MetOp-SG Ice Cloud Imager 183–664 GHz Front-End Receivers Proto-Flight Model Qualification and Acceptance Test Results

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***Abstract*—We present the development of the Proto-Flight Model (PFM) receivers covering the frequency range 183-664 GHz as part of the Ice Cloud Imager (ICI) front-end for the next generation of European polar orbiting Meteorological satellite series (MetOp-SG). State-of-the-art radiometric sensitivity results are reported at room temperature. Qualification results from the underlying semi-conductor GaAs Schottky and MMIC technology will also be presented.**

Keywords—Receiver, Schottky, MMIC, Space, Radiometer.

I. INTRODUCTION

The next generation of near-earth polar-orbiting satellites (MetOp-SG) is a high priority mission from ESA/ EUMETSAT to ensure continuous data acquisition for weather forecasting and climate monitoring in 2023-2043 period [1]. The prime contractor Airbus is currently developing a series of satellites with a suite of microwave instruments that are to be launched sequentially every 7-8 years to cover at least 20 years of cumulated observation time. The Ice Cloud Imager (ICI) instrument on-board one of the satellite series (Sat-B) is a multi-channel passive imaging radiometer dedicated to the remote sensing of water and ice clouds in the millimetre to submillimetre range [1].

ICI features seven Front-End (FE) receivers designed to operate close to room temperature (28°C) around five frequencies (183 GHz, 243 GHz, 325 GHz, 448 GHz and 664 GHz), two of them being dual-polarised (243 and 664 GHz). These receivers rely on semi-conductor GaAs Schottky and MMIC technology packaged and qualified by RPG[1] and RAL[2], as well as hybrid technology procured from Narda-Miteq (DRO and IF LNAs).

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II. DEVELOPMENT STATUS AND RESULTS

A major project milestone was achieved with the successful completion of the Proto-Flight Model (PFM) FE test campaign in 2021 [2] (see Fig.1), followed by delivery to ASE[3] for the next level of integration into the ICI instrument. The FM2 receivers are currently under Assembly, Integration and Test (AIT) at RPG.

An extensive qualification test campaign characterises several stringent requirements such as the noise figure, gain and gain flatness, short-term gain stability (1/f noise), sideband imbalance and spurious response over the qualification temperature range (0°C–60°C). Full functional tests on top of specific EMC, vibration as well as thermal vacuum tests will conclude the PFM verification campaign.

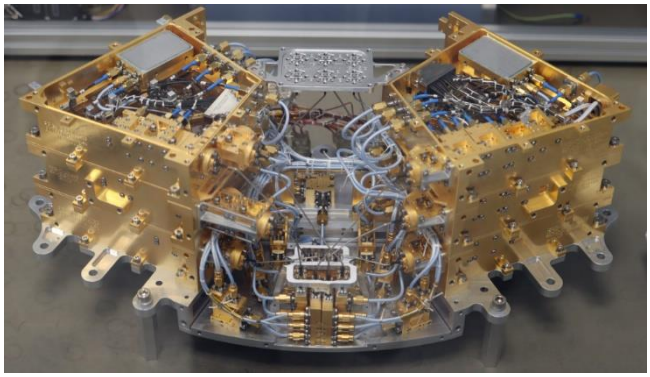

Fig. 1. Photo of the ICI receivers fully assembled, including feed cluster components (middle) and LO generation units (left and right towers) prior to final integration into PFM front-end.

A summary of the state-of-the-art results will be presented. We will discuss the lessons learned from the EQM phase and how this has been applied to improve the PFM and FM2 receivers performance and reliability.

REFERENCES

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