

Fwd: Dualband feedhorn

11 messages

Michelle Thompson

Sat, Nov 12, 2016 at 8:21 PM

To: Paul Williamson

----- Forwarded message -----

From: "Paul Wade"

Date: Nov 12, 2016 5:32 PM

Subject: Dualband feedhorn

To: "Michelle", "Mike N1JEZ"

Cc:

hi Michelle,

I think I have a good design for a dual-band feedhorn. Performance curves and dimension sketches attached. I drew it as two pieces, which is the way one would machine it to minimize the amount of aluminum to be removed.

I also, at Mike's suggestion, made a prototype of the body to actually measure isolation between the two ports. I finished machining it this morning, and hope to assemble and test it Sunday or Monday -- I'd like to have this wrapped up before Tuesday, which will probably put me out of action for a while.

Please review soon in case there are any questions.

Please consider this all preliminary and not for general distribution yet.

73
paul



dualband_feedhorn.zip

593K

Paul Williamson

Sun, Nov 13, 2016 at 9:30 AM

To: Michelle Thompson, Paul Wade, Mike N1JEZ

Cool!

I modeled your beautifully-drawn design up in Fusion 360, as a way to understand it better and as a step toward machining a copy here. I've attached a simple rendering of two views, with both pieces in place.

A few questions for clarification:

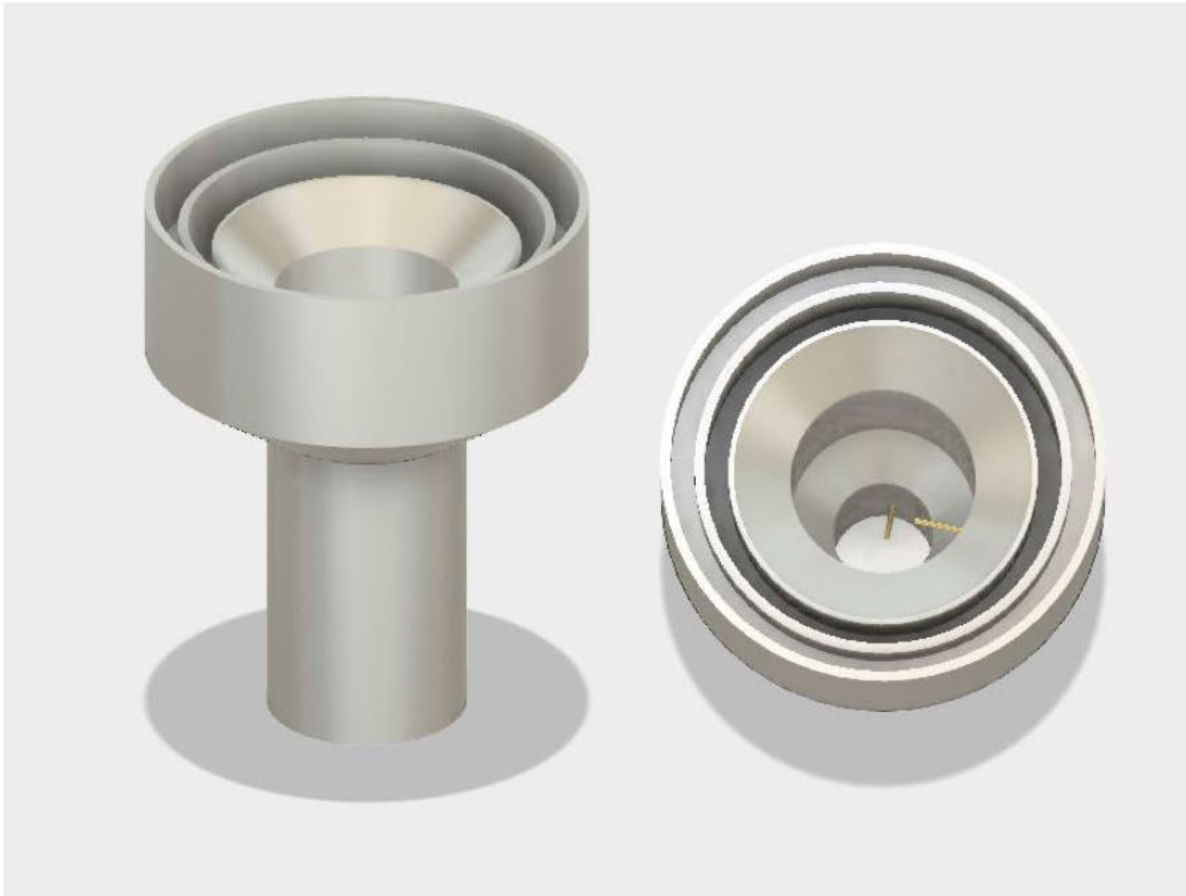
1. Should the top edges of the feed body be tapered to smoothly join with the taper of the horn? I guessed yes. The drawing shows the edges flat-topped, and doesn't specify exactly how it aligns with the horn.

2. Do you expect the bottom end plate to be integral with the feed body, or a separate bolted-on plate for access?
3. How do you envision the horn being attached to the feed body?
4. Do you envision using standard SMA connector with a four-hole square flange, like Amphenol 132146, or some other kind of connector?

I'd like to update my model with practical details like SMA mounting, horn attachment/alignment features, and a way to hold it in front of the dish. Some of these details may require changing the wall thickness of the feed body, I suspect.

How smooth do the tapered parts need to be?

73 -Paul KB5MU



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Paul Wade [REDACTED] Sun, Nov 13, 2016 at 1:59 PM
To: Paul Williamson [REDACTED]
Cc: Michelle Thompson [REDACTED], Mike N1JEZ [REDACTED]

answers inline

On Sun, Nov 13, 2016 at 12:30 PM, Paul Williamson [REDACTED] wrote:
Cool!

I modeled your beautifully-drawn design up in Fusion 360, as a way to understand it better and as a step toward machining a copy here. I've attached a simple rendering of two views, with both pieces in place.

A few questions for clarification:

1. Should the top edges of the feed body be tapered to smoothly join with the taper of the horn? I guessed yes. The

drawing shows the edges flat-topped, and doesn't specify exactly how it aligns with the horn.

I drew it with a flat edge on the body, just to simplify machining, with the edge even with the horn taper. if it were one piece, I'd just extend the taper.

2. Do you expect the bottom end plate to be integral with the feed body, or a separate bolted-on plate for access?

no real need for access, but it might be useful to have it separate as a mounting plate. again, easier to machine a thru hole and use a reamer to make it smooth

3. How do you envision the horn being attached to the feed body?

sliding fit with a couple of set screws.

4. Do you envision using standard SMA connector with a four-hole square flange, like Amphenol 132146, or some other kind of connector?

yes, a four-hole square flange with a long pin

I'd like to update my model with practical details like SMA mounting, horn attachment/alignment features, and a way to hold it in front of the dish. Some of these details may require changing the wall thickness of the feed body, I suspect.

of course, add whatever features needed. one possibility is to start with 1-3/4 inch square aluminum for the body, so the 5G connector mounts right to the side. the horn end would be turned down, and the other end relieved for the 10G connector

How smooth do the tapered parts need to be?

the tapers inside should be reasonably smooth. if 3D printing, that would be an interesting test, but a few mils roughness shouldn't be bad

since there is a fair amount of aluminum in a machined version, I'd imagine it would be much more cost-effective to print or die-cast in any reasonable volume

73 -Paul KB5MU

73

paul

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Paul Williamson

Sun, Nov 13, 2016 at 8:38 PM

To: Paul Wade

Cc: Michelle Thompson, Mike N1JEZ

Are the probe lengths considered exact, or do they need to be made long and trimmed in place?

A long pin SMA (at least the one I found) has 17.87 mm between the flange and the end of the pin. For the 5 GHz probe, that leaves $17.87 - 12.5 = 5.37$ mm. I'm thinking 5mm is a good depth for machine screws in aluminum, and we don't want them to poke through, so we have basically nothing to spare. If the probe length of 12.5mm is exact, I'd consider machining the wall exactly 5.37mm thick (on centerline) so the SMA pin does not need to be trimmed at all. It wouldn't be hard to arrange for that trick to work for the 10 GHz probe as well.

On the other hand, if we need to be able to trim the probe in place, the wall will have to be a bit thinner than I'd like, by however much extra length we need to allow.

By my arithmetic, 1.75" square stock wouldn't be big enough unless it were turned off center, and then it would be a tight squeeze. It's an interesting idea to start with square stock, though. I was assuming we'd start with round stock

and mill some flats where the connectors go.

If the machining effort doesn't matter (because CNC) is it preferable to have the slot walls square topped (as drawn) or tapered?

-Paul KB5MU

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Paul Williamson [REDACTED]

Sun, Nov 13, 2016 at 10:08 PM

To: Paul Wade [REDACTED]

Cc: Michelle Thompson [REDACTED], Mike N1JEZ [REDACTED]

Here's what it might look like if everything is round and diameters are chosen to avoid trimming the SMA pins.

It could be a little lighter if we reduce the diameter at the bottom and trim the 10 GHz SMA pin. It could be lighter still if we machine non-round shapes on the body. The horn could also be made a lot less massive. I'm not sure if the weight matters.

I haven't yet investigated how the feed should mount to the dish.

Bare minimum stock for this design: 4" of 2" round stock, and 2" of 4" round stock. That's about 3.75 lbs of stock, which is how my local metal supply charges, but they don't post their price/pound online. Taking pricing from onlinemetals.com and assuming a 4-foot purchase, that's \$13.40 of aluminum stock per feed. That's more or less independent of design changes, unless length needs to be added for mounting. The aluminum is cheaper than the two SMA connectors.

-Paul KB5MU



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Mon, Nov 14, 2016 at 3:15 AM

Paul Wade [REDACTED]

To: Mike N1JEZ [REDACTED]

Cc: Paul Williamson [REDACTED], Michelle Thompson [REDACTED]

Mon, Nov 14, 2016 at 1:56 PM

>Bare minimum stock for this design: 4" of 2" round stock, and 2" of 4" round stock. That's about >3.75 lbs of stock, which is how my local metal supply charges, but they don't post their >price/pound online. Taking pricing from onlinemetals.com and assuming a 4-foot purchase, >that's \$13.40 of aluminum stock per feed. That's more or less independent of design changes, >unless length needs to be added for mounting. The aluminum is cheaper than the two SMA >connectors.

that's a whole lot of CNC machining, which would cost more than connectors and Aluminum.
fine for prototype, but not great for volume.

my experience with pin length is that they work pretty repeatably when cut to length.
when folks are left to trim them, they start way too long, then give up because it looks so bad -- and that assumes test equipment.

I ran measurements on my prototype (body only). plots and a couple of quicky cellphone photos attached. isolation is > 70 dB, which is the noise floor of my VNA - it didn't change with averaging, so the measurement is just noise.

Isolation at 10 GHz is 40+ dB, probably mostly cross-polarization.

Return Loss is pretty much as expected at 5.8, not as good at 10.4. At 10.4, the termination on the 5.8 probe has an effect. Both will probably change with the horn, so no point in fine tuning the probes until then.

Mike, if you want to pick up the prototype and play with it, I'll leave it on a chair in my shack so you can find it if I can't get down the stairs.

73

paul

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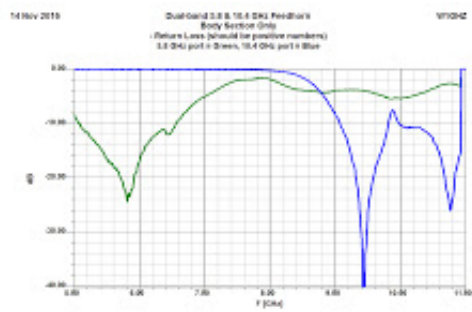
4 attachments



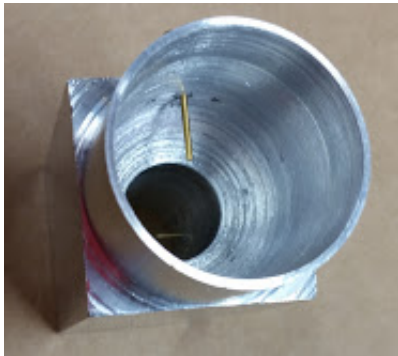
Dualband-510_backview.jpg
665K



Dualband-510_body_isolation.jpg
267K



Dualband-510_body_ReturnLoss.jpg
319K



Dualband-510_frontview.jpg
305K

Paul Wade

Tue, Nov 15, 2016 at 1:18 PM

To:

One more thought - the mounting should be rotatable in polarization, to align with satellite from different latitudes and to enable terrestrial work on both bands.

73

paul

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