

# Augmedics

21/09/2025

# General Description

- The purpose of the work is to perform simulations for two antennas, each implemented on a separate PCB.
- The frequency bands of interest are:
  - 2400 MHz – 2483.5 MHz
  - 5150 MHz – 5850 MHz
- The simulation software used to conduct the evaluation is Ansys HFSS.
- The version of the software used in the simulation is 2023R1.
- The dates of the simulation is September 18-21, 2025.
- The simulation was performed using FEM (finite element method) in the frequency domain. The mesh elements are tetrahedra. A vacuum box with PML material was defined. The antennas were simulated using imported S2P parameter files. The layout files were imported directly from Altium with the specified materials and dimensions.
- The simulation was conducted in a free space evaluation.
- Below are the material parameters used for the simulation.

# General Description Continued

 View / Edit Material

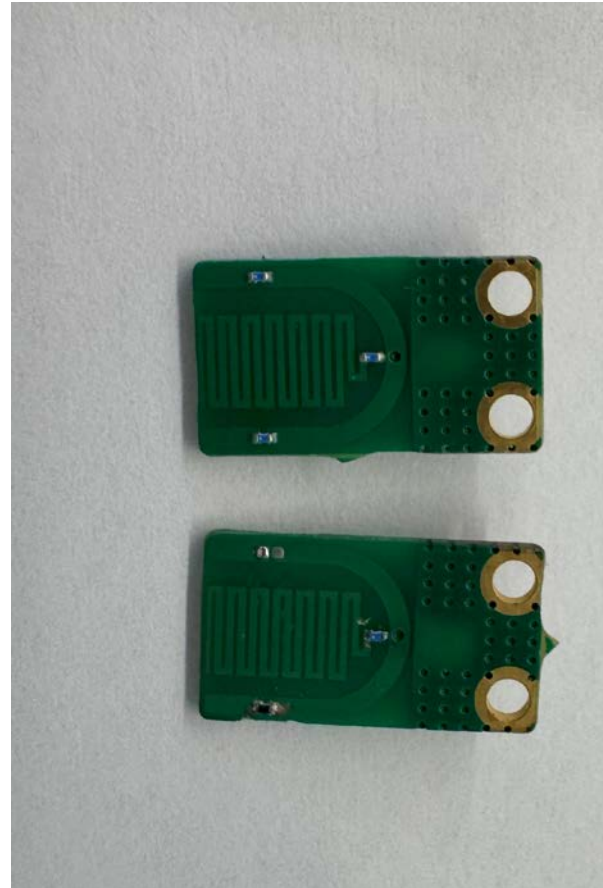
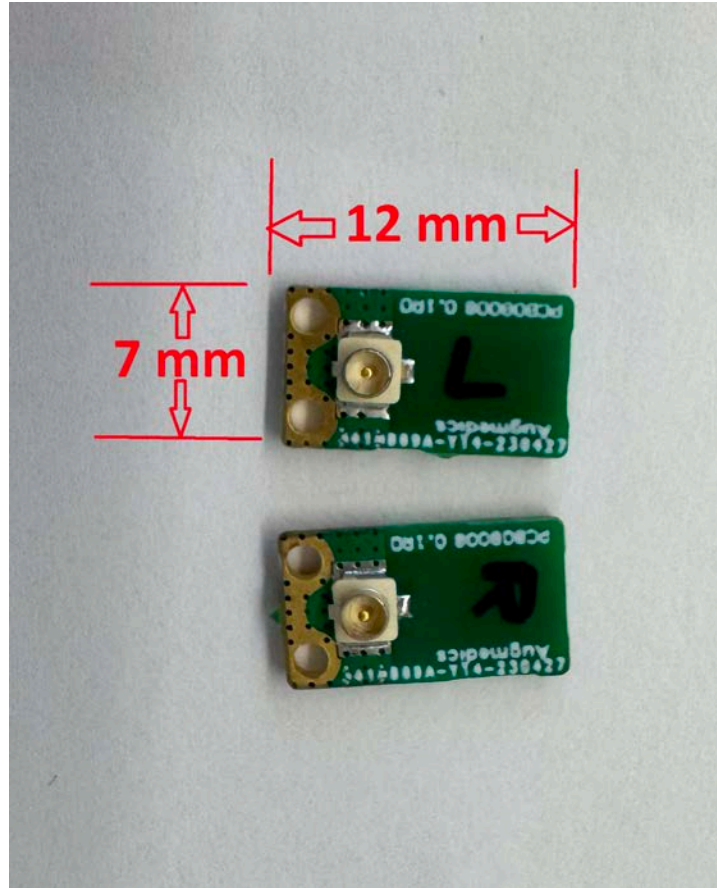
Material Name

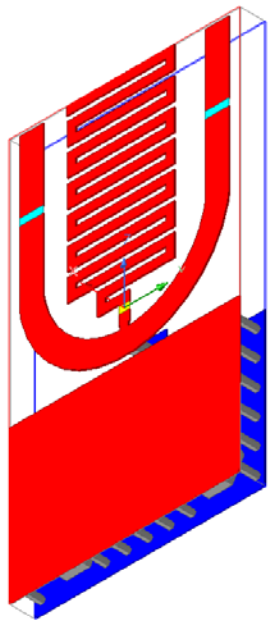
Properties of the Material

|                          | Name                    | Type   | Value | Units     |
|--------------------------|-------------------------|--------|-------|-----------|
| <input type="checkbox"/> | Relative Permittivity   | Simple | 4.5   |           |
| <input type="checkbox"/> | Relative Permeability   | Simple | 1     |           |
| <input type="checkbox"/> | Bulk Conductivity       | Simple | 0     | siemens/m |
| <input type="checkbox"/> | Dielectric Loss Tangent | Simple | 0.02  |           |
| <input type="checkbox"/> | Magnetic Loss Tangent   | Simple | 0     |           |

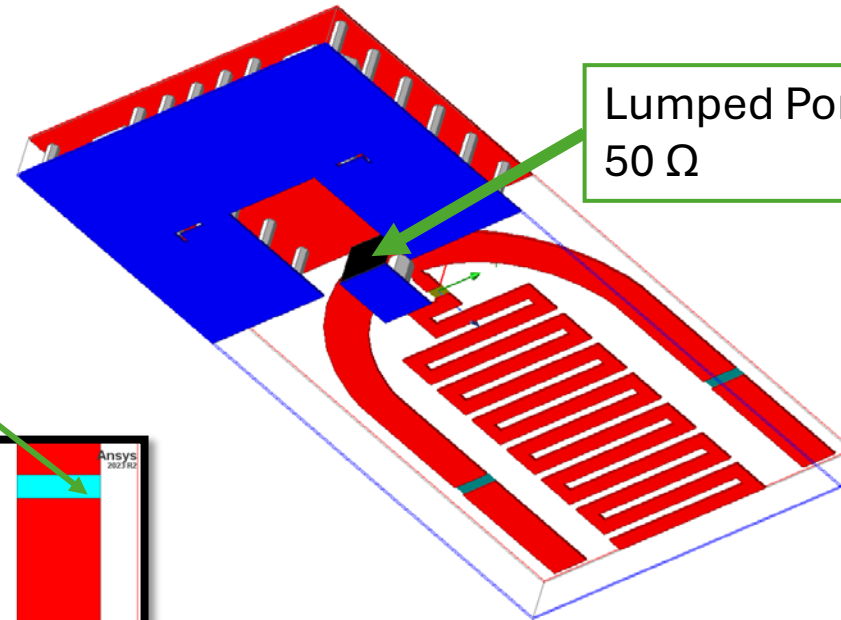
| Parameter                    | Specification |            |             |             |
|------------------------------|---------------|------------|-------------|-------------|
|                              | Antenna1      |            | Antenna2    |             |
| Frequency [MHz]              | 2440          | 5500       | 2440        | 5500        |
| Return Loss [dB]             | -0.18         | -0.98      | -0.38       | -0.98       |
| Polarization                 | Linear        | Linear     | Linear      | Linear      |
| Peak Gain [dBi]              | -19.28        | -4.54      | -17.77      | -4.53       |
| Total Efficiency [dB]        | -21.01        | -7.16      | -19.51      | -7.20       |
| Input Impedance [ $\Omega$ ] | 3.12-111.21i  | 4.18-34.3i | 5.78-102.7i | 4.18-34.28i |

- Photos of the Antennas with Dimensions
- Both Antennas are of the same Dimension

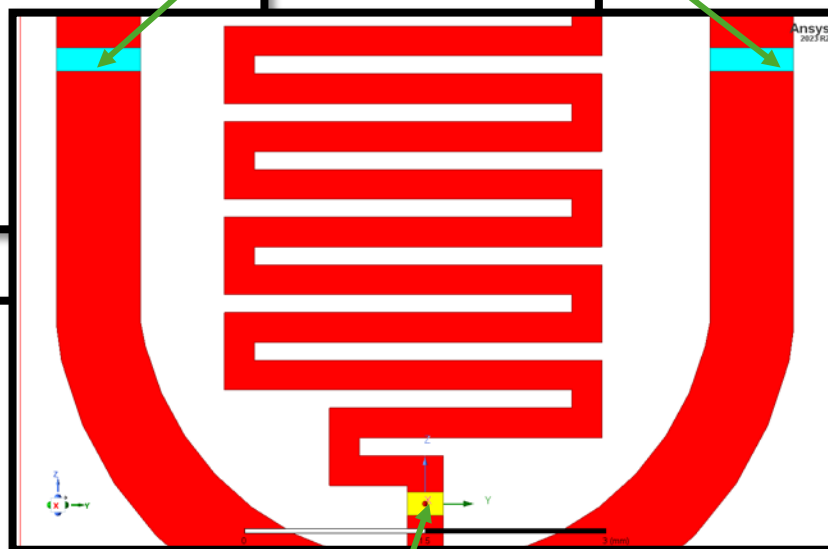




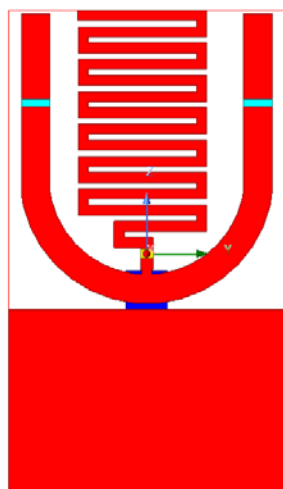
Resistor  $0\ \Omega$



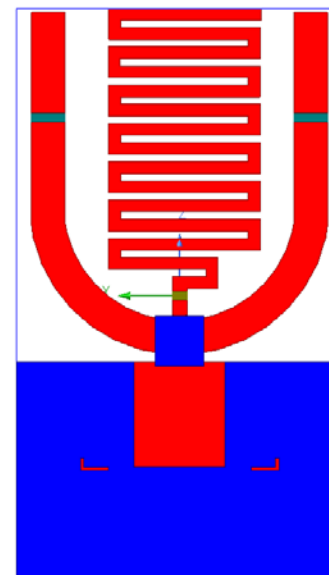
Lumped Port  
 $50\ \Omega$



Front



Back



Inductor

# APCB08008 (Ant 1)

Inductor LQW03AW3N7C00\_series

## Return Loss

APCB08008 **Ansys**  
2023 R2

|   | Freq [GHz] | dB(S(1,1))<br>Setup1 : D1 |
|---|------------|---------------------------|
| 1 | 2.440000   | -0.182666                 |
| 2 | 5.500000   | -0.987976                 |

## Input Impedance

APCB08008 **Ansys**  
2023 R2

|   | Freq [GHz] | Z(1,1)<br>Setup1 : D1  |
|---|------------|------------------------|
| 1 | 2.440000   | 3.128346 - 111.211022i |
| 2 | 5.500000   | 4.183710 - 34.300096i  |

## Efficiency Table

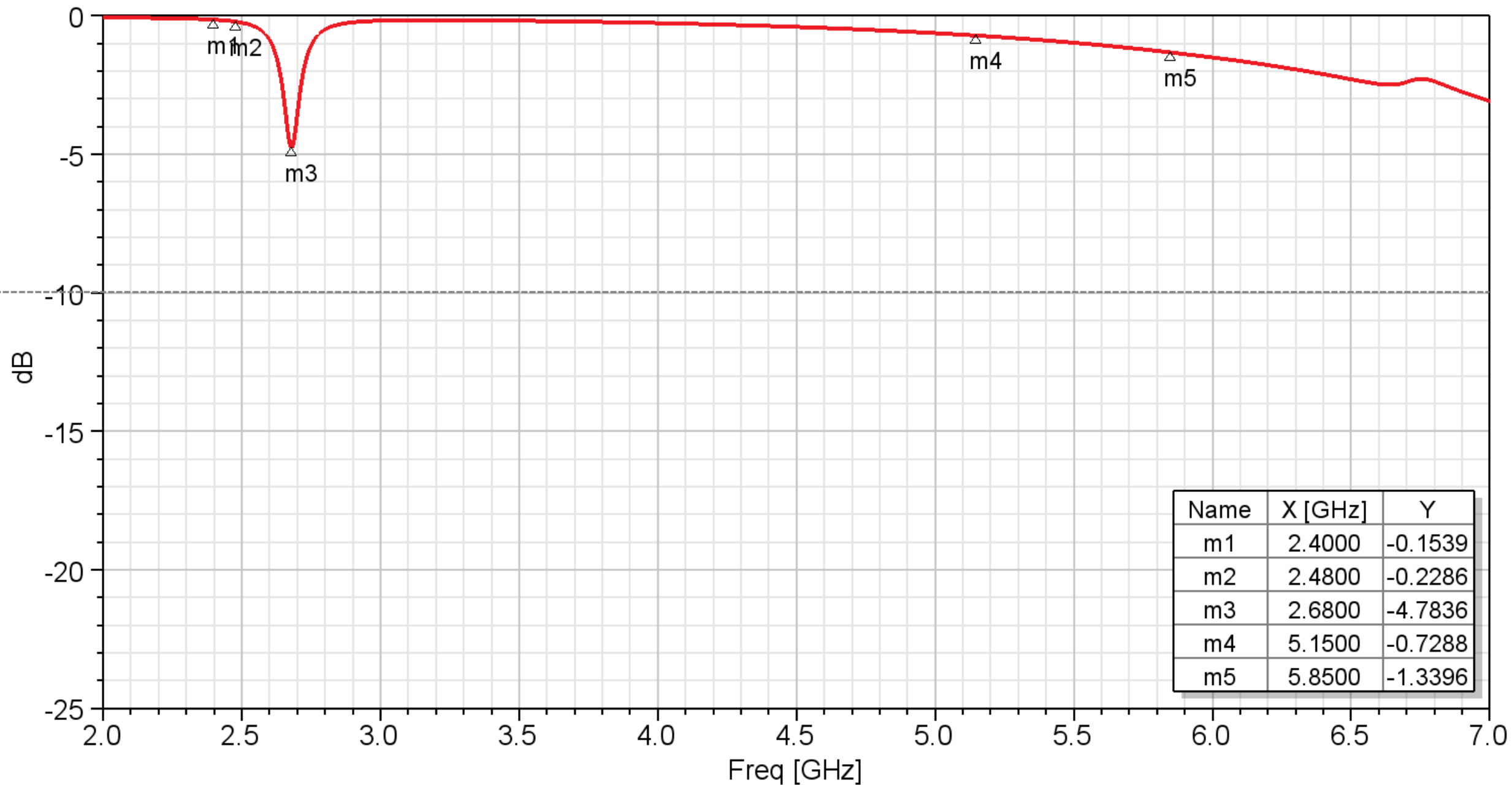
APCB08008 **Ansys**  
2023 R2

|   | Freq [GHz] | dB(RadiationEfficiency)<br>Setup1 : D1 | dB(SystemEfficiency)<br>Setup1 : D1 |
|---|------------|----------------------------------------|-------------------------------------|
| 1 | 2.440000   | -7.160033                              | -21.012309                          |
| 2 | 5.500000   | -0.250032                              | -7.165039                           |

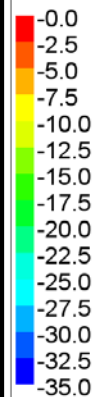
# S11

APCB08008

Ansys  
2023 R2



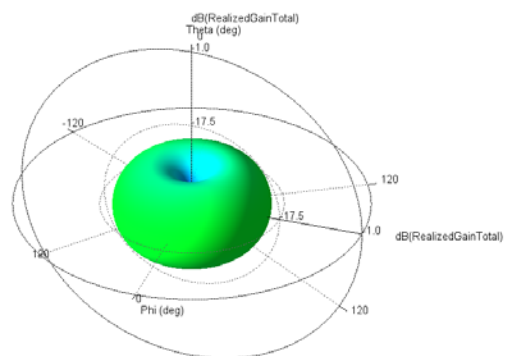
Max: -19.87



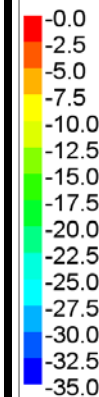
Min: -54.68



Realized Gain Total, @2.4GHz



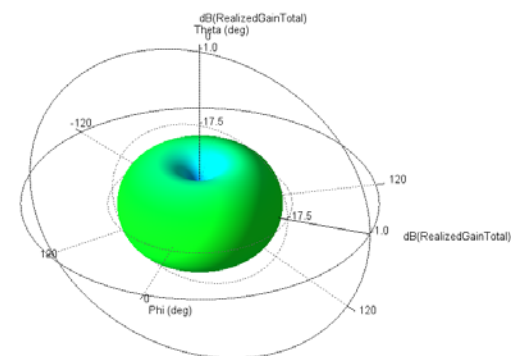
Max: -19.28



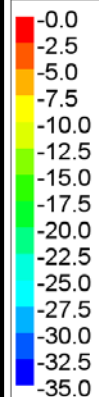
Min: -54.10



Realized Gain Total, @2.44GHz



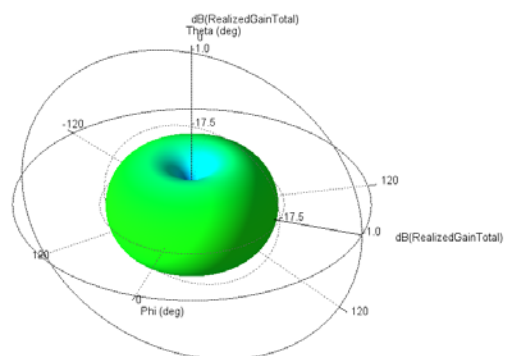
Max: -18.61



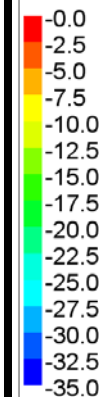
Min: -53.42



Realized Gain Total, @2.48GHz



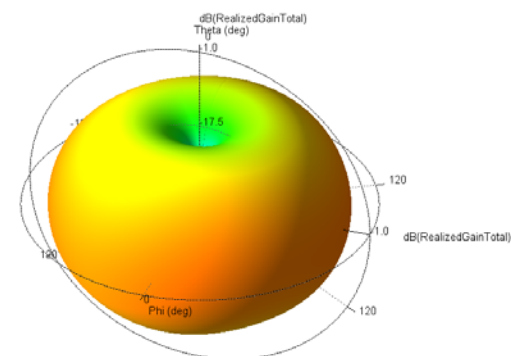
Max: -6.00



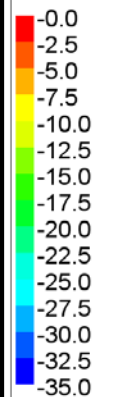
Min: -40.71



Realized Gain Total, @5.15GHz



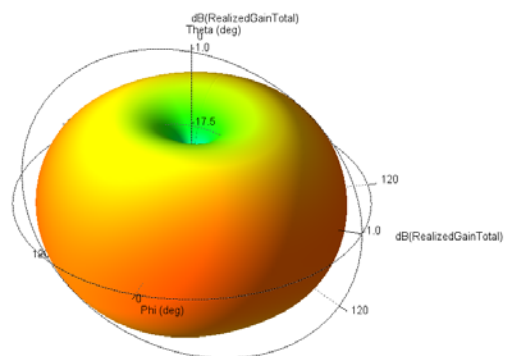
Max: -5.27



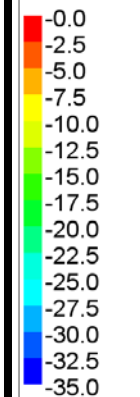
Min: -40.41



Realized Gain Total, @5.325GHz



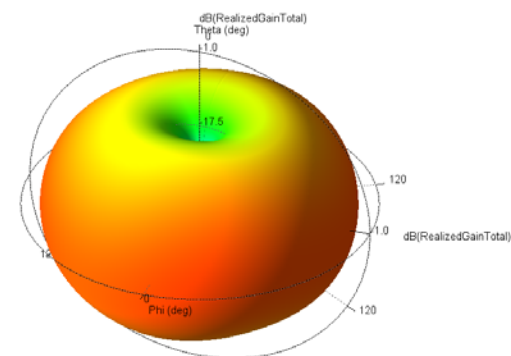
Max: -4.54



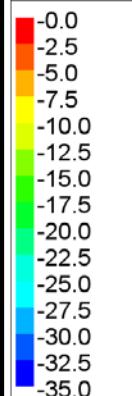
Min: -40.06



Realized Gain Total, @5.5GHz



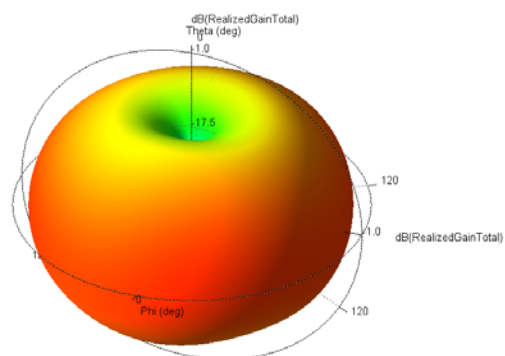
Max: -3.81



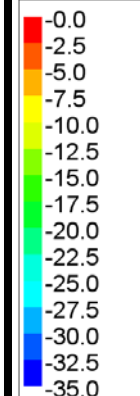
Min: -37.88



Realized Gain Total, @5.675GHz



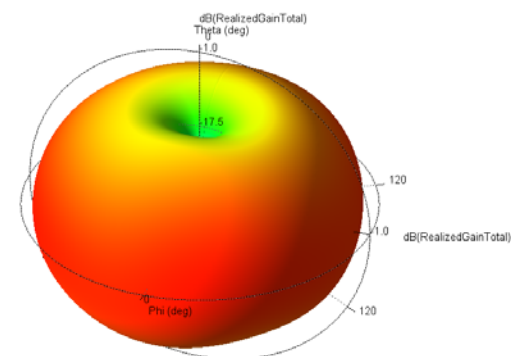
Max: -3.17



Min: -34.55



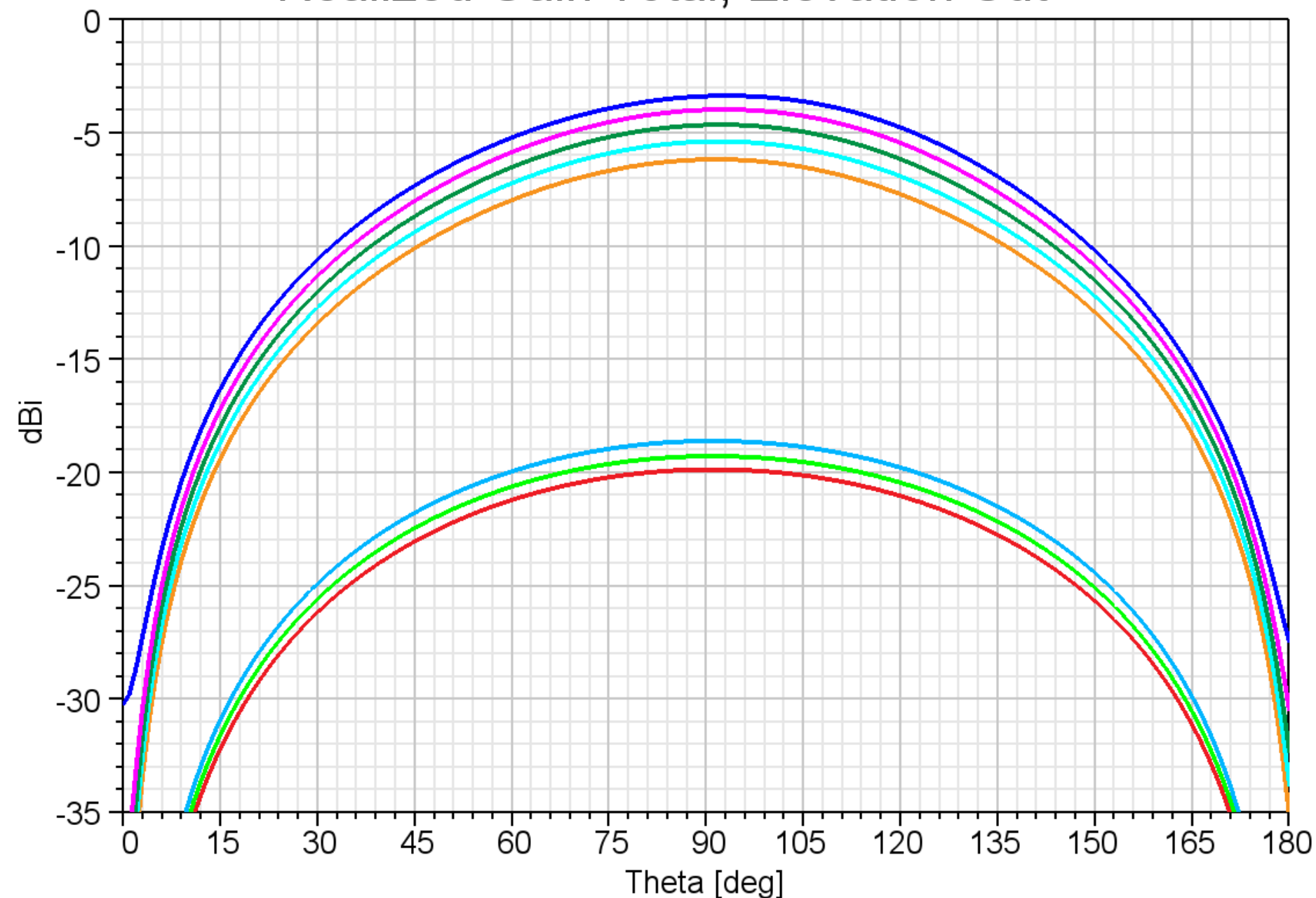
Realized Gain Total, @5.85GHz



# Realized Gain Total, Elevation Cut

APCB08008

Ansyz  
2023 R2

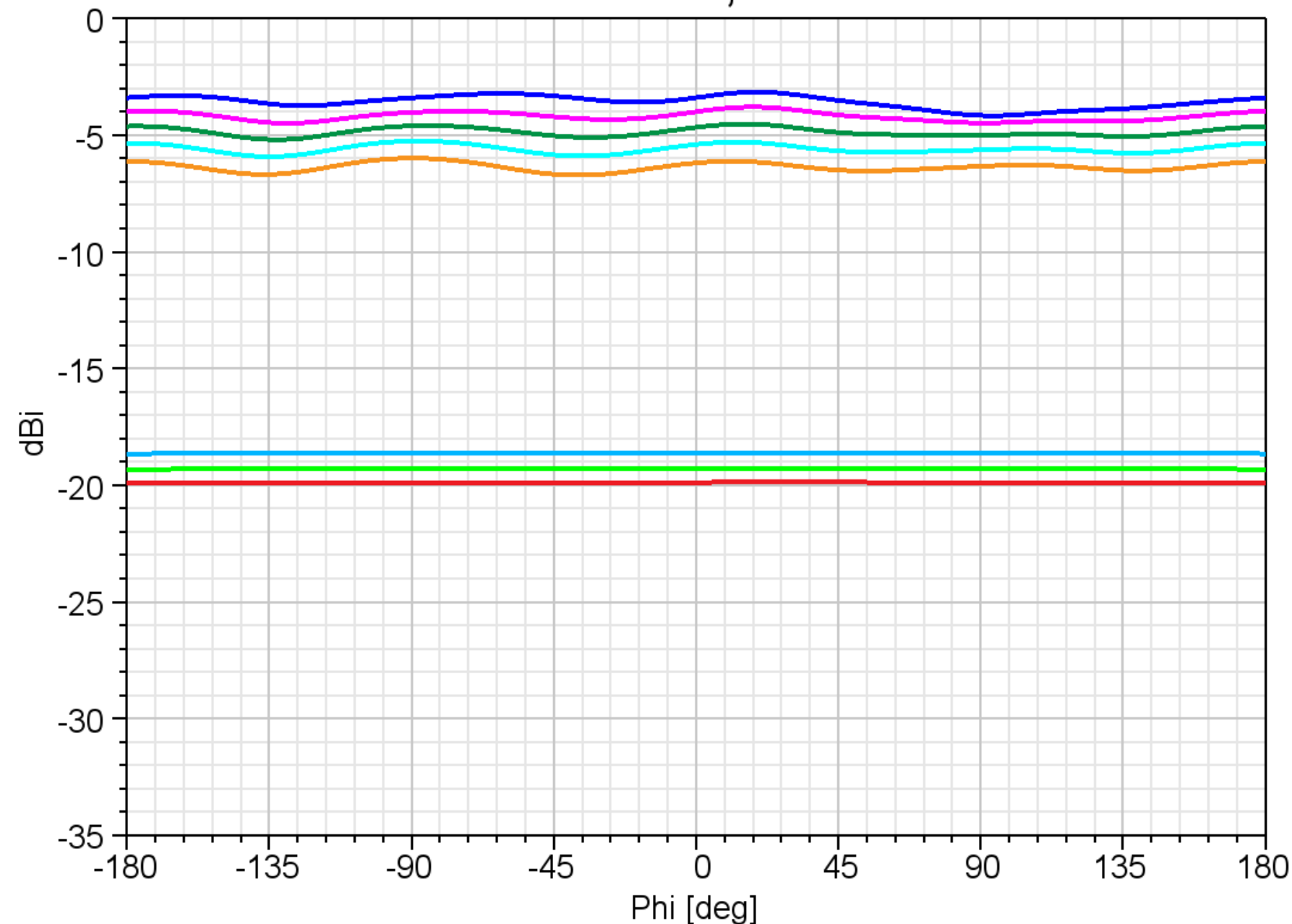


- Freq='2.4GHz' Phi='0deg'
- Freq='2.44GHz' Phi='0deg'
- Freq='2.48GHz' Phi='0deg'
- Freq='5.15GHz' Phi='0deg'
- Freq='5.325GHz' Phi='0deg'
- Freq='5.5GHz' Phi='0deg'
- Freq='5.675GHz' Phi='0deg'
- Freq='5.85GHz' Phi='0deg'

# Realized Gain Total, Azimuth Cut

APCB08008

Ansys  
2023 R2



- Freq='2.4GHz' Theta='90deg'
- Freq='2.44GHz' Theta='90deg'
- Freq='2.48GHz' Theta='90deg'
- Freq='5.15GHz' Theta='90deg'
- Freq='5.325GHz' Theta='90deg'
- Freq='5.5GHz' Theta='90deg'
- Freq='5.675GHz' Theta='90deg'
- Freq='5.85GHz' Theta='90deg'

# APCB08009 (Ant 2)

Inductor LQW03AW4N3J00\_series

## Return Loss

APCB08009 **Ansys**  
2023 R2

|   | Freq [GHz] | dB(S(1,1))<br>Setup1 : D1 |
|---|------------|---------------------------|
| 1 | 2.440000   | -0.384315                 |
| 2 | 5.500000   | -0.988749                 |

## Input Impedance

APCB08009 **Ansys**  
2023 R2

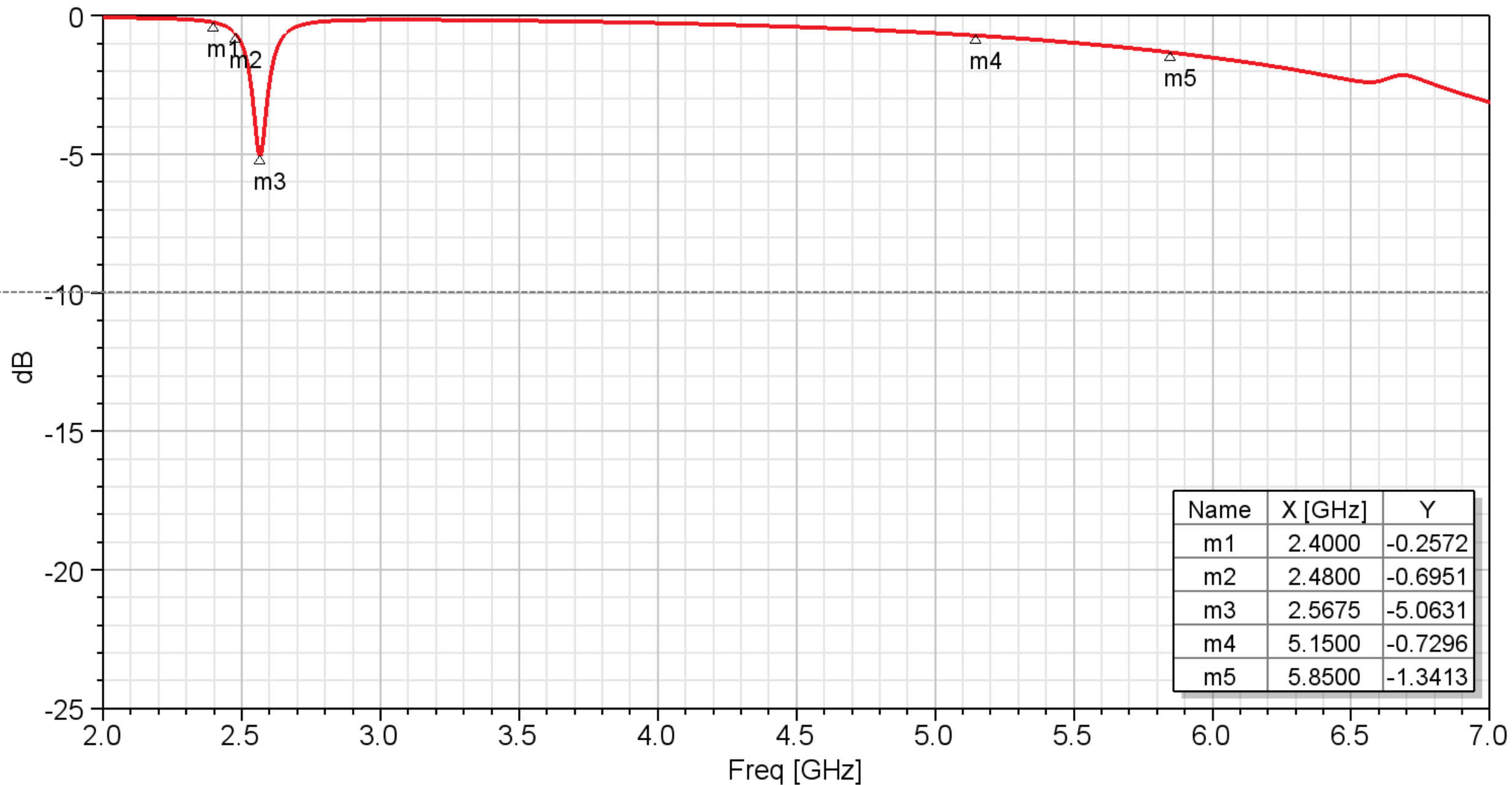
|   | Freq [GHz] | Z(1,1)<br>Setup1 : D1  |
|---|------------|------------------------|
| 1 | 2.440000   | 5.784572 - 102.707161i |
| 2 | 5.500000   | 4.186117 - 34.289032i  |

## Efficiency Table

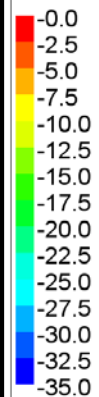
APCB08009 **Ansys**  
2023 R2

|   | Freq [GHz] | dB(RadiationEfficiency)<br>Setup1 : D1 | dB(SystemEfficiency)<br>Setup1 : D1 |
|---|------------|----------------------------------------|-------------------------------------|
| 1 | 2.440000   | -8.798253                              | -19.519964                          |
| 2 | 5.500000   | -0.295493                              | -7.207476                           |

# S11



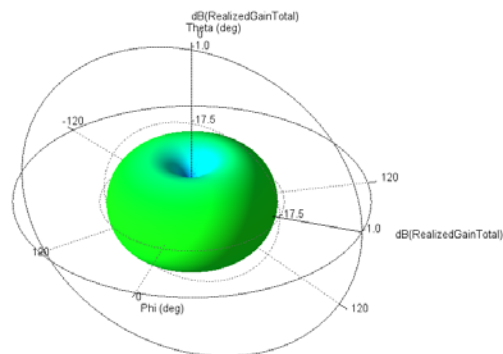
Max: -18.77



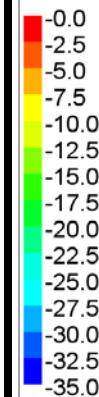
Min: -53.90



Realized Gain Total, @2.4GHz



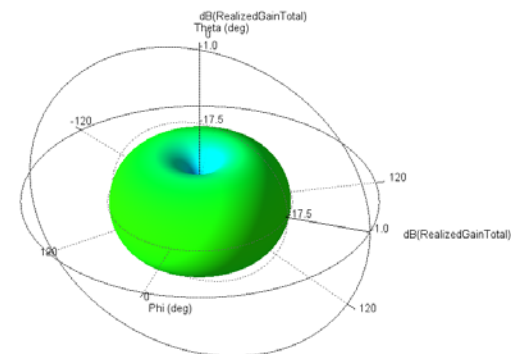
Max: -17.77



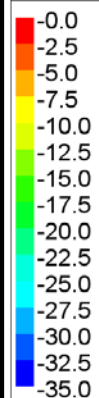
Min: -52.80



Realized Gain Total, @2.44GHz



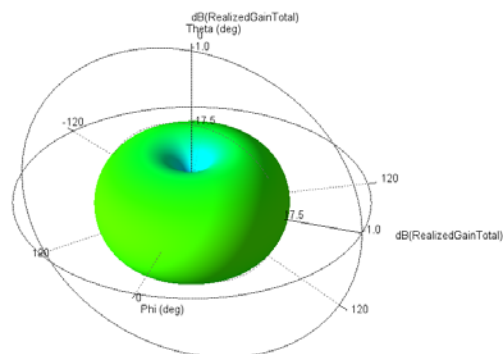
Max: -16.45



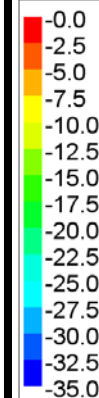
Min: -51.29



Realized Gain Total, @2.48GHz



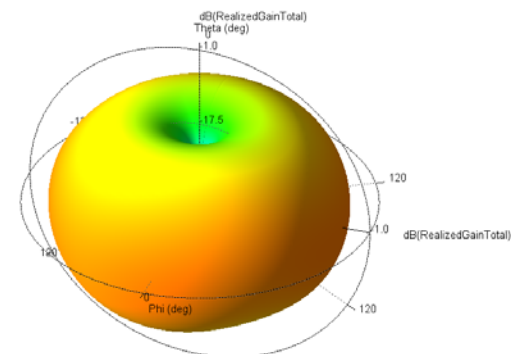
Max: -6.13



Min: -37.49

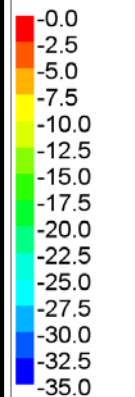


Realized Gain Total, @5.15GHz

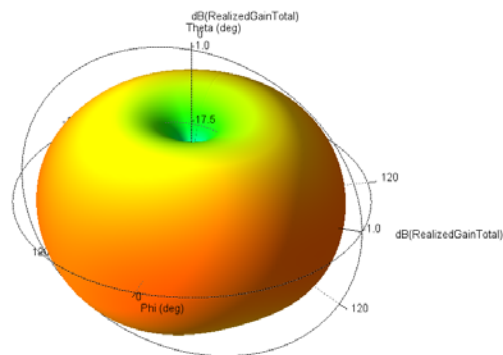


Realized Gain Total, @5.325GHz

Max: -5.30

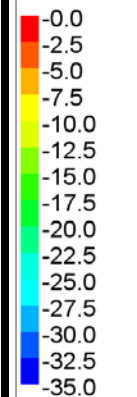


Min: -35.91

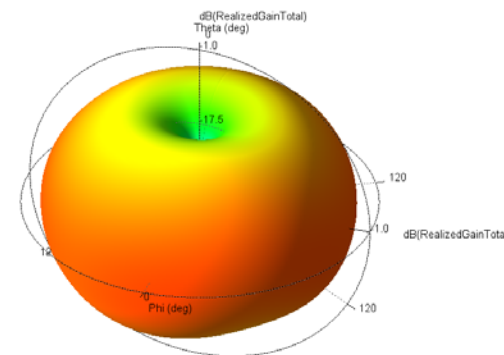


Realized Gain Total, @5.5GHz

Max: -4.53

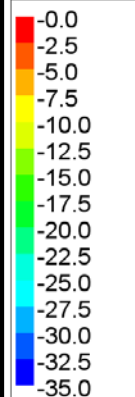


Min: -34.58

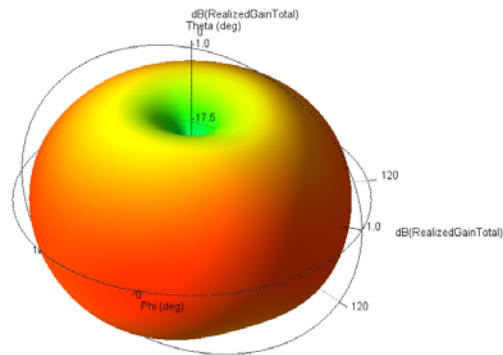


Realized Gain Total, @5.675GHz

Max: -3.81

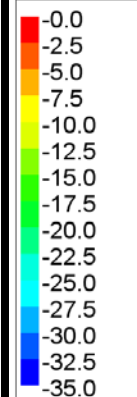


Min: -34.47

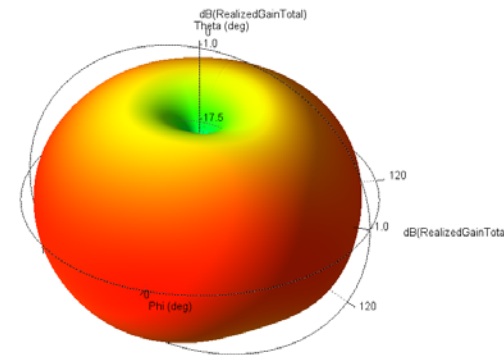


Realized Gain Total, @5.85GHz

Max: -3.16



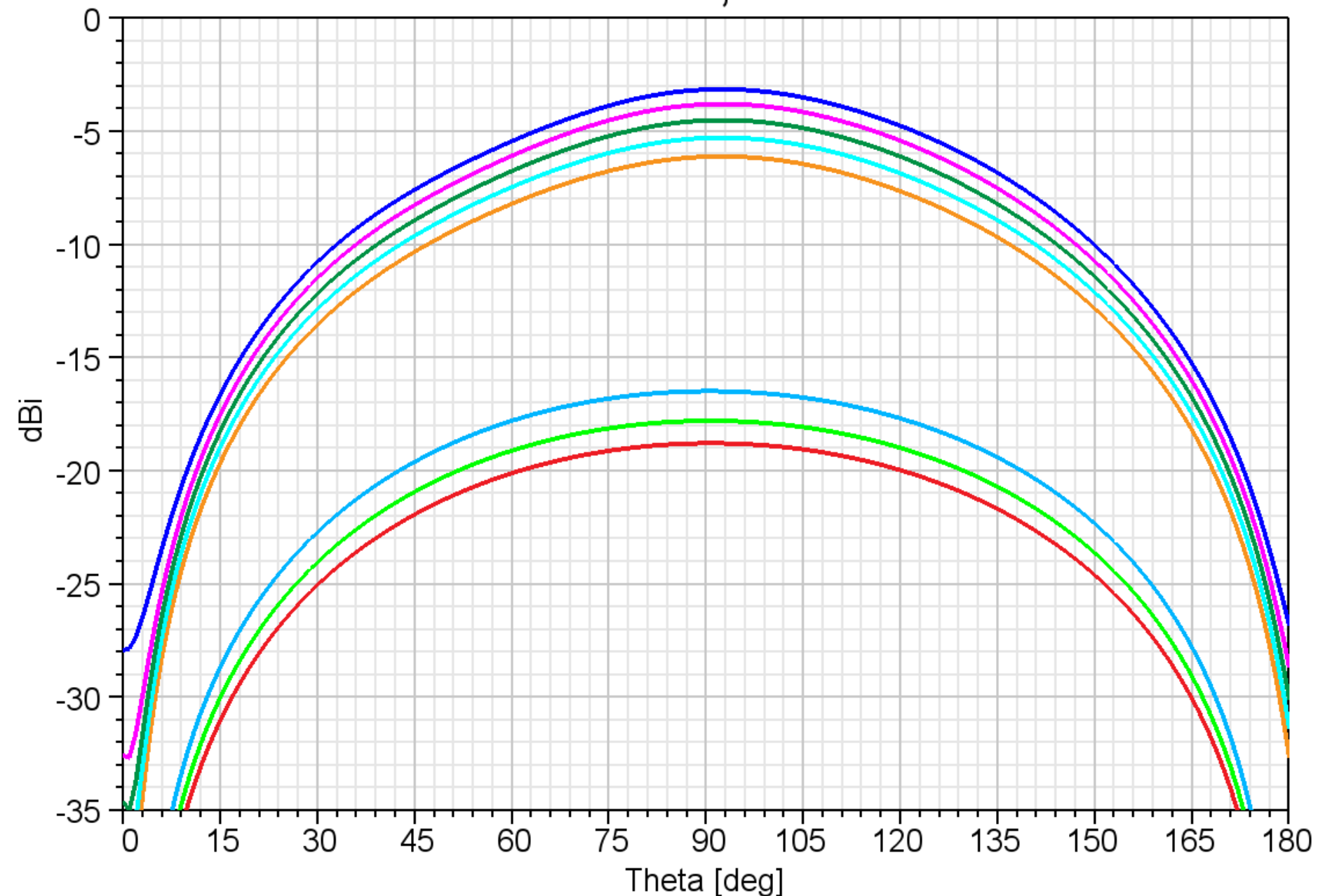
Min: -35.65



# Realized Gain Total, Elevation Cut

APCB08009

Ansyz  
2023 R2

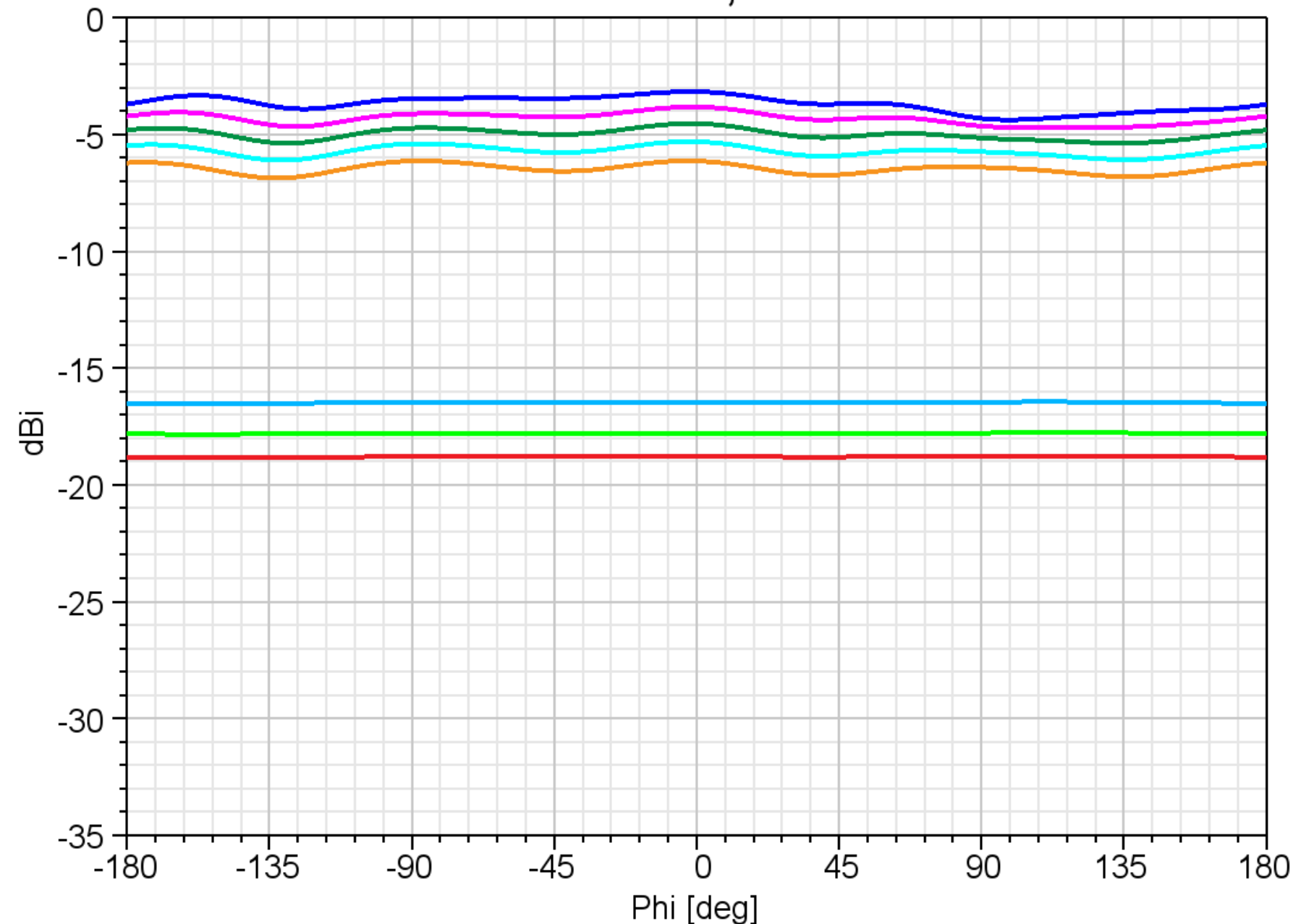


- Freq='2.4GHz' Phi='0deg'
- Freq='2.44GHz' Phi='0deg'
- Freq='2.48GHz' Phi='0deg'
- Freq='5.15GHz' Phi='0deg'
- Freq='5.325GHz' Phi='0deg'
- Freq='5.5GHz' Phi='0deg'
- Freq='5.675GHz' Phi='0deg'
- Freq='5.85GHz' Phi='0deg'

# Realized Gain Total, Azimuth Cut

APCB08009

Ansys  
2023 R2



- Freq='2.4GHz' Theta='90deg'
- Freq='2.44GHz' Theta='90deg'
- Freq='2.48GHz' Theta='90deg'
- Freq='5.15GHz' Theta='90deg'
- Freq='5.325GHz' Theta='90deg'
- Freq='5.5GHz' Theta='90deg'
- Freq='5.675GHz' Theta='90deg'
- Freq='5.85GHz' Theta='90deg'

# Summary

- In the low frequency band, the resonance is out of band of interest
- In the high frequency band, there is no resonance