RO instrument design considerations for the new GNSS signals

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The new signals gradually becoming available from GPS, GALILEO, in the L1/E1 and L5/E5 frequency bands, will enable more accurate measurement at high altitude as well as measurements to lower altitudes than previously. The next generation RO instrument under development at RUAG Space will take advantage of these signals to improve measurement performance as compared to the present GRAS instrument generation that operates on the MetOp satellites. The new signals allow for dual-frequency tracking without anti-spoofing losses, which enables bending angle measurements with lower noise levels than what is available today and dual frequency measurements to low altitudes. This also requires careful design of the front-end electronics such that that the error contribution from receiver phase-noise will not dominate the measurement error. The new signals will also allow for improved tracking using the data-free pilot signal components. A link budget improvement is further obtained by combining the pilot and data signals in the ground processing. Experience from MetOp-GRAS shows that the onboard range and Doppler models are sufficiently accurate to allow for model based control of the data demodulation in the lower part of the atmosphere and allow for bending angle retrieval also in severe conditions of atmospheric multipath. Several studies, covering simulation of signal propagation and instrument receiver models, are performed at RUAG Space with the aim to optimise tracking strategies and algorithms. Simulation results of instrument tracking under challenging conditions will be presented.