NATIONAL RADIO ASTRONOMY OBSERVATORY
GREEN BANK, WEST VIRGINIA

ELECTRONICS DIVISION TECHNICAL NOTE NO. 161

Title: **Phase Jitter Measurements and Noise Floor in the SSB Downconverter**

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Date: August 28, 1990

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Memorandum August 28, 1990

To: Spectral Processor Group

From: Steve White

Subject: **Phase Jitter Measurements and Noise Floor in the SSB Downconverter**

The phase performance of the SSB Downconverters was characterized over an LO frequency range of 260 to 650 Mhz. The Marconi 2022C was used as the signal source with maximum residual fm noise of 7 Hz. The frequency of the generator was set to produce a 10 Khz video signal and then a 5 Mhz signal. The HP digitizing scope was triggered from a 5 Mhz maser reference, which was divided to 10 Khz for the low frequency test. The peak-to-peak deviation was measured at the zero crossing point as shown in Figure 1. The peak-to-peak value was divided by 5 to achieve the root mean square value and then converted to degrees. The specification for the VLBI Mark III Video Converter is < 4 deg for the synthesizer range 100 to 450 Mhz and < 9 deg for the range 450 to 500 Mhz.The plot in figure 2 shows the average value for the eight drawers for the 10 Khz video output along with the hi and lo values for each LO frequency. The plot of figure 3 compares the average values for the 10 Khz measurement with the 5 Mhz values.

A typical video noise spectrum with the RF input terminated and a Lo frequency of 500 Mhz is shown in Figure 4. Spurious signals in the 0 - 40 Mhz band are undetectable with a spectrum analyser. The noise density in this frequency range is -112 Db/Hz. In the range 40- 100 Mhz, a spurious signal is present which is related to the internal synthesizer. The signal is produced by the divide by 10 digital chip in the digital section of the frequency synthesizer. Therefore, the spurious signal has detectable frequency components of LO/10 and 3 x LO/10. The level of these signals is less than 10 Db above the noise floor in the 40 -100 Mhz frequency range. Additional spurious signals are generated by the divide by 256 LO monitor chip. The energy is centered around 60 Mhz. The level of these signals is less than 3 Db above the noise floor. The noise floor level of the 40 -100 Mhz is on average -121 Db/Hz.

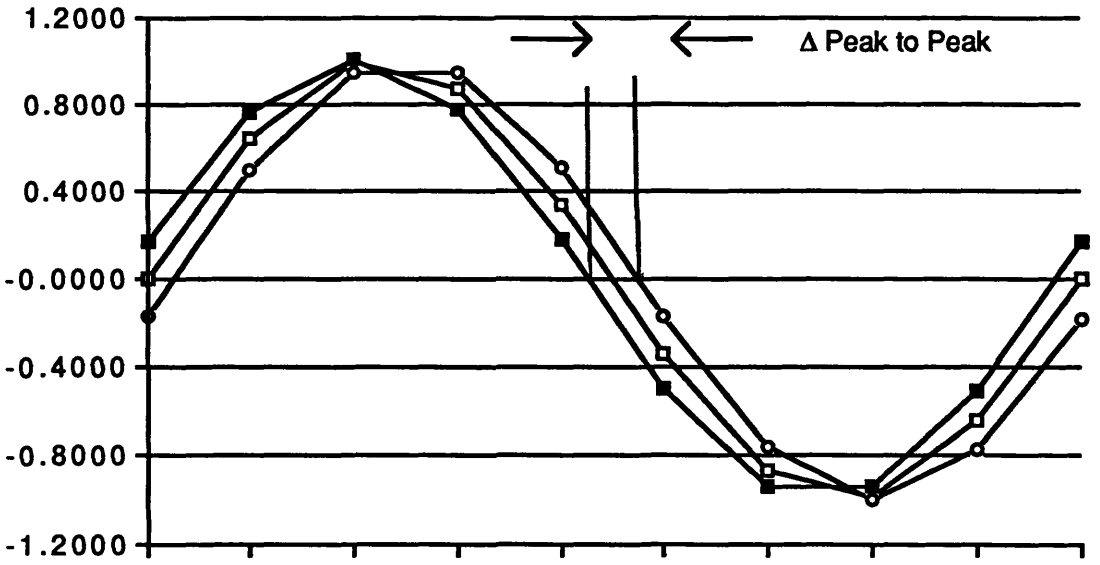


Figure 1 Measurement Technique

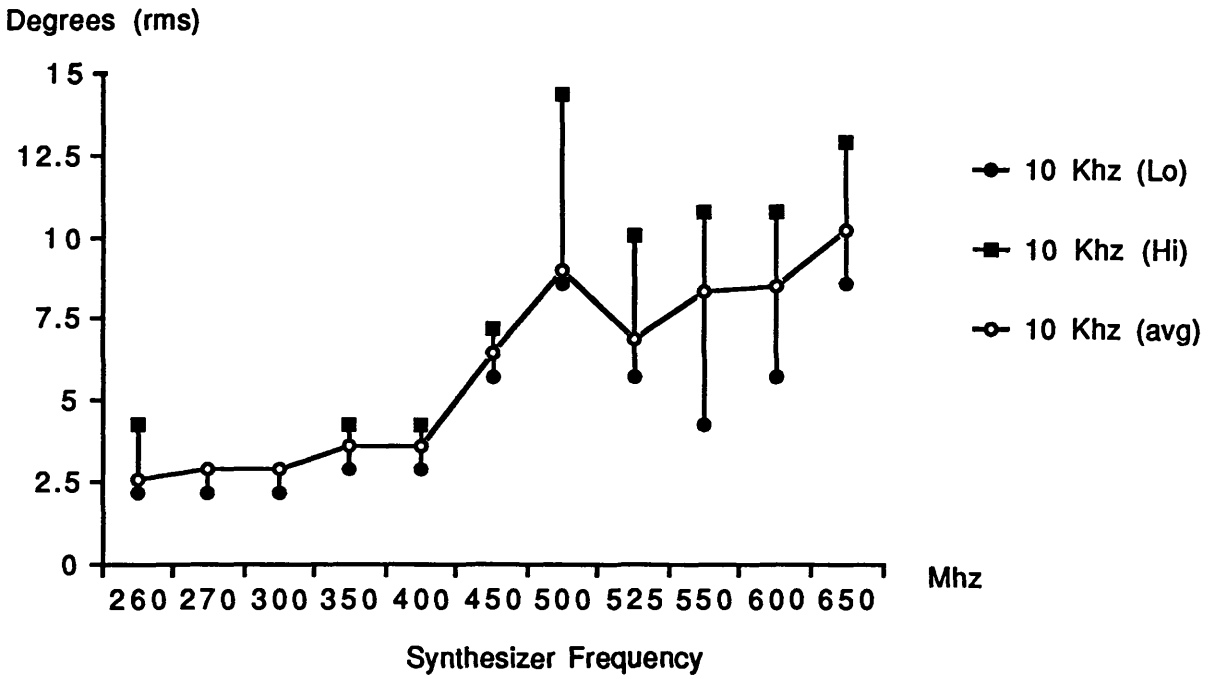


Figure 2. 10 Khz Measurement

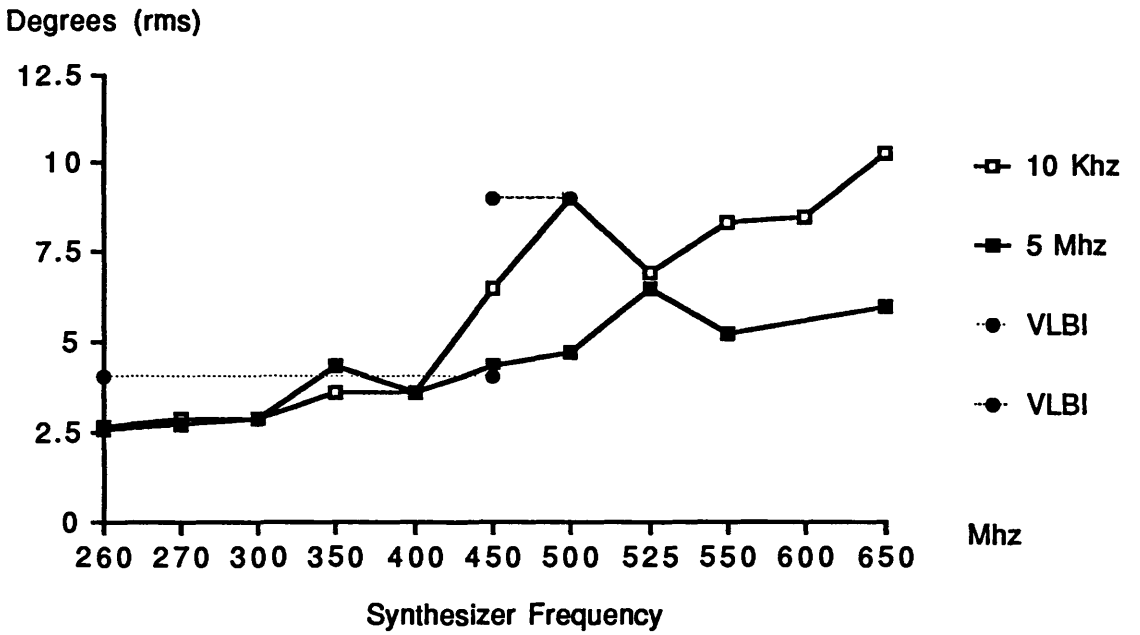
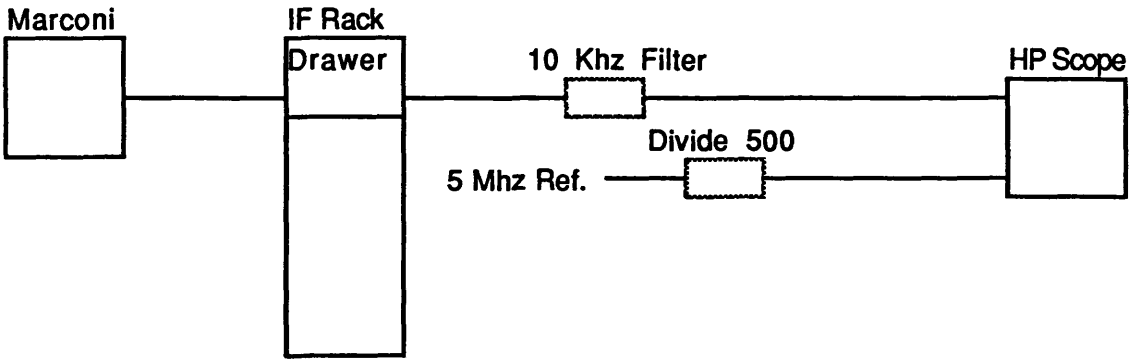


Figure 3. Comparison of 5 Mhz and 10 Khz Phase Jitter.



Test Configuration

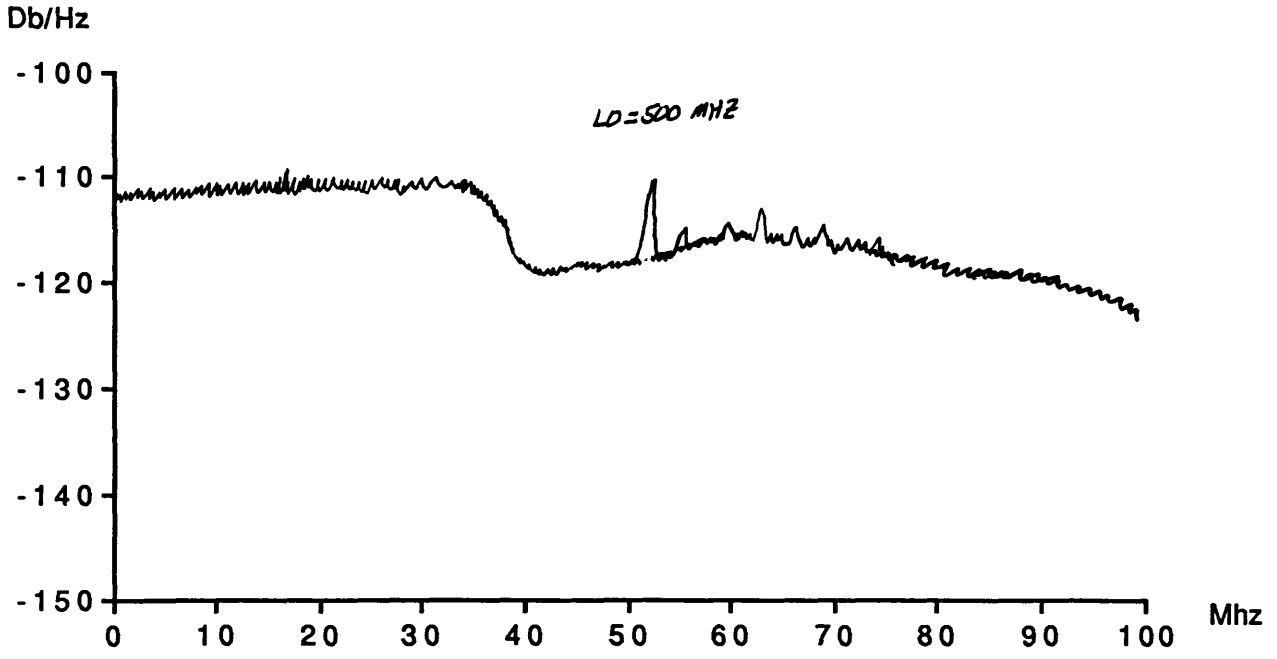


Figure 4. SSB Downconverter Noise Floor Spectrum