1, Y8, Y9,
, Y11, Y12
ACKET, Connector; for P302

diodes and transistors by Motorola part

uency(s), crystal frequency(s), and crystal
crystal type will be found stamped on

(NRB6252A & NRB6262A)
30-50 MHz MOBILE DETECTOR
CIRCUIT BOARD DETAIL AND PARTS LIST

SCHEMATIC AND CIRCUIT BOARD NOTES

1. VOLTAGE READINGS ARE TAKEN WITH THE OSCILLATOR RUNNING.
2. CAPACITOR C116 IS 30 pF FOR 30-33 MHz RANGE AND 20 pF FOR 40-45 MHz RANGE. C116 IS OMITTED FOR ALL OTHER RANGES.
3. VOLTAGE VARIES WITH FREQUENCY AND DRIVE.
4. SQUELCH IC1 PIN 12, +5.6 VOLTS DC WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH.
5. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, k = 1000;
   CAPACITOR VALUES EQUAL TO OR GREATER THAN ONE (1) ARE IN PICOFARADS (pF) AND VALUES LESS THAN ONE (1) ARE IN MICROFARADS (uF).
6. WHERE TWO COMPONENT VALUES ARE SHOWN, TOP VALUE IS FOR 30-40 MHz RANGE AND BOTTOM VALUE IS FOR 40-50 MHz RANGE.
7. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT.
8. WHERE TWO VOLTAGE VALUES ARE SHOWN, I.E. $\frac{2V}{6V}$,
   TOP VALUE IS FOR SQUELCHED OPERATIONAL MODE AND BOTTOM VALUE IS FOR UNSQUELCHED MODE.
9. FREQUENCY LEGEND:
   - f_c = CARRIER FREQUENCY (30-50 MHz)
   - f_{x1} = 1ST OSCILLATOR CRYSTAL FREQUENCY (40.7-60.7 MHz)
   - f_{x2} = 2ND OSCILLATOR CRYSTAL FREQUENCY (10.245-11.155 MHz) (SEE CRYSTAL FREQUENCY TABLE)
   - f_1 = HIGH INTERMEDIATE FREQUENCY (10.7 MHz)
   - f_2 = LOW INTERMEDIATE FREQUENCY (455 kHz)
   - f_c = f_{x1} - 10.7 MHz
   - f_1 = $f_{x2} + f_2$ (FOR f_{x2} = 10.245 MHz)
   - f_1 = $f_{x2} - f_2$ (FOR f_{x2} = 11.155 MHz)

EPF-6974-O

STAGE GAIN MEASUREMENT NOTES

GENERAL

1. 0 dBm = 1 mW INTO 600 OHMS.
2. REFER TO APPLICABLE MONITOR-RECEIVER SCHEMATIC AND MONITOR-RECEIVER GAIN MEASUREMENTS SECTION IN INSTRUCTION MANUAL FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL INFORMATION.
3. MAKE THE FOLLOWING MEASUREMENTS:

(R1) CONNECT RF SIGNAL GENERATOR TO RF INPUT AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.

(R2) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.

(R3) READING WITH ONE OSCILLATOR RUNNING. GROUND TP1, TP2, TP3, TP4, OR TP5 AS APPLICABLE.

(R7) SHORT Q3 (BUFFER AMPL) COLLECTOR TO GROUND WITH A 0.002 uF CAPACITOR. THE CHANGE IN VOLTAGE AT (R7) SHOULD BE GREATER THAN 0.02 V DC.

(R9),(R10) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV FOR THESE READINGS.

(R12) SET RF SIGNAL GENERATOR LEVEL TO 3.0 uV FOR THIS READING (USE AC VOLTMETER FOR MEASUREMENT).

(R13) thru (R28) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.

(R19) thru (R26) ADJUST SQUELCH CONTROL FOR FULL SQUELCH.

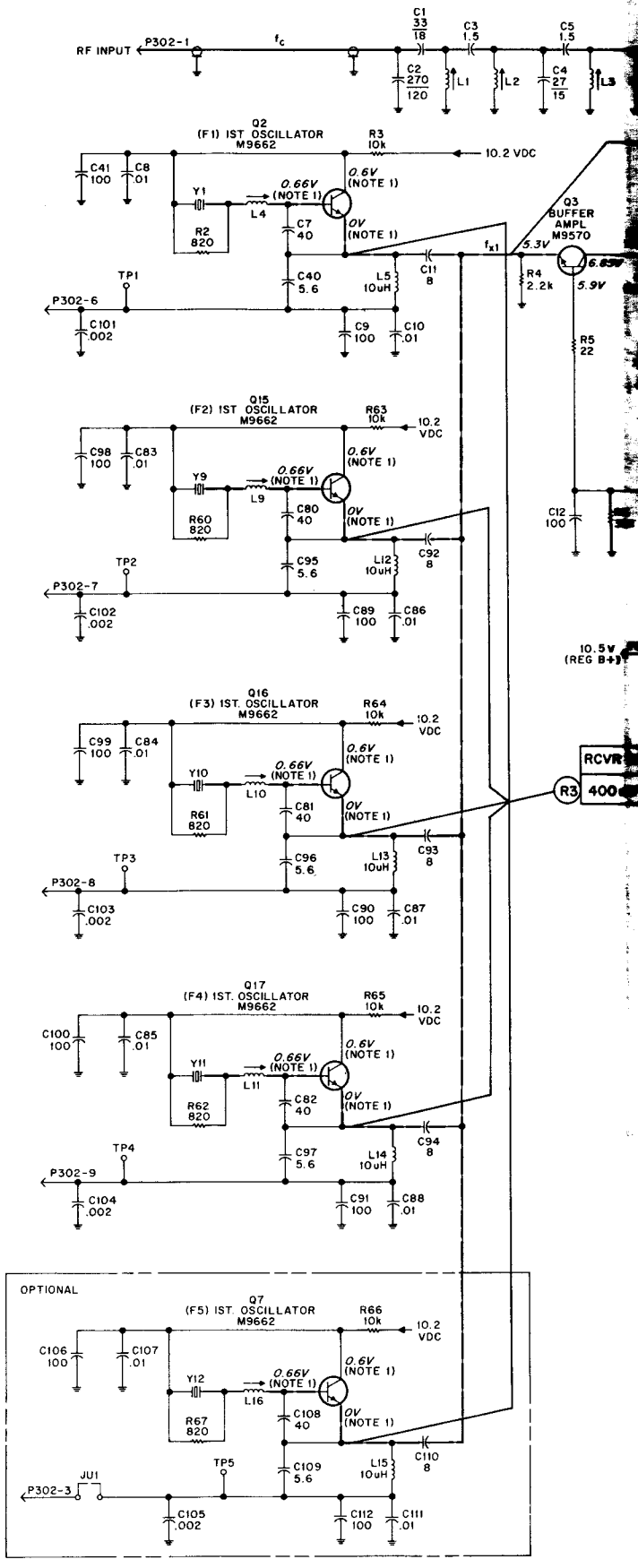
(R29) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

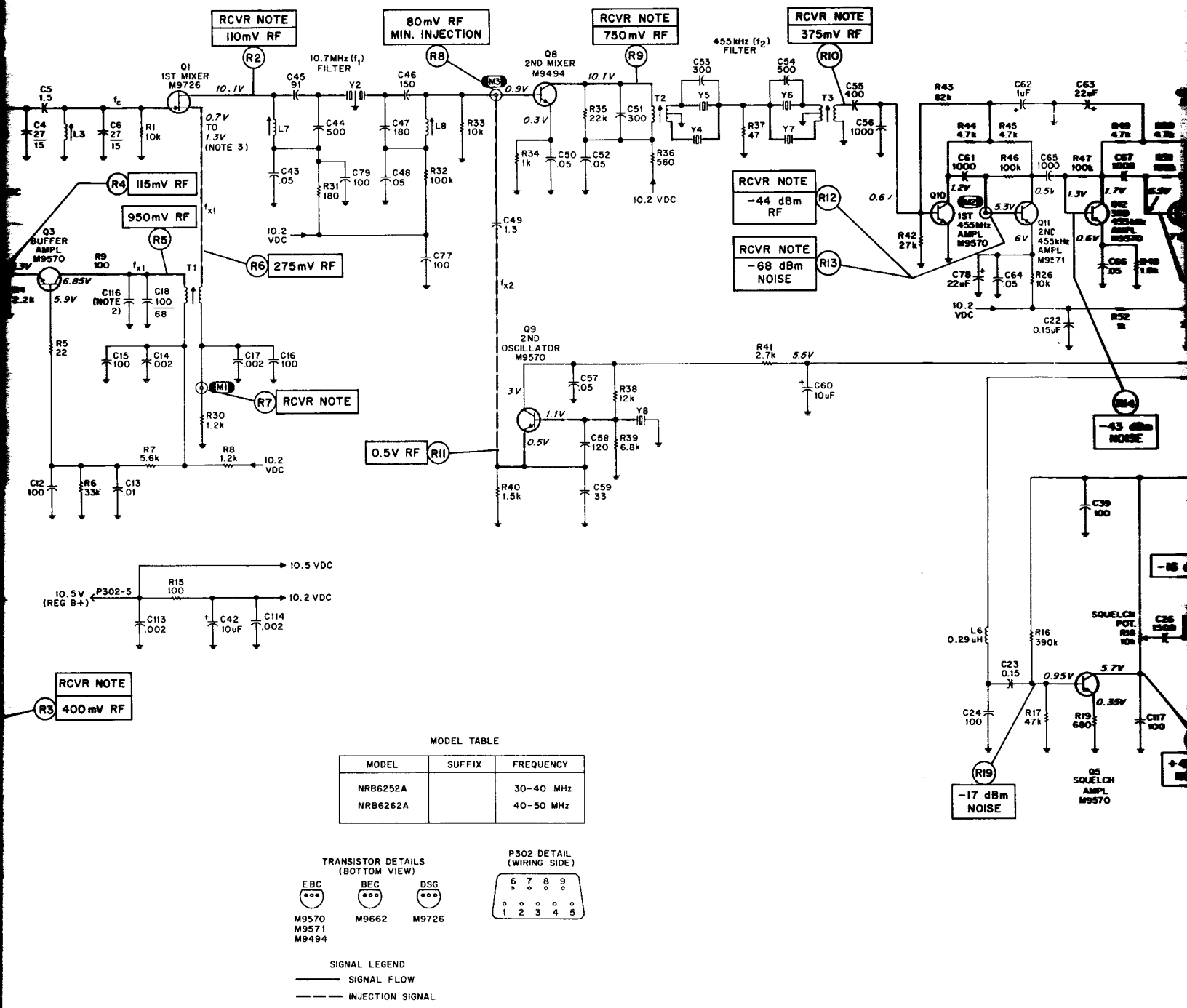
EPF-6973-A

CRYSTAL FREQUENCY TABLE

CARRIER FREQUENCY (f_c)	1ST OSCILLATOR CRYSTAL FREQUENCY (f_{x1})	2ND OSCILLATOR FREQUENCY (f_{x2})
30.000 - 30.760 MHz	40.700 - 41.460 MHz	11.155 MHz
30.761 - 34.440 MHz	41.461 - 45.140 MHz	10.245 MHz
34.441 - 37.260 MHz	45.141 - 47.960 MHz	11.155 MHz
37.261 - 39.760 MHz	47.961 - 50.460 MHz	10.245 MHz
39.761 - 41.000 MHz	50.461 - 51.700 MHz	11.155 MHz
41.001 - 45.600 MHz	51.701 - 56.300 MHz	10.245 MHz
45.601 - 48.320 MHz	56.301 - 59.020 MHz	11.155 MHz
48.321 - 50.000 MHz	59.021 - 60.700 MHz	10.245 MHz

EPF-6974-O





MODEL TABLE

MODEL	SUFFIX	FREQUENCY
NRB6252A		30-40 MHz
NRB6262A		40-50 MHz

TRANSISTOR DETAILS (BOTTOM VIEW)

M9570
M9571
M9494

M9662

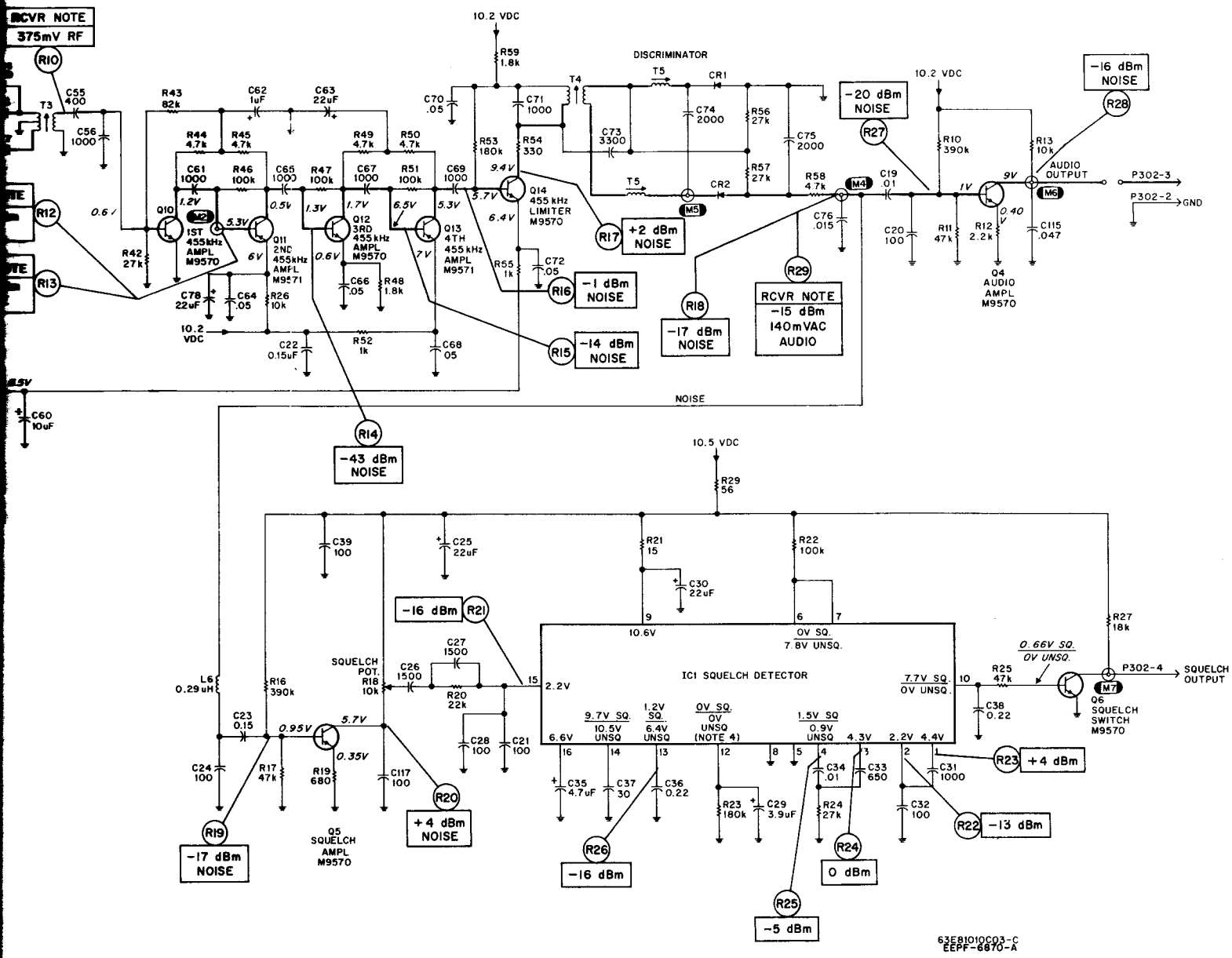
M9726

P302 DETAIL (WIRING SIDE)

SIGNAL LEGEND

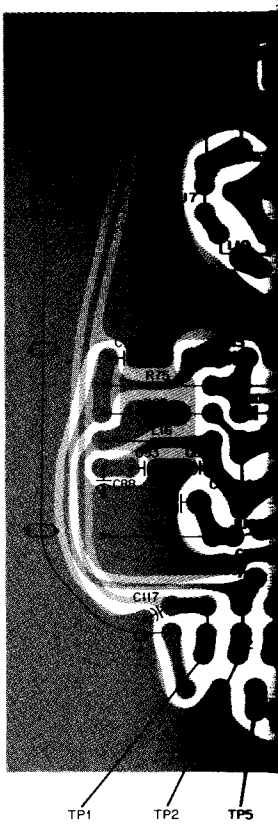
——— SIGNAL FLOW

— — — INJECTION SIGNAL

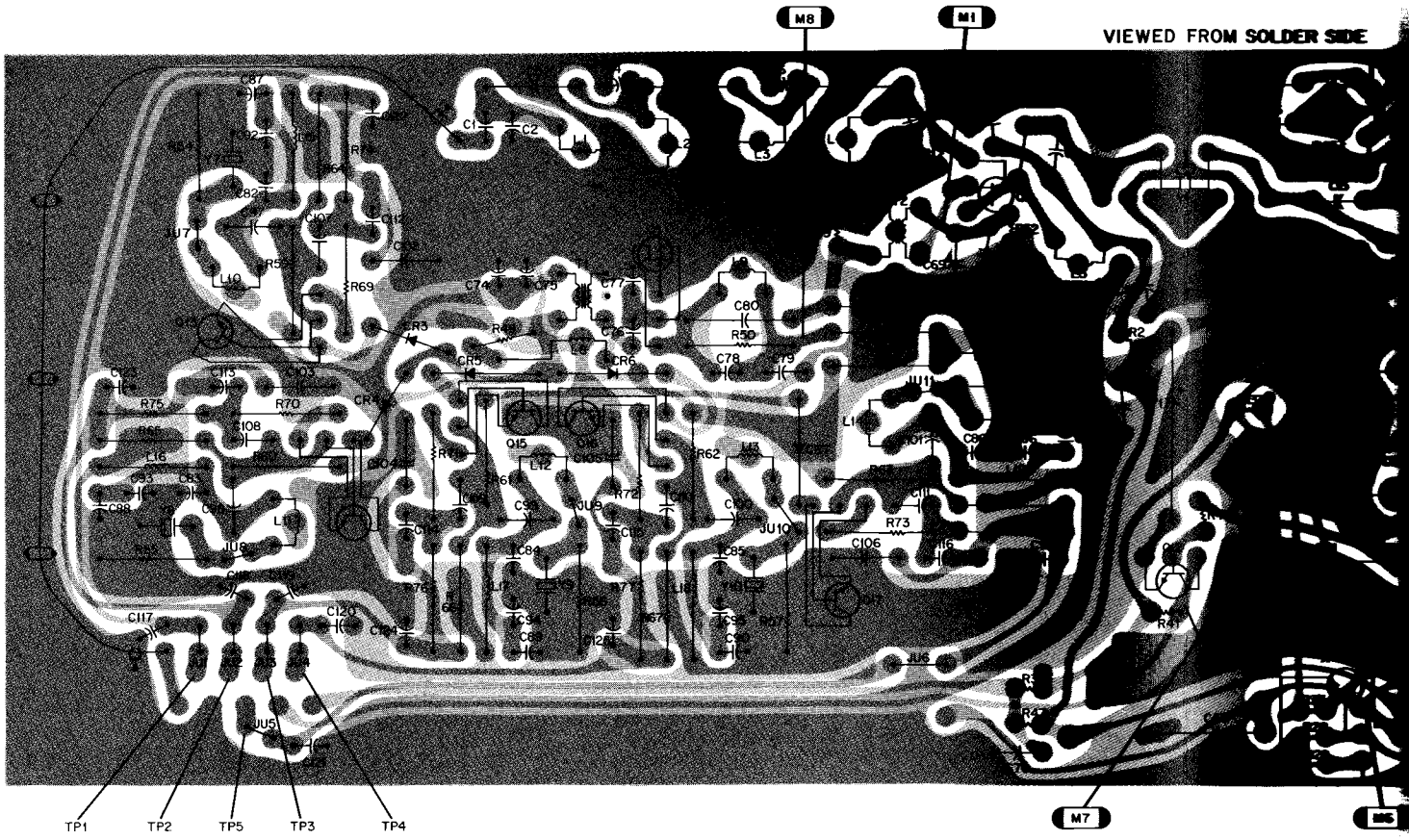


(NRB6252A & NRB6262A) 30-50 MHz
MOBILE DETECTOR SCHEMATIC DIAGRAM

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ±10%; 50 V unless stated
C1	2182358G85	1.9 ±0.1 pF
C2	2184511B84	7.5 ±0.25 pF
C3	2182450B21	0.39 uF; 500 V
C4	2184511B84	7.5 ±0.25 pF
C5	2182450B21	0.39 uF; 500 V
C6	2184511B84	7.5 ±0.25 pF
C7	2182450B21	0.39 uF; 500 V
C8	2184511B75	5.6 ±0.25 pF
C9	2184511B23	91
C10	2182372C07	.05 uF -20 +80%; 25 V
C11	2100847065	500
C12	2184511B24	100
C13	2184511B48	180
C14	2182372C07	.05 uF -20 +80%; 25 V
C15	2184511B26	150
C16	2184511B33	1.3 ±0.25 pF
C17, 18	2182372C07	.05 uF -20 +80%; 25 V
C19	0882163J06	300 ±5%; 63V
C20	2184511B26	150
C21	2184511B49	220; N750
C22	0882163J07	400 ±5%; 63V
C23, 24	2182213E08	1000 ±5%; 100 V
C25	2383441B28	22 uF ±20%; 15 V
C26	2184008H13	.05 uF ±20%; 25 V
C27	2182213E08	1000 ±5%; 100 V
C28	2383441B29	1 uF ±20%; 20 V
C29	2383441B28	22 uF ±20%; 15 V
C30	2182213E08	1000 ±5%; 100 V
C31	2182372C07	.05 uF -20 +80%; 25 V
C32	2184008H03	0.15 uF -20 +80%
C33	2182372C07	.05 uF -20 +80%; 25V
C34	2182187B14	1000; 100 V
C35	2182372C07	.05 uF -20 +80%; 25 V
C36	2182213E08	1000 ±5%; 100 V
C37	2182428B10	3300; 100 V
C38	0882163J09	2000 ±5%; 33 V
C39	2182428B36	2000; 250 V
C40	0882096J14	.015 uF; 250 V
C41	2182372C07	.05 uF -20 +80%; 25 V
C42	2184511B01	100; N750
C43	0882096J04	.047 uF; 250 V
C44	2184511B01	100; N750
C45	0882905G05	0.15 uF
C46	2184511B01	100; N750
C47	2382256J08	22 uF -10 +50%; 40 V
C48	2184511B01	100; N750
C49, 50	0882096J06	1500; 250 V
C51, 52	2184511B01	100; N750
C53	2382256J07	4.7 uF -10 +50%; 63V
C54	2184511B86	30
C55	0882905G12	0.22 uF
C56	2384762H08	3.9 uF ±20%; 15 V
C57	0882905G01	.01 uF
C58	2183162H24	650 ±5%
C59	2184511B01	100: N750
C60	2182213E08	1000 ±5%; 100 V
C61	0882905G12	0.22 uF
C62	2382256J08	22 uF -10 +50%; 40 V
C63	2182372C07	.05 uF -20 +80%; 25 V
C64	2383441B27	10 uF ±20%; 15 V
C65	2182372C07	.05 uF -20 +80%; 25 V
C66	2184511B25	120
C67	2184511B13	33
C68	2184511B01	100; N750
C69, 70	2182213E09	.002 uF
C71	2382256J03	10 uF -10 +50%; 25 V
C72	2182213E09	.002 uF
C73	2184511B24	100
C74, 75	2100861442	.002 uF
C76	2105350B01	13
C77	2184511B12	27
C78	2184511B07	8.2
C79	2184511B01	100; N750
C80	2182450B24	0.47
C81	2184511B07	8.2
C82 thru 86	2184511B84	7.5 ±0.25 pF
C87 thru 91	2184511B36	3.9 ±0.25 pF
C92 thru 96	2105350B01	13
C97 thru 101	2182428B36	2000; 250 V
C102 thru 106	2182428B62	.01 uF -20 +80%; 500 V
C107 thru 111	2184511B51	51
C112 thru 116	2184511B12	27
C117 thru 121	2184511B01	100; N750
C122 thru 126	2100861442	.002 uF
C127	2184511B85	10 ±0.25; N150
		DIODE: See Note I
CR1, 2	4882139G01	Germanium
CR3 thru 7	4883510F03	Switching
		INTEGRATED CIRCUIT:
IC1	5184267A09	Squelch Detector; type M6709



		COIL, RF: unless stated
L1 thru 4	2482827J09	Coded: BLU, 5-1/4 turns; includes 7682451B04 CORE
L5, 6	2482827J08	Coded: GRN, 36-3/4 turns; included 7600861425 CORE
L7	2482723H20	0.29 uH choke
L8	2482723H05	0.41 uH choke
L9	2482827J09	Coded: BLU, 5-1/4 turns; includes 7682451B04 CORE
L10 thru 14	2482827J10	Coded: BRN, 9-3/4 turns; includes 7682451B02 CORE
L15 thru 19	2482723H05	0.41 uH choke
		TRANSISTOR: See Note II
Q1	4800869725	N-channel FET; type M9725
Q2	4800869726	N-channel FET; type M9726
Q3	4800869494	NPN; type M9494
Q4	4800869570	NPN; type M9570
Q5	4800869571	PNP; type M9571
Q6	4800869570	NPN; type M9570
Q7	4800869571	PNP; type M9571
Q8 thru 12	4800869570	NPN; type M9570
Q13 thru 17	4800869724	NPN; type M9724
		RESISTOR, Fixed: Ω ±5% 1/4 W unless stated
R1	0600124A65	4.7 k
R2	0600124A31	180
R3	0600124A97	100 k
R4	0600124A73	10 k
R5	0600124A49	1 k
R6	0600124A81	22 k
R7	0600124A43	560
R8	0600124A17	47
R9	0600124A83	27 k
R10	0600124A95	82 k
R11, 12	0600124A65	4.7 k
R13	0600124A97	100 k
R14	0600124A73	10 k
R15	0600124A97	100 k
R16, 17	0600124A65	4.7 k
R18	0600124A97	100 k
R19	0600124A55	1.8 k
R20	0600124A49	1 k
R21	0600124A55	1.8 k
R22	0600124B04	180 k
R23	0600124A37	330
R24, 25	0600124A83	27 k



	COIL, RF: **unless stated**
709	**Coded:** BLU, 5-1/4 turns; **includes** 7682451B04 CORE
708	**Coded:** GRN, 36-3/4 turns; **included** 7600861425 CORE
220	**0.29** uH choke
205	**0.41** uH choke
209	**Coded:** BLU, 5-1/4 turns; **includes** 7682451B04 CORE
710	**Coded:** BRN, 9-3/4 turns; **includes** 7682451B02 CORE
305	**0.41** uH choke
	TRANSISTOR: See Note II
725	N-channel FET; type M9725
726	N-channel FET; type M9726
494	NPN; type M9494
570	NPN; type M9570
571	PNP; type M9571
570	NPN; type M9570
571	PNP; type M9571
570	NPN; type M9570
724	NPN; type M9724
	RESISTOR, Fixed: Ω ±5% 1/4 W unless stated
A65	4.7 k
A31	180
A97	100 k
A73	10 k
A49	1 k
A81	22 k
A43	560
A17	47
A83	27 k
A95	82 k
A65	4.7 k
A97	100 k
A73	10 k
A97	100 k
A65	4.7 k
A97	100 k
A55	1.8 k
A49	1 k
A55	1.8 k
B04	180 k
A37	330
A83	27 k

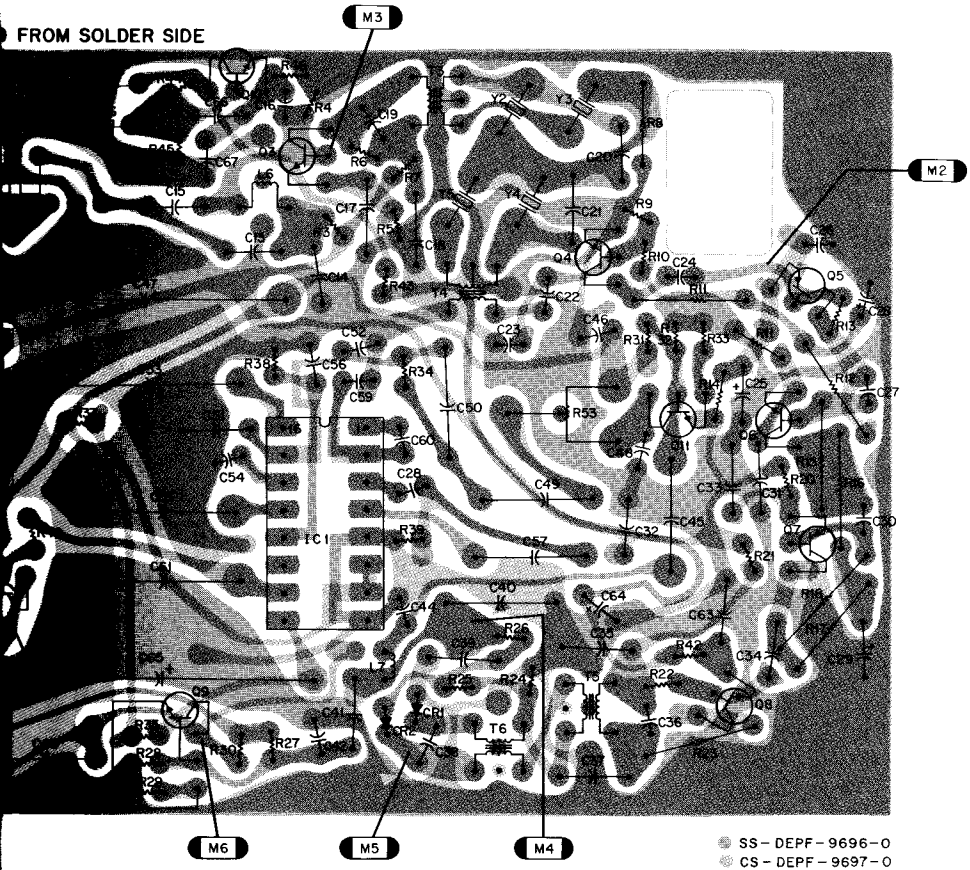
R26	0600124A65	4.7 k
R27	0600124B12	390 k
R28	0600124A89	47 k
R29	0600124A57	2.2 k
R30	0600124A73	10 k
R31	0600124B12	390 k
R32	0600124A89	47 k
R33	0600124A45	680
R34	0600124A81	22 k
R35	0600124A05	15
R36	0600124A19	56
R37	0600124A97	100 k
R38	0600124B04	180 k
R39	0600124A83	27 k
R40	0600124A89	47 k
R41	0600124A79	18 k
R42	0600124A49	1 k
R43	0600124A59	2.7 k
R44	0600124A75	12 k
R45	0600124A69	6.8 k
R46	0600124A53	1.5 k
R47	0600124A25	100
R48	0600124A57	2.2 k
R49	0600124A41	470
R50	0600124A87	39 k
R51	0600124A67	5.6 k
R52	0600124A51	1.2 k
R53	1884944C03	Pot., 10 k
R54 thru 58	0600124A47	820
R59 thru 63	0600124A79	18 k
R64 thru 68	0600124A81	22 k
R69 thru 73	0600124A01	10
R74 thru 78	0600124A57	2.2 k
R79	0600124A73	10 k
		TRANSFORMER:
T1, 2	2482827J11	Coded: YEL; Pri. -5-1/4 turns, Sec. -2-1/4 turns, includes 7682451B04 CORE
T3, 4	2482045J07	455 kHz
T5	0105957A62	ASSEMBLY, includes: 2484235H02 COIL, 2684800H11 SHIELD, and 7682686D06 CORE

T6	0186
Y1	9186
Y2	4886
Y3	4886
Y4	4886
Y5	4886
Y6	4886
	or 4886
Y7 thru 11	KXE
	NO
	0186
	0386
	0386
	0486
	0486
	1486
	1486
	2686
	3086
	4286
	8486

NOTES:

I. For optimum perf and transistors b

II. When ordering cr crystal frequency frequency and cr crystal can.



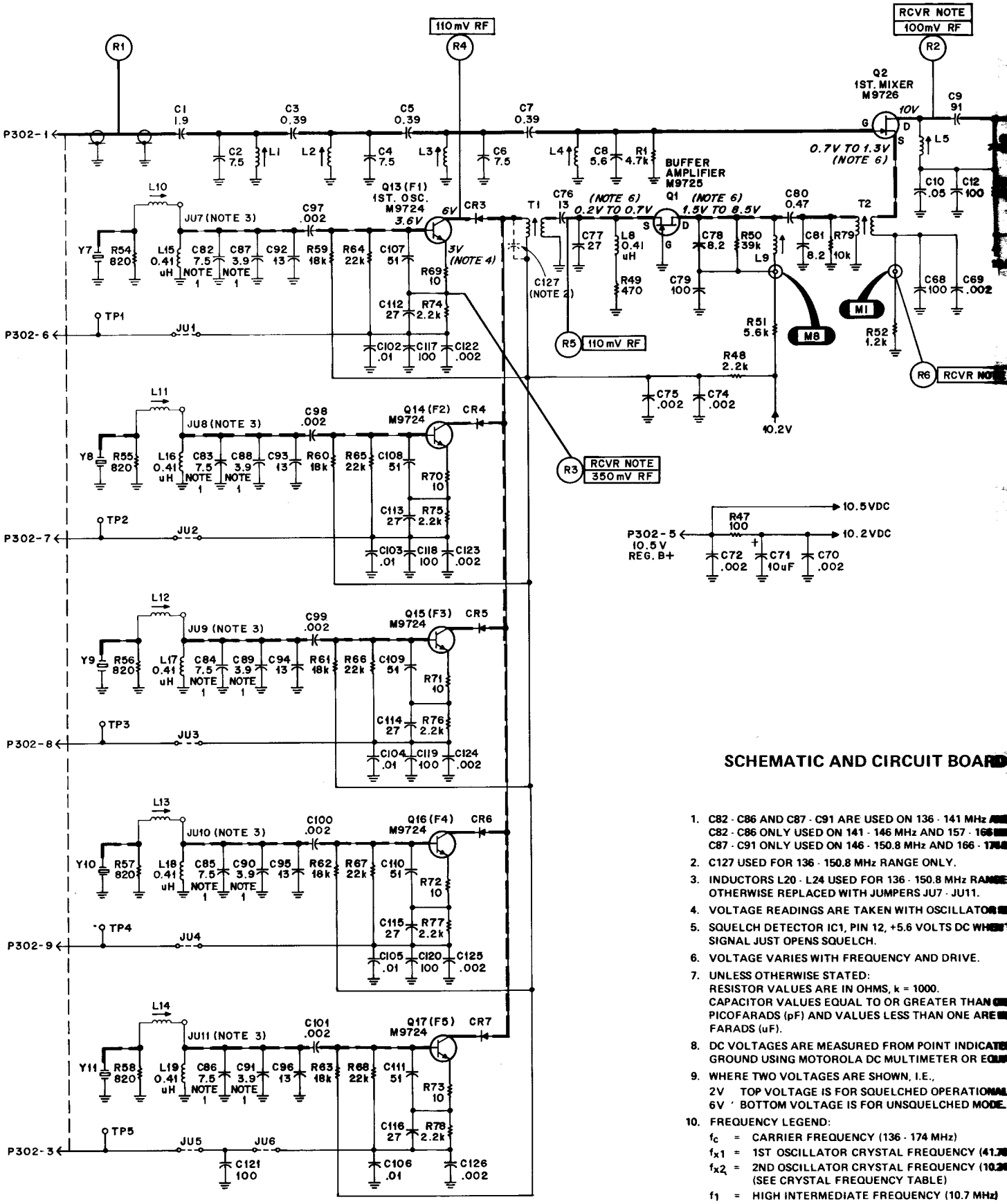
T6	0105957A64	ASSEMBLY, includes: 2484235H01 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
		CRYSTAL: See Note II
Y1	9105898C02	Ceramic, 10.7 MHz
Y2	4883192C22	Resonator, 459.4 kHz
Y3	4883192C13	Resonator, 450.3 kHz
Y4	4883192C22	Resonator, 459.4 kHz
Y5	4883192C13	Resonator, 450.3 kHz
Y6	4884224C07	10.245 MHz
	or 4884224C08	11.155 MHz
Y7 thru 11	KXN6034A	150.8-174 MHz
	NONREFERENCED ITEMS	
	0105953C99	ASSEMBLY, Connector and Bracket; includes: 0705121D01 BRACKET 2882846E02 PLUG, CONNECTOR 0300136772 SCREW, 2-56x5/16"
	0305101D01	SCREW, Phillips; 4-40x7/16"
	0300120621	SCREW, Phillips; 4-40 x1/4"
	0400008434	LOCKWASHER, Split; #4
	0484345A11	WASHER, Insulator
	1483485A01	PAD, Insulator; for Y6 thru Y11
	1484743H01	PAD, Insulator; for T3 & T4
	2684800H14	SHIELD, Coil; for L1 thru 6, L9, T1, & T2
	3083361G01	CABLE, Coaxial
	4284452H02	CLAMP
	8405813H01	CIRCUIT BOARD

NOTES:

I. For optimum performance, order replacement diodes and transistors by Motorola part number only.

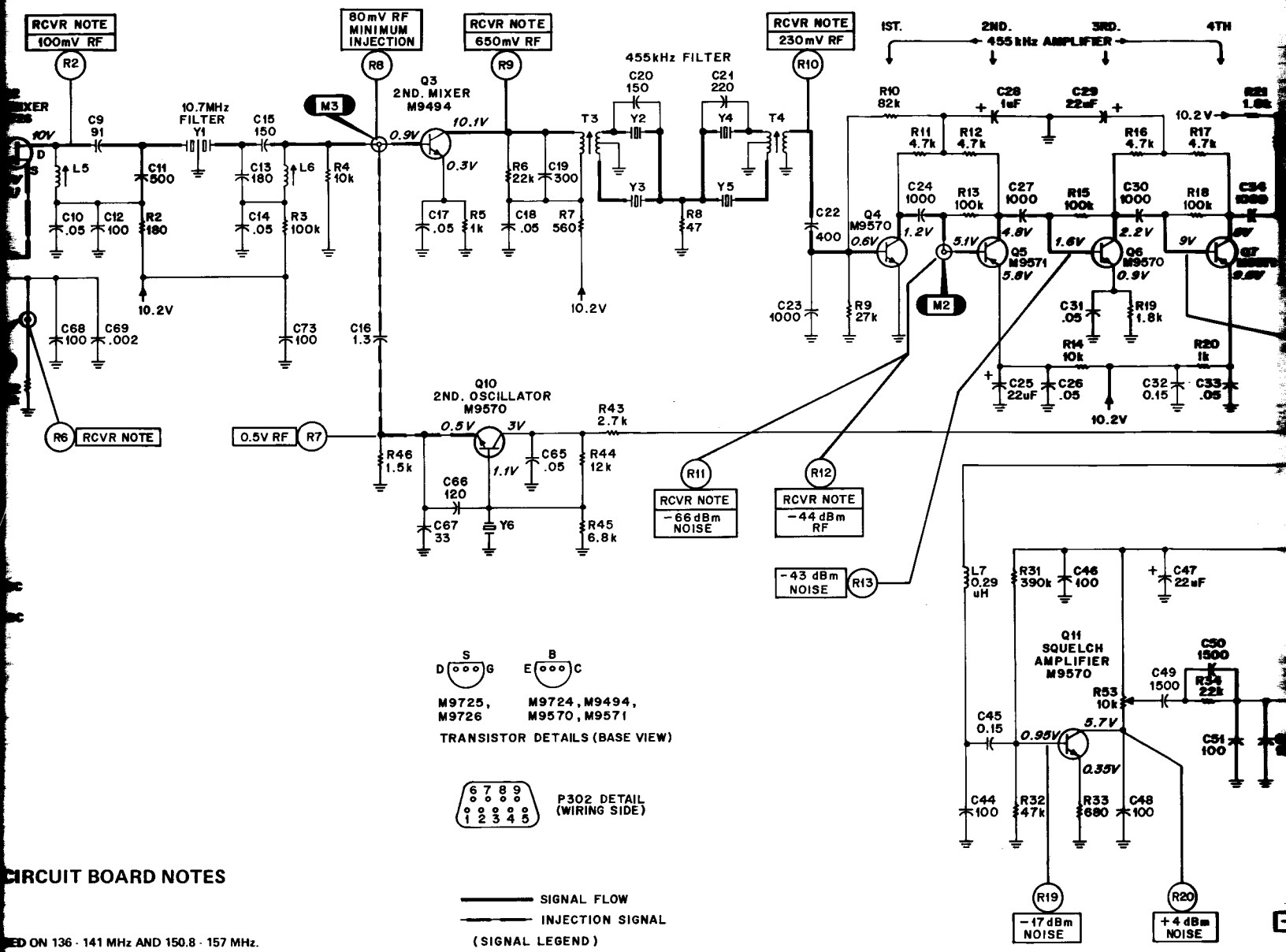
II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Oscillator frequency and crystal type will be found stamped on crystal can.

(CNRD6491A & NRD6632A) VHF MOBILE DETECTOR CIRCUIT BOARD LAYOUT DIAGRAM AND PARTS LIST



SCHEMATIC AND CIRCUIT BOARD

1. C82 - C86 AND C87 - C91 ARE USED ON 136 - 141 MHz [illegible]
   C82 - C86 ONLY USED ON 141 - 146 MHz AND 157 - 166 [illegible]
   C87 - C91 ONLY USED ON 146 - 150.8 MHz AND 166 - 174 [illegible]
2. C127 USED FOR 136 - 150.8 MHz RANGE ONLY.
3. INDUCTORS L20 - L24 USED FOR 136 - 150.8 MHz RANGE [illegible] OTHERWISE REPLACED WITH JUMPERS JU7 - JU11.
4. VOLTAGE READINGS ARE TAKEN WITH OSCILLATOR [illegible]
5. SQUELCH DETECTOR IC1, PIN 12, +5.6 VOLTS DC WHEN [illegible] SIGNAL JUST OPENS SQUELCH.
6. VOLTAGE VARIES WITH FREQUENCY AND DRIVE.
7. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, k = 1000.
   CAPACITOR VALUES EQUAL TO OR GREATER THAN [illegible] PICOFARADS (pF) AND VALUES LESS THAN ONE ARE [illegible] FARADS (uF).
8. DC VOLTAGES ARE MEASURED FROM POINT INDICATED [illegible] GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT.
9. WHERE TWO VOLTAGES ARE SHOWN, I.E.,
   2V TOP VOLTAGE IS FOR SQUELCHED OPERATION [illegible]
   6V ' BOTTOM VOLTAGE IS FOR UNSQUELCHED MODE.
10. FREQUENCY LEGEND:
    - f_c = CARRIER FREQUENCY (136 - 174 MHz)
    - f_{x1} = 1ST OSCILLATOR CRYSTAL FREQUENCY (41.7 [illegible])
    - f_{x2} = 2ND OSCILLATOR CRYSTAL FREQUENCY (10.2 [illegible]) (SEE CRYSTAL FREQUENCY TABLE)
    - f_1 = HIGH INTERMEDIATE FREQUENCY (10.7 MHz)
    - f_2 = LOW INTERMEDIATE FREQUENCY (455 kHz)
    - $f_c = 3f_{x1} + 10.7$ MHz
    - $f_1 = f_{x2} + f_2$ (FOR f_{x2} = 10.245 MHz)
    - $f_1 = f_{x2} - f_2$ (FOR f_{x2} = 11.155 MHz)



CIRCUIT BOARD NOTES

ED ON 136 - 141 MHz AND 150.8 - 157 MHz.
46 MHz AND 157 - 166 MHz.
50.8 MHz AND 166 - 174 MHz.
RANGE ONLY.
R 136 - 150.8 MHz RANGE ONLY;
UMPERS JU7 - JU11.
EN WITH OSCILLATOR RUNNING.
2, +5.6 VOLTS DC WHEN THRESHOLD

IENCY AND DRIVE.

S, k = 1000.
D OR GREATER THAN ONE (1) ARE IN
S LESS THAN ONE ARE IN MICRO-

D FROM POINT INDICATED TO CHASSIS
C MULTIMETER OR EQUIVALENT.
HOWN, I.E.,
UELCHED OPERATIONAL MODE, AND
R UNSQUELCHED MODE.

(136 - 174 MHz)
STAL FREQUENCY (41.700 - 54.433 MHz)
STAL FREQUENCY (10.245 - 11.155 MHz)
ENCY TABLE)
FREQUENCY (10.7 MHz)
REQUENCY (455 kHz)

245 MHz)
155 MHz)

EPF-7991-A

MODEL TABLE

MODEL	FREQ.	SUFFIX
CNRD6491A	136-150.8 MHz	
NRD6632A	150.8-174 MHz	

STAGE GAIN MEASUREMENT NO

GENERAL

1. 0 dBm = 1 mW INTO 600 OHMS.
2. REFER TO APPLICABLE MONITOR-RECEIVER SCHEMATIC/ RECEIVER GAIN MEASUREMENTS SECTION IN INSTRUC FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL
3. MAKE THE FOLLOWING MEASUREMENTS:

(R1) CONNECT RF SIGNAL GENERATOR TO RF M CONNECTED FOR ALL RECEIVER MEASURE

(R2) SET RF SIGNAL GENERATOR LEVEL TO 1 READING.

(R3) READING WITH ONE OSCILLATOR RUNNING. TP2, TP3, TP4, OR TP5 AS APPLICABLE.

(R6) SHORT Q3 (BUFFER AMPL) COLLECTOR TO A 0.002 uF CAPACITOR. THE CHANGE IN V SHOULD BE GREATER THAN 0.02 V DC.

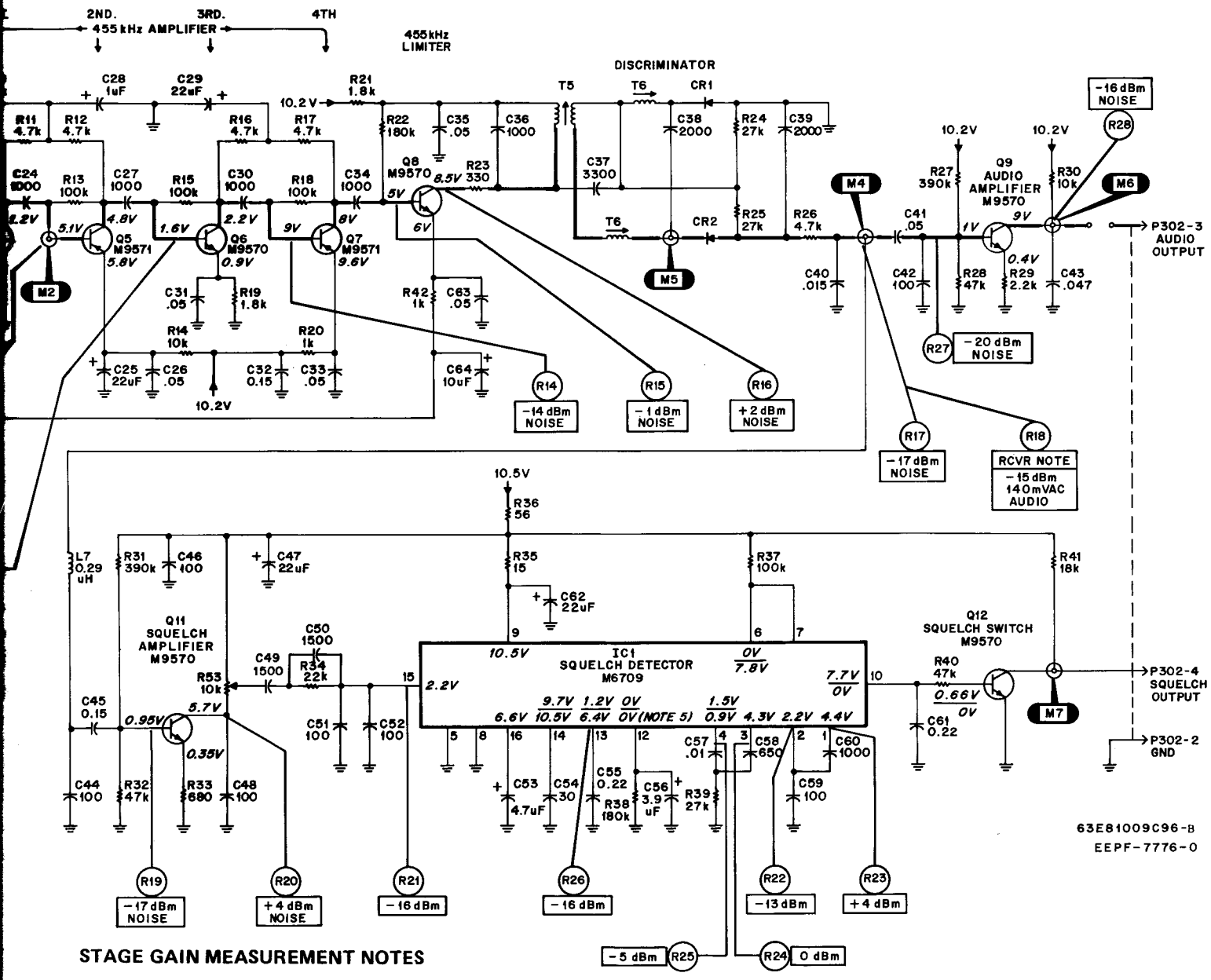
(R9),(R10) SET RF SIGNAL GENERATOR LEVEL TO 1. READINGS.

(R12) SET RF SIGNAL GENERATOR LEVEL TO 3.0 m ING (USE AC VOLTMETER FOR MEASUREME

(R13) thru (R28) SET RF SIGNAL GENERATOR LEVEL TO M FREQUENCY OFF CHANNEL. FOR SOME OF T THERE IS AN ADDITIONAL REQUIREMENT G

(R19) thru (R26) ADJUST SQUELCH CONTROL FOR FULL SQUE

(R18) SET RF SIGNAL GENERATOR LEVEL TO 1.0 m WITH 1 kHz TONE AT 3.3 kHz DEVIATION.



STAGE GAIN MEASUREMENT NOTES

GENERAL

1. 0 dBm = 1 mW INTO 600 OHMS.
2. REFER TO APPLICABLE MONITOR-RECEIVER SCHEMATIC AND MONITOR-RECEIVER GAIN MEASUREMENTS SECTION IN INSTRUCTION MANUAL FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL INFORMATION.
3. MAKE THE FOLLOWING MEASUREMENTS:

(R1) CONNECT RF SIGNAL GENERATOR TO RF INPUT AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.

(R2) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.

(R3) READING WITH ONE OSCILLATOR RUNNING. GROUND TP1, TP2, TP3, TP4, OR TP5 AS APPLICABLE.

(R6) SHORT Q3 (BUFFER AMPL) COLLECTOR TO GROUND WITH A 0.002 uF CAPACITOR. THE CHANGE IN VOLTAGE AT (R6) SHOULD BE GREATER THAN 0.02 V DC.

(R9), (R10) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV FOR THESE READINGS.

(R12) SET RF SIGNAL GENERATOR LEVEL TO 3.0 uV FOR THIS READING (USE AC VOLTMETER FOR MEASUREMENT).

(R13) thru (R28) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.

(R19) thru (R26) ADJUST SQUELCH CONTROL FOR FULL SQUELCH.

(R18) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

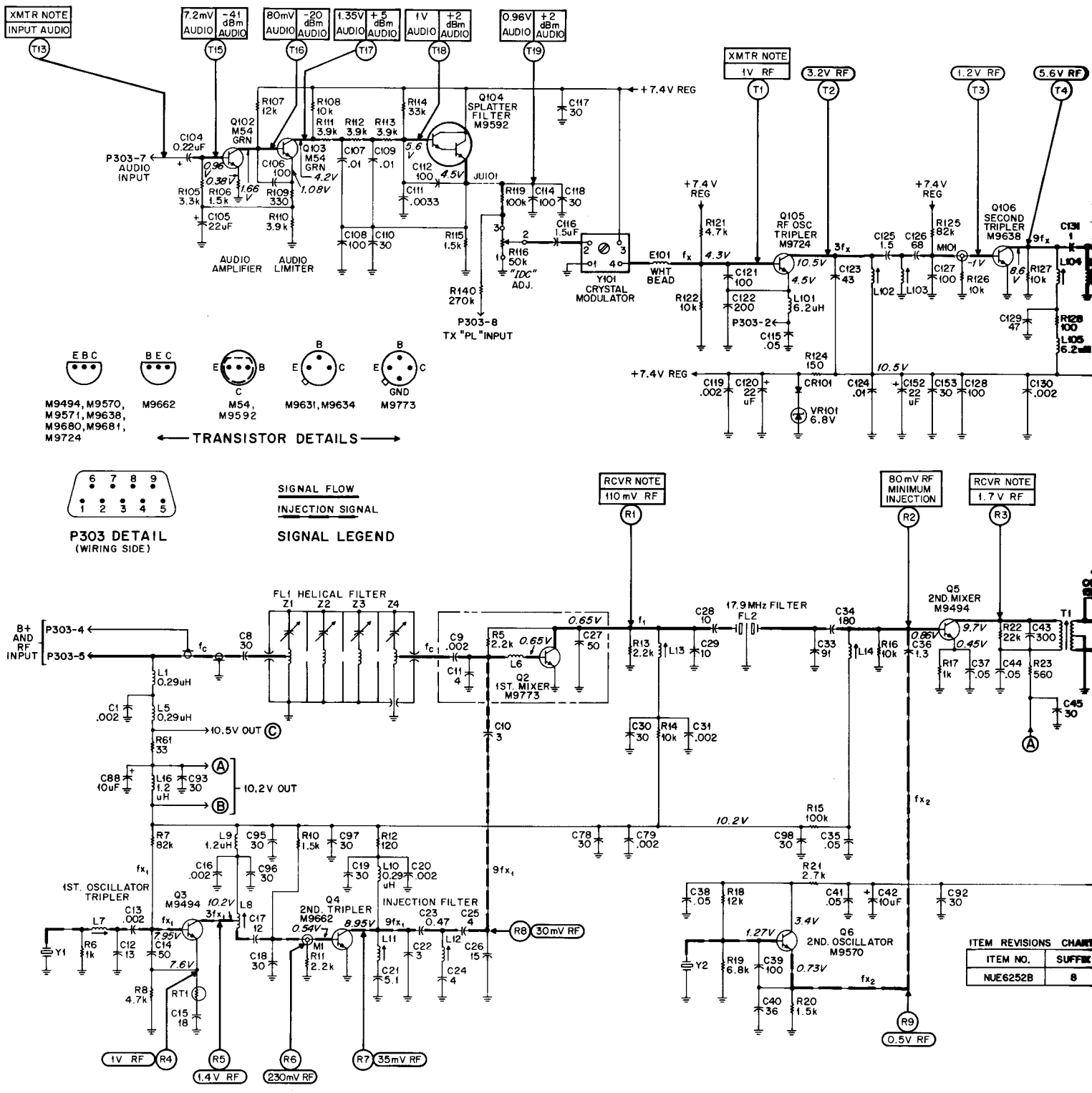
EPF-7177-O

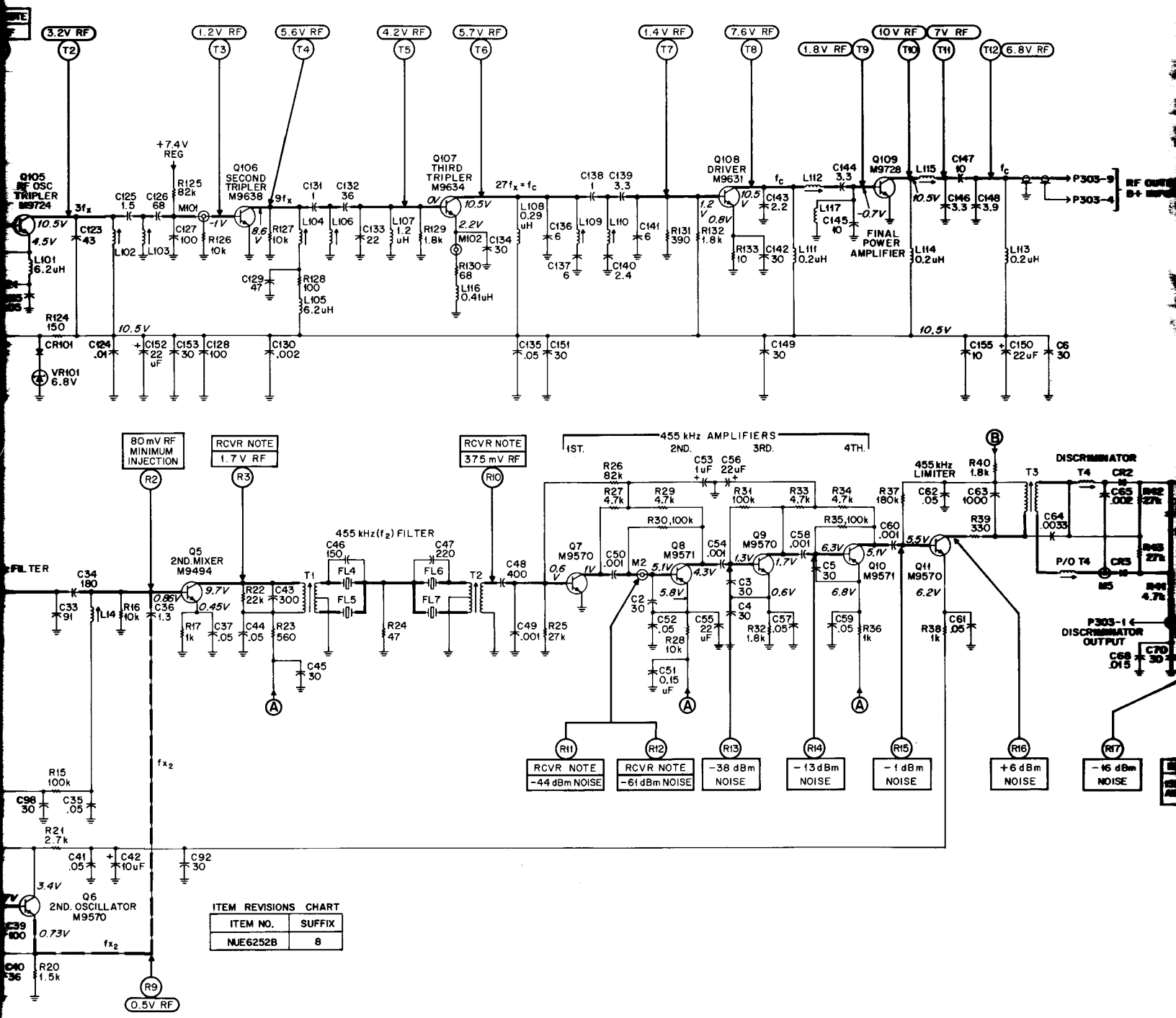
CRYSTAL FREQUENCY TABLE

CARRIER FREQUENCY (f_c)	1ST OSCILLATOR CRYSTAL FREQUENCY (f_{x1})	2ND OSCILLATOR FREQUENCY (f_{x2})
136.00 - 150.80 MHz	41.700 - 46.700 MHz	10.245 MHz
150.80 - 153.30 MHz	46.700 - 47.533 MHz	10.245 MHz
153.33 - 154.80 MHz	47.543 - 48.033 MHz	11.155 MHz
154.83 - 162.69 MHz	48.043 - 50.663 MHz	10.245 MHz
162.72 - 166.20 MHz	50.673 - 51.833 MHz	11.155 MHz
166.23 - 174.00 MHz	51.843 - 54 433 MHz	10.245 MHz

EPF-7992-A

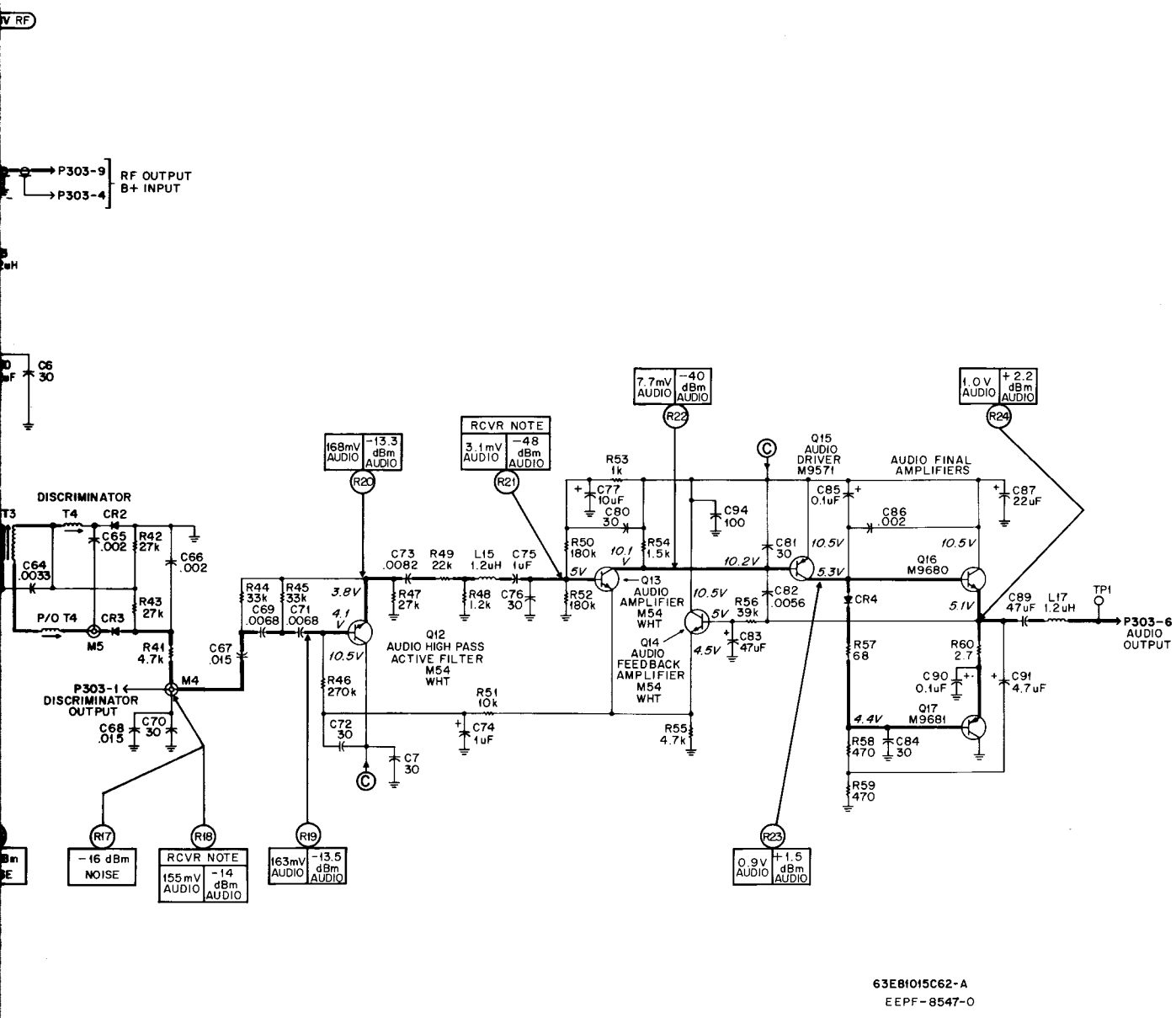
(CNRD6491A & NRD6632A) VHF MOBILE DETECTOR SCHEMATIC DIAGRAM


XMTR NOTE
INPUT AUDIO
T13
7.2mV AUDIO
-41 dBm AUDIO
T15
80mV AUDIO
-20 dBm AUDIO
T16
1.35V AUDIO
+5 dBm AUDIO
T17
1V AUDIO
+2 dBm AUDIO
T18
0.96V AUDIO
+2 dBm AUDIO
T19
+7.4V REG
P303-7
AUDIO INPUT
Q102 M54 GRN
Q103 M54 GRN
Q104 SPLATTER FILTER M9592
AUDIO AMPLIFIER
AUDIO LIMITER
"IDC" ADJ.
Y101 CRYSTAL MODULATOR
E101 WHT BEAD
P303-8
TX "PL" INPUT
XMTR NOTE
1V RF
T1
3.2V RF
T2
1.2V RF
T3
5.6V RF
T4
Q105 RF OSC TRIPLER M9724
Q106 SECOND TRIPLER M9638
M9494, M9570, M9571, M9638, M9680, M9681, M9724
M9662
M54, M9592
M9631, M9634
M9773
TRANSISTOR DETAILS
P303 DETAIL
(WIRING SIDE)
SIGNAL FLOW
INJECTION SIGNAL
SIGNAL LEGEND
RCVR NOTE
110 mV RF
R1
80 mV RF MINIMUM INJECTION
R2
RCVR NOTE
1.7 V RF
R3
FL1 HELICAL FILTER
17.9MHz FILTER FL2
Q5 2ND. MIXER M9494
Q2 1ST. MIXER M9773
B+ AND RF INPUT
P303-4
P303-5
10.5V OUT
10.2V OUT
1ST. OSCILLATOR TRIPLER
Q3 M9494
Q4 2ND. TRIPLER M9662
INJECTION FILTER
Q6 2ND. OSCILLATOR M9570
1V RF
R4
1.4V RF
R5
230mV RF
R6
35mV RF
R7
30mV RF
R8
0.5V RF
R9
ITEM REVISIONS CHART
ITEM NO.
SUFFIX
NUE6252B
8



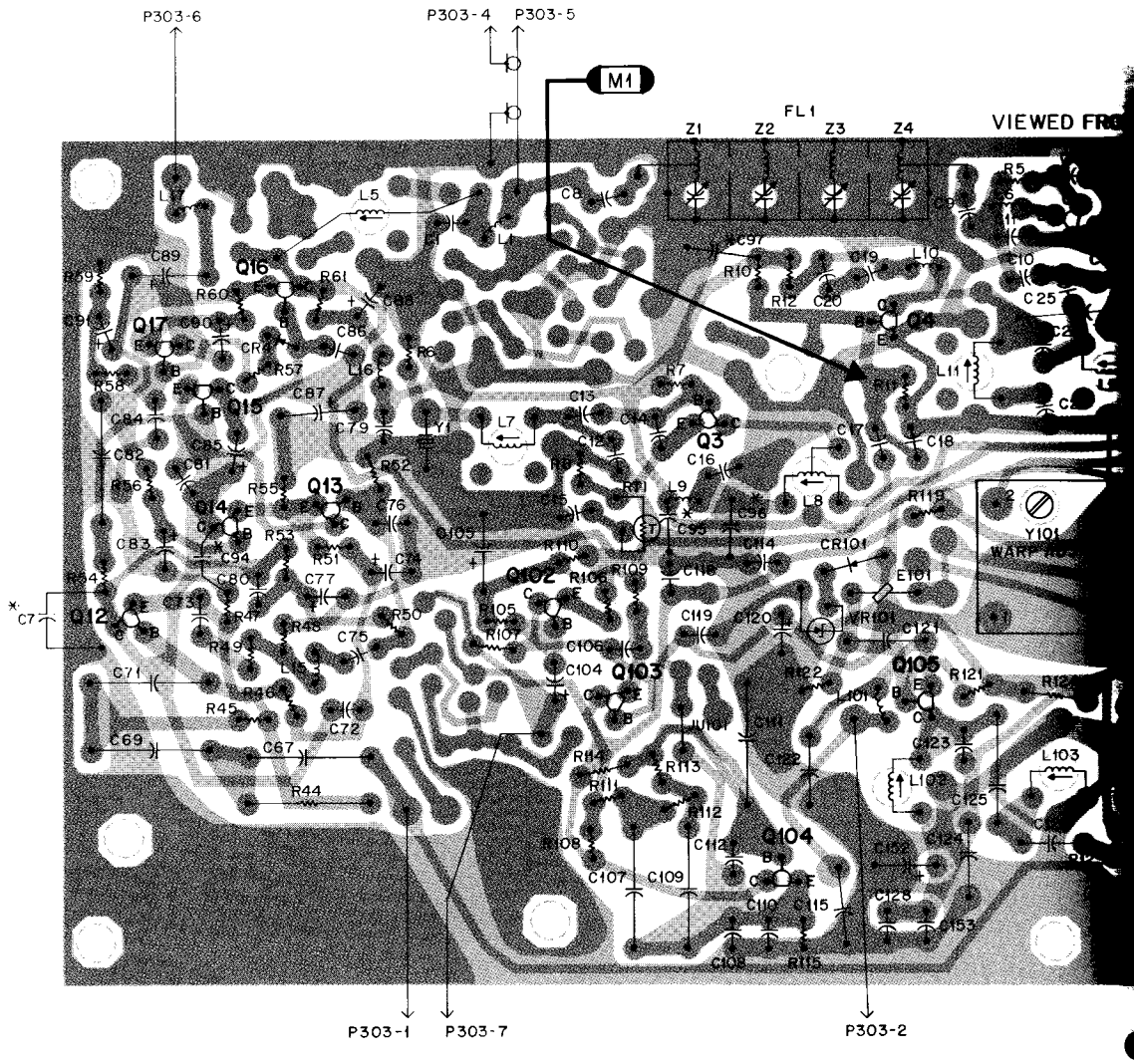
ITEM REVISIONS CHART

ITEM NO.	SUFFIX
NUE6252B	B



63E81015C62-A
EEPF-8547-O

NUE6252B TRANSCEIVER SCHEMATIC DIAGRAM



SCHEMATIC AND CIRCUIT BOARD NOTES

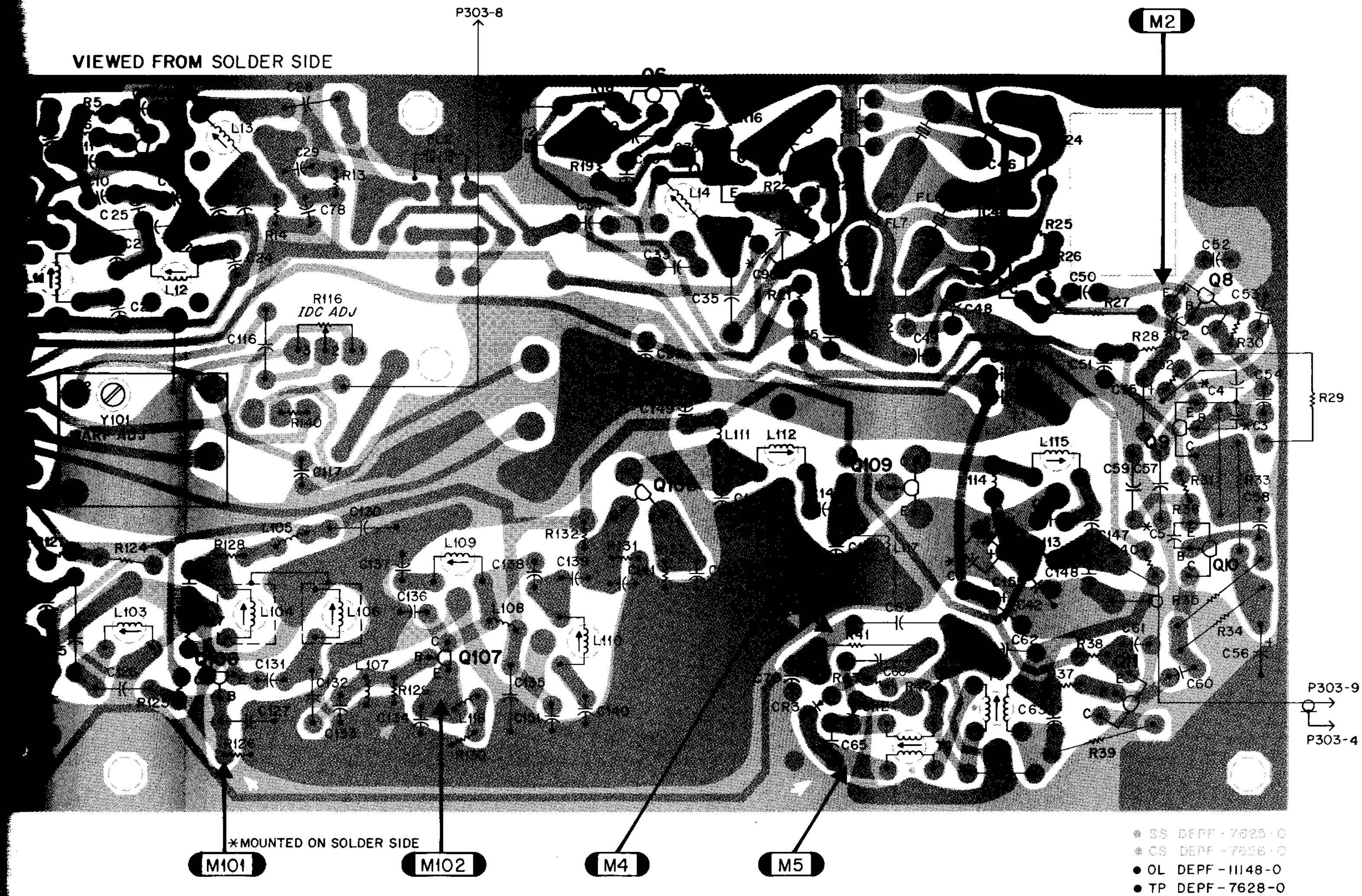
1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE ON OHMS, k = 1000.
   ALL CAPACITOR VALUES EQUAL TO OR GREATER THAN 1 ARE IN PICOFARADS (pF), AND VALUES LESS THAN 1 ARE IN MICROFARADS (uF).
2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT.
3. WHERE 2 VOLTAGE VALUES ARE SHOWN, i.e. $\frac{10\ V}{12\ V}$
   TOP VALUE IS FOR UNSQUELCHED OPERATIONAL MODE, AND BOTTOM VALUE IS FOR SQUELCHED MODE.
4. CIRCUIT BOARD LEGEND:
   * INDICATES COMPONENT MOUNTED ON SOLDER SIDE.
5. FREQUENCY LEGEND:
   GENERAL
   f_c = CARRIER FREQUENCY (450-470 MHz)
   TRANSMITTER
   f_x = CRYSTAL FREQUENCY (16.666-17.407 MHz)
   $f_c = 27 f_x$; $f_x = \frac{f_c}{27}$
   RECEIVER
   f_{x1} = 1ST OSCILLATOR CRYSTAL FREQUENCY (48.01-50.233 MHz)
   f_{x2} = 2ND OSCILLATOR CRYSTAL FREQUENCY (17.445-18.355 MHz)
   SEE TABLE 1
   f_1 = HIGH INTERMEDIATE FREQUENCY (17.9 MHz)
   f_2 = LOW INTERMEDIATE FREQUENCY (455 kHz)
   $f_c = 9 f_{x1} + 17.9\ MHz$, $f_{x1} = \frac{f_c - 17.9\ MHz}{9}$
   $f_1 = f_2 + f_{x2}$ (for f_{x2} = 17.455 MHz)
   $f_1 = f_{x2} - f_2$ (for f_{x2} = 18.355 MHz)

EPF-7630-O

CRYSTAL FREQUENCY TABLE

CARRIER FREQ (f_c)	1ST OSC CRYSTAL FREQ (f_{x1})	2ND OSC CRYSTAL FREQ (f_{x2})
450.000 - 456.000 MHz	48.0111 - 48.6777 MHz	18.355 MHz
456.001 - 458.000 MHz	48.6778 - 48.9000 MHz	17.445 MHz
458.001 - 470.000 MHz	48.9001 - 50.2333 MHz	18.355 MHz

EPF-7631-O



STAGE GAIN MEASUREMENT NOTES

1. 0 dBm = 1 mW INTO 600 OHMS.
2. CIRCUIT BOARD PLATING SHOWN IN SIDE OPPOSITE THE COMPONENTS.
3. TRANSMITTER MEASUREMENTS TAKEN WITH Q309 AND Q421 COLLECTORS GROUNDED.
4. REFER TO APPLICABLE TRANSMITTER AND RECEIVER TROUBLESHOOTING SECTION IN INSTRUCTION MANUAL FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL INFORMATION.

TRANSMITTER:

(T1) → (T12) TAKE MEASUREMENTS WITH TRANSMITTER ALIGNED PER TRANSMITTER ALIGNMENT PROCEDURE.

(T13) CONNECT AUDIO OSCILLATOR TO PIN 7 OF P303 AND ADJUST OUTPUT LEVEL FOR -41 dBm AT 1 kHz. READ LEVELS AT TEST POINTS.

(T15) → (T19)

RECEIVER:

CONNECT RF SIGNAL GENERATOR TO EXTERNAL ANTENNA JACK ON "PAC•PL" RADIO AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.

(R1) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.

(R3) (R10) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV FOR THESE READINGS.

(R11) SET RF SIGNAL GENERATOR LEVEL TO 3.0 uV FOR THIS READING (USE AC VOLTMETER FOR MEASUREMENT).

(R12) → (R17) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY TO OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.

(R18) → (R24) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

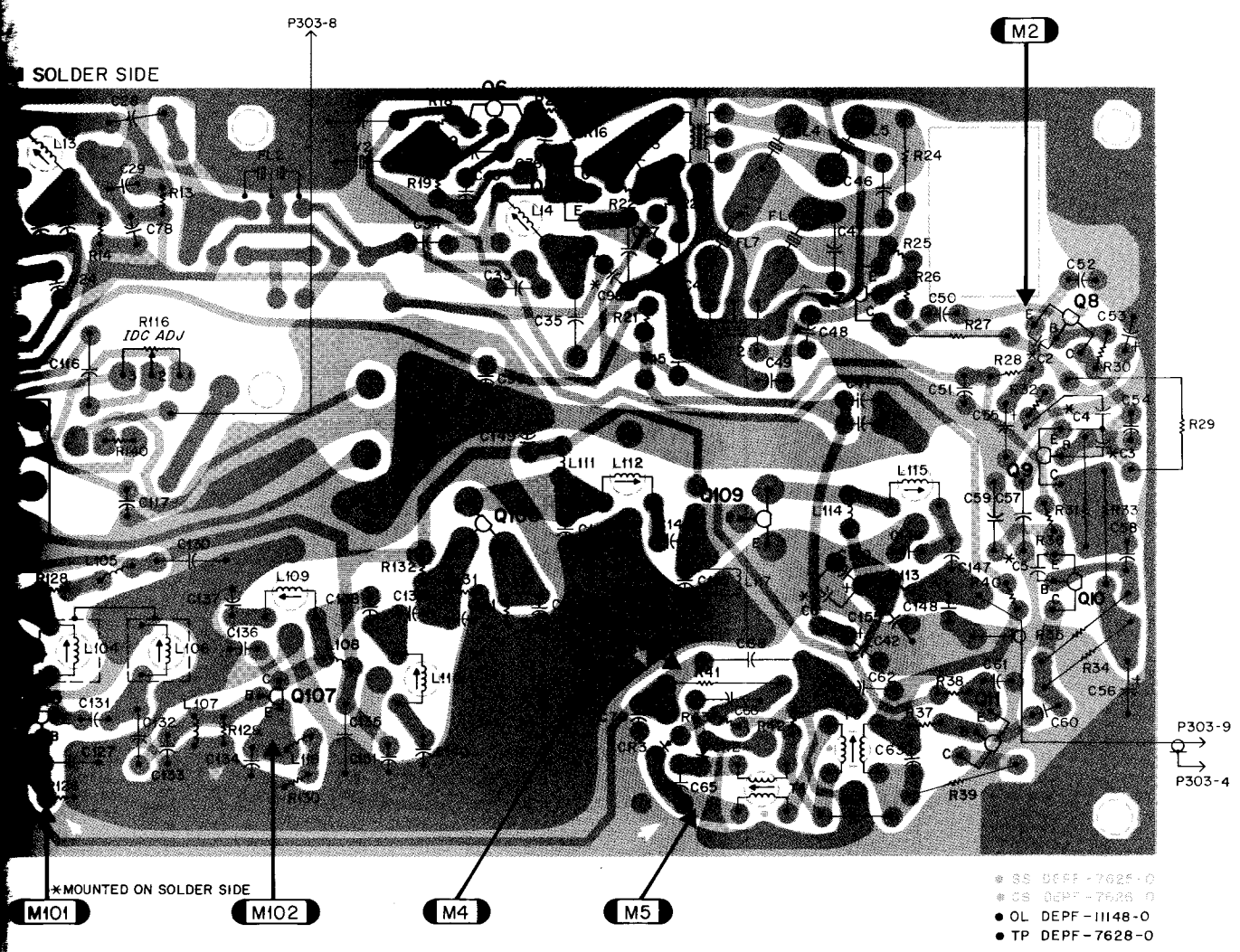
EPF-8549-O

Y TABLE

2ND OSC CRYSTAL FREQ (f_{x2})
18.355 MHz
17.445 MHz
18.355 MHz

EPF-7631-O

NUE6252B TRANSCEIVER CIRCUIT BOARD DETAIL



STAGE GAIN MEASUREMENT NOTES

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2. CIRCUIT BOARD PLATING SHOWN IN SIDE OPPOSITE THE COMPONENTS.
3. TRANSMITTER MEASUREMENTS TAKEN WITH Q309 AND Q421 COLLECTORS GROUNDED.
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(T1) → (T12) TAKE MEASUREMENTS WITH TRANSMITTER ALIGNED PER TRANSMITTER ALIGNMENT PROCEDURE.

(T13) CONNECT AUDIO OSCILLATOR TO PIN 7 OF P303 AND ADJUST OUTPUT LEVEL FOR -41 dBm AT 1 kHz. READ LEVELS AT TEST POINTS.

(T15) → (T19)

RECEIVER:

CONNECT RF SIGNAL GENERATOR TO EXTERNAL ANTENNA JACK ON "PAC•PL" RADIO AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.

(R1) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.

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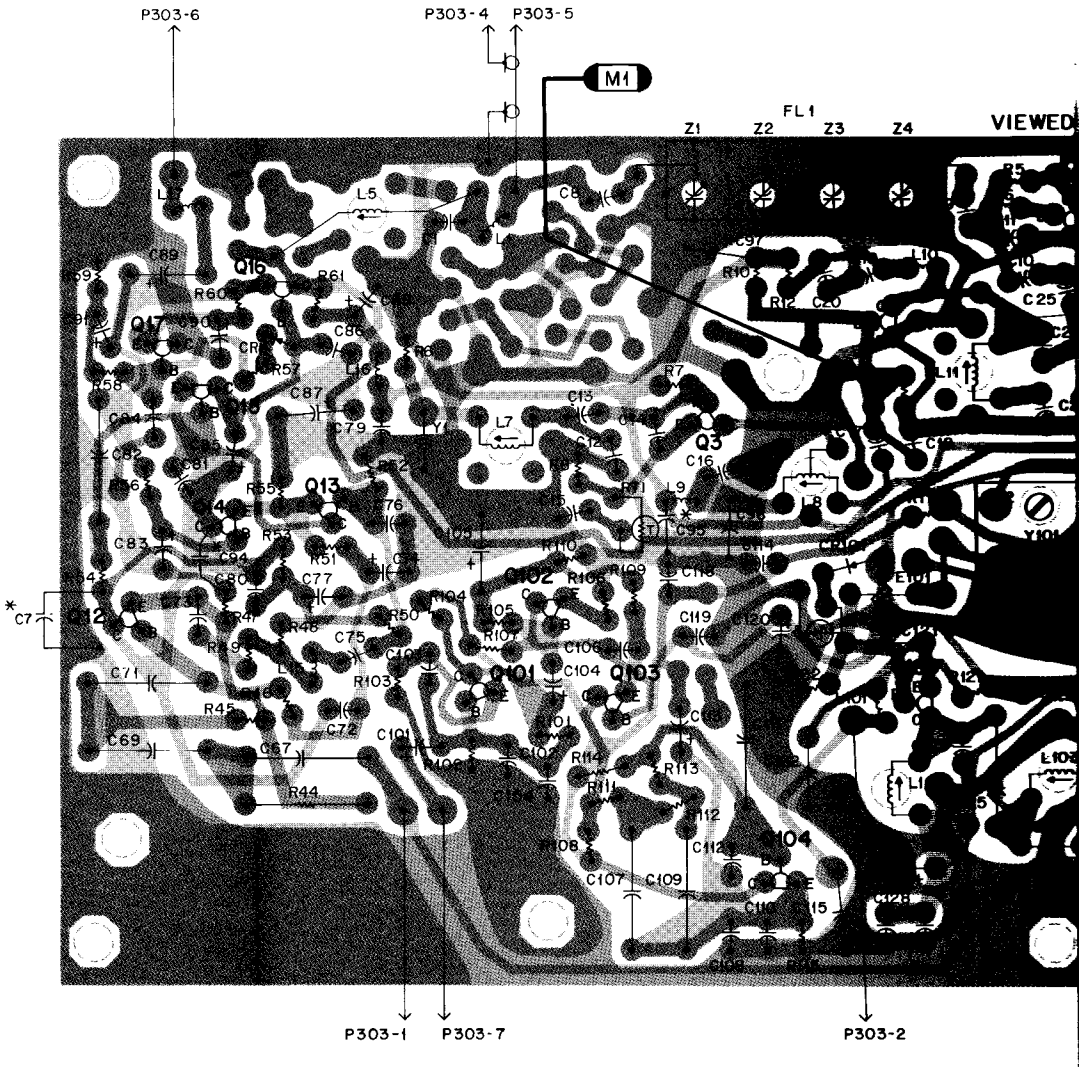
(R12) → (R17) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY TO OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.

(R18) → (R24) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

EPF-8549-O

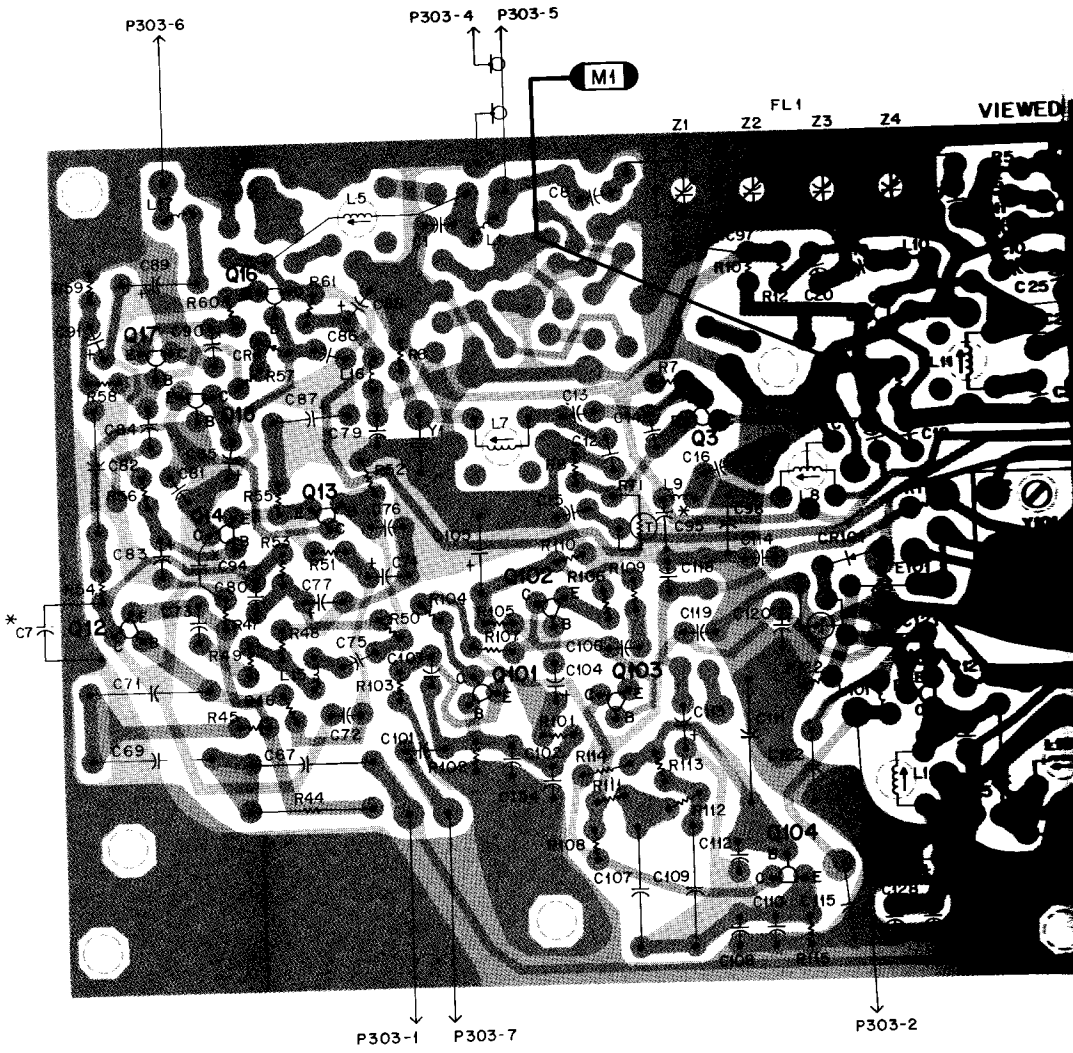
NUE6252B TRANSCEIVER CIRCUIT BOARD DETAIL



SCHEMATIC AND CIRCUIT BOARD NOTES

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE ON OHMS, k = 1000.
   ALL CAPACITOR VALUES EQUAL TO OR GREATER THAN 1 ARE IN PICOFARADS (pF), AND VALUES LESS THAN 1 ARE IN MICROFARADS (uF).
2. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT.
3. WHERE 2 VOLTAGE VALUES ARE SHOWN, i.e. $\frac{10\ V}{12\ V}$,
   TOP VALUE IS FOR UNSQUELCHED OPERATIONAL MODE, AND BOTTOM VALUE IS FOR SQUELCHED MODE.
4. CIRCUIT BOARD LEGEND:
   * INDICATES COMPONENT MOUNTED ON SOLDER SIDE.
5. FREQUENCY LEGEND:
   GENERAL
   f_c = CARRIER FREQUENCY (450-470 MHz)
   TRANSMITTER
   f_x = CRYSTAL FREQUENCY (16.666-17.407 MHz)
   f_c = $27f_x$; $f_x = \frac{f_c}{27}$
   RECEIVER
   f_{x1} = 1ST OSCILLATOR CRYSTAL FREQUENCY (48.01-50.233 MHz)
   f_{x2} = 2ND OSCILLATOR CRYSTAL FREQUENCY (17.445-18.355 MHz)
   SEE TABLE 1
   f_1 = HIGH INTERMEDIATE FREQUENCY (17.9 MHz)
   f_2 = LOW INTERMEDIATE FREQUENCY (455 kHz)
   $f_c = 9f_{x1} + 17.9\ MHz$, $f_{x1} = \frac{f_c - 17.9\ MHz}{9}$
   $f_1 = f_2 + f_{x2}$ (for f_{x2} = 17.455 MHz)
   $f_1 = f_{x2} - f_2$ (for f_{x2} = 18.355 MHz)

EPF-7630-O



SCHEMATIC AND CIRCUIT BOARD NOTES

1. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE ON OHMS, k = 1000.
   ALL CAPACITOR VALUES EQUAL TO OR GREATER THAN 1 ARE IN PICOFARADS (pF), AND VALUES LESS THAN 1 ARE IN MICROFARADS (uF).
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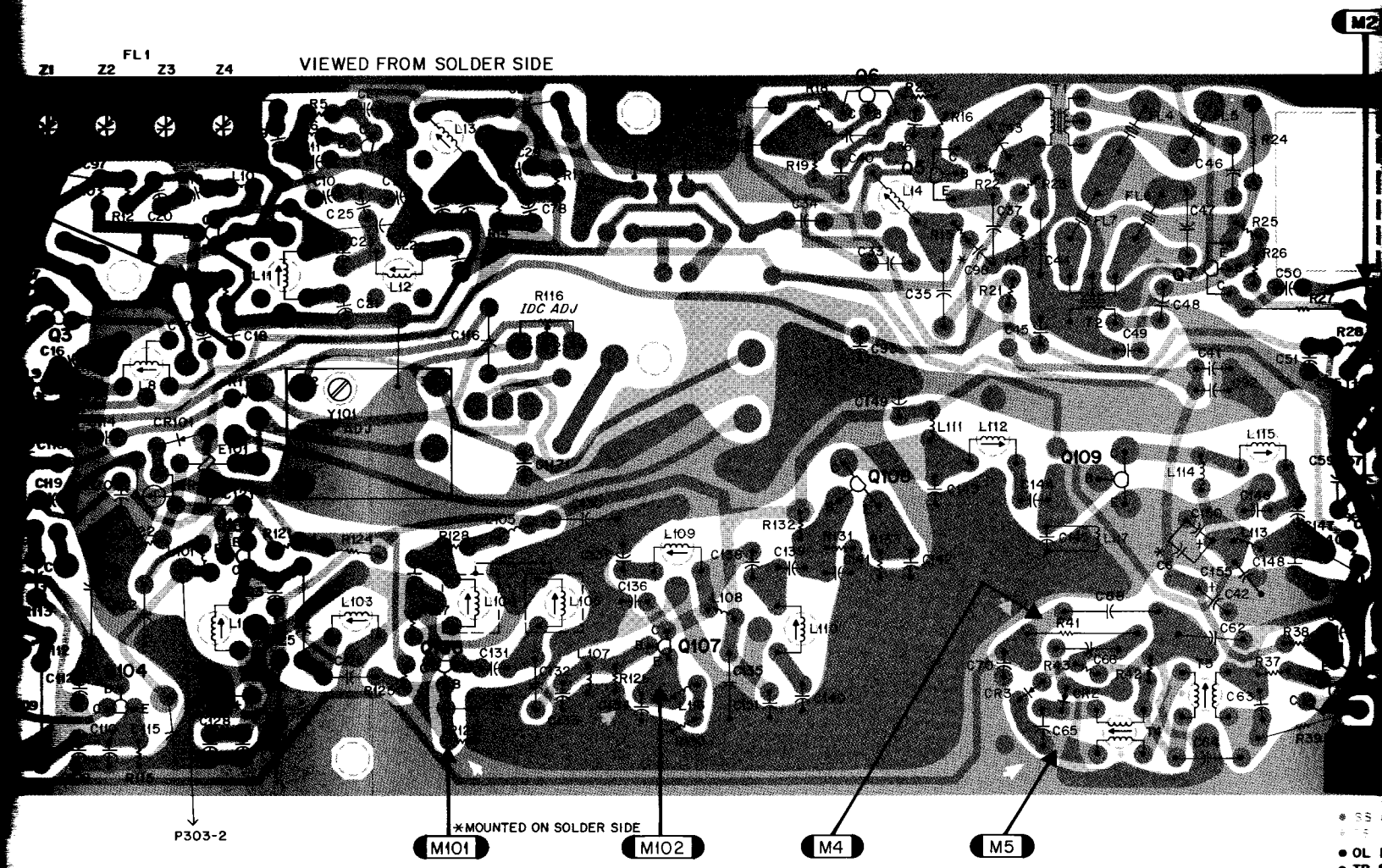
   f_c = CARRIER FREQUENCY (450-470 MHz)
   TRANSMITTER
   f_x = CRYSTAL FREQUENCY (16.666-17.407 MHz)
   f_c = $27f_x$; $f_x = \frac{f_c}{27}$
   RECEIVER
   f_{x1} = 1ST OSCILLATOR CRYSTAL FREQUENCY (48.01-50.233 MHz)
   f_{x2} = 2ND OSCILLATOR CRYSTAL FREQUENCY (17.445-18.355 MHz)
   SEE TABLE 1
   f_1 = HIGH INTERMEDIATE FREQUENCY (17.9 MHz)
   f_2 = LOW INTERMEDIATE FREQUENCY (455 kHz)
   $f_c = 9f_{x1} + 17.9$ MHz, $f_{x1} = \frac{f_c - 17.9\ MHz}{9}$
   $f_1 = f_2 + f_{x2}$ (for f_{x2} = 17.455 MHz)
   $f_1 = f_{x2} - f_2$ (for f_{x2} = 18.355 MHz)

EPF-7630-O



CIRCUIT BOARD NOTES

= 1000.
OR GREATER THAN 1 ARE IN PICOFARADS (pF), AND
FARADS (uF).
POINT INDICATED TO CHASSIS GROUND USING
IVALENT.
OWN, i.e. $\frac{10\ V}{12\ V}$,
PERATIONAL MODE, AND BOTTOM VALUE IS FOR

OUNTED ON SOLDER SIDE.

-470 MHz)

-17.407 MHz)

L FREQUENCY (48.01-50.233 MHz)
L FREQUENCY (17.445-18.355 MHz)

QUENCY (17.9 MHz)
UENCY (455 kHz)
- 17.9 MHz
9

5 MHz)

5 MHz)

EPF-7630-O

CRYSTAL FREQUENCY TABLE

CARRIER FREQ (f_c)	1ST OSC CRYSTAL FREQ (f_{x1})	2ND OSC CRYSTAL FREQ (f_{x2})
450.000 - 456.000 MHz	48.0111 - 48.6777 MHz	18.355 MHz
456.001 - 458.000 MHz	48.6778 - 48.9000 MHz	17.445 MHz
458.001 - 470.000 MHz	48.9001 - 50.2333 MHz	18.355 MHz

EPF-7631-O

STAGE GAIN MEASUREM

1. 0 dBm = 1 mW INTO 600 OHMS.
2. CIRCUIT BOARD PLATING SHOWN IN SIDE OPPOSI
3. TRANSMITTER MEASUREMENTS TAKEN WITH
GROUNDED.
4. REFER TO APPLICABLE TRANSMITTER AND RECE
SECTION IN INSTRUCTION MANUAL FOR RECO
EQUIPMENT AND ADDITIONAL INFORMATION.

TRANSMITTER:

(T1) → (T12) TAKE MEASUREMENTS WITH T
PER TRANSMITTER ALIGNMEN

(T13) CONNECT AUDIO OSCILLATOR TO PIN 7
LEVEL FOR -45 dBm AT 1 kHz. READ LE

(T14) → (T

RECEIVER:

CONNECT RF SIGNAL GENERATOR TO EXTERNA
ON "PAC•RT" RADIO AND LEAVE CONNECTED F
MEASUREMENTS.

(R1) SET RF SIGNAL GENERATOR L
THIS READING.

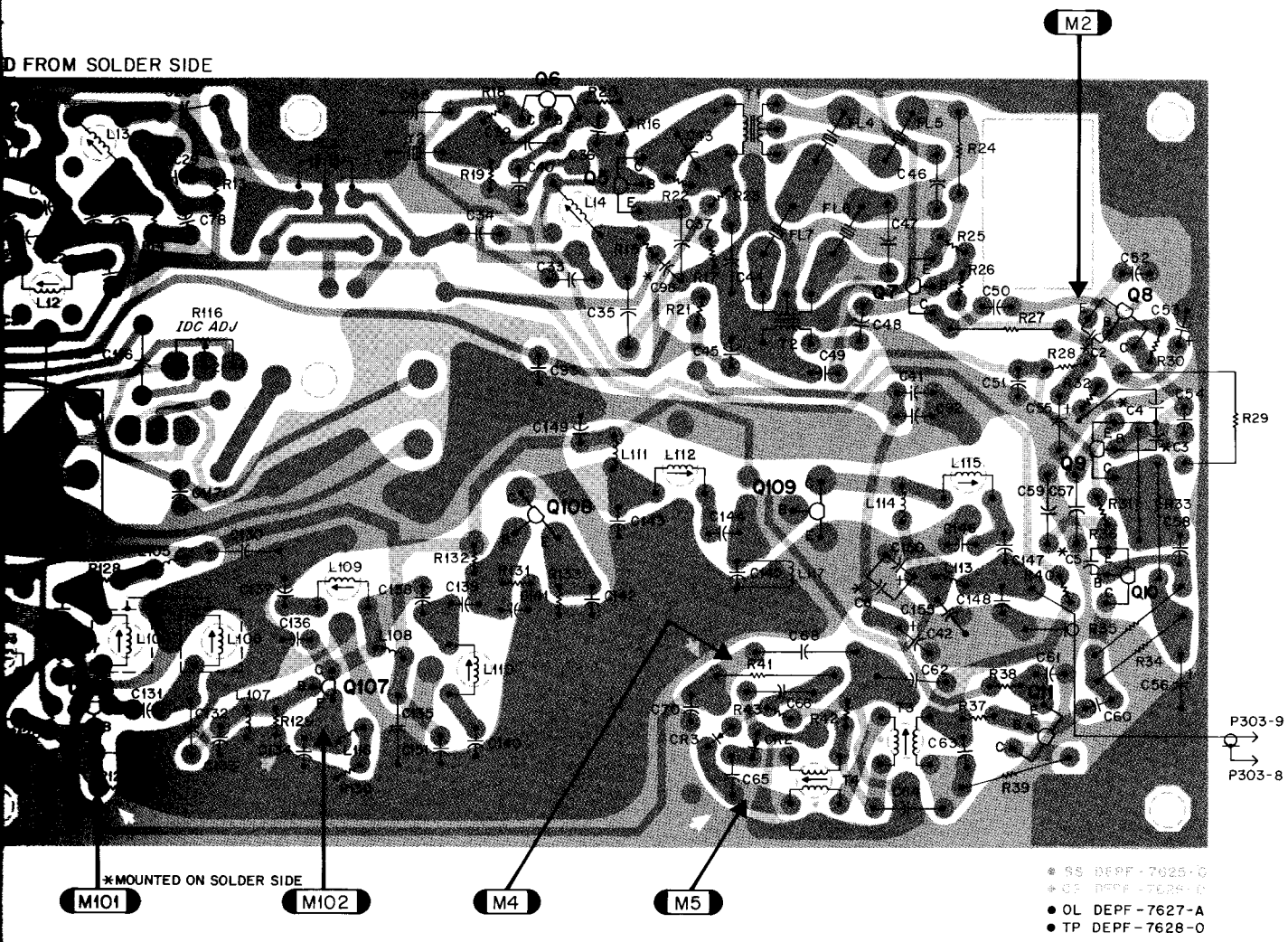
(R3) (R10) SET RF SIGNAL GENERATOR L
THESE READINGS.

(R11) SET RF SIGNAL GENERATOR LEVEL TO
READING (USE AC VOLTMETER FOR M

(R12) → (R17) SET RF SIGNAL GENERATOR LE
FREQUENCY TO OFF CHANNEL
TEST POINTS THERE IS AN ADDI
GIVEN BELOW.

(R18) → (R24) SET RF SIGNAL GENERATOR LE
MODULATE WITH 1 kHz TONE AT

NUE6252A TRANSCEIVER CIRCUIT BOARD DETAIL



CRYSTAL FREQUENCY TABLE

CARRIER FREQ (f_c)	1ST OSC CRYSTAL FREQ (f_{x1})	2ND OSC CRYSTAL FREQ (f_{x2})
450.000 - 456.000 MHz	48.0111 - 48.6777 MHz	18.355 MHz
456.001 - 458.000 MHz	48.6778 - 48.9000 MHz	17.445 MHz
458.001 - 470.000 MHz	48.9001 - 50.2333 MHz	18.355 MHz

EPF-7631-O

STAGE GAIN MEASUREMENT NOTES

1. 0 dBm = 1 mW INTO 600 OHMS.
2. CIRCUIT BOARD PLATING SHOWN IN SIDE OPPOSITE THE COMPONENTS.
3. TRANSMITTER MEASUREMENTS TAKEN WITH Q309 AND Q421 COLLECTORS GROUNDED.
4. REFER TO APPLICABLE TRANSMITTER AND RECEIVER TROUBLESHOOTING SECTION IN INSTRUCTION MANUAL FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL INFORMATION.

TRANSMITTER:

(T1) → (T12) TAKE MEASUREMENTS WITH TRANSMITTER ALIGNED PER TRANSMITTER ALIGNMENT PROCEDURE.

(T13) CONNECT AUDIO OSCILLATOR TO PIN 7 OF P303 AND ADJUST OUTPUT LEVEL FOR -45 dBm AT 1 kHz. READ LEVELS AT TEST POINTS.

(T14) → (T19)

RECEIVER:

CONNECT RF SIGNAL GENERATOR TO EXTERNAL ANTENNA JACK ON "PAC•RT" RADIO AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.

(R1) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.

(R3) (R10) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV FOR THESE READINGS.

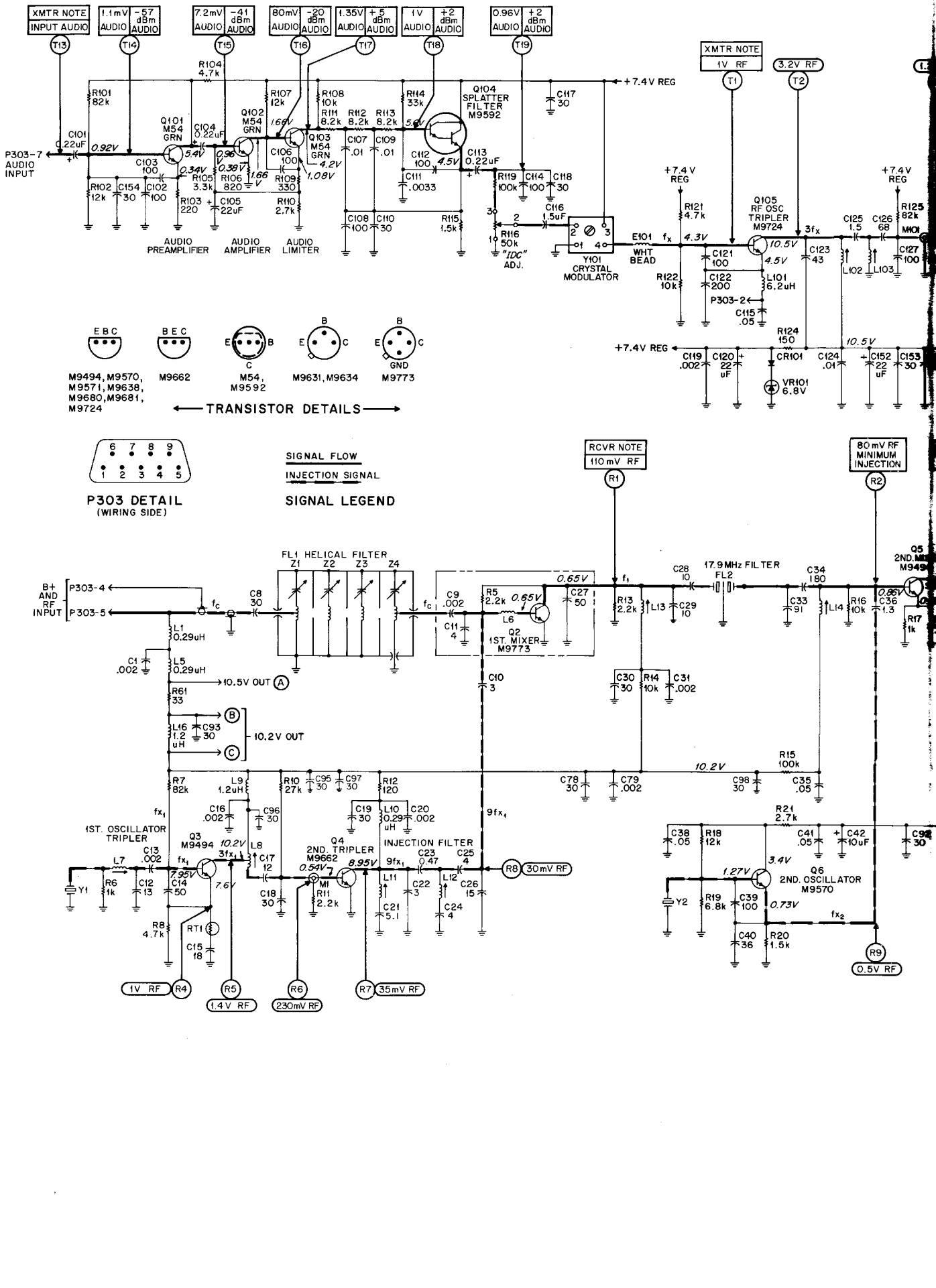
(R11) SET RF SIGNAL GENERATOR LEVEL TO 3.0 uV FOR THIS READING (USE AC VOLTMETER FOR MEASUREMENT).

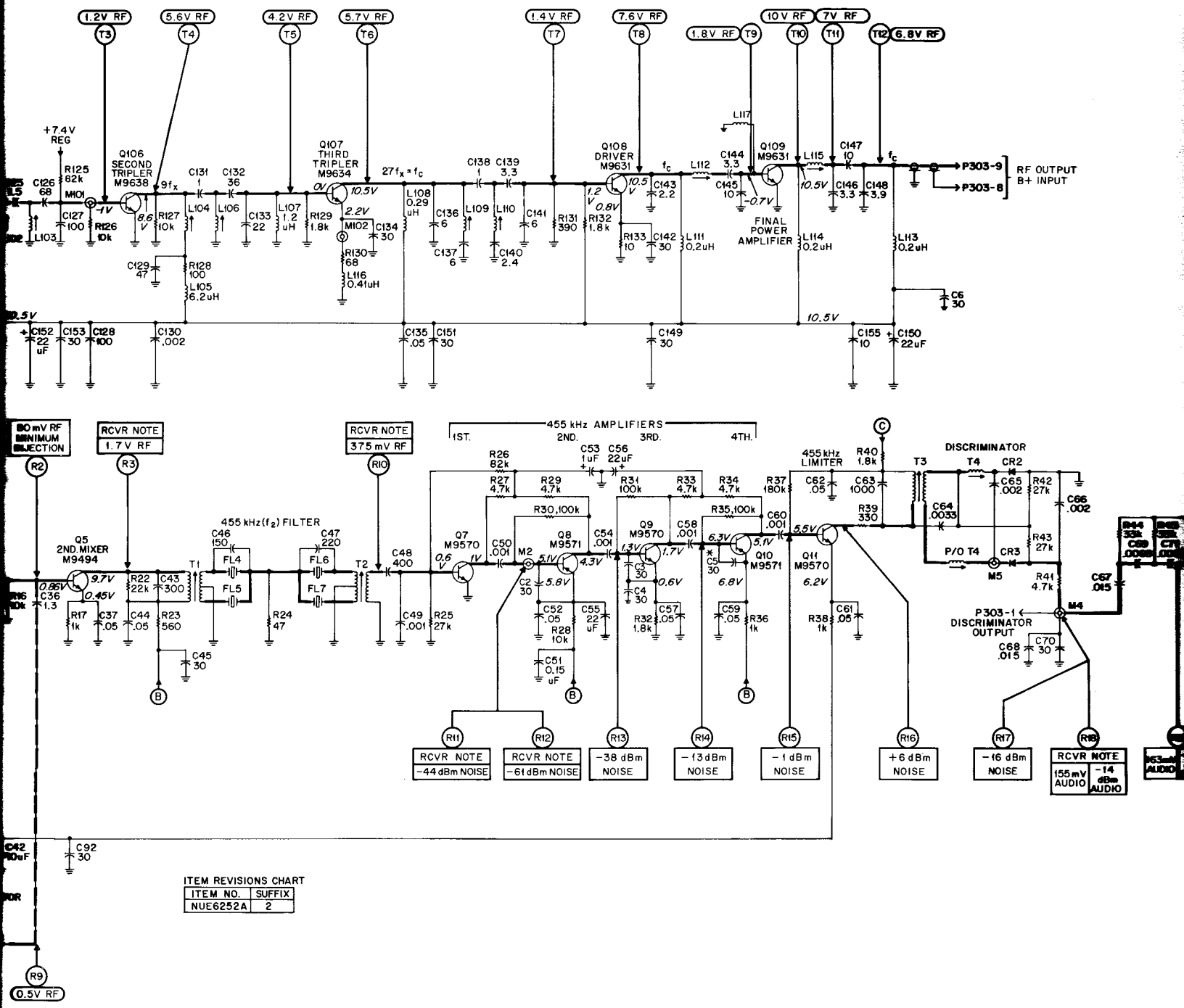
(R12) → (R17) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY TO OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.

(R18) → (R24) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

EPF-7632-O

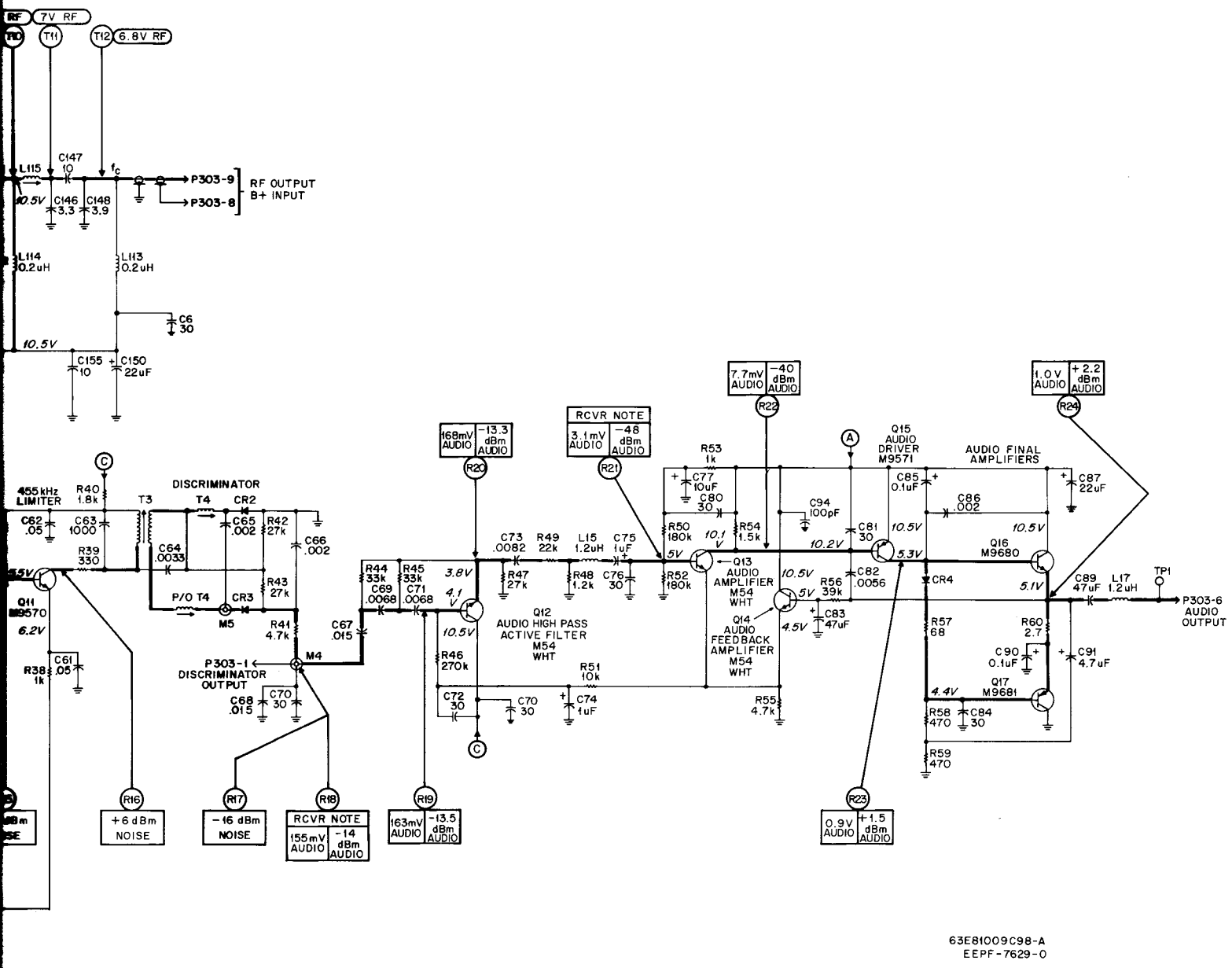
NUE6252A TRANSCEIVER CIRCUIT BOARD DETAIL


XMTR NOTE
INPUT AUDIO
T13
1.1mV AUDIO
-57 dBm AUDIO
T14
7.2mV AUDIO
-41 dBm AUDIO
T15
80mV AUDIO
-20 dBm AUDIO
T16
1.35V AUDIO
+5 dBm AUDIO
T17
1V AUDIO
+2 dBm AUDIO
T18
0.96V AUDIO
+2 dBm AUDIO
T19
XMTR NOTE
1V RF
T1
3.2V RF
T2
+7.4V REG
P303-7
AUDIO INPUT
AUDIO PREAMPLIFIER
AUDIO AMPLIFIER
AUDIO LIMITER
Q104 SPLATTER FILTER M9592
Y101 CRYSTAL MODULATOR
"IDC" ADJ.
E101 WHT BEAD
Q105 RF OSC TRIPLER M9724
M9494, M9570, M9571, M9638, M9680, M9681, M9724
M9662
M54, M9592
M9631, M9634
M9773
TRANSISTOR DETAILS
P303 DETAIL
(WIRING SIDE)
SIGNAL FLOW
INJECTION SIGNAL
SIGNAL LEGEND
RCVR NOTE
110 mV RF
R1
80 mV RF MINIMUM INJECTION
R2
FL1 HELICAL FILTER
Z1 Z2 Z3 Z4
17.9 MHz FILTER
FL2
B+ AND RF INPUT
P303-4
P303-5
10.5V OUT
10.2V OUT
1ST. OSCILLATOR TRIPLER
Q3 M9494
2ND. TRIPLER
Q4 M9662
INJECTION FILTER
1ST. MIXER
M9773
2ND. OSCILLATOR
M9570
R8 30mV RF
R4 1V RF
R5 1.4V RF
R6 230mV RF
R7 35mV RF
R9 0.5V RF



ITEM REVISIONS CHART

ITEM NO.	SUFFIX
NUE6252A	2



NUE6252A TRANSCEIVER SCHEMATIC DIAGRAM

NUE6252A/B
Transmitter-Receiver Circuit Board

PLF1192-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ± 10% 50V N150 unless stated
C1	2100861442	.002uF – 20 + 100%; 75V
C2 thru 8	2182358G96	30
C9	2182213E21	0.002uF – 20 + 100%; 75V
C10	2184511B70	3 ± 0.25pF; NPO
C11	2100861427	4 ± 0.5pF; 75V
C12	2184511B41	13
C13	2182213E21	0.002uF – 20 + 100%; 75V
C14	2182877B03	50; 75V; N750
C15	2182877B39	18; 75V; N750
C16	2182213E21	0.002uF – 20 + 100%; 75V
C17	2184511B08	12
C18	2182358G96	30
C19	2182358G96	30
C20	2182213E21	0.002uF – 20 + 100%; 75V
C21	2184511B06	5.1
C22	2184511B70	3
C23	2182450B24	0.47uF
C24,25	2100861427	4 ± 0.5pF; 75V
C26	2100861462	15; 75V
C27	2182358G32	50
C28,29	2184511B85	10 ± 0.25pF; 50V
C30	2182358G96	30
C31	2182213E21	0.002uF – 20 + 100%; 75V
C33	2184511B23	91
C34	2184511B48	180; N470
C35	2182372C07	0.05uF – 20 + 80%; 25V
C36	2184511B33	1.3 ± 0.25pF; NPO
C37,38	2182372C07	0.05uF – 20 + 80%; 25V
C39	2182358G93	100; 75V; N750
C40	2100861433	36; 75V
C41	2184008H13	0.05uF ± 20%; 25V; Y5R
C42	2383441B27	10uF ± 20%; 15V
C43	0882163J06	300 ± 5%; 63V
C44	2182372C07	0.05uF – 20 + 80%; 25V
C45	2182358G96	30
C46	2184511B26	150
C47	2184511B49	220; N750
C48	0882163J07	400 ± 5%; 63V
C49,50	2182213E08	0.001uF ± 5%; 100V
C51	2184008H03	0.15uF – 20 + 80%
C52	2184008H13	0.05uF ± 20%; 25V; Y5R
C53	2383441B29	1uF ± 20%; 20V
C54	2182213E08	0.001uF ± 5%; 100V
C55,56	2383441B28	22uF ± 20%; 15V
C57	2182372C07	0.05uF – 20 + 80%; 25V
C58	2182213E08	0.001uF ± 5%; 100V
C59	2182372C07	0.05uF – 20 + 80%; 25V
C60	2182213E08	0.001uF ± 5%; 100V
C61	2184008H13	0.05uF ± 20%; 25V; Y5R
C62	2182372C07	0.05uF – 20 + 80%; 25V
C63	2182213E08	0.001uF ± 5%; 100V
C64	2182428B10	0.0033uF; 200V; X5R
C65	0882163J09	0.002uF ± 5%; 33V
C66	2182428B36	0.002uF; 200V; Y5R
C67,68	0882096J14	0.015uF; 250V
C69	0882096J19	0.0068uF; 250V
C70	2182358G96	30
C71	0882096J19	0.0068uF; 250V
C72	2182358G96	30
C73	2184008H04	0.0082; Y5F
C74,75	2383441B29	1uF ± 20%; 20V
C76	2182358G96	30
C77	2383441B27	10uF ± 20%; 15V
C78	2182358G96	30
C79	2100861442	0.002uF – 20 + 100%; 75V
C80,81	2182358G96	30
C82	0882096J07	0.0056uF; 250V
C83	2383441B13	47uF ± 20%; 6V
C84	2182358G96	30
C85	2383441B20	0.1uF ± 20%; 35V
C86	2100861442	0.002uF – 20 + 100%; 75V
C87	2383441B31	22uF ± 20%; 20V
C88	2383441B27	10uF ± 20%; 15V
C89	2383441B32	47uF ± 20%; 6V
C90	2383441B20	0.1uF ± 20%; 35V
C91	2383441B18	4.7uF ± 20%; 20V
C92,93	2182358G96	30
C94	2182358G93	100; 75V; N750
C95,96,97,98	2182358G96	30
C101	2383441B06	0.22uF ± 20%; **20V (N**
C102,103	2184511B01	100; 75V; N750 **(NUE**
C104	2383441B06	0.22uF ± 20%; **20V**
C105	2383441B31	22uF ± 20%; **20V**
C106	2184511B01	100; 75V; N750
C107	0882096J03	0.01uF; 250V
C108	2184511B01	100; 75V; N750
C109	0882096J03	0.01uF; 250V
C110	2182358G96	30
C111	0882096J01	0.0033uF; **250V**
C112	2184511B01	100; 75V; N750
C113	2383441B06	0.22uF ± 20%; **20V (N**
C114	2184511B01	100; 75V; N750
C115	2182372C07	0.05uF – 20 + **80%; 25**
C116	2382397D27	1.5uF; 20V
C117,118	2182358G96	30
C119	2100861442	0.002uF – 20 + **100%;**
C120	2383441B28	22uF ± 20%; **15V**
C121	2182133G03	100 ± 5%; **500V; N750**
C122	2100840812	200 ± 5%; 500V
C123	2184511B43	43
C124	2100832501	0.01uF – 40 + **60%; 25**
C125	2182450B27	1.5; 500V
C126	2184511B20	68
C127	2184511B24	100
C128	2184511B01	100; 75V; N750
C129	2184511B15	47
C130	2182428B36	0.002uF; 200V; **Y5R**
C131	2184511B31	1 ± 0.25pF; NPO
C132	2105529B09	36
C133	2184511B11	22
C134	2182358G96	30
C135	2182372C07	0.05uF – 20 + **80%; 25**
C136,137	2100861428	6 ± 0.5pF; 75V
C138	2184511B31	1 ± 0.25pF; NPO
C139	2184511B34	3.3 ± 0.25pF; **NPO**
C140	2184511B80	2.4 ± 0.25pF; **NPO**
C141	2100861428	6 ± 0.5pF; 75V
C142	2182358G96	30
C143	2184511B04	2.2 ± 0.25pF; **NPO**
C144	2184511B34	3.3 ± 0.25pF; **NPO**
C145	2184511B40	10
C146	2184511B34	3.3 ± 0.25pF; **NPO**
C147	2184511B40	10
C148	2184511B36	3.9 ± 0.25pF; **NPO**
C149	2182358G96	30
C150	2383441B28	22uF ± 20%; 15V
C151	2182358G96	30
C152	2382397D16	22uF ± 20%; 15V
C153	2182358G96	30
C154	2182358G96	30 (NUE6252A)
C155	2184511B40	10
		DIODE: See Note 1
CR2,CR3	4882139G01	Germanium
CR4	4882392B03	Silicon
CR101	4882392B03	Silicon
		FERRITE BEAD:
E101	7683960B03	Coded: WHITE
		FILTER:
FL1	0105951C98	Assembly, Helical; **incl** tuning screw 0305701
FL2	4805712B02	Crystal, 17.9MHz
FL4	4883192C22	Resonator, 459.4kHz
FL5	4883192C13	Resonator, 450.3kHz
FL6	4883192C22	Resonator, 459.4kHz
FL7	4883192C13	Resonator, 450.3kHz
		COIL, RF: unless state
L1	2482723H04	0.29uH Choke
L5	2482723H04	0.29uH Choke
L6	2482723H02	.039uH Choke
L7	2482827J10	Coded: BRN, 9¾ turns includes: 7682451B02
L8	2405636B02	Coded: RED, 5¾ tapp turns, incl: 7682451B0
L9	2482723H01	1.2uH Choke
L10	2482723H04	0.29uH Choke
L11	2484237H03	3¼ turns #20 AWG **Wi**
L12	2484237H01	4¼ turns #20 AWG **Wi**

2182358G93	100; 75V; N750
2182358G96	30
2383441B06	0.22uF ± 20%;20V (NUE6252A)
2184511B01	100; 75V; N750 (NUE6252A)
2383441B06	0.22uF ± 20%; 20V
2383441B31	22uF ± 20%; 20V
2184511B01	100; 75V; N750
0882096J03	0.01uF; 250V
2184511B01	100; 75V; N750
0882096J03	0.01uF; 250V
2182358G96	30
0882096J01	0.0033uF; 250V
2184511B01	100; 75V; N750
2383441B06	0.22uF ± 20%; 20V (NUE6252A)
2184511B01	100; 75V; N750
2182372C07	0.05uF – 20 + 80%; 25V
2382397D27	1.5uF; 20V
2182358G96	30
2100861442	0.002uF – 20 + 100%; 75V
2383441B28	22uF ± 20%; 15V
2182133G03	100 ± 5%; 500V; N750
2100840812	200 ± 5%; 500V
2184511B43	43
2100832501	0.01uF – 40 + 60%; 250V
2182450B27	1.5; 500V
2184511B20	68
2184511B24	100
2184511B01	100; 75V; N750
2184511B15	47
2182428B36	0.002uF; 200V; Y5R
2184511B31	1 ± 0.25pF; NPO
2105529B09	36
2184511B11	22
2182358G96	30
2182372C07	0.05uF – 20 + 80%; 25V
2100861428	6 ± 0.5pF; 75V
2184511B31	1 ± 0.25pF; NPO
2184511B34	3.3 ± 0.25pF; NPO
2184511B80	2.4 ± 0.25pF; NPO
2100861428	6 ± 0.5pF; 75V
2182358G96	30
2184511B04	2.2 ± 0.25pF; NPO
2184511B34	3.3 ± 0.25pF; NPO
2184511B40	10
2184511B34	3.3 ± 0.25pF; NPO
2184511B40	10
2184511B36	3.9 ± 0.25pF; NPO
2182358G96	30
2383441B28	22uF ± 20%; 15V
2182358G96	30
2382397D16	22uF ± 20%; 15V
2182358G96	30
2182358G96	30 (NUE6252A)
2184511B40	10
	DIODE: See Note 1
4882139G01	Germanium
4882392B03	Silicon
4882392B03	Silicon
	FERRITE BEAD:
7683960B03	Coded: WHITE
	FILTER:
0105951C98	Assembly, Helical; includes tuning screw 0305701B01
4805712B02	Crystal, 17.9MHz
4883192C22	Resonator, 459.4kHz
4883192C13	Resonator, 450.3kHz
4883192C22	Resonator, 459.4kHz
4883192C13	Resonator, 450.3kHz
	COIL, RF: unless stated
2482723H04	0.29uH Choke
2482723H04	0.29uH Choke
2482723H02	.039uH Choke
2482827J10	Coded: BRN, 9¾ turns; includes: 7682451B02 CORE
2405636B02	Coded: RED, 5¾ tapped at 2¼ turns, incl: 7682451B04 CORE
2482723H01	1.2uH Choke
2482723H04	0.29uH Choke
2484237H03	3¼ turns #20 AWG Wire
2484237H01	4¼ turns #20 AWG Wire

L13,14	2405262E06	22½ turns
L15,16,17	2482723H01	1.2uH Choke
L101	2482723H06	6.2uH Choke
L102,103	2482827J01	Coded: GRAY, 8¼ turns, includes: 7600861425 CORE
L104	2482827J07	Coded: RED, 7¾ turns, includes: 7600861425 CORE
L105	2482823H06	6.2uH Choke
L106	2483638H04	Coded: BRN, 3¼ turns, includes 7682451B07 CORE
L107	2482723H01	1.2uH Choke
L108	2482723H04	0.29uH Choke
L109	2484237H02	2¼ turns # 20 AWG Wire
L110	2484237H01	4¼ turns # 20 AWG Wire
L111	2482723H11	0.2uH Choke
L112	2484237H03	3¼ turns #20 AWG Wire
L113,114	2482723H11	0.2uH Choke
L115	2484237H02	2¼ turns # 20 AWG Wire
L116	2482723H05	0.41uH Choke
L117	2483961B01	3 turns # 20 AWG Wire
		PLUG:
P303	-----	See **NONREFERENCED ITEMS**
		TRANSISTOR: See Note 1
Q2	4800869773	NPN, Type M9773
Q3	4800869494	NPN, Type M9494
Q4	4800869662	NPN, Type M9662
Q5	4800869494	NPN, Type M9494
Q6,7	4800869570	NPN, Type M9570
Q8	4800869571	PNP, Type M9571
Q9	4800869570	NPN, Type M9570
Q10	4800869571	PNP, Type M9571
Q11	4800869570	NPN, Type M9570
Q12,13,14	4800134674	NPN, Type M54 (White Dot)
Q15	4800869571	PNP, Type M9571
Q16	4800869680	NPN, Type M9680
Q17	4800869681	PNP, Type M9681
Q101	4800134667	NPN, Type M54 (White Dot) (NUE6252A)
Q102,103	4800134667	NPN, Type M54 (Green Dot)
Q104	4800869592	NPN, Type M9592
Q105	4800869724	NPN, Type M9724
Q106	4800869638	NPN, Type M9638
Q107	4800869634	NPN, Type M9634
Q108	4800869631	NPN, Type M9631
Q109	4800869631	NPN, Type M9631 (NUE6252A)
	or 4800869728	NPN, Type M9728 (NUE6252B)
		RESISTOR, Fixed: Ω ± **5%; ¼W** unless stated
R5	0611009C57	2.2k
R6	0611009C49	1k
R7	0611009C95	82k
R8	0611009C65	4.7k
R10	0611009C83	27k (NUE6252A)
	or 0611009C53	1.5k (NUE6252B)
R11	0611009C57	2.2k
R12	0600124A27	120
R13	0611009C57	2.2k
R14	0611009C73	10k
R15	0611009C97	100k
R16	0611009C73	10k
R17	0611009C49	1k
R18	0611009C75	12k
R19	0611009C69	6.8k
R20	0611009C53	1.5k
R21	0611009C59	2.7k
R22	0611009C81	22k
R23	0611009C43	560
R24	0600124A17	47
R25	0611009C83	27k
R26	0611009C95	82k
R27	0611009C65	4.7k
R28	0611009C73	10k
R29	0611009C65	4.7k
R30,31	0611009C97	100k
R32	0611009C55	1.8k
R33,34	0611009C65	4.7k
R35	0611009C97	100k
R36	0611009C49	1k
R37	0611009D04	180k
R38	0611009C49	1k
R39	0611009C37	330

R40	0611[illegible]
R41	0611[illegible]
R42,43	0611[illegible]
R44,45	0611[illegible]
R46	0611[illegible]
R47	0611[illegible]
R48	0611[illegible]
	or 0611[illegible]
R49	0611[illegible]
R50	0611[illegible]
R51	0611[illegible]
R52	0611[illegible]
R53	0611[illegible]
R54	0611[illegible]
R55	0611[illegible]
R56	0611[illegible]
R57	060012[illegible]
R58,59	0611[illegible]
R60	060012[illegible]
R61	060012[illegible]
R101	0611[illegible]
R102	0611[illegible]
R103	060012[illegible]
R104	0611[illegible]
R105	0611[illegible]
R106	0611[illegible]
	or 0611[illegible]
R107	0611[illegible]
R108	0611[illegible]
R109	0611[illegible]
R110	0611[illegible]
	or 0611[illegible]
R111,112,113	0611[illegible]
	or 0611[illegible]
R114	0611[illegible]
R115	0611[illegible]
R116	1805925[illegible]
R119	0611[illegible]
R121	0611[illegible]
R122	0611[illegible]
R124	060012[illegible]
R125	0611[illegible]
R126,127	0611[illegible]
R128	060012[illegible]
R129	0611[illegible]
R130	060012[illegible]
R131	0611[illegible]
R132	0611[illegible]
R133	060012[illegible]
R140	0611[illegible]
RT1	0682769[illegible]
T1,2	2482045[illegible]
T3	0105957[illegible]
T4	0105957[illegible]
VR101	4883696[illegible]
Y1	KXN6054[illegible]
Y2	KXN6116[illegible]
Y101	KXN1013[illegible]

1. For optimum performance, [illegible] Motorola part number only.
2. When ordering crystal [illegible] quency(s), and crystal type [illegible] type will be found stamped on

R40	0611009C55	1.8k
R41	0611009C65	4.7k
R42,43	0611009C83	27k
R44,45	0611009C85	33k
R46	0611009D08	270k
R47	0611009C83	27k
R48	0611009C49	1k (NUE6252A)
	or 0611009C51	1.2k (NUE6252B)
R49	0611009C81	22k
R50	0611009D04	180k
R51	0611009C73	10k
R52	0611009D04	180k
R53	0611009C49	1k
R54	0611009C53	1.5k
R55	0611009C65	4.7k
R56	0611009C87	39k
R57	0600124A21	68
R58,59	0611009C41	470
R60	0600124D55	2.7 ± 10%
R61	0600124A13	33
R101	0611009C95	82k (NUE6252A)
R102	0611009C75	12k (NUE6252A)
R103	0600124A33	220 (NUE6252A)
R104	0611009C95	82k (NUE6252A)
R105	0611009C61	3.3k
R106	0611009C47	820 (NUE6252A)
	or 0611009C53	1.5k (NUE6252B)
R107	0611009C75	12k
R108	0611009C73	10k
R109	0611009C37	330
R110	0611009C59	2.7k (NUE6252A)
	or 0611009C63	3.9k (NUE6252B)
R111,112,113	0611009C71	8.2k (NUE6252A)
	or 0611009C63	3.9k (NUE6252B)
R114	0611009C85	33k
R115	0611009C53	1.5k
R116	1805923C02	Pot.; 50k
R119	0611009C97	100k
R121	0611009C65	4.7k
R122	0611009C73	10k
R124	0600124A21	150
R125	0611009C95	82k
R126,127	0611009C73	10k
R128	0600124A25	100
R129	0611009C55	1.8k
R130	0600124A21	68
R131	0611009C39	390
R132	0611009C55	1.8k
R133	0600124A01	10
R140	0611009D08	270k (NUE6252B)
		THERMISTOR:
RT1	0682769A01	10Ω ± 10%; 25°C
		TRANSFORMER:
T1,2	2482045J07	455 kHz
T3	0105957A62	ASSEMBLY, includes: Form 2484235H02 (pri: 6 turns, sec: 170 turns) SLEEVE 7682686D06 SHIELD 2484800H11
T4	0105957A64	ASSEMBLY, includes: Form 2484235H01 (pri: 48 turns, sec: 48 turns) SLEEVE 7682686D06 SHIELD 2484800H11
		DIODE: See Note 1
VR101	4883696E01	6.8V Zener
		CRYSTAL: See Note 2
Y1	KXN6054A	YVMR, 1st Oscillator
Y2	KXN6116A	YNR 2nd Oscillator 17.445 or 18.355 MHz
Y101	KXN1013B	Resonator Modulator

NOTES

1. For optimum performance, order replacement diodes and transistors by Motorola part number only.
2. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Proper oscillator frequency and crystal type will be found stamped on crystal can.

	MOTOROLA PART NO.	NONREFERENCED ITEMS
	0105953C98	ASSEMBLY, Bracket and Connector; contains: Plug (P303) 2882846E02 Bracket 0705121D01 Screw 0300136772 Coax 0105955C05 Coax 0105955C06
	0180703C54	ASSEMBLY, Heat Sink; for Q109
	4284452H02	HANDLE
	1400861196	INSULATOR, For Q108 and Q109
	1484743H01	INSULATOR, For T1 and T2
	1405798B01	PAD, Insulator; for Q2 and Q107
	2605654B01	SHIELD (at output of Helical Filter)
	2605650B01	SHIELD (at input of Helical Filter)
	2683397H01	HEAT SINK, For Q108
	2684800H11	SHIELD, for L106, L109, L110, L112, L115, L11, L12, L13, & L14
	2684800H14	SHIELD, for L102, L103, L104, L8
	7400861424	FORM, Coil; for L109, L110, L112, L115, L11 & L12
	7505295B01	PAD, Crystal; for FL2, FL3 & Y2
	7683419G02	CORE, Aluminum, for L109, L110, L112, L115, L11 & L12
	8405632E01	CIRCUIT BOARD

BACK-DATING INFORMATION

KIT AND SUFFIX NO.	REFERENCE SYMBOL	CHANGE
NUE6252A	C28	WAS 2183596E06, 410pF
	C29	WAS 2105529B09, 36pF
	C33	WAS 2184511B22, 75pF
	C34	WAS 2183162H13, 680pF
	FL3	DELETED
	FL2	WAS 4805712B01
NUE6252A-1	C2 thru C7	ADDED
	C21	WAS 2184511B07, 8.2pF
	C22	WAS 2184511B08, 6.8pF
	C23	WAS2182450B28, 1pF
	C24	WAS 2184511B70, 3pF
	C32	DELETED
	C94	ADDED
	C95-98	ADDED
	C101	WAS 2383441B06, 1uF
	C104	WAS 2383441B29, 1uF
	C116	WAS 2182372C07, .05uF
	C154	WAS 2182358G96, 30pF
	L11	WAS 2484237H02, 2¼ turns
	L117	ADDED
	Q101	WAS 4800134667, NPN
	R8	WAS 0600124A57, 2.2k
	R104	WAS 0600124A65, 4.7k
	R125	WAS 0600124A91, 56k
NUE6252A-2		AS SHOWN

BACK-DATING INFORMATION

KIT AND SUFFIX NO.	REFERENCE SYMBOL	CHANGE
NUE6252B	L117	ADDED
NUE6252B-1	C116	ADDED
NUE6252B-2	C113	DELETED (replaced with a jumper)
NUE6252B-3	R48	ADDED
NUE6252B-4	C91	DELETED
NUE6252B-5	Q109	WAS 4800869631
NUE6252B-6	C91	ADDED
NUE6252B-7	R140	ADDED
NUE6252B-8		AS SHOWN

Vehicular Repeater Main Logic Board

(V) = 150.8-174 MHz
(U) = 450-470 MHz

PLF-1817-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF ± 10% 50V unless stated
C301	0882096J04	.047; 250V
C302	2182428B36	.002; 200V
C303	0882905G05	0.15
C304	0882096J06	1500pF; 250V
C305	2184511B24	100pF
C306	0882096J20	0.22; 250V
C307	2382256J08	22-10 + 50%; 40V
C308	0882905G12	0.22
C309	2184511B86	30pF
C310	2382256J07	4.7 – 10 + 50%; 63V
C311	2384762H08	3.9 ± 20%; 15V
C312	2182187B29	1000pF; 100V
C313	2184511B24	100pF
C314	2182187B39	470pF; 500V
C315	0882096J03	.01; 250V
C316	0882096J18	0.1; 250V
C334	2382256J04	1; + 50 – 10%;100V
C335	2382256J03	10; 25V
C336	2382601A25	100 + 150 – 10%; 20V
C337	2184511B24	100pF (V)
	2184511B02	30pF; N150 (U)
C338	2184494B40	21pF ± 5%; 500V (V)
	2184511B02	30pF; N150 (U)
C339	0882096J18	0.1; 250V
C340,341	0882096J03	.01; 250V
C342	2100874352	1200pF; ± 5%; 300V
C343	0882096J03	.01; 250V
C344,345	2382256J03	10; 25V
C346	2382256J04	1; + 50 – 10%; 100V
C347	2182428B09	.0047; 200V
C348	2383441B22	10 ± 20%; 4V
C349	2184511B24	100pF
C350	2182428B09	.0047; 200V
C351	2184511B24	100pF
C352	2382256J03	10; 25V
C353	2184511B24	100pF
C354	2182428B36	.002; 200V
C355	2382256J03	10; 25V
C356	2182428B36	.002; 200V
C358,359	2184511B24	100pF
C360	2184511B01	100pF (V)
	2184511B02	30pF; N150; (U)
C397	2383441B19	10 ± 20%; 20V
C398	2382256J03	10; 25V
C399	0882905G12	0.22
C40l	2184511B24	100pF
C402	2382256J03	10; 25V
C403	2382256J04	1; + 50 – 10%;100V
C404	2182428B09	.0047; 200V
C405	2383441B22	10 ± 20%; 4V
C406	2184511B24	100pF
C407	2182428B36	.002; 200V
C408	2184511B24	100pF
C409 thru 411	2382256J03	10; 25V
C412	2182428B36	.002; 200V
C413	2184511B24	100pF
C414	2182428B09	.0047; 200V
C415	2382256J04	1; + 50 – 10%;100V
C416	2184511B24	100pF
C417	2382256J04	1; + 50 – 10%;100V
C418	2184511B24	100pF
C419	2383214C21	6.8 ± 20%; 20V
C420	2382256J04	1; + 50 – 10%; 100V
C421	0882096J18	0.1; 250V
C422	0882096J02	.0047; 100V
C423	0882096J06	1500pF; 250V
C424	2184511B24	100pF; 100V
C425	2382256J08	22; + 50 – 10%; 40V
C426	0882905G11	0.22; 50V
C427	0882905G12	0.22
C428	2184511B86	30pF
C429	2382256J07	4.7; – 10 + 50%; 63V
C431	2184511B24	100pF; 100V
C432	2182187B29	1000pF; 100V
C433	2182187B39	470pF; 500V
C434	0882096J03	.01; 250V
C435	2382256J04	1; + 50 – 10%; 100V
C438,439	2184511B24	100pF
C440	2382256J03	10; 25V
C441	2184511B34	3.3pF (V)
C444	2182428B36	.002; 200V
C501	0882096J18	0.1; 250V
C505,506	0882905G49	0.47
C509	0883445B69	0.255 ± 1%
C513,514	2383441B31	22 ± 20%; 20V
C516,517	0882096J18	0.1; 250V
C518	0882905G49	0.47
C523,524,525	0882096J18	0.1; 250V
C526	0882905G05	0.15
C527	0882096J20	0.22; 250V
C528	0882096J18	0.1; 250V
C529,530	0882096J20	0.22; 250V
		DIODE: See Note
CR301	4882392B03	Silicon
CR302	4883654H01	Silicon
CR306	4883654H01	Silicon
CR307		Not Used
CR308 thru 311	4883654H01	Silicon
CR312		Not Used
CR313	4883654H01	Silicon
CR314		Not Used
CR315 thru 318	4883654H01	Silicon
CR319		Not Used
CR320	4883654H01	Silicon
CR321		Not Used
CR322 thru 325	4883654H01	Silicon
CR326		Not Used
CR327	4883654H01	Silicon
CR328		Not Used
CR329 thru 332	4883654H01	Silicon
CR333		Not Used
CR334,335	4883654H01	Silicon
CR336 thru 338		Not Used
CR339	4882654H01	Silicon
CR340		Not Used
CR341	4883654H01	Silicon
CR342	4885562A01	Silicon
CR343 thru 345	4883654H01	Silicon
CR346		Not Used
CR347	4883654H01	Silicon
CR348	4882392B03	Silicon
CR350		Not Used
CR401 thru 407	4883654H01	Silicon
CR502,503, 505,506	4883654H01	Silicon
CR508 thru 514	4883654H01	Silicon
		RESONANT REED:
E302	KLN6209A	"Vibrasponder"
E401	KLN6209A	"Vibrasponder," Reed Code 23; 847.5Hz
		FUSE:
F301	6505214E01	2-Amp.
		INTEGRATED CIRCUIT:
IC301	5184267A09	Type M6709
IC302,303	5184267A94	Type SC6794
IC304	5184267A09	Type M6709
IC401	5184267A94	Type SC6794
		JACK:
J301	2884085B01	Plug, Connector; 37-line
J302,303	0982847E03	Conn; Female; 9-contact
J304	0982442E01	Receptacle, Antenna
		RELAY
K1,2	8005510D01	PTT Control
		COIL, RF:
L301,302	2482723H01	Choke; 1.2uH (V)
	2482723H11	Choke, 0.2uH (U)
L303	2482723H04	Choke, 0.29uH (V)
	2484238H02	1½ Turns (U)
L304	2482723H04	Choke, 0.29uH (V)
		TRANSISTOR: See Note
Q301, 302	4800869642	NPN; Type M9642
Q308	4800869642	NPN; Type M9642
Q309	4800869570	NPN; Type M9570
Q312	4800869570	NPN; Type M9570
Q313,315,317, 319,321	4800869642	NPN; Type M9642
Q314,316,318,320	4800869570	NPN; Type M9570

Q323	4800869642	NPN; Type M9642
Q324	4800869762	PNP; Type M9762
Q325	4800869642	NPN; Type M9642
Q326	4800869787	NPN; Type M9787
Q327	4800869677	PNP; Type M9677
Q328	4800869787	NPN; Type M9787
Q329 thru 331	4800869642	NPN; Type M9642
Q332	4800869570	NPN; Type M9570
Q401 thru 405	4800869642	NPN; Type M9642
Q415,416	4800869642	NPN; Type M9642
Q421	4800869642	NPN; Type M9642
		RESISTOR, Fixed: Ω ± 5%
		¼W unless stated
R301	0611009D12	390k
R302	0611009D08	270k
R303,305	1884944C03	Pot., 10k
R306	0611009C81	22k
R307	0600124C05	15
R308	0611009C81	22k
R309	0611009C83	27k
R310	0611009C97	100k
R311	0611009C79	18k
R314	0611009C79	18k
R315	0611009D08	270k
R334		Not Used
R335,337,339	0611009C79	18k
R336,343, 350,358	0611009C73	10k
R338,344, 352,359	0611009C87	39k
R340		Not Used
R341,342, 345,346	0611009C79	18k
R348		Not Used
R349,351, 353,354	0611009C79	18k
R355		Not Used
R356,357,360 361,362,363	0611009C79	18k
R364	0611009C89	47k
R365	0611009C79	18k
R366	0611009C57	2.2k
R367	0611009C65	4.7k
R368 thru 371	0611009C79	18k
R372	0611009C87	39k
R374	0600126C35	270; 1W
R376	0611009C63	3.9k
R377	0611009C35	270
R378	0611009C55	1.8k
R379	1884944C01	Pot., 2k
R380	0611009C49	1k
R381,383	0611009C87	39k
R384	0611009C79	18k
R385	0611009C79	18k
R386,387	0611009D02	150k
R388 thru 391	0611009C99	120k
R392	0611009D02	150k
R393	0611009C69	6.8k
R394	0611009C63	3.9k
R395	0611009C57	2.2k
R396	0611009C73	10k
R397	0611009C61	3.3k
R398	0611009C45	680
R399	0611009C89	47k
R401	0600124C25	100
R402	0611009C93	68k
R403,483	0600124C25	100
R404	0611009C95	82k
R405	0611009C75	12k
R406	0611009C49	1k
R407, 408	0611009C73	10k
R409	0611009C97	100k
R410	0611009C49	1k
R411	0611009C57	2.2k
R412	0611009C49	1k
R413	0611009C61	3.3k
R414	0611009C87	39k
R415	0611009C45	680
R416	0611009C89	47k
R417	0611009D02	150k
R418,419	0611009C79	18k
R420	0611009C49	1k

R421,422	0611009C79	18k
R423	0611009C97	100k
R424	0611009D10	330k
R425	0611009C79	18k
R426	0611009D02	150k
R427	0611009C79	18k
R428	0611009D06	220k
R447	0611009C75	12k
R448	0611009C97	100k
R450	1884944C03	Pot., 10k; 0.1W
R451	0611009C45	680
R452	0611009C81	22k
R453	0600124C05	15
R455	0611009C83	27k
R456	0611009C97	100k
R457	0611009C79	18k
R467,468	0611009C79	18k
R469	0600124C19	56 (for Low Band & UHF **Mobile** Detector Boards)
	or 0600124C21	68 (for VHF Mobile **Detector Boa**
R470	0611009C43	560 (for Low Band & UHF **Mobile** Detector Boards)
	or 0600124C33	220 (for VHF Mobile **Detector Bo**
R471	0611009C79	18k
R476	0611009C89	47k
R477	0611009C53	1.5k
R478,479,480	0611009C89	47k
R481	1805923C01	Pot., 200Ω; ½W
R482	0611009A95	82k
R483	0600124C25	100
R501	0600124B34	3.3 Meg. ± 5%
R503	0611009C79	18k
R506,507	0611009D22	1 Meg.
R510	0600124B32	2.7 Meg.
R511	0611009B12	390k
R512	1805923C03	Pot., 1 Meg.
R513	0600124D46	10 Meg.
R514	0611009D22	1 Meg.
R515	0611009C81	22k
R516,517	0611009C79	18k
R521	0600124B34	3.3 Meg. ± 5%
R522	0600124B34	3.3 Meg. ± 5%
R526	0611009C79	18k
R533	0611009C79	18k
R534	0600124D54	22 Meg.
R535	0600124D32	2.7 Meg.
R536	0611009C55	1.8k
R537	0611009C79	18k
R538	0611009D10	330k
R539	0611009D02	150k
R540	0600124D28	1.8 Meg.
R541	0611009D10	330k
R542	0611009B18	680k
R543	0600124D46	10 Meg.
R544	0600124D36	3.9 Meg.
R545	0611009D22	1 Meg.
R546	0611009D14	470k
R547	0611009D12	390k
R548	0611009C97	100k
R549	0600124D46	10 Meg.
R550	0611009D14	470k
R551	0611009D20	820k
R552	0611009C57	2.2k
R553	0600124B32	2.7 Meg. ± 5%
		MODULE, Encapsulated:
U1	5182822F15	Triple 3-input NAND Gate
U2	5182822F43	Quad 2-input OR Gate
U3	5182822F02	Hex Inverter
U4	5182822F03	Quad 2-Input NOR Gate
U5	5182822F08	Quad 2-Input NAND Gate
U6	5182822F03	Quad 2-Input NOR Gate
U8	5182822F43	Quad 2-Input OR Gate
U9	5182822F44	Quad 2-input AND Gate
U10	5182822F25	Dual 4-Input NOR Gate
U11,12	5182822F02	Hex Inverter
U13	5182822F43	Quad 2-Input OR Gate
U14	5182822F08	Quad 2-Input NAND Gate
U15	5182822F31	UP/DOWN Counter
U16	5182822F44	Quad 2-Input AND Gate
U18	5182822F44	Quad 2-Input AND Gate
		DIODE: See Note
VR301, 302	4882256C15	5.1V Zener
VR303	4882256C03	4.7V Zener
VR304	4882256C59	15V Zener

09C79	18k
09C97	100k
09D10	330k
09C79	18k
09D02	150k
09C79	18k
09D06	220k
09C75	12k
09C97	100k
44C03	Pot., 10k; 0.1W
09C45	680
09C81	22k
24C05	15
09C83	27k
09C97	100k
09C79	18k
09C79	18k
24C19	56 (for Low Band & UHF Mobile Detector Boards)
24C21	68 (for VHF Mobile Detector Boards)
09C43	560 (for Low Band & UHF Mobile Detector Boards)
24C33	220 (for VHF Mobile Detector Boards)
09C79	18k
09C89	47k
09C53	1.5k
09C89	47k
23C01	Pot., 200Ω;½W
09A95	82k
24C25	100
24B34	3.3 Meg. ± 5%
09C79	18k
09D22	1 Meg.
24B32	2.7 Meg.
09B12	390k
23C03	Pot., 1 Meg.
24D46	10 Meg.
09D22	1 Meg.
09C81	22k
09C79	18k
24B34	3.3 Meg. ± 5%
24B34	3.3 Meg. ± 5%
09C79	18k
09C79	18k
24D54	22 Meg.
24D32	2.7 Meg.
09C55	1.8k
09C79	18k
09D10	330k
09D02	150k
24D28	1.8 Meg.
09D10	330k
09B18	680k
24D46	10 Meg.
24D36	3.9 Meg.
09D22	1 Meg.
09D14	470k
09D12	390k
09C97	100k
24D46	10 Meg.
09D14	470k
09D20	820k
09C57	2.2k
24B32	2.7 Meg. ± 5%
	MODULE, Encapsulated:
2822F15	Triple 3-input NAND Gate
2822F43	Quad 2-input OR Gate
2822F02	Hex Inverter
2822F03	Quad 2-Input NOR Gate
2822F08	Quad 2-Input NAND Gate
2822F03	Quad 2-Input NOR Gate
2822F43	Quad 2-Input OR Gate
2822F44	Quad 2-input AND Gate
2822F25	Dual 4-Input NOR Gate
2822F02	Hex Inverter
2822F43	Quad 2-Input OR Gate
2822F08	Quad 2-Input NAND Gate
2822F31	UP/DOWN Counter
2822F44	Quad 2-Input AND Gate
2822F44	Quad 2-Input AND Gate
	DIODE: See Note
2256C15	5.1V Zener
2256C03	4.7V Zener
2256C59	15V Zener

BACK-DATING INFORMATION

KIT AND SUFFIX NO.	REFERENCE SYMBOL	CHANGE
NLN4358A	C397	WAS 2382256J03, 10uF – 10 – 50%;
NLN8982A		50V
NLN4358A-1	C397	CHANGED TO 2383441B19, 10uF
NLN8982A-1		± 20%; 20V
NLN4358A-2	C525	WAS 0882905G49, 0.47uF
NLN8982A-2	R308	WAS 0600124D04, 180k
NLN4358A-3	R501	WAS 0600124D46, 10 Meg.
NLN8982A-3	R510	WAS 0600124D06, 220k
	R511	WAS 0682526F43, 100k
	R542	WAS 0600124D22, 1 Meg.
NLN4358A-4	C507,508	DELETED (replaced with jumpers)
NLN8982A-4	CR504	DELETED
	CR513,514	ADDED
	R504,505	DELETED
	R553	ADDED
	VR303	ADDED
NLN4358A-5	CR407	ADDED
NLN8982A-5		
NLN4358A-6	C444	ADDED
NLN8982A-6	R372	WAS 0600124C97, 100k
NLN4358A-7	R372	CHANGED TO 0600124C87, 39k
NLN8982A-7		
NLN4358A-8	C305,313,	WERE 2184511B24, 100pF
NLN8982A-8	424,431	
NLN4358A-9	C305,313,	WERE 2182187B29, 1000pF
NLN8982A-9	424,431	
	C426	WAS 0882905G23, 0.02uF
NLN4358A-10	Q301,303,308	WERE 4800869570
NLN8982A-10	Q309,312	WERE 4800869787
	Q313,315,317	
	319,321,323,	
	325,329,330,	
	331,401 thru	
	405,415,416,	
	421	WERE 4800869570
	R301	WAS 0600124D36, 3.9 Meg.
	R302	WAS 0600124D32, 2.7 Meg.
	R304	DELETED
	R336,343,350,	WERE 0600124C79, 18k
	358	
	R338,344,352,	WERE 0600124C79, 18k
	359	
	R385,471	WERE 0600124C69, 6.8k
	R428	WAS 0600124D22, 1 Meg.
	R482,483	ADDED
	R547	WAS 0600124D02, 150k
	R553	WAS 0600124B12, 390k
	U6	WAS 5182822F02, HEX INVERTER
	VR304	ADDED
NLN4358A-11		
NLN8982A-11		AS SHOWN

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.

CAUTION: This equipment contains MOS devices which are susceptible to damage in handling due to static discharge. Handle with grounded tools and transport in conductive foam or a metallic tray.

BACK-DATING INFORMATION

KIT AND SUFFIX NO.	REFERENCE SYMBOL	CHANGE
NLN4358A	C397	WAS 2382256J03. 10uF - 10 - 50°o:
NLN8982A		50V
NLN4358A-1	C397	CHANGED TO 2383441B19, 10uF
NLN8982A-1		± 20%; 20V
NLN4358A-2	C525	WAS 0882905G49. 0.47uF
NLN8982A-2	R308	WAS 0600124D04. 180k
NLN4358A-3	R501	WAS 0600124D46. 10 Meg.
NLN8982A-3	R510	WAS 0600124D06, 220k
	R511	WAS 0682526F43, 100k
	R542	WAS 0600124D22, 1 Meg.
NLN4358A-4	C507,508	DELETED (replaced with jumpers)
NLN8982A-4	CR504	DELETED
	CR513,514	ADDED
	R504,505	DELETED
	R553	ADDED
	VR303	ADDED
NLN4358A-5	CR407	ADDED
NLN8982A-5		
NLN4358A-6	C444	ADDED
NLN8982A-6	R372	WAS 0600124C97, 100k
NLN4358A-7	R372	CHANGED TO 0600124C87, 39k
NLN8982A-7		
NLN4358A-8	C305,313,	WERE 2184511B24, 100pF
NLN8982A-8	424,431	
NLN4358A-9	C305,313,	WERE 2182187B29, 1000pF
NLN8982A-9	424,431	
	C426	WAS 0882905G23, 0.02uF
NLN4358A-10	Q301,303,308	WERE 4800869570
NLN8982A-10	Q309,312	WERE 4800869787
	Q313,315,317	
	319,321,323,	
	325,329,330,	
	331,401 thru	
	405,415,416,	
	421	WERE 4800869570
	R301	WAS 0600124D36, 3.9 Meg.
	R302	WAS 0600124D32, 2.7 Meg.
	R304	DELETED
	R336,343,350,	WERE 0600124C79, 18k
	358	
	R338,344,352,	WERE 0600124C79, 18k
	359	
	R385,471	WERE 0600124C69, 6.8k
	R428	WAS 0600124D22, 1 Meg.
	R482,483	ADDED
	R547	WAS 0600124D02, 150k
	R553	WAS 0600124B12, 390k
	U6	WAS 5182822F02, HEX INVERTER
	VR304	ADDED
NLN4358A-11		
NLN8982A-11		AS SHOWN

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.

CAUTION: This equipment contains MOS devices which are susceptible to damage in handling due to static discharge. Handle with grounded tools and transport in conductive foam or a metallic tray.

SCHEMATIC NOTES

NOTES:

1. THE BAR ABOVE "LOGIC LINE IDENTIFIERS" IMPLIES A LOGICAL ZERO (GND); AND AN "IDENTIFIER" WITHOUT A BAR IMPLIES A LOGICAL ONE (REG. B+) WHEN THE NAMED CONDITION EXISTS.
2. USED ON SOME EARLIER MODELS WITH LOW BAND MONITOR ONLY. IF UHF MONITOR IS USED, REPLACE C338 WITH L304 & C441.
3. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TRANSMITTER AND "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 3 FOR "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 4 FOR OPERATION WITHOUT TIME-OUT TIMER.
4. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT SIDE PLATING AT U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE TRANSMISSION" OPTION.
5. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, k = 1000;
   CAPACITOR VALUES ARE IN MICROFARADS (uF);
   INDUCTOR VALUES ARE IN HENRYS (H).
6. WHERE COMPONENTS ARE FREQUENCY SENSITIVE, "V" AND "U" ARE USED. "V" DESIGNATES COMPONENT VALUE FOR 150.8-174 MHz RANGE AND "U" IS FOR 450-470 MHz RANGE.
7. ALL LOGIC IC CIRCUITRY IS 500 LEVEL REFERENCE SYMBOL DESIGNATION.
8. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL ONLY.
   △△ INSTALLED FOR "PL" CHANNELS ONLY.

EPF-6861-D

"PAC•RT" "PL" TEST MEASUREMENTS

PROBE POINT	DC VOLTS	AC VOLTS	
	DECODE	DECODE	
	VOLTS	mV	dBm
BASE OF Q329	3.4	16.0	-33.6
EM. OF Q329	3.0	16.0	-33.6
BASE OF Q330	2.8	11.5	-36.5
EM. OF Q330	2.2	11.5	-36.5
IC CHIP PIN 1	6.5	10.5	37.4
IC CHIP PIN 2	5.4	650	-2
IC CHIP PIN 3	10.5	3.0	-43.6
IC CHIP PIN 4	1.3	75	-20
IC CHIP PIN 5	10.5	3.0	-48.5
IC CHIP PIN 6	6.5	20	-31.8
IC CHIP PIN 7	7.2	.8	-59.7
IC CHIP PIN 8	.7	2.0	-42.2
IC CHIP PIN 9	-	-	-
IC CHIP PIN 10	1.3	65	-21.5
IC CHIP PIN 11	.8	65	-21.5
IC CHIP PIN 12	.05	14.5	-34.5
IC CHIP PIN 13	.1	-	-
IC CHIP PIN 14	.5	-	-
IC CHIP PIN 15	.5	-	-
IC CHIP PIN 16	0	-	-

INPUT SIGNAL 14 mV. (-35 dB) OF "PL" TONE AT R317/R386.

(0 dBm IS 1 mW ACROSS 600 OHMS)

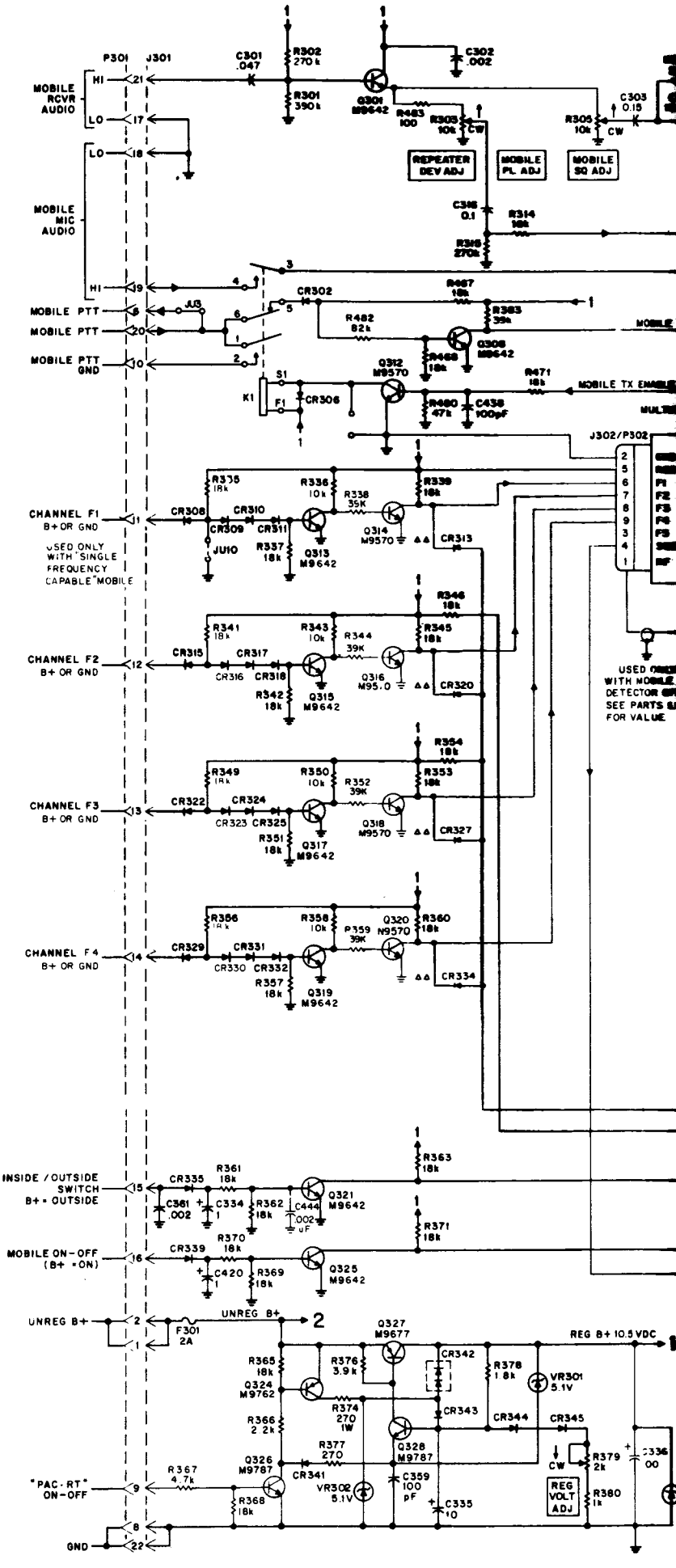
EPF-7305-O

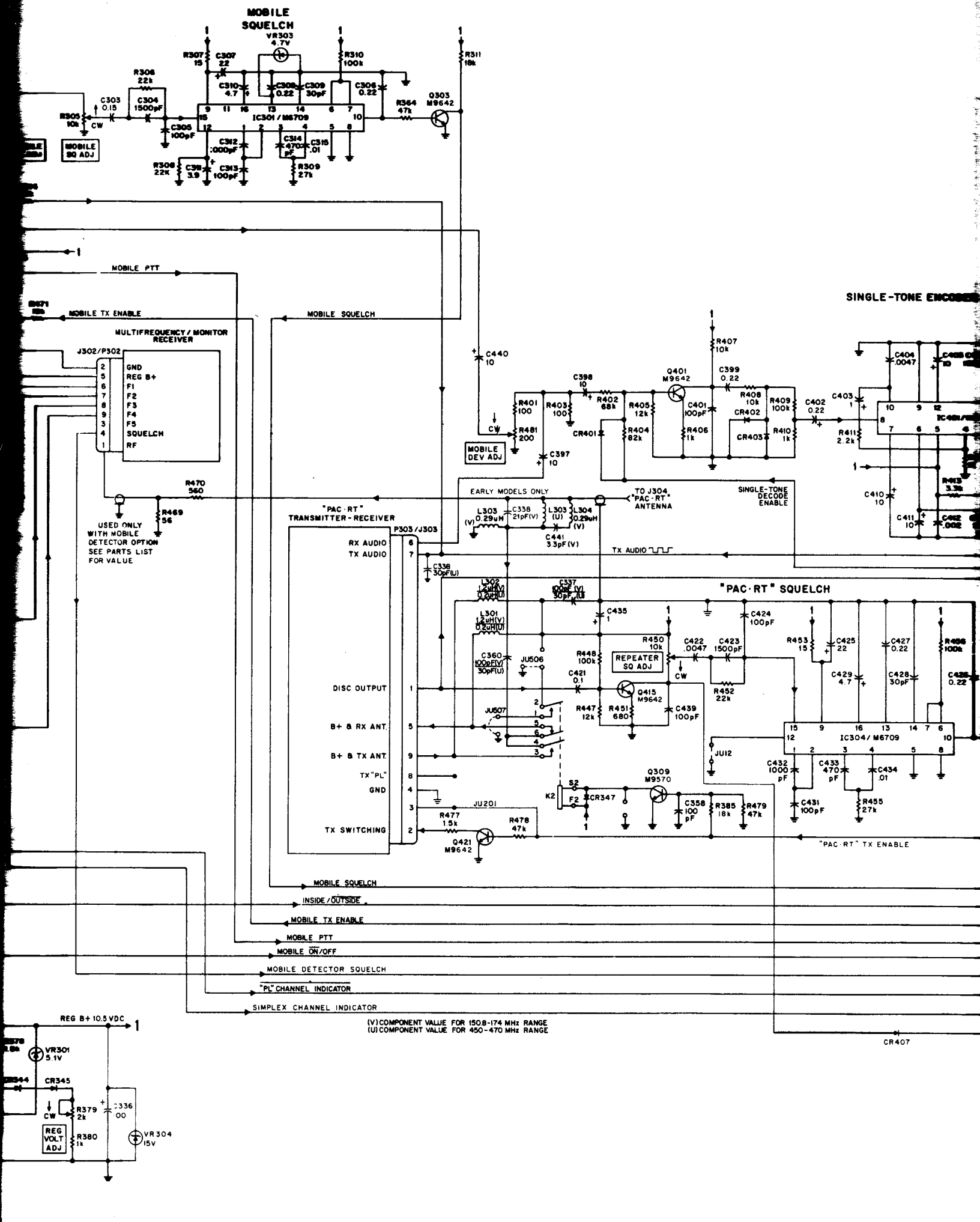
SINGLE-TONE ENCODER/DECODER TEST MEASUREMENTS

PROBE POINT	DC VOLTS		AC VOLTS			
	DECODE	ENCODE	DECODE		ENCODE	
	VOLTS	VOLTS	mV	dBm	mV	dBm
IC CHIP PIN 1	6.5	6.5	10.5	-37.4	-	-
IC CHIP PIN 2	5.4	2.9	650	-2	140	-14.7
IC CHIP PIN 3	10.5	6.0	3.0	-43.6	.6	-2
IC CHIP PIN 4	1.3	1.7	75	-20	390	-6
IC CHIP PIN 5	10.5	10.5	3.0	-48.5	-	-
IC CHIP PIN 6	6.5	3.0	20	-31.8	-	-
IC CHIP PIN 7	7.2	7.1	.8	-59.7	-	-
IC CHIP PIN 8	.7	.3	2.0	-42.2	-	-
IC CHIP PIN 9	-	-	-	-	-	-
IC CHIP PIN 10	1.3	1.4	65	-21.5	340	-7.3
IC CHIP PIN 11	.8	.8	65	-21.5	19	-32.2
IC CHIP PIN 12	.05	1.0	14.5	-34.5	-	-
IC CHIP PIN 13	.1	5.0	-	-	-	-
IC CHIP PIN 14	.5	.8	-	-	-	-
IC CHIP PIN 15	.5	.9	-	-	-	-
IC CHIP PIN 16	0	10.5	-	-	-	-

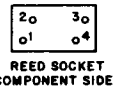
(0 dBm IS 1 mW ACROSS 600 OHMS)

EPF-7306-O




MOBILE SQUELCH
VR303 4.7V
R307 15
C307 22
R308 22k
C310 4.7
C308 0.22
C309 30pF
C306 0.22
R310 100k
R311 18k
R364 47k
Q303 M9642
C303 0.15
R305 10k CW
C304 1500pF
C305 100pF
IC301 / M6709
C312 .000pF
C314 470pF
C315 .01
R306 22K
C311 3.9
C313 100pF
R309 27k
MOBILE 80 ADJ
MOBILE PTT
MOBILE TX ENABLE
MOBILE SQUELCH
MULTIFREQUENCY / MONITOR RECEIVER
J302/P302
2 GND
5 REG B+
6 F1
7 F2
8 F3
9 F4
3 F5
4 SQUELCH
1 RF
R470 560
R469 56
USED ONLY WITH MOBILE DETECTOR OPTION SEE PARTS LIST FOR VALUE
"PAC·RT" TRANSMITTER-RECEIVER
P303/J303
RX AUDIO 6
TX AUDIO 7
DISC OUTPUT 1
B+ & RX ANT. 5
B+ & TX ANT. 9
TX "PL" 8
GND 4
3
TX SWITCHING 2
C440 10
R407 10k
C398 10
Q401 M9642
C399 0.22
R401 100
R403 100
R402 68k
R405 12k
C401 100pF
R408 10k
R409 100k
C402 0.22
CR402
CR403
R410 1k
R411 2.2k
CR401
R404 82k
R406 1k
CW
MOBILE DEV ADJ
R481 200
C397 10
EARLY MODELS ONLY
TO J304 "PAC·RT" ANTENNA
SINGLE-TONE DECODE ENABLE
L303 (V) 0.29uH
C338 21pF(V)
L303 (U)
L304 0.29uH (V)
C441 3.3pF(V)
C338 30pF(U)
L302 1.2uH(V) 0.2uH(U)
C337 100pF (V) 30pF (U)
L301 1.2uH(V) 0.2uH(U)
C435 1
C360 100pF(V) 30pF(U)
JU506
R448 100k
REPEATER SQ ADJ
R450 10k
C422 .0047
C423 1500pF
C424 100pF
C421 0.1
Q415 M9642
R447 12k
R451 680
C439 100pF
R452 22k
JU507
JU201
R477 1.5k
R478 47k
Q421 M9642
"PAC·RT" SQUELCH
IC304 / M6709
JU12
R453 15
C425 22
C427 0.22
C429 4.7
C428 30pF
C426 0.22
C432 1000 pF
C433 470 pF
C434 .01
C431 100pF
R455 27k
S2
K2
F2
CR347
Q309 M9570
C358 100 pF
R385 18k
R479 47k
"PAC·RT" TX ENABLE
MOBILE SQUELCH
INSIDE / OUTSIDE
MOBILE TX ENABLE
MOBILE PTT
MOBILE ON/OFF
MOBILE DETECTOR SQUELCH
"PL" CHANNEL INDICATOR
SIMPLEX CHANNEL INDICATOR
(V) COMPONENT VALUE FOR 150.8-174 MHz RANGE
(U) COMPONENT VALUE FOR 450-470 MHz RANGE
CR407
REG B+ 10.5 VDC
VR301 5.1V
CR345
CW
R379 2k
C336 .00
REG VOLT ADJ
R380 1k
VR304 15V

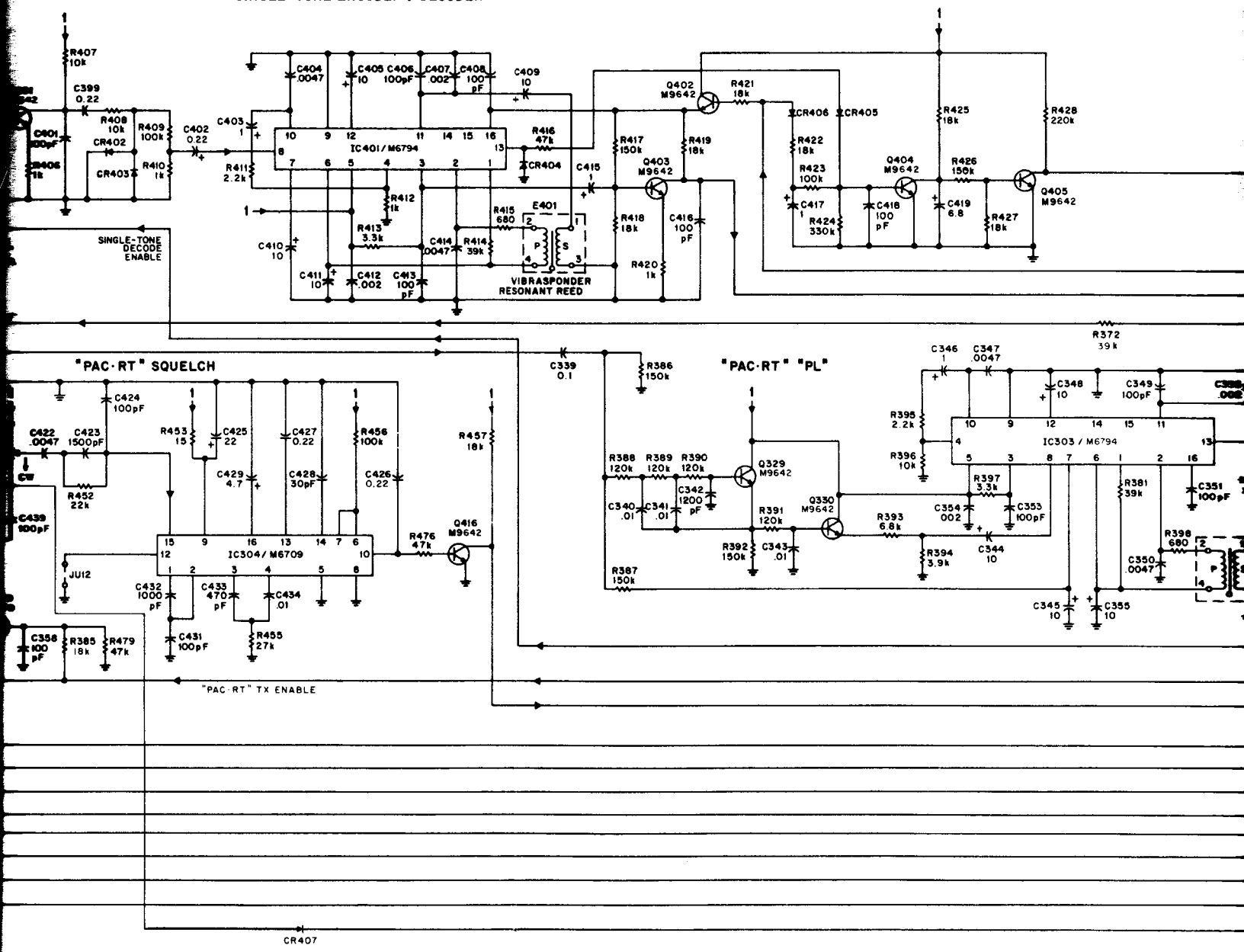
COMPONENT TERMINAL DETAILS



ITEM REVISIONS CHART

MODEL	SUFFIX	FREQUENCY
NLN4358A LOGIC BD W/O "PL" OPERATION	11	150.8-174 MHz 450-470 MHz
NLN8982A LOGIC BD W/ "PL" OPERATION	11	150.8-174 MHz 450-470 MHz
NLD7031A MISC PARTS		150.8-174 MHz
NLE8462A MISC PARTS		450-470 MHz

SINGLE-TONE ENCODER / DECODER

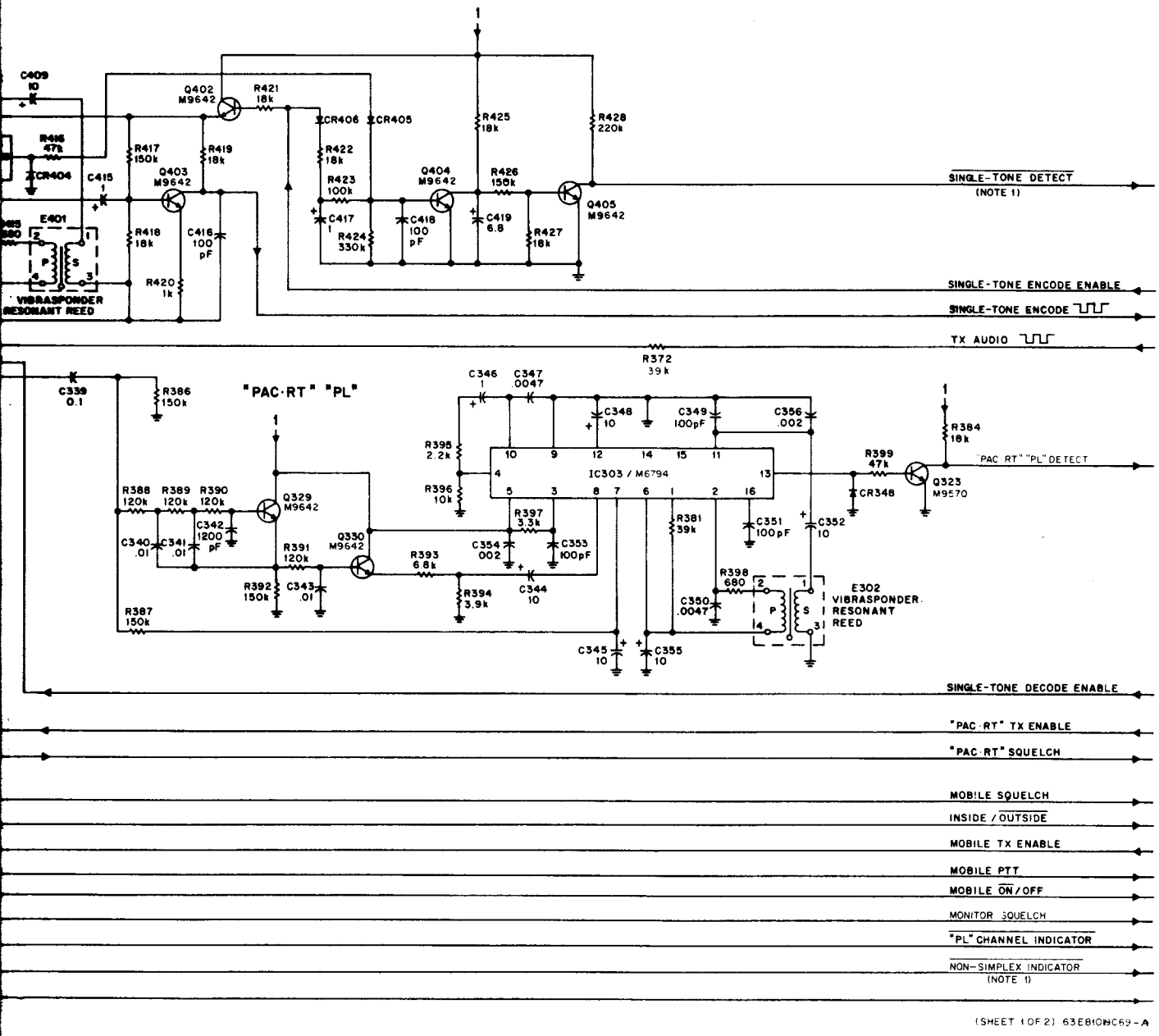


(NLN4358A & NLN8982A)
VEHICULAR REPEATER SCHEMATIC DIAGRAM

COMPONENT TERMINAL DETAILS

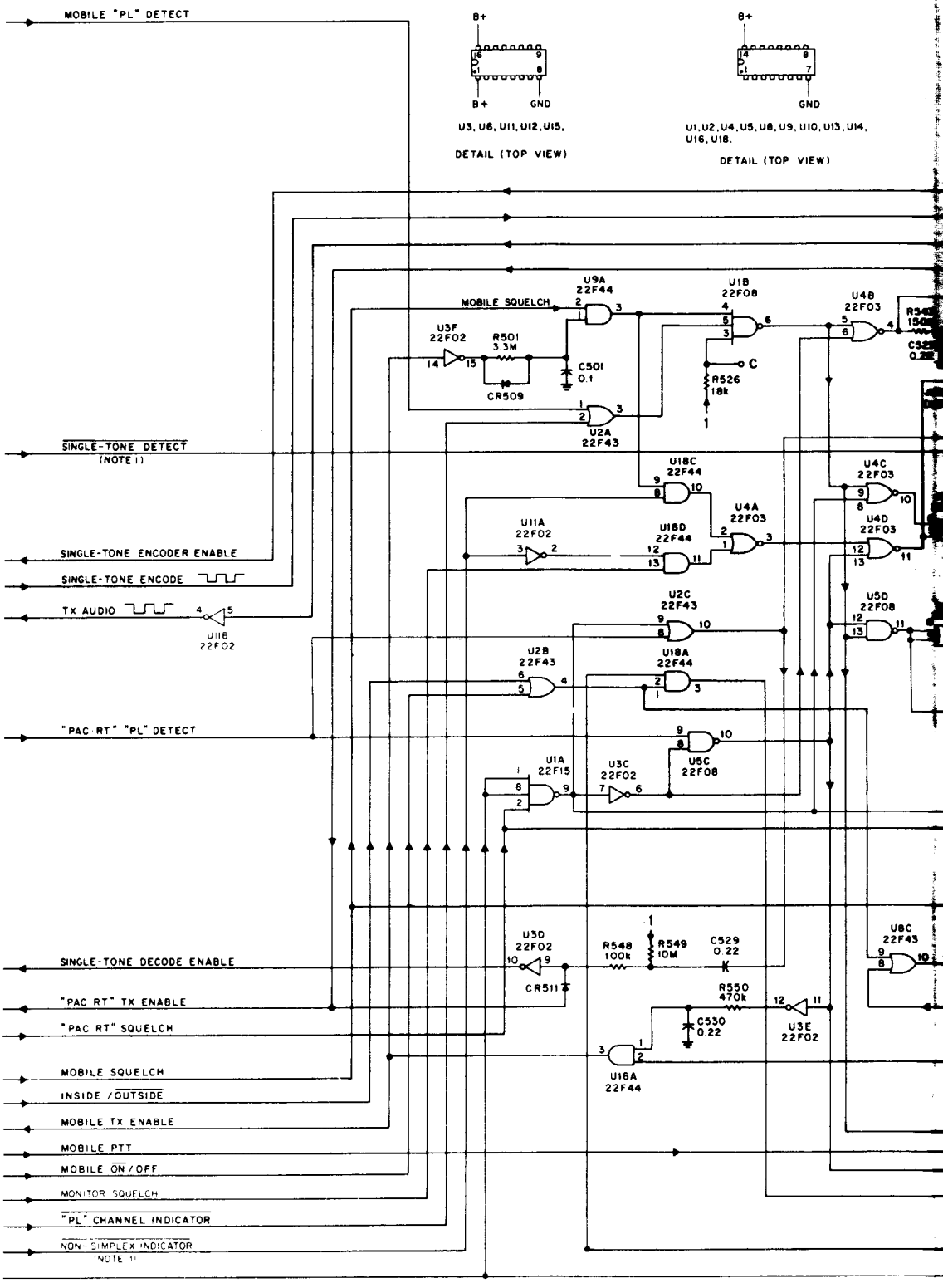
ITEM REVISIONS CHART

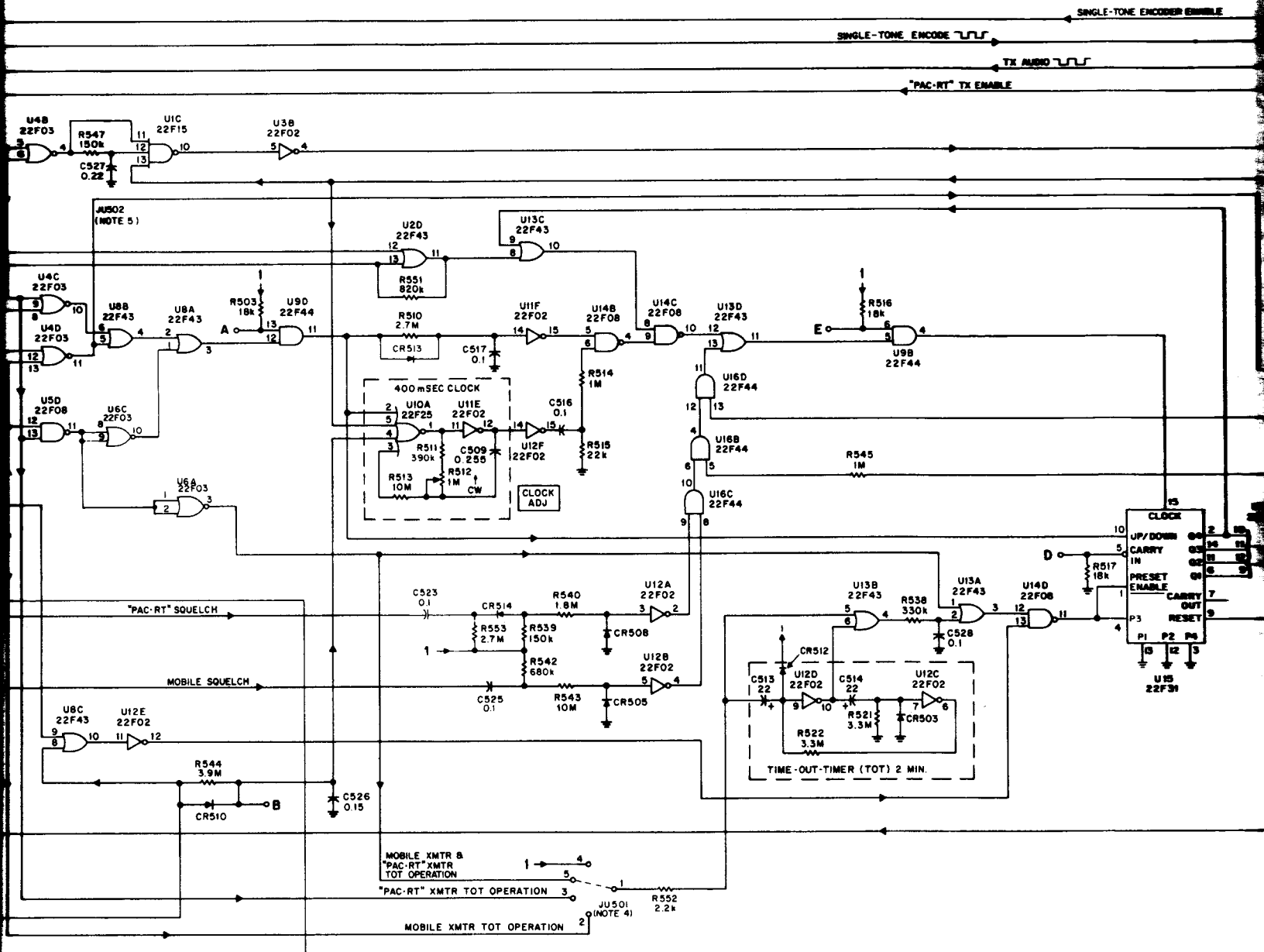
MODEL	SUFFIX	FREQUENCY
NLN4358A LOGIC BD W/O "PL" OPERATION	11	150.8-174 MHz 450-470 MHz
NLN8982A LOGIC BD W/ "PL" OPERATION	11	150.8-174 MHz 450-470 MHz
NLD7031A MISC PARTS		150.8-174 MHz
NLE8462A MISC PARTS		450-470 MHz

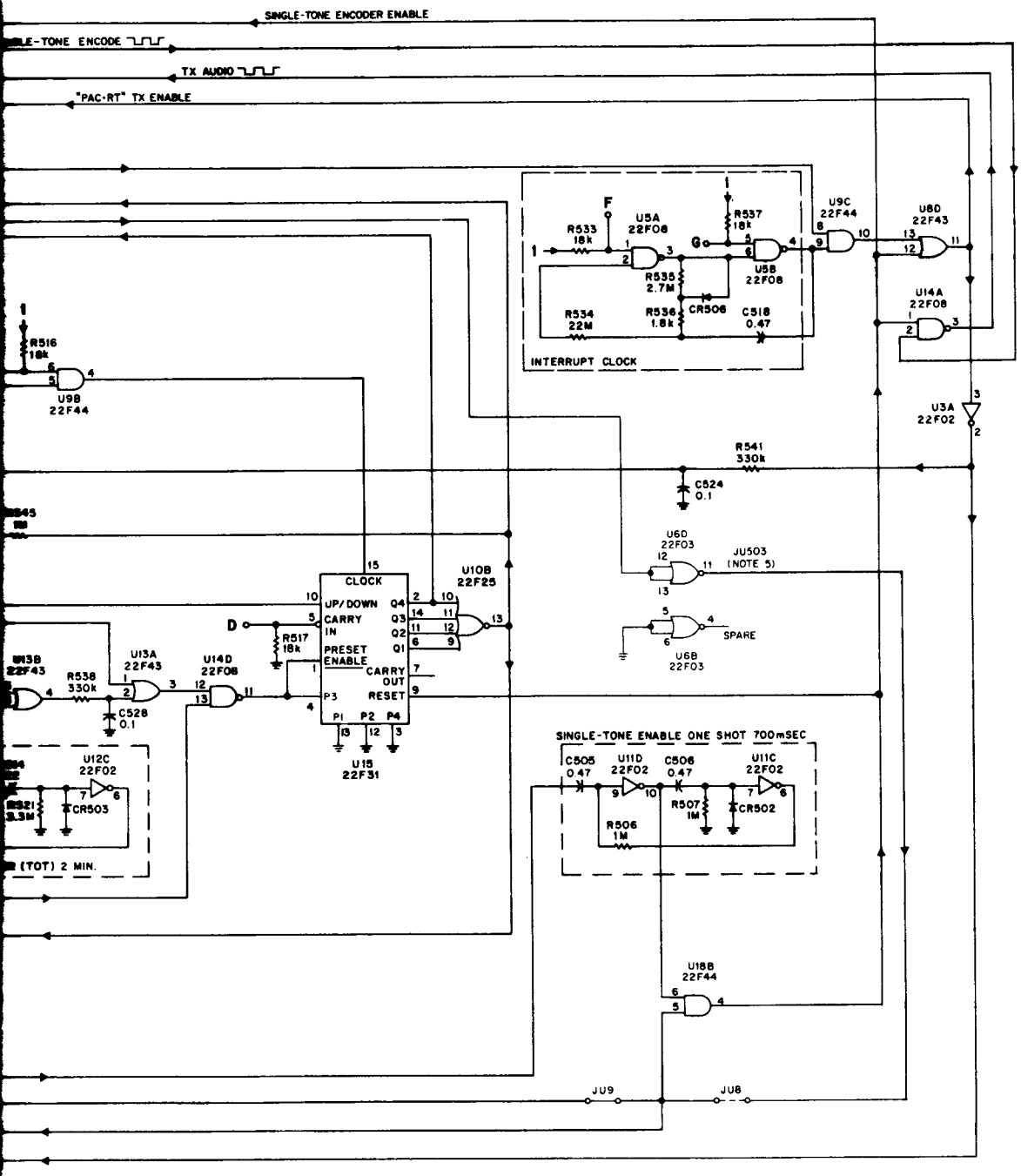


(SHEET 1 OF 2) 63B81089C69-A

(NLN4358A & NLN8982A)
VEHICULAR REPEATER SCHEMATIC DIAGRAM


MOBILE "PL" DETECT
B+
GND
U3, U6, U11, U12, U15,
DETAIL (TOP VIEW)
U1, U2, U4, U5, U8, U9, U10, U13, U14, U16, U18.
DETAIL (TOP VIEW)
U9A 22F44
MOBILE SQUELCH
U1B 22F08
U4B 22F03
U3F 22F02
R501 3.3M
C501 0.1
CR509
R526 18k
C
U2A 22F43
SINGLE-TONE DETECT (NOTE 1)
U18C 22F44
U4C 22F03
U11A 22F02
U18D 22F44
U4A 22F03
U4D 22F03
SINGLE-TONE ENCODER ENABLE
SINGLE-TONE ENCODE
TX AUDIO
U11B 22F02
U2C 22F43
U5D 22F08
U2B 22F43
U18A 22F44
"PAC-RT" "PL" DETECT
U1A 22F15
U3C 22F02
U5C 22F08
U3D 22F02
R548 100k
R549 10M
C529 0.22
U8C 22F43
SINGLE-TONE DECODE ENABLE
CR511
R550 470k
C530 0.22
U3E 22F02
"PAC RT" TX ENABLE
"PAC RT" SQUELCH
U16A 22F44
MOBILE SQUELCH
INSIDE / OUTSIDE
MOBILE TX ENABLE
MOBILE PTT
MOBILE ON / OFF
MONITOR SQUELCH
"PL" CHANNEL INDICATOR
NON-SIMPLEX INDICATOR (NOTE 1)

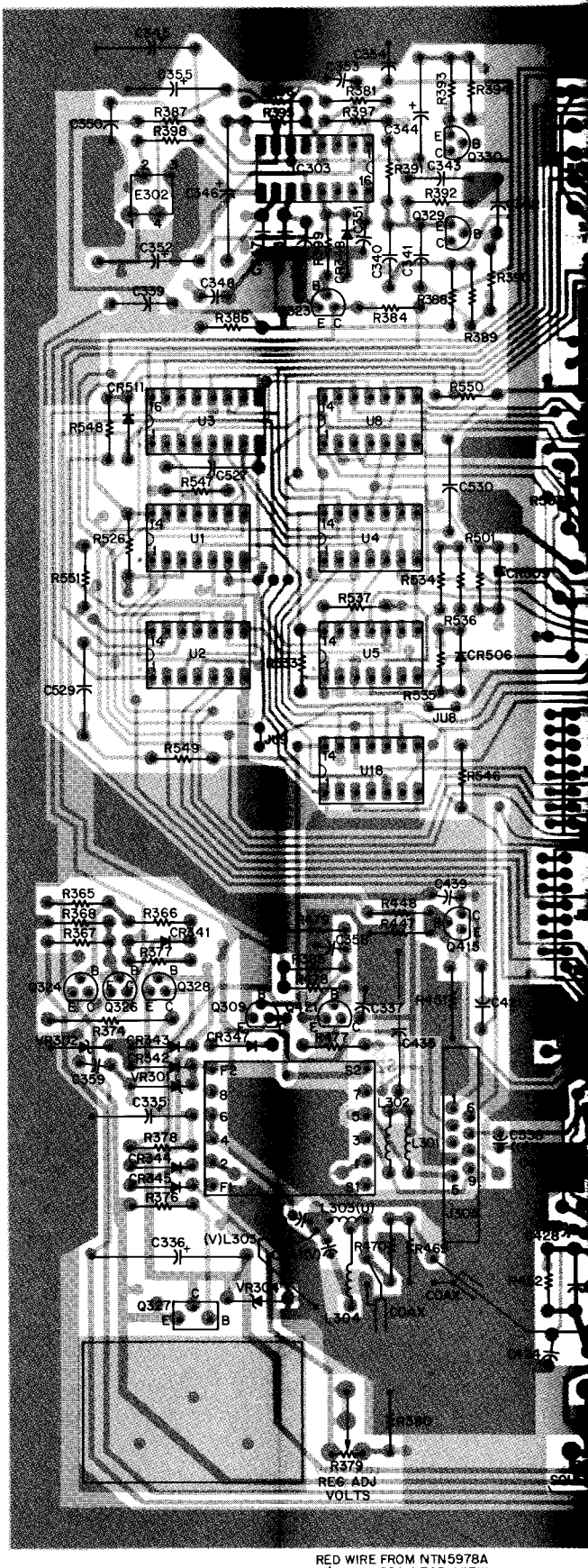

SINGLE-TONE ENCODER ENABLE
SINGLE-TONE ENCODE
TX AUDIO
"PAC-RT" TX ENABLE
U4B 22F03
R547 150k
C527 0.22
U1C 22F15
U3B 22F02
JU502 (NOTE 5)
U2D 22F43
R551 820k
U13C 22F43
U4C 22F03
U4D 22F03
U8B 22F43
U8A 22F43
R503 18k
U9D 22F44
A
R510 2.7M
CR513
C517 0.1
U11F 22F02
U14B 22F08
U14C 22F08
U13D 22F43
R516 18k
E
U9B 22F44
400 mSEC CLOCK
U10A 22F25
U11E 22F02
C516 0.1
R514 1M
U16D 22F44
U5D 22F08
U6C 22F03
R511 390k
C509 0.255
R512 1M CW
R513 10M
U12F 22F02
R515 22k
CLOCK ADJ
U16B 22F44
R545 1M
U16C 22F44
U6A 22F03
CLOCK
UP/DOWN
CARRY IN
PRESET ENABLE
CARRY OUT
RESET
D
R517 18k
U15 22F31
"PAC-RT" SQUELCH
C523 0.1
CR514
R540 1.8M
U12A 22F02
R553 2.7M
R539 150k
CR508
R542 680k
U12B 22F02
MOBILE SQUELCH
C525 0.1
R543 10M
CR505
U13B 22F43
R538 330k
U13A 22F43
U14D 22F08
C528 0.1
CR512
U8C 22F43
U12E 22F02
C513 22
U12D 22F02
C514 22
U12C 22F02
R521 3.3M
CR503
R522 3.3M
TIME-OUT-TIMER (TOT) 2 MIN.
R544 3.9M
CR510
B
C526 0.15
MOBILE XMTR & "PAC-RT" XMTR TOT OPERATION
"PAC-RT" XMTR TOT OPERATION
JU501 (NOTE 4)
R552 2.2k
MOBILE XMTR TOT OPERATION

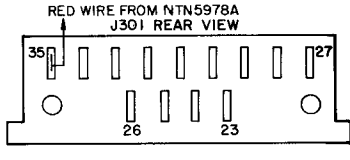


(SHEET 2 OF 2) 63E81019C69-O

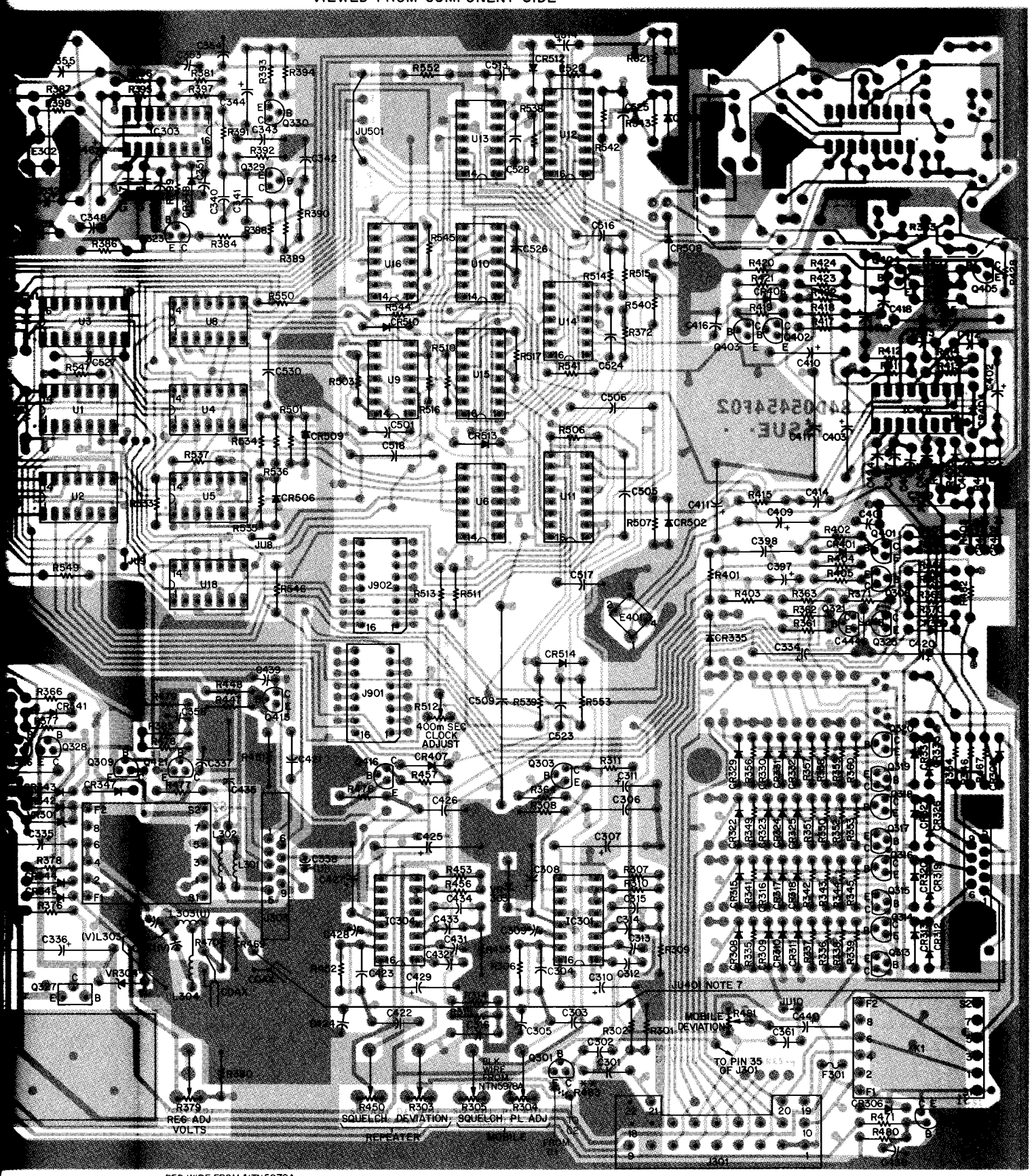
(NLN4358A & NLN8982A)
VEHICULAR REPEATER SCHEMATIC DIAGRAM

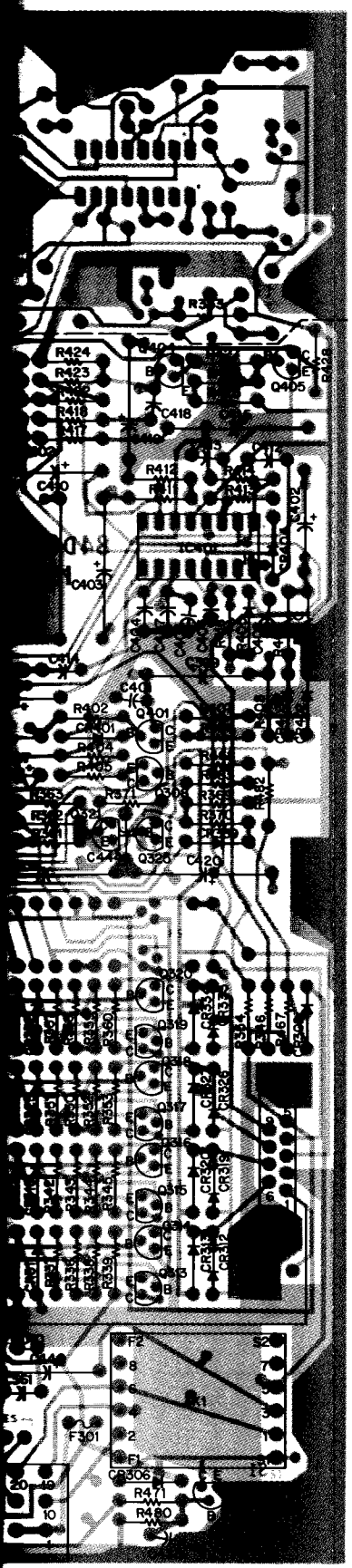
VIEWED


C345
C355
C354
C353
R355
R381
R393
R394
R387
R397
C344
R398
C350
E
B
C
Q330
C303
R391
C343
E302
C346
R392
Q329
C352
C340
C341
R390
C348
C339
R388
R386
Q330
E C
R384
R389
CR511
R550
R548
U3
U8
C527
C530
R547
U1
U4
R501
R526
R551
R534
R537
R536
U2
U5
CR506
C529
R535
JU8
R549
U18
R546
C439
R365
R368
R366
CR341
R448
R367
R377
R447
Q415
Q324
Q328
Q326
Q309
C337
R451
C438
R374
CR343
CR347
VR302
R342
R359
VR301
C335
R378
R344
CR345
R376
C336
(V)L305
VR303
Q327
R394
COAX
R379
REG ADJ
VOLTS


RED WIRE FROM NTN5978A
J301 REAR VIEW
35
27
26
23

VIEWED FROM COMPONENT SIDE





OL-DEPF-10696-D

CIRCUIT BOARD NOTES

NOTES:
1. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT S
   U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE
   OPTION.
2. USED FOR MOBILE "PL" OPERATION ONLY.
3. USED ON SOME EARLIER MODELS WITH LOW BAND MONITO
   MONITOR IS USED, REPLACE C338 WITH L304 & C441.
4. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TIM
   "PACeRT" TRANSMITTER TIME-OUT TIMER OPERATION.
   FROM POINT 1 TO 3 FOR "PACeRT" TRANSMITTER TIME-O
   ATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE
   TIME-OUT TIMER OPERATION. CONNECT R552 FROM POI
   OPERATION WITHOUT TIME-OUT TIMER.
5. JUMPER JU10 IS USED ONLY WITH A SINGLE FREQUENCY CA
6. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL
   △△ INSTALLED FOR "PL" CHANNELS ONLY.
7. JU401 USED WITH MOBILE DETECTOR ONLY.

IC301 AND IC304 AC VOLTAGE MEASUREME

NOTE SQUELCH CONTROL FULLY CLOCKWISE. NO EXTERNAL SIGNAL APPLIED.		
PIN	AC VOLTS	
	mV	dBm
1	1.23 V	+4
2	170	-13
3	770	0
4	440	-5
13	123	-16
15	123	-16

EPF-6868-O

IC301 AND IC304 DC VOLTAGE MEASUREM

PIN	VOLTAGE	PIN	VOLTAGE
1	4.1 V	9	10.3 V
2	2.2 V	10	0 V USQ 6.0-9.0 V FSQ
3	4.0 V	11	---
4	0.94 V USQ 1.6 V FSQ	12	0 V
5	0 V	13	6.3 V USQ 1.1 V FSQ
6	0 V	14	10.5 V USQ 9.7 V FSQ
7	0 V	15	2.2 V
8	0 V	16	6.4 V

EPF-6857-O

(NLN4358A & NLN8982A) VEHICULAR REPEATER CIRCUIT BOARD DETAIL

CIRCUIT BOARD NOTES

NOTES:
1. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT SIDE PLATING AT U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE TRANSMISSION" OPTION.
2. USED FOR MOBILE "PL" OPERATION ONLY.
3. USED ON SOME EARLIER MODELS WITH LOW BAND MONITOR ONLY. IF UHF MONITOR IS USED, REPLACE C338 WITH L304 & C441.
4. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TRANSMITTER AND "PACeRT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 3 FOR "PACeRT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 4 FOR OPERATION WITHOUT TIME-OUT TIMER.
5. JUMPER JU10 IS USED ONLY WITH A SINGLE FREQUENCY CAPABLE MOBILE.
6. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL ONLY.
   △△ INSTALLED FOR "PL" CHANNELS ONLY.
7. JU401 USED WITH MOBILE DETECTOR ONLY.

EPF-6862-C

IC301 AND IC304 AC VOLTAGE MEASUREMENTS

NOTE
SQUELCH CONTROL FULLY CLOCKWISE. NO EXTERNAL SIGNAL APPLIED.

PIN	AC VOLTS	
	mV	dBm
1	1.23 V	+4
2	170	-13
3	770	0
4	440	-5
13	123	-16
15	123	-16

EPF-6868-O

IC301 AND IC304 DC VOLTAGE MEASUREMENTS

PIN	VOLTAGE	PIN	VOLTAGE
1	4.1 V	9	10.3 V
2	2.2 V	10	0 V USQ 6.0-9.0 V FSQ
3	4.0 V	11	---
4	0.94 V USQ 1.6 V FSQ	12	0 V
5	0 V	13	6.3 V USQ 1.1 V FSQ
6	0 V	14	10.5 V USQ 9.7 V FSQ
7	0 V	15	2.2 V
8	0 V	16	6.4 V

EPF-6857-O

(NLN4358A & NLN8982A) VEHICULAR REPEATER CIRCUIT BOARD DETAIL

MOTOROLA

VHF MOBILE DETECTOR, INTERFACE CABLES, AND CONTROL UNIT/RAPID CHARGER

FOR PORTABLE/MOBILE VEHICULAR REPEATER SYSTEM

SUPPLEMENT TO INSTRUCTION MANUALS 68P81010C09 AND 68P81010C20

PERFORMANCE SPECIFICATIONS

HIGH BAND VHF MOBILE DETECTOR

Frequency Range:	150.8 - 174 MHz
Number of Channels:	1 to 4
Modulation Acceptance:	7 kHz
Frequency Stability:	± 0.0025% (-30° C to +60° C; +25° C reference)
Selectivity:	-70 dB
Spurious Response:	-50 dB
Squelch Sensitivity:	1 uV
Sensitivity:	1 uV (20 dB quieting)
FCC Type Number:	RC0112

PAC• RT CONTROL UNIT/RAPID CHARGER

Dimensions (in inches):	6.25 L x 3.0 H x 7.25 W
Nominal Input Voltage:	13.8 Vdc, negative ground
Weight:	63 oz.
Maximum Current Drain:	0.5 A charged, 1 A discharged
Charge Rate:	3 hours
Controls and Indicator Lamps:	CHARGER/ON (green)/OFF REPEATER/ON (blue)/OFF

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

CONTENTS

SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to this equipment. Proper use of this radio will result in exposure below the OSHA limit.

DO NOT hold the radio such that the antenna is within 2 inches (5.1 centimeters) of exposed parts of the body, especially the face or eyes, while transmitting. The radio will perform best if the microphone is two or three inches away from the lips and the radio is upright.

DO NOT operate the transmitter of any radio unless all rf connectors are secure and any open connectors are properly terminated.

DO NOT hold the transmit (PTT) switch on when not actually desiring to transmit.

DO NOT allow children to play with any radio equipment containing a transmitter.

DO NOT operate a portable transmitter near unshielded electrical blasting caps or in any explosive atmosphere unless it is a type especially qualified for such use.

8000 W. Sunrise Blvd., Ft. Lauderdale, FL 33322
Printed in U.S.A. 9/11/79

SERVICE MANUAL REPRODUCTION

The attached manual is for non-current Motorola Equipment. In order to continue to supply this service literature certain steps may have been taken. These may have included the the following:

1) removal of cover
2) alternate binding or packaging method
3) size reduction of some foldouts, e.g. schematics
4) the division of extremely long schematics (over 17") into two or more sheets.
5) photographs and screens reproduced from printed material (as opposed to original screened negatives)
6) the elimination of colors other than black

We feel that these steps have only minor effect on the readability and utility of basic service information and will allow us to continue to supply this literature at a reasonable cost.

Motorola Communications and Electronics Inc.
Communications and Electronics Parts

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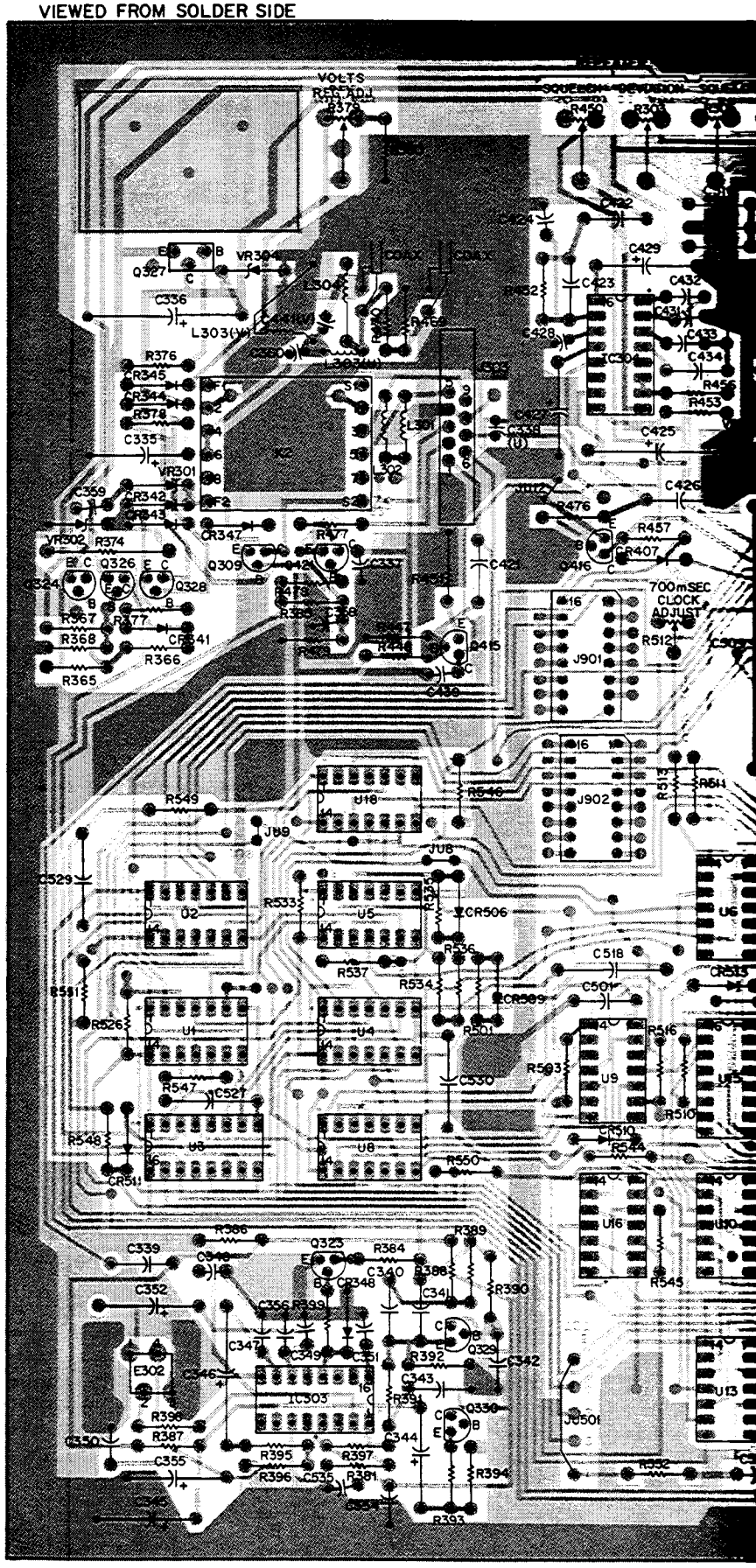
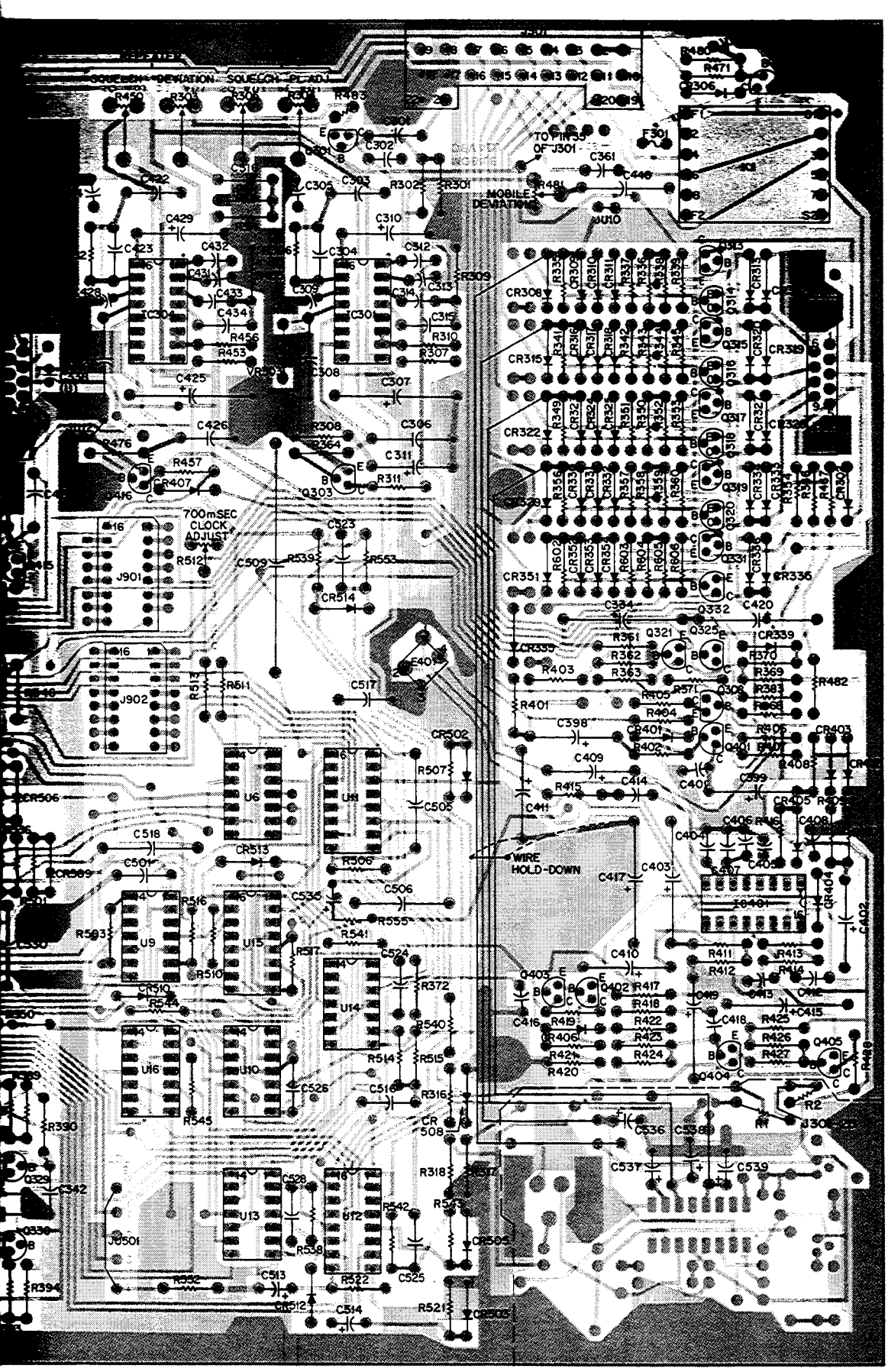
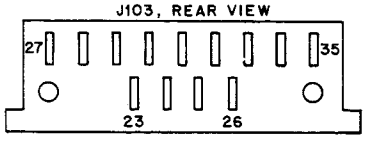
5/93 by PHI.

VIEWED FROM SOLDER SIDE





J103, REAR VIEW



SS DEPF-9691-0
CS DEPF-9692-0
OL DEPF-9693-A

INSTRUCTION MANUAL R

for

Manual No. 68P81019C65-O

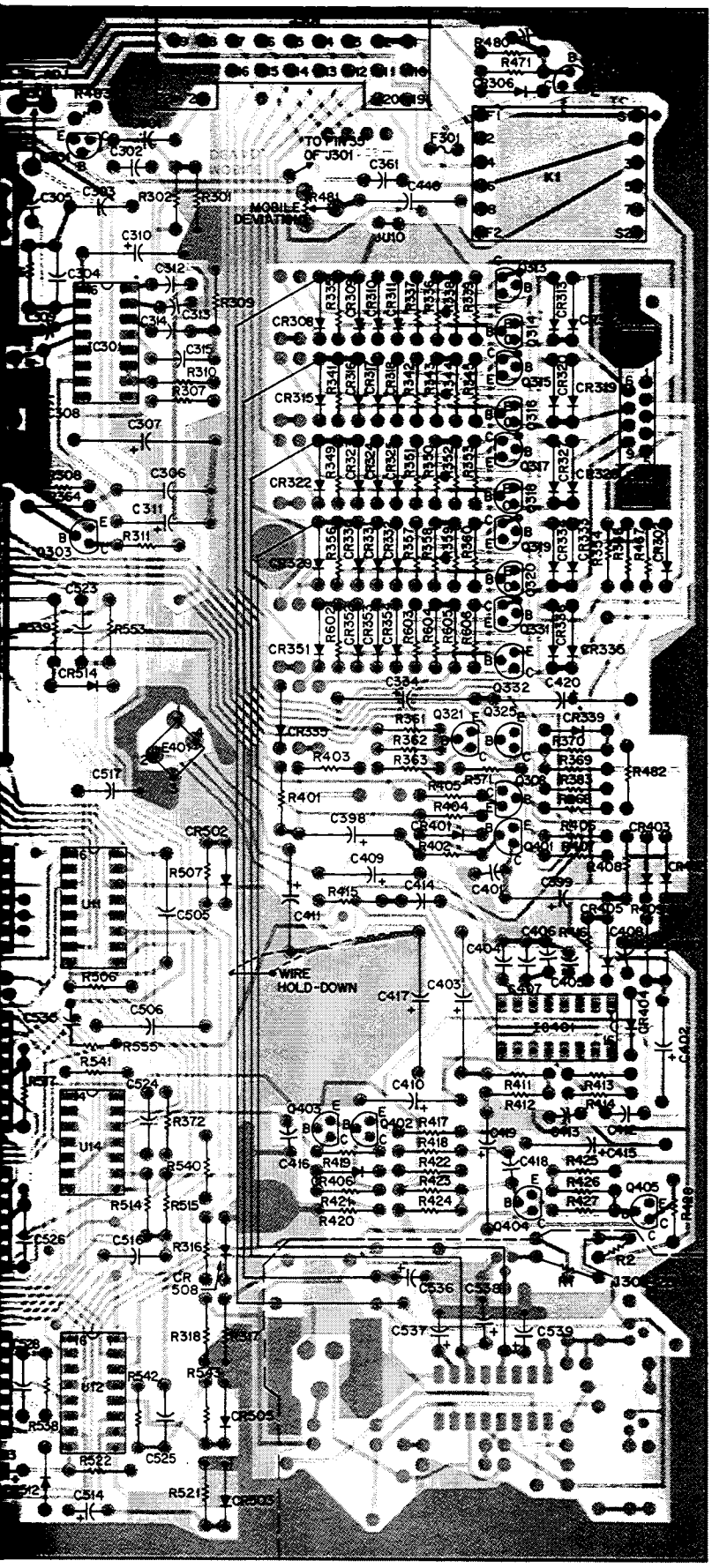
VHF Mobile Detector, Interfa
and Control Unit/Rapid Char

These diagrams replace the V
Board Schematic Diagram (S
Layout Diagram in your man

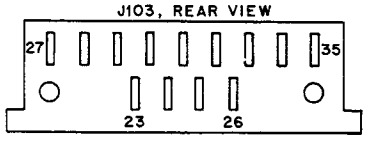
VEHICULAR RE
CIRCUIT BOAR

Manual No. 68P81019C65-O
VHF Mobile Detector, Interface Cables,
and Control Unit/Rapid Charger

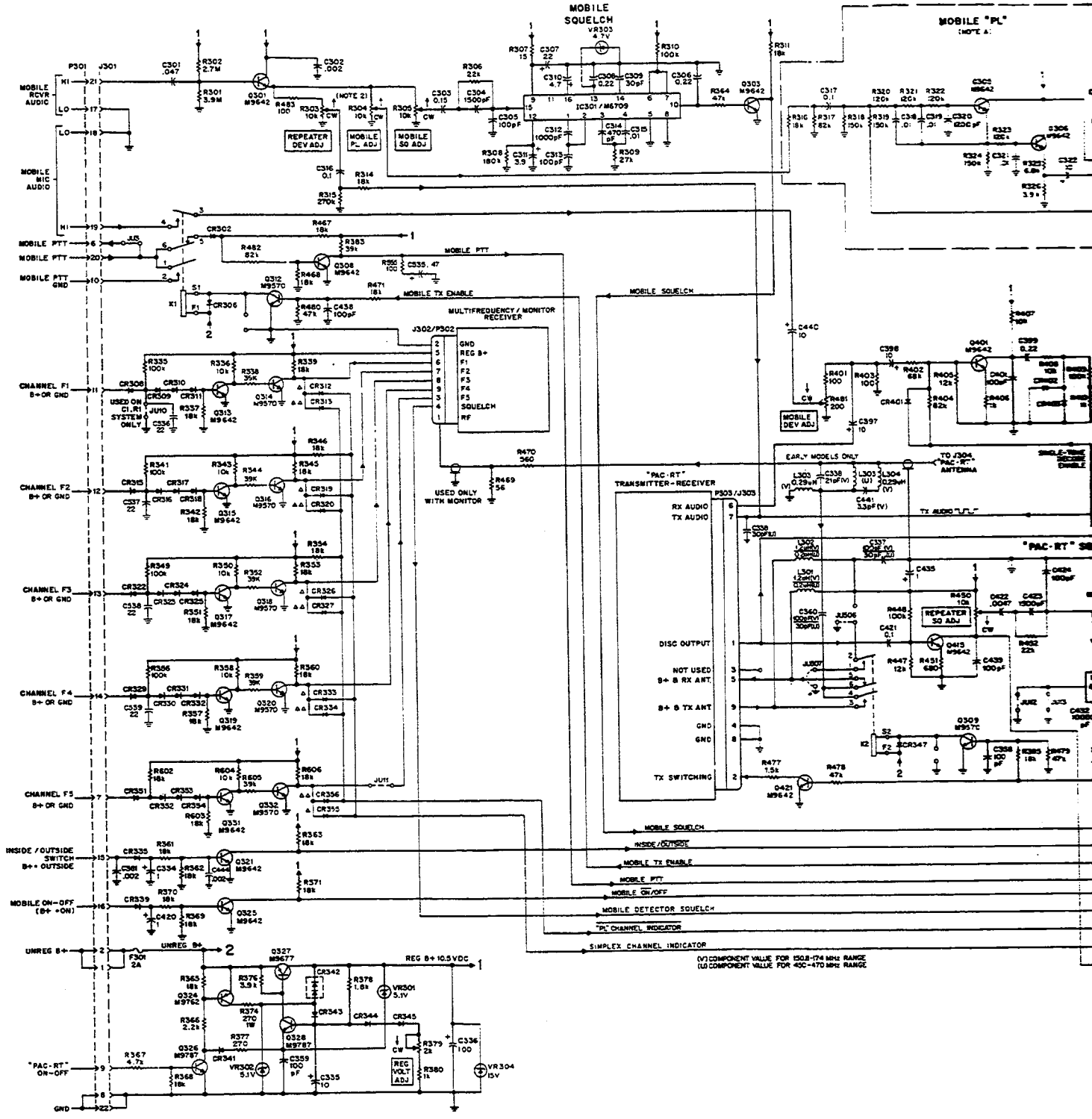
These diagrams replace the Vehicular Repeater Main Logic Board Schematic Diagram (Sheet 2) and Circuit Board Layout Diagram in your manual.

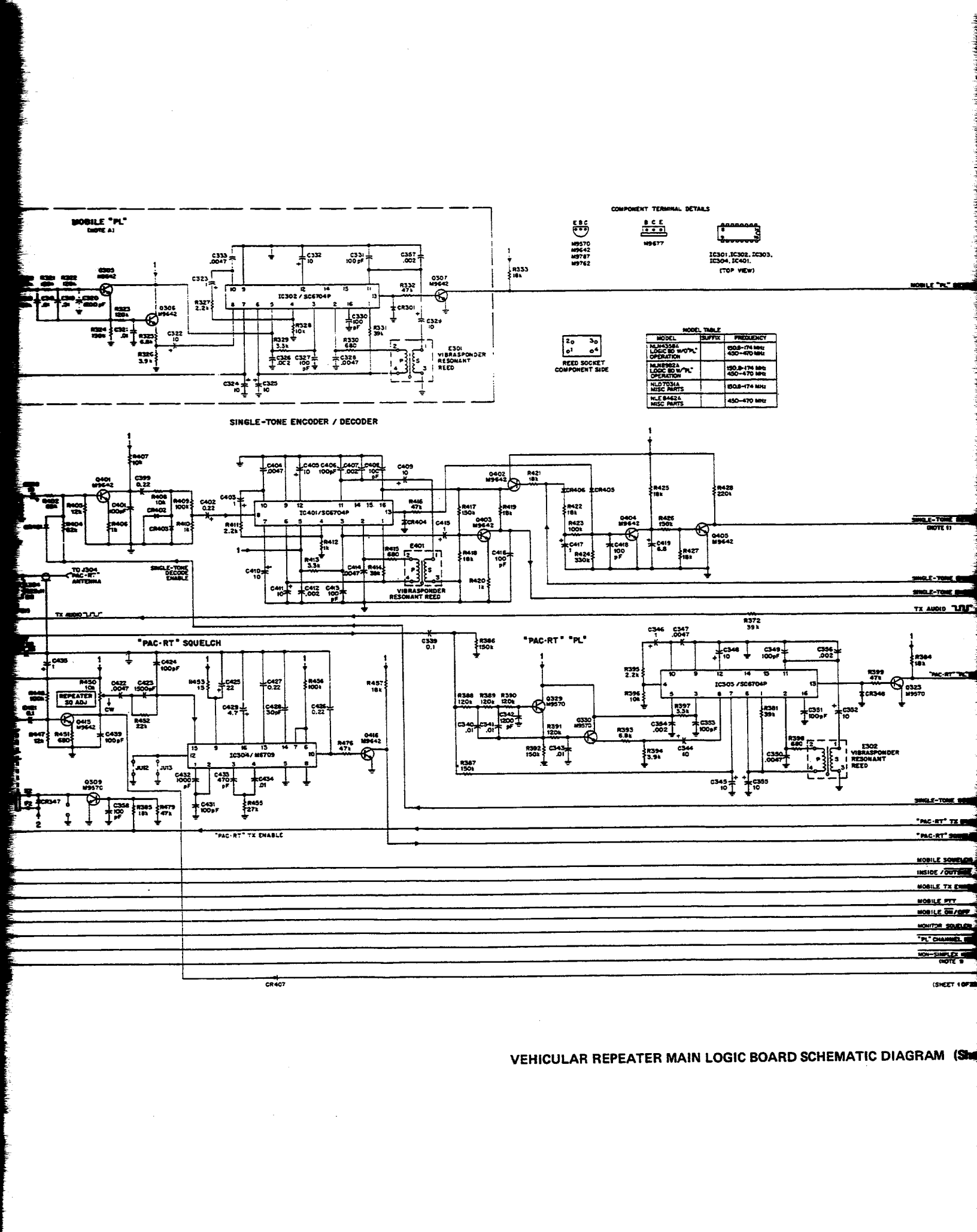


SS DEPF-9691-O
CS DEPF-9692-O
OL DEPF-9693-A

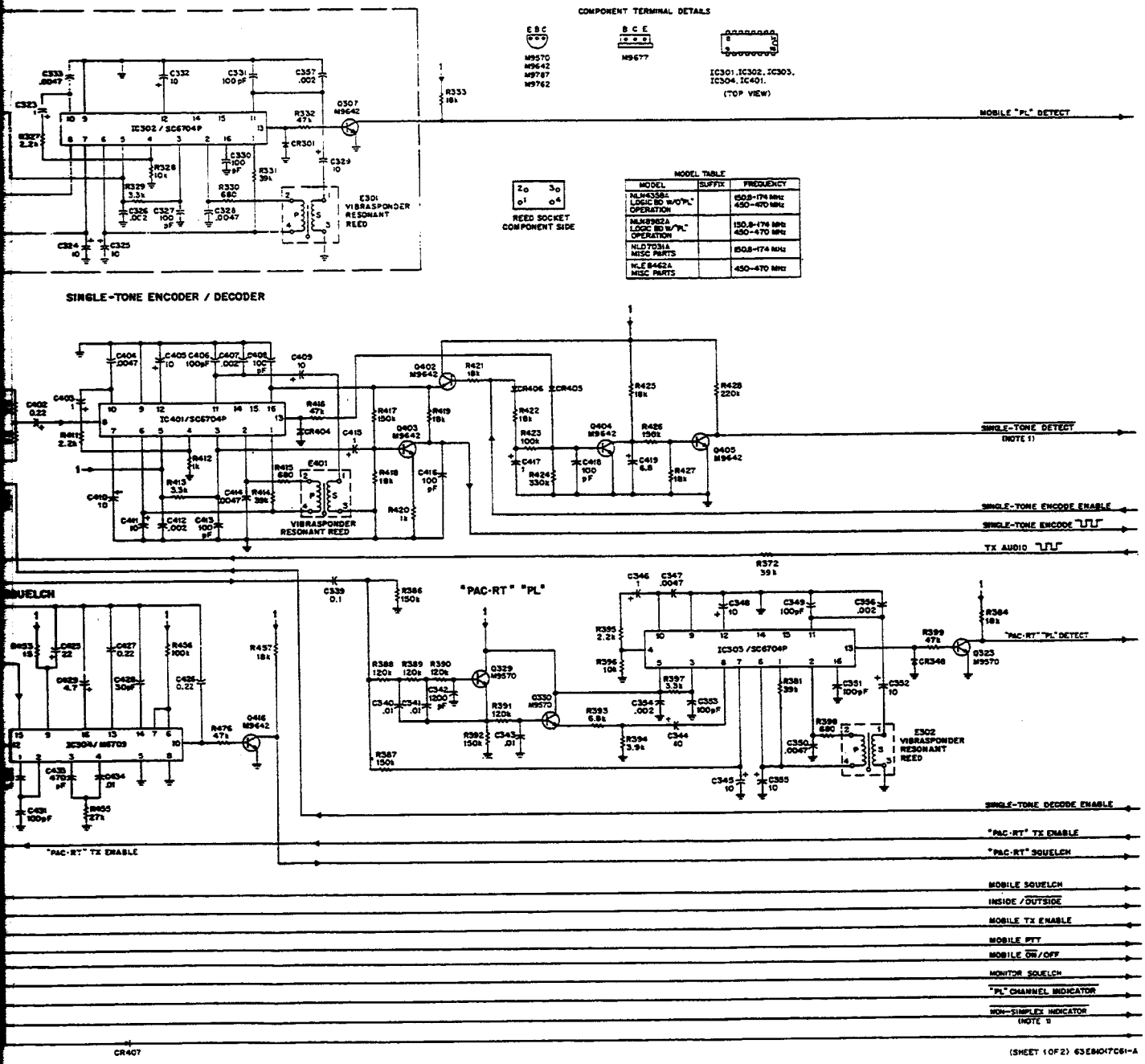


VEHICULAR REPEATER MAIN LOGIC CIRCUIT BOARD LAYOUT DIAGRAM


MOBILE SQUELCH
MOBILE "PL"
MOBILE RCVR AUDIO
MOBILE MIC AUDIO
MOBILE PTT
MOBILE PTT
MOBILE PTT GND
REPEATER DEV ADJ
MOBILE PL ADJ
MOBILE SQ ADJ
MOBILE TX ENABLE
MULTIFREQUENCY / MONITOR RECEIVER
J302/P302
GND
REG B+
F1
F2
F3
F4
F5
SQUELCH
RF
CHANNEL F1 B+ OR GND
CHANNEL F2 B+ OR GND
CHANNEL F3 B+ OR GND
CHANNEL F4 B+ OR GND
CHANNEL F5 B+ OR GND
USED ON C1, R1 SYSTEM ONLY
USED ONLY WITH MONITOR
"PAC-RT" TRANSMITTER-RECEIVER
P303/J303
RX AUDIO
TX AUDIO
DISC OUTPUT
NOT USED
B+ B RX ANT.
B+ B TX ANT
GND
GND
TX SWITCHING
EARLY MODELS ONLY
TO J304 "PAC-RT" ANTENNA
TX AUDIO
"PAC-RT" SE
MOBILE DEV ADJ
REPEATER SQ ADJ
INSIDE / OUTSIDE SWITCH B+ = OUTSIDE
MOBILE ON-OFF (B+ = ON)
UNREG B+
REG B+ 10.5 VDC
"PAC-RT" ON-OFF
REC VOLT ADJ
MOBILE SQUELCH
INSIDE/OUTSIDE
MOBILE TX ENABLE
MOBILE PTT
MOBILE ON/OFF
MOBILE DETECTOR SQUELCH
"PL" CHANNEL INDICATOR
SIMPLEX CHANNEL INDICATOR
(V) COMPONENT VALUE FOR 150.8-174 MHz RANGE
(U) COMPONENT VALUE FOR 450-470 MHz RANGE



VEHICULAR REPEATER MAIN LOGIC BOARD SCHEMATIC DIAGRAM (Sh



VEHICULAR REPEATER MAIN LOGIC BOARD SCHEMATIC DIAGRAM (Sheet 1 of 2)

SCHEMATIC NOTES

1. THE BAR ABOVE "LOGIC LINE IDENTIFIERS" IMPLIES A LOGICAL ZERO (GND); AND AN "IDENTIFIER" WITHOUT A BAR IMPLIES A LOGICAL ONE (REG. B+) WHEN THE NAMED CONDITION EXISTS.
2. USED FOR MOBILE "PL" OPERATION ONLY.
3. USED ON SOME EARLIER MODELS WITH LOW BAND MONITOR ONLY. IF UHF MONITOR IS USED, REPLACE C338 WITH L304 & C441.
4. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TRANSMITTER AND "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 3 FOR "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 4 FOR OPERATION WITHOUT TIME-OUT TIMER.
5. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT SIDE PLATING AT U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE TRANSMISSION" OPTION.
6. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, k = 1000;
   CAPACITOR VALUES ARE IN MICROFARADS (uF);
   INDUCTOR VALUES ARE IN HENRYS (H).
7. WHERE COMPONENTS ARE FREQUENCY SENSITIVE, "V" AND "U" ARE USED. "V" DESIGNATES COMPONENT VALUE FOR 150.8-174 MHz RANGE AND "U" IS FOR 450-470 MHz RANGE.
8. ALL LOGIC IC CIRCUITRY IS 500 LEVEL REFERENCE SYMBOL DESIGNATION.
9. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL ONLY.
   △△ INSTALLED FOR "PL" CHANNELS ONLY.

EPF-6861-C

"PAC•RT" "PL" AND MOBILE "PL" TEST MEASUREMENTS

PROBE POINT	DC VOLTS	AC VOLTS	
	DECODE VOLTS	DECODE mV	DECODE dBm
BASE OF Q329/Q305	3.4	16.0	-33.6
EM. OF Q329/Q305	3.0	16.0	-33.6
BASE OF Q330/Q306	2.8	11.5	-36.5
EM. OF Q330/Q306	2.2	11.5	-36.5
IC CHIP PIN 1	6.5	10.5	37.4
IC CHIP PIN 2	5.4	650	-2
IC CHIP PIN 3	10.5	3.0	-43.6
IC CHIP PIN 4	1.3	75	-20
IC CHIP PIN 5	10.5	3.0	-48.5
IC CHIP PIN 6	6.5	20	-31.8
IC CHIP PIN 7	7.2	.8	-59.7
IC CHIP PIN 8	.7	2.0	-42.2
IC CHIP PIN 9	-	-	-
IC CHIP PIN 10	1.3	65	-21.5
IC CHIP PIN 11	.8	65	-21.5
IC CHIP PIN 12	.05	14.5	-34.5
IC CHIP PIN 13	.1	-	-
IC CHIP PIN 14	.5	-	-
IC CHIP PIN 15	.5	-	-
IC CHIP PIN 16	0	-	-

INPUT SIGNAL 14 mV. (-35 dB) OF "PL" TONE AT R317/R386.

(0 dBm IS 1 mW ACROSS 600 OHMS)

EPF-7305-O

SINGLE-TONE ENCODER/DECODER TEST MEASUREMENTS

PROBE POINT	DC VOLTS		AC VOLTS			
	DECODE VOLTS	ENCODE VOLTS	DECODE mV	DECODE dBm	ENCODE mV	ENCODE dBm
IC CHIP PIN 1	6.5	6.5	10.5	-37.4	-	-
IC CHIP PIN 2	5.4	2.9	650	-2	140	-14.7
IC CHIP PIN 3	10.5	6.0	3.0	-43.6	.6	-2
IC CHIP PIN 4	1.3	1.7	75	-20	390	-6
IC CHIP PIN 5	10.5	10.5	3.0	-48.5	-	-
IC CHIP PIN 6	6.5	3.0	20	-31.8	-	-
IC CHIP PIN 7	7.2	7.1	.8	-59.7	-	-
IC CHIP PIN 8	.7	.3	2.0	-42.2	-	-
IC CHIP PIN 9	-	-	-	-	-	-
IC CHIP PIN 10	1.3	1.4	65	-21.5	340	-7.3
IC CHIP PIN 11	.8	.8	65	-21.5	19	-32.2
IC CHIP PIN 12	.05	1.0	14.5	-34.5	-	-
IC CHIP PIN 13	.1	5.0	-	-	-	-
IC CHIP PIN 14	.5	.8	-	-	-	-
IC CHIP PIN 15	.5	.9	-	-	-	-
IC CHIP PIN 16	0	10.5	-	-	-	-

(0 dBm IS 1 mW ACROSS 600 OHMS)

EPF-7306-O

INSTRUCTION MANUAL REVISION

for

Manual No. 68P81019C65-O
Vhf Mobile Detector, Interface
Cables, and Control Unit/Rapid Charger

GENERAL

This revision outlines changes that have occurred since the printing of your instruction manual. Use this information to supplement your manual. Installation of these changes in earlier equipment is not necessary except as recommended in Motorola Service and Repair Notes (SRN's).

REVISION DETAILS

No.	Change Affects	Item Number	New Suffix
1	General Information	---	---
2 thru 5	Main Logic Circuit Board, Schematic Diagram, and Parts List		
6	General Information		
7	Schematic Diagram and Parts List	ZLN6353A	1
8	Schematic Diagram and Parts List	ZKN6039A	1
9	General Information		

CHANGES

Item No.

1 On page 1, change paragraph a. (Cables and PAC•RT Repeater System) to read as follows:

Installation of the PAC•RT repeater system is covered in service supplement 68P81010C09. However, steps 7 through 9 of the "PAC•RT" VEHICULAR REPEATER ALIGNMENT PROCEDURE should be replaced by the following when using the Aerotron mobile.

Step 7. Set MOBILE SQUELCH ADJ R305 fully clockwise. The PAC•RT will now track the fast squelch line in the Aerotron mobile. Note: Should the PAC•RT start to transmit silent carrier to the portable, the mobile slow squelch adjust, located on the bottom of the mobile control head, should be turned down such that the mobile radio will unsquelch on a weaker signal than that required to activate the repeater.

No.

1 (cont'd) Step 8. Reinstall the "PL" reed, E302. Reassemble the vehicular repeater to its base plate.

The remaining text of paragraph a. is unchanged.

No.	Ref. Sym.	Action	Part Number	Description
				RESISTOR, Fixed:
2	R335, R341, R349, R356	changed to	0600124C97	100 k ±10%; 1/4 W
				CAPACITOR, Fixed:
3	C536, C537, C538, C539	added	2383441B31	22 uF ±20%; 20 V

(Refer to FMR-829A for location)

4 The following four wires have been added to the solder side of the vehicular repeater main logic circuit board:

a. Eight-inch wire from junction of CR308, CR309, and R335 to positive end of C536.

b. Seven-inch wire from junction of CR315, CR316, and R341 to positive end of C537.

c. Six-inch wire from junction of CR322, CR323, and R349 to positive end of C538.

d. Five-and-1/2-inch wire from junction of CR329, CR330, and R356 to positive end of C539.

				CAPACITOR, Fixed:
5	C535	added	2383441B32	47 uF ±20%; 15 V
				RESISTOR, Fixed:
	R555	added	0600124C25	100 ±10%, 1/4 W

(Above components are connected in series from collector of Q308 to ground. Observe polarity of C535 - negative lead to ground.)

NOTE: Refer to FMR-829A for schematic and circuit board layout diagrams, which incorporate the changes for items 2 through 5 above.

6 On page 10 (MAINTENANCE), add the following to section 2. TROUBLESHOOTING.

. . . instruction manual 68P81010C20. However, the priority clock (400 ms clock) should be readjusted to 700 milliseconds as follows:

No.	
6 (cont'd)	a. A PAC•RT test set (S-1351 or equivalent) is required for this adjustment. b. Plug the PAC•RT test set into the vehicular repeater main logic board. c. Place the charger toggle switch to the IN position. d. Set audio oscillator to 1000 Hz. This will turn on the clock. e. Use a frequency counter or an oscilloscope to monitor the period at U11 pin 12. f. Adjust R512 to 700 milliseconds ±15 ms.

No.	Ref. Sym.	Action	Part Number	Description
				CAPACITOR, Fixed:
7	C24, 25	changed to	2383441B15	1 uF ±20%; 35 V
				RESISTOR, Fixed:
8	R22	changed to	0600124A81	22 k ±5%; 1/4 W

9 COMPUTER SOFTWARE COPYRIGHTS

The Motorola products described in this instruction manual may include copyrighted Motorola computer programs stored in semiconductor memories or other mediums. Laws in the United States and other countries preserve for Motorola certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Motorola computer programs contained in the Motorola products described in this instruction manual may not be copied or reproduced in any manner without the express written permission of Motorola. Furthermore, the purchase of Motorola products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Motorola, except for the normal non-exclusive royalty free license to use that arises by operation of law in the sale of a product.

DESCRIPTION

1. INTRODUCTION

Motorola's PAC•RT repeater system is designed to expand the flexibility of current mobile radio users. The uhf PAC•RT repeater system is designed to operate with a uhf portable and a low-band, high-band or 800 MHz mobile radio. Specifically, the system described in this manual has been designed to interface with low-band RCA mobiles and high-band Aerotron mobiles. It consists of the vehicular repeater unit with optional vhf mobile detector and mobile "Private-Line" (PL) detector added, Aerotron and RCA interface cable kits, and a control unit/rapid charger.

2. INSTALLATION

a. Cables and PAC•RT Repeater System

Installation of the PAC•RT repeater system is covered in service supplement 68P81010C09. The Aerotron and RCA cable assembly details are shown in Figures 1 and 2, respectively.

NOTE

In order for the PAC•RT repeater to key the mobile radio, a direct connection to the microphone push-to-talk switch is necessary. Remove four Phillips-head screws and lift off the bottom cover of the Aerotron control head. From inside the control head, insert the female pin of the blue wire (supplied with the PAC•RT) into position number "5" of the cable connector. Route the wire under the printed circuit board and solder the free end to pin number "4" of the microphone connector. Pin number "4" is identified by the orange/white wire connected to it. Reassemble the bottom cover to the control head.

b. RCA-to-Aerotron Retrofit

Perform the following steps when replacing the RCA mobile radio with the Aerotron mobile radio:

(1) Remove the RCA mobile radio, control head, and low-band antenna.

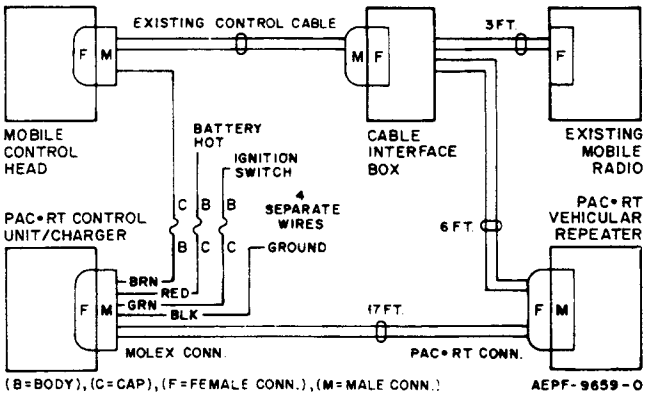


Figure 1. Aerotron Cable Assembly Detail

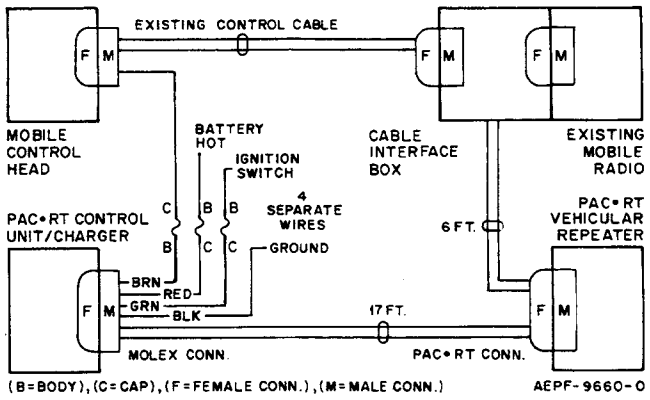


Figure 2. RCA Cable Assembly Detail

(2) Install the Aerotron mobile radio, control head, and high-band antenna per manufacturer's instructions.

(3) Inside the Aerotron mobile control head, ascertain that a jumper from pin 5 to pin 4 of the microphone connector has been installed as described in above note.

(4) Remove the ZKN6040A RCA Interface Cable, and replace it with the ZKN6039A Aerotron Interface Cable. Connect the "Molex" connector on the end of the 17-foot cable to the ZLN6353A Control Unit/Rapid Charger. Connect the three fused wires and body ground to their respective locations (see Figure 1).

(5) Remove the vehicular repeater unit from its base; i.e., reverse the procedures given in the "Installation" section (Figure 2) of service supplement 68P81010C09.

(6) Remove the six mounting screws from the NRB6262A Low-Band Mobile Detector Board, and replace it with the NRD6632A High-Band Mobile Detector board.

(7) Refer to Figure 1 for the interfacing of the cable assembly between the existing mobile radio and control head, and the PAC•RT vehicular repeater and control unit. Note the different cable lengths of the cable assembly being added; they will be used as a means of identification. Perform the following procedures:

(a) Disconnect the plug from the existing mobile radio and connect it to the female plug, as shown in Figure 1 for the Aerotron mobile radio. In Figure 1, the plug is mounted on the interface box.

(b) Connect the male plug from the three-foot cable mounted on the interface box, to the existing mobile radio.

(c) Locate the female plug on the end of the six-foot section of cable, and connect it to the vehicular repeater.

(d) The charger or holder and antenna cables should already be connected.

(e) To minimize pinching or crushing of the cables by boxes or equipment being set upon them, dress the cables in an out-of-the-way place.

(8) Perform steps 5-8 of the "PAC•RT Repeater Alignment Procedure," as given in service supplement 68P81010C09.

(9) Disconnect all test equipment and reinstall PL reed E302.

(10) Set the squelch pot (R53) of the mobile detector per step 15 of the "Vhf Mobile Detector Alignment Procedure."

(11) Reassemble the vehicular repeater to its base plate.

c. Control Unit Rapid Charger

With the exception of four separate wires coming from the rear of the control unit, installation of the unit will follow the procedures outlined in service supplement 68P81010C09. Connect the four separate wires as follows:

BLACK:	Ground
RED:	Vehicle battery (hot side)
GREEN:	Ignition switch or accessory line
BROWN:	Mobile radio control head power wire

The red, green, and brown wires are fused, and are equipped with a cap and body to hold the fuse. In the event the control unit/rapid charger is removed from the vehicle for servicing, the mobile radio can be returned to service by interconnecting the fuse body on the brown wire to the fuse cap on the green wire; see Figure 1 or 2.

3. OPERATION

a. PAC•RT Repeater

There are no operating controls on the PAC•RT repeater. The dc power to the repeater comes from the mobile radio and is controlled by the mobile radio in the vehicle.

b. Control Unit Rapid Charger

(1) Turn on the mobile radio.

(2) Place the REPEATER ON/OFF and the CHARGER ON/OFF switches in the ON positions. Place the portable radio in the charger pocket. The green CHARGER lamp should glow, indicating that the portable radio is charging.

(3) Upon arrival at the desired location, remove the portable. The green lamp should extinguish and the blue REPEATER lamp should glow, indicating that the PAC•RT repeater is active and ready for use. A short alert tone is transmitted to the portable at this time to announce to anyone else with a portable radio in the area that you have arrived.

(4) When the operator returns to his vehicle, the portable radio should be returned to the charger pocket. The blue lamp should then extinguish, indicating that the repeater is deactivated.

THEORY OF OPERATION

1. GENERAL

Unique solid-state logic circuitry eliminates the possibility of interference caused by several repeaters being activated at the same time. Other features and options such as portable priority interrupt, self-clearing, time-out timer, mobile detector, and PL circuits, give the PAC•RT system the flexibility and benefits not found in other system designs. Refer to manual 68P81010C20 for a detailed description of these circuits. The circuit descriptions that follow describe the circuits that have been added to enhance the operation of the PAC•RT system with RCA and Aerotron mobile radios.

2. VHF MOBILE DETECTOR

a. General

The vhf mobile detector is a dual-conversion, superheterodyne receiver consisting of one to five first oscillators, one second oscillator, two mixers, 10.7 MHz ceramic filter, 455 kHz filter, four 455 kHz i-f amplifiers, a 455 kHz limiter stage, discriminator, squelch amplifier, squelch detector, squelch switch, and one audio amplifier stage. Refer to Figure 3 for the mobile detector block diagram.

b. First Mixer Stage (Refer to Figure 4)

The rf signal from rf input connector P302-1 is coupled to first mixer stage Q2 through an isolation pad on the logic circuit board, then through a quadruple-tuned rf filter consisting of L1, L2, L3, and L4. The first mixer heterodynes the rf signal and the injection signal from the first oscillator-tripler to produce the first (high) i-f frequency (10.7 MHz). The high i-f signal passes through the 10.7 MHz ceramic filter to the second mixer.

c. First Oscillator and Buffer Amplifier Stages (Refer to Figure 5)

First oscillator stage Q13 (Q14, Q15, Q16, or Q17) uses an unheated crystal operating in its third overtone series-resonance mode. Crystal Y7 (Y8, Y9, Y10, or Y11) determines the frequency stability of the oscillator. The frequency of the oscillator can be changed an incremental amount (warped) by varying the inductance of L10 (L11, L12, L13, or L14). The third harmonic of the oscillator output is amplified in buffer amplifier Q1 and filtered to provide injection for the first mixer.

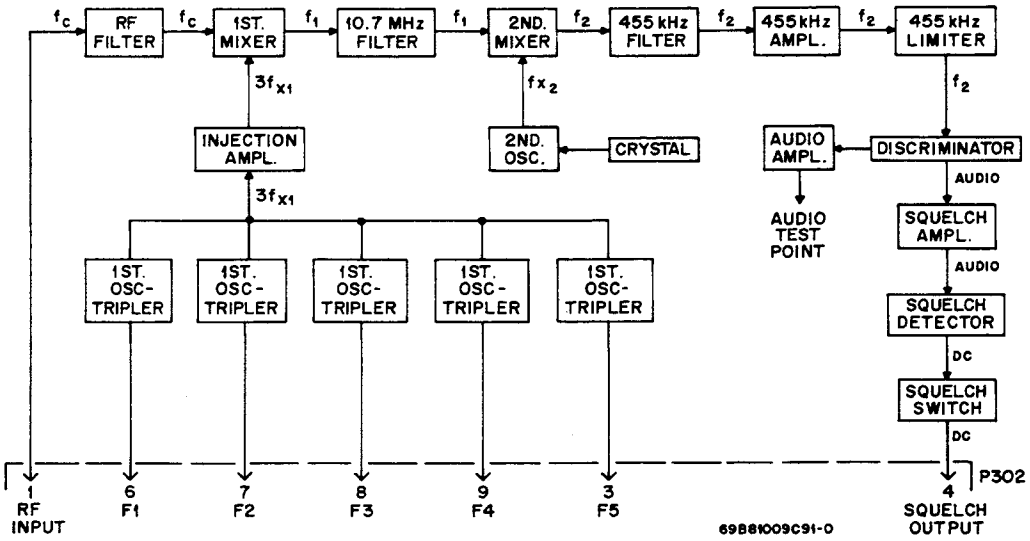


Figure 3. Vhf Mobile Detector Block Diagram

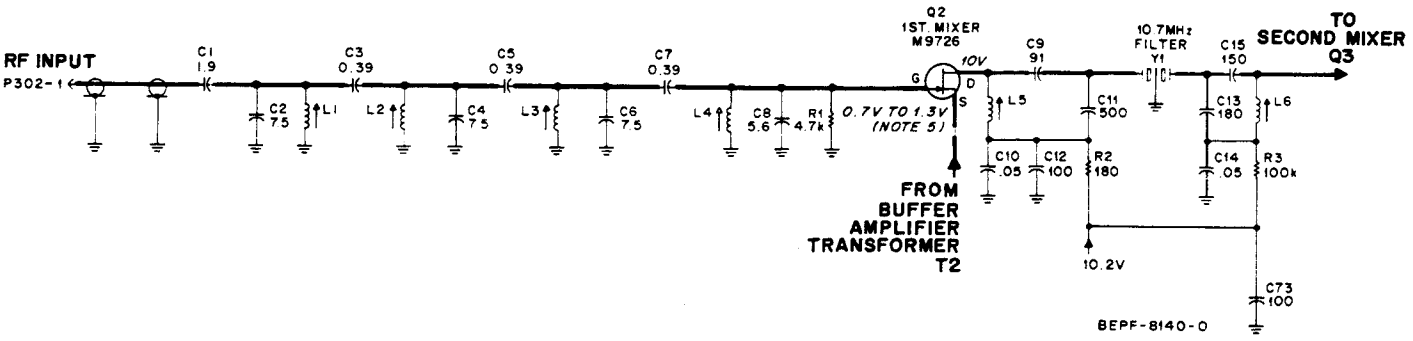


Figure 4. Typical First Mixer Stage

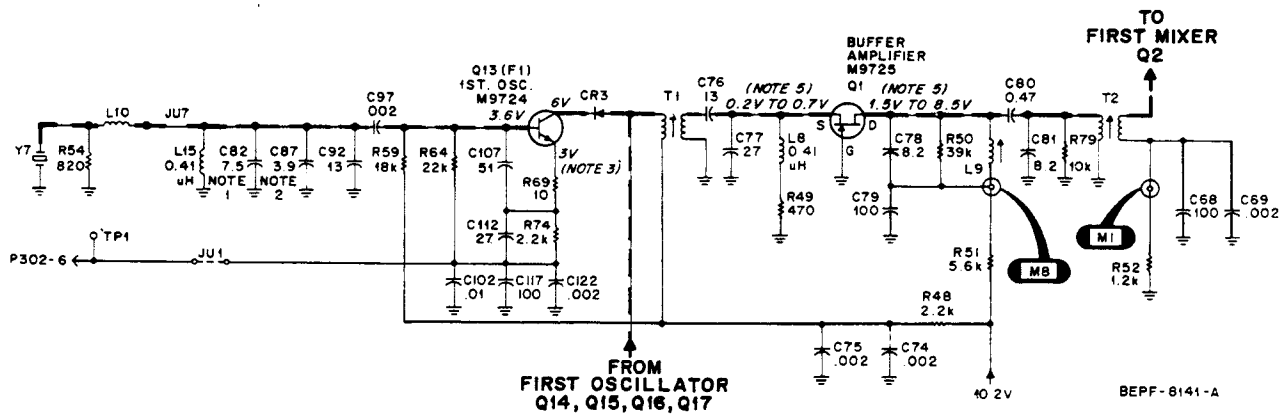


Figure 5. Typical First Oscillator and Buffer Amplifier Stages

d. Second Oscillator and Mixer, 455 kHz Filter, Amplifiers and Limiter, and Discriminator Stages

The high i-f signal is coupled to second mixer Q3 (Figure 6). In the second mixer stage, the first i-f signal and the second oscillator frequency are combined or mixed to produce the second or low 455 kHz i-f signal. This low i-f signal passes through the 455 kHz ceramic filter and is fed to amplifier stages Q4, Q5, Q6, and Q7 (Figure 7). After being amplified, the i-f signal is coupled to limiter stage Q8, where any amplitude variations of the signal is removed (Figure 8). The limited signal is then fed to the discriminator stage (CR1, CR2) where the frequency variations of the incoming signal are translated into an audio signal.

The discriminator circuit (T5, C37, C38, CR1 and CR2) uses the 90-degree phase difference which occurs at resonance between the primary and secondary voltages to recover the audio modulation from the 455 kHz i-f signal. Refer to Figure 9 for the typical discriminator response curve. The resulting recovered audio output is shown to the right of the curve. The output of the discriminator circuit is applied to the audio and squelch circuits.

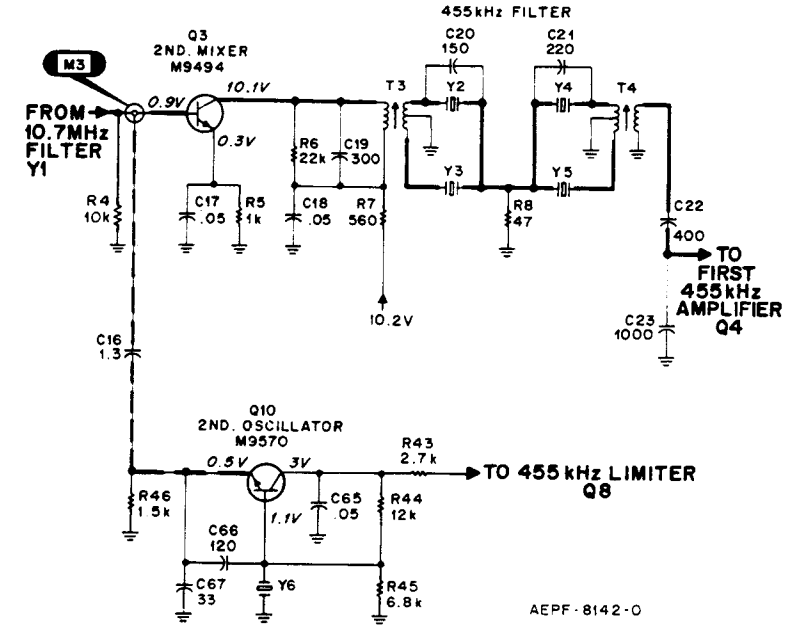


Figure 6. Typical Second Oscillator and Mixer, and 455 kHz Filter Stages

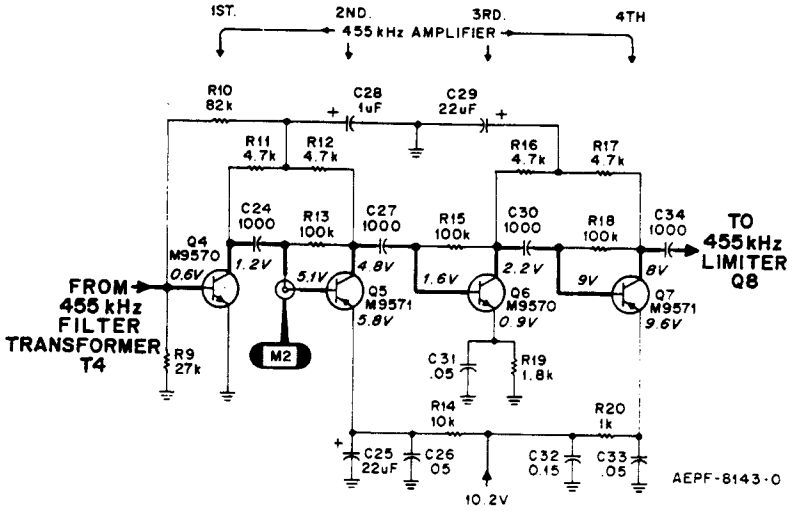


Figure 7. Typical 455 kHz Amplifier Stages

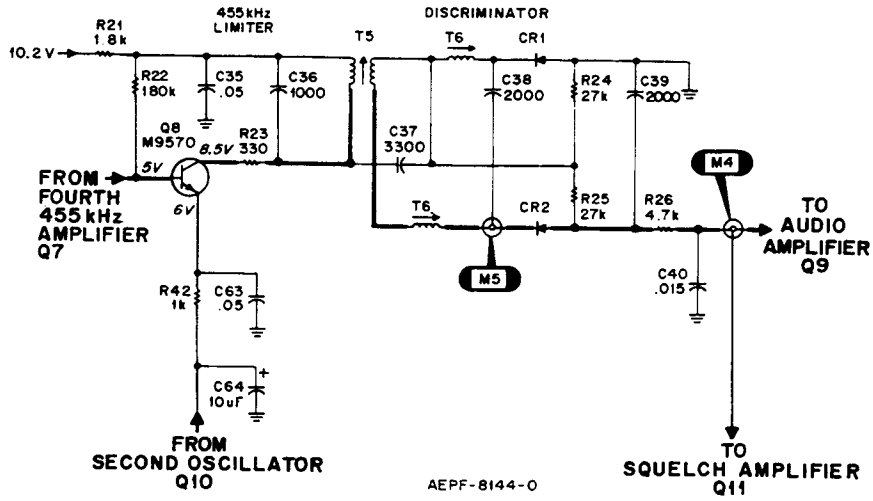


Figure 8. Typical 455 kHz Limiter and Discriminator Stages

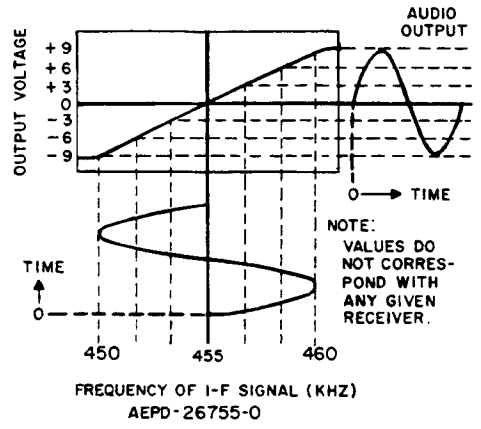


Figure 9. Typical Discriminator Response

e. Audio Amplifier Stage (Refer to Figure 10)

Audio amplifier Q9 is a typical audio amplifier which is used for testing the 20 dB quieting sensitivity of the mobile detector.

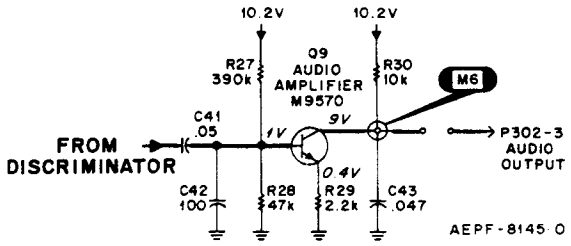


Figure 10. Typical Audio Amplifier Stage

f. Squelch Stages (Refer to Figure 11)

The only function of the squelch circuit, described previously in paragraph 3.d of manual 68P81010C20, is to provide a logic level signal to the main circuit board.

3. AEROTRON INTERFACE CABLE

(Refer to the Aerotron Interface Cable Schematic Diagram)

The Aerotron interface cable (Model ZKN6039A) allows the PAC•RT to be interfaced with the mobile radio without direct access to the discriminator line in the mobile. The high frequency noise necessary for proper squelch operation by the PAC•RT is supplied by a noise oscillator inside the Aerotron cable. The oscillator, gated by logic levels supplied from the mobile's fast squelch line, is summed with the mobile speaker audio to simulate a discriminator line to the PAC•RT.

The audio is fed to voltage follower U1A via dc blocking capacitor C1. Resistors R1 and R2 form an ac voltage divider, with C2 filtering out any high frequency components in the speaker audio. Voltage follower U1A provides isolation for the active filter consisting of C3, R3, R4, R5, and U1B. The filter serves to "flatten" out the audio which is then fed to summing stage U1C, through R6, to provide the proper amount of gain.

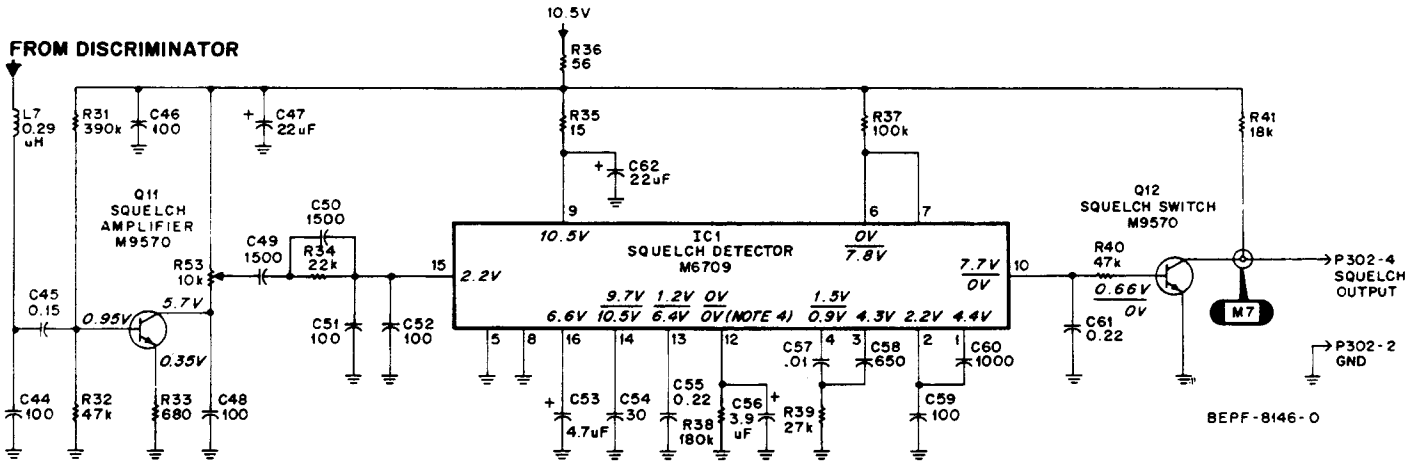


Figure 11. Typical Squelch Stages

Circuit U1D is a voltage comparator used to trigger the gate for the noise oscillator. Resistors R10 and R11 provide a reference level to the comparator, whose output depends on the logic level from the mobile fast squelch line. Upon receiving the proper rf carrier, the mobile radio will quiet, causing pin 13 of U1D to go high, and driving pin 14 of U1D low. A low on pin 9 of U3C inhibits U3C from passing the output of the noise oscillator circuit consisting of U3A and U3B. The period of the noise oscillator is determined by R22 and C4. Resistor R15 isolates R22 and C4 from the input protection diodes associated with U3A. A two-pole, low-pass filter, consisting of R13, C5, R14, and C6, attenuates harmonics of the square wave noise oscillator. Resistor R7 provides the proper amount of attenuation to the summing stage, U1C where the noise and audio are added to simulate a discriminator line to the PAC•RT.

4. MOBILE PL DETECTOR

Refer to Figure 12. The mobile PL detector allows the PAC•RT to monitor the mobile logical PL detect line. The output of the mobile logic PL detect is fed to the PAC•RT's mobile detect logic through the Aerotron cable, pin 25 of J301. Two resistors have been added to the PL detect circuit. Resistor R1 is used for current limiting, while resistor R2 (replaces R333) is a pull-up resistor tied to the supply line (B+). A logic high corresponds to mobile PL detect.

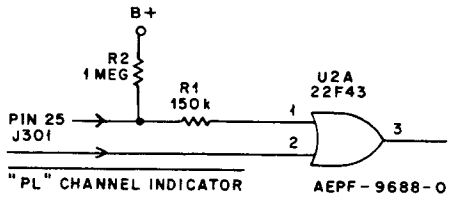


Figure 12. Mobile PL Select Gate

A detailed theory of operation on the complete PAC•RT repeater is given in the instruction manual, 68P81010C20. The vehicular repeater main logic circuit board layout and schematic diagrams of service supplement 68P81010C09, however, are replaced with new circuit board layout and schematic diagrams at the end of this manual. They incorporate the above changes in the mobile PL detect circuit.

5. CONTROL UNIT/RAPID CHARGER

a. General

The PAC•RT control unit/rapid charger (Model ZLN6353A) contains circuitry to charge a portable radio and provides automatic or manual activation and deactivation of the PAC•RT vehicular repeater.

Two switches control the unit; the CHARGER ON/OFF and the REPEATER ON/OFF switches. The CHARGER ON/OFF switch applies power to the charger circuitry and is operational regardless of the position of the vehicle ignition switch or whether the mobile radio or vehicular repeater is present or not. The REPEATER ON/OFF switch, in combination with the charger pocket switch, provides activation and deactivation of the PAC•RT repeater. With the REPEATER ON/OFF switch in the ON position, the repeater is deactivated while the portable radio is in the charger pocket. Removal of the radio then automatically switches the mobile radio power from the ignition switch cold side to the battery, pauses for a second, and then activates the PAC•RT vehicular repeater. With the REPEATER ON/OFF switch in the OFF position, the repeater remains deactivated and the mobile radio power will be from the ignition switch cold side.

Two lamps indicate the status of the PAC•RT repeater and the charger circuitry. The green CHARGE lamp lights when the portable radio is in the charger pocket and the charger ON/OFF switch is ON. The blue REPEATER lamp lights when the PAC•RT repeater is active and has power applied to it. Power is removed from the vehicular repeater when the mobile radio is turned off. Unpluging the PAC•RT repeater will not affect the operation of the mobile radio or that of the charger. The REPEATER/ ON lamp, however, will not light until the PAC•RT repeater is connected.

b. Control Unit

(Refer to the control unit/rapid charger schematic diagram)

Vehicle battery voltage is applied through fuse F1 and pin 15 of J4 to the normally-open contacts of relay K1, which acts as a SPST switch. The contacts are tied together for added reliability.

Components L1 and C1 form a noise filter, preventing inverter noise from the power supply of the charger board, and ignition noise from the vehicle, from getting into the B+ line. Diode CR1 is used for reverse voltage protection. If the battery polarity is reversed, CR1 conducts and fuse F1 blows.

With the charger switch in the OFF position, all power to the charger is removed. Voltage is applied to the top of relay coil K1, resistor R3, and transistor Q2. Resistor R3 biases emitter follower Q2 so that it is on all the time. If the repeater and pocket switches are open, Q2 conducts and the emitter goes high.

The high voltage on the emitter of Q2 is applied to the base of Q1 through R2 which turns on Q1 and pulls in relay K1. The mobile radio connected to pin 13 of J4 is then connected to the vehicle battery source. Therefore, by having the portable radio out of the pocket and the repeater switch in the ON position, the mobile radio receives its power directly from the battery. Also, when the ignition switch is turned on, Q1 is biased on via R45, relay K1 is again activated, and power is supplied to the mobile radio. Thus, there are two ways to get power to the mobile radio: (1) enabling the PAC•RT repeater, which supplies power from the emitter of Q2, or (2) by turning on the ignition switch.

When the repeater is enabled, Q2 biases on Q3 via R4, and pulls the collector of Q3 low. Assuming that the mobile radio is turned on, pin 1 of J4 receives power and the repeater ON lamp lights. With the collector of Q3 low, Q4 (which was on) is now biased off. The collector of Q4 goes high and capacitor C2 charges through R8. As C2 charges, the cathode of CR14 rises in potential and the anode, which is tied to B+, also rises in potential. With the base of transistor Q5 at approximately two thirds the supply voltage, Q5 remains off as long as the emitter is at a lower potential. As C2 continues to charge, the emitter of Q5 increases in voltage until it is approximately 0.6 volt higher than the base and Q5 turns on. Current is supplied from the switched B+, through R46 and Q5, to the base of Q6. Transistor Q6 is an emitter follower used for current buffering, which allows a weak current on the base to drive a low impedance load at the emitter. The emitter of Q6 is tied to the repeater enable/disable line. The delay imposed by the overall circuit in charging C2 acts as a discrete one-shot multivibrator, whose purpose is to delay the enabling of the PAC•RT until the mobile radio and the PAC•RT have had time to "power-up." After the delay, the repeater transmitter sends a single-tone burst, indicating to other repeaters, as well as anyone else with a portable radio in the area, that you have arrived.

c. Rapid Charger

(Refer to the control unit/rapid charger schematic diagram

When the charger switch (S1) is closed, power from the battery is applied to the charger circuit. Circuit U1 and its associated circuitry is connected as an astable multivibrator, with a square-wave output at pin 3. The output is coupled through L2 and R15 and splits between two capacitors, C9 and C10. Capacitor C9 couples the signal to the base of Q7, while C10 couples the signal to the base of Q8. Assuming C10 is discharged, when pin 3 goes high, it turns on Q8 and biases Q10 on hard. Transistors Q8 and Q10 form a Darlington pair. Transistor Q10 is on most of the time that pin 3 is high. The time constant of C10 and R17 is such that Q10 turns off just prior to pin 3 going low. While pin 3 was high, C9 was discharging. Therefore, when pin 3 goes low, C9 pulls the base of Q7 low, turning Q7 on, which, in turn, biases Q9 on hard. Transistors Q7 and Q9 also form a Darlington configuration. Thus, pin 3 going high turns Q10 on hard and pin 3 going low turns Q9 on hard, and the negative side of C11 is alternately tied between B+ and ground.

The output of the Darlington pairs is coupled to the voltage doubler circuit consisting of CR4, CR5, C11, and C12. Capacitor C11 charges through CR4, then discharges C11 through CR5 into C12. The output of the voltage doubler circuit is applied to a current limiter which consists of series pass transistor Q13, diodes CR6, CR7, and CR8, and potentiometer R21. Diodes CR6, CR7, and CR8 are used to establish a voltage reference in the current limiter circuit. The output of the current limiter is then fed through a battery detector circuit consisting of Q17, CR12 and CR13, and on to the battery charger pocket through L3.

Potentiometer R21 is used for setting the magnitude of the charge current. When a portable radio is inserted into the charger pocket, the current drawn by the radio battery causes Q17 to conduct, due to the voltage drop across CR12 and CR13. A portion of the current limiter output is shunted through Q17 to a latching circuit (Q15 and Q18) and the green CHARGER indicator lamp. When Q17 conducts, Q19 is biased on via R44, causing the lamp to light and indicating that charging current is being supplied to the radio battery.

The latch circuit consists of Q18 and Q15. As the radio battery approaches complete charge, the thermistor in the battery increases in value, due to the temperature rise of the charged battery. The voltage at the base of Q15 is sufficient to cause it to conduct, which, in turn, biases on Q12, via R40. A portion of the Q18 collector current is applied to the base of Q15 through R37, thereby causing Q15 to conduct harder, latching the circuit on. The collector current of Q18 also biases on Q16 via R38. When Q16 conducts, it turns on Q12, which shorts out CR6 and CR7 in the current limiter circuit. This causes the battery charge current to drop to a slow or trickle charge rate. If the thermistor decreases to a low value after the rapid charge action, the latch circuit will not revert back to the rapid charge rate due to the blocking action of CR10. This allows the charger circuit to remain in the slow charge mode.

Two other modes of charge control are also designed into the charger circuit: voltage cutoff and dynamic voltage clamp. In the event that the apparent battery voltage during rapid charge exceeds 18 volts due to low temperature, full charge, poor charger-to-radio connection, or poor radio-to-battery connection, the rapid charge rate may be reduced to the trickle charge rate by operation of the latch circuit. Battery terminal voltage is supplied to regulator VR2. Any voltage exceeding 18 volts is coupled to the base of Q15 through R34 and CR9, causing the latch to operate, and reducing the charge rate as previously described. If the battery terminal voltage continues to rise even during trickle charge, the dynamic voltage clamp begins to operate. As the battery voltage approaches 18.6 volts, transistor Q14 begins to conduct, causing Q11 to conduct. Transistor Q11 and R20 are in parallel with the three voltage reference diodes (CR6, CR7, CR8). When Q11 starts to conduct, it effectively causes the reference voltage to approach zero, thereby reducing the slow charge current to an extremely low value.

MAINTENANCE

1. TEST EQUIPMENT

Refer to the PAC•RT instruction manual (68P81010C20) for a list of the recommended test equipment.

2. TROUBLESHOOTING

Refer to the appropriate section in the "Theory of Operation" for troubleshooting the control unit/rapid charger circuitry and cable interface units. Figure 13 can be used as an aid for troubleshooting the vhf mobile detector circuit. For troubleshooting the PAC•RT vehicular repeater, refer to the appropriate section in instruction manual 68P81010C20.

3. DISASSEMBLY

For access to all parts of the control unit/ rapid charger, remove the housing in the following manner.

a. Remove the four hex-head screws on the back panel corners.

b. Remove two Phillips screws on the front escutcheon nearest the charger pocket.

c. Slide the console chassis out from the rear of the housing.

d. To reassemble, reverse the proceding procedure.

4. REPLACEMENT

Replace all parts with the exact replacements indicated in the parts lists. If it is necessary to replace transistors Q9 and Q10 on the control unit/rapid charger board, be sure to use heat conducting silicon grease under the transistors.

5. CHARGING CURRENT ADJUSTMENT

When any component in the current limiter circuit in the control unit/rapid charger is replaced, the charge current should be readjusted as follows:

a. Locate and unsolder the red-yellow wire connected to the terminal strip on the control unit/ rapid charger pocket.

b. Connect a 0.10-ohm ±1%, 1/2 watt resistor between the terminal strip and the wire.

c. Attach a digital voltmeter with a 0-to-0.1 volt dc range across the 0.10-ohm resistor.

d. Install a Motorola MT500 ("omni" size) or HT220 Radio into the charger pocket and turn on the portable radio.

e. Connect the dc input of the unit (red black wires) to a power supply set for 13.8 volts dc.

f. Set the CHARGER switch to ON.

g. The digital voltmeter should indicate 0.036 volt dc. If not, adjust R21 on the circuit board until it does.

CAUTION

Use a non-metallic tool to make this adjustment. Use of a metallic tool may result in damage to the circuit if accidental contact with the chassis is made.

h. Remove the portable radio, disconnect the unit from the power supply, and remove the 0.10-ohm resistor. Reconnect the red-yellow wire to the terminal strip.

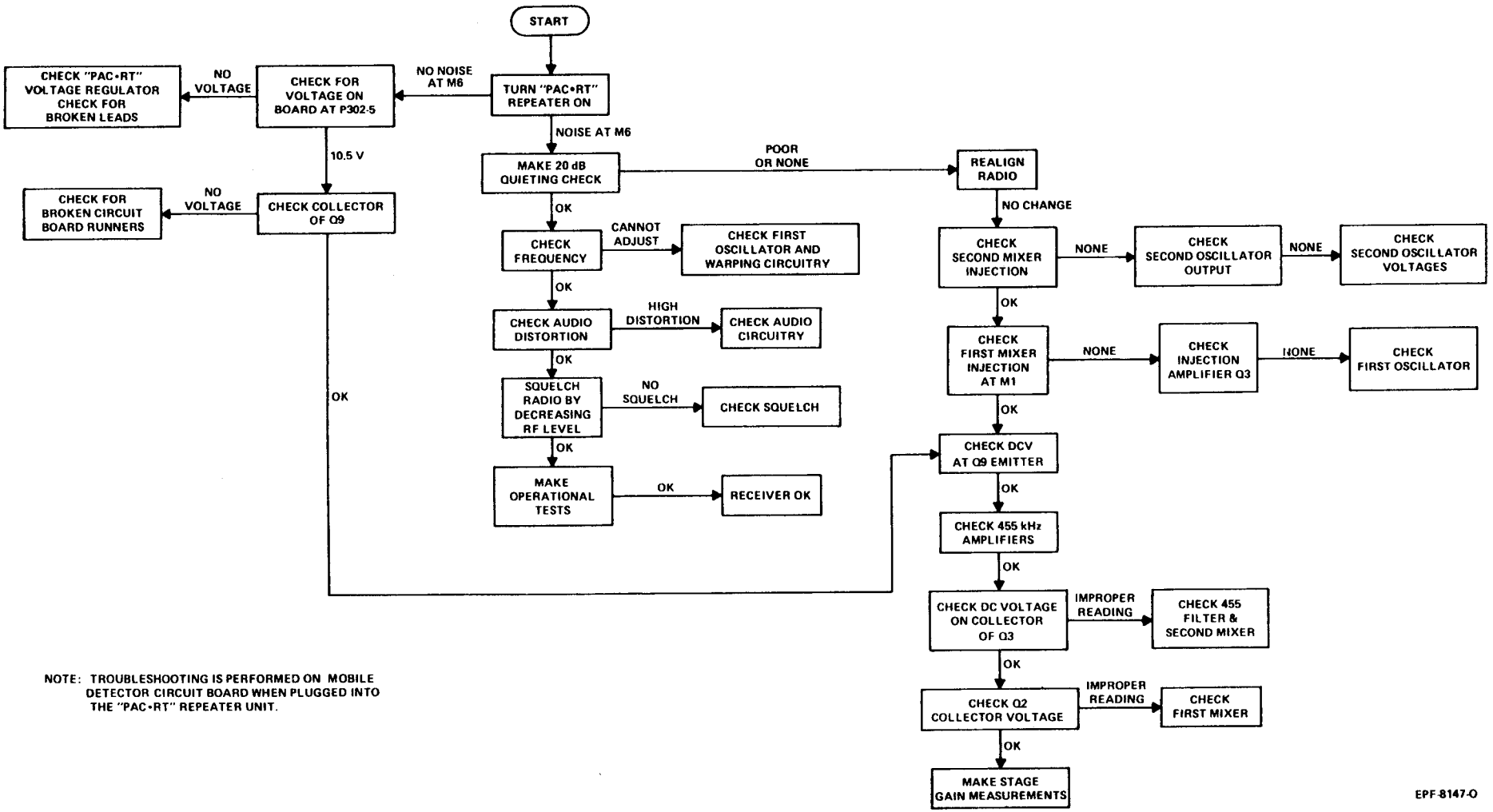
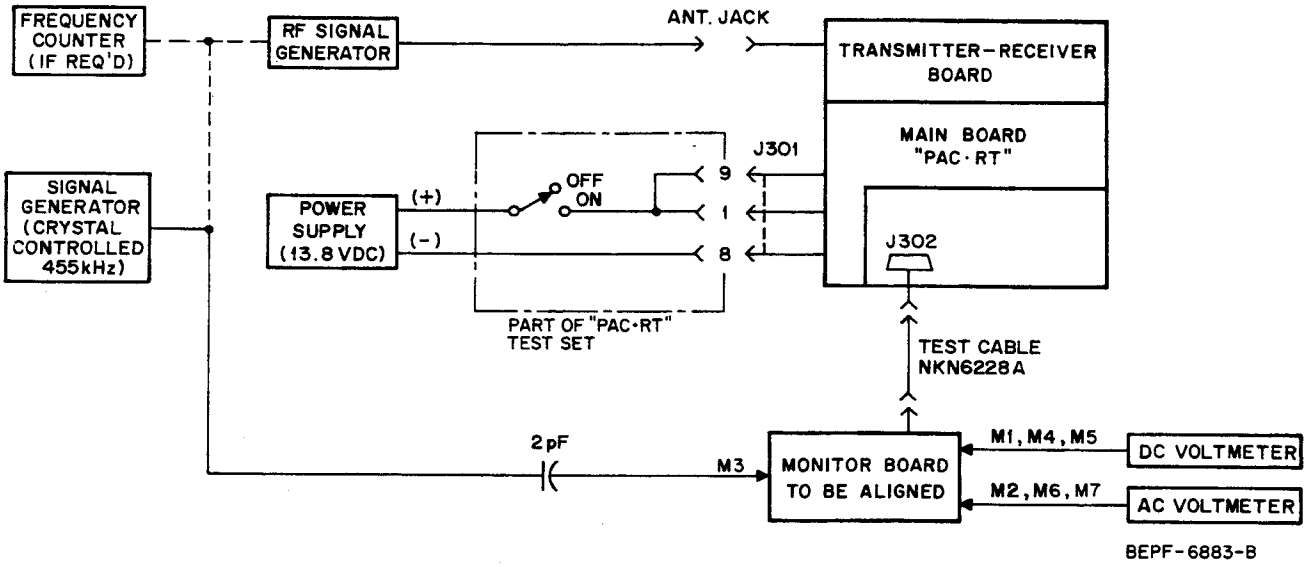


Figure 13. Vhf Mobile Detector Troubleshooting Chart

ALIGNMENT SETUP



STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable NKN6228A			Remove mobile detector circuit board from main circuit board and cl Connect test cable between P302 on mobile detector circuit board and main circuit board. The transmitter-receiver circuit board must be i on the main circuit board.
2				Locate TP1, TP2, TP3, TP4, and TP5 on the mobile detector circuit b Ground TP1 to activate the F1 oscillator. (TP2 for F2, TP3 for F3, etc
3	AC Voltmeter, Signal Generator (455 kHz crystal-controlled)	M2 -40 dB scale	T3, T4	LOW I-F FREQUENCY -- Connect the 455 kHz signal generator to 2nd M3 (use a 2 pF isolation capacitor). Increase and maintain a signal le -40 dBm on meter at point M2. Tune for peak. Peak T4, T3, and rep not repeat.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +3 V dc scale & -40 dB scale	T5	LIMITER -- Adjust the signal generator output for an indication of -4 meter point M2. If T5 has been completely misaligned, position the sl it is 1/16" above the solder side of the board. Adjust T5 for maximum voltage (approximately 2.2 V dc).
5	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.3 V dc scale & -40 dB scale	T6	DISCRIMINATOR -- Adjust the signal generator output for an indicatio on meter point M2. If T6 has been completely misaligned, position the that it is 1/16" above the solder side of the board. Adjust T6 for discr zero (0 ± .05 V). Adjust for the first zero.
6	DC Multimeter	M8	T1, L9	Tune T1 and L9 for a dip at M8.
7	DC Multimeter, .002 uF Cap.	M1	T1, L9, T2	Tune T2 for a peak at M1. Retune T1, L9, and T2 for a peak at M1. S Oscillator transistor base to ground with a .002 uF capacitor. The cha voltage at M1 should be greater than .02 V dc.
8		M6	L5, L6	HIGH I-F FILTER -- If the I-F filter has been completely misaligned o frequency is being changed, position the slugs so that they are 1/16" ab solder side of the board. With no signal input tune L5 & L6 for maxim noise at M6.
9	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L4 for a peak at M2. Keep the reading below -30 dBm by reducing gen output.
10	DC Multimeter	M4 0.3 V dc scale	L10(L11, L12, L13, & L14 if used)	RECEIVE FREQUENCY -- Use the base station transmitter or a freque dard as a signal source and adjust L10 for zero at M4 (±.05 V dc). MULTIPLE FREQUENCY MODELS -- Remove ground from TP1 and re 2 and 10 for each of the remaining points noted in step 2. Adjust the coil for each channel for zero reading at M3: F2-L11, F3-L12, F4-L13,
11	AC Voltmeter, Signal Generator, DC Multimeter	M2 -30 dB scale	L1, L2, L3, L4, T1, T2, L5, L6, T3, and T4	RF SELECTIVITY & HIGH I-F FILTER -- Ground TP1, TP2, TP3, TP4, that is associated with the lowest frequency channel. Retune L1, L2, L3, L5, L6, T3 and T4 in that order to ensure a peak at M2. Keep the readin -30 dBm at M2 and at zero ± .05 V dc at M4.
12				Remove test cable. Reassemble mobile detector circuit board onto m board.
13	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L4 for a peak at M2. Keep the reading below -30 dBm by reducing gen output.
14	AC Voltmeter, Signal Generator	M6		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity m as a check of alignment (13.75 uV maximum at the antenna input corre 1 uV at the rf input to the monitor-receiver).
15	DC Multimeter, Signal Generator	M7 15 V scale	R53	SQUELCH SETTING -- Set R53 fully counterclockwise. Set signal gen the level set in step 14. Slowly turn R53 clockwise until M7 just switch approximately 9.5 volts.

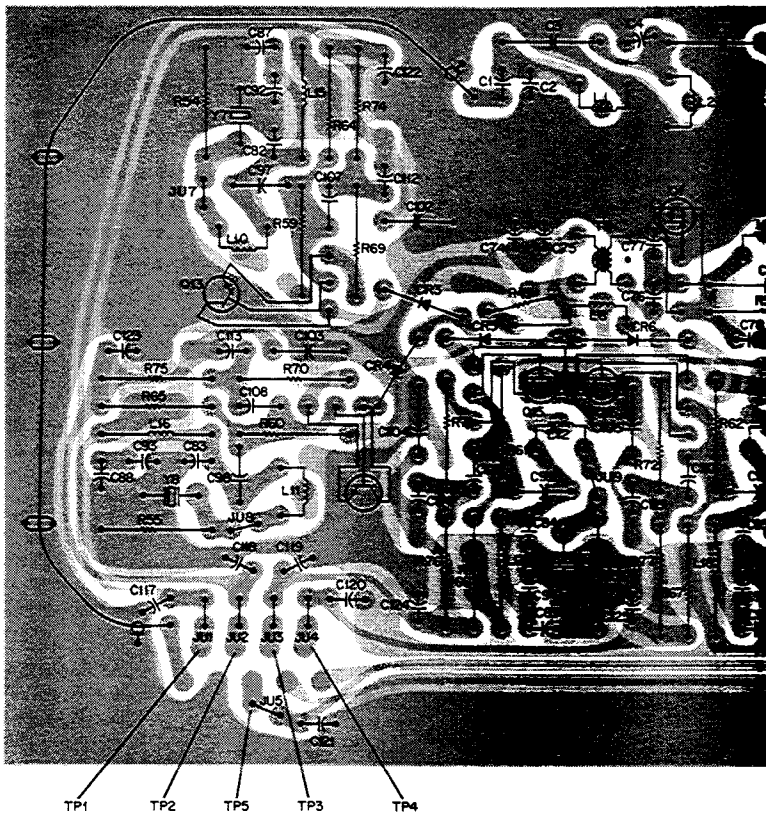
STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable NKN6228A			Remove mobile detector circuit board from main circuit board and chassis. Connect test cable between P302 on mobile detector circuit board and J302 on main circuit board. The transmitter-receiver circuit board must be in position on the main circuit board.
2				Locate TP1, TP2, TP3, TP4, and TP5 on the mobile detector circuit board. Ground TP1 to activate the F1 oscillator. (TP2 for F2, TP3 for F3, etc.)
3	AC Voltmeter, Signal Generator (455 kHz crystal-controlled)	M2 -40 dB scale	T3, T4	LOW I-F FREQUENCY -- Connect the 455 kHz signal generator to 2nd mixer base, M3 (use a 2 pF isolation capacitor). Increase and maintain a signal level of about -40 dBm on meter at point M2. Tune for peak. Peak T4, T3, and repeak T4. Do not repeat.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +3 V dc scale & -40 dB scale	T5	LIMITER -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T5 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T5 for maximum positive voltage (approximately 2.2 V dc).
5	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.3 V dc scale & -40 dB scale	T6	DISCRIMINATOR -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T6 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T6 for discriminator zero (0 ± .05 V). Adjust for the first zero.
6	DC Multimeter	M8	T1, L9	Tune T1 and L9 for a dip at M8.
7	DC Multimeter, .002 uF Cap.	M1	T1, L9, T2	Tune T2 for a peak at M1. Retune T1, L9, and T2 for a peak at M1. Short Oscillator transistor base to ground with a .002 uF capacitor. The change in voltage at M1 should be greater than .02 V dc.
8		M6	L5, L6	HIGH I-F FILTER -- If the I-F filter has been completely misaligned or the frequency is being changed, position the slugs so that they are 1/16" above the solder side of the board. With no signal input tune L5 & L6 for maximum audio noise at M6.
9	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L2, L3 and L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
10	DC Multimeter	M4 0.3 V dc scale	L10(L11, L12, L13, & L14 if used)	RECEIVE FREQUENCY -- Use the base station transmitter or a frequency standard as a signal source and adjust L10 for zero at M4 (±.05 V dc). MULTIPLE FREQUENCY MODELS -- Remove ground from TP1 and repeat steps 2 and 10 for each of the remaining points noted in step 2. Adjust the appropriate coil for each channel for zero reading at M3: F2-L11, F3-L12, F4-L13, and F5-L14.
11	AC Voltmeter, Signal Generator, DC Multimeter	M2 -30 dB scale	L1, L2, L3, L4, T1, T2, L5, L6, T3, and T4	RF SELECTIVITY & HIGH I-F FILTER -- Ground TP1, TP2, TP3, TP4, or TP5 that is associated with the lowest frequency channel. Retune L1, L2, L3, L4, T1, T2, L5, L6, T3 and T4 in that order to ensure a peak at M2. Keep the reading below -30 dBm at M2 and at zero ± .05 V dc at M4.
12				Remove test cable. Reassemble mobile detector circuit board onto main circuit board.
13	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ± .05 V dc. Tune L1, L2, L3, and L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
14	AC Voltmeter, Signal Generator	M6		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity measurement as a check of alignment (13.75 uV maximum at the antenna input corresponds to 1 uV at the rf input to the monitor-receiver).
15	DC Multimeter, Signal Generator	M7 15 V scale	R53	SQUELCH SETTING -- Set R53 fully counterclockwise. Set signal generator at the level set in step 14. Slowly turn R53 clockwise until M7 just switches to approximately 9.5 volts.

EPF-7993-A

NRD6632A Vhf Mobile Detector

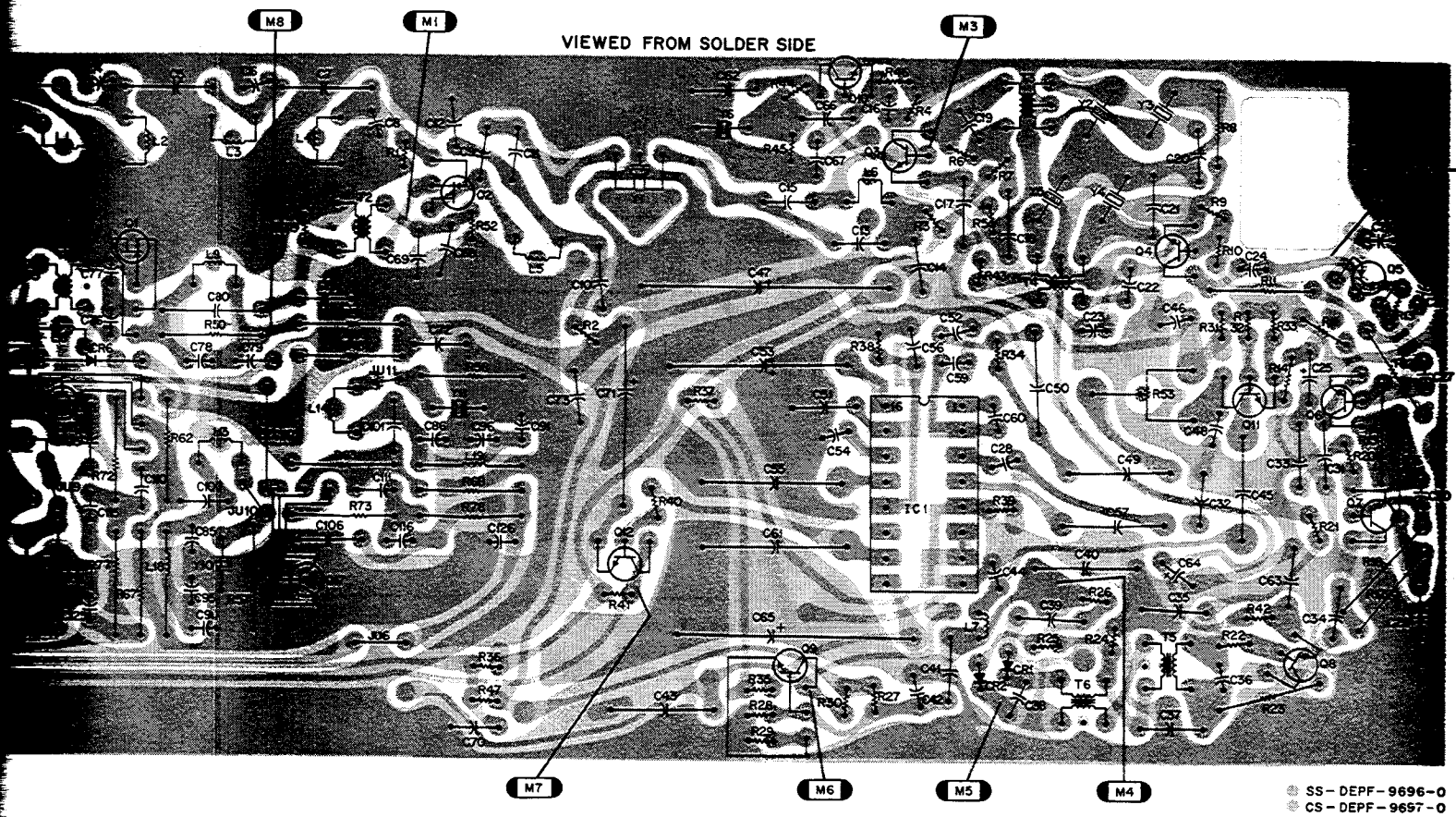
PLF-1629-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ±10%; 50 V unless stated
C1	2182358G85	1.9 ±0.1 pF
C2	2184511B84	7.5 ±0.25 pF
C3	2182450B21	0.39 uF; 500 V
C4	2184511B84	7.5 ±0.25 pF
C5	2182450B21	0.39 uF; 500 V
C6	2184511B84	7.5 ±0.25 pF
C7	2182450B21	0.39 uF; 500 V
C8	2184511B75	5.6 ±0.25 pF
C9	2184511B23	91
C10	2182372C07	.05 uF -20 +80%; 25 V
C11	2100847065	500
C12	2184511B24	100
C13	2184511B48	180
C14	2182372C07	.05 uF -20 +80%; 25 V
C15	2184511B26	150
C16	2184511B33	1.3 ±0.25 pF
C17, 18	2182372C07	.05 uF -20 +80%; 25 V
C19	0882163J06	300 ±5%; 63V
C20	2184511B26	150
C21	2184511B49	220; N750
C22	0882163J07	400 ±5%; 63V
C23, 24	2182213E08	1000 ±5%; 100 V
C25	2383441B28	22 uF ±20%; 15 V
C26	2184008H13	.05 uF ±20%; 25 V
C27	2182213E08	1000 ±5%; 100 V
C28	2383441B29	1 uF ±20%; 20 V
C29	2383441B28	22 uF ±20%; 15 V
C30	2182213E08	1000 ±5%; 100 V
C31	2182372C07	.05 uF -20 +80%; 25 V
C32	2184008H03	0.15 uF -20 +80%
C33	2182372C07	.05 uF -20 +80%; 25V
C34	2182187B14	1000; 100 V
C35	2182372C07	.05 uF -20 +80%; 25 V
C36	2182213E08	1000 ±5%; 100 V
C37	2182428B10	3300; 100 V
C38	0882163J09	2000 ±5%; 33 V
C39	2182428B36	2000; 250 V
C40	0882096J14	.015 uF; 250 V
C41	2182372C07	.05 uF -20 +80%; 25 V
C42	2184511B01	100; N750
C43	0882096J04	.047 uF; 250 V
C44	2184511B01	100; N750
C45	0882905G05	0.15 uF
C46	2184511B01	100; N750
C47	2382256J08	22 uF -10 +50%; 40 V
C48	2184511B01	100; N750
C49, 50	0882096J06	1500; 250 V
C51, 52	2184511B01	100; N750
C53	2382256J07	4.7 uF -10 +50%; 63V
C54	2184511B86	30
C55	0882905G12	0.22 uF
C56	2384762H08	3.9 uF ±20%; 15 V
C57	0882905G01	.01 uF
C58	2183162H24	650 ±5%
C59	2184511B01	100; N750
C60	2182213E08	1000 ±5%; 100 V
C61	0882905G12	0.22 uF
C62	2382256J08	22 uF -10 +50%; 40 V
C63	2182372C07	.05 uF -20 +80%; 25 V
C64	2383441B27	10 uF ±20%; 15 V
C65	2182372C07	.05 uF -20 +80%; 25 V
C66	2184511B25	120
C67	2184511B13	33
C68	2184511B01	100; N750
C69, 70	2182213E09	.002 uF
C71	2382256J03	10 uF -10 +50%; 25 V
C72	2182213E09	.002 uF
C73	2184511B24	100
C74, 75	2100861442	.002 uF
C76	2105350B01	13
C77	2184511B12	27
C78	2184511B07	8.2
C79	2184511B01	100; N750
C80	2182450B24	0.47
C81	2184511B07	8.2
C82 thru 86	2184511B84	7.5 ±0.25 pF
C87 thru 91	2184511B36	3.9 ±0.25 pF
C92 thru 96	2182358G61	13.5
C97 thru 101	2182428B36	2000; 250 V
C102 thru 106	2182428B62	.01 uF -20 +80%; 500 V
C107 thru 111	2184511B51	51
C112 thru 116	2184511B12	27
C117 thru 121	2184511B01	100; N750
C122 thru 126	2100861442	.002 uF
C127	2184511B85	10 ±0.25; N150
		DIODE: See Note I
CR1, 2	4882139G01	Germanium
CR3 thru 7	4883510F03	Switching
		INTEGRATED CIRCUIT:
IC1	5184267A09	Squelch Detector; type M6709



		COIL, RF: unless stated
L1 thru 4	2482827J09	Coded: BLU, 5-1/4 turns; includes 7682451B04 CORE
L5, 6	2482827J08	Coded: GRN, 36-3/4 turns; included 7600861425 CORE
L7	2482723H20	0.29 uH choke
L8	2482723H05	0.41 uH choke
L9	2482827J09	Coded: BLU, 5-1/4 turns; includes 7682451B04 CORE
L10 thru 14	2482827J10	Coded: BRN, 9-3/4 turns; includes 7682451B02 CORE
L15 thru 19	2482723H05	0.41 uH choke
		TRANSISTOR: See Note II
Q1	4800869725	N-channel FET; type M9725
Q2	4800869726	N-channel FET; type M9726
Q3	4800869494	NPN; type M9494
Q4	4800869570	NPN; type M9570
Q5	4800869571	PNP; type M9571
Q6	4800869570	NPN; type M9570
Q7	4800869571	PNP; type M9571
Q8 thru 12	4800869570	NPN; type M9570
Q13 thru 17	4800869724	NPN; type M9724
		RESISTOR, Fixed: ∧ ±5% 1/4 W unless stated
R1	0600124A65	4.7 k
R2	0600124A31	180
R3	0600124A97	100 k
R4	0600124A73	10 k
R5	0600124A49	1 k
R6	0600124A81	22 k
R7	0600124A43	560
R8	0600124A17	47
R9	0600124A83	27 k
R10	0600124A95	82 k
R11, 12	0600124A65	4.7 k
R13	0600124A97	100 k
R14	0600124A73	10 k
R15	0600124A97	100 k
R16, 17	0600124A65	4.7 k
R18	0600124A97	100 k
R19	0600124A55	1.8 k
R20	0600124A49	1 k
R21	0600124A55	1.8 k
R22	0600124B04	180 k
R23	0600124A37	330
R24, 25	0600124A83	27 k

R26	
R27	
R28	
R29	
R30	
R31	
R32	
R33	
R34	
R35	
R36	
R37	
R38	
R39	
R40	
R41	
R42	
R43	
R44	
R45	
R46	
R47	
R48	
R49	
R50	
R51	
R52	
R53	
R54 thru 58	
R59 thru 63	
R64 thru 68	
R69 thru 73	
R74 thru 78	
R79	
T1, 2	
T3, 4	
T5	



R26	0600124A65	4.7 k
R27	0600124B12	390 k
R28	0600124A89	47 k
R29	0600124A57	2.2 k
R30	0600124A73	10 k
R31	0600124B12	390 k
R32	0600124A89	47 k
R33	0600124A45	680
R34	0600124A81	22 k
R35	0600124A05	15
R36	0600124A19	56
R37	0600124A97	100 k
R38	0600124B04	180 k
R39	0600124A83	27 k
R40	0600124A89	47 k
R41	0600124A79	18 k
R42	0600124A49	1 k
R43	0600124A59	2.7 k
R44	0600124A75	12 k
R45	0600124A69	6.8 k
R46	0600124A53	1.5 k
R47	0600124A25	100
R48	0600124A57	2.2 k
R49	0600124A41	470
R50	0600124A87	39 k
R51	0600124A67	5.6 k
R52	0600124A51	1.2 k
R53	1884944C03	Pot., 10 k
R54 thru 58	0600124A47	820
R59 thru 63	0600124A79	18 k
R64 thru 68	0600124A81	22 k
R69 thru 73	0600124A01	10
R74 thru 78	0600124A57	2.2 k
R79	0600124A73	10 k
		TRANSFORMER:
T1, 2	2482827J11	Coded: YEL; Pri. -5-1/4 turns, Sec. -2-1/4 turns, includes 7682451B04 CORE
T3, 4	2482045J07	455 kHz
T5	0105957A62	ASSEMBLY, includes: 2484235H02 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
T6	0105957A64	ASSEMBLY, includes: 2484235H01 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
		CRYSTAL: See Note II
Y1	9105898C02	Ceramic, 10.7 MHz
Y2	4883192C22	Resonator, 459.4 kHz
Y3	4883192C13	Resonator, 450.3 kHz
Y4	4883192C22	Resonator, 459.4 kHz
Y5	4883192C13	Resonator, 450.3 kHz
Y6	4884224C07	10.245 MHz
	or 4884224C08	11.155 MHz
Y7 thru 11	KXN6034A	150.8-174 MHz

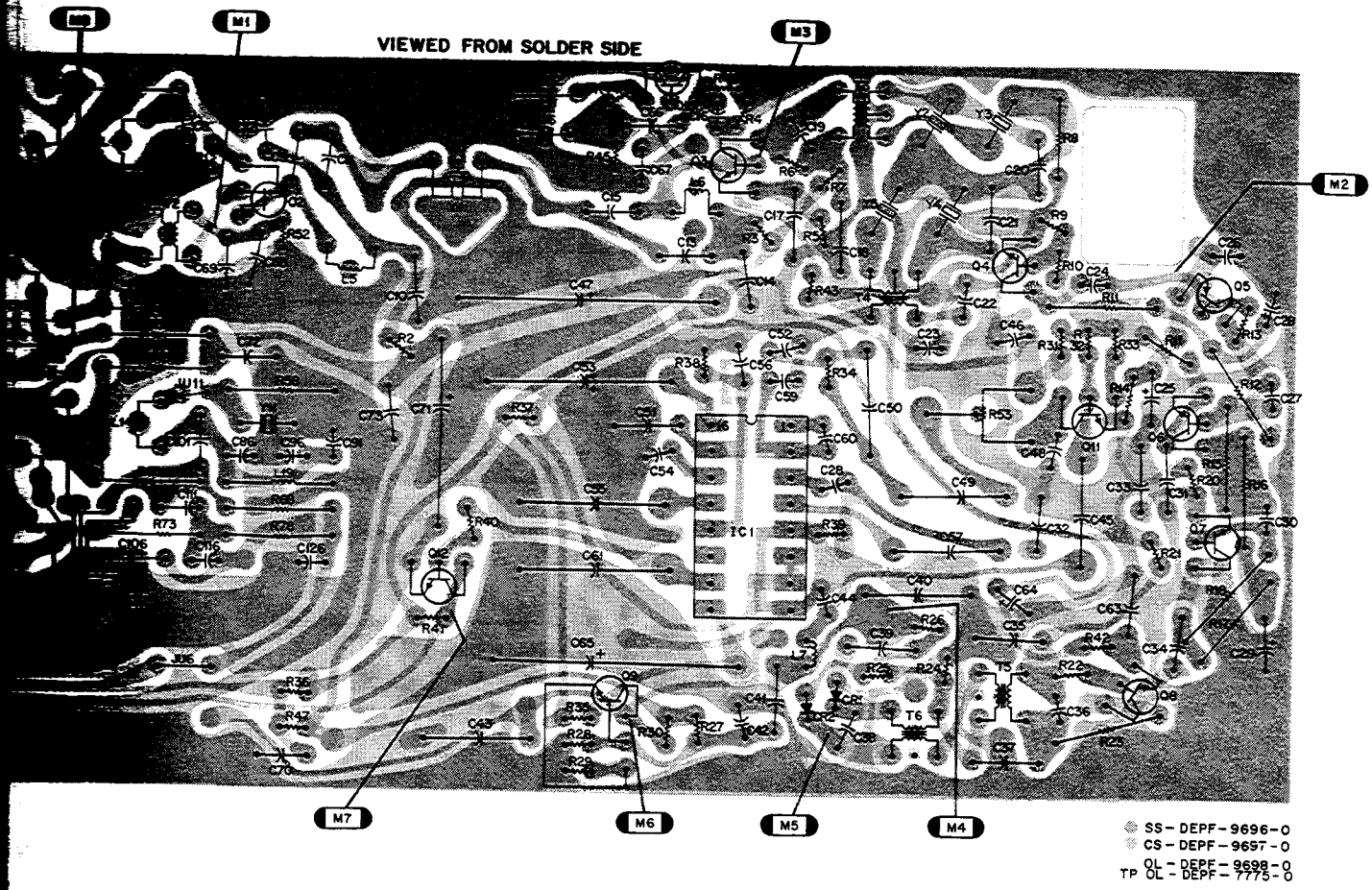
NONREFERENCED ITEMS

	0105953C99	ASSEMBLY, Connector and Bracket; includes: 0705121D01 BRACKET 2882846E02 PLUG, CONNECTOR 0300136772 SCREW, 2-56x5/16"
	0305101D01	SCREW, Phillips; 4-40x7/16"
	0300120621	SCREW, Phillips; 4-40x1/4"
	0400008434	LOCKWASHER, Split; #4
	0484345A11	WASHER, Insulator
	1483485A01	PAD, Insulator; for Y6 thru Y11
	1484743H01	PAD, Insulator; for T3 & T4
	2684800H14	SHIELD, Coil; for L1 thru 6, L9, T1, & T2
	3083361G01	CABLE, Coaxial
	4284452H02	CLAMP
	8405813H01	CIRCUIT BOARD

NOTES:

I. For optimum performance, order replacement diodes and transistors by Motorola part number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Oscillator frequency and crystal type will be found stamped on crystal can.



SS - DEPF - 9696 - O
CS - DEPF - 9697 - O
OL - DEPF - 9698 - O
TP OL - DEPF - 7775 - O

	0600124A65	4.7 k
	0600124B12	390 k
	0600124A89	47 k
	0600124A57	2.2 k
	0600124A73	10 k
	0600124B12	390 k
	0600124A89	47 k
	0600124A45	680
	0600124A81	22 k
	0600124A05	15
	0600124A19	56
	0600124A97	100 k
	0600124B04	180 k
	0600124A83	27 k
	0600124A89	47 k
	0600124A79	18 k
	0600124A49	1 k
	0600124A59	2.7 k
	0600124A75	12 k
	0600124A69	6.8 k
	0600124A53	1.5 k
	0600124A25	100
	0600124A57	2.2 k
	0600124A41	470
	0600124A87	39 k
	0600124A67	5.6 k
	0600124A51	1.2 k
	1884944C03	Pot., 10 k
	0600124A47	820
	0600124A79	18 k
	0600124A81	22 k
	0600124A01	10
	0600124A57	2.2 k
	0600124A73	10 k
		TRANSFORMER:
	2482827J11	Coded: YEL; Pri. -5-1/4 turns, Sec. -2-1/4 turns, includes 7682451B04 CORE
	2482045J07	455 kHz
	0105957A62	ASSEMBLY, includes: 2484235H02 COIL, 2684800H11 SHIELD, and 7682686D06 CORE

T6	0105957A64	ASSEMBLY, includes: 2484235H01 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
		CRYSTAL: See Note II
Y1	9105898C02	Ceramic, 10.7 MHz
Y2	4883192C22	Resonator, 459.4 kHz
Y3	4883192C13	Resonator, 450.3 kHz
Y4	4883192C22	Resonator, 459.4 kHz
Y5	4883192C13	Resonator, 450.3 kHz
Y6	4884224C07	10.245 MHz
	or 4884224C08	11.155 MHz
Y7 thru 11	KXN6034A	150.8-174 MHz

NONREFERENCED ITEMS

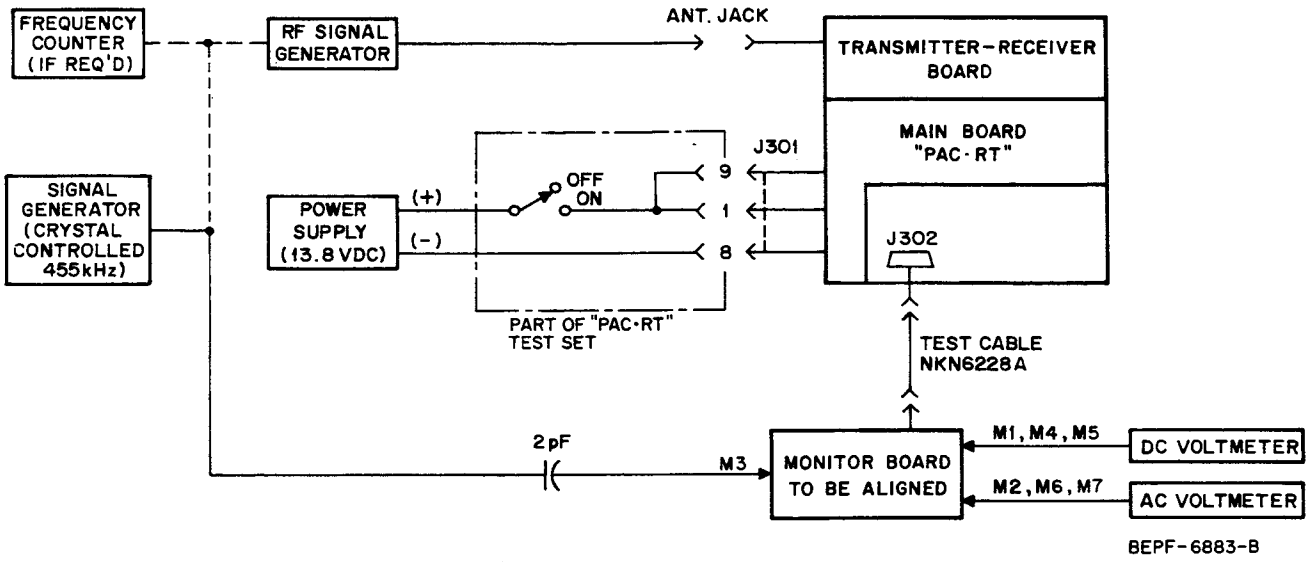
	0105953C99	ASSEMBLY, Connector and Bracket; includes: 0705121D01 BRACKET 2882846E02 PLUG, CONNECTOR 0300136772 SCREW, 2-56x5/16"
	0305101D01	SCREW, Phillips; 4-40x7/16"
	0300120621	SCREW, Phillips; 4-40x1/4"
	0400008434	LOCKWASHER, Split; #4
	0484345A11	WASHER, Insulator
	1483485A01	PAD, Insulator; for Y6 thru Y11
	1484743H01	PAD, Insulator; for T3 & T4
	2684800H14	SHIELD, Coil; for L1 thru 6, L9, T1, & T2
	3083361G01	CABLE, Coaxial
	4284452H02	CLAMP
	8405813H01	CIRCUIT BOARD

NOTES:

I. For optimum performance, order replacement diodes and transistors by Motorola part number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Oscillator frequency and crystal type will be found stamped on crystal can.

ALIGNMENT SETUP



ALIGNMENT PROCEDURE

STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable NKN6228A			Remove mobile detector circuit board from main circuit board and chassis. Connect test cable between P302 on mobile detector circuit board and J302 on main circuit board. The transmitter-receiver circuit board must be in position on the main circuit board.
2				Locate TP1, TP2, TP3, TP4, and TP5 on the mobile detector circuit board. Ground TP1 to activate the F1 oscillator. (TP2 for F2, TP3 for F3, etc.)
3	AC Voltmeter, Signal Generator (455 kHz crystal-controlled)	M2 -40 dB scale	T3, T4	LOW I-F FREQUENCY -- Connect the 455 kHz signal generator to 2nd mixer M3 (use a 2 pF isolation capacitor). Increase and maintain a signal level of -40 dBm on meter at point M2. Tune for peak. Peak T4, T3, and repeak T4. Do not repeat.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +3 V dc scale & -40 dB scale	T5	LIMITER -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T5 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T5 for maximum positive voltage (approximately 2.2 V dc).
5	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.3 V dc scale & -40 dB scale	T6	DISCRIMINATOR -- Adjust the signal generator output for an indication of -40 on meter point M2. If T6 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T6 for discriminator zero (0 ±.05 V). Adjust for the first zero.
6	DC Multimeter	M8	T1, L9	Tune T1 and L9 for a dip at M8.
7	DC Multimeter, .002 uF Cap.	M1	T1, L9, T2	Tune T2 for a peak at M1. Retune T1, L9, and T2 for a peak at M1. Short Oscillator transistor base to ground with a .002 uF capacitor. The change in voltage at M1 should be greater than .02 V dc.
8		M6	L5, L6	HIGH I-F FILTER -- If the I-F filter has been completely misaligned or the frequency is being changed, position the slugs so that they are 1/16" above the solder side of the board. With no signal input tune L5 & L6 for maximum audio noise at M6.
9	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ±.05 V dc. Tune L1, L2, L3, L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
10	DC Multimeter	M4 0.3 V dc scale	L10(L11, L12, L13, & L14 if used)	RECEIVE FREQUENCY -- Use the base station transmitter or a frequency standard as a signal source and adjust L10 for zero at M4 (±.05 V dc). MULTIPLE FREQUENCY MODELS -- Remove ground from TP1 and repeat steps 2 and 10 for each of the remaining points noted in step 2. Adjust the appropriate coil for each channel for zero reading at M3: F2-L11, F3-L12, F4-L13, and F5-L14.
11	AC Voltmeter, Signal Generator, DC Multimeter	M2 -30 dB scale	L1, L2, L3, L4, T1, T2, L5, L6, T3, and T4	RF SELECTIVITY & HIGH I-F FILTER -- Ground TP1, TP2, TP3, TP4, or TP5 that is associated with the lowest frequency channel. Retune L1, L2, L3, L4, T1, T2, L5, L6, T3 and T4 in that order to ensure a peak at M2. Keep the reading below -30 dBm at M2 and at zero ±.05 V dc at M4.
12				Remove test cable. Reassemble mobile detector circuit board onto main circuit board.
13	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ±.05 V dc. Tune L1, L2, L3, L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
14	AC Voltmeter, Signal Generator	M6		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity measurement as a check of alignment (13.75 uV maximum at the antenna input corresponds to 1 uV at the rf input to the monitor-receiver).
15	DC Multimeter, Signal Generator	M7 15 V scale	R53	SQUELCH SETTING -- Set R53 fully counterclockwise. Set signal generator at the level set in step 14. Slowly turn R53 clockwise until M7 just switches to approximately 9.5 volts.

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ALIGNMENT PROCEDURE

STEP	TEST EQUIPMENT	METER POINT	ADJUSTMENT	PROCEDURE
1	Test Cable NKN6228A			Remove mobile detector circuit board from main circuit board and chassis. Connect test cable between P302 on mobile detector circuit board and J302 on main circuit board. The transmitter-receiver circuit board must be in position on the main circuit board.
2				Locate TP1, TP2, TP3, TP4, and TP5 on the mobile detector circuit board. Ground TP1 to activate the F1 oscillator. (TP2 for F2, TP3 for F3, etc.)
3	AC Voltmeter, Signal Generator (455 kHz crystal-controlled)	M2 -40 dB scale	T3, T4	LOW I-F FREQUENCY -- Connect the 455 kHz signal generator to 2nd mixer base, M3 (use a 2 pF isolation capacitor). Increase and maintain a signal level of about -40 dBm on meter at point M2. Tune for peak. Peak T4, T3, and repeak T4. Do not repeat.
4	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M5 +3 V dc scale & -40 dB scale	T5	LIMITER -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T5 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T5 for maximum positive voltage (approximately 2.2 V dc).
5	DC Multimeter, Signal Generator (455 kHz crystal-controlled), AC Voltmeter	M4 0.3 V dc scale & -40 dB scale	T6	DISCRIMINATOR -- Adjust the signal generator output for an indication of -40 dBm on meter point M2. If T6 has been completely misaligned, position the slug so that it is 1/16" above the solder side of the board. Adjust T6 for discriminator zero (0 ±.05 V). Adjust for the first zero.
6	DC Multimeter	M8	T1, L9	Tune T1 and L9 for a dip at M8.
7	DC Multimeter, .002 uF Cap.	M1	T1, L9, T2	Tune T2 for a peak at M1. Retune T1, L9, and T2 for a peak at M1. Short Oscillator transistor base to ground with a .002 uF capacitor. The change in voltage at M1 should be greater than .02 V dc.
8		M6	L5, L6	HIGH I-F FILTER -- If the I-F filter has been completely misaligned or the frequency is being changed, position the slugs so that they are 1/16" above the solder side of the board. With no signal input tune L5 & L6 for maximum audio noise at M6.
9	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ±.05 V dc. Tune L1, L2, L3 and L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
10	DC Multimeter	M4 0.3 V dc scale	L10(L11, L12, L13, & L14 if used)	RECEIVE FREQUENCY -- Use the base station transmitter or a frequency standard as a signal source and adjust L10 for zero at M4 (±.05 V dc). MULTIPLE FREQUENCY MODELS -- Remove ground from TP1 and repeat steps 2 and 10 for each of the remaining points noted in step 2. Adjust the appropriate coil for each channel for zero reading at M3: F2-L11, F3-L12, F4-L13, and F5-L14.
11	AC Voltmeter, Signal Generator, DC Multimeter	M2 -30 dB scale	L1, L2, L3, L4, T1, T2, L5, L6, T3, and T4	RF SELECTIVITY & HIGH I-F FILTER -- Ground TP1, TP2, TP3, TP4, or TP5 that is associated with the lowest frequency channel. Retune L1, L2, L3, L4, T1, T2, L5, L6, T3 and T4 in that order to ensure a peak at M2. Keep the reading below -30 dBm at M2 and at zero ±.05 V dc at M4.
12				Remove test cable. Reassemble mobile detector circuit board onto main circuit board.
13	AC Voltmeter, Signal Generator	M2 -30 dB scale	L1, L2, L3, L4	RF SELECTIVITY -- Adjust signal generator output for -35 dBm at M2. Adjust signal generator frequency for M4 reading within ±.05 V dc. Tune L1, L2, L3, and L4 for a peak at M2. Keep the reading below -30 dBm by reducing generator output.
14	AC Voltmeter, Signal Generator	M6		20 dB QUIETING SENSITIVITY -- Perform 20 dB quieting sensitivity measurement as a check of alignment (13.75 uV maximum at the antenna input corresponds to 1 uV at the rf input to the monitor-receiver).
15	DC Multimeter, Signal Generator	M7 15 V scale	R53	SQUELCH SETTING -- Set R53 fully counterclockwise. Set signal generator at the level set in step 14. Slowly turn R53 clockwise until M7 just switches to approximately 9.5 volts.

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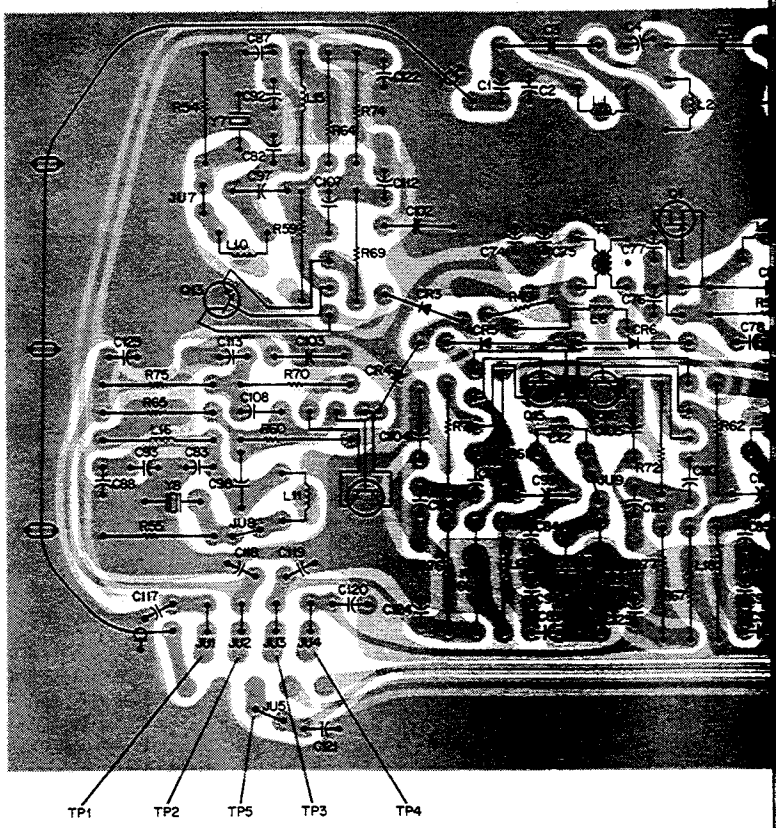
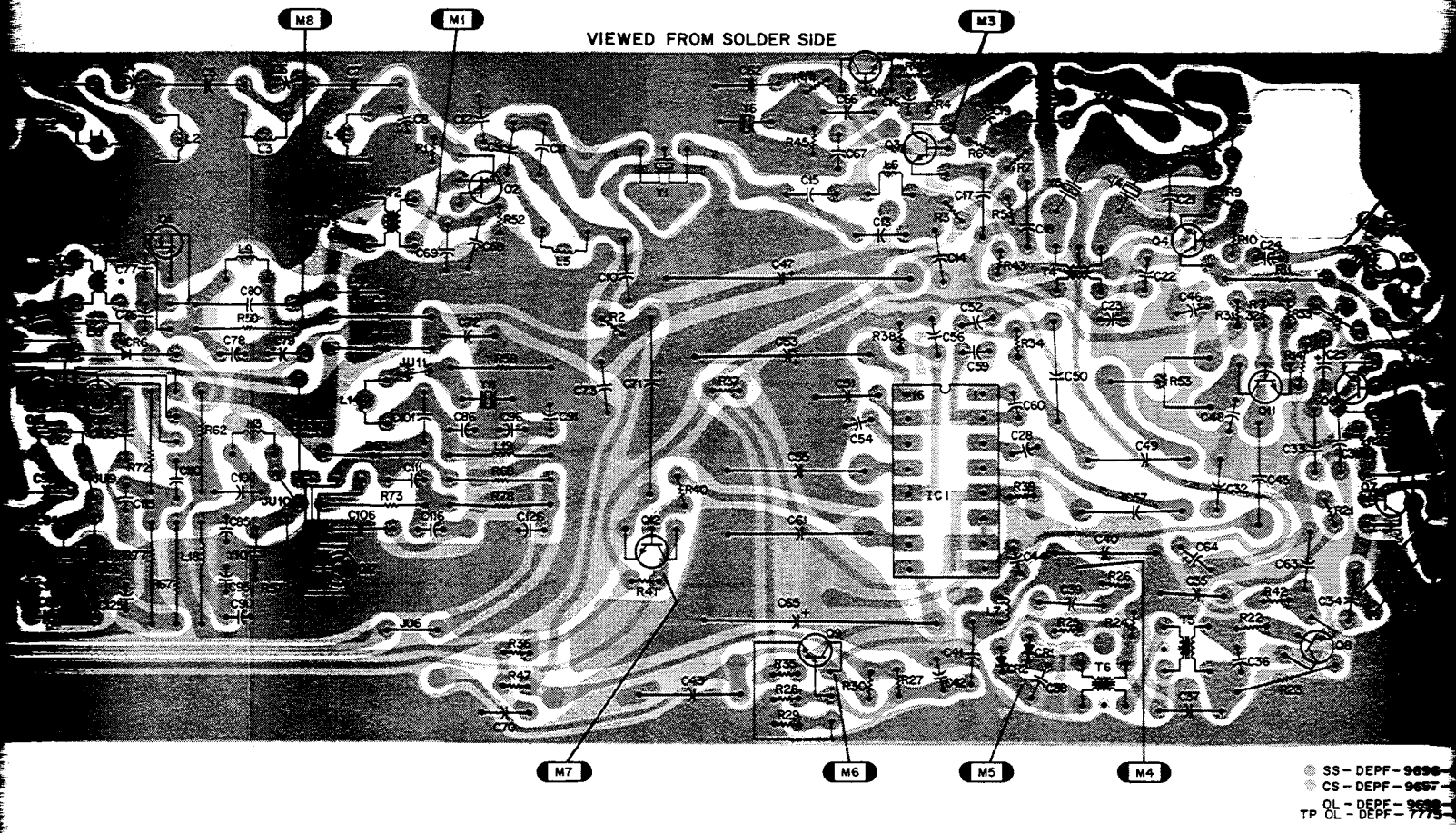
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: pF ±10%; 50 V unless stated
C1	2182358G85	1.9 ±0.1 pF
C2	2184511B84	7.5 ±0.25 pF
C3	2182450B21	0.39 uF; 500 V
C4	2184511B84	7.5 ±0.25 pF
C5	2182450B21	0.39 uF; 500 V
C6	2184511B84	7.5 ±0.25 pF
C7	2182450B21	0.39 uF; 500 V
C8	2184511B75	5.6 ±0.25 pF
C9	2184511B23	91
C10	2182372C07	.05 uF -20 +80%; 25 V
C11	2100847065	500
C12	2184511B24	100
C13	2184511B48	180
C14	2182372C07	.05 uF -20 +80%; 25 V
C15	2184511B26	150
C16	2184511B33	1.3 ±0.25 pF
C17, 18	2182372C07	.05 uF -20 +80%; 25 V
C19	0882163J06	300 ±5%; 63V
C20	2184511B26	150
C21	2184511B49	220; N750
C22	0882163J07	400 ±5%; 63V
C23, 24	2182213E08	1000 ±5%; 100 V
C25	2383441B28	22 uF ±20%; 15 V
C26	2184008H13	.05 uF ±20%; 25 V
C27	2182213E08	1000 ±5%; 100 V
C28	2383441B29	1 uF ±20%; 20 V
C29	2383441B28	22 uF ±20%; 15 V
C30	2182213E08	1000 ±5%; 100 V
C31	2182372C07	.05 uF -20 +80%; 25 V
C32	2184008H03	0.15 uF -20 +80%
C33	2182372C07	.05 uF -20 +80%; 25V
C34	2182187B14	1000; 100 V
C35	2182372C07	.05 uF -20 +80%; 25 V
C36	2182213E08	1000 ±5%; 100 V
C37	2182428B10	3300; 100 V
C38	0882163J09	2000 ±5%; 33 V
C39	2182428B36	2000; 250 V
C40	0882096J14	.015 uF; 250 V
C41	2182372C07	.05 uF -20 +80%; 25 V
C42	2184511B01	100; N750
C43	0882096J04	.047 uF; 250 V
C44	2184511B01	100; N750
C45	0882905G05	0.15 uF
C46	2184511B01	100; N750
C47	2382256J08	22 uF -10 +50%; 40 V
C48	2184511B01	100; N750
C49, 50	0882096J06	1500; 250 V
C51, 52	2184511B01	100; N750
C53	2382256J07	4.7 uF -10 +50%; 63V
C54	2184511B86	30
C55	0882905G12	0.22 uF
C56	2384762H08	3.9 uF ±20%; 15 V
C57	0882905G01	.01 uF
C58	2183162H24	650 ±5%
C59	2184511B01	100; N750
C60	2182213E08	1000 ±5%; 100 V
C61	0882905G12	0.22 uF
C62	2382256J08	22 uF -10 +50%; 40 V
C63	2182372C07	.05 uF -20 +80%; 25 V
C64	2383441B27	10 uF ±20%; 15 V
C65	2182372C07	.05 uF -20 +80%; 25 V
C66	2184511B25	120
C67	2184511B13	33
C68	2184511B01	100; N750
C69, 70	2182213E09	.002 uF
C71	2382256J03	10 uF -10 +50%; 25 V
C72	2182213E09	.002 uF
C73	2184511B24	100
C74, 75	2100861442	.002 uF
C76	2105350B01	13
C77	2184511B12	27
C78	2184511B07	8.2
C79	2184511B01	100; N750
C80	2182450B24	0.47
C81	2184511B07	8.2
C82 thru 86	2184511B84	7.5 ±0.25 pF
C87 thru 91	2184511B36	3.9 ±0.25 pF
C92 thru 96	2182358G61	13.5
C97 thru 101	2182428B36	2000; 250 V
C102 thru 106	2182428B62	.01 uF -20 +80%; 500 V
C107 thru 111	2184511B51	51
C112 thru 116	2184511B12	27
C117 thru 121	2184511B01	100; N750
C122 thru 126	2100861442	.002 uF
C127	2184511B85	10 ±0.25; N150
		DIODE: See Note I
CR1, 2	4882139G01	Germanium
CR3 thru 7	4883510F03	Switching
		INTEGRATED CIRCUIT:
IC1	5184267A09	Squelch Detector; type M6709



		COIL, RF: unless stated
L1 thru 4	2482827J09	Coded: BLU, 5-1/4 turns; includes 7682451B04 CORE
L5, 6	2482827J08	Coded: GRN, 36-3/4 turns; included 7600861425 CORE
L7	2482723H20	0.29 uH choke
L8	2482723H05	0.41 uH choke
L9	2482827J09	Coded: BLU, 5-1/4 turns; includes 7682451B04 CORE
L10 thru 14	2482827J10	Coded: BRN, 9-3/4 turns; includes 7682451B02 CORE
L15 thru 19	2482723H05	0.41 uH choke
		TRANSISTOR: See Note II
Q1	4800869725	N-channel FET; type M9725
Q2	4800869726	N-channel FET; type M9726
Q3	4800869494	NPN; type M9494
Q4	4800869570	NPN; type M9570
Q5	4800869571	PNP; type M9571
Q6	4800869570	NPN; type M9570
Q7	4800869571	PNP; type M9571
Q8 thru 12	4800869570	NPN; type M9570
Q13 thru 17	4800869724	NPN; type M9724
		RESISTOR, Fixed: ∩ ±5% 1/4 W unless stated
R1	0600124A65	4.7 k
R2	0600124A31	180
R3	0600124A97	100 k
R4	0600124A73	10 k
R5	0600124A49	1 k
R6	0600124A81	22 k
R7	0600124A43	560
R8	0600124A17	47
R9	0600124A83	27 k
R10	0600124A95	82 k
R11, 12	0600124A65	4.7 k
R13	0600124A97	100 k
R14	0600124A73	10 k
R15	0600124A97	100 k
R16, 17	0600124A65	4.7 k
R18	0600124A97	100 k
R19	0600124A55	1.8 k
R20	0600124A49	1 k
R21	0600124A55	1.8 k
R22	0600124B04	180 k
R23	0600124A37	330
R24, 25	0600124A83	27 k

R26	0600124A49	1 k
R27	0600124A97	100 k
R28	0600124A49	1 k
R29	0600124A97	100 k
R30	0600124A49	1 k
R31	0600124A97	100 k
R32	0600124A49	1 k
R33	0600124A97	100 k
R34	0600124A49	1 k
R35	0600124A97	100 k
R36	0600124A49	1 k
R37	0600124A97	100 k
R38	0600124A49	1 k
R39	0600124A97	100 k
R40	0600124A49	1 k
R41	0600124A97	100 k
R42	0600124A49	1 k
R43	0600124A97	100 k
R44	0600124A49	1 k
R45	0600124A97	100 k
R46	0600124A49	1 k
R47	0600124A97	100 k
R48	0600124A49	1 k
R49	0600124A97	100 k
R50	0600124A49	1 k
R51	0600124A97	100 k
R52	0600124A49	1 k
R53	0600124A97	100 k
R54 thru 58	0600124A49	1 k
R59 thru 63	0600124A97	100 k
R64 thru 68	0600124A49	1 k
R69 thru 73	0600124A97	100 k
R74 thru 78	0600124A49	1 k
R79	0600124A97	100 k
		TRANSFORMER:
T1, 2	5184267A10	Squelch Detector; type M6709
		TRANSFORMER, RF:
T3, 4	5184267A11	Squelch Detector; type M6709
T5	5184267A12	Squelch Detector; type M6709



R26	0600124A65	4.7 k
R27	0600124B12	390 k
R28	0600124A89	47 k
R29	0600124A57	2.2 k
R30	0600124A73	10 k
R31	0600124B12	390 k
R32	0600124A89	47 k
R33	0600124A45	680
R34	0600124A81	22 k
R35	0600124A05	15
R36	0600124A19	56
R37	0600124A97	100 k
R38	0600124B04	180 k
R39	0600124A83	27 k
R40	0600124A89	47 k
R41	0600124A79	18 k
R42	0600124A49	1 k
R43	0600124A59	2.7 k
R44	0600124A75	12 k
R45	0600124A69	6.8 k
R46	0600124A53	1.5 k
R47	0600124A25	100
R48	0600124A57	2.2 k
R49	0600124A41	470
R50	0600124A87	39 k
R51	0600124A67	5.6 k
R52	0600124A51	1.2 k
R53	1884944C03	Pot., 10 k
R54 thru 58	0600124A47	820
R59 thru 63	0600124A79	18 k
R64 thru 68	0600124A81	22 k
R69 thru 73	0600124A01	10
R74 thru 78	0600124A57	2.2 k
R79	0600124A73	10 k
		TRANSFORMER:
T1, 2	2482827J11	Coded: YEL; Pri. -5-1/4 turns, Sec. -2-1/4 turns, includes 7682451B04 CORE
T3, 4	2482045J07	455 kHz
T5	0105957A62	ASSEMBLY, includes: 2484235H02 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
T6	0105957A64	ASSEMBLY, includes: 2484235H01 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
		CRYSTAL: See Note II
Y1	9105898C02	Ceramic, 10.7 MHz
Y2	4883192C22	Resonator, 459.4 kHz
Y3	4883192C13	Resonator, 450.3 kHz
Y4	4883192C22	Resonator, 459.4 kHz
Y5	4883192C13	Resonator, 450.3 kHz
Y6	4884224C07	10.245 MHz
	or 4884224C08	11.155 MHz
Y7 thru 11	KXN6034A	150.8-174 MHz

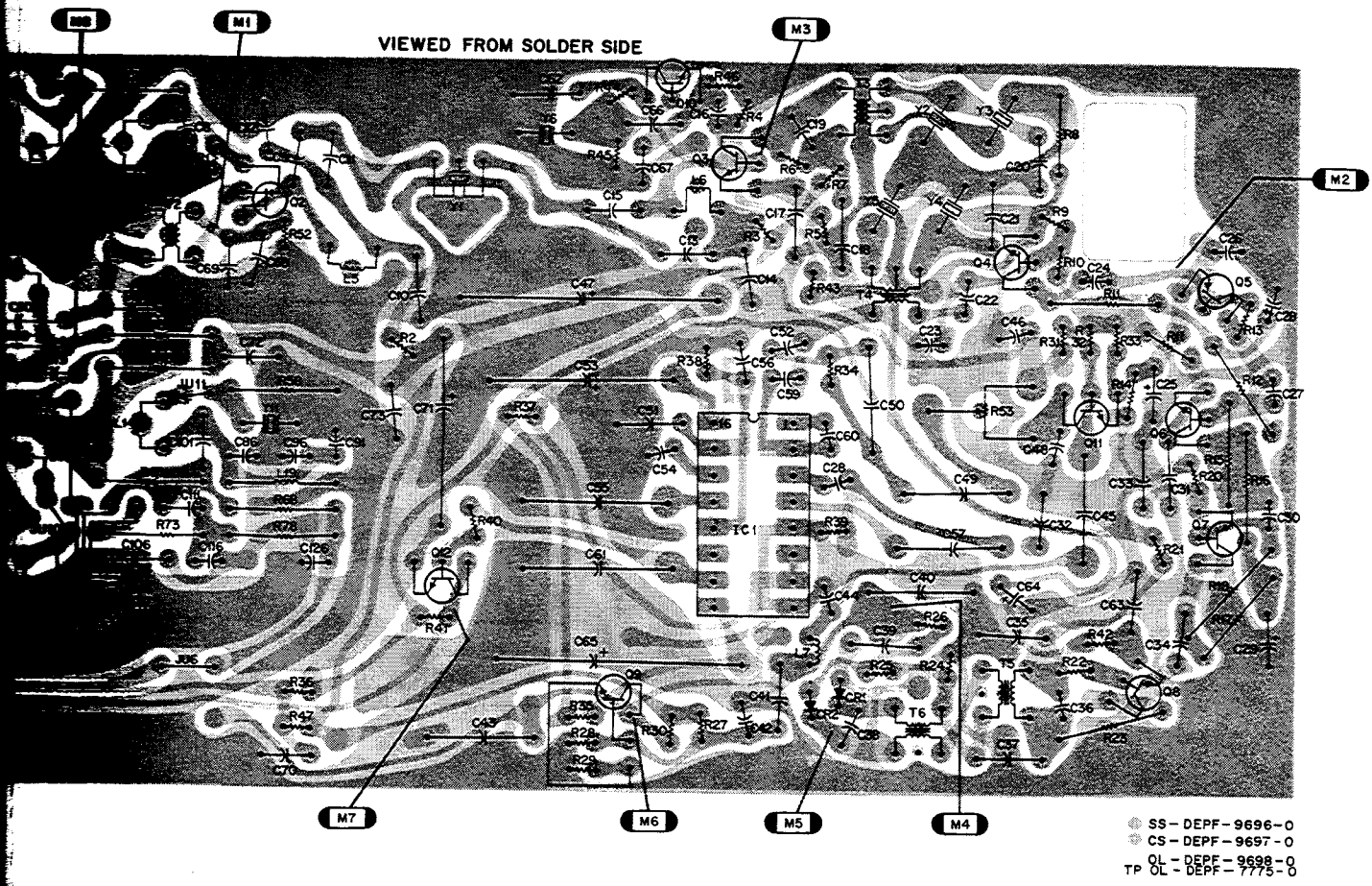
NONREFERENCED ITEMS

	0105953C99	ASSEMBLY, Connector and Bracket; includes: 0705121D01 BRACKET 2882846E02 PLUG, CONNECTOR 0300136772 SCREW, 2-56x5/16"
	0305101D01	SCREW, Phillips; 4-40x7/16"
	0300120621	SCREW, Phillips; 4-40x1/4"
	0400008434	LOCKWASHER, Split; #4
	0484345A11	WASHER, Insulator
	1483485A01	PAD, Insulator; for Y6 thru Y11
	1484743H01	PAD, Insulator; for T3 & T4
	2684800H14	SHIELD, Coil; for L1 thru 6, L9, T1, & T2
	3083361G01	CABLE, Coaxial
	4284452H02	CLAMP
	8405813H01	CIRCUIT BOARD

NOTES:

I. For optimum performance, order replacement diodes and transistors by Motorola part number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Oscillator frequency and crystal type will be found stamped on crystal can.



	0600124A65	4.7 k
	0600124B12	390 k
	0600124A89	47 k
	0600124A57	2.2 k
	0600124A73	10 k
	0600124B12	390 k
	0600124A89	47 k
	0600124A45	680
	0600124A81	22 k
	0600124A05	15
	0600124A19	56
	0600124A97	100 k
	0600124B04	180 k
	0600124A83	27 k
	0600124A89	47 k
	0600124A79	18 k
	0600124A49	1 k
	0600124A59	2.7 k
	0600124A75	12 k
	0600124A69	6.8 k
	0600124A53	1.5 k
	0600124A25	100
	0600124A57	2.2 k
	0600124A41	470
	0600124A87	39 k
	0600124A67	5.6 k
	0600124A51	1.2 k
	1884944C03	Pot., 10 k
	0600124A47	820
	0600124A79	18 k
	0600124A81	22 k
	0600124A01	10
	0600124A57	2.2 k
	0600124A73	10 k
		TRANSFORMER:
	2482827J11	Coded: YEL; Pri. -5-1/4 turns, Sec. -2-1/4 turns, includes 7682451B04 CORE
	2482045J07	455 kHz
	0105957A62	ASSEMBLY, includes: 2484235H02 COIL, 2684800H11 SHIELD, and 7682686D06 CORE

T6	0105957A64	ASSEMBLY, includes: 2484235H01 COIL, 2684800H11 SHIELD, and 7682686D06 CORE
		CRYSTAL: See Note II
Y1	9105898C02	Ceramic, 10.7 MHz
Y2	4883192C22	Resonator, 459.4 kHz
Y3	4883192C13	Resonator, 450.3 kHz
Y4	4883192C22	Resonator, 459.4 kHz
Y5	4883192C13	Resonator, 450.3 kHz
Y6	4884224C07	10.245 MHz
	or 4884224C08	11.155 MHz
Y7 thru 11	KXN6034A	150.8-174 MHz

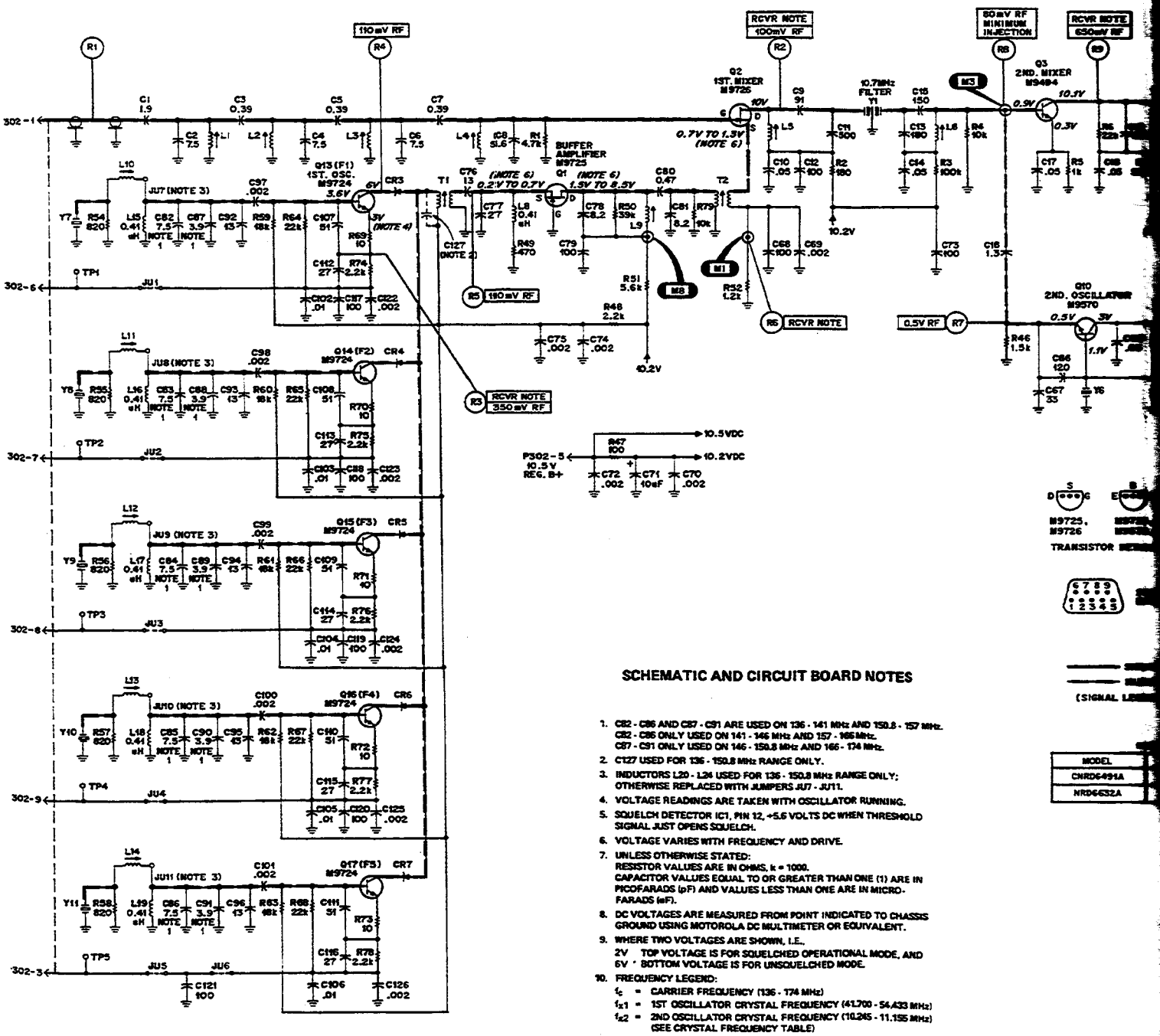
NONREFERENCED ITEMS

	0105953C99	ASSEMBLY, Connector and Bracket; includes: 0705121D01 BRACKET 2882846E02 PLUG, CONNECTOR 0300136772 SCREW, 2-56x5/16"
	0305101D01	SCREW, Phillips; 4-40x7/16"
	0300120621	SCREW, Phillips; 4-40x1/4"
	0400008434	LOCKWASHER, Split; #4
	0484345A11	WASHER, Insulator
	1483485A01	PAD, Insulator; for Y6 thru Y11
	1484743H01	PAD, Insulator; for T3 & T4
	2684800H14	SHIELD, Coil; for L1 thru 6, L9, T1, & T2
	3083361G01	CABLE, Coaxial
	4284452H02	CLAMP
	8405813H01	CIRCUIT BOARD

NOTES:

I. For optimum performance, order replacement diodes and transistors by Motorola part number only.

II. When ordering crystal units, specify carrier frequency(s), crystal frequency(s), and crystal type number. Oscillator frequency and crystal type will be found stamped on crystal can.

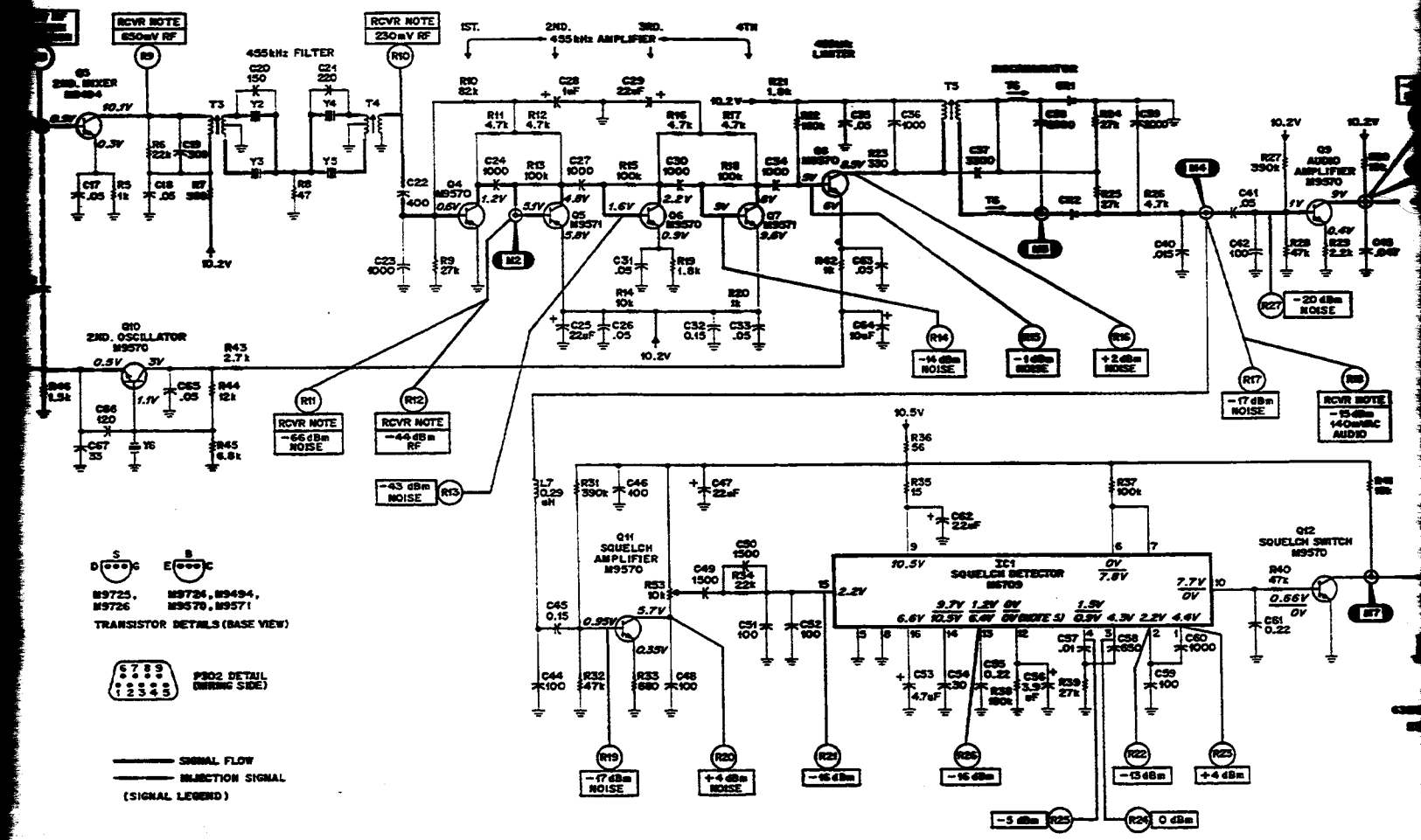


MODEL
CNRD6491A
NRD6632A

SCHEMATIC AND CIRCUIT BOARD NOTES

1. C82 - C86 AND C87 - C91 ARE USED ON 136 - 141 MHz AND 150.8 - 157 MHz.
   C82 - C86 ONLY USED ON 141 - 146 MHz AND 157 - 165 MHz.
   C87 - C91 ONLY USED ON 146 - 150.8 MHz AND 165 - 174 MHz.
2. C127 USED FOR 136 - 150.8 MHz RANGE ONLY.
3. INDUCTORS L20 - L24 USED FOR 136 - 150.8 MHz RANGE ONLY;
   OTHERWISE REPLACED WITH JUMPERS JU7 - JU11.
4. VOLTAGE READINGS ARE TAKEN WITH OSCILLATOR RUNNING.
5. SQUELCH DETECTOR IC1, PIN 12, +5.6 VOLTS DC WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH.
6. VOLTAGE VARIES WITH FREQUENCY AND DRIVE.
7. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, k = 1000.
   CAPACITOR VALUES EQUAL TO OR GREATER THAN ONE (1) ARE IN PICOFARADS (pF) AND VALUES LESS THAN ONE ARE IN MICROFARADS (uF).
8. DC VOLTAGES ARE MEASURED FROM POINT INDICATED TO CHASSIS GROUND USING MOTOROLA DC MULTIMETER OR EQUIVALENT.
9. WHERE TWO VOLTAGES ARE SHOWN, I.E.,
   2V TOP VOLTAGE IS FOR SQUELCHED OPERATIONAL MODE, AND
   6V ' BOTTOM VOLTAGE IS FOR UNSQUELCHED MODE.
10. FREQUENCY LEGEND:
    f_c = CARRIER FREQUENCY (136 - 174 MHz)
    f_{x1} = 1ST OSCILLATOR CRYSTAL FREQUENCY (41.700 - 54.433 MHz)
    f_{x2} = 2ND OSCILLATOR CRYSTAL FREQUENCY (10.245 - 11.155 MHz) (SEE CRYSTAL FREQUENCY TABLE)
    f_1 = HIGH INTERMEDIATE FREQUENCY (10.7 MHz)
    f_2 = LOW INTERMEDIATE FREQUENCY (455 kHz)
    $f_c = 3f_{x1} + 10.7$ MHz
    $f_1 = f_{x2} + f_2$ (FOR f_{x2} = 10.245 MHz)
    $f_1 = f_{x2} - f_2$ (FOR f_{x2} = 11.155 MHz)

EPF-7991-A



MODEL TABLE

MODEL	FREQ.
CNRD6491A	136–150.8 MHz
NRD6632A	150.8–174 MHz

STAGE GAIN MEASUREMENT NOTES

GENERAL

1. 0 dBm = 1 mW INTO 600 OHMS.
2. REFER TO APPLICABLE MONITOR-RECEIVER SCHEMATIC AND MONITOR-RECEIVER GAIN MEASUREMENTS SECTION IN INSTRUCTION MANUAL FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL INFORMATION.
3. MAKE THE FOLLOWING MEASUREMENTS:

- (R1) CONNECT RF SIGNAL GENERATOR TO RF INPUT AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.
- (R2) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.
- (R3) READING WITH ONE OSCILLATOR RUNNING. GROUND TP1, TP2, TP3, TP4, OR TP5 AS APPLICABLE.
- (R6) SHORT Q3 (BUFFER AMPL) COLLECTOR TO GROUND WITH A 0.002 uF CAPACITOR. THE CHANGE IN VOLTAGE AT (R6) SHOULD BE GREATER THAN 0.02 V DC.
- (R9) (R10) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV FOR THESE READINGS.
- (R12) SET RF SIGNAL GENERATOR LEVEL TO 3.0 uV FOR THIS READING (USE AC VOLTMETER FOR MEASUREMENT).
- (R13) thru (R26) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.
- (R19) thru (R26) ADJUST SQUELCH CONTROL FOR FULL SQUELCH.
- (R18) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

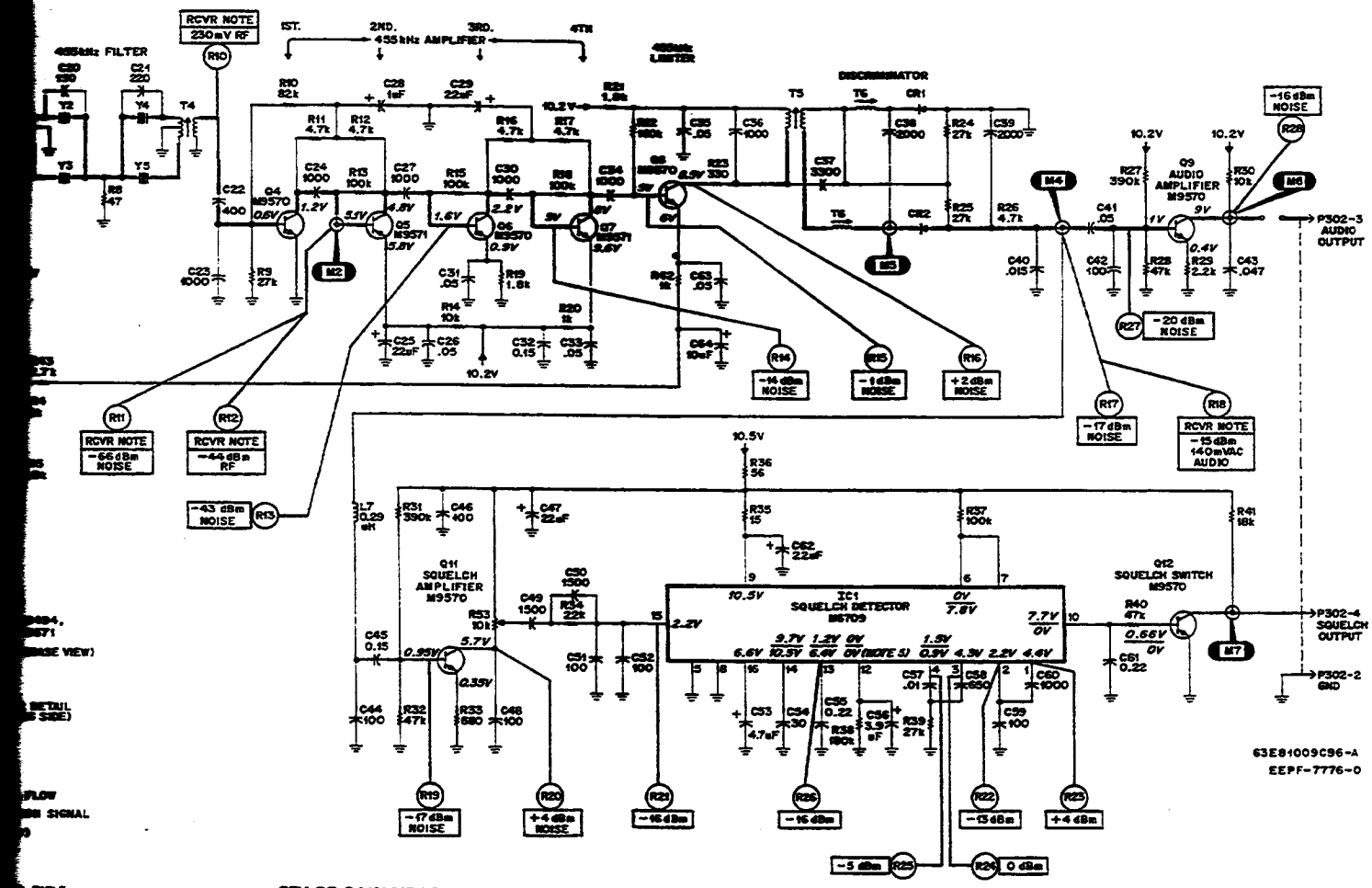
EPF-7177-C

CRYSTAL FREQUENCY TABLE

CARRIER FREQUENCY (f_c)	1ST OSCILLATOR CRYSTAL FREQUENCY (f_{x1})	2ND OSCILLATOR FREQUENCY (f_{x2})
136.00 - 150.80 MHz	41.700 - 46.700 MHz	10.245 MHz
150.80 - 153.30 MHz	46.700 - 47.533 MHz	10.245 MHz
153.33 - 154.80 MHz	47.543 - 48.033 MHz	11.155 MHz
154.83 - 162.69 MHz	48.043 - 50.663 MHz	10.245 MHz
162.72 - 166.20 MHz	50.673 - 51.833 MHz	11.155 MHz
166.23 - 174.00 MHz	51.843 - 54.433 MHz	10.245 MHz

EPF-7232-A

VHF MOBILE DETECTOR SCHEMATIC DIAGRA



STAGE GAIN MEASUREMENT NOTES

GENERAL

1. 0 dBm = 1 mW INTO 600 OHMS.
2. REFER TO APPLICABLE MONITOR-RECEIVER SCHEMATIC AND MONITOR-RECEIVER GAIN MEASUREMENTS SECTION IN INSTRUCTION MANUAL FOR RECOMMENDED TEST EQUIPMENT AND ADDITIONAL INFORMATION.
3. MAKE THE FOLLOWING MEASUREMENTS:

(R1) CONNECT RF SIGNAL GENERATOR TO RF INPUT AND LEAVE CONNECTED FOR ALL RECEIVER MEASUREMENTS.

(R2) SET RF SIGNAL GENERATOR LEVEL TO 10 mV FOR THIS READING.

(R3) READING WITH ONE OSCILLATOR RUNNING. GROUND TP1, TP2, TP3, TP4, OR TP5 AS APPLICABLE.

(R6) SHORT Q3 (BUFFER AMPL) COLLECTOR TO GROUND WITH A 0.002 uF CAPACITOR. THE CHANGE IN VOLTAGE AT (R6) SHOULD BE GREATER THAN 0.02 V DC.

(R9) (R10) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV FOR THESE READINGS.

(R12) SET RF SIGNAL GENERATOR LEVEL TO 3.0 mV FOR THIS READING (USE AC VOLTMETER FOR MEASUREMENT).

(R13) thru (R24) SET RF SIGNAL GENERATOR LEVEL TO MINIMUM AND FREQUENCY OFF CHANNEL. FOR SOME OF THESE TEST POINTS THERE IS AN ADDITIONAL REQUIREMENT GIVEN BELOW.

(R19) thru (R26) ADJUST SQUELCH CONTROL FOR FULL SQUELCH.

(R18) SET RF SIGNAL GENERATOR LEVEL TO 1.0 mV AND MODULATE WITH 1 kHz TONE AT 3.3 kHz DEVIATION.

EPF-7177-O

CRYSTAL FREQUENCY TABLE

CARRIER FREQUENCY (f_c)	1ST OSCILLATOR CRYSTAL FREQUENCY (f_{x1})	2ND OSCILLATOR FREQUENCY (f_{x2})
136.00 - 150.80 MHz	41.700 - 46.700 MHz	10.245 MHz
150.80 - 153.30 MHz	46.700 - 47.533 MHz	10.245 MHz
153.33 - 154.80 MHz	47.543 - 48.033 MHz	11.155 MHz
154.83 - 162.69 MHz	48.043 - 50.663 MHz	10.245 MHz
162.72 - 166.20 MHz	50.673 - 51.833 MHz	11.155 MHz
166.23 - 174.00 MHz	51.843 - 54.433 MHz	10.245 MHz

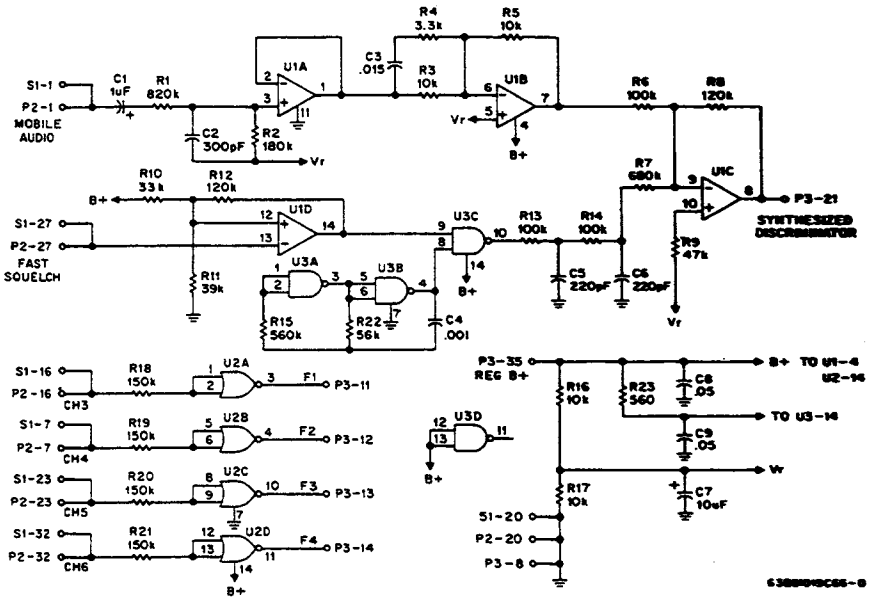
EPF-7992-A

VHF MOBILE DETECTOR SCHEMATIC DIAGRAM

ZKN6039A Aerotron Interface Cable Kit

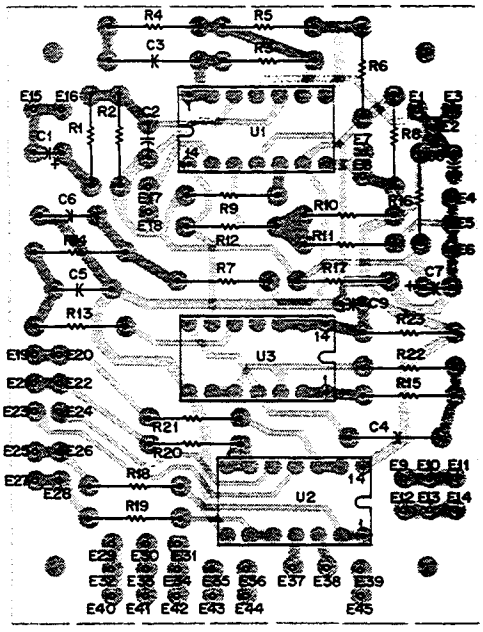
PLF-1631-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF ±20% 25 V; unless stated
C1	2383441B29	1; 20 V
C2	2183162401	300 pF; temperature compensated, Monolithic
C3	0882096J14	0.015 + 10%; 250 V
C4	0882096J16	0.001 - 10%; 250 V
C5, 6	2183596E10	220 pF; 500 V
C7	2383441B27	10; 15 V
C8, 9	2184008H13	0.05; 25 V
		RESISTOR, Fixed: Ω ±5%; 1/4 W unless stated:
R1	0600124B20	820 k
R2	0600124B04	180 k
R3, 5, 16, 17	0600124A73	10 k
R4	0600124A61	3.3 k
R6, 13, 14	0600124A97	100 k
R7	0600124B18	680 k
R8, 12	0600124A99	120 k
R9	0600124A89	47 k
R10	0600124A85	33 k
R11	0600124A87	39 k
R15	0600124B16	560 k
R18, 19, 20, 21	0600124B02	150 k
R22	0600124A91	56 k
R23	0600124A43	560
		INTEGRATED CIRCUIT:
U1	5184621K21	Quad, Op Amp, type MC3403
U2	5182822F03	Quad, 2-in NOR, CMOS type MC14001
U3	5182822F08	Quad 2-in NAND, CMOS type MC14011
NONREFERENCED ITEMS		
	0105776H01	CONNECTOR
	4282018H02	STRAIN RELIEF, Medium
	4282018H03	STRAIN RELIEF, Large
	4282018H16	STRAIN RELIEF, Small
	3005635D01	CABLE, 7 conductor
	3000858513	CABLE, 13 conductor
	3084875E01	CABLE, 27 conductor
	4210217A02	TIE WRAP
	0200119450	NUT: 8-32 x 1/4
	0400007651	WASHER: 8-32
	0305781H01	SCREW, Special: 8-32
	0200007019	NUT, 4-40 x 1/4
	0300008022	SCREW, 4-40 x 1/4
	0400007683	WASHER: No. 4
	0300136701	SCREW, Mounting: 6-32x5/16
	0400007650	WASHER, Mounting
	0300001452	SCREW, 4-40 x 1/2
	0705769H01	BACK PANEL
	0705768H01	FRONT PANEL
	1505774H01	HOUSING
	0984086B01	RECEPTACLE, female: 37 line
	0984151B03	RECEPTACLE CONNECTOR
	0984151B05	RECEPTACLE CONNECTOR
	0984151B06	RECEPTACLE CONNECTOR
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	1583293K01	RECEPTACLE, Connector, Molex
	1482882A01	FUSE BODY
	1482883A01	FUSE CAP
	4182885A01	FUSE SPRING
	4282884A01	FUSE CLIP
	6500052293	FUSE, 5-amp: fast
	6605770H01	TOOL: pin removal
	4305782H01	SPACER
	8405751H01	CIRCUIT BOARD

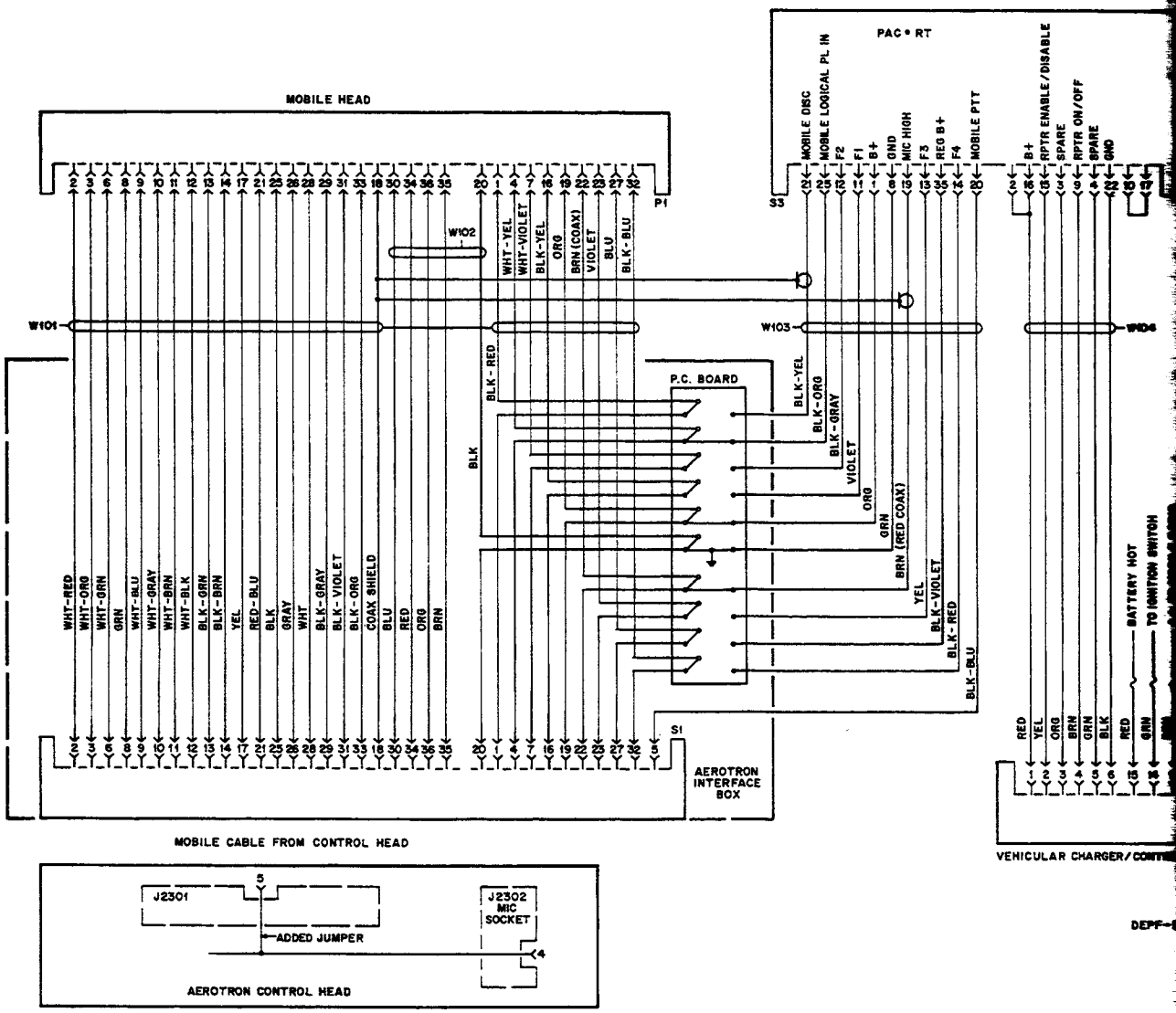


E3	W103	BLK-VIOLET
E4	W102	BLK
E5	S1	BLK
E6	W103	GRN
E8	W103	BLK-YEL
E9	W101	ORG
E10	S1	ORG
E11	W103	ORG
E15	W101	BLK-RED
E16	S1	BLK-RED
E17	S1	BLU
E18	W101	BLU
E19	W101	BLK-BLU
E20	S1	BLK-BLU
E21	S1	VIOLET
E22	W101	VIOLET
E23	W103	BLK-RED
E24	W103	YEL
E25	S1	BLK-YEL
E26	W101	BLK-YEL
E27	S1	WHT-VIOLET
E28	W101	WHT-VIOLET
E29	S1	SHIELD
E30	W103	BRN (COAX)
E31	W101	WHT-YEL
E32	W103	SHIELD (TACK SOLDER W103 DRAIN TO S1 SHIELD)
E33	S1	BRN (COAX)
E34	S1	WHT-YEL
E37	W103	BLK-GRAY
E38	W103	VIOLET
E40	W101	SHIELD
E41	W101	BRN (COAX)
E42	W103	BLK-ORG

VIEWED FROM SOLDER SIDE

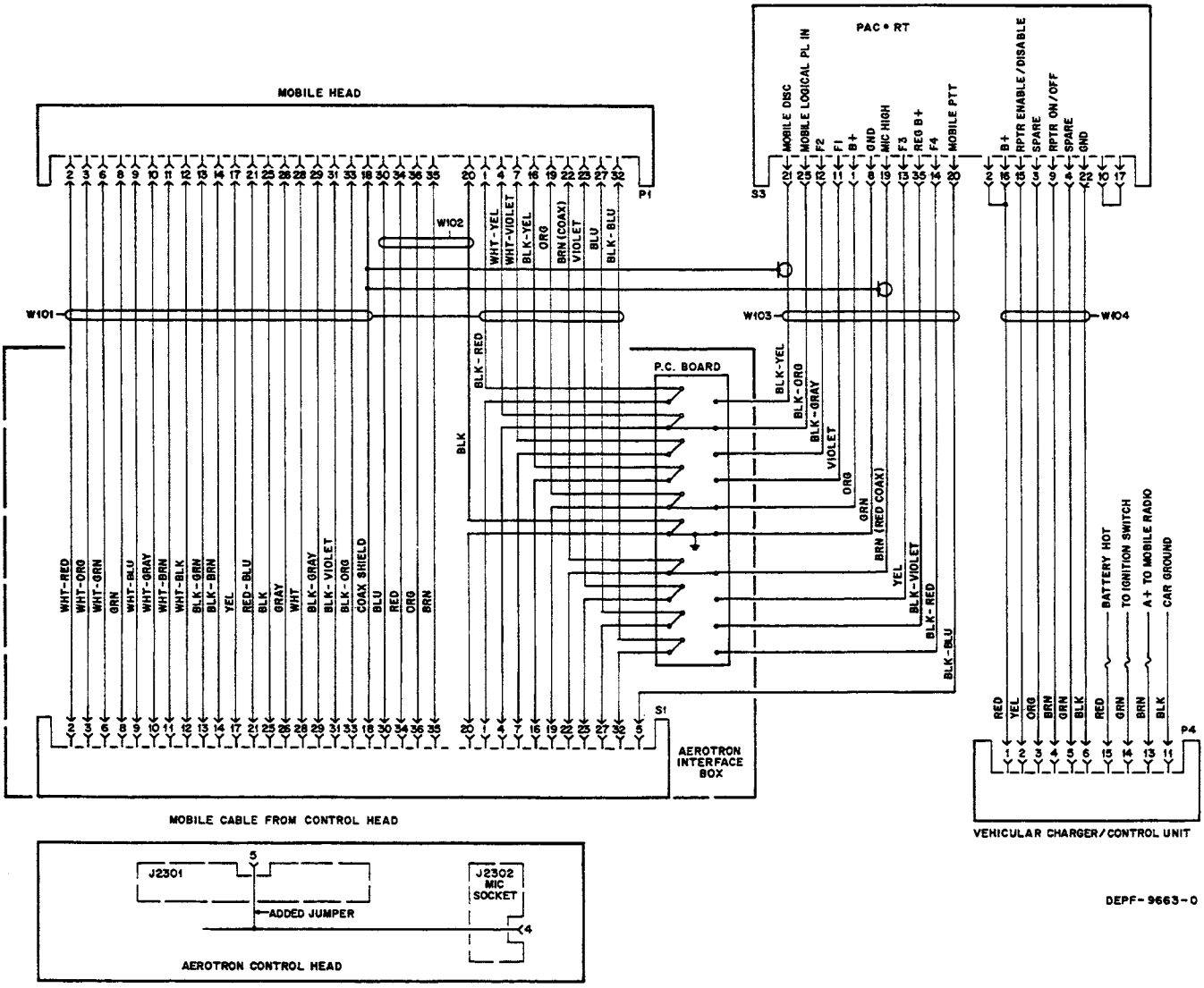


SS-CEPF-9699-O
CS-CEPF-9700-O
OL-CEPF-9701-O

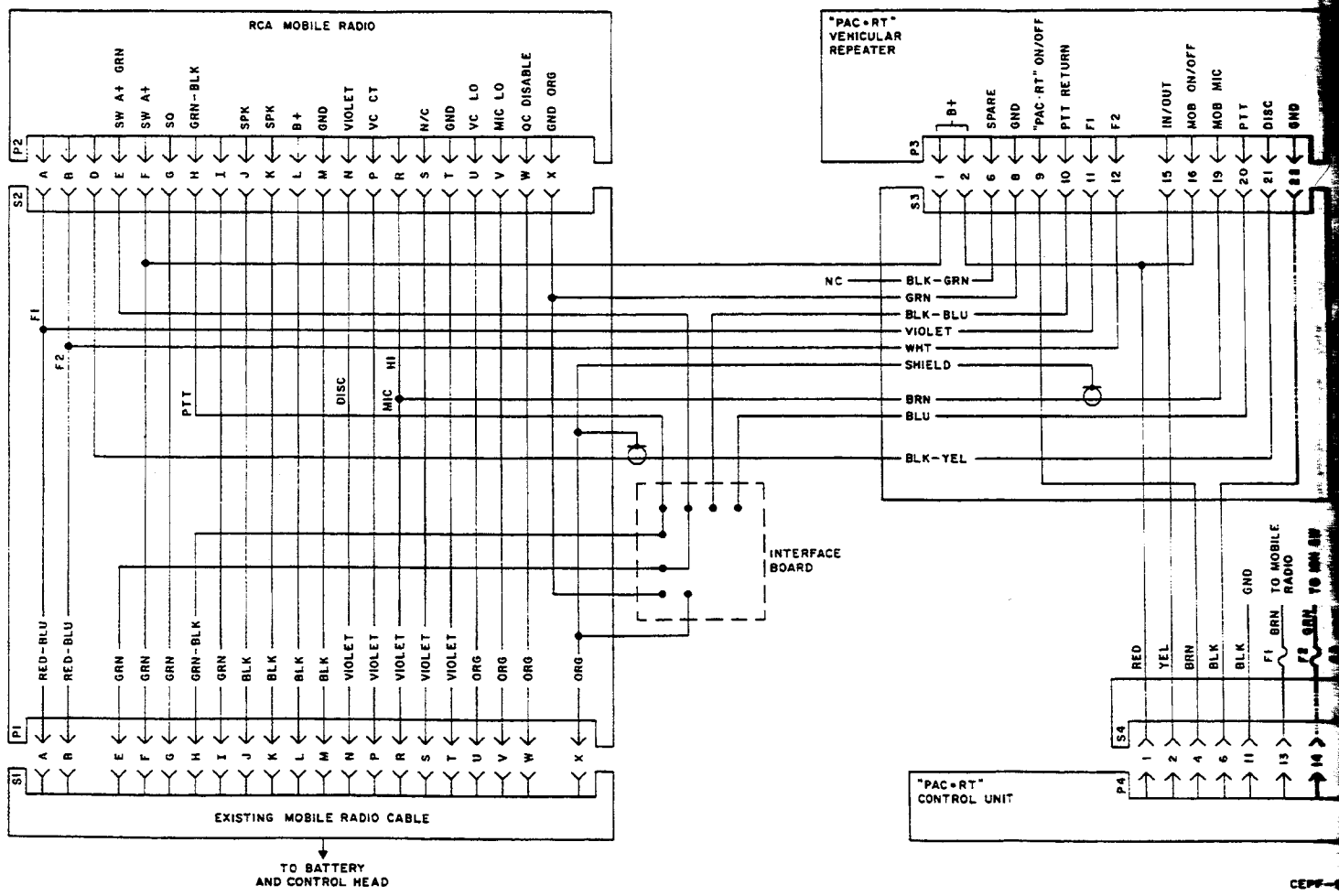


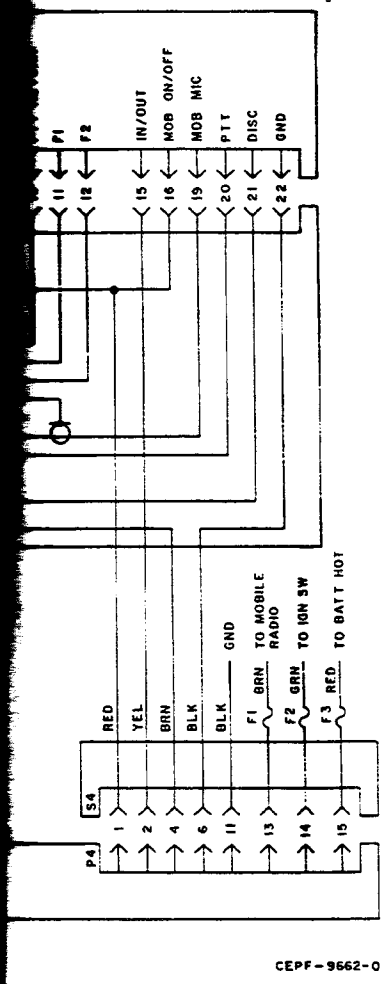
CEPF-9699-0
CEPF-9700-0
CEPF-9701-0

AEROTRON INTERFACE CABLE SCHEMATIC, CIRCUIT BOARD LAYOUT, AND INTERCABLING DIAGRAMS, AND PARTS LIST



AEROTRON INTERFACE CABLE SCHEMATIC, CIRCUIT BOARD LAYOUT, AND INTERCABLING DIAGRAMS, AND PARTS LIST


RCA MOBILE RADIO
"PAC•RT" VEHICULAR REPEATER
P2
P3
S2
S3
P1
S1
S4
P4
A
B
D
E
F
G
H
I
J
K
L
M
N
P
R
S
T
U
V
W
X
SW A+ GRN
SW A+
SO
GRN-BLK
SPK
SPK
B+
GND
VIOLET
VC CT
N/C
GND
VC LO
MIC LO
QC DISABLE
GND ORG
B+
SPARE
GND
"PAC-RT" ON/OFF
PTT RETURN
F1
F2
IN/OUT
MOB ON/OFF
MOB MIC
PTT
DISC
GND
NC
BLK-GRN
GRN
BLK-BLU
VIOLET
WHT
SHIELD
BRN
BLU
BLK-YEL
F1
F2
PTT
DISC
MIC HI
INTERFACE BOARD
RED-BLU
RED-BLU
GRN
GRN-BLK
BLK
VIOLET
ORG
RED
YEL
BRN
BLK
GND
F1 BRN
TO MOBILE RADIO
"PAC•RT" CONTROL UNIT
EXISTING MOBILE RADIO CABLE
TO BATTERY AND CONTROL HEAD

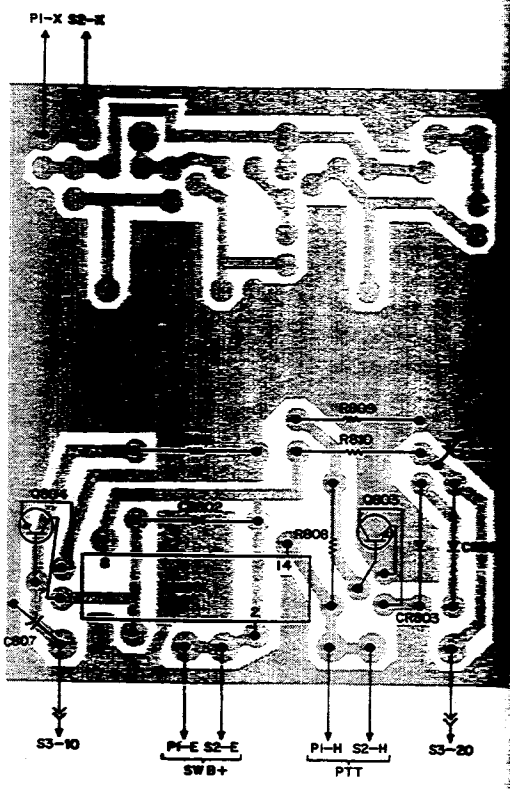


CEPF-9662-O

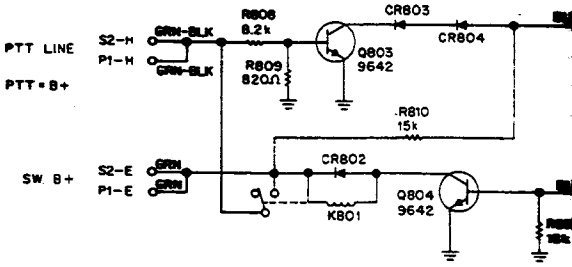
ZKN6040A RCA Interface Cable Kit PLF-1632-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C806, 807	2182213E21	CAPACITOR: 0.002 uF
CR802, 803, 804	4883654H01	DIODE: See Note Silicon
K801	8005837E01	RELAY: Coil, voltage: 12 V, res:500 Ω
Q803, 804	4800869642	TRANSISTOR: See Note NPN: type M9642
		RESISTOR, Fixed: Ω ±5% 1/4 W unless stated
R808	0600124A71	8.2 k
R809	0600124A47	820
R810	0600124A77	15 k
R811	0600124A79	18 k
	NONREFERENCED ITEMS	
	0300007131	SCREW, Set: 10-32 x 1/2
	0300121103	SCREW, Phillips: 6-32 x 3/8
	0300138901	SCREW, Phillips: 6-32 x 5/8
	0905601E02	RECEPTACLE, Connector
	0984086B01	RECEPTACLE, Female, 37-line
	0984151B03	CONTACT, Receptacle
	0984151B05	CONTACT, Receptacle: plated
	0984151B06	CONTACT, Receptacle
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	1505600E01	HOUSING, Connector
	2805602E02	PLUG, Connector
	3000864650	CABLE, 17-conductor
	3005635D01	CABLE, 7-conductor
	2984706E05	TERMINAL, male: Molex
	1583293K01	RECEPTACLE, Connector: Molex
	5405807H01	WARNING LABEL
	1482882A01	FUSE BODY
	1482883A01	FUSE CAP
	4182885A01	FUSE SPRING
	4282884A01	FUSE CLIP
	6500052293	FUSE, 5A: fast
	8405791E01	PC BOARD

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.



SS-CEPF-7926-O
OL-CEPF-9635-O

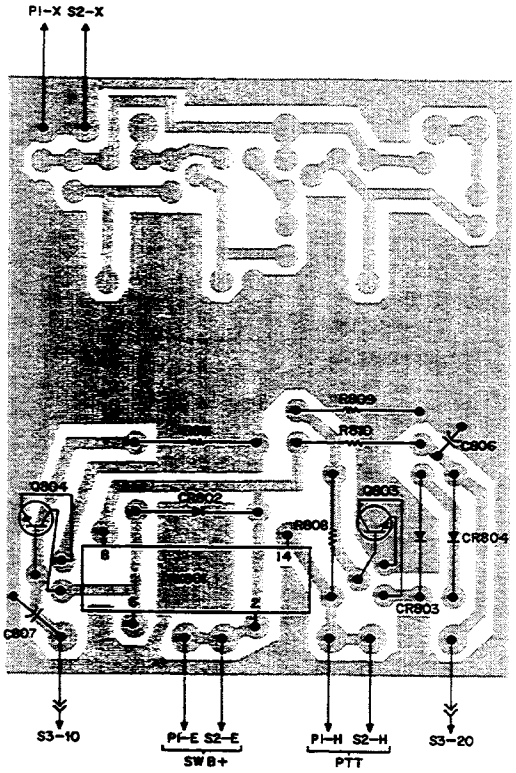


RCA INTERFAC
SCHEMATIC, CIRCUIT BOARD I
AND INTERCABLING DIAGRAMS, AND PA

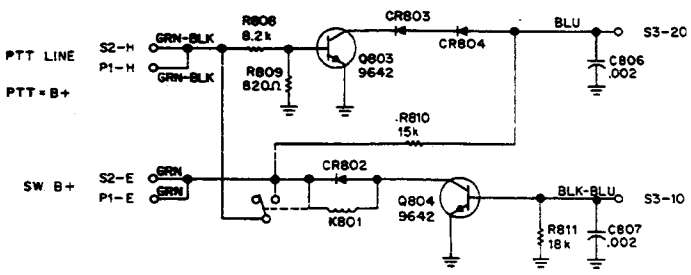
ZKN6040A RCA Interface Cable Kit PLF-1632-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR:
C806, 807	2182213E21	0.002 uF
		DIODE: See Note
CR802, 803, 804	4883654H01	Silicon
		RELAY:
K801	8005837E01	Coil, voltage: 12 V, res:500 Ω
		TRANSISTOR: See Note
Q803, 804	4800869642	NPN: type M9642
		RESISTOR, Fixed: Ω ±5% 1/4 W unless stated
R808	0600124A71	8.2 k
R809	0600124A47	820
R810	0600124A77	15 k
R811	0600124A79	18 k
	NONREFERENCED ITEMS	
	0300007131	SCREW, Set: 10-32 x 1/2
	0300121103	SCREW, Phillips: 6-32 x 3/8
	0300138901	SCREW, Phillips: 6-32 x 5/8
	0905601E02	RECEPTACLE, Connector
	0984086B01	RECEPTACLE, Female, 37-line
	0984151B03	CONTACT, Receptacle
	0984151B05	CONTACT, Receptacle: plated
	0984151B06	CONTACT, Receptacle
	1505572D01	HOUSING, Front
	1505573D01	HOUSING, Rear
	1505600E01	HOUSING, Connector
	2805602E02	PLUG, Connector
	3000864650	CABLE, 17-conductor
	3005635D01	CABLE, 7-conductor
	2984706E05	TERMINAL, male: Molex
	1583293K01	RECEPTACLE, Connector: Molex
	5405807H01	WARNING LABEL
	1482882A01	FUSE BODY
	1482883A01	FUSE CAP
	4182885A01	FUSE SPRING
	4282884A01	FUSE CLIP
	6500052293	FUSE, 5A: fast
	8405791E01	PC BOARD

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.



©SS-CEPF-7924-O
OL-CEPF-9695-O

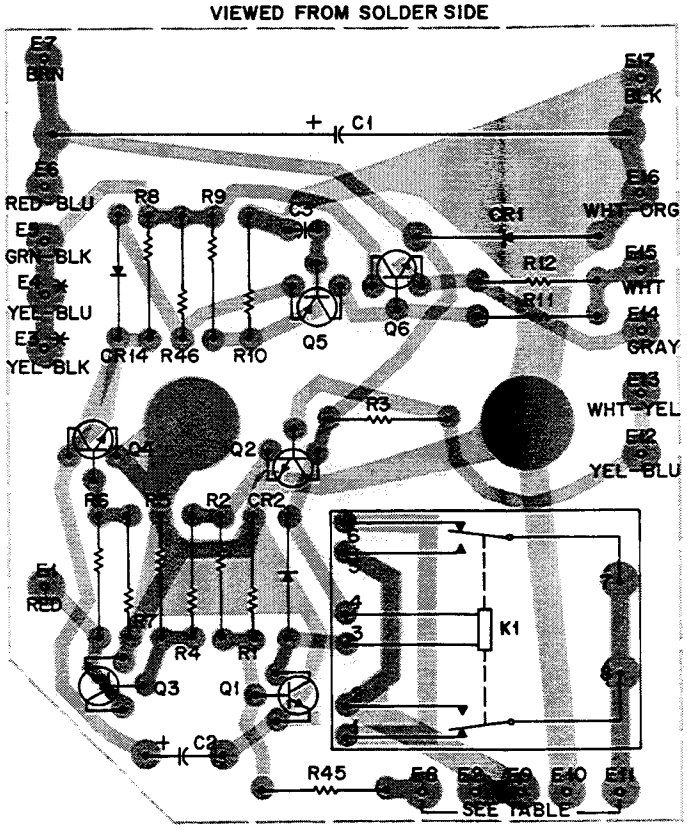


63881019C67-O

RCA INTERFACE CABLE SCHEMATIC, CIRCUIT BOARD LAYOUT, AND INTERCABLING DIAGRAMS, AND PARTS LIST

CONTROL UNIT CIRCUIT BOARD

VIEWED FROM SOLDER SIDE

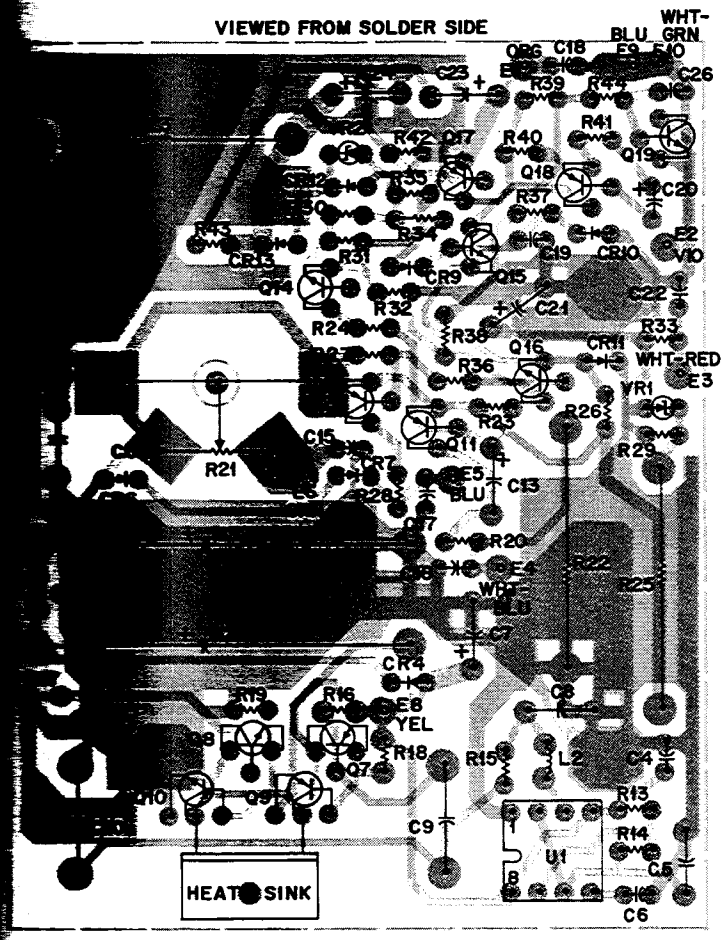


✳ = FROM CONNECTOR

E8	RED-BLK	E2	YEL-BLK
E9	WHT-GRN	E10	BLU
E11	BRN-GRN		

SS-CEPF-9682-0
CS-CEPF-9683-0
OL-CEPF-9684-0

RAPID CHARGER CIRCUIT BOARD



SS-CEPF-9685-0
CS-CEPF-9686-0
OL-CEPF-9687-0

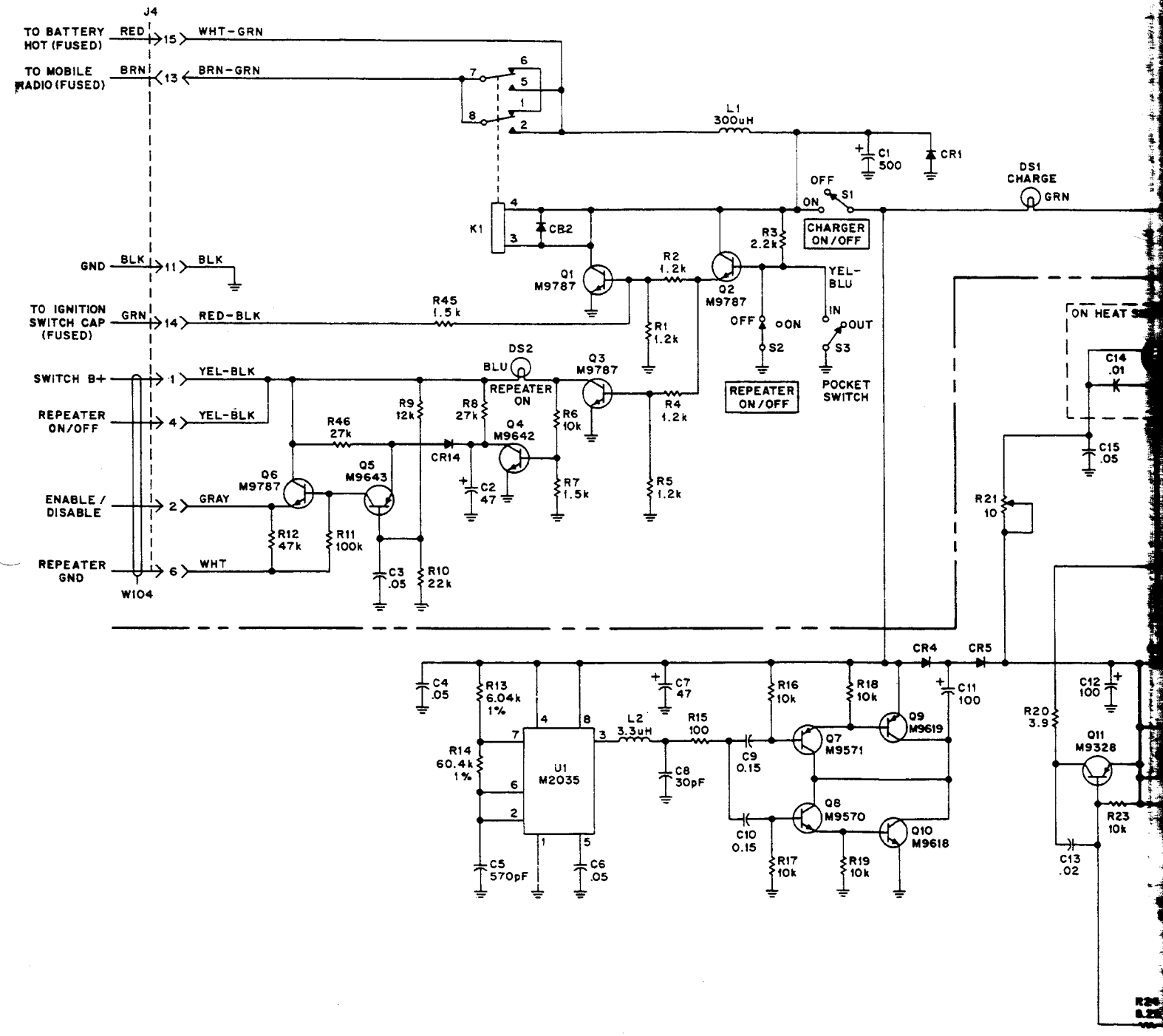
ZLN6353A Control Unit/Rapid Charger PLF-1630-O

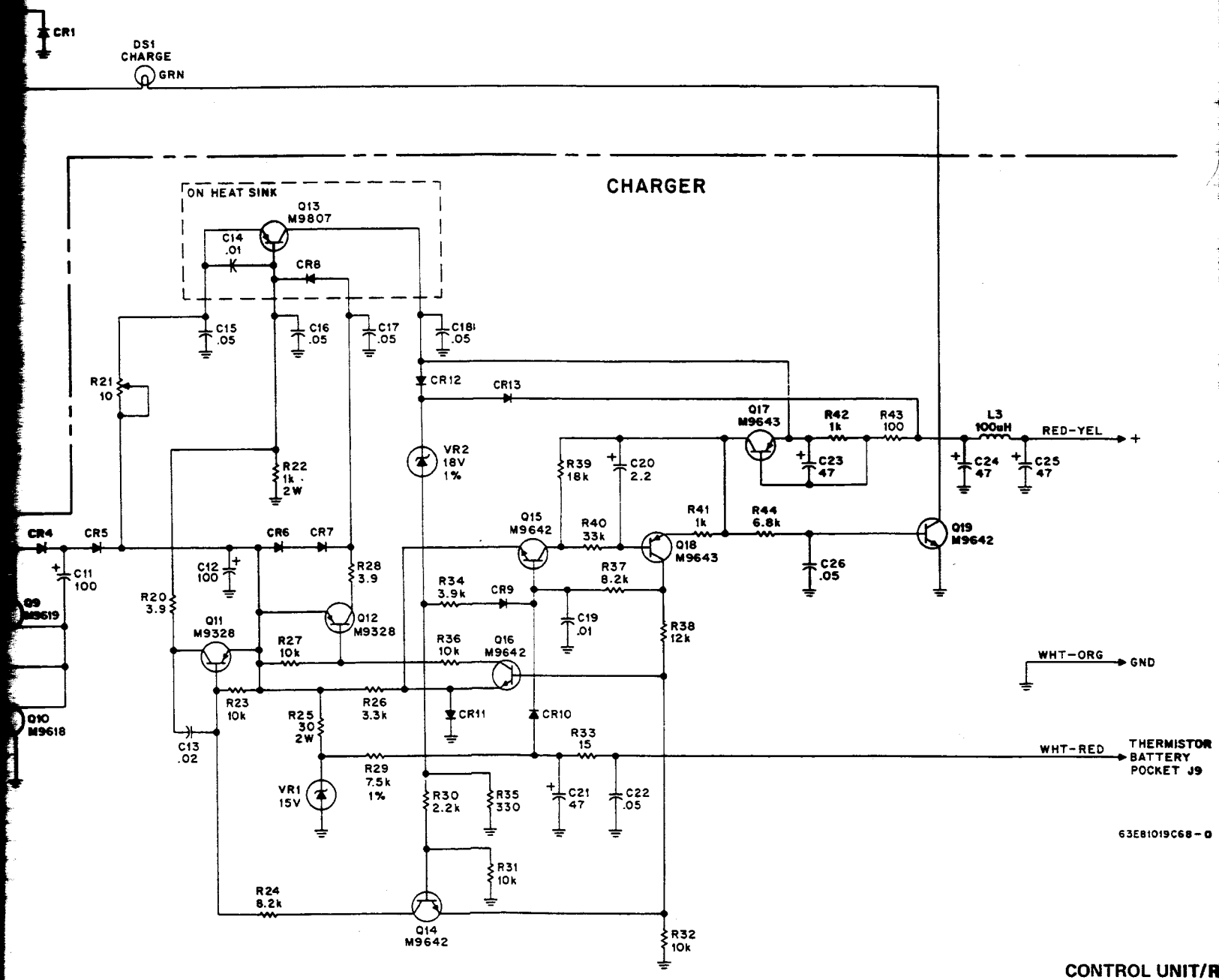
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF ±20% 25 V; unless stated
C1	2383210A19	500; 20 V
C2	2383441B32	47; 20 V
C3, 4, 6, 15, 16 17, 18, 22, 26	2184008H13	0.05
C5	2182633E17	570 pF 5%; 100 V
C7, 21, 23, 24, 25	2383441B32	47; 20 V
C8	2182133G75	30 pF 5%; 100 V
C9, 10	0882905G05	0.15; 50 V
C11, 12	2382077C01	100; 35 V
C13	2182428B18	0.02
C14	2182428B59	0.01 -20+80%; 200 V
C19	2184008H16	0.01 ±5%; 50 V
C20	2383441B12	2.2; 6 V
		DIODE: See Note
CR1	4805349C01	Silicon
CR2, 14	4883654H01	Silicon
CR4, 5	4805648E01	Fast Switching
CR6, 7, 8, 12, 13	4882466H13	Silicon
CR9, 10, 11	4883654H01	Silicon
		RELAY:
K1	8005416D01	Dual Form C
		COIL, RF: unless stated
L1	2582180B01	Choke, filter; 300 uH
L2	2482549D35	Choke, 3.3 uH
L3	2400848627	Choke, Hash Filter; 100 uH
		TRANSISTOR: See Note
Q1, 2, 3, 6	4800869787	NPN; type M9787
Q4, 14, 15, 16, 19	4800869642	NPN; type M9642
Q5, 17, 18	4800869643	NPN; type M9643
Q7	4800869571	NPN; type M9571
Q8	4800869570	NPN; type M9570
Q9	4800869619	NPN; type M9619
Q10	4800869618	NPN; type M9618
Q11, 12	4800869328	NPN; type M9328
Q13	4800869807	NPN; type M9807
		RESISTOR, Fixed: Ω ±5%; 1/4 W unless stated
R1, 2, 4, 5	0600124A51	1.2 k
R3	0600124A57	2.2 k
R6	0600124A73	10 k
R7, 45	0600124A53	1.5 k
R8, 46	0600124A83	27 k
R9, 38	0600124A75	12 k
R10	0600124A81	22 k
R11	0600124A97	100 k
R12	0600124A89	47 k
R13	0683175C86	6.04 k ±1%
R14	0683175C64	60.4 k ±1%
R15, 43	0600124A25	100
R16, 17, 18, 19 23, 27, 31, 32, 36	0600124A73	10 k
R20, 28	0600124B59	3.9
R21	1805821E01	Pot. 10
R22	0600127C49	1 k ±10%; 2 W
R24, 37	0600124A71	8.2 k
R25	0600127C37	330 ±10%, 2 W
R26	0600124A61	3.3 k
R29	0683175C89	7.5 k ±1%
R30	0600124A57	2.2 k
R33	0600124A05	15
R34	0600124A63	3.9 k
R35	0600124A37	330
R39	0600124A79	18 k
R40	0600124A85	33 k
R41, 42	0600124A49	1 k
R44	0600124A69	6.8 k
		DIODE: See Note
VR1	4882256C59	15 V Zener
VR2	4883461E33	18 V Zener
		INTEGRATED CIRCUIT:
U1	5184320A35	Timer, NE555; type M2035

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NONREFERENCED ITEMS
	0105953D11	HEATSINK
	0200007019	NUT, 4-40 x 1/4
	0200120487	NUT, Hex; #2
	0200009627	NUT, 4-40 x 3/16
	0200001354	NUT, Hex; 4-40
	0305662D01	SCREW, Captive; 4-40
	0300131979	SCREW, 4-40 x 7/16
	0300138012	SCREW, 2-56 x 7/16
	0300008022	SCREW, 4-40 x 1/4
	0300008158	SCREW, Tapping; 4-24 x 1/4
	0300134185	SCREW, Tapping; 6-32 x 1/4
	0300136523	SCREW, 4-40 x 7/8
	0400008412	LOCKWASHER, Split; # 4
	0400007683	LOCKWASHER, # 4
	0400009777	LOCKWASHER, Split, # 4
	0400007667	LOCKWASHER, Ext. Tooth #4
	0400002625	LOCKWASHER, Split, #2
	0410057A13	WASHER, Special
	0400490124	WASHER, Flat
	0500001652	RIVET, .008 x 5/32
	0500006843	RIVET, .088 x 3/16
	0500135634	RIVET, .088 x 1/8
	0705763H01	BRACKET, Transistor mounting
	0705766H01	BRACKET, for L1
	1305557D05	ESCUTCHEON
	1483780H04	INSULATOR
	1405536E02	INSULATOR, for Q13
	1405780H01	INSULATOR, charger pocket
	1583053A03	HOUSING
	1583292K01	RECEPTACLE, Housing (Molex)
	2984706E06	TERMINAL, Pin (Molex)
	3100122887	TERMINAL STRIP
	3100131861	TERMINAL STRIP
	3700132251	SLEEVING, BLACK
	3700132049	SLEEVING, CLEAR; Shrink
	3905116G01	CONTACT, charger
	3905590D01	CONTACT SPRING
	4183052A01	SPRING
	4205571F01	RETAINER, component
	4282143C03	CABLE CLIP
	4210240A04	MOUNTING CLIP, for L1
	4384379C01	SPACER, stand-off
	4305782H01	SPACER
	6405772H01	BACKPLATE
	8405764H01	CIRCUIT BOARD; control unit
	8405765H01	CIRCUIT BOARD; charger unit

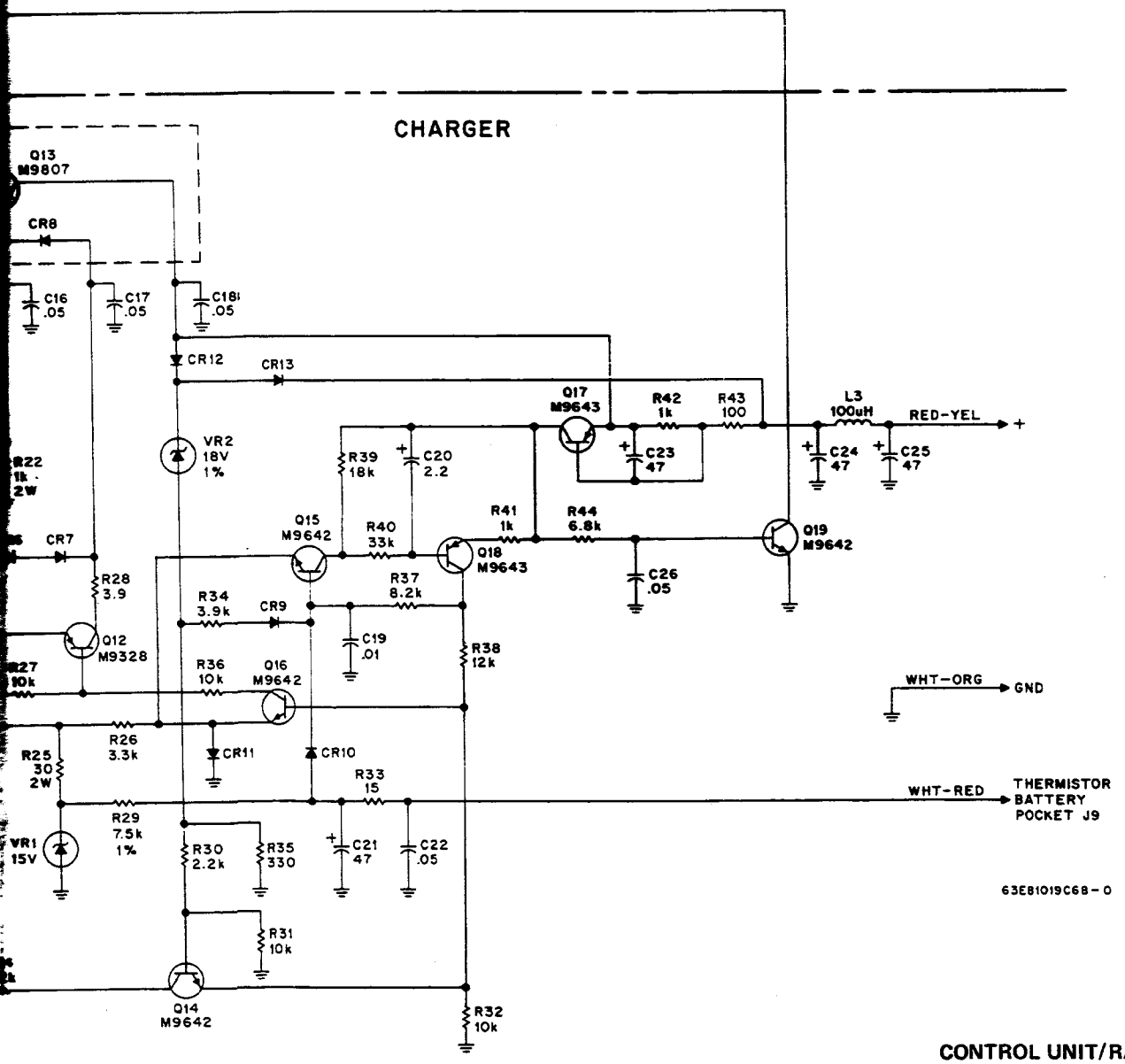
NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.

CONTROL UNIT

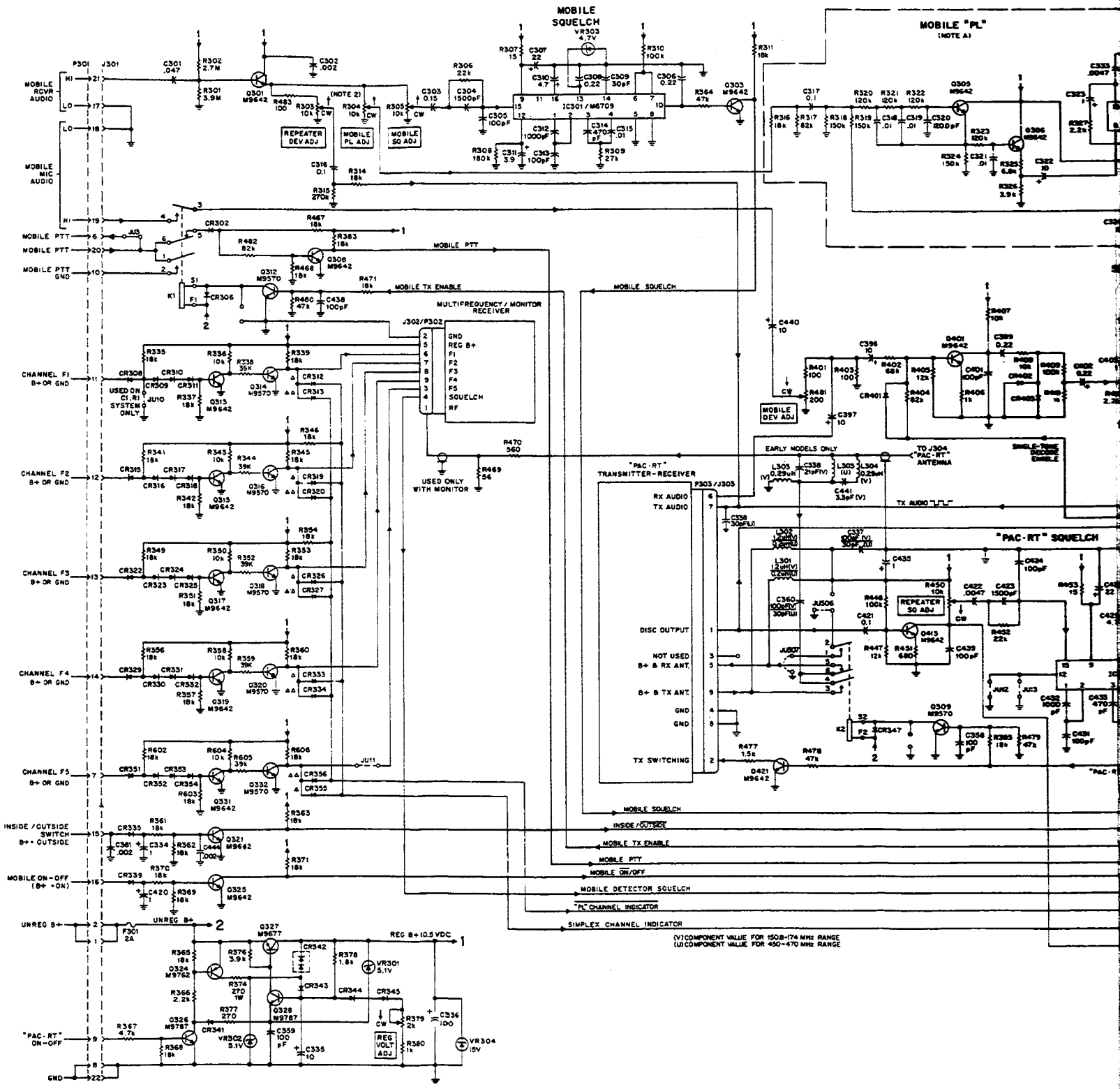


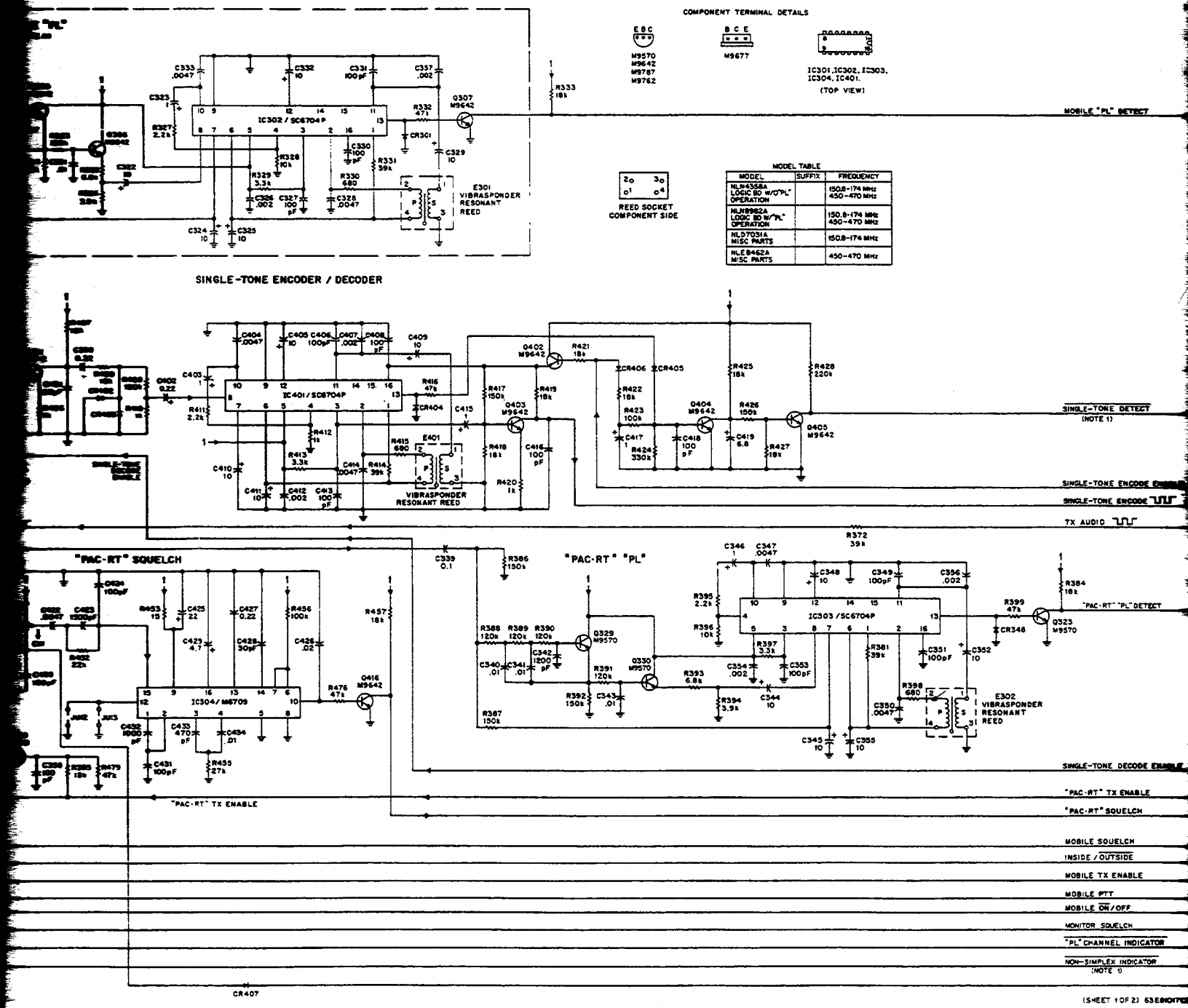


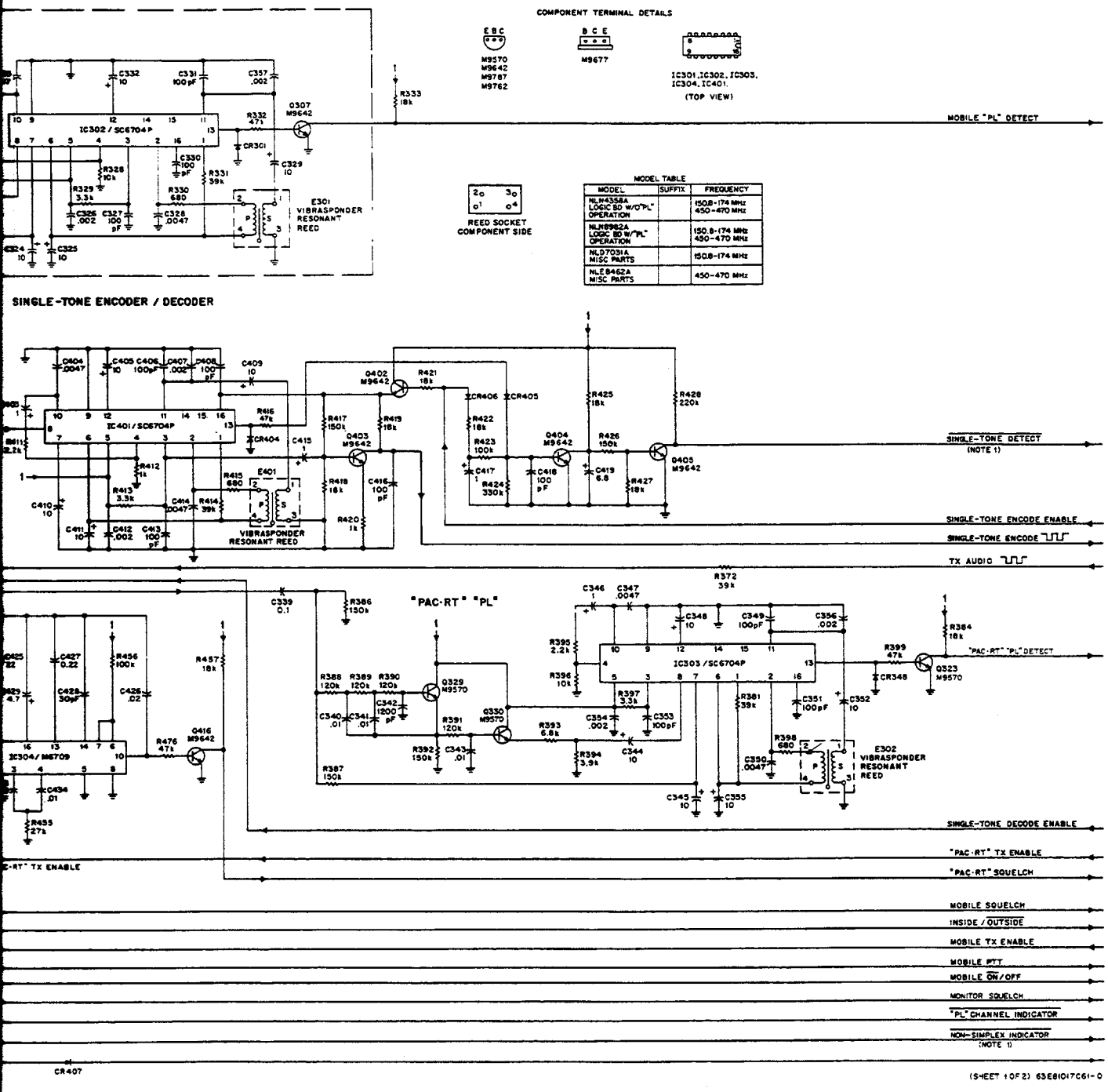
CONTROL UNIT/R
SCHEM



CONTROL UNIT/RAPID CHARGER
SCHEMATIC DIAGRAM


MOBILE SQUELCH
MOBILE "PL"
(NOTE A)
MOBILE RCVR AUDIO
MOBILE MIC AUDIO
MOBILE PTT
MOBILE PTT GND
REPEATER DEV ADJ
MOBILE PL ADJ
MOBILE SQ ADJ
MOBILE TX ENABLE
MOBILE SQUELCH
MULTIFREQUENCY / MONITOR RECEIVER
J302/P302
GND
REG B+
FI
F2
F3
F4
F5
SQUELCH
RF
CHANNEL F1 B+ OR GND
CHANNEL F2 B+ OR GND
CHANNEL F3 B+ OR GND
CHANNEL F4 B+ OR GND
CHANNEL F5 B+ OR GND
USED ON C1, R1 SYSTEM ONLY
USED ONLY WITH MONITOR
MOBILE DEV ADJ
EARLY MODELS ONLY
TO J304 "PAC-RT" ANTENNA
"PAC-RT" TRANSMITTER-RECEIVER
P303/J303
RX AUDIO
TX AUDIO
DISC OUTPUT
NOT USED
8+ & RX ANT.
8+ & TX ANT.
GND
GND
TX SWITCHING
TX AUDIO
"PAC-RT" SQUELCH
REPEATER SQ ADJ
INSIDE / OUTSIDE SWITCH
8+ = OUTSIDE
MOBILE ON-OFF (8+ = ON)
UNREG 8+
REG 8+10.5 VDC
"PAC-RT" ON-OFF
GND
MOBILE SQUELCH
INSIDE / OUTSIDE
MOBILE TX ENABLE
MOBILE PTT
MOBILE ON/OFF
MOBILE DETECTOR SQUELCH
"PL" CHANNEL INDICATOR
SIMPLEX CHANNEL INDICATOR
REG VOLT ADJ
(V) COMPONENT VALUE FOR 150.8-174 MHz RANGE
(U) COMPONENT VALUE FOR 450-470 MHz RANGE


COMPONENT TERMINAL DETAILS
M9570
M9642
M9787
M9762
M9677
IC301, IC302, IC303,
IC304, IC401.
(TOP VIEW)
REED SOCKET
COMPONENT SIDE
MODEL TABLE
MODEL | SUFFIX | FREQUENCY
NLN4358A LOGIC BD W/O "PL" OPERATION | | 150.8-174 MHz 450-470 MHz
NLN8982A LOGIC BD W/ "PL" OPERATION | | 150.8-174 MHz 450-470 MHz
NLD7031A MISC PARTS | | 150.8-174 MHz
NLE8462A MISC PARTS | | 450-470 MHz
IC302 / SC6704P
E301 VIBRASPONDER RESONANT REED
MOBILE "PL" DETECT
SINGLE-TONE ENCODER / DECODER
IC401 / SC6704P
E401 VIBRASPONDER RESONANT REED
SINGLE-TONE DETECT (NOTE 1)
SINGLE-TONE ENCODE ENABLE
SINGLE-TONE ENCODE
TX AUDIO
"PAC-RT" SQUELCH
IC304 / M6709
"PAC-RT" TX ENABLE
"PAC-RT" "PL"
IC303 / SC6704P
E302 VIBRASPONDER RESONANT REED
"PAC-RT" "PL" DETECT
SINGLE-TONE DECODE ENABLE
"PAC-RT" TX ENABLE
"PAC-RT" SQUELCH
MOBILE SQUELCH
INSIDE / OUTSIDE
MOBILE TX ENABLE
MOBILE PTT
MOBILE ON / OFF
MONITOR SQUELCH
"PL" CHANNEL INDICATOR
NON-SIMPLEX INDICATOR (NOTE 1)
CR407
(SHEET 1 OF 2) 63E8407F



VEHICULAR REPEATER MAIN LOGIC BOARD SCHEMATIC DIAGRAM (Sheet 1 of 2)

SCHEMATIC NOTES

1. THE BAR ABOVE "LOGIC LINE IDENTIFIERS" IMPLIES A LOGICAL ZERO (GND); AND AN "IDENTIFIER" WITHOUT A BAR IMPLIES A LOGICAL ONE (REG. B+) WHEN THE NAMED CONDITION EXISTS.
2. USED FOR MOBILE "PL" OPERATION ONLY.
3. USED ON SOME EARLIER MODELS WITH LOW BAND MONITOR ONLY. IF UHF MONITOR IS USED, REPLACE C338 WITH L304 & C441.
4. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TRANSMITTER AND "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 3 FOR "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 4 FOR OPERATION WITHOUT TIME-OUT TIMER.
5. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT SIDE PLATING AT U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE TRANSMISSION" OPTION.
6. UNLESS OTHERWISE STATED:
   RESISTOR VALUES ARE IN OHMS, k = 1000;
   CAPACITOR VALUES ARE IN MICROFARADS (uF);
   INDUCTOR VALUES ARE IN HENRYS (H).
7. WHERE COMPONENTS ARE FREQUENCY SENSITIVE, "V" AND "U" ARE USED. "V" DESIGNATES COMPONENT VALUE FOR 150.8-174 MHz RANGE AND "U" IS FOR 450-470 MHz RANGE.
8. ALL LOGIC IC CIRCUITRY IS 500 LEVEL REFERENCE SYMBOL DESIGNATION.
9. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL ONLY.
   △△ INSTALLED FOR "PL" CHANNELS ONLY.

EPF-6861-C

"PAC•RT" "PL" AND MOBILE "PL" TEST MEASUREMENTS

PROBE POINT	DC VOLTS	AC VOLTS	
	DECODE	DECODE	
	VOLTS	mV	dBm
BASE OF Q329/Q305	3.4	16.0	-33.6
EM. OF Q329/Q305	3.0	16.0	-33.6
BASE OF Q330/Q306	2.8	11.5	-36.5
EM. OF Q330/Q306	2.2	11.5	-36.5
IC CHIP PIN 1	6.5	10.5	37.4
IC CHIP PIN 2	5.4	650	-2
IC CHIP PIN 3	10.5	3.0	-43.6
IC CHIP PIN 4	1.3	75	-20
IC CHIP PIN 5	10.5	3.0	-48.5
IC CHIP PIN 6	6.5	20	-31.8
IC CHIP PIN 7	7.2	.8	-59.7
IC CHIP PIN 8	.7	2.0	-42.2
IC CHIP PIN 9	-	-	-
IC CHIP PIN 10	1.3	65	-21.5
IC CHIP PIN 11	.8	65	-21.5
IC CHIP PIN 12	.05	14.5	-34.5
IC CHIP PIN 13	.1	-	-
IC CHIP PIN 14	.5	-	-
IC CHIP PIN 15	.5	-	-
IC CHIP PIN 16	0	-	-

INPUT SIGNAL 14 mV. (-35 dB) OF "PL" TONE AT R317/R386.

(0 dBm IS 1 mW ACROSS 600 OHMS)

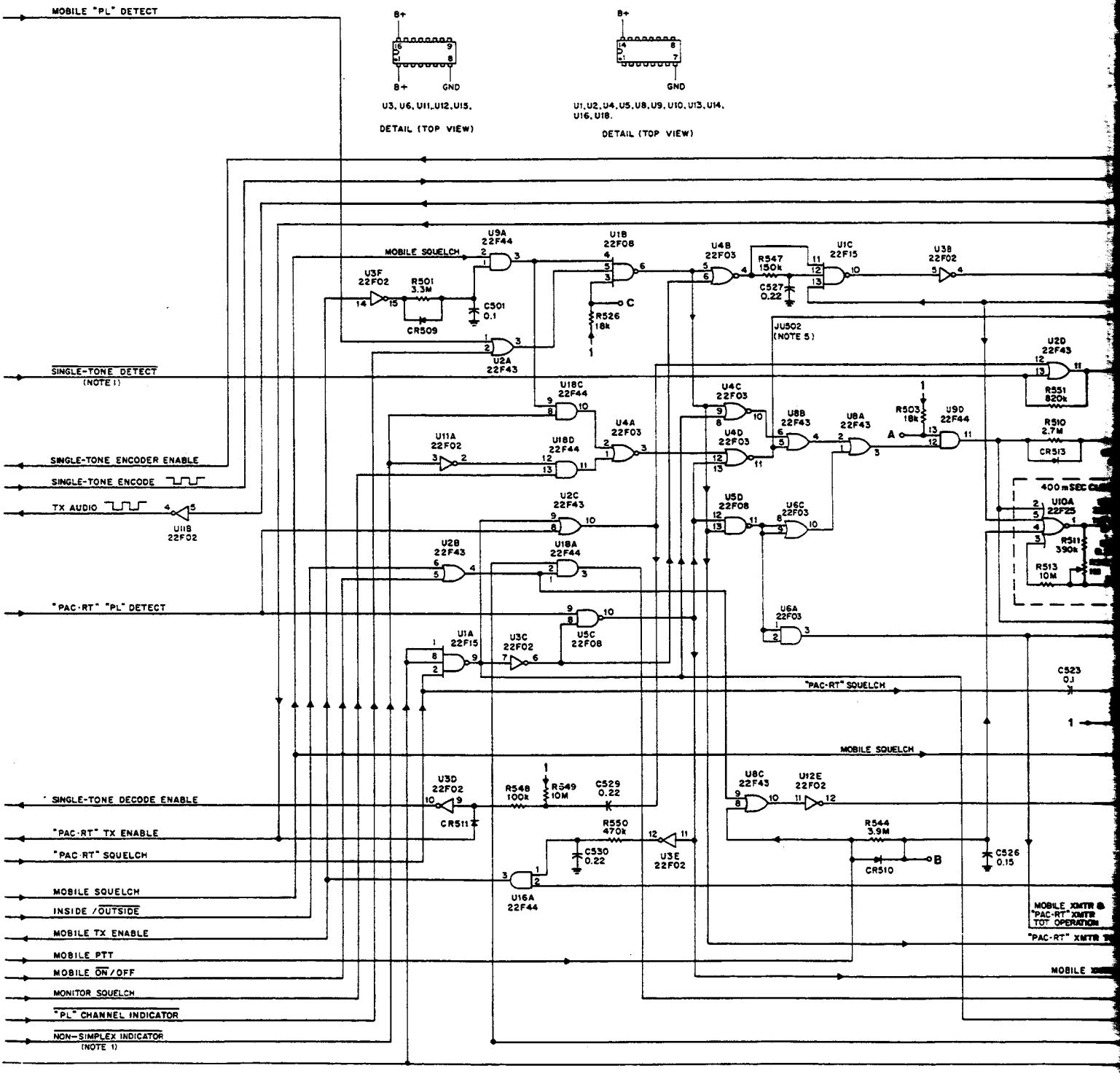
EPF-7305-O

SINGLE-TONE ENCODER/DECODER TEST MEASUREMENTS

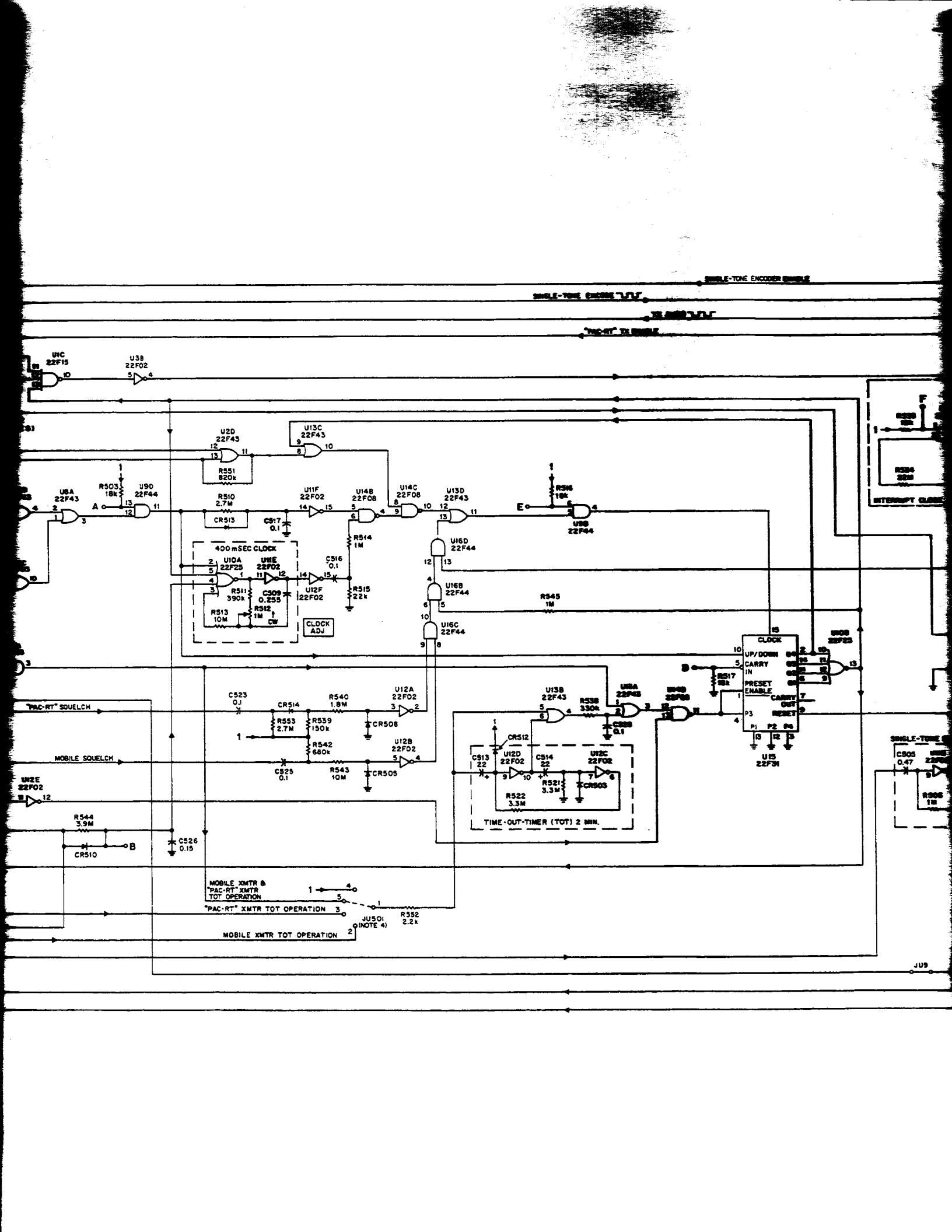
PROBE POINT	DC VOLTS		AC VOLTS			
	DECODE	ENCODE	DECODE		ENCODE	
	VOLTS	VOLTS	mV	dBm	mV	dBm
IC CHIP PIN 1	6.5	6.5	10.5	-37.4	-	-
IC CHIP PIN 2	5.4	2.9	650	-2	140	-14.7
IC CHIP PIN 3	10.5	6.0	3.0	-43.6	.6	-2
IC CHIP PIN 4	1.3	1.7	75	-20	390	-6
IC CHIP PIN 5	10.5	10.5	3.0	-48.5	-	-
IC CHIP PIN 6	6.5	3.0	20	-31.8	-	-
IC CHIP PIN 7	7.2	7.1	.8	-59.7	-	-
IC CHIP PIN 8	.7	.3	2.0	-42.2	-	-
IC CHIP PIN 9	-	-	-	-	-	-
IC CHIP PIN 10	1.3	1.4	65	-21.5	340	-7.3
IC CHIP PIN 11	.8	.8	65	-21.5	19	-32.2
IC CHIP PIN 12	.05	1.0	14.5	-34.5	-	-
IC CHIP PIN 13	.1	5.0	-	-	-	-
IC CHIP PIN 14	.5	.8	-	-	-	-
IC CHIP PIN 15	.5	.9	-	-	-	-
IC CHIP PIN 16	0	10.5	-	-	-	-

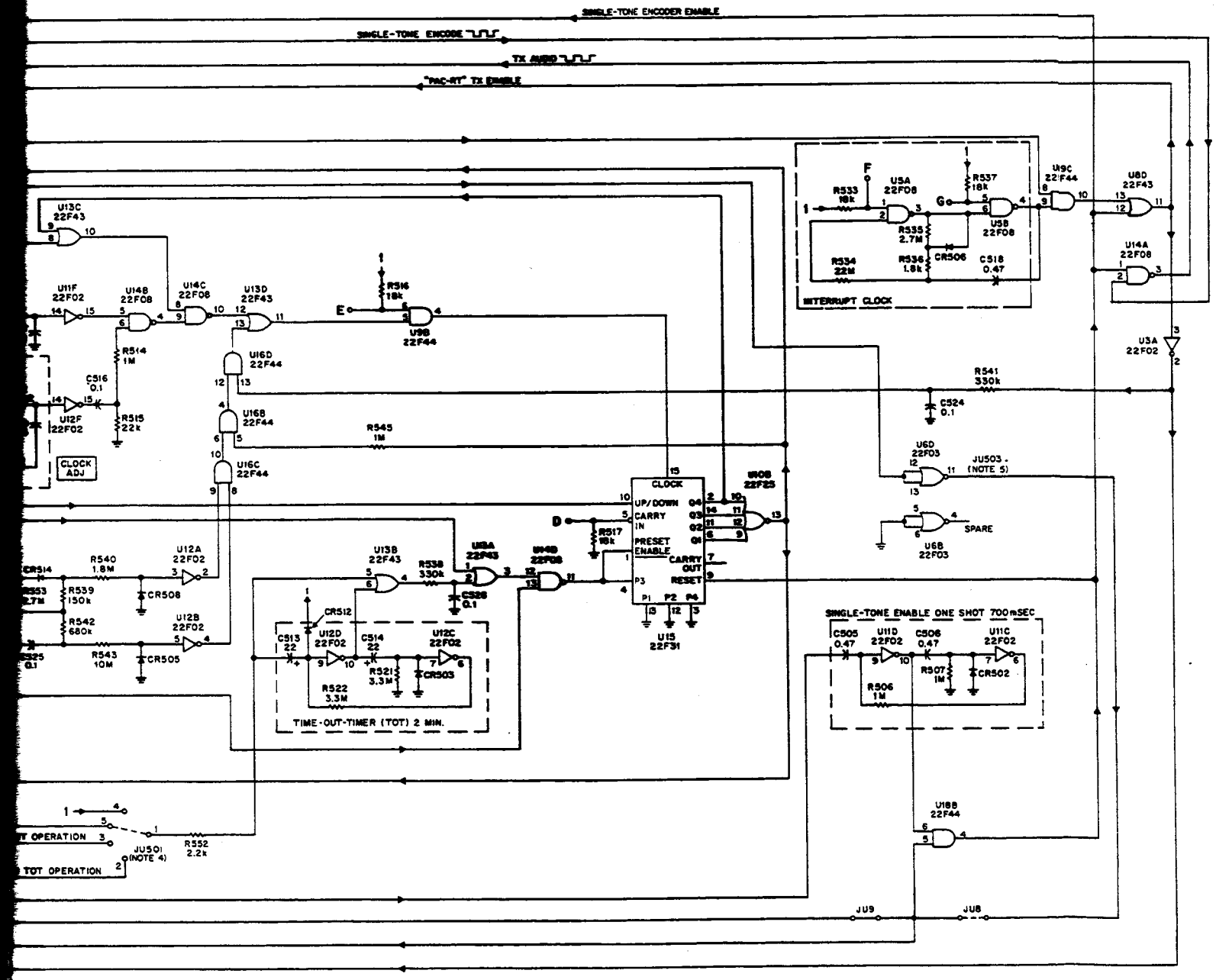
(0 dBm IS 1 mW ACROSS 600 OHMS)

EPF-7306-O



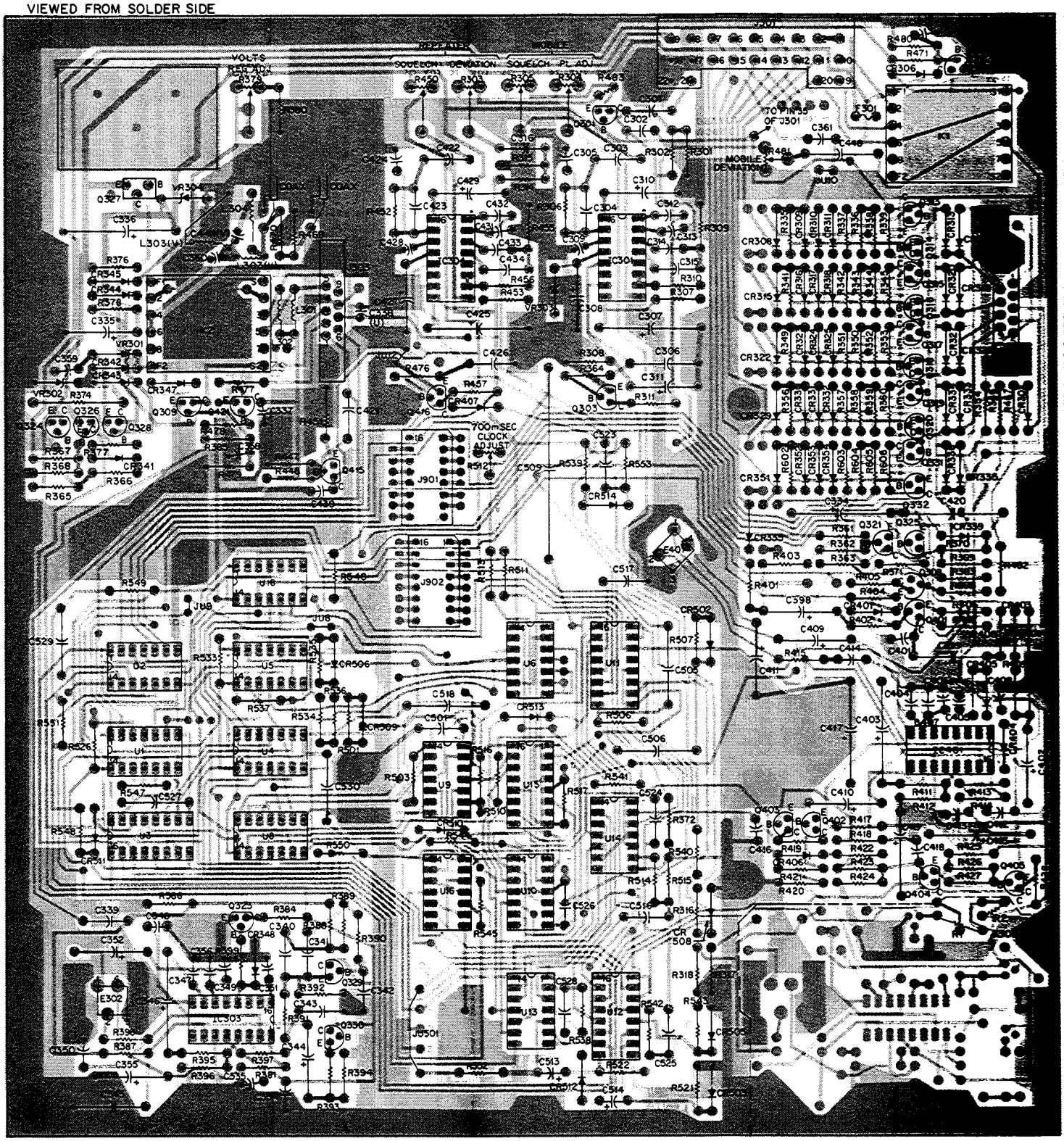
VEHICULAR REPEATER MAIN LOGIC BOARD
SCHEMATIC DIAGRAM (Sheet 2 of 2)


SINGLE-TONE ENCODER ENABLE
"PAC-RT" TX ENABLE
U1C 22F15
U3B 22F02
U2D 22F43
U13C 22F43
R551 820k
U8A 22F43
R503 18k
U9D 22F44
R510 2.7M
CR513
C517 0.1
U11F 22F02
U14B 22F08
U14C 22F08
U13D 22F43
R546 18k
U9B 22F44
400 mSEC CLOCK
U10A 22F25
U11E 22F02
C516 0.1
R511 390k
C509 0.255
R512 1M CW
R513 10M
U12F 22F02
R514 1M
R515 22k
CLOCK ADJ
U16D 22F44
U16B 22F44
R545 1M
U16C 22F44
U9C 22F25
CLOCK
UP/DOWN
CARRY IN
PRESET ENABLE
CARRY OUT
RESET
P1 P2 P4 P3
U15 22F31
R517 18k
"PAC-RT" SQUELCH
MOBILE SQUELCH
C523 0.1
CR514
R540 1.8M
U12A 22F02
R553 2.7M
R539 150k
CR508
R542 680k
U12B 22F02
C525 0.1
R543 10M
CR505
U13B 22F43
R538 330k
C538 0.1
U8A 22F43
U9B 22F44
CR512
C513 22
U12D 22F02
C514 22
U12C 22F02
R521 3.3M
CR503
R522 3.3M
TIME-OUT-TIMER (TOT) 2 MIN.
U12E 22F02
R544 3.9M
CR510
C526 0.15
MOBILE XMTR & "PAC-RT" XMTR TOT OPERATION
"PAC-RT" XMTR TOT OPERATION
JU501 (NOTE 4)
R552 2.2k
MOBILE XMTR TOT OPERATION
C505 0.47
R506 1M
SINGLE-TONE
INTERRUPT CLOSE
JU9

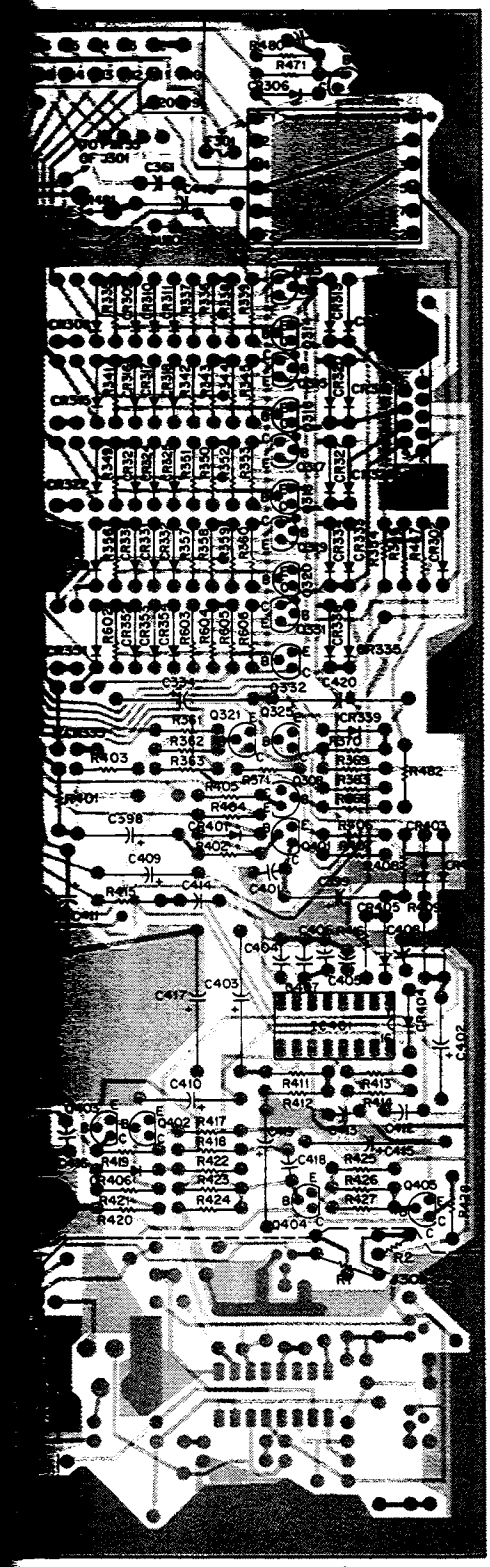


(SHEET 2 OF 2) 63E81017C61-O

VIEWED FROM SOLDER SIDE

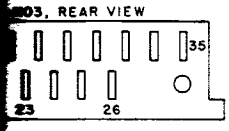


SS DEPF-9691-0
CS DEPF-9692-0
OL DEPF-9693-0



SS DEPF-9691-O
CS DEPF-9692-O
OL DEPF-9693-O

03, REAR VIEW



CIRCUIT BOARD NOTES

1. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT SIDE PLATING AT U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE TRANSMISSION" OPTION.
2. USED FOR MOBILE "PL" OPERATION ONLY.
3. USED ON SOME EARLIER MODELS WITH LOW BAND MONITOR ONLY. IF UHF MONITOR IS USED, REPLACE C338 WITH L304 & C441.
4. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TRANSMITTER AND "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 3 FOR "PAC•RT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 4 FOR OPERATION WITHOUT TIME-OUT TIMER.
5. JUMPER JU10 IS USED ON C1, R1 SYSTEM ONLY.
6. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL ONLY.
   △△ INSTALLED FOR "PL" CHANNELS ONLY.

EPF-6862-B

IC301 AND IC304 AC VOLTAGE MEASUREMENTS

NOTE
SQUELCH CONTROL FULLY CLOCKWISE. NO EXTERNAL SIGNAL APPLIED.

PIN	AC VOLTS	
	mV	dBm
1	1.23 V	+4
2	170	-13
3	770	0
4	440	-5
13	123	-16
15	123	-16

EPF-6868-O

IC301 AND IC304 DC VOLTAGE MEASUREMENTS

PIN	VOLTAGE	PIN	VOLTAGE
1	4.1 V	9	10.3 V
2	2.2 V	10	0 V USQ 6.0-9.0 V FSQ
3	4.0 V	11	---
4	0.94 V USQ 1.6 V FSQ	12	0 V
5	0 V	13	6.3 V USQ 1.1 V FSQ
6	0 V	14	10.5 V USQ 9.7 V FSQ
7	0 V	15	2.2 V
8	0 V	16	6.4 V

EPF-6857-O

VEHICULAR REPEATER MAIN LOGIC CIRCUIT BOARD LAYOUT DIAGRAM

CIRCUIT BOARD NOTES

1. ADD JUMPERS JU502 AND JU503 AND CUT COMPONENT SIDE PLATING AT U6A AND U18A WHEN NOT USING "INHIBIT SINGLE-TONE TRANSMISSION" OPTION.
2. USED FOR MOBILE "PL" OPERATION ONLY.
3. USED ON SOME EARLIER MODELS WITH LOW BAND MONITOR ONLY. IF UHF MONITOR IS USED, REPLACE C338 WITH L304 & C441.
4. CONNECT R552 FROM POINT 1 TO 5 FOR MOBILE TRANSMITTER AND "PACeRT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 3 FOR "PACeRT" TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 2 FOR MOBILE TRANSMITTER TIME-OUT TIMER OPERATION. CONNECT R552 FROM POINT 1 TO 4 FOR OPERATION WITHOUT TIME-OUT TIMER.
5. JUMPER JU10 IS USED ON C1, R1 SYSTEM ONLY.
6. LEGEND:
   △ INSTALLED FOR TWO-FREQUENCY SIMPLEX CHANNEL ONLY.
   △△ INSTALLED FOR "PL" CHANNELS ONLY.

EPF-6862-B

IC301 AND IC304 AC VOLTAGE MEASUREMENTS

NOTE SQUELCH CONTROL FULLY CLOCKWISE. NO EXTERNAL SIGNAL APPLIED.		
PIN	AC VOLTS	
	mV	dBm
1	1.23 V	+4
2	170	-13
3	770	0
4	440	-5
13	123	-16
15	123	-16

EPF-6868-O

IC301 AND IC304 DC VOLTAGE MEASUREMENTS

PIN	VOLTAGE	PIN	VOLTAGE
1	4.1 V	9	10.3 V
2	2.2 V	10	0 V USQ 6.0-9.0 V FSQ
3	4.0 V	11	---
4	0.94 V USQ 1.6 V FSQ	12	0 V
5	0 V	13	6.3 V USQ 1.1 V FSQ
6	0 V	14	10.5 V USQ 9.7 V FSQ
7	0 V	15	2.2 V
8	0 V	16	6.4 V

EPF-6857-O

VEHICULAR REPEATER MAIN LOGIC CIRCUIT BOARD LAYOUT DIAGRAM

Vehicular Repeater Main Logic Board

(V) = 150.8-174 MHz
(U) = 450-470 MHz

PLF-1076-D

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, Fixed: uF ±10% 50 V unless stated
C301	0882096J04	.047; 250 V
C302	2182428B36	.002; 200 V
C303	0882905G05	0.15
C304	0882096J06	1500 pF; 250 V
C305	2182187B29	1000 pF; 100 V
C306	0882096J20	0.22; 250 V
C307	2382256J08	22 -10 +50%; 40 V
C308	0882905G12	0.22
C309	2184511B86	30 pF
C310	2382256J07	4.7 -10 -50%; 63 V
C311	2384762H08	3.9 ±20%; 15 V
C312	2182187B29	1000 pF; 100 V
C313	2182187B29	1000 pF; 100 V
C314	2182187B39	470 pF; 500 V
C315	0882096J03	.01; 250 V
C316, 317	0882096J18	0.1; 250 V
C318, 319	0882096J03	.01; 250 V
C320	2100874352	1200 pF ±5%; 300 V
C321	0882096J03	.01; 250 V
C322	2382256J03	10; 25 V
C323	2382256J04	1; +50 -10%; 100 V
C324, 325	2382256J03	10; 25 V
C326	2182428B36	.002; 200 V
C327	2184511B24	100 pF
C328	2182428B09	.0047; 200 V
C329	2382256J03	10; 25 V
C330, 331	2184511B24	100 pF
C332	2383441B22	10 ±20%; 4 V
C333	2182428B09	.0047; 200 V
C334	2382256J04	1; +50 - 10%; 100 V
C335	2382256J03	10; 25 V
C336	2382601A25	100 +150 -10%; 20 V
C337	2184511B24	100 pF (V)
	2184511B02	30 pF; N150 (U)
C338	2184494B40	21 pF ±5%; 500 V (V)
	2184511B02	30 pF; N150 (U)
C339	0882096J18	0.1; 250 V
C340, 341	0882096J03	.01; 250 V
C342	2100874352	1200 pF; ±5%; 300 V
C343	0882096J03	.01; 250 V
C344, 345	2382256J03	10; 25 V
C346	2382256J04	1; +50 -10%; 100 V
C347	2182428B09	.0047; 200 V
C348	2383441B22	10 ±20%; 4 V
C349	2184511B24	100 pF
C350	2182428B09	.0047; 200 V
C351	2184511B24	100 pF
C352	2382256J03	10; 25 V
C353	2184511B24	100 pF
C354	2182428B36	.002; 200 V
C355	2382256J03	10; 25 V
C356, 357,361	2182428B36	.002; 200 V
C358, 359	2184511B24	100 pF
C360	2184511B01	100 pF (V)
	2184511B02	30 pF; N150 (U)
C397	2383441B19	10 ±20%; 20 V
C398	2382256J03	10; 25 V
C399	0882905G12	0.22
C401	2184511B24	100 pF
C402	2382256J03	10; 25 V
C403	2382256J04	1; +50 -10%; 100 V
C404	2182428B09	.0047; 200 V
C405	2383441B22	10 ±20%; 4 V
C406	2184511B24	100 pF
C407	2182428B36	.002; 200 V
C408	2184511B24	100 pF
C409 thru 411	2382256J03	10; 25 V
C412	2182428B36	.002; 200 V
C413	2184511B24	100 pF
C414	2182428B09	.0047; 200 V
C415	2382256J04	1; +50 - 10%; 100 V
C416	2184511B24	100 pF
C417	2382256J04	1; +50 -10%; 100 V
C418	2184511B24	100 pF
C419	2383214C21	6.8 ±20%; 20 V
C420	2382256J04	1; +50 -10%; 100 V
C421	0882096J18	0.1; 250 V
C422	0882096J02	.0047; 100 V
C423	0882096J06	1500 pF; 250 V
C424	2182187B29	1000 pF; 100 V
C425	2382256J08	22; +50 -10%; 40 V
C426	0882905G23	.02; 100 V
C427	0882905G12	0.22
C428	2184511B86	30 pF
C429	2382256J07	4.7; -10 -50%; 63
C431	2182187B29	1000 pF; 100 V
C432	2182187B29	1000 pF; 100 V
C433	2182187B39	470 pF; 500 V
C434	0882096J03	.01; 250 V
C435	2382256J04	1; +50 -10%; 100
C438, 439	2184511B24	100 pF
C440	2382256J03	10; 25 V
C441	2184511B34	3.3 pF
C444	2182428B36	.002; 200 V
C501	2184511B34	0.1; 250 V
C505,506	0882905G49	0.47
C509	0883445B69	0.255 ±1%
C513, 514	2383441B31	22 ±20%; 20 V
C516, 517	0882096J18	0.1; 250 V
C518	0882905G49	0.47
C523,524,525	0882096J18	0.1; 250 V
C526	0882905G05	0.15
C527	0882096J20	0.22; 250 V
C528	0882096J18	0.1; 250 V
C529, 530	0882096J20	0.22; 250 V
C531,532,533	2184511B02	30 pF
		DIODE: See Note
CR301	4882392B03	Silicon
CR302	4883654H01	Silicon
CR303	4883329G04	Silicon
CR304 thru 335	4883654H01	Silicon
CR339	4883654H01	Silicon
CR341	4883654H01	Silicon
CR342	4805562A01	Silicon
CR343, 344, 345	4883654H01	Silicon
CR347	4883654H01	Silicon
CR348	4882392B03	Silicon
CR350 thru 356	4883654H01	Silicon
CR401 thru 407	4883654H01	Silicon
CR502, 503, 505, 506	4883654H01	Silicon
CR508 thru 514	4883654H01	Silicon
		RESONANT RE
E301, 302	KLN6209A	"Vibrasponder"
E401	KLN6209A	"Vibrasponder," 847.5 Hz
		FUSE:
F301	6505214E01	.2-Amp.
		INTEGRATED C
IC301	5182467A09	type M6709
IC302, 303	5182467A94	type SC6794
IC304	5184267A09	type M6709
IC401	5184267A94	type SC6794
		JACK:
J301	2884085B01	PLUG, Connec
J302, 303	0982847E03	CONN, Female;
J304	0982442E01	RECEPTACLE,
		RELAY:
K1, 2	8005510D01	PTT Control
		COIL, RF:
L301, 302	2482723H01	choke, 1.2 uH
	2482723H11	choke, 0.2 uH
L303	2482723H04	choke, 0.29 uH
	2484238H02	1-1/2 turns (U)
L304	2482723H04	choke, 0.29 uH
		TRANSISTOR: S
Q301, 302, 303	4800869570	NPN; type M957
Q305 thru 308	4800869570	NPN; type M957
Q309	4800869787	NPN; type M978
Q312	4800869787	NPN; type M978
Q313 thru 321	4800869570	NPN; type M957
Q323	4800869570	NPN; type M957
Q324	4800869762	PNP; type M976
Q325	4800869570	NPN; type M957

	0.22
	30 pF
	4.7; -10 -50%; 63 V
	1000 pF; 100 V
	1000 pF; 100 V
	470 pF; 500 V
	.01; 250 V
	1; +50 -10%; 100 V
	100 pF
	10; 25 V
	3.3 pF
	.002; 200 V
	0.1; 250 V
	0.47
	0.255 ±1%
	22 ±20%; 20 V
	0.1; 250 V
	0.47
	0.1; 250 V
	0.15
	0.22; 250 V
	0.1; 250 V
	0.22; 250 V
	30 pF
	DIODE: See Note
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	Silicon
	RESONANT REED:
	"Vibrasponder"
	"Vibrasponder," Reed Code 23; 847.5 Hz
	FUSE:
	2-Amp.
	INTEGRATED CIRCUIT:
	type M6709
	type SC6794
	type M6709
	type SC6794
	JACK:
	PLUG, Connector: 37-line
	CONN, Female; 9-contact
	RECEPTACLE, Antenna
	RELAY:
	PTT Control
	COIL, RF:
	choke, 1.2 uH (V)
	choke, 0.2 uH (U)
	choke, 0.29 uH (V)
	1-1/2 turns (U)
	choke, 0.29 uH (V)
	TRANSISTOR: See Note
	NPN; type M9570
	NPN; type M9570
	NPN; type M9787
	NPN; type M9787
	NPN; type M9570
	NPN; type M9570
	PNP; type M9762
	NPN; type M9570

Q326	4800869787	NPN; type M9787
Q327	4800869677	PNP; type M9677
Q328	4800869787	NPN; type M9787
Q329 thru 332	4800869570	NPN; type M9570
Q401 thru 405	4800869570	NPN; type M9570
Q415, 416	4800869570	NPN; type M9570
Q421	4800869570	NPN; type M9570
		RESISTOR, Fixed: Ω ±10%; 1/4 W unless stated
R301	0600124D36	3.9 Meg.
R302	0600124D32	2.7 Meg.
R303, 304, 305	1884944C03	Pot., 10 k
R306	0600124C81	22 k
R307	0600124C05	15
R308	0600124A81	22 k ±5%
R309	0600124C83	27 k
R310	0600124C97	100 k
R311	0600124C79	18 k
R314	0600124C79	18 k
R315	0600124D08	270 k
R316	0600124C79	18 k
R317	0600124C95	82 k
R318, 319	0600124D02	150 k
R320 thru 323	0600124C99	120 k
R324	0600124D02	150 k
R325	0600124C69	6.8 k
R326	0600124C63	3.9 k
R327	0600124C57	2.2 k
R328	0600124C73	10 k
R329	0600124C61	3.3 k
R330	0600124C45	680
R331	0600124C87	39 k
R332	0600124C89	47 k
R333 thru 346	0600124C79	18 k
R348 thru 363	0600124C79	18 k
R364	0600124C89	47 k
R365	0600124C79	18 k
R366	0600124C57	2.2 k
R367	0600124C65	4.7 k
R368 thru 371	0600124C79	18 k
R372	0600124C87	39 k
R374	0600126C35	270; 1 W
R376	0600124C63	3.9 k
R377	0600124C35	270
R378	0600124C55	1.8 k
R379	1884944C01	Pot., 2 k
R380	0600124C49	1 k
R381, 383	0600124C87	39 k
R384	0600124C79	18 k
R385	0600124C69	6.8 k
R386, 387	0600124D02	150 k
R388 thru 391	0600124C99	120 k
R392	0600124D02	150 k
R393	0600124C69	6.8 k
R394	0600124C63	3.9 k
R395	0600124C57	2.2 k
R396	0600124C73	10 k
R397	0600124C61	3.3 k
R398	0600124C45	680
R399	0600124C89	47 k
R401	0600124C25	100
R402	0600124C93	68 k
R403, 483	0600124C25	100
R404	0600124C95	82 k
R405	0600124C75	12 k
R406	0600124C49	1 k
R407, 408	0600124C73	10 k
R409	0600124C97	100 k
R410	0600124C49	1 k
R411	0600124C57	2.2 k
R412	0600124C49	1 k
R413	0600124C61	3.3 k
R414	0600124C87	39 k
R415	0600124C45	680
R416	0600124C89	47 k
R417	0600124D02	150 k
R418, 419	0600124C79	18 k
R420	0600124C49	1 k
R421, 422	0600124C79	18 k
R423	0600124C97	100 k
R424	0600124D10	330 k
R425	0600124C79	18 k

R426	0600124D02	150 k
R427	0600124C79	18 k
R428	0600124D22	1 Meg.
R447	0600124C75	12 k
R448	0600124C97	100 k
R450	1884944C03	Pot., 10 k; 0.1 W
R451	0600124C45	680
R452	0600124C81	22 k
R453	0600124C05	15
R455	0600124C83	27 k
R456	0600124C97	100 k
R457	0600124C79	18 k
R467, 468	0600124C79	18 k
R469	0600124C19	56
R470	0600124C43	560
R471	0600124C69	6.8 k
R476	0600124C89	47 k
R477	0600124C53	1.5 k
R478, 479, 480	0600124C89	47 k
R481	1805923C01	Pot., 200 Ω; 1/2 W
R501	0600124D46	10 Meg.
R503	0600124C79	18 k
R504	0600124D46	10 Meg.
R505	0600124B14	470 k ±5%
R506, 507	0600124D22	1 Meg.
R510	0600124B32	2.7 Meg
R511	0600124B12	390 k
R512	1805923C03	Pot., 1 Meg.
R513	0600124D46	10 Meg.
R514	0600124D22	1 Meg.
R515	0600124C81	22 k
R516, 517	0600124C79	18 k
R521	0600124B34	3.3 Meg. ±5%
R522	0600124B34	3.3 Meg. ±5%
R526	0600124C79	18 k
R533	0600124C79	18 k
R534	0600124D54	22 Meg.
R535	0600124D32	2.7 Meg.
R536	0600124C55	1.8 k
R537	0600124C79	18 k
R538	0600124B10	330 k ±5%
R539	0600124D02	150 k
R540	0600124D28	1.8 Meg.
R541	0600124B10	330 k ±5%
R542	0600124B18	680 k
R543	0600124D46	10 Meg.
R544	0600124D36	3.9 Meg.
R545	0600124D22	1 Meg.
R546	0600124D14	470 k
R547	0600124D02	150 k
R548	0600124C97	100 k
R549	0600124D46	10 Meg.
R550	0600124D14	470 k
R551	0600185C15	820 k; 1/8 W
R552	0600124C57	2.2 k ±10%
R553	0600124B12	390 k
R602 thru 606	0600124C79	18 k
		MODULE, Encapsulated:
U1	5182822F15	Triple 3-Input NAN
U2	5182822F43	Quad 2-Input OR G
U3	5182822F02	Hex Inverter
U4	5182822F03	Quad 2-Input NOR
U5	5182822F08	Quad 2-Input NAN
U6	5182822F02	Hex Inverter
U8	5182822F43	Quad 2-Input OR G
U9	5182822F44	Quad 2-Input AND
U10	5182822F25	Dual 4-Input NOR
U11, 12	5182822F02	Hex Inverter
U13	5182822F43	Quad 2-Input OR G
U14	5182822F08	Quad 2-Input NAN
U15	5182822F31	UP/DOWN Counter
U16	5182822F44	Quad 2-Input AND
U18	5182822F44	Quad 2-Input AND
		DIODE: See Note
VR301, 302	4882256C15	5.1 V Zener
VR303	4882256C03	4.7 V Zener

NOTE: For optimum performance, order replacemen transistors by Motorola part number only.

CAUTION

This equipment contains MOS devices which a ceptible to damage in handling due to static di Handle with grounded tools and transport in c foam or a metallic tray.

Q326	4800869787	NPN; type M9787
Q327	4800869677	PNP; type M9677
Q328	4800869787	NPN; type M9787
Q329 thru 332	4800869570	NPN; type M9570
Q401 thru 405	4800869570	NPN; type M9570
Q415, 416	4800869570	NPN; type M9570
Q421	4800869570	NPN; type M9570
		RESISTOR, Fixed: Ω ±10%; 1/4 W unless stated
R301	0600124D36	3.9 Meg.
R302	0600124D32	2.7 Meg.
R303, 304, 305	1884944C03	Pot., 10 k
R306	0600124C81	22 k
R307	0600124C05	15
R308	0600124A81	22 k ±5%
R309	0600124C83	27 k
R310	0600124C97	100 k
R311	0600124C79	18 k
R314	0600124C79	18 k
R315	0600124D08	270 k
R316	0600124C79	18 k
R317	0600124C95	82 k
R318, 319	0600124D02	150 k
R320 thru 323	0600124C99	120 k
R324	0600124D02	150 k
R325	0600124C69	6.8 k
R326	0600124C63	3.9 k
R327	0600124C57	2.2 k
R328	0600124C73	10 k
R329	0600124C61	3.3 k
R330	0600124C45	680
R331	0600124C87	39 k
R332	0600124C89	47 k
R333 thru 346	0600124C79	18 k
R348 thru 363	0600124C79	18 k
R364	0600124C89	47 k
R365	0600124C79	18 k
R366	0600124C57	2.2 k
R367	0600124C65	4.7 k
R368 thru 371	0600124C79	18 k
R372	0600124C87	39 k
R374	0600126C35	270; 1 W
R376	0600124C63	3.9 k
R377	0600124C35	270
R378	0600124C55	1.8 k
R379	1884944C01	Pot., 2 k
R380	0600124C49	1 k
R381, 383	0600124C87	39 k
R384	0600124C79	18 k
R385	0600124C69	6.8 k
R386, 387	0600124D02	150 k
R388 thru 391	0600124C99	120 k
R392	0600124D02	150 k
R393	0600124C69	6.8 k
R394	0600124C63	3.9 k
R395	0600124C57	2.2 k
R396	0600124C73	10 k
R397	0600124C61	3.3 k
R398	0600124C45	680
R399	0600124C89	47 k
R401	0600124C25	100
R402	0600124C93	68 k
R403, 483	0600124C25	100
R404	0600124C95	82 k
R405	0600124C75	12 k
R406	0600124C49	1 k
R407, 408	0600124C73	10 k
R409	0600124C97	100 k
R410	0600124C49	1 k
R411	0600124C57	2.2 k
R412	0600124C49	1 k
R413	0600124C61	3.3 k
R414	0600124C87	39 k
R415	0600124C45	680
R416	0600124C89	47 k
R417	0600124D02	150 k
R418, 419	0600124C79	18 k
R420	0600124C49	1 k
R421, 422	0600124C79	18 k
R423	0600124C97	100 k
R424	0600124D10	330 k
R425	0600124C79	18 k

R426	0600124D02	150 k
R427	0600124C79	18 k
R428	0600124D22	1 Meg.
R447	0600124C75	12 k
R448	0600124C97	100 k
R450	1884944C03	Pot., 10 k; 0.1 W
R451	0600124C45	680
R452	0600124C81	22 k
R453	0600124C05	15
R455	0600124C83	27 k
R456	0600124C97	100 k
R457	0600124C79	18 k
R467, 468	0600124C79	18 k
R469	0600124C19	56
R470	0600124C43	560
R471	0600124C69	6.8 k
R476	0600124C89	47 k
R477	0600124C53	1.5 k
R478, 479, 480	0600124C89	47 k
R481	1805923C01	Pot., 200 Ω; 1/2 W
R501	0600124D46	10 Meg.
R503	0600124C79	18 k
R504	0600124D46	10 Meg.
R505	0600124B14	470 k ±5%
R506, 507	0600124D22	1 Meg.
R510	0600124B32	2.7 Meg
R511	0600124B12	390 k
R512	1805923C03	Pot., 1 Meg.
R513	0600124D46	10 Meg.
R514	0600124D22	1 Meg.
R515	0600124C81	22 k
R516, 517	0600124C79	18 k
R521	0600124B34	3.3 Meg. ±5%
R522	0600124B34	3.3 Meg. ±5%
R526	0600124C79	18 k
R533	0600124C79	18 k
R534	0600124D54	22 Meg.
R535	0600124D32	2.7 Meg.
R536	0600124C55	1.8 k
R537	0600124C79	18 k
R538	0600124B10	330 k ±5%
R539	0600124D02	150 k
R540	0600124D28	1.8 Meg.
R541	0600124B10	330 k ±5%
R542	0600124B18	680 k
R543	0600124D46	10 Meg.
R544	0600124D36	3.9 Meg.
R545	0600124D22	1 Meg.
R546	0600124D14	470 k
R547	0600124D02	150 k
R548	0600124C97	100 k
R549	0600124D46	10 Meg.
R550	0600124D14	470 k
R551	0600185C15	820 k; 1/8 W
R552	0600124C57	2.2 k ±10%
R553	0600124B12	390 k
R602 thru 606	0600124C79	18 k
		MODULE, Encapsulated:
U1	5182822F15	Triple 3-Input NAND Gate
U2	5182822F43	Quad 2-Input OR Gate
U3	5182822F02	Hex Inverter
U4	5182822F03	Quad 2-Input NOR Gate
U5	5182822F08	Quad 2-Input NAND Gate
U6	5182822F02	Hex Inverter
U8	5182822F43	Quad 2-Input OR Gate
U9	5182822F44	Quad 2-Input AND Gate
U10	5182822F25	Dual 4-Input NOR Gate
U11, 12	5182822F02	Hex Inverter
U13	5182822F43	Quad 2-Input OR Gate
U14	5182822F08	Quad 2-Input NAND Gate
U15	5182822F31	UP/DOWN Counter
U16	5182822F44	Quad 2-Input AND Gate
U18	5182822F44	Quad 2-Input AND Gate
		DIODE: See Note
VR301, 302	4882256C15	5.1 V Zener
VR303	4882256C03	4.7 V Zener

NOTE: For optimum performance, order replacement diodes and transistors by Motorola part number only.

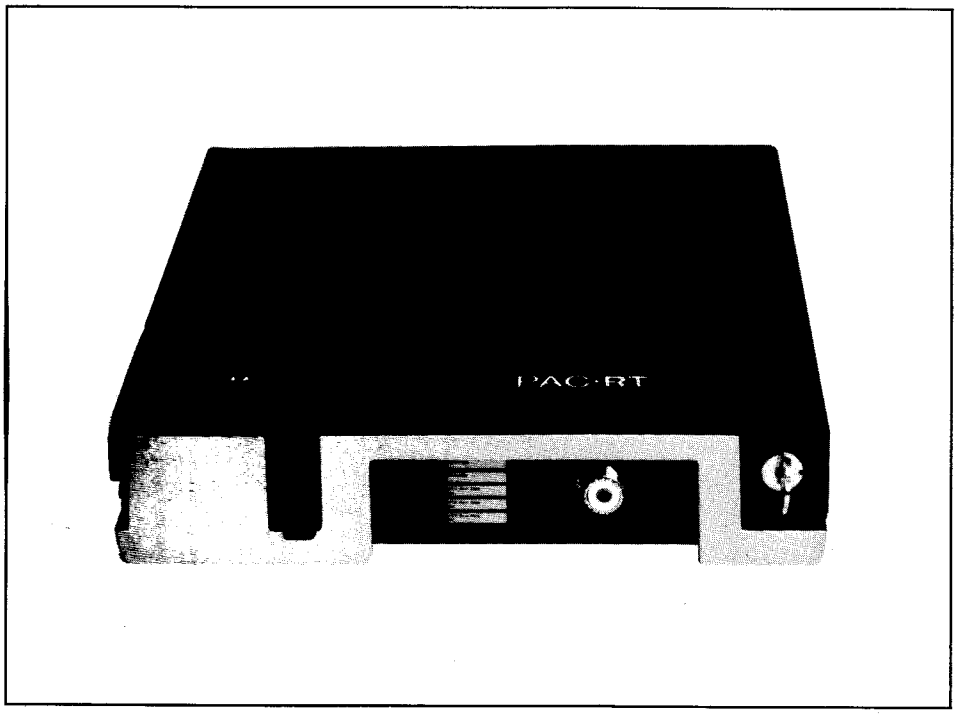
CAUTION

This equipment contains MOS devices which are susceptible to damage in handling due to static discharge. Handle with grounded tools and transport in conductive foam or a metallic tray.

MOTOROLA

PAC•RT

Portable/Mobile Vehicular Repeater System



Theory/Maintenance Manual

68P81010C05-A

FOREWORD

SCOPE OF INSTRUCTION MANUAL

This manual offers descriptive data and service information for the equipment listed. Service diagrams, parts lists, and printed circuit board details are either a part of this instruction manual, or contained in a supplementary service manual.

NOMENCLATURE

Motorola equipment is specifically identified by the model number on the nameplate.

NOTE: Be sure to use the entire model number when making inquiries about your equipment.

Identifiers have been assigned to chassis and kits. Use these identifiers when requesting information or ordering replacements.

PRODUCTION CHANGES

When production and engineering changes are incorporated into the equipment, a revision number is assigned to the chassis or kit affected; -1, -2, -3, etc.

The chassis number complete with revision number, if any, is stamped on the chassis at the time of production. The revision number becomes an integral part of the chassis identifier. Revisions, if any, are listed on the schematic diagram.

INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in the Instruction Manual Revision. These bulletins give the reader complete information on the change including pertinent parts listing data.

NATIONAL SERVICE ORGANIZATION

Motorola provides a nationwide service organization. Through its maintenance and installation program, Motorola makes available the finest service to those desiring reliable continuous communications on a contract basis.

Motorola's National Service Organization is the largest service organization specializing in mobile communications. It includes over 800 independently owned and operated service stations, strategically located and manned by a staff of several thousand FCC licensed personnel.

The area administrative staff, district service managers and district service representatives are in the direct employ of Motorola.

For your contract service requirements, please contact your local Motorola representative or write to:

National Service Manager
Motorola Communications & Electronics, Inc.
1301 Algonquin Road, Schaumburg, IL 60196

SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic energy safety standard which applies to this equipment. Proper use of this radio will result in exposure below the OSHA limit.

DO NOT operate the transmitter of a mobile radio when someone outside the vehicle is within two feet (0.6 meter) of the antenna.

DO NOT hold the transmit (PTT) switch on when not actually desiring to transmit.

DO NOT allow children to play with any radio equipment containing a transmitter.

DO NOT operate a transmitter near unshielded electrical blasting caps or in an explosive atmosphere unless it is a type especially qualified for such use.

MOTOROLA

PAC•RT
Portable/Mobile
Vehicular Repeater System

CONTENTS

SUPPLEMENTAL SERVICE LITERATURE AVAILABLE SEPARATELY

Operating Instructions	68P81009C95
VHF Service Manual	68P81010C06
UHF Service Manual	68P81010C09
Control Unit/Vehicular Charger or Radio Holder Section	68P81102C03

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LIST OF ILLUSTRATIONS

TROUBLESHOOTING CHARTS

MOTOROLA

VHF MODEL/OPTION CHART

CODE:

[1], [2], [3] = NUMBER OF ITEMS SUPPLIED

[O] = ITEM OMITTED

[A] = ONE ALTERNATE ITEM SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

[B] = TWO ALTERNATE ITEMS SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

[C] = THREE ALTERNATE ITEMS SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

[D] = FOUR ALTERNATE ITEMS SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

ITEM	DESCRIPTION	MODEL H13TTY3110A	OPTIONS:	H563	H564	H567	H805	H811	H812	H813	H814	H826	H911AA	H912AA	H913AA	H914AA	H911AC	H912AC	H913AC	H914AC	H928AB	H928AC	H937
	DESCRIPTION	"PAC-RT" VEHICULAR REPEATER (VHF)		IF INJECTION, HIGH SIDE	IF INJECTION, LOW SIDE	.0005% FREQUENCY STABILITY	VEHICULAR REPEATER "PRIVATE-LINE" DECODER	CHANNEL ONE "PRIVATE-LINE" DISABLE (Requires H805)	CHANNEL TWO "PRIVATE-LINE" DISABLE (Requires H805)	CHANNEL THREE "PRIVATE-LINE" DISABLE (Requires H805)	CHANNEL FOUR "PRIVATE-LINE" DISABLE (Requires H805)	MOBILE "PRIVATE-LINE" DETECTOR	MOBILE DETECTOR FOR ONE FREQUENCY (30-50 MHz)	MOBILE DETECTOR FOR TWO FREQUENCIES (30-50 MHz)	MOBILE DETECTOR FOR THREE FREQUENCIES (30-50 MHz)	MOBILE DETECTOR FOR FOUR FREQUENCIES (30-50 MHz)	MOBILE DETECTOR FOR ONE FREQUENCIES (450-512 MHz)	MOBILE DETECTOR FOR TWO FREQUENCIES (450-512 MHz)	MOBILE DETECTOR FOR THREE FREQUENCIES (450-512 MHz)	MOBILE DETECTOR FOR FOUR FREQUENCIES (450-512 MHz)	SCAN MUTE	"DIGITAL PRIVATE-LINE" SCAN MUTE	BASE REPEATER
NLN4358A	LOGIC BOARD WITHOUT "PRIVATE-LINE" OPERATION	1					O	O	O	O	O												
NUD6022AB	TRANSCEIVER BOARD (EARLY VERSION)	1																					
NUD6022BB	TRANSCEIVER BOARD (LATER VERSION)	1																					
KXN1014A	TRANSMITTER RESONATOR (±.002% FREQUENCY STABILITY)	1				O																	
KXN6034A	RECEIVER CONTROL CRYSTAL	1																					
NXN6015A	SECOND OSCILLATOR CRYSTAL	1		1	1								1	1	1	1							
NLN8987A	"VIBRASPONDER" RESONANT REED HOLDER	2					1																
KLN6209A	"VIBRASPONDER" RESONANT REED	2					1																
NHN6246A	HOUSING	1																					
NHN6247A	TRAY	1																					
NLN8984A	LABEL	1																					
NLN4375A	HARDWARE	1																					
NLN4388A	MOUNTING HARDWARE	1																					
NLN8985A	TUNING TOOL KIT	1																					
KXN1013B	TRANSMITTER RESONATOR (±.0005% FREQUENCY STABILITY)					1																	
NLN4943A	SCAN MUTE BOARD																			1			
NLN4944A	SCAN MUTE HARDWARE																			1			
NLN4962A	"DIGITAL PRIVATE LINE"																				1		
NLN4963A	SCAN MUTE "DIGITAL PRIVATE LINE"																				1		
NLN4970A	SCAN MUTE MISCELLANEOUS PARTS																			1			
NLN8982A	LOGIC BOARD WITH "PRIVATE-LINE" OPERATION						1	1	1	1	1												
NRB6252A	MOBILE DETECTOR BOARD (30.00-39.99 MHz)												A	A	A	A							
NRB6262A	MOBILE DETECTOR BOARD (40.00-50.00 MHz)												A	A	A	A							
KXN6126AA	RECEIVER CONTROL CRYSTAL (30.00-32.99 MHz)												A	B	C	D							
KXN6126AB	RECEIVER CONTROL CRYSTAL (33.00-46.39) MHz)												A	B	C	D							
KXN6126AC	RECEIVER CONTROL CRYSTAL (46.40-50.00 MHz)												A	B	C	D							
NRE6191A	MOBILE DETECTOR BOARD (450-470 MHz)																A	A	A	A			
NRE6192A	MOBILE DETECTOR BOARD (470-480 MHz)																A	A	A	A			
NRE6193A	MOBILE DETECTOR BOARD (480-512 MHz)																A	A	A	A			
NLN4374A	MOBILE DETECTOR CONNECTOR ASSEMBLY												1	1	1	1	1	1	1	1			
NLN8986A	MISCELLANEOUS PARTS, LOGIC BOARD							1	1	1	1		1	2	3	4	1	2	3	4			
NXN6031A	SECOND OSCILLATOR CRYSTAL																A	B	C	D			
ZLN6355A	MOBILE "PRIVATE-LINE" DETECTOR PARTS											1											

EPF-7186-A

MOTOROLA

UHF MODEL/OPTION CHART

CODE:

[1], [2], [3] = NUMBER OF ITEMS SUPPLIED

[O] = ITEM OMITTED

[A] = ONE ALTERNATE ITEM SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

[B] = TWO ALTERNATE ITEMS SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

[C] = THREE ALTERNATE ITEMS SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

[D] = FOUR ALTERNATE ITEMS SUPPLIED, CHOICE DEPENDS UPON CARRIER FREQUENCY

ITEM	DESCRIPTION	MODEL H14TTY3110A	OPTIONS: H563	H564	H805	H811	H812	H813	H814	H826	H911AA	H912AA	H913AA	H914AA	H911AB	H912AB	H913AB	H914AB	H928AB	H928AC	H937
	DESCRIPTION	"PAC-RT" VEHICULAR REPEATER (UHF)	IF INJECTION, HIGHSIDE	IF INJECTION, LOW SIDE	MOBILE "PRIVATE-LINE" DECODER	CHANNEL ONE "PRIVATE-LINE" DISABLE (Requires H805)	CHANNEL TWO "PRIVATE-LINE" DISABLE (Requires H805)	CHANNEL THREE "PRIVATE-LINE" DISABLE (Requires H805)	CHANNEL FOUR "PRIVATE-LINE" DISABLE (Requires H805)	MOBILE "PRIVATE-LINE" DETECTOR	MOBILE DETECTOR FOR ONE FREQUENCY (30-50 MHz)	MOBILE DETECTOR FOR TWO FREQUENCIES (30-50 MHz)	MOBILE DETECTOR FOR THREE FREQUENCIES (30-50 MHz)	MOBILE DETECTOR FOR FOUR FREQUENCIES (30-50 MHz)	MOBILE DETECTOR FOR ONE FREQUENCY (150.8-174 MHz)	MOBILE DETECTOR FOR TWO FREQUENCIES (150.8-174 MHz)	MOBILE DETECTOR FOR THREE FREQUENCIES (150.8-174 MHz)	MOBILE DETECTOR FOR FOUR FREQUENCIES (150.8-174 MHz)	SCAN MUTE	"DIGITAL PRIVATE-LINE" SCAN MUTE	BASE REPEATER
NLN4358A	LOGIC BOARD WITHOUT "PRIVATE-LINE" OPERATION	1			0	0	0	0	0												
NUE6252A	TRANSCEIVER BOARD (EARLY VERSION)	1																			
NUE6252B	TRANSCEIVER BOARD (LATER VERSION)	1																			
KXN1013B	TRANSMITTER RESONATOR (±.0005% FREQUENCY STABILITY)	1																			
KXN6054A	RECEIVER CONTROL CRYSTAL, YVMR (406-512 MHz)	1																			
YNR	SECOND OSCILLATOR CRYSTAL (17-445, 18355 MHz)	1																			
NLN8987A	"VIBRASPONDER" RESONANT REED HOLDER	2																			
KLN6209A	"VIBRASPONDER" RESONANT REED	2																			
NLE8462A	UHF MISCELLANEOUS PARTS, LOGIC BOARD	1																			
NHN6246A	HOUSING	1																			
NHN6247A	TRAY	1																			
NLN8984A	LABEL	1																			
NLN4375A	HARDWARE	1																			
NLN4388A	MOUNTING HARDWARE	1																			
NLN8985A	TUNING TOOL KIT	1																			
NLN4943A	SCAN MUTE BOARD																		1		
NLN4944A	SCAN MUTE HARDWARE																		1		
NLN4962A	"DIGITAL PRIVATE-LINE"																			1	
NLN4963A	SCAN MUTE "DIGITAL PRIVATE-LINE"																			1	
NLN4970A	SCAN MUTE MISCELLANEOUS PARTS																		1		
NLN8982A	LOGIC BOARD WITH "PRIVATE-LINE" OPERATION				1	1	1	1	1												
NRB6252A	MOBILE DETECTOR BOARD (30.00-39.99 MHz)										A	A	A	A							
NRB6262A	MOBILE DETECTOR BOARD (40.00-50.00 MHz)										A	A	A	A							
CNRD6492A	MOBILE DETECTOR BOARD (150.8-174 MHz)														1	1	1	1			
KXN6126AA	RECEIVER CONTROL CRYSTAL (30.00-32.99 MHz)										A	B	C	D							
KXN6126AB	RECEIVER CONTROL CRYSTAL (33.00-46.39 MHz)										A	B	C	D							
KXN6126AC	RECEIVER CONTROL CRYSTAL (46.40-50.00 MHz)										A	B	C	D							
KXN6034A	RECEIVER CONTROL CRYSTAL (150.8-174 MHz)														1	2	3	4			
YNR	SECOND OSCILLATOR CRYSTAL (10.245, 11.155 MHz)														1	1	1	1			
NLN4374A	MOBILE DETECTOR CONNECTOR ASSEMBLY										1	1	1	1	1	1	1	1			
NLN8986A	MISCELLANEOUS PARTS, LOGIC BOARD					1	1	1	1		1	2	3	4	1	2	3	4			
NXN6015A	SECOND OSCILLATOR CRYSTAL			1		1	1	1	1												
NXN6032A	SECOND OSCILLATOR CRYSTAL		1																		
ZLN6355A	MOBILE "PRIVATE-LINE" DETECTOR PARTS									1											

EPF-7757-A

REQUIRED ACCESSORIES

MODEL NUMBER	DESCRIPTION
NAD6300	Trunk-Lip Mount Antenna
NKN6212	Interface Cable for multiple-frequency MICOR Mobile Radios
NKN6214	Interface Cable for all MOCOM•70, MOTRAC, MOTRAN, MITREK Mobile Radios
NKN6231	Interface Cable for GE "MASTR Progress Line" Mobile Radios
NKN6232	Interface Cable for GE "MASTR II" Mobile Radios
NKN6233	Interface Cable for RCA "Series 1000" Mobile Radios
NKN6250	Interface Cable for Maxar Mobile Radios
NLN6313	Interface Cable for Syntor Mobile Radios
NLN6314	Interface Cable for Syntor X Mobile Radios
NLN4537	Control Switch Kit for controlling the PAC•RT Vehicular Repeater
NLN4367	Control Unit/Vehicular Charger for use with all PL Model "Handie-Com" Radios
NLN4368	Control Unit/Vehicular Charger for use with all PL Model HT220 Omni-Housing "Handie-Talkie" Radios
NLN4369	Control Unit/Vehicular Charger for use with all PL Model MX310 or MX320 "Handie-Talkie" Radios
NLN8981	Control Unit/Vehicular Charger for use with all PL Model HT220 Slim-Line Housing "Handie-Talkie" Radios
NLN8980	Control Unit/Holder for use with all PL Model HT220 Slim-Line Housing "Handie-Talkie" Radios

NOTE: Portable radios used with PAC•RT Vehicular Repeater units may be MX310, MX320, HT220 Series "Handie-Talkie" or "Handie-Com" radios. The portable radios require switchable PL operation on the transmit frequency and carrier squelch operation on the receive frequency.

DESCRIPTION

1. INTRODUCTION

A PAC•RT Portable/Mobile Vehicular Repeater System consists of the vehicular repeater unit and the following required accessories: a high-band antenna, a control unit to enable and disable the vehicular repeater, interconnecting cables, and a high-band portable radio (Figure 1). Refer to the "Required Accessories" table at the front of this manual for a detailed listing of accessories available.

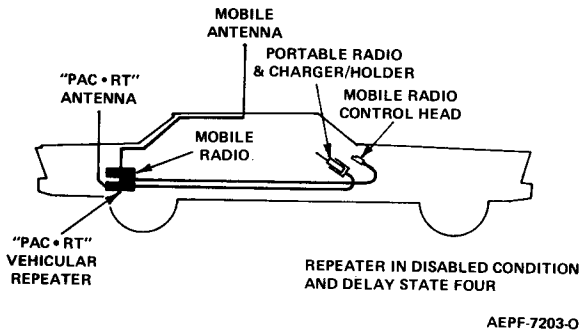


Figure 1.
PAC•RT Vehicular Repeater System Components

The PAC•RT vehicular repeater can be added to any MAXAR, MITREK, MICOR, MOTRAC, MOTRAN, MOCOM•70, SYNTOR, or SYNTOR X mobile radio not operating in the same frequency range. It can also be used with many non-Motorola mobile radios. The vehicular repeater connects between the mobile radio control head and the mobile radio. With a portable radio and a control unit/vehicular charger or radio holder, the user is ready for total out-of-the-vehicle communications.

When the PAC•RT vehicular repeater is used with the Motorola required accessories, the system is enabled and disabled automatically. When the operator leaves the vehicle, he takes his portable radio. Removing the portable radio from the control unit/vehicular charger automatically switches the vehicular repeater from its disabled condition to its enabled condition. When he is away from the vehicle, the operator transmits from his portable radio to the PAC•RT vehicular repeater receiver (Figure 2.) The vehicular repeater activates the mobile radio transmitter; which retransmits the portable radio message at a greatly increased rf power on a frequency different from the PAC•RT or portable radio frequency.

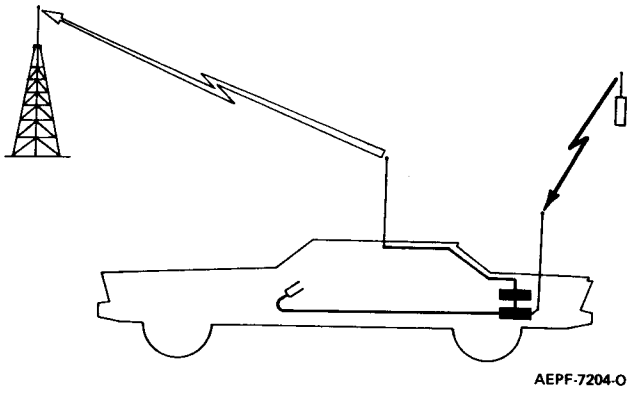


Figure 2. Portable-to-Base Communication

The reverse is true for base-to-portable communications (Figure 3). The base station transmits to the mobile radio receiver which activates the PAC•RT vehicular repeater transmitter for simultaneous transmission to the portable radio. This use of different frequencies for mobile radio and PAC•RT operation eliminates the problem of interference and the need for isolators and duplexers. When the operator returns to his vehicle and places the portable radio back in the control unit/vehicular charger, the vehicular repeater automatically returns to the disabled condition. Further communication is maintained by use of the mobile radio.

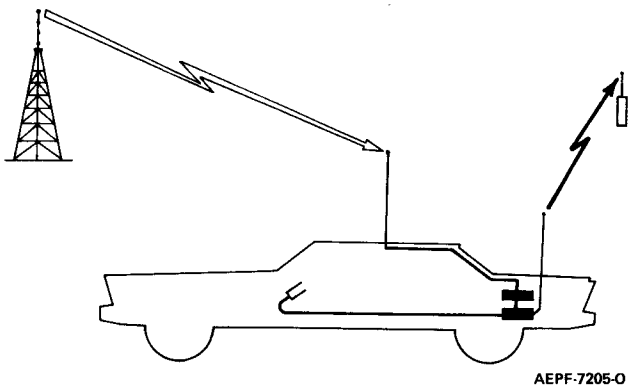


Figure 3. Base-to-Portable Communication

Portable-to-portable communication is accomplished by setting the portable radio PL switch to the OFF position. The user can talk to other portable radio users within the same communication system without activating any of the vehicular repeaters.

2. SPECIAL FEATURES

The digital logic circuitry of the PAC•RT vehicular repeater prevents interference caused by several repeaters being activated at the same time. Even if eight or more repeaters are being used in the same area at the same time, only one unit repeats the communication in either direction.

A portable priority interrupt feature gives the operator "talk-back" ability from the portable radio. This overcomes the problem of repeater access when the mobile channel is active. Without priority interrupt, the operator could be locked out of the system until the channel is clear, even though it may only be "skip" or some other interference tying up the channel.

The time-out timer circuit prevents prolonged system tie-up. Should the time-out timer turn off the priority PAC•RT vehicular repeater, the logic circuit automatically removes the repeater from the priority state, allowing another unit in the system to assume the repeat function.

3. OPTIONAL FEATURES

An optional monitor receiver is available for the mobile radio systems using different transmit and receive frequencies, as when a two-frequency simplex system is in use. Such offset frequencies do not allow the portable radio user to determine if the mobile channel is in use. By using the optional monitor receiver, the logic circuit in the PAC•RT vehicular repeater senses the use of other channels and ensures that multiple repeaters in the same general area are not "keyed."

In some systems using a base station repeater, the base station repeater provides the means to monitor the mobile transmit frequency in place of a mobile detector. To do this, the 400-ms countdown clock is increased to 700-ms. This change allows the extra time required for the base station repeater to respond.

INSTALLATION AND OPERATION

1. INSTALLATION

Complete installation instructions are packed in the shipping carton with the PAC•RT vehicular repeater.

2. OPERATION

a. Turn On

(1) Turn on the mobile radio as described in its operating instructions.

(2) Turn on the PAC•RT vehicular repeater by setting the control unit on/off switch to the ON position. When the Control Switch Kit is used, power is supplied to the PAC•RT repeater through the mobile on/off switch.

(3) Set the control unit on/off switch to the ON position.

(4) Turn on the portable radio as described in its operating instructions.

(5) Set the portable radio PL switch to the ON position.

b. Portable-to-Base Operation

Automatic activation of the vehicular repeater is accomplished by removing the portable radio from the control unit/vehicular charger or radio holder. When away from the vehicle, contact with the base station can be maintained using the portable radio (via the repeater in the vehicle). When the portable radio is returned to the control unit/vehicular charger or radio holder pocket, repeater operation is disabled and conventional mobile operation is resumed. Switching the control unit on/off switch to the OFF position also serves to resume conventional mobile operation when the portable is not in the control unit.

c. Portable-to-Portable Operation

When the portable radio PL switch is in the OFF position, the portable radio operator can talk with other portable radio operators in the system without activating any repeaters.

d. Vehicular Repeater Manual Operation

NOTE

Care in using this procedure is recommended because of the element of human error in REMEMBERING to perform the necessary switching functions.

The automatic switching function of the vehicular repeater can be manually overridden using the control unit on/off switch. When the operator is in the vehicle and is wearing the portable radio, the control unit on/off switch should be in the disable position so that proper prioritization will take place when another vehicle arrives and its portable is removed.

The control switch kit contains only an enable/disable switch. A light-emitting diode (LED) is included as a reminder to the operator. When the LED glows, the PAC•RT repeater is enabled.

When the operator leaves the vehicle, he MUST switch the on/off switch in the on position. This switching action triggers the repeater logic circuitry to establish which vehicular repeater in the same area is to be the priority vehicular repeater.

Upon returning to the vehicle, the control unit on/off switch is placed in the off position.

The operator MUST REMEMBER to set the on/off switch when arriving at the vehicle or leaving it. If this procedure is not carefully observed, increased interference may result until the unit self-clears, or increased delay may result until the unit counts down to zero since the priority state will be determined by previous events instead of the current situation.

THEORY OF OPERATION

1. SYSTEM DESCRIPTION

a. General

NOTE

For the following descriptions, refer to Appendices A and B for aid in understanding terms and logic functions used.

A PAC•RT Portable/Mobile Vehicular Repeater notifies other vehicular repeaters in the same area that it has arrived and that the repeater has been enabled. With two or more vehicular repeaters near each other, all but one must be automatically disabled in order to maintain one vehicular repeater as the priority unit through which all communications in that area are received and transmitted. This eliminates interference caused by several vehicular repeaters being activated at the same time. Furthermore, if the priority unit leaves the area, another vehicular repeater in the area automatically assumes the priority role.

b. Arrival of First Vehicle
(Refer to Figure 4)

Assume that in a given area no vehicular repeaters are present and that the first vehicular repeater (unit A) arrives on the scene. Communication with the base station is accomplished via the mobile radio as long as the operator is in the vehicle. When the operator decides to leave the vehicle, he removes the portable radio from the control unit/vehicular charger or radio holder. Assuming the control unit on/off switch is in the "ON" position, the vehicular repeater is switched from its disabled condition to its enabled condition and the repeater transmitter transmits a single-tone burst. If the control unit is in the "off" position and the portable radio has already been removed, the operator must move the on/off switch from the "off" to the "on" position before leaving the vehicle. This achieves the same results as if the control unit switch were in the "ON" position and the portable radio were removed; the repeater switches from its disabled condition to its enabled condition and a single-tone burst is transmitted. When the vehicular repeater transmits a single-tone burst, its priority counter is reset from a "delay state one" (priority counter delay state for disabled condition) to a "delay state zero," making it the priority unit.

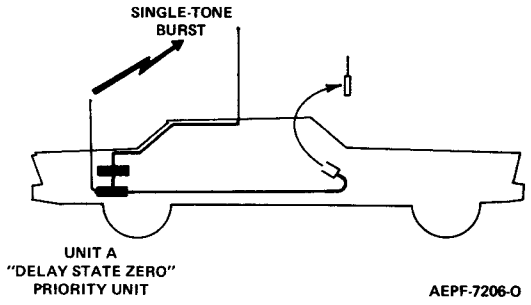


Figure 4.
Arrival of First Vehicular Repeater

c. Arrival of Second Vehicular Repeater
(Refer to Figure 5)

Arrival of the second vehicular repeater (unit B) in the area of the first vehicular repeater (unit A) does not affect the operation of unit A until the operator of unit B removes the portable radio from the control unit. Here again, when the control unit is in the enable mode, the unit B vehicular repeater is switched to its enabled condition and the repeater transmitter transmits a single-tone burst, unless portable frequency traffic with the proper PL code and mobile frequency traffic are present, indicating another repeater is present and transmitting. The unit B vehicular repeater priority counter is reset from a "delay state one" to a "delay state zero" making unit B the priority unit. Upon receiving the single-tone burst transmission

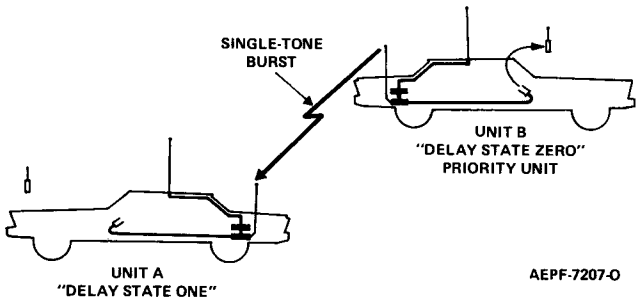


Figure 5.
Arrival of Second Vehicular Repeater

from unit B, the unit A priority counter counts up from "delay state zero" to "delay state one." The existing condition now is that unit A is in "delay state one" and unit B is in "delay state zero," making it the priority unit. Therefore, all transmissions from portable units in the area are now repeated through unit B.

Figure 6 illustrates the existing condition for portable-to-base communications. When the portable radio operator transmits (depicted by solid arrows), all portable radios and all vehicular repeaters on the same frequency and in the same area receive the transmitted message. The priority unit (unit B) repeats the portable radio message (depicted by open arrows) to the base station and other mobile radios via the mobile radio transmitter.

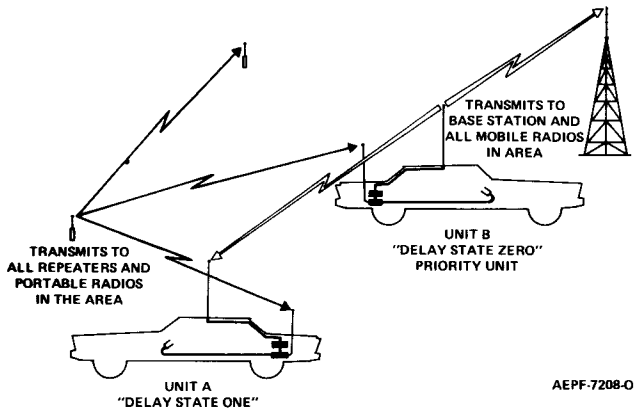


Figure 6. Portable-to-Base Communications

Unit A cannot count down and repeat until the end of one delay increment; however, since it detects the presence of a mobile carrier (open arrow in Figure 6) before the end of the delay increment, the priority counter will not count down. Therefore, unit A remains in "delay state one" and does not repeat the portable radio transmission.

d. Arrival of Third Vehicular Repeater

Another vehicle (unit C) arrives in proximity to units A and B. If the same assumptions are made for unit C as were previously made for unit B when it arrived on the scene (no portable radio communication traffic, control unit in enable mode) unit C transmits a single-tone burst when its portable radio is removed from the holder and becomes the priority unit. The unit B priority counter counts to "delay state one," and the unit A priority counter counts up to "delay state two" upon receipt of the single-tone burst transmission from unit C.

Figure 7 illustrates what happens when portable-to-base communication is already in progress when the unit C vehicle arrives on the scene. The solid arrows show that when a portable radio transmits, all portable radios and all vehicular repeaters on the same frequency and in the same area receive the transmitted message. Unit C is still under mobile radio operation while its portable radio remains in the holder and it is not affected by the portable radio transmission.

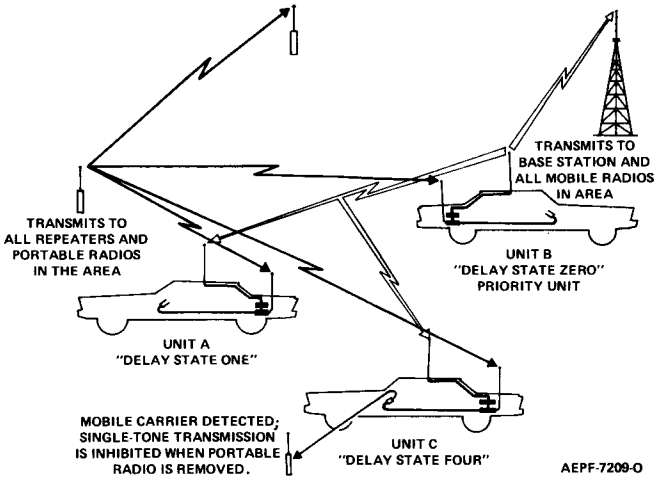


Figure 7. Arrival of Third Vehicular Repeater During Repeat Condition

Nonpriority unit A waits one delay increment for detection of a mobile carrier. If none is detected, unit A begins to count down until a priority unit is established for retransmission of the portable radio message through the mobile transmitter. However, in this example, priority unit B retransmits the portable radio message to the base station and other mobile radios in the area. Unit A detects this mobile carrier and does not count down. Therefore, unit A remains in the same priority state as is shown in the figure.

During unit B mobile radio transmission, the operator in unit C decides to leave his vehicle. At this time unit C is receiving both portable and mobile radio carriers. When the portable radio is removed from unit C, the repeater detects the presence of both carriers and inhibits the

single-tone burst transmission. Since there was no single-tone transmission, the delay states of units A, B, and C remain as shown in the figure.

If the repeater is equipped with the "Inhibit Single-tone Transmission" option, the repeater is inhibited from transmitting a single-tone burst when there is any portable radio communications traffic; the repeater will transmit a single-tone burst only when mobile radio traffic is present.

e. Portable Priority Interrupt

The PAC•RT vehicular repeater contains a portable priority interrupt feature which overcomes repeater access problems when the mobile/base channel is active. When the priority unit is repeating base to portable (Figure 8) on either an actual base signal or "skip," the portable priority interrupt clock interrupts the vehicular repeater transmitter approximately every two seconds, enabling the repeater receiver to search for a portable radio signal. (Refer to timing chart of Figure 8.) If a portable signal without PL tone is present, the repeater transmitter remains inhibited for the duration of the high-band signal. If the portable signal is modulated with a PL signal, the priority unit repeats the message back to the base station on top of the incoming signal.

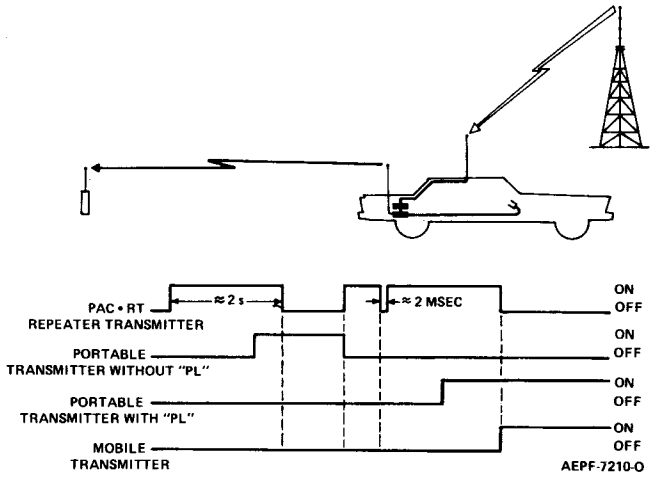


Figure 8. Portable Priority Interrupt

f. Departure of a Vehicle

As vehicles leave the scene, and depending upon the order in which they leave, the priority unit may change. Continuing the example shown in Figure 7, unit C disables his vehicular repeater by placing his portable radio back into the control unit and leaving the scene. The priority unit does not change since unit C was not in the priority mode; unit B continues to repeat all communication traffic.

Next, unit B disables his repeater and leaves the scene. (Refer to Figure 9.) Unit A is the only vehicle remaining at the scene and is still in "delay state one." When conditions to repeat messages portable-to-base or base-to-portable begin, the absence of a repeater transmitter signal causes unit A to count down to "delay state zero" to become the priority unit and repeat all communications.

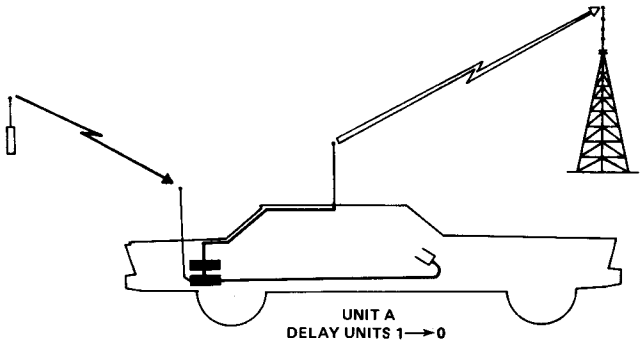


Figure 9.
Priority Assignment with Departure of Vehicles

g. Self-Clearing Feature
(Refer to Figure 10)

If more than one PAC•RT vehicular repeater is in the priority state, the system self-clears on the first base-to-portable transmission that is greater than two seconds duration. This is accomplished through the use of the portable priority interrupt pulse previously discussed. If unit A and unit B are in the priority state and conditions to repeat base-to-portable commence, both units begin to transmit.

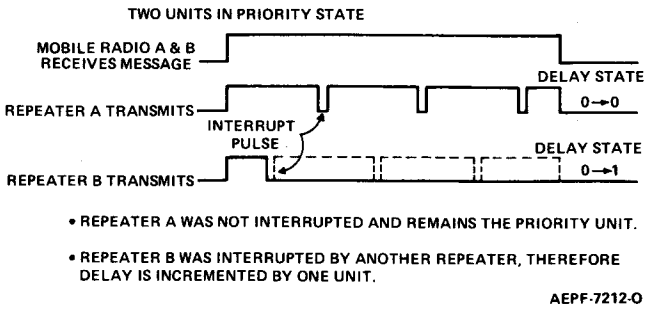


Figure 10. Self-Clearing Timing Diagram

In Figure 10, the unit B interrupt pulse occurs first. When unit B interrupts, its repeater transmitter remains inhibited due to the presence of high-band carrier from the unit A vehicular repeater. When conditions to repeat cease (base "dekeys"), unit B steps its priority counter to delay state one, leaving unit A as the sole priority repeater.

h. Time-Out Timer Feature

Each PAC•RT vehicular repeater is equipped with a time-out timer (TOT) which is operational when repeating in either direction. This prevents prolonged system tie-up. The time-out timer turns off the priority repeater and automatically removes the repeater from the priority state to allow another repeater to assume the role as priority repeater. R552 can be moved to provide operation for base-to-portable or portable-to-base communications or for no time-out timer operation at all.

NOTE

Time-out timer operation is required on any repeater not controlled by PL; therefore, it should not be removed from the PAC•RT transmitter unless option H805 Mobile PL is present.

i. Monitor Receiver (Optional)
(Refer to Figure 11)

Conditions to repeat messages portable-to-base exist in a multiple-frequency simplex mobile radio system where there are different transmit and receive frequencies or where the mobile is already using a fixed repeater, or anytime the mobile receiver cannot detect the presence of a mobile transmitter carrier. The absence of a detected mobile transmitter signal causes the non-priority unit priority counter to count down from its present delay state to "delay state zero", making it a priority unit.

The optional monitor receiver, tuned to the mobile transmitter frequency, detects the presence of a mobile transmitter carrier. The detection of the mobile transmitter carrier inhibits the non-priority vehicular repeater priority counter from counting down and becoming the priority unit.

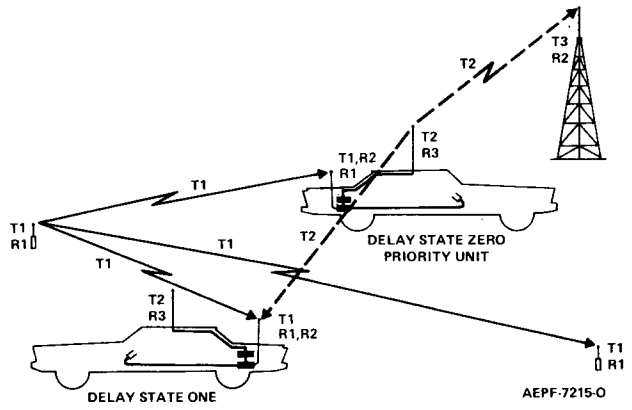


Figure 11.
Multiple-Frequency Simplex Operation

2. DETAILED LOGIC DESCRIPTION

a. Detection of Portable Radio Removed from Control Unit

A 700-millisecond single-tone burst is transmitted when the portable radio is removed from the control unit (Inside / $\overline{\text{Outside}}$ line goes low or to logic zero). If a portable carrier with PL tone and a mobile carrier is present, the PAC•RT repeater will not transmit a single-tone burst. Figures 12 and 13 illustrate the logic operation for removing the portable radio from the vehicular repeater control unit under one of four conditions: (1) portable carrier, (2) mobile carrier, (3) portable carrier with PL tones and mobile carrier, and (4) no carriers present.

Refer to conditions (2) and (4) in the timing diagram where there is either a mobile carrier or no carrier present. For both conditions, when the portable radio is removed from the control unit (Inside/$\overline{\text{Outside}}$ line goes low), the PAC•RT Squelch line goes unsquelched shortly after the PAC•RT repeater transmitter is enabled because the repeater receiver is on at all times to detect high-band transmissions.

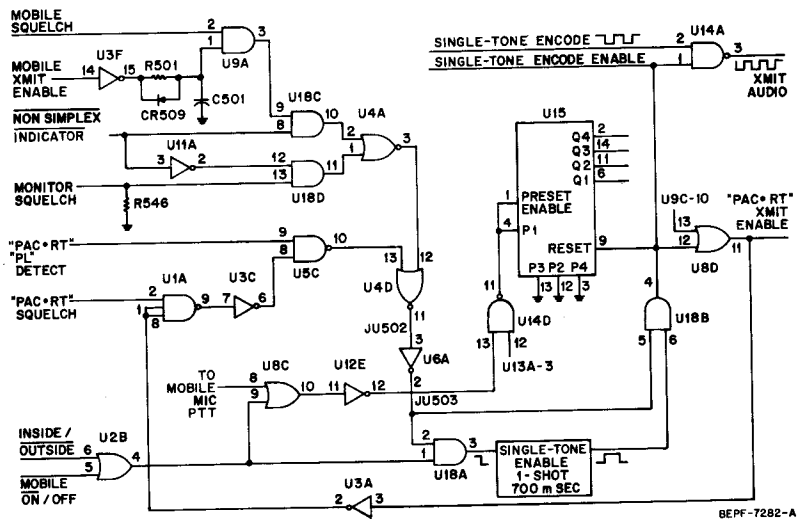


Figure 12. Single-tone Encode Logic Diagram

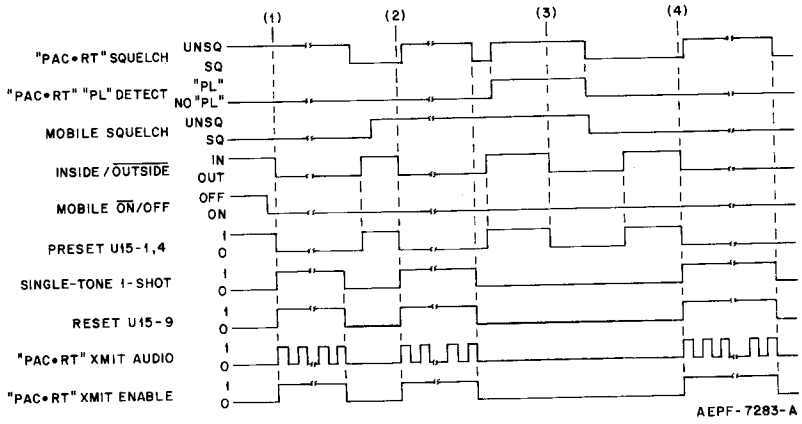


Figure 13. Single-tone Encode Timing Diagram

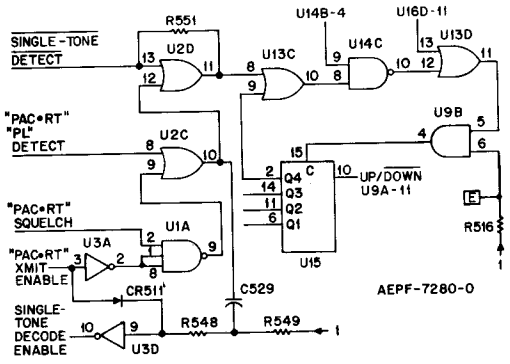


Figure 14.
Single-tone Decode Logic Diagram

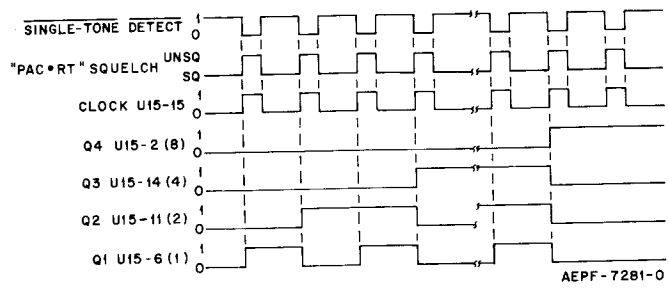


Figure 15.
Single-tone Decode Timing Diagram

b. Single-tone Decode Logic Circuitry

The single-tone detect input is a logic one to logic zero transition at U2D-13. Resistor R551 is present to provide hysteresis. Refer to Figures 14 and 15 for the logic circuitry and timing diagrams. When a portable carrier frequency signal modulated with the single-tone frequency is received, the PAC•RT Squelch line goes high (logic one) and the Single-tone Detect line goes low (logic zero), producing a high at clock input U15-15.

The high input to the clock causes U15-6 to go high to signify a count of one. This entire process continues to count (binary) until U15-2 (Q4) goes high and U15-14 (Q3), -11 (Q2), and -6 (Q1) go low to signify a count of eight. When U15-2 goes high, this high is fed to U13C-9 to inhibit any further single-tone detect transitions from reaching the clock.

c. Priority Counter Logic Circuitry

The manner in which the PAC•RT vehicular repeater counts down from a nonpriority delay state to priority "delay state zero" is shown in Figures 16 and 17. When conditions to repeat a message (mobile carrier) exist, the priority clocks in the nonpriority units begin to count down until a portable frequency carrier is detected or until the unit becomes the priority unit.

Refer to Figure 17. Condition (1) shows that when a mobile carrier is detected, the priority clock starts to count down from its delay state to a lower delay state. The figure uses "delay state three" as the repeaters initial delay state (Q1 and Q2 high). Each time priority clock output U11E-12 goes low after mobile carrier detection, the clock is stepped one increment as shown for conditions (2) and (3). Notice that with each clock pulse the binary state of Q1 and Q2 changes; condition (2) shows that only Q2 is high for a "delay state two"; condition (3) shows that another clock pulse changes the repeater to "delay state one" (Q1 high; Q2, Q3, Q4 low). The priority clock stops counting when the repeater receiver detects a portable transmission (condition (4), PAC•RT Squelch line goes unsquelched) indicating that another repeater has assumed the role of priority repeater.

Next, if the repeater receives a portable-to-base communication, (condition (5)), PAC•RT squelch goes high, turning on the priority clock. The priority clock steps the clock one increment (condition (6)) to "delay state zero" (Q1, Q2, Q3, Q4 are low) and causes the repeater to assume the role of the priority repeater. As soon as this occurs, the repeater begins to repeat (Mobile Transmit Enable line goes high).

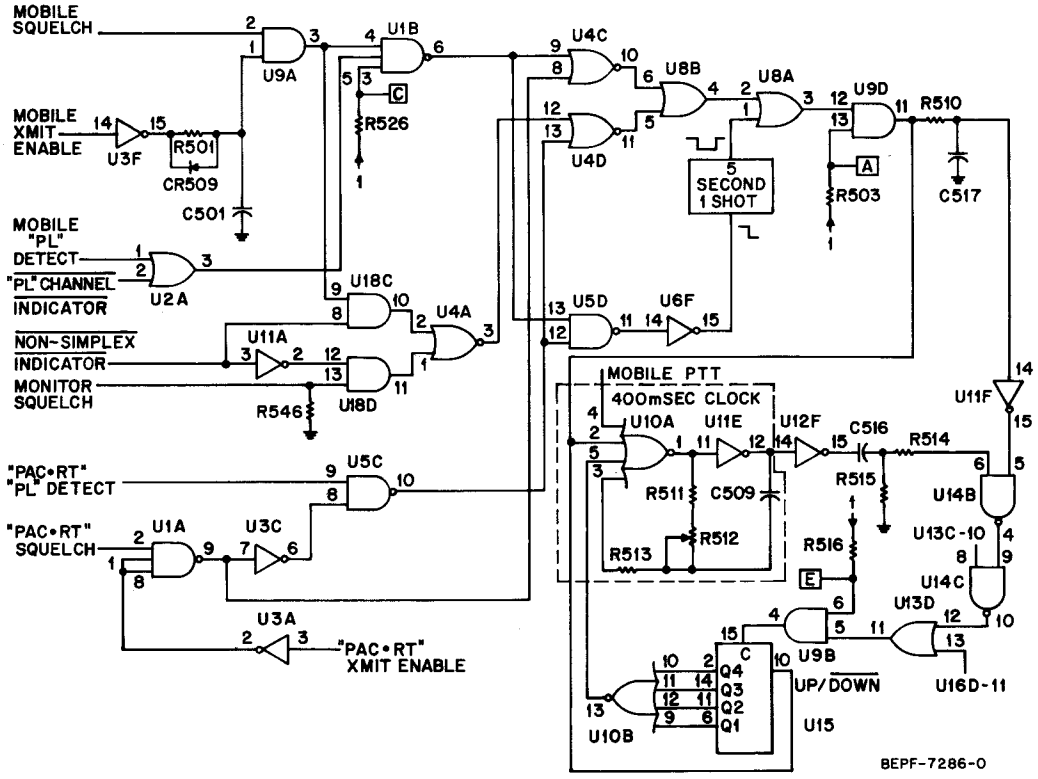


Figure 16. Priority Counter Logic Diagram

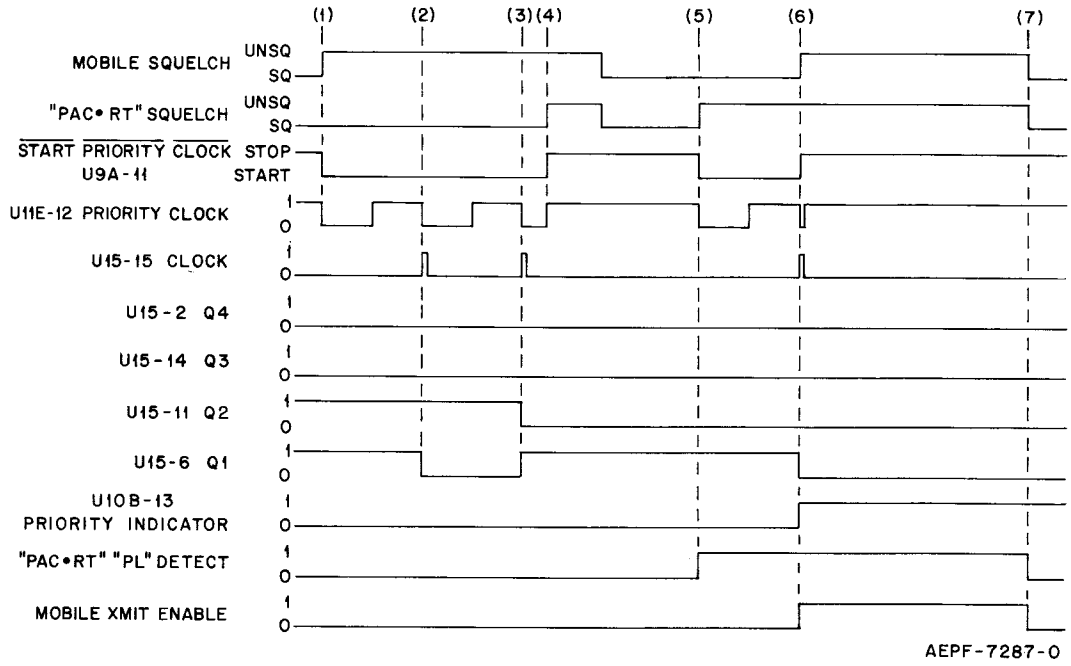


Figure 17. Priority Counter Timing Diagram

d. Portable Interrupt/Portable Priority Logic Circuitry

The operation of the portable interrupt and the portable priority feature is illustrated in Figures 18 and 19. When the Mobile Squelch line goes unsquelched (base-to-portable repeat), the PAC•RT Transmit Enable line goes high. Since the PAC•RT receiver is on all the time, the PAC•RT Squelch line goes unsquelched because of the presence of its own carrier.

The Interrupt Clock is an astable multivibrator that interrupts the PAC•RT Transmit Enable line for 2-3 milliseconds approximately every 1-2 seconds, allowing the PAC•RT receiver to monitor the portable frequency channel. The actual time width of the interrupt pulse is one millisecond. If no portable frequency traffic is present, the PAC•RT squelch stretches the interrupt pulse width to approximately 2.5 milliseconds. The actual time is determined by the rf decay time of the receiver and all interrupt times are approximate.

In Figure 19, condition (1), the first interrupt pulse does not detect the presence of portable frequency carrier, causing the PAC•RT Transmit Enable line to go low for the duration of the interrupt pulse and then go back high to repeat the base-to-portable message.

Condition (2) illustrates the presence of portable communications without PL tones at the time the interrupt pulse appears. The presence of portable frequency traffic causes the PAC•RT transmitter to be disabled (PAC•RT Transmit Enable line goes low). When the portable frequency carrier ceases, the PAC•RT Transmit Enable is enabled again (point (3)) and repeats the base-to-portable message.

Condition (4) shows that if base-to-portable repeat and a portable frequency signal with PL tones are present at the time the interrupt pulse appears, the repeater transmitter is inhibited and the mobile transmitter is enabled.

At the end of the portable-to-base transmission, the mobile transmitter is inhibited and the repeater transmitter is enabled, and the PAC•RT repeater continues to retransmit the carrier present on the mobile frequency.

When the Mobile Squelch line goes low (condition 5), indicating that base-to-portable communication has ceased, the PAC•RT Transmit Enable line goes low to inhibit the PAC•RT transmitter from repeating.

e. Self-Clearing Logic Circuitry

As briefly described before, if more than one PAC•RT vehicular repeater is in the priority

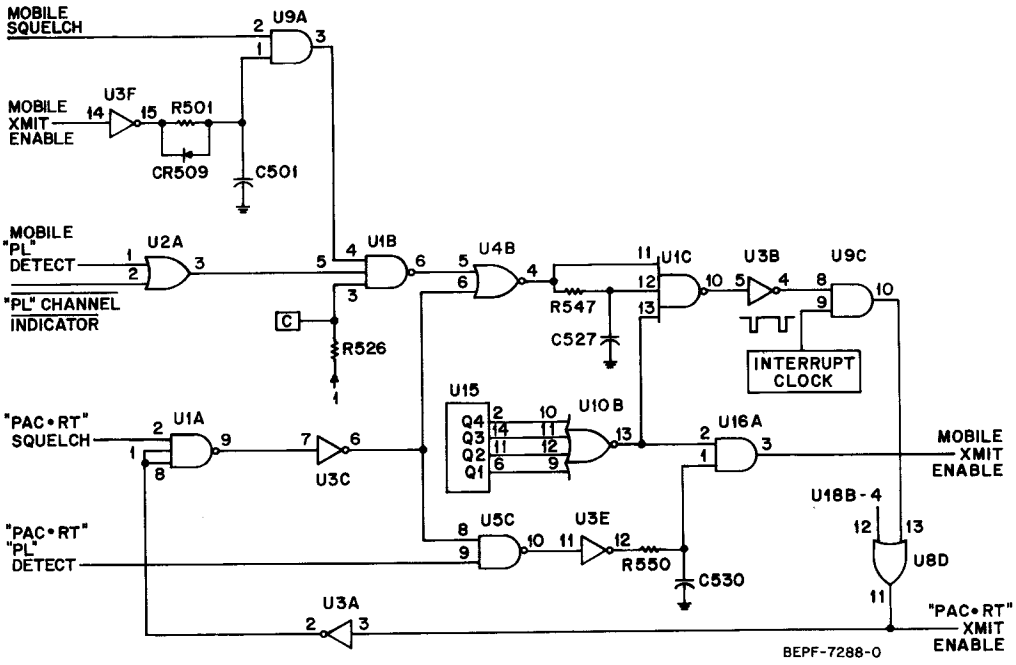


Figure 18. Portable Interrupt/Portable Priority Logic Diagram

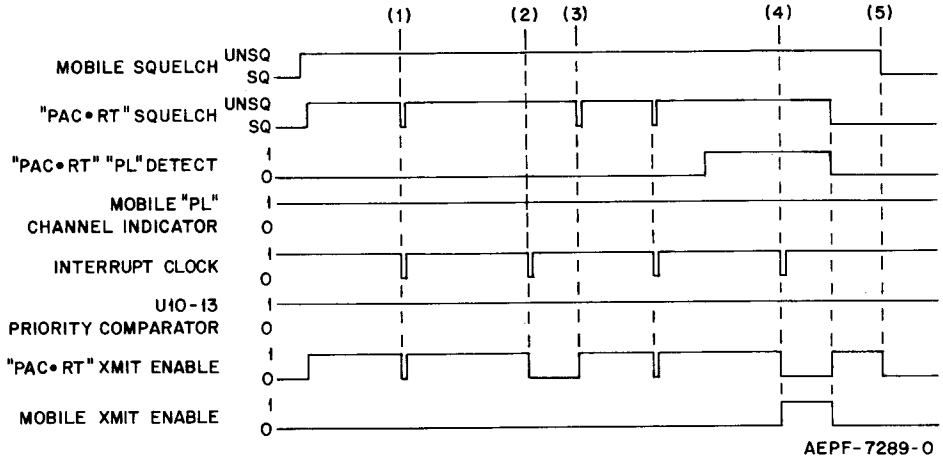


Figure 19. Portable Interrupt/Portable Priority Timing Diagram

state, the system self-clears on the first base-to-portable transmission that is greater than the time from the beginning of a repeat transmission until one unit interrupts. On an average, this would be one-half the nominal interrupt of 1-2 seconds duration. Refer to Figures 20 and 21. When conditions to repeat base-to-portable exist (point 1 of Figure 21), the PAC•RT Transmit Enable line goes high. On the first interrupt pulse (point 2), the presence of portable frequency carrier is detected, causing the PAC•RT transmitter to be inhibited. For this example, the detected portable frequency carrier is that of another PAC•RT repeater. When conditions to repeat cease (point 3), the Mobile Squelch line goes low causing mobile squelch one-shot U12B-4 to fire. Next, the PAC•RT Squelch line goes low because the other repeater stopped repeating, and this causes PAC•RT squelch one-shot U12A-2 to fire which ultimately supplies a clock pulse to the priority counter to set it to "delay state one."

If it is desirable to defeat the interrupt feature for any reason, it is necessary to ground point G on the main circuit board.

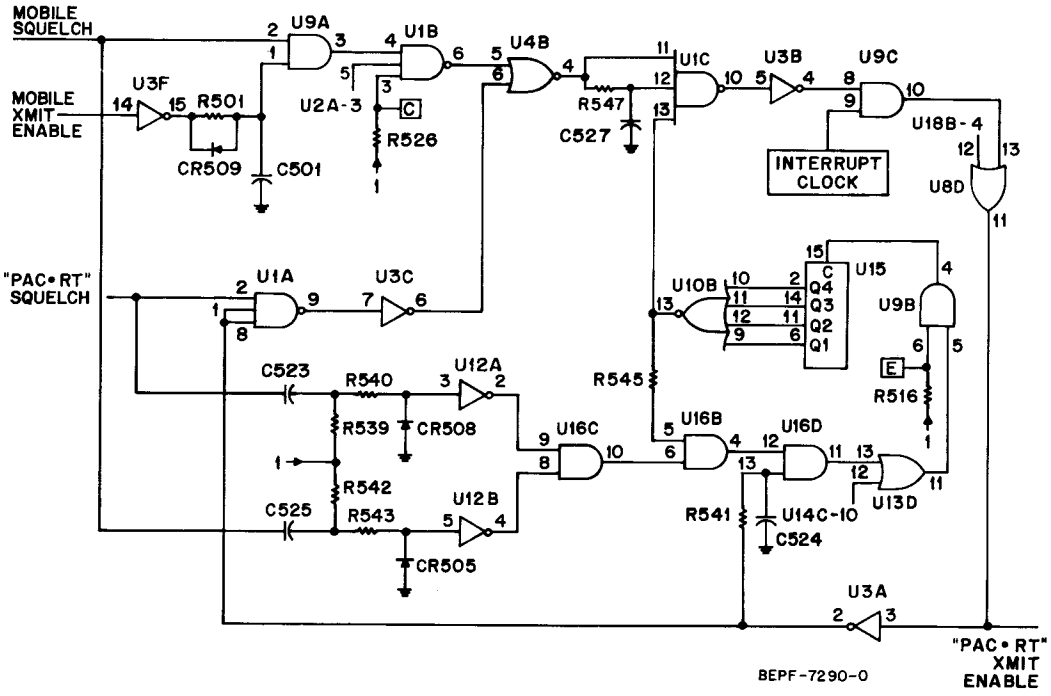


Figure 20. Self-Clearing Logic Diagram

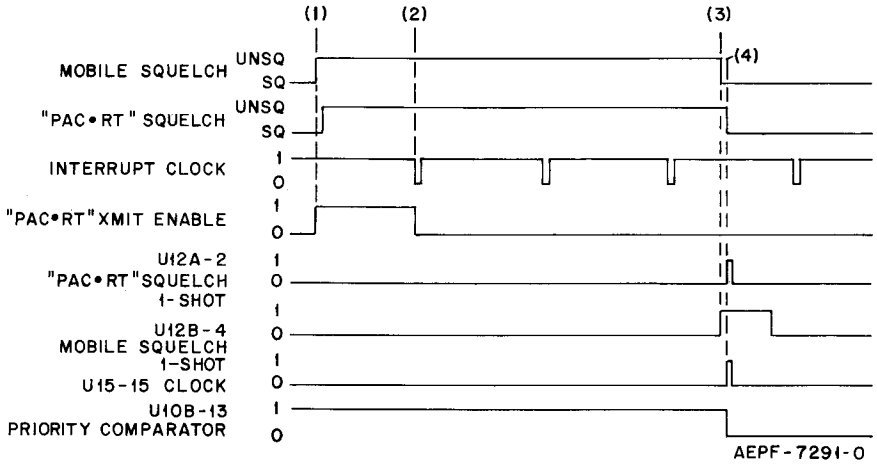


Figure 21. Self-Clearing Timing Diagram

f. Time-out Timer Circuitry

When conditions to repeat are present, the time-out timer (TOT) one-shot is fired. If these conditions are still present after approximately two minutes, an output from the TOT presets the counter to "logic state one," taking the repeater out of the priority state and, consequently, stopping the repeater from transmitting.

3. FUNCTIONAL CIRCUIT ANALYSIS

a. Voltage Regulator
(Refer to Figure 22)

The voltage regulator shown in Figure 22 uses dc negative feedback reference amplifier Q328 to control the output voltage. The desired regulated voltage is obtained by adjusting R379. Once set, any variation in the regulated voltage is applied to the emitter of Q328 because of the constant voltage drop across Zener diode VR301. A fraction of the variation, determined by the voltage divider action of R378 with CR344, CR345, R379, and R380, is applied to the base of Q328. The resultant change in base-emitter voltage varies the collector current through Q328 which changes the base drive to Q327 returning the regulated voltage to its original value.

Short circuit protection is provided by CR342 which turns off Q328 and Q327 in the event the regulated voltage line is momentarily shorted to ground. When the PAC•RT control unit on/off switch is in the ON position, unregulated B+ is applied to pin 9 of J301. Setting the on/off switch to the OFF position, removes B+ from pin 9 which turns Q326 and the rest of the circuit off. Q324, in conjunction with VR302, provides start-up voltage through CR343 to the base of Q328 when unregulated B+ is initially applied. Once regulation is achieved, CR343 becomes back-biased, isolating the start-up circuit from the rest of the regulator.

b. "Private-Line" Circuits
(Refer to Figure 23)

Recovered audio from the discriminator is filtered to suppress the high-frequency voice components and to pass the low-frequency (below 200 Hertz) PL tone. The tone is coupled into the PL module at pin 8. The tone is amplified, coupled externally from pin 4 to pin 10 of the module, and further amplified before being applied to the primary of the "Vibrasponder" resonant reed. If the tone has the proper frequency, it is coupled electromechanically to the reed secondary, then back into the module at pin 11 for further amplification and detection. With the proper tone, the voltage at pin 13 drops to zero, which produces a 10.5 V dc signal at the PL output.

c. Single-tone Encoder/Decoder Circuit
(Refer to Figure 24)

With the single-tone encoder/decoder circuit in the decode mode, receiver audio is coupled into IC401 when the Single-tone Decode Enable line goes high, turning on Q401. The Single-tone Decode Enable line is triggered high when the PAC•RT Squelch line goes from squelched to unsquelched.

Diodes CR402 and CR403 clip the incoming waveform to 1.2 volts dc peak-to-peak. The signal is then fed to voltage divider R409 and R410 to provide IC401 with the proper signal level.

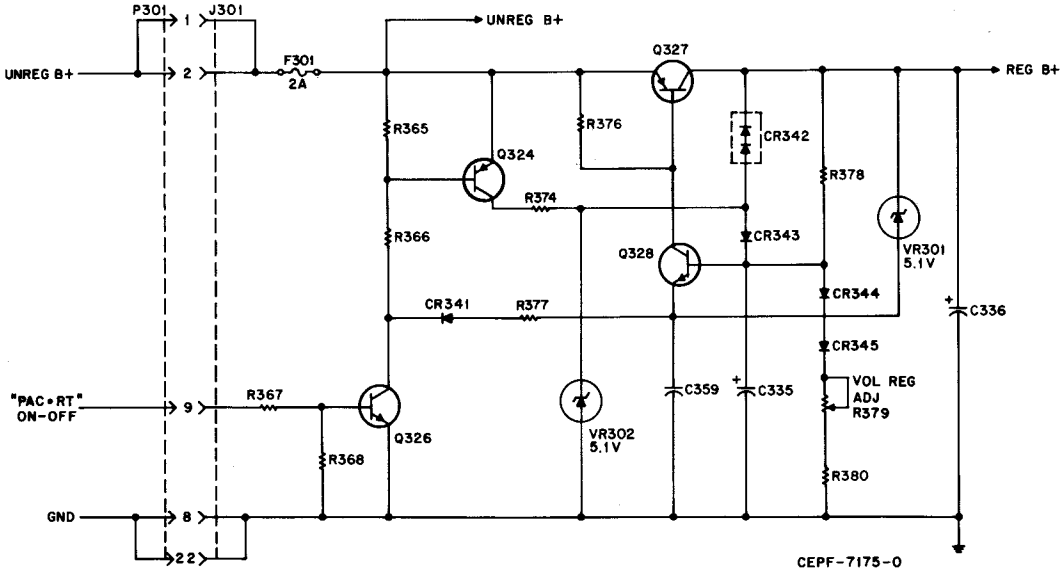


Figure 22. Typical Voltage Regulator

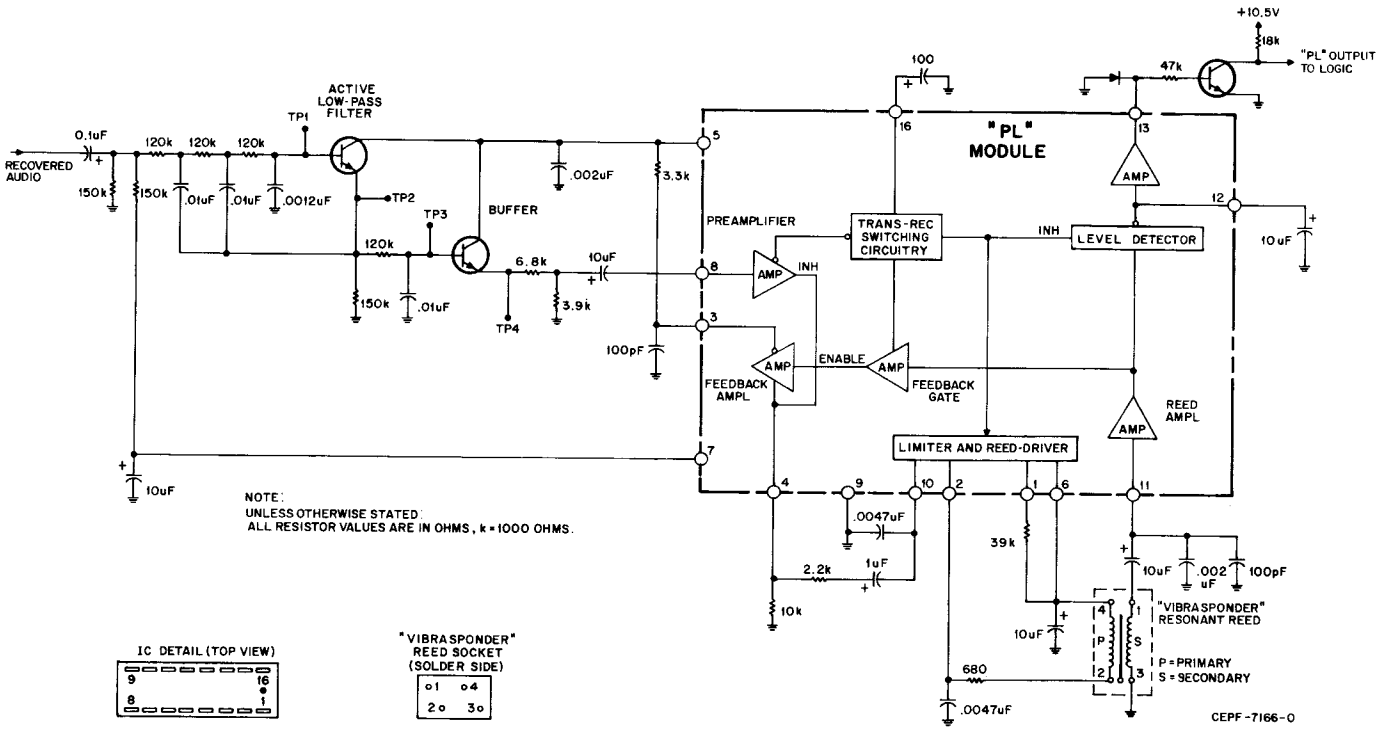


Figure 23. Typical "Private-Line" Circuit

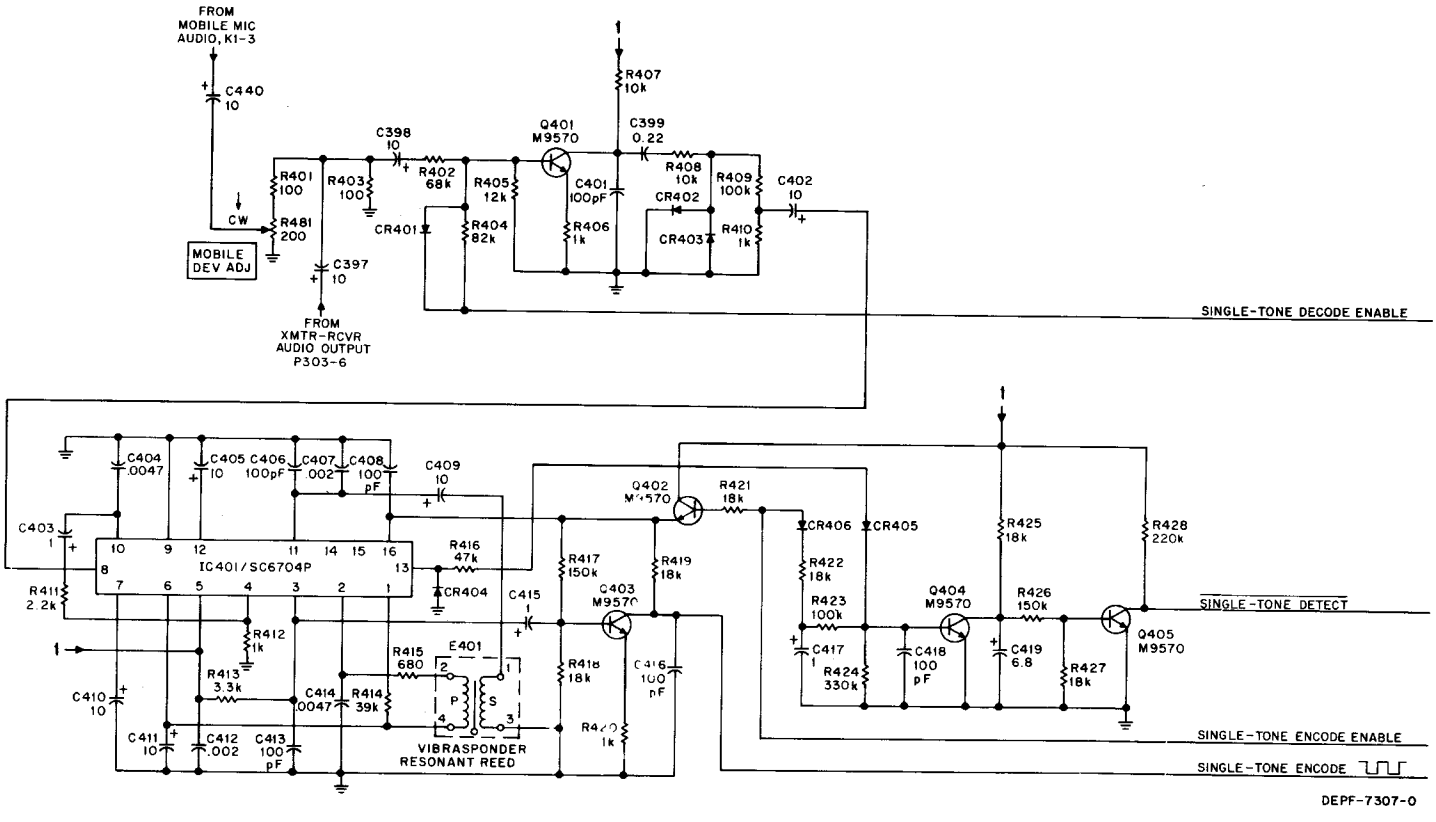


Figure 24. Single-tone Encoder/Decoder Circuit

If the incoming signal has the same frequency as the "Vibrasponder" resonant reed, pin 13 of IC401 switches from 5 volts dc to approximately 0.1 volt dc. The single-tone detect transition is delayed through Q404 and Q405,and is fed to the logic circuitry.

In the encode mode, the Single-tone Encode Enable line goes high, turning on Q402 which supplies B+ to pin 16 of IC401, placing it in the encode mode. In addition, Q404 is held in saturation, preventing any transitions from reaching the logic circuitry. A single-tone encode signal is then applied to the logic circuitry and ultimately to the PAC•RT transmitter audio input.

d. Squelch Circuitry

The same integrated circuit is used in the mobile squelch, the PAC•RT squelch, and in the monitor receiver squelch circuits. The mobile circuit is used to describe the operation of all three squelch circuits.

(1) Squelch Input Circuit
(Refer to Figure 25)

The input signal from the squelch control may consist of noise, audio message, and/or PL tones.

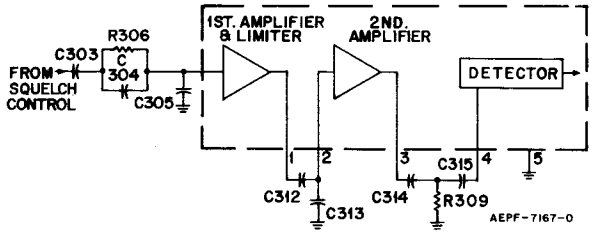


Figure 25. Squelch Input Circuit

An input shaping network precedes IC301 that passes high frequencies and attenuates low frequencies. Use of high frequencies eliminates the effect of voice and PL tones and results in a more sensitive threshold squelch.

The first amplifier and limiter is driven into limiting by its signal and prevents squelch blocking on PL tone and voice signals. Amplified, limited noise is then passed through a coupling network to the second amplifier. This coupling network is also a high-pass filter which further attenuates voice and PL tone signals to the second amplifier.

The second amplifier amplifies the noise signal and applies it through an RC coupling network to the detector. Components C314 and R309 form another high-pass filter that attenuates the low frequencies. Capacitor C315 is used to produce a peak-to-peak detector action from the noise detector and, thus, generate twice the output voltage of a peak detector. This capacitor does not affect frequency response.

(2) Detector and Switching Circuits
(Refer to Figure 26)

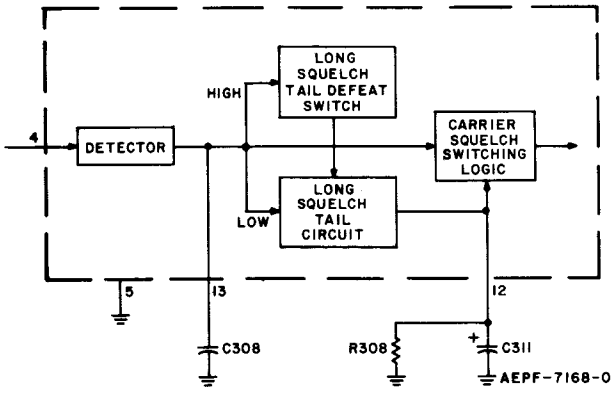


Figure 26. Detector and Switching Circuits

The detector output level is a function of received signal strength and the setting of the squelch control. The detector develops the dc output voltage across filter capacitor C308. The lowest dc output voltage corresponds to a no-signal input (maximum noise) condition. The output voltage increases as the received rf carrier signal level increases (noise decreases). A voltage higher than approximately 2.8 volts dc indicates that the channel is being used.

The primary function of the detector output is to control shunt switching. It is applied to three squelch circuits simultaneously: "long squelch tail circuit," "long squelch tail defeat switch," and "carrier squelch switching logic." With no received rf carrier signal (maximum noise condition), the "long squelch tail circuit" and "long squelch tail defeat switch" are off and the "carrier squelch switching logic" is on, causing a squelched condition at the output.

As the input signal level increases (noise decreases), the detector output voltage increases. A detector output voltage above 2.8 volts dc turns on the "long squelch tail circuit." The "long squelch tail circuit" produces a voltage at IC301-12 of 5.5 volts dc; this voltage causes the "carrier squelch switching logic circuit" to unsquelch. Capacitor C311 and resistor R308 provide a rapid rise, slow decay, time constant to the voltage applied to the "carrier squelch switching logic circuit." This permits a weak signal to immediately unsquelch the unit, yet delays squelching if the signal is in a "flutter" condition. The voltage necessary to enable the carrier squelch switching logic is approximately 3.8 volts dc.

A voltage greater than 5 volts dc at the detector output (rf carrier signal level that produces 20 dB quieting, or better with the squelch control set at threshold), turns on the "long squelch tail defeat switch." This disables the "long squelch tail circuit" and the 150-millisecond delay function. Audio channel disabling now occurs immediately after the rf carrier disappears.

(3) Squelch Output Circuit (Refer to Figure 27)

In this application, the shunt switches and the associated squelch control logic are not used. The squelch output is taken from pin 10 of IC301 and fed to inverter stage Q303. The collector of Q303 is grounded in the squelched condition and supplies 10.5 volts dc to the logic in the unsquelched condition.

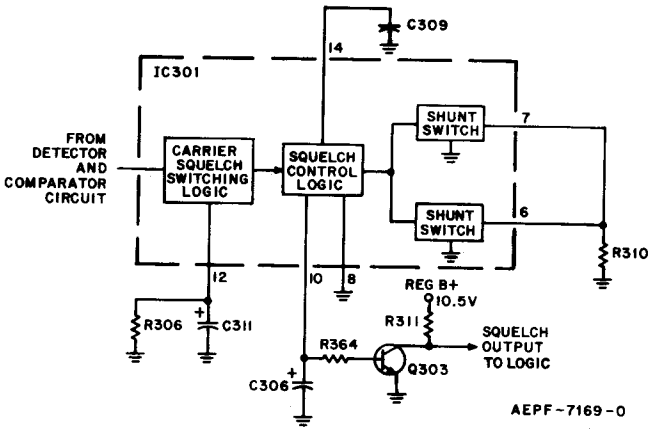


Figure 27. Squelch Output Circuit

e. Channel Selector Circuits

Two different channel selector circuits are used in the PAC•RT repeater, allowing either ground or B+ switching to be used. In systems using B+ switching, the circuit is as shown in Figure 28.

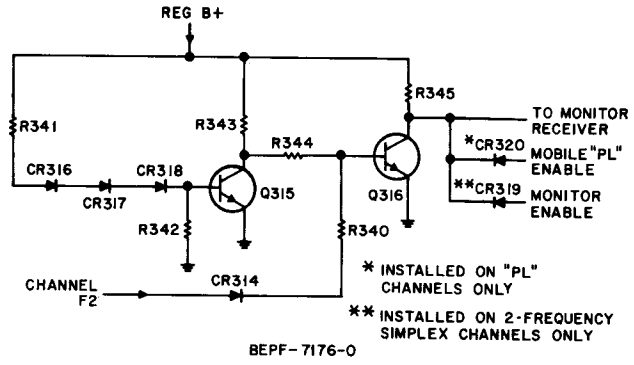


Figure 28. B+ Switching Channel Selector Circuits

If B+ is applied to the input, Q316 is turned on, which produces a logical zero (low) at the output enabling channel two in the monitor receiver circuit.

In systems using ground switching, the circuit is as shown in Figure 29.

When a ground is applied to the input, Q315 is turned off which saturates Q316, producing a logical zero (low) at the output to enable channel two in the monitor receiver circuit.

f. Monostable Multivibrator Circuits

Two types of monostable multivibrators (one-shots) are used in the PAC•RT repeater. Monostable multivibrator circuits are characterized by one stable state and one quasi-stable state. The circuit is placed in the quasi-stable state by an appropriate trigger signal and remains there for a time determined by an RC network.

The one-shot shown in Figure 30 is the one used in the mobile and PAC•RT squelch one-shot circuits. A negative transition at V_{in} triggers the circuit as shown. The output remains high until the voltage at points 1 and 2 charge to the transition voltage (V_{tr}) which for CMOS (Complementary Metal Oxide Semiconductor) gates is approximately equal to one half the supply voltage. The charging time is controlled by the following

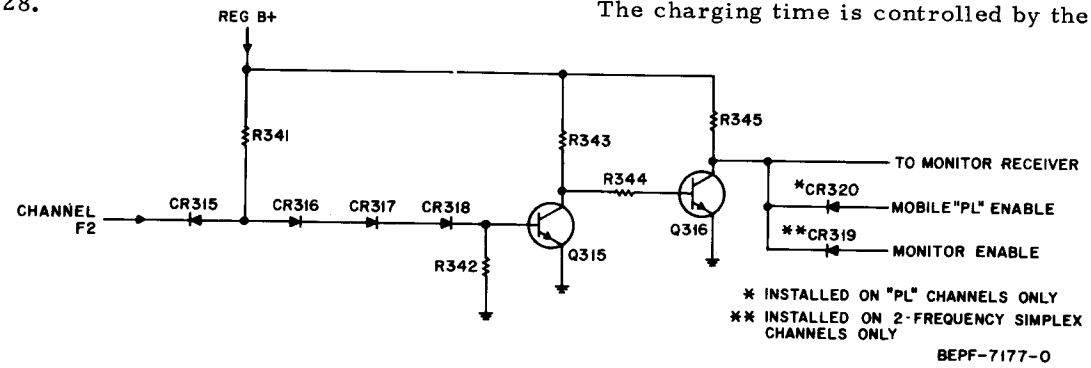


Figure 29. Ground Switching Channel Selector Circuits

relationship: $T = -R_1C_1 \ln 0.5$ or $T = .69R_1C_1$. Resistor R2 and diode CR1 are used for input protection to the CMOS gate and do not affect the normal operation of the one-shot.

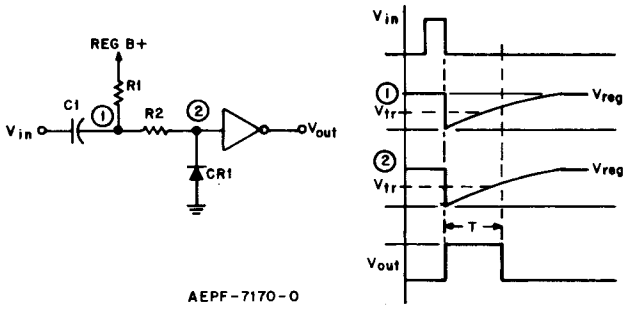


Figure 30. Squelch One-Shot

The second type of one-shot used in the PAC•RT repeater is shown in Figure 31. As shown, a negative transition at point 1 triggers this circuit also. The output can be taken from either point 3 or point 5 depending on the sense and length of the pulse desired. If the output is taken at point 5, then the pulse duration is $T = -R_2C_2 \ln 0.5$ or $T = .69R_2C_2$. If the output is taken from point 3, the duration is $T = -R_1C_1 \ln 0.5 - R_2C_2 \ln 0.5$ or $T = .69R_1C_1 + .69R_2C_2$. This circuit is used in the time-out timer and single tone one-shot.

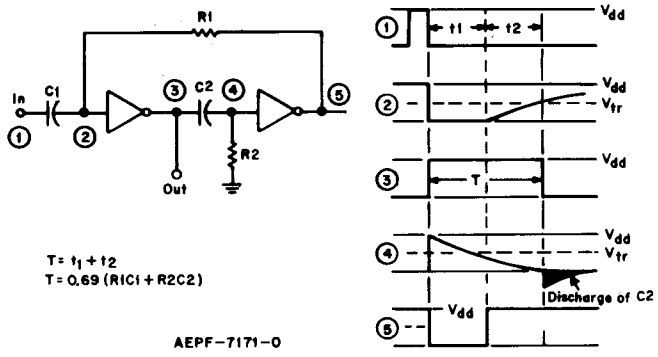


Figure 31. Conventional One-Shot

g. Clock Circuits

The two clocks used in the PAC•RT repeater are the same conventional configuration as that shown in Figure 32. Resistor R2 isolates R1 and C1 from the input protection diodes associated with the first gate. The period, T1, is determined by R1 and C1 and is approximately $1.39R_1C_1$.

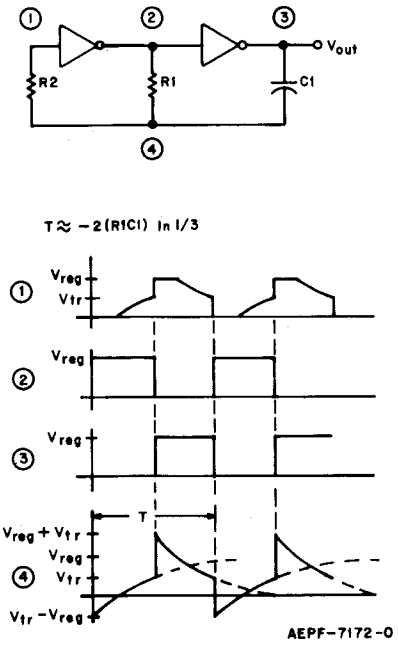


Figure 32. Conventional Clock Circuit

(1) Priority Clock (400 ms Clock)

The priority clock circuit is shown in Figure 33. The use of a four-input NOR gate for the first gate allows the mobile PTT line, the clock enable line, or the priority comparator line to control the clock operation. If any one of these lines is a logical one, the clock is turned off. Resistor R512 is used to adjust the clock period to 400 milliseconds.

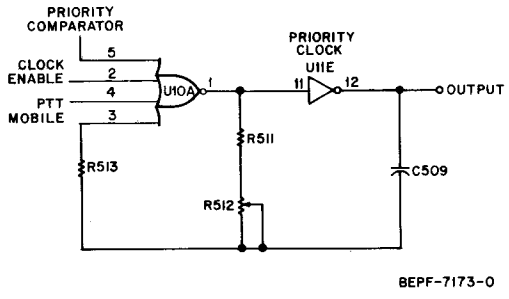


Figure 33. Priority Clock Circuit

(2) Interrupt Clock

The interrupt clock circuit is shown in Figure 34. Diode CR506 allows C518 to charge quickly through R536 and discharge slowly through R536 and R535, resulting in an output waveform as shown in the figure.

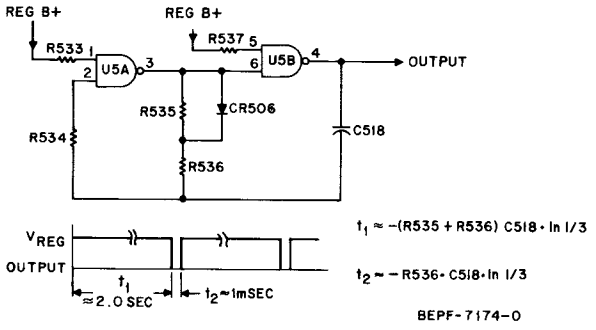


Figure 34. Interrupt Clock

h. Priority Counter

Priority counter U15 is a four-bit, binary, presettable, resettable, up/down counter. The timing diagram and truth table in Figure 35 describe its operation. The counter determines the delay state of the PAC•RT repeater. When the outputs of Q1, Q2, Q3, and Q4 are low, the repeater is in "delay state zero" and, therefore, is the priority repeater.

i. Mobile Discriminator Interface
(Refer to Figure 36)

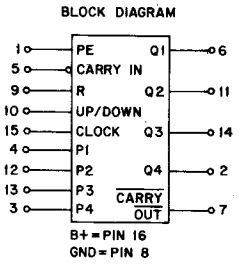
Emitter followers Q301 and Q302 are used to interface the PAC•RT repeater with the mobile discriminator. The repeater deviation is adjusted by resistor R303. Resistors R304 and R305 adjust the signal level to the mobile PL and mobile squelch circuits respectively.

TRUTH TABLE

CARRY IN	UP/DOWN	PRESET ENABLE	RESET	ACTION
1	X	0	0	NO COUNT
0	1	0	0	COUNT UP
0	0	0	0	COUNT DOWN
X	X	1	0	PRESET
X	X	X	1	RESET

X = DON'T CARE

BLOCK DIAGRAM



TIMING DIAGRAM

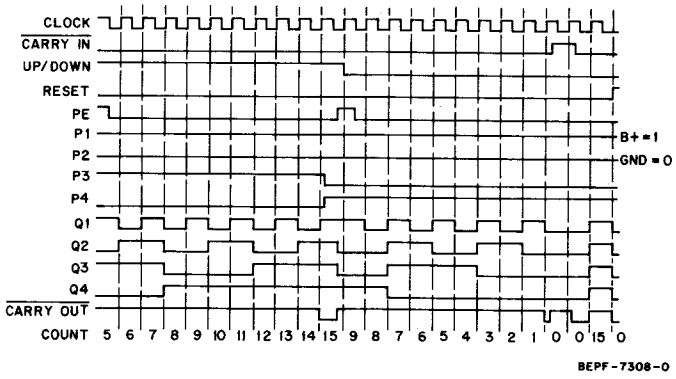


Figure 35. Priority Counter

j. Additional Switching Circuits

Inversion switching for the inside/outside and the mobile on/off functions is provided by Q321 and Q325 respectively. Refer to Figures 37 and 38. When B+ is applied to the input, the transistor is turned on and applies a ground (logic zero) to the associated logic circuitry.

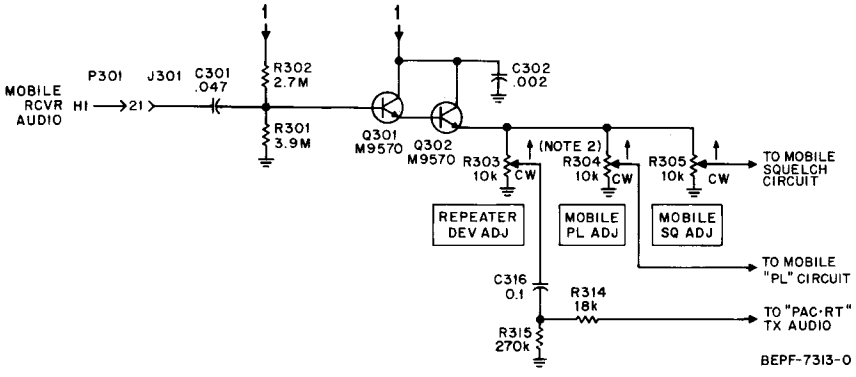


Figure 36. Mobile Discriminator Interface Circuit

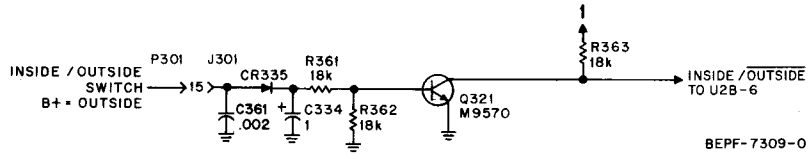


Figure 37. Inside/Outside Switching Circuit

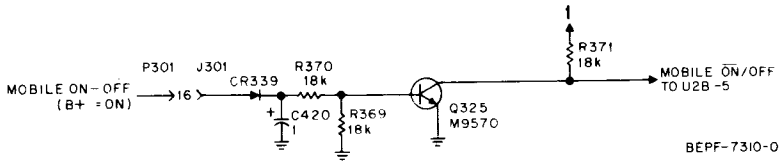


Figure 38. Mobile On/Off Switching Circuit

Relay switching for PAC•RT transmit enable and mobile transmit enable is accomplished by Q309 and Q312 respectively. The circuits are identical, therefore, the PAC•RT transmit enable circuit shown in Figure 39 typifies the relay switching circuit. Also illustrated in Figure 39 is the transmitter-receiver transmit switching circuit, Q421.

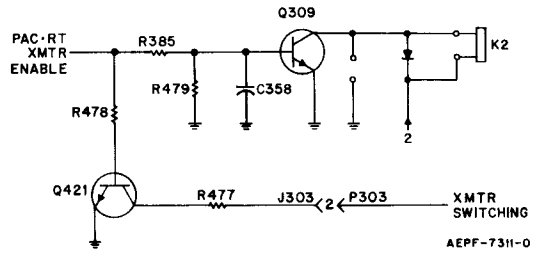


Figure 39. Typical Relay Switching Circuit

The switching action for this circuit is accomplished in the same manner as the switching action for the switching circuits found in Figures 37 and 38. A positive voltage level at the PAC•RT input causes K2 to pull-in and Q421 to apply a ground signal to the transmitter-receiver transmit switching circuit.

The mobile PTT (microphone PTT) interface (Figure 40) is provided by Q308. CR302 and R467 are installed for ground switching mobile radios only. A voltage of approximately three volts dc or less at pin 20 of P301 causes Q308 to switch and apply a ground signal to point K on the main circuit board.

k. VHF Transceiver Board

The vhf transceiver circuit board consists of a crystal-controlled transmitter and receiver operating in the 150.8-174 MHz range. The transmitter contains an audio section and an rf section (Figure 41). The audio section consists of an audio preamplifier, audio amplifier, limiter, splatter filter, and an "Instantaneous Deviation Control" (IDC) circuit. The rf section includes a crystal-controlled rf oscillator-tripler, tripler, driver, and a final amplifier stage.

The receiver (Figure 42) is a dual-conversion, superheterodyne unit consisting of an rf amplifier, two oscillators, two mixers, 10.7 MHz crystal filters, a 455 kHz filter, four 455 kHz i-f amplifiers, a 455 kHz limiter stage, dc feedback amplifier, audio driver, and final amplifiers.

(1) Transmitter

(a) Audio and IDC Stages (Refer to Figure 43)

Recovered audio from the mobile radio receiver is capacitively coupled to the input of preamplifier stage Q102. This stage provides the amplification. Clipping is performed in limiter stage Q103.

Audio "splatter" filter Q104 and its associated components provide attenuation of all audio frequencies above 3000 Hz. The audio signal is then fed to the "Instantaneous Deviation Control" (IDC) circuit.

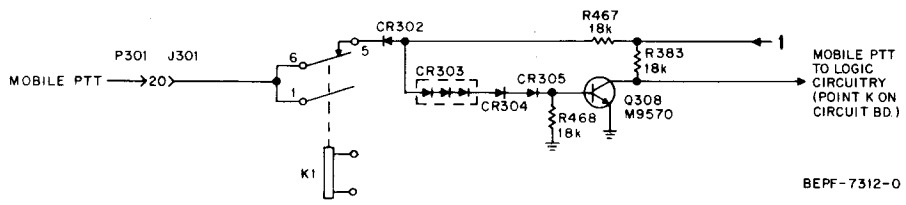


Figure 40. Mobile PTT Interface Circuit

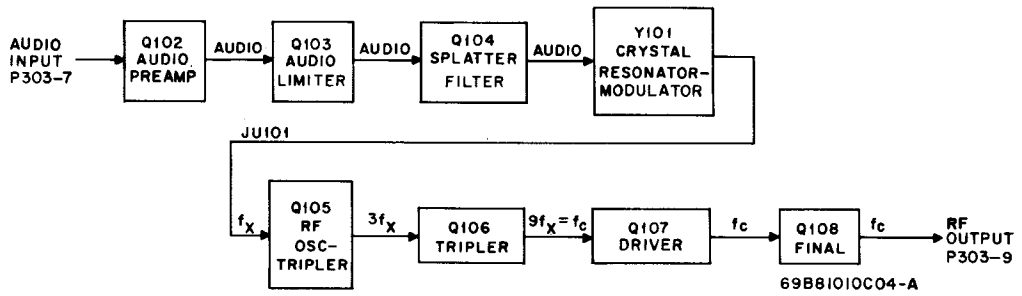


Figure 41. Transmitter Block Diagram

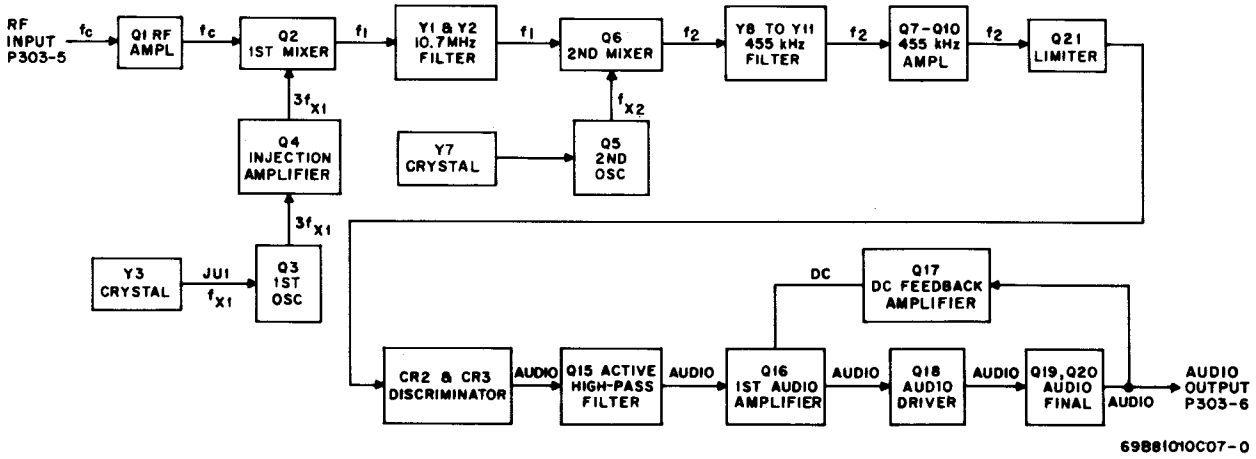


Figure 42. Receiver Block Diagram

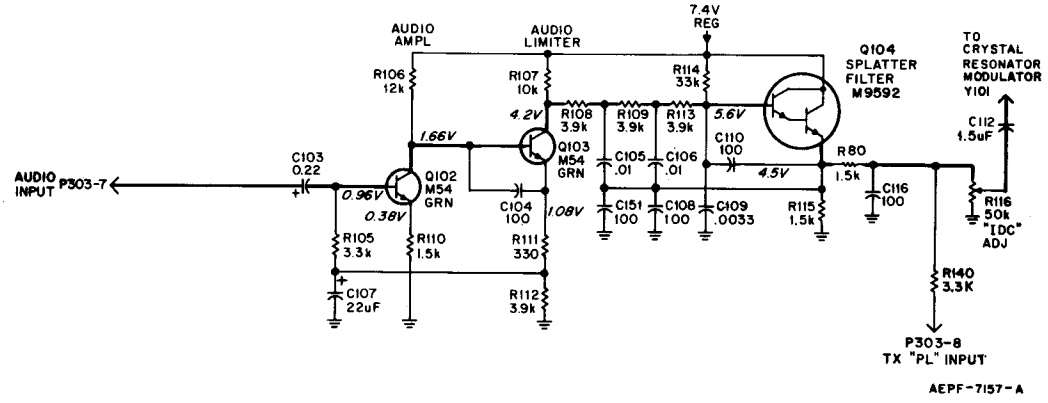


Figure 43. Typical Audio and IDC Stages

The "Instantaneous Deviation Control" circuit is shown in detail in Figure 43. The audio signal appearing at the output of the IDC circuit has been amplified and clipped from 300-3000 Hz, and attenuated if its frequency is above 3000 Hz.

(b) Modulator, RF Oscillator-Tripler, and Tripler Stages
(Refer to Figure 44)

RF oscillator-tripler Q105 is directly modulated and controlled by the resonator-modulator element Y101. The double-tuned circuit, L101 and L102 at the output of the rf oscillator-tripler, tunes to the third harmonic of the crystal frequency.

Tripler Q106 is biased to operate Class A. The output of the tripler stage is the ninth harmonic of the crystal frequency which is equal to the carrier frequency.

(c) RF Power Amplifier Stages
(Refer to Figure 45)

The next two stages of the transmitter operate "straight through" at the carrier frequency. Driver amplifier stage Q107 serves as a buffer to isolate the tripler from the succeeding amplifier and is biased to operate Class A.

Final power amplifier stage Q108 is biased for Class C operation and delivers at least 0.25 watt of rf power. The rf power output from the final power amplifier is coupled to the impedance matching network consisting of L109 and L110. The network is a low-pass filter type which attenuates harmonics of the transmitter carrier frequency. The rf power output is then coupled through P303-9 to the logic circuit board.

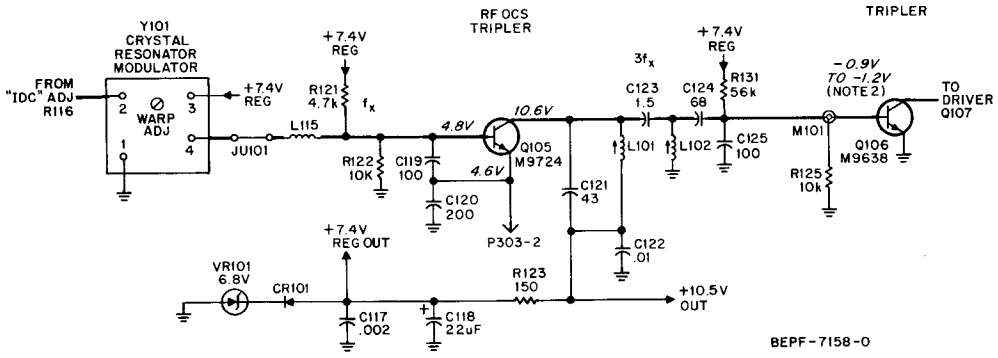


Figure 44. Typical Modulator, RF Oscillator-Tripler, and Tripler Stages

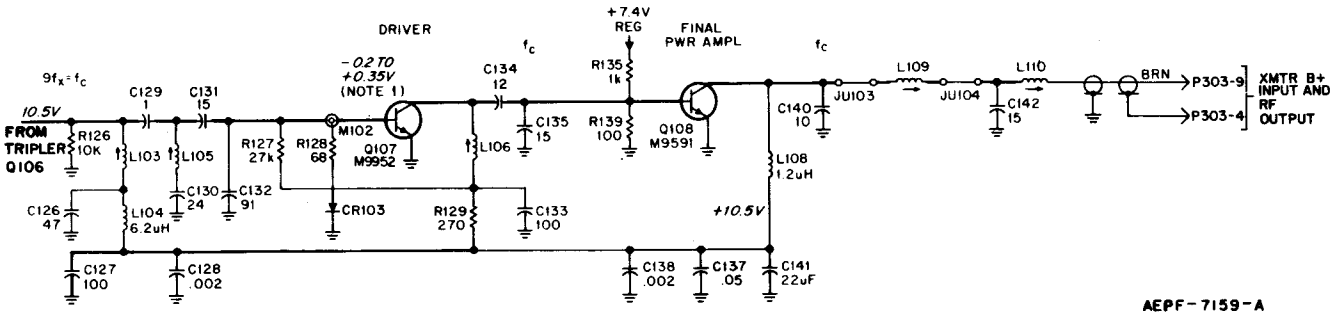


Figure 45. Typical RF Power Amplifier Stages

(2) Receiver

(a) RF Amplifier and First Mixer Stages (Refer to Figure 46)

The rf signal from rf input P303-5 is coupled through the double-tuned rf circuit consisting of L2 and L3 to first rf stage Q1. The signal is amplified in the rf amplifier and fed to first mixer Q2. The rf amplifier and first mixer are field-effect transistors (FETs). The first mixer heterodynes the rf signal and the harmonic injection signal from injection amplifier Q4 to produce the first or high i-f frequency (10.7 MHz). The high i-f signal passes through the 10.7 MHz crystal filters and is fed to the second mixer.

(b) First Oscillator and Injection Amplifier Stages (Refer to Figure 47)

First oscillator stage Q3 uses an unheated crystal operating in its third overtone series-resonant mode. The third harmonic of the oscillator output is amplified in injection amplifier Q4 and filtered to provide injection for the first mixer.

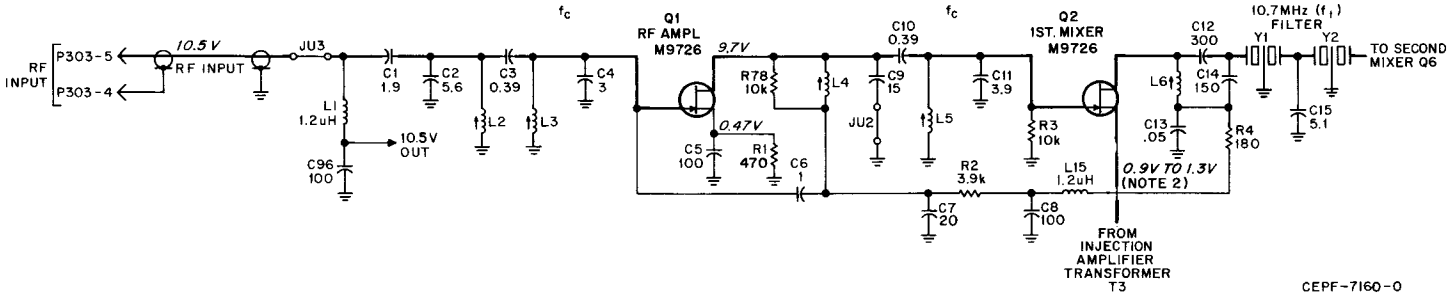


Figure 46. Typical RF Amplifier and First Mixer Stages

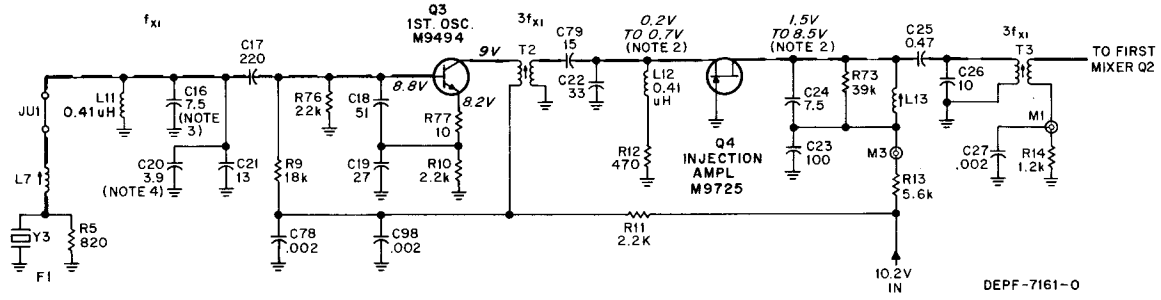


Figure 47. Typical First Oscillator and Injection Amplifier Stages

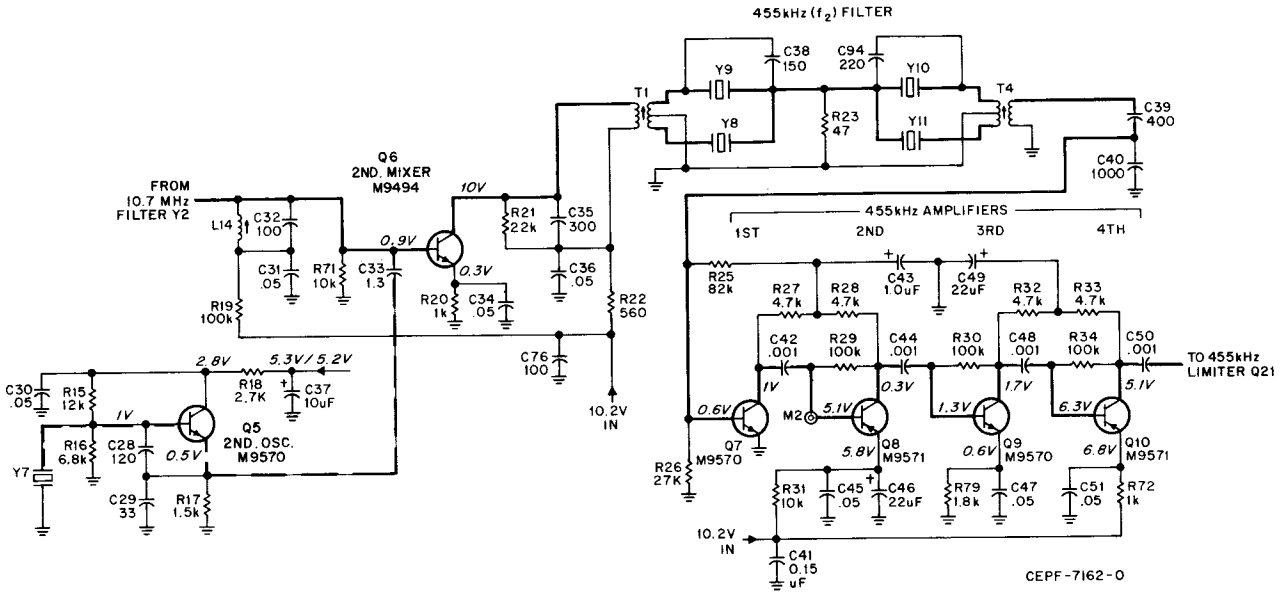


Figure 48. Typical Second Oscillator and Mixer, 455 kHz Filter, and 455 kHz Amplifier Stages

(c) Second Oscillator and Mixer, 455 kHz Filter and Amplifiers, and Limiter Stages
(Refer to Figure 48)

The first i-f signal is coupled to second mixer Q6. In the second mixer stage, the first i-f signal and the second oscillator frequency are combined or mixed to produce the second or low i-f signal at 455 kHz.

The low i-f passes through the 455 kHz ceramic filter and is fed into the 455 kHz amplifier.

After being amplified, the i-f signal is coupled to limiter stage Q21 where any amplitude modulation of the signal is removed (Figure 49). The limited signal is then fed to the discriminator stage (CR2, CR3) where the frequency variations of the incoming signal are translated into an audio signal. This signal is then filtered and amplified further by Q15, Q16, Q18, Q19, and Q20.

The discriminator circuit (T6, C55, C54, and audio recovery rectifiers) uses the 90° phase difference which occurs at resonance between the primary and secondary voltages to recover the audio modulation from the 455 kHz i-f signal. Refer to Figure 50 for the typical discriminator recovery curve. The variation in the i-f signal, at an audio rate, is shown below the curye. The resulting recovered audio output is shown to the right of the curve. The output of the discriminator circuit is applied to the audio circuits.

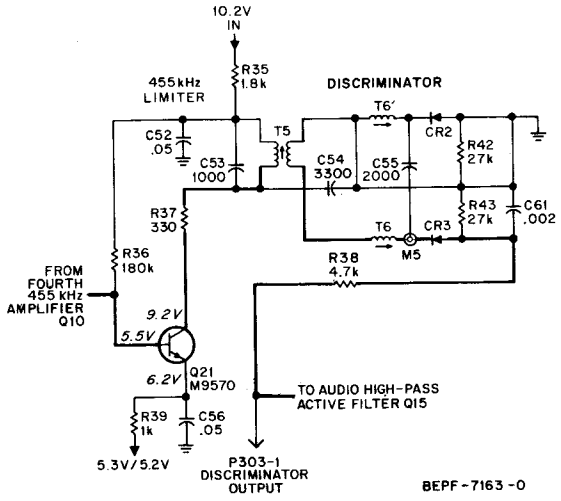


Figure 49. Typical Limiter and Discriminator Stages

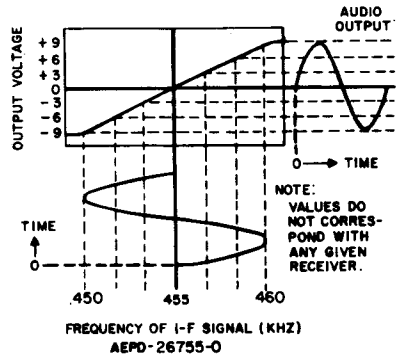


Figure 50. Typical Discriminator Response

(d) Audio Amplifier Stages
(Refer to Figure 51)

The first stage in the receiver audio amplifier stages is Q15, which is an active high-pass filter with unity gain in the pass band. At the cut-off frequency, the filter has a gain of approximately 5 dB, and at lower frequencies, the roll-off is 18 dB per octave. The output of the active filter is fed to voltage divider R46 and R47.

From the junction of R46 and R47, the signal is fed into direct-coupled audio stages Q16, Q18, Q19, and Q20; and then applied through audio output connector P303-6 to the logic circuit board. A dc feedback amplifier stage, Q17, provides dc stability.

(3) "Private-Line" Circuits
(Refer to Figure 52)

Recovered audio from the discriminator is filtered to suppress the high-frequency voice component and pass the low-frequency (below 200 Hz) PL tone. The tone is coupled into the PL module at pin 8. The tone is amplified, coupled externally from pin 4 to pin 10 of the module, and further amplified before being applied to the primary of the "Vibrasponder" resonant reed. If the tone is of the proper frequency, it is coupled electromechanically to the reed secondary, then back into the module at pin 11 for further amplification, detected, and filtered by the 10 uF capacitor on pin 12. With the proper tone, the voltage at pin 13 drops to zero, which produces a 10.5 V dc signal at the PL output.

1. UHF Transceiver Board

The uhf transceiver circuit board consists of a crystal-controlled transmitter and receiver operating in the 450-470 MHz range. The transmitter contains an audio section and an rf section (Figure 53). The audio section consists of an audio preamplifier, limiter, splatter filter, and an "Instantaneous Deviation Control" (IDC) circuit. The rf section includes a crystal-controlled rf oscillator-tripler, second and third tripler, driver, and a final amplifier stage.

The receiver (Figure 54) is a dual-conversion, superheterodyne unit consisting of two oscillators, two mixers, 17.9 MHz crystal filters, a 455 kHz filter, four 455 kHz i-f amplifiers, a 455 kHz limiter stage, dc feedback amplifier, audio driver, a driver, and final amplifiers.

(1) Transmitter

(a) Audio and IDC Stages
(Refer to Figure 55)

Recovered audio from the mobile radio receiver is capacitively coupled to the input of preamplifier stage Q102. This stage provides the amplification. Clipping is performed in limiter stage Q103.

Audio "splatter" filter Q104 and its associated components provide attenuation of all audio frequencies above 3000 Hertz. The audio signal is then fed to the "Instantaneous Deviation Control" (IDC) circuit.

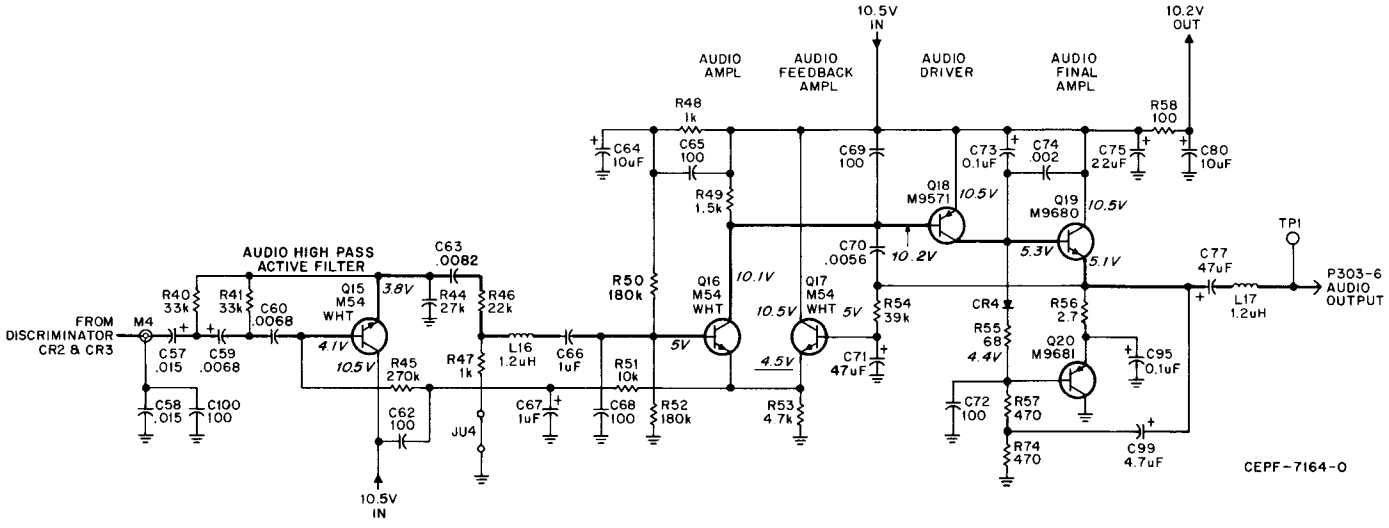


Figure 51. Typical Audio Amplifier Stages

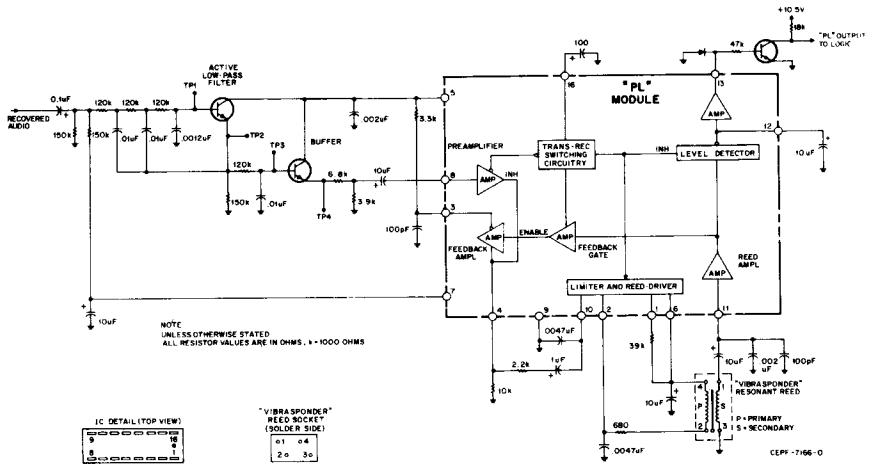


Figure 52. Typical "Private-Line" Circuit

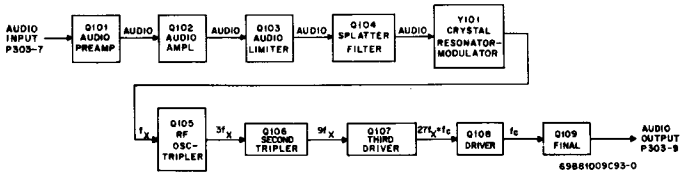


Figure 53. Transmitter Block Diagram

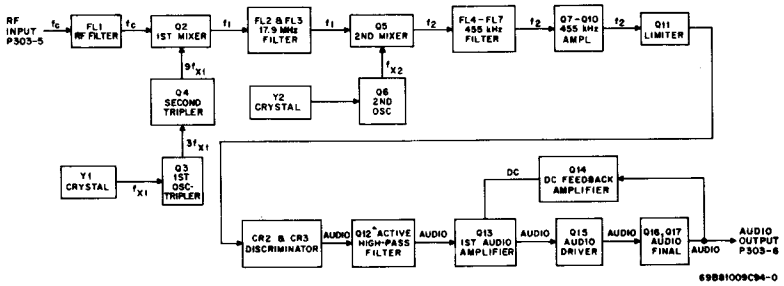


Figure 54. Receiver Block Diagram

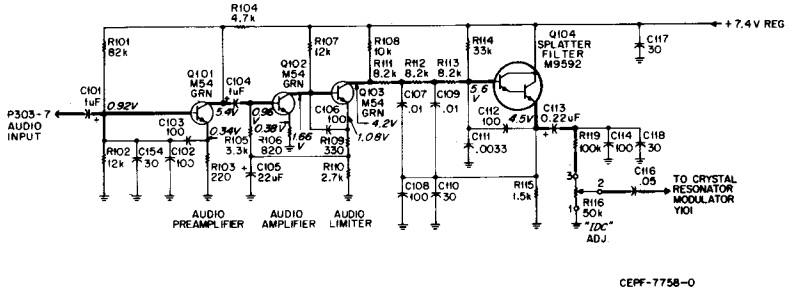


Figure 55. Typical Audio and IDC Stages

The "Instantaneous Deviation Control" circuit is shown in detail in Figure 43. The audio signal appearing at the output of the IDC circuit has been amplified and clipped from 300-3000 Hz, and attenuated if its frequency is above 3000 Hz.

(b) Modulator, RF Oscillator-Tripler, and Tripler Stages (Refer to Figure 56)

RF oscillator-tripler Q105 is directly modulated and controlled by the resonator-modulator element Y101. The double-tuned circuit, L102 and L103 at the output of the rf oscillator-tripler, tunes to the third harmonic of the crystal frequency.

Second tripler Q106 is biased to operate Class A. The output of the tripler stage is the ninth harmonic of the crystal frequency.

Third tripler Q107 is biased to operate Class A. The output of the third tripler stage (which is equal to the carrier frequency) is the 27th harmonic of the oscillator frequency.

(c) RF Power Amplifier Stages (Refer to Figure 57)

The next two stages of the transmitter operate "straight through" at the carrier frequency. Driver amplifier stage Q108 serves as a buffer to isolate the tripler from the succeeding amplifier and is biased to operate Class A.

Final power amplifier stage Q109 is biased for Class C operation and delivers at least 0.25 watt of rf power. The rf power output from the final power amplifier is coupled to the impedance matching network consisting of L115, C146, C147, and C148. The network is a low-pass filter which attenuates harmonics of the transmitter carrier frequency. The rf power output is then coupled through P303-9 to the logic circuit board.

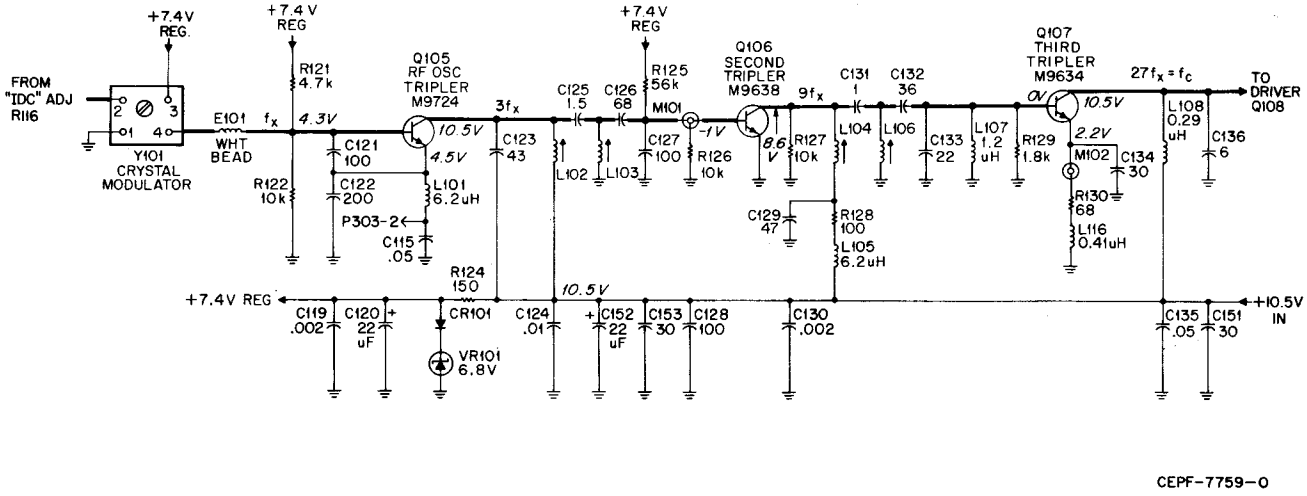


Figure 56. Typical Modulator, RF Oscillator-Tripler, and Tripler Stages

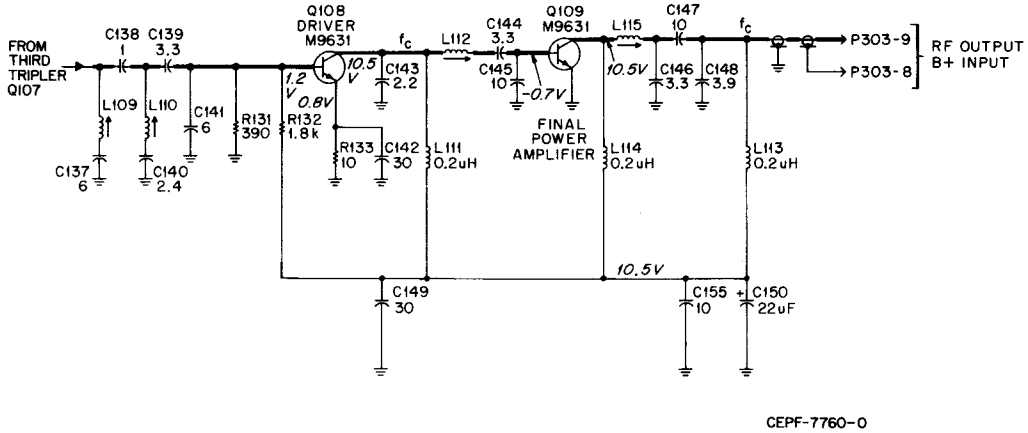


Figure 57. Typical RF Power Amplifier Stages

(2) Receiver

(a) Helical Filter and First Mixer Stages (Refer to Figure 58)

The rf signal from rf input P303-5 is coupled through a helical filter to first mixer Q2. The filter consists of four low-loss, highly selective, helical resonant cavities. Capacitive coupling is used to couple the signal through the resonant cavity apertures. The helical filter has a flat acceptance bandwidth and a steep skirt response to provide rapid attenuation of signals outside the accepted bandwidth. The first mixer heterodynes the rf signal and the harmonic injection signal from the second tripler injection filter to produce the first or high i-f frequency (17.9 MHz). The high i-f signal passes through the 17.9 MHz crystal filters and is fed to the second mixer.

(b) First Oscillator-Tripler, Second Tripler, and Injection Filter Stages (Refer to Figure 59)

First oscillator-tripler stage Q3 uses an unheated crystal operating in its third overtone series-resonant mode. The third harmonic of the oscillator output is fed to second tripler Q4 and the ninth harmonic of the oscillator output is filtered to provide injection for the first mixer.

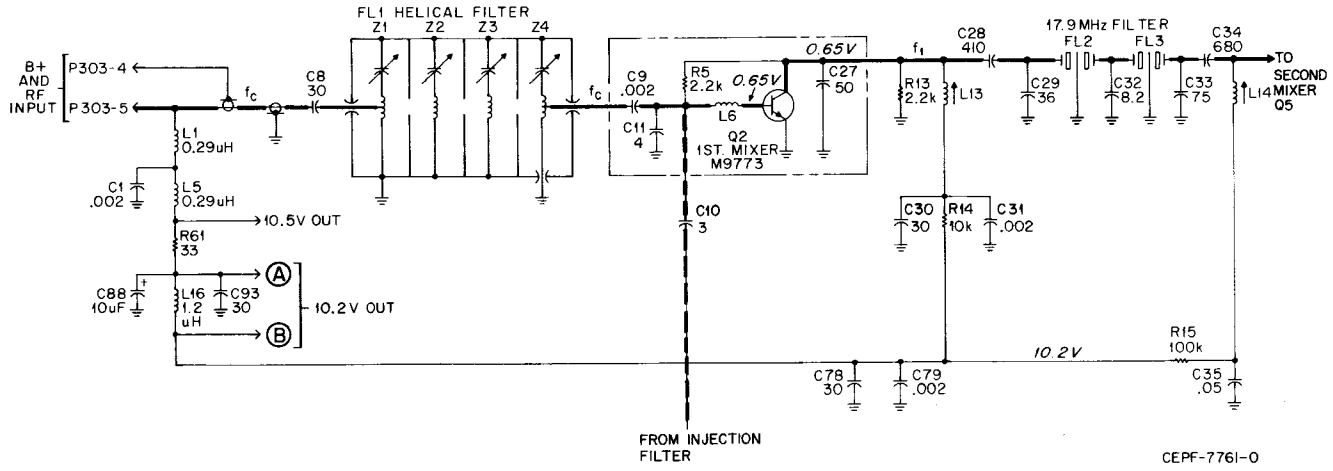


Figure 58. Typical Helical Filter and First Mixer Stages

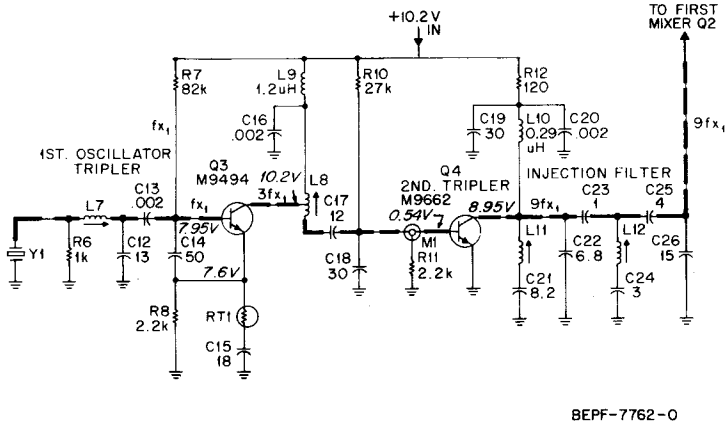


Figure 59. Typical First Oscillator-Tripler, Second Tripler, and Injection Filter Stages

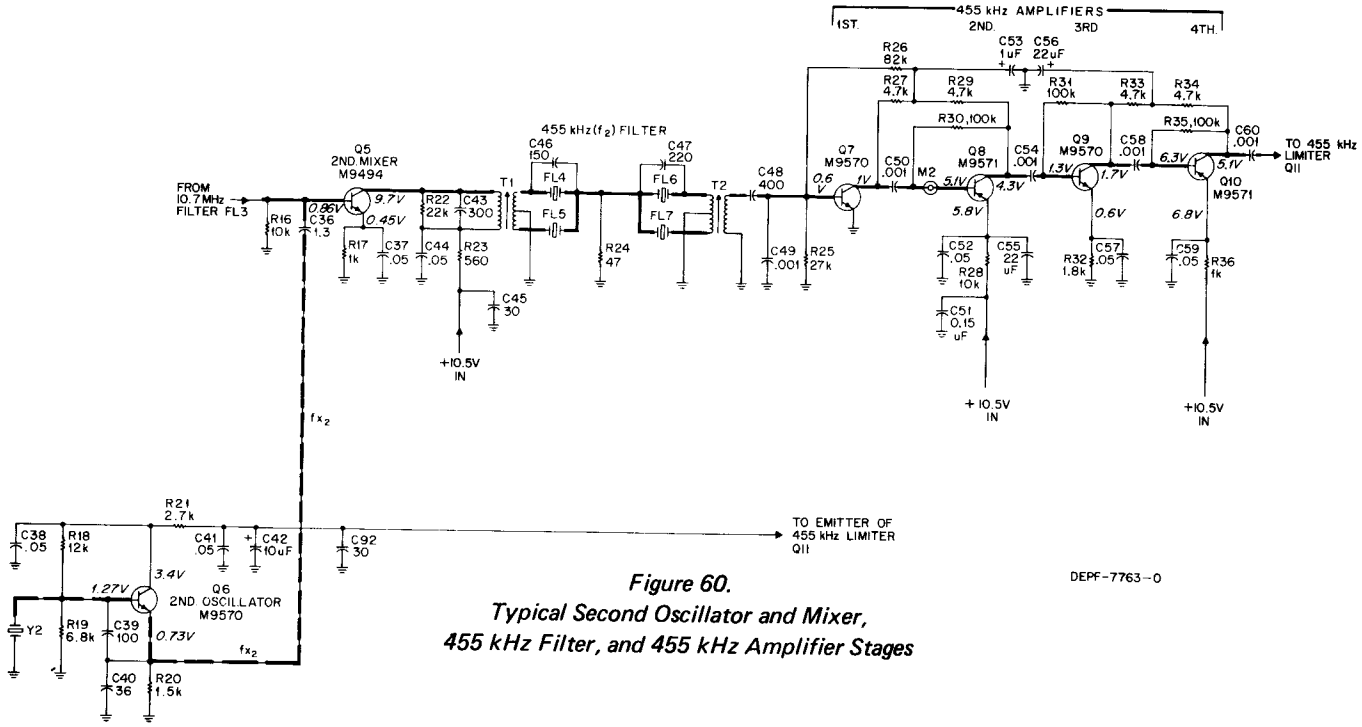


Figure 60.
Typical Second Oscillator and Mixer, 455 kHz Filter, and 455 kHz Amplifier Stages

(c) Second Oscillator and Mixer, 455 kHz Filter and Amplifiers, and Limiter Stages
(Refer to Figure 60)

The first i-f signal is coupled to second mixer Q5. In the second mixer stage, the first i-f signal and the second oscillator frequency are combined or mixed to produce the second or low i-f signal at 455 kHz.

The low i-f passes through the 455 kHz ceramic filter and is fed into the 455 kHz amplifier.

After being amplified, the i-f signal is coupled to limiter stage Q11 where any amplitude modulation of the signal is removed (Figure 61). The limited signal is then fed to the discriminator stage (CR2, CR3) where the frequency variations of the incoming signal are translated into an audio signal. This signal is then filtered and amplified further by Q12, Q13, Q15, Q16, and Q17.

The discriminator circuit (T4, C65, C64, and audio recovery rectifiers) uses the 90° phase difference which occurs at resonance between the primary and secondary voltages to recover the audio modulation from the 455 kHz i-f signal. Refer to Figure 62 for the typical discriminator recovery curve. The variation in the i-f signal, at an audio rate, is shown below the curve. The resulting recovered audio output is shown to the right of the curve. The output of the discriminator circuit is applied to the audio circuits.

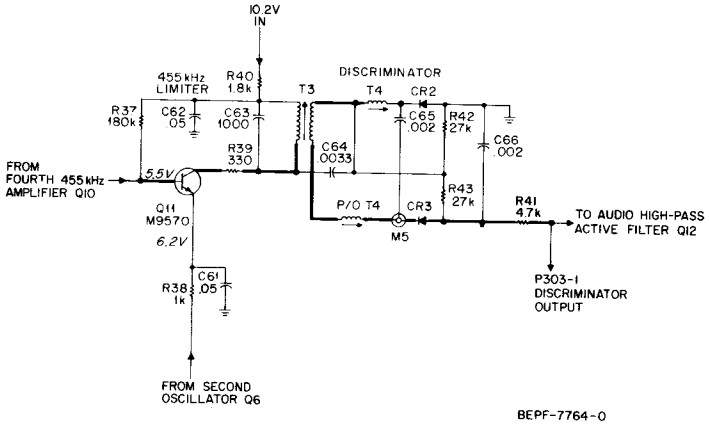


Figure 61. Typical Limiter and Discriminator Stages

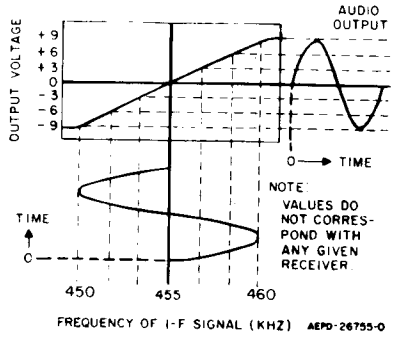


Figure 62. Typical Discriminator Response

(d) Audio Amplifier Stages
(Refer to Figure 63)

The first stage in the receiver audio amplifier stages is Q12 which is an active high-pass filter with unity gain in the pass band. At the cut-off frequency, the filter has a gain of approximately 5 dB, and at lower frequencies, the roll-off is 18 dB per octave. The output of the active filter is fed to voltage divider R48 and R49.

From the junction of R48 and R49, the signal is fed into direct-coupled audio stages Q13, Q15, Q16, and Q17; and then applied through audio output connector P303-6 to the logic circuit board. A dc feedback amplifier stage, Q14, provides dc stability.

(3) "Private-Line" Circuits
(Refer to Figure 64)

Recovered audio from the discriminator is filtered to suppress the high-frequency voice component and pass the low-frequency (below 200 Hz) PL tone. The tone is coupled into the PL module at pin 8. The tone is amplified, coupled externally from pin 4 to pin 10 of the module, and further amplified before being applied to the primary of the "Vibrasponder" resonant reed. If the tone is of the proper frequency, it is coupled electromechanically to the reed secondary, then back into the module at pin 11 for further amplification, detected, and filtered by the 10 uF capacitor on pin 12. With the proper tone, the voltage at pin 13 drops to zero, which produces a 10.5 V dc signal at the PL output.

m. 30-50 mHz Mobile Detector Circuit Board (Optional)

The mobile detector is a dual-conversion, superheterodyne type of unit consisting of one to five first oscillators, one second oscillator, two mixers, 10.7 MHz ceramic filter, 455 kHz filter, four 455 kHz i-f amplifiers, a 455 kHz limiter stage, discriminator, squelch amplifier, squelch IC detector, squelch switch, and one audio amplifier stage. Refer to Figure 65 for the mobile detector block diagram.

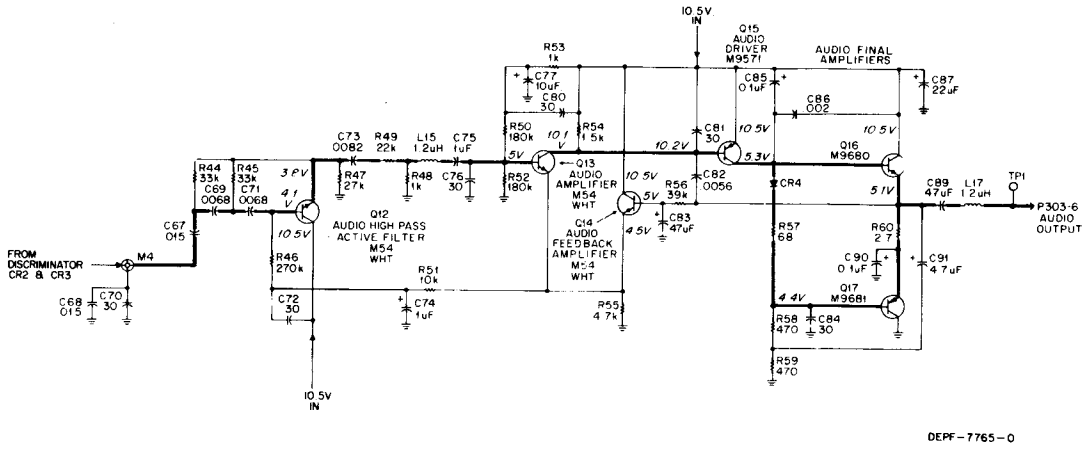


Figure 63. Typical Audio Amplifier Stages

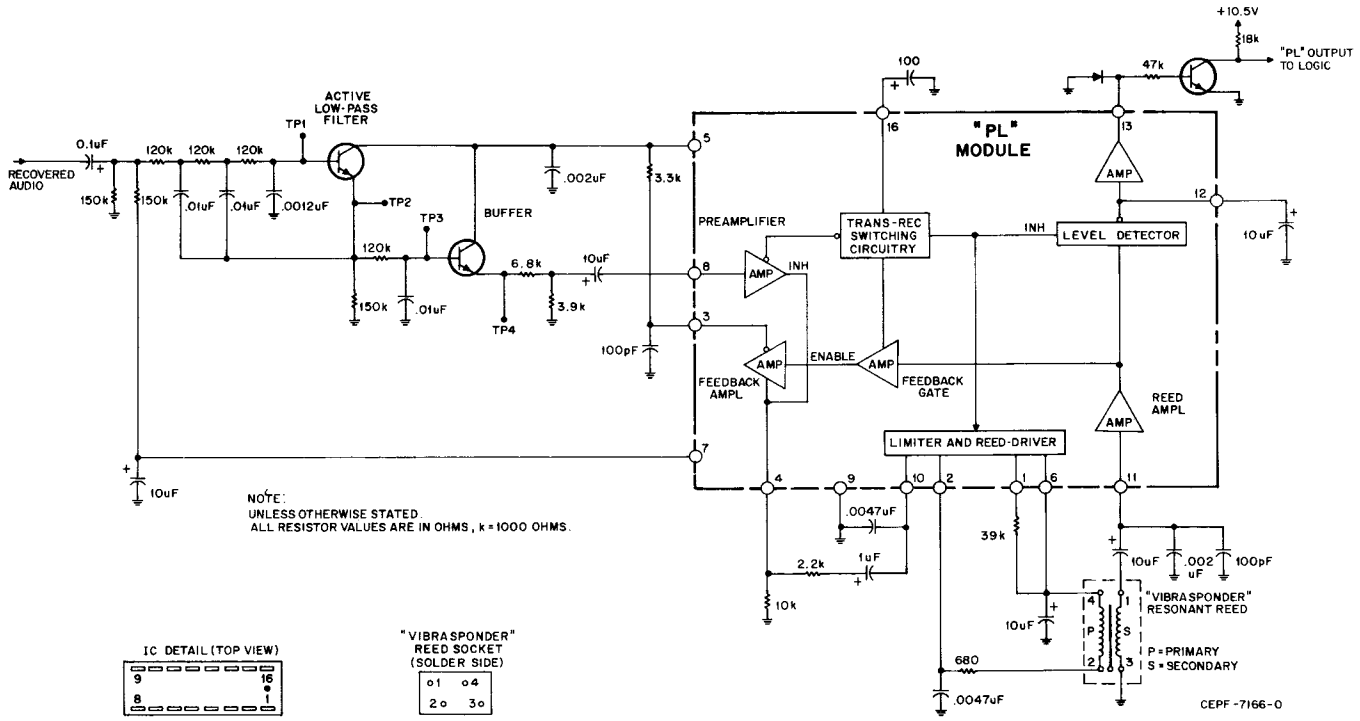


Figure 64. Typical "Private-Line" Circuit

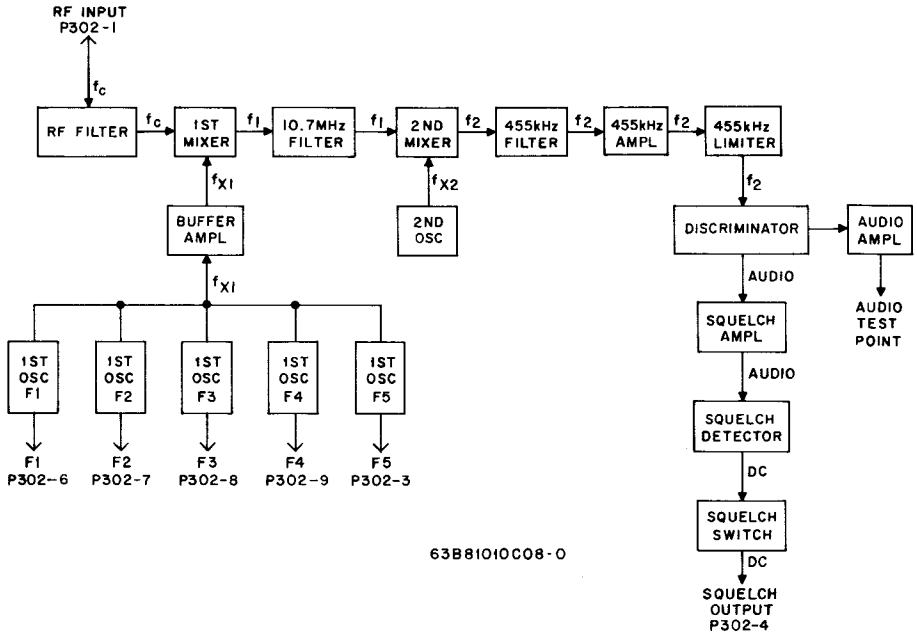


Figure 65. 30-50 MHz Mobile Detector Block Diagram

(1) First Mixer Stage
(Refer to Figure 66)

The rf signal from rf input connector P302-1 is coupled to first mixer stage Q1 through an isolation pad on the logic circuit board, then through a triple-tuned rf filter consisting of L1, L2, and L3. The first mixer heterodynes the rf signal and the injection signal from the first oscillator to produce the first or high i-f frequency (10.7 MHz). The high i-f signal passes through the 10.7 MHz ceramic filter to the second mixer.

(2) First Oscillator and Injection Amplifier Stages
(Refer to Figure 67)

The injection signal originates from first oscillator Q2 (Q15, Q16, Q17, or Q7). This oscillator is a modified Colpitts oscillator with a series-resonant feedback circuit consisting of L4, Y1, and R2. The oscillator operates on the crystal third overtone frequency. Components L5 and C40 prevent crystal Y1 from operating at its fundamental frequency. Crystal Y1 determines the frequency stability of the oscillator. The frequency of the oscillator can be changed an incremental amount (warped) by varying the inductance of L4.

A common base buffer amplifier stage is used to increase the injection into the mixer.

(3) Second Oscillator and Mixer, 455 kHz Filter and Amplifiers, and Limiter and Discriminator Stages

The high i-f signal is coupled to second mixer Q8 (Figure 68). In the second mixer stage, the first i-f signal and the second oscillator frequency are combined or mixed to produce the low 455 kHz i-f signal.

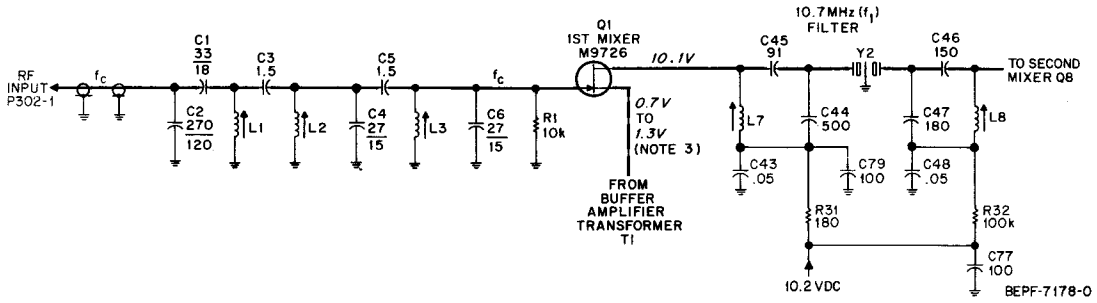


Figure 66. Typical First Mixer Stage

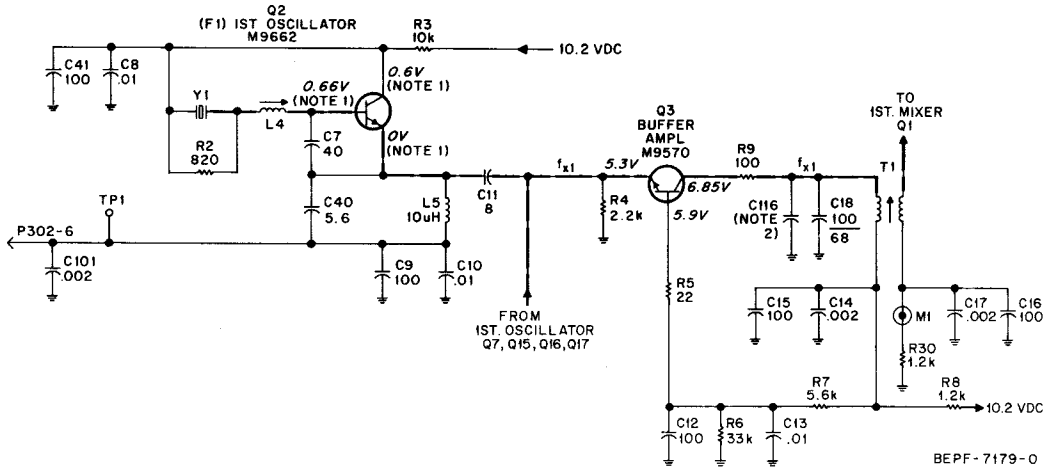


Figure 67. Typical First Oscillator and Buffer Amplifier Stages

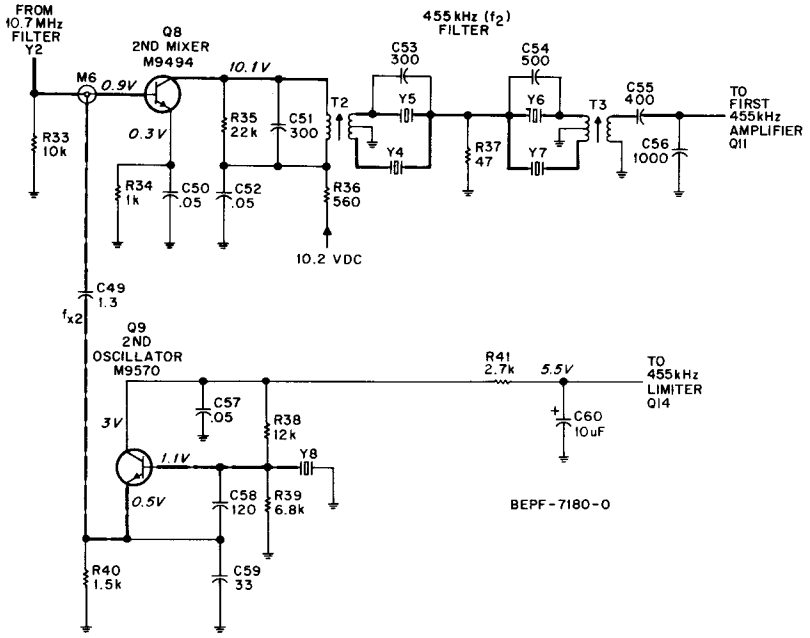


Figure 68. Typical Second Oscillator and Mixer, and 455 kHz Filter Stages

The low i-f passes through the 455 kHz ceramic filter and is fed to 455 kHz amplifier stages Q10, Q11, Q12, and Q13 (Figure 69).

After being amplified, the i-f signal is coupled to limiter stage Q14,where any amplitude modulation of the signal is removed (Figure 70). The limited signal is then fed to the discriminator stage (CR1, CR2) where the frequency variations of the incoming signal are translated into an audio signal.

The discriminator circuit (T5, C73, C74, CR1 and CR2) uses the 90° phase difference which occurs at resonance between the primary and secondary voltages to recover the audio modulation from the 455 kHz i-f signal. Refer to Figure 71 for the typical discriminator recovery curve. The variation in the i-f signal, at an audio rate, is shown below the curve. The resulting recovered audio output is shown to the right of the curve. The output of the discriminator circuit is applied to the audio and squelch circuits.

(4) Audio Amplifier Stage
(Refer to Figure 72)

Audio amplifier Q4 is a typical audio amplifier which is used for testing the 20 dB quieting sensitivity of the mobile detector.

(5) Squelch Stages
(Refer to Figure 73)

The only function of the squelch circuit, described previously in paragraph 3.d., is to provide a logic level signal to the main circuit board.

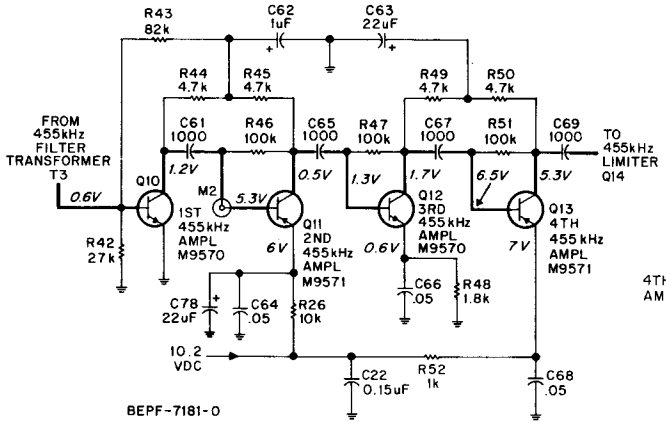


Figure 69. Typical 455 kHz Amplifiers Stages

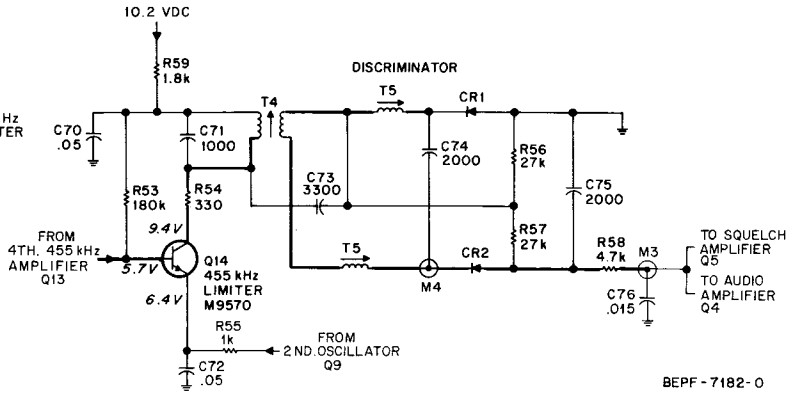


Figure 70. Typical 455 kHz Limiter and Discriminator Stages

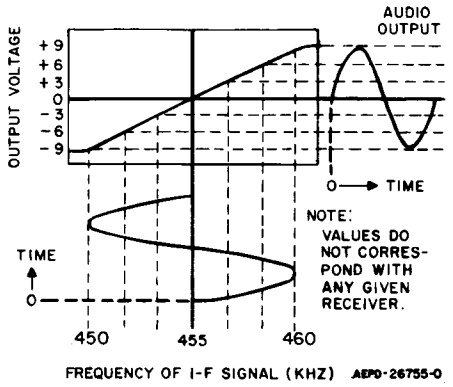


Figure 71. Typical Discriminator Response

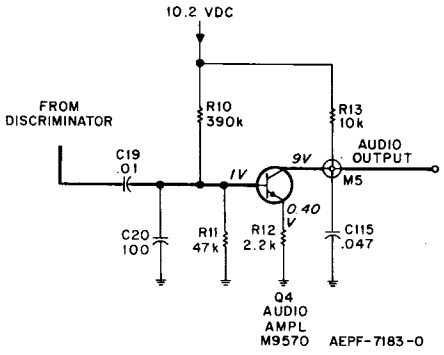


Figure 72. Typical Audio Amplifier Stage

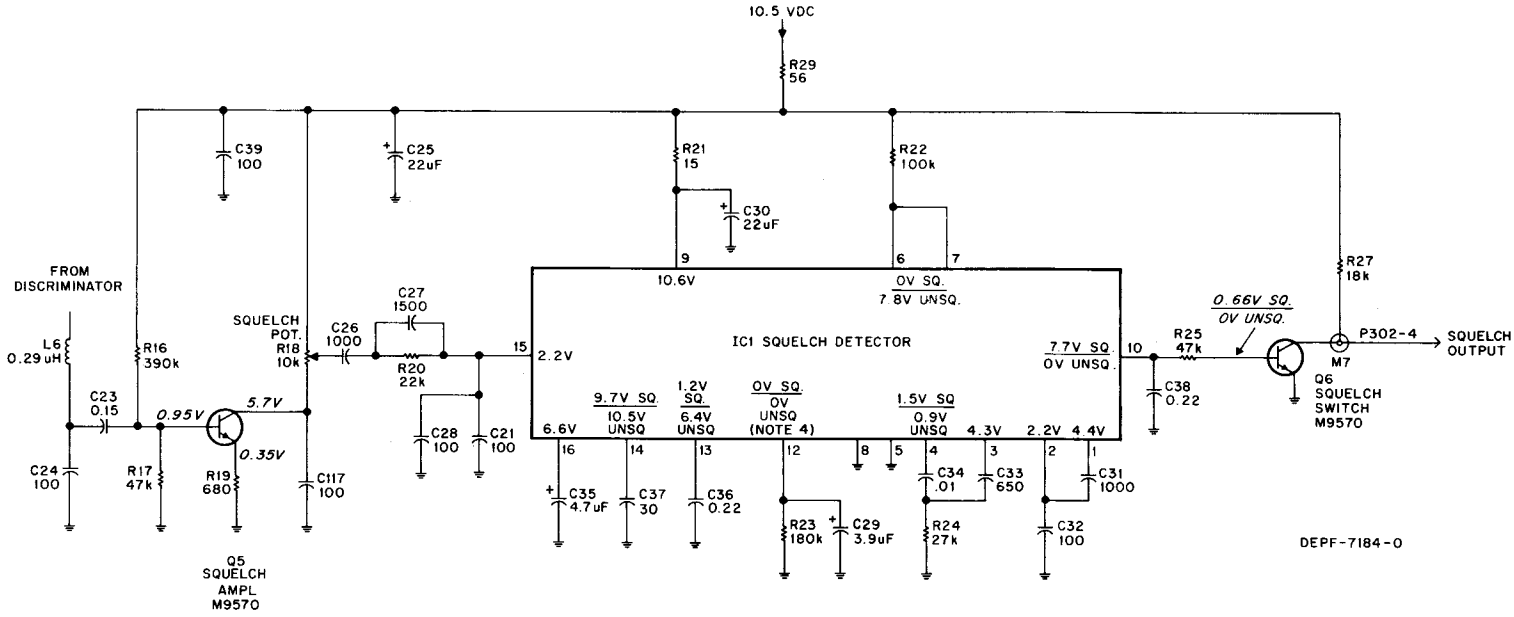


Figure 73. Typical Squelch Stages

n. 150.8 to 174 MHz Mobile Detector Circuit Board (Optional)

The mobile detector is a dual-conversion, superheterodyne type of unit consisting of one to five first oscillators, one second oscillator, two mixers, 10.7 MHz ceramic filter, 455 kHz filter, four 455 kHz i-f amplifiers, a 455 kHz limiter stage, discriminator, squelch amplifier, squelch IC detector, squelch switch, and one audio amplifier stage. Refer to Figure 74 for the mobile detector block diagram.

(1) First Mixer Stage (Refer to Figure 75)

The rf signal from rf input connector P302-1 is coupled to first mixer stage Q2 through an isolation pad on the logic circuit board, then through a quadruple-tuned rf filter consisting of L1, L2, L3, and L4. The first mixer heterodynes the rf signal and the injection signal from the first oscillator-tripler to produce the first or high i-f frequency (10.7 MHz). The high i-f signal passes through the 10.7 MHz ceramic filter to the second mixer.

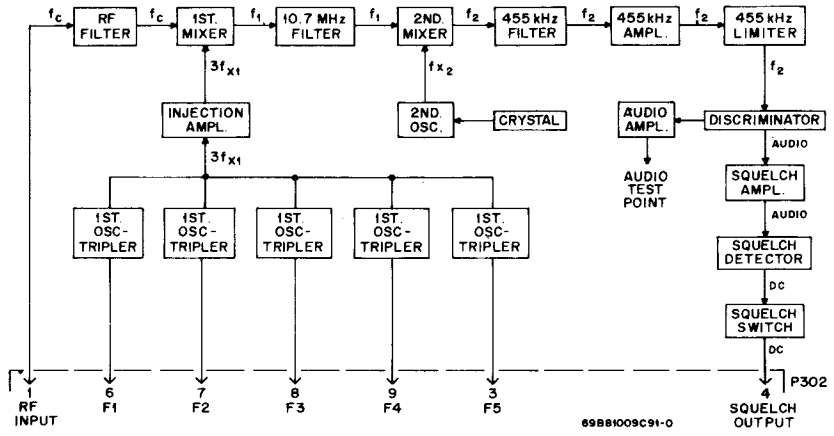


Figure 74. 150.8-174 MHz Mobile Detector Block Diagram

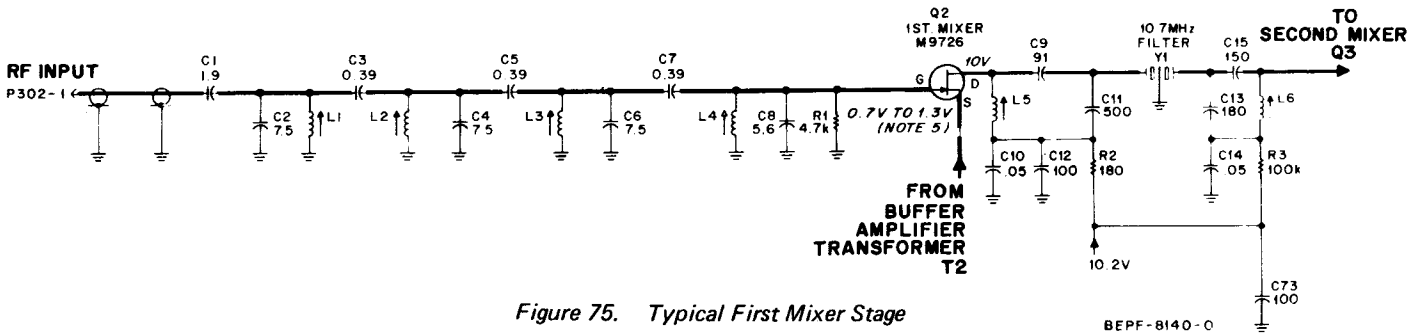


Figure 75. Typical First Mixer Stage

(2) First Oscillator and Buffer Amplifier Stages (Refer to Figure 76)

First oscillator stage Q13 (Q14, Q15, Q16, or Q17) uses an unheated crystal operating in its third overtone series-resonance mode. Crystal Y7 (Y8, Y9, Y10, or Y11) determines the frequency stability of the oscillator. The frequency of the oscillator can be changed an incremental amount (warped) by varying the inductance of L10 (L11, L12, L13, or L14). The third harmonic of the oscillator output is amplified in buffer amplifier Q1 and filtered to provide injection for the first mixer.

(3) Second Oscillator and Mixer, 455 kHz Filter and Amplifiers, and Limiter and Discriminator Stages

The high i-f signal is coupled to second mixer Q3 (Figure 77). In the second mixer stage, the first i-f signal and the second oscillator frequency are combined or mixed to produce the low 455 kHz i-f signal.

The low i-f passes through the 455 kHz ceramic filter and is fed to 455 kHz amplifier stages Q4, Q5, Q6, and Q7 (Figure 78).

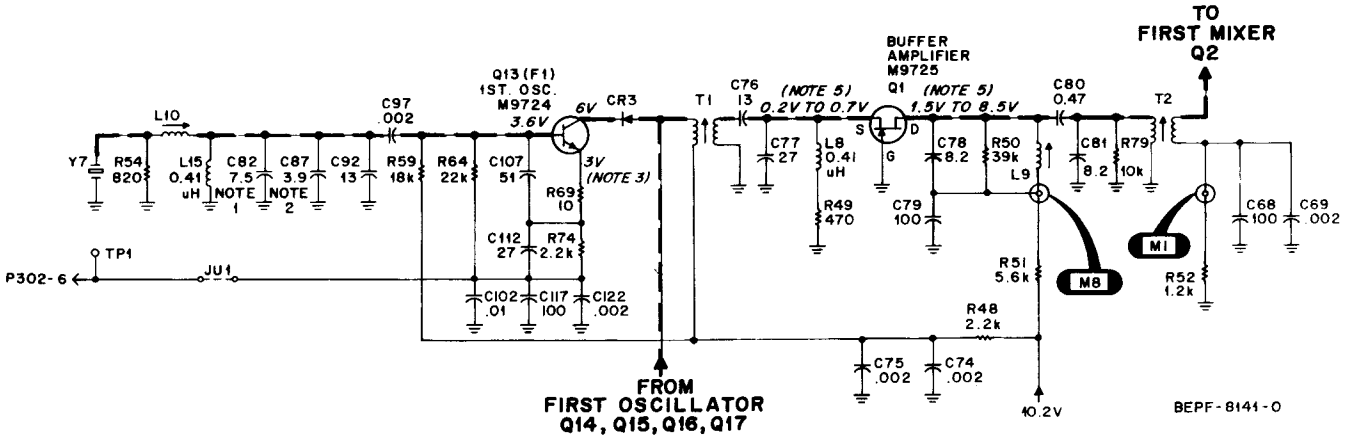


Figure 76. Typical First Oscillator and Buffer Amplifier Stages

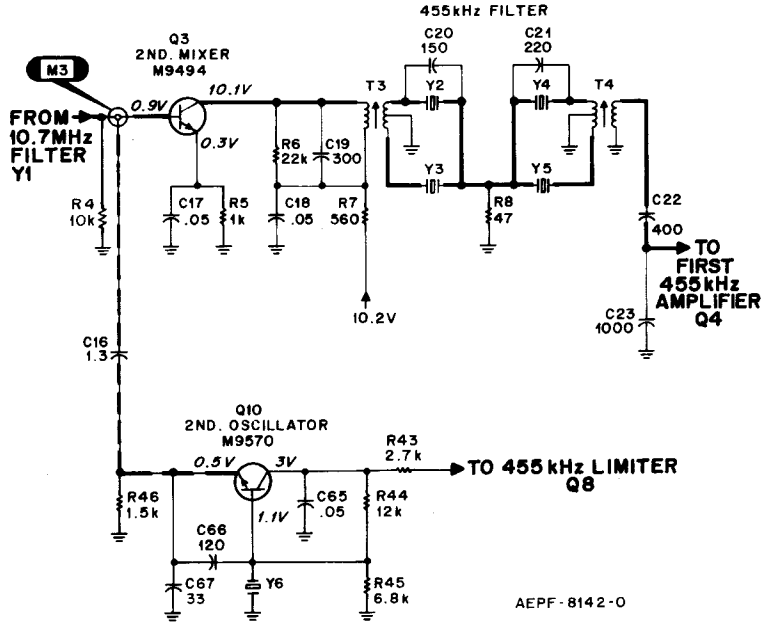


Figure 77. Typical Second Oscillator and Mixer, and 455 kHz Filter Stages

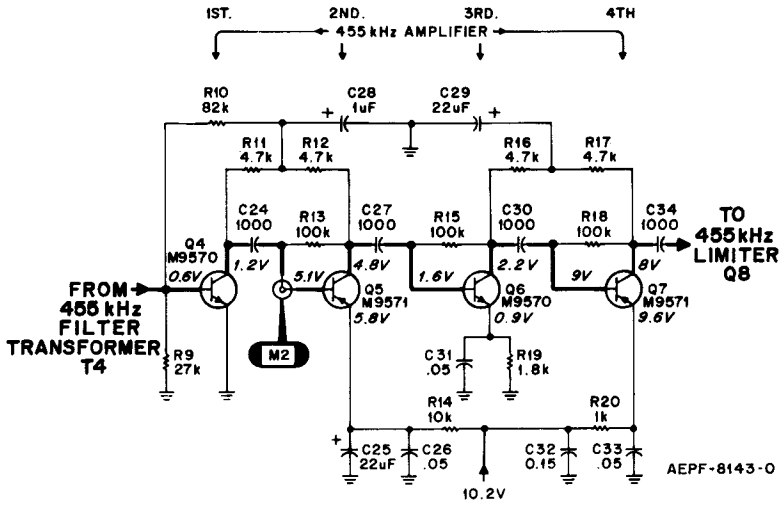


Figure 78. Typical 455 kHz Amplifier Stages

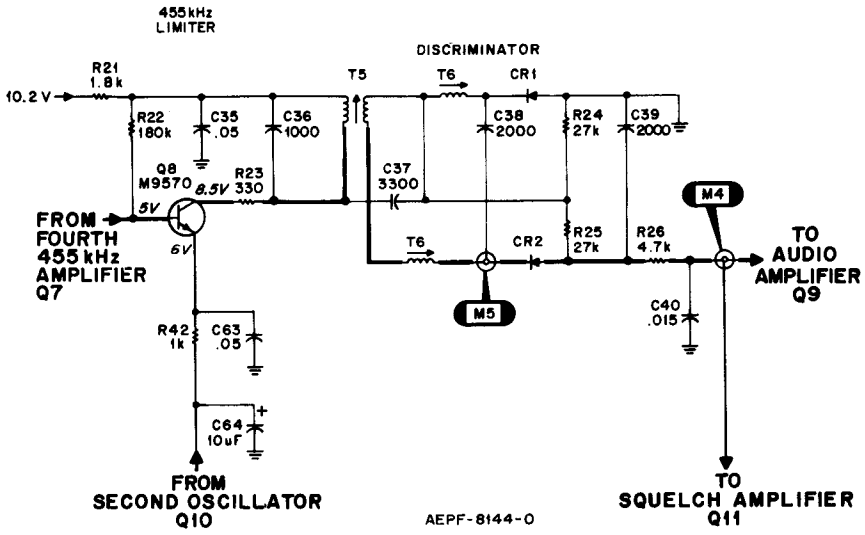


Figure 79. Typical 455 kHz Limiter and Discriminator Stages

After being amplified, the i-f signal is coupled to limiter stage Q8 where any amplitude modulation of the signal is removed (Figure 79). The limited signal is then fed to the discriminator stage (CR1, CR2) where the frequency variations of the incoming signal are translated into an audio signal.

The discriminator circuit (T6, C37, C38, CR1 and CR2) uses the 90° phase difference which occurs at resonance between the primary and secondary voltages to recover the audio modulation from the 455 kHz i-f signal. Refer to Figure 80 for the typical discriminator recovery curve. The variation in the i-f signal, at an audio rate, is shown below the curve. The resulting recovered audio output is shown to the right of the curve. The output of the discriminator circuit is applied to the audio and squelch circuits.

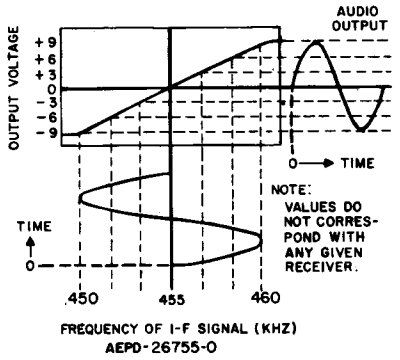


Figure 80. Typical Discriminator Response

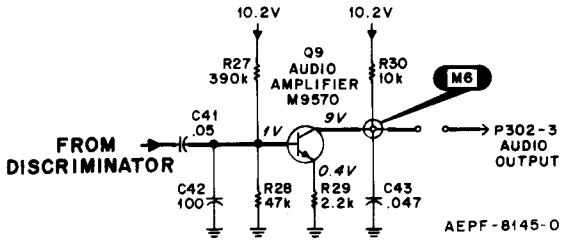


Figure 81. Typical Audio Amplifier Stage

(4) Audio Amplifier Stage (Refer to Figure 81)

Audio amplifier Q4 is a typical audio amplifier which is used for testing the 20 dB quieting sensitivity of the mobile detector.

(5) Squelch Stages (Refer to Figure 82)

The only function of the squelch circuit, described previously in paragraph 3.d., is to provide a logic level signal to the main circuit board.

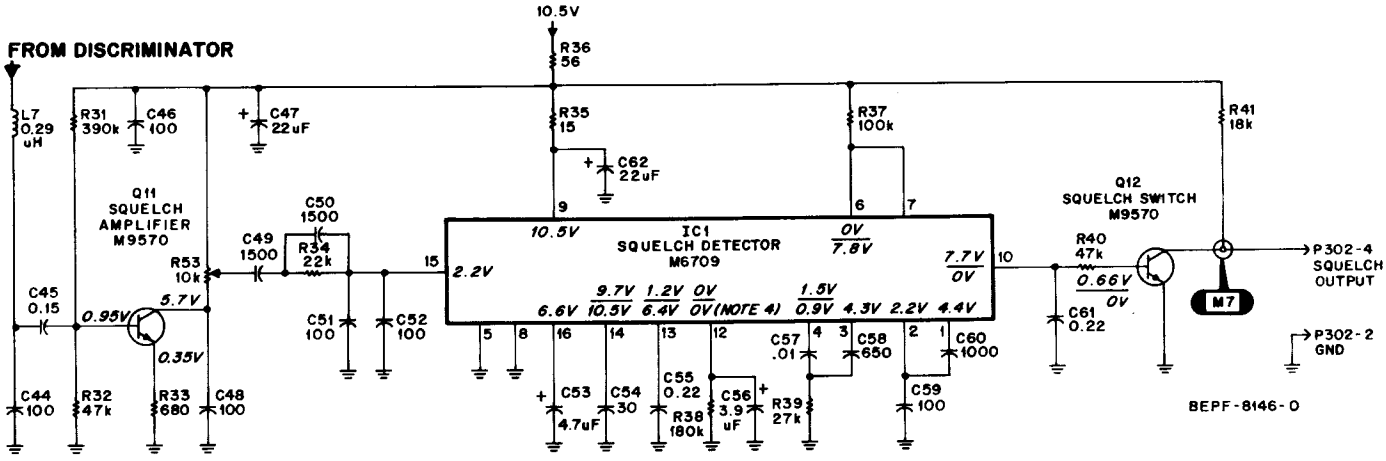


Figure 82. Typical Squelch Stages

o. 450-512 MHz Mobile Detector Circuit Board (Optional)

The mobile detector is a dual-conversion, superheterodyne type of unit consisting of one to four first oscillators, one second oscillator, two mixers, 17.9 MHz crystal filter, 455 kHz filter, four 455 kHz i-f amplifiers, a 455 kHz limiter stage, discriminator, squelch amplifier, squelch IC detector, squelch switch, and one audio amplifier stage. Refer to Figure 83 for the mobile detector block diagram.

(1) First Mixer Stage
(Refer to Figure 84)

The rf signal from rf input connector P302-1 is coupled to first mixer stage Q1 through an isolation pad on the logic circuit board, then through preselector filter FL1. The first mixer heterodynes the rf signal and the injection signal from the second tripler to produce the first or high i-f frequency (17.9 MHz). The high i-f signal passes through the 17.9 MHz crystal filter to the second mixer.

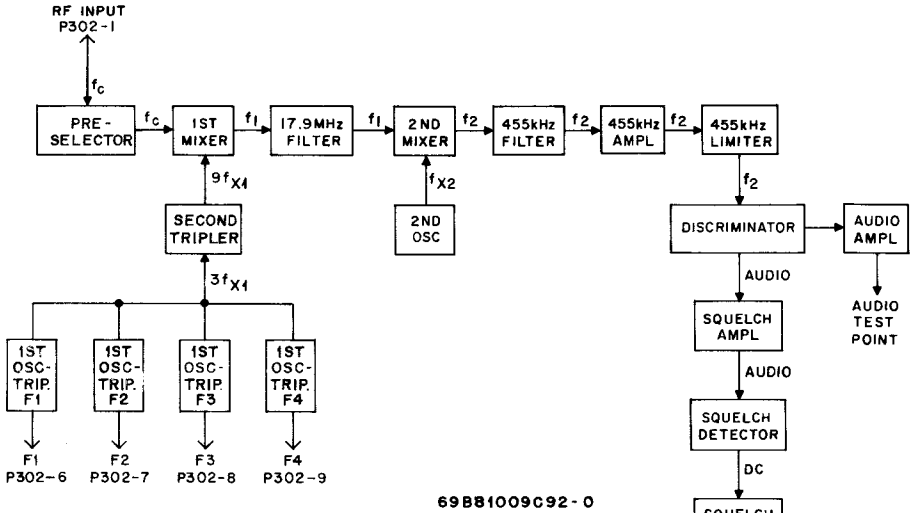


Figure 83. 450-512 MHz Mobile Detector Block Diagram

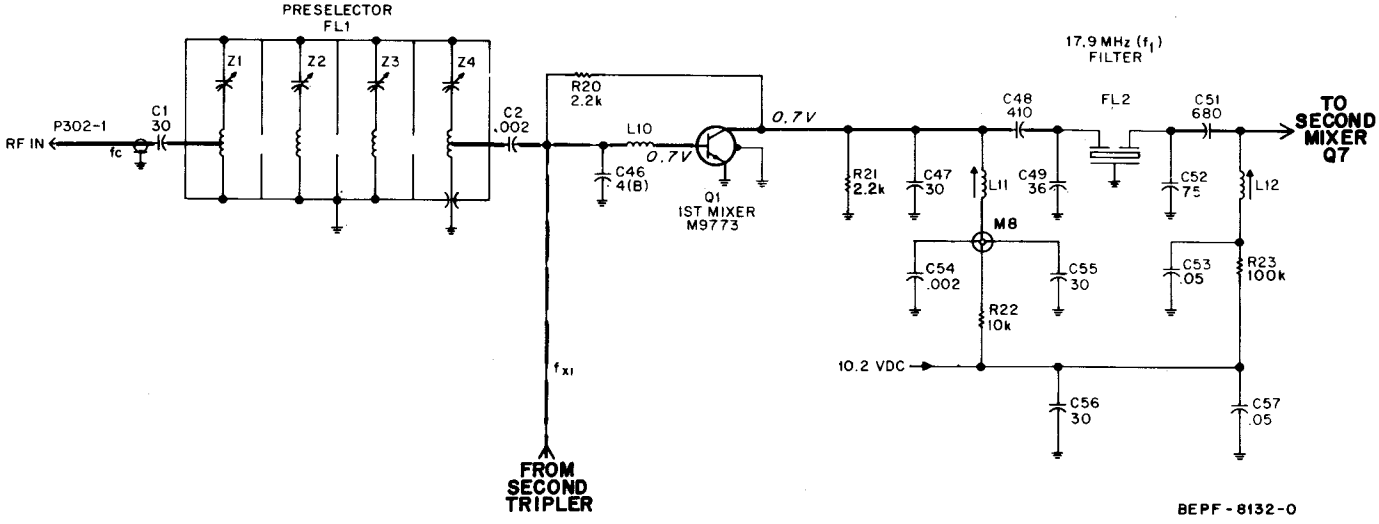


Figure 84. Typical First Mixer Stage

(2) First Oscillator-Tripler and Second Tripler Stages (Refer to Figure 85)

The injection signal originates from first oscillator-tripler Q5 (Q2, Q3, or Q4) and second tripler Q6. This oscillator is a modified Colpitts oscillator. Crystal Y4 determines the frequency stability of the oscillator. The frequency of the oscillator can be changed an incremental amount (warped) by varying the inductance of L4. The oscillator operates on the crystal third overtone frequency, and the third harmonic is chosen and coupled into second tripler Q6. The ninth harmonic oscillator output from Q6 is filtered to provide injection for the first mixer.

(3) Second Oscillator and Mixer, 455 kHz Filter and Amplifiers, and Limiter and Discriminator Stages

The high i-f signal is coupled to second mixer Q7 (Figure 86). In the second mixer stage, the first i-f signal and the second oscillator frequency are combined or mixed to produce the low 455 kHz i-f signal.

The low i-f passes through the 455 kHz ceramic filter and is fed to 455 kHz amplifier stages Q9, Q10, Q11, and Q12 (Figure 87).

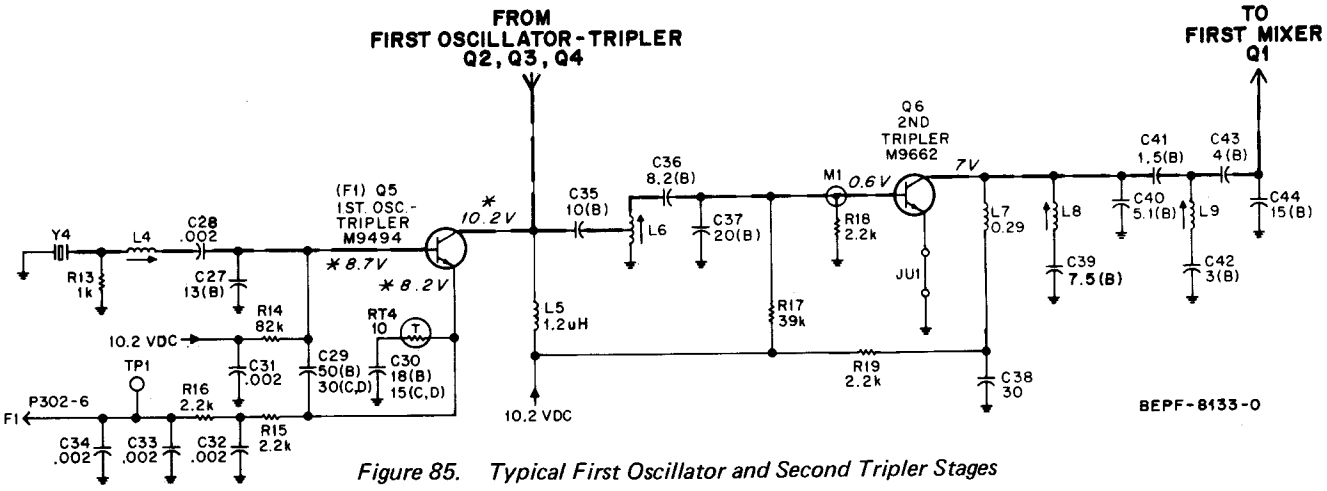


Figure 85. Typical First Oscillator and Second Tripler Stages

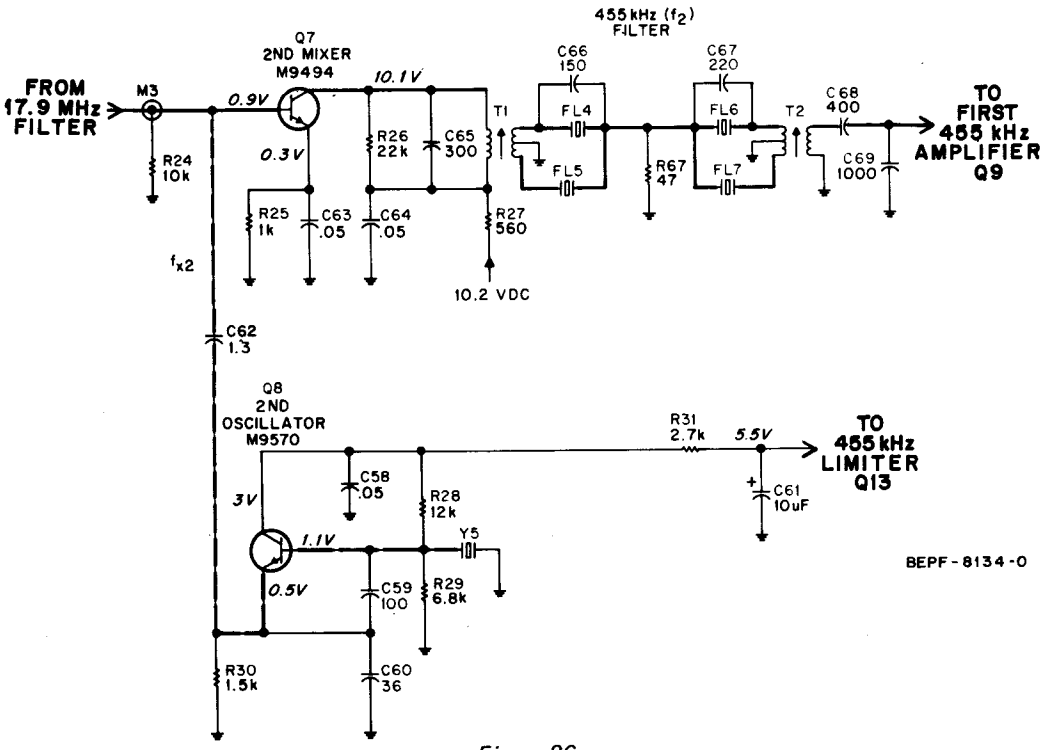


Figure 86.
Typical Second Oscillator and Mixer, and 455 kHz Filter Stages

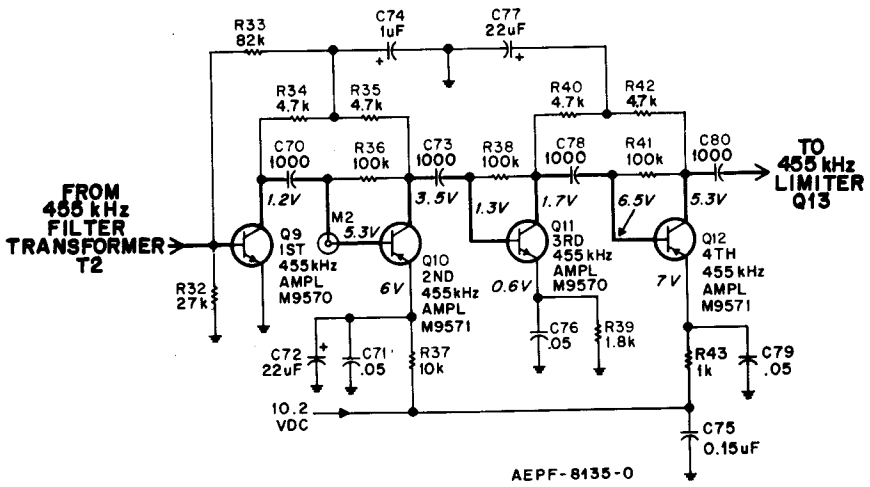


Figure 87. Typical 455 kHz Amplifier Stages

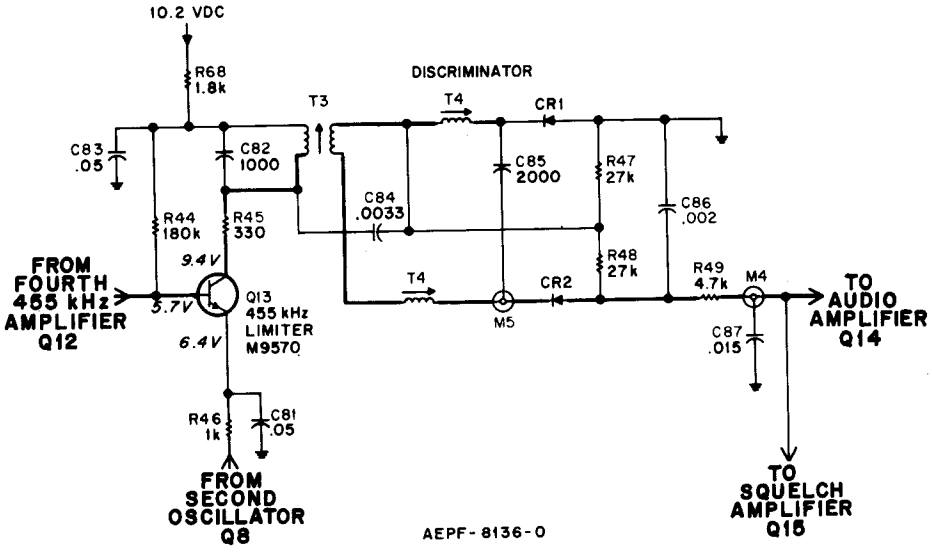


Figure 88. Typical 455 kHz Limiter and Discriminator Stages

After being amplified, the i-f signal is coupled to limiter stage Q13 where any amplitude modulation of the signal is removed (Figure 88). The limited signal is then fed to the discriminator stage (CR1, CR2) where the frequency variations of the incoming signal are translated into an audio signal.

The discriminator circuit (T4, C84, C85, CR1 and CR2) uses the 90° phase difference which occurs at resonance between the primary and secondary voltages to recover the audio modulation from the 455 kHz i-f signal. Refer to Figure 89 for the typical discriminator recovery curve. The variation in the i-f signal, at an audio rate, is shown below the curve. The resulting recovered audio output is shown to the right of the curve. The output of the discriminator circuit is applied to the audio and squelch circuits.

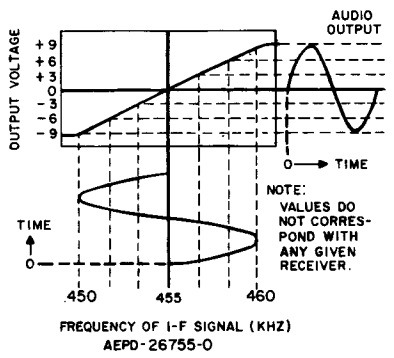


Figure 89. Typical Discriminator Response

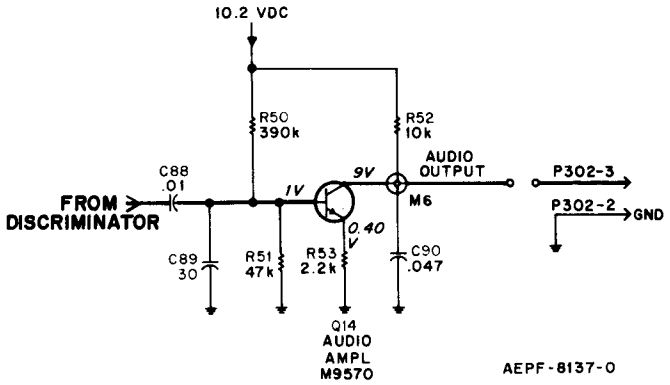


Figure 90. Typical Audio Amplifier Stage

(4) Audio Amplifier Stage (Refer to Figure 90)

Audio amplifier Q14 is a typical audio amplifier which is used for testing the 20 dB quieting sensitivity of the monitor receiver.

(5) Squelch Stages (Refer to Figure 91)

The only function of the squelch circuit, described previously in paragraph 3.d., is to provide a logic level signal to the main circuit board.

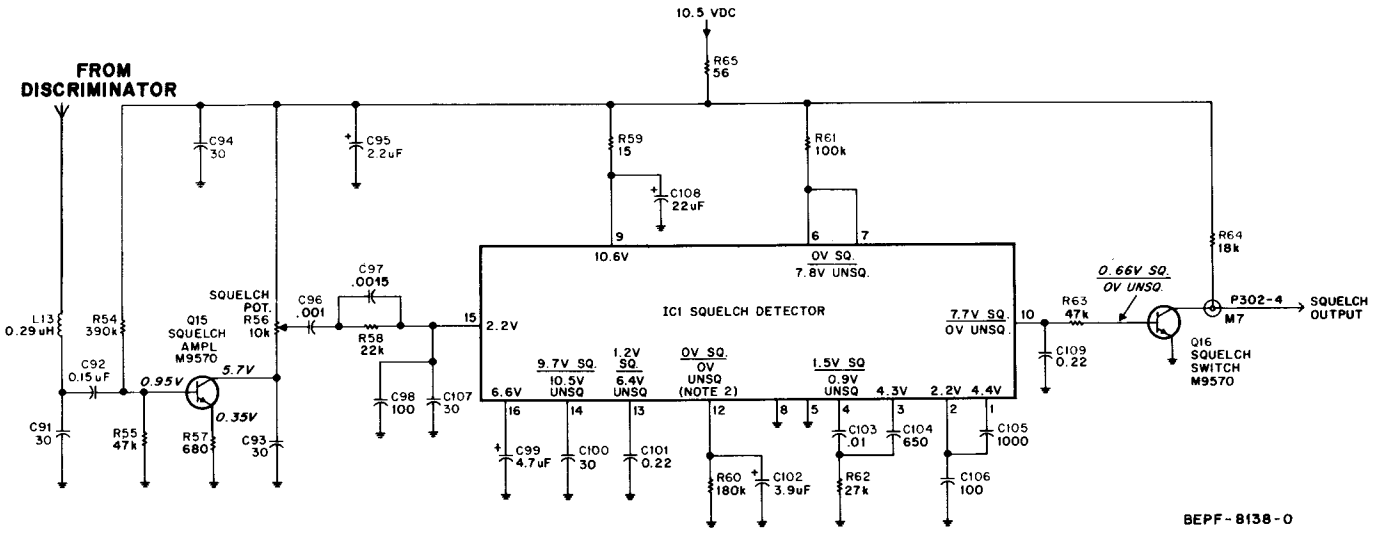


Figure 91. Typical Squelch Stages

TEST EQUIPMENT AND SERVICE AIDS

1. GENERAL

This section describes test equipment and service aids required for maintaining the PAC•RT vehicular repeater. See a Motorola sales representative for aid in ordering test equipment. If requested, he will analyze your requirements and help you select the latest available equipment to suit your individual needs. He can also advise you of new test equipment and service aids that become available after the printing of this manual.

2. TEST EQUIPMENT

Refer to the list of test equipment in Table 1. The listed items are described in greater detail in the "Motorola Buyer's Guide." They or equivalent test equipment may be used.

Table 1. Test Equipment

EQUIPMENT	PURPOSE
R2001 Communication System Analyzer	Spectrum Analyzer, Duplex Offset Generator, Modulation Oscilloscope, Frequency Counter, AC/DC Digital-Analog Voltmeter, RF Wattmeter, General Purpose Oscilloscope, Multi-Mode Code Synthesizer, SINAD Meter, Sweep Generator
Motorola S1063 DC Multimeter with Motorola SLN6055 RF Probe	All dc and rf measurements. Monitoring input current when external power supply is used.
Motorola AC Voltmeter S1053	All ac signal measurements
Motorola S1339 Solid-State Analog RF Millivoltmeter or Motorola S1340A Digital RF Millivoltmeter	Receiver rf and i-f stage measurements
Motorola R1004 Dual-Trace Oscilloscope	Waveform measurements and general maintenance
Motorola S1350 RF Wattmeter, and T1013 RF resistor (Dummy Load).	RF output power measurements
Motorola S1347 or S1348 DC Power Supply	Supplying dc power to the unit during extended servicing
Motorola TEK-1B Solid-State Tone Generator	1000 Hz test tone frequency
Motorola S1067 Solid-State Audio Oscillator or Motorola S1333 Digital Tone Generator	Troubleshooting the PL decoder, and audio circuitry
Motorola RTL4014 Logic Probe	Tests and indicates logic state present at a TTL, DTL and CMOS chip lead.

3. SERVICE AIDS

Service aids have been designed especially for servicing the PAC•RT vehicular repeater. These parts are available from the Motorola Communications Division Parts Department. Refer to Table 2.

Table 2. Service Aids

ITEM	FUNCTION
S1351A PAC•RT Test Set	Test set provides convenient simulation of mobile controls and interface to test equipment.
NKN6228A PAC•RT Test Cable	Cable allows transmitter-receiver circuit and/or monitor receiver circuit board to be serviced when removed from the main circuit board and, yet, remain electrically connected to the main circuit board.
NLN8985A Tuning Tool Kit	Kit includes alignment tool 6605832B01 for tuning coils. Also, it includes wrench 6605789D01 for loosening and tightening the trunk-lip-mounted antenna clutch nut (topmost nut).

4. S-1351A "PAC•RT" TEST SET

a. General

The S-1351A PAC•RT Test Set simulates the control unit/vehicular charger and mobile controls. The test set enables the serviceman to test the PAC•RT vehicular repeater without the use of a mobile radio.

Refer to Table 3 for a description of the test set controls and indicators.

b. Using the S-1351A PAC•RT Test Set

(1) Transmit and IDC Adjust

(a) Set the test set controls as follows:

PAC•RT ON/OFF	OFF
CHARGER IN/OUT	IN
MONITOR RECEIVER (Mobile Detector) Frequency switch	"O"

(b) To transmit – set the PAC•RT ON/OFF switch ON, then switch the CHARGER IN/OUT switch to the OUT position. No oscillator input is needed to transmit; however, a 1 kHz tone is required to set the maximum deviation (R116). To send a single-tone burst, momentarily switch the CHARGER IN/OUT switch from the IN position, then to the OUT position.

(2) PAC•RT Receiver Testing

(a) Set the test set controls as follows:

PAC•RT ON/OFF	ON
CHARGER IN/OUT	OUT
Mobile Detector Frequency switch	"O"

(b) To activate the PAC•RT receiver – if the PAC•RT transmitter is transmitting, momentarily press the MOBILE PTT pushbutton switch. The repeater receiver and squelch circuits are always operational. The SCOPE output reflects the receiver audio output to the mobile microphone when conditions for portable-to-base repeat operation are present.

(3) Mobile Detector Testing

(a) Set the test set controls as follows:

PAC•RT ON/OFF	ON
CHARGER IN/OUT	OUT
Mobile Detector Frequency switch	Select Frequency 1-5

(b) To activate the monitor receiver – if the PAC•RT transmitter is transmitting, momentarily press the MOBILE PTT pushbutton switch. The mobile detector and squelch circuits are always operational.

Table 3. S-1351A PAC•RT Test Set Controls and Indicators

CONTROL	FUNCTION
POWER Jack	Input for 13.8 V dc to energize the PAC•RT vehicular repeater.
SCOPE Jack	Output to monitor the mobile microphone output from the PAC•RT vehicular repeater.
OSC. Jack	Input for a high frequency signal (5 to 10 kHz) to operate mobile squelch circuits. Removal of this signal simulates reception of mobile frequency carrier. If the simulated signal is not there the PAC•RT will go into a continuous transmit mode.
PAC•RT ON/OFF Toggle Switch	Applies 13.8 V dc input to PAC•RT vehicular repeater voltage regulator circuit.
CHARGER IN/OUT Toggle Switch	Simulates pocket switch in the control unit/vehicular charger.
MOBILE OFF Pushbutton Switch	Pushing pushbutton simulates turning mobile radio off. Releasing pushbutton returns repeater back to normal operation. Function of switch is the same as CHARGER IN/OUT switch.
MOBILE PTT Pushbutton Switch	Simulates push-to-talk switch on mobile microphone.
MOBILE PTT RETURN B+/GND Switch	Used for return to ground or B+ when MOBILE PTT switch is pushed. MICOR, MOCOM, and MOTRAC negative ground mobiles use ground return.
MONITOR RECEIVER (Mobile Detector) Frequency Switch	Used if repeater has optional mobile detector circuit. Position "O" disables all channel switching circuits.
MONITOR RECEIVER (Mobile Detector) Frequency Switch RETURN B+/GND	Used for B+ or ground switching on frequency switch. MICOR, MOCOM, and MOTRAC negative ground mobiles use ground return.
MOBILE TX Indicator Lamp	Glows when the mobile radio would be transmitting.

MOS DEVICE PRECAUTIONS

MOS (Metal Oxide Semiconductor) devices are used in the PAC•RT vehicular repeater. While the attributes of MOS type devices are many, characteristics make them susceptible to damage by electrostatic or high voltage charges. Therefore, when the service technician encounters MOS circuits, he must take special precautions to prevent device damage during repair procedures outlined in the following sections. The following handling precautions are recommended for MOS circuits and are especially true in dry-humidity conditions.

1. Store and transport all MOS devices in conductive material so that all exposed leads are shorted together. Do not insert MOS devices into conventional plastic "snow" or plastic trays of the type used for storage and transportation of other semiconductor devices.

2. Ground the working surface of the service bench to protect the MOS device.

3. Wear a conductive wrist strap in series with a 100 k resistor to ground.

4. Do not wear nylon clothing while handling MOS devices.

5. Neither insert nor remove MOS devices with power applied. Check all power supplies to be used for testing MOS devices and be certain no voltage transients are present.

6. When straightening MOS leads, provide ground straps for apparatus used.

7. When soldering, use a grounded soldering iron.

8. If at all possible, handle all MOS devices by the packages and not by the leads. Before touching the unit, touch an electrical ground to remove any static charge that you may have accumulated. The package and substrate may be electrically common. If so, the reaction of a discharge to the case would cause the same damage as touching the leads.

TROUBLESHOOTING

1. GENERAL

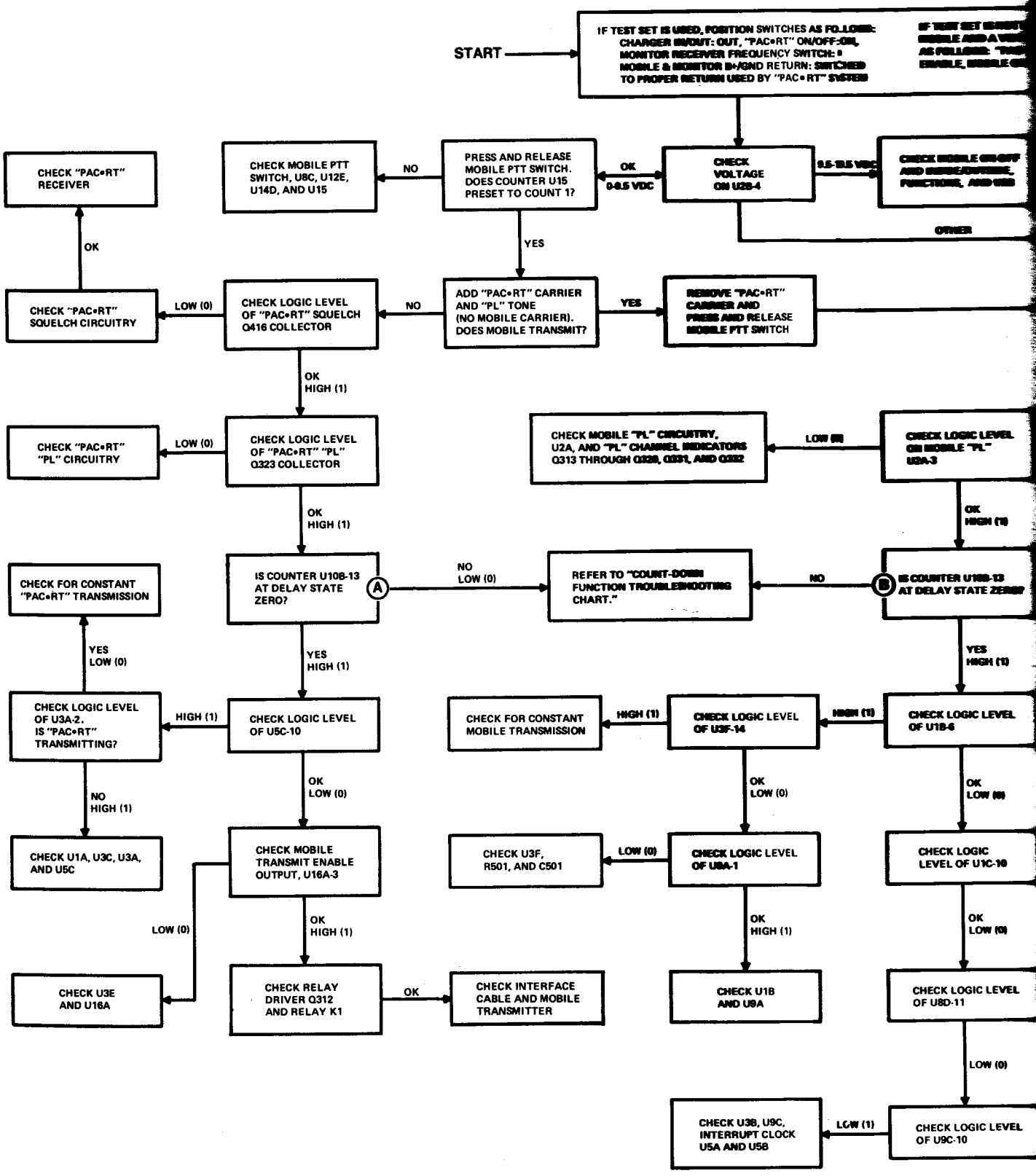
Three basic maintenance approaches may be used for localizing and repairing trouble in the PAC•RT vehicular repeater: replace the entire repeater, replace the defective circuit board, or isolate and repair the trouble.

Replacing the entire repeater with a spare and returning the defective repeater to a maintenance shop for repair is well suited for fleet users with several identical repeaters. Operational testing of the repeater after replacement is necessary to ensure that the repeater and its associated system components are operating properly.

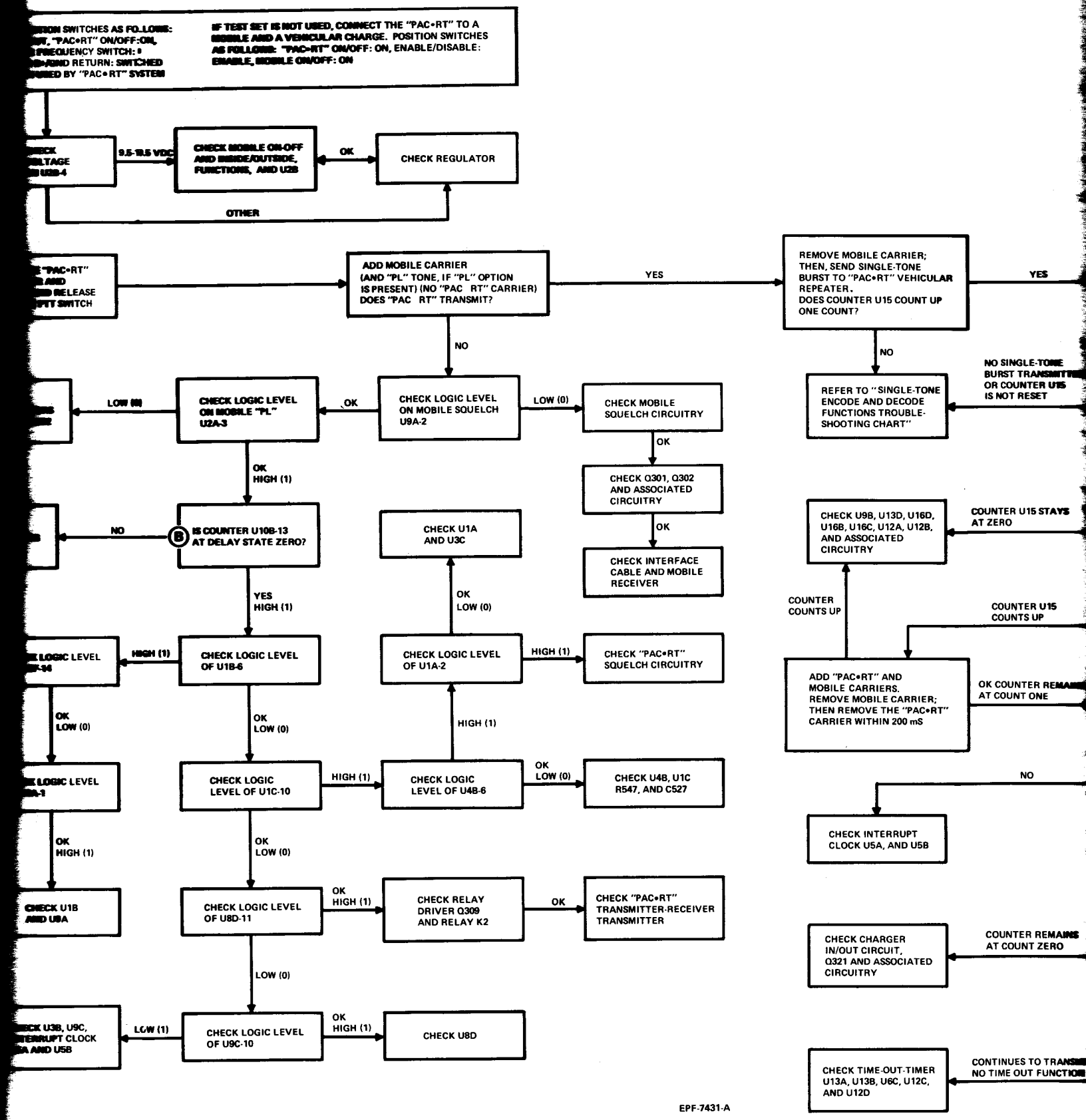
Replacing the defective circuit board with a spare and returning the defective board to a maintenance shop for repair is recommended for maintenance facilities that maintain several similar repeaters. Testing and realignment must be performed after board replacement to ensure that all troubles have been corrected.

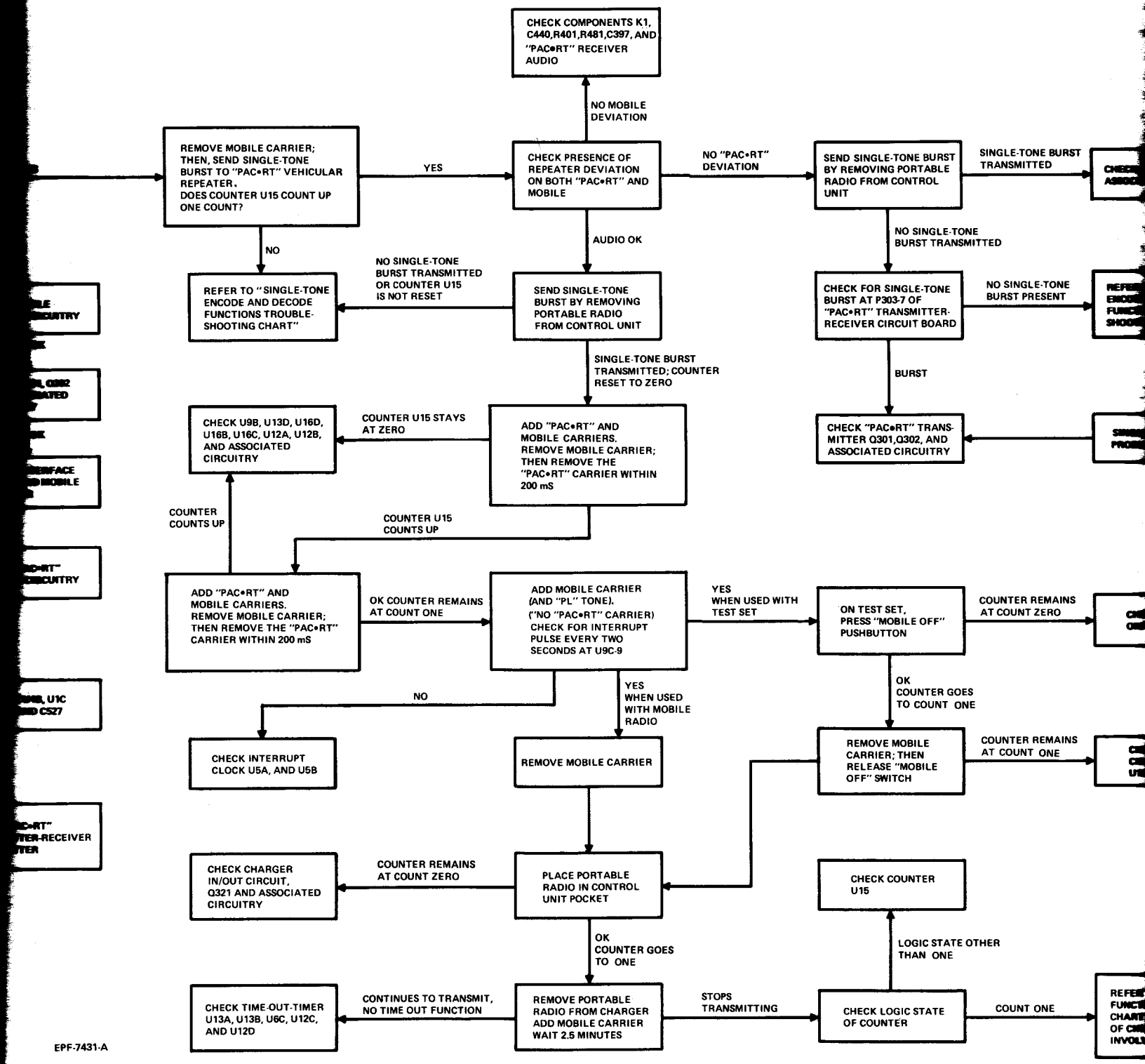
Isolating and repairing the trouble on the spot must be used if spares are not available. A few simple tests will isolate the trouble to a specific board. Then detailed troubleshooting of the defective board may be performed.

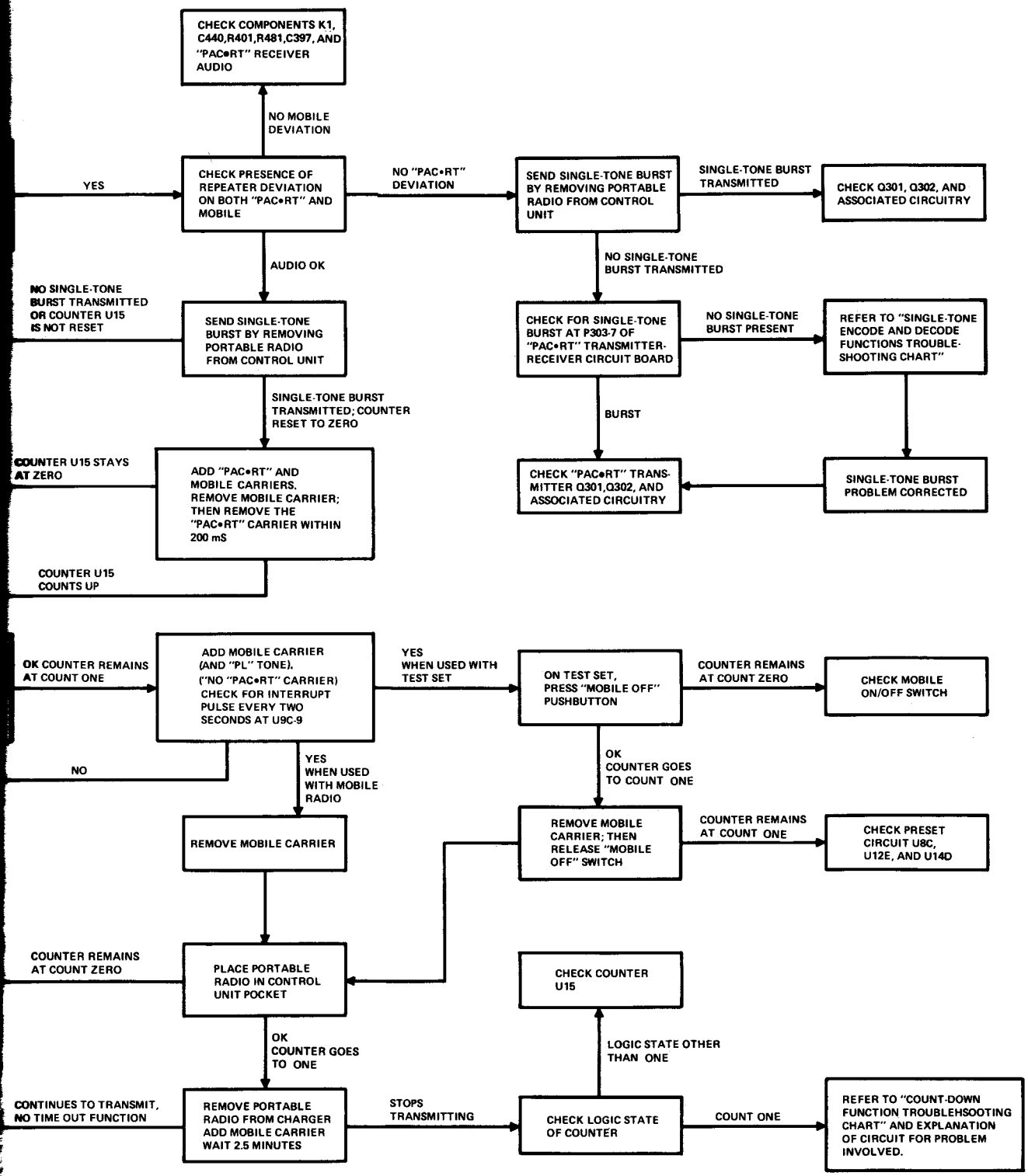
This section of the manual includes troubleshooting procedures to isolate the defective component through the use of flow diagrams. Refer to the schematic diagrams in the appropriate service manuals.

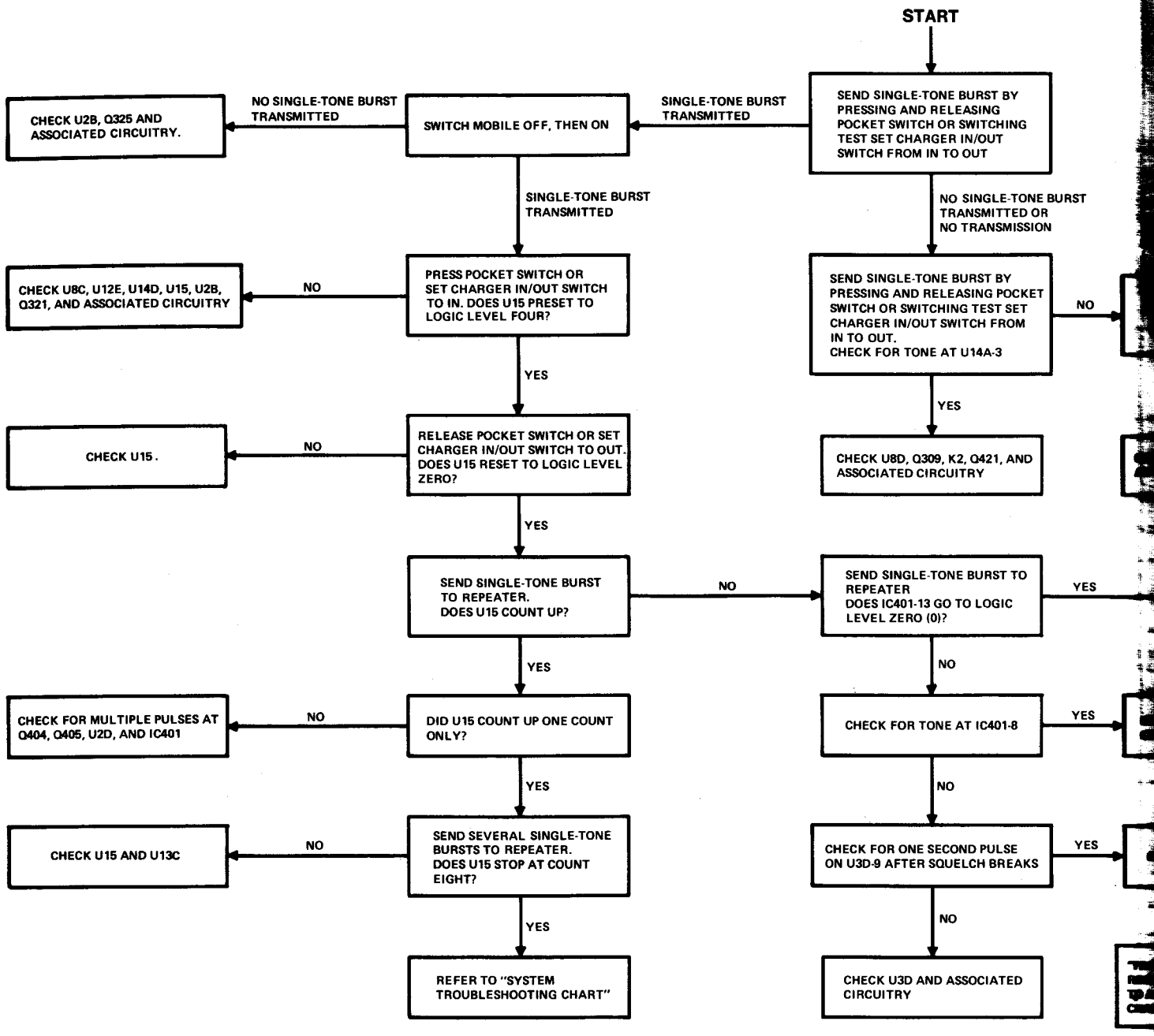


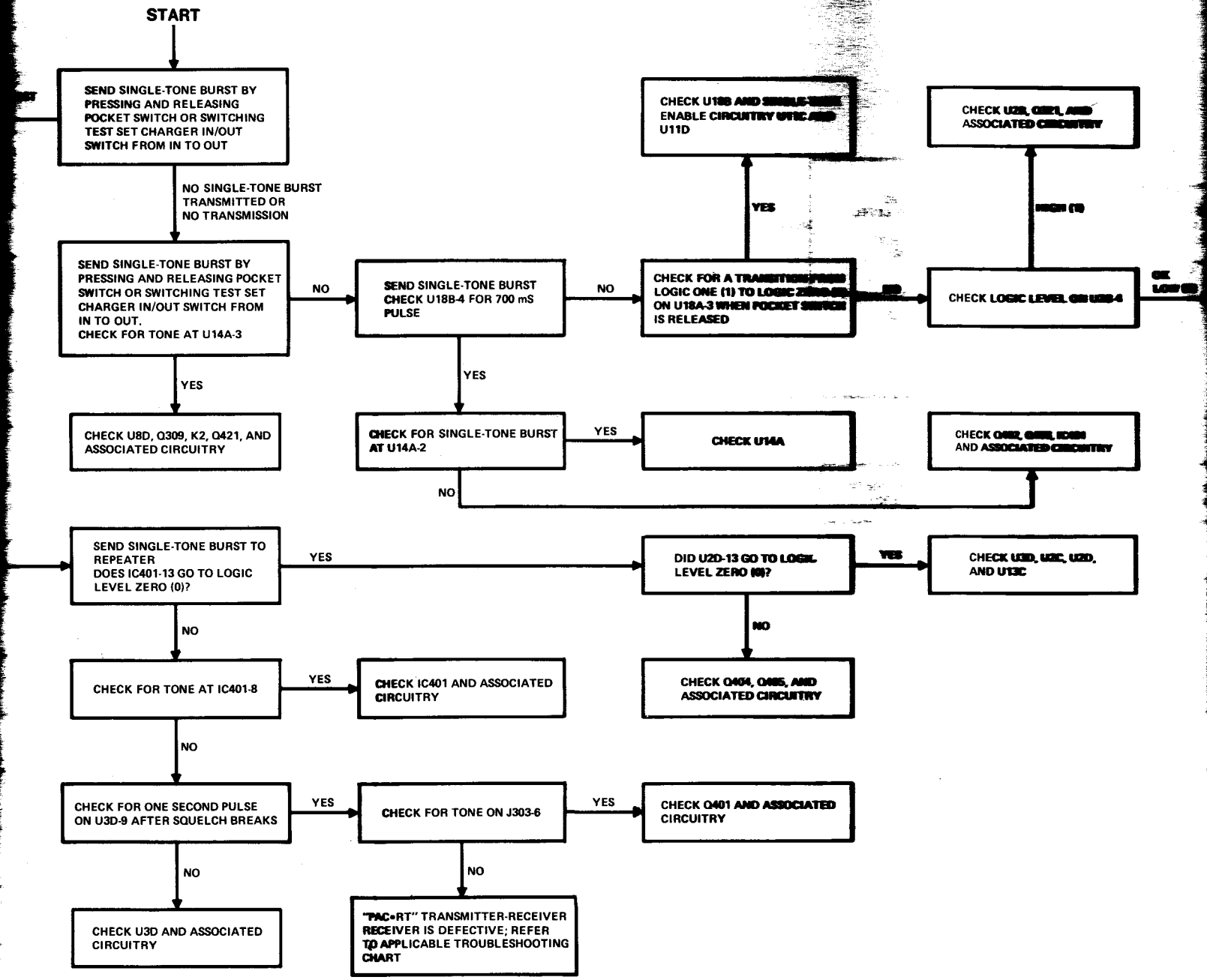
SYSTEM TROUBLESHOOTING CHART


IF TEST SET IS NOT USED, CONNECT THE "PAC•RT" TO A MOBILE AND A VEHICULAR CHARGE. POSITION SWITCHES AS FOLLOWS: "PAC•RT" ON/OFF: ON, ENABLE/DISABLE: ENABLE, MOBILE ON/OFF: ON
9.5-13.5 VDC
CHECK MOBILE ON-OFF AND INSIDE/OUTSIDE, FUNCTIONS, AND U2B
OK
CHECK REGULATOR
OTHER
ADD MOBILE CARRIER (AND "PL" TONE, IF "PL" OPTION IS PRESENT) (NO "PAC RT" CARRIER) DOES "PAC RT" TRANSMIT?
YES
REMOVE MOBILE CARRIER; THEN, SEND SINGLE-TONE BURST TO "PAC•RT" VEHICULAR REPEATER. DOES COUNTER U15 COUNT UP ONE COUNT?
YES
NO
REFER TO "SINGLE-TONE ENCODE AND DECODE FUNCTIONS TROUBLE-SHOOTING CHART"
NO SINGLE-TONE BURST TRANSMITTED OR COUNTER U15 IS NOT RESET
NO
CHECK LOGIC LEVEL ON MOBILE SQUELCH U9A-2
LOW (0)
CHECK MOBILE SQUELCH CIRCUITRY
OK
CHECK Q301, Q302 AND ASSOCIATED CIRCUITRY
OK
CHECK INTERFACE CABLE AND MOBILE RECEIVER
OK
CHECK LOGIC LEVEL ON MOBILE "PL" U2A-3
LOW (0)
OK
HIGH (1)
IS COUNTER U10B-13 AT DELAY STATE ZERO?
NO
YES
HIGH (1)
CHECK U1A AND U3C
OK
LOW (0)
CHECK LOGIC LEVEL OF U1B-6
HIGH (1)
CHECK LOGIC LEVEL OF U1A-2
HIGH (1)
CHECK "PAC•RT" SQUELCH CIRCUITRY
OK
LOW (0)
OK
LOW (0)
HIGH (1)
CHECK LOGIC LEVEL OF U1C-10
HIGH (1)
CHECK LOGIC LEVEL OF U4B-6
OK
LOW (0)
CHECK U4B, U1C R547, AND C527
OK
HIGH (1)
OK
LOW (0)
CHECK U1B AND U8A
CHECK LOGIC LEVEL OF U8D-11
OK
HIGH (1)
CHECK RELAY DRIVER Q309 AND RELAY K2
OK
CHECK "PAC•RT" TRANSMITTER-RECEIVER TRANSMITTER
LOW (0)
CHECK U3B, U9C, INTERRUPT CLOCK U5A AND U5B
LOW (1)
CHECK LOGIC LEVEL OF U9C-10
OK
HIGH (1)
CHECK U8D
CHECK U9B, U13D, U16D, U16B, U16C, U12A, U12B, AND ASSOCIATED CIRCUITRY
COUNTER U15 STAYS AT ZERO
COUNTER COUNTS UP
COUNTER U15 COUNTS UP
ADD "PAC•RT" AND MOBILE CARRIERS. REMOVE MOBILE CARRIER; THEN REMOVE THE "PAC•RT" CARRIER WITHIN 200 mS
OK COUNTER REMAINS AT COUNT ONE
NO
CHECK INTERRUPT CLOCK U5A, AND U5B
CHECK CHARGER IN/OUT CIRCUIT, Q321 AND ASSOCIATED CIRCUITRY
COUNTER REMAINS AT COUNT ZERO
CHECK TIME-OUT-TIMER U13A, U13B, U6C, U12C, AND U12D
CONTINUES TO TRANSMIT NO TIME OUT FUNCTION
EPF-7431-A

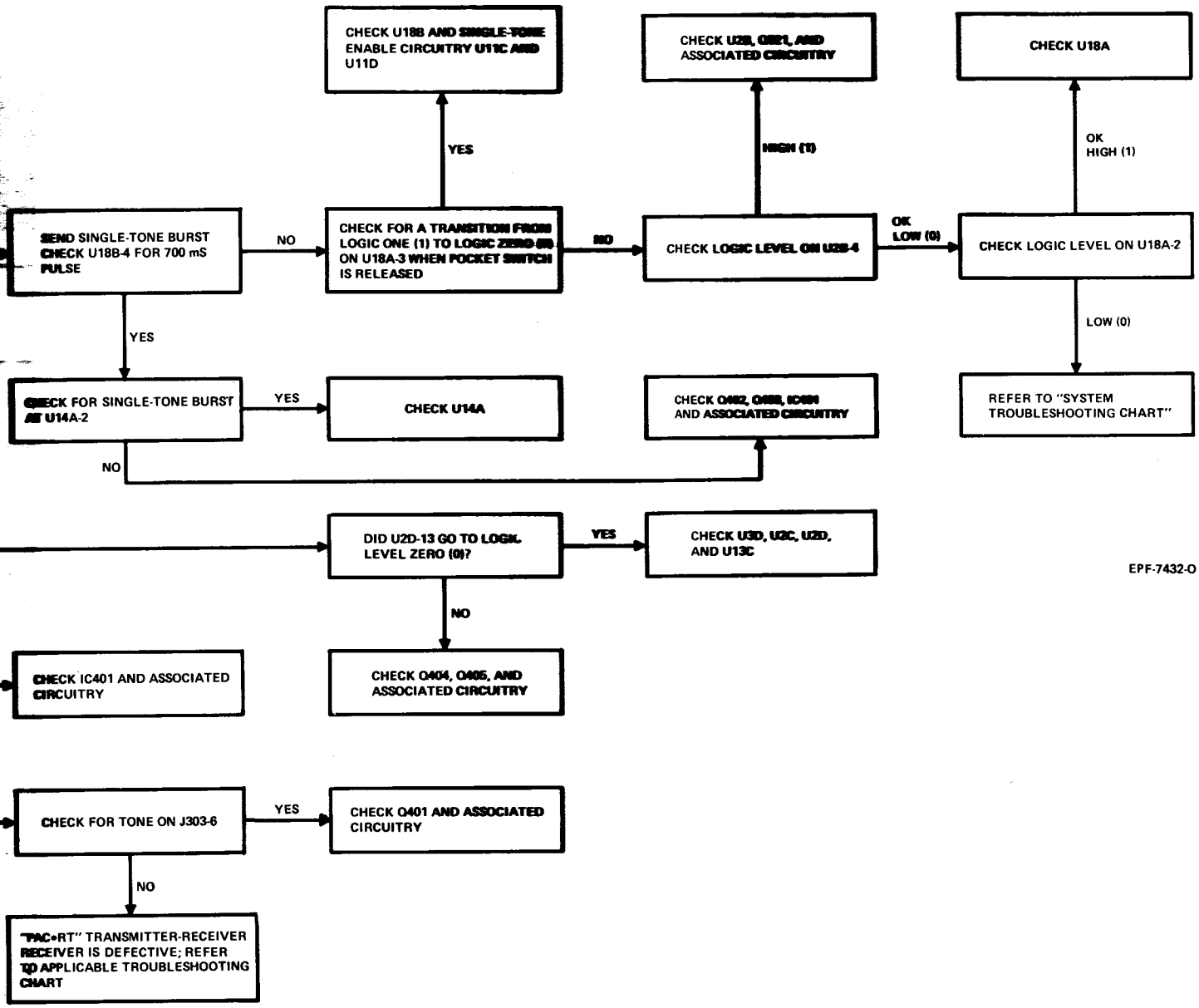

CHECK COMPONENTS K1, C440,R401,R481,C397, AND "PAC•RT" RECEIVER AUDIO
NO MOBILE DEVIATION
REMOVE MOBILE CARRIER; THEN, SEND SINGLE-TONE BURST TO "PAC•RT" VEHICULAR REPEATER. DOES COUNTER U15 COUNT UP ONE COUNT?
YES
CHECK PRESENCE OF REPEATER DEVIATION ON BOTH "PAC•RT" AND MOBILE
NO "PAC•RT" DEVIATION
SEND SINGLE-TONE BURST BY REMOVING PORTABLE RADIO FROM CONTROL UNIT
SINGLE-TONE BURST TRANSMITTED
NO
AUDIO OK
NO SINGLE-TONE BURST TRANSMITTED
NO SINGLE-TONE BURST TRANSMITTED OR COUNTER U15 IS NOT RESET
REFER TO "SINGLE-TONE ENCODE AND DECODE FUNCTIONS TROUBLE-SHOOTING CHART"
SEND SINGLE-TONE BURST BY REMOVING PORTABLE RADIO FROM CONTROL UNIT
CHECK FOR SINGLE-TONE BURST AT P303-7 OF "PAC•RT" TRANSMITTER-RECEIVER CIRCUIT BOARD
NO SINGLE-TONE BURST PRESENT
SINGLE-TONE BURST TRANSMITTED; COUNTER RESET TO ZERO
BURST
CHECK U9B, U13D, U16D, U16B, U16C, U12A, U12B, AND ASSOCIATED CIRCUITRY
COUNTER U15 STAYS AT ZERO
ADD "PAC•RT" AND MOBILE CARRIERS. REMOVE MOBILE CARRIER; THEN REMOVE THE "PAC•RT" CARRIER WITHIN 200 mS
CHECK "PAC•RT" TRANSMITTER Q301,Q302, AND ASSOCIATED CIRCUITRY
COUNTER COUNTS UP
COUNTER U15 COUNTS UP
ADD "PAC•RT" AND MOBILE CARRIERS. REMOVE MOBILE CARRIER; THEN REMOVE THE "PAC•RT" CARRIER WITHIN 200 mS
OK COUNTER REMAINS AT COUNT ONE
ADD MOBILE CARRIER (AND "PL" TONE). ("NO "PAC•RT" CARRIER) CHECK FOR INTERRUPT PULSE EVERY TWO SECONDS AT U9C-9
YES WHEN USED WITH TEST SET
ON TEST SET, PRESS "MOBILE OFF" PUSHBUTTON
COUNTER REMAINS AT COUNT ZERO
NO
YES WHEN USED WITH MOBILE RADIO
OK COUNTER GOES TO COUNT ONE
CHECK INTERRUPT CLOCK U5A, AND U5B
REMOVE MOBILE CARRIER
REMOVE MOBILE CARRIER; THEN RELEASE "MOBILE OFF" SWITCH
COUNTER REMAINS AT COUNT ONE
CHECK CHARGER IN/OUT CIRCUIT, Q321 AND ASSOCIATED CIRCUITRY
COUNTER REMAINS AT COUNT ZERO
PLACE PORTABLE RADIO IN CONTROL UNIT POCKET
CHECK COUNTER U15
OK COUNTER GOES TO ONE
LOGIC STATE OTHER THAN ONE
CHECK TIME-OUT-TIMER U13A, U13B, U6C, U12C, AND U12D
CONTINUES TO TRANSMIT, NO TIME OUT FUNCTION
REMOVE PORTABLE RADIO FROM CHARGER ADD MOBILE CARRIER WAIT 2.5 MINUTES
STOPS TRANSMITTING
CHECK LOGIC STATE OF COUNTER
COUNT ONE
EPF-7431-A


CHECK COMPONENTS K1, C440,R401,R481,C397, AND "PAC•RT" RECEIVER AUDIO
NO MOBILE DEVIATION
YES
CHECK PRESENCE OF REPEATER DEVIATION ON BOTH "PAC•RT" AND MOBILE
NO "PAC•RT" DEVIATION
SEND SINGLE-TONE BURST BY REMOVING PORTABLE RADIO FROM CONTROL UNIT
SINGLE-TONE BURST TRANSMITTED
CHECK Q301, Q302, AND ASSOCIATED CIRCUITRY
AUDIO OK
NO SINGLE-TONE BURST TRANSMITTED
NO SINGLE-TONE BURST TRANSMITTED OR COUNTER U15 IS NOT RESET
SEND SINGLE-TONE BURST BY REMOVING PORTABLE RADIO FROM CONTROL UNIT
CHECK FOR SINGLE-TONE BURST AT P303-7 OF "PAC•RT" TRANSMITTER-RECEIVER CIRCUIT BOARD
NO SINGLE-TONE BURST PRESENT
REFER TO "SINGLE-TONE ENCODE AND DECODE FUNCTIONS TROUBLE-SHOOTING CHART"
SINGLE-TONE BURST TRANSMITTED; COUNTER RESET TO ZERO
BURST
COUNTER U15 STAYS AT ZERO
ADD "PAC•RT" AND MOBILE CARRIERS. REMOVE MOBILE CARRIER; THEN REMOVE THE "PAC•RT" CARRIER WITHIN 200 mS
CHECK "PAC•RT" TRANSMITTER Q301,Q302, AND ASSOCIATED CIRCUITRY
SINGLE-TONE BURST PROBLEM CORRECTED
COUNTER U15 COUNTS UP
OK COUNTER REMAINS AT COUNT ONE
ADD MOBILE CARRIER (AND "PL" TONE). ("NO "PAC•RT" CARRIER) CHECK FOR INTERRUPT PULSE EVERY TWO SECONDS AT U9C-9
YES WHEN USED WITH TEST SET
ON TEST SET, PRESS "MOBILE OFF" PUSHBUTTON
COUNTER REMAINS AT COUNT ZERO
CHECK MOBILE ON/OFF SWITCH
NO
YES WHEN USED WITH MOBILE RADIO
OK COUNTER GOES TO COUNT ONE
REMOVE MOBILE CARRIER
REMOVE MOBILE CARRIER; THEN RELEASE "MOBILE OFF" SWITCH
COUNTER REMAINS AT COUNT ONE
CHECK PRESET CIRCUIT U8C, U12E, AND U14D
COUNTER REMAINS AT COUNT ZERO
PLACE PORTABLE RADIO IN CONTROL UNIT POCKET
CHECK COUNTER U15
OK COUNTER GOES TO ONE
LOGIC STATE OTHER THAN ONE
CONTINUES TO TRANSMIT, NO TIME OUT FUNCTION
REMOVE PORTABLE RADIO FROM CHARGER ADD MOBILE CARRIER WAIT 2.5 MINUTES
STOPS TRANSMITTING
CHECK LOGIC STATE OF COUNTER
COUNT ONE
REFER TO "COUNT-DOWN FUNCTION TROUBLEHSOOTING CHART" AND EXPLANATION OF CIRCUIT FOR PROBLEM INVOLVED.

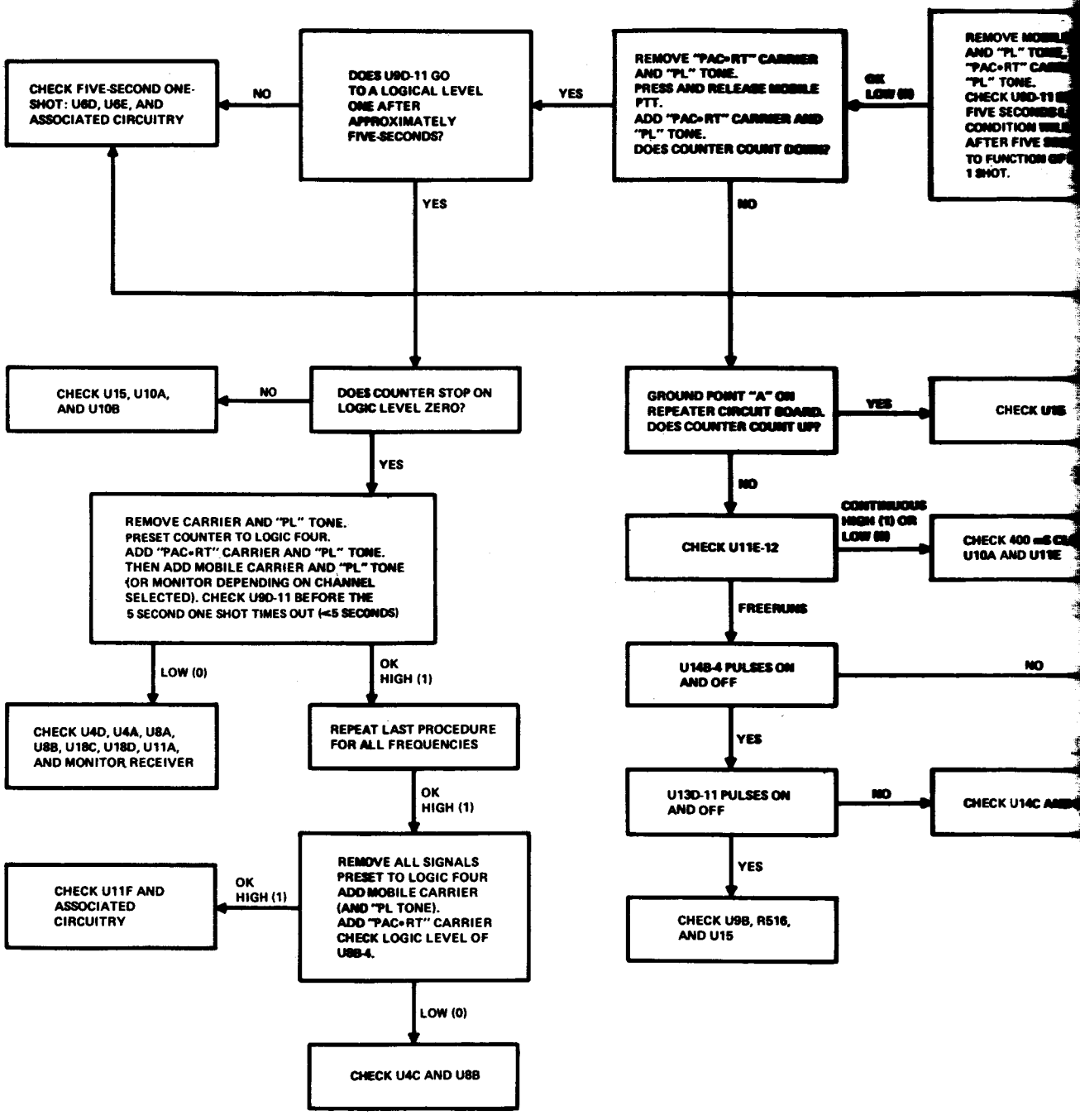

START
SEND SINGLE-TONE BURST BY PRESSING AND RELEASING POCKET SWITCH OR SWITCHING TEST SET CHARGER IN/OUT SWITCH FROM IN TO OUT
SINGLE-TONE BURST TRANSMITTED
SWITCH MOBILE OFF, THEN ON
NO SINGLE-TONE BURST TRANSMITTED
CHECK U2B, Q325 AND ASSOCIATED CIRCUITRY.
NO SINGLE-TONE BURST TRANSMITTED OR NO TRANSMISSION
SINGLE-TONE BURST TRANSMITTED
SEND SINGLE-TONE BURST BY PRESSING AND RELEASING POCKET SWITCH OR SWITCHING TEST SET CHARGER IN/OUT SWITCH FROM IN TO OUT. CHECK FOR TONE AT U14A-3
NO
PRESS POCKET SWITCH OR SET CHARGER IN/OUT SWITCH TO IN. DOES U15 PRESET TO LOGIC LEVEL FOUR?
NO
CHECK U8C, U12E, U14D, U15, U2B, Q321, AND ASSOCIATED CIRCUITRY
YES
YES
CHECK U8D, Q309, K2, Q421, AND ASSOCIATED CIRCUITRY
RELEASE POCKET SWITCH OR SET CHARGER IN/OUT SWITCH TO OUT. DOES U15 RESET TO LOGIC LEVEL ZERO?
NO
CHECK U15.
YES
SEND SINGLE-TONE BURST TO REPEATER. DOES U15 COUNT UP?
NO
SEND SINGLE-TONE BURST TO REPEATER DOES IC401-13 GO TO LOGIC LEVEL ZERO (0)?
YES
YES
NO
DID U15 COUNT UP ONE COUNT ONLY?
NO
CHECK FOR MULTIPLE PULSES AT Q404, Q405, U2D, AND IC401
CHECK FOR TONE AT IC401-8
YES
YES
NO
SEND SEVERAL SINGLE-TONE BURSTS TO REPEATER. DOES U15 STOP AT COUNT EIGHT?
NO
CHECK U15 AND U13C
CHECK FOR ONE SECOND PULSE ON U3D-9 AFTER SQUELCH BREAKS
YES
YES
NO
REFER TO "SYSTEM TROUBLESHOOTING CHART"
CHECK U3D AND ASSOCIATED CIRCUITRY

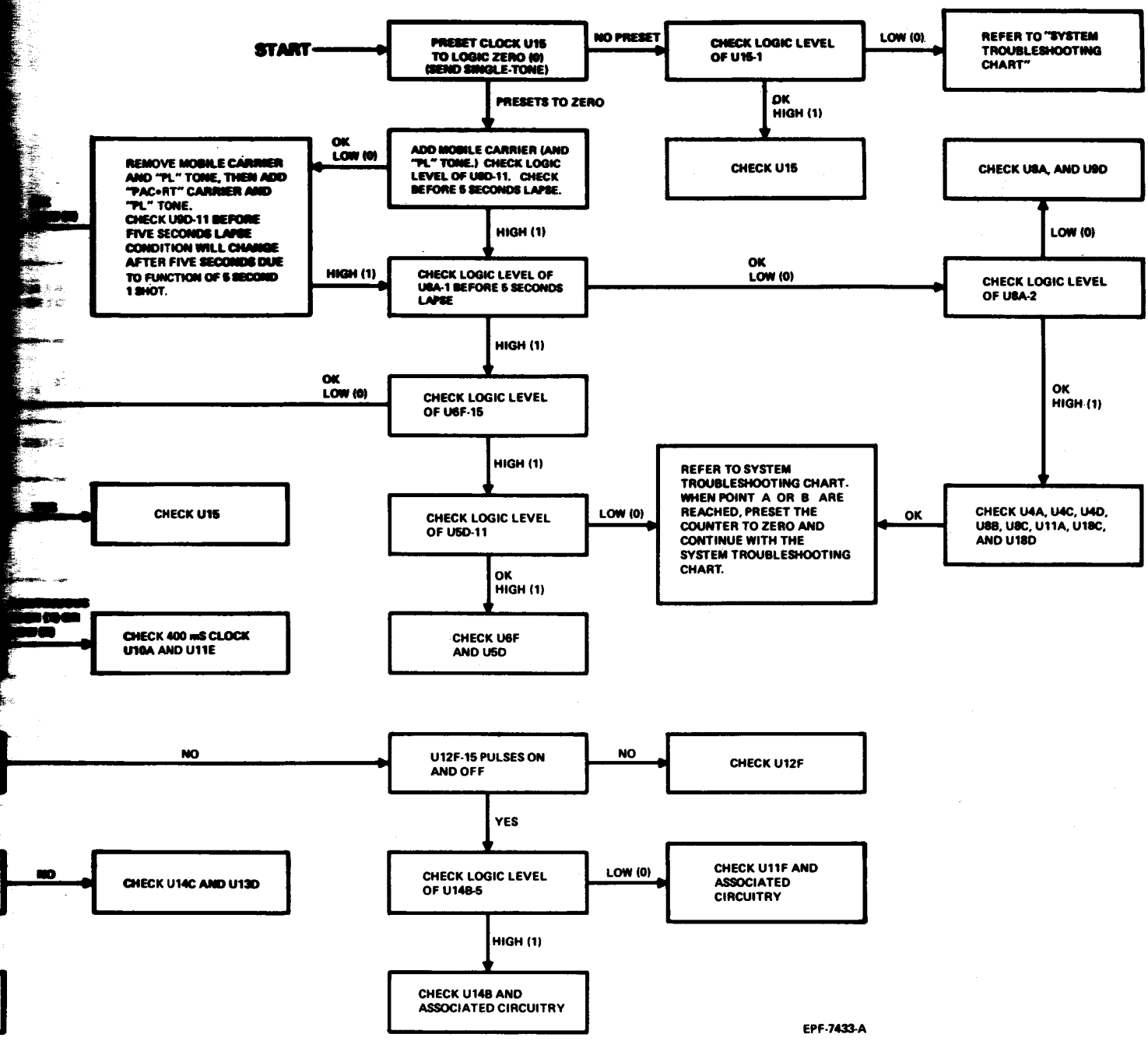


SINGLE-TONE ENCODE /
TROUBLESHOOTING CH

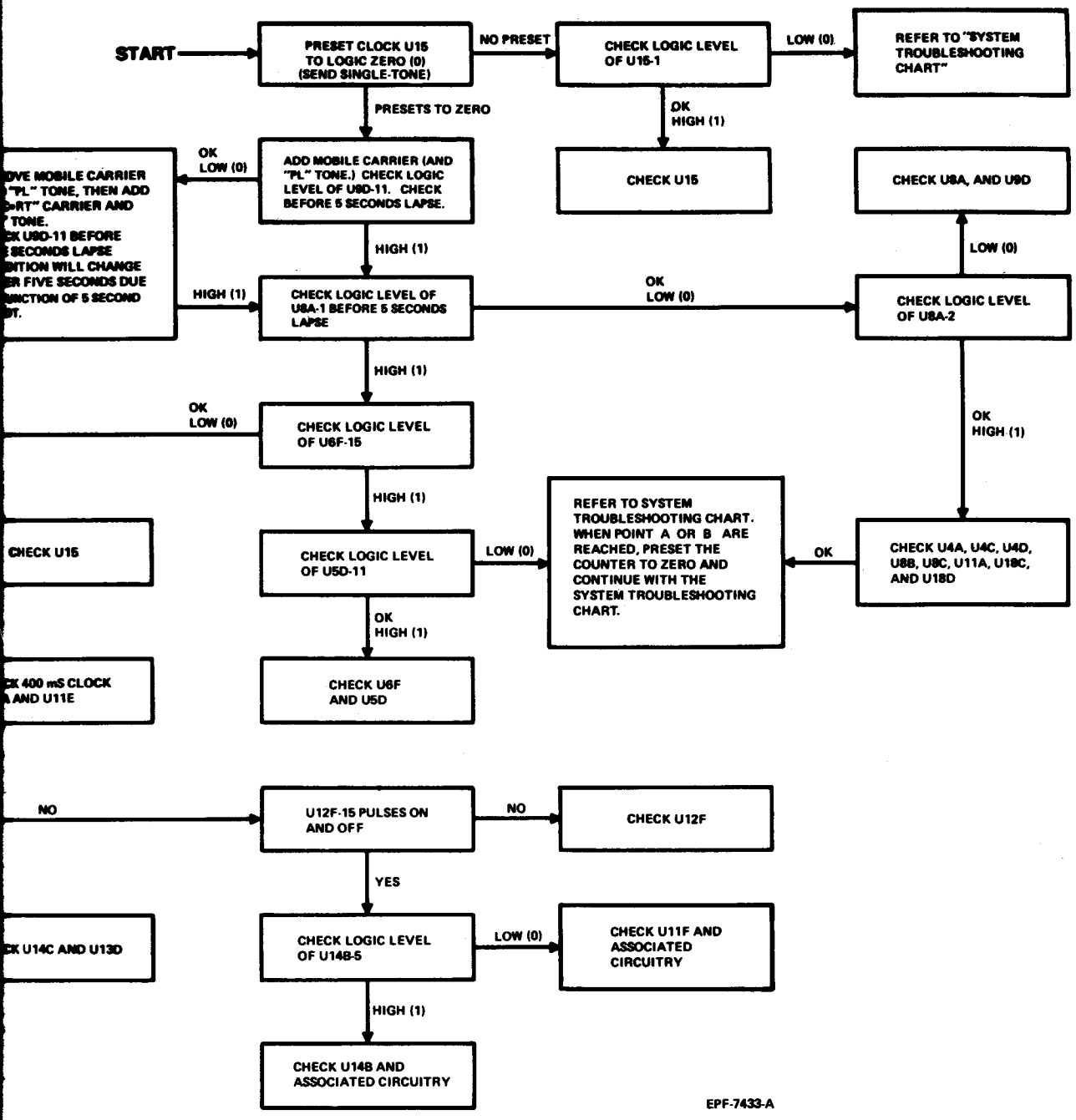


SINGLE-TONE ENCODE AND DECODE FUNCTION TROUBLESHOOTING CHART

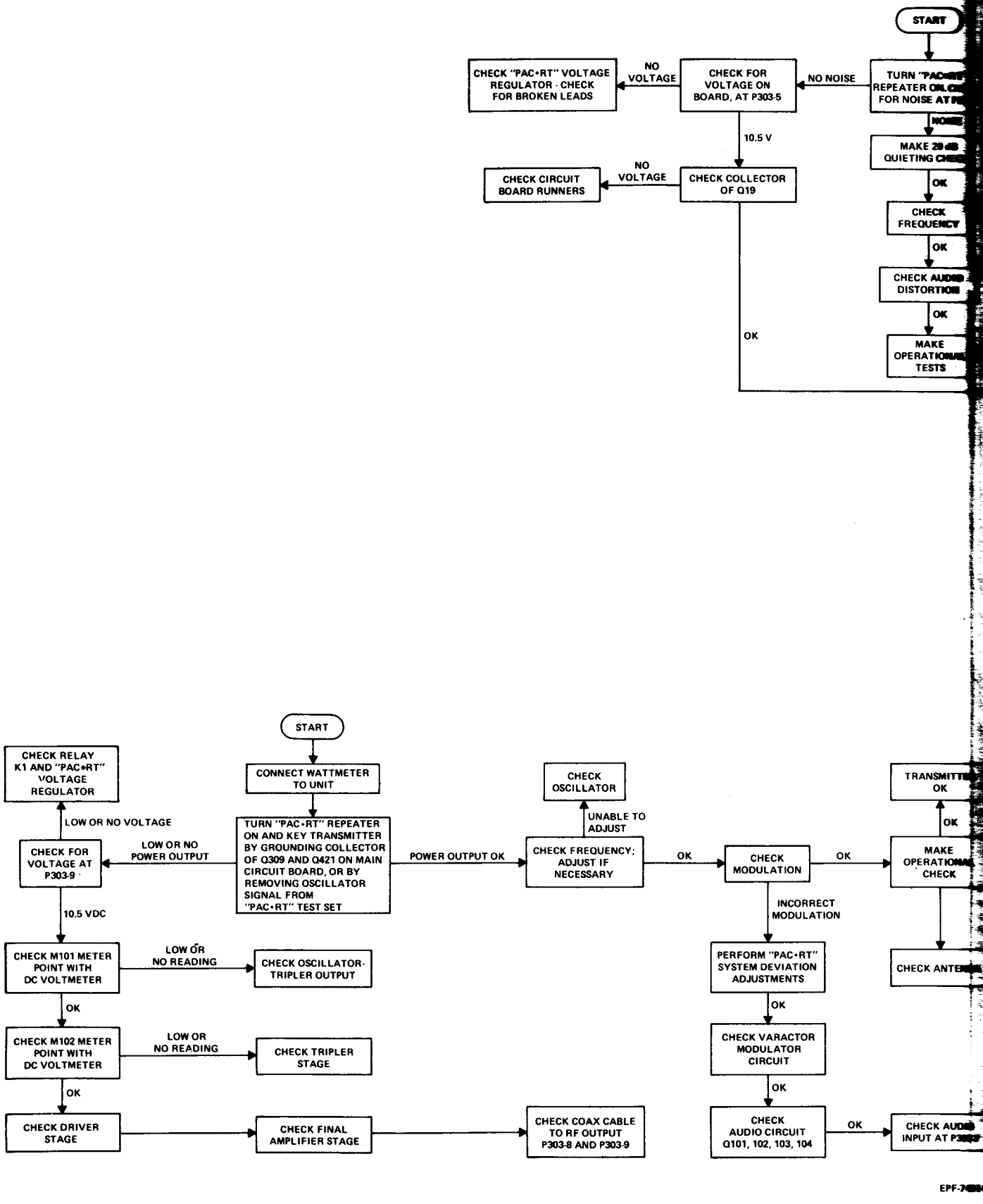

CHECK FIVE-SECOND ONE-SHOT: U6D, U6E, AND ASSOCIATED CIRCUITRY
NO
DOES U9D-11 GO TO A LOGICAL LEVEL ONE AFTER APPROXIMATELY FIVE-SECONDS?
YES
REMOVE "PAC•RT" CARRIER AND "PL" TONE.
PRESS AND RELEASE MOBILE PTT.
ADD "PAC•RT" CARRIER AND "PL" TONE.
DOES COUNTER COUNT DOWN?
OK
LOW (0)
REMOVE MOBILE AND "PL" TONE.
"PAC•RT" CARRIER
"PL" TONE.
CHECK U9D-11
FIVE SECONDS
CONDITION
AFTER FIVE
TO FUNCTION
1 SHOT.
YES
NO
CHECK U15, U10A, AND U10B
NO
DOES COUNTER STOP ON LOGIC LEVEL ZERO?
GROUND POINT "A" ON REPEATER CIRCUIT BOARD. DOES COUNTER COUNT UP?
YES
CHECK U15
YES
NO
REMOVE CARRIER AND "PL" TONE.
PRESET COUNTER TO LOGIC FOUR.
ADD "PAC•RT" CARRIER AND "PL" TONE.
THEN ADD MOBILE CARRIER AND "PL" TONE (OR MONITOR DEPENDING ON CHANNEL SELECTED). CHECK U9D-11 BEFORE THE 5 SECOND ONE SHOT TIMES OUT (<5 SECONDS)
CHECK U11E-12
CONTINUOUS HIGH (1) OR LOW (0)
CHECK 400 mS CLK
U10A AND U11E
FREERUNS
LOW (0)
OK
HIGH (1)
U14B-4 PULSES ON AND OFF
NO
CHECK U4D, U4A, U8A, U8B, U18C, U18D, U11A, AND MONITOR RECEIVER
REPEAT LAST PROCEDURE FOR ALL FREQUENCIES
YES
OK
HIGH (1)
U13D-11 PULSES ON AND OFF
NO
CHECK U14C AND
YES
CHECK U11F AND ASSOCIATED CIRCUITRY
OK
HIGH (1)
REMOVE ALL SIGNALS
PRESET TO LOGIC FOUR
ADD MOBILE CARRIER (AND "PL TONE).
ADD "PAC•RT" CARRIER
CHECK LOGIC LEVEL OF U9B-4.
CHECK U9B, R516, AND U15
LOW (0)
CHECK U4C AND U8B

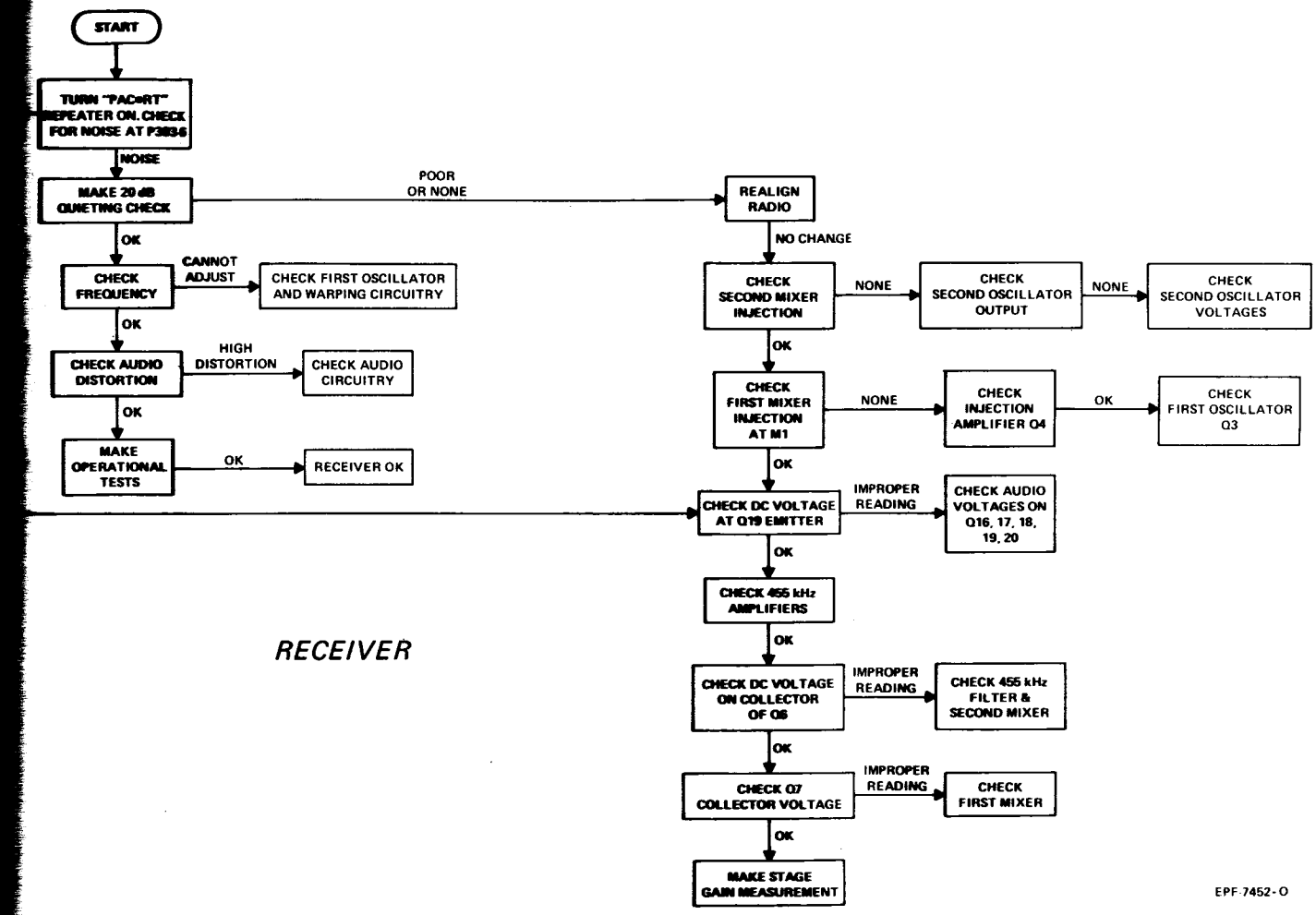


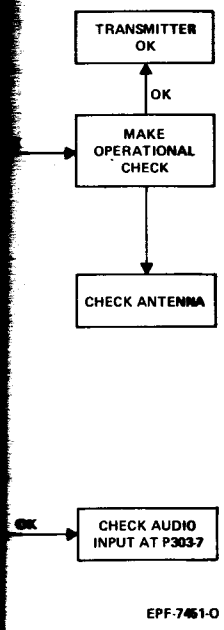
COUNT-DOWN FUNCTION TROUBLESHOOTING CHART



COUNT-DOWN FUNCTION TROUBLESHOOTING CHART

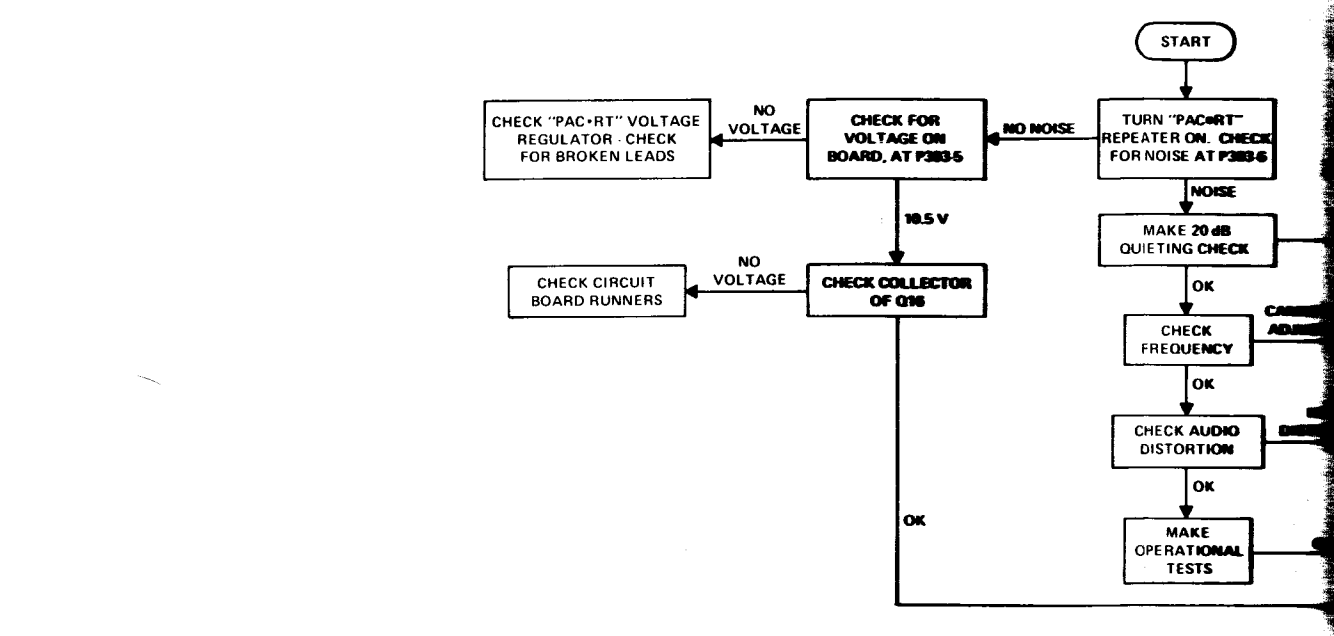

START
CHECK "PAC•RT" VOLTAGE REGULATOR - CHECK FOR BROKEN LEADS
NO VOLTAGE
CHECK FOR VOLTAGE ON BOARD, AT P303-5
NO NOISE
10.5 V
CHECK CIRCUIT BOARD RUNNERS
NO VOLTAGE
CHECK COLLECTOR OF Q19
OK
OK
OK
OK
CHECK RELAY K1 AND "PAC•RT" VOLTAGE REGULATOR
START
CONNECT WATTMETER TO UNIT
CHECK OSCILLATOR
UNABLE TO ADJUST
LOW OR NO VOLTAGE
CHECK FOR VOLTAGE AT P303-9
LOW OR NO POWER OUTPUT
TURN "PAC•RT" REPEATER ON AND KEY TRANSMITTER BY GROUNDING COLLECTOR OF Q309 AND Q421 ON MAIN CIRCUIT BOARD, OR BY REMOVING OSCILLATOR SIGNAL FROM "PAC•RT" TEST SET
POWER OUTPUT OK
CHECK FREQUENCY; ADJUST IF NECESSARY
OK
CHECK MODULATION
OK
OK
10.5 VDC
CHECK M101 METER POINT WITH DC VOLTMETER
LOW OR NO READING
CHECK OSCILLATOR-TRIPLER OUTPUT
INCORRECT MODULATION
PERFORM "PAC•RT" SYSTEM DEVIATION ADJUSTMENTS
OK
CHECK M102 METER POINT WITH DC VOLTMETER
LOW OR NO READING
CHECK TRIPLER STAGE
CHECK VARACTOR MODULATOR CIRCUIT
OK
OK
CHECK DRIVER STAGE
CHECK FINAL AMPLIFIER STAGE
CHECK COAX CABLE TO RF OUTPUT P303-8 AND P303-9
CHECK AUDIO CIRCUIT Q101, 102, 103, 104
OK

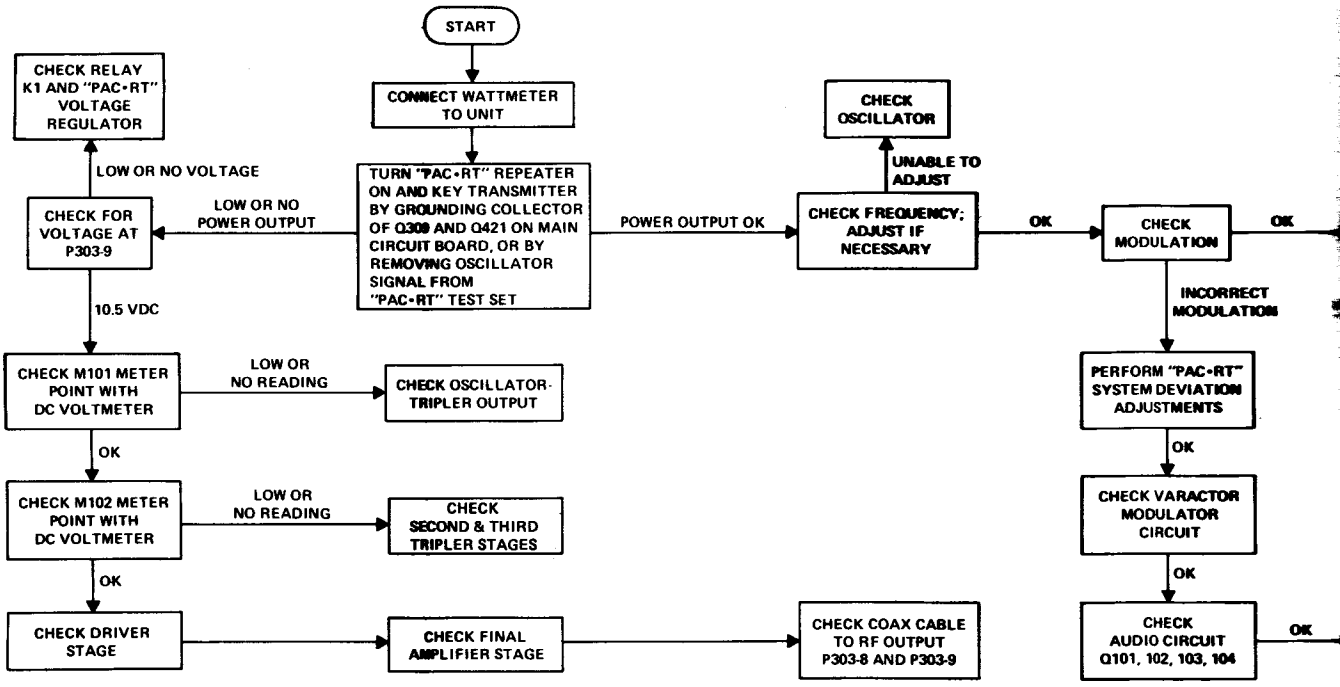




EPF-7451-O

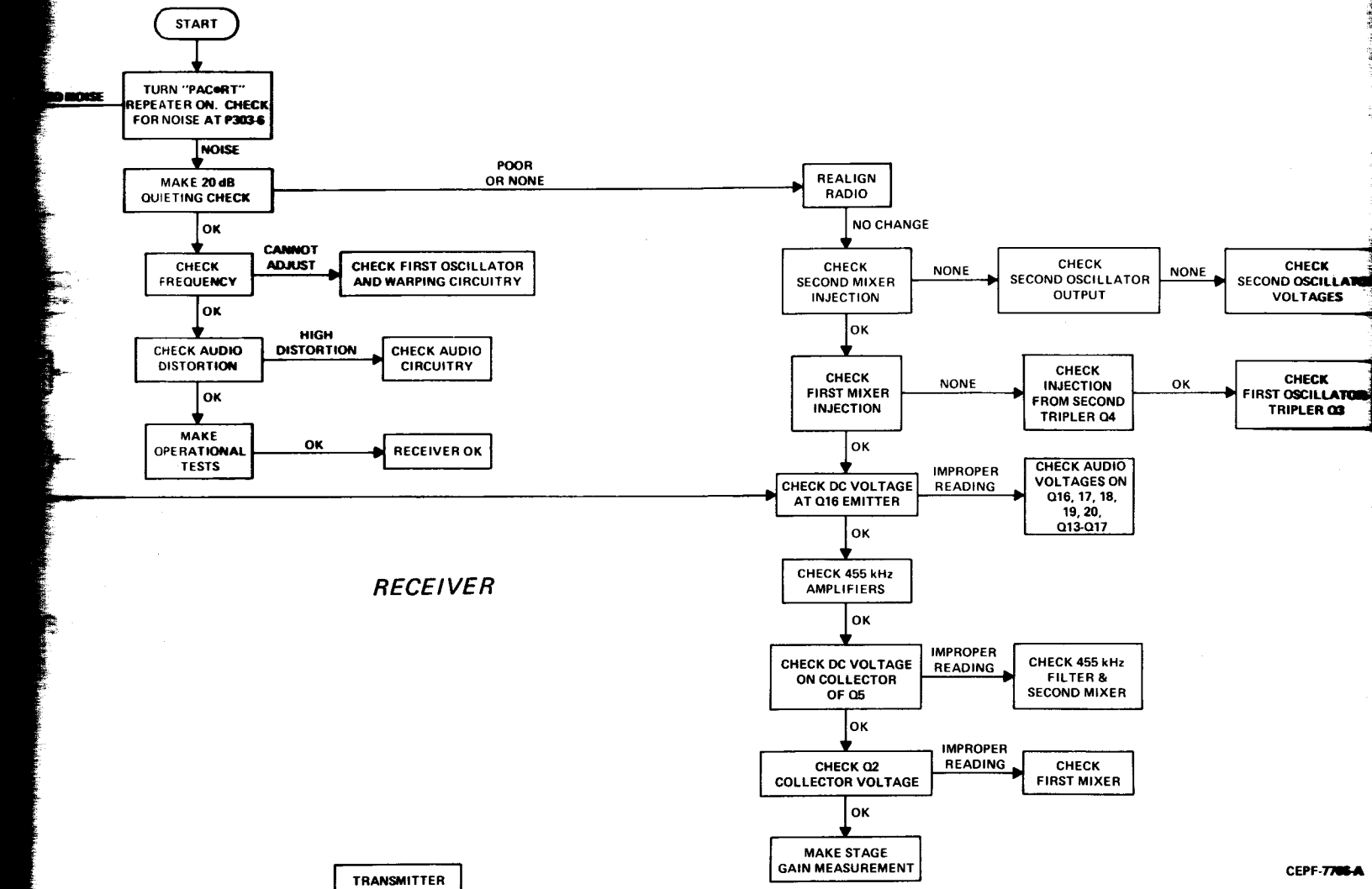
"VHF" TRANSCEIVER TROUBLESHOOTING CHARTS



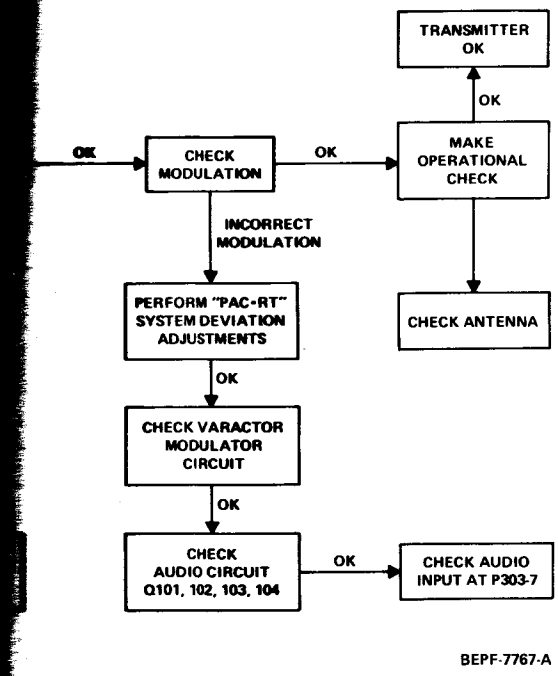


TRANSMITTER

"UHF
TROU

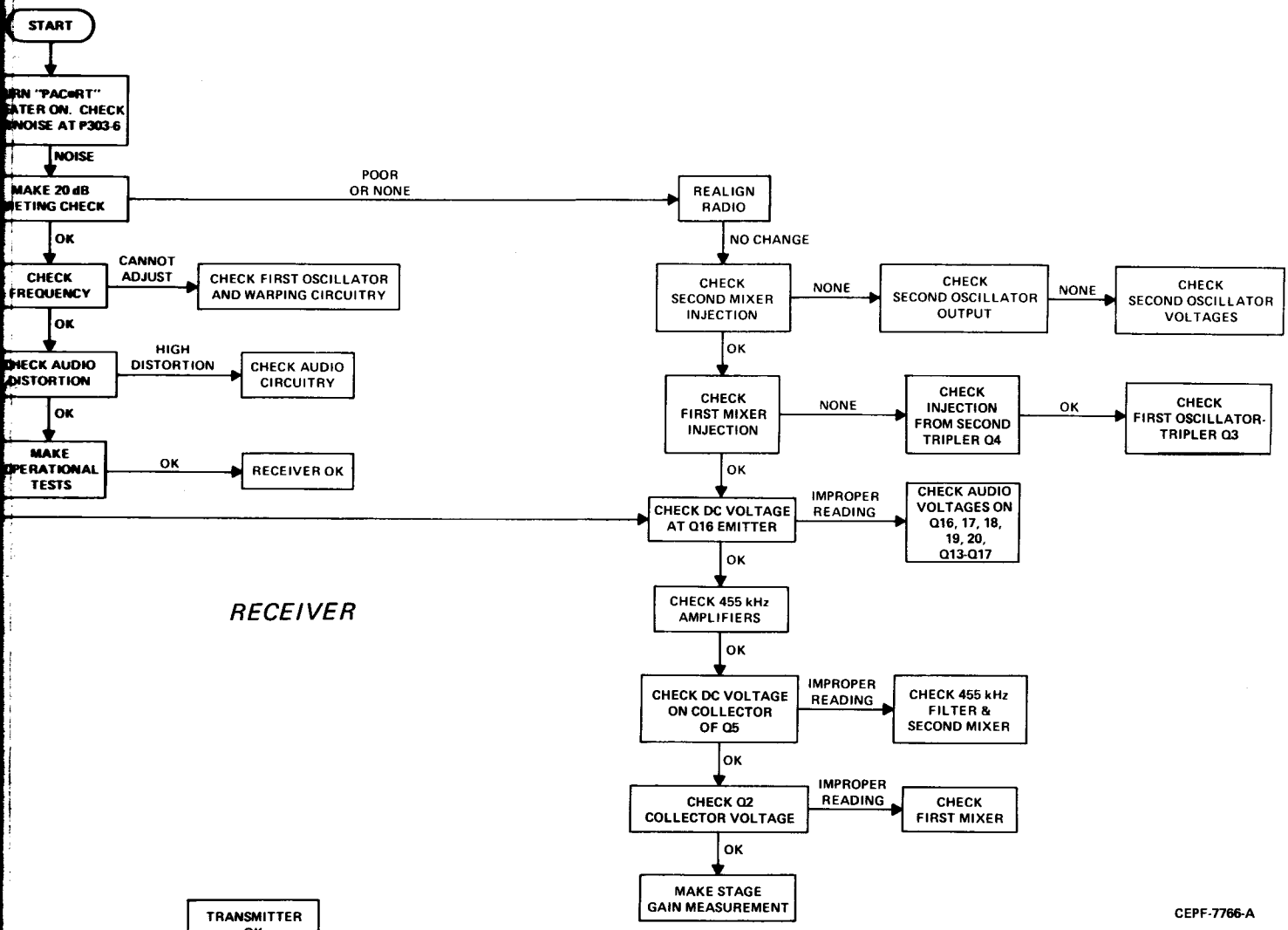


RECEIVER

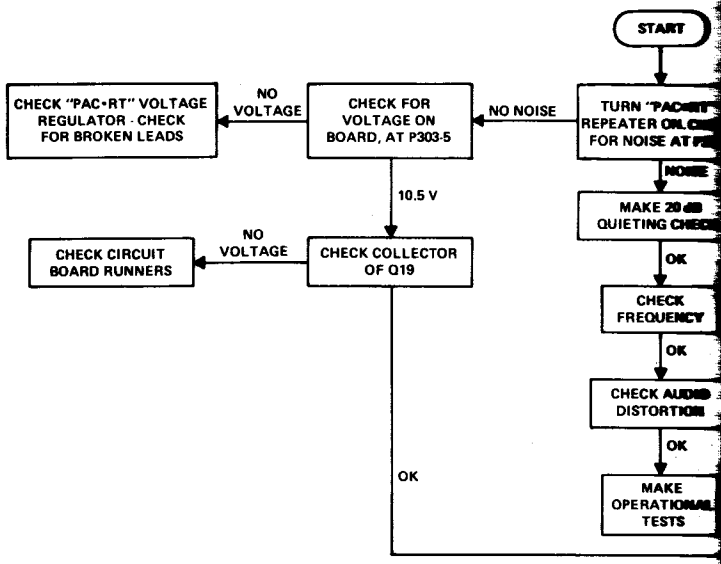


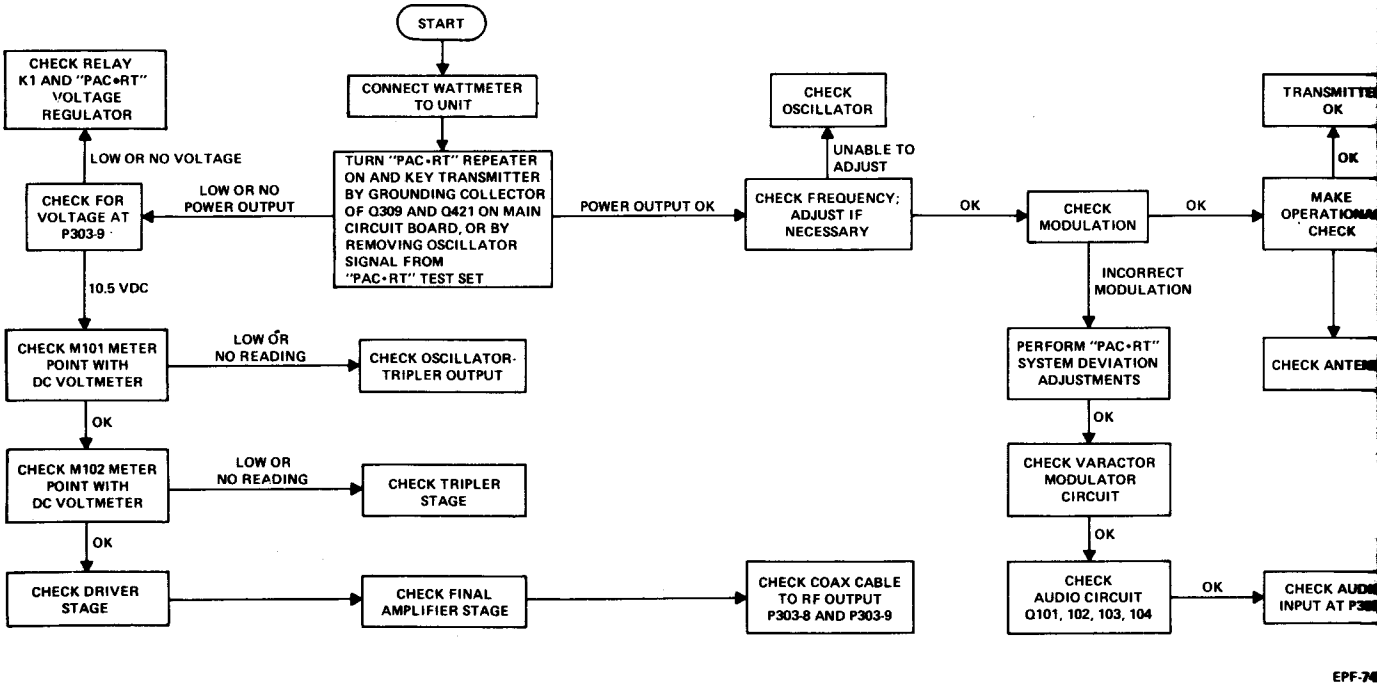
BEPF-7767-A

"UHF" TRANSCEIVER TROUBLESHOOTING CHARTS



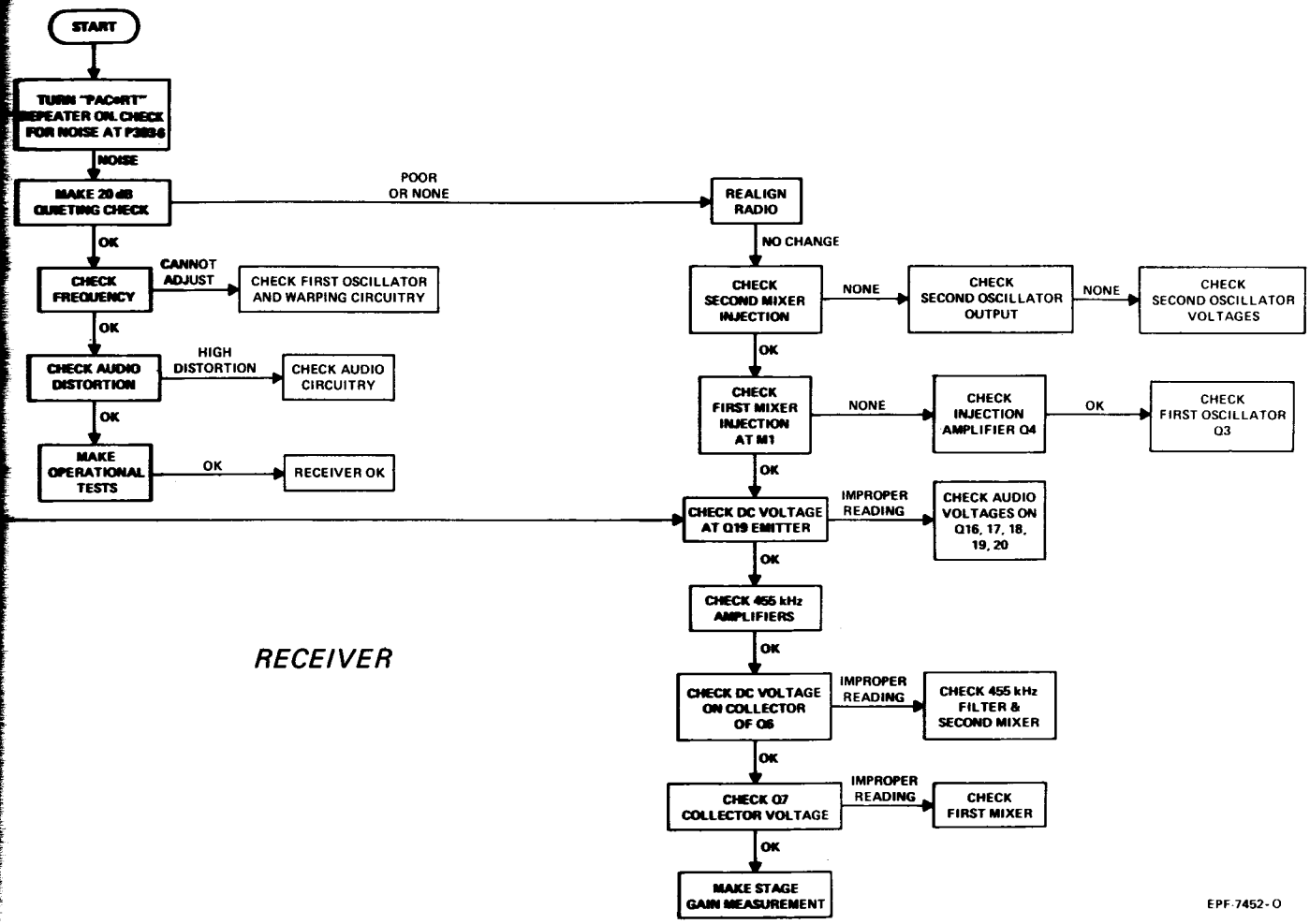
"UHF" TRANSCEIVER TROUBLESHOOTING CHARTS



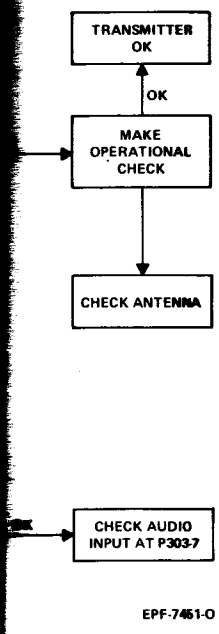


EPF-7

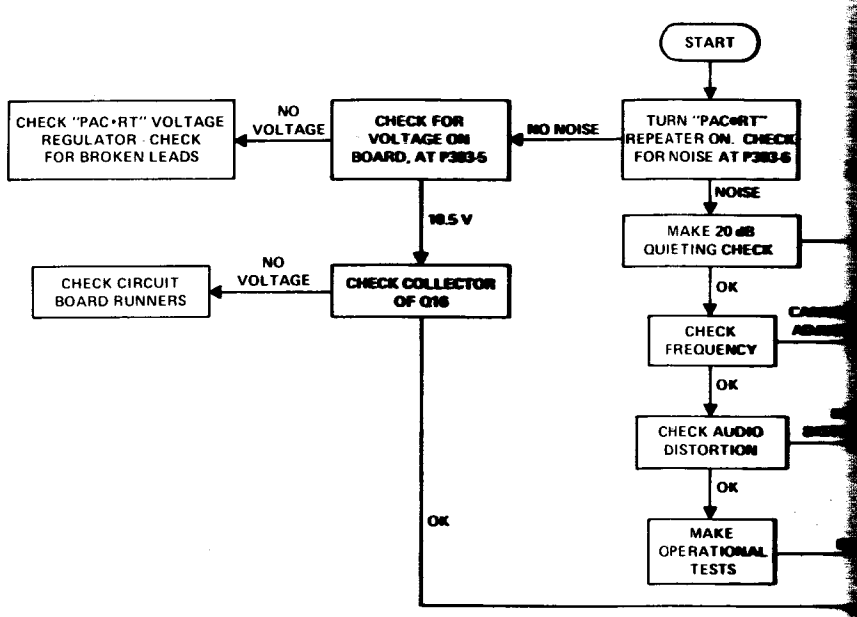
TRANSMITTER

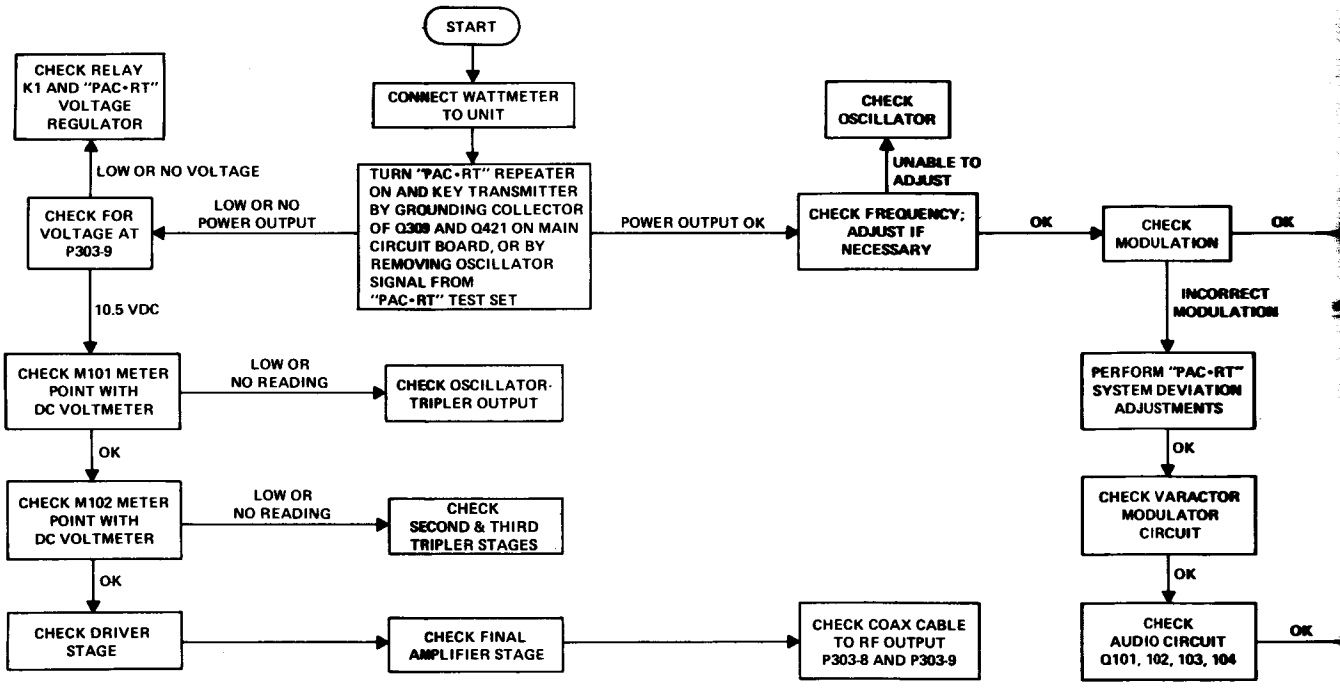


RECEIVER



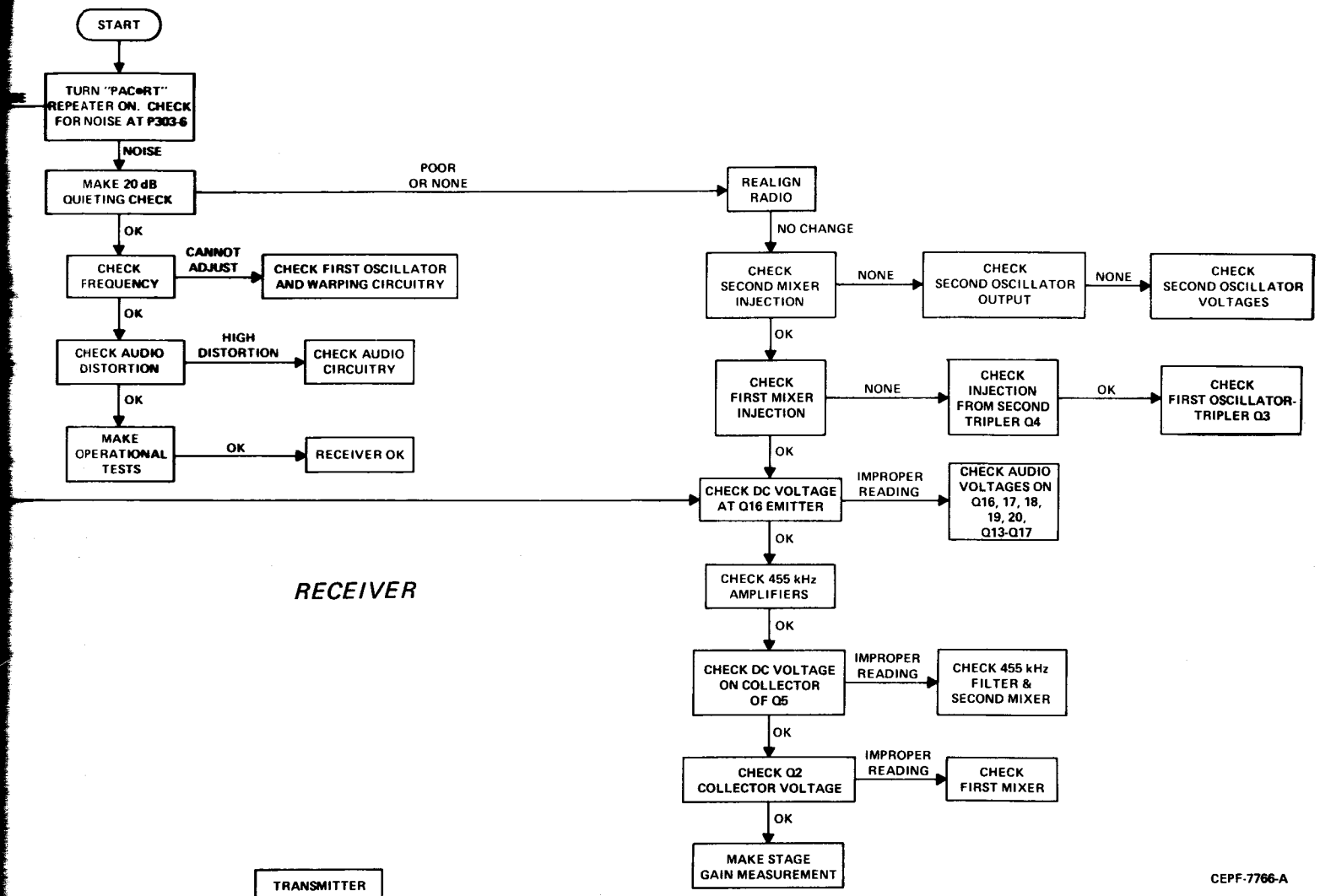
"VHF" TRANSCEIVER TROUBLESHOOTING CHARTS



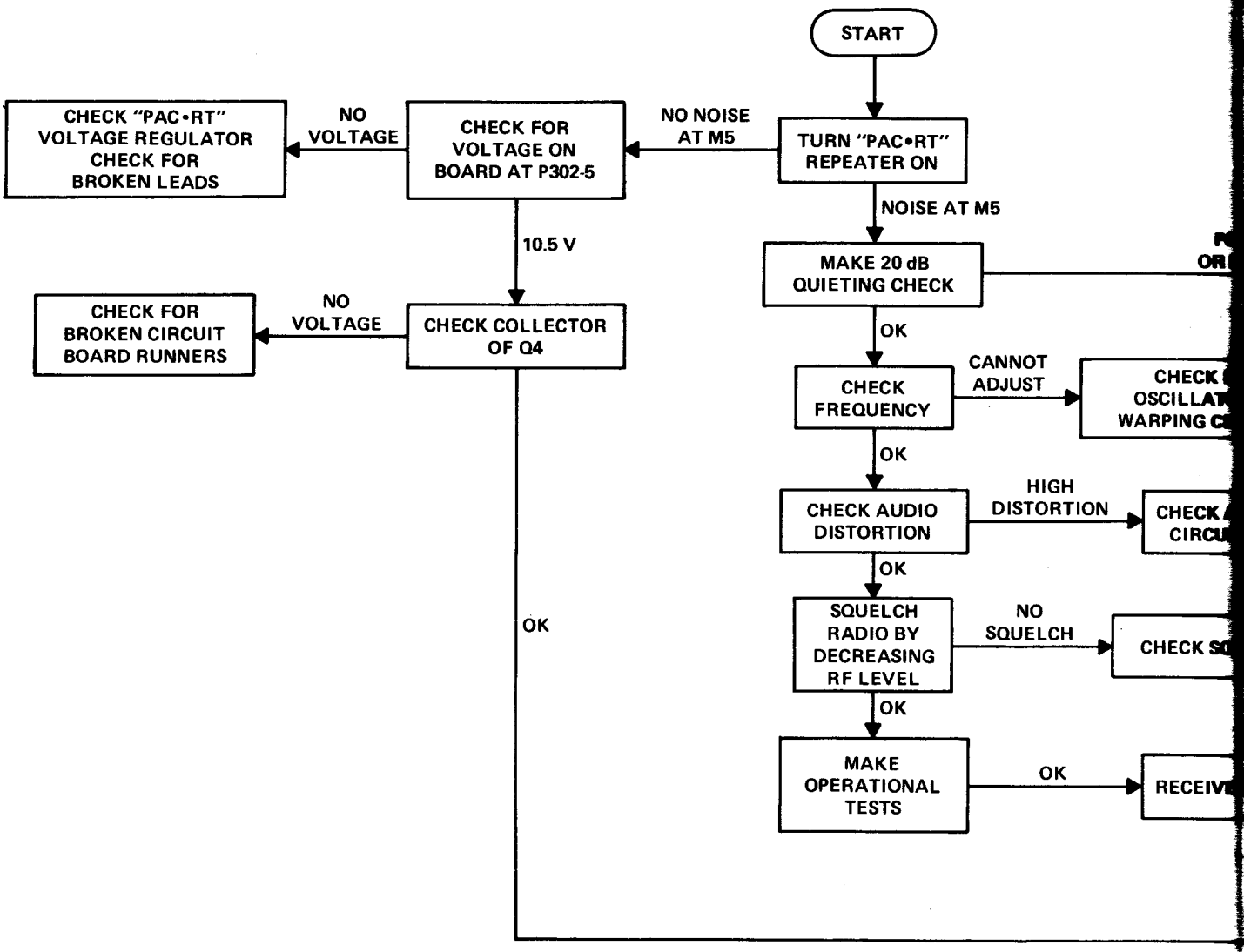


TRANSMITTER

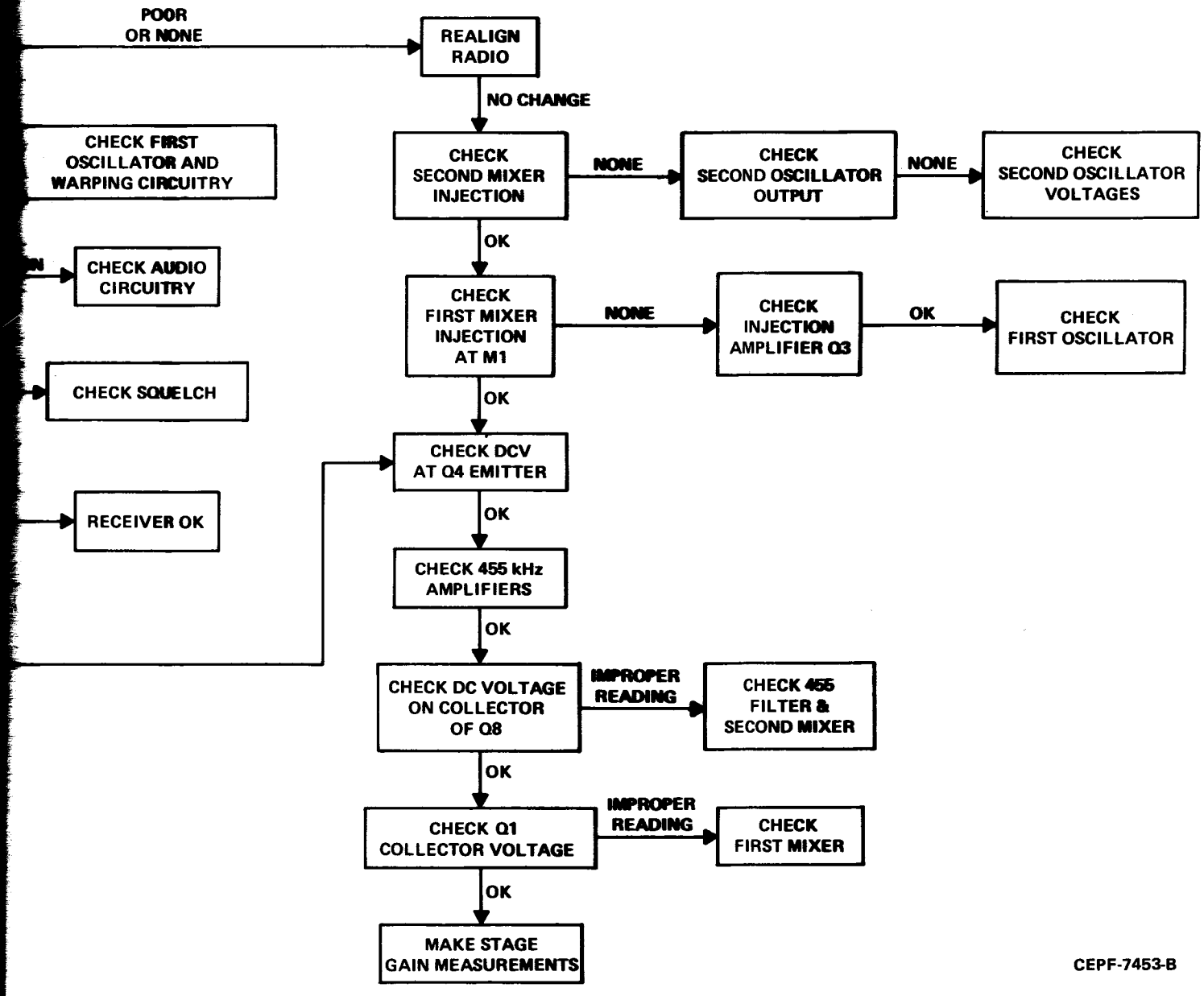
"UHF
TROU



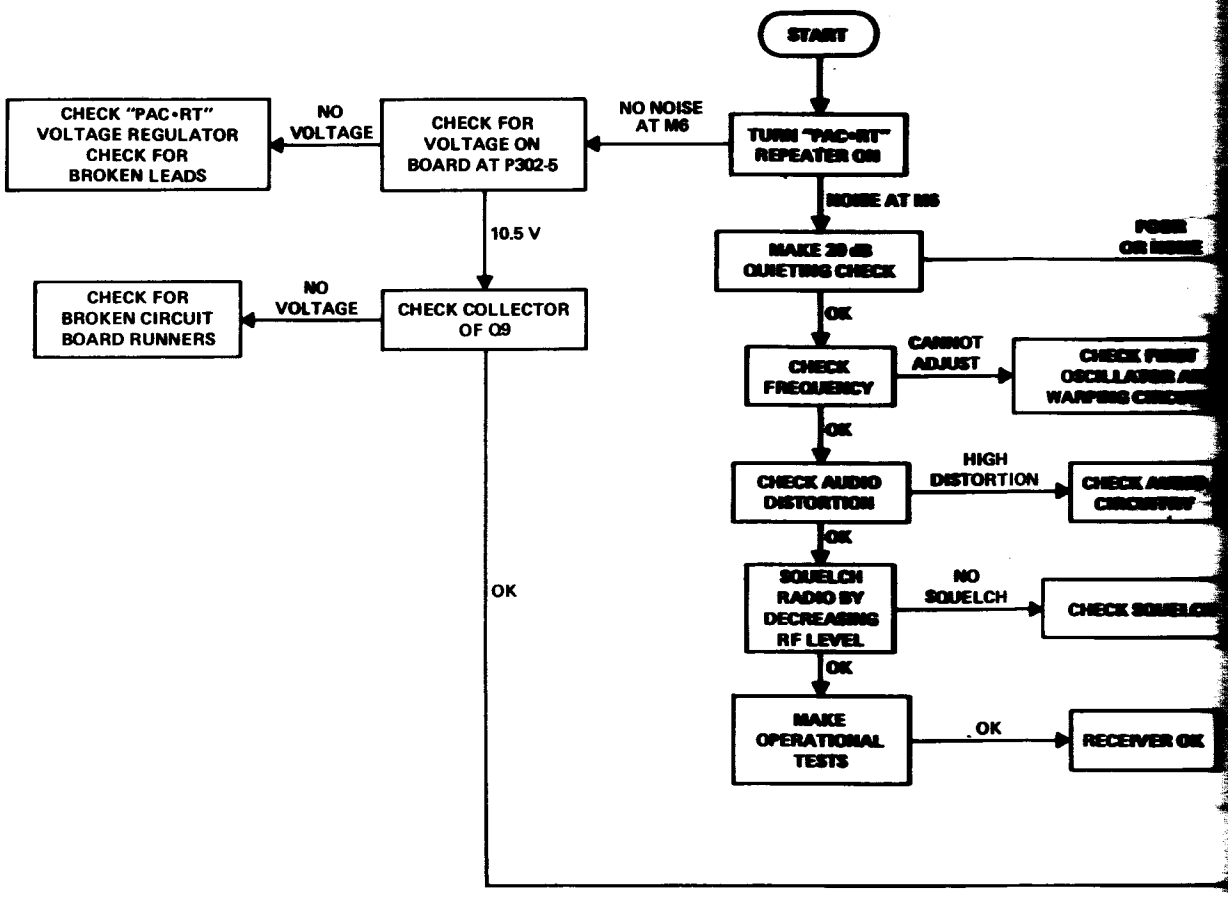
"UHF" TRANSCEIVER TROUBLESHOOTING CHARTS



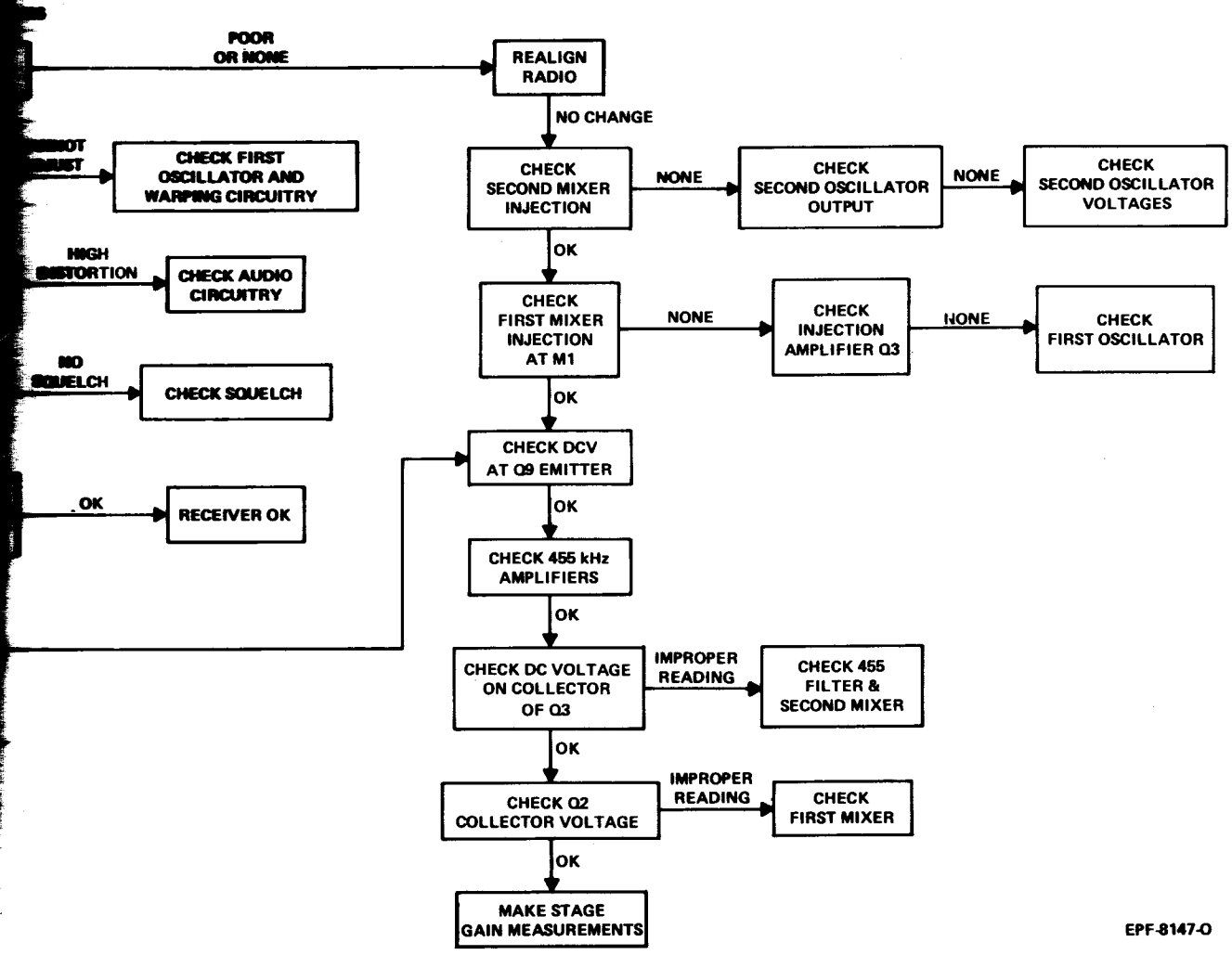
NOTE: TROUBLESHOOTING IS PERFORMED ON MOBILE DETECTOR CIRCUIT BOARD WHEN PLUGGED INTO THE "PAC•RT" REPEATER UNIT.



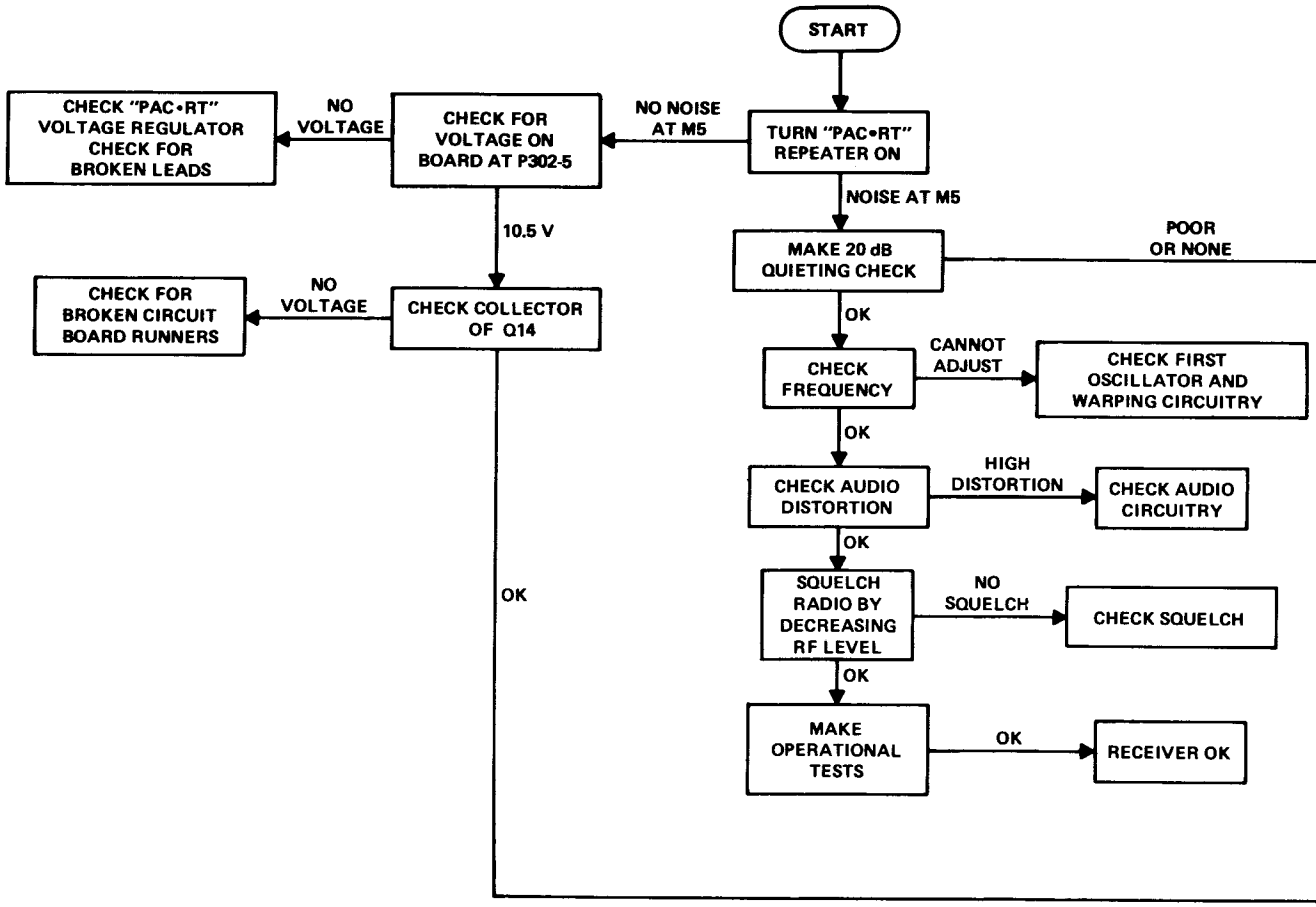
30-50 MHz MOBILE DETECTOR TROUBLESHOOTING CHART



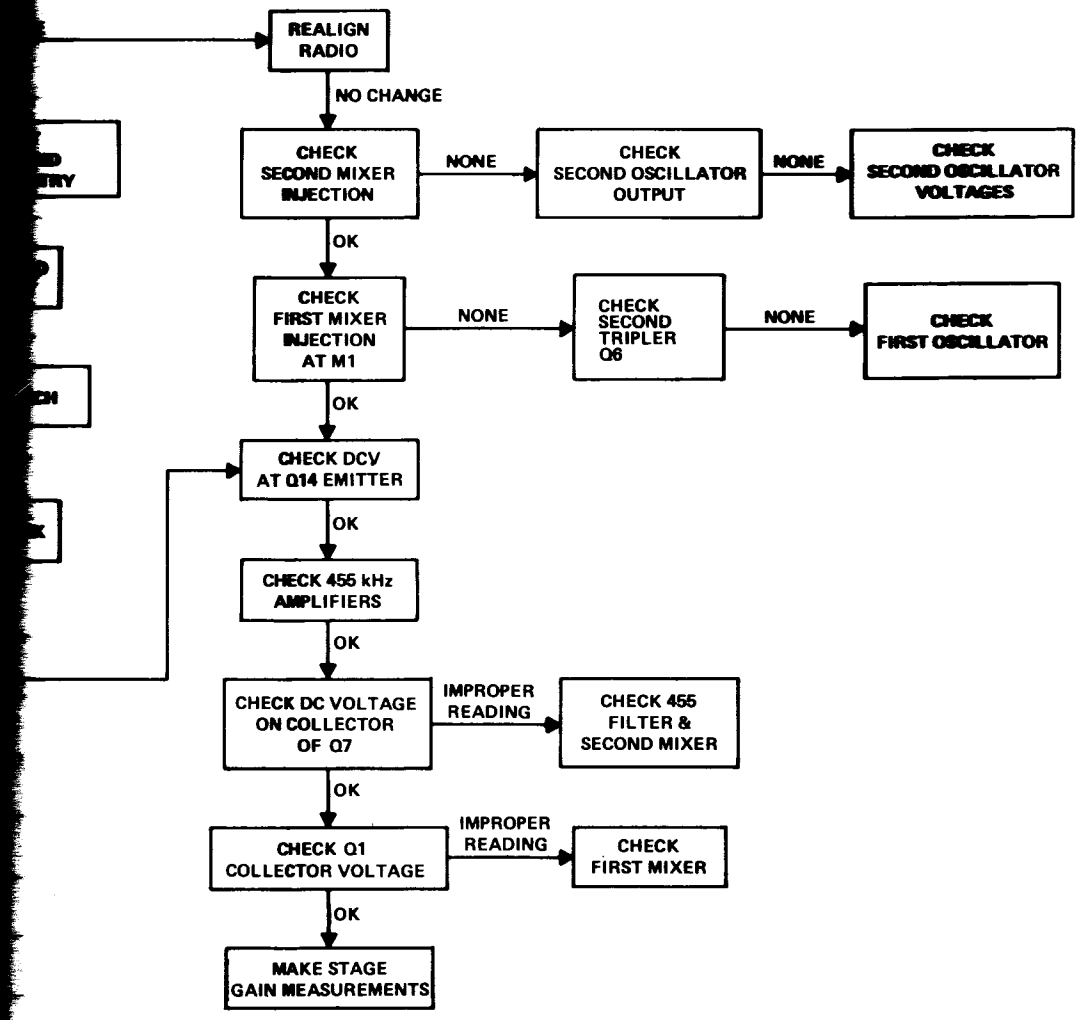
NOTE: TROUBLESHOOTING IS PERFORMED ON MOBILE DETECTOR CIRCUIT BOARD WHEN PLUGGED INTO THE "PAC•RT" REPEATER UNIT.



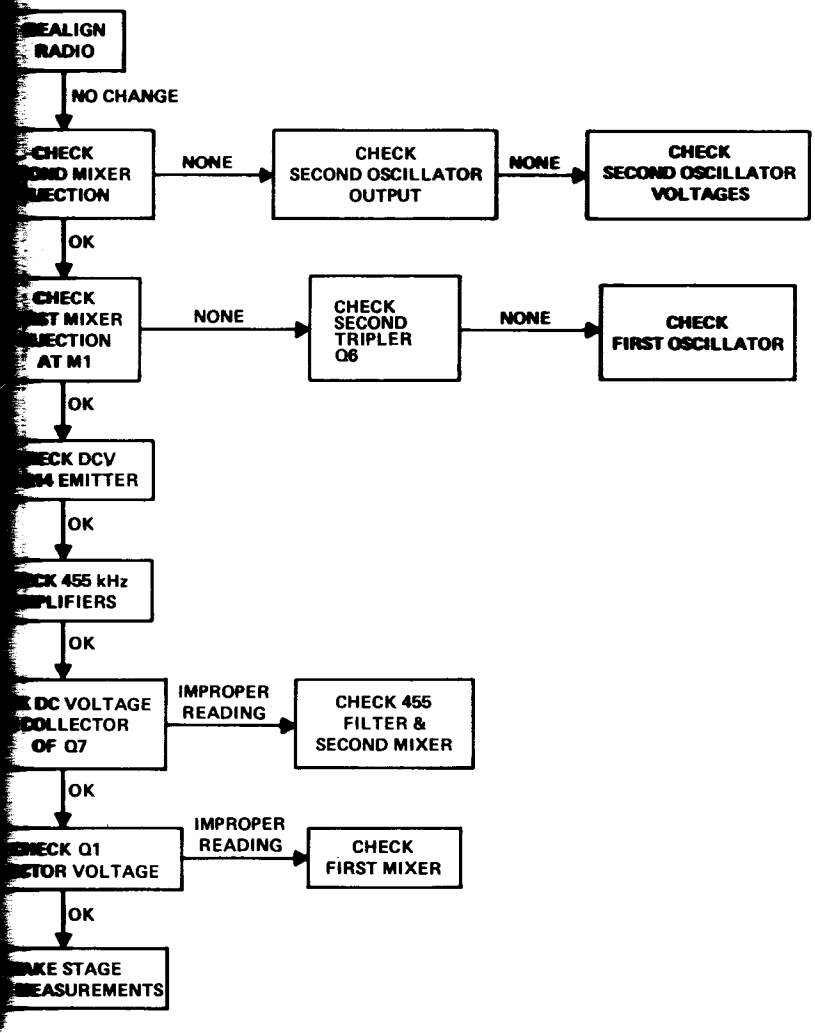
150.8-174 MHz MOBILE
DETECTOR TROUBLESHOOTING CHART



NOTE: TROUBLESHOOTING IS PERFORMED ON MOBILE DETECTOR CIRCUIT BOARD WHEN PLUGGED INTO THE "PAC•RT" REPEATER UNIT.


REALIGN RADIO
NO CHANGE
CHECK SECOND MIXER INJECTION
NONE
CHECK SECOND OSCILLATOR OUTPUT
NONE
CHECK SECOND OSCILLATOR VOLTAGES
OK
CHECK FIRST MIXER INJECTION AT M1
NONE
CHECK SECOND TRIPLER Q6
NONE
CHECK FIRST OSCILLATOR
OK
CHECK DCV AT Q14 EMITTER
OK
CHECK 455 kHz AMPLIFIERS
OK
CHECK DC VOLTAGE ON COLLECTOR OF Q7
IMPROPER READING
CHECK 455 FILTER & SECOND MIXER
OK
CHECK Q1 COLLECTOR VOLTAGE
IMPROPER READING
CHECK FIRST MIXER
OK
MAKE STAGE GAIN MEASUREMENTS

BEPF-8139-A



BEPF-8139-A

450-512 MHz MOBILE
DETECTOR TROUBLESHOOTING CHART

REPAIR AND REPLACEMENT

1. PRINTED CIRCUIT BOARDS

The circuit boards are made of glass-epoxy material with copper plated runners on both sides. Plating the copper onto the board extends copper in and through the component mounting holes, thereby providing a better mechanical and electrical connection than obtained with an eyeletted etched board. Some holes that are not used and appear to be unnecessary will be found in the board. These holes are in addition to the component mounting holes and ensure a reliable means of electrically connecting narrow runners from opposite sides of the board. Product reliability is increased through the use of this double-sided, plated-through circuit board.

Early printed circuit board repair techniques stressed the use of low-wattage soldering tools to prevent board damage when components were removed. Experience has shown that the low-wattage iron may actually cause printed circuit damage. A considerable amount of time is usually required to heat a connection to the melting point with a low-wattage iron. During this time, heat is conducted away from the connection along the printed wiring. This conducted heat may separate the printed wiring from the board or damage nearby solder connections. A medium-wattage soldering iron (approximately 50 watts) is recommended for printed circuit repair. The iron should have a temperature-controlled tip to prevent excessive heating and to increase tip life. The ST-1087 Soldering Station, with an 800-degree tip, is an excellent choice for printed circuit work.

Clearing circuit board holes of excess solder with a pick, as formerly recommended for some Motorola products, has been shown to cause damage to the plating in and around the hole when excessive zeal is used in applying this technique. To prevent this occurrence, it is recommended that holes be cleared only by solder extraction. The ST-725 Solder Remover Bulb or ST-1163 "Precista" Vacuum Desolder Pump may be used to extract molten solder.

2. DISCRETE COMPONENT REPLACEMENT (RESISTORS, CAPACITORS, COILS, ETC.)

Place the circuit board in a convenient position and gently grasp the component lead with a "seizer" (Motorola ST-207) or needle-nose pliers. Heat the solder connection and simultaneously apply a small amount of solder until molten and remove the lead from the board. Do not apply the soldering iron any longer than necessary to free the lead. After the component has been removed, prepare the board for the replacement component by extracting all solder from the component mounting holes. Use resin solvent and a small brush to clean this portion of the printed circuit after the excess solder has been removed. Use the leads of the defective component as a model to form the leads of the replacement. Remove insulators and spacers on the defective component and install these on the replacement component. Insert the new component with a slight bend on the leads at the board to prevent movement while soldering. Heat the lead and the printed circuit at the connection pad with a clean, hot, well-tinned iron. Apply solder in moderation. Use only enough to fill the holes, coat the pad, and provide a slight fillet around the component lead. Immediately remove the solder and iron when this has been accomplished. Allow time for solidification before proceeding. Do not disturb the component while the connection is cooling. After the solder has solidified, clip the lead as close to the board as possible. Clean away residue with resin solvent and a small brush. The finished connection should have a bright, mirror-like appearance.

3. INTEGRATED CIRCUIT REPLACEMENT

Place the circuit board in a convenient position and gently grasp the defective integrated circuit (IC) module with a Motorola ST-909 IC Extractor. From the solder side of the circuit board, heat the IC leads until the solder is molten. The spring-loaded action of the IC extractor automatically releases the IC from the circuit board when the solder is heated.

After the IC module has been removed, prepare the circuit board for the replacement IC module by extracting all solder from the component mounting holes. Use resin solvent and a small brush to clean this portion of the printed circuit after the excess solder has been removed.

Insert the new IC module with a slight bend on the leads at the board to prevent movement while soldering. Heat the lead and the printed circuit at the connection pad with a clean, hot,

well-tinned iron. Apply solder in moderation. Use only enough to fill the holes, coat the pad, and provide a slight fillet around the component lead. Immediately remove the solder and iron when this has been accomplished. Do not disturb the IC module while the connection is cooling. Clean away the residue with resin solvent and a small brush. The finished connection should have a bright, mirror-like appearance.

4. ALIGNMENT NOTES

When replacing crystals, realign the radio as described in the alignment procedure. Also, if any component in a tunable stage is replaced, realign the associated, the preceding, and the following stages.

5. SERVICING AIDS

Motorola has available several items which can be used to aid in parts replacement and repair of the printed circuit board:

The ST-639 Printed Circuit Repair Kit supplies the basic tools needed for work on printed circuitry and miniature components. The following tools are included:

Tweezers	Soldering Aids (2)
Brush	(Needle point & prong
Soldering Iron	types)
Soldering Iron Tip	Magnifying Glass
Solder	

The components of the repair kit are standard items and need no special mention at this time. A solder extractor bulb (ST-725 or ST-726) is used to "take up" the molten solder from a soldered connection on the printed circuit board when the soldering iron has brought the connection up to a high enough heat. With the excess solder removed from the connection, the component can be removed from the board by heating the connection while working the component loose. Clamping pliers or seizers (ST-207) may be used during component replacement or removal, and also as a heat sink when replacing diodes or transistors, since excessive heat may damage these latter components. Use the resin solvent to remove excess flux after installing a new component.

6. EQUIPMENT IDENTIFICATION

When production changes and engineering changes are incorporated into the equipment, a revision number is assigned to the chassis or kit; -1, -2, -3, etc. The chassis number, complete with applicable revision number, is stamped on the chassis when manufactured. The revision number becomes an integral part of the chassis identifier. The applicable suffix revisions are listed on the schematic diagram.

7. INSTRUCTION MANUAL REVISIONS

Changes which occur after an instruction manual is printed are described in manual revisions. These bulletins give complete information on the change, including applicable parts list data. Before changing or ordering parts, always check the revisions supplied.

APPENDIX A
GLOSSARY

CARRIER - used to denote the presence of a signal on any given frequency regardless of whether there is modulation or not.

DELAY STATE - only one repeater does the repeating for any given area. To do this, the PAC•RT repeater system assigns numbers to all repeaters in the area. These numbers are called the delay state and the repeater doing the work for the area is in delay state zero, also known as the priority repeater.

INSIDE/OUTSIDE - refers to whether the portable radio is inside of the charger pocket or not. This logic line is also controlled by the enable/disable switch.

MOBILE DETECTOR - a receiver mounted in the PAC•RT repeater which detects the presence of a mobile carrier coming from another vehicle in the area. The receiver in the mobile radio normally provides this function. A Mobile Detector is only required when the mobile channel to be used has different transmit and receive frequencies. The Mobile Detector has also been referred to as a "Monitor Receiver."

MOBILE FREQUENCY - describes any signal on the frequency of the mobile radio.

MONOSTABLE MULTIVIBRATOR - a digital logic circuit used to delay either the leading edge or the falling edge or both of a signal.

PORTABLE FREQUENCY - describes any signal on the frequency of the PAC•RT transmitter-receiver or the portable radio.

PRIORITY REPEATER - a repeater which is in delay state zero.

SINGLE-TONE - a short burst of an audio frequency tone that is transmitted for the purpose of controlling equipment. In the PAC•RT repeater system, this tone is used to assign delay states.

SHAPING - refers to the altering of the frequency response of a circuit.

APPENDIX B
BASIC LOGIC CIRCUITS

1. GENERAL

Symbolic logic provides a simplified means of presenting a series of events which are controlled by two-state devices. The two states of the logic devices are "1" (high) and "0" (low); there are no in-between states or voltage levels. As an aid to understanding and servicing the PAC•RT logic board, a brief description of the functions of the various logic building blocks used in the PAC•RT repeater are given in the following paragraphs.

The simplest circuit used is the inverter circuit which is shown symbolically in Figure 1. The inverter circuit element produces an output which is the inverse of the input; i.e., a logic "high" at the input pin becomes a logic "low" at the output pin and vice versa. A 1 indicates a "high" signal and a 0 indicates a "low" signal.

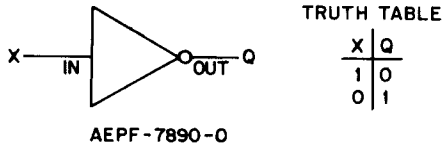


Figure 1. Inverter Circuit

2. GATES

The most basic logic operations involving two or more signals are performed by gating circuits, of which there are several types. Each gate has two or more inputs which correspond to two or more active or inactive input signals. Generally, an active signal is defined as a "high" signal and an inactive signal as a "low" signal. The output can be determined by consulting a "truth table" which lists all combinations of input signals and the resulting output for each combination. The logic symbols and truth tables are shown in Figure 2.

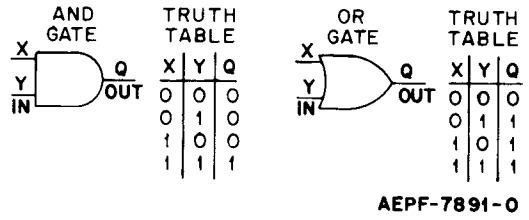


Figure 2. AND/OR Gates

The presence of a circle on a logic symbol indicates the signal is inverted at the circle (a "high" would be changed to a "low" and a "low" would be inverted to a "high"). A circle on the output of an AND gate changes it to a NAND gate. A circle on the output of an OR gate changes it to a NOR gate. These logic symbols and their truth tables are shown in Figure 3. Note that the truth tables are the same as the corresponding tables in Figure 2 except the output column, Q, has the "0" changed to a "1" and the "1" changed to a "0."

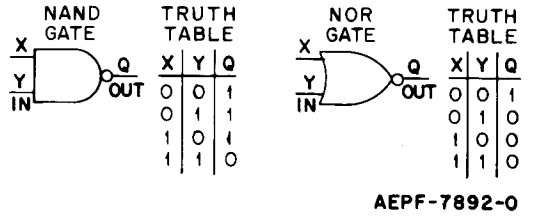


Figure 3. NAND/NOR Gates

Further information on logic circuits is available in the publication "Basic Logic Circuit Guide," 68P81105E88. Address your request for this publication to:

Motorola, Inc.
National Accounts Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196