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Evaluation of the radiation pattern and the input impedance for RIME dipole aboard JUICE

Dirk Plettemeier (1), Ronny Hahnel (1), Fabrizio Masin (2), and Lorenzo Bruzzone (2)

(1) TU Dresden, Dresden, Germany (dirk.plettemeier@tu-dresden.de), (2) Remote Sensing Laboratory, University of Trento, Trento, Italy (lorenzo.bruzzone@ing.unitn.it)

JUICE (JUpiter ICy moon Explorer) belongs to ESA's largest future missions and has the goal to explore Jupiter and three of the Galilean moons. The launch of the spacecraft (S/C) is planned for 2022 and the arrival in the Jovian system in the year 2030. One of the experiments aboard JUICE is the subsurface-radar RIME (Radar for Icy Moons Exploration). RIME will penetrate the celestial bodies with electromagnetic waves to gain knowledge about subsurface structures. The main objective of RIME is the exploration of the upper layers and the detection of potentially available subsurface liquid water on the moons Europa, Callisto and Ganymede.
In order to achieve this goal, the radar-sounder uses a center frequency of 9 MHz and a bandwidth of 3 MHz. In this configuration, a penetration depth of approximately 9 km and a maximum vertical resolution of 50 m can be achieved. A 16.6 m long dipole radiates the chirp-signal towards ground. The dipole antenna is made of two 8.8 m long booms, each fed by a 50 Ohm coaxial cable, which is connected to a matching network.
For the evaluation of the radiation pattern and the input impedance, extensive field tests with a helicopter and a mock-up of the S/C were conducted on the airfield in Heiligenberg. During the measurements, the mock-up is mounted with a 70 m long rope underneath the helicopter. In this configuration, the helicopter flies a predefined trajectory and the RIME-antenna radiates the chirp-signal. Due to the low frequency, the radiation pattern can only be measured in free space at selected points. Therefore, two antennas on ground measure the receiving power continuously during the flight phase.
Moreover, the input impedance for each antenna boom is measured separately. The impedance has to be known very well, because it is the basis for the design of the matching network.
The poster presents the analysis and the comparison between measurements and simulations.