

Fermilab Morocco Site Visit Summary

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The Hosts

Hassane and Khalid



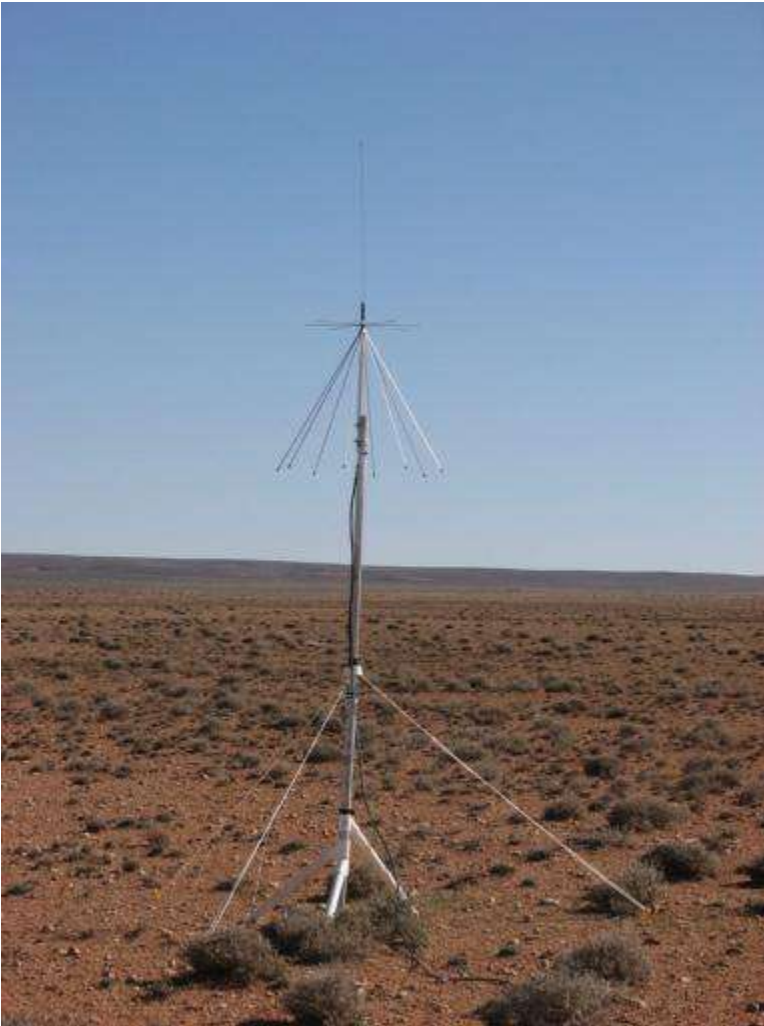
Moroccan Hospitality



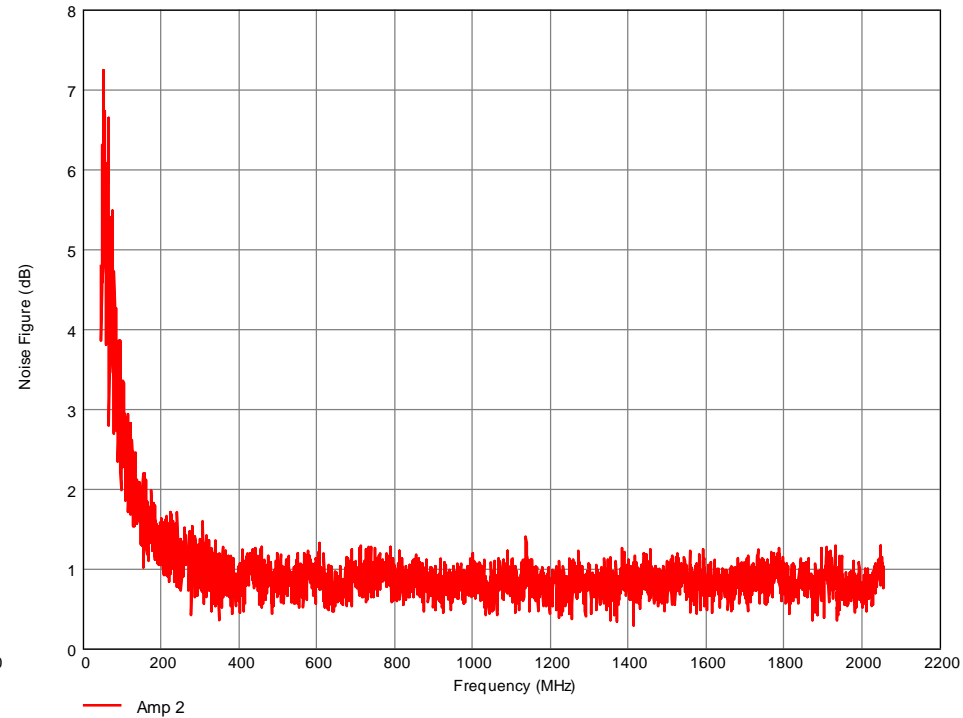
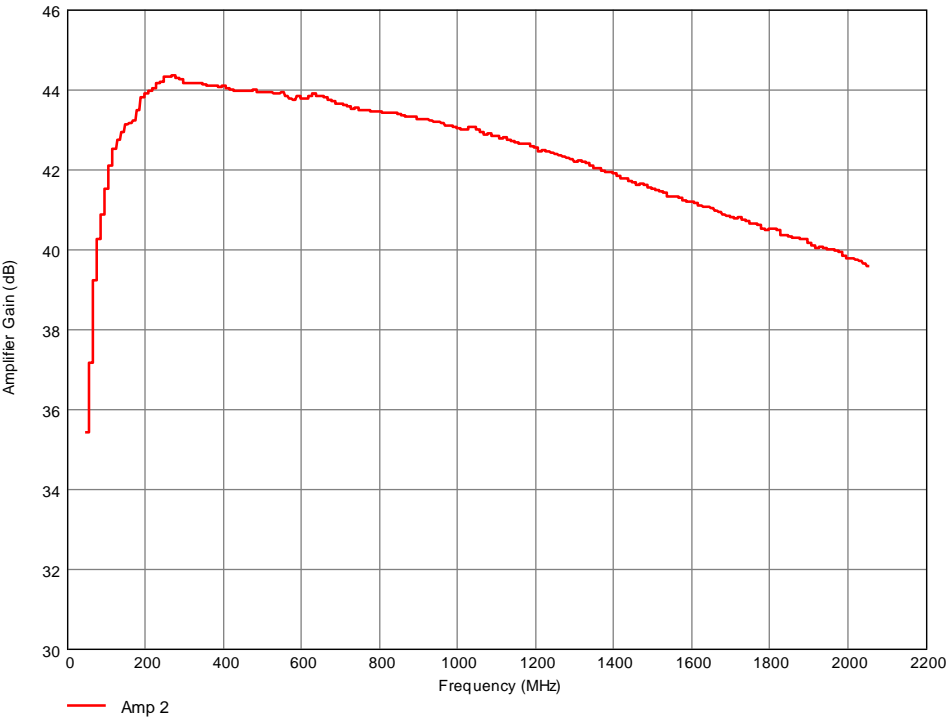
Antenna and Amplifier

- Antennas
 - Broadband Discone antenna (150-1300 MHz)
 - Log Periodic Antenna (150-1500 MHz)
 - Telescoping mast up to 5 meters in height with portable stand
 - 30 meters of flexible heliax coaxial cable
- Amplifiers
 - <1dB NF
 - >45dB Gain
 - 500-1000 MHz
 - 15V power supply and regulator included

Antennas

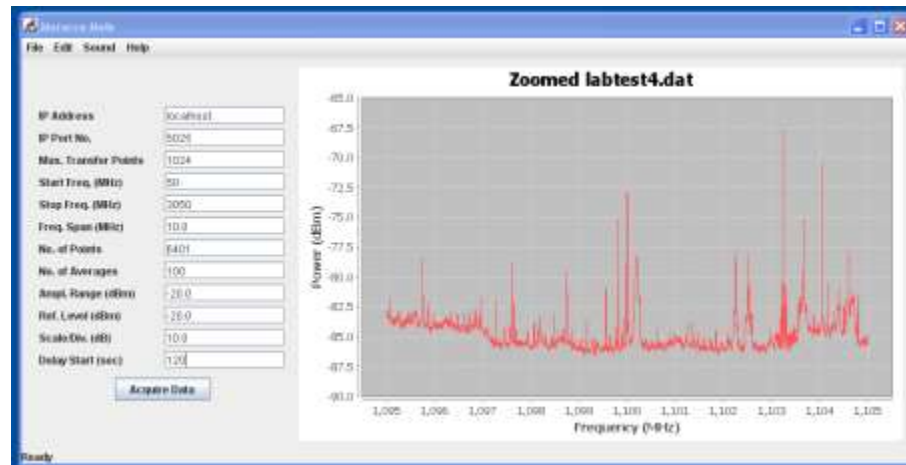


Amplifier and Cable Gain



Data Acquisition

- Agilent 9020 MXA signal analyzer with vector signal and swept spectrum analysis
- On board data Acquisition program
- Program features
 - Audio status, Graphical Status, Peak hold large sweep display, zoomable display
 - Acquisition Rate ~ 3 sec/ GHz-Sweep for a resolution Bandwidth of 6 kHz (need to check this again)
 - 1GHz of bandwidth at 6 kHz resolution bandwidth requires 640kB of storage. (MXA has over 10GB of spare storage space)



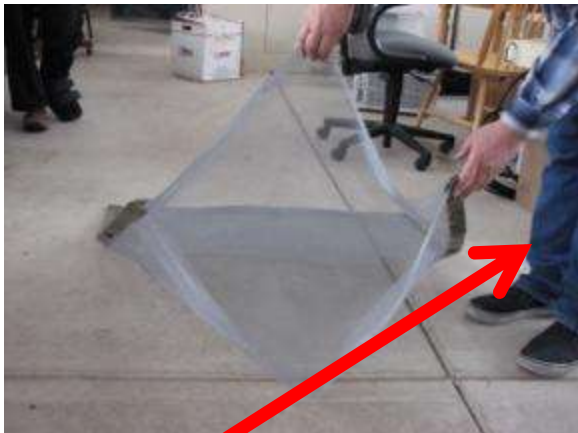
Power Source

- Honda 4 cycle gasoline power generator
 - Can supply 900Watts of Power
 - MXA and amplifiers consume < 180Watts of Power
 - 8 hours of operation at 200 Watts require 2 liters of gasoline

RFI Shielding

- MXA and Generator will be inside double walled Ronco™ Shield bags
- Power cord between the generator and the MXA consists of RG8 coaxial pair with shields tied together and RFI filter at both ends of the cord.
- Shield bags will be grounded together with low distributed low inductance
- Antenna will be over 30 meters away from power generator
- Amplifier will be mounted on the antenna mast

Ronco Screen Bag*



*Technician not included

If ordered TODAY!

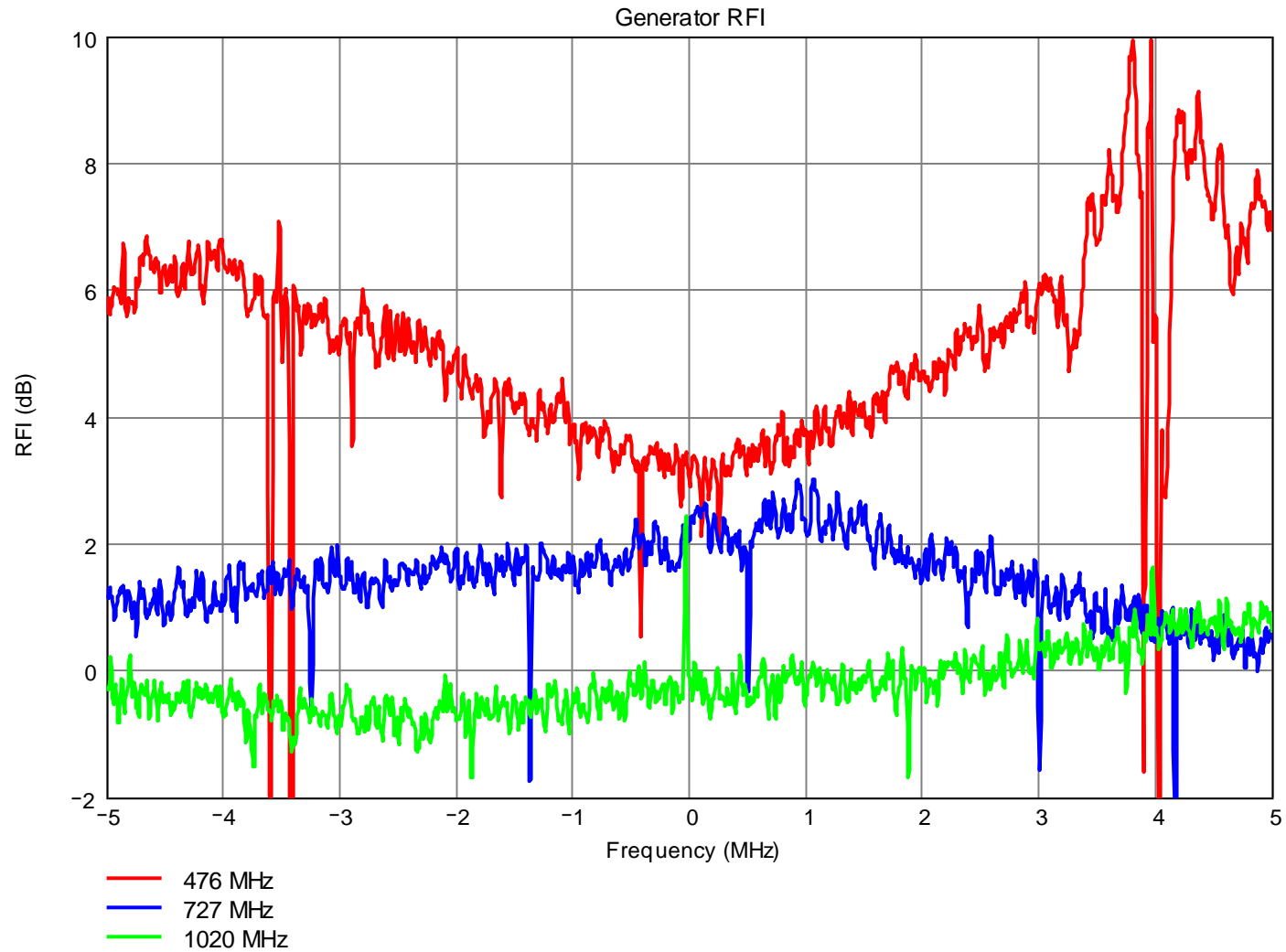
Gasoline Generator RFI

- Configuration
 - Measurements made inside a screen room
 - Discone antenna connected to a 40dB gain, 1db NF amplifier . Amplifier bandwidth 500 – 1000 MHz bandwidth
 - Antenna placed 1 meter away from generator
 - Made with Agilent Vector signal analyzer with a 10 MHz instantaneous bandwidth, a resolution bandwidth of 6.25 kHz, 1000 averages at three frequencies with low external RFI (476, 727, 1020 MHz)
- Measurements
 - Generator on with no screen bag
 - Generator on with screen bag
 - Generator off with screen bag

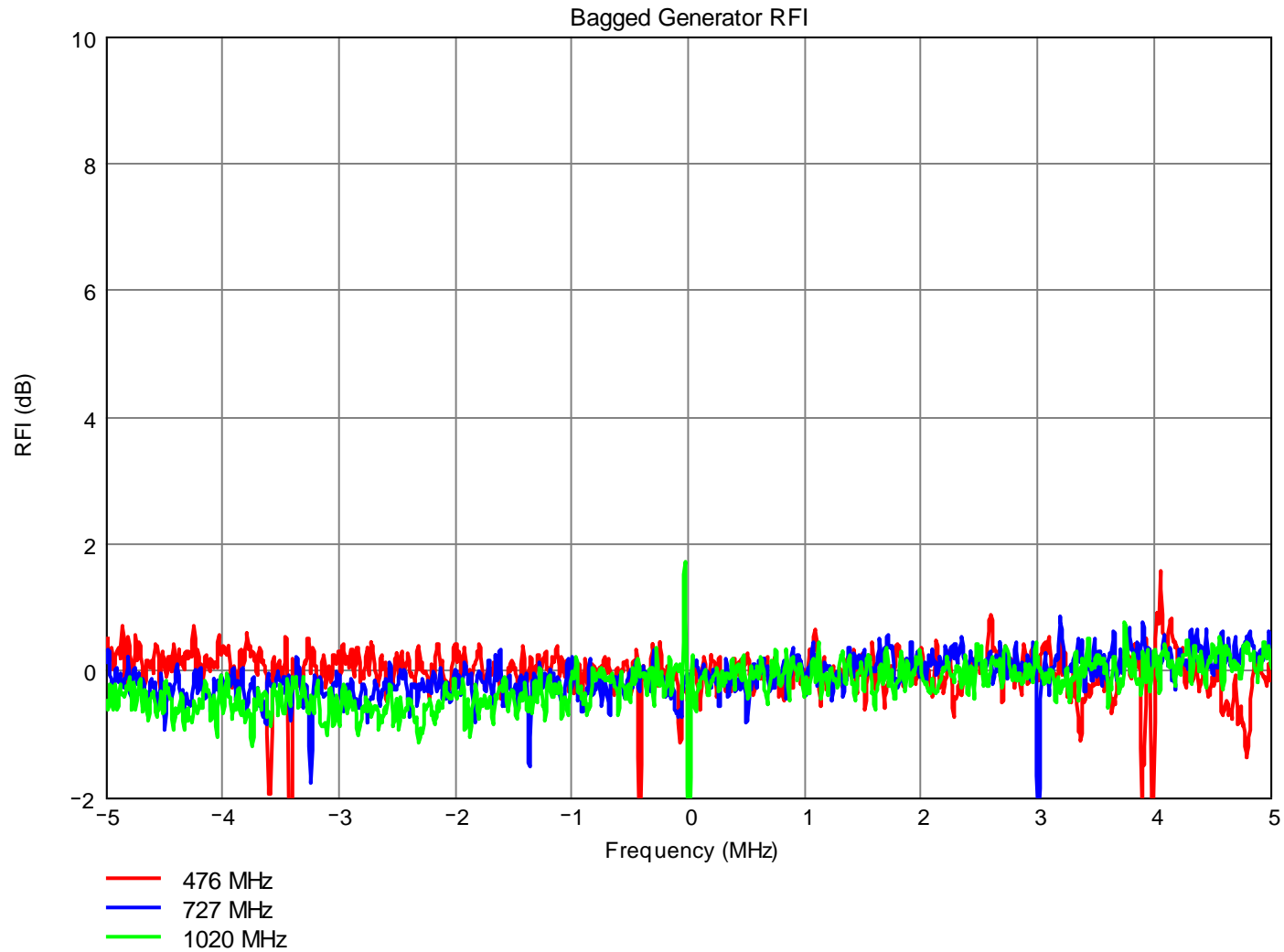
Generator RFI Test



Unshielded Generator RFI



Shielded Generator RFI



Site Candidates



Candidates



Site Candidates



Normalization

$$N = \frac{P(\text{mW})}{G_{\text{amp}} R_{\text{bw}} \left(\frac{c}{f} \right)^2 \frac{D}{4\pi} \frac{1000\text{mW}}{W}}$$

G_{amp} = Amplifier Gain x Cable Loss

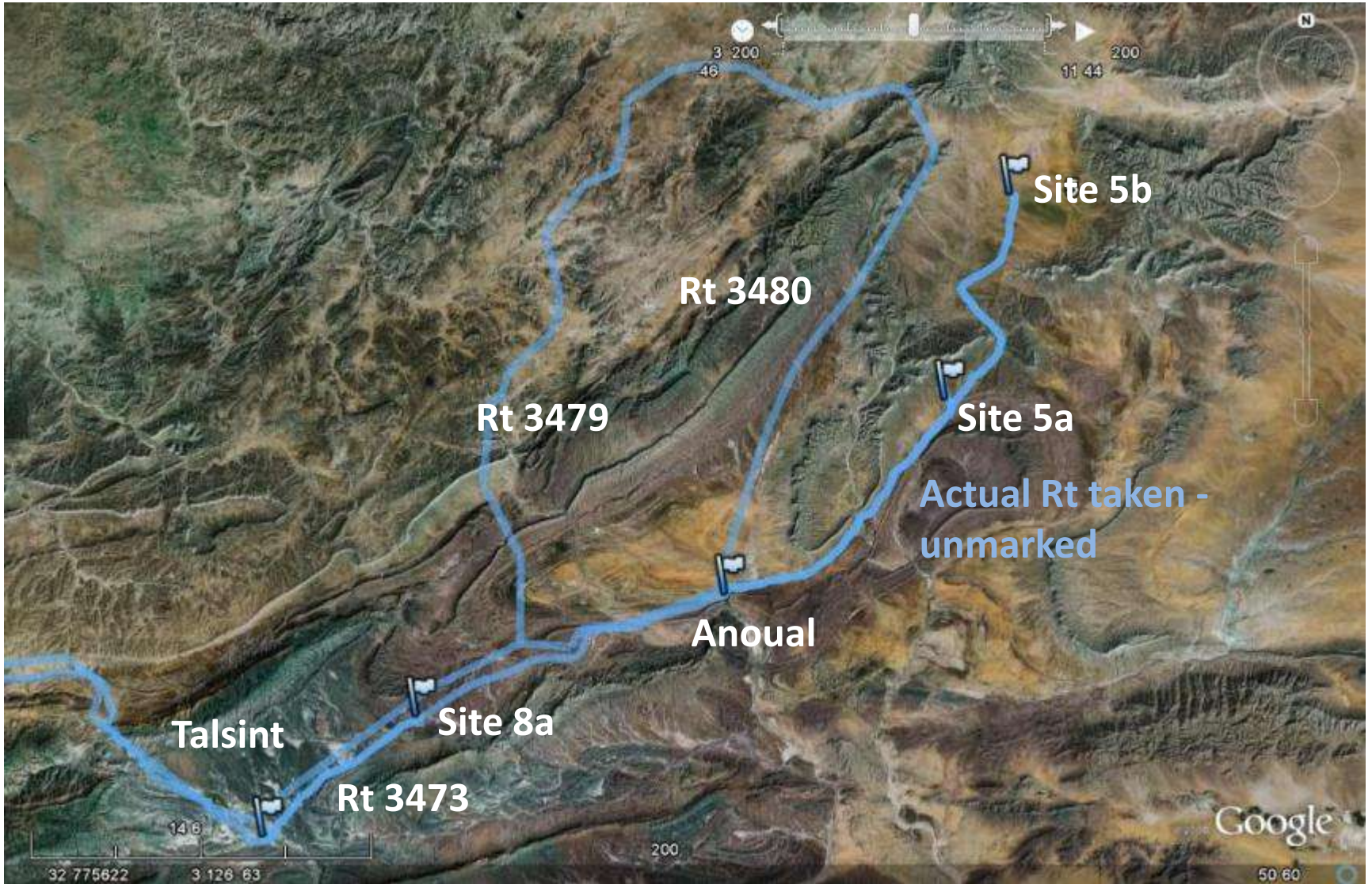
R_{bw} = Resolution Bandwidth of the spectrum (25kHz)

$\left(\frac{c}{f} \right)^2 \frac{D}{4\pi}$ = Area of the antenna

D=2dBi (Discone)

D=11dBi(Log Periodic) (~5dB half space)

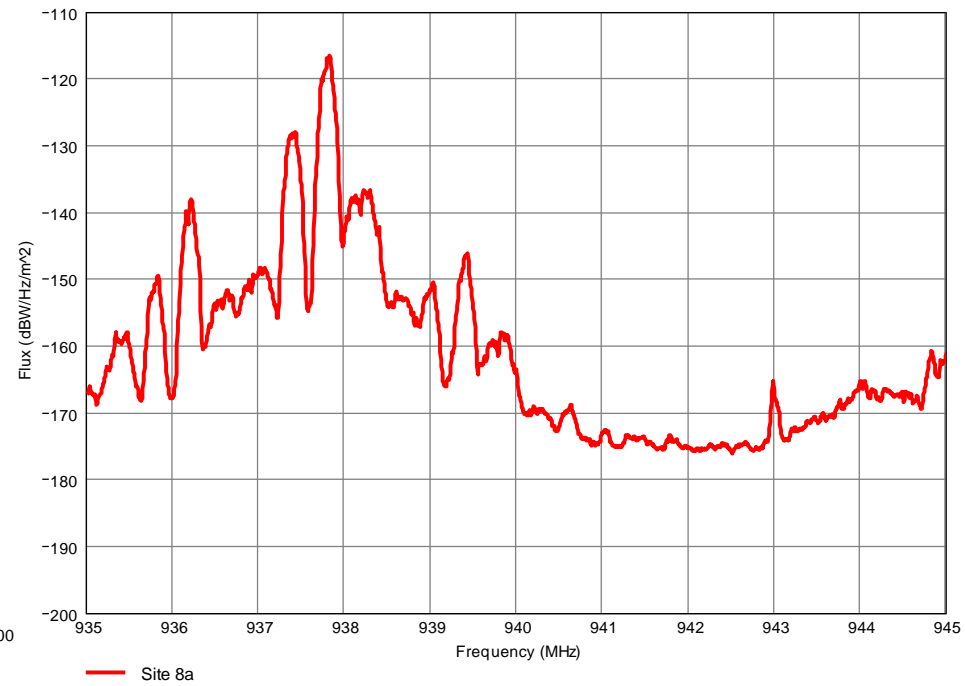
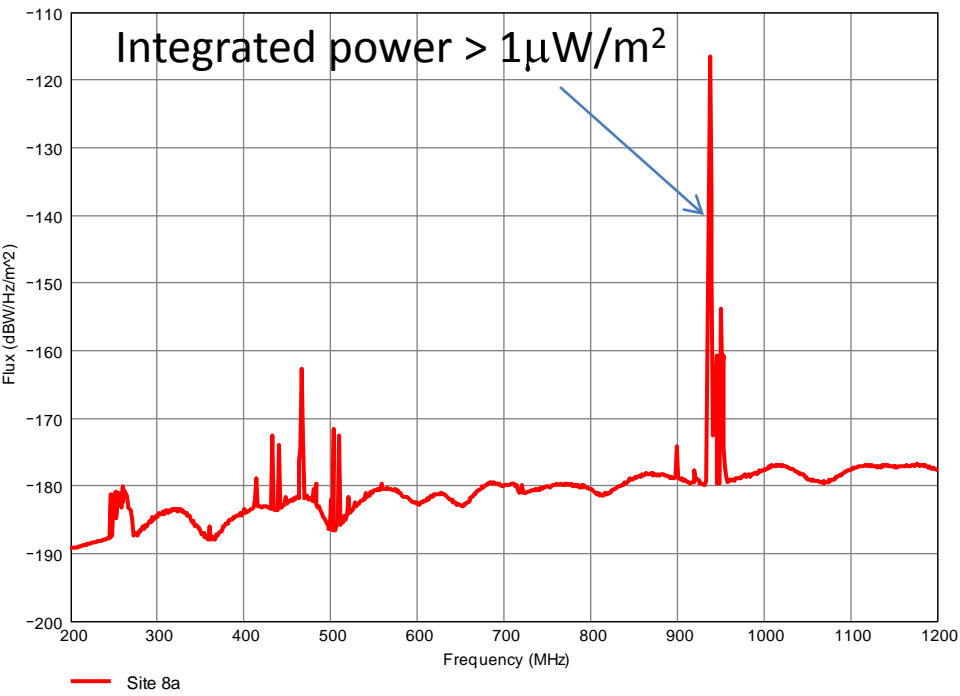
Measured Sites



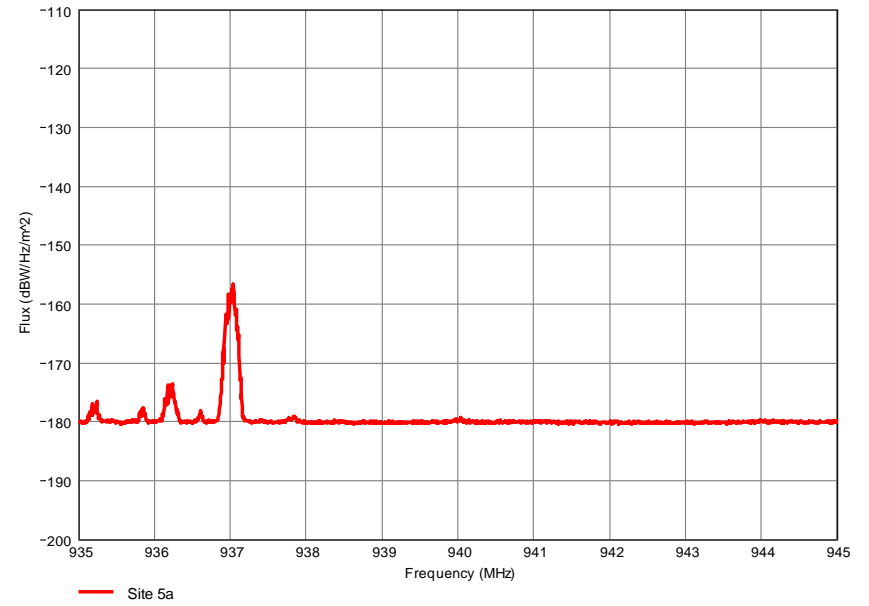
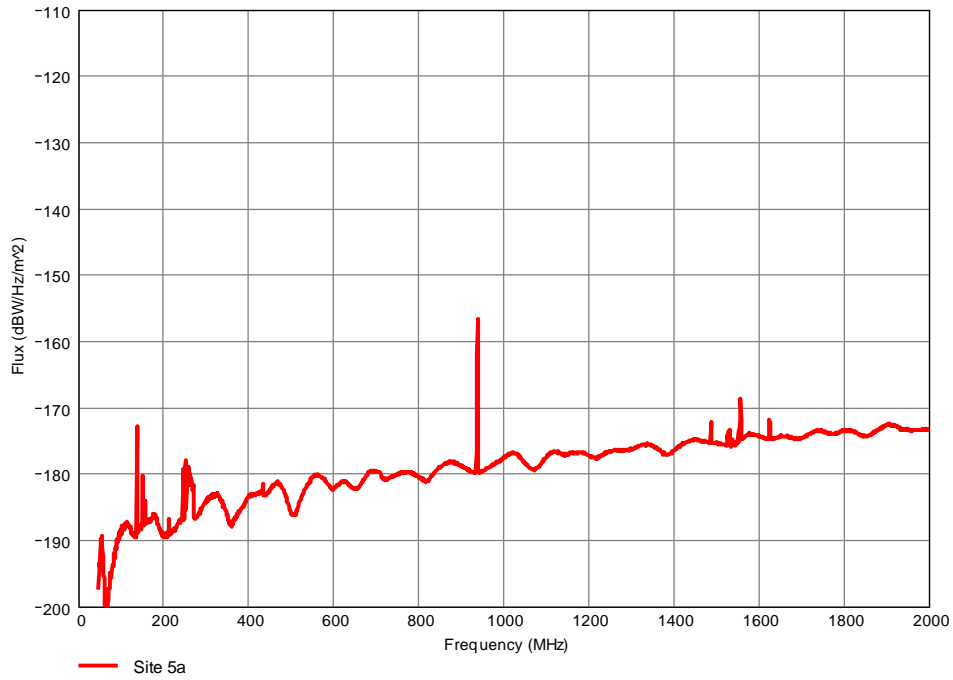
Site 5a



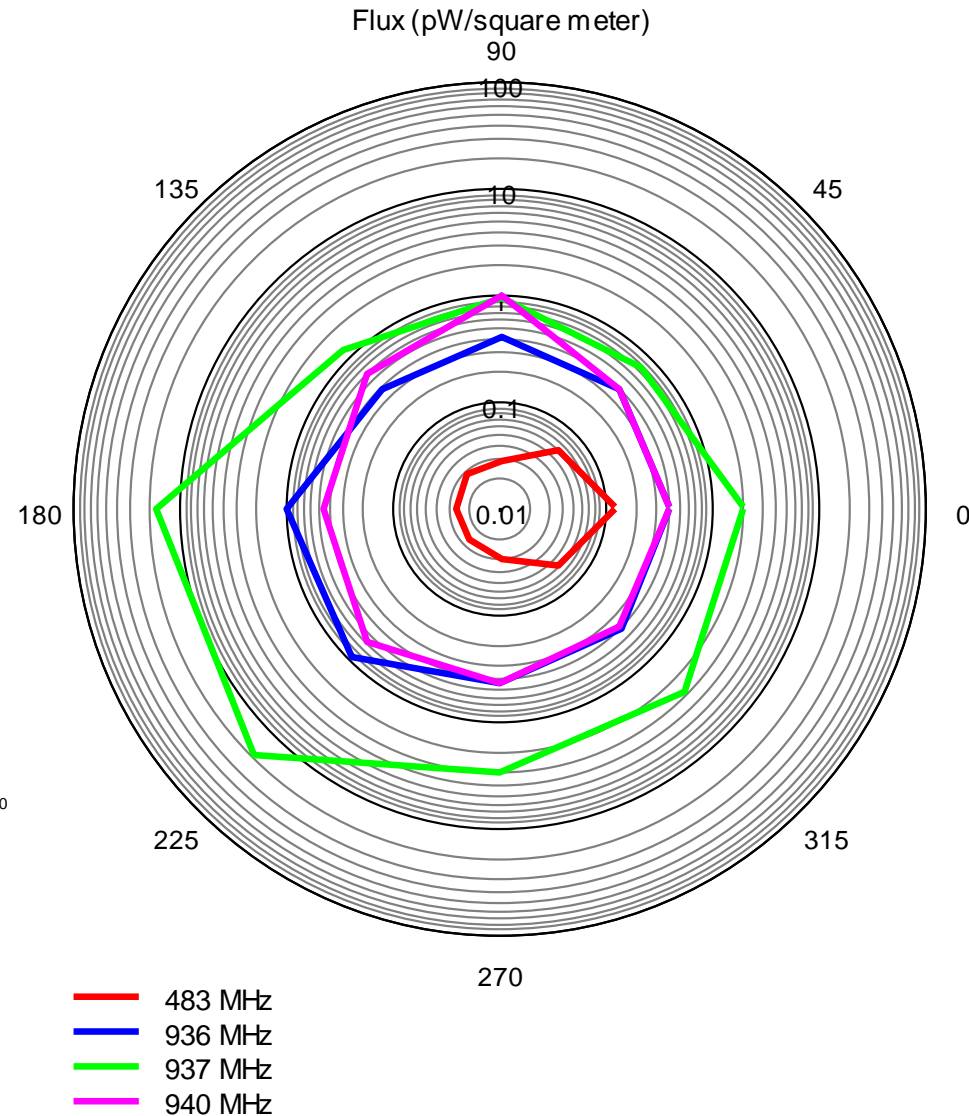
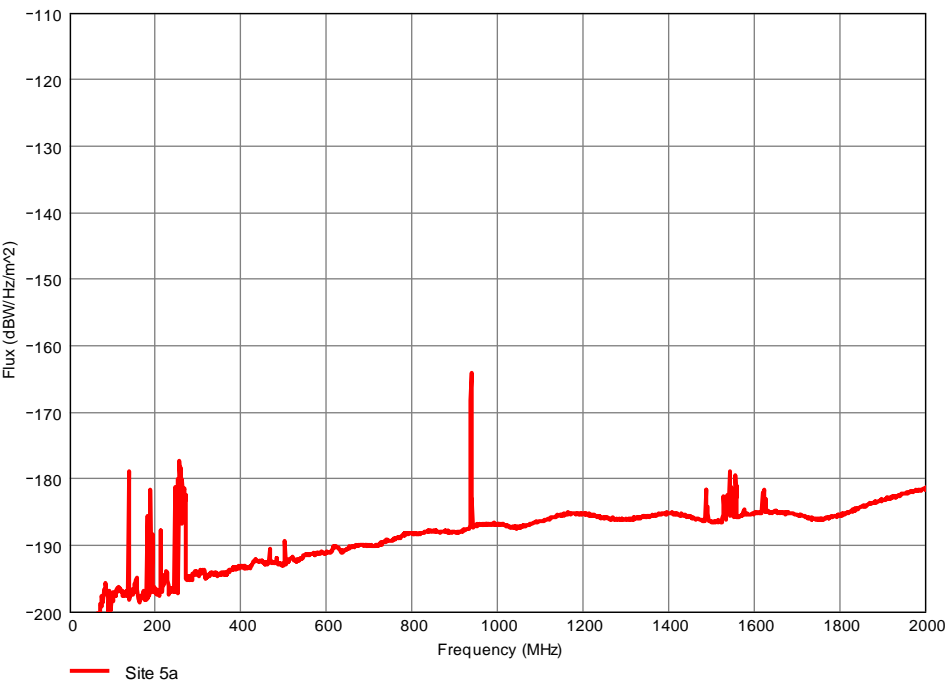
Site 8a



Site 5a



Site 5a Directional Measurements

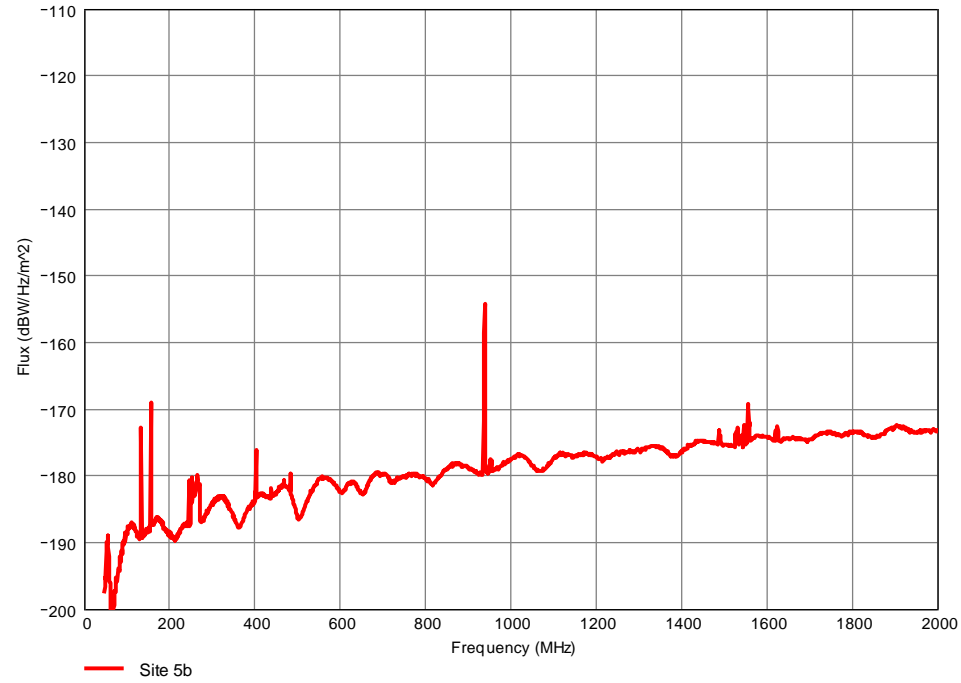
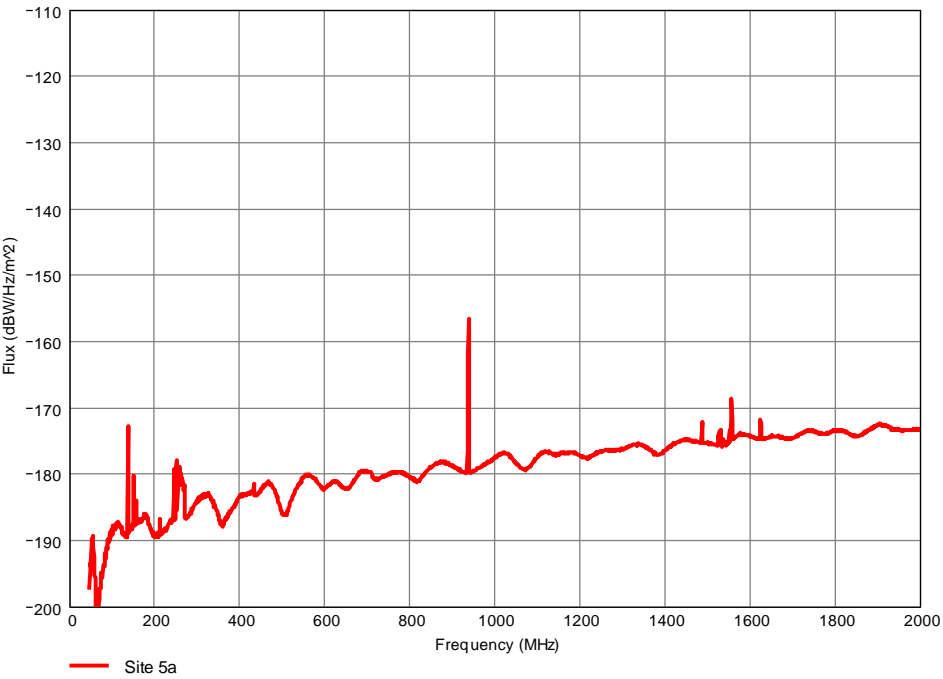


The integral of the noise power into the log-periodic antenna from an ideal 300K sky from 500MHz to 1400 MHz is about $40\text{pW}/\text{m}^2$

Night Measurements



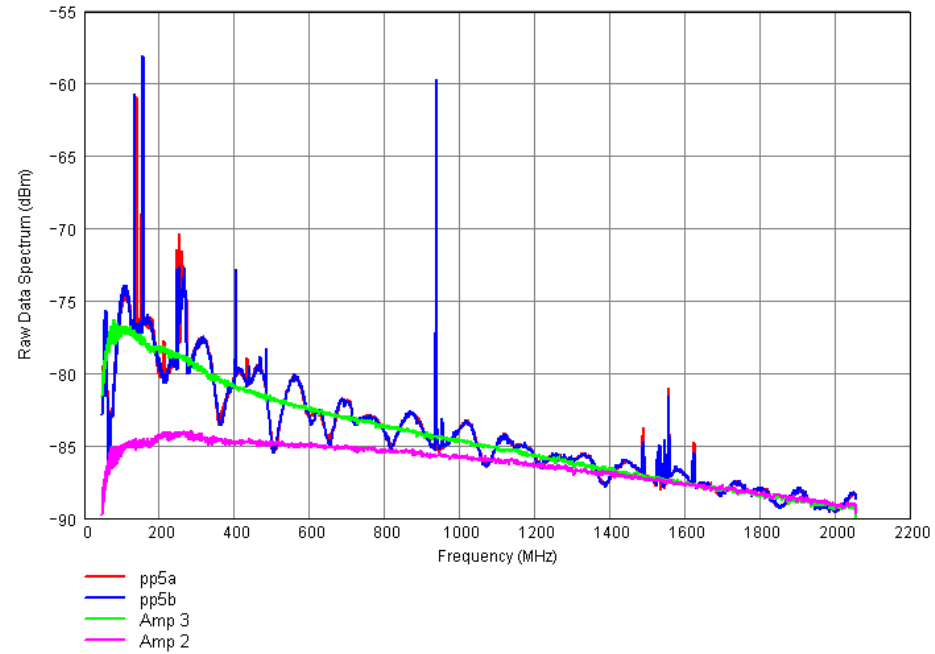
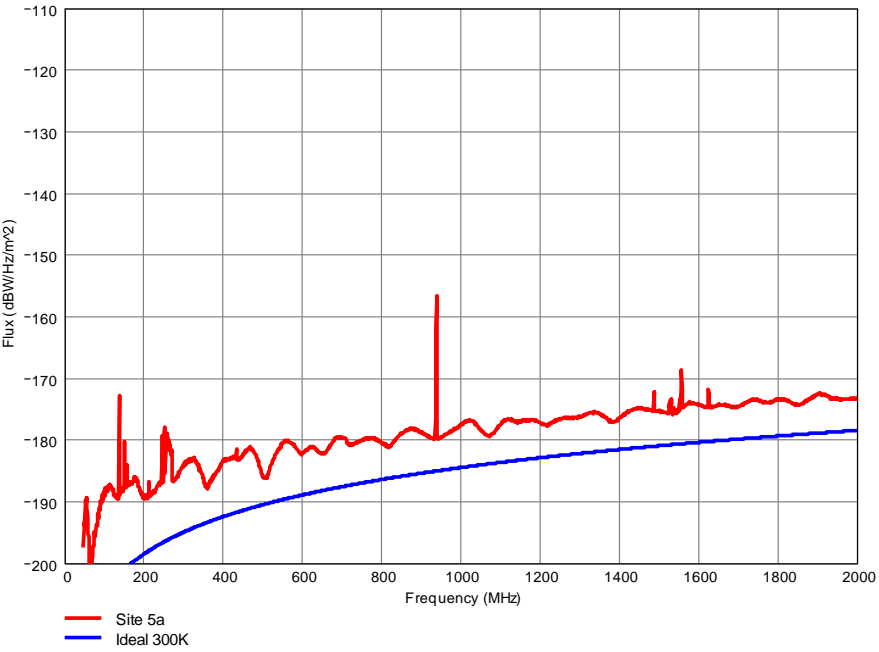
Site 5a and 5b



Measurements

File Name	Date	Latitude degees N	Longitude degrees W	Elevation m	Antenna	Pointing	Start Freq MHz	Stop Freq MHz	Step Freq kHz
pp8a	1/6/2009 16:55	32.60925	3.32593	1360	Discone	All	245	1255	6.25
pp5a	1/7/2009 16:54	32.79833	2.93024	1303	Discone	All	45	2055	1.5625
pp5aSS	1/7/2009 18:15	32.79833	2.93024	1303	Log Per	South	45	2055	6.25
pp5aWW	1/7/2009 19:28	32.79833	2.93024	1303	Log Per	West	45	2055	6.25
pp5aNN	1/7/2009 20:29	32.79833	2.93024	1303	Log Per	North	45	2055	6.25
pp5aEE	1/7/2009 21:23	32.79833	2.93024	1303	Log Per	East	45	2055	6.25
pp5aNE	1/7/2009 22:15	32.79833	2.93024	1303	Log Per	North East	45	2055	6.25
pp5aSE	1/7/2009 23:08	32.79833	2.93024	1303	Log Per	South East	45	2055	6.25
pp5aSW	1/8/2009 0:00	32.79833	2.93024	1303	Log Per	South West	45	2055	6.25
pp5aNW	1/8/2009 0:51	32.79833	2.93024	1303	Log Per	North West	45	2055	6.25
pp5b	1/8/2009 12:04	32.92462	2.87838	1465	Discone	All	45	2055	6.25

Noise Performance

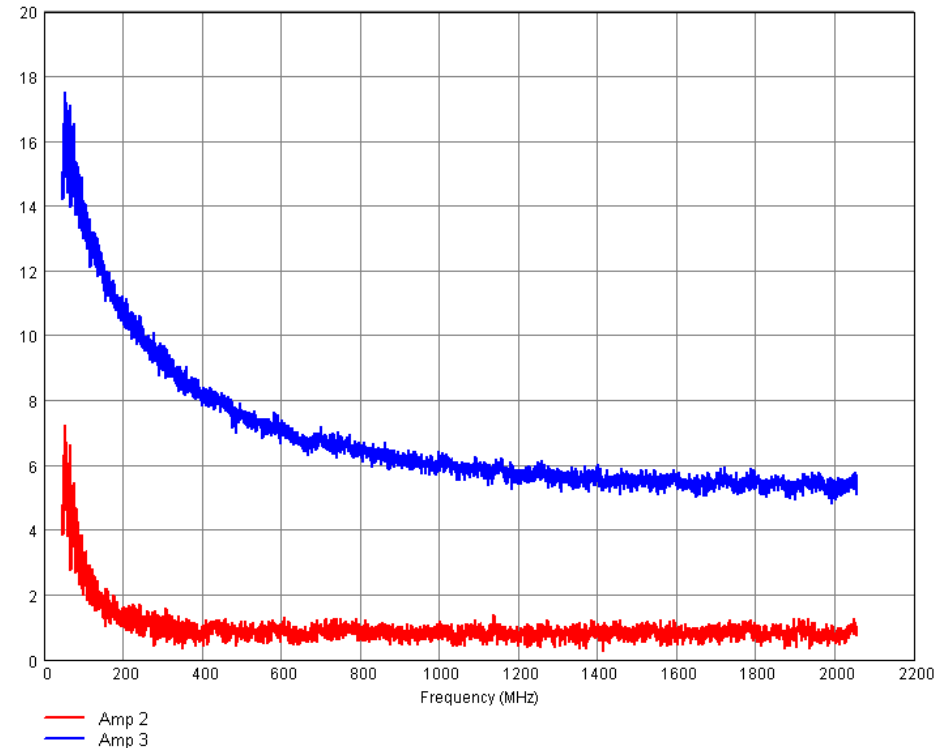
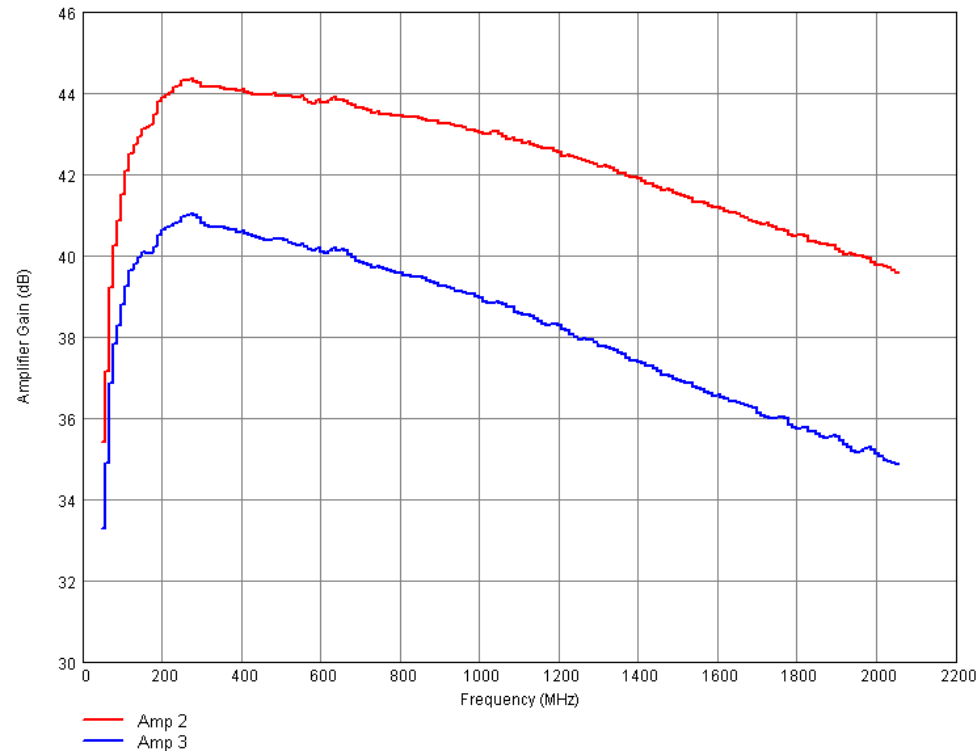


Amplifier Gain and Cable loss

- The amplifier used “lost” 5 dB of Gain during transit to Morocco
- Amp 3 was the amplifier used in Morocco.
- Amp 2 was the spare amplifier on the same plate.
- Before the trip to Morocco, both amplifiers had very similar gain.
- The measurement includes 100 ft of cable after the amplifier used during the measurements
- The loss of gain seemed to occur on the front end of the amp so the noise figure increased significantly

Amplifier Noise

- The loss of gain seemed to occur on the front end of the amp so the noise figure increased significantly



Summary

