

The IVS Technology Development Center at the Onsala Space Observatory

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Abstract

During 2006 the technical development at the Onsala Space Observatory concentrated on a satellite tracking module for the VLBI field system, a new S/X-receiver for the 20 m telescope, and maintenance of the two microwave radiometers at the observatory.

1. Development of a Satellite Tracking Module for the VLBI Field System

As part of a master's thesis project a satellite tracking module for the VLBI field system (FS) was developed during 2006. The idea is to use satellites that transmit in X-band as radio sources for pointing measurements with radio telescopes. For that purpose, it should be made possible to track satellites directly with the FS and run the command 'fivepoint' during a satellite pass. The need to do such pointing measurements on X-band satellites came from the radio telescope TIGO in Chile that suffers from the low number of strong X-band radio sources in the southern hemisphere that are visible for such a small telescope (6 m diameter). A master's thesis student from Chalmers University of Technology worked on the topic and developed the module SATTRACK for the FS. Initial tests of the module were done in the summer of 2006 with the 20 m telescope at Onsala. We tracked the two earth observation satellites TERRA [1] and AQUA [2] that both use X-band to broadcast observational data to ground stations. TERRA transmits at 8212.5 MHz, while AQUA transmits at 8160.0 MHz. Both satellites are low earth orbiting satellites in polar orbit with about 700 km orbital height and orbital periods of approximately 100 minutes. Figure 1 shows an example of a spectrum observed while tracking the satellite TERRA with the Onsala 20 m telescope. The TERRA X-band signal was down-converted with the usual local oscillator frequency of 8080 MHz and is clearly visible at 132.5 MHz

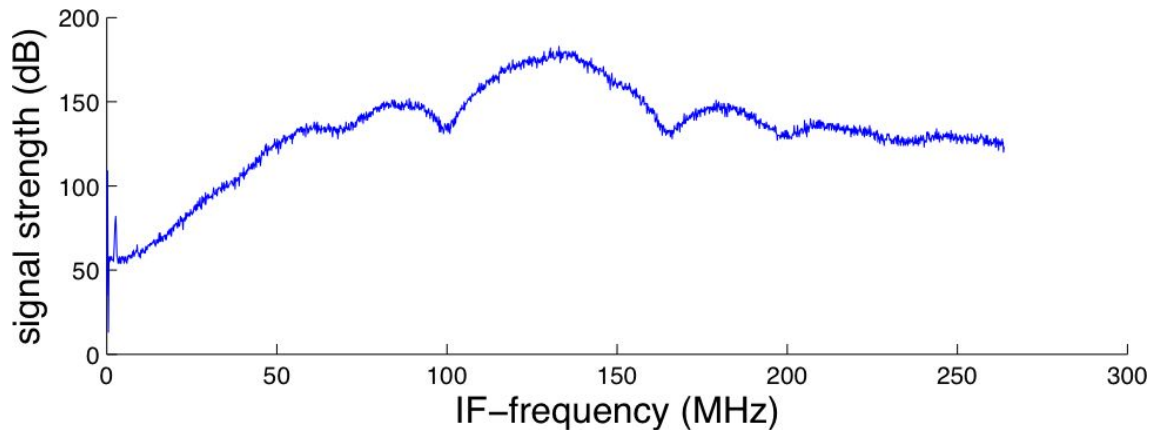


Figure 1. Spectrum of the TERRA satellite tracked and observed with the 20 m telescope at Onsala.

2. A New S/X-band Receiver for the 20 m Telescope

During 2006 work has started to build a new S/X-receiver for the 20 m telescope, see Figure 2. This new receiver has two polarizations for X-band and one polarization for S-band. The HEMT amplifiers for X-band have noise temperatures on the order of 7–8 K. A new cooling system will be used, and the previously used LO-multipliers will be re-used. The new receiving system is expected to achieve system noise temperatures that are on the order of 15 to 20% better than those of the current system.

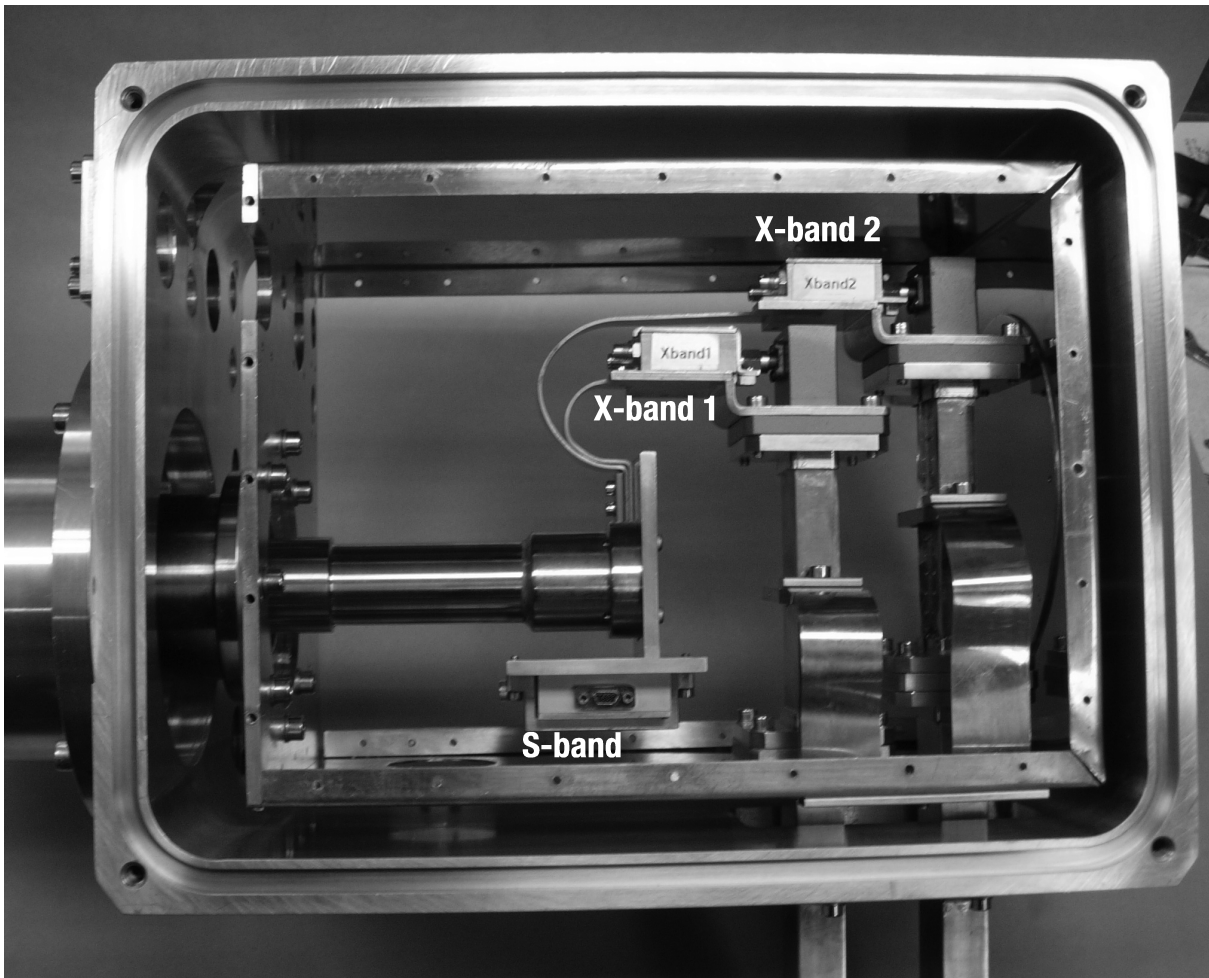


Figure 2. The new S/X-receiver for the 20 m telescope: The two HEMT-amplifiers for the two X-band polarizations are labelled as ‘X-band 1’ and ‘X-band 2’, the S-band amplifier with ‘S-band’. The cooling system is attached on the left side as seen in this picture, while the two waveguides for X-band and the coaxial waveguide for S-band enter the box from the bottom as seen in this picture.

3. The Microwave Radiometers at Onsala

During 2006 the two radiometers at the observatory, Astrid [3] and Konrad [4], were subjected to maintenance work for the second half of the year. Astrid had problems with unstable power supplies and a failure of the hot load in the 31.4 GHz channel, while Konrad had problems with the azimuth and elevation drives.

4. Outlook and Future Plans

We will install and test the new S/X-receiver system for the 20 m telescope in the spring of 2007. We will continue the maintenance work of the two radiometers and expect to have them in place and running again in the spring of 2007.

References

- [1] <http://terra.nasa.gov/>
- [2] <http://aqua.nasa.gov/>
- [3] Elgered, G., and Jarlemark, P.O.J.: Ground-Based Microwave Radiometry and Long-Term Observations of Atmospheric Water Vapor, *Radio Science*, **33**, 707–717, 1998.
- [4] Stoew, B., and Rieck, C.: Dual Channel Water Vapour Radiometer Development. In: W. Schlüter and H. Hase (Eds.): *Proceedings of the 13th Working Meeting on European VLBI for Geodesy and Astrometry*, 261–264, 1999.