The Ice Cloud Imager Front End Receivers onboard MetOp-SG satellite – Preliminary Design and Results

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Abstract—MetOp-SG is a joint ESA/EUMETSAT program that will provide high quality weather monitoring data from a series of polar-orbiting satellites (A&B) over the 2020-2040 timeframe. One of the instruments onboard satellite-B will be dedicated to the remote sensing and atmospheric retrieval of high altitude ice clouds: the Ice Cloud Imager (ICI) is a conical scanning instrument featuring seven uncooled heterodyne receivers operating at five frequencies between 183 GHz and 664 GHz, two of them being dual-polarized.

RPG is responsible for the overall development of the ICI Front-End (FE) which will be mounted on top of the cylindrical rotating structure. The 183 GHz, 243 GHz and 325 GHz FE receivers development is under the responsibility of RAL, whereas RPG is undertaking the development of 448 GHz and 664 GHz channels, integration of receivers and test of all channels into the Front-End including horn antennas, and verification of the Front-End to Back-End operation. The ICI receivers rely on European technology for the high frequency Low Noise Amplifiers (IAF-Freiburg transistor MMICs), mixers and multipliers (Teratech and ACST Schottky diodes) to be qualified by RPG and RAL, and on US space grade MMIC & hybrid technology for Medium Power Amplifiers (AD/Hittite), IF Low Noise Amplifiers and DROs (L3/Narda/Miteq).

The preliminary design of the ICI FE receivers has been successfully reviewed by Airbus and ESA, and will be presented at this conference. Special focus will be put on the development of high frequency RF modules which were designed in a minimal envelope to meet the 8mm wide footprint imposed by the feed-cluster arrangement. For instance, semi-rigid coaxial waveguide with custom miniature flanges have been developed specifically for this purpose. First light RF results for all channels showing state-of-the-art performance in terms of Noise Figure will be presented. Short term gain stability (i.e. 1/f noise) has also been extensively investigated in order to ensure that this requirement can be met over the mission temperature and lifetime. Demonstration of compliance to these requirements are key to ensure the successful scientific & operational return of this mission.