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FLIGHT RESULTS OF MARCONISSTA - AN RF SPECTRUM ANALYZER ABOARD THE ISS TO IMPROVE FREQUENCY SHARING AND SATELLITE OPERATIONS

Abstract

Satellite operations become more and more difficult as hundreds of new satellites have been launched in the recent years. Particularly frequency bands for satellite communication below 3 GHz are so crowded that the chance of harmful interference rises to a non-acceptable level. The International Telecommunication Union (ITU) files all systems and coordinates between different users and services. However, there often exists a difference in the claimed use of frequency bands and the actual implementation and bringing into use of systems. Additionally, interferers are hard to define by using ITU paper filings or terrestrial measurements only. An orbiting system that can analyze the current spectrum usage and identify potential interferers would significantly improve frequency sharing. For this reason, a spectrum analyzer experiment is introduced that can assess the current spectrum use from the International Space Station.

MarconISSta is a spectrum analyzer for VHF, UHF, L and S band frequencies that is operated on the ISS from June 2018 until October 2018. The system's core components are the Commercial Off-the-shelf (COTS) Software Defined Radio (SDR) LimeSDR which serves as an RF receiver and a Raspberry Pi Single Board Computer for data storage and processing. For signal reception it makes use of the ARISS (Amateur Radio on the ISS) VHF/UHF and L/S antennas. The experiment is integrated in the existing ARISS setup in a way that it allows continuous measurement of RF spectrum without interfering with amateur services. Over mission lifetime, a global map of spectrum use will be established.

MarconISSta has been initiated as a research and educational project at Technische Universität Berlin. The project is supported by DLR and ESA to become part of the ESA horizons mission during the ISS stay of ESA astronaut Alexander Gerst. As the project focuses on radio amateur bands and is led by radio amateurs, ARISS agreed to cooperate and to provide their antennas for the mission.

This paper will describe the MarconISSta mission concept and the experiment setup. It will give

insight into the process of integrating an RF payload aboard the ISS and its benefits for the planning of satellite operations. Most importantly, the paper will present first flight results of MarconISSta.