



## MEASUREMENT REPORT

### FCC PART 15.236 Wireless Microphone

---

**FCC ID:** DD4SLXD1G58

**APPLICANT:** Shure Incorporated

**Application Type:** Certification

**Product:** Digital Wireless Microphone Transmitter

**Model No.:** SLXD1 G58

**Brand Name:**  **SHURE**

**FCC Classification:** Part 15 Wireless Microphone (DWM)

**FCC Rule Part(s):** Part 15 Subpart C (Section 15.236)

**Test Procedure(s):** ANSI C63.10-2013, KDB 206256 D01v02  
ETSI EN 300 422-1 V1.4.2 (2011-08)

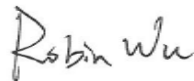
**Test Date:** October 21 ~ November 25, 2019

Reviewed By:



( Jame Yuan )

Approved By:



( Robin Wu )



The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

### Revision History

| Report No.    | Version | Description    | Issue Date | Note  |
|---------------|---------|----------------|------------|-------|
| 1910RSU041-U1 | Rev. 01 | Initial Report | 11-25-2019 | Valid |
|               |         |                |            |       |

## CONTENTS

| Description                                               | Page      |
|-----------------------------------------------------------|-----------|
| <b>CONTENTS .....</b>                                     | <b>3</b>  |
| <b>1. INTRODUCTION .....</b>                              | <b>6</b>  |
| 1.1. Scope .....                                          | 6         |
| 1.2. MRT Test Location .....                              | 6         |
| <b>2. PRODUCT INFORMATION .....</b>                       | <b>7</b>  |
| 2.1. Equipment Description.....                           | 7         |
| 2.2. Product Specification Subjective to this Report..... | 7         |
| 2.3. Working Frequencies for this report .....            | 7         |
| 2.4. Test Software .....                                  | 7         |
| 2.5. EMI Suppression Device(s) / Modifications.....       | 8         |
| 2.6. Labeling Requirements.....                           | 8         |
| <b>3. DESCRIPTION of TEST .....</b>                       | <b>9</b>  |
| 3.1. Evaluation Procedure .....                           | 9         |
| 3.2. AC Line Conducted Emissions .....                    | 9         |
| 3.3. Radiated Emissions .....                             | 10        |
| <b>4. TEST EQUIPMENT CALIBRATION DATE .....</b>           | <b>11</b> |
| <b>5. MEASUREMENT UNCERTAINTY .....</b>                   | <b>13</b> |
| <b>6. TEST RESULT .....</b>                               | <b>14</b> |
| 6.1. Summary .....                                        | 14        |
| 6.2. 99% Occupied Bandwidth Measurement .....             | 15        |
| 6.2.1. Test Limit .....                                   | 15        |
| 6.2.2. Test Procedure Used .....                          | 15        |
| 6.2.3. Test Setting.....                                  | 15        |
| 6.2.4. Test Setup.....                                    | 15        |
| 6.2.5. Test Result.....                                   | 16        |
| 6.3. Frequency Tolerance Measurement.....                 | 17        |
| 6.3.1. Test Limit .....                                   | 17        |
| 6.3.2. Test Procedure Used .....                          | 17        |
| 6.3.3. Test Setting.....                                  | 17        |
| 6.3.4. Test Setup.....                                    | 18        |
| 6.3.5. Test Result.....                                   | 19        |
| 6.4. Output Power Measurement .....                       | 21        |
| 6.4.1. Test Limit .....                                   | 21        |

|           |                                                 |           |
|-----------|-------------------------------------------------|-----------|
| 6.4.2.    | Test Procedure Used .....                       | 21        |
| 6.4.3.    | Test Setting .....                              | 21        |
| 6.4.4.    | Test Setup.....                                 | 21        |
| 6.4.5.    | Test Result .....                               | 22        |
| 6.5.      | Necessary Bandwidth Measurement .....           | 23        |
| 6.5.1.    | Test Limit .....                                | 23        |
| 6.5.2.    | Test Procedure Used .....                       | 23        |
| 6.5.3.    | Test Setting .....                              | 23        |
| 6.5.4.    | Test Setup.....                                 | 24        |
| 6.5.5.    | Test Result .....                               | 25        |
| 6.6.      | Radiated Spurious Emission Measurement .....    | 31        |
| 6.6.1.    | Test Limit .....                                | 31        |
| 6.6.2.    | Test Procedure Used .....                       | 31        |
| 6.6.3.    | Test Setting .....                              | 31        |
| 6.6.4.    | Test Setup.....                                 | 32        |
| 6.6.5.    | Test Result .....                               | 33        |
| 6.7.      | AC Conducted Emissions Measurement.....         | 35        |
| 6.7.1.    | Test Limit .....                                | 35        |
| 6.7.2.    | Test Setup.....                                 | 35        |
| 6.7.3.    | Test Result of Conducted Emissions.....         | 35        |
| <b>7.</b> | <b>CONCLUSION.....</b>                          | <b>36</b> |
|           | <b>Appendix A - Test Setup Photograph .....</b> | <b>37</b> |
|           | <b>Appendix B - EUT Photograph.....</b>         | <b>38</b> |

## General Information

|                                |                                                                                                                                 |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Applicant:</b>              | Shure Incorporated                                                                                                              |
| <b>Applicant Address:</b>      | 5800 West Touhy Avenue, Niles, IL 60714-4608, USA                                                                               |
| <b>Manufacturer:</b>           | Shure Incorporated                                                                                                              |
| <b>Manufacturer Address:</b>   | 5800 West Touhy Avenue, Niles, IL 60714-4608, USA                                                                               |
| <b>Test Site:</b>              | MRT Technology (Suzhou) Co., Ltd                                                                                                |
| <b>Test Site Address:</b>      | D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China                                              |
| <b>Test Device Serial No.:</b> | N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering |

## Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC accredited (MRT Designation No. CN1166) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



## 1. INTRODUCTION

### 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

### 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

|                                |                                                               |
|--------------------------------|---------------------------------------------------------------|
| Product Name                   | Digital Wireless Microphone Transmitter                       |
| Model No.                      | SLXD1 G58                                                     |
| Power Type                     | Two AA batteries (3.0Vdc) or Rechargeable Li-ion Battery Pack |
| Working Voltage                | 1.9 ~ 4.2 Vdc                                                 |
| Operating Temperature          | -18 ~ 50°C                                                    |
| <b>Accessories</b>             |                                                               |
| Rechargeable<br>Li-ion Battery | Model: SB903<br>Output: 3.6Vdc, 1200mAh, 4.32Wh               |

### 2.2. Product Specification Subjective to this Report

|                      |                |
|----------------------|----------------|
| Frequency Range      | 470 ~ 514MHz   |
| Declared Power Level | 1mW & 10mW     |
| Type of Modulation   | 4FSK           |
| Channel Spacing      | 25kHz          |
| Antenna Type         | Dipole Antenna |
| Antenna Gain         | 2.80dBi        |

Note 1: For other features of this EUT, test report will be issued separately.

Note 2: Power level and operating frequency can be selected via EUT screen.

### 2.3. Working Frequencies for this report

| Channel | Frequency   |
|---------|-------------|
| Low     | 470.125 MHz |
| ...     | ...         |
| Mid     | 492.125 MHz |
| ...     | ...         |
| High    | 514.000 MHz |

Note: The frequency selection can be offset from the upper or lower band limits by 25 kHz. This upper or lower band means 470~616 MHz frequency range is defined in FCC Part15.236 title.

### 2.4. Test Software

The test utility software used during testing was "IPOP", and the version was V4.1, all test commands were provided by the manufacturer.

**2.5. EMI Suppression Device(s) / Modifications**

No EMI suppression device(s) were added and/or no modifications were made during testing.

**2.6. Labeling Requirements**

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.



### 3. DESCRIPTION of TEST

#### 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance was used in the measurement.

**Deviation from measurement procedure.....None**

#### 3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions were used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

### **3.3. Radiated Emissions**

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

#### 4. TEST EQUIPMENT CALIBRATION DATE

##### Conducted Emissions - SR2

| Instrument         | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver  | R&S          | ESR3        | MRTSUE06185 | 1 year         | 2020/04/15     |
| Two-Line V-Network | R&S          | ENV 216     | MRTSUE06002 | 1 year         | 2020/06/13     |
| Two-Line V-Network | R&S          | ENV 216     | MRTSUE06003 | 1 year         | 2020/06/13     |
| Thermohygrometer   | Testo        | 608-H1      | MRTSUE06404 | 1 year         | 2020/08/08     |
| Shielding Room     | MIX-BEP      | Chamber-SR2 | MRTSUE06215 | N/A            | N/A            |

##### Radiated Emissions - AC1

| Instrument                 | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------|--------------|-------------|-------------|----------------|----------------|
| EMI Test Receiver          | R&S          | ESR7        | MRTSUE06001 | 1 year         | 2020/08/01     |
| PXA Signal Analyzer        | Keysight     | 9030B       | MRTSUE06395 | 1 year         | 2020/09/03     |
| Loop Antenna               | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2020/11/10     |
| Bilog Period Antenna       | Schwarzbeck  | VULB 9168   | MRTSUE06172 | 1 year         | 2020/03/31     |
| Broad Band Horn Antenna    | Schwarzbeck  | BBHA 9120D  | MRTSUE06023 | 1 year         | 2020/10/13     |
| Broad Band Horn Antenna    | Schwarzbeck  | BBHA 9170   | MRTSUE06024 | 1 year         | 2019/12/17     |
| Microwave System Amplifier | Agilent      | 83017A      | MRTSUE06076 | 1 year         | 2020/11/15     |
| Preamplifier               | Schwarzbeck  | BBV 9721    | MRTSUE06121 | 1 year         | 2020/06/11     |
| Thermohygrometer           | Testo        | 608-H1      | MRTSUE06403 | 1 year         | 2020/08/08     |
| Anechoic Chamber           | TDK          | Chamber-AC1 | MRTSUE06212 | 1 year         | 2020/04/30     |

##### Radiated Emission - AC2

| Instrument                     | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|--------------------------------|--------------|-------------|-------------|----------------|----------------|
| Spectrum Analyzer              | Keysight     | N9038A      | MRTSUE06125 | 1 year         | 2020/08/01     |
| Loop Antenna                   | Schwarzbeck  | FMZB 1519   | MRTSUE06025 | 1 year         | 2020/11/10     |
| Bilog Period Antenna           | Schwarzbeck  | VULB 9162   | MRTSUE06022 | 1 year         | 2020/10/13     |
| Horn Antenna                   | Schwarzbeck  | BBHA9120D   | MRTSUE06171 | 1 year         | 2020/10/27     |
| Broad Band Horn Antenna        | Schwarzbeck  | BBHA 9170   | MRTSUE06024 | 1 year         | 2019/12/17     |
| Broadband Coaxial Preamplifier | Schwarzbeck  | BBV 9718    | MRTSUE06176 | 1 year         | 2020/11/15     |
| Preamplifier                   | Schwarzbeck  | BBV 9721    | MRTSUE06121 | 1 year         | 2020/06/11     |
| Temperature/Humidity Meter     | Minggao      | ETH529      | MRTSUE06170 | 1 year         | 2019/12/13     |
| Anechoic Chamber               | RIKEN        | Chamber-AC2 | MRTSUE06213 | 1 year         | 2020/04/30     |

## Conducted Test Equipment - TR3

| Instrument                             | Manufacturer | Type No.    | Asset No.   | Cali. Interval | Cali. Due Date |
|----------------------------------------|--------------|-------------|-------------|----------------|----------------|
| EXA Signal Analyzer                    | Agilent      | N9020A      | MRTSUE06106 | 1 year         | 2020/04/15     |
| EXA Signal Analyzer                    | Keysight     | N9010B      | MRTSUE06452 | 1 year         | 2020/07/11     |
| Signal Analyzer                        | R&S          | FSV40       | MRTSUE06218 | 1 year         | 2020/04/15     |
| Power Meter                            | Agilent      | U2021XA     | MRTSUE06030 | 1 year         | 2020/11/18     |
| USB wideband power sensor              | Keysight     | U2021XA     | MRTSUE06446 | 1 year         | 2020/06/30     |
| USB wideband power sensor              | Keysight     | U2021XA     | MRTSUE06447 | 1 year         | 2020/06/30     |
| Bluetooth Test Set                     | Anritsu      | MT8852B-042 | MRTSUE06389 | 1 year         | 2020/06/13     |
| Audio Analyzer                         | Agilent      | U8903B      | MRTSUE06143 | 1 year         | 2020/06/13     |
| Modulation Analyzer                    | HP           | 8901A       | MRTSUE06098 | 1 year         | 2020/10/10     |
| Wideband Radio<br>Communication Tester | R&S          | CMW 500     | MRTSUE06243 | 1 year         | 2020/11/07     |
| DC Power Supply                        | GWINSTEK     | DPS-3303C   | MRTSUE06064 | N/A            | N/A            |
| Temperature & Humidity<br>Chamber      | BAOYT        | BYH-150CL   | MRTSUE06051 | 1 year         | 2020/11/07     |
| Thermohygrometer                       | testo        | 608-H1      | MRTSUE06401 | 1 year         | 2020/08/08     |

| Software     | Version | Function          |
|--------------|---------|-------------------|
| EMI Software | V3      | EMI Test Software |

## 5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k = 2$ .

| Conducted Emission Measurement - SR2                 |                      |
|------------------------------------------------------|----------------------|
| The maximum measurement uncertainty is evaluated as: |                      |
| 9kHz~150kHz: 3.84dB                                  |                      |
| 150kHz~30MHz: 3.46dB                                 |                      |
| Radiated Emission Measurement - AC1                  |                      |
| The maximum measurement uncertainty is evaluated as: |                      |
| Horizontal:                                          | 30MHz~300MHz: 4.07dB |
|                                                      | 300MHz~1GHz: 3.63dB  |
|                                                      | 1GHz~18GHz: 4.16dB   |
| Vertical:                                            | 30MHz~300MHz: 4.18dB |
|                                                      | 300MHz~1GHz: 3.60dB  |
|                                                      | 1GHz~18GHz: 4.76dB   |
| Radiated Emission Measurement - AC2                  |                      |
| The maximum measurement uncertainty is evaluated as: |                      |
| Horizontal:                                          | 30MHz~300MHz: 3.75dB |
|                                                      | 300MHz~1GHz: 3.53dB  |
|                                                      | 1GHz~18GHz: 4.28dB   |
| Vertical:                                            | 30MHz~300MHz: 3.86dB |
|                                                      | 300MHz~1GHz: 3.53dB  |
|                                                      | 1GHz~18GHz: 4.33dB   |

## 6. TEST RESULT

### 6.1. Summary

| FCC Part Section(s) | Test Description                         | Test Limit            | Test Condition | Test Result | Reference   |
|---------------------|------------------------------------------|-----------------------|----------------|-------------|-------------|
| 15.236(f)(2)        | Occupied Bandwidth                       | < 200kHz              | Conducted      | Pass        | Section 6.2 |
| 15.236(f)(3)        | Frequency Tolerance                      | $\pm 0.005\%$         |                | Pass        | Section 6.3 |
| 15.236(d)(1)        | RF Output Power                          | EIRP < 50mW           |                | Pass        | Section 6.4 |
| 15.236(g)           | Necessary Bandwidth                      | Refer to clause 6.5.1 |                | Pass        | Section 6.5 |
| 15.236(g)           | Radiated Spurious Emission               | Refer to clause 6.6.1 | Radiated       | Pass        | Section 6.6 |
| 15.207              | AC Conducted Emissions<br>150kHz - 30MHz | < FCC 15.207 limits   | Line Conducted | N/A         | Section 6.7 |

#### Notes:

- 1) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 2) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 3) Besides RF Output Power & Necessary Bandwidth & Radiated Spurious Emission perform two power levels, any others test item only perform max power level.
- 4) We selected DC voltage 3.6V as normal test voltage.

## 6.2. 99% Occupied Bandwidth Measurement

### 6.2.1. Test Limit

The operating bandwidth shall not exceed 200 kHz.

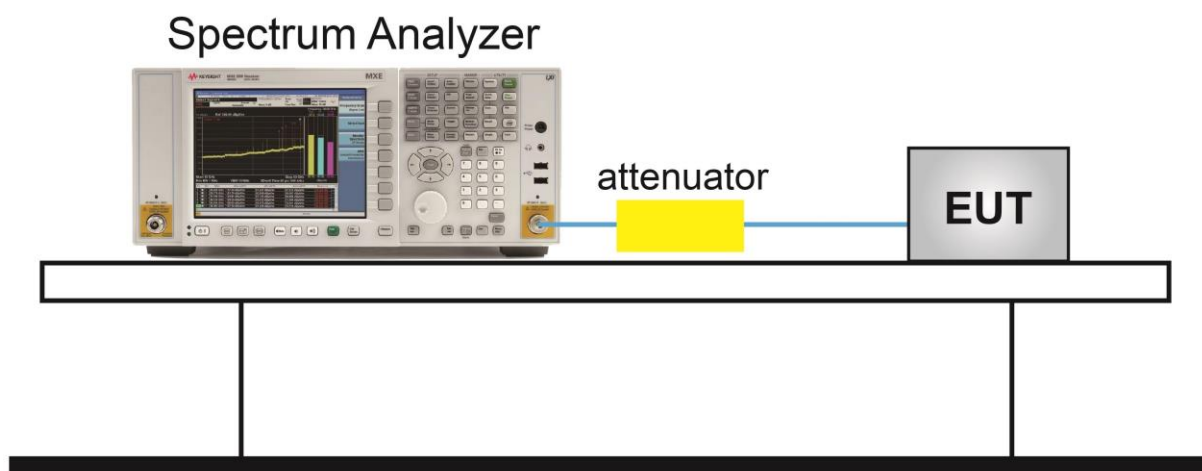
### 6.2.2. Test Procedure Used

ANSI C63.10-2013 - Section 6.9.3

### 6.2.3. Test Setting

1. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
2. Set RBW  $\geq$  1% to 5% of the OBW
3. VBW = Approximately three times RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize
8. Use the 99% power bandwidth function of the instrument and report the measured bandwidth.

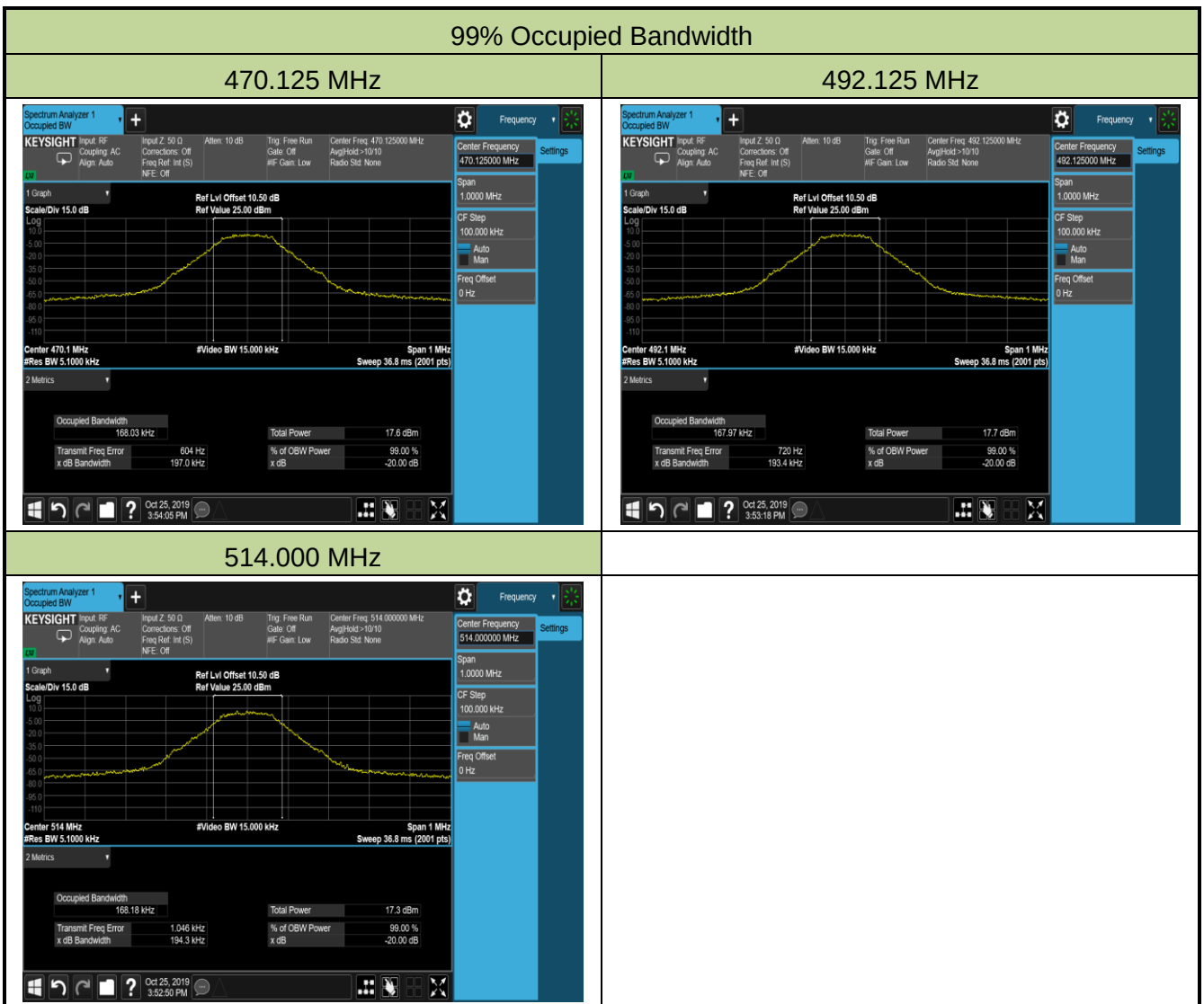
### 6.2.4. Test Setup



### 6.2.5. Test Result

|               |                 |                   |            |
|---------------|-----------------|-------------------|------------|
| Test Engineer | Andy Zhu        | Temperature       | 25°C       |
| Test Site     | TR3             | Relative Humidity | 52%        |
| Test Mode     | G58 Band - 10mW | Test Date         | 2019/10/25 |

| Frequency (MHz) | 99% Bandwidth (kHz) | Limit (kHz) | Result |
|-----------------|---------------------|-------------|--------|
| 470.125         | 168.03              | < 200       | Pass   |
| 492.125         | 167.97              | < 200       | Pass   |
| 514.000         | 168.18              | < 200       | Pass   |





### **6.3. Frequency Tolerance Measurement**

#### **6.3.1. Test Limit**

The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.005\%$  of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. Battery operated equipment shall be tested using a new battery.

#### **6.3.2. Test Procedure Used**

ANSI C63.10-2013 - Section 6.8

#### **6.3.3. Test Setting**

The EUT was programmed to transmit with an unmodulated carrier.

#### **Frequency Stability Under Temperature Variations:**

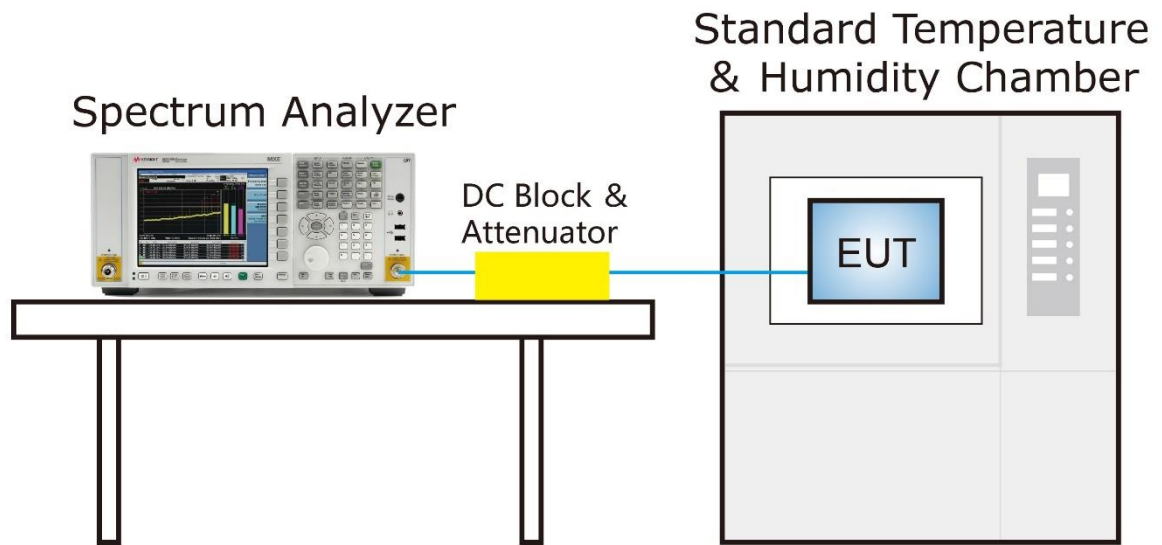
The equipment under test was connected to an external DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

#### **Frequency Stability Under Voltage Variations:**

Set chamber temperature to 20°C. Use a variable DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.

Reduce the input voltage to specify extreme voltage variation ( $\pm 15\%$ ) and endpoint, record the maximum frequency change.

### 6.3.4. Test Setup



### 6.3.5. Test Result

|               |                 |                   |            |
|---------------|-----------------|-------------------|------------|
| Test Engineer | Andy Zhu        | Temperature       | -20 ~ 50°C |
| Test Site     | TR3             | Relative Humidity | 48 ~ 55%RH |
| Test Mode     | G58 Band - 10mW | Test Date         | 2019/10/25 |

| Voltage (%) | Power (V <sub>DC</sub> ) | Temp (°C)    | Nominal Frequency (MHz) | Measured Frequency (MHz) | Deviation (%) | Limit (%) | Result |
|-------------|--------------------------|--------------|-------------------------|--------------------------|---------------|-----------|--------|
| 100%        | 3.60                     | -20          | 470.125                 | 470.124815               | -0.000039     | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.124817               | -0.000037     | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 513.999816               | -0.000036     | -/+0.005  | Pass   |
|             |                          | -10          | 470.125                 | 470.124920               | -0.000017     | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.124922               | -0.000016     | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 513.999926               | -0.000014     | -/+0.005  | Pass   |
|             |                          | 0            | 470.125                 | 470.125036               | 0.000008      | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.125041               | 0.000008      | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 514.000046               | 0.000009      | -/+0.005  | Pass   |
|             |                          | +10          | 470.125                 | 470.125103               | 0.000022      | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.125117               | 0.000024      | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 514.000133               | 0.000026      | -/+0.005  | Pass   |
|             |                          | +20<br>(Ref) | 470.125                 | 470.125198               | 0.000042      | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.125210               | 0.000043      | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 514.000223               | 0.000043      | -/+0.005  | Pass   |
|             |                          | +30          | 470.125                 | 470.125224               | 0.000048      | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.125234               | 0.000048      | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 514.000247               | 0.000048      | -/+0.005  | Pass   |
|             |                          | +40          | 470.125                 | 470.125251               | 0.000053      | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.125260               | 0.000053      | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 514.000273               | 0.000053      | -/+0.005  | Pass   |
|             |                          | +50          | 470.125                 | 470.125207               | 0.000044      | -/+0.005  | Pass   |
|             |                          |              | 492.125                 | 492.125298               | 0.000061      | -/+0.005  | Pass   |
|             |                          |              | 514.000                 | 514.000314               | 0.000061      | -/+0.005  | Pass   |

| Voltage (%) | Power (V <sub>DC</sub> ) | Temp (°C) | Nominal Frequency (MHz) | Measured Frequency (MHz) | Deviation (%) | Limit (%) | Result |
|-------------|--------------------------|-----------|-------------------------|--------------------------|---------------|-----------|--------|
| 115%        | 4.14                     | +20       | 470.125                 | 470.125155               | 0.000033      | -/+0.005  | Pass   |
|             |                          |           | 492.125                 | 492.125158               | 0.000032      | -/+0.005  | Pass   |
|             |                          |           | 514.000                 | 514.000165               | 0.000032      | -/+0.005  | Pass   |
| 85%         | 3.06                     | +20       | 470.125                 | 470.125152               | 0.000032      | -/+0.005  | Pass   |
|             |                          |           | 492.125                 | 492.125160               | 0.000033      | -/+0.005  | Pass   |
|             |                          |           | 514.000                 | 514.000171               | 0.000033      | -/+0.005  | Pass   |

Note 1: Frequency Tolerance (%) = {[Measured Frequency (MHz) - Nominal Frequency (MHz)] / Nominal Frequency (MHz)} \*10<sup>2</sup>.

Note 2: Four measurements (0 & 2 & 5 & 10 minutes) test data was recorded and only show worst data in report.

## 6.4. Output Power Measurement

### 6.4.1. Test Limit

In the bands allocated and assigned for broadcast television and in the 600 MHz service band: 50 mW EIRP.

### 6.4.2. Test Procedure Used

N/A

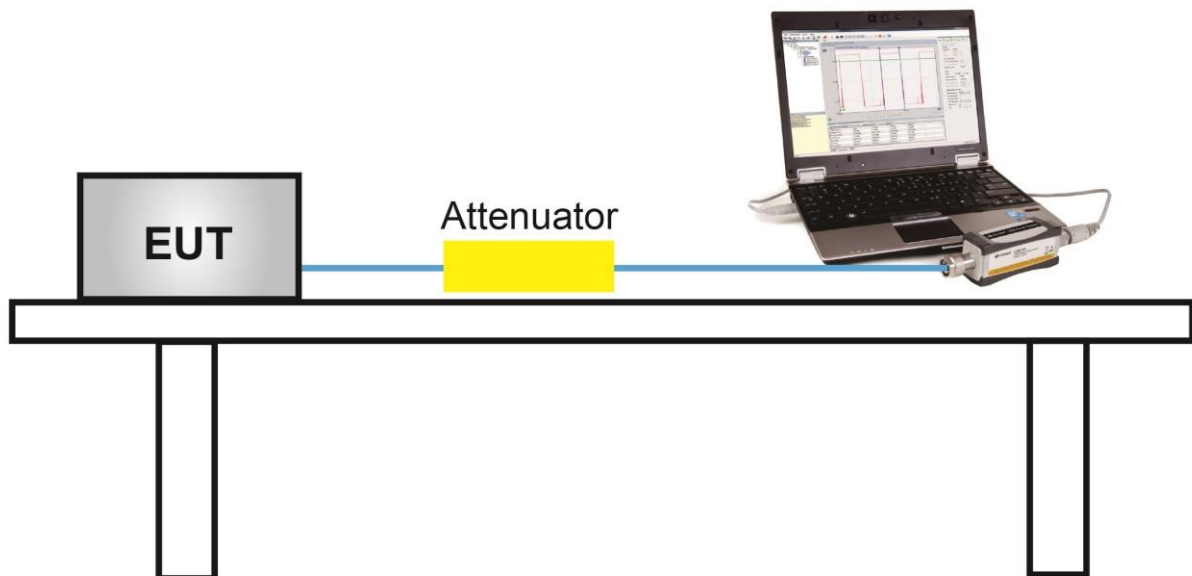
### 6.4.3. Test Setting

The output of the EUT was connected to an RF average power meter through fixed attenuation.

The EUT was set to transmit on the low, middle, and high frequencies in each power level.

Measure the average power of the transmitter. This EUT's duty cycle is 100%.

### 6.4.4. Test Setup



#### 6.4.5. Test Result

|               |          |                   |            |
|---------------|----------|-------------------|------------|
| Test Engineer | Andy Zhu | Temperature       | 25°C       |
| Test Site     | TR3      | Relative Humidity | 52%        |
| Test Mode     | G58 Band | Test Date         | 2019/10/25 |

| Frequency<br>(MHz) | Power Meter Level<br>(dBm) | Antenna Gain<br>(dBi) | EIRP<br>(dBm) | EIRP Limit<br>(dBm) |
|--------------------|----------------------------|-----------------------|---------------|---------------------|
| <b>1mW</b>         |                            |                       |               |                     |
| 470.125            | 1.36                       | 2.80                  | 4.16          | ≤ 16.99             |
| 492.125            | 0.77                       | 2.80                  | 3.57          | ≤ 16.99             |
| 514.000            | 0.64                       | 2.80                  | 3.44          | ≤ 16.99             |
| <b>10mW</b>        |                            |                       |               |                     |
| 470.125            | 9.77                       | 2.80                  | 12.57         | ≤ 16.99             |
| 492.125            | 9.70                       | 2.80                  | 12.50         | ≤ 16.99             |
| 514.000            | 9.97                       | 2.80                  | 12.77         | ≤ 16.99             |

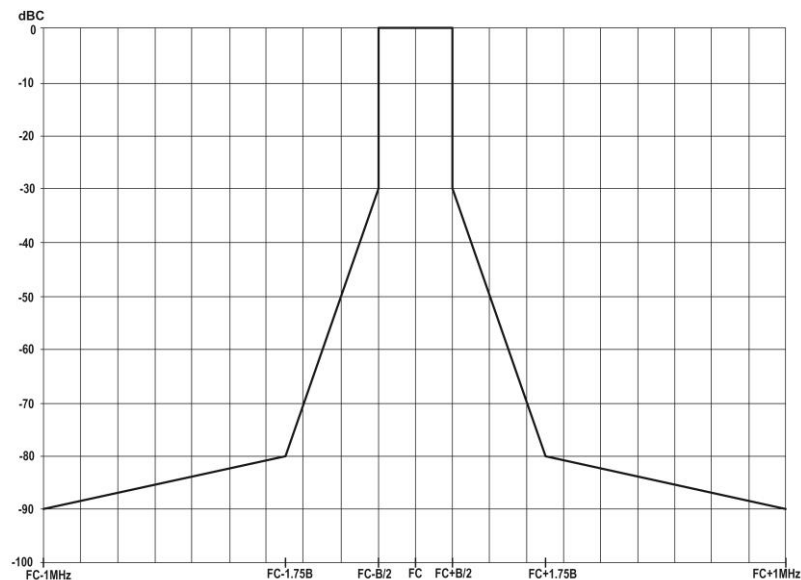
Note 1: EIRP (dBm) = Average Power (dBm) + Antenna Gain (dBi), Antenna gain is provided by the manufacturer.

Note 2: EIRP Limit (dBm) =  $10 \cdot \log(50 \text{ mW}) = 16.99 \text{ dBm}$ .

## 6.5. Necessary Bandwidth Measurement

### 6.5.1. Test Limit

According to EN 300 422-1 V1.4.2 clause 8.3.2.2, the transmitter output spectrum shall be within the mask defined as below figure.



### 6.5.2. Test Procedure Used

ETSI EN 300 422-1 V1.4.2 clause 8.3.2.1.

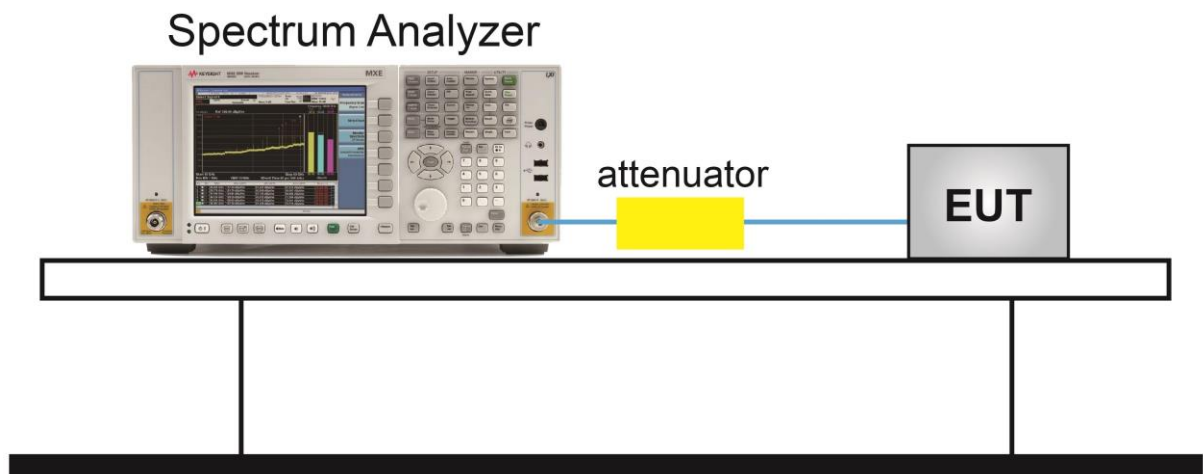
### 6.5.3. Test Setting

The EUT was powered up and the transmit frequency & power output of the EUT were selected.

The spectrum analyzer center frequency is set to the nominal EUT channel center frequency.

Only lowest and highest channel is required, at an output power level of 1mW and 10mW.

#### 6.5.4. Test Setup





### 6.5.5. Test Result

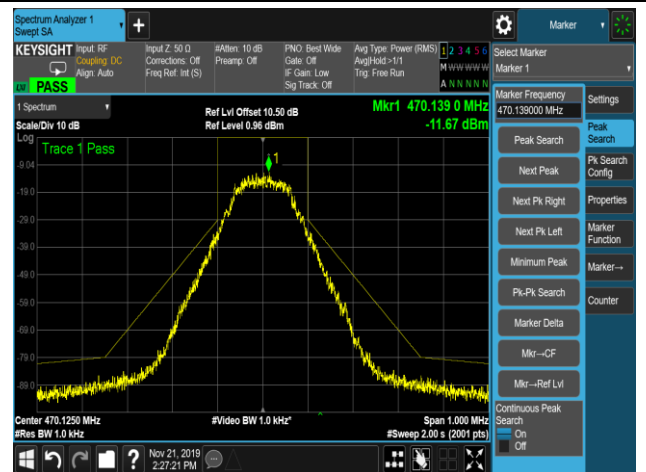
|               |          |                   |                         |
|---------------|----------|-------------------|-------------------------|
| Test Site     | TR3      | Temperature       | 25°C                    |
| Test Engineer | Andy Zhu | Relative Humidity | 52%                     |
| Test Mode     | G58 Band | Test Date         | 2019/10/25 ~ 2019/11/21 |

#### Necessary Bandwidth - 1mW, 470.125MHz

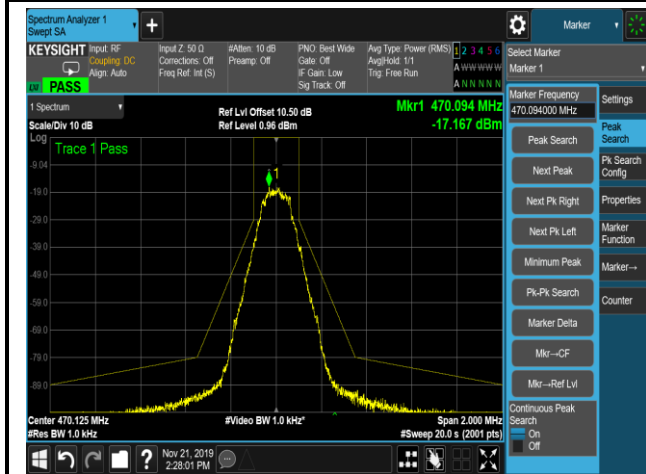
##### Step 1



##### Step 2



##### Step 3

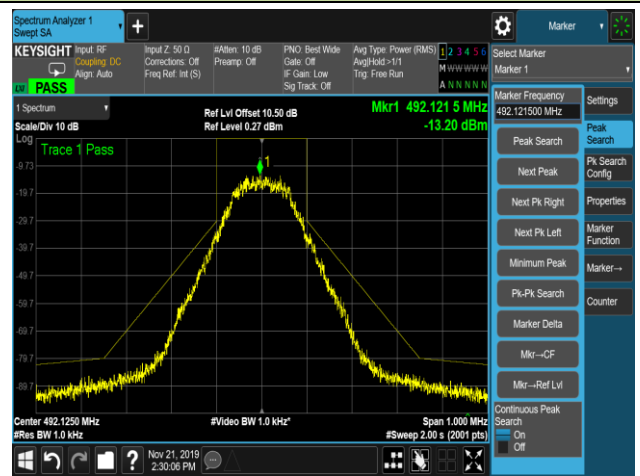


## Necessary Bandwidth - 1mW, 492.125MHz

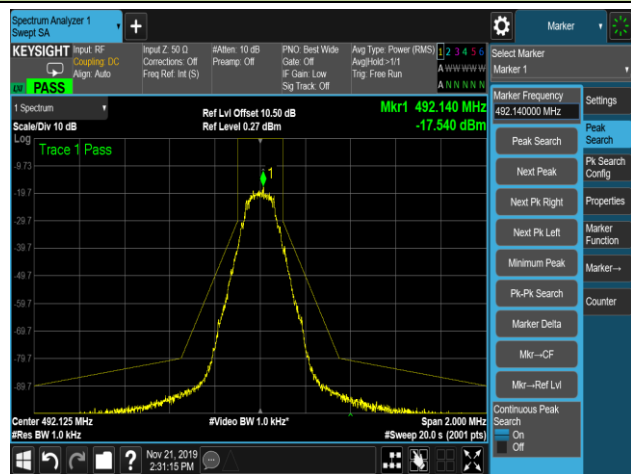
### Step 1



### Step 2



### Step 3

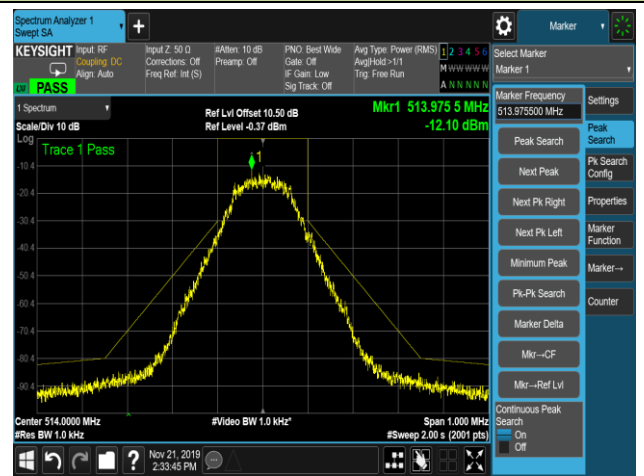


## Necessary Bandwidth - 1mW, 514.000MHz

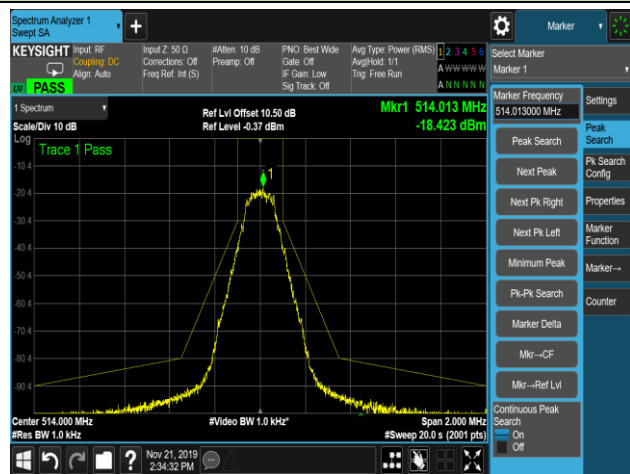
### Step 1



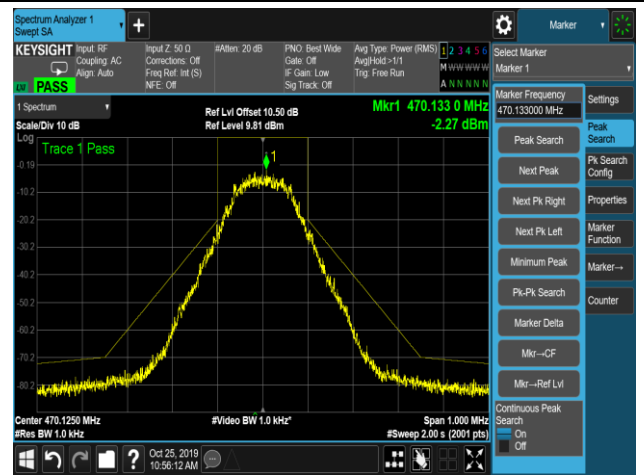
### Step 2



### Step 3



## Step 2



The screenshot displays the Keysight Spectrum Analyzer 1 interface. The main display shows a spectrum trace with a peak labeled 'Mkr1' at 470.120 MHz with a level of -8.826 dBm. The trace is labeled 'Trace 1 Pass'. The interface includes various control panels and status indicators.

**Top Panel:**

- Keysight Logo:** Spectrum Analyzer 1, Sweet SA
- Input Section:** Input 2: 50.0, Connections: Off, Ref: Int (S), NFE: Off
- Attenuation:** #Att: 20 dB
- Gate Section:** PNO: Best Wide, Gate: Off, IF: Gain Low, Sig: Track: Off
- Power Section:** Avg Type: Power (RMS), Applied: 1:1, Trg: Free Run
- Marker Section:** Select Marker, Marker 1
- Frequency Section:** Marker Frequency: 470.120000 MHz
- Settings Section:** Peak Search, PK Search, Next Peak, Properties, Next Pk Right, Marker Function, Next Pk Left, Marker-->, Minimum Peak, Marker-->, Pk-Pk Search, Counter, Marker Delta, Mix--CF, Mix--Ref Lvl

**Main Display:**

- Trace:** Trace 1 Pass
- Peak:** Mkr1 470.120 MHz, -8.826 dBm
- Ref Level:** Ref Lvl Offset: 10.50 dB, Ref Level: 9.81 dBm
- Span:** Span 2.000 MHz
- Resolution Bandwidth:** #Res BW 1.0 kHz
- Sweep:** #Sweep 20.0 s (2001 pts)
- Center Frequency:** Center 470.125 MHz
- Bandwidth:** #Video BW 1.0 kHz

**Bottom Panel:**

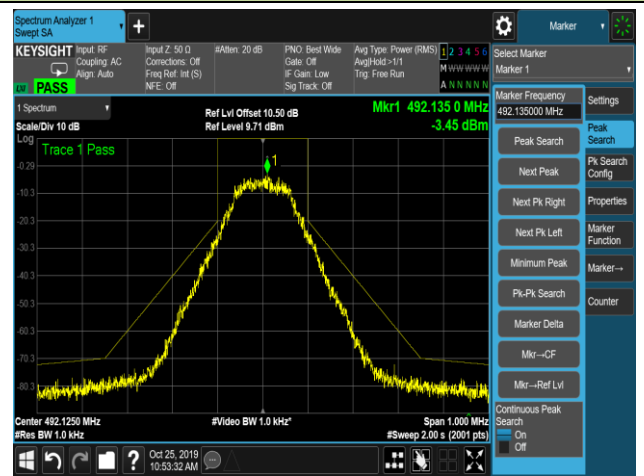
- Navigation:** Home, Back, Forward, Search, Help, etc.
- Date/Time:** Oct 25, 2019, 10:57:07 AM
- Buttons:** Various function buttons for navigation and control.

## Necessary Bandwidth - 10mW, 492.125MHz

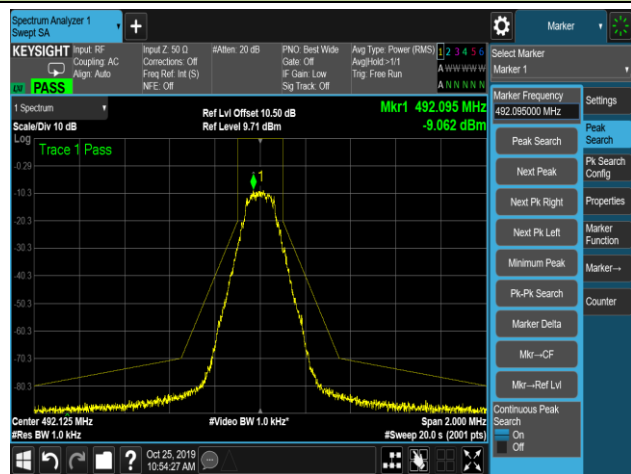
### Step 1



### Step 2



### Step 3

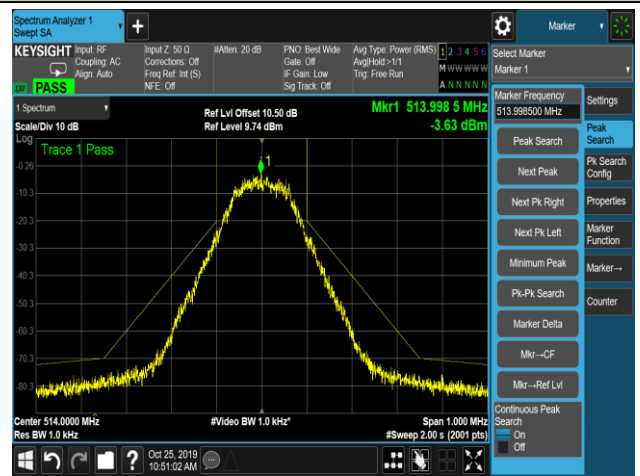


## Necessary Bandwidth - 10mW, 514.000MHz

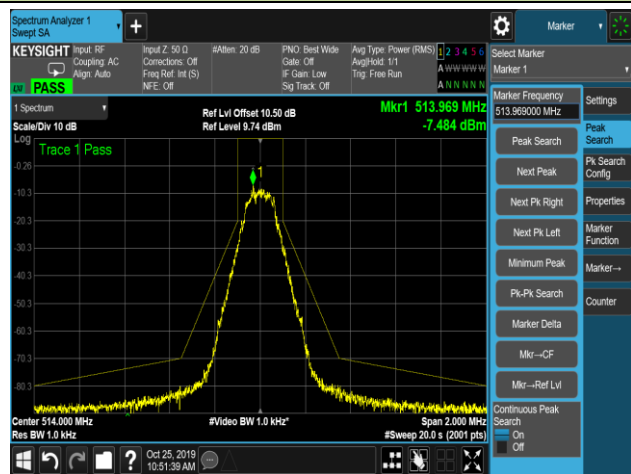
### Step 1



### Step 2



### Step 3



## 6.6. Radiated Spurious Emission Measurement

### 6.6.1. Test Limit

According to FCC Part 15.236(g), emissions outside of this band shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 V1.4.2.

| State     | Frequency                                                               |                                    |                              |
|-----------|-------------------------------------------------------------------------|------------------------------------|------------------------------|
|           | 47MHz to 74MHz, 87.5MHz to 137MHz<br>174MHz to 230MHz, 470MHz to 862MHz | Other Frequencies<br>below 1000MHz | Frequencies above<br>1000MHz |
| Operation | 4nW                                                                     | 250nW                              | 1uW                          |
| Standby   | 2nW                                                                     | 2nW                                | 20nW                         |

### 6.6.2. Test Procedure Used

ETSI EN 300 422-1 V1.4.2 clause 8.4.2.

### 6.6.3. Test Setting

**Table 1 - RBW as a function of frequency**

| Frequency       | RBW     |
|-----------------|---------|
| 25 ~ 30 MHz     | 9 kHz   |
| 30 ~ 1000 MHz   | 100 kHz |
| 1000 ~ 6000 MHz | 1 MHz   |

Emissions shall be investigated up to the 10<sup>th</sup> harmonic of the fundamental.

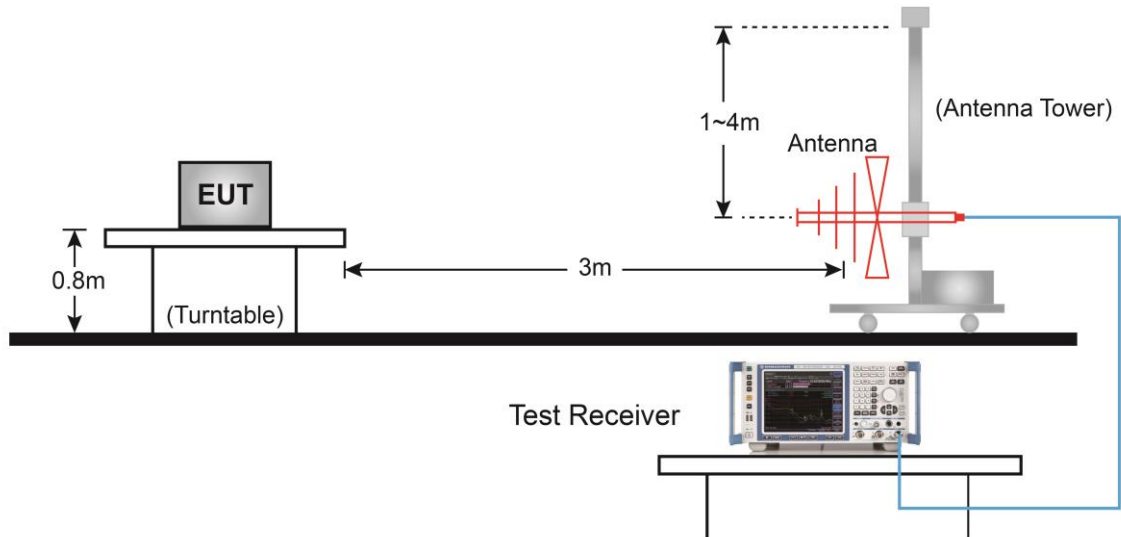
All the emissions shall be demonstrated using a QP detector below 1 GHz and a RMS Average detector above 1 GHz.

All significant broadband and narrowband signals found in the preliminary sweeps were measured using a peak detector at a test distance of 3 meters.

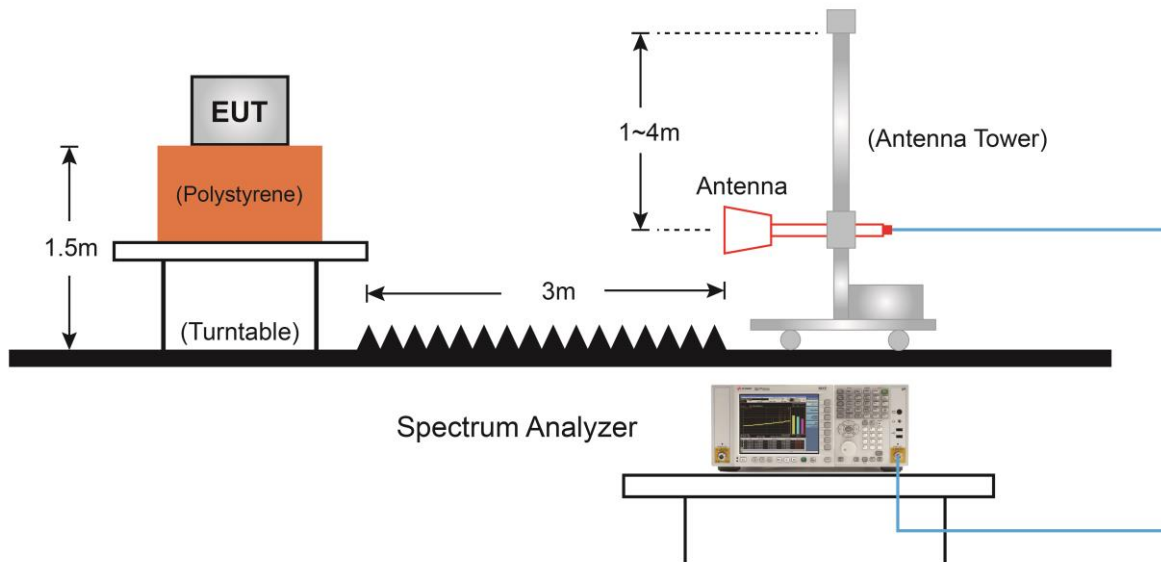
At each frequency at which a component is detected, the sample shall be rotated to obtain maximum response and the effective radiated power of that component determined by a substitution measurement.

#### 6.6.4. Test Setup

##### Below 1GHz Test Setup:



##### Above 1GHz Test Setup:





### 6.6.5. Test Result

|               |                |                   |            |
|---------------|----------------|-------------------|------------|
| Test Site     | TR3            | Temperature       | 25°C       |
| Test Engineer | Lewis Huang    | Relative Humidity | 54%        |
| Test Mode     | G58 Band - 1mW | Test Date         | 2019/11/10 |

| Test Channel (MHz) | Frequency (MHz) | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Substitute Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | Margin (dB) |
|--------------------|-----------------|-----------------|------------------|-----------------|-------------------------------|------------|-------------|-------------|
| 470.125            | 2350.63         | H               | -58.67           | 3.79            | 9.93                          | -52.53     | -30.00      | -22.53      |
|                    | 3761.00         | H               | -55.54           | 4.76            | 12.73                         | -47.57     | -30.00      | -17.57      |
|                    | 4231.00         | H               | -55.99           | 5.09            | 12.71                         | -48.37     | -30.00      | -18.37      |
|                    | 4702.00         | V               | -50.74           | 5.39            | 12.56                         | -43.57     | -30.00      | -13.57      |
|                    | 5171.38         | V               | -55.30           | 5.61            | 12.83                         | -48.08     | -30.00      | -18.08      |
|                    | 5641.50         | V               | -54.82           | 5.89            | 13.14                         | -47.57     | -30.00      | -17.57      |
| 492.125            | 1968.50         | H               | -63.56           | 3.46            | 10.38                         | -56.64     | -30.00      | -26.64      |
|                    | 4429.13         | H               | -56.72           | 5.26            | 12.70                         | -49.28     | -30.00      | -19.28      |
|                    | 4921.25         | H               | -53.68           | 5.56            | 12.62                         | -46.62     | -30.00      | -16.62      |
|                    | 3937.00         | V               | -57.96           | 4.89            | 12.64                         | -50.21     | -30.00      | -20.21      |
|                    | 4921.00         | V               | -51.50           | 5.56            | 12.62                         | -44.44     | -30.00      | -14.44      |
|                    | 5413.38         | V               | -56.48           | 5.80            | 13.13                         | -49.15     | -30.00      | -19.15      |
| 514.000            | 3598.00         | H               | -58.88           | 4.68            | 12.56                         | -51.00     | -30.00      | -21.00      |
|                    | 5140.00         | H               | -52.96           | 5.62            | 12.80                         | -45.78     | -30.00      | -15.78      |
|                    | 5654.00         | H               | -53.29           | 5.86            | 12.80                         | -46.35     | -30.00      | -16.35      |
|                    | 4112.00         | V               | -58.16           | 5.01            | 12.64                         | -50.53     | -30.00      | -20.53      |
|                    | 5140.00         | V               | -52.94           | 5.62            | 12.80                         | -45.76     | -30.00      | -15.76      |
|                    | 5654.00         | V               | -56.71           | 5.86            | 13.13                         | -49.44     | -30.00      | -19.44      |

Note 1: EIRP (dBm) = SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBi)

Note 2: Margin (dB) = EIRP (dBm) - Limit (dBm)

Note 3: All data in this table is based on peak detection. Due to peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak and RMS detector. Thus, the data measured using the peak detector of a spectrum analyzer or EMI receiver will represent the worst-case results.

|               |                 |                   |            |
|---------------|-----------------|-------------------|------------|
| Test Site     | TR3             | Temperature       | 25°C       |
| Test Engineer | Lewis Huang     | Relative Humidity | 54%        |
| Test Mode     | G58 Band - 10mW | Test Date         | 2019/11/10 |

| Test Channel (MHz) | Frequency (MHz) | Ant. Pol. (H/V) | SG Reading (dBm) | Cable Loss (dB) | Substitute Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | Margin (dB) |
|--------------------|-----------------|-----------------|------------------|-----------------|-------------------------------|------------|-------------|-------------|
| 470.125            | 1411.00         | H               | -55.66           | 3.02            | 8.09                          | -50.58     | -30.00      | -20.58      |
|                    | 1882.00         | H               | -57.16           | 3.40            | 10.43                         | -50.12     | -30.00      | -20.12      |
|                    | 2350.00         | H               | -54.56           | 3.79            | 9.93                          | -48.42     | -30.00      | -18.42      |
|                    | 1411.00         | V               | -55.88           | 3.02            | 8.09                          | -50.80     | -30.00      | -20.80      |
|                    | 2350.00         | V               | -56.74           | 3.79            | 9.93                          | -50.60     | -30.00      | -20.60      |
|                    | 4702.00         | V               | -50.72           | 5.39            | 12.56                         | -43.55     | -30.00      | -13.55      |
| 492.125            | 1477.00         | H               | -58.99           | 3.06            | 8.65                          | -53.40     | -30.00      | -23.40      |
|                    | 1969.00         | H               | -58.44           | 3.46            | 10.38                         | -51.52     | -30.00      | -21.52      |
|                    | 3444.00         | H               | -57.02           | 4.59            | 10.38                         | -51.22     | -30.00      | -21.22      |
|                    | 1477.00         | V               | -58.53           | 3.06            | 8.65                          | -52.95     | -30.00      | -22.95      |
|                    | 2952.75         | V               | -59.32           | 4.22            | 11.49                         | -52.06     | -30.00      | -22.06      |
|                    | 4921.00         | V               | -50.67           | 5.56            | 12.62                         | -43.60     | -30.00      | -13.60      |
| 514.000            | 4112.00         | H               | -57.52           | 5.01            | 12.64                         | -49.89     | -30.00      | -19.89      |
|                    | 5140.00         | H               | -52.19           | 5.62            | 12.80                         | -45.02     | -30.00      | -15.02      |
|                    | 5654.00         | H               | -55.23           | 5.86            | 13.13                         | -47.96     | -30.00      | -17.96      |
|                    | 4112.00         | V               | -58.71           | 5.01            | 12.64                         | -51.08     | -30.00      | -21.08      |
|                    | 5140.00         | V               | -51.75           | 5.62            | 12.80                         | -44.58     | -30.00      | -14.58      |
|                    | 6169.00         | V               | -50.39           | 6.26            | 12.87                         | -43.79     | -30.00      | -13.79      |

Note 1: EIRP (dBm) = SG Reading (dBm) - Cable Loss (dB) + Substitute Antenna Gain (dBi)

Note 2: Margin (dB) = EIRP (dBm) - Limit (dBm)

Note 3: All data in this table is based on peak detection. Due to peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak and RMS detector. Thus, the data measured using the peak detector of a spectrum analyzer or EMI receiver will represent the worst-case results.

## 6.7. AC Conducted Emissions Measurement

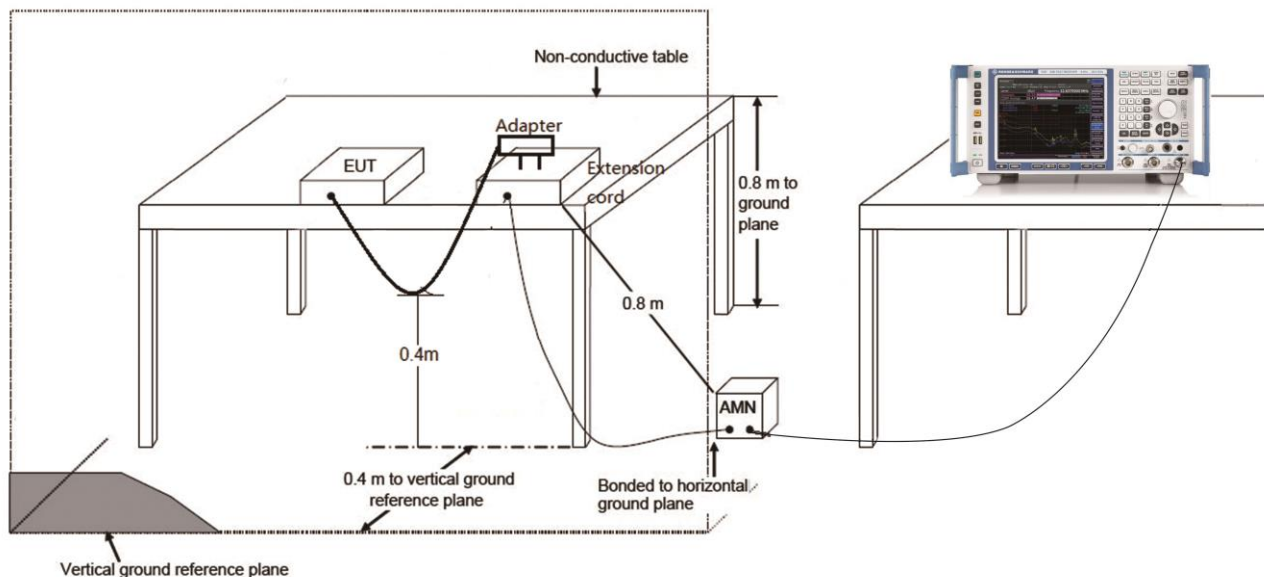
### 6.7.1. Test Limit

| FCC Part 15 Subpart C Paragraph 15.207 Limits |                 |                      |
|-----------------------------------------------|-----------------|----------------------|
| Frequency (MHz)                               | QP (dB $\mu$ V) | Average (dB $\mu$ V) |
| 0.15 - 0.50                                   | 66 - 56         | 56 - 46              |
| 0.50 - 5.0                                    | 56              | 46                   |
| 5.0 - 30                                      | 60              | 50                   |

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

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

### 6.7.2. Test Setup



### 6.7.3. Test Result of Conducted Emissions

The EUT is powered by battery, so this requirement does not apply.

## 7. CONCLUSION

The data collected relate only the item(s) tested and show that the unit is compliance with Part 15C of the FCC rules.

---

The End

## **Appendix A - Test Setup Photograph**

Refer to “1910RSU041-UT” file.

## **Appendix B - EUT Photograph**

Refer to "1910RSU041-UE" file.