

# ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT



**Applicant:** Darfon Electronics Czech s.r.o.  
Turanka 1315/112, 627 00 Brno, Czech Republic.

**Product Name:** Dongle

**Brand Name:** QPAD

**Model No.:** QH-900-D

**Model Difference:** N/A

**Report Number:** E2/2021/30049

**FCC ID** 2AZDI-QH-900-D

**IC:** 27074-QH900D

**Issue Date:** Jun.11 ,2021

**Date of Test:** Jan.04 , 2021 ~ Apr.16 , 2021

**Date of EUT Received:** Jan.04 , 2021

Approved By

  
Jay Lin/Asst. Supervisor

## We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Central RF Lab The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10:2013 and the energy emitted by the sample EUT comply with FCC rule part §15.247, ISED RSS-247.

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## Revision History

| Report Number | Revision | Description | Issue Date   | Revised By |
|---------------|----------|-------------|--------------|------------|
| E2/2021/30049 | Rev.00   | Original    | Jun.11 ,2021 | Viola Su   |

**Note:**

- 1、Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.

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# 1 GENERAL INFORMATION

## 1.1 Product Description

|                   |                                     |
|-------------------|-------------------------------------|
| Product Name:     | Dongle                              |
| Brand Name:       | QPAD                                |
| Model No.:        | QH-900-D                            |
| Model Difference: | N/A                                 |
| Hardware Version: | R0C                                 |
| Firmware Version: | 1.0.3                               |
| EUT Series No.:   | N/A                                 |
| Power Supply:     | 3.7 Vdc from Li-ion Polymer Battery |

## 1.2 RF Specification

|                   |                      |
|-------------------|----------------------|
| Radio Technology: | 2.4GHz               |
| Frequency Range:  | 2403.35 – 2477.35MHz |
| Channel number:   | 38 channels          |
| Modulation type:  | DQPSK                |
| Transmit Power:   | 6.50 dBm             |

## 1.3 Antenna Designation

| Antenna Type               | Supplier                      | Antenna Part No.        | Freq. (MHz)   | Peak Antenna Gain (dBi) |
|----------------------------|-------------------------------|-------------------------|---------------|-------------------------|
| Multilayer Ceramic Antenna | Walsin Technology Corporation | RFANT3216120AT5T Series | 2402 ~2480MHz | 2.12                    |

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### 1.4 Test Methodology of Applied Standards

FCC Part 15, Subpart C §15.247  
 FCC KDB 558074 D01 15.247 Meas Guidance v05r02  
 RSS-247 issue 2 Feb. 2017  
 RSS-Gen Issue 5, Amendment 2, February 2021  
 ANSI C63.10:2013

### 1.5 Test Facility

| Laboratory  | Test Site Address   | Test Site Name | FCC Designation number | IC CAB identifier |
|---|---|----------------|------------------------|-------------------|
| SGS Taiwan Ltd.<br>Central RF Lab.<br>(TAF code 3702) | No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan. | SAC 1          | TW0027                 | TW3702            |
|   |   | SAC 3          |                        |                   |
|   |   | Conduction 1   |                        |                   |
|   |   | Conducted 1    |                        |                   |
|   |   | Conducted 2    |                        |                   |
|   |   | Conducted 3    |                        |                   |
|   |   | Conducted 4    |                        |                   |
|   |   | Conducted 5    |                        |                   |
|   | Conducted 6   |                |                        |                   |
|   | No.2, Keji 1st Rd., Guishan District, Taoyuan City, Taiwan 333                            | Conduction A   | TW0028                 |                   |
|   |   | SAC C          |                        |                   |
|   |   | SAC D          |                        |                   |
|   |   | SAC G          |                        |                   |
|   |   | Conducted A    |                        |                   |
|   |   | Conducted B    |                        |                   |
|   |   | Conducted C    |                        |                   |
|   |   | Conducted D    |                        |                   |
|   |   | Conducted E    |                        |                   |
|   |   | Conducted F    |                        |                   |
| Conducted G   |   |                |                        |                   |

**Note:** Test site name is remarked on the equipment list in each section of this report as an indication where measurements occurred in specific test site and address.

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## 1.6 Special Accessories

There are no special accessories used while test was conducted.

## 1.7 Equipment Modifications

There was no modification incorporated into the EUT.

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## 2 SYSTEM TEST CONFIGURATION

### 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

### 2.2 EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

### 2.3 Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is placed on a table which is 0.8 m above ground plane. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz. The CISPR Quasi-Peak and Average detector mode is employed. The two LISNs provide 50uH/50 ohm of coupling impedance for the measuring instrument. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

#### 2.3.2 Conducted Test (RF)

The active antenna port of the unlicensed wireless device is connected to the spectrum analyzer with attenuator to protect the instrumentation. If a second antenna port is available, it is tested at one operating frequency, with other port(s) appropriately terminated, to verify it has similar output characteristics as the fully tested port.

#### 2.3.3 Radiated Emissions

The EUT is placed on a turn table. For emissions testing at or below 1 GHz, the table height shall be 0.8 m above the reference ground plane. For emission measurements above 1 GHz, the table height shall be 1.5 m. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.

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## 2.4 Measurement Results Explanation Example

### 2.4.1 Radiated Emission Test Sites For Measurements From 9 kHz To 30 MHz

Radiated emission below 30MHz is measured in a 9m\*9m\*6m semi-anechoic chamber, the measurements correspond to those obtained at an open-field test site.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

### 2.4.2 For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuation factor between EUT conducted port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly EUT RF output level.

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## 2.5 Configuration of Tested System

Fig. 2-1 Conducted Setup & Radiated Setup & Conduction Setup



Table 2-1 Equipment Used in Tested System

| Item | Equipment             | MRF/Brand | Model/Type No. | Series No. | Version              |
|------|-----------------------|-----------|----------------|------------|----------------------|
| 1.   | Avnera Continue Power | N/A       | N/A            | N/A        | RF Power 2020.11.4.1 |
| 2.   | Notebook              | Lenovo    | L420           | S0012467   | N/A                  |
| 3.   | Notebook              | Lenovo    | T420           | S0012599   | N/A                  |
| 4.   | Notebook              | Lenovo    | T470           | P0001293   | N/A                  |

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### 3 SUMMARY OF TEST RESULTS

| FCC Rules                        | IC Rules   | Description Of Test                                  | Result    |
|----------------------------------|--|--|-----------|
| §15.207(a)                       | RSS-Gen §8.8   | AC Power Line Conducted Emission                     | Compliant |
| §15.247(b) (3)                   | RSS-247 §5.4 d   | Peak Output Power                                    | Compliant |
| §15.247(a)(2)                    | RSS-247 §5.2 a<br>RSS-Gen §6.7                                 | Emission Bandwidth                                   | Compliant |
| §15.205<br>§15.209<br>§15.247(d) | RSS-247 §5.5<br>RSS-Gen §8.9<br>RSS-Gen §8.10<br>RSS-Gen §6.13 | Radiated & Conducted Band Edge and Spurious Emission | Compliant |
| §15.247(e)                       | RSS-247 §5.2 b   | Power Spectral Density                               | Compliant |
| §15.203<br>§15.247(b)            | N/A  | Antenna Requirement                                  | Compliant |

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## 4 DESCRIPTION OF TEST MODES

### 4.1 Operated in 2403.35 ~ 2477.35MHz Band

38 channels are provided for 2.4G

| ITEM | FREQUENCY   | ITEM | FREQUENCY   | ITEM | FREQUENCY   |
|------|-------------|------|-------------|------|-------------|
| 1    | 2403.35 MHz | 15   | 2431.35 MHz | 29   | 2459.35 MHz |
| 2    | 2405.35 MHz | 16   | 2433.35 MHz | 30   | 2461.35 MHz |
| 3    | 2407.35 MHz | 17   | 2435.35 MHz | 31   | 2463.35 MHz |
| 4    | 2409.35 MHz | 18   | 2437.35 MHz | 32   | 2465.35 MHz |
| 5    | 2411.35 MHz | 19   | 2439.35 MHz | 33   | 2467.35 MHz |
| 6    | 2413.35 MHz | 20   | 2441.35 MHz | 34   | 2469.35 MHz |
| 7    | 2415.35 MHz | 21   | 2443.35 MHz | 35   | 2471.35 MHz |
| 8    | 2417.35MHz  | 22   | 2445.35 MHz | 36   | 2473.35 MHz |
| 9    | 2419.35 MHz | 23   | 2447.35 MHz | 37   | 2475.35 MHz |
| 10   | 2421.35 MHz | 24   | 2449.35 MHz | 38   | 2477.35 MHz |
| 11   | 2423.35 MHz | 25   | 2451.35 MHz |      |             |
| 12   | 2425.35 MHz | 26   | 2453.35 MHz |      |             |
| 13   | 2427.35 MHz | 27   | 2455.35 MHz |      |             |
| 14   | 2429.35 MHz | 28   | 2457.35 MHz |      |             |

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## 4.2 The Worst Test Modes and Channel Details

1. The EUT has been tested under operating condition.
2. Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.
3. Investigation has been done on all the possible configurations for searching the worst case.

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**4.3 Radiated Emission Test:**

| RADIATED EMISSION TEST (BELOW 1 GHz) |                   |                |              |
|--------------------------------------|-------------------|----------------|--------------|
| MODE                                 | AVAILABLE CHANNEL | TESTED CHANNEL | ANTENNA PORT |
| 2.4G                                 | 1 to 38           | 1,20,38        | ch0          |

| RADIATED EMISSION TEST (ABOVE 1 GHz) |                   |                |              |
|--------------------------------------|-------------------|----------------|--------------|
| MODE                                 | AVAILABLE CHANNEL | TESTED CHANNEL | ANTENNA PORT |
| 2.4G                                 | 1 to 38           | 1,20,38        | ch0          |

**Note:** The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for channel Low, Mid and High, the worst case position was reported.

**4.4 Antenna Port Conducted Measurement:**

| CONDUCTED TEST |                   |                |              |
|----------------|-------------------|----------------|--------------|
| MODE           | AVAILABLE CHANNEL | TESTED CHANNEL | ANTENNA PORT |
| 2.4G           | 1 to 38           | 1,20,38        | ch0          |

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## 5 MEASUREMENT UNCERTAINTY

| Test Items                                | Uncertainty            |
|---|------------------------|
| AC Power Line Conducted Emission          | +/- 2.34 dB            |
| Peak Output Power                         | +/- 1 dB               |
| 6dB Bandwidth                             | +/- 1.54 Hz            |
| 100 KHz Bandwidth Of Frequency Band Edges | +/- 1.69 dB            |
| Peak Power Density                        | +/- 1.54 dB            |
| Temperature                               | +/- 0.4 °C             |
| Humidity                                  | +/- 3.5 %              |
| DC / AC Power Source                      | DC= +/- 1%, AC= +/- 1% |

| Radiated Spurious Emission Measurement Uncertainty |             |                             |  |
|--|-------------|-----------------------------|--|
| Polarization: Vertical                             | +/- 2.64 dB | 9kHz~30MHz: +-2.3dB         |  |
|  | +/- 4.93 dB | 30MHz - 1000MHz: +/- 3.37dB |  |
|  | +/- 4.81 dB | 1GHz - 18GHz: +/- 4.04dB    |  |
|  | +/- 4.52 dB | 18GHz - 40GHz: +/- 4.04dB   |  |
| Polarization: Horizontal                           | +/- 2.64 dB | 9kHz~30MHz: +-2.3dB         |  |
|  | +/- 4.45 dB | 30MHz - 1000MHz: +/- 4.22dB |  |
|  | +/- 4.81 dB | 1GHz - 18GHz: +/- 4.08dB    |  |
|  | +/- 4.52 dB | 18GHz - 40GHz: +/- 4.08dB   |  |

**Note:**

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.
2. The conformity assessment statement in this report is based solely on the test results, measurement uncertainty is excluded.

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## 6 CONDUCTED EMISSION TEST

### 6.1 Standard Applicable

Frequency range within 150kHz to 30MHz shall not exceed the Limit table as below.

| Frequency range<br>MHz | Limits<br>dB(uV) |          |
|------------------------|------------------|----------|
|                        | Quasi-peak       | Average  |
| 0.15 to 0.50           | 66 to 56         | 56 to 46 |
| 0.50 to 5              | 56               | 46       |
| 5 to 30                | 60               | 50       |

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

### 6.2 Measurement Equipment Used

| Radiated Emission Test Site: Conduction A |                             |               |                     |            |            |
|---|-----------------------------|---------------|---------------------|------------|------------|
| EQUIPMENT TYPE                            | MFR/BRAND                   | MODEL NUMBER  | SERIAL NUMBER       | LAST CAL.  | CAL DUE.   |
| Test Software                             | audix                       | e3            | Ver. 6.11-20180419c | N.C.R      | N.C.R      |
| LISN                                      | SCHWARZBECK Mess-Elektronik | NSLK8127      | 973                 | 03/25/2021 | 03/24/2022 |
| EMI Test Receiver                         | R&S                         | ESCI          | 101342              | 04/28/2020 | 04/27/2021 |
| Coaxial Cable                             | EC Lab                      | RF-HY-CAB-250 | RF-HY-CAB-250-01    | 03/27/2021 | 03/26/2022 |
| Pulse Limiter                             | EC Lab                      | VTSD 9561F-N  | 485                 | 03/27/2021 | 03/26/2022 |

NOTE: N.C.R refers to Not Calibrated Required.

### 6.3 EUT Setup

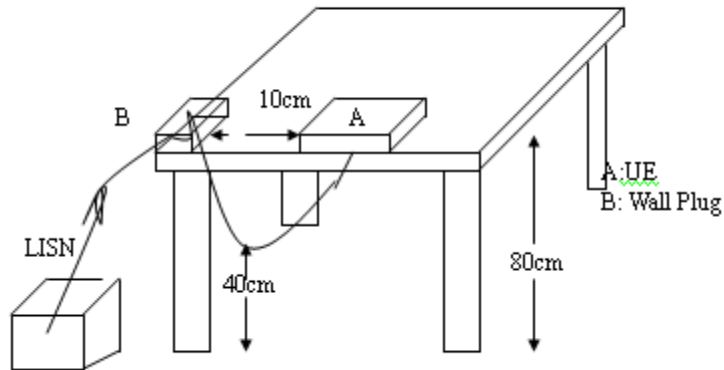
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.10:2013.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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### 6.4 Test SET-UP (Block Diagram of Configuration)



### 6.5 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

### 6.6 Measurement Result

Note: Refer to next page for measurement data and plots.

Note2: The \* reveals the worst-case results that closet to the limit.

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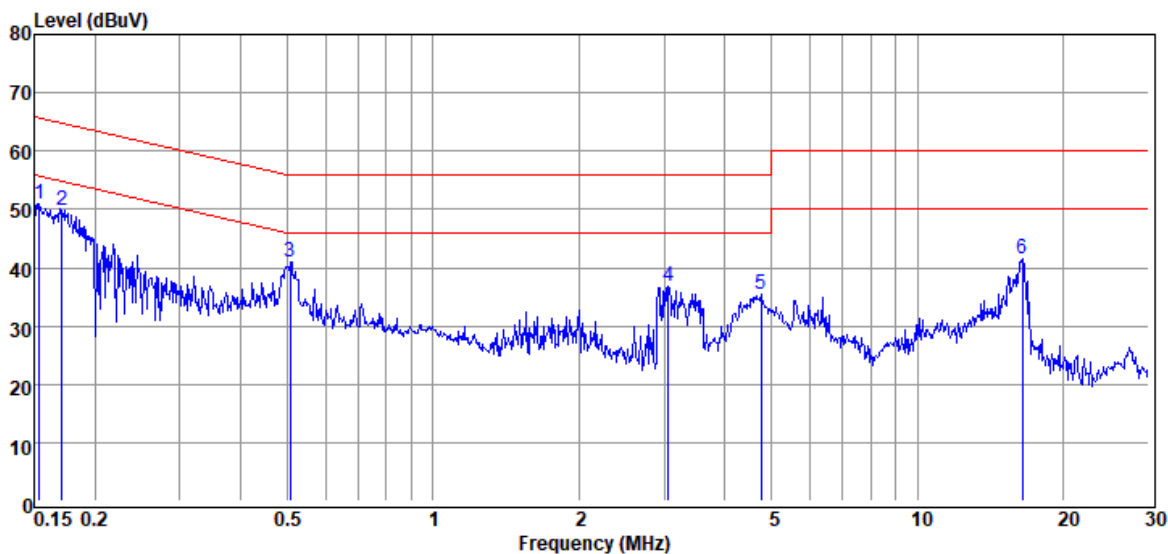
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### AC POWER LINE CONDUCTED EMISSION TEST DATA

Report Number :E2/2021/30049  
 Test Mode :2.4G  
 Power :120V/60Hz  
 Probe :L1  
 Note: : Dongle

Test Site :Conduction Room C  
 Test Date :2021-04-13  
 Temp./Humi. :23.6/65  
 Engineer :Ashton Chiu



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V | Limit<br>dB $\mu$ V | Margin<br>dB |
|--------------|------------------------------|---|--------------|----------------------------|---------------------|--------------|
| 0.15         | Peak                         | 40.67                                   | 10.30        | 50.97                      | 65.78               | -14.81       |
| 0.17         | Peak                         | 39.59                                   | 10.30        | 49.89                      | 64.90               | -15.01       |
| 0.51         | Peak                         | 30.74                                   | 10.31        | 41.05                      | 56.00               | -14.95       |
| 3.06         | Peak                         | 25.97                                   | 10.87        | 36.84                      | 56.00               | -19.16       |
| 4.75         | Peak                         | 24.74                                   | 10.58        | 35.32                      | 56.00               | -20.68       |
| 16.49        | Peak                         | 30.74                                   | 10.82        | 41.56                      | 60.00               | -18.44       |

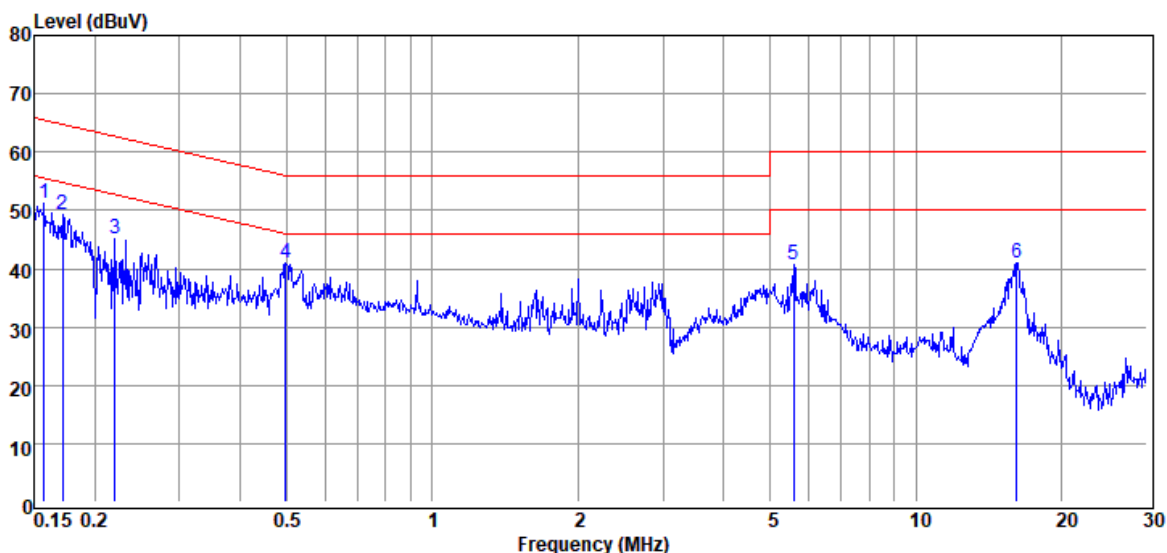
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Report Number :E2/2021/30049  
 Test Mode :2.4G  
 Power :120V/60Hz  
 Probe :N  
 Note: : Dongle

Test Site :Conduction Room C  
 Test Date :2021-04-13  
 Temp./Humi. :23.6/65  
 Engineer :Ashton Chiu



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V | Limit<br>dB $\mu$ V | Margin<br>dB |
|--------------|------------------------------|---|--------------|----------------------------|---------------------|--------------|
| 0.16         | Peak                         | 40.98                                   | 10.31        | 51.29                      | 65.60               | -14.31       |
| 0.17         | Peak                         | 38.88                                   | 10.31        | 49.19                      | 64.86               | -15.67       |
| 0.22         | Peak                         | 34.78                                   | 10.30        | 45.08                      | 62.79               | -17.71       |
| 0.50         | Peak                         | 30.76                                   | 10.32        | 41.08                      | 56.05               | -14.97       |
| 5.59         | Peak                         | 30.09                                   | 10.61        | 40.70                      | 60.00               | -19.30       |
| 16.14        | Peak                         | 30.18                                   | 10.90        | 41.08                      | 60.00               | -18.92       |

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## 7 DUTY CYCLE OF TEST SIGNAL

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle.

All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

### 7.1 Measurement Procedure:

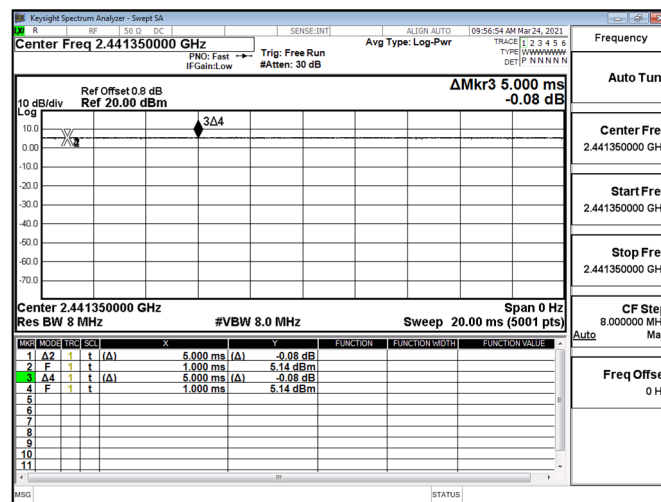
1. Set span = Zero
2. RBW = 8MHz
3. VBW = 8MHz,
4. Detector = Peak

### 7.2 Duty Cycle:

|      | Duty Cycle (%)<br>= Ton / (Ton+Toff) | Duty Factor (dB)<br>=10*log ( 1/Duty Cycle ) | 1/T (kHz) | VBW setting<br>(kHz) |
|------|--------------------------------------|--|-----------|----------------------|
| 2.4G | 100.00                               | 0.00   | 0.00      | 0.01                 |

### 7.3 Duty Cycle test plots

Duty Cycle\_2441.35MHz



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## 8 PEAK OUTPUT POWER MEASUREMENT

### 8.1 Standard Applicable

For systems using digital modulation in the 2400-2483.5 MHz bands, the limit for peak output power is 1Watt and the e.i.r.p. shall not exceed 4 W .

If the transmitting antenna of directional gain greater than 6dBi are used the peak output power form the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6dBi.

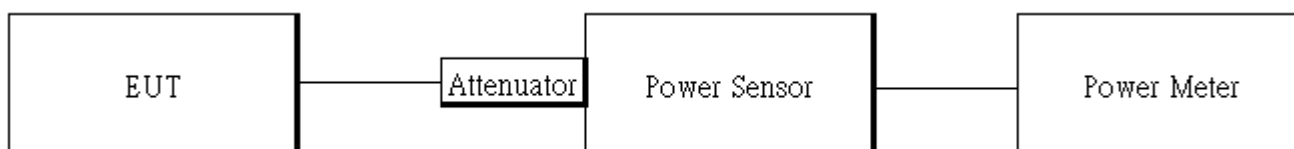
In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of Antenna exceeds 6dBi.

### 8.2 Measurement Equipment Used

| Conducted Emission Test Site: Conducted C |           |                |               |            |            |
|---|-----------|----------------|---------------|------------|------------|
| EQUIPMENT TYPE                            | MFR/BRAND | MODEL NUMBER   | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Power Meter                               | Anritsu   | ML2496A        | 1512003       | 07/23/2020 | 07/22/2021 |
| Power Sensor                              | Anritsu   | MA2411B        | 1339378       | 07/23/2020 | 07/22/2021 |
| Power Sensor                              | Anritsu   | MA2411B        | 1339379       | 07/23/2020 | 07/22/2021 |
| Coaxial Cables                            | Woken     | 00100A1F2A196C | RF51          | 11/19/2020 | 11/18/2021 |

### 8.3 Test Set-up

Power Meter:



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### 8.4 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.

**Power Meter:**

It is used as the auxiliary test equipment to conduct the output power measurement.

4. Record the max. Reading as observed from Spectrum or Power Meter.

*\* Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.*

### 8.5 Measurement Result

| 2.4G Ch0 |             |           |           |                         |             |        |
|----------|-------------|-----------|-----------|-------------------------|-------------|--------|
| CH       | Freq. (MHz) | Data Rate | Power set | Peak Output Power (dBm) | Limit (dBm) | RESULT |
| 1        | 2403.35     | 1         | default   | 6.50                    | 30.00       | PASS   |
| 20       | 2441.35     | 1         | default   | 5.96                    | 30.00       | PASS   |
| 38       | 2477.35     | 1         | default   | 5.06                    | 30.00       | PASS   |

*\* Note: The duty cycle factor is compensated to obtain the maximum value of measurement in average.*

### EIRP

| 2.4G Ch0 |             |           |                         |                    |            |             |        |
|----------|-------------|-----------|-------------------------|--------------------|------------|-------------|--------|
| CH       | Freq. (MHz) | Data Rate | Avg. Output Power (dBm) | Antenna Gain (dBi) | EIRP (dBm) | Limit (dBm) | RESULT |
| 1        | 2403.35     | 1         | 4.46                    | 2.12               | 6.58       | 36          | PASS   |
| 20       | 2441.35     | 1         | 3.90                    | 2.12               | 6.02       | 36          | PASS   |
| 38       | 2477.35     | 1         | 2.96                    | 2.12               | 5.08       | 36          | PASS   |

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## 9 EMISSION BANDWIDTH MEASUREMENT

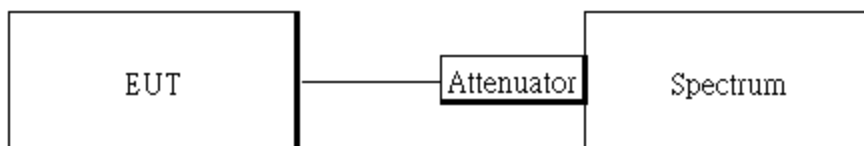
### 9.1 Standard Applicable

The minimum 6 dB bandwidth shall be at least 500 kHz.

### 9.2 Measurement Equipment Used

| Conducted Emission Test Site: Conducted C |           |                |               |            |            |
|---|-----------|----------------|---------------|------------|------------|
| EQUIPMENT TYPE                            | MFR/BRAND | MODEL NUMBER   | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer                         | KEYSIGHT  | N9010A         | MY51440113    | 07/23/2020 | 07/22/2021 |
| DC Block                                  | PASTERNAK | PE8210         | RF152         | 11/19/2020 | 11/18/2021 |
| Coaxial Cables                            | Woken     | 00100A1F2A196C | RF51          | 11/19/2020 | 11/18/2021 |

### 9.3 Test Set-up



### 9.4 Measurement Procedure

- Place the EUT on the table and set it in transmitting mode.
- The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
- Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- Set the spectrum analyzer as  
 RBW= 100kHz ,  
 VBW = 3 X RBW,  
 Span= 2 to 5 times of the OBW,  
 Sweep=auto,  
 Detector = Peak, and Max hold for -6dB Bandwidth test.
- Set the spectrum analyzer as  
 RBW= 1 % to 5% of 99% Bandwidth ,  
 VBW ≥ 3 X RBW,  
 Span= large enough to capture all products of the modulation process,  
 Sweep=auto,  
 Detector = Peak, and Max hold for 99% Bandwidth test.
- Turn on the 99% bandwidth function, max reading.
- Repeat above procedures until all test default channel is completed

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9.5 6dB Bandwidth

2.4G Ch0

| Freq. (MHz) | 6dB BW (kHz)   | Limit (kHz) | Result |
|-------------|----------------|-------------|--------|
| 2403.35     | 1692.00        | > 500       | PASS   |
| 2441.35     | 1626.00        | > 500       | PASS   |
| 2477.35     | <b>1697.00</b> | > 500       | PASS   |

\* Note: Offset 0.8dB for 2.4G

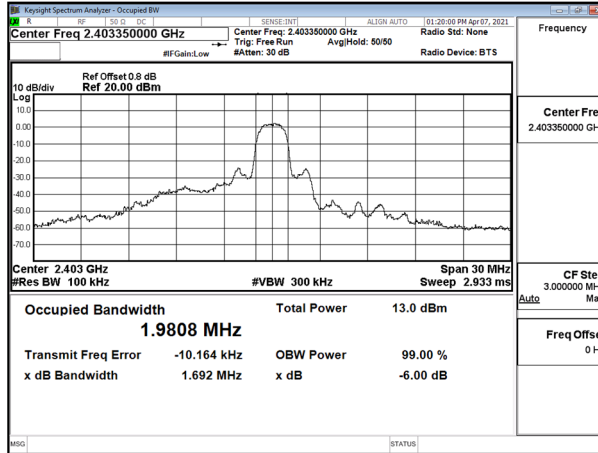
\*Refer to next page for plots

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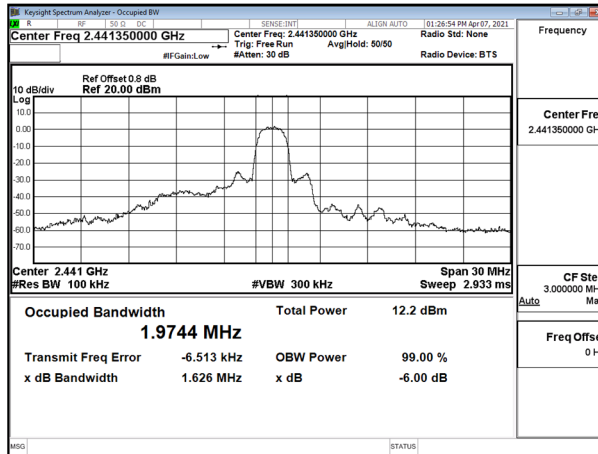
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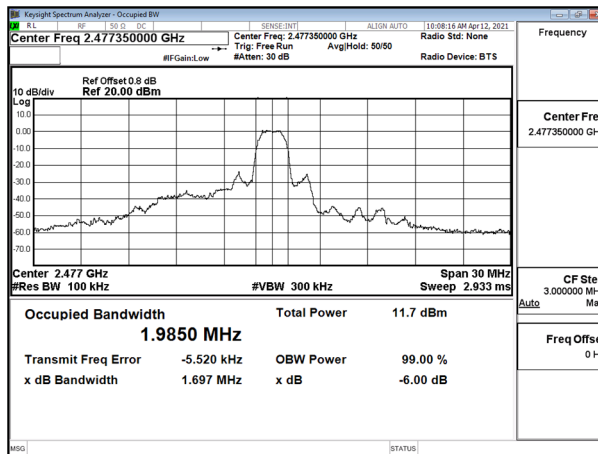
OBW 6dB \_2403.35MHz



OBW 6dB \_2441.35MHz



OBW 6dB \_2477.35MHz



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9.6 99% Bandwidth

| 2.4G Ch0    |               |
|-------------|---------------|
| Freq. (MHz) | 99% BW (MHz)  |
| 2403.35     | 2.1506        |
| 2441.35     | 2.1506        |
| 2477.35     | <b>2.1606</b> |

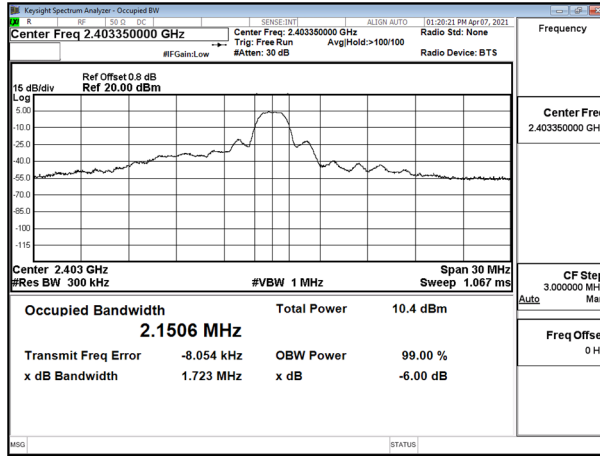
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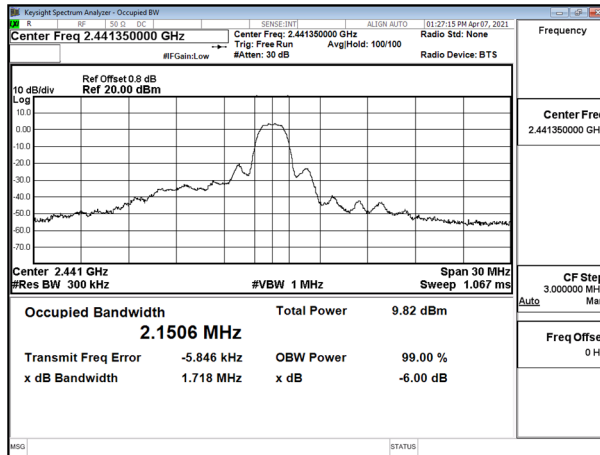
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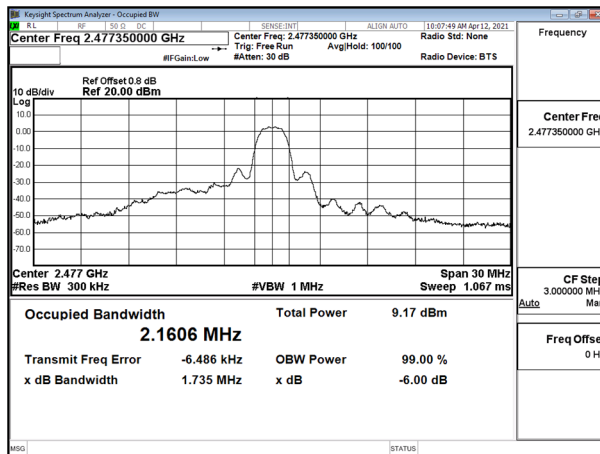
IC OBW 99%\_2403.35



IC OBW 99%\_2441.35



IC OBW 99%\_2477.35



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## 10 CONDUCTED BAND EDGES AND SPURIOUS EMISSION MEASUREMENT

### 10.1 Standard Applicable

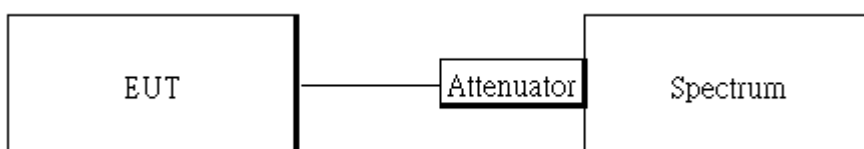
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a) & RSS-Gen §8.10, must also comply with the radiated emission limits specified in §15.209(a) & RSS-Gen §8.9.

### 10.2 Measurement Equipment Used

| Conducted Emission Test Site: Conducted C |           |                |               |            |            |
|---|-----------|----------------|---------------|------------|------------|
| EQUIPMENT TYPE                            | MFR/BRAND | MODEL NUMBER   | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer                         | KEYSIGHT  | N9010A         | MY51440113    | 07/23/2020 | 07/22/2021 |
| DC Block                                  | PASTERNAK | PE8210         | RF152         | 11/19/2020 | 11/18/2021 |
| Coaxial Cables                            | Woken     | 00100A1F2A196C | RF51          | 11/19/2020 | 11/18/2021 |

### 10.3 Test SET-UP



### 10.4 Measurement Procedure

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**Reference Level of Emission Limit:**

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 100kHz & VBW = 300 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

**Conducted Band Edge:**

1. To connect Antenna Port of EUT to Spectrum.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
4. Set start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
5. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Detector = Peak, Sweep = auto
6. Mark the highest reading of the emission as the reference level measurement.
7. Set DL as the limit = reading on marker of reference level measurement – 20dBm
8. Mark the highest readings of the emissions outside of 2400MHz~2483.5MHz.
9. Repeat above procedures until all default test channel (low, middle, and high) was complete.

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**Conducted Spurious Emission:**

1. To connect Antenna Port of EUT to Spectrum
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set RBW = 100 kHz & VBW= 300 kHz, Detector =Peak, Sweep = Auto.
4. Allow trace to fully stabilize.
5. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.
6. Repeat above procedures until all default test channel measured were complete.

**10.5 Measurement Result**

| Reference Level of Limit 2.4G mode |           |                                |
|------------------------------------|-----------|--------------------------------|
| Freq. (MHz)                        | PSD (dBm) | Reference Level of Limit (dBm) |
| 2403.35                            | 2.34      | -17.66                         |
| 2441.35                            | 1.90      | -18.10                         |
| 2477.35                            | 2.09      | -17.91                         |

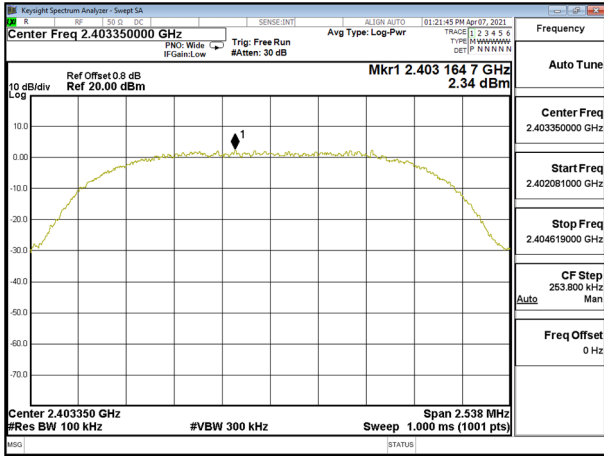
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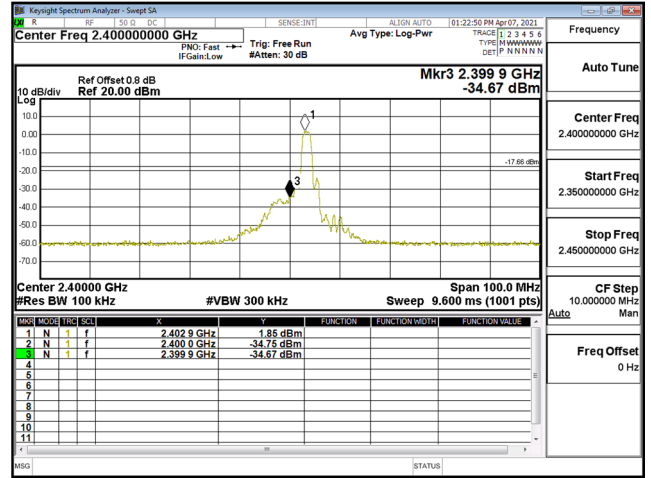
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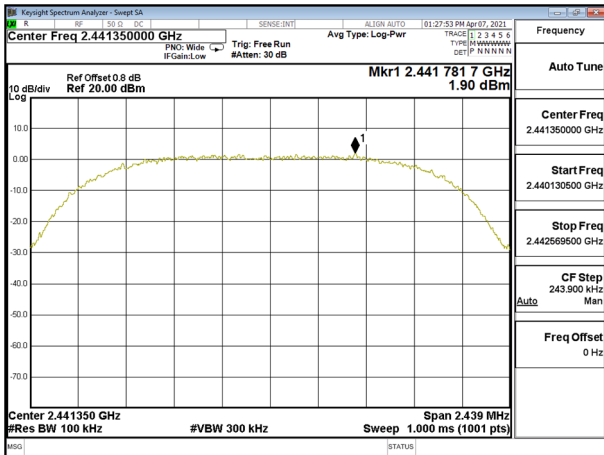
Reference Level\_2403.35



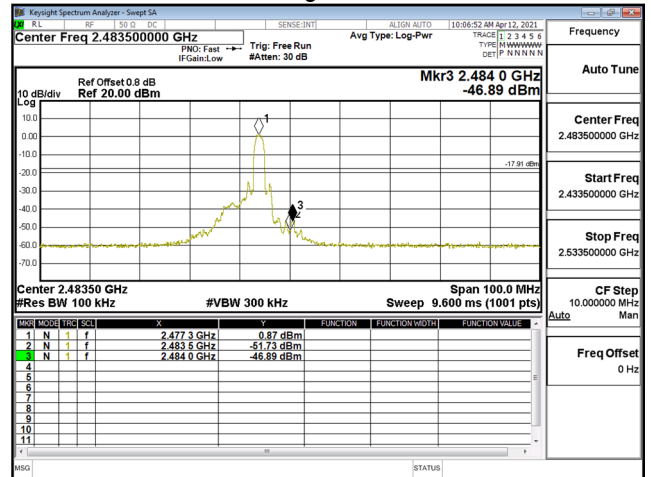
Band Edge\_2403.35



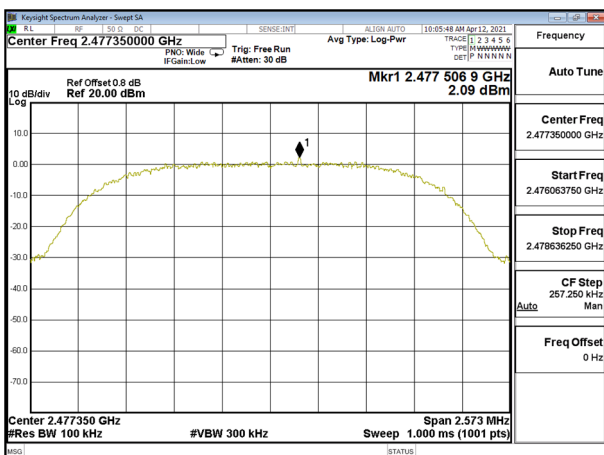
Reference Level\_2441.35



Band Edge\_2477.35



Reference Level\_2477.35



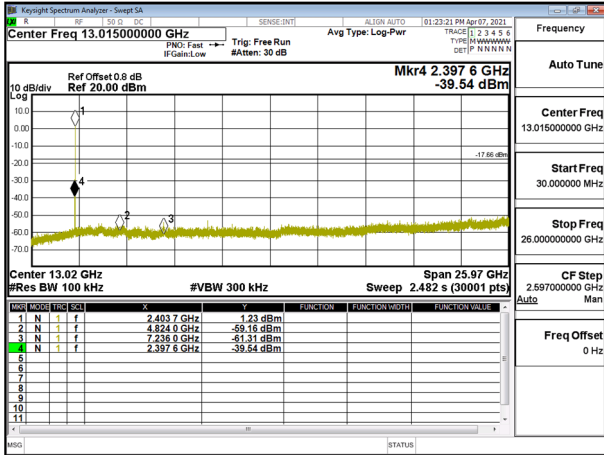
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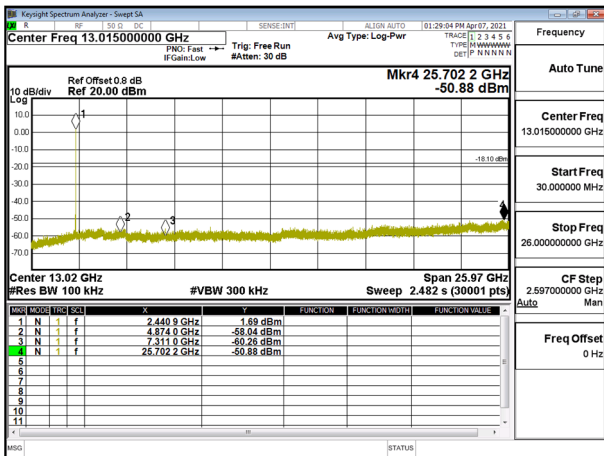
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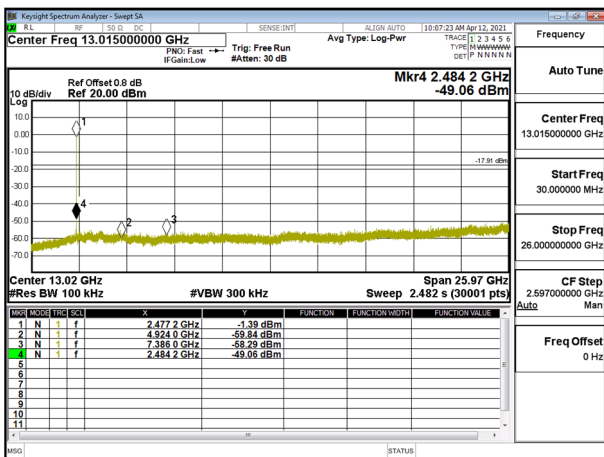
Spurious Emission\_ 2403.35



Spurious Emission\_ 2441.35



Spurious Emission\_ 2477.35



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## 11 RADIATED BANDEDGE AND SPURIOUS EMISSION MEASUREMENT

### 11.1 Standard Applicable

Radiated emissions which fall in the restricted bands must also comply with the §15.209 and RSS-Gen §8.9 Table 5 and 6 limit as below.

And according to §15.33(a) (1) & RSS-Gen §6.13.2.a, for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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

**Note:**

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBµV/m) = 20 log Emission level (µV/m)

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**11.2 Measurement Equipment Used:**

| Radiated Emission Test Site: SAC C |                 |               |                 |            |            |
|------------------------------------|-----------------|---------------|-----------------|------------|------------|
| EQUIPMENT TYPE                     | MFR/BRAND       | MODEL NUMBER  | SERIAL NUMBER   | LAST CAL.  | CAL DUE.   |
| Broadband Antenna                  | TESEQ           | CBL 6112D     | 35240           | 09/08/2020 | 09/07/2021 |
| Horn Antenna                       | Schwarzbeck     | BBHA9170      | 184             | 12/11/2020 | 12/10/2021 |
| Horn Antenna                       | Schwarzbeck     | BBHA9120D     | 1187            | 01/11/2021 | 01/10/2022 |
| Loop Antenna                       | ETS.LINDGREN    | 6502          | 143303          | 04/28/2020 | 04/27/2021 |
| Test Software                      | audix           | e3            | 20923 sgs Ver.9 | N.C.R      | N.C.R      |
| EMI Test Receiver                  | R&S             | ESU 40        | 100363          | 04/29/2020 | 04/28/2021 |
| Pre-Amplifier                      | EMC Instruments | EMC330        | 980096          | 11/19/2020 | 11/18/2021 |
| Pre-Amplifier                      | EMC Instruments | EMC0011830    | 980199          | 11/19/2020 | 11/18/2021 |
| Pre-Amplifier                      | EMC Instruments | EMC184045B    | 980135          | 10/27/2020 | 10/26/2021 |
| Attenuator                         | Woken           | WATT-218FS-10 | RF03            | 11/19/2020 | 11/18/2021 |
| Band Rejection Filter              | Micro-Tronics   | BRM50701-01   | RF201           | 11/19/2020 | 11/18/2021 |
| Coaxial Cable                      | Huber Suhner    | SUCOFLEX 104  | MY17388/4       | 11/19/2020 | 11/18/2021 |
| Coaxial Cable                      | Huber Suhner    | RG 214/U      | W22.03          | 11/19/2020 | 11/18/2021 |

NOTE: N.C.R refers to Not Calibrated Required.

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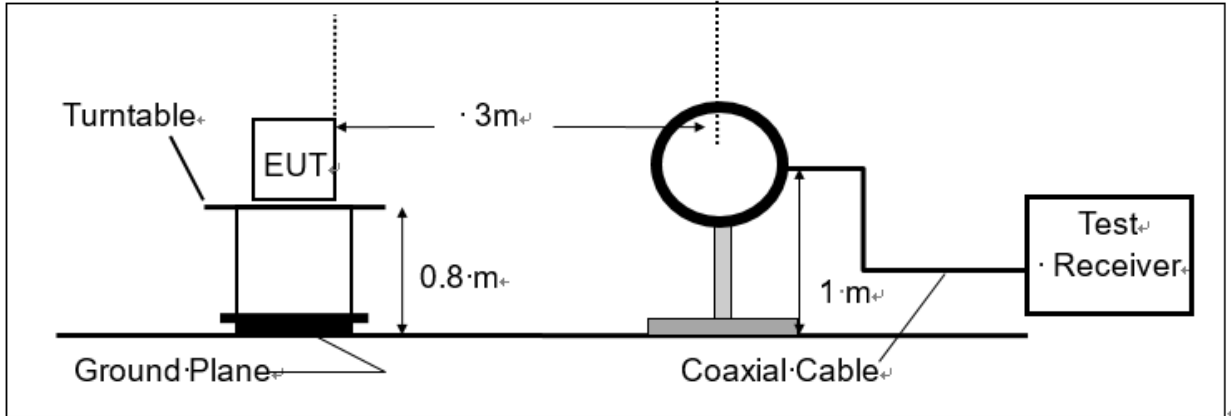
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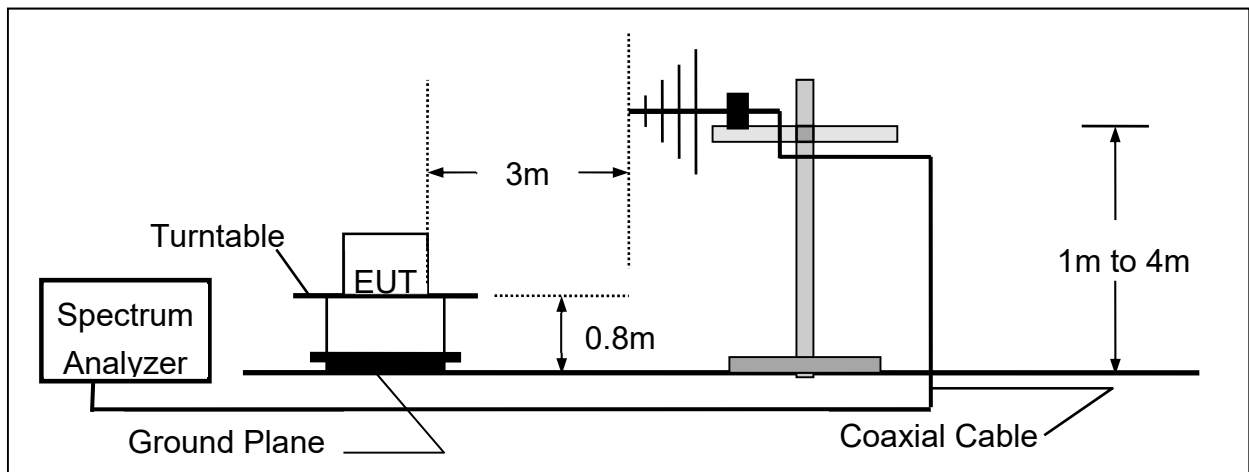
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### 11.3 Test SET-UP

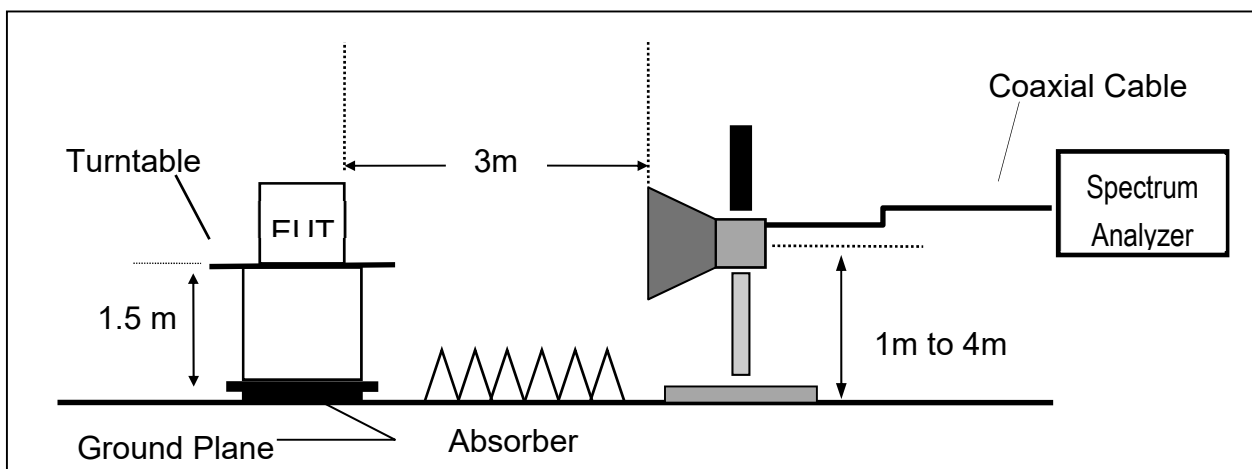
(A) Radiated Emission Test Set-UP Frequency Below 30MHz.



(B) Radiated Emission Test Set-UP, Frequency form 30MHz to 1000MHz



(C) Radiated Emission Test Set-UP Frequency Over 1 GHz



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## 11.4 Measurement Procedure

1. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
2. The EUT was placed on a turn table with 0.8m for frequency< 1GHz and 1.5m for frequency> 1GHz above ground plane.
3. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
4. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
5. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
6. Set the spectrum analyzer as RBW=120 kHz and VBW=300 kHz for Peak Detector (PK) and Quasi-peak (QP) at frequency below 1 GHz.
7. Set the spectrum analyzer as RBW=1 MHz, VBW=3 MHz for Peak Detector at frequency above 1 GHz.
8. Set the spectrum analyzer as RBW=1 MHz, VBW=10 Hz (Duty cycle > 98%) or VBW ≥ 1/T (Duty cycle < 98%) for Average Detector at frequency above 1 GHz.
9. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
10. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
11. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. On spectrum, change spectrum mode in linear display mode, and reduce VBW = 10Hz if average reading is measured.
12. Repeat above procedures until all default test channel measured were complete.

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### 11.5 Field Strength Calculation

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

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

**Where** *FS = Field Strength*

*CL = Cable Attenuation Factor (Cable Loss)*

*RA = Reading Amplitude*

*AG = Amplifier Gain*

*AF = Antenna Factor*

*The limit of the emission level is expressed in dBuV/m, which converts  $20 \cdot \log(uV/m)$*

*Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)*

*Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre\_Amplifier Gain(dB)*

### 11.6 Test Results of Radiated Spurious Emissions form 9 kHz to 30 MHz

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit per 15.31(o) & RSS-GEN §6.13.2 was not reported.

### 11.7 Measurement Result

**Note:**

1. *Refer to next page spectrum analyzer data chart and tabular data sheets.*
2. *Measurements are completed at peak and average level, the mark of average is the highest emission in restricted bands*

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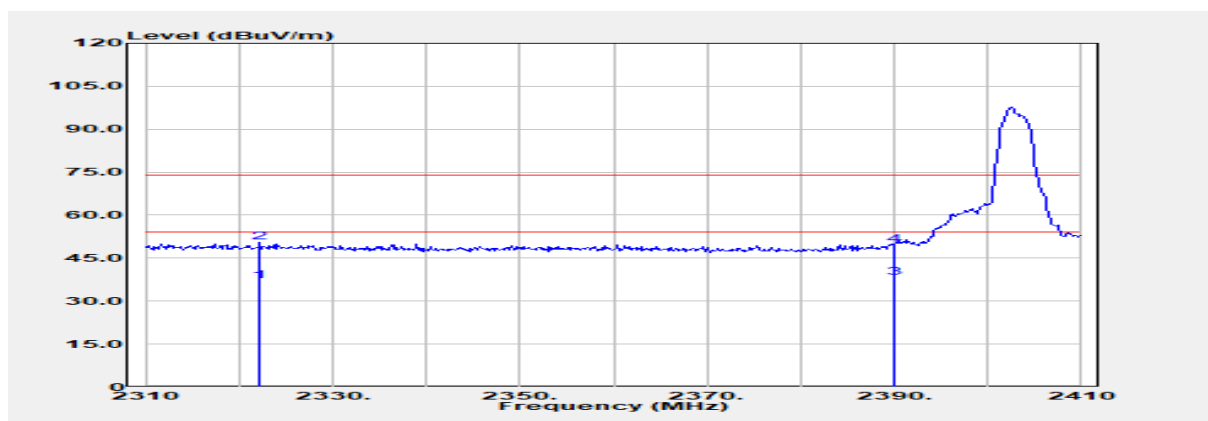
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### 11.7.1 Radiated Band Edge Measurement Result

|                |                |              |                |
|----------------|----------------|--------------|----------------|
| Report Number  | :E2/2021/30049 | Test Site    | :966 Chamber C |
| Operation Mode | :2.4G          | Test Date    | :2021-04-08    |
| Test Frequency | :2403.35 MHz   | Temp./Humi.  | :22.5/67       |
| Test Mode      | :BE CH LOW     | Antenna Pol. | :Vertical      |
| EUT Pol        | :E1 Plane      | Engineer     | :Ashton Chiu   |



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2322.179     | Average                      | 31.31                                   | 5.79         | 37.10                        | 54.00                        | -16.90       |
| 2322.179     | Peak                         | 44.70                                   | 5.79         | 50.49                        | 74.00                        | -23.51       |
| 2390.000     | Average                      | 32.87                                   | 5.18         | 38.05                        | 54.00                        | -15.95       |
| 2390.000     | Peak                         | 44.44                                   | 5.18         | 49.62                        | 74.00                        | -24.38       |

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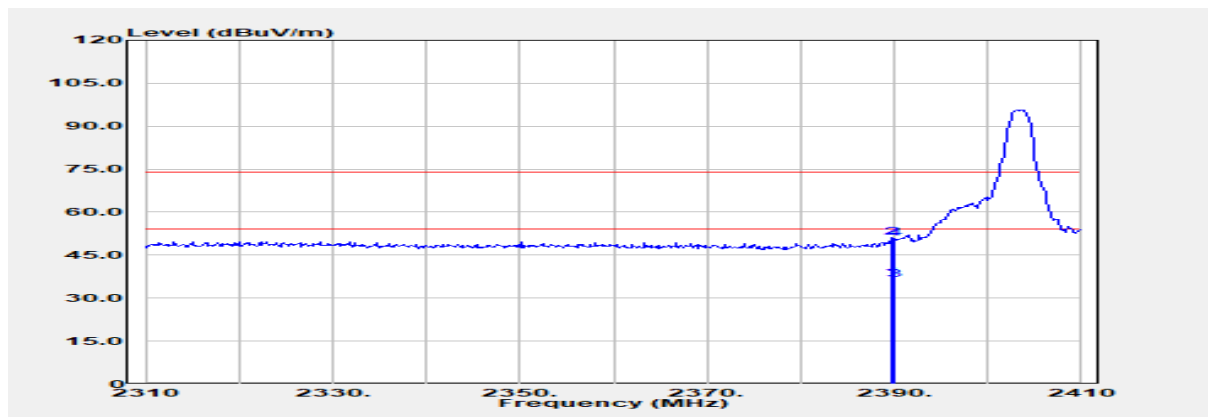
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2403.35 MHz  
 Test Mode :BE CH LOW  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-08  
 Temp./Humi. :22.5/67  
 Antenna Pol. :Horizontal  
 Engineer :Ashton Chiu



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2389.647     | Average                      | 31.95                                   | 5.16         | 37.11                        | 54.00                        | -16.89       |
| 2389.647     | Peak                         | 45.86                                   | 5.16         | 51.03                        | 74.00                        | -22.97       |
| 2390.000     | Average                      | 31.24                                   | 5.18         | 36.42                        | 54.00                        | -17.58       |
| 2390.000     | Peak                         | 45.67                                   | 5.18         | 50.85                        | 74.00                        | -23.15       |

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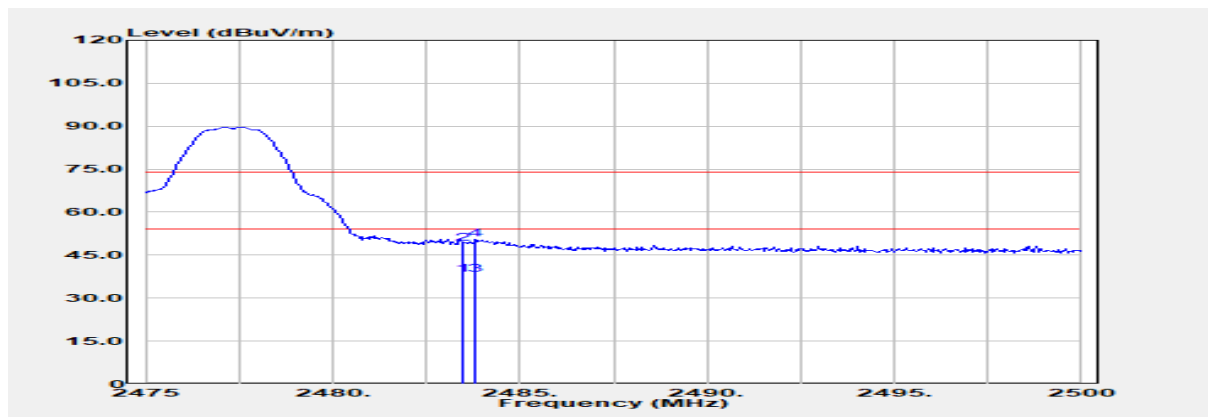
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2477.35 MHz  
 Test Mode :BE CH HIGH  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-08  
 Temp./Humi. :22.5/67  
 Antenna Pol. :Vertical  
 Engineer :Ashton Chiu



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2483.500     | Average                      | 34.27                                   | 4.04         | 38.31                        | 54.00                        | -15.69       |
| 2483.500     | Peak                         | 44.90                                   | 4.04         | 48.93                        | 74.00                        | -25.07       |
| 2483.814     | Average                      | 34.28                                   | 4.03         | 38.31                        | 54.00                        | -15.69       |
| 2483.814     | Peak                         | 46.46                                   | 4.03         | 50.49                        | 74.00                        | -23.51       |

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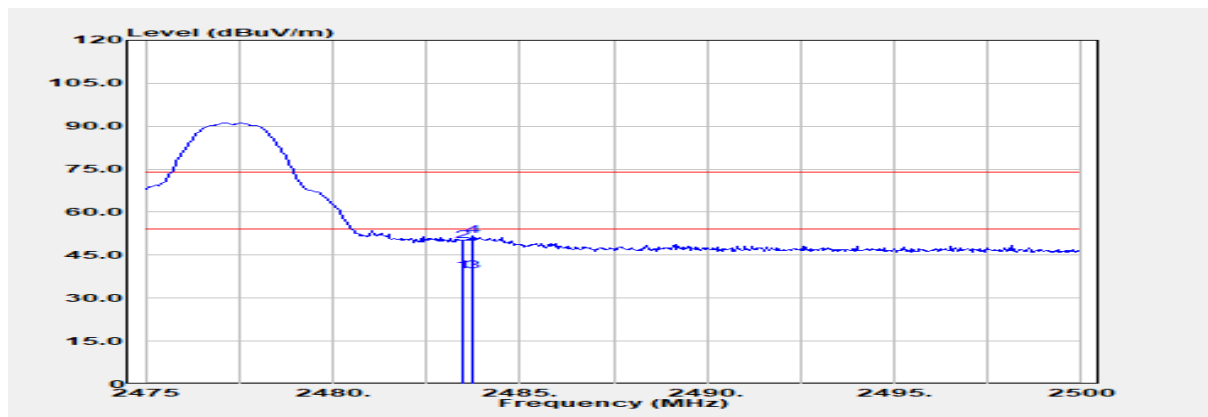
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2477.35 MHz  
 Test Mode :BE CH HIGH  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-08  
 Temp./Humi. :22.5/67  
 Antenna Pol. :Horizontal  
 Engineer :Ashton Chiu



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 2483.500     | Average                      | 35.36                                   | 4.04         | 39.40                        | 54.00                        | -14.60       |
| 2483.500     | Peak                         | 45.77                                   | 4.04         | 49.80                        | 74.00                        | -24.20       |
| 2483.734     | Average                      | 35.37                                   | 4.03         | 39.40                        | 54.00                        | -14.60       |
| 2483.734     | Peak                         | 47.55                                   | 4.03         | 51.58                        | 74.00                        | -22.42       |

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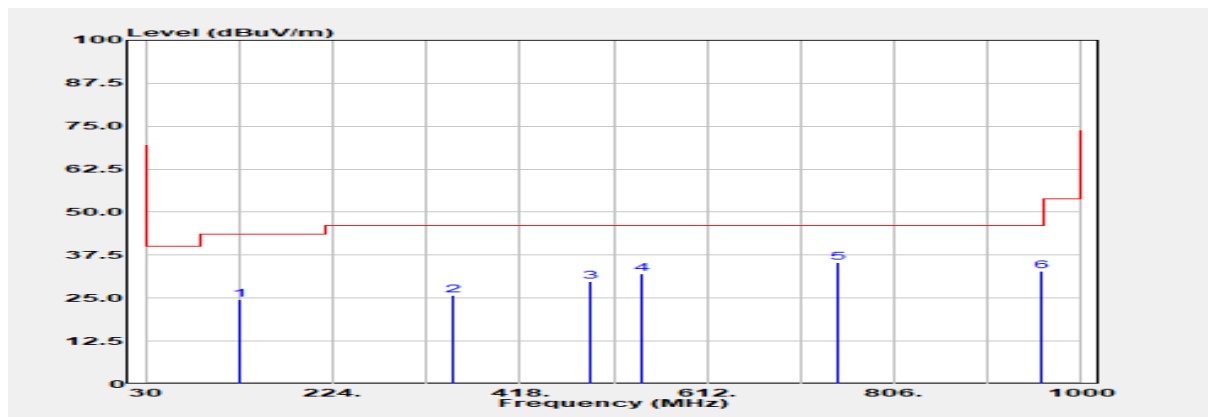
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**11.7.2 Below 1GHz Worst-Case Emission:**

|                |                |              |                |
|----------------|----------------|--------------|----------------|
| Report Number  | :E2/2021/30049 | Test Site    | :966 Chamber C |
| Operation Mode | :2.4G          | Test Date    | :2021-04-12    |
| Test Frequency | :2441.35 MHz   | Temp./Humi.  | :22.5/64       |
| Test Mode      | :TX CH MID     | Antenna Pol. | :Vertical      |
| EUT Pol        | :E1 Plane      | Engineer     | :Andy Wang     |



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dBµV | Factor<br>dB | Actual<br>FS<br>dBµV/m | Limit<br>@3m<br>dBµV/m | Margin<br>dB |
|--------------|------------------------------|-----------------------------------|--------------|------------------------|------------------------|--------------|
| 127.933      | Peak                         | 41.53                             | -16.91       | 24.62                  | 43.50                  | -18.88       |
| 348.670      | Peak                         | 39.98                             | -14.15       | 25.82                  | 46.00                  | -20.18       |
| 490.128      | Peak                         | 40.49                             | -10.56       | 29.93                  | 46.00                  | -16.07       |
| 544.535      | Peak                         | 41.25                             | -9.28        | 31.97                  | 46.00                  | -14.03       |
| 748.173      | Peak                         | 42.85                             | -7.54        | 35.31                  | 46.00                  | -10.69       |
| 958.029      | Peak                         | 38.57                             | -5.74        | 32.83                  | 46.00                  | -13.17       |

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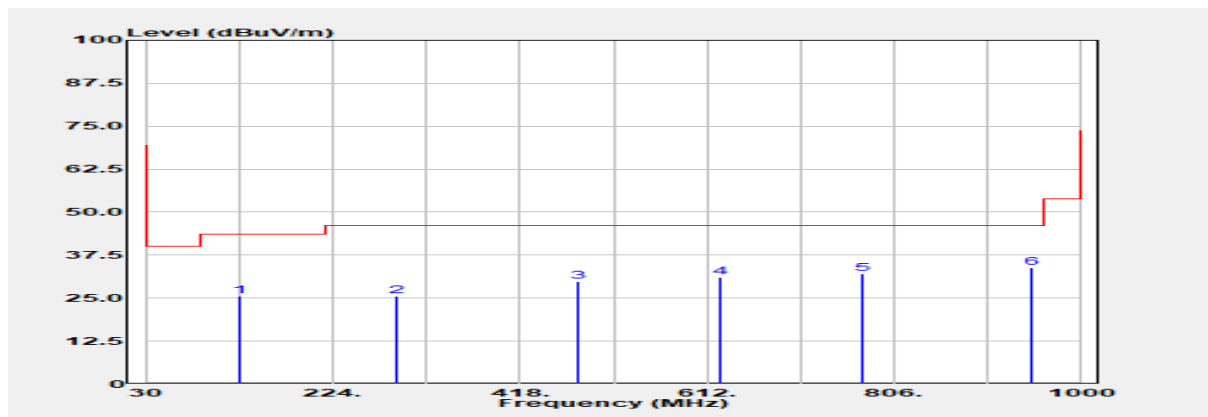
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2441.35 MHz  
 Test Mode :TX CH MID  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-12  
 Temp./Humi. :22.5/64  
 Antenna Pol. :Horizontal  
 Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 126.378      | Peak                         | 42.27                                   | -16.78       | 25.49                        | 43.50                        | -18.01       |
| 289.599      | Peak                         | 41.07                                   | -15.51       | 25.56                        | 46.00                        | -20.44       |
| 477.692      | Peak                         | 40.49                                   | -10.60       | 29.89                        | 46.00                        | -16.11       |
| 625.369      | Peak                         | 39.25                                   | -8.26        | 30.99                        | 46.00                        | -15.01       |
| 773.045      | Peak                         | 39.48                                   | -7.42        | 32.06                        | 46.00                        | -13.94       |
| 948.702      | Peak                         | 39.12                                   | -5.30        | 33.82                        | 46.00                        | -12.18       |

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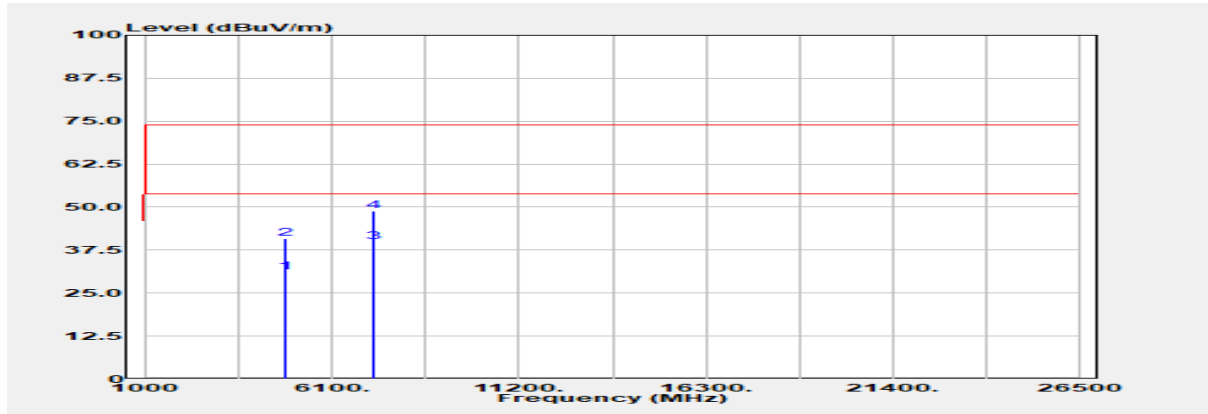
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**11.7.3 Above 1GHz Emission:**

|                |                |              |                |
|----------------|----------------|--------------|----------------|
| Report Number  | :E2/2021/30049 | Test Site    | :966 Chamber C |
| Operation Mode | :2.4G          | Test Date    | :2021-04-08    |
| Test Frequency | :2403.35MHz    | Temp./Humi.  | :22.8/62       |
| Test Mode      | :TX CH LOW     | Antenna Pol. | :Vertical      |
| EUT Pol        | :E1 Plane      | Engineer     | :Andy Wang     |

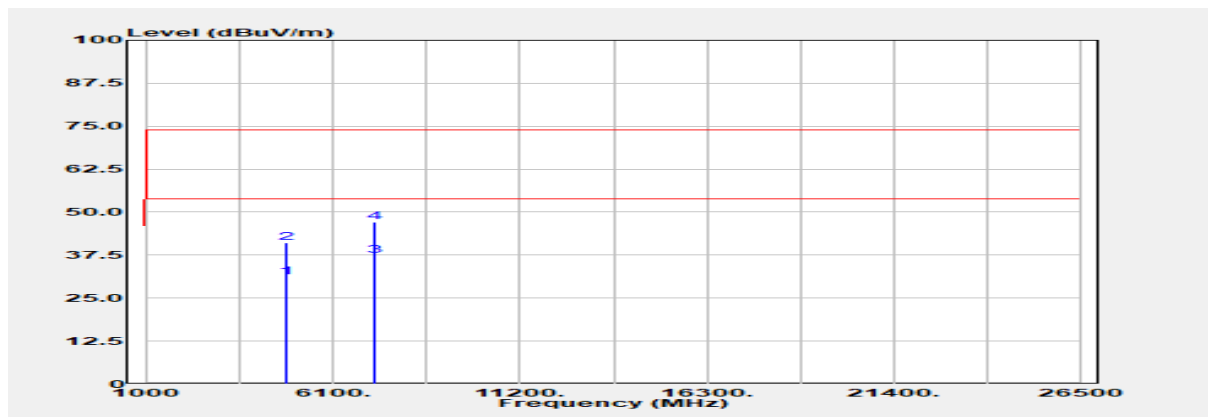


| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 4806.700     | Average                      | 20.17                                   | 10.93        | 31.10                        | 54.00                        | -22.90       |
| 4806.700     | Peak                         | 29.85                                   | 10.93        | 40.78                        | 74.00                        | -33.22       |
| 7210.050     | Average                      | 22.75                                   | 17.01        | 39.76                        | 54.00                        | -14.24       |
| 7210.050     | Peak                         | 31.82                                   | 17.01        | 48.83                        | 74.00                        | -25.17       |

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Report Number :E2/2021/30049  
Operation Mode :2.4G  
Test Frequency :2403.35MHz  
Test Mode :TX CH LOW  
EUT Pol :E1 Plane

Test Site :966 Chamber C  
Test Date :2021-04-08  
Temp./Humi. :22.8/62  
Antenna Pol. :Horizontal  
Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 4806.700     | Average                      | 20.11                                   | 10.93        | 31.04                        | 54.00                        | -22.96       |
| 4806.700     | Peak                         | 30.05                                   | 10.93        | 40.98                        | 74.00                        | -33.02       |
| 7210.050     | Average                      | 20.32                                   | 17.01        | 37.33                        | 54.00                        | -16.67       |
| 7210.050     | Peak                         | 30.08                                   | 17.01        | 47.09                        | 74.00                        | -26.91       |

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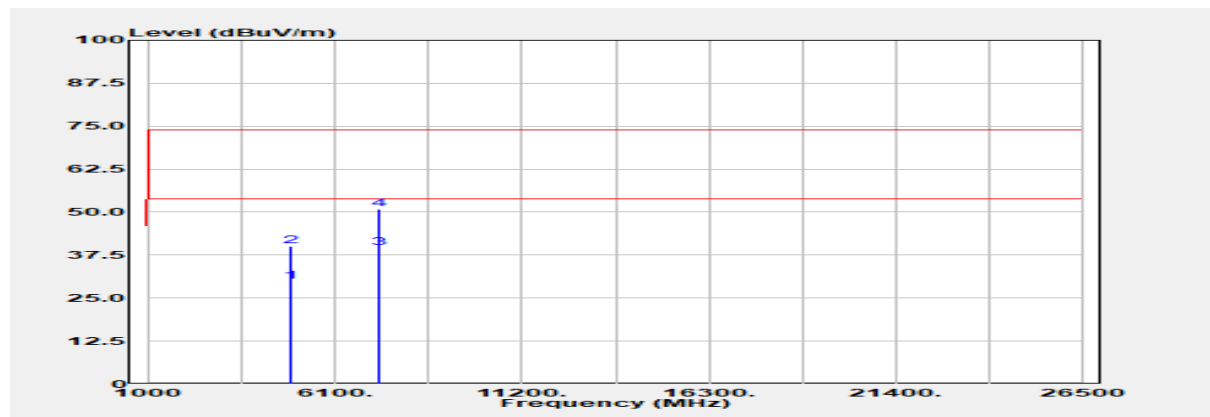
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2441.35 MHz  
 Test Mode :TX CH MID  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-08  
 Temp./Humi. :22.8/62  
 Antenna Pol. :Vertical  
 Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 4882.700     | Average                      | 19.74                                   | 10.13        | 29.87                        | 54.00                        | -24.13       |
| 4882.700     | Peak                         | 30.05                                   | 10.13        | 40.18                        | 74.00                        | -33.82       |
| 7324.050     | Average                      | 21.23                                   | 18.39        | 39.62                        | 54.00                        | -14.38       |
| 7324.050     | Peak                         | 32.47                                   | 18.39        | 50.85                        | 74.00                        | -23.15       |

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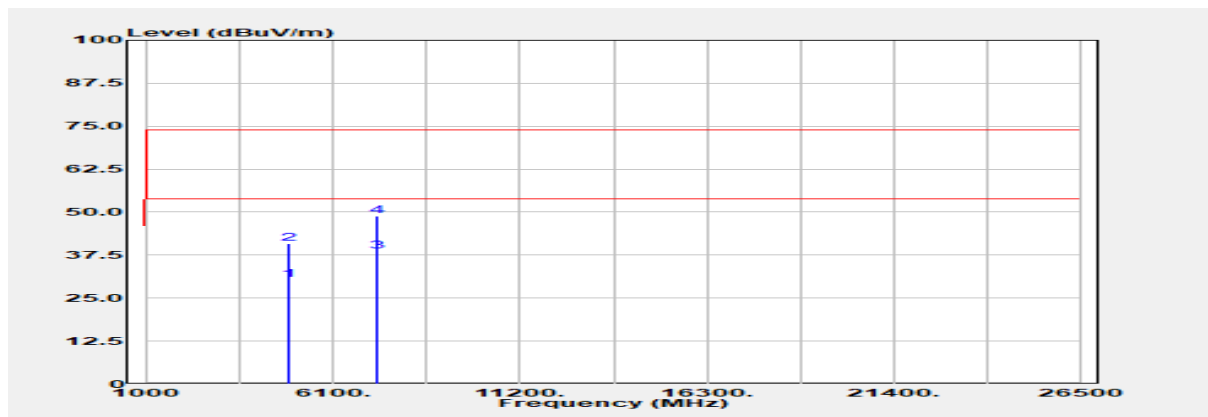
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2441.35 MHz  
 Test Mode :TX CH MID  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-08  
 Temp./Humi. :22.8/62  
 Antenna Pol. :Horizontal  
 Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 4882.700     | Average                      | 20.13                                   | 10.13        | 30.26                        | 54.00                        | -23.74       |
| 4882.700     | Peak                         | 30.74                                   | 10.13        | 40.87                        | 74.00                        | -33.13       |
| 7324.050     | Average                      | 20.27                                   | 18.39        | 38.66                        | 54.00                        | -15.34       |
| 7324.050     | Peak                         | 30.40                                   | 18.39        | 48.79                        | 74.00                        | -25.21       |

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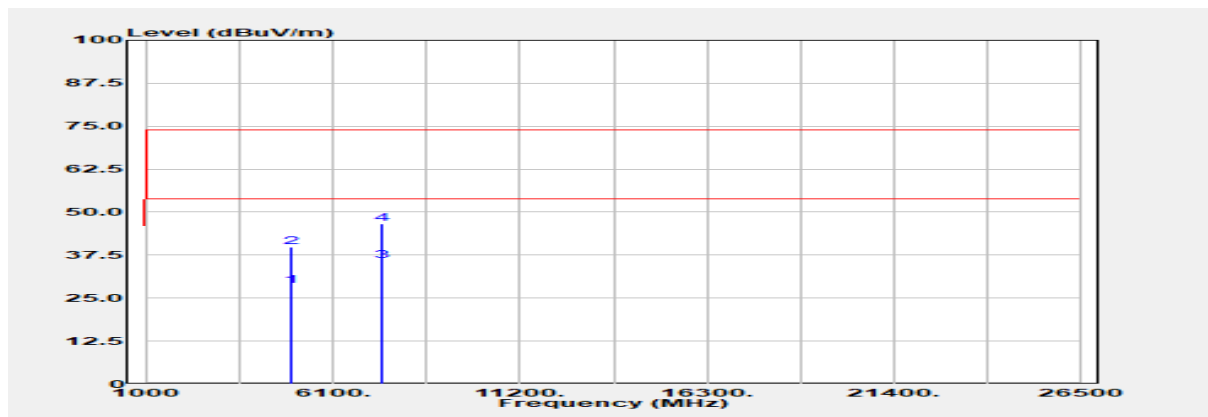
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Report Number :E2/2021/30049  
 Operation Mode :2.4G  
 Test Frequency :2477.35 MHz  
 Test Mode :TX CH HIGH  
 EUT Pol :E1 Plane

Test Site :966 Chamber C  
 Test Date :2021-04-08  
 Temp./Humi. :22.8/62  
 Antenna Pol. :Vertical  
 Engineer :Andy Wang



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 4954.700     | Average                      | 18.52                                   | 9.96         | 28.49                        | 54.00                        | -25.51       |
| 4954.700     | Peak                         | 29.86                                   | 9.96         | 39.82                        | 74.00                        | -34.18       |
| 7432.050     | Average                      | 18.70                                   | 17.25        | 35.96                        | 54.00                        | -18.04       |
| 7432.050     | Peak                         | 29.34                                   | 17.25        | 46.59                        | 74.00                        | -27.41       |

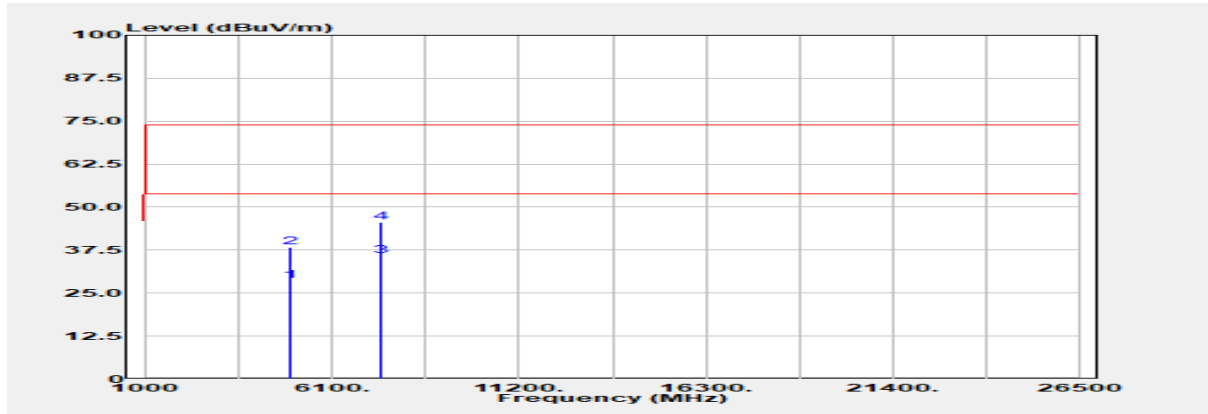
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|                |                |              |                |
|----------------|----------------|--------------|----------------|
| Report Number  | :E2/2021/30049 | Test Site    | :966 Chamber C |
| Operation Mode | :2.4G          | Test Date    | :2021-04-08    |
| Test Frequency | :2477.35 MHz   | Temp./Humi.  | :22.8/62       |
| Test Mode      | :TX CH HIGH    | Antenna Pol. | :Horizontal    |
| EUT Pol        | :E1 Plane      | Engineer     | :Andy Wang     |



| Freq.<br>MHz | Detector<br>Mode<br>PK/QP/AV | Spectrum<br>Reading Level<br>dB $\mu$ V | Factor<br>dB | Actual<br>FS<br>dB $\mu$ V/m | Limit<br>@3m<br>dB $\mu$ V/m | Margin<br>dB |
|--------------|------------------------------|---|--------------|------------------------------|------------------------------|--------------|
| 4954.700     | Average                      | 18.48                                   | 9.96         | 28.45                        | 54.00                        | -25.55       |
| 4954.700     | Peak                         | 28.45                                   | 9.96         | 38.41                        | 74.00                        | -35.59       |
| 7432.050     | Average                      | 18.66                                   | 17.25        | 35.92                        | 54.00                        | -18.08       |
| 7432.050     | Peak                         | 28.46                                   | 17.25        | 45.72                        | 74.00                        | -28.28       |

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## 12 POWER SPECTRAL DENSITY

### 12.1 Standard Applicable

Per Part 15.247 (e)

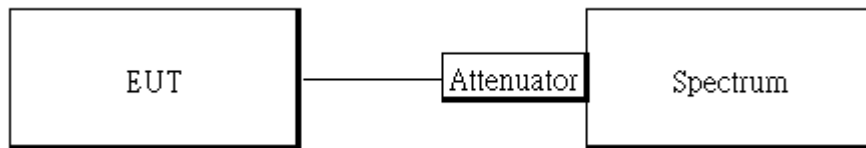
The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 12.2 Measurement Equipment Used

| Conducted Emission Test Site: Conducted C |           |                |               |            |            |
|---|-----------|----------------|---------------|------------|------------|
| EQUIPMENT TYPE                            | MFR/BRAND | MODEL NUMBER   | SERIAL NUMBER | LAST CAL.  | CAL DUE.   |
| Spectrum Analyzer                         | KEYSIGHT  | N9010A         | MY51440113    | 07/23/2020 | 07/22/2021 |
| DC Block                                  | PASTERNAK | PE8210         | RF152         | 11/19/2020 | 11/18/2021 |
| Coaxial Cables                            | Woken     | 00100A1F2A196C | RF51          | 11/19/2020 | 11/18/2021 |

### 12.3 Test Set-up



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## 12.4 Measurement Procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. The testing follows the Measurement Procedure of FCC KDB 558074 D01 DTS Meas. Guidance .
3. Set the span to 1.5 times the DTS channel bandwidth.
4. Set the RBW = 3 kHz & VBW = 10 kHz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.

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## 12.5 Power spectral density

| Gain                   | 2.12       |                   | dBi                 |        |
|------------------------|------------|-------------------|---------------------|--------|
| Mimo support           | SISO       |                   |                     |        |
| POWER DENSITY 2.4G_Ch0 |            |                   |                     |        |
| Freq.<br>(MHz)         | Ch0<br>PSD | PSD<br>(dBm/3kHz) | Limit<br>(dBm/3kHz) | Result |
| 2403.35                | -11.4      | -11.40            | 8.00                | PASS   |
| 2441.35                | -12.8      | -12.80            | 8.00                | PASS   |
| 2477.35                | -12.93     | -12.93            | 8.00                | PASS   |

### Note

Cable Loss: 0.80 dB

*\*Refer to next page for plots*

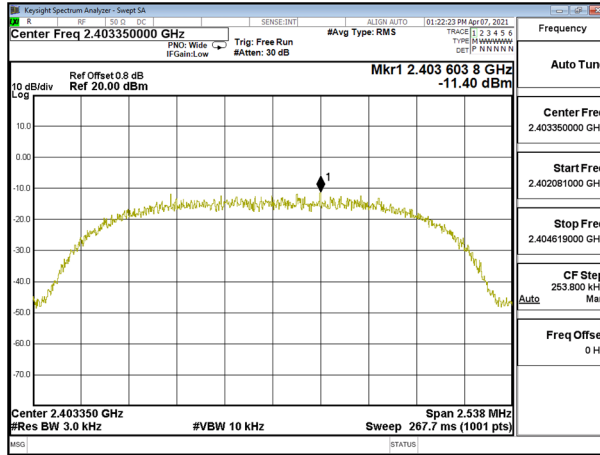
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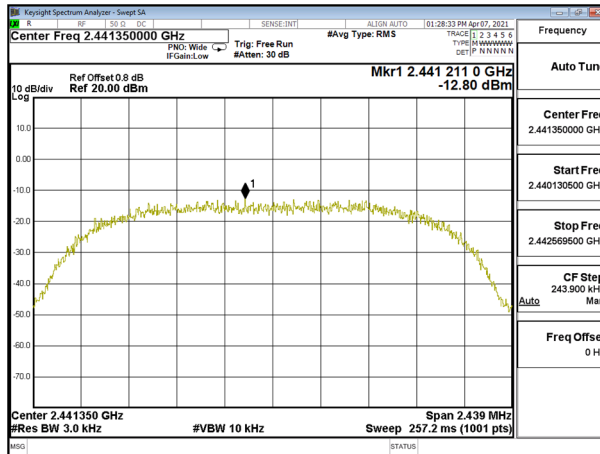
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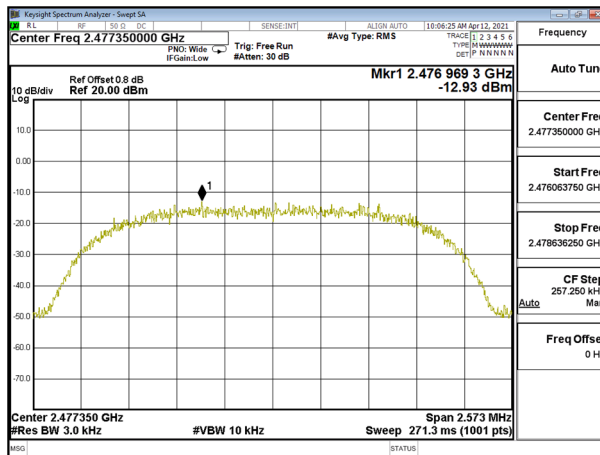
### Power Density\_2403.35



### Power Density\_2441.35



### Power Density\_2477.35



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## 13 ANTENNA REQUIREMENT

### 13.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

If the transmitting antenna is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi.

### 13.2 Antenna Connected Construction

The antenna is designed as permanently attached and no consideration of replacement. Please see EUT photo for details.

*~ End of Report ~*

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