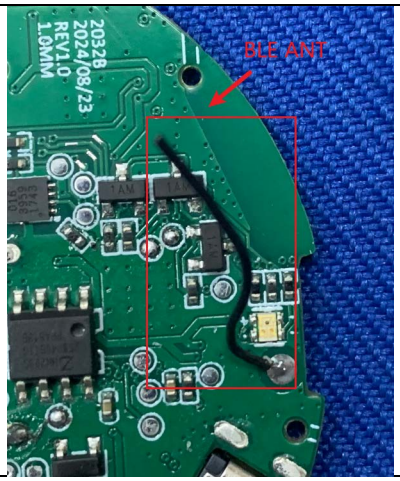
Summary Result *TUV Rheinland*

Prüfbericht-Nr.: *Test report no.:*	N/A	**Auftrags-Nr.:** *Order no.:*	238542086
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2022/04/11
Auftraggeber: *Client:*	Zeroplus Technology Corporation 3F, No.121, Jian 8th Rd, Chung Ho District New Taipei City, 235, Taiwan		
Prüfgegenstand: *Test item:*	Atenna gain		
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	ANT-S1		
Auftrags-Inhalt: *Order content:*	OTA summary data		
Prüfgrundlage: *Test specification:*	ANSI/IEE Std 149 CTIA Test Plan for Wireless Device Over-the-Air Performance		
Wareneingangsdatum: *Date of sample receipt:*	2022/04/19		
Prüfmuster-Nr.: *Test sample no:*			
Prüfzeitraum: *Testing period:*	2022/4/19 - 2022/4/19		
Ort der Prüfung: *Place of testing:*	EMC/RF Taipei Testing Site		
Prüflaboratorium: *Testing laboratory:*	Taipei Testing Laboratories		
Prüfergebnis*: *Test result*:*			
überprüft von: reviewed by: **Datum:** *Date:* **Stellung** */ Position:*	Project Engineer	**genehmigt von:** authorized by: **Datum:** *Date:* **Stellung** */ Position:*	Senior Project Manager
Sonstiges */ Other:*			

Manufacturer: Becool Technology (Shenzhen)Co., Ltd
Address: 8F,Building A3,Tianrui Industrial Park, No.35 Fuyuan 1st Road, Zhancheng Community, Fuhai,Baoan District, Shenzhen China

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1 GENERAL REMARK

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:
Appendix EP - Photographs of EUT

Applied Standard and Test Levels

Radio
ANSI/IEE Std 149

1.2 Decision Rule of Conformity

The decision rule of conformity of this test report is following the requirements of the requested standard in the quotation, and agreed among testing laboratory and manufacturer (applicant) to exclude the consideration of Measurement Uncertainty, unless it is required by the specific standard.

2 TEST SITES

2.1 Test Laboratory

Taipei Testing Laboratories

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.
Taipei City 105
Taiwan (R.O.C.)

2.2 Test Facility

Taipei Testing Laboratories

No.458-18, Sec. 2, Fenliao Rd., Linkou Dist.,
New Taipei City 244
Taiwan (R.O.C.)
FCC Registration No.: 226631
ISED Registration No.: 25563

3 PRODUCT INFORMATION

Product Information	
Brand	Zeroplus
Model name	ANT-S1
Device Class	NA
Geographical area of operation	NA
Operating frequency	2402MHz，2440MHz，2480MHz
Output Power	NA
Number / Type of Antenna(s)	Meander line antenna
Antenna Gain (peak, max.)	-12.50dBi

Submitted Documents

- N/A

Remarks

This test was performed as a reference test upon customer’s requirements.
Requested tests:

- Antenna gain in vertical and horizontal polarization
- Radiation pattern in both polarizations

4 MEASUREMENT UNCERTAINTY

Measurement Type	Frequency	Uncertainty
OTA chamber	< 6GHz	0.91dB

5 TEST SET-UP AND OPERATION MODES

Test Methodology

Antenna gain: The equipment under test (EUT) was performed by ANSI/IEE Std 149. The method is based on the 12.3 Gain-Transfer Measurements for 12.3.1 Measurement of linearly polarized antennas.

The gain-transfer method is one in which the unknown power gain of a test antenna is measured by comparing it to that of a gain-standard antenna. The measurements can be performed on either a free-space or a ground-reflection range. (Itcan also be performed with a test antenna the power gain of which has to be measured as discussed in 12.3.3 and 12.4.) Ideally the test antenna is illuminated by a plane wave which is polarization matched to it, and the received power is measured into a matched load. The test antenna is replaced by a gain standard, leaving all other conditions the same. The received power into its matched load is again measured. From the Friis trans- mission formula it can be shown that the power gain (GT)dB Of the test antenna, in decibels, is given by
(GT)dB = (Gs)dB + 10logPT/PS

where (Gs)dB is the power gain of the gain- standard antenna, PT is the power received with the test antenna, and Ps is that power received with the gain- standard antenna. One method of achieving this exchange between test and gain-standard antennas is to mount the two antennas back to back on either MEASUREMENT OF POWER GAIN side of the axis of an azimuth positioner. With this configuration the antennas can be switched by a 180“ rotation of the positioner. Care shall be taken to position the antennas so that they will be in the same location when switched. Usually absorbing material is required immediately behind the gain standard to reduce reflections in its vicinity which might perturb the illuminating field. Swept-frequency gain-transfer measurements can be performed for testing broad-band antennas. The procedure is essentially the same as that for the swept- frequency absolute-gain measurement, except that the measurement is repeated with the test antenna and the gain standard. The reflection coefficients of all the components shall be measured as a function of frequency so that corrections can be made to the measured power gain.

Operation Modes

The basic operation mode used for testing is:

A. EUT measurement by OTA chamber, transmitted by a network analyzer & horn antenna at nominal frequency (2402MHz, 2440MHz, 2480MHz).

6 TEST RESULTS

Return Loss, Radiation Pattern (3D) and Antenna gain

Date of testing:	2022/4/19
Ambient temperature:	23°C
Relative humidity:	61%
Reference standard:	ANS/IEEE Std 149, CTIA Test Plan for Wireless Device Over-the- Air Performance
Measurement distance:	3m
Kind of test site:	OTA chamber WPTC-L
Supply voltage during testing:	DC ==V

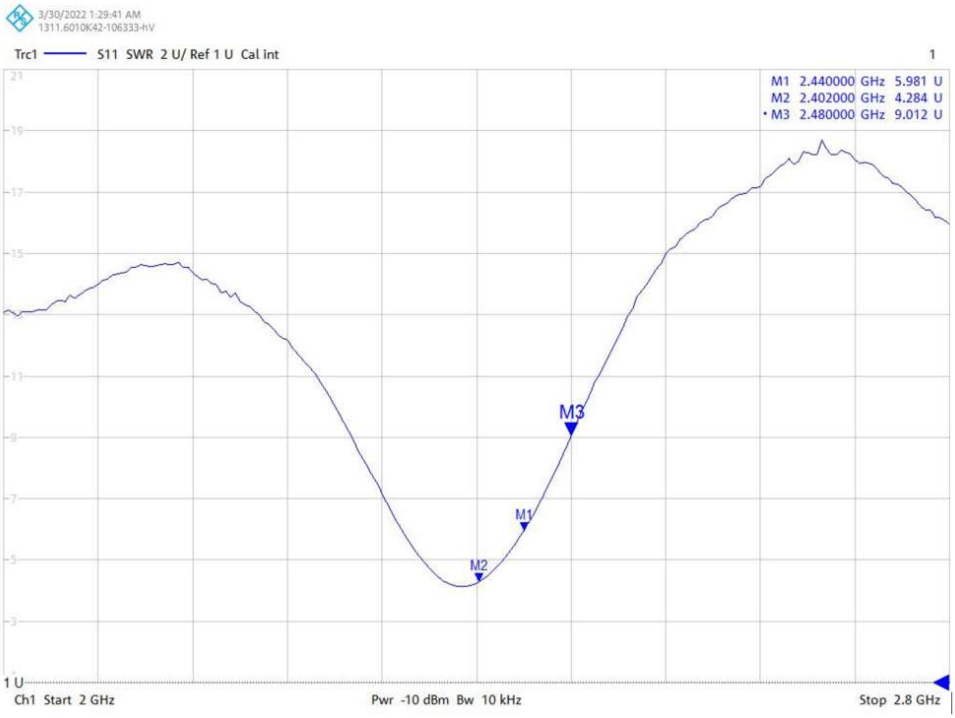
The EUT was placed on a styrene foam table in a Semi-Anechoic Chamber with absorber on the floor and set to produce an unmodulated signal. The power emitted by the EUT was measured by a test antenna connected to a spectrum analyzer.

The measurement was performed for both horizontal and vertical polarizations of the test antenna. The table was rotated in order to find the maximum emission angle and the measured power was corrected by a substitution method factor.

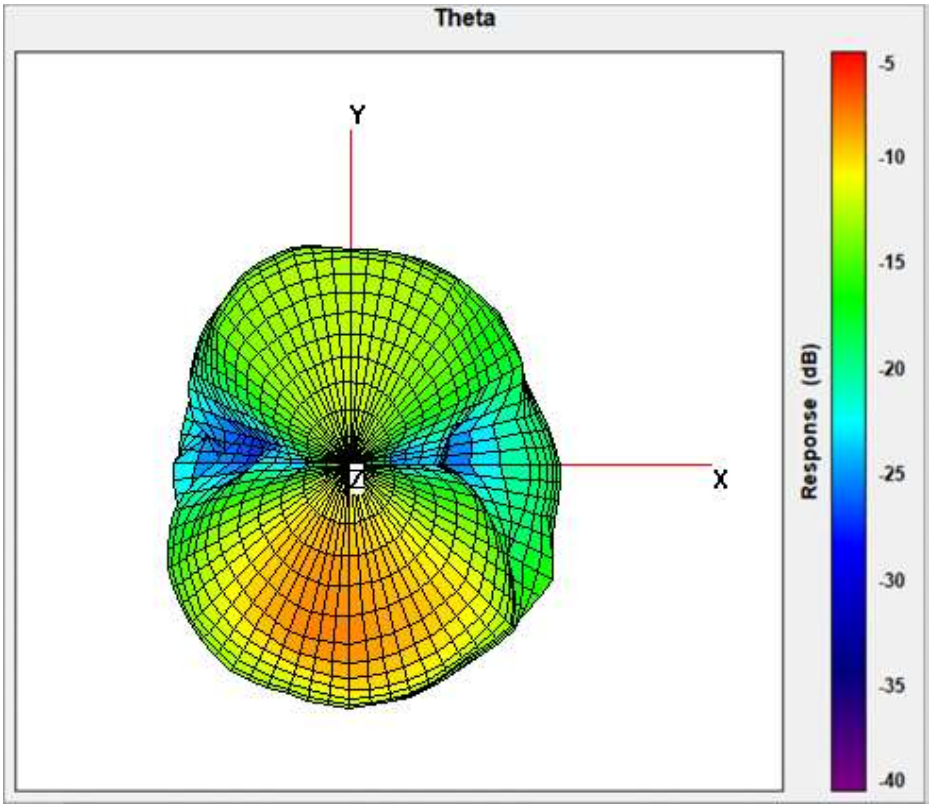
This correction factor was obtained by replacing the EUT by a substitution antenna connected to a signal generator (SG). The factor was calculated based on the known SG output power, substitution antenna gain and reading of the spectrum analyzer.

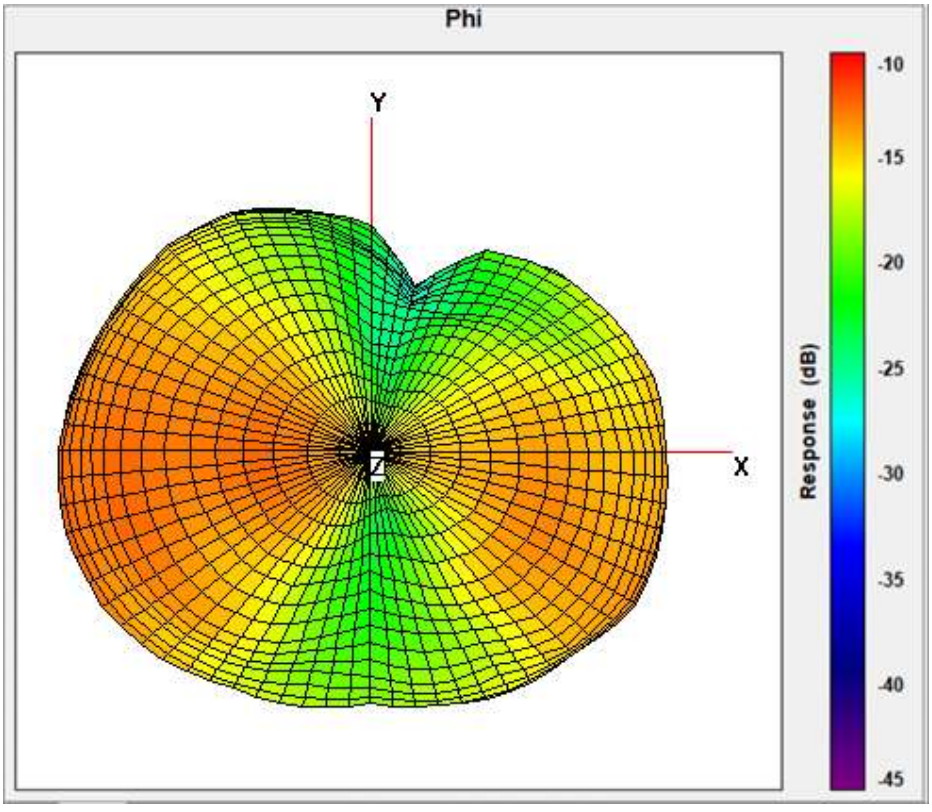
Measurements were performed with a spectrum analyzer using the Sample detector with a resolution bandwidth and a video bandwidth of 100kHz.

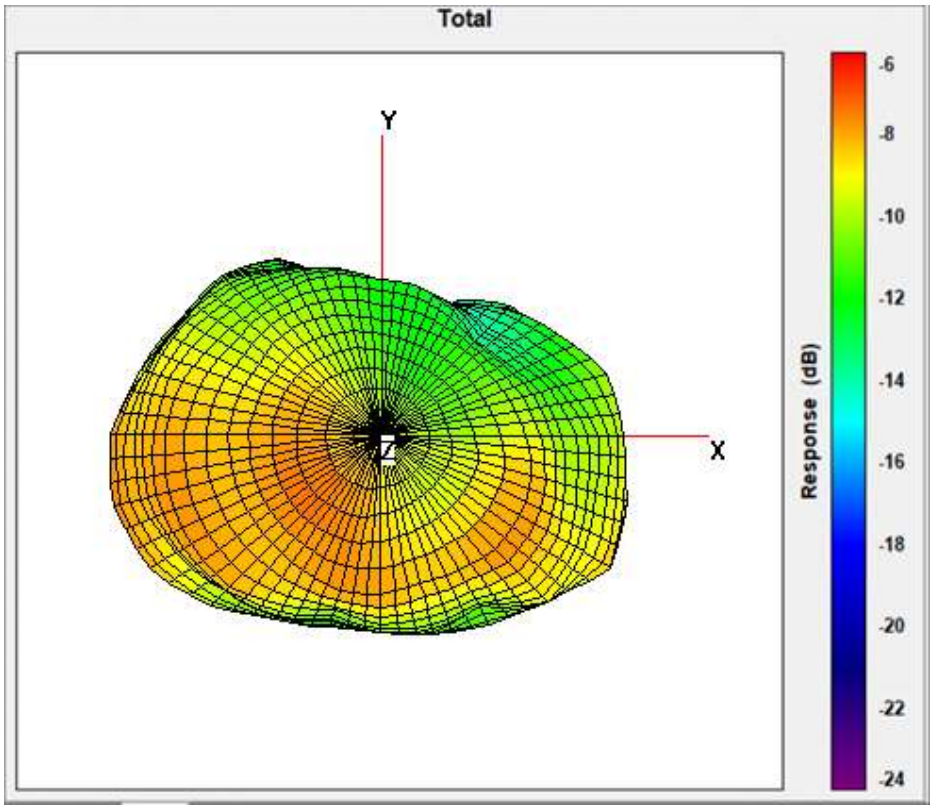
The measurements were taken during the full rotation and are recorded in 15 degree steps.
The highst value is indicated as maximum antenna gain.



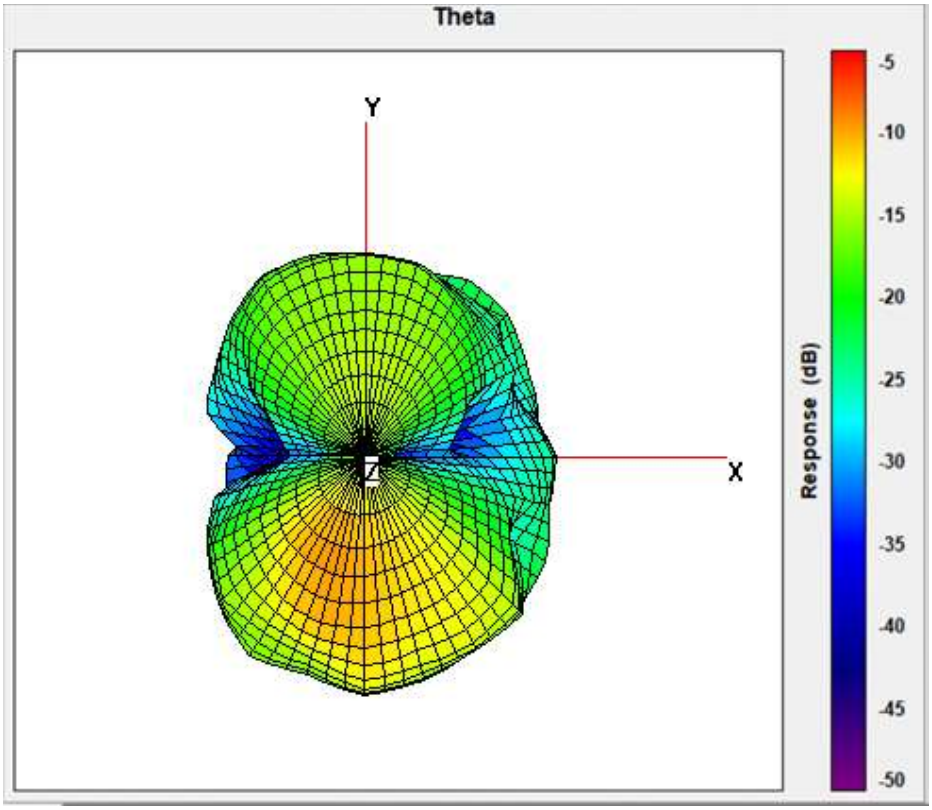
OTA Test Results for Frequency 2402 MHz

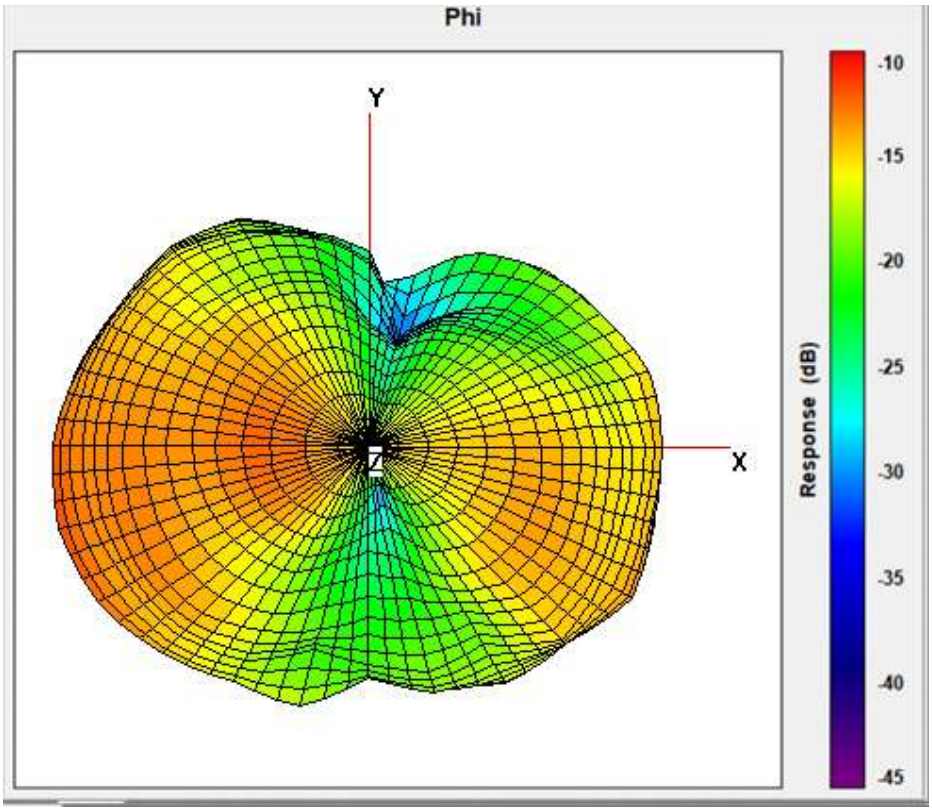


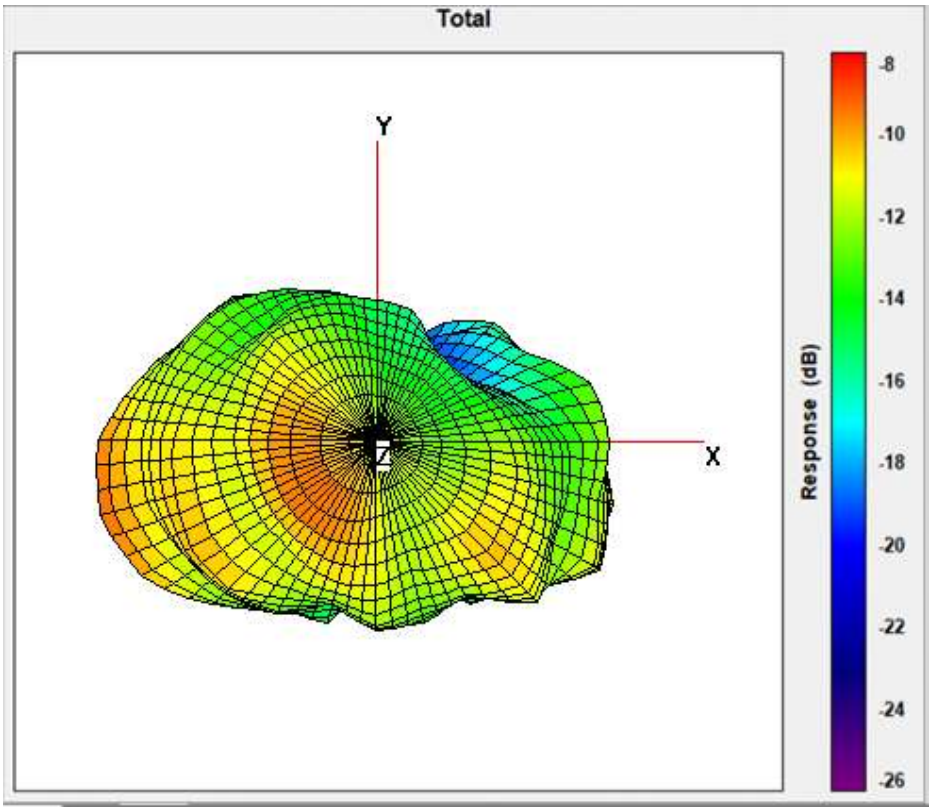



Total
Y
X
Z
Response (dB)
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24

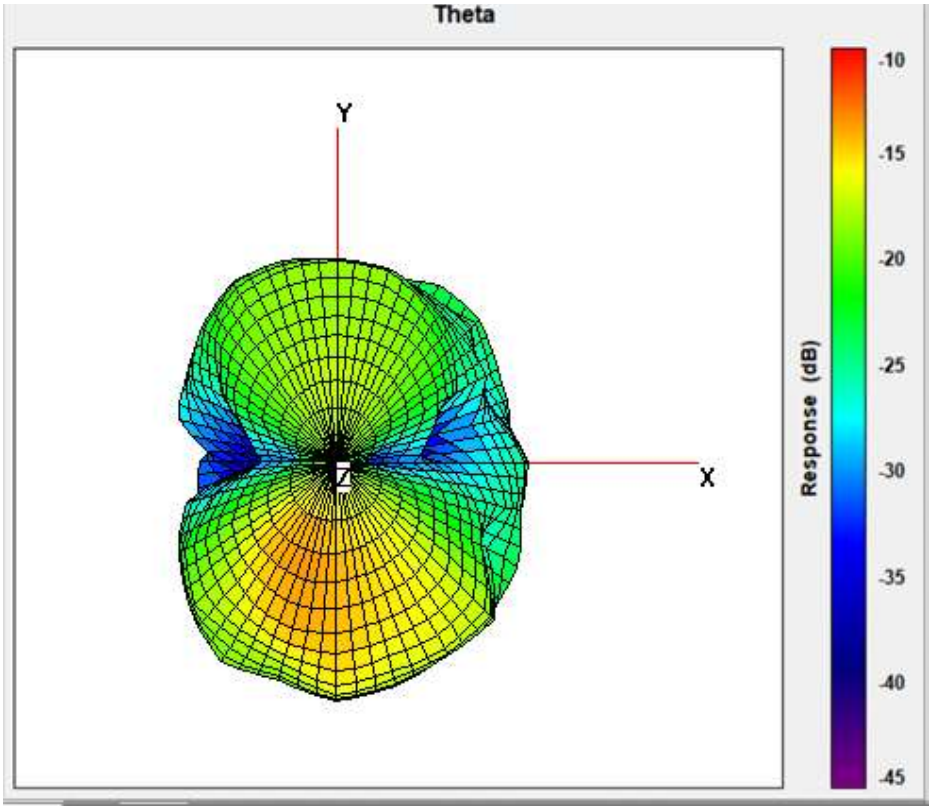
OTA Test Results for Frequency 2440 MHz

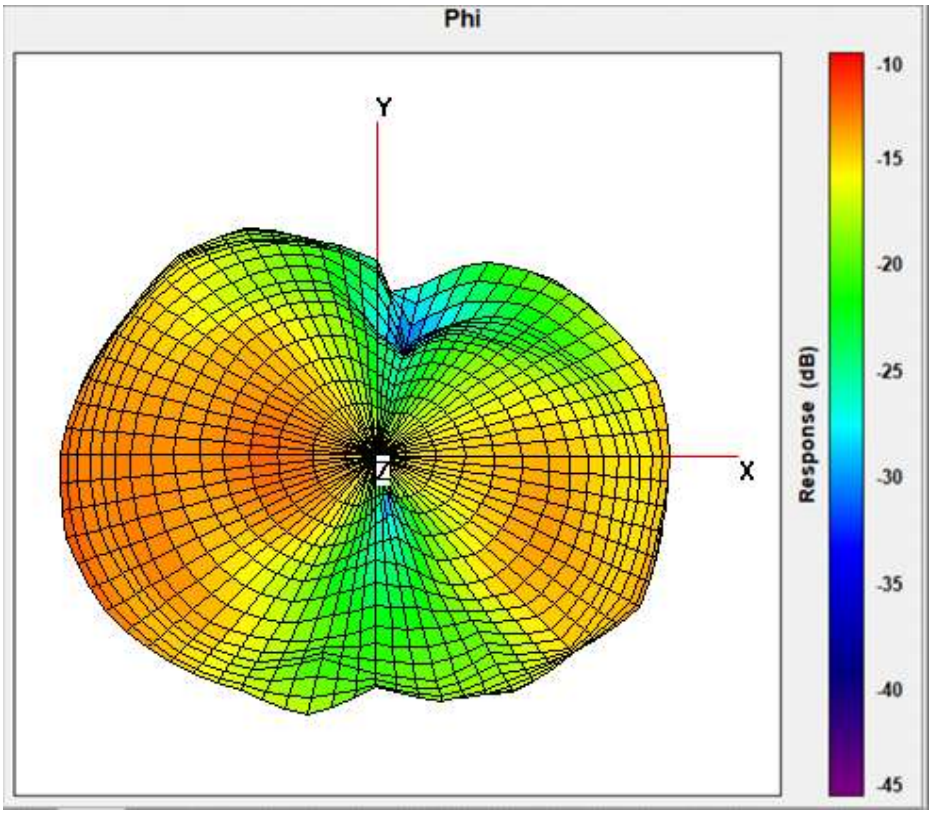


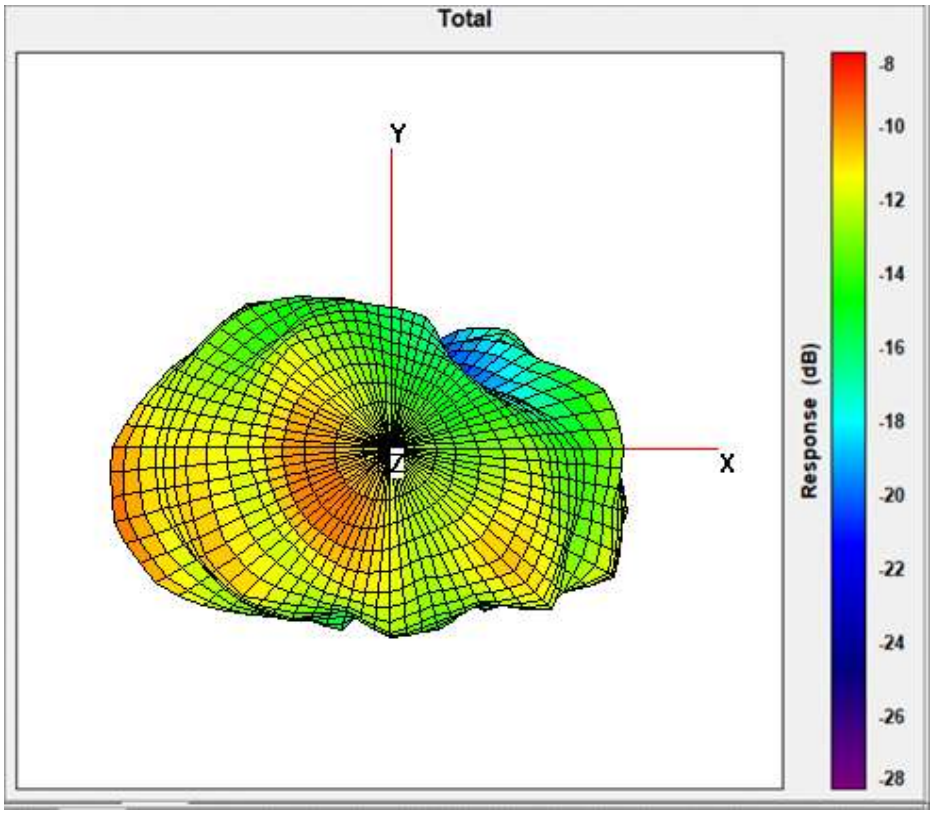



Total
Y
X
Z
Response (dB)
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26

OTA Test Results for Frequency 2480 MHz






Total
Y
X
Response (dB)
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28

Antenna Gain

Ambient temperature:	23°C
Relative humidity:	61%
Reference standard:	ANS/IEEE Std 149, CTIA Test Plan for Wireless Device Over-the- Air Performance
Measurement distance:	3m
Kind of test site:	Semi-Anechoic Chamber with absorber on the floor
Supply voltage during testing:	DC ==V

Table 1: Effective Isotropic Radiated Power

Model name	ZPP005Z		
Postion	3D-FS		
Frequency (MHz)	2402	2440	2480
Ant. Port Input Pwr. (dBm)			
Tot. Rad. Pwr. (dBm)	**-21.44**	**-21.47**	**-21.34**
Peak EIRP (dBm)	-17.39	-16.97	-15.90
Directivity (dBi)	4.05	4.50	5.43
Efficiency (dB)	-21.44	-21.47	-21.34
Efficiency (%)	**0.72**	**0.71**	**0.74**
Gain (dBi)	-12.83	-13.10	-12.50
NHPRP ±Pi/4 (dBm)	-23.20	-23.24	-23.14
NHPRP ±Pi/6 (dBm)	-24.83	-24.80	-24.62

Dimension drawing