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TECHNICAL CAPABILITIES OF SDR BASED GROUND STATION FOR MULTI-SATELLITE COMMUNICATIONS

Abstract

Universities and other organizations involved with satellites always desire a quick communication link upon launch and deployment to verify orbit insertion and initial telemetry. Per usual, the satellite's orbital parameters determine the coverage area (as indicated by a ground trace). The satellite-ground station (GS) line-of-sight communication duration (pass time) varies for each pass depending on the local horizon (Azimuth and Elevation angles), antenna characteristics and satellite orientation. For many satellites the link is established approximately 5 to 7 degrees above the horizon. But ground stations located in an urban environment face additional difficulties due to towers and other obstructions. For this paper, we developed prototype of a Software Defined Radio (SDR) based GS as an internet-to-orbit gateway built at the author's site. We discuss the technical details of this gateway that virtually connects participating clients remotely to access LEO amateur satellites both with data and voice transmissions. For this paper, experiments were carried out to verify the technical capabilities of the SDR-GS in preparation of its use as a remote and automatic satellite GS. The data collected regarding automatic operations is critical for future missions. With several stations operating automatically, a user anywhere in the world can connect, monitor and control a formation of satellites from their single laptop computer, a capability that has not been realized by the CubeSat / Small Satellite community. Until now, results were obtained by remotely controlling and simultaneously downloading real-time data and voice by remote users, taking into account the relationship of horizon with satellite pass time (loss of satellite/signal – acquisition of satellite/signal), and interference phenomena. Results of these coordinated studies will be presented in this paper to inform the community about latency effects and the advantages that automatic operations may provide. We close the paper with a case-study, using SDR-GS data, of a coordinated GS network, operated remotely, that can be utilized for formation satellite communications.