SPACE OPERATIONS SYMPOSIUM (B6)
Ground Operations - Systems and Solutions (1)

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SDR BASED AUTONOMOUS REMOTE GROUND STATION FOR LEO AMATEUR SATELLITES

Abstract

The cost is a major factor in the satellite development at universities. This can be reduced up to 10 % by automating ground-satellite operations as these are routinely for limited times per satellite pass in LEO. Use of COTS components designed for non-space applications is one of the driving philosophies of university class satellite design for fast and inexpensive construction. Another paradigm growing faster is to reduce groundstation (GS) operation cost by automating the GS and to operate it remotely whenever required. The mission requires extensive but short time usage like determining position of spacecraft in space, receiving and executing commands from GS to receive specific data, and to switching a subsystem on/off and/or uploading configuration/new software and many more. Among many other requirements is the Doppler compensation with a computer program along with tracking and updating TLEs. Many of the above mentioned requirements do not need personnel presence the whole day, as the communication window of LEO satellite depending on maximum elevation (MEL) is 10 - 20 minutes a satellite pass. For ease of maintenance the GS is located at university campus, so interference from sources in the urban environment were considered. In the course of this work it was shown that the interference from mobile radio is present but does not hinder or influence the communication with the satellite. Man-made noise corrupts communication with the satellite at very low elevation angles. The SDR based GS operates as a virtual GS by authenticated remote users throughout the world via internet for operating convenience. Since September 2012 the GS is working in remote user mode and up to now, there were more than 10,000 passes of many satellites over the GS. From all satellite passes with an elevation angle above 0 degree, successful communication was established with a reliability of 99 % data analyzed in real–time. The basic design of the automated GS on the user side is based on free software suites. A basic architecture of the single existing system and the benefits of its adaptability to be included in GENSO are discussed. Details of the software tools and their applicability to tracking, monitoring and processing are also provided as used by students and researchers performing GS operations. Among many constraints, synchronization losses and port blocking were resolved and an API solution is worked out as a future task to avoid network latency.