



**Unlicensed Band Antenna Gain (BT/WLAN/UWB/NFC)**

**Model: SM-F946B/DS, SM-F946B**

**FCC ID: A3LSMF946B**

# 1. BT + WLAN antenna type : Metal + LDS

## BT/WIFI 1\_2.4/5/6GHz (SUB4)

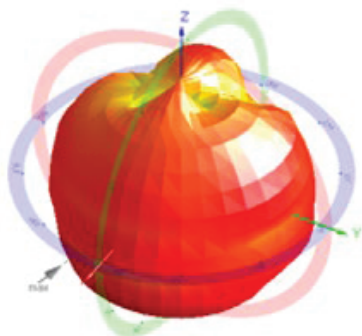
| Freq. [Hz]       | Peak. [dBi] |
|------------------|-------------|
| 2,400,000,000 Hz | -6.52 dBi   |
| 2,412,000,000 Hz | -6.87 dBi   |
| 2,437,000,000 Hz | -5.21 dBi   |
| 2,442,000,000 Hz | -4.64 dBi   |
| 2,450,000,000 Hz | -3.61 dBi   |
| 2,462,000,000 Hz | -3.58 dBi   |
| 2,472,000,000 Hz | -3.2 dBi    |
| 2,484,000,000 Hz | -2.76 dBi   |
| 2,500,000,000 Hz | -1.76 dBi   |
| 5,150,000,000 Hz | -5.12 dBi   |
| 5,200,000,000 Hz | -5.86 dBi   |
| 5,220,000,000 Hz | -5.36 dBi   |
| 5,250,000,000 Hz | -5.00 dBi   |
| 5,280,000,000 Hz | -5.14 dBi   |
| 5,300,000,000 Hz | -4.57 dBi   |
| 5,350,000,000 Hz | -3.88 dBi   |
| 5,400,000,000 Hz | -4.82 dBi   |
| 5,500,000,000 Hz | -4.97 dBi   |
| 5,600,000,000 Hz | -4.27 dBi   |
| 5,700,000,000 Hz | -3.59 dBi   |
| 5,785,000,000 Hz | -4.68 dBi   |
| 5,800,000,000 Hz | -3.96 dBi   |
| 5,805,000,000 Hz | -4.26 dBi   |
| 5,850,000,000 Hz | -4.53 dBi   |
| 5,885,000,000 Hz | -4.44 dBi   |
| 5,895,000,000 Hz | -3.89 dBi   |
| 5,925,000,000 Hz | -7.62 dBi   |
| 6,025,000,000 Hz | -7.91 dBi   |
| 6,125,000,000 Hz | -7.82 dBi   |
| 6,225,000,000 Hz | -7.67 dBi   |
| 6,325,000,000 Hz | -7.89 dBi   |
| 6,425,000,000 Hz | -7.52 dBi   |
| 6,525,000,000 Hz | -7.63 dBi   |
| 6,625,000,000 Hz | -7.47 dBi   |
| 6,725,000,000 Hz | -7.8 dBi    |
| 6,825,000,000 Hz | -7.63 dBi   |
| 6,925,000,000 Hz | -8.33 dBi   |
| 7,025,000,000 Hz | -9.71 dBi   |
| 7,125,000,000 Hz | -9.02 dBi   |

# WIFI 2 #1\_2.4GHz (SUB3), WIFI2 #2\_5/6GHz (SUB6)

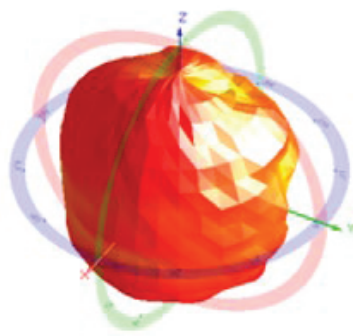
| Freq. [Hz]       | Peak. [dBi] |
|------------------|-------------|
| 2,400,000,000 Hz | -3.36 dBi   |
| 2,412,000,000 Hz | -2.13 dBi   |
| 2,437,000,000 Hz | -2.58 dBi   |
| 2,442,000,000 Hz | -2.88 dBi   |
| 2,450,000,000 Hz | -2.56 dBi   |
| 2,462,000,000 Hz | -2.23 dBi   |
| 2,472,000,000 Hz | -1.53 dBi   |
| 2,484,000,000 Hz | -1.58 dBi   |
| 2,500,000,000 Hz | -2.15 dBi   |
| 5,150,000,000 Hz | -3.11 dBi   |
| 5,200,000,000 Hz | -3.05 dBi   |
| 5,220,000,000 Hz | -2.96 dBi   |
| 5,250,000,000 Hz | -3.08 dBi   |
| 5,280,000,000 Hz | -3.18 dBi   |
| 5,300,000,000 Hz | -2.24 dBi   |
| 5,350,000,000 Hz | -3.21 dBi   |
| 5,400,000,000 Hz | -2.79 dBi   |
| 5,500,000,000 Hz | -2.59 dBi   |
| 5,600,000,000 Hz | -2.77 dBi   |
| 5,700,000,000 Hz | -2.76 dBi   |
| 5,785,000,000 Hz | -2.19 dBi   |
| 5,800,000,000 Hz | -2.5 dBi    |
| 5,805,000,000 Hz | -2.33 dBi   |
| 5,850,000,000 Hz | -2.33 dBi   |
| 5,885,000,000 Hz | -2.81 dBi   |
| 5,895,000,000 Hz | -2.39 dBi   |
| 5,925,000,000 Hz | -5.51 dBi   |
| 6,025,000,000 Hz | -5.53 dBi   |
| 6,125,000,000 Hz | -5.55 dBi   |
| 6,225,000,000 Hz | -5.76 dBi   |
| 6,325,000,000 Hz | -5.69 dBi   |
| 6,425,000,000 Hz | -5.79 dBi   |
| 6,525,000,000 Hz | -5.85 dBi   |
| 6,625,000,000 Hz | -5.92 dBi   |
| 6,725,000,000 Hz | -5.6 dBi    |
| 6,825,000,000 Hz | -5.93 dBi   |
| 6,925,000,000 Hz | -6 dBi      |
| 7,025,000,000 Hz | -5.83 dBi   |
| 7,125,000,000 Hz | -6.29 dBi   |

## Radiation plots for max gain plane (3D)

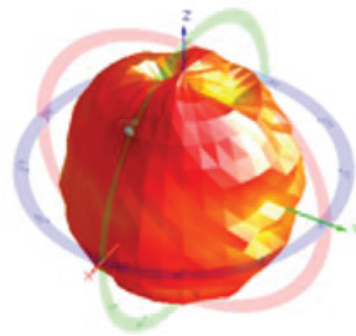
### WiFi 1



2.4G

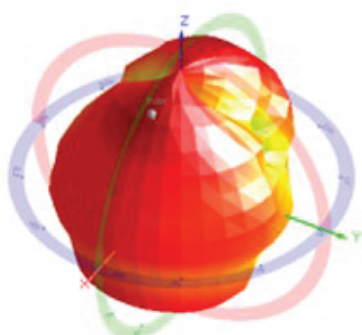


5G

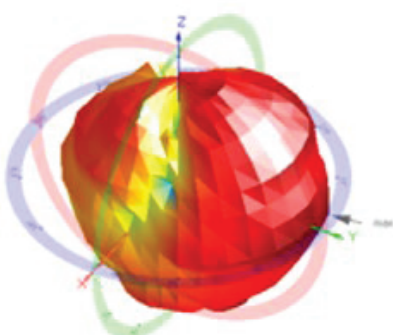


6G

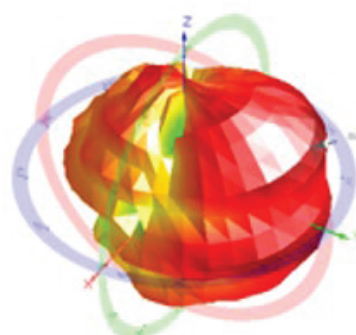
### WiFi 2



2.4G



5G

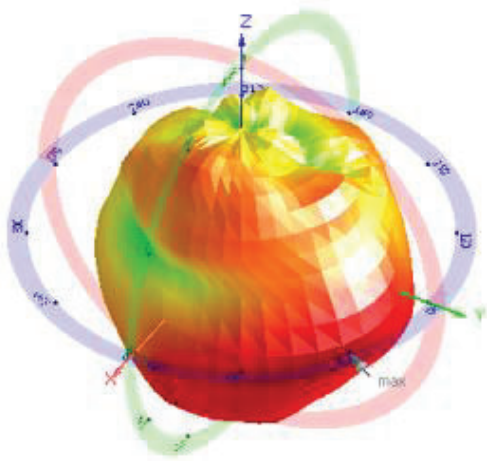


6G

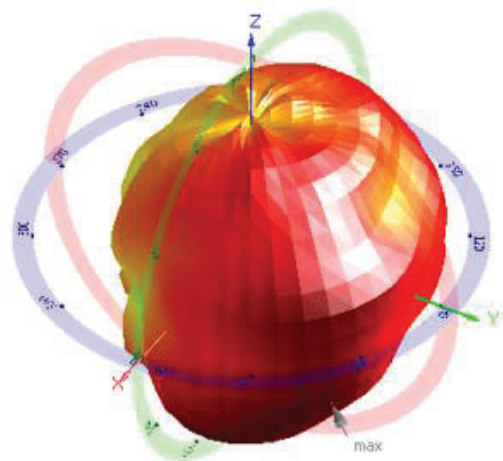
## 2.1 UWB Ranging (UWB ANT1 - Metal)

| Metal ANT | Frequency | Avg. gain (dBi) | Peak gain (dBi) |
|-----------|-----------|-----------------|-----------------|
| CH5       | 6.25GHz   | -12.4           | -5.4            |
|           | 6.5GHz    | -9.8            | -2.3            |
|           | 6.75GHz   | -9.8            | -2.7            |
| CH9       | 7.75GHz   | -7.7            | -0.3            |
|           | 8GHz      | -6.6            | -0.4            |
|           | 8.25GHz   | -8.6            | -1.4            |

Radiation plots for max gain plane (3D)



6500 MHz

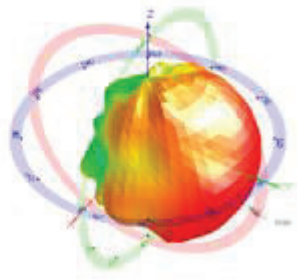


8000 MHz

## 2.2 Antenna UWB AOA (UWB ANT2 - Patch ANT)

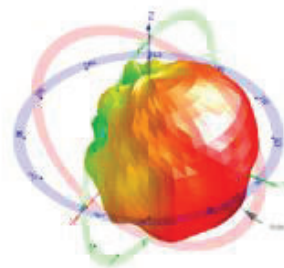
|     | Frequency | Patch 1         |                 | Patch 2         |                 | Patch 3         |                 |  |
|-----|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|--|
|     |           | Avg. gain (dBi) | Peak gain (dBi) | Avg. gain (dBi) | Peak gain (dBi) | Avg. gain (dBi) | Peak gain (dBi) |  |
| CH5 | 6.25GHz   | -               | -               | -               | -               | -               | -               |  |
|     | 6.5GHz    | -               | -               | -               | -               | -               | -               |  |
|     | 6.75GHz   | -               | -               | -               | -               | -               | -               |  |
| CH9 | 7.75GHz   | -10.4           | -3.6            | -9.3            | -1.5            | -10.1           | -2.3            |  |
|     | 8GHz      | -9.9            | -2.8            | -9.7            | -2.4            | -8.3            | -0.3            |  |
|     | 8.25GHz   | -11.6           | -4.4            | -13.0           | -5.5            | -11.6           | -3.3            |  |

8.000GHz



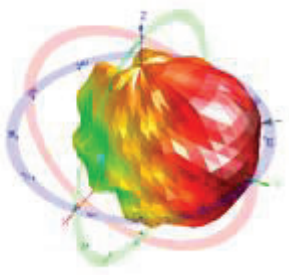
**Patch 1**

8.000GHz



**Patch 2**

8.000GHz



**Patch 3**

## Radiation Pattern Test

Antennas tested for Gain and Efficiency must be assembled into the enclosure and tested in the fully assembled and operating Q5 handset. The antenna is tested in free space in the anechoic chamber in the H, E1 and, E2 planes. The radiation patterns are measured at the center of transmit and receive bands.

Photo #1

Note: Please refer to photos uploaded in separate antenna test setup photos exhibit.

Figure 1: Geometry for Q5 for Radiation patterns

### Chamber Information

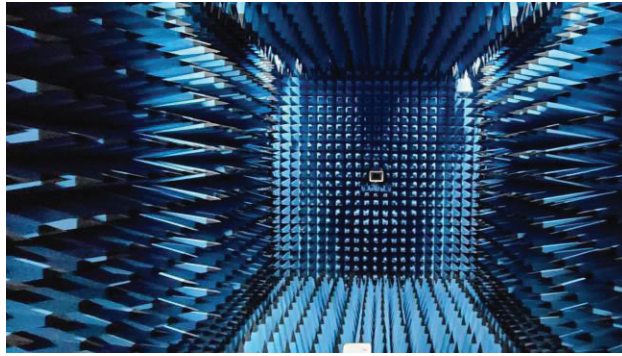


Figure 2: Geometry of Anechoic Chamber for Radiation patterns.

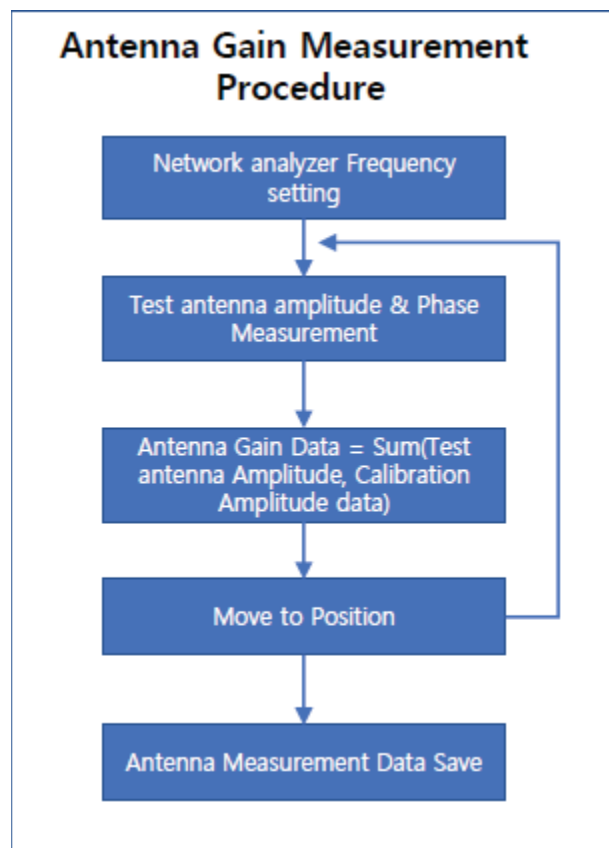
- ✓ Location : Samsung R&D Center R5 bld.
- ✓ Size : 4m x 2.5 x 2.5m (L x W x H)
- ✓ Frequency : 600 MHz -18GHz
- ✓ TX Antenna : 2GHz –18GHz Dual Polarization
- ✓ Quiet zone : 22cm @ 6GHz (Far-Field Length 2m)
- ✓ 2-axis DUT positioner -360°continuous rotation

### Test setup photos

Photo #2

Note: Please refer to photos uploaded in separate antenna test setup photos exhibit.

## Antenna Gain Measurement Procedure

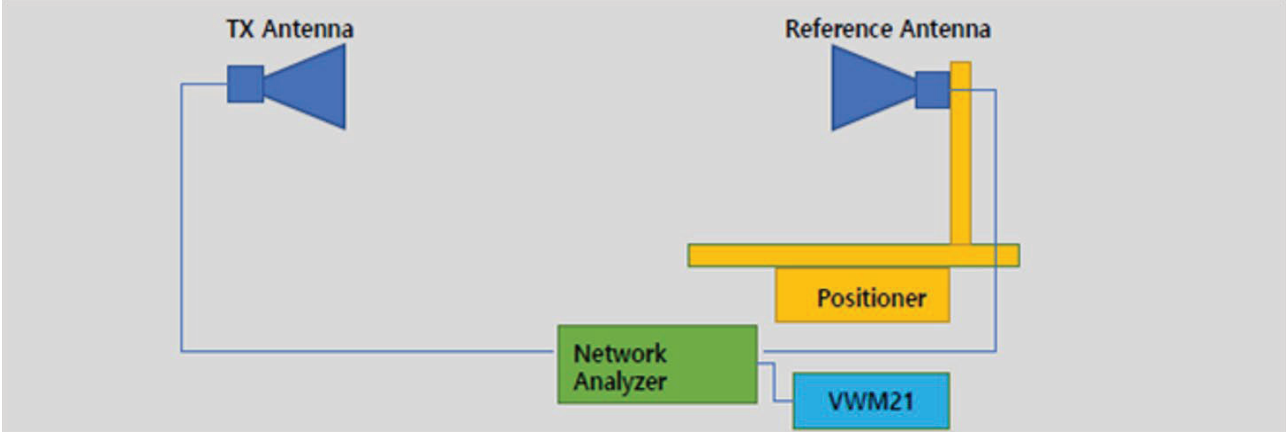


## Detail antenna description

Photo #3

Note: Please refer to photos uploaded in separate antenna test setup photos exhibit.

Table of calibrated equipment (BT & WLAN)



| Part                 | Model Name    | Specification     | Cal date                                                                                  | Serial number |
|----------------------|---------------|-------------------|-------------------------------------------------------------------------------------------|---------------|
| Tx Antenna           | QRH-006M-006G | 600MHz to 6GHz    | Calibrated date :2022.8.8 / Cal. Due : 2023.12.28                                         | -             |
|                      | QRH-002G-018G | 2GHz to 18GHz     | Calibrated date :2022.8.8 / Cal. Due : 2023.12.28                                         | -             |
| Reference Antenna    | BBHA9120LFA   | 680MHz to 6500MHz | Calibration Frequency(680MHzto 6GHz)<br>Calibrated date:2022.8.8 / Cal. Due : 2023.12.28  | 9120LF-365    |
|                      | BBHA9120C     | 2GHz to 18GHz     | Calibration Frequency(2GHz to 8.5GHz)<br>Calibrated date:2022.8.8 / Cal. Due : 2023.12.28 | BBHA9120C#714 |
| Network Analyzer     | Agilent 5071B | 300KHz to 8.5GHz  | Calibrated date :2022.8.8 / Cal. Due : 2023.12.28                                         | C000026236    |
| Measurement Software | VWM21         |                   | MTG Visual Wave-Mobile(Ver.2.1)                                                           | -             |

Test dates

2023.03.31

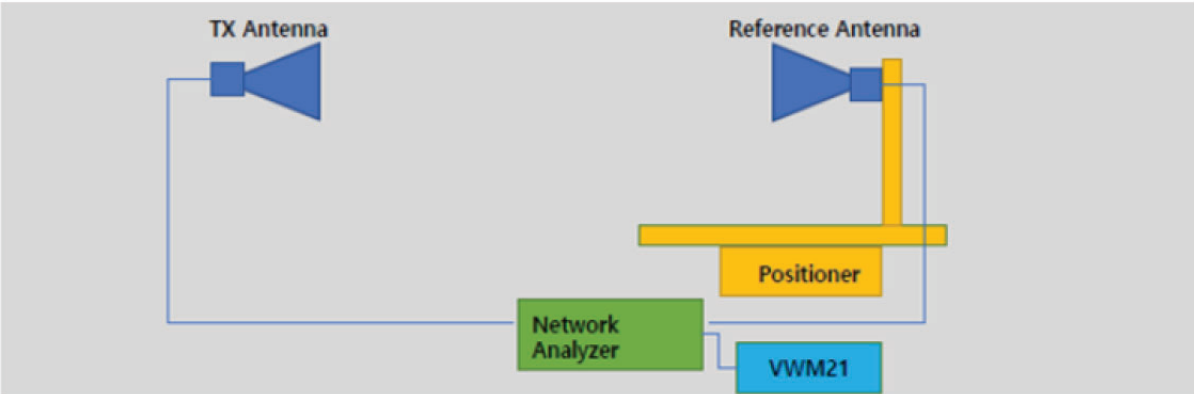
Names of test personnel

Seongyong An

Names of commercial test software being used

MTG Visual Wave-Mobile (Ver.2.1)

Table of calibrated equipment UWB



| Part                 | Model Name    | Specification     |                                        |
|----------------------|---------------|-------------------|----------------------------------------|
| TX Antenna           | QRH-006M-006G | 600MHz to 6GHz    |                                        |
|                      | QRH-002G-018G | 2GHz to 18GHz     |                                        |
| Reference Antenna    | BBHA9120LFA   | 680MHz to 6500MHz | Calibration Frequency (680MHz to 6GHz) |
|                      | BBHA9120C     | 2GHz to 18GHz     | Calibration Frequency (2GHz to 8.5GHz) |
| Network Analyzer     | Agilent 5071B | 300KHz to 8.5GHz  | Cal. Due : 2023.12.28                  |
| Measurement Software | VWM21         |                   | MTG Visual Wave-Mobile (Ver.2.1)       |

Test date

2023. 05. 11

Name of test personnel

Hyun-jeong Lee, Seong-yong Ahn.

Names of commercial test software being used

MTG Visual Wave-Mobile (Ver.2.1)

### **3. NFC antenna**

- Antenna type: FPCB type
- Antenna number of turns: 4 turns
- Antenna size: 43.18 x 74.4 mm
- Antenna photo: Please refer to internal photo