DESIGN AND TECHNICAL ASPECTS OF AN EUROPEAN MEDIA CALIBRATION SYSTEM FOR DEEP SPACE MISSIONS

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ABSTRACT

Media Calibration Systems (MCS) are intended as a group of one or more meteorological instruments, to be used to estimate the troposphere path delay at a Deep Space Station (DSS) to calibrate the RF-links of deep space probes. The most accurate MCS are capable of estimating the path delay along the Line-of-Sight between the probe and the ground station. These accurate MCS are based on steerable microwave radiometers (MWRs), which represents the most critical component of the entire system.

The European Space Agency (ESA) has funded a study focused on the investigation of the state of the art of its microwave radiometers to examine their capability to satisfy the stringent radioscience experiments requirements.

Since the ESA MWRs have been developed for satellite telecommunication applications some changes in the instrument are likely to be required. The crucial outcome of the study is that the latest developed ESA MWR presents very high long-term stability but some architectural changes are needed to fulfill also the performance requirements at short integration times.

The study highlighted some critical aspects: Sun contamination, ground emission noise, turbulence effects. This work presents the proposed solutions to solve possible critical aspect of the troposphere calibration system. Moreover, different configurations of the MCS have been proposed in order to provide a continuous, accurate and stable estimation of the path delay during the tracking activity.

After an introduction to deep space missions and radioscience experiments, the paper presents the technological improvements to be carried out to current MWR technologies to satisfy the stringent radioscience requirements. The work shows also different MCS designs and their possible final deployment configuration in an ESA Deep Space Station.