

# FCC Test Report

Report No.: AGC10423170801FE08

**FCC ID** : 2ADSH-UMV3BT  
**APPLICATION PURPOSE** : Original Equipment  
**PRODUCT DESIGNATION** : Universal Module V3  
**BRAND NAME** : Danalock  
**MODEL NAME** : UMV3-BT  
**CLIENT** : Poly-Control ApS  
**DATE OF ISSUE** : Jan. 16, 2018  
**STANDARD(S)** : FCC Part 15 Subpart C Section 15.247  
**REPORT VERSION** : V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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### Report Revise Record

| Report Version | Revise Time | Issued Date   | Valid Version | Notes           |
|----------------|-------------|---------------|---------------|-----------------|
| V1.0           | /           | Jan. 16, 2018 | Valid         | Initial release |

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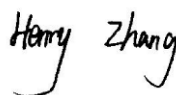
## 1. VERIFICATION OF COMPLIANCE

|                                 |                                                                                    |
|---------------------------------|------------------------------------------------------------------------------------|
| <b>Applicant</b>                | Poly-Control ApS                                                                   |
| <b>Address</b>                  | Gammel Stillingvej 427C, DK-8462 Harlev J, Denmark                                 |
| <b>Manufacturer</b>             | Xiamen CMM CO., LTD.                                                               |
| <b>Address</b>                  | No.136 Xin Guang Road, Haicang District   Xiamen city, Fujian Province, P.R. China |
| <b>Product Designation</b>      | Universal Module V3                                                                |
| <b>Brand Name</b>               | Danalock                                                                           |
| <b>Test Model</b>               | UMV3-BT                                                                            |
| <b>Date of test</b>             | Jan. 08, 2018 to Jan. 15, 2018                                                     |
| <b>Deviation</b>                | None                                                                               |
| <b>Condition of Test Sample</b> | Normal                                                                             |
| <b>Report Template</b>          | AGCRT-US-BLE/RF (2013-03-01)                                                       |

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, the energy emitted by the sample tested as described in this report is in compliance with the requirements of FCC Rules Part 15.247. The test results of this report relate only to the tested sample identified in this report.

Tested By



Henry Zhang(Zhang Zhuorui) Jan. 15, 2018

Reviewed By



Forrest Lei(Lei Yonggang) Jan. 16, 2018

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## 2.GENERAL INFORMATION

### 2.1PRODUCT DESCRIPTION

The EUT is designed as a “Universal Module V3”. It is designed by way of utilizing the FHSS technology to achieve the system operation.

A major technical description of EUT is described as following

|                                      |                                                       |
|--------------------------------------|-------------------------------------------------------|
| <b>Operation Frequency</b>           | 2.402 GHz to 2.480GHz                                 |
| <b>RF Output Power</b>               | 1.83dBm(Max)                                          |
| <b>Bluetooth Version</b>             | V4.2                                                  |
| <b>Modulation ( BLE )</b>            | GFSK                                                  |
| <b>Number of channels</b>            | 40 Channels(37 Hopping Channel,3 advertising Channel) |
| <b>Antenna Designation</b>           | Ceramic Antenna                                       |
| <b>Antenna Gain</b>                  | 3.1dBi                                                |
| <b>Hardware Version</b>              | 101-026_D1                                            |
| <b>Software Version</b>              | 0.6.0                                                 |
| <b>Power Supply</b>                  | DC 12V by DC source                                   |
| Note: The EUT didn't support BR/EDR. |                                                       |

### 2.2TEST METHOD

All measurements contained in this report were conducted with ANSI C63.10-2013.

### 2.3 EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

### 2.4 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement  $y \pm U$ , where expended uncertainty  $U$  is based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

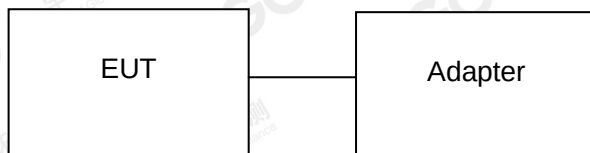
- Uncertainty of Conducted Emission,  $U_c = \pm 3.2$  dB
- Uncertainty of Radiated Emission below 1GHz,  $U_c = \pm 3.9$  dB
- Uncertainty of Radiated Emission above 1GHz,  $U_c = \pm 4.8$  dB

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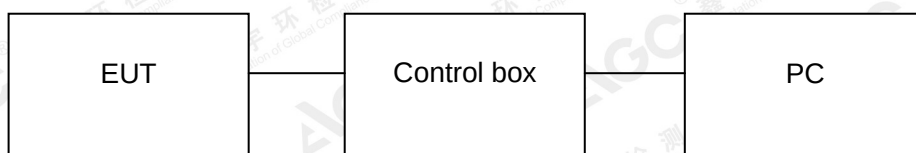
### 3. SYSTEM TEST CONFIGURATION

#### 3.1 CONFIGURATION OF TESTED SYSTEM

Configure 1: (Normal hopping)



Configuration: Continuous TX



#### 3.2 EQUIPMENT USED IN TESTED SYSTEM

| Item | Equipment                   | Mfr/Brand | Model/Type No.   | Remark |
|------|-----------------------------|-----------|------------------|--------|
| 1    | Universal Module V3         | Danalock  | UMV3-BT          | EUT    |
| 2    | Battery                     | SAIL      | 12V 60Ah 356A    | A.E    |
| 3    | PC                          | APPLE     | A1465            | A.E    |
| 4    | PC                          | DELL      | Inspiron 14-3437 | A.E    |
| 5    | Control box                 | TTL232R   | N/A              | A.E    |
| 6    | Adapter                     | IPRO      | NTR-S01          | A.E    |
| 7    | Temporary Antenna Connector | T10       | N/A              | A.E    |

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### 3.3. SUMMARY OF TEST RESULTS

| FCC RULES             | DESCRIPTION OF TEST              | RESULT    |
|-----------------------|----------------------------------|-----------|
| §15.203               | Antenna Requirement              | Compliant |
| §15.209<br>§15.247(d) | Radiated Emission                | Compliant |
| §15.247(d)            | Band Edges                       | Compliant |
| §15.247(a) (2)        | 6 dB Bandwidth                   | Compliant |
| §15.247(b)            | Conducted Output Power           | Compliant |
| §15.247(d)            | Conducted Spurious Emission      | Compliant |
| §15.247(e)            | Conducted Power Spectral Density | Compliant |
| §15.207               | Line Conduction Emission         | Compliant |

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#### 4. DESCRIPTION OF TEST MODES

The EUT has been operated in one modulation: GFSK.

| NO. | TEST MODE DESCRIPTION |
|-----|-----------------------|
| 1   | Low channel GFSK      |
| 2   | Middle channel GFSK   |
| 3   | High channel GFSK     |
| 4   | BT Link with charging |
| 5   | BT Link               |

Note:

1. Only the result of the worst case was recorded in the report if no any records.
2. Transmitting duty cycle >98%, The average correction factor is about -0.18.

Software Setting

The screenshot shows the 'BLE DTM Tester - 1.1 (05-02-2016)' window. The 'COM port' is set to 'COM8 (hcdcacm0)'. Under 'Tests', the settings are: Frequency: 2402 MHz, Payload length: 0 bytes, Packet type: Prbs9, Tx Power: 0 dBm. There are buttons for 'Transmit', 'Receive', 'Rec. loop', 'End', and 'Reset'. The output log shows the following sequence of commands and results:

```

Packet count: 0
Sending command: 4000 -> 0000
Ok
Sending command: c000 -> 8000
Packet count: 0
Sending command: 0000 -> 0000
Ok
Sending command: 4000 -> 0000
Ok
Sending command: c000 -> 8ccc
Packet count: 3276
  
```

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## 5. TEST FACILITY

|                           |                                                                                                                                                                                                                  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Site</b>          | Attestation of Global Compliance (Shenzhen) Co., Ltd                                                                                                                                                             |
| <b>Location</b>           | 1-2F., Bldg.2, No.1-4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District B112-B113, Bldg.12, Baoan Bldg Materials Center, No.1 of Xixiang Inner Ring Road, Baoan District, Shenzhen 518012 |
| <b>NVLAP Lab Code</b>     | 600153-0                                                                                                                                                                                                         |
| <b>Designation Number</b> | CN5028                                                                                                                                                                                                           |
| <b>Description</b>        | Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by National Voluntary Laboratory Accreditation program, NVLAP Code 600153-0                                                                    |

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## 6. TEST EQUIPMENT LIST

### TEST EQUIPMENT OF CONDUCTED EMISSION TEST

| Equipment     | Manufacturer | Model   | S/N    | Cal. Date    | Cal. Due     |
|---------------|--------------|---------|--------|--------------|--------------|
| TEST RECEIVER | R&S          | ESPI    | 101206 | Jun.20, 2017 | Jun.19, 2018 |
| LISN          | R&S          | ESH2-Z5 | 100086 | Aug.21, 2017 | Aug.20, 2018 |

### TEST EQUIPMENT OF RADIATED EMISSION TEST

| Equipment                    | Manufacturer    | Model       | S/N        | Cal. Date     | Cal. Due      |
|------------------------------|-----------------|-------------|------------|---------------|---------------|
| TEST RECEIVER                | R&S             | ESCI        | 10096      | Jun.20, 2017  | Jun.19, 2018  |
| EXA Signal Analyzer          | Aglient         | N9010A      | MY53470504 | Dec.08, 2017  | Dec.07, 2018  |
| Horn antenna                 | SCHWARZBECK     | BBHA 9170   | #768       | Sep.20, 2017  | Sep.19, 2018  |
| preamplifier                 | ChengYi         | EMC184045SE | 980508     | Sep.15, 2017  | Sep.14, 2018  |
| Double-Ridged Waveguide Horn | ETS LINDGREN    | 3117        | 00034609   | May.18, 2017  | May.17, 2019  |
| Broadband Preamplifier       | SCHWARZBECK     | BBV 9718    | 9718-205   | Jun.20, 2017  | Jun.19, 2018  |
| ANTENNA                      | SCHWARZBECK     | VULB9168    | D69250     | Sep.28, 2017  | Sep.27, 2018  |
| Loop Antenna                 | A.H.Systems,Inc | SAS-562B    | --         | Mar. 01, 2016 | Feb. 28, 2018 |

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## 7. ANTENNA REQUIREMENT

### 7.1. STANDARD APPLICABLE

According to FCC 15.203, An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

### 7.2. TEST RESULT

This product has a permanent antenna, fulfill the requirement of this section.

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## 8. RADIATED EMISSION

### 8.1 LIMITS

| Frequency<br>(MHz) | Distance<br>Meters | Field Strengths Limit                                                        |                                   |
|--------------------|--------------------|------------------------------------------------------------------------------|-----------------------------------|
|                    |                    | $\mu\text{V/m}$                                                              | $\text{dB}(\mu\text{V})/\text{m}$ |
| 0.009 ~ 0.490      | 300                | 2400/F(kHz)                                                                  | ---                               |
| 0.490 ~ 1.705      | 30                 | 24000/F(kHz)                                                                 | ---                               |
| 1.705 ~ 30         | 30                 | 30                                                                           | ---                               |
| 30 ~ 88            | 3                  | 100                                                                          | 40.0                              |
| 88 ~ 216           | 3                  | 150                                                                          | 43.5                              |
| 216 ~ 960          | 3                  | 200                                                                          | 46.0                              |
| 960 ~ 1000         | 3                  | 500                                                                          | 54.0                              |
| Above 1000         | 3                  | Other:74.0 dB( $\mu\text{V}$ )/m (Peak) 54.0 dB( $\mu\text{V}$ )/m (Average) |                                   |

Remark: (1) Emission level  $\text{dB}\mu\text{V} = 20 \log \text{Emission level } \mu\text{V/m}$   
 (2) The smaller limit shall apply at the cross point between two frequency bands.  
 (3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

### 8.2 MEASUREMENT PROCEDURE

- The measuring distance of 3m shall be used for measurements. The EUT was placed on the top of a rotating table 0.8 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Below 1GHz)
- The measuring distance of 3m shall used for measurements. The EUT was placed on the top of a rotating table 1.5 meter above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation(Above 1GHz)
- The height of the test antenna shall vary between 1m to 4m.Both horizontal and vertical polarization Of the antenna are set to make the measurement.
- The initial step in collecting radiated emission data is a receive peak detector mode. Pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- All readings are peak unless otherwise stated QP in column of Note. Peak denoted that the Peak reading compliance with the QP limits and then QP Mode measurement didn't perform(Below 1GHz)
- All readings are Peak mode value unless otherwise stated AVG in column of Note. If the Peak mode measured value compliance with the Peak limits and lower than AVG Limits, the EUT shall be deemed to meet Peak&AVG limits and then only Peak mode was measured, but AVG mode didn't perform.(Above 1GHz)

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The following table is the setting of spectrum analyzer and receiver.

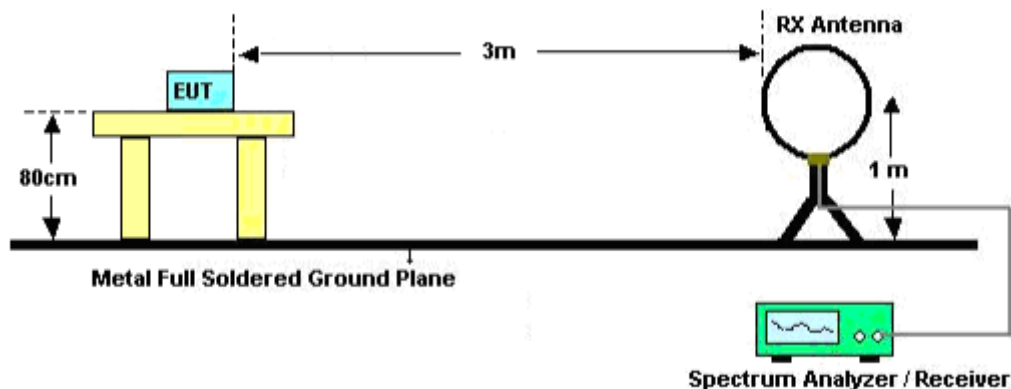
| Spectrum Parameter    | Setting                                                                          |
|-----------------------|----------------------------------------------------------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP                                                      |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP                                                      |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP                                                   |
| Start ~Stop Frequency | 1GHz~26.5GHz<br>RBW 2MHz/ VBW 6MHz for Peak,<br>RBW 1.5MHz/ VBW 10Hz for Average |

| Receiver Parameter    | Setting                        |
|-----------------------|--------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP    |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP    |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |

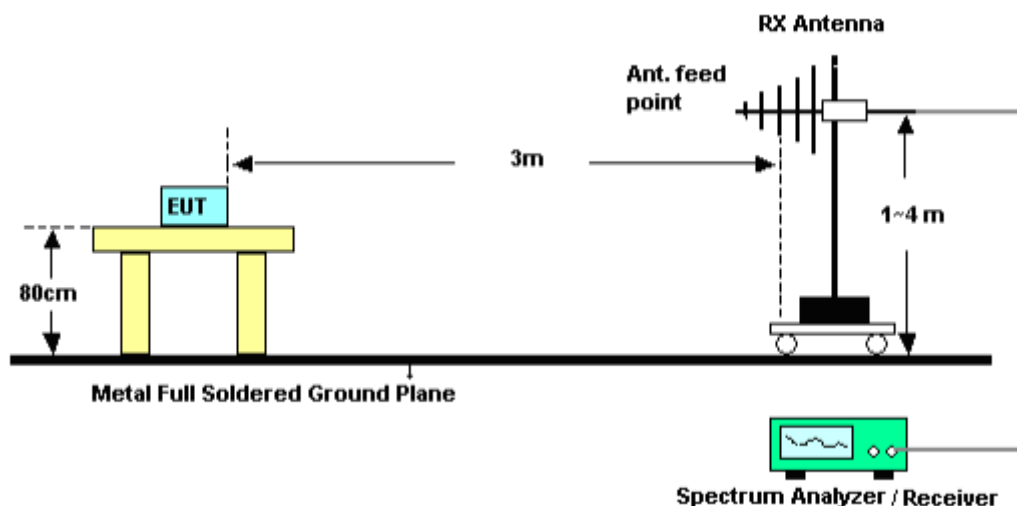
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### 8.3 TEST SETUP

#### RADIATED EMISSION TEST SETUP BELOW 30MHz

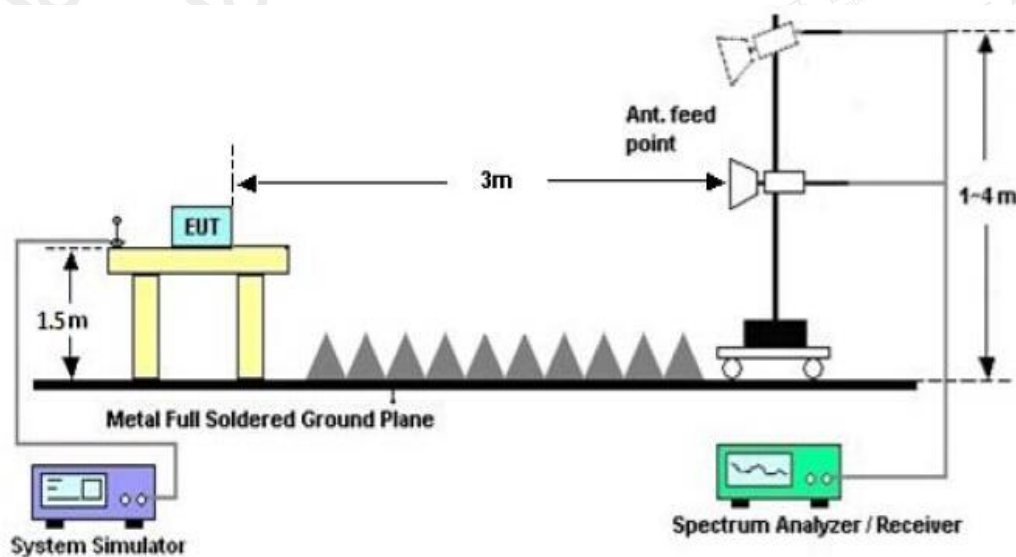


#### RADIATED EMISSION TEST SETUP 30MHz-1000MHz



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RADIATED EMISSION TEST SETUP ABOVE 1000MHz



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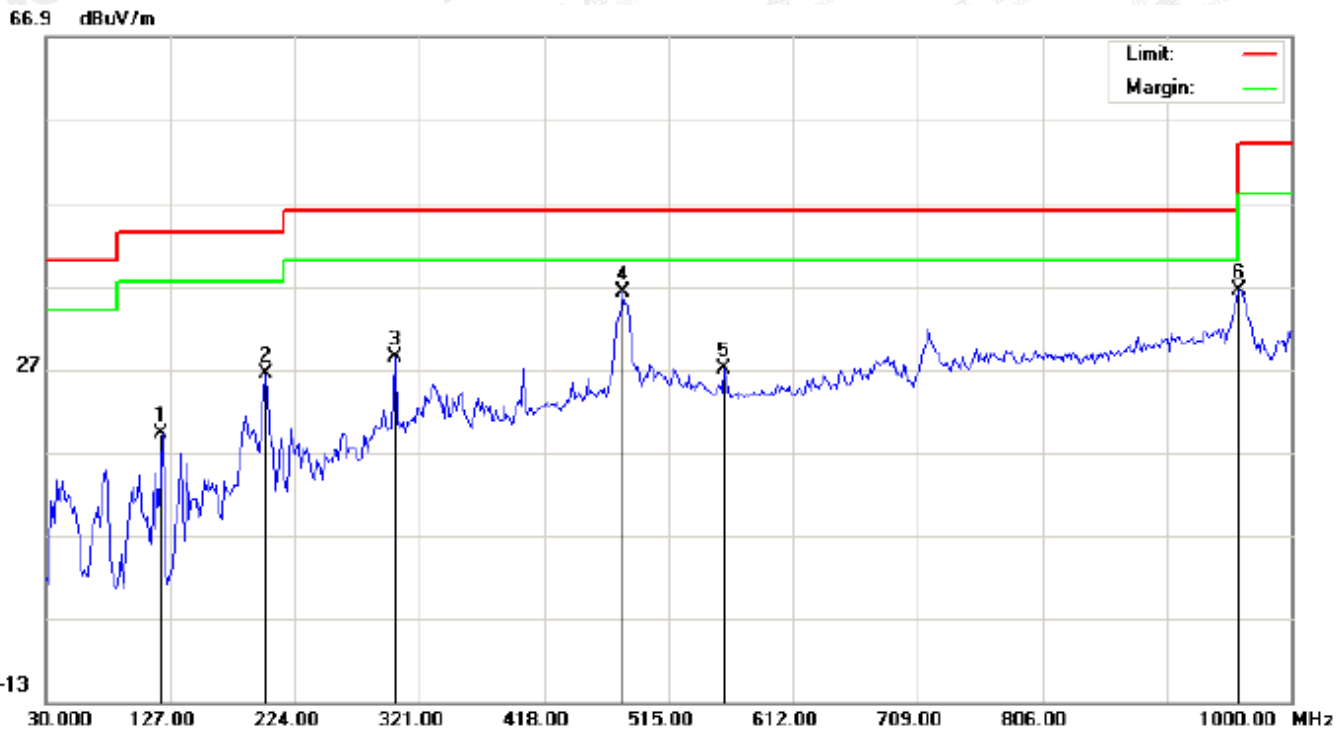
## 8.4 TEST RESULT

### RADIATED EMISSION BELOW 30MHz

No emission found between lowest internal used/generated frequencies to 30MHz.

### RADIATED EMISSION BELOW 1GHz

RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL-HORIZONTAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 120.5332 | 13.04   | 6.11   | 19.15       | 43.50  | -24.35 | peak     |                |              |         |
| 2   |    | 201.3667 | 14.57   | 11.86  | 26.43       | 43.50  | -17.07 | peak     |                |              |         |
| 3   |    | 301.6000 | 12.95   | 15.52  | 28.47       | 46.00  | -17.53 | peak     |                |              |         |
| 4   |    | 479.4332 | 15.23   | 20.91  | 36.14       | 46.00  | -9.86  | peak     |                |              |         |
| 5   |    | 558.6499 | 4.38    | 22.70  | 27.08       | 46.00  | -18.92 | peak     |                |              |         |
| 6   | *  | 959.5833 | 6.50    | 29.91  | 36.41       | 46.00  | -9.59  | peak     |                |              |         |

**RESULT: PASS**

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RADIATED EMISSION TEST- (30MHz-1GHz)-LOW CHANNEL -VERTICAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 127.0000 | 16.74   | 9.78   | 26.52       | 43.50  | -16.98 | peak     |                |              |         |
| 2   |    | 169.0332 | 11.81   | 14.76  | 26.57       | 43.50  | -16.93 | peak     |                |              |         |
| 3   |    | 301.6000 | 4.86    | 15.52  | 20.38       | 46.00  | -25.62 | peak     |                |              |         |
| 4   |    | 382.4332 | 5.85    | 18.95  | 24.80       | 46.00  | -21.20 | peak     |                |              |         |
| 5   |    | 479.4332 | 10.56   | 20.91  | 31.47       | 46.00  | -14.53 | peak     |                |              |         |
| 6   | *  | 959.5833 | 3.27    | 29.91  | 33.18       | 46.00  | -12.82 | peak     |                |              |         |

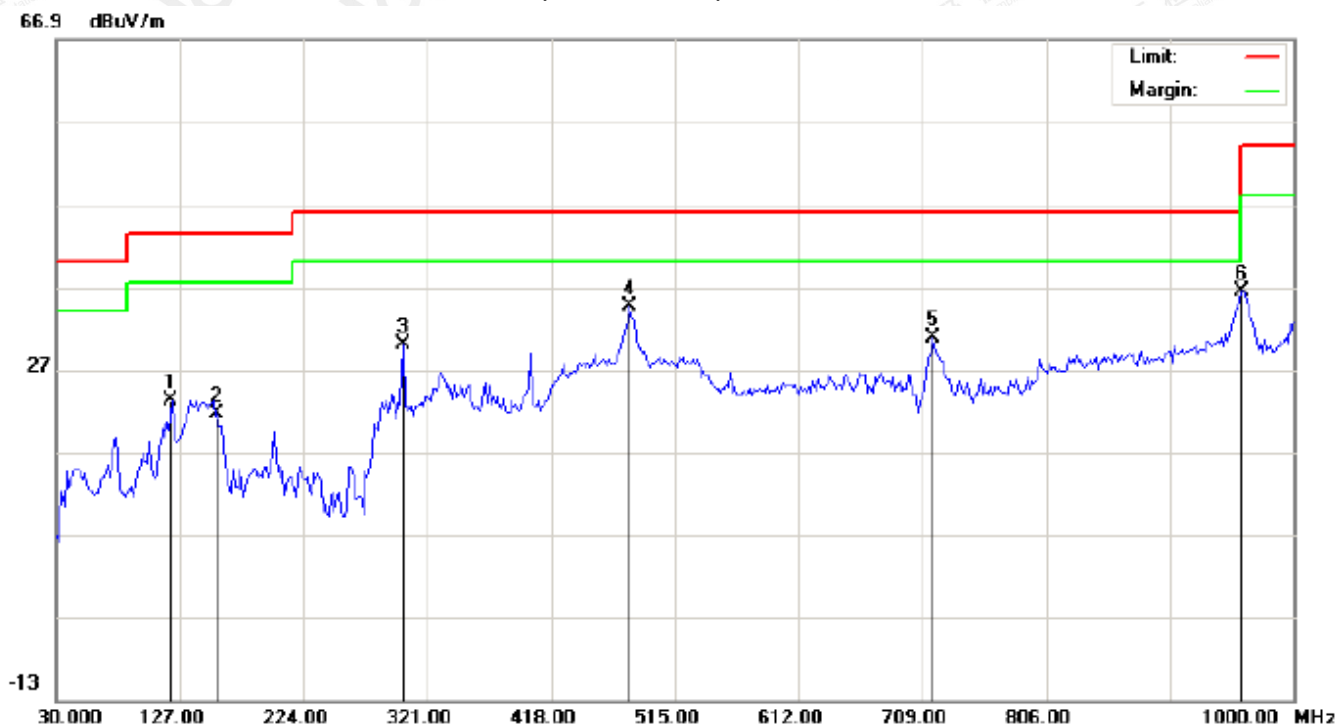
**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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RADIATED EMISSION TEST- (30MHz-1GHz)-MIDDLE CHANNEL-HORIZONTAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 120.5332 | 17.04   | 6.11   | 23.15       | 43.50  | -20.35 | peak     |                |              |         |
| 2   |    | 156.0999 | 10.27   | 11.28  | 21.55       | 43.50  | -21.95 | peak     |                |              |         |
| 3   |    | 301.6000 | 14.45   | 15.52  | 29.97       | 46.00  | -16.03 | peak     |                |              |         |
| 4   |    | 479.4332 | 13.73   | 20.91  | 34.64       | 46.00  | -11.36 | peak     |                |              |         |
| 5   |    | 717.0833 | 5.17    | 25.68  | 30.85       | 46.00  | -15.15 | peak     |                |              |         |
| 6   | *  | 959.5833 | 6.50    | 29.91  | 36.41       | 46.00  | -9.59  | peak     |                |              |         |

RESULT: PASS

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RADIATED EMISSION TEST- (30MHz-1GHz)-MIDDLE CHANNEL -VERTICAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 38.0833  | 11.43   | 6.39   | 17.82       | 40.00  | -22.18 | peak     |                |              |         |
| 2   |    | 127.0000 | 15.74   | 9.78   | 25.52       | 43.50  | -17.98 | peak     |                |              |         |
| 3   |    | 169.0332 | 11.81   | 14.76  | 26.57       | 43.50  | -16.93 | peak     |                |              |         |
| 4   |    | 301.6000 | 8.86    | 15.52  | 24.38       | 46.00  | -21.62 | peak     |                |              |         |
| 5   |    | 484.2832 | 11.69   | 20.96  | 32.65       | 46.00  | -13.35 | peak     |                |              |         |
| 6   | *  | 959.5833 | 4.77    | 29.91  | 34.68       | 46.00  | -11.32 | peak     |                |              |         |

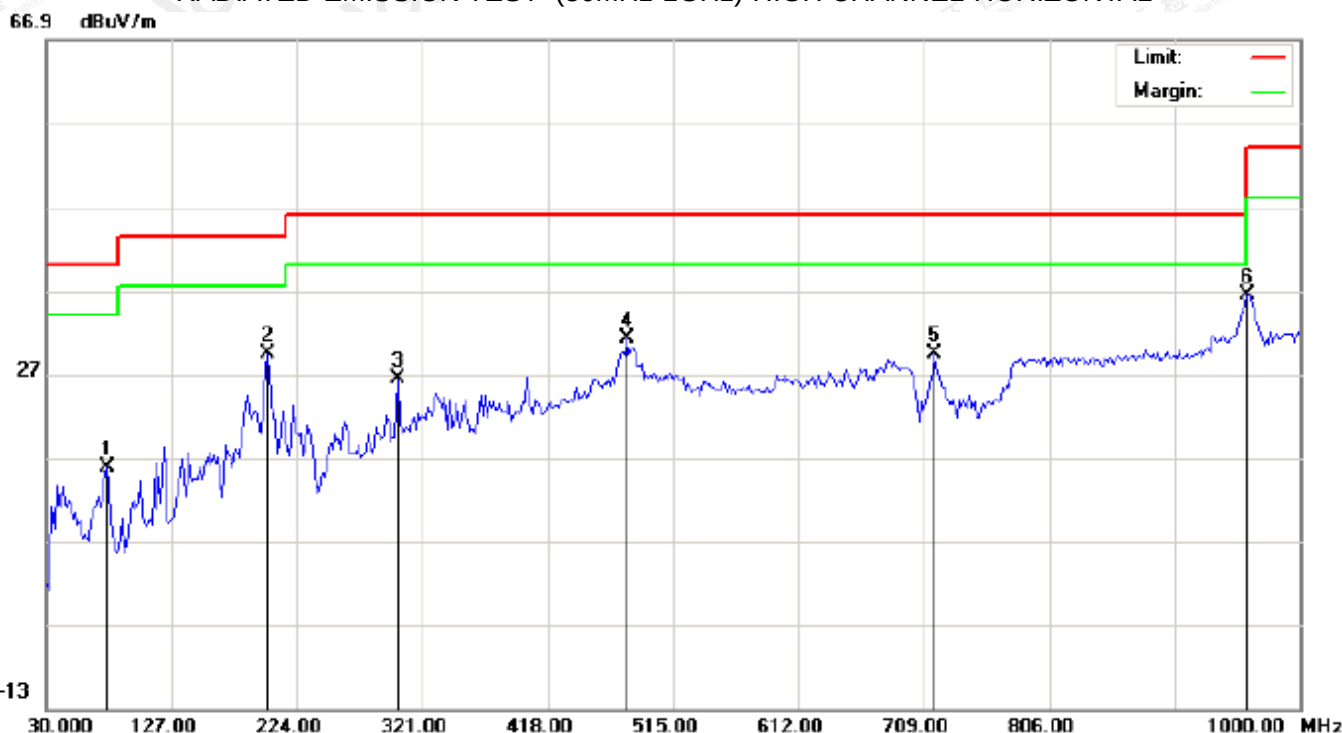
**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL-HORIZONTAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 76.8833  | 12.34   | 3.54   | 15.88       | 40.00  | -24.12 | peak     |                |              |         |
| 2   |    | 201.3667 | 17.57   | 11.86  | 29.43       | 43.50  | -14.07 | peak     |                |              |         |
| 3   |    | 301.6000 | 10.95   | 15.52  | 26.47       | 46.00  | -19.53 | peak     |                |              |         |
| 4   |    | 479.4332 | 10.23   | 20.91  | 31.14       | 46.00  | -14.86 | peak     |                |              |         |
| 5   |    | 717.0833 | 3.67    | 25.68  | 29.35       | 46.00  | -16.65 | peak     |                |              |         |
| 6   | *  | 959.5833 | 6.50    | 29.91  | 36.41       | 46.00  | -9.59  | peak     |                |              |         |

RESULT: PASS

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RADIATED EMISSION TEST- (30MHz-1GHz)-HIGH CHANNEL -VERTICAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 127.0000 | 16.24   | 9.78   | 26.02       | 43.50  | -17.48 | peak     |                |              |         |
| 2   |    | 169.0332 | 12.81   | 14.76  | 27.57       | 43.50  | -15.93 | peak     |                |              |         |
| 3   |    | 241.7832 | 11.84   | 13.09  | 24.93       | 46.00  | -21.07 | peak     |                |              |         |
| 4   | *  | 482.6666 | 12.61   | 20.94  | 33.55       | 46.00  | -12.45 | peak     |                |              |         |
| 5   |    | 718.7000 | 5.09    | 25.73  | 30.82       | 46.00  | -15.18 | peak     |                |              |         |
| 6   |    | 959.5833 | 3.27    | 29.91  | 33.18       | 46.00  | -12.82 | peak     |                |              |         |

**RESULT: PASS**

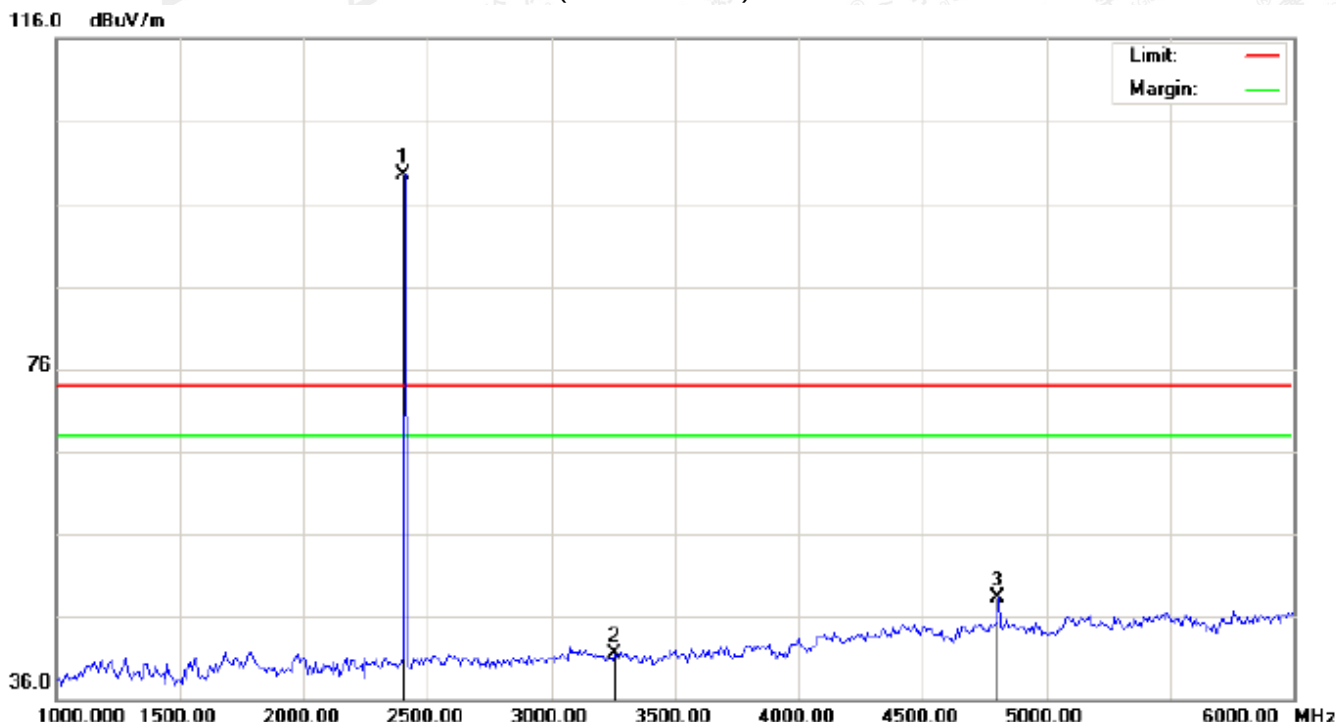
**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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# RADIATED EMISSION ABOVE 1GHz

## RADIATED EMISSION TEST- (ABOVE 1GHz)-LOW CHANNEL-HORIZONTAL

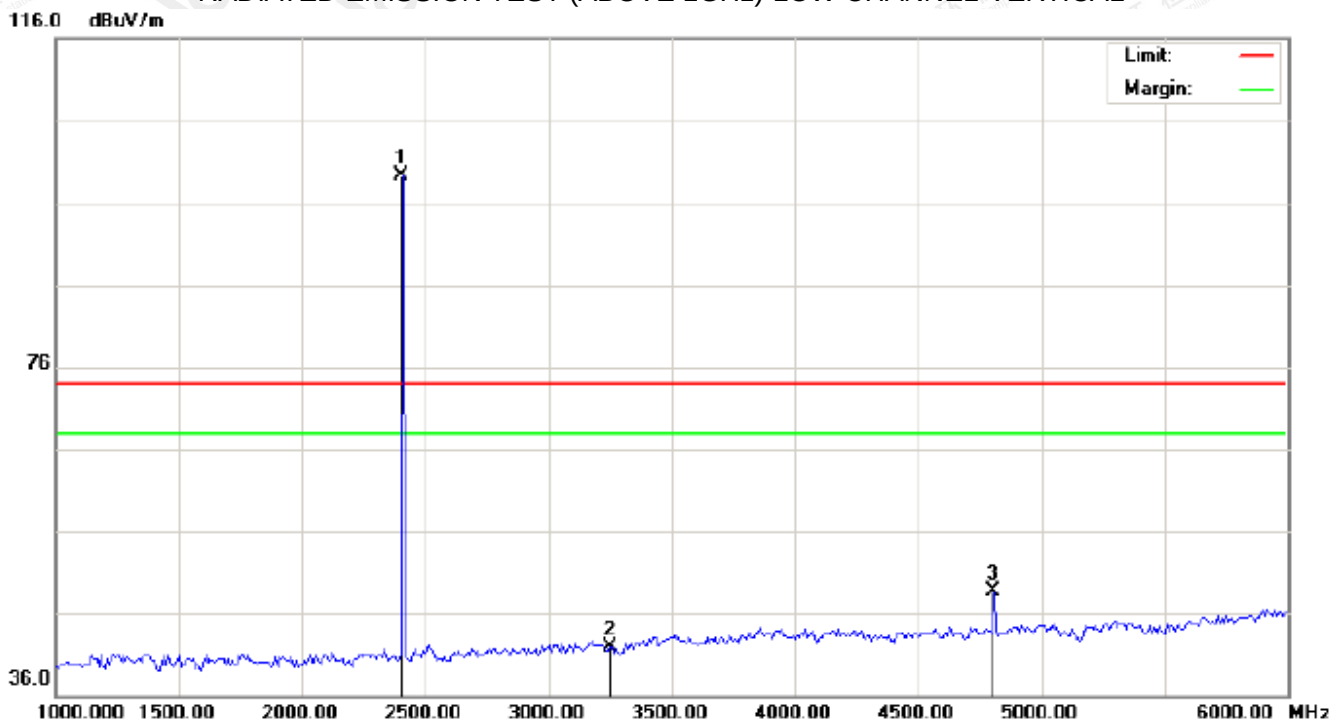


| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2402.000 | 89.21   | 10.32  | 99.53       | 74.00  | 25.53  | peak     |                |              |         |
| 2   |    | 3254.000 | 29.71   | 11.88  | 41.59       | 74.00  | -32.41 | peak     |                |              |         |
| 3   |    | 4804.000 | 40.71   | 7.69   | 48.40       | 74.00  | -25.60 | peak     |                |              |         |

RESULT: PASS

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RADIATED EMISSION TEST-(ABOVE 1GHz)-LOW CHANNEL-VERTICAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2402.000 | 88.94   | 10.32  | 99.26       | 74.00  | 25.26  | peak     |                |              |         |
| 2   |    | 3251.000 | 30.06   | 11.88  | 41.94       | 74.00  | -32.06 | peak     |                |              |         |
| 3   |    | 4804.000 | 41.05   | 7.69   | 48.74       | 74.00  | -25.26 | peak     |                |              |         |

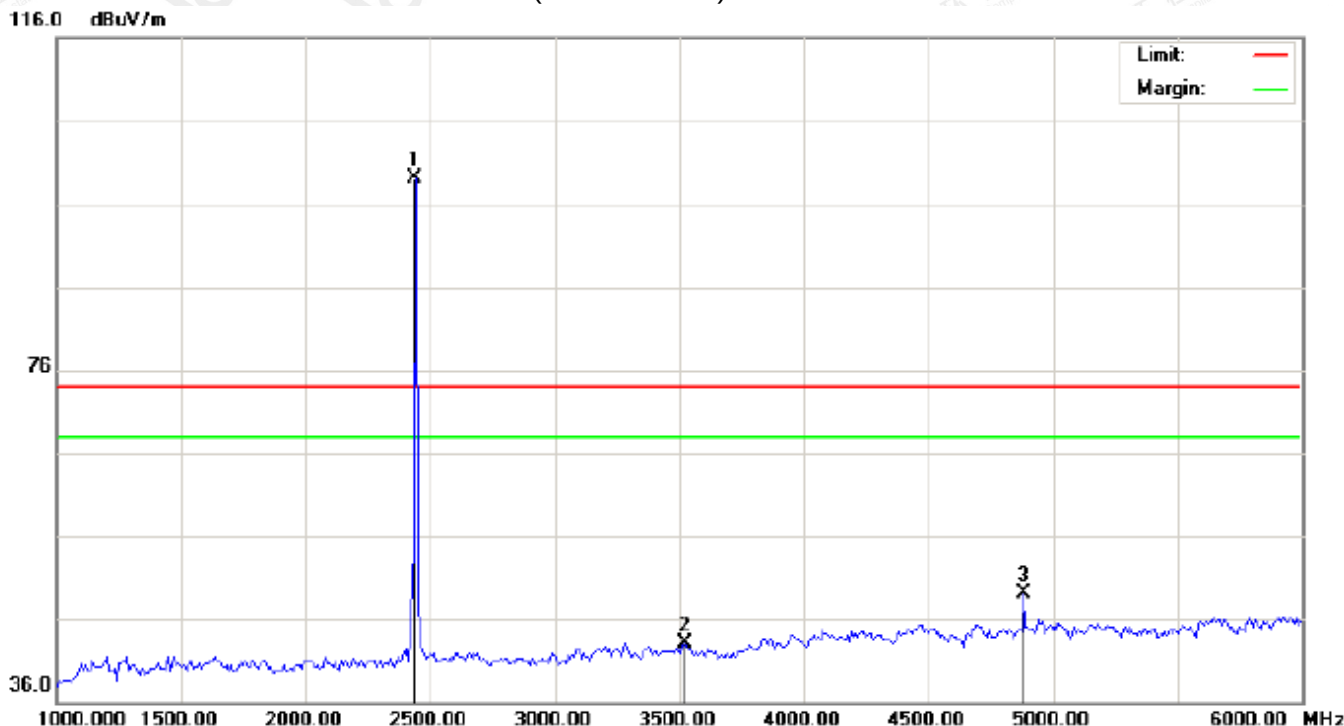
**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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RADIATED EMISSION TEST-(ABOVE 1GHz)-MIDDLE CHANNEL-HORIZONTAL

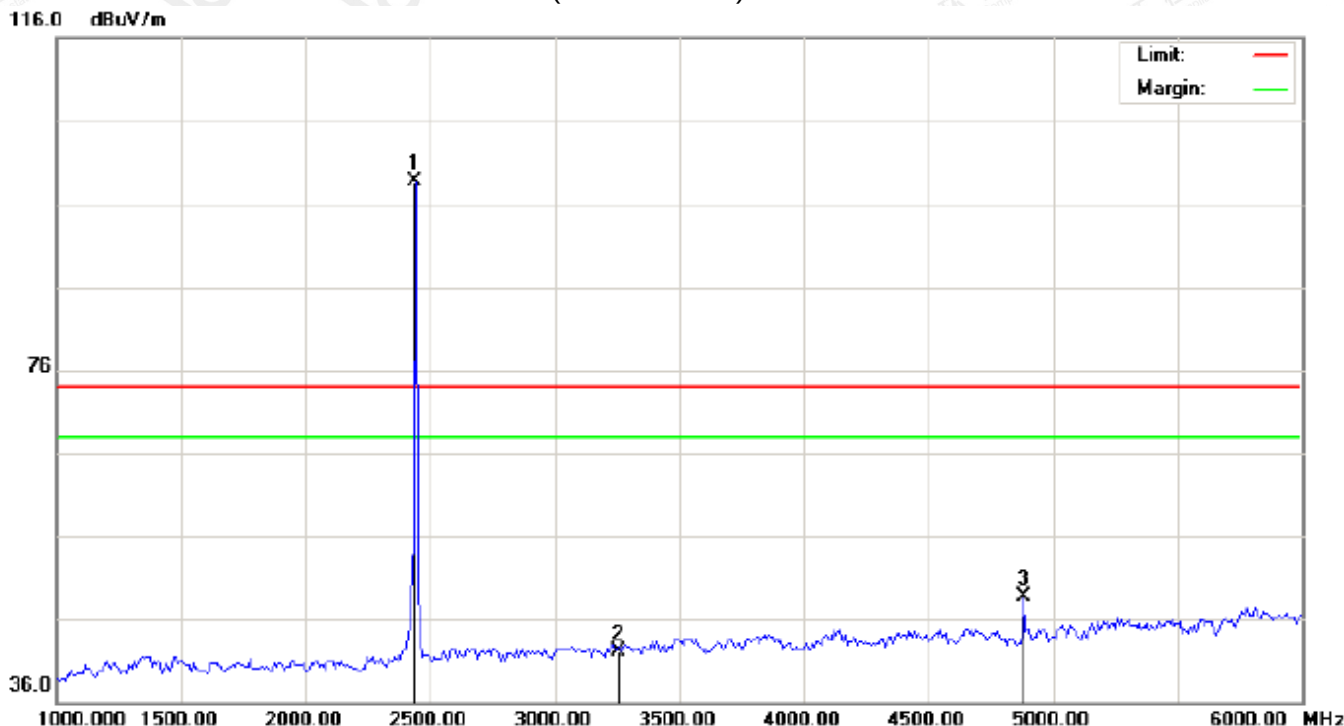


| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2440.000 | 88.70   | 10.36  | 99.06       | 74.00  | 25.06  | peak     |                |              |         |
| 2   |    | 3521.000 | 30.88   | 12.24  | 43.12       | 74.00  | -30.88 | peak     |                |              |         |
| 3   |    | 4880.000 | 41.16   | 7.89   | 49.05       | 74.00  | -24.95 | peak     |                |              |         |

RESULT: PASS

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RADIATED EMISSION TEST-(ABOVE 1GHz)-MIDDLE CHANNEL-VERTICAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2440.000 | 88.39   | 10.36  | 98.75       | 74.00  | 24.75  | peak     |                |              |         |
| 2   |    | 3259.000 | 30.14   | 11.88  | 42.02       | 74.00  | -31.98 | peak     |                |              |         |
| 3   |    | 4880.000 | 40.89   | 7.89   | 48.78       | 74.00  | -25.22 | peak     |                |              |         |

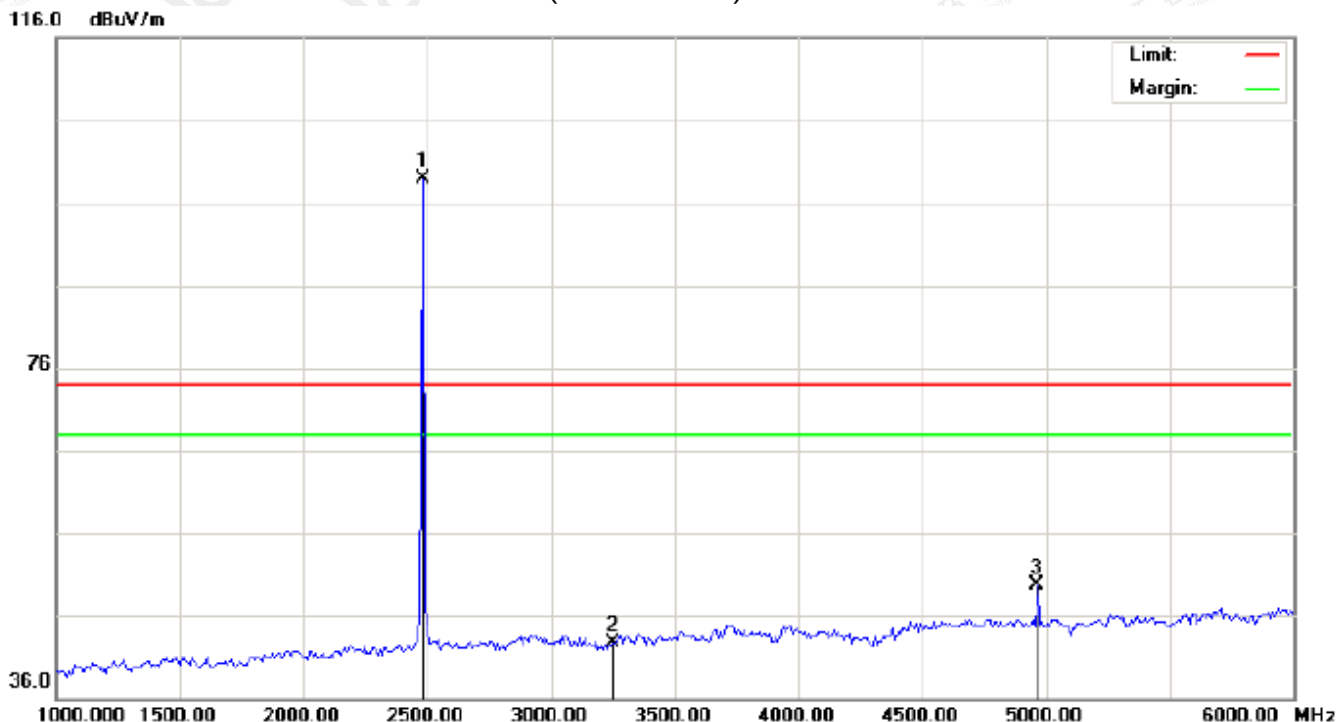
**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The "Factor" value can be calculated automatically by software of measurement system.

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RADIATED EMISSION TEST-(ABOVE 1GHz)-HIGH CHANNEL-HORIZONTAL

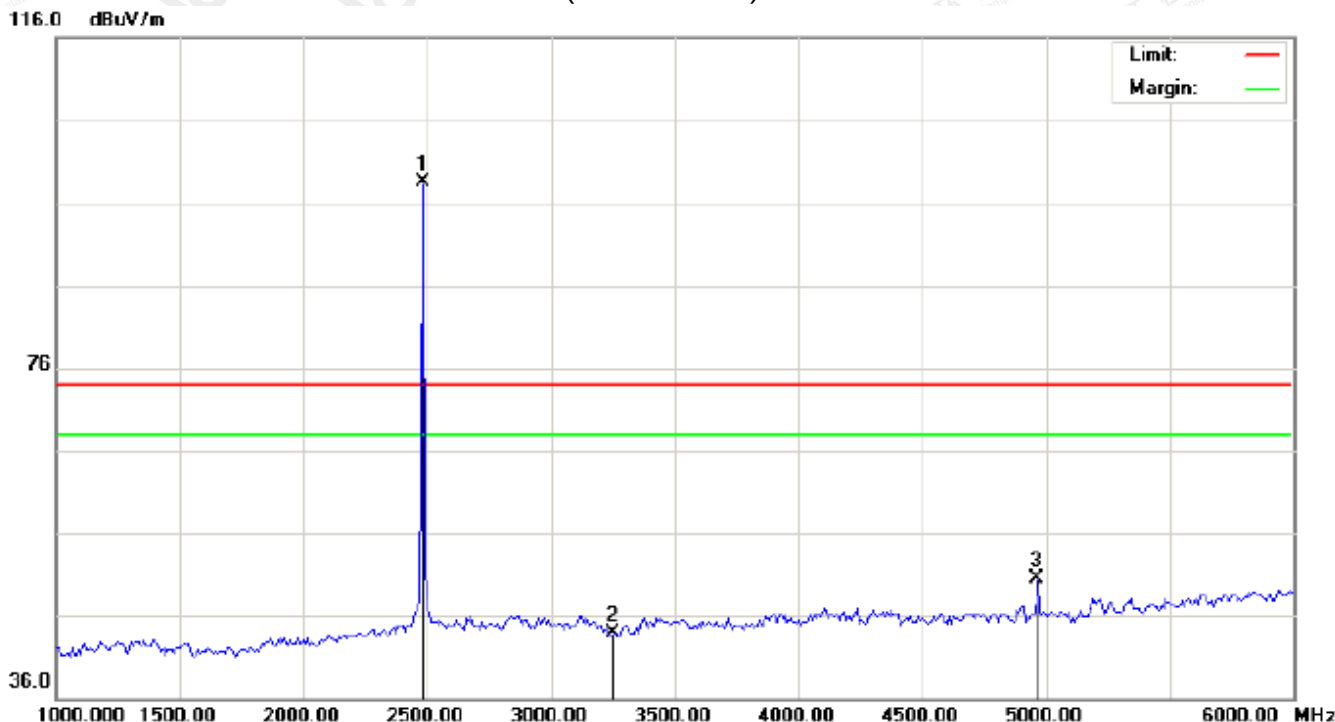


| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2480.000 | 88.43   | 10.41  | 98.84       | 74.00  | 24.84  | peak     |                |              |         |
| 2   |    | 3251.000 | 30.91   | 11.88  | 42.79       | 74.00  | -31.21 | peak     |                |              |         |
| 3   |    | 4960.000 | 41.60   | 8.09   | 49.69       | 74.00  | -24.31 | peak     |                |              |         |

RESULT: PASS

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# RADIATED EMISSION TEST-(ABOVE 1GHz)-HIGH CHANNEL-VERTICAL



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2480.000 | 88.02   | 10.41  | 98.43       | 74.00  | 24.43  | peak     |                |              |         |
| 2   |    | 3251.000 | 31.95   | 11.88  | 43.83       | 74.00  | -30.17 | peak     |                |              |         |
| 3   |    | 4960.000 | 42.41   | 8.09   | 50.50       | 74.00  | -23.50 | peak     |                |              |         |

## RESULT: PASS

**Note:** 6~25GHz at least have 20dB margin. No recording in the test report.

Factor=Antenna Factor+ Cable loss-Amplifier gain,

Margin=Measurement-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

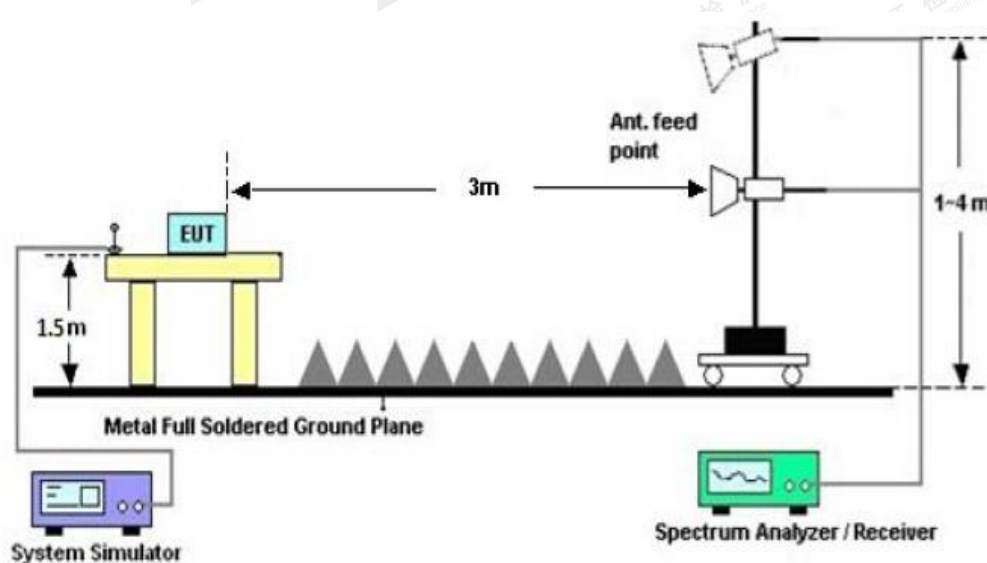
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## 9. BAND EDGE EMISSION

### 9.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the bottom operation frequency individually.
2. Set SPA Start or Stop Frequency=Operation Frequency,  
For unrestricted band: RBW=100kHz, VBW=300kHz  
For restricted band: RBW=1MHz, VBW=3\*RBW  
Center frequency =Operation frequency
3. The band edges was measured and recorded.

### 9.2. TEST SET-UP



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### 9.3. TEST RESULT

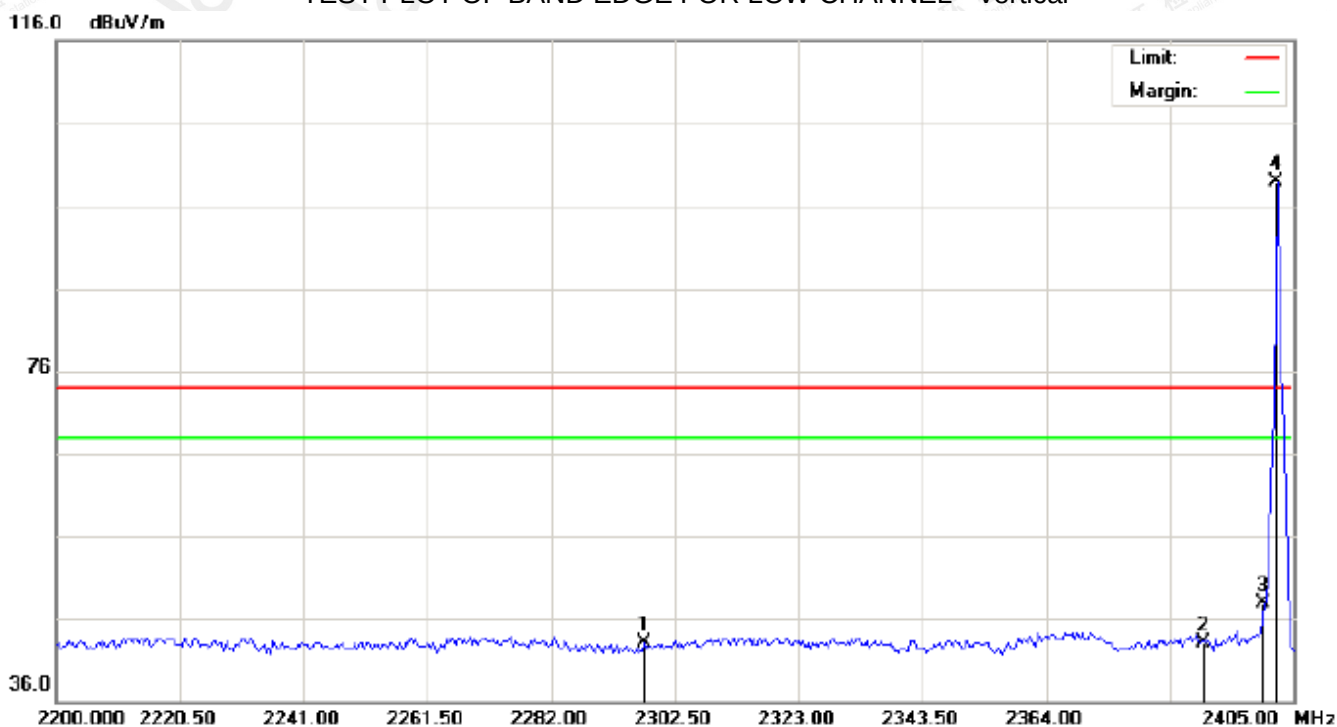
#### TEST PLOT OF BAND EDGE FOR LOW CHANNEL -Horizontal



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 2322.658 | 33.06   | 10.23  | 43.29       | 74.00  | -30.71 | peak     |                |              |         |
| 2   |    | 2390.000 | 33.00   | 10.31  | 43.31       | 74.00  | -30.69 | peak     |                |              |         |
| 3   |    | 2400.000 | 40.47   | 10.32  | 50.79       | 74.00  | -23.21 | peak     |                |              |         |
| 4   | *  | 2402.000 | 89.14   | 10.32  | 99.46       | 74.00  | 25.46  | peak     |                |              |         |

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TEST PLOT OF BAND EDGE FOR LOW CHANNEL - Vertical

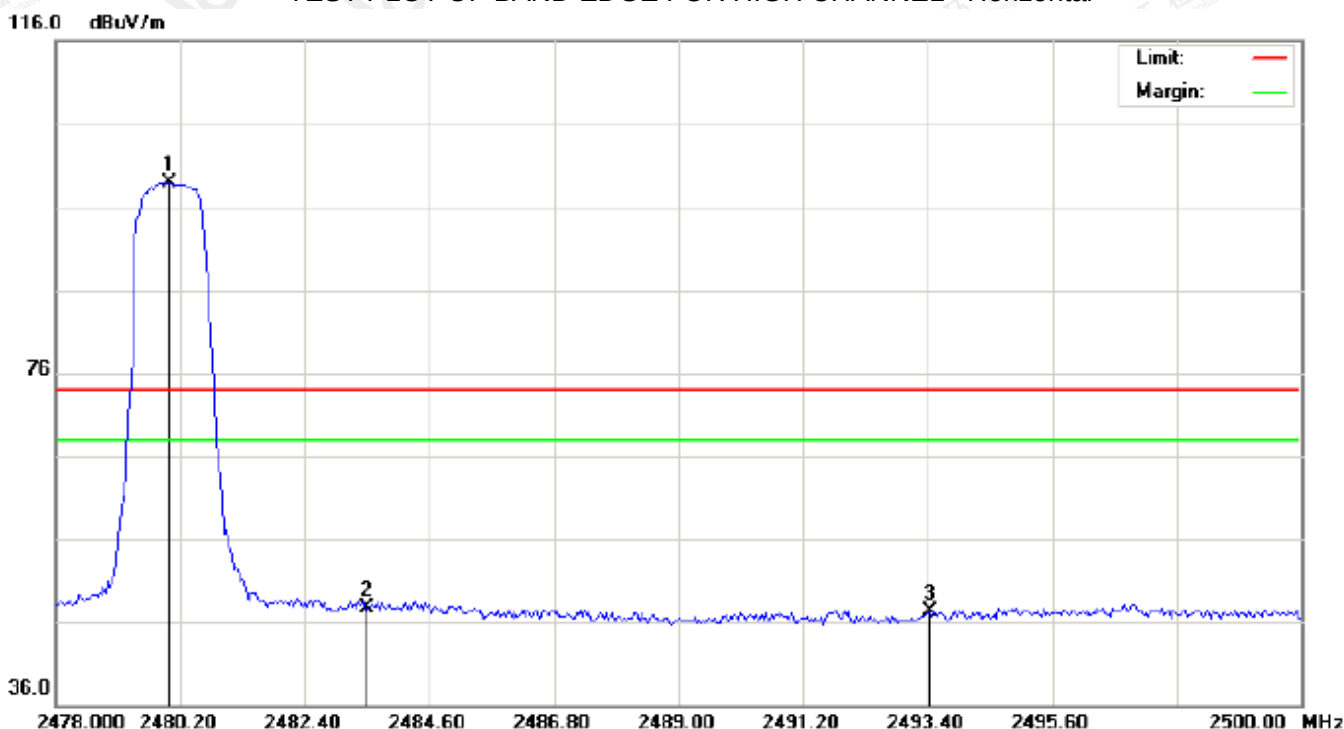


| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   |    | 2297.375 | 32.92   | 10.21  | 43.13       | 74.00  | -30.87 | peak     |                |              |         |
| 2   |    | 2390.000 | 32.71   | 10.31  | 43.02       | 74.00  | -30.98 | peak     |                |              |         |
| 3   |    | 2400.000 | 37.56   | 10.32  | 47.88       | 74.00  | -26.12 | peak     |                |              |         |
| 4   | *  | 2402.000 | 88.59   | 10.32  | 98.91       | 74.00  | 24.91  | peak     |                |              |         |

RESULT: PASS

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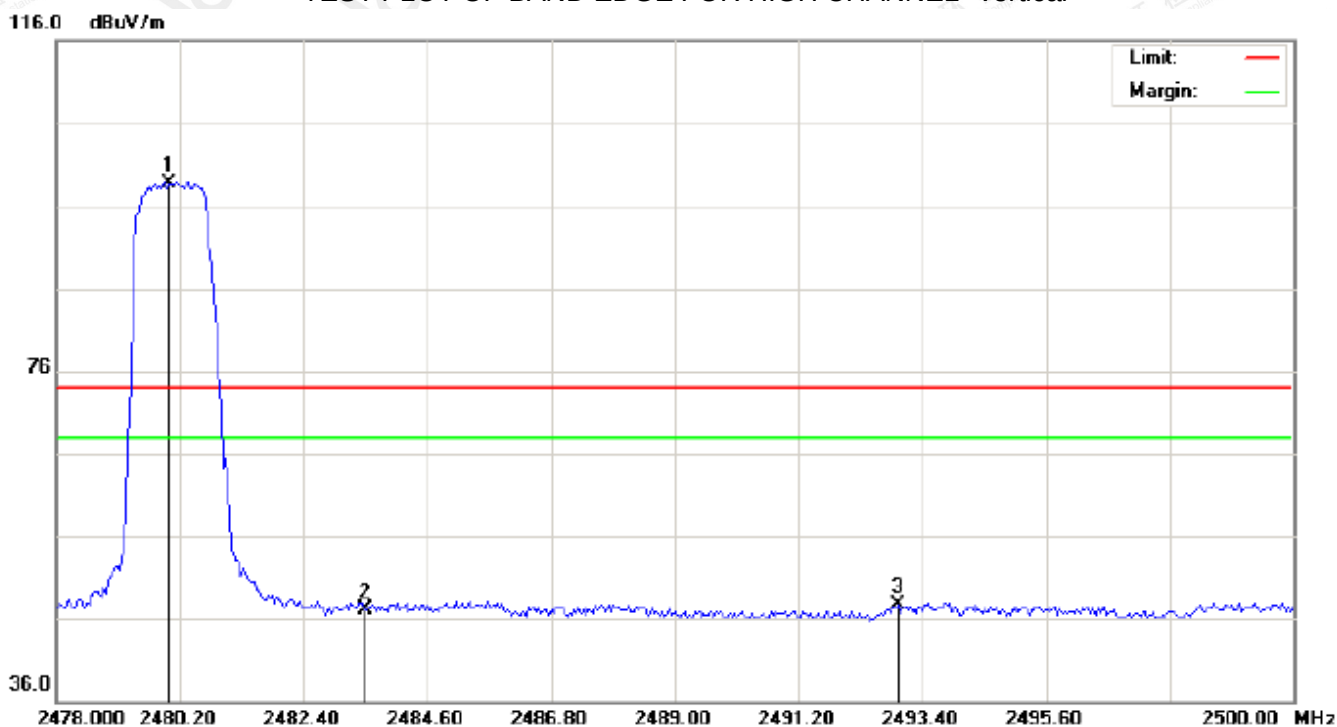
TEST PLOT OF BAND EDGE FOR HIGH CHANNEL –Horizontal



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2480.000 | 88.48   | 10.41  | 98.89       | 74.00  | 24.89  | peak     |                |              |         |
| 2   |    | 2483.500 | 37.19   | 10.41  | 47.60       | 74.00  | -26.40 | peak     |                |              |         |
| 3   |    | 2493.437 | 36.86   | 10.42  | 47.28       | 74.00  | -26.72 | peak     |                |              |         |

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TEST PLOT OF BAND EDGE FOR HIGH CHANNEL -Vertical



| No. | Mk | Freq.    | Reading | Factor | Measurement | Limit  | Over   | Detector | Antenna Height | Table Degree | Comment |
|-----|----|----------|---------|--------|-------------|--------|--------|----------|----------------|--------------|---------|
|     |    | MHz      | dBuV    | dB/m   | dBuV/m      | dBuV/m | dB     |          | cm             | degree       |         |
| 1   | *  | 2480.000 | 88.32   | 10.41  | 98.73       | 74.00  | 24.73  | peak     |                |              |         |
| 2   |    | 2483.500 | 36.76   | 10.41  | 47.17       | 74.00  | -26.83 | peak     |                |              |         |
| 3   |    | 2492.960 | 37.22   | 10.42  | 47.64       | 74.00  | -26.36 | peak     |                |              |         |

RESULT: PASS

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## 10. 6DB BANDWIDTH

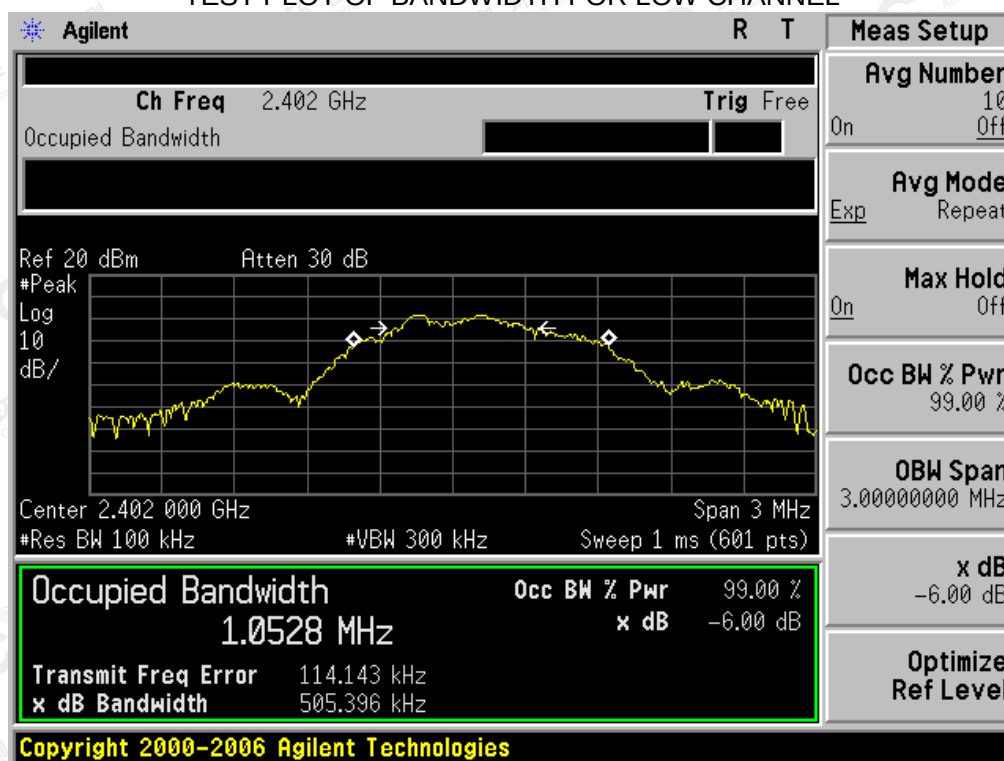
### 10.1. TEST PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW $\geq$ 3\*RBW.
4. Set SPA Trace 1 Max hold, then View.

### 10.2. SUMMARY OF TEST RESULTS/PLOTS

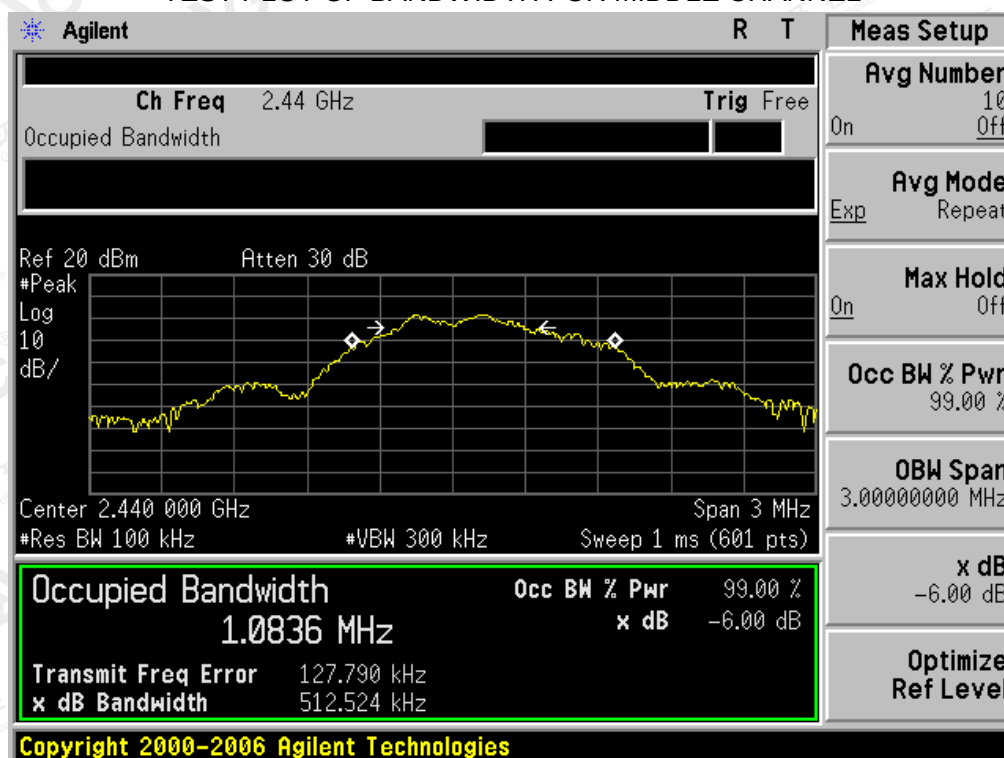
| Channel | 6dB Bandwidth (KHz) | Minimum Limit (KHz) | Pass/Fail |
|---------|---------------------|---------------------|-----------|
| Low     | 505                 | 500KHz              | Pass      |
| Middle  | 513                 |                     | Pass      |
| High    | 524                 |                     | Pass      |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

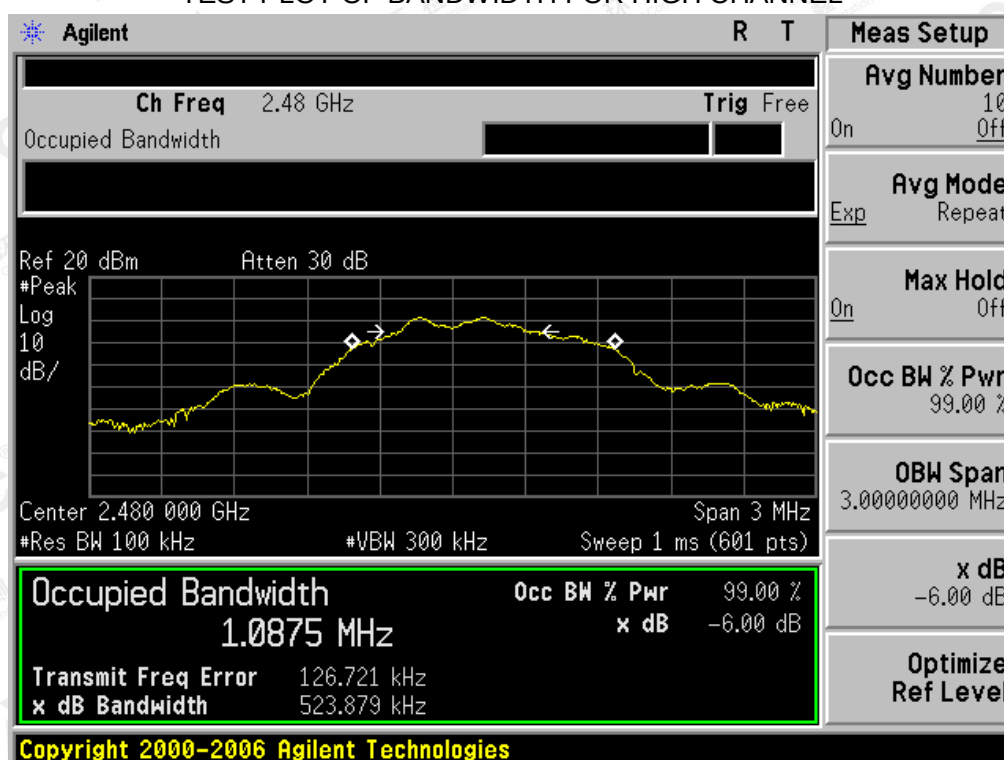


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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



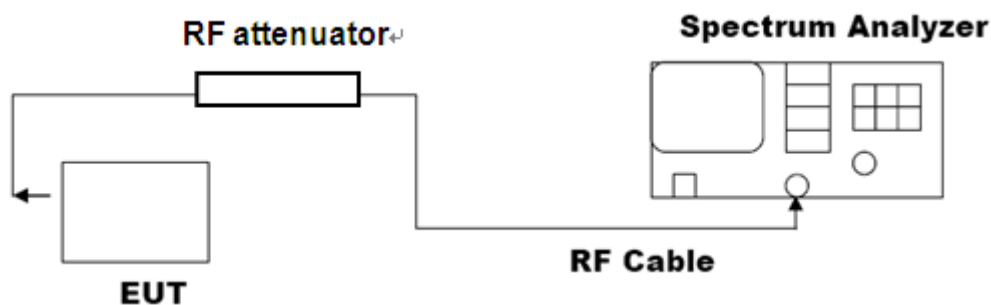
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## 11. CONDUCTED OUTPUT POWER

### 11.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, middle and the bottom operation frequency individually.
3. Use the following spectrum analyzer settings:
  - a) Set the RBW  $\geq$  DTS bandwidth.
  - b) Set VBW  $\geq$  3 RBW.
  - c) Set span  $\geq$  3 x RBW
  - d) Sweep time = auto couple.
  - e) Detector = peak.
  - f) Trace mode = max hold.
  - g) Allow trace to fully stabilize.
  - h) Use peak marker function to determine the peak amplitude level.
4. Allow the trace to stabilize.
5. Record the result form the Spectrum Analyzer.

### 11.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

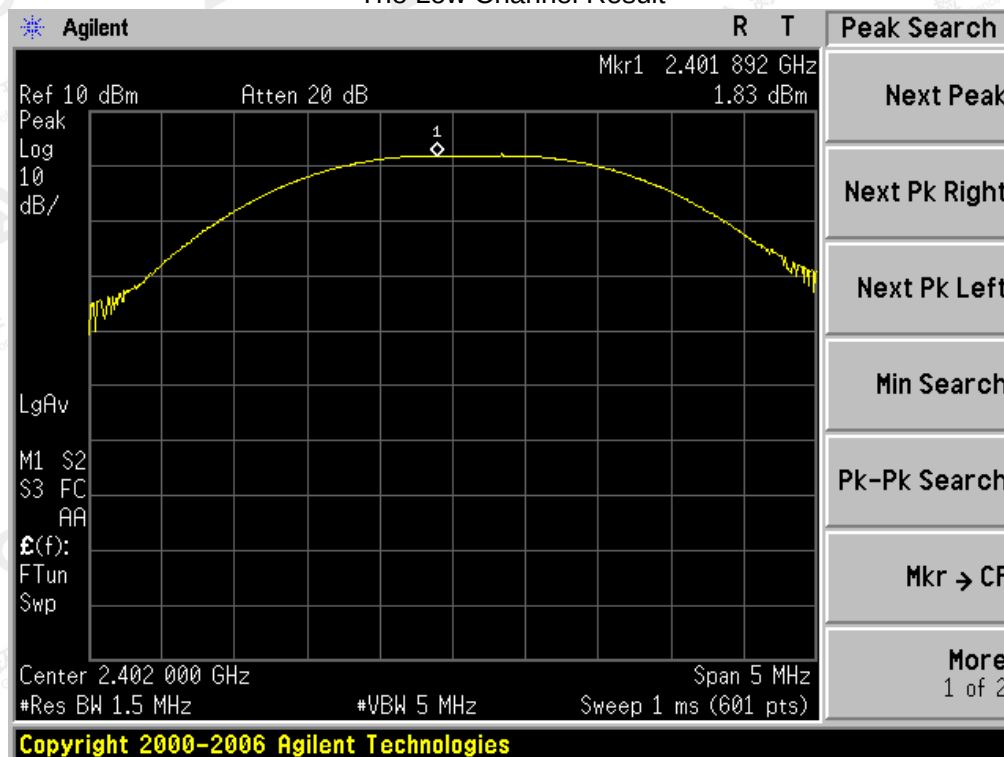


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### 11.3. LIMITS AND MEASUREMENT RESULT

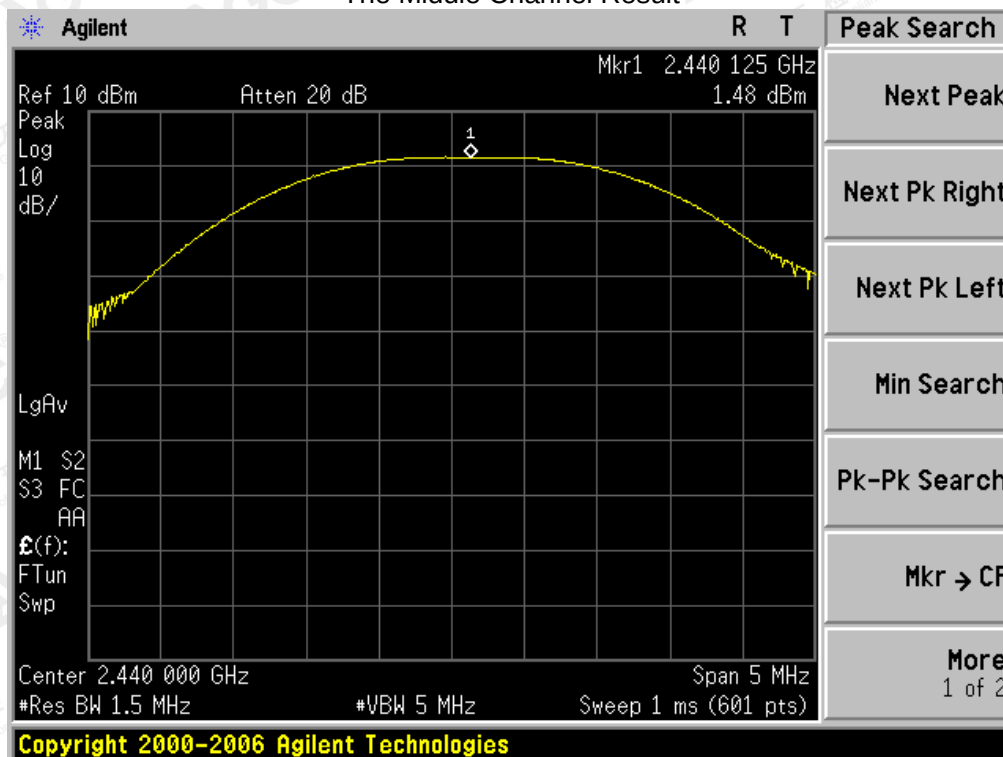
| Channel        | Peak Power (dBm) | Applicable Limits (dBm) | Pass/Fail |
|----------------|------------------|-------------------------|-----------|
| Low Channel    | 1.83             | 30                      | Pass      |
| Middle Channel | 1.48             | 30                      | Pass      |
| High Channel   | 1.15             | 30                      | Pass      |

The Low Channel Result

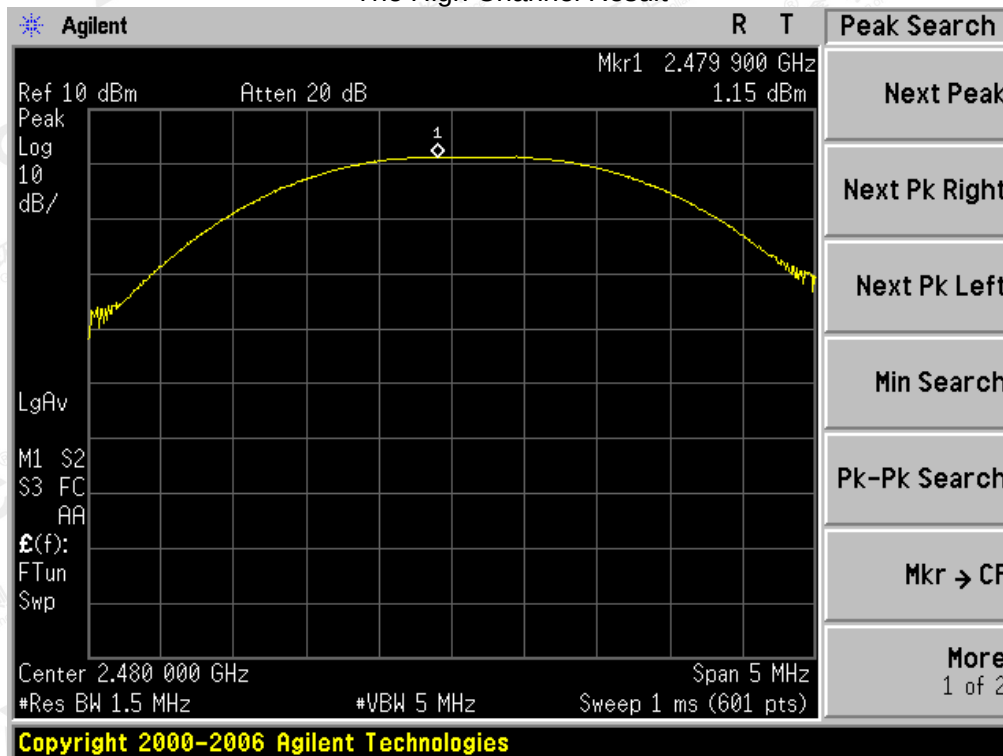


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### The Middle Channel Result



### The High Channel Result



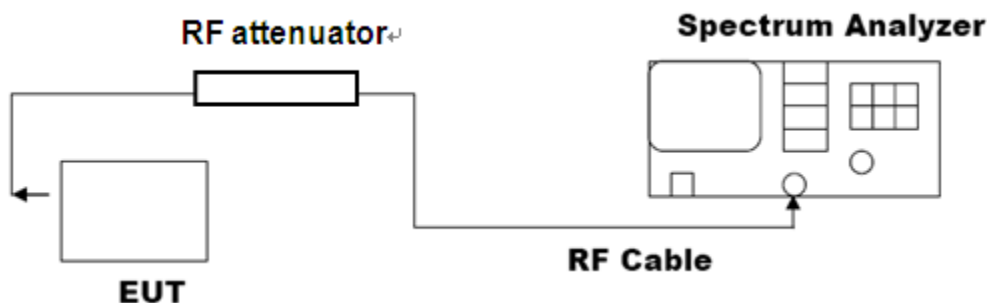
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## 12. CONDUCTED SPURIOUS EMISSION

### 12.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.  
RBW = 100kHz; VBW = 300kHz; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

### 12.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

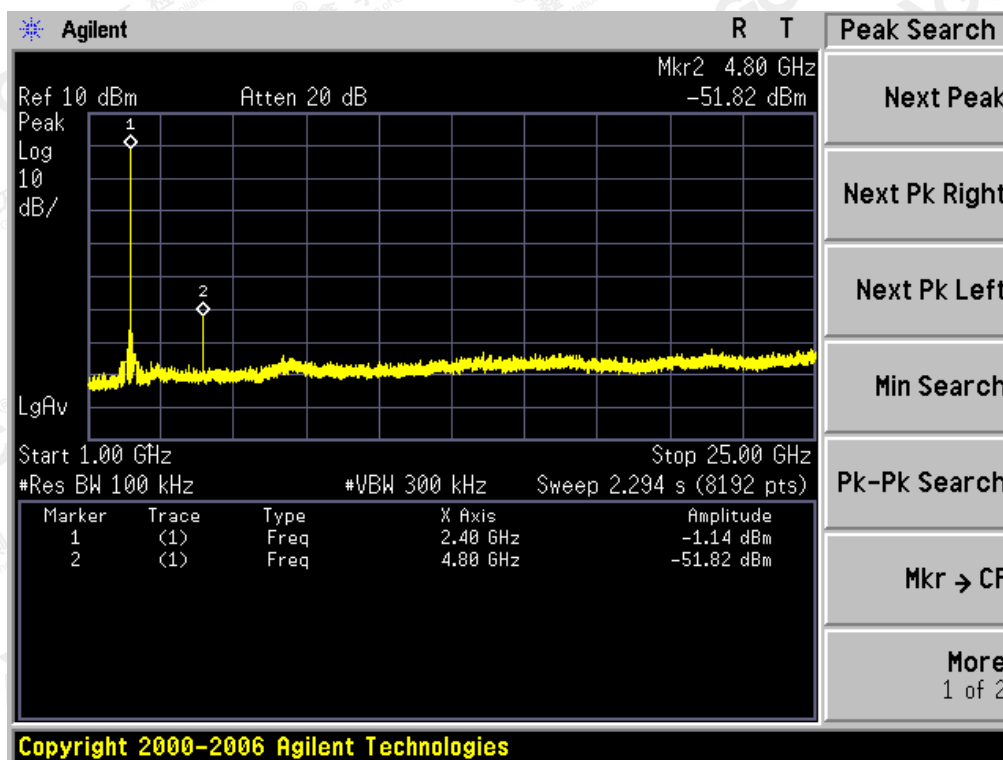
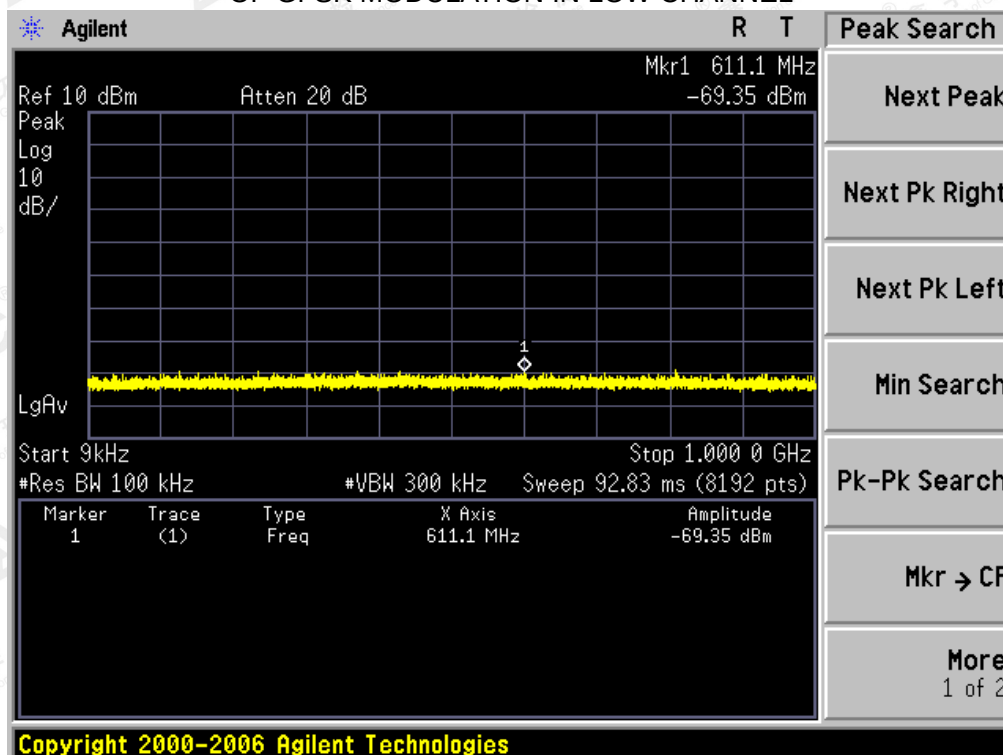


### 12.3. LIMITS AND MEASUREMENT RESULT

| LIMITS AND MEASUREMENT RESULT                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|--------|
| Applicable Limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Measurement Result                                             |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Test Data                                                      | Result |
| In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.<br>In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a) | At least -20dBc than the limit Specified on the BOTTOM Channel | PASS   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | At least -20dBc than the limit Specified on the TOP Channel    | PASS   |

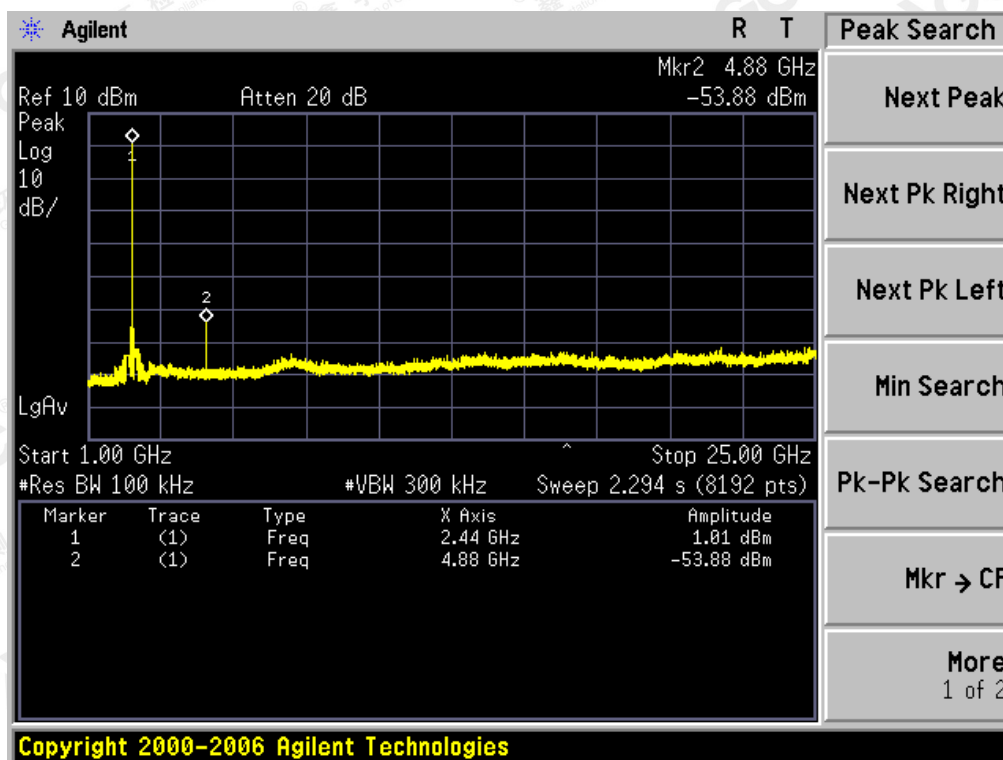
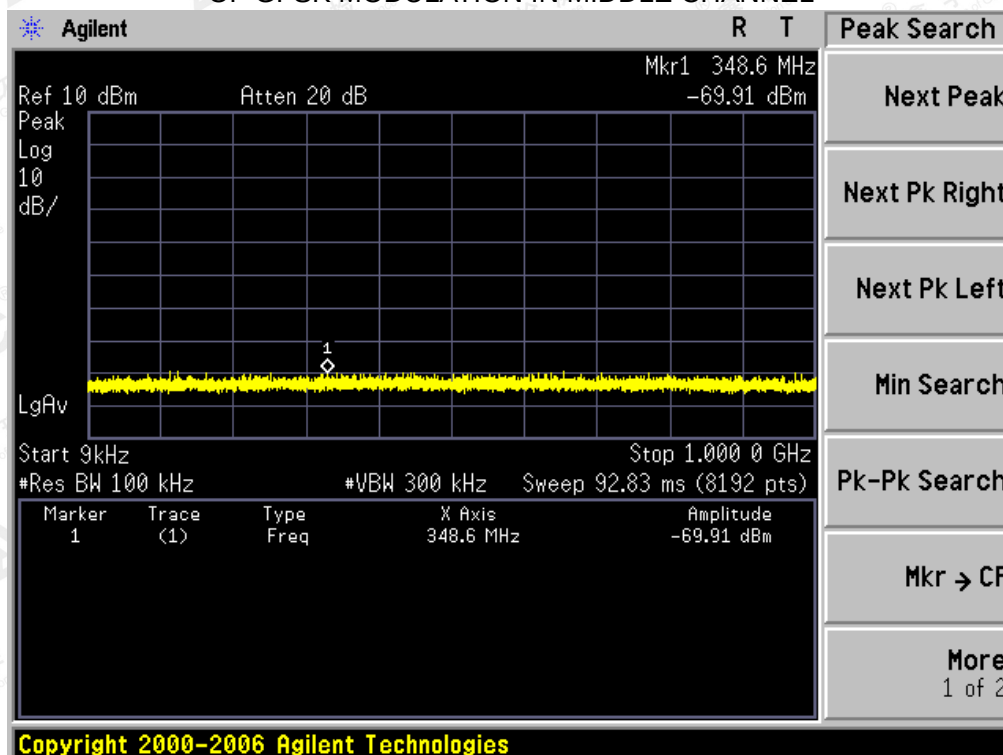
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**TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE  
OF GFSK MODULATION IN LOW CHANNEL**



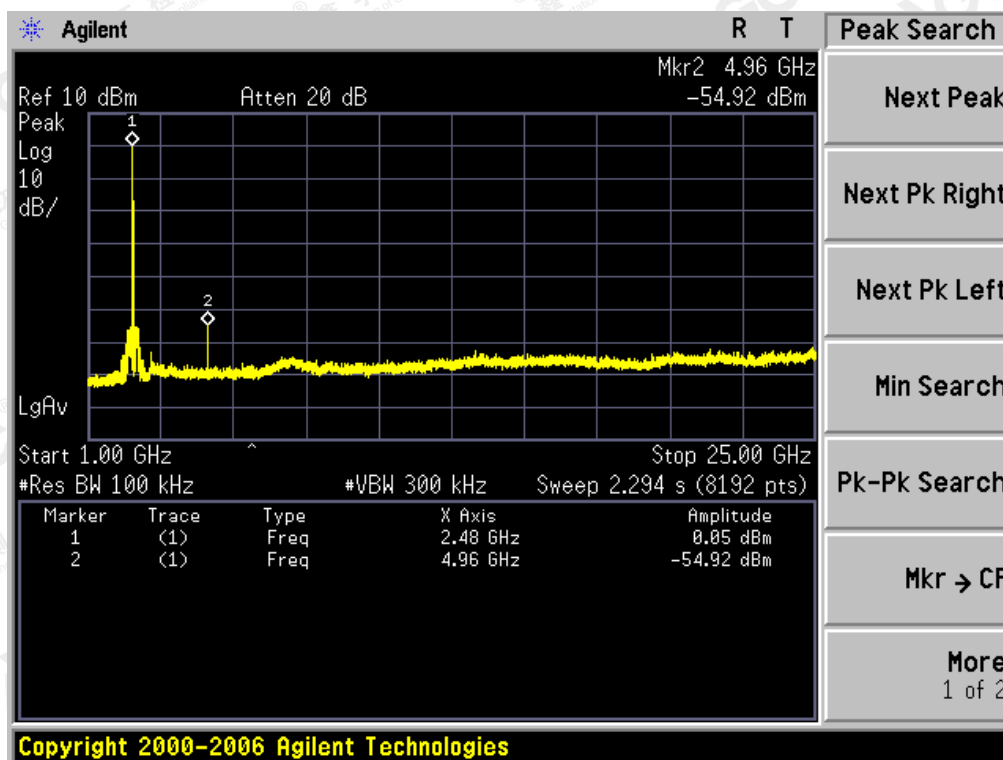
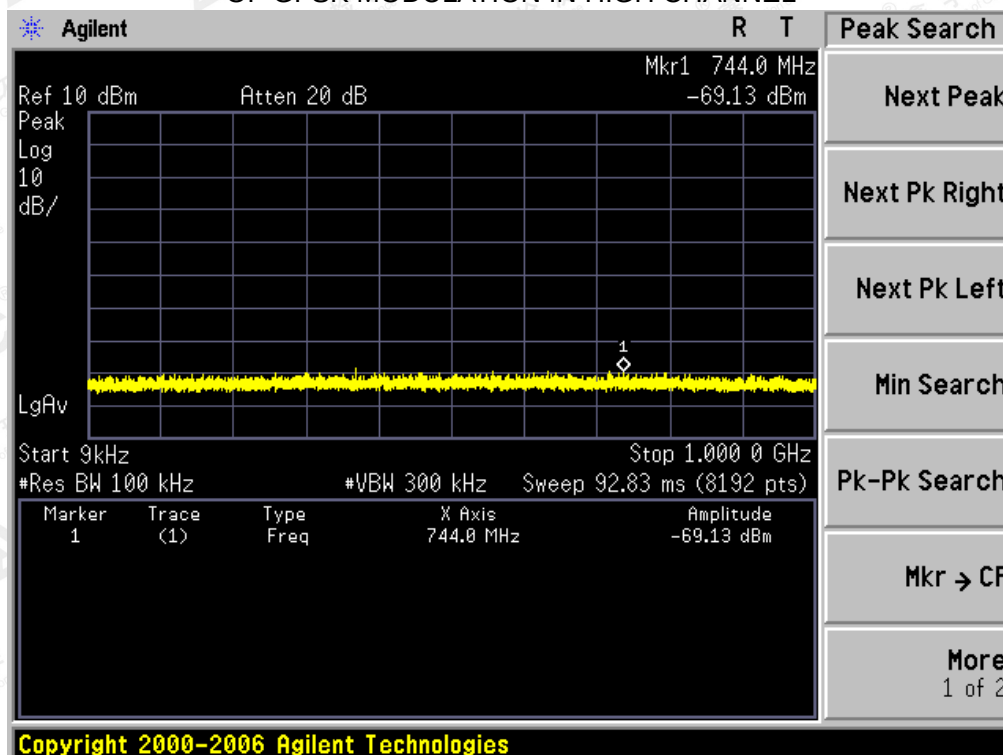
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TEST PLOT OF OUT OF BAND EMISSIONS  
OF GFSK MODULATION IN MIDDLE CHANNEL



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TEST PLOT OF OUT OF BAND EMISSIONS  
OF GFSK MODULATION IN HIGH CHANNEL



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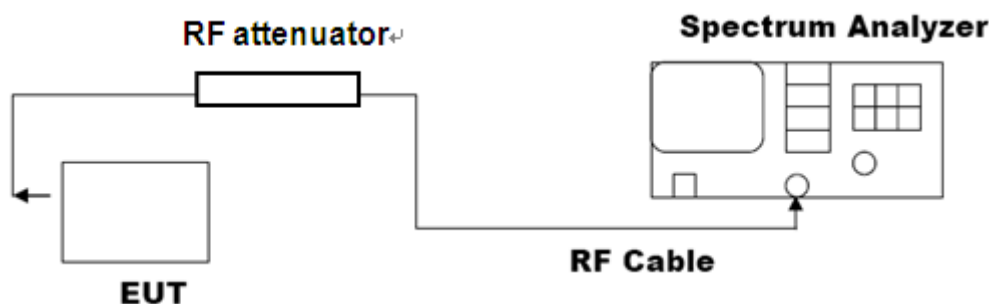
### 13. CONDUCTED OUTPUT POWER SPECTRAL DENSITY

#### 13.1 MEASUREMENT PROCEDURE

- (1). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- (2). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- (3). Set the span to 1.5times the DTS bandwidth, RBW:  $3\text{kHz} \leq \text{RBW} \leq 100\text{kHz}$ , VBW  $\geq 3 \times \text{RBW}$
- (4). Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

#### 13.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

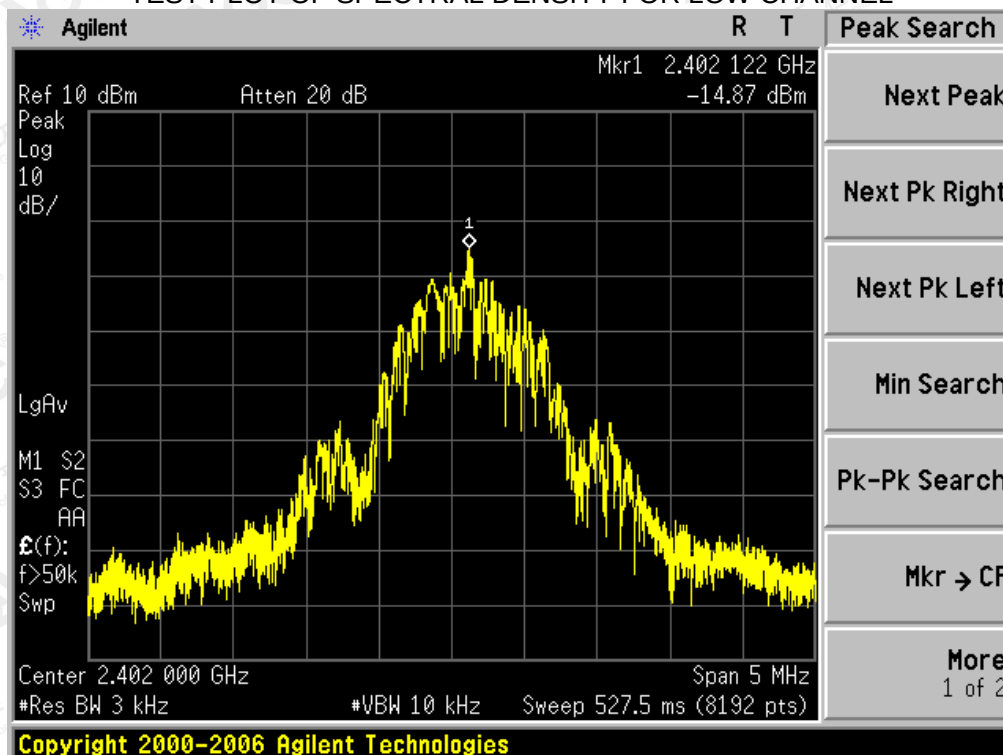


#### 13.3 LIMITS AND MEASUREMENT RESULT

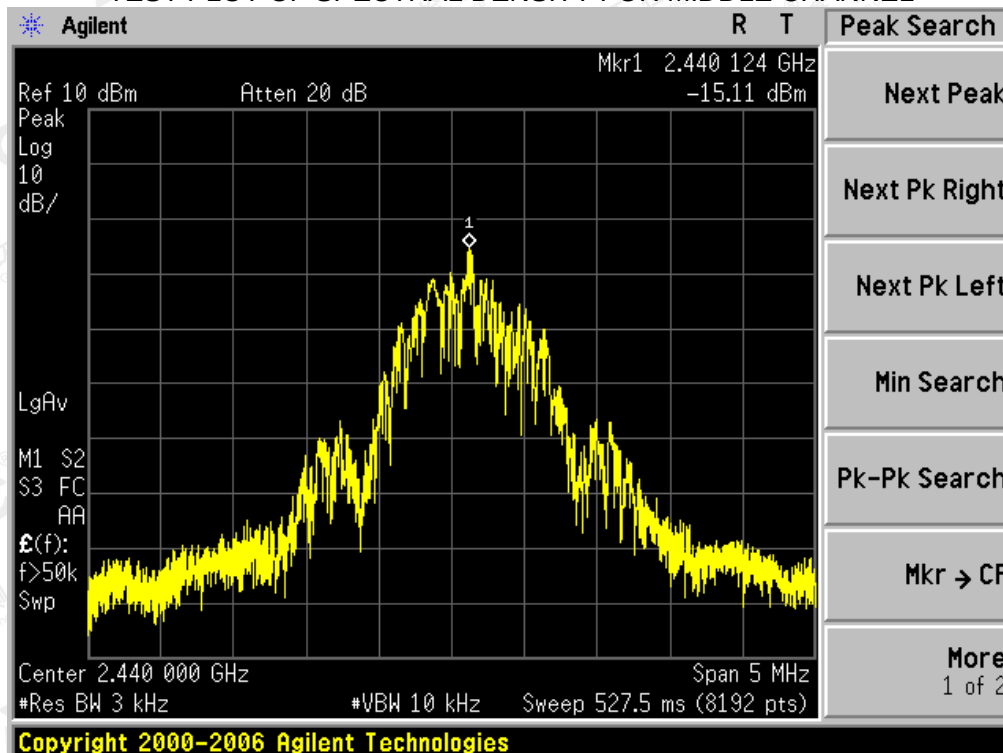
| Channel No.    | PSD<br>(dBm/3KHz) | Limit<br>(dBm/3KHz) | Result |
|----------------|-------------------|---------------------|--------|
| Low Channel    | -14.87            | 8                   | Pass   |
| Middle Channel | -15.11            | 8                   | Pass   |
| High Channel   | -15.66            | 8                   | Pass   |

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### TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

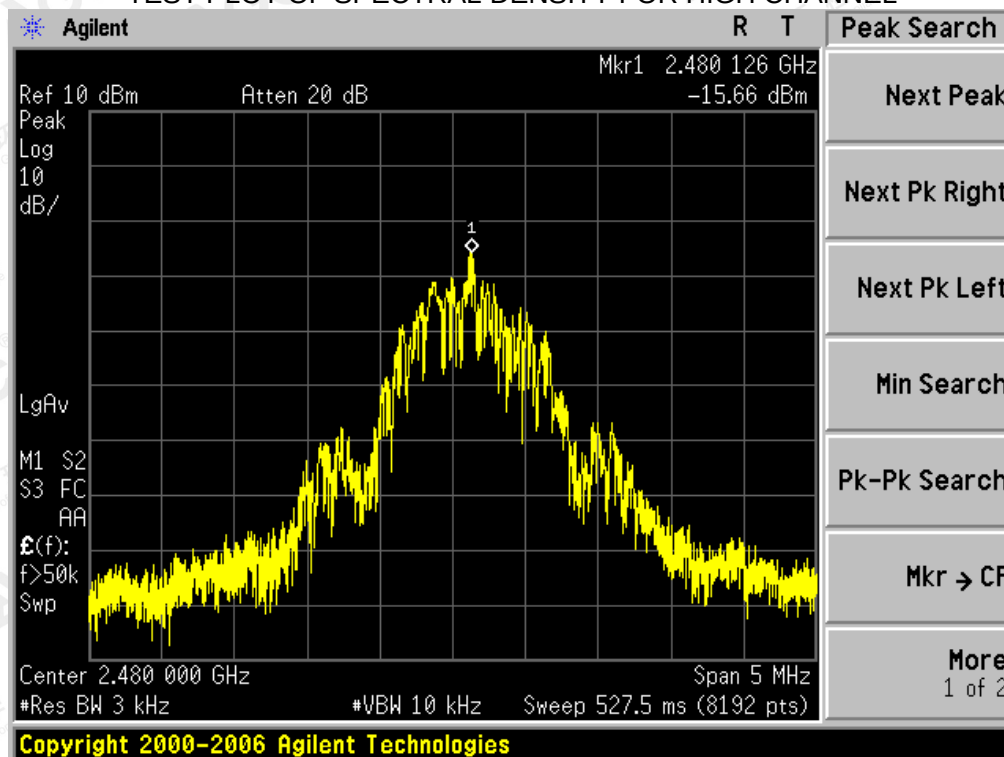


### TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL



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TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL



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## 14. LINE CONDUCTED EMISSION TEST

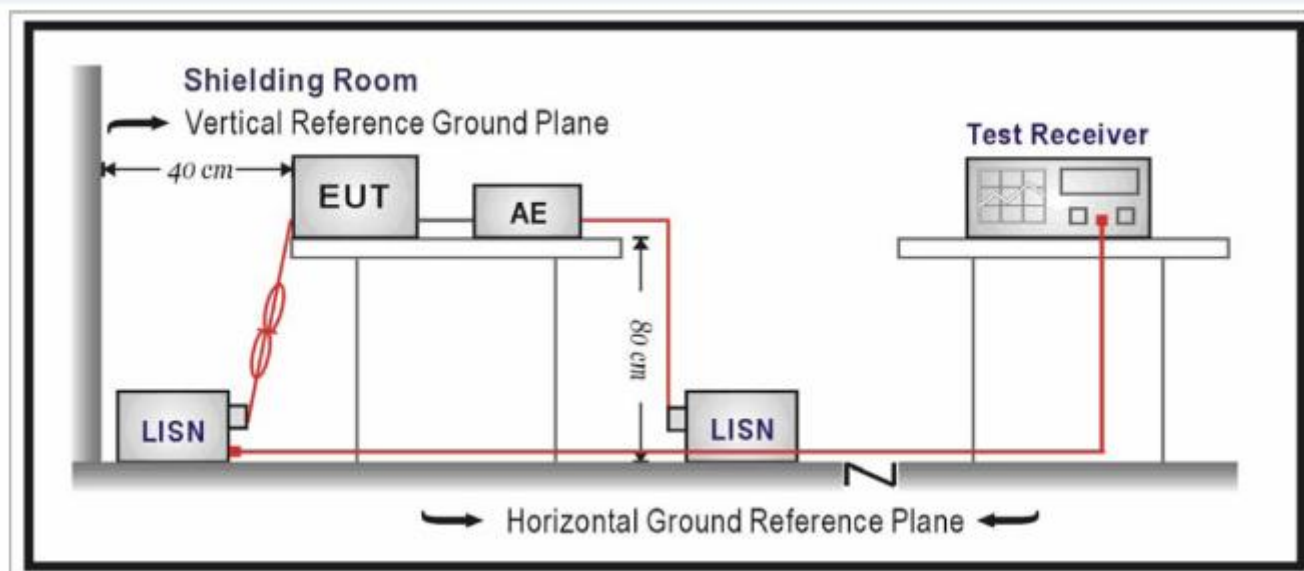
### 14.1 LIMITS

| Frequency     | Maximum RF Line Voltage |                |
|---------------|-------------------------|----------------|
|               | Q.P.( dBuV)             | Average( dBuV) |
| 150kHz~500kHz | 66-56                   | 56-46          |
| 500kHz~5MHz   | 56                      | 46             |
| 5MHz~30MHz    | 60                      | 50             |

Note: 1. The lower limit shall apply at the transition frequency.

2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz

### 14.2 TEST SETUP



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### 14.3 PRELIMINARY PROCEDURE

- 1) The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- 2) Support equipment, if needed, was placed as per ANSI C63.10.
- 3) All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4) All support equipments received AC120V/60Hz power from a LISN, if any.
- 5) The EUT received DC charging voltage by adapter which received 120V/60Hz power by a LISN.
- 6) The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7) Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
- 8) During the above scans, the emissions were maximized by cable manipulation.
- 9) The following test mode(s) were scanned during the preliminary test.  
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

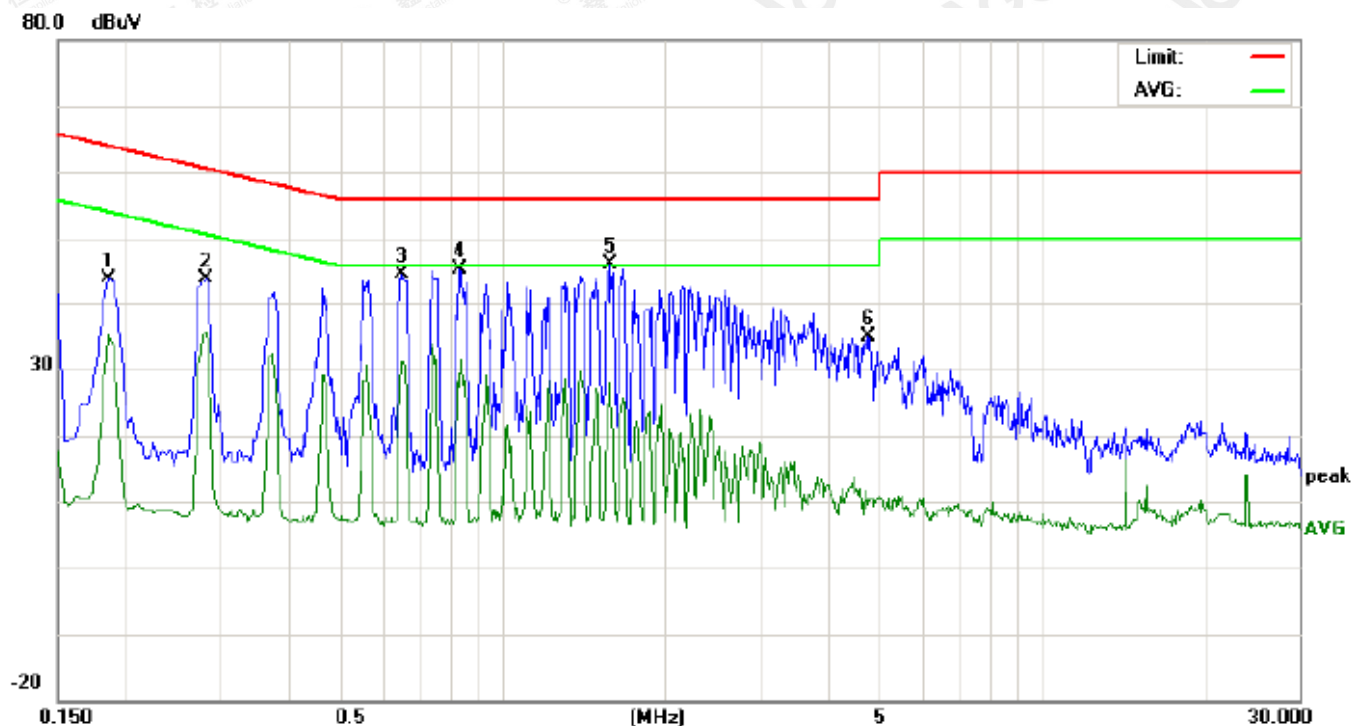
### 14.4 FINAL TEST PROCEDURE

- 1) EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
- 2) A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less -2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
- 3) The test data of the worst case condition(s) was reported on the Summary Data page.

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**14.5 TEST RESULT OF POWER LINE**  
**By adapter (worst case)**  
**FOR BLE**

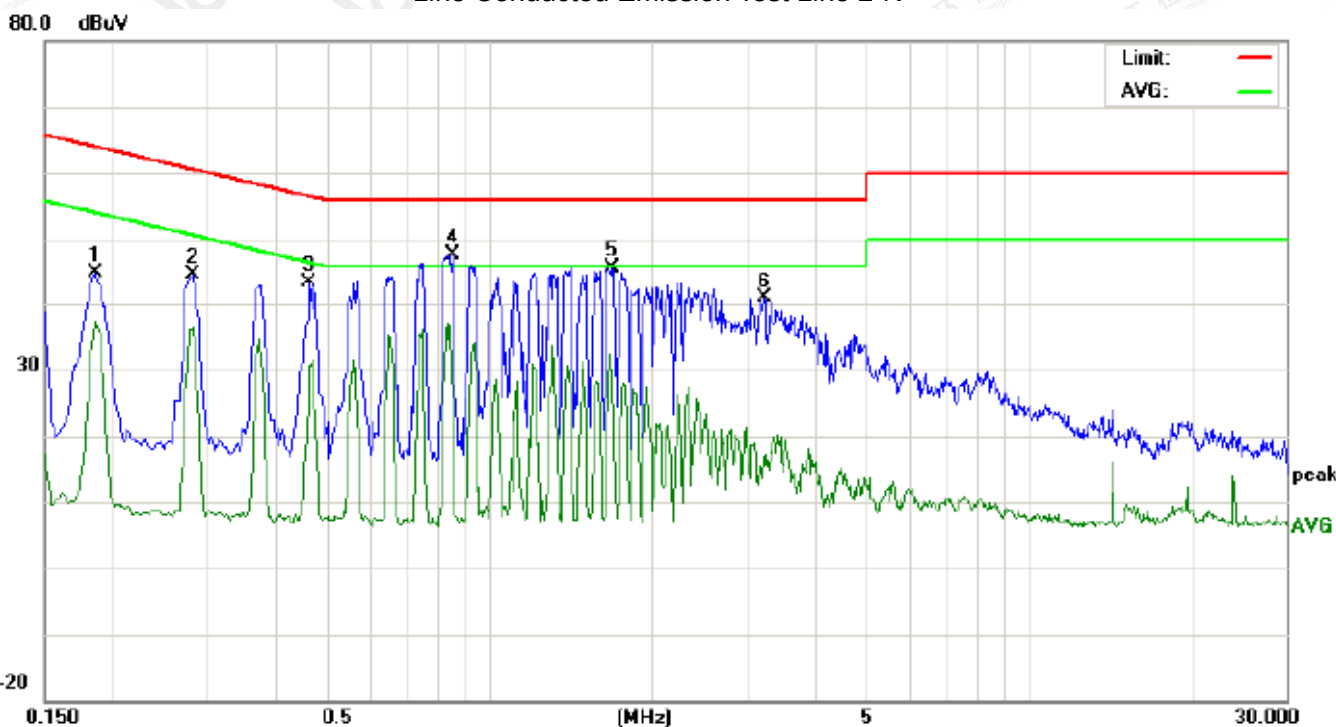
Line Conducted Emission Test Line 1-L



| No. | Freq. (MHz) | Reading_Level (dBuV) |    |       | Correct Factor (dB) | Measurement (dBuV) |    |       | Limit (dBuV) |       | Margin (dB) |        | P/F | Comment |
|-----|-------------|----------------------|----|-------|---------------------|--------------------|----|-------|--------------|-------|-------------|--------|-----|---------|
|     |             | Peak                 | QP | AVG   |                     | Peak               | QP | AVG   | QP           | AVG   | QP          | AVG    |     |         |
| 1   | 0.1860      | 33.78                |    | 24.99 | 10.20               | 43.98              |    | 35.19 | 64.21        | 54.21 | -20.23      | -19.02 | P   |         |
| 2   | 0.2819      | 33.49                |    | 25.35 | 10.28               | 43.77              |    | 35.63 | 60.76        | 50.76 | -16.99      | -15.13 | P   |         |
| 3   | 0.6540      | 34.21                |    | 20.79 | 10.33               | 44.54              |    | 31.12 | 56.00        | 46.00 | -11.46      | -14.88 | P   |         |
| 4   | 0.8340      | 35.17                |    | 17.02 | 10.32               | 45.49              |    | 27.34 | 56.00        | 46.00 | -10.51      | -18.66 | P   |         |
| 5   | 1.5820      | 35.78                |    | 17.51 | 10.35               | 46.13              |    | 27.86 | 56.00        | 46.00 | -9.87       | -18.14 | P   |         |
| 6   | 4.7699      | 24.61                |    | 0.18  | 10.23               | 34.84              |    | 10.41 | 56.00        | 46.00 | -21.16      | -35.59 | P   |         |

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Line Conducted Emission Test Line 2-N



| No. | Freq. (MHz) | Reading Level (dBuV) |    |       | Correct Factor (dB) | Measurement (dBuV) |    |       | Limit (dBuV) |       | Margin (dB) |        | P/F | Comment |
|-----|-------------|----------------------|----|-------|---------------------|--------------------|----|-------|--------------|-------|-------------|--------|-----|---------|
|     |             | Peak                 | QP | AVG   |                     | Peak               | QP | AVG   | QP           | AVG   | QP          | AVG    |     |         |
| 1   | 0.1860      | 34.71                |    | 27.17 | 10.20               | 44.91              |    | 37.37 | 64.21        | 54.21 | -19.30      | -16.84 | P   |         |
| 2   | 0.2819      | 34.39                |    | 26.10 | 10.28               | 44.67              |    | 36.38 | 60.76        | 50.76 | -16.09      | -14.38 | P   |         |
| 3   | 0.4660      | 32.91                |    | 20.22 | 10.38               | 43.29              |    | 30.60 | 56.58        | 46.58 | -13.29      | -15.98 | P   |         |
| 4   | 0.8540      | 37.36                |    | 15.86 | 10.35               | 47.71              |    | 26.21 | 56.00        | 46.00 | -8.29       | -19.79 | P   |         |
| 5   | 1.6900      | 35.20                |    | 19.11 | 10.32               | 45.52              |    | 29.43 | 56.00        | 46.00 | -10.48      | -16.57 | P   |         |
| 6   | 3.2340      | 30.36                |    | 6.31  | 10.53               | 40.89              |    | 16.84 | 56.00        | 46.00 | -15.11      | -29.16 | P   |         |

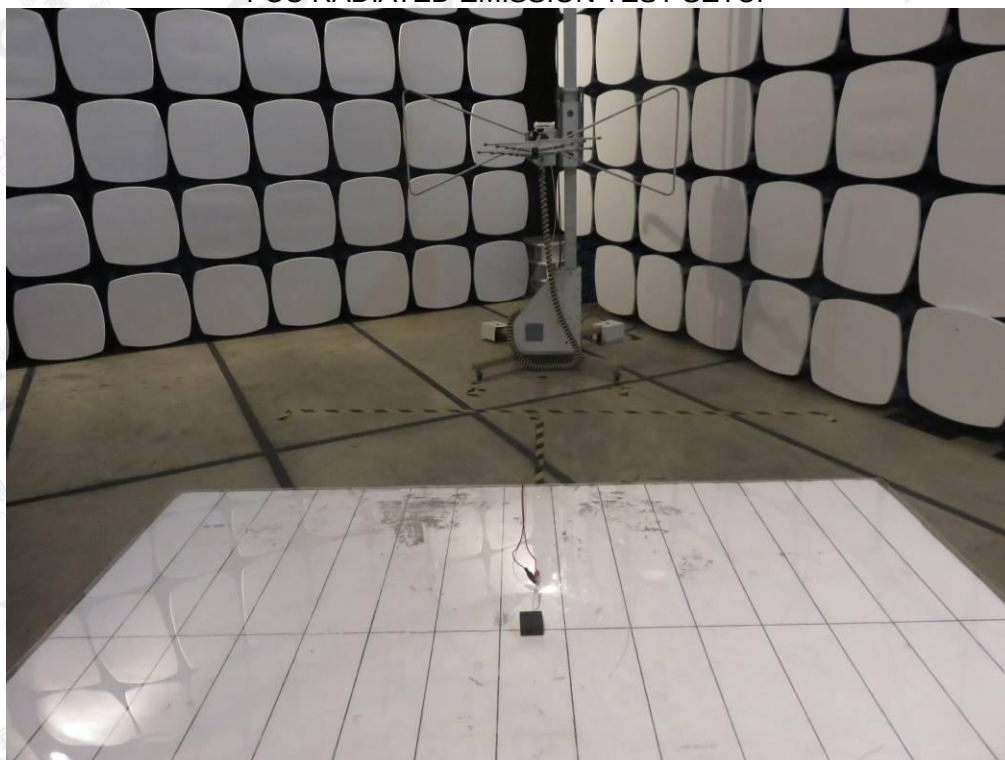
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## APPENDIX A: PHOTOGRAPHS OF TEST SETUP

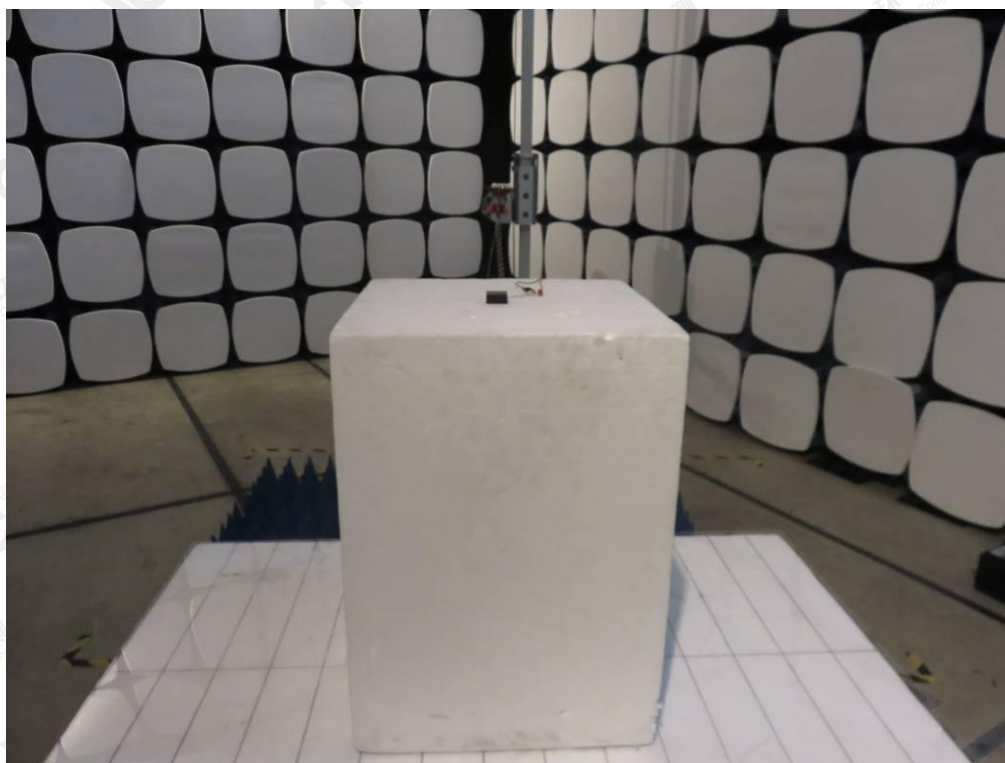
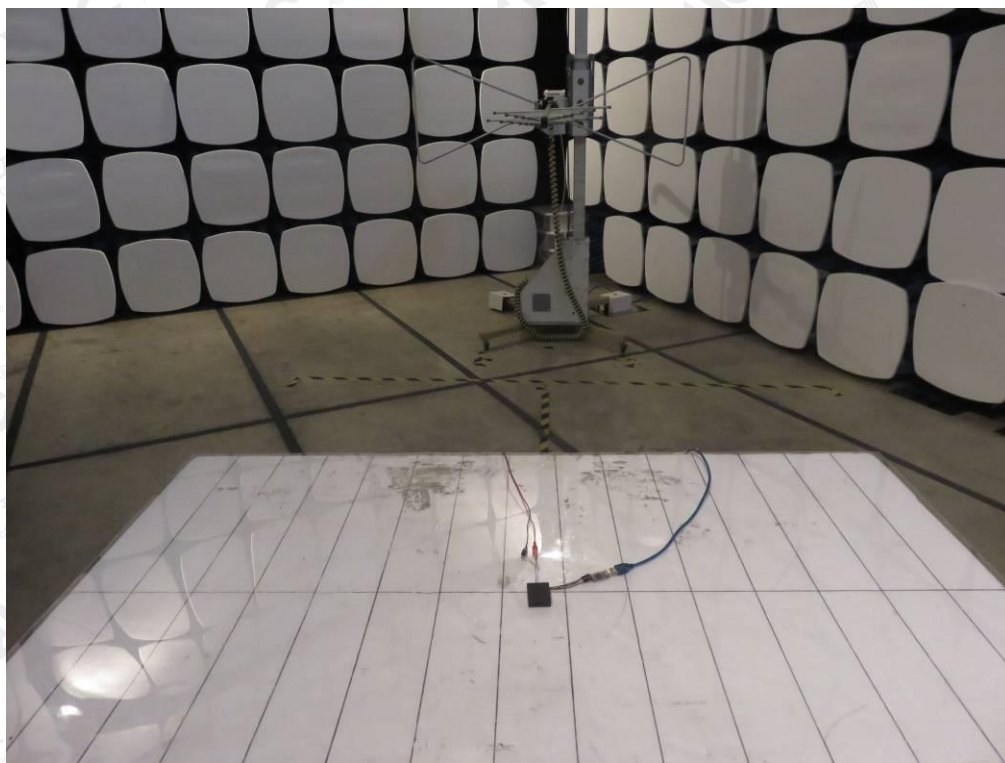
### FCC LINE CONDUCTED EMISSION TEST SETUP



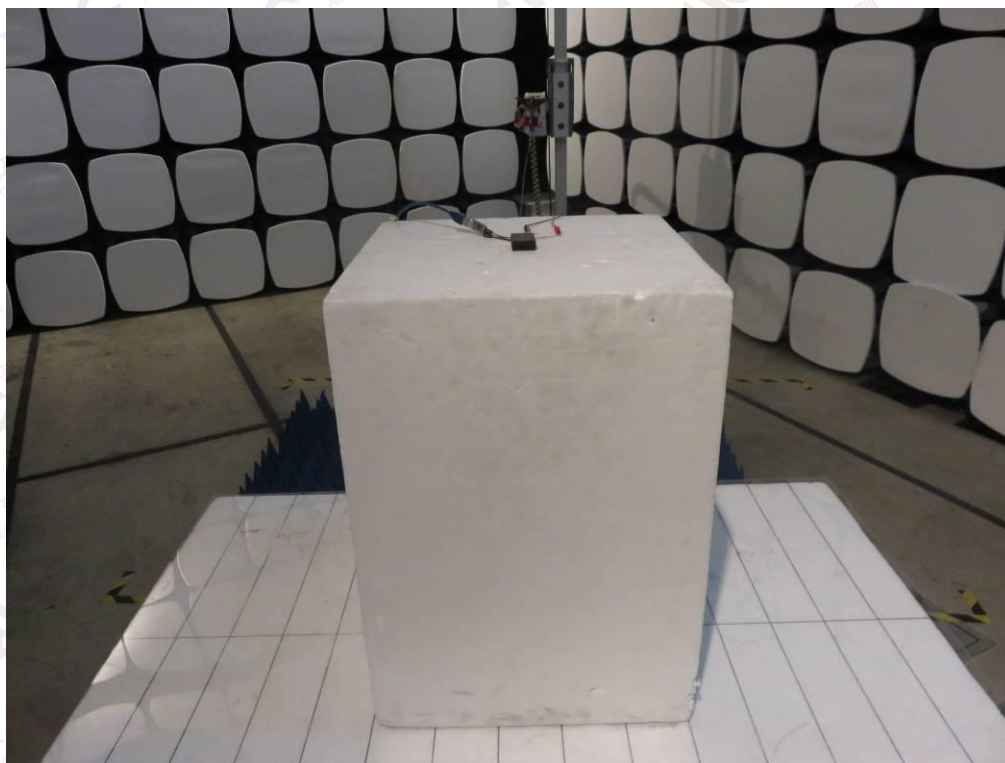
FCC RADIATED EMISSION TEST SETUP



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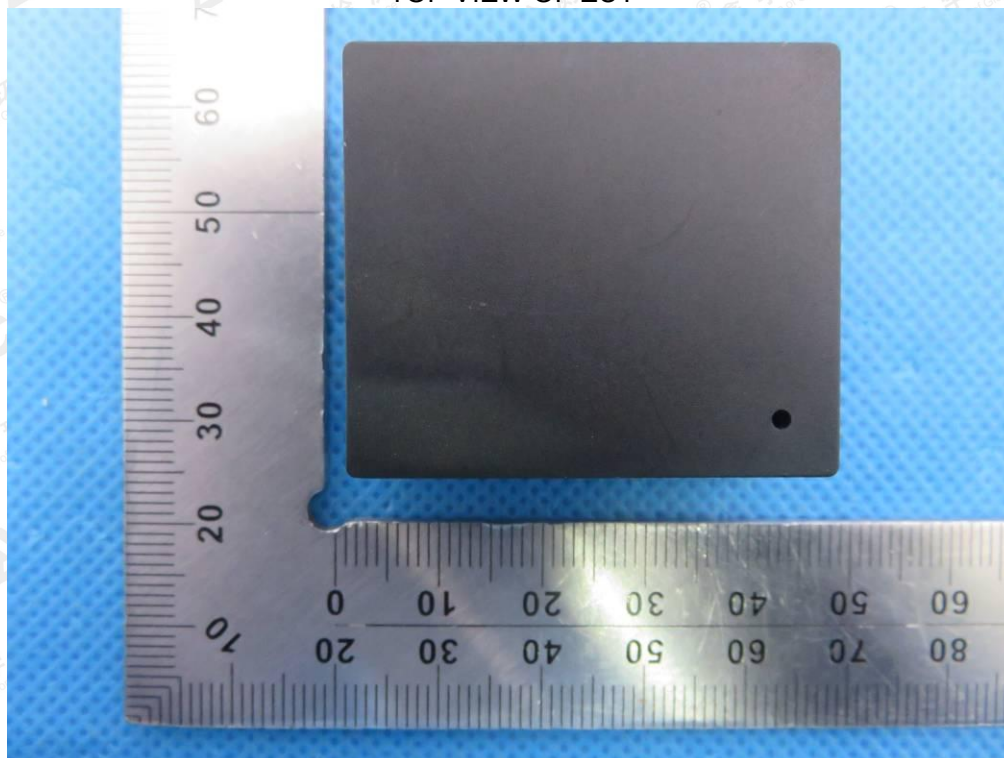
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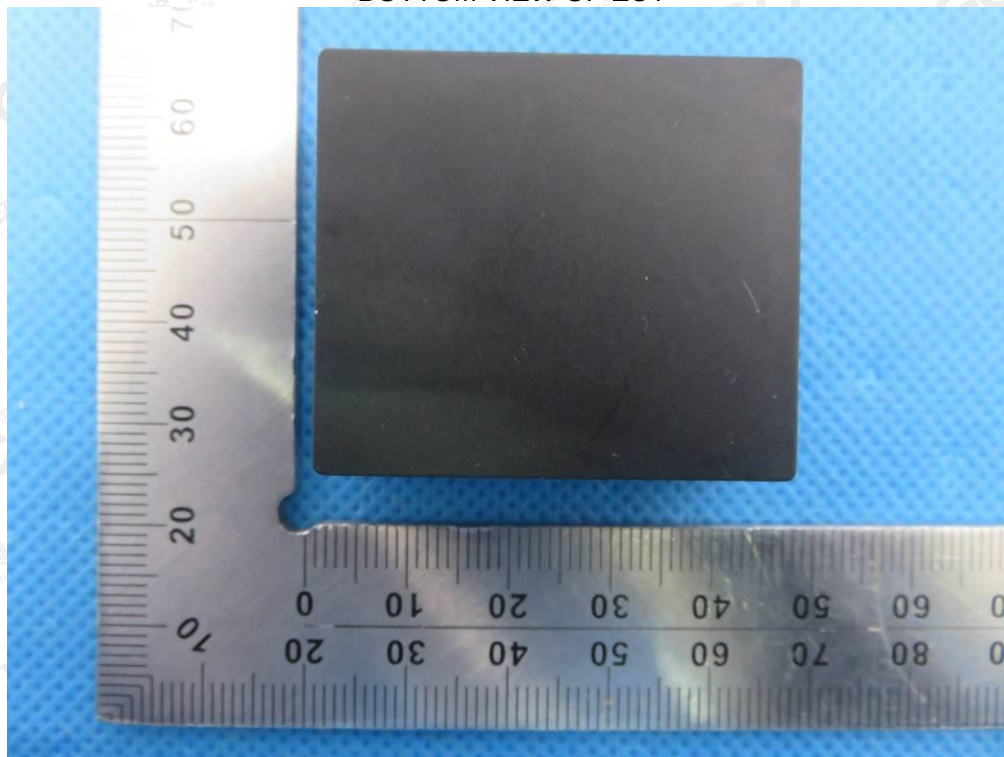
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## APPENDIX B: PHOTOGRAPHS OF EUT

### TOP VIEW OF EUT

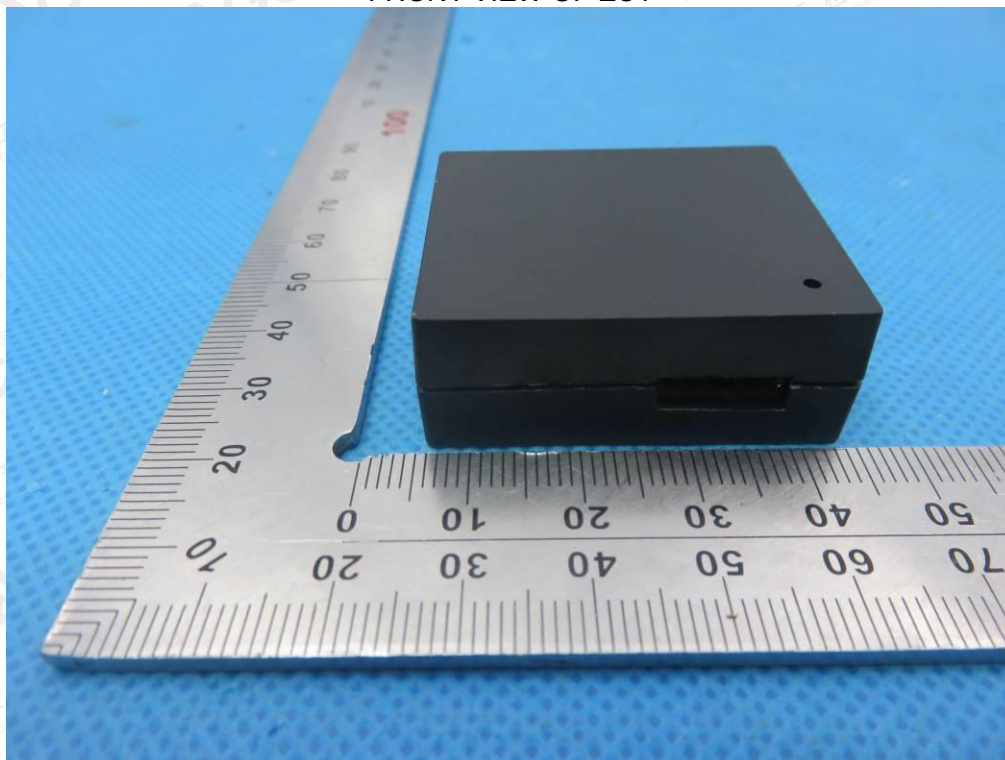


BOTTOM VIEW OF EUT

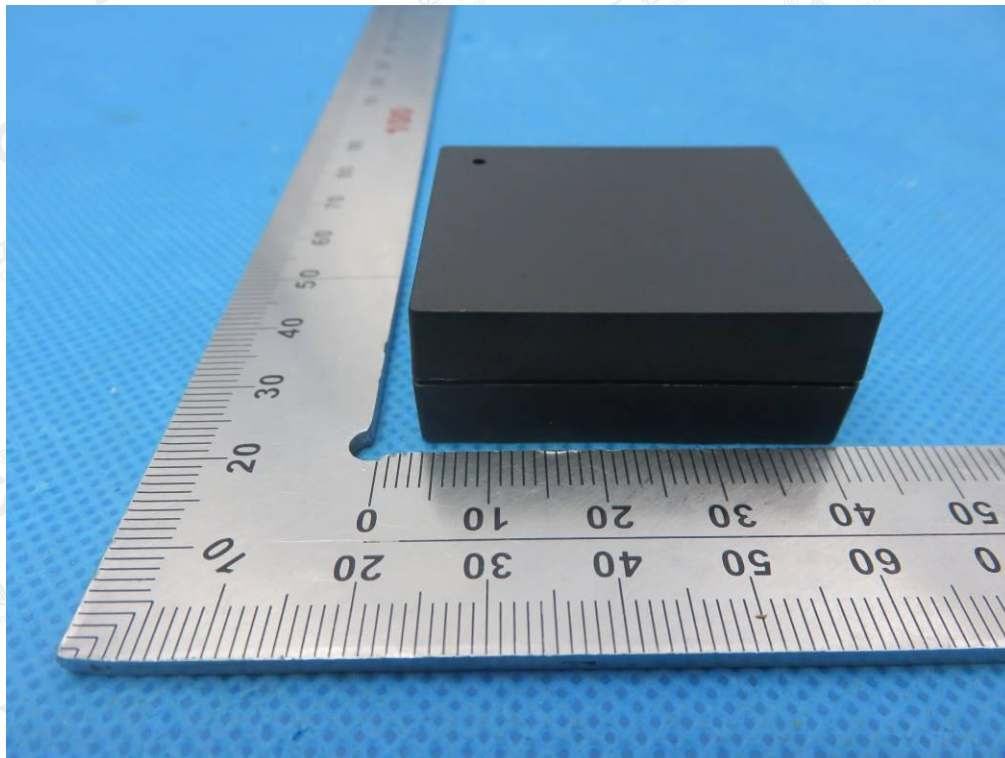


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FRONT VIEW OF EUT

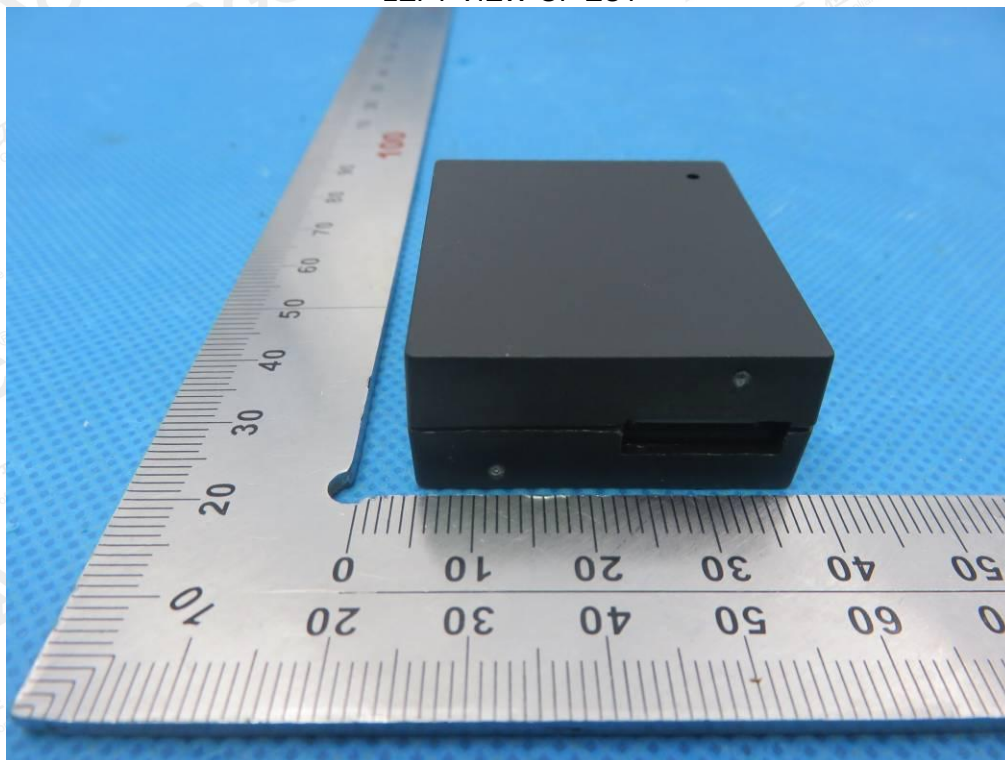


BACK VIEW OF EUT

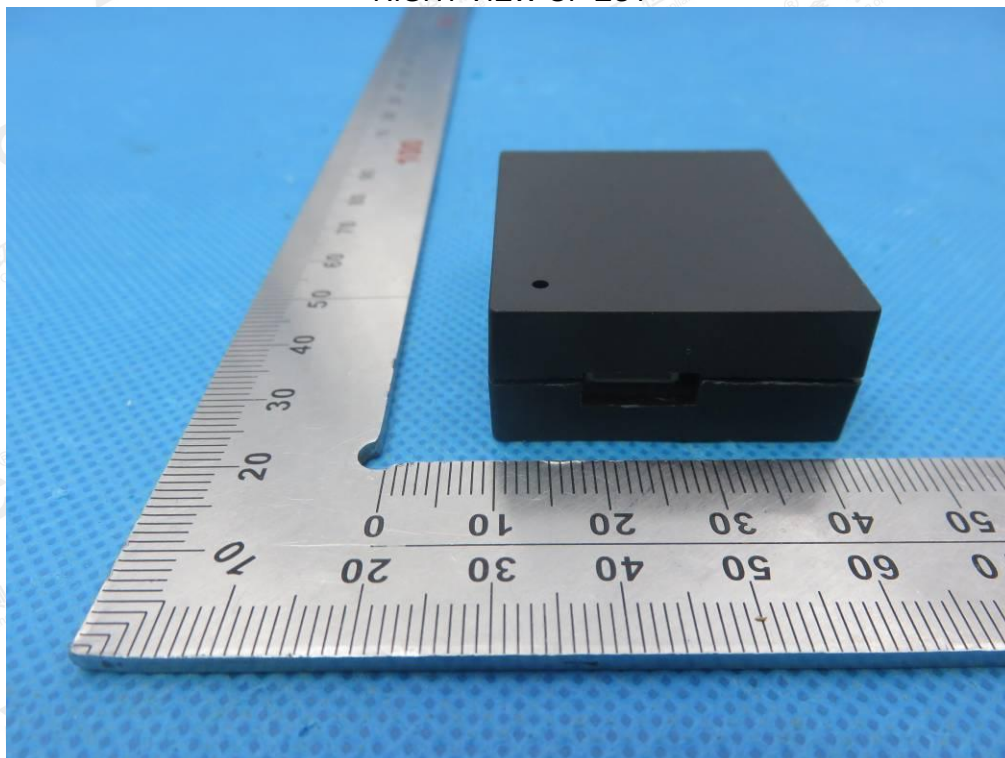


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LEFT VIEW OF EUT



RIGHT VIEW OF EUT



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VIEW OF EUT (PORT)

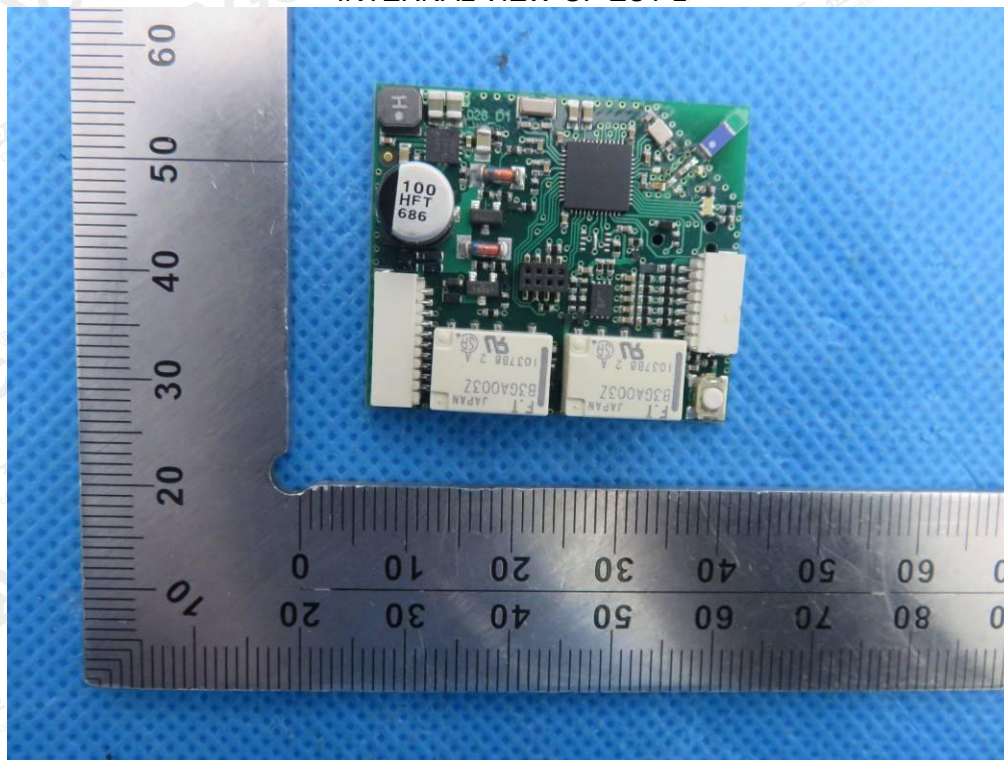


OPEN VIEW OF EUT

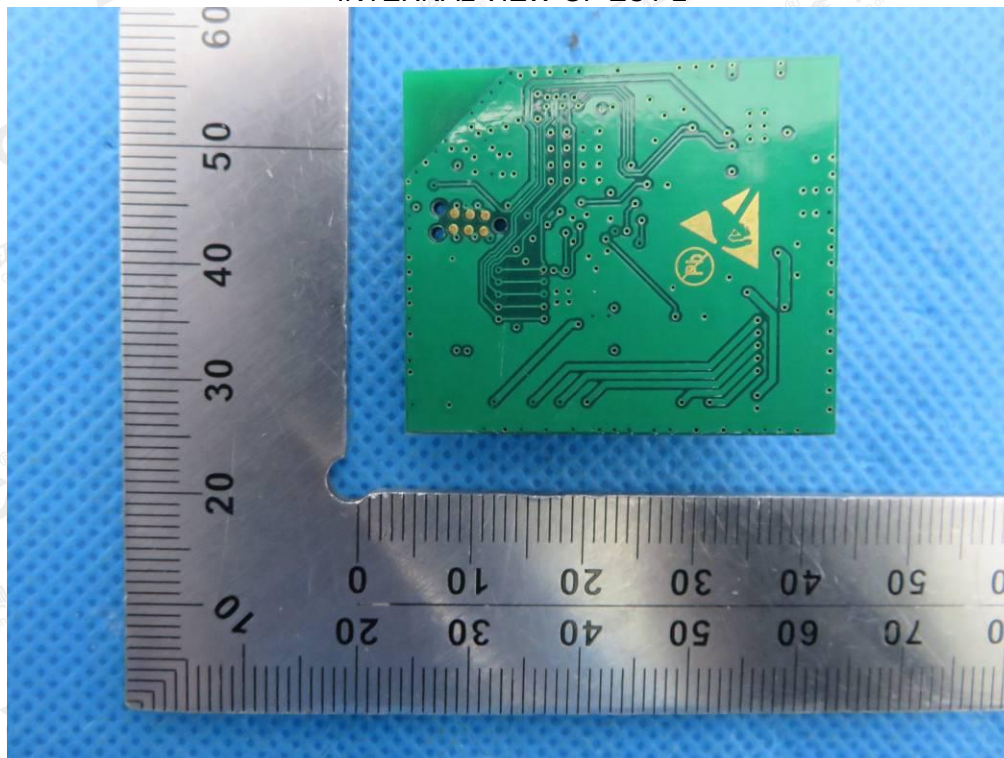


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INTERNAL VIEW OF EUT-1

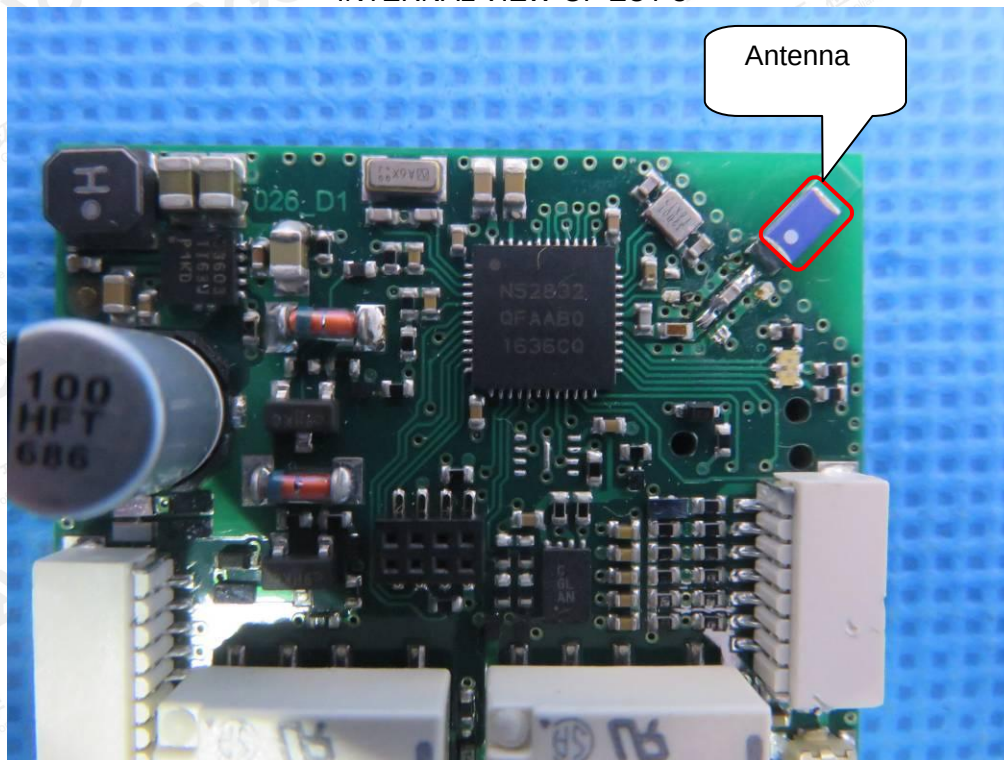


INTERNAL VIEW OF EUT-2



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INTERNAL VIEW OF EUT-3



VIEW OF ADAPTER (AE)



THE ADAPTER SUPPLIED BY AGC  
----END OF REPORT----

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