



# APPLICATION SPECIFICATION

## TITLE

# 3IN1 (4G/GPS/WIFI) EXTERNAL ANETNNA

## TABLE OF CONTENTS

1.0 SCOPE

2.0 PRODUCT DESCRIPTION

3.0 APPLICABLE DOCUMENTS

4.0 ANTENNA PERFORMANCE

5.0 PRODUCT STRUCTURE INFORMATION

6.0 ANTENNA EFFICIENCY

7.0 RADIATION PATTERN

8.0 LNA

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>1 of 25</b>           |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

## 3IN1 (4G/GPS/WIFI) EXTERNAL ANTENNA

### 1.0 SCOPE

This specification describes the antenna application. The information in this document is for reference and benchmark purposes only. The user is responsible for validating antenna RF performance based on user's actual implementation.

Antenna illustrations in this document are generic representations. They are not intended to be an image of any antenna listed in the scope.

### 2.0 PRODUCT DESCRIPTION

#### 2.1 PRODUCT NAME AND SERIES NUMBER (S)

Product name: 3in1 (GPS/4G/WiFi) external antenna

Series Number: 2068663000

#### 2.2 DESCRIPTION

206866 is 4G/GPS/WiFi 3in1 external antenna for use in Automotive Telematics, Transportation and remote monitoring applications.

#### 2.3 PRODUCT STRUCTURE INFORMATION

Please refer to PS-2068663000 for full information.



FIGURE 2.3.1 DIMENSION OF THE 3IN1 (4G/GPS/WiFi)

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>2 of 25</b>           |
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### 3.0 APPLICABLE DOCUMENTS

| DOCUMENT                   | NUMBER        | DESCRIPTION                         |
|----------------------------|---------------|-------------------------------------|
| Sale Drawing (SD)          | SD-2068663000 | Mechanical Dimension of the product |
| Product Specification (PS) | PS-2068663000 | Product Specification               |
| Packing Drawing (PK)       | PK-2068663000 | Product packaging specifications    |

### 4.0 ANTENNA PERFORMANCE

#### 4.1 RF TEST CONDITIONS



FIGURE 4.1.1 ANTENNA TESTED WITH VNA E5071C

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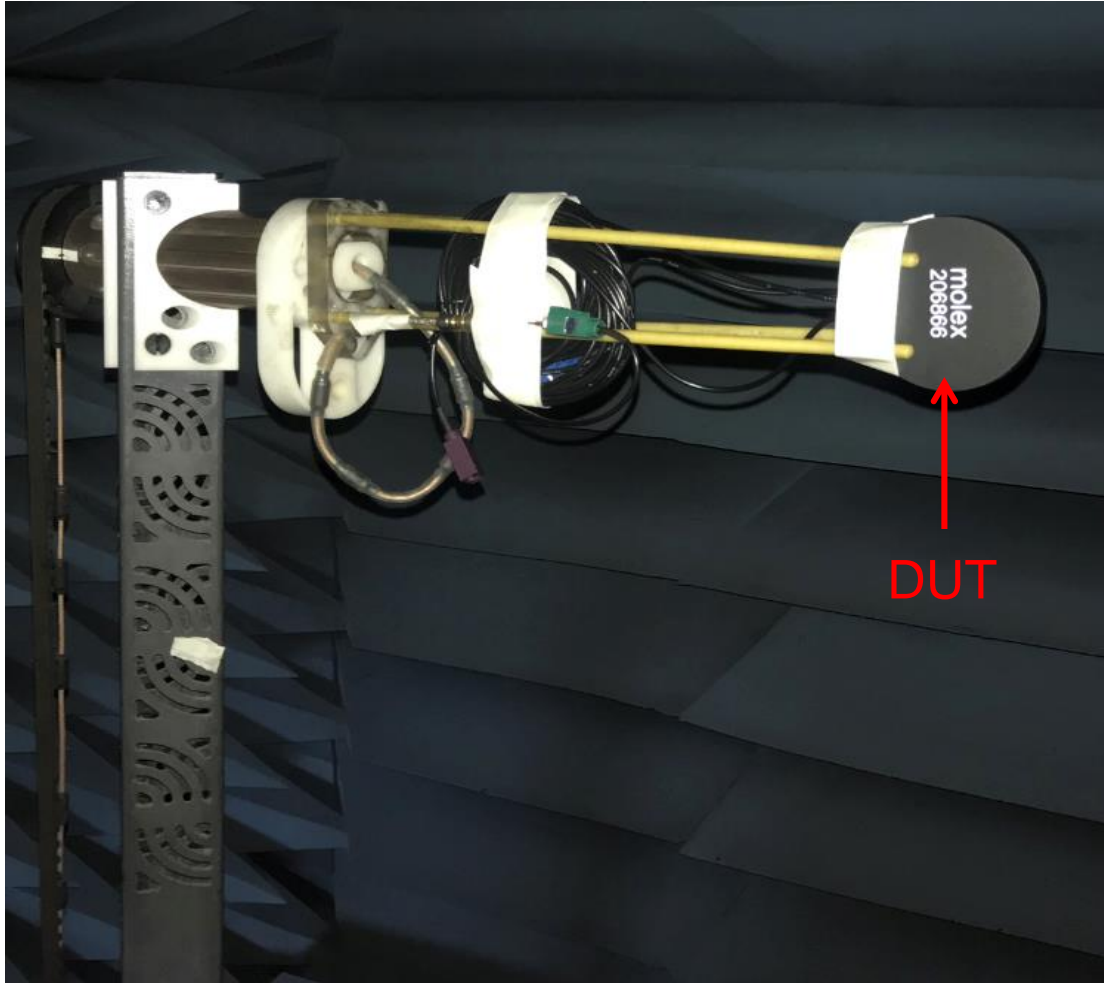


FIGURE4.1.2 ANTENNA TESTED WITH OTA CHAMBER

|  |   |   |                                       |
|--|---|---|---------------------------------------|
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# APPLICATION SPECIFICATION

## 4.2 ANTENNA PERFORMANCE

### 4.2.1 GPS ANTENNA

| DESCRIPTION              | EQUIPMENT   | REQUIREMENT                         |
|--------------------------|-------------|-------------------------------------|
| Frequency Range          | VNA E5071C  | 1575.42±1.023 MHz                   |
| VSWR                     | VNA E5071C  | ≤2.0                                |
| Average Total Efficiency | OTA Chamber | 26.2%                               |
| Peak Gain (Max)          | OTA Chamber | 3dBic Based on 70*70mm ground plane |
| Polarization             | OTA Chamber | RHCP                                |
| Input Impedance          | VNA E5071C  | 50 ohms                             |

### 4.2.2 GPS LNA

| DESCRIPTION     | EQUIPMENT   | REQUIREMENT       |
|-----------------|-------------|-------------------|
| Frequency Range | VNA E5071C  | 1575.42±1.023 MHz |
| DC Voltage      | DC Supplier | 3-5V              |
| Gain            | VNA E5071C  | 28±3dB            |
| VSWR            | VNA E5071C  | ≤2.0              |
| Noise Figure    | VNA E5071C  | ≤1.5dB            |
| DC Current      | DC Supplier | 11±3m A (at 3.3V) |

|  |   |   |                                       |
|--|---|---|---------------------------------------|
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# APPLICATION SPECIFICATION

## 4.2.3 4G ANTENNA

| DESCRIPTION              | EQUIPMENT   | REQUIREMENT  |              |
|--------------------------|-------------|--------------|--------------|
| Frequency Range          | VNA E5071C  | 824-960MHz   | 1710-2690MHz |
| Average Total Efficiency | OTA Chamber | 21.6%        | 27.2%        |
| Peak Gain (Max)          | OTA Chamber | -0.5dBi type | 0dBi type    |
| Polarization             | OTA Chamber | Linear       |              |
| VSWR                     | VNA E5071C  | ≤3.0         |              |
| Input Impedance          | VNA E5071C  | 50 ohms      |              |

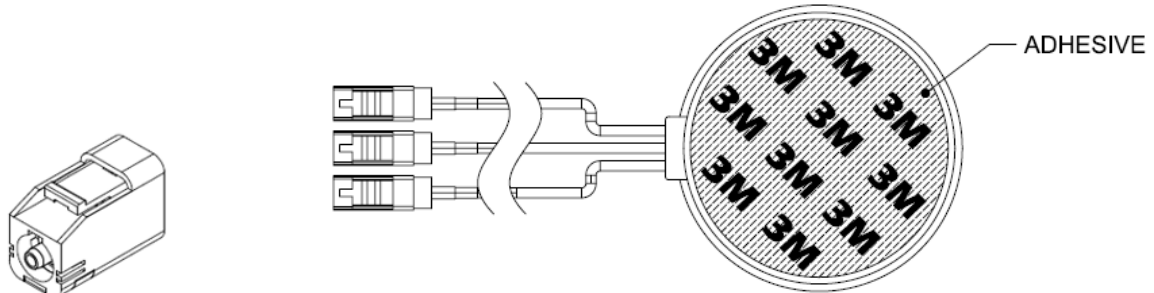
## 4.2.4 WIFI&BT ANTENNA

| DESCRIPTION              | EQUIPMENT   | REQUIREMENT |  |
|--------------------------|-------------|-------------|--|
| Frequency Range          | VNA E5071C  | 2.4-2.5GHz  |  |
| VSWR                     | VNA E5071C  | ≤2.0        |  |
| Average Total Efficiency | OTA Chamber | 23.3%       |  |
| Peak Gain (Max)          | OTA Chamber | -2.7dBi     |  |
| Polarization             | OTA Chamber | Linear      |  |
| Input Impedance          | VNA E5071C  | 50 ohms     |  |

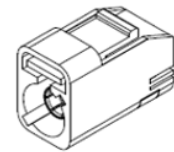
|  |   |   |                                       |
|--|---|---|---------------------------------------|
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## 5.0 PRODUCT STRUCTURE INFORMATION

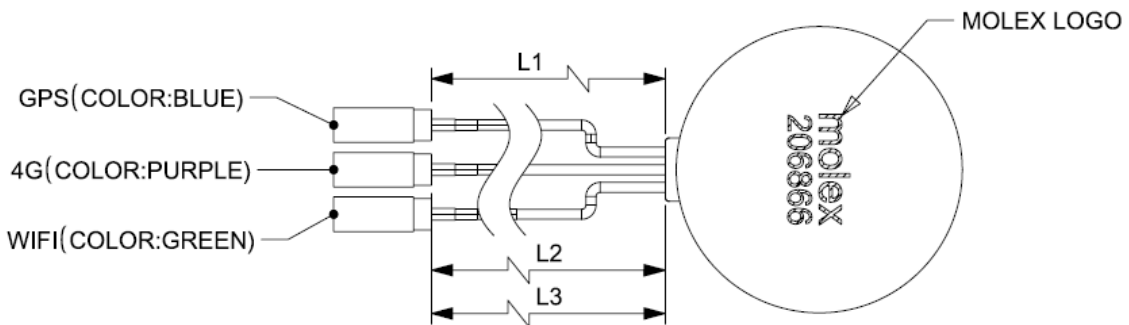
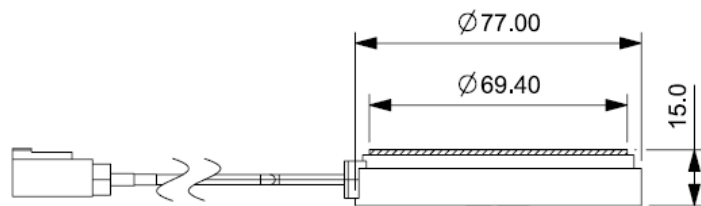
P/N 2068663000



A SIDE



FAKRA



B SIDE

NOTE:

- CABLE LENGTH:L1=3000±100mm;L2=3000±100mm;L3=3000±100mm
- FOAM GLUE FIXED ON THE A SIDE, A SIDE UP WHEN USED.
- MATERIAL PLEASE REFER TO TABLE A.

| ITE | MATERIAL       | DESCRIPTION        |
|-----|----------------|--------------------|
| 1   | ANTENNA        | DIELECTRIC CERAMIC |
| 2   | PLASTIC CASE   | ABS                |
| 3   | PCB            | FR4                |
| 4   | SHIELDING CASE | TINPLATE           |
| 5   | CABLE          | RG174              |
| 6   | GPS CONNECTOR  | FAKRA-C            |
| 7   | GSM CONNECTOR  | FAKRA-D            |
| 8   | WIFI CONNECTOR | FAKRA-E            |
| 9   | ADHSIVE        | 3M CIP-66          |

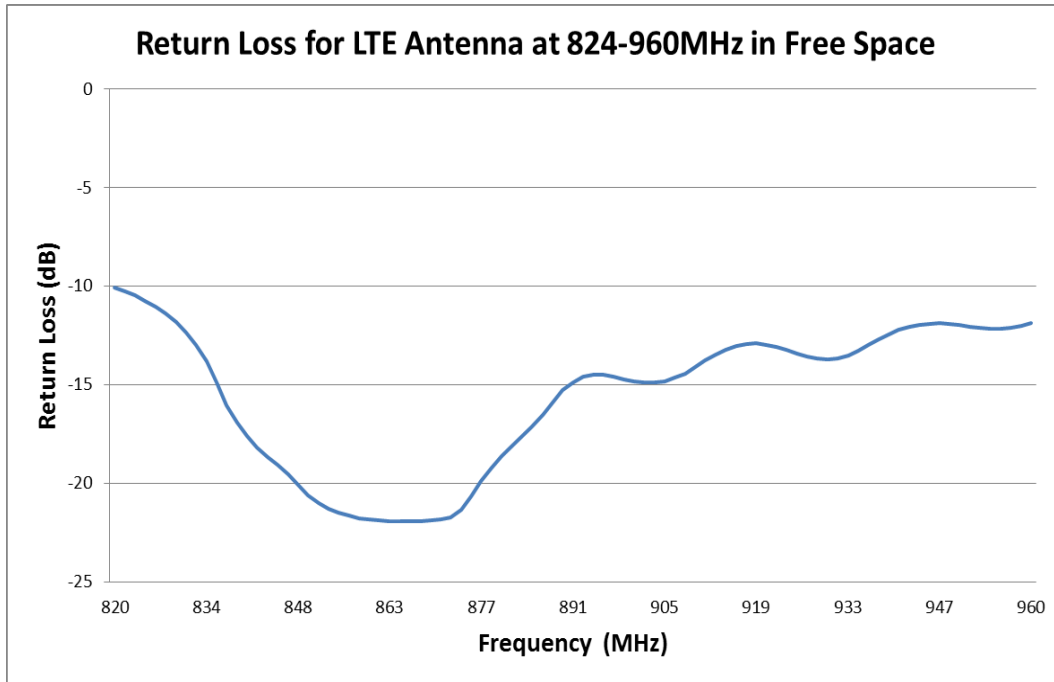
Mechanical Structure Information for 2068663000

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>7 of 25</b>           |
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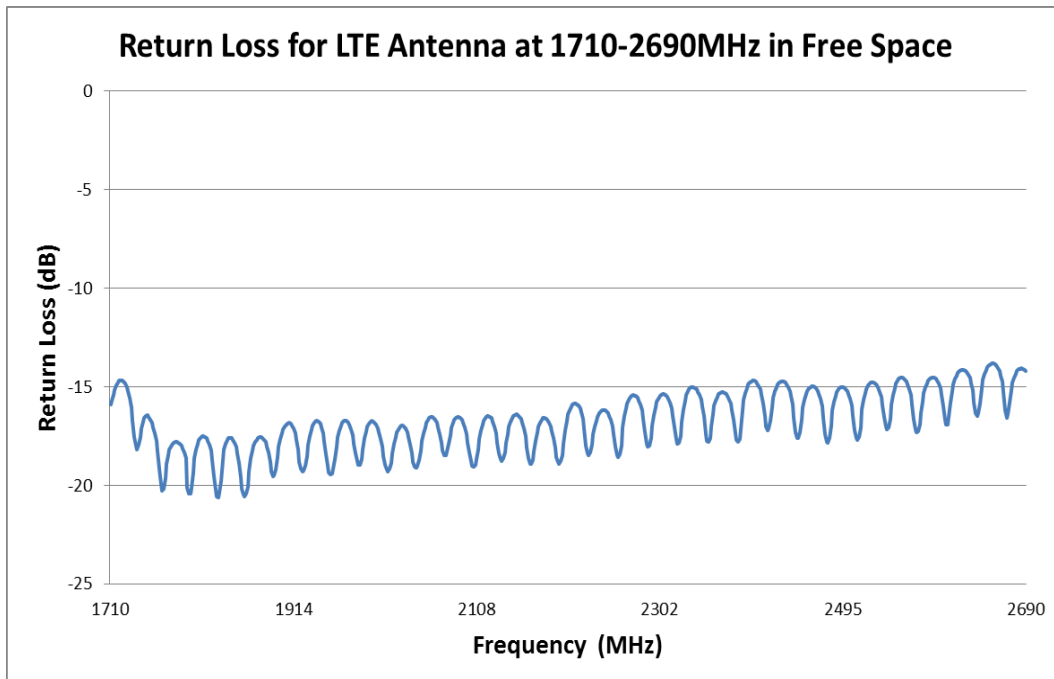
## 6.0 ANTENNA PERFORMANCE

### 6.1 RETURN LOSS PLOT

All measurements in this document are done with cable length of 3000mm



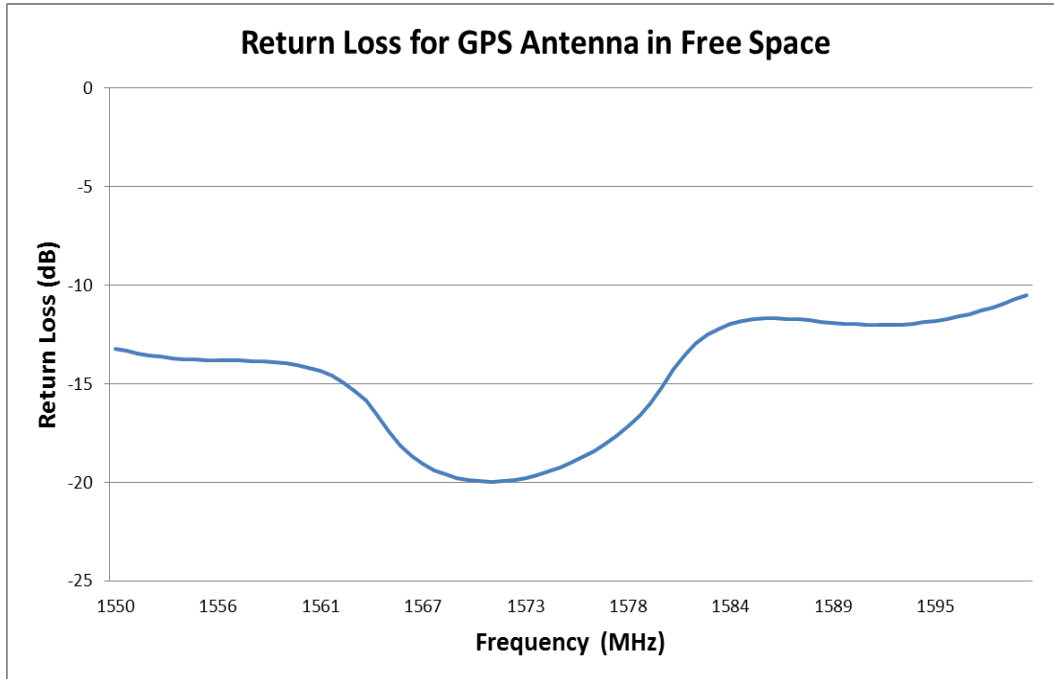
#### 6.1.1 RETURN LOSS OF LTE ANTENNA AT 824-960MHZ IN FREE SPACE



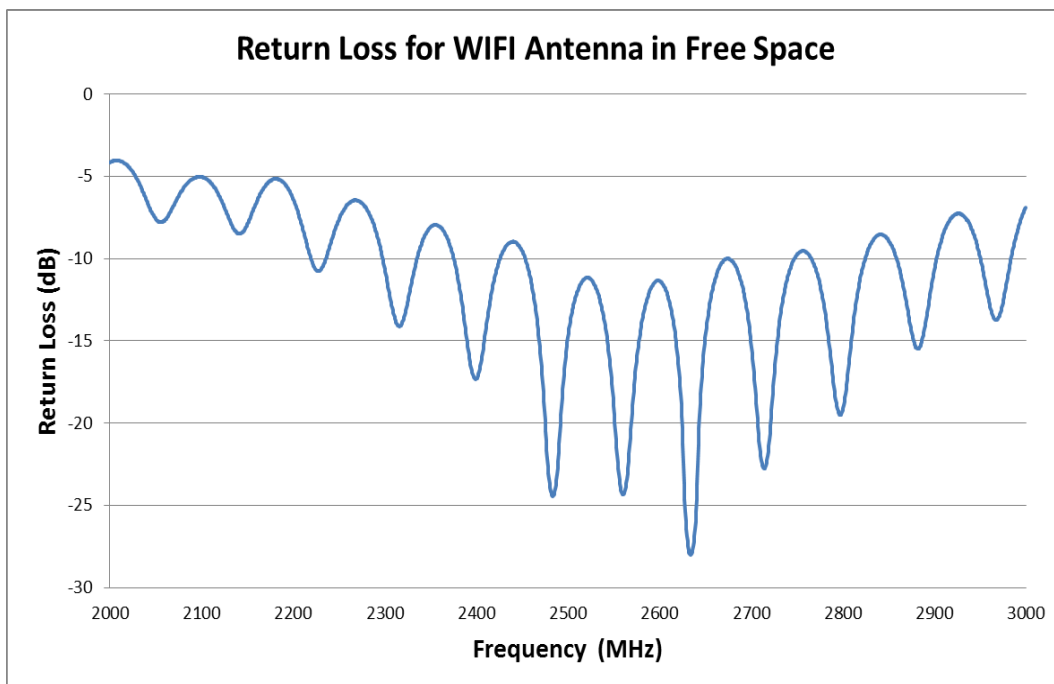
#### 6.1.2 RETURN LOSS OF LTE ANTENNA AT 1710-2690MHZ IN FREE SPACE

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>8 of 25</b>           |
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### 6.1.3 RETURN LOSS OF GPS ANTENNA IN FREE SPACE

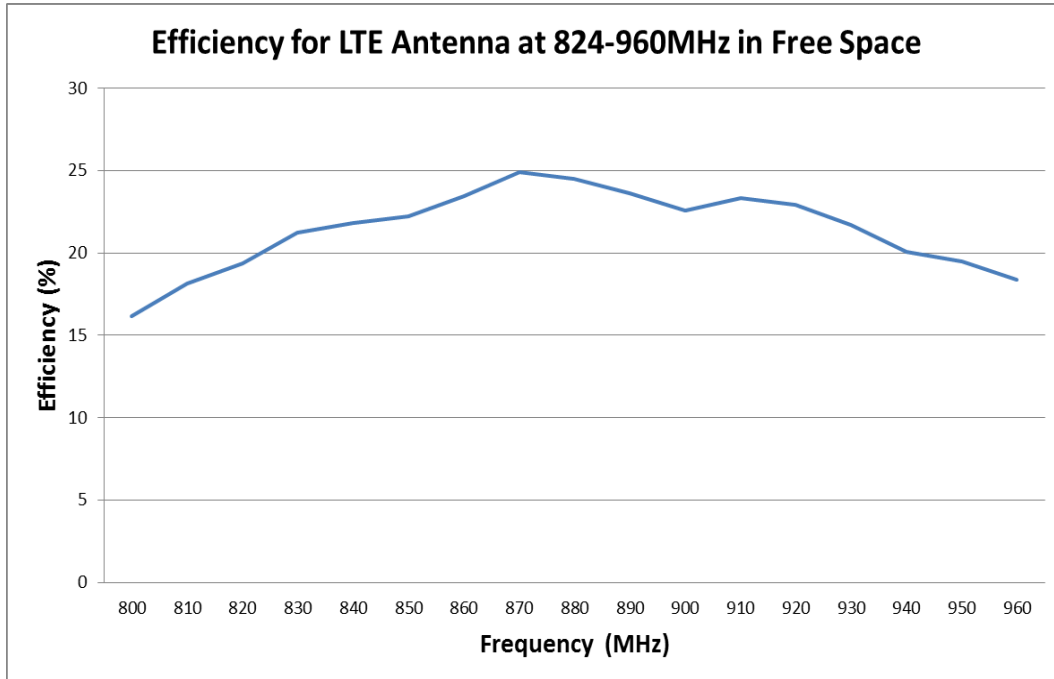


### 6.1.4 RETURN LOSS OF WIFI ANTENNA IN FREE SPACE

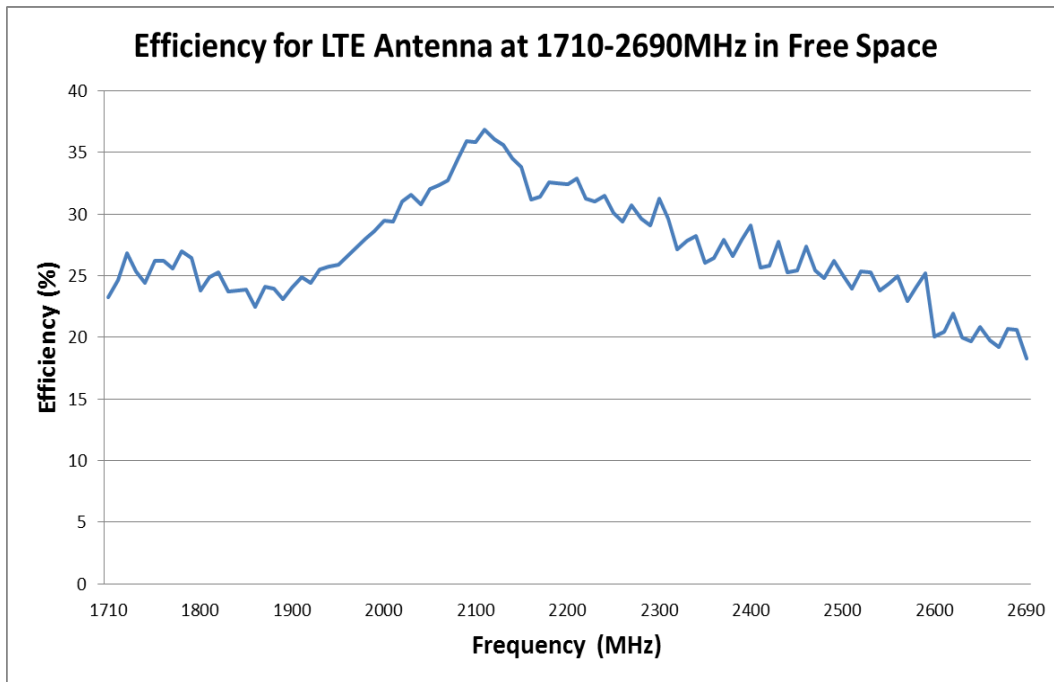
|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>9 of 25</b>           |
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## 6.2 EFFICIENCY PLOT

All measurements in this document are done with cable length of 3000mm

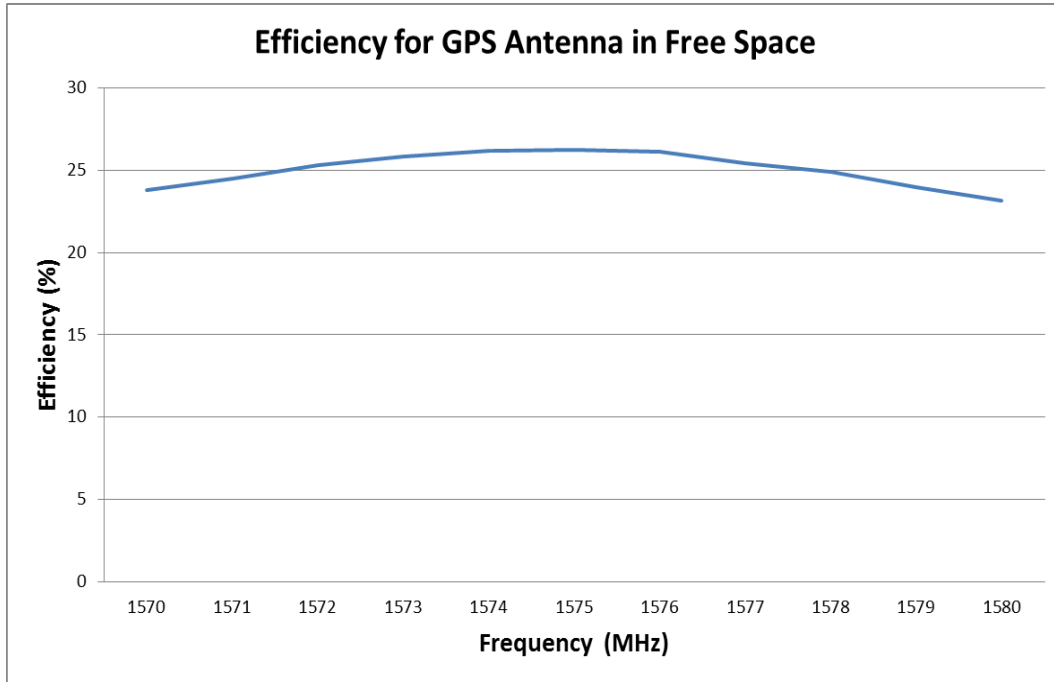


### 6.2.1 EFFICIENCY OF LTE ANTENNA AT 824-960MHZ IN FREE SPACE

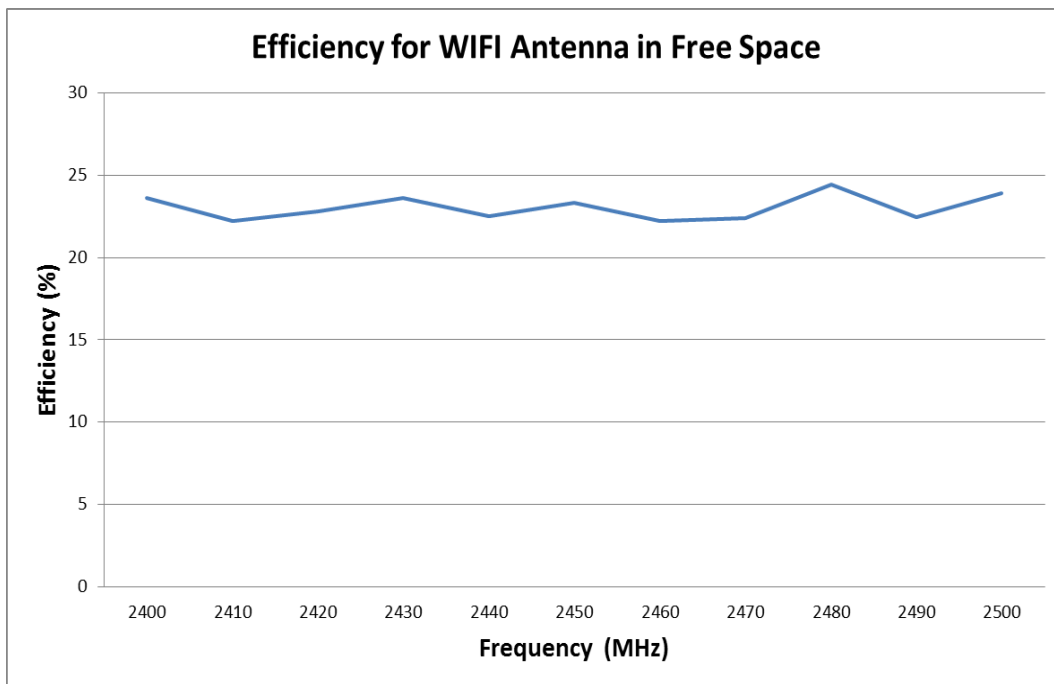


### 6.2.2 EFFICIENCY OF LTE ANTENNA AT 1710-2690MHZ IN FREE SPACE

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>10 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |



### 6.2.3 EFFICIENCY OF GPS ANTENNA IN FREE SPACE



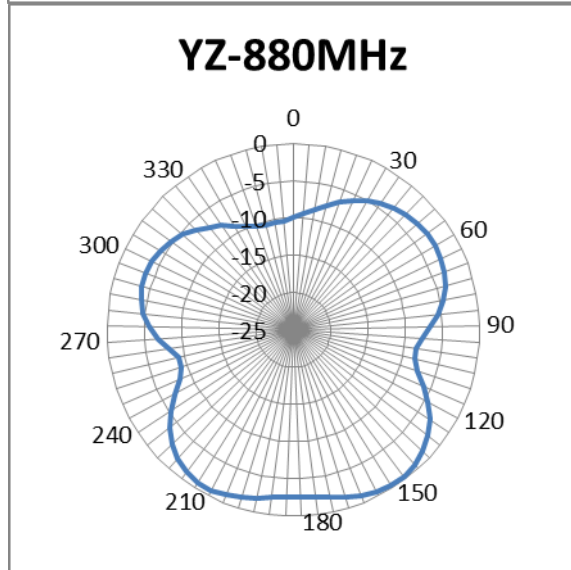
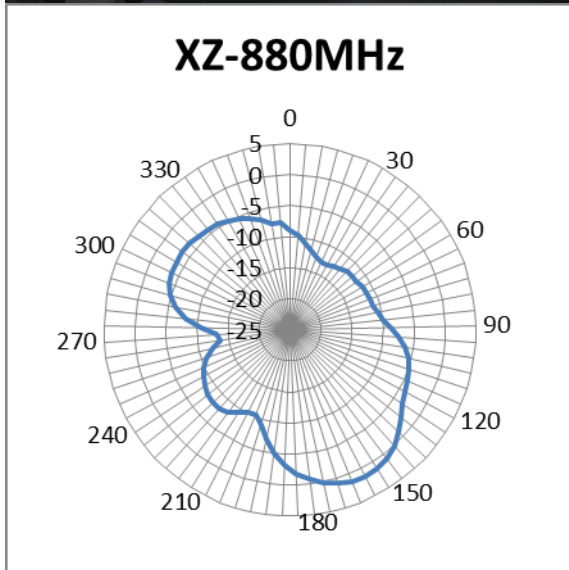
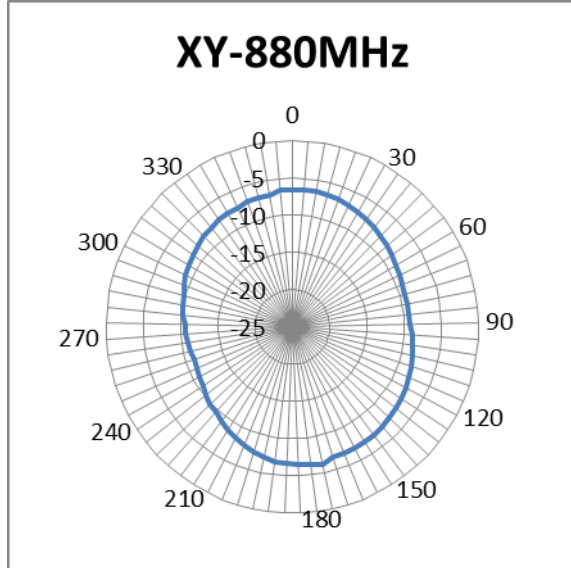
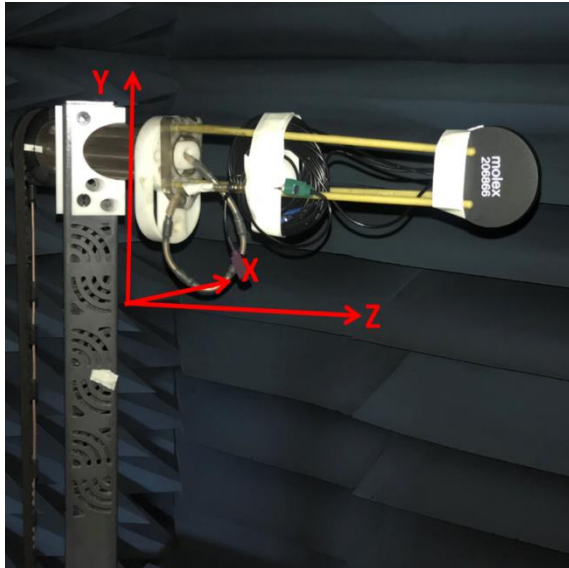
### 6.2.4 EFFICIENCY OF WIFI ANTENNA IN FREE SPACE

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>11 of 25</b>          |
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## 7.0 RADIATION PATTERN

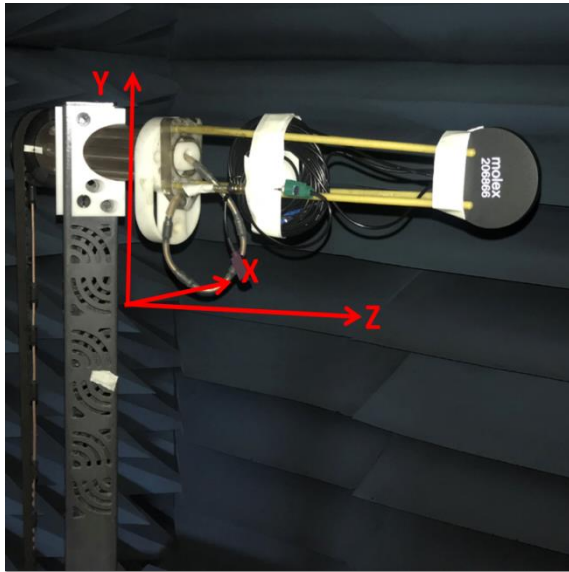
### 7.1 LTE ANTENNA 2D RADIATION PATTERN

All measurements in this document are done with cable length of 3000mm

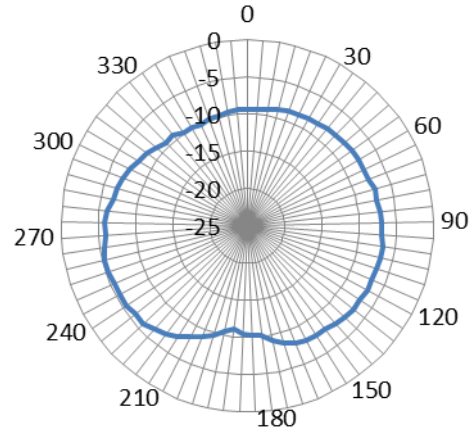


**FIGURE 7.1.1 2D RADIATION PATTERN OF ANTENNA AT 880MHZ IN FREE SPACE**

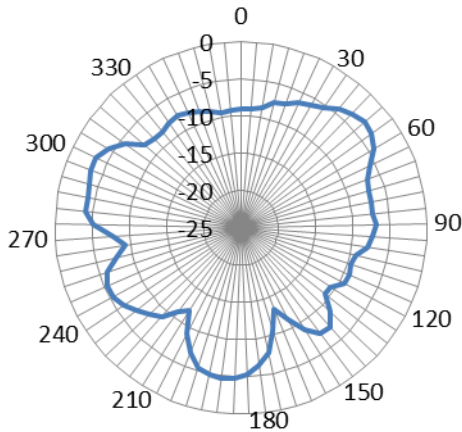
|  |   |   |                                       |
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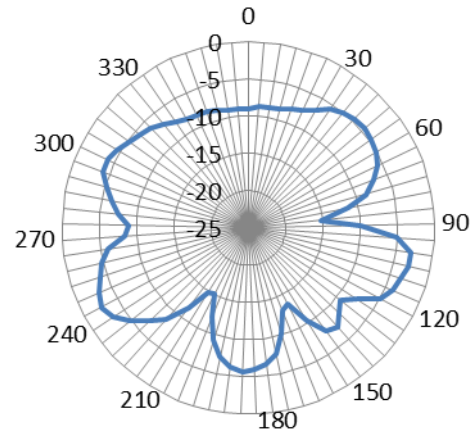
**XY-1880MHz**



**XZ-1880MHz**

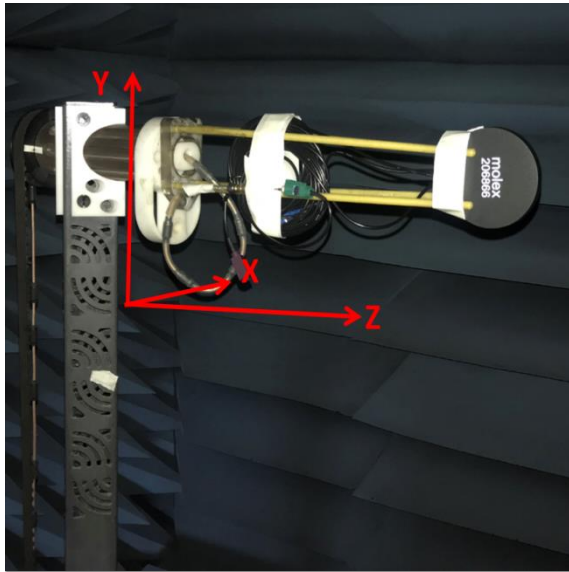


**YZ-1880MHz**

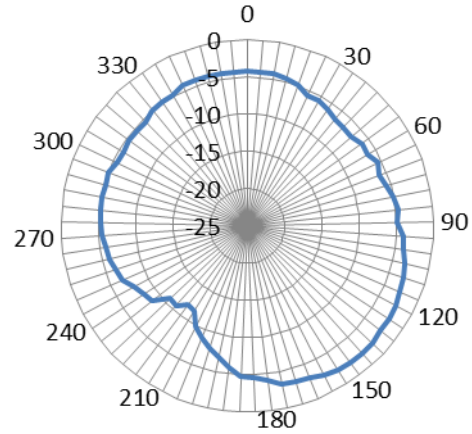


**FIGURE 7.1.2 2D RADIATION PATTERN OF ANTENNA AT 1880MHz IN FREE SPACE**

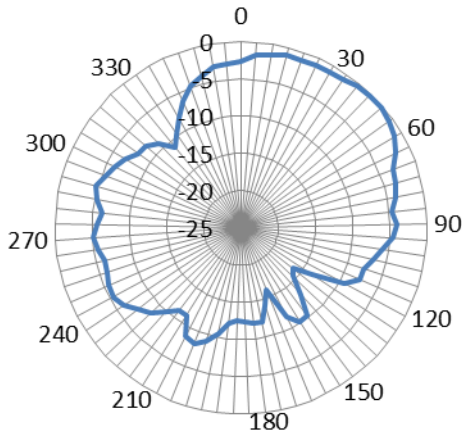
|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><br><b>13 of 25</b>      |
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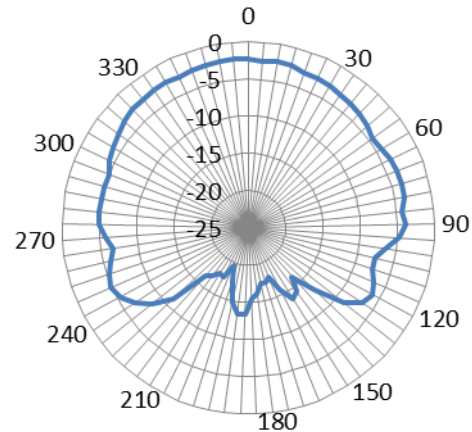
**XY-2170MHz**



**XZ-2170MHz**

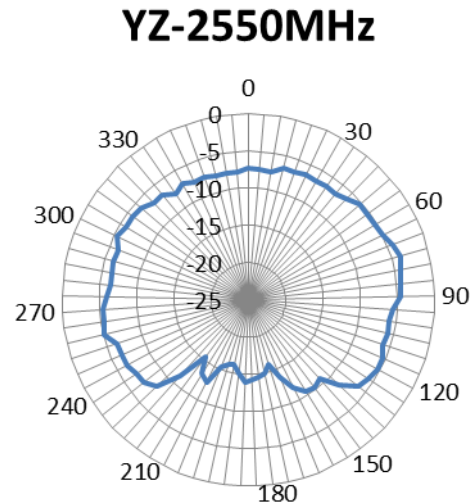
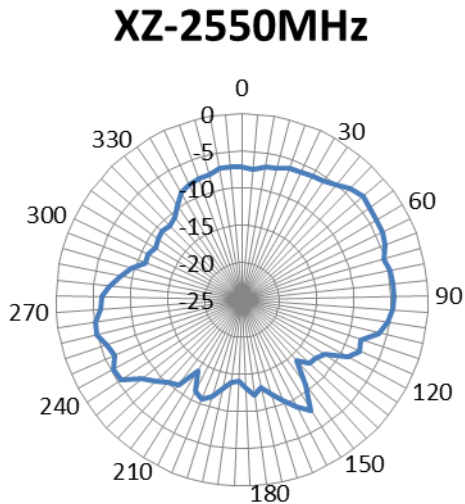
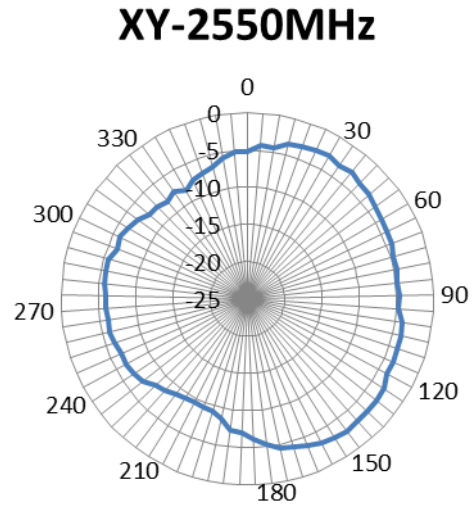
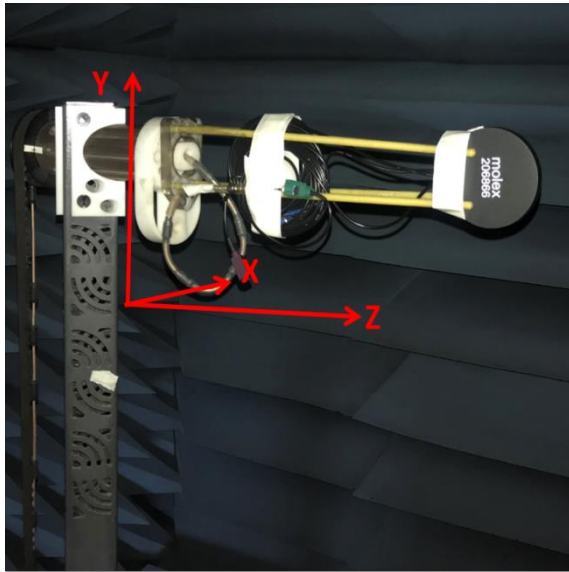


**YZ-2170MHz**



**FIGURE 7.1.3 2D RADIATION PATTERN OF ANTENNA AT 2170MHZ IN FREE SPACE**

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>14 of 25</b>          |
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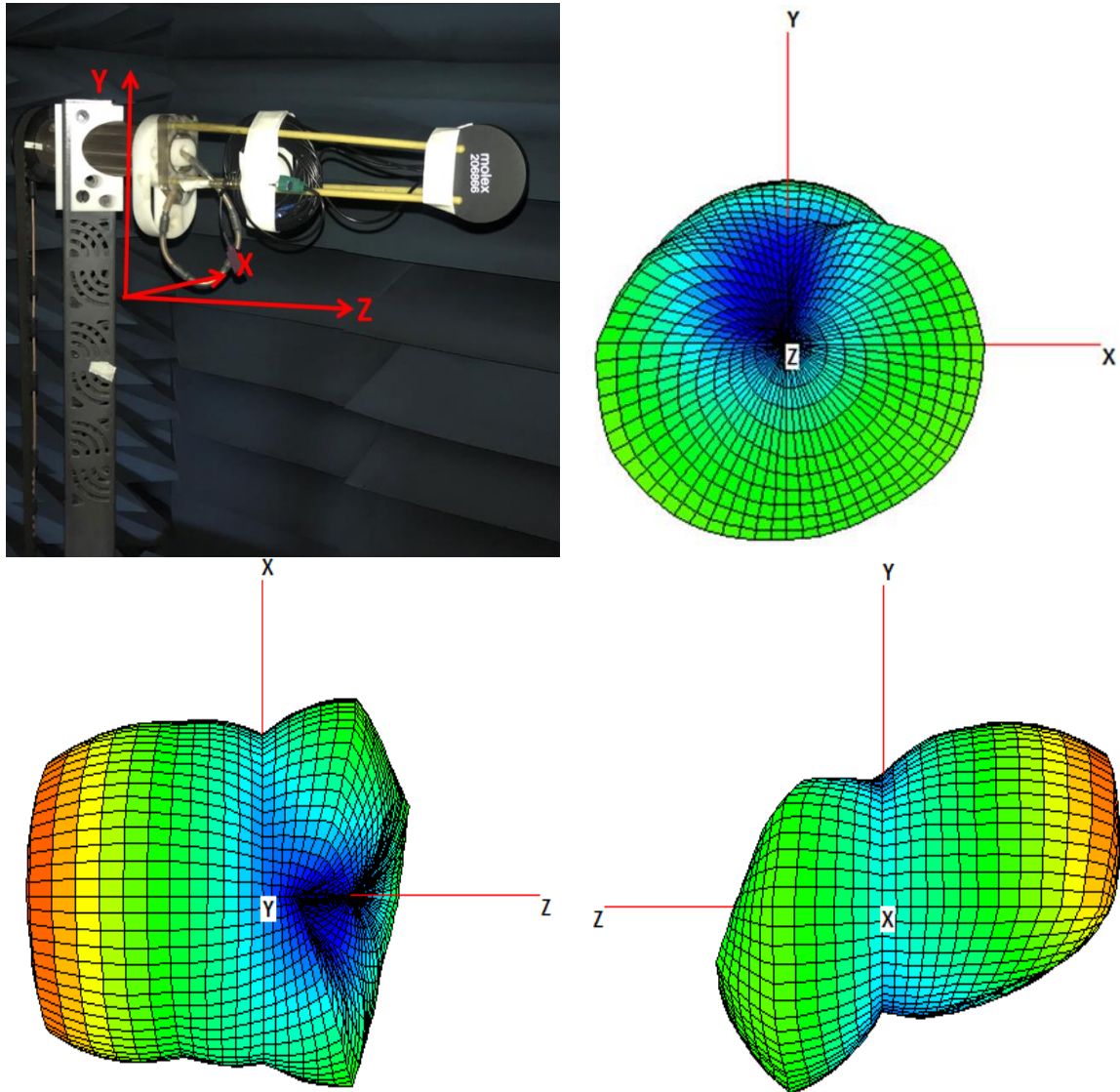


**FIGURE 7.1.4 2D RADIATION PATTERN OF ANTENNA AT 2550MHZ IN FREE SPACE**

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>15 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

## 7.2 3D RADIATION PATTERN

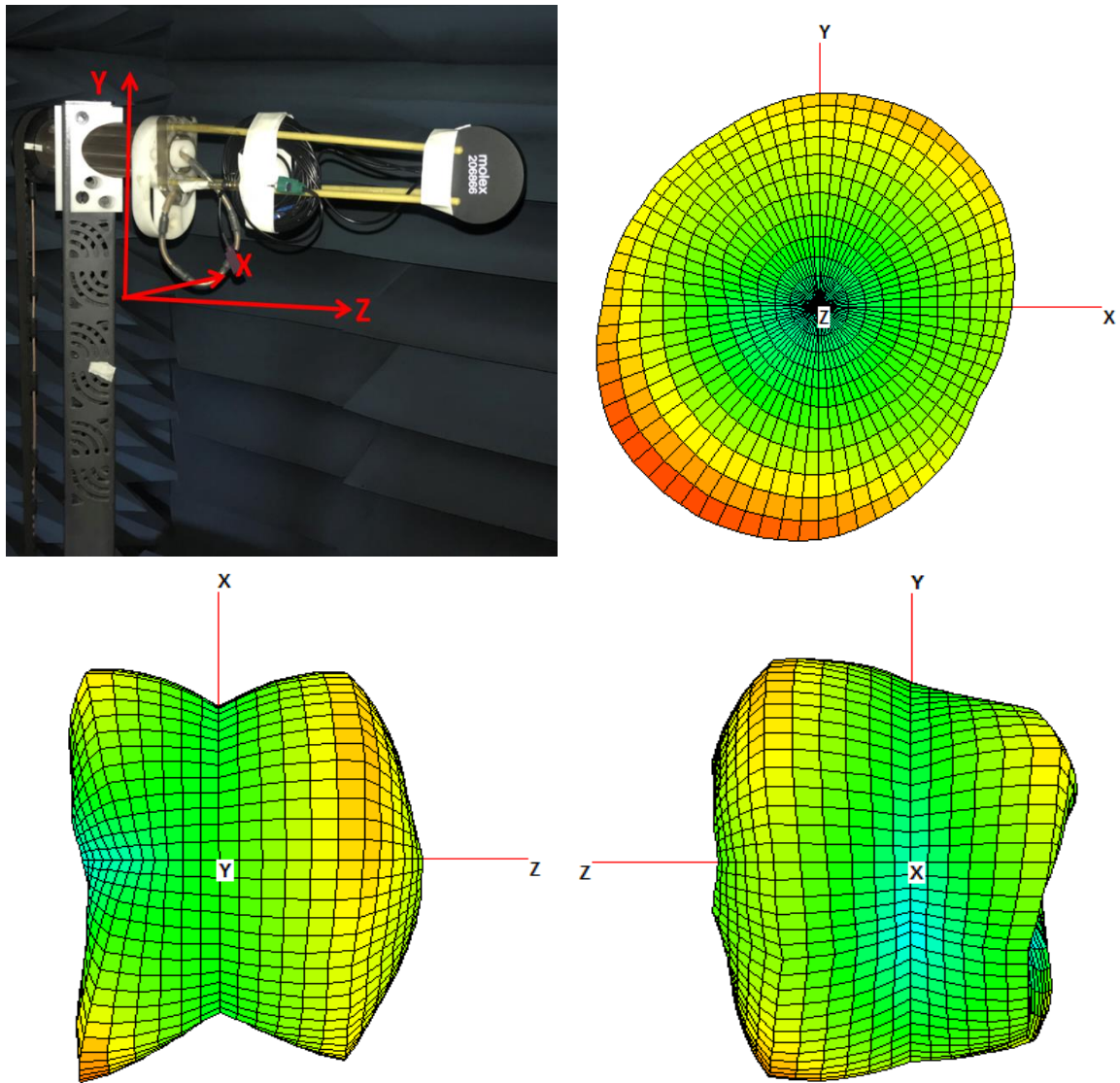
All measurements in this document are done with cable length of 3000mm



**FIGURE 7.2.1 3D RADIATION PATTERN OF ANTENNA AT 880MHZ IN FREE SPACE**

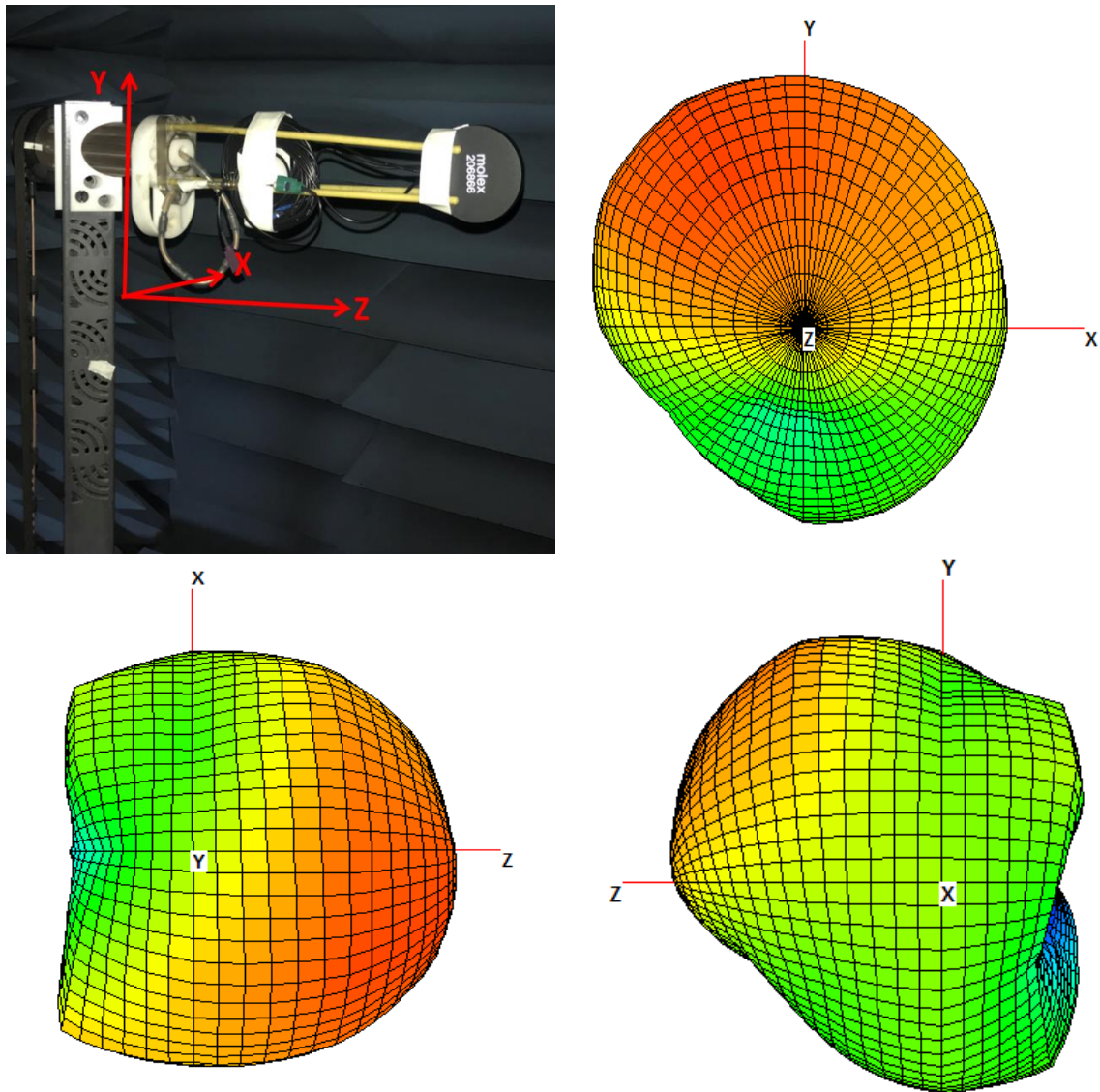
|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>16 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |





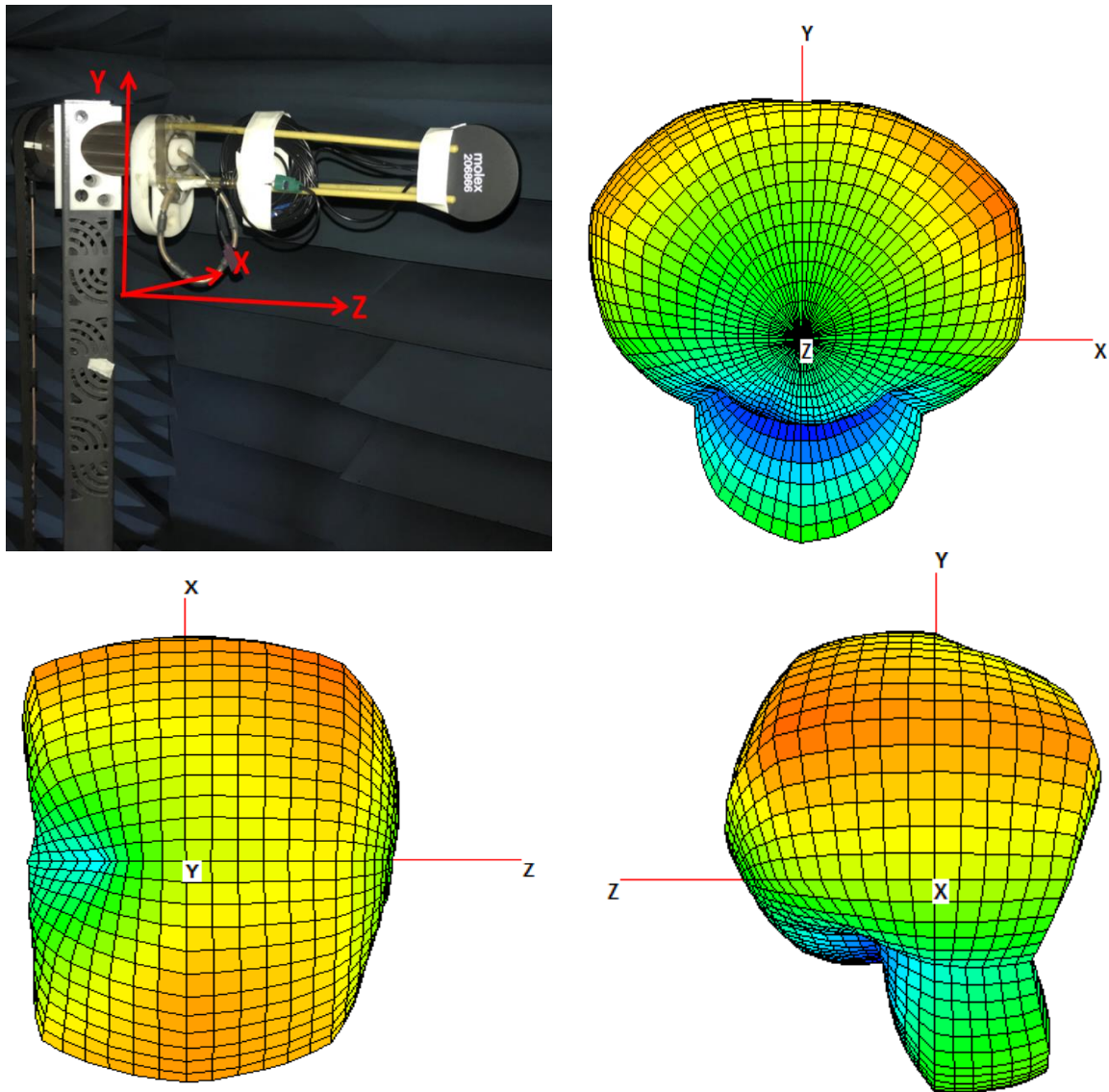
**FIGURE 7.2.2 3D RADIATION PATTERN OF ANTENNA AT 1880MHZ IN FREE SPACE**

|  |   |   |                                      |                                       |
|--|---|---|--------------------------------------|---------------------------------------|
| REVISION:<br><br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> |                                      | SHEET No.<br><br><b>17 of 25</b>      |
| DOCUMENT NUMBER:<br><br><b>AS-2068663000</b> |   | CREATED / REVISED BY:<br>Liu Hai 2019/11/19   | CHECKED BY:<br>Cheng Kang 2019/11/19 | APPROVED BY:<br>Andy Zhang 2019/11/19 |



**FIGURE 7.2.3 3D RADIATION PATTERN OF ANTENNA AT 2170MHZ IN FREE SPACE**

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><br><b>18 of 25</b>      |
| DOCUMENT NUMBER:<br><br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

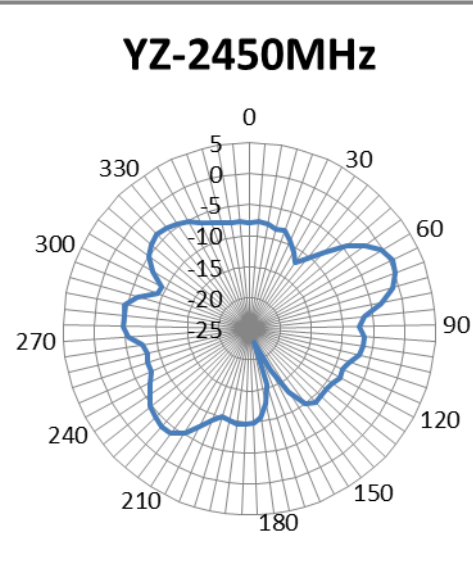
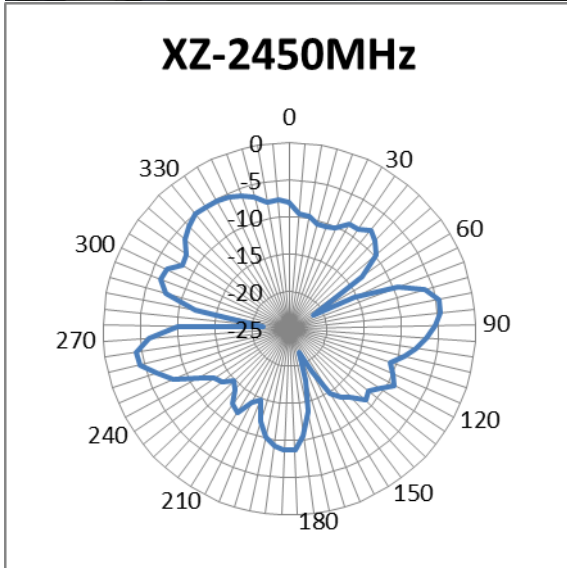
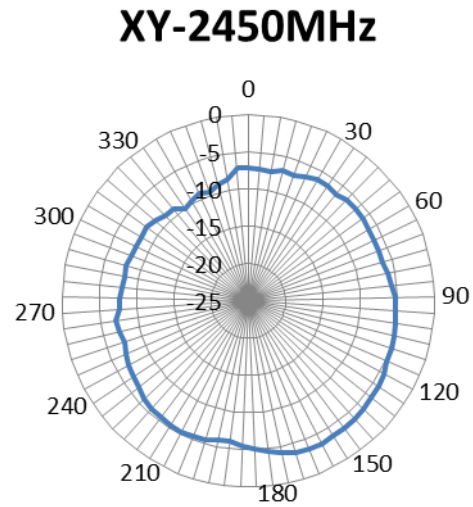
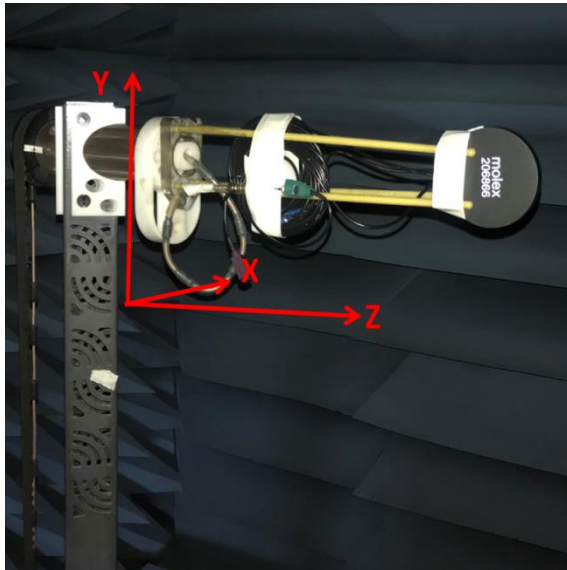


**FIGURE 7.2.4 3D RADIATION PATTERN OF ANTENNA AT 2550MHZ IN FREE SPACE**

|  |   |   |   |
|--|---|---|---|
| REVISION:<br><br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><br><b>19 of 25</b>          |
| DOCUMENT NUMBER:<br><br><b>AS-2068663000</b> | CREATED / REVISED BY:<br><br>Liu Hai 2019/11/19           | CHECKED BY:<br><br>Cheng Kang 2019/11/19  | APPROVED BY:<br><br>Andy Zhang 2019/11/19 |

## 7.3 WIFI ANTENNA 2D RADIATION PATTERN

All measurements in this document are done with cable length of 3000mm



**FIGURE 7.3 2D RADIATION PATTERN OF ANTENNA AT 2450MHZ IN FREE SPACE**

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>20 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

## 7.4 WIFI ANTENNA 3D RADIATION PATTERN

All measurements in this document are done with cable length of 3000mm

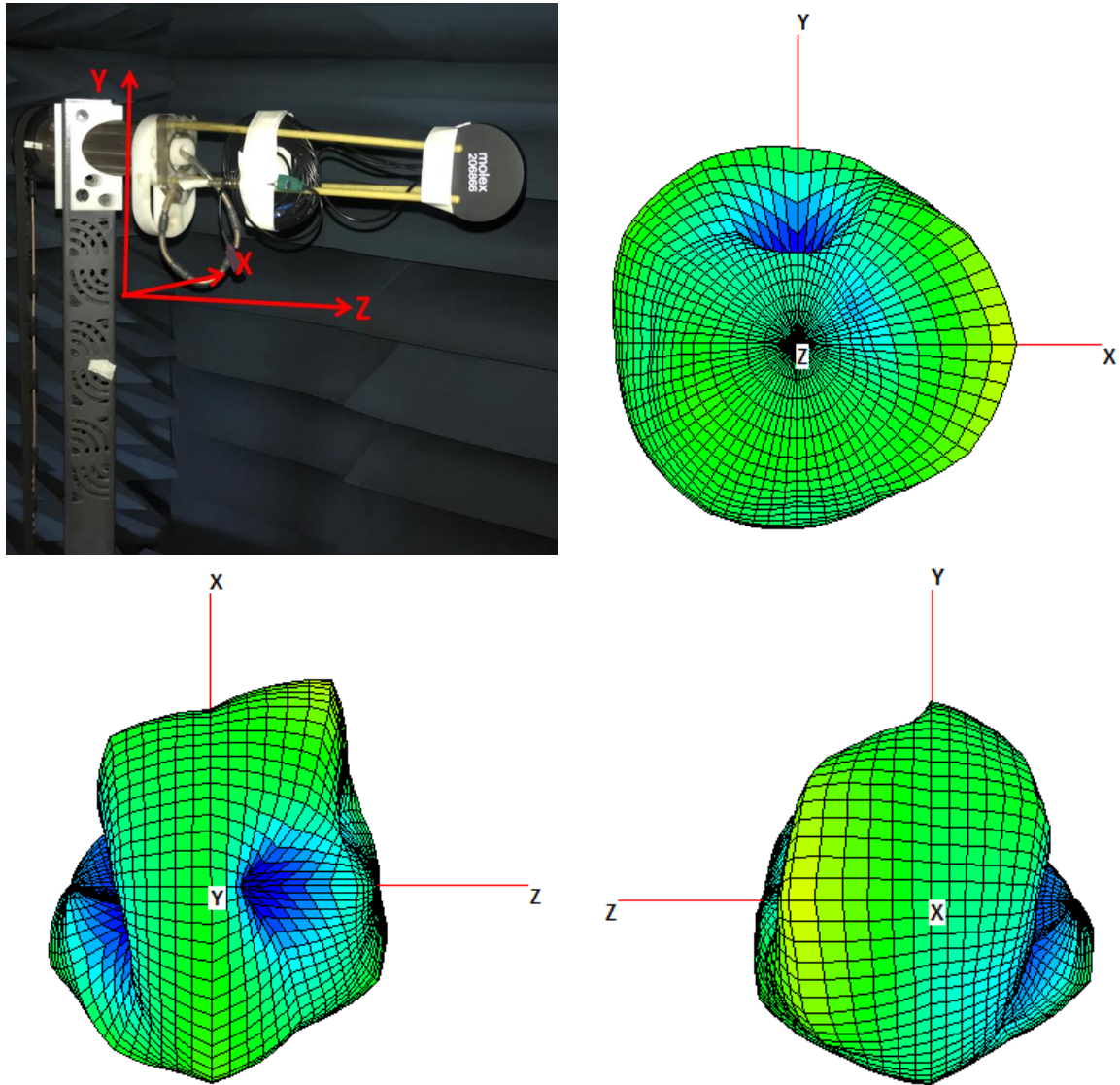
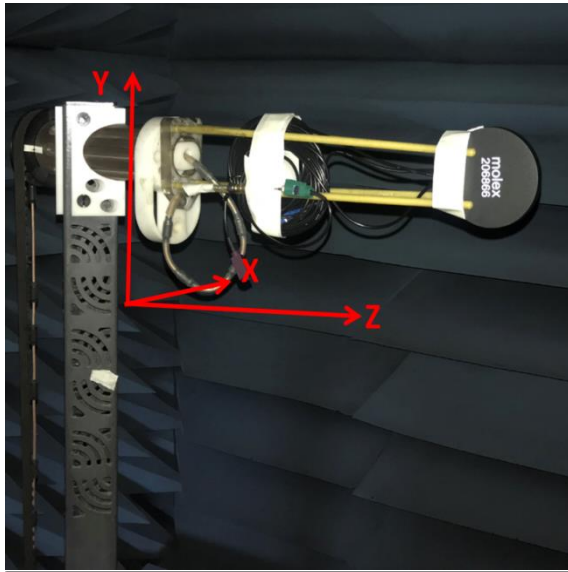


FIGURE 7.4 3D RADIATION PATTERN OF ANTENNA AT 2450MHZ IN FREE SPACE

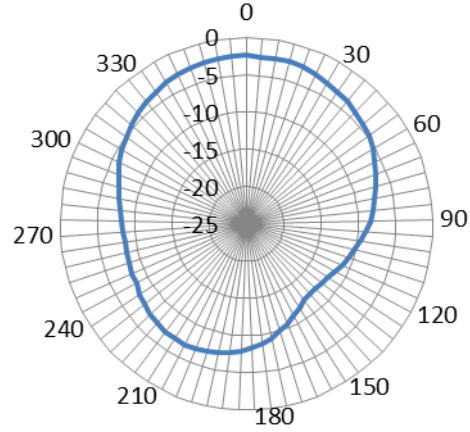
|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>21 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

## 7.5 GPS ANTENNA 2D RADIATION PATTERN

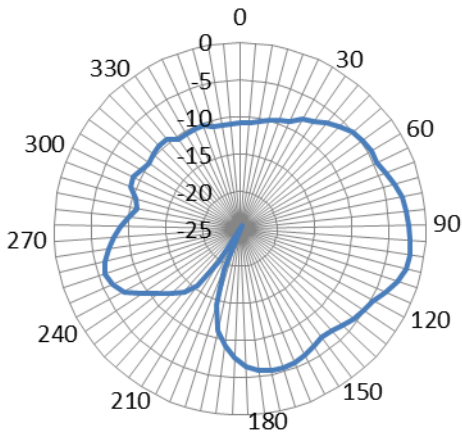
All measurements in this document are done with cable length of 3000mm



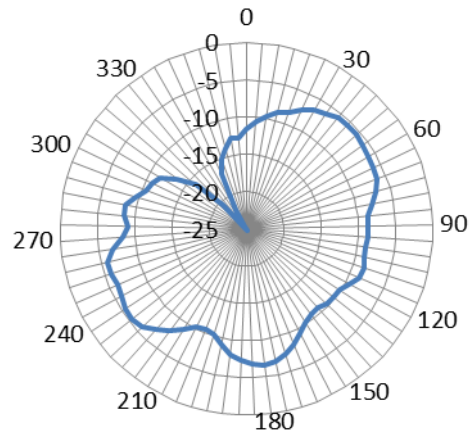
**XY-1575MHz**



**XZ-1575MHz**



**YZ-1575MHz**



**FIGURE 7.5 2D RADIATION PATTERN OF ANTENNA AT 1575MHZ IN FREE SPACE**

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>22 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

## 7.6 GPS ANTENNA 3D RADIATION PATTERN

All measurements in this document are done with cable length of 3000mm

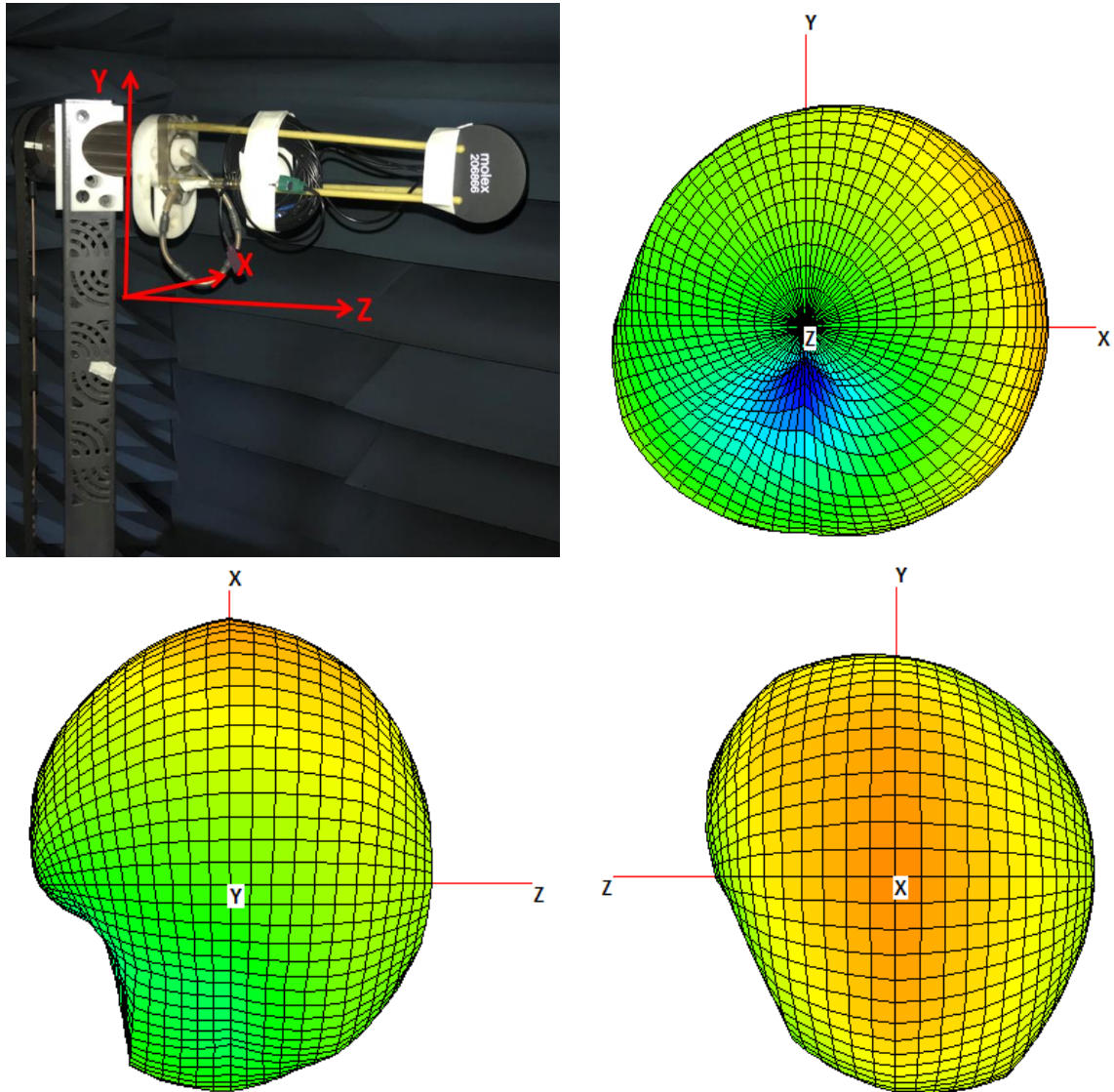
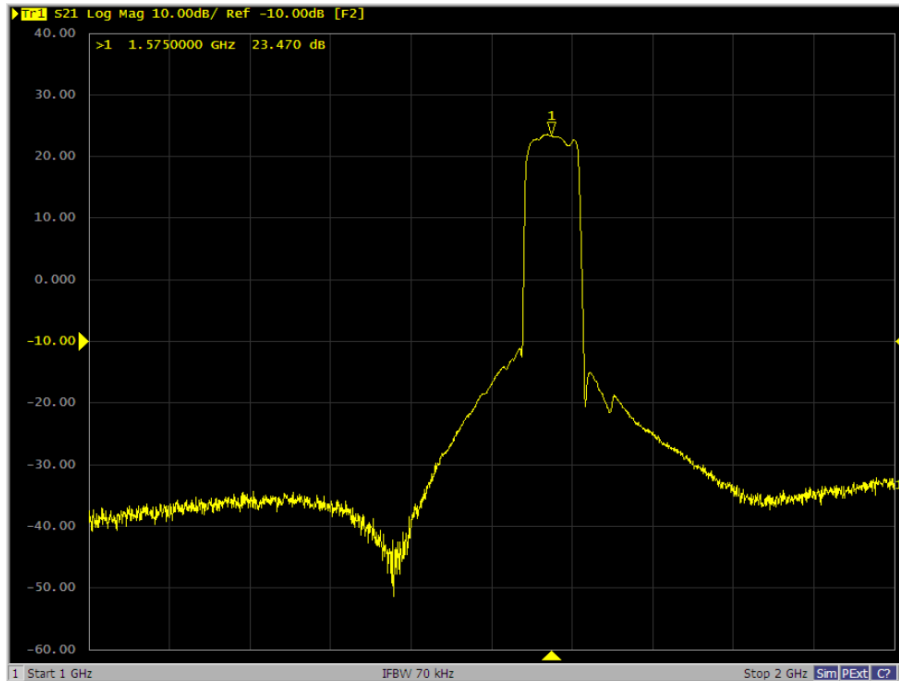


FIGURE 7.6 3D RADIATION PATTERN OF ANTENNA AT 1575MHZ IN FREE SPACE

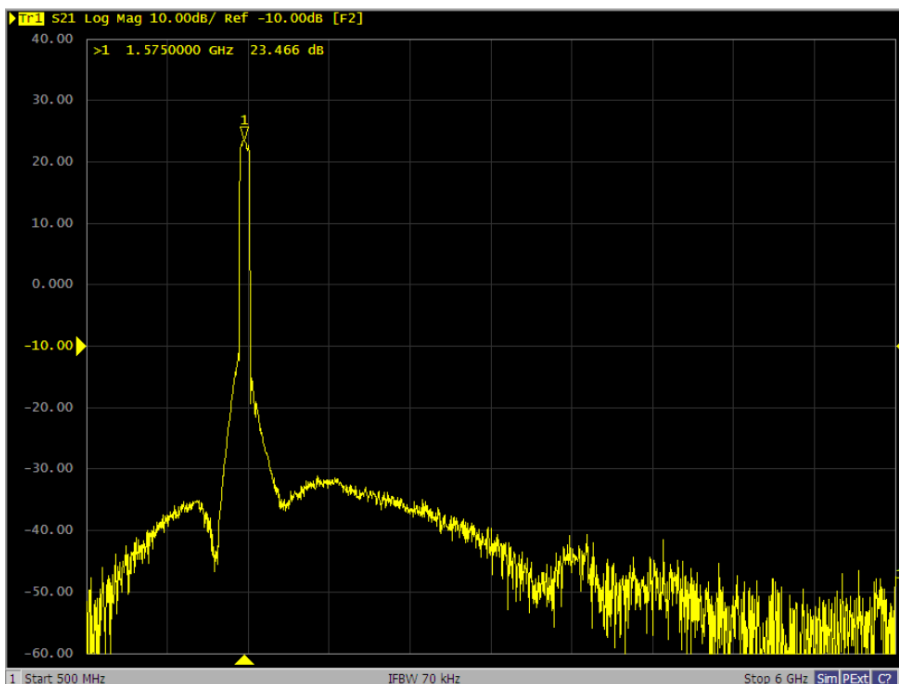
|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>23 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |

## 8.0 LNA GAIN

All measurements in this document are done with cable length of 3000mm



## 8.1 LNA GAIN OF GPS ANTENNA IN FREE SPACE



## 8.2 OUT-BAND REJECTION IN FREE SPACE

|  |   |   |                                       |
|--|---|---|---------------------------------------|
| REVISION:<br><b>B</b>                    | ECR/ECN INFORMATION:<br>EC No: 627634<br>DATE: 2019/11/25 | TITLE:<br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | SHEET No.<br><b>24 of 25</b>          |
| DOCUMENT NUMBER:<br><b>AS-2068663000</b> | CREATED / REVISED BY:<br>Liu Hai 2019/11/19               | CHECKED BY:<br>Cheng Kang 2019/11/19  | APPROVED BY:<br>Andy Zhang 2019/11/19 |





# APPLICATION SPECIFICATION

| CHANGE HISTORY |            |                |  |
|----------------|------------|----------------|--|
| REV            | DATE       | DESCRIPTION    | PAGES CHANGED  |
| A              | 2018/06/05 | First Release  | NA   |
| B              | 2019/11/26 | Update Release | Add to S11 data, the 2D and 3D radiation pattern of GPS antenna, the LNA gain and outband rejection. |

|   |  |  |  |
|---|--|--|--|
| <u>REVISION:</u><br><b>B</b>                    | <u>ECR/ECN INFORMATION:</u><br>EC No: 627634<br>DATE: 2019/11/25 | <u>TITLE:</u><br><b>3IN1(4G/GPS/WIFI) External Antenna<br/>Application Specification</b> | <u>SHEET No.</u><br><b>25 of 25</b>          |
| <u>DOCUMENT NUMBER:</u><br><b>AS-2068663000</b> | <u>CREATED / REVISED BY:</u><br>Liu Hai 2019/11/19               | <u>CHECKED BY:</u><br>Cheng Kang 2019/11/19  | <u>APPROVED BY:</u><br>Andy Zhang 2019/11/19 |