

**Shenzhen Global Test Service Co.,Ltd.**

1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong

**FCC PART 15 SUBPART C TEST REPORT****FCC PART 15.247****Report Reference No.....: GTSR17042032-01****FCC ID.....: 2AL2CBH693**

Compiled by

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Date of issue.....: May. 09, 2017

**Representative Laboratory Name.: Shenzhen Global Test Service Co.,Ltd.**

Address .....: 1F, Building No. 13A, Zhonghaixin Science and Technology City,  
No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District,  
Shenzhen, Guangdong

**Applicant's name.....: Shenzhen Leigao Technology Co. Ltd.**

Address .....: Room 101, unit 1 Mei Ran Building 4,Yan Nan Road,Futian  
District,Shenzhen City,Guangdong Province,China

**Test specification .....**

Standard .....: **FCC Part 15.247-2015: Operation within the bands 902-928  
MHz, 2400-2483.5 MHz and 5725-5850 MHz**

TRF Originator.....: Shenzhen Global Test Service Co.,Ltd.

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**Test item description .....: Bluetooth earphone**

Trade Mark .....: banpa

Manufacturer .....: Shenzhen Leigao Technology Co. Ltd.

Model/Type reference.....: BH693

Listed Models .....: /

Modulation Type .....: GFSK

Operation Frequency.....: From 2402MHz to 2480MHz

EUT Type .....: Production Unit

Hardware Version .....: CSR8610V1.2

Software Version .....: V1.0

Rating .....: DC 3.7V

Result.....: **PASS**

**TEST REPORT**

|                                          |               |
|------------------------------------------|---------------|
| <b>Test Report No. :</b> GTSR17042032-01 | May. 09, 2017 |
|                                          | Date of issue |

Equipment under Test : Bluetooth earphone

Model /Type : BH693

Listed Models : /

**Applicant** : **Shenzhen Leigao Technology Co. Ltd.**

Address : Room 101, unit 1 Mei Ran Building 4, Yan Nan Road, Futian District, Shenzhen City, Guangdong Province, China

**Manufacturer** : **Shenzhen Leigao Technology Co. Ltd.**

Address : Room 101, unit 1 Mei Ran Building 4, Yan Nan Road, Futian District, Shenzhen City, Guangdong Province, China

|                     |             |
|---------------------|-------------|
| <b>Test Result:</b> | <b>PASS</b> |
|---------------------|-------------|

The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

## Contents

|           |                                                             |                  |
|-----------|-------------------------------------------------------------|------------------|
| <b>1.</b> | <b><u>TEST STANDARDS .....</u></b>                          | <b><u>4</u></b>  |
| <b>2.</b> | <b><u>SUMMARY .....</u></b>                                 | <b><u>5</u></b>  |
| 2.1.      | General Remarks                                             | 5                |
| 2.2.      | Product Description                                         | 5                |
| 2.3.      | Equipment Under Test                                        | 5                |
| 2.4.      | Short description of the Equipment under Test (EUT)         | 5                |
| 2.5.      | EUT operation mode                                          | 5                |
| 2.6.      | Block Diagram of Test Setup                                 | 6                |
| 2.7.      | Related Submittal(s) / Grant (s)                            | 6                |
| 2.8.      | EUT configuration                                           | 6                |
| 2.9.      | Modifications                                               | 6                |
| <b>3.</b> | <b><u>TEST ENVIRONMENT .....</u></b>                        | <b><u>7</u></b>  |
| 3.1.      | Address of the test laboratory                              | 7                |
| 3.2.      | Test Facility                                               | 7                |
| 3.3.      | Environmental conditions                                    | 7                |
| 3.4.      | Test Description                                            | 8                |
| 3.5.      | Statement of the measurement uncertainty                    | 8                |
| 3.6.      | Equipments Used during the Test                             | 9                |
| <b>4.</b> | <b><u>TEST CONDITIONS AND RESULTS.....</u></b>              | <b><u>10</u></b> |
| 4.1.      | AC Power Conducted Emission .....                           | 10               |
| 4.2.      | Radiated Emission.....                                      | 13               |
| 4.3.      | Maximum Peak Output Power.....                              | 18               |
| 4.4.      | Power Spectral Density .....                                | 19               |
| 4.5.      | 6dB Bandwidth .....                                         | 21               |
| 4.6.      | Band Edge Compliance of RF Emission .....                   | 23               |
| 4.7.      | Spurious RF Conducted Emission .....                        | 25               |
| 4.8.      | Antenna Requirement.....                                    | 32               |
| <b>5.</b> | <b><u>TEST SETUP PHOTOS OF THE EUT .....</u></b>            | <b><u>33</u></b> |
| <b>6.</b> | <b><u>EXTERNAL AND INTERNAL PHOTOS OF THE EUT .....</u></b> | <b><u>35</u></b> |

## **1. TEST STANDARDS**

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB558074 D01 V04](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

## 2. SUMMARY

### 2.1. General Remarks

|                                |   |               |
|--------------------------------|---|---------------|
| Date of receipt of test sample | : | Apr. 18, 2017 |
|                                |   |               |
| Testing commenced on           | : | Apr. 18, 2017 |
|                                |   |               |
| Testing concluded on           | : | May. 09, 2017 |

### 2.2. Product Description

|                                   |                    |
|-----------------------------------|--------------------|
| Name of EUT                       | Bluetooth earphone |
| Trade Mark                        | /                  |
| Model Number                      | BH693              |
| List Model                        | /                  |
| FCC ID                            | 2AL2CBH693         |
| Power supply                      | Battery DC 3.7V    |
| Antenna Type                      | Internal Antenna   |
| Bluetooth FCC Operation frequency | 2402MHz-2480MHz    |
| Bluetooth Modulation              | GFSK               |
| Bluetooth                         | Supported BT4.0    |
| Antenna gain                      | 0.84dBi            |

### 2.3. Equipment Under Test

#### Power supply system utilised

|                      |   |                                                                   |                                   |
|----------------------|---|-------------------------------------------------------------------|-----------------------------------|
| Power supply voltage | : | <input type="radio"/> 230V / 50 Hz                                | <input type="radio"/> 120V / 60Hz |
|                      |   | <input type="radio"/> 12 V DC                                     | <input type="radio"/> 24 V DC     |
|                      |   | <input checked="" type="radio"/> Other (specified in blank below) |                                   |

DC 3.7V

### 2.4. Short description of the Equipment under Test (EUT)

This is a Bluetooth earphone.

For more details, refer to the user's manual of the EUT.

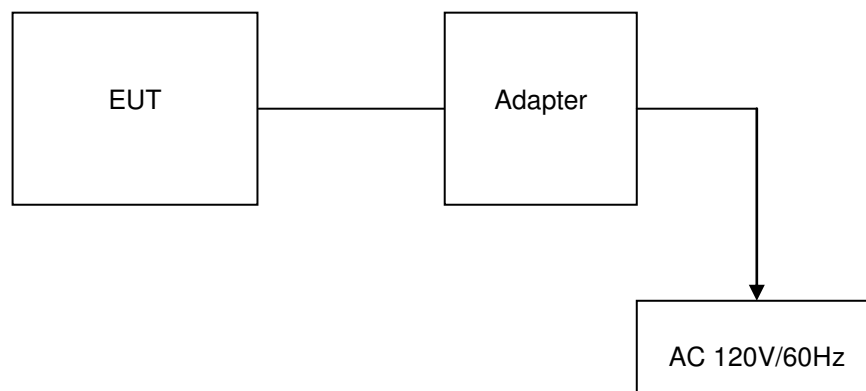
### 2.5. EUT operation mode

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 40 channels provided to the EUT.

Channel 00/19/39 was selected to test.

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---------|----------------|---------|----------------|
| 0       | 2402           | 20      | 2442           |
| 1       | 2404           | 21      | 2444           |
| 2       | 2406           | 22      | 2446           |
| 3       | 2408           | 23      | 2448           |
| 4       | 2410           | 24      | 2450           |
| 5       | 2412           | 25      | 2452           |
| 6       | 2414           | 26      | 2454           |
| 7       | 2416           | 27      | 2456           |
| 8       | 2418           | 28      | 2458           |
| 9       | 2420           | 29      | 2460           |
| 10      | 2422           | 30      | 2462           |
| 11      | 2424           | 31      | 2464           |
| 12      | 2426           | 32      | 2466           |
| 13      | 2428           | 33      | 2468           |
| 14      | 2430           | 34      | 2470           |
| 15      | 2432           | 35      | 2472           |
| 16      | 2434           | 36      | 2474           |
| 17      | 2436           | 37      | 2476           |
| 18      | 2438           | 38      | 2478           |
| 19      | 2440           | 39      | 2480           |

## 2.6. Block Diagram of Test Setup



## 2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AL2CBH693** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.8. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

● - supplied by the manufacturer

○ - Supplied by the lab

|           |               |            |
|-----------|---------------|------------|
| ○ Adapter | M/N:          | A70-502000 |
|           | Manufacturer: | KUNXING    |

## 2.9. Modifications

No modifications were implemented to meet testing criteria.

### **3. TEST ENVIRONMENT**

#### **3.1. Address of the test laboratory**

**Shenzhen Global Test Service Co.,Ltd.**

1F, Building No. 13A, Zhonghaixin Science and Technology City, No.12,6 Road, Ganli Industrial Park, Buji Street, Longgang District, Shenzhen, Guangdong

**Shenzhen CTL Testing Technology Co., Ltd.**

1/F.-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, Guangdong, China

#### **3.2. Test Facility**

The test facility is recognized, certified, or accredited by the following organizations:

**FCC-Registration No.: 964637**

Shenzhen Global Test Service Co.,Ltd EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 964637, Jul 24, 2015.

**CNAS-Lab Code: L8169**

Shenzhen Global Test Service Co.,Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. Date of Registration: Dec. 11, 2015. Valid time is until Dec. 10, 2018.

**FCC-Registration No.: 970318**

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December 19, 2013.

#### **3.3. Environmental conditions**

During the measurement the environmental conditions were within the listed ranges:

|                       |              |
|-----------------------|--------------|
| Temperature:          | 15-35 ° C    |
|                       |              |
| Humidity:             | 30-60 %      |
|                       |              |
| Atmospheric pressure: | 950-1050mbar |

### 3.4. Test Description

| Test Specification clause | Test case                               | Test Mode | Test Channel                                                                                                                            | Recorded In Report |                                                                                                                                         | Pass                                                                                                              | Fail                     | NA                                  | NP                       | Remark   |
|---------------------------|-----------------------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------|--------------------------|----------|
| §15.247(b)(4)             | Antenna gain                            | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.247(e)                | Power spectral density                  | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.247(a)(2)             | Spectrum bandwidth – 6 dB bandwidth     | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.247(b)(1)             | Maximum output power                    | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/><br><input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.247(d)                | Band edge compliance conducted          | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.205                   | Band edge compliance radiated           | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Highest                                               | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.247(d)                | TX spurious emissions conducted         | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/><br><input checked="" type="checkbox"/>                                        | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.247(d)                | TX spurious emissions radiated          | GFSK      | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | GFSK               | <input checked="" type="checkbox"/> Lowest<br><input checked="" type="checkbox"/> Middle<br><input checked="" type="checkbox"/> Highest | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.109                   | RX spurious emissions radiated          | -/-       | -/-                                                                                                                                     | -/-                | -/-                                                                                                                                     | <input type="checkbox"/>                                                                                          | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | complies |
| §15.209(a)                | TX spurious Emissions radiated < 30 MHz | GFSK      | -/-                                                                                                                                     | GFSK               | -/-                                                                                                                                     | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |
| §15.107(a)<br>§15.207     | Conducted Emissions < 30 MHz            | GFSK      | -/-                                                                                                                                     | GFSK               | -/-                                                                                                                                     | <input checked="" type="checkbox"/>                                                                               | <input type="checkbox"/> | <input type="checkbox"/>            | <input type="checkbox"/> | complies |

Remark:

1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

### 3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

| Test                  | Range      | Measurement Uncertainty | Notes |
|-----------------------|------------|-------------------------|-------|
| Radiated Emission     | 30~1000MHz | 4.10 dB                 | (1)   |
| Radiated Emission     | 1~18GHz    | 4.32 dB                 | (1)   |
| Radiated Emission     | 18-40GHz   | 5.54 dB                 | (1)   |
| Conducted Disturbance | 0.15~30MHz | 3.12 dB                 | (1)   |

- (1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

**3.6. Equipments Used during the Test**

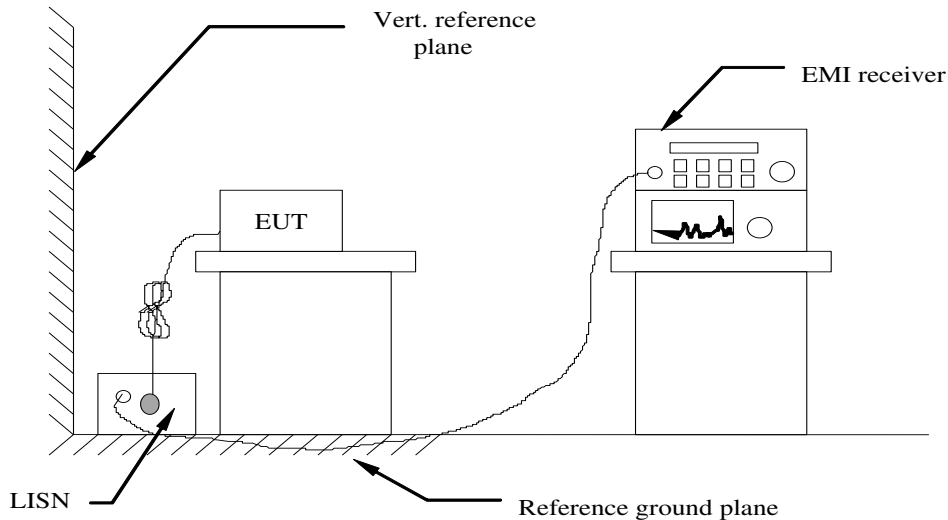
| Test Equipment             | Manufacturer         | Model No.             | Serial No.   | Calibration Date | Calibration Due Date |
|----------------------------|----------------------|-----------------------|--------------|------------------|----------------------|
| LISN                       | R&S                  | ENV216                | 3560.6550.08 | 2016/05/28       | 2017/05/27           |
| LISN                       | R&S                  | ESH2-Z5               | 893606/008   | 2016/05/27       | 2017/05/26           |
| Bilog Antenna              | Sunol Sciences Corp. | JB1                   | A061713      | 2016/06/02       | 2017/06/01           |
| EMI Test Receiver          | R&S                  | ESCI                  | 101102       | 2016/06/26       | 2017/06/25           |
| Spectrum Analyzer          | Agilent              | N9020A                | MY48010425   | 2016/06/17       | 2017/06/16           |
| Controller                 | EM Electronics       | Controller EM 1000    | N/A          | 2016/05/21       | 2017/05/20           |
| Horn Antenna               | Sunol Sciences Corp. | DRH-118               | A062013      | 2016/05/19       | 2017/05/18           |
| Active Loop Antenna        | SCHWARZBEC K         | FMZB1519              | 1519-037     | 2016/05/19       | 2017/05/18           |
| Amplifier                  | Agilent              | 8349B                 | 3008A02306   | 2016/05/19       | 2017/05/18           |
| Amplifier                  | Agilent              | 8447D                 | 2944A10176   | 2016/05/19       | 2017/05/18           |
| Temperature/Humidity Meter | Gangxing             | CTH-608               | 02           | 2016/05/20       | 2017/05/19           |
| High-Pass Filter           | K&L                  | 9SH10-2700/X12750-O/O | N/A          | 2016/05/20       | 2017/05/19           |
| High-Pass Filter           | K&L                  | 41H10-1375/U12750-O/O | N/A          | 2016/05/20       | 2017/05/19           |
| RF Cable                   | HUBER+SUHNER         | RG214                 | N/A          | 2016/05/20       | 2017/05/19           |
| Data acquisition card      | Agilent              | U2531A                | TW53323507   | 2016/05/20       | 2017/05/19           |
| Power Sensor               | Agilent              | U2021XA               | MY5365004    | 2016/05/20       | 2017/05/19           |

Note: The Cal.Interval was one year.

## 4. TEST CONDITIONS AND RESULTS

### 4.1. AC Power Conducted Emission

#### TEST CONFIGURATION



#### TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. 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 C63.10-2013.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2013
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
- 4 The EUT received DC 5V power from adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT 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.

#### AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

| Frequency range (MHz) | Limit (dBuV) |           |
|-----------------------|--------------|-----------|
|                       | Quasi-peak   | Average   |
| 0.15-0.5              | 66 to 56*    | 56 to 46* |
| 0.5-5                 | 56           | 46        |
| 5-30                  | 60           | 50        |

\* Decreases with the logarithm of the frequency.

#### TEST RESULTS

Power supply:

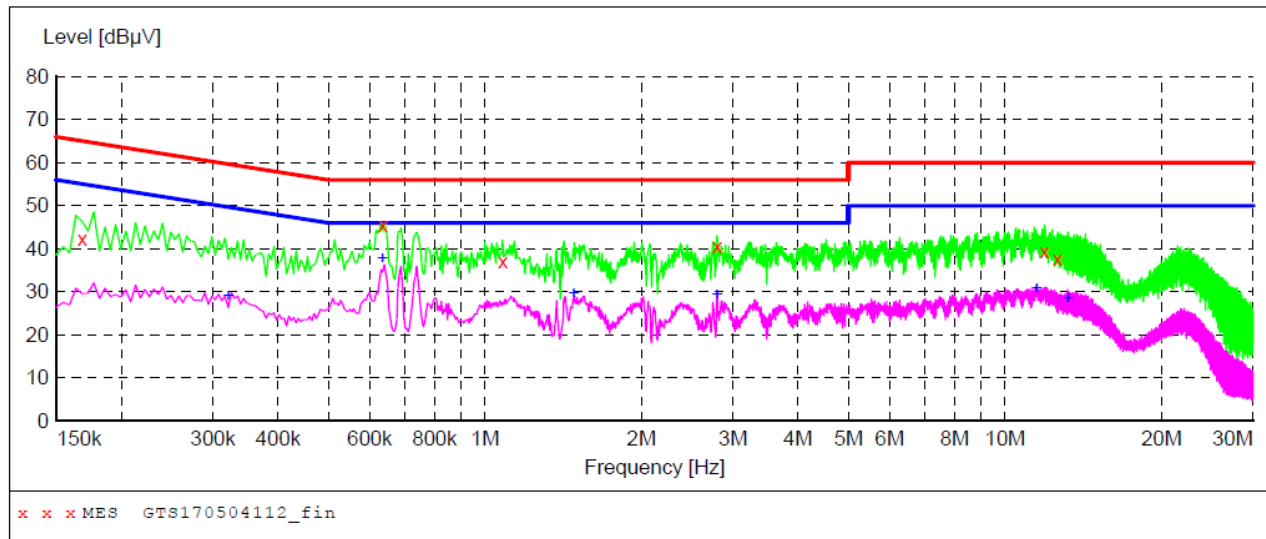
DC 5V from Adapter  
AC 120V/60Hz

Polarization

L

**SCAN TABLE: "Voltage (9K-30M) FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "GTS170504112\_fin"**

5/4/2017 10:34AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.168000         | 42.40         | 10.0         | 65            | 22.7         | QP       | L1   | GND |
| 0.636000         | 45.40         | 9.7          | 56            | 10.6         | QP       | L1   | GND |
| 1.081500         | 37.10         | 9.6          | 56            | 18.9         | QP       | L1   | GND |
| 2.796000         | 40.60         | 9.5          | 56            | 15.4         | QP       | L1   | GND |
| 11.908500        | 39.30         | 8.6          | 60            | 20.7         | QP       | L1   | GND |
| 12.624000        | 37.70         | 8.5          | 60            | 22.3         | QP       | L1   | GND |

**MEASUREMENT RESULT: "GTS170504112\_fin2"**

5/4/2017 10:34AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.321000         | 28.80         | 9.9          | 50            | 20.9         | AV       | L1   | GND |
| 0.636000         | 37.70         | 9.7          | 46            | 8.3          | AV       | L1   | GND |
| 1.482000         | 29.50         | 9.6          | 46            | 16.5         | AV       | L1   | GND |
| 2.796000         | 29.30         | 9.5          | 46            | 16.7         | AV       | L1   | GND |
| 11.503500        | 30.70         | 8.7          | 50            | 19.3         | AV       | L1   | GND |
| 13.200000        | 28.30         | 8.4          | 50            | 21.7         | AV       | L1   | GND |

Power supply:

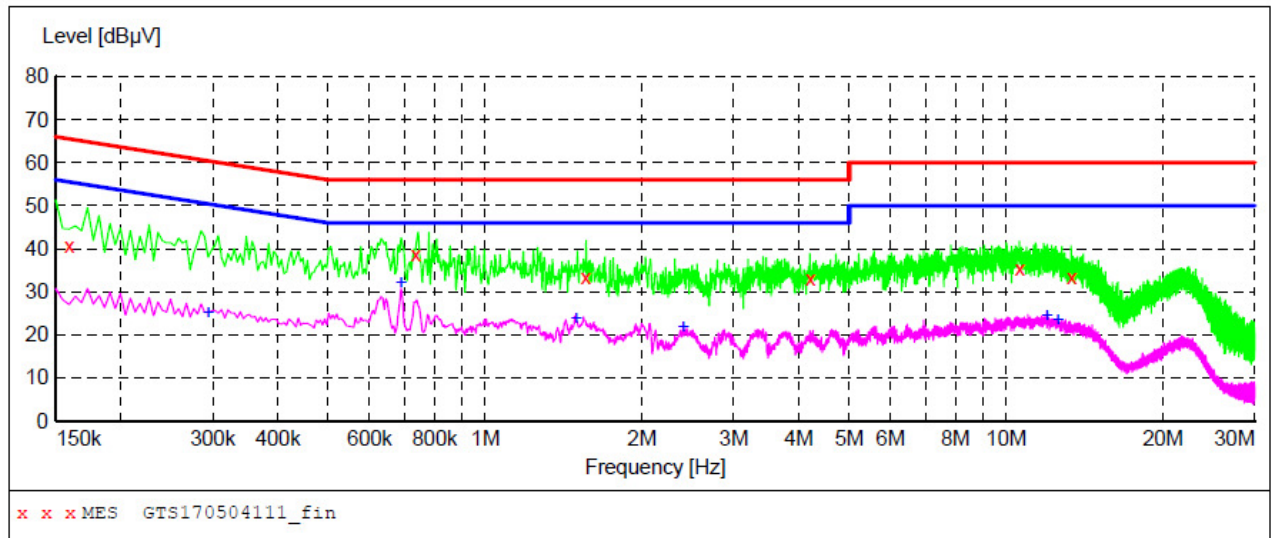
DC 5V from Adapter  
AC 120V/60Hz

Polarization

N

**SCAN TABLE: "Voltage (9K-30M) FIN"**

Short Description: 150K-30M Voltage

**MEASUREMENT RESULT: "GTS170504111\_fin"**

5/4/2017 10:31AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.159000         | 40.80         | 10.0         | 66            | 24.7         | QP       | N    | GND |
| 0.735000         | 38.80         | 9.7          | 56            | 17.2         | QP       | N    | GND |
| 1.558500         | 33.30         | 9.5          | 56            | 22.7         | QP       | N    | GND |
| 4.204500         | 33.00         | 9.4          | 56            | 23.0         | QP       | N    | GND |
| 10.617000        | 35.50         | 8.8          | 60            | 24.5         | QP       | N    | GND |
| 13.357500        | 33.30         | 8.4          | 60            | 26.7         | QP       | N    | GND |

**MEASUREMENT RESULT: "GTS170504111\_fin2"**

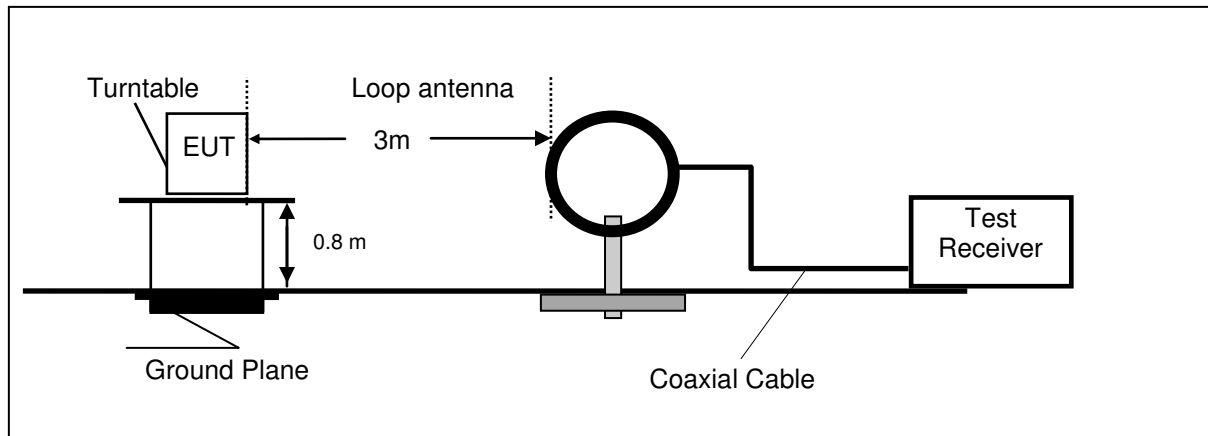
5/4/2017 10:31AM

| Frequency<br>MHz | Level<br>dBμV | Transd<br>dB | Limit<br>dBμV | Margin<br>dB | Detector | Line | PE  |
|------------------|---------------|--------------|---------------|--------------|----------|------|-----|
| 0.294000         | 25.10         | 9.9          | 50            | 25.3         | AV       | N    | GND |
| 0.690000         | 32.10         | 9.7          | 46            | 13.9         | AV       | N    | GND |
| 1.495500         | 23.80         | 9.6          | 46            | 22.2         | AV       | N    | GND |
| 2.400000         | 21.80         | 9.5          | 46            | 24.2         | AV       | N    | GND |
| 11.967000        | 24.40         | 8.6          | 50            | 25.6         | AV       | N    | GND |
| 12.570000        | 23.50         | 8.5          | 50            | 26.5         | AV       | N    | GND |

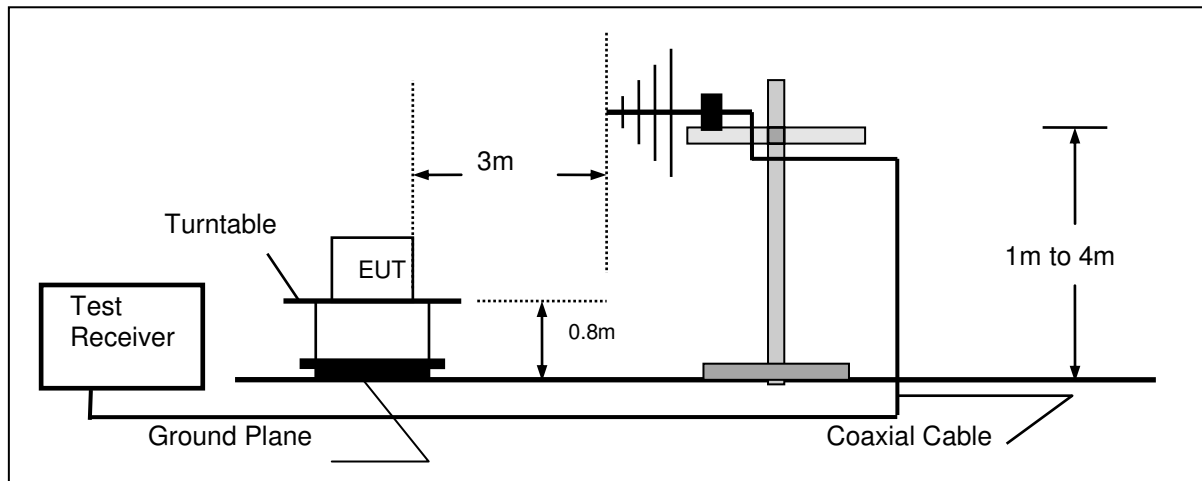
## 4.2. Radiated Emission

### TEST CONFIGURATION

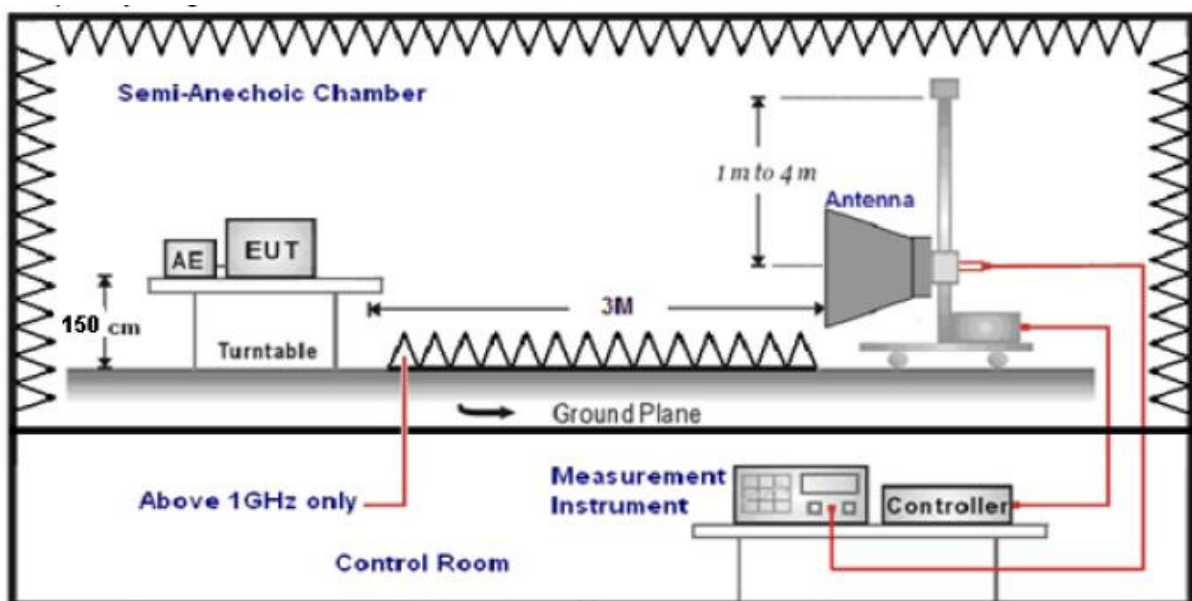
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



**TEST PROCEDURE**

1. The EUT was placed on a turn table which is 0.8m above ground plane when testing frequency range 9 KHz –1GHz;the EUT was placed on a turn table which is 1.5m above ground plane when testing frequency range 1GHz – 25GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 26MHz and maximum operation frequency was 2480MHz. So radiated emission test frequency band from 9KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type          | Test Distance |
|----------------------|----------------------------|---------------|
| 9KHz-30MHz           | Active Loop Antenna        | 3             |
| 30MHz-1GHz           | Ultra-Broadband Antenna    | 3             |
| 1GHz-18GHz           | Double Ridged Horn Antenna | 3             |
| 18GHz-25GHz          | Horn Antenna               | 1             |

7. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting                                                                            | Detector |
|----------------------|-----------------------------------------------------------------------------------------------------------|----------|
| 9KHz-150KHz          | RBW=200Hz/VBW=3KHz,Sweep time=Auto                                                                        | QP       |
| 150KHz-30MHz         | RBW=9KHz/VBW=100KHz,Sweep time=Auto                                                                       | QP       |
| 30MHz-1GHz           | RBW=120KHz/VBW=1000KHz,Sweep time=Auto                                                                    | QP       |
| 1GHz-40GHz           | Peak Value: RBW=1MHz/VBW=3MHz,<br>Sweep time=Auto<br>Average Value: RBW=1MHz/VBW=10Hz,<br>Sweep time=Auto | Peak     |

**Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

|                           |                                            |
|---------------------------|--------------------------------------------|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude    | AG = Amplifier Gain                        |
| AF = Antenna Factor       |                                            |

$$\text{Transd}=AF +CL-AG$$

**RADIATION LIMIT**

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

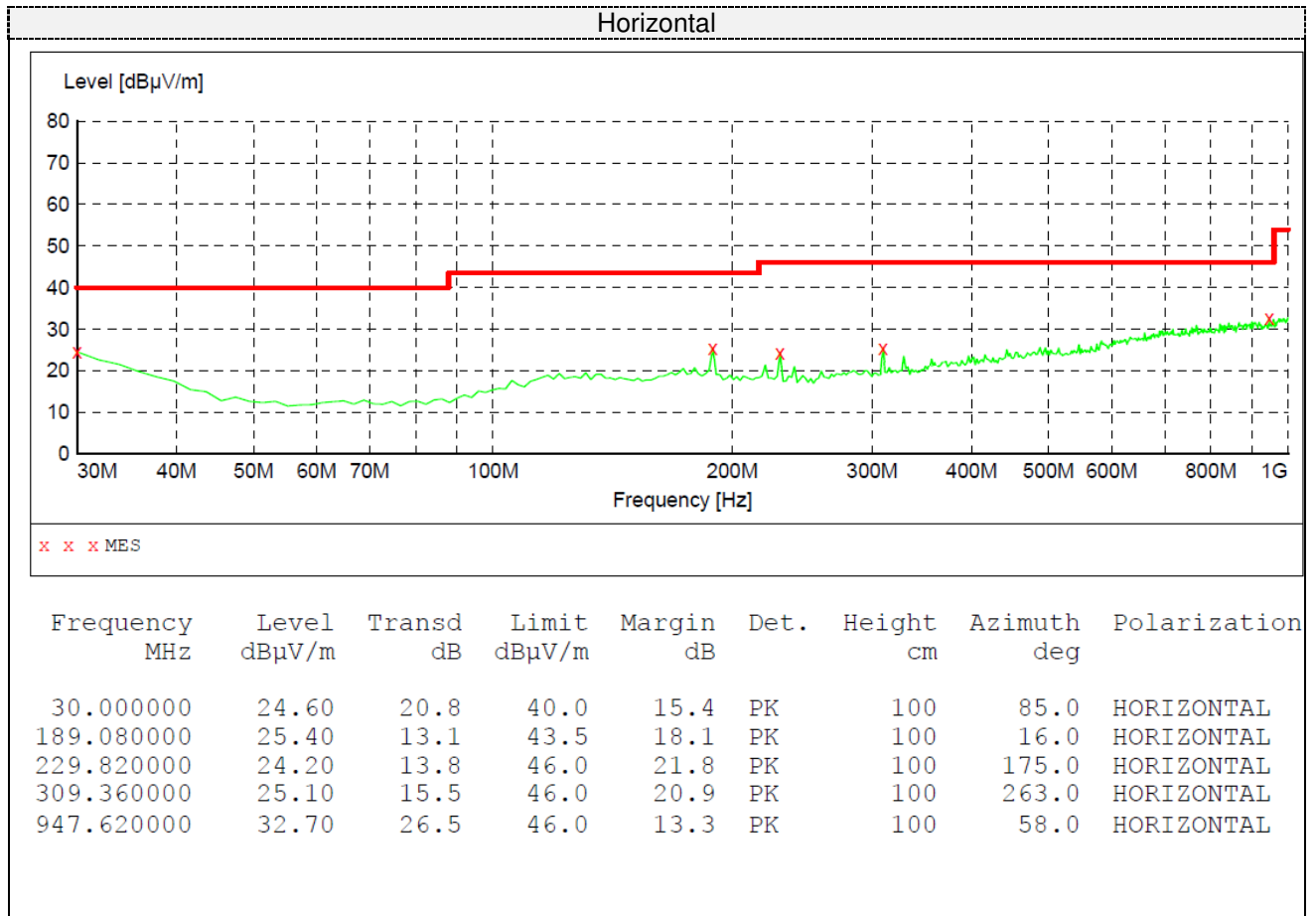
| Frequency (MHz) | Distance (Meters) | Radiated (dBµV/m)                          | Radiated (µV/m)       |
|-----------------|-------------------|--------------------------------------------|-----------------------|
| 0.009-0.49      | 3                 | $20\log(2400/F(\text{KHz}))+40\log(300/3)$ | $2400/F(\text{KHz})$  |
| 0.49-1.705      | 3                 | $20\log(24000/F(\text{KHz}))+40\log(30/3)$ | $24000/F(\text{KHz})$ |
| 1.705-30        | 3                 | $20\log(30)+40\log(30/3)$                  | 30                    |
| 30-88           | 3                 | 40.0                                       | 100                   |
| 88-216          | 3                 | 43.5                                       | 150                   |
| 216-960         | 3                 | 46.0                                       | 200                   |
| Above 960       | 3                 | 54.0                                       | 500                   |

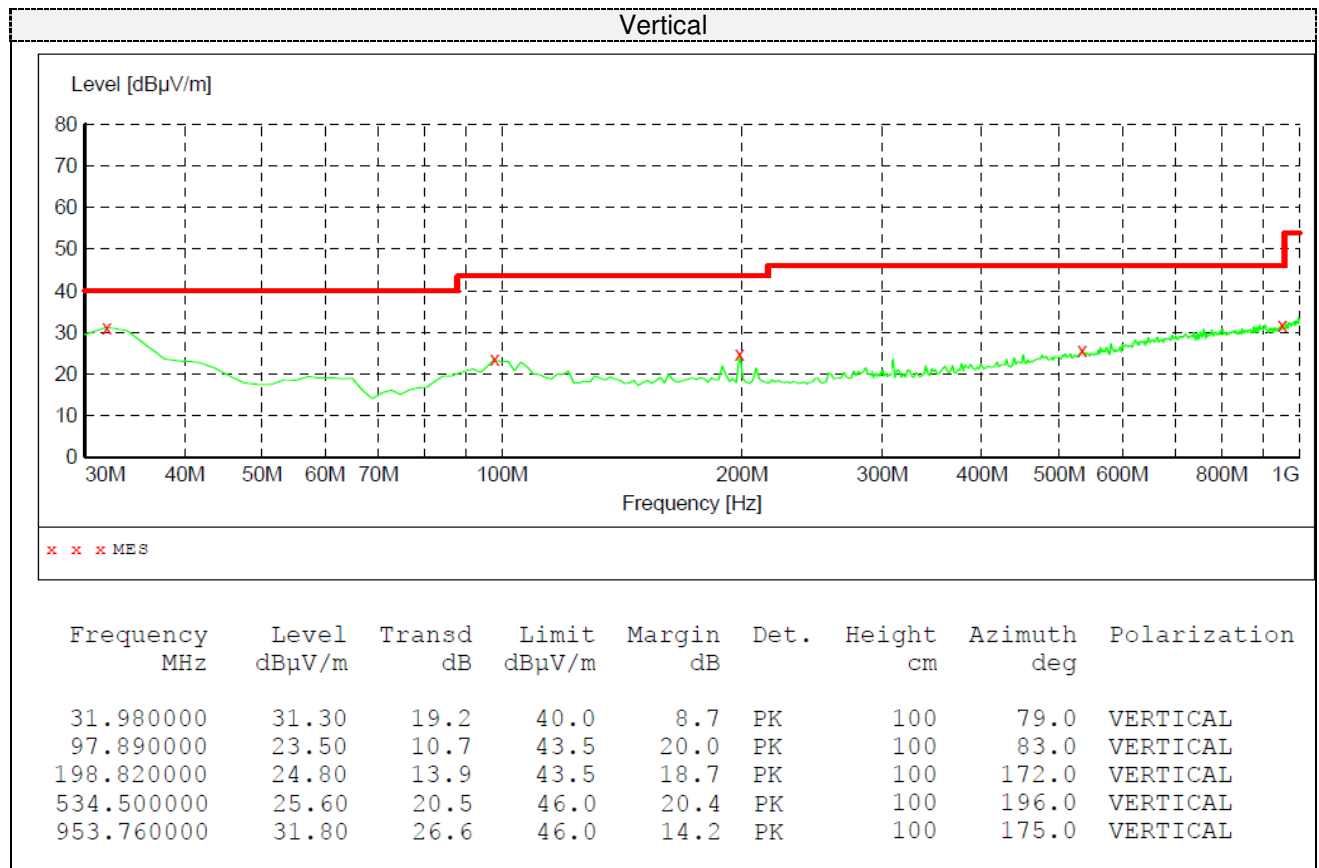
**TEST RESULTS**

Test site: Shenzhen CTL Testing Technology Co., Ltd.

**For 9KHz to 30MHz**

| Frequency (MHz) | Corrected Reading (dBuV/m)@3m | FCC Limit (dBuV/m) @3m | Margin (dB) | Detector | Result |
|-----------------|-------------------------------|------------------------|-------------|----------|--------|
| 0.42            | 49.88                         | 95.14                  | 45.26       | QP       | PASS   |
| 2.48            | 39.70                         | 69.54                  | 29.84       | QP       | PASS   |
| 19.54           | 40.89                         | 69.54                  | 28.65       | QP       | PASS   |
| 27.62           | 41.48                         | 69.54                  | 28.06       | QP       | PASS   |

**For 30MHz to 1000MHz**



### For 1GHz to 25GHz

[illegible][illegible]

| Frequency(MHz): |                 |                         |    | 2440           |             |                    | Polarity:            |                  |                       | HORIZONTAL        |               |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|---------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 1               | 4880.00         | 47.94                   | PK | 74.00          | 26.06       | 1.00 H             | 96                   | 45.88            | 30.98                 | 7.58              | 36.5          | 2.06                     |
| 1               | 4880.00         | 36.94                   | AV | 54.00          | 17.06       | 1.00 H             | 96                   | 34.88            | 30.98                 | 7.58              | 36.5          | 2.06                     |
| 2               | 7320.00         | 40.53                   | PK | 74.00          | 33.47       | 1.00 H             | 185                  | 29.61            | 37.66                 | 8.56              | 35.3          | 10.92                    |
| 2               | 7320.00         | --                      | AV | --             | --          | --                 | --                   | --               | --                    | --                | --            | --                       |

| Frequency(MHz): |                 |                         |    | 2440           |             |                    | Polarity:            |                  |                       | VERTICAL          |               |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|---------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 1               | 4880.00         | 50.07                   | PK | 74.00          | 23.93       | 1.00 V             | 117                  | 48.01            | 30.98                 | 7.58              | 36.5          | 2.06                     |
| 1               | 4880.00         | 39.85                   | AV | 54.00          | 14.15       | 1.00 V             | 117                  | 37.79            | 30.98                 | 7.58              | 36.5          | 2.06                     |
| 2               | 7320.00         | 43.74                   | PK | 74.00          | 30.26       | 1.00 V             | 229                  | 32.82            | 37.66                 | 8.56              | 35.3          | 10.92                    |
| 2               | 7320.00         | --                      | AV | --             | --          | --                 | --                   | --               | --                    | --                | --            | --                       |

| Frequency(MHz): |                 |                         |    | 2480           |             |                    | Polarity:            |                  |                       | HORIZONTAL        |               |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|---------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 1               | 4960.00         | 49.81                   | PK | 74.00          | 24.19       | 1.00 H             | 186                  | 46.74            | 31.47                 | 7.80              | 36.2          | 3.07                     |
| 1               | 4960.00         | 40.34                   | AV | 54.00          | 13.66       | 1.00 H             | 186                  | 37.27            | 31.47                 | 7.80              | 36.2          | 3.07                     |
| 2               | 7440.00         | 42.78                   | PK | 74.00          | 31.22       | 1.00 H             | 235                  | 31.04            | 38.32                 | 8.72              | 35.3          | 11.74                    |
| 2               | 7440.00         | --                      | AV | --             | --          | --                 | --                   | --               | --                    | --                | --            | --                       |

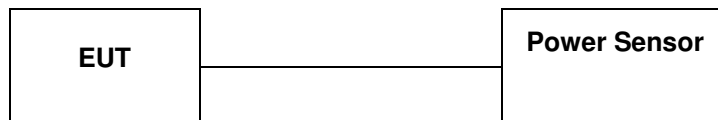
| Frequency(MHz): |                 |                         |    | 2480           |             |                    | Polarity:            |                  |                       | VERTICAL          |               |                          |
|-----------------|-----------------|-------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|---------------|--------------------------|
| No.             | Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 1               | 4960.00         | 49.09                   | PK | 74.00          | 24.91       | 1.00 V             | 116                  | 46.02            | 31.47                 | 7.80              | 36.2          | 3.07                     |
| 1               | 4960.00         | 37.97                   | AV | 54.00          | 16.03       | 1.00 V             | 116                  | 34.90            | 31.47                 | 7.80              | 36.2          | 3.07                     |
| 2               | 7440.00         | 41.08                   | PK | 74.00          | 32.92       | 1.00 V             | 182                  | 29.34            | 38.32                 | 8.72              | 35.3          | 11.74                    |
| 2               | 7440.00         | --                      | AV | --             | --          | --                 | --                   | --               | --                    | --                | --            | --                       |

## REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

### 4.3. Maximum Peak Output Power

#### TEST CONFIGURATION



#### TEST PROCEDURE

According to KDB558074 D01 DTS Measurement Guidance Section 9.1 Maximum peak conducted output power, 9.1.2. and Average conducted output power, 9.2.3.1.

The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

The maximum Average conducted output power may be measured using a wideband RF power meter with a thermocouple detector or equivalent. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

#### LIMIT

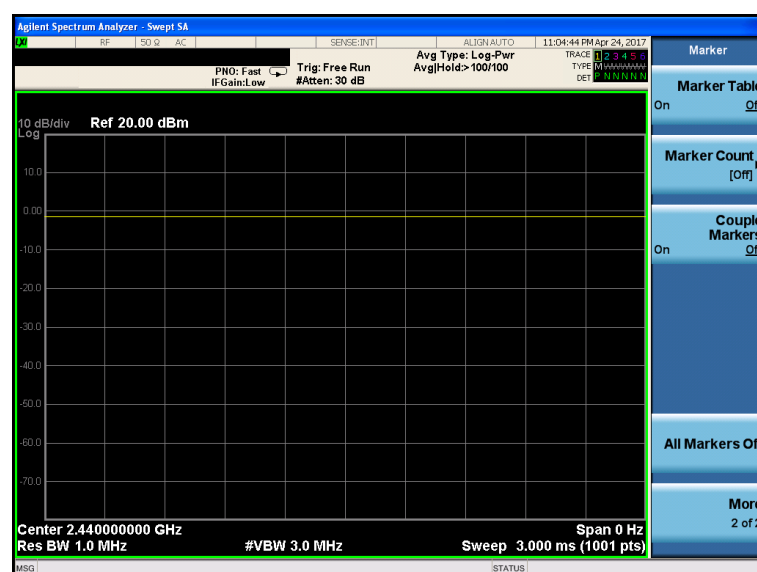
The Maximum Peak Output Power Measurement is 30dBm.

#### TEST RESULTS

| Type | Channel | Output power PK (dBm) | Output power AV(dBm) | Limit (dBm) | Result |
|------|---------|-----------------------|----------------------|-------------|--------|
| GFSK | 00      | -2.54                 | -3.42                | 30          | Pass   |
|      | 19      | -2.15                 | -3.04                |             |        |
|      | 39      | -2.44                 | -3.36                |             |        |

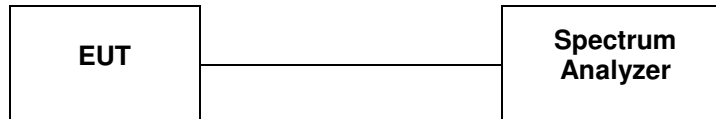
Note: The test results including the cable loss.

Duty cycle used in all test items: 100%



#### 4.4. Power Spectral Density

##### TEST CONFIGURATION



##### TEST PROCEDURE

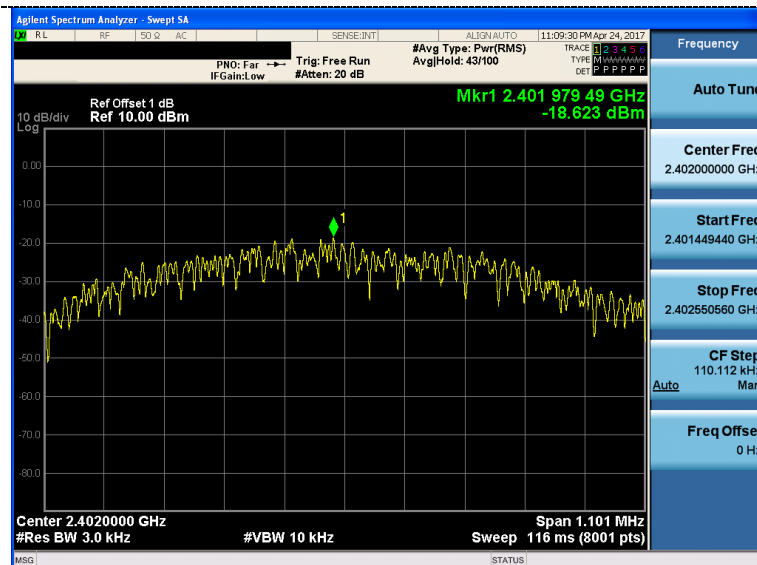
1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 3 kHz.
3. Set the VBW = 10 KHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8 dBm.

##### LIMIT

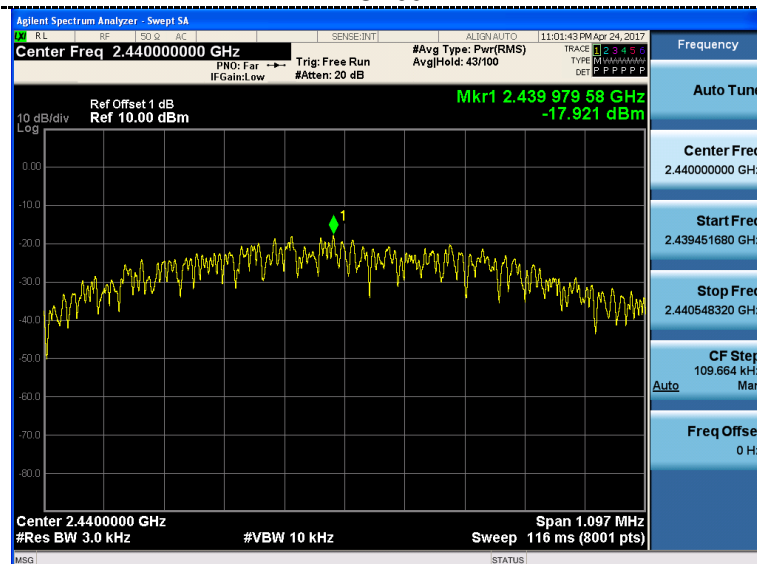
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

##### TEST RESULTS

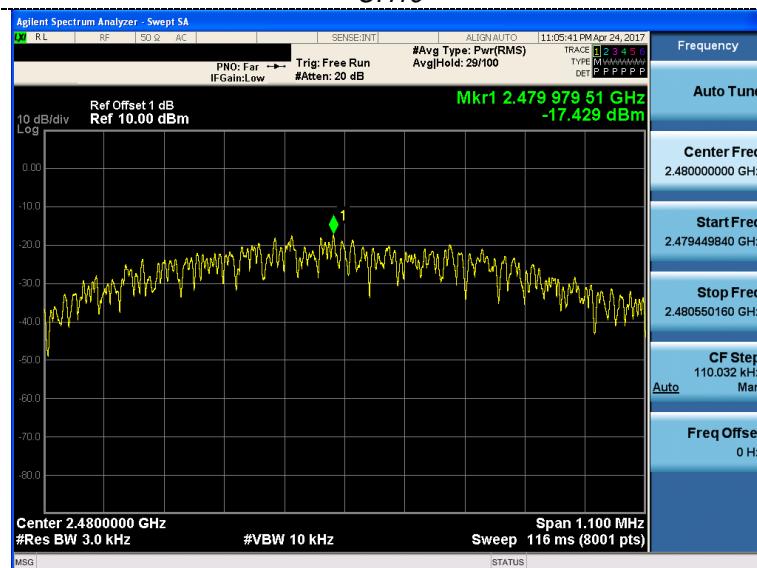
| Type | Channel | Power Spectral Density (dBm/3KHz) | Limit (dBm/3KHz) | Result |
|------|---------|-----------------------------------|------------------|--------|
| GFSK | 00      | -18.623                           | 8.00             | Pass   |
|      | 19      | -17.921                           |                  |        |
|      | 39      | -17.429                           |                  |        |



CH00



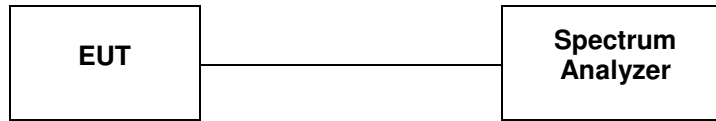
CH19



CH39

#### 4.5. 6dB Bandwidth

##### TEST CONFIGURATION



##### TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300KHz. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. According to KDB558074 D01 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.

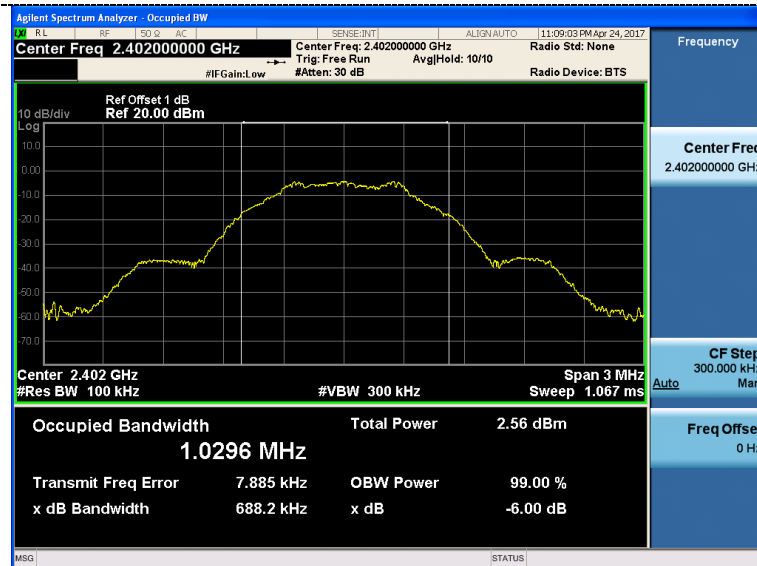
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

##### LIMIT

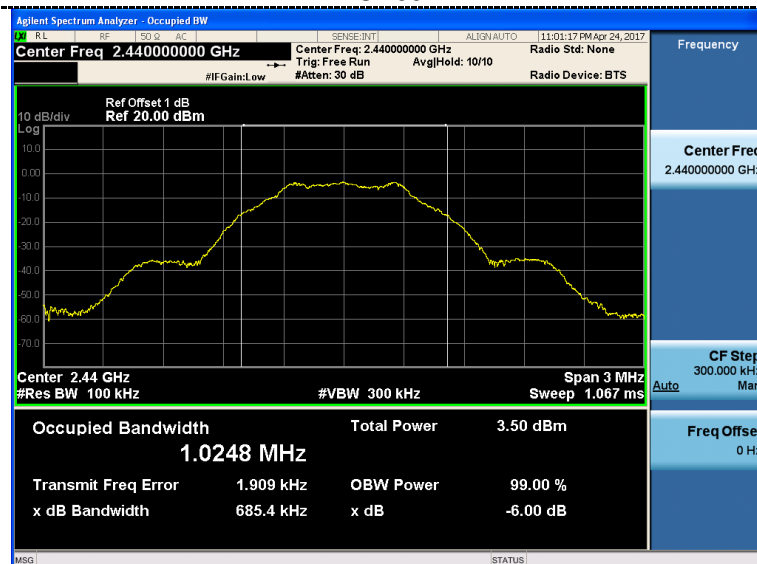
For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz

##### TEST RESULTS

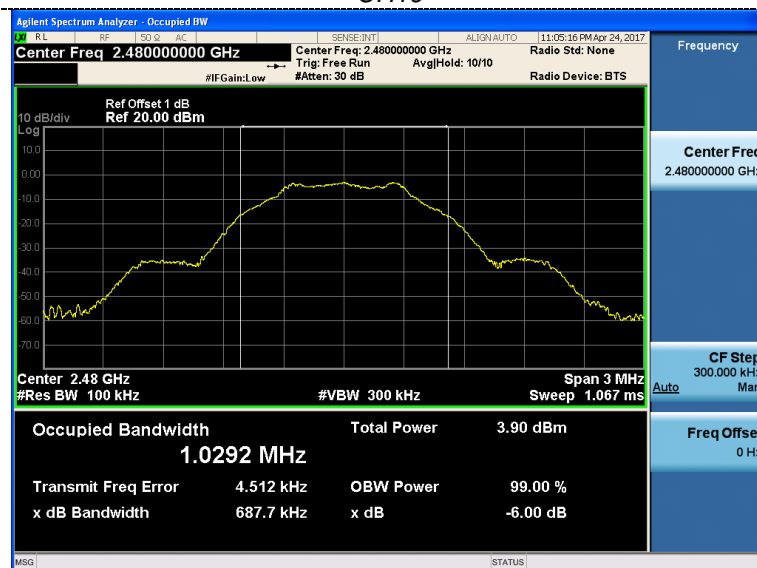
| Type | Channel | 6dB Bandwidth (KHz) | Limit (KHz) | Result |
|------|---------|---------------------|-------------|--------|
| GFSK | 00      | 688.2               | $\geq 500$  | Pass   |
|      | 19      | 685.4               |             |        |
|      | 39      | 687.7               |             |        |



CH00



CH19



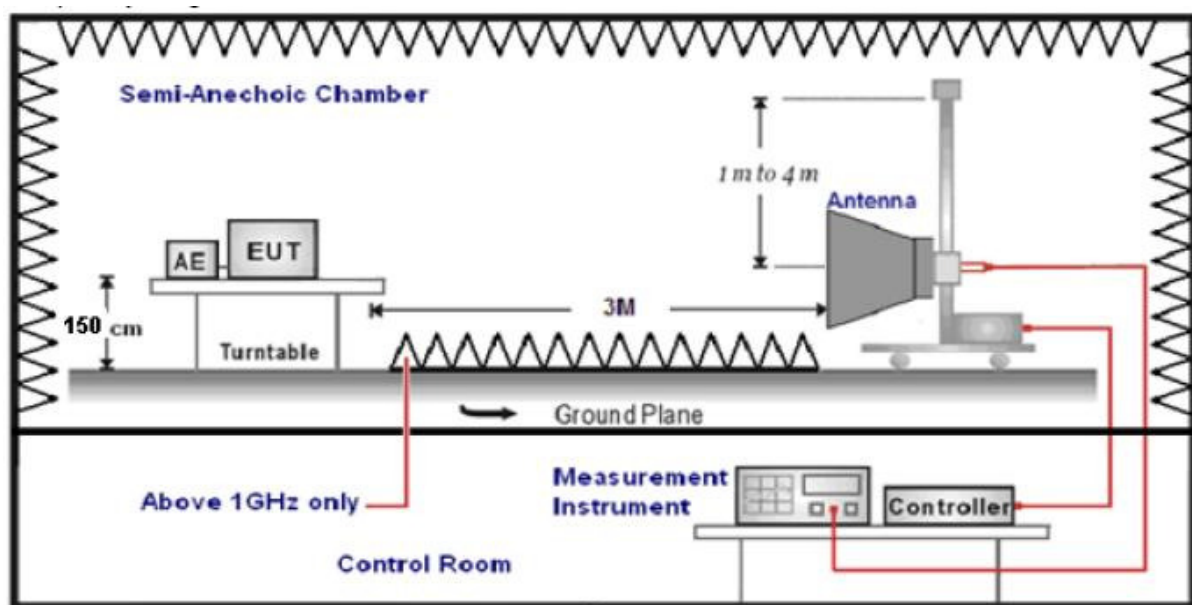
CH39

## 4.6. Band Edge Compliance of RF Emission

### TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated 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) (see §15.205(c)).

### TEST CONFIGURATION



### TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting                                                                            | Detector |
|----------------------|-----------------------------------------------------------------------------------------------------------|----------|
| 1GHz-40GHz           | Peak Value: RBW=1MHz/VBW=3MHz,<br>Sweep time=Auto<br>Average Value: RBW=1MHz/VBW=10Hz,<br>Sweep time=Auto | Peak     |

### LIMIT

Below -20dB of the highest emission level in operating band.

Radiated 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)

**TEST RESULTS**

Test site: Shenzhen CTL Testing Technology Co., Ltd.

**4.6.1 For Radiated Bandedge Measurement**

| Frequency(MHz): |                         |    | 2402           |             |                    | Polarity:            |                  |                       | HORIZONTAL        |               |                          |
|-----------------|-------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|---------------|--------------------------|
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2390.00         | 49.29                   | PK | 74.00          | 24.71       | 1.00               | 81                   | 54.60            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| 2390.00         | 40.01                   | AV | 54.00          | 13.99       | 1.00               | 81                   | 45.32            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| Frequency(MHz): |                         |    | 2402           |             |                    | Polarity:            |                  |                       | VERTICAL          |               |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2390.00         | 49.74                   | PK | 74.00          | 24.26       | 1.00               | 129                  | 55.05            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| 2390.00         | 40.95                   | AV | 54.00          | 13.05       | 1.00               | 129                  | 46.26            | 27.49                 | 3.32              | 36.12         | -5.31                    |
| Frequency(MHz): |                         |    | 2480           |             |                    | Polarity:            |                  |                       | HORIZONTAL        |               |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2483.50         | 49.28                   | PK | 74.00          | 24.72       | 1.00               | 206                  | 55.00            | 27.45                 | 3.38              | 36.55         | -5.72                    |
| 2483.50         | 38.96                   | AV | 54.00          | 15.04       | 1.00               | 206                  | 44.68            | 27.45                 | 3.38              | 36.55         | -5.72                    |
| Frequency(MHz): |                         |    | 2480           |             |                    | Polarity:            |                  |                       | VERTICAL          |               |                          |
| Frequency (MHz) | Emission Level (dBuV/m) |    | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier | Correction Factor (dB/m) |
| 2483.50         | 51.24                   | PK | 74.00          | 22.76       | 1.00               | 191                  | 56.96            | 27.45                 | 3.38              | 36.55         | -5.72                    |
| 2483.50         | 41.41                   | AV | 54.00          | 12.59       | 1.00               | 191                  | 47.13            | 27.45                 | 3.38              | 36.55         | -5.72                    |

**4.6.2 For Conducted Bandedge Measurement**

| Frequency (MHz) | Delta Peak to Band emission (dBc) | Limit (dBc) | Verdict |
|-----------------|-----------------------------------|-------------|---------|
| 2400.00         | -38.09                            | -20         | PASS    |
| 2483.50         | -49.11                            | -20         | PASS    |

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.360000000 GHz

Mkr4 2.377 187 5 GHz -47.861 dBm

Start Freq 2.310000000 GHz

Stop Freq 2.410000000 GHz

#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 1.07 ms (8001 pts)

CF Step 10.000000 MHz

Freq Offset 0 Hz

2402

Agilent Spectrum Analyzer - Swept SA

Center Freq 2.520000000 GHz

Mkr4 2.484 675 0 GHz -48.157 dBm

Start Freq 2.470000000 GHz

Stop Freq 2.570000000 GHz

#Res BW 1.0 MHz

#VBW 3.0 MHz

Sweep 1.07 ms (8001 pts)

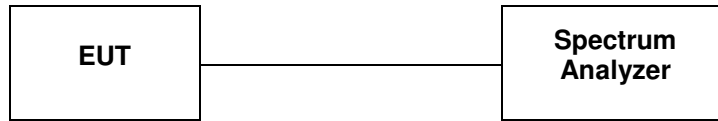
CF Step 10.000000 MHz

Freq Offset 0 Hz

2480

#### 4.7. Spurious RF Conducted Emission

##### TEST CONFIGURATION



##### TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013, For 9KHz-150kHz, Set RBW=1kHz and VBW= 3KHz;For 150KHz-10MHz, Set RBW=10kHz and VBW= 30KHz;For 10MHz-25GHz ,Set RBW=100kHz and VBW= 300KHz in order to measure the peak field strength, and measure frequency range from 9KHz to 25GHz.

##### LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.
3. For below 30MHz, For 9KHz-150kHz, 150K-10MHz, We use the RBW 1KHz, 10KHz, So the limit need to be calculated by " $10\lg(BW1/BW2)$ ". for example For 9KHz-150kHz, RBW 1KHz, The Limit= the highest emission level-20-10log(100/1)= the highest emission level-40.

##### TEST RESULTS

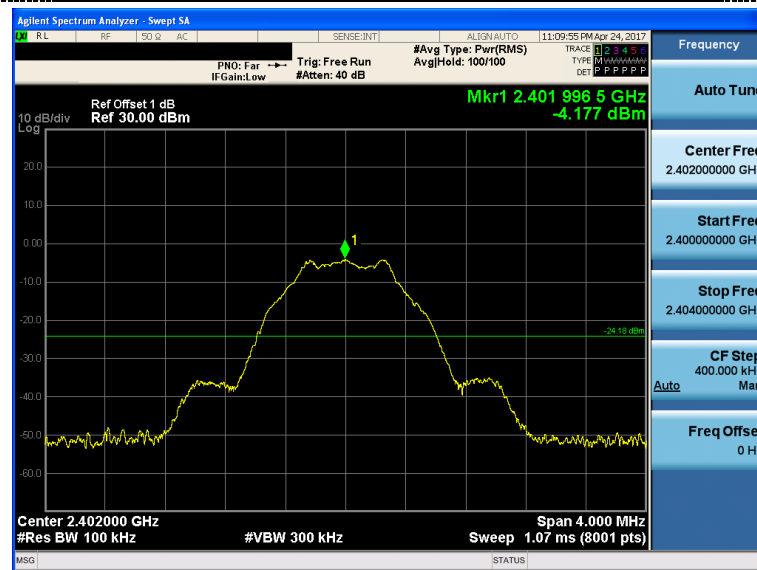
Remark: The measurement frequency range is from 9KHz to the 10<sup>th</sup> harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.

Test Mode:

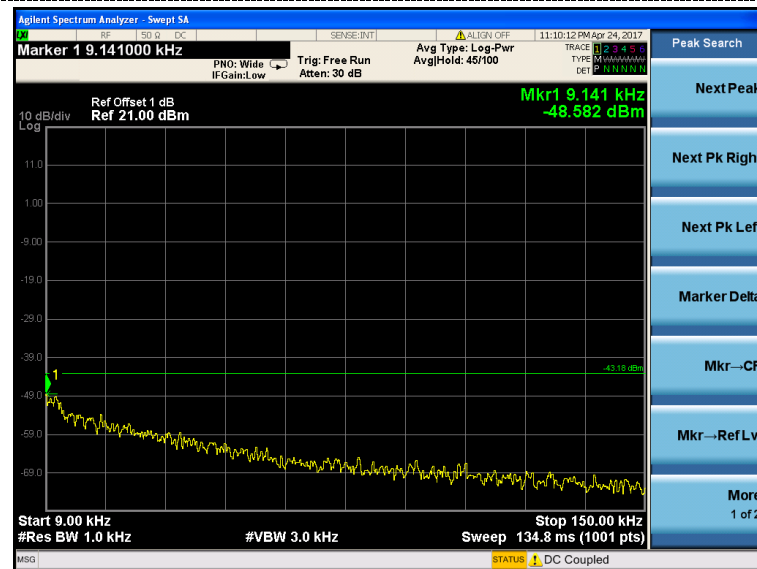
GFSK

Test channel :

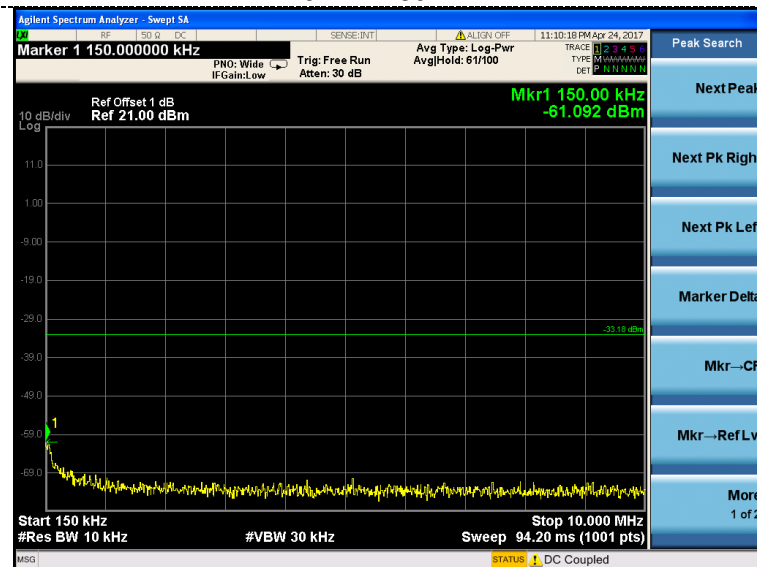
00



Channel 0



9KHz~150KHz



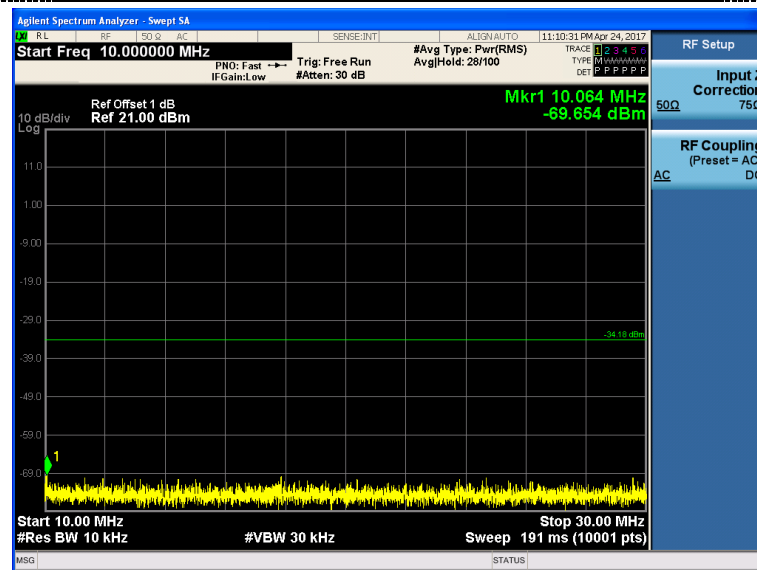
150KHz ~10MHz

Test Mode:

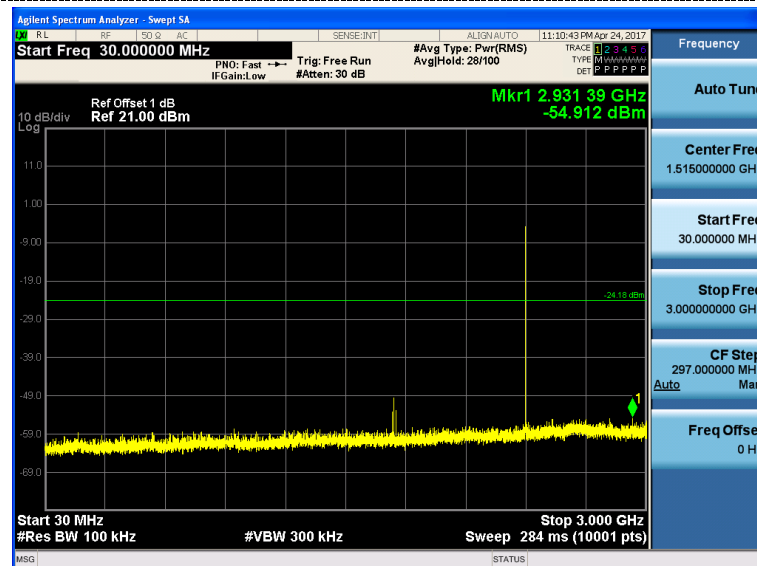
GFSK

Test channel :

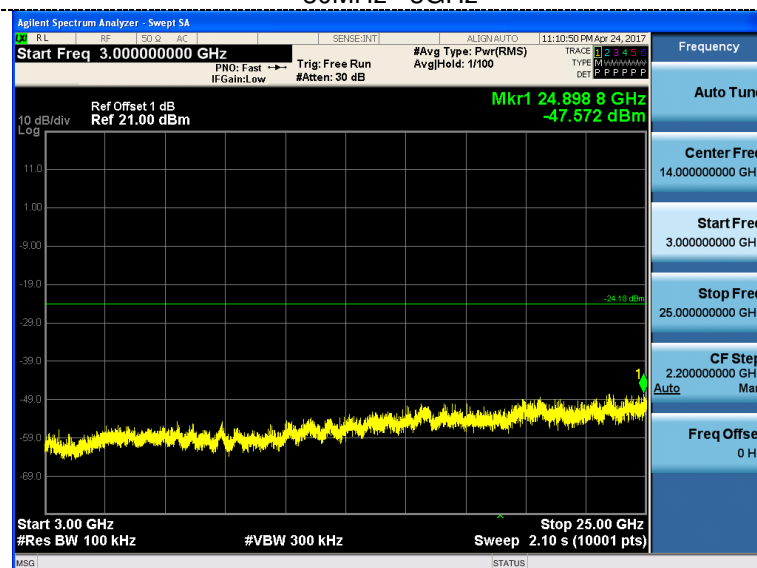
00



10MHz ~30MHz



30MHz ~3GHz



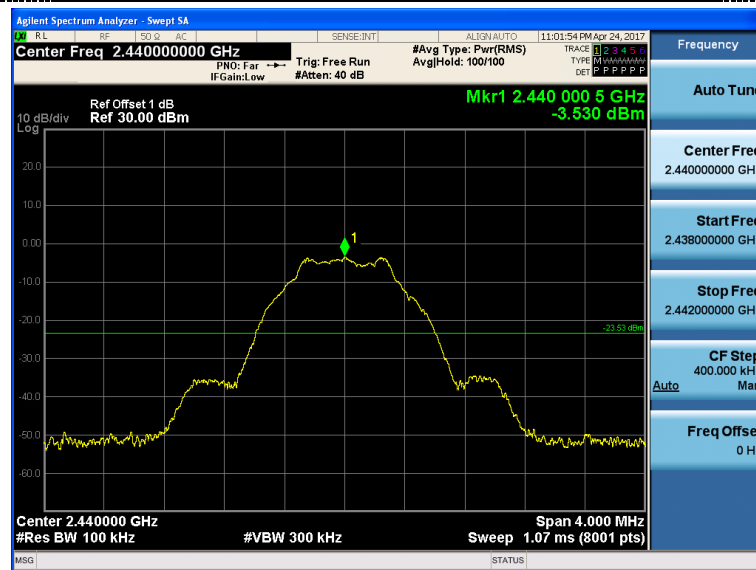
3GHz~25GHz

Test Mode:

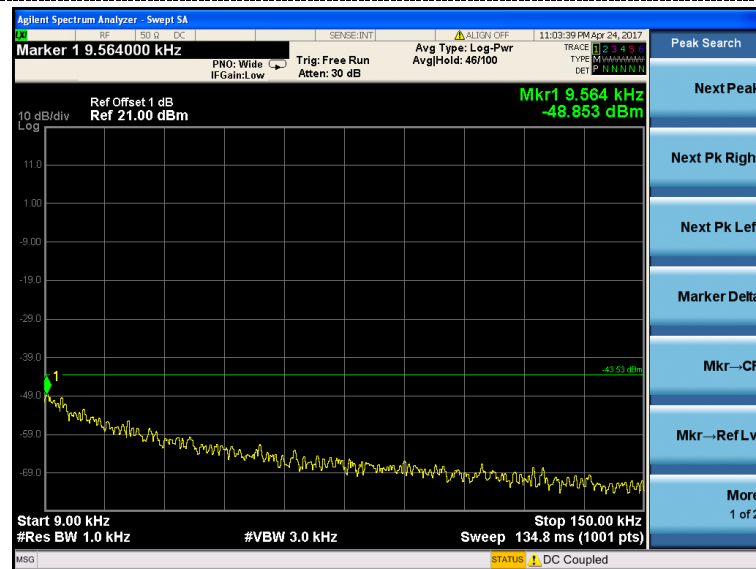
GFSK

Test channel :

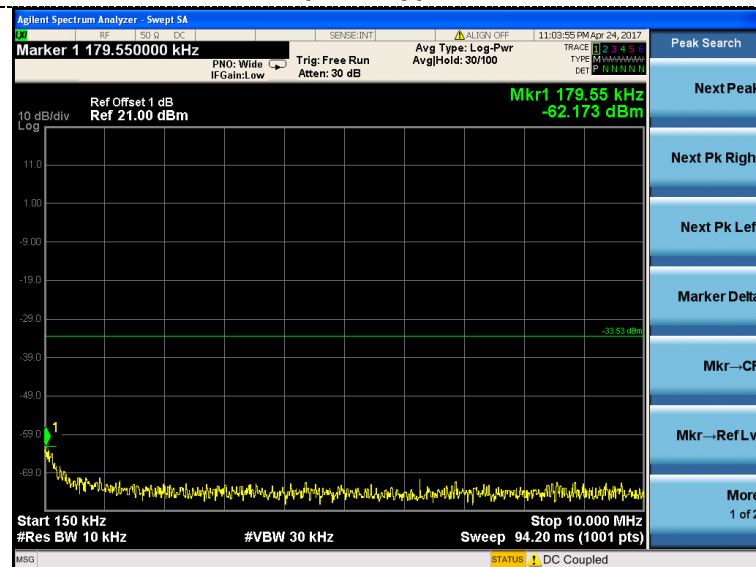
19



Channel 19



9KHz~150KHz



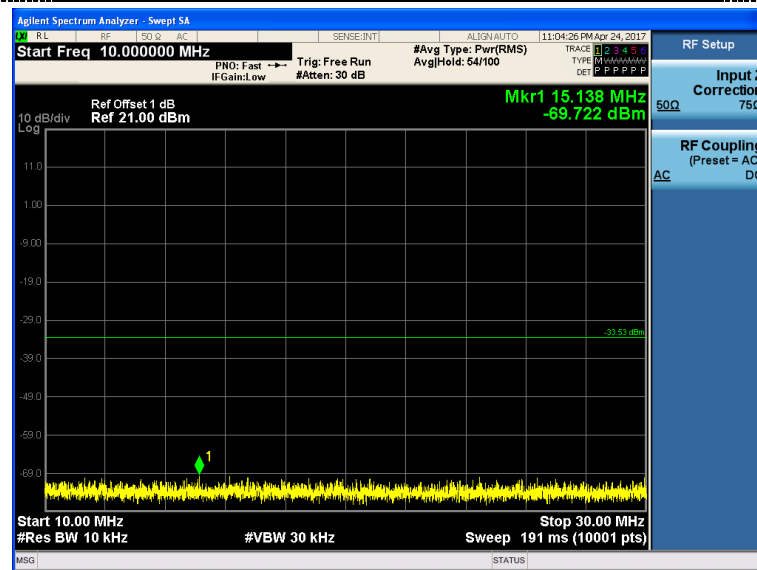
150KHz ~10MHz

Test Mode:

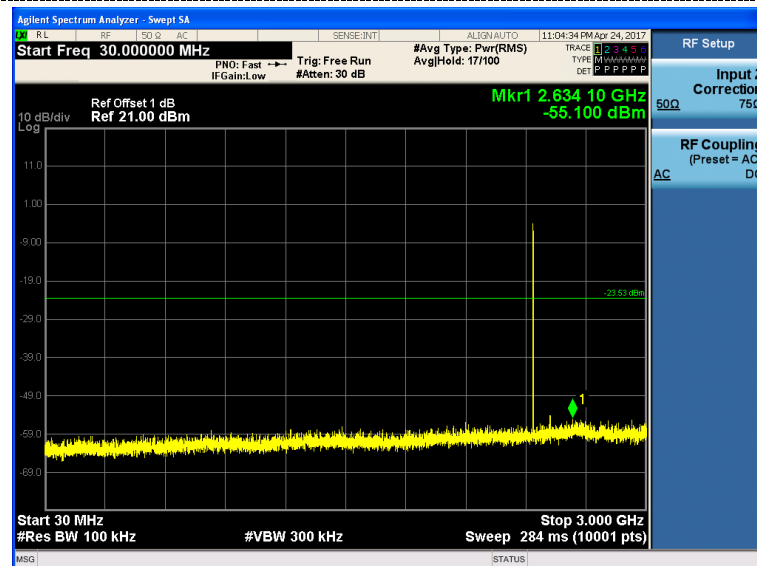
GFSK

Test channel :

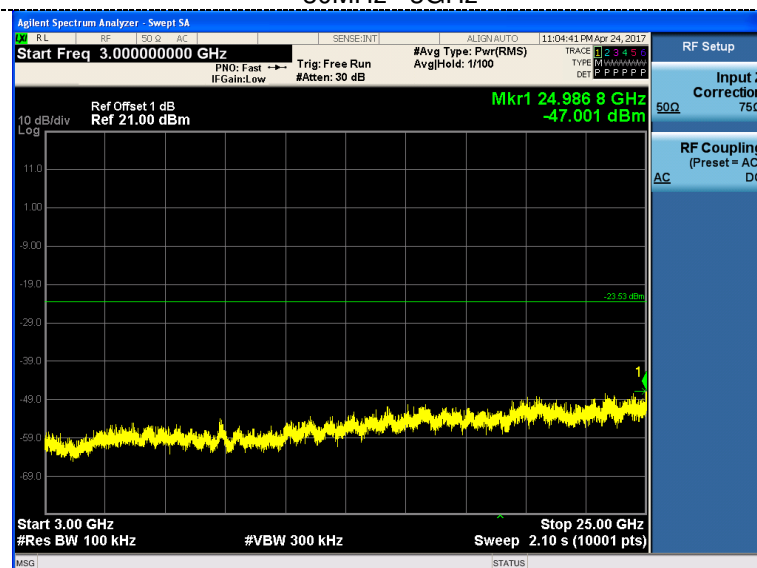
19



10MHz ~30MHz



30MHz ~3GHz



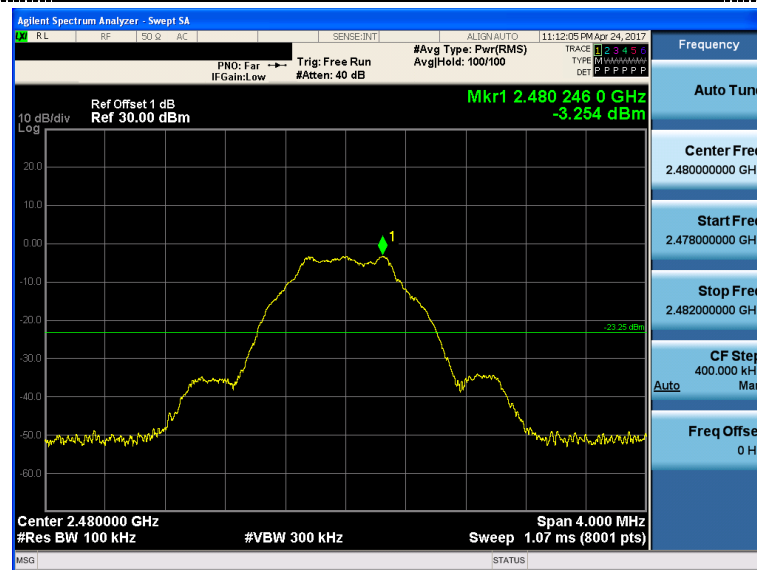
3GHz~25GHz

Test Mode:

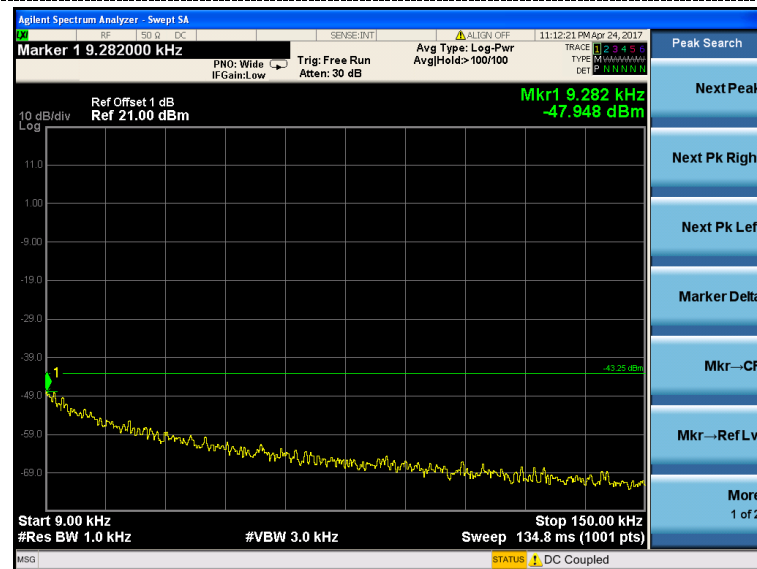
GFSK

Test channel :

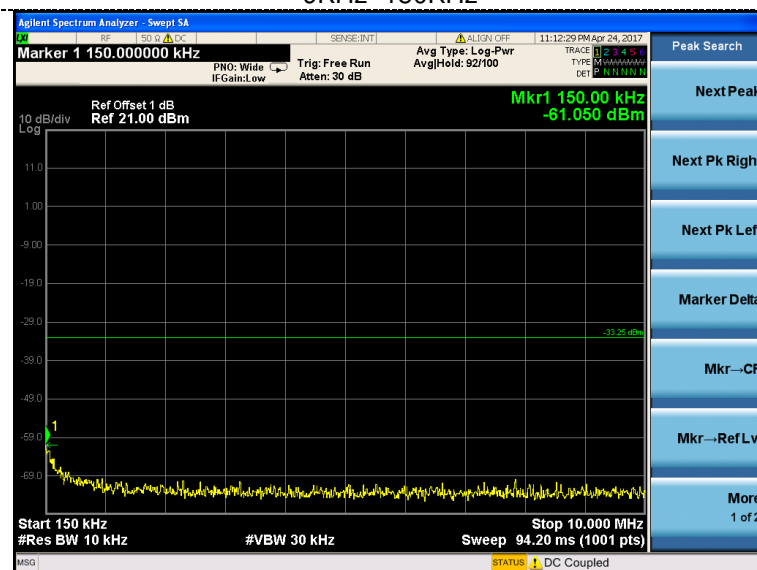
39



Channel 39



9KHz~150KHz



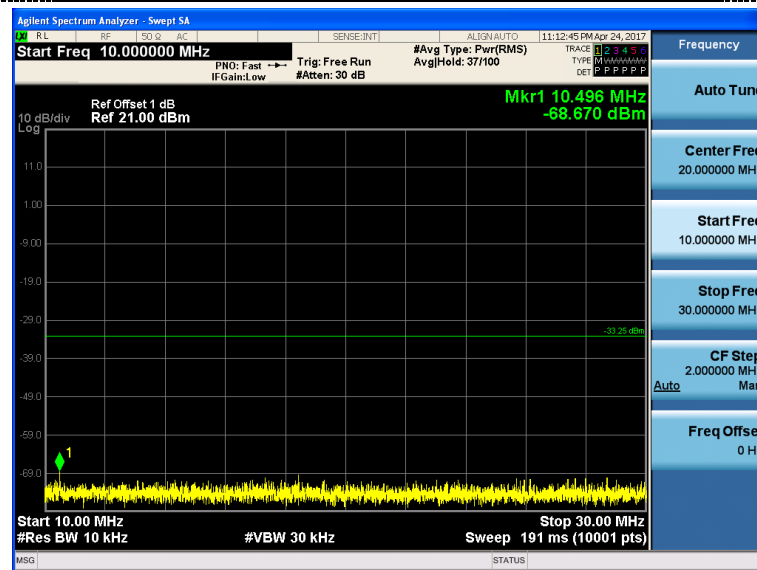
150KHz ~10MHz

Test Mode:

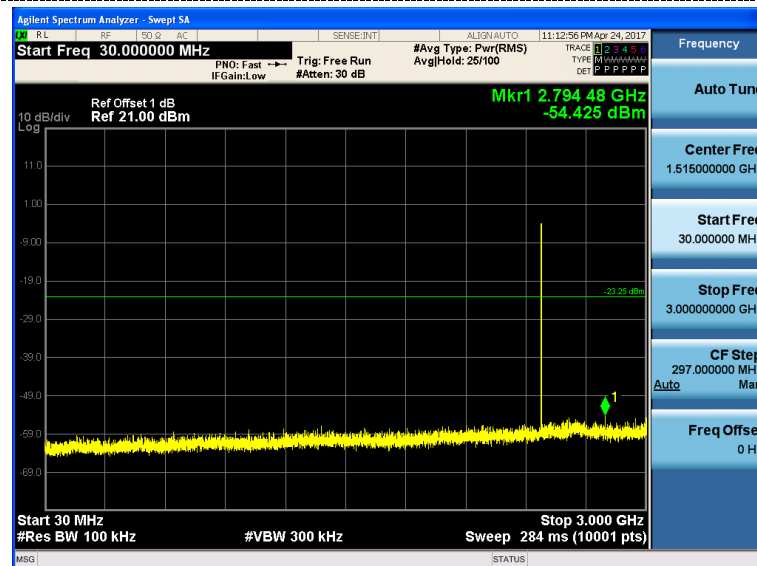
GFSK

Test channel :

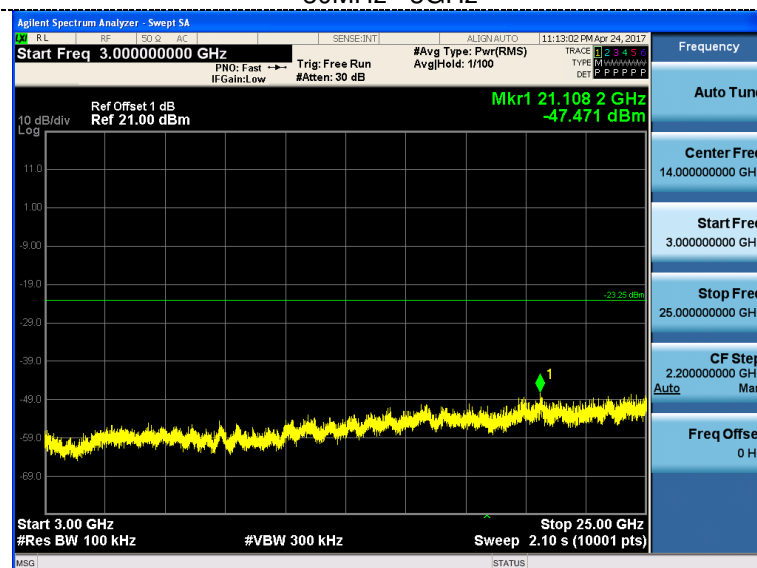
39



10MHz ~30MHz



30MHz ~3GHz



3GHz~25GHz

## 4.8. Antenna Requirement

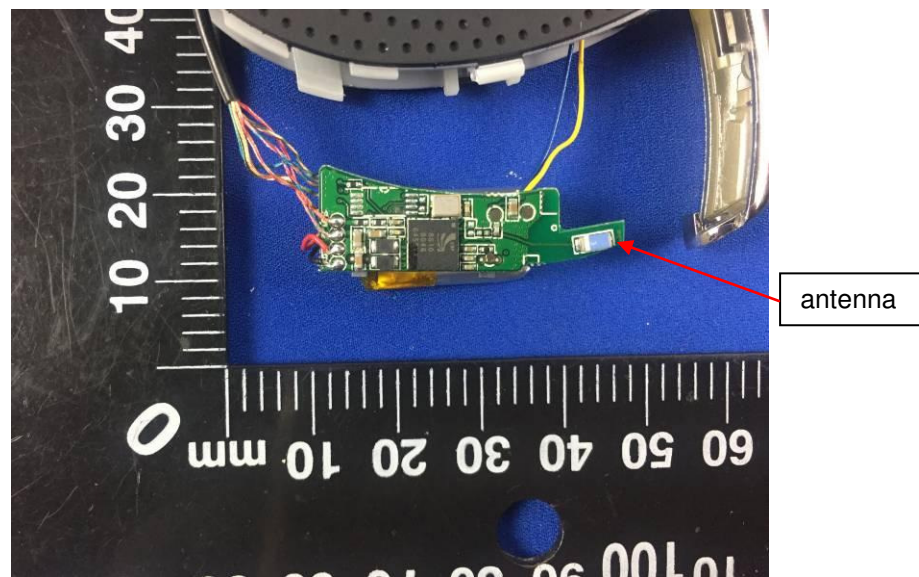
### Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

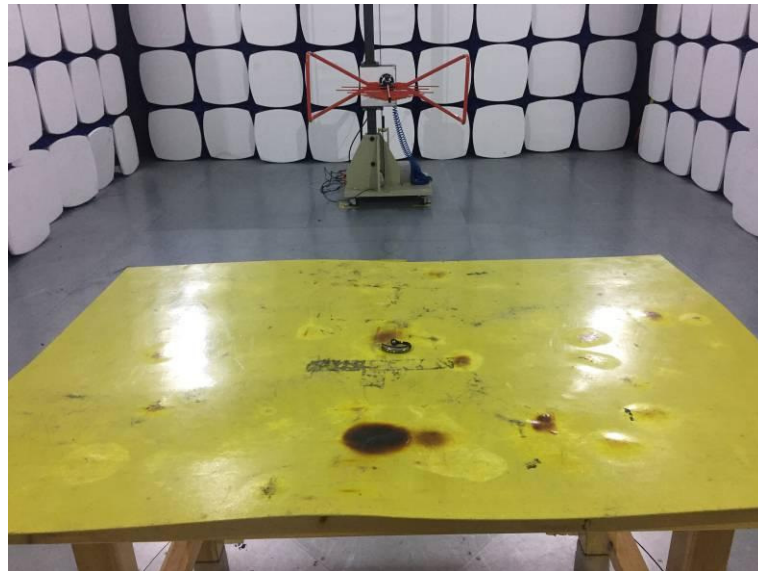
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

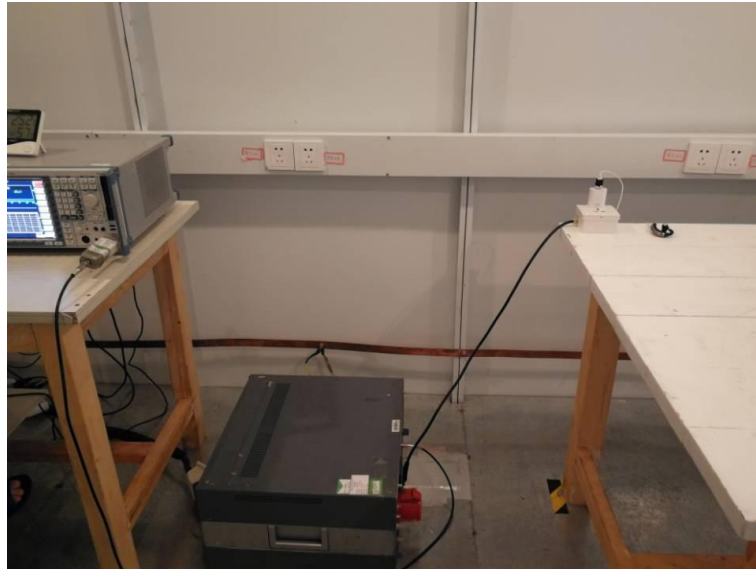
### Antenna Information

The antenna used is a Ceramic antenna, The directional gains of antenna used for transmitting is 0.84dBi.



## 5. Test Setup Photos of the EUT





## 6. External and Internal Photos of the EUT

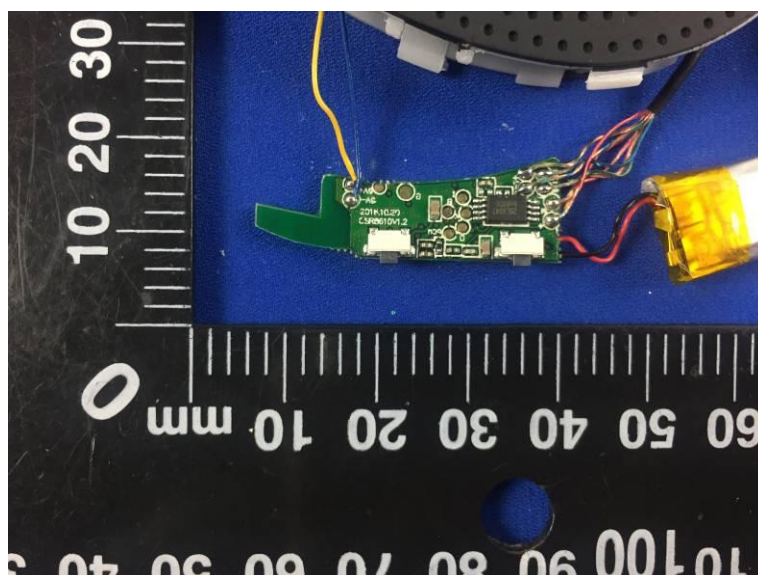
### External Photos

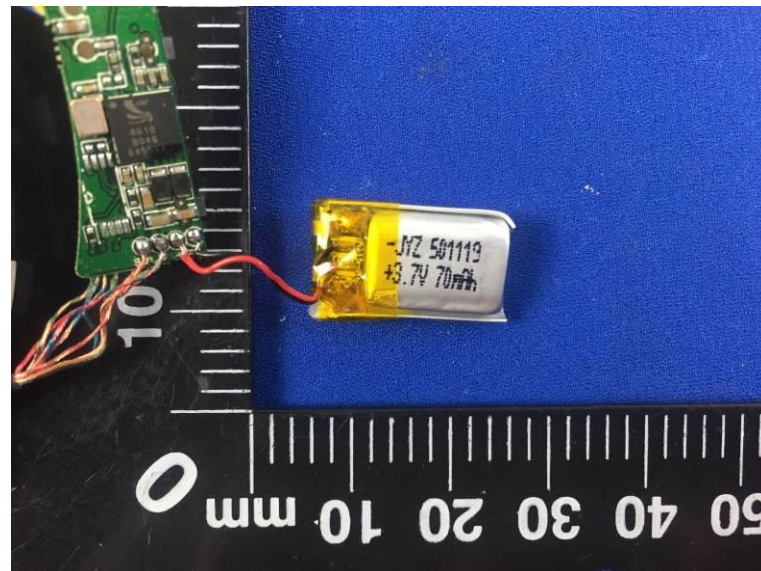
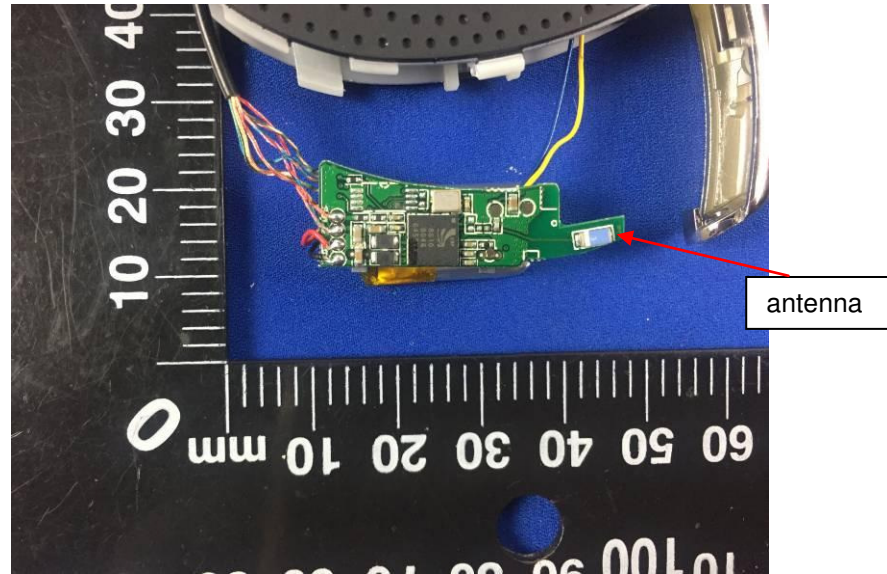






Internal Photos





.....End of Report.....