

Spline Feed Horns for the STEAMR Instrument

Arvid Hammar^{*,†}, Yogesh Karandikar^{*}, Per Forsberg^{*}, Anders Emrich^{*} and Jan Stake[†]

^{*}Omnisys Instruments AB

August Barks gata 6B, SE-42132 Västra Frölunda, Sweden Email: arvid.hammar@omnisys.se

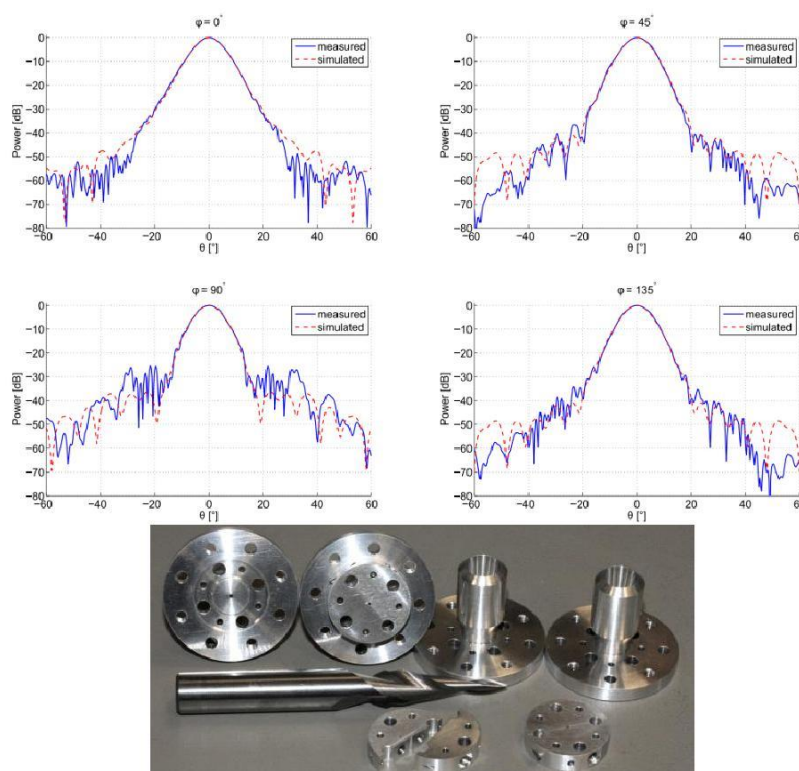
[†]Terahertz and Millimetre Wave Laboratory

Department of Microtechnology and Nanoscience – MC2

Chalmers University of Technology, Göteborg, Sweden

A smooth walled spline feed horn antenna at 340 GHz for STEAMR [1] has been designed, manufactured and measured using a planar near-field scanner. The design was based on a method which, for a certain desired beam waist, can be used to optimize the horn profile for high Gaussicity and ultra-low sidelobes. A beam waist of 1.9 mm over the band 323-357 GHz with Gaussian coupling efficiency exceeding 98% and cross-polar sidelobe levels below -28 dB was achieved in the simulations. In order to avoid de-focusing losses, the horn design was optimized so that variations of the waist location inside the horn aperture were minimized. Simulations reveal a variation less than 0.8 mm over the operating frequency band. The feed horns were manufactured by drilling out the spline profile from a solid metal block using a custom-made broach. This method is cost effective and ensures high repeatability.

Phase and amplitude of the feed horns were measured in a plane located approximately 70 mm from the horn aperture. The results show a Gaussicity of approximately 97% and a waist radius of 1.9 mm located 11.8 mm inside the antenna aperture.



Figures showing beam patterns in four different cuts from measurements (solid lines) and simulations (dashed lines) and a photo of four prototype feeds, rectangular to quadratic waveguide transitions and the custom-made broach used for manufacturing the feeds.

References

1. K. Kerridge, M. Hegglin, J. McConnell, D. Murtagh, J. Orphal, V. Peuch, M. Riese, and M. v. W. (2012, feb), Report for mission selection: Premier, esa sp-1324/3. [Online]. Available: http://esamultimedia.esa.int/docs/EarthObservation/SP1324-3_PREMIERr.pdf