GBT MEMO 170

GBT Spectrometer Sampler Tests

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During the last few weeks we have been performing tests on the samplers used in the GBT spectrometer. Long term integrations were run on both the 100 MHZ and 1.6 GHz samplers. A single sampler of each type was tested. This report gives the results of these tests.

An additional test was run with the software developed for the sampler test to try and find out the severity of the correlator chip ground bounce problem. Results of this test are also given.

A program was written for the spectrometer VME computer that did long term (signal reference)/reference integrations. Integrations of up to 100 hours were performed. The integrations were done with a GBT filter module as a driving source for the GBT spectrometer. The input to the filter module was a wideband noise source so the spectrometer output upon taking a spectrum produced the normal filter module filter shape. Wideband inputs to the samplers were 50 to 100 MHZ into the 100 MHZ sampler and 800 to 1600 MHZ into the 1.6 GHz sampler (this being normal inputs for the GBT spectrometer).

Integrations were performed for 60 seconds on signal and 60 seconds on reference (there was no difference between the two). The lags produced by each integration were quantization corrected, Hanning windowed, and FFTed. Since "signal" and "reference" were the same, the long term integration should have trended towards zero. After each sig/ref sequence, the RMS of spectral points from 512 to 3584 was calculated from the running integration and plotted on a log-log plot against time (4096 lags were generated resulting in a 4096 point spectrum).

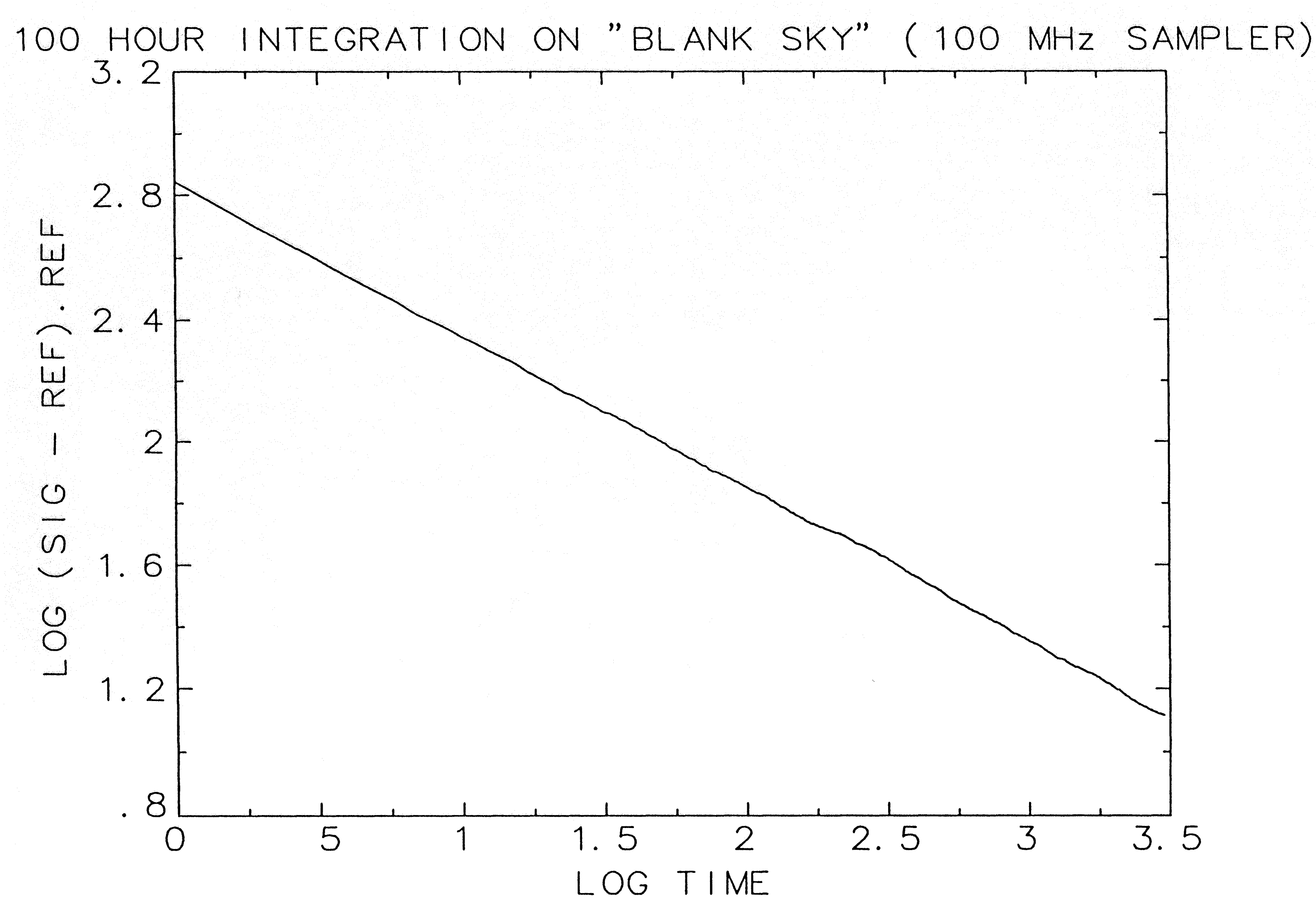
After the long integration was halted, the residual sig-ref/ref spectrum for the entire scan was plotted.

Tests on both GBT spectrometer samplers indicated normal operation. The 100 MHZ sampler was run for 100 hours (50 hours, total, on signal and 50 hours on reference) and the 1.6 GHz sampler was run for 96 hours. In both cases the noise level went down with a slope of -0.5 when plotted on a log-log graph against time for the entire duration of the test. Results of the two long term integration integrations may be seen in the attached figures.

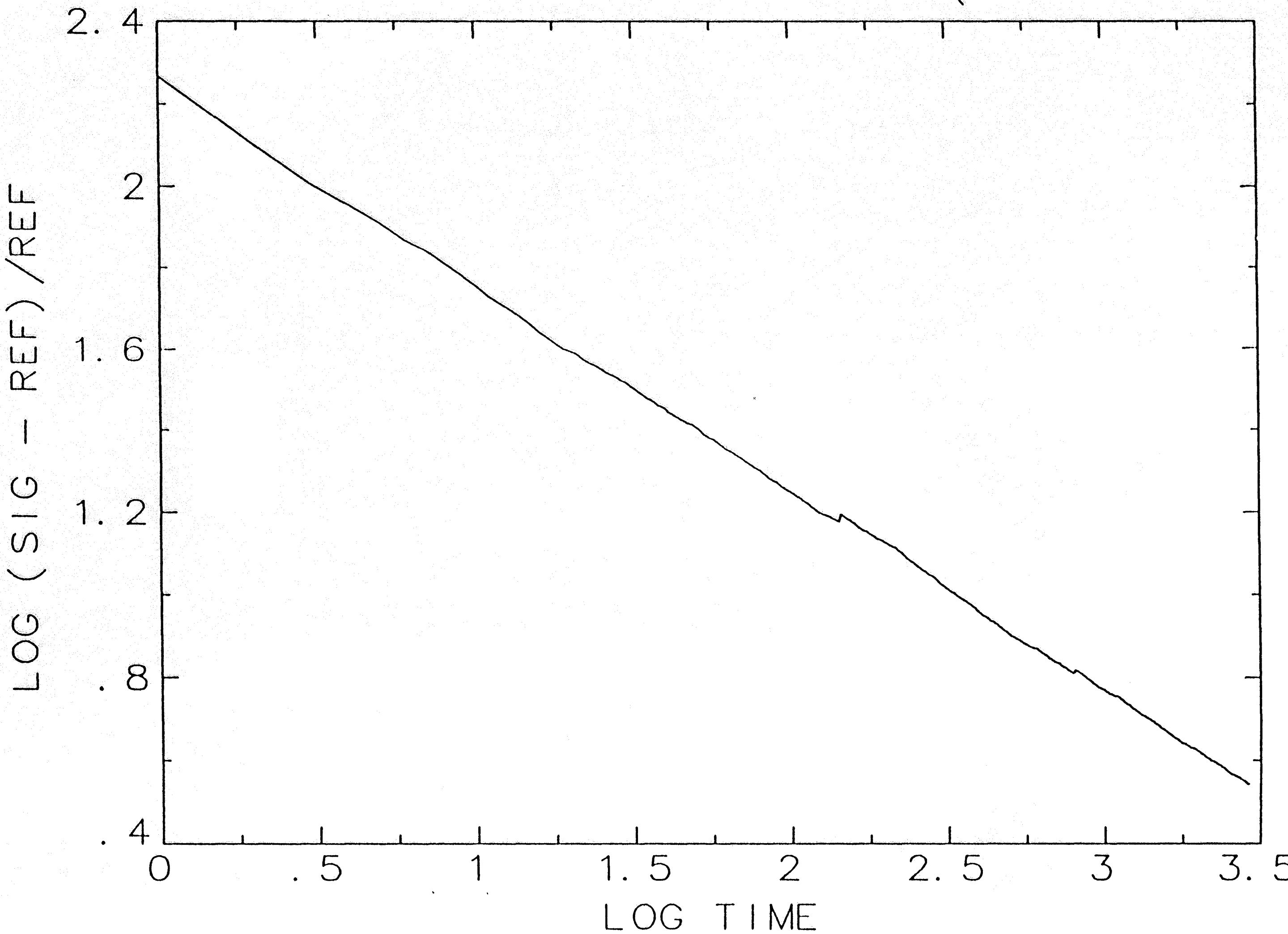
The residual sig-ref/ref spectra at the end of the long integrations showed flat featureless spectra except for the band edges where the filter skirts were. This also indicates acceptable operation in both samplers.

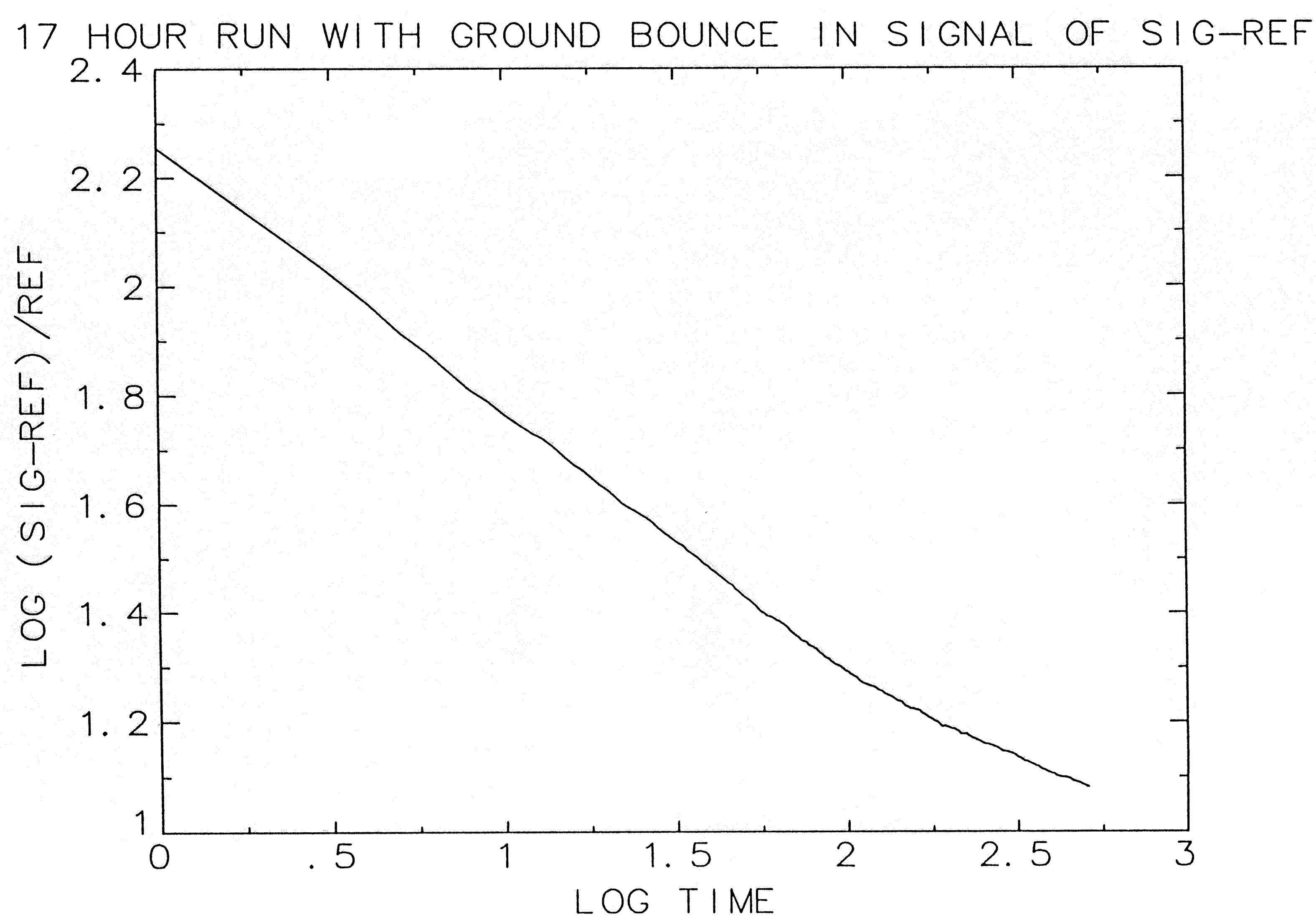
A variation of the signal-reference/reference test was performed to see how important avoiding the correlator chip ground bounce problem is. This test set the LTA clock delay in the spectrometer to the worst delay setting (that is, the delay that caused the most ground bounce errors) during the signal integration and to the best (error free) setting during the reference integration. The purpose of the test was to see if the ground bounce problem produced any residual problems in the spectrum or in the long term integration.

After about 2.6 hours (1.3 hours on signal and 1.3 hours on reference) the plot started to deviate from a straight line -0.5 slope (the total run made was 17 hours long). Thus, the chip ground bounce problem can show up as a serious problem in deep integrations. Again, test results may be seen in the attached figures.


100 HOUR INTEGRATION ON "BLANK SKY" (100 MHz SAMPLER)
LOG (SIG - REF). REF
3. 2
2. 8
2. 4
2
1. 6
1. 2
. 8
0
5
1
1. 5
2
2. 5
3
3. 5
LOG TIME

96 HOUR INTEGRATION ON "BLANK SKY" (1.6 GHz SAMPLER)




17 HOUR RUN WITH GROUND BOUNCE IN SIGNAL OF SIG-REF
LOG (SIG-REF)/REF
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0
.5
1
1.5
2
2.5
3
LOG TIME