

Name of research institute or organization:

Institute of Applied Physics, University of Bern

Title of project:

Atmospheric Observations with STEAMR/PREMIER Receiver Prototypes

Project leader and team:

Dr. Axel Murk, project leader
Matthias Renker, Michael von Grünigen

Project description:

The “Stratosphere-Troposphere Exchange And climate Monitor Radiometer” (STEAMR) is a multi-beam limb sounder for the ESA Earth Explorer Mission PREMIER. The Institute of Applied Physics collaborates with Omnisys Instruments (Sweden) and the Rutherford Appleton Laboratory (UK) in the optical design and the receiver development.

The STEAMR receivers consist of double sideband heterodyne mixers operating in two frequency bands between 324 and 355 GHz. The combined intermediate frequency band is analyzed using broadband digital autocorrelation spectrometers. A precise knowledge of the sideband ratio of the mixers and the channel response of the spectrometers is of vital importance for the scientific data analysis. In order to validate our laboratory measurements of these parameters we deployed the STEAMR receiver prototype in an atmospheric observation campaign at the High Altitude Research Station Gornergrat. The high altitude of this site and the dry atmospheric conditions during winter are mandatory for ground-based observations in this frequency range.

Figure 2 gives an example of the observed spectral lines, mostly from stratospheric ozone, in comparison with model data. The analysis of the differences between measurement and simulation provides important information about the sideband ratio, channel response and the linearity of the receiver.



Figure 1. 340 GHz radiometer breadboard with the STEAMR receiver prototype, calibration optics and thermal stabilization installed outdoors at the Gornergrat Observatory (instrument housing removed).

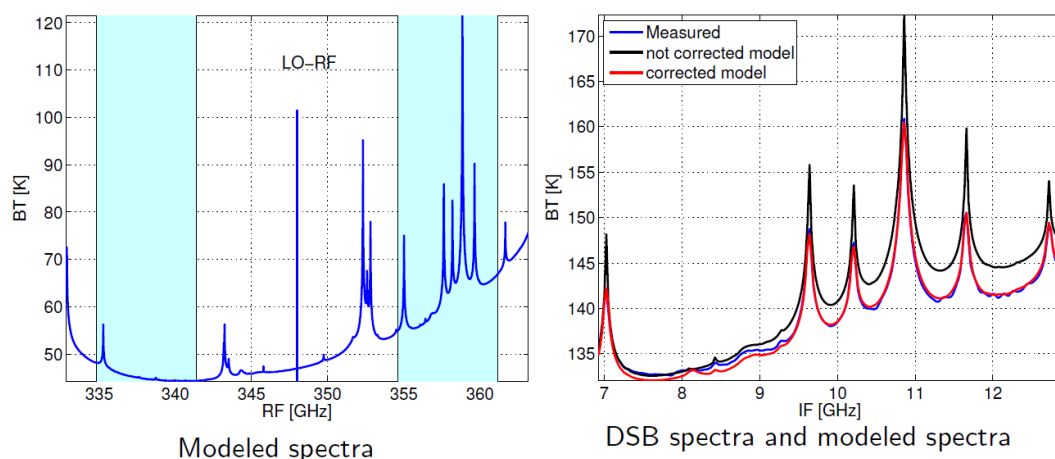


Figure 2. Simulated spectral emission lines in the two sidebands at radio frequencies (RF), left, and observed spectrum in the intermediate frequency band (IF), right. Without sideband ratio correction, the measurements deviate significantly from the model, whereas the good match of the corrected spectra validates the results of the laboratory calibration.

Key words:

Microwave remote sensing, submillimeter wave receiver

Internet data bases:

<http://www.iapmw.unibe.ch/research/projects/STEAMR/>

Collaborating partners/networks:

Simon Rea, STFC Rutherford Appleton Laboratory, Didcot, Oxfordshire, UK
Anders Emrich, Omnisys Instruments AB, Göteborg, Sweden (www.omnisys.se)

Scientific publications and public outreach 2013:

Conference papers

Renker M., A. Murk, M. von Gruenigen, A. Emrich, U. Frisk, Atmospheric Observations and Laboratory Measurements of a broadband 340 GHz Receiver System for STEAMR, URSI Microwave Signatures Conference, Helsinki, Finland, October 30, 2013.

Data books and reports

Murk A., M. Whale, M. Renker, STEAMR Focal Plane Array Optics: Executive Summary, IAP Research Report, No. 2013-05-MW, Institut für angewandte Physik, Universität Bern, 2013.

Theses

Von Grünigen M., Analysis of Sub-Millimeter Spectra from STEAMR Breadboard Receiver, MSc Thesis, Institut für angewandte Physik, Universität Bern, September, 2013.

Address:

Institut für Angewandte Physik
Universität Bern
Sidlerstrasse 5
CH-3012 Bern

Contacts:

Axel Murk
Tel.: +41 31 631 8674
Fax: +41 31 631 3765
e-mail: murk@iap.unibe.ch
URL: <http://www.iapmw.unibe.ch>