Building the Aerialix ARLX-OM2400 Collinear Antenna Kit

Revision 2.0

December 11th, 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.

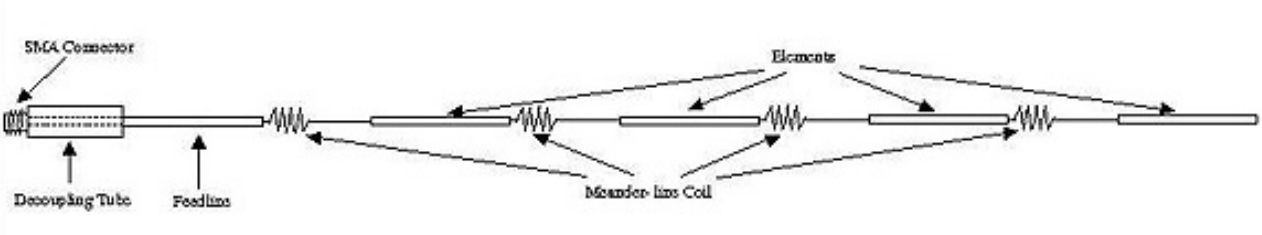


Figure 1. Conceptual physical diagram. Your kit may contain more or less elements than depicted in the diagram.

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, threaded mounting component, and a vinyl end cap.

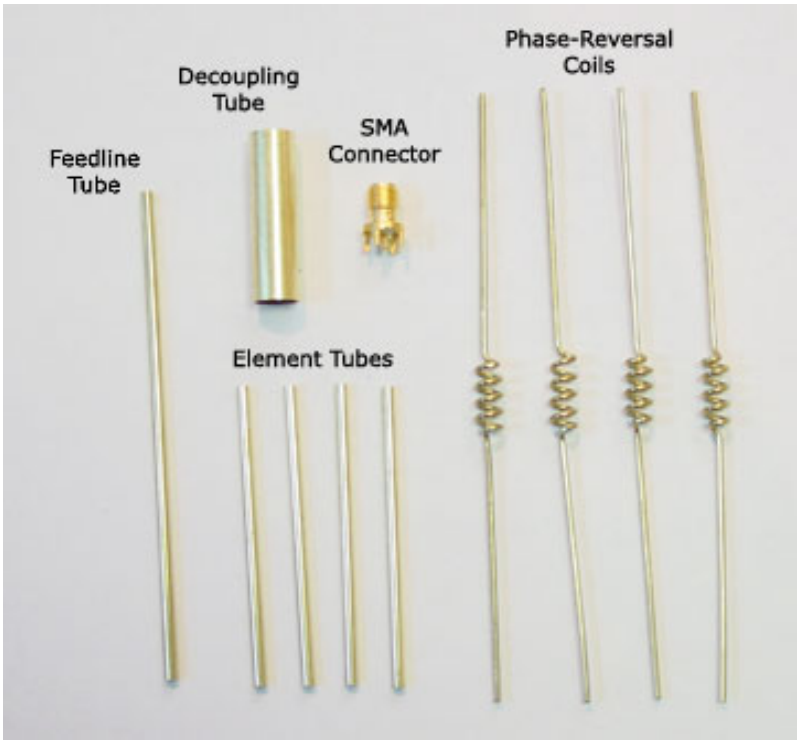


Figure 3. Contents of the bag of brass components, includes a feedline tube, a decoupling tube, four element tubes, four phase-reversal coils, and an round base SMA connector. Your kit may contain more or less than the number of element tubes and phase-reversal coils as shown. Review the checklist for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

CHECKLIST:

Check	Quantity	Item Description
	1 4 8	3/64in / 1.1mm brass rod phasing coils (4.50in / 11.5cm long) ARLX-OM2400-5 ARLX-OM2400-8 ARLX-OM2400-12
	1 4 8	3/32in / 2.37mm brass tube elements (2.20in / 5.6cm long) ARLX-OM2400-5 ARLX-OM2400-8 ARLX-OM2400-12
	1	3/32in / 2.37mm brass tube feed element (3.65in / 9.15cm long)
	1	11/32in / 8.75mm diameter brass tube decoupler (1.25in / 3.25cm 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	Threaded mounting component
	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) (NOTE: A butane mini-torch works faster and better than a soldering Iron.)
- Ruler (Metric/english)

Measurements

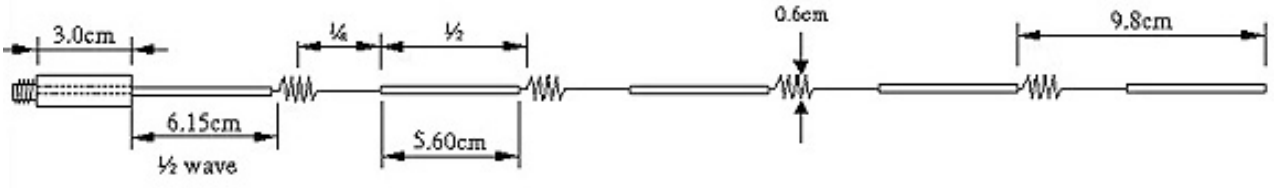


Figure 4. Antenna segment measurements.

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 purpendicular 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.

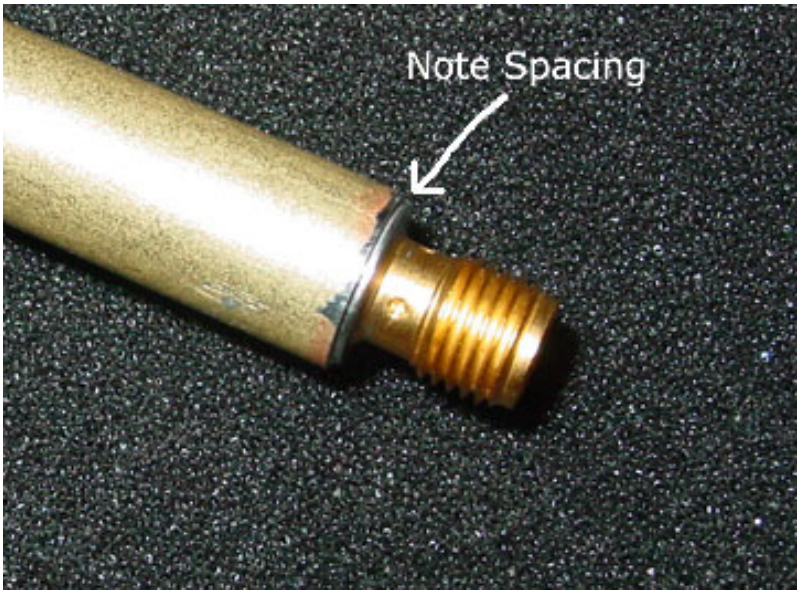


Figure 6: Decoupling sleeve over SMA connector. Note minimal spacing between SMA base and edge of decoupler sleeve.

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.

IMPORTANT: Be sure to not leave excessive amounts of solder on the outer diameter of the decoupler as you will face difficulty when inserting the antenna into the threaded mounting component later.

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 an 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.

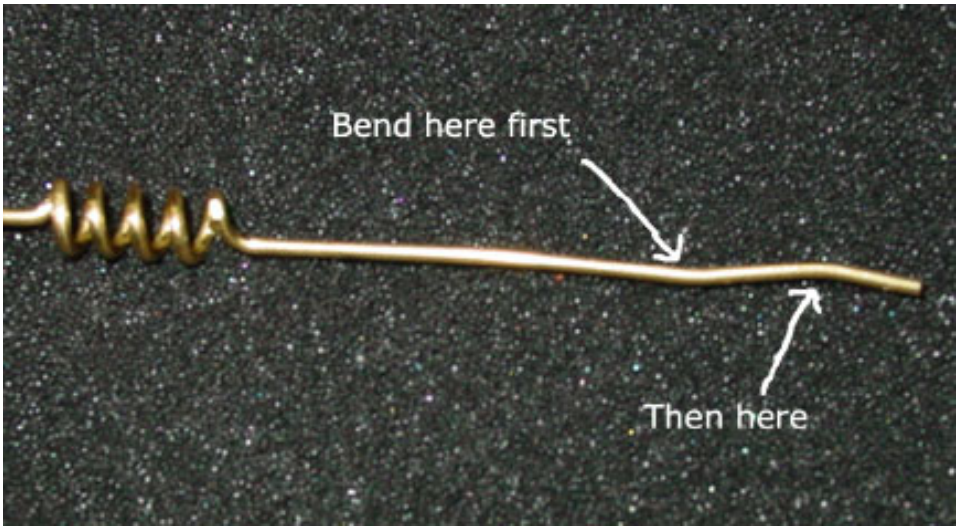


Figure 8. Illustrating the friction bends in one end of the coil.

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

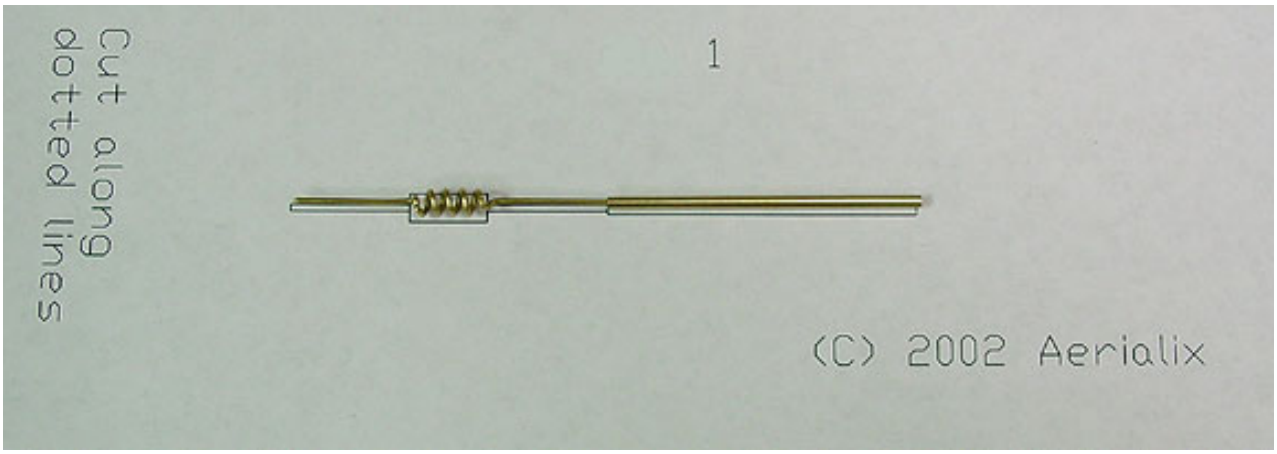


Figure 9. Aligning an element assembly using template T1 as a guide.

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.

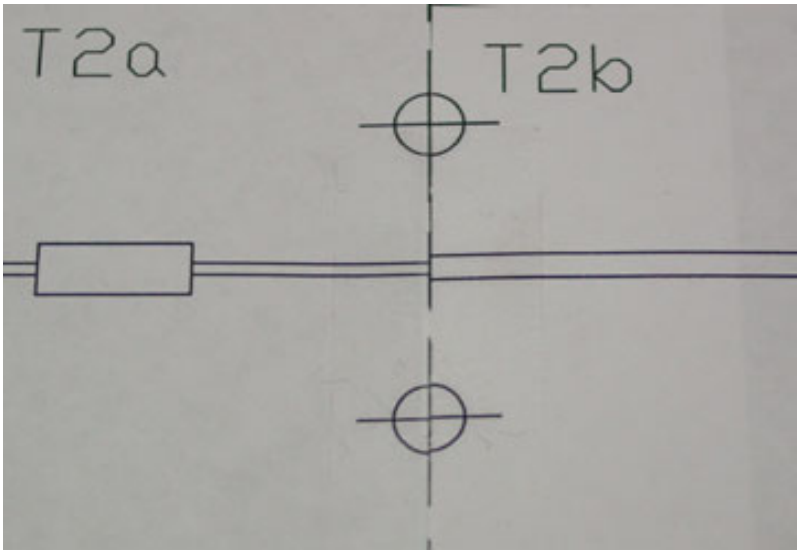


Figure 10. Proper joining of template T2a and T2b.

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.

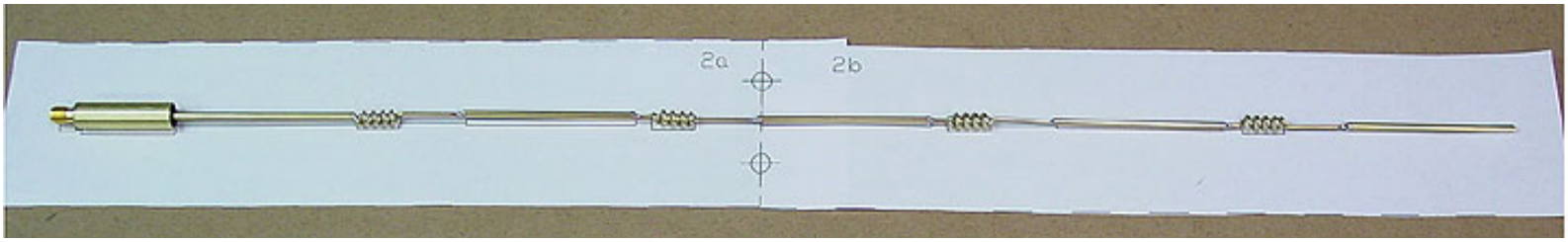


Figure 11. Completed antenna assembly. Your kit may have more or less elements than shown in this figure.

Radome construction:

The radome consists of a primed fiberglass tube, a threaded mounting component, a vinyl cap, all 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 bending of brass elements. This should only be done if rattling is of concern.

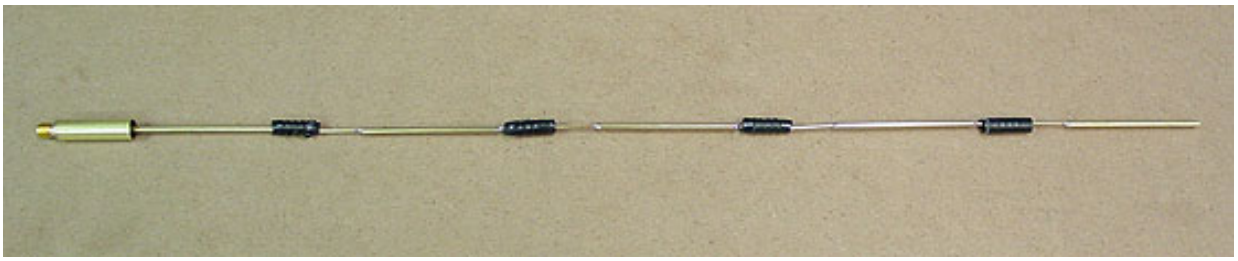


Figure 13. Anti-rattling tape applied to the coils.

Insert the top element of the antenna into the end of the radome with a 1/4" hole. If you wrapped electrical tape over the coils, you may encounter resistance. Gently twisting the antenna as you guide it into the radome helps significatly. If you encounter a lot of resistance, remove the antenna and unwrap any coils that have an abundant amout 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 a portion of the feedline remain exposed.

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

Be sure to read the instructions and follow all safety procedures outlined on the epoxy manufacturers label. Then, dispense approximately 10ml(.338 oz) 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.

Apply a moderate amount of epoxy onto the end of the decoupler just above the connector as seen in figure 14.. Take care to not get epoxy on the connector.

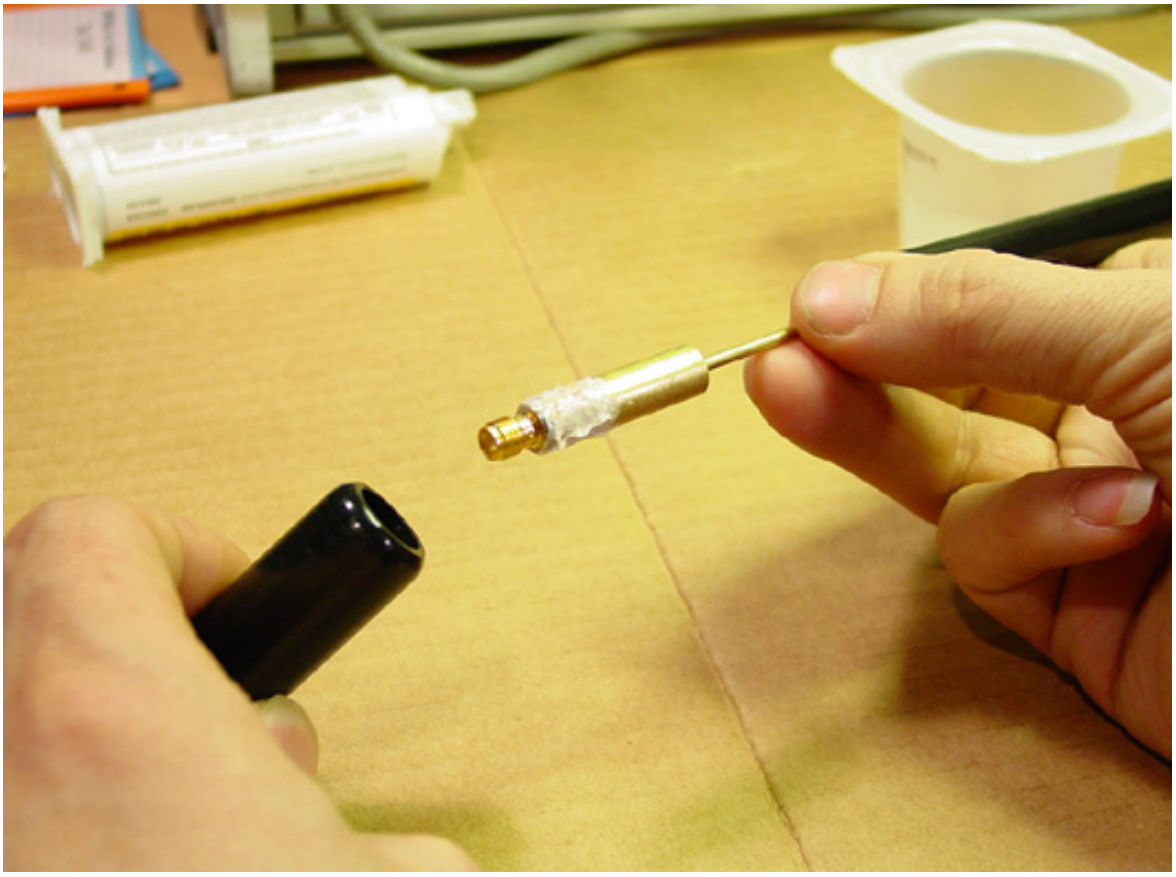


Figure 14. Epoxy applied to decoupler and about to be aligned into the threaded mounting component.

Next, gently insert decoupler into the wide end of the threaded mounting component. The SMA connector should make its way into the smaller hole inside which is about an 1.25" down. DO NOT FORCE THE DECOUPLER INTO THE HOLE BY PUSHING ON THE FEEDLINE. Instead, using the fiberglass radome and the decoupler aligned as depicted in Figure 15, insert the radome into the threaded mounting component pushing the decoupler down until the SMA connector is completely exposed at the opposite end.

Figure 15. Aligning the decoupler in the threaded mounting component.

Next, pull the radome back out of the threaded mounting component as shown in figure 16.

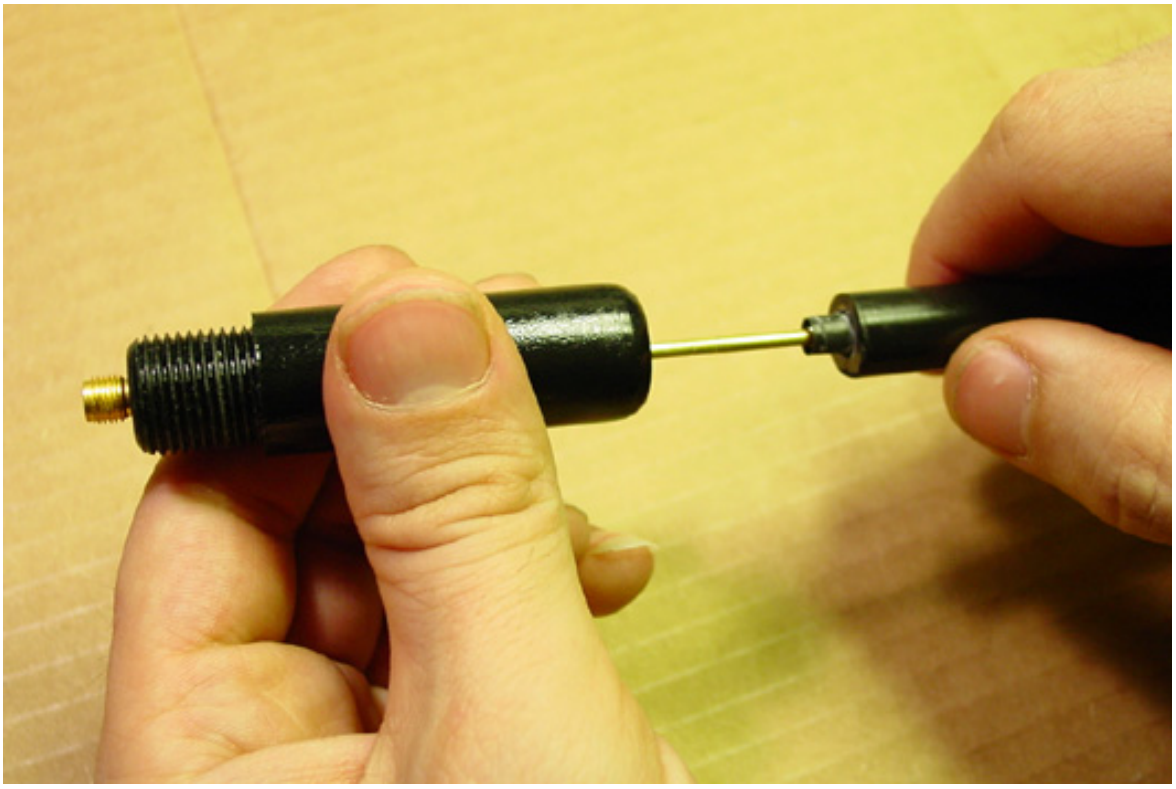


Figure 16. Retracting the radome once decoupler is set.

Apply a moderate amout of epoxy to the end of the radome as depicted in Figure 17.

Figure 17. Epoxy applied to radome prior to insertion into threaded mounting component.

Press the radome firmly into the threaded mounting component until it stops, then twist 180 degrees.

If your epoxy has hardened, dispense another 10ml(.338 oz) 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.

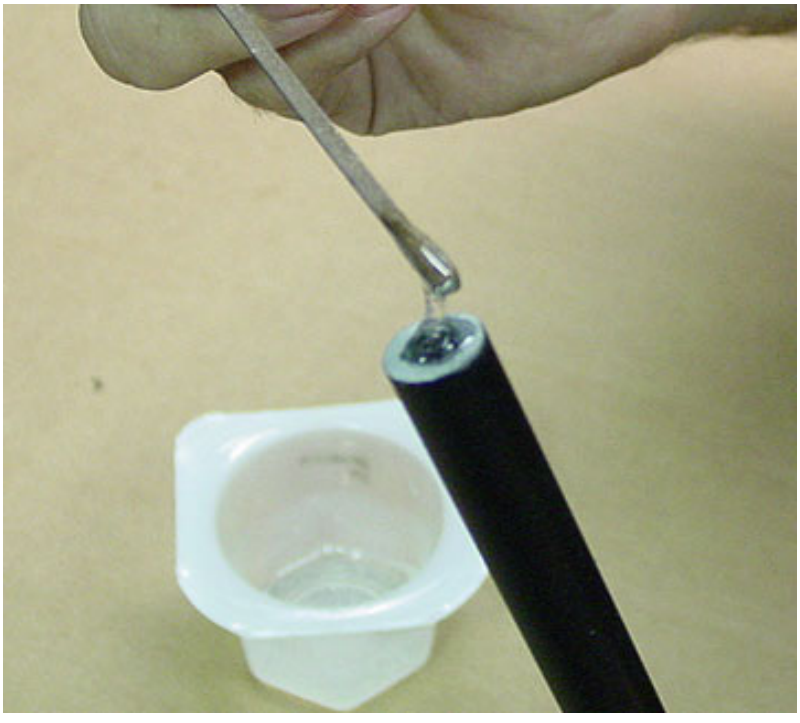
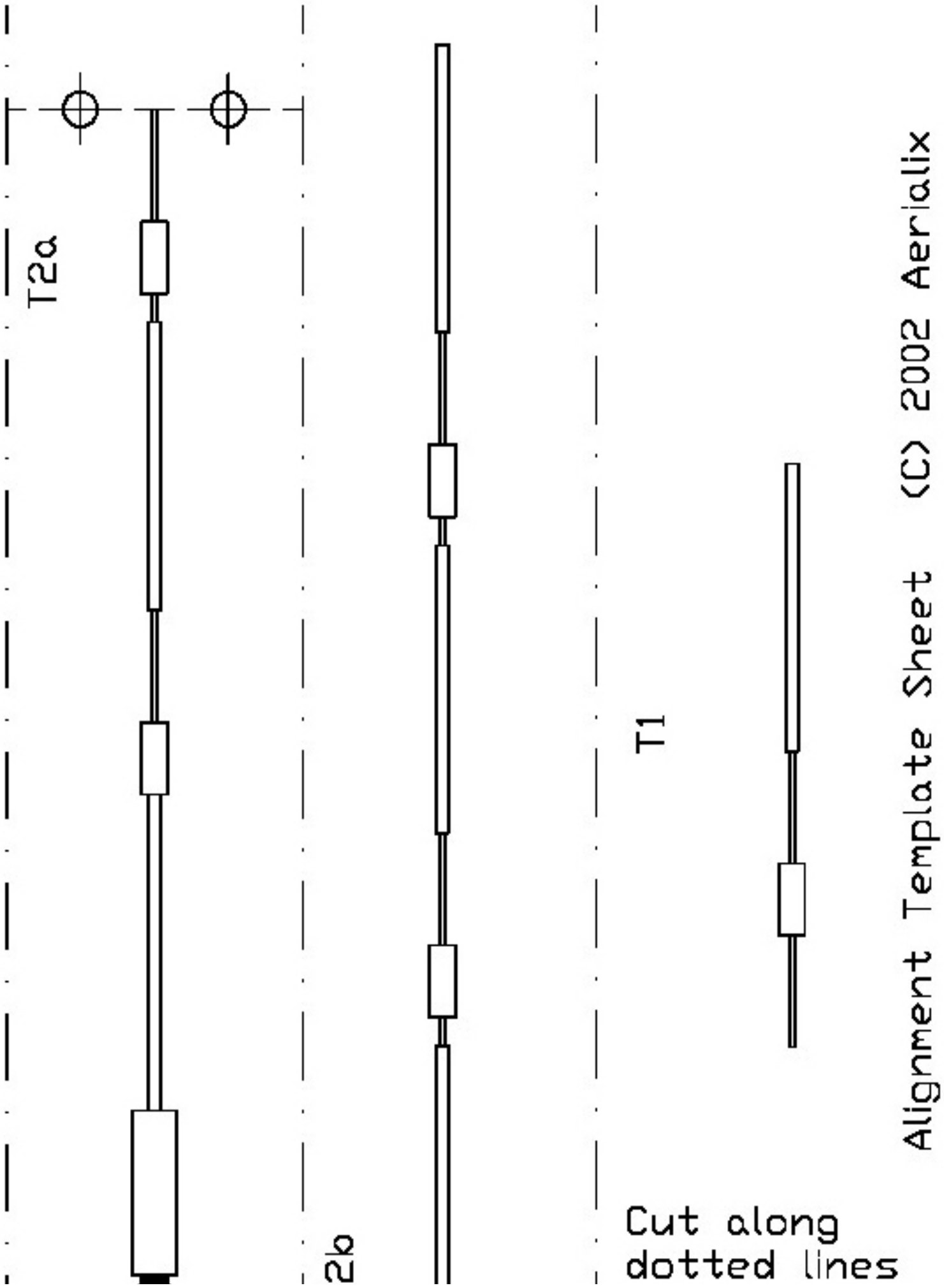


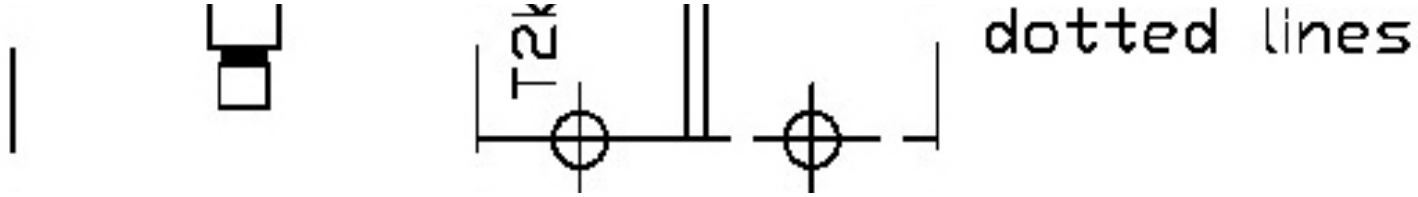
Figure 18. Applying epoxy into the top end of the radome.

Place a moderate amount of epoxy into the cap then mount the cap on top of the radome, turn over and hold (or set aside) 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.


T2a
2b
T1
Alignment Template Sheet (C) 2002 Aerialix
Cut along
dotted lines


T2k
dotted lines