



MOTOROLA INC.
Communications
Sector

DUPLEXER
MODELS TLD2502A, TLD2622A
148-174 MHz

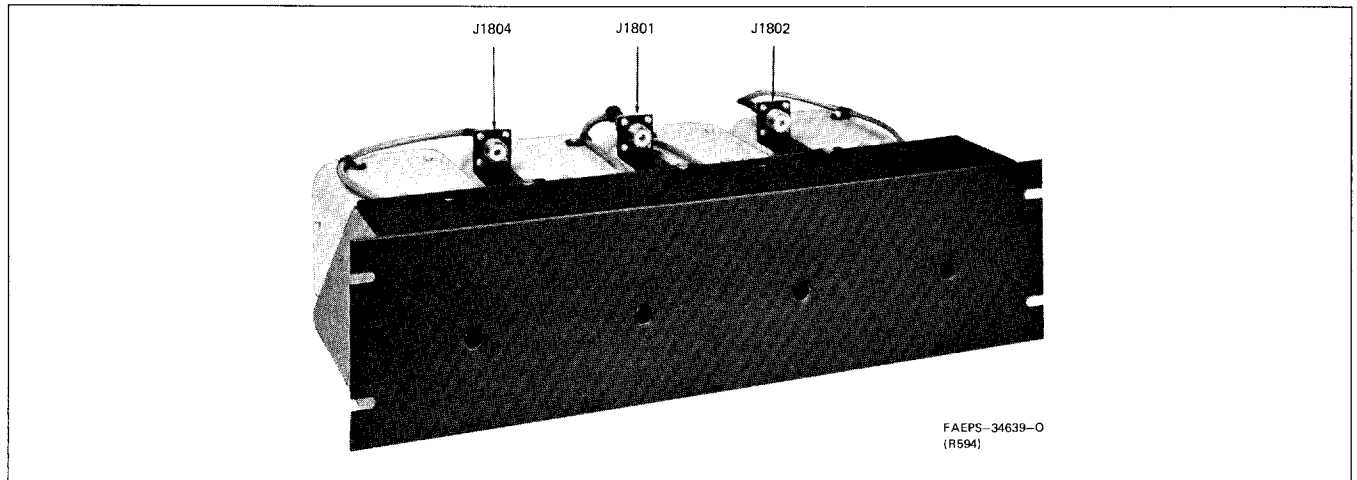


Figure 1. Typical 4-Cavity Duplexer

1. INTRODUCTION

This duplexer is for use with Motorola FM two-way radio communications equipment operating in the 148-174 MHz frequency range. Figure 1 is a typical 4-cavity duplexer. It utilizes cavity resonators with a special internal loading construction to achieve a size much less than one-quarter wavelength. The resonators are tuned with an adjustable center conductor. The resonators use a unique temperature compensating mechanism and uniquely adjustable coupling loops. Specially designed low-profile cable connectors are used to obtain an extremely compact package.

These units may be used in the antenna circuit of a base station or repeater to eliminate or minimize receiver desensitization or intermodulation from strong signals. Similarly, they may be used to reduce transmitter noise or intermodulation products.

2. FIELD INSTALLATION

Step 1. Carefully unpack the unit and check for concealed damage.

Step 2. The units are designed to mount on any standard 19-inch wide rack. Select position in rack for best location of unit, i.e., closest proximity to associated equipment inputs and outputs.

Step 3. Mount the unit in place in rack with appropriate mounting hardware. The hardware supplied is intended for use with Motorola cabinetry and equipment racks.

Step 4. Connect the duplexer to the transmitter and receiver. See Refer to Figure 2 (for 2-cavity hook-up), and Figure 12 (for 4-cavity, hook-up).

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Table 1.
Model TLD2502A Performance Specifications

Model Number	TLD2502A
Insertion Loss	1.7 dB
Isolation at Transmit Frequency	82 dB
Isolation at Receiver Frequency	82 dB
Minimum Transmitter Receiver Isolation	52 dB
Minimum Frequency Separation	1.5 MHz
VSWR Maximum	1.5:1
Maximum Power Input	125 W
Temperature Range	-30°C to +60°C
Size	19" x 5-1/2" x 8-1/2"
Termination	UHF Female

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Model Complement

TLD2502A Duplexer	
TKN6471A	Cable (2 used)
TKN8292A	Cable, Antenna
TKN8293A	Cables, Receiver/Transmitter
TLD8392A	Cavity Filter (4 used)
TRN5445A	Hardware

Table 2.
Model TLD2622A Performance Specifications

Model Number	TLD2622A
Insertion Loss	1.0 dB
Isolation at Transmit Frequency	52 dB
Isolation at Receiver Frequency	52 dB
Minimum Transmitter Receiver Isolation	35 dB
Minimum Frequency Separation	3.5 MHz
VSWR Maximum	1.5:1
Maximum Power Input	125 W
Temperature Range	-30°C to +60°C
Size	19" x 5-1/2" x 8-1/2"
Termination	UHF Female

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Model Complement

TLD2622A Duplexer	
TKN8404A	Cable, Antenna
TKN8934A	Cables, Receiver/Transmitter
TLD8392A	Cavity Filter (2 used)
TRN9417A	Hardware

Step 5. The duplexer must be connected to the transmitter and receiver with appropriate lengths of 50-ohm coaxial cable (customer supplied) to fit the individual installation.

IMPORTANT

All duplexers are factory set and SHOULD NOT be "fine-tuned" into the antenna systems, since isolation changes significantly with any readjustment of the center tuning shaft. Station and duplexer performance will remain within specification without duplexer readjustment, if the antenna VSWR is LTE 1:51. Antenna VSWR can be measured by inserting a VHF-rated, in-line wattmeter (capable of withstanding at least 120 watts) between the duplexer and the antenna, via J1810. The ratio of the forward to reverse power should be GTE 25. If the antenna VSWR exceeds 1.51, the antenna system must be corrected. If the duplexers must be retuned, due to station frequency re-assignment, follow Recommended Tuning Procedure, paragraph 5.

3. THEORY OF OPERATION

Each resonant cavity, technically a reentrant quarter-wave resonator, is a very high Q (low loss) tunable tank circuit. A special internal construction uses two different characteristic impedances for the center conductor to achieve an overall length considerably less than a quarter-wavelength. The dimensions are designed for minimum loss. The cavities are tuned to the required pass frequency by an adjustment which changes the length of the center conductor. Lower frequencies have more of the center conductor inside the cavity, higher frequencies have correspondingly less. Special bimetal washers are used for temperature compensation to minimize detuning due to ambient temperature changes.

Each resonant cavity is fitted with a specially designed pair of coupling elements (loops). These loops efficiently convert energy from the 50-ohm coaxial cable to the correct mode inside the resonant structure. When the cavity is not tuned to resonance, most of the energy is reflected. Only a small portion is able to excite the correct mode and reach the output element.

The input and output coupling loops are placed very close to each other, to take advantage of mutual coupling. A small amount of energy is always being transferred between coupling loops because of their proximity. At one frequency, the energy transferred by mutual coupling cancels the energy transferred across by the resonant mode within the cavity. Thus, at one frequency, there is a reject notch in addition to the normal selectivity of the cavity. The proximity of the loops provides inductive coupling. In addition, a precision high Q trimmer capacitor is connected across the loops. This capacitor can adjust the net coupling to be inductive, the notch occurs above the pass frequency. When the net

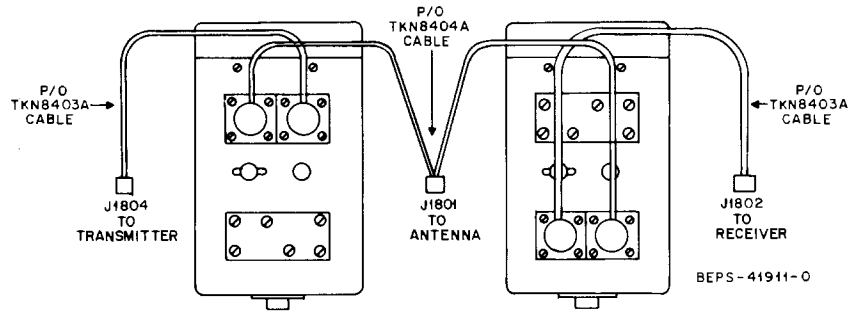


Figure 2. 2-Cavity Duplexer Cabling Detail

coupling is capacitive, the notch occurs below the pass frequency.

Cavities are used on each side of the duplexer. The cavities tuned to pass the lower frequency have the coupling loops tuned to notch out higher frequency, while the cavities tuned to pass the higher frequency have the coupling loops tuned to notch out the lower frequency. Quarter-wave coupling is used between cavities to obtain minimum passband bandwidth and minimum insertion loss.

4. REMOVAL/REPLACEMENT OF COUPLING LOOPS

Coupling loops are factory-installed. If it becomes necessary to change coupling loops, refer to Figures 3, 9 and 10 and use the following procedure.

4.1 REMOVAL PROCEDURE

The cable shields are soldered to the connector portion of the loops. These shields must first be unsoldered before the loops can be removed. The shields cannot be attached to the cavity body because the cavity body acts as a heat sink.

Step 1. Remove the eight screws securing the connectors to the cavity body.

Step 2. The two coupling loops are internally connected and must be removed together. Using a 150-watt soldering iron, first unsolder and remove the connector covers from the two connectors.

Step 3. Grasp the center connector of the cable (at the point where it enters the center pin of the connector) with long nose pliers. Melt the solder around the cable shield and pull the cable off the connector. Do the same for the other connector.

Step 4. Remove the two knurled adjusting knobs taking care not to lose the washers. Now the loops are completely free and can be removed from the can.

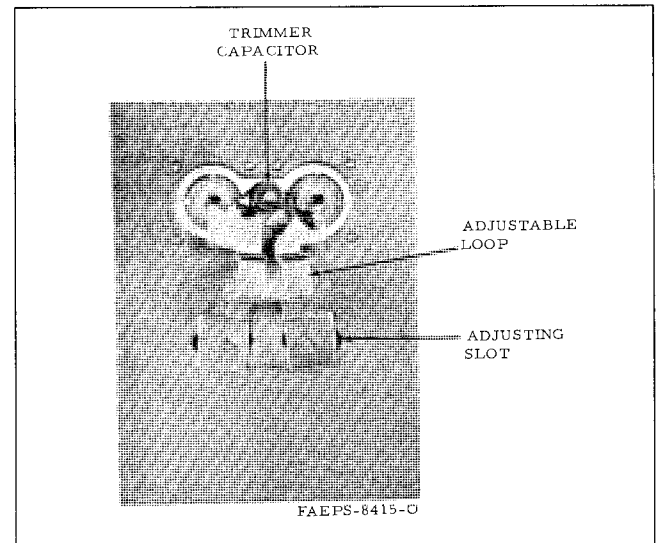


Figure 3. Coupling Loop (Interior View)

Step 5. Maneuver both loops to the left so that the trimmer capacitor can fit through the left side of the hole and then remove the two loops together.

4.2 REPLACEMENT PROCEDURE

Step 1. Insert the loop assembly into the mounting holes and maneuver both loops to the left so that the trimmer capacitor will fit through the left side of the hole.

Step 2. Position the loops so that the tapped holes in the end of the loops are visible through the adjusting slots.

Step 3. Insert the knurled adjusting screw, along with the nylon and lock washers, into the tapped hole.

Step 4. Attach the connectors to the can using the eight self-tapping screws making certain that the connector cable slot is facing in the proper direction to insert the cable.

Step 5. Insert the cable into the connector cable slot while pressing the center conductor into the center pin of the connector.

Step 6. Place the connector cover over the connector and solder the cable shield and connector cover to the connector.

5. RECOMMENDED TUNING PROCEDURE

All duplexers are tuned to the customer-specified frequencies prior to shipment from the factory. If system performance indicates that the duplexer is detuned, one of the following procedures may be used. Do not attempt to retune unless the following procedures have been read and it is certain that performance does not meet specifications.

The following tuning procedures assume that the entire duplexer is to be retuned. If it is desired to perform a minor "touch-up", refer to paragraph 5.3 of this tuning procedure. When left and right are used in the following procedures, this shall mean facing the tuning shaft end and with the connectors facing up.

5.1 METHOD 1

5.1.1 Recommended Test Equipment

- Motorola R-2001 or R-1201 Signal Generator.
- Tunable receiver or two Motorola receivers, one tuned to each of the frequencies to be duplexed.

5.1.2 Tuning Procedure

Step 1. Move sliding screws as far apart as possible on each cavity and then tighten the screws.

Step 2. Turn trimmer capacitors fully counter-clockwise. **CHANGED PER SMR-5812**

Step 3. Tune the signal generator and the receiver to the duplex receive frequency.

Step 4. Connect the signal generator to the antenna port and the receiver to the right-hand port.

Step 5. Tune the right-hand cavity(s) for minimum insertion loss by adjusting the tuning rod screw.

Step 6. Tune the signal generator and the receiver to the duplex transmit frequency.

Step 7. Connect the receiver to the left-hand port.

Step 8. Tune the left-hand cavity(s) for minimum insertion loss by adjusting the tuning rod screw.

Step 9. Connect the receiver to the right-hand port.

Step 10. Tune the right-hand cavity(s) for maximum attenuation by using procedure 5.4, "Tuning the Notch".

Step 11. Tune the signal generator and the receiver to the duplex receive frequency.

Step 12. Connect the receiver to the left-hand port.

Step 13. Tune the left-hand cavity(s) for maximum attenuation by using procedure 5.4.

Step 14. Repeat Steps 3 through 13, but only tune the trimmer capacitors when tuning the notches.

5.2 METHOD 2

5.2.1 Recommended Test Equipment

- Mixer circuit constructed as shown in Figure 4.

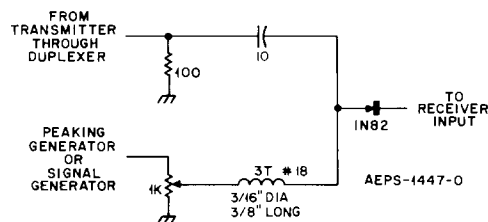


Figure 4. Mixer Circuit

- Motorola R-2001 or R1040 Signal Generator.
- I-F output from R1201 Series Signal Generator equal to the duplex frequency separation or a Motorola R1033A Portable Test Set with a crystal frequency equal to the duplex frequency separation.
- Motorola S1350A Wattmeter.
- Motorola T1013A RF Load Resistor.
- Isolated Tee connector (construct this by removing the Tee port center pin of a UHF Tee connector). This provides 30 to 40 dB of isolation between the shunt

path and the direct path through the Tee to protect the receiver when the transmitter is keyed.

- Transmitter and receiver from the station to be duplexed.

5.2.2 Operation of the Mixer Circuit

Alignment of the duplexers can be simplified by using the mixer circuit shown in Figure 4. The mixer receives inputs from the transmitter and a low frequency source. The outputs from the mixer are frequencies above and below the transmitter frequency at separations equal to the output of the low frequency generator.

The receiver will respond to one of the mixer products and thus can be used indirectly to detect the transmitter frequency.

5.2.3 Tuning Procedure

Step 1. Move sliding screws as far apart as possible on each cavity and then tighten the screws.

Step 2. Turn trimmer capacitors fully counterclockwise.

Step 3. Connect the equipment as shown in Figure 5.

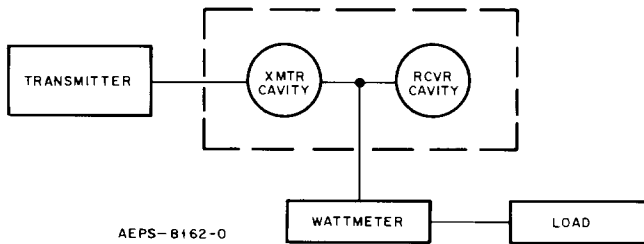


Figure 5.
Method 2 Transmitter Branch Pass Test Setup

Step 4. Tune the left-hand cavity(s) for a maximum power reading on the wattmeter by adjusting the tuning rod screw.

Step 5. Connect the equipment as shown in Figure 6.

Step 6. Tune the signal generator to the receive frequency.

Step 7. Tune the right-hand cavity(s) for a minimum insertion loss (maximum signal at the receiver) by adjusting the tuning rod screw.

Step 8. Connect the equipment as shown in Figure 7.

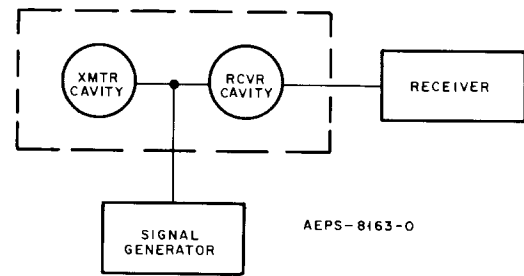


Figure 6.
Method 2 Receiver Branch Pass Test Setup

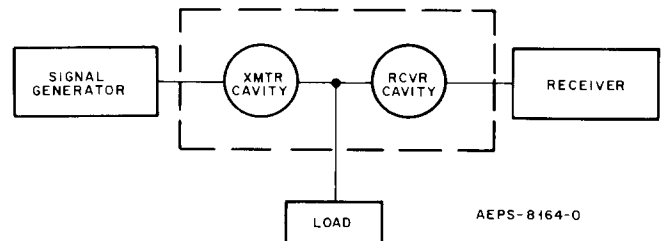


Figure 7.
Method 2 Transmitter Branch Reject Test Setup

Step 9. Tune the left-hand cavity(s) for maximum attenuation by using procedure 5.4, "Tuning the Notch".

Step 10. Connect the equipment as shown in Figure 8.

Step 11. Set the local oscillator source to the exact duplex frequency separation.

Step 12. Tune the right-hand cavity(s) for maximum attenuation by using procedure 5.4.

Step 13. Repeat Steps 3 through 12 but only tune the trimmer capacitors when tuning the notches.

Step 14. Connect the duplexer to the transmitter, receiver and antenna with 50-ohm coaxial cable. Adjust the transmitter final amplifier for rated power into the duplexer.

5.3 MINOR "TOUCH-UP" PROCEDURES

5.3.1 Method A

Step 1. Using the Recommended Test Equipment given in paragraph 5.1.1, tune the signal generator and the receiver to the duplex receive frequency.

Step 2. Connect the signal generator to the antenna port and the receiver to the right-hand port.

Step 3. Tune the right-hand cavity(s) for minimum insertion loss by adjusting the tuning rod screw.

Step 4. Tune the signal generator and the receiver to the duplex transmit frequency.

Step 5. Connect the receiver to the left-hand port.

Step 6. Tune the left-hand cavity(s) for minimum insertion loss by adjusting the tuning rod screw.

Step 7. Connect the receiver to the right-hand port.

Step 8. Tune the trimmer capacitor(s) on the righthand cavity(s) for maximum attenuation.

Step 9. Tune the signal generator and the receiver to the duplex receive frequency.

Step 10. Connect the receiver to the left-hand port.

Step 11. Tune the trimmer capacitor(s) on the left-hand cavity(s) for maximum attenuation.

5.3.2 Method B

Step 1. Using the Recommended Test Equipment given in paragraph 5.2.1, connect the equipment as shown in Figure 5.

Step 2. Tune the left-hand cavity(s) for a maximum power reading on the wattmeter by adjusting the tuning rod screw.

Step 3. Connect the equipment as shown in Figure 6.

Step 4. Tune the signal generator to the receive frequency.

Step 5. Tune the right-hand cavity(s) for a minimum insertion loss (maximum signal at the receiver) by adjusting the tuning rod screw.

Step 6. Connect the equipment as shown in Figure 7.

Step 7. Tune the trimmer capacitor(s) on the left-hand cavity(s) for maximum attenuation.

Step 8. Connect the equipment as shown in Figure 8.

Step 9. Set the local oscillator source to the exact duplex frequency separation.

Step 10. Tune the trimmer capacitor(s) on the righthand cavity(s) for maximum attenuation.

5.4 TUNING THE NOTCH

5.4.1 If the Notch (Reject) Frequency is Below the Pass Frequency:

Step 1. Move the sliding screws as far apart as possible and then tighten the screws.

Step 2. Tune the trimmer capacitor for maximum attenuation at the notch frequency.

5.4.2 If the Notch (Reject) Frequency is Above the Pass Frequency:

Step 1. Turn the trimmer capacitor completely counterclockwise and then clockwise two full turns.

Step 2. Adjust the sliding screws for maximum attenuation at the notch frequency and then tighten the screws.

Step 3. Tune the trimmer capacitor for maximum attenuation at the notch frequency.

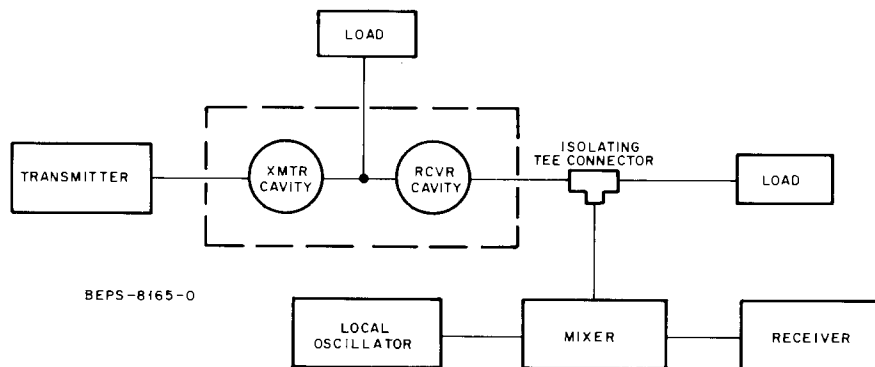


Figure 8.
Method 2 Receiver Branch Reject Test Setup

NOTE

The overall dimensions and the stripping of cables are critical, and it is therefore recommended that an entire cable kit be ordered using the correct TKN number (TKN6471A, TKN8292A, TKN8293A, TKN8403A, or TKN8404A). The connector covers (Code No. 6) are included in the cable kits TKN8292A and TKN8293A or Hardware Kit TRN9417A.

parts list

TLD8392A Cavity Filter PL-1677-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
1	3-3375	SCREW, tapping: 6-20 x 5/16" plain hex head (4 req'd)
2	1-84312D01	CAVITY ASSEMBLY
3	1-80723B90	LOOP ASSEMBLY, coupling
4	47-84313D01	TUNING SHAFT
5	3-400356	SCREW, tapping: 4-32 x 1/4" Phillips hex head (8 req'd)
5	4-9777	LOCKWASHER, #4 split (8 used)
7	3-82245E04	SCREW, knurled head (2 req'd)
7	4-9746	LOCKWASHER, No. 8 med. split (2 req'd)
7	4-82418B01	WASHER, nylon (2 req'd)
9	15-84993C01	COVER, housing
10	4-84994C01	WASHER, temperature compensating ("LE" stamped on concave side)
11	4-84994C02	WASHER, temperature compensating ("LE" stamped on convex side)
12	1-84985C01	LOCKING NUT ASSEMBLY
13	3-7110	SCREW, set: 8-32 x 3/16" allen head
14	1-84314D01	TUNING CAN ASSEMBLY
15	42-824977	RING, truarc
—	33-84332B01	LABEL, nameplate

TKN8403A Station Duplexer Cable PL-9732-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1802,1804	9-82442E05	connector, receptacle: female; single contact
mechanical parts		
18	2-131435	NUT, 4-40 x 1/4 x 3/32"; 4 used
18	3-1937	SCREW, machine: 4-40 x 5/16"; 4 used
18	4-114583	LOCKWASHER, #4 split; 4 used
19	7-83454N01	BRACKET, connector; 1 used
20	15-483599	HOOD, receptacle; 1 used
non-referenced item		
—	30-83278B01	CABLE, coaxial

TRN9417A Duplexer Hardware Mounting PL-9733-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
6	15-84002D01	COVER, connector; 4 used
8	3-3398	SCREW, tapping: 6-20 x 5/16"; 11 used
—	3-83498N08	SCREW, tapping: black; M6 x 7.0 x 10; 4 used
16	27-82934N01	CHASSIS
—	66-82846D01	TOOL, tuning

TKN8404A Antenna Duplexer Cable PL-9734-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1801	9-82442E05	connector, receptacle: female; single contact
mechanical parts		
18	2-131435	NUT, 4-40 x 1/4 x 3/32"; 4 used
18	3-1937	SCREW, machine: 4-40 x 5/16"; 4 used
18	4-114583	LOCKWASHER, #4 split; 4 used
19	7-83454N01	BRACKET, connector
21	15-82582H01	HOOD, receptacle
non-referenced item		
—	30-83278B01	CABLE, coaxial

TKN8293A Cable Duplexer-Station PL-8047-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1802,1804	9-82442E05	connector, receptacle: female; single contact
mechanical parts		
6	15-84002D01	COVER, connector; 2 used
18	2-131435	NUT, 4-40 x 1/4 x 3/32"; 8 used
18	3-1937	SCREW, machine: 4-40 x 5/16"; 8 used
18	4-114583	LOCKWASHER, #4 split; 8 used
19	7-83454N01	BRACKET, connector; 2 used
20	15-483599	HOOD, receptacle; 2 used

TKN6471A Cable Duplexer PL-8048-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
6	15-84002D01	COVER, connector; 2 used
mechanical parts		
8	3-3398	SCREW, tapping: 6-20 x 5/16"; 19 used
—	3-83498N08	SCREW, tapping: black; M6 x 7.0 x 10; 4 used
16	27-82934N01	CHASSIS
17	42-82143C05	CLAMP, cable 3/16"; 4 used
—	66-82846D01	TOOL, tuning

TRN5445A Hardware Mounting Duplexer PL-8049-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
8	3-3398	SCREW, tapping: 6-20 x 5/16"; 19 used
—	3-83498N08	SCREW, tapping: black; M6 x 7.0 x 10; 4 used
16	27-82934N01	CHASSIS
17	42-82143C05	CLAMP, cable 3/16"; 4 used
—	66-82846D01	TOOL, tuning

TKN8292A Cable Duplexer-Antenna PL-8050-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1801	9-82442E05	connector, receptacle: female; single contact
mechanical parts		
6	15-84002D01	COVER, connector; 2 used
18	2-131435	NUT, 4-40 x 1/4 x 3/32"; 4 used
18	3-1937	SCREW, machine: 4-40 x 5/16"; 4 used
18	4-114583	LOCKWASHER, #4 split; 4 used
19	7-83454N01	BRACKET, connector
21	15-82582H01	HOOD, receptacle

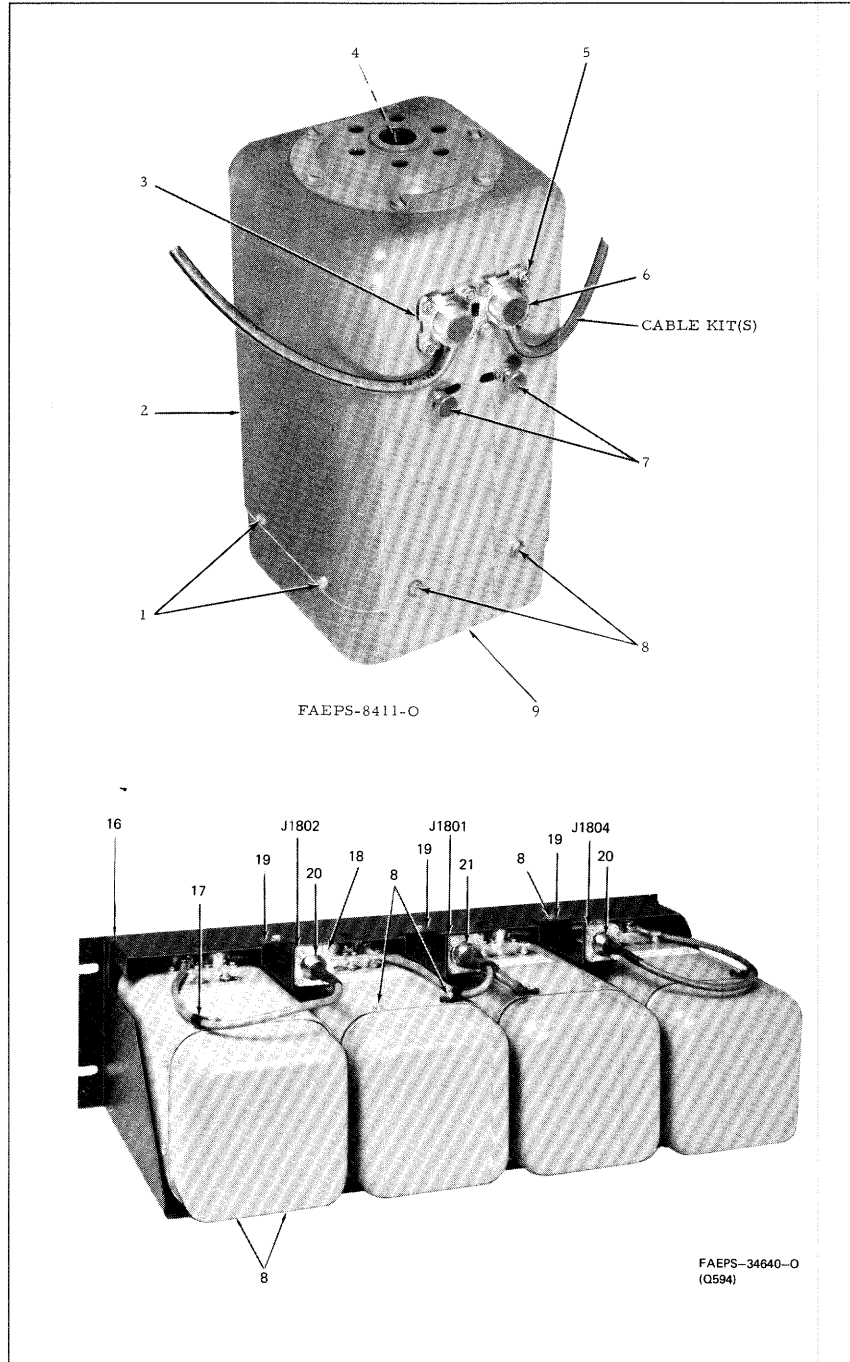


Figure 9. Cavity Filter Parts Location Detail

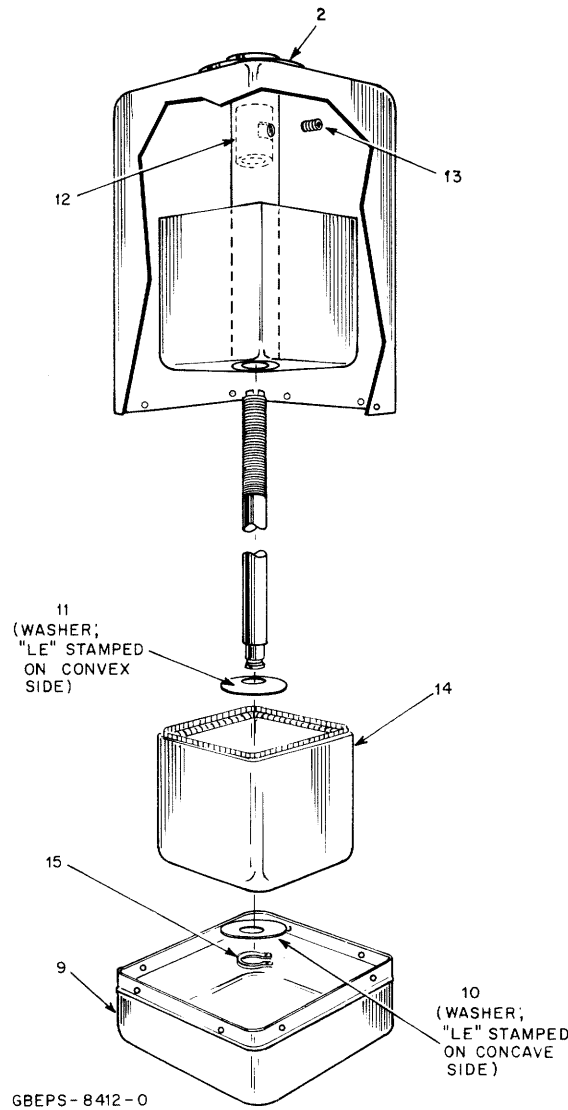
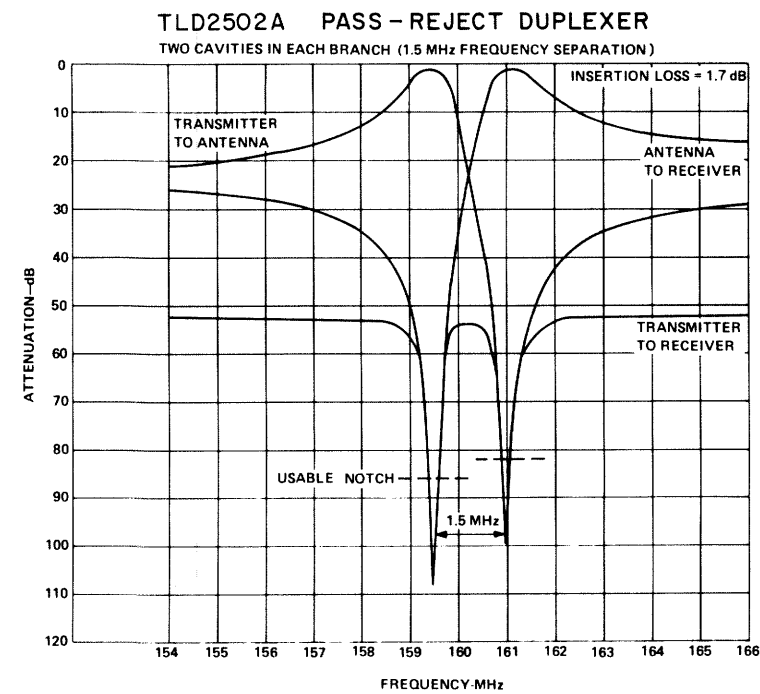
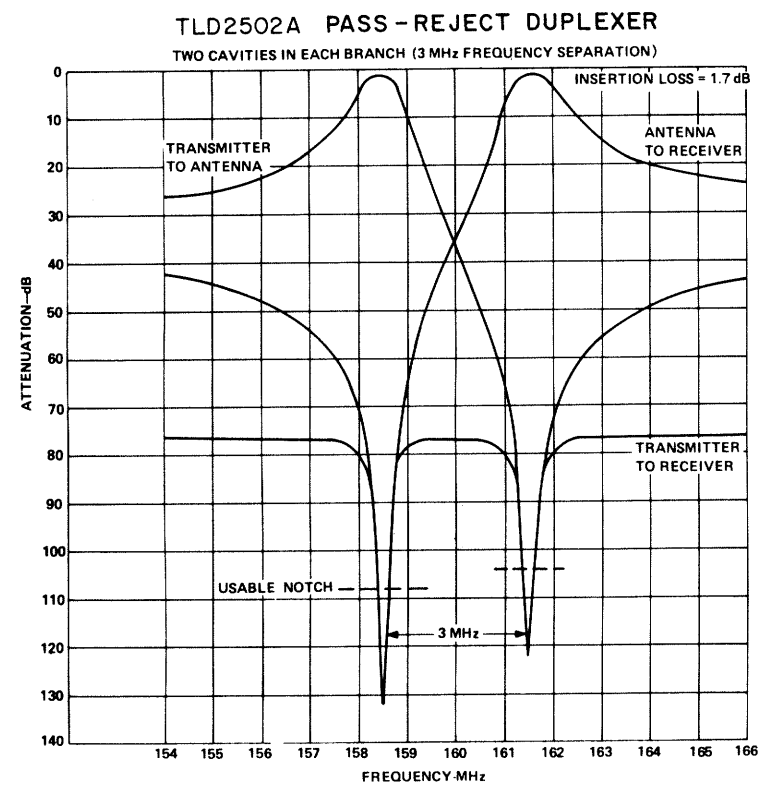
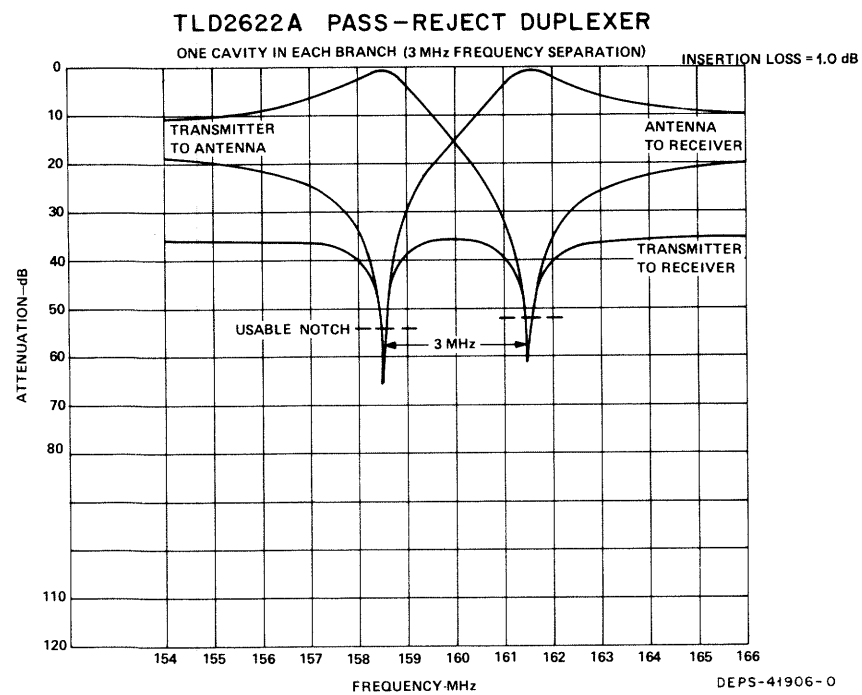
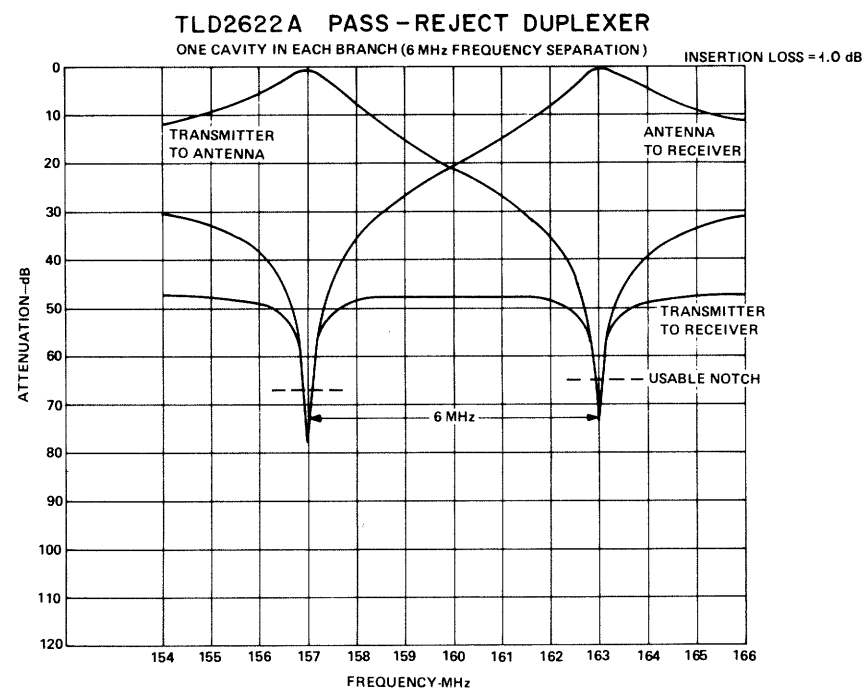


Figure 10. Cavity Internal Construction & Parts Location Detail



CEPS-34642-A



DEPS-41906-0

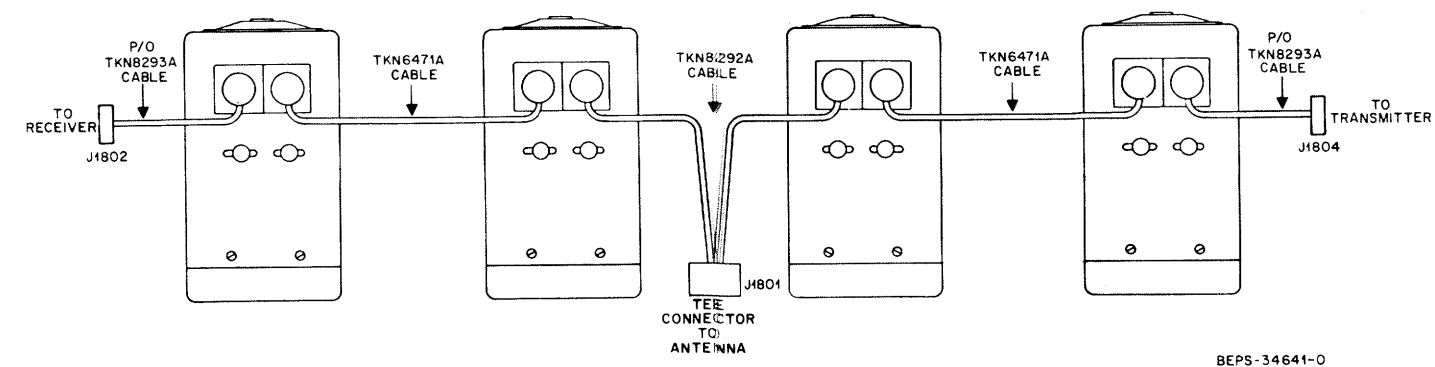


Figure 12. Duplexer Wiring Detail

Figure 11. Duplexer Selectivity Curves



MOTOROLA INC.
Communications
Sector

2-RECEIVER COUPLER

MODEL TRD6270A
(EIA RACK INSTALLATIONS)

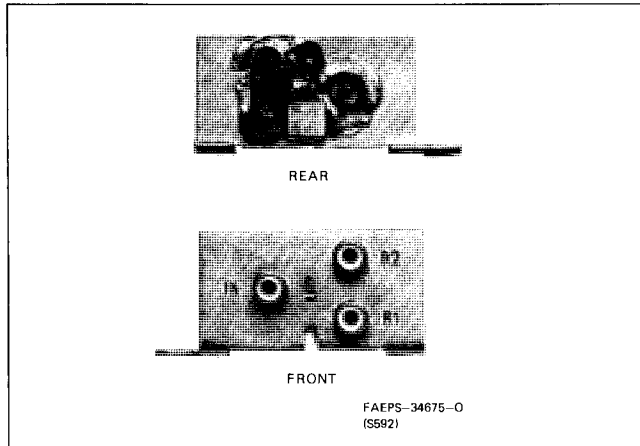


Figure 1.
2-Receiver Coupler Front and Rear View

1. ELECTRICAL DESCRIPTION

This unit allows two receivers to operate from a single antenna source without interaction. It provides a correct impedance match between both receivers and the antenna source, and also provides isolation between the two receivers. Signal coupling and impedance matching is accomplished by utilizing two transformers and a resistor. A capacitor in the coupler partially cancels the

circuit inductance and thereby makes the circuit appear resistive.

2. PHYSICAL DESCRIPTION

The 2-receiver coupler, consisting of a bracket which mounts the electrical components and three cable connectors, is mounted on a chassis installed in the base station. When the coupler is used, the input to the receiver is disconnected and reconnected to the IN connector on the coupler. Coupler cable W1 connects between the R1 coupler connector and the receiver module input connector J201. Coupler cable W2 connects between the R2 coupler connector and the second receiver module input connector J301.

3. INSTALLATION

Step 1. Seat the two screws (3-135841) from the outside of the radio, in the two holes located on the back of the EIA rack. These screws are the mounting studs that the mounting bracket mount to.

Step 2. Slide spacers (43-84882N01) and screw nuts (2-121841) on each stud four turns.

Step 3. Align the assembled TRD6270A 2-Receiver Coupler on mounting screws by placing the mounting bracket over the screws and sliding it to the right.

Step 4. Tighten the nuts.

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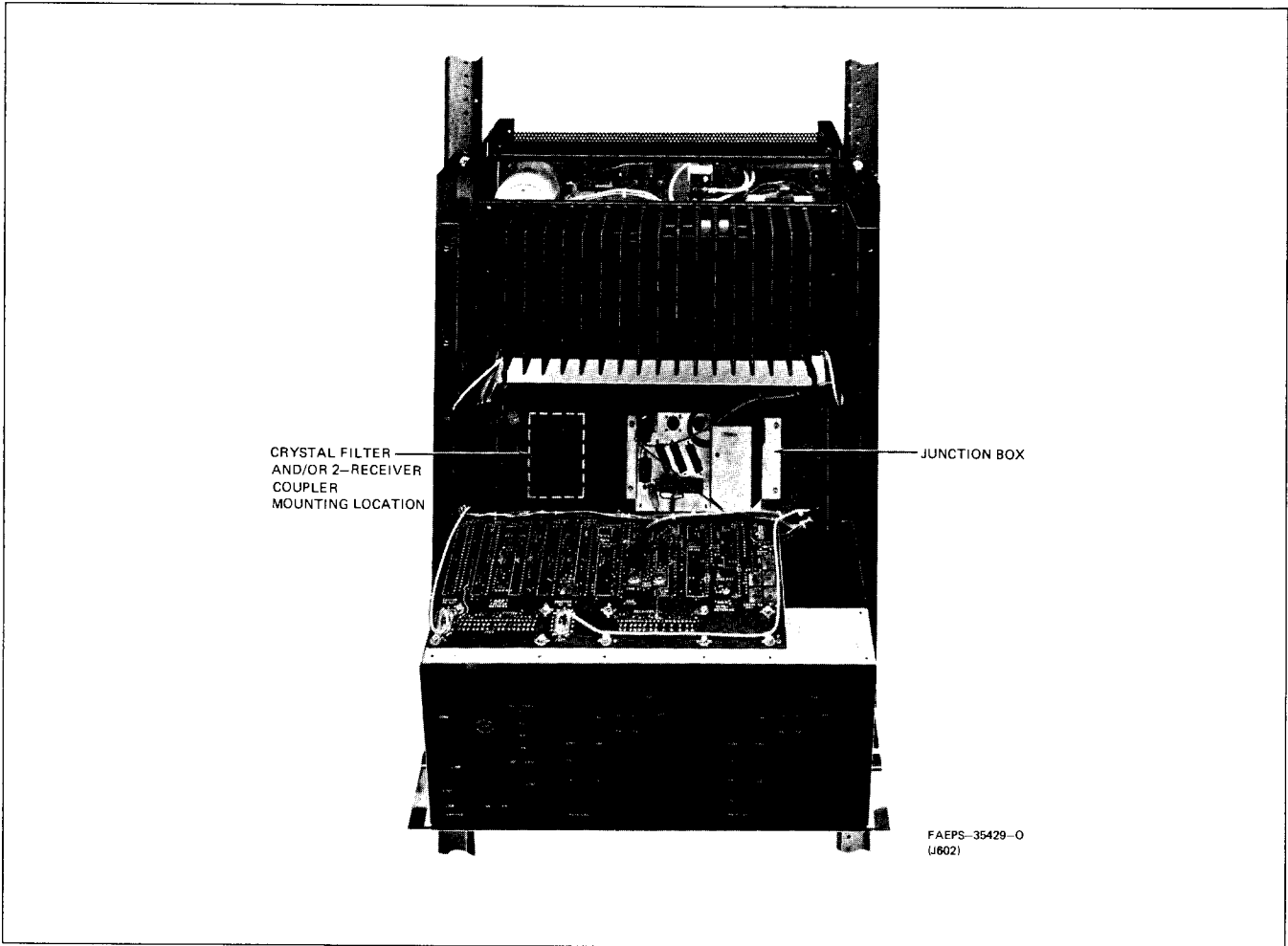
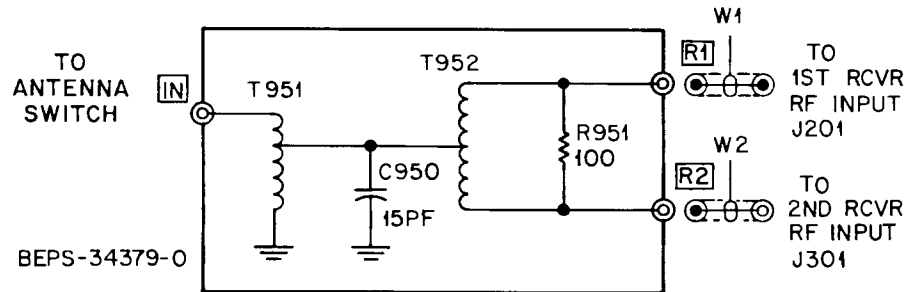


Figure 2.
2-Receiver Coupler Installed Location

EIA RACK INSTALLATION SCHEMATIC DIAGRAM & PARTS LIST



parts list

TRD6270A 2-Receiver Coupler

PL-8276-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C950	21-82785H57	capacitor, fixed: 15 pF \pm 0.5 pF; 850 V
R951	6-125A25	resistor, fixed: 100 \pm 5%; 1 $\frac{1}{2}$ W
T951	24-84130G02	transformer: splitter
T952	24-84130G01	splitter
W1	1-80763D70 30-83794C01 28-84282D01	cable assembly: includes: CABLE, coaxial; 45" long CONNECTOR, plug; single contact type
W2	28-82875N01 1-80763D71 30-83794C01 28-82875N01 28-82331G01	PLUG, board mount; phono type includes: CABLE, coaxial; 40" long PLUG, board mount; phono type CONNECTOR, plug; single contact type
non-referenced items		
	1-80737B78	ASSEMBLY, splitter board
	2-131435	NUT, 4-40 \times 1/4"; 2 used
	3-134186	SCREW, thread forming: 6-32 \times 5/16"; 2 used
	3-135500	SCREW, machine: 4-40 \times 1/4"; 2 used
	7-83020N01	BRACKET, coupler
	42-10217A02	STRAP, tie; 6 used
	42-82143C05	CLIP, cable
	42-82143C08	CLIP, cable
	42-82143C09	CLIP, cable; 2 used
	3-135841	SCREW, thread forming: 6-32 \times 7/8"; 2 used
	2-121841	NUT, locking: 6-32; 2 used
	43-84882N01	SPACER, 7/16; 2 used

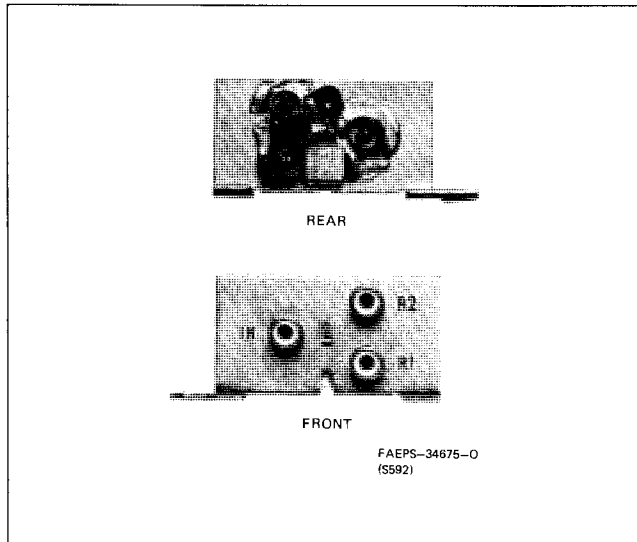


Figure 1.
2-Receiver Coupler Front and Rear View

1. ELECTRICAL DESCRIPTION

This unit allows two receivers to operate from a single antenna source without interaction. It provides a correct impedance match between both receivers and the antenna source, and also provides isolation between the two receivers. Signal coupling and impedance matching is accomplished by utilizing two transformers and a resistor. A capacitor in the coupler partially cancels the circuit inductance and thereby makes the circuit appear resistive.

2. PHYSICAL DESCRIPTION

The 2-receiver coupler, consisting of a bracket which mounts the electrical components and three cable connectors, is mounted on a chassis installed in the base

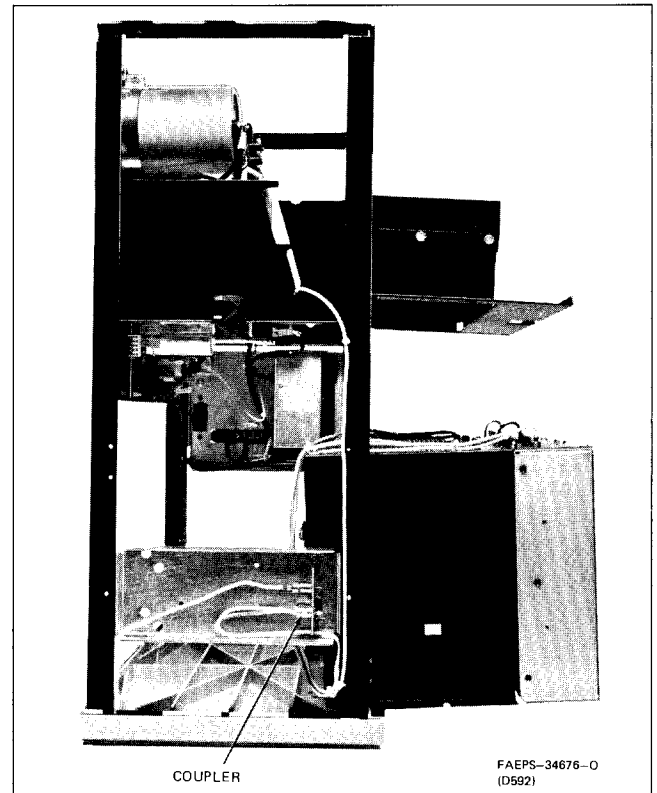
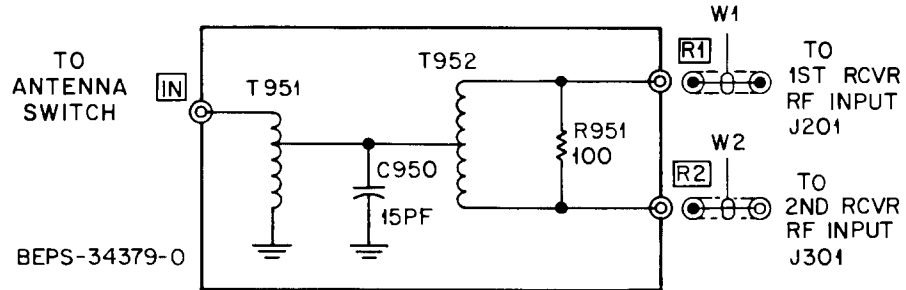


Figure 2.
2-Receiver Coupler Installed Location

station. When the coupler is used, the input to the receiver is disconnected and reconnected to the IN connector on the coupler. Coupler cable W1 connects between the R1 coupler connector and the receiver module input connector J201. Coupler cable W2 connects between the R2 coupler connector and the second receiver module input connector J301.

SCHEMATIC DIAGRAM & PARTS LISTS



parts list

TRD6210A 2-Receiver Coupler

PL-8008-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C950	21-82785H57	15 pF \pm 0.5 pF; 850 V
R951	6-125A25	resistor, fixed: 100 \pm 5%; 1/2 W
T951	24-84130G02	transformer: splitter
T952	24-84130G01	splitter
W1	1-80736D03 30-83794C01 28-84282D01	cable assembly: includes: CABLE, coaxial; 31" long CONNECTOR, plug; single contact type PLUG, board mount; phono type
W2	28-82875N01 1-80736D04 30-83794C01 28-82785N01 28-82331G01	includes: CABLE, coaxial; 37.5" long PLUG, board mount; phono type CONNECTOR, plug; single contact type
non-referenced items		
	1-80737B78	ASSEMBLY, splitter board
	2-131435	NUT, 4-40 x 1/4"; 2 used
	3-134186	SCREW, tapping: 6-32 x 5/16"; 2 used
	3-82227A03	SCREW, machine: 4-40 x 5/16"; 2 used
	7-83020N01	BRACKET, coupler
	42-10217A02	STRAP, tie; 7 used
	42-82143C05	CLIP, cable
	42-82143C08	CLIP, cable
	42-82143C09	CLIP, cable; 3 used



MOTOROLA INC.
Communications
Sector

**MSR 2000 BASE STATION
SERVICE ACCESSORIES**
TRN5080A DC METERING CHASSIS
TRN5079A SERVICE INTERCOM
WITH SPEAKER CHASSIS

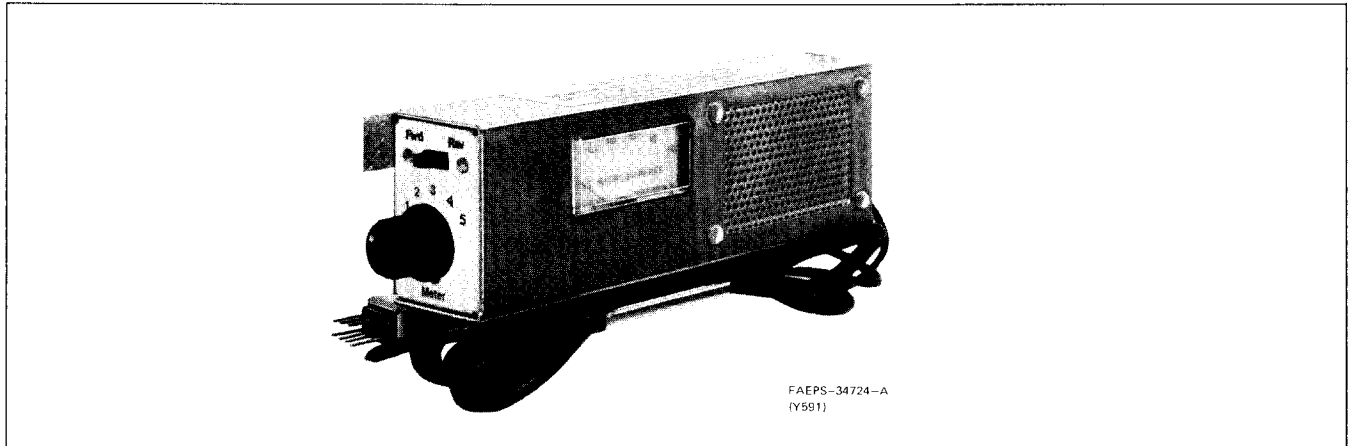


Figure 1. TRN5080A DC Metering Chassis

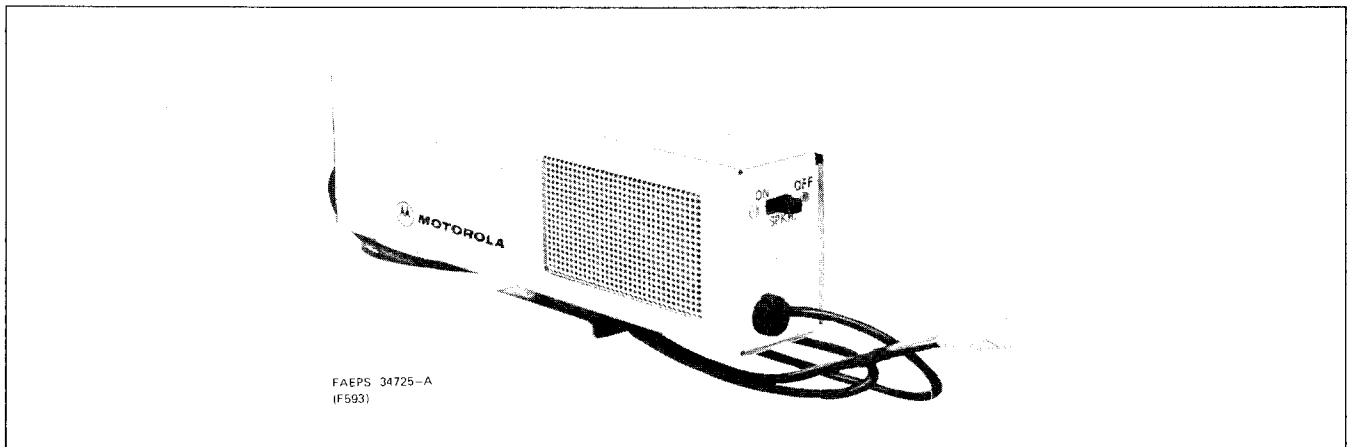


Figure 2. TRN5079A Service Intercom with Speaker Chassis

technical writing services
1301 E. Algonquin Road, Schaumburg, IL 60196

1. DESCRIPTION

1.1 The TRN5079A Service Intercom with Speaker Chassis provides a local audio speaker for use in troubleshooting the station, and for intercom use when the station is provided with the intercom option. The TRN5080A DC Metering Chassis provides the same local speaker, and in addition, provides most station metering required for normal servicing and maintenance.

1.2 The meter is a 0-50 uA instrument mounted on the dc metering chassis. A selector switch chooses the specific function to be metered. Every function available at the metering receptacle of the exciter, power amplifier/power control board, and receiver board(s) can be selected for metering. The dc metering chassis is equipped with a connection cable terminated with the standard Motorola 7-pin metering connector, which may be connected to the metering connectors provided in the station.

CAUTION

The TRN5080A DC Metering Chassis must not be connected to control metering connector J2 on the backplane interconnect board. (This connector may be labeled either TEST SET MTR or CONTROL MTR, depending on station model.) Damage to the metering circuit will result. The control metering connector is intended for connection to the Motorola TEK-5 Metering Panel or the S1056-59 Portable Test Set only.

2. OPERATING INSTRUCTIONS

2.1 LOCAL SPEAKER

Press the two-conductor speaker connector onto pins 22 and 23 of the receiver 1 audio board position on the back of the station backplane interconnect board. This connection may be left permanently if desired. The speaker is switched on or off as desired, by changing the position of the SPKR switch.

2.2 METERING

Step 1. Connect the metering connector from the dc metering chassis to the desired metering connector in the station. In the Motorola *MSR 2000* station, exciter and receiver metering connectors are both located on the backplane interconnect board. The power amplifier/power control metering connector is located on the power control board. See Caution.

Step 2. Select the meter position required. If the meter deflects in the wrong direction, change the position of the FWD-REV switch.

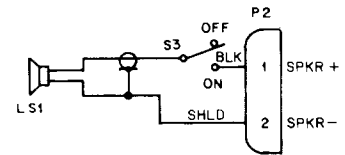
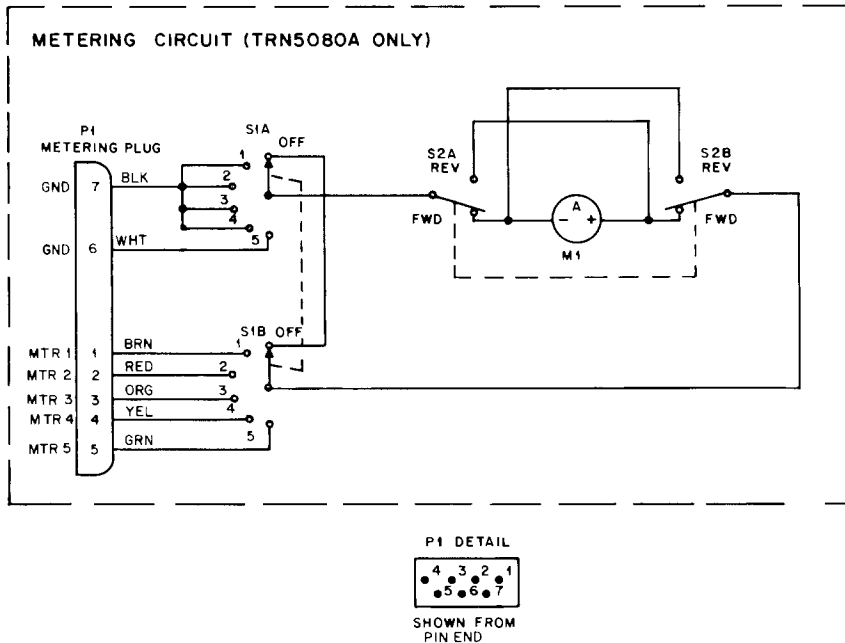
NOTE

Refer to the Transmitter and Receiver sections of the station manual for typical meter readings. Also, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference, note any degradation of performance.

Meter Polarity Switch Position

Board Metered	Position
Receiver	FWD
Exciter	REV
PA/Power Control	FWD

SCHEMATIC DIAGRAM & PARTS LISTS



BEPS-34726-0

parts list

TRN5079A Service Intercom with Speaker Chassis
TRN5080A DC Metering Chassis

PL-8037-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
LS1	50-82913N01	speaker: 8 ohms; 1-3/4 x 3"
M1	72-83319G01	meter: 50 uA (TRN5080A)
P1	28-84208B01	connector, plug: male, 7-contact (TRN5080A) housing; 2-position
P2	15-83498F38	
S1	40-82924N01	switch: rotary (TRN5080A) slide, dpdt
S2, 3	40-83204B01	
mechanical parts		
	3-124616	SCREW, tapping; 6-32 x 1/4"; 2 used
	3-136934	SCREW, tapping; 6-32 x 3/8"; 2 used (TRN5080A)
	15-82927N01	COVER
	35-82928N01	GRILLE
	36-82929N01	KNOB (TRN5080A)
	42-850861	RETAINER, cable (TRN5080A)
	42-82018H07	RETAINER, cable
	29-83499F01	TERMINAL; 2 used
	30-824275	CABLE, shielded; 42" used
	15-82926N01	HOUSING (TRN5080A)
	3-129674	SCREW, machine; 4-40 x 3/16"; 2 used (TRN5080A)
	3-132341	SCREW, machine; 4-36 x 1/4"; 2 used (TRN5080A)
	15-83947K01	COVER; 2 used (TRN5080A)
	30-83678K01	CABLE, 7-conductor; 42" used (TRN5080A)
	42-83948K01	CLIP; 2 used (TRN5080A)
	15-82926N02	HOUSING (TRN5079A)
	5-10281A05	RIVET; 4 used
	14-84717F01	INSULATOR (used on TRN5080A only)



MSR 2000™ BASE (RA), REPEATER (RA), & GUARD TONE KEYING CONFIGURATIONS

OPTION C150, C160, AND C170 SERIES

1. DESCRIPTION AND APPLICATION

1.1 INTRODUCTION

1.1.1 The options described in this instruction section are designed to provide for the remote control of a base station which, because of its location, cannot be economically connected via a wire line pair to the control point. Mountain top sites or locations in uninhabited regions (where no telephone lines exist) are typical examples of base station sites which need to be controlled using specialized radio equipment instead of a wire line pair.

1.1.2 By definition, an "RA" link (part of a "radio repeater (RA) system") is the radio equipment required to replace the usual wire-line control when operating a remote base station from its control point. The remote base station is termed an RA base. The repeater station that controls the RA base is called an RA repeater. It is co-located with the RA base and interconnected by a single, multi-conductor cable (customer supplied). A console and/or control station is located where the normal dispatch operations are carried out. See Figures 1 and 2.

1.1.3 RA links usually operate on 72 MHz, 450 MHz, or 960 MHz. Within the United States, the Federal Communications Commission (FCC) has certain restrictions making it difficult to license a 72 MHz RA link within 80 miles of a channel 4 or 5 TV station, or a UHF RA link within 75 to 100 miles of a metropolitan area with a population 200,000 or more.

1.2 BASE (RA) OPTION C150

1.2.1 The base (RA) option C150 can be used with all *MSR 2000*, single receiver, dc or tone remote control base station models in the 132-174 MHz, or 450-512 MHz frequency bands. The base (RA) option cannot be used with repeater (RT) models.

1.2.2 The *MSR 2000* base (RA) station may be connected to an RA link made up of *MICOR* stations. Refer to the Interconnect Diagrams provided at the end of this section.

1.2.3 The base (RA) option adds a squelch gate module which keys the companion repeater (RA) station when a message is received at the base (RA) station. The squelch gate module provides a PTT function

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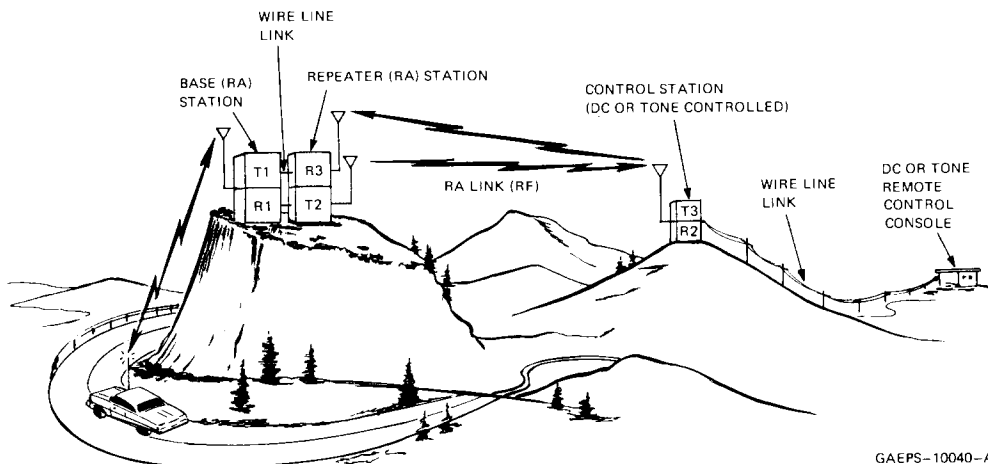


Figure 1. Typical Repeater (RA) System

OPTION C150, C160, AND C170 SERIES

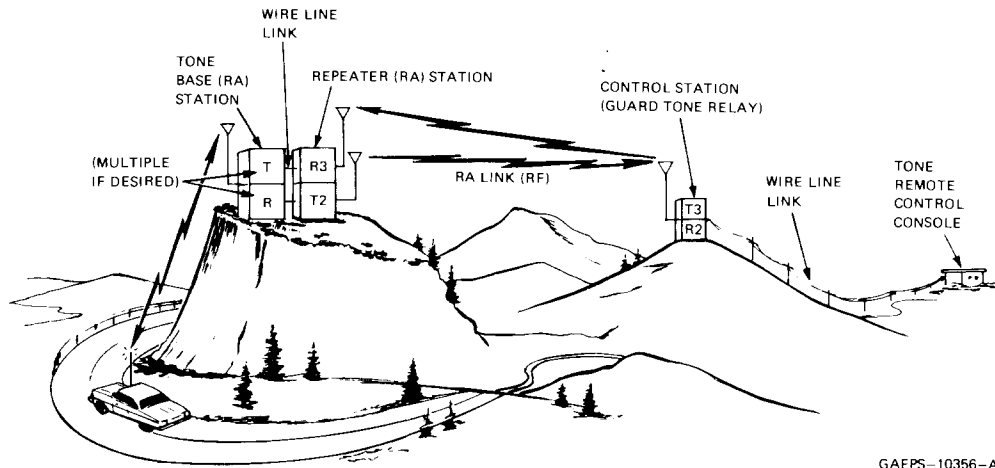


Figure 2. Typical Guard Tone Relay System

(switched ground) to the repeater (RA) station when the receiver in the base (RA) station quiets (receives a message).

1.2.4 When the station is converted for base (RA) operation, separate wire-line remote control is not required. Control is via rf from the control dispatch point or mobile with the control point given priority. This does not involve further model complement change concerning tone remote control models, but does remove the dc transfer module in dc remote control models.

1.2.5 RA link equipment (Base (RA)-Repeater (RA) stations) is used in two basic systems — “Repeater (RA) Systems” and “Guard Tone Relay Systems.” Both systems are used where extended range operation is required, or where natural or man made limitations to direct communications are encountered.

1.3 REPEATER (RA) OPTION C160

1.3.1 The repeater (RA) option C160 may be used with either *MSR 2000* or Micor™ 450-512 MHz repeater (RT) models (PL or carrier squelch). Note that either a duplexer or separate receive and transmit antennas are required on an RA repeater station to satisfy FCC rules and regulations for dispatcher priority.

1.3.2 A repeater (RA) station in conjunction with a base (RA) station and two or more remote stations, such as a mobile station and a control station, together form a “radio repeater (RA) system”. See Figure 1.

1.3.3 The repeater (RA) - base (RA) combination has two modes of operation. It can: (1) receive and re-transmit a message from a control station to a mobile station; and, (2) receive and re-transmit a message from a mobile station to a control station.

1.3.4 The mobile units and the base (RA) station operate on frequency F1. The repeater (RA) station transmits on frequency T2 and receives on frequency R3. The control station transmits on frequency T3 and receives on frequency R2.

1.3.5 When the control station calls the mobile unit, the repeater (RA) turns on the base (RA) station transmitter. When receiver quieting of the repeater (RA) station reaches a predetermined level, the squelch gate in the repeater (RA) station actuates. This keys the transmitter in the base (RA) station. Audio is routed from the repeater (RA) station’s receiver to the base (RA) station’s transmitter audio input. The control station (dispatcher’s) message is then sent to the mobile units on frequency T1 by the base (RA) station’s transmitter.

1.3.6 When a mobile station calls the control station (dispatcher), the base (RA) station turns on the repeater (RA) station’s transmitter. (When receiver quieting of the base (RA) stations reaches a predetermined level, the squelch gate in the base (RA) station actuates. This keys the transmitter in the repeater (RA) station.) Audio is routed from the base (RA) station’s receiver to the repeater (RA) station’s transmitter audio input. The mobile station’s message is then sent to the control station on frequency T2 by the repeater (RA) station’s transmitter.

1.3.7 The control station has operational priority of the base (RA) station. The dispatcher can seize control of the RA system even through a mobile transmission is in process. The control station transmits on T3. Repeater (RA) receiver (R3) is always fully operational, and will, when its receiver quieting reaches a predetermined level, cause the base (RA) station to key, over-riding the mobile.

1.4 GUARD TONE RELAY OPTION C170

1.4.1 A guard tone relay system is much like the usual "RA" system -- with greatly expanded control capability.

1.4.2 In the repeater (RA) system (refer to Figure 1) a received message at the repeater (RA) station actuates the squelch gate in that station. This keys the companion base (RA) station which retransmits the message to mobile units. Only transmitter turn-on and turn-off control of the base (RA) station is possible in a repeater (RA) system, determined by receiver quieting and the squelch gate module in the repeater (RA) station.

1.4.3 In the guard tone relay system (see to Figure 2), the presence of an rf signal *alone* at the repeater (RA) station does NOT cause the companion station to transmit. Instead, the companion station is controlled via tone signals, just as if it were connected directly to a remote control console by wire lines. This permits multiple frequency operation, PL disable (PL or DPL coded squelch models), unique function commands, etc., of the companion base (RA) station.

1.4.4 For example, should the tone remote control console operator (dispatcher) want to talk to a mobile unit on frequency T4, a high level guard tone signal burst is applied to the control station. The control station keys *immediately* on frequency T3 and transmits the remaining *guard tone* signal to the repeater (RA) station. The repeater (RA) station applies this high level guard tone signal to the audio input of the companion tone remote control base (RA) station, which is then ready to accept and react to the forthcoming T4 function tone. The flexibility and number of functions in the guard tone relay system is limited only by the sophistica-

tion of the companion tone remote control base (RA) station and the remote control console. It should be noted that a squelch gate is used in the repeater (RA) station in this guard tone application to provide a transmitter channel element ground when the station is keyed. This is necessary since neither an F1-CS (carrier squelch) or F1-PL control module is used, which would otherwise supply the ground. The squelch gate is NOT used to key the companion base (RA) station.

NOTE

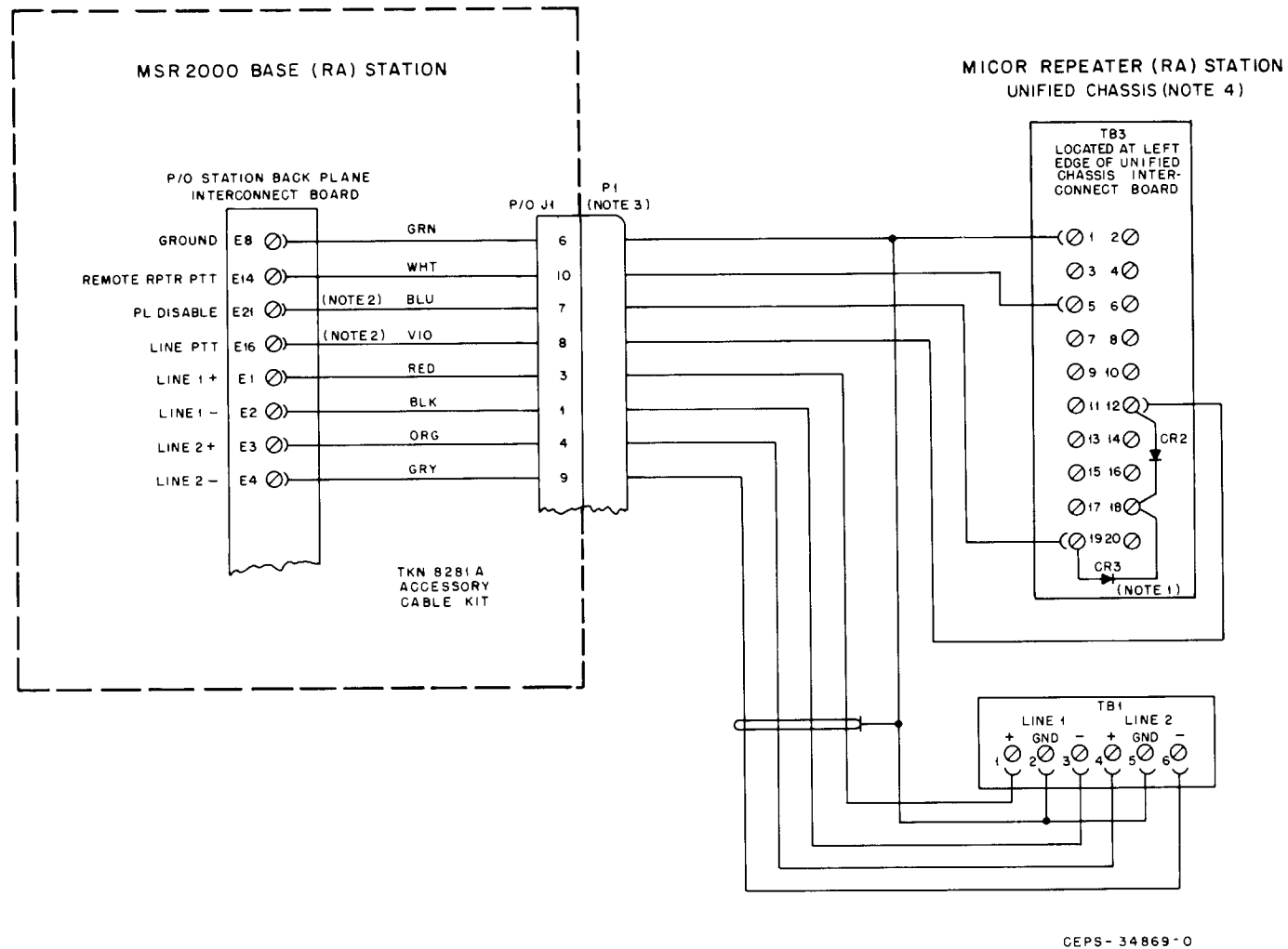
The transmit time of the high level guard tone burst sent by the remote control console should be lengthened to compensate for the delay time encountered in the keying of the guard tone relay station. Refer to the tone remote control console instruction manual for details.

2. CONNECTIONS BETWEEN BASE (RA) AND REPEATER (RA) STATIONS

The base (RA) station is connected to a companion repeater (RA) station via a single, multi-conductor cable (customer supplied). Since the cable is normally short and within the same installation site room, the usual telephone company line restrictions do not apply; adjust audio levels at +14 dBm. Control functions are also carried by direct connections. Connect the base (RA) station to the companion repeater (RA) station. Refer to Interconnect Diagrams provided at the end of this section.

NOTE

Antenna and power connections are not changed by the use of the base (RA) conversion.



CAUTION
REMOVE DIODE CR15 AND RESISTOR R59 IN SQUELCH GATE MODULES OF BOTH STATIONS WHEN RELAY K1 IS NOT USED.

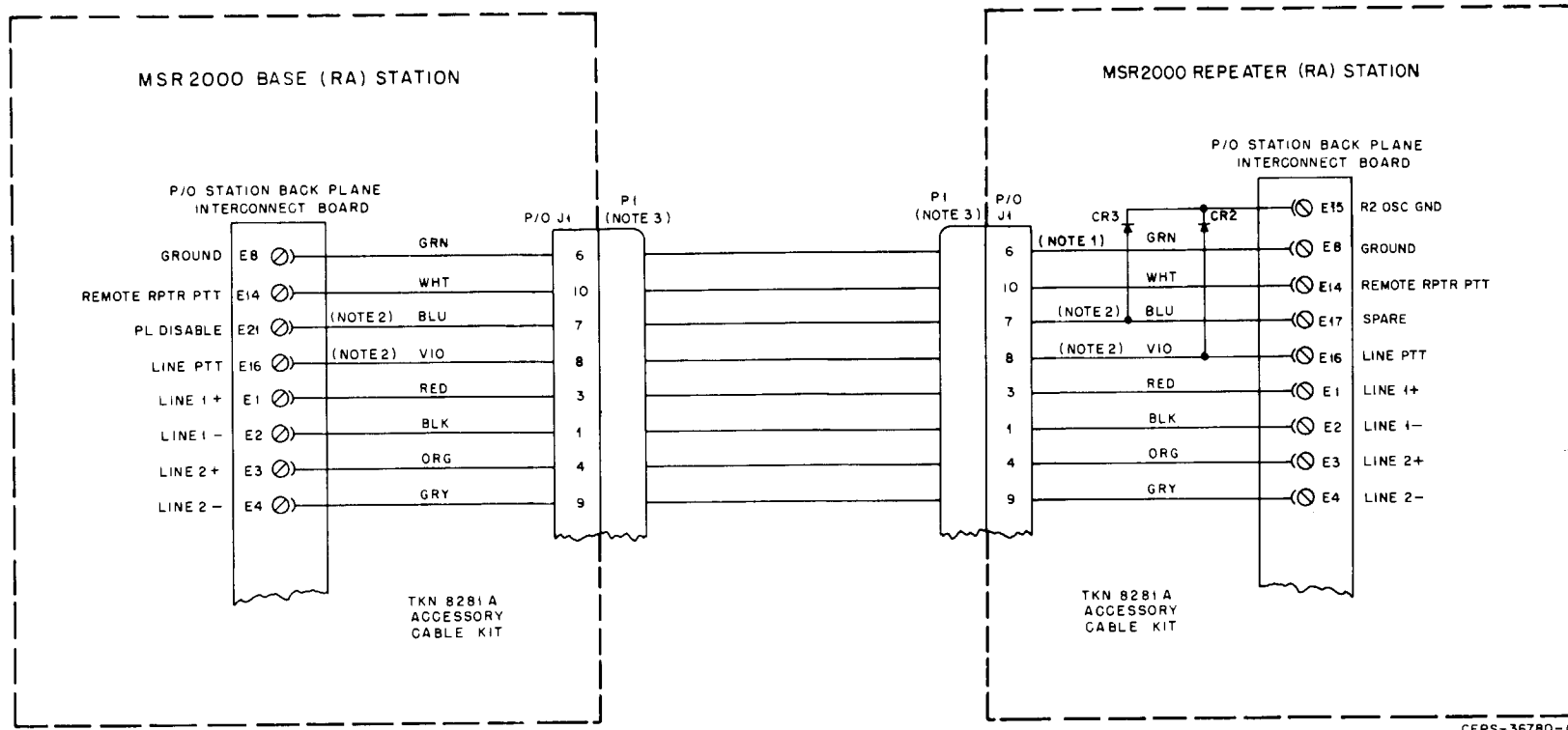
- NOTES:**
- IF PL/DPL DISABLE IS REQUIRED, CR2 AND CR3 (MOTOROLA PART NO. 48-82392 B03) SHOULD BE INSTALLED ON THE REPEATER (RA) STATION. THE 5-SECOND JUMPER (JU1) IN THE SINGLE TONE DECODER MODULE MUST BE REMOVED.
 - "LINE PTT" AND "PL DISABLE" LINES ARE NOT CONNECTED IN GUARD TONE RELAY APPLICATIONS.
 - CONNECTOR P1 IS SUPPLIED WITH MSR 2000 BASE (RA) STATION, AS PART OF TKN 8281A KIT. INTERSTATION CABLING IS NOT SUPPLIED.
 - FOR REPEATER (RA) STATIONS OTHER THAN SHOWN REFER TO APPROPRIATE REPEATER (RA) STATION MANUAL. INTERCONNECT MATCHING FUNCTIONS.

CEPS-34869-0

parts list

TKN8281A Auxiliary Interconnect Cable PL-8087-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J1	9-84538E03	connector, receptacle: female; 25-contact
mechanical parts		
	2-84586C01	NUT, machine; 4-40; square; 2 used
	3-129674	SCREW, machine; 4-40 x 3/16"; 2 used
	29-812979	LUG, crimp terminal; 10 used
	42-10217A02	STRAP, tie; 12 used
	30-86970A02	CABLE; 10 conductor; 46" used
	43-10646A09	SPACER; 2 used
	28-84506E08	CONNECTOR, male; 25-contact
	15-82486M01	HOOD



CAUTION
REMOVE DIODE CR15 AND RESISTOR R59 IN SQUELCH GATE MODULES OF BOTH STATIONS WHEN RELAY K1 IS NOT USED.

- NOTES:**
- IF PL/DPL DISABLE IS REQUIRED, CR2 AND CR3 (MOTOROLA PART NO. 48-82392 B03) SHOULD BE INSTALLED ON THE REPEATER (RA) STATION. THE 5-SECOND JUMPER (JU1) IN THE SINGLE TONE DECODER MODULE MUST BE REMOVED.
 - "LINE PTT" AND "PL DISABLE" LINES ARE NOT CONNECTED IN GUARD TONE RELAY APPLICATIONS.
 - CONNECTOR P1 IS SUPPLIED WITH EACH MSR 2000 RA STATION, AS PART OF TKN 8281A KIT. INTERSTATION CABLING IS NOT SUPPLIED.

CEPS-36780-0

Base (RA) To Repeater (RA)
Station Interconnect Diagrams and Parts List
Motorola No. PEPS-37325-O
8/19/83-UP

OPTION C150, C160, AND C170 SERIES

DYNAMIC MICROPHONE

MODEL TMN6054A

electrical parts list

important
Use *only* the following Motorola part numbers when ordering replacement parts.

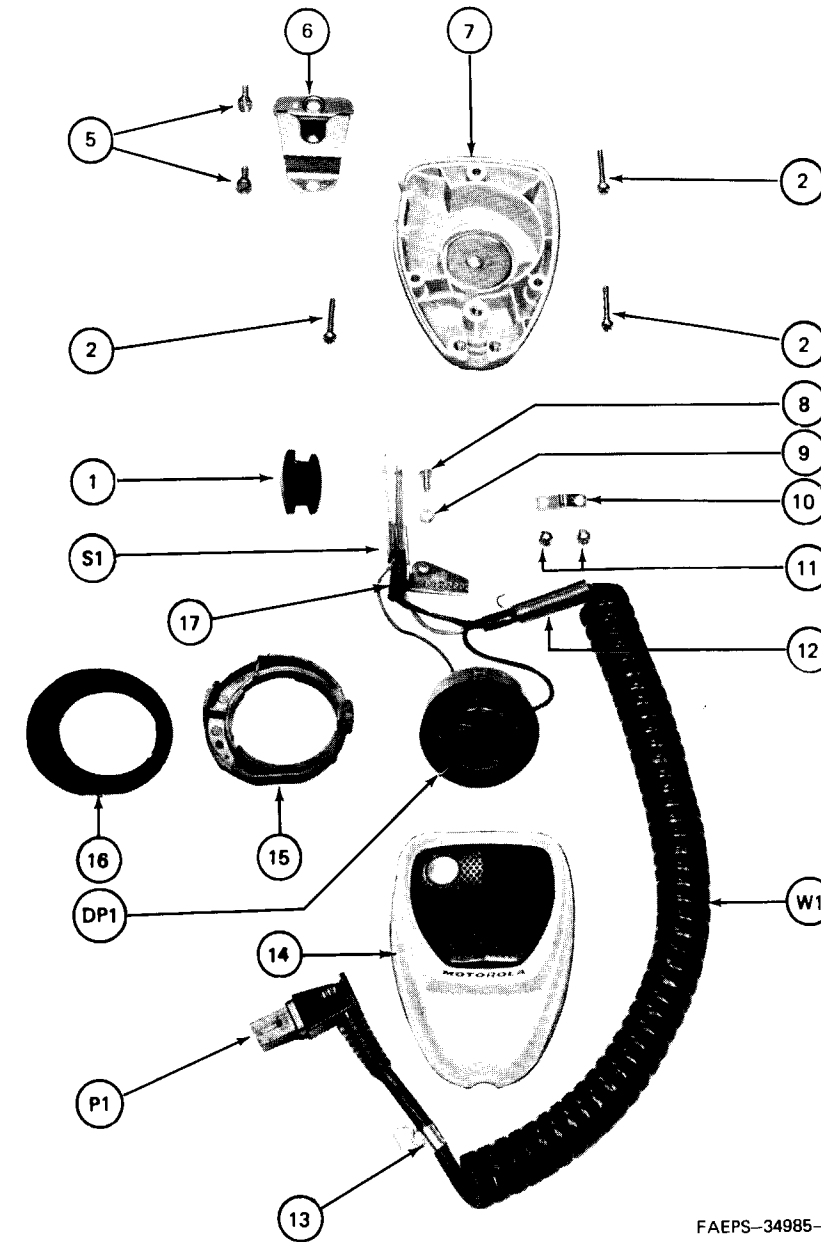
TMN6054A Microphone PL-8092-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
DP1	59-83272G01 or 59-84013A01 or 59-82933C02	cartridge, microphone: dynamic; includes transistor preamplifier
P1103	—	connector, plug: part of W1
W1	30-83731M01	cord, microphone; coiled: 4-conductor; includes ref. part P1, CLAMP, cable "S" hook (ref. part 13), SPRING, strain relief (ref. part 12), and non-ref. LUG (4 req'd.) 29-83277G02
S1	40-82263G02	switch, push: dpst
non-referenced items		
	29-83277G02	LUG, insulation piercing: 4 req'd. (p/o W1)
	33-82599D01	NAMEPLATE
	13-84599B01	EMBLEM

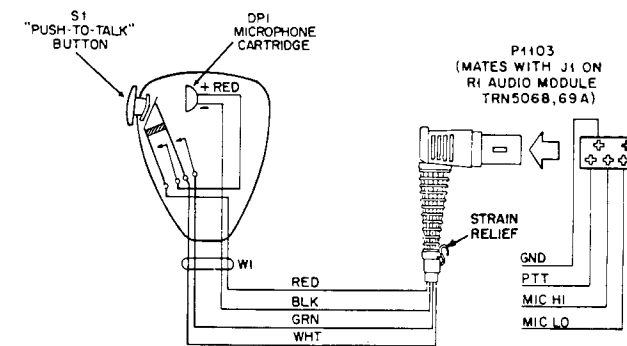
mechanical parts list

TMN6054A Microphone PL-8093-O

CODE	MOTOROLA PART NO.	DESCRIPTION
1	38-84559B01	PUSHBUTTON
2	3-140000	SCREW, tapping: no. 6-19 x 3/8"; 3 req'd.
5	3-122830	SCREW, tapping: no. 8 x 1/2"; 2 req'd.
6	1-80707T05	BRACKET & SPRING ASSY. (eyeletted)
7	1-80709B93	HOUSING, microphone (front and rear)
8	3-129498	SCREW, lock: no 6-32 x 5/16"; "Phillips" round head
9	4-7666	LOCKWASHER: no. 6 external
10	42-852710	STRAP, strain relief
11	3-139999	SCREW, tapping: no. 6-19 x 3/4"; "Phillips" round head; 2 req'd.
12	41-852707	SPRING, strain relief (p/o W1)
13	42-893647	CLAMP, cable "S" hook (p/o W1)
15	42-82702B02	RETAINER, cartridge
16	32-82703B01	GASKET, neoprene
17	11-2506	TUBING, no. 9 black; 5" length req'd.



FAEPS-34985-O



AEPS-34913-O

68P81062E39-O

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END OF DOCUMENT