

# FCC Part 15C

## Measurement and Test Report

For

ShenZhen Shi Jiu He Electronics Co., Ltd

**FCC ID: 2APIS-JH-9097**

|                                      |                               |                    |
|--------------------------------------|-------------------------------|--------------------|
| <b>FCC Rule(s):</b>                  | <u>FCC Part 15.249</u>        |                    |
| <b>Product Description:</b>          | <u>Wireless earphone</u>      |                    |
| <b>Tested Model:</b>                 | <u>JH-9097</u>                |                    |
| <b>Report No.:</b>                   | <u>BSL190612630001RF</u>      |                    |
| <b>Tested Date:</b>                  | <u>July 17-22, 2019</u>       |                    |
| <b>Issued Date:</b>                  | <u>July 22, 2019</u>          |                    |
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| <b>Prepared By:</b>                  |                               |                    |

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## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: ShenZhen Shi Jiu He Electronics Co., Ltd  
 Address of applicant: 3/F.,No.29,PoTouDu Road West,Longxi community  
 Long Gang District,Shenzhen,China

Manufacturer: ShenZhen Shi Jiu He Electronics Co., Ltd  
 Address of manufacturer: 3/F.,No.29,PoTouDu Road West,Longxi community  
 Long Gang District,Shenzhen,China

| General Description of EUT                                                                     |                                                                                    |
|------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| Product Name:                                                                                  | Wireless earphone                                                                  |
| Trade Name:                                                                                    |  |
| Model No.:                                                                                     | JH-9097                                                                            |
| Adding Model(s):                                                                               | XG-60,JH-9108                                                                      |
| Rated Voltage:                                                                                 | DC 5V from adapter or 3.7V from battery                                            |
| Power Adapter Model:                                                                           | N/A                                                                                |
| <i>Note: The test data is gathered from a production sample, provided by the manufacturer.</i> |                                                                                    |

| Technical Characteristics of EUT  |                         |
|-----------------------------------|-------------------------|
| Frequency Range:                  | 2402-2480MHz            |
| Max. Field Strength:              | 94.55dBuV/m@1.5m        |
| Data Rate:                        | 1Mbps, 2Mbps, 3Mbps     |
| Modulation:                       | GFSK, Pi/4 QDPSK, 8DPSK |
| Quantity of Channels:             | 79                      |
| Channel Separation:               | 1MHz                    |
| Antenna Type:                     | Ceramic antenna         |
| Antenna Gain:                     | 0dBi                    |
| Lowest Internal Frequency of EUT: | 16MHz                   |

## 1.2 Test Standards

The following report is prepared on behalf of the ShenZhen Shi Jiu He Electronics Co., Ltd in accordance with FCC Part 15, Subpart B, Subpart C, and section 15.107, 15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.107,15.203, 15.205, 15.207, 15.209 and 15.249 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

## 1.4 Test Facility

BSL Testing Co.,LTD.

NO. 24, ZH Park, Nantou, Shenzhen, 518000 China

Designation Number : CN1217

Test Firm Registration Number: 866035

Tel: 86- 755-26508703

Fax: 86- 755-26508703

## 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

| Test Mode List |                |              |
|----------------|----------------|--------------|
| Test Mode      | Description    | Remark       |
| TM1            | Low Channel    | 2402MHz      |
| TM2            | Middle Channel | 2442MHz      |
| TM3            | High Channel   | 2480MHz      |
| TM4            | Hopping        | 2402-2480MHz |

| Modulation Configure                                                                                                                    |        |             |             |
|-----------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|-------------|
| Modulation                                                                                                                              | Packet | Packet Type | Packet Size |
| GFSK                                                                                                                                    | DH1    | 4           | 27          |
|                                                                                                                                         | DH3    | 11          | 183         |
|                                                                                                                                         | DH5    | 15          | 339         |
| Pi/4 DQPSK                                                                                                                              | 2DH1   | 20          | 54          |
|                                                                                                                                         | 2DH3   | 26          | 367         |
|                                                                                                                                         | 2DH5   | 30          | 679         |
| 8DPSK                                                                                                                                   | 3DH1   | 24          | 83          |
|                                                                                                                                         | 3DH3   | 27          | 552         |
|                                                                                                                                         | 3DH5   | 31          | 1021        |
| Normal mode: the Bluetooth has been tested on the modulation of GFSK, (Pi/4)DQPSK and 8DPSK, compliance test and record the worst case. |        |             |             |

| Special Cable List and Details |            |                     |                        |
|--------------------------------|------------|---------------------|------------------------|
| Cable Description              | Length (m) | Shielded/Unshielded | With / Without Ferrite |
|                                |            |                     |                        |

| Auxiliary Equipment List and Details |              |       |               |
|--------------------------------------|--------------|-------|---------------|
| Description                          | Manufacturer | Model | Serial Number |
| Notebook                             | Lenovo       | E23   | EB12648265    |
| USB                                  | ESR          | S01   | 19682904994   |

EUT Exercise Software

The test software: ‘FCC Test tool’ was used in test.

The worst condition (maximum power) was configured by default setting.

1.6 Measurement Uncertainty

| Measurement uncertainty        |            |                     |
|--------------------------------|------------|---------------------|
| Parameter                      | Conditions | Uncertainty         |
| RF Output Power                | Conducted  | $\pm 0.42\text{dB}$ |
| Occupied Bandwidth             | Conducted  | $\pm 1.5\%$         |
| Conducted Spurious Emission    | Conducted  | $\pm 2.17\text{dB}$ |
| Conducted Emissions            | Conducted  | $\pm 2.88\text{dB}$ |
| Transmitter Spurious Emissions | Radiated   | $\pm 5.1\text{dB}$  |

## 1.7 Test Equipment List and Details

| Dscription                          | Manufacturer        | Model              | Serial No. | Cal Date   | Due. Date  |
|-------------------------------------|---------------------|--------------------|------------|------------|------------|
| Communication Tester                | Rohde & Schwarz     | CMW500             | 100358     | 2018-11-08 | 2019-11-07 |
| Spectrum Analyzer                   | R&S                 | FSP40              | 100550     | 2018-10-08 | 2019-10-07 |
| Test Receiver                       | R&S                 | ESCI7              | US47140102 | 2018-10-08 | 2019-10-07 |
| Signal Generator                    | HP                  | 83630B             | 3844A01028 | 2018-10-08 | 2019-10-07 |
| Test Receiver                       | R&S                 | ESPI-3             | 100180     | 2018-10-08 | 2019-10-07 |
| Amplifier                           | Agilent             | 8449B              | 4035A00116 | 2018-10-08 | 2019-10-07 |
| Amplifier                           | HP                  | 8447E              | 2945A02770 | 2018-10-08 | 2019-10-07 |
| Signal Generator                    | IFR                 | 2023A              | 202307/242 | 2018-10-08 | 2019-10-07 |
| Broadband Antenna                   | SCHAFFNER           | 2774               | 2774       | 2018-10-21 | 2019-10-20 |
| Biconical and log periodic antennas | ELECTRO-METRI<br>CS | EM-6917B-1         | 171        | 2018-10-21 | 2019-10-20 |
| Horn Antenna                        | R&S                 | HF906              | 100253     | 2018-10-21 | 2019-10-20 |
| Horn Antenna                        | EM                  | EM-6961            | 6462       | 2018-10-21 | 2019-10-20 |
| LISN                                | R&S                 | ESH3-Z5            | 100196     | 2018-10-08 | 2019-10-07 |
| LISN                                | COM-POWER           | LI-115             | 02027      | 2018-10-08 | 2019-10-07 |
| 3m Semi-Anechoic Chamber            | Chengyu Electron    | 9 (L)*6 (W)* 6 (H) | BSL086     | 2018-10-08 | 2019-10-07 |
| Horn Antenna                        | Schwarzbeck         | BBHA9170           | 00814      | 2018-10-21 | 2019-10-20 |
| EZ                                  | EMC test software   | /                  | /          | /          | /          |

## 2. SUMMARY OF TEST RESULTS

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| FCC Rules      | Description of Test Item     | Result |
|----------------|------------------------------|--------|
| § 15.203       | Antenna Requirement          | PASS   |
| §15.205        | Restricted Band of Operation | PASS   |
| § 15.207(a)    | Conducted Emission           | PASS   |
| § 15.209(a)(f) | Radiated Spurious Emissions  | PASS   |
| §15.249(a)     | Field Strength of Emissions  | PASS   |
| §15.249(d)     | Out of Band Emission         | PASS   |
| §15.215 (c)    | Emission Bandwidth           | PASS   |

Note: PASS: applicable, N/A: not applicable.

### **3. Antenna Requirements**

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#### **3.1 Standard Applicable**

According to FCC Part 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.

#### **3.2 Test Result**

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

## 4. Radiated Emissions

### 4.1 Standard Applicable

According to §15.249(a), the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency | Field strength of fundamental<br>(milli-volts/meter) | Field strength of Harmonics<br>(micro-volts/meter) |
|-----------------------|------------------------------------------------------|----------------------------------------------------|
| 902-928 MHz           | 50                                                   | 500                                                |
| 2400-2483.5 MHz       | 50                                                   | 500                                                |
| 5725-5875 MHz         | 50                                                   | 500                                                |
| 24.0-24.25 GHz        | 250                                                  | 2500                                               |

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

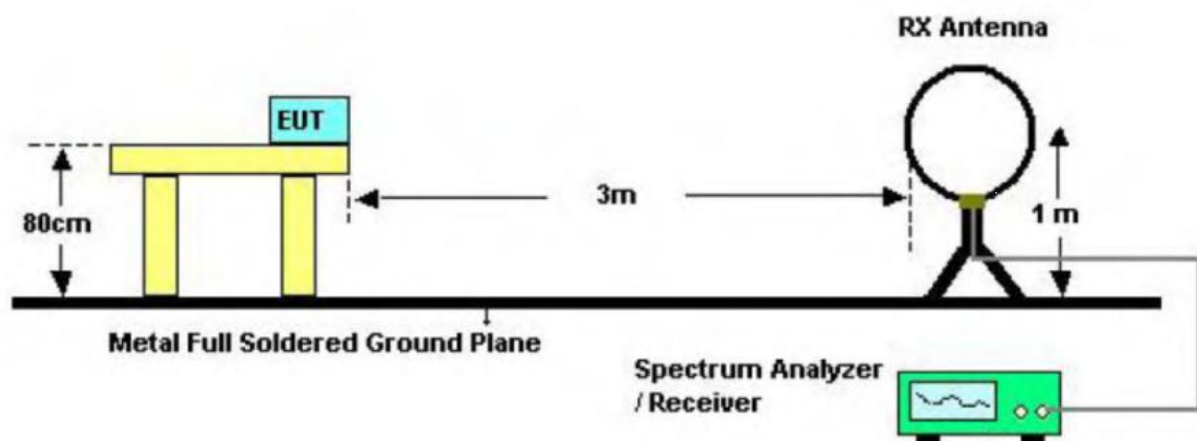
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

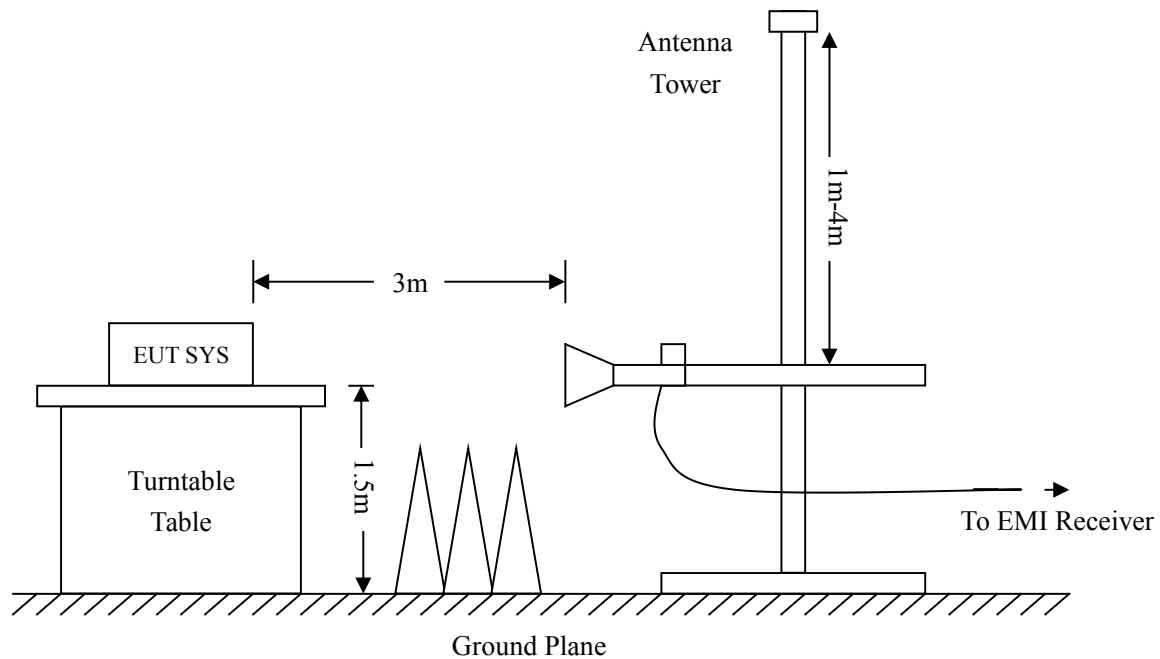
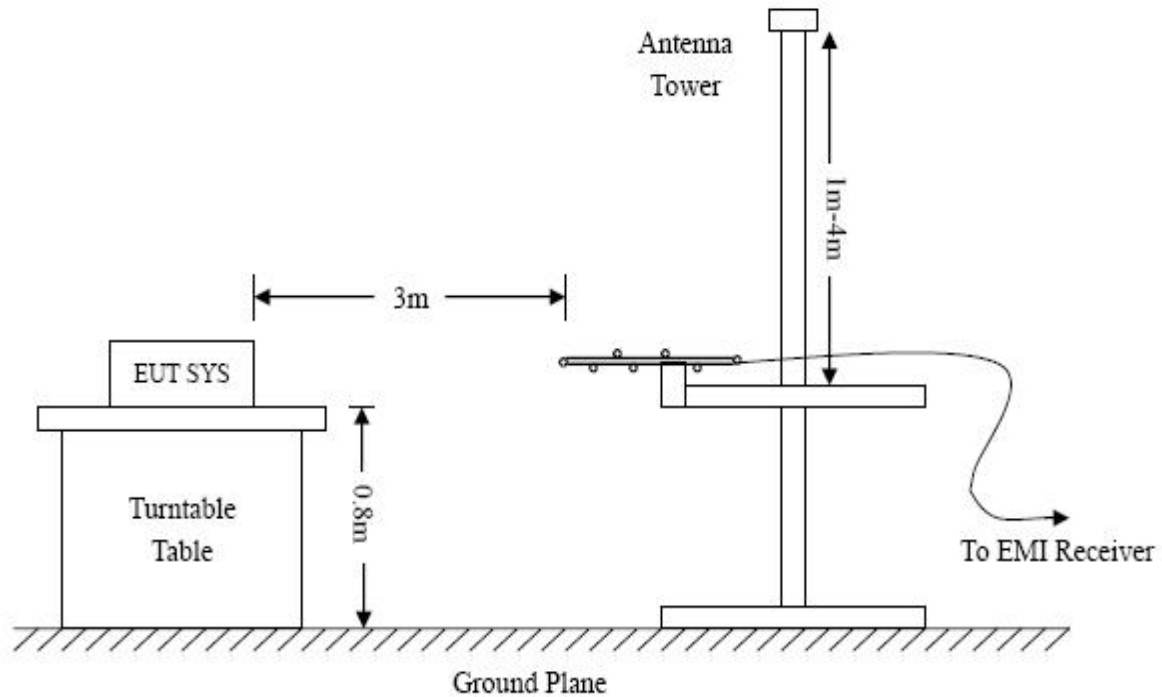
### 4.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.249(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz  
 RBW=10KHz,  
 VBW =30KHz  
 Sweep time= Auto  
 Trace = max hold  
 Detector function = peak

Frequency :30MHz-1GHz  
 RBW=120KHz,  
 VBW=300KHz  
 Sweep time= Auto  
 Trace = max hold  
 Detector function = peak, QP

Frequency :Above 1GHz  
 RBW=1MHz,  
 VBW=3MHz(Peak), 10Hz(AV)  
 Sweep time= Auto  
 Trace = max hold  
 Detector function = peak, AV

### 4.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

### 4.4 Environmental Conditions

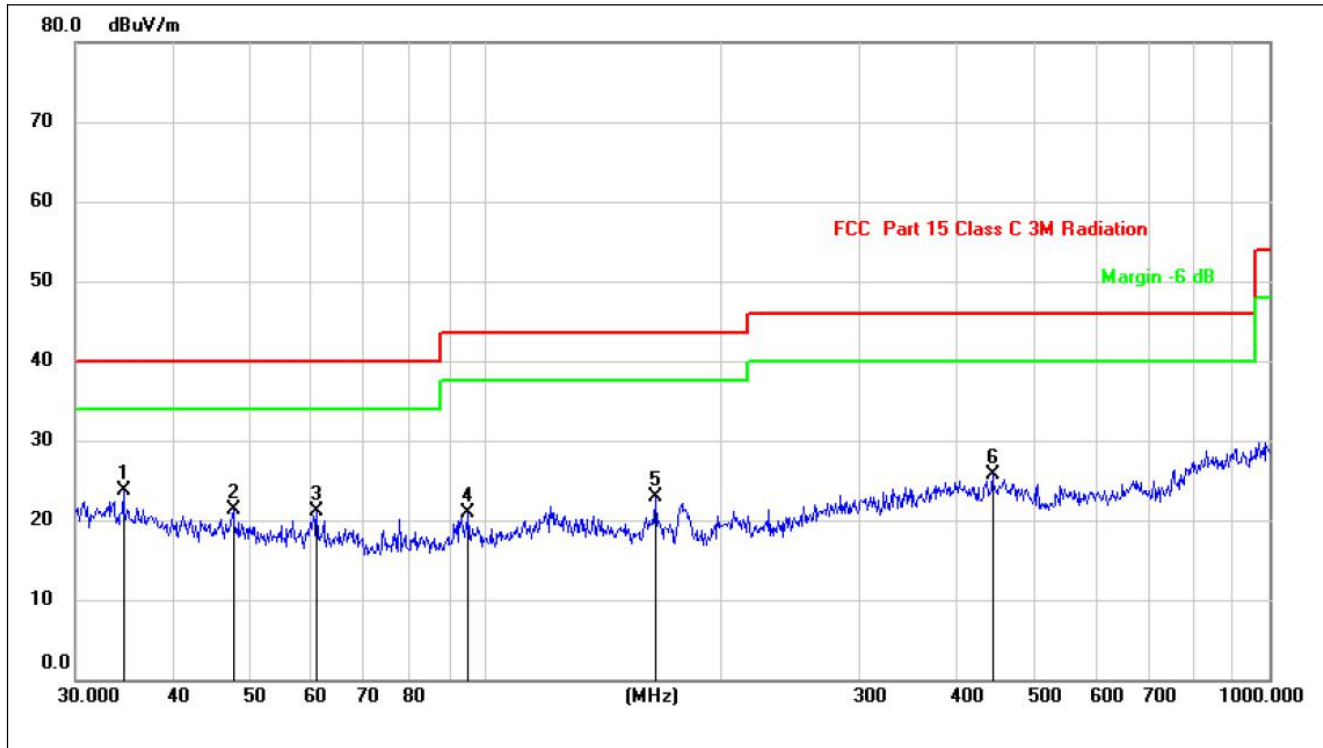
|                    |           |
|--------------------|-----------|
| Temperature:       | 24 °C     |
| Relative Humidity: | 60 %      |
| ATM Pressure:      | 1012 mbar |

### 4.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.249 standards, and had the worst cases.

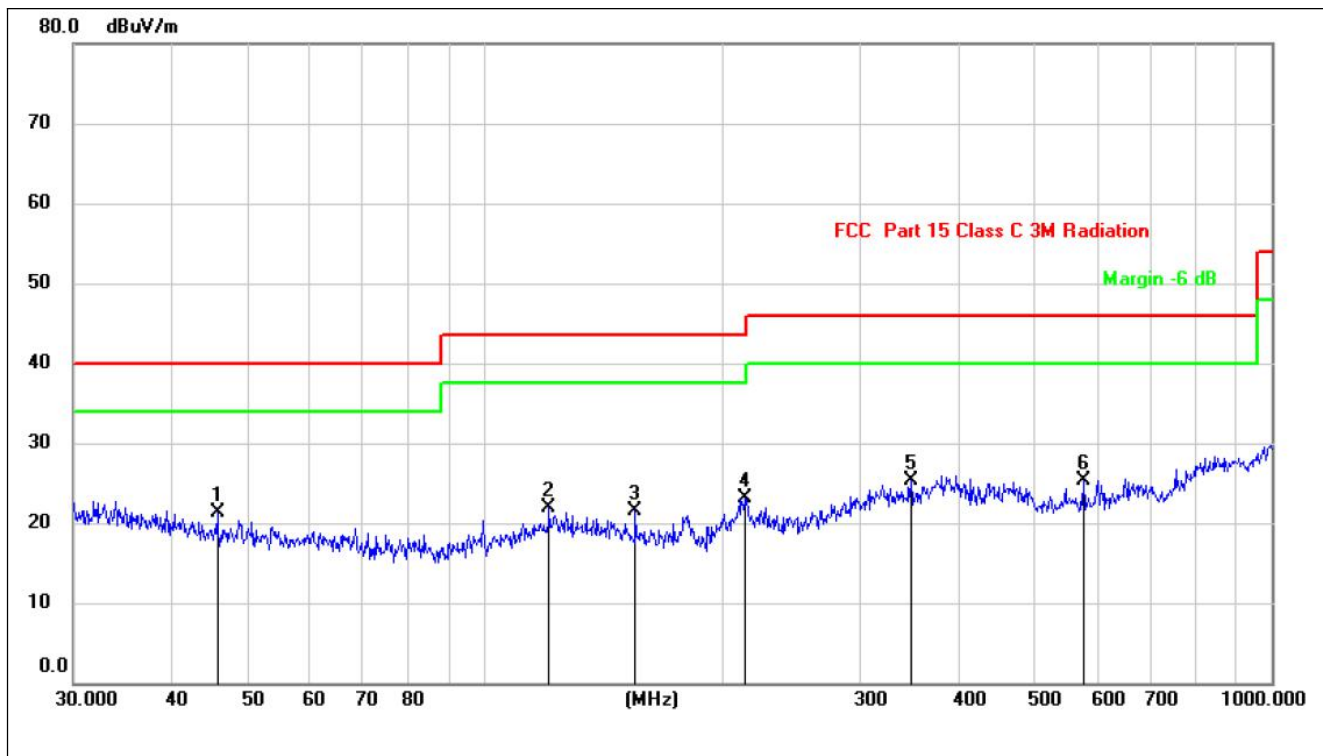
*Note:*

- 1. Worst-case radiated emission below 1GHz is GFSK (CH High) mode.*
- 2. Worst-case radiated emission above 1GHz is (Pi/4)DQPSK (CH Low, Middle, High) mode.*

**Plot of Radiated Emissions Test Data (30MHz to 1GHz): GFSK (CH High) mode:***Test Specification: Horizontal*

| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dBuV/m | Measure-<br>ment<br>dBuV/m | Limit<br>dBuV/m | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-----------------------------|----------------------------|-----------------|------------|----------|---------|
| 1   | *   | 34.5172      | 14.97                    | 8.76                        | 23.73                      | 40.00           | -16.27     | QP       |         |
| 2   |     | 47.6584      | 14.80                    | 6.49                        | 21.29                      | 40.00           | -18.71     | QP       |         |
| 3   |     | 60.9176      | 15.92                    | 5.25                        | 21.17                      | 40.00           | -18.83     | QP       |         |
| 4   |     | 95.0930      | 15.92                    | 4.91                        | 20.83                      | 43.50           | -22.67     | QP       |         |
| 5   |     | 164.9074     | 17.35                    | 5.55                        | 22.90                      | 43.50           | -20.60     | QP       |         |
| 6   |     | 443.2943     | 14.74                    | 11.06                       | 25.80                      | 46.00           | -20.20     | QP       |         |

Test Specification: Vertical



| No. | Mk. | Freq.    | Reading Level | Correct Factor | Measurement | Limit  | Over   |          |         |
|-----|-----|----------|---------------|----------------|-------------|--------|--------|----------|---------|
|     |     | MHz      | dBuV          | dBuV/m         | dBuV/m      | dBuV/m | dB     | Detector | Comment |
| 1   | *   | 45.6948  | 14.62         | 6.64           | 21.26       | 40.00  | -18.74 | QP       |         |
| 2   |     | 120.6991 | 14.31         | 7.55           | 21.86       | 43.50  | -21.64 | QP       |         |
| 3   |     | 155.3643 | 15.58         | 5.88           | 21.46       | 43.50  | -22.04 | QP       |         |
| 4   |     | 213.7633 | 16.64         | 6.50           | 23.14       | 43.50  | -20.36 | QP       |         |
| 5   |     | 348.0274 | 14.98         | 10.38          | 25.36       | 46.00  | -20.64 | QP       |         |
| 6   |     | 576.6443 | 16.08         | 9.31           | 25.39       | 46.00  | -20.61 | QP       |         |

*Spurious Emissions Above 1GHz :(Pi/4)DQPSK (CH Low, Middle, High) mode.*

| Frequency              | Rearding Level | Factor | Result         | Limit          | Margin | Polar | Detector |
|------------------------|----------------|--------|----------------|----------------|--------|-------|----------|
| (MHz)                  | (dB $\mu$ V)   | (dB/m) | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   | H/V   |          |
| Low Channel-2402MHz    |                |        |                |                |        |       |          |
| 2402                   | 88.93          | 5.62   | 94.55          | 114            | -19.45 | H     | PK       |
| 2402                   | 71.44          | 5.62   | 77.06          | 94             | -16.94 | H     | AV       |
| 4804                   | 57.28          | 4.62   | 61.90          | 74             | -12.10 | H     | PK       |
| 4804                   | 43.45          | 4.62   | 48.07          | 54             | -5.93  | H     | AV       |
| 7206                   | 47.24          | 3.51   | 50.75          | 74             | -23.25 | H     | PK       |
| 7206                   | 35.17          | 3.51   | 38.68          | 54             | -15.32 | H     | AV       |
| 2402                   | 83.28          | 5.62   | 88.90          | 114            | -25.10 | V     | PK       |
| 2402                   | 72.52          | 5.62   | 78.14          | 94             | -15.86 | V     | AV       |
| 4804                   | 52.49          | 4.62   | 57.11          | 74             | -16.89 | V     | PK       |
| 4804                   | 38.36          | 4.62   | 42.98          | 54             | -11.02 | V     | AV       |
| 7206                   | 60.57          | 3.51   | 64.08          | 74             | -9.92  | V     | PK       |
| 7206                   | 36.89          | 3.51   | 40.40          | 54             | -13.60 | V     | AV       |
| Middle Channel-2442MHz |                |        |                |                |        |       |          |
| 2442                   | 83.78          | 4.52   | 88.30          | 114            | -25.70 | H     | PK       |
| 2442                   | 73.52          | 4.52   | 78.04          | 94             | -15.96 | H     | AV       |
| 4884                   | 53.11          | 3.65   | 56.76          | 74             | -17.24 | H     | PK       |
| 4884                   | 42.23          | 3.65   | 45.88          | 54             | -8.12  | H     | AV       |
| 7326                   | 48.45          | 3.48   | 51.93          | 74             | -22.07 | H     | PK       |
| 7326                   | 42.79          | 3.48   | 46.27          | 54             | -7.73  | H     | AV       |
| 2442                   | 84.34          | 4.52   | 88.86          | 114            | -25.14 | V     | PK       |
| 2442                   | 73.28          | 4.52   | 77.80          | 94             | -16.20 | V     | AV       |
| 4884                   | 54.16          | 3.65   | 57.81          | 74             | -16.19 | V     | PK       |
| 4884                   | 37.21          | 3.65   | 40.86          | 54             | -13.14 | V     | AV       |
| 7326                   | 52.49          | 3.48   | 55.97          | 74             | -18.03 | V     | PK       |
| 7326                   | 38.22          | 3.48   | 41.70          | 54             | -12.30 | V     | AV       |

| Frequency           | Rearding Level | Factor | Result         | Limit          | Margin | Polar | Detector |
|---------------------|----------------|--------|----------------|----------------|--------|-------|----------|
| (MHz)               | (dB $\mu$ V)   | (dB/m) | (dB $\mu$ V/m) | (dB $\mu$ V/m) | (dB)   | H/V   |          |
| Low Channel-2480MHz |                |        |                |                |        |       |          |
| 2480                | 86.33          | 3.52   | 89.85          | 114            | -24.15 | H     | PK       |
| 2480                | 72.49          | 3.52   | 76.01          | 94             | -17.99 | H     | AV       |
| 4960                | 58.28          | 2.51   | 60.79          | 74             | -13.21 | H     | PK       |
| 4960                | 38.43          | 2.51   | 40.94          | 54             | -13.06 | H     | AV       |
| 7440                | 49.09          | 3.10   | 52.19          | 74             | -21.81 | H     | PK       |
| 7440                | 42.29          | 3.10   | 45.39          | 54             | -8.61  | H     | AV       |
| 2480                | 85.41          | 3.52   | 88.93          | 114            | -25.07 | V     | PK       |
| 2480                | 73.52          | 3.52   | 77.04          | 94             | -16.96 | V     | AV       |
| 4960                | 47.68          | 2.51   | 50.19          | 74             | -23.81 | V     | PK       |
| 4960                | 41.05          | 2.51   | 43.56          | 54             | -10.44 | V     | AV       |
| 7440                | 45.20          | 3.10   | 48.30          | 74             | -25.70 | V     | PK       |
| 7440                | 38.66          | 3.10   | 41.76          | 54             | -12.24 | V     | AV       |

Note:

1.  $Result = Reading + Correct Factor$ .

2.  $Correct Factor = Ant. Factor + Cable Loss - Ampl. Gain$ .

Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 5<sup>th</sup> Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz..

## 5. Out of Band Emissions

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### 5.1 Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### 5.2 Test Procedure

As the radiation test, set the Lowest and Highest Transmitting Channel, observed the outside band of 2400MHz to 2483.5MHz, than mark the higher-level emission for comparing with the FCC rules.

### 5.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 24 °C     |
| Relative Humidity: | 60 %      |
| ATM Pressure:      | 1012 mbar |

### 5.4 Summary of Test Results/Plots

Note: We pre-scan all mode, the worst data is DH1, 2DH1, 3DH1.

| Modulation | Frequency | Reading (dBuV) | Factor (dB/m) | Measurement (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark | Result |
|------------|-----------|----------------|---------------|----------------------|----------------|-------------|--------|--------|
| GFSK       | 2390.00   | 48.12          | 2.36          | 50.48                | 74             | -23.52      | Peak   | PASS   |
|            | 2390.00   | 36.31          | 2.36          | 38.67                | 54             | -15.33      | AV     | PASS   |
|            | 2400.00   | 48.44          | 3.45          | 51.89                | 74             | -22.11      | Peak   | PASS   |
|            | 2400.00   | 37.21          | 3.45          | 40.66                | 54             | -13.34      | AV     | PASS   |
|            | 2483.50   | 50.09          | 2.51          | 52.60                | 74             | -21.40      | Peak   | PASS   |
|            | 2483.50   | 38.63          | 2.51          | 41.14                | 54             | -12.86      | AV     | PASS   |
|            | 2488.25   | 48.77          | 2.76          | 51.53                | 74             | -22.47      | Peak   | PASS   |
|            | 2488.25   | 37.91          | 2.76          | 40.67                | 54             | -13.33      | AV     | PASS   |
| Pi/4 DQPSK | 2390.00   | 48.27          | 2.36          | 50.63                | 74             | -23.37      | Peak   | PASS   |
|            | 2390.00   | 35.49          | 2.36          | 37.85                | 54             | -16.15      | AV     | PASS   |
|            | 2400.00   | 50.19          | 3.45          | 53.64                | 74             | -20.36      | Peak   | PASS   |
|            | 2400.00   | 37.57          | 3.45          | 41.02                | 54             | -12.98      | AV     | PASS   |
|            | 2483.50   | 48.29          | 2.51          | 50.80                | 74             | -23.20      | Peak   | PASS   |
|            | 2483.50   | 36.33          | 2.51          | 38.84                | 54             | -15.16      | AV     | PASS   |
|            | 2486.36   | 49.78          | 2.73          | 52.51                | 74             | -21.49      | Peak   | PASS   |
|            | 2486.36   | 37.49          | 2.73          | 40.22                | 54             | -13.78      | AV     | PASS   |
| 8DPSK      | 2390.00   | 48.47          | 2.36          | 50.83                | 74             | -23.17      | Peak   | PASS   |
|            | 2390.00   | 37.86          | 2.36          | 40.22                | 54             | -13.78      | AV     | PASS   |
|            | 2400.00   | 46.95          | 3.45          | 50.40                | 74             | -23.60      | Peak   | PASS   |
|            | 2400.00   | 35.24          | 3.45          | 38.69                | 54             | -15.31      | AV     | PASS   |
|            | 2483.50   | 50.62          | 2.51          | 53.13                | 74             | -20.87      | Peak   | PASS   |
|            | 2483.50   | 39.53          | 2.51          | 42.04                | 54             | -11.96      | AV     | PASS   |
|            | 2496.42   | 49.89          | 2.94          | 52.83                | 74             | -21.17      | Peak   | PASS   |
|            | 2496.42   | 37.08          | 2.94          | 40.02                | 54             | -13.98      | AV     | PASS   |

## 6. Emission Bandwidth

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### 6.1 Standard Applicable

According to 15.215 (c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

### 6.2 Test Procedure

According to the ANSI 63.10-2013, the emission bandwidth test method as follows.

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

Set span = 3MHz, centered on a transmitting channel

RBW  $\geq$  1% 20dB Bandwidth, VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down and 99% bandwidth of the emission.

### 6.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 53%       |
| ATM Pressure:      | 1018 mbar |

## 6.4 Summary of Test Results/Plots

Worst mode: GFSK (DH1)

| Channel        | Frequency<br>MHz | 20dB Bandwidth<br>kHz |
|----------------|------------------|-----------------------|
| Low Channel    | 2402             | 834                   |
| Middle Channel | 2442             | 828                   |
| High Channel   | 2480             | 828                   |

Worst mode: Pi/4 QDPSK (2DH1)

| Channel        | Frequency<br>MHz | 20dB Bandwidth<br>kHz |
|----------------|------------------|-----------------------|
| Low Channel    | 2402             | 1122                  |
| Middle Channel | 2442             | 1122                  |
| High Channel   | 2480             | 1122                  |

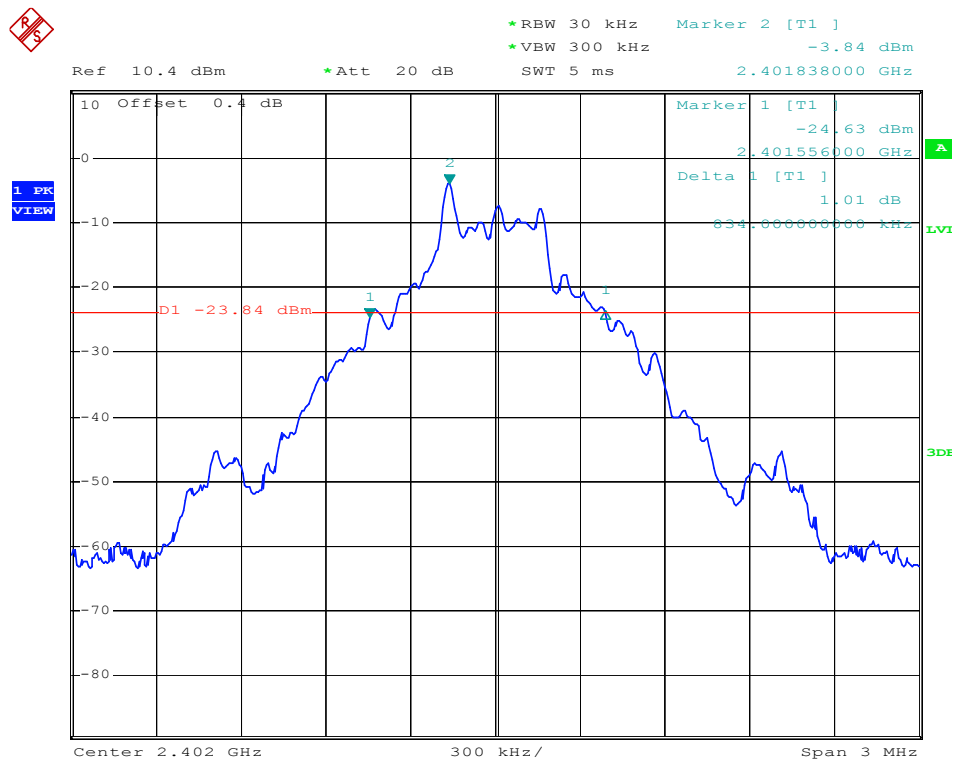
Worst mode: 8DPSK (3DH1)

| Channel        | Frequency<br>MHz | 20dB Bandwidth<br>kHz |
|----------------|------------------|-----------------------|
| Low Channel    | 2402             | 1170                  |
| Middle Channel | 2442             | 1170                  |
| High Channel   | 2480             | 1170                  |

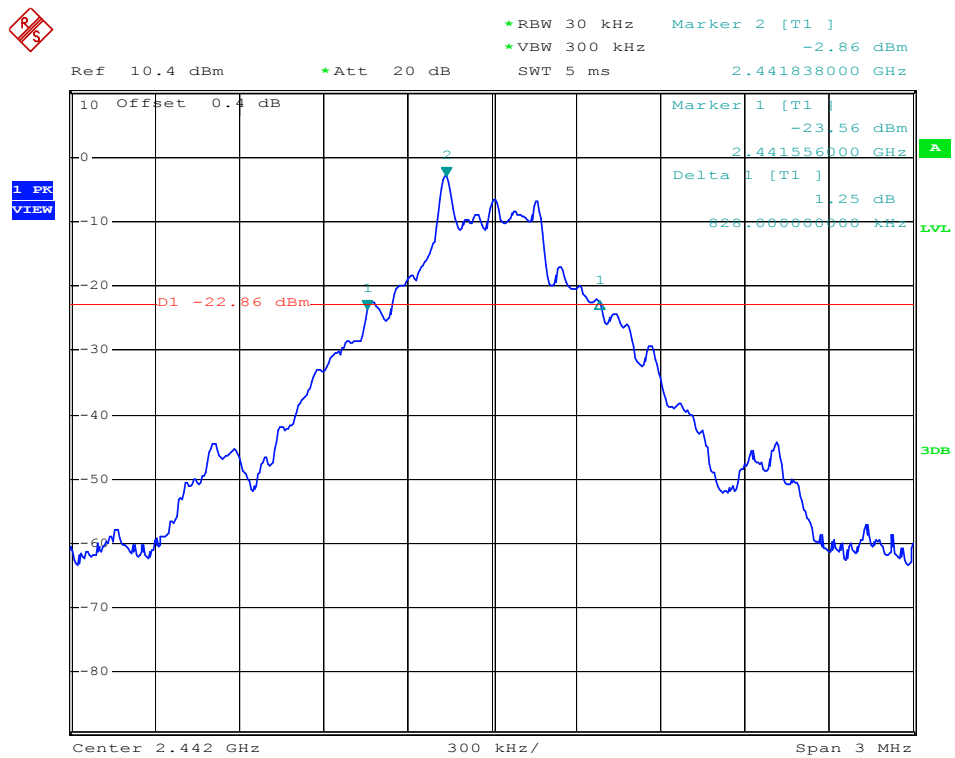
Please refer to the following test plots

Worst mode: GFSK (DH1)

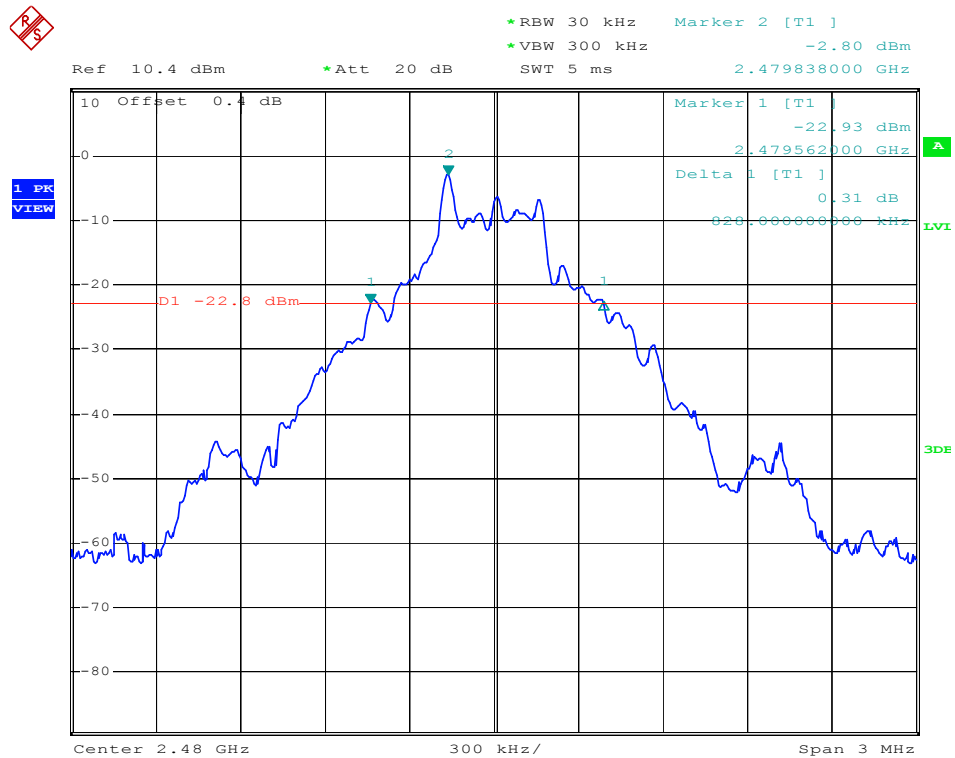
Low Channel:



Middle Channel:

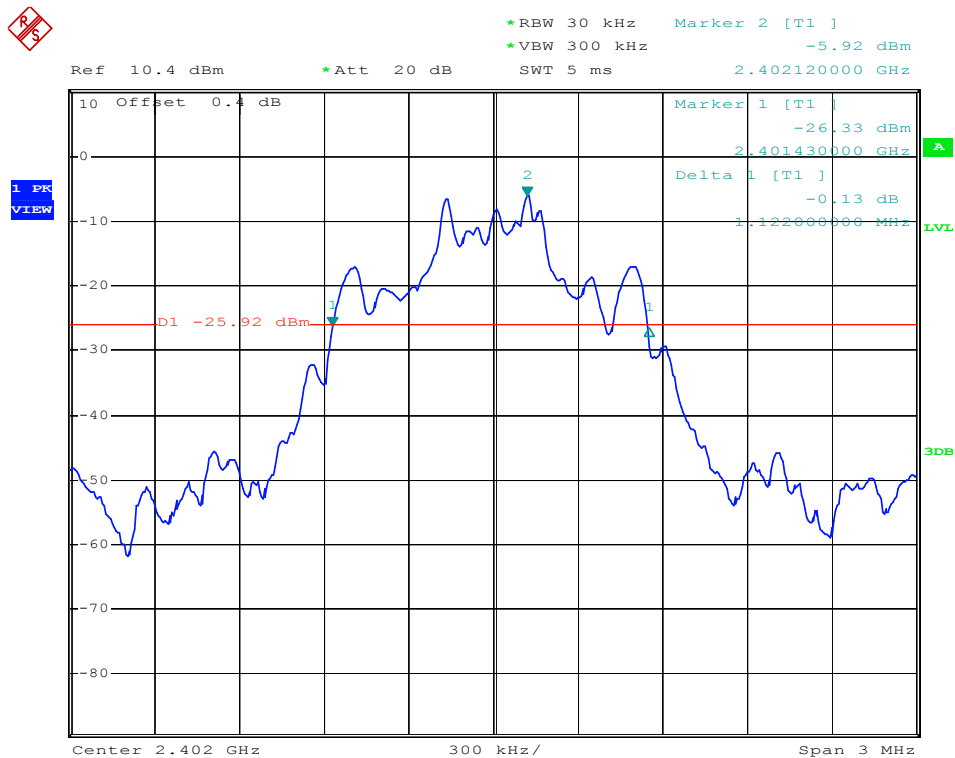


High Channel:

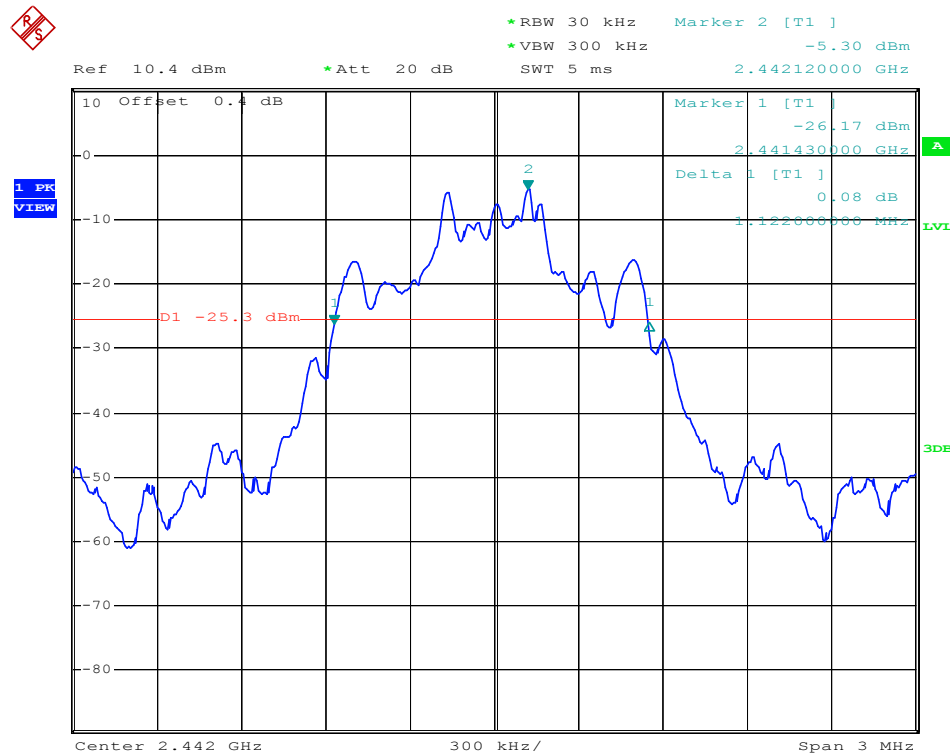


Worst mode: Pi/4 QDPSK (2DH1)

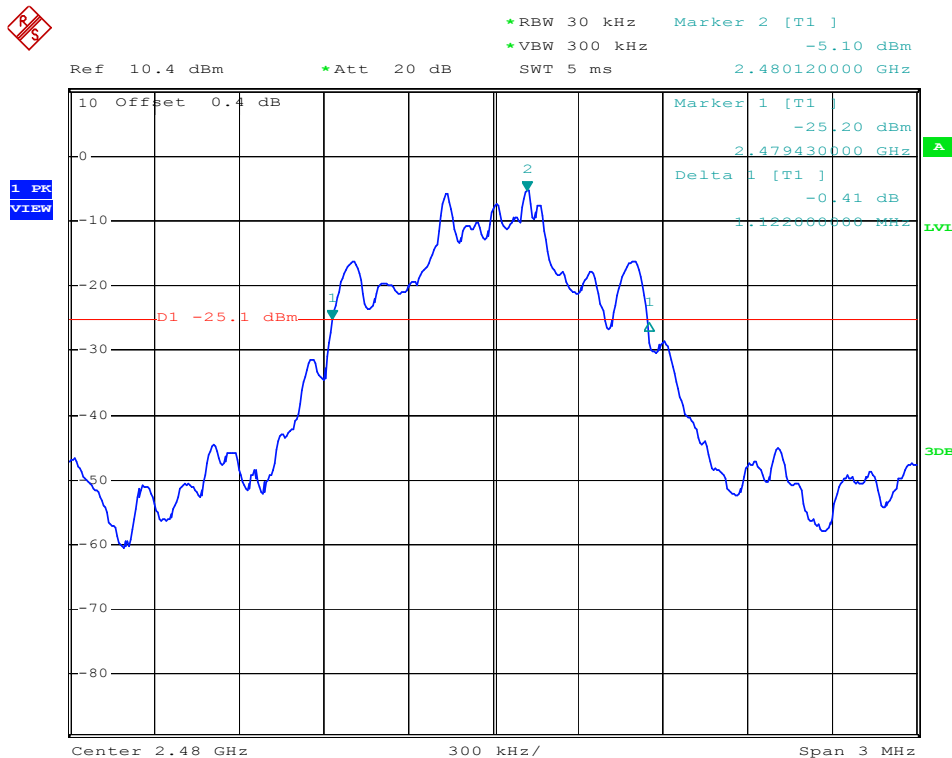
Low Channel:



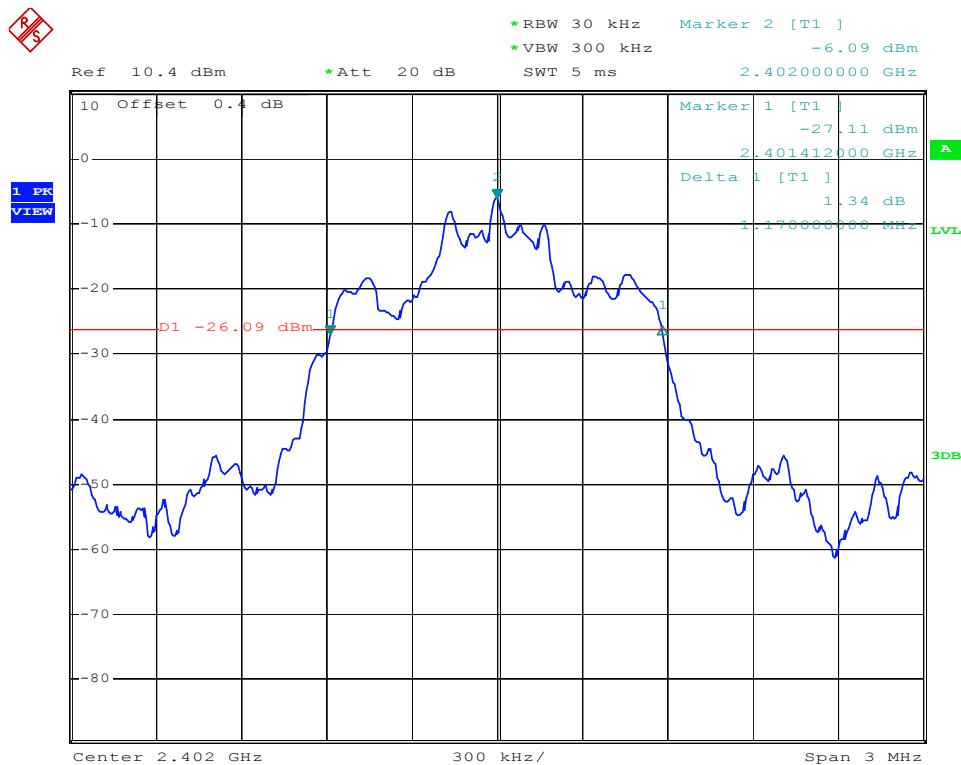
Middle Channel:



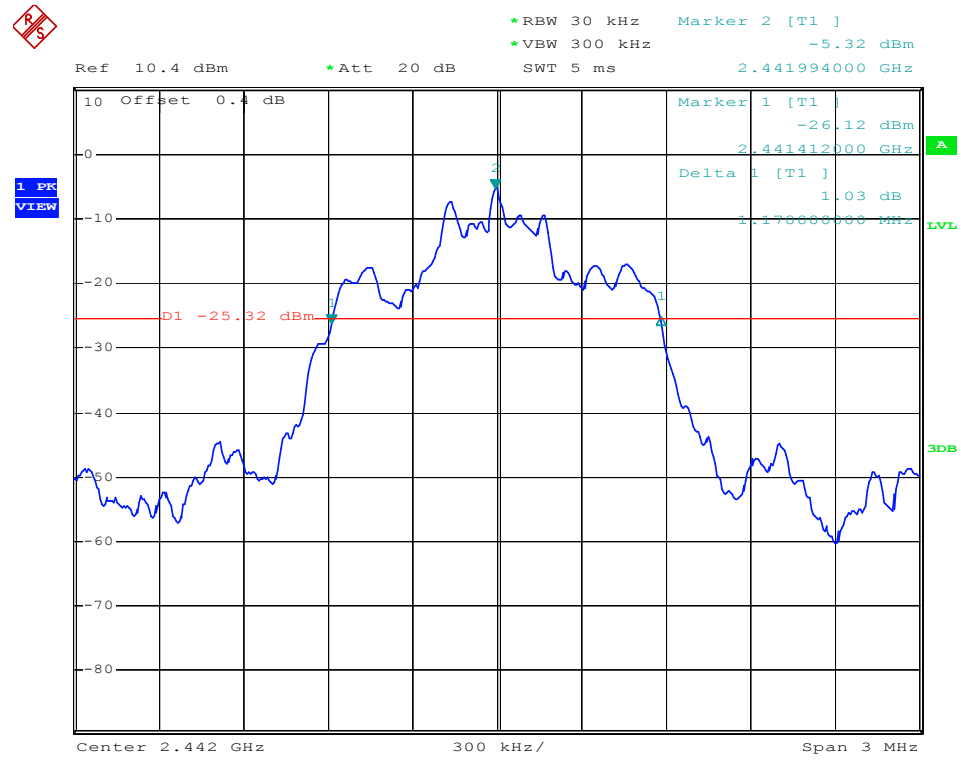
High Channel:



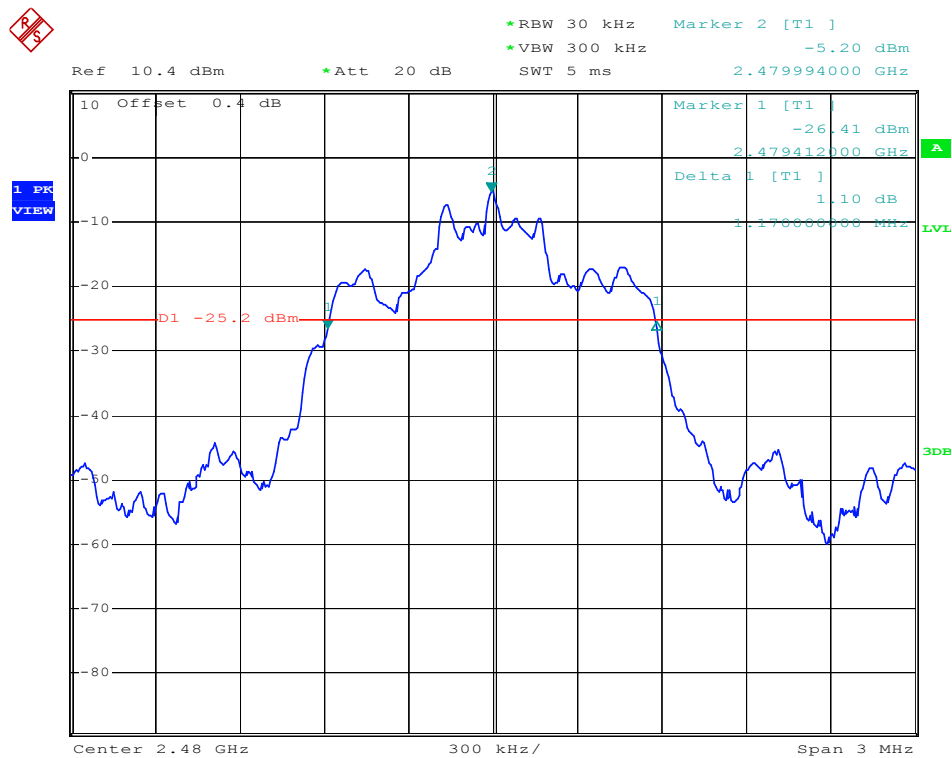
Worst mode: 8DPSK (3DH1)  
Low Channel:



Middle Channel:



High Channel:



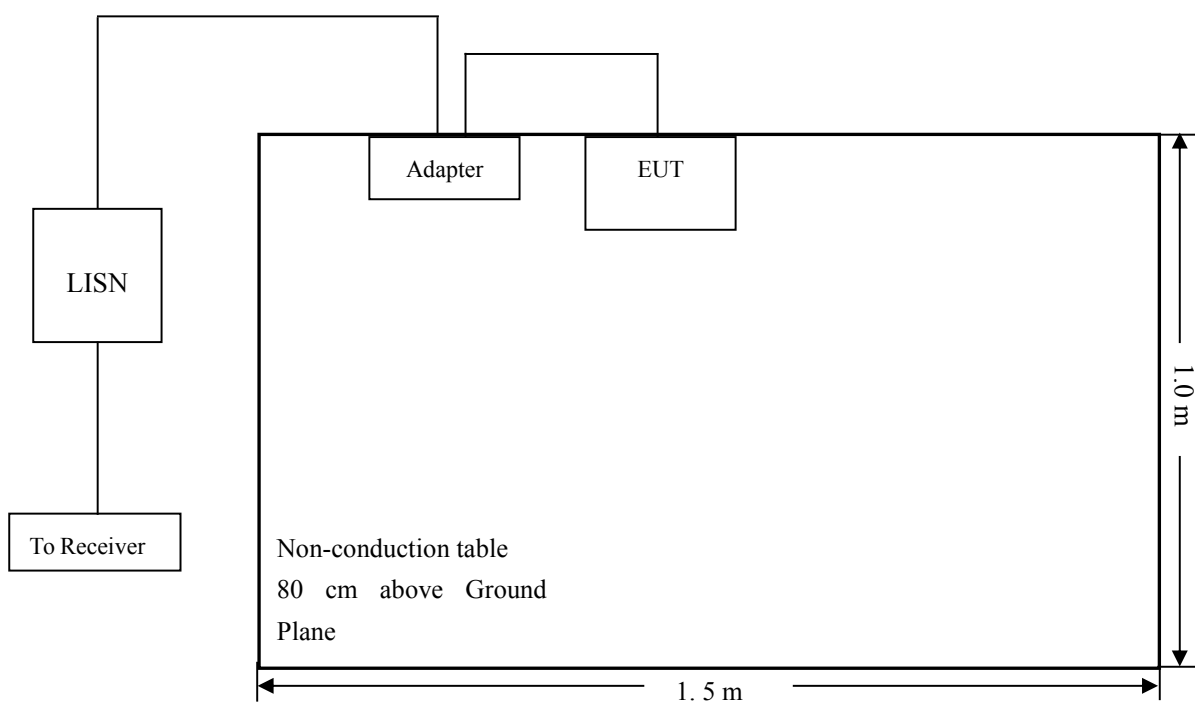
## 7. Conducted Emissions

### 7.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

### 7.2 Basic Test Setup Block Diagram



### 7.3 Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 52%       |
| ATM Pressure:      | 1012 mbar |

7.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

|                                   |         |
|-----------------------------------|---------|
| Start Frequency.....              | 150 kHz |
| Stop Frequency.....               | 30 MHz  |
| Sweep Speed.....                  | Auto    |
| IF Bandwidth.....                 | 10 kHz  |
| Quasi-Peak Adapter Bandwidth..... | 9 kHz   |
| Quasi-Peak Adapter Mode.....      | Normal  |

7.5 Summary of Test Results/Plots

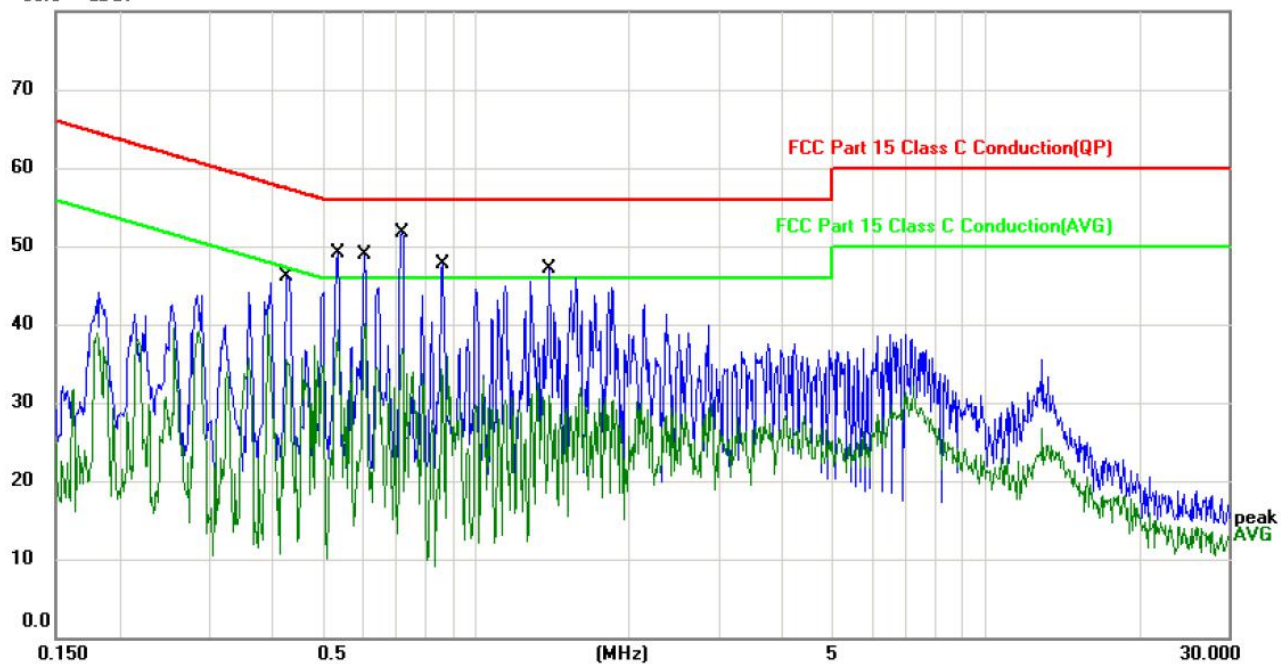
According to the data in section 7.7, the EUT complied with the FCC Part 15.207 Conducted margin for this device.

7.6 Conducted Emissions Test Data

Note: We pre-scan all mode, the worst data is GFSK (Low channel).

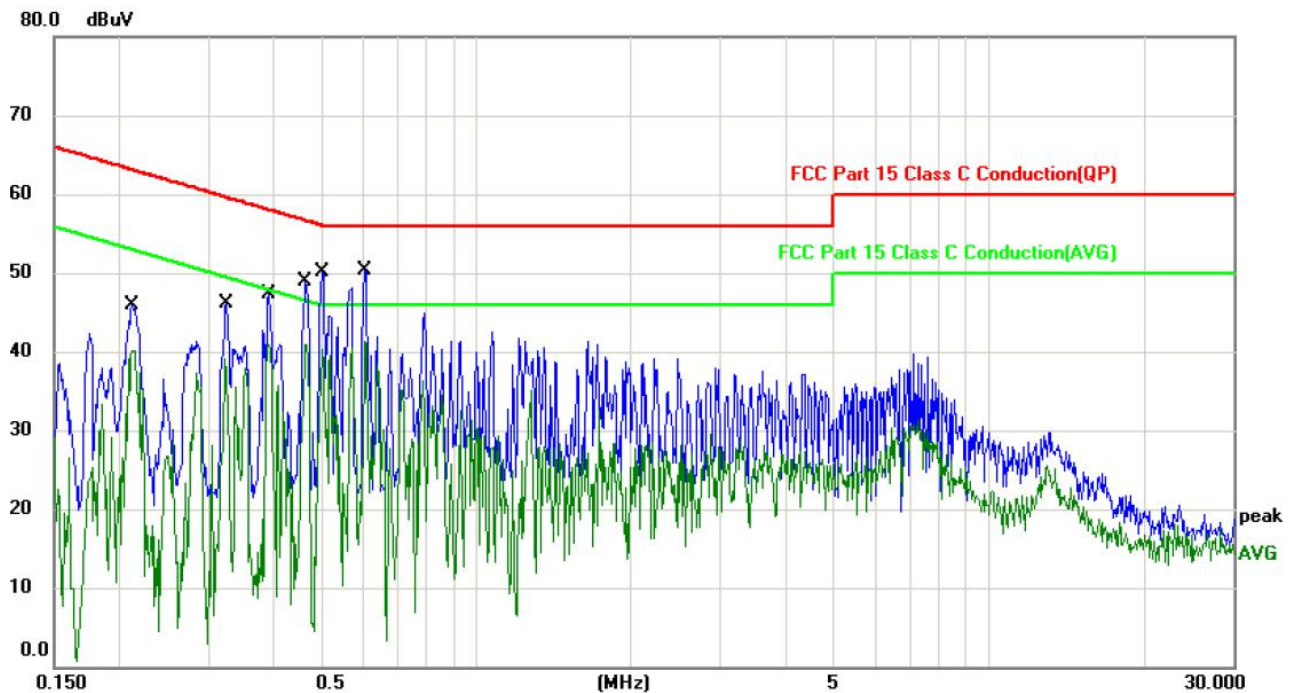
**Plot of Conducted Emissions The Worst Test Data GFSK (Low channel):***Test Specification: Neutral*

80.0 dBuV



| No. | Mk. | Freq.<br>MHz | Reading<br>Level<br>dBuV | Correct<br>Factor<br>dB | Measure-<br>ment<br>dBuV | Limit<br>dBuV | Over<br>dB | Detector | Comment |
|-----|-----|--------------|--------------------------|-------------------------|--------------------------|---------------|------------|----------|---------|
| 1   |     | 0.4259       | 45.73                    | 0.39                    | 46.12                    | 57.33         | -11.21     | QP       |         |
| 2   |     | 0.4259       | 34.08                    | 0.39                    | 34.47                    | 47.33         | -12.86     | AVG      |         |
| 3   |     | 0.5350       | 48.60                    | 0.44                    | 49.04                    | 56.00         | -6.96      | QP       |         |
| 4   |     | 0.5350       | 38.16                    | 0.44                    | 38.60                    | 46.00         | -7.40      | AVG      |         |
| 5   |     | 0.6041       | 48.53                    | 0.44                    | 48.97                    | 56.00         | -7.03      | QP       |         |
| 6   |     | 0.6041       | 39.12                    | 0.44                    | 39.56                    | 46.00         | -6.44      | AVG      |         |
| 7   | *   | 0.7158       | 51.25                    | 0.54                    | 51.79                    | 56.00         | -4.21      | QP       |         |
| 8   |     | 0.7158       | 35.29                    | 0.54                    | 35.83                    | 46.00         | -10.17     | AVG      |         |
| 9   |     | 0.8618       | 47.11                    | 0.61                    | 47.72                    | 56.00         | -8.28      | QP       |         |
| 10  |     | 0.8618       | 38.17                    | 0.61                    | 38.78                    | 46.00         | -7.22      | AVG      |         |
| 11  |     | 1.3956       | 46.29                    | 0.74                    | 47.03                    | 56.00         | -8.97      | QP       |         |
| 12  |     | 1.3956       | 37.00                    | 0.74                    | 37.74                    | 46.00         | -8.26      | AVG      |         |

Test Specification: Line



| No. | Mk. | Freq.  | Reading | Correct | Measure- | Limit | Over   |          |         |
|-----|-----|--------|---------|---------|----------|-------|--------|----------|---------|
|     |     | MHz    | Level   | Factor  | ment     |       |        | Detector | Comment |
|     |     |        | dBuV    | dB      | dBuV     | dBuV  | dB     |          |         |
| 1   |     | 0.2127 | 45.54   | 0.29    | 45.83    | 63.10 | -17.27 | QP       |         |
| 2   |     | 0.2127 | 39.72   | 0.29    | 40.01    | 53.10 | -13.09 | AVG      |         |
| 3   |     | 0.3251 | 45.83   | 0.36    | 46.19    | 59.57 | -13.38 | QP       |         |
| 4   |     | 0.3251 | 34.55   | 0.36    | 34.91    | 49.57 | -14.66 | AVG      |         |
| 5   |     | 0.3933 | 47.01   | 0.38    | 47.39    | 57.99 | -10.60 | QP       |         |
| 6   |     | 0.3933 | 40.56   | 0.38    | 40.94    | 47.99 | -7.05  | AVG      |         |
| 7   |     | 0.4637 | 48.44   | 0.41    | 48.85    | 56.63 | -7.78  | QP       |         |
| 8   |     | 0.4637 | 38.94   | 0.41    | 39.35    | 46.63 | -7.28  | AVG      |         |
| 9   |     | 0.4994 | 49.76   | 0.42    | 50.18    | 56.01 | -5.83  | QP       |         |
| 10  |     | 0.4994 | 31.24   | 0.42    | 31.66    | 46.01 | -14.35 | AVG      |         |
| 11  |     | 0.6041 | 49.95   | 0.44    | 50.39    | 56.00 | -5.61  | QP       |         |
| 12  | *   | 0.6041 | 40.70   | 0.44    | 41.14    | 46.00 | -4.86  | AVG      |         |

NOTE:

Corret Factor=LISN Factor+Cable loss.

Measurementt=Reading level+Corret Factor.

\*\*\*\*\* END OF REPORT \*\*\*\*\*