

MEMO

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PAON2-OptX21cm/11.02.13

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Subject: Summary of Electronic Test Bench analysis at LAL (08/02/13)

1 Introduction

In references Nançay/Amas/09.02.12 & 13.02.12 and PAON2/04.02.13 problems of oscillations seen in BAOelec data have been presented and the case of thin lines has been addressed on Amas data on references Nançay/Amas/16.03.12 & 04.04.12. It is reminded that in Amas setup the analog & digital electronic chain are coupled to the standard Nançay electronic chain, while for PAON2 this is a stand-alone chain. Besides this difference, the cabling is different, few meters in Amas setup while 50+9m in case of PAON2, and the interconnection too in case of PAON2.

2 The setups

To clarify and analyze the different sources of problems it was decided to build a complete test bench with analog and digital chain coupled to the standard BAO DAQ (Figure 1).

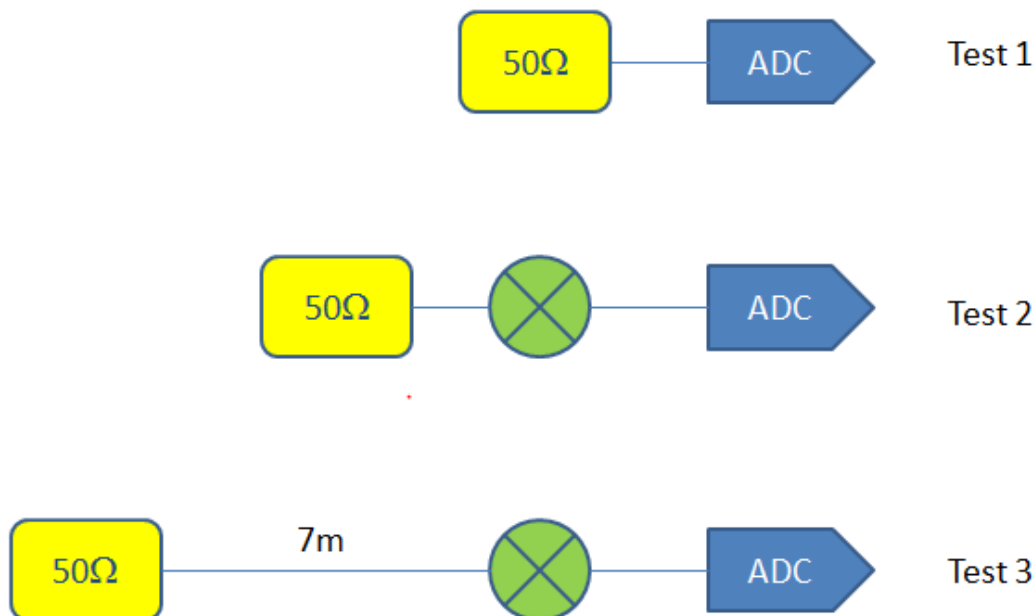


Figure 1 Schema of tests analyzed in this MEMO.

Three tests have been analyzed the 8th Feb. 2013: the first one (Test 1) concern the ADC response only, for the second one (Test 2) it is added the mixer-OL while for the last one

(Test 3) 7m of coax-cable is added. For all of them, a single channel was used with 8192 x 2 time samples (8192 freq. bins), the trigger was set to 1kHz and RAW data was saved before FFT processing which was done after with spectra averaged every 1sec.

2.1 ADC alone

On Figure 2 is shown the spectra (ie. auto-correlation) over the full frequency band (top panel) and a zoom (bottom panel)

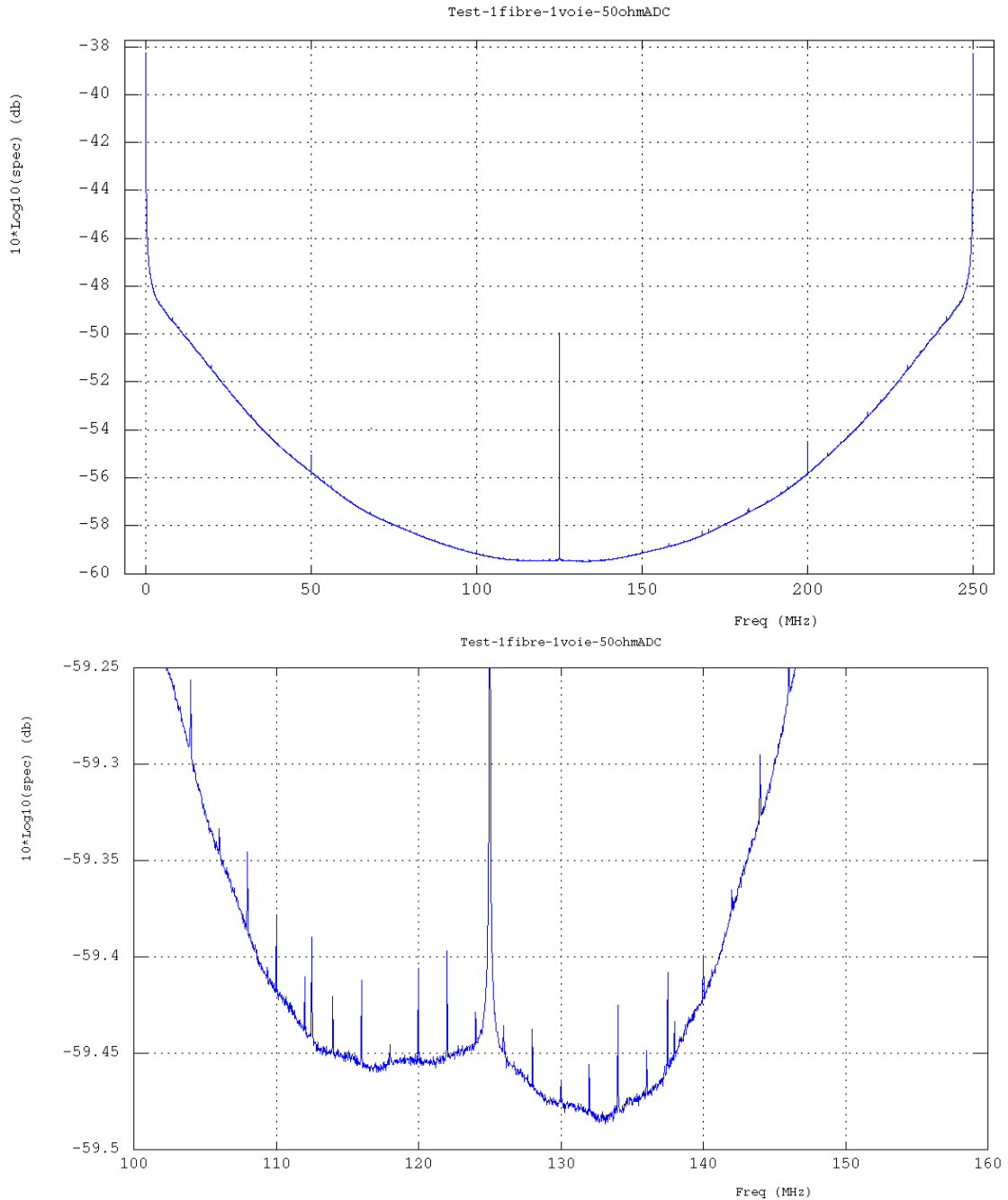


Figure 2 Power in dB of the ADC alone

There are no oscillations modulating the spectra. The 125MHz-line is understood as a FPGA clock which is unavoidable. The other tiny line may also originate from FPGA clock harmonic and/or ADC non linearity artifacts .

2.2 ADC + OL-mixer

On Figure 3 the output of the ADC with OL-mixer (1250MHz) is presented on the full frequency band (top panel) and a zoom (bottom panel).

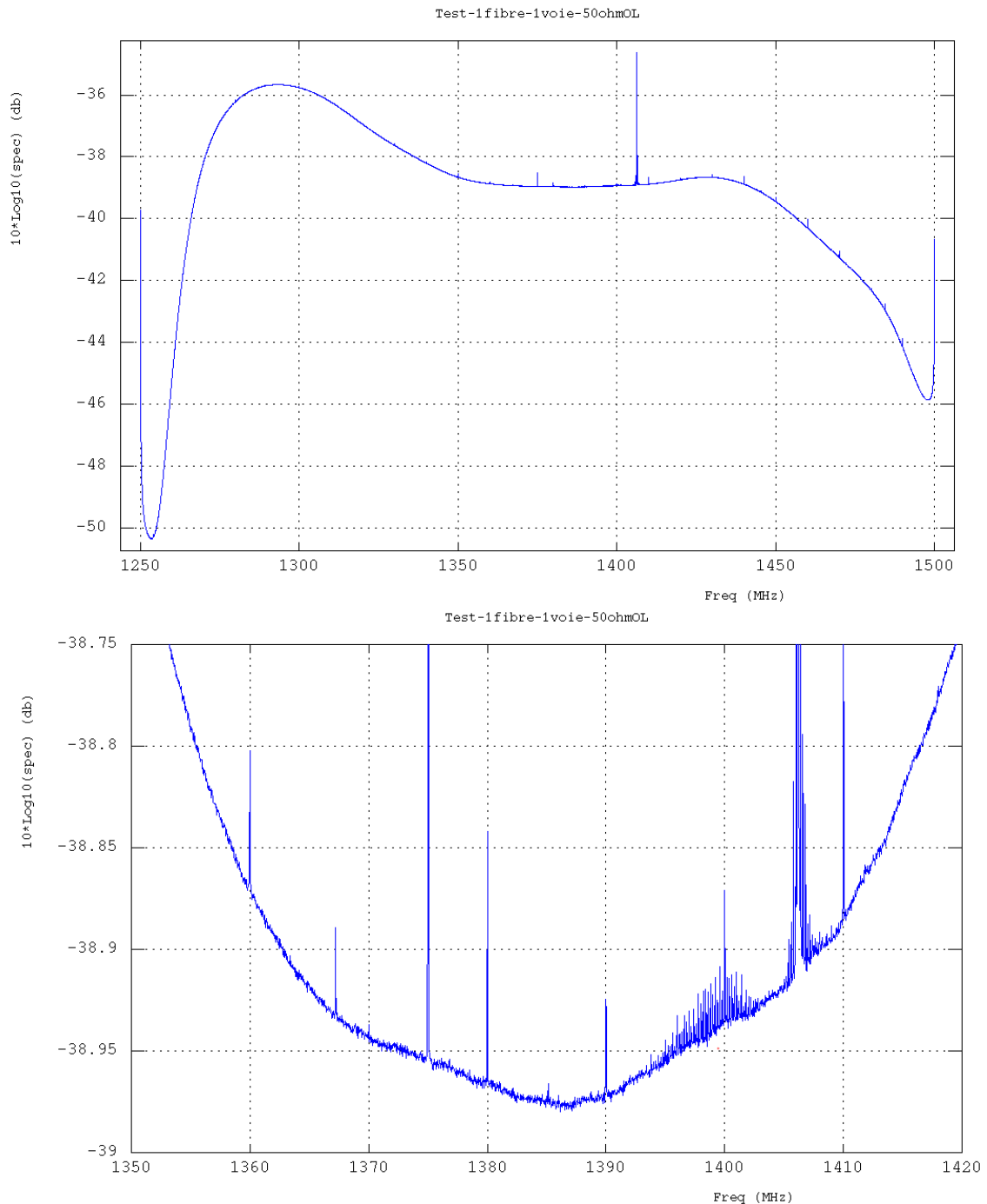


Figure 3 Power in dB of the ADC + OL-mixer (mind the freq. band)

The spectra don't show any oscillation pattern, but there are new features concerning thin lines which are potentially a source of limitation of the useful frequency bands:

- A powerful and composite line has emerged around $(156.2+1250)$ MHz

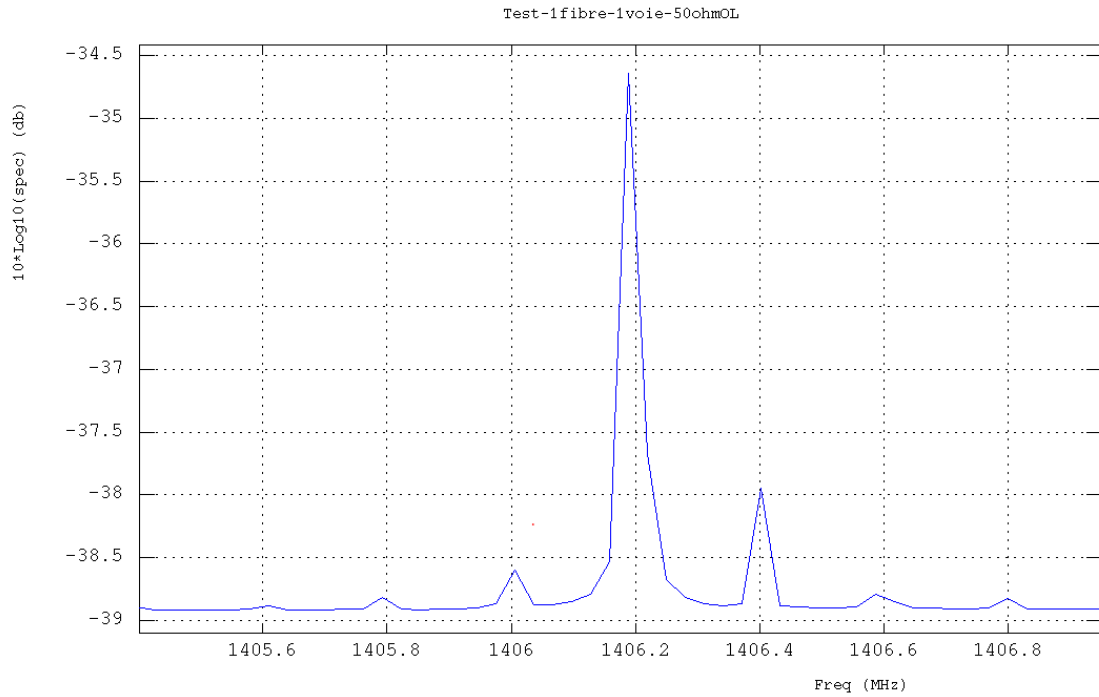


Figure 4

- A series of small line affect the full range [144,153]+1250MHz

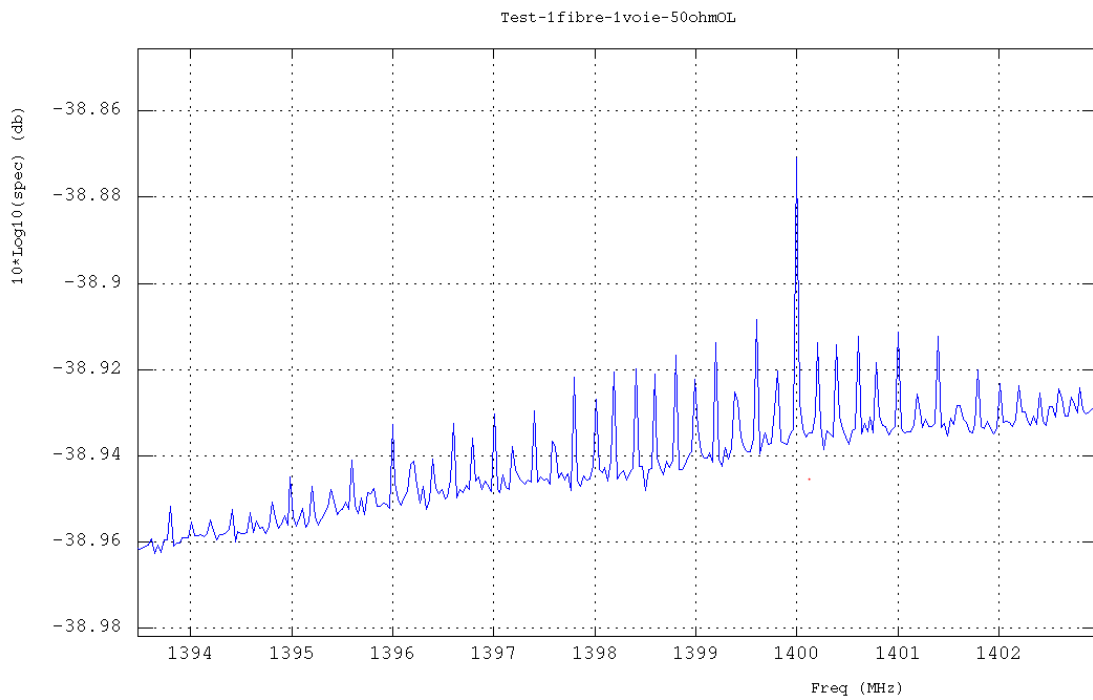


Figure 5

- Most of the lines present on Figure 3 have disappeared but some have been enhanced.

2.3 ADC + OL-mixer + 7m cable

The last test differs from the previous one by the addition of 7m coax cable (always terminated by a 50Ω load). This test is representative of the Amas (and future OptX21cm) setup in the RT chariot. See the results are presented on Figure 6.

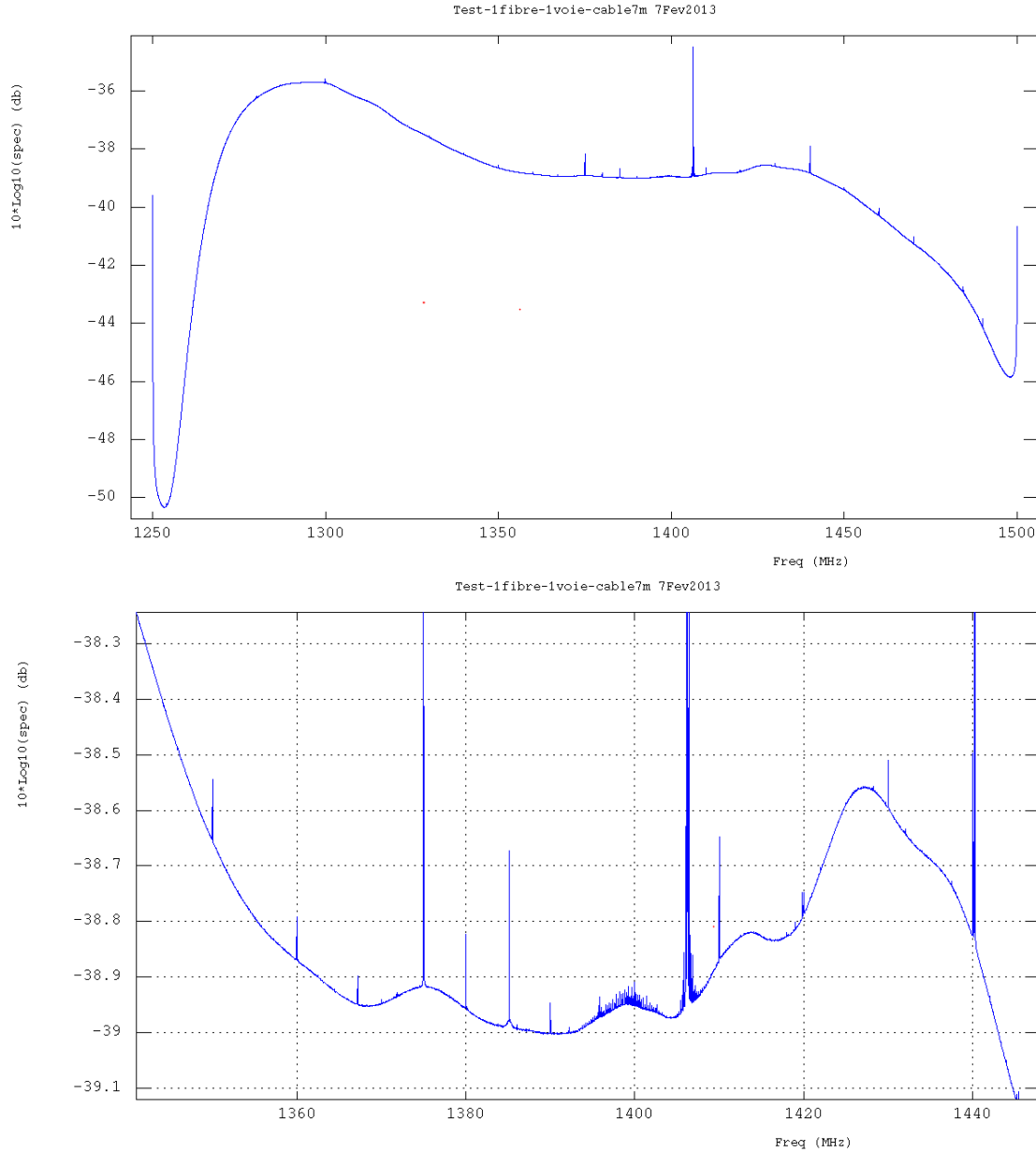


Figure 6 Power in dB of the ADC + OL-mixer + 7m cable (mind the freq. band)

The lines present in previous test are also there and the spectra show clearly oscillation distortions with 15MHz p-t-p spacing.

3 Summary & Outlook

The test analyzed in this MEMO show clearly the spectra distortions (so-called oscillations) due to the presence of the cable. This may be due to a miss-adaptation of the mixer-OL to the real cable impedance. Also it has been discovered thin lines and sometimes so grouped that

an entire frequency band is affected, already present when the OL-mixer is coupled to the ADC.

More investigations are needed to answer questions like: is these phenomena are reproduced for all channels, is there any PLL dis-locking process, etc, and also to study the stability of such effects which may be clearly a limitation of the BAO sensitivity.