

## FCC&ISED RF TEST REPORT

**No. 170902301SHA-003**

Applicant : Muuselabs NV  
Rue du Tocsin 12, 1000 Brussels, Belgium

Manufacturing site : Hansong (Nanjing) Technology Ltd.  
8th Kangping Road, Jiangning Economy and Technology  
Development Zone, Nanjing, 211106, China.

Product Name : Wireless module

Type/Model : ML-MW01A

**TEST RESULT : PASS**

### SUMMARY

The equipment complies with the requirements according to the following standard(s) or specification:

**47CFR Part 15 (2016):** Radio Frequency Devices (Subpart C)

**ANSI C63.10 (2013):** American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

**RSS-247 Issue 2 (February 2017):** Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

**RSS-Gen Issue 4 (November 2014):** General Requirements for Compliance of Radio Apparatus

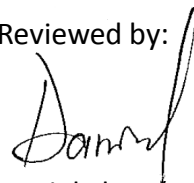
Date of issue: December 5, 2017

Prepared by:



Wade Zhang (Project engineer)

Reviewed by:



Daniel Zhao (Reviewer)

## Description of Test Facility

Name: Intertek Testing Service Shanghai

Address: Building No.86, 1198 Qinzhou Road (North), Shanghai 200233, P.R. China

FCC Designation Number: CN1175

IC Assigned Code: 2042B-1

Name of contact: Leah Xu

Tel: 86 21 61278200

Fax: 86 21 54262353

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## 1 GENERAL INFORMATION

### 1.1 Description of Client

Applicant : Muuselabs NV  
Rue du Tocsin 12, 1000 Brussels, Belgium  
Name of contact : Mr Theodore Marescaux  
Tel : +32 495 89 07 74  
Fax : /  
Manufacturing site : Hansong (Nanjing) Technology Ltd.  
8th Kangping Road, Jiangning Economy and Technology  
Development Zone, Nanjing, 211106, China.

### 1.2 Identification of the EUT

Product Name : Wireless module  
Type/model : ML-MW01A  
FCC ID : 2ANI9-MW01A  
IC : 23121-MW01A

### 1.3 Technical Specification

Operation Frequency : 2402-2480MHz  
Band  
Type of Modulation : GFSK  
EUT Modes of : Bluetooth 4.1(BLE)  
Modulation  
Transfer Rate : 1Mbps  
Power Class : Class II  
Channel Number : 40 (0-39)  
Description of EUT : The EUT is a wireless module which support 2.4GHz WIFI and Bluetooth 4.1 technology, there have only one mode, we tested it and listed the BLE result in this report.  
Antenna : 1: External PCB antenna, 2.0dBi Peak gain  
2: Internal PCB antenna, 2.0dBi Peak gain  
Rating : DC 3.8V  
Category of EUT : Class B  
EUT type : ☒ Table top  
☐ Floor standing  
Sample received date : October 11, 2017  
Date of test : October 11, 2017 to October 28, 2017

**Antenna Requirement:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

**The EUT used a print internal PCB antenna or used a no-standard electrical connector for an external antenna, so fulfill these requirements.**

## 2 TEST SPECIFICATIONS

### 2.1 Standards or specification

47CFR Part 15 (2016)  
ANSI C63.10 (2013)  
RSS-247 Issue 2 (February 2017)  
RSS-Gen Issue 4 (November 2014)  
KDB 558074 (v04)

### 2.2 Mode of operation during the test

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

The lowest, middle and highest channel were tested as representatives.

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

#### Data rate VS Power:

The test setting software is offered by the manufactory. The pre-scan for the conducted power with all rates in each modulation and bands was used, and the worst case was found and used in all test cases.

| Test software and Power Setting parameter |         |         |         |
|-------------------------------------------|---------|---------|---------|
| Test Software                             | Command |         |         |
| Working Mode                              | BLE     |         |         |
| Test Channel                              | 2402MHz | 2440MHz | 2480MHz |
| Power Setting                             | 7       | 7       | 7       |

The EUT will use two types antenna, and there have the following test mode:

Radiated test mode:

Mode 1: EUT transmitted signal with internal antenna;

Mode 2: EUT transmitted signal with external antenna;

Conducted test mode:

Mode 3: EUT transmitted signal from RF port connected to SPA directly;

We have verified all test modes, and choose the worst mode 1 for radiated test and mode 3 for conducted test as representatively to list the results in this report.

## 2.3 Test software list

| Test Items         | Software | Manufacturer | Version |
|--------------------|----------|--------------|---------|
| Conducted emission | ESxS-K1  | R&S          | V2.1.0  |
| Radiated emission  | ES-K1    | R&S          | V1.71   |

## 2.4 Test peripherals list

| Item No. | Name            | Band and Model   | Description          |
|----------|-----------------|------------------|----------------------|
| 1        | Laptop computer | HP ProBook 6470b | 100-240V AC, 50/60Hz |

## 2.5 Instrument list

| Conducted Emission                  |                             |                   |                 |              |            |
|-------------------------------------|-----------------------------|-------------------|-----------------|--------------|------------|
| Used                                | Equipment                   | Manufacturer      | Type            | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | Test Receiver               | R&S               | ESCS 30         | EC 2107      | 2018-10-18 |
| <input checked="" type="checkbox"/> | A.M.N.                      | R&S               | ESH2-Z5         | EC 3119      | 2017-12-01 |
| <input checked="" type="checkbox"/> | Shielded room               | Zhongyu           | -               | EC 2838      | 2018-01-08 |
| Radiated Emission                   |                             |                   |                 |              |            |
| Used                                | Equipment                   | Manufacturer      | Type            | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | Test Receiver               | R&S               | ESIB 26         | EC 3045      | 2018-10-18 |
| <input checked="" type="checkbox"/> | Bilog Antenna               | TESEQ             | CBL 6112D       | EC 4206      | 2018-05-30 |
| <input checked="" type="checkbox"/> | Horn antenna                | R&S               | HF 906          | EC 3049      | 2018-09-22 |
| <input checked="" type="checkbox"/> | Horn antenna                | ETS               | 3117            | EC 4792-1    | 2018-08-23 |
| <input checked="" type="checkbox"/> | Horn antenna                | TOYO              | HAP18-26W       | EC 4792-3    | 2020-07-09 |
| <input checked="" type="checkbox"/> | Pre-amplifier               | R&S               | Pre-amp 18      | EC5881       | 2018-06-19 |
| <input checked="" type="checkbox"/> | Semi-anechoic chamber       | Albatross project | -               | EC 3048      | 2018-09-08 |
| RF test                             |                             |                   |                 |              |            |
| Used                                | Equipment                   | Manufacturer      | Type            | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | PXA Signal Analyzer         | Keysight          | N9030A          | EC 5338      | 2018-09-10 |
| <input checked="" type="checkbox"/> | Power sensor                | Agilent           | U2021XA         | EC 5338-1    | 2018-03-03 |
| <input checked="" type="checkbox"/> | Vector Signal Generator     | Agilent           | N5182B          | EC 5175      | 2018-03-06 |
| <input checked="" type="checkbox"/> | MXG Analog Signal Generator | Agilent           | N5181A          | EC 5338-2    | 2018-03-03 |
| <input checked="" type="checkbox"/> | Mobile Test System          | Litepoint         | lqxl            | EC 5176      | 2018-01-11 |
| <input checked="" type="checkbox"/> | Test Receiver               | R&S               | ESCI 7          | EC 4501      | 2018-02-23 |
| Additional instrument               |                             |                   |                 |              |            |
| Used                                | Equipment                   | Manufacturer      | Type            | Internal no. | Due date   |
| <input checked="" type="checkbox"/> | Therom-Hygrograph           | ZJ1-2A            | S.M.I.F.        | EC 3323      | 2018-06-14 |
| <input checked="" type="checkbox"/> | Therom-Hygrograph           | ZJ1-2A            | S.M.I.F.        | EC 3324      | 2018-04-09 |
| <input checked="" type="checkbox"/> | Therom-Hygrograph           | ZJ1-2A            | S.M.I.F.        | EC 3325      | 2018-03-23 |
| <input checked="" type="checkbox"/> | Pressure meter              | YM3               | Shanghai Mengde | EC 3320      | 2018-06-28 |

## 2.6 Test Summary

This report applies to tested sample only. The test results have been compared directly with the limits, and the measurement uncertainty is recorded. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

| TEST ITEM                                  | FCC REFERENCE   | IC REFERENCE                  | RESULT |
|--------------------------------------------|-----------------|-------------------------------|--------|
| Minimum 6dB Bandwidth & Occupied bandwidth | 15.247(a)(2)    | RSS-247 Issue 2<br>Clause 5.2 | Pass   |
| Maximum peak output power                  | 15.247(b)       | RSS-247 Issue 2<br>Clause 5.4 | Pass   |
| Power spectrum density                     | 15.247(e)       | RSS-247 Issue 2<br>Clause 5.2 | Pass   |
| Radiated emission                          | 15.205 & 15.209 | RSS-247 Issue 2<br>Clause 5.5 | Pass   |
| Emission outside the frequency band        | 15.247(d)       | RSS-Gen Issue 4<br>Clause 8.9 | Pass   |
| Power line conducted emission              | 15.207          | RSS-Gen Issue 4<br>Clause 8.8 | Pass   |
| Occupied bandwidth                         | -               | RSS-Gen Issue 4<br>Clause 6.6 | Tested |

Notes: 1: NA =Not Applicable

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## 2.7 Measurement uncertainty

The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

| Test item                                                   | Measurement uncertainty |
|-------------------------------------------------------------|-------------------------|
| Maximum peak output power                                   | $\pm 0.74\text{dB}$     |
| Radiated Emissions in restricted frequency bands below 1GHz | $\pm 4.90\text{dB}$     |
| Radiated Emissions in restricted frequency bands above 1GHz | $\pm 5.02\text{dB}$     |
| Emission outside the frequency band                         | $\pm 2.89\text{dB}$     |
| Power line conducted emission                               | $\pm 3.19\text{dB}$     |

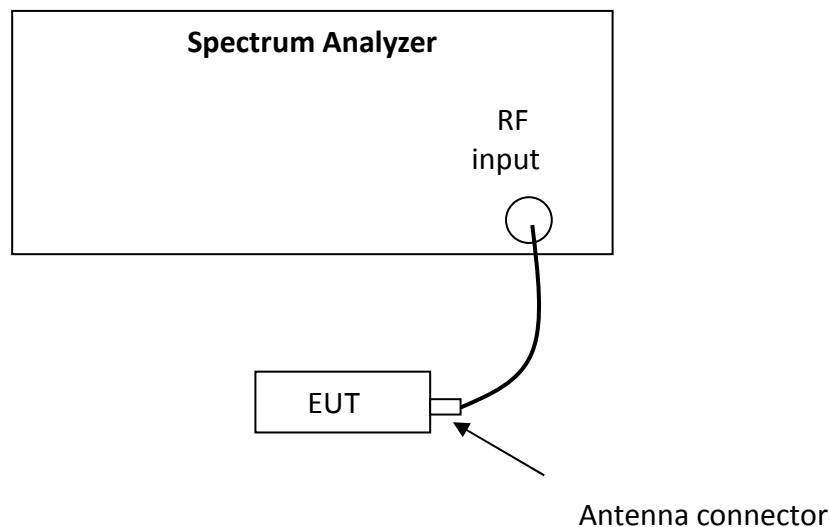
### 3 Minimum 6dB Bandwidth

Test result: Pass

#### 3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

#### 3.2 Test Configuration



#### 3.3 Test Procedure and test setup

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance" for compliance to FCC 47CFR 15.247 requirements (clause 8.2).

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

### 3.4 Test Protocol

Temperature: 25 °C  
Relative Humidity: 55 %

| Modulation | Frequency (MHz) | Minimum 6dB Bandwidth (KHz) | Limits (KHz) |
|------------|-----------------|-----------------------------|--------------|
| BLE        | 2402            | 690.1                       | > 500        |
|            | 2440            | 690.0                       | > 500        |
|            | 2480            | 690.3                       | > 500        |

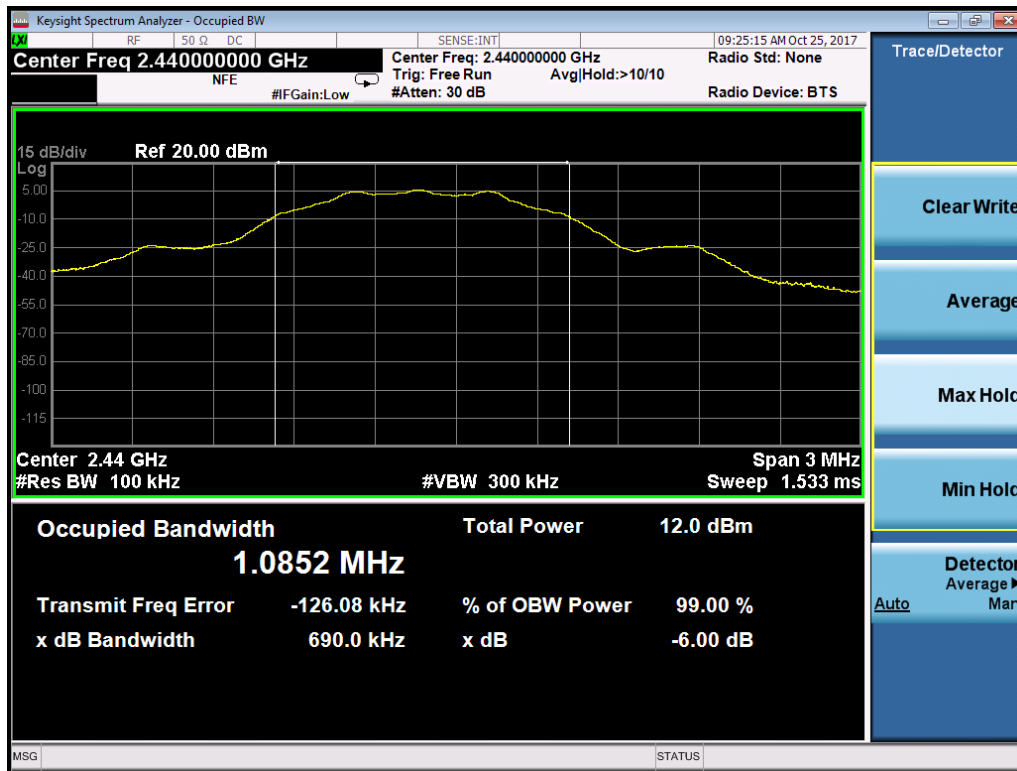
| Modulation | Frequency (MHz) | 99% Occupied Bandwidth (MHz) |
|------------|-----------------|------------------------------|
| BLE        | 2402            | 1.0848                       |
|            | 2440            | 1.0852                       |
|            | 2480            | 1.0854                       |

Test Plots:

Channel L



### Channel M



### Channel H



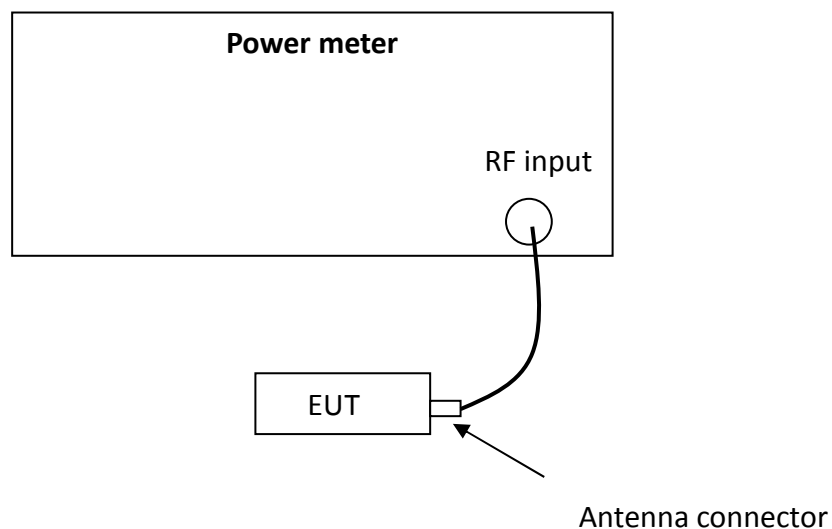
## 4 Maximum Conducted Output power

**Test result:** Pass

### 4.1 Test limit

- ☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
- ☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
- ☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt and the e.i.r.p. shall not exceed 4 W.

### 4.2 Test Configuration



### 4.3 Test procedure and test setup

- a) Set the RBW  $\geq$  DTS bandwidth.
- b) Set VBW  $\geq 3 \times$  RBW.
- c) Set span  $\geq 3 \times$  RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

#### 4.4 Test protocol

Temperature: 25 °C

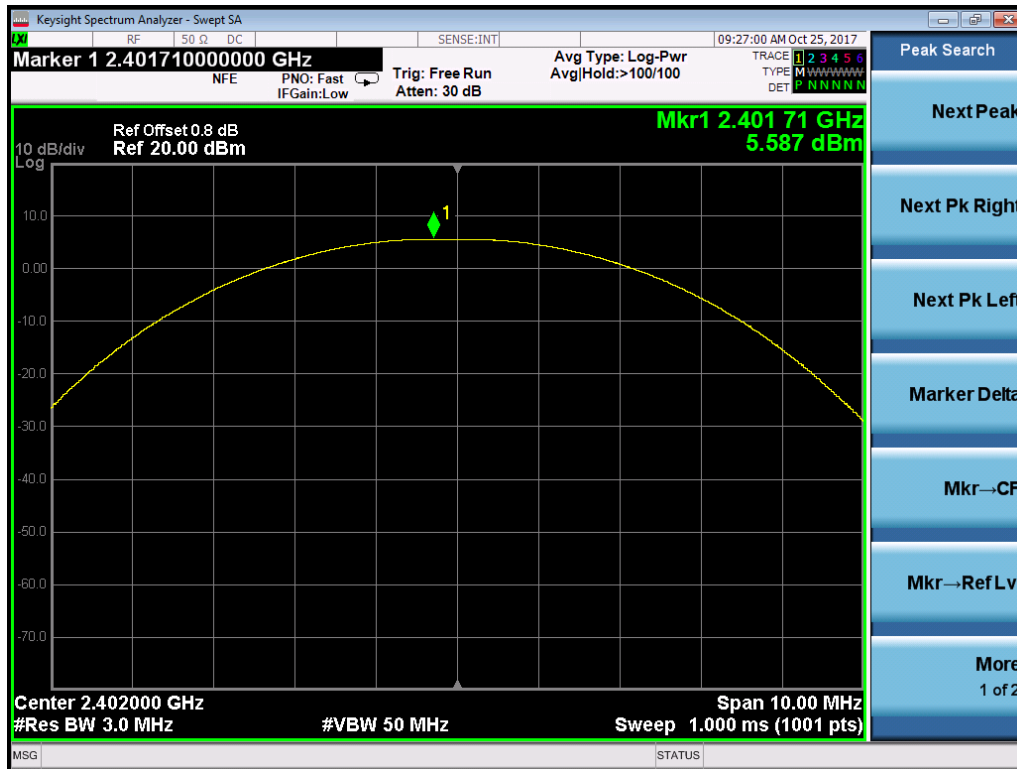
Relative Humidity: 55 %

| Modulation | Frequency (MHz) | MaxConducted Power (dBm) | Limit (dBm) |
|------------|-----------------|--------------------------|-------------|
| BLE        | 2402            | 5.587                    | 30          |
|            | 2440            | 5.925                    | 30          |
|            | 2480            | 5.567                    | 30          |

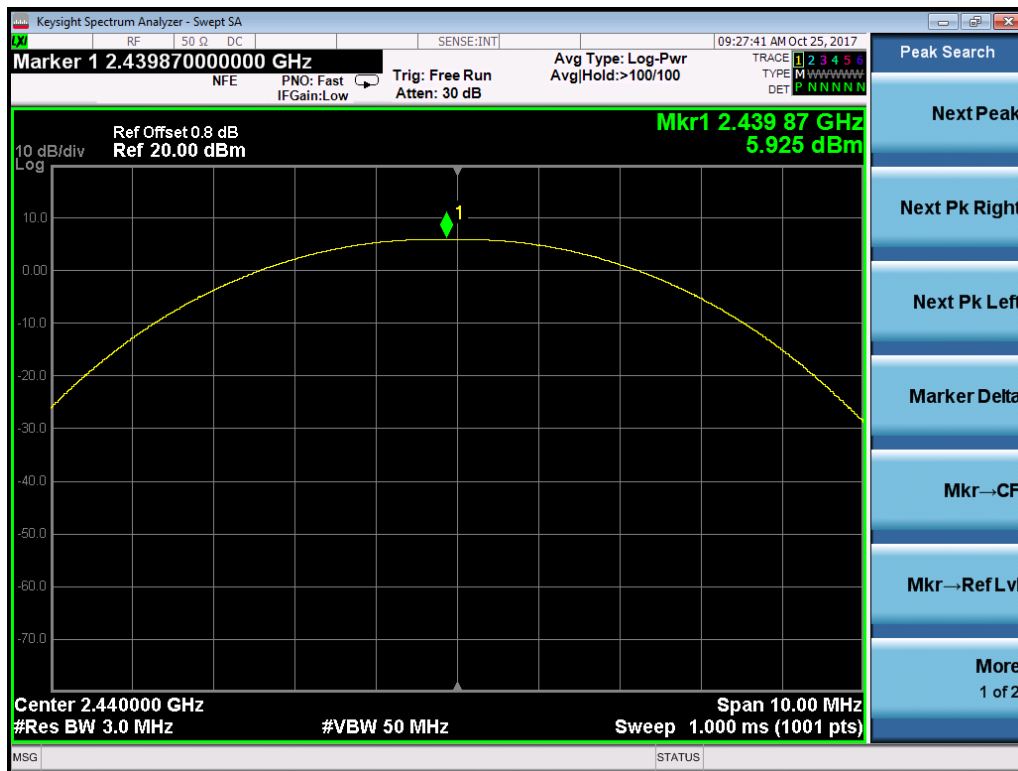
**Conclusion:** The maximum EIRP = 5.925dBm+2.0dBi = 7.925dBm = 0.006W which is lower than the limit of 4W listed in RSS-247.

Test Plots:

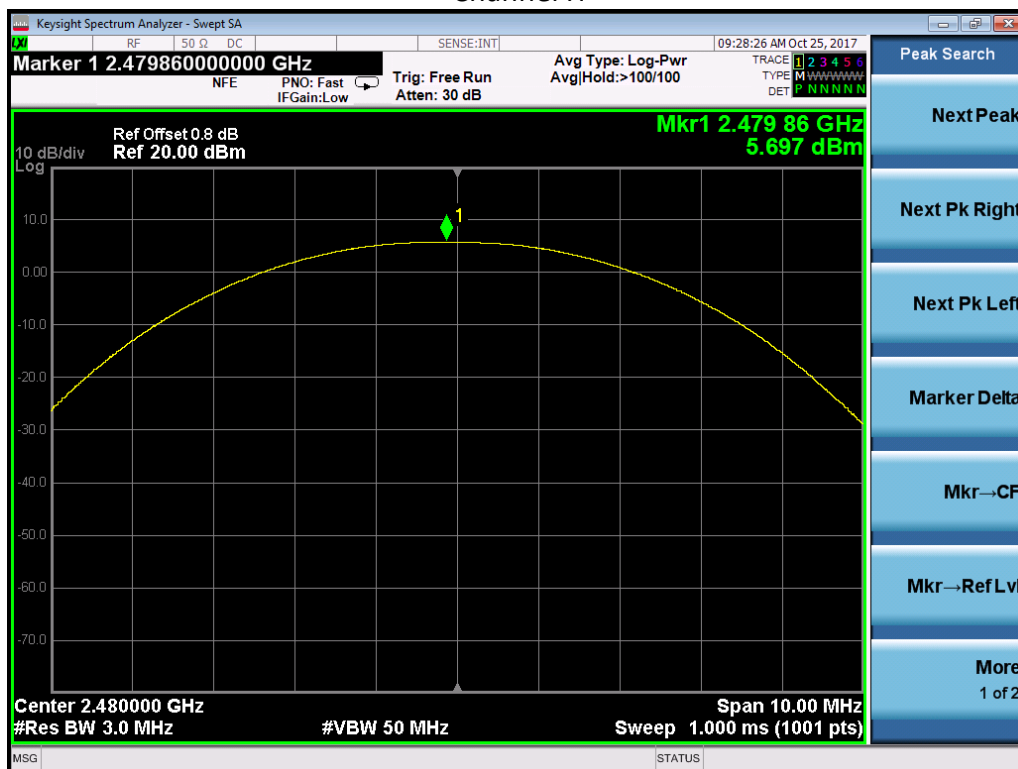
Channel L



Channel M



Channel H



## 5 Power spectrum density

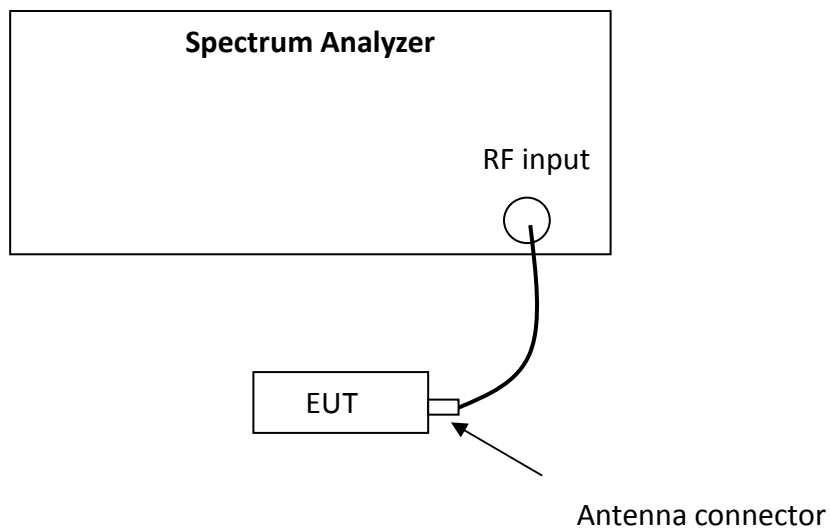
**Test result:Pass**

### 5.1 Test limit

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

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi. If there have a beam forming type, the limit should be the minimum of 8dBm/3kHz and  $8 + (6 - \text{antenna gain} - \text{beam forming gain})$ .

### 5.2 Test Configuration



### 5.3 Test procedure and test setup

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

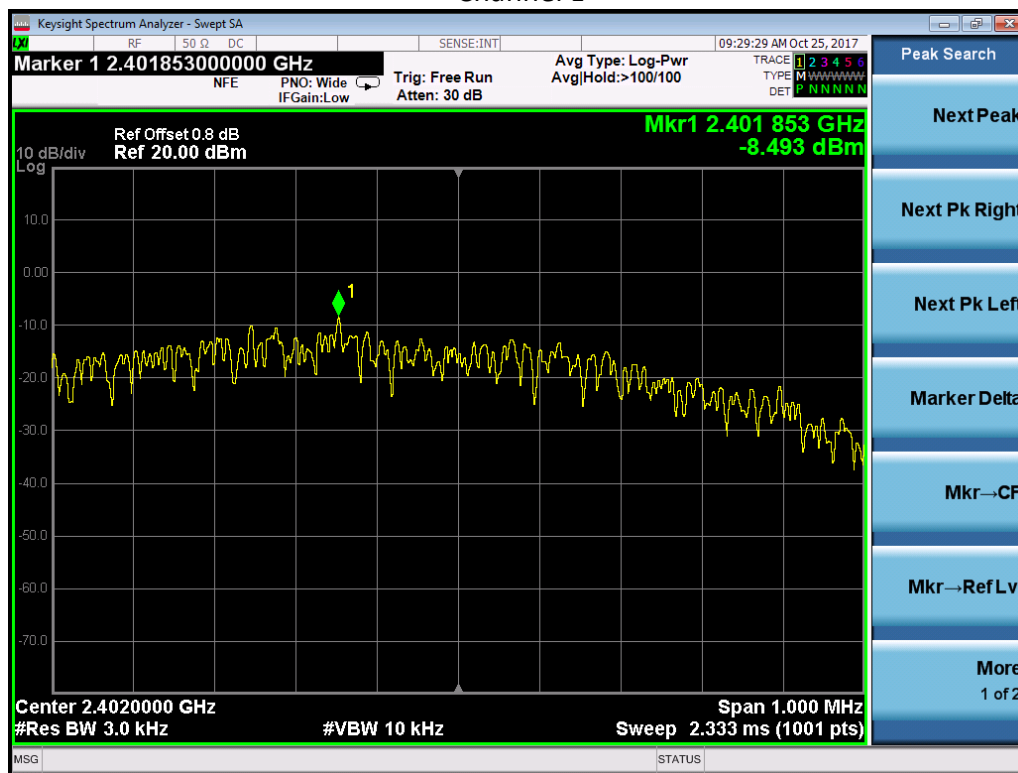
## 5.4 Test Protocol

Temperature: 25 °C  
Relative Humidity: 55 %

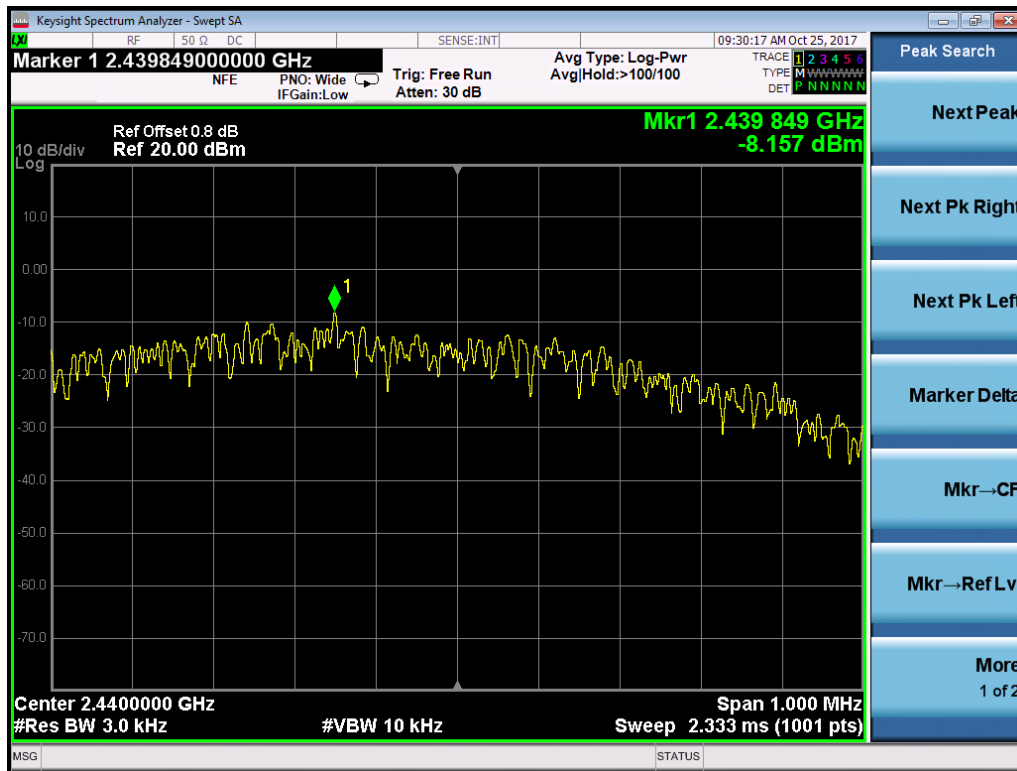
| Modulation | Frequency (MHz) | Maximum Power spectrum density (dBm/3KHz) | Limit (dBm/3KHz) |
|------------|-----------------|-------------------------------------------|------------------|
| BLE        | 2402            | -8.493                                    | 8                |
|            | 2440            | -8.157                                    | 8                |
|            | 2480            | -8.462                                    | 8                |

Test Plots:

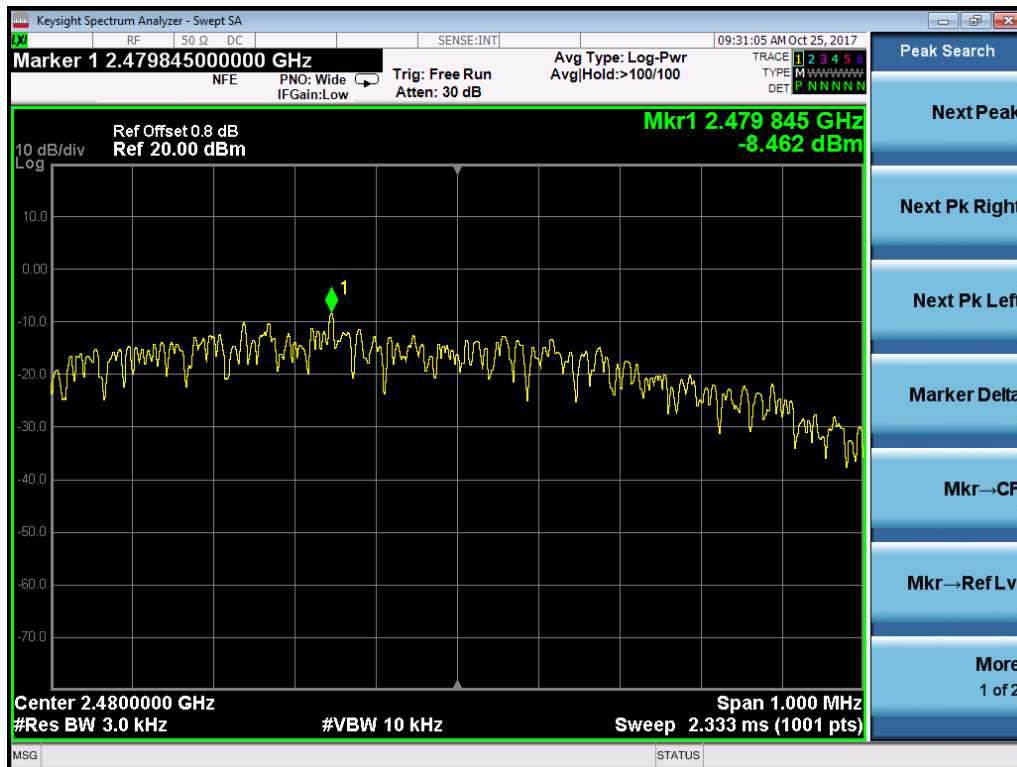
Channel L



### Channel M



### Channel H



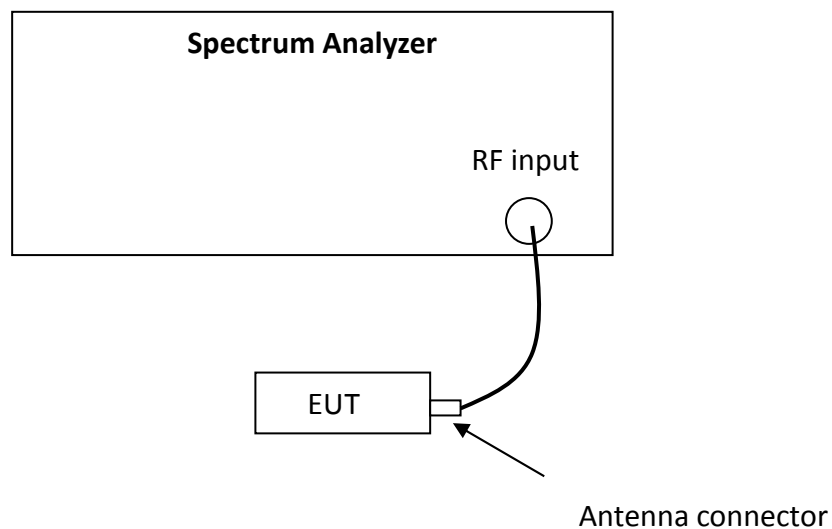
## 6 Emission outside the frequency band

Test result: Pass

### 6.1 Test limit

In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

### 6.2 Test Configuration



### 6.3 Test procedure and test setup

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance” (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

#### Reference level measurement

Establish a reference level by using the following procedure:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to  $\geq 1.5$  times the *DTS bandwidth*.
- c) Set the RBW = 100 kHz.
- d) Set the VBW  $\geq 3 \times$  RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

#### Emission level measurement

- a) Set the center frequency and span to encompass frequency range to be measured.
- b) Set the RBW = 100 kHz.
- c) Set the VBW  $\geq 3 \times$  RBW.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the peak marker function to determine the maximum amplitude level.

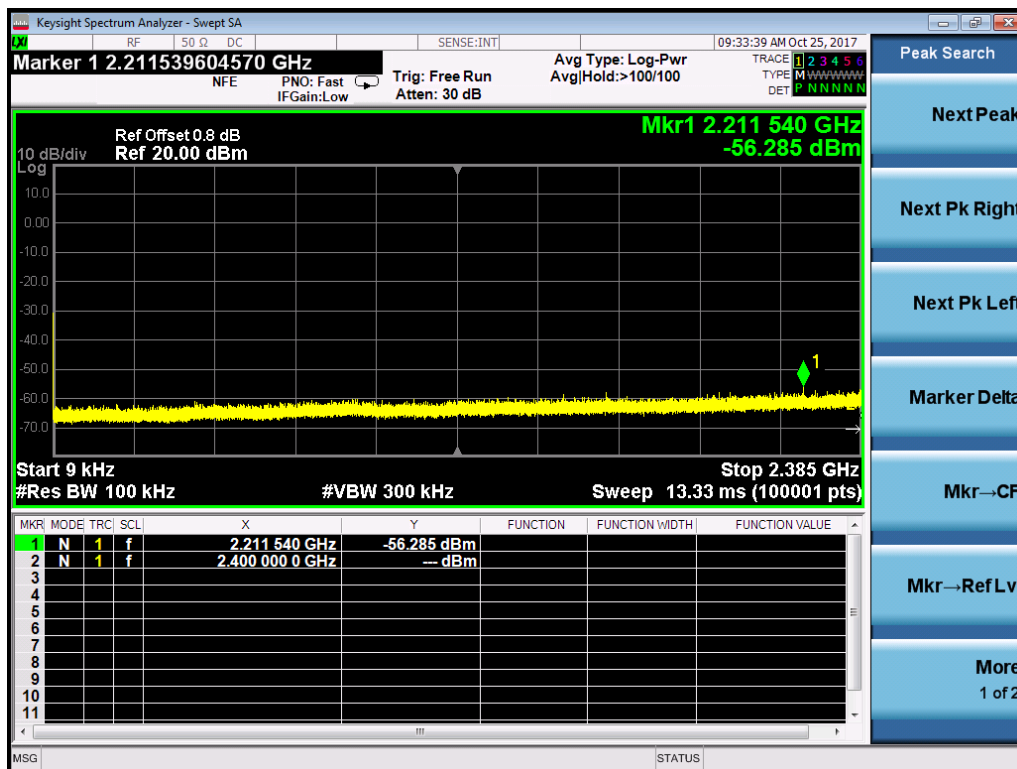
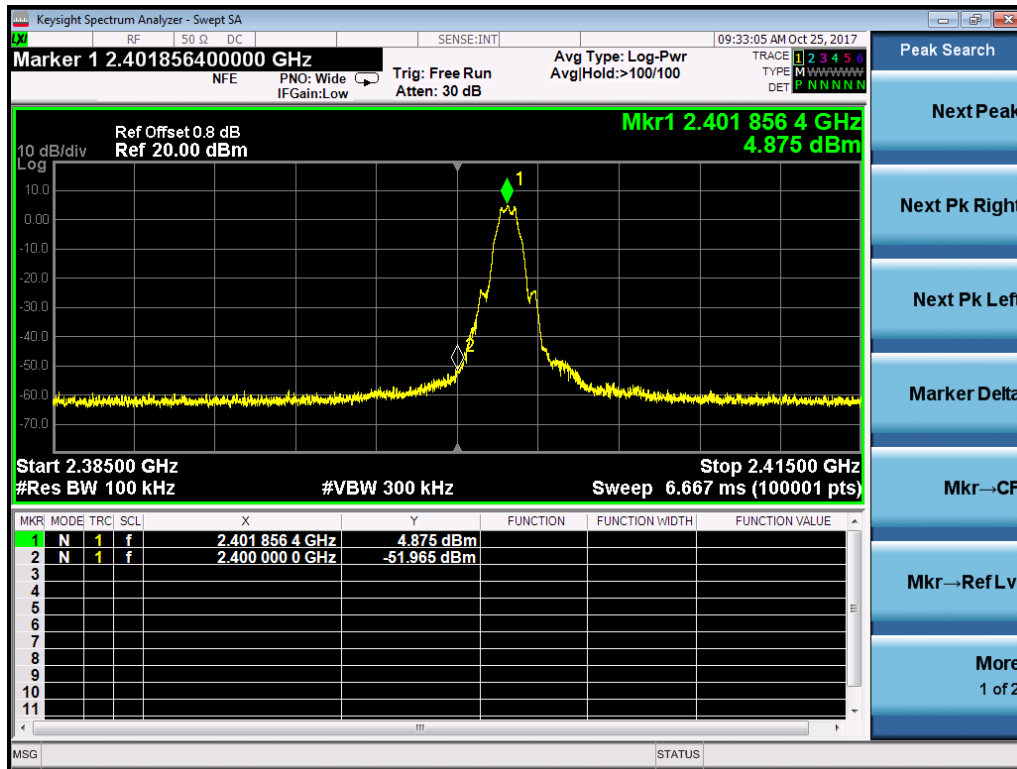
Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

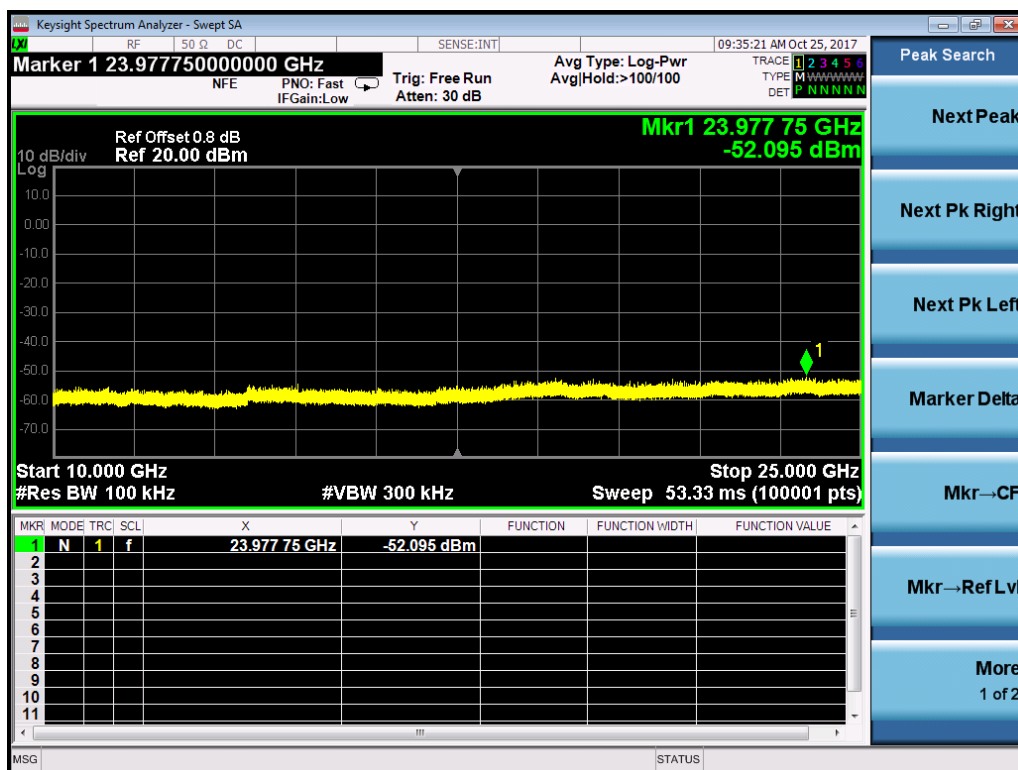
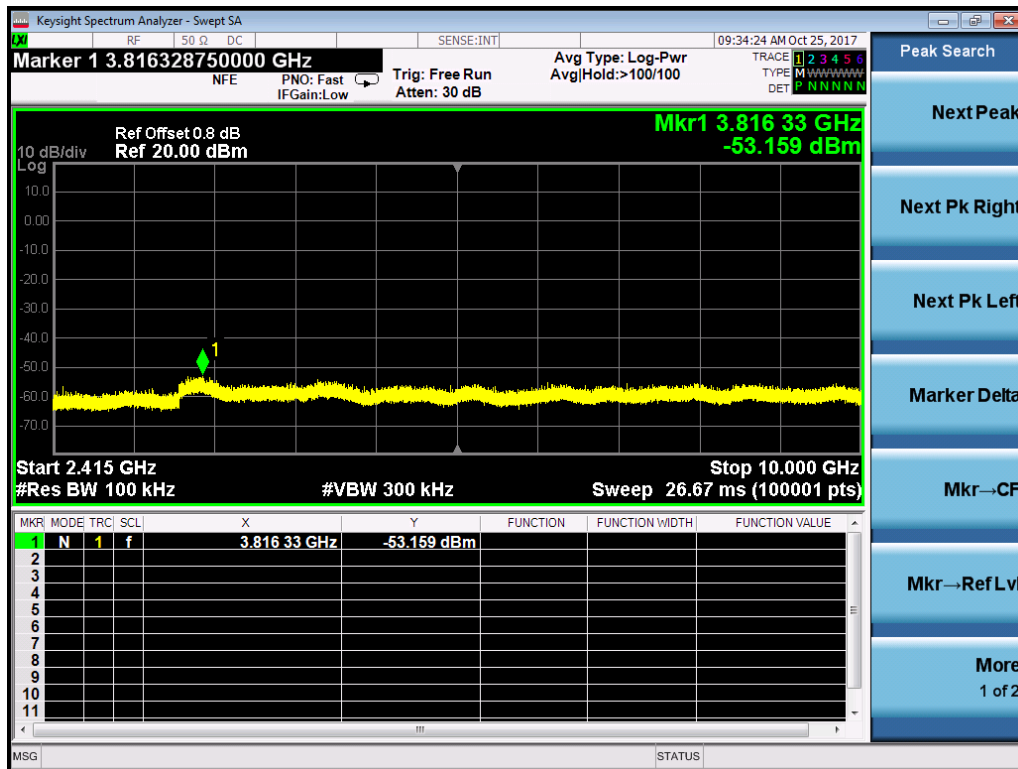
## 6.4 Test Protocol

Temperature: 25 °C

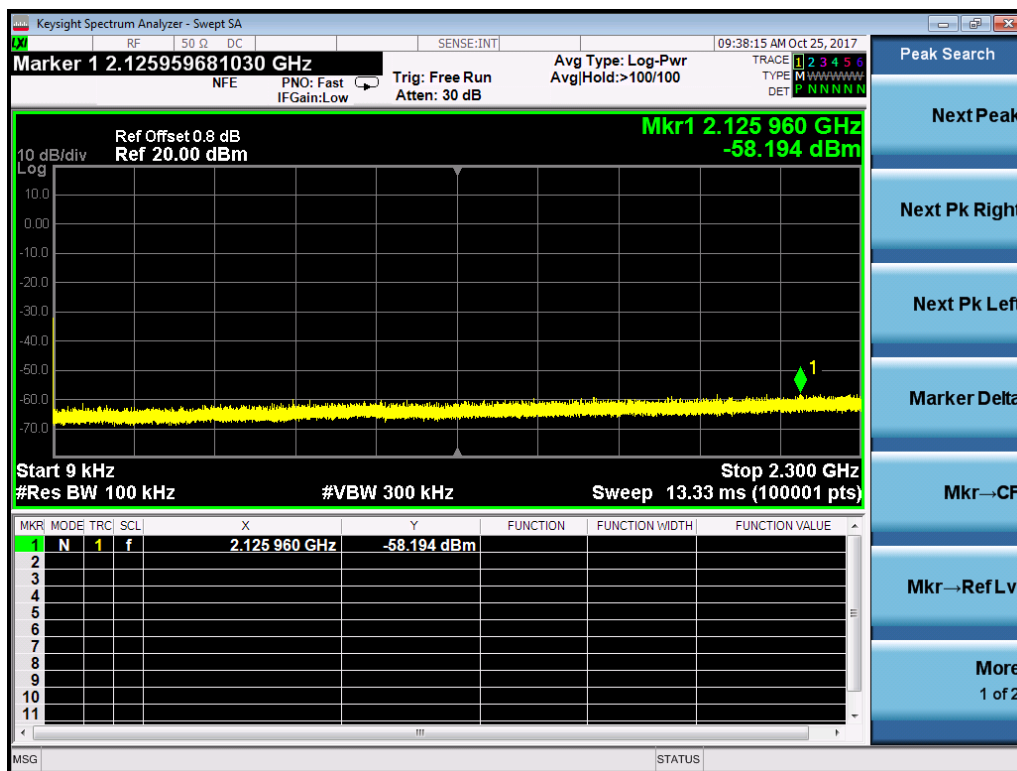
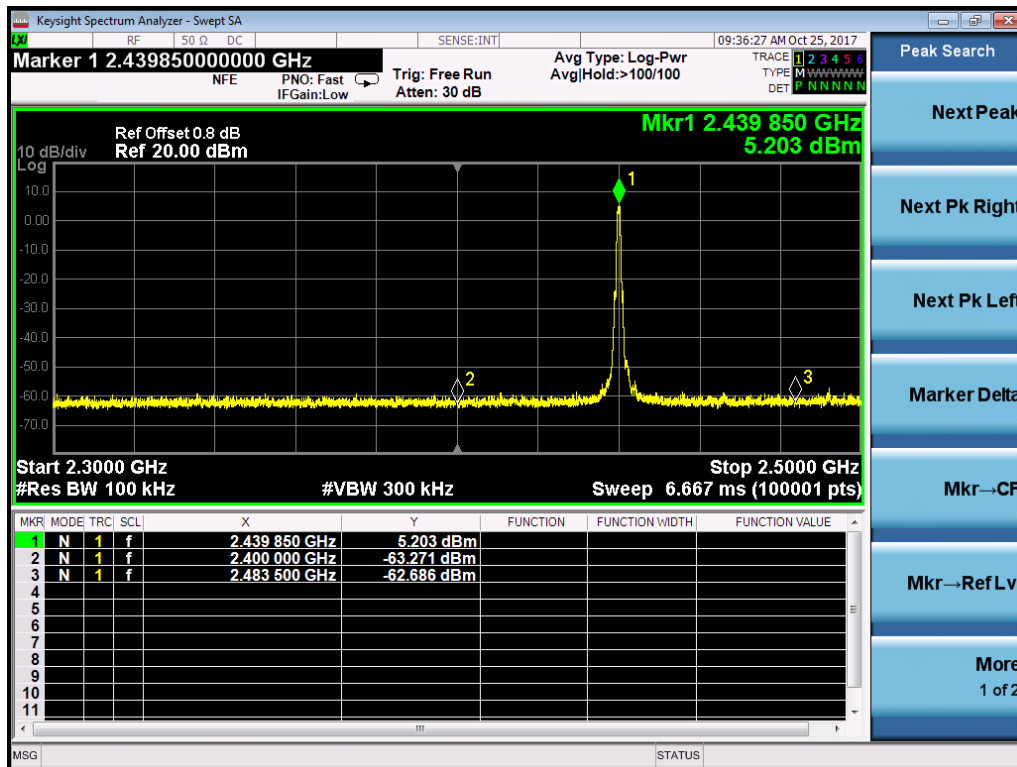
Relative Humidity: 55 %

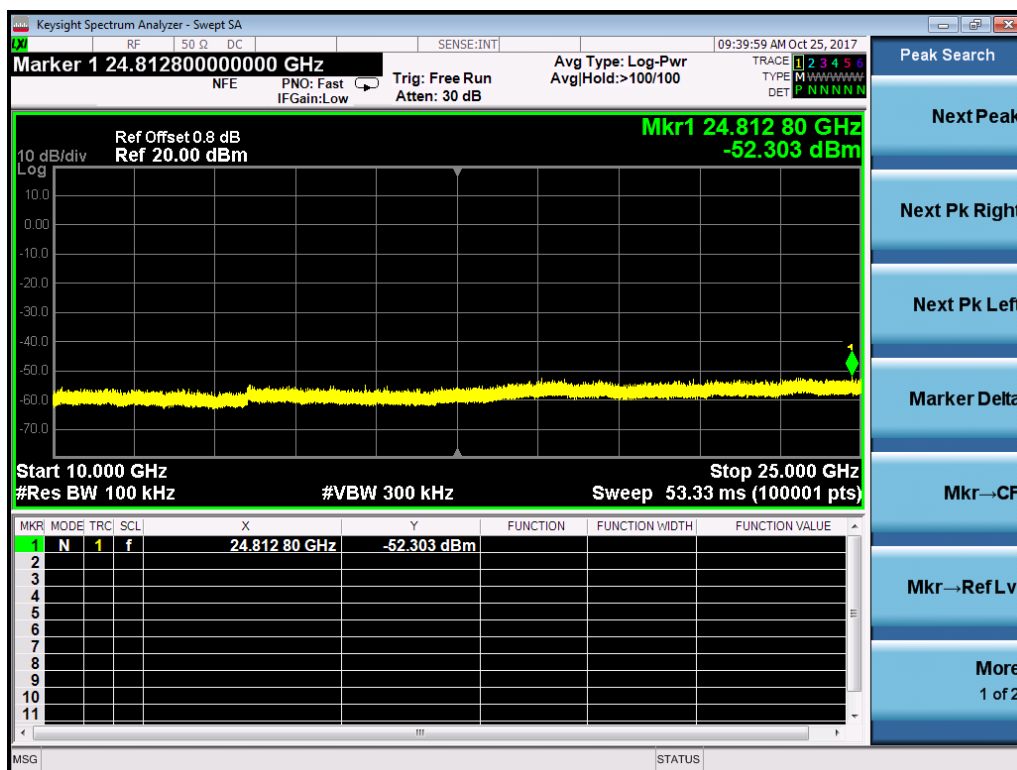
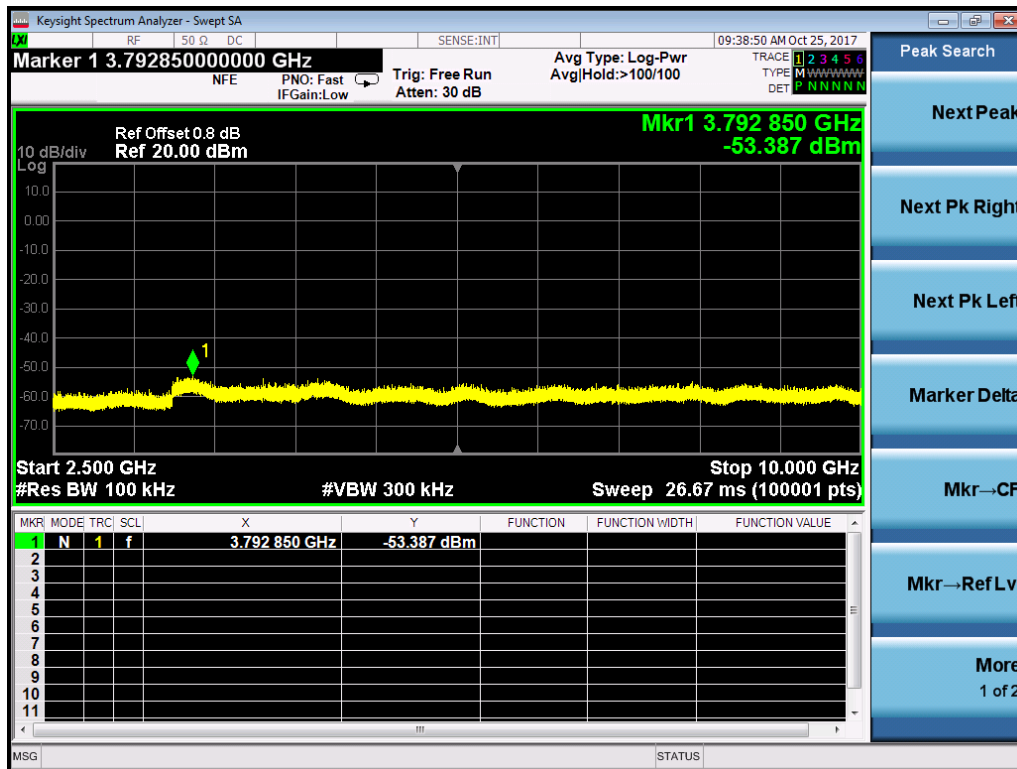
Channel L



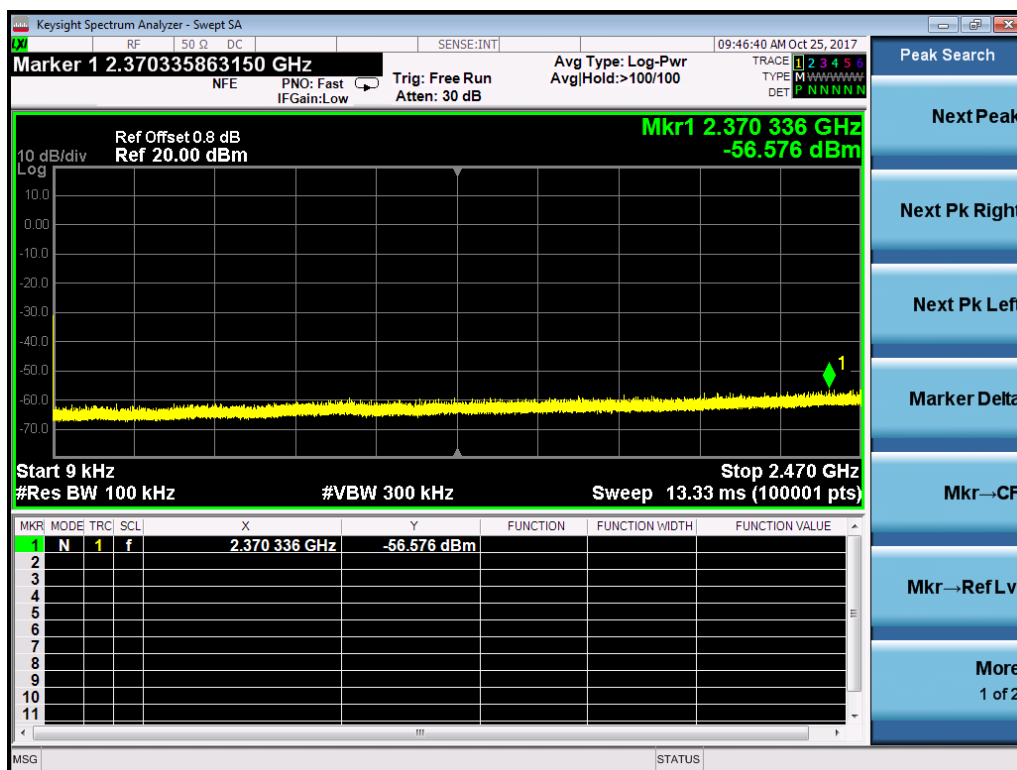
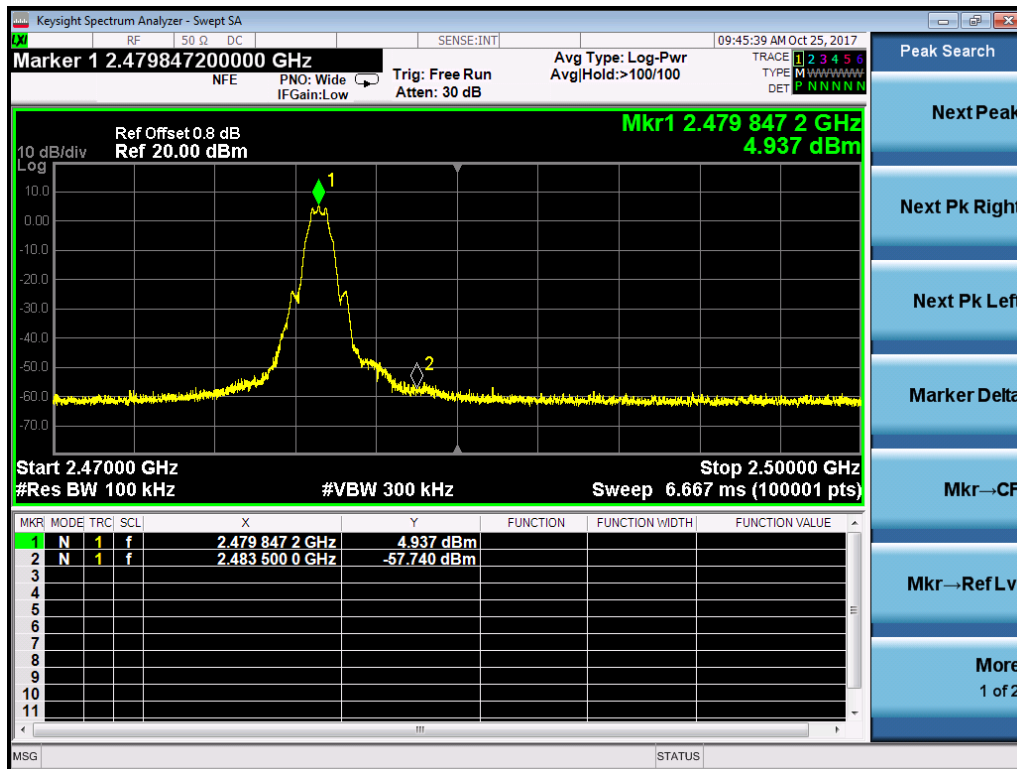


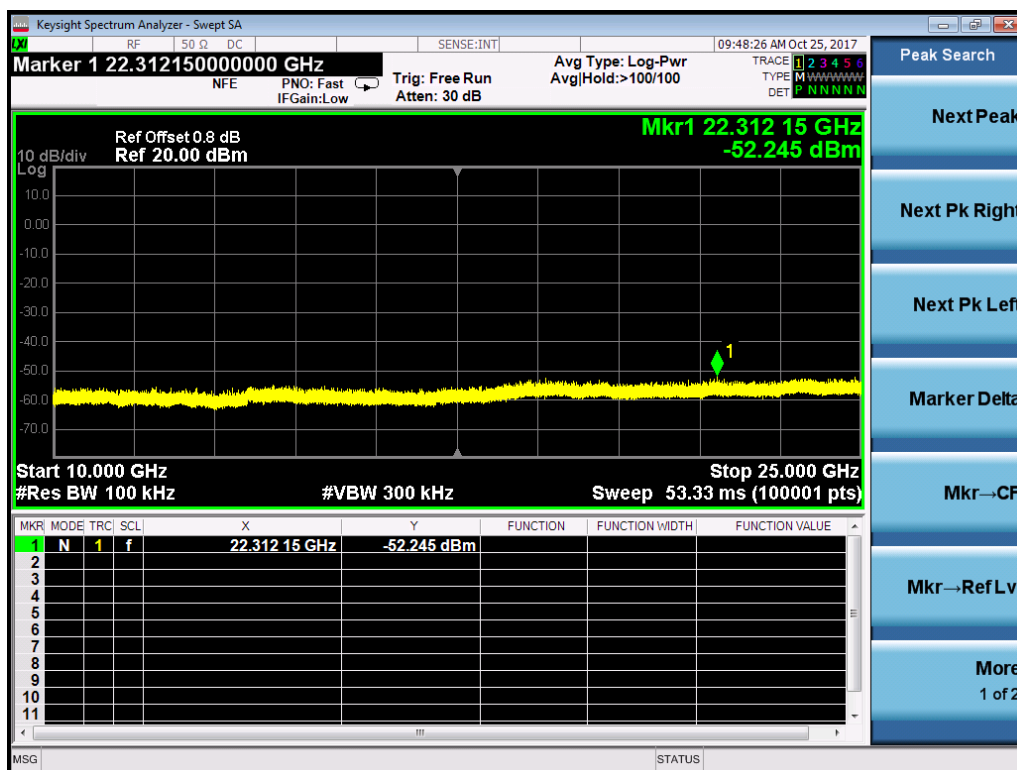
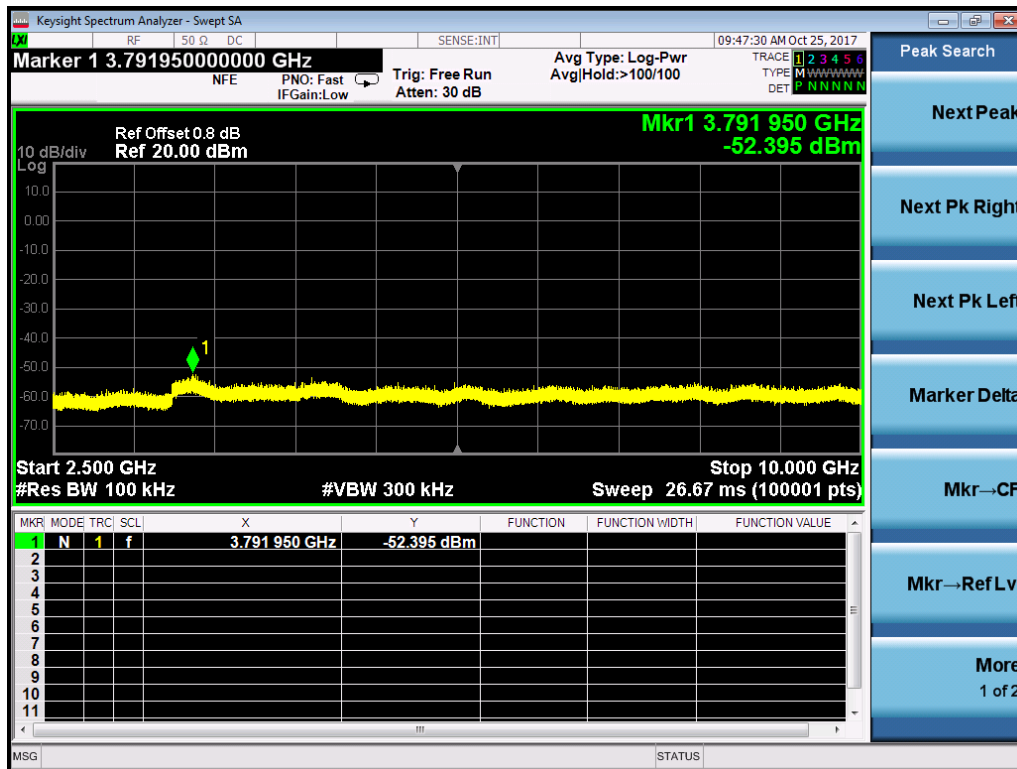
Channel M





Channel H





## 7 Radiated Emissions

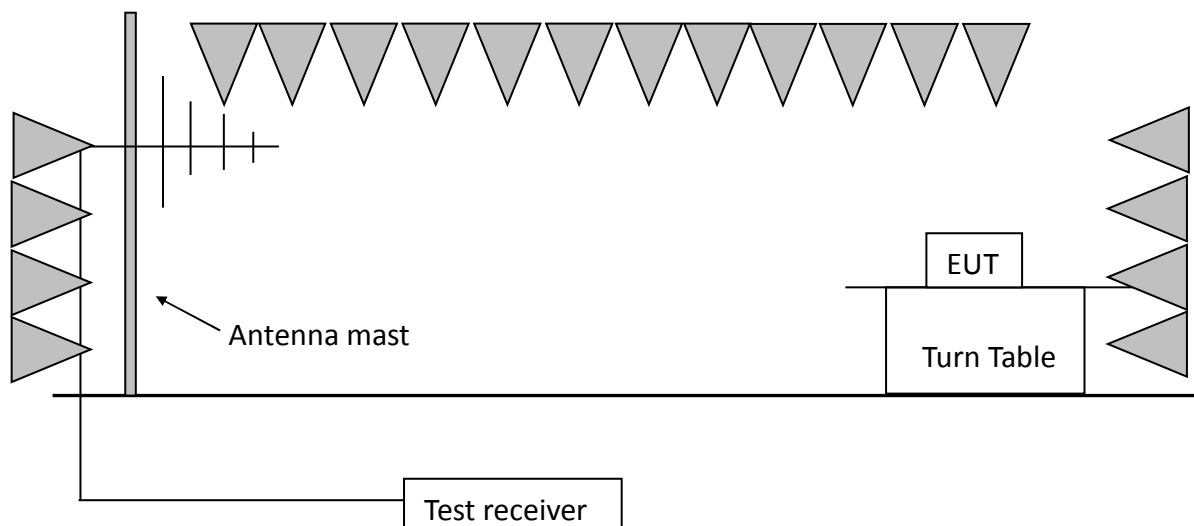
**Test result:** Pass

### 7.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-------------------|-----------------------------------|-------------------------------|
| 0.009 ~ 0.490     | 2400/F(kHz)                       | 300                           |
| 0.490 ~ 1.705     | 24000/F(kHz)                      | 30                            |
| 1.705 ~ 30.0      | 30                                | 30                            |
| 30 ~ 88           | 100                               | 3                             |
| 88 ~ 216          | 150                               | 3                             |
| 216 ~ 960         | 200                               | 3                             |
| Above 960         | 500                               | 3                             |

### 7.2 Test Configuration



### 7.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

Tabletop devices shall be placed on a nonconducting platform with nominal top surface dimensions 1 m by 1.5 m. For emissions testing at or below 1 GHz, the table height shall be 80 cm above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m.

The turntable rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The EUT was tested according to DTS test procedure of KDB558074 D01 DTS "Meas Guidance" for compliance to FCC 47CFR 15.247 requirements.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 300 Hz, VBW = 1 kHz (9 kHz~150 kHz);  
RBW = 10 kHz, VBW = 30 kHz (150 kHz~30MHz);  
RBW = 100 kHz, VBW = 300 kHz (30MHz~1GHz for PK)  
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

Remark:

1. Factor= Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Measured level= Original Receiver Reading + Factor
3. Margin = Limit – Measured level
4. If the PK measured level is lower than AV limit, the AV test can be elided.

Example:

Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,  
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.  
Then Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;  
Measured level = 10dBuV + 0.20dB/m = 10.20dBuV/m  
Assuming limit = 54dBuV/m,  
Measured level = 10.20dBuV/m, then Margin = 54 - 10.20 = 43.80dBuV/m.

## 7.4 Test Protocol

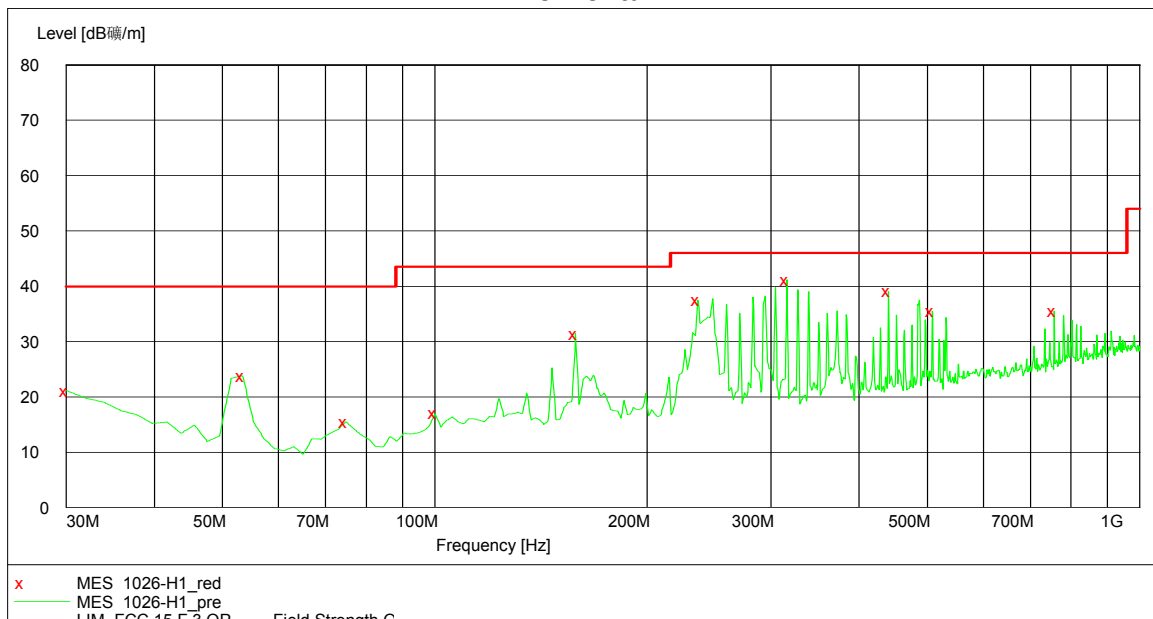
Temperature: 25 °C

Relative Humidity: 55 %

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

The worst waveform from 30MHz to 1000MHz is listed as below:

Horizontal



Vertical



**Test data 30MHz~1GHz:**

| Polarization | Frequency (MHz) | Measured level (dB $\mu$ V/m) | Limits (dB $\mu$ V/m) | Margin (dB) | Detector |
|--------------|-----------------|-------------------------------|-----------------------|-------------|----------|
| H            | 30.00           | 21.1                          | 40.0                  | 18.9        | PK       |
|              | 53.33           | 23.8                          | 40.0                  | 16.2        | PK       |
|              | 74.71           | 15.5                          | 40.0                  | 24.5        | PK       |
|              | 99.98           | 17.0                          | 43.5                  | 26.5        | PK       |
|              | 158.30          | 31.4                          | 43.5                  | 12.1        | PK       |
|              | 236.05          | 37.5                          | 46.0                  | 8.5         | PK       |
|              | 315.75          | 41.1                          | 46.0                  | 4.9         | PK       |
|              | 440.16          | 39.0                          | 46.0                  | 7.0         | PK       |
|              | 508.20          | 35.5                          | 46.0                  | 10.5        | PK       |
|              | 757.01          | 35.5                          | 46.0                  | 10.5        | PK       |
| V            | 30.00           | 21.7                          | 40.0                  | 18.3        | PK       |
|              | 53.33           | 24.9                          | 40.0                  | 15.1        | PK       |
|              | 66.93           | 19.4                          | 40.0                  | 20.6        | PK       |
|              | 99.98           | 22.4                          | 43.5                  | 21.1        | PK       |
|              | 158.30          | 35.4                          | 43.5                  | 8.1         | PK       |
|              | 232.16          | 26.5                          | 46.0                  | 19.5        | PK       |
|              | 315.75          | 35.0                          | 46.0                  | 11.0        | PK       |
|              | 486.81          | 28.1                          | 46.0                  | 17.9        | PK       |
|              | 665.65          | 35.1                          | 46.0                  | 10.9        | PK       |
|              | 745.35          | 31.7                          | 46.0                  | 14.3        | PK       |

**Test result above 1GHz:**

The emission was conducted from 1GHz to 25GHz.

| CH | Antenna | Frequency (MHz) | Correct Factor (dB/m) | Corrected Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|----|---------|-----------------|-----------------------|----------------------------|----------------|-------------|----------|
| L  | H       | 2402.00         | 30.70                 | 95.70                      | Fundamental    | /           | PK       |
|    | V       | 2402.00         | 30.70                 | 92.50                      | Fundamental    | /           | PK       |
|    | H       | 2390.00         | 30.30                 | 48.70                      | 74.00          | 25.30       | PK       |
|    | H       | 2390.00         | 30.30                 | 42.30                      | 54.00          | 11.70       | AV       |
|    | H       | 4804.00         | -1.50                 | 46.70                      | 74.00          | 27.30       | PK       |
|    | H       | 7206.00         | 3.50                  | 49.30                      | 74.00          | 24.70       | PK       |
|    | V       | 2390.00         | 30.30                 | 47.60                      | 74.00          | 26.40       | PK       |
|    | V       | 2390.00         | 30.30                 | 41.40                      | 54.00          | 12.60       | AV       |
|    | V       | 4804.00         | -1.50                 | 46.30                      | 74.00          | 27.70       | PK       |
|    | V       | 7206.00         | 3.50                  | 47.20                      | 74.00          | 26.80       | PK       |
| M  | H       | 2440.00         | 30.70                 | 96.10                      | Fundamental    | /           | PK       |
|    | V       | 2440.00         | 30.70                 | 93.70                      | Fundamental    | /           | PK       |
|    | H       | 4880.00         | -1.10                 | 47.30                      | 74.00          | 26.70       | PK       |
|    | H       | 7320.00         | 3.60                  | 48.20                      | 74.00          | 25.80       | PK       |
|    | V       | 4880.00         | -1.10                 | 46.10                      | 74.00          | 27.90       | PK       |
|    | V       | 7320.00         | 3.60                  | 45.80                      | 74.00          | 28.20       | PK       |
| H  | H       | 2480.00         | 30.70                 | 95.60                      | Fundamental    | /           | PK       |
|    | V       | 2480.00         | 30.70                 | 92.80                      | Fundamental    | /           | PK       |
|    | H       | 2483.50         | 30.80                 | 48.30                      | 74.00          | 25.70       | PK       |
|    | H       | 2483.50         | 30.80                 | 42.50                      | 54.00          | 11.50       | AV       |
|    | V       | 2483.50         | 30.80                 | 46.40                      | 74.00          | 27.60       | PK       |
|    | V       | 2483.50         | 30.80                 | 40.70                      | 54.00          | 13.30       | AV       |
|    | H       | 4960.00         | -0.80                 | 45.60                      | 74.00          | 28.40       | PK       |
|    | H       | 7440.00         | 3.80                  | 46.80                      | 74.00          | 27.20       | PK       |
|    | V       | 4960.00         | -0.80                 | 45.50                      | 74.00          | 28.50       | PK       |
|    | V       | 7440.00         | 3.80                  | 47.30                      | 74.00          | 26.70       | PK       |

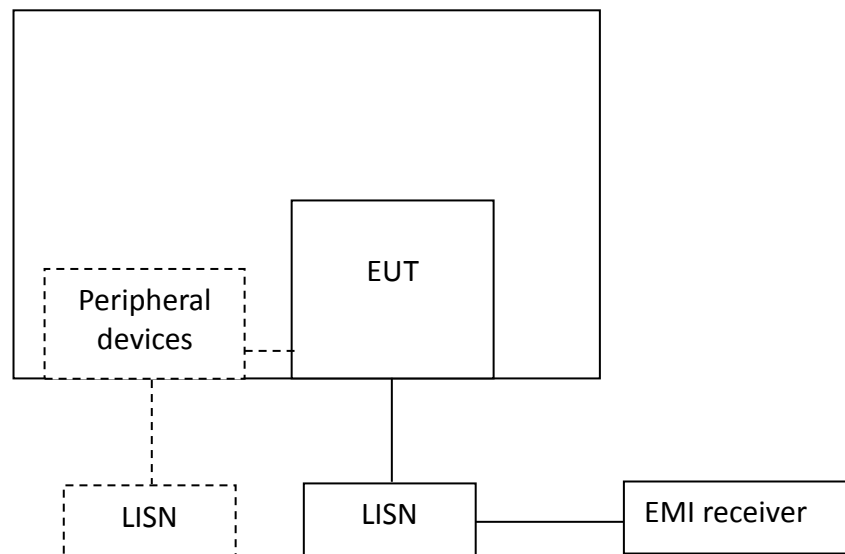
## 8 Power line conducted emission

Test result: Pass

### 8.1 Limit

| Frequency of Emission (MHz)                      | Conducted Limit (dBuV) |            |
|--------------------------------------------------|------------------------|------------|
|                                                  | QP                     | AV         |
| 0.15-0.5                                         | 66 to 56*              | 56 to 46 * |
| 0.5-5                                            | 56                     | 46         |
| 5-30                                             | 60                     | 50         |
| * Decreases with the logarithm of the frequency. |                        |            |

### 8.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

### 8.3 Test procedure and test set up

Measured levels of ac power-line conducted emission shall be the emission voltages from the voltage probe, where permitted, or across the 50  $\Omega$  LISN port (to which the EUT is connected), where permitted, terminated into a 50  $\Omega$  measuring instrument. All emission voltage and current measurements shall be made on each current-carrying conductor at the plug end of the EUT power cord by the use of mating plugs and receptacles on the LISN, if used. Equipment shall be tested with power cords that are normally supplied or recommended by the manufacturer and that have electrical and shielding characteristics that are the same as those cords normally supplied or recommended by the manufacturer. For those measurements using a LISN, the 50  $\Omega$  measuring port is terminated by a measuring instrument having 50  $\Omega$  input impedance. All other ports are terminated in 50  $\Omega$  loads.

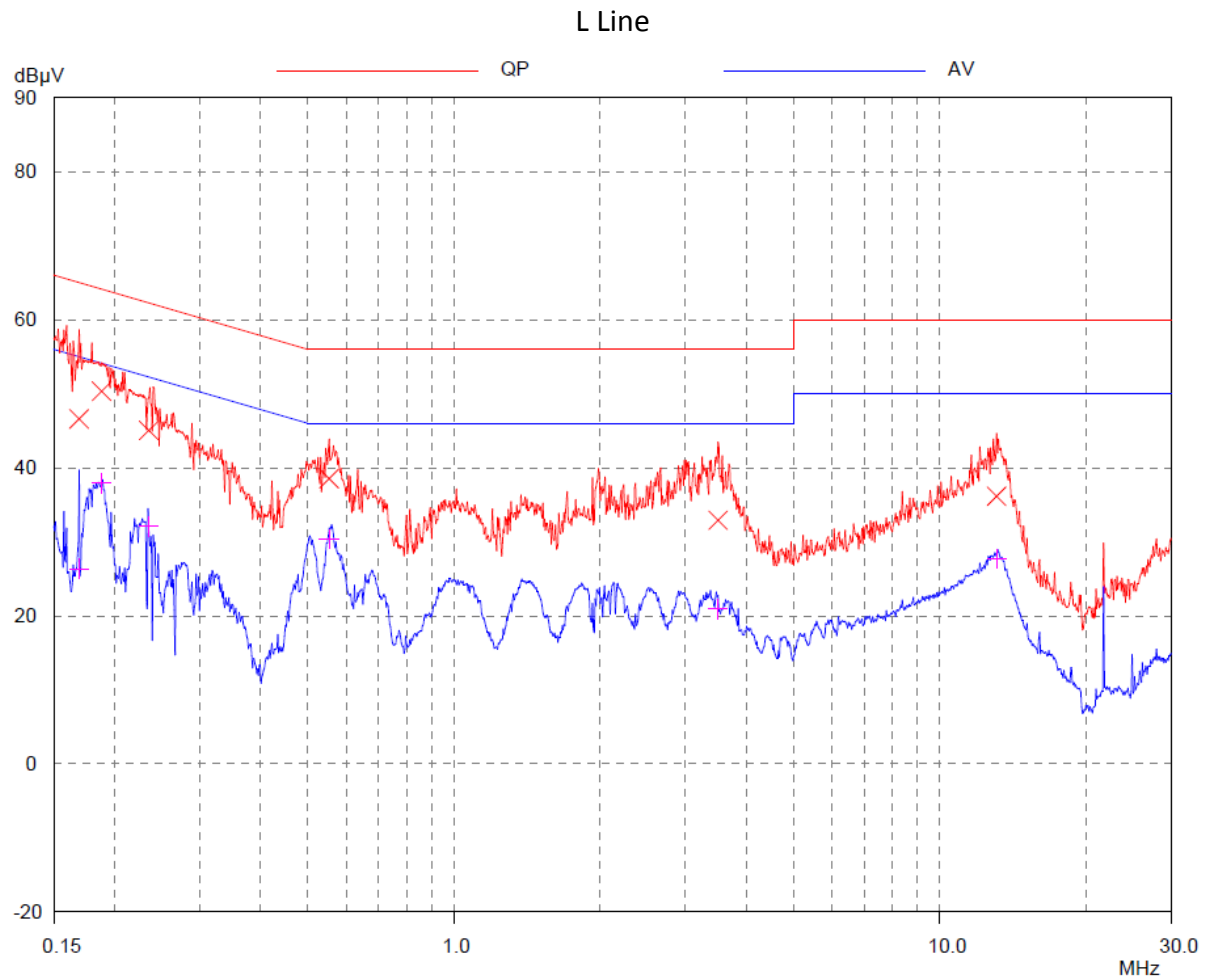
Tabletop devices shall be placed on a platform of nominal size 1 m by 1.5 m, raised 80 cm above the reference ground plane. The vertical conducting plane or wall of an RF-shielded (screened) room shall be located 40 cm to the rear of the EUT. Floor-standing devices shall be placed either directly on the reference ground-plane or on insulating material as described in ANSI C63.4. All other surfaces of tabletop or floor-standing EUTs shall be at least 80 cm from any other grounded conducting surface, including the case or cases of one or more LISNs.

The bandwidth of the test receiver is set at 9 kHz.

## 8.4 Test protocol

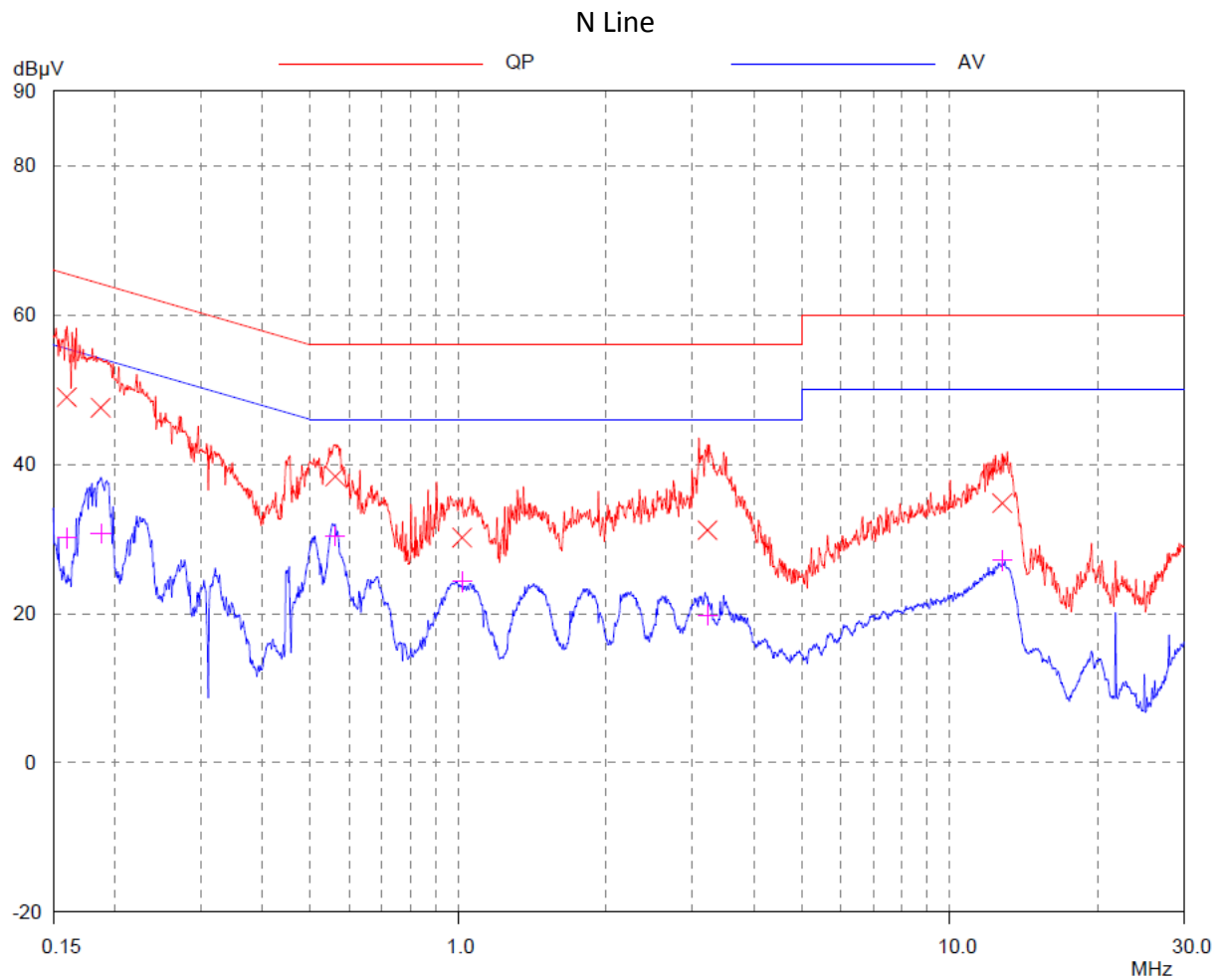
Temperature: 22 °C

Relative Humidity: 52 %



### Test Data:

| Frequency<br>(MHz) | Quasi-peak      |                 |                | Average         |                 |                |
|--------------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|                    | level<br>dB(μV) | Limit<br>dB(μV) | Margin<br>(dB) | level<br>dB(μV) | limit<br>dB(μV) | Margin<br>(dB) |
| 0.169              | 46.59           | 65.01           | 18.42          | 26.35           | 55.01           | 28.66          |
| 0.188              | 50.33           | 64.11           | 13.78          | 37.90           | 54.11           | 16.21          |
| 0.236              | 45.04           | 62.25           | 17.21          | 32.04           | 52.25           | 20.21          |
| 0.553              | 38.53           | 56.00           | 17.47          | 30.35           | 46.00           | 15.65          |
| 3.499              | 32.92           | 56.00           | 23.08          | 20.88           | 46.00           | 25.12          |
| 13.117             | 36.14           | 60.00           | 23.86          | 27.67           | 50.00           | 22.33          |



**Test Data:**

| Frequency<br>(MHz) | Quasi-peak      |                 |                | Average         |                 |                |
|--------------------|-----------------|-----------------|----------------|-----------------|-----------------|----------------|
|                    | level<br>dB(μV) | Limit<br>dB(μV) | Margin<br>(dB) | level<br>dB(μV) | limit<br>dB(μV) | Margin<br>(dB) |
| 0.160              | 48.98           | 65.47           | 16.49          | 30.09           | 55.47           | 25.38          |
| 0.188              | 47.57           | 64.14           | 16.57          | 30.70           | 54.14           | 23.44          |
| 0.562              | 38.35           | 56.00           | 17.65          | 30.41           | 46.00           | 15.59          |
| 1.019              | 30.18           | 56.00           | 25.82          | 24.26           | 46.00           | 21.74          |
| 3.218              | 31.16           | 56.00           | 24.84          | 19.82           | 46.00           | 26.18          |
| 12.807             | 34.77           | 60.00           | 25.23          | 27.12           | 50.00           | 22.88          |