W5ZN Dual Band 10 GHz / 24 GHz Feedhorn

by

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Recent articles by Al Ward and I have previewed dual band feedhorn designs for 2.3 and 3.4 GHz as well as 5.7 and 10 GHz[1]. Our recent design work on 24 GHz equipment naturally prompted the next logical dual band design step – a 10 GHz / 24 GHz dual band feed.

Why a Dual Band Feed for 10/24 GHz?

If you have experienced operating on 24 GHz you know (if you haven't, you need to know) that antenna alignment with the other station is extremely critical, not only in azimuth but elevation as well. Even with a one foot dish, the beamwidth is so narrow that communication at distances of only 30 miles is difficult without the ability to properly aim the antenna before attempting communication. While antenna alignment is critical at 10 GHz, it provides a wider beamwidth to work with to accomplish accuracy for 24 GHz work.

The Design

While in Germany on business last year, I had a discussion with Erhard Seibt, DC4RH, about 24 GHz activity and distance achievement. Erhard told me of a design which is used regularly in Germany to reduce the complications associated with antenna alignment.

The design was a basic 10 GHz feedhorn made from a length of ¾" copper pipe with a WR-42 waveguide flange soldered to the pipe as the closed end. During my construction attempts, I experienced difficulty maintaining a clean non-soldered area on the flange waveguide opening while ensuring sufficient uniform contact with the end of the ¾" pipe. In addition, I was unable to obtain an acceptable return loss (SWR) on 24 GHz.

My modified design uses the basic10 GHz feedhorn idea utilizing a length of ¾" copper pipe, with modifications to the 24 GHz section. Rather than attempt to maintain a clean entrance area on the waveguide flange opening, I used an approximate one inch length of WR-42 waveguide with a flange on each end. This provides easier attachment to the ¾" copper pipe while maintaining an ideal flange entrance area. Also, the short length of WR-42 waveguide can be used for tuning by inserting a tuning screw if needed.

Construction Tips

- Construct the 10 GHz Waveguide section first by soldering the SMA connector and probe to the ¾" copper pipe.
- Next, solder a WR-42 waveguide flange to a 1" length of WR-42.

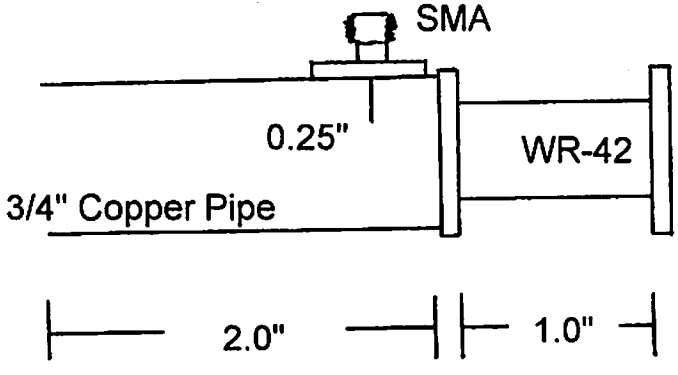
- Wrap a moist paper towel around the SMA connector, secure in place, then solder the flange to the copper pipe. The moist towel allows removal of heat in the connector area to prevent desoldering of the SMA connector while soldering the flange. Likewise, use vice grips to lightly clamp the WR-42 waveguide at the flange. This will provide support during the soldering process as well as prevent desoldering of the WR-42 waveguide section from the flange.

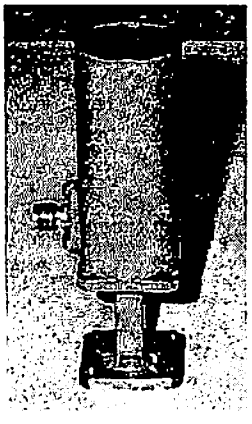
- Solder a flange to the other end of the WR-42.

- Check return loss. If necessary, tuning screws can be used on both the 10 GHz and 24 GHz sections.

I have obtained repeatable results in constructing this design of feedhorn. Return loss on 10 GHz has been >20 dB and > 16 dB on 24 GHz. I have used a tuning screw on 10 GHz, but it has not been necessary on 24 GHz. After cleanup, you can paint the feedhorn your favorite color.

Good luck on 24 GHz!





References:

1. Horns for the Holiday's, Joel Harrison, W5ZN, 31st Central States VHF Society Proceedings, 1997, Hot Springs, Arkansas and Microwave Update '97 Proceedings, Sandusky, Ohio.
2. Dual Band 5.7 / 10 GHz Feedhorn, Al Ward, W5LUA, 31st Central States VHF Society Proceedings, 1997, Hot Springs, Arkansas and Microwave Update '97, Sandusky, Ohio.