

Paccar Silverbox

Matching network update
and Gain Measurements
PV Sample
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Group

Glossary

Concepts and Acronyms

- **Antenna Efficiency** – The ratio of power radiated by the antenna to the total input power, accounting for losses.
- **Antenna Gain** – A measure of how effectively an antenna directs radio frequency energy in a specific direction compared to an isotropic source
- **Matching Network (MN)** – A circuit that optimizes power transfer between the antenna and its feeding trace by minimizing impedance mismatch.
- **S11 / Return Loss** – A parameter indicating how much power is reflected back from the antenna input, revealing impedance matching quality.
- **S12 / Coupling** – A measure of how much signal leaks or transfers from one port to another in a multi-port system.
- **dB/dBm** – Power quantity in logarithmic scale, 0 dBm = 1 mWatt, 0 dB = 1Watt.
- **dBi** – Gain relative to ideal isotropic radiator in dB.
- **S11 threshold: -10 dB** – 90% of Power is transmitted, 10% is reflected.
- **S11 threshold: -6 dB** – 75% of Power is transmitted, 25% is reflected.

Measurement and Sample Setup

Passive Measurements in VNA and Anechoic Chamber

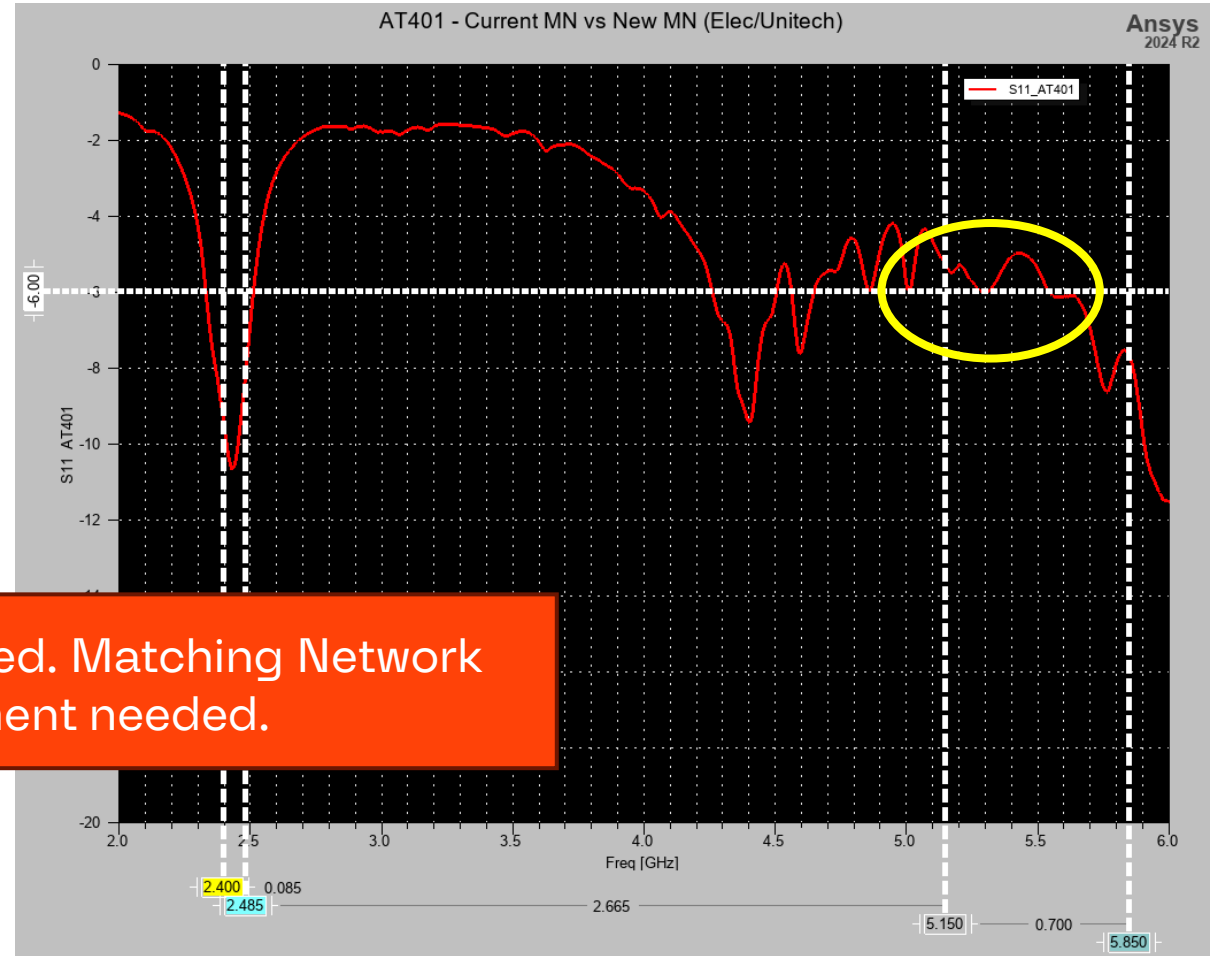
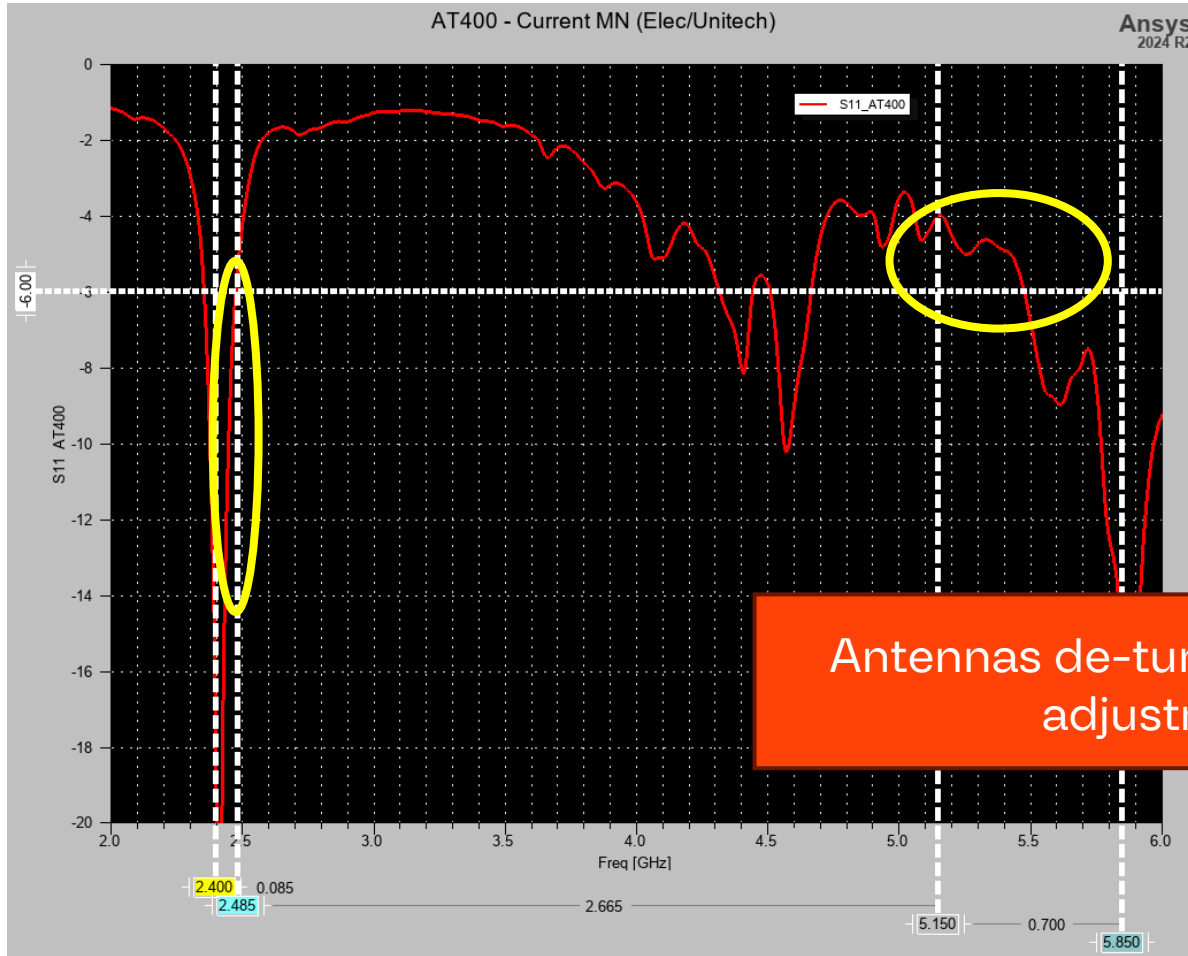
Passive measurement considering only Antenna + Matching Network, including housing effect.

Measurement Frequency: 2.4GHz and 5GHz Bands.



PV sample with current Matching Network

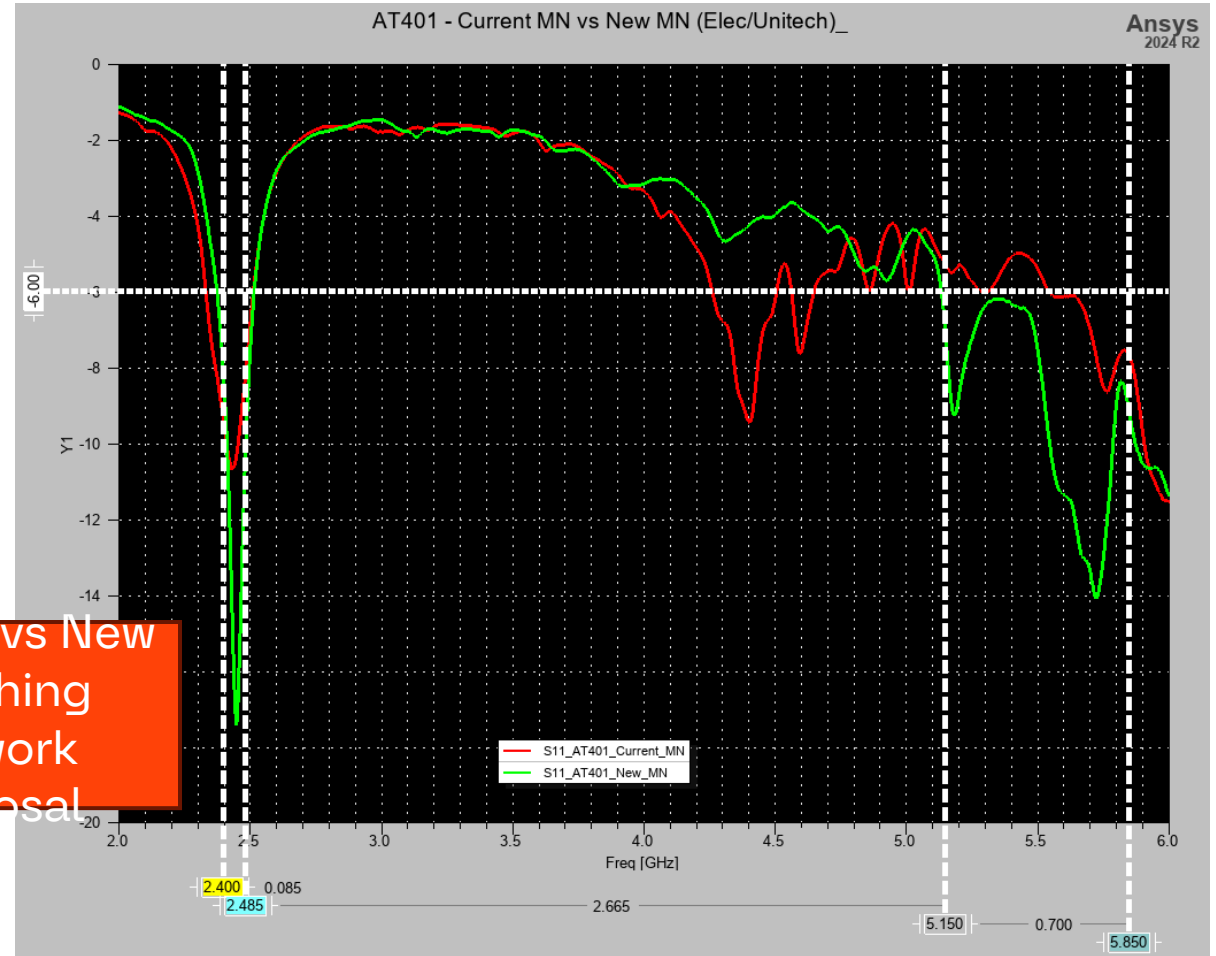
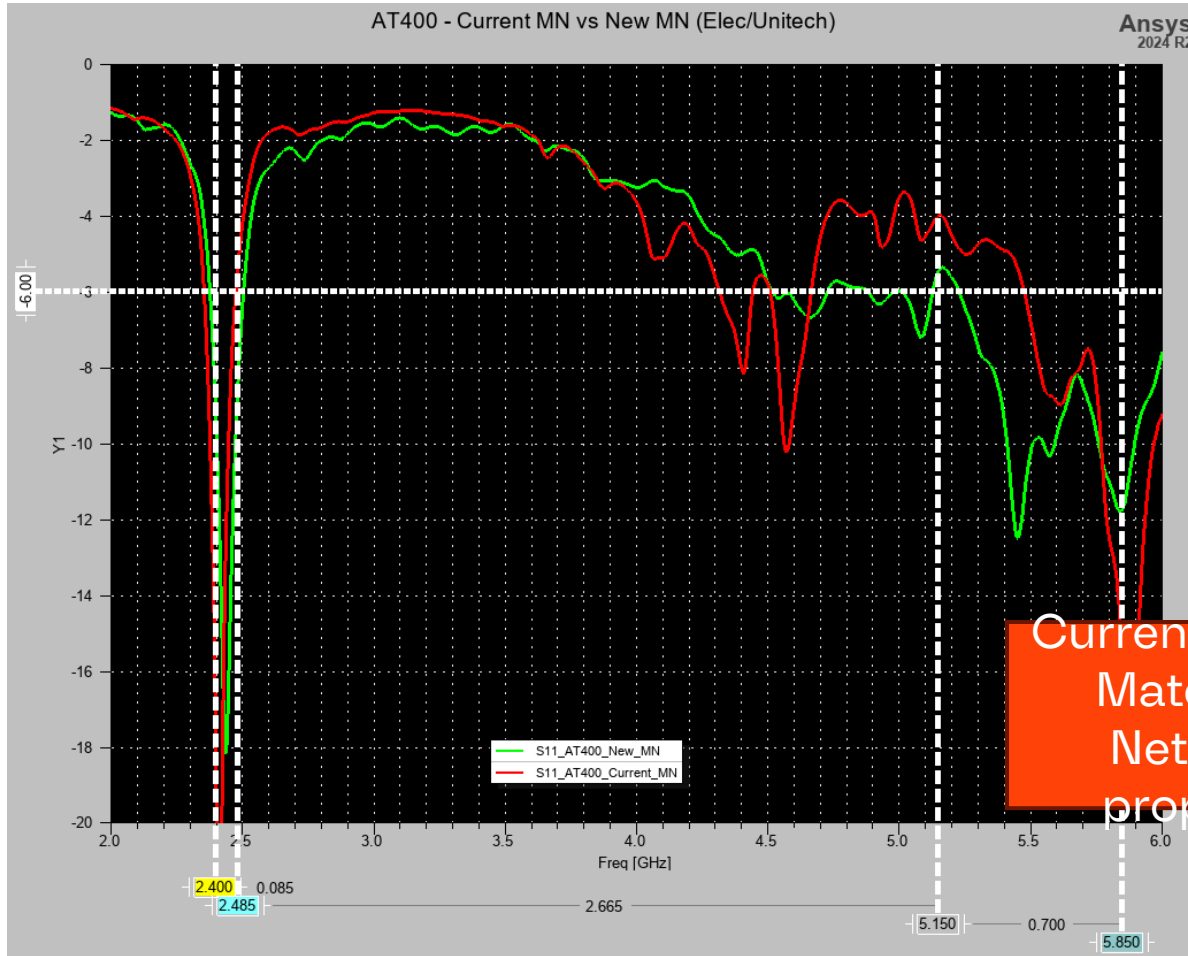
Antennas S11 –Sample with current Matching Network



Antennas de-tuned. Matching Network adjustment needed.

PV sample with New Matching Network

Antennas S11 –Sample with current Matching Network

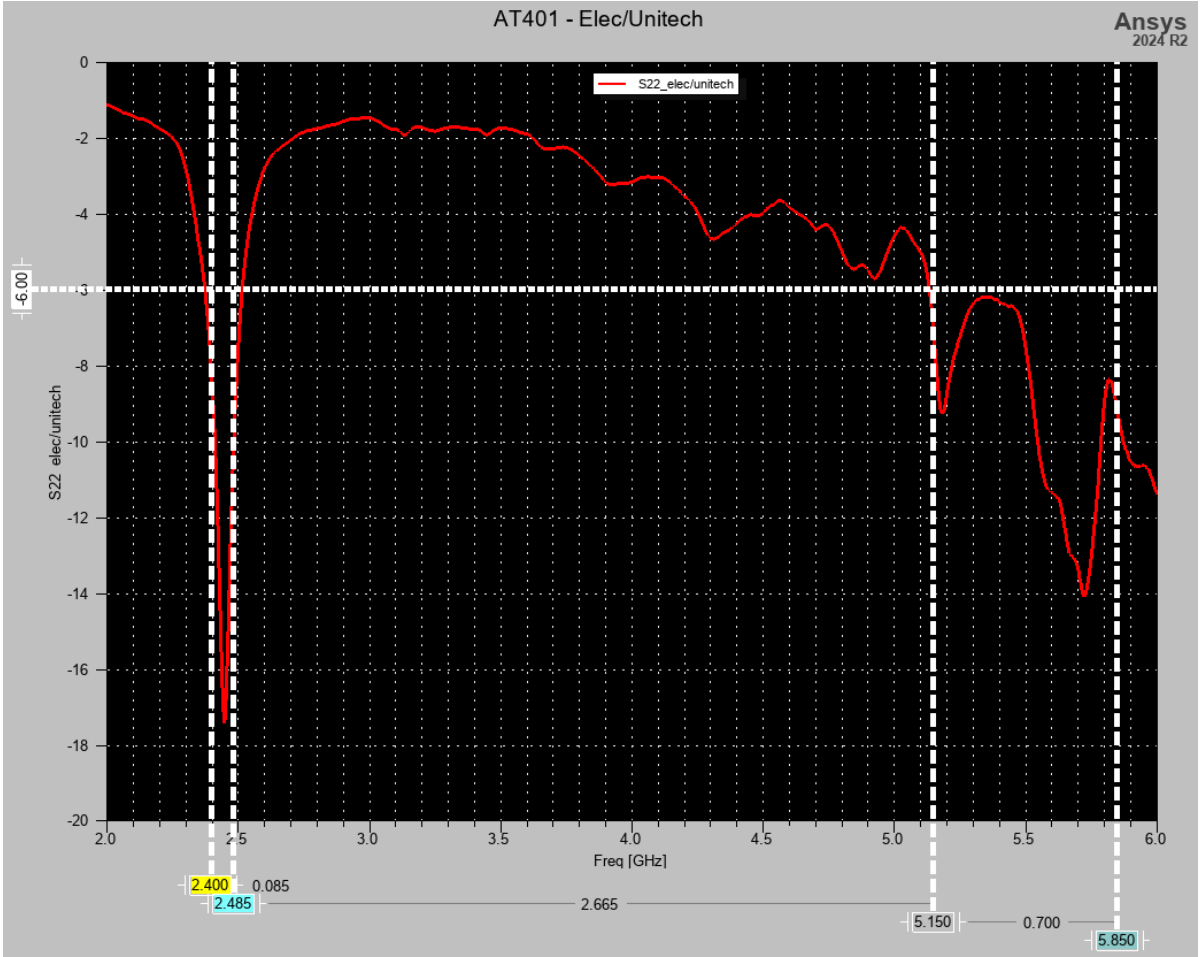
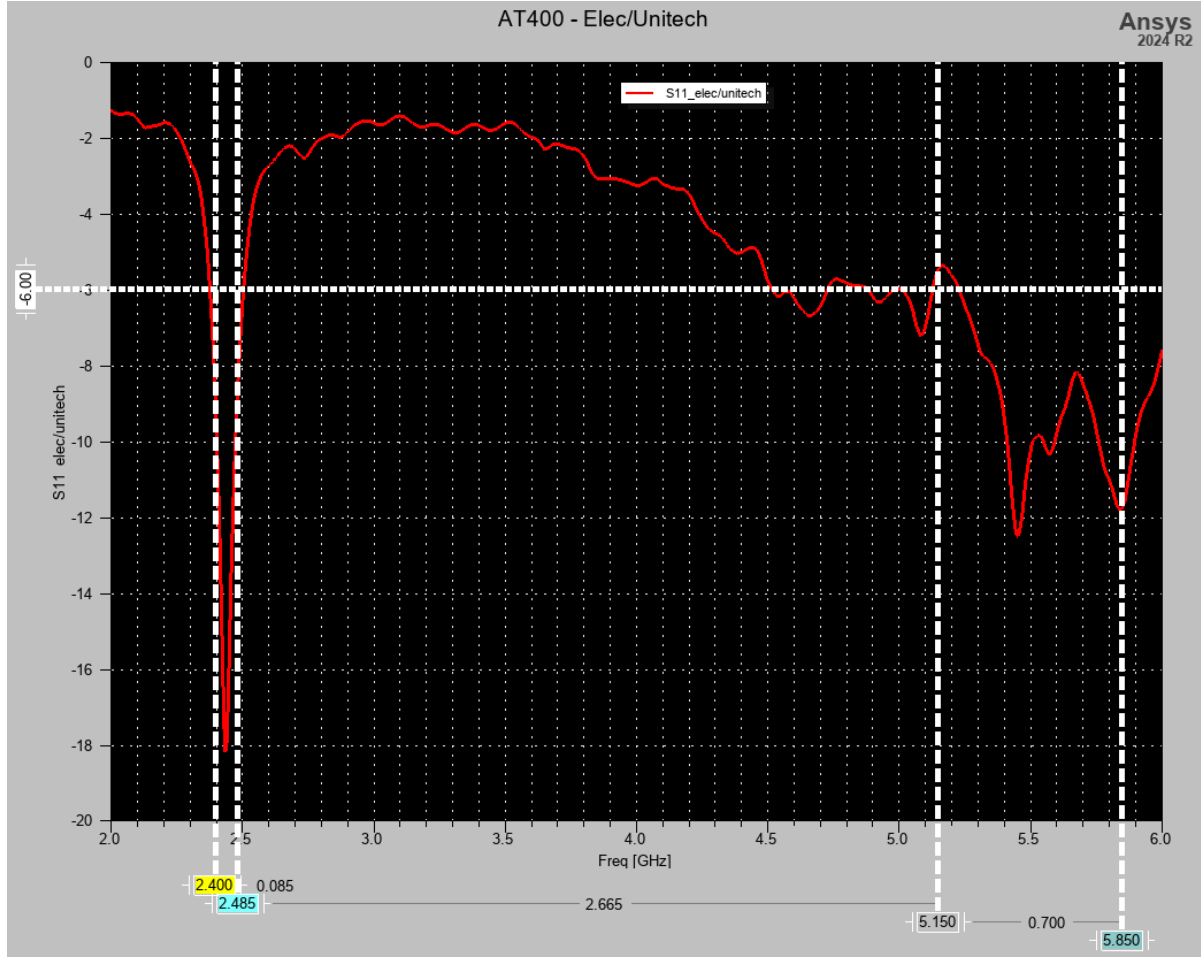


VNA Measurements

S-Parameters

New Matching Network - Reflection

Antenna S11



Radiated Measurements Gain & Efficiency Tables

2.4 GHz Band

Peak Gain Tables [dBi]

WIFI 2.4GHz Band – Anechoic Chamber Measurement

Frequency	Average	
	AT400	AT401
2400	2.3	1.6
2410	2.5	1.7
2420	2.7	1.8
2430	2.8	1.8
2440	2.7	1.9
2450	2.5	1.9
2460	2.3	1.9
2470	2.1	1.9
2480	1.9	1.9

5 GHz Band

Peak Gain Tables [dBi] – WIFI: 5150 – 5320 MHz

Frequency	Average	
	AT400	AT401
5150	2.2	1.6
5160	2.3	1.8
5170	2.0	2.2
5180	1.9	2.0
5190	1.8	2.0
5200	1.6	2.1
5210	1.8	2.4
5220	2.1	2.1
5230	1.8	1.9
5240	2.2	2.1
5250	1.7	1.5
5260	2.3	1.5
5270	2.1	1.5
5280	2.1	1.7
5290	2.1	1.5
5300	2.2	1.5
5310	2.2	1.9
5320	2.4	1.7

Peak Gain Tables [dBi] – WIFI: 5330 – 5500 MHz

Frequency	Average	
	AT400	AT401
5330	2.5	1.8
5340	2.9	2.0
5350	2.8	2.4
5360	2.7	2.3
5370	3.1	2.8
5380	2.7	2.7
5390	3.1	2.7
5400	3.2	2.9
5410	3.3	2.9
5420	3.5	2.9
5430	3.8	3.2
5440	3.6	3.3
5450	3.8	3.0
5460	3.7	3.2
5470	3.8	3.3
5480	3.8	3.2
5490	3.3	3.4
5500	4.0	3.6

Peak Gain Tables [dBi] – WIFI: 5510 – 5680 MHz

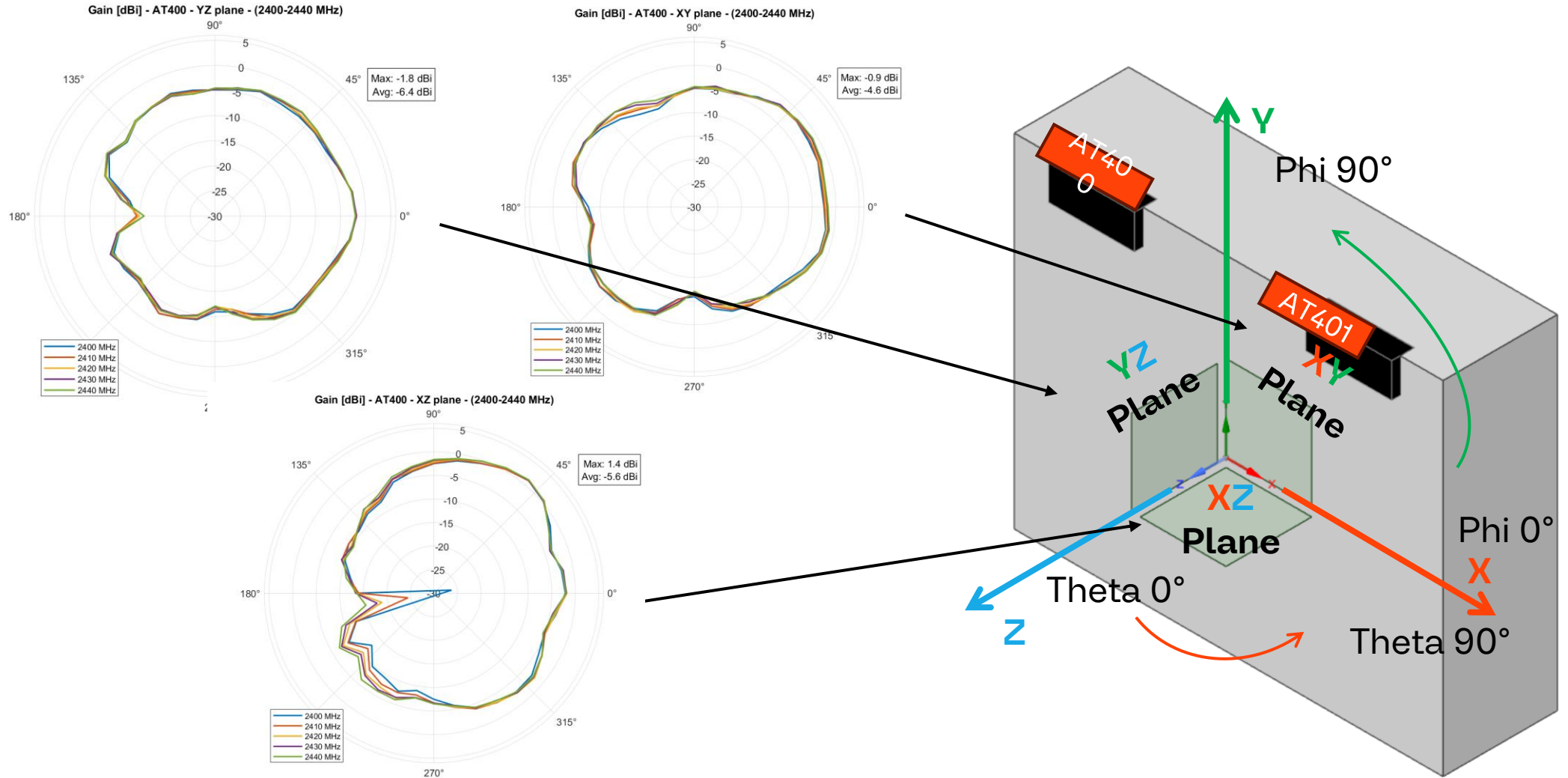
Frequency	Average	
	AT400	AT401
5510	3.7	3.9
5520	3.5	4.0
5530	3.5	4.2
5540	3.6	4.4
5550	3.8	4.2
5560	3.8	4.6
5570	3.9	4.6
5580	4.3	4.9
5590	4.5	4.9
5600	4.4	4.9
5610	4.0	4.9
5620	4.3	5.0
5630	4.6	5.4
5640	4.5	5.2
5650	4.4	4.9
5660	4.7	4.8
5670	4.3	4.8
5680	4.6	4.6

Peak Gain Tables [dBi] – WIFI: 5690 – 5850 MHz

Frequency	Average	
	AT400	AT401
5690	5.1	4.6
5700	4.8	4.4
5710	5.0	4.4
5720	5.1	4.3
5730	5.3	4.7
5740	4.9	4.3
5750	4.9	3.7
5760	4.8	3.8
5770	4.6	3.7
5780	4.8	3.6
5790	4.7	3.5
5800	4.8	3.7
5810	5.3	3.5
5820	5.1	3.9
5830	5.5	4.0
5840	5.3	3.8
5850	5.5	4.2

Radiation Pattern
All suppliers average Gain

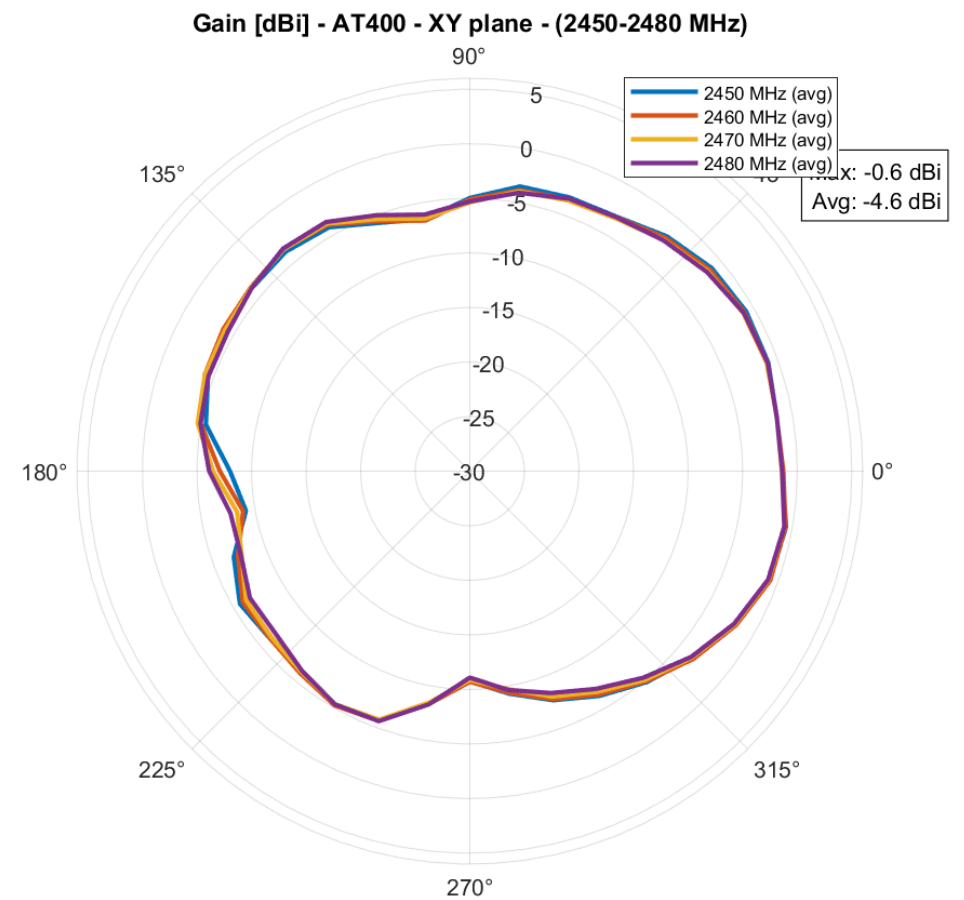
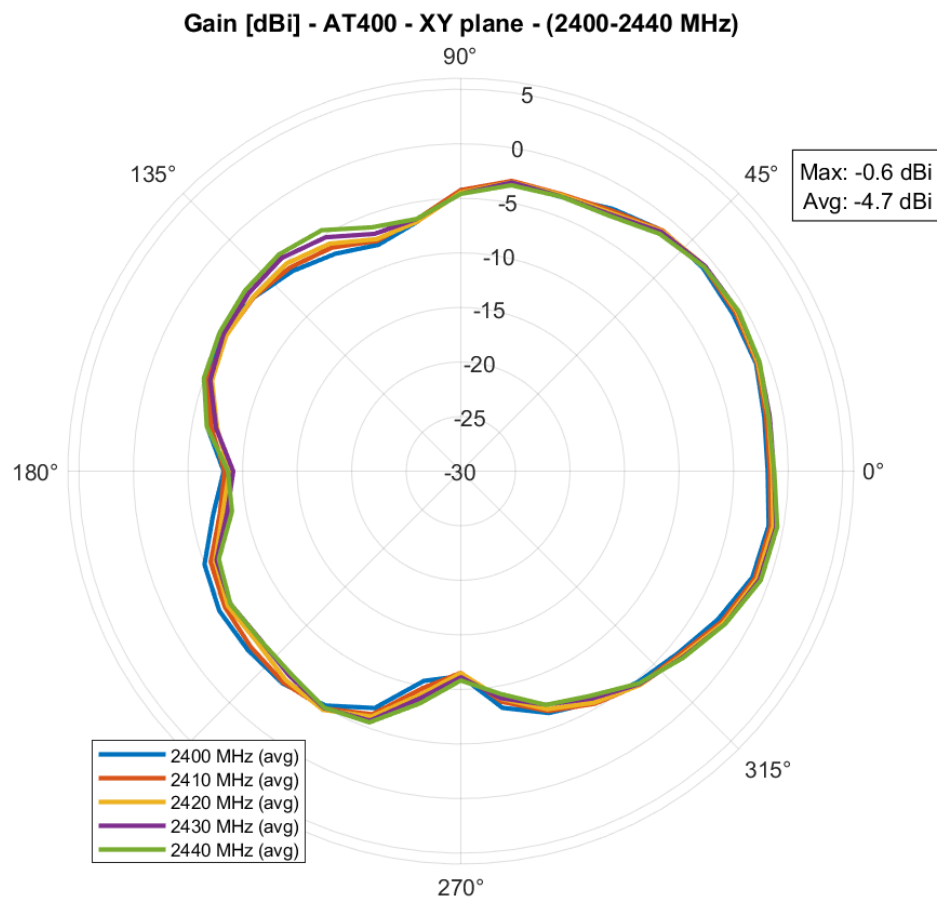
Anechoic Chamber and Pattern Coordinate System



2.4 GHz Band

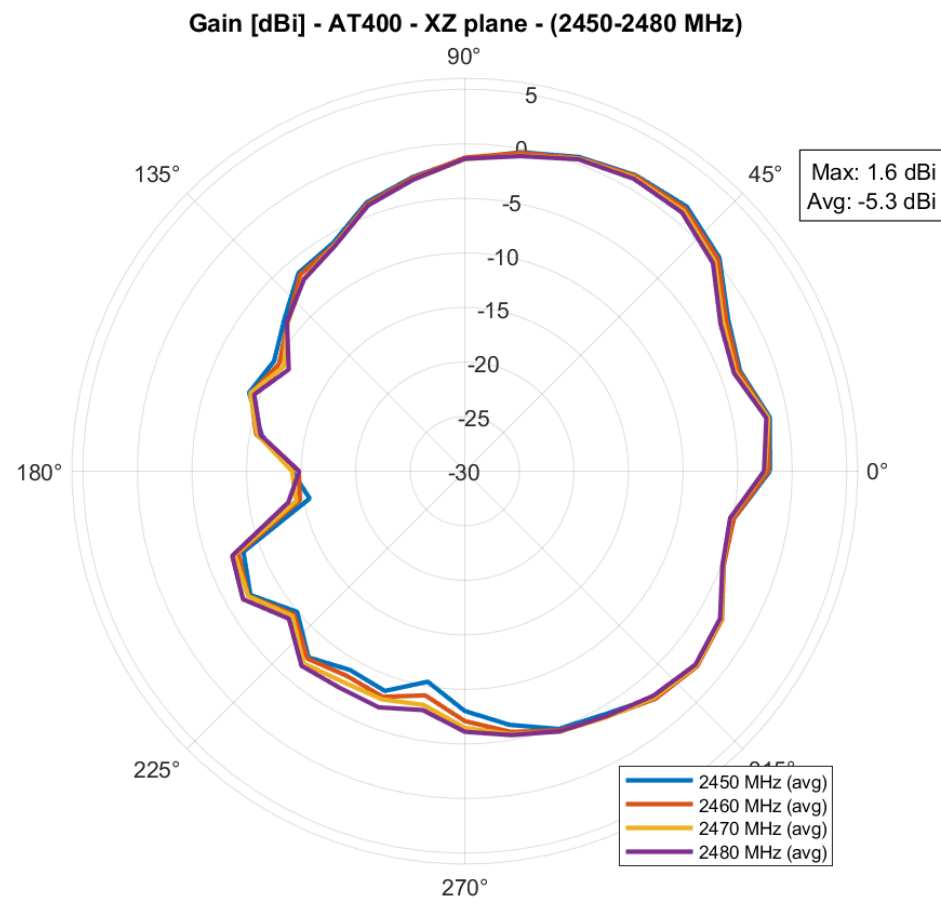
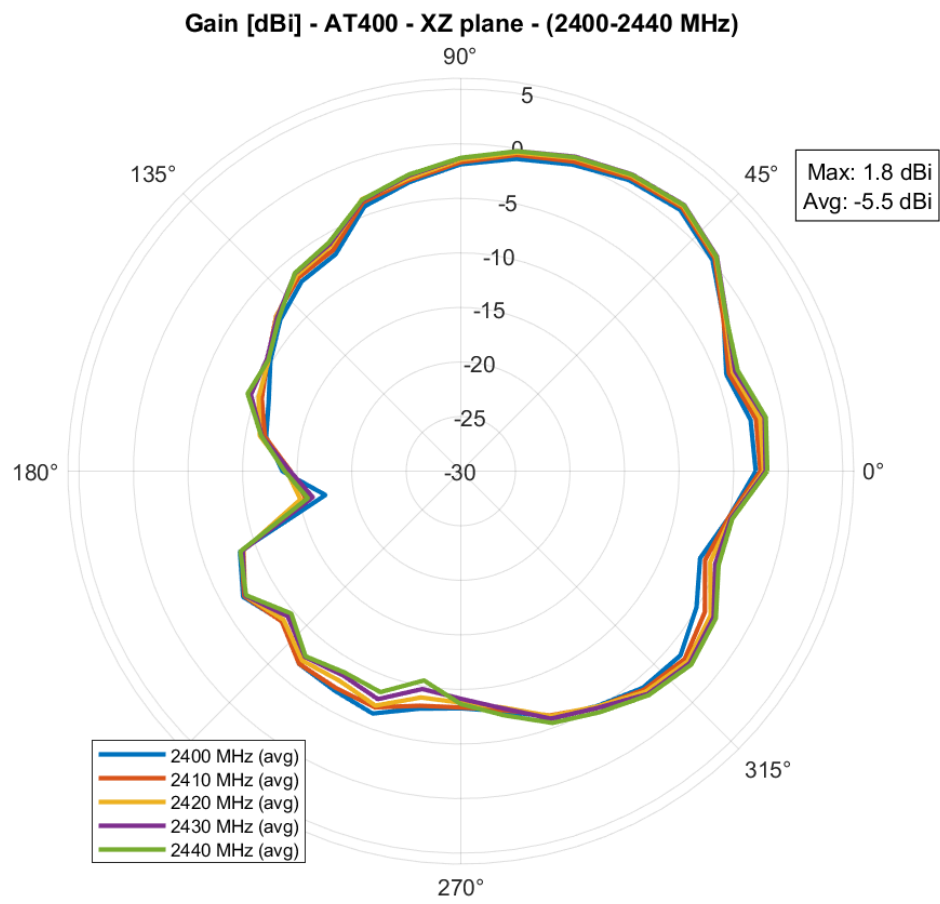
2GHz Band

AT400



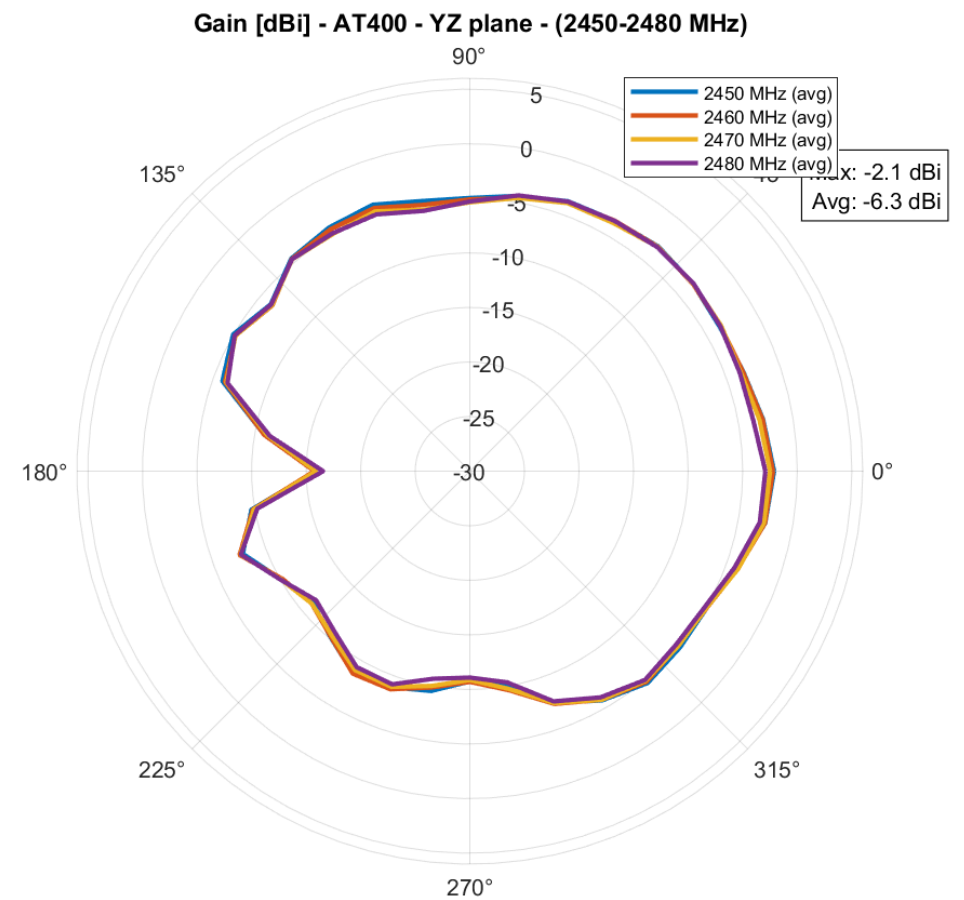
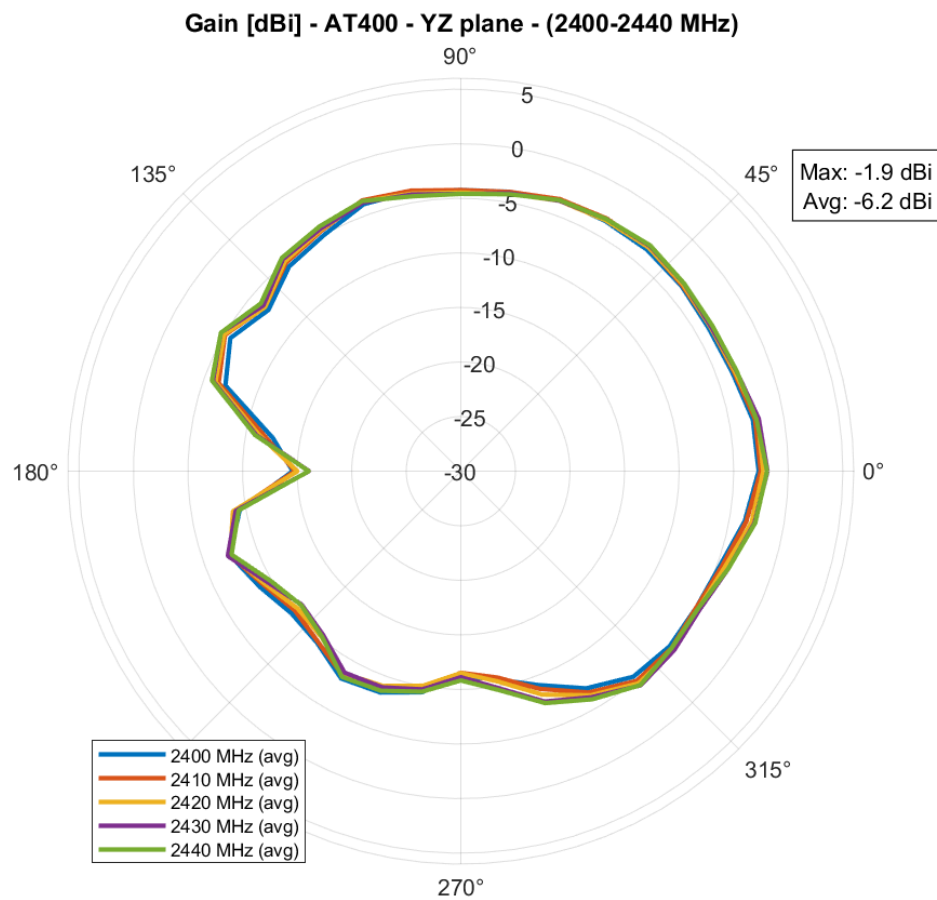
2GHz Band

AT400



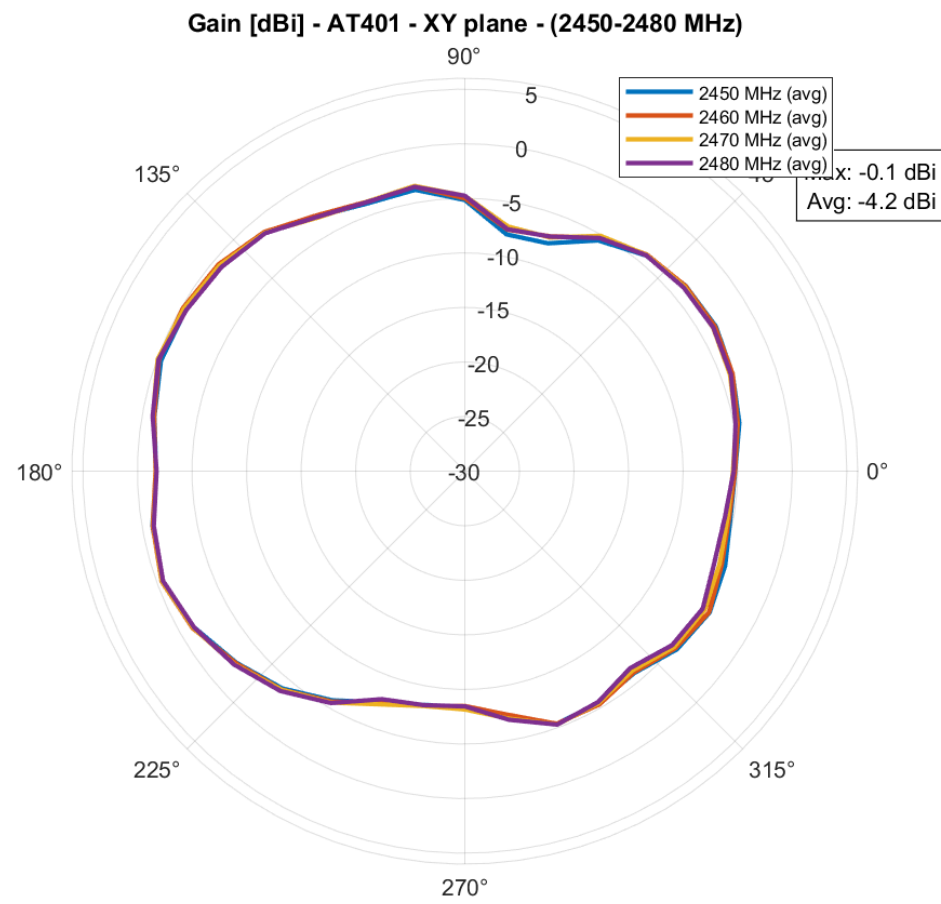
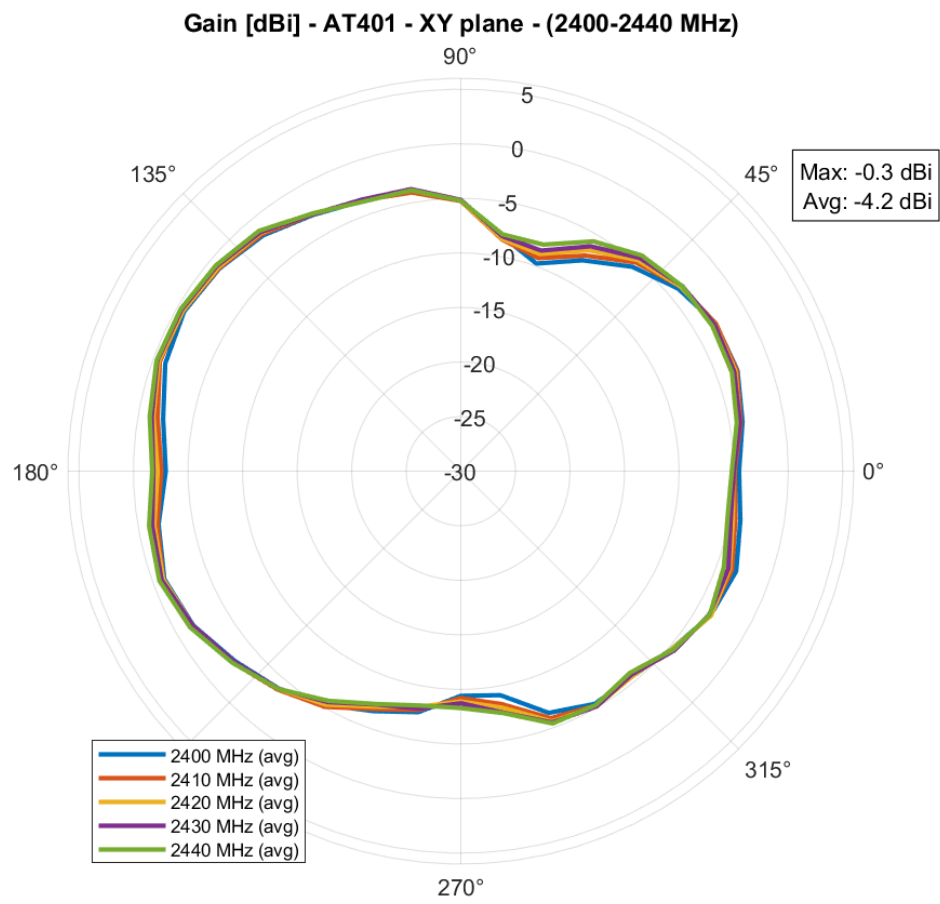
2GHz Band

AT400



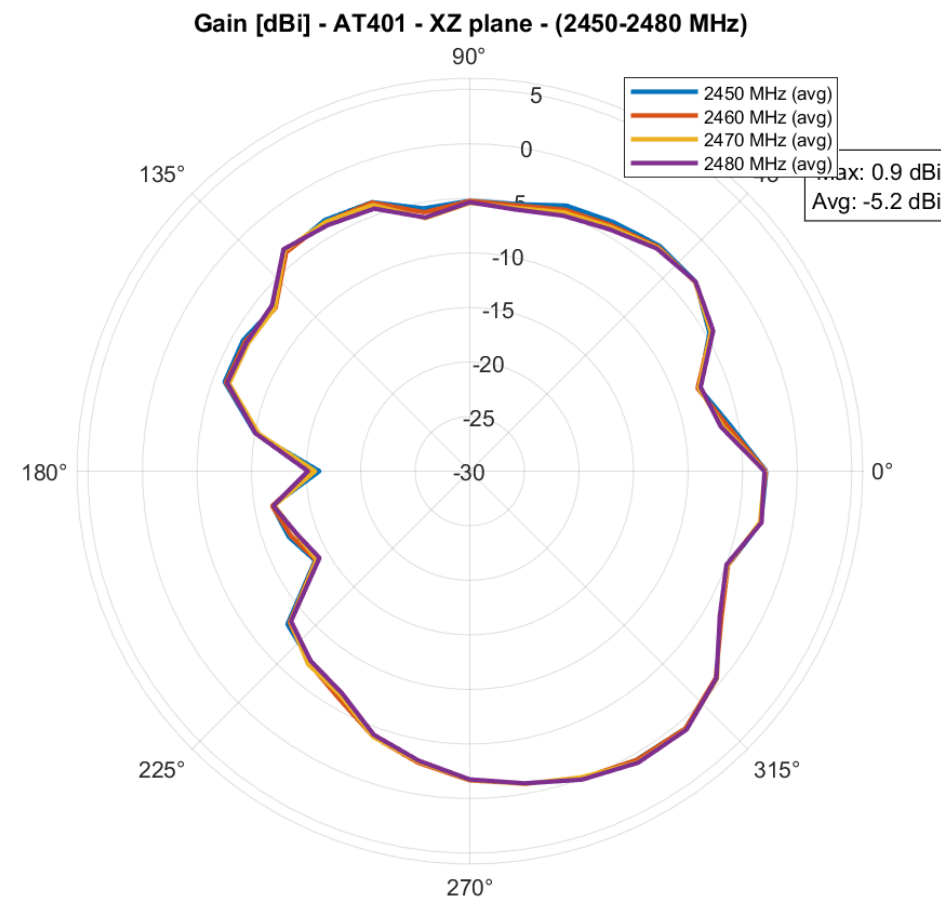
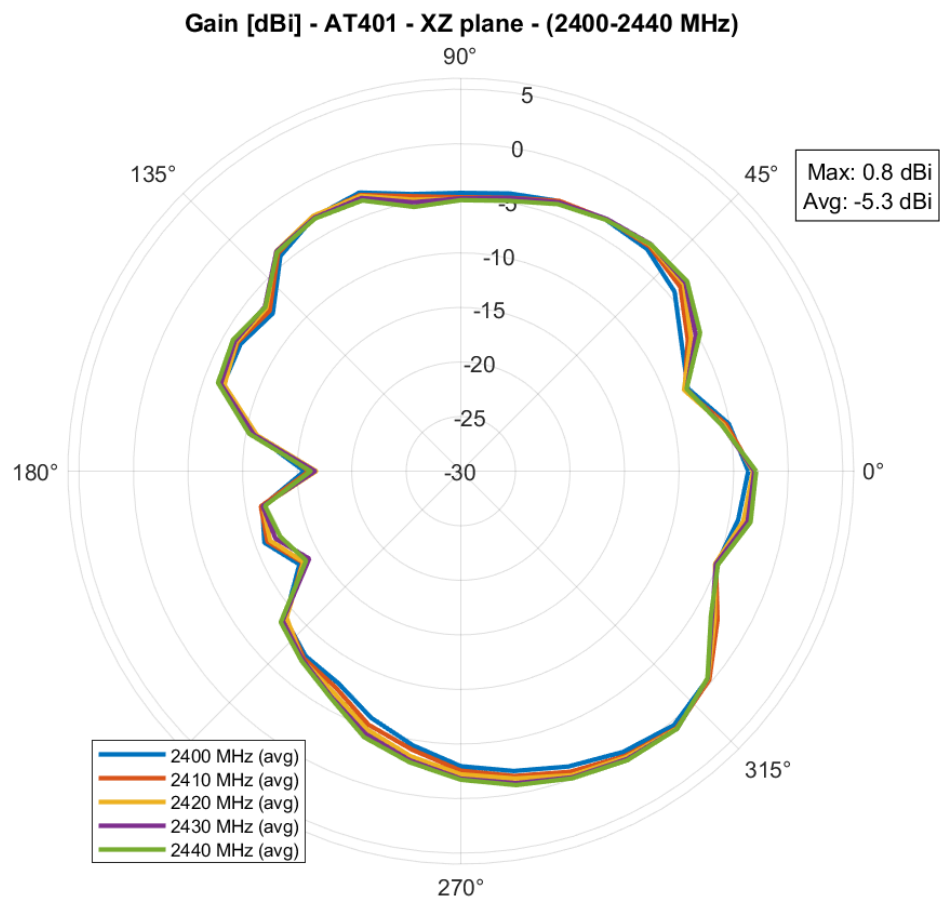
2GHz Band

AT401



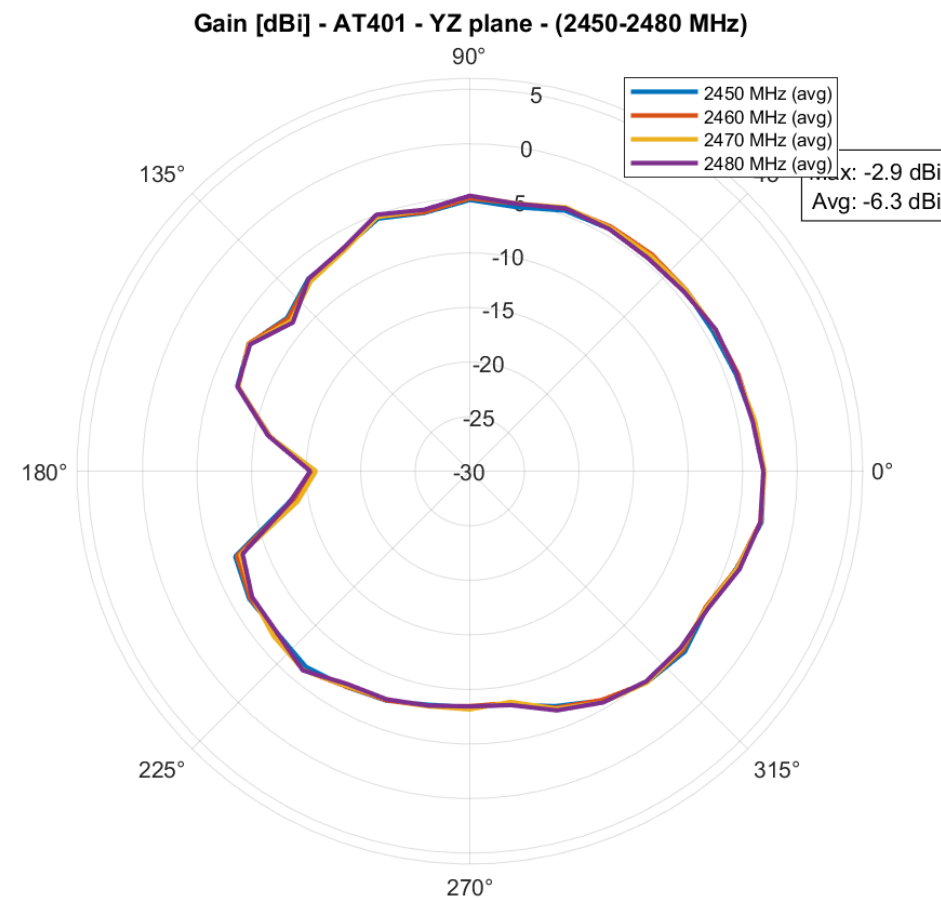
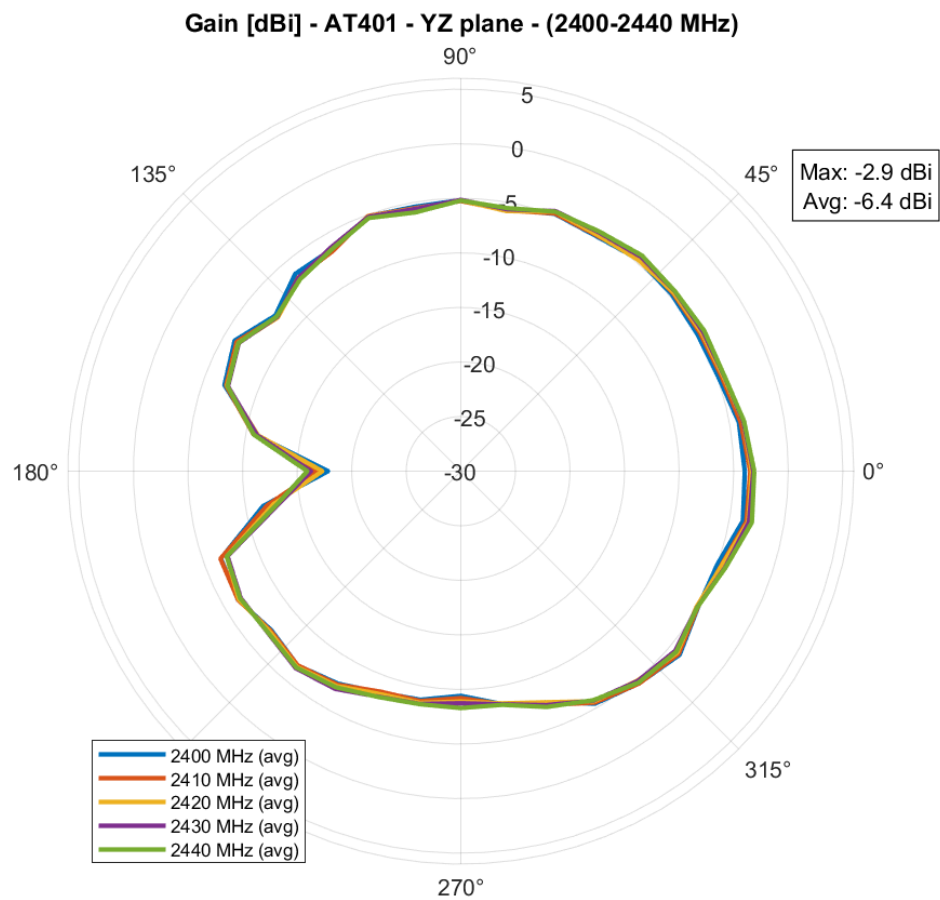
2GHz Band

AT401



2GHz Band

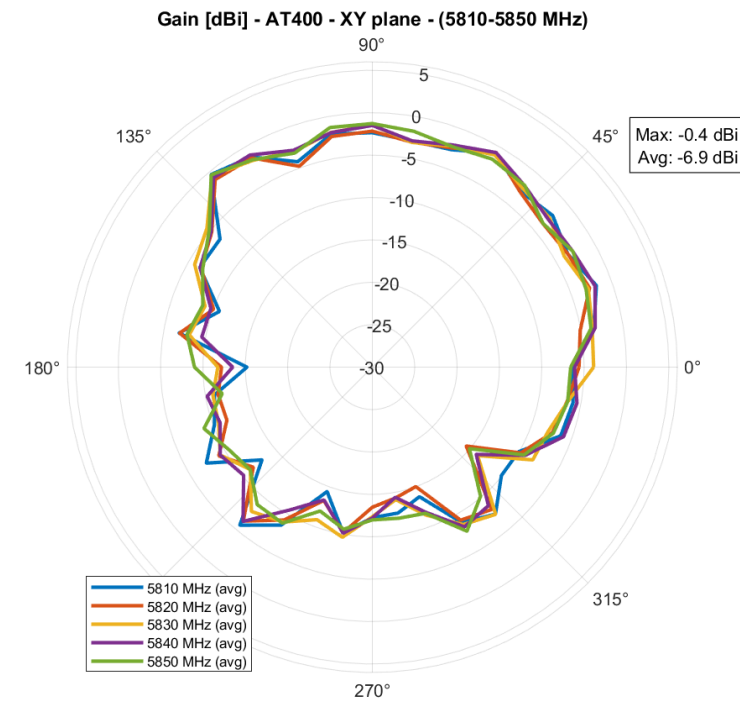
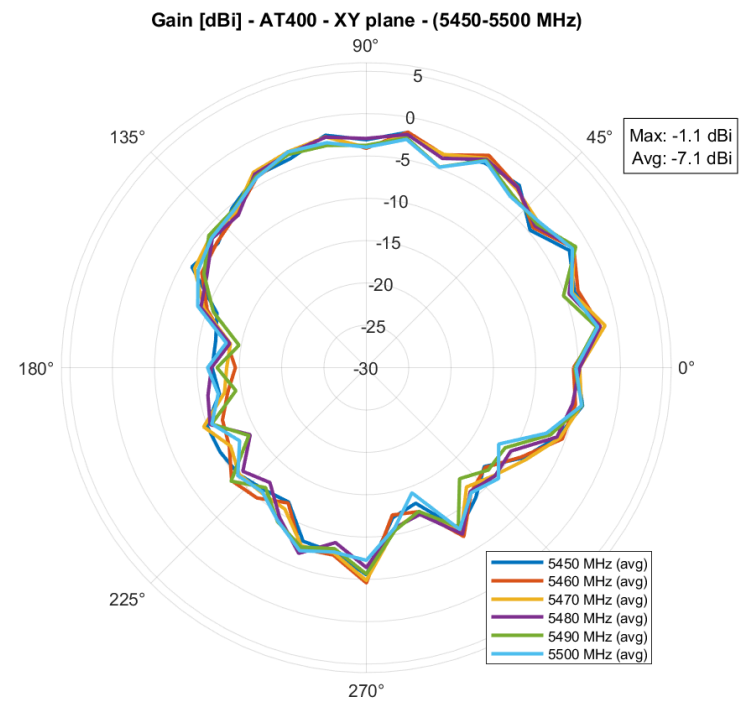
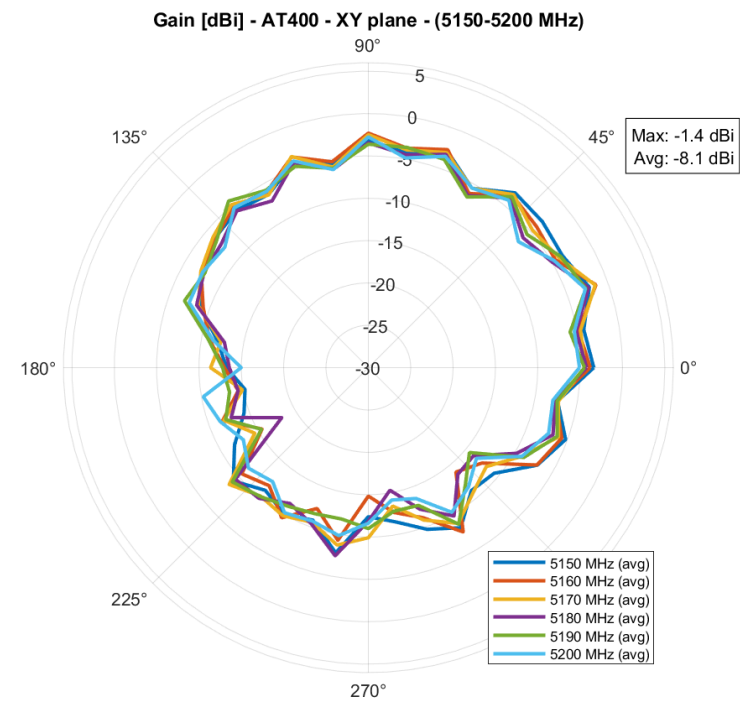
AT401



5 GHz Band

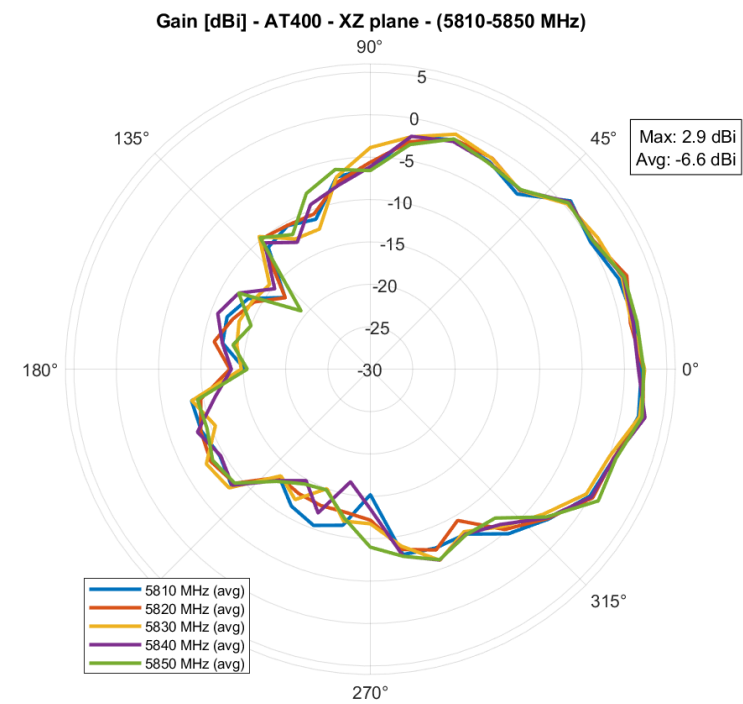
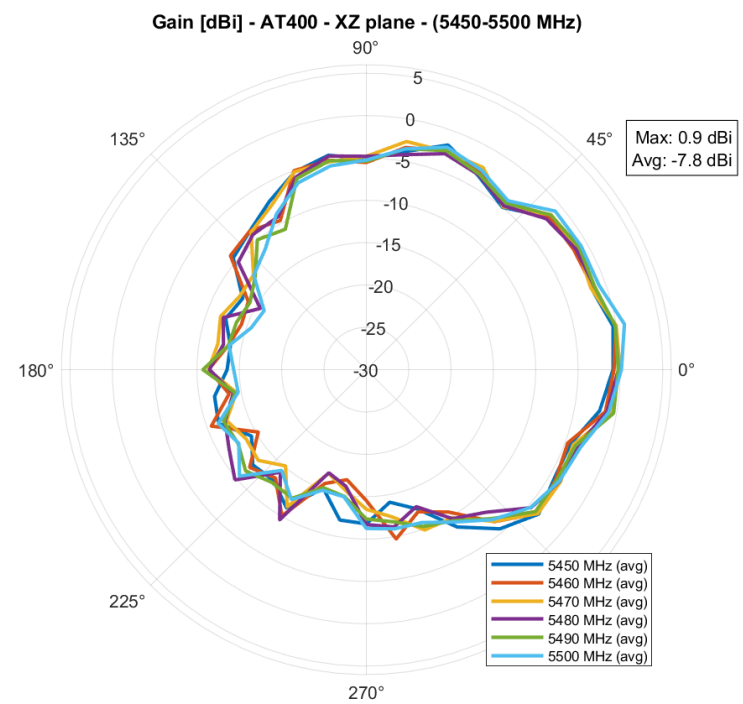
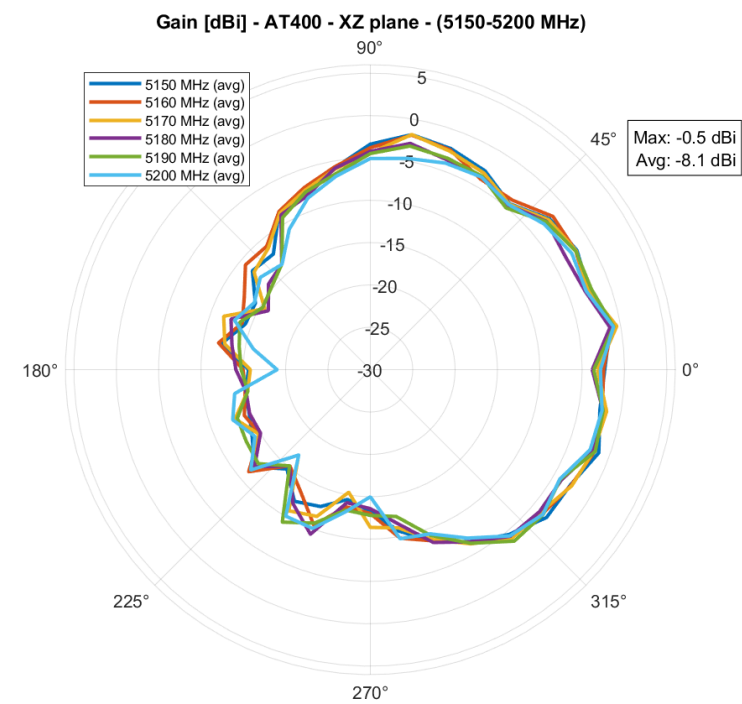
5GHz Band

AT400



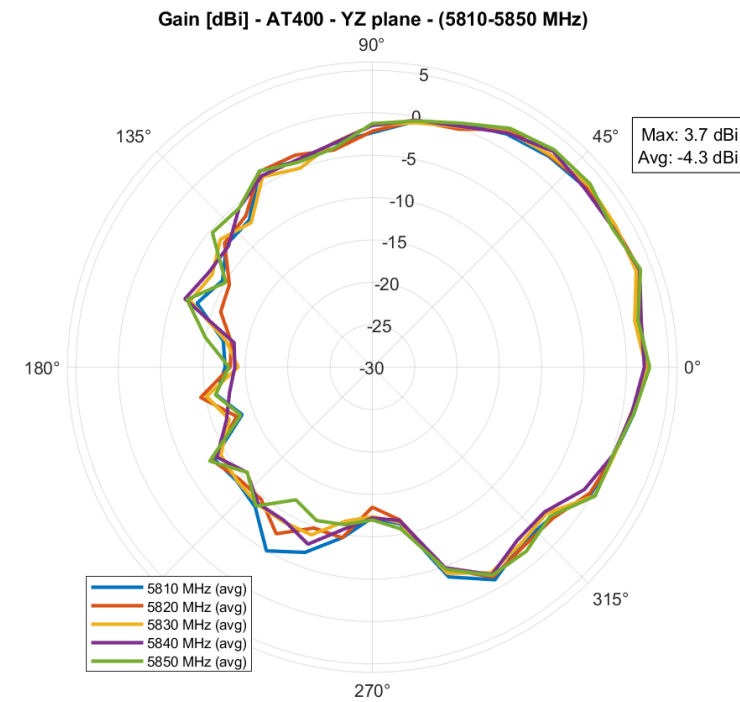
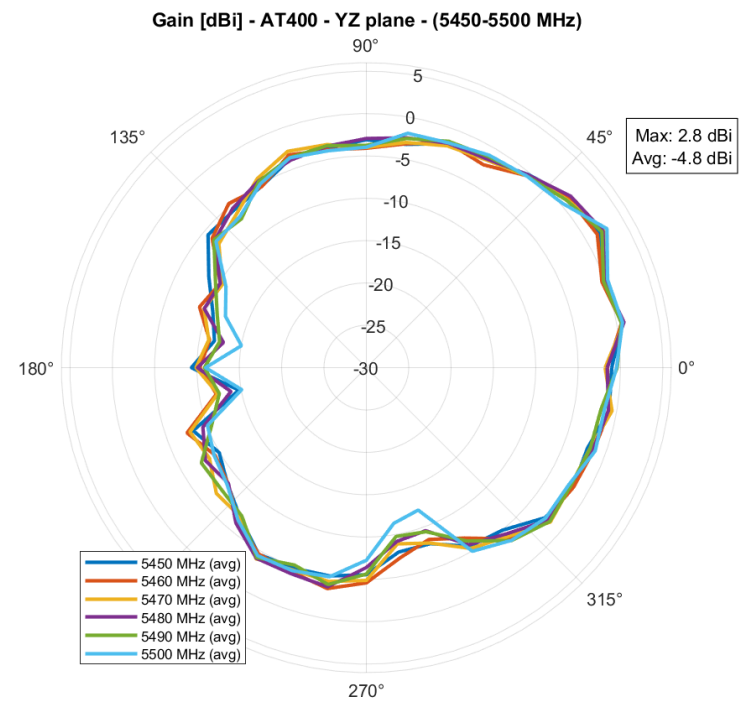
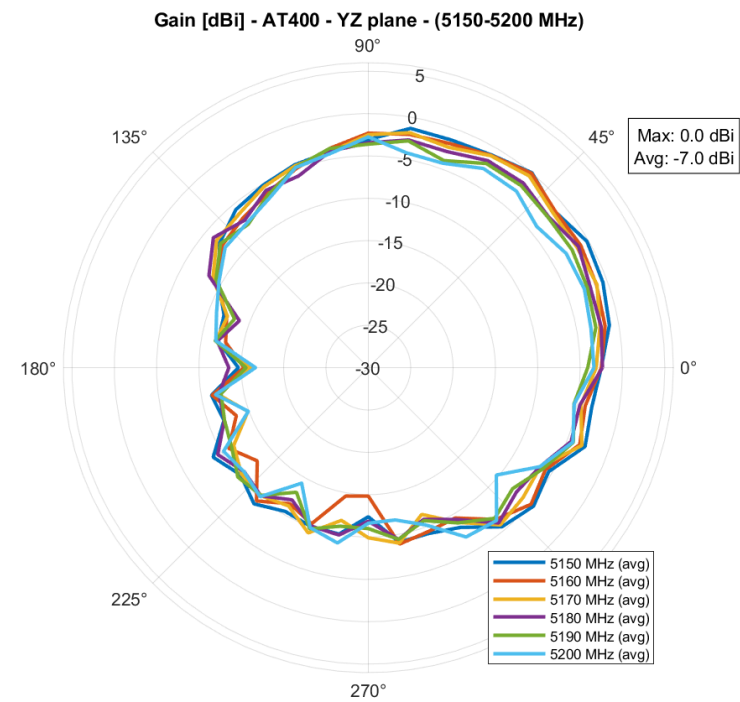
5GHz Band

AT400



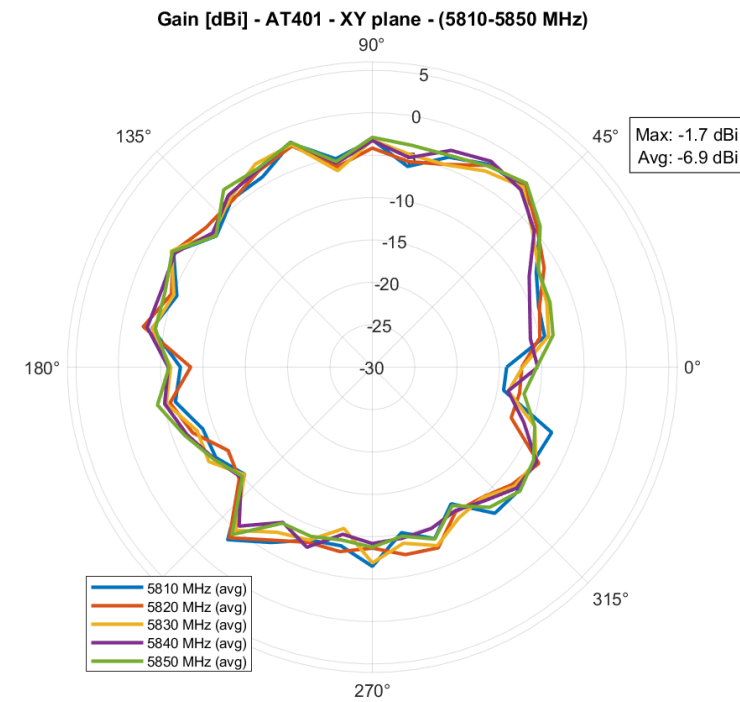
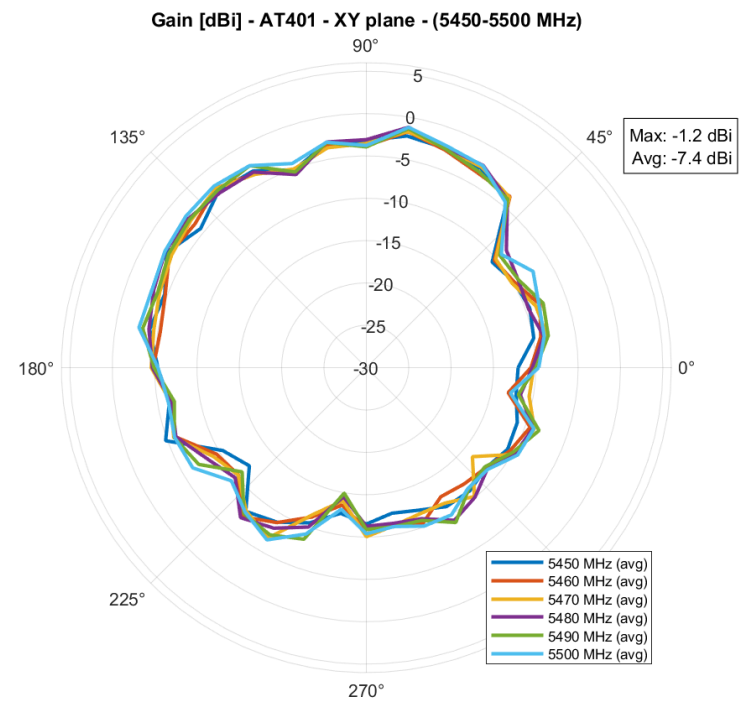
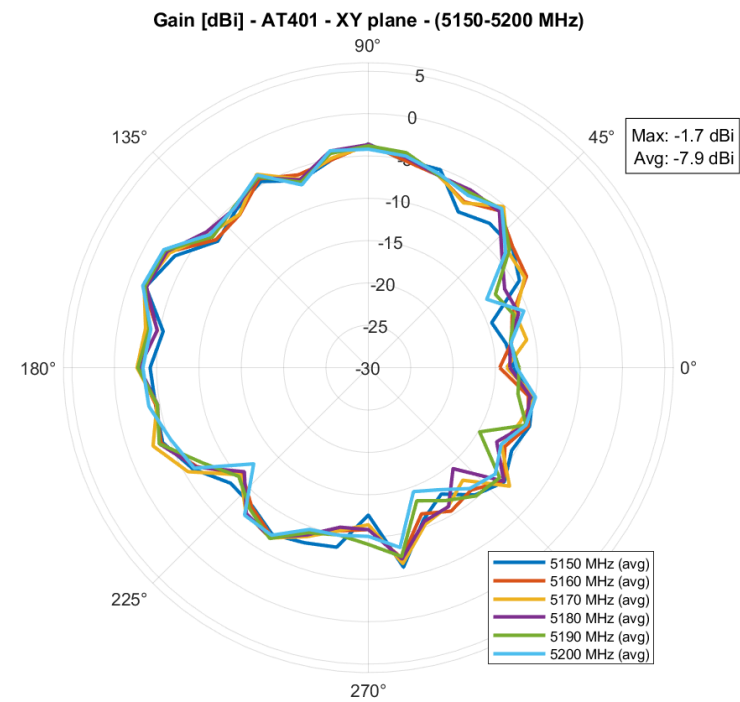
5GHz Band

AT400



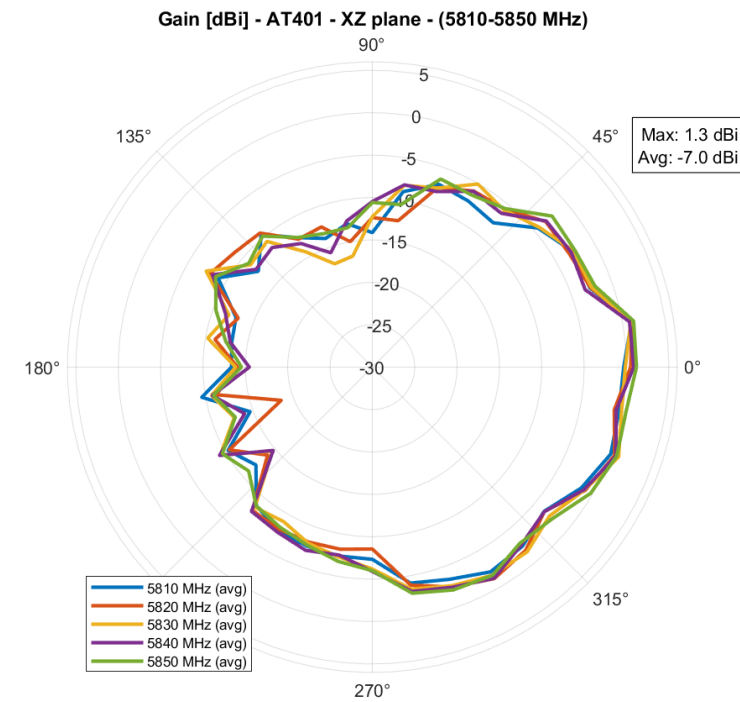
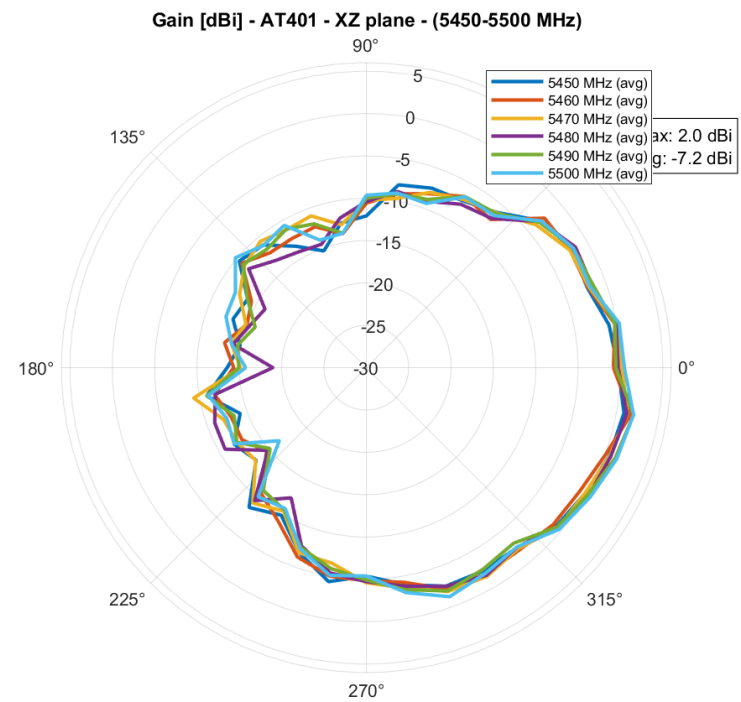
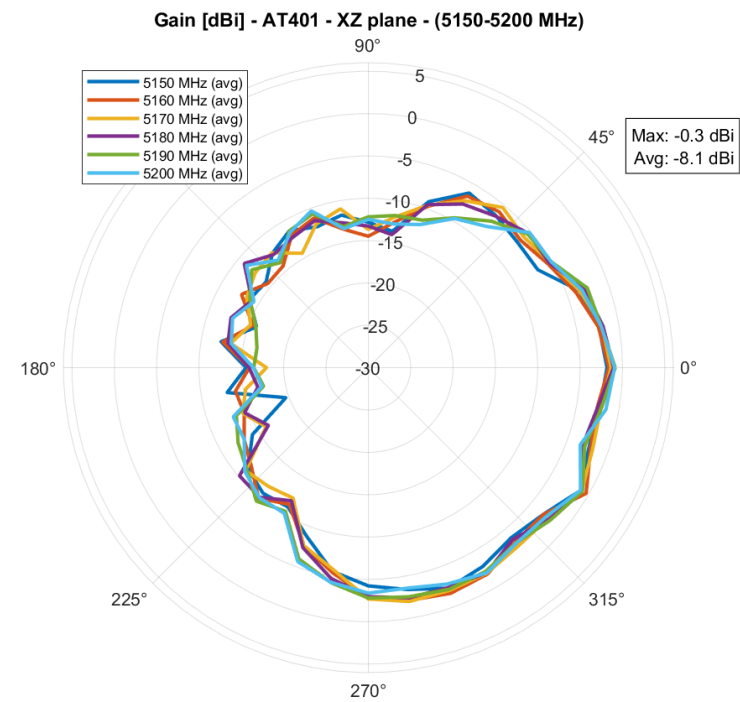
5GHz Band

AT401



5GHz Band

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5GHz Band

AT401

