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MAXIMIZING DATA THROUGHPUT IN EARTH OBSERVATION SATELLITE TO GROUND TRANSMISSION BY EMPLOYING A FLEXIBLE HIGH DATA RATE TRANSMITTER OPERATING IN X-BAND AND KA-BAND

Abstract

Earth Observation (EO) and Intelligence, Surveillance and Reconnaissance (ISR) Systems equipped with Synthetic Aperture Radar (SAR) and/or High Resolution Optical instruments are designed for high-performance operations in terms of fast revisit time, for very short system response time and for providing actionable intelligence with low data latency. The increased reliance on this data for increasingly more urgent applications has created demand for decreasing latency, for all datasets, including Earth observation, radar, communication, and weather satellites.

However, higher speeds and increasing bandwidth for data download are needed with the increasing numbers of satellites. At the same time, the scarce frequency resources especially in X-band (8.025 GHz to 8.4 GHz) but also in Ka-band (25.5 GHz to 27 GHz) call for more bandwidth efficient modulation schemes.

The paper will share details regarding a new data transmission solution to efficiently use the available radio frequency (RF) bandwidth both in X-Band and Ka-Band by using Adaptive Coding & Modulation (ACM) as a key technology, allowing the volume of data to adapt to link budget characteristics. At the same time, high performance forward error correction coding such as SCCC and LDPC (DVB-S2) and high order modulation schemes (up to 64-APSK) are used, yielding both high power and spectrum efficiency.

A discussion of advantages compared to legacy systems will be included. In terms of end-to-end performance, such sophisticated systems need to account for the ground station receiver characteristics. The proposed solution has therefore been verified using engineering models.

Finally, a specific highly integrated transmitter design suited for smaller Earth Observation satellites down to SmallSats will be presented.