# Revision History

| Version | Date | Author | Note |
|---|---|---|---|
| 1.0 | 2025-06-16 | Weston.Zhang | Libris Aura and Charging Cradle Antenna Debug Report |

# Project Overview

- Project Name: Libris Aura
- Device Dimensions: 62 mm x 34 mm x 12 mm
- Antenna Number: 4

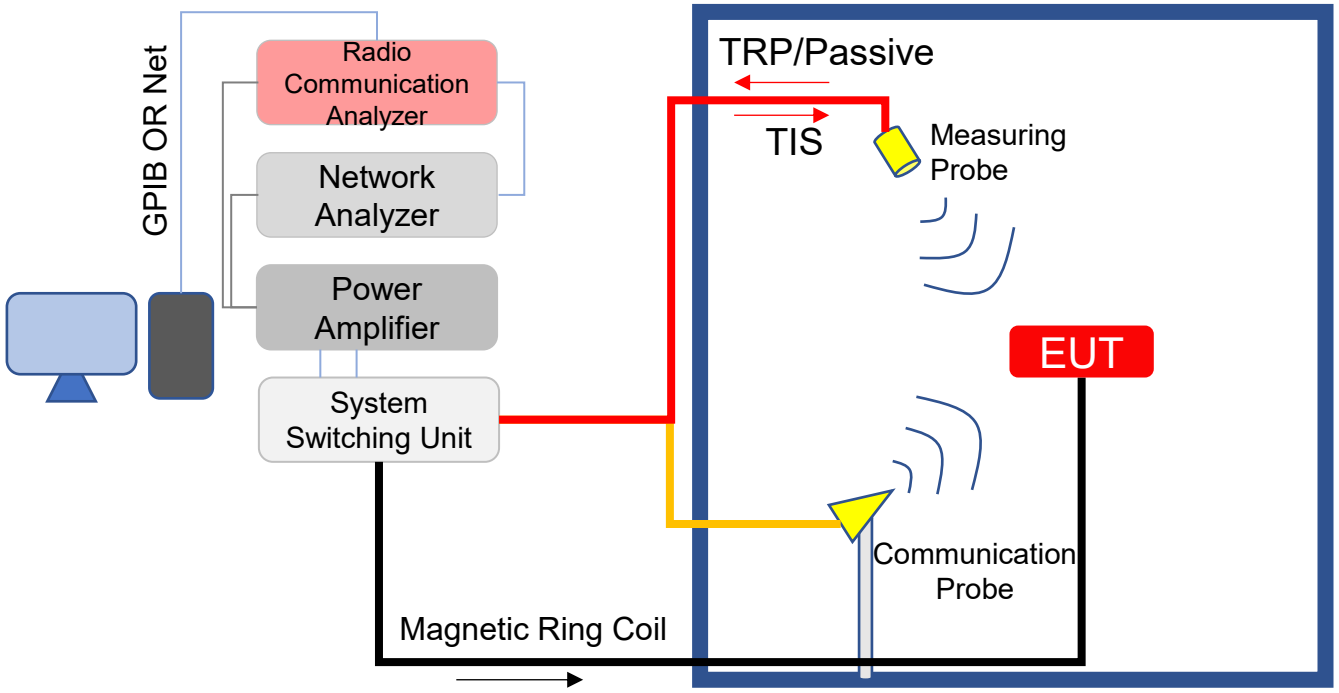
- Antenna Network Type & Frequency Band：
  - LTE*1: 699-746MHz & 1710-2180MHz (LDS)
  - WiFi*1: 2400-2500MHz (LDS)
  - GPS&BT *1 : 1575.42MHz & 2400-2500MHz (LDS)
  - BLE *1 : 2400-2500MHz (Metal Antenna)
- Requirement: AT&T

# Antenna Test

- Network Analyzer: Keysight E5071C (Device number: QTB6331E; Calibration date: 2023-12-27; Due date: 2025-06-26)
- Chamber: OTA RayZone 2800 GTS (Device number: QTA0709; Calibration date: 2024-07-14; Due date: 2025-07-13)
- Testing Software: Libra
- Product Name: LTE & WiFi & BT&GNSS Antenna
- Test Engineer: Weston Zhang

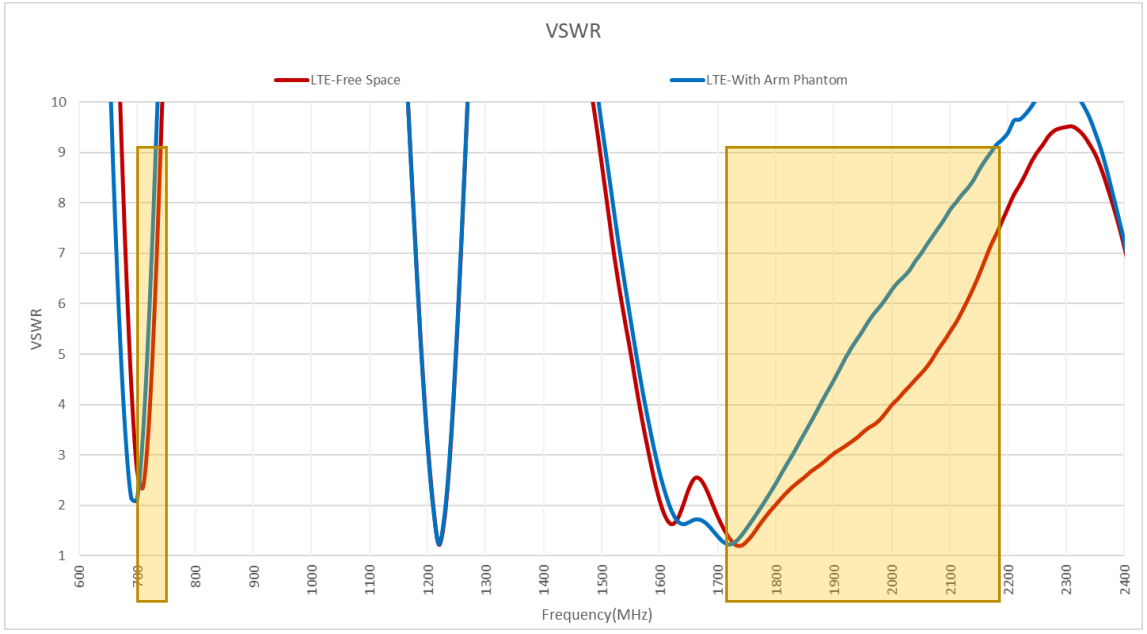
# Antenna Test

- Chamber Coordinate System GL-G-1

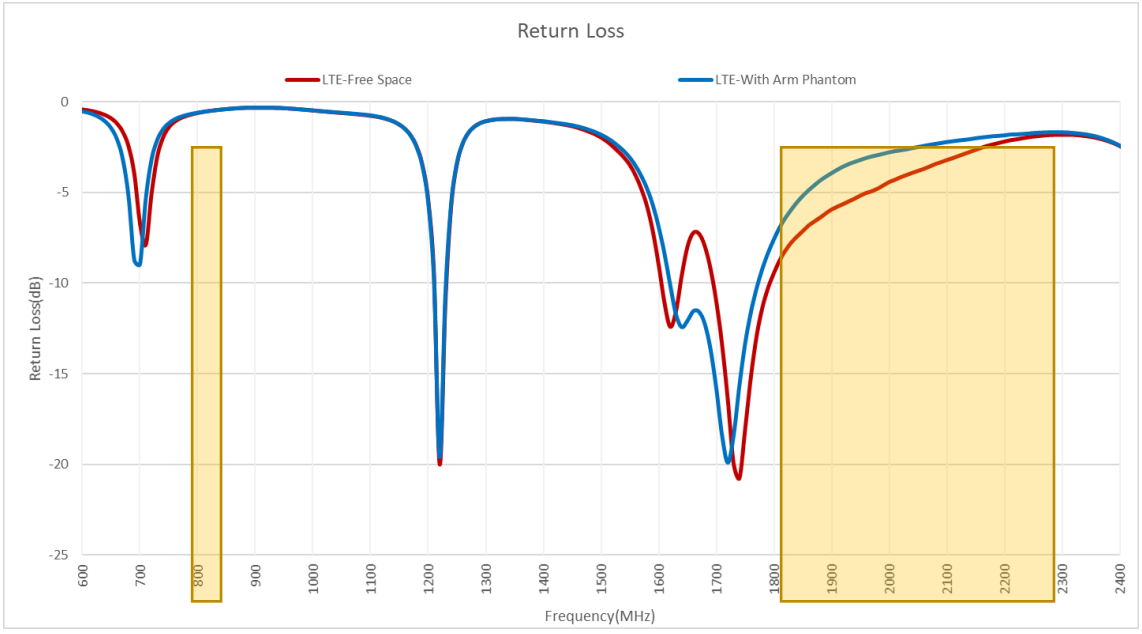


# Antenna Passive Performance—LTE ANT

VSWR




S11



# Antenna Passive Performance—LTE ANT

## Efficiency & Gain

| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 700 | -8.0 | -3.0 | 15.8 |
| 710 | -8.0 | -3.0 | 15.8 |
| 720 | -8.7 | -3.7 | 13.4 |
| 730 | -10.0 | -5.0 | 10.1 |
| 740 | -11.7 | -6.7 | 6.7 |
| 750 | -13.4 | -8.3 | 4.6 |
| | | | |
| 1710 | -4.0 | 0.2 | 40.0 |
| 1720 | -3.6 | 0.4 | 44.1 |
| 1730 | -3.3 | 0.6 | 47.3 |
| 1740 | -3.1 | 0.5 | 48.6 |
| 1750 | -3.1 | 0.5 | 49.2 |
| 1760 | -3.1 | 0.3 | 48.5 |
| 1770 | -3.2 | 0.3 | 47.5 |
| 1780 | -3.3 | 0.3 | 46.6 |
| 1790 | -3.4 | 0.4 | 46.0 |
| 1800 | -3.6 | 0.3 | 44.0 |
| 1810 | -3.7 | 0.3 | 43.2 |
| 1820 | -3.6 | 0.4 | 43.7 |
| 1830 | -3.6 | 0.6 | 43.3 |
| 1840 | -3.7 | 0.6 | 42.3 |
| 1850 | -3.8 | 0.6 | 42.1 |
| 1860 | -3.8 | 0.7 | 42.1 |
| 1870 | -3.9 | 0.7 | 41.2 |
| 1880 | -3.9 | 0.7 | 40.9 |
| 1890 | -3.9 | 0.4 | 40.6 |
| 1900 | -3.8 | 0.4 | 41.6 |

| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 1910 | -3.68 | 0.54 | 42.84 |
| 1920 | -3.73 | 0.67 | 42.33 |
| 1930 | -3.87 | 0.57 | 41 |
| 1940 | -4.03 | 0.45 | 39.58 |
| 1950 | -4.14 | 0.45 | 38.57 |
| 1960 | -4.28 | 0.39 | 37.36 |
| 1970 | -4.41 | 0.28 | 36.25 |
| 1980 | -4.62 | -0.08 | 34.55 |
| 1990 | -4.66 | -0.38 | 34.19 |
| 2000 | -4.66 | -0.49 | 34.16 |
| 2010 | -4.83 | -0.68 | 32.87 |
| 2020 | -4.98 | -0.87 | 31.77 |
| 2030 | -5.11 | -1.03 | 30.81 |
| 2040 | -5.26 | -1.23 | 29.77 |
| 2050 | -5.47 | -1.45 | 28.4 |
| 2060 | -5.54 | -1.66 | 27.92 |
| 2070 | -5.59 | -1.71 | 27.62 |
| 2080 | -5.66 | -1.85 | 27.17 |
| 2090 | -5.79 | -1.91 | 26.35 |
| 2100 | -6.01 | -2.07 | 25.03 |
| 2110 | -6.29 | -2.37 | 23.48 |
| 2120 | -6.49 | -2.67 | 22.44 |
| 2130 | -6.63 | -2.75 | 21.73 |
| 2140 | -6.84 | -2.94 | 20.7 |
| 2150 | -6.99 | -2.87 | 19.99 |
| 2160 | -7.19 | -2.9 | 19.12 |
| 2170 | -7.44 | -3.17 | 18.01 |
| 2180 | -7.67 | -3.32 | 17.1 |

Test in free space

| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 700 | -10.3 | -7.5 | 9.4 |
| 710 | -10.7 | -7.6 | 8.6 |
| 720 | -11.7 | -8.5 | 6.8 |
| 730 | -12.3 | -8.8 | 5.8 |
| 740 | -13.1 | -9.4 | 4.9 |
| 750 | -14.2 | -10.4 | 3.8 |
| | | | |
| 1710 | -9.7 | -5.3 | 10.8 |
| 1720 | -9.7 | -5.1 | 10.8 |
| 1730 | -9.4 | -4.7 | 11.4 |
| 1740 | -9.1 | -4.7 | 12.2 |
| 1750 | -8.8 | -4.6 | 13.3 |
| 1760 | -8.4 | -4.5 | 14.5 |
| 1770 | -8.1 | -4.4 | 15.6 |
| 1780 | -7.8 | -4.4 | 16.8 |
| 1790 | -7.5 | -4.3 | 18.0 |
| 1800 | -7.3 | -4.4 | 18.7 |
| 1810 | -7.1 | -4.2 | 19.5 |
| 1820 | -6.9 | -4.1 | 20.4 |
| 1830 | -6.9 | -3.8 | 20.5 |
| 1840 | -6.9 | -3.6 | 20.5 |
| 1850 | -6.9 | -3.4 | 20.5 |
| 1860 | -6.9 | -3.4 | 20.4 |
| 1870 | -7.1 | -3.7 | 19.7 |
| 1880 | -7.2 | -3.7 | 19.1 |
| 1890 | -7.4 | -3.8 | 18.1 |
| 1900 | -7.6 | -3.8 | 17.5 |

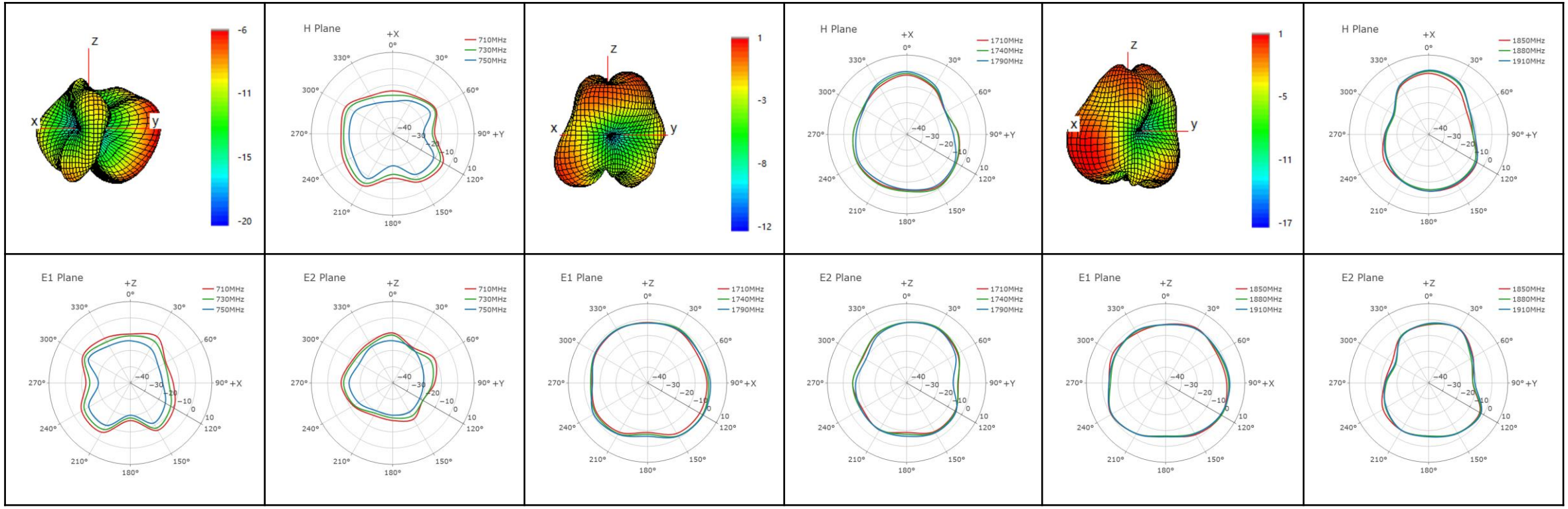
| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 1910 | -7.66 | -4.12 | 17.14 |
| 1920 | -7.78 | -4.7 | 16.66 |
| 1930 | -7.94 | -4.96 | 16.09 |
| 1940 | -8.12 | -5.22 | 15.42 |
| 1950 | -8.2 | -5.28 | 15.13 |
| 1960 | -8.32 | -5.33 | 14.71 |
| 1970 | -8.51 | -5.67 | 14.1 |
| 1980 | -8.78 | -6.28 | 13.26 |
| 1990 | -8.81 | -6.2 | 13.16 |
| 2000 | -8.82 | -6.15 | 13.11 |
| 2010 | -9 | -6.23 | 12.6 |
| 2020 | -9.11 | -6.21 | 12.27 |
| 2030 | -9.25 | -6.3 | 11.88 |
| 2040 | -9.37 | -6.28 | 11.56 |
| 2050 | -9.57 | -6.36 | 11.05 |
| 2060 | -9.65 | -6.24 | 10.83 |
| 2070 | -9.72 | -6.25 | 10.66 |
| 2080 | -9.75 | -6.13 | 10.6 |
| 2090 | -9.78 | -5.97 | 10.51 |
| 2100 | -9.91 | -6.03 | 10.2 |
| 2110 | -10 | -6.18 | 10 |
| 2120 | -9.99 | -6.29 | 10.03 |
| 2130 | -9.89 | -6.25 | 10.25 |
| 2140 | -9.84 | -6.41 | 10.37 |
| 2150 | -9.76 | -6.36 | 10.58 |
| 2160 | -9.75 | -6.38 | 10.58 |
| 2170 | -9.82 | -6.45 | 10.41 |
| 2180 | -9.9 | -6.49 | 10.23 |

Test with arm phantom

# Antenna Performance—LTE ANT

- Radiation Pattern

Test in free space

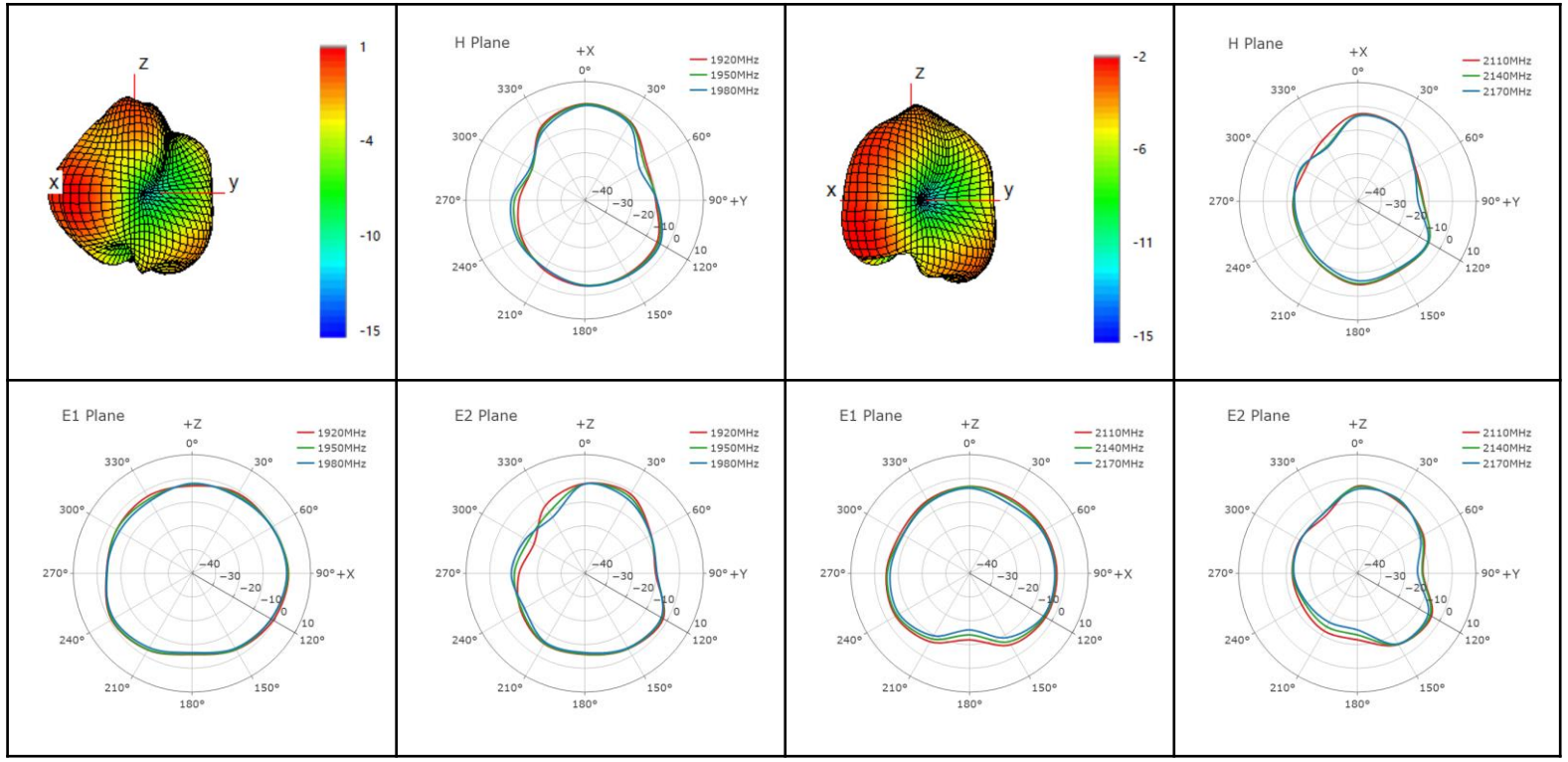



**730MHz** | **1740MHz** | **1880MHz**

# Antenna Performance—LTE ANT

- Radiation Pattern

Test in free space



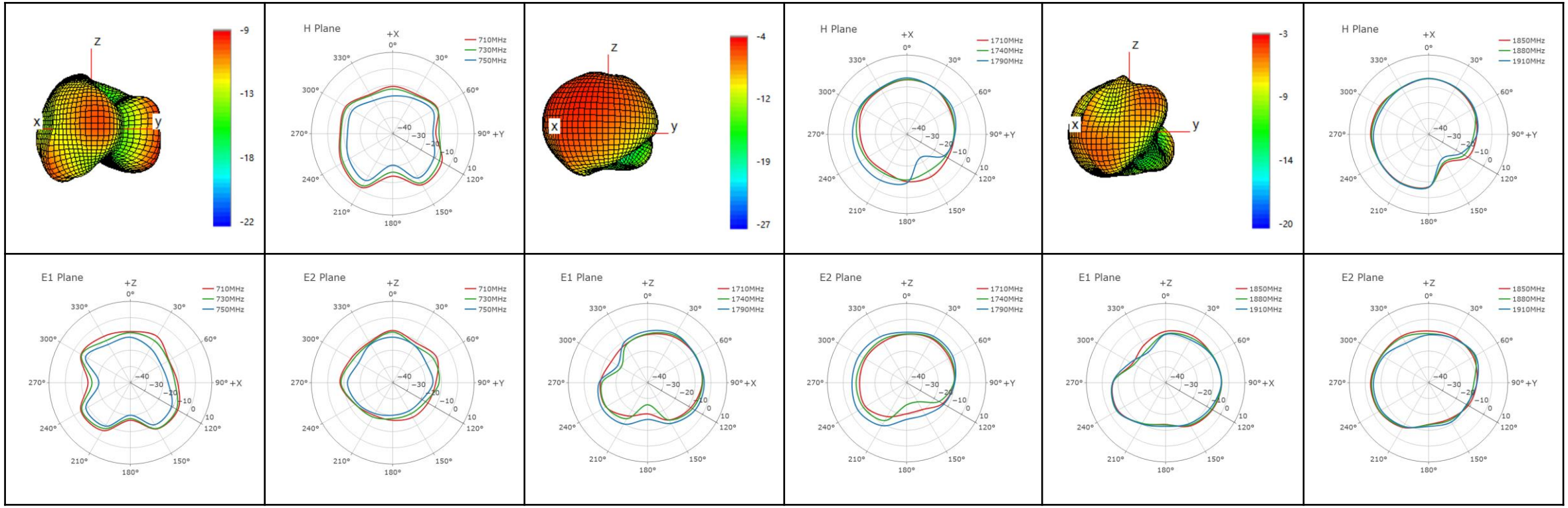

**1950MHz**

**2140MHz**

# Antenna Performance—LTE ANT

- Radiation Pattern

Test with arm phantom

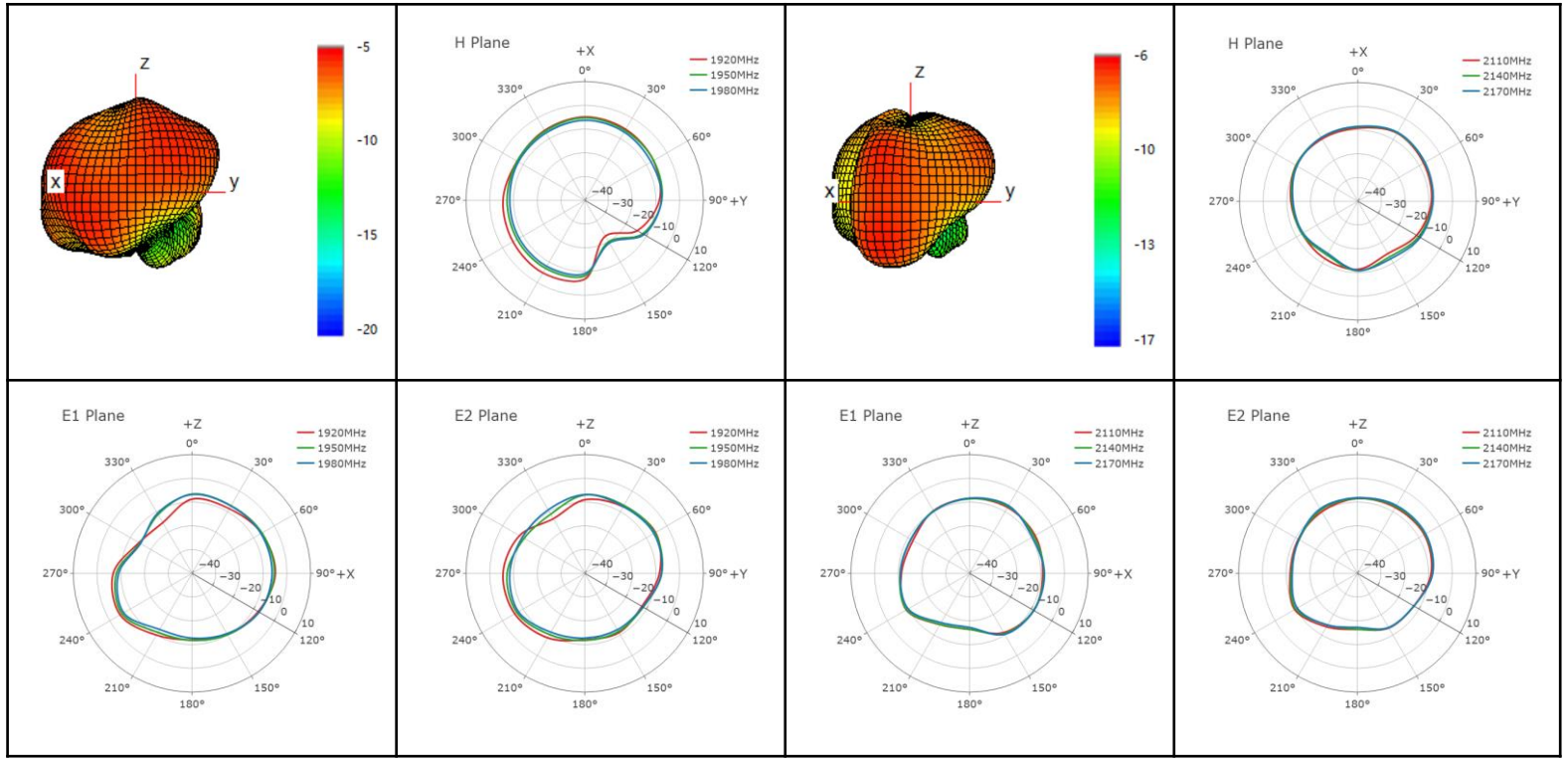



**730MHz** **1740MHz** **1880MHz**

# Antenna Performance—LTE ANT

- Radiation Pattern

Test with arm phantom

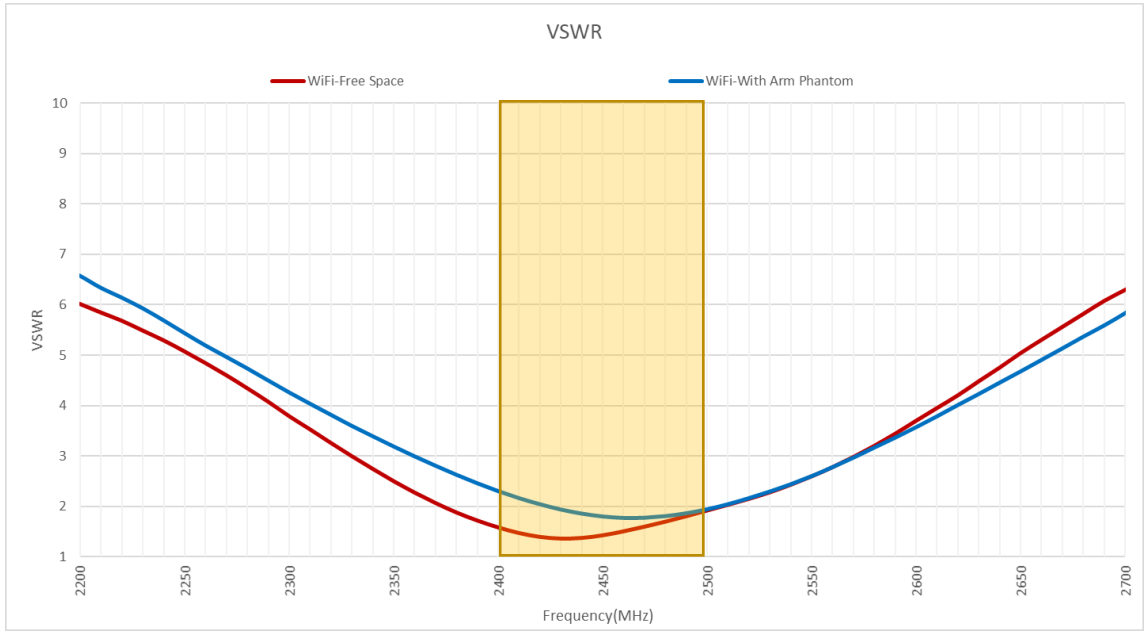



**1950MHz**

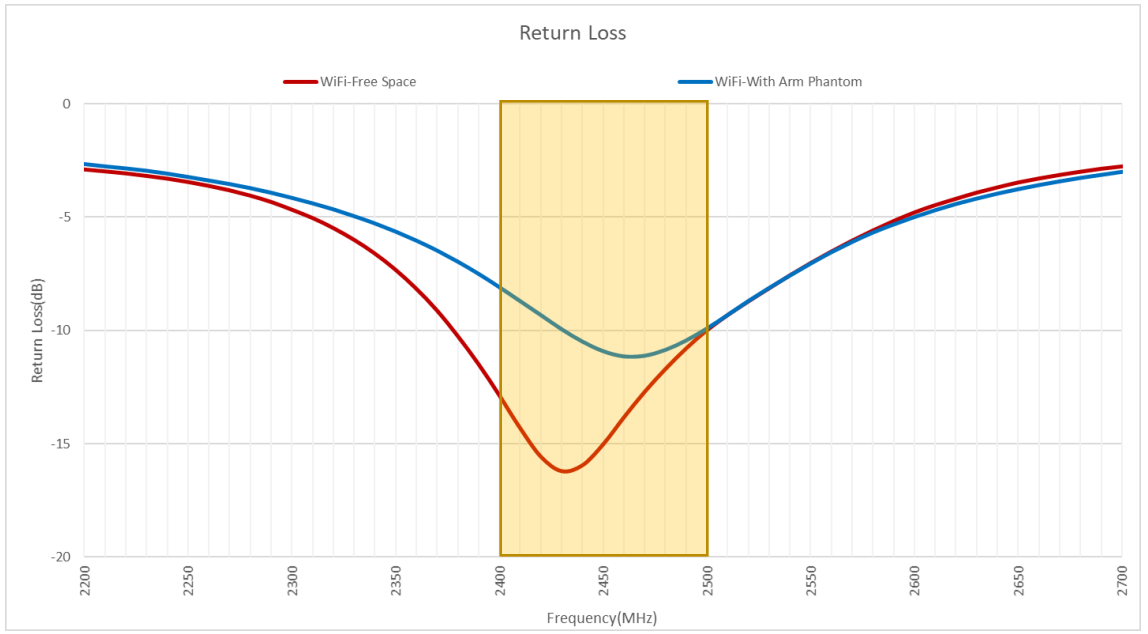
**2140MHz**

# Antenna Passive Performance—WiFi ANT

VSWR




S11



# Antenna Passive Performance—WiFi ANT

## Efficiency & Gain

| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 2400 | -4.6 | 1.3 | 35.1 |
| 2410 | -4.5 | 1.3 | 35.2 |
| 2420 | -4.5 | 1.4 | 35.8 |
| 2430 | -4.4 | 1.3 | 36.0 |
| 2440 | -4.5 | 1.2 | 35.8 |
| 2450 | -4.4 | 1.2 | 36.1 |
| 2460 | -4.5 | 0.9 | 35.6 |
| 2470 | -4.5 | 0.7 | 35.8 |
| 2480 | -4.7 | 0.3 | 34.3 |
| 2490 | -4.7 | 0.1 | 34.0 |
| 2500 | -4.7 | -0.2 | 33.8 |

Test in free space

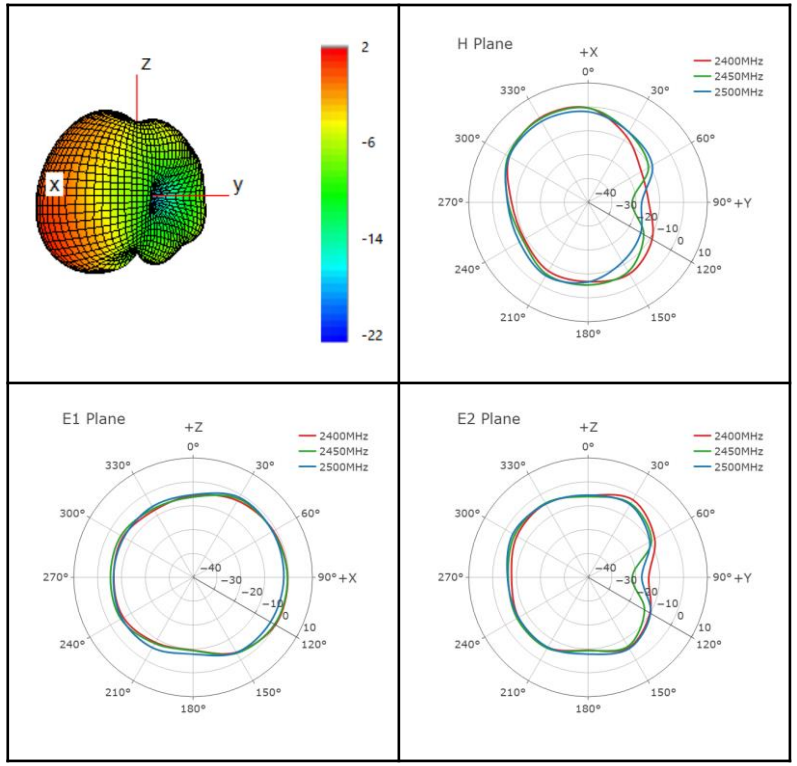
| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 2400 | -7.2 | -1.9 | 19.0 |
| 2410 | -7.2 | -1.8 | 19.3 |
| 2420 | -7.0 | -1.6 | 19.8 |
| 2430 | -7.1 | -1.5 | 19.7 |
| 2440 | -7.1 | -1.4 | 19.7 |
| 2450 | -7.0 | -1.5 | 19.8 |
| 2460 | -7.0 | -1.5 | 20.0 |
| 2470 | -7.0 | -1.5 | 20.2 |
| 2480 | -7.1 | -1.8 | 19.6 |
| 2490 | -7.2 | -2.1 | 19.2 |
| 2500 | -7.2 | -2.2 | 19.1 |

Test with arm phantom

# Antenna Performance—WiFi ANT

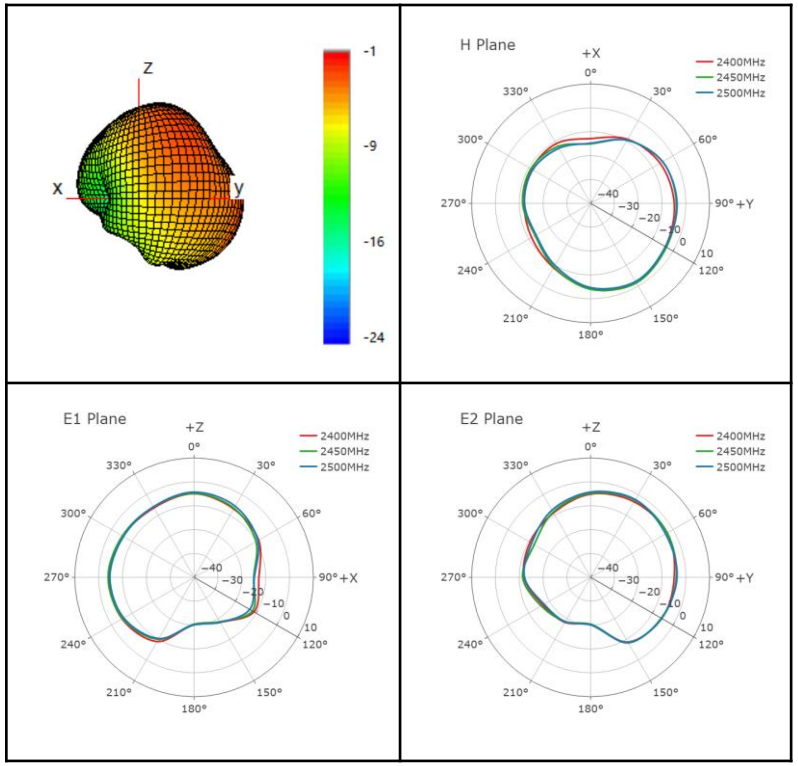
- Radiation Pattern

Test in free space




2450MHz

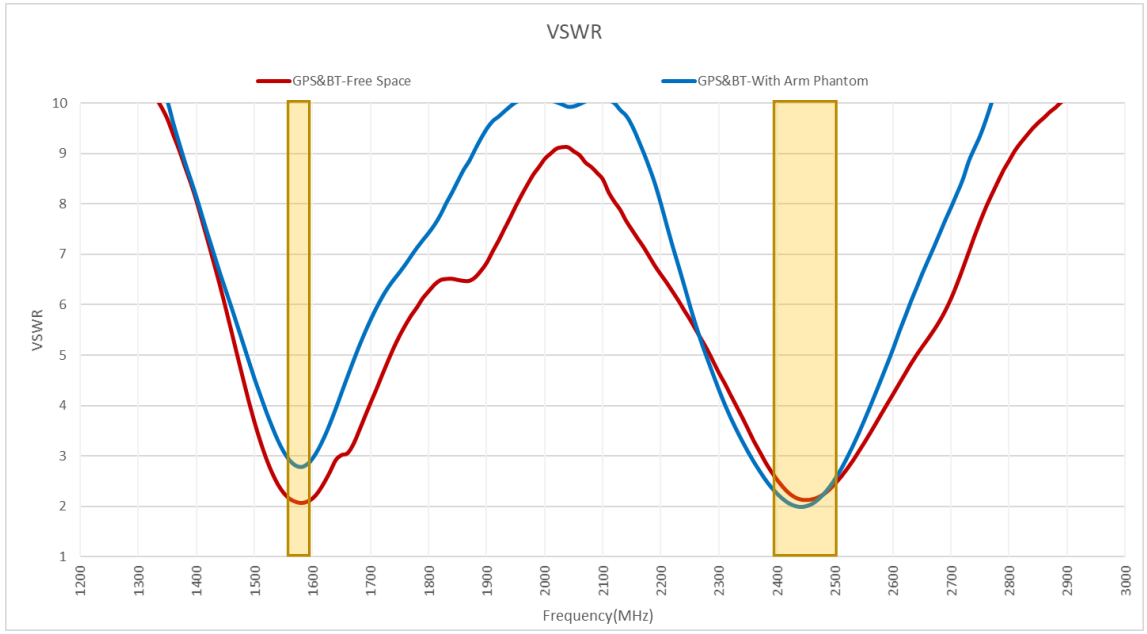
Test with arm phantom



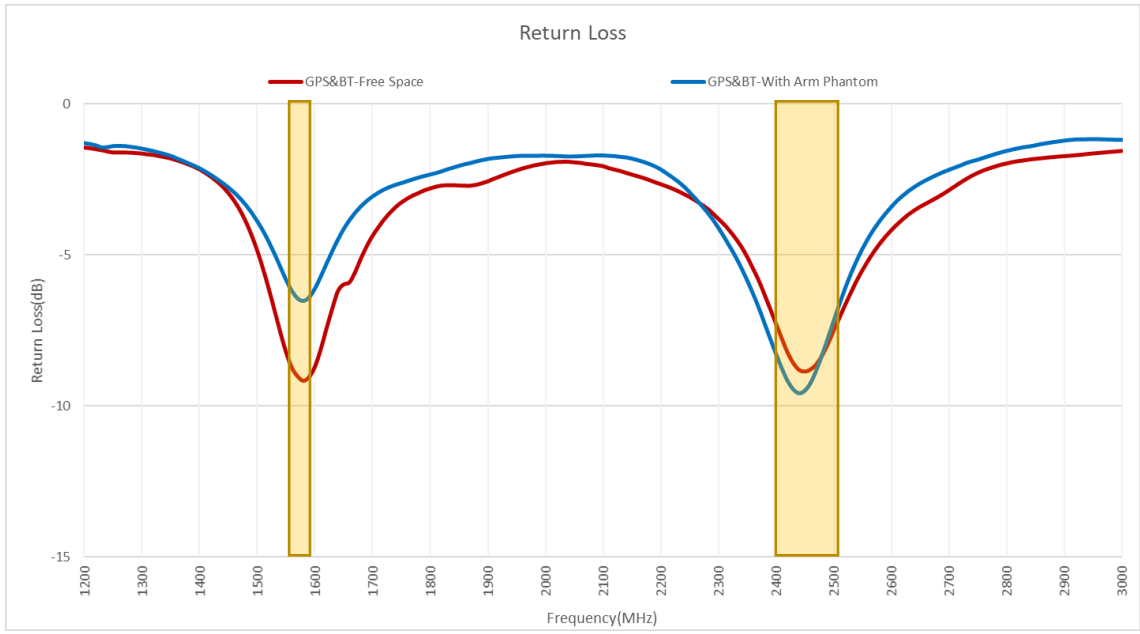

2450MHz

# Antenna Passive Performance—GPS&BT ANT

VSWR




S11



# Antenna Passive Performance—GPS&BT ANT

## Efficiency & Gain

| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 1560 | -3.4 | 0.2 | 46.0 |
| 1570 | -3.4 | 0.4 | 45.9 |
| 1580 | -3.5 | 0.4 | 44.3 |
| | | | |
| 2400 | -6.0 | -3.7 | 25.3 |
| 2410 | -5.9 | -3.7 | 25.5 |
| 2420 | -5.9 | -3.4 | 25.8 |
| 2430 | -6.0 | -3.4 | 25.2 |
| 2440 | -6.1 | -3.5 | 24.3 |
| 2450 | -6.2 | -3.5 | 23.9 |
| 2460 | -6.3 | -3.5 | 23.4 |
| 2470 | -6.4 | -3.6 | 23.0 |
| 2480 | -6.7 | -3.7 | 21.6 |
| 2490 | -6.9 | -3.6 | 20.5 |
| 2500 | -7.0 | -3.5 | 19.9 |

Test in free space

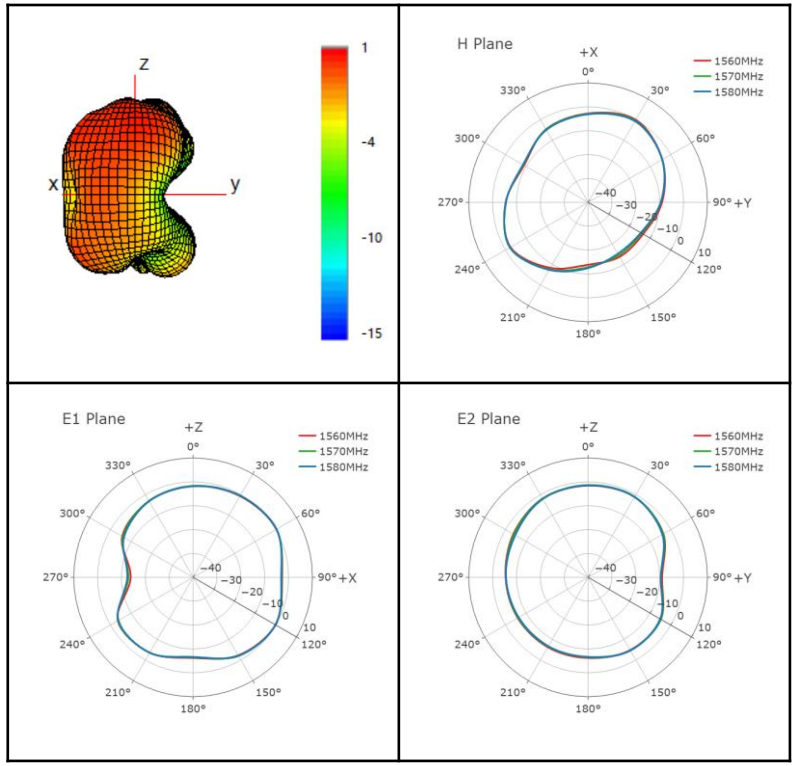
| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 1560 | -7.2 | -4.9 | 19.0 |
| 1570 | -7.1 | -5.1 | 19.3 |
| 1580 | -7.1 | -5.4 | 19.3 |
| | | | |
| 2400 | -7.7 | -4.4 | 17.1 |
| 2410 | -7.8 | -4.5 | 16.7 |
| 2420 | -7.9 | -4.3 | 16.4 |
| 2430 | -8.0 | -4.3 | 15.9 |
| 2440 | -8.1 | -4.4 | 15.4 |
| 2450 | -8.2 | -4.5 | 15.3 |
| 2460 | -8.3 | -4.5 | 14.9 |
| 2470 | -8.3 | -4.5 | 14.7 |
| 2480 | -8.6 | -4.4 | 13.8 |
| 2490 | -8.8 | -4.3 | 13.2 |
| 2500 | -8.9 | -4.0 | 13.0 |

Test with arm phantom

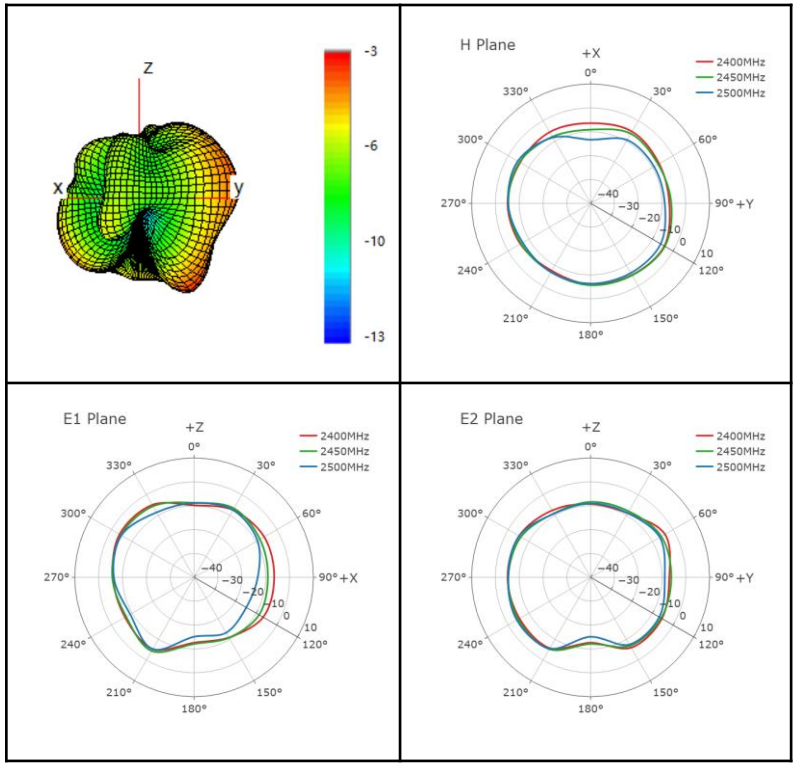
# Antenna Performance—GPS&BT ANT

- Radiation Pattern

Test in free space




1570MHz

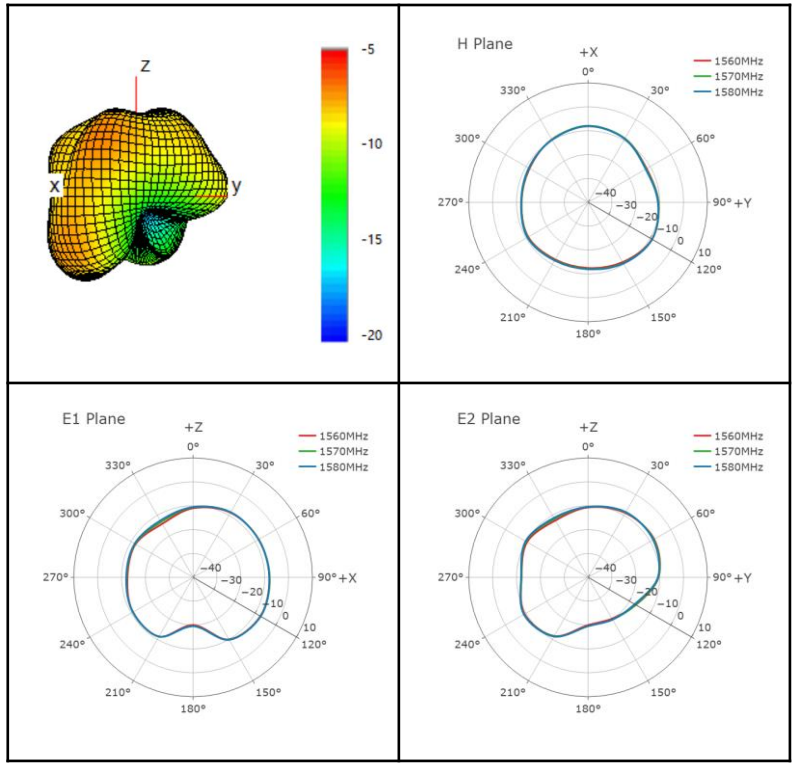



2450MHz

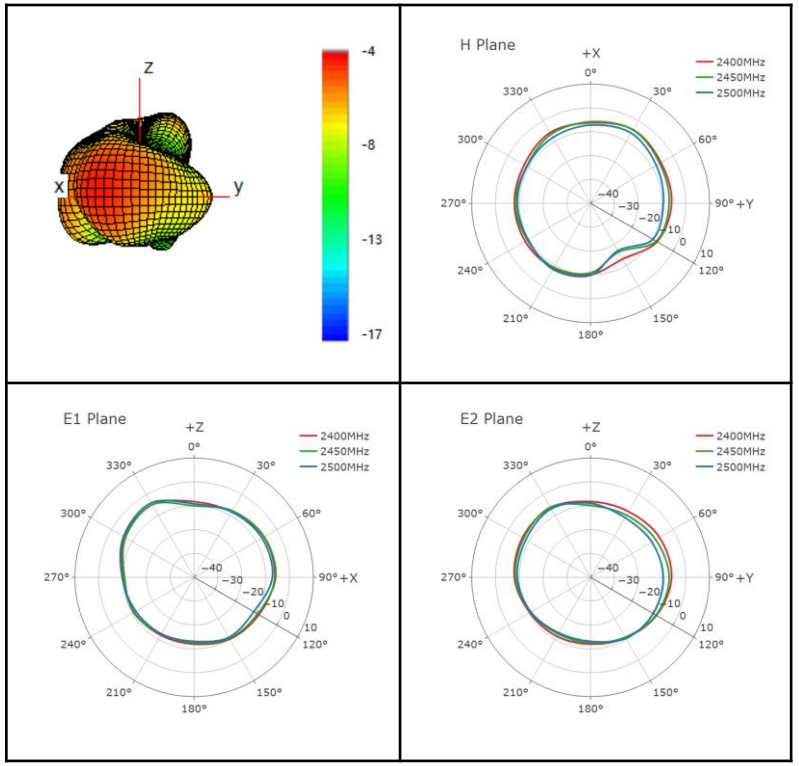
# Antenna Performance—GPS&BT ANT

- Radiation Pattern

Test with arm phantom



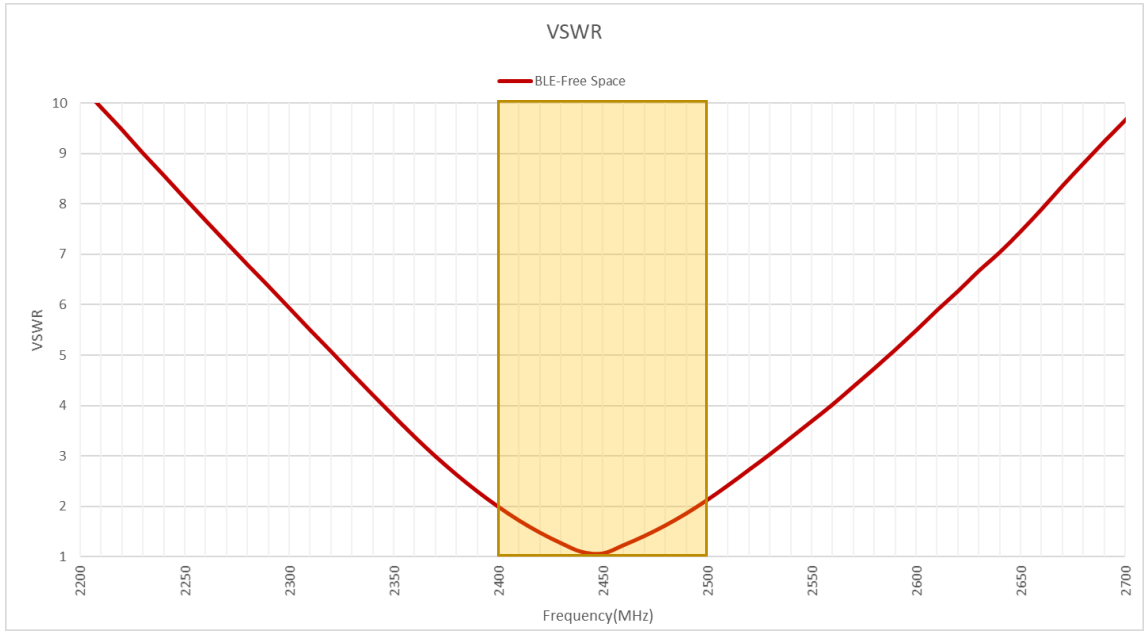

1570MHz



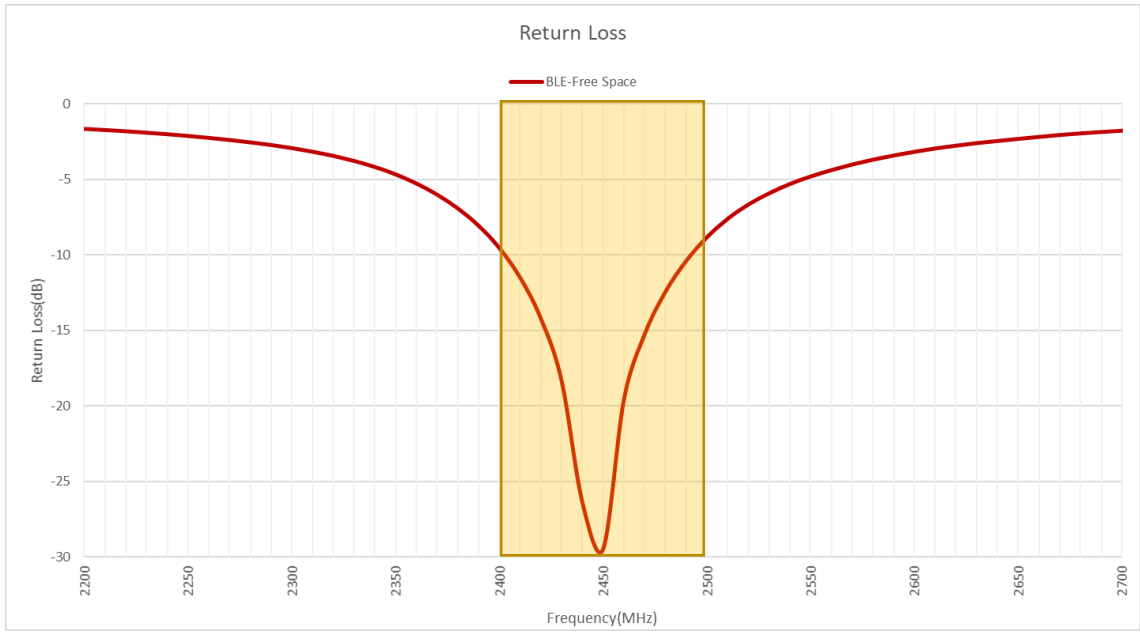

2450MHz

# Antenna Passive Performance–BLE ANT (Charging Cradle)

VSWR




S11



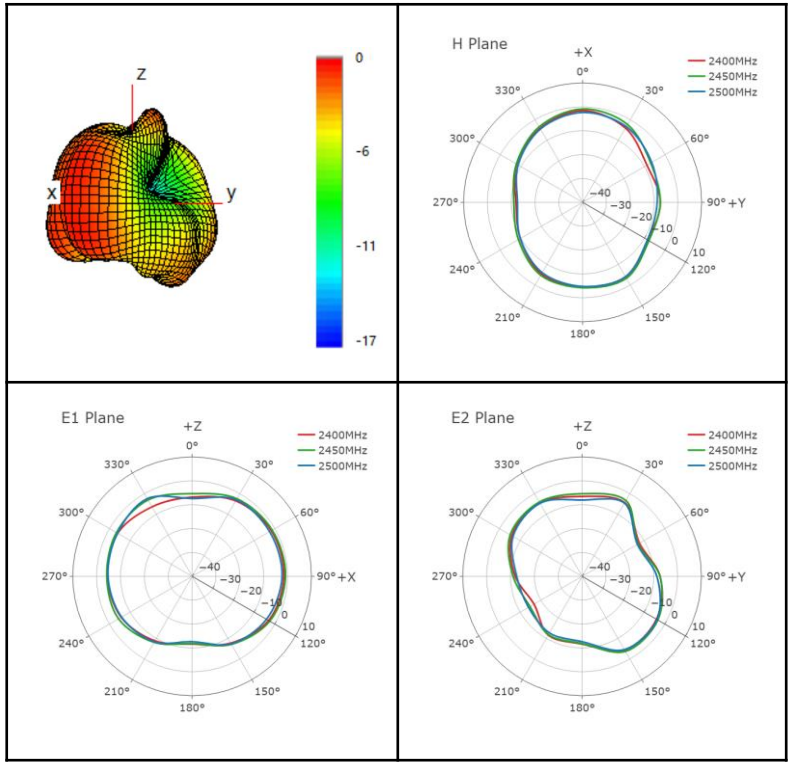
# Antenna Passive Performance—BLE ANT

## Efficiency & Gain

| Frequency (MHz) | Efficiency (dB) | Gain (dBi) | Efficiency (%) |
|---|---|---|---|
| 2400 | -5.5 | -1.6 | 28.2 |
| 2410 | -5.2 | -1.4 | 30.0 |
| 2420 | -4.9 | -1.0 | 32.3 |
| 2430 | -4.8 | -0.9 | 33.3 |
| 2440 | -4.7 | -0.8 | 33.9 |
| 2450 | -4.6 | -0.9 | 34.4 |
| 2460 | -4.7 | -1.0 | 34.0 |
| 2470 | -4.7 | -1.2 | 33.7 |
| 2480 | -5.0 | -1.6 | 31.5 |
| 2490 | -5.2 | -1.8 | 30.1 |
| 2500 | -5.3 | -1.9 | 29.4 |

# Antenna Performance—BLE ANT

- Radiation Pattern




**2450MHz**

# Antenna Active Performance

## OTA: B2 & B4 & B12

| BAND | Channel | Frequency | TRP | Channel | Frequency | TIS |
|---|---|---|---|---|---|---|
| 2 (10MHz) | 18650 | 1855 | 19.53 | | | |
| | 18900 | 1880 | 18.94 | | | |
| | 19150 | 1905 | 18.88 | 1150 | 1985 | -92.43 |
| 4 (10MHz) | 20000 | 1715 | 16.36 | | | |
| | 20175 | 1732.5 | 18.01 | | | |
| | 20350 | 1750 | 19.46 | 2350 | 2150 | -90.74 |
| 12 (5MHz) | 23035 | 701.5 | 12.55 | | | |
| | 23095 | 707.5 | 13.45 | | | |
| | 23155 | 713.5 | 14.39 | 5155 | 743.5 | -86.83 |

| BAND | Channel | Frequency | TRP | Channel | Frequency | TIS |
|---|---|---|---|---|---|---|
| 2 (10MHz) | 18650 | 1855 | 14.13 | | | |
| | 18900 | 1880 | 13.42 | | | |
| | 19150 | 1905 | 12.97 | 1150 | 1985 | -86.73 |
| 4 (10MHz) | 20000 | 1715 | 12.17 | | | |
| | 20175 | 1732.5 | 13.09 | | | |
| | 20350 | 1750 | 14.12 | 2350 | 2150 | -85.53 |
| 12 (5MHz) | 23035 | 701.5 | 12.06 | | | |
| | 23095 | 707.5 | 11.62 | | | |
| | 23155 | 713.5 | 10.88 | 5155 | 743.5 | -83.05 |