

Building the Aerialix ARLX-OM2400 Collinear Antenna Kit

Revision 1.5

September 27th, 2002

For the:

ARLX-OM2400-5
ARLX-OM2400-8
ARLX-OM2400-12

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Thank you for purchasing the Aerialix omnidirectional antenna kit. The enclosed kit requires basic mechanical and electrical skills. Aerialix disclaims responsibility for any damage or injury caused in the construction of this antenna. This kit is easy to assemble as long as you follow the directions, take your time, and measure twice. Construction time is one hour, if done carefully. However it could take much longer if done in haste. You should check our website for the latest version of this manual at: <http://www.aerialix.com/support.html>

CONSTRUCTION WARNING:

The radome (enclosure) of this antenna is constructed of fiberglass. Small particles of this material are known to be a skin irritant and are probably harmful in other ways as well. While we have made an effort to keep exposure to any of this fiberglass dust to a minimum and the radome has been treated with a black acrylic urethane paint further reducing fiberglass dust, rubber gloves should be worn, and caution used, when touching any unfinished portion of the radome. Children should be supervised by adults when constructing this kit.

There are two main sections to this antenna. Starting from the bottom of the antenna, the first is the RF connector/decoupler section with feedline and the second is the elemental array section comprised of a meander-line phase reversal coil, and the element tubing. The antenna is basically an array of dipoles that are phased aligned by meander line phase-reversal coils that mate each $1/2$ wavelength element to one another.

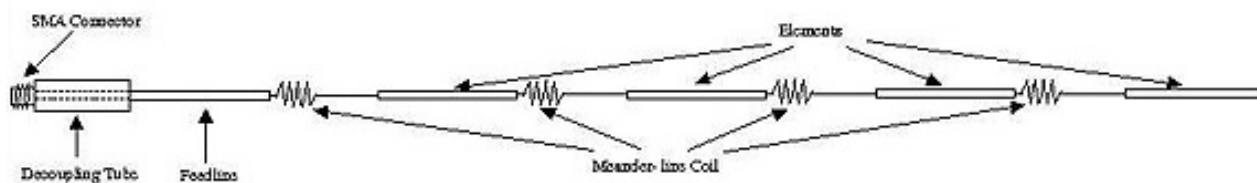


Figure 1. Conceptual physical diagram. Your kit may contain more or less elements than depicted in the diagram.

Equipment and Materials Needed

Inventory:

When unpacking your kit, do so on a clean and uncluttered workbench.



Figure 2. Contents of Kit includes, a bag of brass components, a fiberglass radome, and a vinyl end cap.

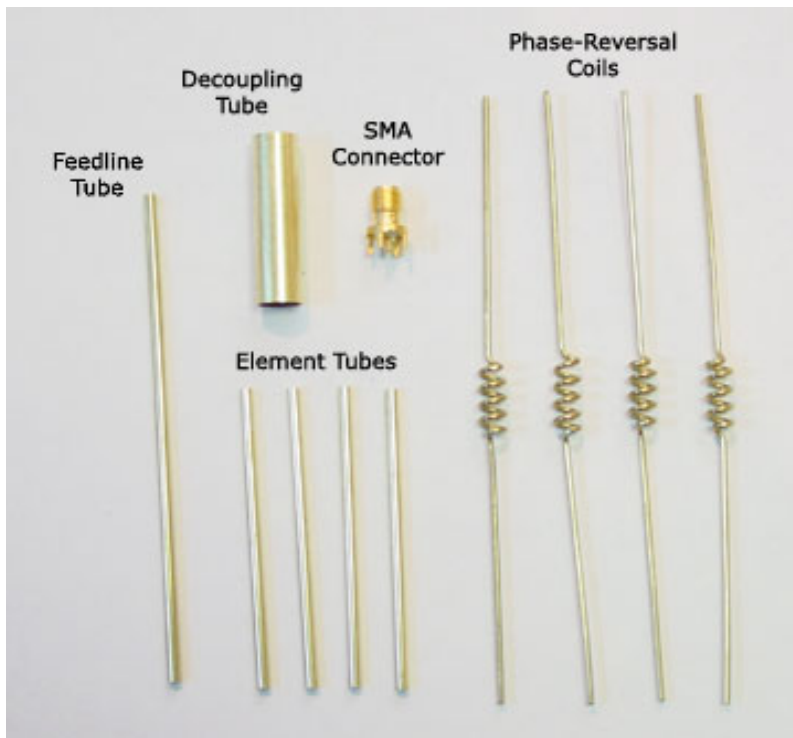


Figure 3. Contents of the bag of brass components, includes a feedline tube, a decoupling tube, four element tubes, four phase-reversal coils, and an round base SMA connector. Your kit may contain more or less than the number of element tubes and phase-reversal coils as shown. Review the checklist for the correct number.

CHECKLIST:

Check	Quantity	Item Description
	1	3/64in / 1.1mm brass rod phasing coils (4.50in / 115mm long)
	4	ARLX-OM2400-5
	8	ARLX-OM2400-8
	8	ARLX-OM2400-12
	1	3/32in / 2.37mm brass tube elements (2.20in / 56mm long)
	4	ARLX-OM2400-5
	8	ARLX-OM2400-8
	8	ARLX-OM2400-12

	1	3/32in / 2.37mm brass tube feed element (3.60in / 90mm long)
	1	11/32in / 8.75mm diameter brass tube decoupler (1.25in / 30mm long)
	1	SMA Female PCB mount connector (round base, OD 0.31in / 7.95mm)
	1	Black plastic radome end cap (OD 0.50in / 13mm)
	1	Fiberglass radome ARLX-OM2400-5 (8" / 20.32cm) ARLX-OM2400-8 (19.5" / 49.53cm) ARLX-OM2400-12 (34" / 86.36cm)
	1	Instruction booklet with alignment cutout sheet

If any parts are missing, first double-check your unpacking and counting. If parts are still missing, please contact Aerialix immediately at support@aerialix.com.

Note: The fiberglass radome is painted with a protective coating of black acrylic-urethane paint. If you would like to paint the radome with another color of acrylic-urethane paint, first sand lightly with 220 grit sandpaper and apply the new coat.

Materials and Tools Required

The following are common mechanical and electrical tools and should be readily available to those persons with the skill level required to build this kit:

- Solder (rosin core)
- electrical tape
- Small Vise
- 50/50 Epoxy (most hardware stores carry this)
- popsicle or other small applicator/mixing stick for epoxy
- small disposable plastic mixing container (ie: plastic cup)
- dry cloth or paper towel
- wire cutters
- needlenose pliers
- Soldering iron (>60 Watt)
- Ruler (Metric/english)

Measurements

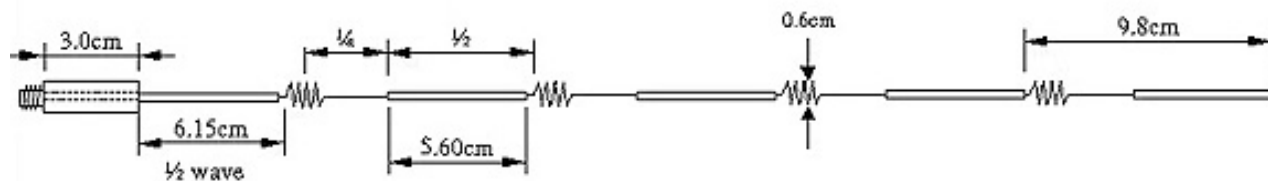


Figure 4. Antenna segment measurements.

The schematic of the electrical components of the antenna is displayed in Figure 4. Note: this schematic is for a four element Collinear array. The 1/2 wavelength and 1/4 wavelength measurements calculated above are to be applied to the various elements in this schematic.

The length of the feedline is approximately 9.15cm.

Note that the first measurement from the end of the decoupling tube is a $1/2$ wavelength to the *beginning of the first coil*.

The next critical measurement is from the middle of the coil to the beginning of the first brass tube element, which is $1/4$ wavelength. The cycle then repeats again for the remaining elements, where a $1/2$ wavelength exists between the beginning of the next brass tube element to the beginning of the next coil.

Construction

Decoupler Assembly:

The decoupler assembly is a simple process. First, set the SMA connector upright with the legs facing up. Then apply some solder to the soldering iron and then apply soldering iron with solder on tip to the center conductor of the SMA connector. Apply a little more solder to the now very hot center conductor and then pull the soldering tip up and away from the center pin. Take care in ensuring you didn't create a solder bridge between the center conductor and the Grounding pins. Next put the feedline into a vise, and apply heat to the top of the feedline tube. With a free hand, pickup the SMA connector and put it onto the very hot feedline tube. You may need to apply a little heat to the solder bulb on the center conductor to get the solder to flow from the cold connector down into the feedline. When the connector rests perpendicular to the top of the feedline, remove heat and wait to cool. When completed, it should look like Figure 5.



Figure 5: The image on the left shows the solder applied to the center conductor now resting on the feed prior to feedline heating. The center image shows the feedline in vise, after heating the tube and allowing the connector to rest flat on the top of the feedline tube. The image on the right shows the completed feedline soldered to SMA center conductor.

Next, take the 11/32 decoupler tubing and insert the SMA connector with the feedline now soldered to it, feedline first. Leave a very small amount of the round SMA connector base exposed for soldering to the brass tube as illustrated in Figure 6. You may notice that the feedline is not exactly centered in the middle of the decoupling tube. Do not try to center the feedline by bending the feedline. You WILL break the center conductor off of the SMA connector. Instead, remove the feedline tube by applying heat to the base of the feedline tube. Once the solder is molten, press down lightly until you feel the feedline resting flat on the surface of the SMA connector. Remove the heat, and wait for the joint to cool and solidify before removing your hand.

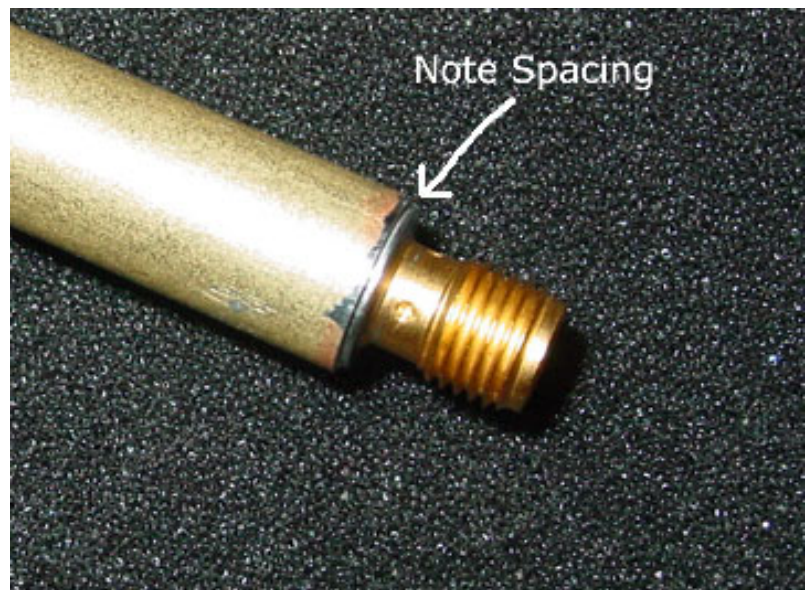


Figure 6: Decoupling sleeve over SMA connector. Note minimal spacing between SMA base and edge of decoupler sleeve.

Solder the decoupler onto the base of the SMA connector by applying a molten bead of solder along the edge and rotate the feedline between the thumb and fore finger. Eventually you will have an evenly soldered joint. You have now completed the decoupler assembly as depicted in figure 7.



Figure 7: Completed decoupler assembly.

Set aside the completed assembly and continue on to the next section.

Element assembly:

Each element is matched with a coil segment. The relationships are indicated in figure 4 above. The important relationship is from the middle of the coil to the beginning of the brass tube element and measures $1/4$ wavelength. Then from the beginning of each tube to the start of the first turn of the next coil is a $1/2$ wavelength all the way up the antenna until the final element is placed.

You will find the template sheet with template T1, T2a, and T2b on the last page of this document. It is advisable to download and print the standalone template jpeg or pdf file, as many web browsers shrink or expand images in order to fit to page. If you are reading the hardcopy version of this document as provided from Aerialix, the template is to scale. Cut out the three templates, setting T2a and T2b aside for later. We will assemble all four element sections using Template T1 as a guide. Gather one coil and one element tube and set aside. Using needlenose pliers, bend one end of the coil slightly in two places as shown in Figure 8. These bends will provide friction inside the tube to enable precise alignment to template T1 and to hold the two pieces together while soldering.

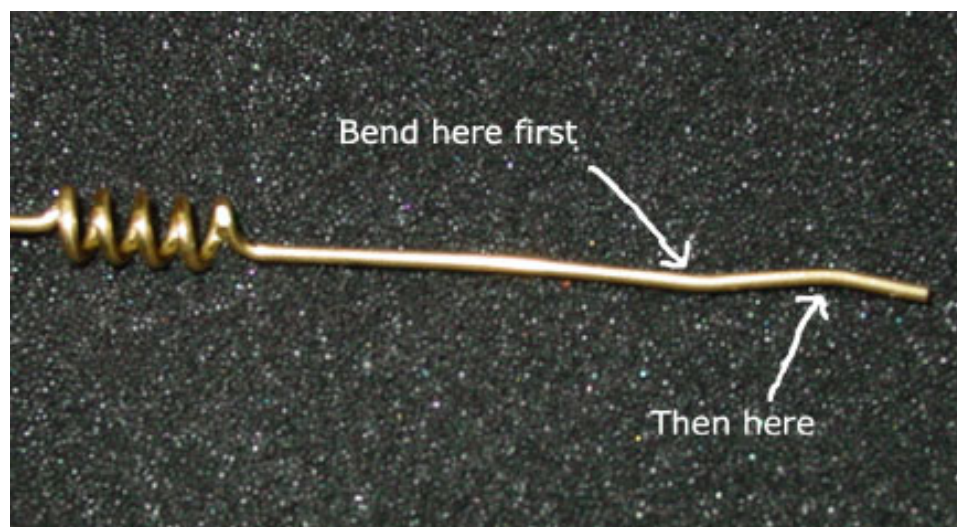


Figure 8. Illustrating the friction bends in one end of the coil.

Figure 9 shows the proper alignment using template T1 as a guide. Repeat alignment for all remaining sections.

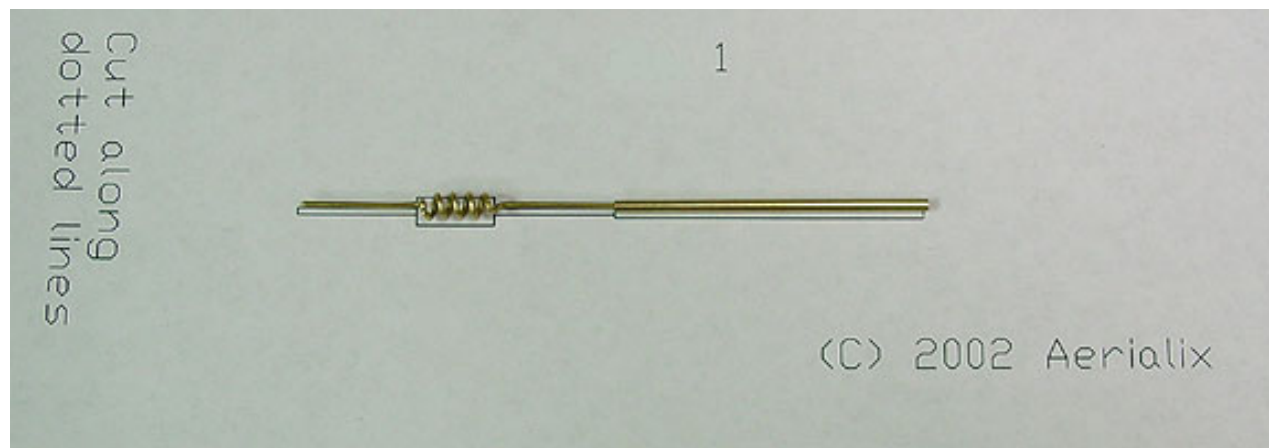


Figure 9. Aligning an element assembly using template T1 as a guide.

Once all element assemblies have been aligned, solder in place. Trim approximately 1 inch from the coil unsoldered coil lead.

You may use template T1 as a guide for appropriate length. Discard trimmings, set aside the element assemblies, and proceed to next section.

Final assembly

Locate template T2a and T2b that you cut out earlier and tape together using the registration marks as shown in Figure 10.

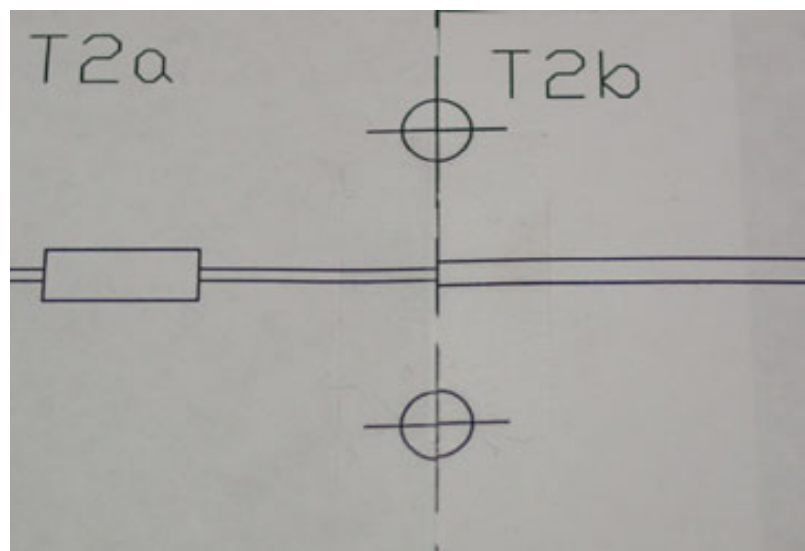


Figure 10. Proper joining of template T2a and T2b.

Using needlenose pliers, bend the unsoldered coil leads as done previously when aligning the element assemblies (refer to Figure 8). Repeat for every remaining element.

Starting with decoupling assembly, insert an unsoldered, bent coil lead of one of the element assemblies into the feedline, using Template T2a/T2b as a guide. Then continue to slip the next unsoldered coil lead into the previous element assemblies tubing until complete.

Once all element assemblies have been aligned, solder into place, beginning again, with the feedline junction, proceeding to the last element assembly. Figure 11 depicts a completed antenna assembly aligned on the T2a/T2b template guide.

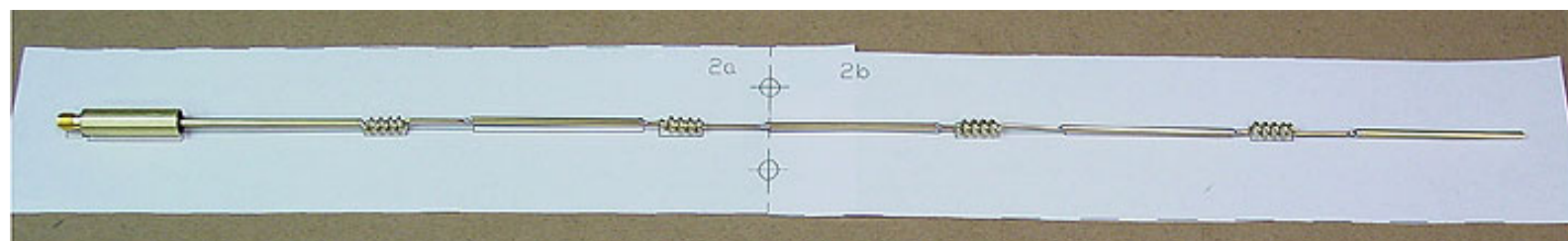


Figure 11. Completed antenna assembly. Your kit may have more or less elements than shown in this figure.

Radome construction:

The radome consists of a primed fiberglass tubing, a vinyl cap, sealed with 50/50 epoxy. Figure 12 shows the workspace properly prepared for radome assembly.



Figure 12. Radome construction materials.

In order to prevent the brass from "rattling" inside the radome, we suggest wrapping 1in/2.52cm of standard black electrical tape to each coil as shown in Figure 13. When wrapping the coils with electrical tape, be sure to wrap it tight, as it will be rubbing up against the interior of the radome during insertion. Loose fitting tape may cause jamming and subsequent bend of brass elements. This should only be done if rattling is of concern.

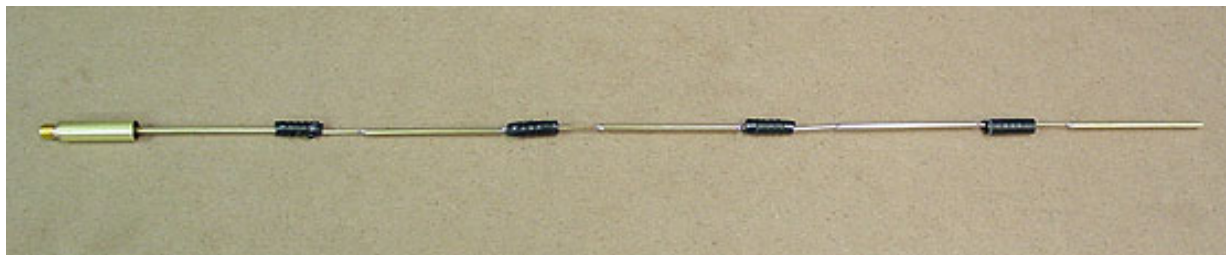


Figure 13. Anti-rattling tape applied to the coils.

You will notice that one end of the radome has a larger inner diameter than the other end. Insert the top element of the antenna into the milled end of the radome carefully. If you wrapped electrical tape over the coils, you may encounter resistance. If you encounter a lot of resistance, remove the antenna and unwrap any coils that have an abundant amount of tape on them. Do not force the antenna assembly into the radome. Continue inserting the antenna assembly into the radome until the entire decoupler and 0.50in/1.27cm of feedline, as seen in figure 14.



Figure 14. Leave enough room to apply epoxy into the decoupler end of the radome.

Set aside and prepare to ready the epoxy. Ready the mixing container, the stirring/applicator utensil, and a dry cloth or paper towel.

Be sure to read the instructions and follow the safety procedures outlined on the epoxy manufacturers label. Then, dispense approximately 10ml(.338 oz), or 1/4 of the container, of the 50/50 epoxy into the mixing container and prepare in accordance with manufacturers directions. If you chose fast acting epoxy, you probably have only 5 minutes or so before the epoxy begins to SUDDENLY harden.

Starting with the decoupler end of the radome, apply epoxy liberally into the opening of the radome as shown in Figure 15. Take care to not let any epoxy dribble down the side of the radome. If this should occur, quickly wipe away with a dry cloth or paper towel.

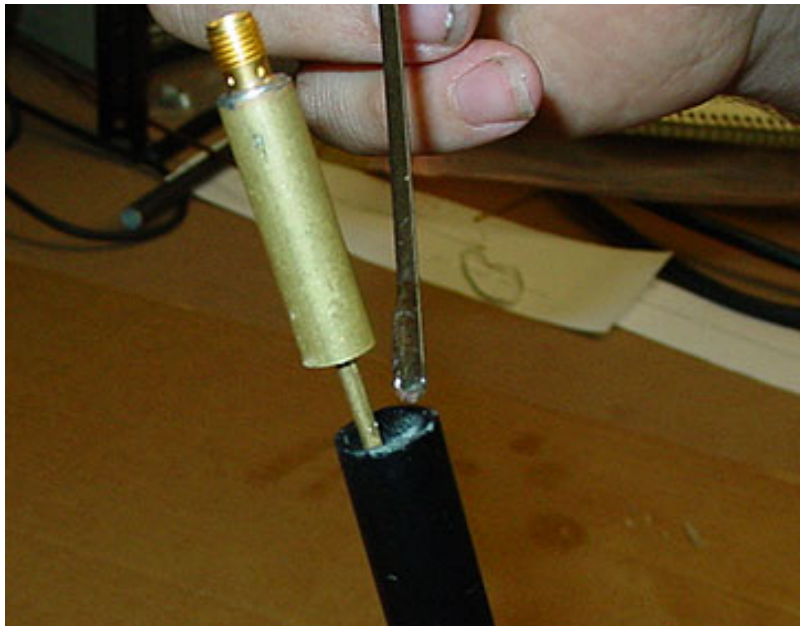


Figure 15. Applying epoxy into decoupler end of radome.

Insert the antenna the rest of the way, stopping when the base of the decoupler is flush with the end of the radome. Apply more

epoxy to fill any voids as shown in Figure 16. Again, if any epoxy should not go where intended, wipe away with dry cloth or paper towel.

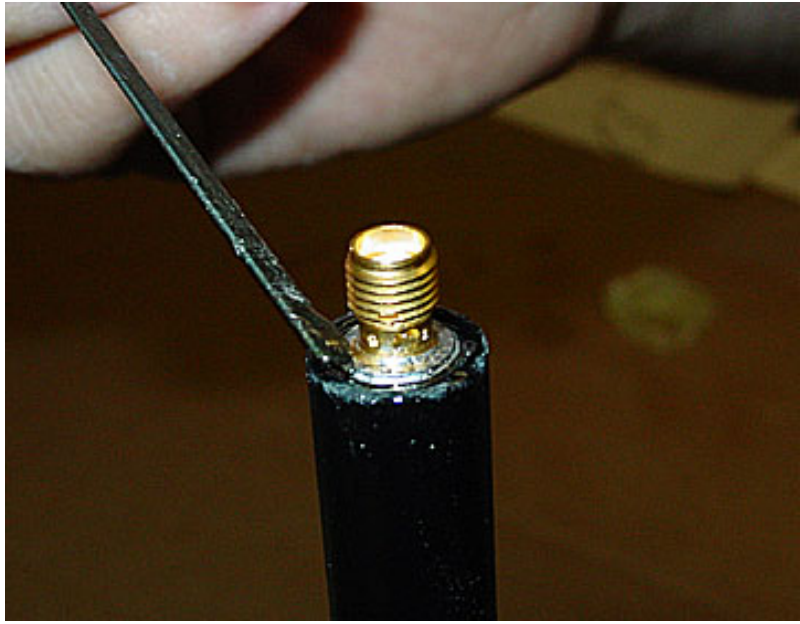


Figure 16. Filling voids after antenna assembly is inserted into radome.

Once all voids are filled, hold radome with SMA connector end up, using your finger to center the connector until epoxy hardens as shown in Figure 17. Once the epoxy sets, you can proceed to the next task.



Figure 17. Centering antenna in radome while epoxy sets.

Dispense another 10ml(.338 oz), or 1/4 of the container, of the 50/50 epoxy into the mixing container and prepare in accordance with manufacturers directions.

Turn the radome over (opposite of the decoupler), and apply epoxy liberally into the top of the radome as shown in Figure 18. Take care to not let epoxy dribble down the side of the radome. If this occurs, quickly wipe away with a dry cloth or paper towel.

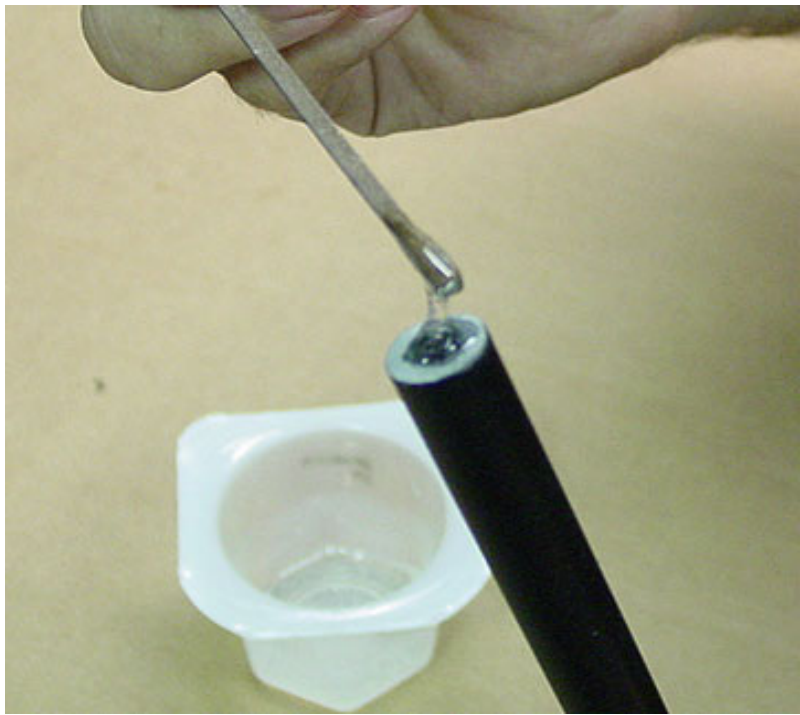


Figure 18. Applying epoxy into the top end of the radome.

Place the cap on top of the radome, turn over and hold upside down until epoxy sets as shown in Figure 19.



Figure 19. Holding the antenna on the cap until epoxy cures.

Congratulations! You have completed the antenna kit. The antenna should be let to cure overnight before being installed. If you have any further questions, feel free to contact us at support@aerialix.com or check our web site, www.aerialix.com for errata, updates to this documentation or information on other products.