Build a Broadbanded Pizza Pan Vertical

BY KENT BRITAIN,* WA5VJB

We start the column this time with a construction project. There are families of antennas known as "Ultra Wideband" antennas, with operating frequency spans of 10 to 1, or even more. This version is known as a *Planar Disk* antenna. The theory is pretty simple. The size of the disks determines the lowest frequency at which the antenna works, while the width of the gap between the disks determines its highest frequency. And while the term UWB, or "Ultra Wide Band," is new, this design goes back to the 1930s.

Start with a trip to your local 'dollar' store. You are looking for a pair of pizza pans 16 to 18 inches across. I find the steel ones with tin coating are easier to use than the aluminum ones. I guess you could drill some holes and screw in some solder lugs if you only have aluminum ones, but I can solder directly to the steel ones. You can use 14-inch pans, but the SWR is a bit high at 2 meters.

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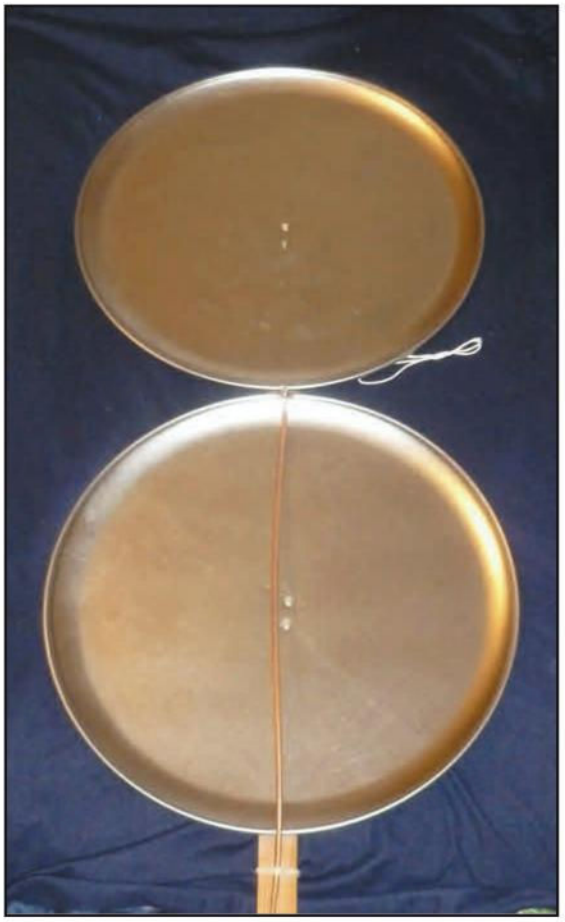


Photo A. A planar disk antenna … built from two dollar-store pizza pans!

Next, get a piece of wood and some screws, and mount the pans as close to each other as practical (see *Photo A*). A separation of 1/8- to 1/4-inch will work for these big pans. I find that putting a bit of construction adhesive between the pans and the wood makes the antenna a lot more stable. Or you could use more screws than I did. Now, solder your coax across the gap as I have done in *Photo B*. Center conductor goes to the top pan, shield to the bottom pan. Now add some tape or tie wraps to hold the coax in place and you're ready to go. Result? Just have a look at the sweep in Plot 1. On this scale, a -10 dB return loss is about a 2:1 SWR, and -20 dB return loss is about a 1.2:1 SWR, so the antenna has a 2:1 or better SWR from 2 meters through 2,000 MHz. How about a vertical that covers five ham bands! Great for those multiband rigs or use it with a scanner.

Mounting

With a bit of cord, I found it easiest to just hang mine from a beam in the attic as shown in *Photo C*.

If you plan to mount it outside, you will need to build it more stoutly and I highly recommend painting your planar disk. I find light gray spray paint works well to slow down the rust. It also makes the antenna a bit less visible to nosy neighbors. Be sure to use some silicon glue or putty to seal that open coax braid.

Antenna on Board

The pans were easy to use, but most any conductive material in a circle can be used. Which brings us to the next way to build them, on PC board. In *Photo D*, we have three versions. On the left are

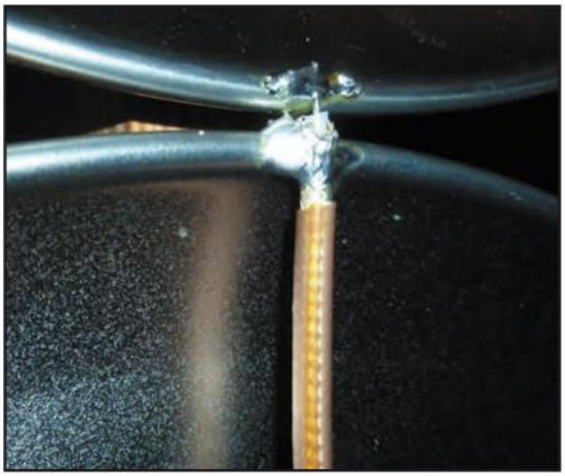


Photo B. Detail of coax connections to the planar disk. The center conductor goes to the top pizza plate; the shield to the lower one. Be sure to use some silicone sealant at the feedpoint if you're mounting the antenna outdoors.

the 2- to 26-GHz versions and on the right are two made for an AMSAT CubeSat. One of the planned birds wants a backup omni-directional antenna that covers our 5- and 10-GHz ham bands. The prototypes came out covering 4 to 26 GHz, and 26 GHz is really the limit for common SMA connectors. The left-hand small antenna is built on common PCB material, the right-hand one on space-qualified Arlon 25N material. The PCB material is so thin it has little effect on the frequency or loss of the antenna.

Want to Play?

I was so impressed by the 2- to 26-GHz version that I had the PCB house run off a big batch. They will be available at <www.wa5vjb.com> for $6 plus mailing. You will need to use your own coax. I like to use 0.085-inch semi-rigid coax, but any small Teflon®-insulated coax could be used. These should be great as test antennas on signal generators, spectrum analyzers, or SDRs. You can see the 1- to 26-GHz frequency response in Plot 2.

Repealing the Laws of Physics (Again)

This is one of those urban myths I had to track down. I have had three separate groups contact me about developing the same product. One offered me 30% of the stock in their start-up company if I would develop the antenna. Another guy had me sign an 8-page, non-disclosure agreement (NDA) before he would tell me what he wanted. *(In talking with a local judge, if the NDA wants you to do something illegal or in this case, impossible, the NDA is not valid.)* Oh, and the third guy just wanted me to make them.

All three wanted an antenna about the size of a QSL card that you pointed at a cell phone cell site, captured the energy out of the air, and used that energy to recharge your cell phone. I tried to explain microvolts per meter, but got that deer in the headlights response.

"OK, imagine you are in a coal mine," I tried to explain. "A half mile down a dark shaft is a 100-watt light bulb. How big a solar panel do you need to recharge a cell phone?" There is a common belief that all these RF signals passing around contain a lot of energy. But the available energy is millions of times less than what much of the public believes.

If you *do* want to experiment with RF energy harvesting, I suggest using the FM broadcast band. Those guys run some serious power and most urban areas have several of them. Maybe you will get enough to run a micro power

Photo C. I've got mine just hanging in the attic.

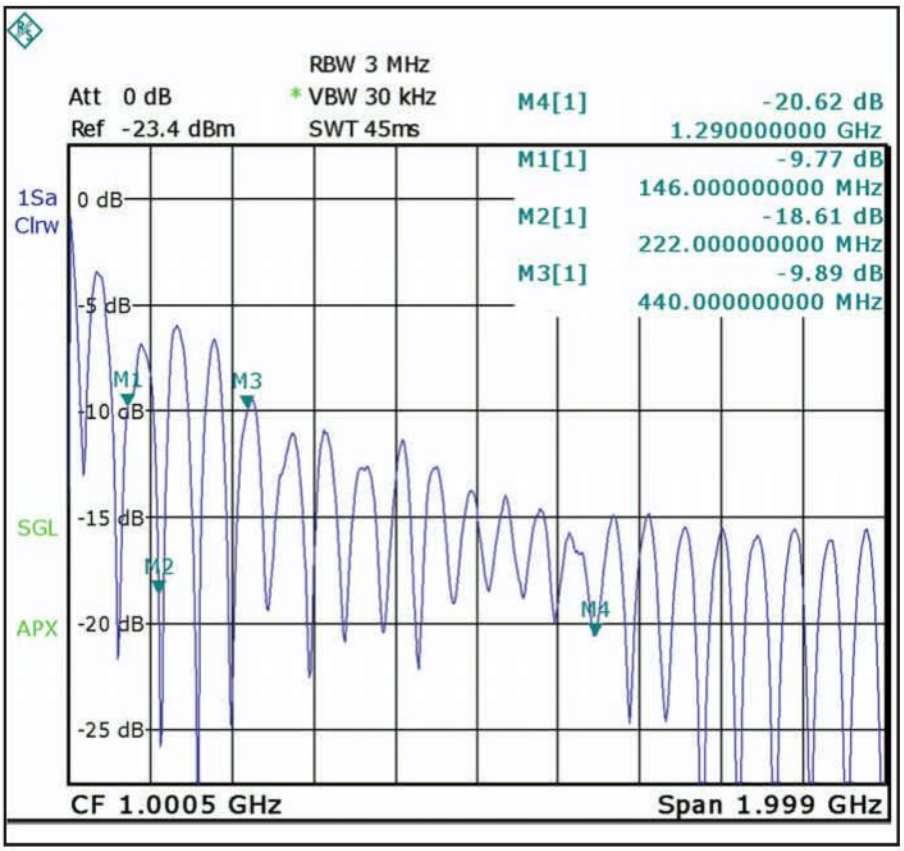
Photo D. Several 2- to 26-GHz and AMSAT 4- to 26-GHz planar disks.

PIC, but don't expect to even light a tiny LED unless you live under their tower!

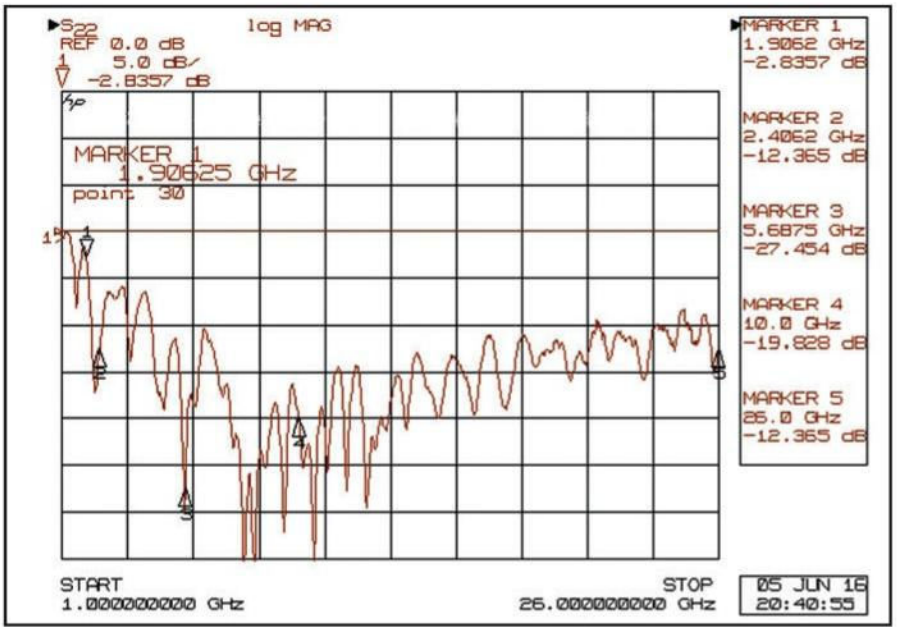
Keep the Ideas Comin'!

As always, you guys (& gals) provide some of the best ideas for column topics.

I'm working on an article on stacking dissimilar antennas, and one on dish feeds using common pipes and cans. Antenna topics and antenna questions are both welcome. Email goes to <wa5vjb@cq-amateur-radio.com> or snail mail to my QRZ.com address. As always, feel free to visit <wa5vjb.com> for more antenna articles in the reference section.



Plot 1. Frequency response of the 16-inch planar disk antenna.



Plot 2. Frequency response of the 2- to 26-GHz PCB planar disk antenna.