http://www.qsl.net/dl4mup/Septum/RWST.htm

Rectangular Waveguide Septum Transformer (RWST) Feed Construction Notes for 23cm and 13cm versions

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These notes have been written to provide more detailed constructional information to augment the paper presented by Zdenek, OK1DFC, at EME 2002 in Prague. Zdenek's paper should be read for an understanding of how the feed works, some examples of measurements and comparisons against VE4MA/W2IMU circular feeds.

These notes also apply specifically to the implementation that I decided to use – there are other ways of fabricating the metalwork, and comments made here may or may not be applicable!

Basic Design

I decided to fabricate the square outer tube in two equal U sections, with a short(13mm) flanges on the top of each leg of the U, so that the two halves can be bolted together. The septum plate was to be cut from a single sheet, and 10mm wide spacing pieces of the same thickness were to be inserted between two casing halves in front of the septum plate. A thick back plate would be used, for two reasons:

- A thread can be cut in it for the tuning screws, so that only a locking nut is needed externally, and
- The back plate can be mounted by drilling and tapping into the edge of the plate

All parts were fabricated from aluminium, with the exception of the tuning screws and feed monopoles. All dimensions were taken from the Excel spreadsheet provided by Zdenek. 3mm stainless steel machine screws would be used for all fixings. For other constructional dimensions see the appropriate tables below.

Marking Out & Assembly

1. First take the two halves of the casing and check the bending dimensions. Check that this is consistent at each end of each half, and decide how the two halves will be aligned with each other – small errors in the distance and the degree of bend can be compensated for by deciding the orientation of the two sections against each other - once you have decided the best fit, mark the two sections carefully to identify the mating points. Also decide which will be the back of the feed – I decided to make this the end that presented the most accurate set of angles and distances.
2. Mark a line along each flange 6mm from the edge, for the whole length of the flange. Measuring from the back of the feed, mark out the holes for securing the sections together.
3. Drill all points 3mm
4. Using 4 screws and nuts, fasten the two sections together at the back and front most holes only. Carefully correct any slight mis-alignment of the remaining holes with a needle file.
5. Now take the septum plate. Mark out the drilling lines, allowing for the overlap on each side of the plate.
6. Allowing for the thickness of the back-plate, use the data from the table to mark the drilling positions for the holes.
7. Separate the two halves of the cavity. Lay the drilled septum plate on upturned half and check the hole alignment. Again, put the second half in place, and fix with two screws at the back – one each side. Put another screw into the hole at the front of the septum, and then re-check the alignment of all the holes, adjusting as necessary.
8. Similarly, mark out the spacing pieces and fit.
9. Using the assembled cavity as a guide, offer up the back plate and check whether any fine shaping is required to get a good fit into the back of the cavity. Once a good push fit is obtained, mark out and drill the plate – a 5mm plate will take carefully centred and

drilled 3mm threads – use a 2.5mm drill. I used 4 screws along each side, equally spaced about the centre line. Tap all holes.

10. Also mark out the holes for the two tuning screws in the back plate. Drill these and tap M6.
11. Decide on the connectors you will use for the Tx and Rx ports – I used SMA for Rx (to minimize the no of adaptors etc in connecting a relay and preamp) and 7/16 for Tx, to handle the power.
12. Referring to the diagrams in Zdeneks presentation, mark the sides of the cavity for the Tx and Rx connectors. Remove the sides of the cavity and drill for the connectors.
13. Make up the tuning screws – I used M6 x 50mm brass screws, and soldered a 15mm brass disc to the head. A slot was cut in the other end to aid adjustment.
14. Once re-assembled, the feed is ready for setting up!

Dimensions Tables

WG thickness	2	Screw length – backplate fixing	6	Hole spacing for back plate mounting	40
Septum plate and spacer thickness	1.5	Spacing across WG - internal	144.9	Tuning screw spacing from side of cavity	30
Back Plate thickness	5	Offset from back of WG to first screw	15	Diameter of tuning disc	15
Screw length- WG sections	10	Subsequent hole spacing	60		

Table 1 -23 cm dimensions -all dimensions in mm

WG thickness	1	Screw length – backplate fixing	6	Hole spacing for back plate mounting	20
Septum plate and spacer thickness	1	Spacing across WG - internal	82	Tuning screw spacing from side of cavity	15
Back Plate thickness	5	Offset from back of WG to first screw	25	Diameter of tuning disc	screw head only
Screw length- WG sections	6	Subsequent hole spacing	30		

Table 2 -13 cm dimensions -all dimensions in mm

Setting Up and Measurements

The following comments apply to 1296MHz – for 13cm band measurements follow the same procedures; results should be similar.

I used a sweeper and network analyzer for my initial measurements, although a signal source and an SWR bridge will do! Mount the feed so that there are no obstructions in front of it, and connect the signal via the bridge to one of the ports. Carefully adjust the tuning screw for minimum SWR – with care an SWR better than 1.1:1 should obtained. Now repeat on the other port. On both ports I have been able to establish a VSWR of better than 1.07:1 – a return loss in excess of 30dB. Remember to lock the tuning screw in position with an M6 nut once the best match is obtained.

There are no more adjustments – just checks to confirm that the feed is working correctly:

Isolation between the ports should be around 27dB. Feed a signal of a known level into one port, and measure the power level present on the other port.

Check the circularity of the feed by using a linear antenna (dipole) and a power meter. Feeding low power 1296MHz signal to either port of the feed, measure the power level received via the dipole. Now rotate the dipole through 90 degrees to the other polarisation, and measure the power level – it should be within 1.1dB of the first measurement. Now slowly rotate it back to the first position, and watch that the level stays within about 1 dB of the orthogonal power measurements.

Using the Feed

Remember that the feed has a beamwidth of about 130 degrees – so is best suited for dishes of around 0.35 f/D. You will need to experiment with choke collars and /or flaring of the mouth of the feed to properly illuminate other sized dishes.

References

[1] Feed for Parabolic Dish with Circular Polarisation – Zdenek Samek OK1DFC: 10th International EME Conference, Prague, August 2002

[2] Analysis of the OK1DFC Septum Feed – Paul Wade W1GHZ; DUBUS 1/03