



**ANTENNA MEASUREMENTS AT  
UNIVERSITY OF PRETORIA FOR TELKOM**

Argus NNNOX310R Dualband 6 port

**REPORT No:** CEM 10/08 Final

**DATE:** 18 March 2010

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## **1 INTRODUCTION**

In this report measured radiation pattern and gain results obtained in an indoor static measurement facility are presented for one mobile base station antenna. The measurement frequencies range from 1 710 MHz to 2 170 MHz.

## **2 DISCUSSION OF THE MEASUREMENT PROCEDURE**

The gain measurements in the compact range were performed according to Measurement procedure CP00820 (Available on request).

Software gating was employed to improve the accuracy of gain measurements below 2GHz. The effect is the elimination of unwanted contributions from the back of the room and the backlobe of the feed antenna. The azimuth and elevation patterns of the antenna were measured with a 0°, 5° and 10° tilt in elevation.

## **3 MEASURED RESULTS**

In this section, the measured results for the antenna is summarized and presented.

### Argus

Model	NNNOX 310R Dual band 6 port
Serial number	12360506

Sector 1 antenna +45° port			
Tilt (°)	0	5	10
Gain (dBi) Max	17.9	17.8	17.8
Average	17.6	17.5	17.3
Squint Az (°)	0.5	0.2	0.2
Azimuth Beamwidth (°)	66	66	66
Peak Ele (°)	0.3	4.8	9.6
Elevation Beamwidth (°)	6.8	6.9	6.9
Side lobe suppression (dB)	24	22	20
Front to back ratio (-dB)	25	25	25
Isolation: Ports (dB)	>30		
Isolation: Sectors (dB)	>35		
Cross polarization (- dB)	>15	>15	>15
Return Loss (dB)	>17		

Sector 1 antenna -45° port			
Tilt (°)	0	5	10
Gain (dBi) Max	17.9	17.7	17.8
Average	17.5	17.4	17.2
Squint Az (°)	1.1	0.7	0.5
Azimuth Beamwidth (°)	66	66	66
Peak Ele (°)	0.3	5.1	9.7
Elevation Beamwidth (°)	6.9	7	7
Side lobe suppression (dB)	23.5	22	19
Front to back ratio (-dB)	25	25	25
Isolation: Ports (dB)	>30		
Isolation: Sectors (dB)	>40		
Cross polarization (- dB)	>15	>15	>15
Return Loss (dB)	>15		



Sector 2 antenna +45° port			
Tilt (°)	0	5	10
Gain (dBi) Max	17.8	17.6	17.7
Average	17.4	17.4	17.2
Squint Az (°)	3	2.4	1.9
Azimuth Beamwidth (°)	66	66	66.5
Peak Ele (°)	0.4	5.1	9.6
Elevation Beamwidth (°)	6.9	6.9	7
Side lobe suppression (dB)	23.5	21	19
Front to back ratio (-dB)	25	25	25
Isolation: Ports (dB)	>30		
Isolation: Sectors (dB)	>35		
Cross polarization (- dB)	>15	>15	>15
Return Loss (dB)	>15		

Sector 2 antenna -45° port			
Tilt (°)	0	5	10
Gain (dBi) Max	17.9	17.6	17.7
Average	17.5	17.3	17.1
Squint Az (°)	2.6	2.4	2.2
Azimuth Beamwidth (°)	66	66	66.6
Peak Ele (°)	0.6	5.2	9.7
Elevation Beamwidth (°)	6.9	7	7
Side lobe suppression (dB)	25	24	20
Front to back ratio (-dB)	25	27	25
Isolation: Ports (dB)	>30		
Isolation: Sectors (dB)	>35		
Cross polarization (- dB)	>15	>15	>15
Return Loss (dB)	>15		

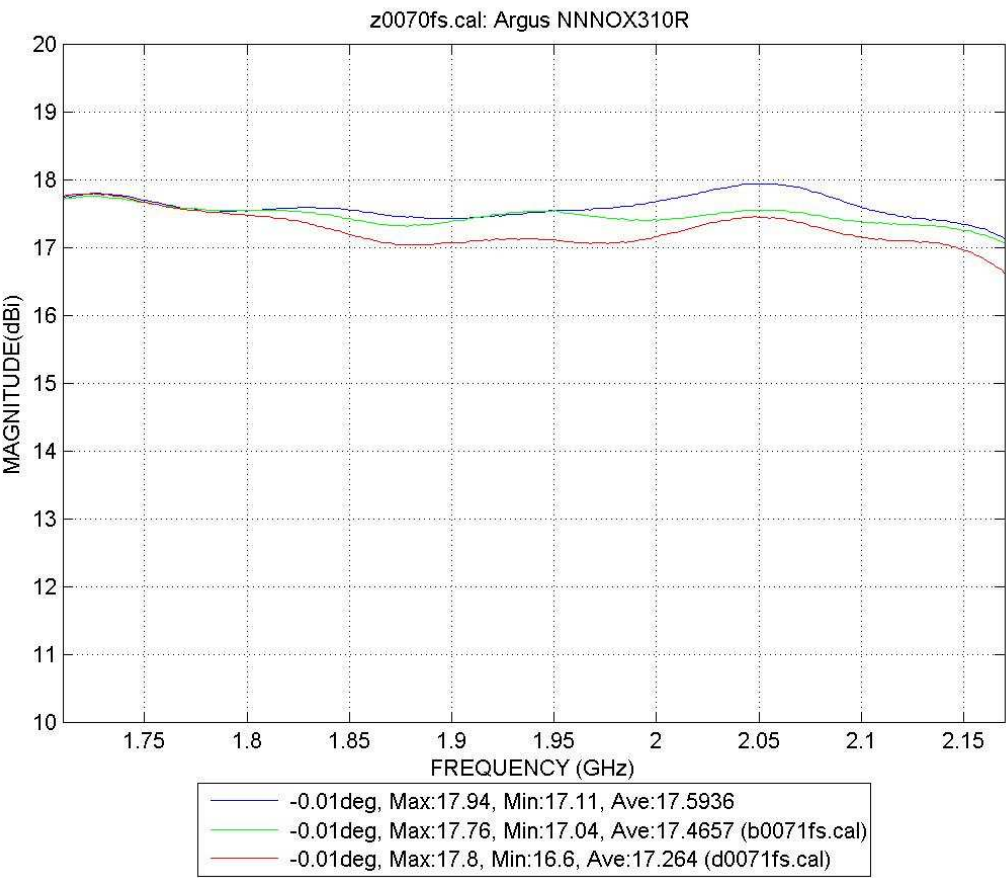
Sector 3 antenna +45° port			
Tilt (°)	0	5	10
Gain (dBi) Max Average	17.9	17.7	17.8
	17.5	17.3	17.2
Squint Az (°)	3.4	3.0	2.9
Azimuth Beamwidth (°)	66.7	66.5	66.5
Peak Ele (°)	0.6	5.1	9.8
Elevation Beamwidth (°)	6.9	6.9	6.9
Side lobe suppression (dB)	23	22	20
Front to back ratio (-dB)	27	26	25
Isolation: Ports (dB)	>30		
Isolation: Sectors (dB)	>35		
Cross polarization (- dB)	>15	>15	>15
Return Loss (dB)	>15		

Sector 3 antenna -45° port			
Tilt (°)	0	5	10
Gain (dBi) Max Average	17.7	17.5	17.6
	17.3	17.1	16.9
Squint Az (°)	2.2	2.2	2.1
Azimuth Beamwidth (°)	66.6	66.6	66.7
Peak Ele (°)	0.7	5.4	10
Elevation Beamwidth (°)	6.9	7	7
Side lobe suppression (dB)	24	22	21
Front to back ratio (-dB)	25	26	25
Isolation: Ports (dB)	>30		
Isolation: Sectors (dB)	>35		
Cross polarization (- dB)	>15	>15	>15
Return Loss (dB)	>15		

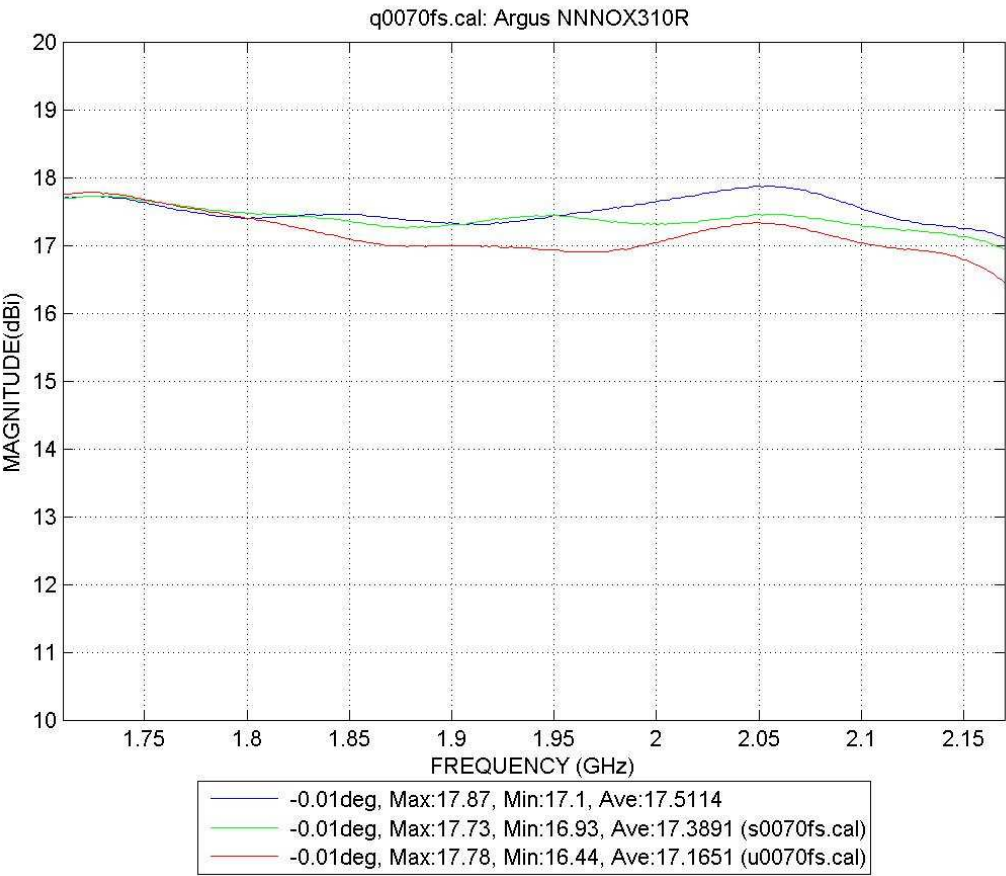
#### **4 CONCLUSION**

The antenna complied (within measurement tolerance) with the following specified values of the parameters measured and summarized in the tables above: Gain, Beamwidth, First Side lobe suppression above horizon, Cross polarization, Front-to-back ratio, VSWR and Isolation.

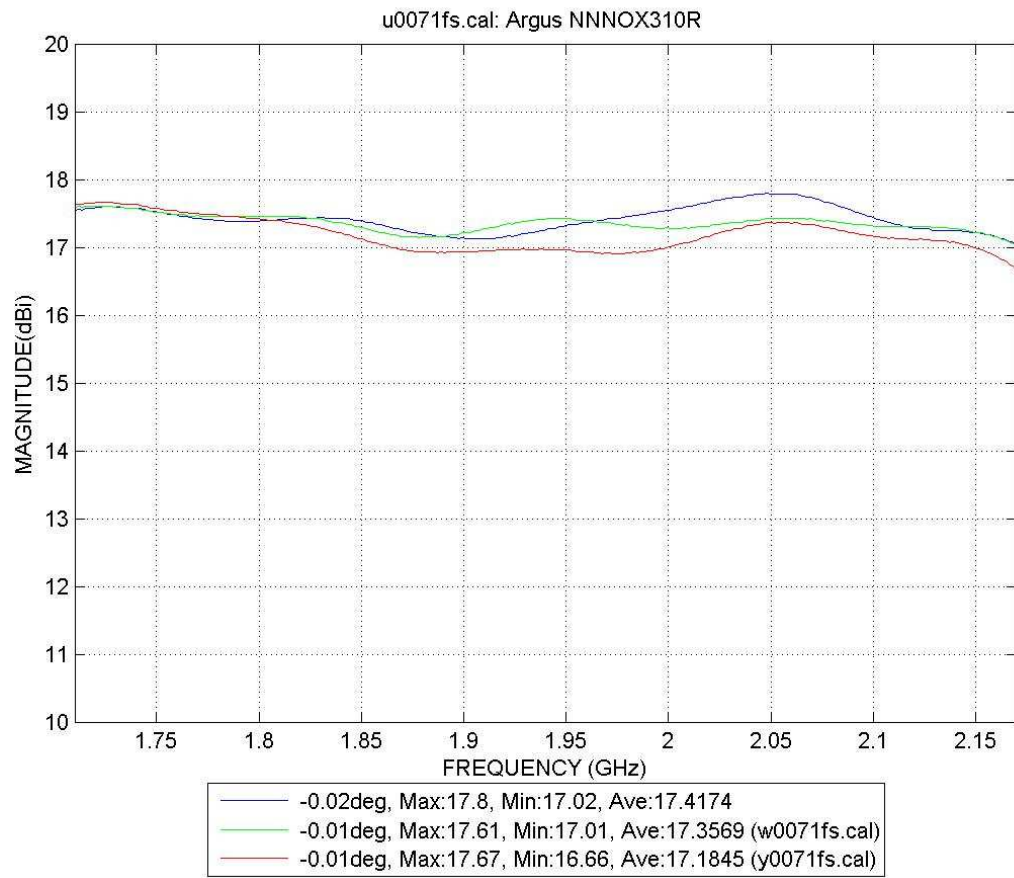
Sector 1 antenna: Gain for +45° port at 0°, 5° and 10° tilt.



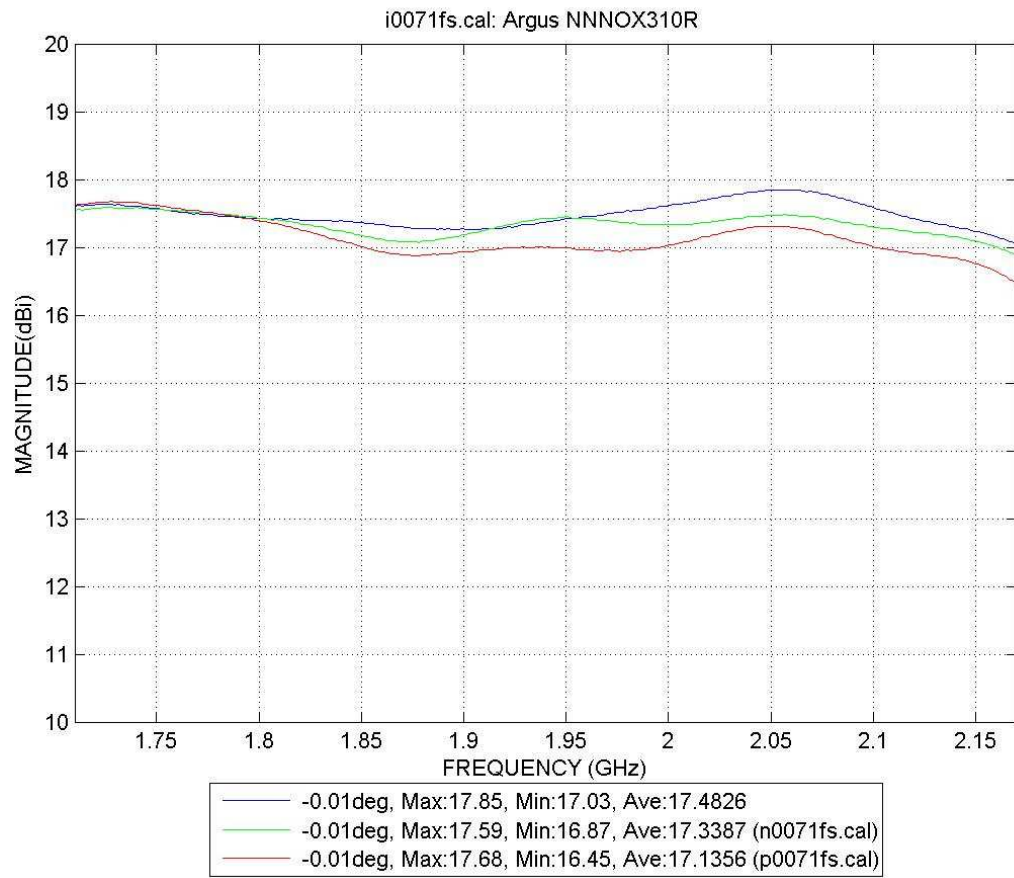
Sector 1 antenna: Gain for -45° port at 0°, 5° and 10° tilt.



Sector 2 antenna: Gain for +45° port at 0°, 5° and 10° tilt.



Sector 2 antenna: Gain for -45° port at 0°, 5° and 10° tilt.

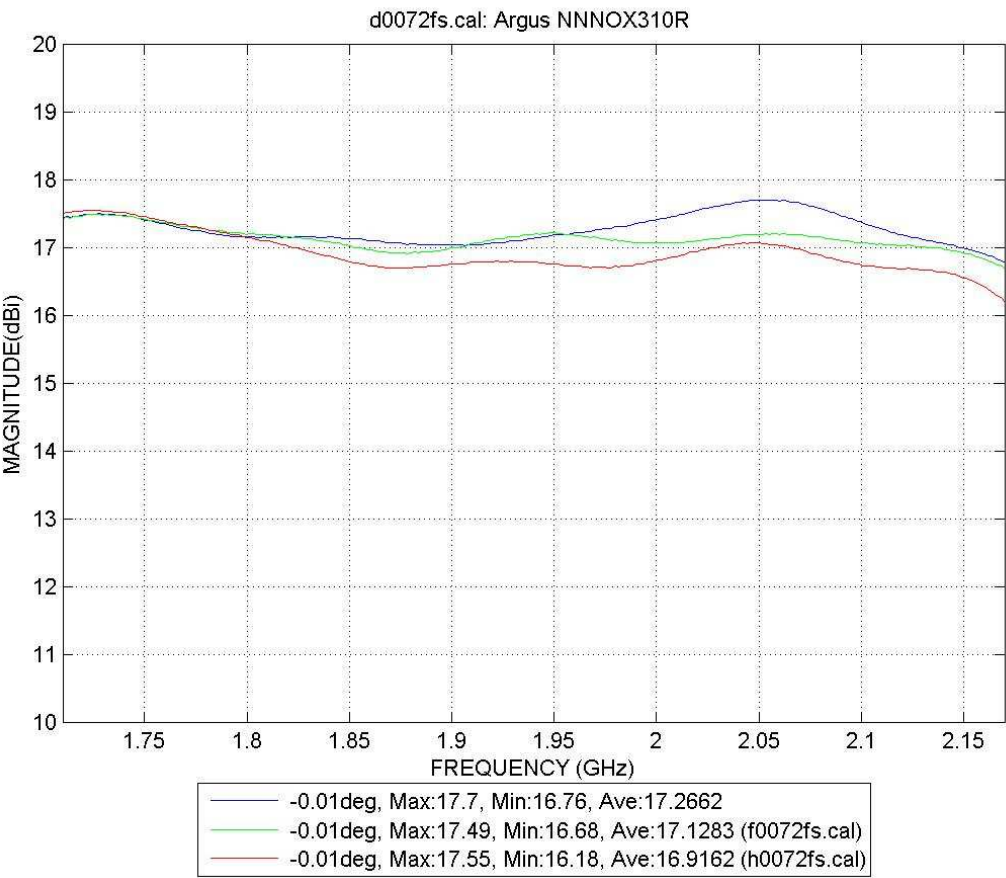


Sector 3 antenna: Gain for +45° port at 0°, 5° and 10° tilt.

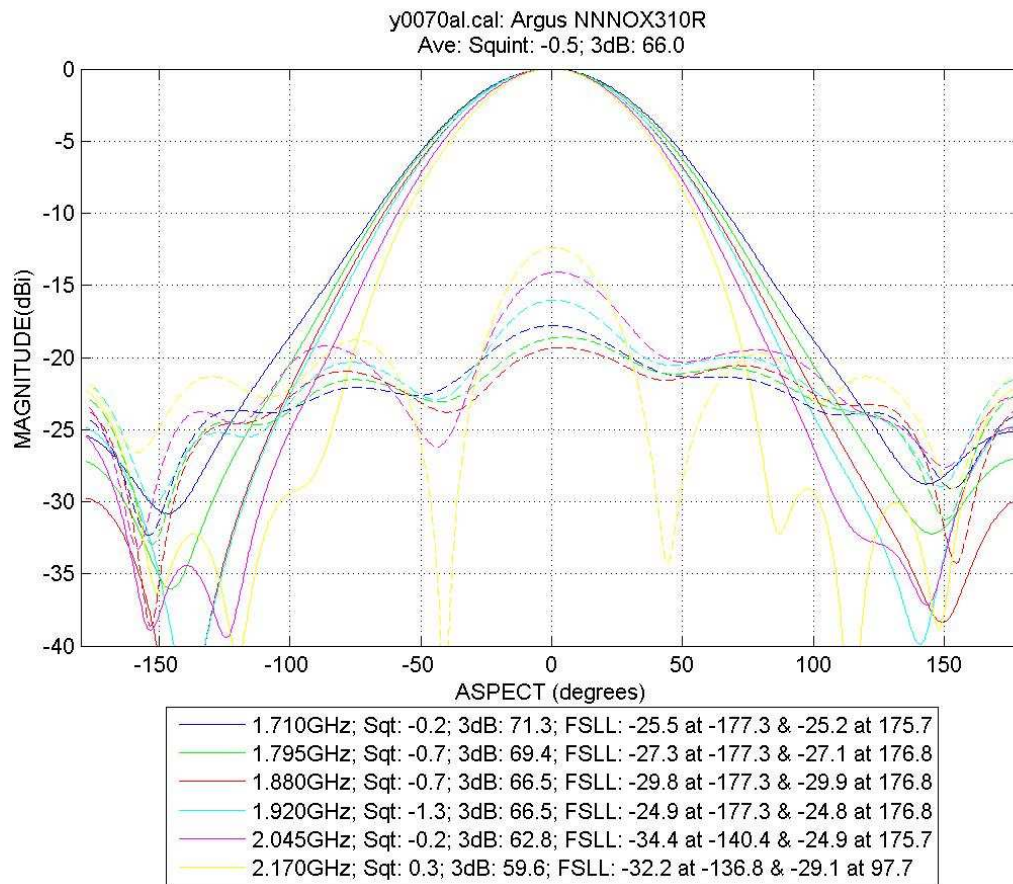




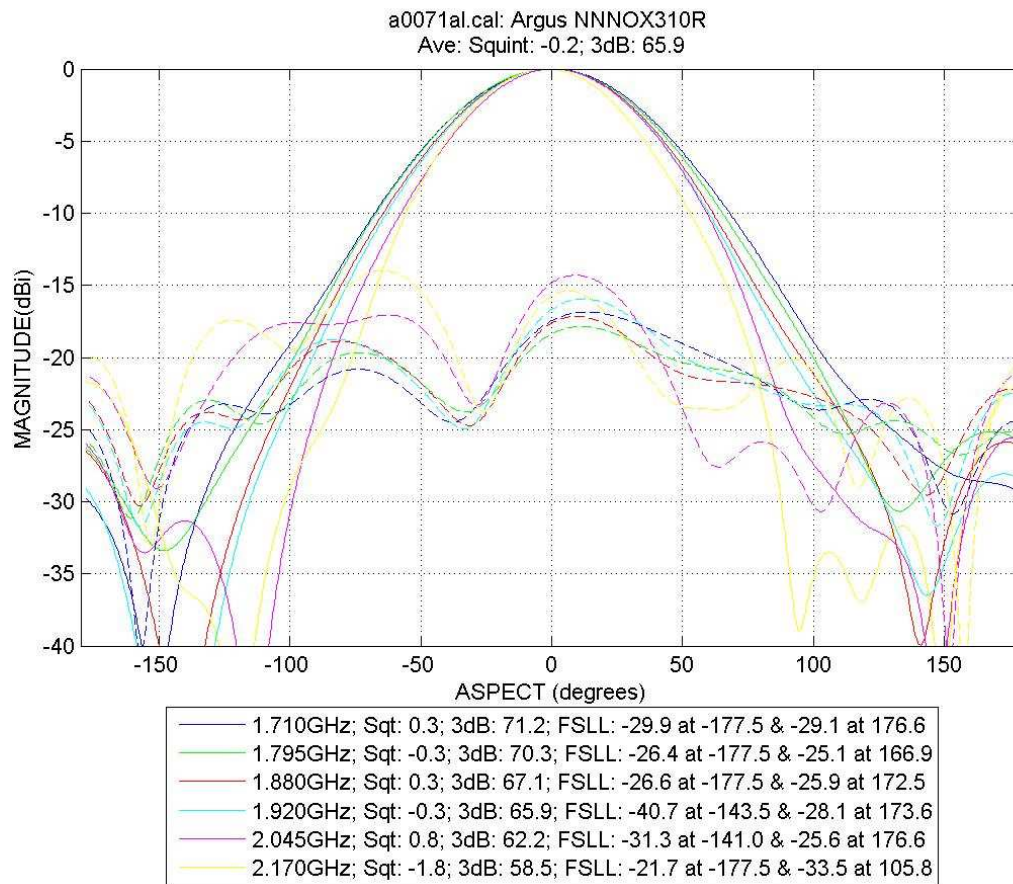
Sector 3 antenna: Gain for -45° port at 0°, 5° and 10° tilt.



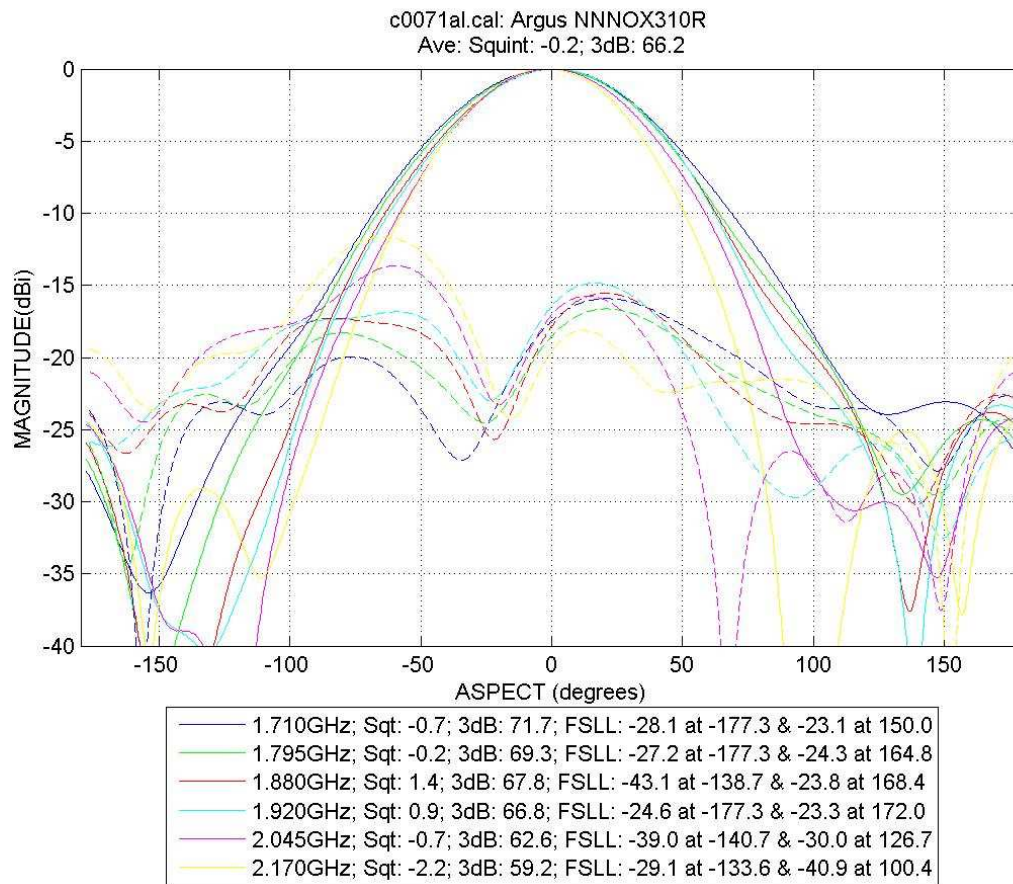
Sector 1 antenna: Azimuth co- and x-polarization patterns for +45° port at 0° tilt.



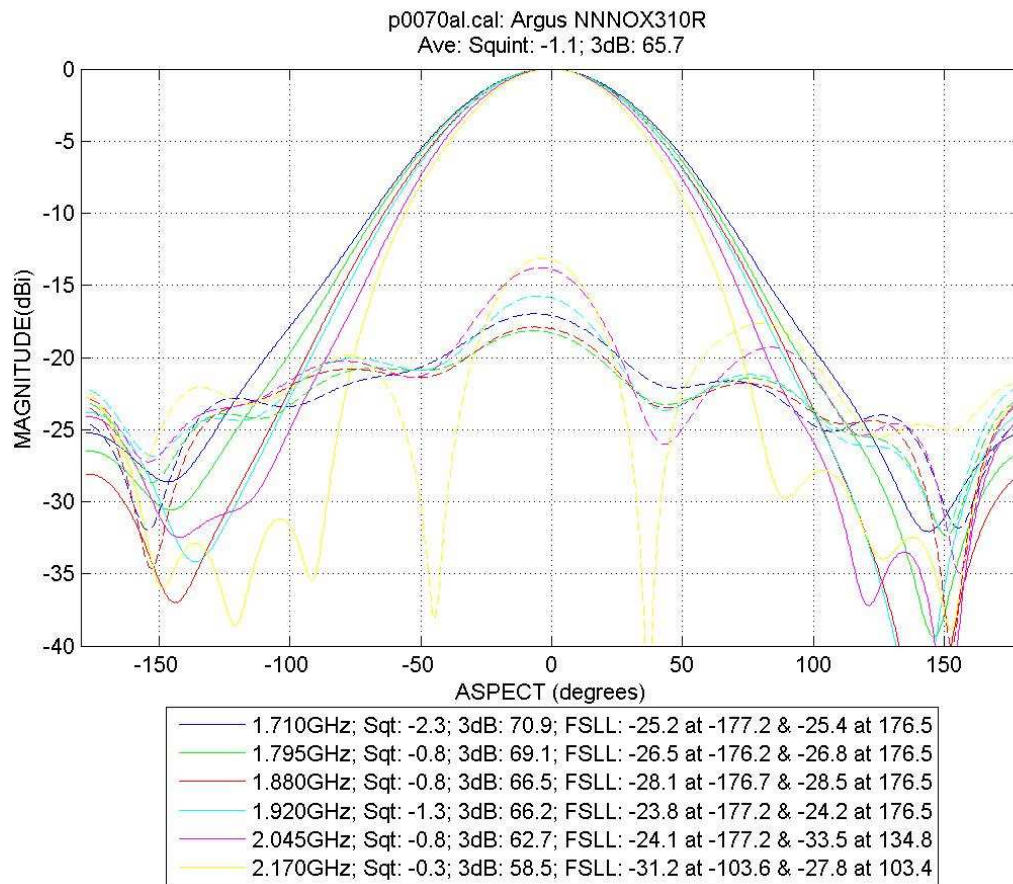
Sector 1 antenna: Azimuth co- and x-polarization patterns for +45° port at 5° tilt.



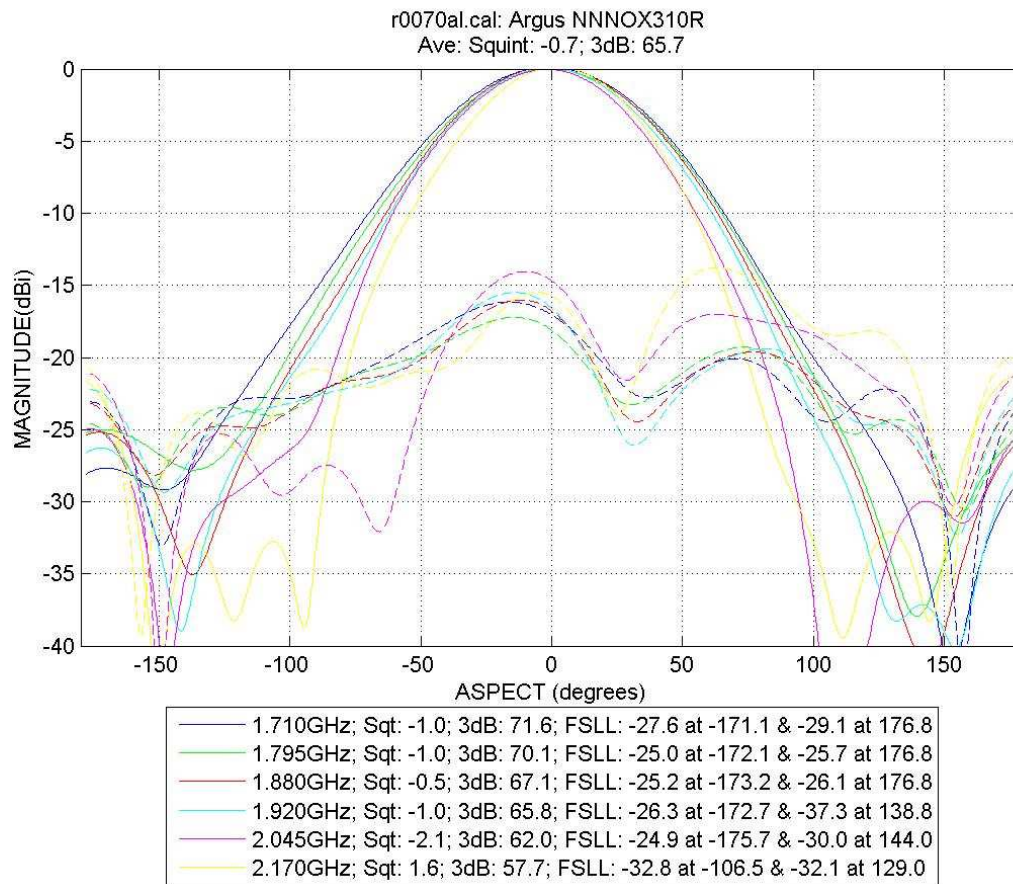
Sector 1 antenna: Azimuth co- and x-polarization patterns for +45° port at 10° tilt.



Sector 1 antenna: Azimuth co- and x-polarization patterns for -45° port at 0° tilt.

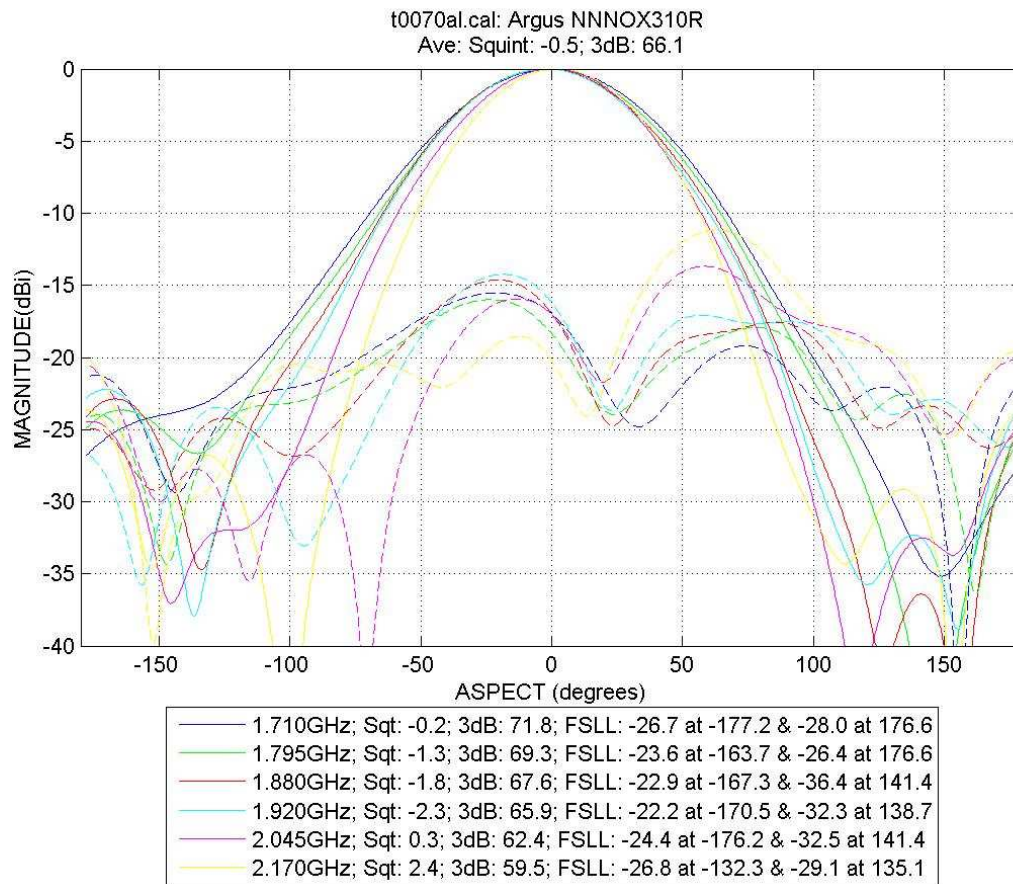


Sector 1 antenna: Azimuth co- and x-polarization patterns for -45° port at 5° tilt.

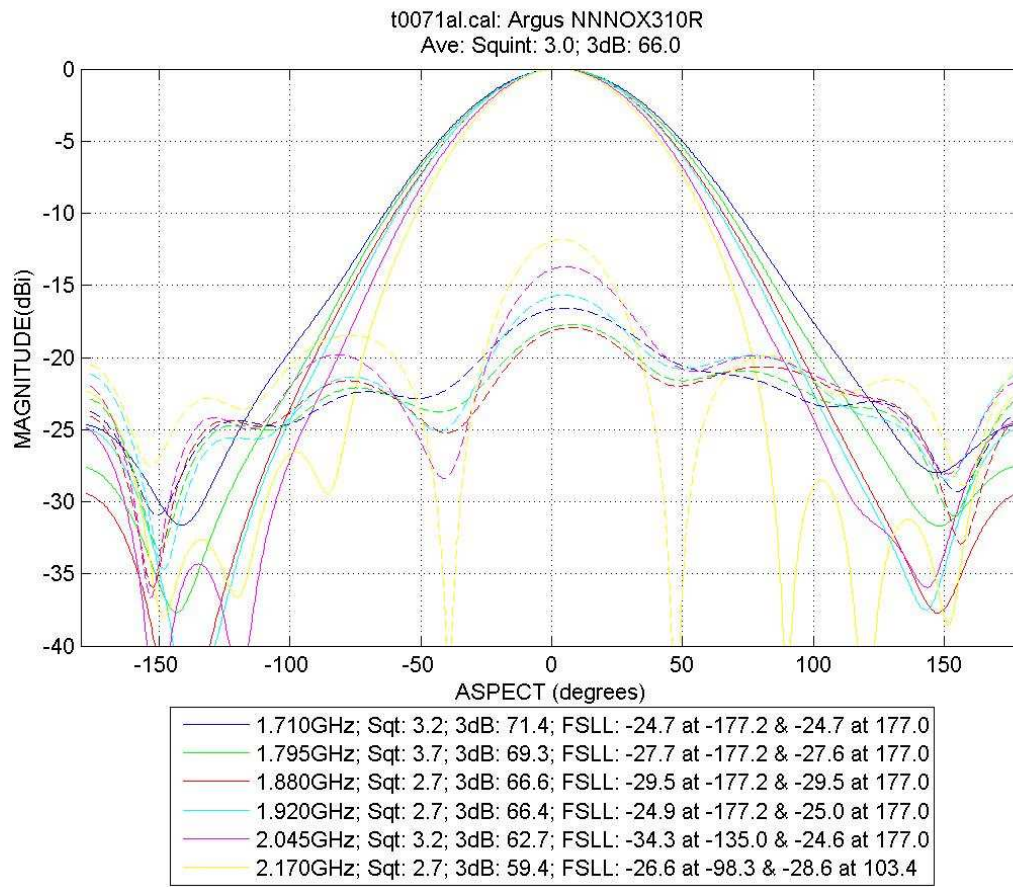




Sector 1 antenna: Azimuth co- and x-polarization patterns for -45° port at 10° tilt.

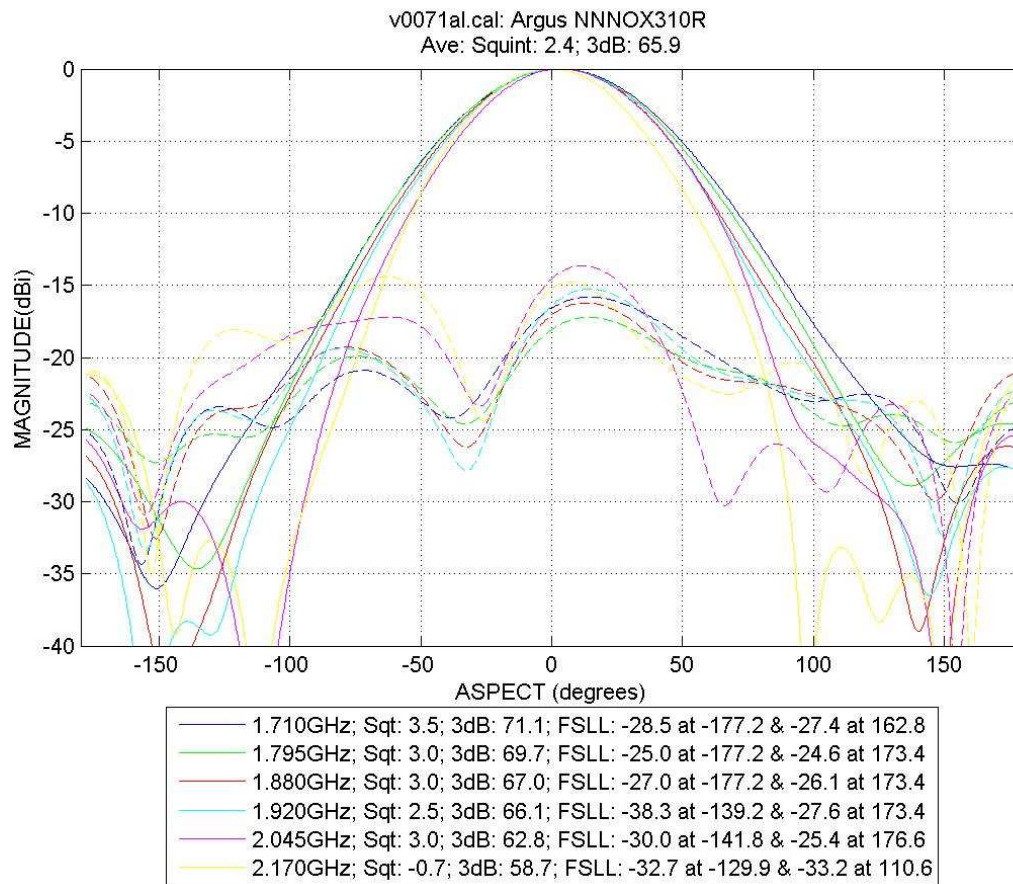


Sector 2 antenna: Azimuth co- and x-polarization patterns for +45° port at 0° tilt.

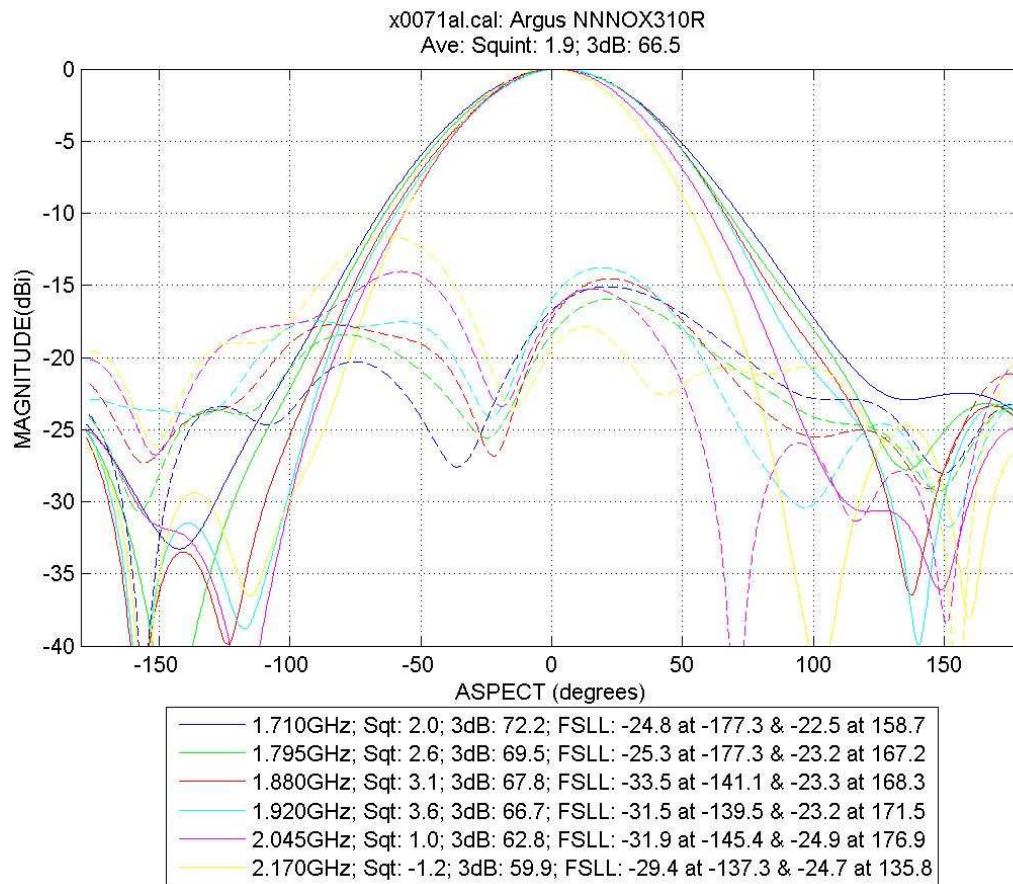




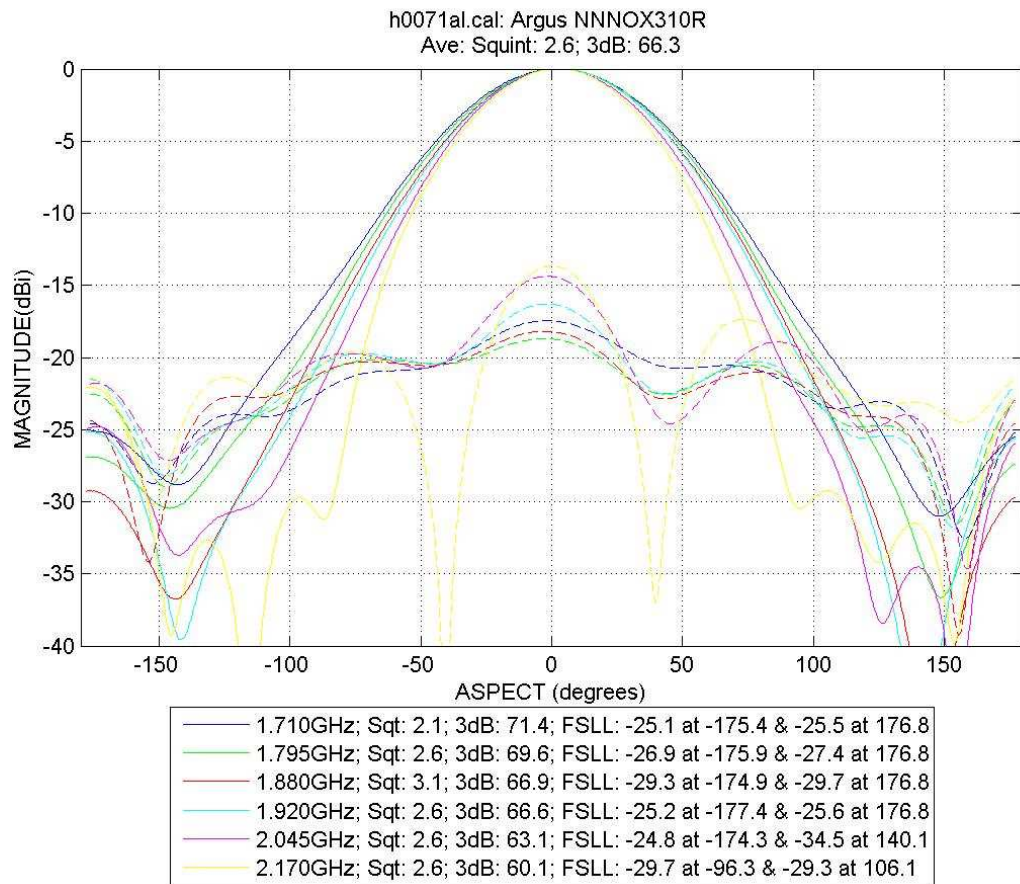
Sector 2 antenna: Azimuth co- and x-polarization patterns for +45° port at 5° tilt.



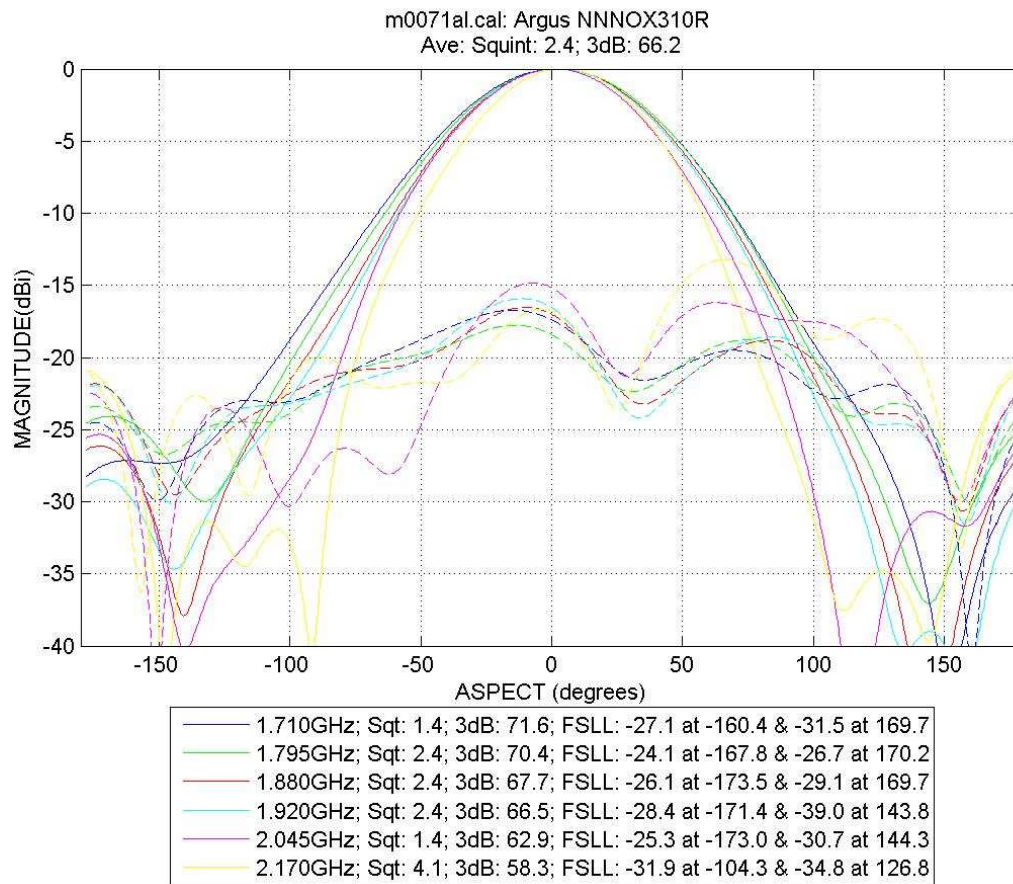
Sector 2 antenna: Azimuth co- and x-polarization patterns for +45° port at 10° tilt.



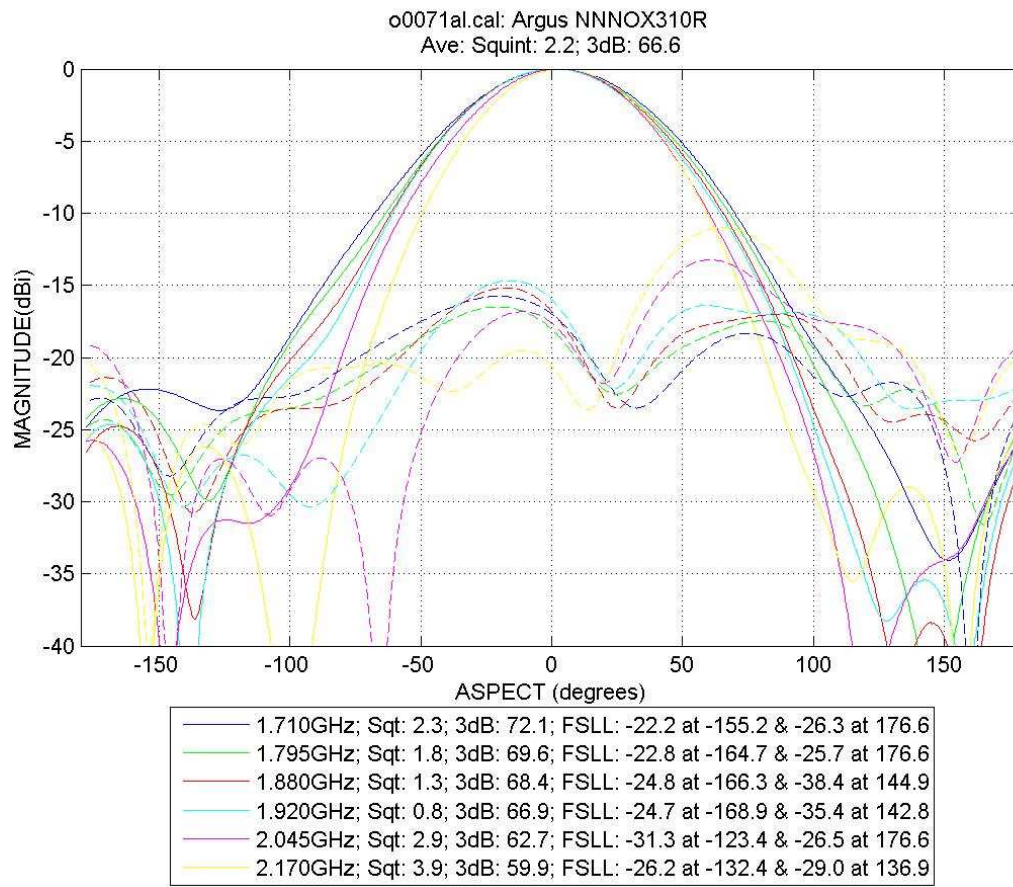
Sector 2 antenna: Azimuth co- and x-polarization patterns for -45° port at 0° tilt.



Sector 2 antenna: Azimuth co- and x-polarization patterns for -45° port at 5° tilt.

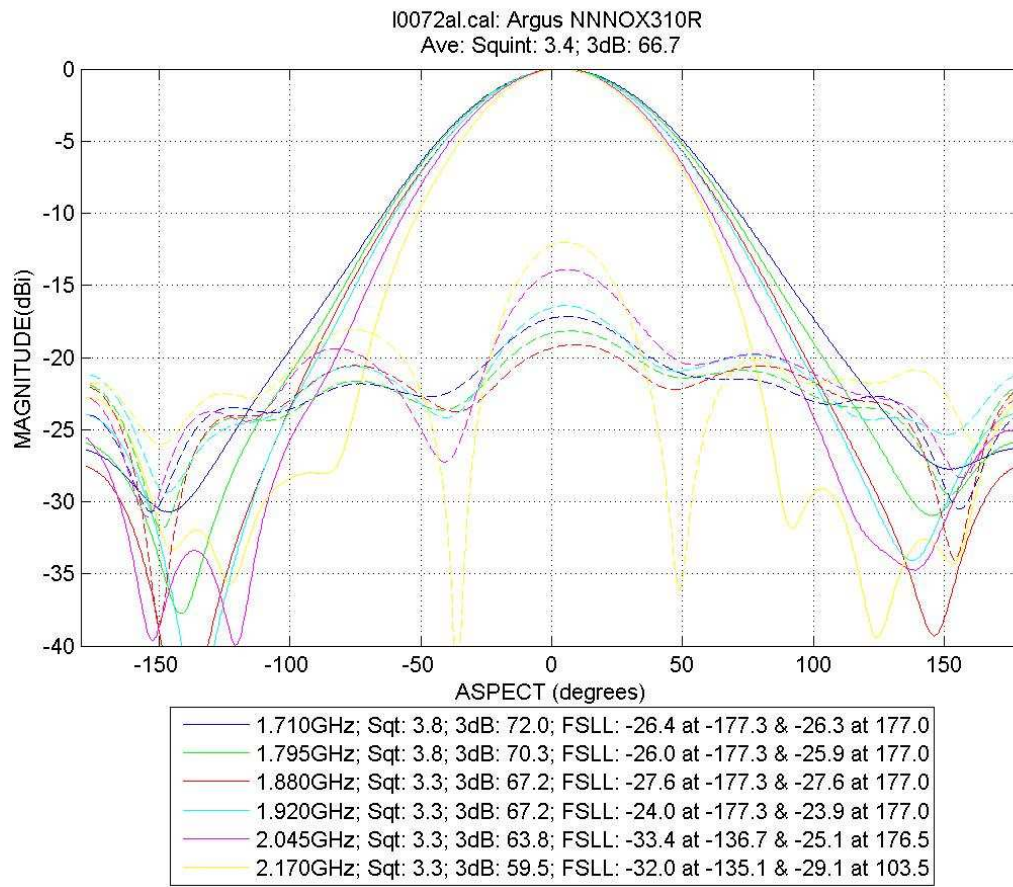


Sector 2 antenna: Azimuth co- and x-polarization patterns for -45° port at 10° tilt.

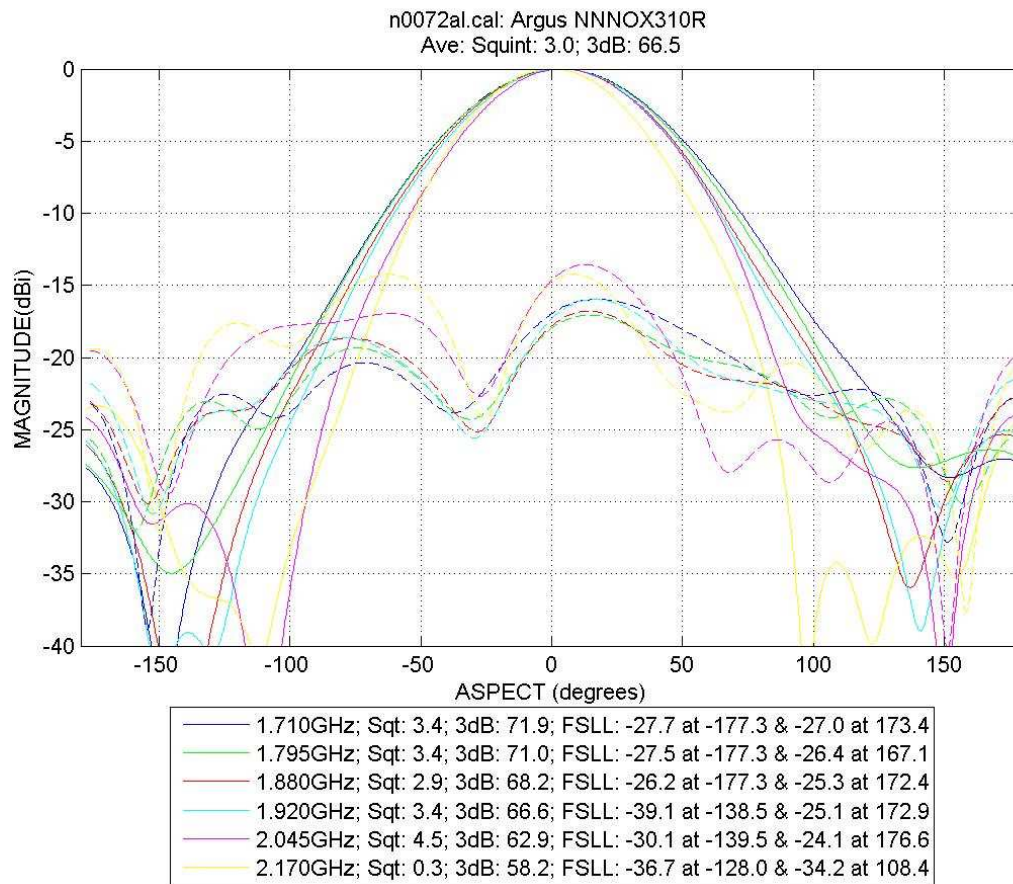




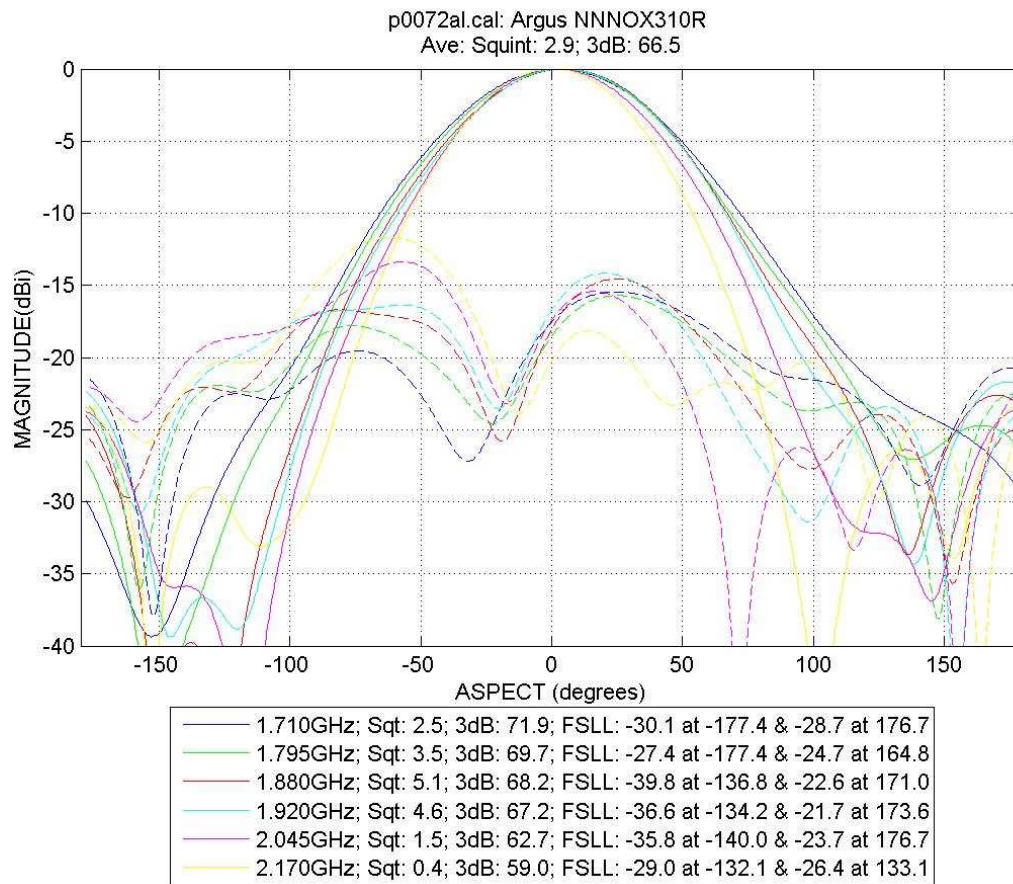
Sector 3 antenna: Azimuth co- and x-polarization patterns for +45° port at 0° tilt.



Sector 3 antenna: Azimuth co- and x-polarization patterns for +45° port at 5° tilt.

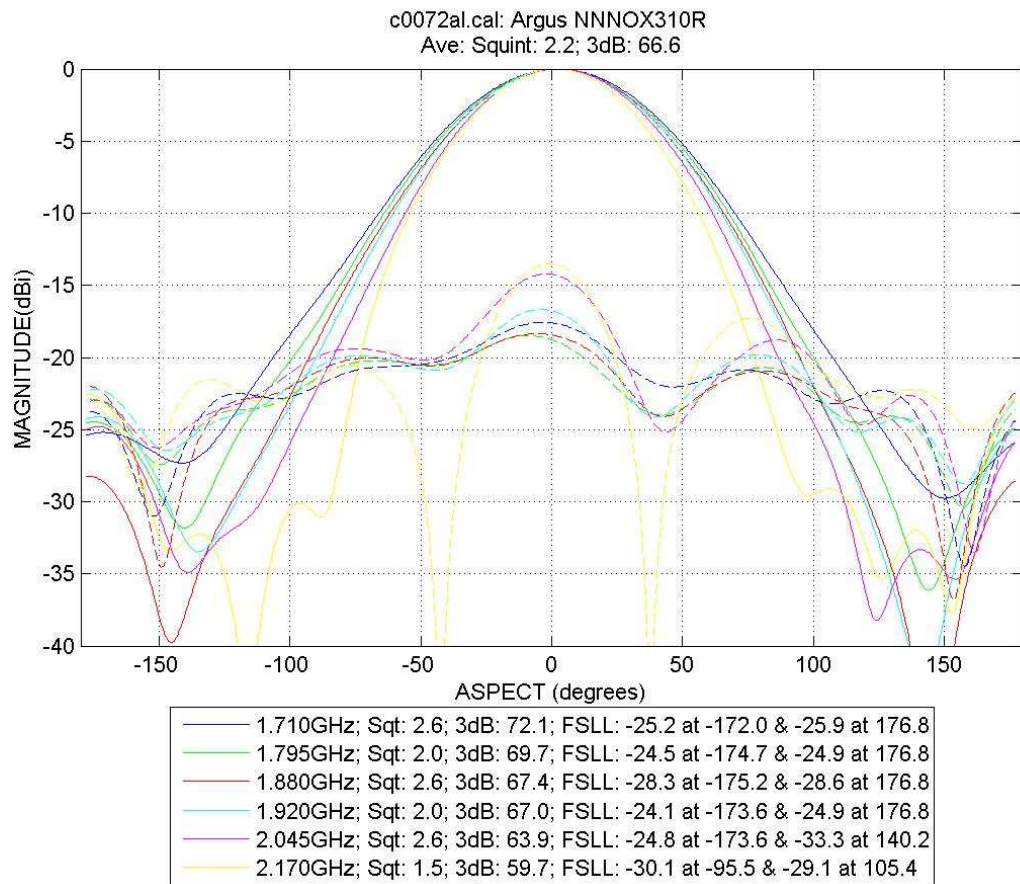


Sector 3 antenna: Azimuth co- and x-polarization patterns for +45° port at 10° tilt.

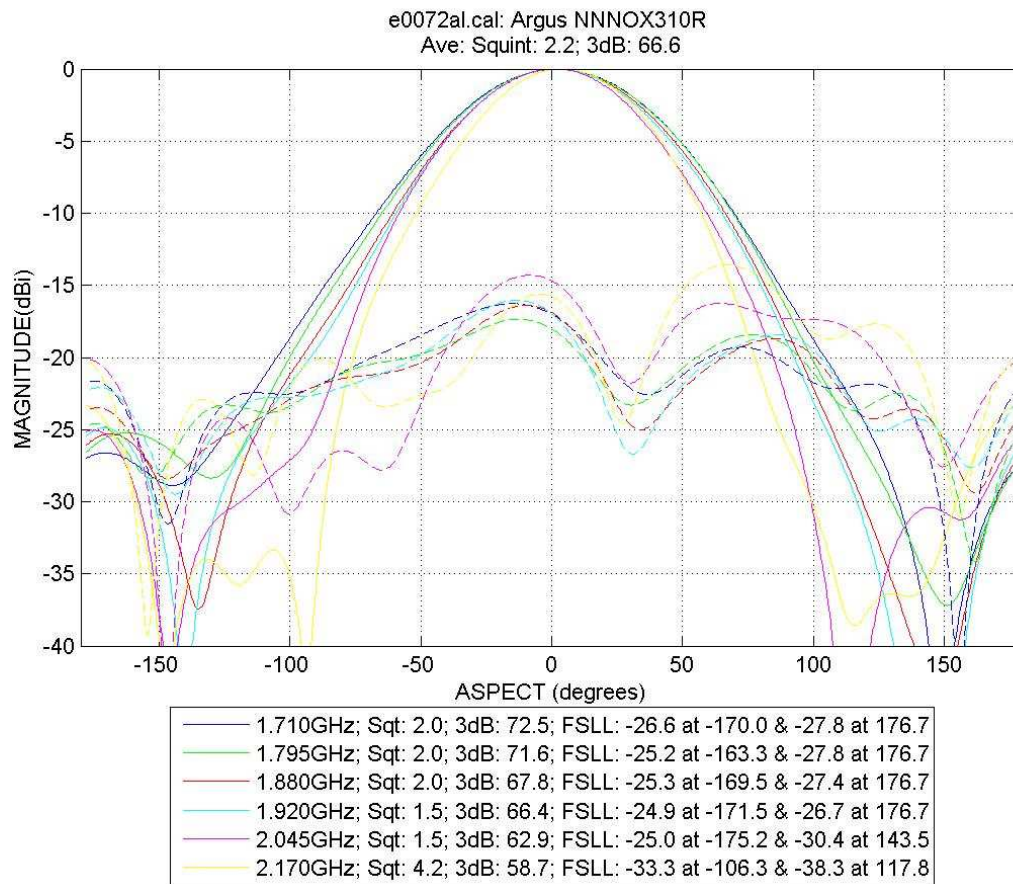




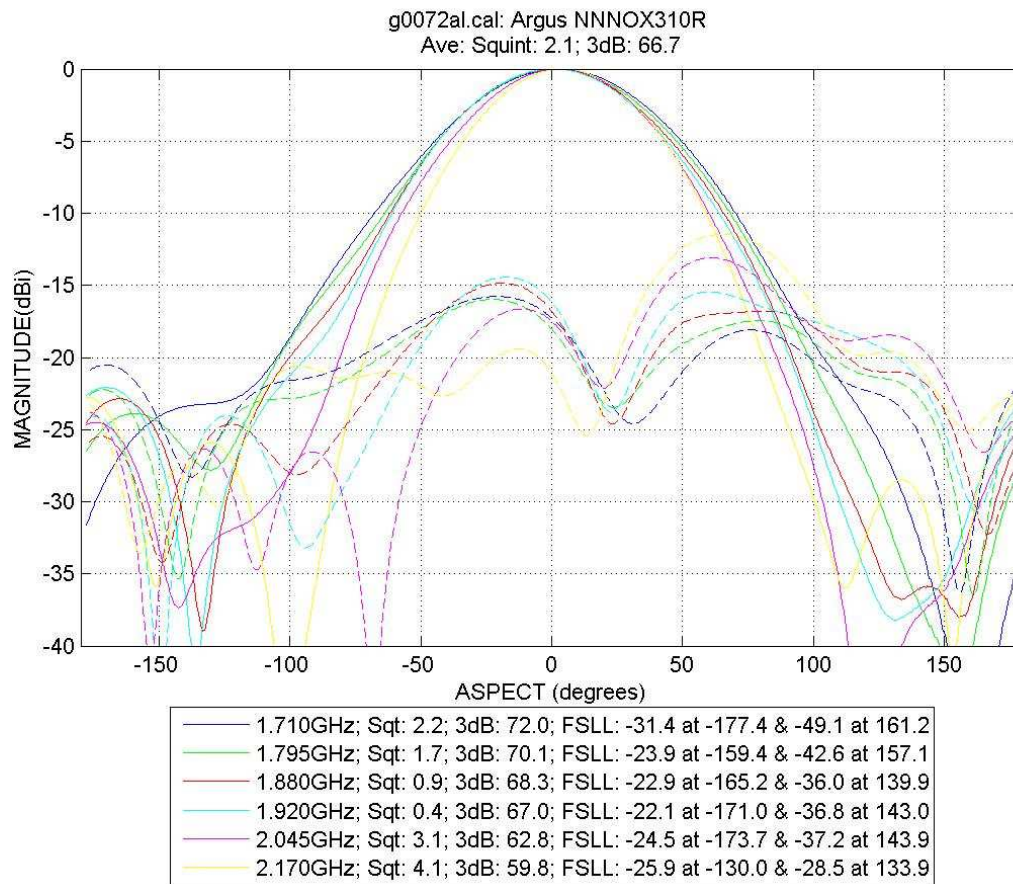
Sector 3 antenna: Azimuth co- and x-polarization patterns for -45° port at 0° tilt.



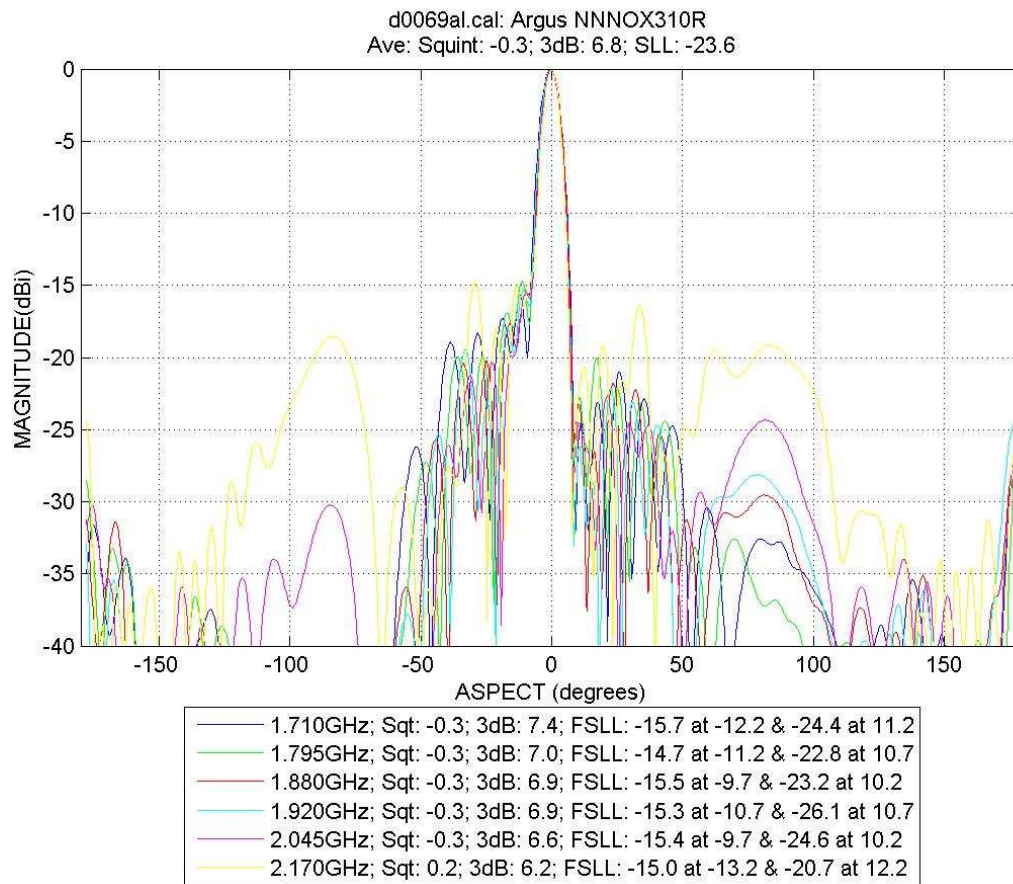
Sector 3 antenna: Azimuth co- and x-polarization patterns for -45° port at 5° tilt.



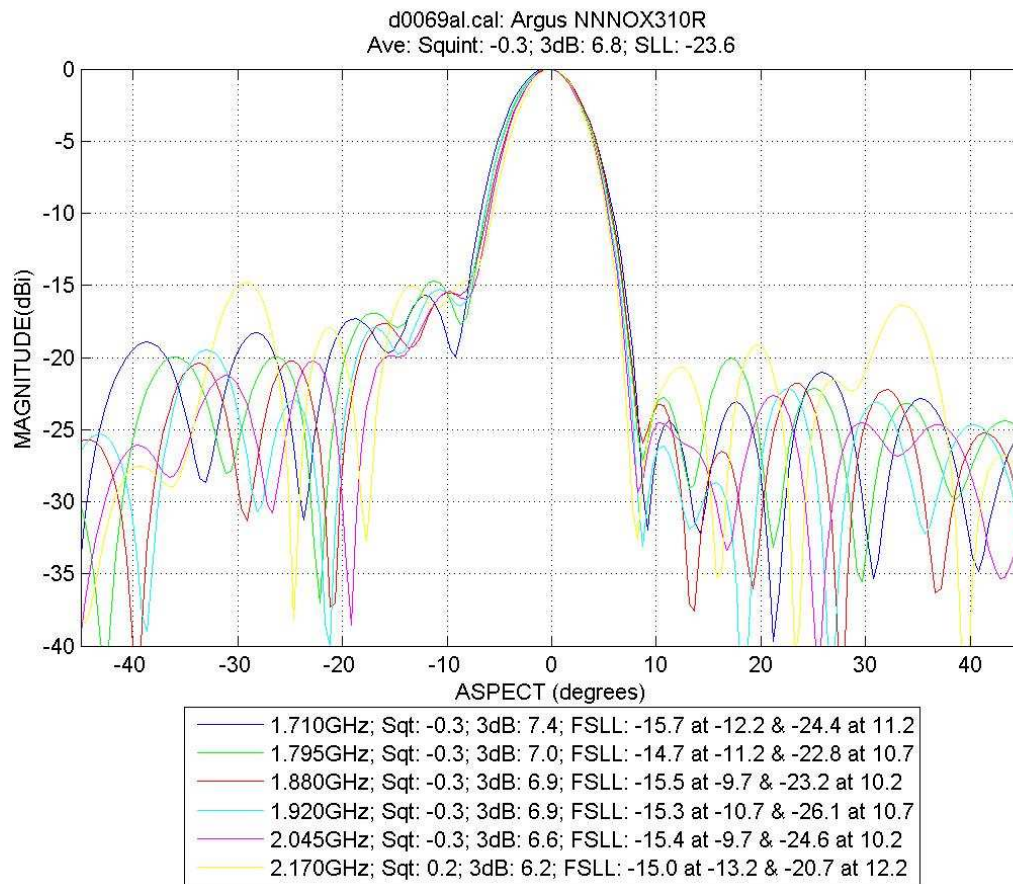
Sector 3 antenna: Azimuth co- and x-polarization patterns for -45° port at 10° tilt.



Sector 1 antenna: Elevation co-polarization patterns for +45° port at 0° tilt.

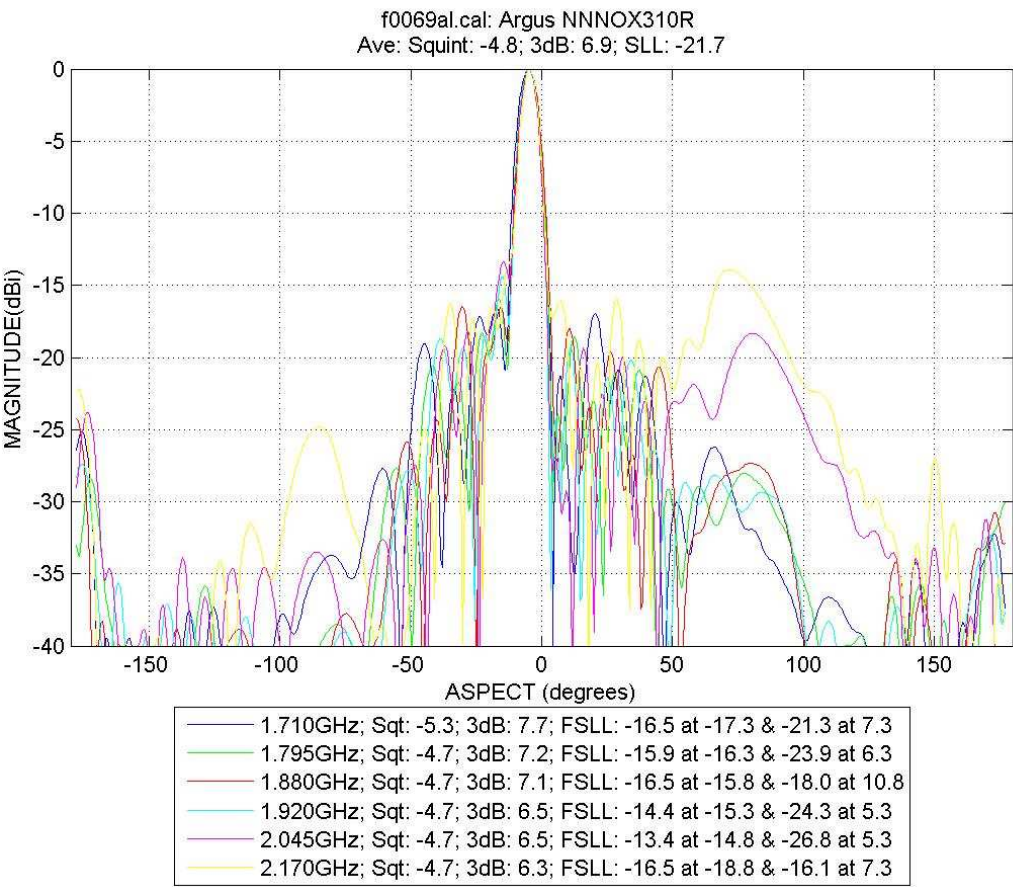


Sector 1 antenna: Elevation co-polarization patterns for +45° port at 0° tilt.

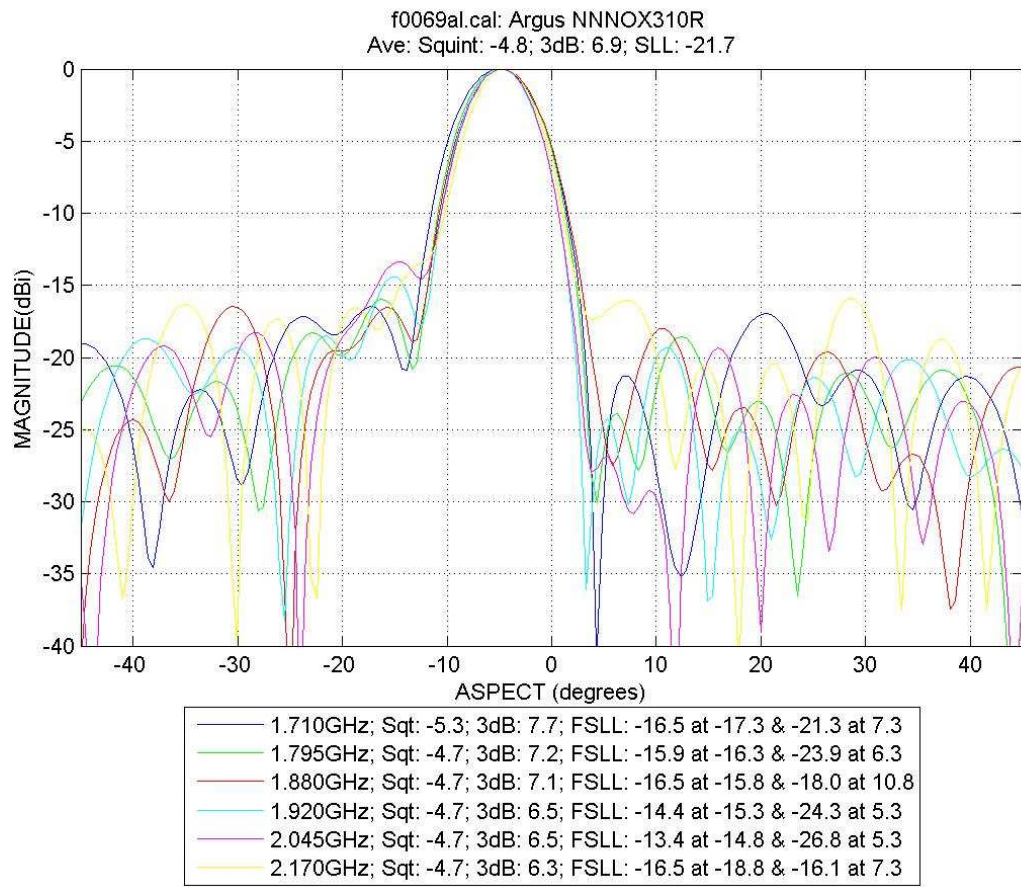




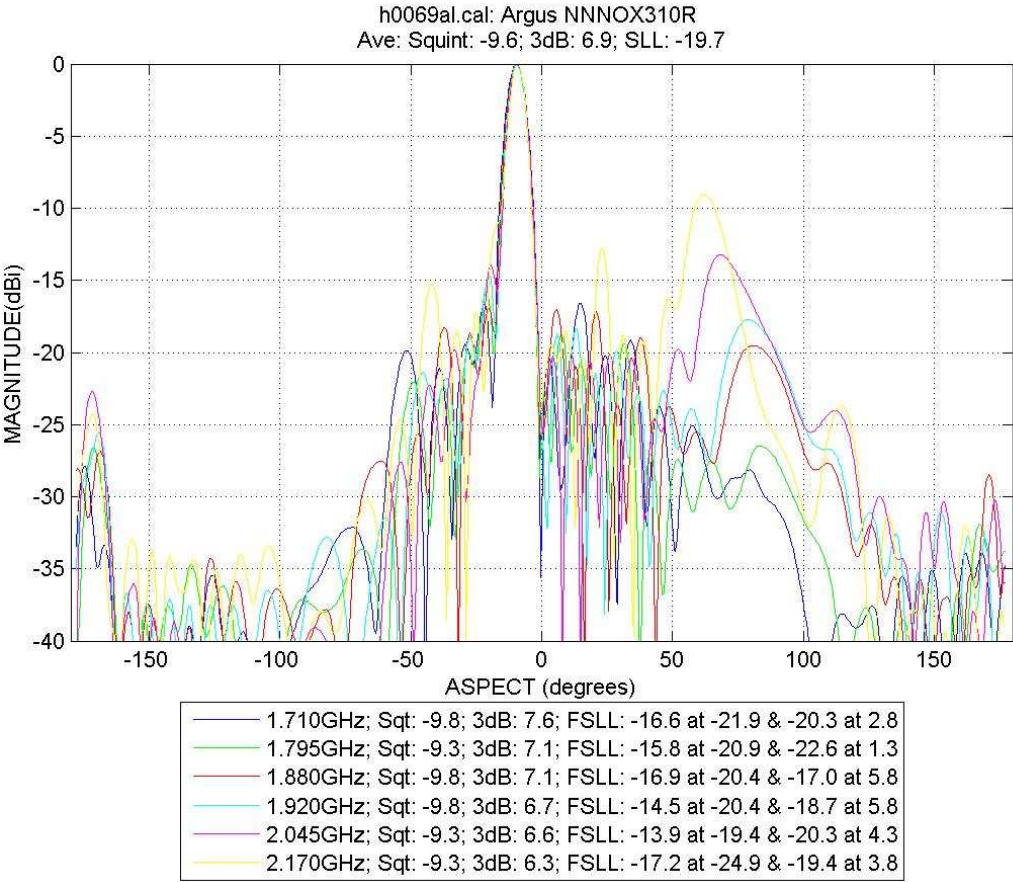
Sector 1 antenna : Elevation co-polarization patterns for +45° port at 5° tilt.



Sector 1 antenna: Elevation co-polarization patterns for +45° port at 5° tilt.

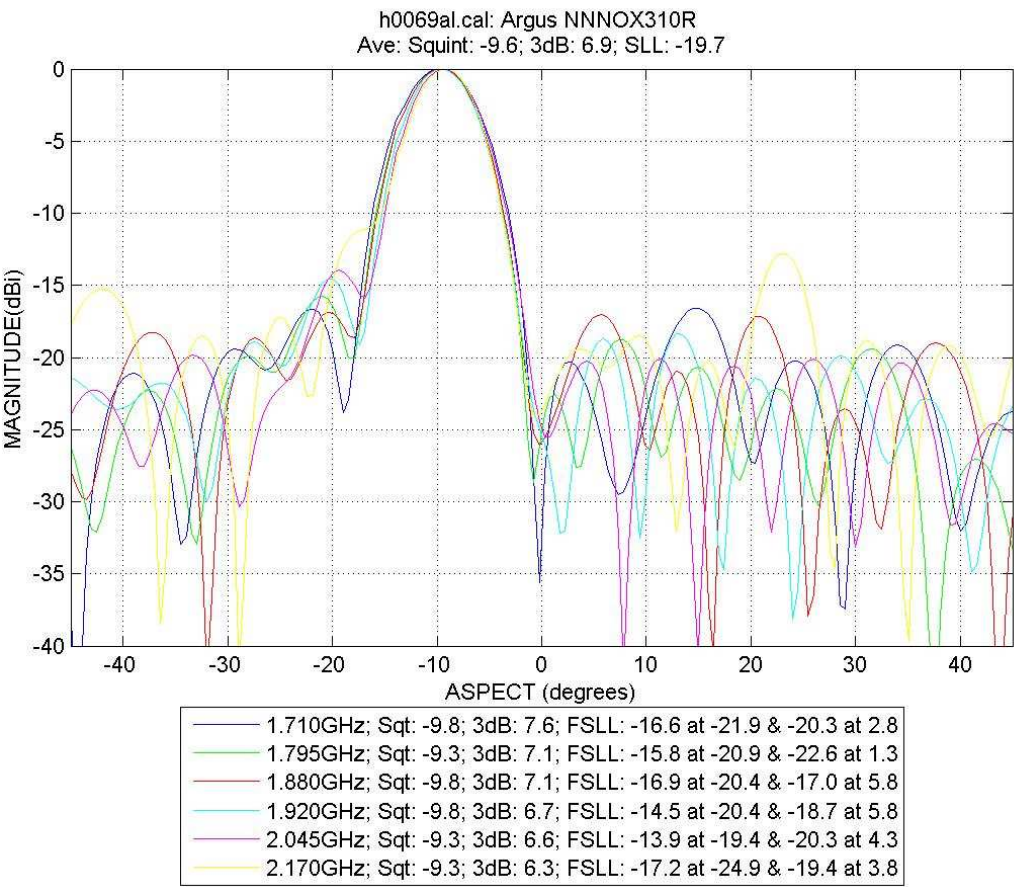


Sector 1 antenna: Elevation co-polarization patterns for +45° port at 10° tilt.

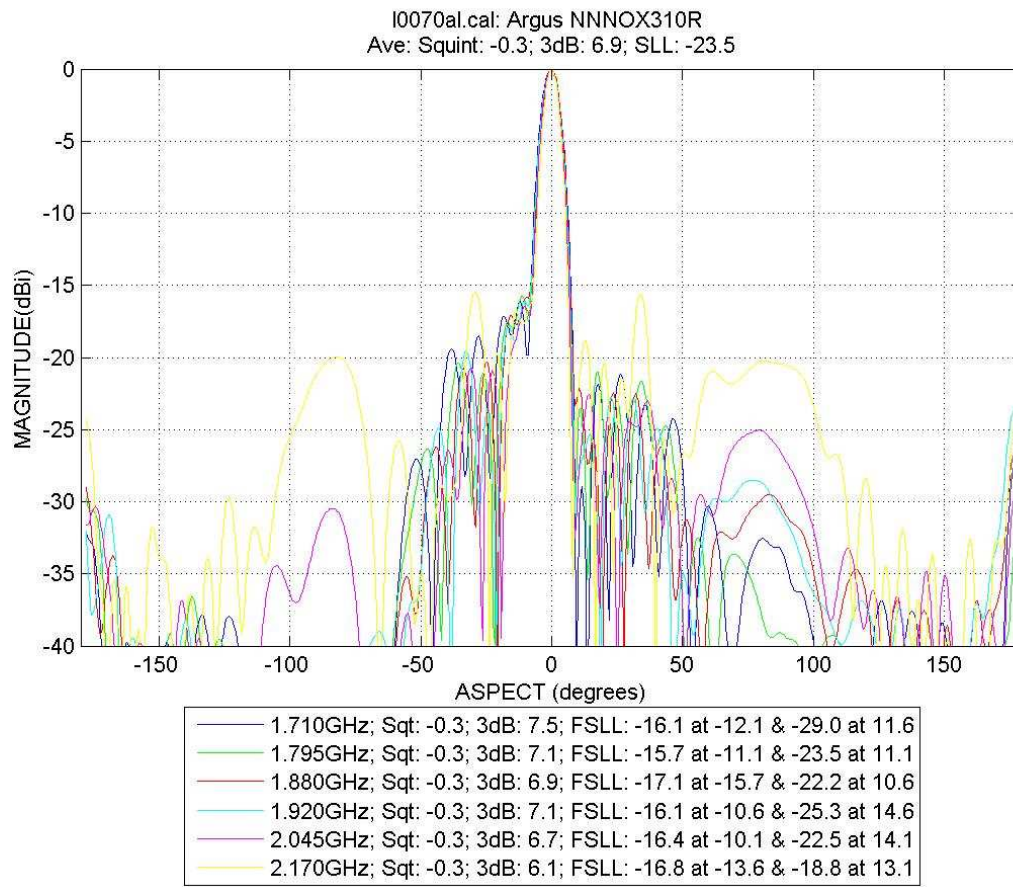




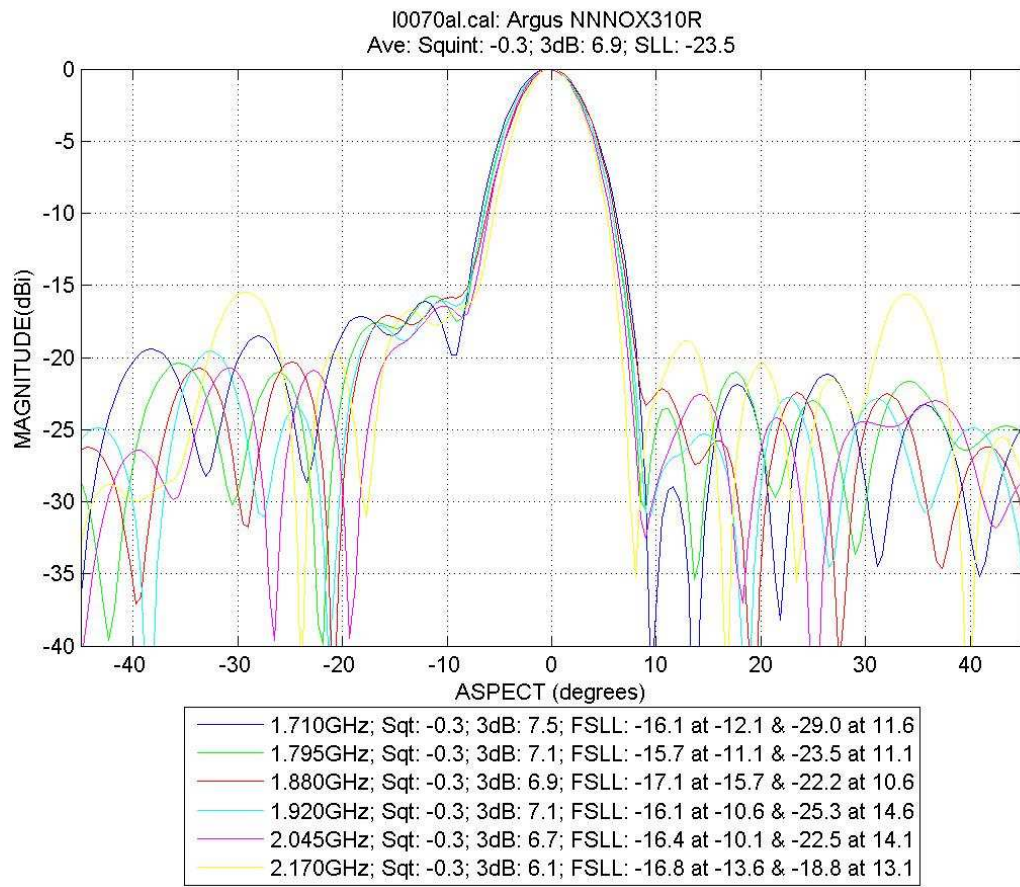
Sector 1 antenna: Elevation co-polarization patterns for +45° port at 10° tilt.



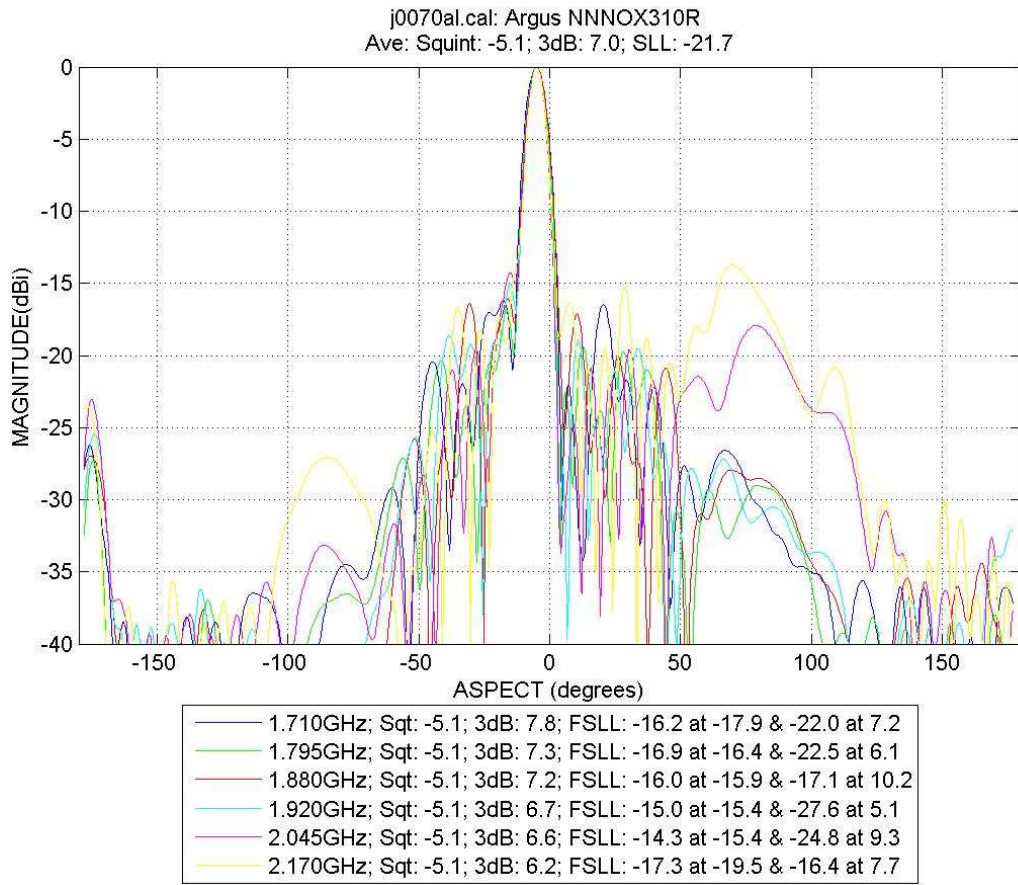
Sector 1 antenna: Elevation co-polarization patterns for -45° port at 0° tilt.



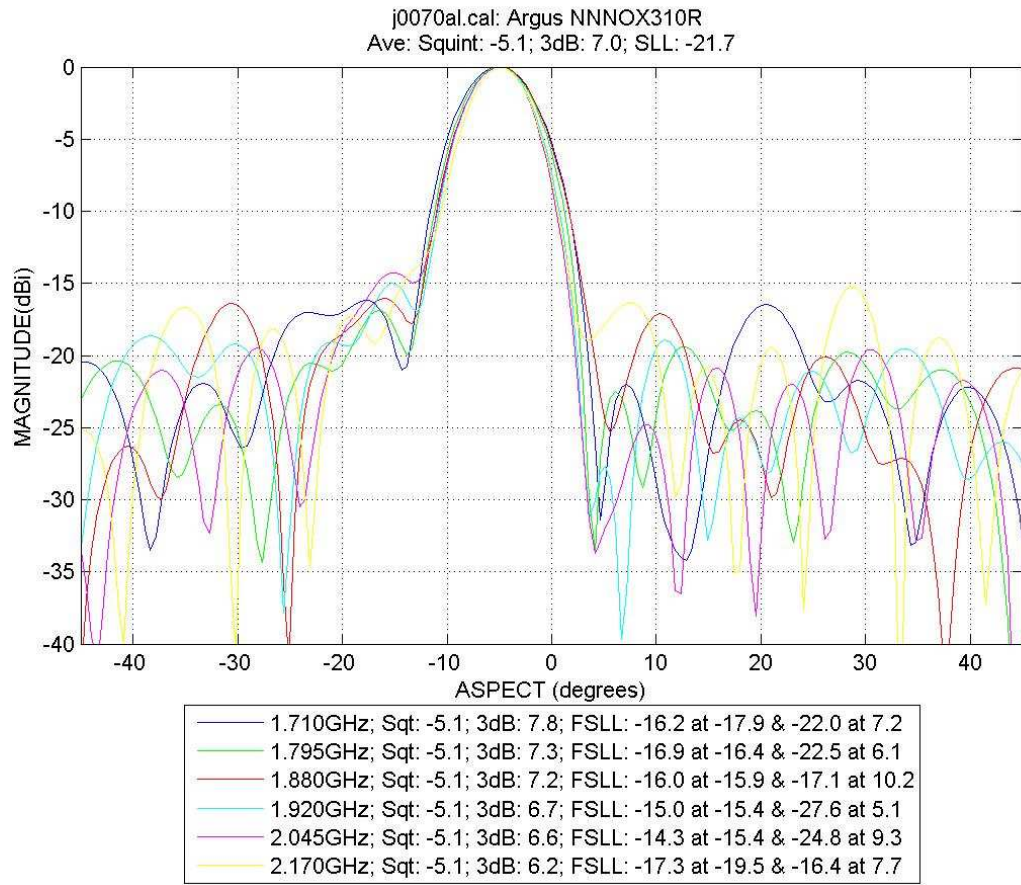
Sector 1 antenna: Elevation co-polarization patterns for -45° port at 0° tilt.



Sector 1 antenna: Elevation co-polarization patterns for -45° port at 5° tilt.

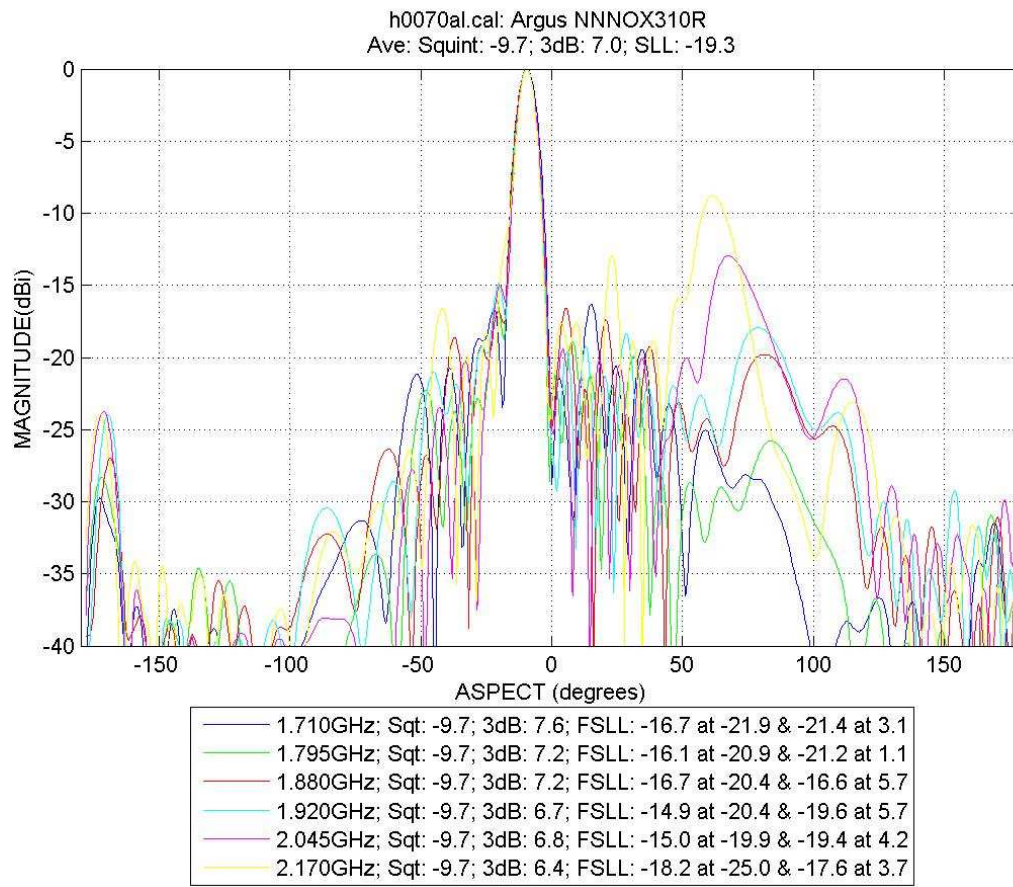


Sector 1 antenna: Elevation co-polarization patterns for -45° port at 5° tilt.

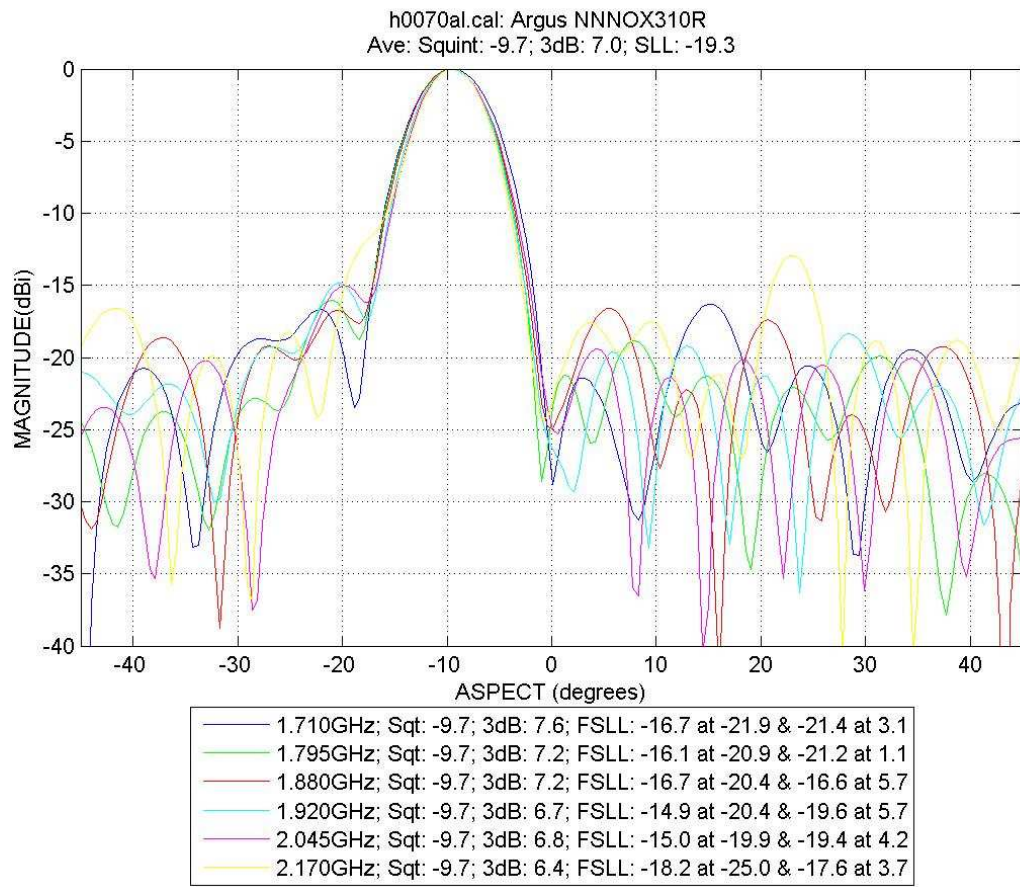




Sector 1 antenna: Elevation co-polarization patterns for -45° port at 10° tilt.



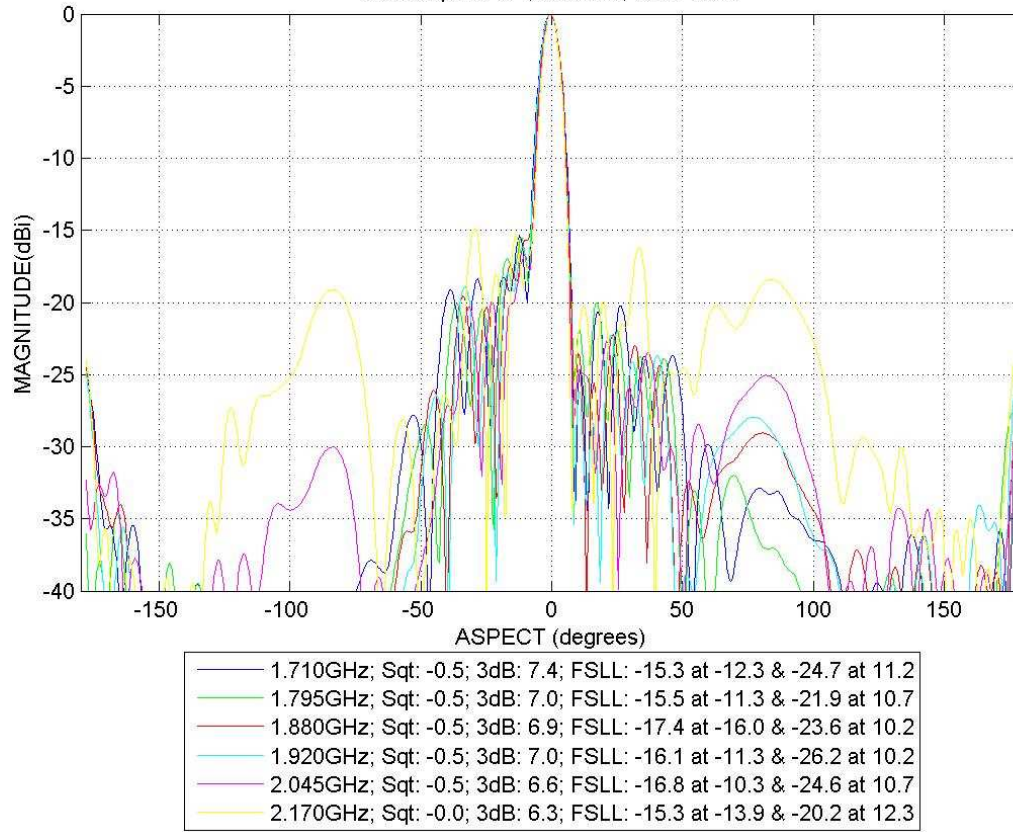
Sector 1 antenna: Elevation co-polarization patterns for -45° port at 10° tilt.



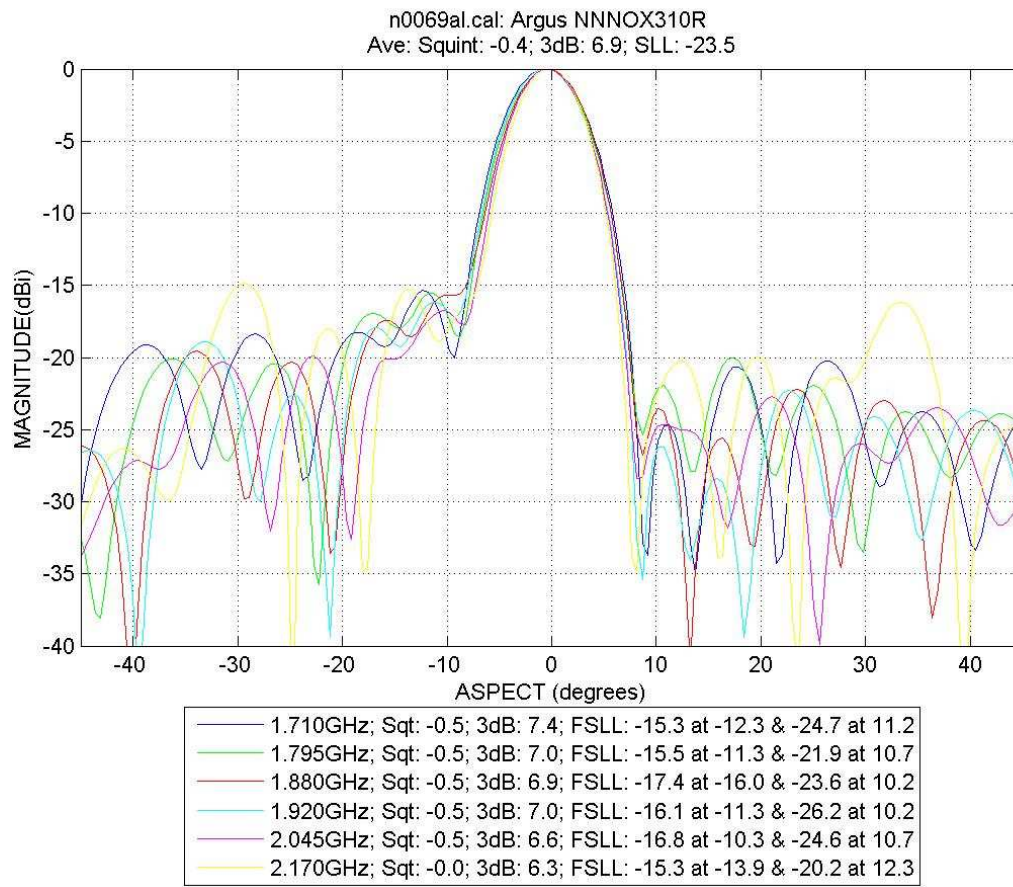


Sector 2 antenna: Elevation co-polarization patterns for +45° port at 0° tilt.

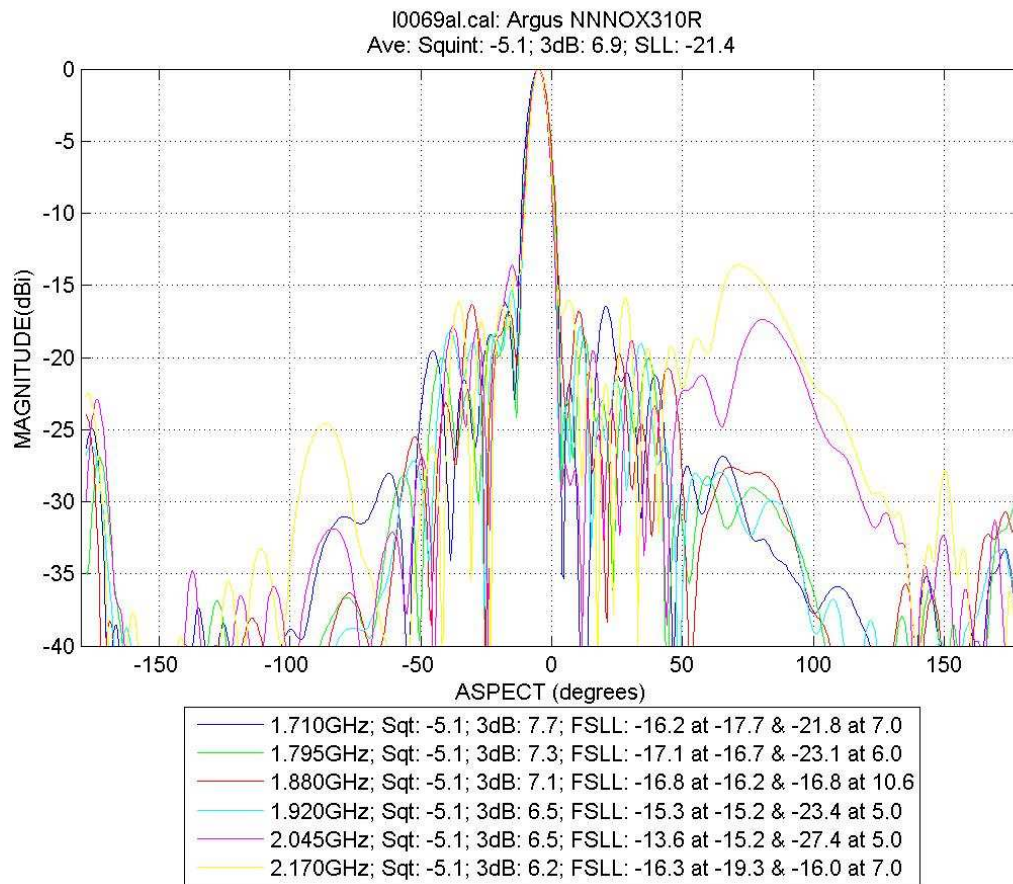
n0069a1.cal: Argus NNNOX310R  
Ave: Squint: -0.4; 3dB: 6.9; SLL: -23.5



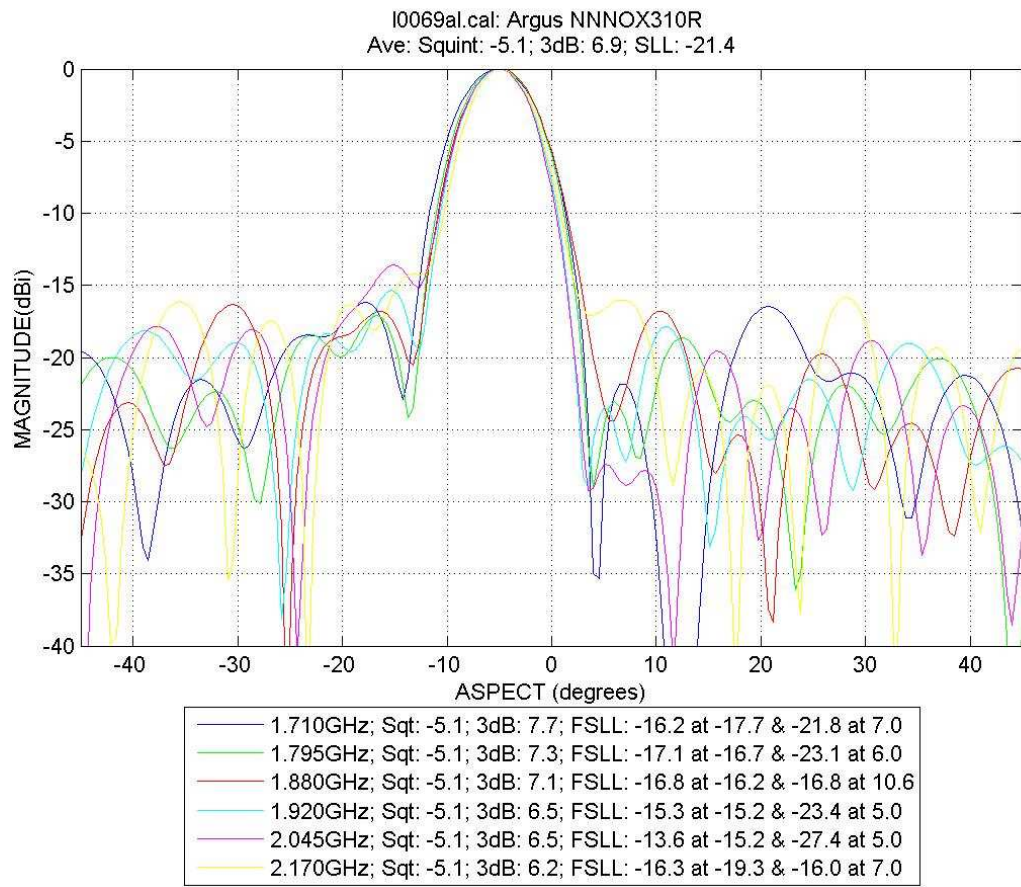
Sector 2 antenna: Elevation co-polarization patterns for +45° port at 0° tilt.



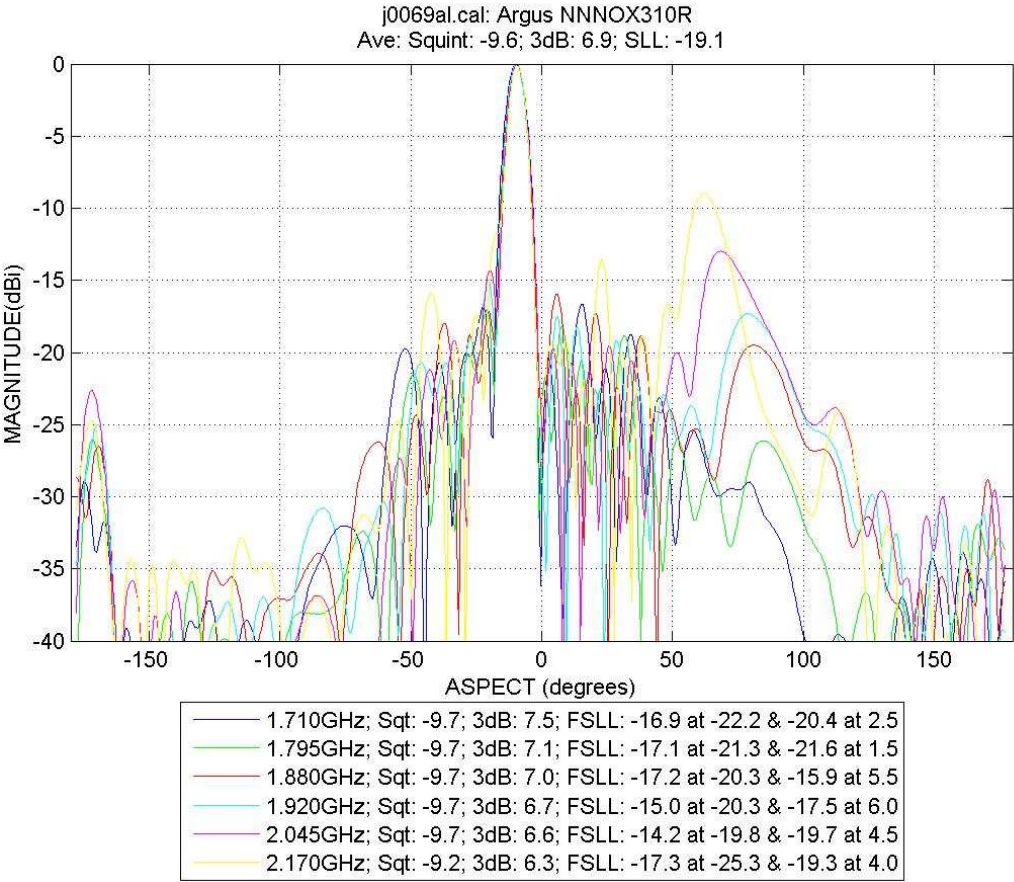
Sector 2 antenna: Elevation co-polarization patterns for +45° port at 5° tilt.



Sector 2 antenna: Elevation co-polarization patterns for +45° port at 5° tilt.

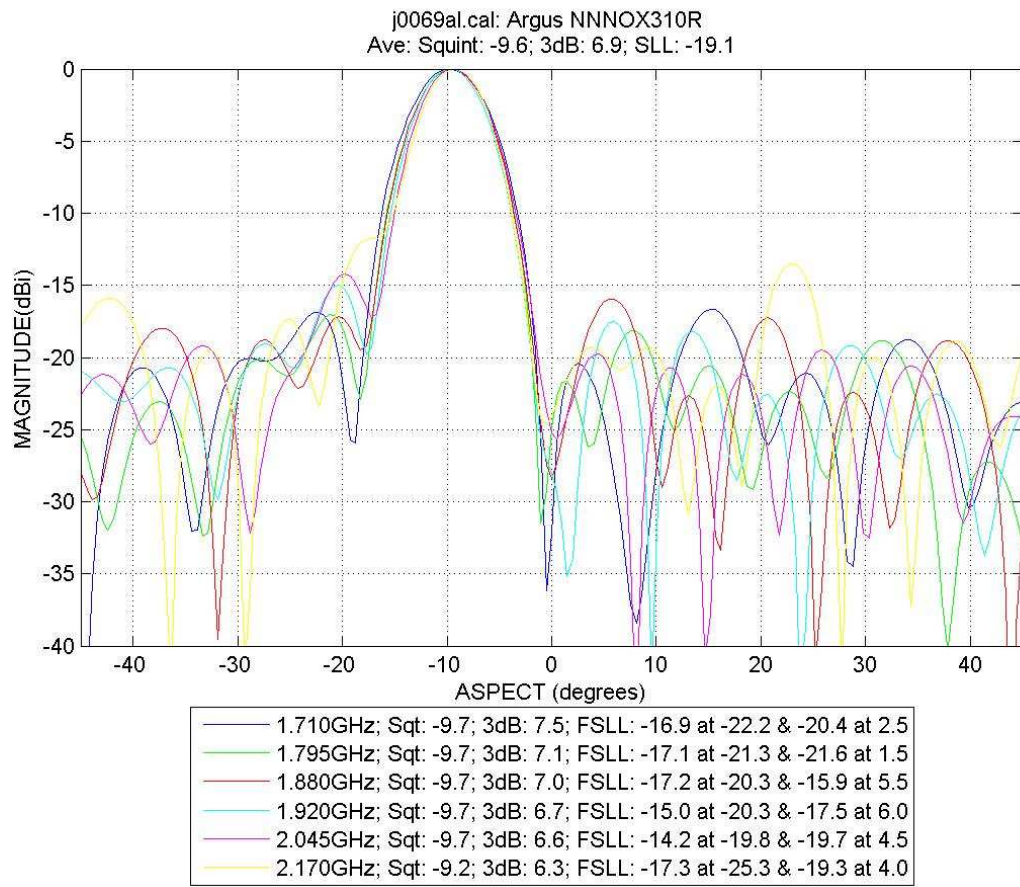


Sector 2 antenna: Elevation co-polarization patterns for +45° port at 10° tilt.

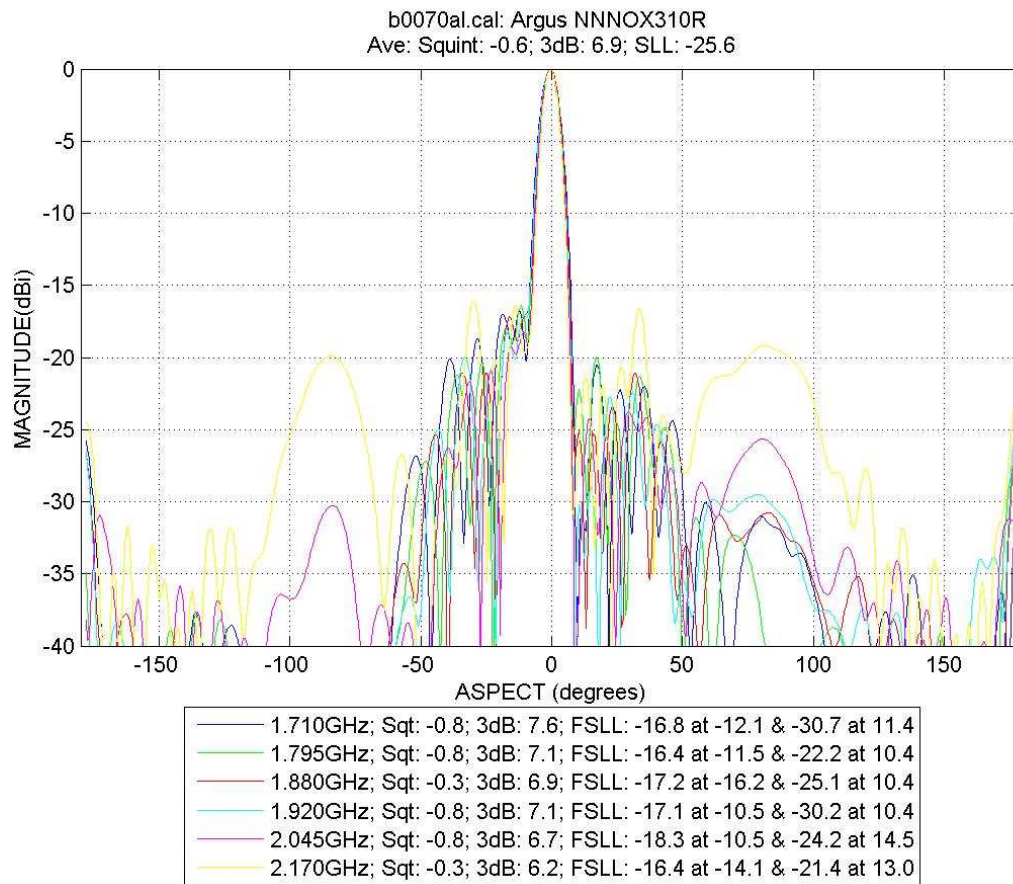




Sector 2 antenna: Elevation co-polarization patterns for +45° port at 10° tilt.

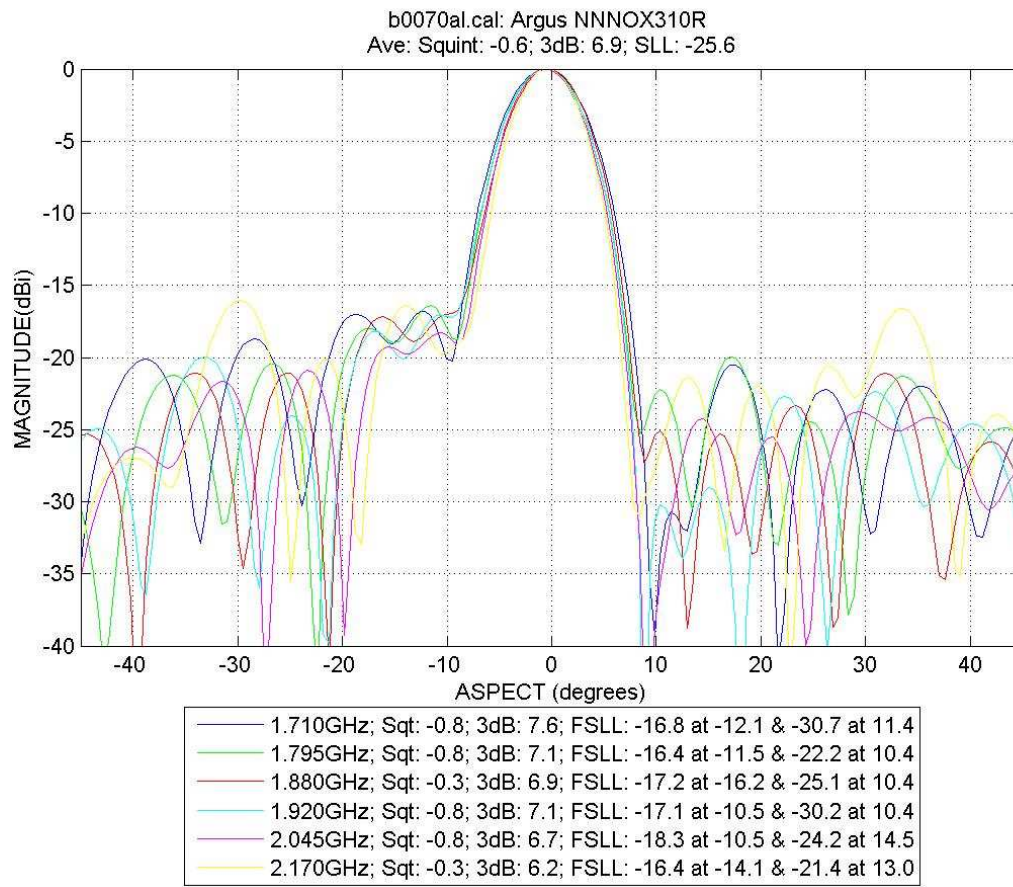


Sector 2 antenna: Elevation co-polarization patterns for -45° port at 0° tilt.

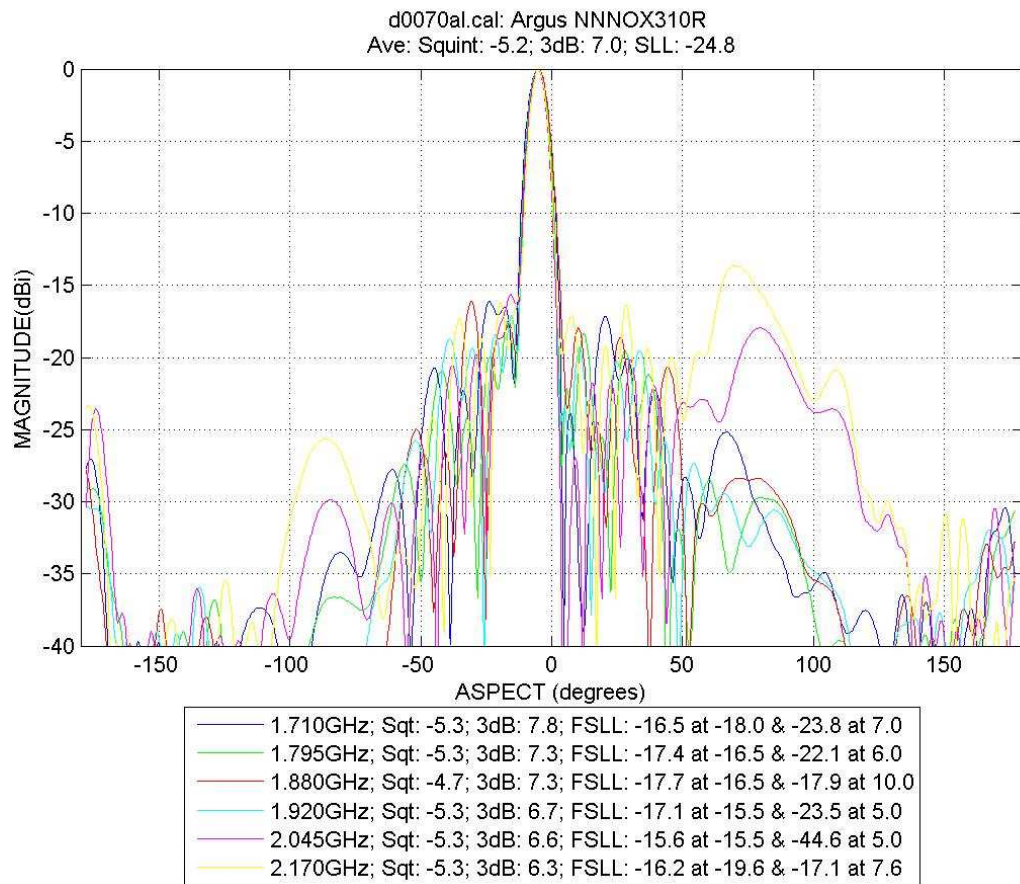




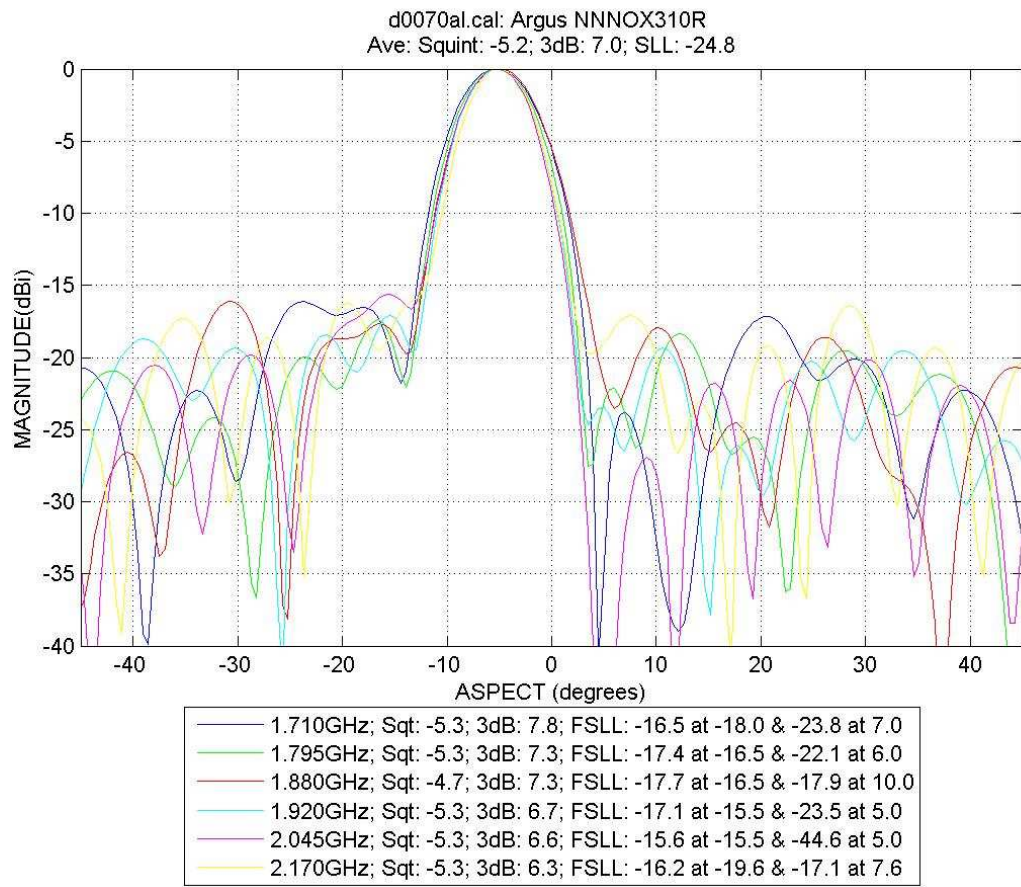
Sector 2 antenna: Elevation co-polarization patterns for -45° port at 0° tilt.



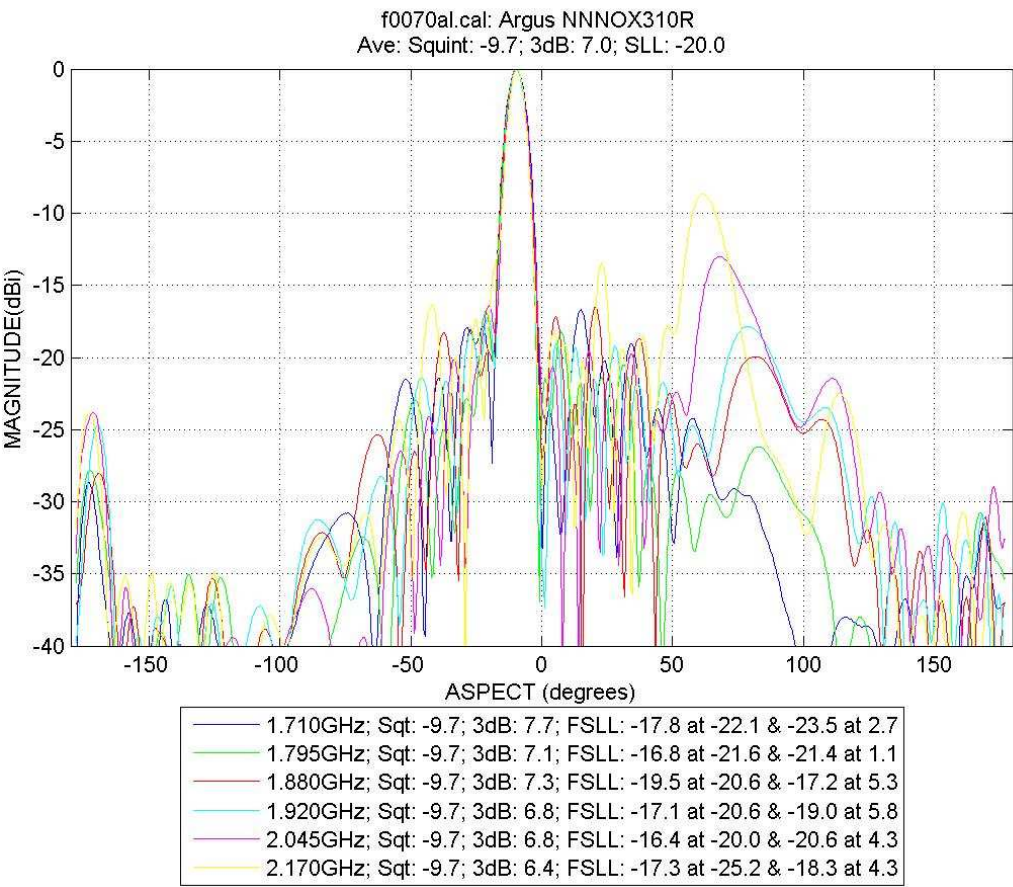
Sector 2 antenna: Elevation co-polarization patterns for -45° port at 5° tilt.



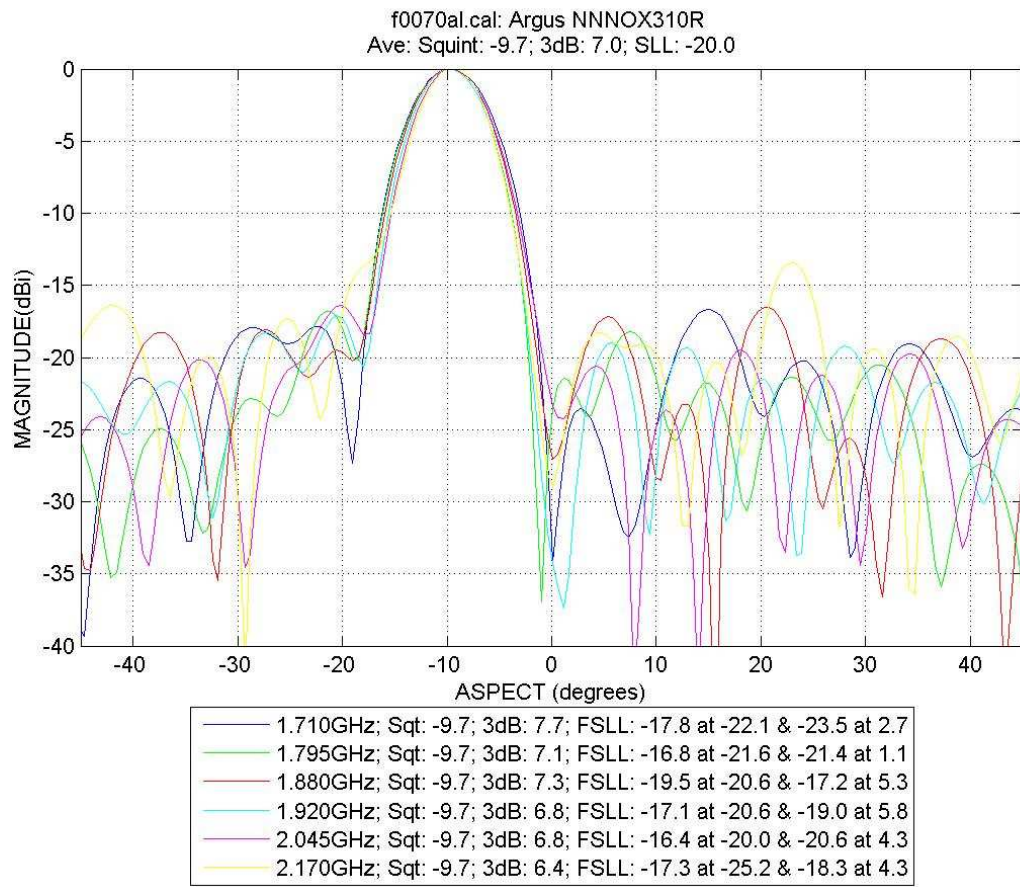
Sector 2 antenna: Elevation co-polarization patterns for -45° port at 5° tilt.



Sector 2 antenna: Elevation co-polarization patterns for -45° port at 10° tilt.



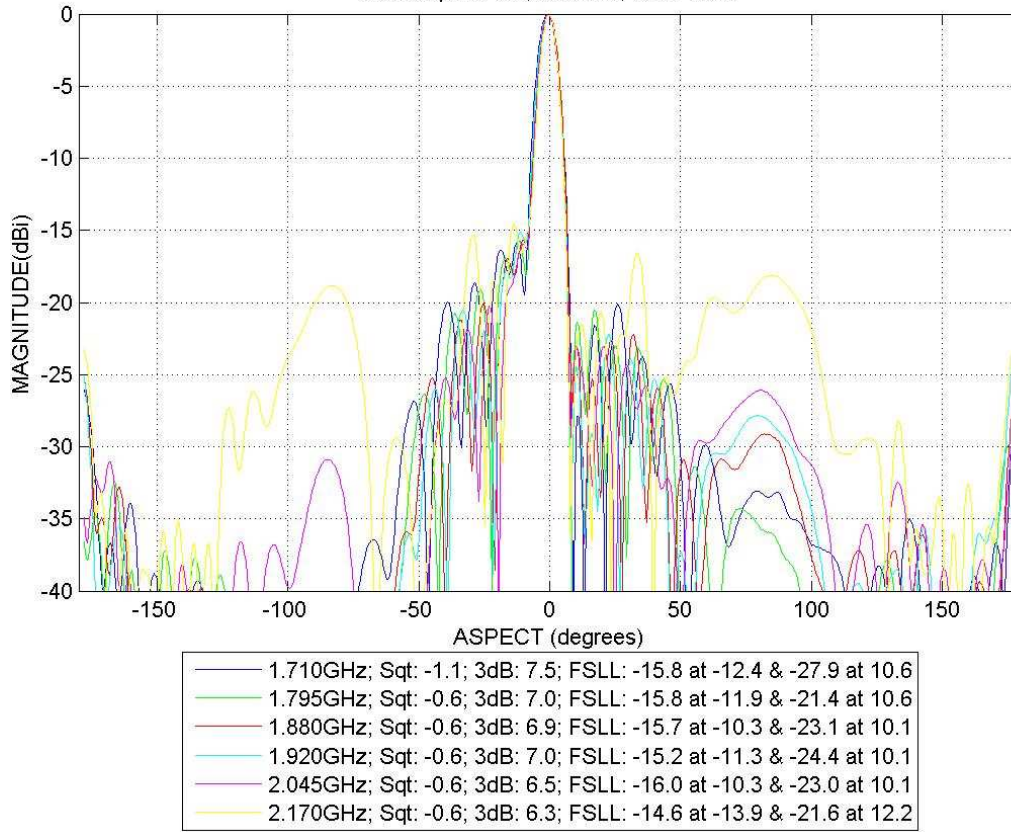
Sector 2 antenna: Elevation co-polarization patterns for -45° port at 10° tilt.



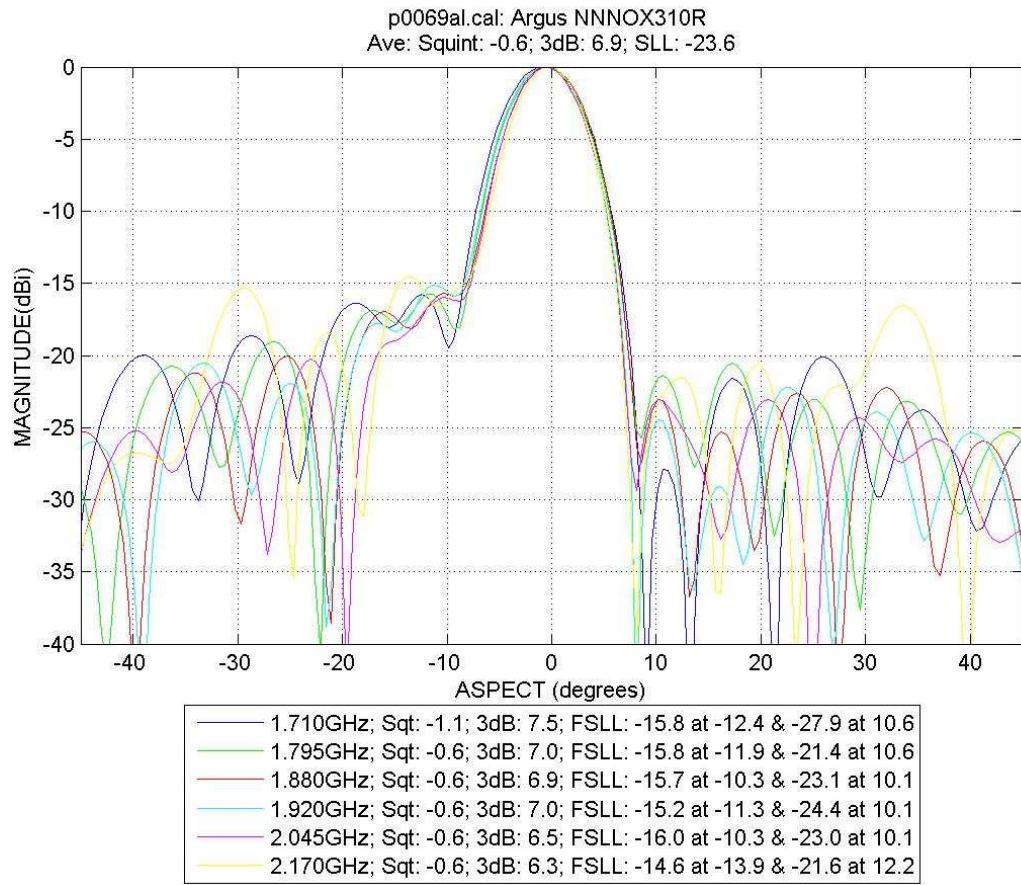


Sector 3 antenna: Elevation co-polarization patterns for +45° port at 0° tilt.

p0069a1.cal: Argus NNNOX310R  
Ave: Squint: -0.6; 3dB: 6.9; SLL: -23.6

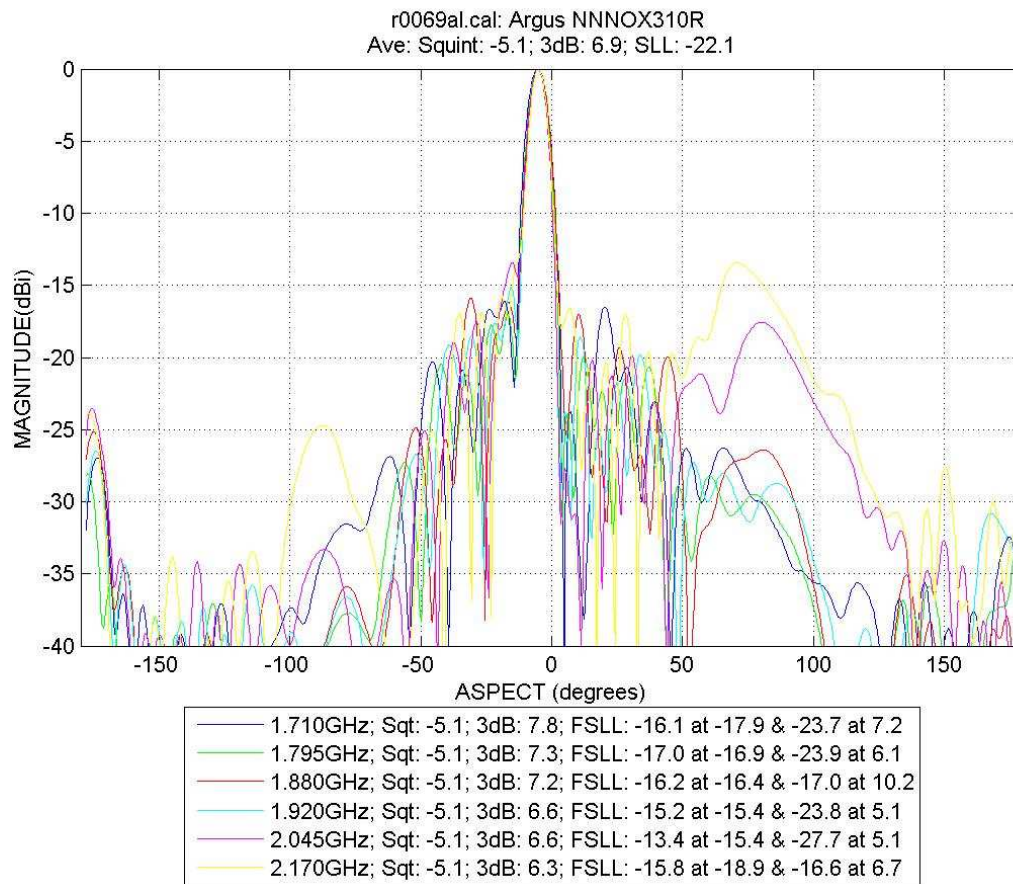


Sector 3 antenna: Elevation co-polarization patterns for +45° port at 0° tilt.

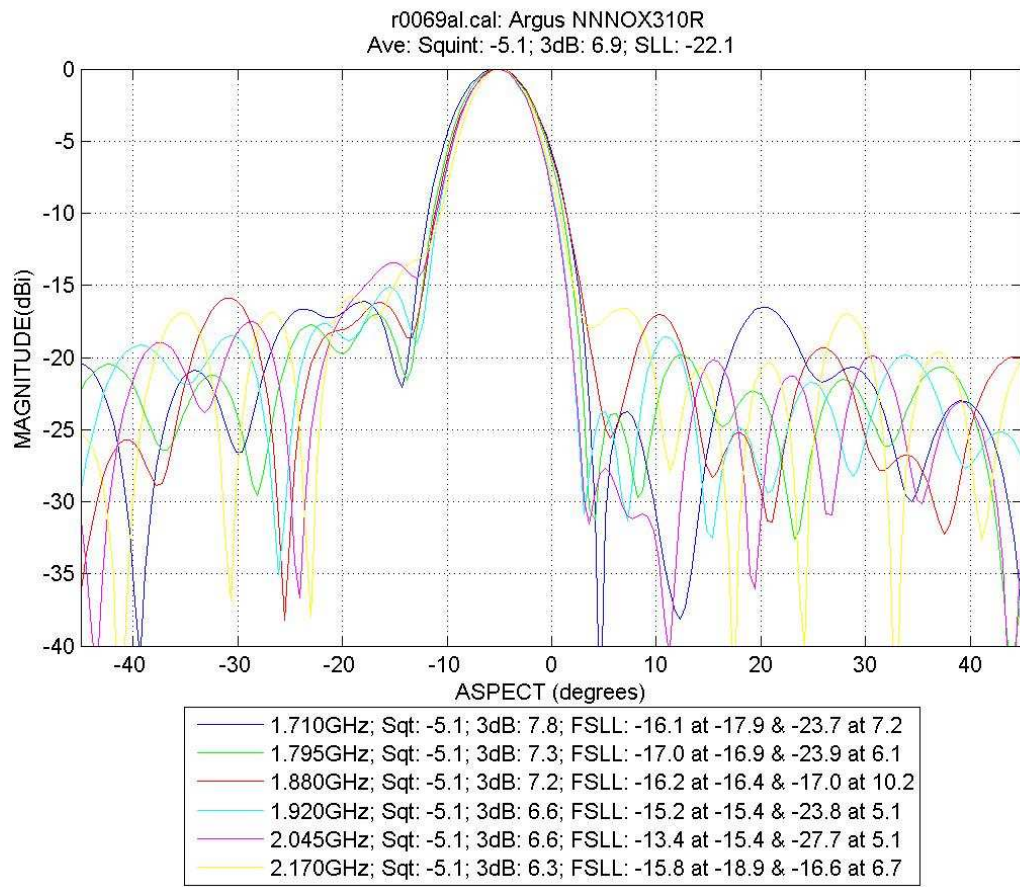




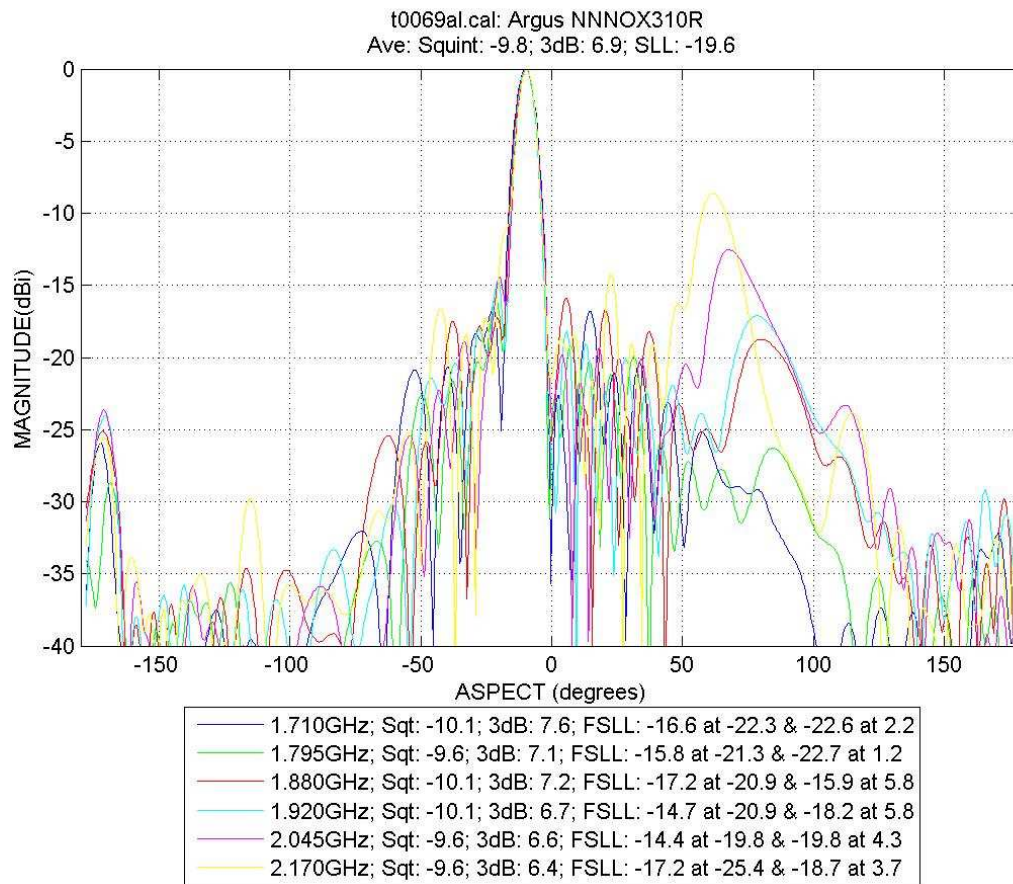
Sector 3 antenna: Elevation co-polarization patterns for +45° port at 5° tilt.



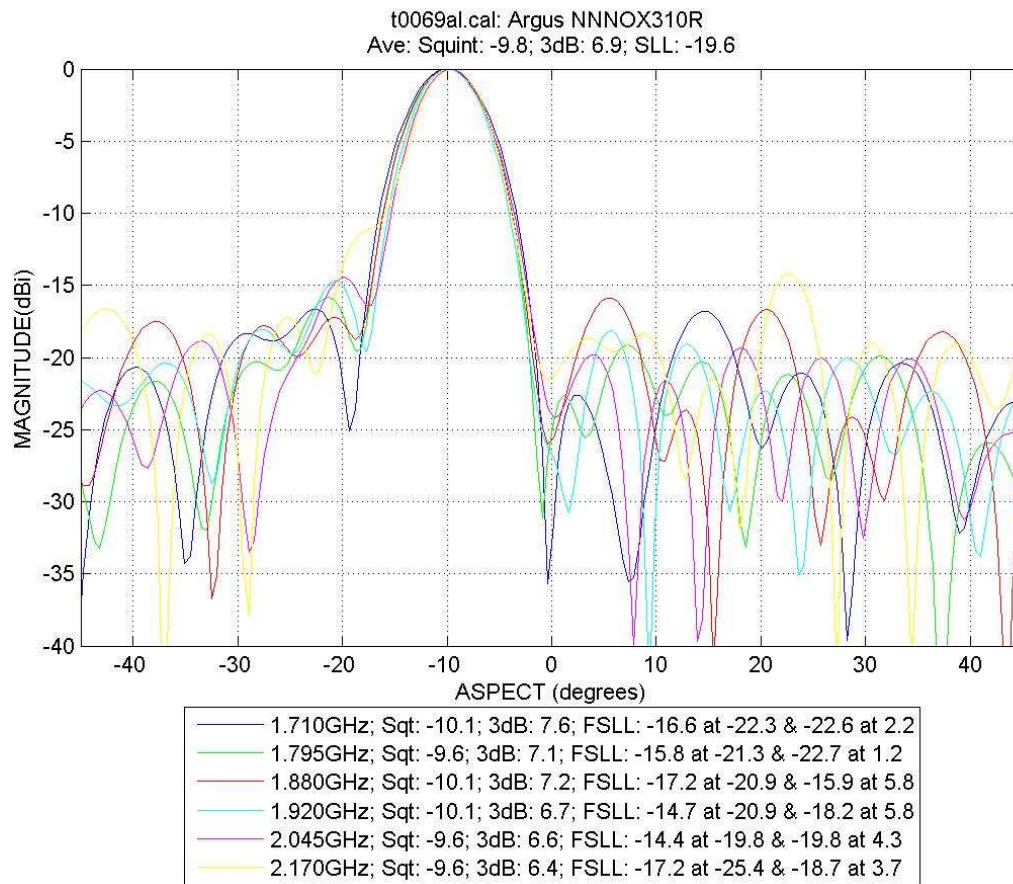
Sector 3 antenna: Elevation co-polarization patterns for +45° port at 5° tilt.



Sector 3 antenna: Elevation co-polarization patterns for +45° port at 10° tilt.

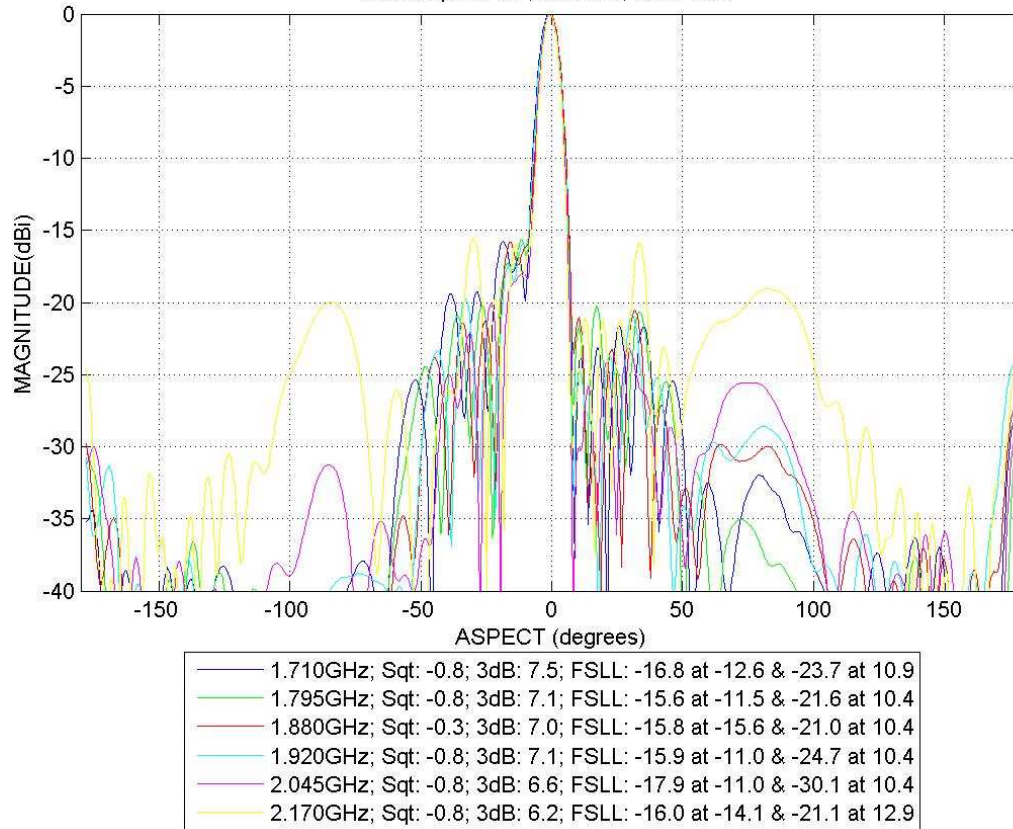


Sector 3 antenna: Elevation co-polarization patterns for +45° port at 10° tilt.



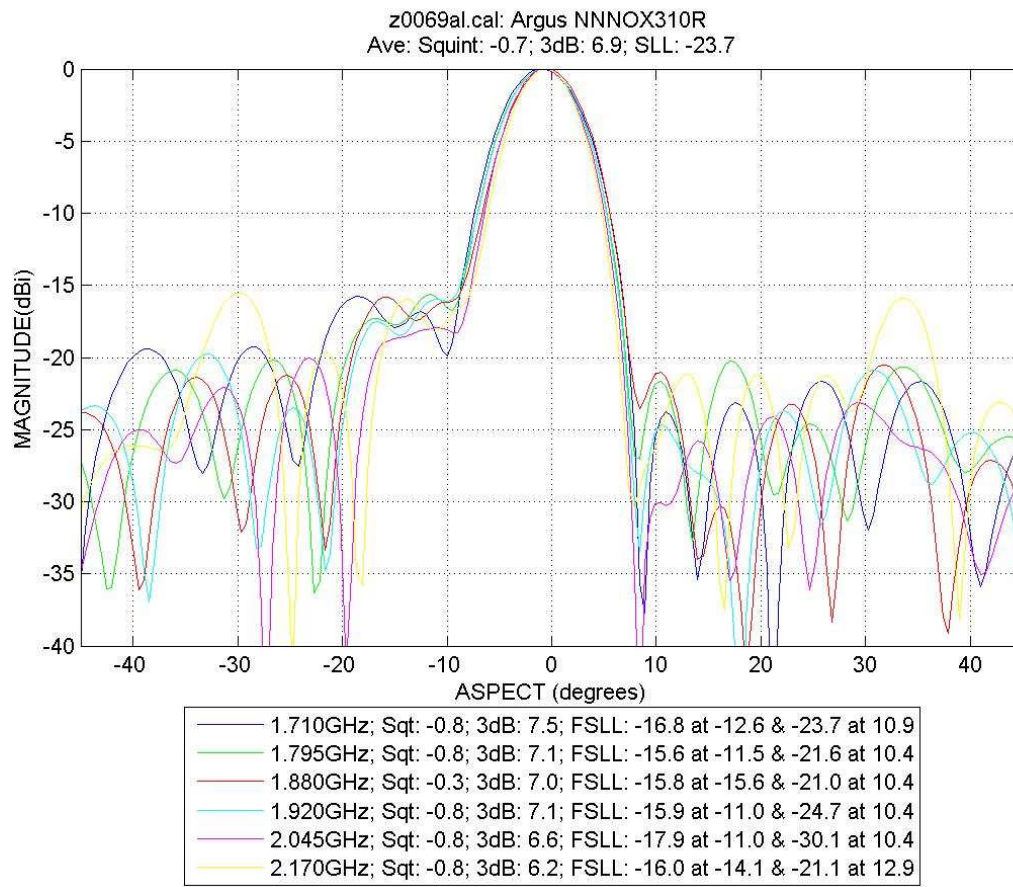
Sector 3 antenna: Elevation co-polarization patterns for -45° port at 0° tilt.

z0069a1.cal: Argus NNNOX310R  
Ave: Squint: -0.7; 3dB: 6.9; SLL: -23.7

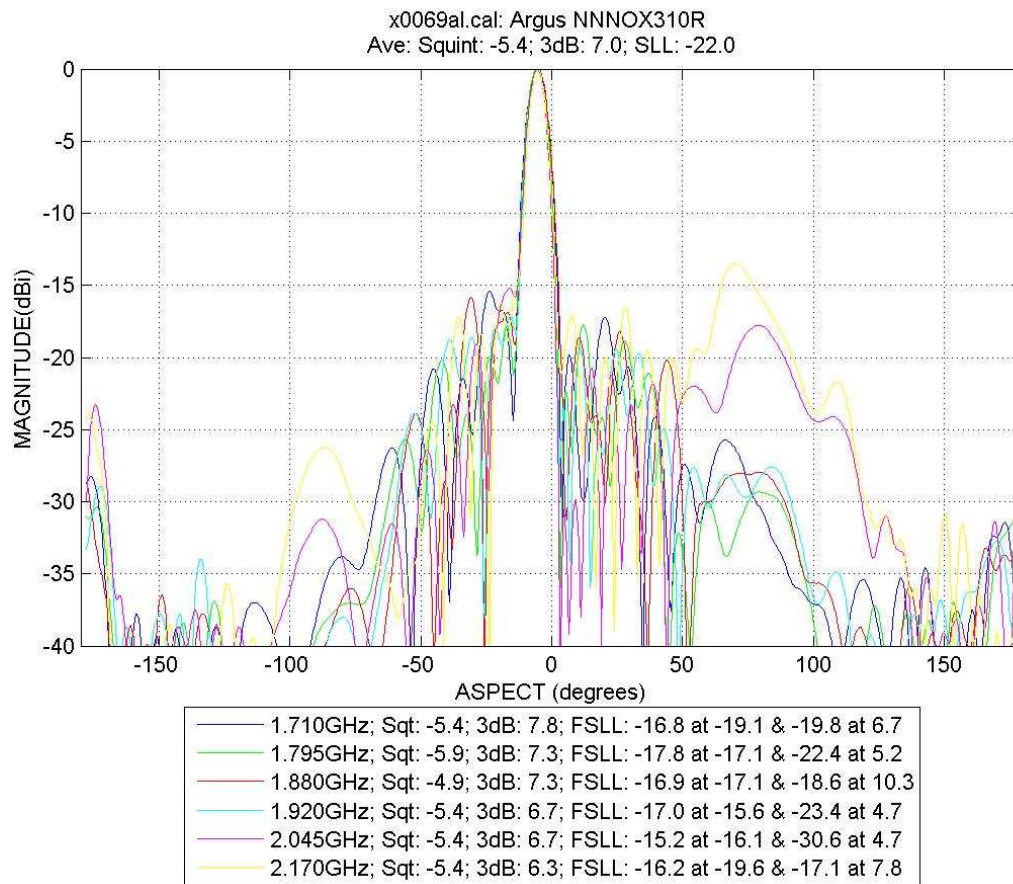




Sector 3 antenna: Elevation co-polarization patterns for -45° port at 0° tilt.

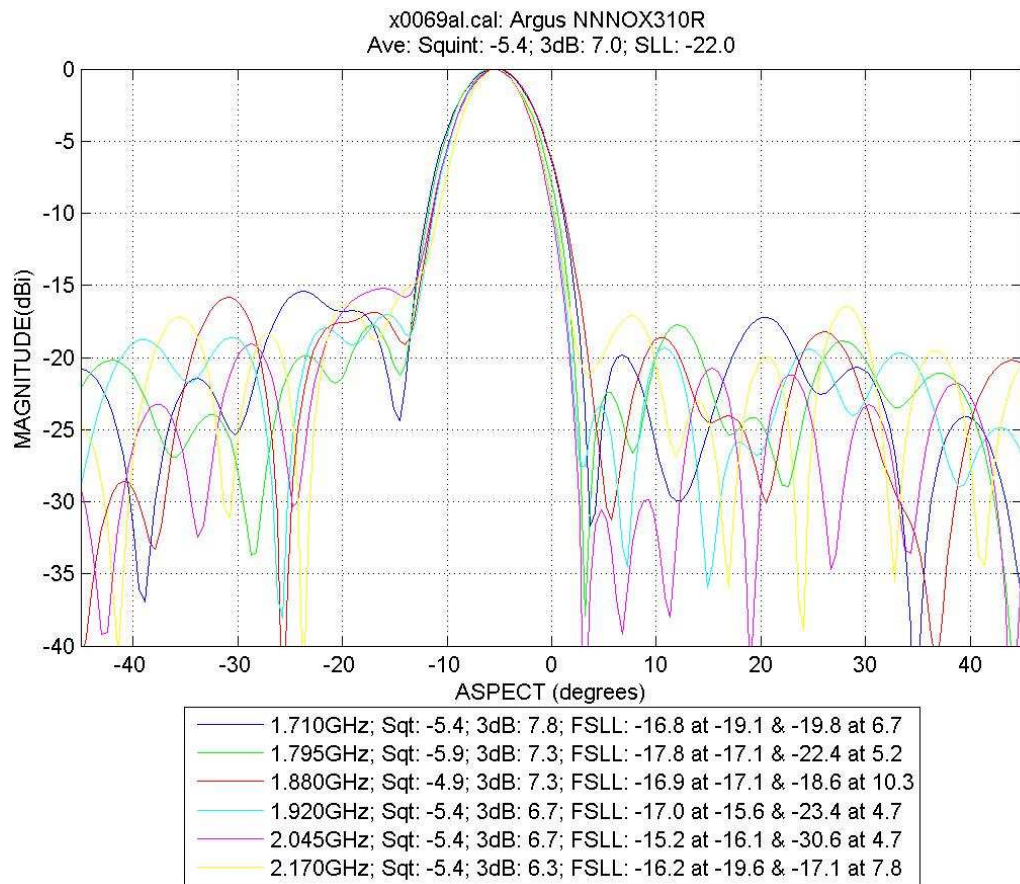


Sector 3 antenna: Elevation co-polarization patterns for -45° port at 5° tilt.

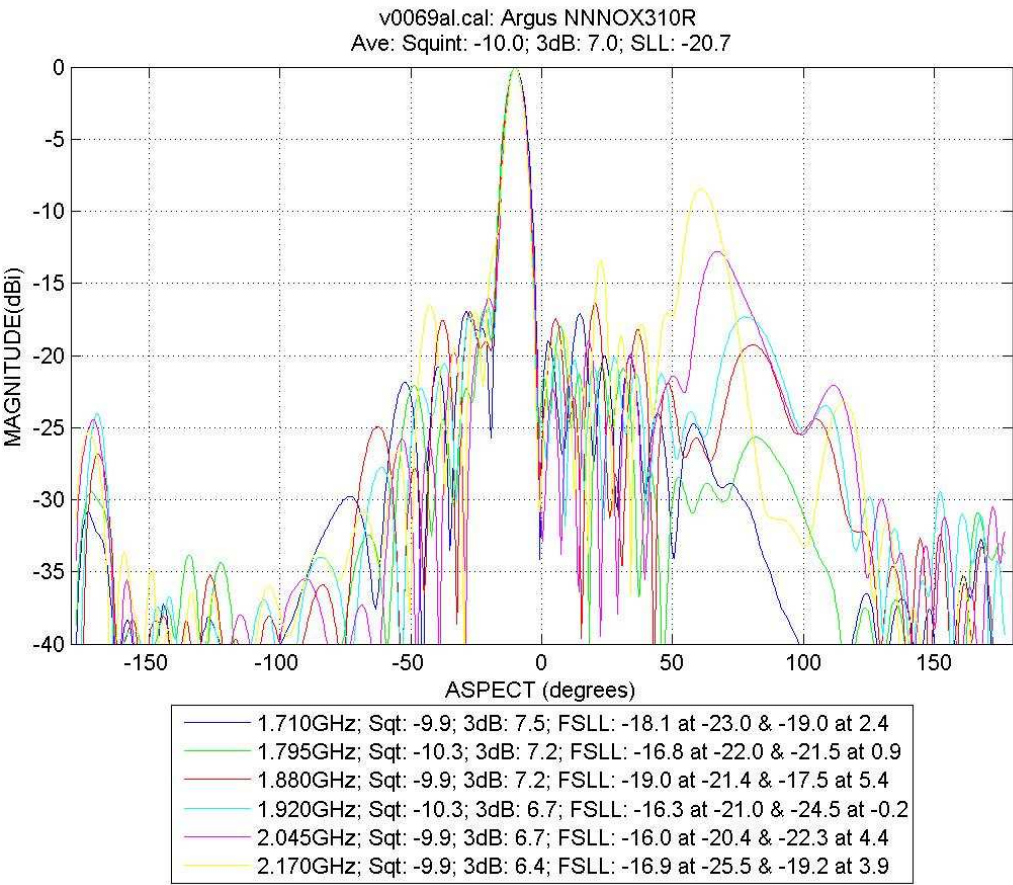




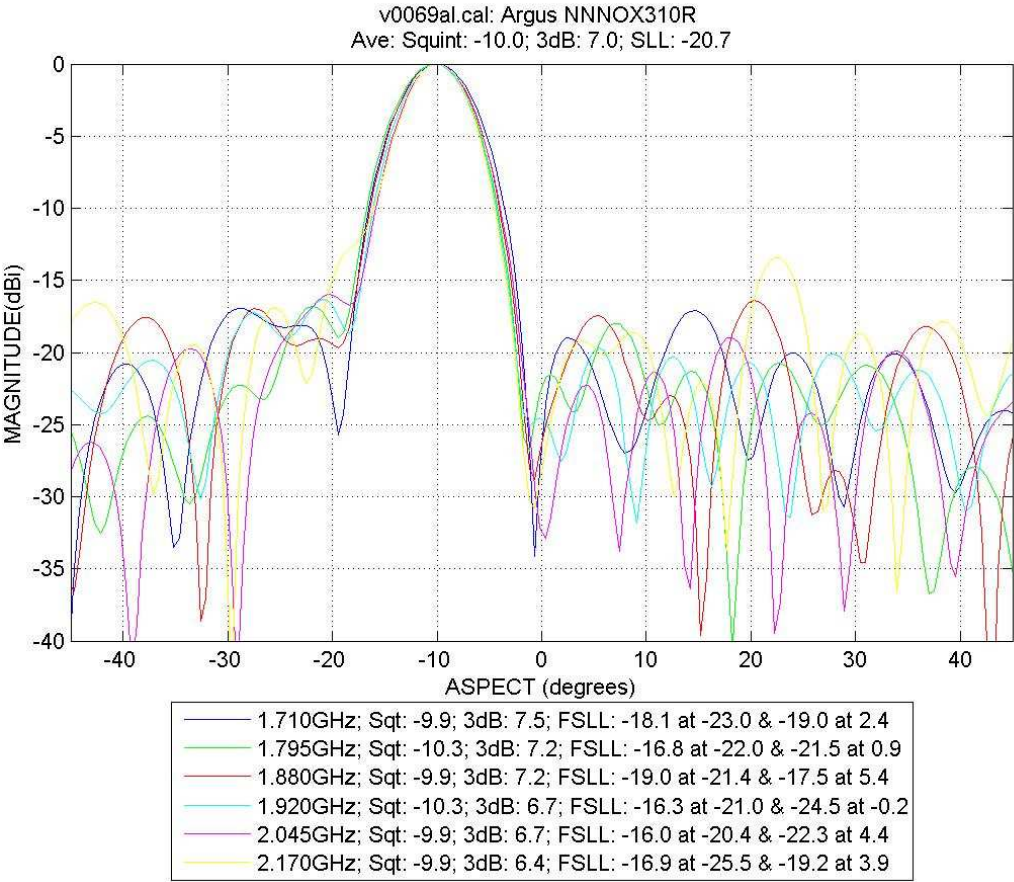
Sector 3 antenna: Elevation co-polarization patterns for -45° port at 5° tilt.



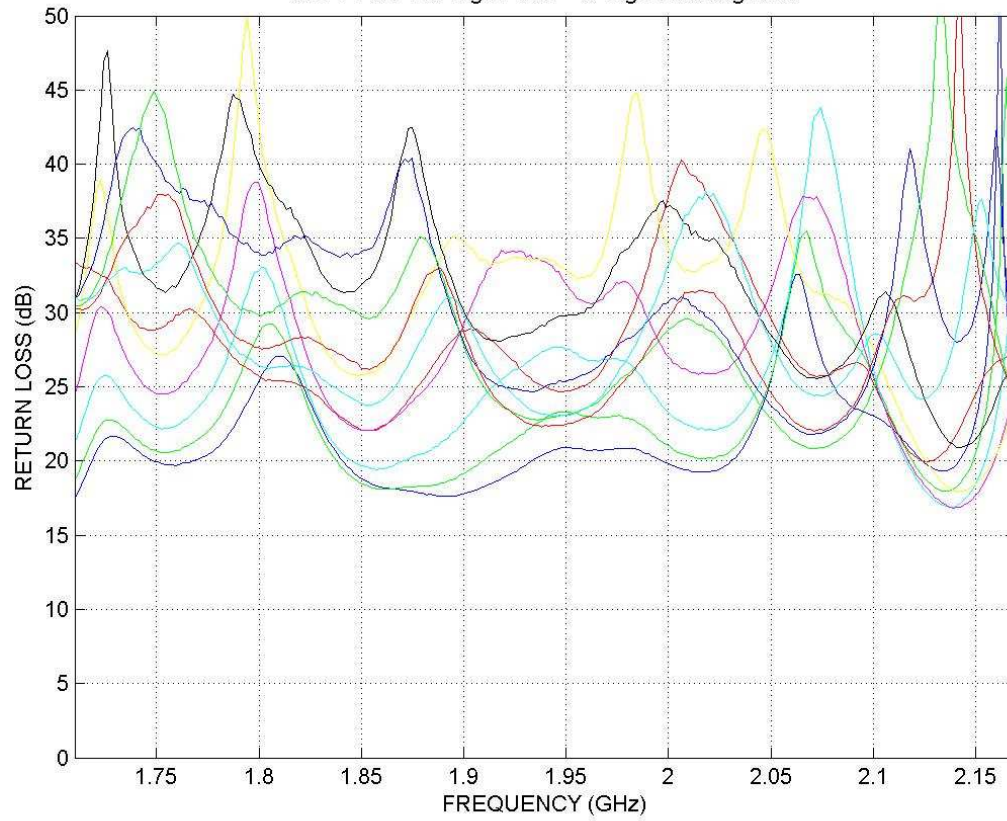
Sector 3 antenna: Elevation co-polarization patterns for -45° port at 10° tilt.



Sector 3 antenna: Elevation co-polarization patterns for -45° port at 10° tilt.

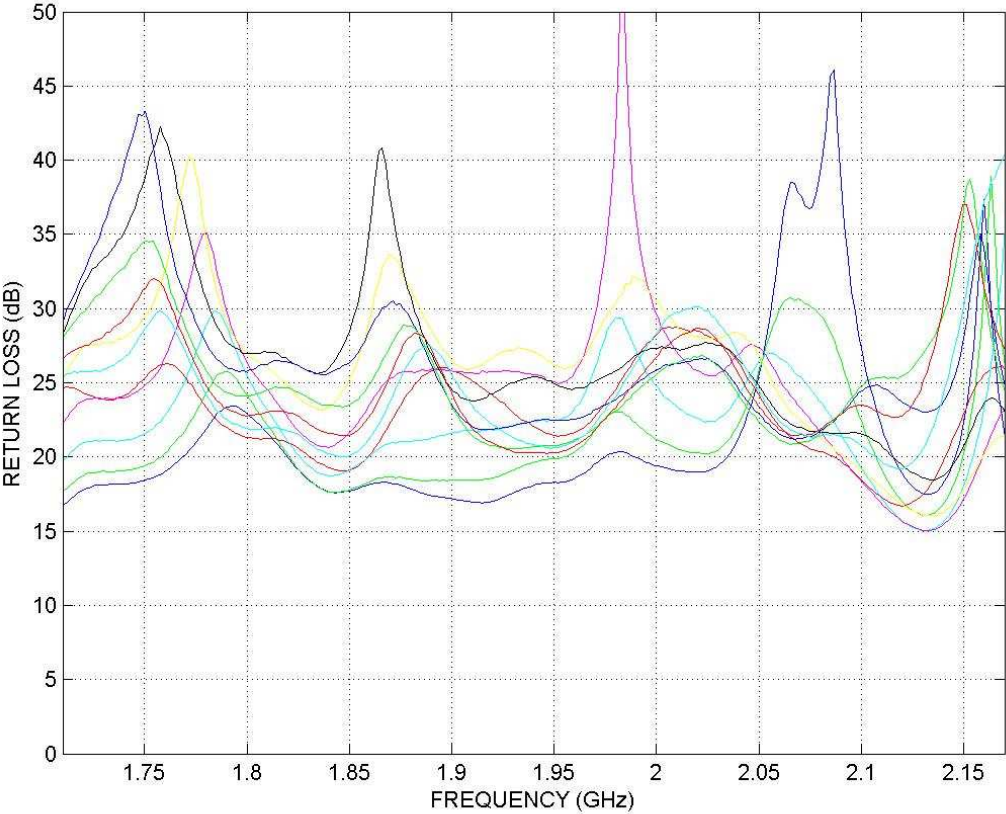


S11 P1 S1 +45 High P2 S1 -45 High Tilt 0 deg fs.txt



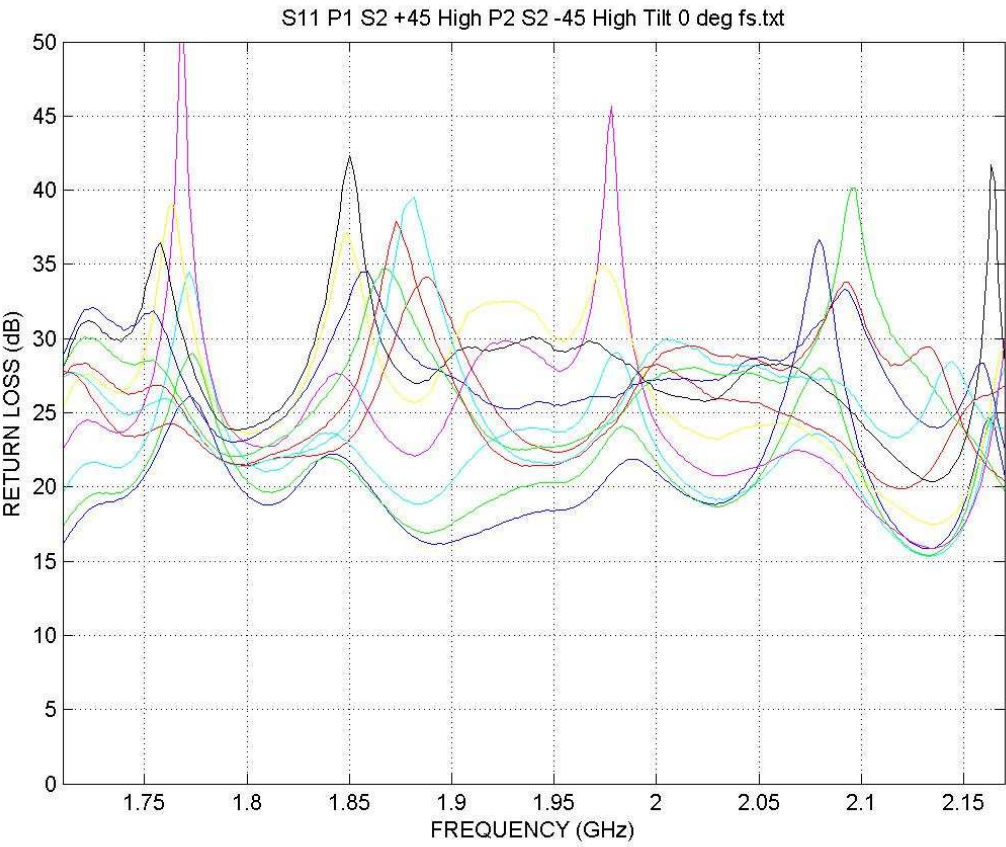
Sector 1 antenna: Return Loss for -45° port.

S22 P1 S1 +45 High P2 S1 -45 High Tilt 0 deg fs.txt



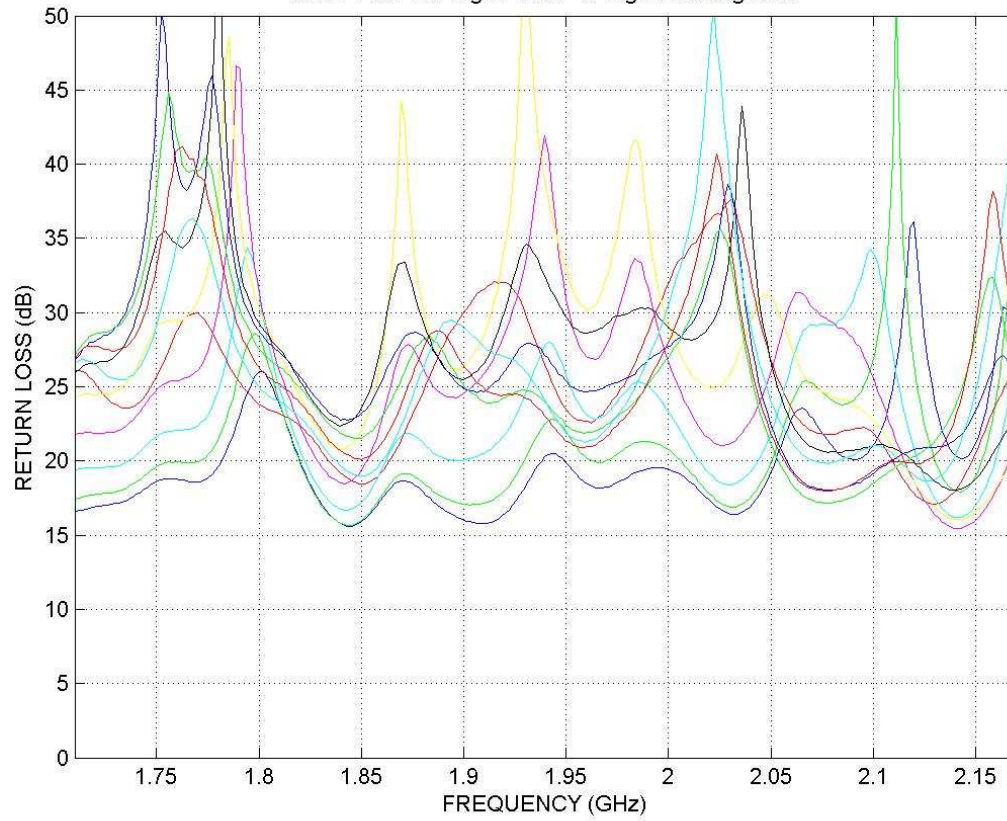


Sector 2 antenna: Return Loss for +45° port.



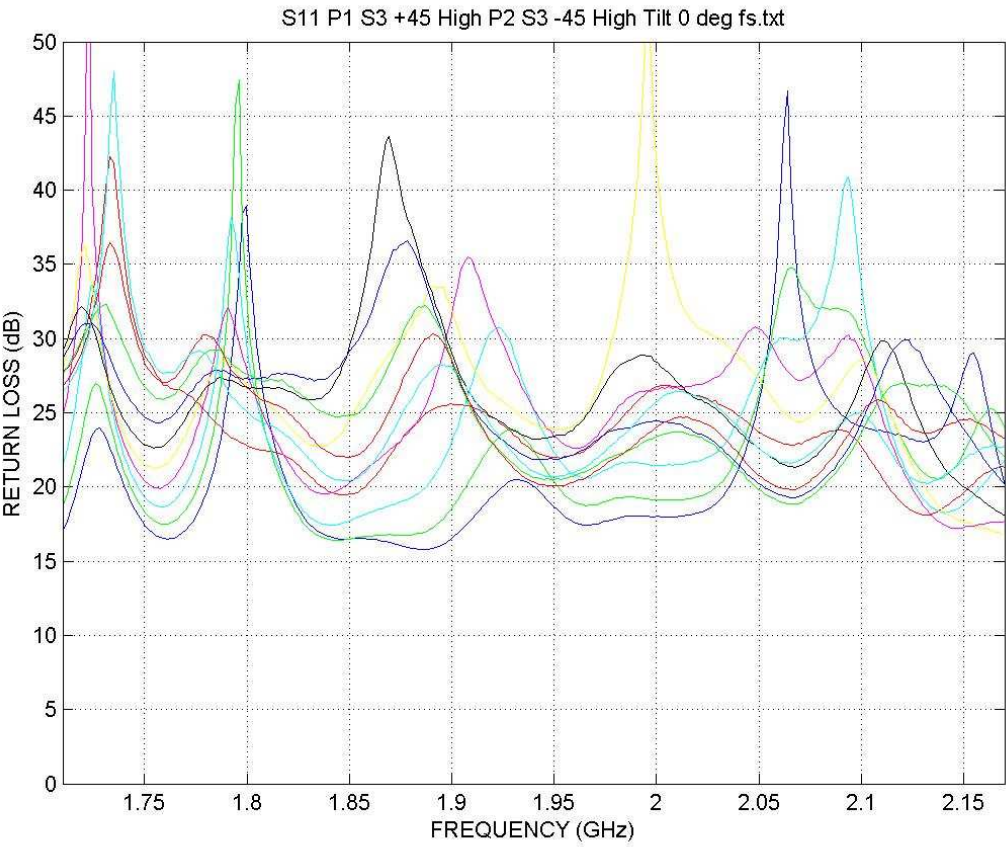
Sector 2 antenna: Return Loss for -45° port.

S22 P1 S2 +45 High P2 S2 -45 High Tilt 0 deg fs.txt



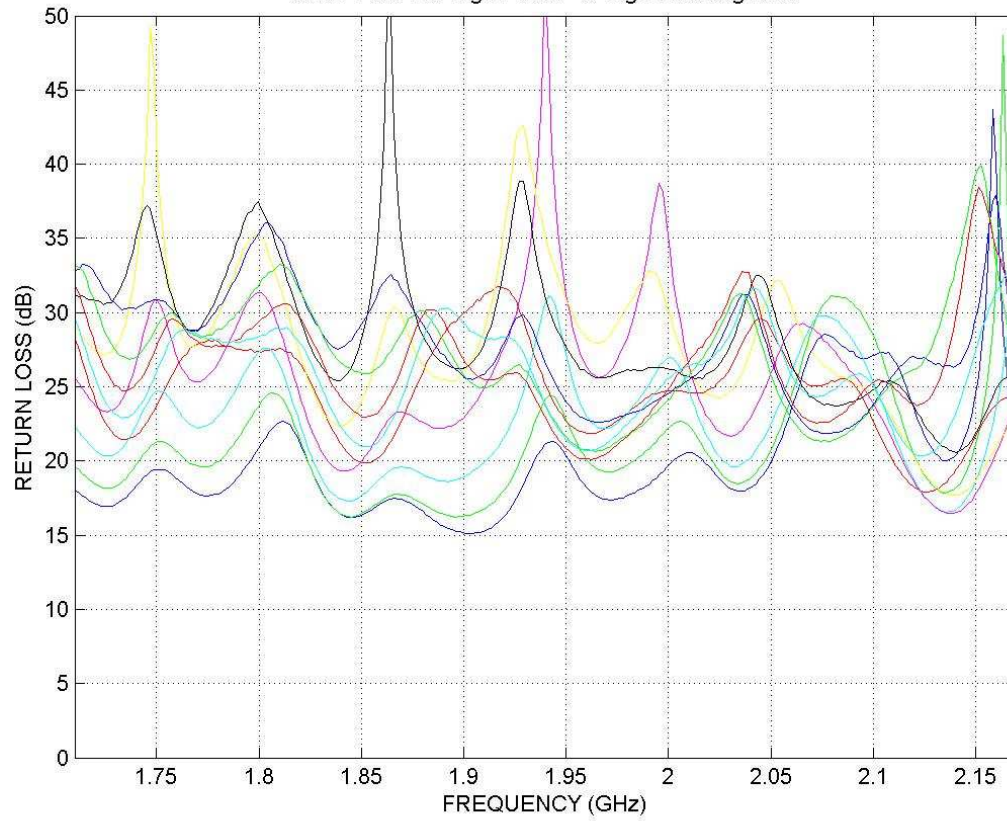


Sector 3 antenna: Return Loss for +45° port.

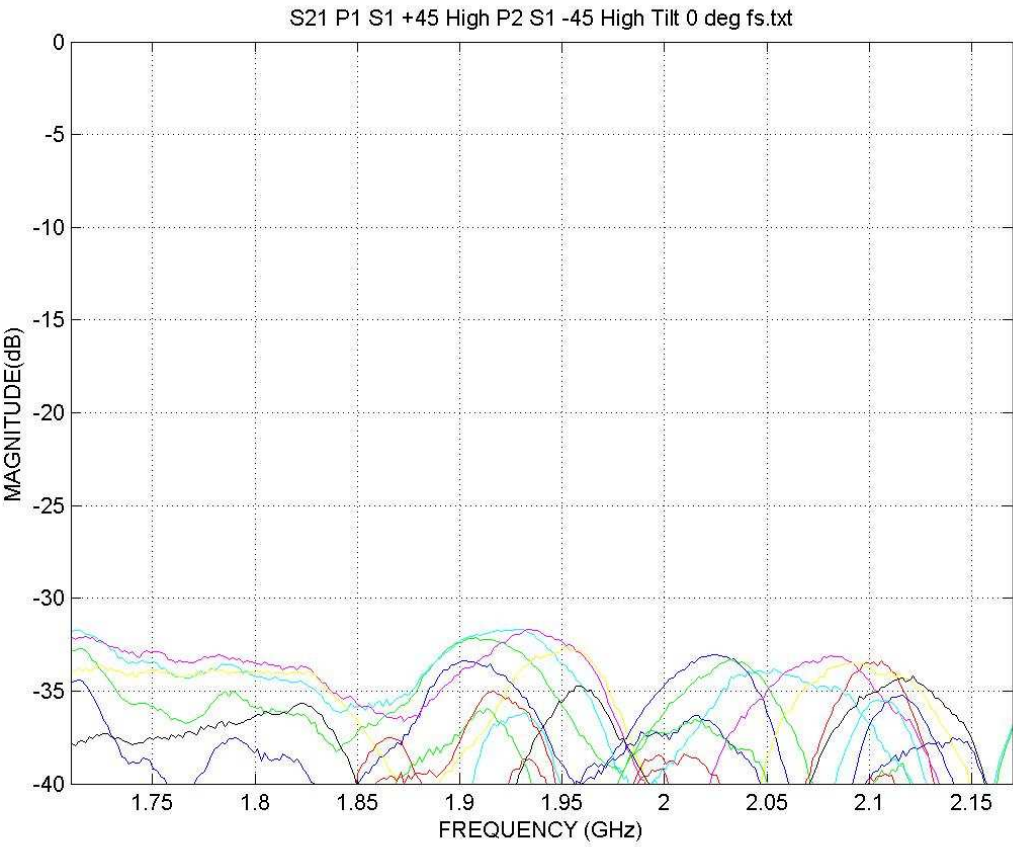


Sector 3 antenna: Return Loss for -45° port.

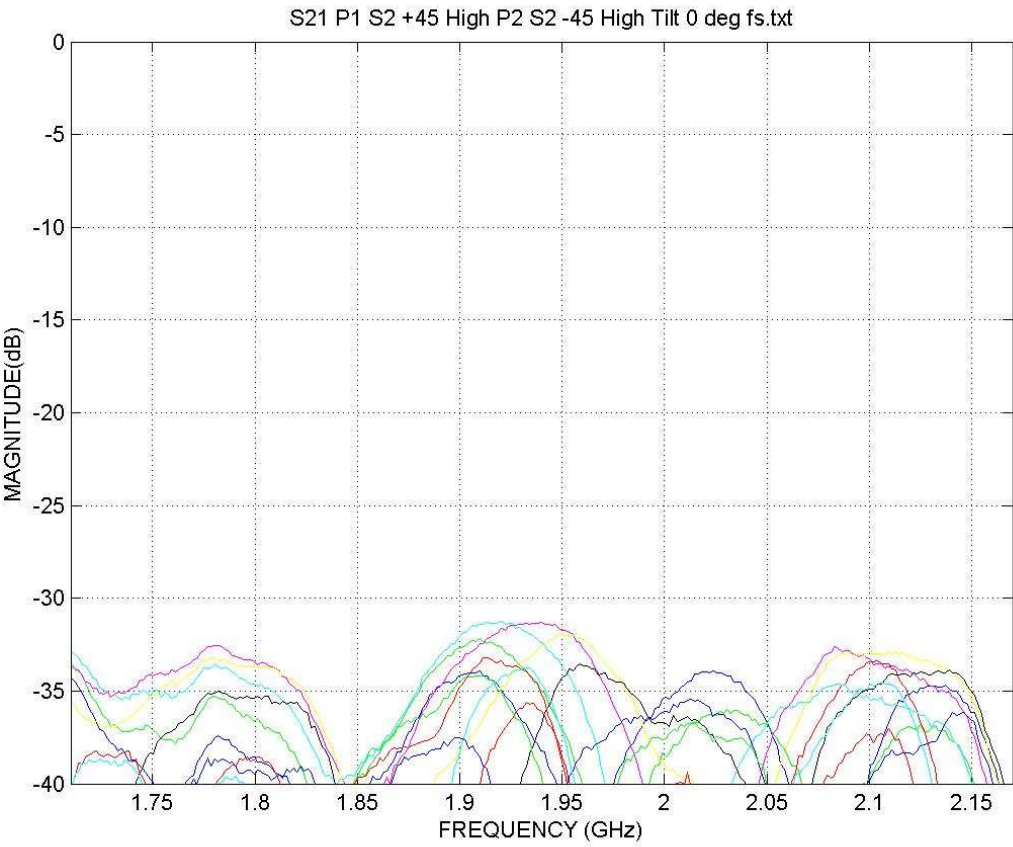
S22 P1 S3 +45 High P2 S3 -45 High Tilt 0 deg fs.txt



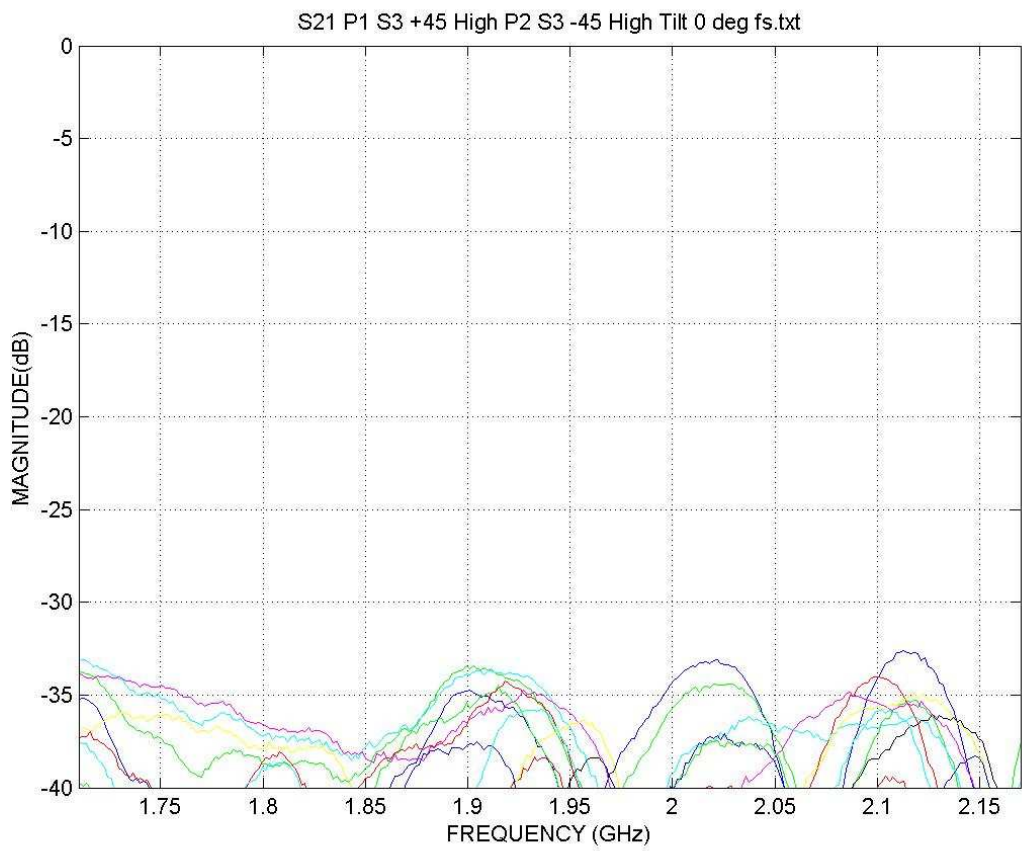
Isolation between Sector 1 +45° and -45° ports.



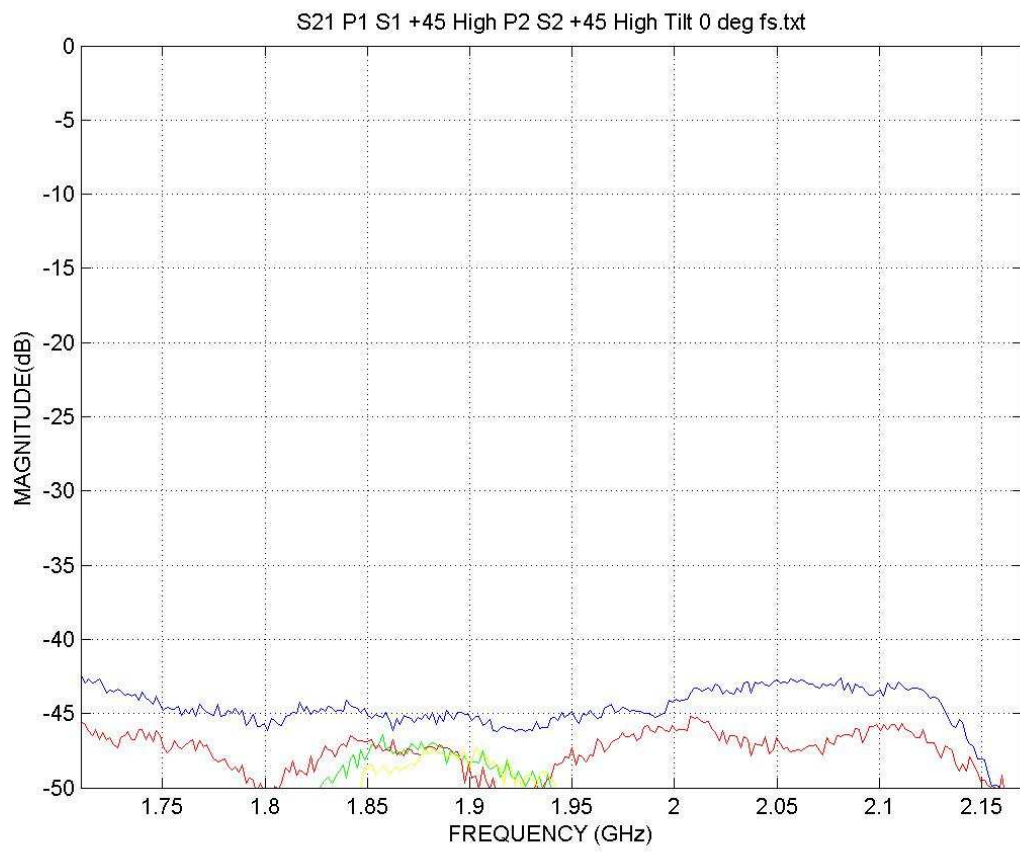
Isolation between Sector 2 +45° and -45° ports.



Isolation between Sector 3 +45° and -45° ports.

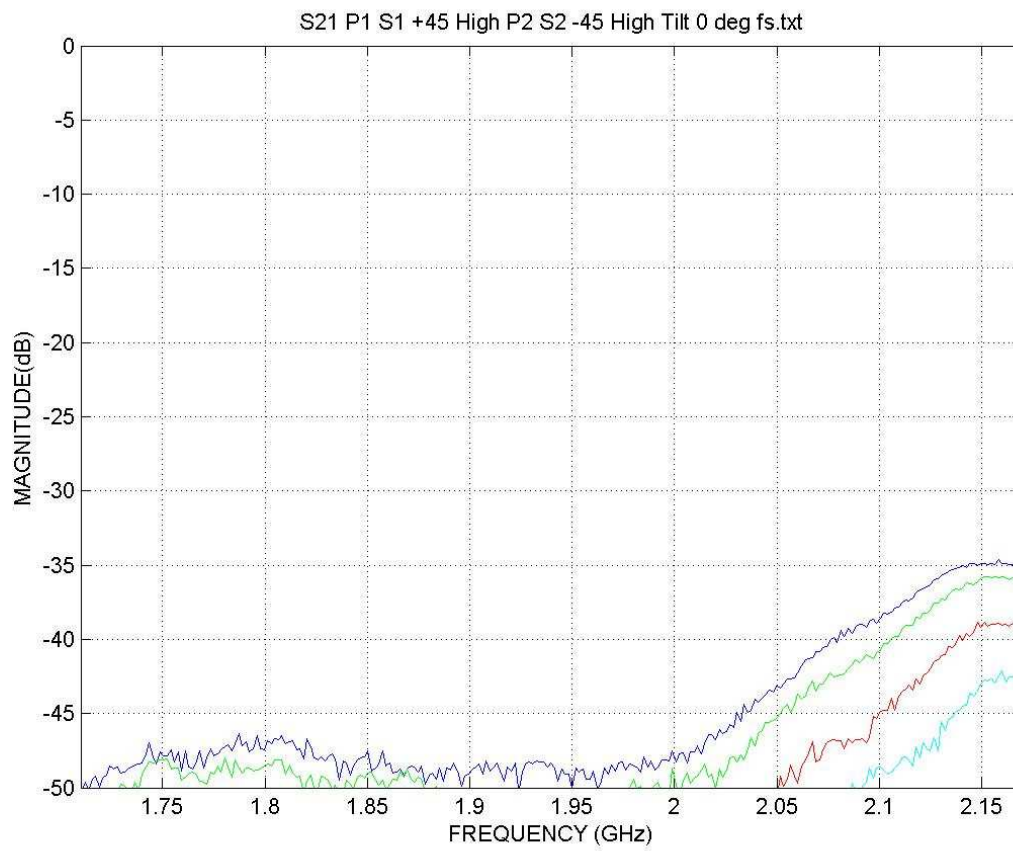


Isolation between Sector 1 +45° and Sector 2 +45° ports.

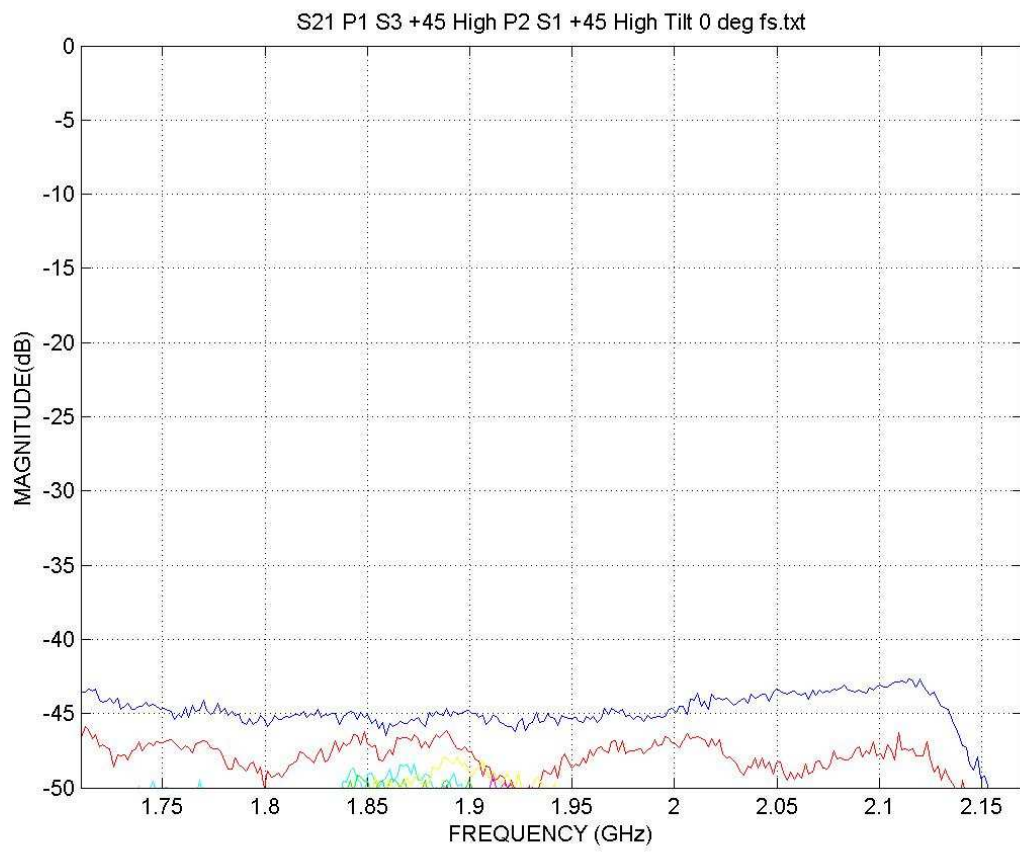




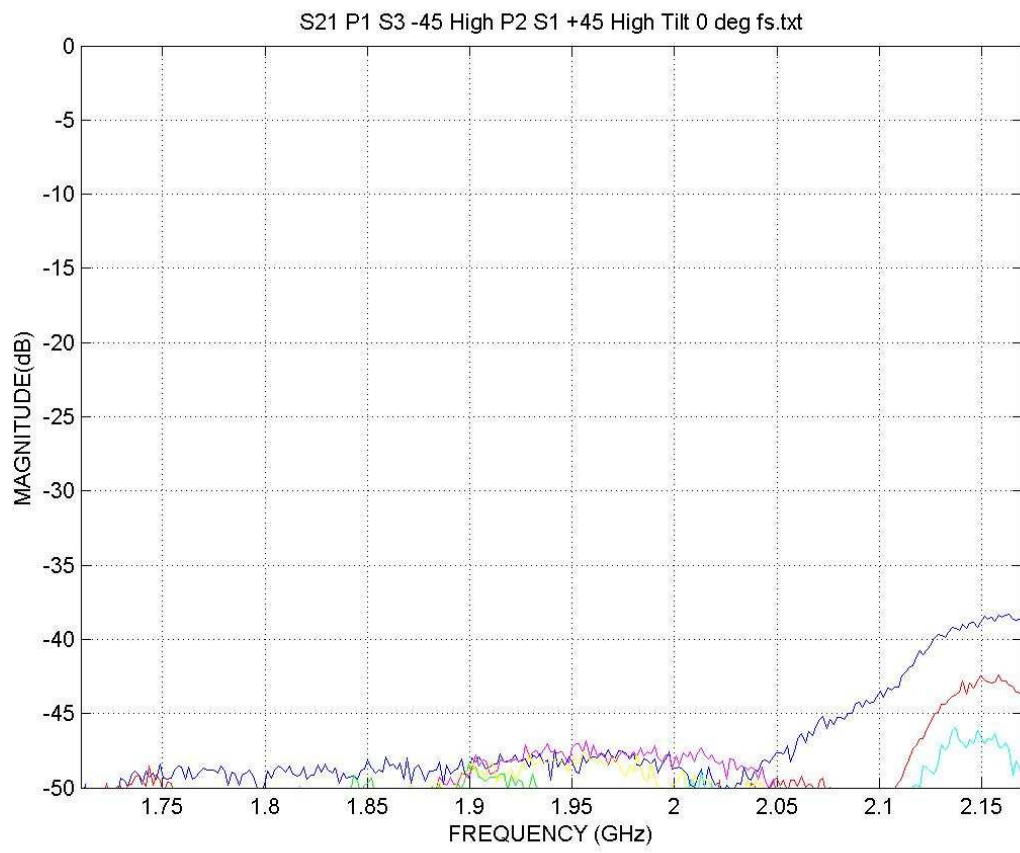
Isolation between Sector 1 +45° and Sector 2 -45° ports.



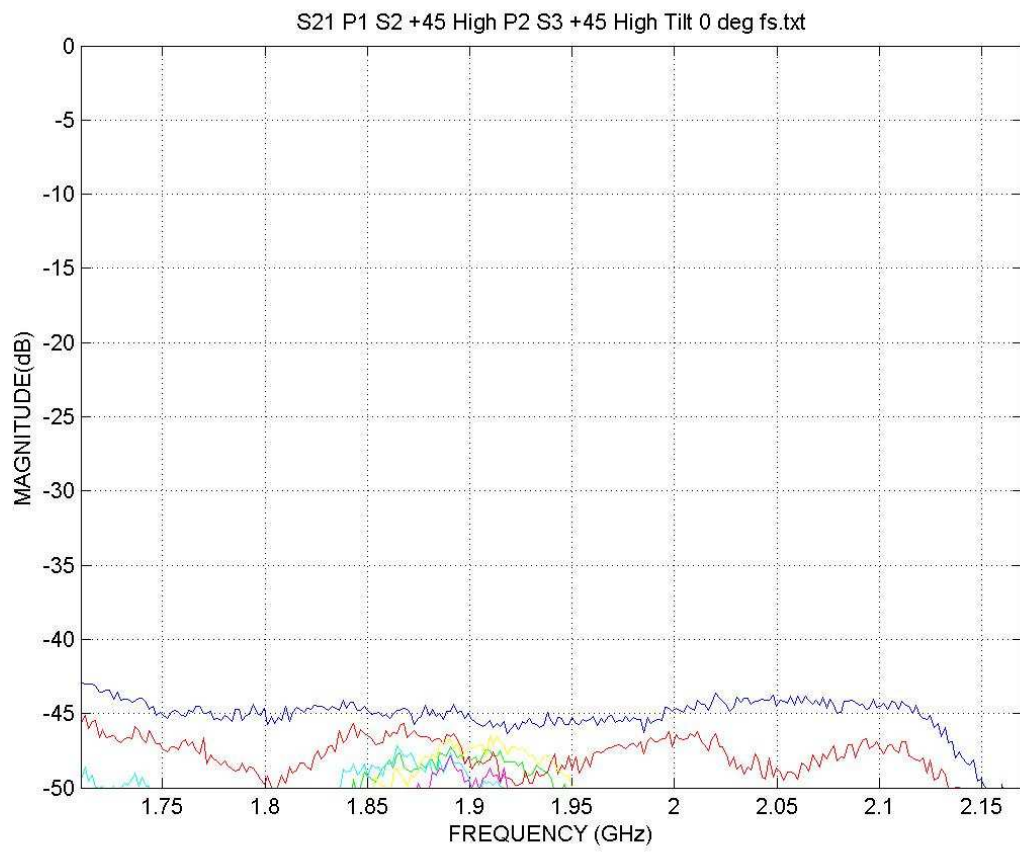
Isolation between Sector 1 +45° and Sector 3 +45° ports.



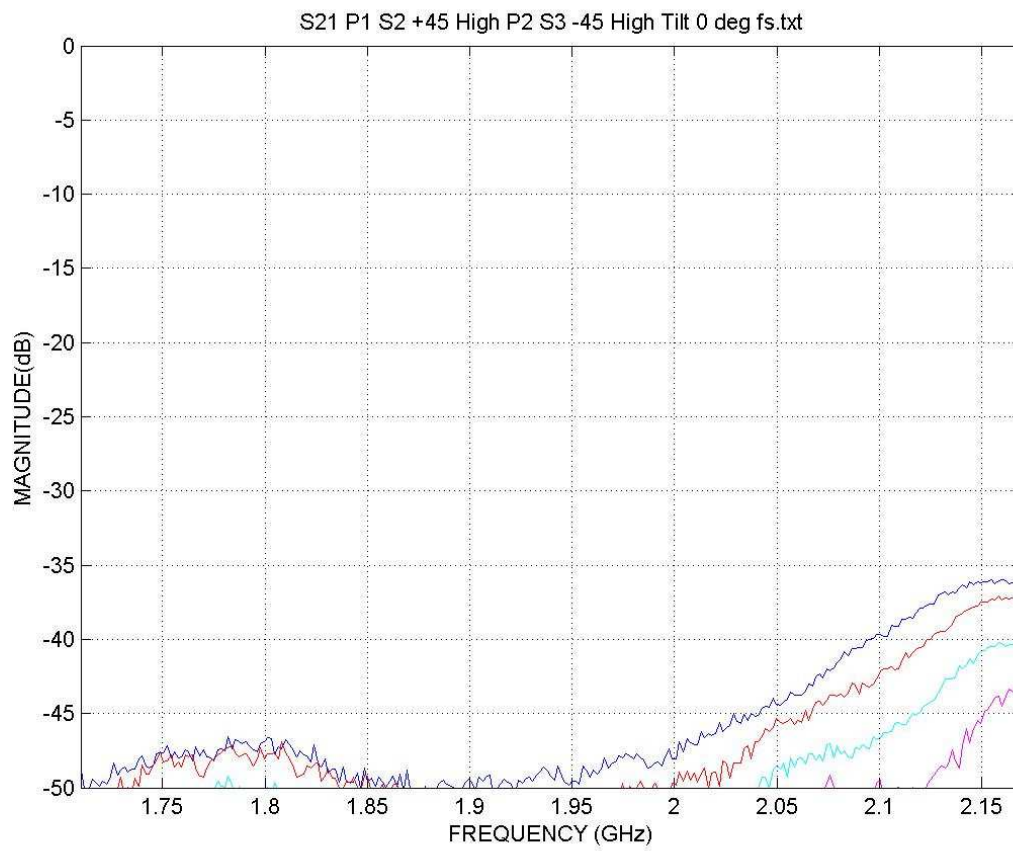
Isolation between Sector 1 +45° and Sector 3 -45° ports.



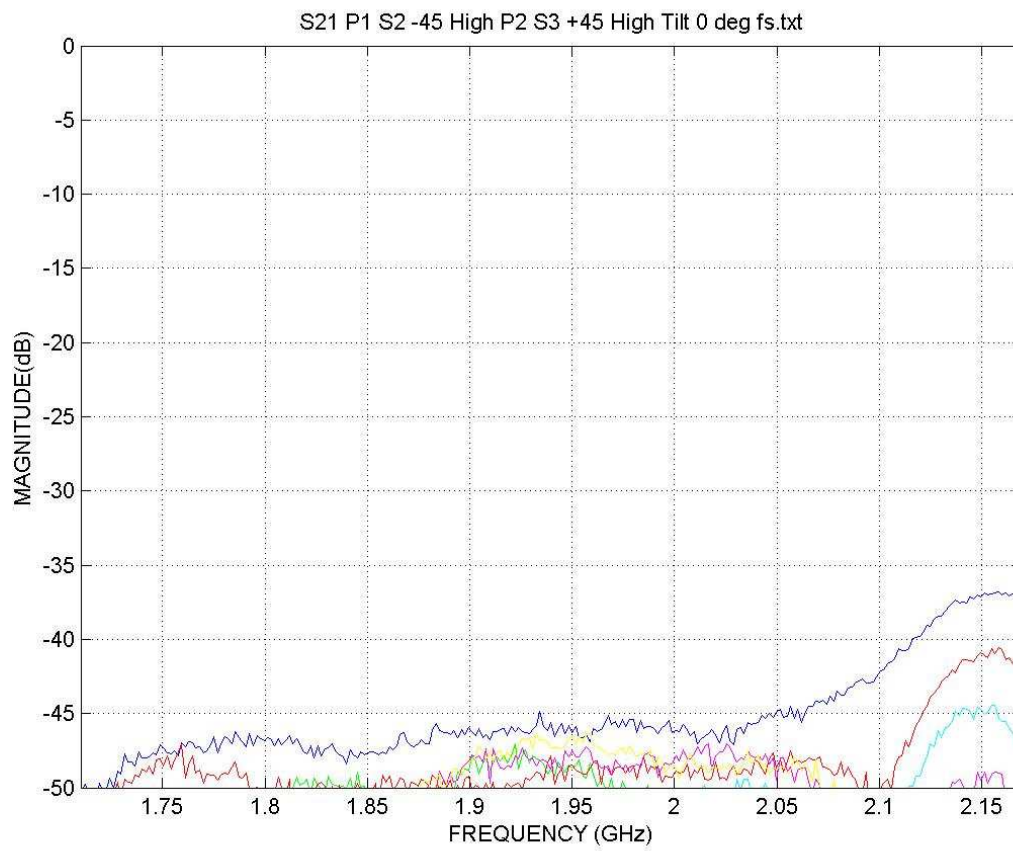
Isolation between Sector 2 +45° and Sector 3 +45° ports.



Isolation between Sector 2 +45° and Sector 3 -45° ports.



Isolation between Sector 2  $-45^\circ$  and Sector 3  $+45^\circ$  ports.





Isolation between Sector 2 -45° and Sector 3 -45° ports.

