MEMO

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PAON2-OptX21cm/15.02.13rev3

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Subject: Summary of Electronic Test Bench analysis at LAL (11-14/02/13)

1 Introduction

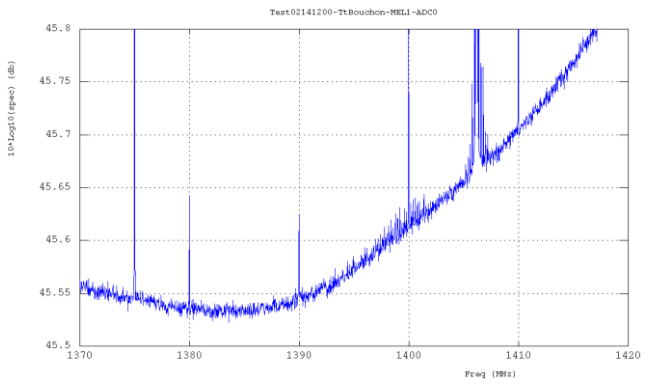
Following the tests of 8/02/13 (ref. PAON2-OptX21cm/08.02.13) a series of systematical cross-checks have been performed on the same test banch. This MEMO summarizes these studies.

2 The setup

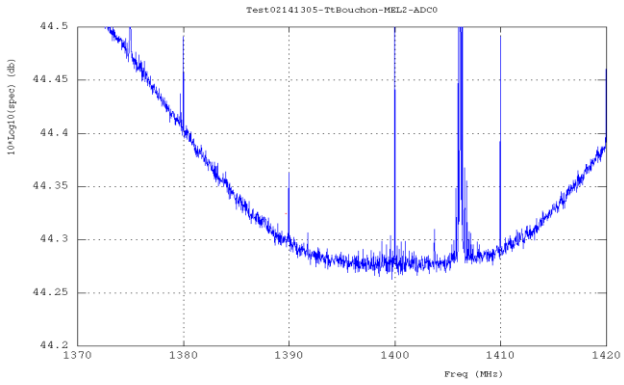
The setup is essentially the one used in PAON2-OptX21cm/08.02.13 but we have restricted the study to OL-mixer and ADC board, ie. no cable added, and we have put 50Ω loads on all unused channels both on OL-mixer and ADC boards.

First, it has been established that the results shown on PAON2-OptX21cm/08.02.13 are stable to switch ON/OFF of the PLL and the problem remains considering the minimal setup 1 single mixer-OL board and a single ADC board.

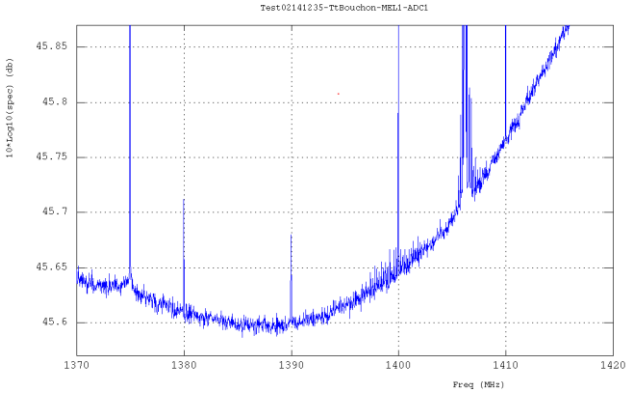
Table 1



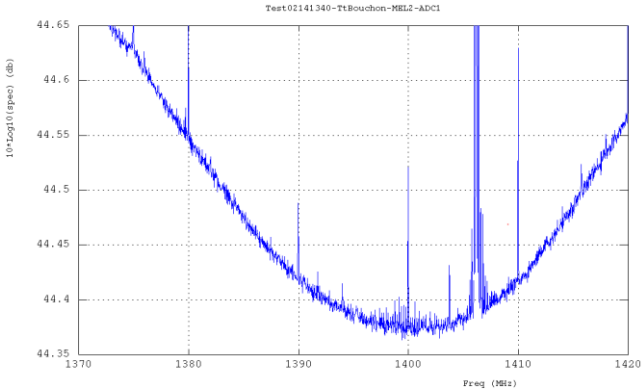
MEL-1 ⇔ ADC-0



MEL-2 ⇔ ADC-0



MEL-1 ⇔ ADC 1



MEL-2 ⇔ ADC 1

Second, it was used different connection setup between 1 single channel of mixer-OL and ADC boards. In the following MEL-x ADC-y stand for channel "x" of mixer-OL and adc "y" of ADC board[1] (see Table 1). The MEL channel is most responsible of the general shape with minor changes due to adc front-end uni-polar to bi-polar circuit. Notice the lines are quite similar for the 4 combinations indicating an intrinsic feature. The 1375MHz line is the 125MHz line noted in the ADC-alone spectra. The other ADC lines (see Figure 2 PAON2-OptX21cm/08.02.13) are of the order of 0.05dB so less powerful then those seen in Table 1 which indicates that the general powerful lines have certainly an OL-mixer origin. This is confirmed by using a 1250MHz frequency synthesizer in place of the OL oscillator (Figure 1): no more 1406MHz composite line as well as the 1400MHz series of lines and 1380, 1390, 1410MHz lines. In an other hand new lines emerge between 1390 and 1400 MHz.

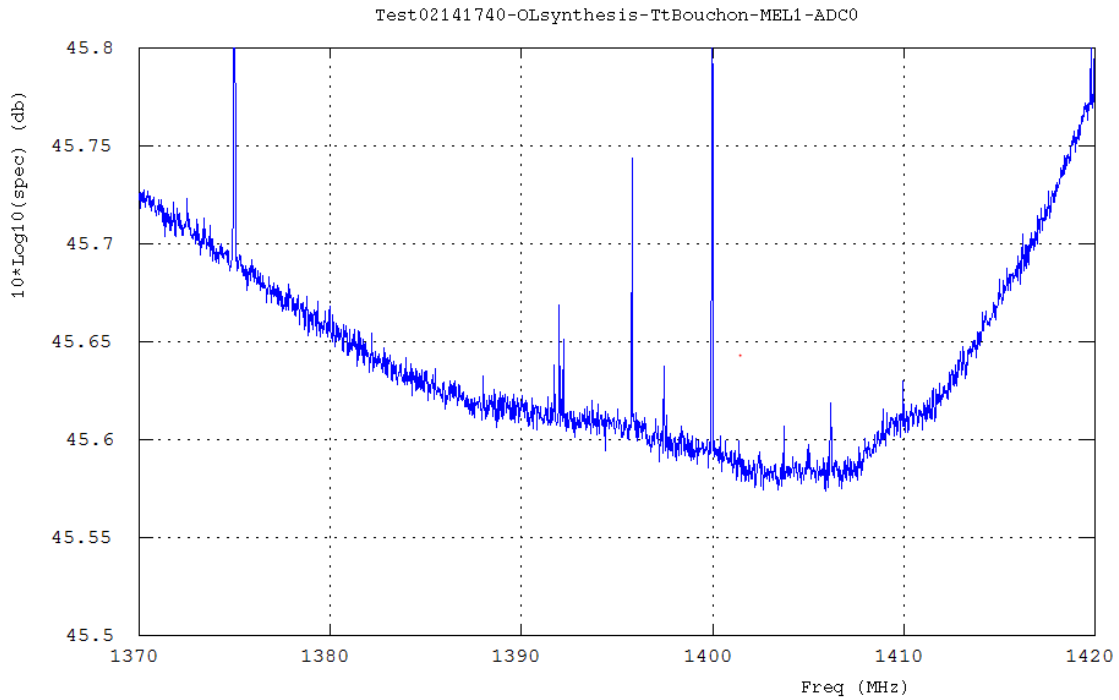
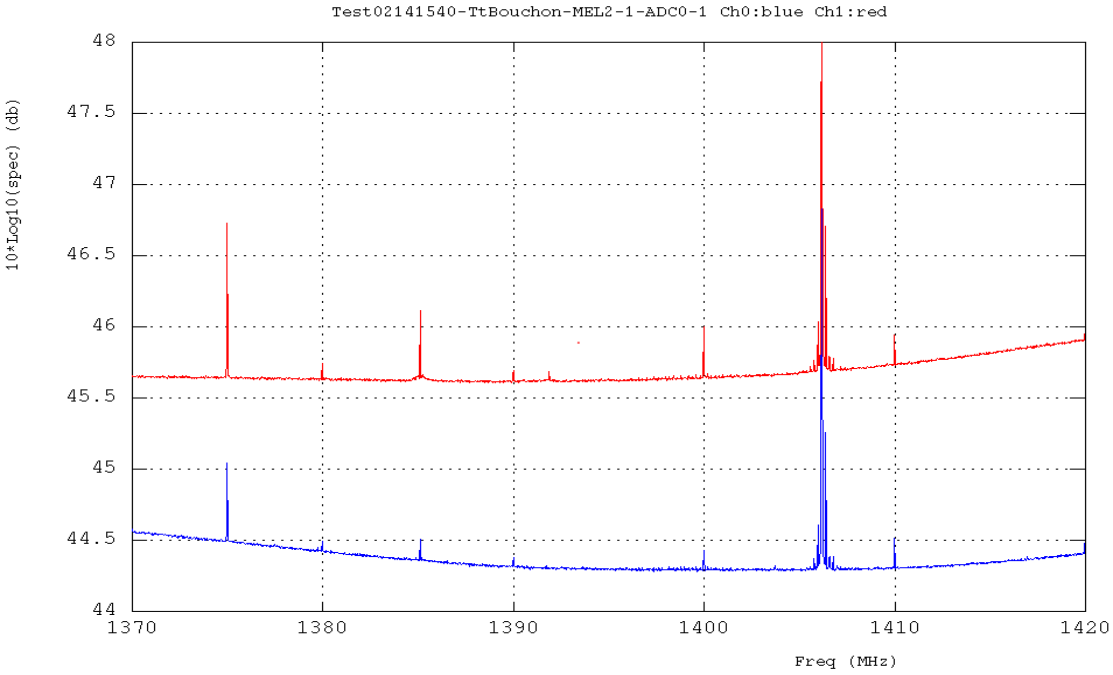


Figure 1 This picture is equivalent of Table 1 MEL-1 ⇔ ADC-0 setup but using a frequency synthesizer to generate the 1250MHz.

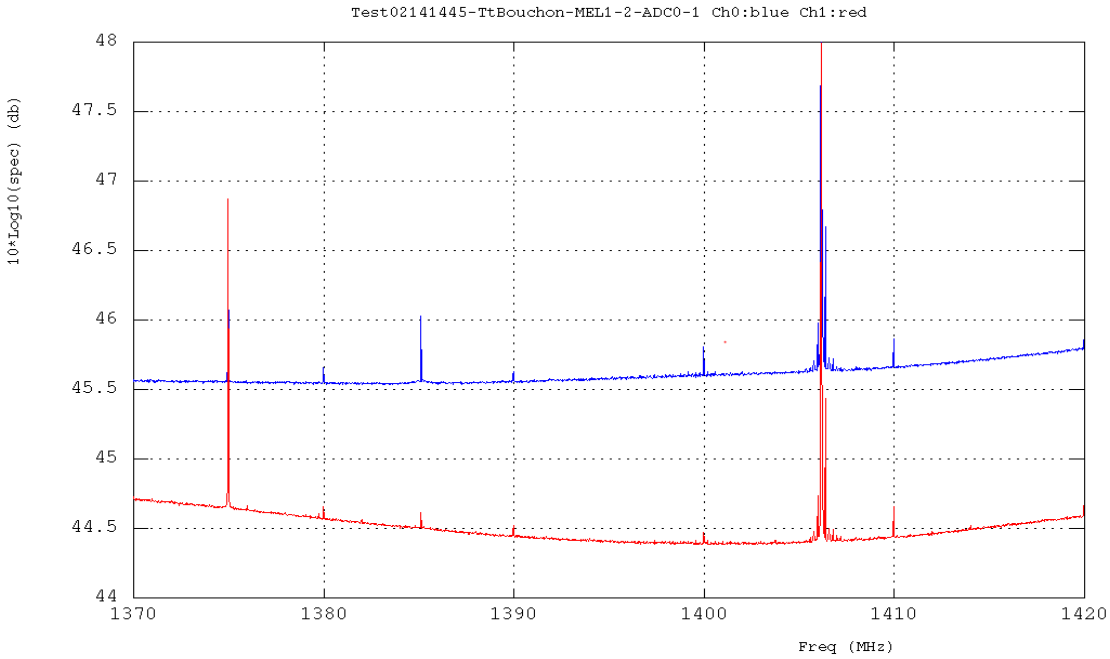
Then, analysis was done in a setup mimicking the Amas setup with 2 mixer-OL channels associated one-to-one to the 2 adcs of the same ADC board (1 fiber per adc chip). One can see that the result do not depend on the adc chip.

[1] One ADC board has 2 adc chips with each one 2 entries.

Table 2



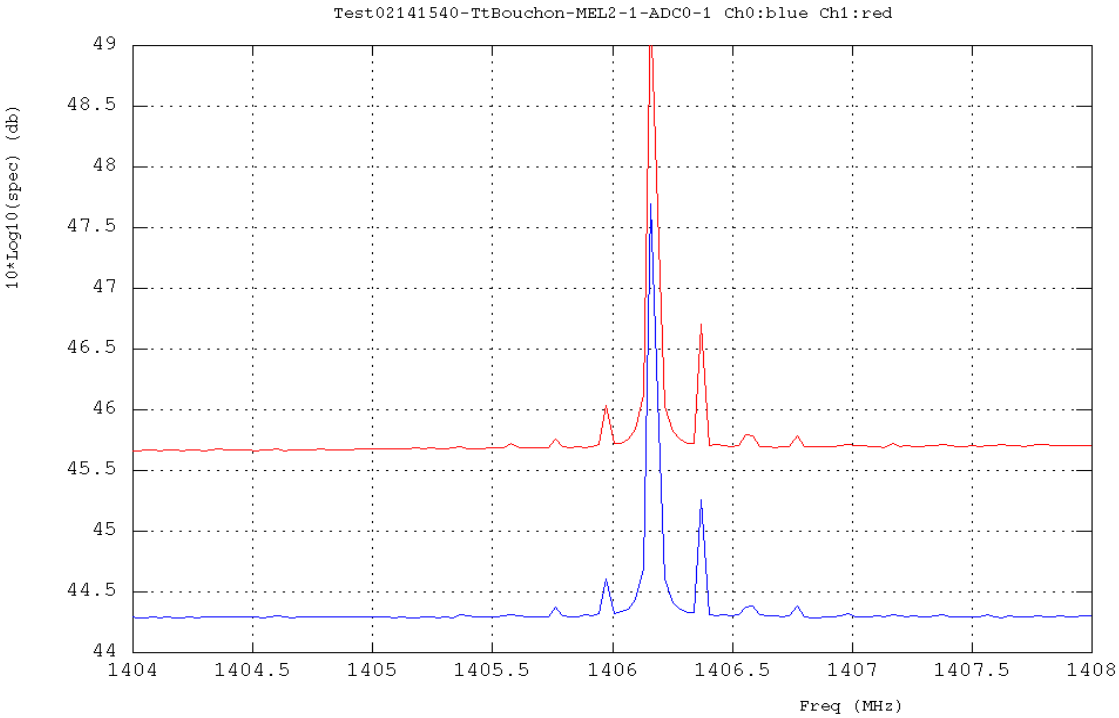
MEL-1 ⇔ ADC-1 (red) and MEL-2 ⇔ ADC-0 (blue)



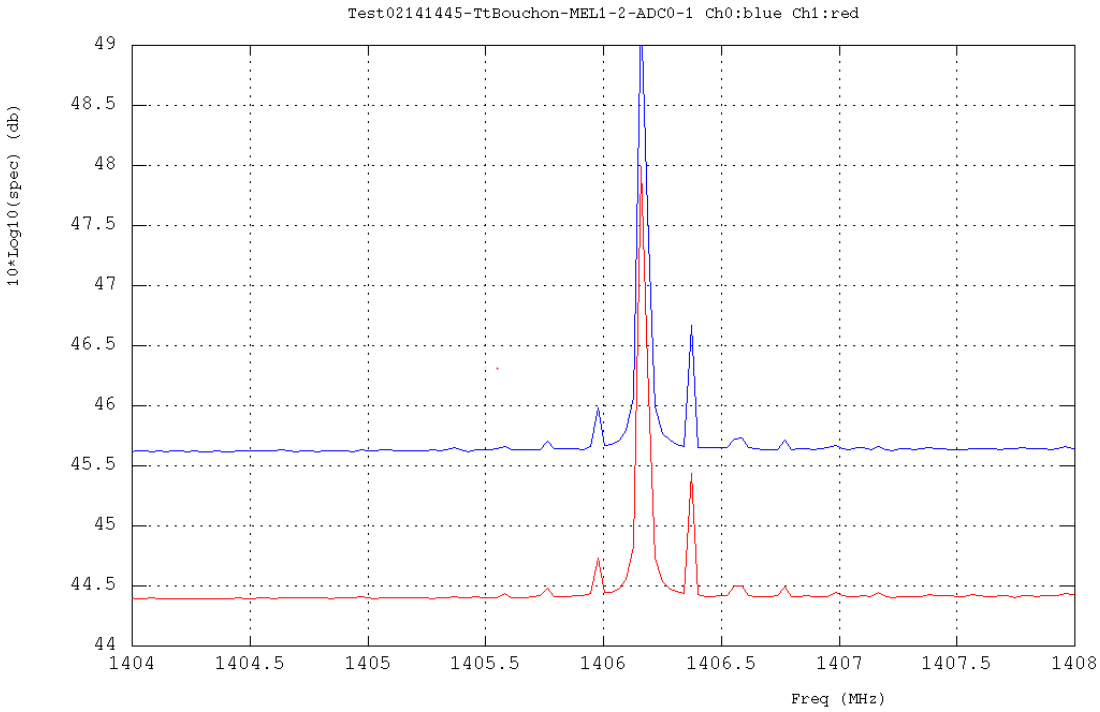
MEL-1 ⇔ ADC-0 (blue) and MEL-2 ⇔ ADC-1(red)

And in the following table, it is presented a zoom on the 1406MHz composite line which shows that the strength of this line is the same for both channels.

Table 3



MEL-1 ⇔ ADC-1 (red) and MEL-2 ⇔ ADC-0 (blue)



MEL-1 ⇔ ADC-0 (blue) and MEL-2 ⇔ ADC-1(red)

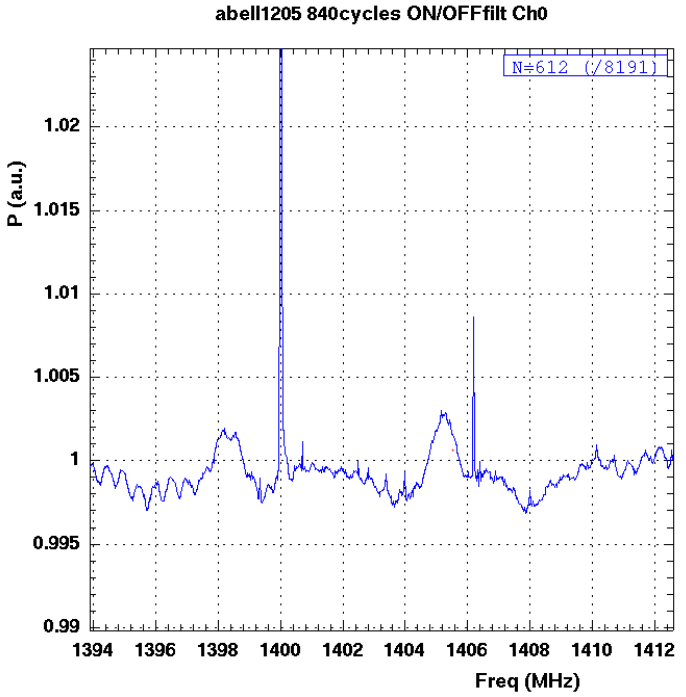
3 Summary & Outlook

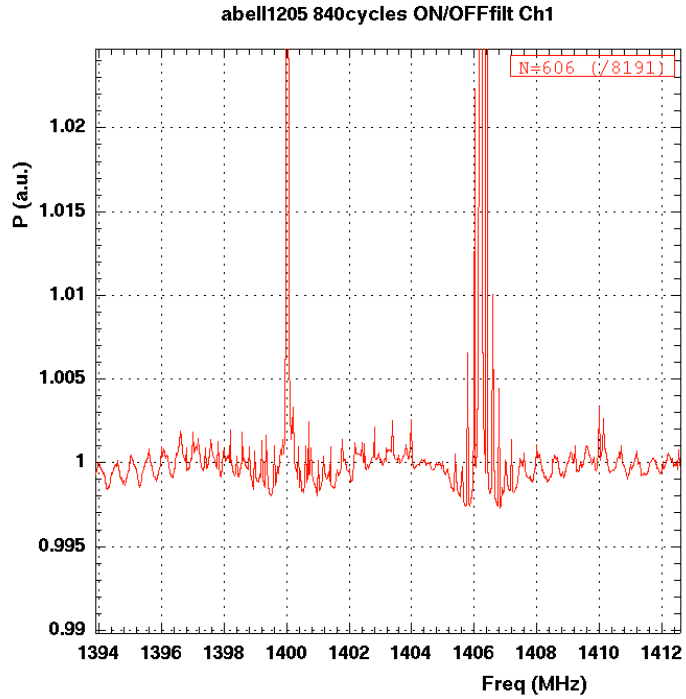
The test analyzed in this MEMO show that the problem of 1406MHz composite line as well as ~1400MHz multi-lines (and others) take their origin to the OL-mixer board especially on

the OL generation part. We have change OL board and see the same results and finaly using a synthesized 1250MHz to feed the mixer clearly points out the OL.

We have also discovered by pure hazard that the 50 loads are necessary to make the results stable and reliable. At Nançay Amas data was taken without these loads on unused channels, we can see the 1406MHz composite line much more pronounced in on channel associated to the 1400MHz-series of lines.

Table 4





For the future OptX21cm experiment it could be investigated the possibility to put the 50Ω loads in every unused channels and to use a synthesizer to generate the OL. Then we have to

focus on how to remove/attenuate the large oscillation/distortion of the spectra analyzed PAON2-OptX21cm/08.02.13 Sec. 2.3.