



PRO1

Diversitech R755W_D

Custom Antenna Design Review

28 October 2025

DESIGN ENGINEERING · SUPPLY CHAIN · MANUFACTURING



A Celestica Company

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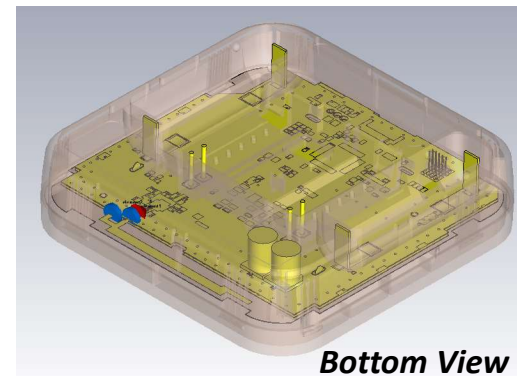
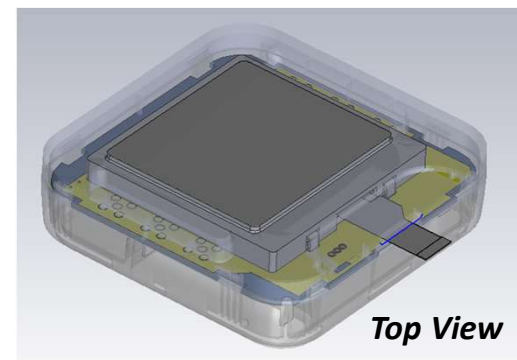
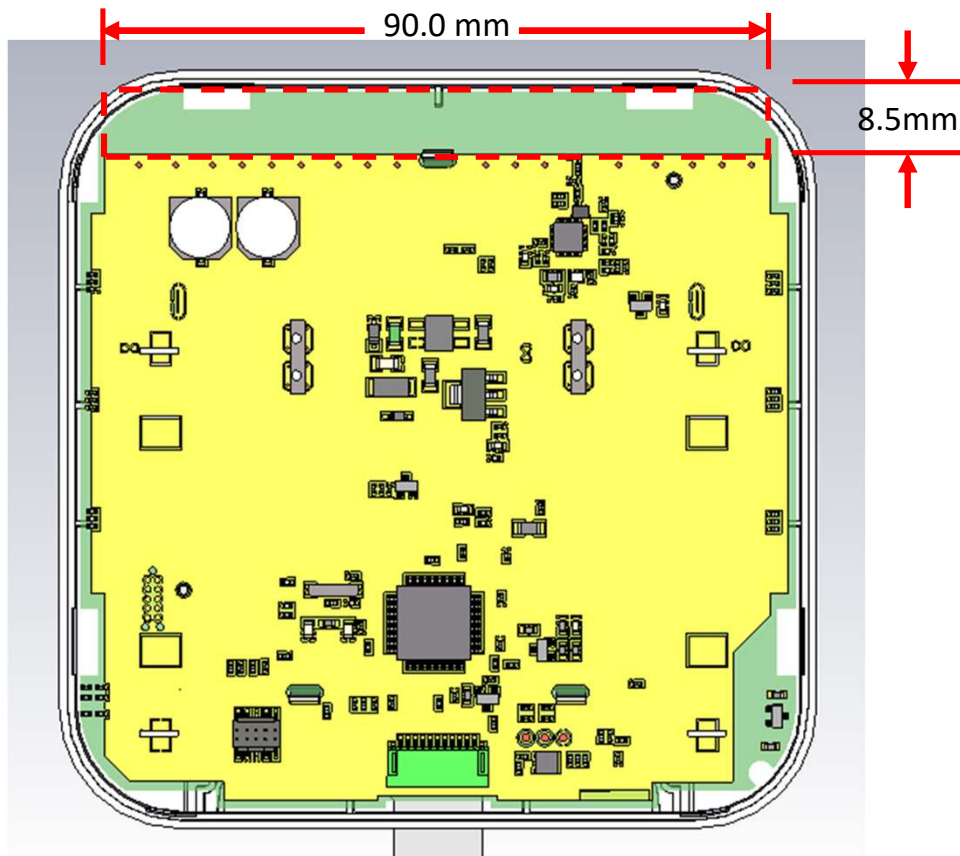
- Executive Summary (Background and Requirements)
- Customer Sample (R755WHO) & Test Results
- New Mechanical Design (with Board Dimensions)
- Antenna Design 1 (Grounded Loop)
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Executive Summary

- PRO1 is redesigning its R755WHO thermostat product which has a new smaller housing (R755W_D)
- A new antenna is required with an equivalent or better performance than R755WHO when placed on the available space provided with the following specifications:
 - Frequency of Operation: **900MHz to 930MHz**
 - Board Size: **97mm x 97mm**
 - Antenna Size: **90mm x 8.5mm (max)**
 - Antenna Type: **Printed PCB antenna** (or others if meeting pricing & procurement requirements)

Executive Summary

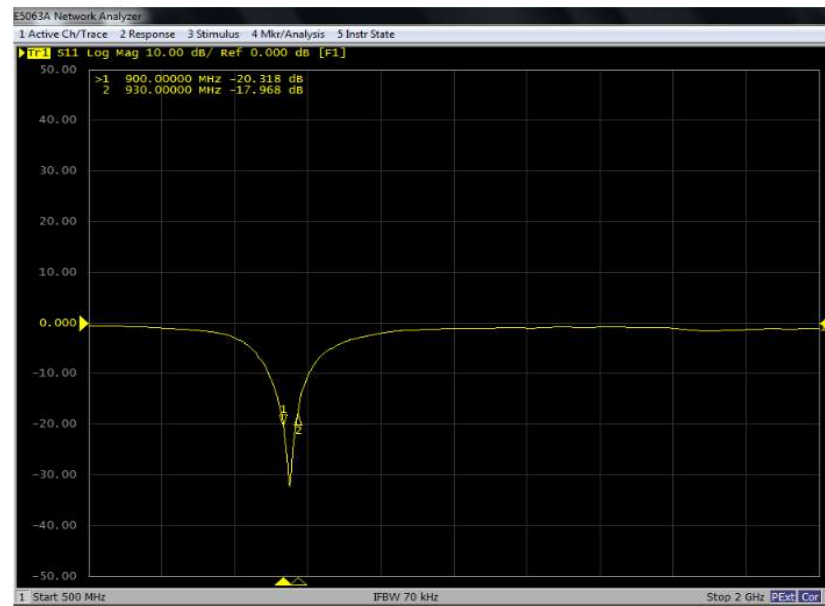
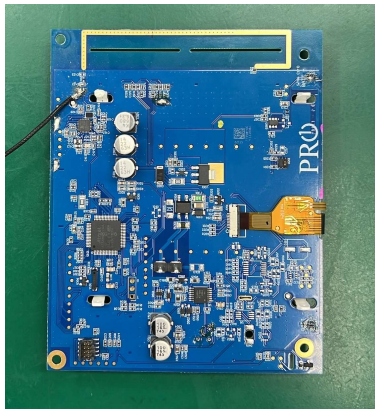
- New mechanical design with available antenna space (8.5mm X 90.0mm)



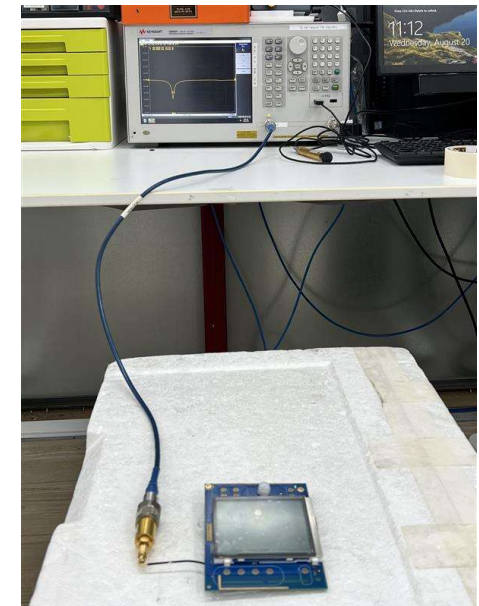
Customer Sample (R755WHO) Evaluation

The customer sample has a *Grounded Monopole Antenna* and was tested as follows:

- Antenna S11 (**BOARD ONLY**)



R755WHO Antenna S11 Test Results

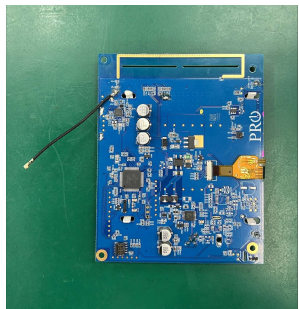


S11 Test Setup

Customer Sample (R755WHO) & Test Results

Customer Sample Antenna Performance:

- Total Efficiency (**BOARD ONLY**)



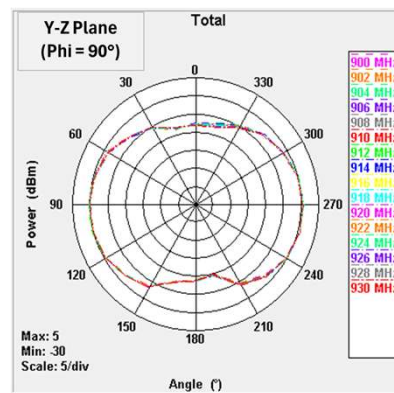
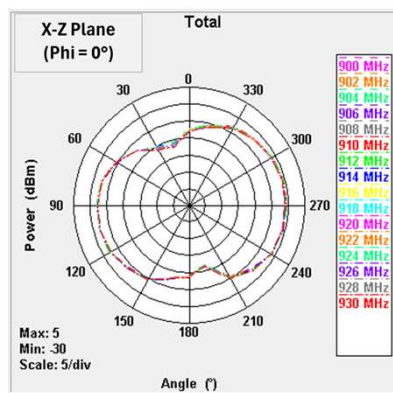
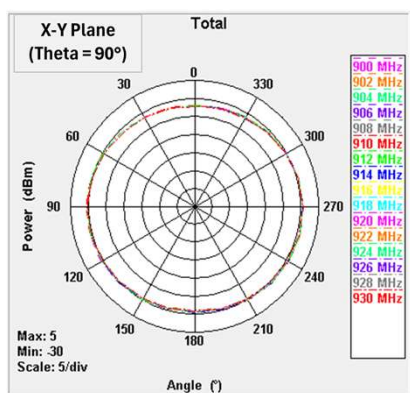
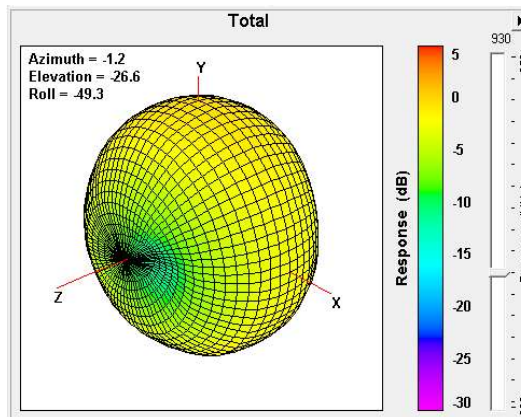
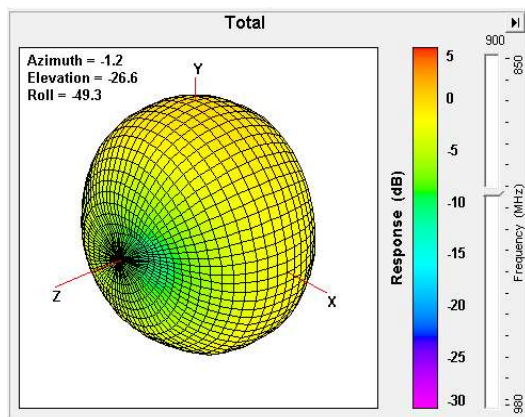
R755WHO Antenna Total Efficiency



Customer Sample (R755WHO) & Test Results

Customer Sample Antenna Performance:

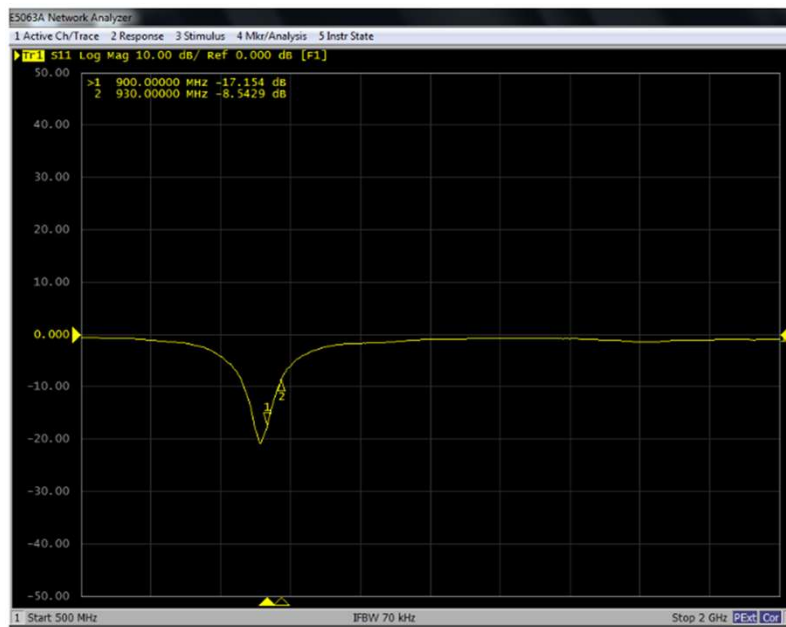
➤ Radiation Pattern (**BOARD ONLY**)



Customer Sample (R755WHO) Evaluation

Customer Sample Antenna Performance:

- S11 (With HOUSING)



R755WHO Antenna S11 Test Results

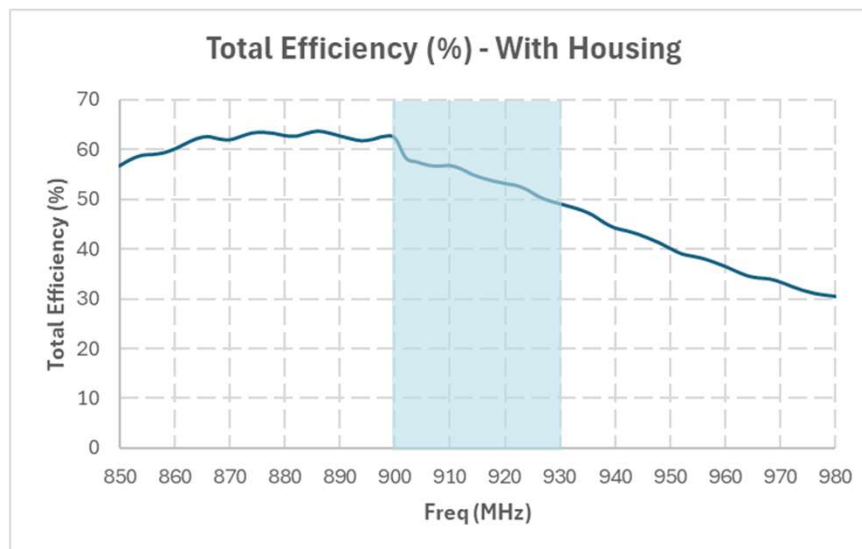


S11 Test Setup

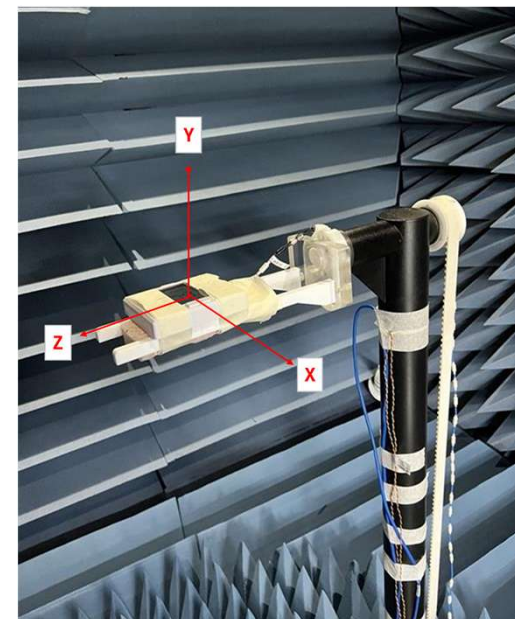
Customer Sample (R755WHO) & Test Results

Customer Sample Antenna Performance:

- Total Efficiency (**With HOUSING**)



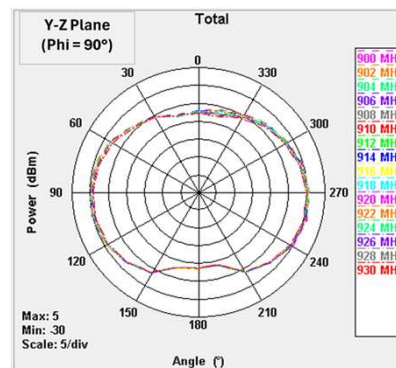
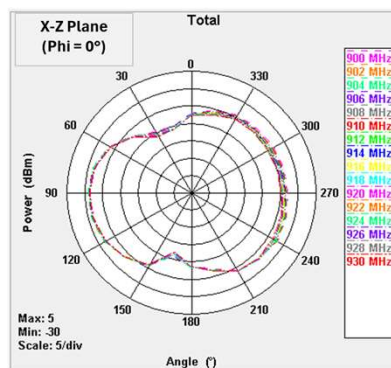
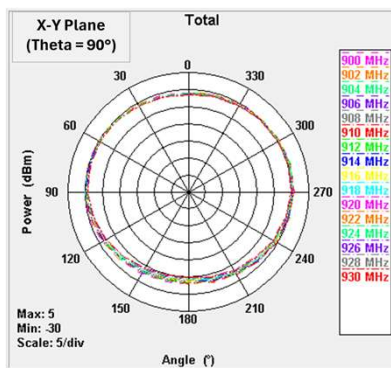
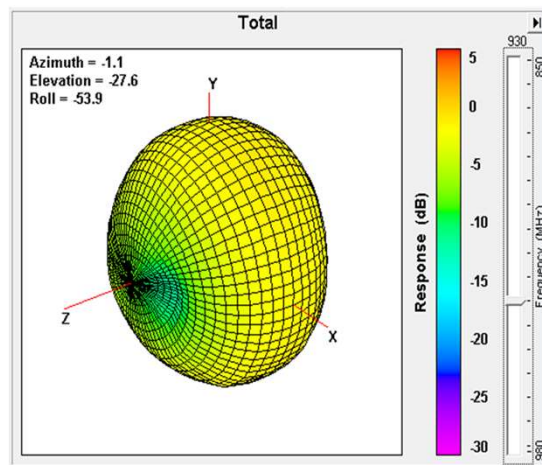
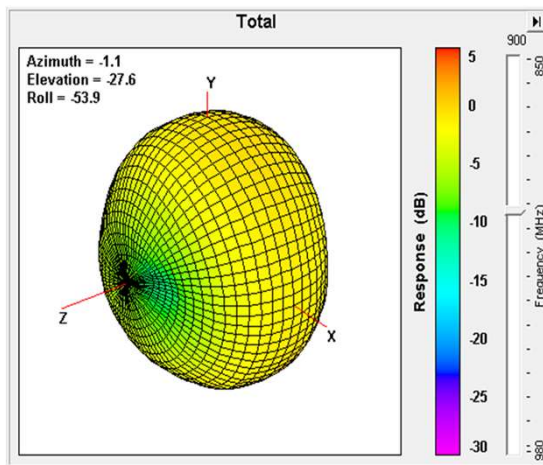
R755WHO Antenna Total Efficiency



Customer Sample (R755WHO) & Test Results

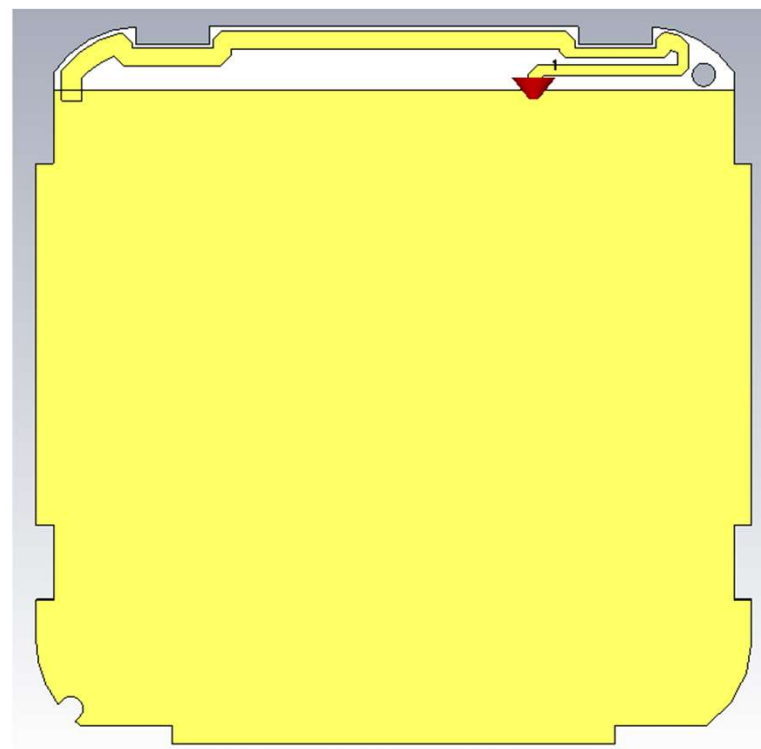
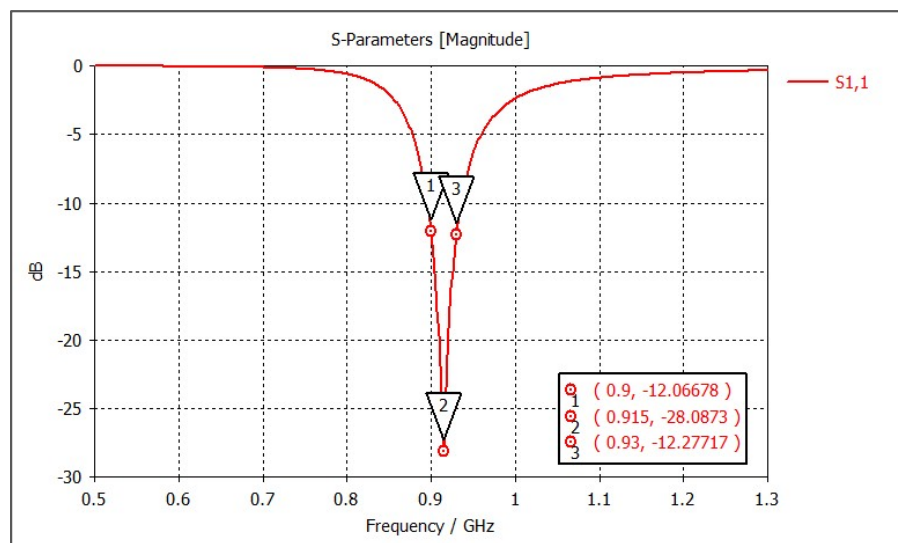
Customer Sample Antenna Performance:

➤ Radiation Pattern (With HOUSING)



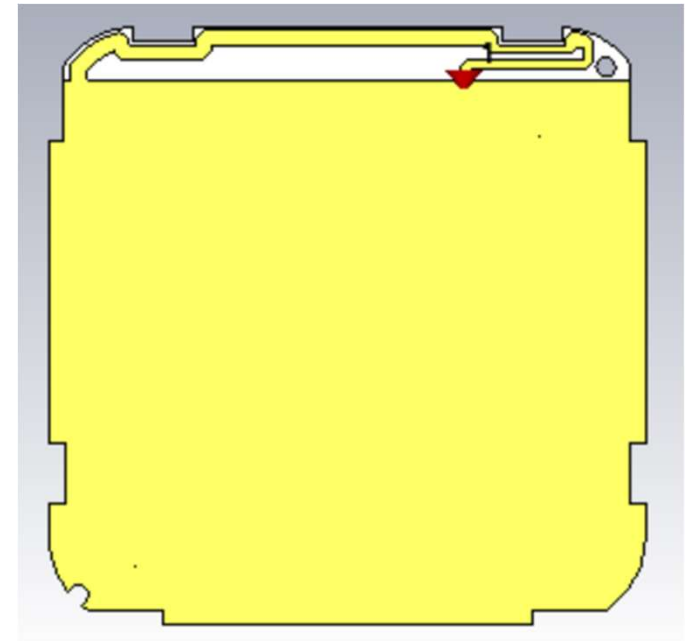
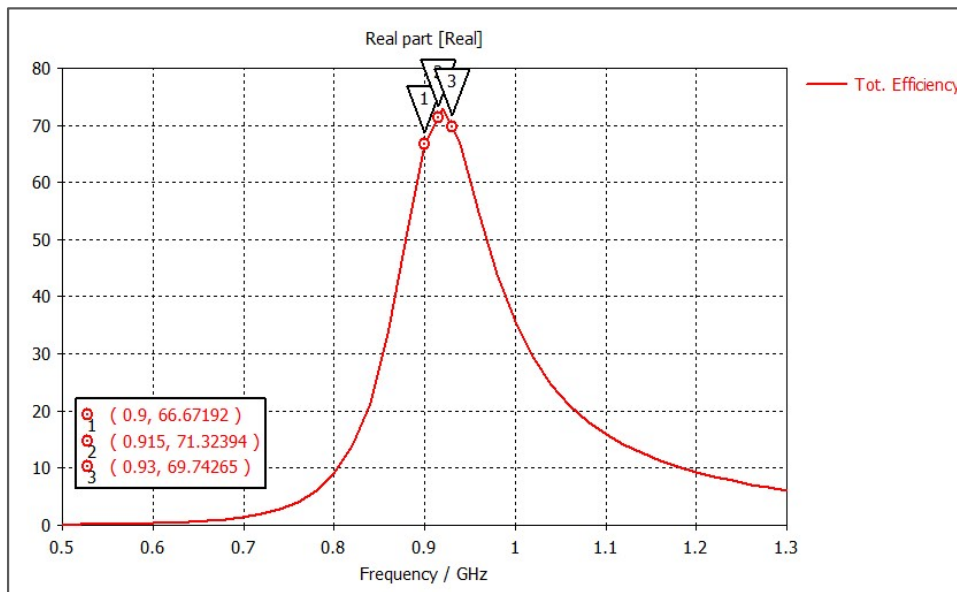
Antenna Design 1 (Grounded Monopole)

- Simulated Antenna Performance
 - S11 of Grounded Monopole Antenna



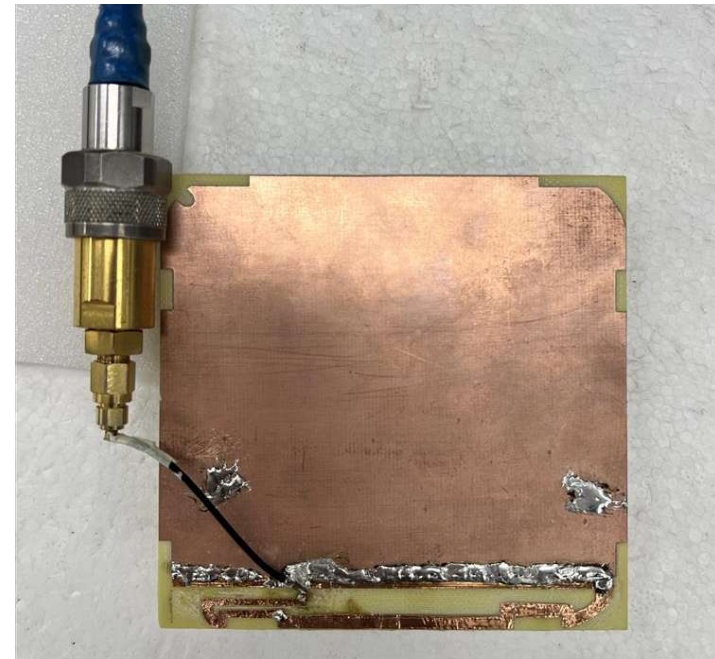
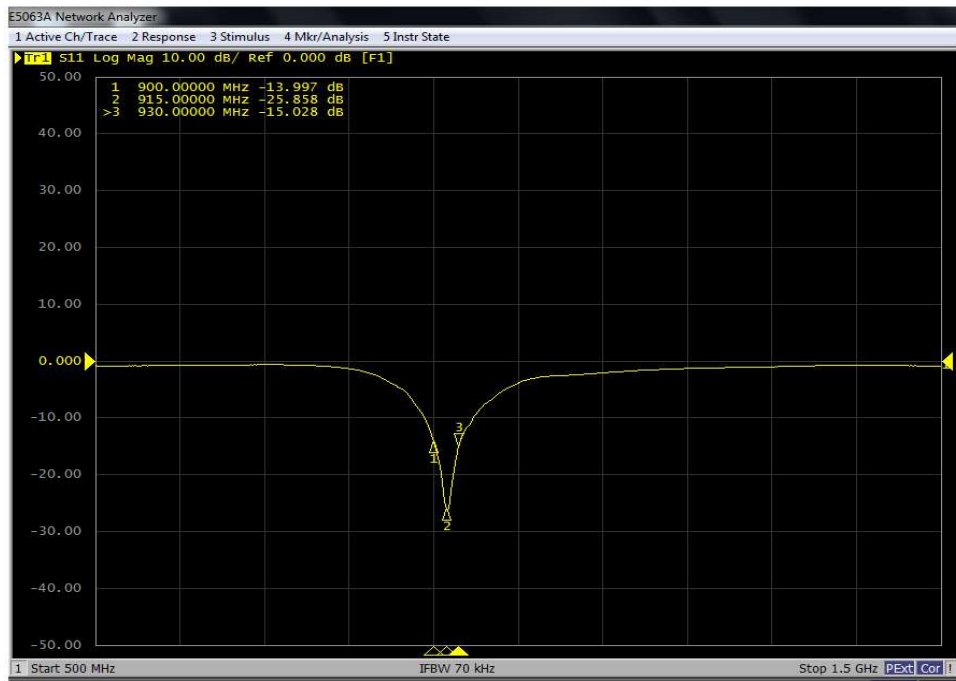
Antenna Design 1 (Grounded Monopole)

- Simulated Antenna Performance
 - Total Efficiency (%) of Grounded Monopole Antenna



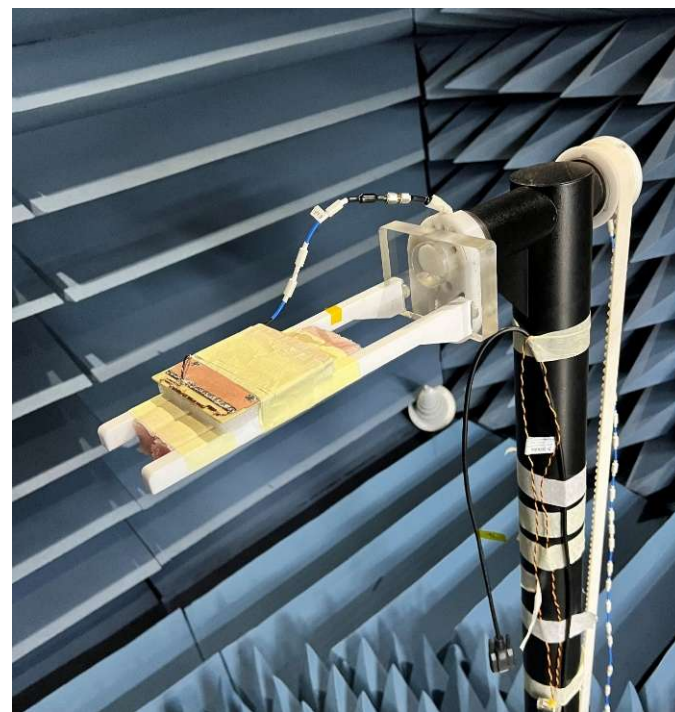
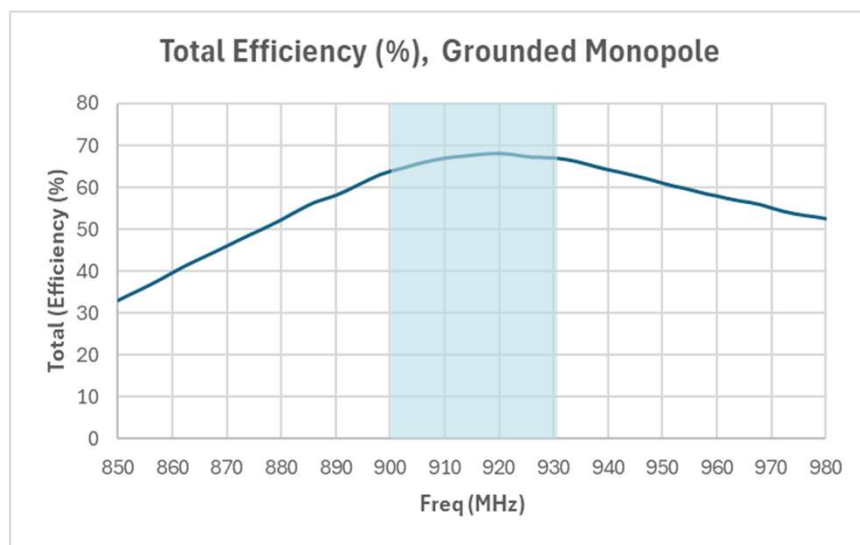
Antenna Design 1 (Grounded Monopole)

- Mockup and Test Results
 - Measured S11 of Grounded Monopole Antenna



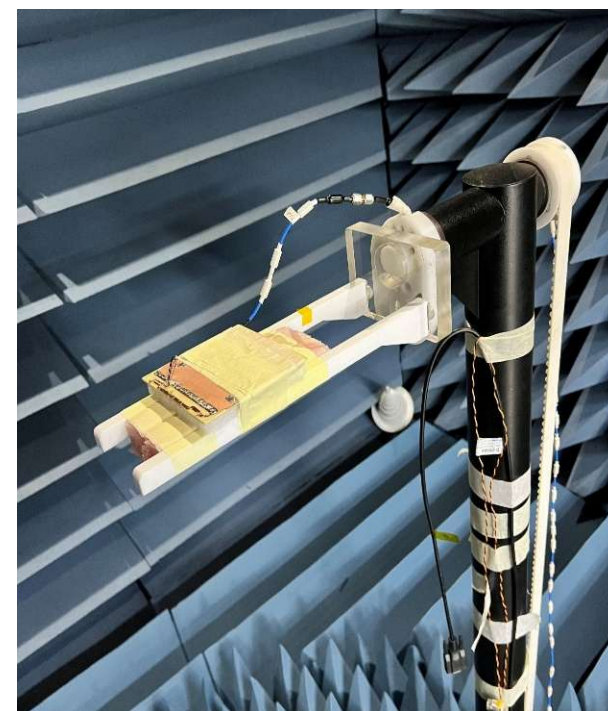
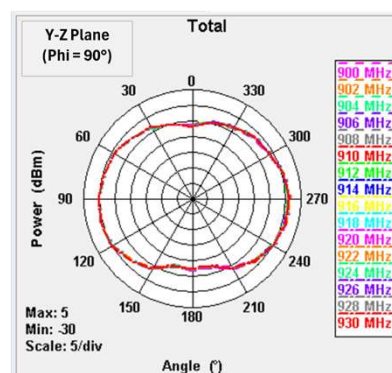
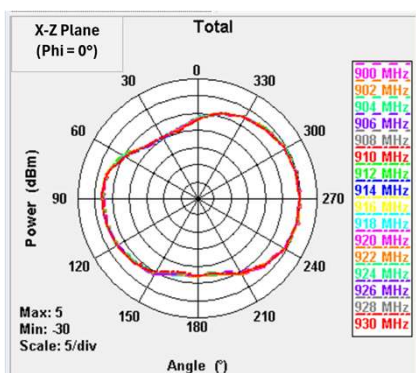
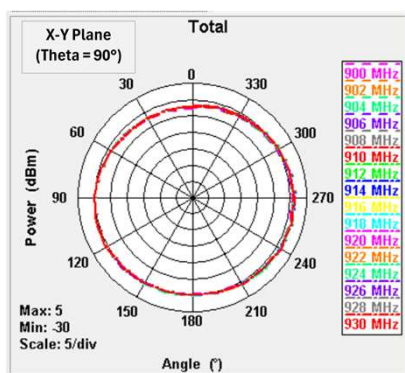
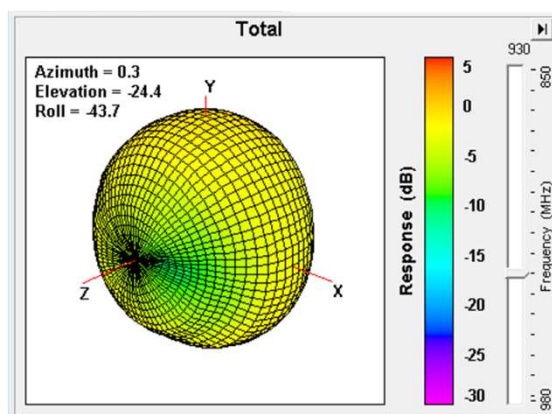
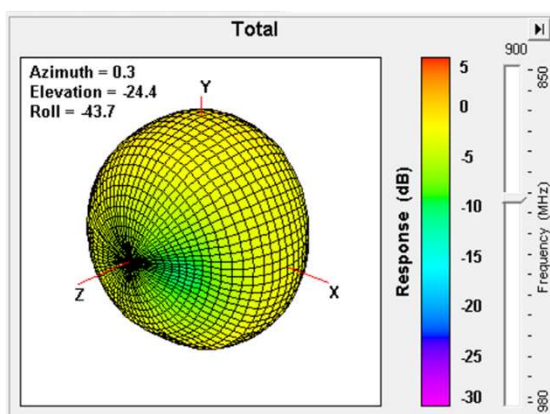
Antenna Design 1 (Grounded Monopole)

- Mockup and Test Results
 - Measured Total Efficiency (%) of Grounded Monopole Antenna



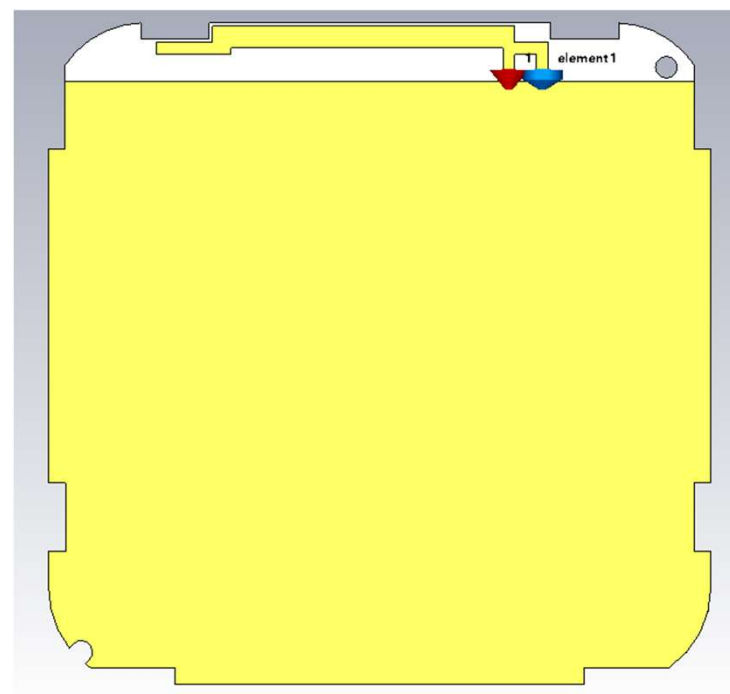
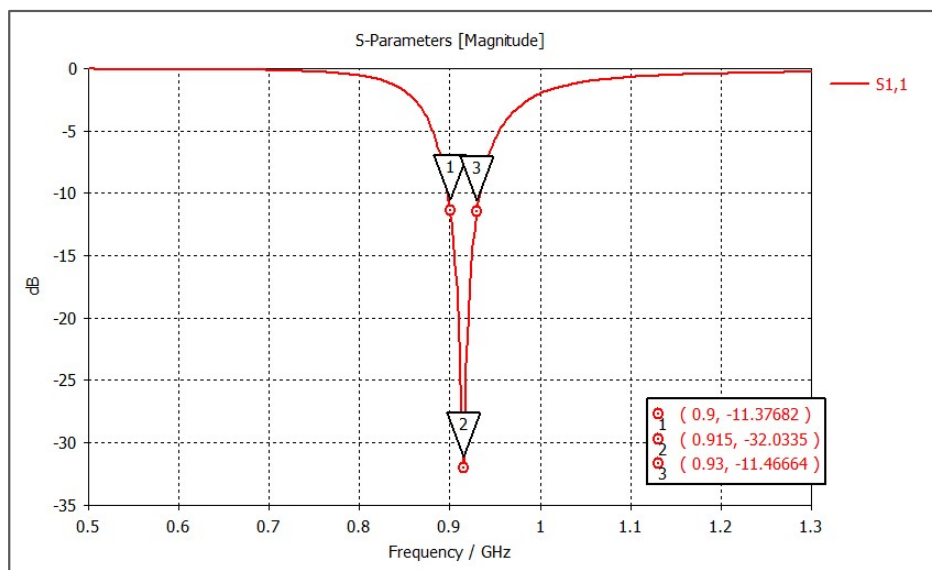
Antenna Design 1 (Grounded Monopole)

- Mockup and Test Results
 - Radiation Pattern of Grounded Monopole Antenna at 915MHz



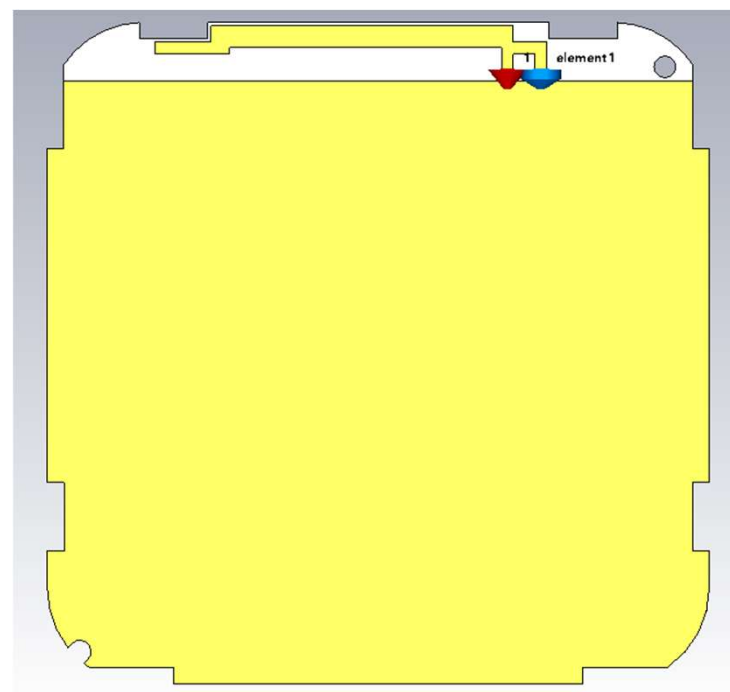
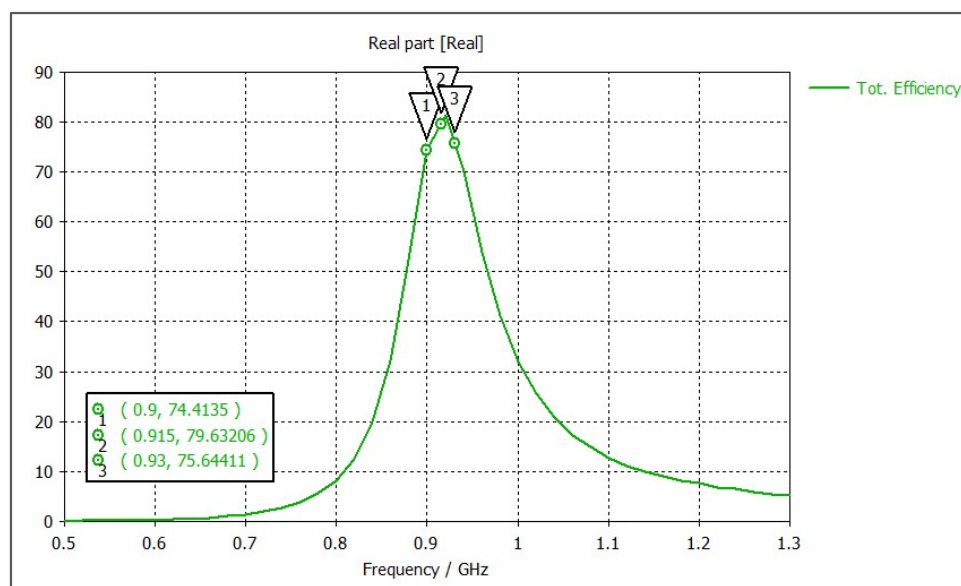
Antenna Design 2 (Inverted F)

- Simulated Antenna Performance
 - S11 of Inverted F Antenna



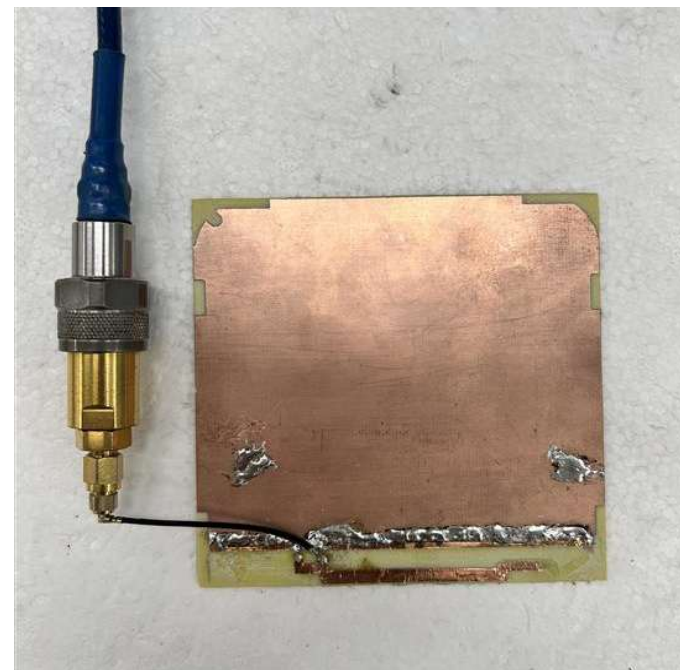
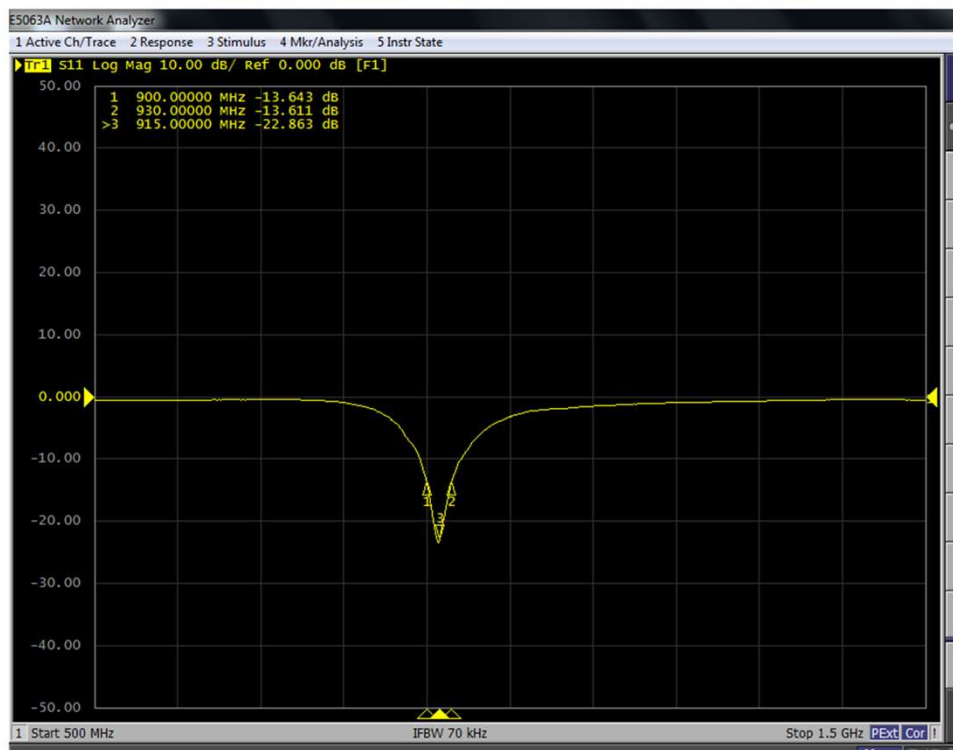
Antenna Design 2 (Inverted F)

- Simulated Antenna Performance
 - Total Efficiency (%) of Inverted F Antenna



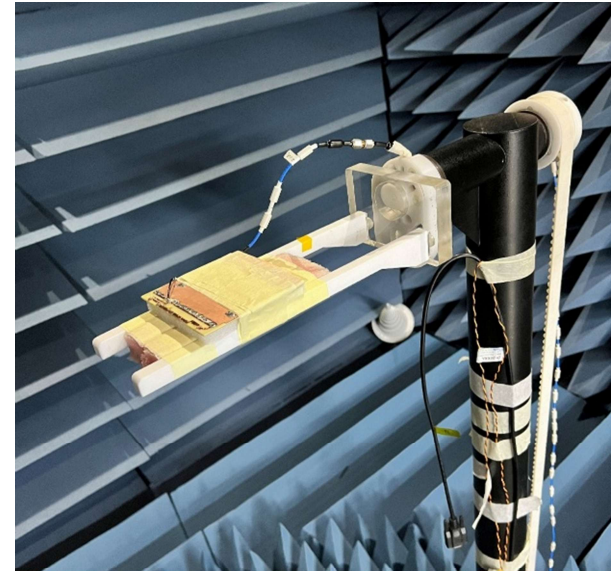
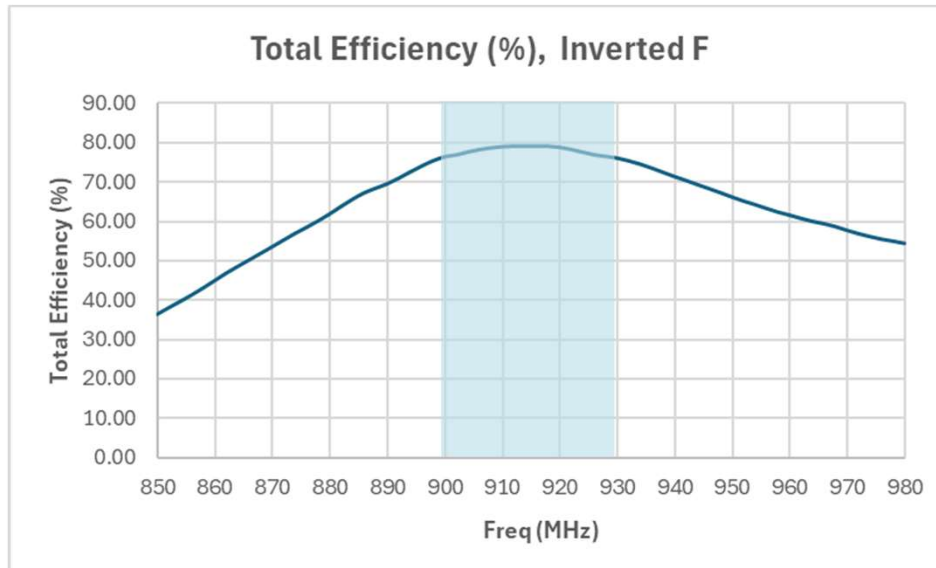
Antenna Design 2 (Inverted F)

- Mockup and Test Results
 - Measured S11 of Inverted F Antenna



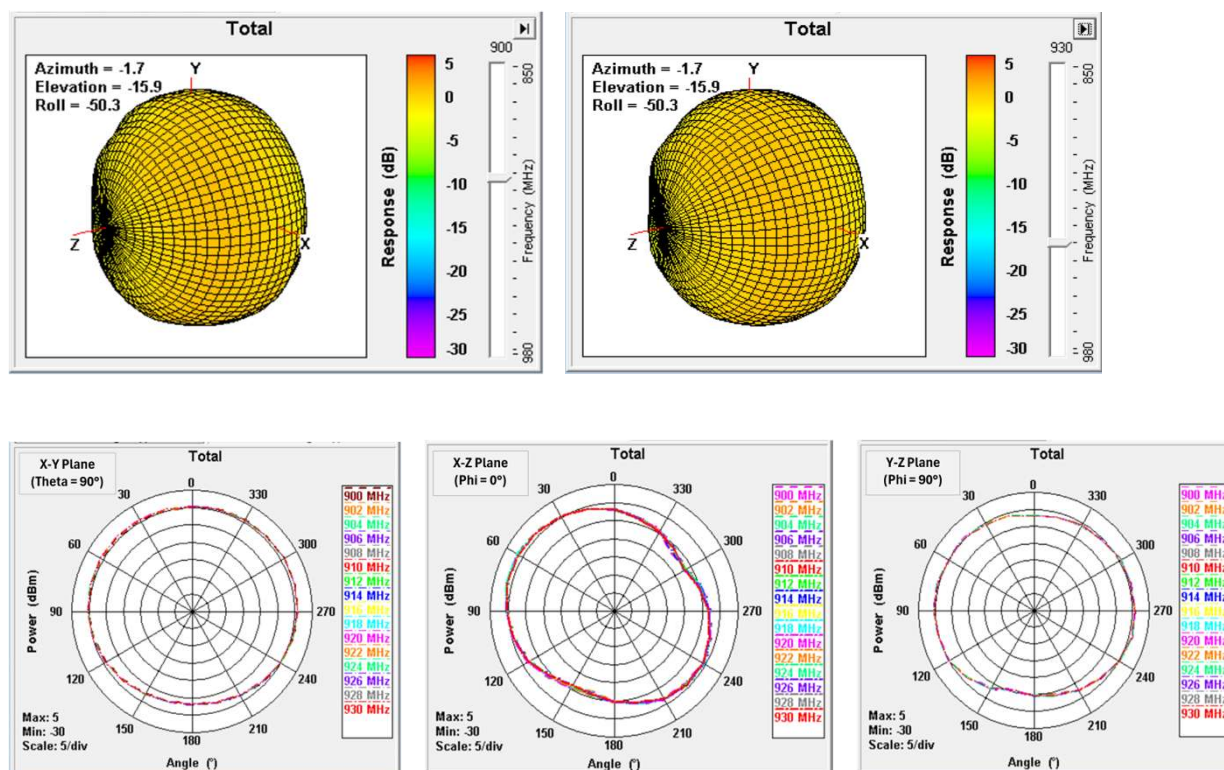
Antenna Design 2 (Inverted F)

- Measured Antenna Performance
 - Measured Total Efficiency (%) of Inverted F Antenna



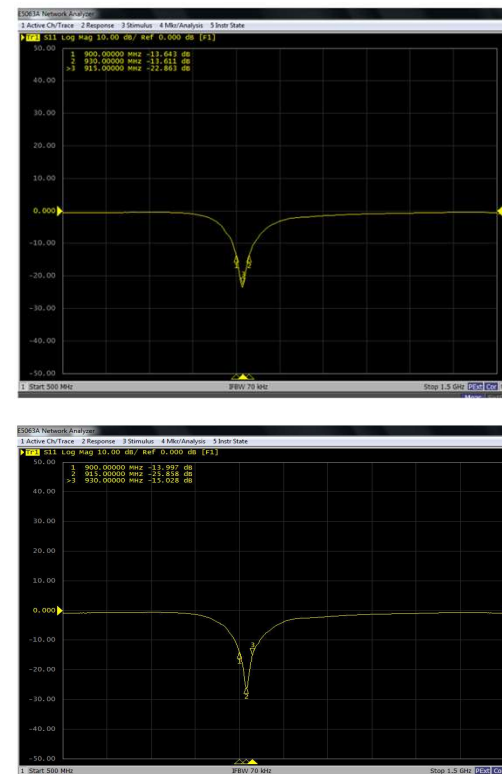
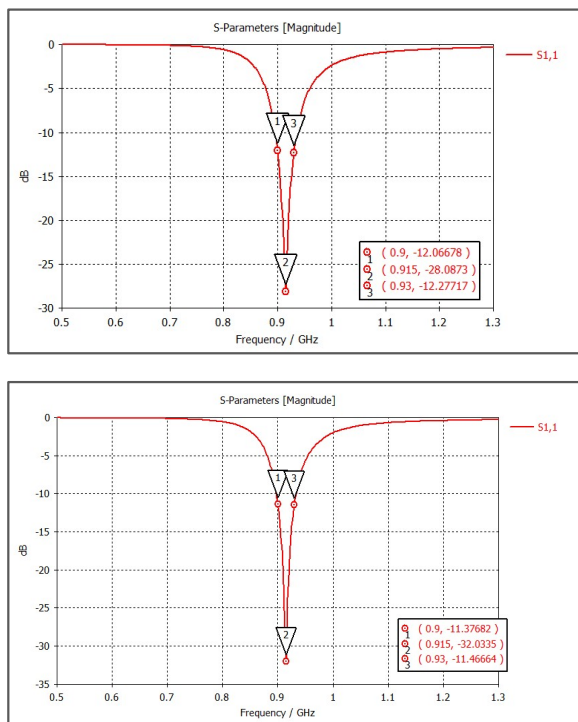
Antenna Design 2 (Inverted F)

- Simulated Antenna Performance
 - Radiation Pattern of Inverted F Antenna at 915MHz



Grounded Monopole vs. Inverted F

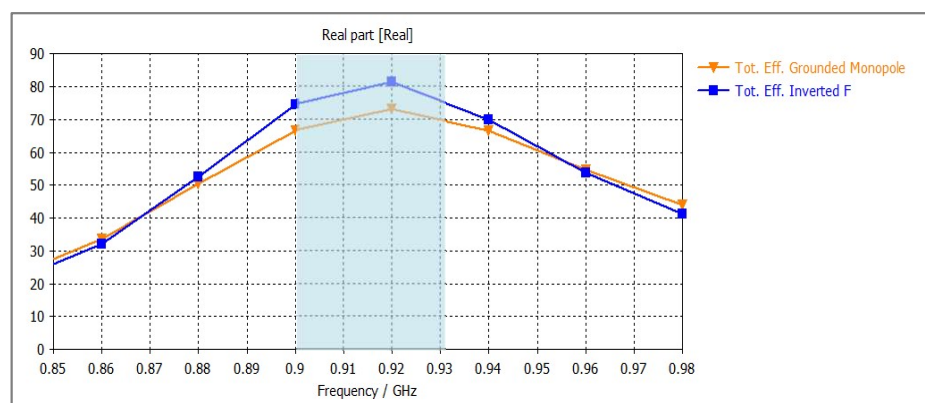
- Simulated & Measured Results (S11)



- Return Loss performance (S11) is comparable between Grounded Monopole and Inverted F

Grounded Monopole vs. Inverted F

- Simulated & Measured Results (Total Efficiency)



Grounded Monopole vs. Inverted F (SIMULATION)

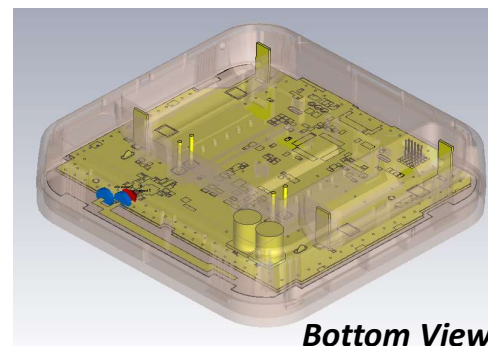
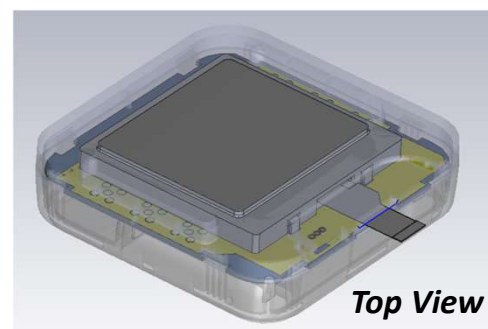
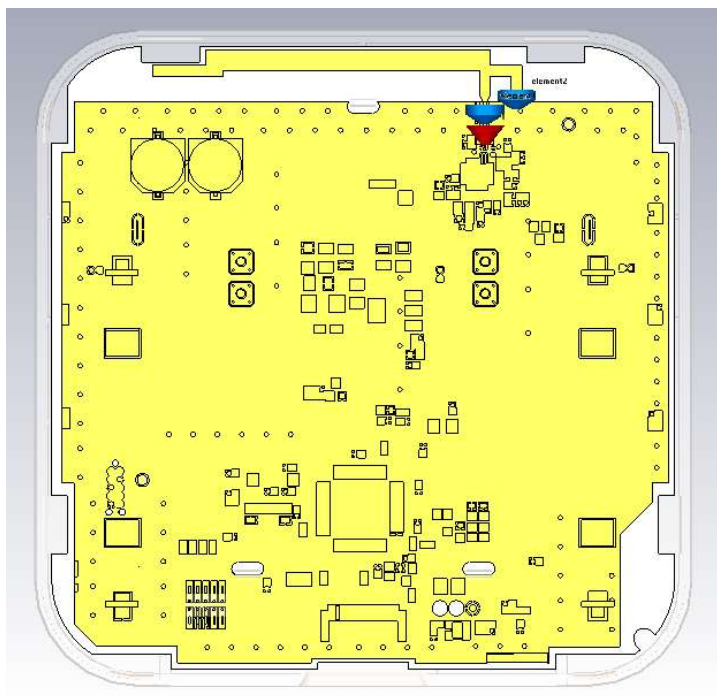


Grounded Monopole vs. Inverted F (MEASUREMENT)

- There is good correlation between simulated and measured results
- Total Efficiency of **Inverted F** antenna is >10% than that of **Grounded Monopole** over the frequency band (900-930MHz):
 - Grounded Monopole Total Efficiency: >64%
 - Inverted F Total Efficiency : >75%
- Inverted F antenna has better overall RF performance than Grounded Monopole antenna***

Inverted F Antenna Verification

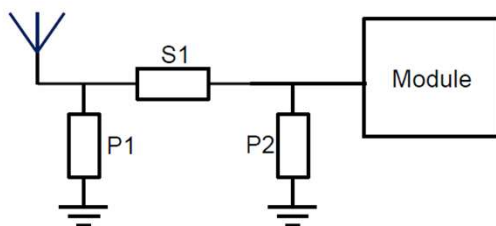
- Inverted F Antenna was simulated with actual PCB layout and full assembly step file provided
- RF port after matching circuit



Inverted F Antenna Verification

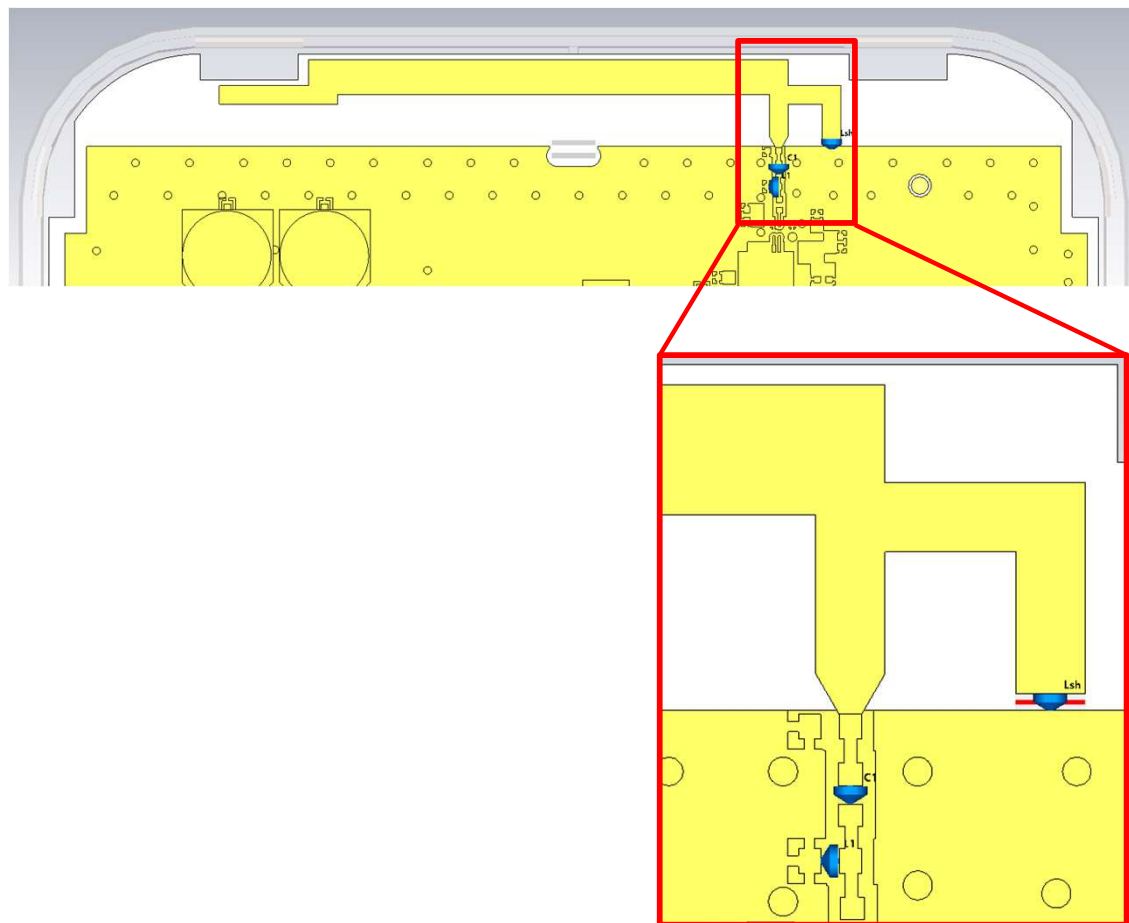
- Matching circuit elements and shunt inductor

- Matching Circuit Diagram



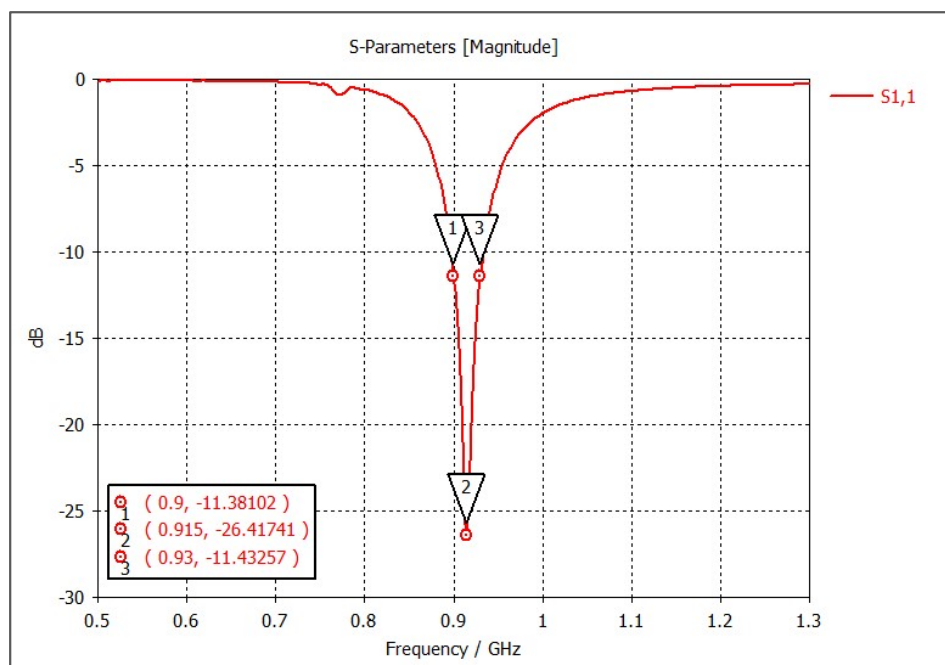
- Matching Elements & Shunt Inductor Values

Element	L/C
P1	/
S1	$C1 = 12\text{pF}$
P2	$L1 = 7.7\text{nH}$
Lsh	1nH

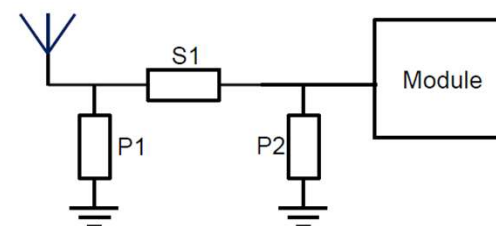


Inverted F Antenna Verification

- Simulated Antenna Performance
 - S11 of Inverted F Antenna on Full Assembly
 - Includes matching circuit elements



- Matching Circuit Diagram

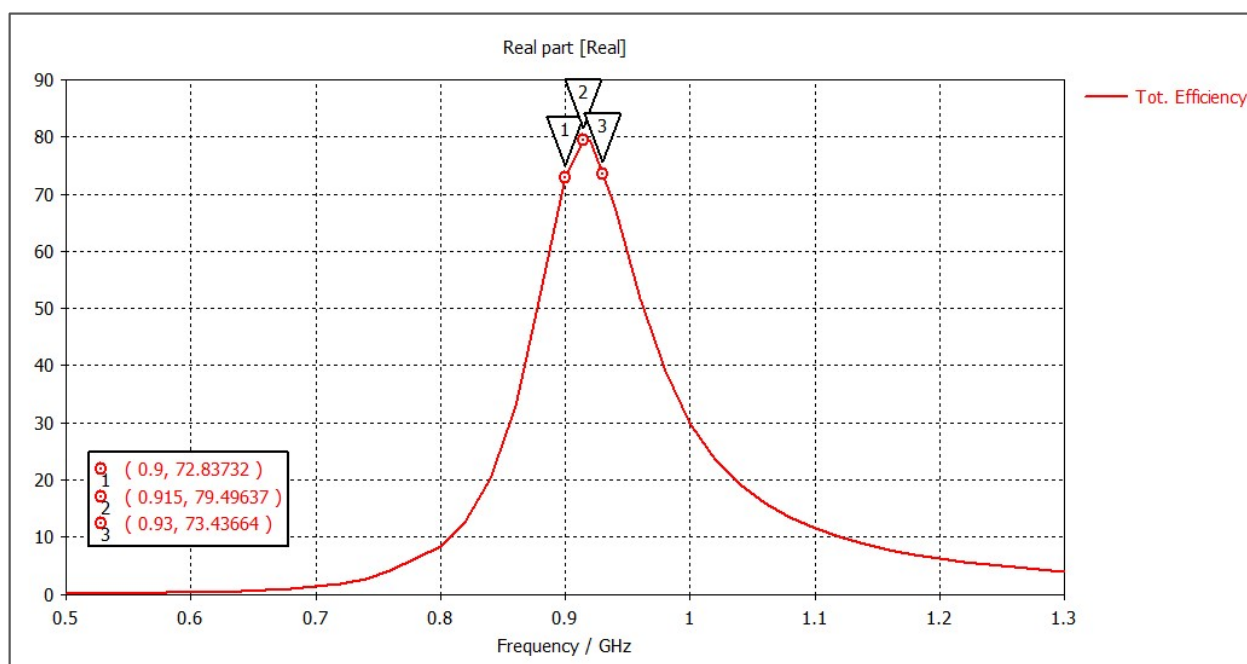


- Matching Elements Values

Element	L/C
P1	/
S1	12pF
P2	7.7nH

Inverted F Antenna Verification

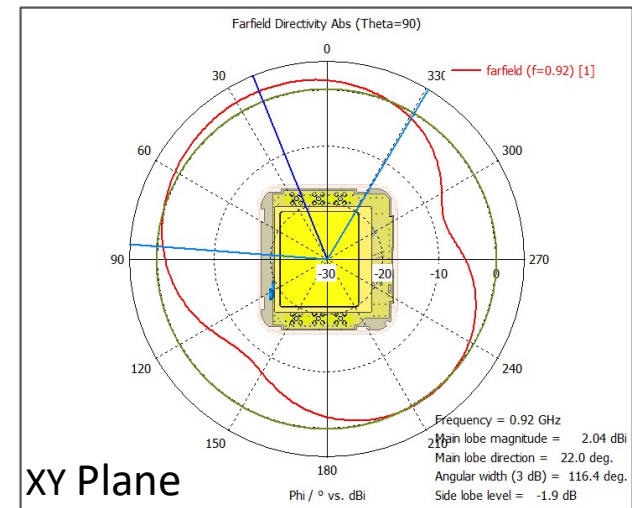
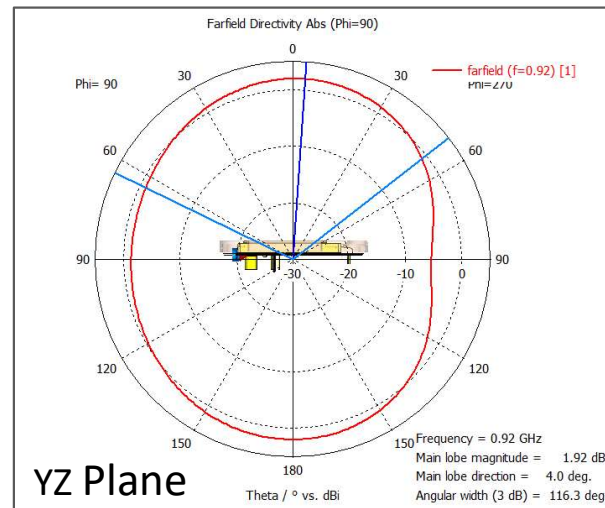
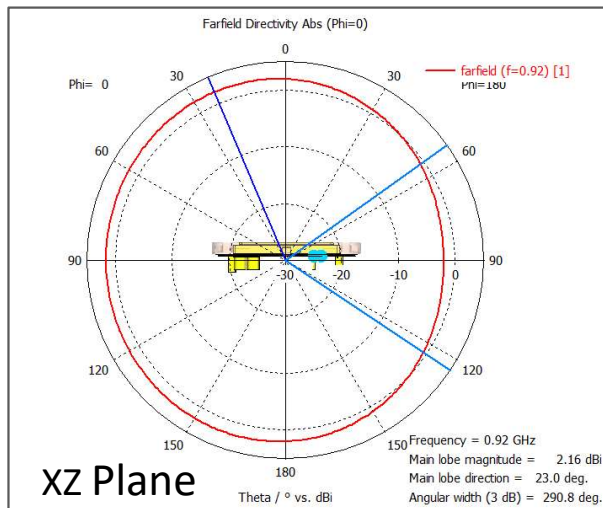
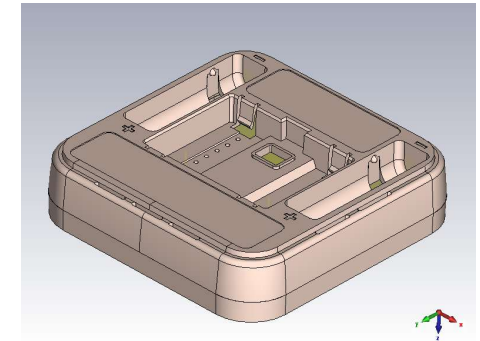
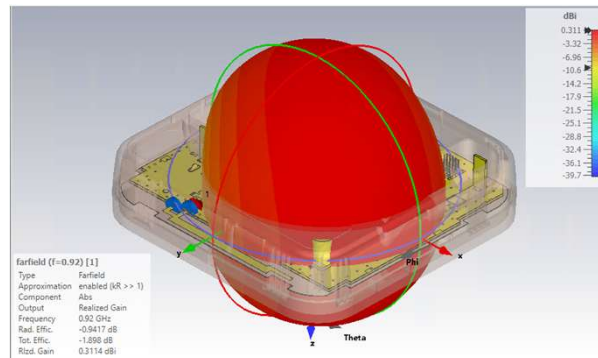
- Simulated Antenna Performance
 - Total Efficiency of Inverted F Antenna on Full Assembly



Inverted F Antenna Verification

- Simulated Antenna Performance

- Radiation Pattern Antenna at 915MHz



RF Proposal Summary and Conclusion

- The proposal outlines the recommended antenna type and matching circuit
- Two types of antenna (Grounded & Inverted F) were initially simulated with bare PCB and a prototype was built to verify the performance and also compare with the customer sample provided
- The Inverted F antenna was selected with a better overall performance
- For verification, the final antenna design is simulated with the PCB layout and full assembly provided
- Simulation results are shown below:

Internal Antenna	Frequency Covered	Antenna Type	Simulated S11	Simulated Total Efficiency
915MHz Inverted F	900-930MHz	PCB Antenna	> 11dB	> 72%

Thank You

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