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- Carlo.Riva@polimi.it
- His main research interests include atmospheric propagation of centimetre and millimetre radio wave in satellite links; propagation experiments; physical and statistical modelling of tropospheric effects on radio waves; propagation impairments mitigation techniques; telecommunication adaptive systems. He is author of about 180 publications on international journals or at international conferences.
- He is Principal Investigator of the Italian Space Agency for the Alphasat Aldo Paraboni propagation experiment and the scientific coordinator of the international experimenters. He is Chairman of the Working Party 3J ('Propagation fundamentals') of the Study Group 3 of ITU-R and Associate Editore of IEEE Transactions on Antennas and Propagation. He joined several EU COST projects, Olympus and Italsat experiments, Satellite Communications Network of Excellence and numerous research studies for the European and Italian space agencies.
- He gives courses in Informatics Engineering Laurea degree.
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Publications

- Aldo Paraboni, Antonio Martellucci, Carlo Capsoni, Carlo Riva, "The physical basis of atmospheric depolarization in slant paths in the V band: theory, Italsat experiment and models", *IEEE Transactions on Antennas and Propagation*, 59(11), 2011
- • Lorenzo Luini, Roberto Nebuloni, Carlo Riva, "Ka-to-W Band EM Wave Propagation: Tropospheric Effects and Countermeasures", Chapter 3 of "Wave Propagation Concepts for Near-Future Telecommunication Systems", Edited by Sandra Costanzo, ISBN 978-953-51-3128-1, Print ISBN 978-953-51-3127-4, InTech, Chapters published May 03, 2017 under CC BY 3.0 license, DOI: 10.5772/61383
- • Tommaso Rossi, Mauro De Sanctis, Marina Ruggieri, Carlo Riva, Lorenzo Luini, Giuseppe Codispoti, Enrico Russo, Giorgia Parca, "Satellite Communication and Propagation Experiments Through the Alphasat Q/V Band Aldo Paraboni Technology Demonstration Payload", *IEEE Aerospace and Electronic Systems Magazine*, 31(3), part I of II, 2016, DOI: 10.1109/T AES.2016.150220
- Tommaso Rossi, Mauro De Sanctis, Marina Ruggieri, Carlo Riva, Lorenzo Luini, Giuseppe Codispoti, Enrico Russo, Giorgia Parca, "Satellite Communication and Propagation Experiments Through the Alphasat Q/V Band Aldo Paraboni Technology Demonstration Payload", *IEEE Aerospace and Electronic Systems Magazine*, 31(3), part I of II, 2016, DOI: 10.1109/T AES.2016.150220.

research

Alphasat Aldo Paraboni Experiment

Carlo Riva is the principal Investigator and responsible for the coordination of the international experimenters of the Alphasat Aldo Paraboni propagation experiment. The experiment (conceived and supported by the Italian Space Agency and executed by the European Space Agency) allows the joint acquisition of attenuation and depolarization measurements at 19.7 and 39.4 GHz at the two main Italian ground stations (with a 4.2 m antenna), located in Tito Scalo and Spino d'Adda. Other about 18 sites joined the experiment in Europe. The experiment aims at assessing the atmospheric channel characteristics in Ka, Q/V band.

Project start: January 2014, duration: 6 years

Partners:

- Dipartimento di Elettronica, Informazione e Bioingegneria (DEIB), Politecnico di Milano, Italy
- Other 13 European universities and research institutions and NASA

Instruments

A “METEK USA-1” sonic anemometer is installed on the rooftop of Building 20 of DEIB, within the campus of Politecnico di Milano. It carries out measurements of the 3D wind components (x , y , z) and of the sonic temperature of the air based on the propagation time of ultrasound waves between three pairs of transducers. This sensor provides accurate measurements of wind and turbulence parameters. Data are sampled every 1-s and stored on daily .txt files. The sensor is not operated continuously, however historical data or on-demand measurements can be requested by contacting ClimateLab staff.



The RPG (Radiometer Physics GmbH) HATPRO radiometer, installed on the rooftop of Building 20 of DEIB, collects brightness temperature measurements at 4 channels in the Ka (23.8 and 31.6 GHz) and V band (72.5 and 82.5 GHz) with 1-second sampling time. Such data allow inferring the liquid water content in clouds and the water vapor content in the troposphere. The instrument is also useful to quantify the attenuation induced by the troposphere (in nonrainy conditions) on EM waves. The HATPRO radiometer also features meteorological sensors monitoring pressure, temperature and relative humidity



The tipping bucket rain gauge, installed on the rooftop of Building 20 of DEIB, monitors precipitation events. The instrument provides as output the number of tips occurred every minute, from which rain rate time series can be derived (1-minute integration time). The tip resolution is 0.1 mm.



The Thies CLIMA laser disdrometer, installed on the rooftop of Building 20 of DEIB, provides detailed information on hydrometeors by measuring their particles size, their falling velocity and their state (liquid drops, snow flakes, hail particles, ...). Results are output with 1-minute integration time and they are of key importance for the in-depth investigation of the effects of precipitation on EM waves.



The beacon receivers installed on the rooftop of Building 20 of DEIB monitor the oscillations of the signal emitted by the Alphasat satellite (geosynchronous with orbital position at 25° E) at two frequencies: 19.7 GHz and 39.4 GHz. The measurements (the sampling frequency is 8 Hz) allow the deep analysis of the effects of the troposphere on EM waves, including: absorption by water vapor and oxygen, attenuation induced by clouds and hydrometeors, depolarization effects due to cloud ice crystals and signal rapid fluctuations (scintillation) due to atmospheric turbulence.

