



# Quectel

T20/ Y0BQDOCA0

## Antenna Debugging Report

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Date: 2024.03.18

Build a Smarter World



# Revision History



| Revision | Date       | Reporter | Reviewer | Note                              |
|----------|------------|----------|----------|-----------------------------------|
| V1.0     | 2025/03/18 | Charming | /        | First Prototype Debugging Antenna |



## Project Overview

Antenna Performance Evaluation and Debugging  
Conclusion and Suggestion

Build a Smarter World



# Project Overview



**Prototype Schematic**

- Device Dimensions: 54 × 32 x 16 mm
- Mainboard Dimensions: 43 × 27 mm
- Antenna Quantity: 5
- Network Standard and Frequency Band:
  - ✓ LTE: 698–960 MHz & 1710–2690 MHz
  - ✓ WiFi: 2400-2500 MHz
  - ✓ BT: 2400-2500 MHz
  - ✓ GNSS: L1
- Performance Requirements:
  - ✓ TBD



## Project Overview

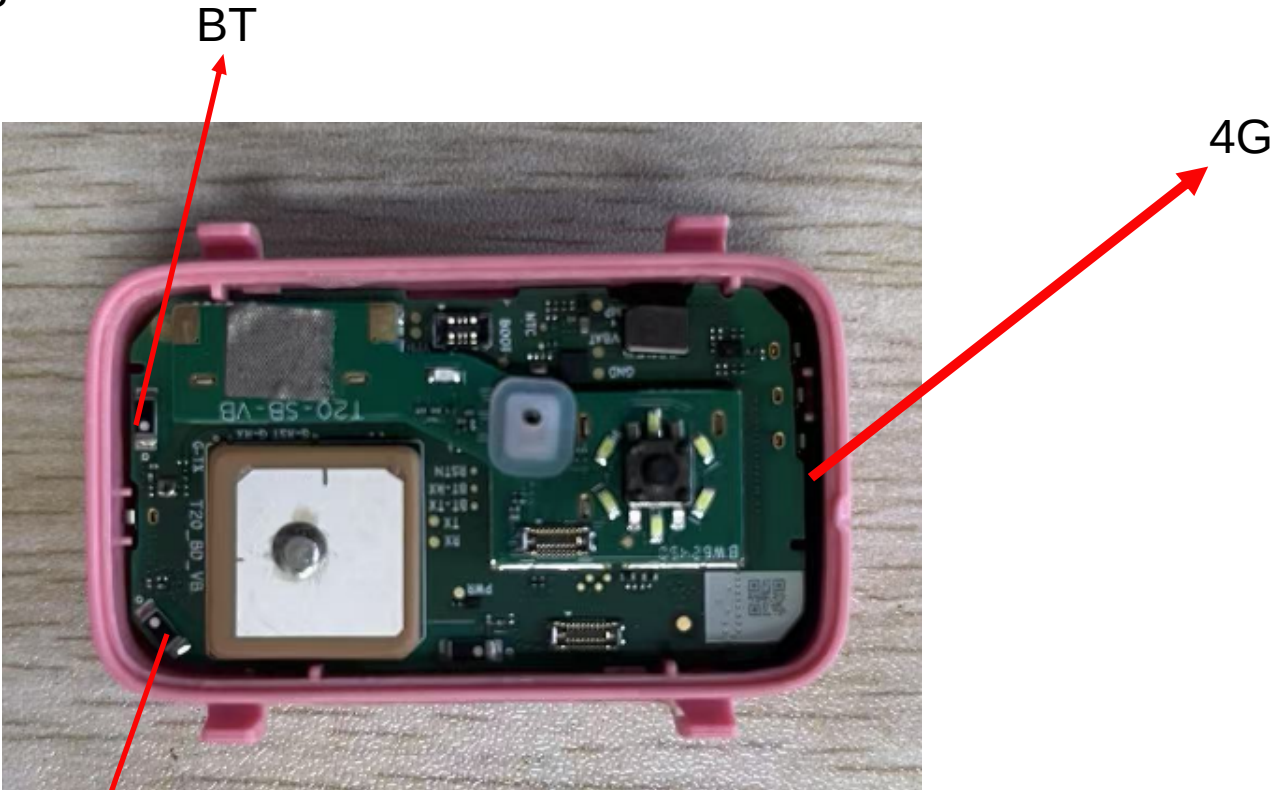
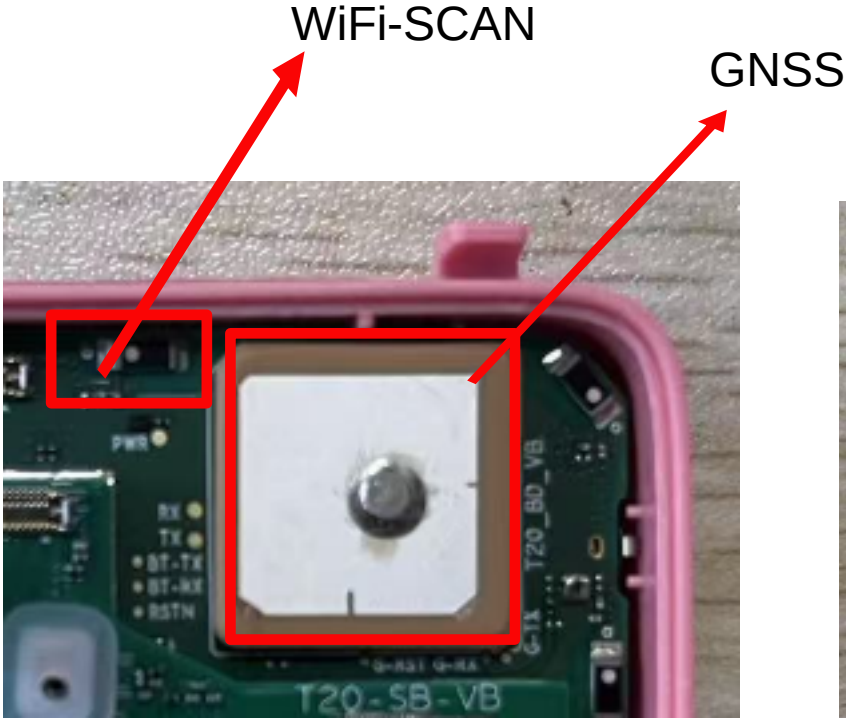
# Antenna Performance Evaluation and Debugging

## Conclusion and Suggestion

Build a Smarter World

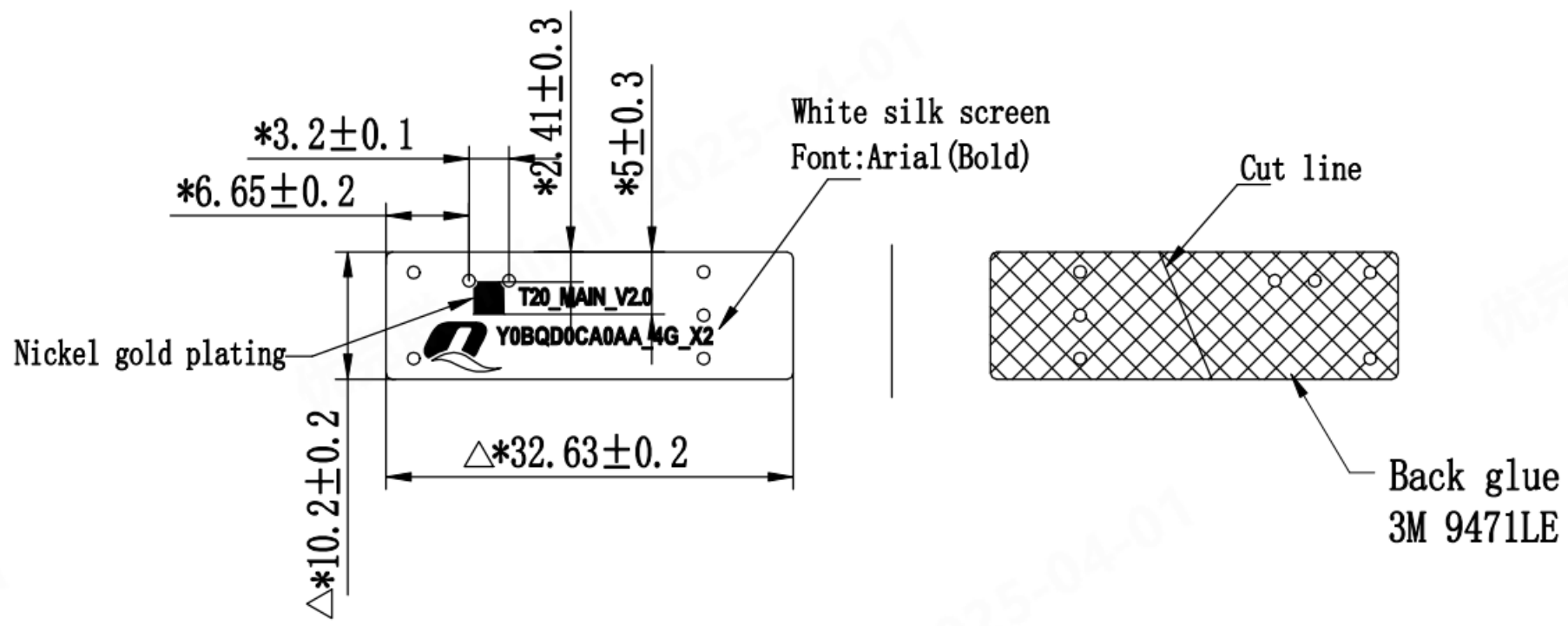


# Antenna Placement Analysis

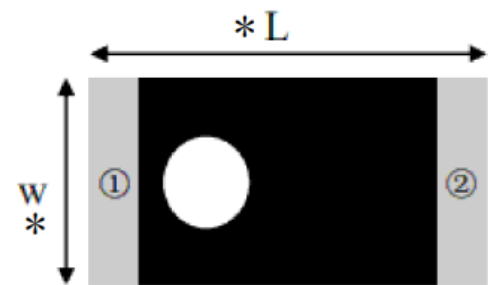


# Antenna Size

## a. 4G Antenna Size



b. Wifi Antenna Size



( Top View )



( Bottom View )

| Number | Terminal Name |
|--------|---------------|
| ①      | INPUT         |
| ②      | NC            |

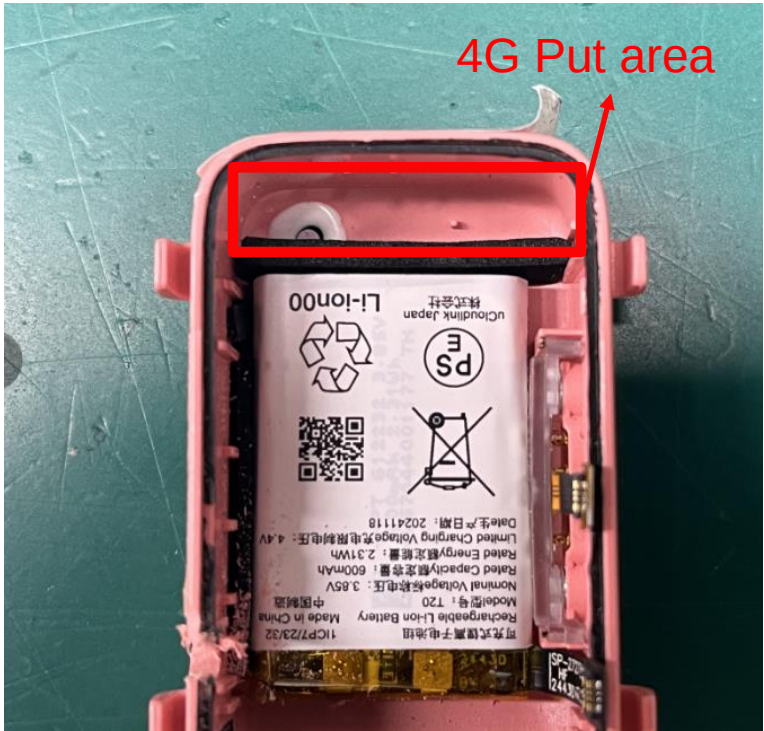


( Side View )

| Symbols    | L         | W         | T         | A         |
|------------|-----------|-----------|-----------|-----------|
| Dimensions | 3.2+/-0.2 | 1.6+/-0.2 | 0.5+/-0.1 | 0.4+/-0.1 |

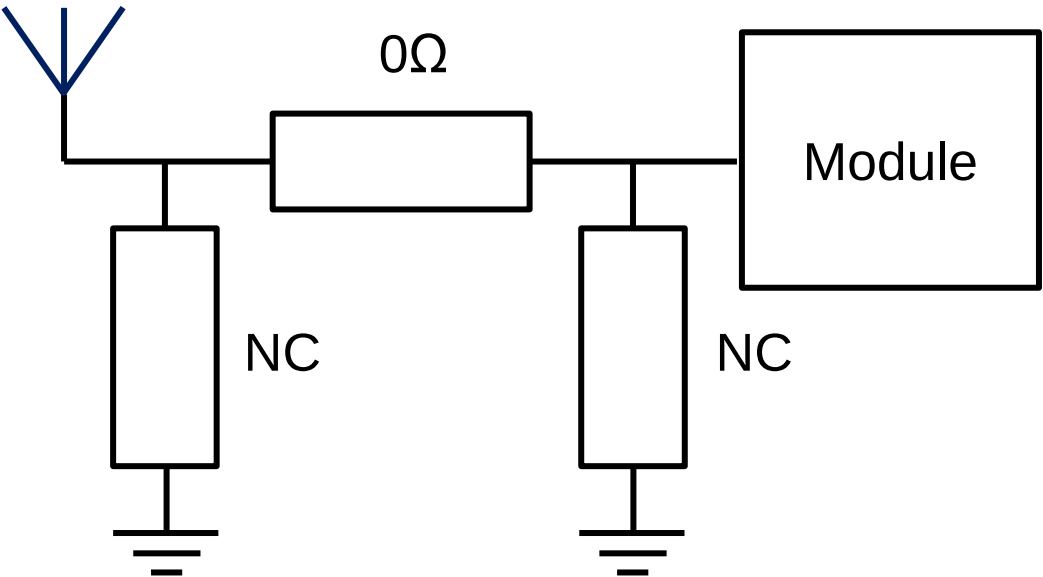


# Antenna Placement Analysis



- Matching Circuit Diagram

4G Antenna



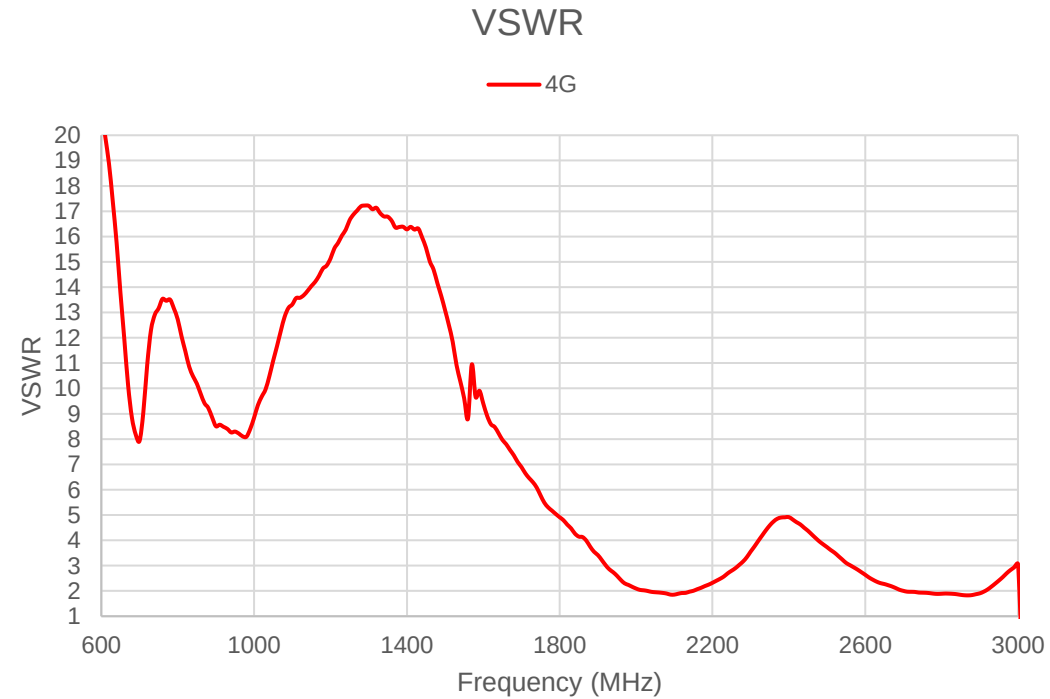
- Match Value:

| No. | L/C |
|-----|-----|
| F1  | NA  |
| F2  | 0Ω  |
| F3  | NA  |

# Passive Test--4G



- VSWR (Voltage Standing Wave Ratio)



## VSWR (Voltage Standing Wave Ratio):

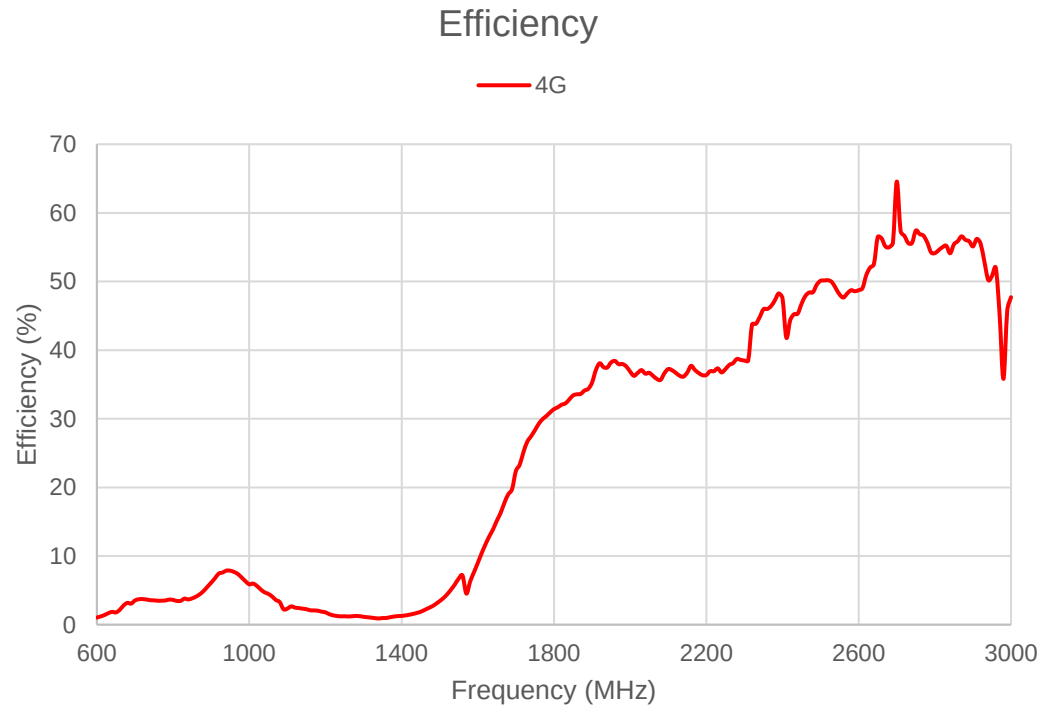
700–960 MHz < 11

1710–2690 MHz < 6.7

# Passive Test--4G



- Efficiency

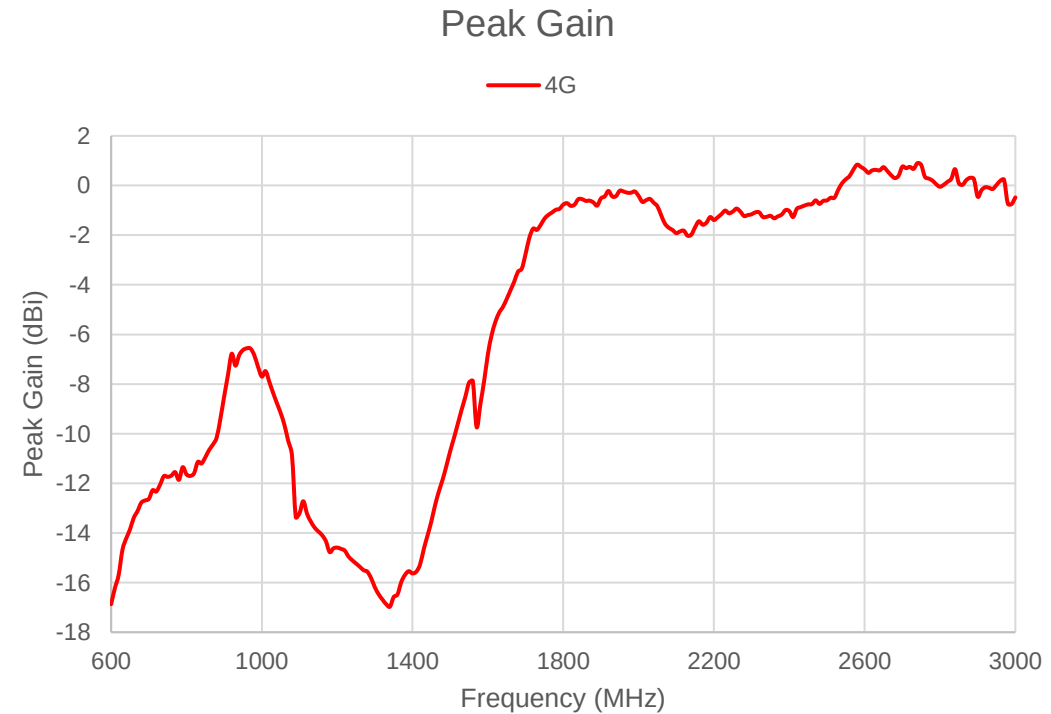


**Efficiency:**

700–960 MHz > 3%

1710–2690 MHz > 23%

- Peak Gain



**Peak Gain:**

700–960 MHz: -6.56 dBi

1710–2690 MHz: 0.84 dBi

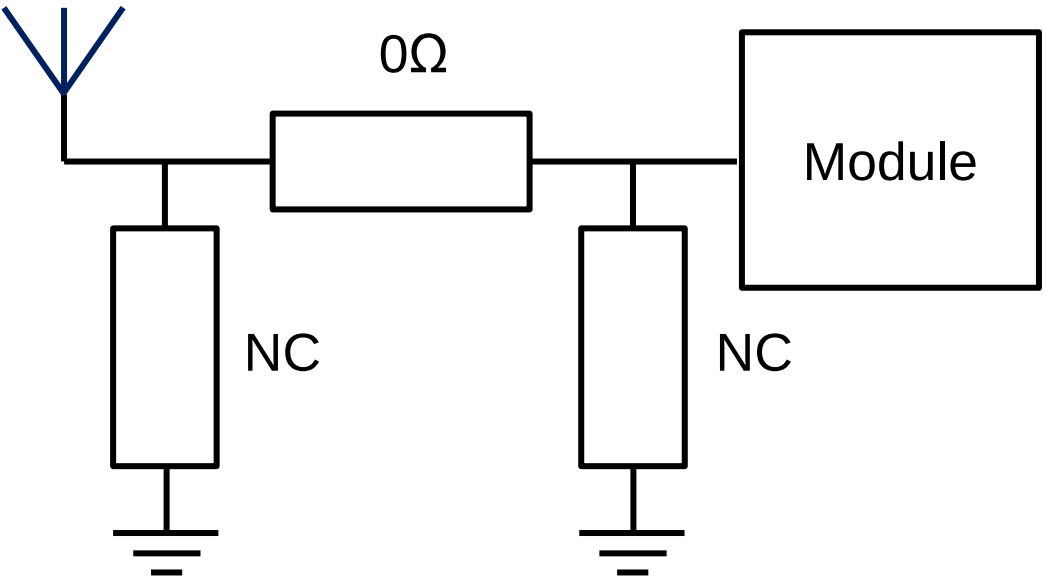


# Antenna Matching



- Matching Circuit Diagram

## GNSS Antenna



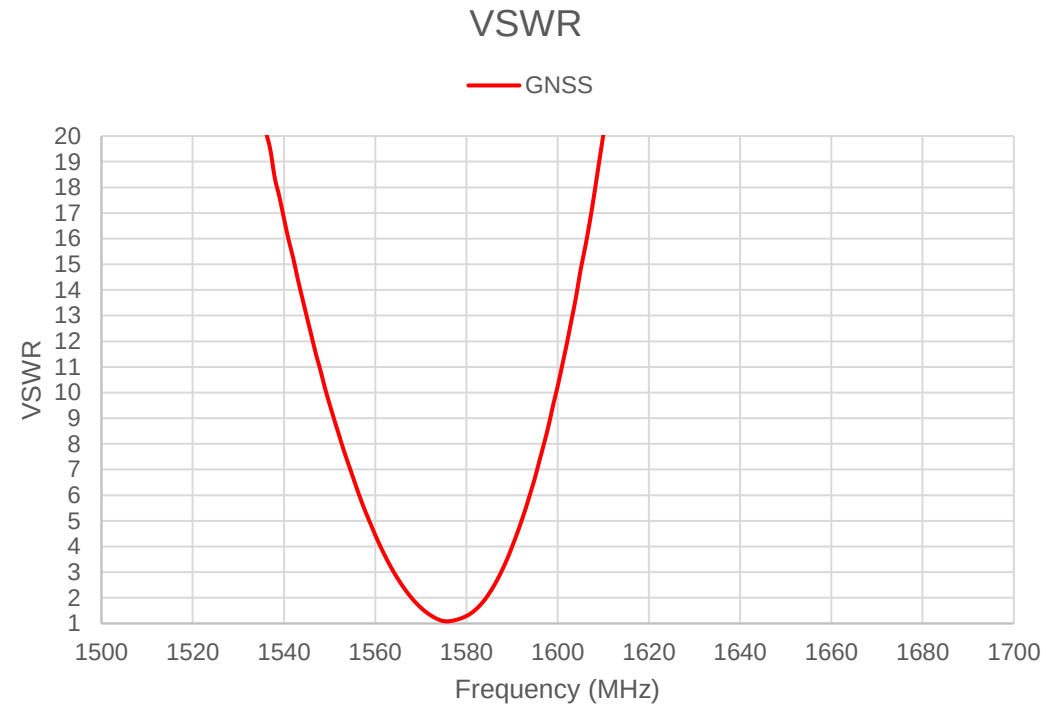
- Match Value:

| No. | L/C |
|-----|-----|
| F1  | NA  |
| F2  | 0Ω  |
| F3  | NA  |

# Passive Test--GNSS



- VSWR (Voltage Standing Wave Ratio)



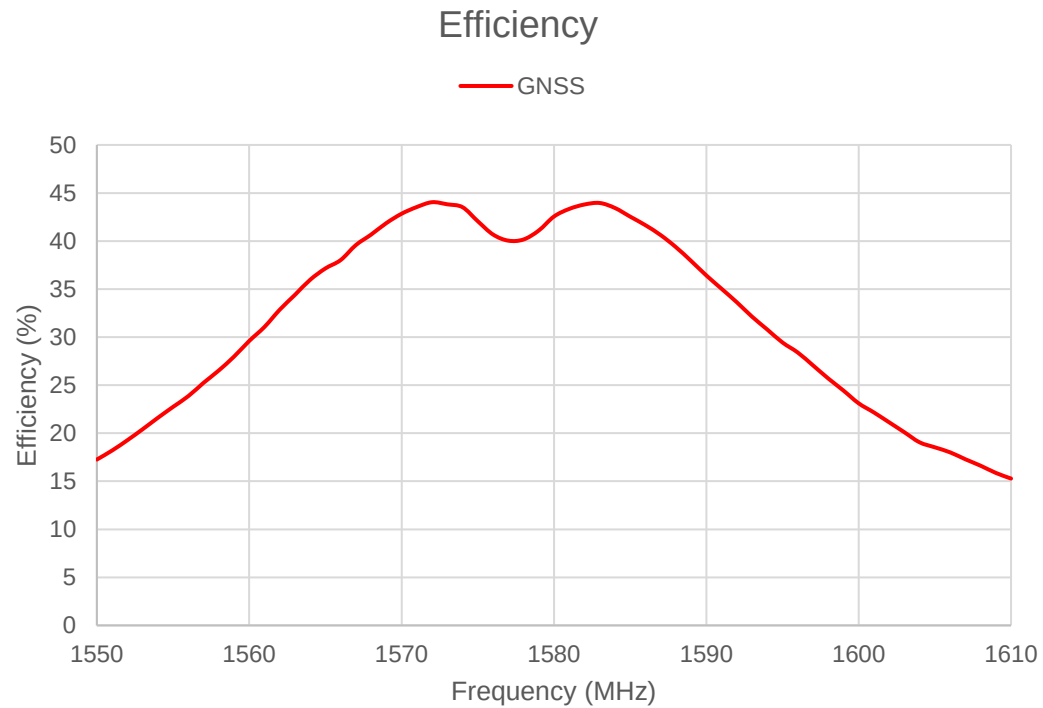
**VSWR (Voltage Standing Wave Ratio):**

1575MHz: 1.1

# Passive Test--GNSS



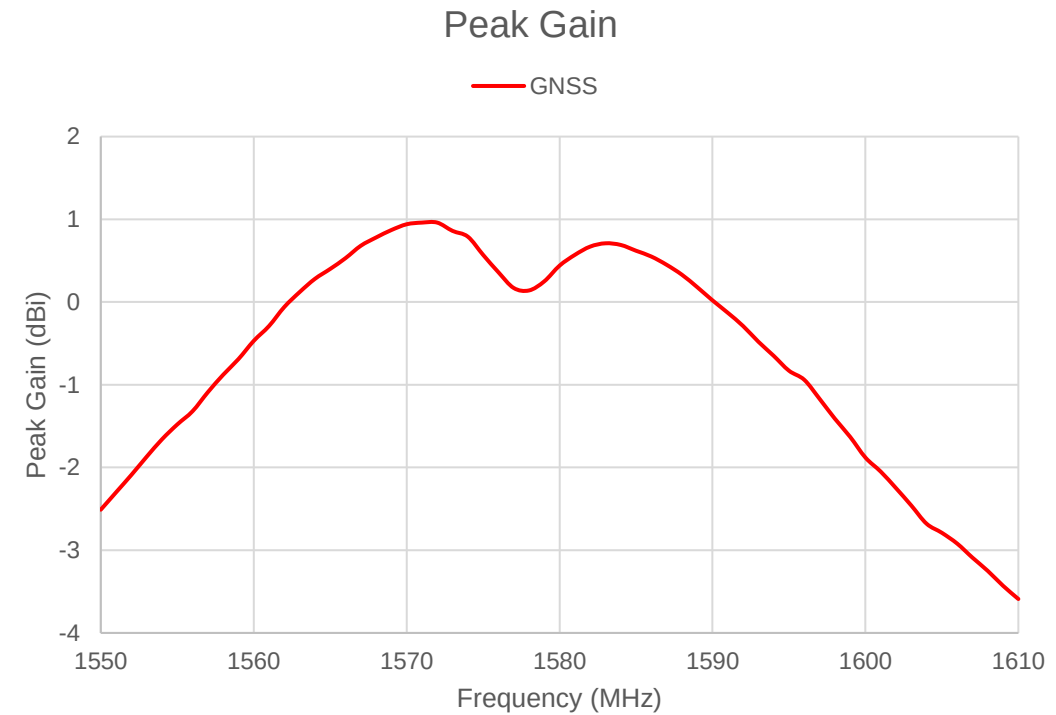
- Efficiency



**Efficiency:**

1575MHz: 42.06%

- Peak Gain

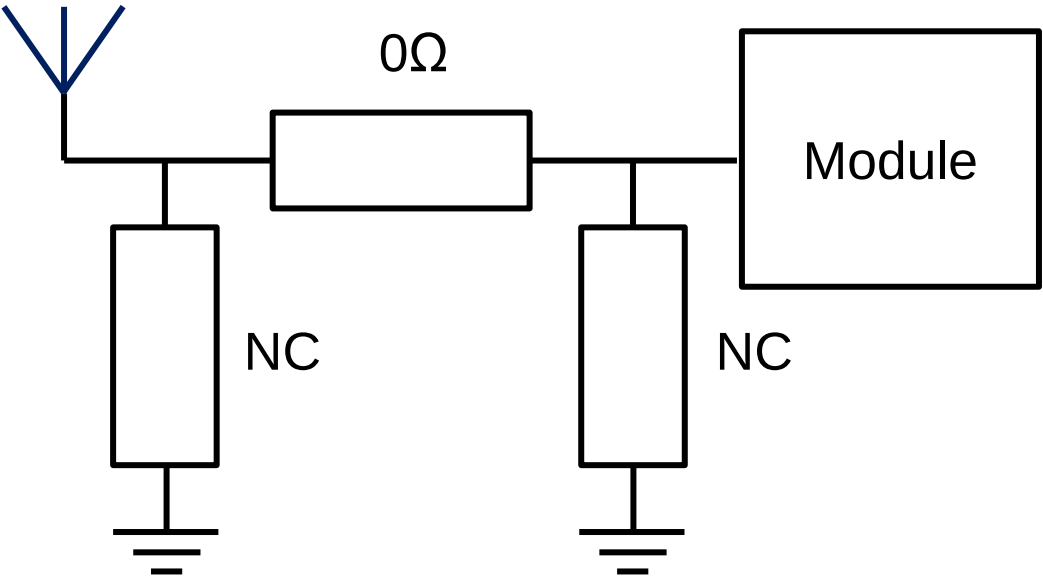


**Peak Gain:**

1575MHz: 0.57dBi

- Matching Circuit Diagram

## WiFi-AP Antenna



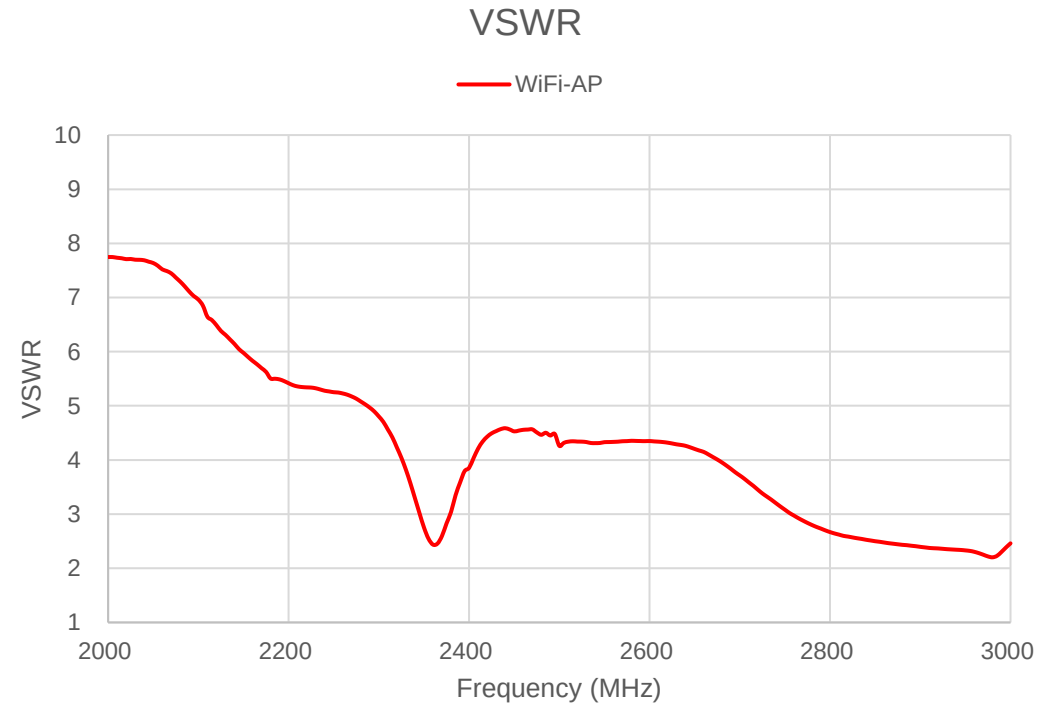
- Match Value:

| No. | L/C |
|-----|-----|
| F1  | NA  |
| F2  | 0Ω  |
| F3  | NA  |

# Passive Test—WiFi-AP



- VSWR (Voltage Standing Wave Ratio)



**VSWR (Voltage Standing Wave Ratio):**

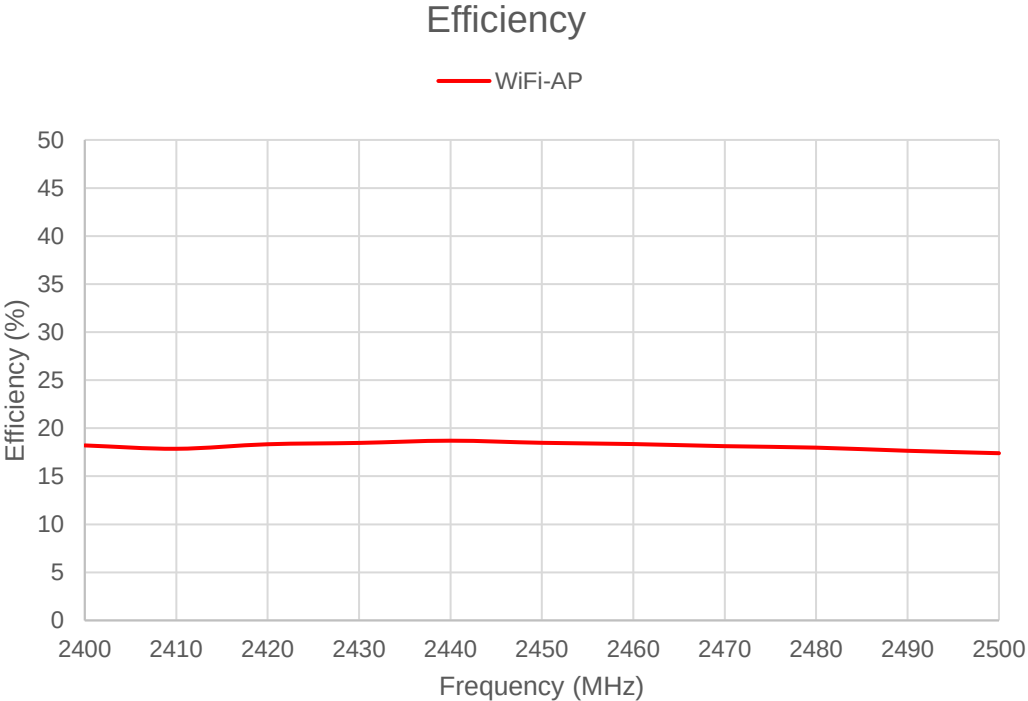
2400-2500MHz < 5



# Passive Test—WiFi-AP



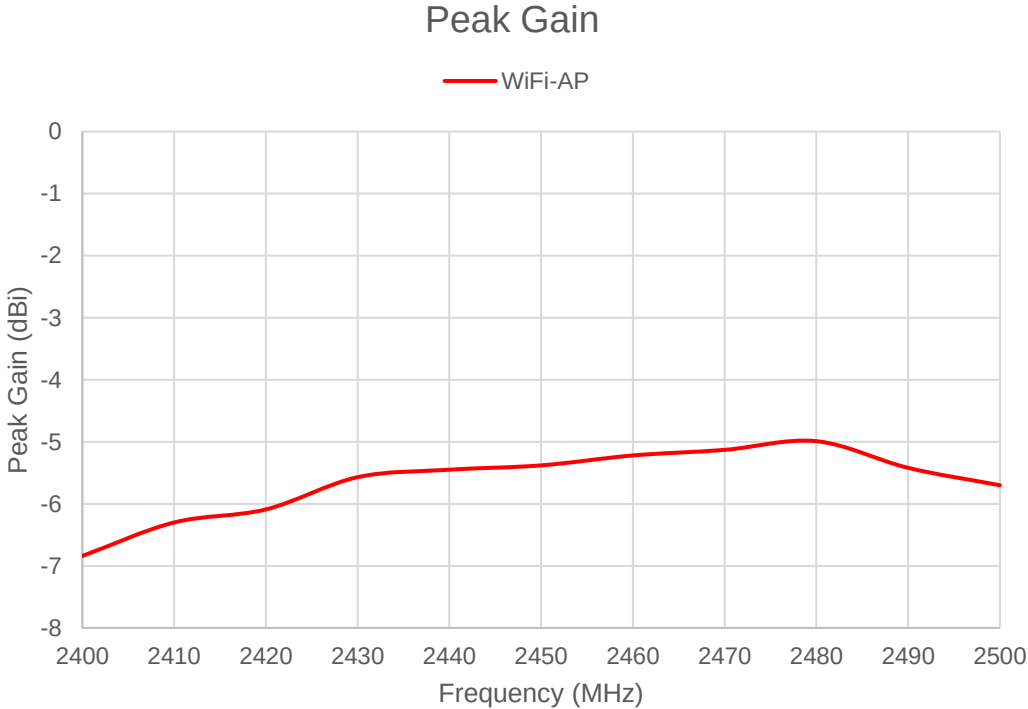
- Efficiency



**Efficiency:**

2400-2500MHz > 18%

- Peak Gain

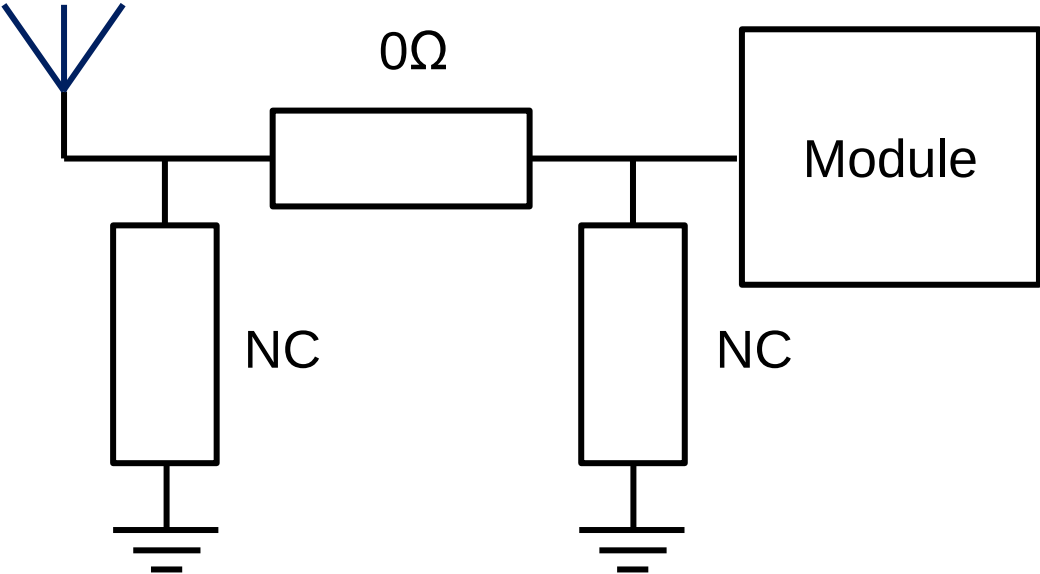


**Peak Gain:**

2400-2500MHz: -4.99 dBi

- Matching Circuit Diagram

BT Antenna



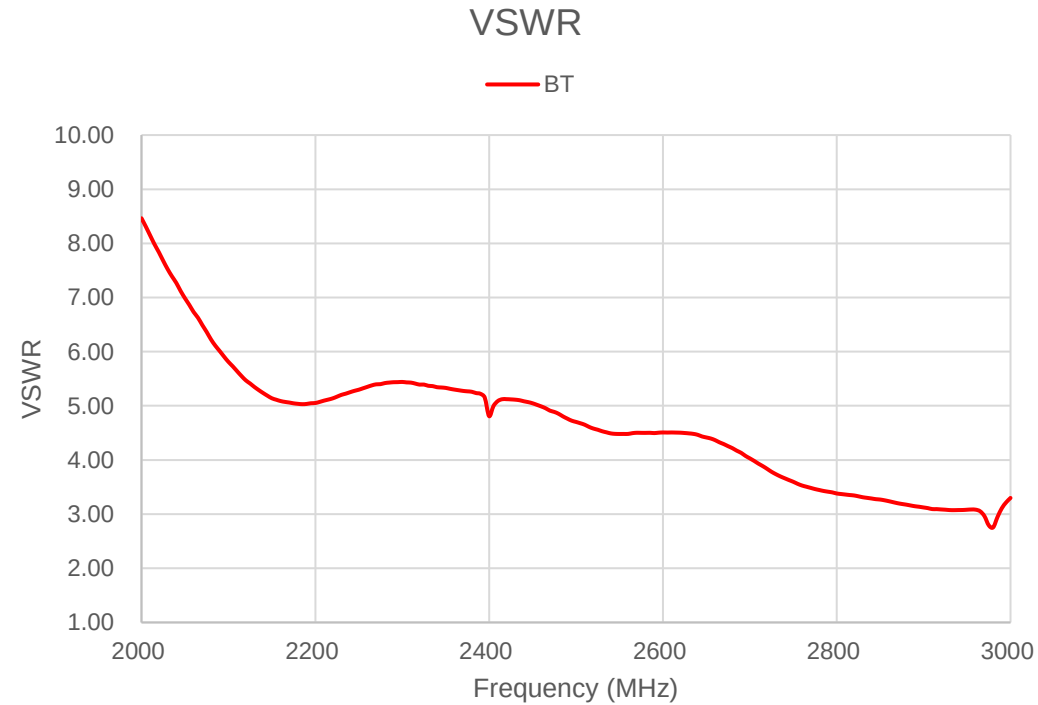
- Match Value:

| No. | L/C       |
|-----|-----------|
| F1  | NA        |
| F2  | $0\Omega$ |
| F3  | NA        |

# Passive Test—BT



- VSWR (Voltage Standing Wave Ratio)



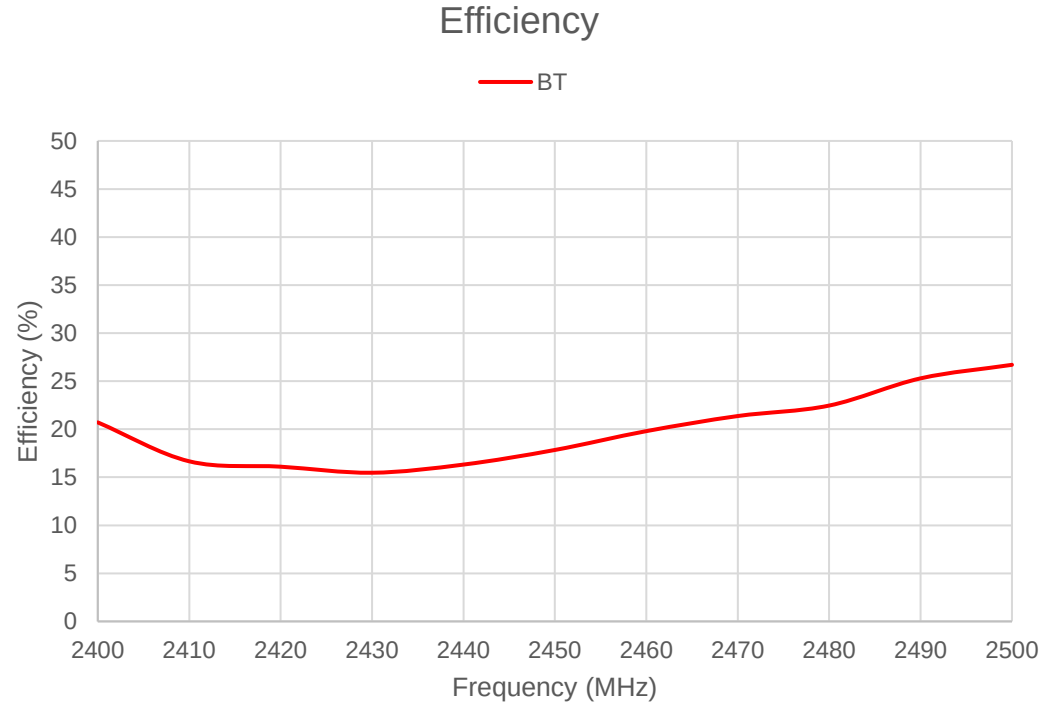
**VSWR (Voltage Standing Wave Ratio):**

2400-2500MHz < 5

# Passive Test—BT



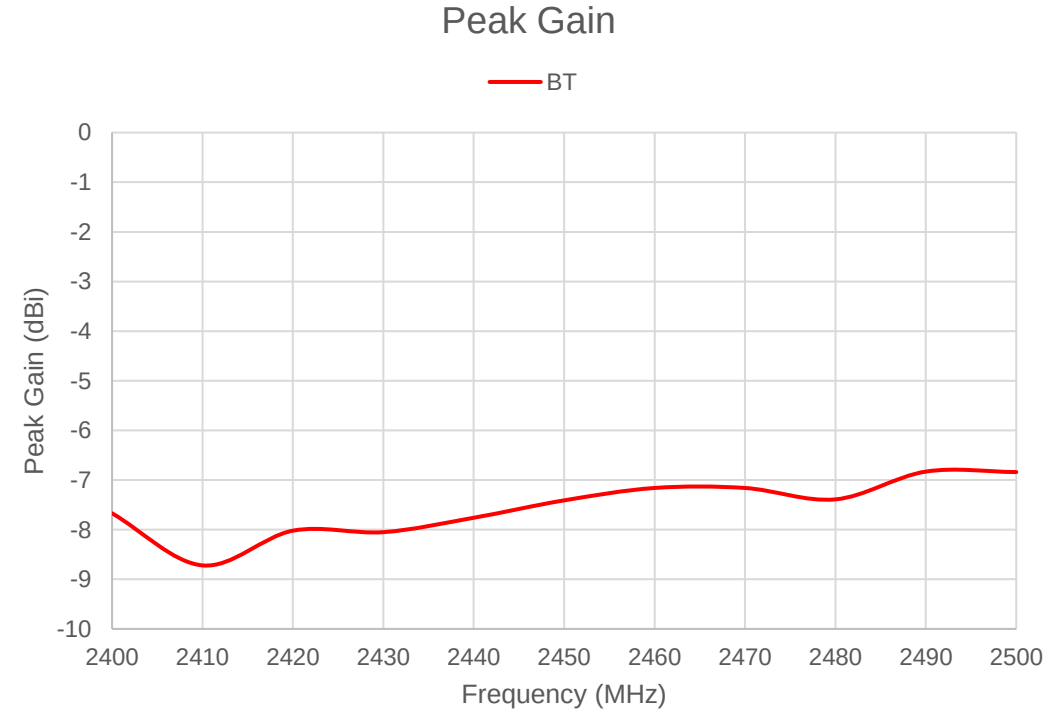
- Efficiency



**Efficiency:**

2400-2500MHz > 15%

- Peak Gain

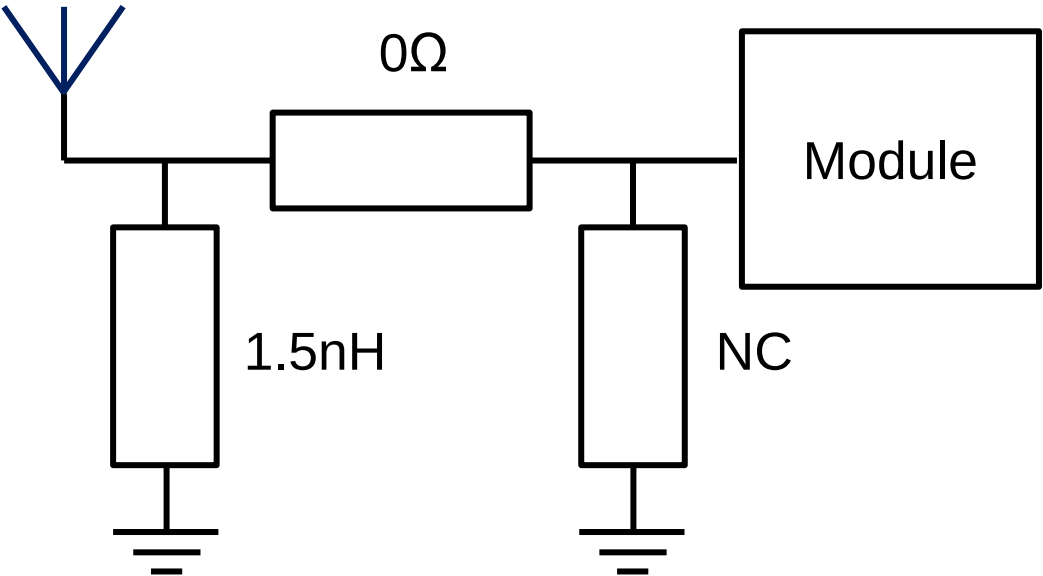


**Peak Gain:**

2400-2500MHz: -6.83 dBi

- Matching Circuit Diagram

## WiFi-SCAN Antenna



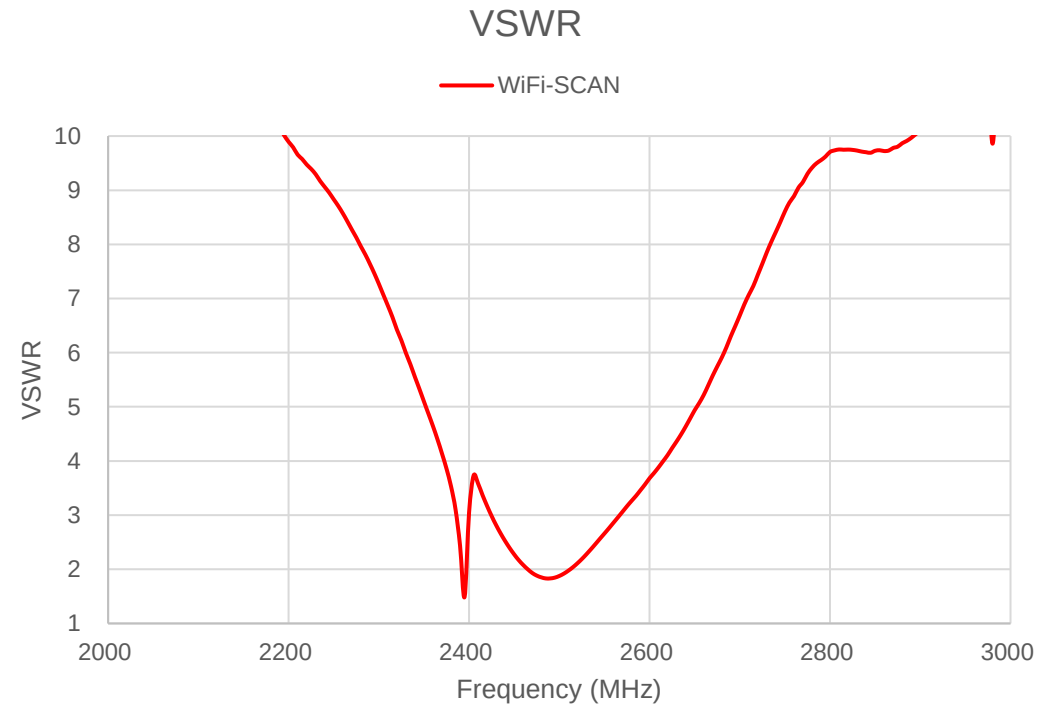
- Match Value:

| No. | L/C   |
|-----|-------|
| F1  | 1.5nH |
| F2  | 0Ω    |
| F3  | NA    |

# Passive Test—WiFi-SCAN



- VSWR (Voltage Standing Wave Ratio)



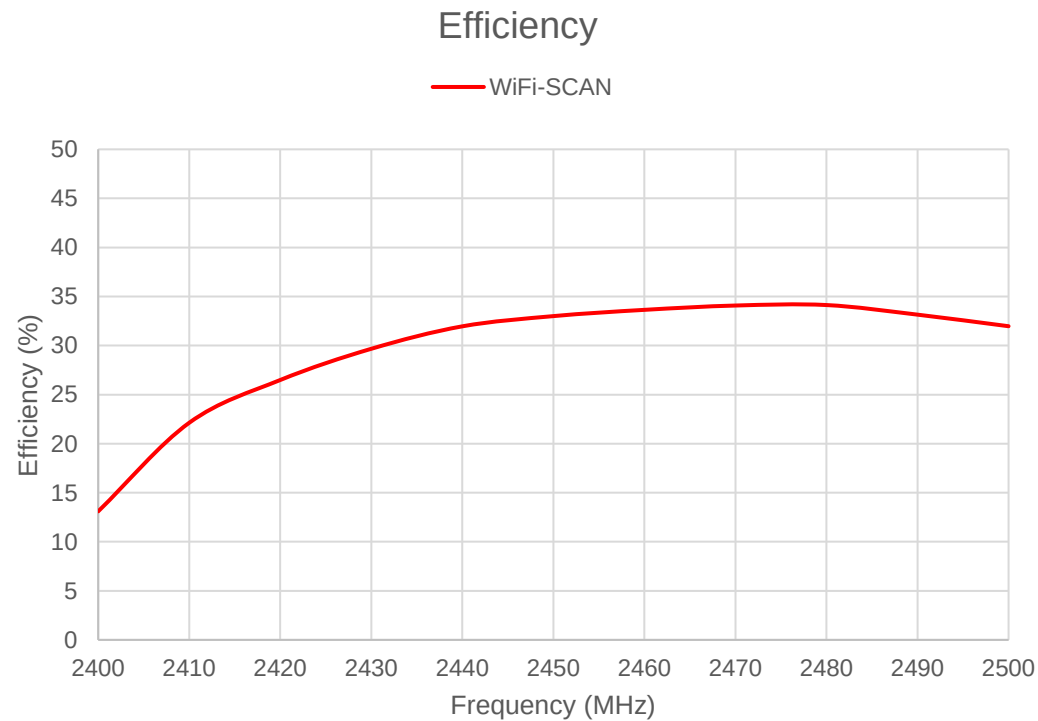
**VSWR (Voltage Standing Wave Ratio):**

2400-2500MHz < 4

# Passive Test—WiFi-SCAN



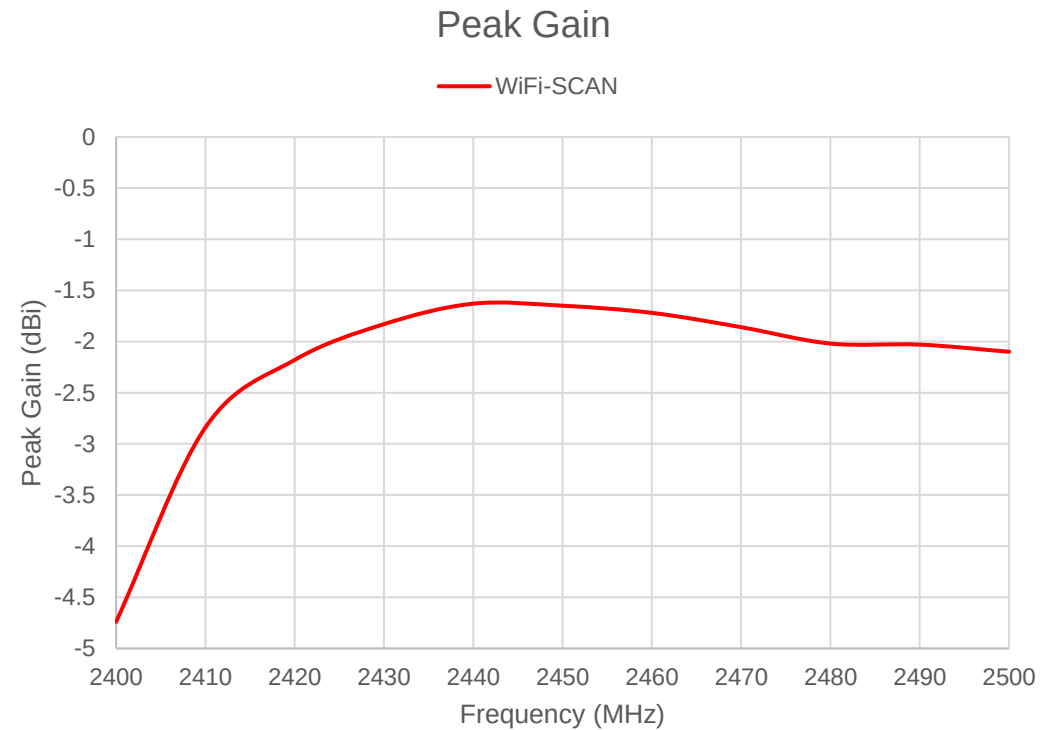
- Efficiency



**Efficiency:**

2400-2500MHz > 13%

- Peak Gain



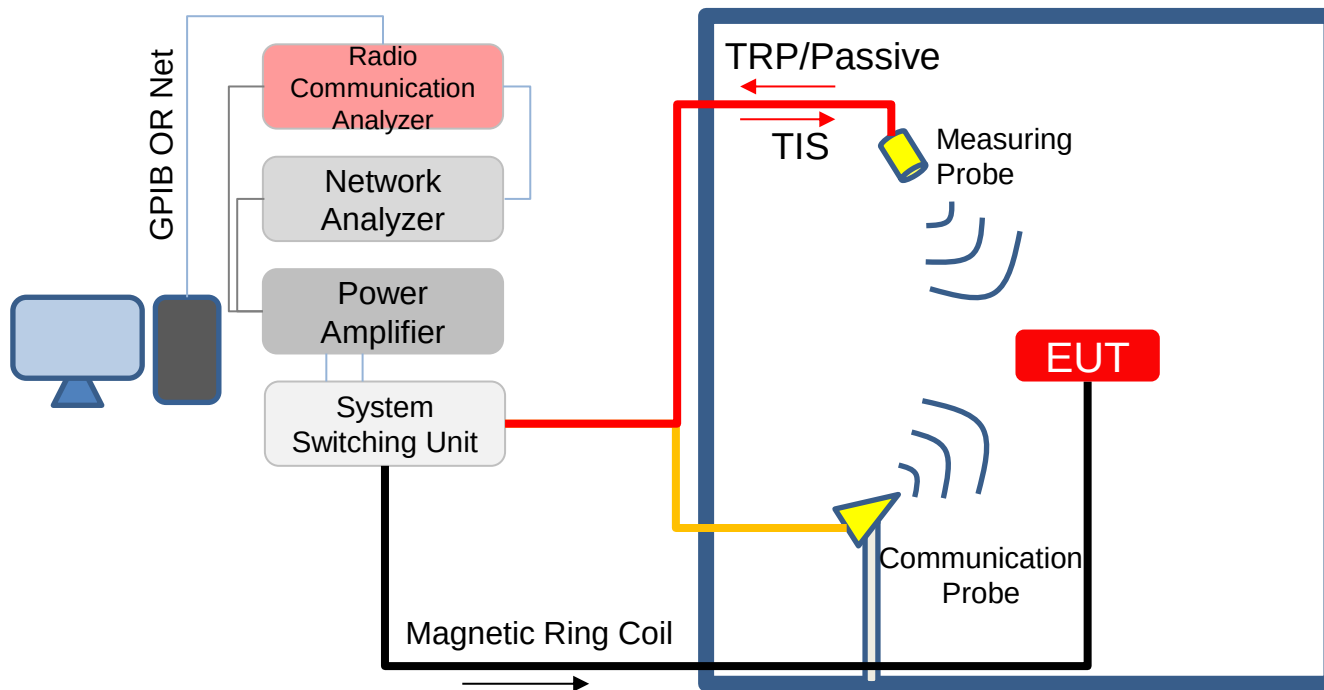
**Peak Gain:**

2400-2500MHz: -1.63 dBi

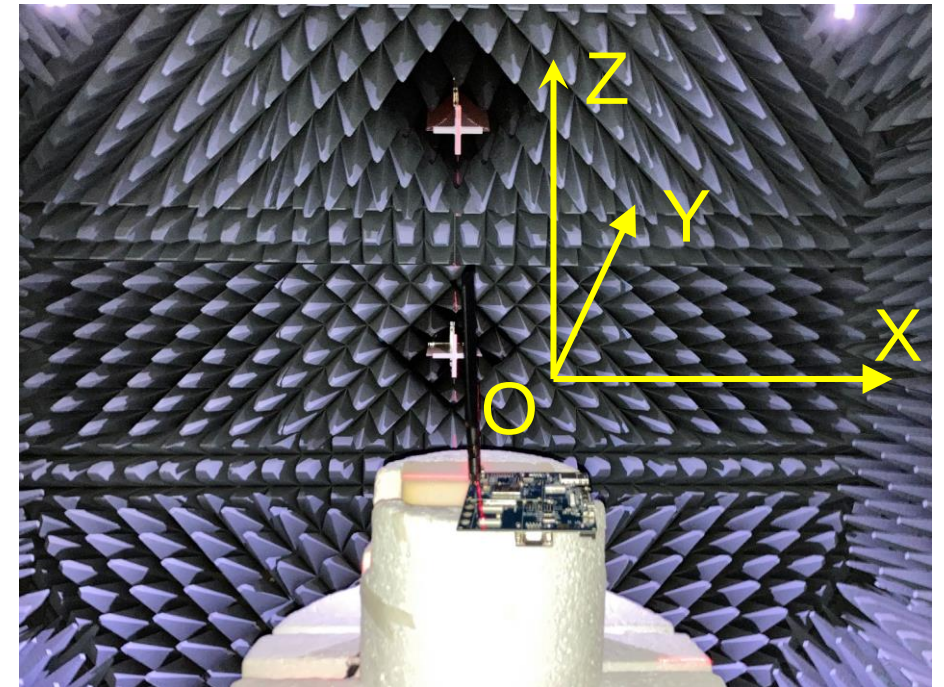


# Antenna Test

- Chamber Coordinate System FS-S-1



H Plane: XY  
E1 Plane: XZ  
E2 Plane: YZ



# Active Test

- OTA Data

| Band | channel | TRP    | channel | TIS     |
|------|---------|--------|---------|---------|
| B1   | 18050   | 20. 41 |         |         |
|      | 18300   | 19. 63 |         |         |
|      | 18550   | 18. 66 | 550     | -85. 49 |
| B2   | 18650   | 18. 15 |         |         |
|      | 18900   | 19. 18 |         |         |
|      | 19150   | 19. 16 | 1150    | -95. 64 |
| B3   | 19250   | 16. 08 |         |         |
|      | 19575   | 16. 8  |         |         |
|      | 19900   | 18. 23 | 1900    | -93. 44 |
| B4   | 20000   | 19. 25 |         |         |
|      | 20175   | 17. 47 |         |         |
|      | 20350   | 18. 9  | 2350    | -79. 16 |
| B5   | 20450   | 11. 19 |         |         |
|      | 20525   | 8. 59  |         |         |
|      | 20600   | 8. 32  | 2600    | -84. 17 |
| B7   | 20800   | 15. 75 |         |         |
|      | 21100   | 17. 23 |         |         |
|      | 21400   | 16. 84 | 3400    | -87. 64 |
| B8   | 21500   | 9. 51  |         |         |
|      | 21625   | 10. 07 |         |         |
|      | 21750   | 11. 63 | 3750    | -86. 93 |
| B12  | 23060   | 5. 37  |         |         |
|      | 23095   | 5. 73  |         |         |
|      | 23130   | 5. 92  | 5130    | -79. 56 |
| B13  | 23230   | 8. 52  | 5230    | -80. 3  |
|      |         |        |         |         |
|      |         |        |         |         |
| B20  | 24200   | 10. 59 |         |         |
|      | 24300   | 9. 84  |         |         |
|      | 24400   | 10. 42 | 6400    | -83. 28 |
| B28  | 27260   | 3. 87  |         |         |
|      | 27435   | 4. 33  |         |         |
|      | 27610   | 5. 93  | 9610    | -76. 25 |
| B38  | 37800   | 19. 37 |         |         |
|      | 38000   | 17. 97 |         |         |
|      | 38200   | 16. 43 | 38200   | -90. 02 |
| B41  | 40340   | 21. 04 |         |         |
|      | 40620   | 18. 6  |         |         |
|      | 41140   | 17. 66 | 41140   | -91. 11 |
| B66  | 132022  | 20. 33 |         |         |
|      | 132322  | 19. 59 |         |         |
|      | 132622  | 20. 64 | 67086   | -83. 41 |

| Band | channel | TRP    | channel | TIS     |
|------|---------|--------|---------|---------|
| B17  | 23780   | 2. 82  |         |         |
|      | 23790   | 3. 67  |         |         |
|      | 23800   | 4. 77  | 5800    | -79. 68 |
| B18  | 23900   | 9. 06  |         |         |
|      | 23925   | 10. 54 |         |         |
|      | 23950   | 11. 15 | 5950    | -84. 72 |
| B19  | 24050   | 8. 61  |         |         |
|      | 24075   | 9. 19  |         |         |
|      | 24100   | 9. 5   | 6100    | -84. 6  |
| B25  | 26090   | 19. 78 |         |         |
|      | 26365   | 19. 24 |         |         |
|      | 26640   | 17. 91 | 8640    | -80. 91 |
| B26  | 26740   | 8. 91  |         |         |
|      | 26865   | 10. 17 |         |         |
|      | 26990   | 9. 22  | 8990    | -83. 98 |



| WiFi         |    |       |              |    |         |
|--------------|----|-------|--------------|----|---------|
| 模式           | 信道 | TRP   | 模式           | 信道 | TIS     |
| 2. 4G-B(11M) | 1  | 7. 59 | 2. 4G-B(11M) | 1  | -78. 09 |
|              | 6  | 5. 97 |              | 6  | -74. 43 |
|              | 13 | 4. 33 |              | 13 | -72. 29 |



# Project Overview

## Antenna Performance Evaluation and Debugging

## Conclusion and Suggestion

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- **Antenna Performance**

1. 4G antenna adopts the form of FPC+ shrapnel, limited by the size of the whole machine, low frequency passive is poor, high frequency is good
2. WiFi-SCAN adopts the form of FPC welding and has good performance
3. Wifi-ap and BT adopt the form of wire, in the current environment, the performance has reached the optimal, the wire should be placed in the clearance area (refer to P7), the active data of WiFi is based on the conductor in the clearance test.

- **How to improve antenna performance**

1. WiFi and BT change form, made into FPC/ steel sheet form, can effectively improve performance

- **Next step**

1. Antenna mounting confirmation & customer measurement





**We are a global IoT solutions provider,  
backed by outstanding support and  
services, to deliver a smarter world.**

- Unbeatable choice from the broadest module portfolio in the world
- High quality range of off-the-shelf and customized antennas
- Superb support with the largest R&D team in the industry
- Continuous innovation – in 5G, LPWA, Automotive, Smart module technology
- A passionate, dedicated team of "Quectelers" ensures our customers always come first

*Thank You*

**Build a Smarter World**

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