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A GAME – CHANGING RADIO COMMUNICATION ARCHITECTURE FOR CUBE/NANO-SATELLITES

Abstract

technological improvements achieved since 15 years allowed nanosatellites to emerge. 3u and bigger cubesats permit functions and reliability once specific to microsatellites. the rf game-changing is related to higher frequencies and data rates.

the uhf/vhf or uhf cubesat ttc subsystem still used today is increasingly subject to rf interferences as the frequency set is shared with ground and space telecommunications. another drawback is the data rate limitation, poorly suited to software uploads and accurate platform monitoring.

in parallel, more cubesat missions need some tens of mbits/s to download hd imaging or collected rf signals for ground processing center analysis. earth exploration satellite system (eess) s-band telemetry is sometimes used for such downloads, but itu filing could generally be obtained if the recommendation

fulfill with 6 mhz maximum. the 2.4-2.4835 ghz band is sometimes used for higher telemetry datarate but is subject to significant interference issues.

therefore, a combined s/s+x band architecture permits datarate increase. both eess s ttc and x bands look well adapted, since very few interferences have been monitored by cnes ground stations network in these bands.

esa and cnes designed such hybrid (s/x) architecture and proposed an experimental in-orbit test of a miniature x band transmitter in the frame of ops-sat triple cubesat esa project. ops-sat will demonstrate new area of mission operation. uhf ttc subsystem will be used as a backup, a variable rate s band ttc system (256 kpbs uplink, 1 mpbs downlink) and a vbr x band transmitter (50 mbits/s). tu-graz lead a consortium up to phase b2cde. Gomspace delivers core avionics.

in 2014, cnes selected the eye-sat triple cubesat to use a single s/s + x band rf architecture.

the first in-orbit test of the syrlinks x-band transmitter will occur onboard the gomx-3 triple cubesat. gomx-3 will be the inaugural esa-cubesat, led by gomspace. it will achieve pointing within 2 of both nadir and geostationary targets will demonstrate aircraft ads-b signal reception and characterize geostationary telecommunication satellite spot beam signal quality.

syrlinks works jointly with cnes, esa, tu-graz, and gomspace to develop advanced radio solutions for cubesats, especially X band Transmitter, S band TTC Transceiver, inheriting from in-flight proven solution

the paper will describe the s/s + x band rf architecture, the 3 mentioned triple cubesats, and the way they totally or partially implement this architecture. finally, evolutions of related equipment will be presented, in applications (ISL), frequency, modulation, and data rates.