THE MICROSCOPE SPACECRAFT

- MICRO-Satellite with drag free Control for the Observation of the Principle of Equivalence
- Proposed by ONERA and CERGA Institutes, collaboration with CNES, ESA, DLR, ZARM and PTB
- Based on a MYRIAD platform.
- Mission goal: verify the Einstein equivalence principle, related to gravitational versus inertial mass, with an accuracy never reached before (equivalence at 1e-15).
- Payload: attitude control and fine drag compensation system, differential micro-accelerometers
- Reference orbit: 18h Sun-synchronous circular orbit, altitude: 700 km.

MICROSCOPE in a few words

- two CNES/ Syrlinks EWC15 transceivers (receivers in hot redundancy),
- two MBDA omnidirectional S-Band antennas (in opposite orientation and polarization) for transmission and reception
- RADIALL hybrid 3 dB coupler,
- RF harness composed of 5 pieces of SU CO FLEX 300 cable,
- Telemetry and Telecommand protocols are CCSDS compatible and managed by the onboard data-handling computer (DHU).

RF EQUIPMENT NOW AND THEN

Table 1. EWC 15 transceiver characterstics

<table>
<thead>
<tr>
<th>Transceiver</th>
<th>Receiver</th>
<th>Transmitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature range: -40/+50 °C</td>
<td>Frequency stability in temperature range: 0.1 ppm</td>
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<tr>
<td>External power supply: 21 to 35 V</td>
<td>Sensitivity: -120 dBm at 20 kbps data rate. Up to 150 kbps.</td>
<td>Data rate: up to 625 kbps</td>
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<tr>
<td>Mass: 1.1 kg</td>
<td>Power supply consumption at 25 °C: 1.6 W (active mode) 1.1 W (standby mode)</td>
<td>Power supply consumption at 25 °C: 9.2 W (active mode) 2.1 W (standby mode)</td>
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<tr>
<td>Dimension: 1 liter</td>
<td>RF output power: 2 W</td>
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</table>

GNSS RECEIVER

- Based on COTS => high performance in processing capabilities, flexibility and power consumption
- Functions management dispatched between a FPGA (high speed processing) and a DSP (heavy computations)
- Electrically and mechanically split into 3 parts (power supply, digital and RF front-end)
- GNSS software functions
  - Satellite acquisition (GPS C/A)
  - Signal tracking for GPS/GALILEO channels
  - Navigation operations (satellite prediction, PVT, ephemeris)
  - Management and control (including health and SEU mitigation mechanisms)
  - Communication with On Board Processor (TM/TC)

GNSS equipment

- Powered on at end of April 2016
- Receiver gives an availability of about 99.95%
- GNSS measurements and TM ranging enable orbit restitution accuracy of about 0.089 m radial, 0.297 m along-track and 0.205 m cross-track
- No fault events
- Latest software release to be uploaded during summer 2016

Some in-flight results

- New S band TT&C equipment more robust to Doppler impairment preventing compensation
- Class 2 version of EWC29, up to 10 years in LEO
- EWC31 for Cube and Nanosatellites (CCSDS compliant, low S band consumption)