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Strandmount Direction Gain Calculation

Date : Mar. 20, 2024

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Antenna Datasheet (1/2)

Small Cell

DATASHEET

AWL3975-T5

Common Name- 4 Port, 6 Panel, Band 48 Strand Mount

3550 - 3700MHz	4	Fixed	8.8	360°
Frequency	Ports	Tilt	Gain	Beamwidth

PRODUCT INFORMATION

This strand mount antenna offers Alpha Wireless' patented 4x4 MIMO capability in a pseudo omni configuration for CBRS applications. This special antenna allows a radio chassis to sit within the inside cavity and attach directly to the antenna's frame. The antenna has integrated jumper cables to connect to the radio's RF ports.

APPLICATION

Alpha Wireless pseudo omni antenna provides 360° coverage in a strand mount form factor. This 4X4 MIMO Omni antenna is composed of two 2x2 MIMO Omni arrays with azimuth patterns that are offset 180° from one another. The composite of both 2x2 MIMO Omni-directional patterns features no nulls and minimum azimuth pattern ripple which provides consistent coverage for 4x4 MIMO applications.

FEATURES

- Four ports operating over the 3GPP band 48.
- Optimized Pseudo omni with reduced azimuth ripple for strand-mount applications.
- Extended antenna length with higher gain.
- 6 Panel design with integrated in-fill panels.
- Aluminum back plane to enhance heat dissipation.

Antenna Datasheet (2/2)

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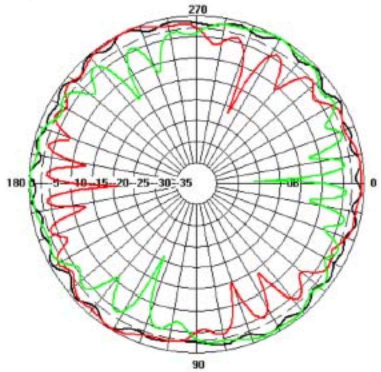
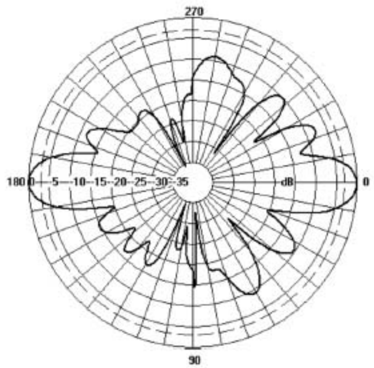
TECHNICAL SPECIFICATION **AWL3975-T5**

Electrical Specifications			
Frequency Range		MHz	3550 - 3700MHz
Polarisation		Degree	+/- 45º Slant Linear
Gain	Basta	dBi	8.8±0.5
	Max	dBi	9.3
Azimuth Beamwidth		Degree	360º
Elevation Beamwidth		Degree	17º
Electrical Downtilt		Degree	T5º
Electrical Downtilt Deviation		Degree<	1º
Impedance		Ohms	50
VSWR		<	1.5
Return Loss		dB>	14
Isolation		dB>	20
Cross-Polar Discrimination		dB>	10
Maximum Effective Power Per Port		W	50

Representative Pattern Files

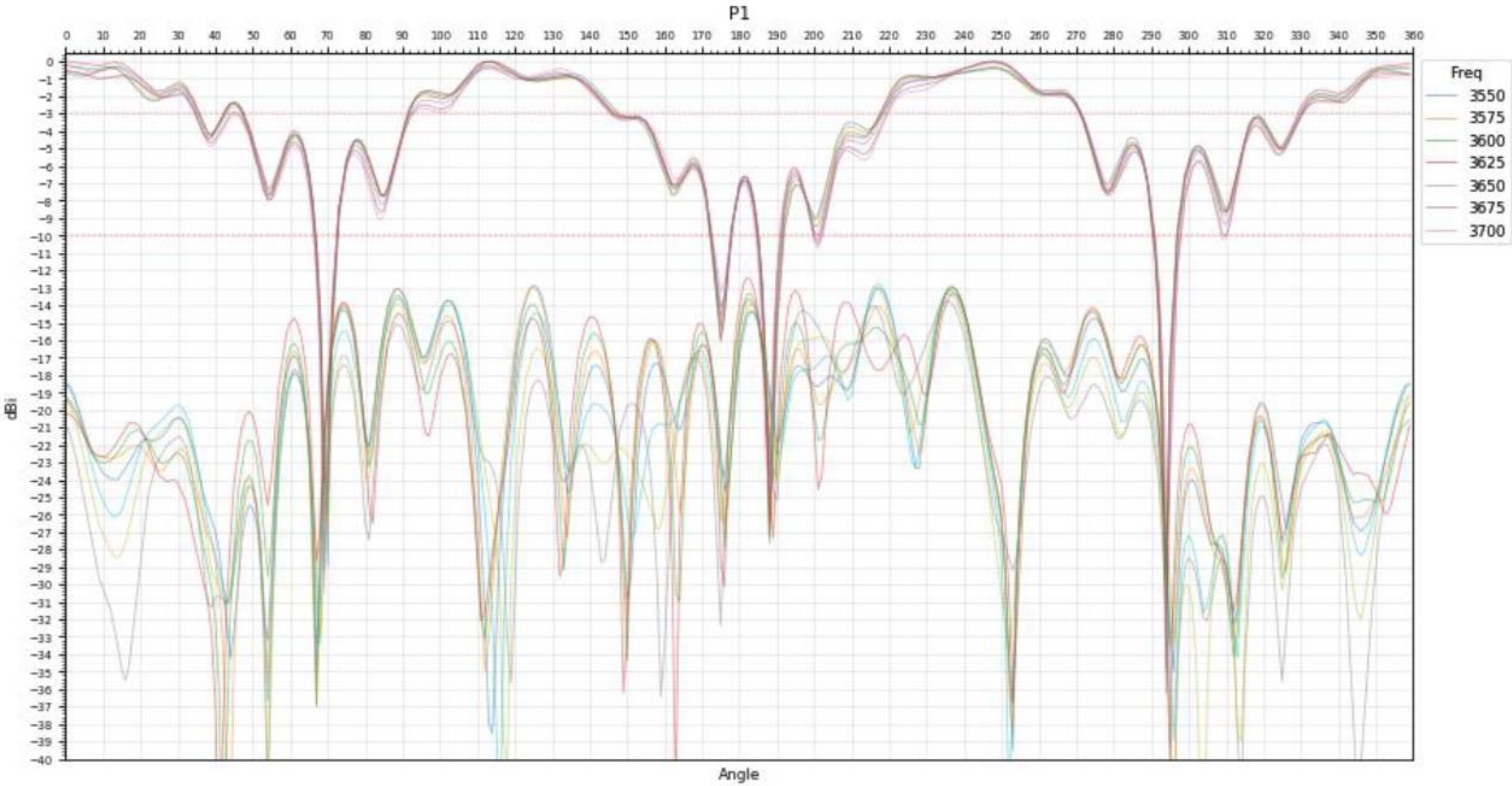




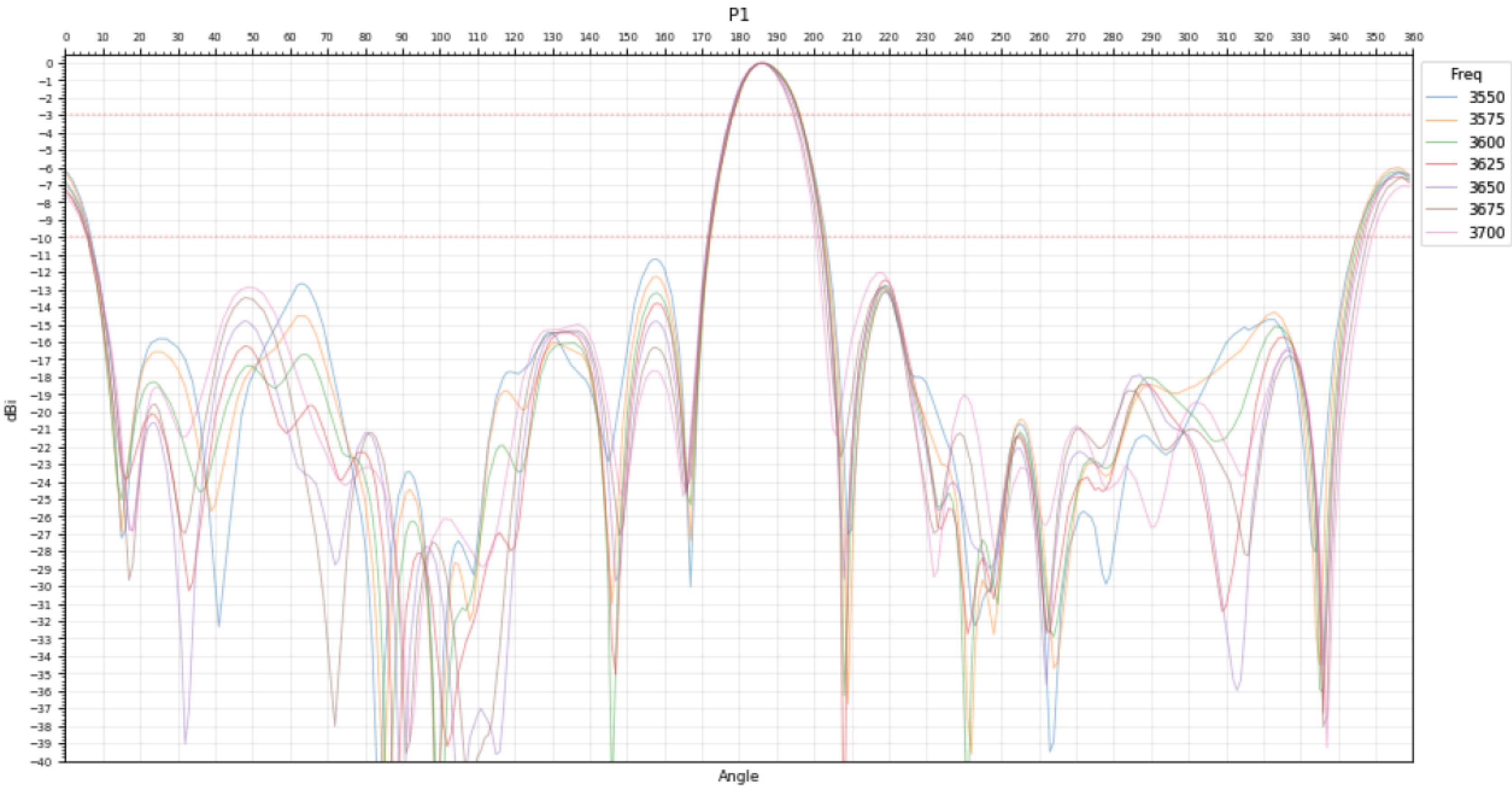
Azimuth	Elevation

The green curve represents the azimuth pattern of Ports 1 & 2.
The red curve represents the azimuth pattern of Ports 3 & 4.
The black curve represents the composite azimuth pattern, a smooth Omni pattern with minimized nulls.
For radiation pattern files, please login at www.alphawireless.com

Radiation Pattern Port1 Azimuth



Radiation Pattern Port1 Elevation



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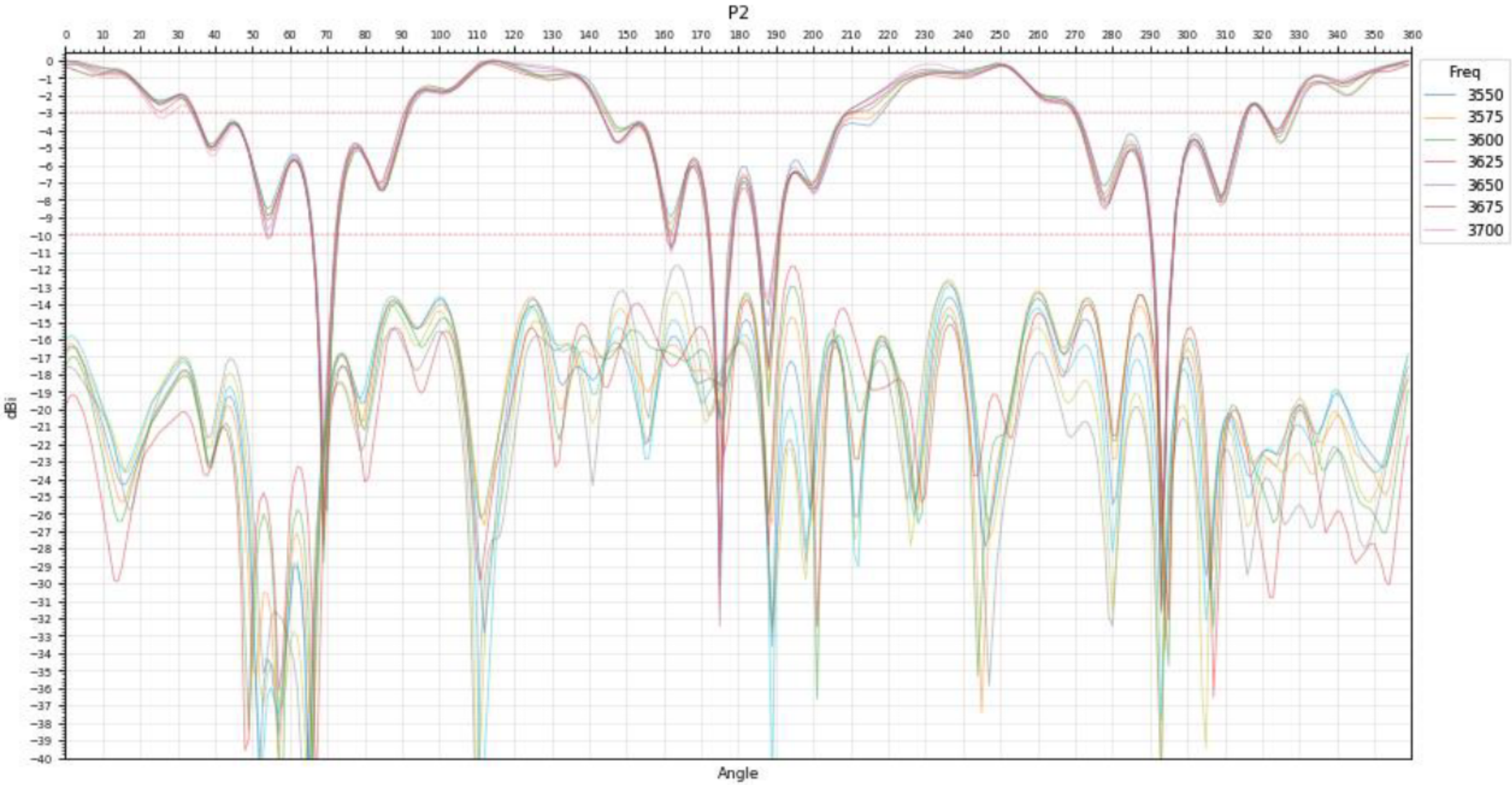
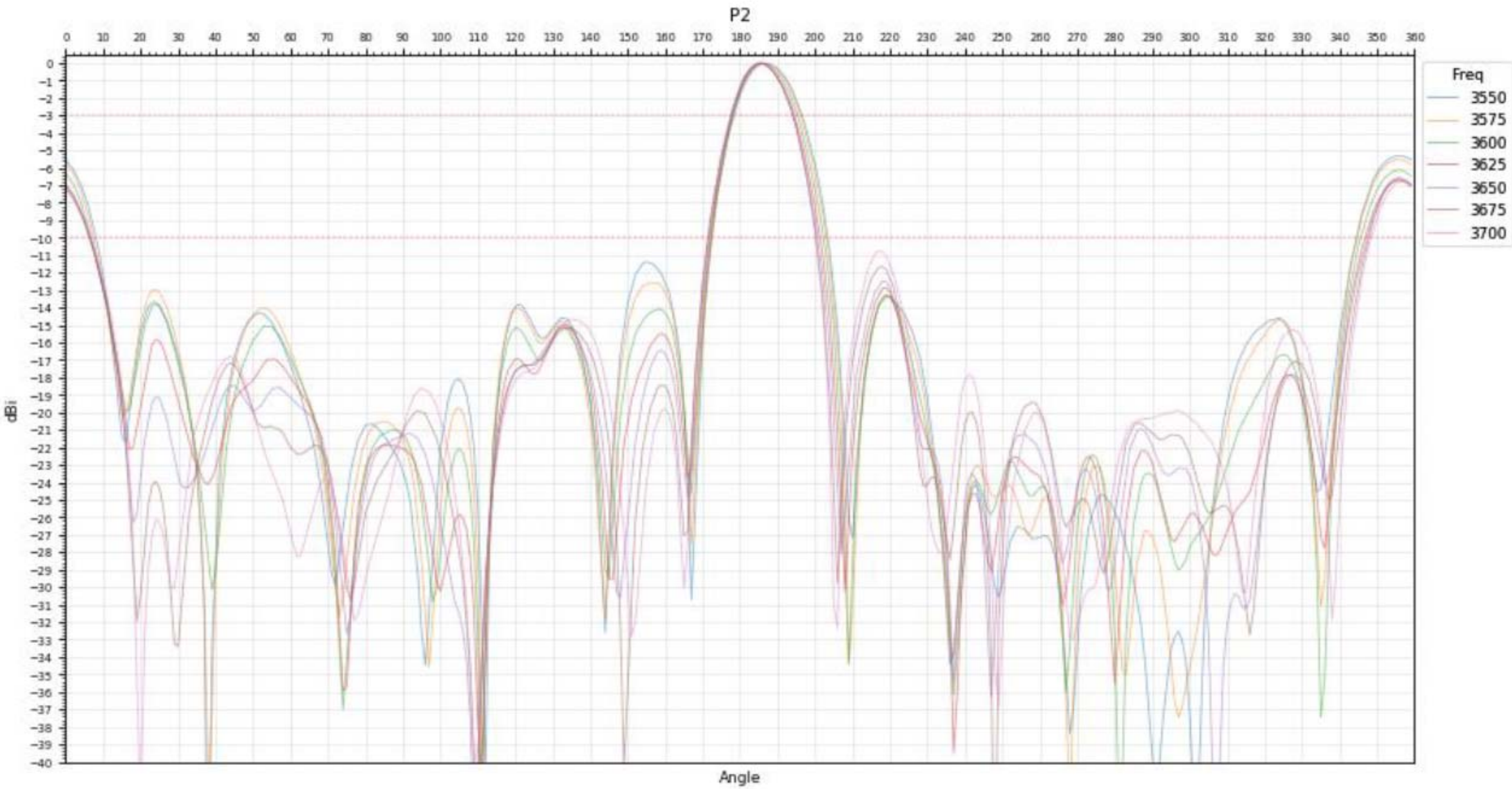
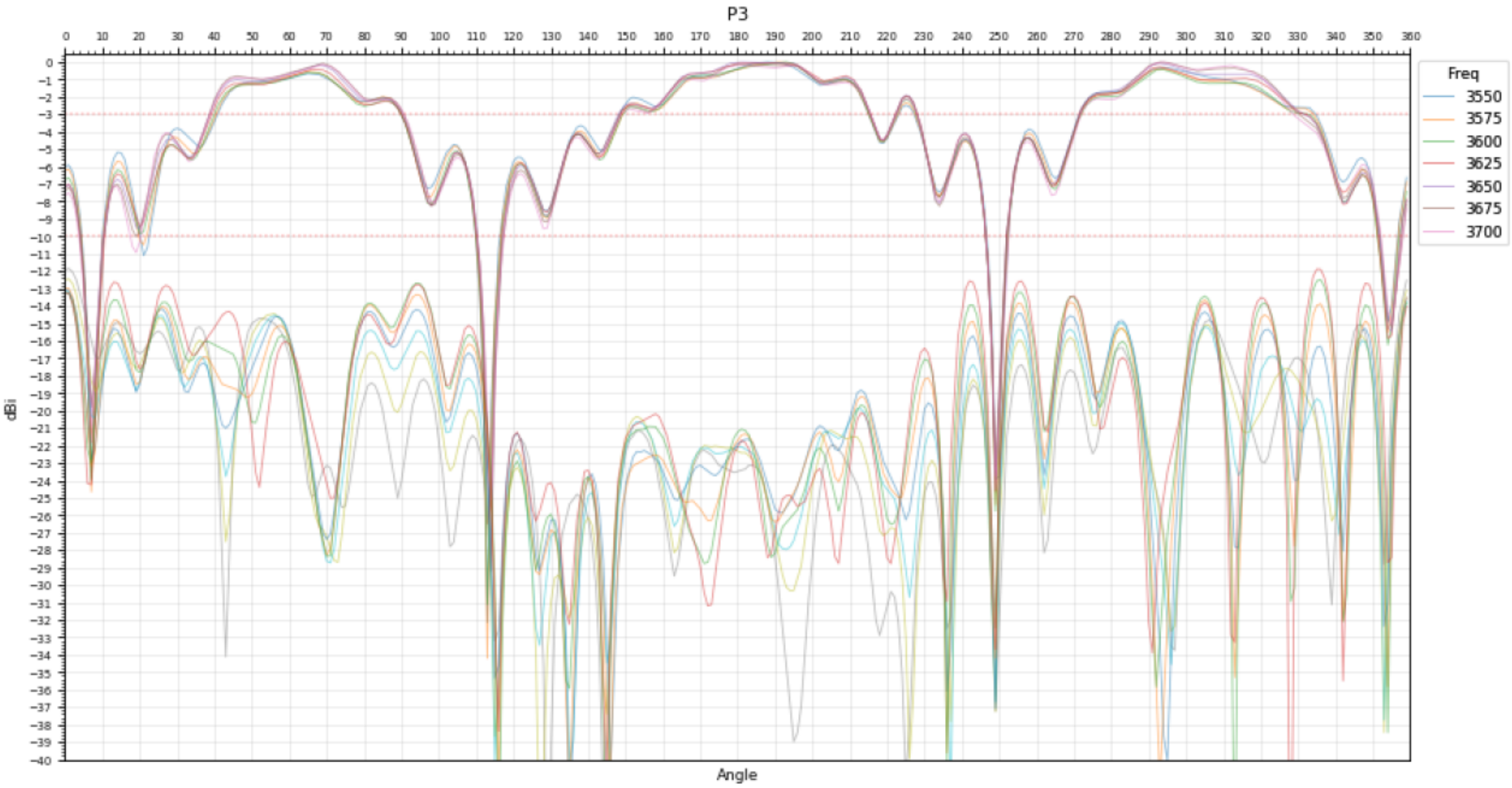
Radiation Pattern Port2 Azimuth



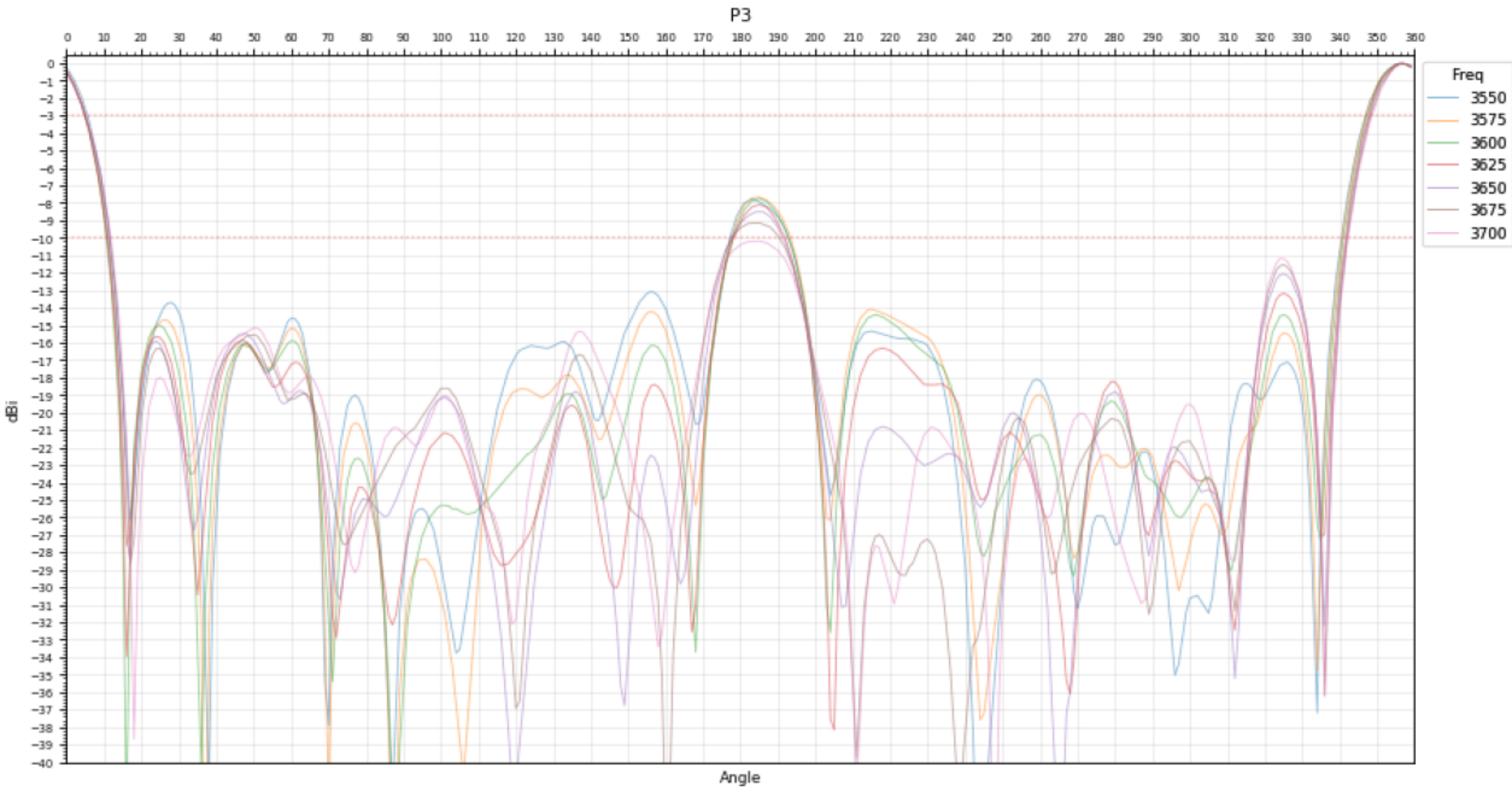
Radiation Pattern Port2 Elevation



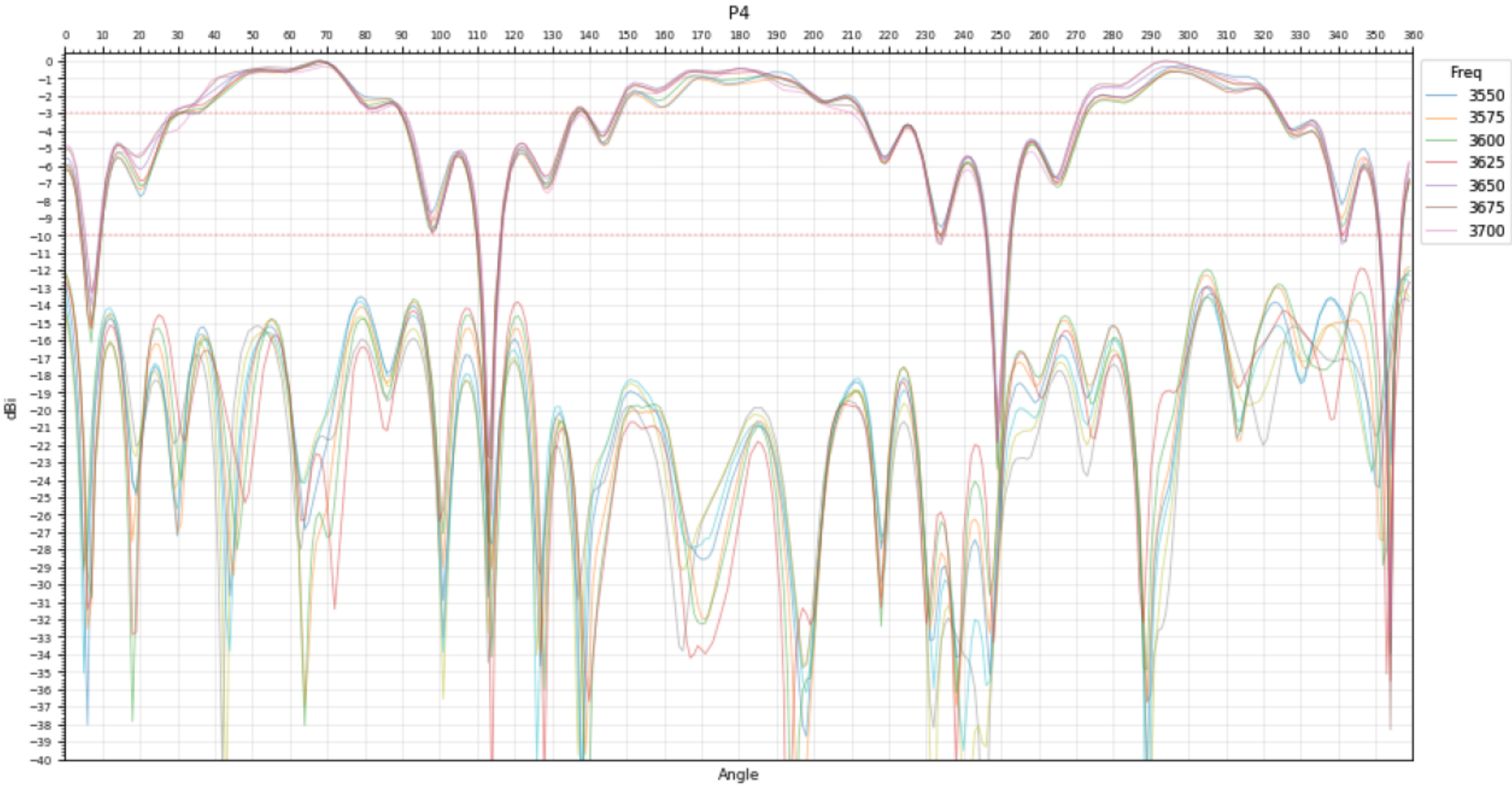
Radiation Pattern Port3 Azimuth



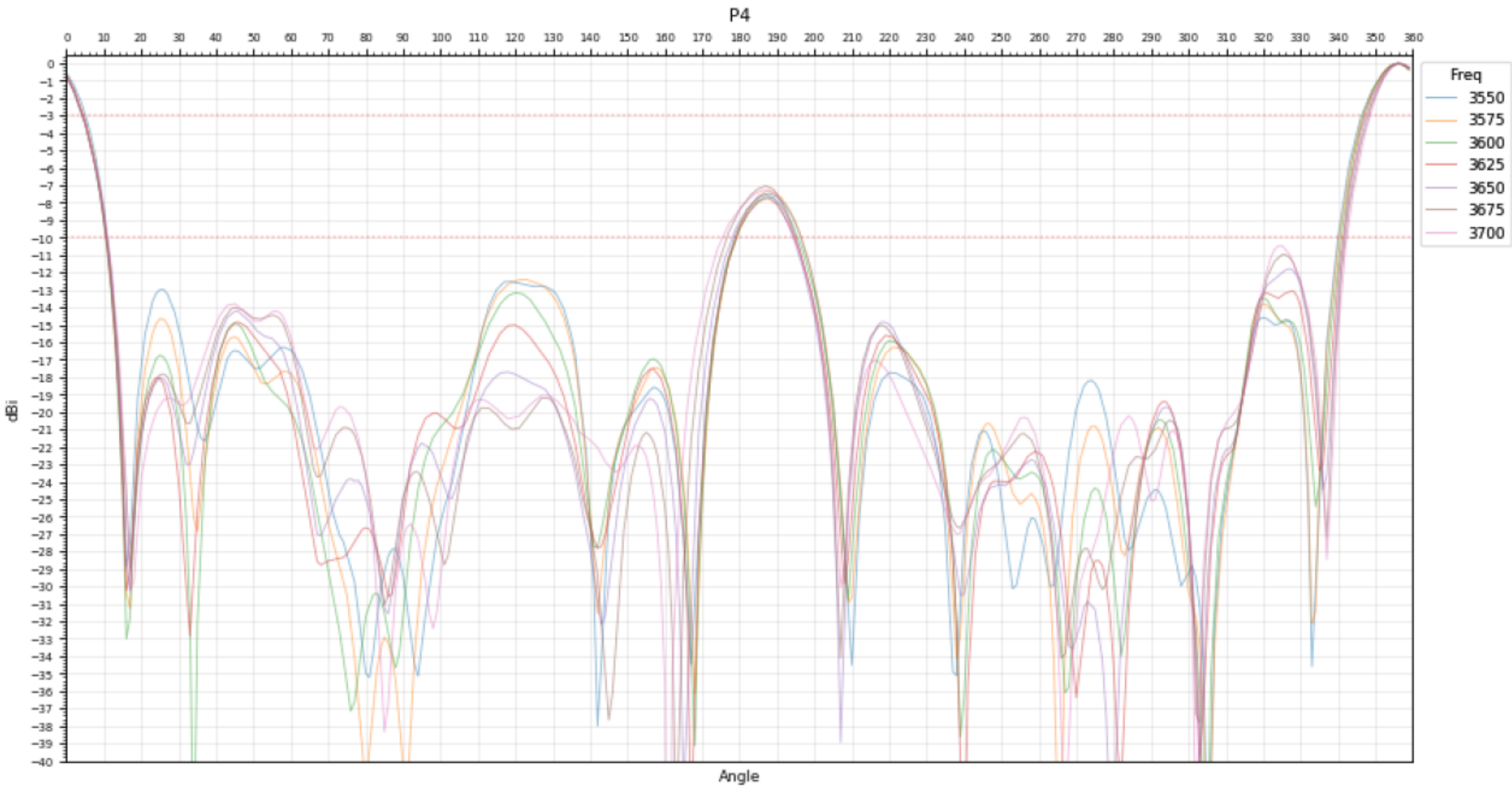
Radiation Pattern Port3 Elevation



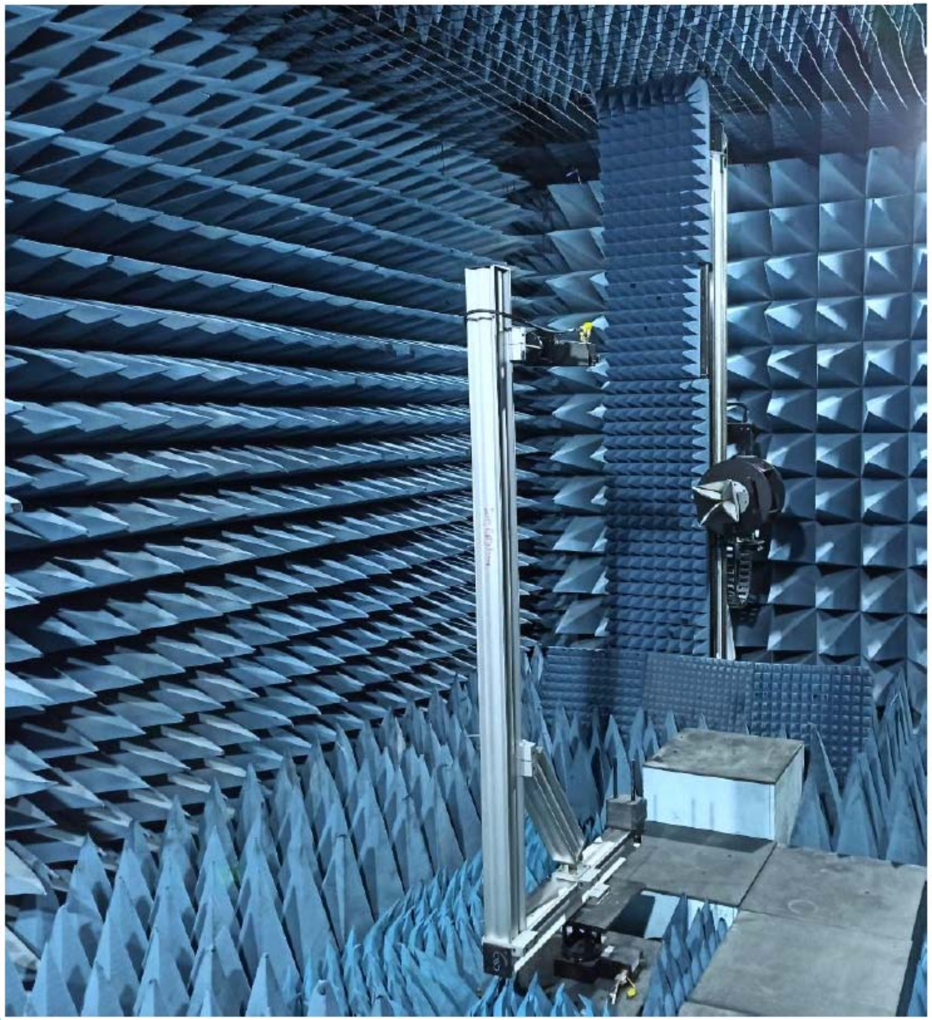
Radiation Pattern Port4 Azimuth



Radiation Pattern Port4 Elevation



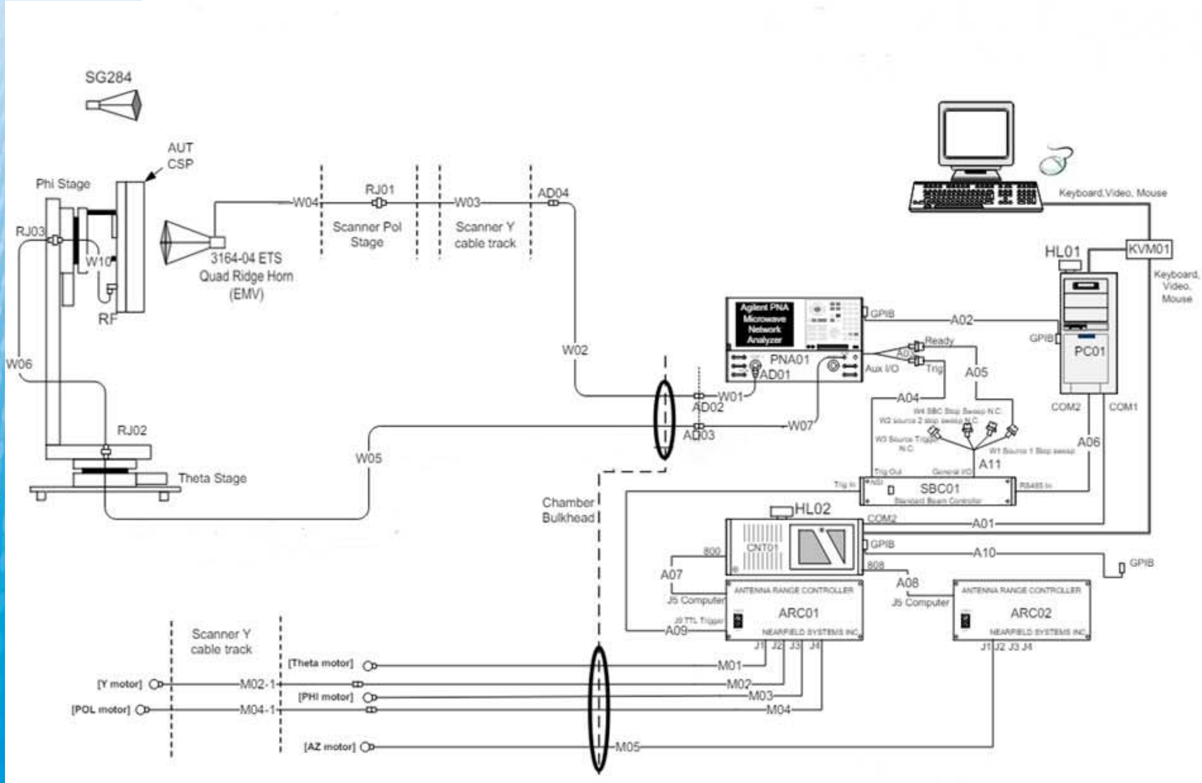
Chamber Information



Alpha Wireless Antenna Measurement Chamber

- NSI 600C antenna measurement system
- Chamber Dimensions: 10(L)x5(W)x5(H)m
- Operation Band 700MHz – 12GHz

Test Set Up



Item	Model No
PC Workstation	Dell Precision 380
Antenna Range Controller ARC #1	NS1-SC-5911-402-00084
Antenna Range Controller ARC #2	NS1-SC-5911-402-00084
Standard Beam Controller	NS1-RF-591802-00152
Positioning Equipment	NSI -SC-5633B
Positioning Equipment	NSI -SC-5632A RT100A
Positioning Equipment	NSI -SC-5633B RT150B
Positioning Equipment	NSI -SC-5635 RT300B
Standard Gain Horn [2.6 - 3.95GHz]	SG284
Quad Ridge Horn (ETS LINDGREN) [0.7 - 6GHz]	3164-04 ETS
Network Analsyer	Agilent E8326B PNA

Test date: 10/10/2023.
Test personnel: MJ McAssey.
Equipment: NSI 600C antenna measurement system.
Calibration: System verified with standard gain horn on date of test.

Calculations

Because the antennas are fixed in location within the device the directional antenna gain for MIMO is calculated over a sphere using the raw spatial data taken at 15 degree steps of theta and phi for each antenna using the equations from KDB 662911 D01. The raw antenna data is located in the appendix of this report.

The system has four port split into two pairs. Within each pair the two antennas are co-polarized, but cross polarized to the other pair. The correlated gain is therefore calculated by determining the correlated gain separately for each pair and then combining the effective gains of the two cross-polarized pairs using the equations for non-correlated antennas. This is explained in the OET presentation at TCBC Workshop April 2016, slide 14 of "Directional Gain and EIRP Calculations for Transmitters with Multiple Outputs".

For 3.55GHz , Port1 and Port3 are co-polarized (+45 degree), Port2 and Port4 are co-polarized (-45 degree).

The correlated gain was calculated using the following steps:

1. For the correlated gain the equation F(2)(d)(i) from KDB 662911 D01 is applied on a spatial basis (i.e. at each theta/phi) to determine the effective gain for each pair of co-polarized antennas.
2. The two gains are then combined (again, on a spatial basis at each theta-phi) using the formula for non-correlated transmissions , F(2)(d)(ii) from KDB 662911 D01

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Calculations(cont'd)

3.55GHz correlated calculation for P1&P3 , P2&P4:

Maximum correlated gain for port1 and port3:9.41dBi ,This occurs at: 3550MHz: phi 315 / theta 90
= 10*LOG(((10^(Port1/20))+10^(Port3/20))^2/2) = 10*LOG(((10^(5.0/20))+10^(7.6/20))^2/2)

Maximum correlated gain for port2 and port4:9.28dBi ,This occurs at: 3550MHz: phi 315 / theta 90
= 10*LOG(((10^(Port2/20))+10^(Port4/20))^2/2) = 10*LOG(((10^(4.1/20))+10^(8.0/20))^2/2)

3.55GHz uncorrelated calculation for two cross-polarized pairs:

Maximum uncorrelated gain for two cross-polarized pairs:9.35 ,This occurs at: 3550MHz: phi 315 / theta 90
=10*LOG(((10^(P1&P3 Correlated/10))+10^(P2&P4 Correlated/10))/2) = 10*LOG(((10^(9.41/10))+10^(9.28/10))/2)

Worst-case gains used to calculate the directional gain for cross-polarization:

	Gain at Position (dBi)				
Position (θ, ϕ)	Ant. 0 (Port 1)	Ant. 1 (Port 2)	Ant. 2 (Port 3)	Ant. 3 (Port 4)	Calculated Correlated Directional Gain (dBi)
(90, 315)	5.0		7.6		9.41
(90, 315)		4.1		8.0	9.28

Single antenna port peak gains

Antenna Type	Patch			
Antenna Connector	NEX 10 Female			
Ant. No.	Ant. 0 (Port 1)	Ant. 1 (Port 2)	Ant. 2 (Port 3)	Ant. 3 (Port 4)
Band	Gain (dBi)			
Band 48	8	7.8	8.3	8.6

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