Centro de Astrofísca y Tecnologías Afines

Band 1 iniciative at the U. Chile MM-Wave Laboratory

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History

•The main objective of the mm-wave Laboratory is to lead the development of astronomical instrumentation in Chile.

•Its main project is the development of Band 1 technology for ALMA.

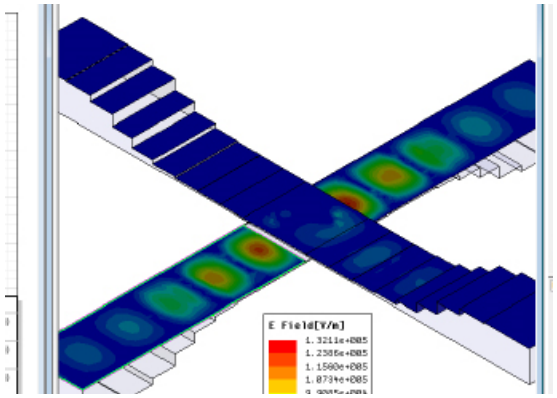
•The Band 1 initiative was funded by the Chilean government for the period 2008-2012, as part of a Center for Astrophysics and Associated Technologies. Funding may be renewed for 5 more years.

•Synergies with ALMA:

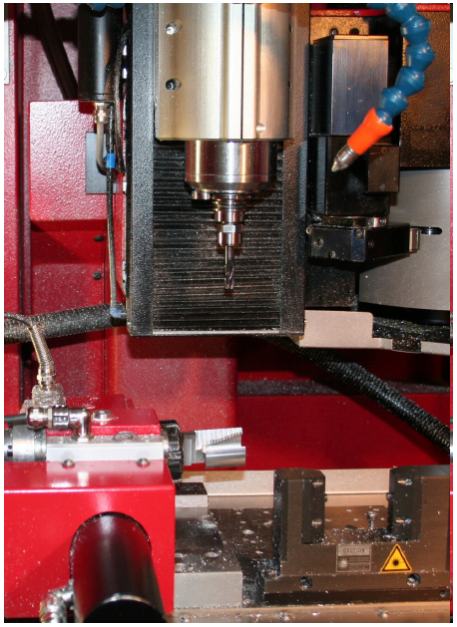
- •As we are an University laboratory, we are providing hands-on training with state-of-the-art projects to engineering students.
- •The laboratory can contribute to the development of instrumentation for ALMA.

Facilities

- Simulation: High Frequency Structure Simulator (HFSS), Ansoft Designer
- Prototyping: High precision CNC machine.(accuracy 1um, 40.000 rpm, 5 axes)



W-Band coupler



5 axes CNC machine

Facilities

- Testing: RF Equipment (including a 50 GHz VNA)
- Cryogenic equipment (ALMA Test Cryostat, NAOJ)

Vector Network Analyzer

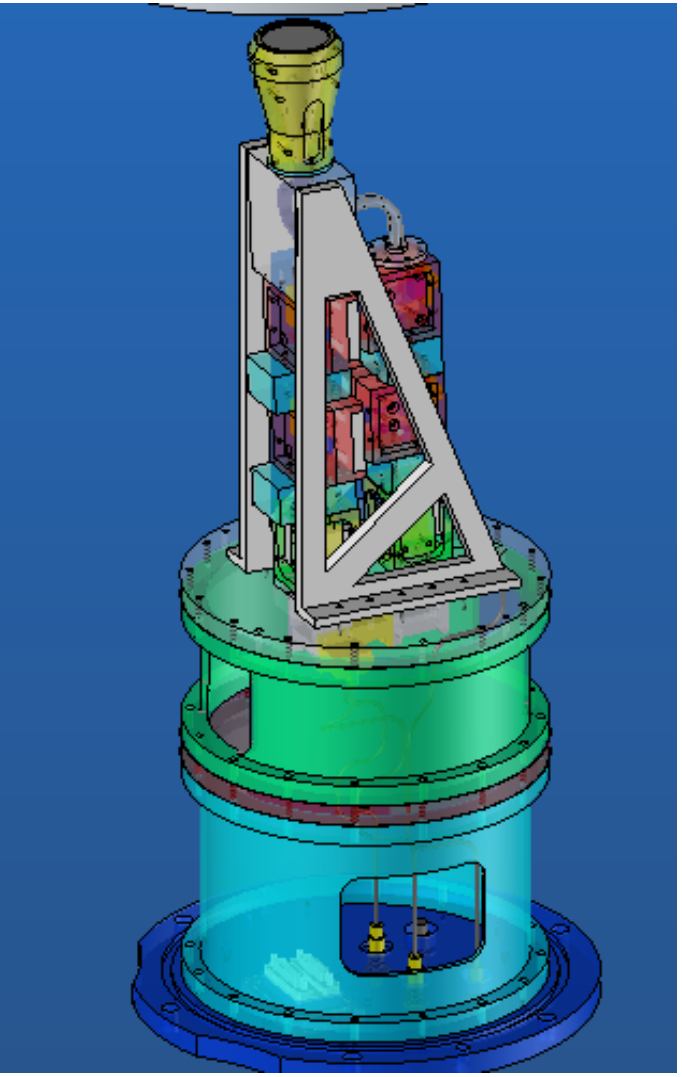
ALMA test cryostate

Current Personnel

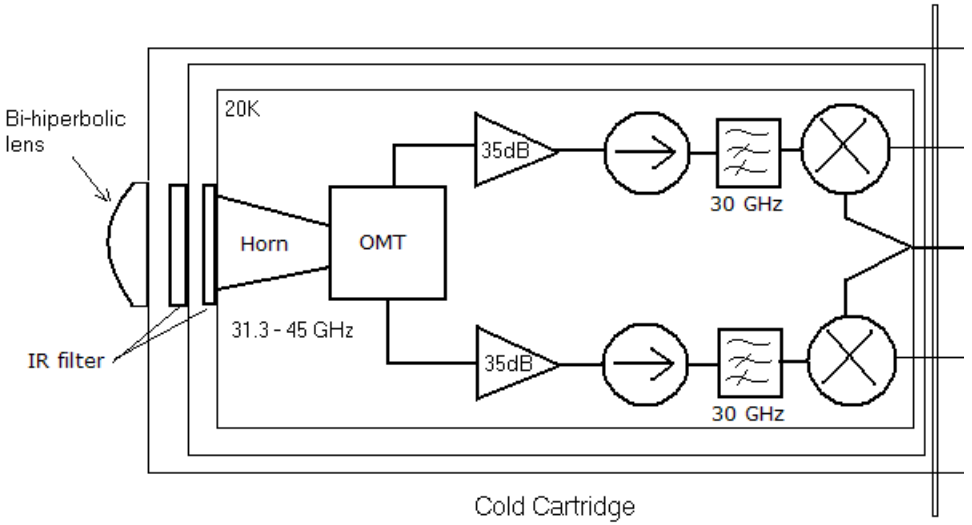
- 2 Professors (P. Mena, Eng. & L. Bronfman, Ast.)
- 3 Engineers, 1 Professional Technician
- 4 Graduate Students, 5 Undergraduates.
- Close collaboration with Photonics lab (10 more people)

Celebration of 50 years of Radio Astronomy in Chile (2009).

Projects: Band 1

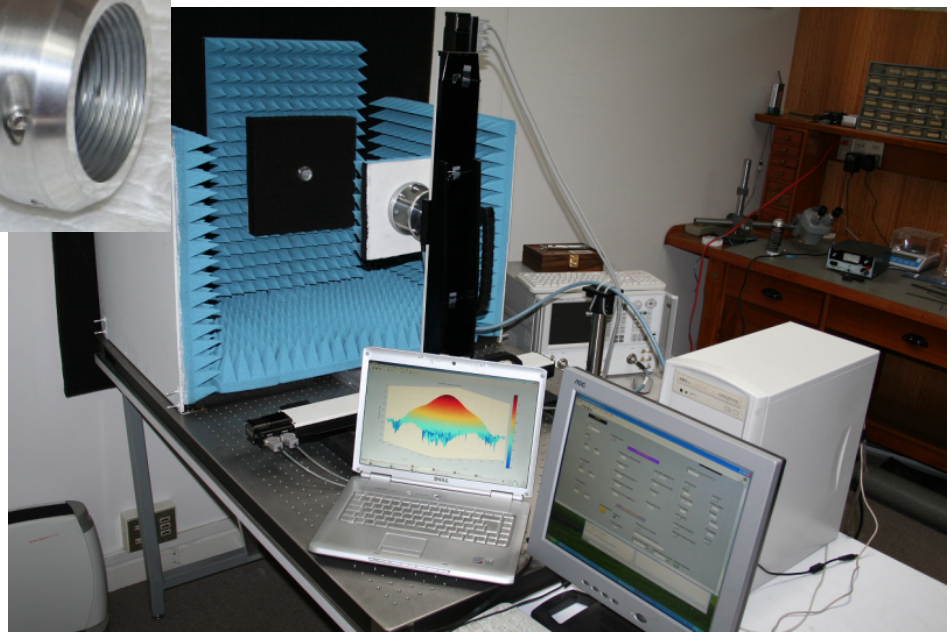


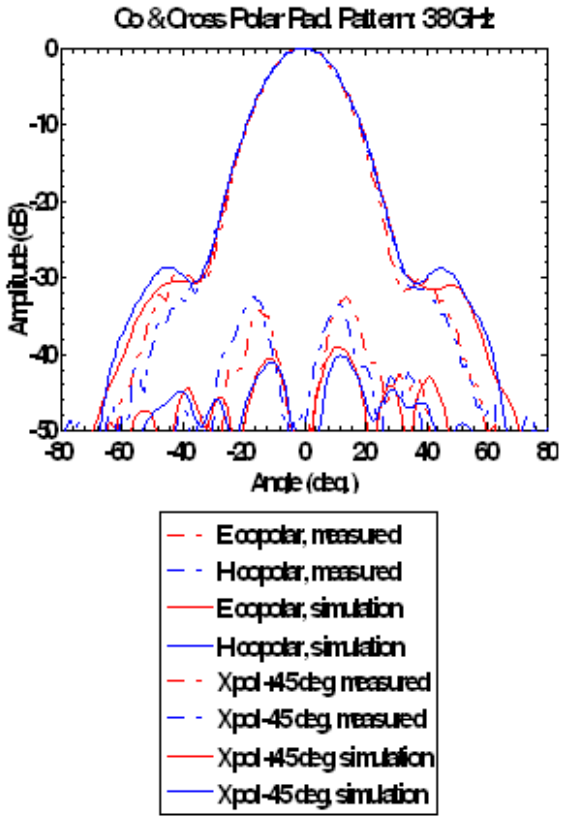
- The main project is the development of Band 1 technology.
- We are in a close collaboration with HIA and ASIAA.
- Several components for a prototype receiver have been designed and tested in the Lab.



Projects: Band 1

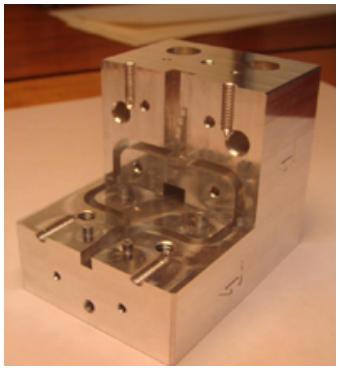
- A corrugated spline horn, was designed by Pablo Zorzi as part of his PhD thesis
- This is a more compact solution than the standard corrugated horn.

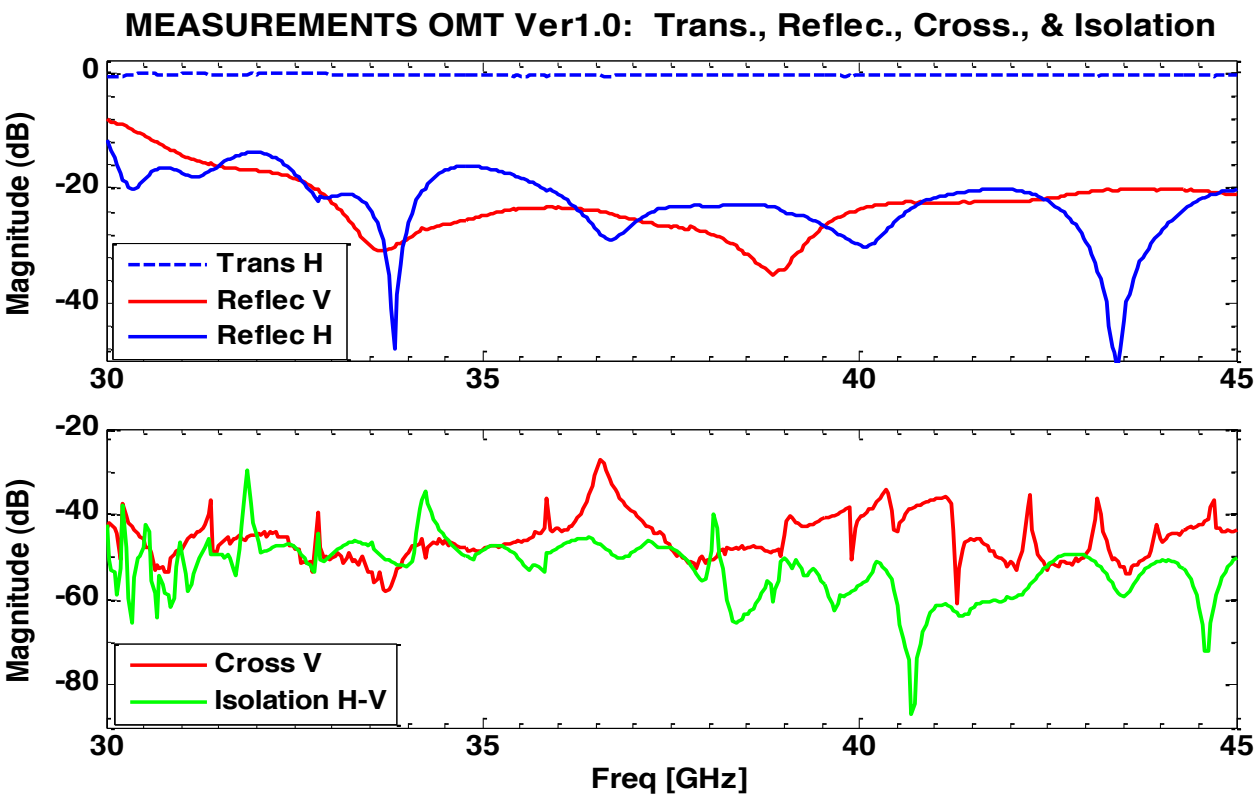




Projects: Band 1

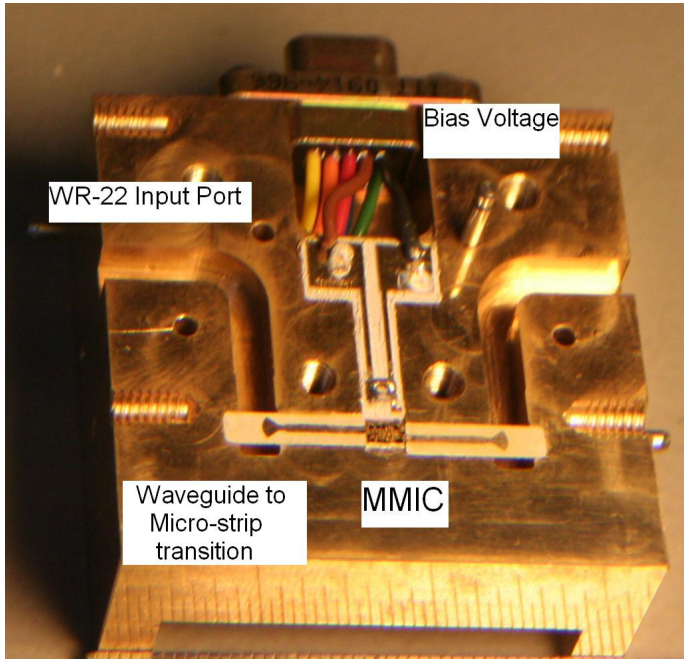
•A double ridge OMT for Band 1, based on Asayama design for Band 4 and 8.

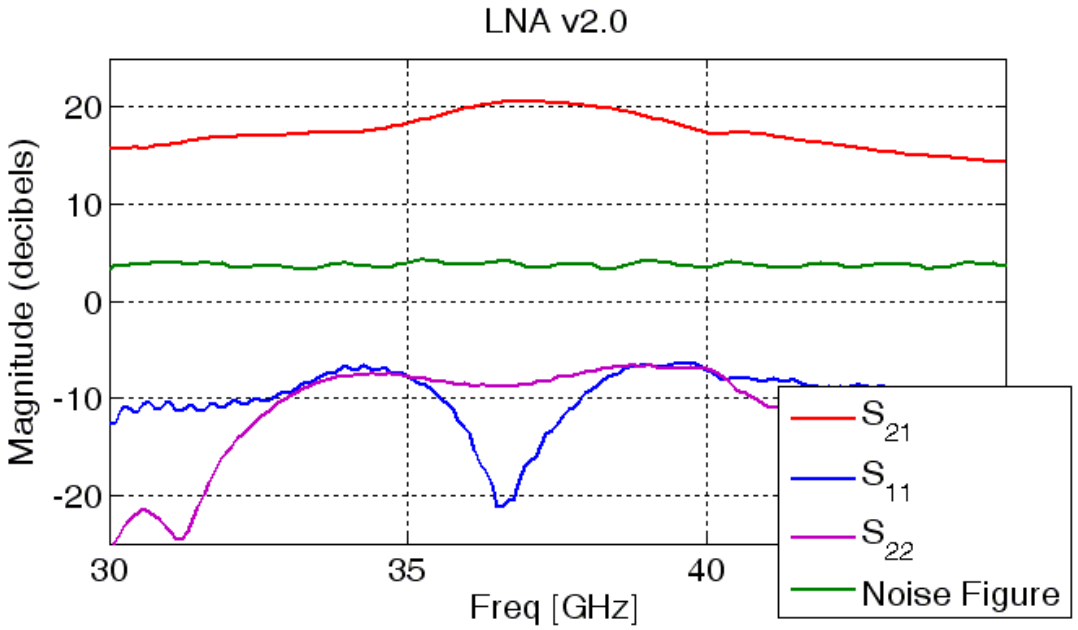




Projects: Band 1

- First LNA based on commercially avalaible MMICs.

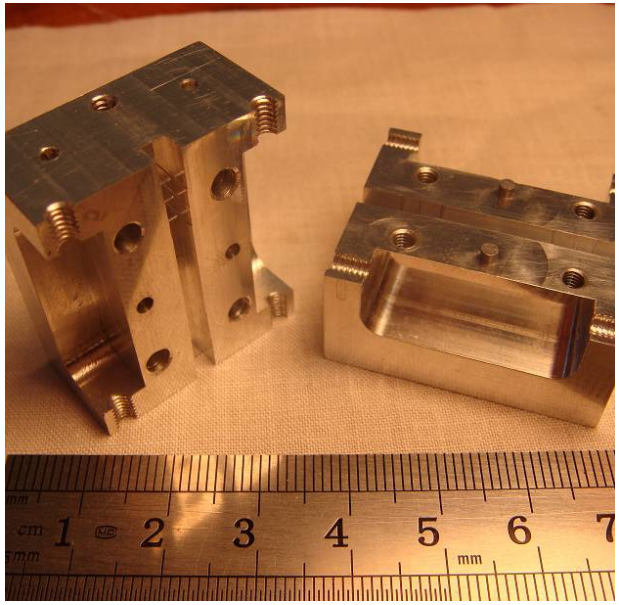


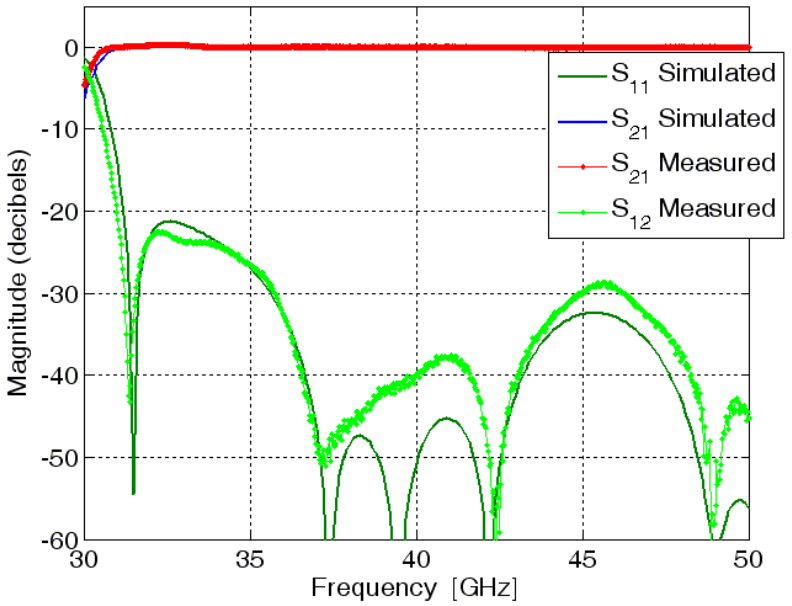


- Second LNA based on hybrid design under fabrication, as part of N. Reyes Thesis.

Projects: Band 1

- A high pass filter to reject the low side band was designed.
- Rejection better than 20 dB.





- Isolators, mixer and IF amplifier: Testing available commercial solutions.

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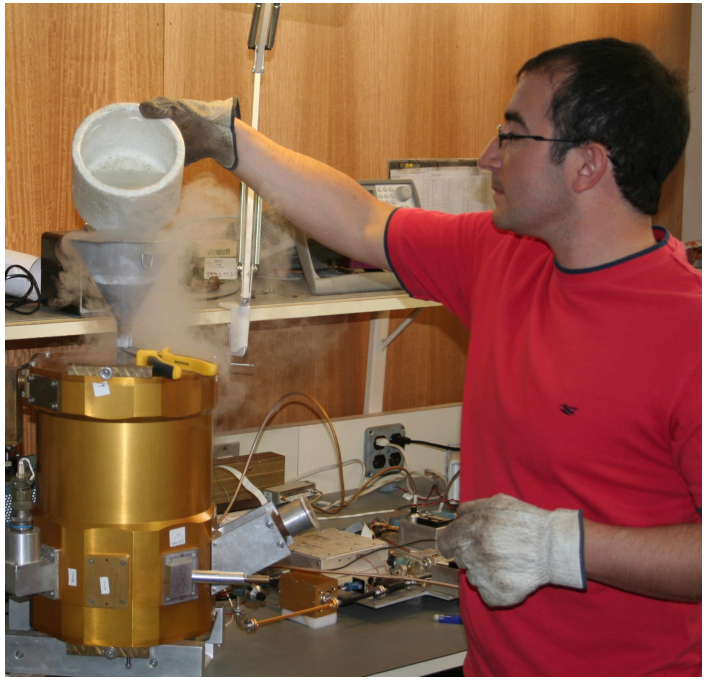
SUMMARY

- Setting up of a mm-wave laboratory and a workshop.
- A team has been formed and many students trained.
- Conceptual design of an ALMA Band 1 prototype receiver achieved.
- OMT, Horn, and LNAs, have been designed, fabricated and characterized.
- Synergy between Astronomy and Engineering driven by ALMA installation in Chile.

Projects: Mini Telescope

- We are starting to operate a 3mm telescope (1.2m) at our campus in Santiago.
- The telescope was moved from cerro Tololo were it operate from 1982 to 1998. Modifications of the receiver and LO technology were done at the lab.



Projects: Band 5

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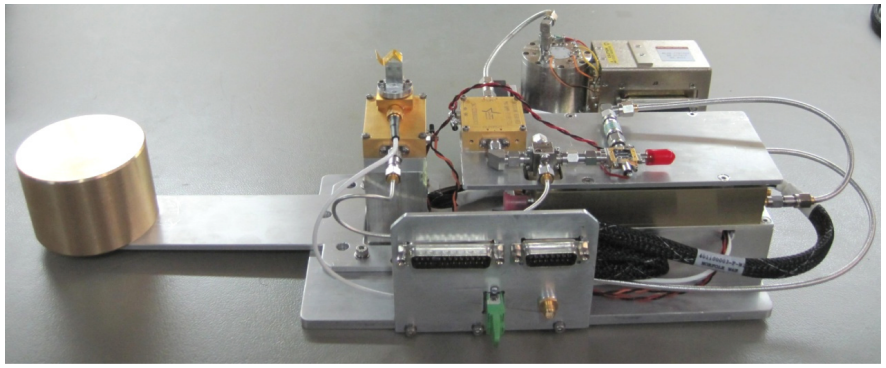
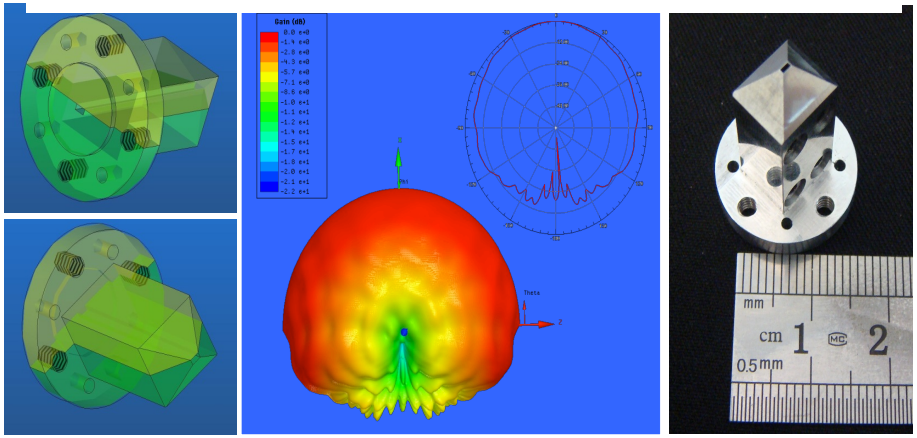
- One of our engineers is working in the Band 5 project. He participate in the test setup for Band 5 at GARD and now at RAL. Test source for Band 5 was built at our lab.





Projects: Band 9

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- Collaboration with SRON in the upgrading of the Band 9 mixer .