Calibration of Lowband Receiver 03

Leroy Johnson, Nivedita Mahesh

Introduction

- Here we show the calibration results for the Low Band 3 receiver at 25◦C done in August 2018
- The calibration coefficients obtained from these measurements do not reduce the RMS on the Antsim2 Spectra
- Hence the measurements from November 2017 is looked at
- The RMS on the Antsim2 after applying the coefficients calculated from 2017 measurements, is found to be a reasonable value of 75mK in the 50-100MHz range
- Thus the spectra and S11 of the individual loads from both the measurements are overplotted to see if any obvious discrepancy can be spotted.

- The calibration coefficients is initially estimated for the limited frequency range of 50 -100 MHz.
- As a precaution, in order to avoid periods of instability of the calibrators, we remove ~ 10% of the data at the beginning of each period covered by the listed spectra files.

Files used:

/data5/edges/data/Receiver03_2018_08_23_040_to_200/*temp*C

Corrected s11:

/data5/edges/data/Receiver01_2018_08_23_040_to_200/*temp*C/S11/corrected

Standards used:

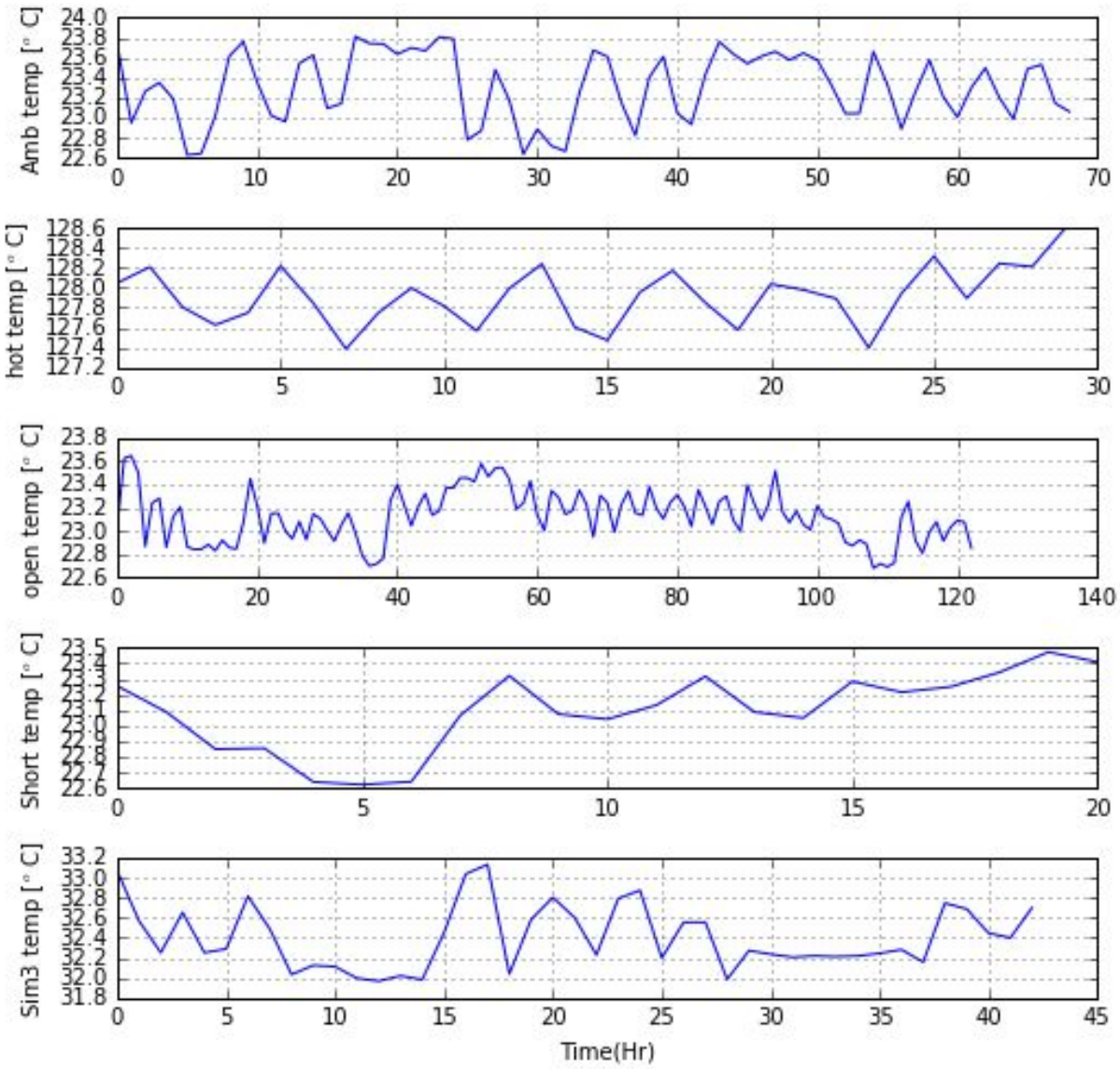
Male standard - Maury - 50.177 ohm (25 degC)

Female Standard - Phil's kit - 49.99 ohm (25 degC)

2018_08

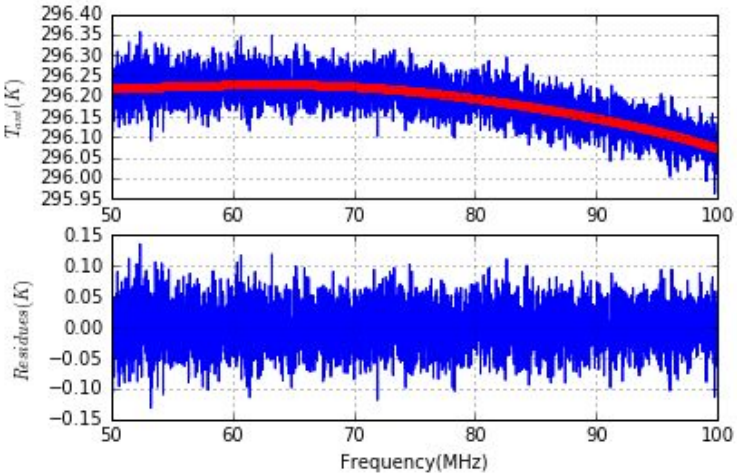
Temperature - 25 C

Temperature of calibration loads @ 25C

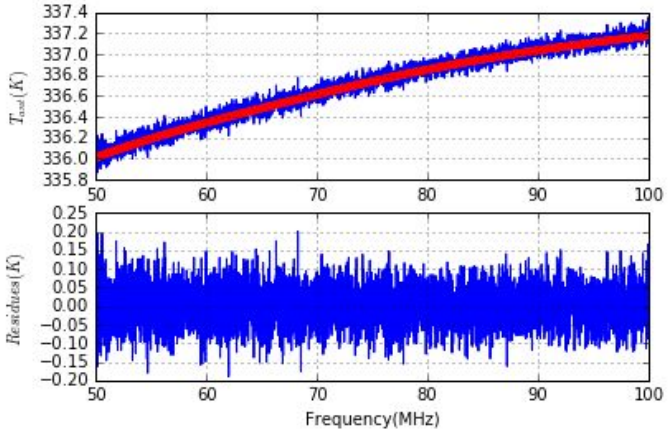


Spectra data @ 25C for the loads

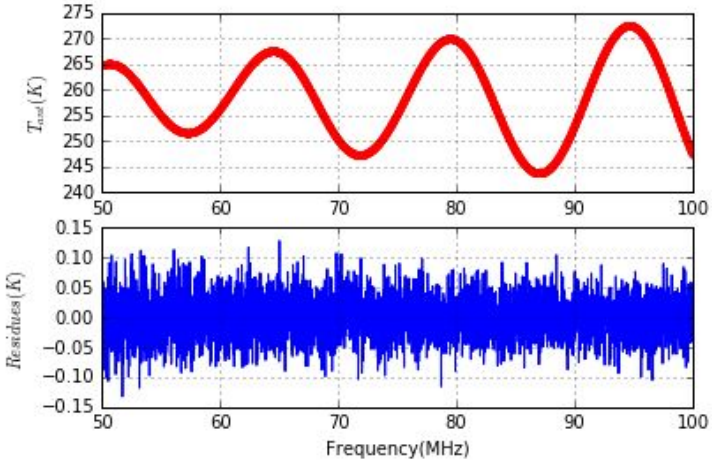
Ambient Load



Hot Load



Long Cable Open



Long Cable Short

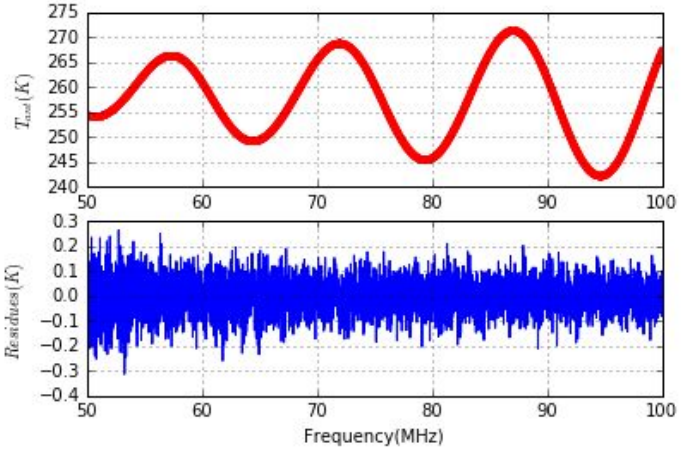


Figure1: Raw spectra of the calibration loads. Top panel- blue is the data & red is the fit. Bottom panel shows the residues of the fit to the data.

Spectra data @ 25C for the loads

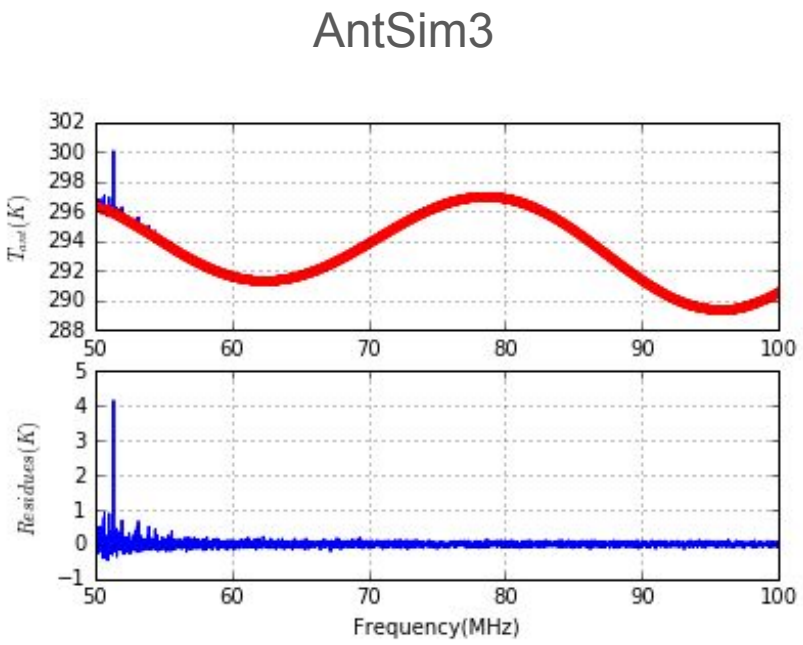
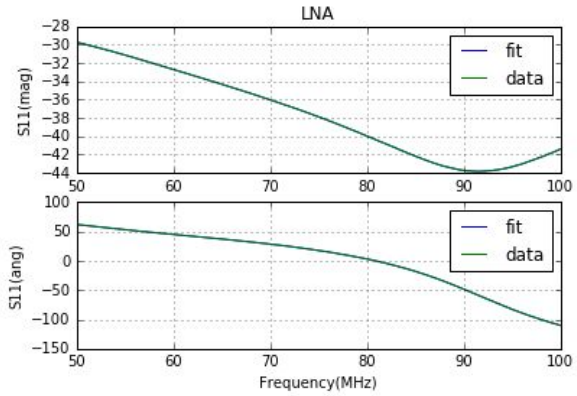
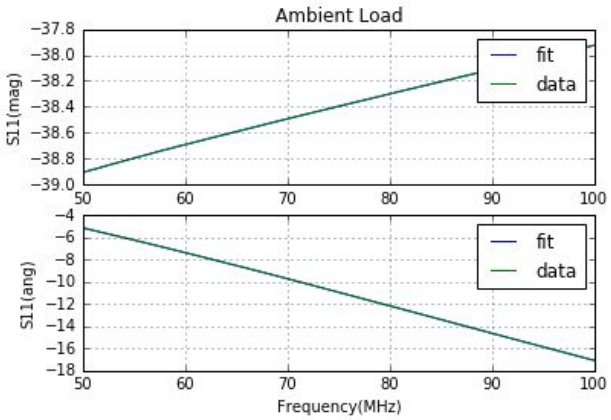
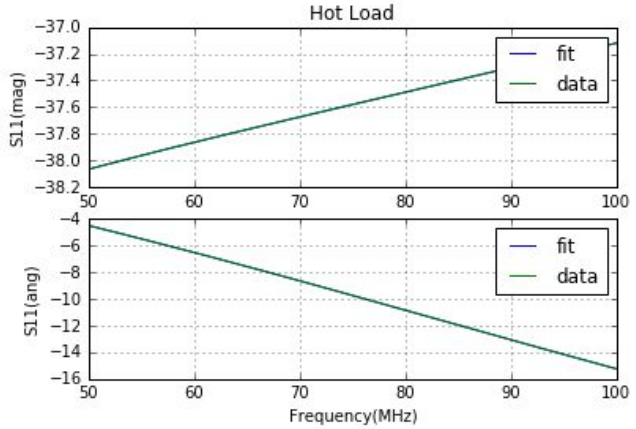


Figure1b: Raw spectra of the calibration loads. Top panel- blue is the data & red is the fit. Bottom panel shows the residues of the fit to the data.

Reflection coefficients of the loads @25C [50 -100 MHz]

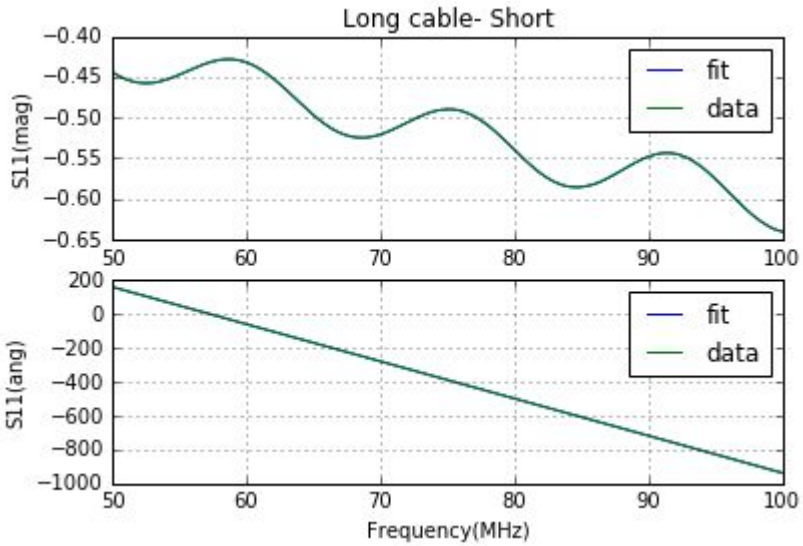


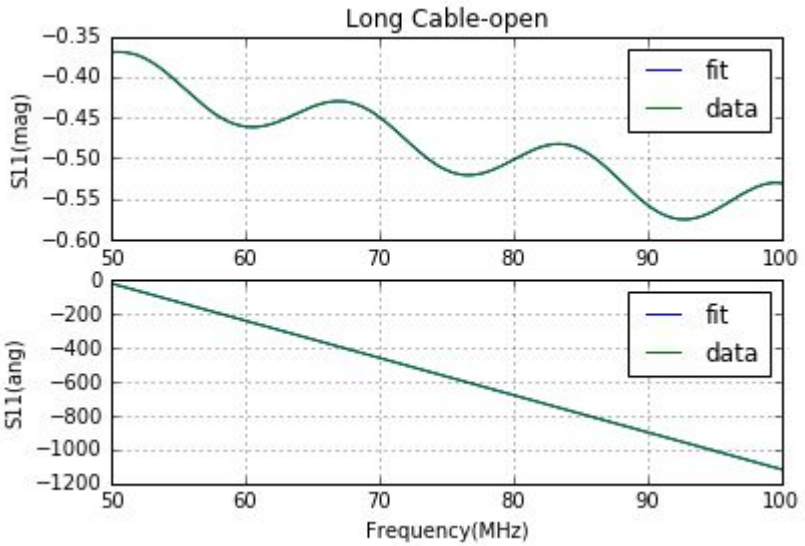




LNA S11 was modelled with a polynomial fit using 37 terms. The four loads were modelled using fourier series with 37 terms.

Reflection coefficients of the loads @25C





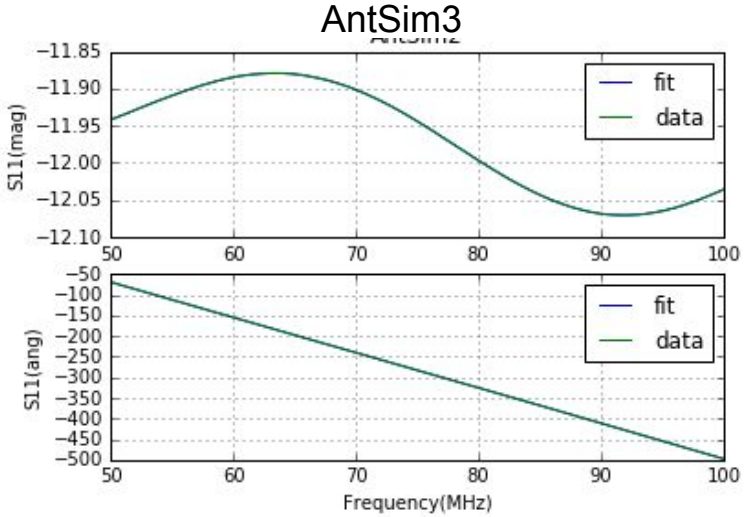
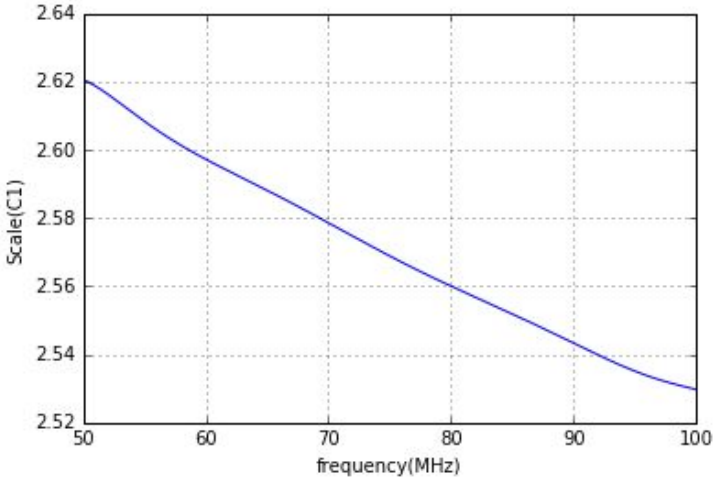
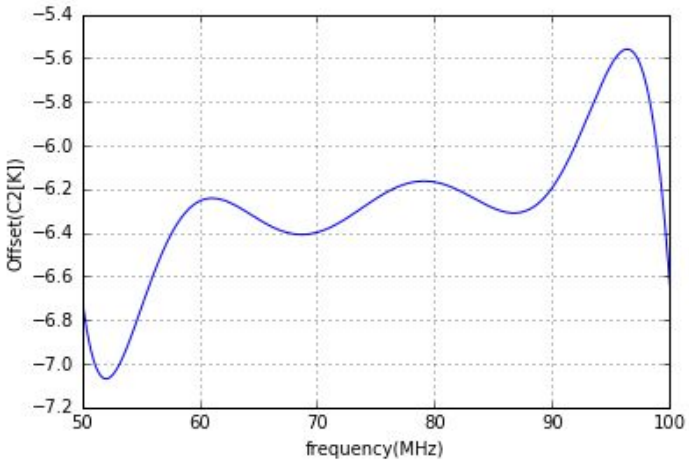
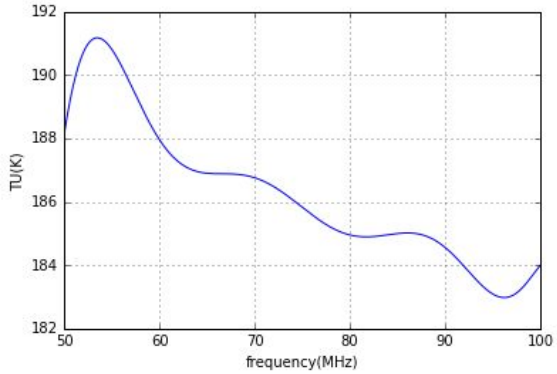


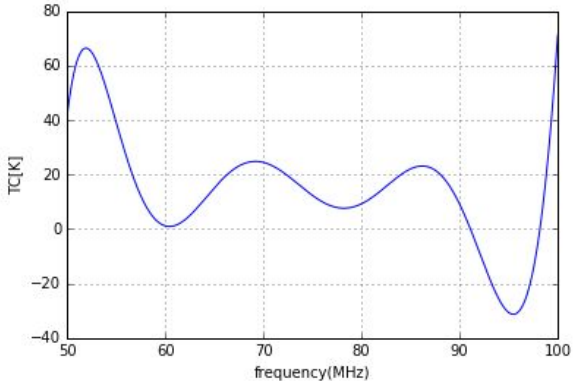
Figure3b: Reflection coefficients (Mag -top panel & phase- bottom panel) of the LNA and the calibration loads.

Cal coefficients derived from 25C









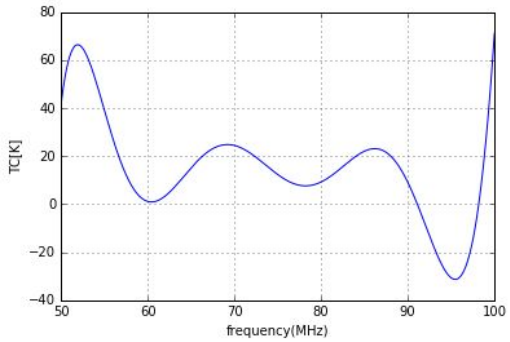
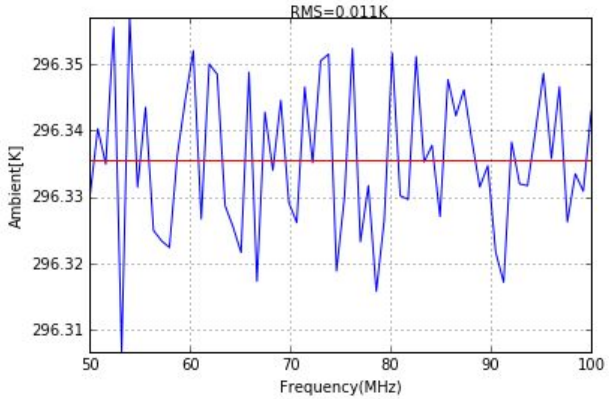
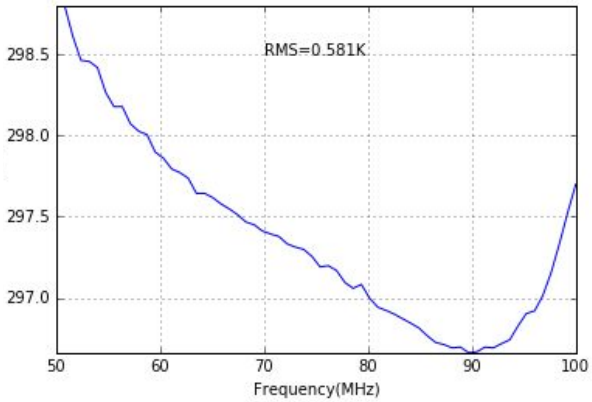


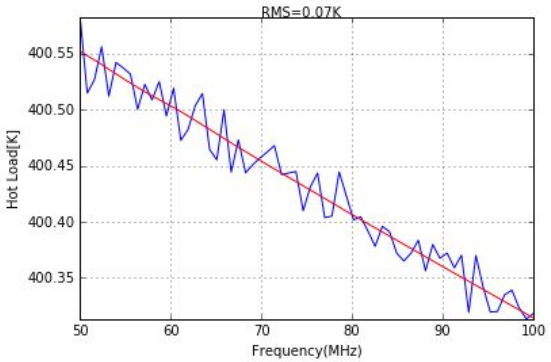
Figure4: Calibration parameters for the Low-Band3 receiver. Over 50-100 MHz, we use 9 terms to model C1 & C2 and 10 terms to model Tu,Tc,Ts.

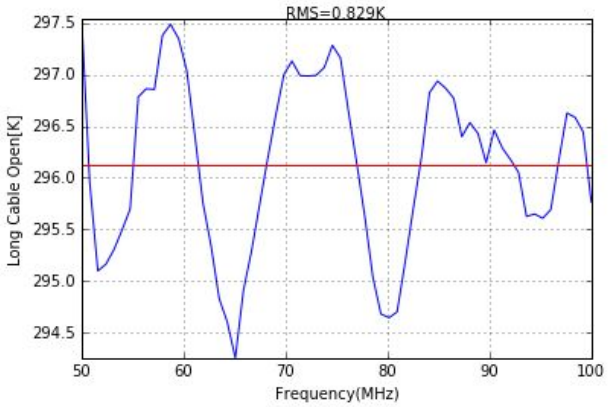
Calibration Cross check for 25 C (Trial 1)



Sim3







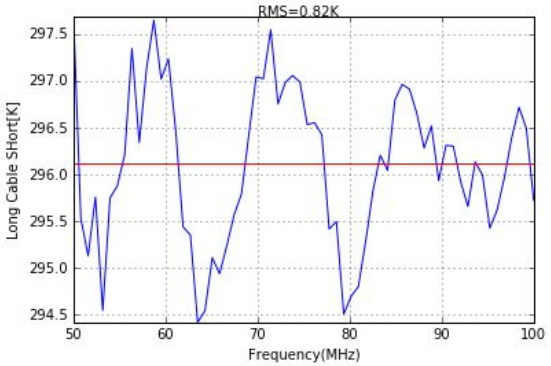
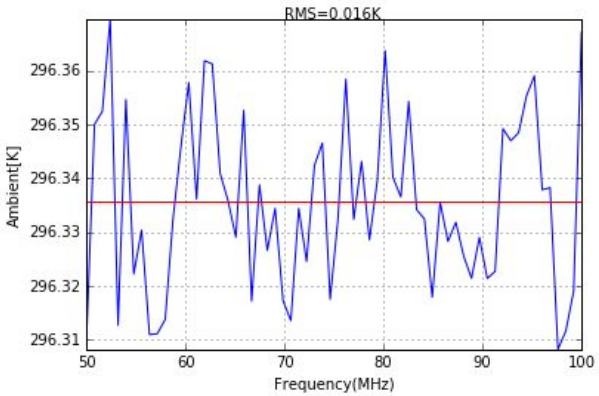
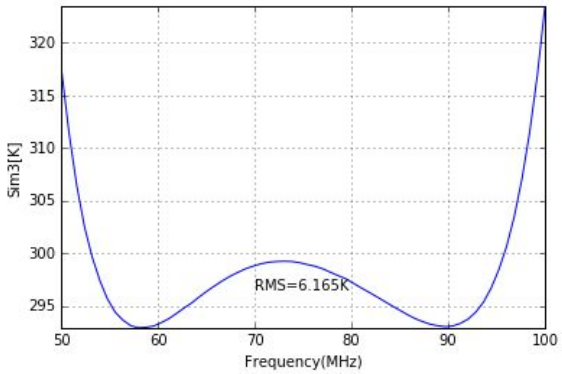
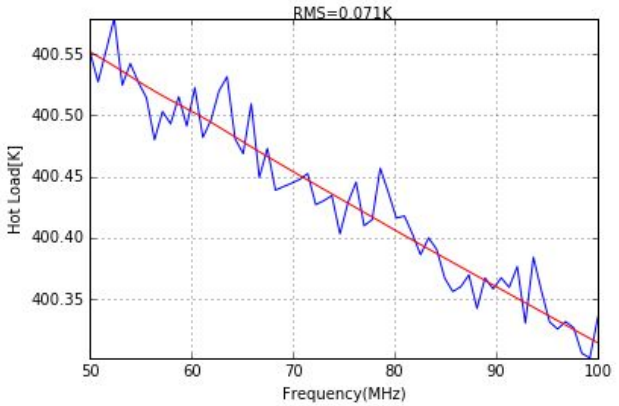


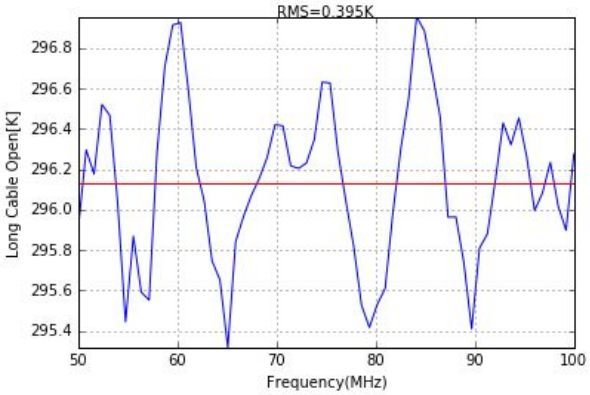
Figure6: Cross checks for calibration of Low-Band3, 2018-05. 8 (C1,C2)& 8(Tu,Tc,Ts) terms

Calibration Cross check for 25 C (Trial 2)









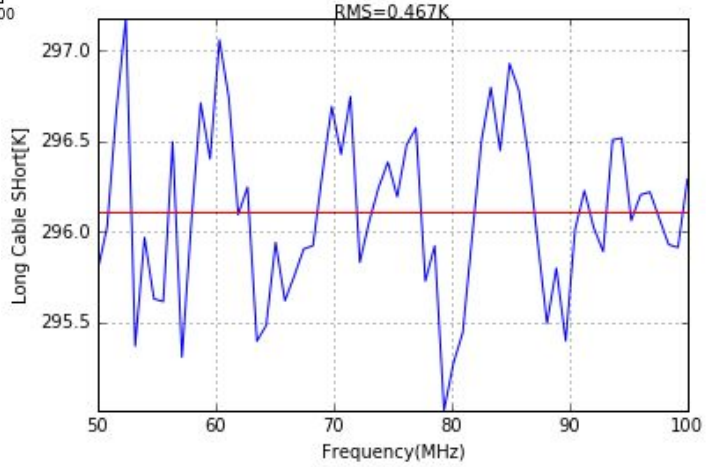


Figure6b: Cross checks for calibration of Low-Band3, 2018-05. 9(C1,C2) & 10 (Tu,Tc,Ts) terms

Cross verifying with the Measurements from October 2017

Files used:

/data5/edges/data/Lowband3_october_2017_recalibration/*temp*C

Corrected s11:

/data5/edges/data/Lowband3_october_2017_recalibration/*temp*C/S11/corrected

Standards used:

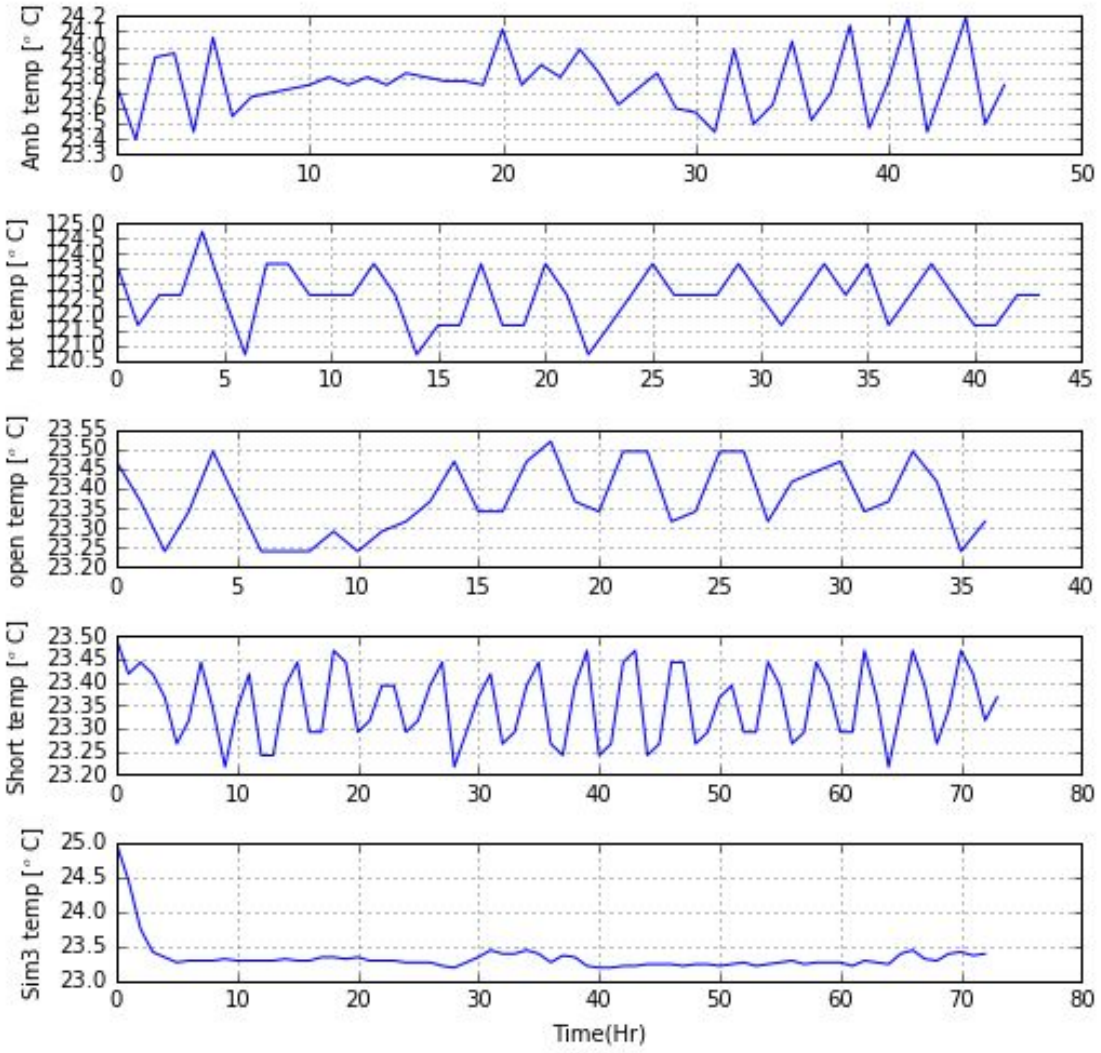
Male standard - Phil's kit - 50.027 ohm (25 degC)

Female Standard - Keysight- 50.009 ohm (25 degC)

2017_10

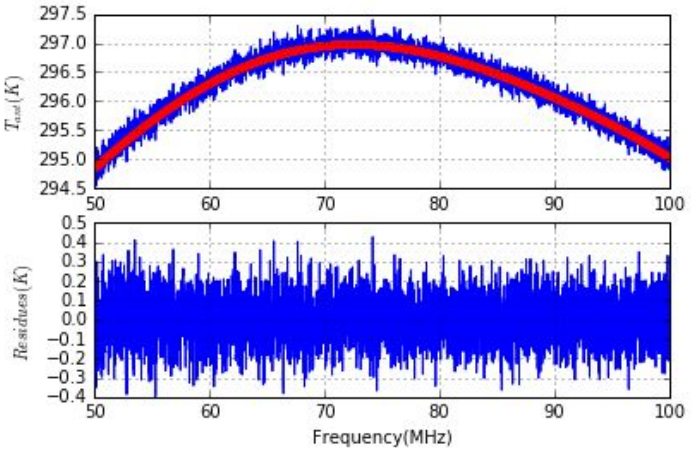
Temperature - 25 C

Temperature of calibration loads @ 25C

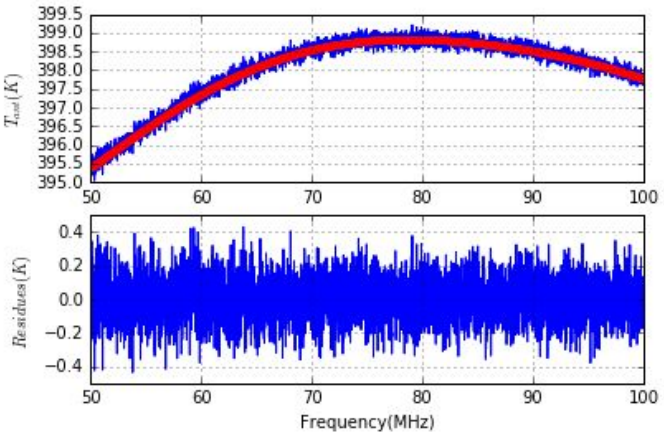


Spectra data @ 25C for the loads

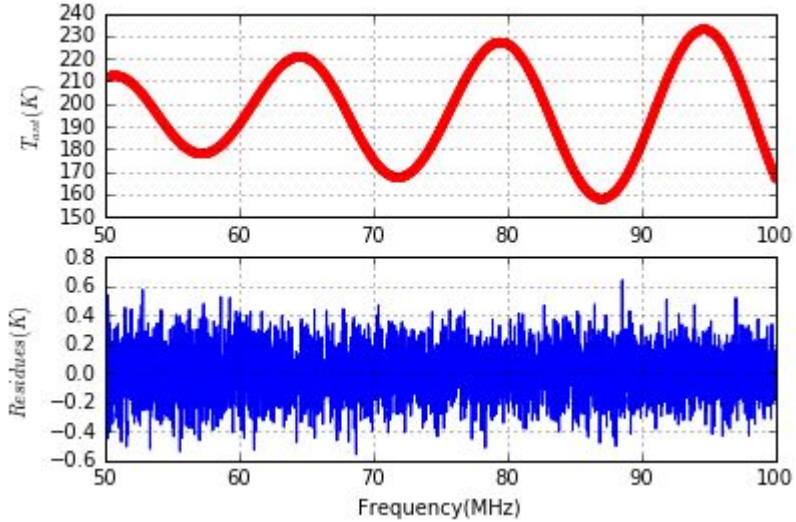
Ambient Load



Hot Load



Long Cable Open



Long Cable Short

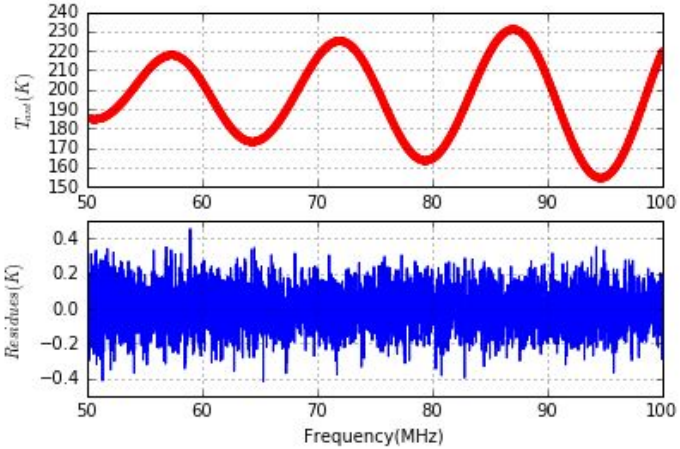


Figure1: Raw spectra of the calibration loads. Top panel- blue is the data & red is the fit. Bottom panel shows the residues of the fit to the data.

Spectra data @ 25C for the loads

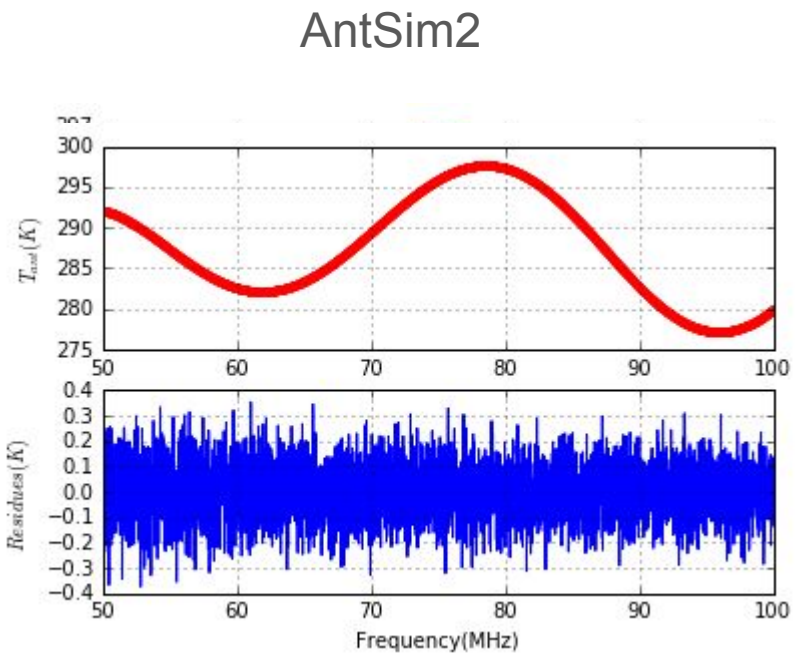
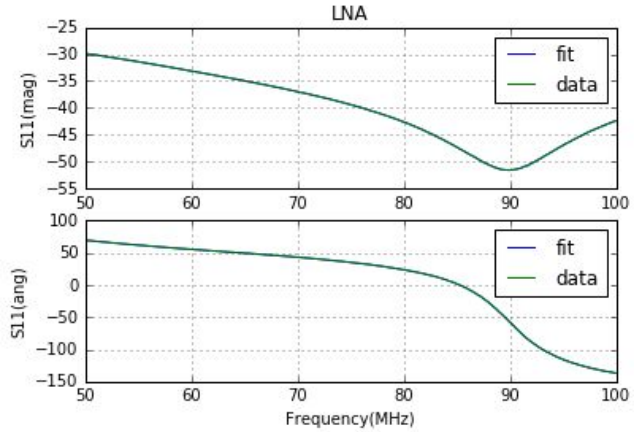
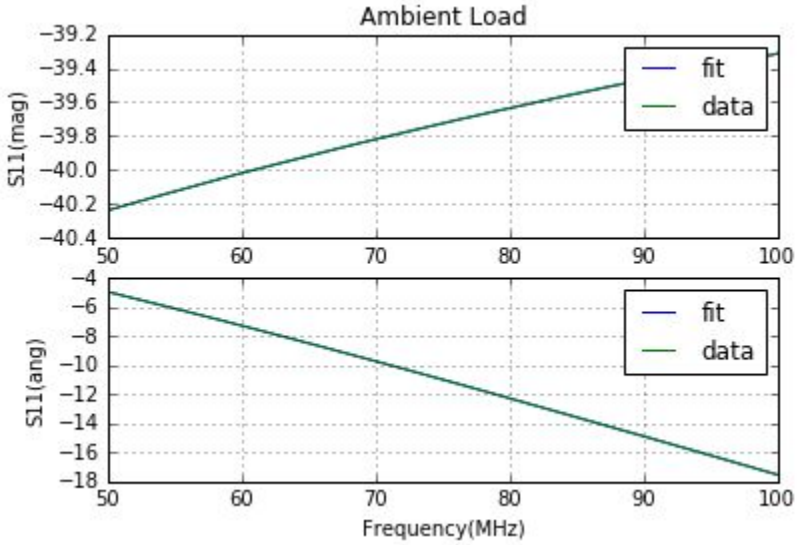
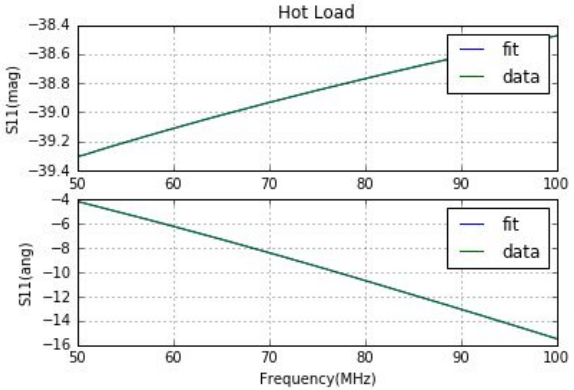


Figure1b: Raw spectra of the calibration loads. Top panel- blue is the data & red is the fit. Bottom panel shows the residues of the fit to the data.

Reflection coefficients of the loads @25C [50 -100 MHz]

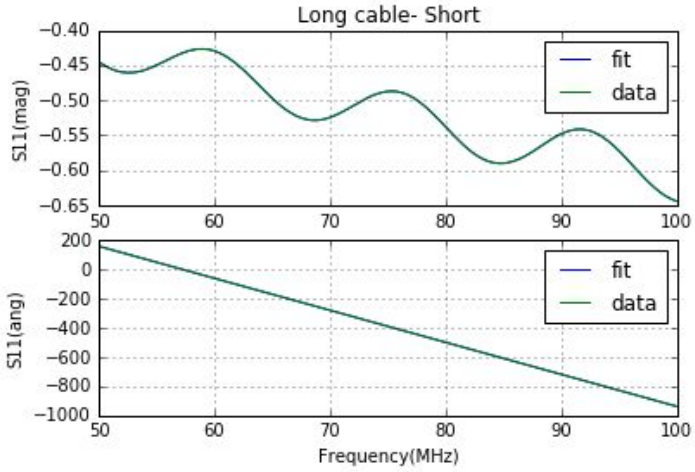


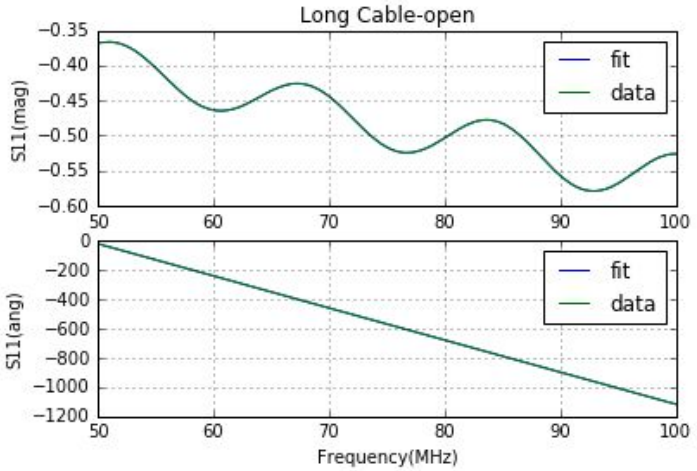




LNA S11 was modelled with a polynomial fit using 37 terms. The four loads were modelled using fourier series with 37 terms.

Reflection coefficients of the loads @25C





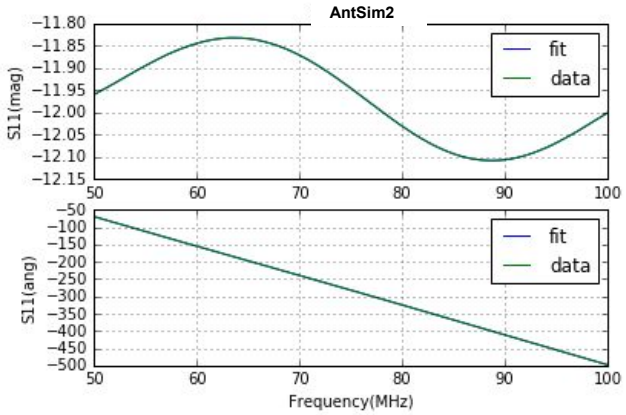
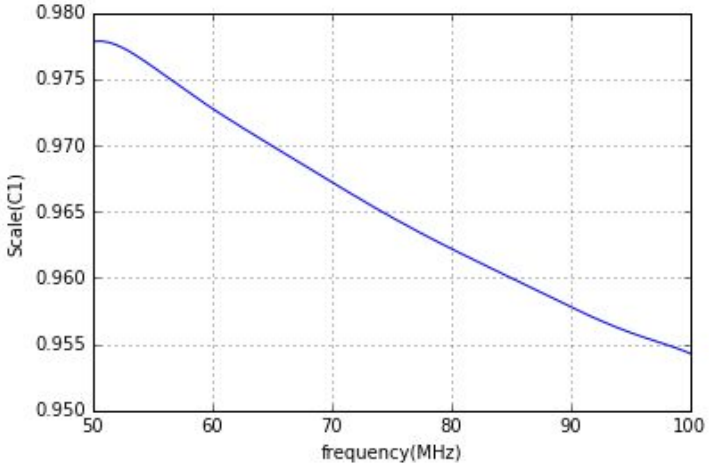
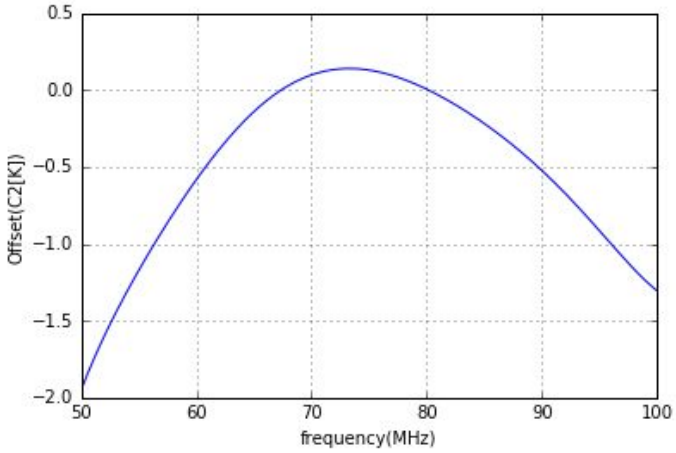
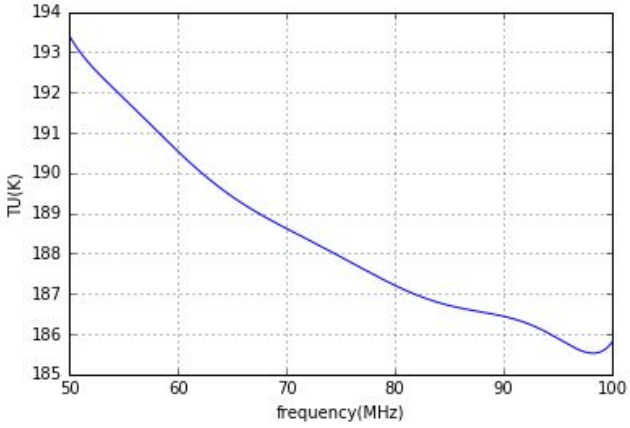


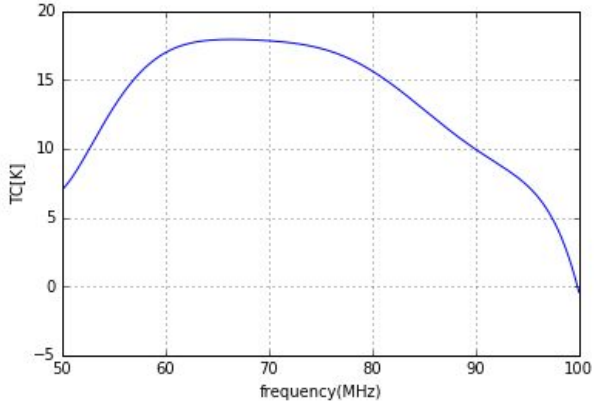
Figure3b: Reflection coefficients (Mag -top panel & phase- bottom panel) of the LNA and the calibration loads.

Cal coefficients derived from 25C









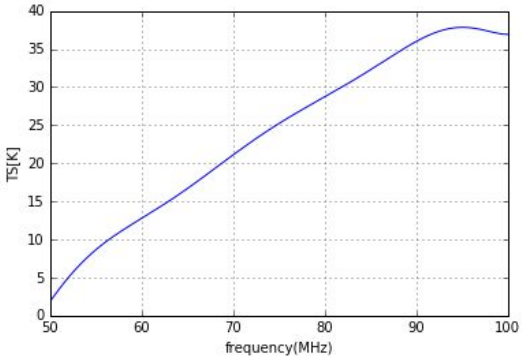
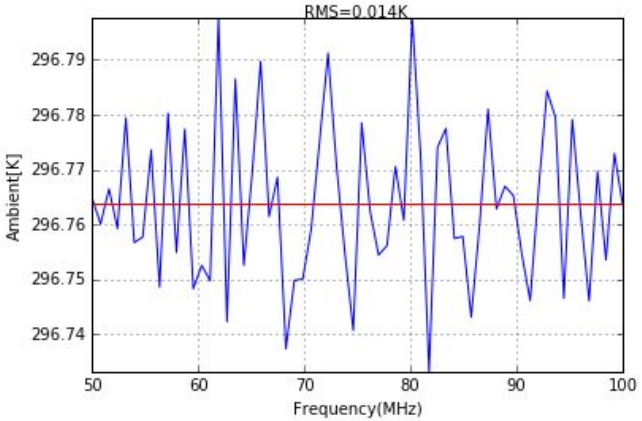
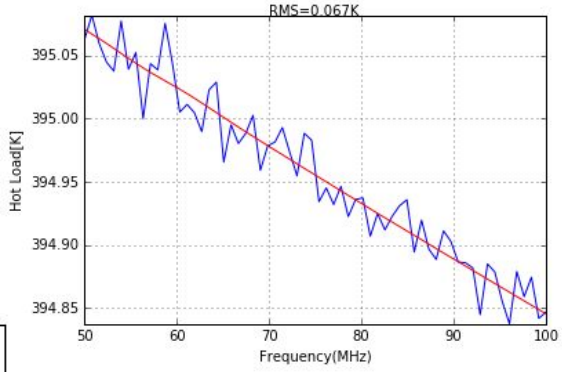
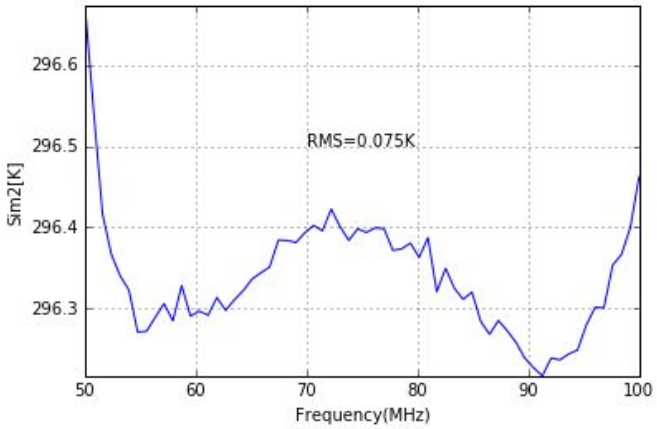


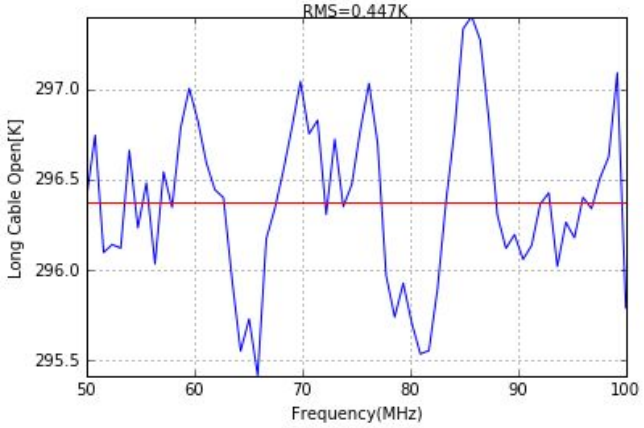
Figure4: Calibration parameters for the Low-Band3 receiver. Over 50-100 MHz, we use 9 terms to model C1 & C2 and 9 terms to model Tu,Tc,Ts.

Calibration Cross check for 25 C (Trial 1)









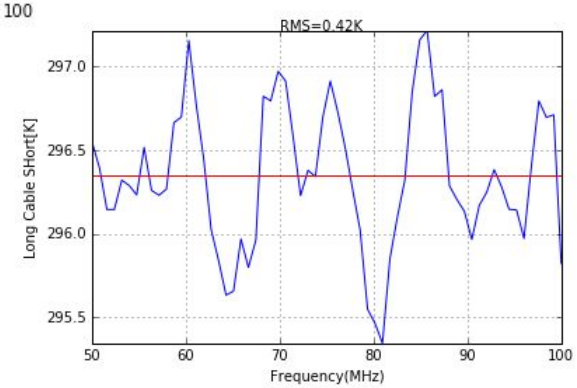
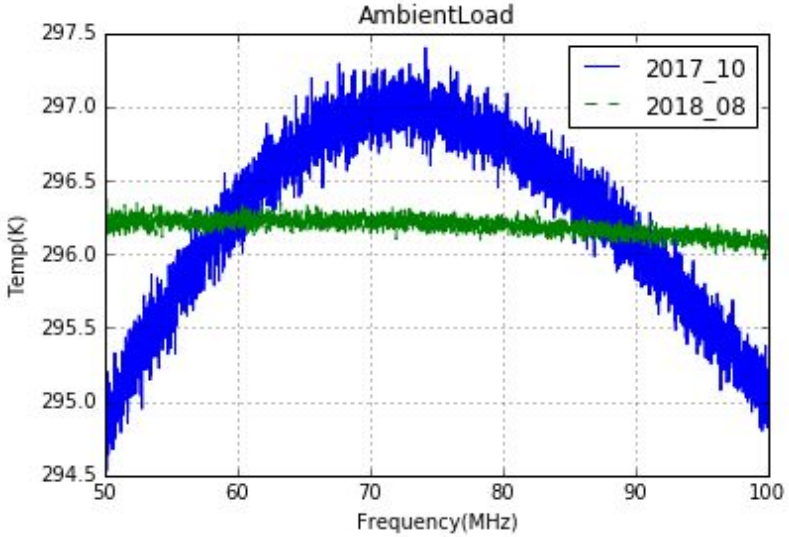
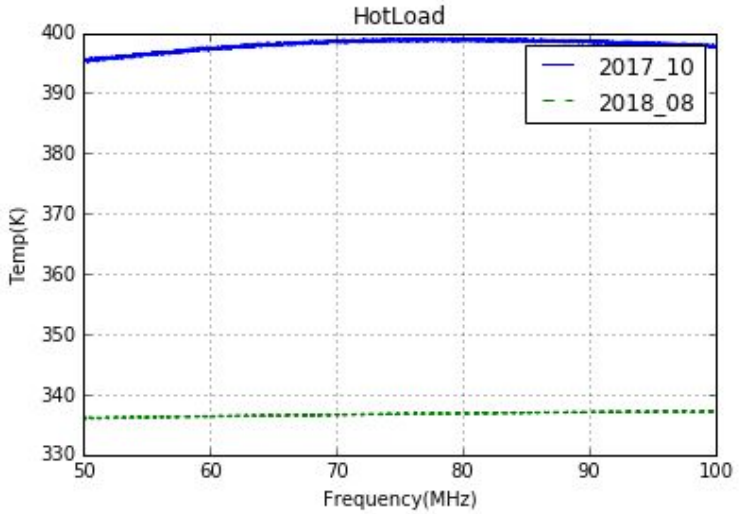


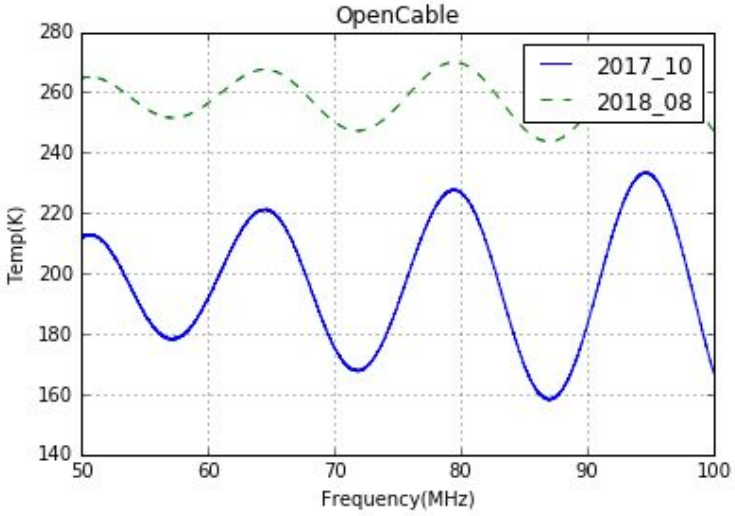
Figure6: Cross checks for calibration of Low-Band3, 2018-05. 9 (C1,C2)& 9(Tu,Tc,Ts) terms

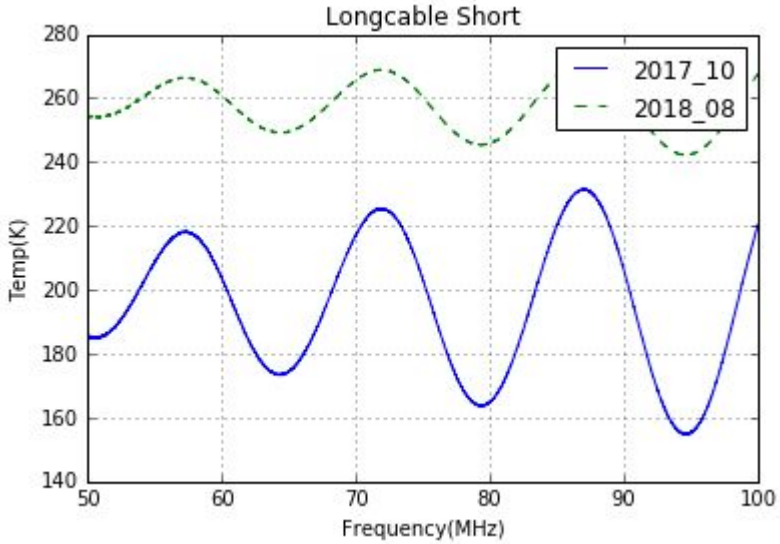
To check the differences, spectra and S11 from the old and new measurements are overplotted

Spectra data @ 25C for the loads

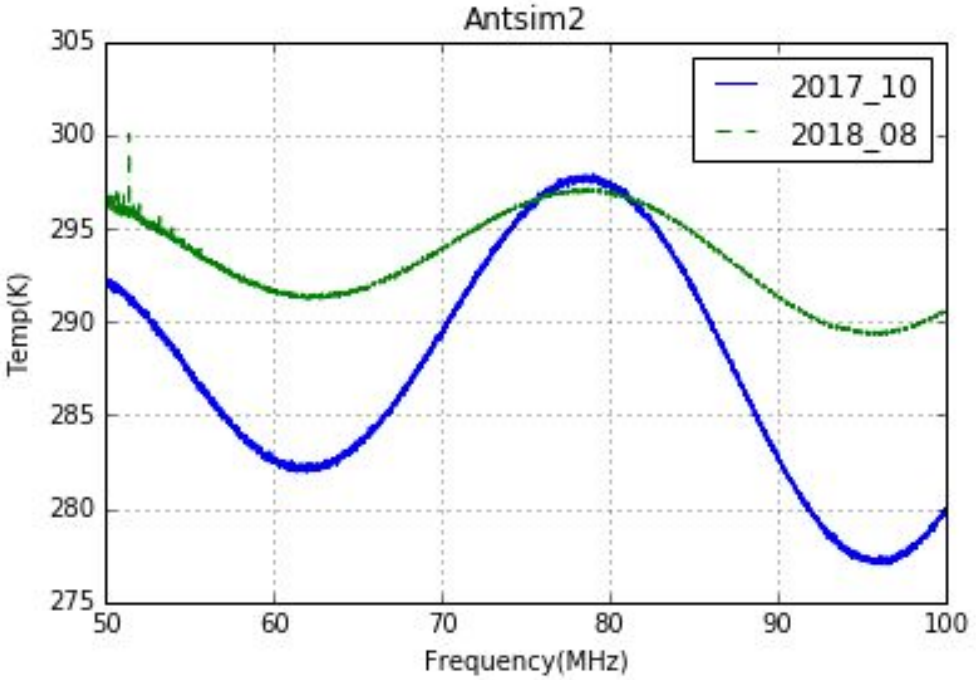




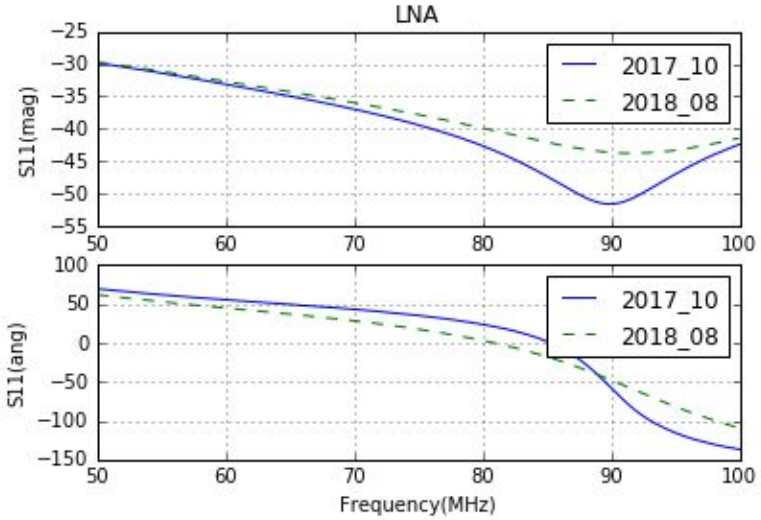


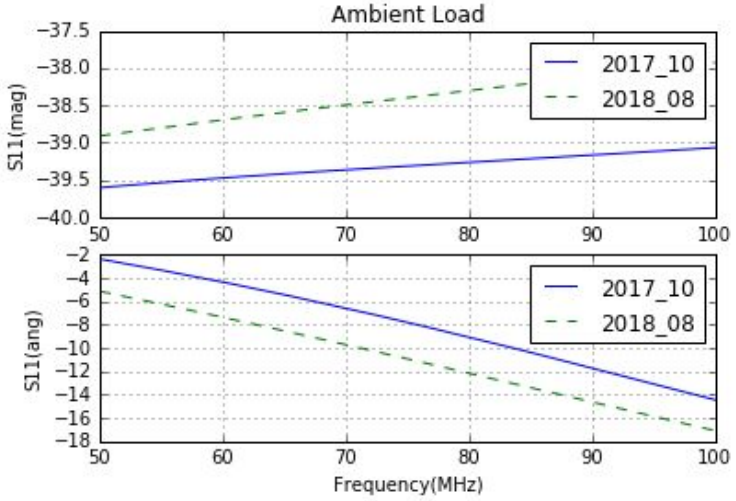


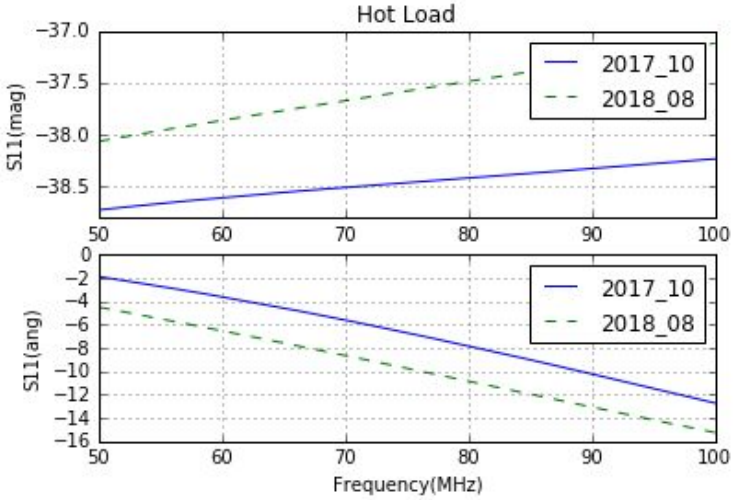
Spectra data @ 25C for the loads



Reflection coefficients of the loads @25C [50 -100 MHz]







Reflection coefficients of the loads @25C