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IOD MISSION FOR DIRECT 5G BROADBAND ACCESS FROM LEO

**Abstract**

The completion of the first global standard on the 5G New Radio standard by the 3rd Generation Partnership Project (3GPP) and the growing interest in space-based connectivity through Low Earth-orbiting satellites (LEO) have opened avenues for integrating 5G with traditional satellite communications. This integration, aligning with the paradigm of ubiquitous connectivity termed "anything, anytime, anywhere," introduces novel possibilities. The "DEMONSTRATION OF DIRECT 5G BROADBAND ACCESS FROM LEO TO SMALL APERTURE TERMINALS" project, under the European Space Agency's ARTES framework, explores this integration with a focus on terminals featuring small apertures.

Technical solutions for this venture are being developed by Tyvak International, European Small Satellite leader, PICOSATS, specializing in nano-satellite telecommunications, Radio Analog Micro Electronics (RAME), an expert in microelectronics, and TIM, a telecommunications services leader. The program leverages recent NR 3GPP standards to define Non-terrestrial Networks (NTN), facilitating data links between ground devices and space-based assets.

The project encompasses two mission concepts: "Direct Access 5G Satcom Reference Mission" (REMI) and "Direct Access Live Demonstration" (LIDE). REMI assesses the feasibility of 5G NTN broadband access using a constellation of small satellites, while LIDE involves designing, manufacturing, and testing a 12U spacecraft and two dedicated ground terminals for a live demonstration.

The 12U spacecraft, based on Tyvak International's Renegade standard Platform, integrates transparent bent-pipe transponders from PICOSATS and K/Ka Band patch array antennae. In-orbit experiments aim to establish bidirectional K/Ka band links, evaluating key performance indicators (KPIs) such as C/N, latency, and throughput with data rates of at least 1 Mbps in uplink and 10 Mbps in downlink. Ground terminals incorporate Software Radio Stack solutions compatible with the latest NTN scenario (Release 17).

Following a successful first phase focused on technical specifications and budget consolidation, the Consortium achieved the Critical Design Review. Current efforts involve the procurement process, Payload environmental qualification, and validation of critical elements, including antennae, through dedicated tests at TIM's anechoic chamber.

Upcoming milestones include the System Integration Readiness Review, spacecraft final assembly and testing, and the Flight Readiness Review. The satellite launch is planned at the end of 2024.

This mission, a pivotal step in the European 5G/6G telecommunication roadmap, aims to surpass previous 5G demonstration mission throughputs, setting the stage for future platforms capable of achieving transmission speeds in the range of hundreds of Mbps.