EDGES MEMO #237

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To: EDGES Group

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Subject: Sensitivity of absorption signature search to LNA S11 error

The measurement of the LNA S11 is difficult because it has to be done at a low enough level to avoid obtaining a value, which is influenced by saturation in the post LNA amplification. While some care was taken in the design to use a second stage with large dynamic range the second stage does start to saturate with input level above -30 dBm for the low band which has 3 dB attenuation before the LNA. Even at -30 dBm there may be some effect of the saturation of the third stage, which is isolated by only 10 dB. In future receivers this might be increased to 20 dB and the third stage gain increased by 10 dB to compensate.

Figure 1 shows the result of a signature search using all the low band data discussed in memo #236. Figure 2 show the result of a search with the LNA S11 increased by 1 dB and Figure 3 shows the result of also using LNA S11 increased by 1 dB for the calibration. The similarity of Figures 2 and 3 show that the calibration itself is not strongly affected by the change in LNA S11 and that the change is the spectra from the antenna is dominated by the change in the term in memo 113.

$$F = \left(\left(1+\left|\Gamma_\ell\right|^2\right)^{1/2} \Big/ \left(1-\Gamma_a\Gamma_\ell\right) \right)$$

Figure 4 shows the result of a signature search using the LNA S11 measurements from 2015-08-09-03-07-31_rep1 which were instead the LNA S11 measurements from 2015-09-16-12-130-29_simulator2_long used for Figure 1. In another test, the LNA S11 from 2015-06-27-00-45-47_power_-35dBm was used for the search shown in Figure 5.

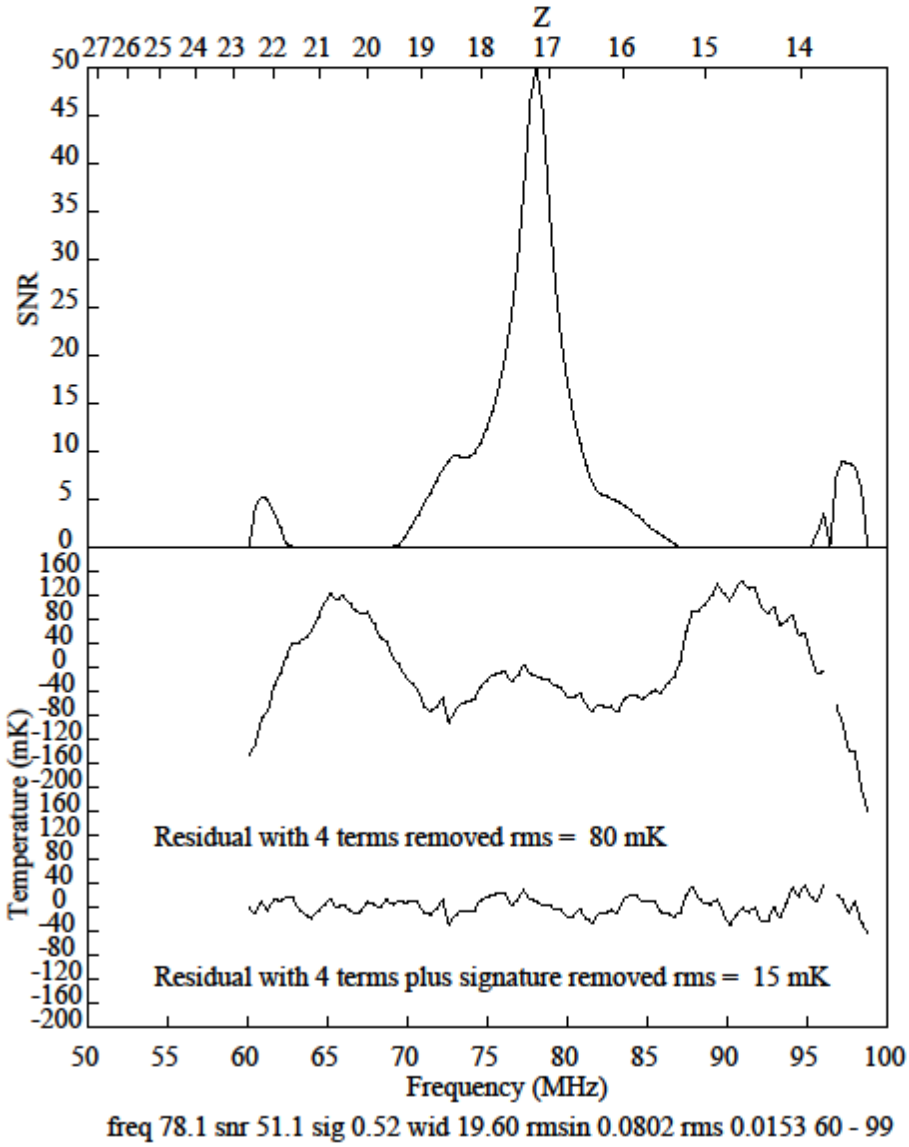

Figure 1. Signature search using all low band data processed with LNA S11 from September 2015.

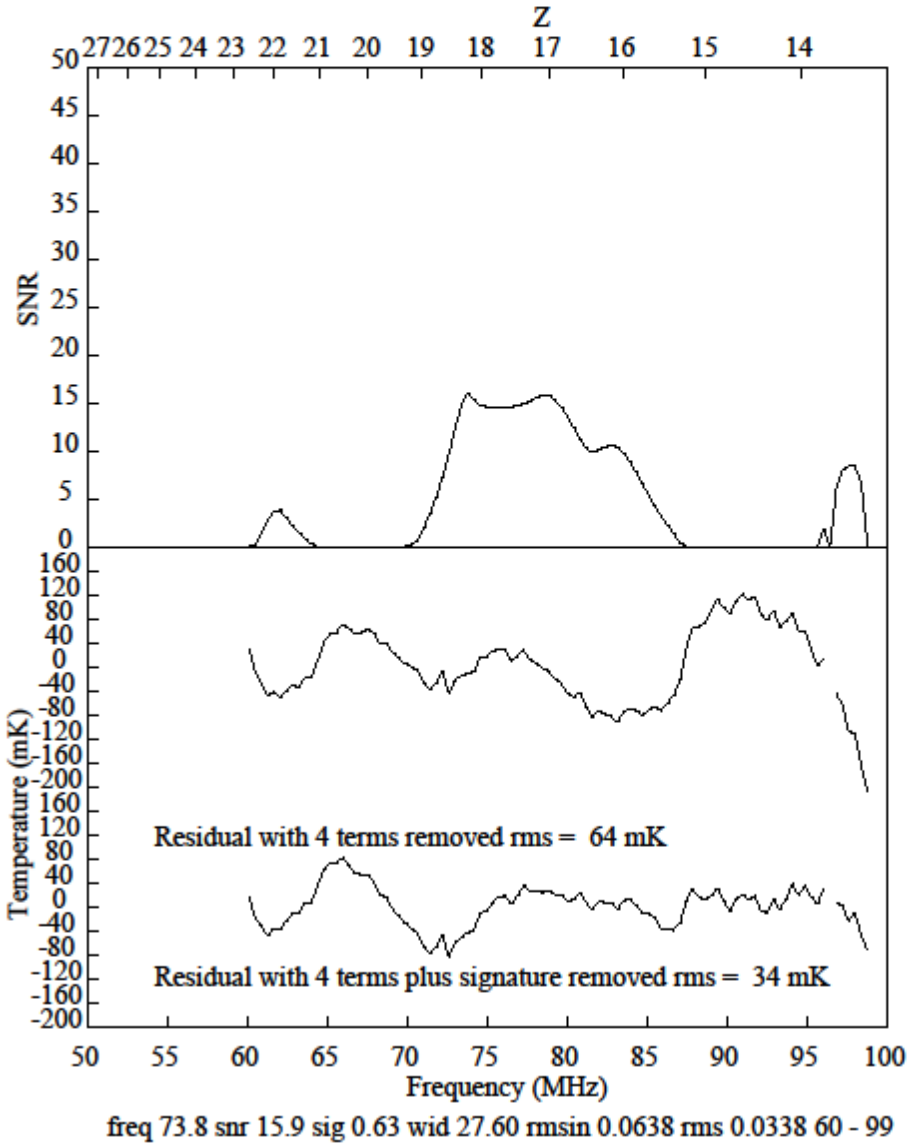

Figure 2. Search with LNA S11 increased by 1 dB.

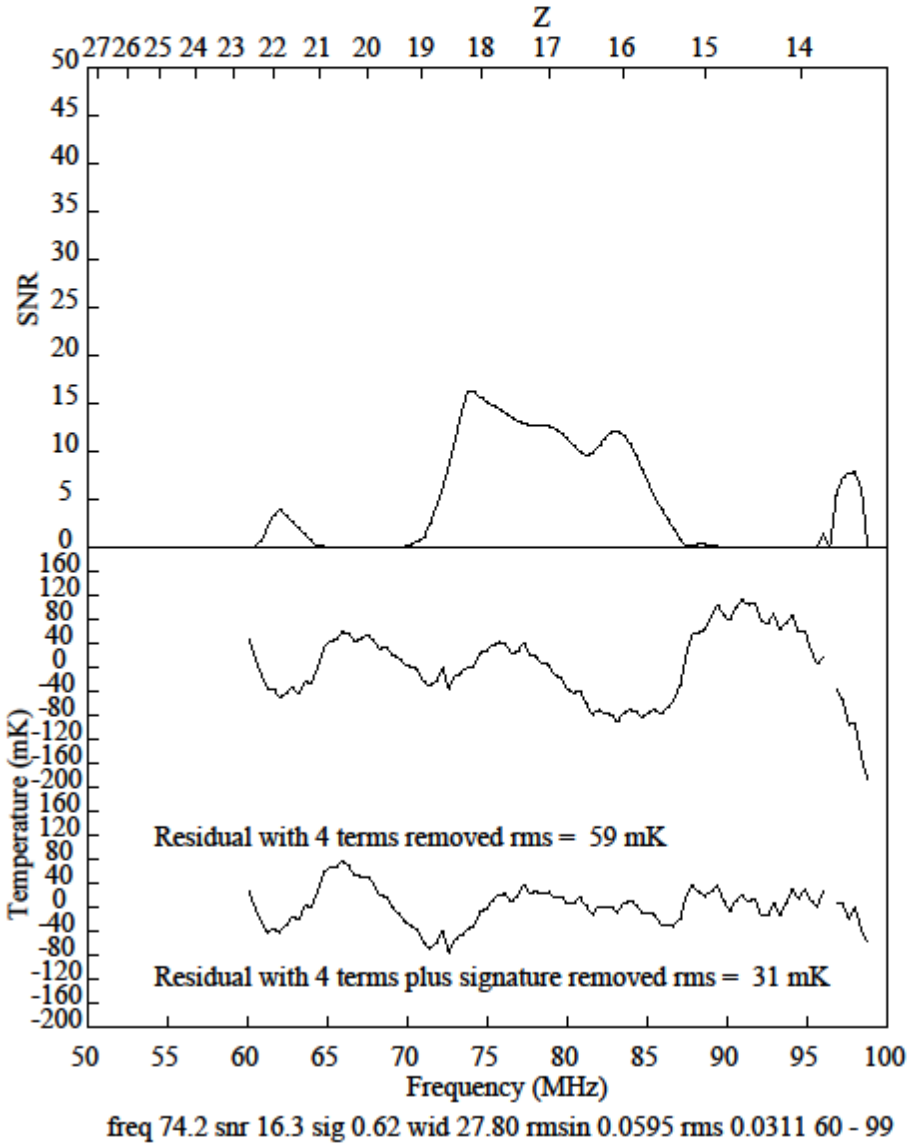

Figure 3. Search using LNA S11 increased by 1 dB in processing and in calibration.

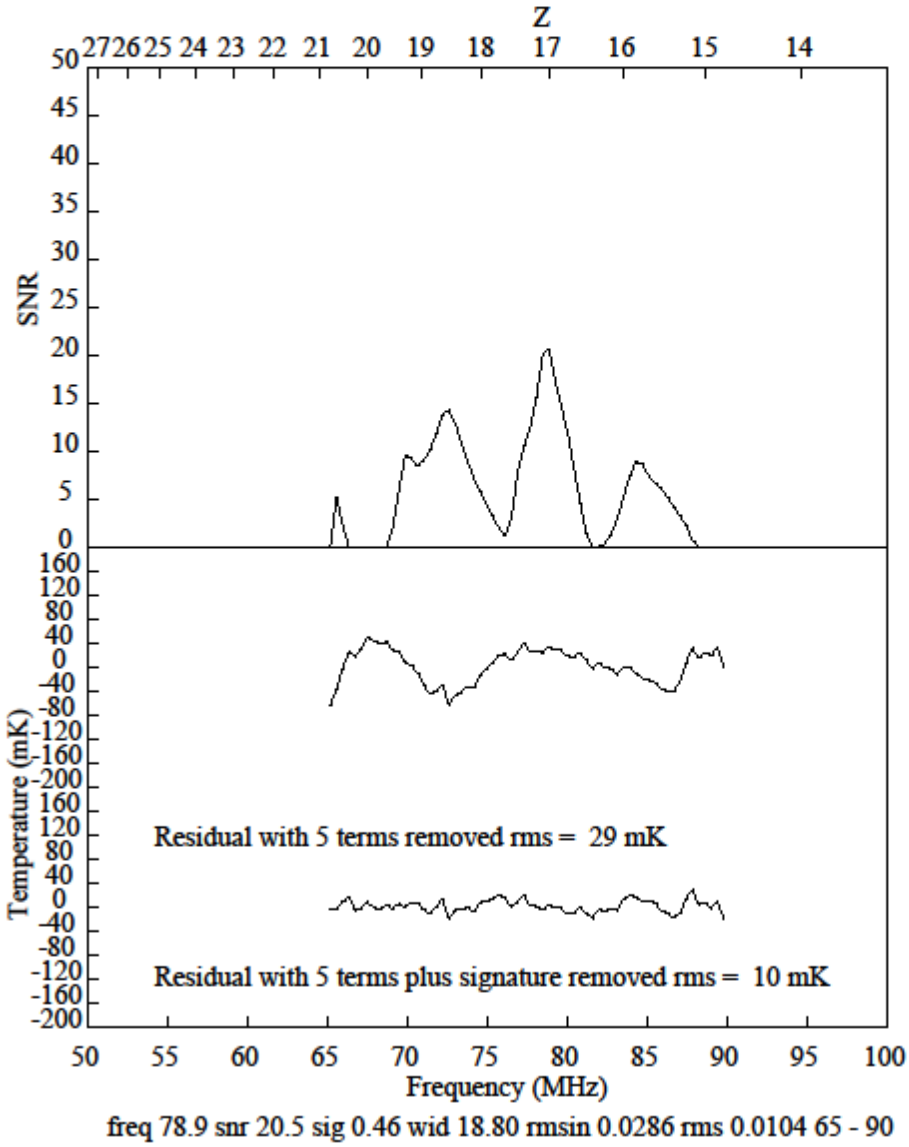

Figure 4. Search using LNA S11 from August 2015 prior to change of Dowkey switch.

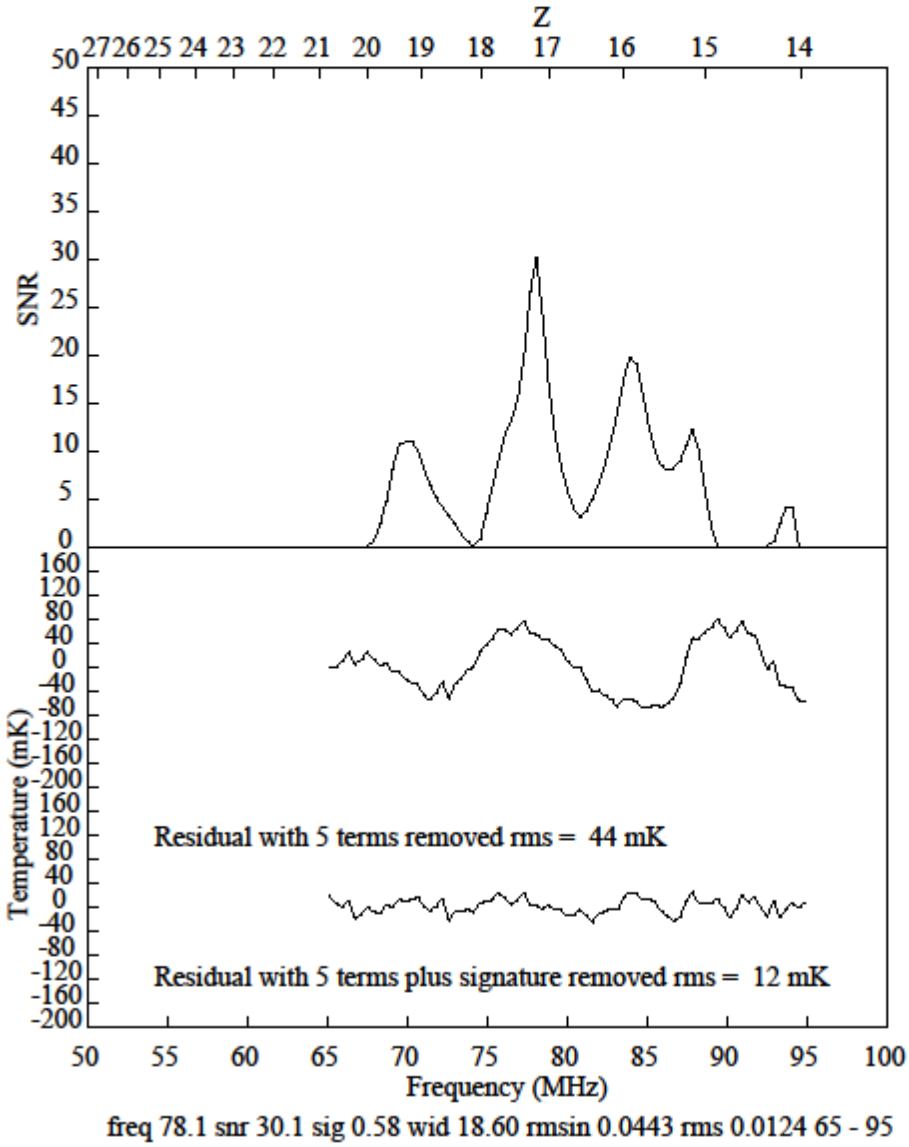

Figure 5. Search using LNA S11 from June 2015.