Lowband1 Recalibration
May 2nd - May26th

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Set Up - May 2nd 2017

- The VNA is in line with the receiver and a rigid cable is used for S11 measurements via the receiver.
- Air circulation through the receiver is set up with fans and PVC pipes.(Fig1.)
- The temperature of the receiver set to 25^{o}C and the pxspec code is running to keep the receiver switching.
- Top Level Directory of data on Enterprise is: /data5/edges/data/Lowband1_May2017_recalibration

Power Sensitivity Test - 05/03/2017

- *Folder Name:* S11/Power_sensitivity_1mCable/
- A 1 m cable was used from the receiver to the backend
- VNA settings: 40-120 MHz, 321 points (0.25 MHz steps), 100 Hz IF
- Receiver was switching before measurements started
- Order of measurement - O,S,L,6dB attenuator & receiver. (x2)
  The LNA S11 is measured at the VNA at different power levels
  in the following given order:
  - 30dBm, 30 trace average
  - 35 dBm, 40 trace average
  - 40 dBm, 50 trace average
  - 20 dBm, 20 trace average
  - 10 dBm, 10 trace average
  0 dBm, 10 trace average

Power Sensitivity test 50m backend - 05/04/2017

- The same power sensitivity test was done with a 50 m cable from the receiver to the backend.
- *Folder Name*: S11/Power_sensitivity_50mCable/

Ambient Load - 05/05/2017

Spectra Files:

Ambient_load_2017_126_00.acq
Ambient_load_2017_127_00.acq
Ambient_load_2017_128_00.acq
Ambient_load_2017_129_00.acq

Resistance Files:

Ambient_load.csv

S11:

S11/Ambient_load/

Set Up

- The Ambient load was connected to the receiver. Voltage source to the connector was turned off. The backend cable was set back to 1m.
- A ferrite core was used over the connector and copper shielding tape that connected the edges of the ambient load and the receiver were on all four sides.
- A Lowpass filter was connected to both connections to the ambient load i.e, to the thermistor and from the voltage source
- Resistance was set to log every one minute.

Measurements Done

After 3 days of switching,
VNA settings: 40 -120 MHz, 10 Trace average, 0dBm
S11 of the Ambient load was measured via the receiver
Order of the measurement -
Open (28V), Short(31.3V), Load(34V), and External (37V). (x2)

Hot Load - 05/08/2017

Spectra Files:

Hot_load_2017_128_22.acq
Hot_load_2017_129_00.acq
Hot_load_2017_130_00.acq

Resistance Files:

Hot_load.csv

S11:

S11/Hot_load/

Set Up:

- The setup was same as the ambient load except that the input voltage on the voltage source was set to 12V
- The metal ring, copper tape and Low Pass Filters were left in.

  Measurements done:

  After 2 days of switching;
- VNA settings: 40-120MHz, 0 dBm, 10 avg.
- The S11 of the ambient load was taken via the receiver.
- Order of the measurement -

  Open (28V), Short(31.3V), Load(34V), and External (37V). (x2)

ANT Sim2 5/10/2017

Data discarded because 4 Position switch was set to “external”

RFI TEST on Cable - 05/11/2017

- The RFI test was performed for the 1m and 50m cable cases.
- The VNA averaging was turned off. We took an S11 trace measurement of the receiver with the 1m cable going from the receiver to the back. We stored that trace on the VNA display and then displayed both this stored trace and the current live trace. We then added a choke to the male-male adapter between the VNA and the receiver and the trace did not budge - they were still identical. We then disconnected the 1m LNA cable (which kills power to the receiver) and connected the 50 m cable. We immediately saw that the S11 was different (higher - less negative) from the stored trace, 1dB, difference on the screen with a valley shaped curve as in Nivedita's report. While watching this curve, it slowly decreased in magnitude and eventually just about exactly matched the original curve.

- So after talking with Alan, we concluded that this was a thermal issue. We were able to make the S11 trace go higher on the plot by lowering the temperature to 18 C on the thermal plate. Raising it to 30 C made the trace go in the opposite direction. We let the receiver switch overnight so that the S11 can be measured the next day. We will also monitor the other thermistor to make sure both measurements with the 50m and 1m cables are done at the same internal temperatures. We are not sure why our previous measurements differed as there should have been enough time for the receiver's temperature to stabilize internally. Removing the 50m cable and putting the 1m cable back on had the same effect - the S11 was ~ 1 dB less negative at the -38 dB valley bottom, and slowly (over 3-4 minutes) recovered and matched the original trace again.
- The bottom line is that we think there was a thermal difference rather than feedback.

LNA S11 - 05/12/2017

Resistance Files:

Receiver_S11_cabletest.csv

S11:

Folder Name: S11/Receiver_after_antsim2/

S11 of the receiver at the VNA was measured at -30dBm (30 trace average). The resistance at the other thermistor of the receiver was recorded.

- The measurements were taken by changing the 1m and 50m cables to the receiver. The temperatures and time taken for the S11 to stabilized were recorded.
- The results of this test is in the report - "Investigation of changes in receiver S11 with back-end cable length" sent out on May 18th. EDGES Reports # 95: (http://loco.lab.asu.edu/memos/).
- Data location - base directory:
  /data5/edges/data/Lowband1_May2017_recalibration/Power_sensitivity1m/
  Subfolders:
  Power_sensitivity1m
  Power_sensitivity50m
- In conclusion, there is a resistance drop at every cable swap for a brief amount of time. And it takes ~8 mins for the S11 values to stabilize.

Antenna Simulator 2 - 05/12/2017

Spectra Files:

AntSim2_redo_2017_133_22.acq
AntSim2_redo_2017_134_00.acq
Antsim2_redo_2017_135_00.acq

Resistance Files:

AntSim2_redo.csv

S11:

S11/AntSim2_redo/

Set Up:

- The Ant Sim2 was connected to the receiver.
- The metal ring and copper tape were used as in the case of the ambient load and the hot loads.
- The connection to the thermistor was made via a LPF.

Measurements done:

After 3 days of switching;

- VNA settings: 40-120MHz, 0dBm, 10 avg.
- The S11 of the AntSim2 was taken via the receiver.
- Order of the measurement - Open (28V), Short(31.3V), Load(34V) & External (37V). (x2)

Antenna Simulator 1 - 05/15/2017

Spectra Files:

AntSim1_2017_135_20.acq

AntSim1_2017_136_00.acq

Resistance Files:

AntSim1.csv

S11:

S11/AntSim1/

Set Up:

- The Ant Sim1 was connected to the receiver.
- The metal ring and copper tape were used as in the case of the ambient load and the hot loads.
- The connection to the thermistor was made via a LPF.

Measurements done:

After 1 day of switching;

- VNA settings: 40-120MHz, 0dBm, 10 avg.
- The S11 of the AntSim2 was taken via the receiver.
- Order of the measurement - Open (28V), Short(31.3V), Load(34V) & External (37V). (x2)

Alan's Noise Source - 05/16/2017

Spectra Files:

Noise_Source_6dB_2017_136_21.acq

Noise_Source_6dB_2017_137_00.acq

S11:

S11/Alan_Noise_source_6dB/

Set Up:

- Alan's noise source with the inherent 6dB and no additional attenuator was connected to the receiver.
- The noise source was placed in a Faraday cage and the 12V power supply was connected to it.
- No copper tape or metal ring was used.
- The power supply was connected to the Noise source without a Low pass Filter

Measurements done:

After 1 day of switching;

- VNA settings: 40-120MHz, 0dBm, 10 avg.
- The S11 of the Noise source was taken via the receiver.
- Order of the measurement - Open (28V), Short(31.3V), Load(34V) & External (37V). (x2)

Alan's Noise source + Cable Box- 05/17/2017

Spectra Files:

Noise_Source_6dB_cablebox_2017_137_23.acq

Noise_Source_6dB_cablebox_2017_138_00.acq

S11:

S11/Alan_Noise_source_6dB_with_cablebox/

Set Up:

- Alan's noise source with the inherent 6dB and no additional attenuator was connected to the cable box and which in turn was connected to the receiver.
- The setup was placed in a Faraday cage and the 12V power supply was connected to the Noise source
- No copper tape or metal ring was used.
- The power supply was connected to the Noise source without a Low pass Filter

Measurements done:

After 1 day of switching;

- VNA settings: 40-120MHz, 0dBm, 10 avg.
- The S11 of the Noise source+cablebox was taken via the receiver.
- Order of the measurement - Open (28V), Short(31.3V), Load(34V) & External (37V). (x2)

05/18-19/2017 - Shorted cable

Spectra Files:

Short_Cable_2017_138_23.acq

Short_Cable_2017_139_00.acq

S11:

S11/Short_Cable/

Resistance:

Short_Cable.csv

Set Up:

- The long cable box was placed in the faraday cage. The short termination was connected to the cable box.
- No copper tape or metal ring was used.
- The connection to the thermistor was made via a LPF.

Measurements done:

After 1 day of switching;

- VNA settings: 40-120MHz, 0dBm, 10 avg.
- The S11 of the Noise source was taken via the receiver.
- Order of the measurement - Open (28V), Short(31.3V), Load(34V) & External (37V). (x2)

05/19-20/2017- Open cable

Spectra Files:

Open_Cable_2017_139_19.acq

Open_Cable_2017_140_00.acq

S11:

S11/Open_Cable/

Resistance:

Open_Cable.csv

Set Up:

- The long cable box was placed in the faraday cage. The open termination was connected.
- No copper tape or metal ring was used.
- The connection to the thermistor was made via a Low Pass Filter.

Measurements done:

After 1 day of switching;

- VNA settings: 40-120MHz, 0dBm, 10 avg.
- The S11 of the Open Cable was taken via the receiver.
- Order of the measurement - Open (28V), Short(31.3V), Load(34V) & External (37V). (x2)

Alan's Noise Source S11 parameters with a 3dB intrinsic attenuator
Folder Name: S11/Alans_noise_source_at_VNA_3dB (May 23rd)
40 to 120 MHz, -20dBm, 30 trace average
Measurements:
A) OSL standards at the VNA
B) Powered up noise source at the VNA

Alan's Cablebox S11 parameters:
Folder Name: S11/AlansCableBox_at_the_VNA (May 30th)
40 to 120 MHz, 0dBm, 10 trace average
Measurements:
A) OSL standards at the VNA
B) Port 1 of the CableBox at the VNA with Port 2 connected to OSL standards

Airline measurement at the Receiver
40 to 120 MHz, 0dBm, 10 trace average
A) OSL standards plus a 6dB attenuator attached to the receiver
B) Airline at the receiver with OSL and a 6 dB attenuator attached to the Airline

AlansNoiseSource (3dB version) and Cable Box as a Receiver Load (May 23)
Spectra files:
AlansNoiseSource_and_CableBox_3dB_2017_142_22.acq
AlansNoiseSource_and_CableBox_3dB_2017_143_00.acq
S11 folder:
AlansNoiseSource_at_the_Receiver_3dB
Resistance logging:
N/A

AlansNoiseSource (3dB version) as a Receiver Load (May 24)
Spectra file:
AlansNoiseSource_at_Receiver_3dB_2017_144_00.acq
S11 folder:
AlansNoiseSource_at_the_Receiver_3dB
Resistance logging file:
N/A

Ambient Load Rerun (May 25-26)
(due to a dip in the spectra of the previous run)
Spectra files:
Ambient_redo_2017_144_21.acq
Ambient_redo_2017_145_00.acq
Ambient_redo_2017_146_00.acq
S11 folder:
Ambient_2nd_time
Resistance logging file:
Ambient_redo.csv

Measure S11 of the receiver Friday morning May 26
Folder Name: S11/Receiver_after_Ambient_may_26
40 to 120 MHz, -30dBm, 30 trace average

Monitor Thermistor #2 while switching and with 4 pos switch accidentally in position 1 (Open 28V)
Spectra file:
Spectra_while_monitoring_2nd_thermistor_2017_146_16.acq
Resistance logging file:
Monitor_of_2nd_thermistor.csv

Last 20 mins of the spectra logging: mistake noticed and switch was set to 0V
Resistance logging file for last 20 mins:
Monitor_of_2nd_thermistor_after_4pos_sw_at_0V.csv

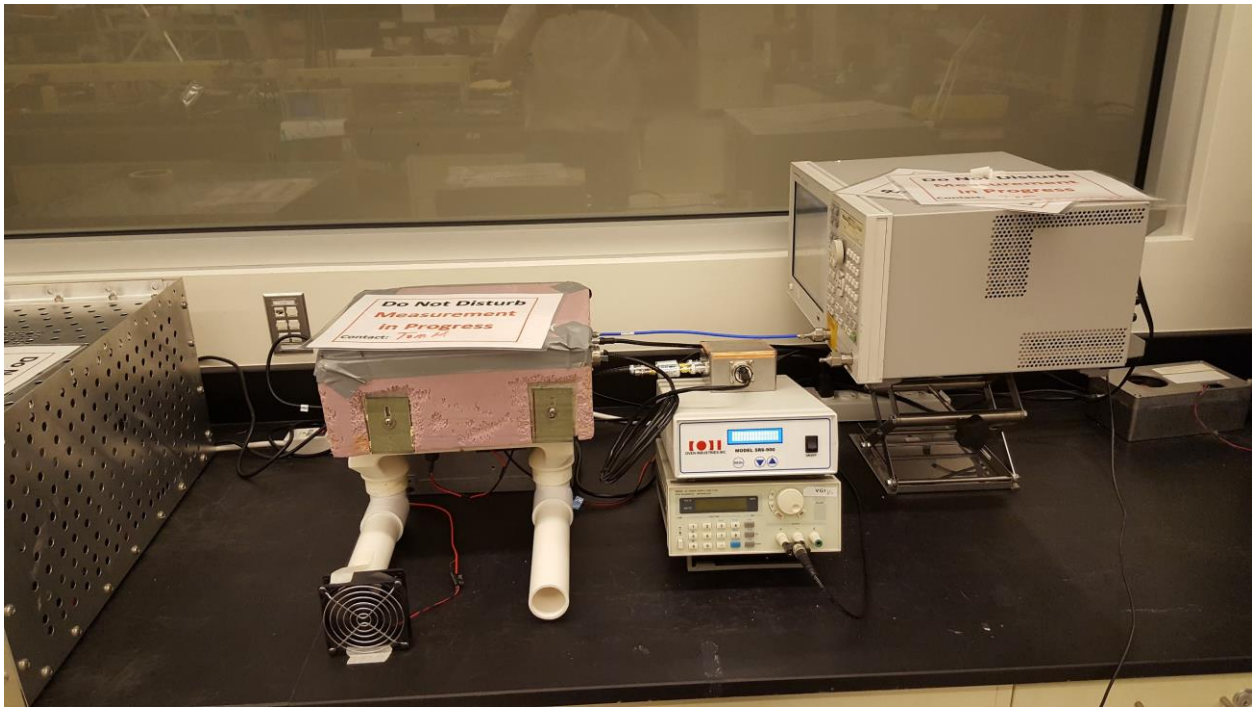

Figure 1. Set up of the VNA and receiver.