IF Baseline Experiments
Project TBASERDN030522, May 22, 2003

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Introduction

Over the past few weeks, baseline ripples with periods of about 60 MHz have been isolated to the Converter Racks, and it was also determined that the ripples went away if three of four Optical Receiver output ports are terminated, rather than connected to the Converter Modules. (See the reports on TBASERDN030519 and TBASERDN030521.) The May 21 tests were inconclusive, so testing the system with various combinations of pads at the Optical Receiver - Converter Module interfaces was repeated on the evening of May 22.

The Spectrometer was used in an four-bank, eight sampler, 800MHz mode, with 10 second records, and 360 second scan times. Optical fiber channels 1 and 3 were used, with CM1-8, and SF1-8. OR1 outputs connect to CM1-4, and OR3 to CM5-8.

Test Description

For the initial scans (1-9), the system was connected as usual. Then, 6dB pads were installed at all outputs of OR3, but no change to OR1 and CM1-4. Attenuators in CM5-8 were adjusted to maintain optimum power at the spectrometer samplers. Scans 10-19 were run with this arrangement.

After the completion of scan 19, the total attenuation at the outputs of OR3 was taken to 12dB by the addition of a second 6dB pad on each port. The level at ODM3 was increased by 4dB, and CM5-8 adjusted to maintain optimum levels at the spectrometer. Scans 20-27 were taken with these conditions.

After completion of scan 27, all pads were removed, and three of four outputs of OR3 were terminated, leaving only CM6 connected to OR3. The attenuator in ODM3 was returned to the original level, and attenuators in CM6 were adjusted to maintain optimum levels at the spectrometer. Scans 28-37 were taken with these conditions.

Finally, the connections were returned to the normal arrangement, and scans 38-42 were taken.

Discussion

Figure 1 shows a single pair of scans taken during each system configuration, for the CM6 channel. Figure 2 is a similar display for the CM1 channel. Since the 60MHz ripple "comes-and-goes" with time, it is necessary to observe the performance for at least 1/2 hour to after making a change. Figures 3 and 4 show multiple scan pairs for each configuration, overlaid. Examining these, there is no clear improvement with 6 or 12dB pads at the outputs of OR3, yet the baseline flatness clearly improves when three of the four OR outputs are terminated. While small slopes and curvatures do occur with some pairs, there is no evidence of the fine-grain ripple which is so bothersome. Figure 5 shows in greater detail baselines when only one converter module is fed from an optical receiver, and figures 6 and 7 for comparison show baselines when four are fed simultaneously. In many respects, the baselines in figures 6 and 7 for scans taken nearly an hour apart are superior to those taken adjacently. This is probably due to the "comes-and-goes" characteristic of the 60MHz ripple.

Summary

It is fairly surprising that there was no apparent improvement brought on by using pads at the Optical Receiver outputs. Earlier tests hinted at some improvement, but I believe we were fooled by drifts and by not watching the performance for sufficient lengths of time. In light of these findings, it's not clear whether buffer amps at the 4-way power divider outputs would solve the ripple problem.

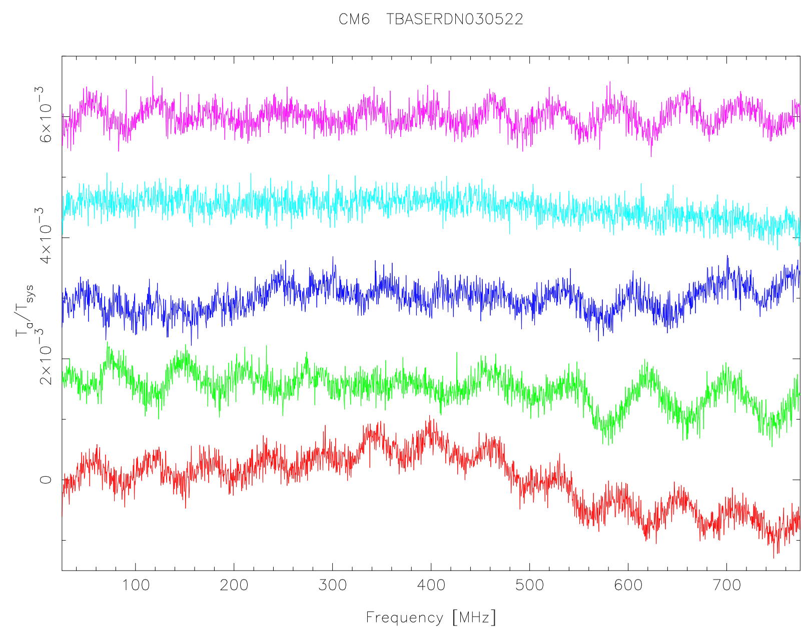

Figure 1: $(sig - ref)/ref$, for the OR3/CM6/SF6 IF path. One scan pair from each of the system configurations is plotted. A DC mean is subtracted from each trace, and the traces are offset for clarity. From the bottom: normal connections (scans 1,2), 6dB pads on OR3 outputs (scans 10,11), 12dB pads on OR3 outputs (scans 20,21), 3 of 4 OR3 outputs terminated (scans 28,29), normal connections (scans 38,39).

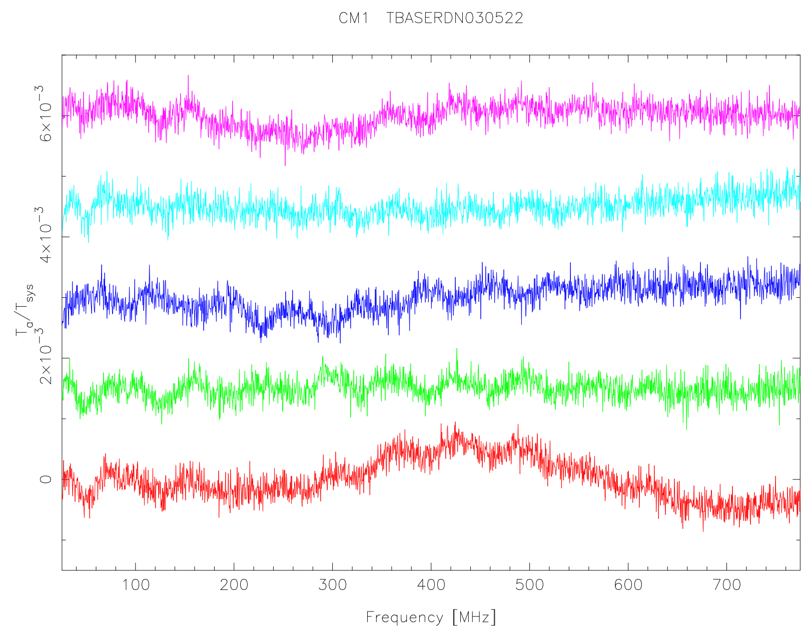

Figure 2: $(sig - ref)/ref$, for the OR1/CM1/SF1 IF path. One scan pair from each of the system configurations is plotted. A DC mean is subtracted from each trace, and the traces are offset for clarity. Note that there were no changes in the hardware that should impact this IF path; all changes were in the paths connected to OR3. From the bottom: normal connections (scans 1,2), 6dB pads on OR3 outputs (scans 10,11), 12dB pads on OR3 outputs (scans 20,21), 3 of 4 OR3 outputs terminated (scans 28,29), normal connections (scans 38,39).

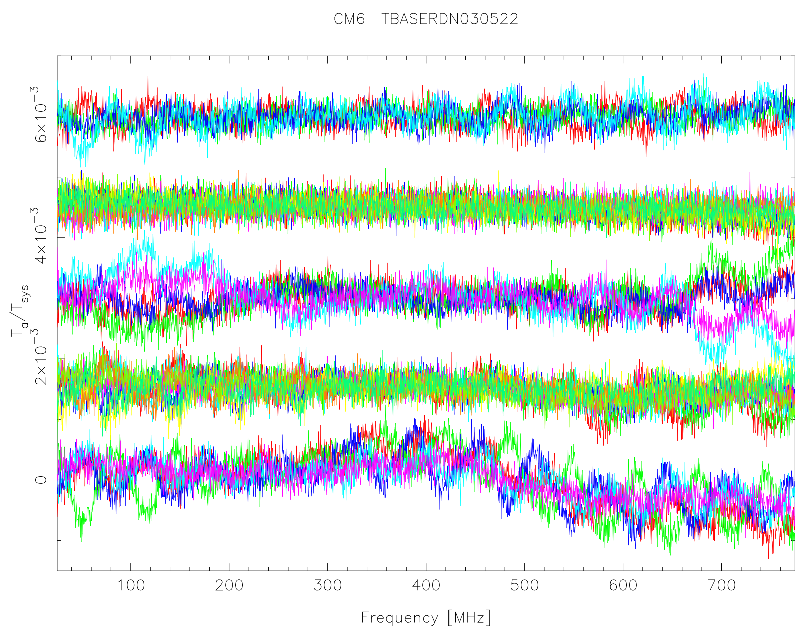

Figure 3: $(sig - ref)/ref$, for the OR3/CM6/SF6 IF path. Several scan pairs from each of the system configurations are plotted. A DC mean is subtracted from each trace, and the groups are offset for clarity. From the bottom: normal connections (scans 1-9), 6dB pads on OR3 outputs (scans 10-19), 12dB pads on OR3 outputs (scans 20-25), 3 of 4 OR3 outputs terminated (scans 28-37), normal connections (scans 38-42).

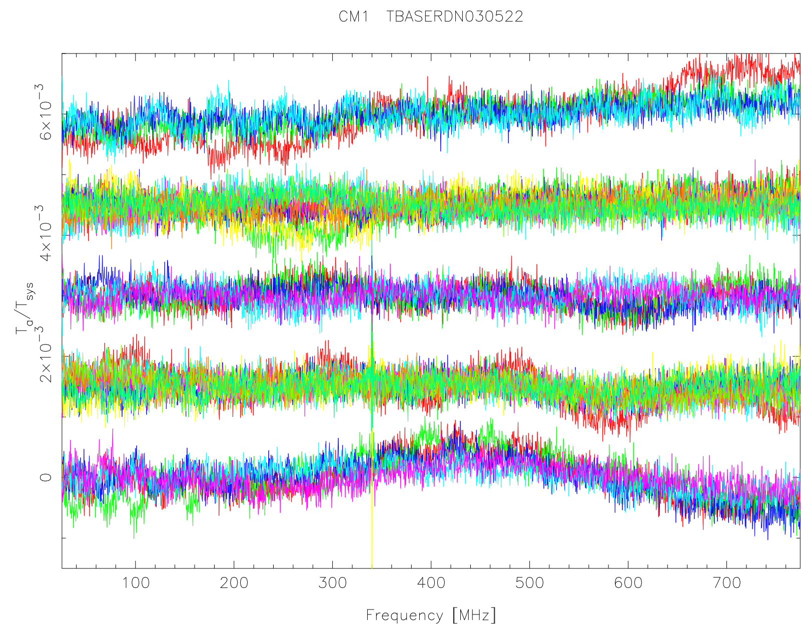

Figure 4: $(sig - ref)/ref$, for the OR1/CM1/SF1 IF path. Several scan pairs from each of the scan groups as the system configuration was changed. A DC mean is subtracted from each trace, and the groups are offset for clarity. Note that there were no changes in the hardware that should impact this IF path; all changes were in the paths connected to OR3. From the bottom: normal connections (scans 1-9), 6dB pads on OR3 outputs (scans 10-19), 12dB pads on OR3 outputs (scans 20-25), 3 of 4 OR3 outputs terminated (scans 28-37, normal connections (scans 38-42).

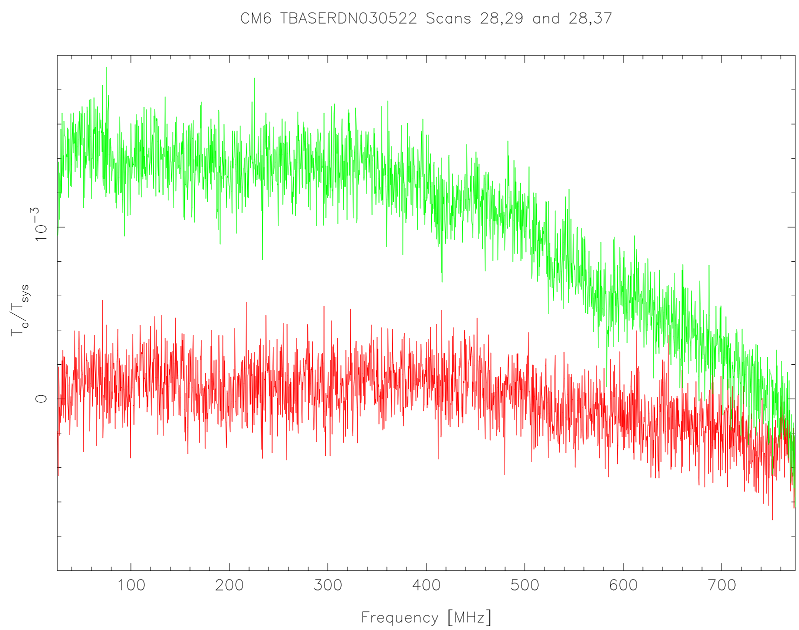

Figure 5: $(sig - ref)/ref$, for the OR3/CM6/SF6 IF path for two scan pairs while 3 of 4 OR3 outputs were terminated. The red trace is scan 29 referenced to 28, and the green trace is scan 37 referenced to 28. Each scan was 6 minutes long.

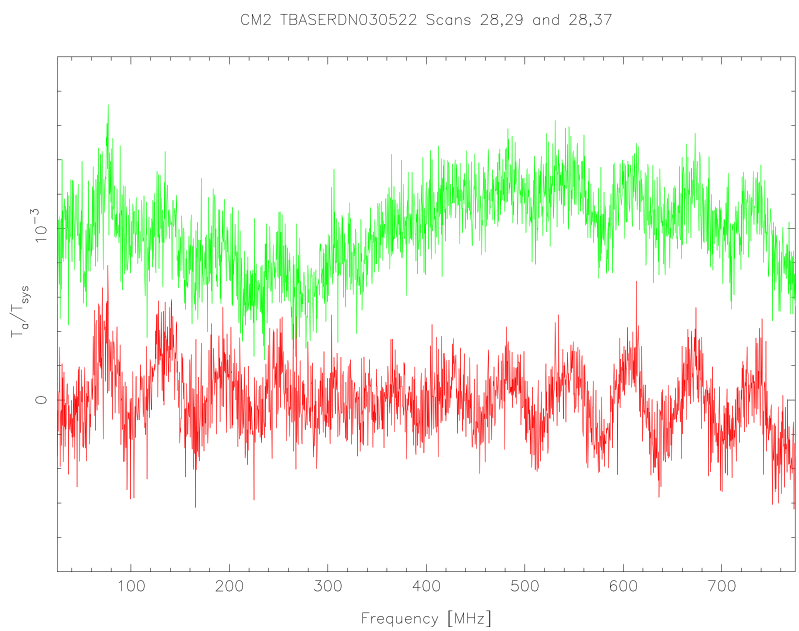

Figure 6: $(sig - ref)/ref$, for the OR1/CM2/SF2 IF path for two scan pairs. The red trace is scan 29 referenced to 28, and the green trace is scan 37 referenced to 28. Each scan was 6 minutes long.

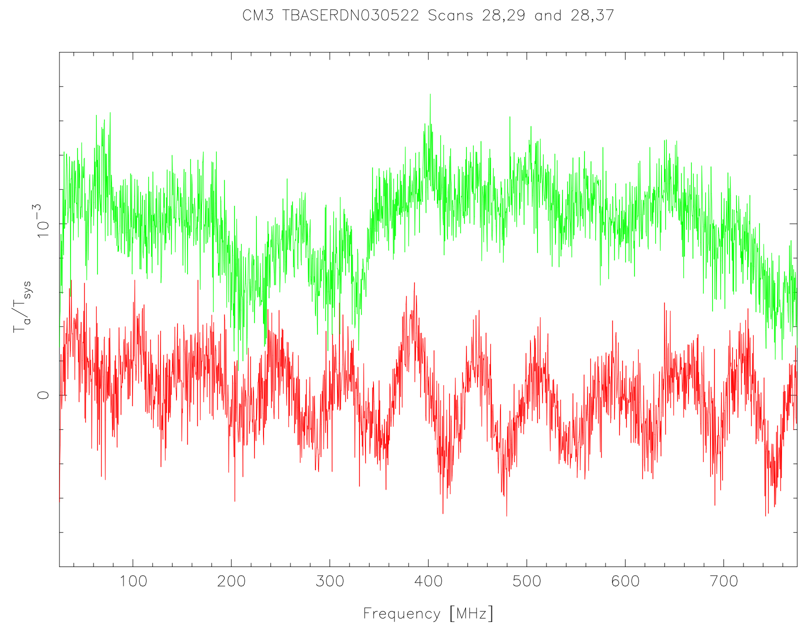

Figure 7: $(sig - ref)/ref$, for the OR1/CM3/SF3 IF path for two scan pairs. The red trace is scan 29 referenced to 28, and the green trace is scan 37 referenced to 28. Each scan was 6 minutes long.