# Logitech
# Antenna Under Test (AUT)
# Report

**Report No.:** EVT-700-006274

**Model Name:** MR0097

**Equipment Type:** Mouse

**Manufacturer:** Logitech Far East LTD.

**Test Location:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City, Taiwan

**Tested by: Jeff Hsieh**

**Report Date: 2023/01/04**

# Report Release History

| Report version | Description | Date Issued |
|---|---|---|
| MR0097 AUT Report | Original release | 2023/01/04 |

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# 1. EUT Antenna Information

1) Antenna Material : PCB on board
2) Antenna Type : PIFA
3) Antenna Dimension: 21.05 x 8.76 mm
4) Operating Frequency : 2.4 GHz - 2.4835 GHz
5) Input Impedance : 50 Ω
6) Standing-Wave Ratio : 2:1

# 2. Measured Values and Calculation of Antenna Gains

Measure peak horizontal/vertical EIRP on each x-y, y-z, x-z plane. The highest measured values will be used to calculate the antenna peak gain.

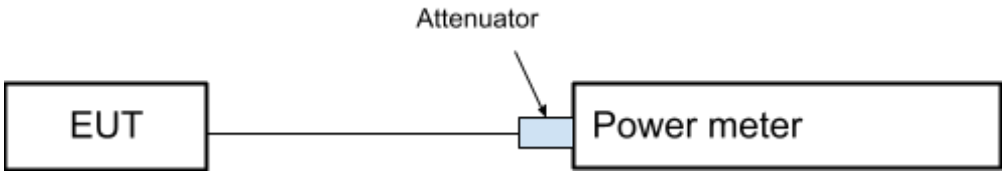
Antenna Peak Gain (dBi) = Max EIRP(dBm) - Conducted Power (dBm)

| Frequency | X-Y Plane $\phi$=0~360°, $\theta$=90° | | X-Z Plane $\phi$=0°, $\theta$=0~360° | | Y-Z Plane $\phi$=90°, $\theta$=0~360° | | Max Peak EIRP (dBm) | Conducted Power (dBm) | Antenna Peak Gain (dBi) |
|---|---|---|---|---|---|---|---|---|---|
| | Ver. Peak EIRP (dBm) | Hori. Peak EIRP (dBm) | Ver. Peak EIRP (dBm) | Hori. Peak EIRP (dBm) | Ver. Peak EIRP (dBm) | Hori. Peak EIRP (dBm) | | | |
| 2403 | -3.82 | 7.72 | 8.34 | -6.30 | 5.19 | 7.94 | 8.34 | 5.97 | 2.37 |
| 2442 | -4.45 | 7.63 | 8.55 | -8.06 | 5.66 | 8.20 | 8.55 | 5.9 | 2.65 |
| 2479 | -5.83 | 7.47 | 8.68 | -8.13 | 5.56 | 8.56 | 8.68 | 5.66 | 3.02 |

**Test Date: 2022/12/13**

# 3. RF Conducted Power Measurement

## 3.1 Test Setup




## 3.2 Test Instruments

| Description | Model No. | Serial No. | Last Calibration |
|---|---|---|---|
| Power Meter Anritsu | ML2495A | 1529002 | 2022/6/22 |
| Pulse Power Sensor Anritsu | MA2411B | 1339443 | 2022/5/29 |
| Attenuator Keysight | MDCS18N-10 | MDCS18N-10-01 | 2022/4/5 |

Note: The calibration interval of the above test instruments is __12__ months

## 3.3 Test Procedure

A spectrum analyzer or Power meter was used to perform output power measurement, setting the detector to average and configuring EUT continuously transmitting power(100% duty cycle).

## 3.4 Test Result of RF conducted Power

| Frequency (MHz) | Measured Power (dBm) |
|---|---|
| 2403 | 5.97 |
| 2442 | 5.9 |
| 2479 | 5.66 |

**Test Date: 2022/12/20**

# 4. 2D Radiation Pattern Measurement

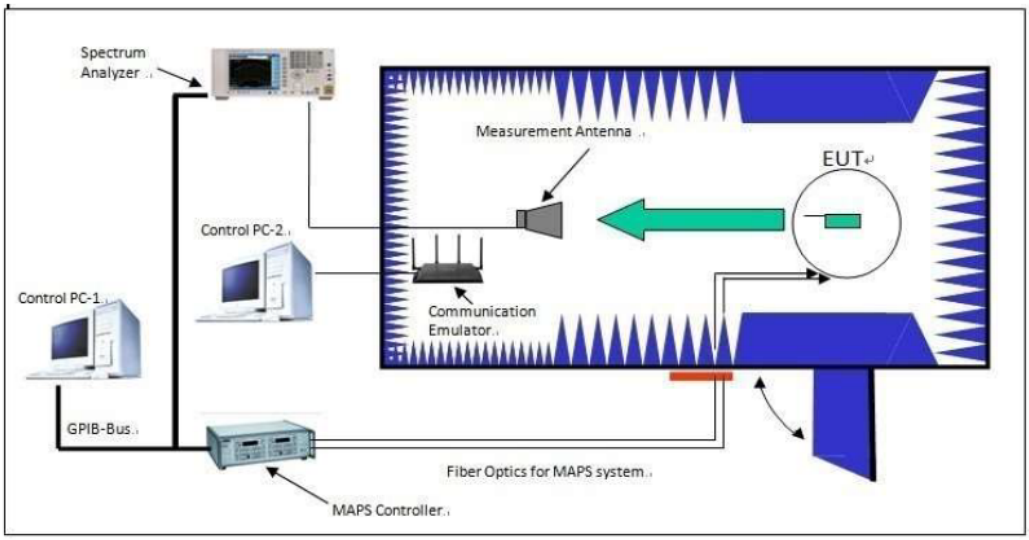
## 4.1 Test Location

2D radiation pattern measurement in the anechoic chamber

## 4.2 Description of the anechoic chamber

Anechoic Chamber

- Length: 10m
- Width: 5m
- Height: 5m
- Turntable height: 1.5m
- Measurement Antenna height: 1.5m




## 4.3 Test Instruments

| Description | Model No. | Serial No. | Last Calibration |
|---|---|---|---|
| Spectrum Analyzer Keysight | N9030A | MY54490520 | 2022/8/5 |
| Horn Antenna ETS | BBHA 9120 D | 9120D-1479 | 2022/11/13 |

| | | | |
|---|---|---|---|
| Software | Antenna Pattern V6.2-210118 | N/A | N/A |
| Antenna Tower/ Turntable | MF-7802 | MF780208542 | N/A |
| PSG analog signal generator (from 250 kHz to 50 GHz) Keysight | E8257D | MY53401987 | 2022/6/21 |
| RF Coaxial Cable | SUCOFLEX104 | RF104-215 | 2022/11/04 |

Note: The calibration interval of the above test instruments is __12__ months

## 4.4 Test Procedure

i. Connect the EUT to power meter and record the power setting of EUT and the measured conducted power.
ii. Fasten the EUT in the center of the turntable, record the coordinates and take pictures.
iii. Configuring EUT continuously transmitting (100% duty cycle).
iv. Make sure the transmit signal is stable and at the maximum RF power level.
v. Setup the channel power function by spectrum analyzer.
vi. Read the power level on the spectrum analyzer and record in the following positions.
    1. The turntable is then stepped between 0 to 360 degrees along the horizontal plane in 1-degree increments.
    2. Data is recorded using the spectrum analyzer for both theta and phi polarizations at each position.
vii. Rotate the EUT with 90 degrees and repeat step f.1 and step f.2 until all 3 planes(X-Y,X-Z,Y-Z) were measured.
viii. The substitution horn antenna is substituted for EUT at the same position and signals generator export the CW signal to the substitution antenna via a TX cable. Rotated the Turn Table and moved receiving antenna to find the maximum radiation power. Adjust output power level of S.G to get a Value of spectrum reading equal to “Raw Value”. Record the power level of S.G.
    EIRP = $P_{SigGen} + G_T – L_C$
    where:
    $P_{SigGen}$ = power setting of the signal generator that produces the same received power reading as the DUT, in dBm;
    $G_T$ = gain of the substitute antenna, in dBd (ERP) or dBi (EIRP);
    $L^C$ = signal loss in the cable connecting the signal generator to the substitute antenna, in dB

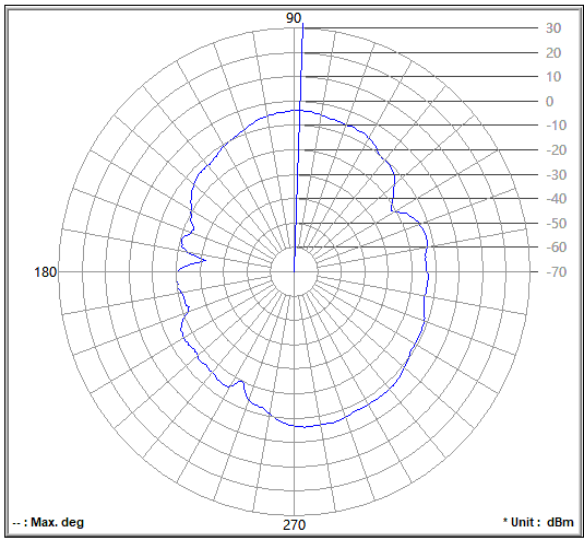
ix. Antenna Peak Gain (dBi) = Max EIRP(dBm) - Conducted Power (dBm)

## 4.5 Test Setup photos (please see another document confidentiality)

| | |
|---|---|
| | |
| | |
| | |

# 4.6 2D Pattern Test Plot

**X-Y Plane**



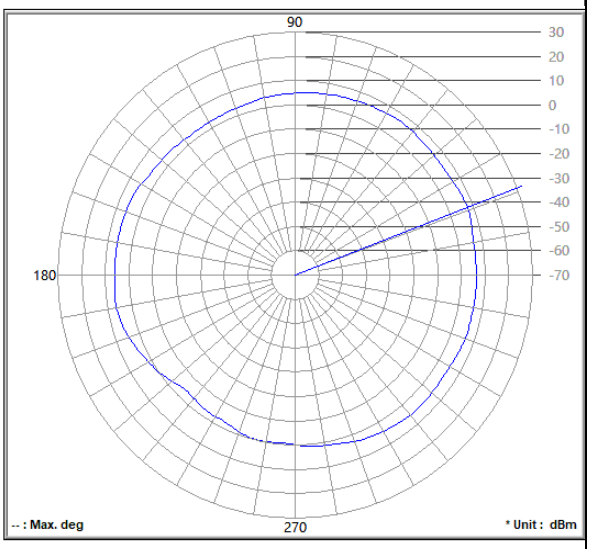

Frequency (MHz) : **2403.00** Antenna Polarity : **Vertical** Average Value (dBm) : **-9.76**

Maximum Value (dBm) : **-3.82** Maximum Value (degree) : **88**

Minimum Value (dBm) : **-32.43** Minimum Value (degree) : **173**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130037.png




Frequency (MHz) : **2403.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **4.73**

Maximum Value (dBm) : **7.72** Maximum Value (degree) : **21**

Minimum Value (dBm) : **-3.93** Minimum Value (degree) : **227**

V 6.3

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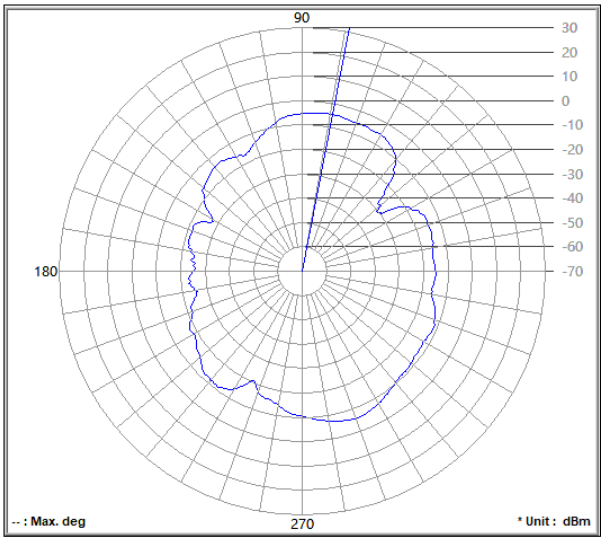


Frequency (MHz) : **2442.00** Antenna Polarity : **Vertical** Average Value (dBm) : **-10.78**

Maximum Value (dBm) : **-4.45** Maximum Value (degree) : **79**

Minimum Value (dBm) : **-30.81** Minimum Value (degree) : **39**

V 6.3

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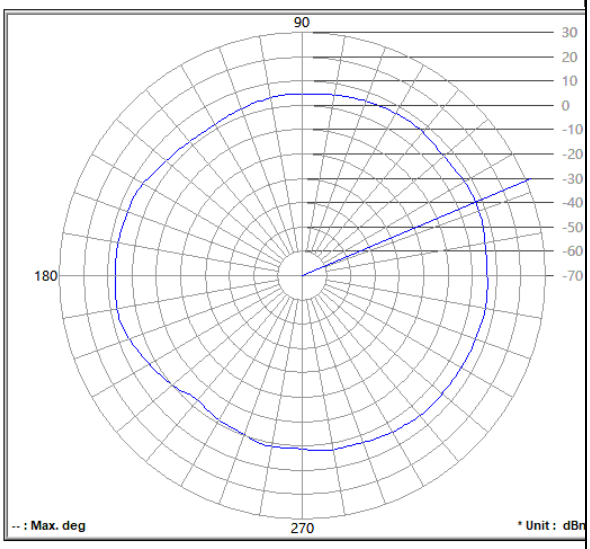


Frequency (MHz) : **2442.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **5.00**

Maximum Value (dBm) : **7.63** Maximum Value (degree) : **23**

Minimum Value (dBm) : **-3.19** Minimum Value (degree) : **230**

V 6.3

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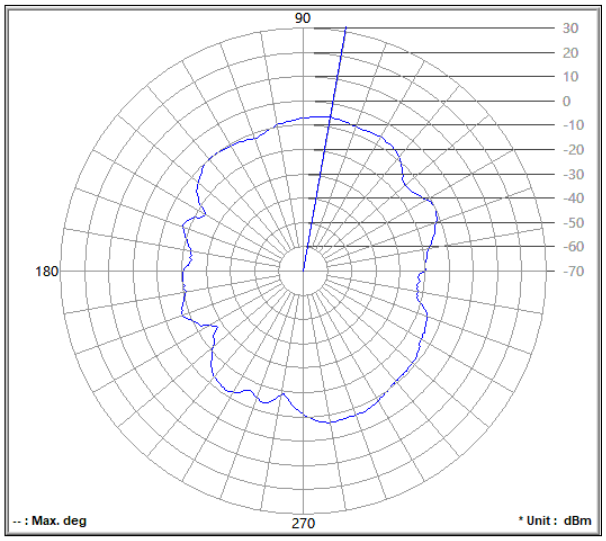


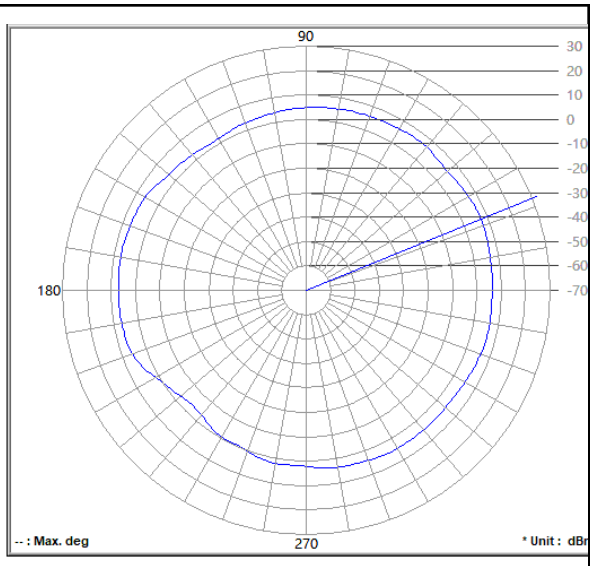

Frequency (MHz) : **2479.00** Antenna Polarity : **Vertical** Average Value (dBm) : **-11.17**

Maximum Value (dBm) : **-5.83** Maximum Value (degree) : **80**

Minimum Value (dBm) : **-27.77** Minimum Value (degree) : **213**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130041.png




Frequency (MHz) : **2479.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **4.98**

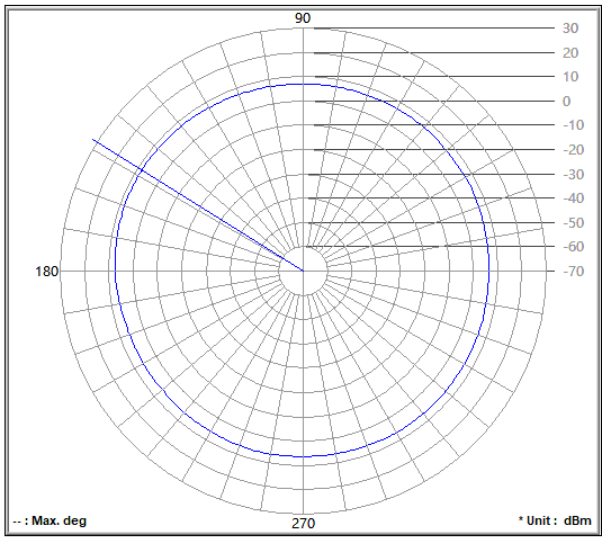
Maximum Value (dBm) : **7.47** Maximum Value (degree) : **22**

Minimum Value (dBm) : **-3.80** Minimum Value (degree) : **227**

V 6.

D:\Antenna Pattern V6.3\Graph\1213\12130042.png

## X-Z Plane




Frequency (MHz) : **2403.00** Antenna Polarity : **Vertical** Average Value (dBm) : **6.92**

Maximum Value (dBm) : **8.34** Maximum Value (degree) : **148**

Minimum Value (dBm) : **5.76** Minimum Value (degree) : **221**

V 6.3

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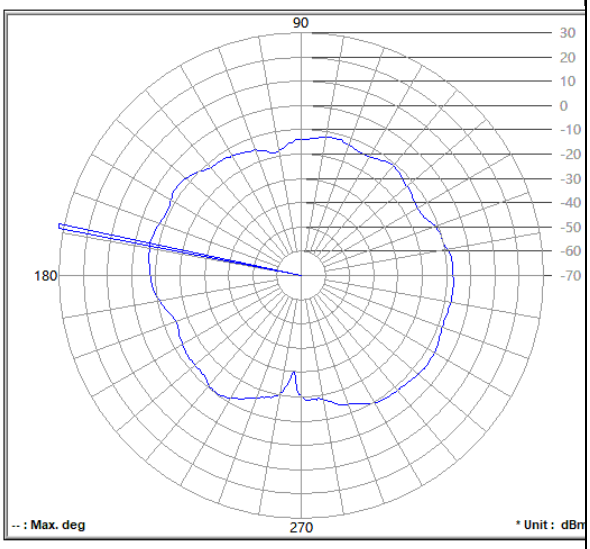


Frequency (MHz) : **2403.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **-10.34**

Maximum Value (dBm) : **-6.30** Maximum Value (degree) : **168**

Minimum Value (dBm) : **-30.71** Minimum Value (degree) : **266**

V 6.3

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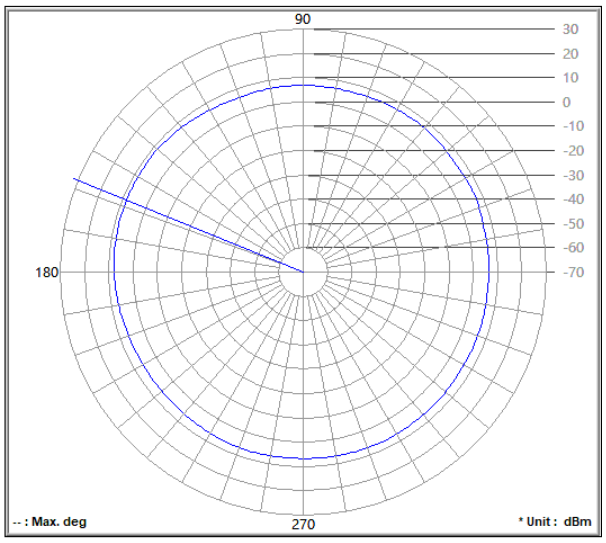


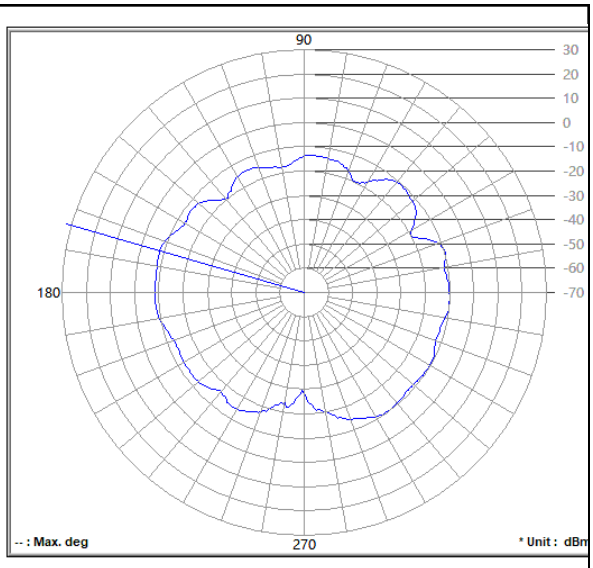

Frequency (MHz) : **2442.00** Antenna Polarity : **Vertical** Average Value (dBm) : **7.00**

Maximum Value (dBm) : **8.55** Maximum Value (degree) : **158**

Minimum Value (dBm) : **5.92** Minimum Value (degree) : **223**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130045.png




Frequency (MHz) : **2442.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **-12.45**

Maximum Value (dBm) : **-8.06** Maximum Value (degree) : **164**

Minimum Value (dBm) : **-29.51** Minimum Value (degree) : **269**

V 6.3

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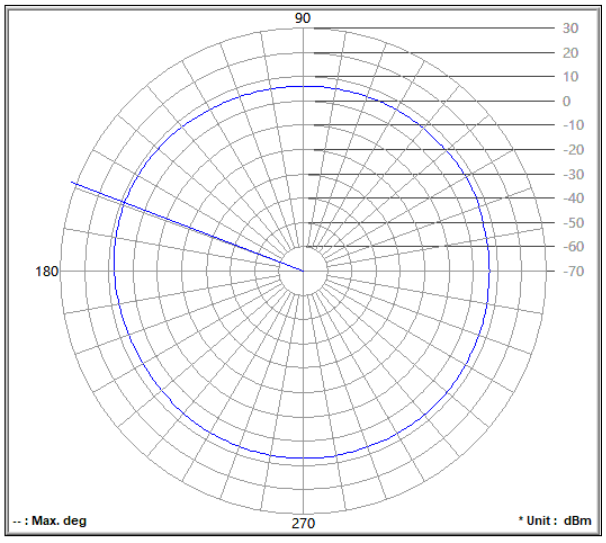


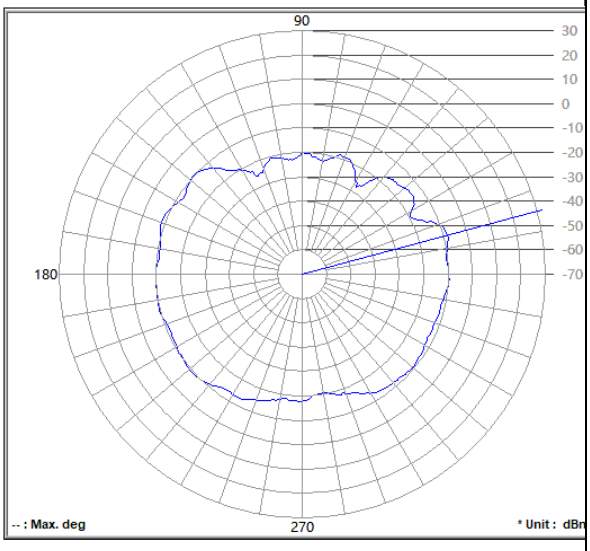

Frequency (MHz) : **2479.00** Antenna Polarity : **Vertical** Average Value (dBm) : **7.01**

Maximum Value (dBm) : **8.68** Maximum Value (degree) : **159**

Minimum Value (dBm) : **5.96** Minimum Value (degree) : **209**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130044.png




Frequency (MHz) : **2479.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **-12.50**

Maximum Value (dBm) : **-8.13** Maximum Value (degree) : **15**

Minimum Value (dBm) : **-27.83** Minimum Value (degree) : **58**

V 6.3

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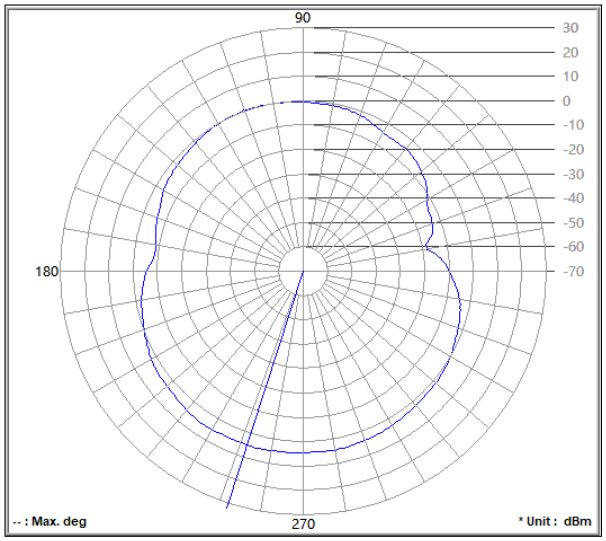
## Y-Z Plane




Frequency (MHz) : **2403.00** Antenna Polarity : **Vertical** Average Value (dBm) : **0.60**

Maximum Value (dBm) : **5.19** Maximum Value (degree) : **252**

Minimum Value (dBm) : **-18.22** Minimum Value (degree) : **10**

V 6.3

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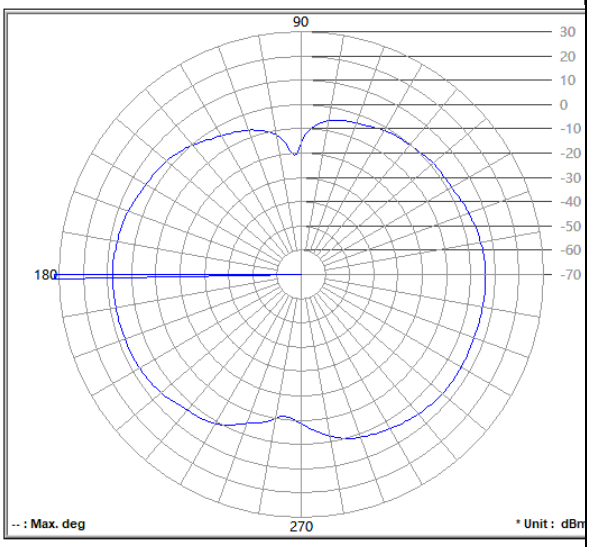


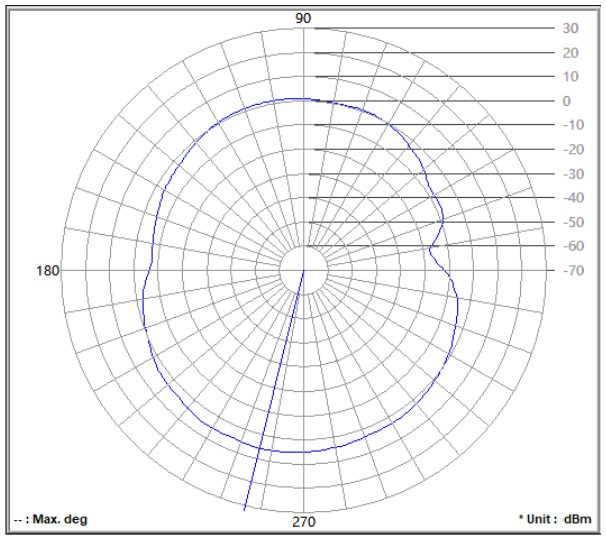

Frequency (MHz) : **2403.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **3.67**

Maximum Value (dBm) : **7.94** Maximum Value (degree) : **180**

Minimum Value (dBm) : **-20.90** Minimum Value (degree) : **93**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130050.png



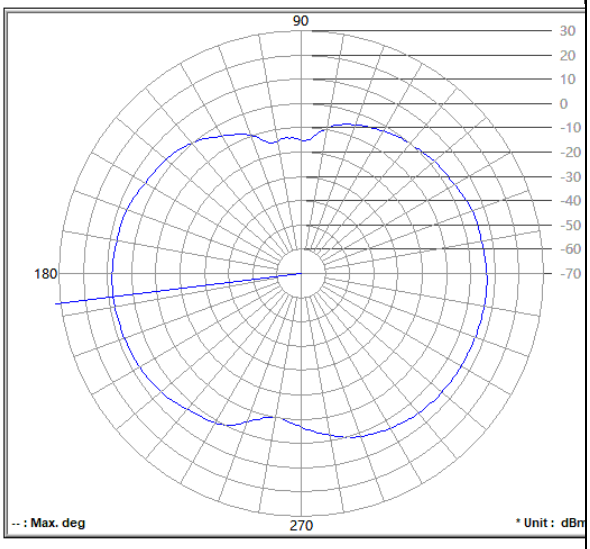

Frequency (MHz) : **2442.00** Antenna Polarity : **Vertical** Average Value (dBm) : **0.84**

Maximum Value (dBm) : **5.66** Maximum Value (degree) : **256**

Minimum Value (dBm) : **-17.42** Minimum Value (degree) : **10**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130052.png




Frequency (MHz) : **2442.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **3.96**

Maximum Value (dBm) : **8.20** Maximum Value (degree) : **187**

Minimum Value (dBm) : **-15.40** Minimum Value (degree) : **89**

V 6.3

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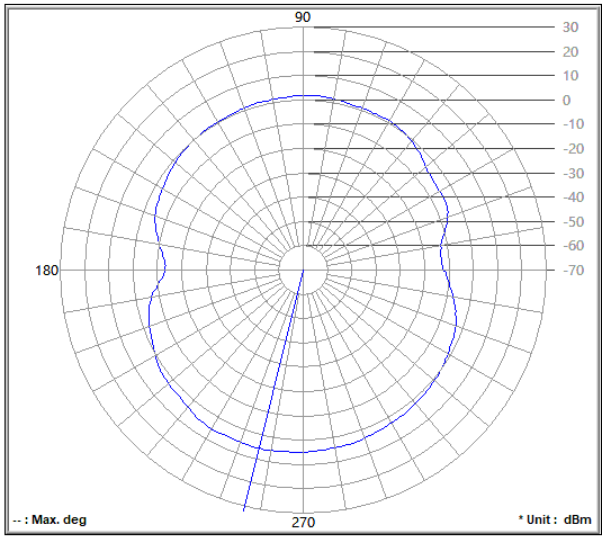


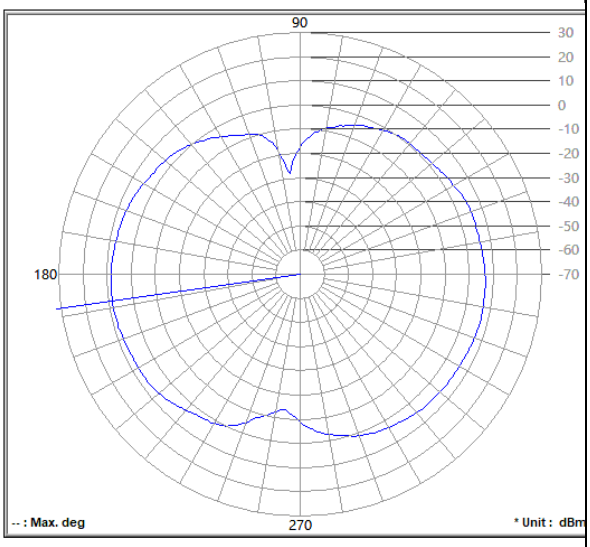

Frequency (MHz) : **2479.00** Antenna Polarity : **Vertical** Average Value (dBm) : **0.83**

Maximum Value (dBm) : **5.56** Maximum Value (degree) : **256**

Minimum Value (dBm) : **-13.33** Minimum Value (degree) : **178**

V 6.3

D:\Antenna Pattern V6.3\Graph\1213\12130053.png




Frequency (MHz) : **2479.00** Antenna Polarity : **Horizontal** Average Value (dBm) : **4.14**

Maximum Value (dBm) : **8.56** Maximum Value (degree) : **188**

Minimum Value (dBm) : **-28.21** Minimum Value (degree) : **96**

V 6.3

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