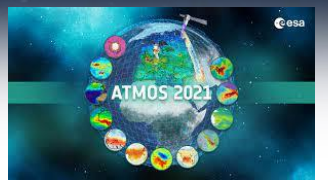
SATCROSS Project: Mission Analysis & Payload

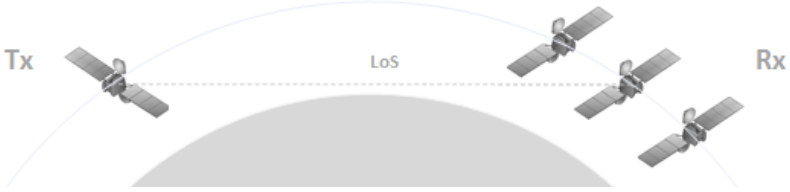


Federico Dogo, Luca Severin, Alessio Berto, Mario Fragiacomo, Anna Gregorio

Mission design

The SATCROSS mission aims at measuring the **water vapor content** in the **lower troposphere**, by observing how it attenuates a couple of very close radiofrequency (20 GHz) K-band signals which are exchanged between satellites.

Architecture: a train of transmitting (Tx) and receiving (Rx) satellites is placed along the same orbit in such a way their line of sight (LoS) passes tangentially to the Earth troposphere.

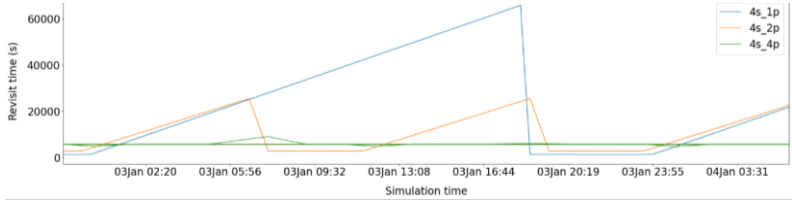


Orbit altitude is defined:

- on the upper side, by *link budget* and *ionising radiation environment*;
- on the lower side, by *atmospheric drag*;
- as about *400 km*, that is compatible with International Space Station.

Mission scenario **simulations** were investigated with respect to the best **revisiting time** performance:

- to assess specific orbits;
- to design *constellations*:
  - up to four trains of satellites were distributed along one, two and four orbits.



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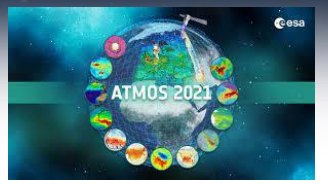

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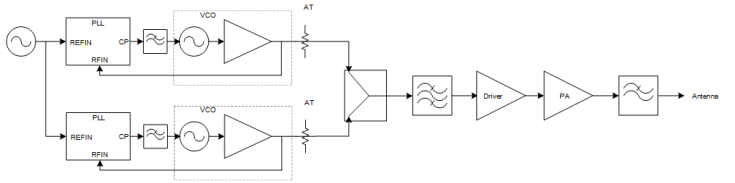
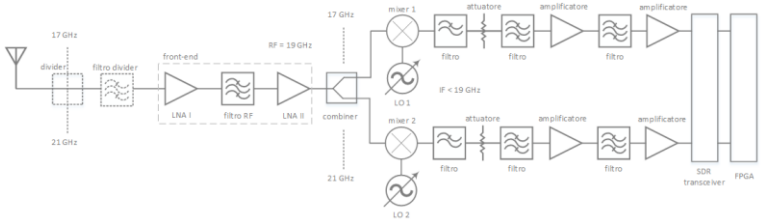
Payload design



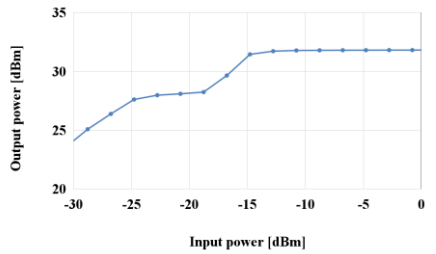


Solutions compatible with **CubeSat platform** have been sought:

- *miniaturised design* driven by commercial-of-the-shelf (*COTS*) *components*:
  - reduced production costs and times.

The purpose built **scientific equipment** consists of:

- scientific *antenna* which is featured by greater than 30 dB gain:
  - a corrugated horn or a reflector antenna;
- a scientific either *transmitter* or *receiver* which may be based on analogue or digital architectures:
  - since the two very close signals have to be acquired together and detected separately, the selectivity of the scientific receiver must be accurately elaborated;
  - the scientific transmitter needs a significant power amplification chain that is able to produce RF power level above 30 dBm;
  - preliminary verifications demonstrate these challenge performances are *achievable*.



All other **satellite systems** can be obtained in the CubeSat **market**.