

Simultaneous X- and Ka-Band Receiver for Astrometry and Navigation

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A wideband 8-36 GHz prototype receiver that can simultaneously observe at X and Ka-band is in development. A key technology in this development is the wideband cryogenic monolithic microwave integrated circuit (MMIC) Low Noise Amplifier (LNA). This receiver has potential use in expanding and maintaining an X-Ka reference frame for astrometry and navigation. Reference frames are needed for spacecraft navigation, including determining positions of quasars for navigation beacons, measuring station locations, and measuring earth orientation to the nano-radian level or better. Further, there are numerous spectral lines within this band, including methanol (CH_3OH) and water (H_2O), from which the composition and dynamics of astronomical objects can be measured.

Simultaneous measurements of X and Ka band allow for calibrations of both the Earth's ionosphere and solar plasma at the exact time and direction of the observations. The acquisition of data in the 8-36 GHz range would consolidate several receiver systems (X, Ku, K, and Ka) into one receiver package, which saves space, power, minimizes maintenance cost, and allows for additional receivers in VLBI systems.

This receiver was designed for possible use with the Very Long Baseline Array (VLBA). The prototype includes a broadband single quadridge feed and a broadband LNA [1] and provides dual polarization (RCP/LCP) full Stokes images of intensity and polarization. The receiver will output at least two bands simultaneously with the potential for four simultaneous bands (X, Ku, K, Ka). Testing at JPL is currently taking place, with a goal to demonstrate interferometric fringe detection with the VLBA at X and K band.

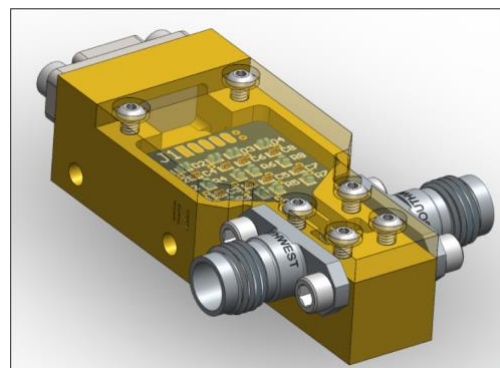


Figure 1- Very Long Baseline Array (Owens Valley site) at left. 8-36 GHz Low Noise Amplifier and housing at right.

References

- [1] A. Fung, L. Samoska, J. Bowen, S. Montanez, J. Kooi, M. Soriano, C. Jacobs, R. Manthana, D. Hoppe, A. Akgiray, R. Lai, X. Mei, M. Barsky, "X- to Ka- Band Cryogenic LNA Module for Very Long Baseline Interferometry," *2020 IEEE/MTT-S International Microwave Symposium (IMS)*, Los Angeles, CA, USA, 2020, pp. 189-192, doi: 10.1109/IMS30576.2020.9224106.

- [2] J. Velazco, L. Ledezma, J. Bowen, L. Samoska, M. Soriano A. Akgiray, S. Weinreb, J. Lazio “Ultra-Wideband Low Noise Amplifiers For The Next Generation Very Large Array,” *2019 IEEE Aerospace Conference*, Big Sky, MT, USA, 2019, pp. 1-6, doi: 10.1109/AERO.2019.8742126.