

Millimeter-wave telecommunication systems for Radio-Science CubeSat missions

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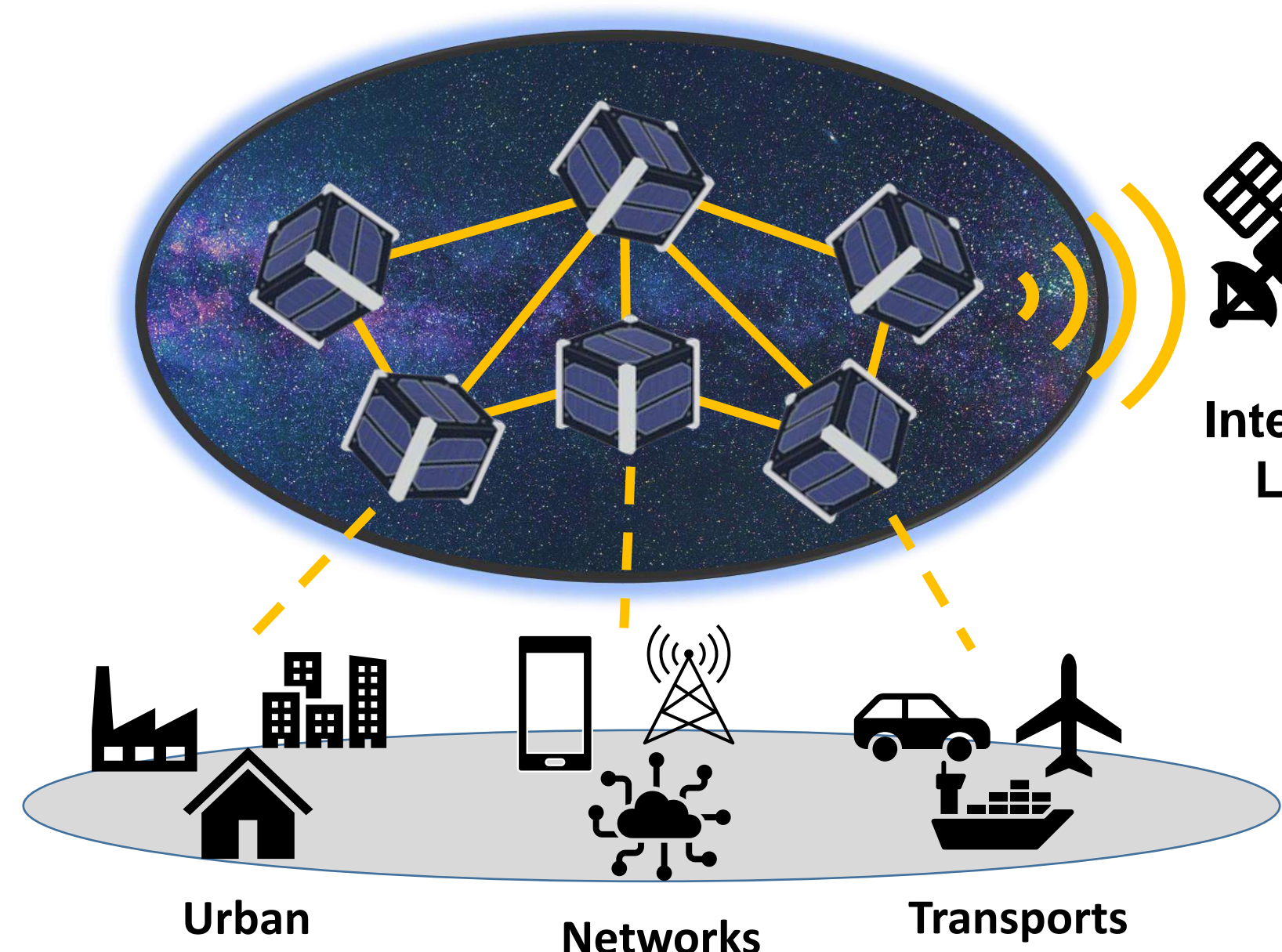
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via Goffredo Duranti 93, 06125 Perugia, Italy



PicoSaTs s.r.l., Area Science Park, Padriciano 99,
34127 Trieste, Italy

Scenario



Internet of Space (IoS):

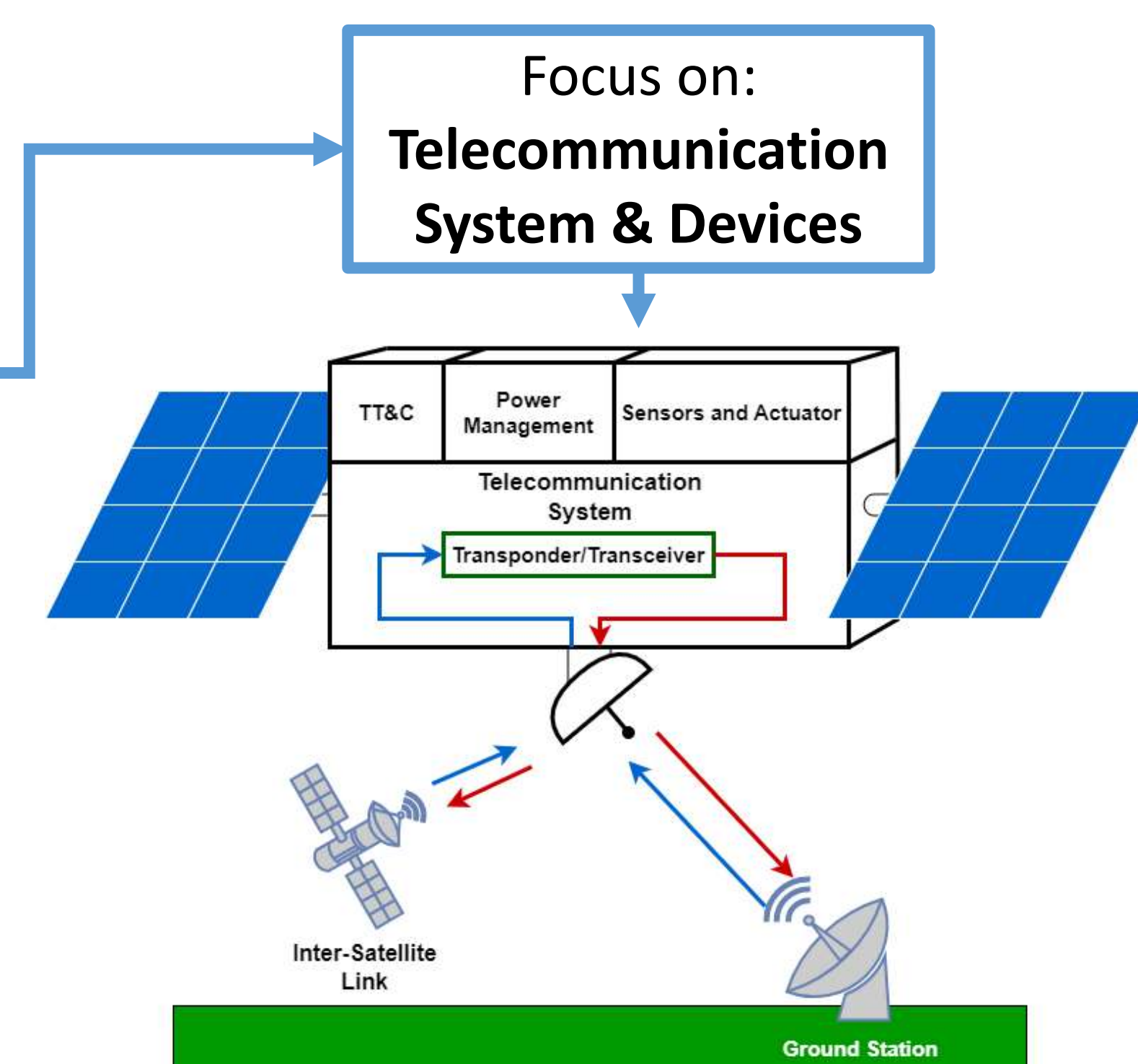
- Telecommunication and connection capabilities to remote places
- Earth/Space observation, radio for science
- Constellations and infrastructure capability

Architecture



Cubesats: standardize architecture composed by multiple Units.

Allowed clusters: 1U up to 27U
(1U: 10cmx10cmx10cm max 2Kg)



Main Ideas

Telecommunication system on different operational bandwidth

Specifications:

- Transponders in Ku & Ka bands
- GEO Satellite
- Less than 1U occupation
- Power dissipation <50W

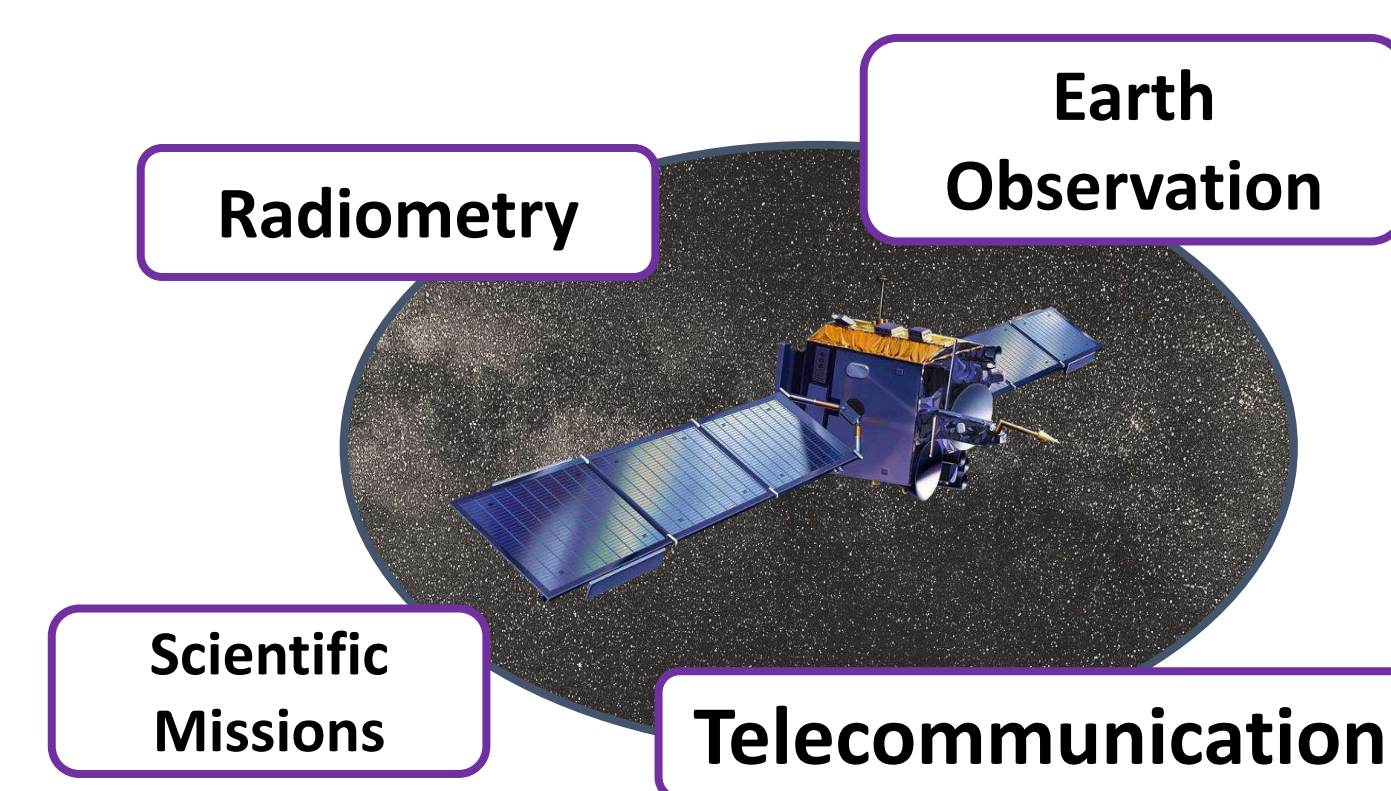


Flight Model Transponder
Curtesy of PicoSaTs s.r.l.

Reconfigurability, what does it mean?

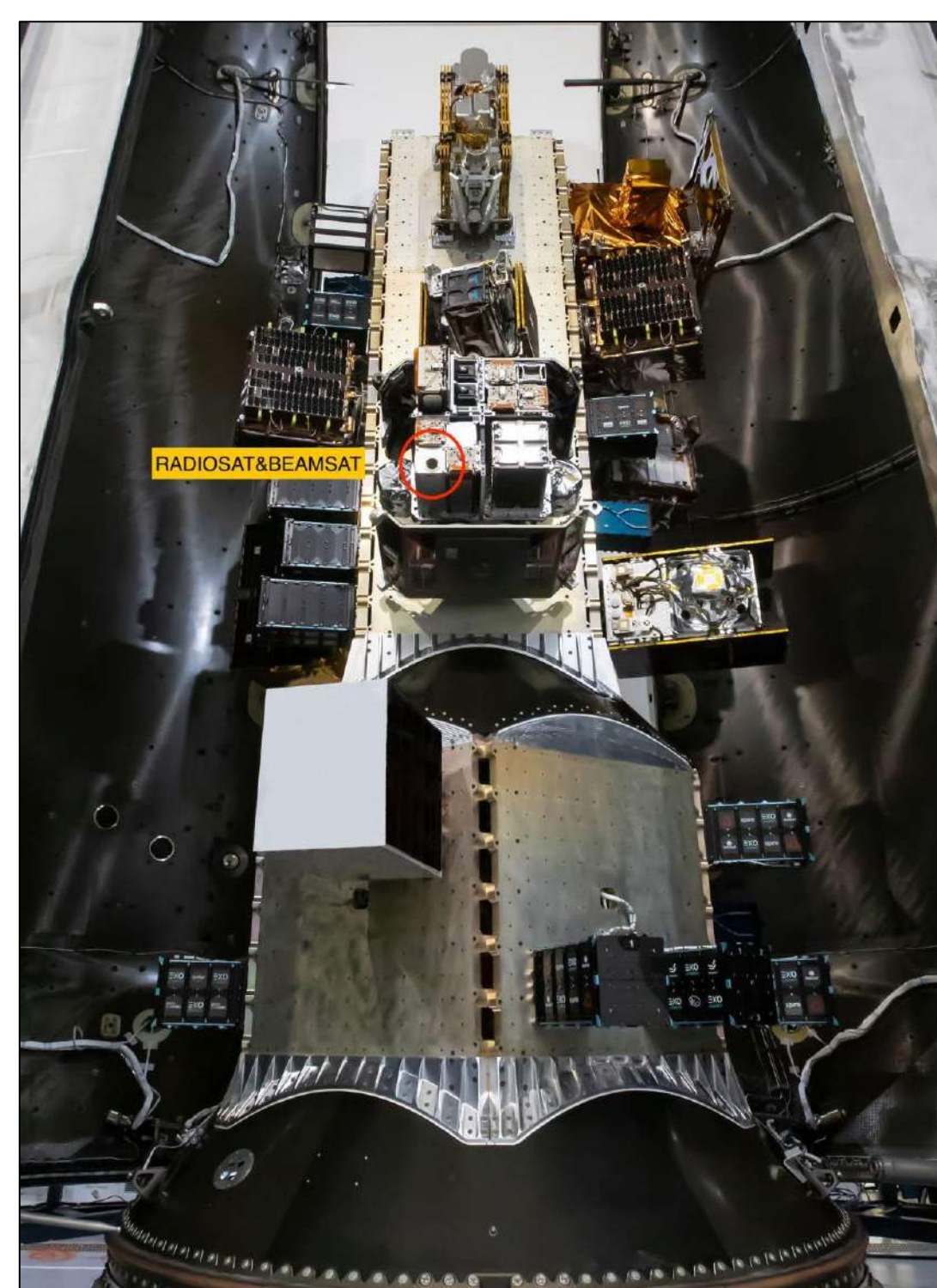
Enable our telecommunication systems to fulfill other functions, by reusing in a smart way what we developed :

- Autonomous signal generation: Propagation Test, Self-Test
- Noise Measurements: Radiometry, Self-Test/Calibration



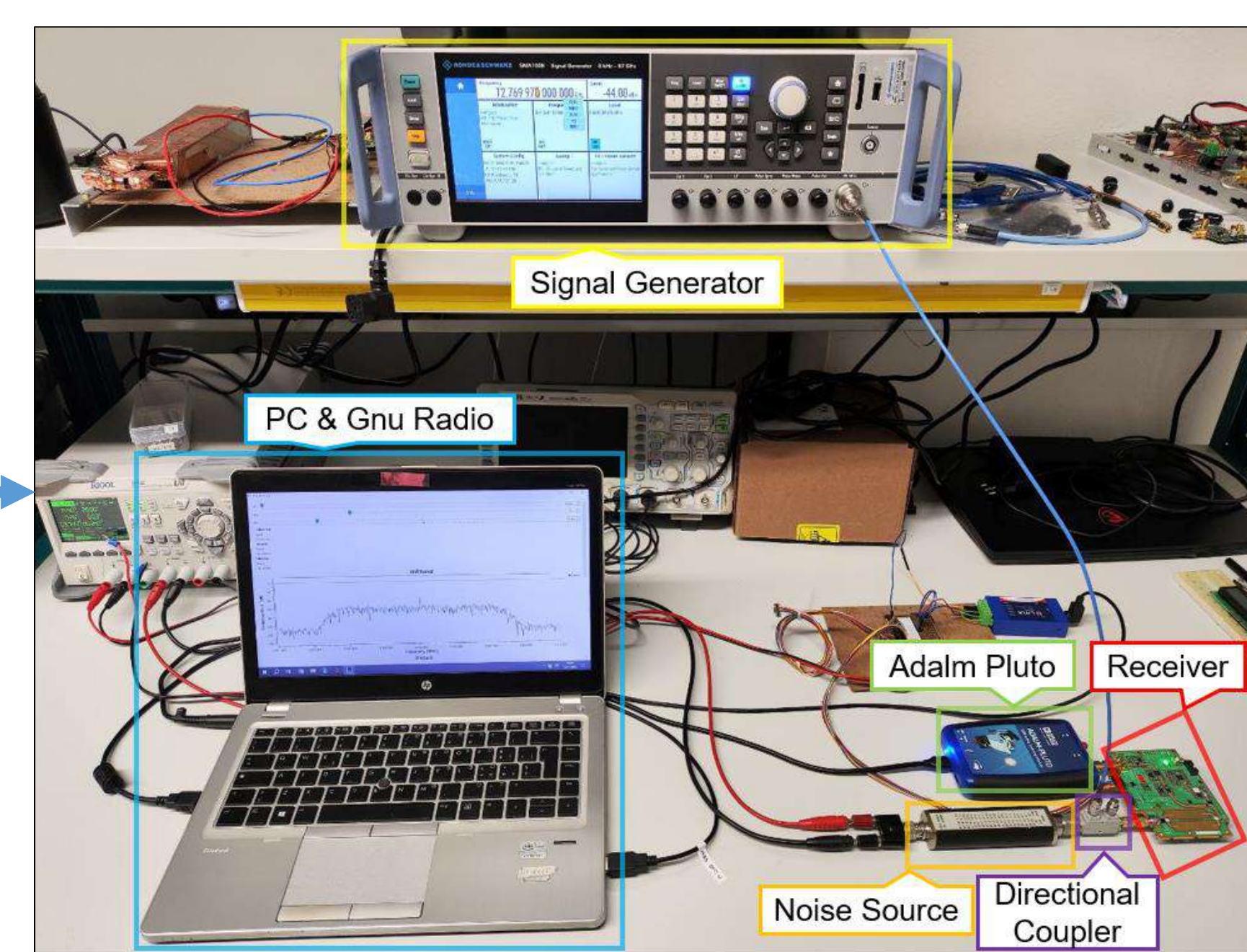
Results

- Realization of two Flight model Ka and Ku band transponders (TRL7)
- Ka transponder tested in space environment (TRL9) !
- Laboratory prototype of Q/V band transponder (TRL4)



Integration into SpaceX carrier
Curtesy of PicoSaTs s.r.l.

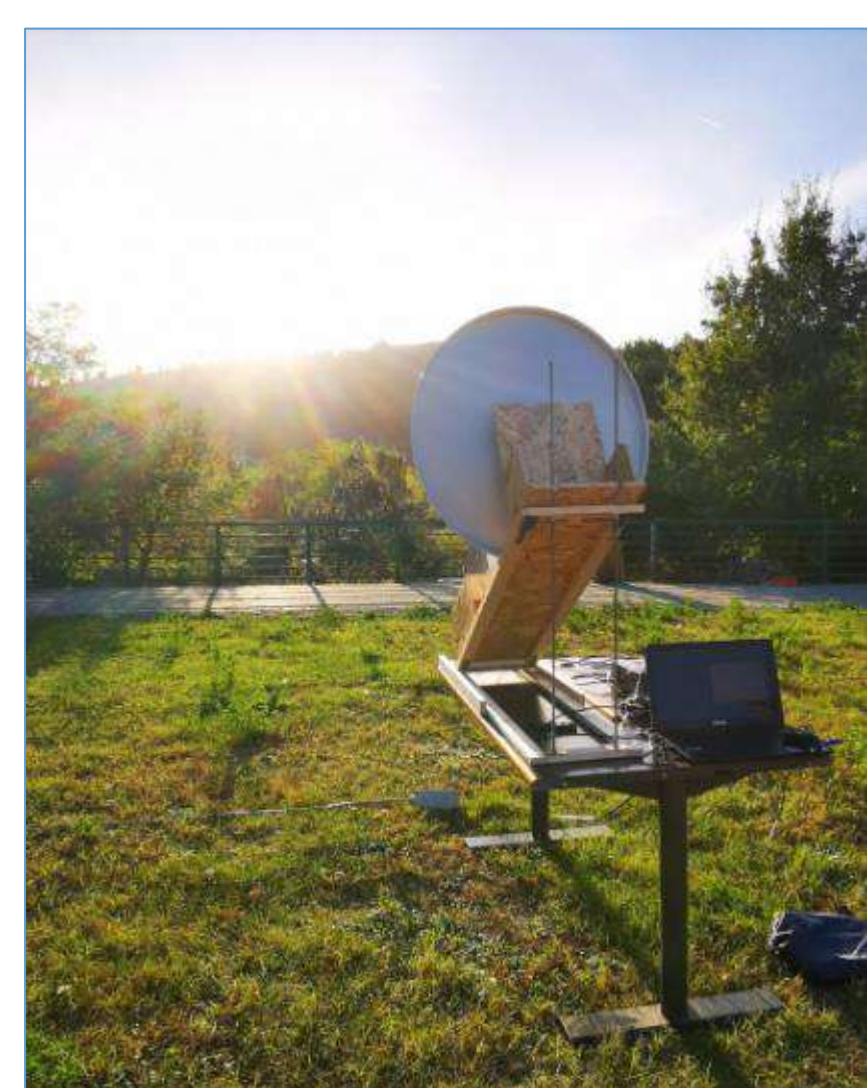
- Autonomous signal generation by telecommunication system
- First demonstration of calibration and self-test by exploiting radiofrequency noise and Software Defined Radio



Future Steps

• Radiometer

Working to transform our telecommunication system into a radiometer fronted

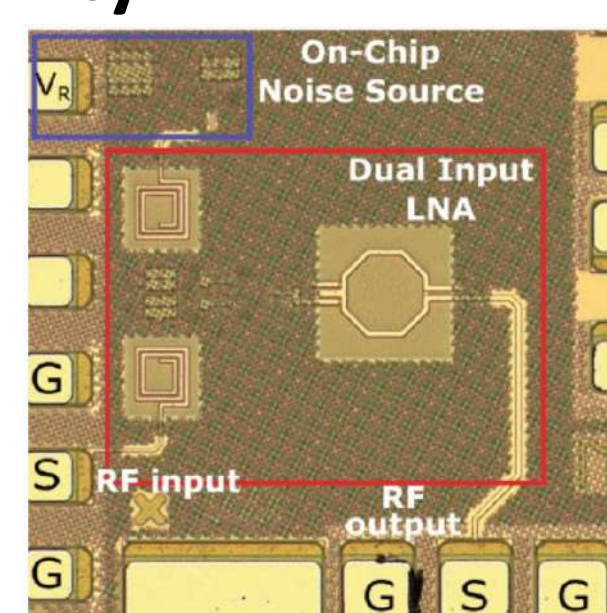


• IC Design



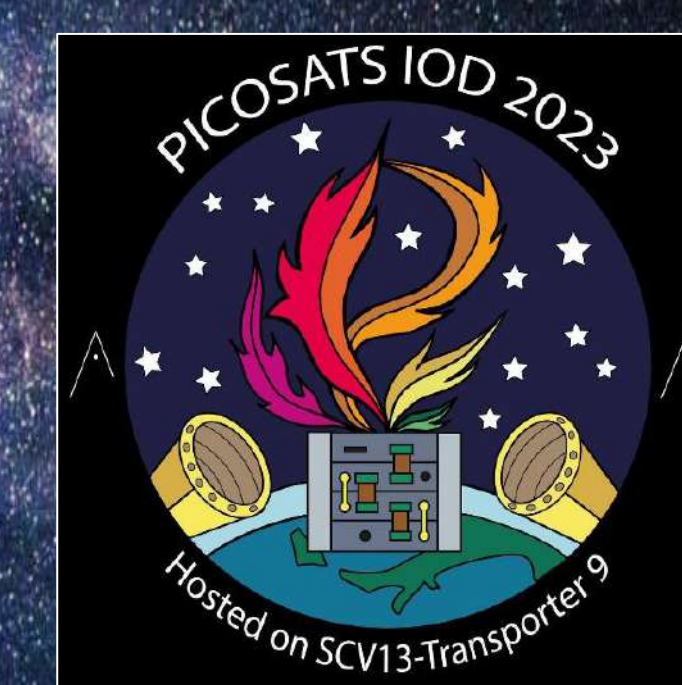
Leibniz Institute for high performance microelectronics

Working with IHP microelectronics to realize integrated frontend and noise source for self-test and calibration capability



Curtesy of G. Simoncini, et al.,
Fully Integrated Built-in Self Test of Millimeter-Wave LNA based on Avalanche Noise Diodes in 130 nm SiGe BiCMOS Technology

• In Orbit Validation



Working with PicoSaTs to validate in space environment the developed systems

ID 188, tLine 1716543485, 7683226, Rx SW 1191081110810880, Rx ADDR 0018119, Data: PICOATS Ka band Radiosat@beamst - 100 2823 BER % 0.0
ID 189, tLine 1716543485, 8555868, Rx SW 1191081110810880, Rx ADDR 0018119, Data: PICOATS Ka band Radiosat@beamst - 100 2823 BER % 0.0
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