

# ANTENNA PASSIVE TEST REPORT

|                                 |                        |
|---------------------------------|------------------------|
| Application No.                 | ZEWM2306000848OA       |
| Applicant                       | SKULLCANDY, INC.       |
| Manufacturer                    | SKULLCANDY, INC.       |
| Product Name                    | ECOBUDS                |
| Model No.                       | S2EOW                  |
| Standards                       | ANSI/IEEE Std 149-2008 |
| Date Initial Sample(s) Received | 2023.10.23             |
| Testing Start Date              | 2023.10.23             |
| Testing Finish Date             | 2023.10.23             |
| Report Issue Date               | 2023.11.15             |

\* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

*Turner He*

Prepared by

*Max. Huang*

Reviewed By

*Ervin Li*

Approved by



## Revision Version

| Report No.         | Version | Date       | Memo                       |
|--------------------|---------|------------|----------------------------|
| ZEWM2306000848OA01 | 00      | 2023.11.15 | Initial creation of report |



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## 1 General Information

### 1.1 Testing Laboratory

|          |   |
|----------|---|
| Test Lab | SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch   |
| Address  | No.1 Workshop, M-10, Middle section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China 518057 |
| Contact  | Ervin Li  |
| Tel.     | +86 18823369694   |
| Fax      | +86-755-25328600  |
| E-mail   | Ervin.Li@sgs.com  |

### 1.2 Details of Applicant

|                     |  |
|---------------------|--|
| Applicant's Name    | SKULLCANDY, INC.   |
| Applicant's Address | 6301 N Landmark Dr Park City UT 84098, Utah United States of America |
| Contact             | Andrew Carter  |
| Tel.                | (404) 561-0830   |
| Fax                 | N/A  |
| E-mail              | andrew.carter@skullcandy.com   |

### 1.3 Details of Manufacturer

|                        |  |
|------------------------|--|
| Manufacturer's Name    | SKULLCANDY, INC.   |
| Manufacturer's Address | 6301 N Landmark Dr Park City UT 84098, Utah United States of America |
| Contact                | Andrew Carter  |
| Tel.                   | (404) 561-0830   |
| Fax                    | N/A  |
| E-mail                 | andrew.carter@skullcandy.com   |



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Shenzhen Branch

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中国·广东·深圳市南山区科技园中区M-10栋1号厂房

t (86-755) 26012053 www.sgsgroup.com.cn  
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## 1.4 General Description of EUT

|                      |                  |
|----------------------|------------------|
| Device Description:  | ECOBUDS          |
| Device Manufacturer: | SKULLCANDY, INC. |
| Device Model:        | S2EOW            |
| Hardware Version:    | N/A              |
| Software Version:    | N/A              |

## 1.5 Test Procedure

Testing is performed according to the **ANSI/IEEE Std 149-2008**.



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## 1.6 Test Specification

| Identity               | Document Title                             |
|------------------------|--|
| ANSI/IEEE Std 149-2008 | IEEE Standard Test Procedures for Antennas |

## 1.7 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                    |         |



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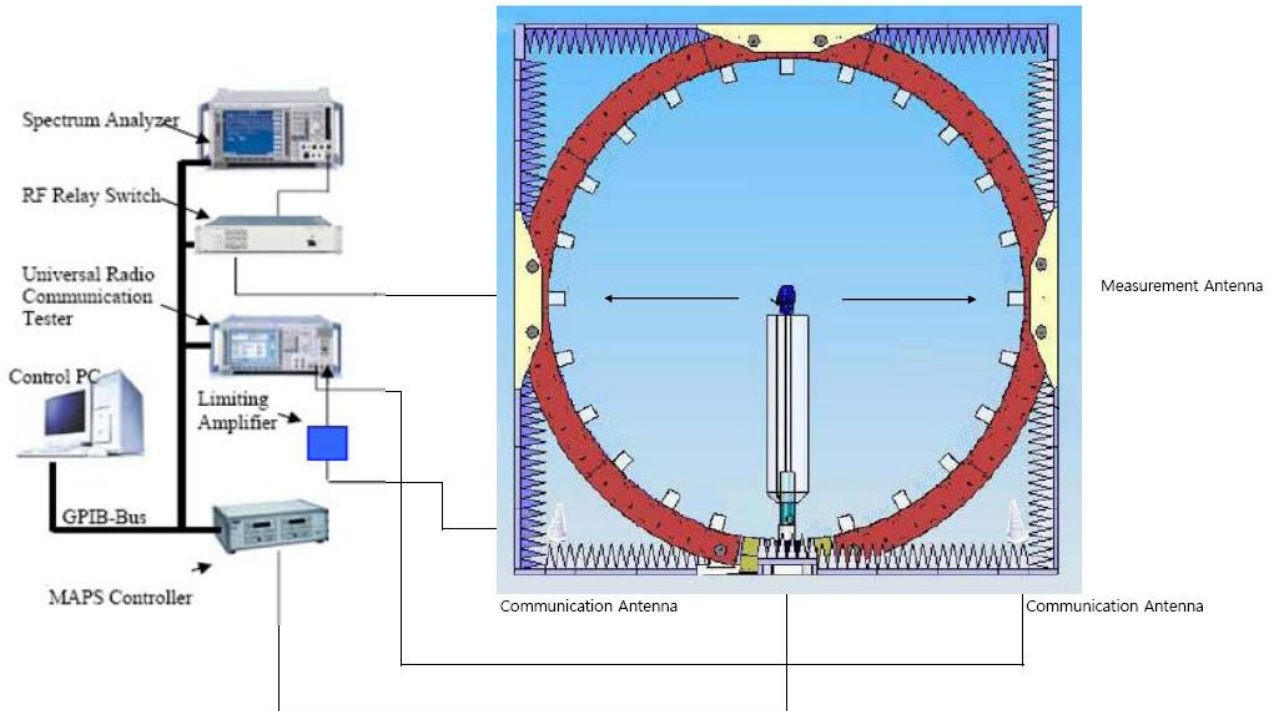
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## 2 OTA Measurements System Configuration

### 2.1 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



F-1. OTA Measurement System Configuration



### 3 Test Equipment List

| Type of Equipment                         | Model Number               | Manufacture       | Calibration Date | Valid Period |
|---|----------------------------|-------------------|------------------|--------------|
| Network Analyzer                          | E5071C<br>S/N MY46523591   | Keysight          | 2023/2/16        | 2024/2/15    |
| Quad-Ridge Horn Antenna<br>700 MHz-10 GHz | EMCO 3164-08<br>S/N 161915 | ETS-Lindgren L.P. | N/A              | N/A          |
| MAPS Controller                           | EMCENTER<br>S/N 160485     | ETS-Lindgren L.P. | N/A              | N/A          |
| SAM V4.5BS Head Phantom                   | Head Phantom<br>S/N 3609   | SPEAG             | NCR              | NCR          |



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## 4 Measurement Uncertainty

| Item  | 2400-2500 MHz (dB) |
|---|--------------------|
| Gain  | 0.88               |
| Efficiency  | 0.88               |
| Measurement Uncertainty (95% CONFIDENCE INTERVAL) K=2 |                    |



## 5 Test Results

| Free Space Left #3 |                 |                |            |
|--------------------|-----------------|----------------|------------|
| Frequency (MHz)    | Efficiency (dB) | Efficiency (%) | Gain (dBi) |
| 2350               | -6.41           | 22.84          | -3.18      |
| 2355               | -6.40           | 22.93          | -3.19      |
| 2360               | -6.05           | 24.84          | -2.76      |
| 2365               | -6.02           | 24.99          | -2.68      |
| 2370               | -5.87           | 25.90          | -2.51      |
| 2375               | -5.83           | 26.09          | -2.30      |
| 2380               | -5.55           | 27.87          | -2.08      |
| 2385               | -5.23           | 29.97          | -1.57      |
| 2390               | -5.01           | 31.58          | -1.40      |
| 2395               | -4.69           | 33.97          | -0.88      |
| 2400               | -4.78           | 33.26          | -0.91      |
| 2402               | -4.76           | 33.41          | -0.86      |
| 2405               | -4.70           | 33.86          | -0.70      |
| 2410               | -4.63           | 34.46          | -0.63      |
| 2415               | -4.47           | 35.71          | -0.38      |
| 2420               | -4.23           | 37.78          | -0.07      |
| 2425               | -4.24           | 37.66          | -0.01      |
| 2430               | -4.19           | 38.08          | 0.17       |
| 2435               | -4.29           | 37.25          | 0.10       |
| 2440               | -4.20           | 37.98          | 0.31       |
| 2441               | -4.14           | 38.51          | 0.37       |
| 2445               | -4.06           | 39.27          | 0.48       |
| 2450               | -3.95           | 40.27          | 0.72       |
| 2455               | -3.77           | 41.93          | 0.96       |
| 2460               | -3.92           | 40.52          | 0.93       |

| Free Space Right #3 |                 |                |            |
|---------------------|-----------------|----------------|------------|
| Frequency (MHz)     | Efficiency (dB) | Efficiency (%) | Gain (dBi) |
| 2350                | -6.37           | 23.04          | -2.80      |
| 2355                | -6.25           | 23.71          | -2.77      |
| 2360                | -5.91           | 25.65          | -2.42      |
| 2365                | -5.91           | 25.63          | -2.38      |
| 2370                | -5.62           | 27.42          | -2.11      |
| 2375                | -5.67           | 27.10          | -2.02      |
| 2380                | -5.21           | 30.13          | -1.63      |
| 2385                | -4.95           | 31.95          | -1.24      |
| 2390                | -4.64           | 34.38          | -1.06      |
| 2395                | -4.35           | 36.69          | -0.67      |
| 2400                | -4.52           | 35.34          | -0.84      |
| 2402                | -4.41           | 36.22          | -0.73      |
| 2405                | -4.36           | 36.66          | -0.56      |
| 2410                | -4.41           | 36.19          | -0.70      |
| 2415                | -4.17           | 38.27          | -0.37      |
| 2420                | -3.96           | 40.20          | -0.11      |
| 2425                | -3.99           | 39.91          | -0.02      |
| 2430                | -3.90           | 40.73          | 0.25       |
| 2435                | -4.11           | 38.79          | 0.03       |
| 2440                | -3.95           | 40.31          | 0.34       |
| 2441                | -3.87           | 41.05          | 0.39       |
| 2445                | -3.87           | 41.05          | 0.34       |
| 2450                | -3.73           | 42.37          | 0.57       |
| 2455                | -3.53           | 44.36          | 0.79       |
| 2460                | -3.69           | 42.71          | 0.76       |



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|      |       |       |       |
|------|-------|-------|-------|
| 2465 | -3.96 | 40.21 | 0.94  |
| 2470 | -4.21 | 37.92 | 0.79  |
| 2475 | -4.24 | 37.69 | 0.79  |
| 2480 | -4.31 | 37.11 | 0.83  |
| 2482 | -4.33 | 36.88 | 0.78  |
| 2485 | -4.31 | 37.10 | 0.88  |
| 2490 | -4.30 | 37.11 | 0.98  |
| 2495 | -4.21 | 37.96 | 1.11  |
| 2500 | -4.21 | 37.94 | 1.25  |
| 2505 | -4.15 | 38.46 | 1.35  |
| 2510 | -4.18 | 38.19 | 1.40  |
| 2515 | -4.41 | 36.26 | 1.21  |
| 2520 | -4.65 | 34.26 | 0.97  |
| 2525 | -4.98 | 31.75 | 0.67  |
| 2530 | -5.16 | 30.47 | 0.51  |
| 2535 | -5.34 | 29.21 | 0.39  |
| 2540 | -5.42 | 28.73 | 0.36  |
| 2545 | -5.41 | 28.80 | 0.46  |
| 2550 | -5.51 | 28.12 | 0.39  |
| 2555 | -5.66 | 27.15 | 0.31  |
| 2560 | -5.93 | 25.52 | 0.11  |
| 2565 | -6.13 | 24.37 | -0.04 |
| 2570 | -6.34 | 23.22 | -0.17 |
| 2575 | -6.42 | 22.79 | -0.24 |
| 2580 | -6.57 | 22.04 | -0.34 |

|      |       |       |       |
|------|-------|-------|-------|
| 2465 | -3.66 | 43.05 | 0.78  |
| 2470 | -3.98 | 39.97 | 0.64  |
| 2475 | -3.98 | 40.02 | 0.67  |
| 2480 | -4.07 | 39.15 | 0.71  |
| 2482 | -4.12 | 38.73 | 0.66  |
| 2485 | -4.07 | 39.20 | 0.78  |
| 2490 | -4.13 | 38.61 | 0.86  |
| 2495 | -4.07 | 39.20 | 0.99  |
| 2500 | -4.12 | 38.73 | 1.13  |
| 2505 | -4.06 | 39.29 | 1.23  |
| 2510 | -4.07 | 39.19 | 1.31  |
| 2515 | -4.27 | 37.43 | 1.13  |
| 2520 | -4.46 | 35.78 | 0.90  |
| 2525 | -4.82 | 32.95 | 0.62  |
| 2530 | -5.00 | 31.62 | 0.45  |
| 2535 | -5.23 | 29.99 | 0.32  |
| 2540 | -5.30 | 29.49 | 0.27  |
| 2545 | -5.35 | 29.21 | 0.35  |
| 2550 | -5.46 | 28.47 | 0.27  |
| 2555 | -5.66 | 27.18 | 0.17  |
| 2560 | -5.93 | 25.55 | -0.03 |
| 2565 | -6.14 | 24.35 | -0.19 |
| 2570 | -6.33 | 23.26 | -0.31 |
| 2575 | -6.35 | 23.16 | -0.40 |
| 2580 | -6.52 | 22.29 | -0.46 |



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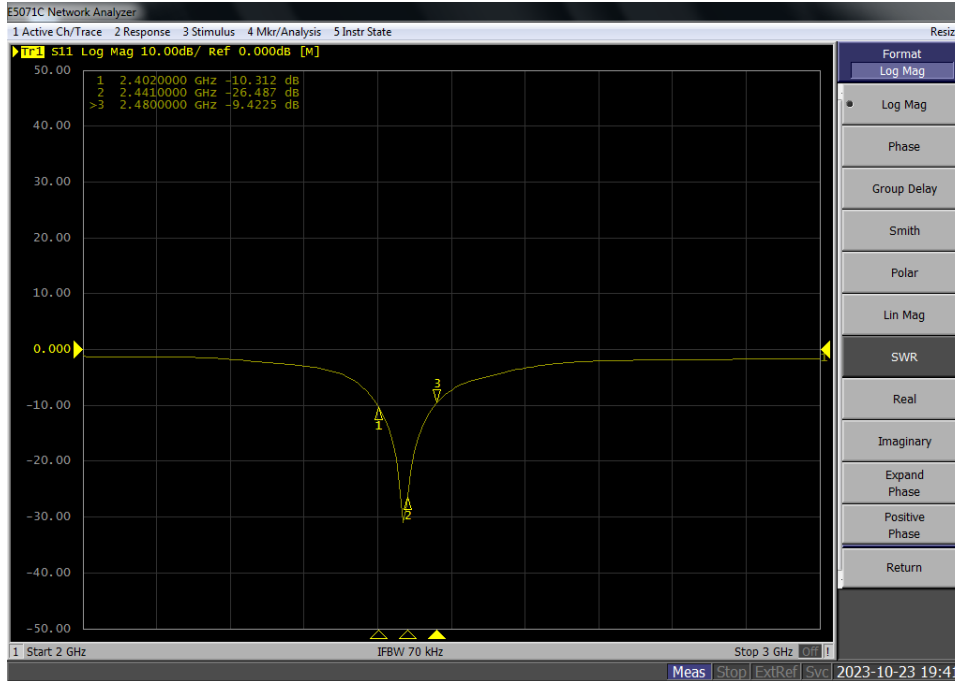
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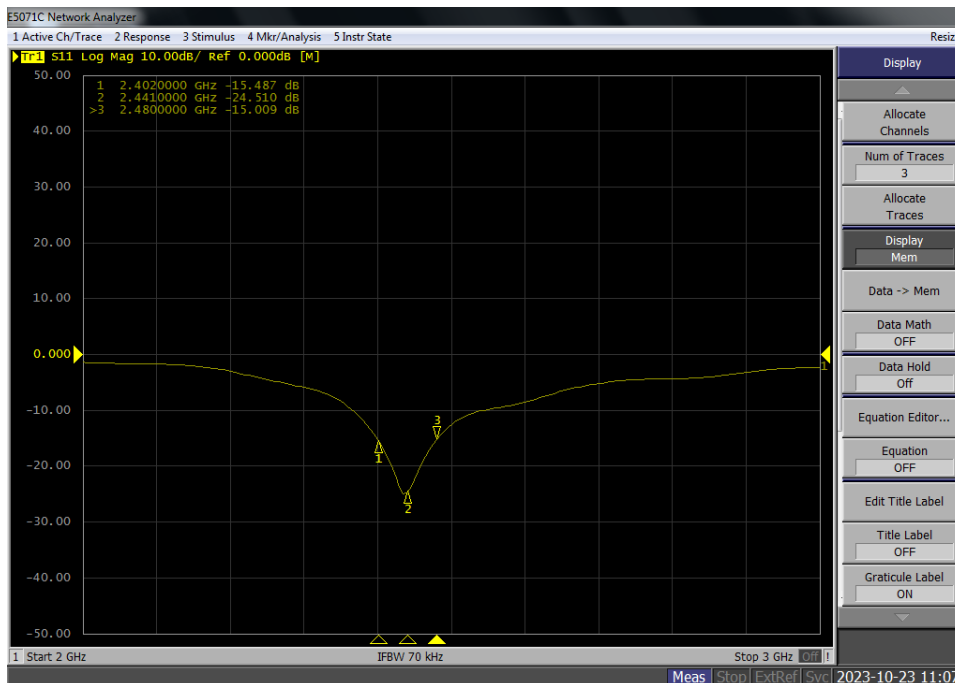
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## 6 Pattern Plots

### 6.1 Return Loss



Free Space Left #3



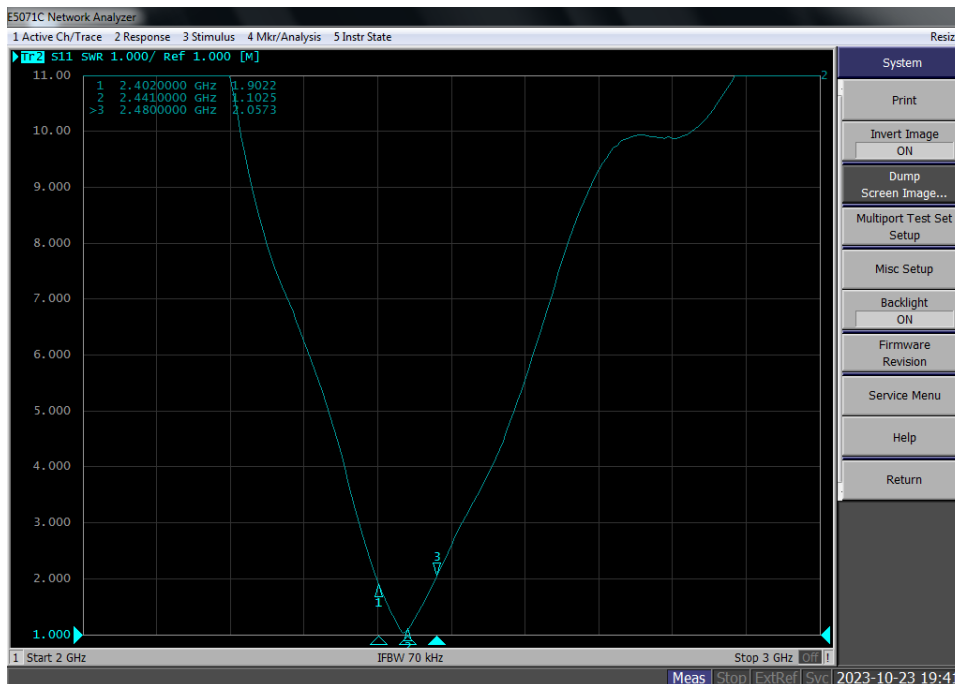
Free Space Right #3



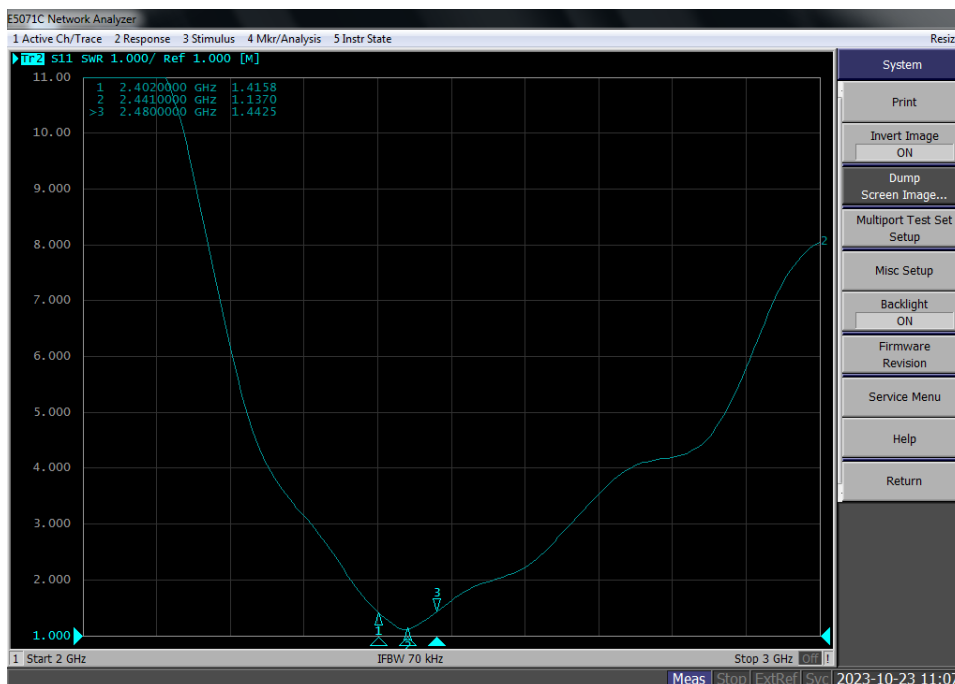
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## 6.2 VSWR



Free Space Left #3



Free Space Right #3



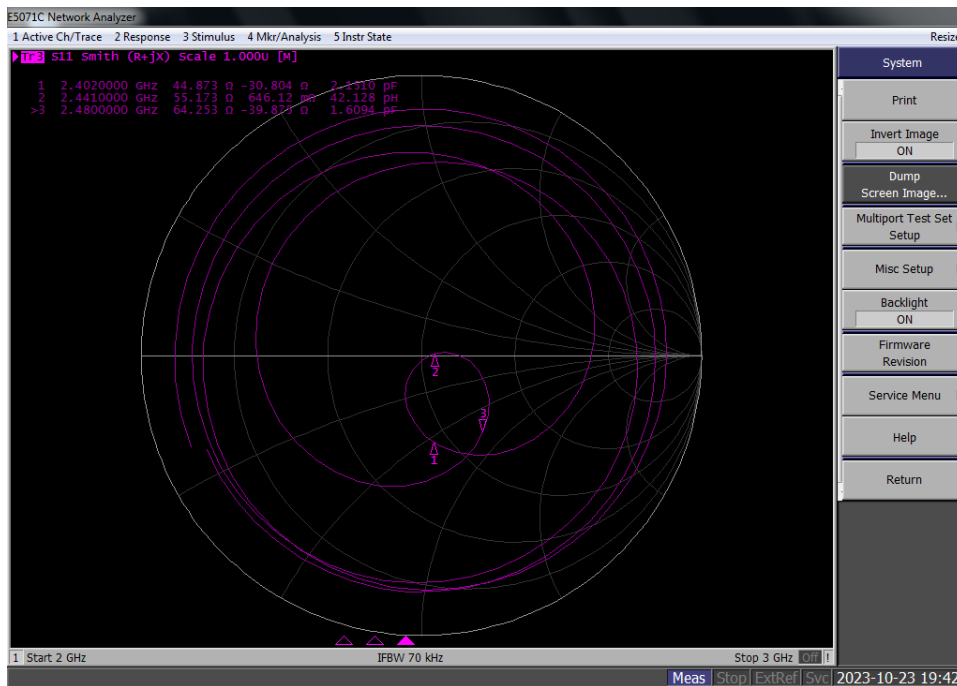
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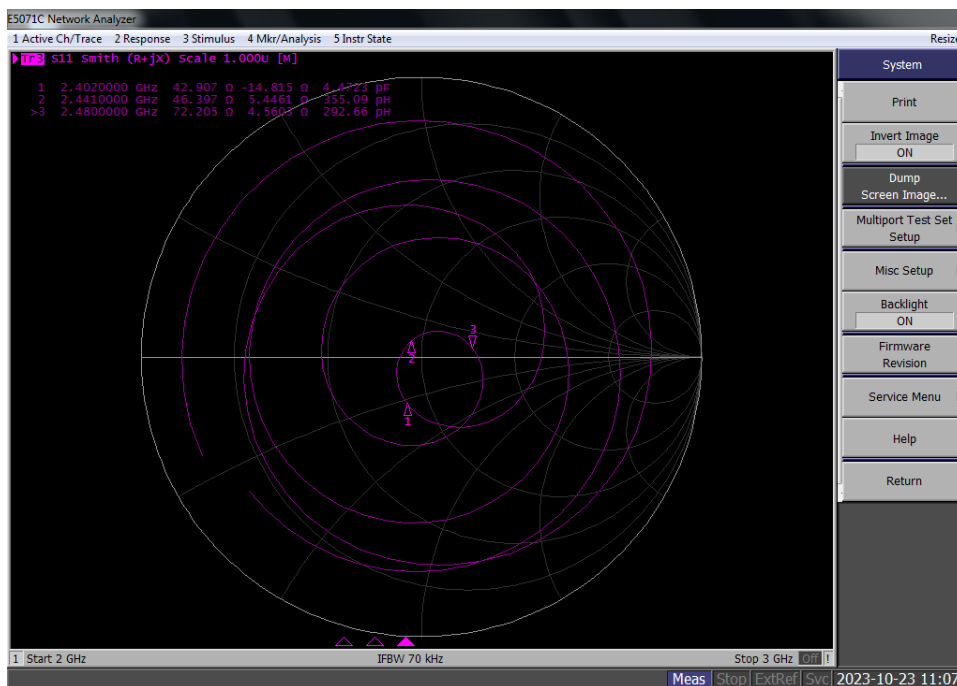
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### 6.3 Stimulus



Free Space Left #3



Free Space Right #3



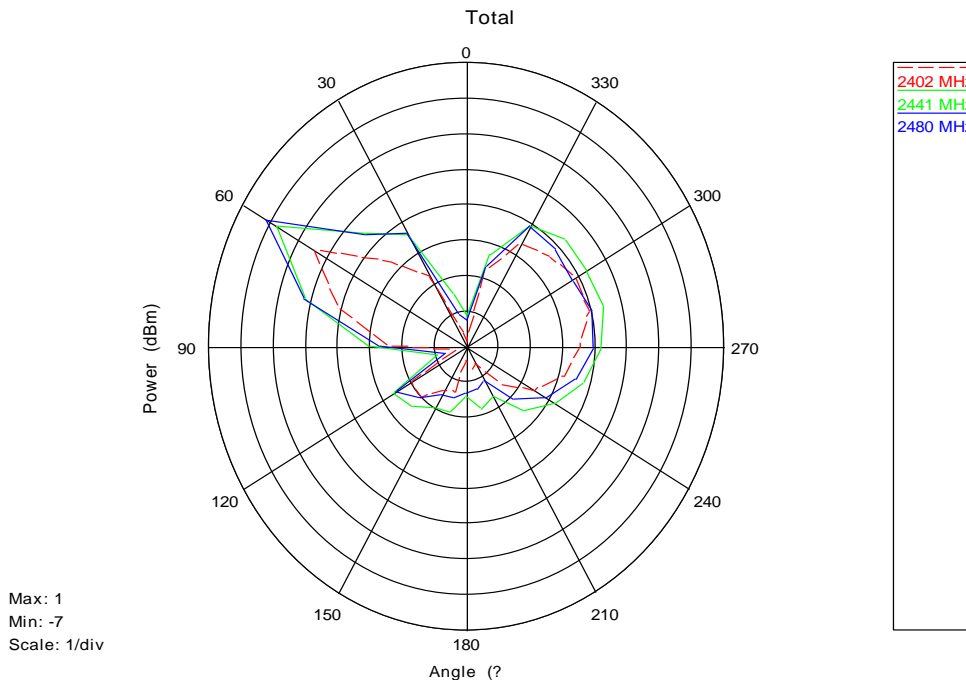
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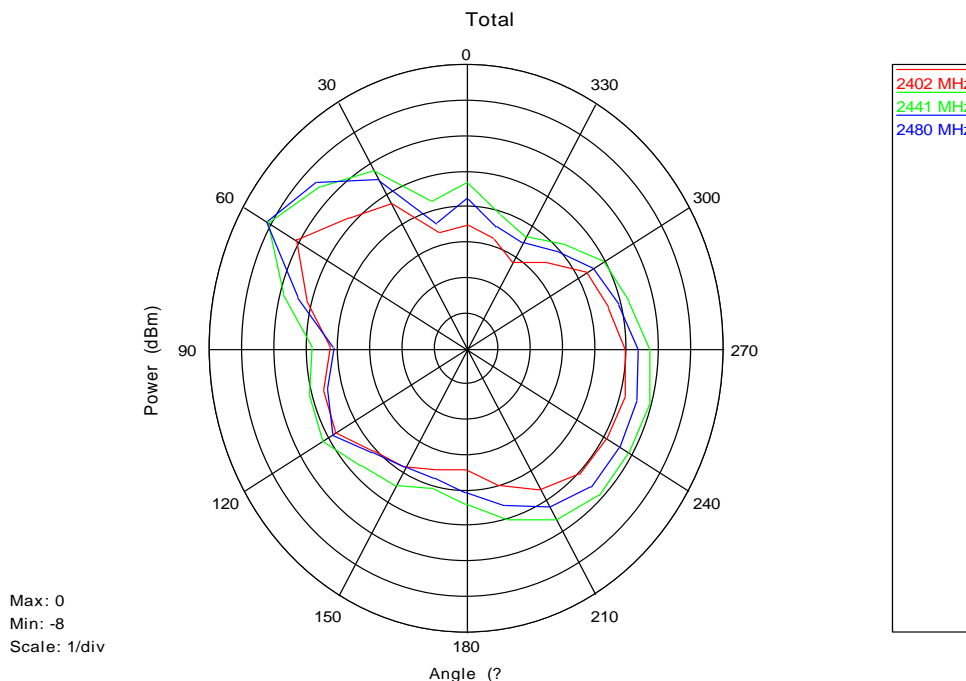
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中国·广东·深圳市南山区科技园中区M-10栋1号厂房 邮编: 518057 t (86-755) 26012053 sgs.china@sgs.com



## 7 2-D Antenna Pattern(Theta=90°)



Free Space Left #3



Free Space Right #3

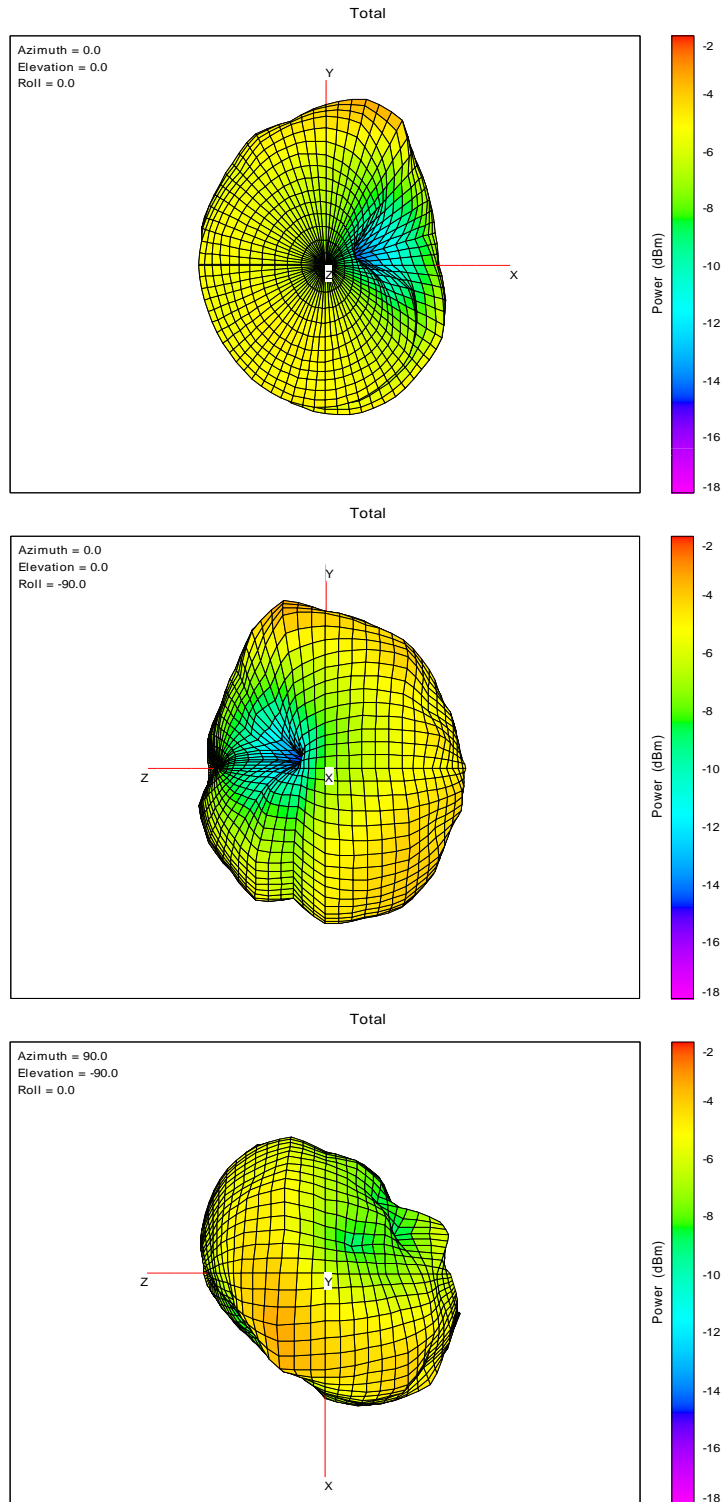


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## 8 3-D Antenna Pattern

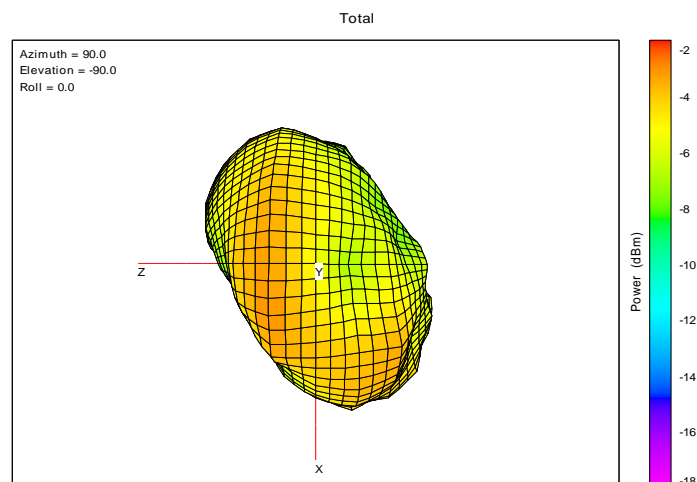
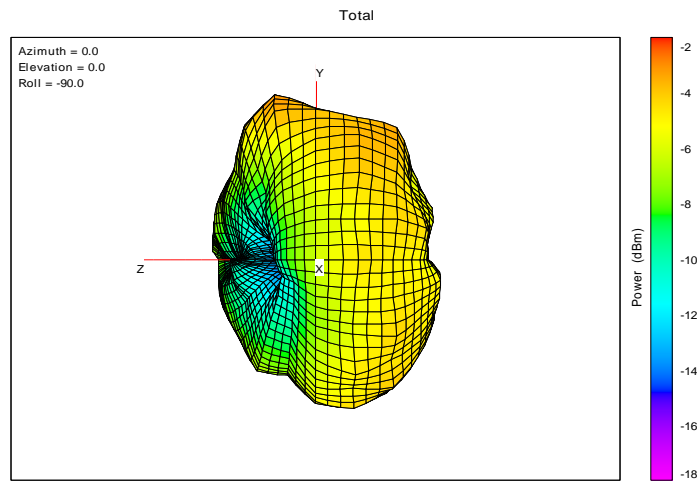
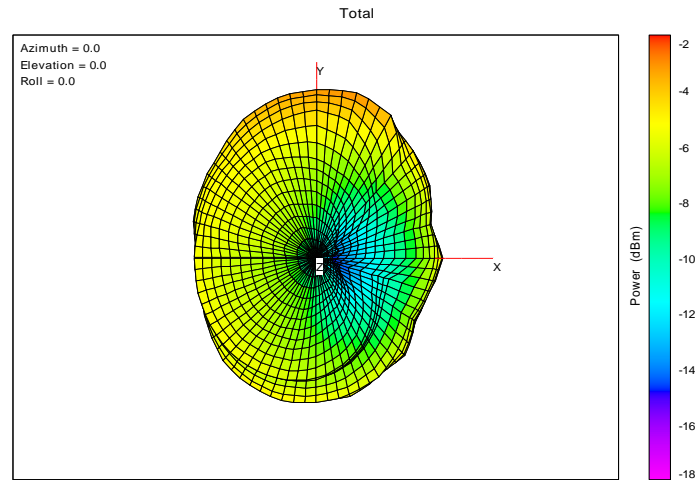


Free Space Left #3



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Free Space Right #3



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## 9 The EUT and Test Configuration

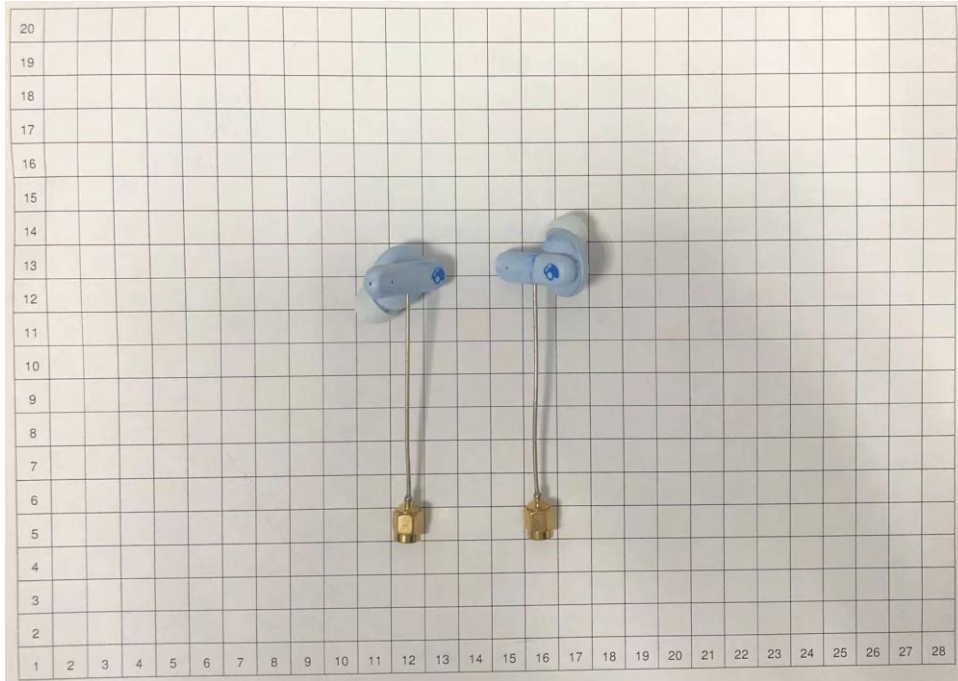


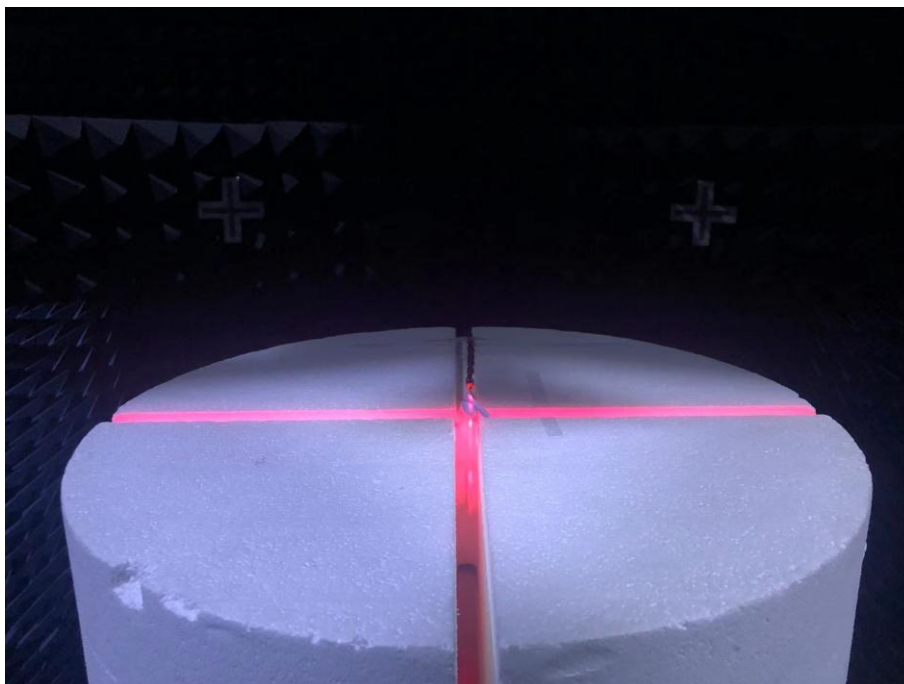
Photo of EUT



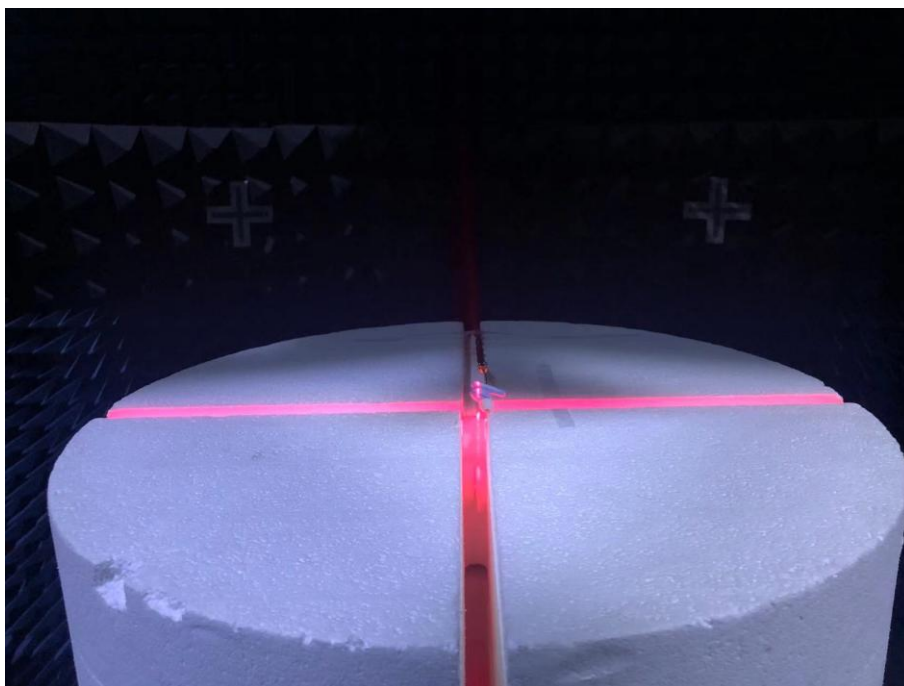
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Free Space Left View



Free Space Right View

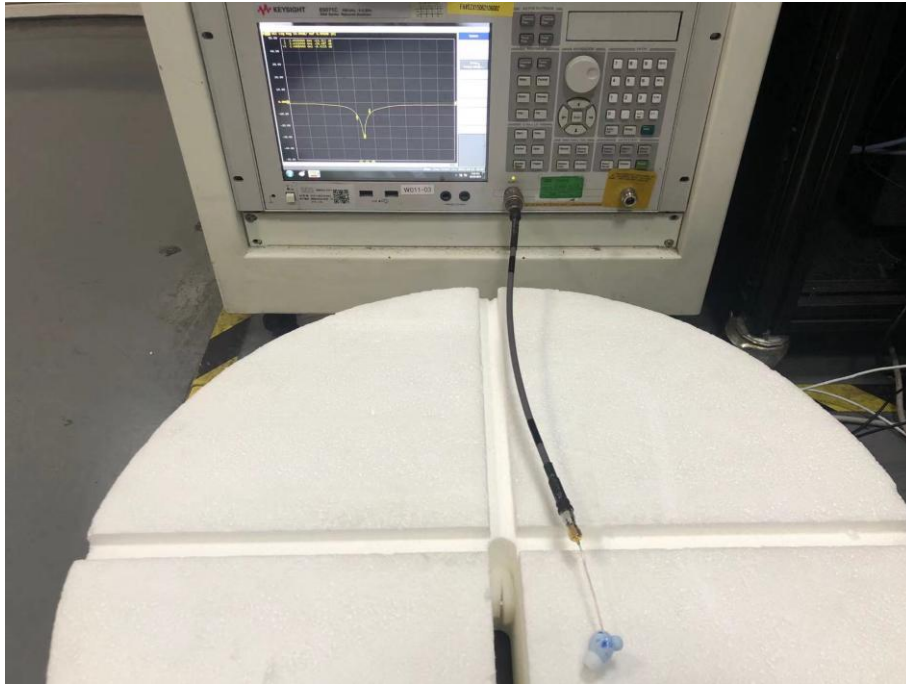


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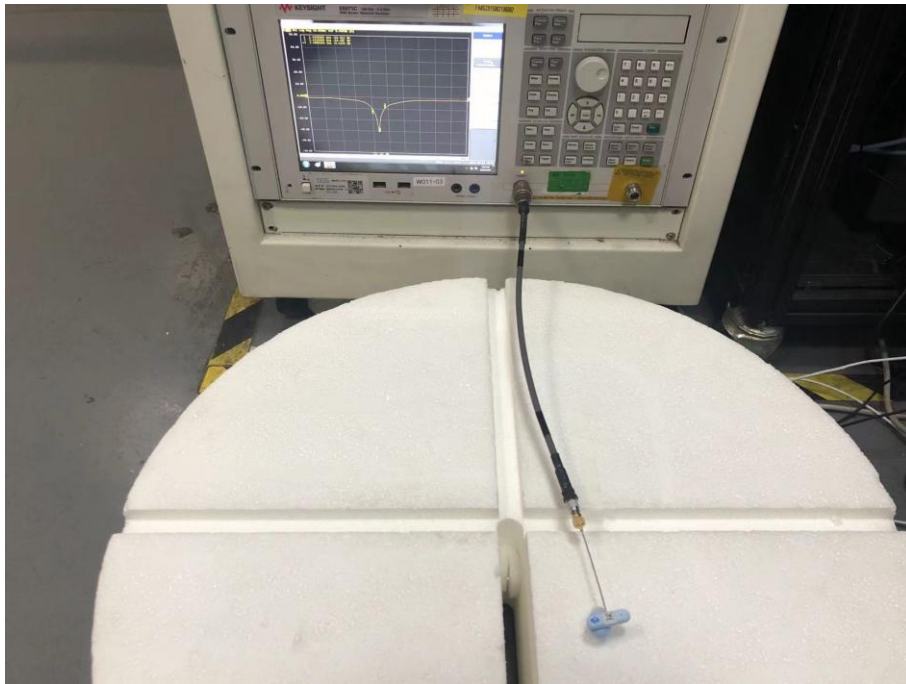
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Free Space Left Impedance Setup



Free Space Right Impedance Setup

---END---



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