IF Baseline Experiments
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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 report on TBASERDN030519.) On May 21, additional experiments were done using various combinations of pads at the Optical Receiver - Converter Module interfaces.

The Spectrometer was used in an four-bank, eight sampler, 800MHz mode, with 10 second records, and 60 or 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 (1-15), the scan time was 60 seconds, and the system was connected as usual. Then, 6dB pads were installed at all outputs of OR1 and OR3. Attenuators in the converter modules were adjusted to maintain adequate power at the spectrometer samplers. Scans 18-37 were run with this arrangement, and with 60 second scan times.

The scan time was then changed to 360 seconds, and scans 38-41 taken with no change to the hardware connections.

After the completion of scan 41, the total attenuation at the outputs of OR1 was taken to 12dB by the addition of a second 6dB pad, and the pads on OR3 were changed to 10dB units. The IF Rack was rebalanced to 3V, from the previous 1V level, and the converter modules adjusted to maintain optimum levels at the spectrometer. Scans 42-45 were taken with these conditions.

After completion of scan 45, pads at the outputs of OR1 were rearranged, placing 6dB at the OR1 output port, and 6dB at the corresponding converter module input connector. No changes were made to the OR3 pads. Scans 46-48 were run with this arrangement. During scan 48 (at about 15:24 UT), the door of Converter Rack A was opened, inducing a change in the rack air stream.

Table 1: Color Key to Figures 1-8

Color	Scans	Scan Length	Conditions
red	1,12	60s	Normal Connections
green	23,35	60s	OR1,OR3 with 6dB pads
blue	39,40	360s	Same as green
cyan	43,44	360s	OR1 w/ 12dB, OR3 w/ 10dB
violet	46,47	360s	OR1 w/ 6dB/6dB, OR3 w/ 10dB
yellow	53,54	360s	3 of 4 OR outputs terminated

After completion of scan 48, all pads were removed, and three of four outputs of OR1 and OR3 were terminated, leaving only CM3 and CM7 connected. Attenuators in these converter modules were adjusted to maintain optimum levels at the spectrometer, and scans 49-54 were run. At the start of scan 51, the door to Converter Rack A was closed.

Figures 1-8 show the quantity $(sig - ref)/ref$ for two scans taken with each configuration. Table 1 provides a key to the colors in these figures. For the red and green traces, two 60s scans taken 12 minutes apart were selected, and for the remainder two adjacent 360s scans were used. Some thoughts on these results are presented in the Summary section below.

Summary

It is clear from the figures that the large scale ripple in the red traces has much in common across all eight channels, and that the baselines improved significantly after the 6dB pads were installed. One has to be somewhat cautious however to ascribe all the improvement to the pads. The red traces were offset by -0.01 to bring them within the shown scale; all other traces were not offset. This indicates a drift in total power during the early part of the measurements. Whether some of the baseline ripple in the red traces are due to this "warm-up" is not clear. In the past, it has been noted that the system takes time to settle after connection to the IF Rack noise source, and it could be that this settling accounts for some of the improvement seen during the early part of the tests. In retrospect, it probably would be better to only modify one-half of the channels at a time, and make sure the system is settled down before beginning the modifications.

The introduction of the pads at the OR outputs both improves the match at this point, and increases the isolation through the 4-way splitter in the optical receivers. We know that terminating three of four outputs greatly improves the baselines, so cross-coupling through the splitter is probably a factor. The effect of the 10 or 12 dB pads compared to the 6dB pads is not clear; in fact, the cyan traces in some cases appear worse than the blue. We would like to determine how much isolation improvement is needed to achieve desired performance. In this matter, variations unrelated to the configuration changes we introduce are always a factor, and more data is needed to get a better statistical view. Probably it was a bad step to open the Converter Rack door during these tests, as

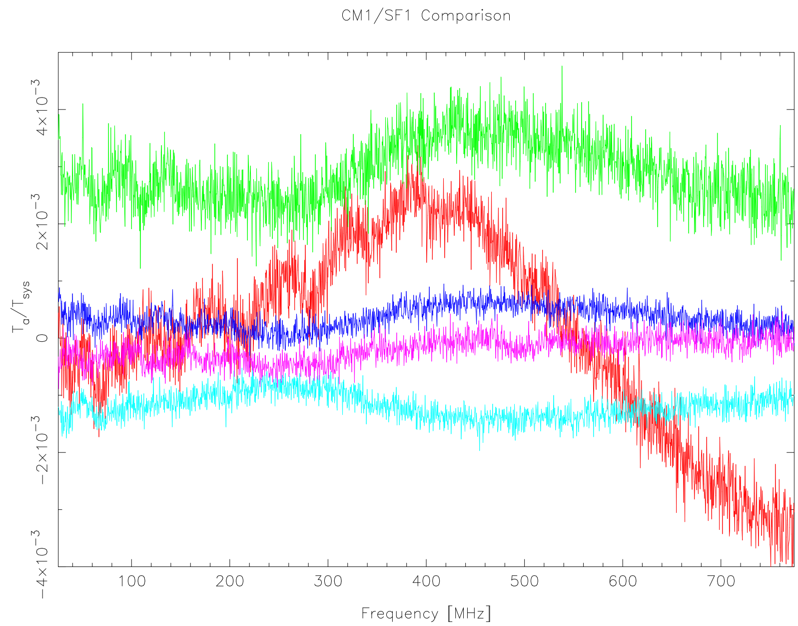

Figure 1: $(sig - ref)/ref$, for the OR1/CM1/SF1 IF path.

it confused the results.

After studying these results, it seems best to repeat the tests allowing more time to better judge the impact of various configurations.

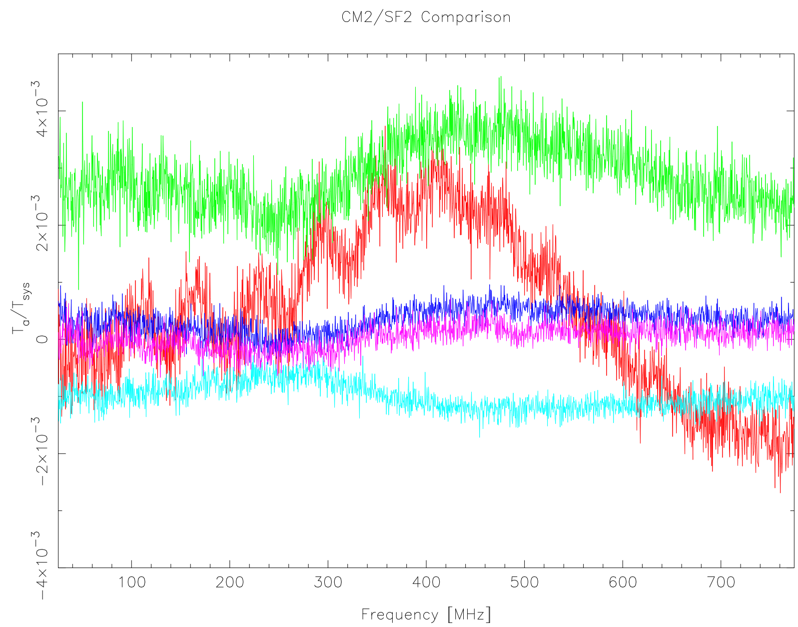

Figure 2: $(sig - ref)/ref$, for the OR1/CM2/SF2 IF path.

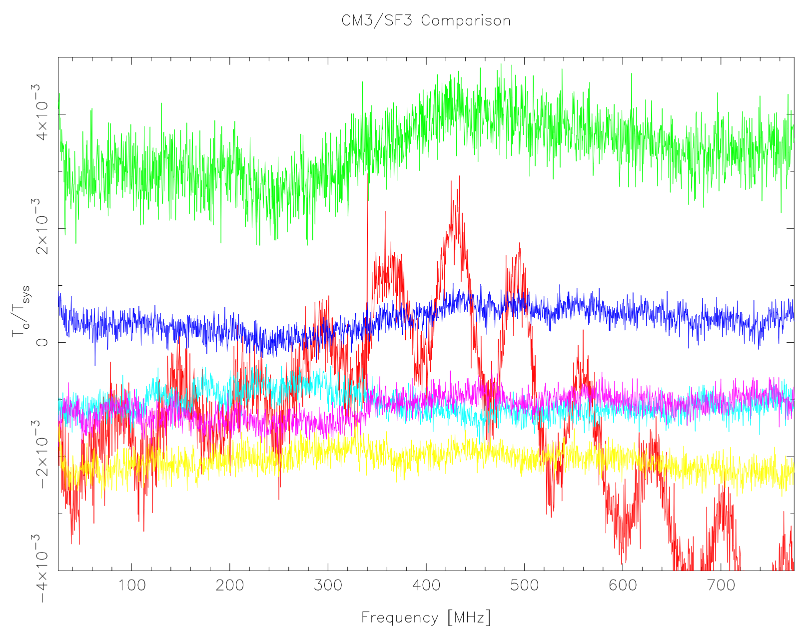

Figure 3: $(sig - ref)/ref$, for the OR1/CM3/SF3 IF path.

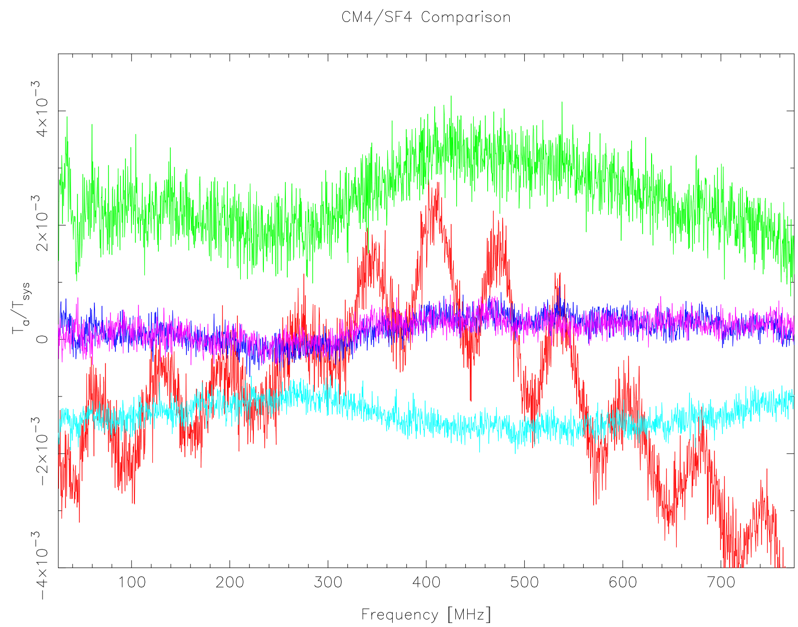

Figure 4: $(sig - ref)/ref$, for the OR1/CM4/SF4 IF path.

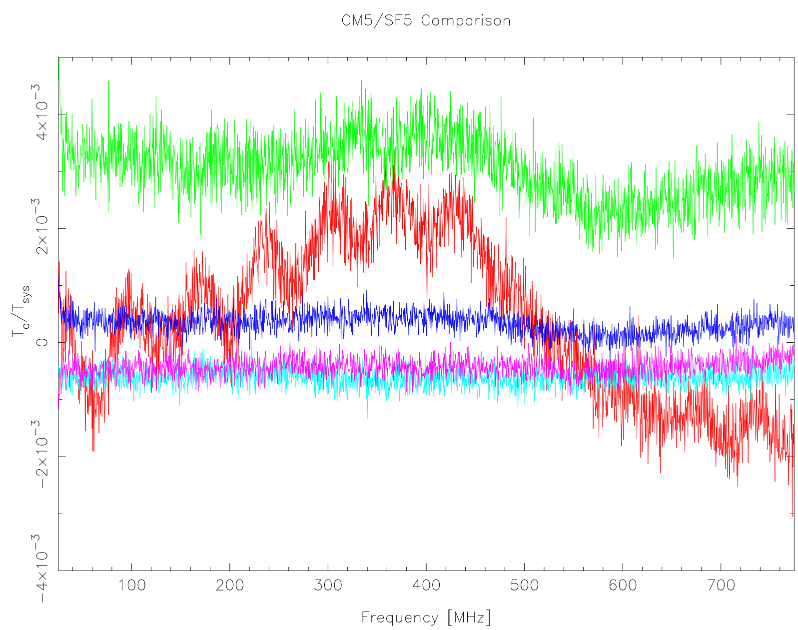

Figure 5: $(sig - ref)/ref$, for the OR3/CM5/SF5 IF path.

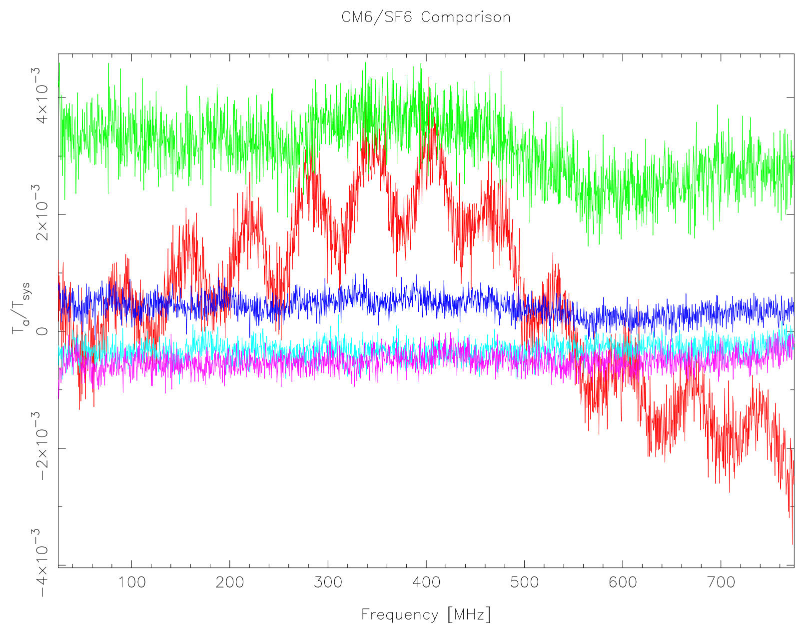

Figure 6: $(sig - ref)/ref$, for the OR3/CM6/SF6 IF path.

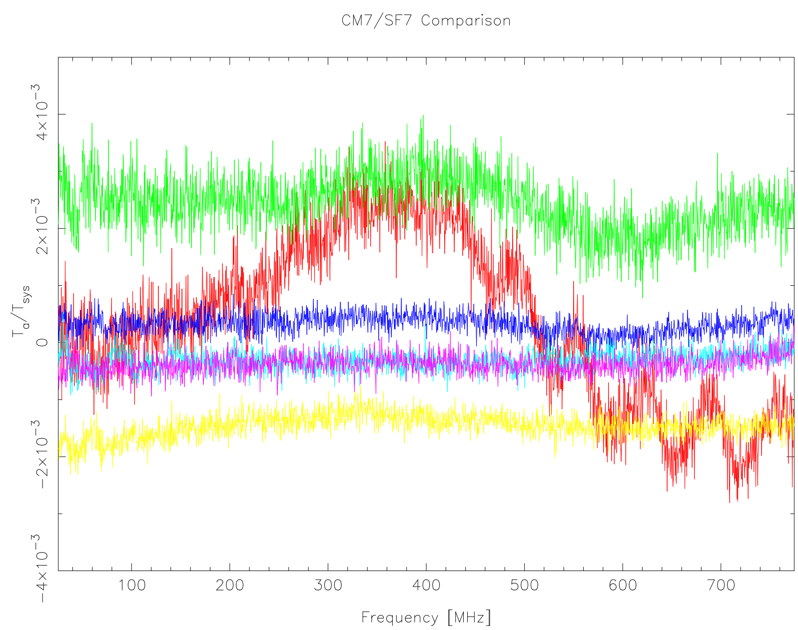

Figure 7: $(sig - ref)/ref$, for the OR3/CM7/SF7 IF path.

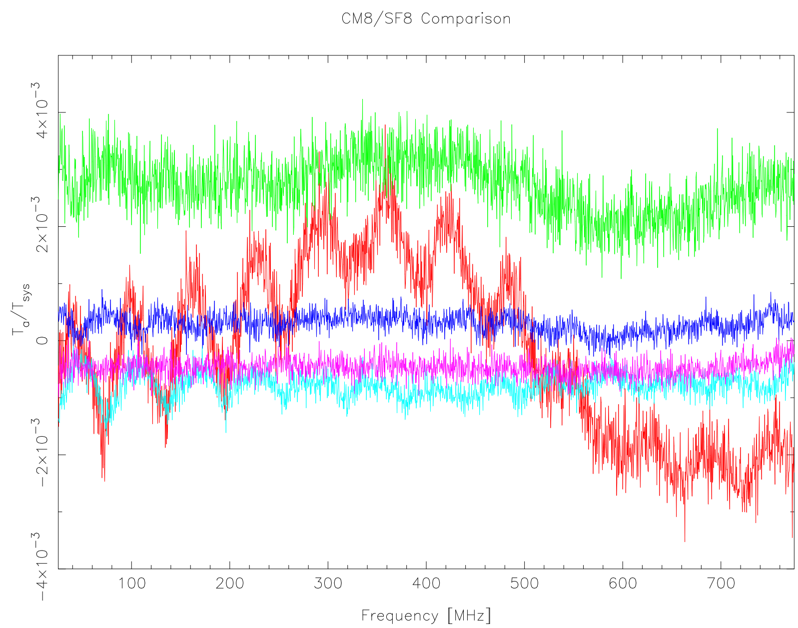

Figure 8: $(sig - ref)/ref$, for the OR3/CM8/SF8 IF path.