Beam-Steerable GNSS Radio Occultation ASIC

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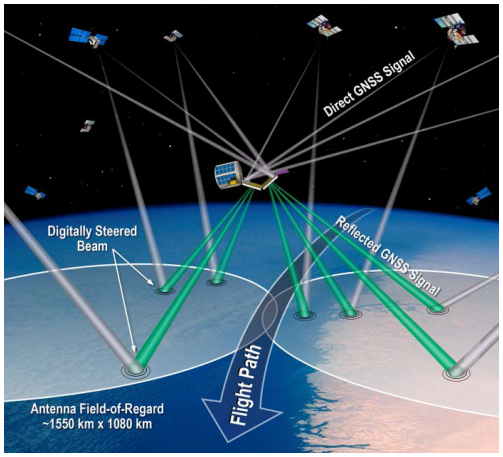
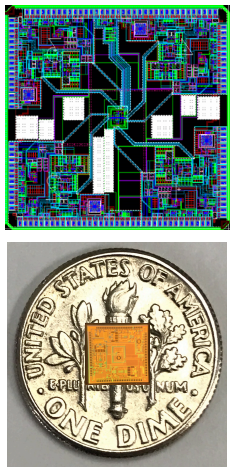
Objective

- Develop a new GNSS (Global Navigation Systems Satellite) RF receiver front end ASIC that is:
  - Compact, lightweight, and low-power to enable a new generation of low-cost GNSS constellations, as well as easier accommodation on missions of opportunity, for high quality radio occultation weather observations
  - Capable of sampling multiple RF inputs to enable high performance, high SNR beamforming for occultation and surface reflection measurements in support of ocean altimetry and scatterometry observations



GNSS receiver concept with beam-steerable ASIC for reception and beamforming of direct and reflected GNSS signals



SiGe GNSS receiver chip layout (top) and fabricated chip (bottom)

Accomplishments

- Developed detailed requirements for a 3-antenna-input, 9-RF-output, broadband receiver frontend for next-generation GNSS and reflectometry applications
- Designed an integrated, low-power receiver frontend circuit suitable for application in a radiation environment
- Fabricated the receiver frontend ASIC chip using the 130 nm SiGe 8HP BiCMOS process
  - Demonstrated superior functional capabilities and physical characteristics over the current state-of-the-art, including the reception of all known GPS networks worldwide; 3 times the number of output channels; more than 90% reductions in size and power consumption
- Integrated and tested the receiver frontend with the JPL GNSS receiver, simulator and beam steerable antenna, including thermal cycling test
  - Verified that the measured radiometric performance was in compliance with the requirements, and that the group delay and phase stability are more than an order of magnitude better than those of the current receivers

Co-Is/Partners: Jeff Dickson, Anthony Mannucci, JPL; Russ Hershbarger, James Little, Jeff Illgner, GigOptix

TRL_{in} = 2 TRL_{out} = 5