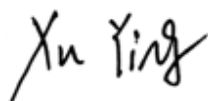


# OTA TEST REPORT

|                   |                   |
|-------------------|-------------------|
| <b>Applicant</b>  | Espressif Systems |
| <b>Product</b>    | ESP ANT B         |
| <b>Model</b>      | ESP ANT B         |
| <b>Report No.</b> | Y2302A0204-T1     |
| <b>Issue Date</b> | March 22, 2023    |

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **ANSI/IEEE Std 149-2021**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.



*Prepared by: Xu Ying*



*Approved by: Xu Kai*

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## 1. Test Laboratory

### 1.1. Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

### 1.2. Test Facility

#### A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

### 1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.  
Address: Building 3, No.145, Jintang Rd, Pudong Shanghai, P.R.China  
City: Shanghai  
Post code: 201201  
Country: P. R. China  
Contact: Xu Kai  
Telephone: +86-021-50791141/2/3  
Fax: +86-021-50791141/2/3-8000  
Website: <http://www.ta-shanghai.com>  
E-mail: [xukai@ta-shanghai.com](mailto:xukai@ta-shanghai.com)

### 1.4. Laboratory Environment

|                   |                         |         |
|-------------------|-------------------------|---------|
| Temperature       | Min. =19°C, Max. = 25°C |         |
| Relative humidity | Min. =40%, Max. =72%    |         |
| Shield effect     | 0.7-6GHz                | > 100dB |
| Ground resistance | <0.5Ω                   |         |

## 2. General Description of Equipment Under Test

### 2.1. Applicant and Manufacturer Information

|                      |                                                                           |
|----------------------|---------------------------------------------------------------------------|
| Applicant Name       | Espressif Systems                                                         |
| Applicant address    | #101, Block 2, 690 Bibo Road, Zhang Jiang High-Tech Park, Shanghai, China |
| Manufacturer Name    | Espressif Systems                                                         |
| Manufacturer address | #101, Block 2, 690 Bibo Road, Zhang Jiang High-Tech Park, Shanghai, China |

### 2.2. General Information

| EUT Description                                                                                                                                                                                                                                                                                                                                                                                           |                   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Product Name:                                                                                                                                                                                                                                                                                                                                                                                             | ESP ANT B         |
| Model                                                                                                                                                                                                                                                                                                                                                                                                     | ESP ANT B         |
| HW Version:                                                                                                                                                                                                                                                                                                                                                                                               | /                 |
| SW Version:                                                                                                                                                                                                                                                                                                                                                                                               | /                 |
| Antenna Type:                                                                                                                                                                                                                                                                                                                                                                                             | PCB Antenna       |
| Antenna Manufacturer:                                                                                                                                                                                                                                                                                                                                                                                     | Espressif Systems |
| Test Frequency:                                                                                                                                                                                                                                                                                                                                                                                           | 2400MHz ~ 2494MHz |
| <p>Note: The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.</p> <p>All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.</p> |                   |

**This report only tests 2400MHz, 2402MHz and 2494MHz frequency points. For other test frequency points, please refer to the ESP ANT B report (Report No: Y1806A0621-T1V3).**

### 2.3. Test Date

The test is performed from February 27, 2023 to March 1, 2023 for Report No: Y2302A0204-T1.

The test is performed from June 25, 2018 to August 3, 2018 for Report No: Y1806A0621-T1V3.

### 2.4. Received Date

The sample was received on February 27, 2023 for Report No: Y2302A0204-T1.

## 2.5. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test Method: **ANSI/IEEE Std 149-2021**

### 3. Test Conditions

#### 3.1. Test Configuration

Great-Circle-Cut method is used to measure the antenna 3D GAIN of EUT in OTA qualified anechoic chamber. Equipment Under Test (EUT) geometry centre vertical projection at the centre of platform, the distance from EUT to measurement antenna is 5m.

#### 3.2. Test Measurement

##### Spherical coordinate system

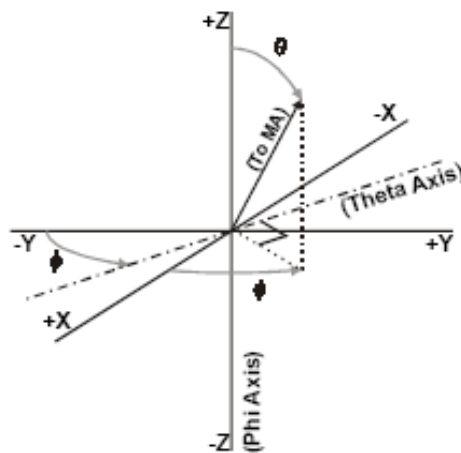
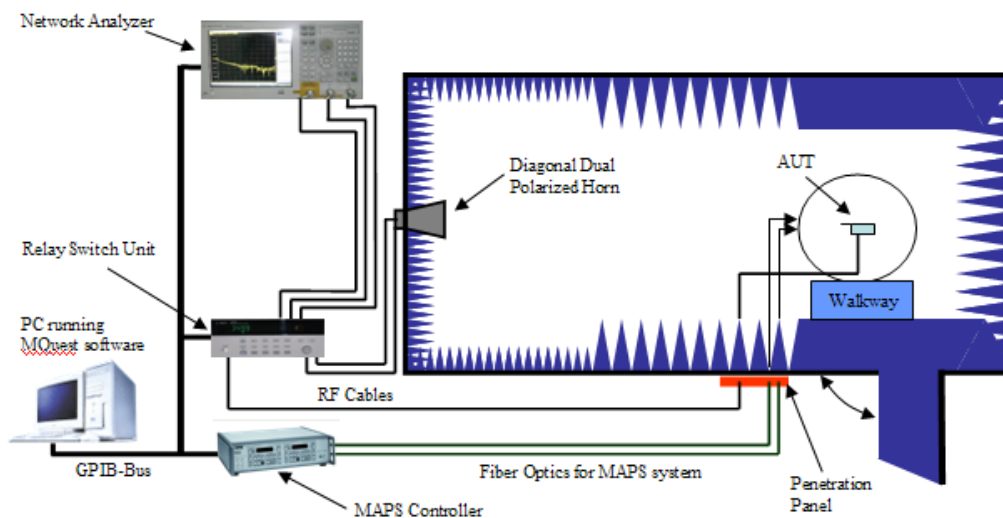


Figure 1 Test coordinate system

Note: Theta is from 0~180 degree. Phi is from 0~360. Rotate the EUT and record the Data, the step of rotation is 15 degree.

##### Test Setup

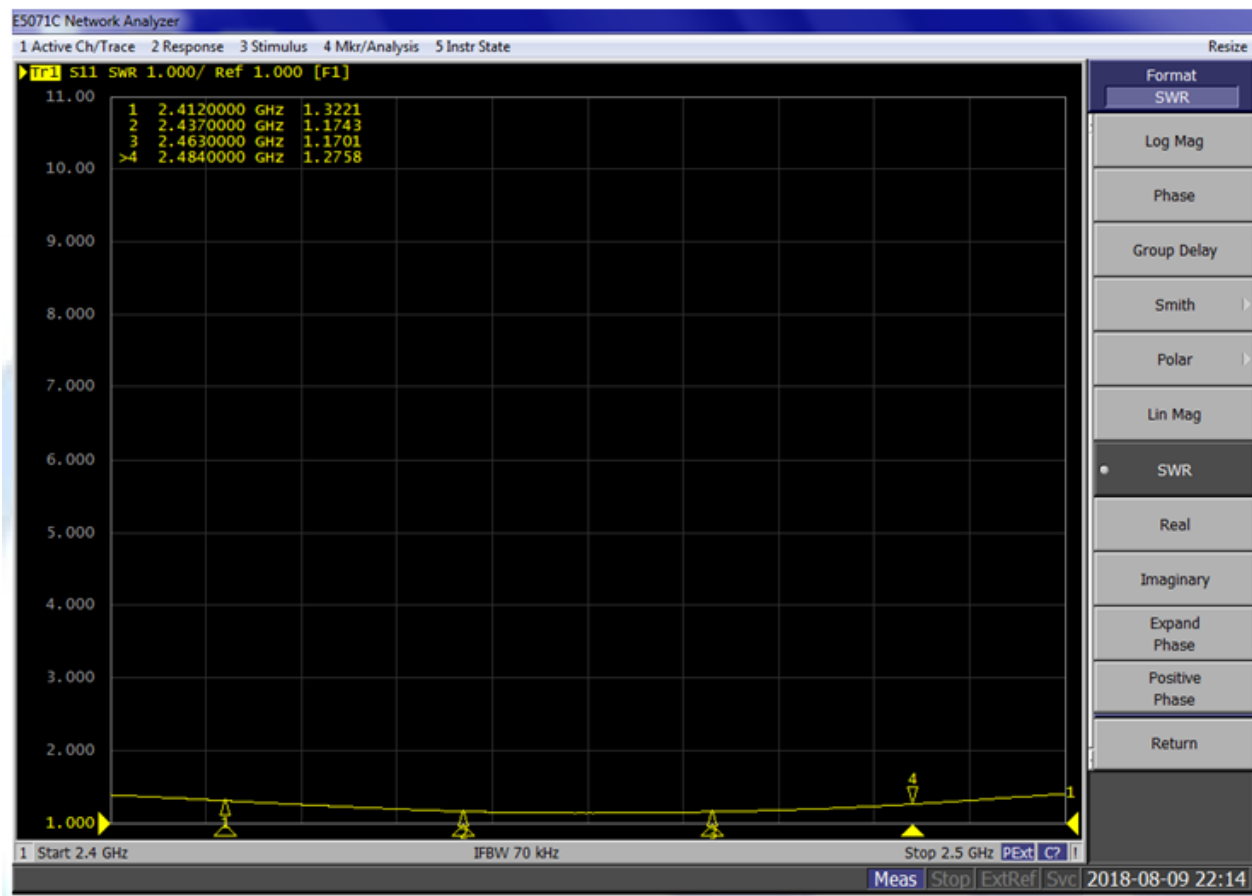


## 4. Test Results

### 4.1. Gain and Efficiency

| Model                                                                                                                                                                      | Test Item | Test State | Frequency (MHz) | Efficiency (%) | Gain (dBi) | Note |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|-----------------|----------------|------------|------|
| ESP-ANT B                                                                                                                                                                  | Gain      | Free Space | 2400            | 67.12          | 3.14       | /    |
|                                                                                                                                                                            |           |            | 2402            | 62.06          | 2.89       |      |
|                                                                                                                                                                            |           |            | 2412            | 73.79          | 2.39       |      |
|                                                                                                                                                                            |           |            | 2417            | 77.04          | 2.97       |      |
|                                                                                                                                                                            |           |            | 2422            | 79.83          | 2.80       |      |
|                                                                                                                                                                            |           |            | 2427            | 81.19          | 2.89       |      |
|                                                                                                                                                                            |           |            | 2432            | 80.54          | 3.04       |      |
|                                                                                                                                                                            |           |            | 2437            | 76.86          | 2.86       |      |
|                                                                                                                                                                            |           |            | 2442            | 76.17          | 2.99       |      |
|                                                                                                                                                                            |           |            | 2447            | 73.99          | 2.96       |      |
|                                                                                                                                                                            |           |            | 2452            | 72.00          | 2.80       |      |
|                                                                                                                                                                            |           |            | 2457            | 70.71          | 2.72       |      |
|                                                                                                                                                                            |           |            | 2462            | 71.31          | 2.94       |      |
|                                                                                                                                                                            |           |            | 2467            | 71.32          | 3.12       |      |
|                                                                                                                                                                            |           |            | 2472            | 72.03          | 3.28       |      |
|                                                                                                                                                                            |           |            | 2477            | 72.71          | 3.24       |      |
|                                                                                                                                                                            |           |            | 2482            | 75.42          | 3.42       |      |
|                                                                                                                                                                            |           |            | 2494            | 61.49          | 2.65       |      |
| Note:                                                                                                                                                                      |           |            |                 |                |            |      |
| 1. comment variation is +/- 0.02dBi                                                                                                                                        |           |            |                 |                |            |      |
| 2. The 2400MHz, 2402MHz, and 2494MHz frequencies were tested on February 27, 2023 to March 1, 2023. Other test frequencies were tested on June 25, 2018 to August 3, 2018. |           |            |                 |                |            |      |

## 4.2. Voltage Standing Wave Ratio (VSWR)



| Frequency (MHz) | 2412 | 2437 | 2463 | 2484 |
|-----------------|------|------|------|------|
| VSWR            | 1.32 | 1.17 | 1.17 | 1.28 |

### 4.3. Antenna S11



| Frequency (MHz) | 2412   | 2437   | 2463   | 2484   |
|-----------------|--------|--------|--------|--------|
| S11(dB)         | -17.07 | -21.64 | -22.52 | -18.51 |

## 5. Equipment List

Date of Testing: June 25, 2018 ~ August 3, 2018

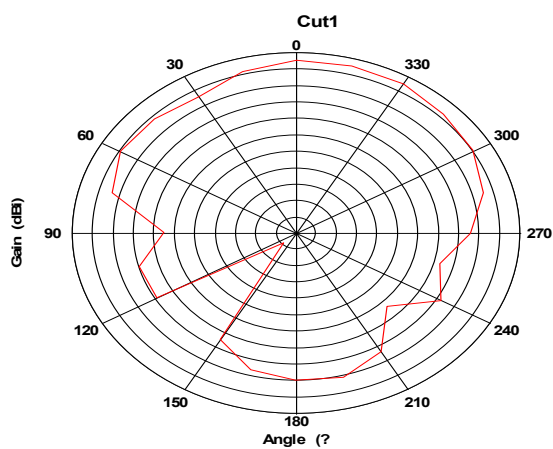
| Type of Equipment           | Manufacture  | Model Number                         | S/N                 | Calibration Date | Expiration Time |
|-----------------------------|--------------|--------------------------------------|---------------------|------------------|-----------------|
| Network Analyzer            | Key sight    | E5071B                               | MY42404014          | 2018-05-20       | 2019-05-19      |
| Switch Control System       | ETS          | 7006/7001                            | 00059957/MY42001152 | 2018-05-20       | 2019-05-19      |
| Dual polarized horn antenna | ETS          | 3164-04                              | 00062743            | 2018-05-20       | 2019-05-19      |
| Anechoic Chamber            | ETS          | AMS-8500                             | CT-001157-1219      | /                | /               |
| Software                    | ETS-lindgren | EMQ-100 Pattern Measurement software | 1.09                | /                | /               |

Date of Testing: February 27, 2023 ~ March 1, 2023

| Type of Equipment              | Manufacture | Model Number | S/N                 | Calibration Date | Expiration Time |
|--------------------------------|-------------|--------------|---------------------|------------------|-----------------|
| Anechoic Chamber               | ETS         | AMS-8500     | CT-001157-1219      | 2020-05-17       | 2025-05-16      |
| Test Software                  | ETS         | EMQuest™     | REV 1.16            | /                | /               |
| EMCenter_Switch Control System | ETS         | 7006/7001    | 00059957/MY42001152 | /                | /               |
| Diagonal Dual Polarized Horn   | ETS         | ETS 3164-04  | 00062743            | 2020-04-14       | 2025-04-13      |
| Network Analyzer               | Keysight    | E5071B       | MY42404014          | 2022-05-14       | 2023-05-13      |

## ANNEX A: 2-D Pattern Plots

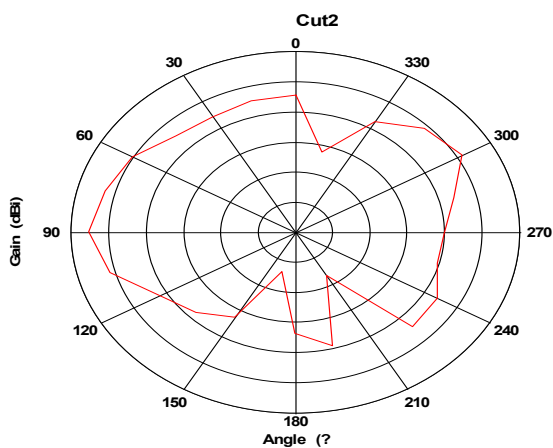
Max: 5  
 Min: -50  
 Scale: 5/div



Horizontal X-Y

2400 MHz

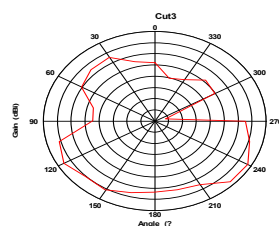
Max: 5  
 Min: -25  
 Scale: 5/div



Horizontal X-Z

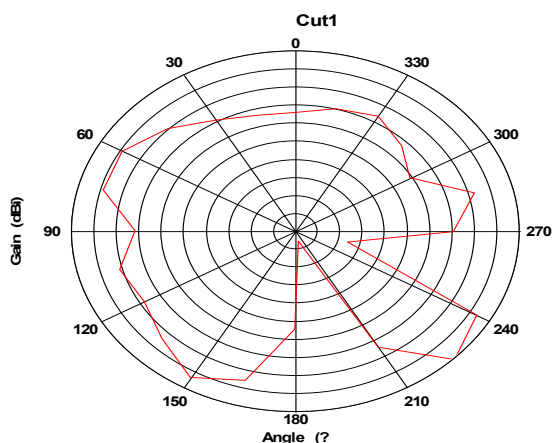
2400 MHz

Max: 0  
 Min: -40  
 Scale: 5/div

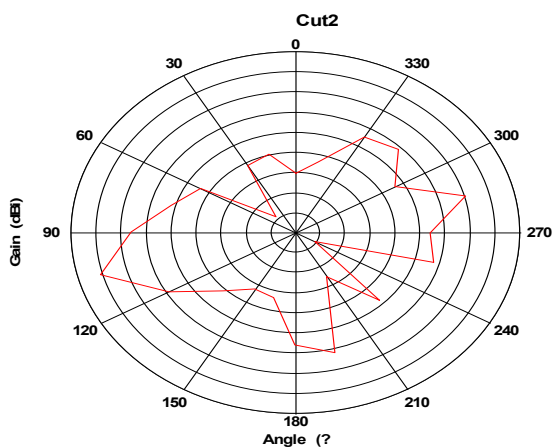


Horizontal Y-Z

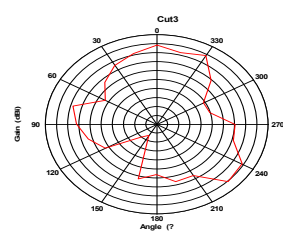
2400 MHz



Vertical X-Y



Vertical X-Z

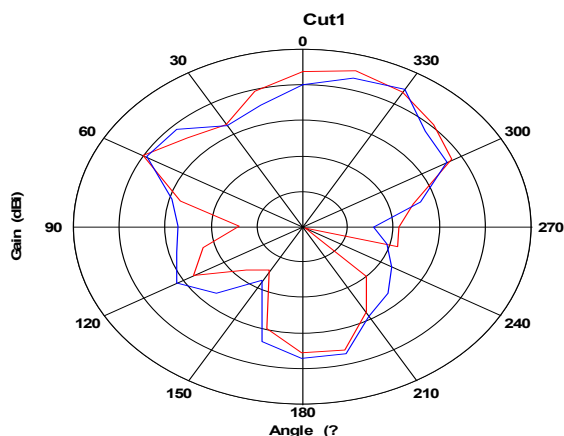


Vertical Y-Z

2400 MHz

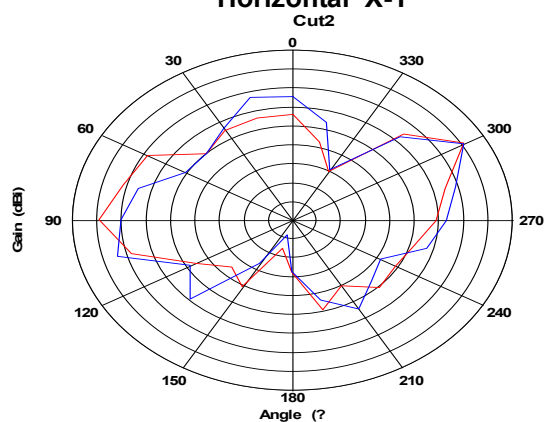
2400 MHz

2400 MHz



2402 MHz  
2494 MHz

### Horizontal X-Y



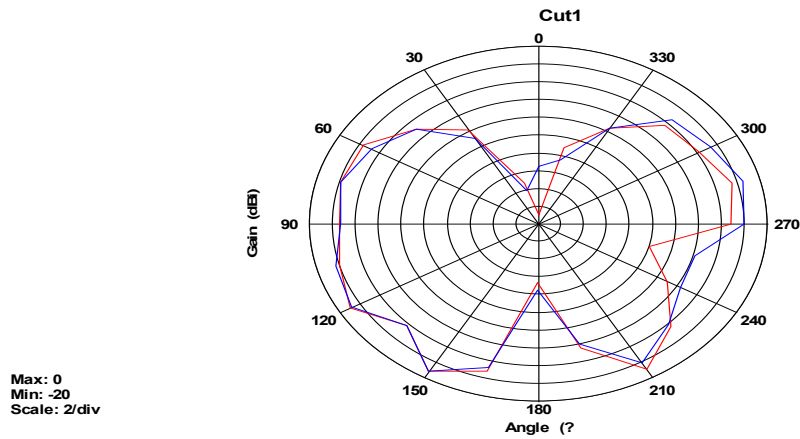
2402 MHz  
2494 MHz

### Horizontal X-Z

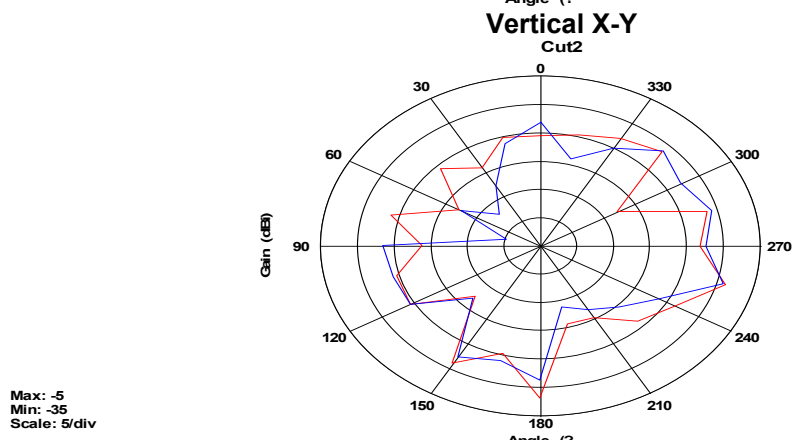


2402 MHz  
2494 MHz

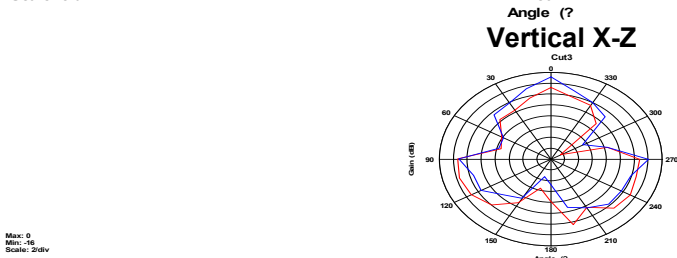
### Horizontal Y-Z



2402 MHz  
2494 MHz



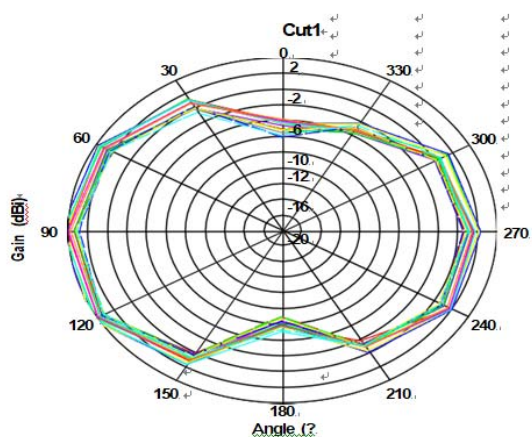
2402 MHz  
2494 MHz



2402 MHz  
2494 MHz

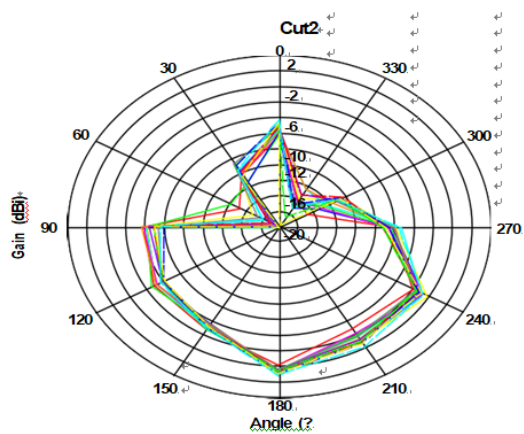
**Vertical Y-Z**

Max: 2,  
Min: -20,  
Scale: 2/div.



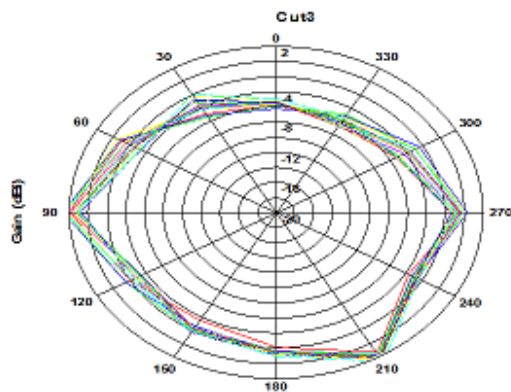
Horizontal X-Y

Max: 2,  
Min: -20,  
Scale: 2/div.



Horizontal X-Z

Max: 2  
Min: -20  
Scale: 2/div



Horizontal Y-Z

