Ruby Antenna Test Report
P3 Sku-D

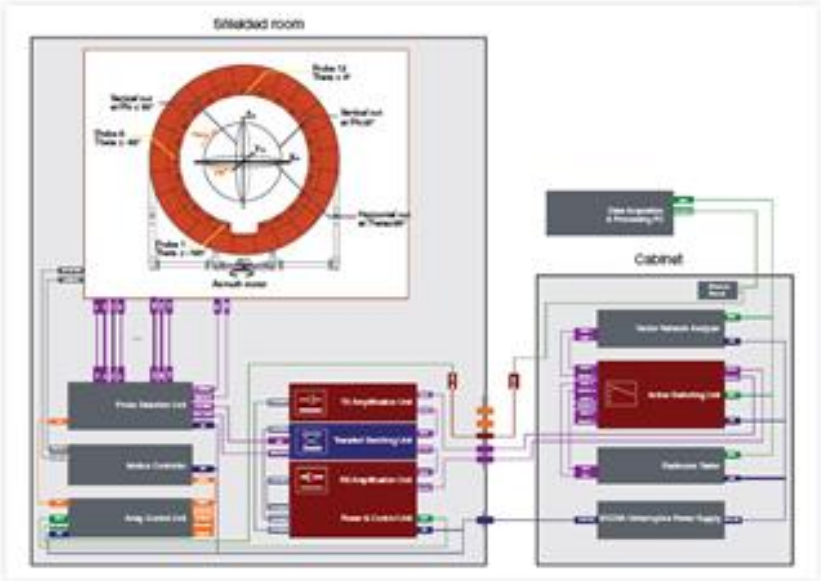
Brand : Juniper
Model Name : AP47D

2024/10/25

Contents Ruby P3 Sku-D

Chamber Information

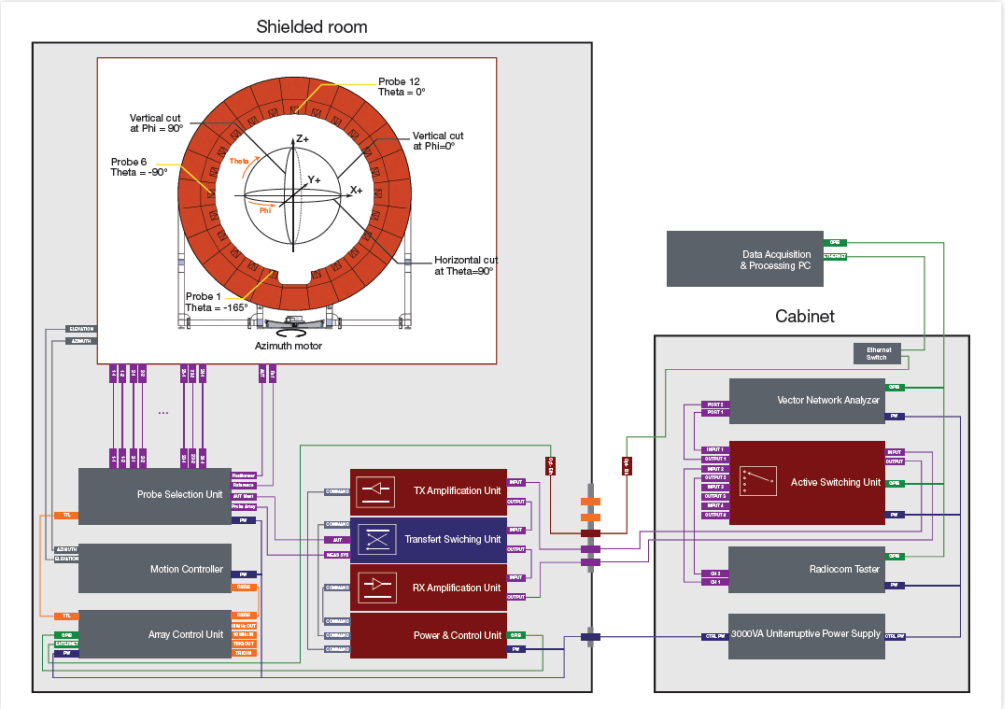
- Antenna Vendor：WNC
- Test Date：20241014
- Test Engineer：Lucien Hsieh
- Measurement System：SATIMO SG24-L
- Software Name：Wave Studio
- Software Version：22.5.6



※ The antenna test chamber located in WNC which address is：
20 Park Avenue II (or Yuanchiu 2nd Rd.), Hsinchu Science Park, Hsinchu 300, Taiwan
Tel：+886-3-666-7799

Test Equipment

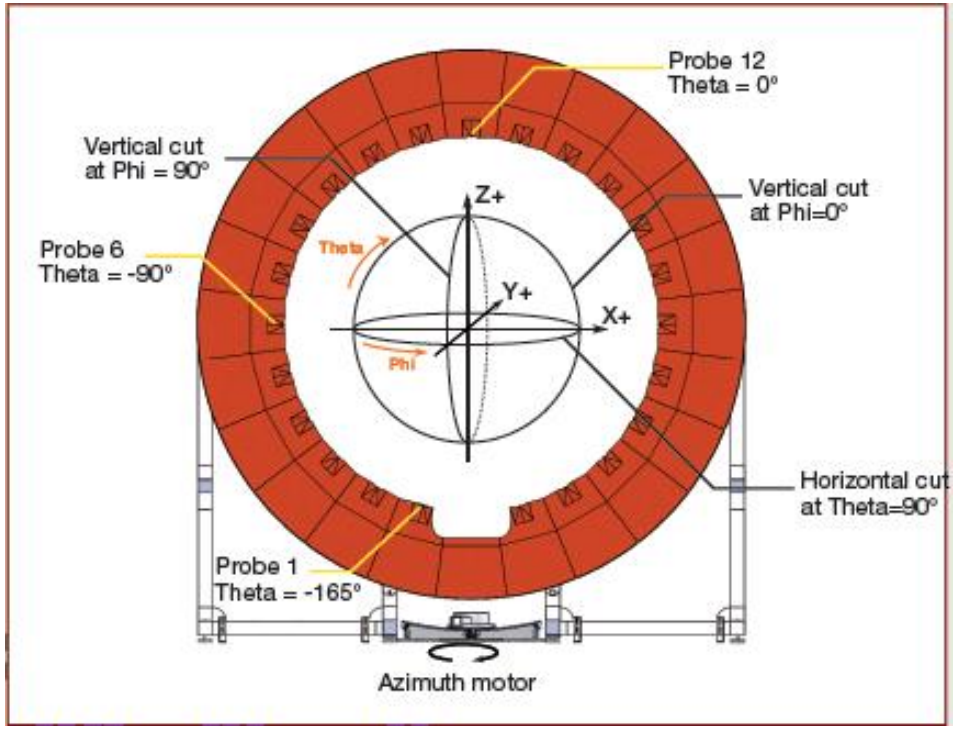
- Measurement System：SATIMO SG24-L Chamber
- Measurement Setup
  - pattern & gain measurement
    - SATIMO chamber (SG24-L)
    - SATIMO program (wave studio)
    - System overview
  - Test item
    - antenna passive test 400MHz~9GHz
- Calibration Information



Device	Type / Model	Serial #	Manufacture	Cal. Date	Cal. Until
Antenna Measurement System	SG24-L	HKG1669S	MVG-SATIMO	2024-06-05	2025-06-04
Network Analyzer	Keysight E5080B	MY59203136	Keysight	2024-06-05	2025-06-04

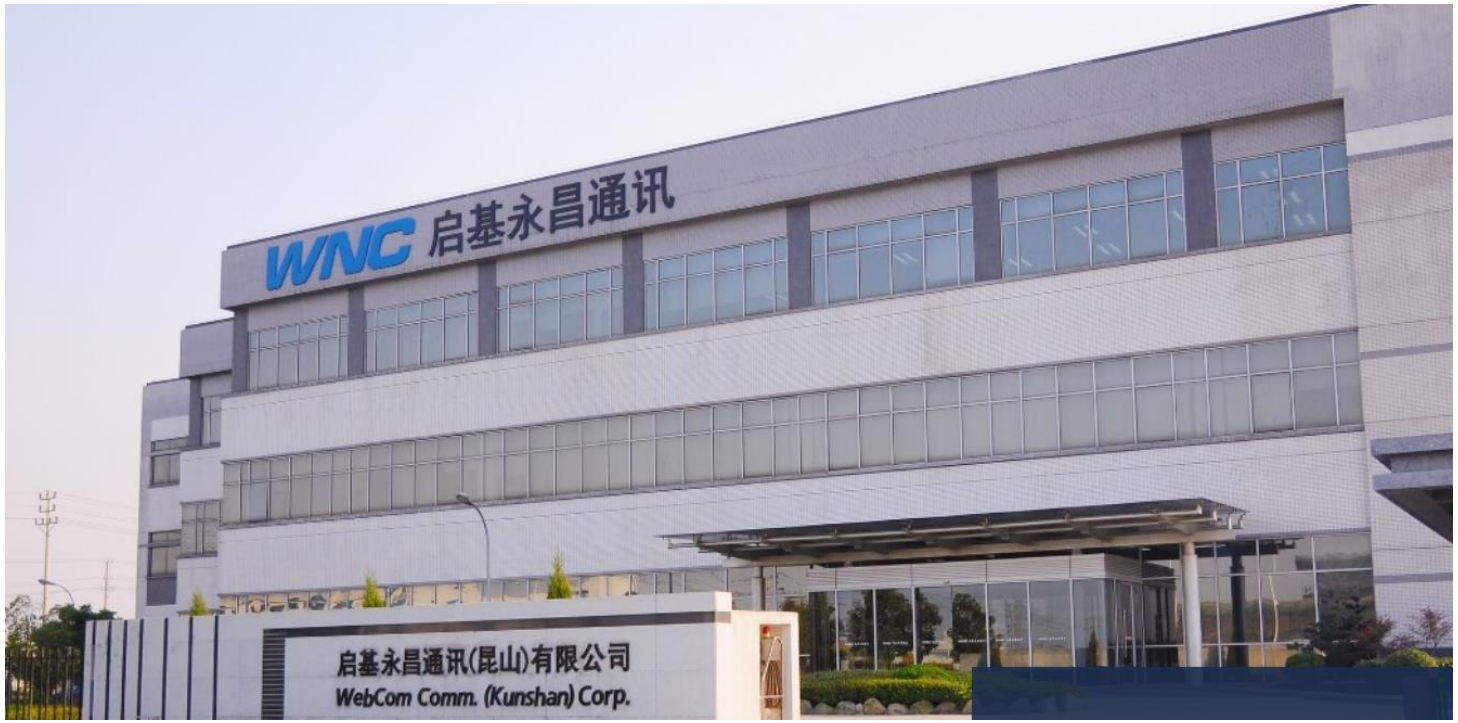
Test Procedure

1. Place the device to be tested on the fixture and align it with the center of the chamber.
2. Connect the antenna cable to the RF connector of the chamber.
3. Use the SW to configure parameters (antenna name, frequency points, measurement angles, antenna dimension), and then run the test SW (wave studio).
4. By phi from 0° to 360° and theta from 0° to 180° with a step size of 3 degrees, get the 3D data, including efficiency, peak gain, 2D and 3D radiation patterns.
5. This is far field test for antenna verification.
6. This is passive measurement, which means the device is off and not in any operating mode.



Name and Address of The Antenna Manufacture

- WebCom Communication (Kunshan) Corporation - Kunshan Plant
- 121 Dujuan Rd., Precision Machinery Industrial Park, Kunshan City, Jiangsu Province, P.R.C
- +86-512-5761-0668
- +86-512-5761-0666



Summary(1)

The summary of antenna performance are shown in below.

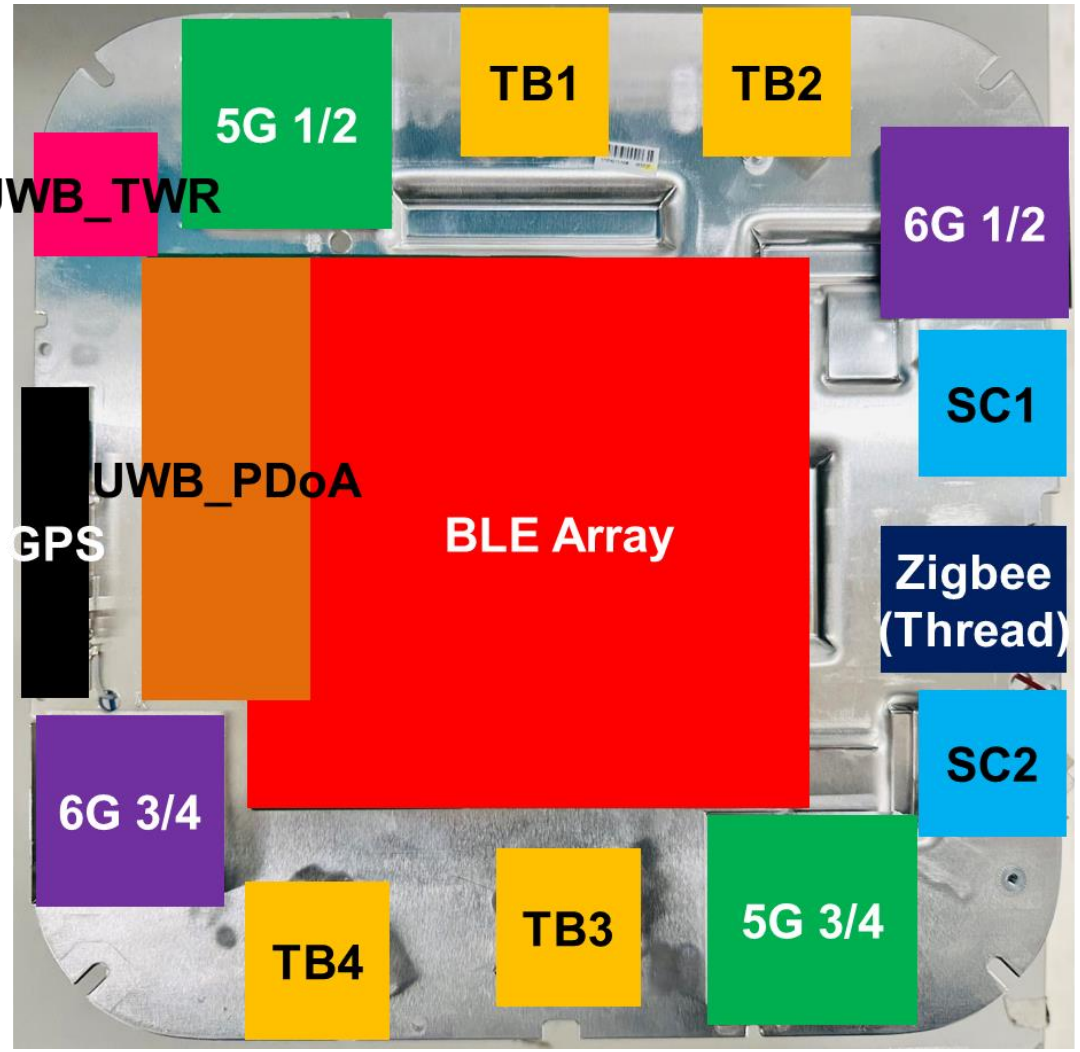
- Radiation efficiency
  - ~65% for 2.4GHz, ~60% for 5GHz, ~63% for 6GHz Wi-Fi Tri-band antennas [TB1, TB2, TB3, TB4]
  - ~60% for 5GHz Wi-Fi 5G antennas [5G1, 5G2, 5G3, 5G4]
  - ~60% for 6GHz Wi-Fi 6G antennas [6G1, 6G2, 6G3, 6G4]
  - ~64% for 2.4GHz ~65% for 5GHz, ~68% for 6GHz Scanning antennas [SC1, SC2]
  - ~58% for 2.4GHz Zigbee(Thread) antenna [Zigbee(Thread)]
  - ~51% for L1, ~74% for L5 GPS antenna [GPS]
  - ~55% for Ch9 UWB TWR antenna [UWB_TWR]
  - ~4% for Ch5, ~24% for Ch9 UWB PDoA antennas [UWB2, UWB3, UWB4]
  - ~16% for 2.4GHz BLE array [Beam1~Beam8]; ~26% for 2.4GHz BLE slot directional antenna [Beam9]
  - ~23% for 2.4GHz BLE array [Omni]
- Peak gain
  - 6.4dBi for 2.4GHz, 6.3dBi for 5GHz, 9.3dBi for 6GHz Wi-Fi Tri-band antennas [TB1, TB2, TB3, TB4]
  - 7.6dBi for 5GHz Wi-Fi 5G antennas [5G1, 5G2, 5G3, 5G4]
  - 8.5dBi for 6GHz Wi-Fi 6G antennas [6G1, 6G2, 6G3, 6G4]
  - 5.8dBi for 2.4GHz, 6.3dBi for 5GHz, 8.2dBi for 6GHz Scanning antennas [SC1, SC2]
  - 6.6dBi for 2.4GHz Zigbee(Thread) antenna [Zigbee(Thread)]
  - 2.3dBi for L1, 4.6dBi for L5 GPS antenna [GPS]
  - 6.7dBi for Ch9 UWB TWR antenna [UWB_TWR]
  - -3.2dBi for Ch5, 3.4dBi for Ch9 UWB PDoA antennas [UWB2, UWB3, UWB4]
  - 4.3dBi for 2.4GHz BLE array [Beam1~Beam8]; 3.7dBi for 2.4GHz BLE slot directional antenna [Beam9]
  - 0.2dBi for 2.4GHz BLE array [Omni]

Summary(2)

The summary of antenna performance are shown in below.

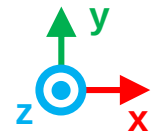
- 3 dB Beamwidth
  - 80°/84° on XZ/YZ plane for 2.4GHz, 71°/69° on XZ/YZ plane for 5GHz, 60°/59° on XZ/YZ plane for 6GHz Wi-Fi Tri-band antennas [TB1, TB2, TB3, TB4]
  - 63°/61° on XZ/YZ plane for 5GHz Wi-Fi 5G antennas [5G1, 5G2, 5G3, 5G4]
  - 57°/56° on XZ/YZ plane for 6GHz Wi-Fi 6G antennas [6G1, 6G2, 6G3, 6G4]
  - 100°/77° on XZ/YZ plane for 2.4GHz 81°/81° on XZ/YZ plane for 5GHz, 55°/68° on XZ/YZ plane for 6GHz Scanning antennas [SC1, SC2]
  - 80°/45° on XZ/YZ plane for 2.4GHz Zigbee(Thread) antenna [Zigbee(Thread)]
  - 88°/62° on XZ/YZ plane for Ch9 UWB TWR antenna [UWB_TWR]

Antenna Placement Ruby – P3 Sku-D



Antenna Plate: 246x246mm

Radio	Antenna Type
TB(1-4)	Dipole
5G(1-4)	Patch
6G(1-4)	Patch
SC(1-2)	Dipole
GPS	PIFA
UWB-TWR	Patch
UWB-PDoA	Patch
Zigbee(Thread)	Dipole
BLE [Beam1~Beam8/Omni]	PIFA
BLE [Beam9]	Slot



Peak Gain Table

UWB_TWR	Peak Gain	Position of Peak Gain (θ, ϕ)
TWR	6.7 dBi	θ = 9° , ϕ = 177°

Zigbee(Thread)	Peak Gain	Position of Peak Gain (θ, ϕ)
Zigbee(Thread)	6.6 dBi	θ = 9° , ϕ = 159°

BLE Array	Peak Gain	Position of Peak Gain (θ, ϕ)
BLE Array (Beam5)	4.3 dBi	θ = 53° , ϕ = 270°

Wi-Fi Tri-band

- **Maximum VSWR**
  - 2.0:1 on 2.4GHz / 2.0:1 on 5/6GHz
- **Minimum Isolation**
  - 23.2dB on 2.4GHz / 32.1dB on 5/6GHz
- **Average Efficiency**
  - ~65% on 2.4GHz / ~60% on 5GHz / ~63% on 6GHz
- **Peak Gain**
  - 6.4dBi on 2.4GHz / 6.3dBi on 5GHz / 9.3dBi on 6GHz

- **Cable Length**

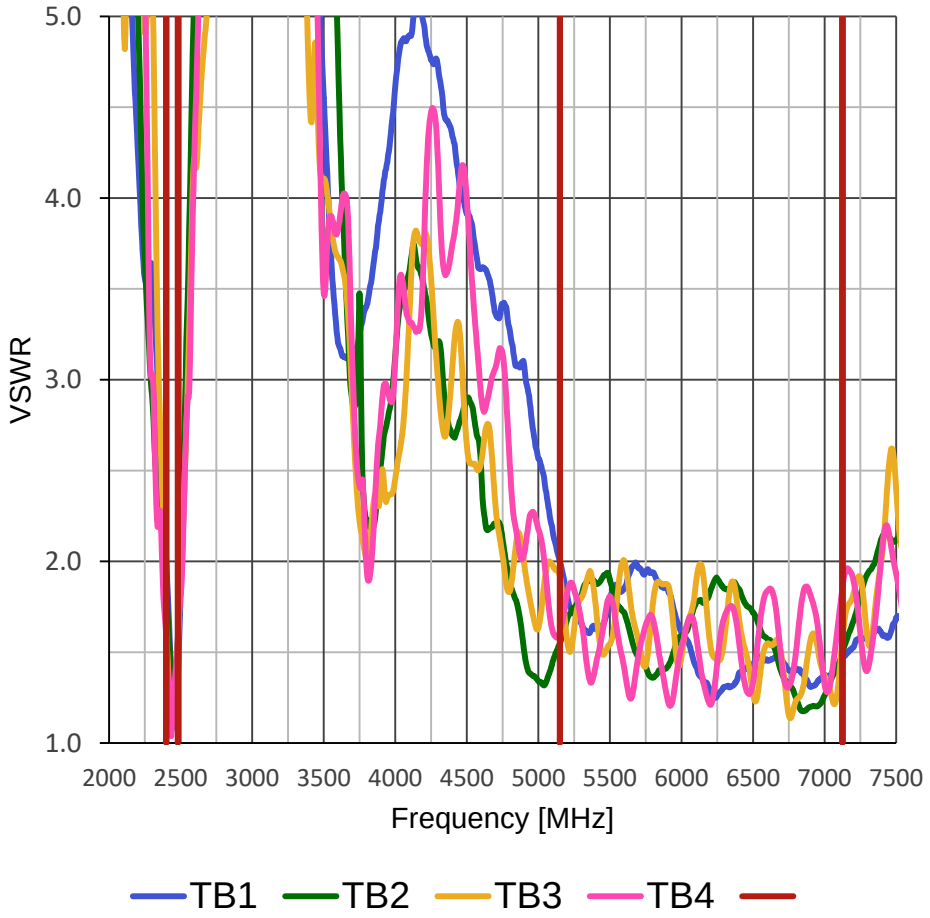
TB1：87mm

TB2：95mm

TB3：389mm

TB4：381mm

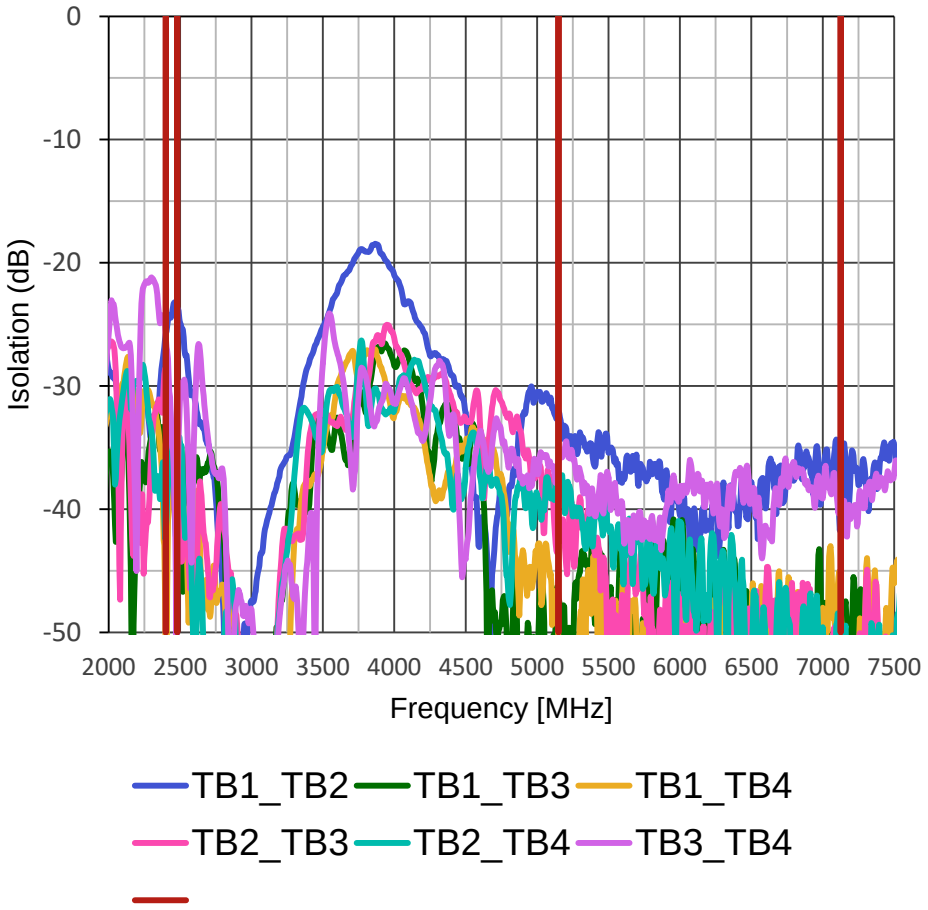
VSWR Wi-Fi Tri-band



2.4GHz	Max	Mean	Min
TB1	2.0	1.4	1.1
TB2	1.9	1.5	1.2
TB3	1.6	1.3	1.2
TB4	1.6	1.3	1.0
Summary	2.0	1.4	1.0

5/6GHz	Max	Mean	Min
TB1	2.0	1.6	1.2
TB2	1.9	1.6	1.2
TB3	2.0	1.6	1.1
TB4	1.9	1.6	1.2
Summary	2.0	1.6	1.1

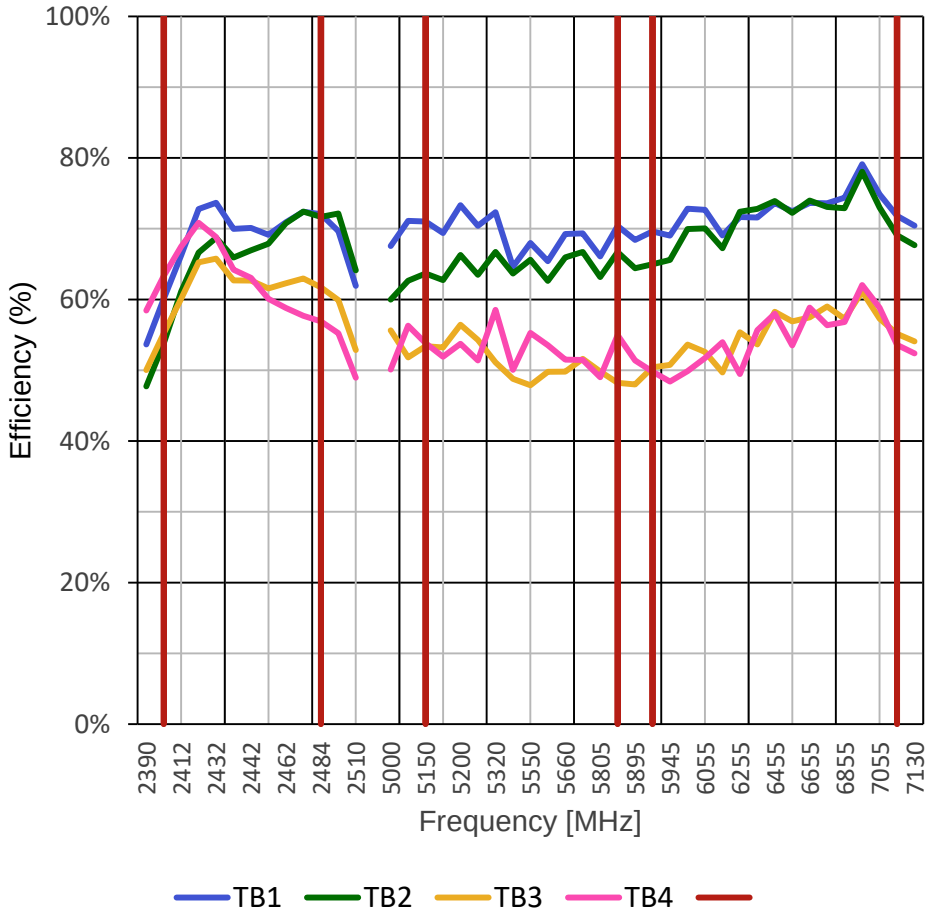
Isolation Wi-Fi Tri-band



2.4GHz	Max	Mean	Min
TB1_TB2	-23.2	-24.2	-25.8
TB1_TB3	-31.8	-34.5	-36.7
TB1_TB4	-37.7	-41.4	-54.2
TB2_TB3	-28.7	-34.5	-40.3
TB2_TB4	-33.5	-37.8	-42.2
TB3_TB4	-26.0	-35.2	-57.5
Summary	-23.2	-34.6	-57.5

5/6GHz	Max	Mean	Min
TB1_TB2	-32.1	-37.6	-45.4
TB1_TB3	-40.8	-50.1	-79.0
TB1_TB4	-43.0	-51.9	-69.5
TB2_TB3	-39.0	-49.1	-69.7
TB2_TB4	-37.1	-46.8	-66.3
TB3_TB4	-34.5	-38.9	-44.0
Summary	-32.1	-45.8	-79.0

Efficiency Wi-Fi Tri-band



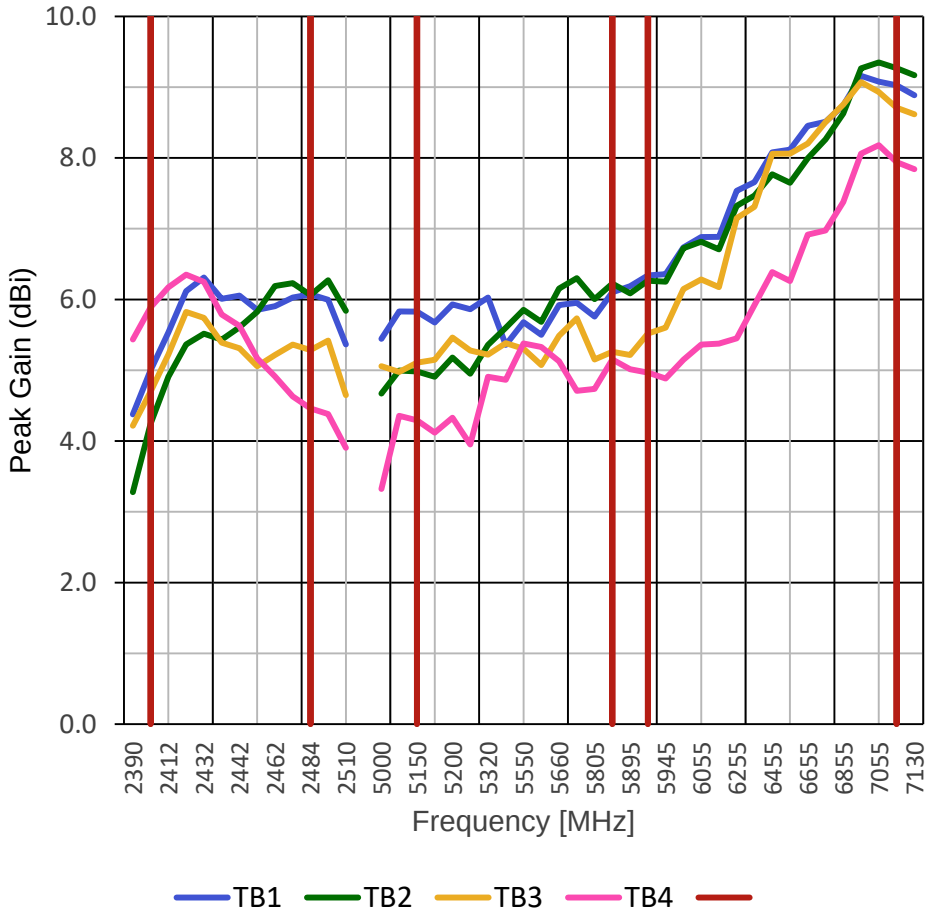
2.4GHz	Max	Mean	Min
TB1	74 %	70 %	60 %
TB2	72 %	67 %	54 %
TB3	66 %	62 %	55 %
TB4	71 %	63 %	57 %
Summary	74 %	65 %	54 %

5GHz	Max	Mean	Min
TB1	73 %	69 %	65 %
TB2	67 %	65 %	63 %
TB3	56 %	51 %	48 %
TB4	59 %	53 %	49 %
Summary	73 %	60 %	48 %

6GHz	Max	Mean	Min
TB1	79 %	73 %	69 %
TB2	78 %	71 %	65 %
TB3	61 %	55 %	50 %
TB4	62 %	54 %	48 %
Summary	79 %	63 %	48 %

- **Cable Length**
  - **TB1 : 87mm**
  - **TB2 : 95mm**
  - **TB3 : 389mm**
  - **TB4 : 381mm**

Peak Gain Wi-Fi Tri-band



2.4GHz	Max	Mean	Min
TB1	6.3 dBi	5.9 dBi	5.0 dBi
TB2	6.2 dBi	5.5 dBi	4.2 dBi
TB3	5.8 dBi	5.3 dBi	4.7 dBi
TB4	6.4 dBi	5.5 dBi	4.5 dBi
Summary	6.4 dBi	5.6 dBi	4.2 dBi

5GHz	Max	Mean	Min
TB1	6.1 dBi	5.8 dBi	5.4 dBi
TB2	6.3 dBi	5.6 dBi	4.9 dBi
TB3	5.7 dBi	5.3 dBi	5.1 dBi
TB4	5.4 dBi	4.7 dBi	4.0 dBi
Summary	6.3 dBi	5.4 dBi	4.0 dBi

6GHz	Max	Mean	Min
TB1	9.2 dBi	7.8 dBi	6.3 dBi
TB2	9.3 dBi	7.7 dBi	6.3 dBi
TB3	9.1 dBi	7.5 dBi	5.5 dBi
TB4	8.2 dBi	6.3 dBi	4.9 dBi
Summary	9.3 dBi	7.3 dBi	4.9 dBi

■ **Cable Length**

TB1：87mm

TB2：95mm

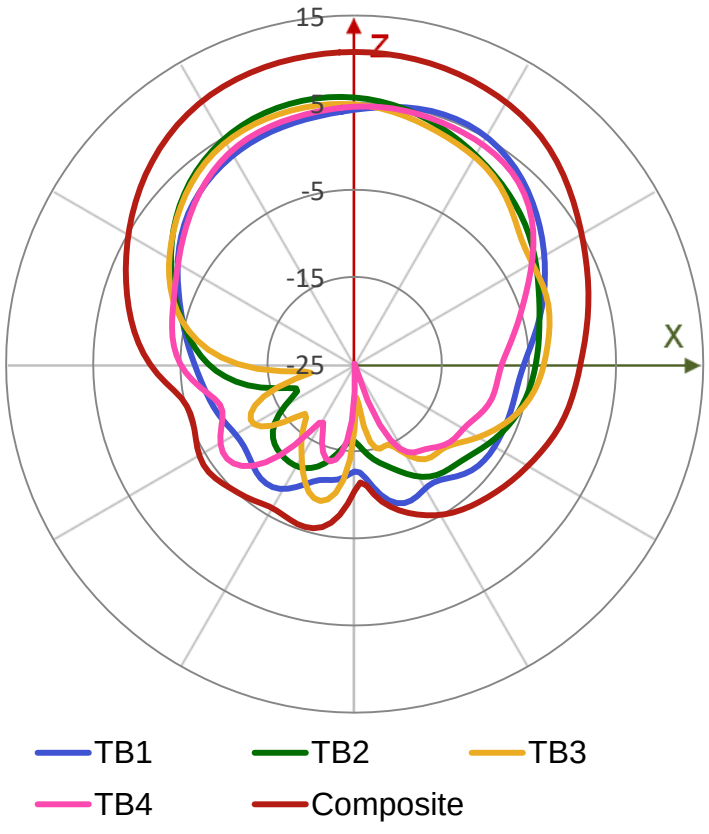
TB3：389mm

TB4：381mm

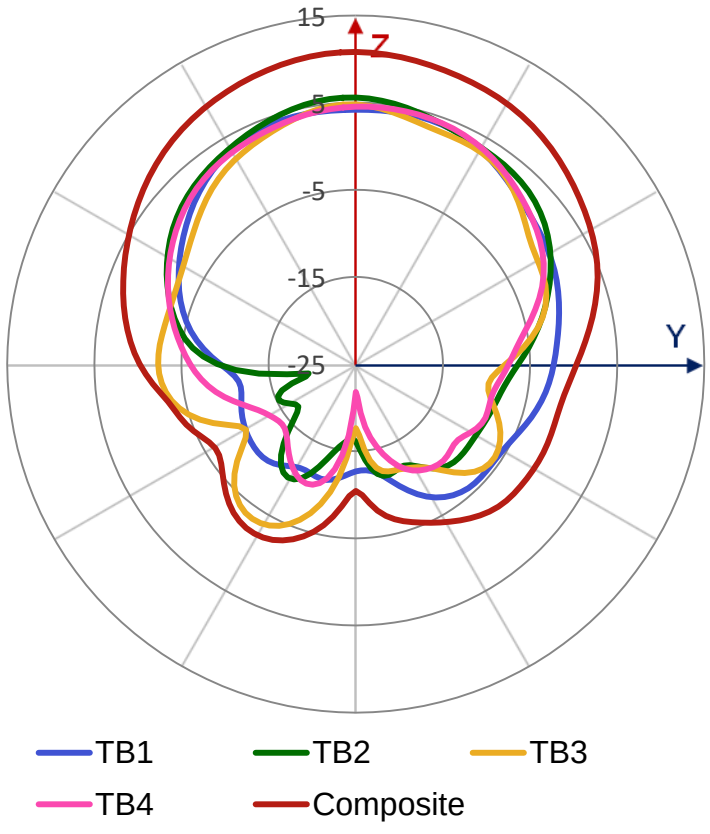
Realized Gain Pattern Wi-Fi Tri-band @2.4G for Gtotal

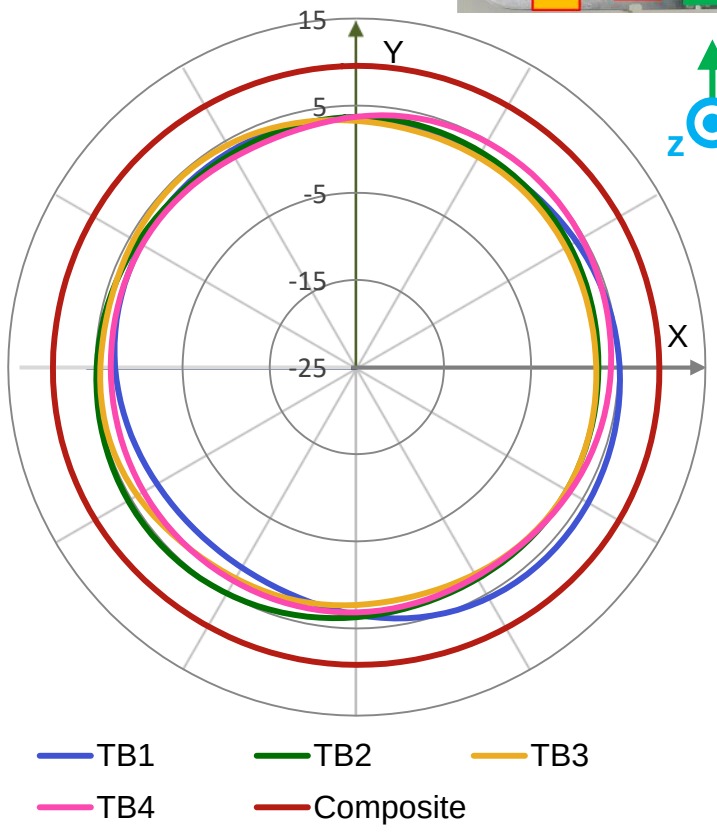
theta = 30

phi = 0



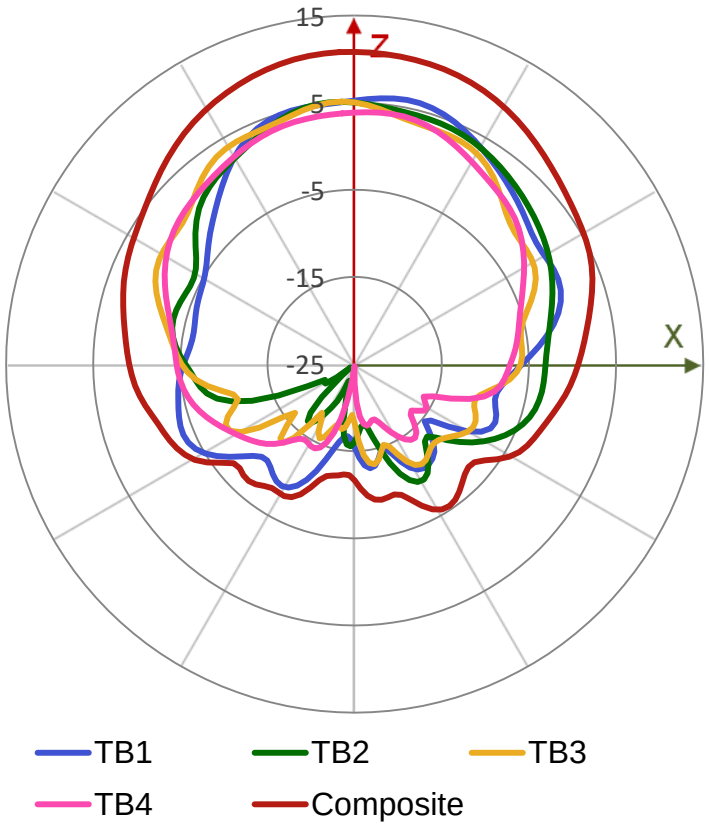
phi = 90



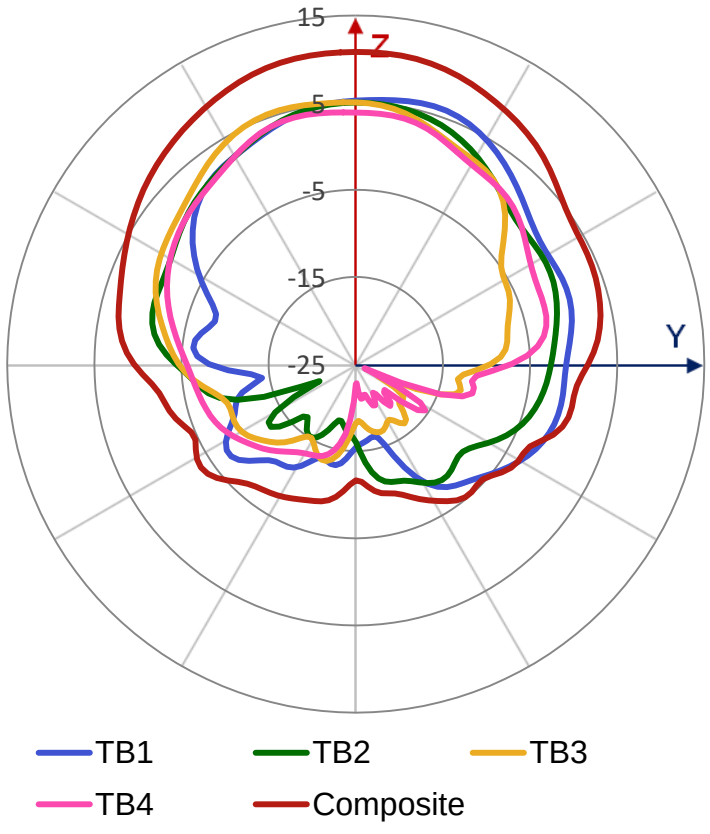


Realized Gain Pattern Wi-Fi Tri-band @5G for Gtotal

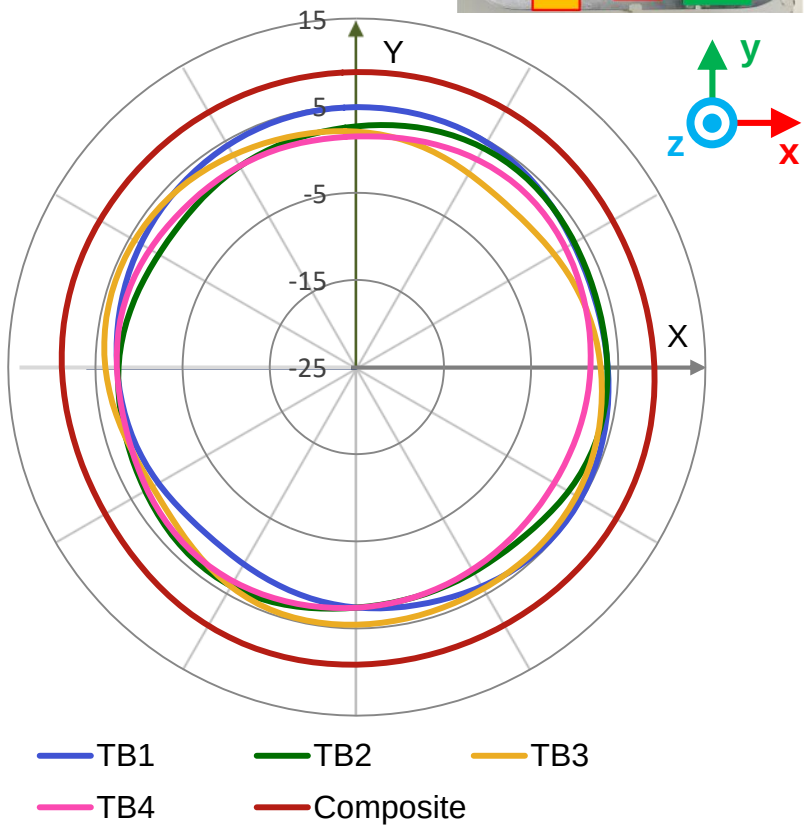
phi = 0



phi = 90

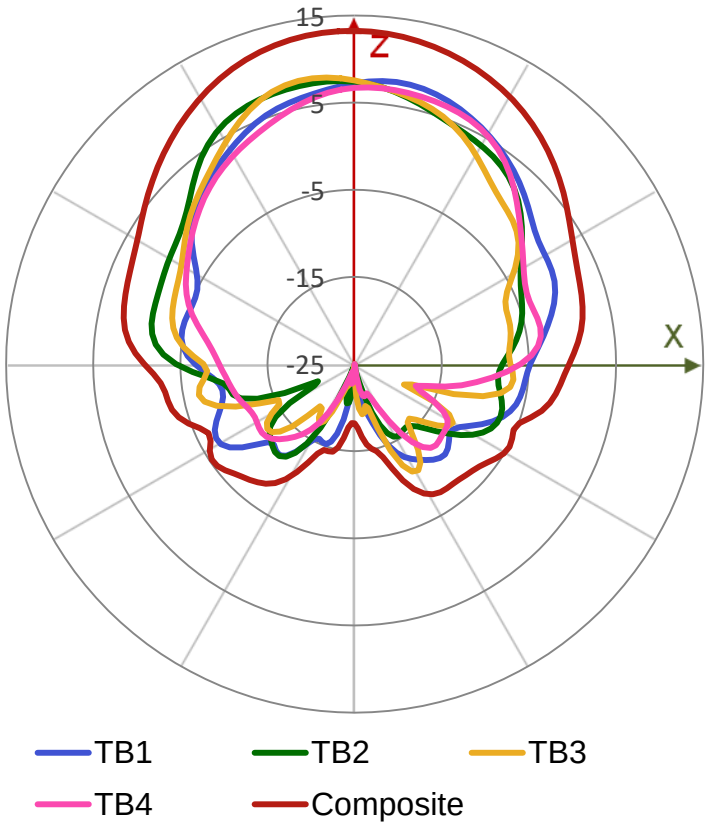


theta = 30

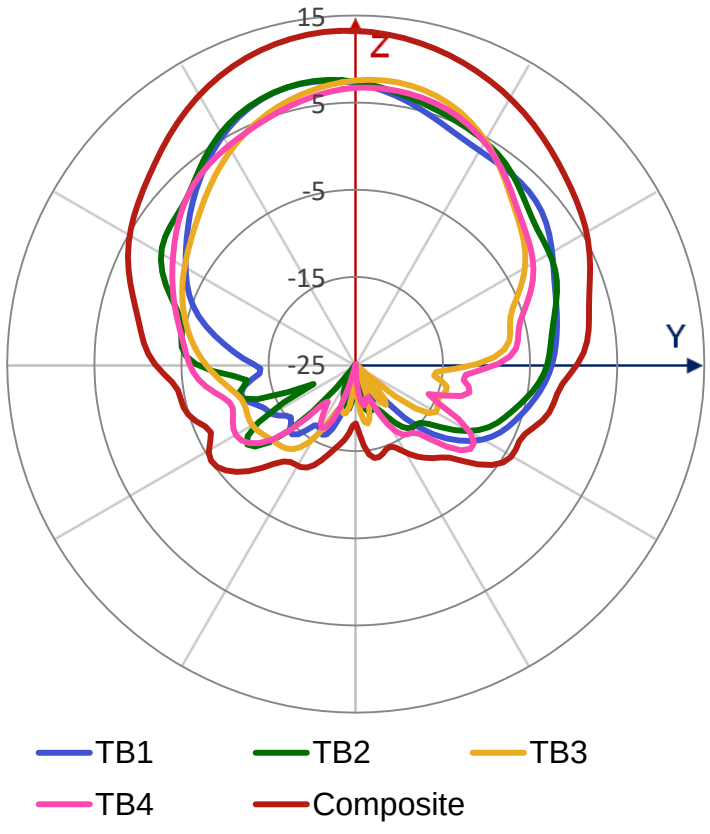


Realized Gain Pattern Wi-Fi Tri-band @6G for Gtotal

phi = 0



phi = 90



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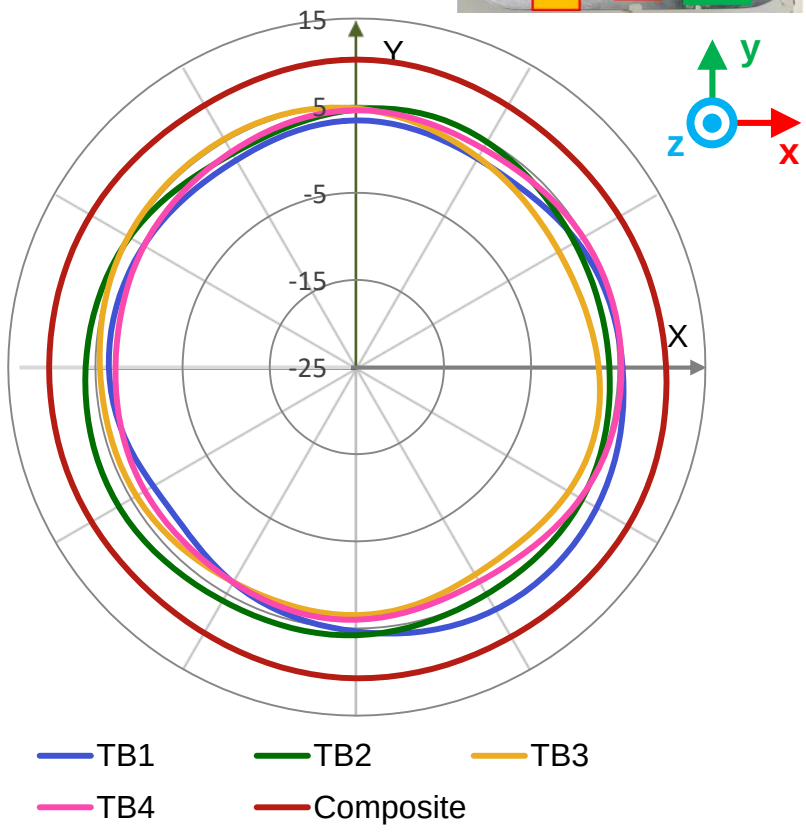


Wi-Fi 5G

- **Maximum VSWR**
  - 2.0:1 on 5GHz
- **Minimum Isolation**
  - 20.0dB on 5GHz
- **Average Efficiency**
  - ~60% on 5GHz
- **Peak Gain**
  - 7.6dBi on 5GHz

- **Cable Length**

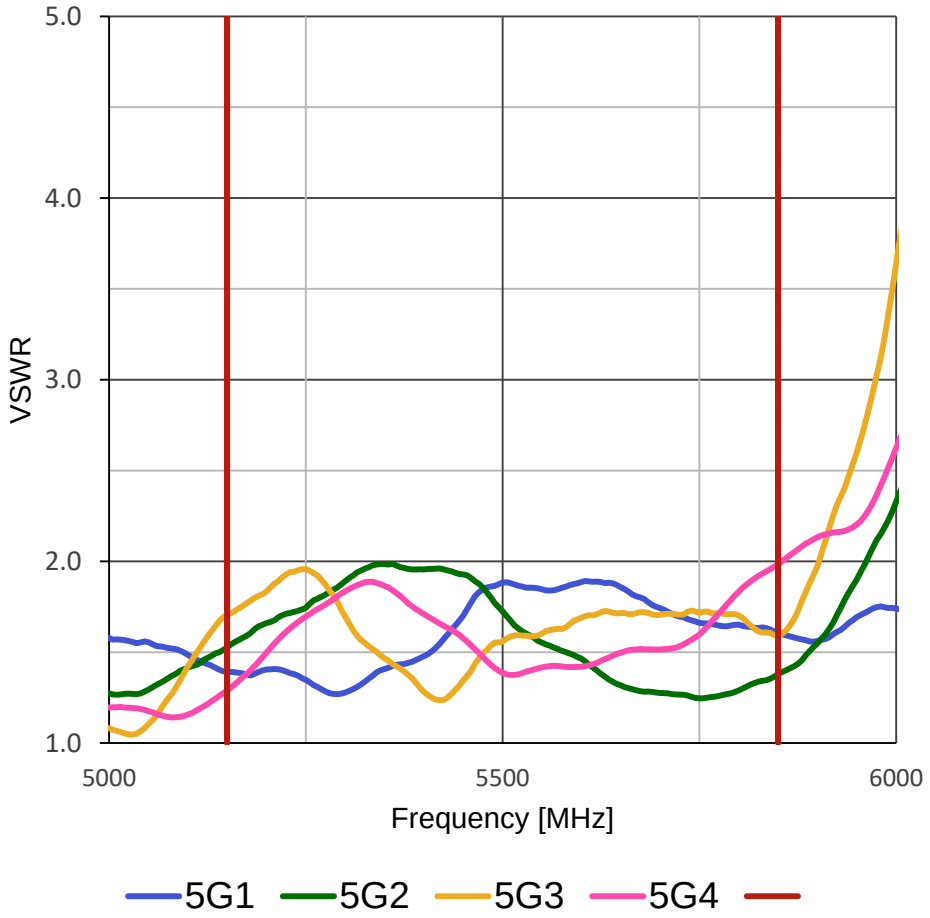
5G1：167mm

5G2：163mm

5G3：263mm

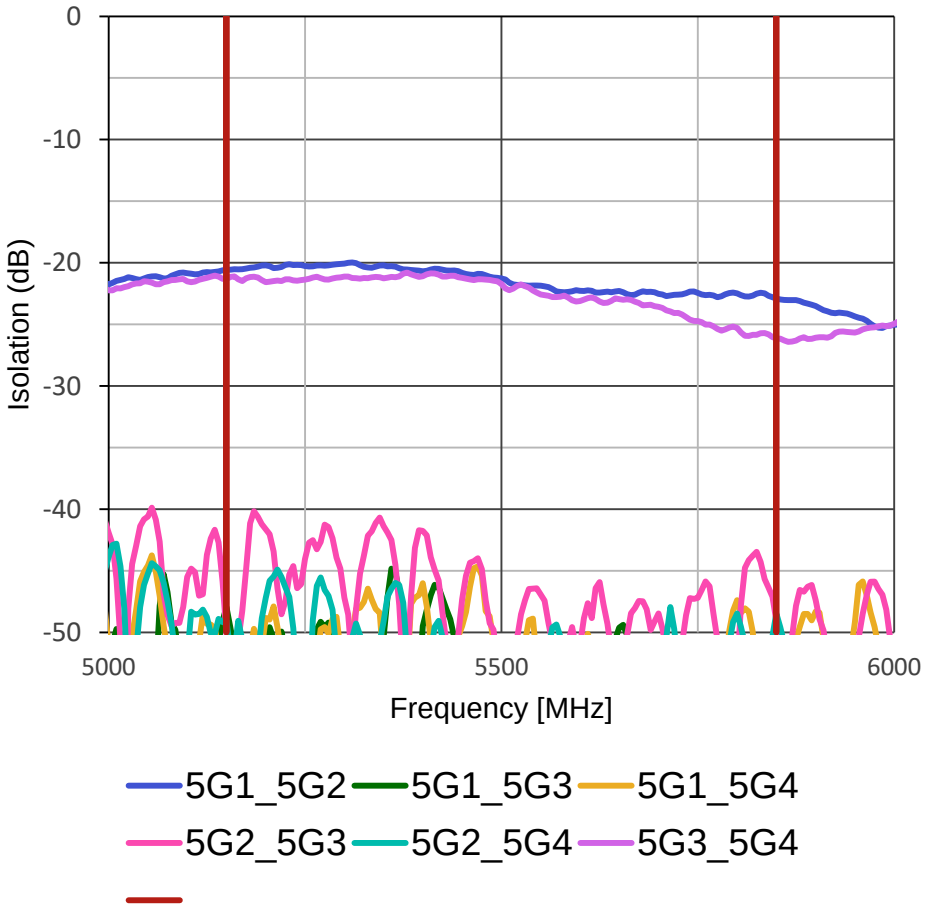
5G4：261mm

VSWR Wi-Fi 5G



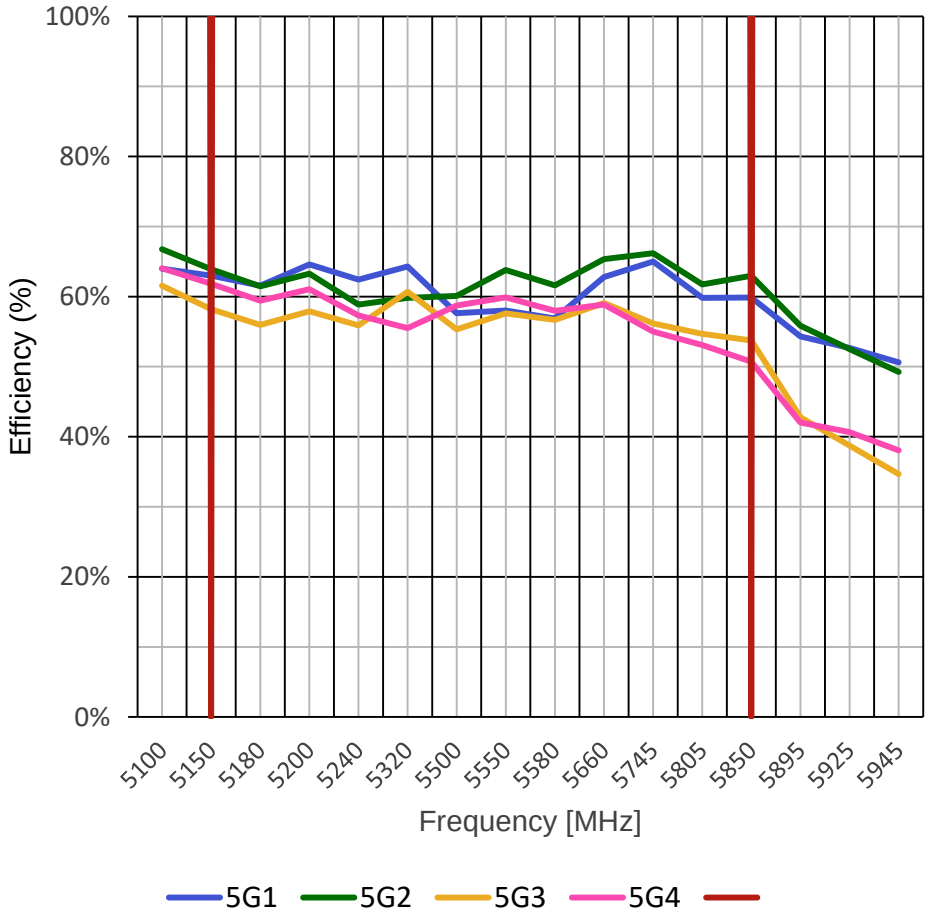
5GHz	Max	Mean	Min
5G1	1.9	1.6	1.3
5G2	2.0	1.6	1.2
5G3	2.0	1.6	1.2
5G4	2.0	1.6	1.3
Summary	2.0	1.6	1.2

Isolation Wi-Fi 5G



5GHz	Max	Mean	Min
5G1_5G2	-20.0	-21.4	-22.9
5G1_5G3	-44.8	-55.0	-71.3
5G1_5G4	-44.6	-53.8	-72.4
5G2_5G3	-40.2	-47.7	-62.8
5G2_5G4	-44.9	-53.9	-71.1
5G3_5G4	-20.8	-22.5	-26.1
Summary	-20.0	-42.4	-72.4

Efficiency Wi-Fi 5G



5GHz	Max	Mean	Min
5G1	65 %	61 %	57 %
5G2	66 %	62 %	59 %
5G3	61 %	57 %	54 %
5G4	62 %	57 %	51 %
Summary	66 %	60 %	51 %

■ **Cable Length**

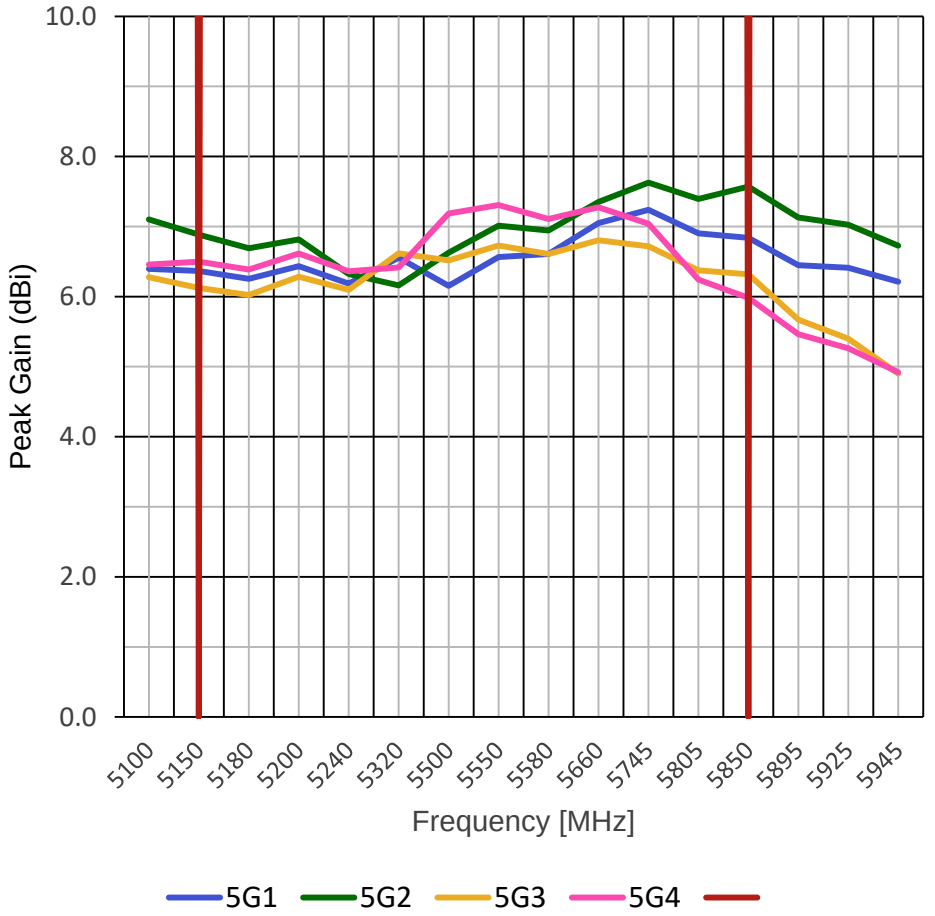
5G1 : 167mm

5G2 : 163mm

5G3 : 263mm

5G4 : 261mm

Peak Gain Wi-Fi 5G



5GHz	Max	Mean	Min
5G1	7.2 dBi	6.6 dBi	6.2 dBi
5G2	7.6 dBi	6.9 dBi	6.2 dBi
5G3	6.8 dBi	6.4 dBi	6.0 dBi
5G4	7.3 dBi	6.7 dBi	6.0 dBi
Summary	7.6 dBi	6.7 dBi	6.0 dBi

■ **Cable Length**

5G1 : 167mm

5G2 : 163mm

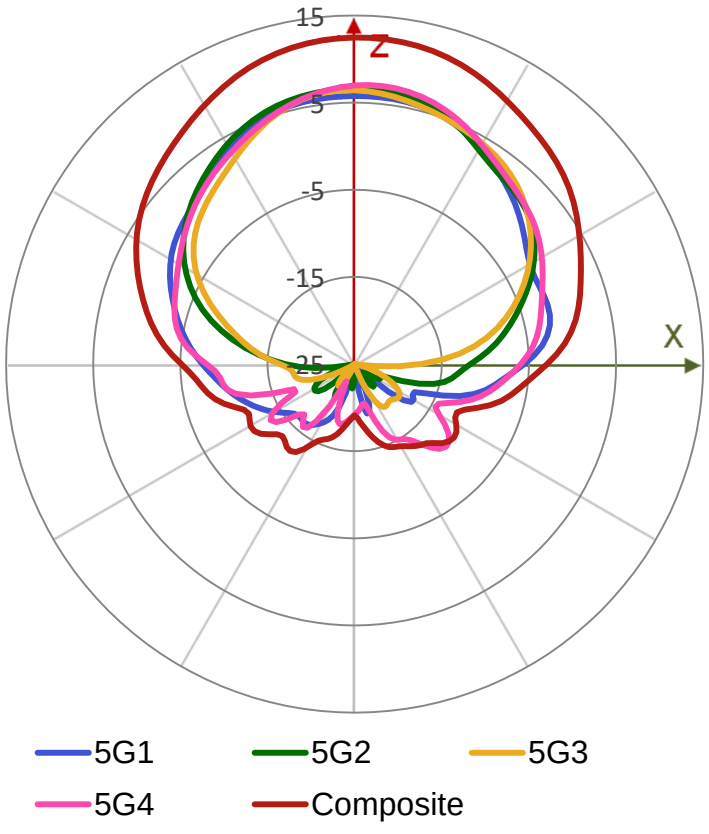
5G3 : 263mm

5G4 : 261mm

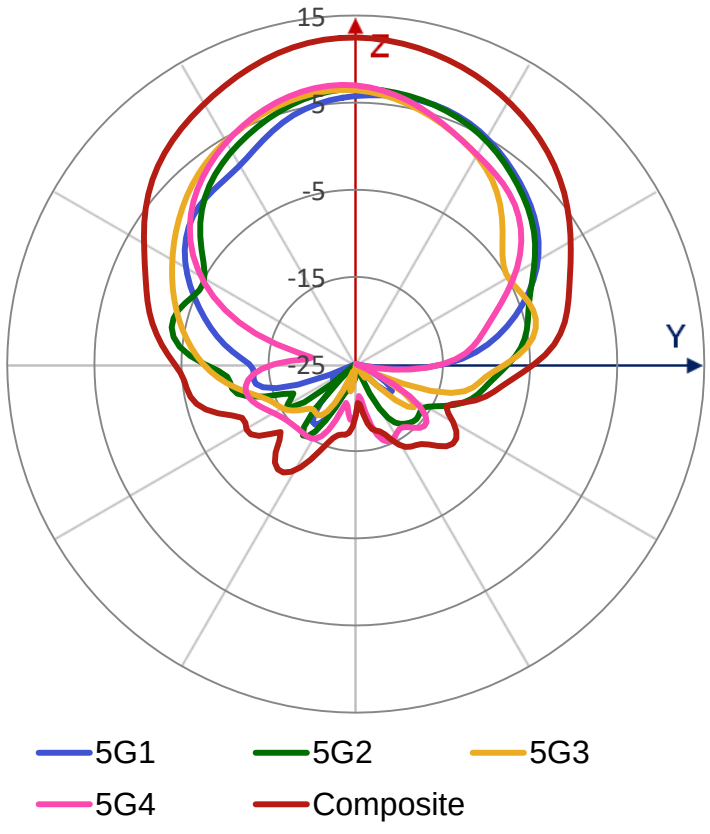
Realized Gain Pattern Wi-Fi 5G @5G for Gtotal

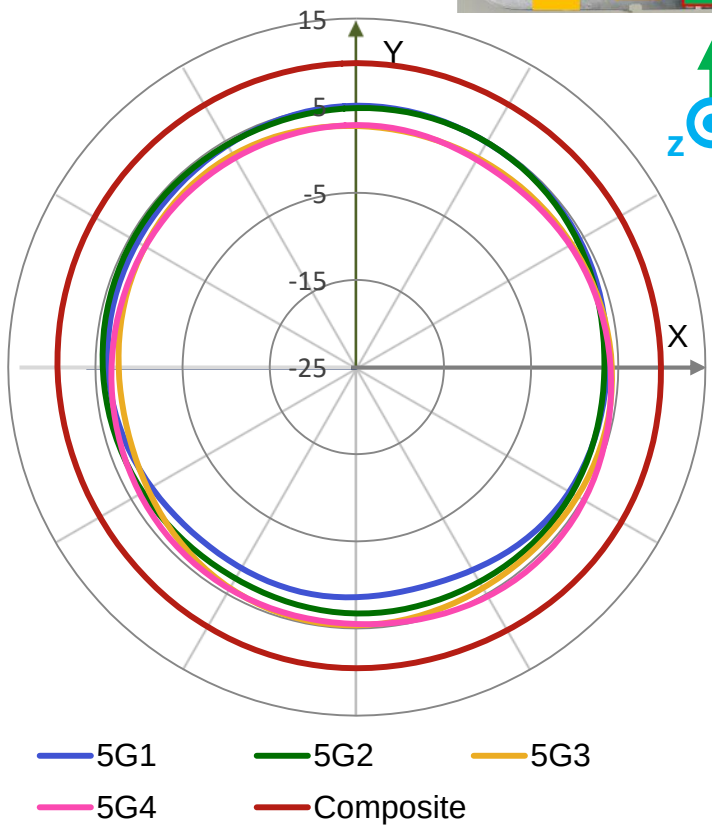
theta = 30

phi = 0



phi = 90





Wi-Fi 6G

- **Maximum VSWR**
  - 2.0:1 on 6GHz
- **Minimum Isolation**
  - 20.1dB on 6GHz
- **Average Efficiency**
  - ~60% on 6GHz
- **Peak Gain**
  - 8.5dBi on 6GHz

- **Cable Length**

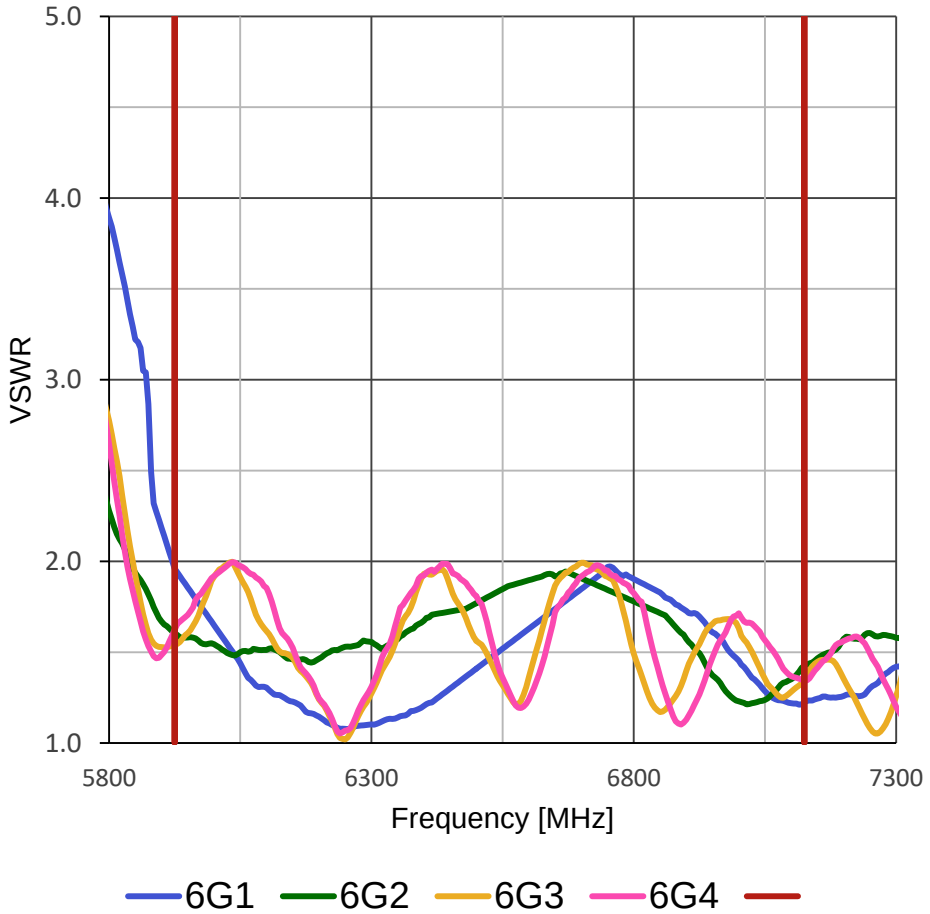
6G1：106mm

6G2：93mm

6G3：347mm

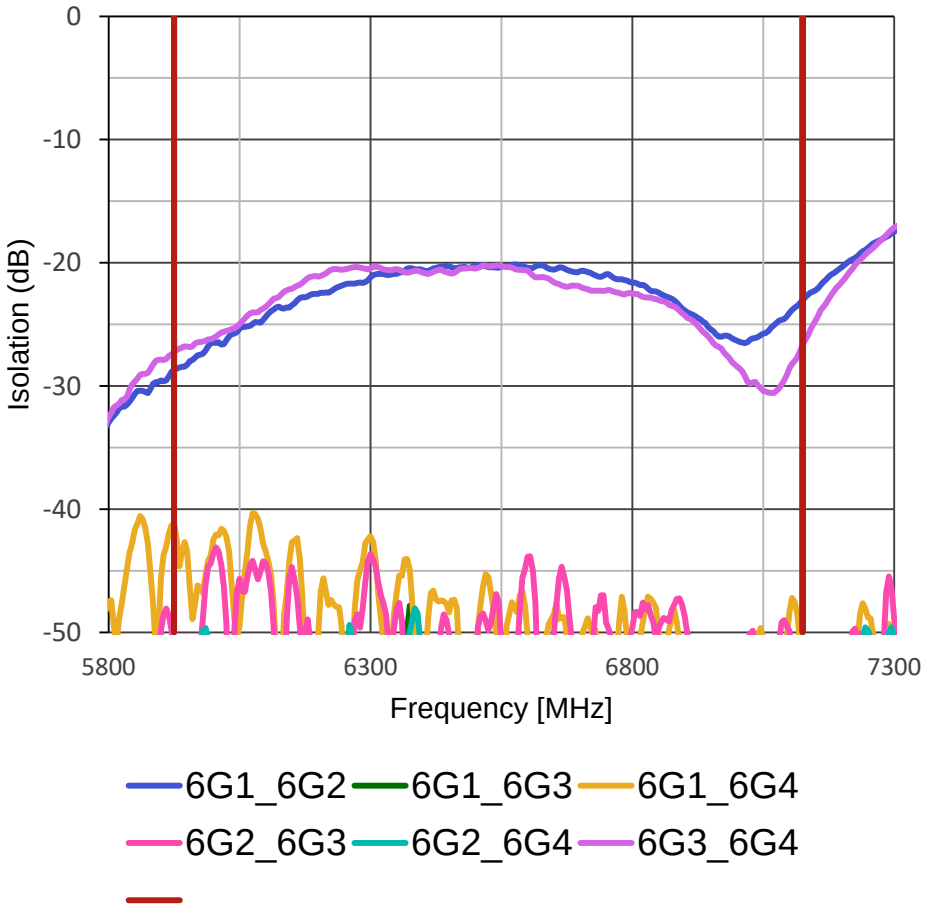
6G4：331mm

VSWR Wi-Fi 6G



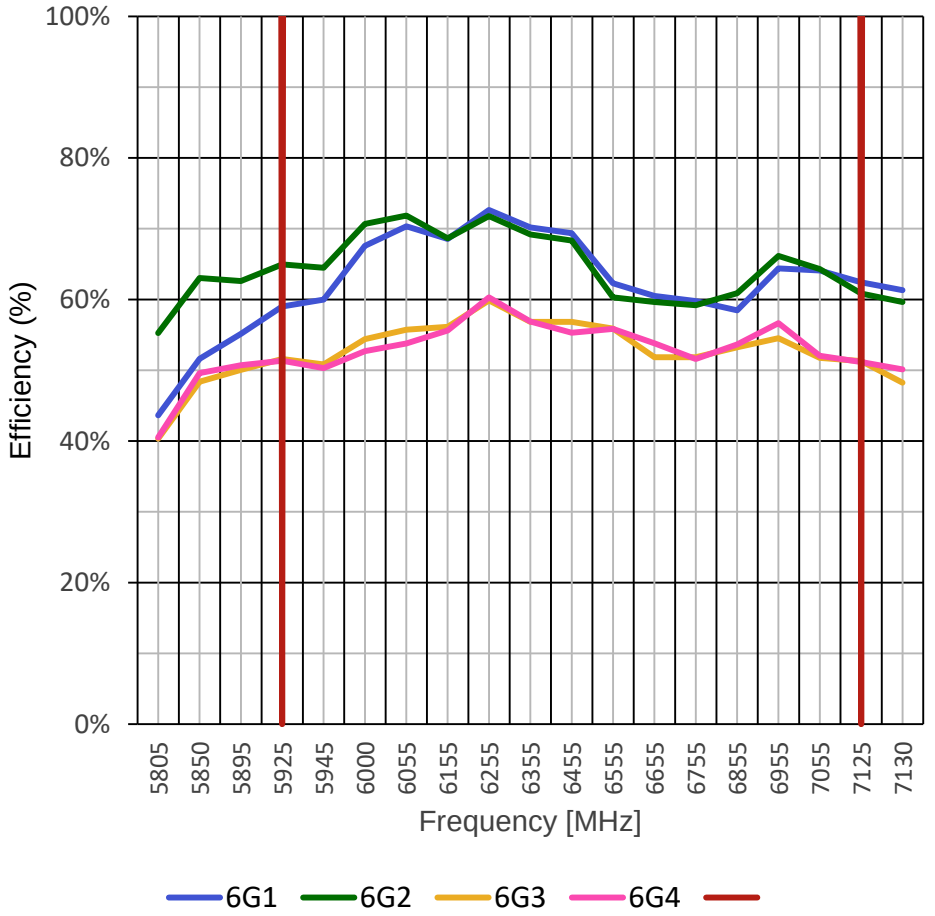
6GHz	Max	Mean	Min
6G1	2.0	1.5	1.1
6G2	1.9	1.6	1.2
6G3	2.0	1.6	1.0
6G4	2.0	1.6	1.1
Summary	2.0	1.6	1.0

Isolation Wi-Fi 6G



6GHz	Max	Mean	Min
6G1_6G2	-20.1	-22.8	-28.7
6G1_6G3	-47.8	-58.9	-86.9
6G1_6G4	-40.3	-50.2	-67.1
6G2_6G3	-43.1	-52.2	-82.4
6G2_6G4	-48.1	-57.1	-83.0
6G3_6G4	-20.2	-23.2	-30.6
Summary	-20.1	-44.1	-86.9

Efficiency Wi-Fi 6G



6GHz	Max	Mean	Min
6G1	73 %	65 %	58 %
6G2	72 %	65 %	59 %
6G3	60 %	54 %	51 %
6G4	60 %	54 %	50 %
Summary	73 %	60 %	50 %

■ **Cable Length**

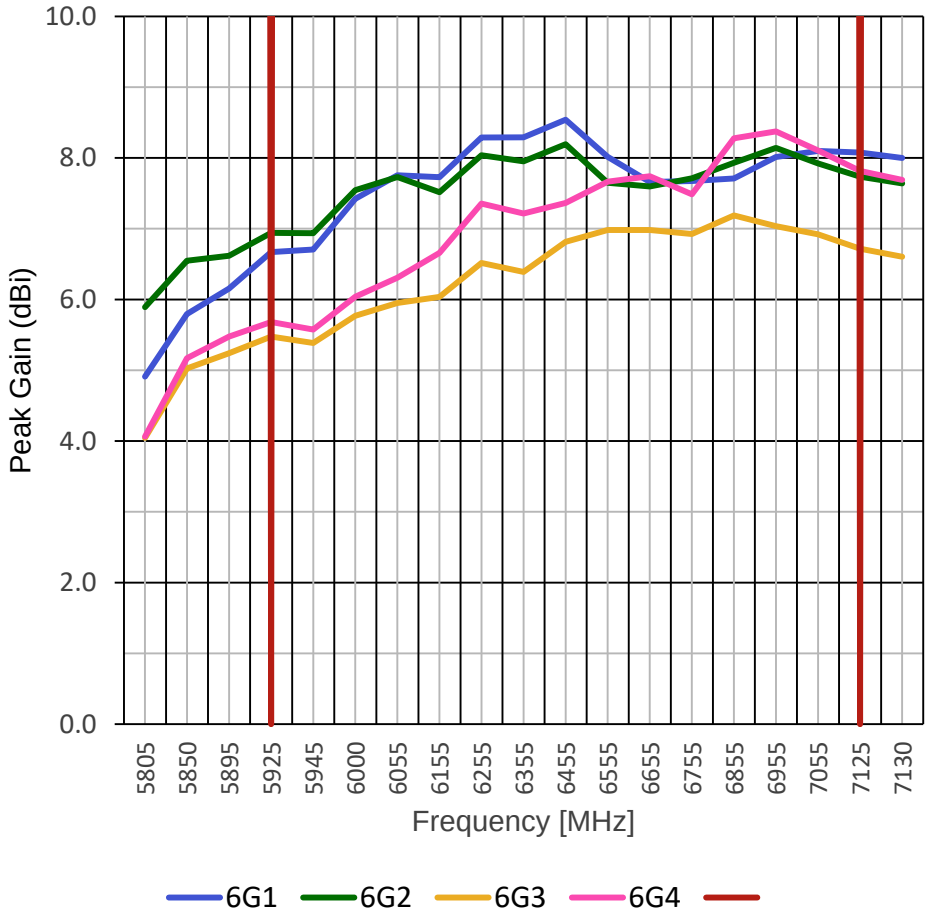
6G1 : 106mm

6G2 : 93mm

6G3 : 347mm

6G4 : 331mm

Peak Gain Wi-Fi 6G



6GHz	Max	Mean	Min
6G1	8.5 dBi	7.8 dBi	6.7 dBi
6G2	8.2 dBi	7.7 dBi	6.9 dBi
6G3	7.2 dBi	6.5 dBi	5.4 dBi
6G4	8.4 dBi	7.2 dBi	5.6 dBi
Summary	8.5 dBi	7.3 dBi	5.4 dBi

■ **Cable Length**

6G1 : 106mm

6G2 : 93mm

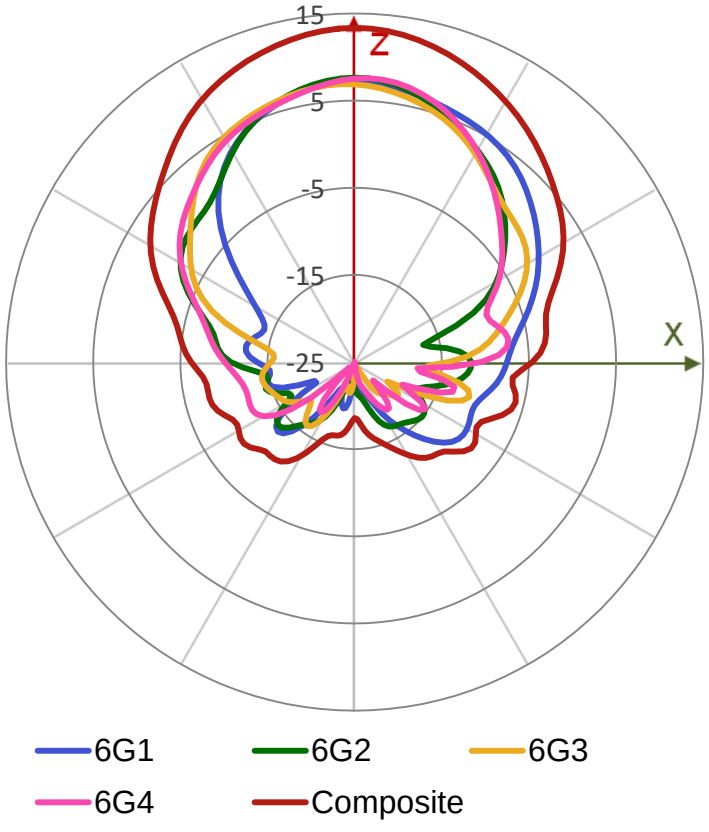
6G3 : 347mm

6G4 : 331mm

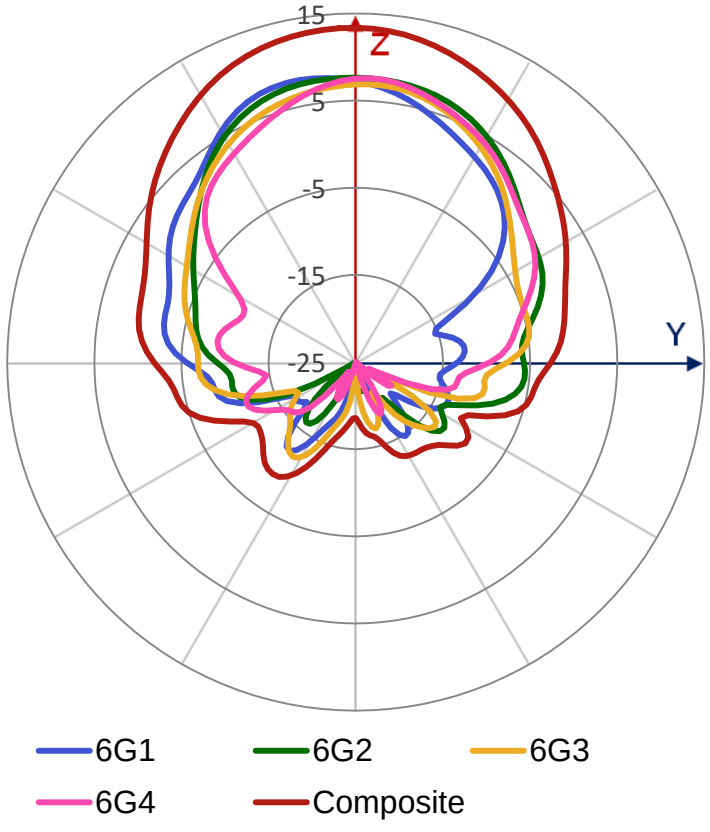
Realized Gain Pattern Wi-Fi 6G @6G for Gtotal

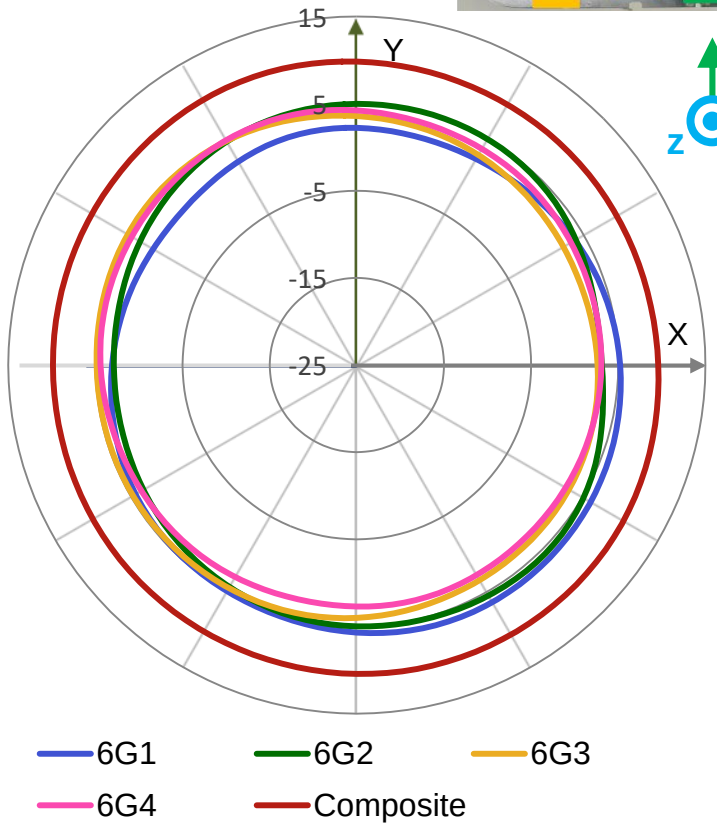
theta = 30

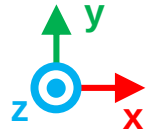
phi = 0



phi = 90







Scanning Radio

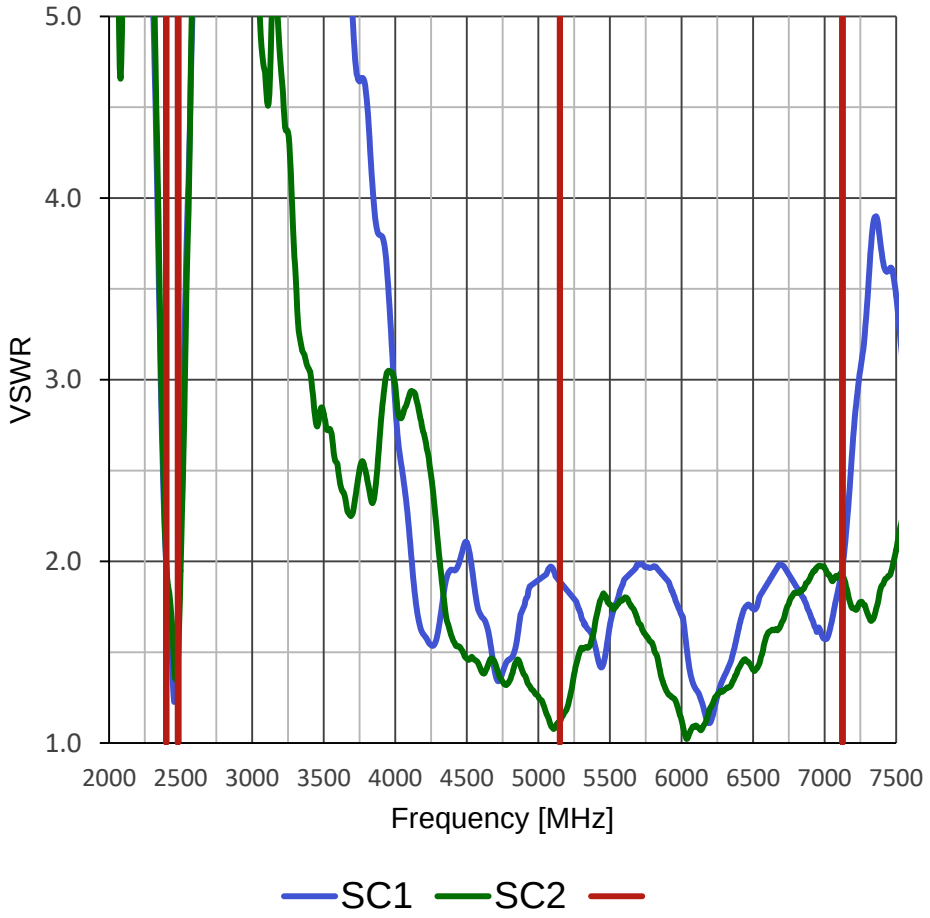
- **Maximum VSWR**
  - 2.0:1 on 2.4GHz / 2.0:1 on 5/6GHz
- **Minimum Isolation**
  - 17.2dB on 2.4GHz / 36.7dB on 5/6GHz
- **Average Efficiency**
  - ~64% on 2.4GHz / ~65% on 5GHz / ~68% on 6GHz
- **Peak Gain**
  - 5.8dBi on 2.4GHz / 6.3dBi on 5GHz / 8.2dBi on 6GHz

- **Cable Length**

  SC1：141mm

  SC2：91mm

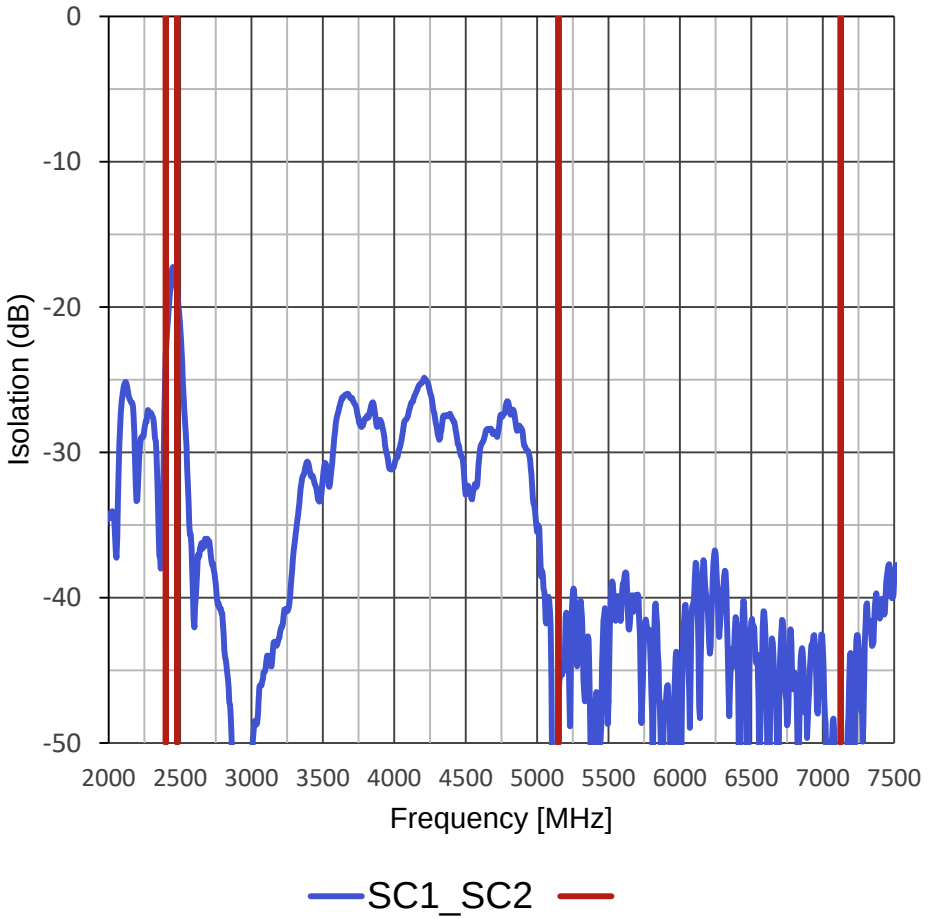
VSWR Scanning Radio



2.4GHz	Max	Mean	Min
SC1	2.0	1.6	1.2
SC2	2.0	1.6	1.3
Summary	2.0	1.6	1.2

5/6GHz	Max	Mean	Min
SC1	2.0	1.7	1.1
SC2	2.0	1.5	1.0
Summary	2.0	1.6	1.0

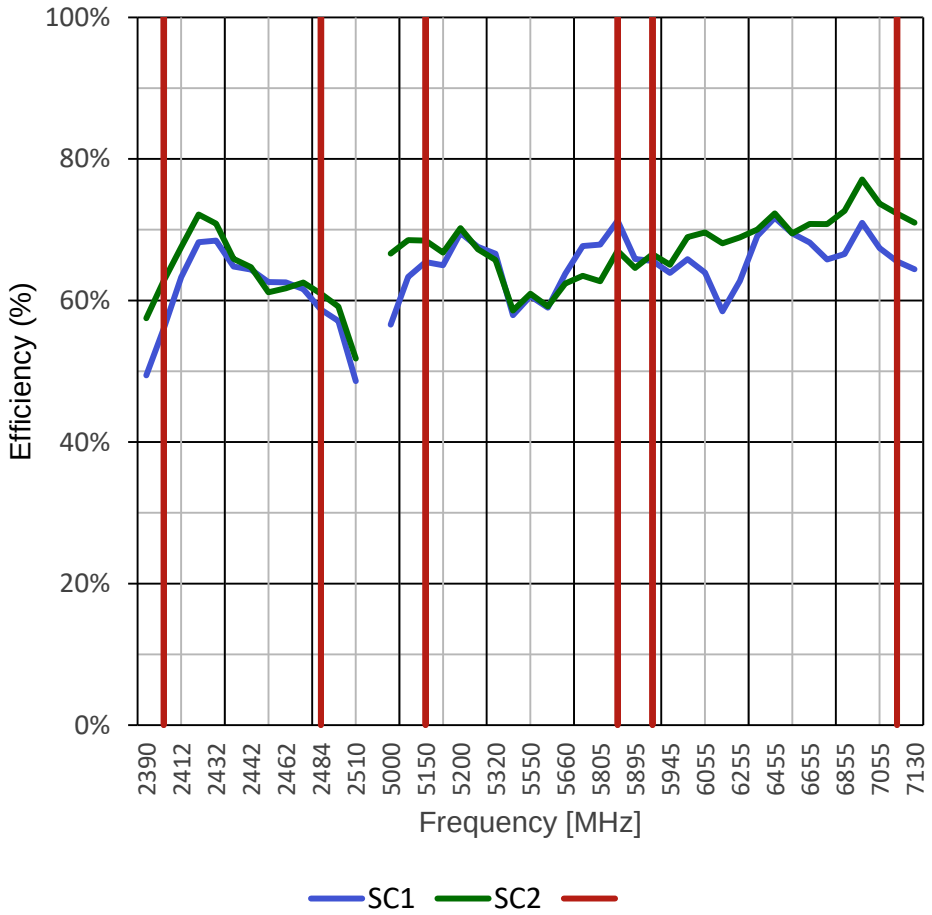
Isolation Scanning Radio



2.4GHz	Max	Mean	Min
SC1_SC2	-17.2	-19.2	-23.3

5/6GHz	Max	Mean	Min
SC1_SC2	-36.7	-45.0	-77.4

Efficiency Scanning Radio



2.4GHz	Max	Mean	Min
SC1	68 %	63 %	56 %
SC2	72 %	65 %	61 %
Summary	72 %	64 %	56 %

5GHz	Max	Mean	Min
SC1	71 %	65 %	58 %
SC2	70 %	64 %	59 %
Summary	71 %	65 %	58 %

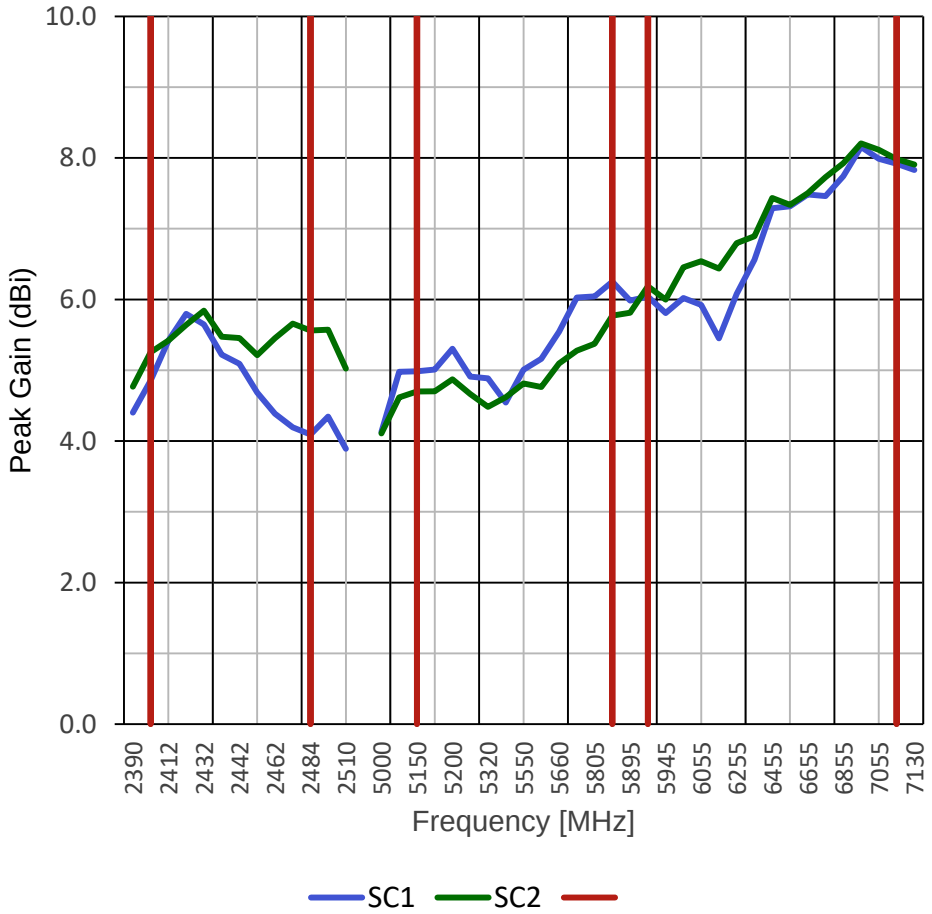
6GHz	Max	Mean	Min
SC1	72 %	66 %	58 %
SC2	77 %	70 %	65 %
Summary	77 %	68 %	58 %

■ **Cable Length**

SC1 : 141mm

SC2 : 91mm

Peak Gain Scanning Radio



2.4GHz	Max	Mean	Min
SC1	5.8 dBi	4.9 dBi	4.1 dBi
SC2	5.8 dBi	5.5 dBi	5.2 dBi
Summary	5.8 dBi	5.2 dBi	4.1 dBi

5GHz	Max	Mean	Min
SC1	6.3 dBi	5.3 dBi	4.5 dBi
SC2	5.8 dBi	4.9 dBi	4.5 dBi
Summary	6.3 dBi	5.1 dBi	4.5 dBi

6GHz	Max	Mean	Min
SC1	8.2 dBi	6.9 dBi	5.5 dBi
SC2	8.2 dBi	7.2 dBi	6.0 dBi
Summary	8.2 dBi	7.0 dBi	5.5 dBi

■ **Cable Length**

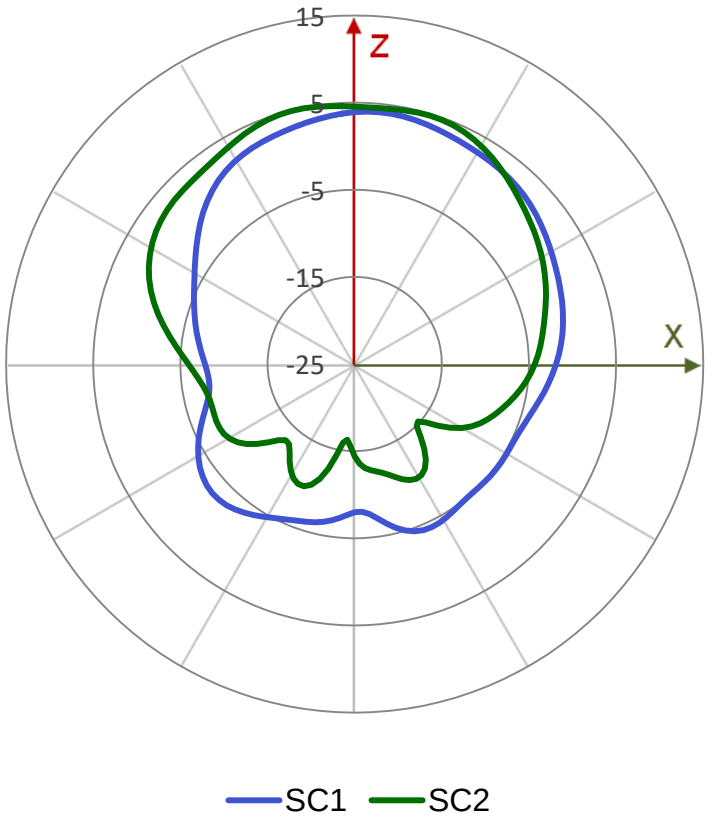
SC1 : 141mm

SC2 : 91mm

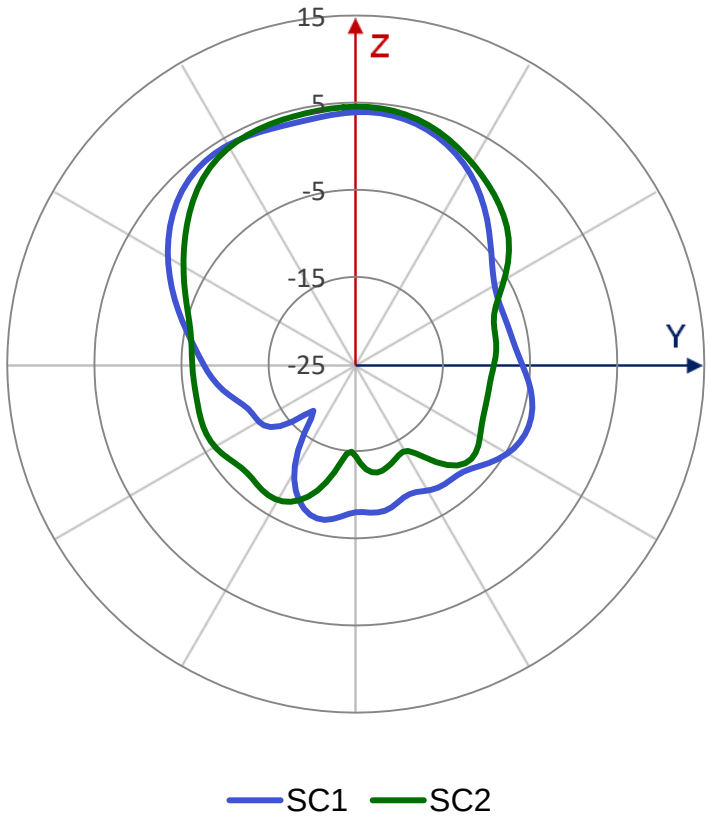
Realized Gain Pattern Scanning Radio @2.4G for Gtotal

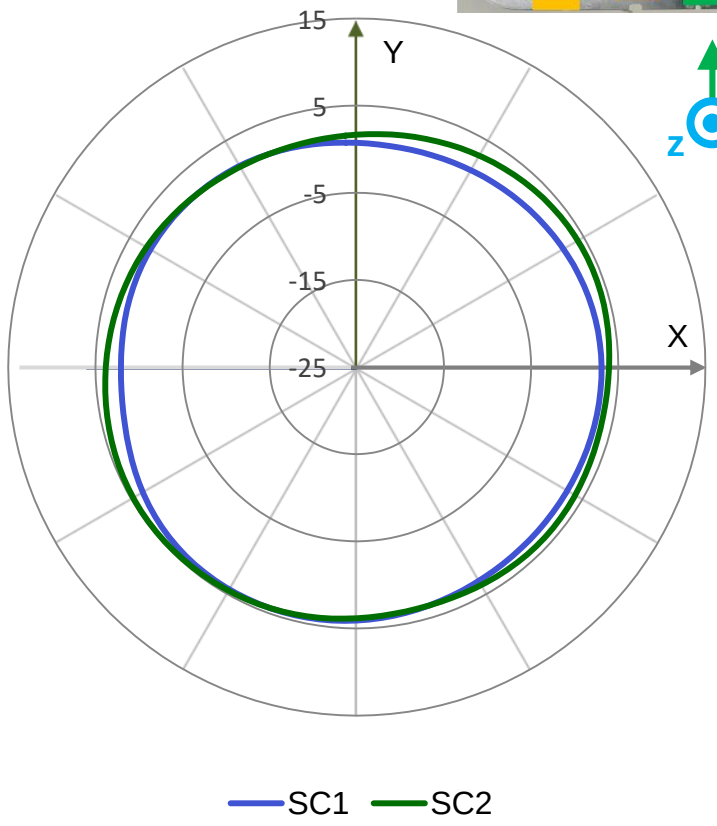
theta = 30

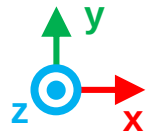
phi = 0



phi = 90



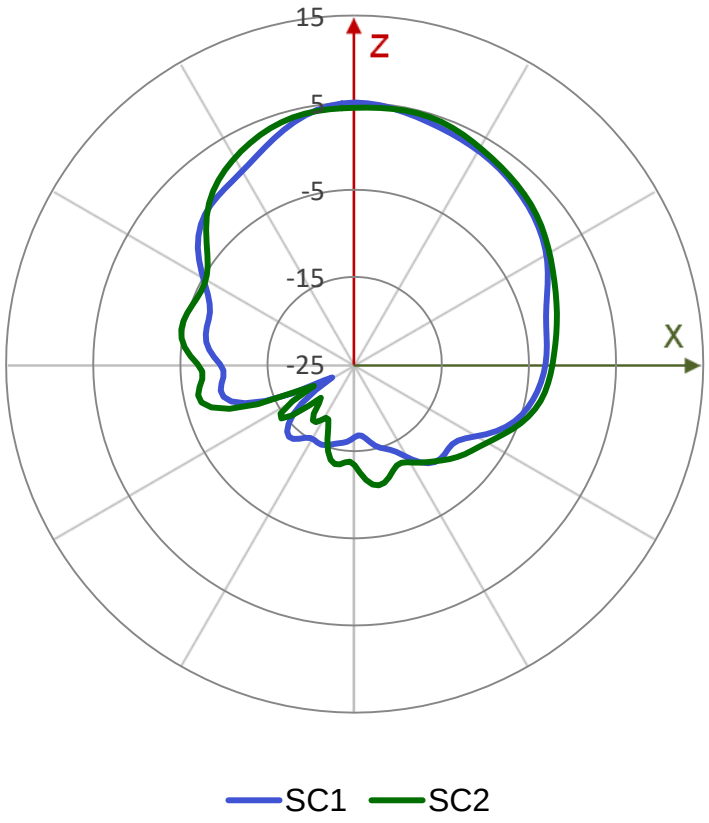




Realized Gain Pattern Scanning Radio @5G for Gtotal

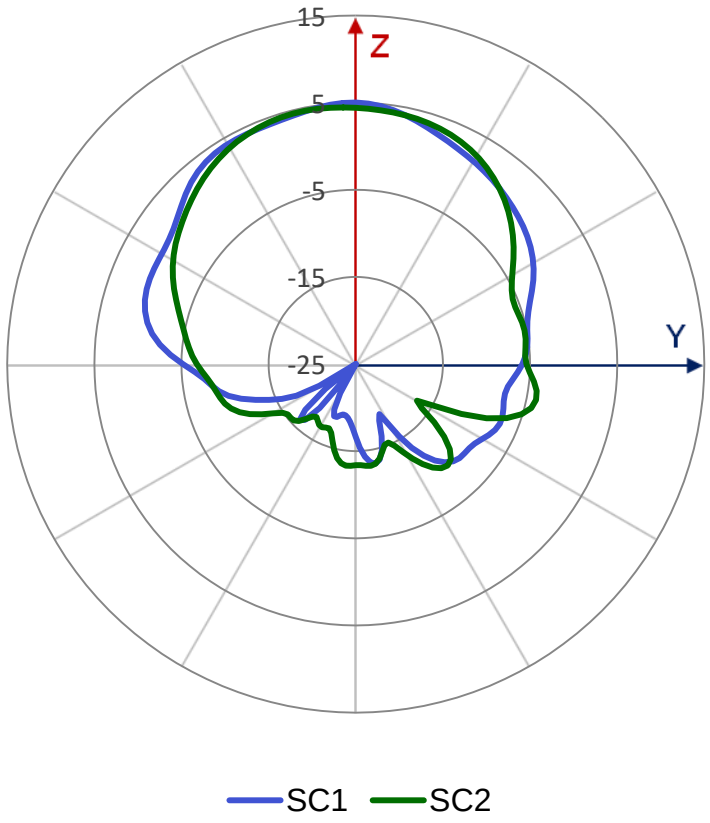
theta = 30

phi = 0

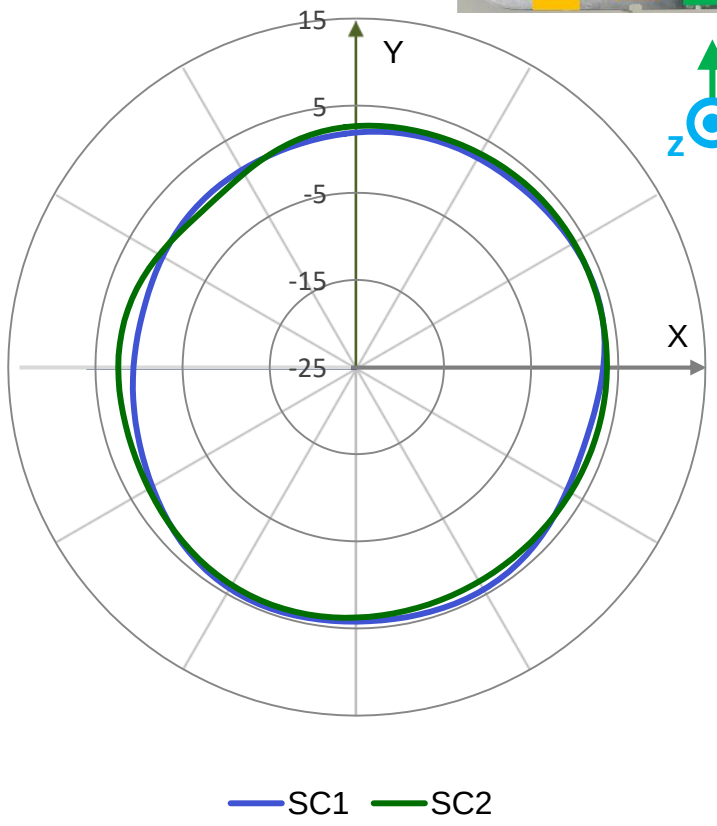


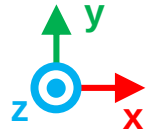
SC1 SC2

phi = 90



SC1 SC2



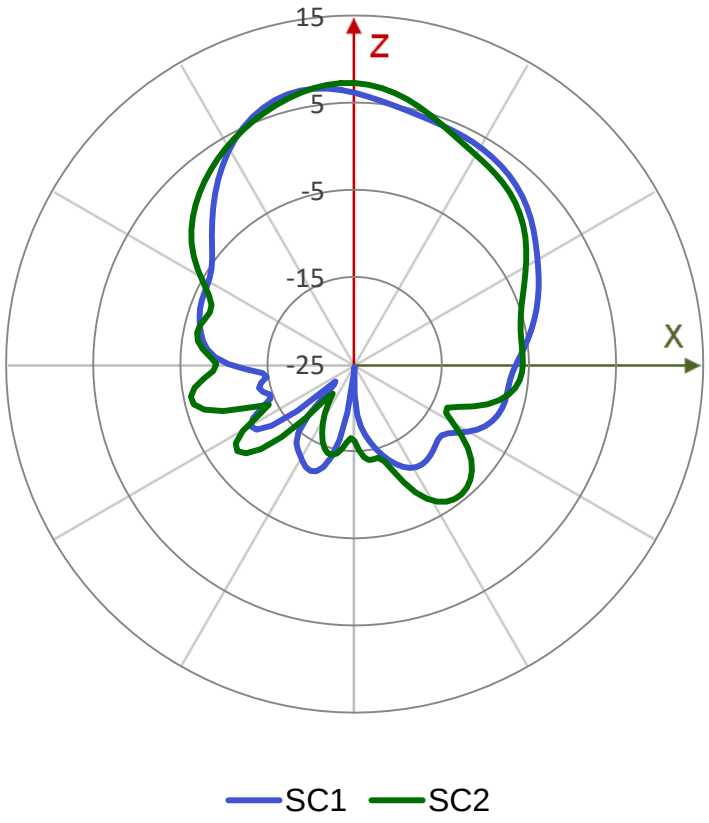


SC1 SC2

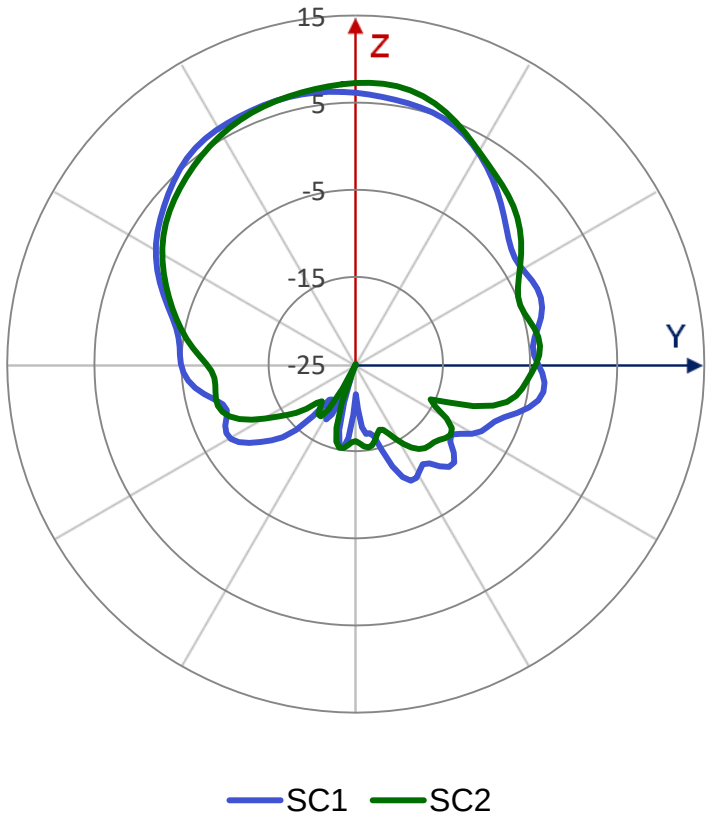
Realized Gain Pattern Scanning Radio @6G for Gtotal

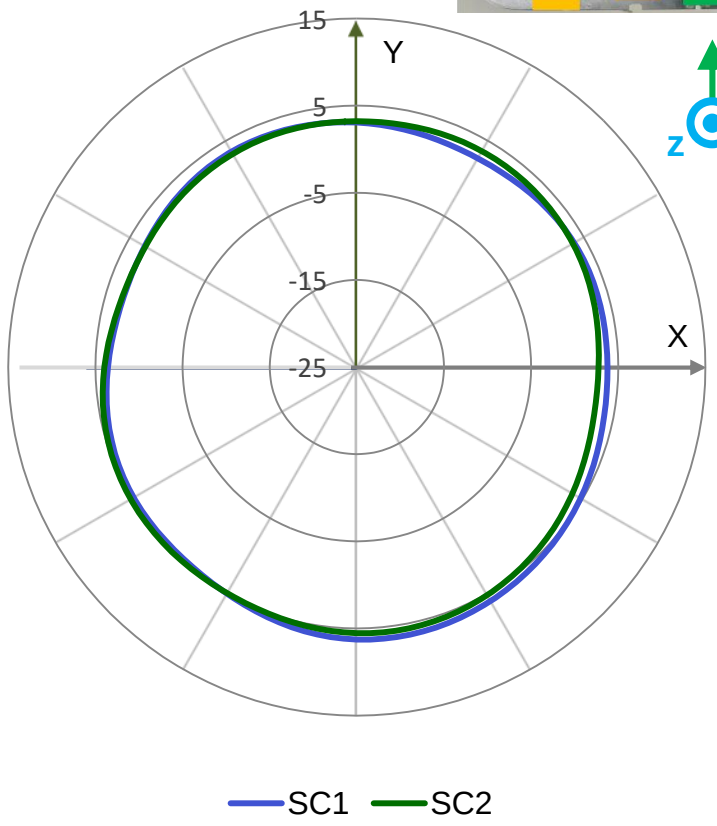
theta = 30

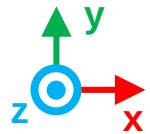
phi = 0



phi = 90







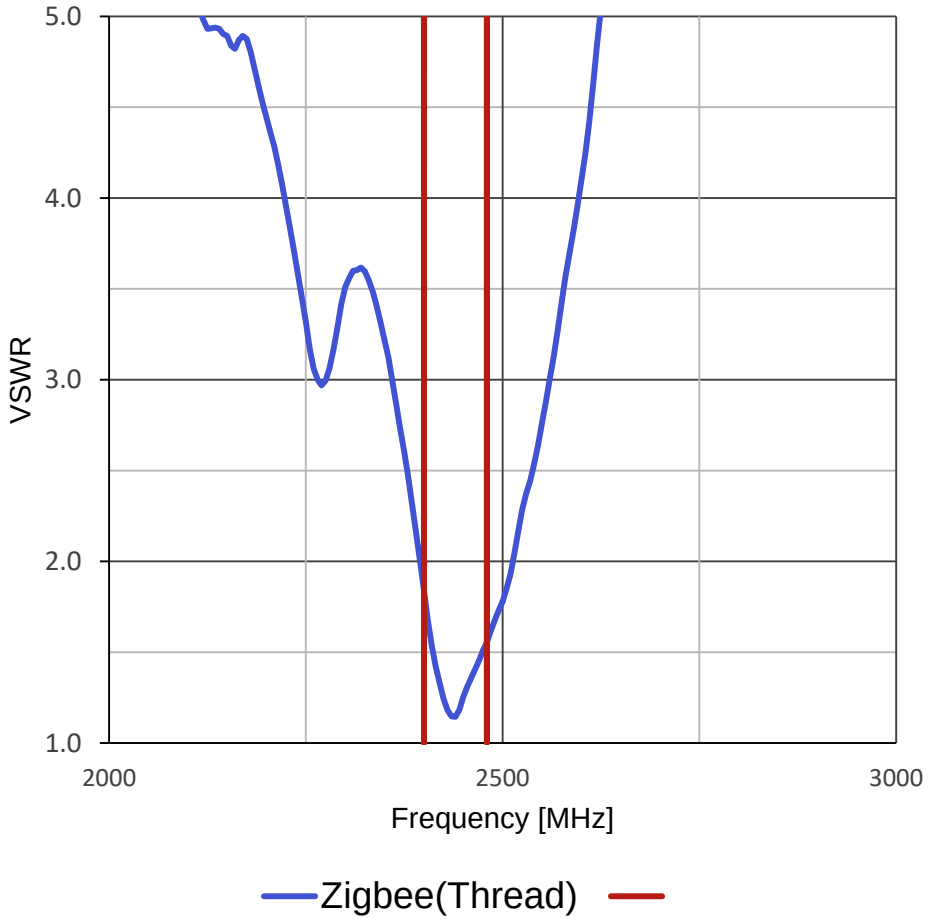
Zigbee(Thread)

- **Maximum VSWR**
  - 1.8:1 on 2.4GHz
- **Average Efficiency**
  - ~58% on 2.4GHz
- **Peak Gain**
  - 6.6dBi on 2.4GHz

- **Cable Length**

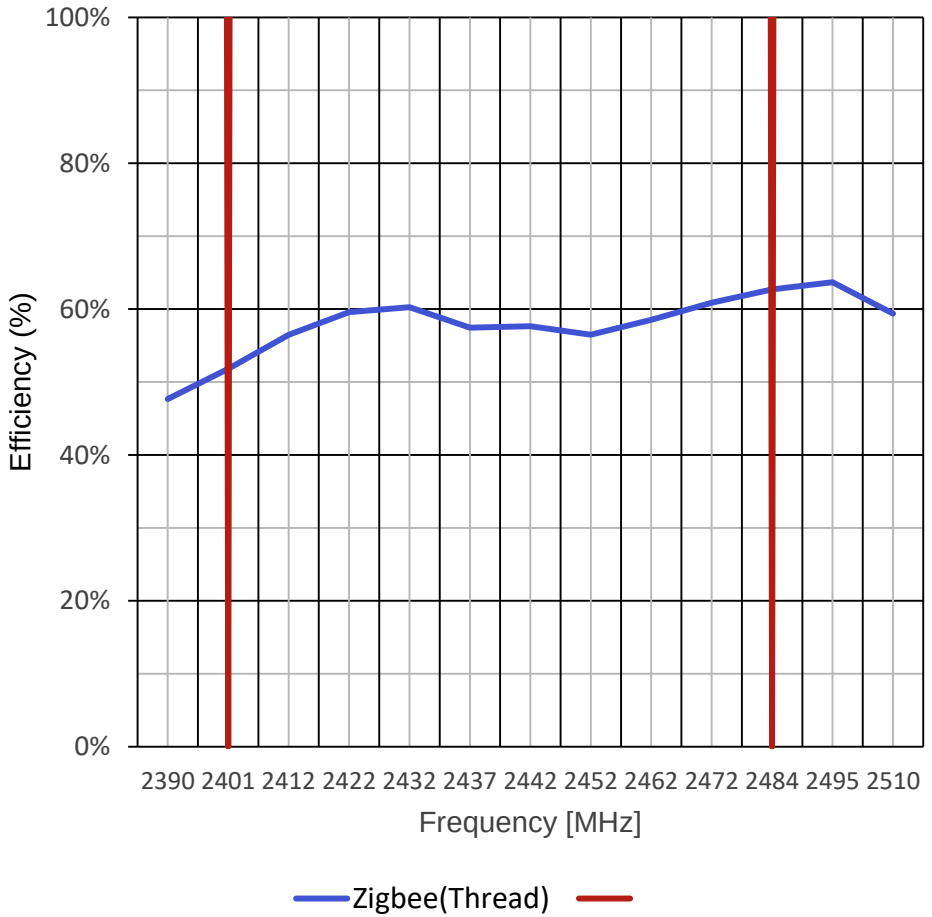
  Zigbee(Thread)：208mm

VSWR Zigbee(Thread)



2.4GHz	Max	Mean	Min
Zigbee(Thread)	1.8	1.4	1.1

Efficiency Zigbee(Thread)

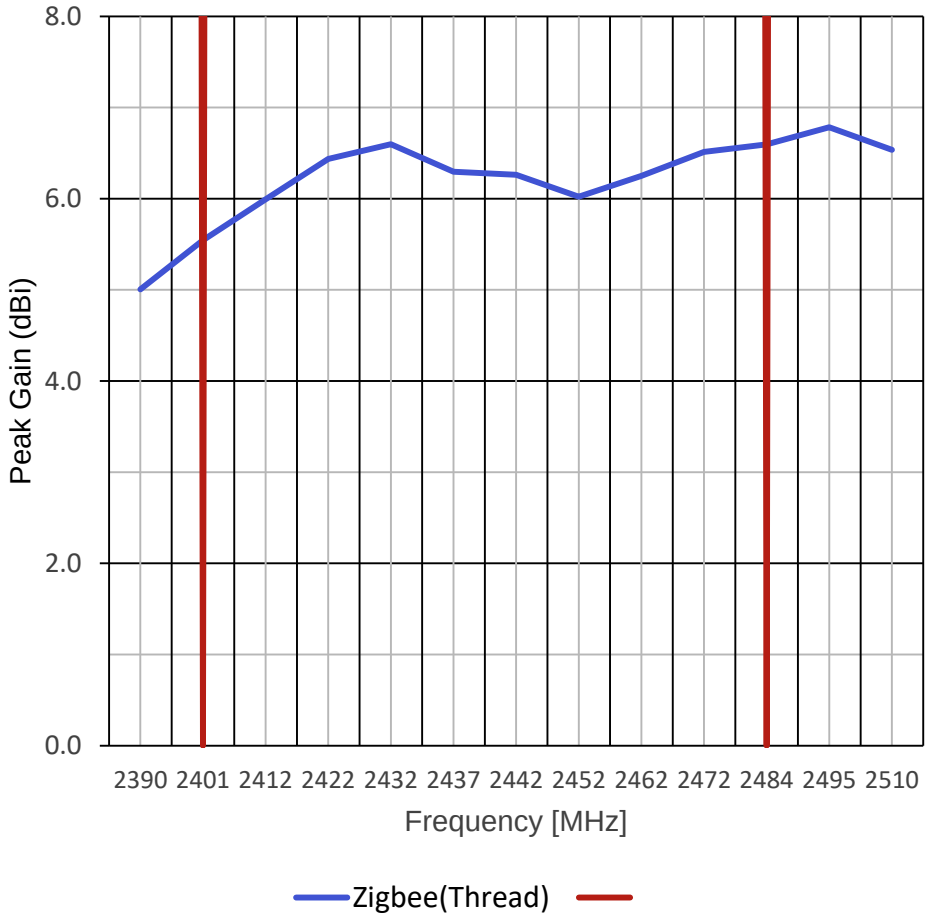


2.4GHz	Max	Mean	Min
Zigbee(Thread)	63 %	58 %	52 %

■ **Cable Length**

Zigbee(Thread)：208mm

Peak Gain Zigbee(Thread)



2.4GHz	Max	Mean	Min
Zigbee(Thread)	6.6 dBi	6.3 dBi	5.5 dBi

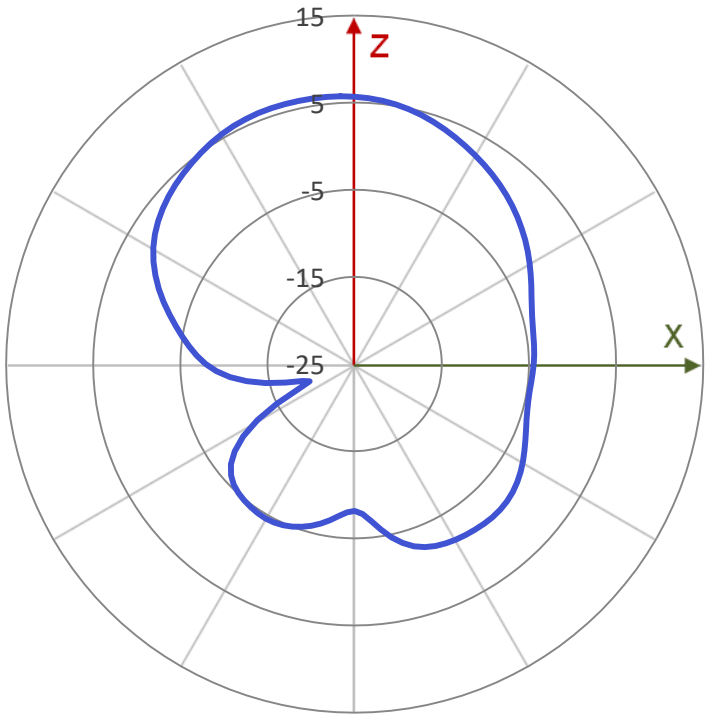
■ **Cable Length**

Zigbee(Thread)：208mm

Realized Gain Pattern Zigbee(Thread) @2.4G for Gtotal

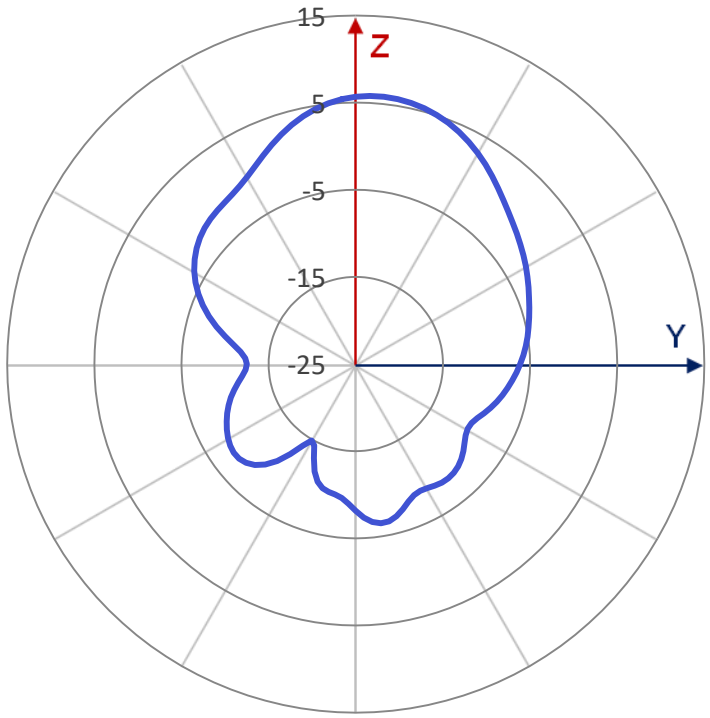
theta = 30

phi = 0

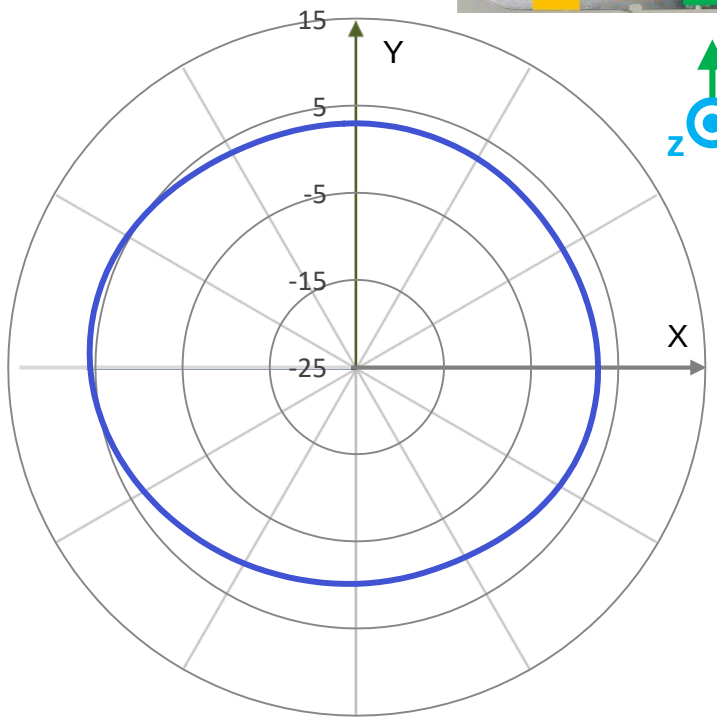


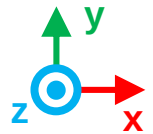
Zigbee(Thread)

phi = 90



Zigbee(Thread)





Zigbee(Thread)

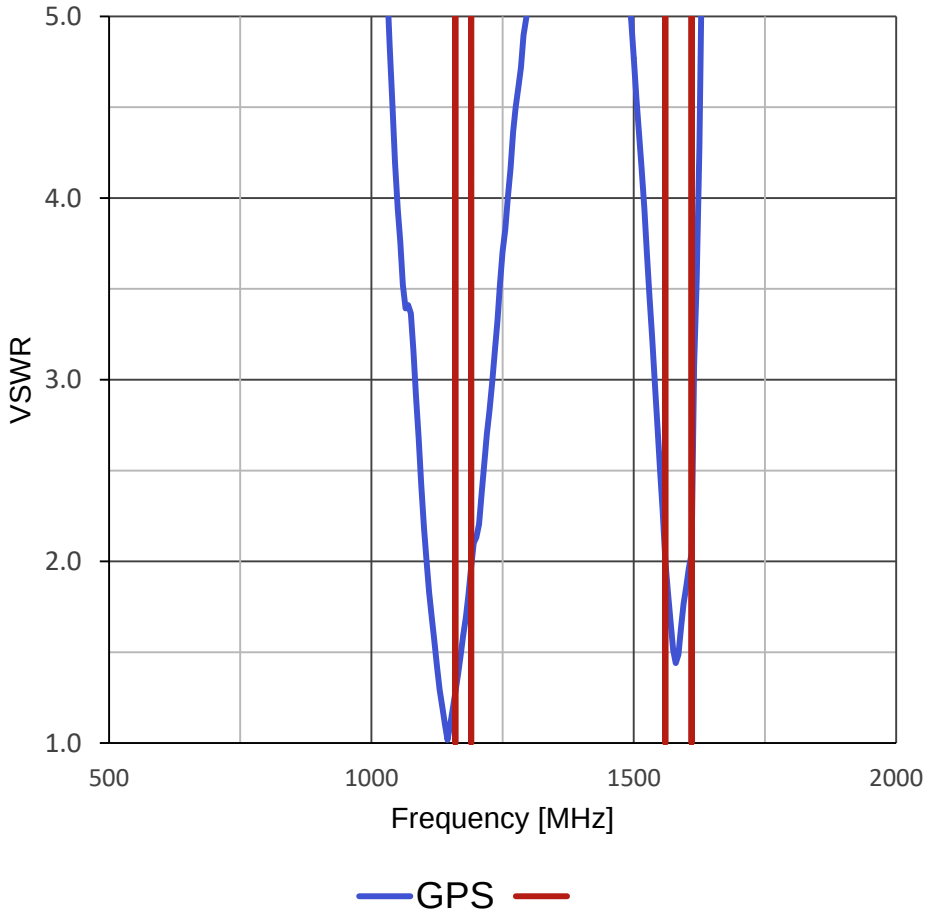
GPS

- **Maximum VSWR**
  - 2.0:1 on L1 / 2.0:1 on L5
- **Minimum Isolation**
  - 39.0dB on L1 / 28.2dB on L5 / 34.0dB on 2.4G
- **Average Efficiency**
  - ~51% on L1 / ~74% on L5
- **Peak Gain**
  - 2.3dBi on L1 / 4.6dBi on L5

- **Cable Length**

GPS：208mm

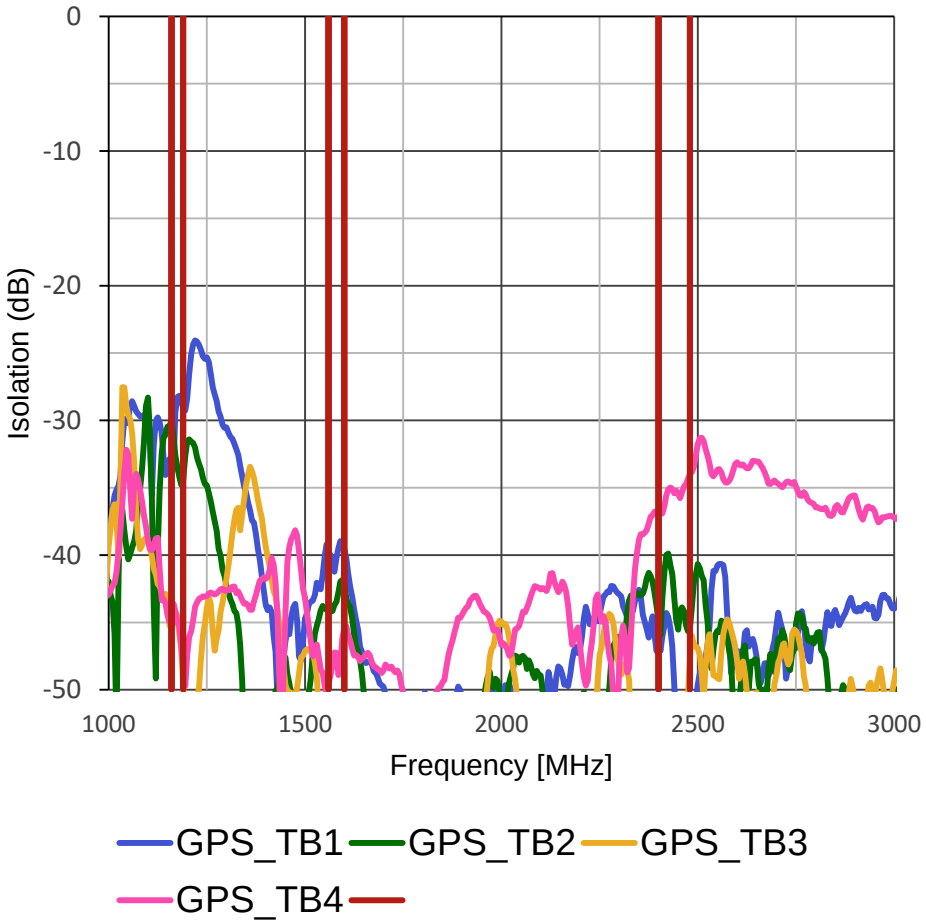
VSWR GPS



L1	Max	Mean	Min
GPS	2.0	1.7	1.4

L5	Max	Mean	Min
GPS	2.0	1.6	1.3

Isolation GPS

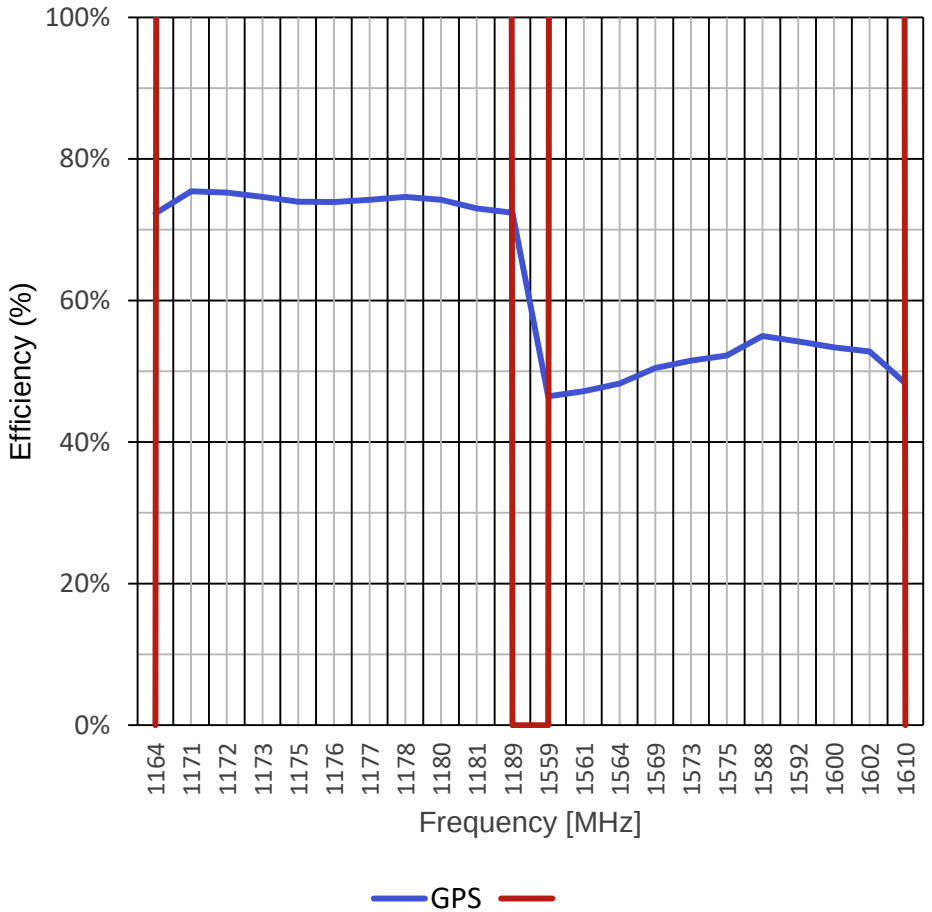


L1	Max	Mean	Min
GPS_TB1	-39.0	-39.9	-41.2
GPS_TB2	-41.8	-43.2	-44.2
GPS_TB3	-52.5	-54.9	-60.1
GPS_TB4	-45.4	-47.8	-49.5
Summary	-39.0	-46.4	-60.1

L5	Max	Mean	Min
GPS_TB1	-28.2	-30.1	-34.0
GPS_TB2	-29.9	-32.9	-34.8
GPS_TB3	-44.2	-45.9	-49.8
GPS_TB4	-43.6	-45.4	-48.5
Summary	-28.2	-38.6	-49.8

2.4GHz	Max	Mean	Min
GPS_TB1	-44.3	-49.6	-55.2
GPS_TB2	-39.9	-43.5	-45.9
GPS_TB3	-47.8	-52.7	-57.3
GPS_TB4	-34.0	-35.5	-37.0
Summary	-34.0	-45.3	-57.3

Efficiency GPS



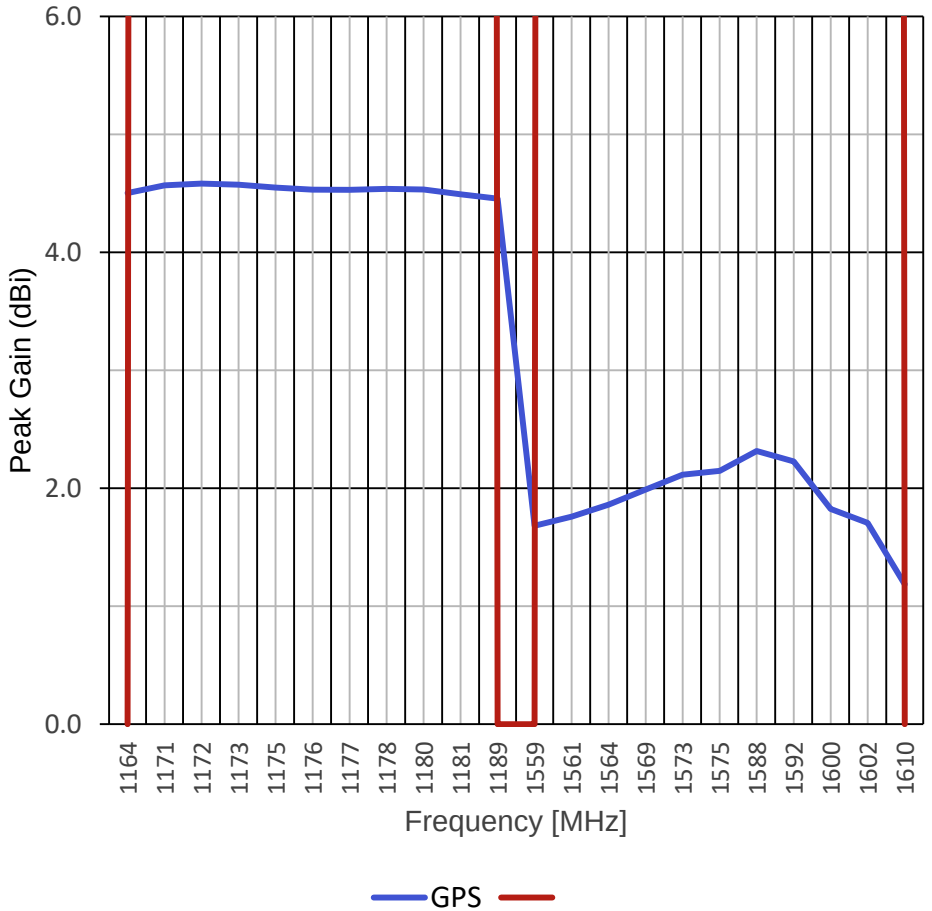
L1	Max	Mean	Min
GPS	55 %	51 %	46 %

L5	Max	Mean	Min
GPS	75 %	74 %	72 %

- **Cable Length**

  GPS：208mm

Peak Gain GPS



L1	Max	Mean	Min
GPS	2.3 dBi	1.9 dBi	1.2 dBi

L5	Max	Mean	Min
GPS	4.6 dBi	4.5 dBi	4.5 dBi

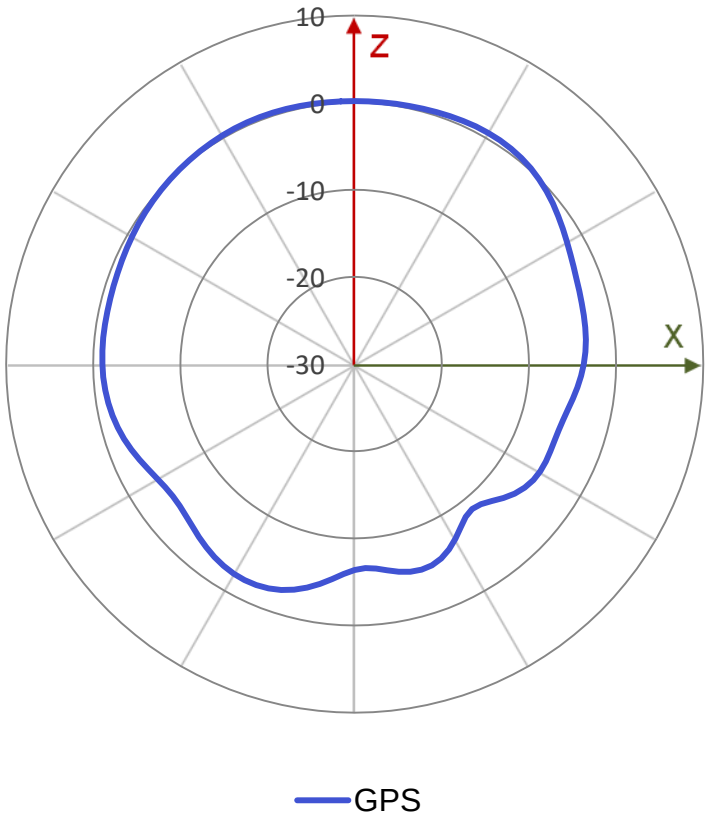
■ **Cable Length**

GPS：208mm

Realized Gain Pattern GPS @L5 for Gtotal

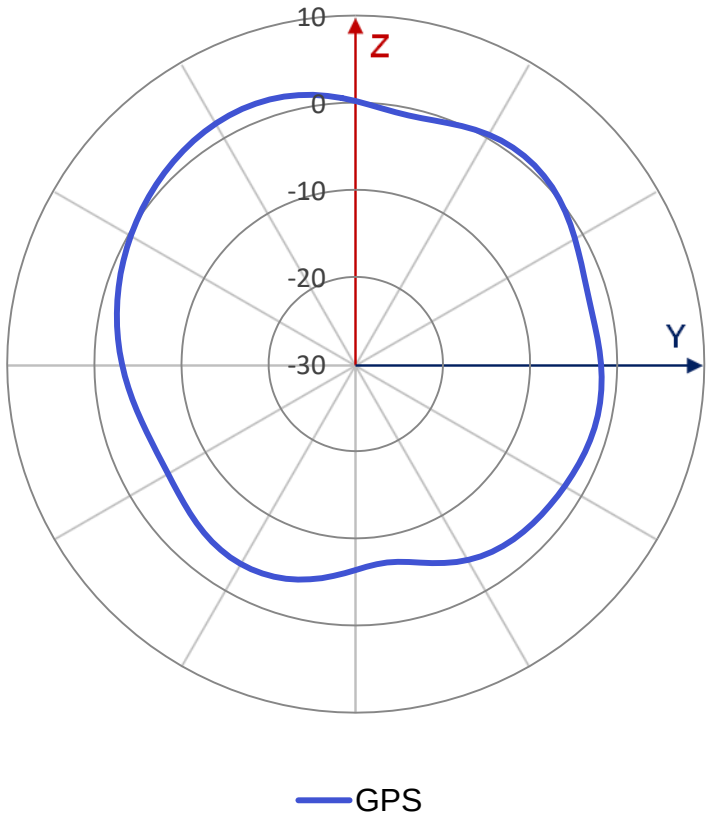
theta = 90

phi = 0

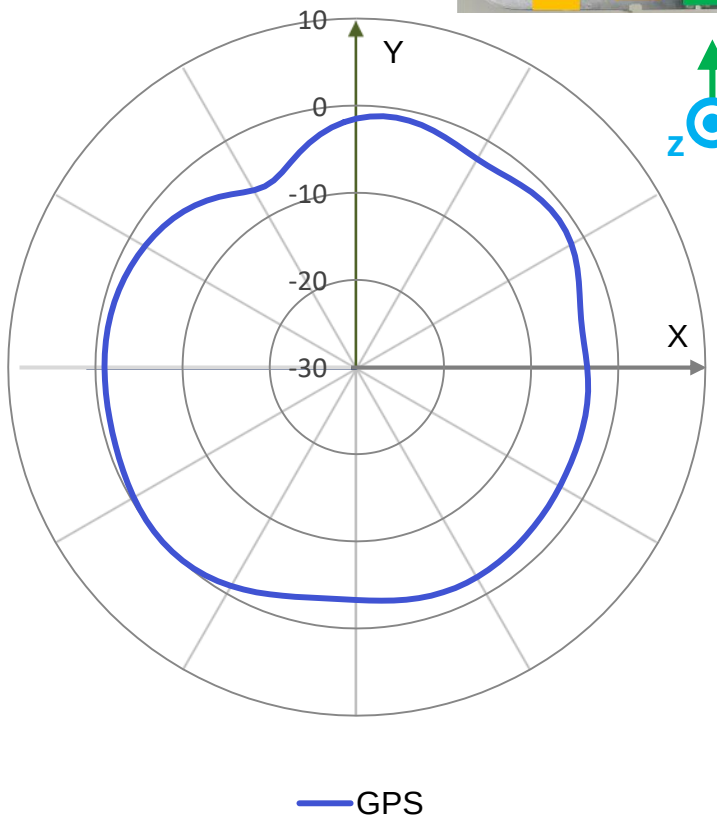


GPS

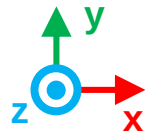
phi = 90



GPS



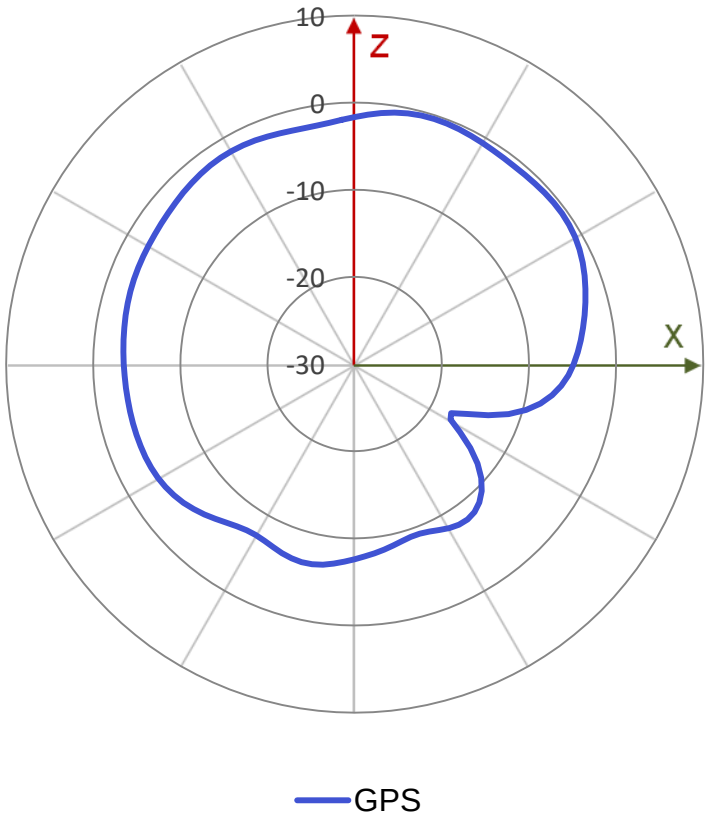
GPS



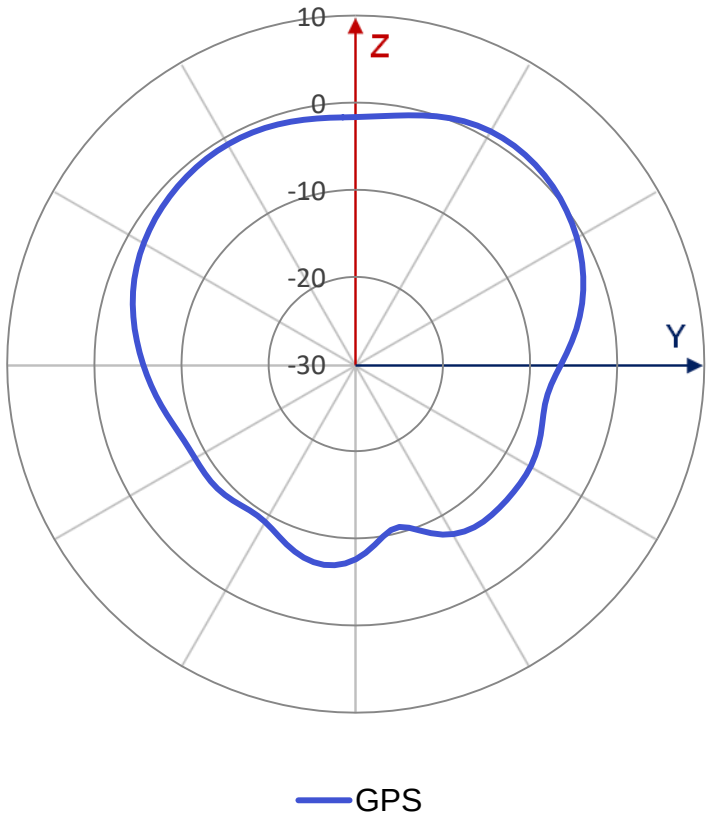
Realized Gain Pattern GPS @L1 for Gtotal

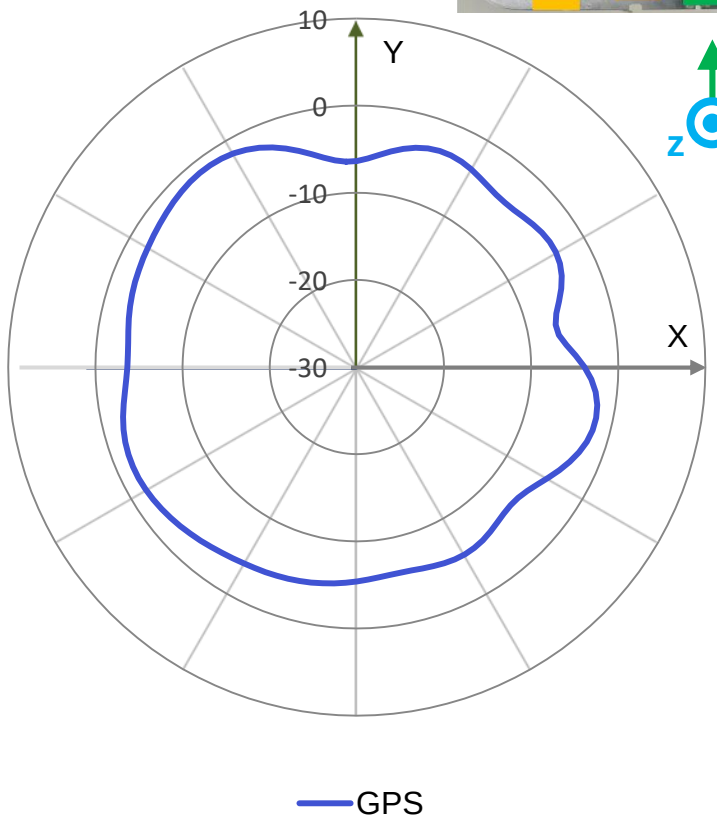
theta = 90

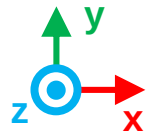
phi = 0



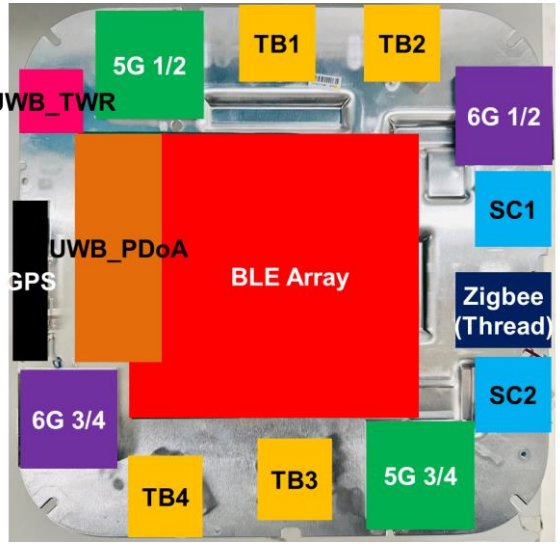
phi = 90







UWB_TWR

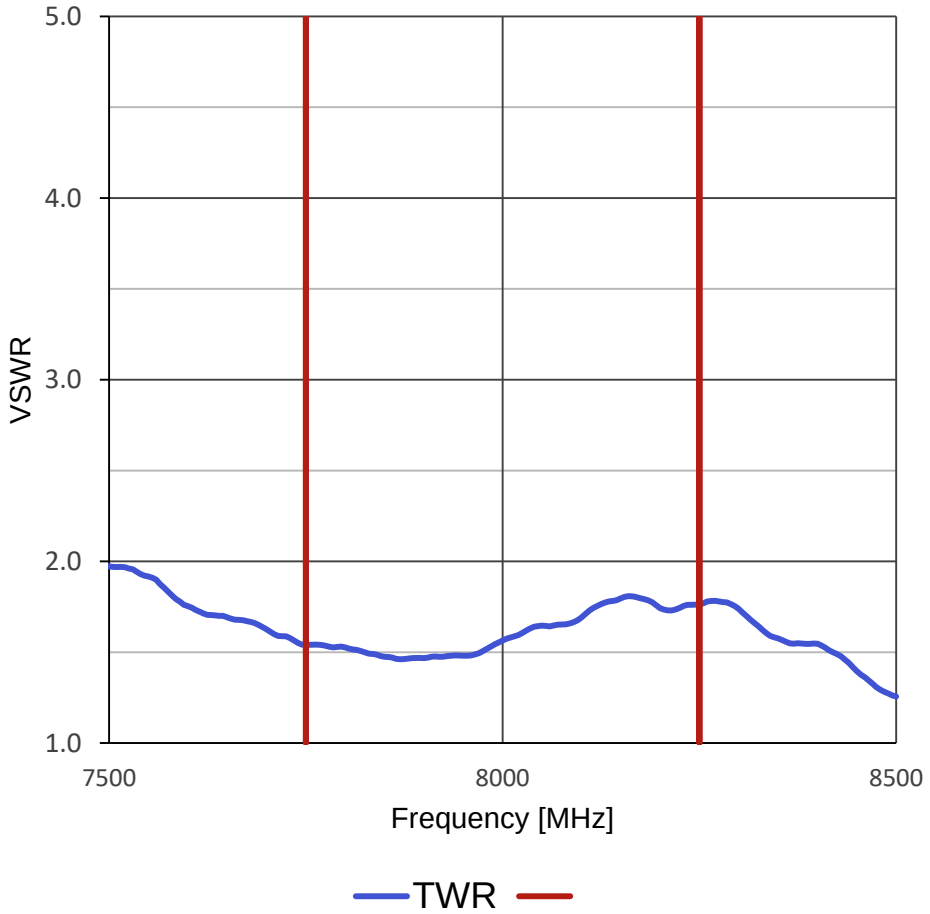


- **Maximum VSWR**
  - 1.8:1 on CH 9
- **Average Efficiency**
  - ~55% on CH 9
- **Peak Gain**
  - 6.7dBi on CH 9

- **Cable Length**

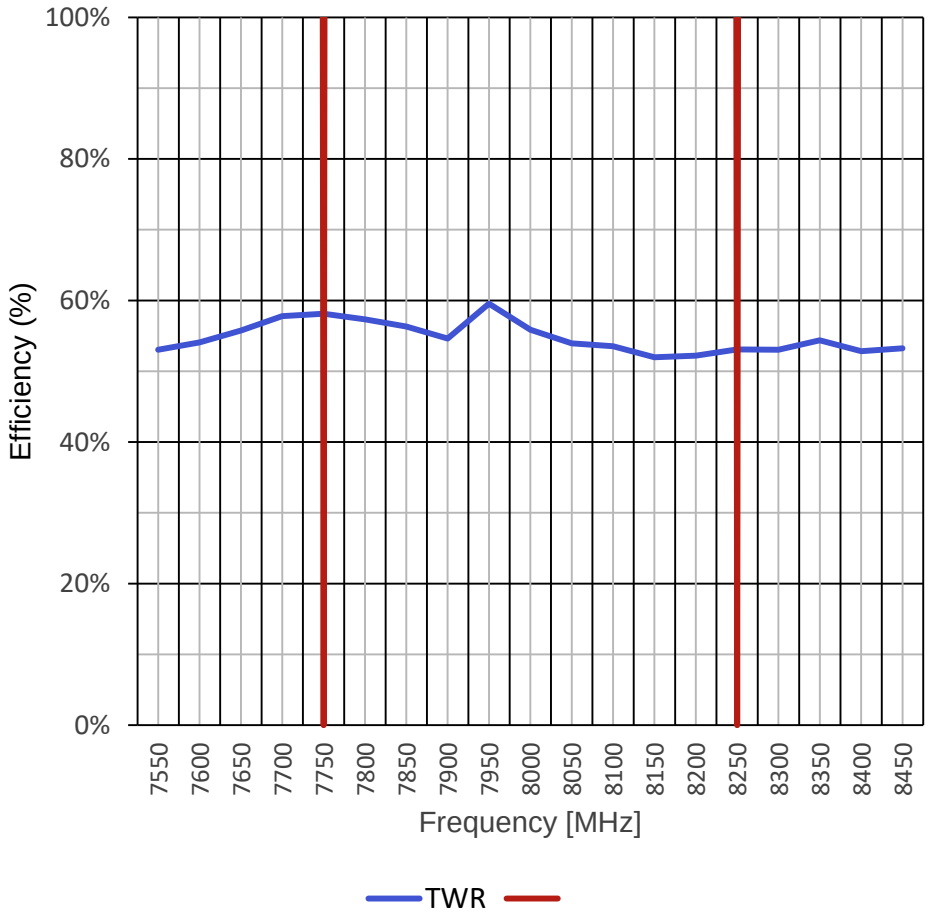
  TWR：125mm

VSWR UWB_TWR



CH 9	Max	Mean	Min
TWR	1.8	1.6	1.5

Efficiency UWB_TWR

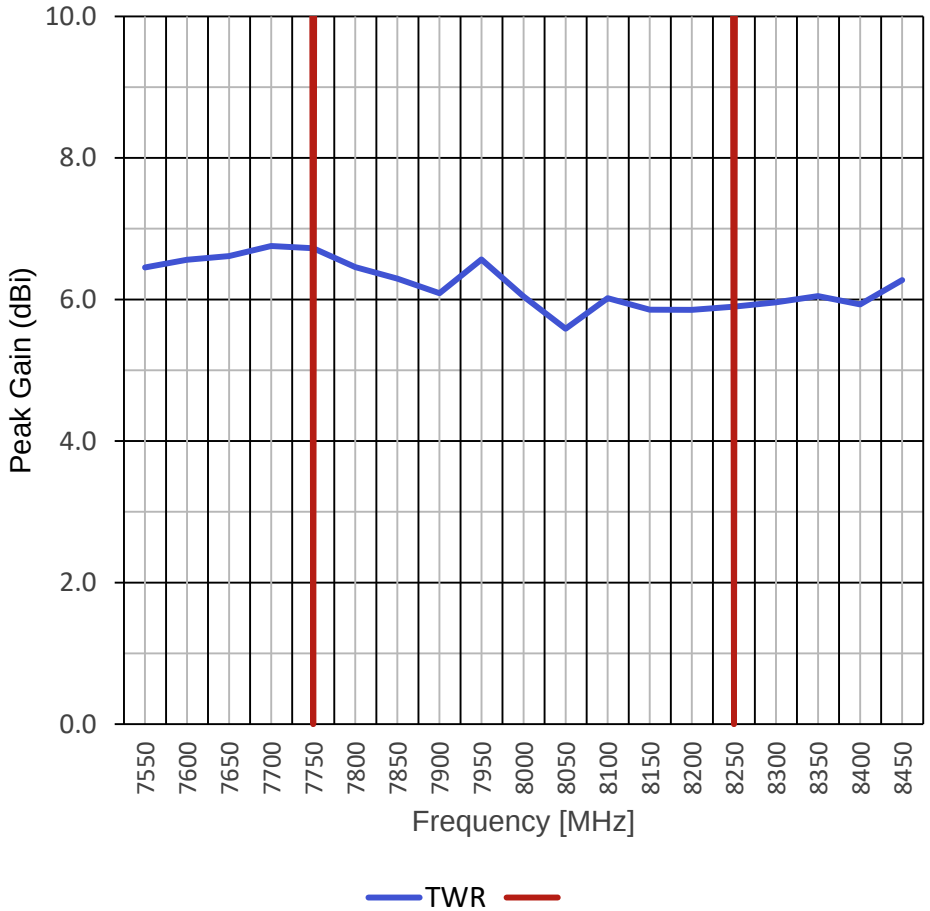


CH 9	Max	Mean	Min
TWR	60 %	55 %	52 %

- **Cable Length**

  TWR：125mm

Peak Gain UWB_TWR

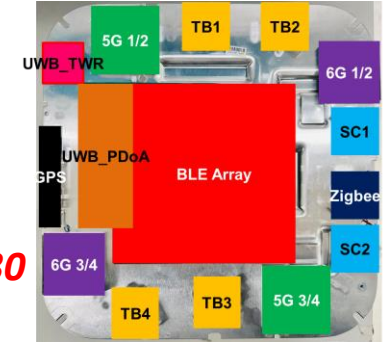


CH 9	Max	Mean	Min
TWR	6.7 dBi	6.1 dBi	5.6 dBi

- **Cable Length**

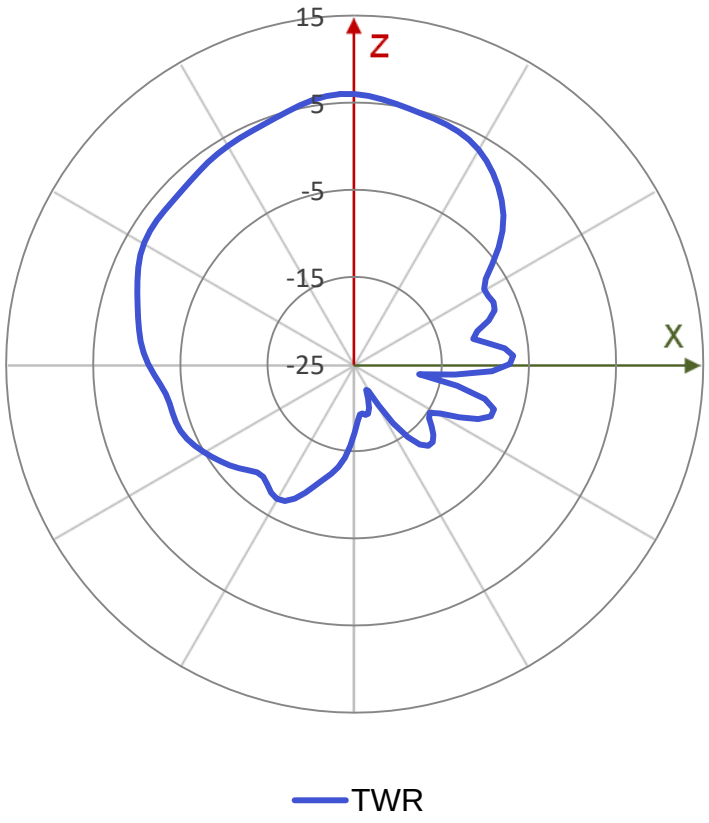
  TWR：125mm

Realized Gain Pattern UWB_TWR @8G for Gtotal



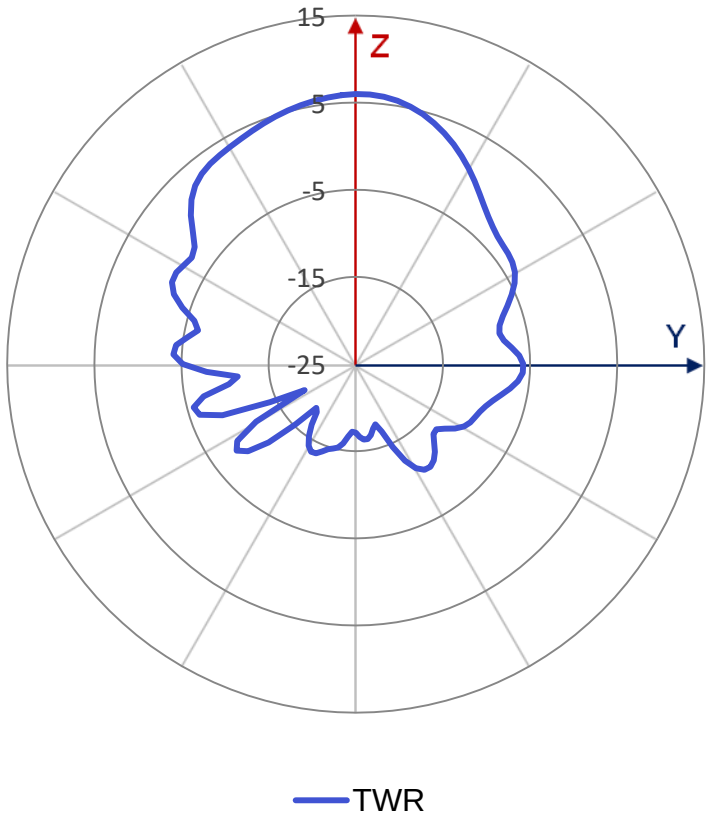
theta = 30

phi = 0

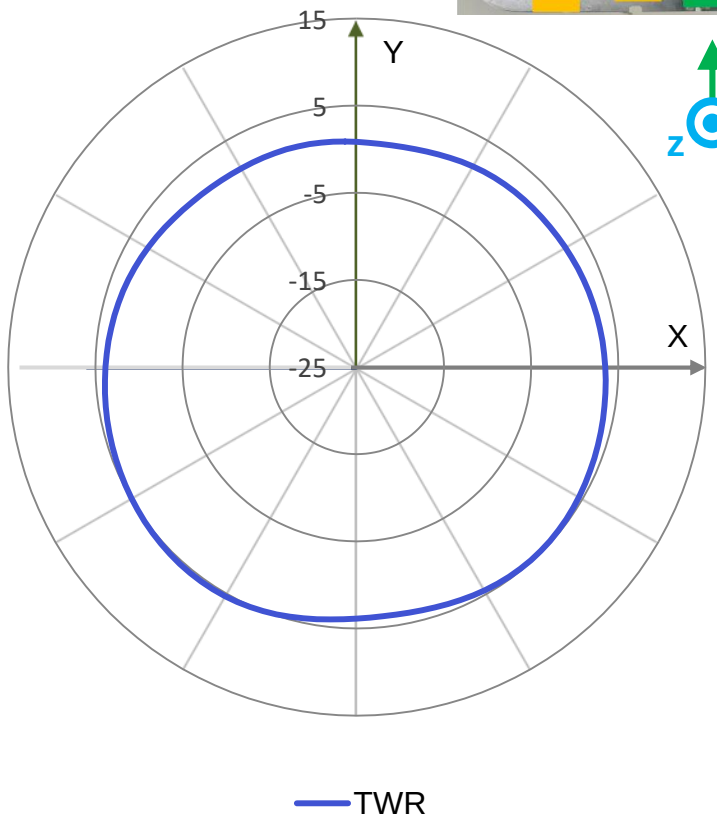


TWR

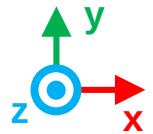
phi = 90



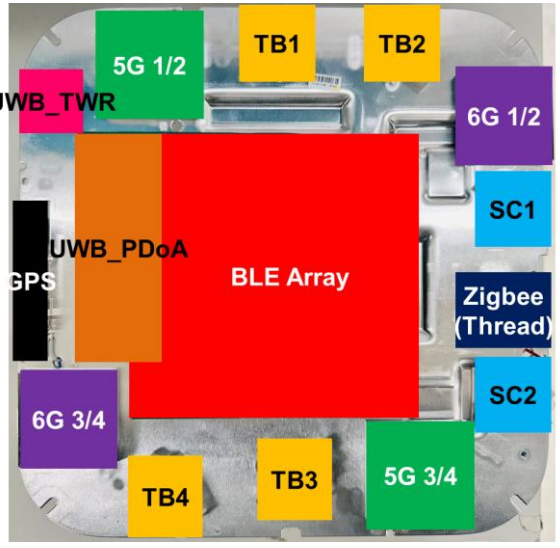
TWR



TWR

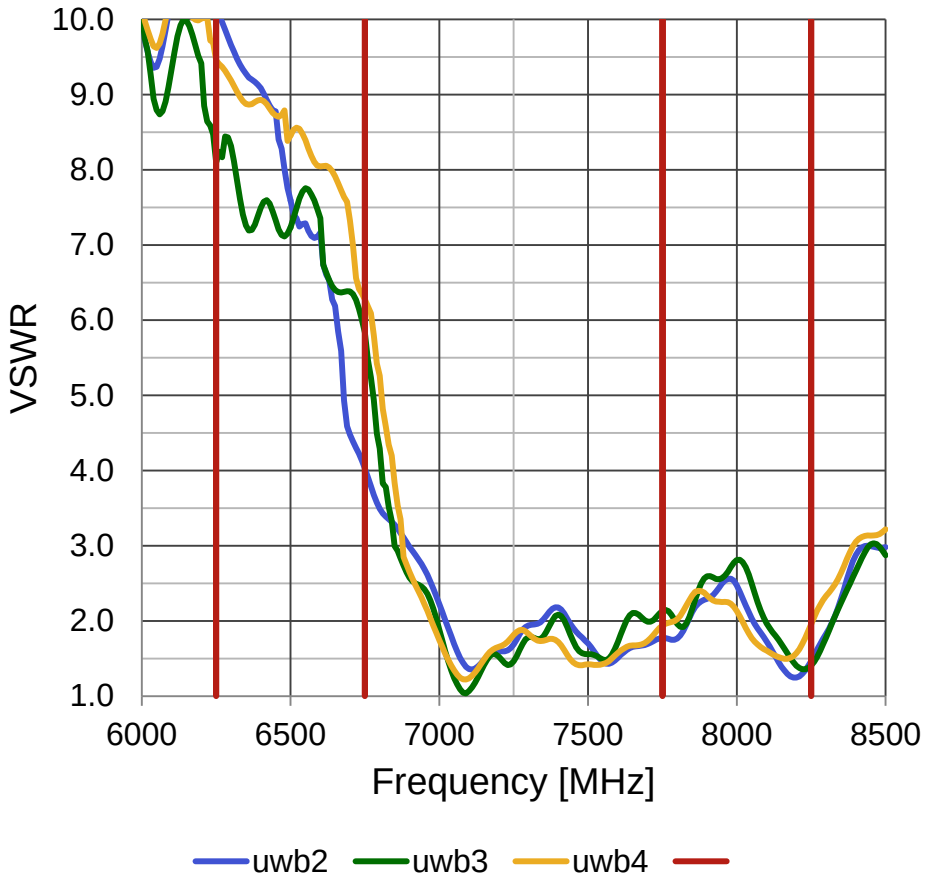


UWB_PDoA



- **Maximum VSWR**
  - 10.1:1 on Ch5 / 2.7:1 on Ch9
- **Average Efficiency**
  - ~4% on Ch5 / ~18% on Ch9
- **Peak Gain**
  - -3.2dBi on Ch5 / 3.4dBi on Ch9

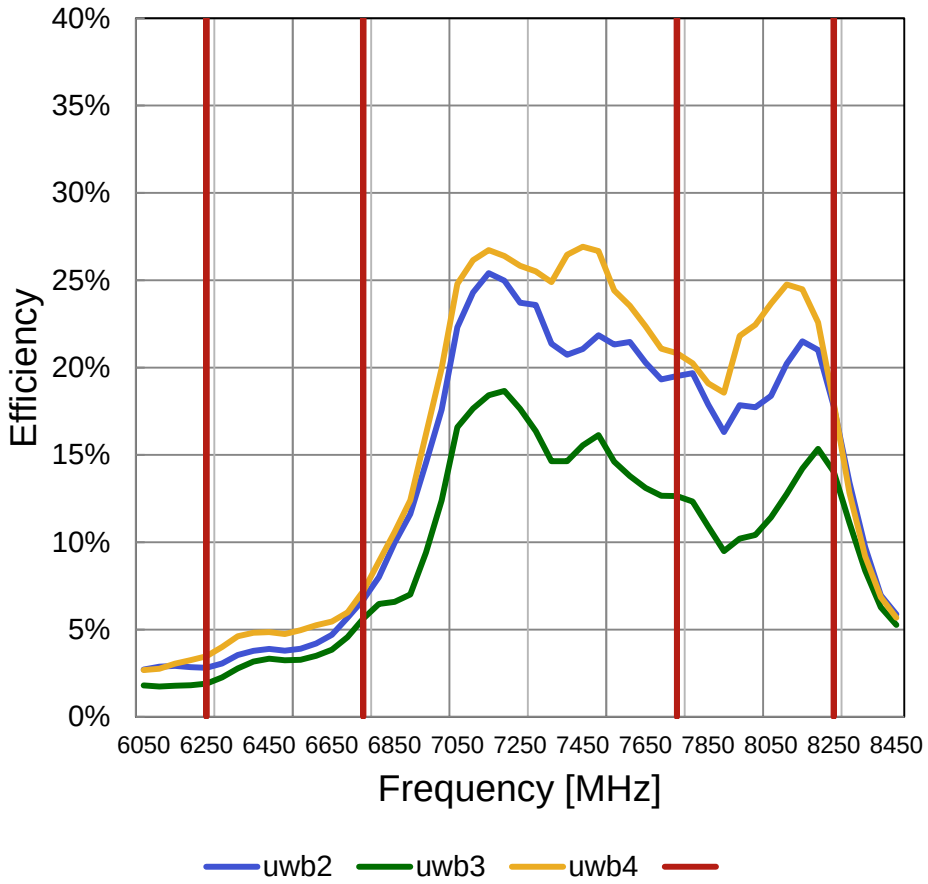
VSWR UWB_PDoA



Ch5	Max	Mean	Min
uwb2	10.1	7.6	4.0
uwb3	8.4	7.2	5.8
uwb4	9.5	8.4	6.3
Summary	10.1	7.5	4.0

Ch9	Max	Mean	Min
uwb2	2.6	1.9	1.2
uwb3	2.8	2.1	1.4
uwb4	2.4	1.9	1.5
Summary	2.8	2.0	1.2

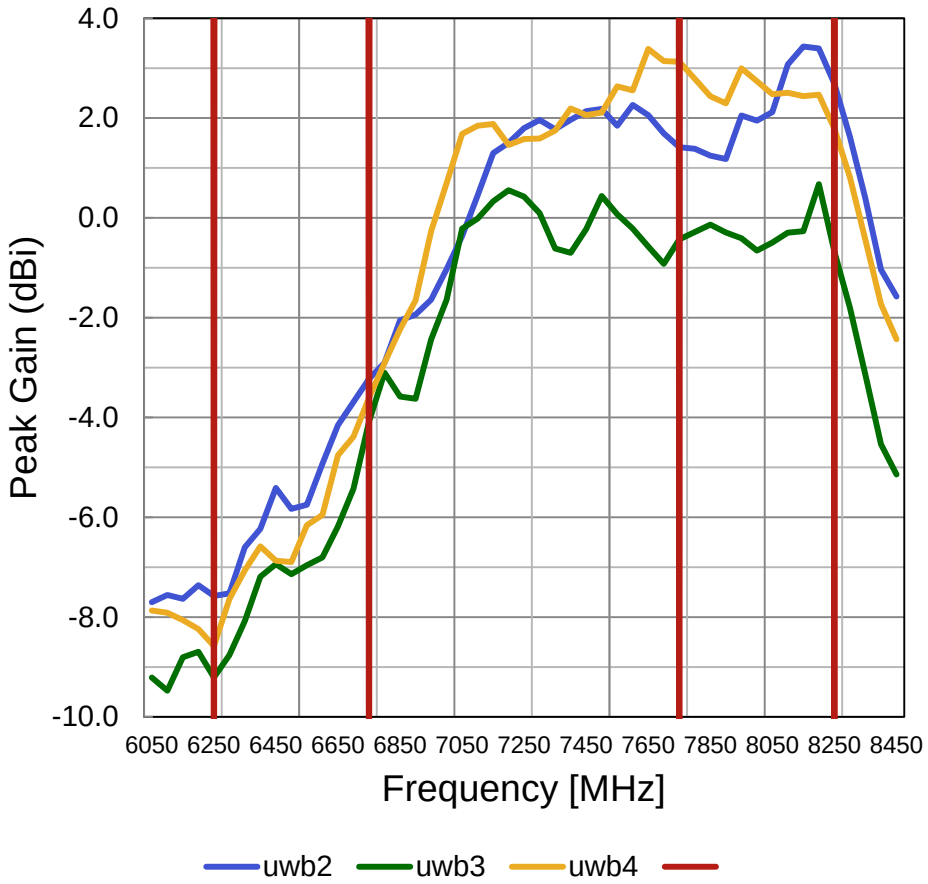
Efficiency UWB_PDoA



Ch5	Max	Mean	Min
uwb2	7%	4%	3%
uwb3	6%	3%	2%
uwb4	7%	5%	3%
Summary	7%	4%	2%

Ch9	Max	Mean	Min
uwb2	22%	19%	16%
uwb3	15%	12%	9%
uwb4	25%	21%	18%
Summary	25%	18%	9%

Peak Gain UWB_PDoA

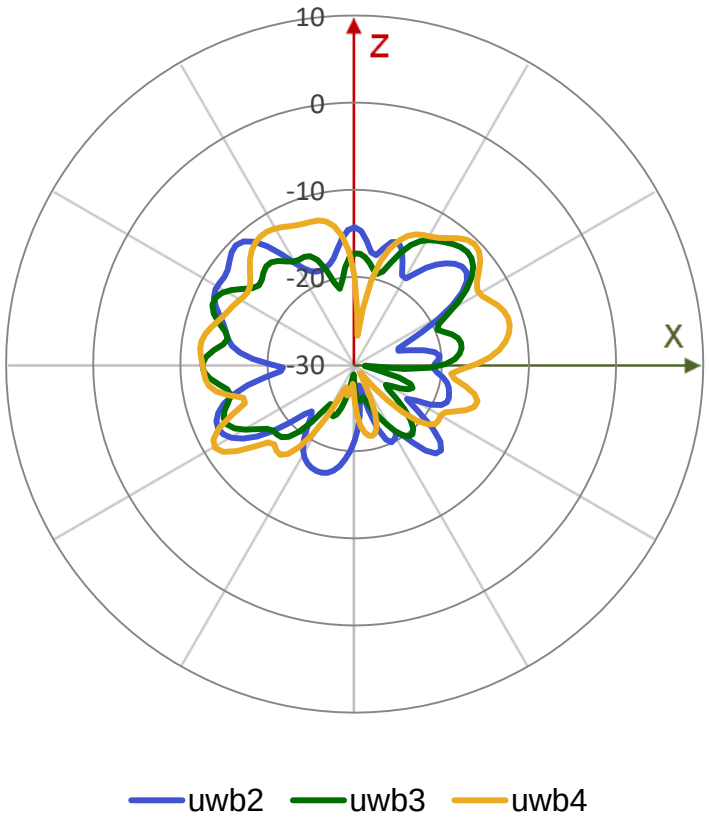


Ch5	Max	Mean	Min
uwb2	-3.2 dBi	-5.5 dBi	-7.6 dBi
uwb3	-4.1 dBi	-7.0 dBi	-9.2 dBi
uwb4	-3.6 dBi	-6.2 dBi	-8.6 dBi
Summary	-3.2 dBi	-6.2 dBi	-9.2 dBi

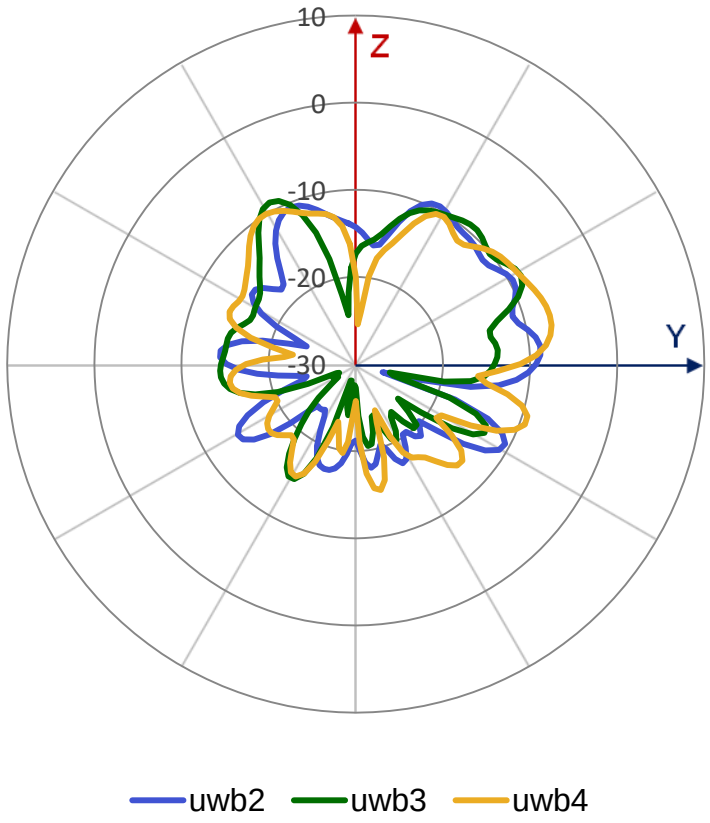
Ch9	Max	Mean	Min
uwb2	3.4 dBi	2.2 dBi	1.2 dBi
uwb3	0.7 dBi	-0.3 dBi	-0.7 dBi
uwb4	3.1 dBi	2.6 dBi	1.8 dBi
Summary	3.4 dBi	1.5 dBi	-0.7 dBi

Realized Gain Pattern UWB_PDoA @6500MHz for Gtotal

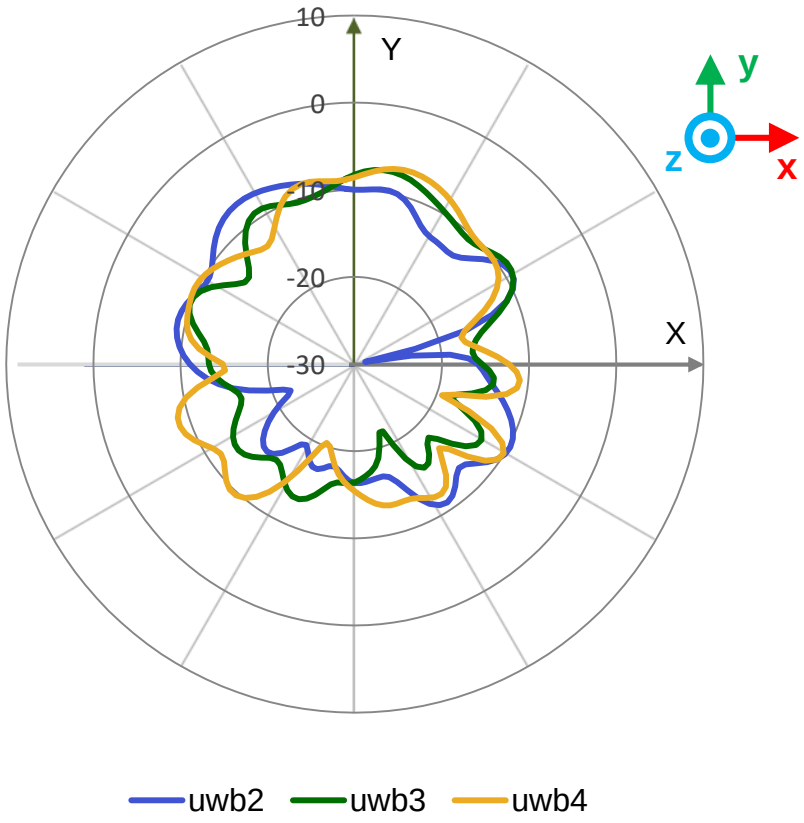
phi = 0



phi = 90

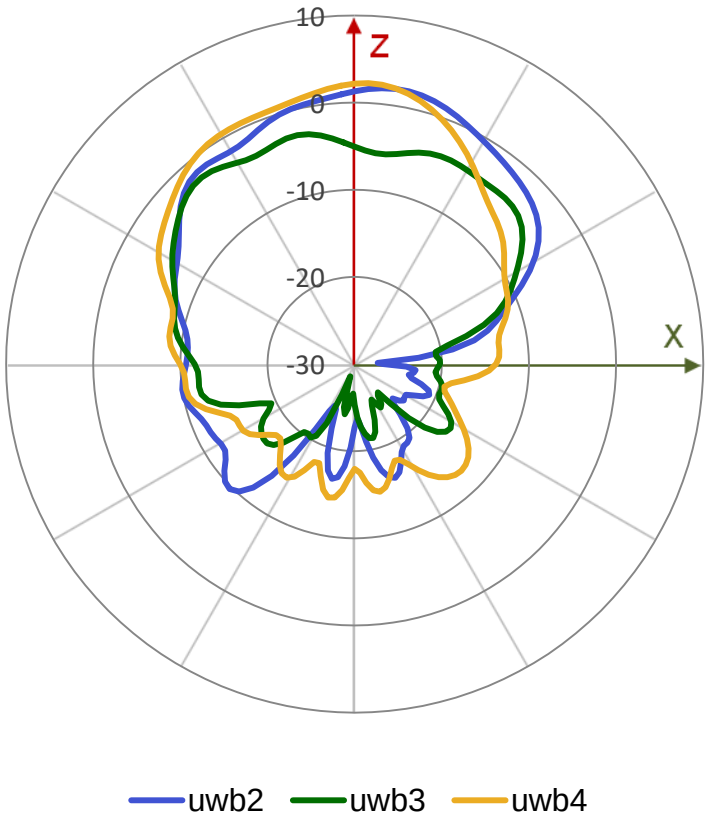


theta = 60

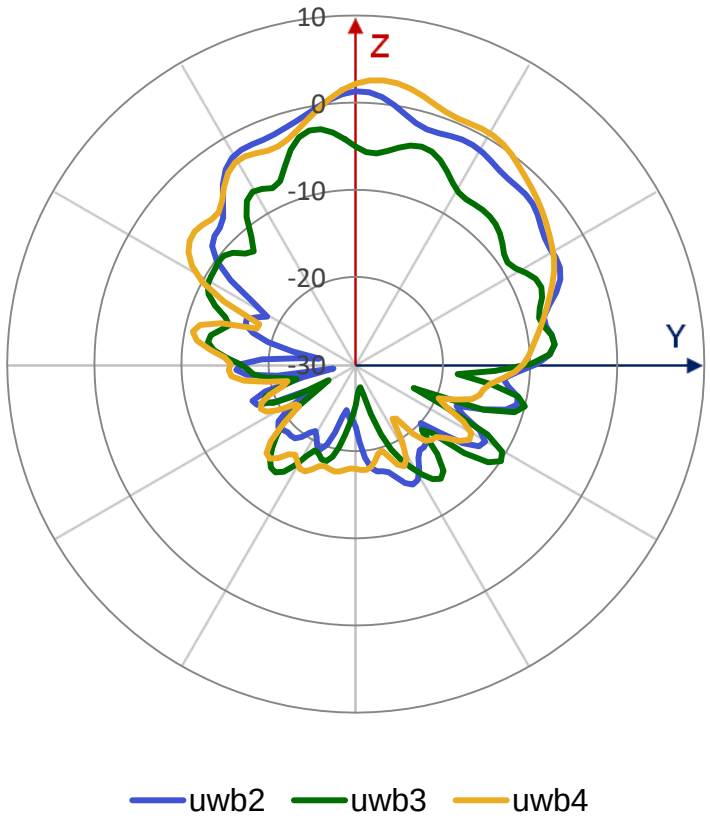


Realized Gain Pattern UWB_PDoA @8000MHz for Gtotal

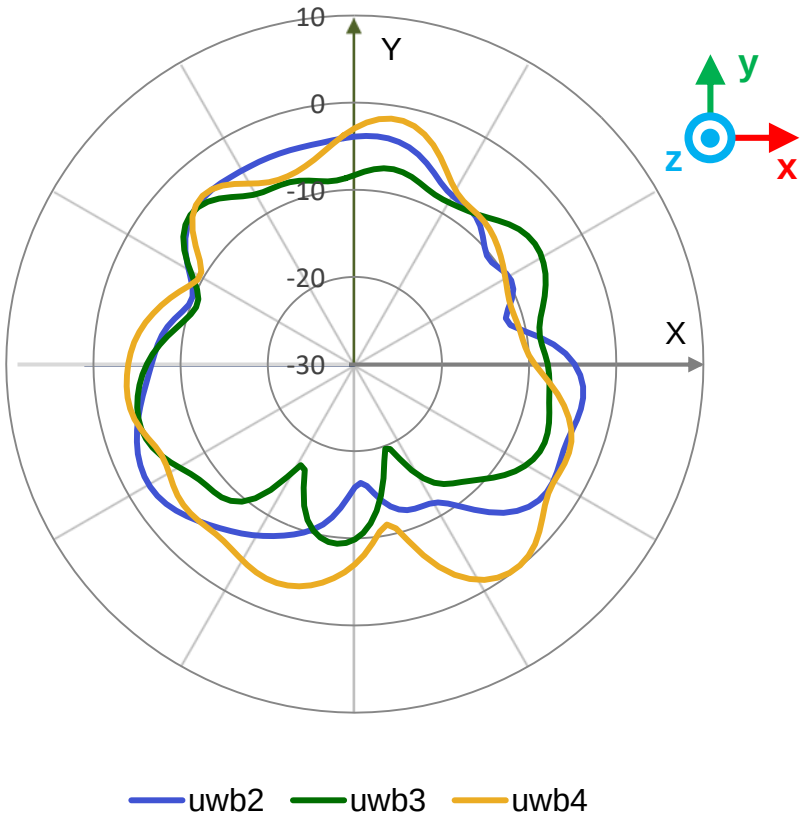
phi = 0



phi = 90



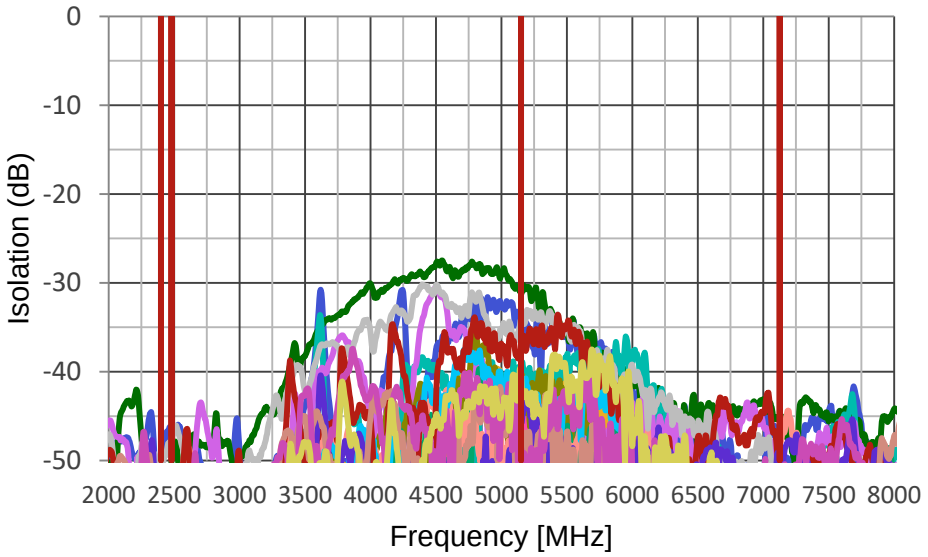
theta = 60



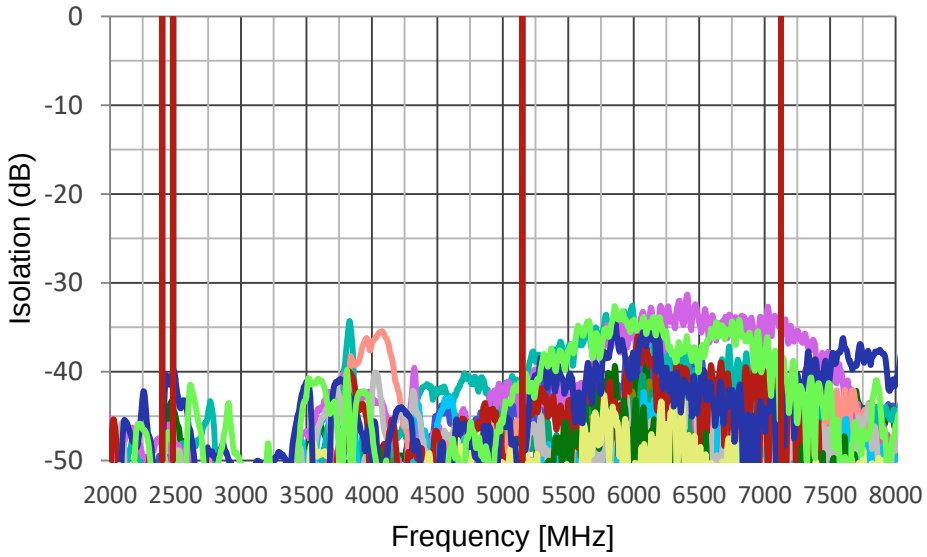
Isolation among Radio

- **Wi-Fi 5G to Wi-Fi Tri-Band**
  - 46.2dB on 2.4GHz / 30.2dB on 5-7GHz
- **Wi-Fi 6G to Wi-Fi Tri-Band**
  - 40.0dB on 2.4GHz / 31.3dB on 5-7GHz
- **Wi-Fi 6G to Wi-Fi 5G**
  - 38.7dB on 5-7GHz
- **UWB_TWR to Wi-Fi Radio**
  - 33.0dB on 5GHz / 33.6dB on 6GHz / 40.0dB on Ch9

Isolation Wi-Fi Tri-band to Wi-Fi 5G / Wi-Fi Tri-Band to Wi-Fi 6G

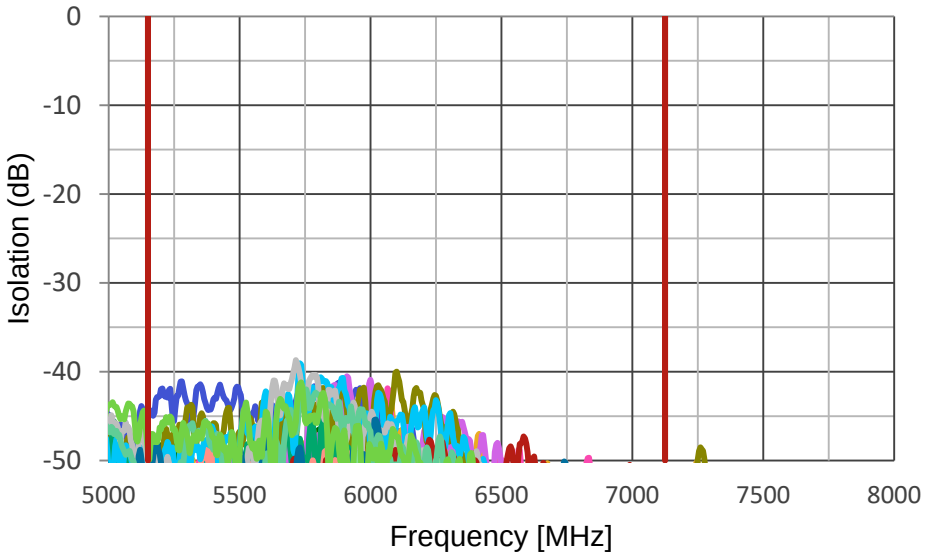


➢ Wi-Fi Tri-Band to Wi-Fi 5G

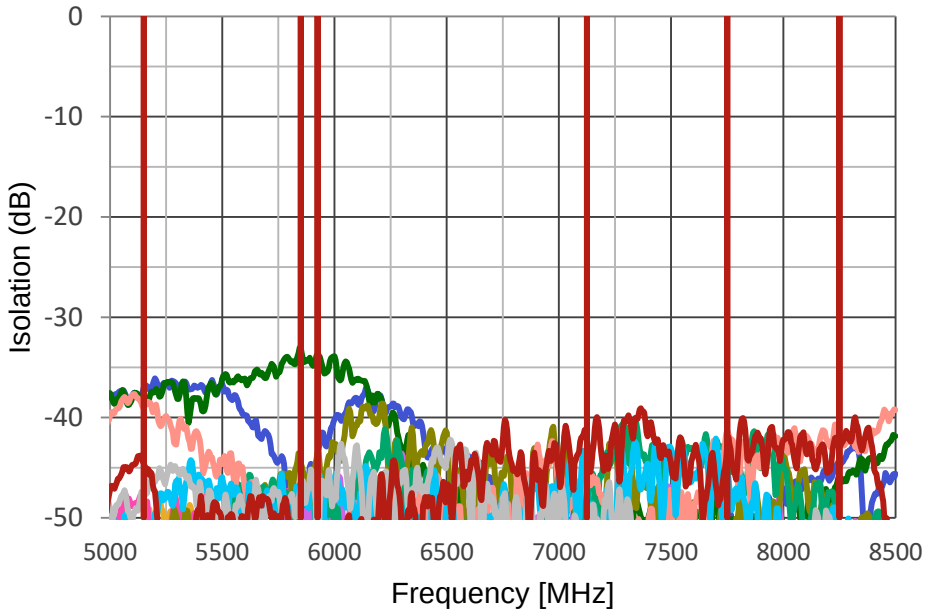


➢ Wi-Fi Tri-Band to Wi-Fi 6G

Isolation Wi-Fi 5G to Wi-Fi 6G / UWB_TWR to Wi-Fi Radio



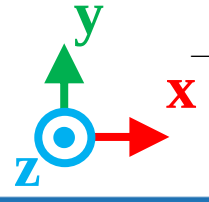
➢ Wi-Fi 5G to Wi-Fi 6G



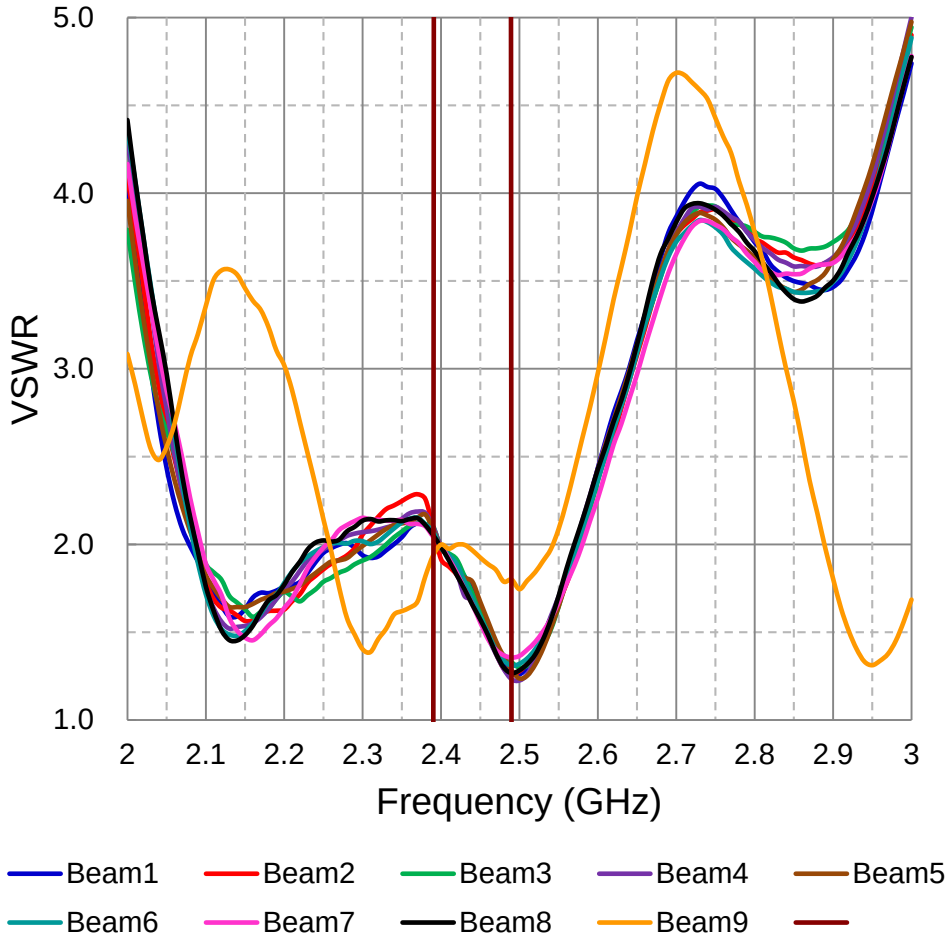
➢ UWB_TWR to Wi-Fi Radio

BLE Array – Directional Beam [P3 Sku-D Sample]

- **Efficiency**
  - ~15% on 2.4GHz [Beam1~Beam8]
  - ~27% on 2.4GHz [Beam9]
- **Peak Gain**
  - 4.3dBi on 2.4GHz [Beam1~Beam8]
  - 3.7dBi on 2.4GHz [Beam9]
- **Beam Width**
  - ~46° on 2.4GHz [Beam1~Beam8]
- **Front to Back Ratio**
  - ~11.8dB on 2.4GHz [Beam1~Beam8]

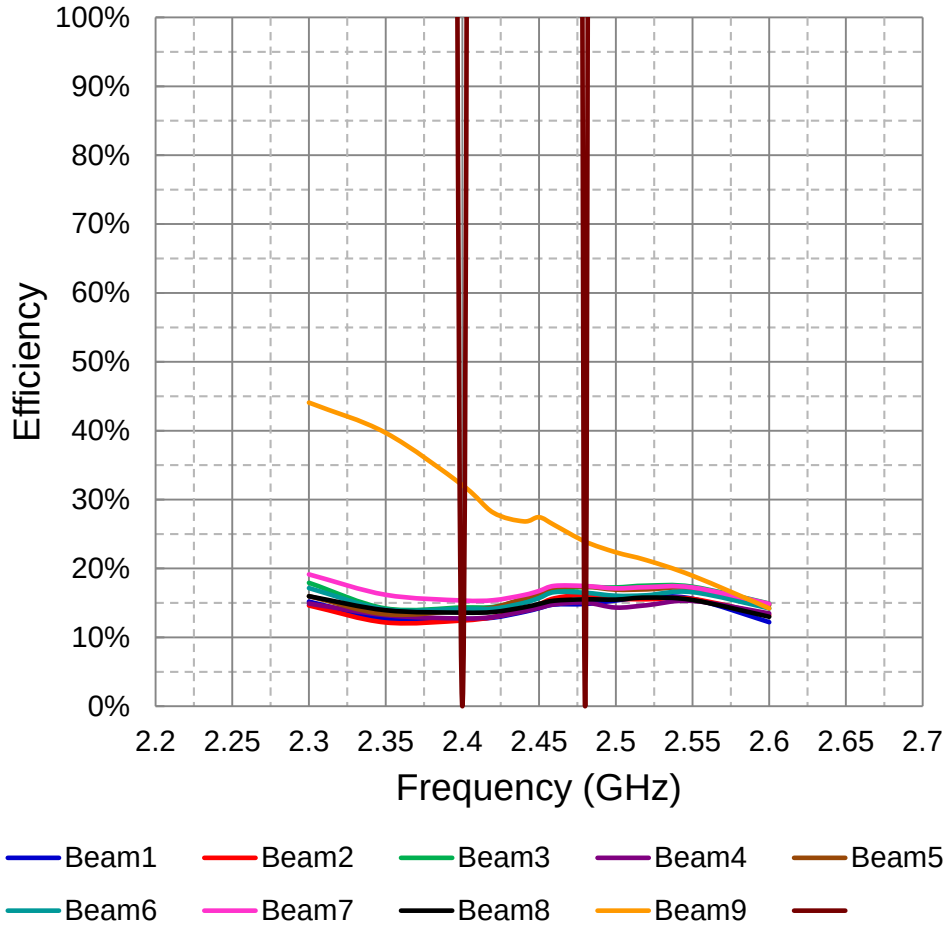


VSWR Directional Beam – P3 Sku-D Sample



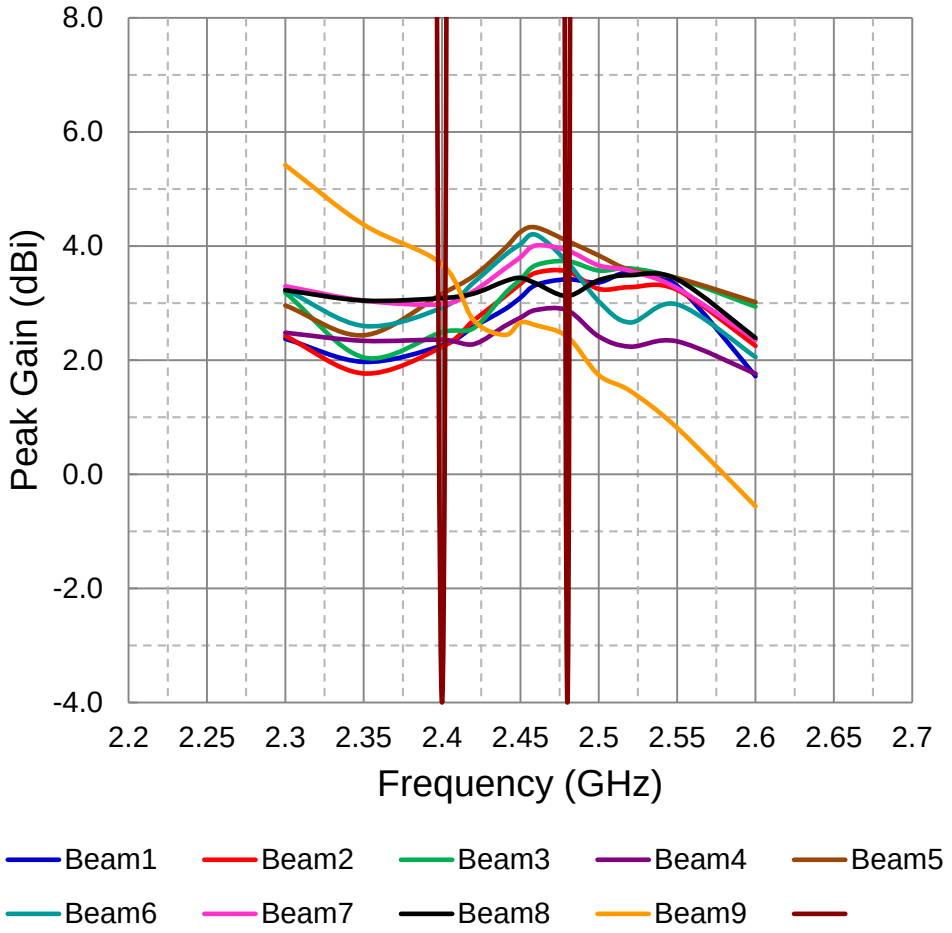
2.4GHz	Max	Mean	Min
Beam 1	2.0	1.7	1.3
Beam 2	1.9	1.6	1.3
Beam 3	2.0	1.7	1.4
Beam 4	2.0	1.7	1.4
Beam 5	2.0	1.7	1.4
Beam 6	2.0	1.7	1.4
Beam 7	2.0	1.7	1.4
Beam 8	2.0	1.7	1.3
Beam 9	2.0	1.9	1.8

Efficiency Directional Beam – P3 Sku-D Sample



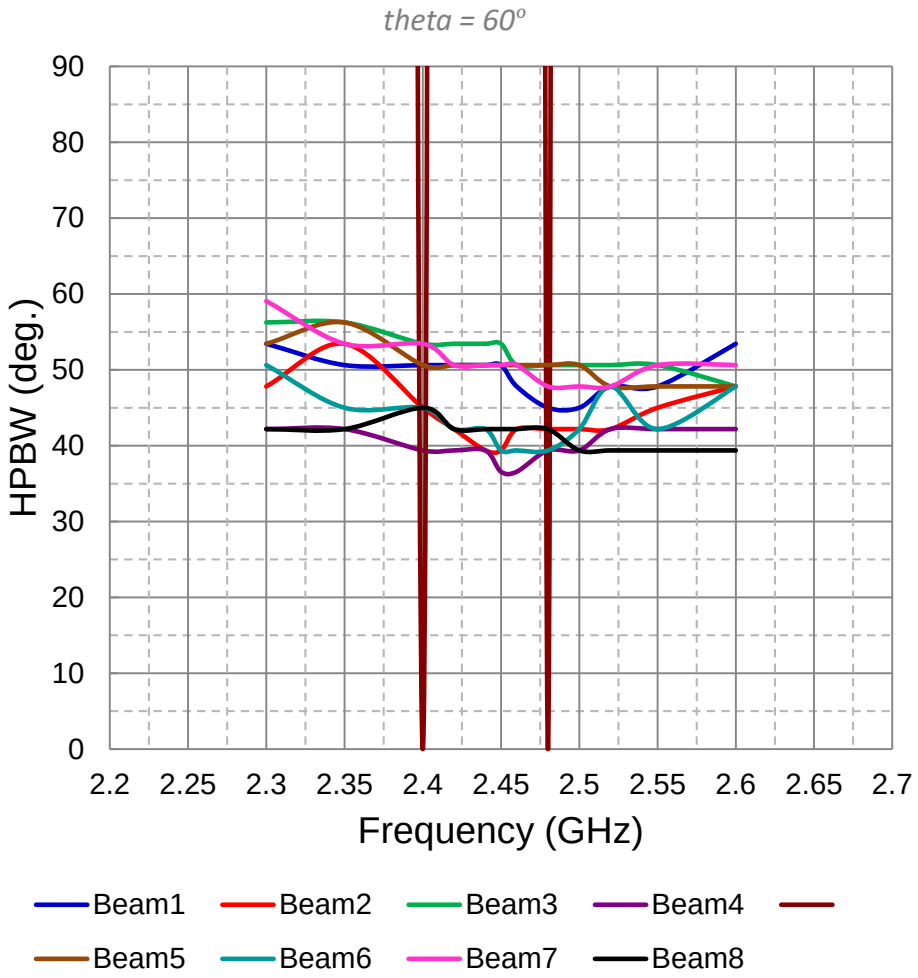
2.4GHz	Max	Mean	Min
Beam 1	15 %	14 %	13 %
Beam 2	16 %	14 %	12 %
Beam 3	17 %	16 %	14 %
Beam 4	15 %	14 %	13 %
Beam 5	17 %	16 %	14 %
Beam 6	17 %	15 %	14 %
Beam 7	17 %	16 %	15 %
Beam 8	16 %	15 %	14 %
Beam 9	32 %	27 %	24 %

Peak Gain Directional Beam – P3 Sku-D Sample



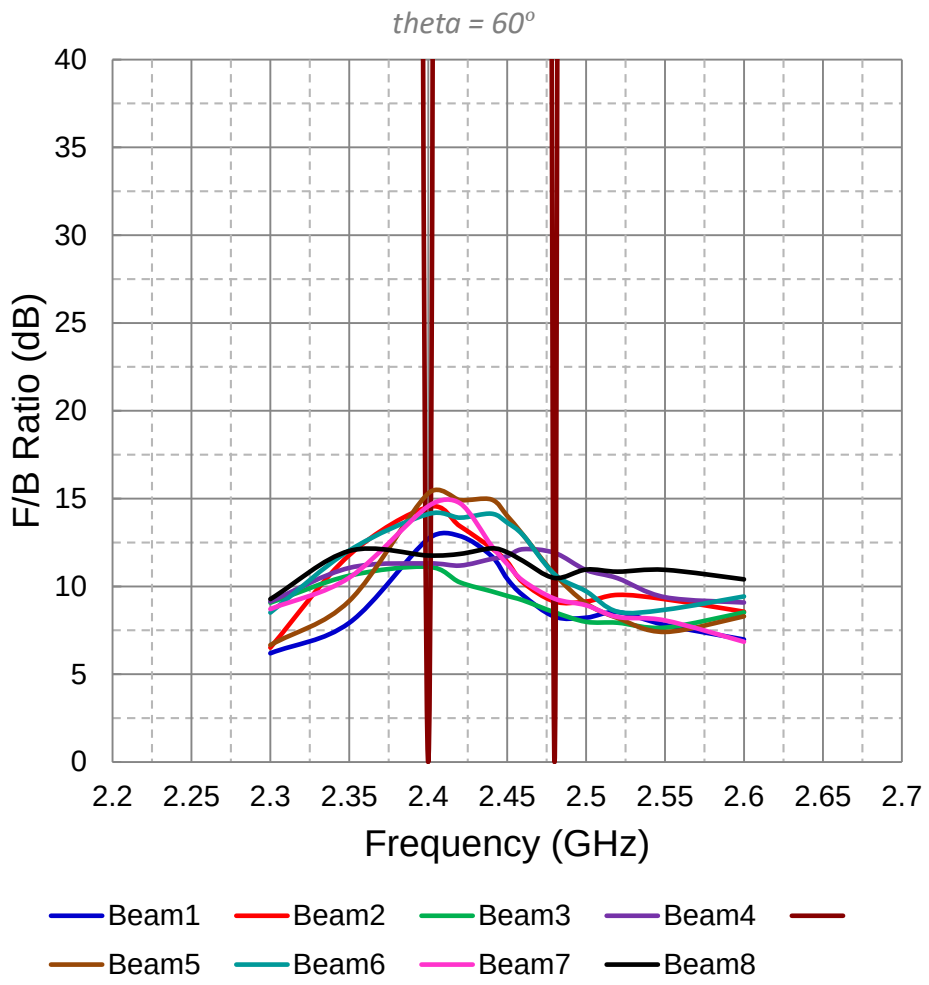
2.4GHz	Max	Mean	Min
Beam 1	3.4 dBi	2.9 dBi	2.3 dBi
Beam 2	3.6 dBi	3.1 dBi	2.2 dBi
Beam 3	3.7 dBi	3.2 dBi	2.5 dBi
Beam 4	2.9 dBi	2.6 dBi	2.3 dBi
Beam 5	4.3 dBi	3.9 dBi	3.2 dBi
Beam 6	4.2 dBi	3.7 dBi	2.9 dBi
Beam 7	4.0 dBi	3.6 dBi	3.0 dBi
Beam 8	3.4 dBi	3.3 dBi	3.1 dBi
Beam 9	3.7 dBi	2.8 dBi	2.4 dBi

3dB Beam Width Directional Beam – P3 Sku-D Sample



2.4GHz	Max	Mean	Min
Beam 1	51	49	45
Beam 2	45	42	39
Beam 3	53	53	51
Beam 4	39	38	37
Beam 5	51	51	51
Beam 6	45	41	39
Beam 7	53	51	48
Beam 8	45	43	42
Summary	53	46	37

Front to Back Ratio Directional Beam – P3 Sku-D Sample

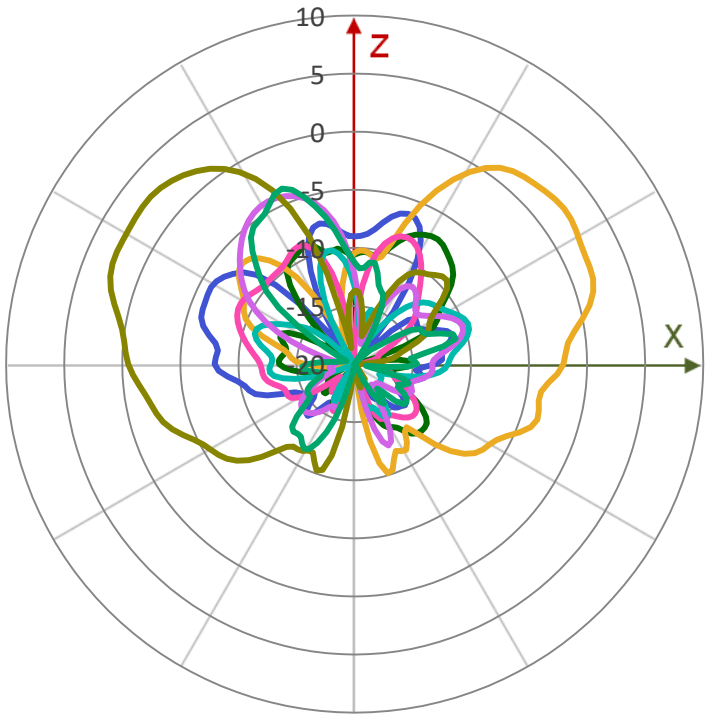


2.4GHz	Max	Mean	Min
Beam 1	12.9	10.9	8.3
Beam 2	14.5	11.8	9.1
Beam 3	11.1	9.7	8.5
Beam 4	12.1	11.6	11.2
Beam 5	15.3	13.8	10.7
Beam 6	14.1	13.2	10.7
Beam 7	14.7	12.1	9.3
Beam 8	12.2	11.6	10.5
Summary	15.3	11.8	8.3

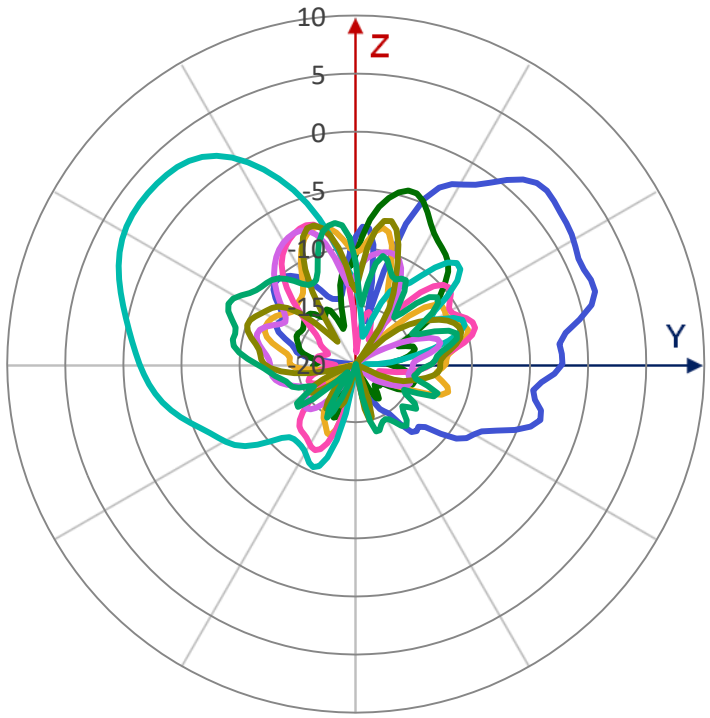
Realized Gain Pattern

Directional Beam 1-8 – P3 Sku-D Sample @2400MHz for G_{total}

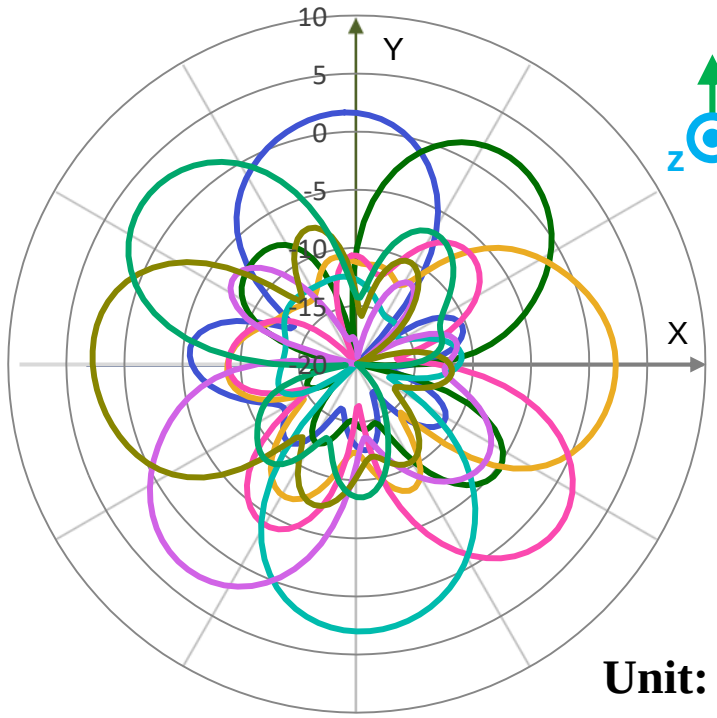
phi = 0



phi = 90



theta = 60

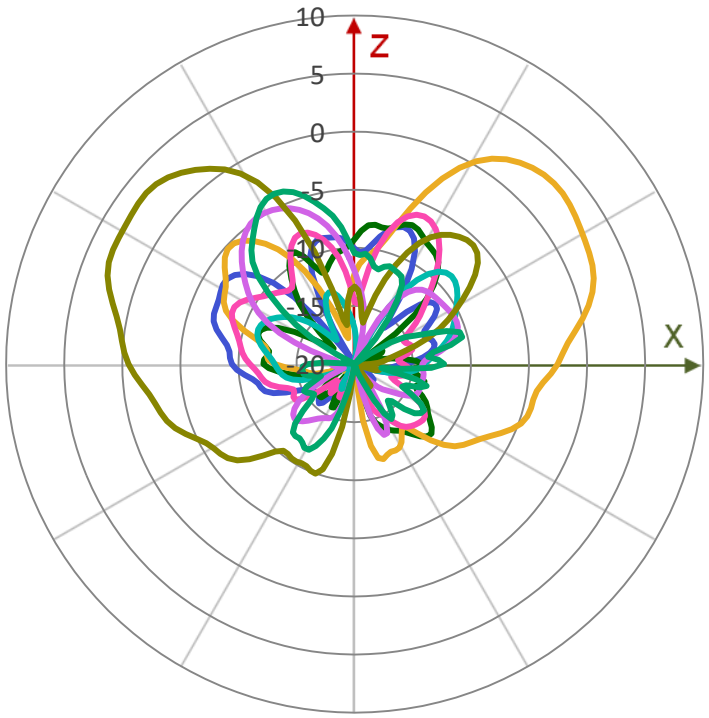


Unit: dBi

Realized Gain Pattern

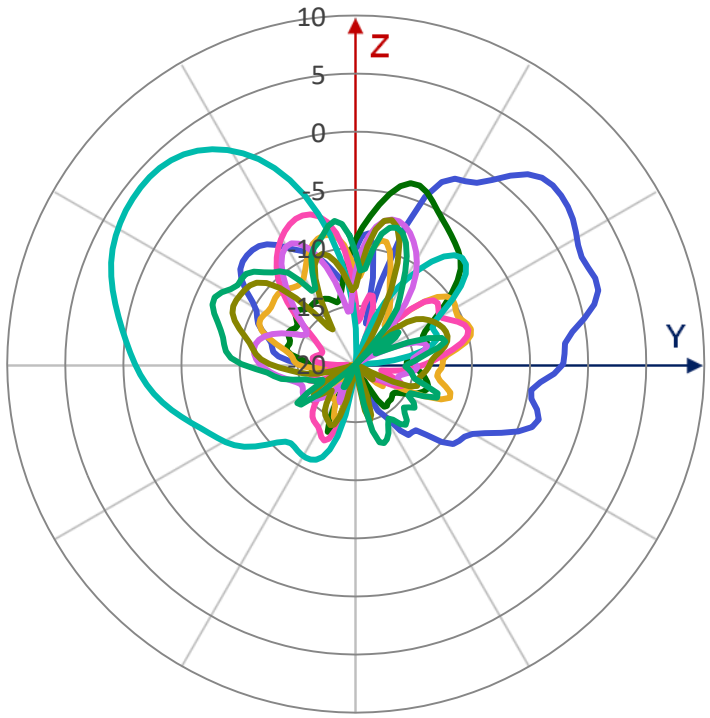
Directional Beam 1-8 – P3 Sku-D Sample @2440MHz for G_{total}

phi = 0



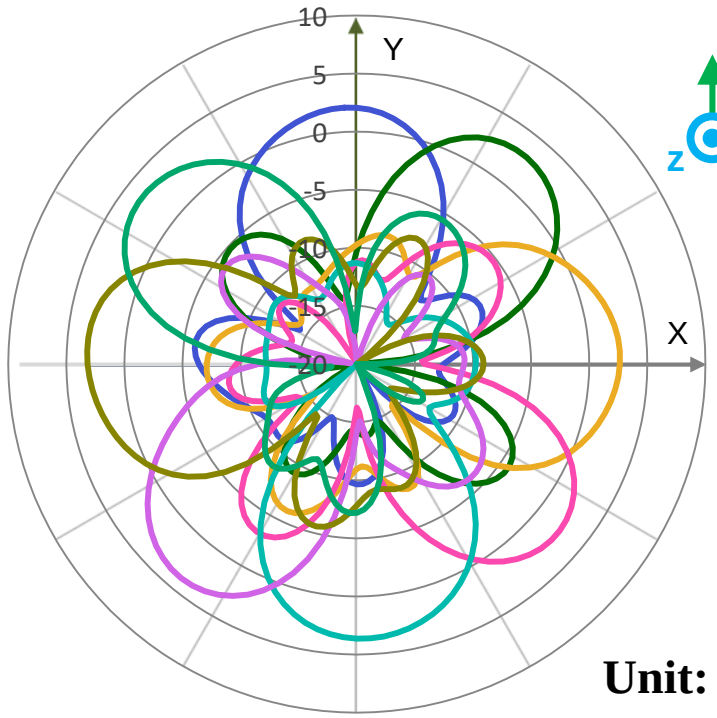
Beam1 Beam2 Beam3 Beam4
Beam5 Beam6 Beam7 Beam8

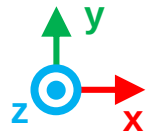
phi = 90



Beam1 Beam2 Beam3 Beam4
Beam5 Beam6 Beam7 Beam8

theta = 60





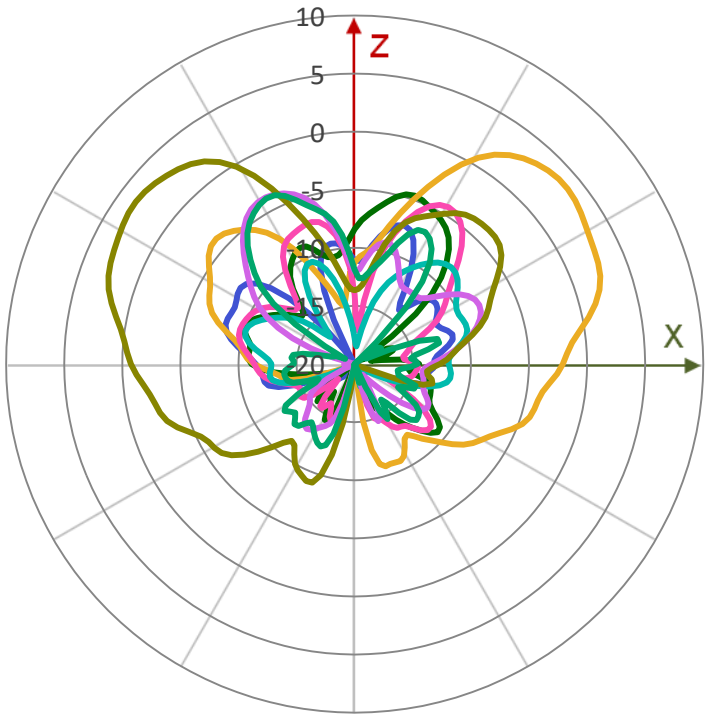
Unit: dBi

Beam1 Beam2 Beam3 Beam4
Beam5 Beam6 Beam7 Beam8

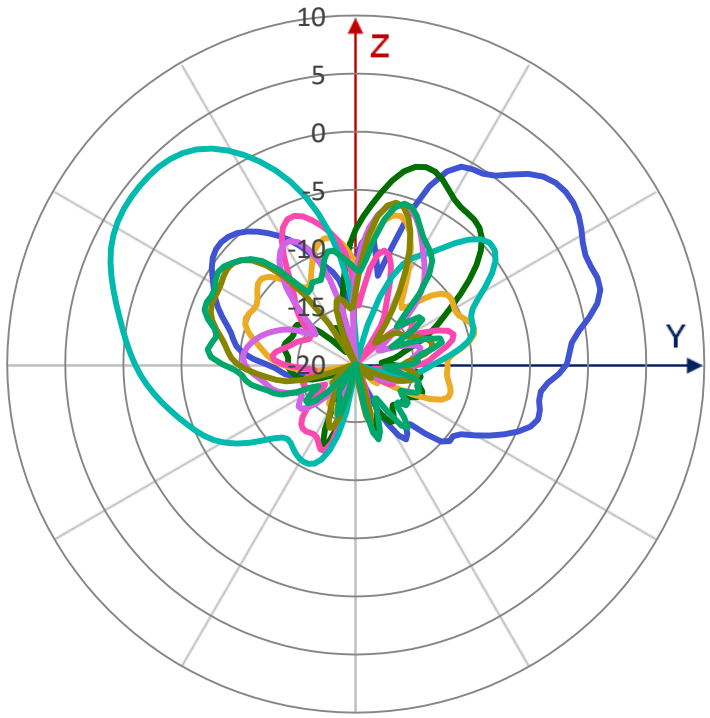
Realized Gain Pattern

Directional Beam 1-8 – P3 Sku-D Sample @2480MHz for G_{total}

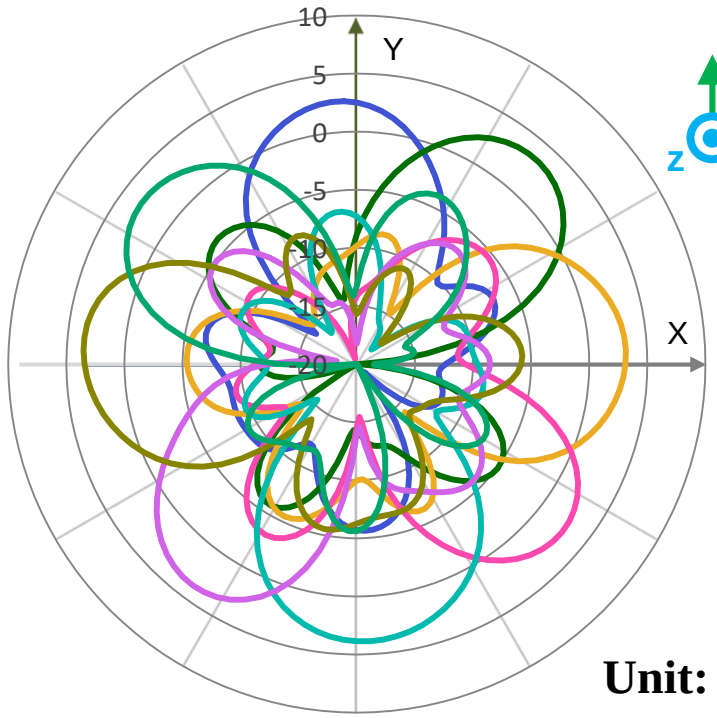
phi = 0



phi = 90



theta = 60

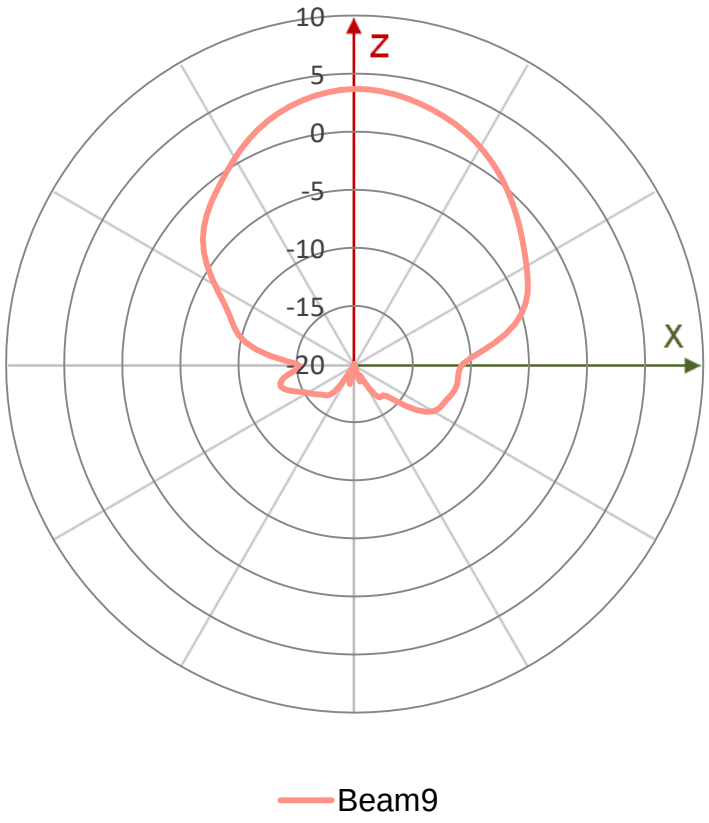


Unit: dBi

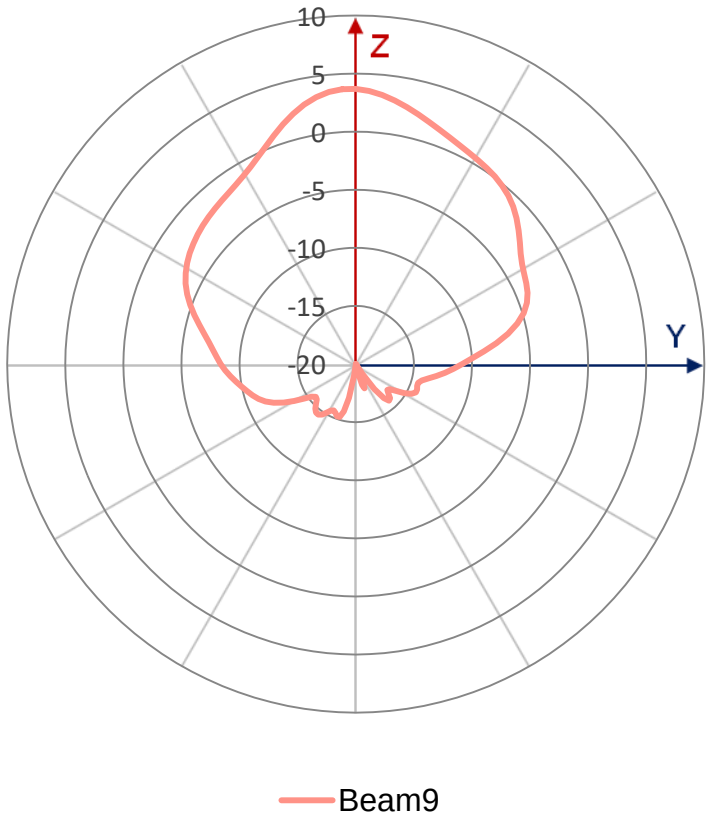
Realized Gain Pattern

Directional Beam 9 – P3 Sku-D Sample @2400MHz for Gtotal

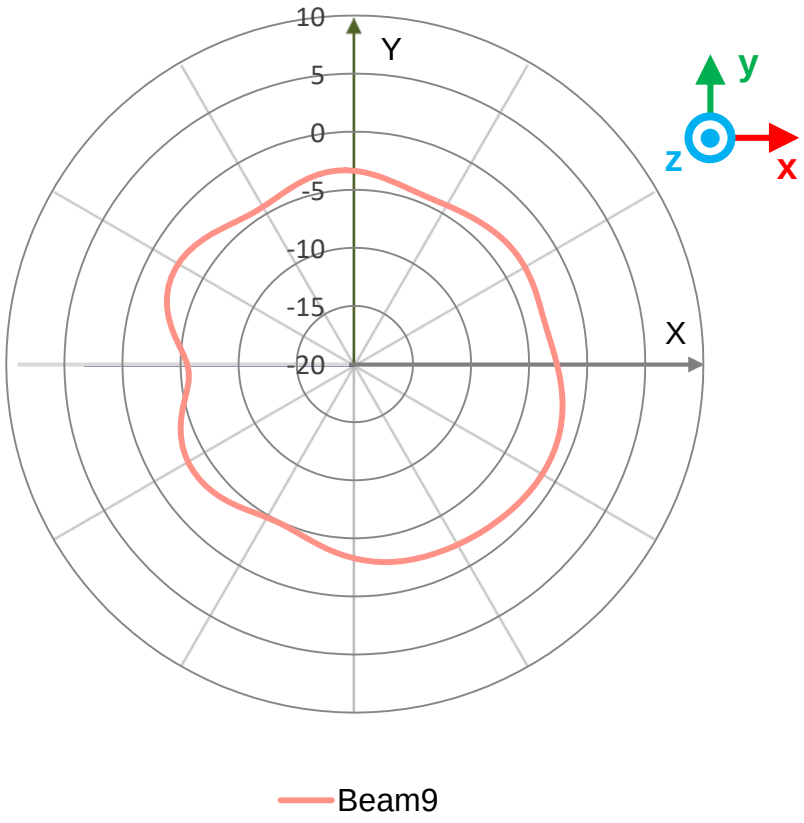
phi = 0



phi = 90



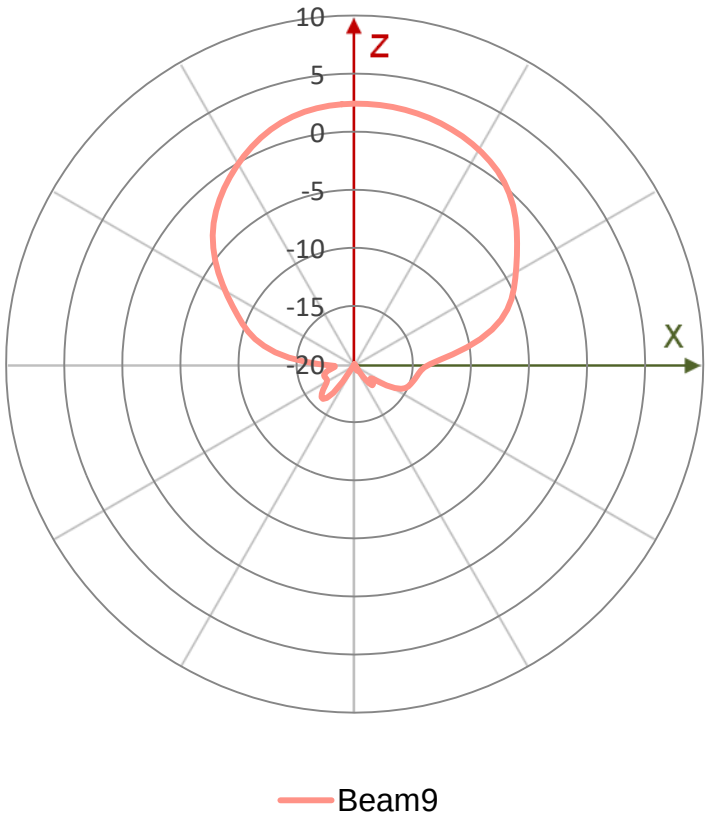
theta = 60



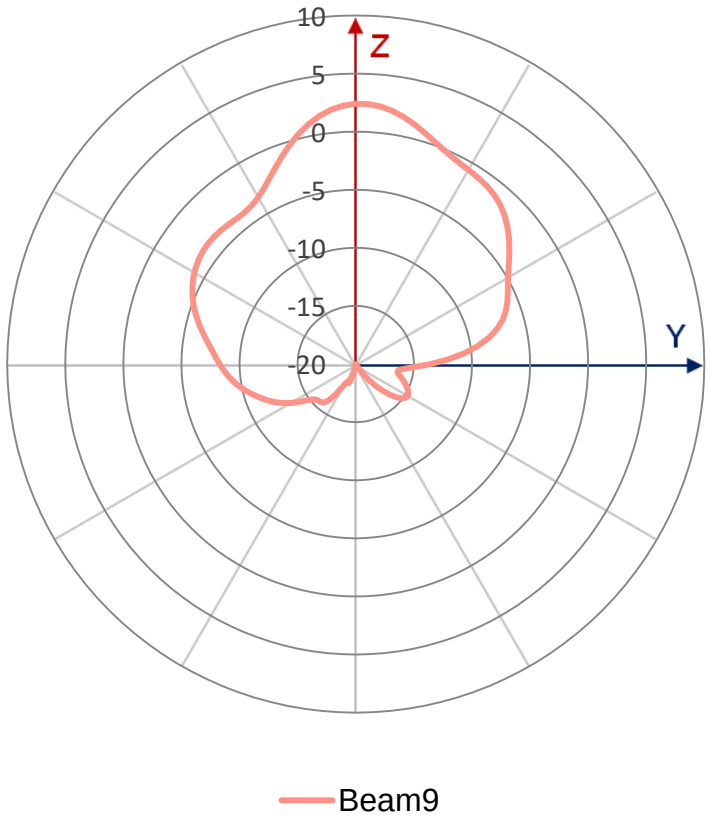
Realized Gain Pattern

Directional Beam 9 – P3 Sku-D Sample @2440MHz for Gtotal

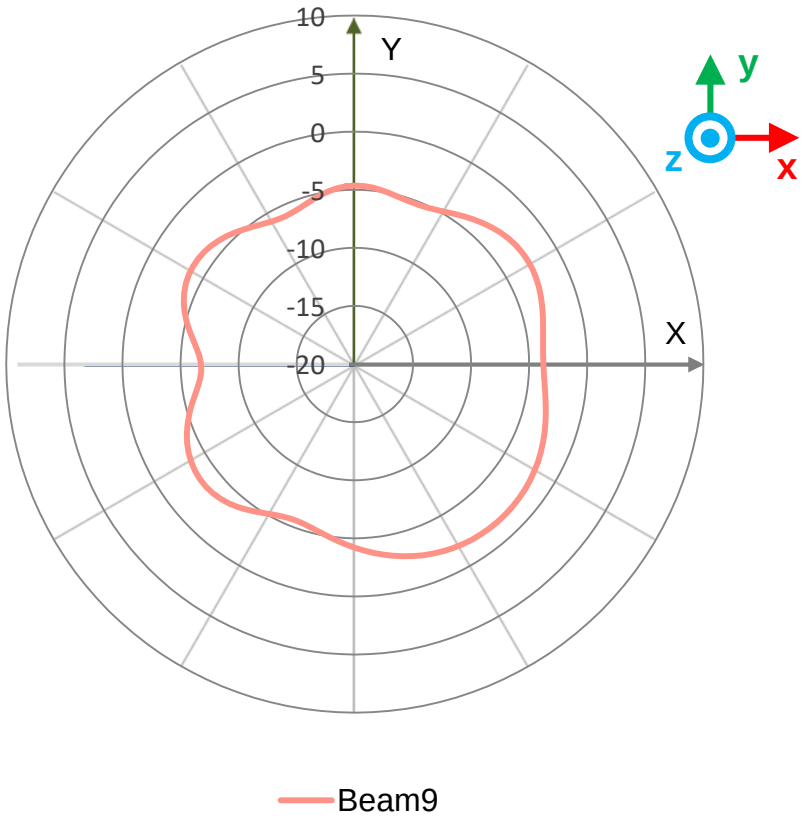
phi = 0



phi = 90



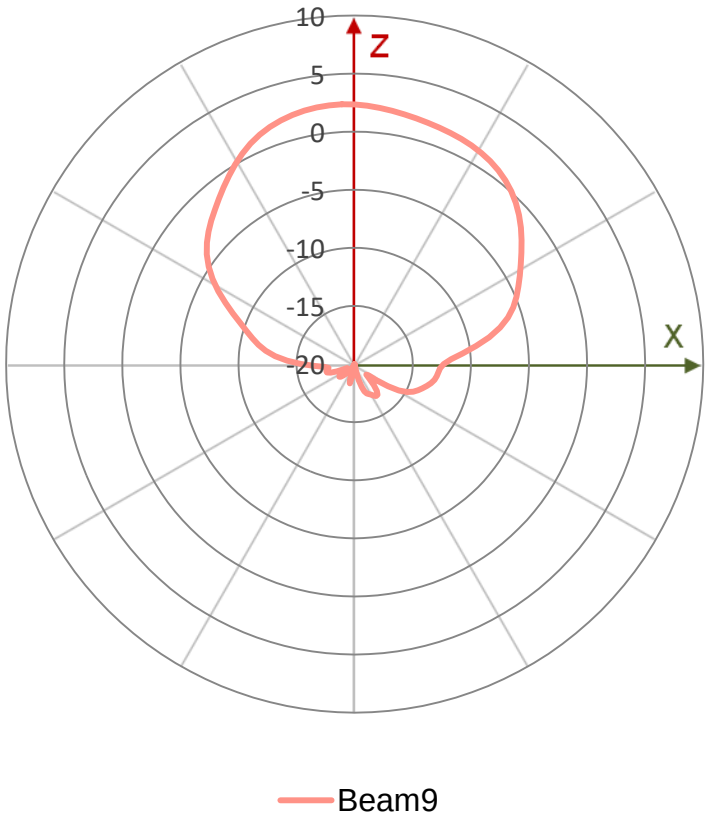
theta = 60



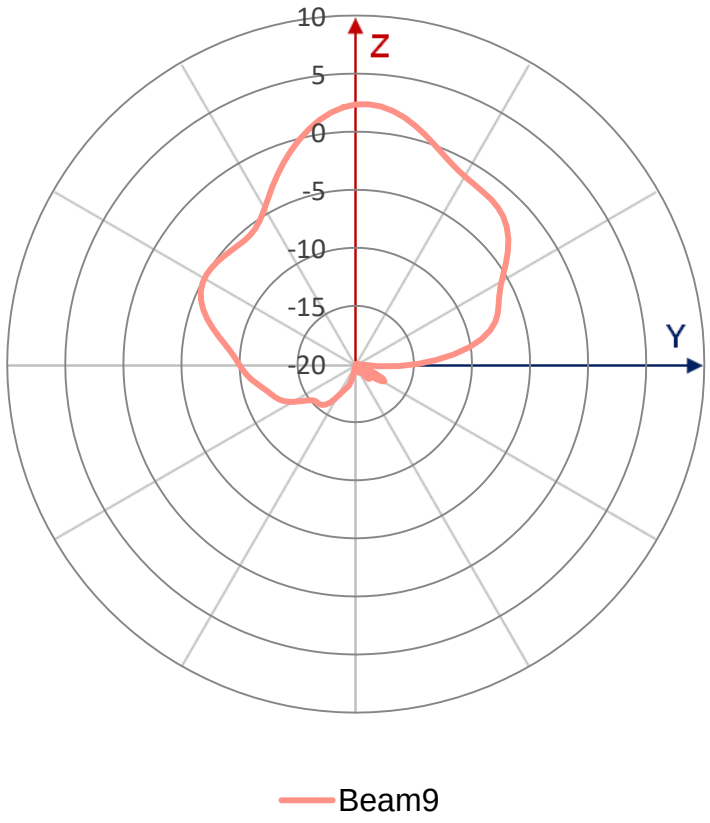
Realized Gain Pattern

Directional Beam 9 – P3 Sku-D Sample @2480MHz for Gtotal

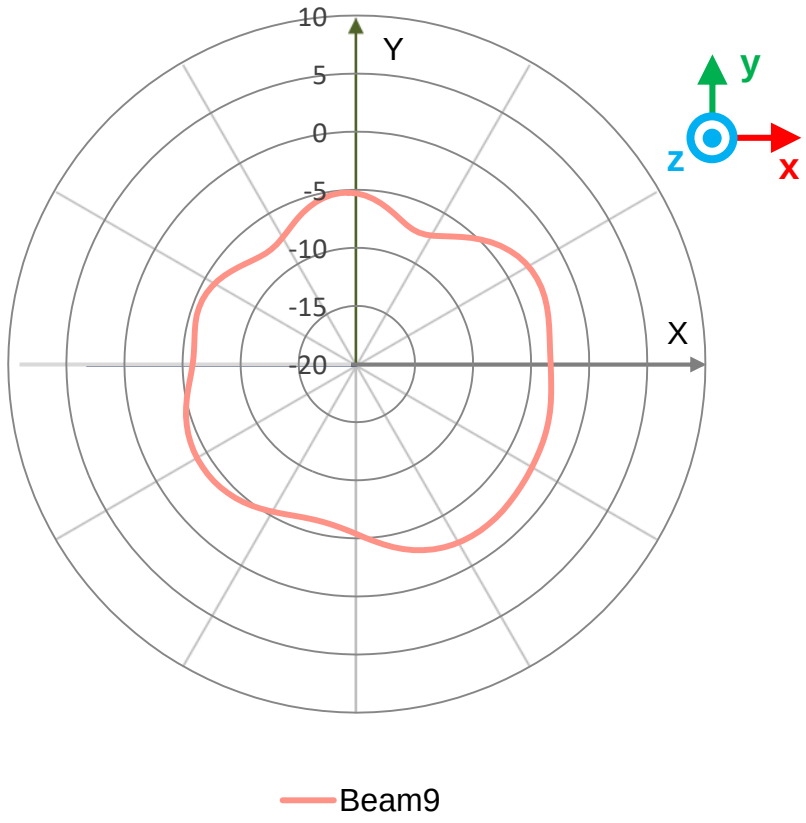
phi = 0



phi = 90

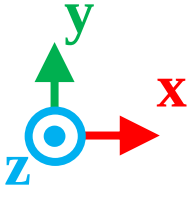


theta = 60

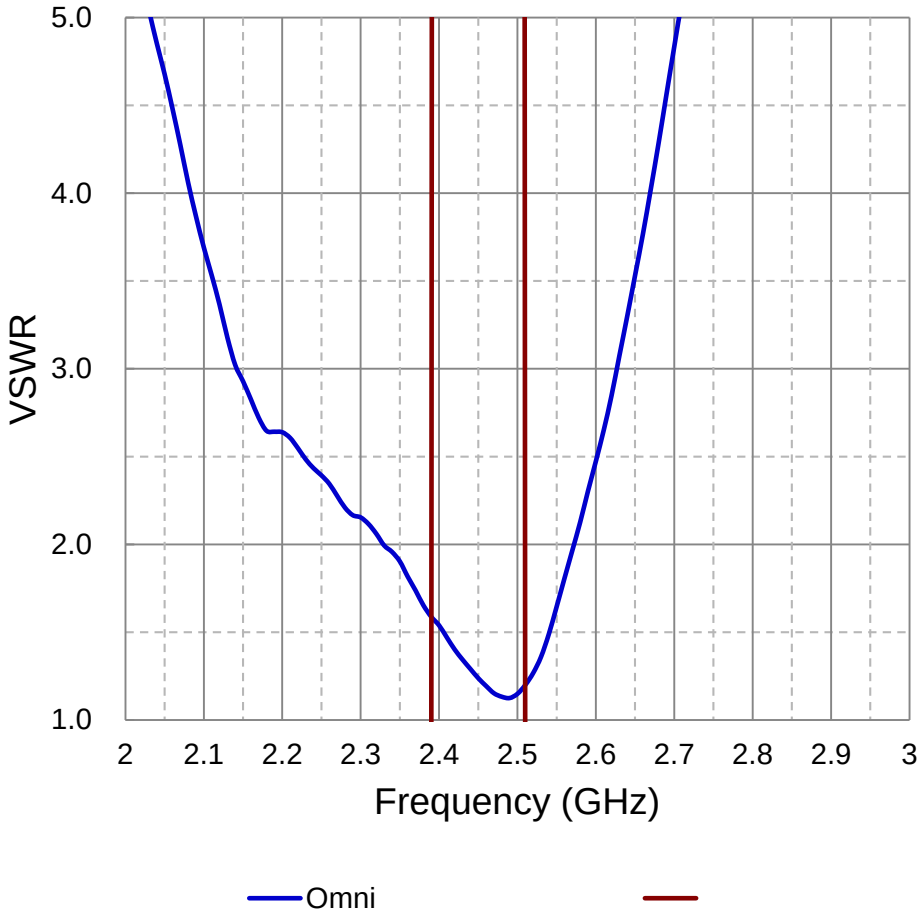


BLE Array – Omni Beam [P3 Sku-D Sample]

- **Maximum VSWR**
  - 1.5 on 2.4GHz
- **Efficiency**
  - ~20% on 2.4GHz
- **Peak Gain**
  - 0.2 dBi on 2.4GHz

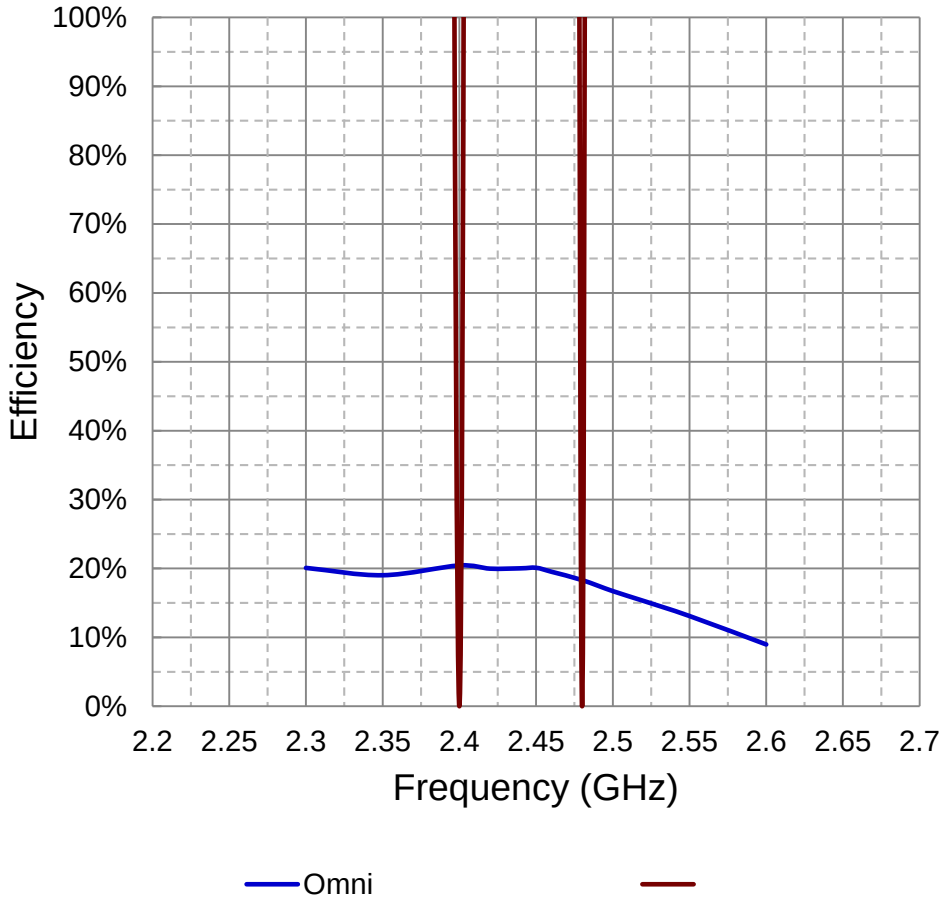


VSWR Omni Beam – P3 Sku-D Sample



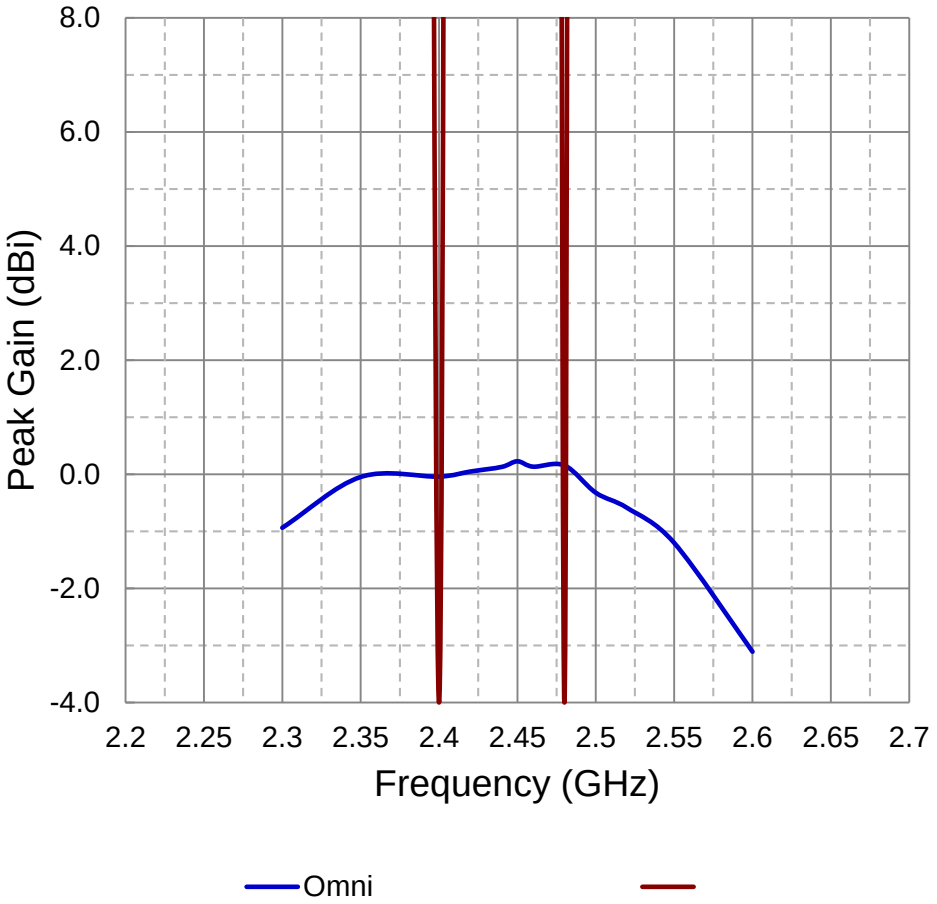
2.4GHz	Max	Mean	Min
Omni	1.5	1.3	1.1

Efficiency Omni Beam – P3 Sku-D Sample



2.4GHz	Max	Mean	Min
Omni	20 %	20 %	18 %

Peak Gain Omni Beam – P3 Sku-D Sample

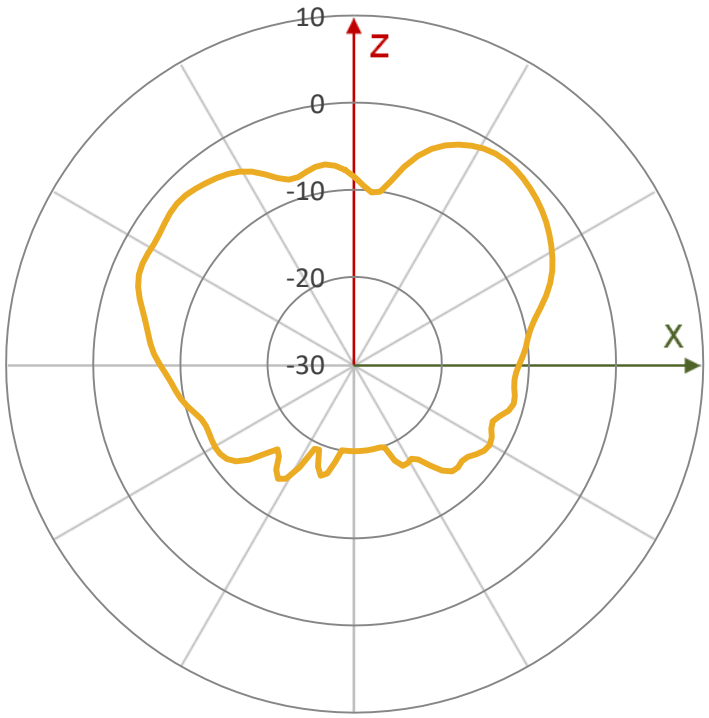


2.4GHz	Max	Mean	Min
Omni	0.2 dBi	0.1 dBi	0.0 dBi

Realized Gain Pattern

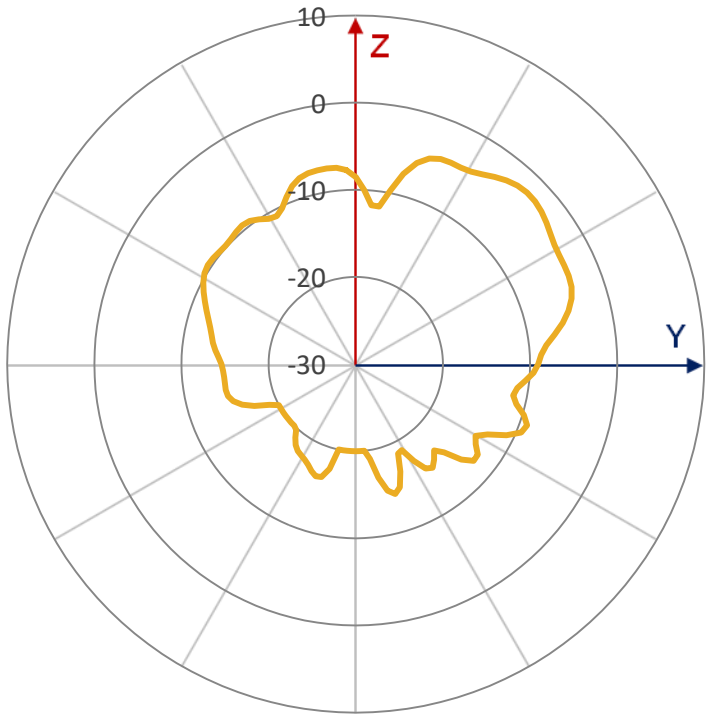
Omni Beam – P3 Sku-D Sample @2440MHz for G_{total}

phi = 0



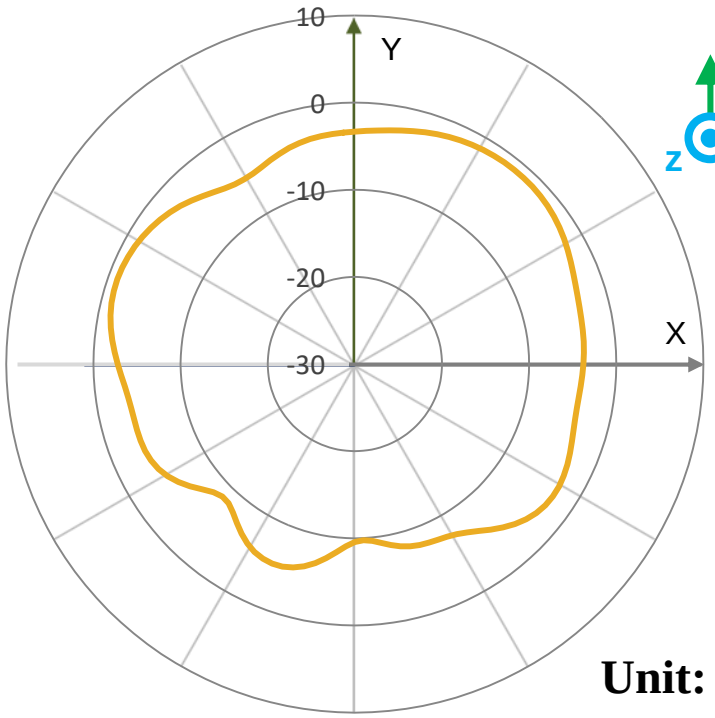
Omni

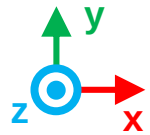
phi = 90



Omni

theta = 60





Omni

Unit: dBi

WNC

Wistron NeWeb Corp.