Indoor 10 Meter Beam

A 2-element coaxial antenna.

by Jacquelyn J. McGlothlin N9CAP

In May 1981, I wrote "The 'No Antennas' Antenna," which appeared under my former name and call, Jacquelyn Schoewe WA9BBX. It was intended to shed some light on the problems many of us face when the landlord says, "No indoor antennas!" What do you do, give up your hobby? No way! You resort to an indoor, "invisible" antenna. What is not seen will not be noticed. From the mail I received, it appears that many of you tried the indoor coaxial dipole with great success. For those of you who wish to go one step further, here's an indoor, invisible coaxial beam that will improve your signal both ways. It requires only another length of coax to turn the original dipole into a beam.

The coaxial beam antenna has the same features as the coaxial dipole. It greatly attenuates harmonics, thus lessening any TVI problems. This antenna is also very broad-banded, covering the entire 10 meter band with a VSWR under 2:1 at band edges. The broad-band characteristics are due to the feedline being matched to the antenna and electrically incorporating its own balun. The coaxial beam antenna has a definite gain over a coaxial dipole, with 5–6 dBd being typical. It is also a very "quiet" antenna; the vinyl jacket reduces static charge build-up that can cause a popping noise in the receiver when discharged.

First, the Dipole

I'll begin with step-by-step construction of the 10 meter dipole, then modify it into a 2-element, 10 meter beam antenna. For antenna dimensions, see Figure 1.

Construction of the antenna is simple. RG-58A/U coax is best because it's light and flexible, but you can also use RG-8/U or RG-8X. Maximum legal power can be used with any choice of coax, providing the VSWR is under 1.5:1.

Begin construction by removing 1" (2.5cm) of vinyl jacket (1/2" on each side of center) at the center of the antenna. Cut the shield in the center all the way around the coax. Take care not to cut the dielectric or the center conductor. Next, form two leads with the shield, as shown in Figure 2. This is the feedpoint of the antenna.

From this center feedpoint, measure out each side of center 4'2" (1.3 meters) and cut

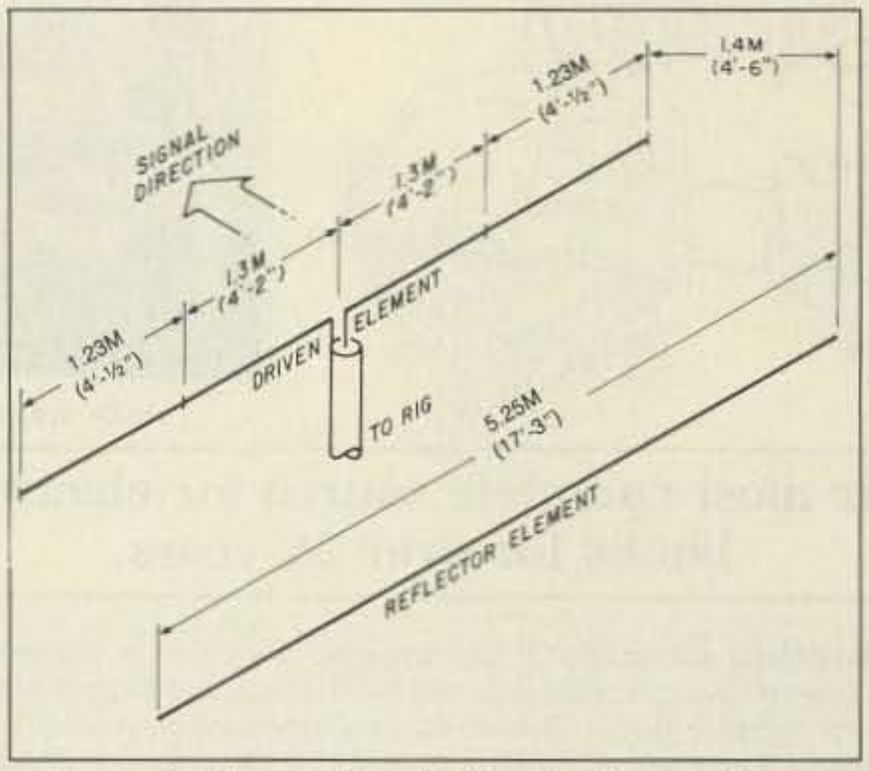

Figure 1. Element lengths for the 10 meter beam.

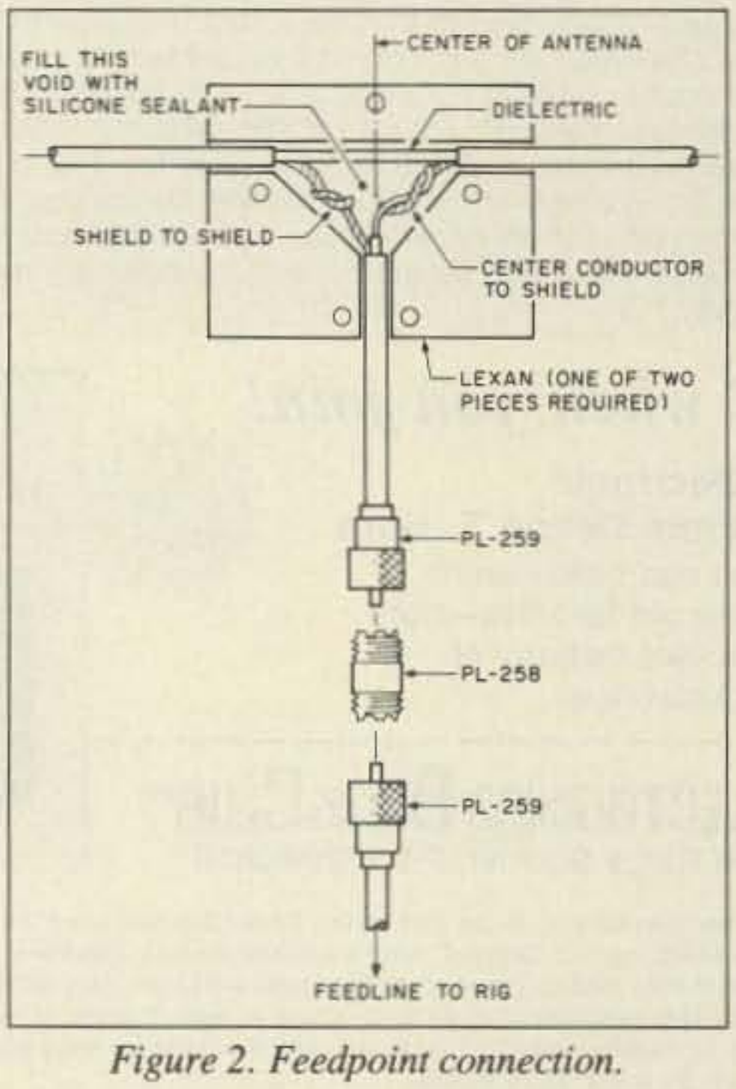

Figure 2. Feedpoint connection.

the coax at that point. Remove approximately 1" (2.5cm) of vinyl jacket from each of the ends, and fold back the shield so that the dielectric is exposed. Cut and remove about an inch of this dielectric, being careful not to cut the center conductor. Then, twist the shield and center conductor together and solder. Do this at both ends. It forms the 52 ohm matching section and balun.

Next, cut two lengths of coax, each 4' 1/2" (1.23 meters) long. Then remove an inch of vinyl jacket from all four ends, fold back the shield, remove the dielectric, and twist the shield and center conductor together as before. This forms the end sections of the antenna. Attach one of these end sections to one end of the matching section by twisting together the prepared ends and soldering. In the same fashion, solder the remaining end section to the other end of the matching section. If you plan to install this antenna in an attic or outdoors, waterproof these joints as best you can. This will prevent any moisture from seeping in and deteriorating the coax. An easy method is to use heat-shrink tubing over the joint, heating it until it shrinks snugly, then wrapping it tightly with black vinyl electrical tape. Waterproofing the ends will come later, as they may need trimming for tuning purposes.

Attaching the Feedline

Refer to Figure 2. A short length of coax approximately 12" (30cm) long will do, providing it is of the same type used for construction of the antenna. Remove about 1" (2.5cm) of vinyl jacket from one end, fold back the shield, and remove the dielectric, being careful once again not to cut the center conductor. Form two leads with the shield and center conductor. At the feedpoint of the antenna, connect this feedline by soldering the feedline center conductor to one of the feedpoint leads. Then solder the feedline shield to the remaining lead. Waterproof this area if desired, being sure that the feedpoint leads do not touch each other and short out. One method is to cut two pieces of 1/4" (6.5mm) thick Lexan or similar material into a 3" x 4" (7.5cm x 10cm) shape.

Using a router or hand chisel, remove enough of the material inside each half so that it will make for a snug fit over the feedpoint. Fill this area with silicone sealant such as RTV prior to sandwiching the halves together. Drill holes through both pieces at a few locations to allow for several screws, nuts, and lockwashers to hold the unit tightly together. Drill a hole at roughly the center top portion of this insulator block so that a small nylon rope may be passed through it for supporting the center of the antenna later. At the opposite end of the feedline, attach a PL-259 connector and a PL-258, also called a barrel connector. Then prepare a random length of

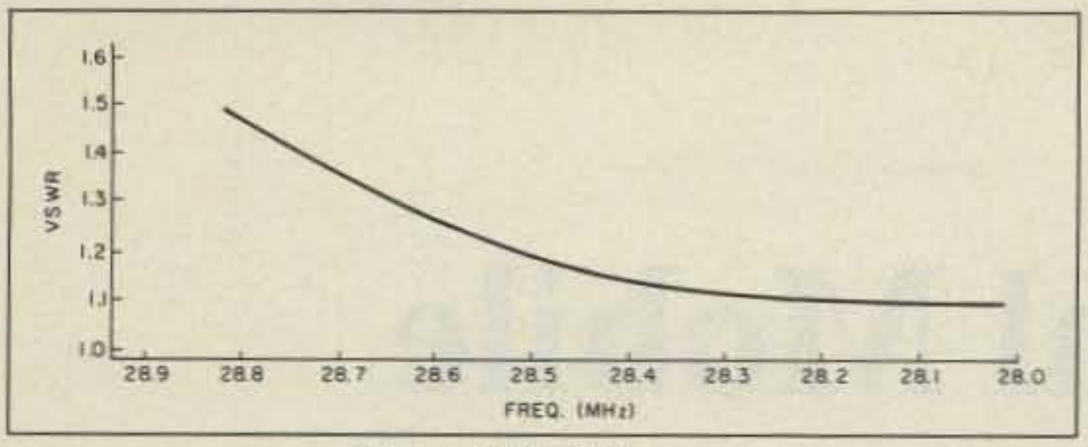

Figure 3. VSWR curve.

coax long enough to reach from the antenna to your rig and attach PL-259s to both ends. This will allow you to easily switch from one antenna to another, if desired, merely by unscrewing the feedline and attaching it to another antenna of your choice.

Erecting the Antenna

In choosing a location, be sure to allow enough room for an additional element running parallel to and approximately 4′6″ (1.4 meters) away from the antenna. It should also be oriented in your favorite direction, as indicated by the arrow in Figure 1. An attic or crawl space will provide ample room in most cases. Try to erect as much of it as possible in a straight line, keeping it as far away from large metal objects as feasible. The ends may hang down as long as they don't touch any nearby metal objects. Monofilament fishing line tied in a series of half-hitches along the vinyl jacket ends of antenna will do nicely for anchoring it. The line will bite into the vinyl as it is pulled taunt.

If you don't have an attic or access to one, the antenna may be stapled to a ceiling with plastic cable ties or any other non-conducting material as support. Wrap the cable ties around the antenna at intervals and staple the free ends of the ties to the ceiling. Do not staple directly through the antenna itself. Again, the ends may hang down if need be, providing they don't touch any nearby metal objects.

Tuning the Antenna

After erecting the antenna, check VSWR and trim the ends if needed, keeping track of the total amount trimmed. I used a design frequency of 28.5 MHz for tuning purposes. Be sure to twist the ends of the antenna as before (shield to center conductor), then recheck VSWR. The antenna will interact with any hidden wiring in the walls or ceiling, so a considerable amount may have to be trimmed from each end. Try to achieve a preliminary VSWR of 1.5:1 or 1.6:1 at the design frequency of your choice. This completes construction of the coaxial dipole at this point, so now we'll call it the driven element, and continue its transformation into a 2-element beam antenna.

The 2-element Transformation

The reflector element which we'll add requires only another length of coax, the same type used for construction of the driven element. To determine the length of the reflector, note the total amount, if any, trimmed from the driven element (you did keep track, didn't you?). Subtract this from the total starting length of 17′3″ (5.25 meters) to derive the actual length. This is the length required for the reflector element.

Cut a new length of coax to that dimension and prepare each end as you did with the driven element, then twist together as before (shield to center conductor). Erect this element in the same manner, being sure to align it parallel to the driven element and centered as best as you can so that an equal amount from each end extends beyond the ends of driven element. It should be placed 1.4 meters 4′6″ (1.4 meters) behind driven element for 0.13-wavelength spacing, or 9 feet (2.8 meters) for 1/4-wavelength spacing if you have the room for it. A slightly better front-to-back ratio will result. I had to use 0.13-wavelength spacing because of limited ceiling space, but it still provides overall good performance.

Now, check the VSWR again. You may find that it has risen from the last check, so trim the ends of the reflector element as needed, making sure you trim the same amount from driven element ends at the same time. Final VSWR checks run on the antenna at my QTH gave the results shown in Figure 3. Once you have gotten the VSWR down to an acceptable level, solder all four ends of the antenna and waterproof them if desired. This completes construction.

On-the-Air Results

Comparing the beam antenna to a coaxial dipole, there was a definite increase of 2 S-units, indicating a moderate gain of 5–6 dBd. Front-to-back ratio is not very much, so contacts off the back should be of sufficient signal strength for solid copy both ways. Should you desire to change direction of the antenna 180 degrees, you can convert the reflector element to a director element simply by trimming the ends so that it is 5% shorter in length than the driven element.

This is especially handy on 10 meters when winter European DX fades and summer South American DX predominates. If you like to experiment, a third director element 5% shorter than the driven element can be added for additional gain and front-to-back ratio. Or perhaps a 15 meter beam would appeal to you. Experiment! The possibilities are varied and intriguing!

With this antenna in use at my apartment QTH for over a year, I've been able to work many areas of the world with solid copy both ways that previously weren't strong enough to copy on the dipole for a QSO. Stations have expressed amazement or total disbelief about my antenna, but also provided some very interesting QSOs! Once you start enjoying the pleasures of DXing from your apartment or condo with an indoor beam antenna, I'm sure you'll raise many eyebrows, too! Happy DXing. 73

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