

Recalibration of Lowband Receiver 02 15C, 25C, 35C

Leroy Johnson, Nivedita Mahesh

Introduction

One of the motivations to redo the calibration was to check if the calibration procedure and equipment being used for calibration were all working as expected. Because we didn't get expected calibration results from Receiver 03 whose calibration was performed in July/August.

- Here we show the calibration results for the Low Band 2 receiver at 15°C,25°C,35°C.
- The specific calibrations considered correspond to Low-Band 2 receiver done in 2018_09.
- The calibration coefficients were estimated for the following frequency ranges:
 - 50-190 MHz.
 - 50-100 MHz
- The Calibration coefficients over the 50-190MHz were calculated for two cases and compared:
 - 7 terms for constants & 9 terms for Noise wave parameters
 - 6 terms for constants & 8 terms for Noise wave parameters
- The calibration results for the 50-100 MHz range was compared with those obtained in March 2017 (Memo 92)
- As a precaution, in order to avoid periods of instability of the calibrators, we remove ~ 5% of the data at the beginning of each period covered by the listed spectra files.

Files used:

/data5/edges/data/Receiver02_2018_09_24_040_to_200/25C

Corrected s11:

/data5/edges/data/Receiver02_2018_09_24_040_to_200/25C/
S11/corrected

Note: The s11's used in this report were the first measurement in each set.

Standards used:

Male standard -50.177 ohm (25 degC)

Female Standard - 49.999 ohm (25 degC)

Temperature of calibration loads @ 25C

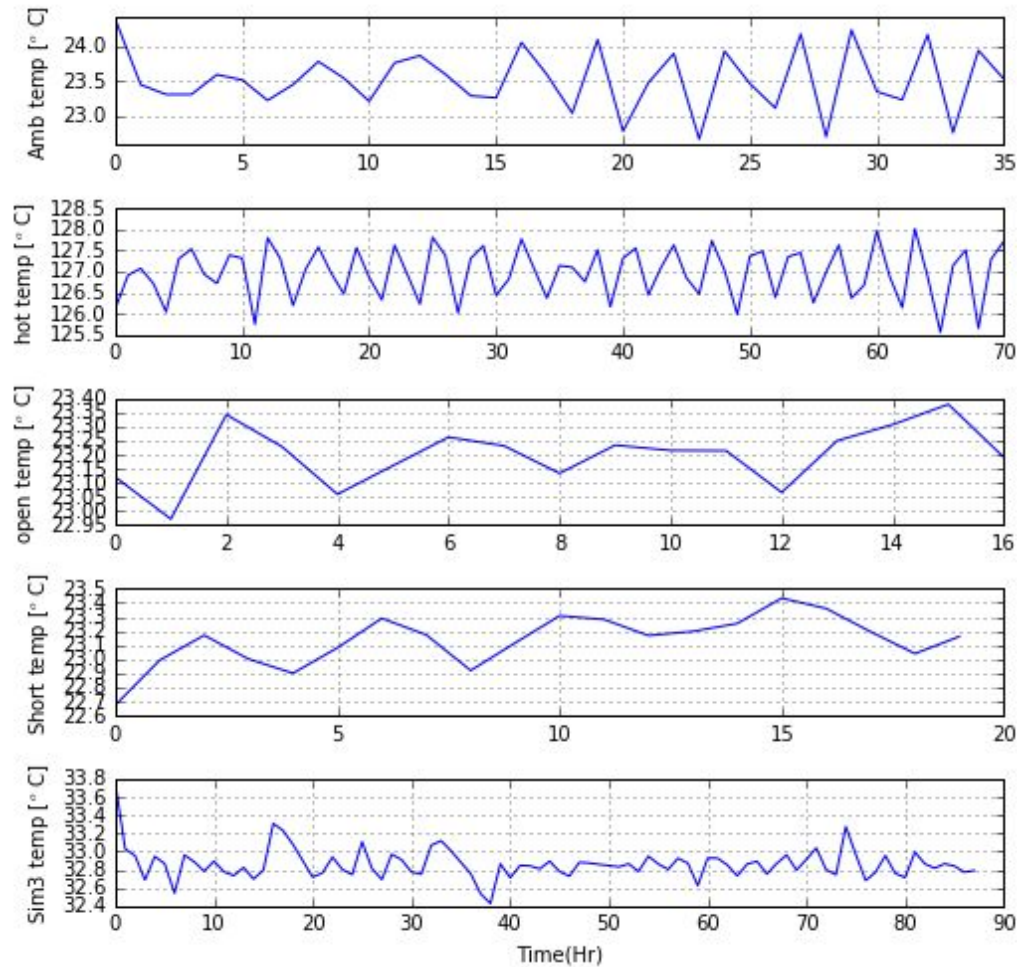
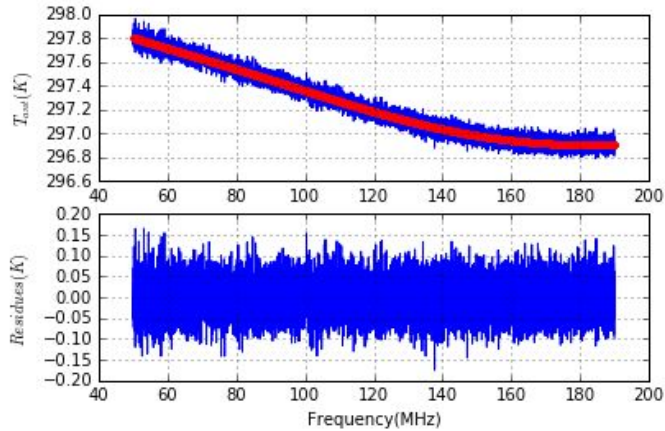


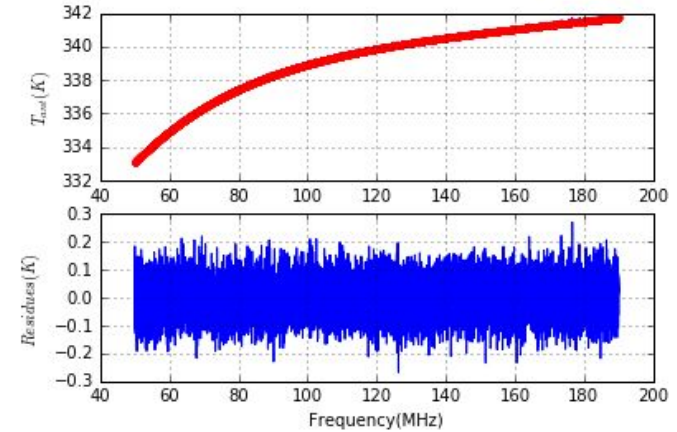
Figure1: Temperature of the calibration loads and antenna simulator 3.

Spectra data @ 25C for the loads

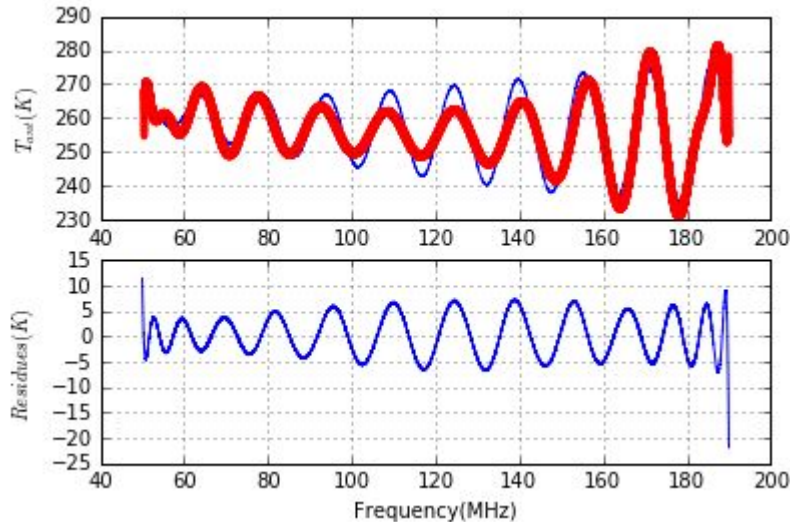
Ambient Load



Hot Load



Long Cable Open



Long Cable Short

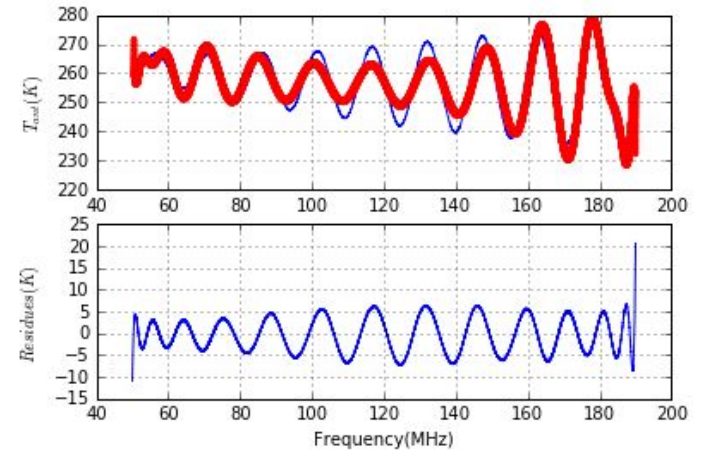
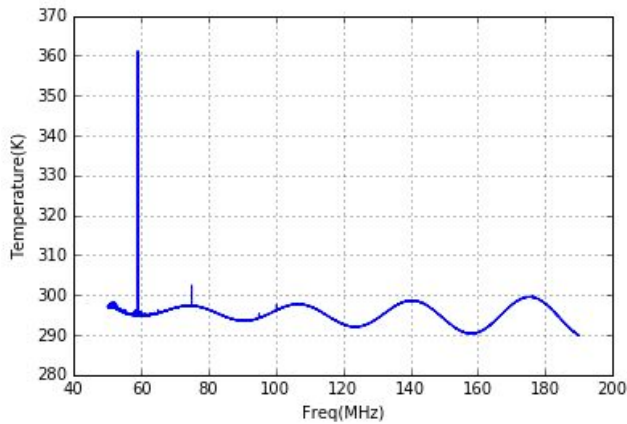


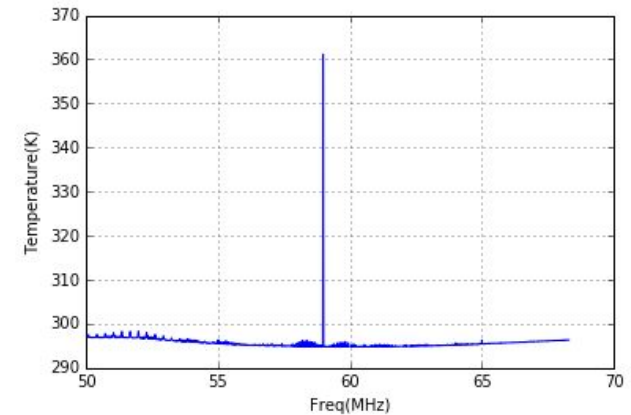
Figure2: Raw spectra of the calibration loads. Top panel- blue is the data & red is the fit. Bottom panel shows the residues of the fit to the data.

Spectra data @ 25C for the loads

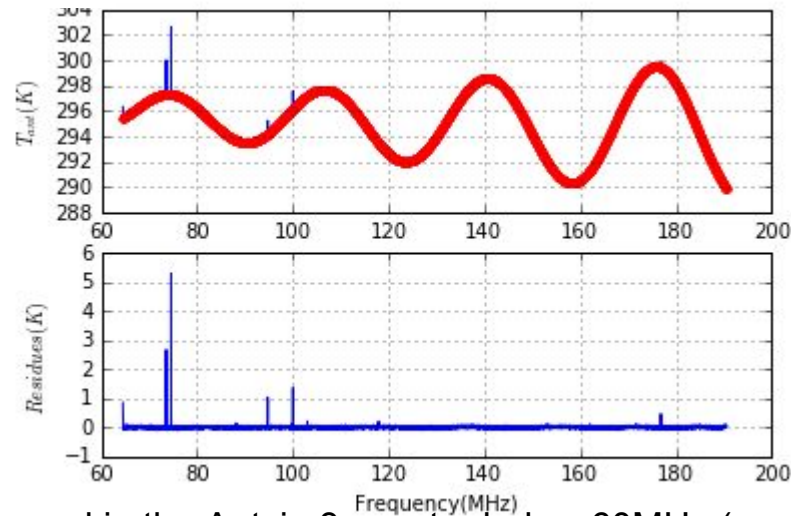
AntSim3



a.



b.



There is a lot of RFI observed in the Antsim3 spectra below 60MHz (as shown in figures a & b). This is the reason the calibration of Antsim3 is show only for 60-190MHz.

Reflection coefficients of the loads @25C; Freq: 50-190MHz

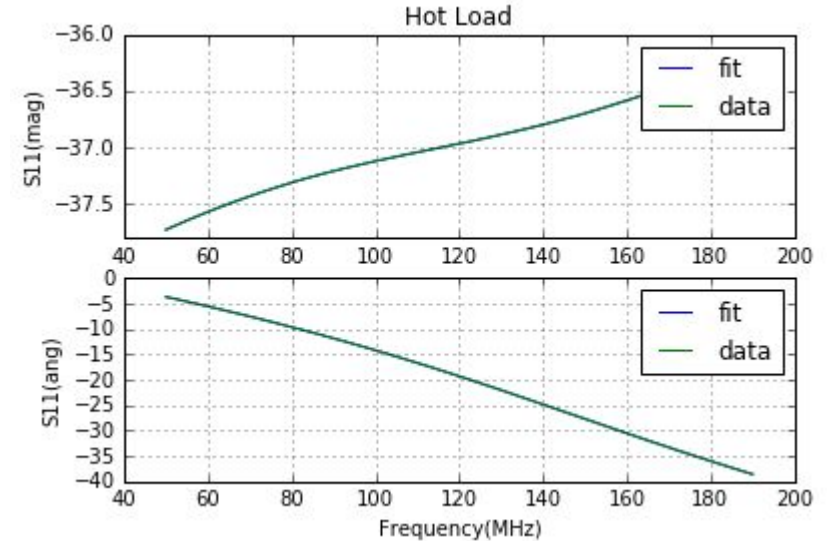
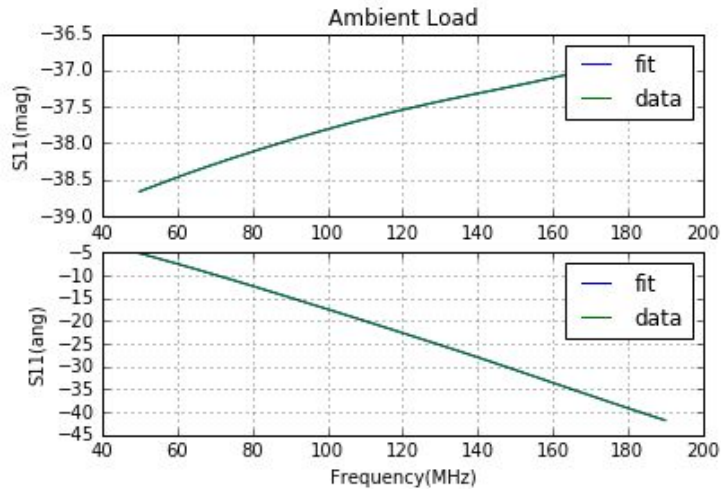
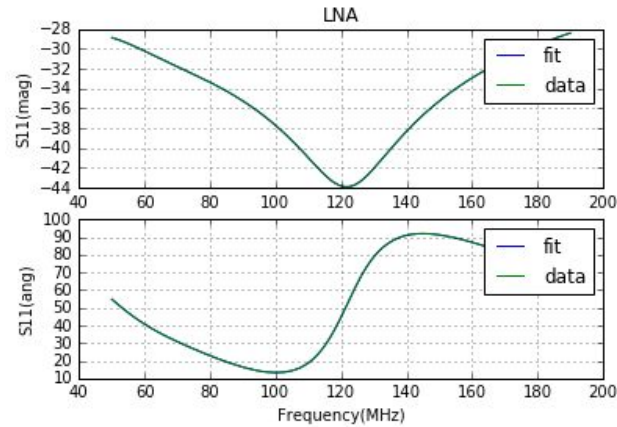


Figure3a: Reflection coefficients (Mag -top panel & phase- bottom panel) of the LNA and the calibration loads.

Reflection coefficients of the loads @25C

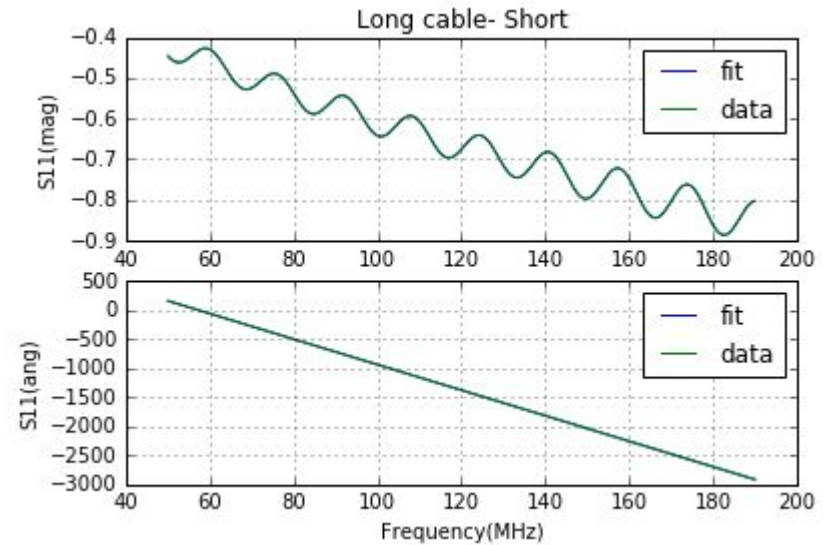
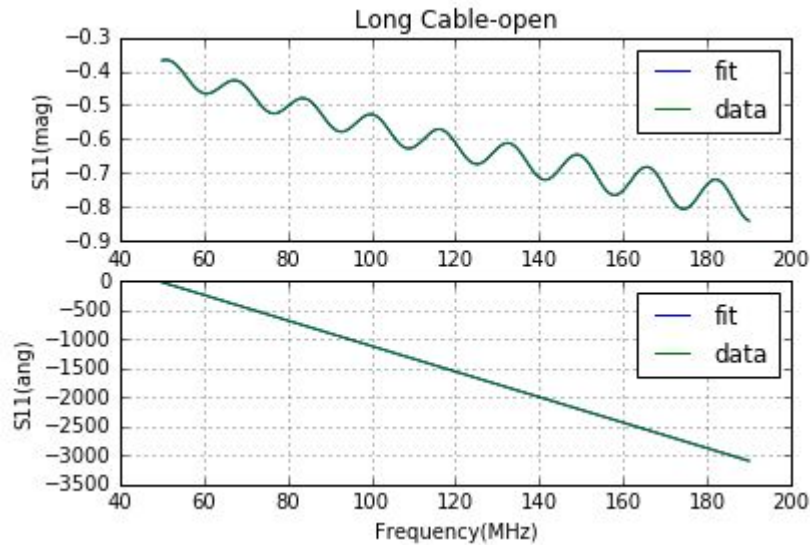


Figure3b: Reflection coefficients (Mag -top panel & phase- bottom panel) of the LNA and the calibration loads.

Reflection coefficients of the loads @25C; Freq: 50-100MHz

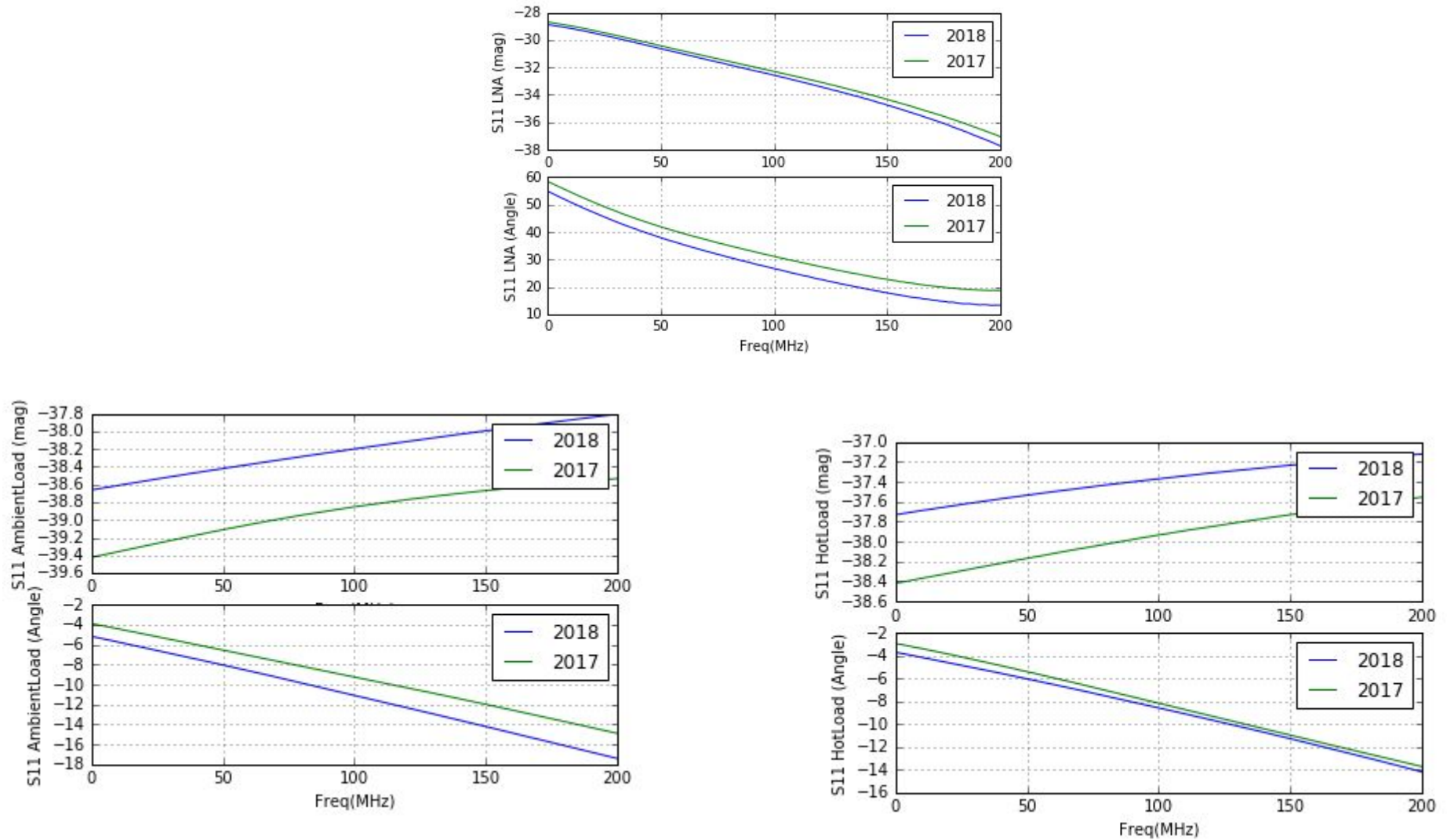


Figure4a: Reflection coefficients (Mag -top panel & phase- bottom panel) of the LNA and the calibration loads. Also shown for comparison is the S11 obtained from 2017 measurements

Reflection coefficients of the loads @25C

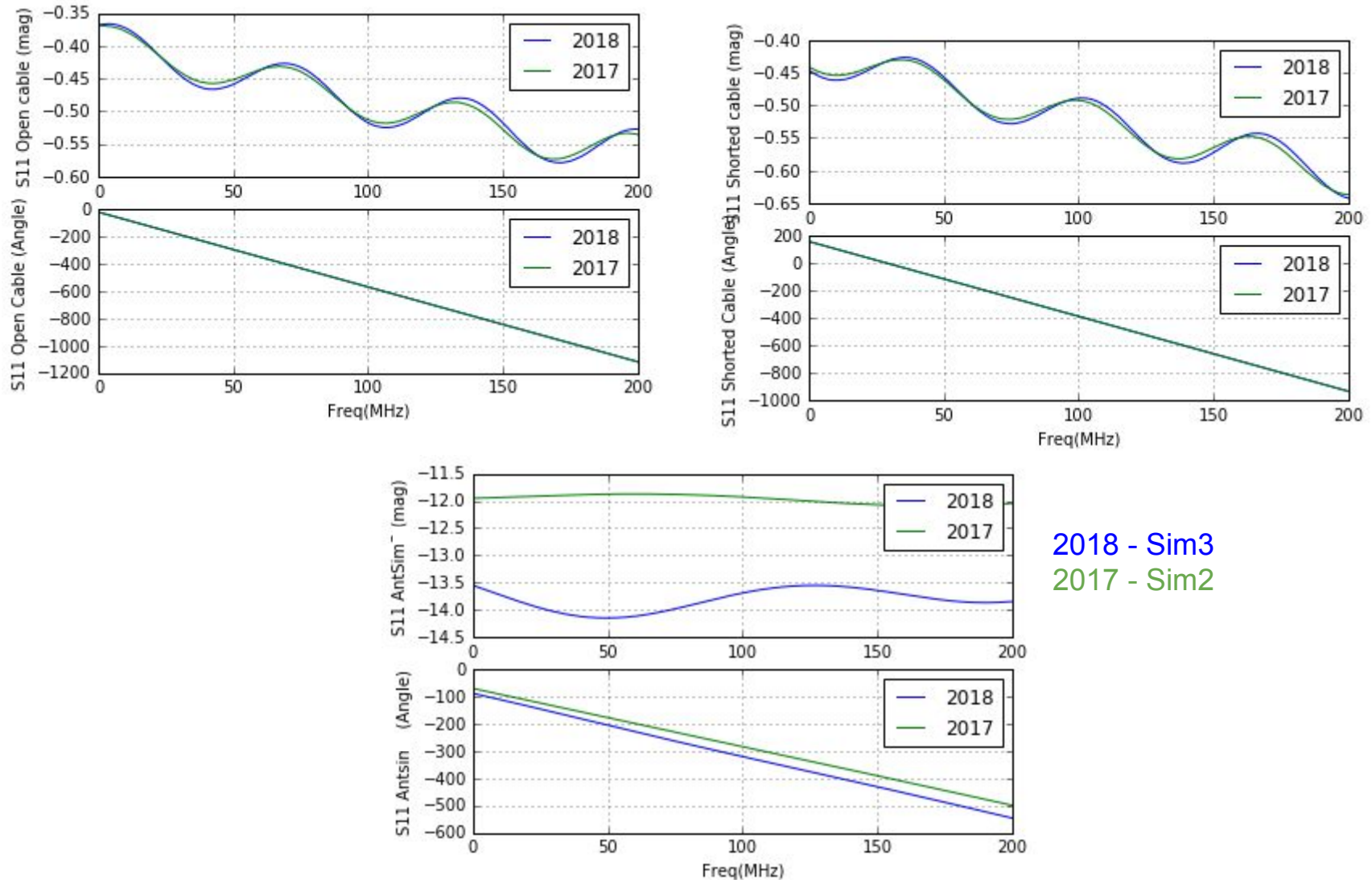


Figure4b: Reflection coefficients (Mag -top panel & phase- bottom panel) of the LNA and the calibration loads. Also shown for comparison is the S11 obtained from 2017 measurements

Cal coefficients derived from 25C; Freq: 50-190MHz

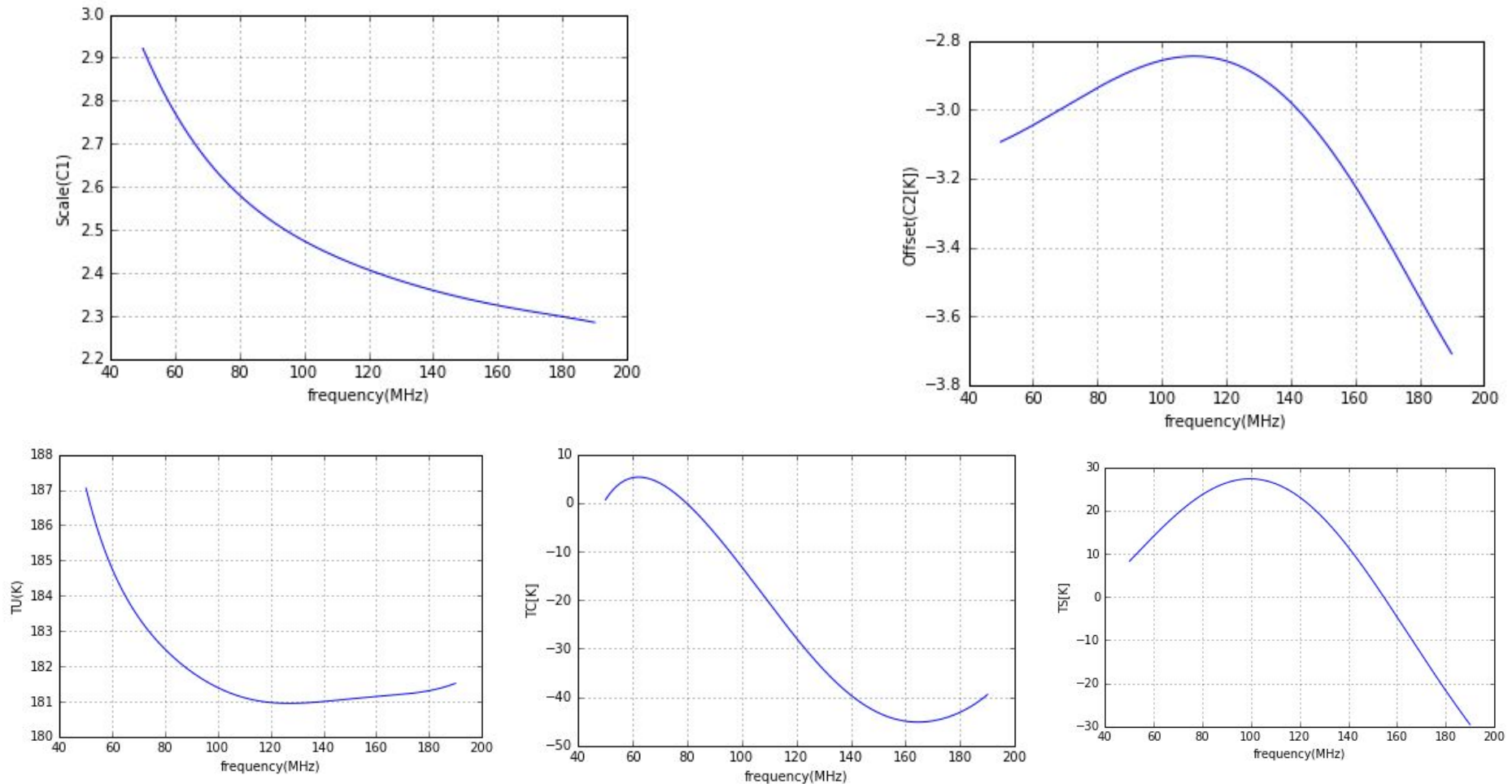


Figure5: Calibration parameters for the Low-Band 1 receiver. Over 50-190 MHz, we use 6 terms to model C1 & C2 and 8 terms to model Tu, Tc, Ts.

Cal coefficients derived from 25C; Freq: 50-100MHz

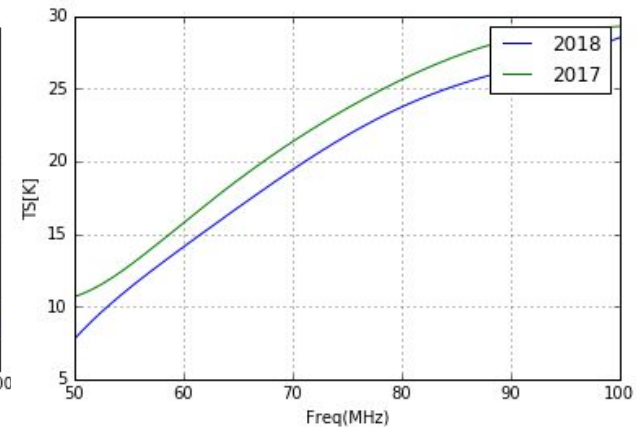
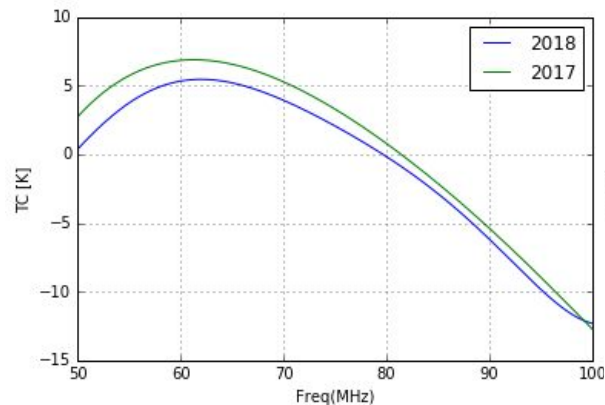
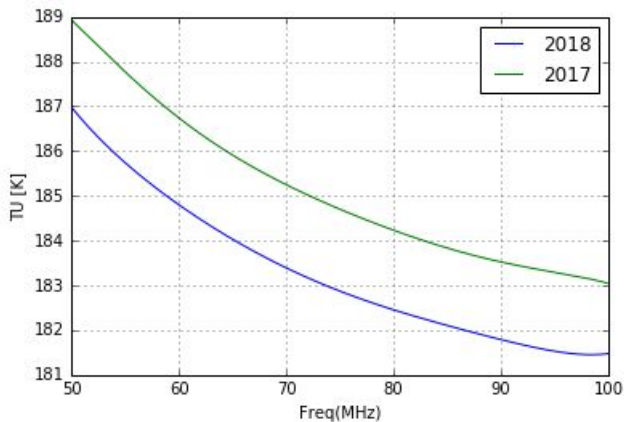
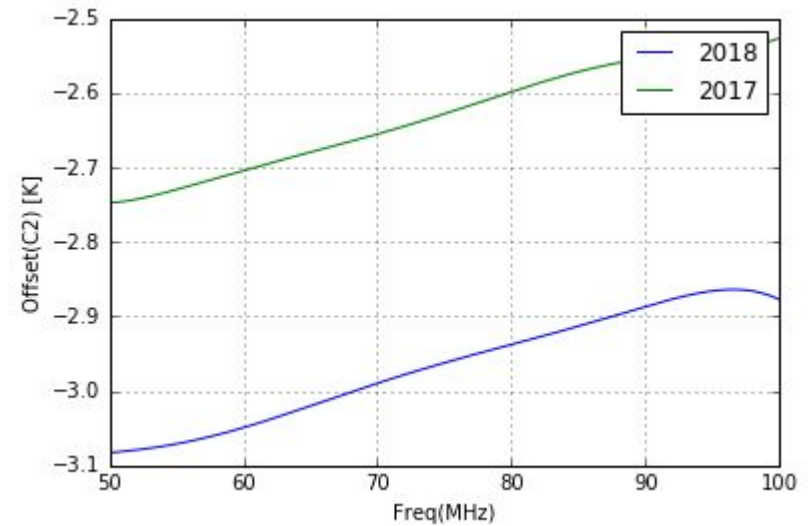
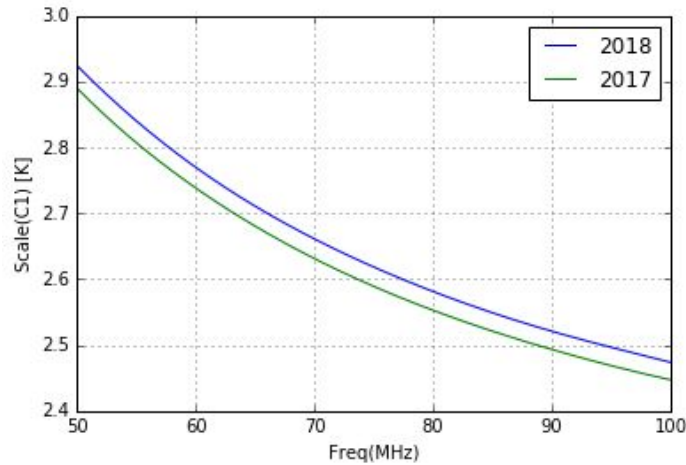


Figure5b: Calibration parameters for the Low-Band 2 receiver. Over 50-100 MHz, we use 7 terms to model all the calibration coefficients for both the 2017 & 2018 calibrations.

Cal coefficients derived from 15C; Freq: 50-100MHz

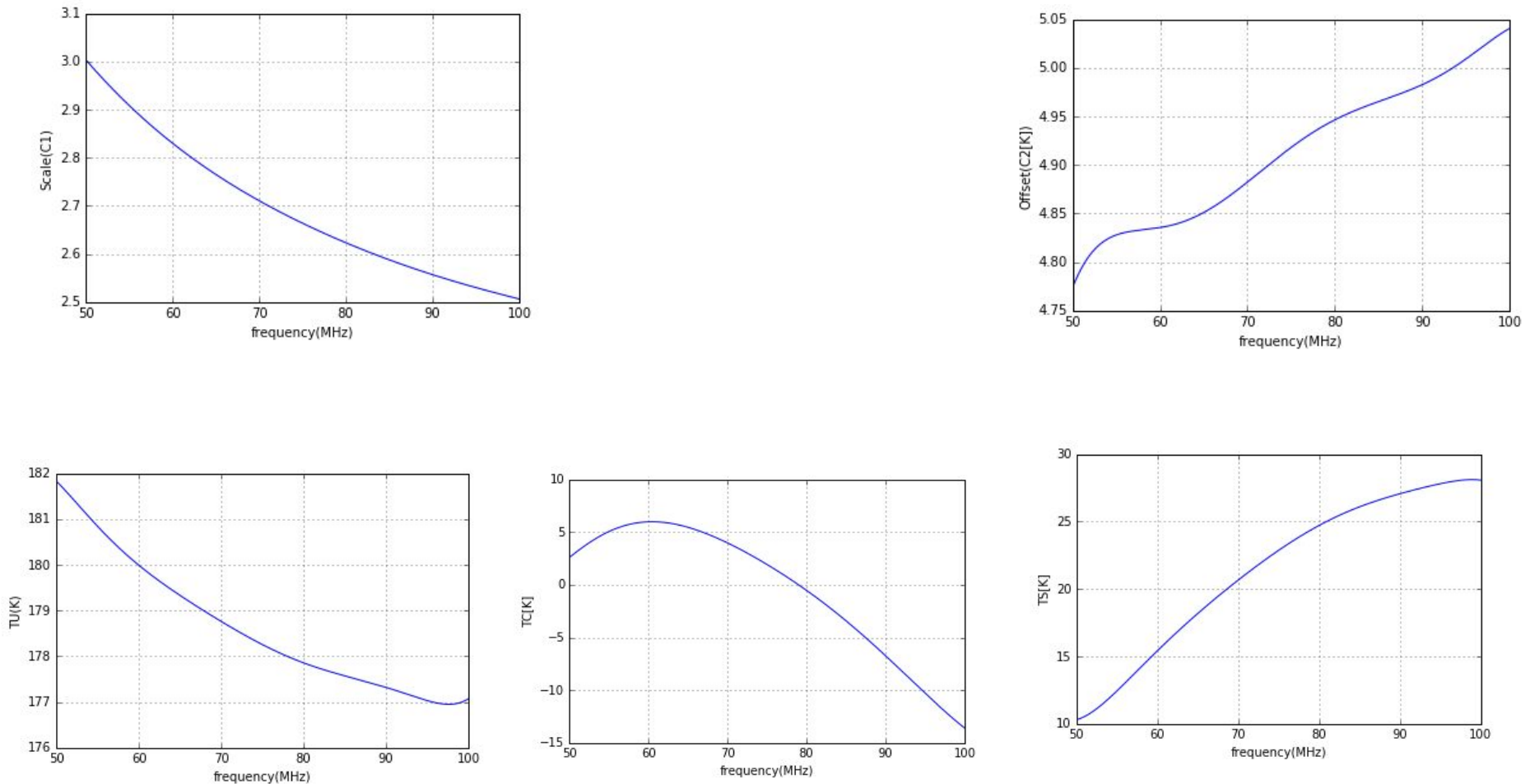


Figure6: Calibration parameters for the Low-Band 2 receiver. Over 50-100 MHz, we use 7 terms to model the constants and 8 terms to model the noise wave parameters.

Cal coefficients derived from 35C; Freq: 50-100MHz

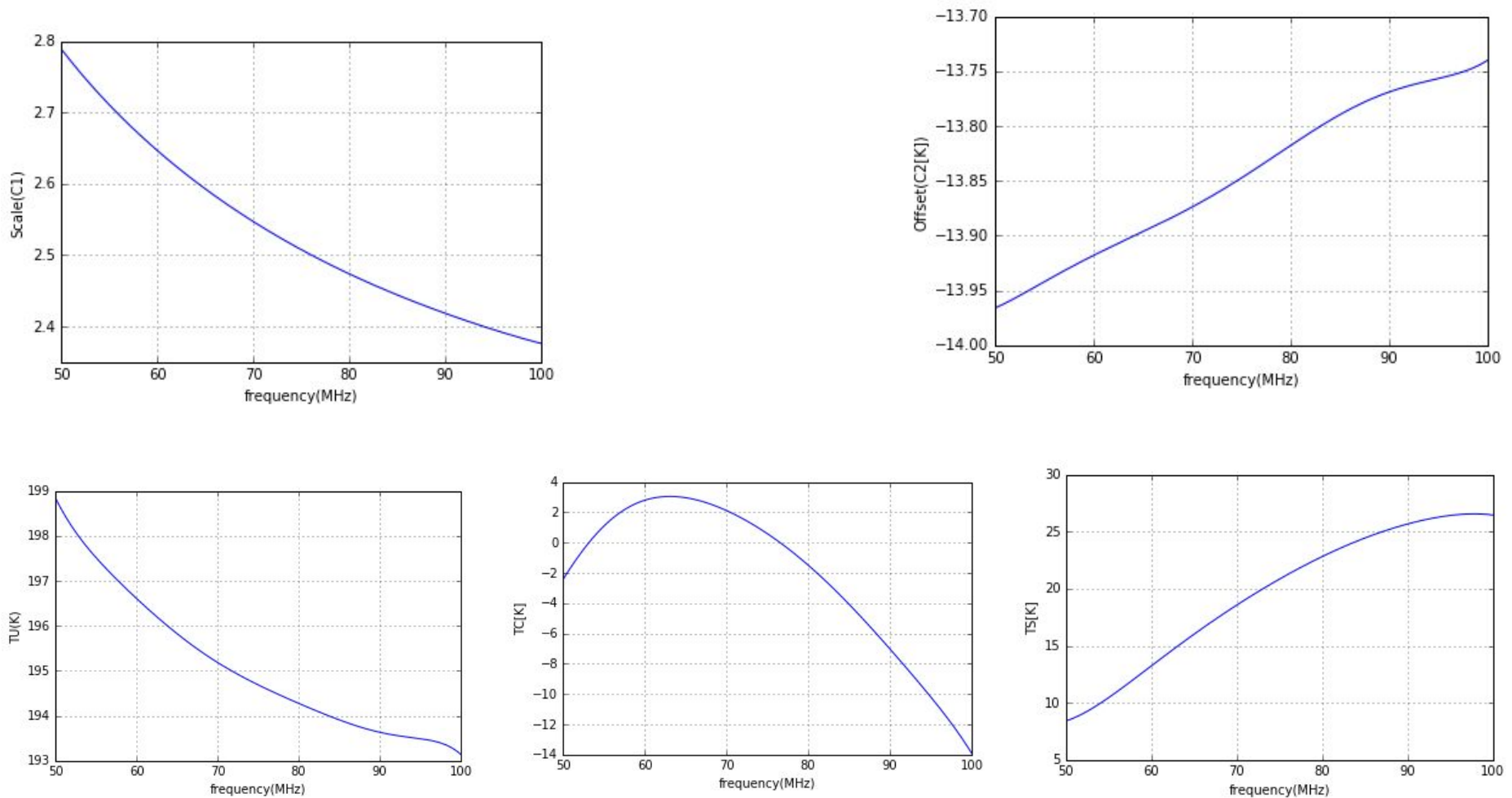


Figure7: Calibration parameters for the Low-Band 2 receiver. Over 50-100 MHz, we use 7 terms to model the constants and 8 terms to model the noise wave parameters.

Calibration Cross check for 25 C; Freq: 50-190 MHz

09/24/2018

Case1 - 6 terms for constants and 8 terms for noise wave parameters

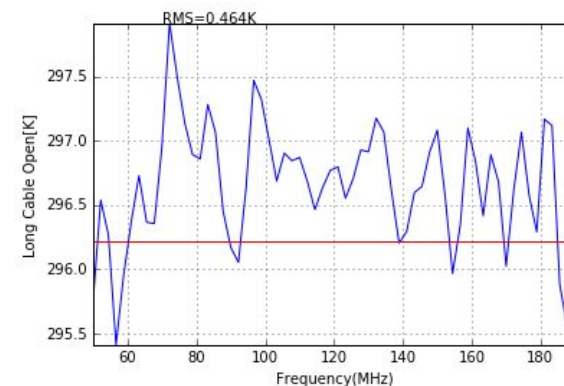
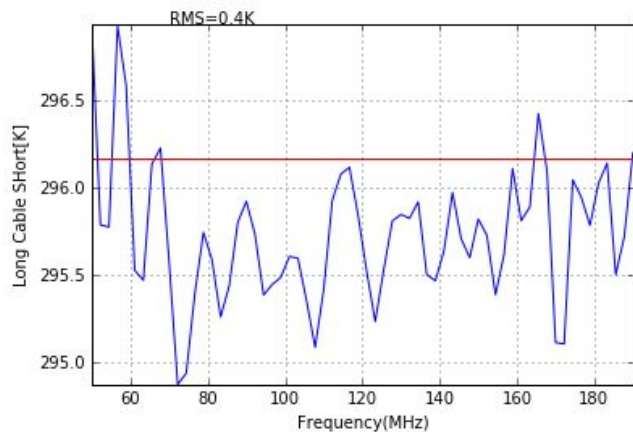
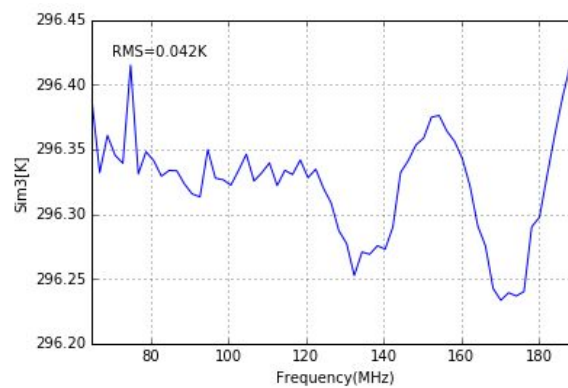
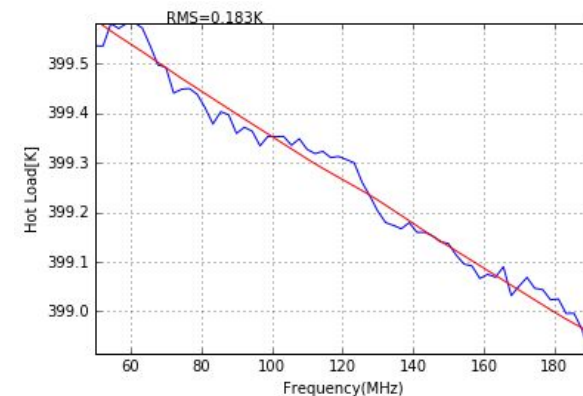
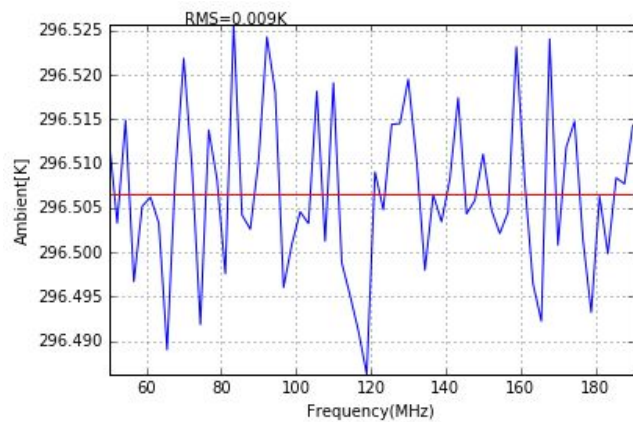
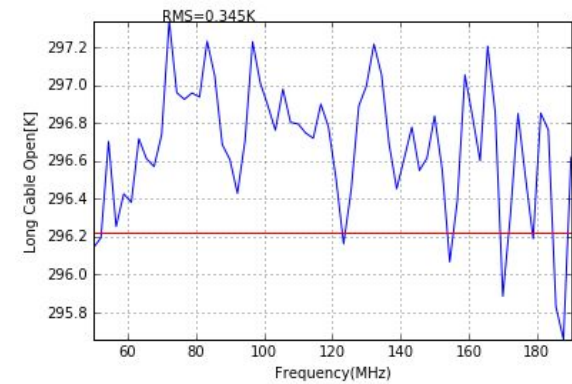
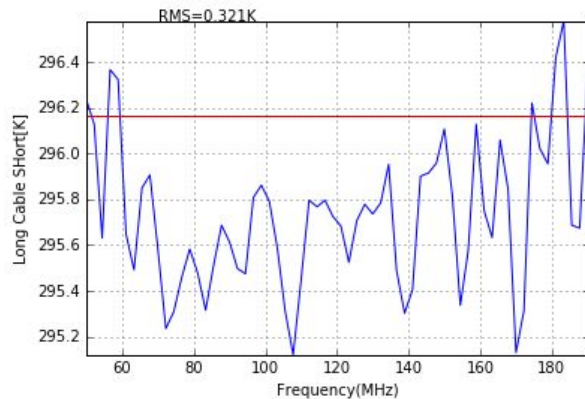
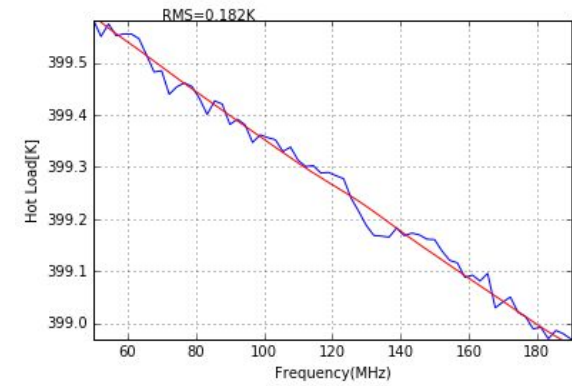
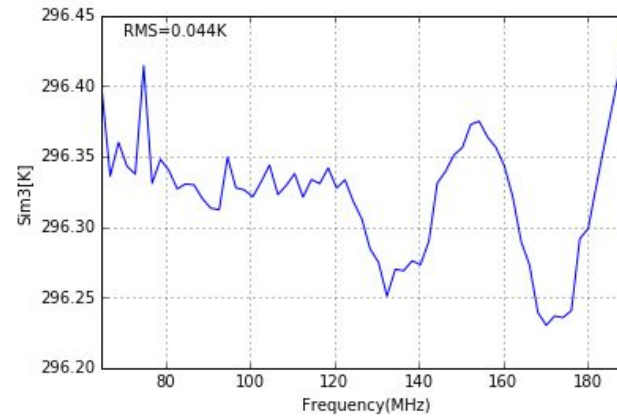
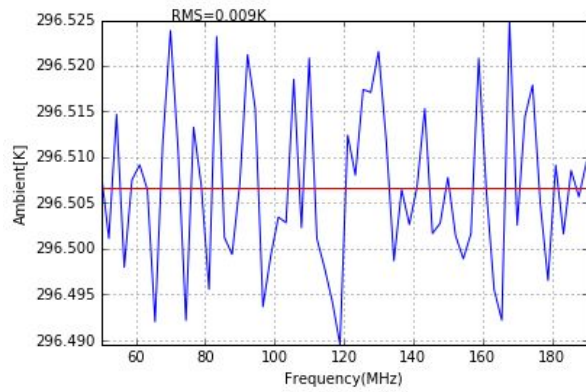


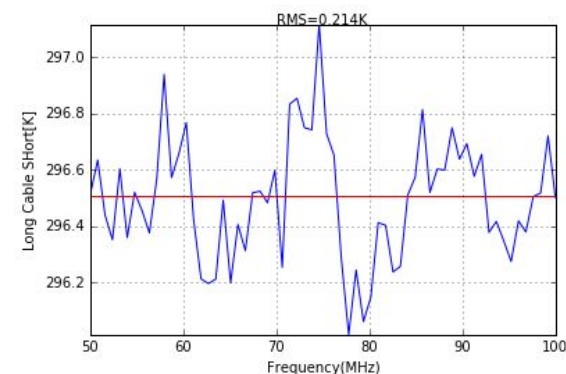
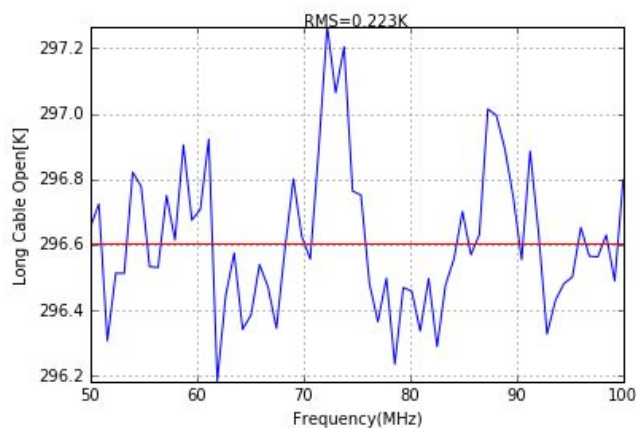
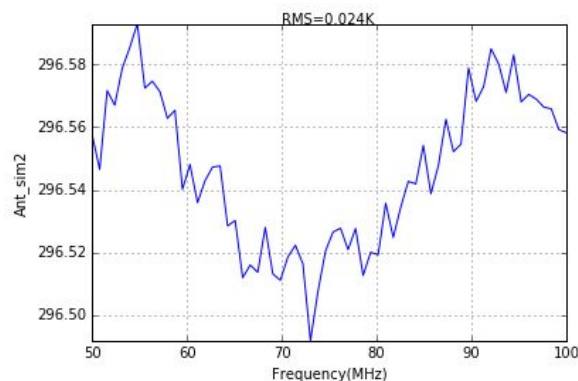
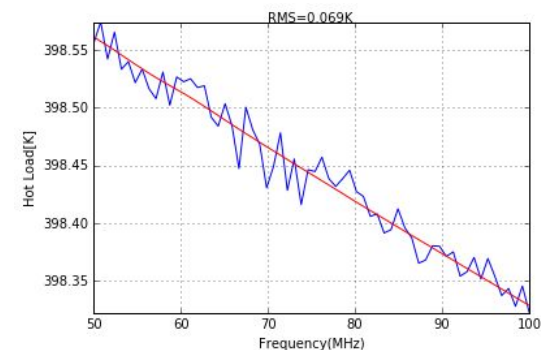
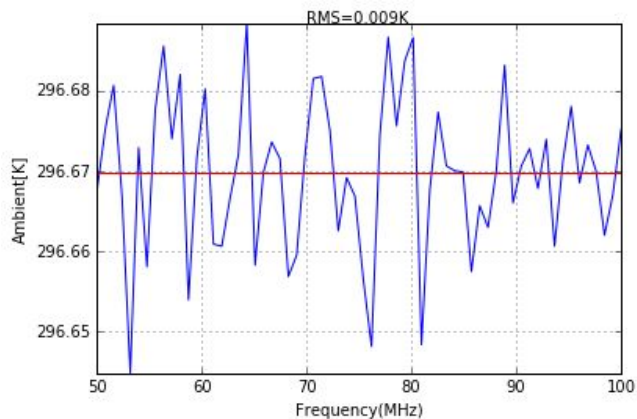
Figure8: Cross checks for calibration of Low-Band 2, 2018-09

Calibration Cross check for 25 C; Freq: 50-190 MHz

Case2 - 7 terms for constants and 9 terms for noise wave parameters

**Figure8b:** Cross checks for calibration of Low-Band 2, 2018-09

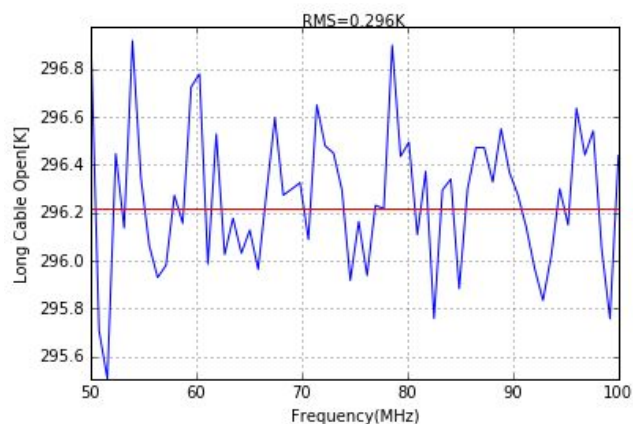
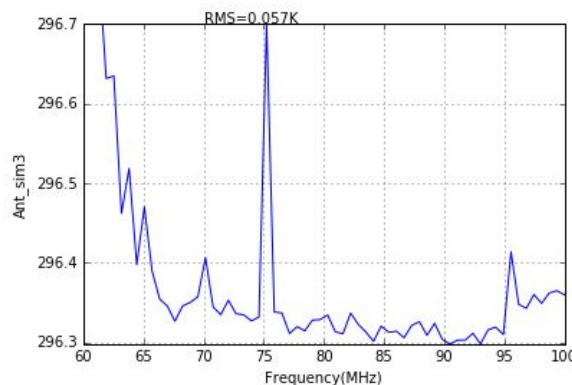
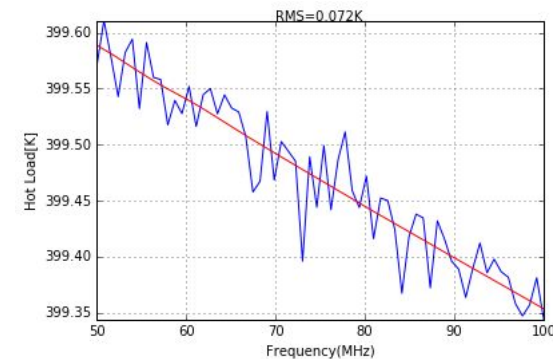
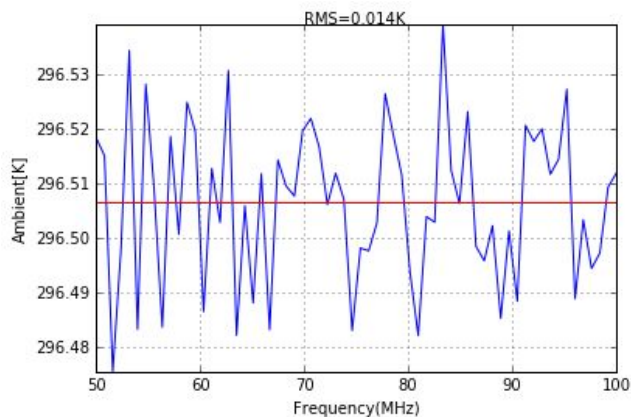
Case1 - 7 terms for constants and 7 terms for noise wave parameters



The rms of the residues obtained with Sim2 connected to Rcv2 (march 2017) is 24mK. This agrees with results in Memo 92.

Figure8c: Cross checks for calibration of Low-Band 2, 2017-03

Case1 - 7 terms for constants and 7 terms for noise wave parameters



The residues from all the calibration loads are similar to values obtained in March 2017 calibration (compare previous slide). The RMS obtained with Antsim3 is higher than what was seen with Sim2

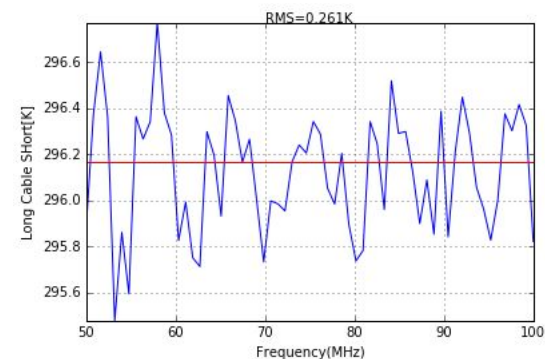
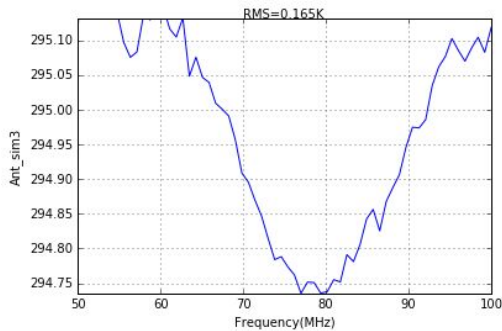
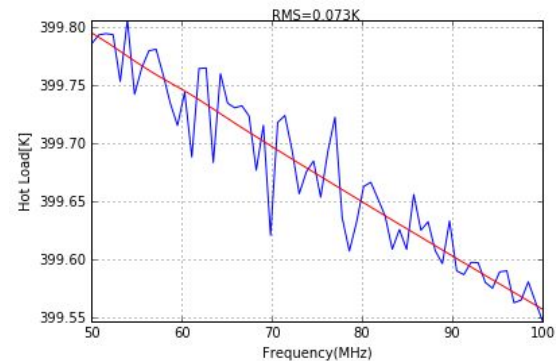
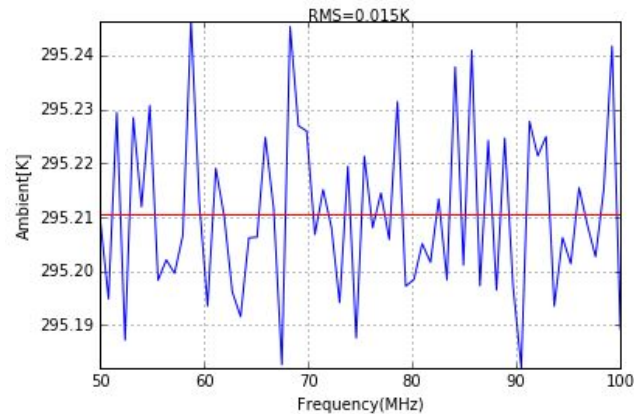


Figure8d: Cross checks for calibration of Low-Band 2, 2018-09

Case1 - 7 terms for constants and 8 terms for noise wave parameters



The RMS obtained with Antsim3 is higher than what was seen at 25C

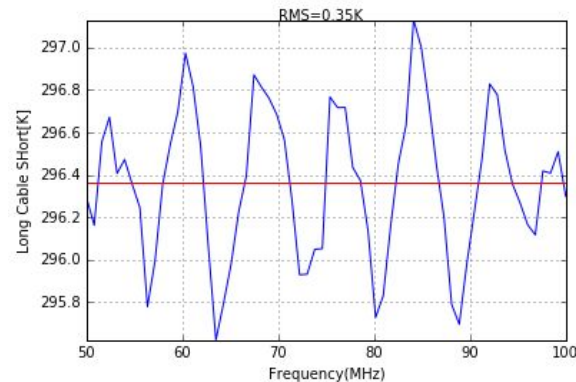
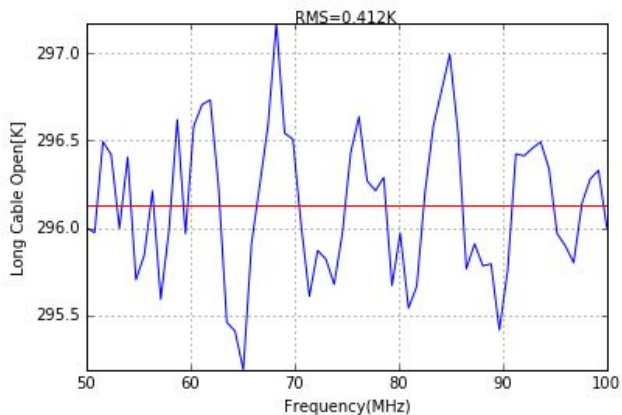
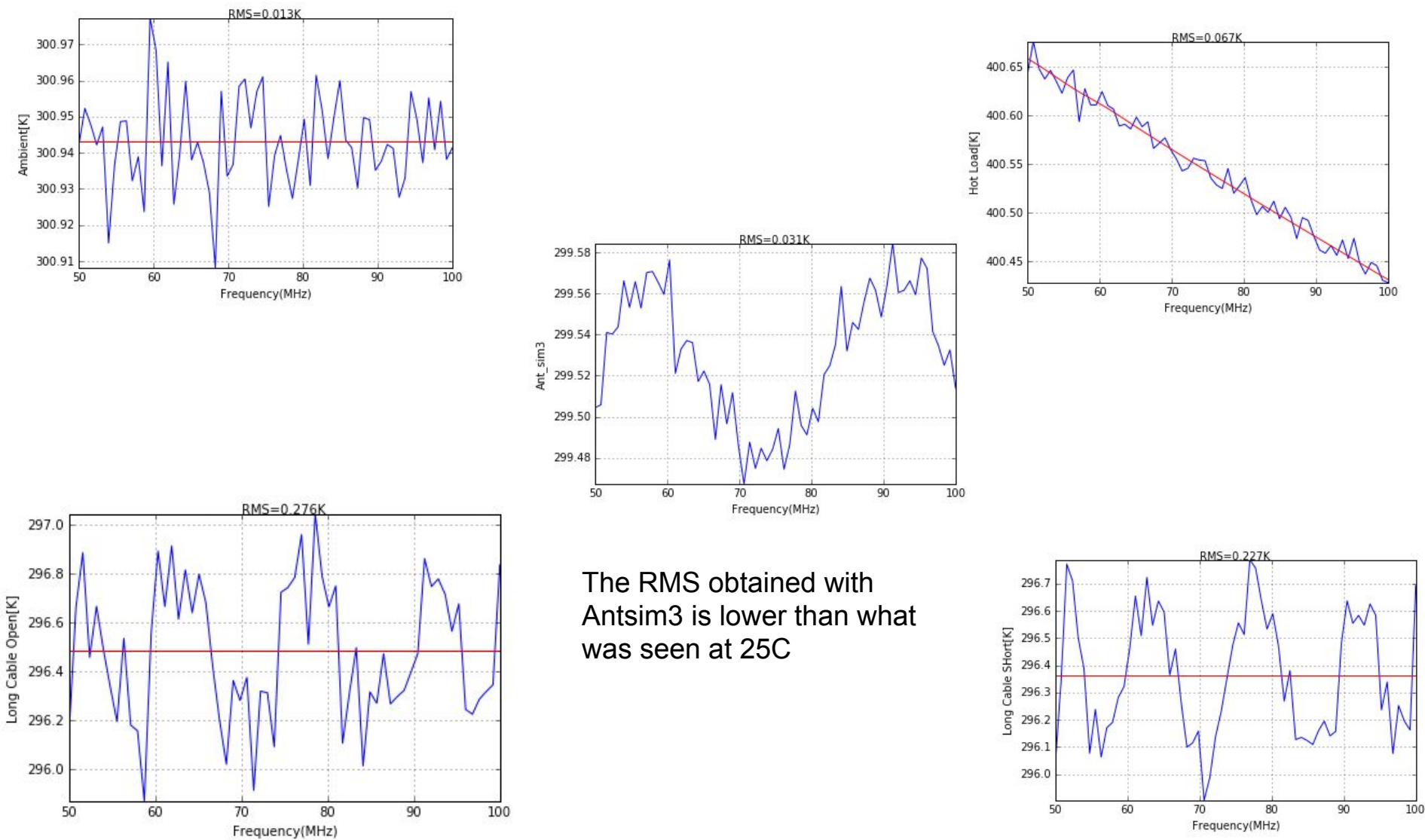


Figure9: Cross checks for calibration of Low-Band 2, 2018-09

Case1 - 7 terms for constants and 8 terms for noise wave parameters



The RMS obtained with Antsim3 is lower than what was seen at 25C

Figure10: Cross checks for calibration of Low-Band 2, 2018-09