The RO Instrument for MetOp-SG
First Test Results

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Presentation Outline

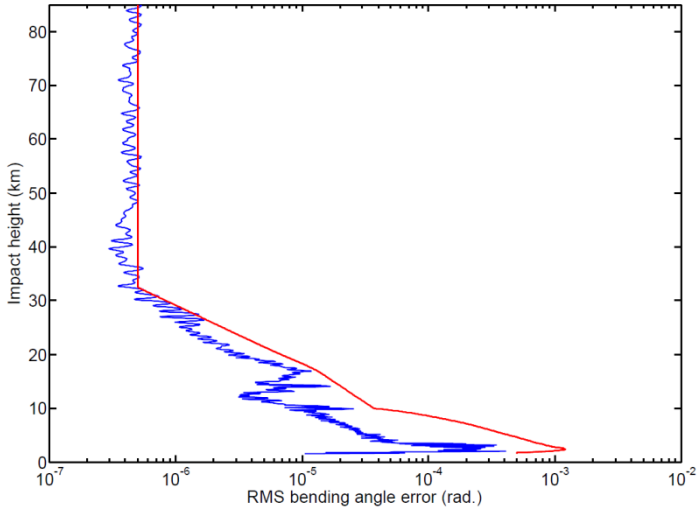
- MetOp-SG RO Instrument design overview
- Antenna test results
- LNA test results
- Instrument test results
  - Test set-up
  - Signal tracking
  - Interference mitigation
- Conclusion

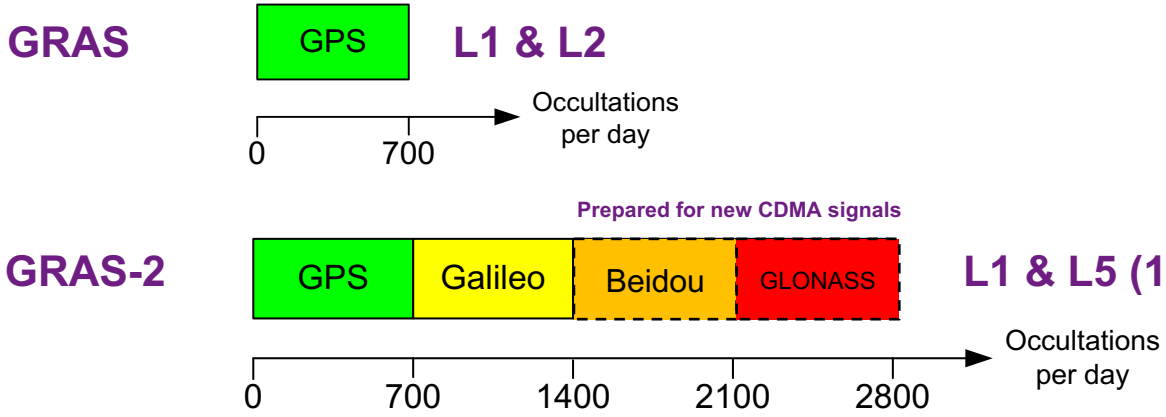
RO for MetOp-SG (GRAS-2)

- Total mass (incl.harness): ~25 kg
- Total power: ~ 50W
- Data rate: ~ 400 kbps per constellation

RO for MetOp-SG (GRAS-2) Design overview

- More occultations: 2800 per day and instrument, enabled by new signal processing ASIC (ESA-developed AGGA-4)
- Full open loop tracking from -300 km SLTA as required for measurements at super-refractive conditions
- Bending angle accuracy <0.5 μrad by improved USO
- Ionosphere coverage up to 500 km
- Mitigation device for DME/TACAN interference on L5
- 7.5 years lifetime (partial redundancy)





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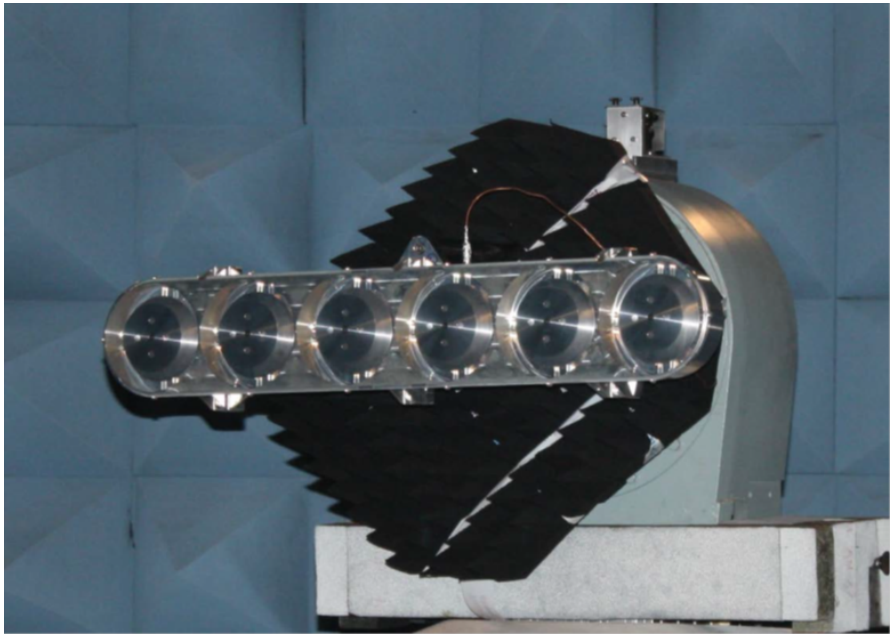
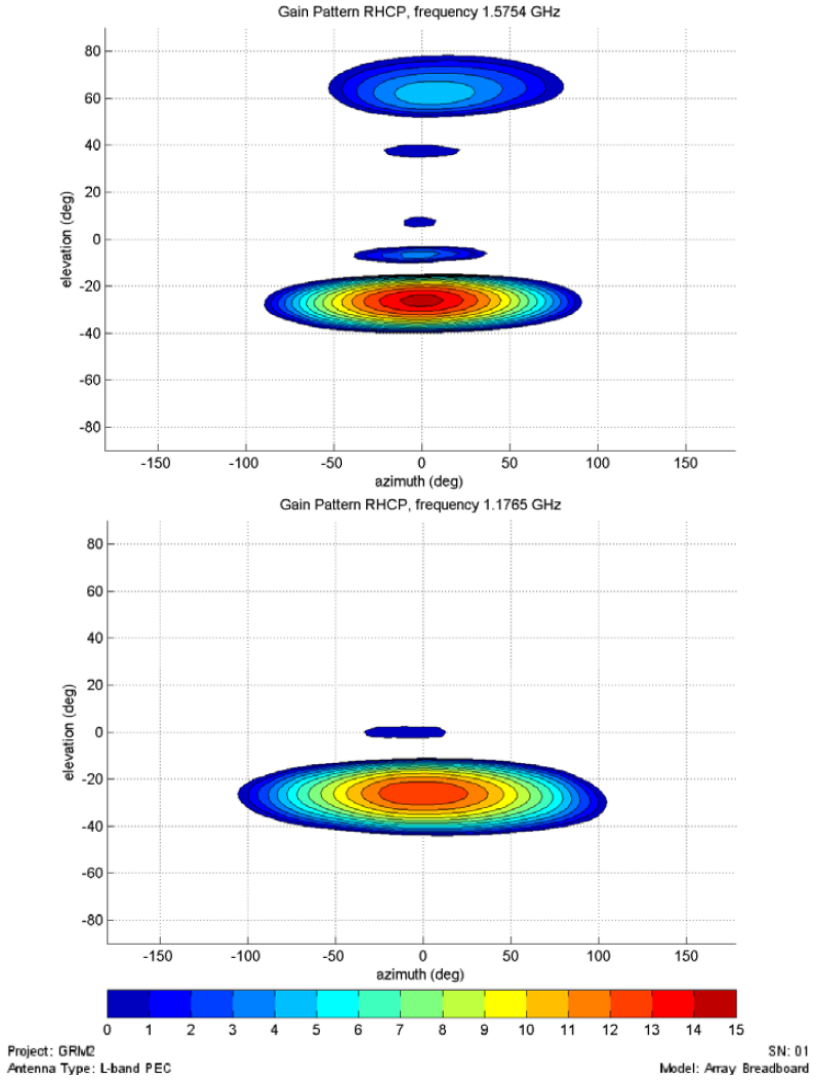
Antenna test results





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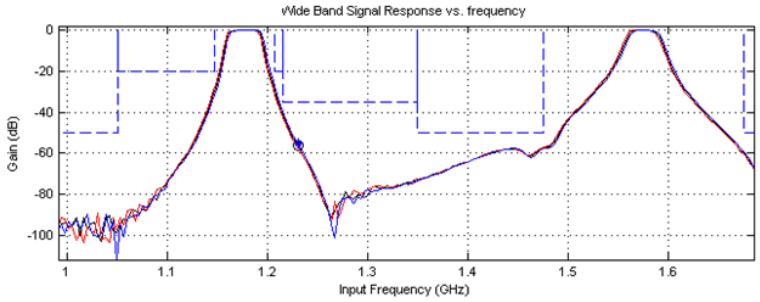
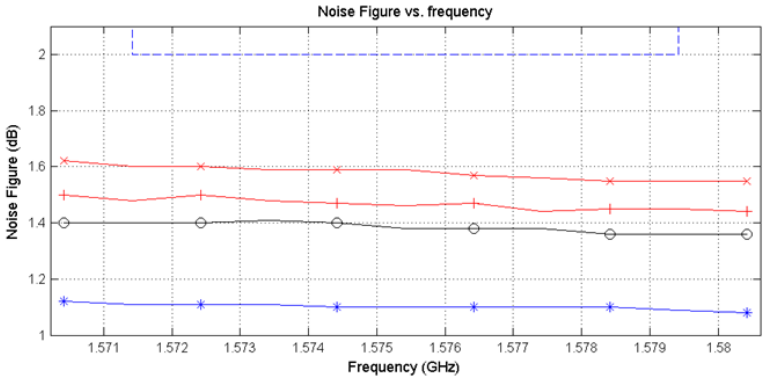
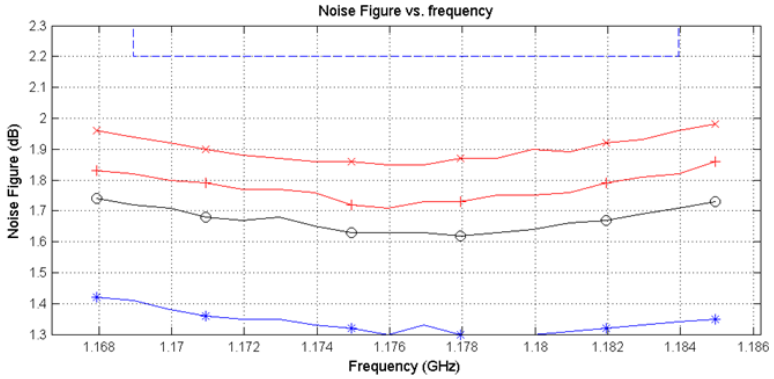
LNA test results

LNA BB (LNA-V, LNA-AV, LNA-Z)







NF at -30, +24, +40, +60 deg C

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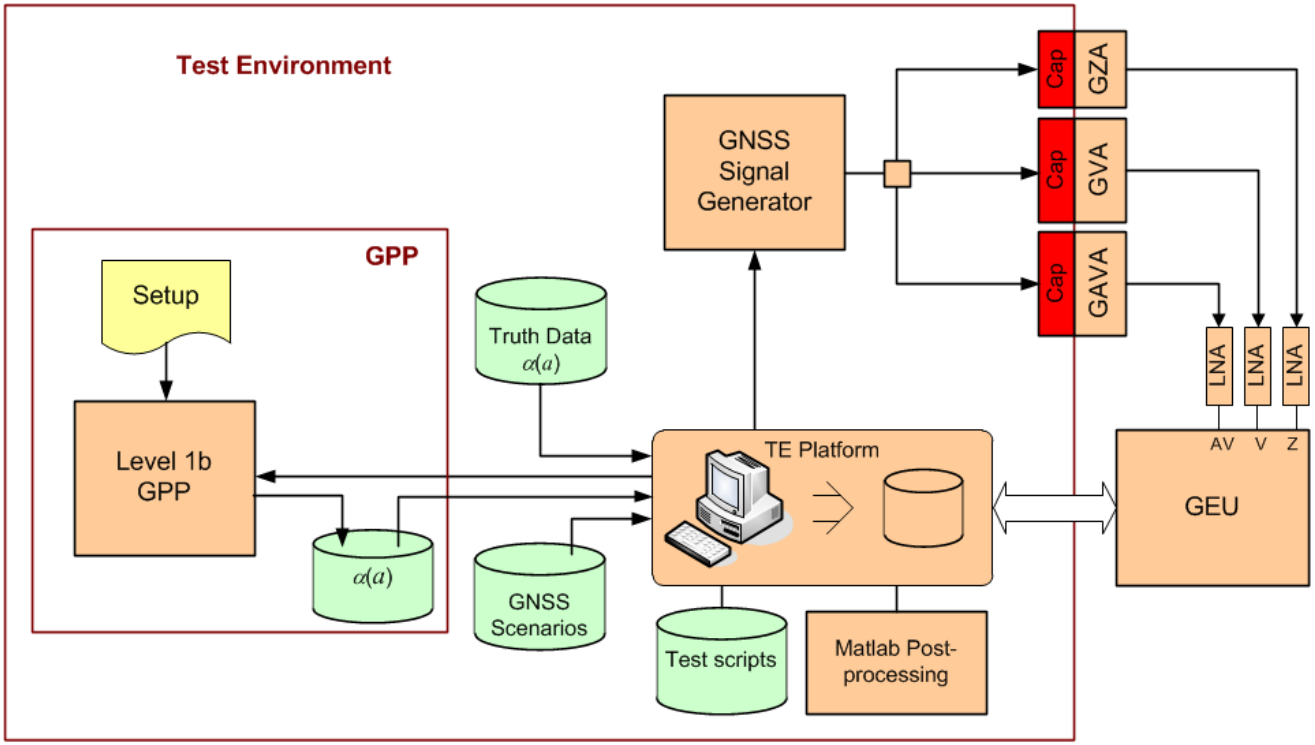
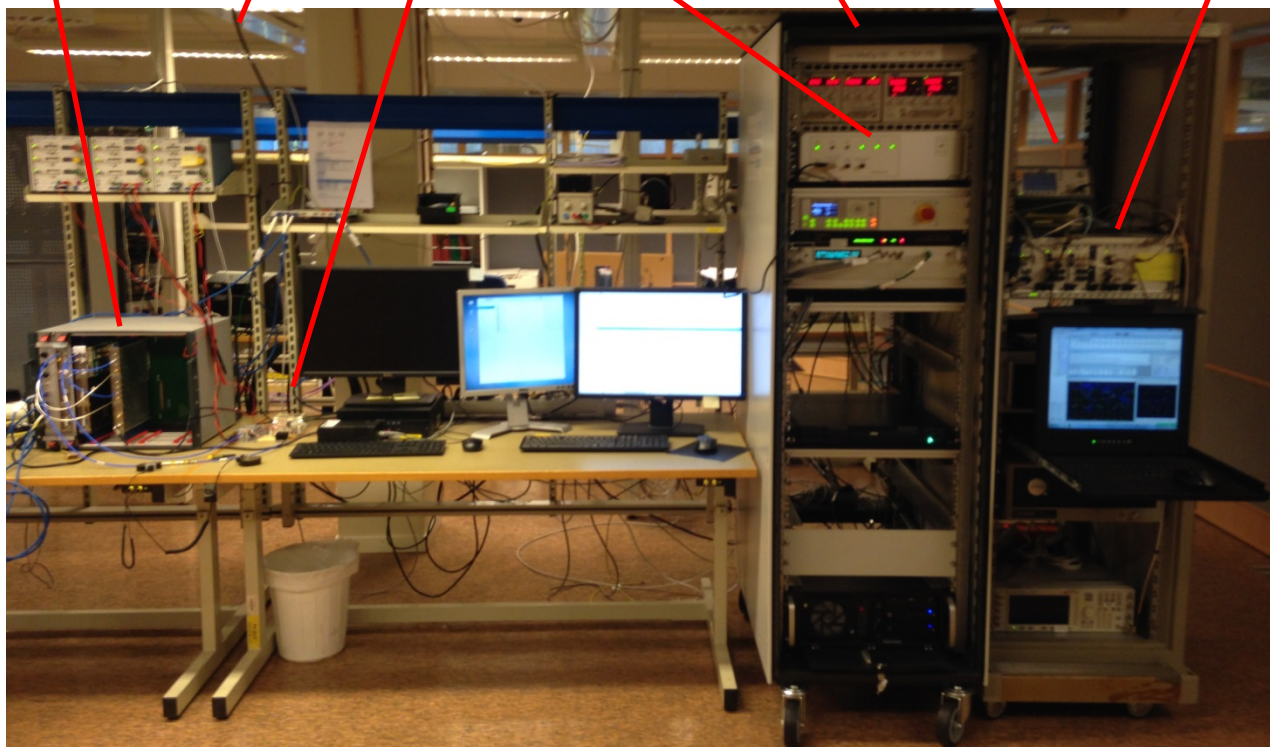
End-to-End Performance Test Set-Up

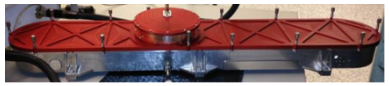


The aim is to verify the bending angle measurement performance by
1) Generate GNSS signal with modulation according to wave optics propagation through different atmospheres.
2) Inject the signal through antenna test caps to the complete instrument
3) Perform processing to bending angle versus impact parameter.
4) Comparison to the theoretically expected bending angle (i.e. the Abel inverse)

Breadboard Test Set-up



Antennas with test-caps



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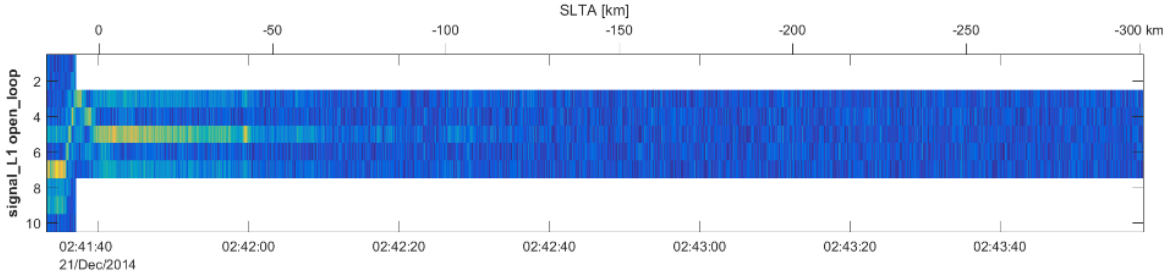
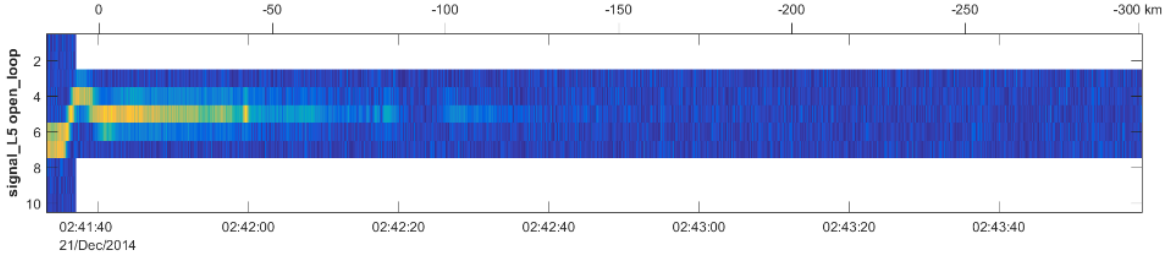
Preliminary tracking test results

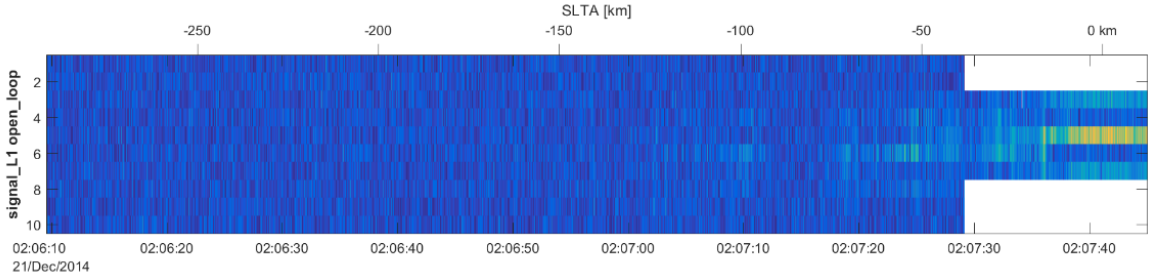
Setting Open Loop L1



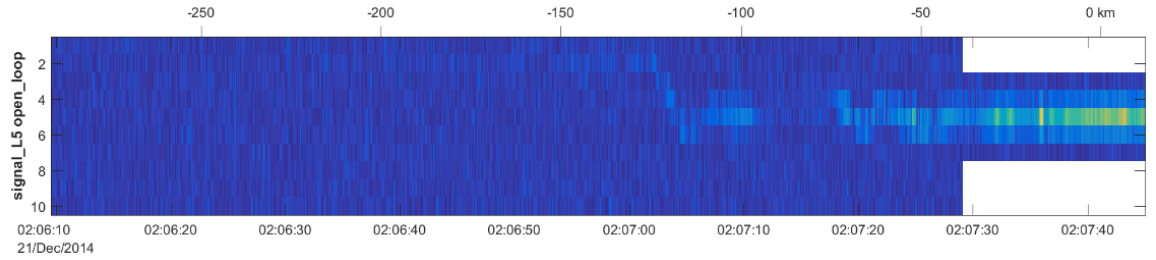
Setting Open Loop L5



Rising Open Loop L1



Rising Open Loop L5



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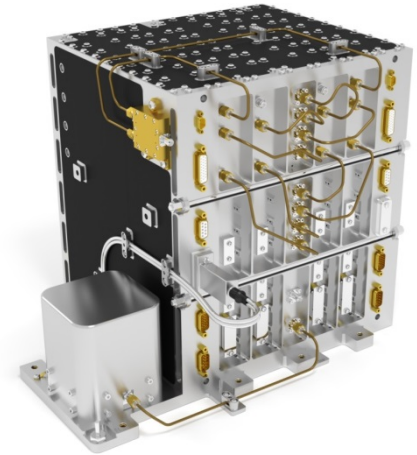
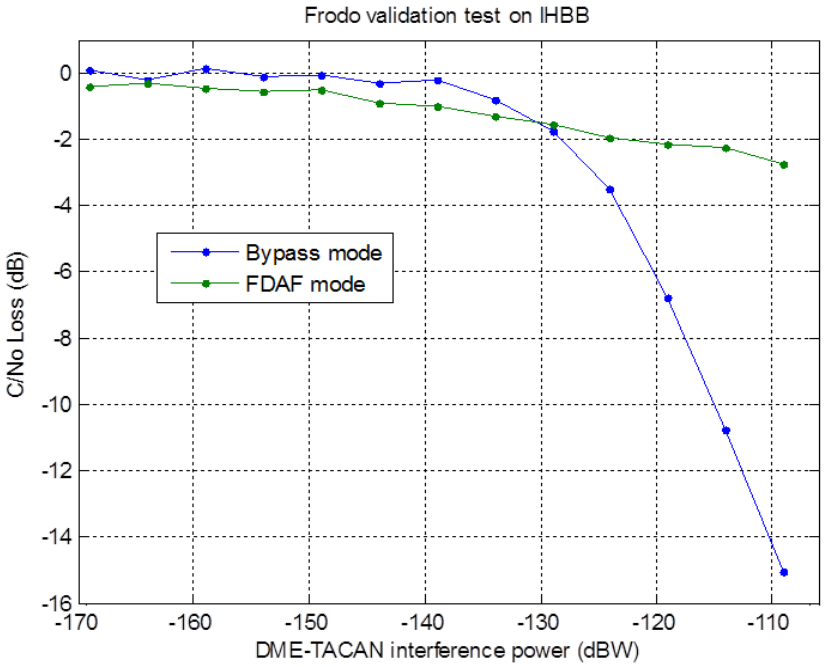
Test results for DME/TACAN interference filtering on the L5 chain

The GNSS signals in the L5 band are interfered by ground based transmitters for the aeronautical radio navigation system DME/TACAN.

The GRAS-2 instrument is therefore equipped with an interference mitigation device which suppresses this interference.

A breadboard version of the instrument have been tested with RO signal stimuli generated by a GNSS signal generator and simulated DME/TACAN interference.





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Conclusion

- Test results so far:
  - Antenna patterns and LNA performance
  - GPS and Galileo tracking at L1/L5
  - Full open loop tracking with multiple correlators
  - DME/TACAN mitigation performance in the L5 receive chain
- Still to be done:
  - Integration of final software (closed loop)
  - End-to-end test of bending angle performance
- The good cooperation with the MetOp-SG RO teams at EUMETSAT, ESA, Airbus, SSF, Tryo, Thales Alenia Space, Spectratime, RUAG Space in Vienna and Gothenburg is gratefully acknowledged