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)

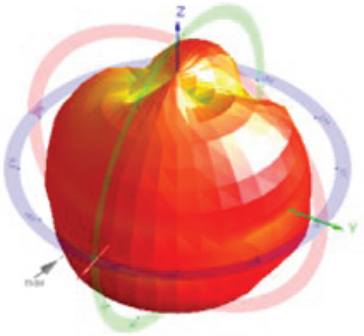
Freq. [Hz]	Peak. [dBi]
2,400,000,000 Hz	-6.52 dBi
2,412,000,000 Hz	-6.87 dBi
2,437,000,000 Hz	-5.21 dBi
2,442,000,000 Hz	-4.64 dBi
2,450,000,000 Hz	-3.61 dBi
2,462,000,000 Hz	-3.58 dBi
2,472,000,000 Hz	-3.2 dBi
2,484,000,000 Hz	-2.76 dBi
2,500,000,000 Hz	-1.76 dBi
5,150,000,000 Hz	-5.12 dBi
5,200,000,000 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)

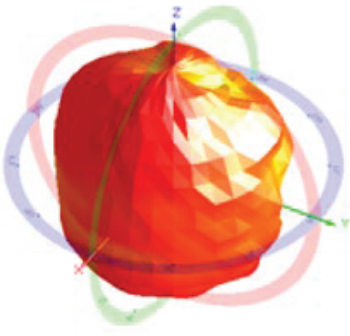
Freq. [Hz]	Peak. [dBi]
2,400,000,000 Hz	-3.36 dBi
2,412,000,000 Hz	-2.13 dBi
2,437,000,000 Hz	-2.58 dBi
2,442,000,000 Hz	-2.88 dBi
2,450,000,000 Hz	-2.56 dBi
2,462,000,000 Hz	-2.23 dBi
2,472,000,000 Hz	-1.53 dBi
2,484,000,000 Hz	-1.58 dBi
2,500,000,000 Hz	-2.15 dBi
5,150,000,000 Hz	-3.11 dBi
5,200,000,000 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)

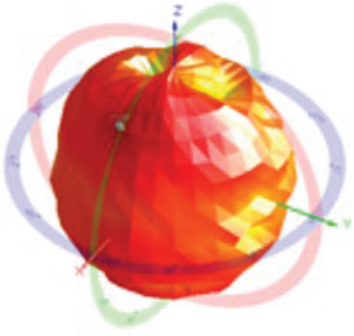
WiFi 1



2.4G

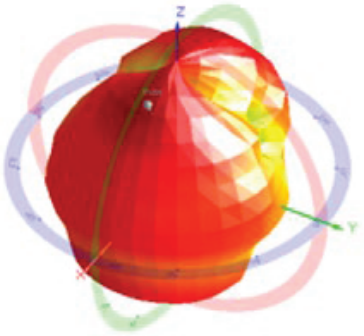


5G

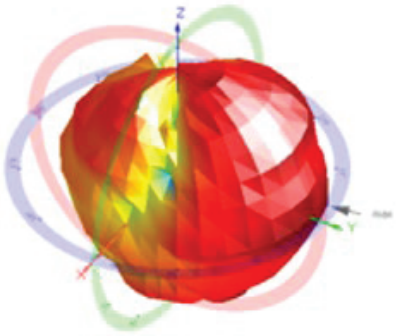


6G

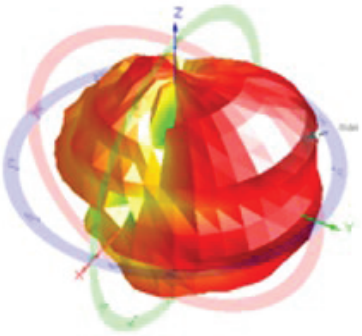
WiFi 2



2.4G



5G

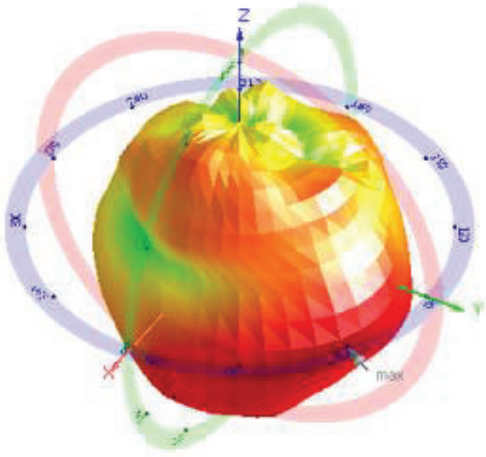


6G

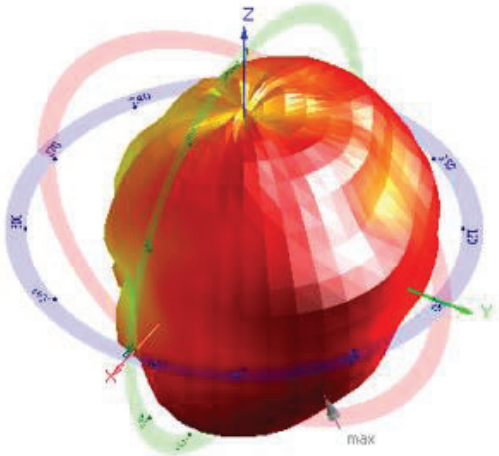
2.1 UWB Ranging (UWB ANT1 - Metal)

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)



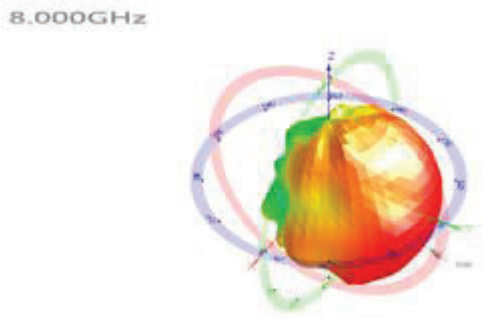
6500 MHz



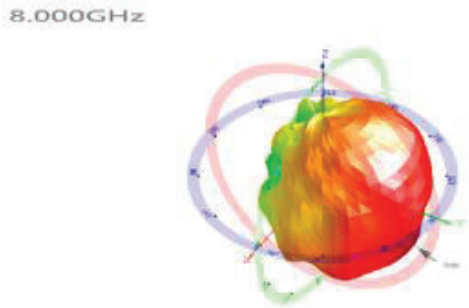
8000 MHz

2.2 Antenna UWB AOA (UWB ANT2 - Patch ANT)

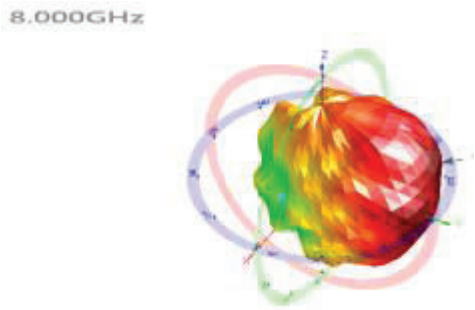
	Frequency	Patch 1		Patch 2		Patch 3		
		Avg. gain (dBi)	Peak gain (dBi)	Avg. gain (dBi)	Peak gain (dBi)	Avg. gain (dBi)	Peak gain (dBi)	
CH5	6.25GHz	-	-	-	-	-	-	
	6.5GHz	-	-	-	-	-	-	
	6.75GHz	-	-	-	-	-	-	
CH9	7.75GHz	-10.4	-3.6	-9.3	-1.5	-10.1	-2.3	
	8GHz	-9.9	-2.8	-9.7	-2.4	-8.3	-0.3	
	8.25GHz	-11.6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



Patch 1



Patch 2



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

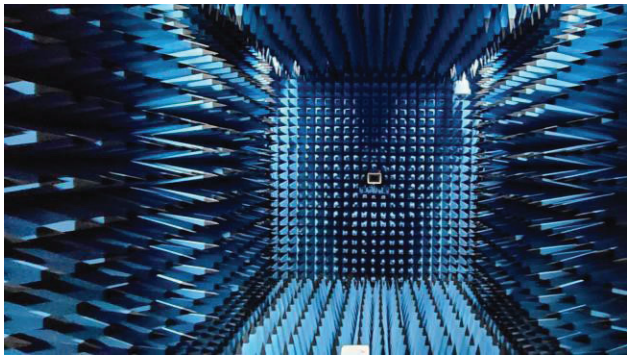


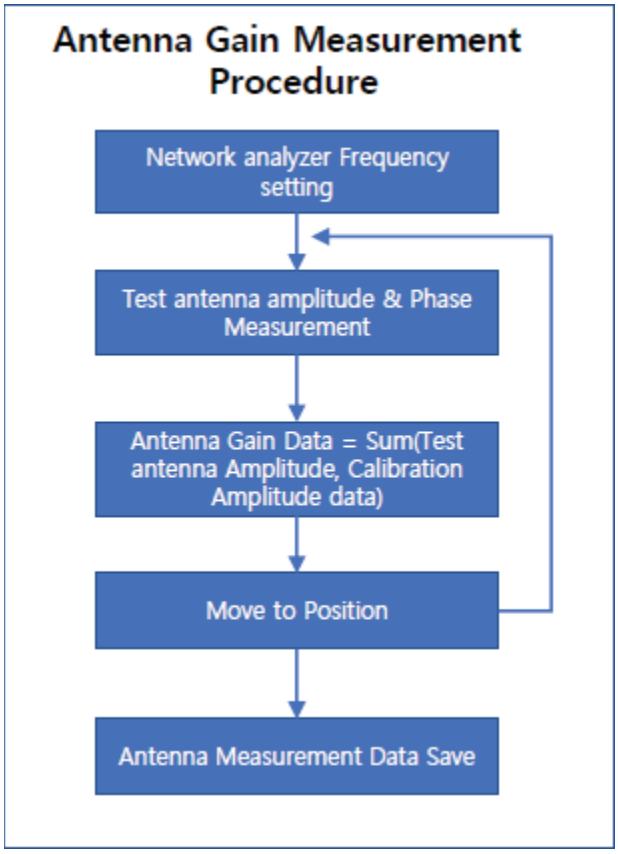
Figure 2: Geometry of Anechoic Chamber for Radiation patterns.

- ✓ 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.

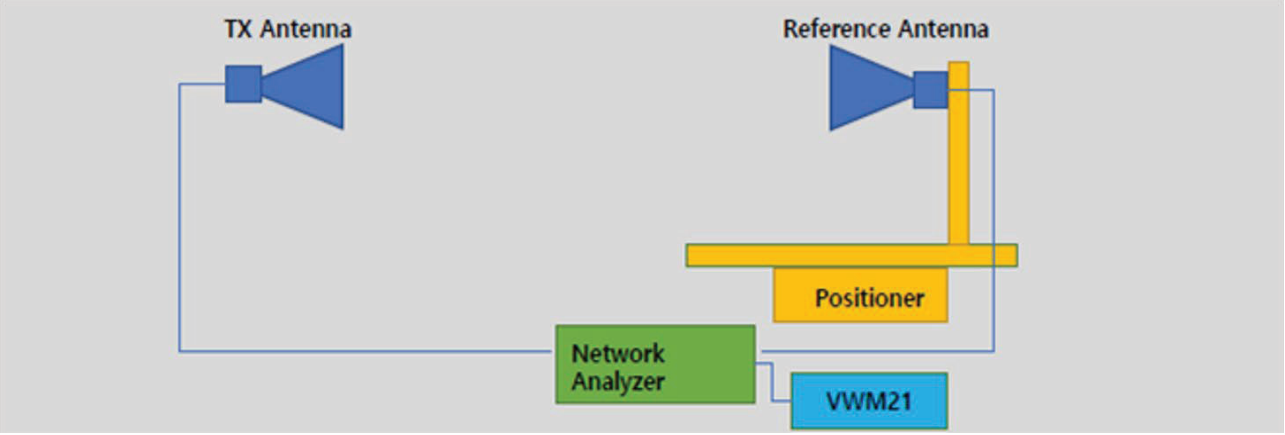
Antenna Gain Measurement Procedure



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) Calibrated date:2022.8.8 / Cal. Due : 2023.12.28	9120LF-365
	BBHA9120C	2GHz to 18GHz	Calibration Frequency(2GHz to 8.5GHz) 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

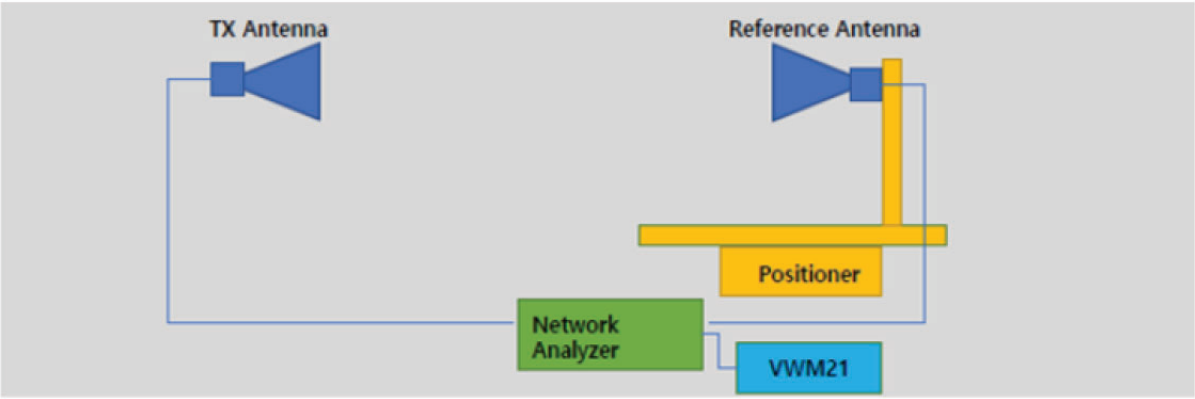
Names of test personnel

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