Test New Optical Fiber Modulator
Project TBASEDSB021212, 12 December 2002

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Setup

The goal was to test a new optical fiber modulator which was purchased from the manufacturer and placed in IF rack channel 6 during the day on 12 Dec 2002. It is expected that the amplitude of the 2.4 MHz will be reduced by more than 10 dB. Optical driver modules (ODMs) 1, 2, 3, 5, and 7 were external modulators; ODMs 4 and 7 were out of service; ODM 8 was an older direct modulator; and ODM 6 was the new external modulator unit.

The narrow band IF noise source was used for all observations. The IF rack pass band was 2360-3640 MHz. The analog filter rack pass band was 800-1600 MHz. For all scans the telescope was stationary (Az=137.88, El=77.99). For continuum measurements DCR channel 1-8 were connected to IF rack ODM 1-8 (before the fiber), while DCR channels 9-16 were connected to SF 1-8 (See Table 1). For spectral line measurements the Spectrometer mode was 1W2-001-800 (two samplers; BW = 800 MHz). Only optical driver modules 6 and 8 were tested (see Table 2).

Results

Figure 1 summarizes the results of 15 minutes of total power observing with the DCR for optical driver modules (ODMs) 2, 6, and 8 (this is the same data shown in Figure 2 for report TBASEDSB021210). ODM 2 and 6 are external

Table 1: IF Rack to DCR Connection Matrix

OR odd	OR even	CM	SF	DCR
1	2	1	1	9
1	2	2	2	10
5	6	11	3	11
5	6	12	4	12
3	4	5	5	13
3	4	6	6	14
7	8	15	7	15
7	8	16	8	16

Table 2: IF Rack to Spectrometer Connection Matrix

OR	CM	SF	AC Sampler
6	9	1	0
8	13	5	1

modulators, while ODM 8 is a direct modulator. Figure 2 summarizes the results of 30 minutes of total power observing under similar conditions but with a new external modulator in channel 6. Note that the scales in these figures are different. For both figures the red, green, and blue curves show the total power fluctuations for ODMs 2, 6, and 8, respectively, before entering the fiber. The orange curves show ODM 2 after passing through the fiber, different convert modules, and the analog filter rack. Similarly, the cyan (blue-green) and magenta (red-blue) correspond to ODMs 6 and 8, respectively. There appears to be no major difference in the total power characteristics of the new optical modulator compared to the original units. The 8 minute period oscillation observed in most data has been correlated with environmental temperature fluctuations (see TBASErdn021209 report).

Figures 3–7 summarize the results of 30 minute scans using the Spectrometer for ODM 6. (For all spectra a jump in the ACF was observed at the center lag for 3% of the records. These records were not used in the data reduction.) Figure 3 shows the 2.4 MHz ripple in the total power spectrum for the original external modulator. The auto correlation function is given in Figure 4 where a signal at lag 667, corresponding to 2.40 MHz, is obvious. In Figure 5 the total power spectrum does not reveal any ripple for the new external modulator. However, a signal at lag 673 (2.38 MHz) is visible in the ACF, reduced in amplitude by $\sim$ 20 dB compared with the original external modulator (Figure 6). A comparison of the two units is shown in Figure 7.

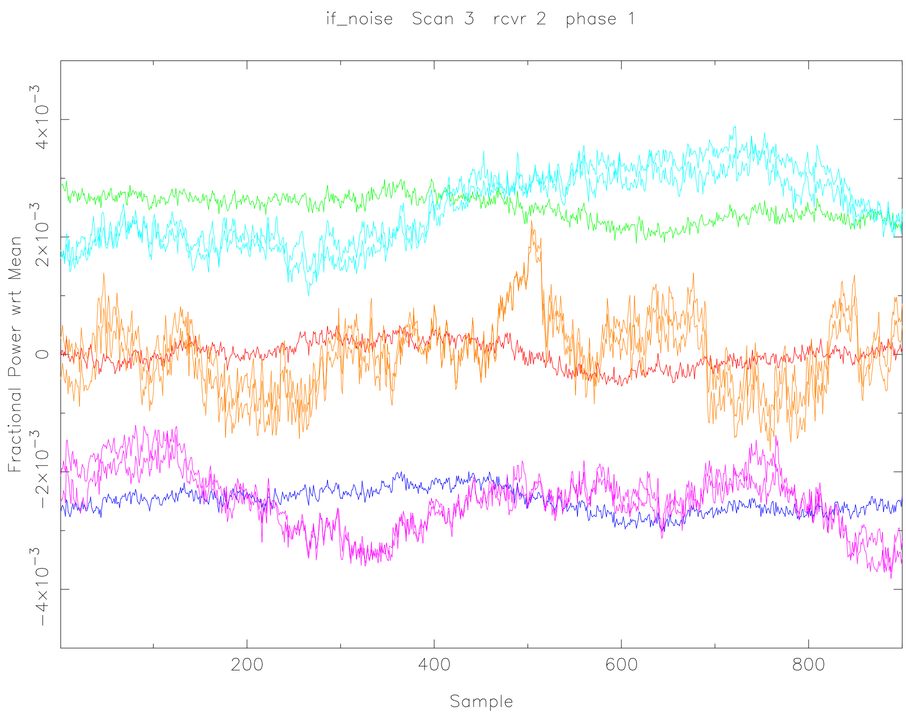

Figure 1: Project TBASEDSB021210, scan 3, even number fibers, antenna stationary. The original external modulator is in channel 6. Plotted is the relative total power versus sample where each sample corresponds to one second of time. ODM 2 before fiber (DCR channel 2, red) and after fiber (DCR channels 9 & 10, orange); ODM 6 before fiber (DCR channel 6, green) and after fiber (DCR channels 11 & 12); ODM 8 before fiber (DCR channel 8, blue) and after fiber (DCR channels 15 & 16). ODM 6 data are offset by +0.0025 while ODM 8 data are offset by −0.0025 for clarity.

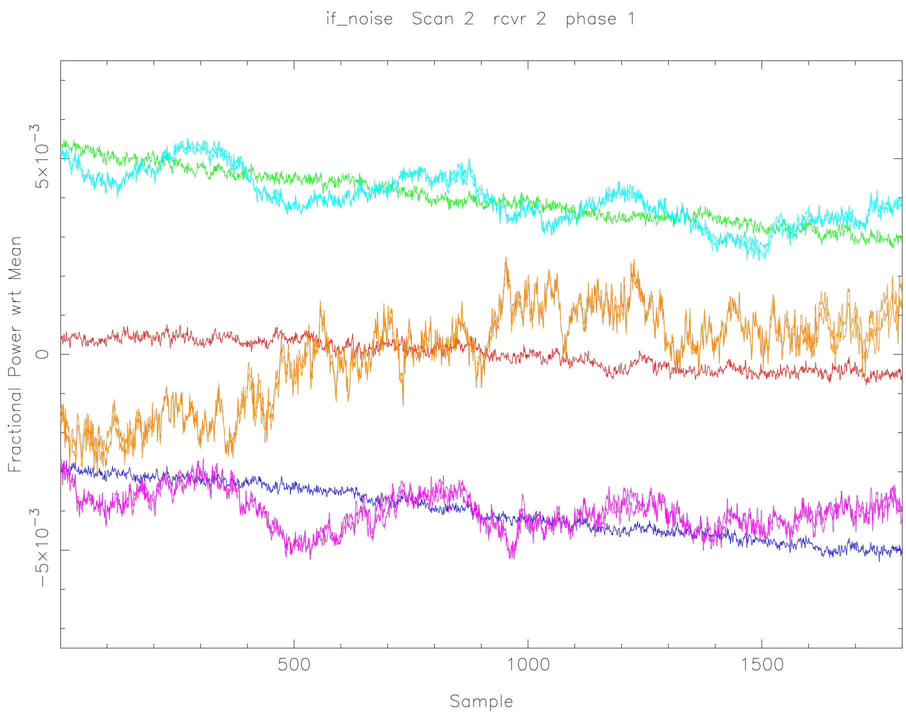

Figure 2: Project TBASEDSB021212, scan 2, even number fibers, antenna stationary. The new external modulator is in channel 6. Plotted is the relative total power versus sample where each sample corresponds to one second of time. ODM 2 before fiber (DCR channel 2, red) and after fiber (DCR channels 9 & 10, orange); ODM 6 before fiber (DCR channel 6, green) and after fiber (DCR channels 11 & 12); ODM 8 before fiber (DCR channel 8, blue) and after fiber (DCR channels 15 & 16). ODM 6 data are offset by +0.004 while ODM 8 data are offset by −0.004 for clarity.

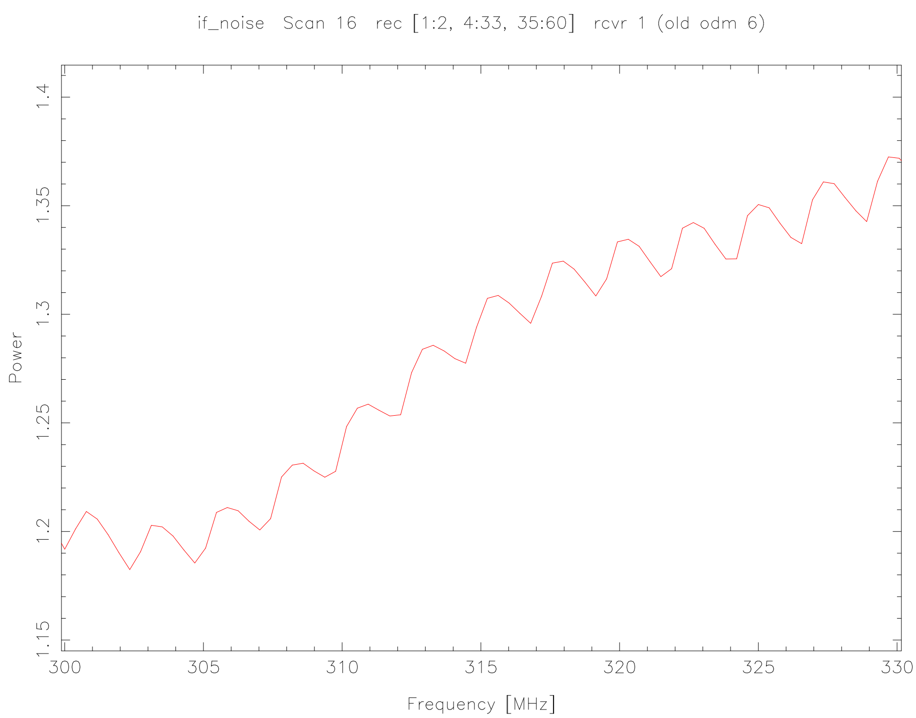

Figure 3: Project TBASEDSB021211, scan 16, antenna stationary. Total power spectrum of IF noise source using the original external modulator in ODM 6. Note the 2.4 MHz ripple in the spectrum.

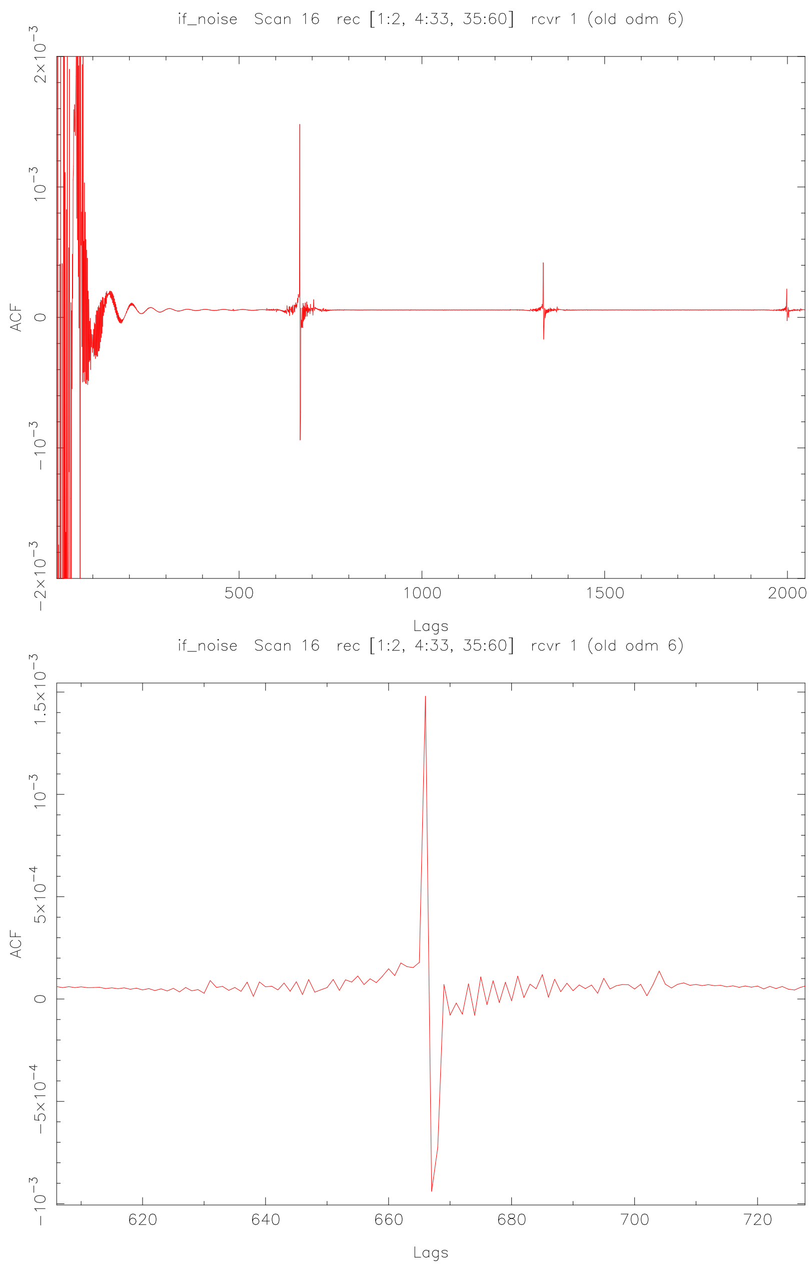

Figure 4: Project TBASEDSB021211, scan 16, antenna stationary. Auto correlation function of the IF noise source using the original external modulator in ODM 6. Note the spikes at lags 667, 1333, and 1999. This corresponds to a frequency of 2.40 MHz. The bottom panel shows an expanded view.

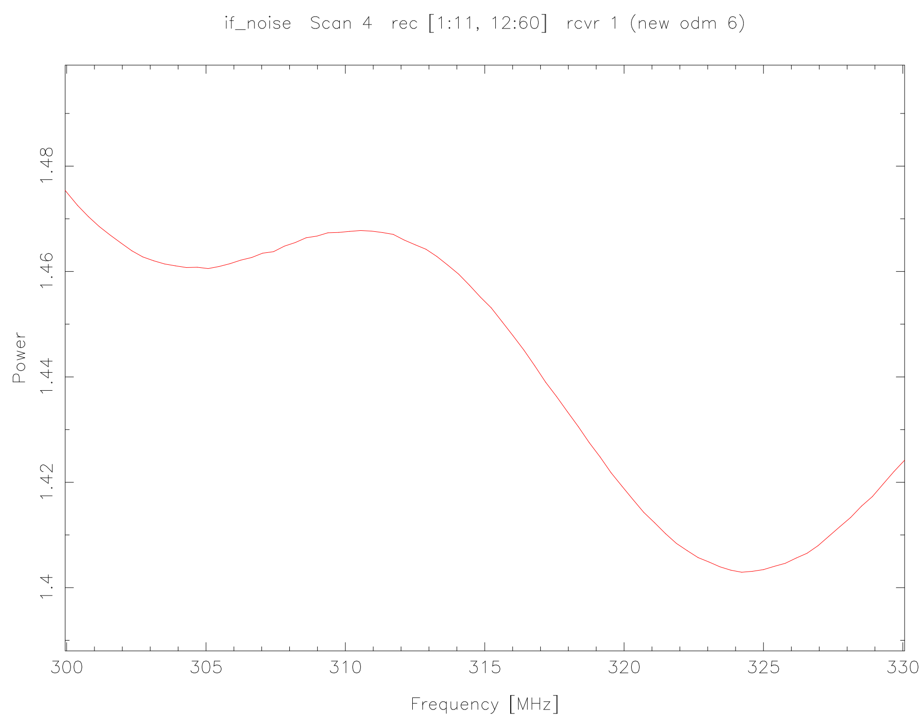

Figure 5: Project TBASEDSB021212, scan 4, antenna stationary. Total power spectrum of IF noise source using the new external modulator in ODM 6. There is no obvious ripple in the spectrum.

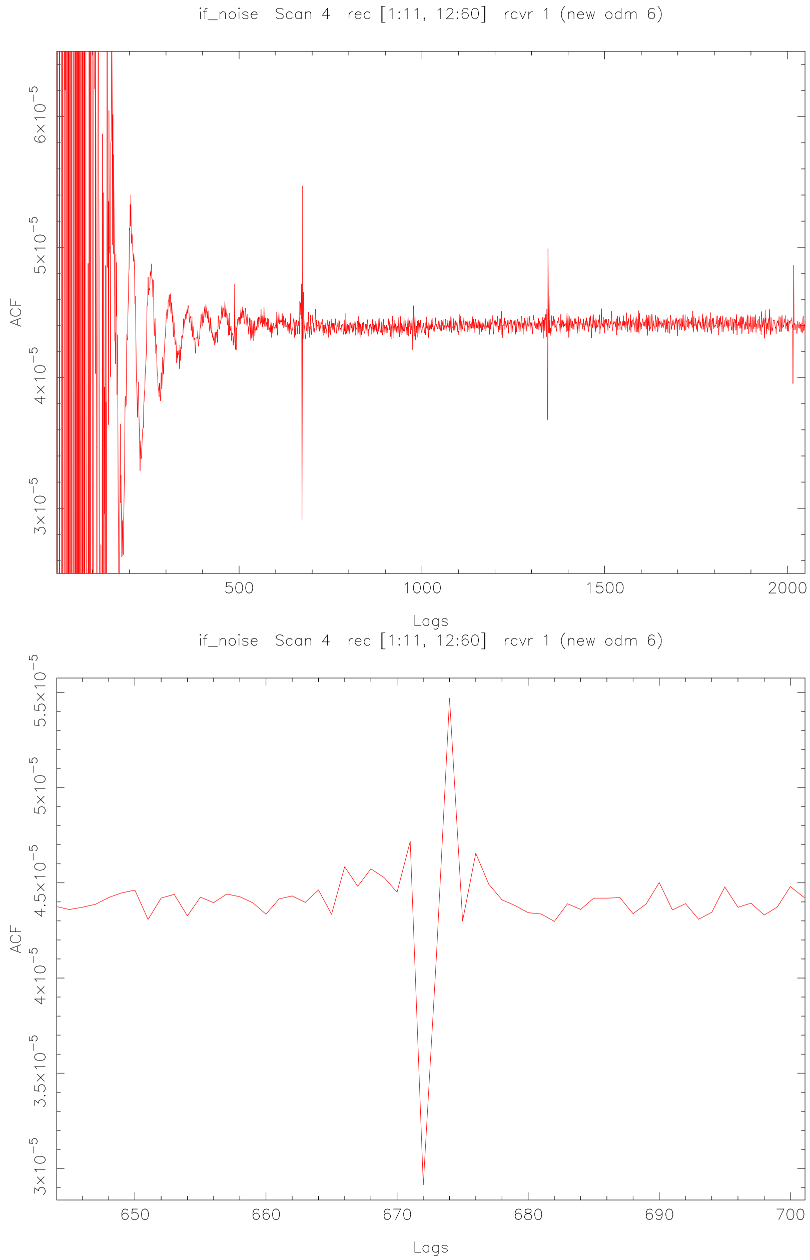

Figure 6: Project TBASEDSB021212, scan 4, antenna stationary. Auto correlation function of the IF noise source using the new external modulator in ODM 6. Note the spikes at lags 667, 1333, and 1999. This corresponds to a frequency of 2.38 MHz. The bottom panel shows an expanded view.

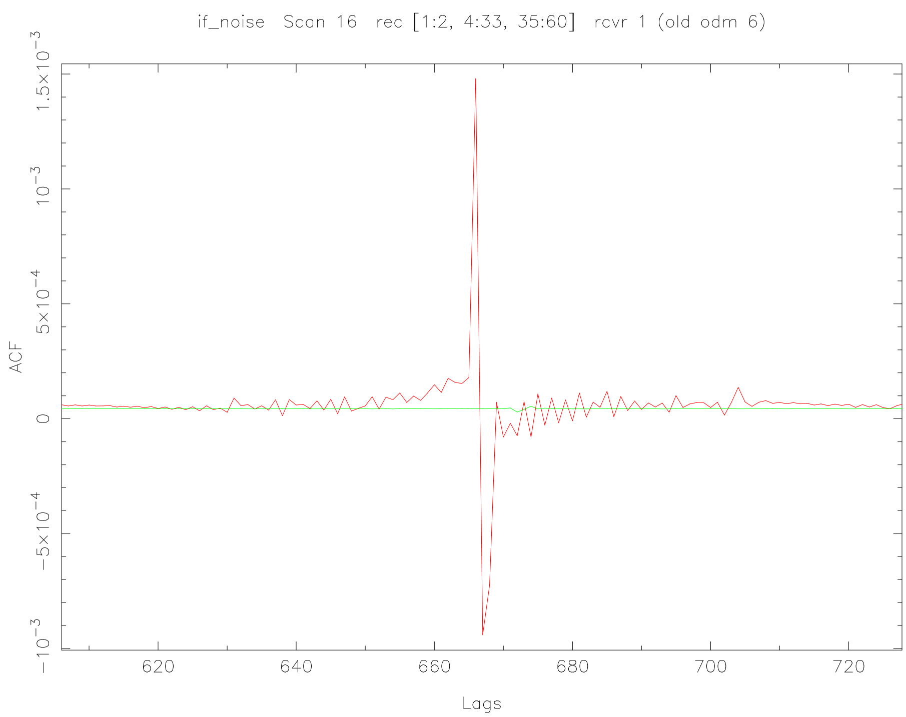

Figure 7: Comparison of the original external modulator in red (project TBASEDSB021211, scan 16) with the new external modulator in green (project TBASEDSB021212, scan 4). Plotted is the ACF versus Lag.