IAF SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advances in Space-based Communication Technologies, Part 1 (4)

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# PHLEXSAT - A NOVEL PHOTO-DIGITAL COMMUNICATION PAYLOAD FOR VERY HIGH THROUGHPUT SATELLITES

**Abstract**

Increasing the capacity of Very High Throughput Satellites (VHTS) while decreasing their in-orbit cost has become an important area of interest. The high capacity demands of future VHTS missions can be met by minimizing power consumption, mass, volume. Current purely RF based solutions are limited in size, weight and power (SWaP) whereas the properties of photonics components make them an obvious choice for designing future generation Satcom payloads.

Photonics offers a limitless bandwidth in THz range at the band around 1550 nm. Lightweight and low volume photonic components are capable of handling high data rates and frequencies and offer almost lossless propagation in an optical fiber and immunity to Electromagnetic Interference (EMI).

However, the use of photonics devices is currently restricted to a few demonstrations in non-critical equipment and with limited degree of integration. This paper presents the system design of an innovative photonic enabled digital payload called PhLEXSAT for future Terabit per second satellites by focusing on the advancement of the maturity level of key photonic technologies.

PhLEXSAT project, funded under the European Union H2020, is led by DAS Photonics in cooperation with MDA UK, Eutelsat, Axenic, HHI Fraunhofer and Argotech. The aim is to design, develop and test space qualified TRL 5 photonic based equipment's and modules. The baseline reference mission considered for the payload design has a target capacity of 1 Tbps. The forward uplink considers V-Band and W-Band while the forward downlink is in Ka-Band. The return uplink is in Ka-Band whereas the return downlink takes into account Q-Band and W-Band.

The number of gateways is 13 using dual polarization in the forward uplink (aggregated bandwidth 260 GHz) and single polarization in the return downlink (aggregated bandwidth of 130 GHz). 500 user beams with 500 MHz allocated bandwidth per user in the forward uplink (aggregated bandwidth of 250 GHz) and 250 MHz allocated bandwidth per user in the return uplink (aggregated bandwidth of 125 GHz) have been considered. The Tbps-like software defined photonic payload architecture incorporates advanced broadband photonic ADC and photonic DAC with digital processing firmware with a high degree of miniaturization and power-consumption efficiency. The selected photonic sampler architecture consists of two main components: Mach-Zehnder modulators (MZM) PIC and high-linear photodetector (HL-PD) PIC. The photonic sampler is driven by a space-grade pulsed laser which acts as a frequency clock.