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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DESIGN OF MIMO ANTENNA FOR COMMUNICATION SYSTEMS

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❖ABSTRACT

- **In fifth-generation (5G) communication systems**, the use of multiple input, multiple output (MIMO) antenna technology satisfies **the need for higher data speeds** and more channel capacity. MIMO systems use several antennas inside mobile terminals to improve communication and spectrum efficiency.
- The rise of MIMO technology as a viable option for wireless communication offers **increased effectiveness and performance**.
- Traditional **F-type** topologies are usually restricted to **dual-frequency bands**, even though they have made MIMO miniaturization easier.
- Many designs of **triple-band antennas** have been created to maximize the **utilization of the spectrum**. These designs frequently use methods to achieve numerous frequency bands, such as slot apertures and etchings or coupled feed and parasitic arms.
- **Three-segment zigzag patches** and shared feeder connections to microstrip lines are two examples.
- However, these developments frequently lead to greater antenna volumes, which restricts their usefulness. Subsequent efforts ought to concentrate on improving MIMO antenna **designs to achieve a balance between small form factors and performance enhancement.**

❖OBJECTIVES

- The main objective of this project is to understand the working and the design of the antenna.
- To design the antenna according to designed specifications.
- To be acquainted with some of the characteristics of parasitic antenna element modelling and operations.
- To know the antenna radiation pattern.
- To perform fastest data transfer
- Test antenna and verify it performs as expected.

❖ EXISTING METHOD

- For multi input multi output (MIMO) functioning, a new tri-band monopole antenna is mirrored. Although grounded antennas meet all the requirements and are therefore commonly employed, their large size and three-dimensional shape make them impractical. As a result, MIMO antennas are becoming more common.
- It has been thoroughly studied that MIMO technology can **increase data transmission speed** and provides **resistance against multiple path fading**.
- The **FR4 Substrate**, upon which the MIMO antenna is developed, generates its tri **band performance** through its antenna design.
- Based on the comparison, it can be concluded that the proposed MIMO antenna offers greater accomplishments and **foregoing antenna qualitie**s, which are required for the modern mobile devices that are heading toward 5G wireless systems

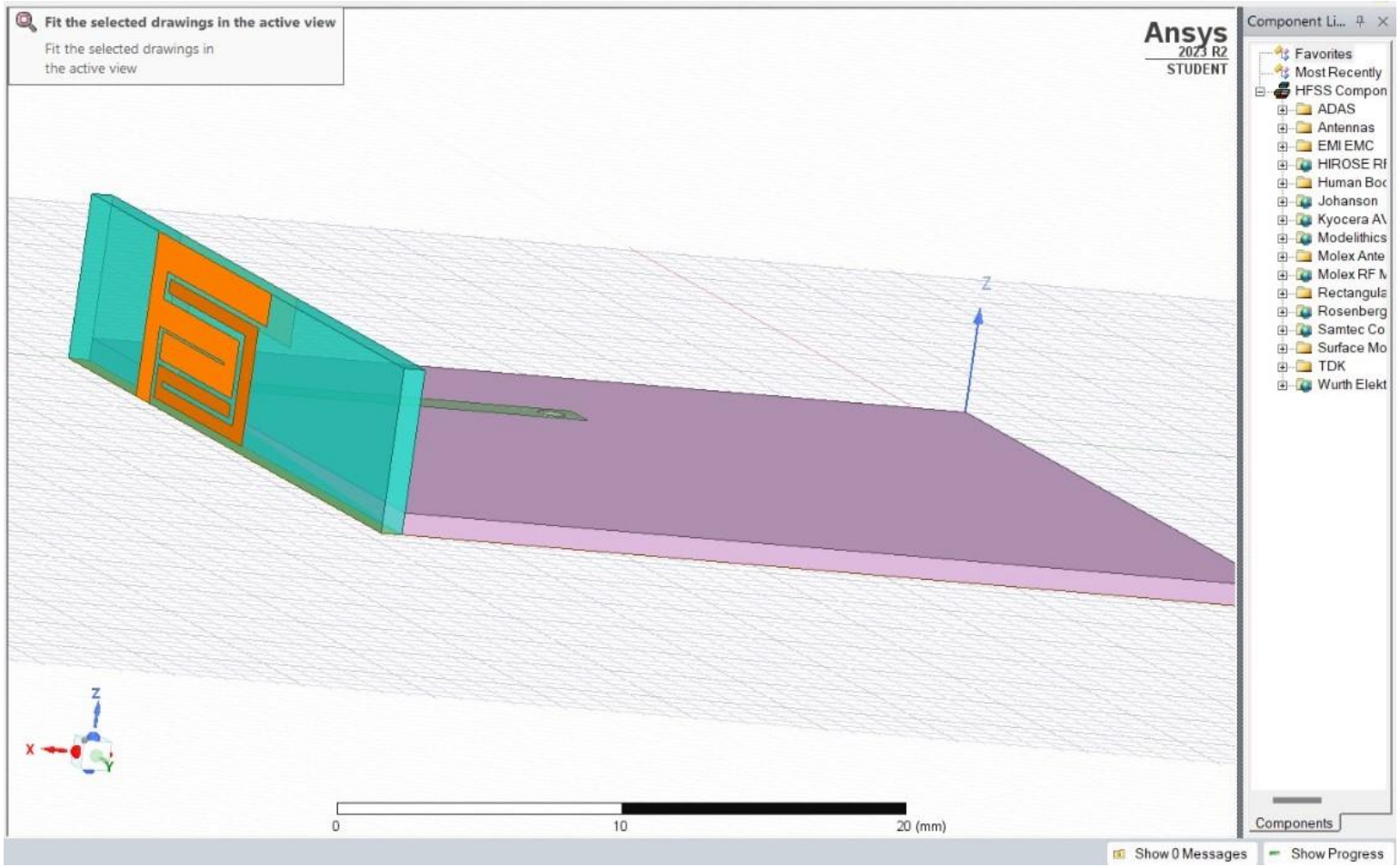
❖ PROPOSED METHOD

- Reflected grounded antennas are a novel type of antenna used for multi input multi output (MIMO) operations. They meet all the requirements and are typically utilized, but their large size and three-dimensional shape make them impractical. Thus, MIMO antennas are becoming more and more common.
- It has been thoroughly studied that MIMO technology can **increase data transmission speed and provides resistance against multiple path fading**. The tri-band performance of the **FR4 Substrate**, upon which the MIMO antenna is based, is produced by the antenna design.
- The MIMO **performance and radiation parameters** of the suggested 5G smartphone antenna array are representations of the **diversity antenna element's design and features**. It looks into the intended smartphone antenna array's radiation behavior close to the user.
- Ansoft HFSS software is used to model the beams in the proposed structure**. Beam forming antennas' reduced power** needs for antenna design huge MIMO systems' lower power consumption and amplifier expenses are **the consequence of cost savings and signal transmission** to the intended user.

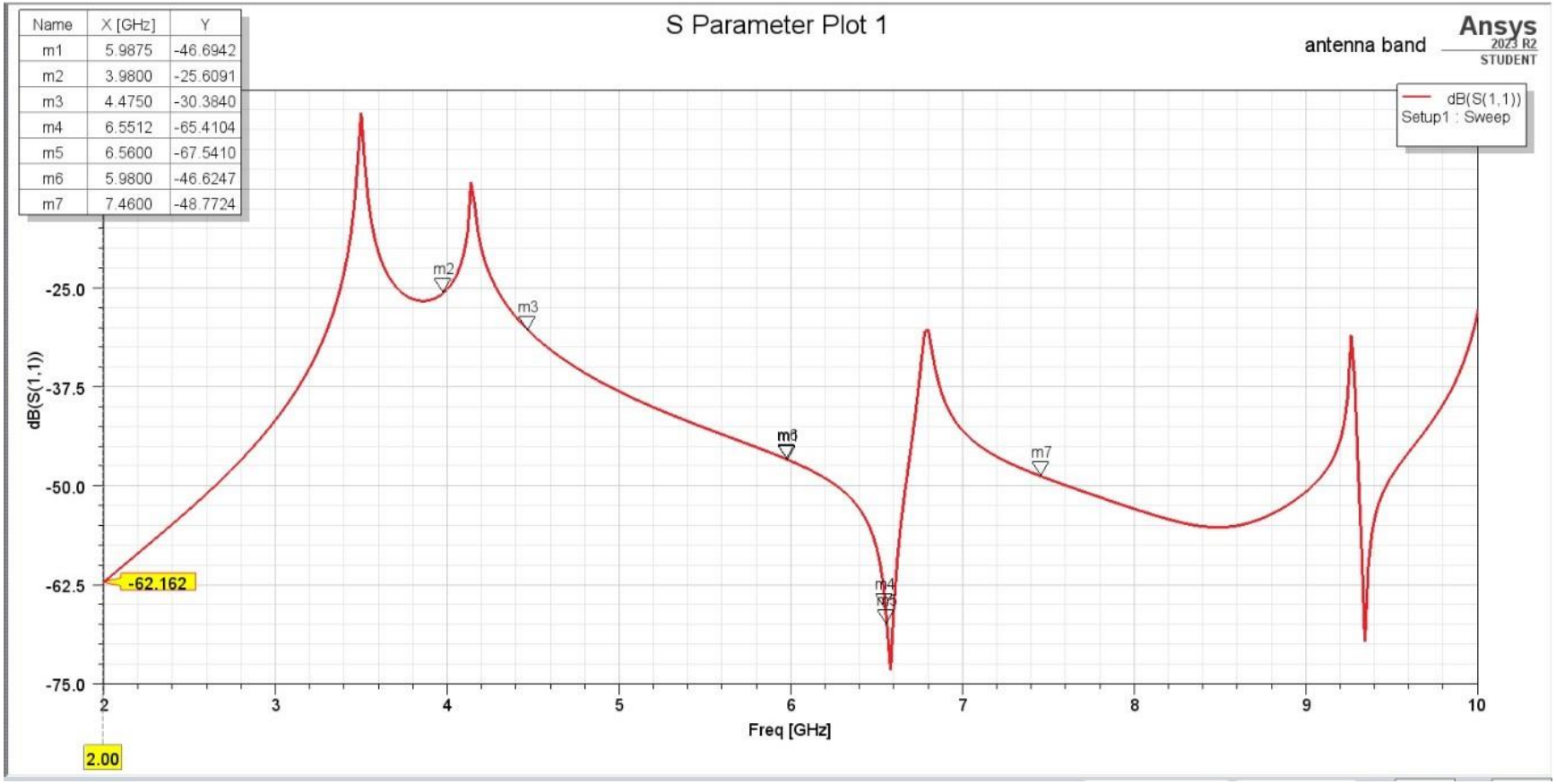
❖ SOFTWARE USED

- Ansys HFSS.
- HFSS - High Frequency Structure Simulator

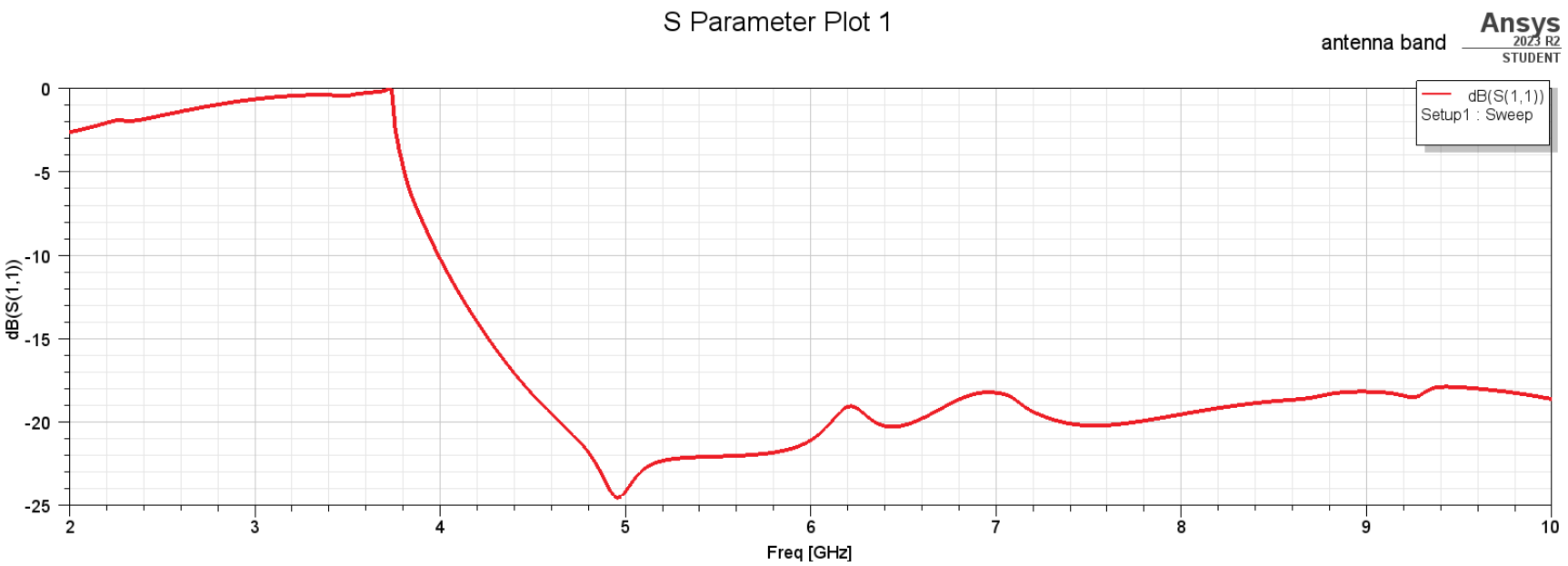
❖ PROPOSED DESIGN



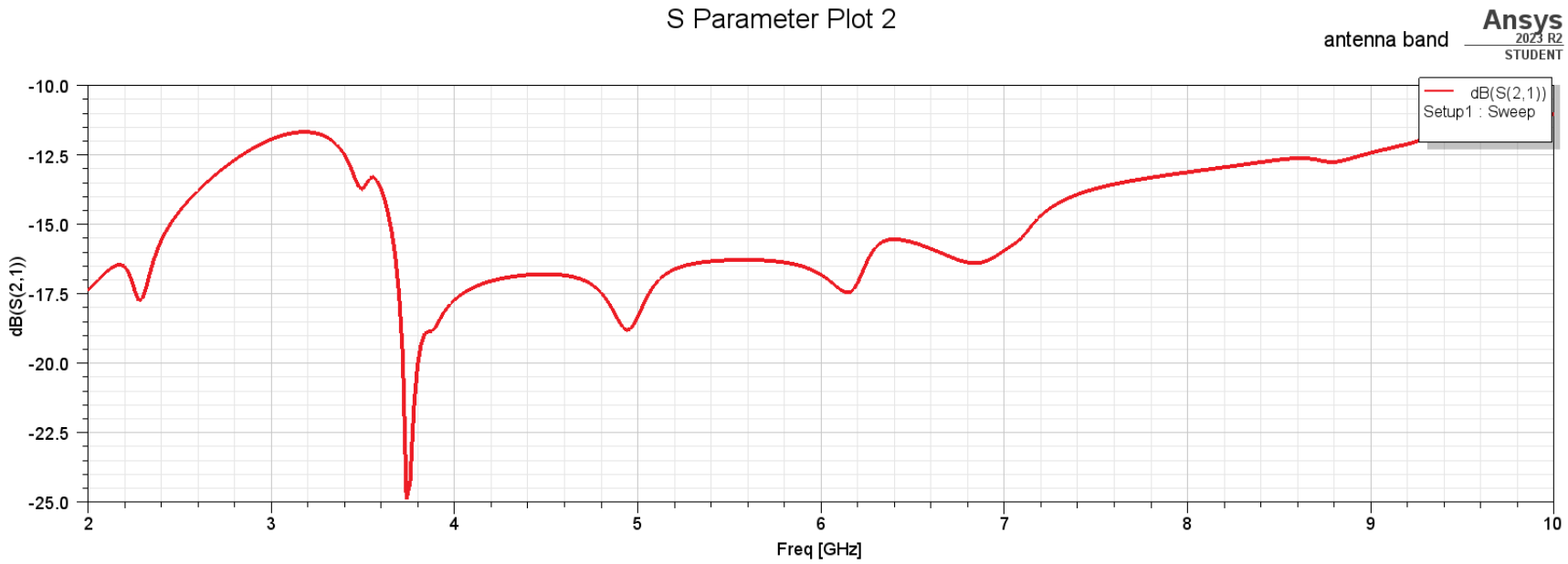
❖ S PARAMETER


Name | X [GHz] | Y
m1 | 5.9875 | -46.6942
m2 | 3.9800 | -25.6091
m3 | 4.4750 | -30.3840
m4 | 6.5512 | -65.4104
m5 | 6.5600 | -67.5410
m6 | 5.9800 | -46.6247
m7 | 7.4600 | -48.7724
S Parameter Plot 1
antenna band
Ansys
2023 R2
STUDENT
dB(S(1,1))
Setup1 : Sweep
dB(S(1,1))
-25.0
-37.5
-50.0
-62.5
-75.0
-62.162
2.00
2
3
4
5
6
7
8
9
10
Freq [GHz]
m1
m2
m3
m4
m5
m6
m7

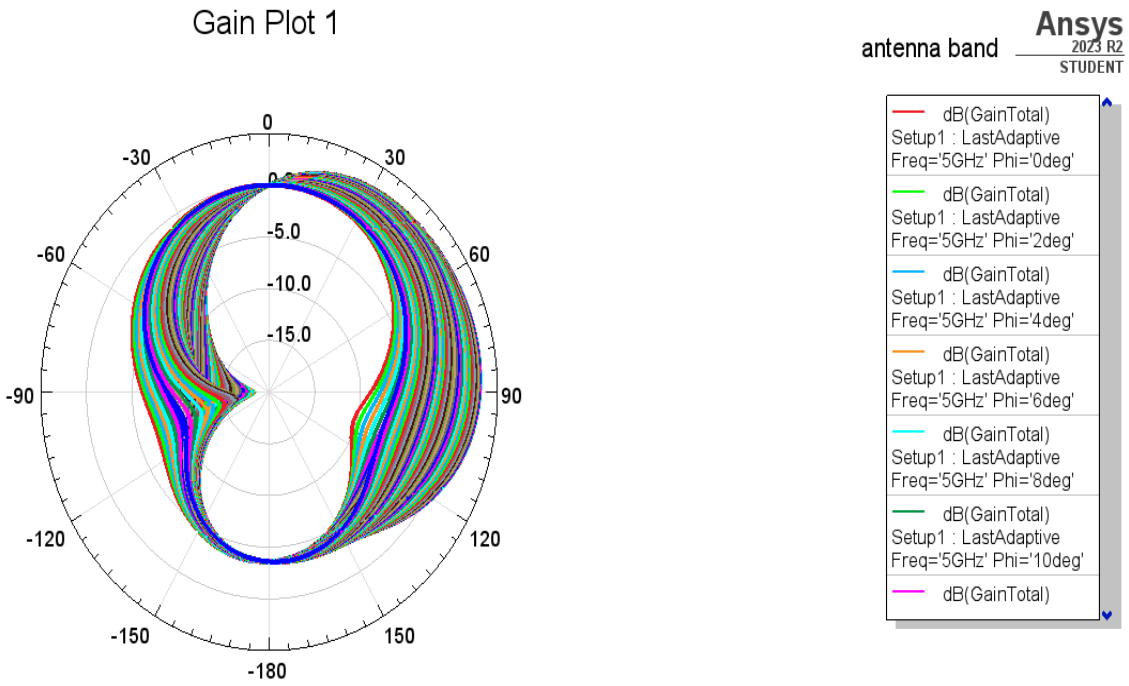
❖ RETURN LOSS


S Parameter Plot 1
antenna band
Ansys
2023 R2
STUDENT
dB(S(1,1))
Setup1 : Sweep
0
-5
-10
-15
-20
-25
dB(S(1,1))
2
3
4
5
6
7
8
9
10
Freq [GHz]

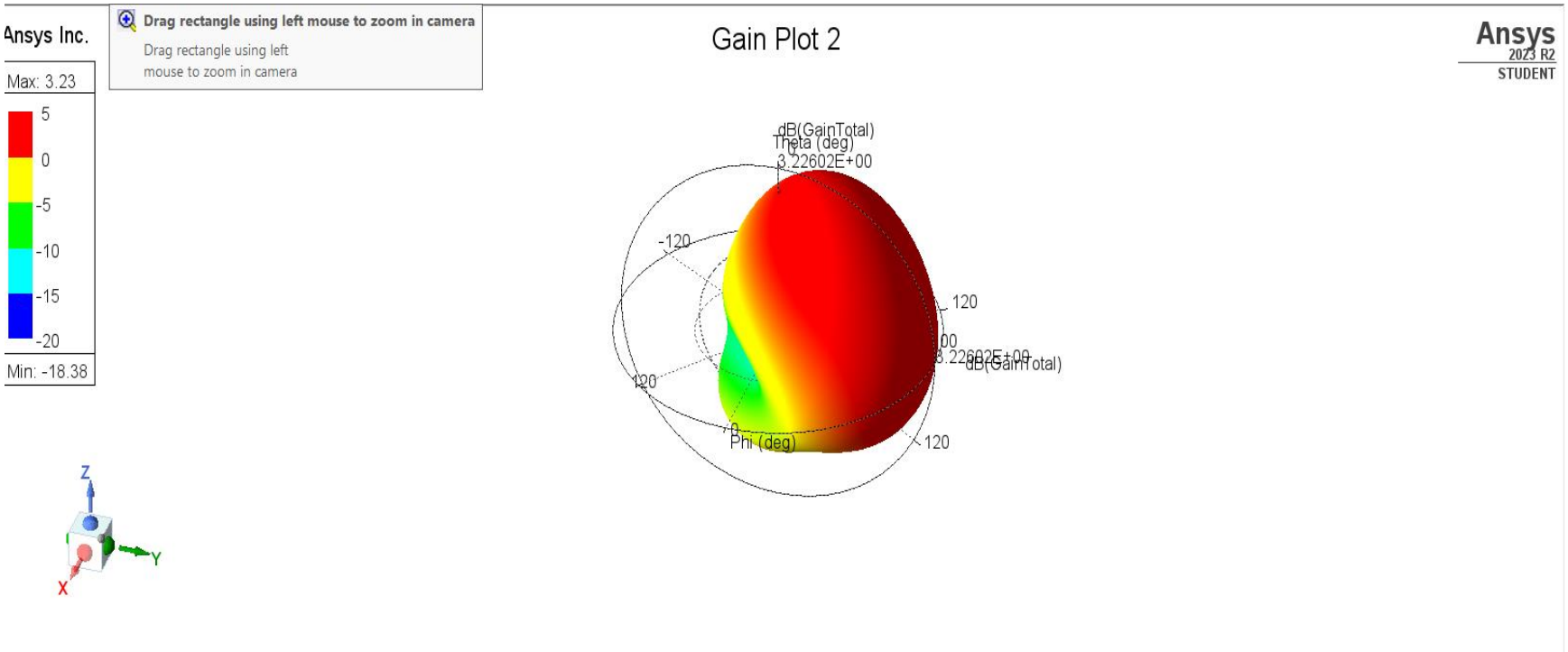
❖ INSERTION LOSS



❖ GAIN


Gain Plot 1
antenna band
Ansys
2023 R2
STUDENT
0
30
60
90
120
150
-180
-150
-120
-90
-60
-30
-5.0
-10.0
-15.0
dB(GainTotal)
Setup1 : LastAdaptive
Freq='5GHz' Phi='0deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='5GHz' Phi='2deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='5GHz' Phi='4deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='5GHz' Phi='6deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='5GHz' Phi='8deg'
dB(GainTotal)
Setup1 : LastAdaptive
Freq='5GHz' Phi='10deg'
dB(GainTotal)

❖ RADIATION PATTERN



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❖ OUTCOME

- International conference on recent development in engineering & technology – ICRDET’24

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Thank you!