

Nominal Calibration Data and Results for the Low Band 1 and 2 Receivers at 25°C

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Summary

Here we show nominal data and calibration results for the Low Band 1 and 2 receivers at 25°C . The specific calibrations considered correspond to Low-Band 1 receiver done in 2015-08 and 2017-05, and also to Low-Band 2 receiver done in 2017-03 (in this case the spectra measurements were done in 2016-09 and the receiver reflection coefficient was measured in 2017-03).

First, we list the calibration files used in each case. In particular, different test calibrations were conducted with different subsets of spectra files but the calibration results did not depart significantly from the nominal, which use the files listed. Specifically, when using subsets of files the residuals in the calibrated long cable and the antenna simulator spectra did not decrease or “flatten”. As a precaution, in order to avoid periods of instability of the calibrators, we remove $\sim 10\%$ of the data at the beginning of each period covered by the listed spectra files. Finally, in the case of the Low-Band 1, 2017-05, we do not show results for the antenna simulator 1 due to obvious RFI in that measurement.

Figure 1 shows the physical temperatures of the calibration loads and antenna simulators for the three calibrations. The temperature fluctuates to within $\approx 1^{\circ}\text{C}$, after an initial stabilization period. For all except the hot load, the temperature is close to the temperature of the ASU lab, of $\approx 23^{\circ}\text{C}$. These temperatures are mainly shown for reference. The time periods and durations shown do not necessarily match the periods covered by the selected spectra measurements.

Figures 2 through 8 show the reflection coefficient of the receiver input (Fig. 2), calibration loads (3-6), and antenna simulators (7, 8) for the three calibrations. The top panels show the magnitude and phase. The bottom panels show the difference between the 2017 and 2015 calibrations of the Low Band 1 receiver. One thing to notice is that the long open and shorted cable, and the antenna simulators, were measured using an additional F-M adapter in the 2017 calibration of the Low-Band 1 receiver (green lines in top panels), as well as for the Low-Band 2 receiver (red lines in top panels). Therefore, the green and red lines match closely in the top panels. This is also observed as a significant phase difference ($\approx 5^{\circ}$ at 100 MHz) between the 2017 and the 2015 Low-Band 1 calibrations, in the lower right panels for these devices.

Figures 9 and 10 show the 5 calibration parameters. Over the range 50-100 MHz, we use 7 terms to model C_1 , C_2 , T_U , T_C , and T_S . In the only case where the modeling is done over 50-120 MHz (Low-Band 1, 2017-05), we use 7 terms for C_1 and C_2 , and 8 terms for T_U , T_C , and T_S .

Finally, figures 11 through 18 show the calibration crosschecks for all cases.

Files for Calibration of Low-Band1 2015-08 at 25°C

Reflection Coefficients:

s11_calibration_low_band_LNA25degC_2015-09-16-12-30-29_simulator2_long.txt

Spectra:

Ambient:

2015.245.02

2015.246.00

Hot:

2015.246.04

2015.247.00

Open:

2015.243.14

2015.244.00

2015.245.00

Shorted:

2015.241.04

2015.242.00

2015.243.00

Sim1:

2015.247.22

2015.248.00

2015.249.00

Sim2:

2015.255.02

2015.256.00

2015.257.00

Files for Calibration of Low-Band1 2017-05 at 25°C

Reflection Coefficients:

s11_calibration_low_band_LNA25degC_2017-05-26-11-42-38_second_ambient.load.txt

Spectra:

Ambient:

2017.144.21

2017.145.00

2017.146.00

Hot:

2017.129.00

2017.130.00

Open:

2017.139.19

Shorted:

2017.139.00

Sim2:

2017.133.00

2017.134.00

2017.135.00

Files for Calibration of Low-Band2 2017-03 at 25°C

Reflection Coefficients:

s11_calibration_low_band_LNA25degC_2017-03-02-02-53-40.txt

Spectra:

Ambient:

2016.266.18

2016.267.00

2016.268.00

2016.269.00

Hot:

2016.269.20

2016.270.00

2016.271.00

2016.272.00

Open:

2016.275.01

2016.276.00

2016.277.00

Shorted:

2016.273.00

2016.274.00

2016.275.00

Sim1:

2016.277.02

2016.278.00

2016.279.00

2016.280.00

2016.281.00

Sim2:

2016.281.02

2016.282.00

2016.283.00

2016.284.00

2016.285.00

Temperature of Calibration Loads

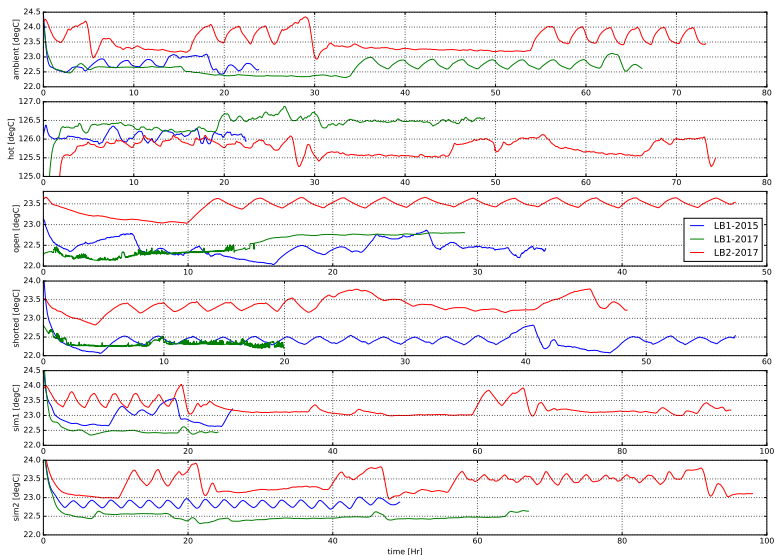


Figure : (1) Temperature of the calibration loads and antenna simulators for the three calibrations. The periods and durations do not match exactly the periods covered by the spectra files listed on the previous pages.

Reflection Coefficient of Receiver Input

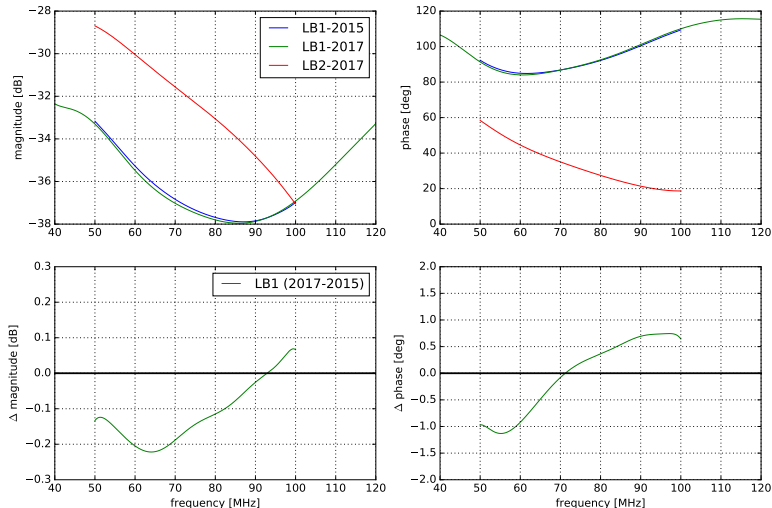


Figure : (2) Reflection coefficient of the receiver input for the three calibrations. **BOTTOM:** Differences between the two measurements of the Low-Band 1 receiver.

Reflection Coefficient of Ambient Load

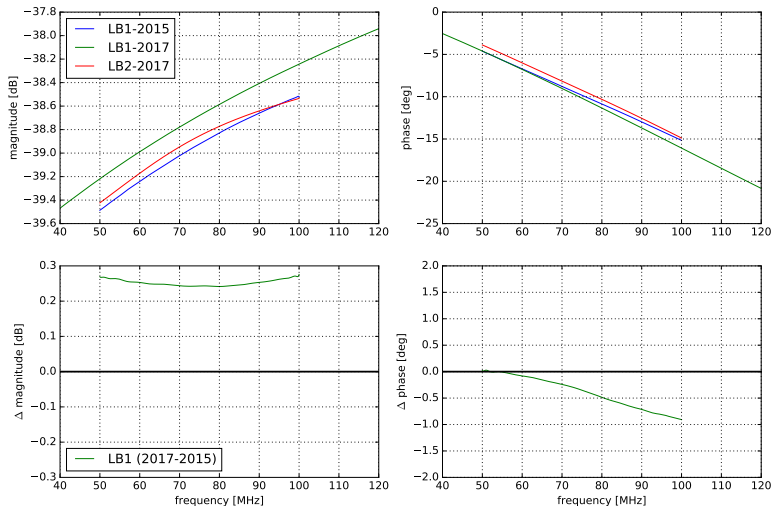


Figure : (3) Reflection coefficient of the ambient load for the three calibrations.

Reflection Coefficient of Hot Load

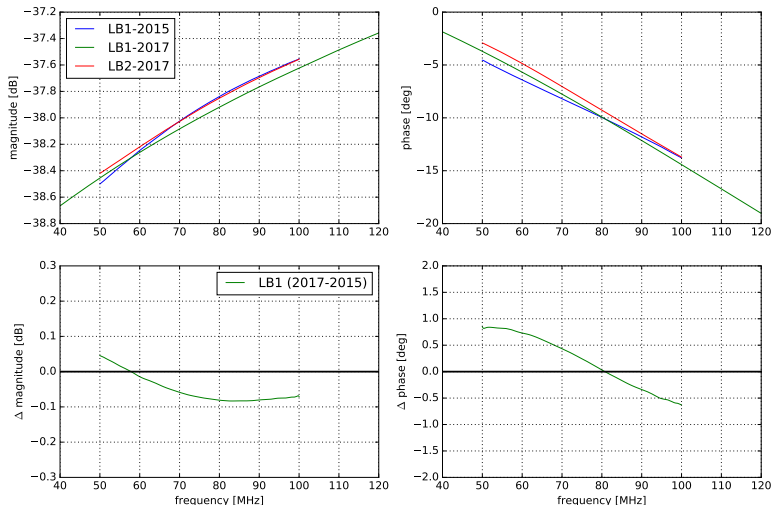


Figure : (4) Reflection coefficient of the hot load for the three calibrations.

Reflection Coefficient of Open Cable

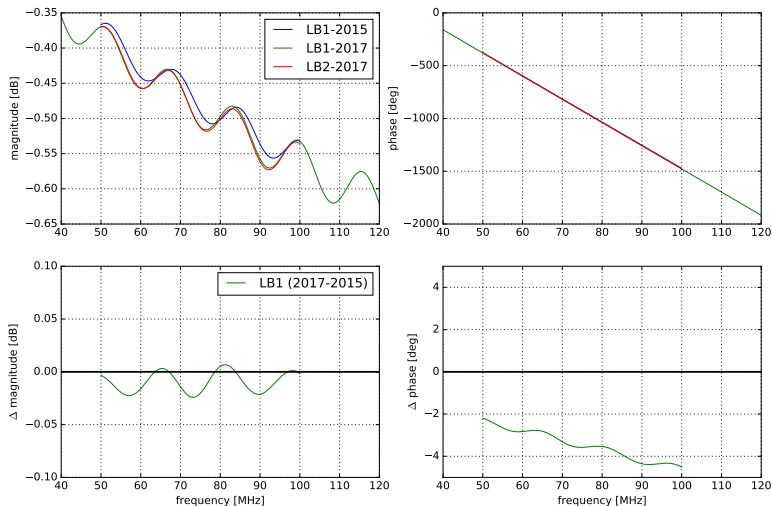


Figure : (5) Reflection coefficient of the open cable for the three calibrations. A F-M adapter was used in the 2017 calibrations of the Low-Band 1 and Low-Band 2 receivers.

Reflection Coefficient of Shorted Cable

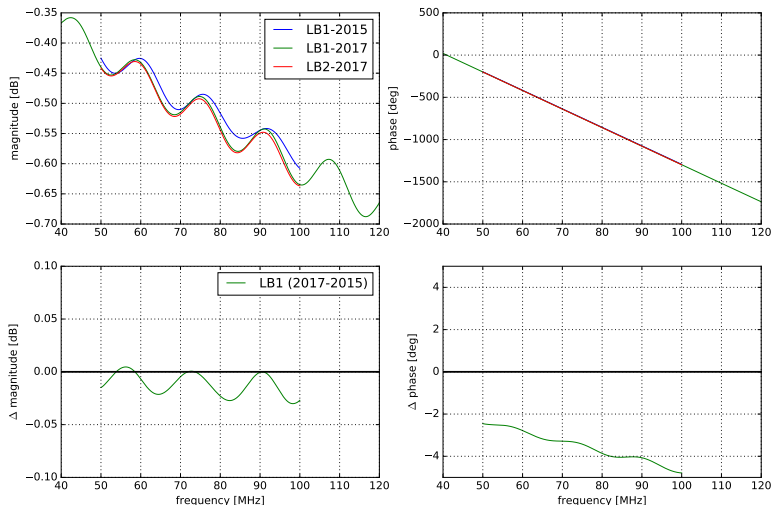


Figure : (6) Reflection coefficient of the shorted cable for the three calibrations. A F-M adapter was used in the 2017 calibrations of the Low-Band 1 and Low-Band 2 receivers.

Reflection Coefficient of Antenna Simulator 1

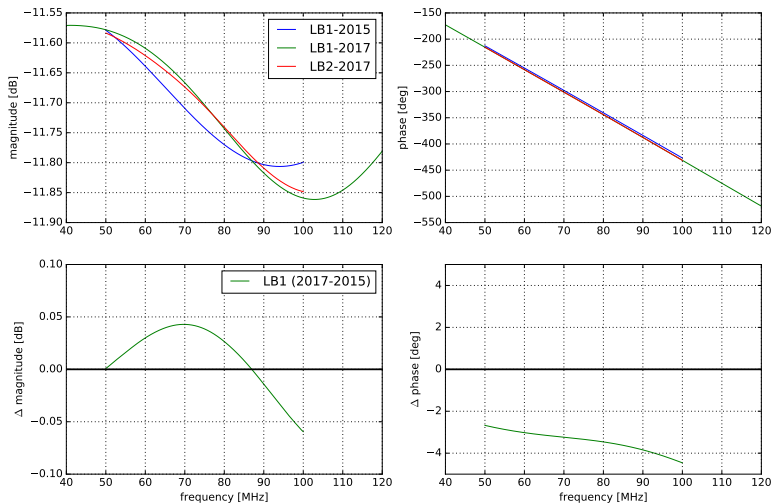


Figure : (7) Reflection coefficient of the antenna simulator 1 for the three calibrations. A F-M adapter was used during the 2017 calibrations of the Low-Band 1 and Low-Band 2 receivers.

Reflection Coefficient of Antenna Simulator 2

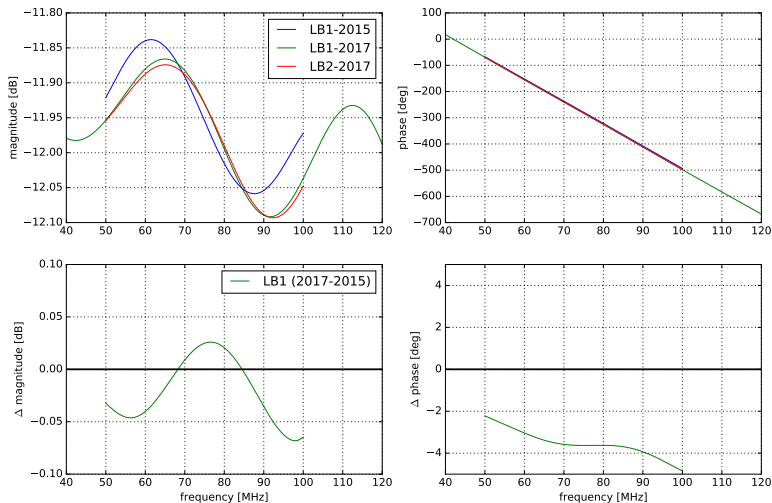


Figure : (8) Reflection coefficient of the antenna simulator 2 for the three calibrations. A F-M adapter was used during the 2017 calibrations of the Low-Band 1 and Low-Band 2 receivers.

Calibration Parameters Low-Band 1

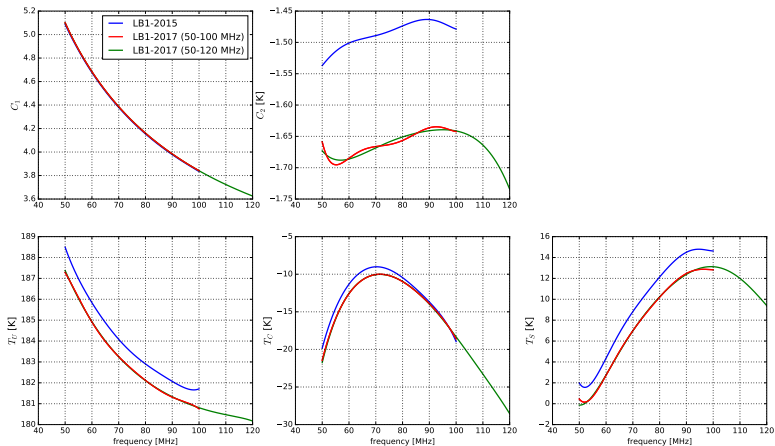


Figure : (9) Calibration parameters for the Low-Band 1 receiver. Over 50-100 MHz, we use 7 terms to model all parameters. Over 50-120 MHz (Low-Band 1, 2017-05), we use 7 terms for C_1 and C_2 and 8 terms for T_U , T_C , and T_S .

Calibration Parameters Low-Band 2

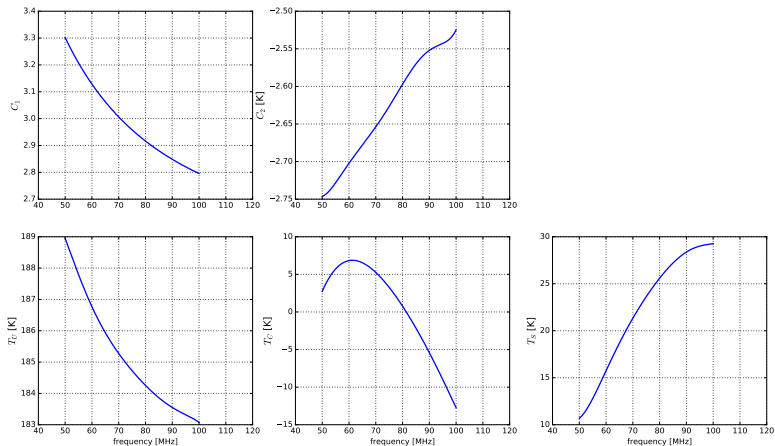


Figure : (10) Calibration parameters for the Low-Band 2 receiver. We use 7 terms to model all parameters over 50-100 MHz.

Calibration Crosscheck Low-Band 1, 2015-08

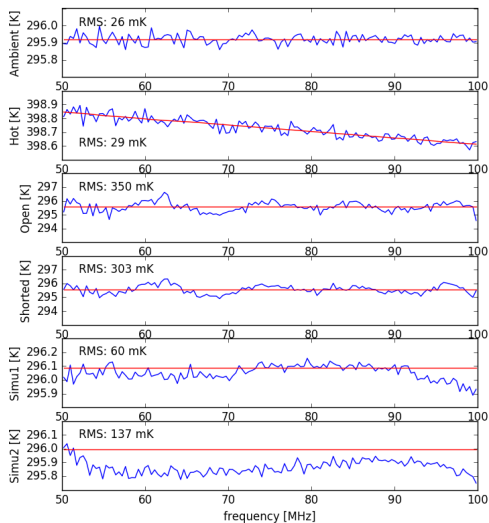


Figure : (11) Crosschecks for calibration of Low-Band 1, 2015-08.

Calibration Crosscheck Low-Band 1, 2015-08

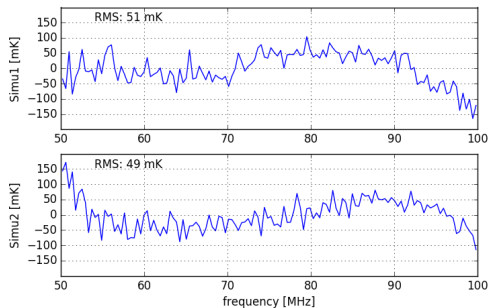


Figure : (12) Crosschecks for calibration of Low-Band 1, 2015-08.

Calibration Crosscheck Low-Band 1, 2017-05

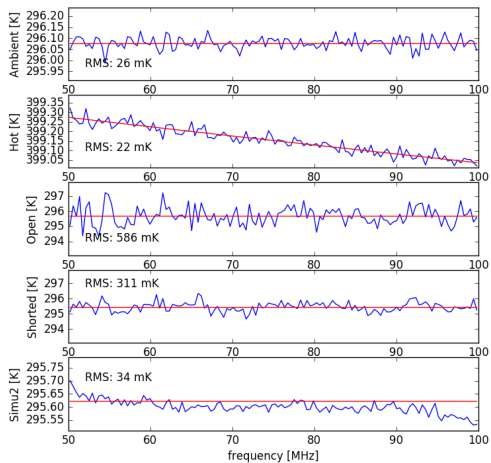


Figure : (13) Crosschecks for calibration of Low-Band 1, 2017-05 (50-100 MHz).

Calibration Crosscheck Low-Band 1, 2017-05

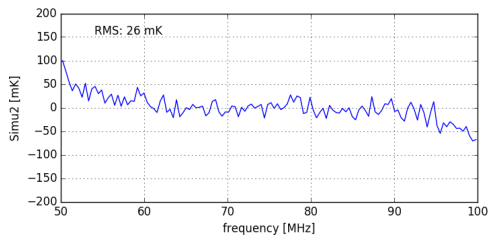


Figure : (14) Crosschecks for calibration of Low-Band 1, 2017-05 (50-100 MHz).

Calibration Crosscheck Low-Band 1, 2017-05

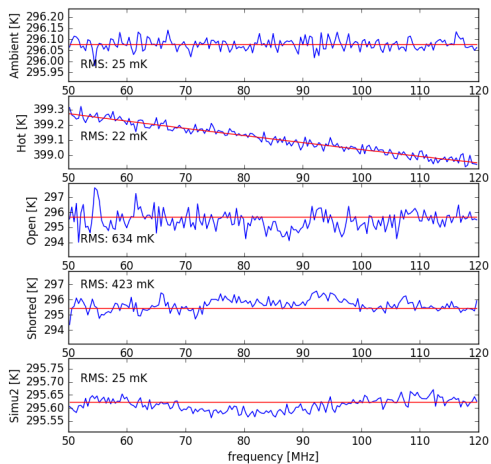


Figure : (15) Crosschecks for calibration of Low-Band 1, 2017-05 (50-120 MHz).

Calibration Crosscheck Low-Band 1, 2017-05

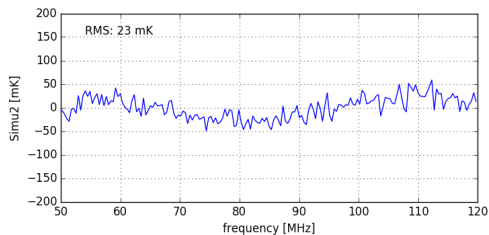


Figure : (16) Crosschecks for calibration of Low-Band 1, 2017-05 (50-120 MHz).

Calibration Crosscheck Low-Band 2, 2017-03

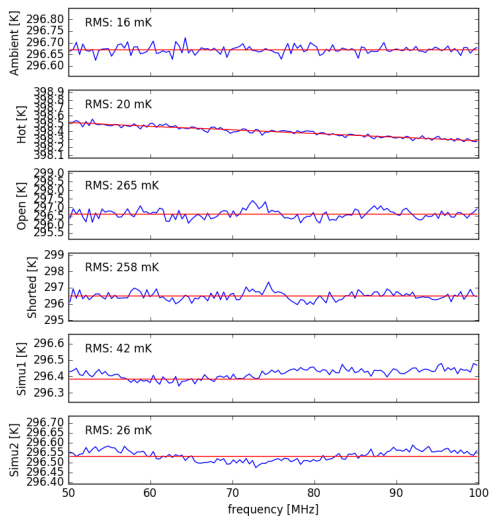


Figure : (17) Crosschecks for calibration of Low-Band 2, 2017-03.

Calibration Crosscheck Low-Band 2, 2017-03

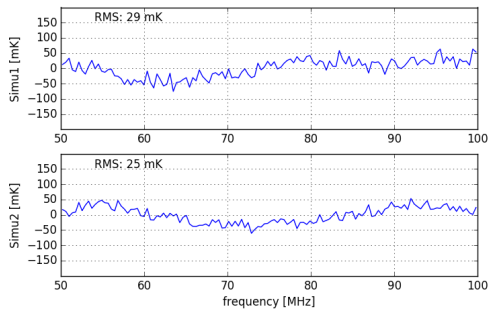


Figure : (18) Crosschecks for calibration of Low-Band 2, 2017-03.