MOTOROLA INC.
Communications Group

Diplex Antenna Ma

1. Introduction

The diplex antenna installation allows two antennas, each operating at it's own frequency, to share a single radio output port. Precise lengths of coaxial cable are paired to ensure that the operation of one antenna does not interfere with the operation of the other. This manual shows you how to install the diplex antenna kit and includes instructions for selecting antenna mounting locations. However, the antennas are not included in the kit; they must be purchased separately. This information will help you to calculate the lengths of coaxial cables for diplex antennas, including half-wavelength cables. It shows you how to dress the ends of the cables and install the UHF connectors, and how to fine tune each antenna.

2. Antenna Location

Warning

To meet electromagnetic safety standards, install antennas at least two feet (0.6 meter) from the vehicle's passenger compartment unless the occupants will be shielded by a metallic surface.

Where several antennas are used, the greater the distance between antennas, the better. Select mounting locations at least three-feet from each other and from any other antenna. Prior to installation, identify cable lengths and the mounting location of the connector that joins the two cables.

If cable lengths restrict a desired location, you may add a half wavelength of coaxial cable to either antenna, but not to both.

Note

Use proper mounting procedures when installing antennas. See the mounting instructions supplied with the antennas.

3. Coaxial Cable Construction

The coaxial cable cutting chart shows the cable lengths for the desired frequency pairs. ''On-Channel Frequency'' refers to the frequency of the antenna for which a cable is to be cut. ''Off-Channel Frequency'' refers to the frequency of the other antenna. Areas in the chart left blank represent frequency pairs too close together to permit proper operation of a diplex system. Use the chart independently for cutting each cable.

Chart design assumptions are that:

(1) Only standard base-loaded antennas are used.

(2) The antennas used will each produce a VSWR of 1.5:1 (max) over their respective operating bandwidths.

(3) A VSWR of 2:1 presented to the radio is acceptable.

Cut the coaxial cable (standard RG-58A/U) for the desired frequencies according to the chart. The following example explains the procedure for determining lengths.

Example: A mobile system requires frequencies of 48.2 MHz and at 33.9 MHz.

(1) Round the frequencies to the closest whole number; for this example, the frequencies are 48 and 34.

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Coaxial Cable Cutting Chart

ON CHANNEL	OFF CHANNEL FREQUENCY (MHz)																				
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
30					80	77	73	70	67	65	63	61	59	57	55	53	52	51	50	48	47
32							72	70	68	67	65	63	60	58	56	54	53	52	50	49	48
34	84								71	69	67	64	62	60	57	56	54	53	51	51	49
36	87	83	79								69	66	63	61	59	57	55	54	52	51	49
38	91	87	83	79	74								67	65	64	62	61	58	56	55	53
40	95	91	87	83	80	76	72								70	68	66	63	61	58	56
42	98	94	90	86	82	79	75	71	68								71	68	65	62	60
44	99	95	91	87	83	79	76	72	69	65	61	63								61	58
46	99	95	91	88	84	80	77	74	70	66	62	59	55								60
48	100	96	92	88	84	81	78	75	72	68	64	61	57	54	50						
50	100	96	92	89	85	82	79	76	73	71	68	65	63	60	58	55	52				

Cable length in inches; tolerance ±3-inches

(2) Determine the length of coaxial cable required between the center of the antenna mount base and the 'T' connector (See Figure 1) as follows:

48 MHz antenna—In the cable cutting chart, find the intersection of the *row* for on-channel frequency of 48 MHz and the *column* for off-channel frequency of 34 MHz. In this example, the number at the intersection is 84. An 84-inch length of cable is required for the 48 MHz antenna.

34 MHz antenna—In the same chart, find the intersection of the *row* for on-channel frequency of 34 MHz and the *column* for off-channel frequency of 48 MHz. In this example, the number at the intersection is 51. A 51-inch length of cable is required for the 34 MHz antenna.

(3) Before cutting the cables, be sure the lengths determined above will fit the installation. If either cable length is too short, construct a cable with an additional half-wavelength as detailed in the following paragraph.

4. Half-Wavelength Cable Construction

In the following table, find the off-channel frequency for the antenna requiring an additional half-wavelength. Using values from the previous example, and assuming the 34 MHz cable is too short, find the off-channel frequency, 48. The number under 48 is 81. Add the original length of the 34 MHz cable, 51 inches, to the additional length, 81 inches. The total cable length is 132 inches.

5. UHF Connector Installation

Route the cable from the antenna mount location to the 'T' connector before installing the UHF connector. When you have completed preparations, install the UHF connector by following the steps listed below.

Caution

Do not trim the length of coaxial cable between the 'T' connector and the antenna. The length, as determined above, is critical for proper operation.

(1) Disassemble the UHF connector. The parts that comprise the connector are shown in Figure 2A.

(2) Cut off the end of the cable squarely. Remove ¾ inch of the vinyl jacket (Figure 2B).

(3) Slide the coupling ring and adapter onto the cable (Figure 2C).

(4) Fan the braid slightly and fold it back as shown in Figure 2D.

(5) Position adapter as shown in Figure 2E. Press the braid back over the body of the adapter and trim it to ⅜ inch. Bare ⅝ inch of the conductor.

(6) Screw the adapter into the body of the plug subassembly. Solder the braid to the body of the plug subassembly through the holes. Solder the center conductor of the cable to the plug subassembly (Figure 2F).

Caution

Use a hot soldering iron. Solder quickly and avoid melting the surrounding insulation. *Do not use excessive heat or solder.*

Half Wavelength Cable Table

F =	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
L =	130	126	122	118	115	111	108	105	103	100	97	95	93	91	89	87	85	83	81	80	78

Note: F = off-channel frequency in MHz; L = additional length in inches.

(7) For final assembly, screw the coupling ring onto the plug subassembly.

(8) Connect the cable to the antenna receptacle on the radio. Tighten the coupling ring. (See the cross section of the final assembly in Figure 2G.) The installation is now complete.

6. Antenna Rod Fine Tuning

(1) Connect a bi-directional wattmeter between the radio antenna connector and the antenna.

(2) Key the radio to transmit on its predetermined operating frequency.

(3) Measure the incident power (P_i) and reflected power (P_r). Unkey the radio.

(4) Calculate the VSWR using the following equation:

$$VSWR = \frac{\sqrt{P_i} + \sqrt{P_r}}{\sqrt{P_i} - \sqrt{P_r}}$$

(5) Record the VSWR.

(6) Loosen the setscrews that secure the antenna rod and pull the rod up approximately one-half inch. Tighten the setscrews.

(7) Key the radio to transmit; measure the P_i and P_r. Unkey the radio.

(8) Calculate and record the VSWR.

(9) Compare the two VSWR's; if the VSWR is higher with the rod pulled up, trim the rod.

(10) Remove the rod and cut off one-quarter inch.

(11) Install the antenna with the bottom of the rod flush with the bottom of the bushing hole. Tighten the setscrews.

(12) Repeat Steps 7 through 11 until no more decrease in the VSWR is apparent.

(13) If the VSWR reading increases slightly on the last trim, pull the rod up an amount equal to the last trim to offset the increased VSWR. Secure the rod at this point.

(14) Repeat this procedure for the other antenna.

parts list

Mechanical Parts List MXW-2158-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	09-00086150	UHF T-connector
	58-00109152	UHF thru-connector
	28-82021G01	connector, 4 used
	58-00854020	adaptor plug, 4 used
	30-00475378	coax cable (17')

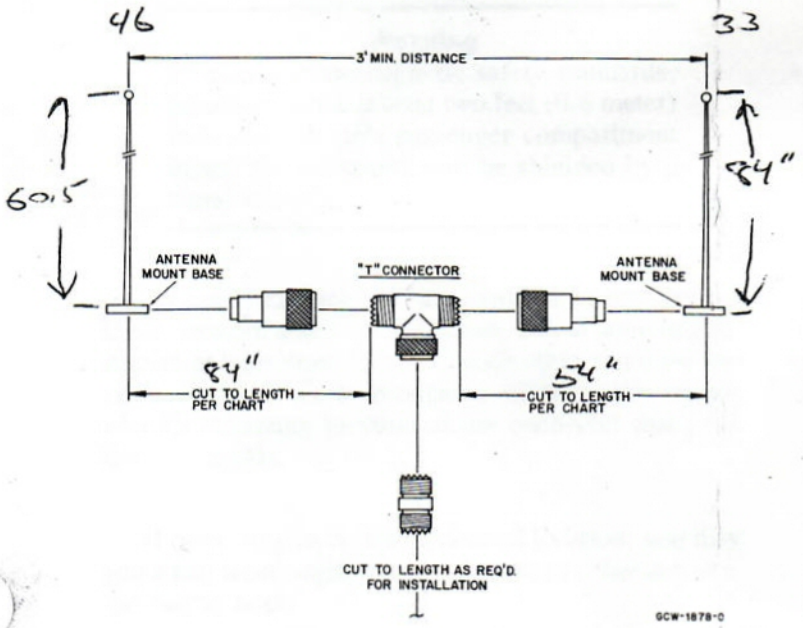

Figure 1. Diplex Antenna Installation

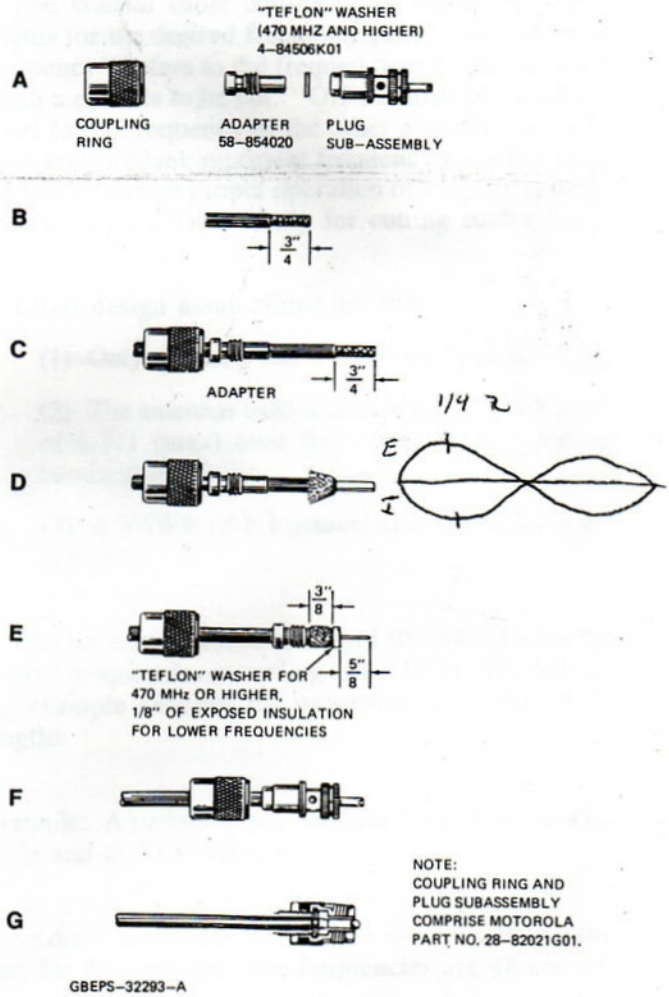

Figure 2. UHF Connector Assembly