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Technologies for the Ground Segment of the future Q/V band Satellite Systems: The QV –LIFT project

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Abstract

This paper presents a summary of the project: "*Q/V band earth segment LInk for Future high Throughput space systems*" (QV-LIFT), recently funded in the framework of the EU program Horizon 2020. The project aims at developing up to date hardware and software technologies for the Ground Segment of the future Q/V band terabit Satcom infrastructure.

1. Introduction

The future High Throughput Satellites (HTS) paradigm has the objective to support the so-called "Terabit connectivity" thereby bringing to fore requirements for radical changes of technologies. A core element of envisioned future HTS systems is the use of "beyond Ka-band frequencies", in particular Q/V band frequencies (around 40 GHz for downlink and 50 GHz for uplink), which offer larger bandwidth availability for the feeder links and for specific segments requiring high data rates such as aeronautical in-flight services. The development of the Ground Segment for Q/V band satellite communications faces many challenges. Antennas and power amplifiers with high efficiency and Low Noise receivers, are needed to support high data rate transmissions. Furthermore, to counteract atmospheric impairments, a system able to implement and to manage a handover mechanism between gateways is also fundamental.
The QV-LIFT project, funded by the EU in the framework of the Horizon2020 program, aims at developing all the hardware and software building blocks for the future Q/V band Terabit SatCom systems and to integrate them in a way they can be tested in a realistic scenario. The project started on November 16th 2016 and it will last for about 3 years.

2. QV-LIFT

In figure 1 is shown the overall QV-LIFT system. It is built around the Aldo Paraboni QV band payload on board of Alphasat, developed by the Italian Space Agency (ASI) and currently in operation. The QV-LIFT ground segment includes two already operational Earth Stations, owned and operated by ASI , Earth station 1, located in Tito Scalo (Italy), and Earth Station 3, located in Spino d'Adda (Italy). One more ground station (Earth Station 2) and an aeronautical terminal are also included in the system and are both currently in development.

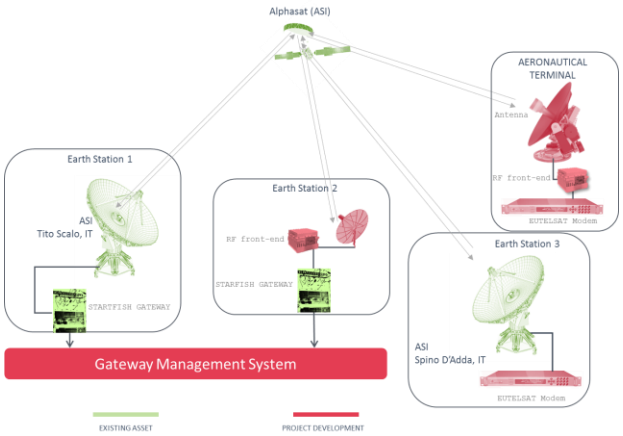

Figure 1 The QV-LIFT system

The Earth Stations and the terminal will make use of Block Up Converters based on power combined GaN MMICs, developed in the project. The MMICs operates around the 47.8 GHz, which is the Alphasat uplink frequency.
In figure 1, the Gateway Management System (GMS) is also shown. The system takes in charge the network control functions needed to support smart handover of communications between multiple gateway nodes (smart gateway). Also, the GMS is designed to be used to define new transmission modes which are better suited to cope with the Q/V channel specifications and peculiarity (i.e. highest dynamic range). GMS is integrated in an already existing gateway management system (STARFISH) operating in the S, C, Ku and Ka bands.

Once the system will be set up many possible experiments could be devised. Between them, two have been already defined. The first one will validate the Smart Gateway handover functionality between two stations in the same spot. The second one will experiment Q/V band communication in mobility.

During the presentation, the project will be described in details and an account of the status of the developments will be also given.