

안테나특성 확인결과 Antenna characteristic confirmation result

Model: ML5; Brand: Carrier

항 목 Item	결 과 Result
안테나의 종류 및 형태 Types and types of antennas	PCB Antenna
안테나 이득(dBi) Antenna gain (dBi)	4.54 dBi
지향특성 Orientation characteristics	무지향성 Omnidirectional
안테나의 편파특성 Antenna polarization characteristics	직선편파 linear polarization
송신장치와의 접속형태 Connection type with transmission device	내장형 built-in
안테나의 제작자 및 안테나의 모델명 The manufacturer of the antenna and the model name of the antenna	UTECH, INC. / None
이득 측정기관명 Name of the gain measuring institution	L&T Technology Services



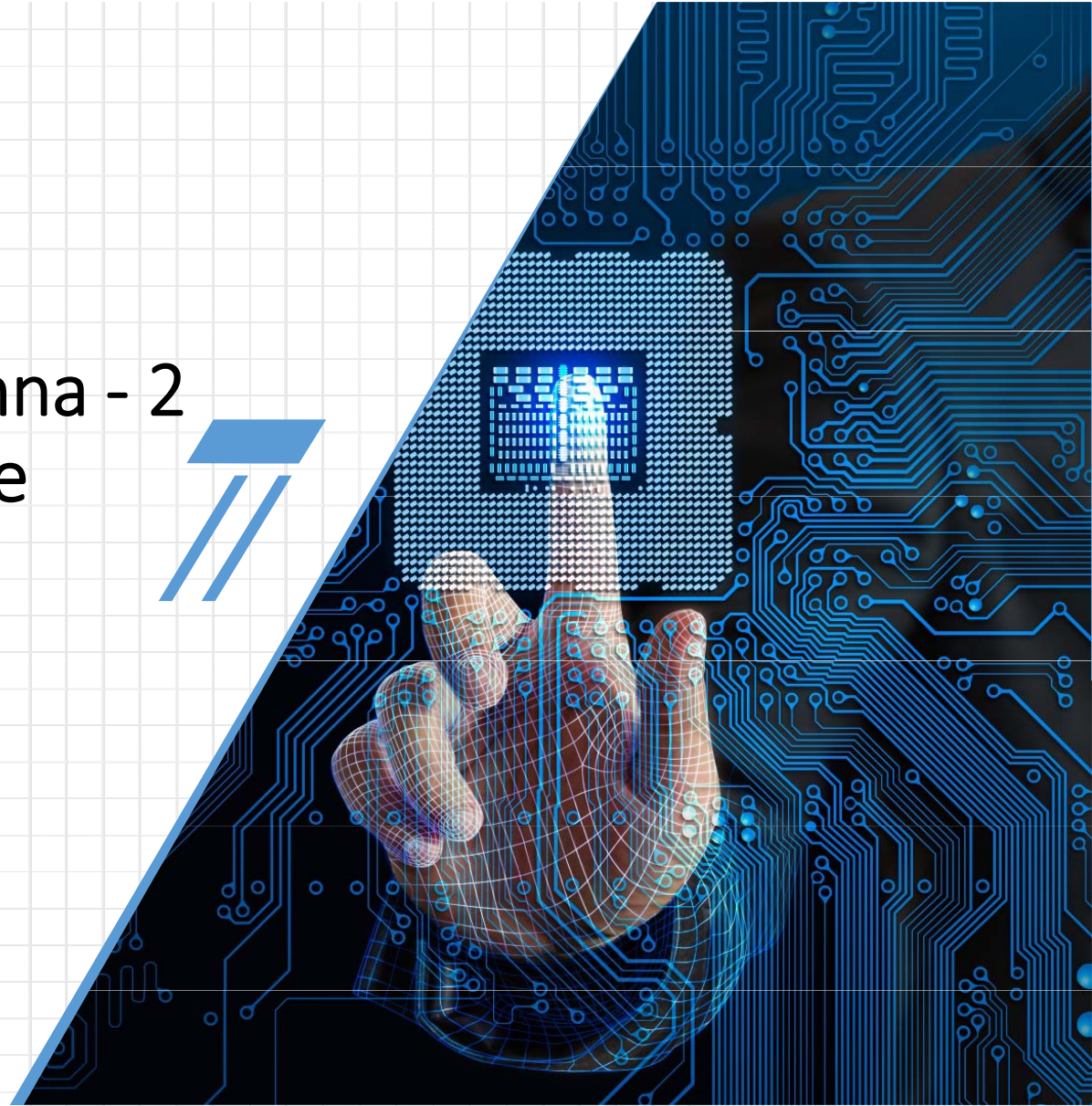
Note: 본 기자재의 안테나 특성은 안테나의 제작자가 시험하여 작성한 성적서, 이득 패턴도 또는 안테나 카탈로그로 확인하였음.



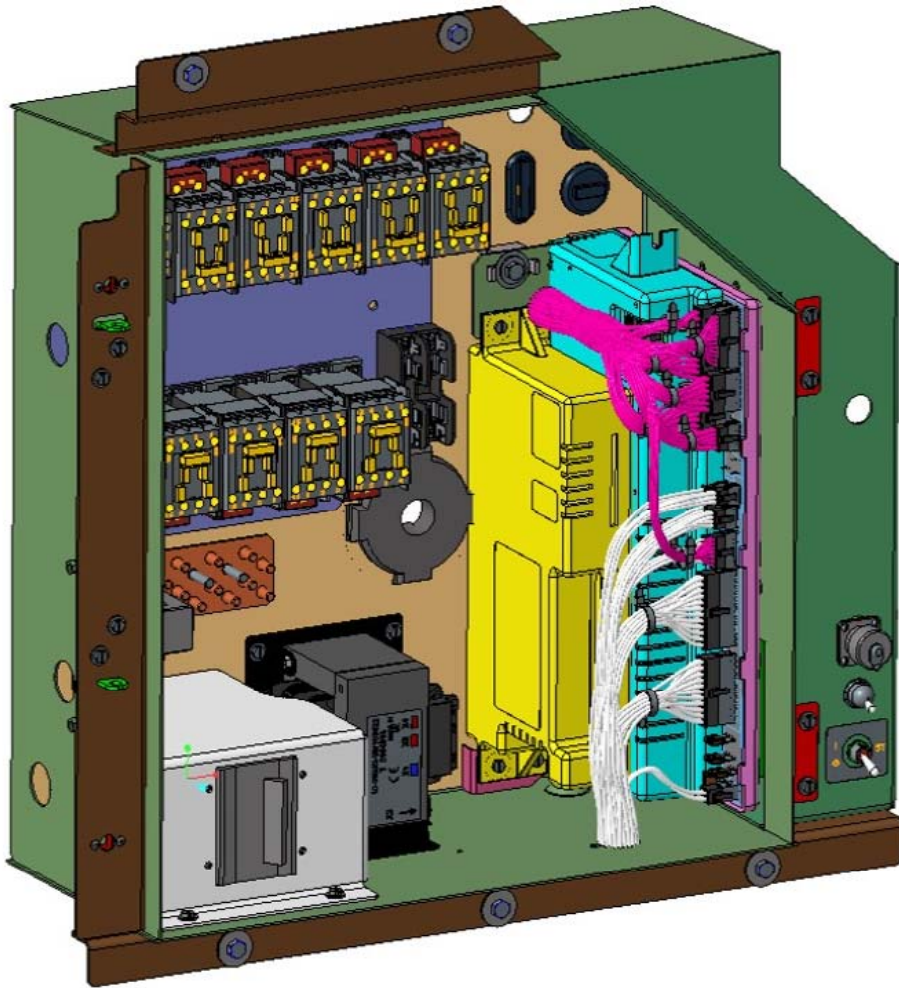
Wi-Fi Antenna -1 & Antenna - 2 with Metal enclosure simulation Result



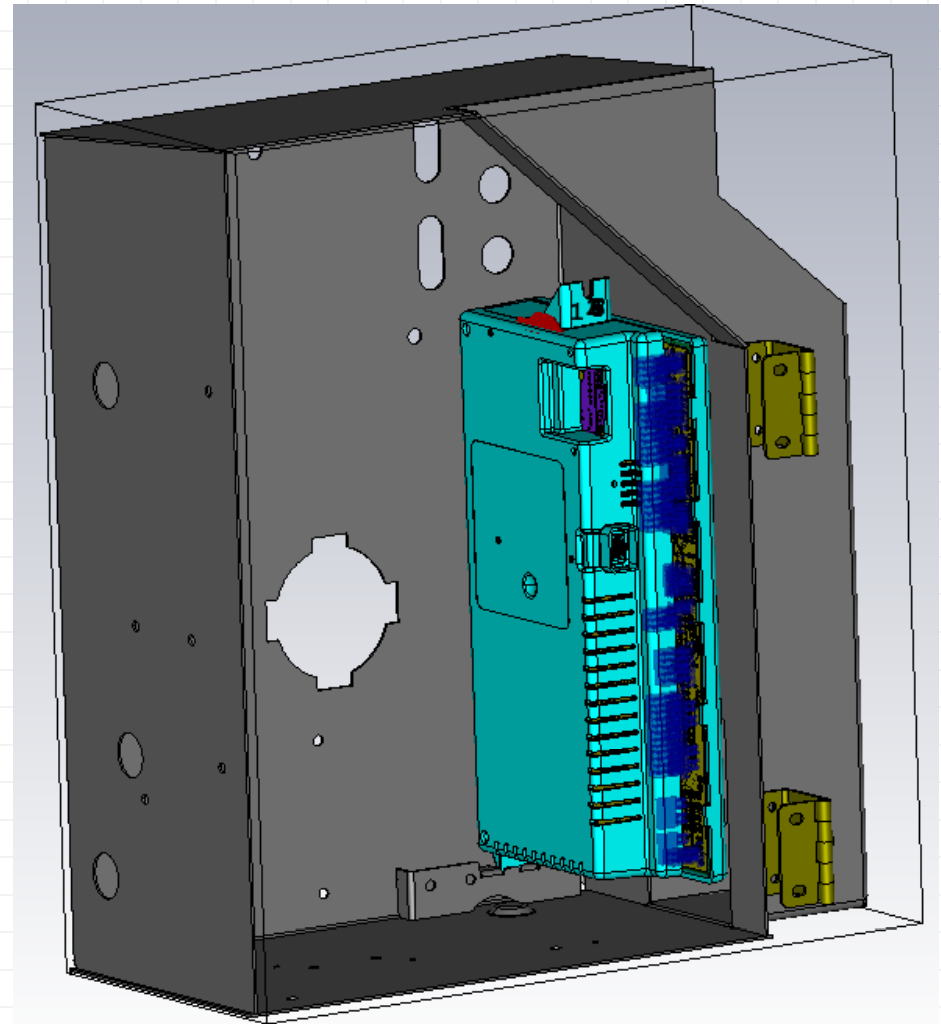
 L&T Technology Services



Metal enclosure diagram

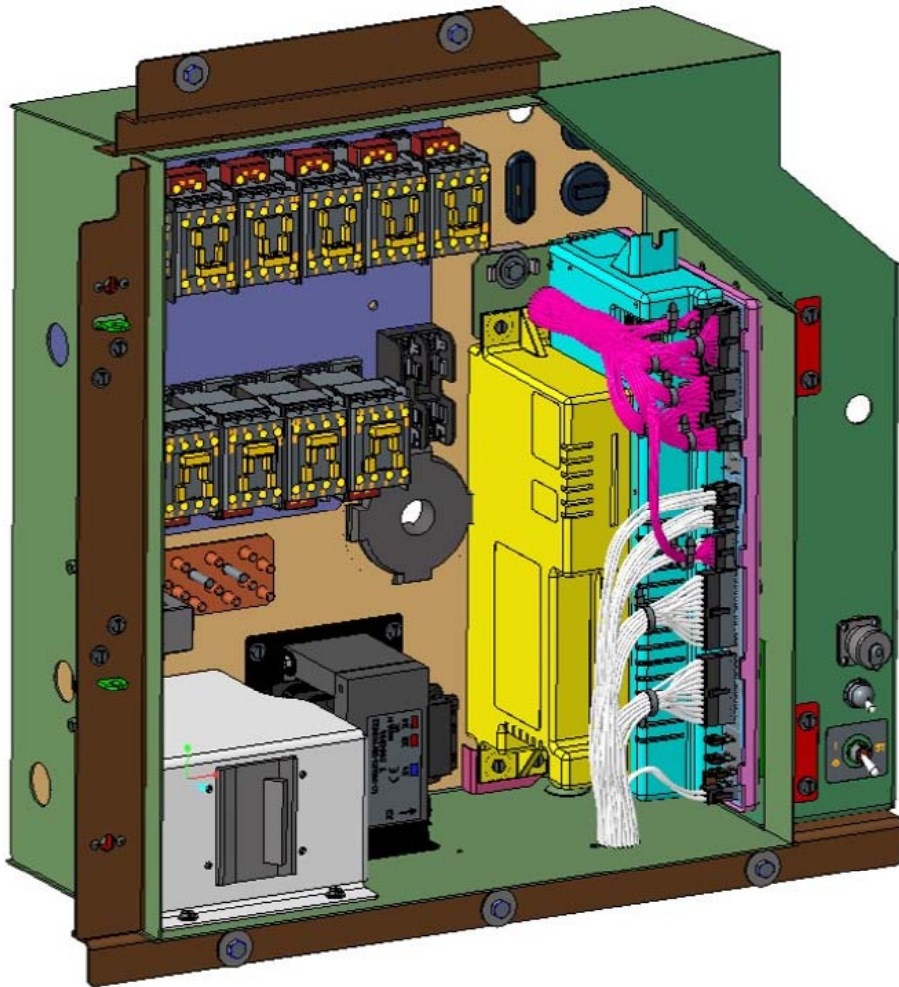


CAD model Metal enclosure diagram

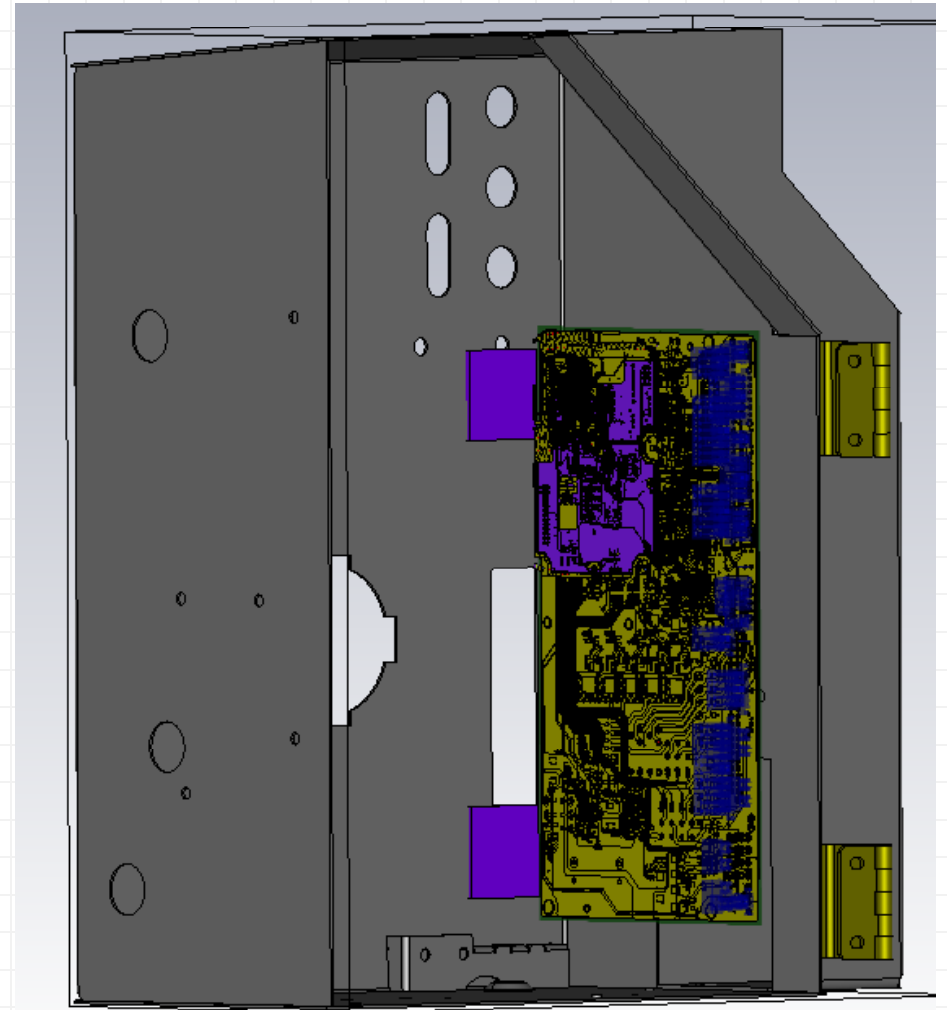


CST software model Metal enclosure diagram

Wi-Fi Antenna diagram

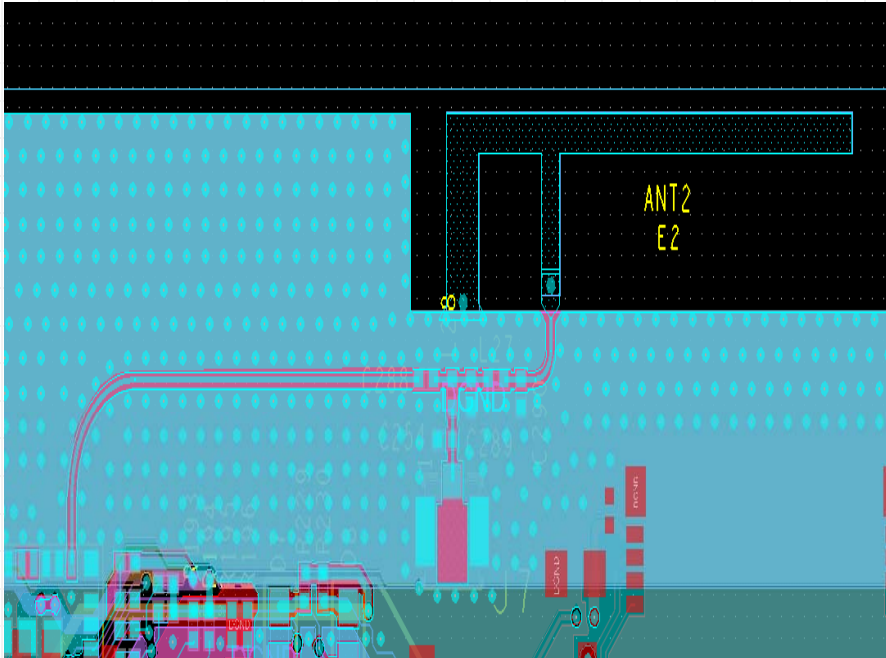


CAD model Metal enclosure diagram

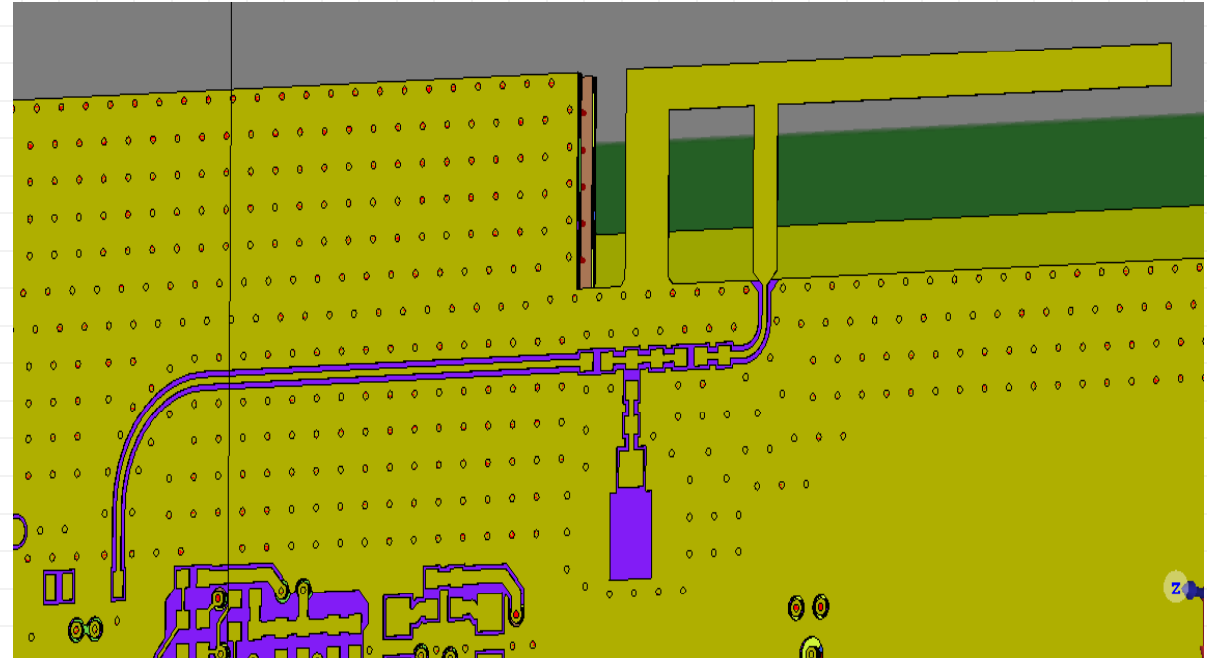


CST software model Antenna 1 with Metal enclosure

Wi-Fi Antenna – 1(U18-18) Diagram

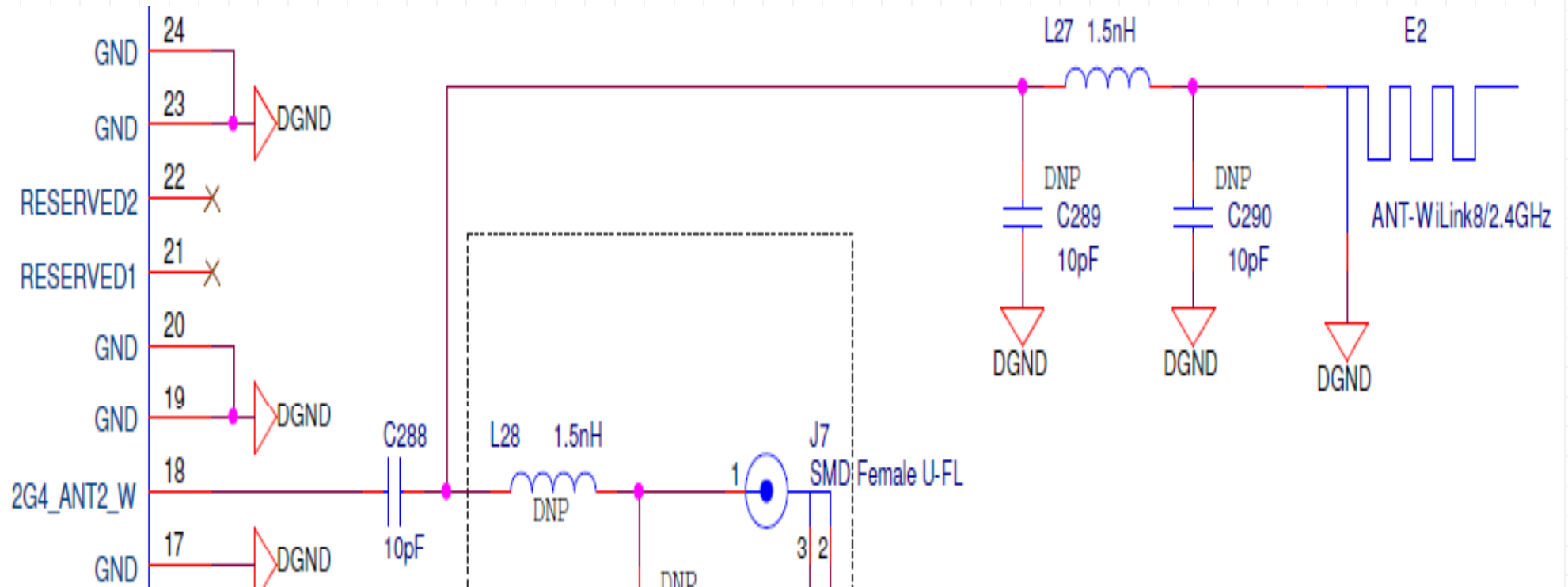


Antenna – 1 OrCAD model diagram

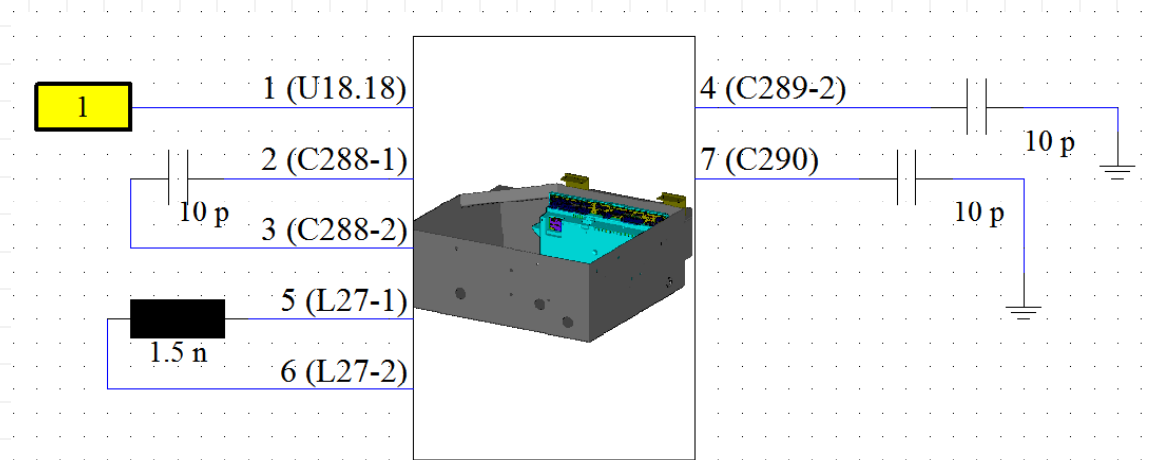


Antenna – 1 CST software model diagram

Antenna -1 schematic circuit



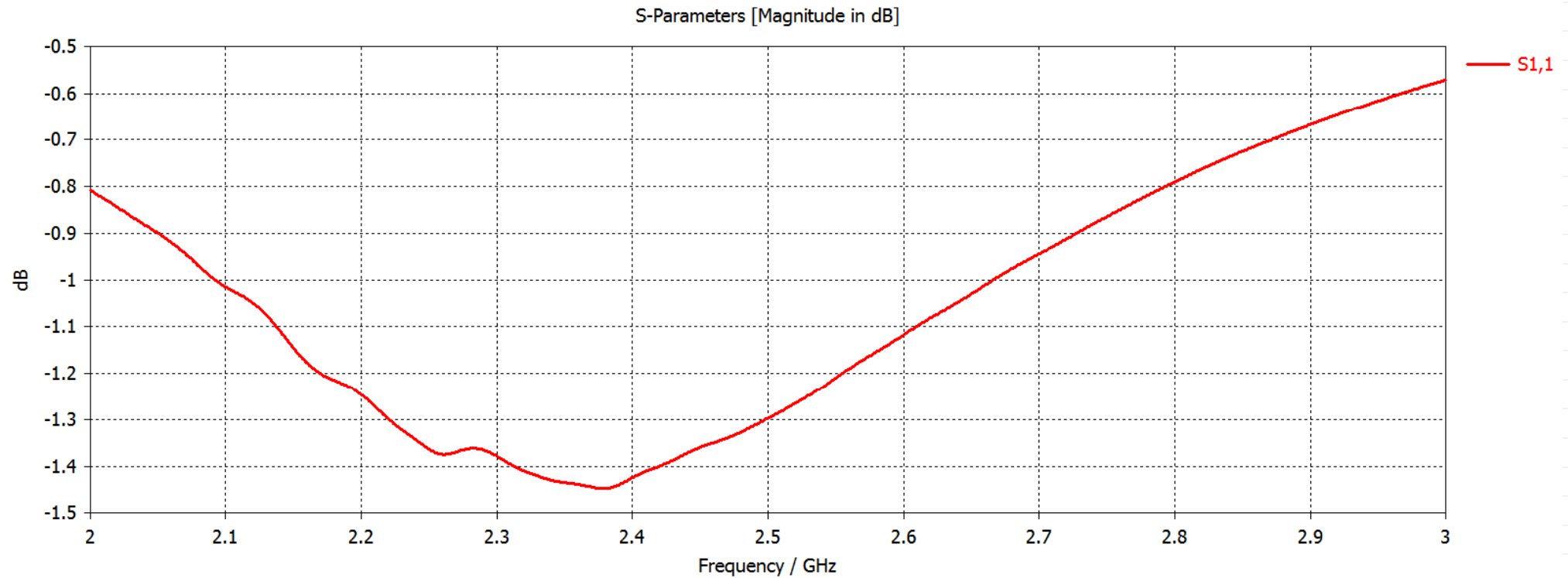
Antenna -1 simulation with schematic values in CST



- CST Library Components Used for Simulation**

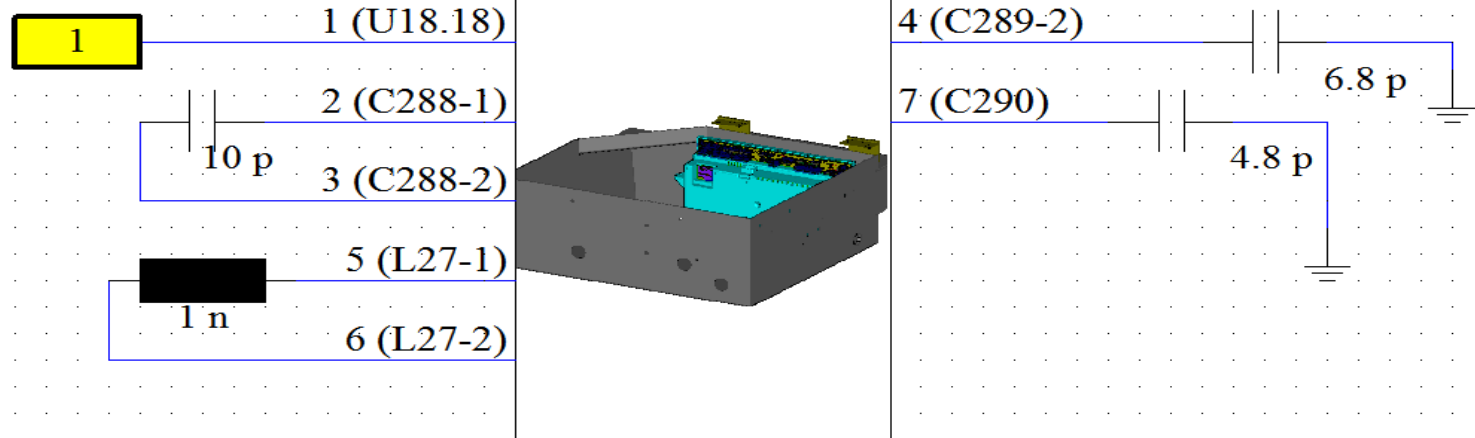
S. No.	Schematic Ref. Des	Value
1	C288	10 pF
2	C289	10 pF
3	L27	1.5 nH
4	C290	10 pF

Antenna -1 simulation result with schematic values



With the Matching network Provided in the Schematic circuit, the min Return Loss is **-1.3dB** for the frequency band of **2.4 to 2.48GHz**

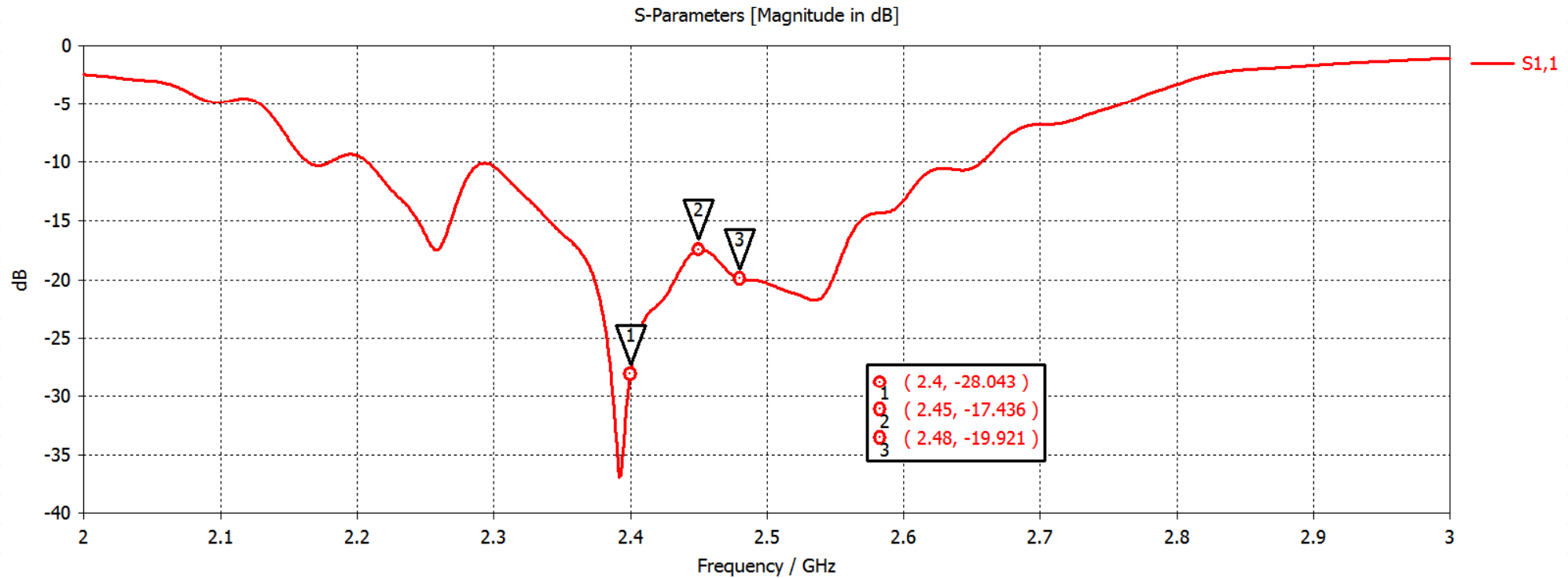
Antenna – 1 Optimized matching Network



- CST Library Component Used for Simulation**

S. No.	Schematic Ref. Des	Value
1	C288	10 pF
2	C289	6.8 pF
3	L27	1 nH
4	C290	4.8 pF

Antenna – 1 Optimized matching Network simulation result



- Min Return Loss of ~17 dB is observed @ 2.4 – 2.48GHz

Comparison table

- Component values comparison**

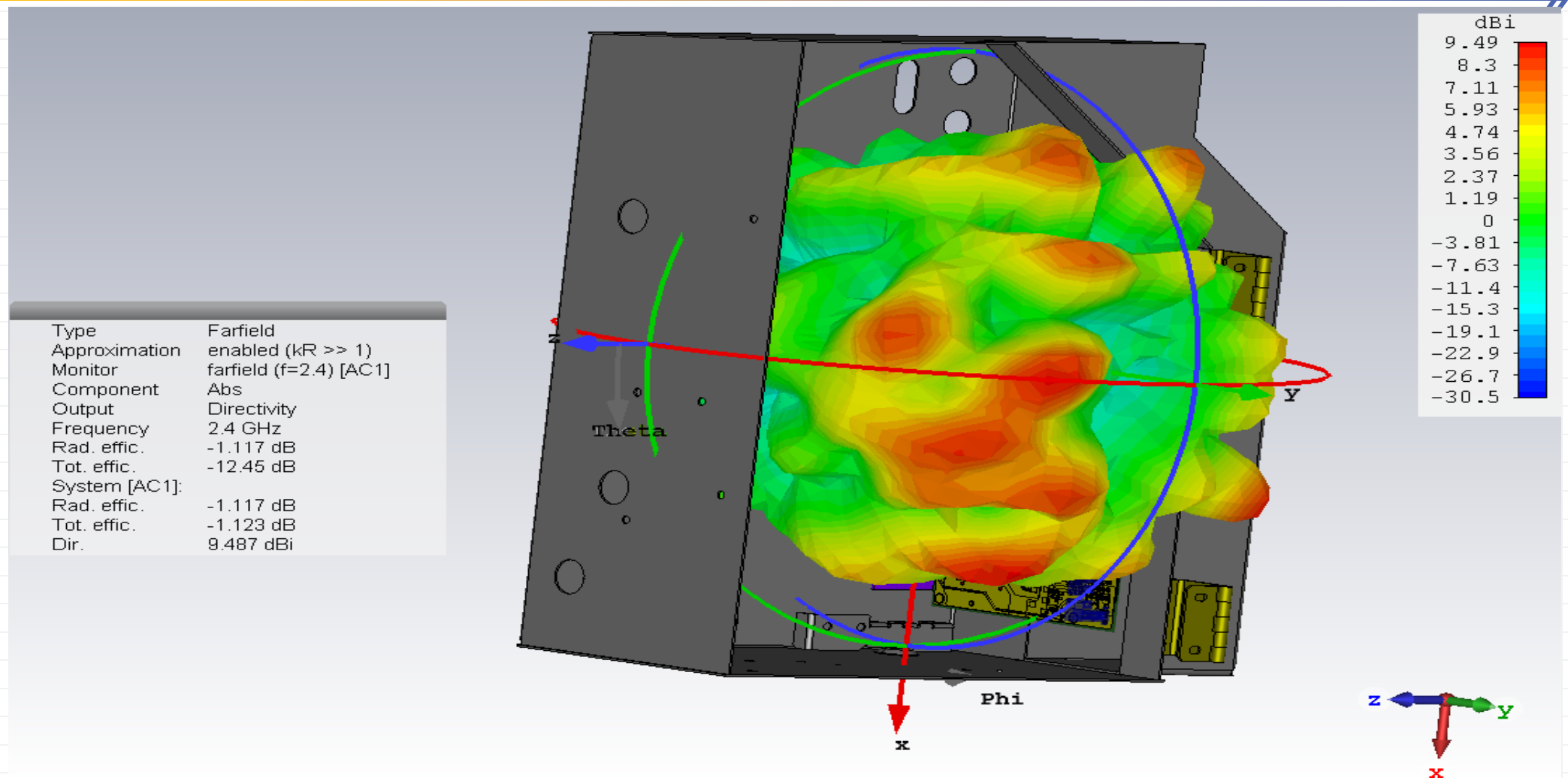
S. No.	Schematic Ref. Des	Values as per Schematic	Optimized Matching Network
1	C288	10 pF	10 pF
2	C289	10 pF	6.8 pF
3	L27	1.5 nH	1 nH
4	C290	10 pF	4.8 pF

**Antenna 1 peak gain
: 4.54 dBi**

- Return Loss comparison**

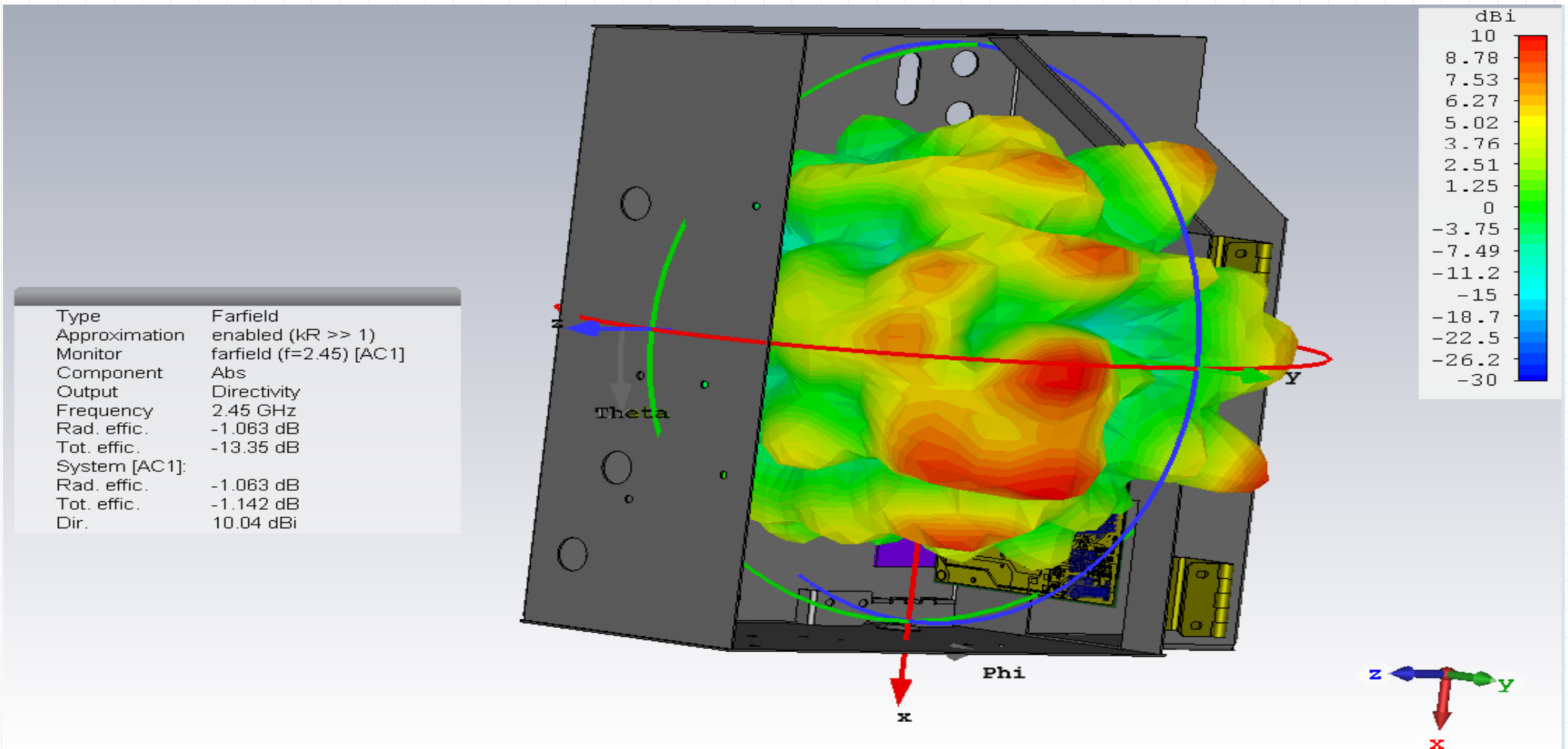
Parameter	Values as per Schematic	Optimized Matching Network
Min Return Loss for Freq band 2.4 -2.48GHz	-1.3 dB	-17dB

Antenna -1 3D Radiation pattern at 2.4 GHz



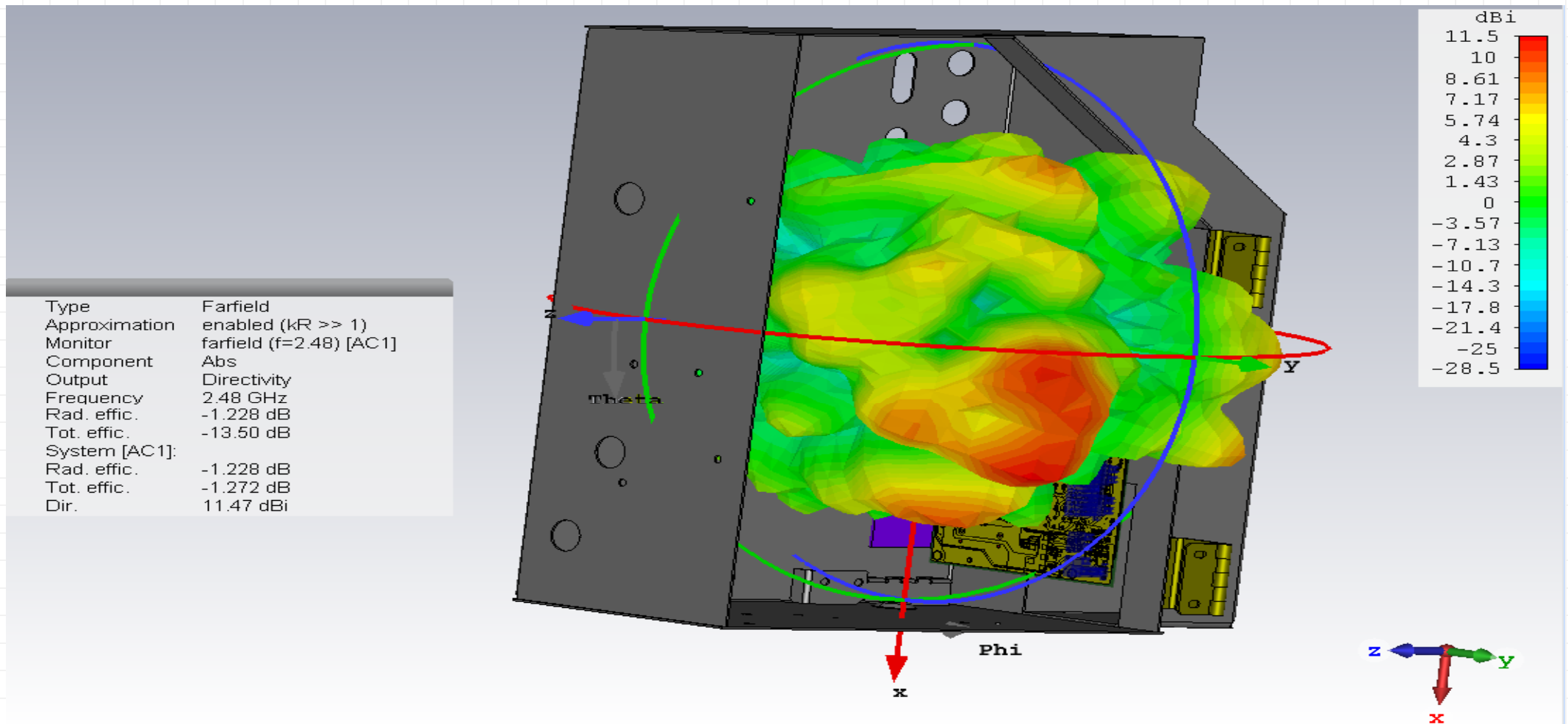
RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna -1 3D Radiation pattern at 2.45 GHz



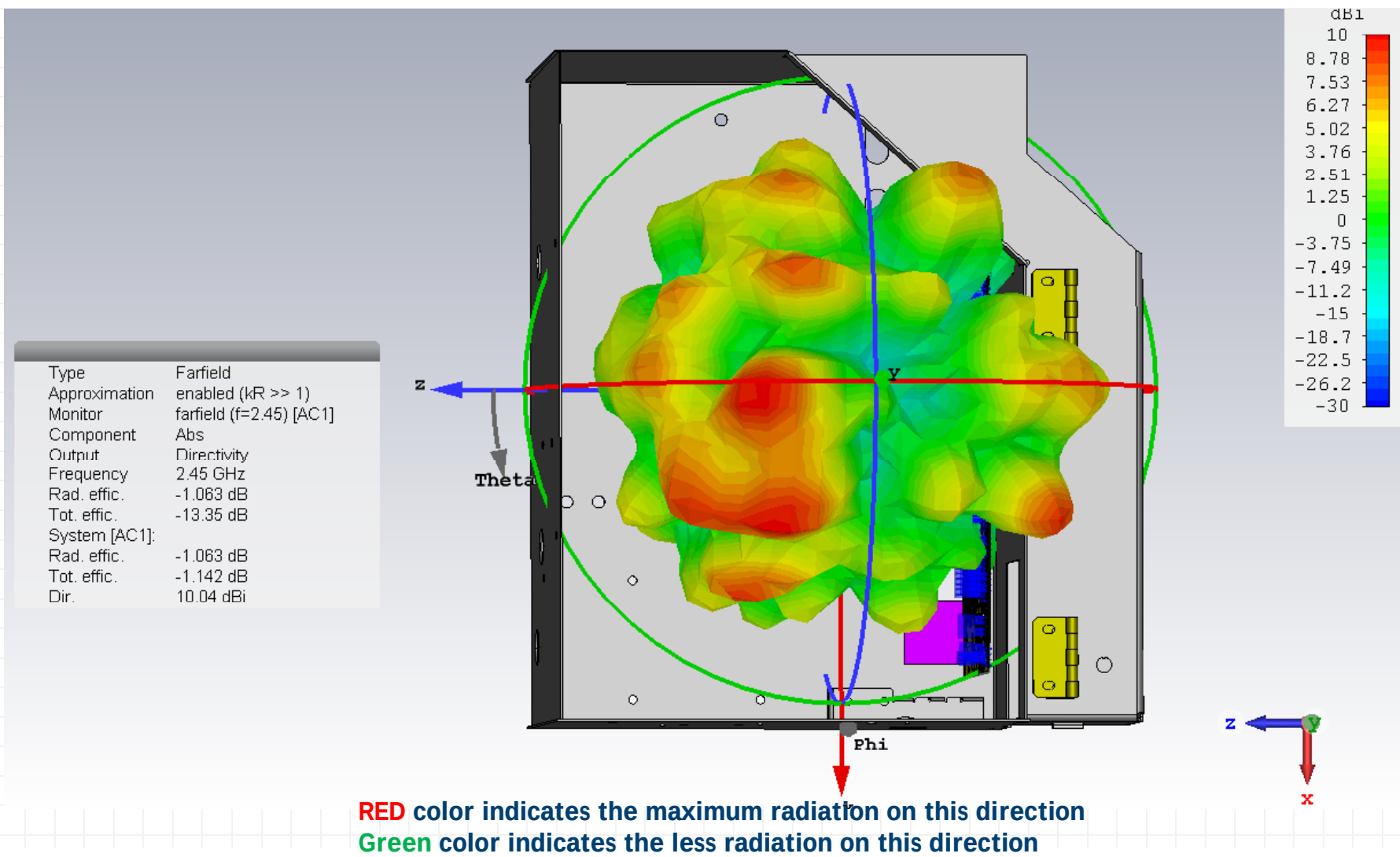
RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna -1 3D Radiation pattern at 2.48 GHz

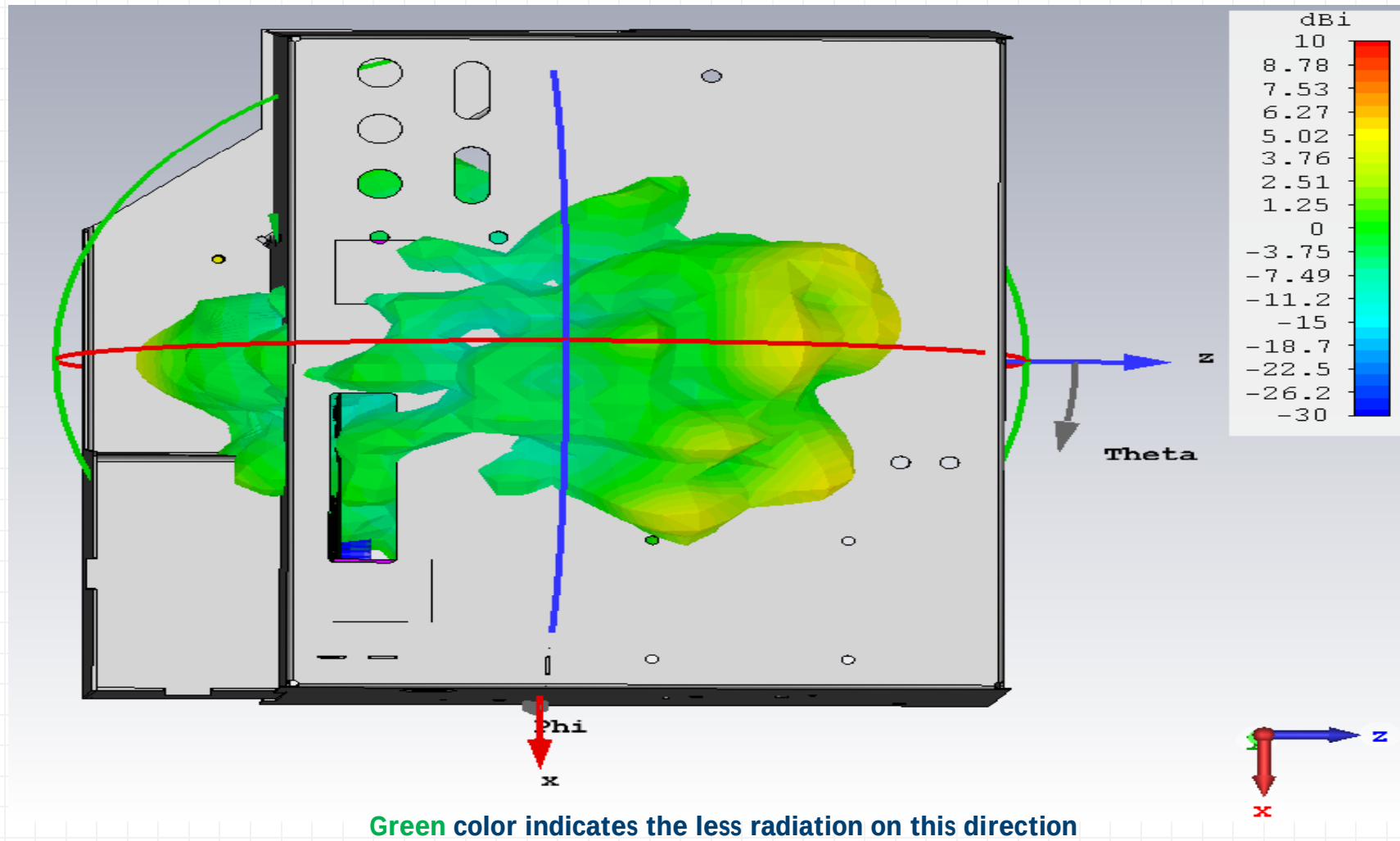


RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

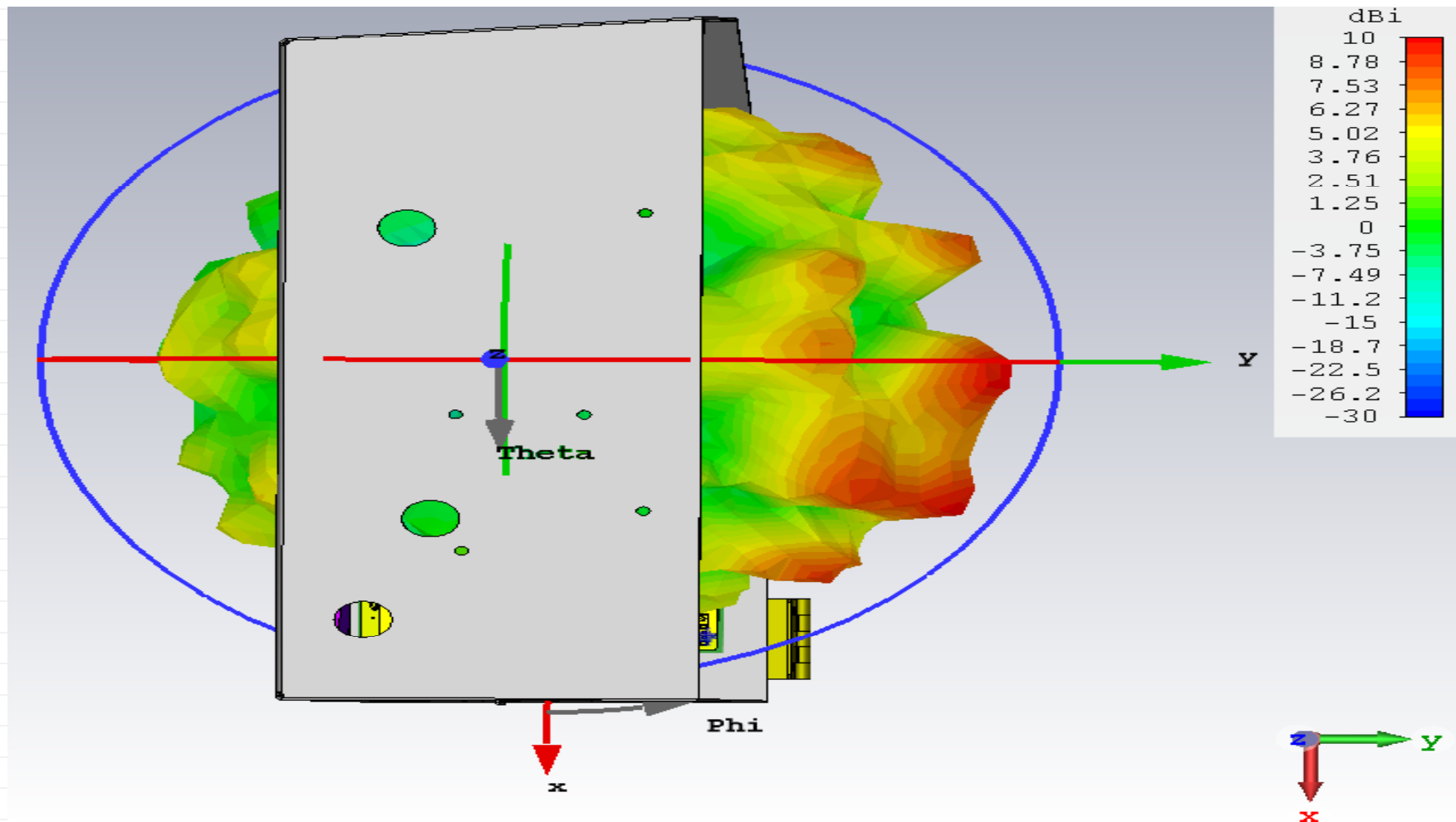
3D Radiation pattern at front side view at 2.45 GHz



Radiation pattern at backside view enclosure at 2.45 GHz

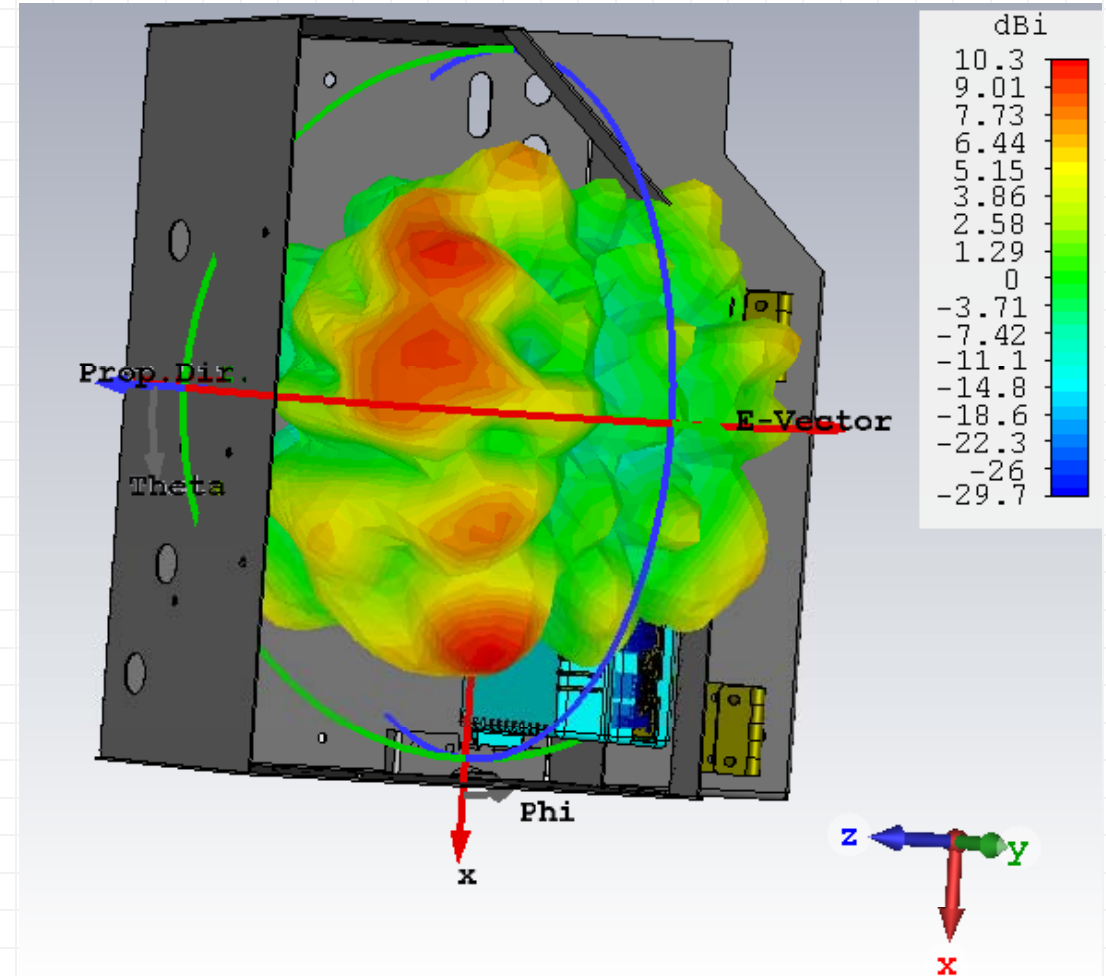
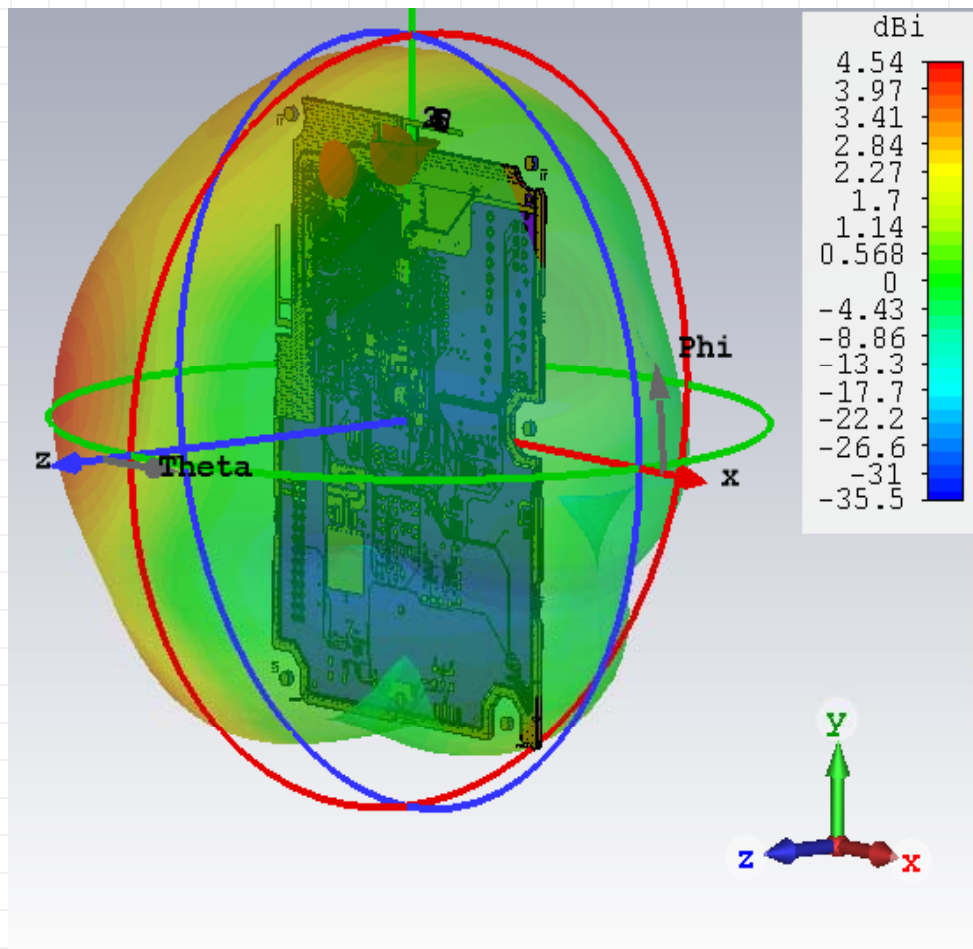


Radiation pattern at side view enclosure at 2.45 GHz



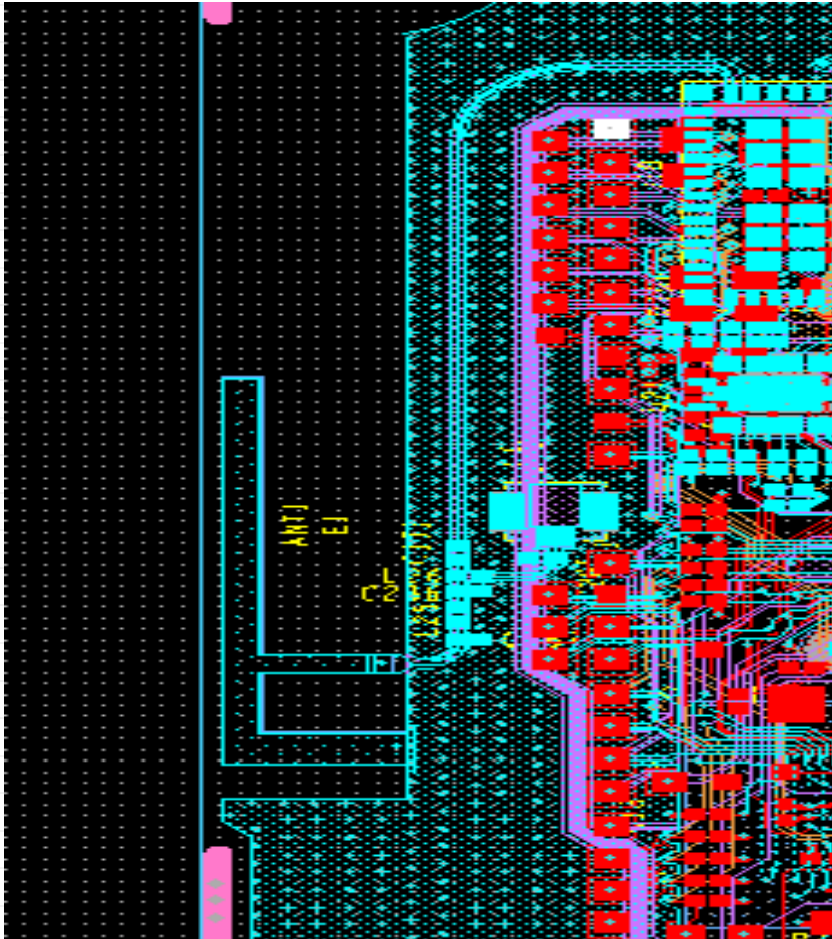
RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna – 1 radiation pattern result comparison

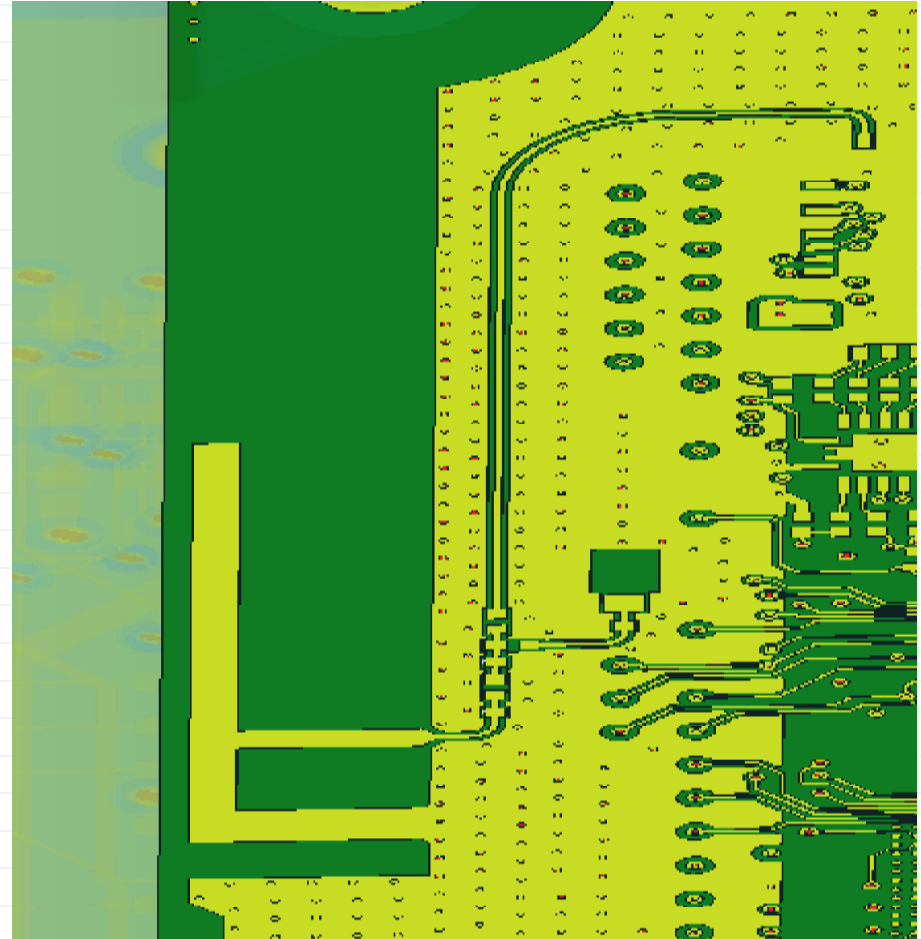


Comparison of radiation pattern of standalone antenna and antenna when placed in the metal enclosure

Wi-Fi Antenna - 2(U18-32) Diagram

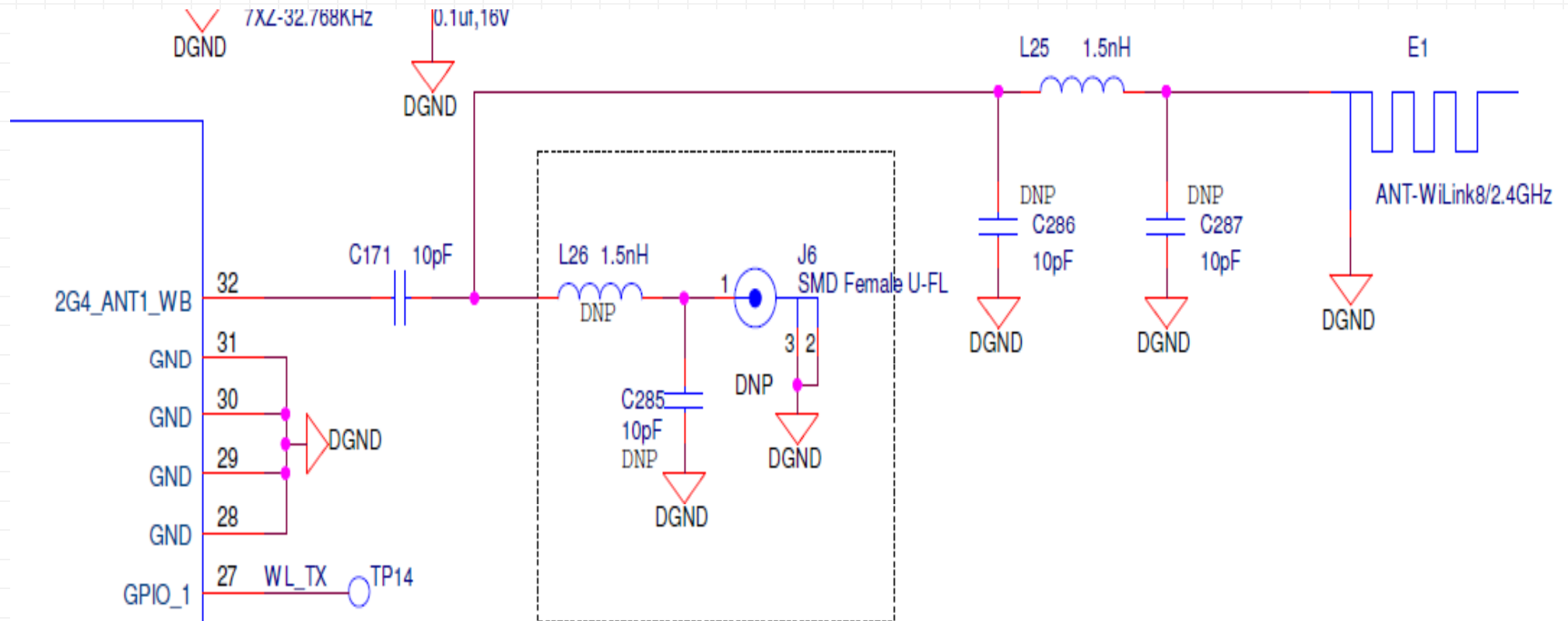


Antenna - 2 OrCAD model diagram

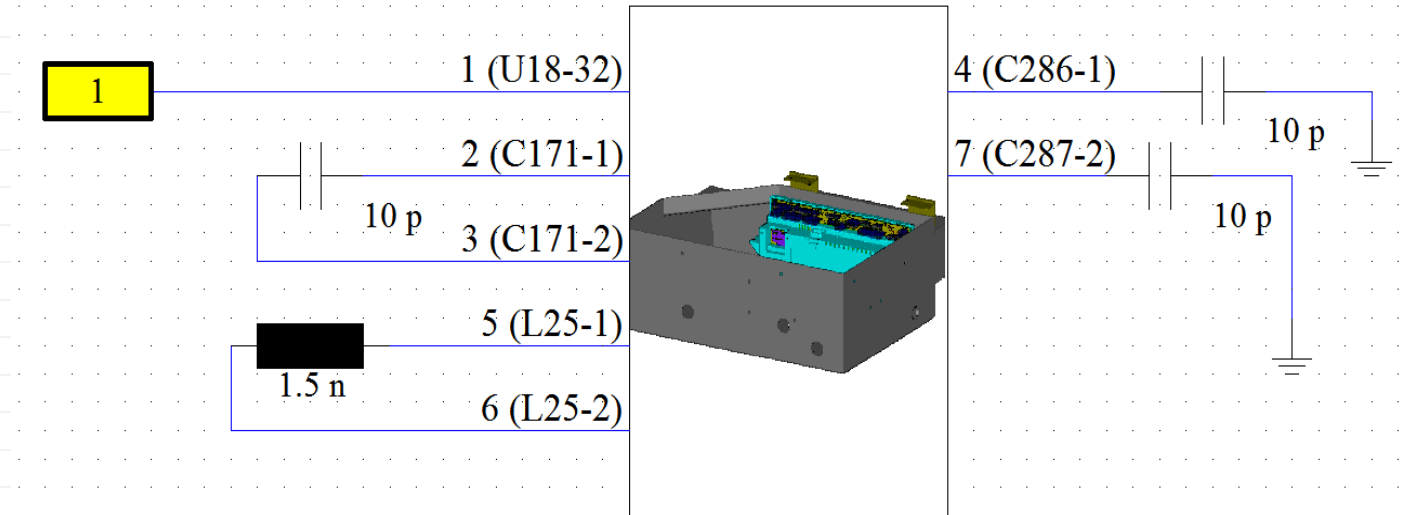


Antenna - 2 CST software model diagram

Antenna -2 schematic circuit



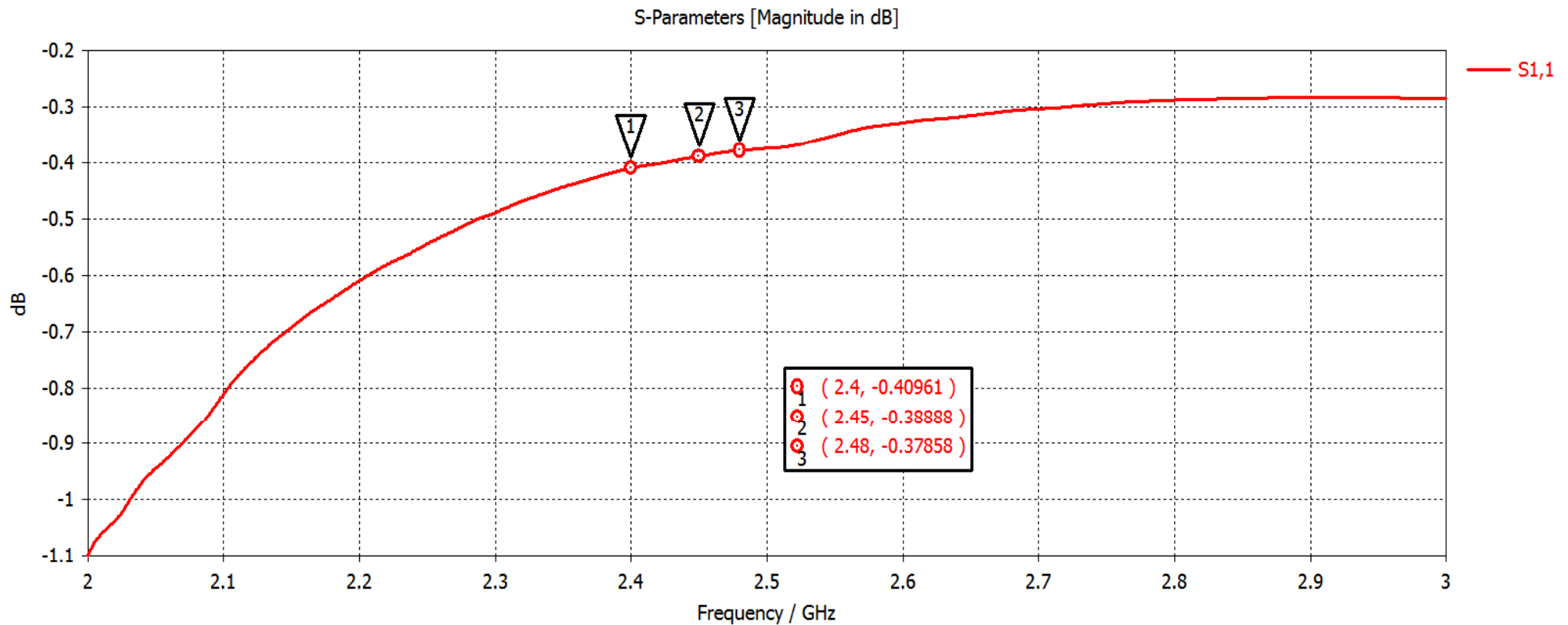
Antenna -2 simulation with schematic circuit values in CST



- CST Library Components Used for Simulation**

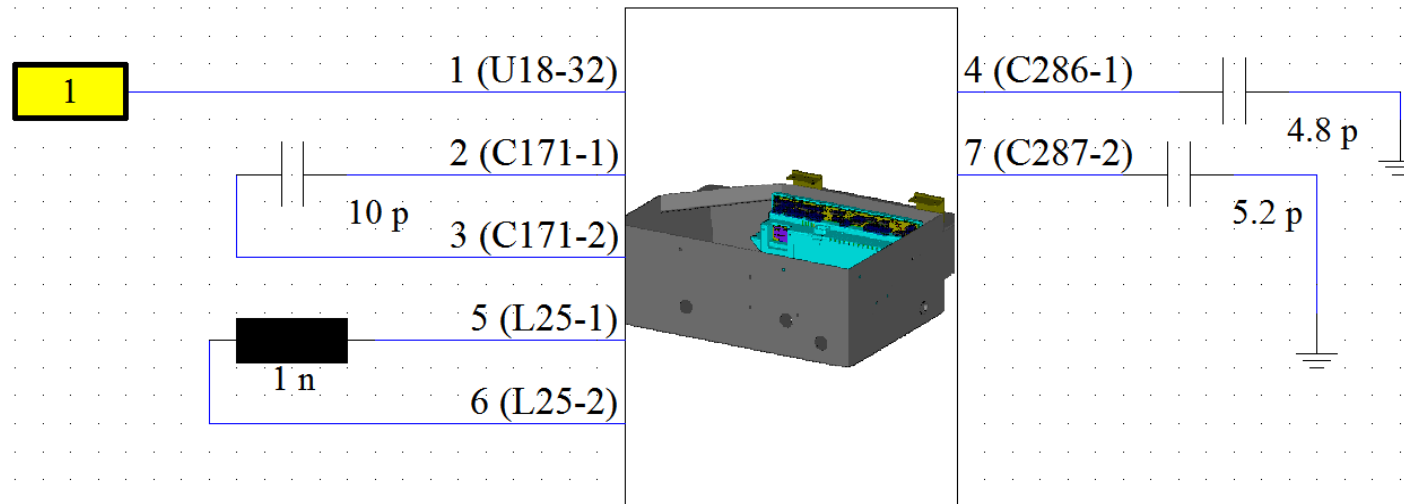
S. No.	Schematic Ref. Des	Value
1	C171	10 pF
2	C286	10 pF
3	L25	1.5 nH
4	C287	10 pF

Antenna -2 simulation result with schematic circuit values



With the Matching network Provided in the Schematic circuit, The min Return Loss is **-0.37dB** for frequency band **2.4** to **2.48GHz**

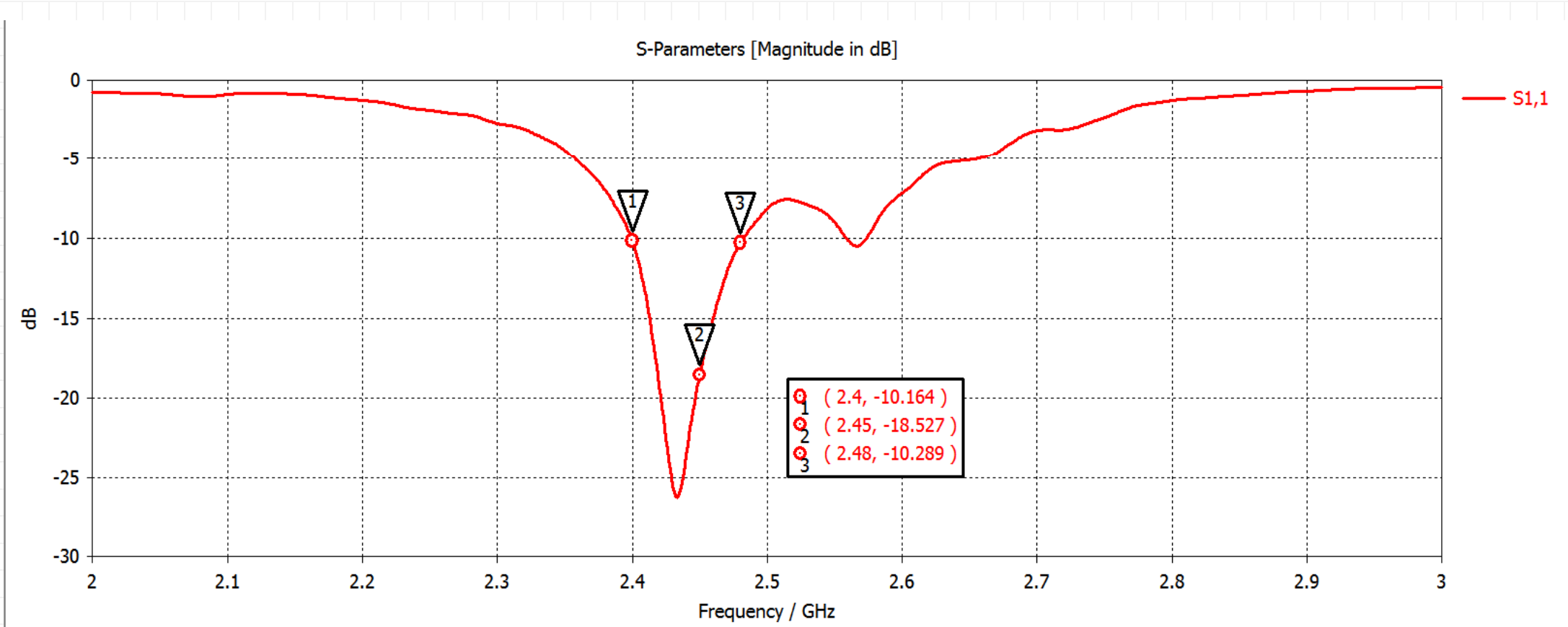
Antenna - 2 Optimized matching Network



- CST Library Component Used for Simulation**

S. No.	Schematic Ref. Des	Value
1	C171	10 pF
2	C286	4.8 pF
3	L25	1 nH
4	C287	5.2 pF

Antenna – 2 Optimized matching Network simulation result



- Min Return Loss of ~10.2 dB is observed @ 2.4 – 2.48GHz

Comparison table

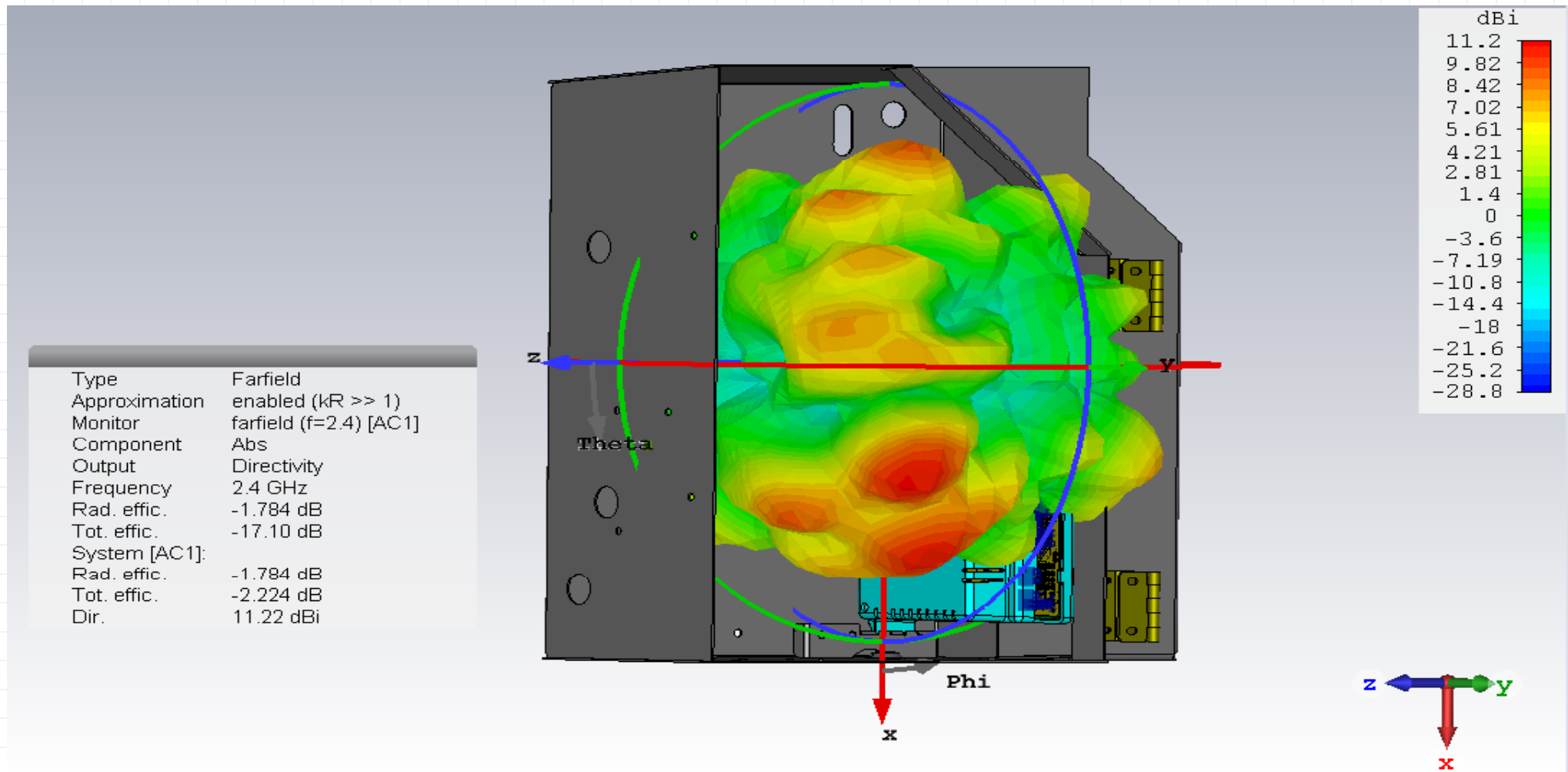
- Component values comparison**

S. No.	Schematic Ref. Des	Values as per Schematic circuit	Optimized Matching Network
1	C171	10 pF	10 pF
2	C286	10 pF	4.8 pF
3	L25	1.5 nH	1 nH
4	C287	10 pF	5.2 pF

- Return Loss comparison**

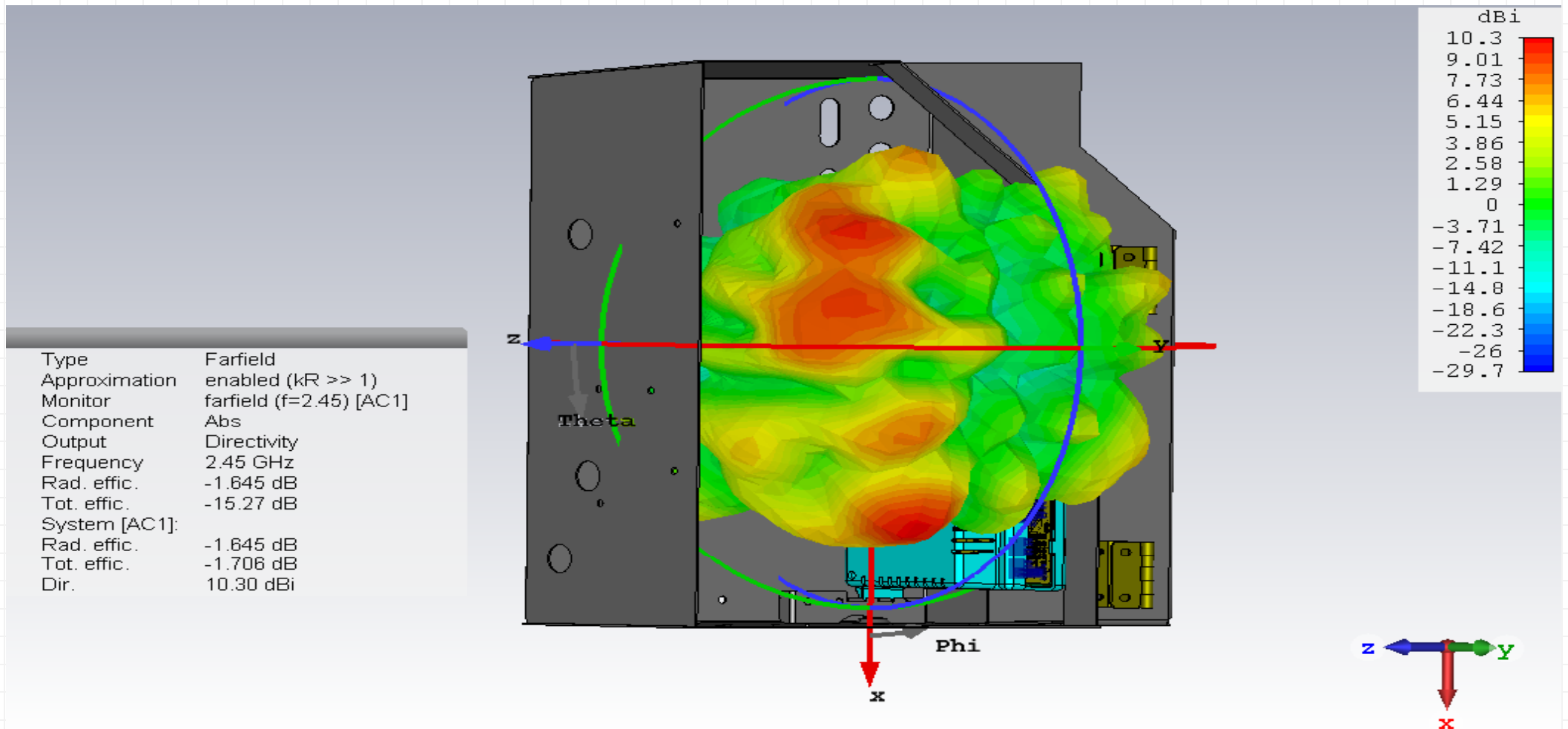
Parameter	Values as per Schematic circuit	Optimized Matching Network
Min Return Loss value for the Frequency band 2.4 -2.48GHz	-0.3 dB	-10.2dB

Antenna -2 3D Radiation pattern at 2.4 GHz



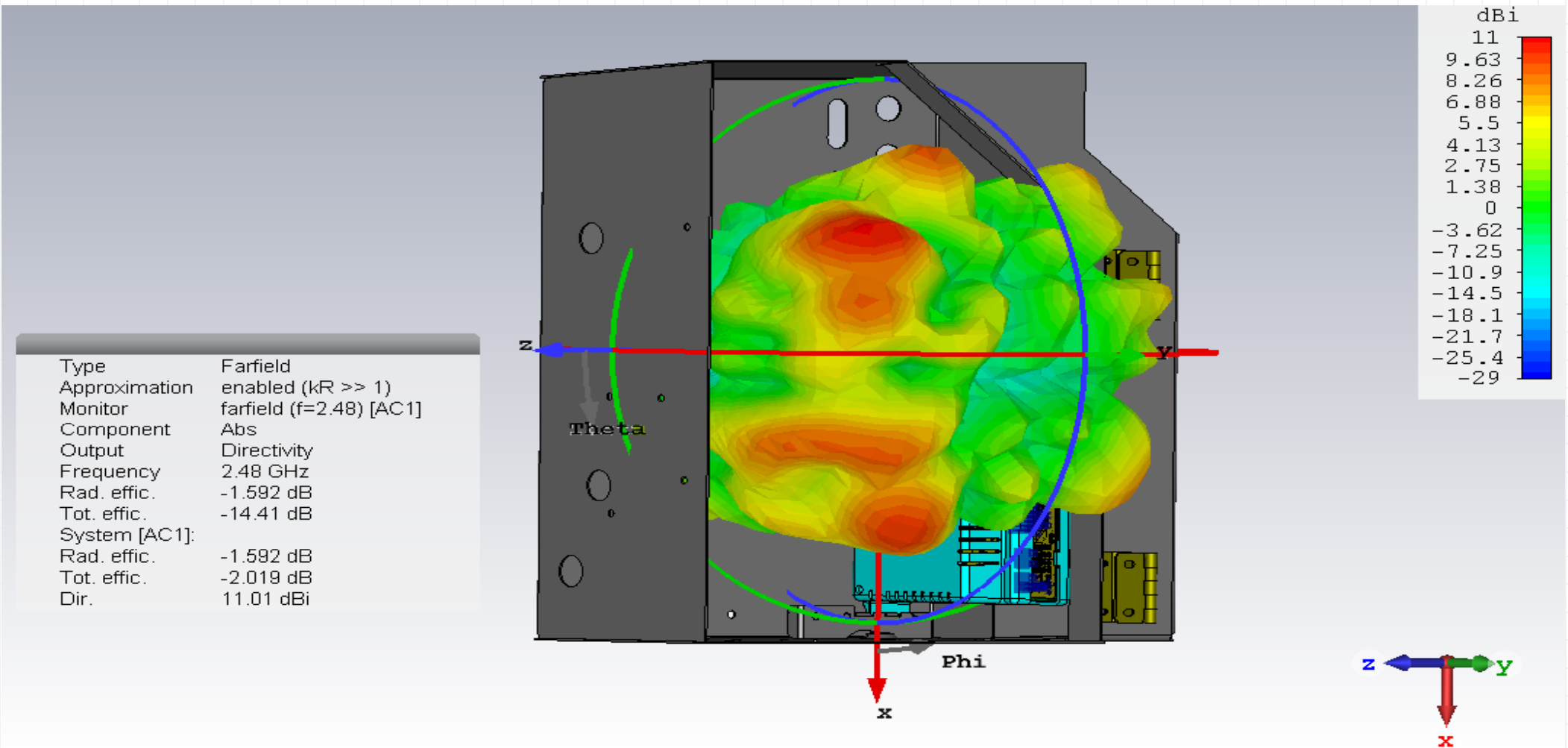
RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna -2 3D Radiation pattern at 2.45 GHz



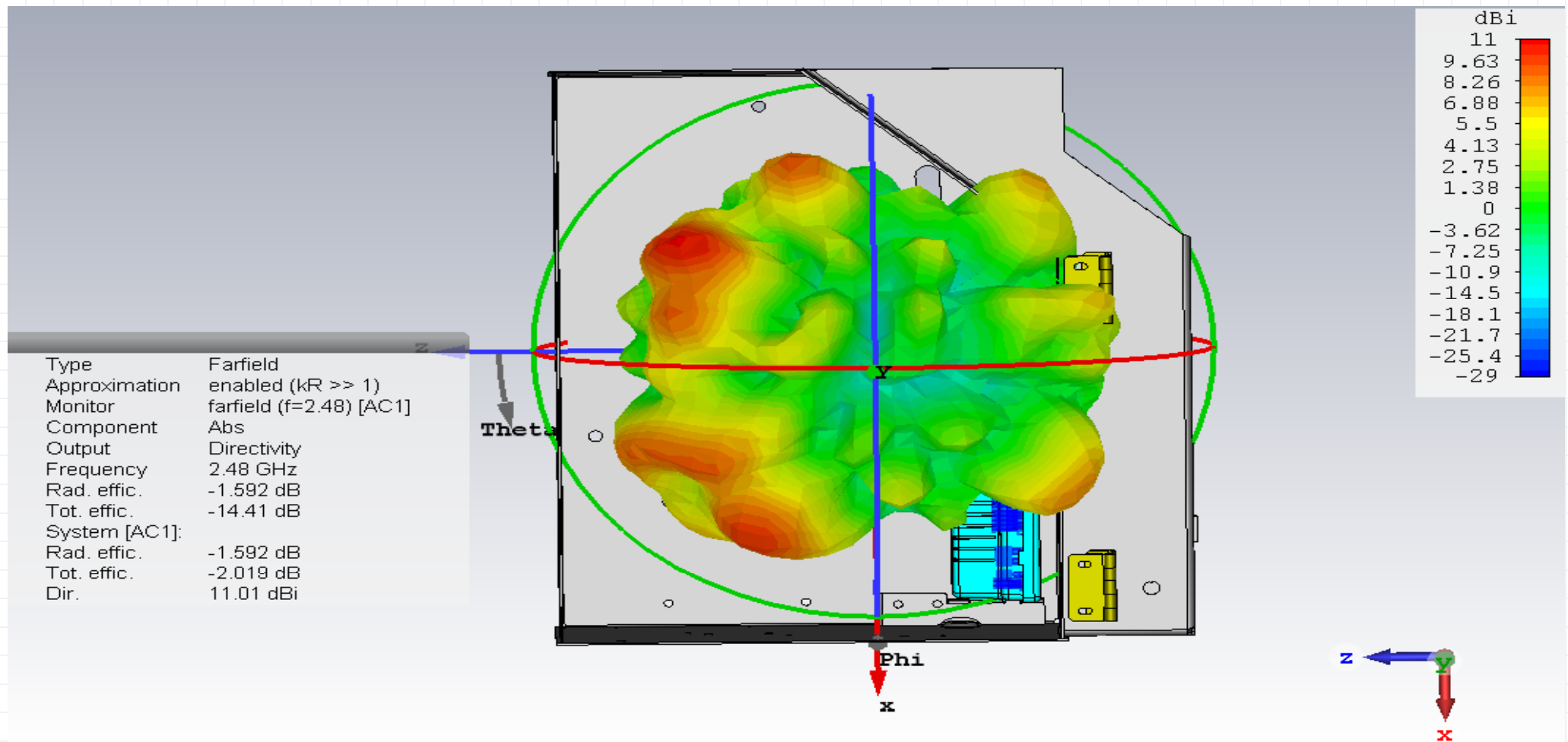
RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna -2 3D Radiation pattern at 2.48 GHz



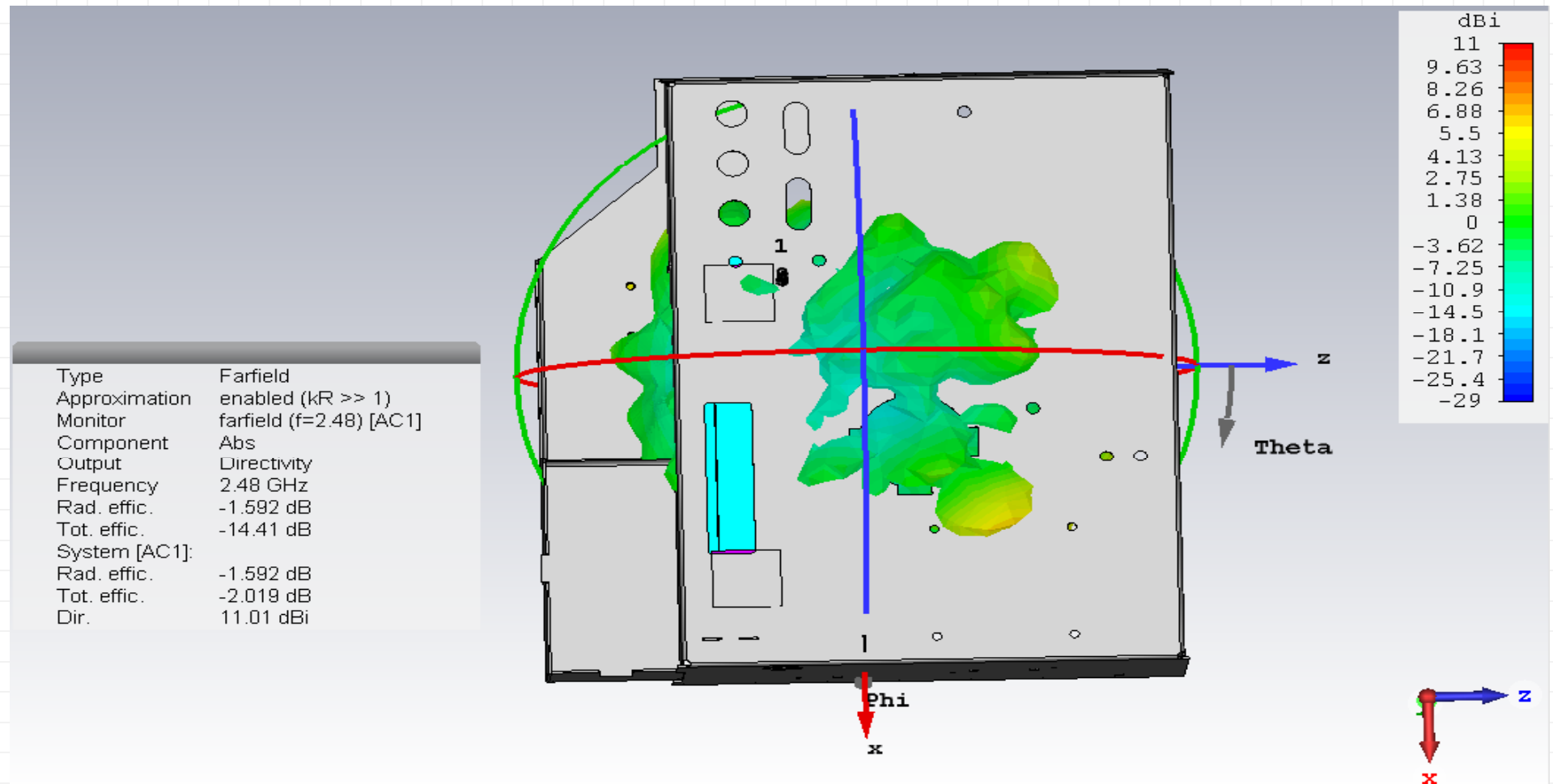
RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna-2 3D Radiation pattern at front side view at 2.45 GHz

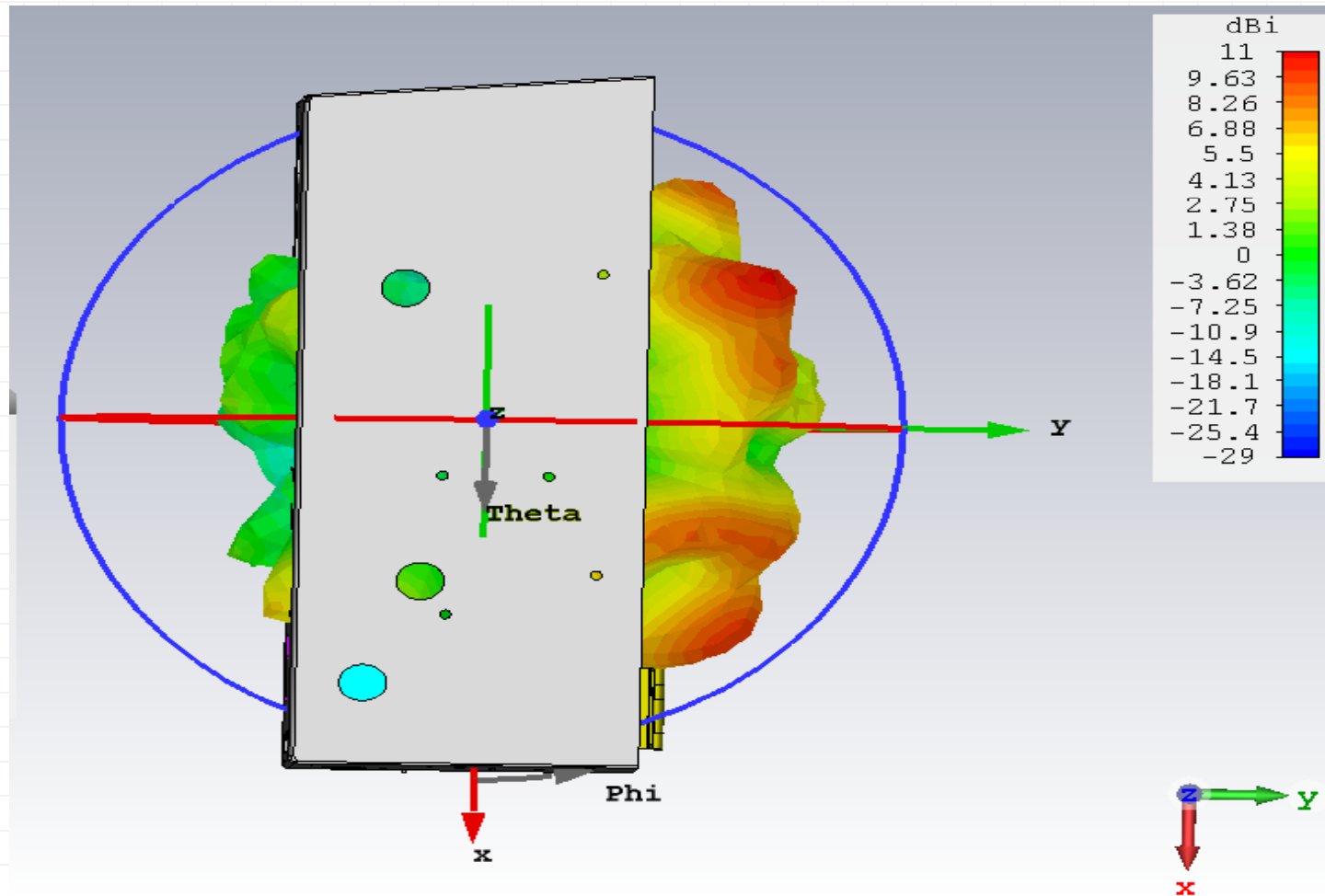


RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna -2 Radiation pattern at backside view enclosure at 2.45 GHz

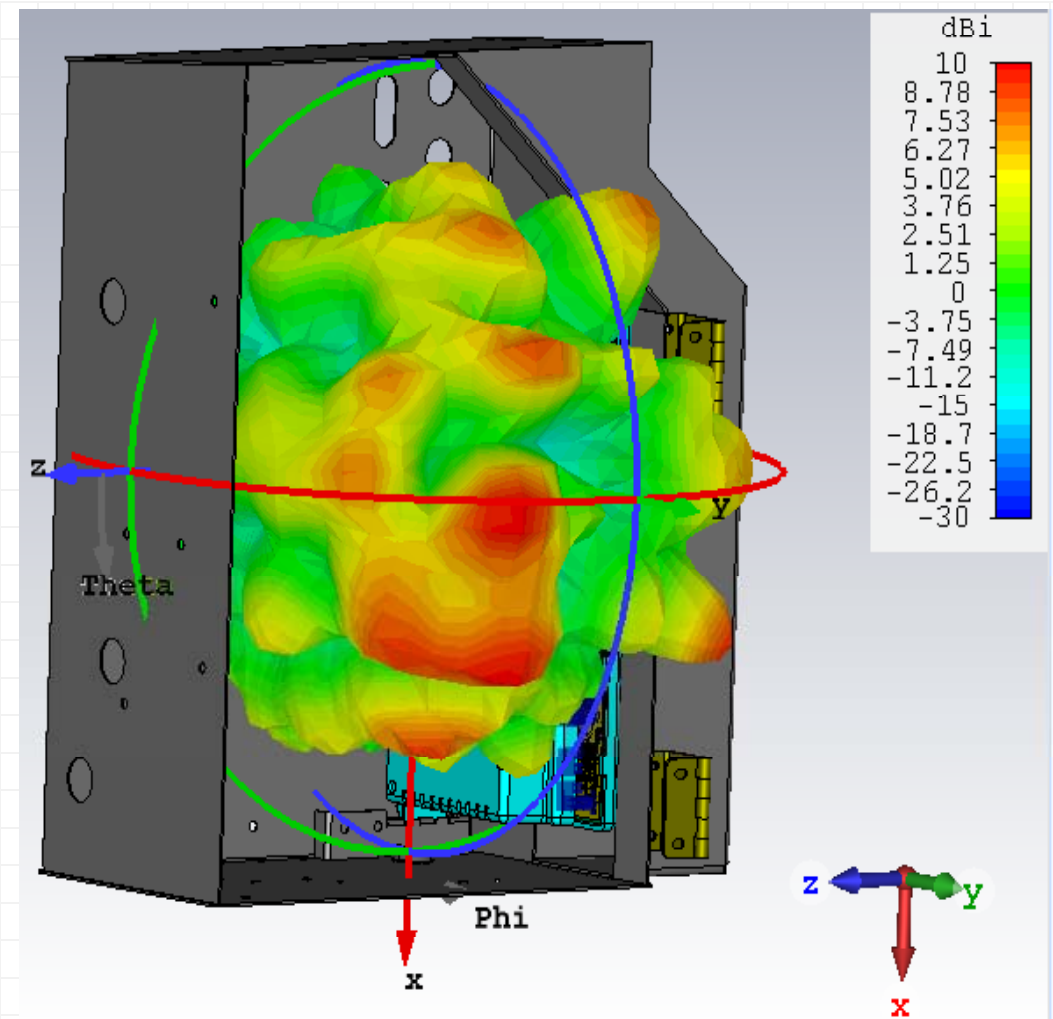
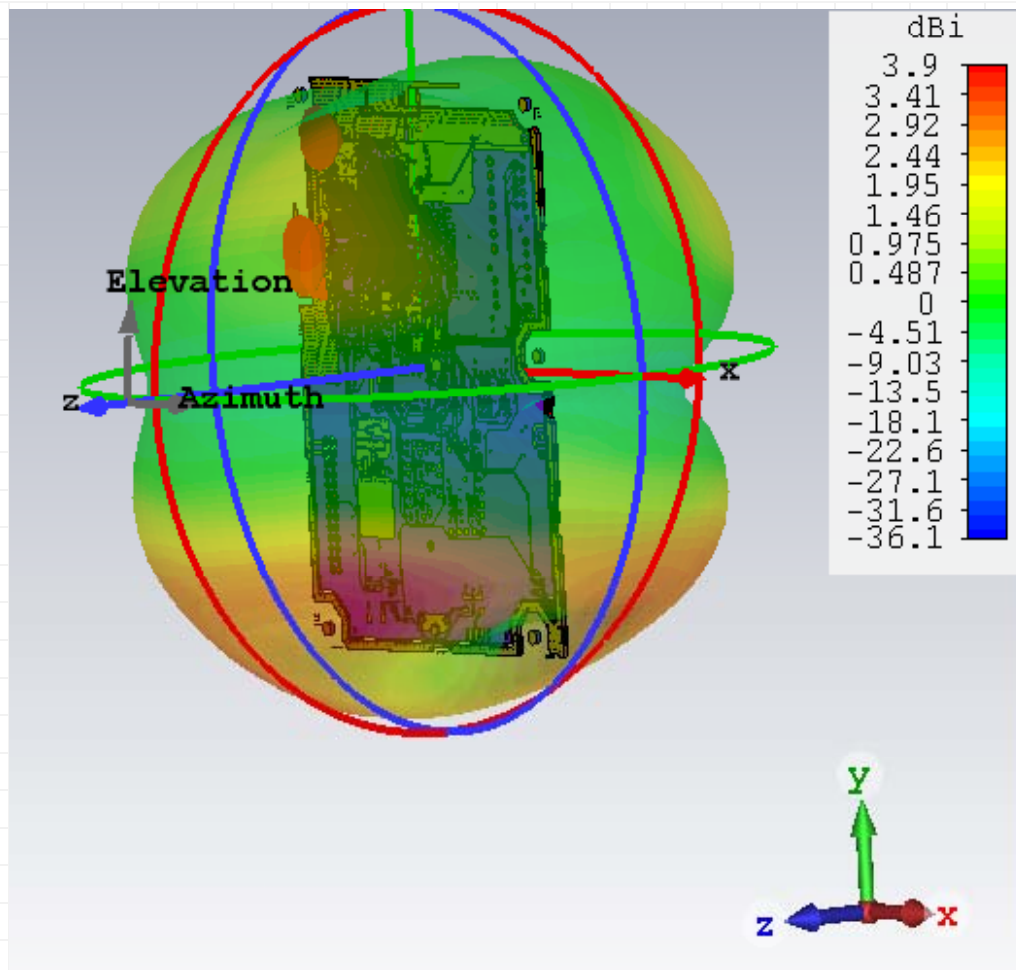


Antenna -2 Radiation pattern at side view enclosure at 2.45 GHz

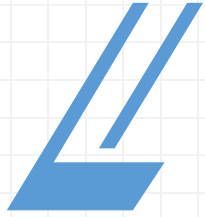


RED color indicates the maximum radiation on this direction
Green color indicates the less radiation on this direction

Antenna – 2 radiation pattern result comparison



Comparison of radiation pattern of standalone antenna and antenna when placed in the metal enclosure



THANK YOU

