Modular Design of GIMS (Geostationary Interferometric Microwave Sounder) Based on Customized MMIC and ASIC

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Abstract

The Geostationary Interferometric Microwave Sounder (GIMS) is a new concept imaging radiometer proposed by CAS/NSSC, aiming for China's next generation geostationary meteorological satellite (FY-4M). The concept of GIMS is based on MIR(Microwave Interferometric Radiometer) technology with a rotating circular thinned array.

A ground-based 50~56GHz GIMS demonstrator with 28 elements has been developed in 2011[1]. Many imaging experiments and systematic performance tests had been carried out on the demonstrator. Although the instrument concept (MIR with rotating thinned circular array) and performance (50km spatial resolution, 0.8K radiometric resolution, 3000*3000km FOV and 5 minutes imaging period per channel) has been successfully demonstrated by the 28-element proof-of-concept demonstrator, there are still several technical issues should be solved before the instrument eligible for a real mission, including: (1) the instrument FOV is expected to extend to full-disk coverage, which implies the least antenna spacing to be 3.5 wavelengths. The number of overall antenna units will increase to around 70. The radiometric budget analysis and system design need to be updated.; (2) power consumption and mass should be further reduced for space application, which implies the design of the sub-system should be improved by using MMIC and ASIC technology; (3) adding humidity sounding capability: 183GHz channel is on high priority.

A new demonstration plan has been approved to address above technical issues. Compared with the proof-of-concept demonstrator with 28 elements, the new demonstrator will have more elements (~70), larger circular array diameter (~3.5m), smaller element antenna aperture size (~3.5 wave length). More important, the new demonstrator will be built based on modular system design and customized 50~56GHz LNA/IQ Mixer MMIC and 10-channel 3-level quantization ADC, which can largely reduce the mass/power/volume of the whole system and ensure the inter-element consistency and in-orbit performance.

In this paper, the system design of the new GIMS demonstrator will be introduced. Preliminary performance of the MMIC/ASIC based modules will also be introduced.

Reference:

[1] ZHANG Cheng, LIU Hao, WU Ji, etc, Imaging Analysis and First Results of the Geostationary Interferometric Microwave Sounder (GIMS) Demonstrator, IEEE Transaction on Geoscience and Remote Sensing, to be published

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