

A MULTICHANNEL DUAL-MIXER STABILITY ANALYZER: PROGRESS REPORT

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The Frequency Standards Laboratory at JPL is developing a new stability analyzer for 100-MHz sources in the Deep Space Network. Goals for the instrument are high sensitivity along with simple and flexible operation. Results are to be available both locally and remotely. In order to measure the Compensated Sapphire Oscillators developed in support of Cassini radio science experiments, we are aiming for an Allan deviation noise floor of a few parts in 10^{15} at 1 second.

The instrument will have a single reference source, offset 100 Hz in frequency by means of two single-sideband mixers followed by a cleanup loop. As many as eight sources will be beat against the reference; the zero crossings of all the beat notes will be captured by an event timer PC card and averaged down to phase residuals on a fixed 0.5-s grid. The residuals will be stored on disk, from which any interval of data can be processed into time series and sigma-tau plots.

Phase residuals from any two single-mixer channels can be subtracted to give dual-mixer residuals, with noise from the offset reference being cancelled by the subtraction. For this scheme to succeed, the beat frequency has to be much greater than the 2-Hz sample rate; this is because uncanceled reference noise in the averaged phase residuals comes from sidebands of width 2 Hz that are separated from the reference carrier by multiples of the beat frequency.

At this writing, the offset generator and zero-crossing detectors are almost built; we expect to give a report on the measurement performance.

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