



# TEST REPORT

|                                                                                                                                                                                                                                    |                                 |                                                          |                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------------------|------------------------------|
| <b>Eurofins KCTL Co.,Ltd.</b><br>65, Sinwon-ro, Yeongtong-gu,<br>Suwon-si, Gyeonggi-do, 16677, Korea<br>TEL: 82-70-5008-1021 FAX: 82-505-299-8311<br><a href="http://www.kctl.co.kr">www.kctl.co.kr</a>                            |                                 | Report No.:<br><b>KR23-SRF0191-B</b><br>Page (1) of (32) | <b>KCTL</b>                  |
| <b>1. Client</b><br>◦ Name : MVTECH<br>◦ Address : 1004, Hanshin IT Tower, 272, Digital-ro, Guro-gu, Seoul,<br>Republic of Korea<br>◦ Date of Receipt : 2023-06-01                                                                 |                                 |                                                          |                              |
| <b>2. Use of Report</b> : Certificate                                                                                                                                                                                              |                                 |                                                          |                              |
| <b>3. Name of Product / Model</b> : IOT_4_VIBRATION / IOT_4_VIBRATION                                                                                                                                                              |                                 |                                                          |                              |
| <b>4. Manufacturer / Country of Origin</b> : MVTECH / Korea                                                                                                                                                                        |                                 |                                                          |                              |
| <b>5. FCC ID</b> : 2A8WW-IOT4VIBRATION                                                                                                                                                                                             |                                 |                                                          |                              |
| <b>6. Date of Test</b> : 2023-07-18 to 2023-07-24                                                                                                                                                                                  |                                 |                                                          |                              |
| <b>7. Location of Test</b> : <input checked="" type="checkbox"/> Permanent Testing Lab <input type="checkbox"/> On Site Testing<br>(Address: 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea)                     |                                 |                                                          |                              |
| <b>8. Test method used</b> : FCC Part 15 Subpart E, 15.407                                                                                                                                                                         |                                 |                                                          |                              |
| <b>9. Test Result</b> : Refer to the test result in the test report                                                                                                                                                                |                                 |                                                          |                              |
| Affirmation                                                                                                                                                                                                                        | Tested by<br>                   |                                                          | Technical Manager<br>        |
|                                                                                                                                                                                                                                    | Name : Eunseong Lim (Signature) |                                                          | Name : Heesu Ahn (Signature) |
| 2023-08-03                                                                                                                                                                                                                         |                                 |                                                          |                              |
| <b>Eurofins KCTL Co.,Ltd.</b>                                                                                                                                                                                                      |                                 |                                                          |                              |
| As a test result of the sample which was submitted from the client, this report does not guarantee the whole product quality. This test report should not be used and copied without a written agreement by Eurofins KCTL Co.,Ltd. |                                 |                                                          |                              |

|                                                                                                                                                                                                         |                                                   |                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------|
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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------------------|

## REPORT REVISION HISTORY

| Date       | Revision          | Page No |
|------------|-------------------|---------|
| 2023-07-27 | Originally issued | -       |
| 2023-07-31 | Updated           | 6       |
| 2023-08-03 | Updated           | 6       |
|            |                   |         |
|            |                   |         |

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Note. The report No. KR23-SRC0191-A is superseded by the report No. KR23-SRC00191-B.

## General remarks for test reports

### Statement concerning the uncertainty of the measurement systems used for the tests

(may be required by the product standard or client)

☐ Internal procedure used for type testing through which traceability of the measuring uncertainty has been established:

### Procedure number, issue date and title:

Calculations leading to the reported values are on file with the testing laboratory that conducted the testing.

☒ Statement not required by the standard or client used for type testing

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## 2.1. Accessory information

| Equipment                     | Manufacturer                          | Model    | Serial No. | Power source                                                     |
|-------------------------------|---------------------------------------|----------|------------|------------------------------------------------------------------|
| AC/DC<br>SWITCHING<br>ADAPTOR | -MEAN WELL<br>Technology<br>Co., Ltd. | GST60A24 | SC191N8978 | Input : 100-240 VAC,<br>50/60 Hz, 1.4A<br>Output : 24V, 2.5A 60W |

## 2.2. Frequency/channel operations

### UNII-1

| Ch. | Frequency<br>(MHz) |
|-----|--------------------|
| 36  | 5 180              |
| 40  | 5 200              |
| 48  | 5 240              |

### UNII-3

| Ch. | Frequency<br>(MHz) |
|-----|--------------------|
| 149 | 5 745              |
| 157 | 5 785              |
| 165 | 5 825              |

Table 2.2.1. 802.11a mode

## 2.3. RF power setting in TEST SW

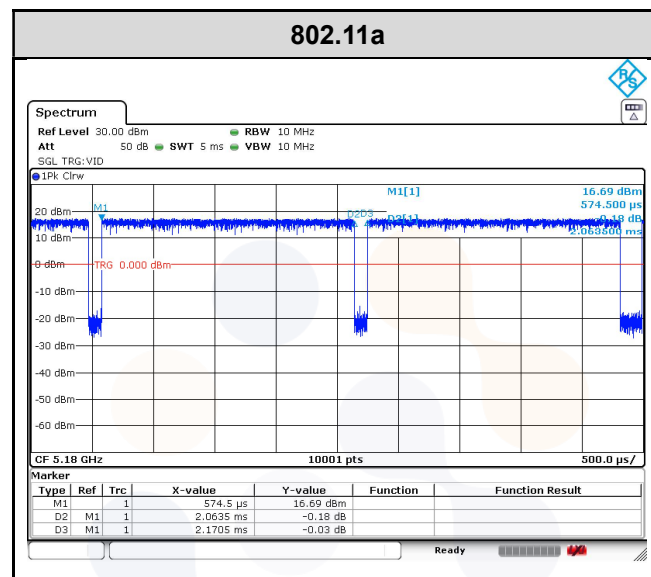
| Test Condition |        | Frequency (MHz) | Test Program | Power Setting |
|----------------|--------|-----------------|--------------|---------------|
| 802.11a        | UNII-1 | 5 180           | CP210xVCP    | 16            |
|                |        | 5 200           |              | 18            |
|                |        | 5 240           |              | 20            |
|                | UNII-3 | 5 745           |              | 20            |
|                |        | 5 785           |              | 19            |
|                |        | 5 825           |              | 19            |
|                |        |                 |              |               |

## 2.4. Duty Cycle Factor

| Test mode | Period (ms) | T <sub>on</sub> time (ms) | Duty cycle |       | Duty cycle factor (dB) |
|-----------|-------------|---------------------------|------------|-------|------------------------|
|           |             |                           | (Linear)   | (%)   |                        |
| 802.11a   | 2.170 5     | 2.063 5                   | 0.950 7    | 95.07 | 0.22                   |

### Notes.

1. Duty cycle (Linear) = T<sub>on</sub> time / Period
2. DCF(Duty cycle factor) = 10log(1/duty cycle)
3. DCF is not compensated to average result if duty cycle is more than 98%



## 3. Antenna requirement

### Requirement of FCC part section 15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 transmitter has permanently attached Dipole Antenna on device.
- The E.U.T Complies with the requirement of §15.203, §15.407.

#### 4. Summary of tests

| FCC Part section(s)                   | Parameter                      | Test Condition | Test results      |
|---------------------------------------|--------------------------------|----------------|-------------------|
| 15.407(a)                             | Maximum conducted output power | Conducted      | Pass              |
| 15.407(a)                             | Maximum power spectral density |                | N/T <sup>1)</sup> |
| 15.407(a)                             | 26 dB Channel Bandwidth        |                | N/T <sup>1)</sup> |
| 15.407(e)                             | 6 dB Channel Bandwidth         |                | N/T <sup>1)</sup> |
| 15.207(a)                             | AC Conducted Emissions         |                | Pass              |
| 15.407(b),<br>15.205(a),<br>15.209(a) | Spurious emission              | Radiated       | Pass              |

#### Notes:

1. This report is a host device test report with approved modules installed.  
 These test items were performed. (FCC ID: 2AATL-8223A-SR, Test Report No. TCT171018E032 issued on 06, December, 2017 by Shenzhen Tongce Testing Lab.)
2. According to exploratory test no any obvious emission were detected from 9 kHz to 30 MHz. Although these tests were performed other than open field site, adequate comparison measurements were confirmed against 30 m open field site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.
3. All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
4. The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z. It was determined that **X** orientation was worst-case orientation. Therefore, all final radiated testing was performed with the EUT in **X** orientation.
5. The test procedure(s) in this report were performed in accordance as following.
  - ANSI C63.10-2013
  - KDB 789033 D02 v02r01
6. Based on the baseline scan, the worst-case data rates were:  
 802.11a mode: 6Mbps

## 5. Measurement uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013.

All measurement uncertainty values are shown with a coverage factor of  $k=2$  to indicated a 95 % level of confidence. The measurement data shown herein meets or exceeds the  $U_{\text{CISPR}}$  measurement uncertainty values specified in CISPR 16-4-2 and thus, can be compared directly to specified limits to determine compliance.

| Parameter           | Expanded Uncertainty ( $\pm$ ) |        |
|---------------------|--------------------------------|--------|
| Radiated Emissions  | Below 30 MHz                   | 2.3 dB |
|                     | 30 MHz to 1 000 MHz            | 2.5 dB |
|                     | 1 000 MHz to 18 000 MHz        | 4.7 dB |
|                     | Above 18 000 MHz               | 4.8 dB |
| Conducted Emissions | 150 kHz to 30 MHz              | 2.7 dB |



## 6. Measurement results explanation example

The offset level is set in the spectrum analyzer to compensate the RF cable loss factor between EUT conducted output port and spectrum analyzer.

With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

| Frequency (MHz) | Factor(dB) | Frequency (MHz) | Factor(dB) |
|-----------------|------------|-----------------|------------|
| 30              | 10.14      | 9 000           | 13.92      |
| 50              | 10.17      | 10 000          | 15.06      |
| 100             | 10.23      | 11 000          | 15.19      |
| 200             | 10.37      | 12 000          | 15.16      |
| 300             | 10.48      | 13 000          | 15.06      |
| 400             | 10.54      | 14 000          | 15.17      |
| 500             | 10.59      | 15 000          | 14.63      |
| 600             | 10.66      | 16 000          | 15.11      |
| 700             | 10.70      | 17 000          | 15.34      |
| 800             | 10.78      | 18 000          | 14.77      |
| 900             | 10.78      | 19 000          | 14.96      |
| 1 000           | 10.78      | 20 000          | 14.84      |
| 2 000           | 11.11      | 21 000          | 15.63      |
| 3 000           | 11.39      | 22 000          | 15.94      |
| 4 000           | 11.53      | 23 000          | 15.46      |
| 5 000           | 11.96      | 24 000          | 15.30      |
| 6 000           | 11.99      | 25 000          | 15.46      |
| 7 000           | 12.28      | 26 000          | 15.24      |
| 8 000           | 14.36      | 26 500          | 16.27      |

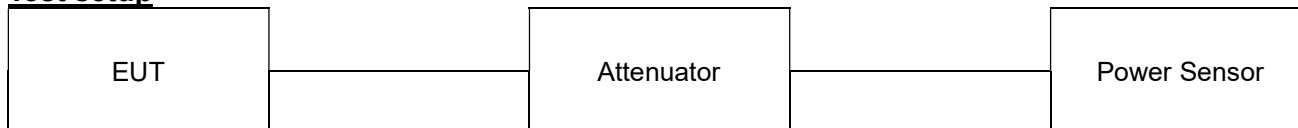
### Notes:

Offset(dB) = RF cable loss(dB) + Attenuator(dB)

## 7. Test results

### 7.1. Maximum conducted output power

#### Test setup



#### Limit

According to §15.407(a),

| Band    | EUT category |                                   | Conducted output power limit            |
|---------|--------------|-----------------------------------|-----------------------------------------|
| UNII-1  |              | Outdoor access point              | 1 W (30 dBm)                            |
|         | √            | Indoor access point               |                                         |
|         |              | Fixed point-to-point access point |                                         |
|         |              | Client device                     | 250 mW (23.98 dBm)                      |
| UNII-2A |              |                                   | 250 mW or 11 dBm + 10logB <sup>1)</sup> |
| UNII-2C |              |                                   | 250 mW or 11 dBm + 10logB <sup>1)</sup> |
| UNII-3  |              | √                                 | 1 W (30 dBm)                            |

#### Note:

1) Conducted output power limit B is the 26 dB emission bandwidth.

#### Test procedure

ANSI C63.10-2013-Section 12.3.3.2

KDB 789033 D02 v02r01 - Section E.2.d)

#### Test settings

Used test method is Section E.2.d)

#### ◆ KDB 789033 D02 v02r01

#### Section E.3.a)

##### Method PM (Measurement using an RF average power meter):

- (i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.
  - The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
  - At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.
  - The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five
- (ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in II
- (iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
- (iv) Adjust the measurement in dBm by adding 10 log (1/x) where x is the duty cycle (e.g., 10 log (1/0.25) if the duty cycle is 25%).

## Test results

| Test mode | Band   | Frequency (MHz) | Measured output power |          |              | Limit (dBm) |
|-----------|--------|-----------------|-----------------------|----------|--------------|-------------|
|           |        |                 | Reading (dBm)         | DCF (dB) | Result (dBm) |             |
| 802.11a   | UNII 1 | 5 180           | 15.31                 | 0.22     | 15.53        | 30.00       |
|           |        | 5 200           | 16.63                 | 0.22     | 16.85        |             |
|           |        | 5 240           | 18.18                 | 0.22     | 18.40        |             |
|           | UNII 3 | 5 745           | 17.05                 | 0.22     | 17.27        | 30.00       |
|           |        | 5 785           | 15.94                 | 0.22     | 16.16        |             |
|           |        | 5 825           | 16.49                 | 0.22     | 16.71        |             |

### Note.

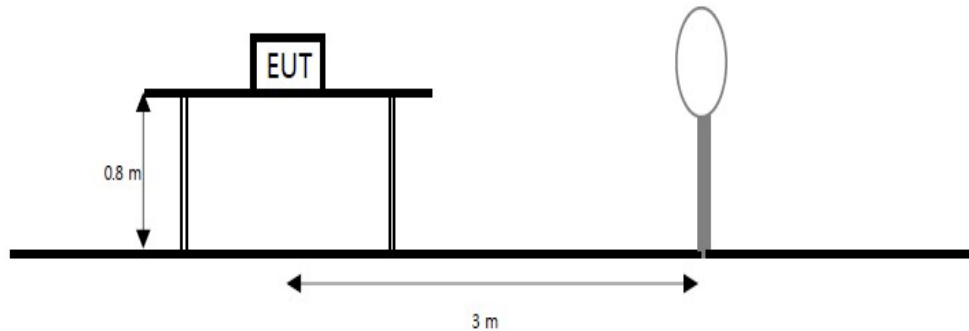
1. Result(dBm) = Reading Power + D.C.F



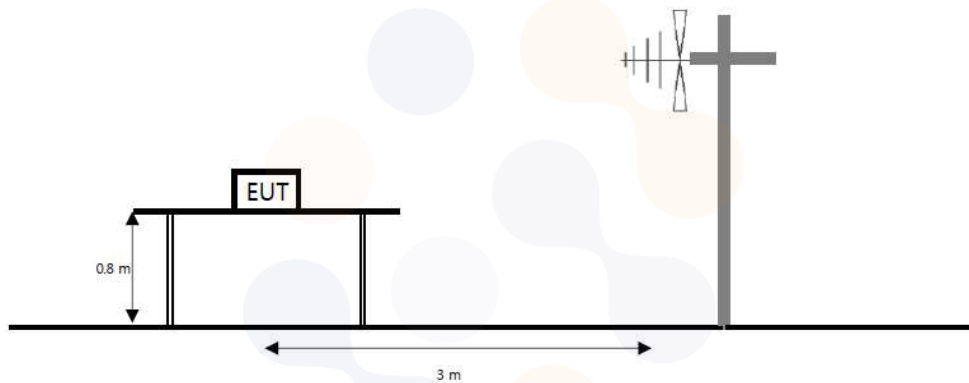
## 7.2. Spurious Emission, Band Edge and Restricted bands

### Test setup

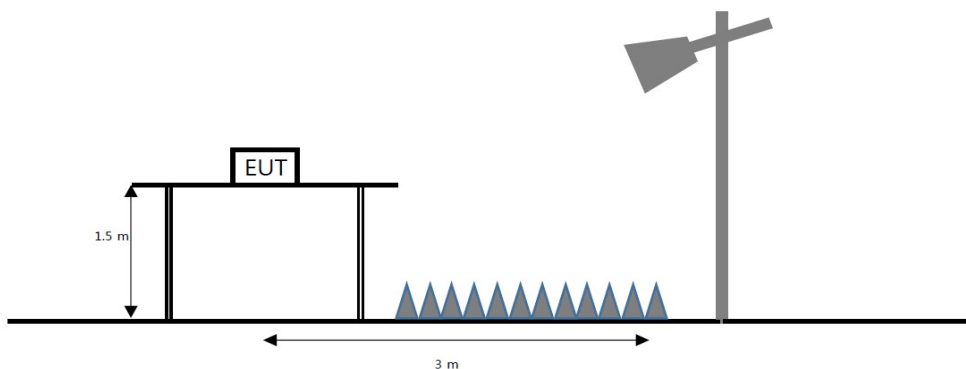
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



## Limit

According to section 15.209(a) except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field strength ( $\mu V/m$ ) | Measurement distance (m) |
|-----------------|------------------------------|--------------------------|
| 0.009 - 0.490   | 2 400/F(kHz)                 | 300                      |
| 0.490 - 1.705   | 24 000/F(kHz)                | 30                       |
| 1.705 - 30      | 30                           | 30                       |
| 30 - 88         | 100**                        | 3                        |
| 88 - 216        | 150**                        | 3                        |
| 216 - 960       | 200**                        | 3                        |
| Above 960       | 500                          | 3                        |

\*\*Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76–88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Section 15.231 and 15.241.

According to section 15.205(a) and (b) only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                   | MHz                   | MHz               | GHz           |
|-----------------------|-----------------------|-------------------|---------------|
| 0.009 - 0.110         | 16.42 - 16.423        | 399.9 - 410       | 4.5 - 5.15    |
| 0.495 - 0.505         | 16.694 75 - 16.695 25 | 608 - 614         | 5.35 - 5.46   |
| 2.173 5 - 2.190 5     | 16.804 25 - 16.804 75 | 960 - 1 240       | 7.25 - 7.75   |
| 4.125 - 4.128         | 25.5 - 25.67          | 1 300 - 1 427     | 8.025 - 8.5   |
| 4.177 25 - 4.177 75   | 37.5 - 38.25          | 1 435 - 1 626.5   | 9.0 - 9.2     |
| 4.207 25 - 4.207 75   | 73 - 74.6             | 1 645.5 - 1 646.5 | 9.3 - 9.5     |
| 6.215 - 6.218         | 74.8 - 75.2           | 1 660 - 1 710     | 10.6 - 12.7   |
| 6.267 75 - 6.268 25   | 108 - 121.94          | 1 718.8 - 1 722.2 | 13.25 - 13.4  |
| 6.311 75 - 6.312 25   | 123 - 138             | 2 200 - 2 300     | 14.47 - 14.5  |
| 8.291 - 8.294         | 149.9 - 150.05        | 2 310 - 2 390     | 15.35 - 16.2  |
| 8.362 - 8.366         | 156.524 75 - 156.525  | 2 483.5 - 2 500   | 17.7 - 21.4   |
| 8.376 25 - 8.386 75   | 25                    | 2 690 - 2 900     | 22.01 - 23.12 |
| 8.414 25 - 8.414 75   | 156.7 - 156.9         | 3 260 - 3 267     | 23.6 - 24.0   |
| 12.29 - 12.293        | 162.012 5 - 167.17    | 3 332 - 3 339     | 31.2 - 31.8   |
| 12.519 75 - 12.520 25 | 167.72 - 173.2        | 3 345.8 - 3 358   | 36.43 - 36.5  |
| 12.576 75 - 12.577 25 | 240 - 285             | 3 600 - 4 400     | Above 38.6    |
| 13.36 - 13.41         | 322 - 335.4           |                   |               |

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in section 15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in section 15.35 apply to these measurements.

### **Test procedure**

ANSI C63.10-2013 Section 12.7.7.2, 12.7.5, 12.7.6

KDB 789033 D02 v02r01 – Section G

KDB 291074 D02 v01 – 2.10.2

### **Test settings**

#### **Peak field strength measurements**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in table
3. VBW  $\geq$  (3 $\times$ RBW)
4. Detector = peak
5. Sweep time = auto
6. Trace mode = max hold
7. Allow sweeps to continue until the trace stabilizes

**Table. RBW as a function of frequency**

| Frequency           | RBW                |
|---------------------|--------------------|
| 9 kHz to 150 kHz    | 200 Hz to 300 Hz   |
| 0.15 MHz to 30 MHz  | 9 kHz to 10 kHz    |
| 30 MHz to 1 000 MHz | 100 kHz to 120 kHz |
| > 1 000 MHz         | 1 MHz              |

#### **Average field strength measurements**

#### **Trace averaging with continuous EUT transmission at full power**

If the EUT can be configured or modified to transmit continuously ( $D \geq 98\%$ ), then the average emission levels shall be measured using the following method (with EUT transmitting continuously):

1. RBW = 1 MHz (unless otherwise specified).
2. VBW  $\geq$  (3 $\times$ RBW).
3. Detector = RMS (power averaging), if  $[\text{span} / (\# \text{ of points in sweep})] \leq (\text{RBW} / 2)$ . Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this condition cannot be satisfied, then the detector mode shall be set to peak.
4. Averaging type = power (i.e., rms):
  - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
  - 2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
5. Sweep time = auto.
6. Perform a trace average of at least 100 traces.

#### **Trace averaging across ON and OFF times of the EUT transmissions followed by duty cycle correction**

If continuous transmission of the EUT ( $D \geq 98\%$ ) cannot be achieved and the duty cycle is constant (duty cycle variations are less than  $\pm 2\%$ ), then the following procedure shall be used:

1. The EUT shall be configured to operate at the maximum achievable duty cycle.
2. Measure the duty cycle D of the transmitter output signal as described in 11.6.
3. RBW = 1 MHz (unless otherwise specified).
4. VBW  $\geq$  [3  $\times$  RBW].
5. Detector = RMS (power averaging), if  $[\text{span} / (\# \text{ of points in sweep})] \leq (\text{RBW} / 2)$ . Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If this

condition cannot be satisfied, then the detector mode shall be set to peak.

6. Averaging type = power (i.e., rms):
  - 1) As an alternative, the detector and averaging type may be set for linear voltage averaging.
  - 2) Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.
7. Sweep time = auto.
8. Perform a trace average of at least 100 traces.
9. A correction factor shall be added to the measurement results prior to comparing with the emission limit to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
  - 1) If power averaging (rms) mode was used in step f), then the applicable correction factor is  $[10 \log (1 / D)]$ , where D is the duty cycle.
  - 2) If linear voltage averaging mode was used in step f), then the applicable correction factor is  $[20 \log (1 / D)]$ , where D is the duty cycle.
  - 3) If a specific emission is demonstrated to be continuous ( $D \geq 98\%$ ) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

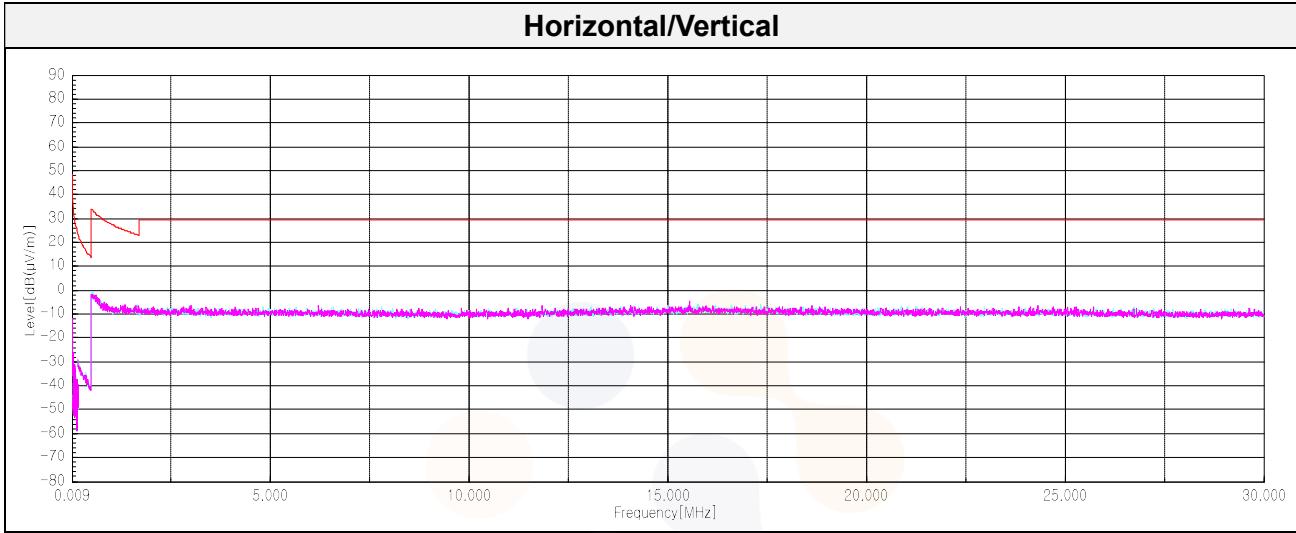
#### **Notes:**

1.  $f < 30$  MHz, extrapolation factor of 40 dB/decade of distance.  $F_d = 40 \log(D_m/D_s)$   
 $f \geq 30$  MHz, extrapolation factor of 20 dB/decade of distance.  $F_d = 20 \log(D_m/D_s)$   
 Where:  
 $F_d$  = Distance factor in dB  
 $D_m$  = Measurement distance in meters  
 $D_s$  = Specification distance in meters
2. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or  $F_d$ (dB)
3. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
4. Average test would be performed if the peak result were greater than the average limit.
5. <sup>1)</sup> means restricted band.
6. Below 30 MHz frequency range, In order to search for the worst result, all orientations about parallel, perpendicular, and ground-parallel were investigated then reported. when the emission level was higher than 20 dB of the limit, then the following statement shall be made: "No spurious emissions were detected within 20 dB of the limit."
7. For above 1 GHz pre-scan to detect harmonic and spurious emissions, the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 kHz for peak measurements.

# **Test results**

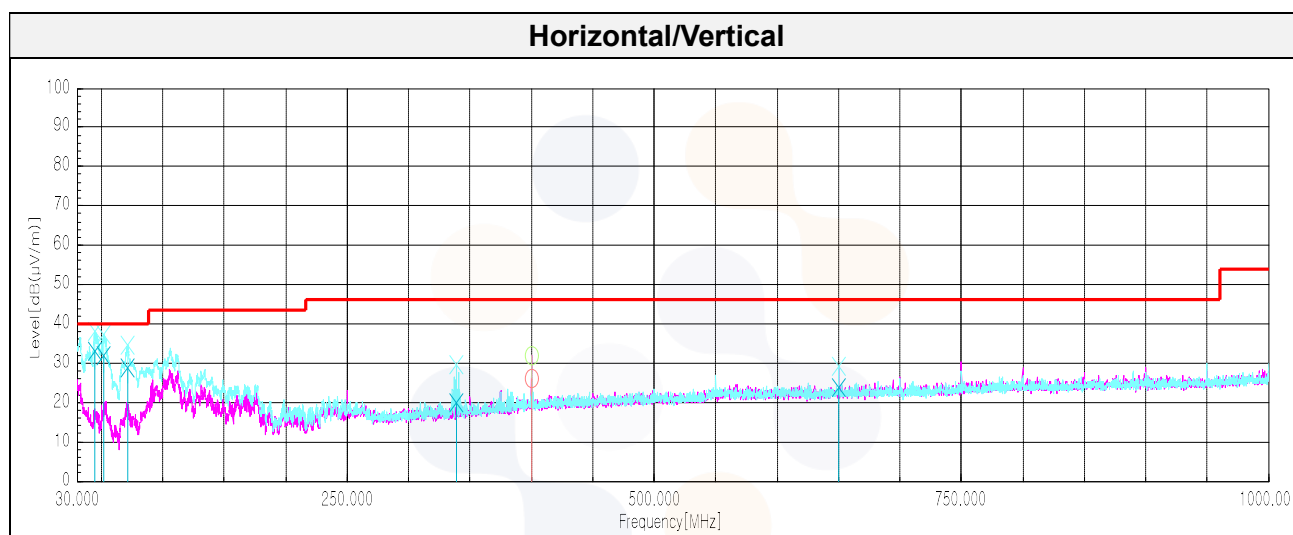
## **Test results (Below 30 MHz) – Worst case: 802.11a\_UNII 1\_5 240 MHz**

| Frequency                                                      | Pol.  | Reading  | Cable Loss | Amp Gain | Antenna Factor | DCF  | Result     | Limit      | Margin |
|----------------------------------------------------------------|-------|----------|------------|----------|----------------|------|------------|------------|--------|
| (MHz)                                                          | (V/H) | (dB(μV)) | (dB)       | (dB)     | (dB)           | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| No spurious emissions were detected within 20 dB of the limit. |       |          |            |          |                |      |            |            |        |



**Test results (Below 1 000 MHz) – Worst case: 802.11a\_UNII 1\_ 5 240 MHz**

| Frequency              | Pol.  | Reading  | Amp. + Cable | Antenna Factor | DCF  | Result     | Limit      | Margin |
|------------------------|-------|----------|--------------|----------------|------|------------|------------|--------|
| (MHz)                  | (V/H) | (dB(μV)) | (dB)         | (dB)           | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Quasi peak data</b> |       |          |              |                |      |            |            |        |
| 44.31                  | V     | 47.50    | 16.55        | -31.97         | -    | 32.08      | 40.00      | 7.92   |
| 52.19                  | V     | 49.20    | 13.34        | -31.84         | -    | 30.70      | 40.00      | 9.30   |
| 71.10                  | V     | 47.30    | 12.20        | -31.70         | -    | 27.80      | 40.00      | 12.20  |
| 338.82                 | V     | 30.30    | 19.80        | -31.10         | -    | 19.00      | 46.00      | 27.00  |
| 400.06 <sup>1)</sup>   | H     | 34.40    | 21.60        | -31.09         | -    | 24.91      | 46.00      | 21.09  |
| 650.07                 | V     | 28.70    | 24.80        | -30.48         | -    | 23.02      | 46.00      | 22.98  |

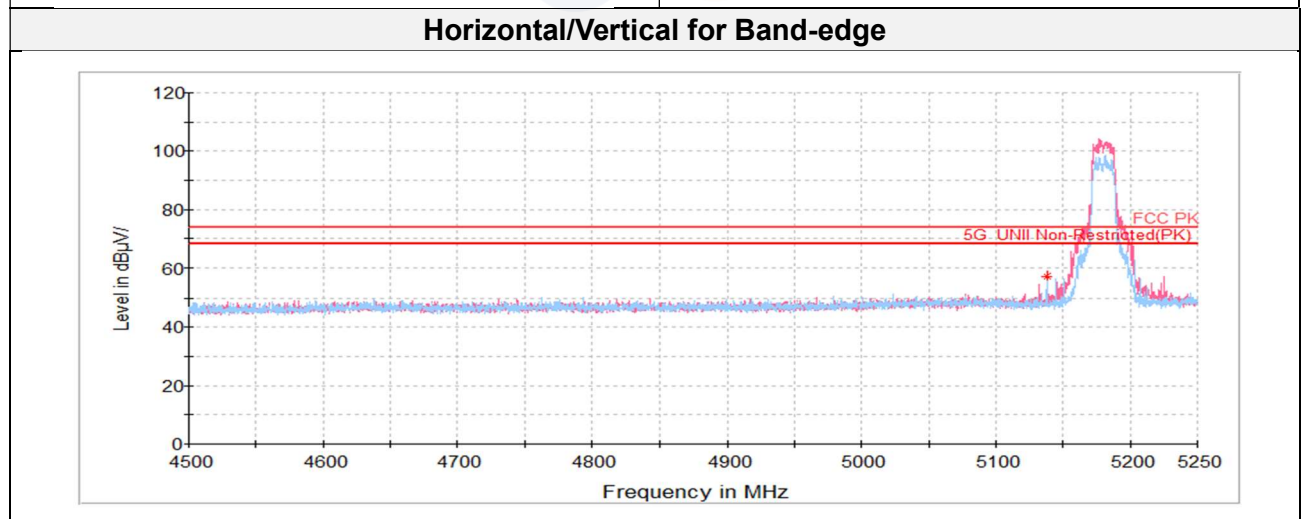
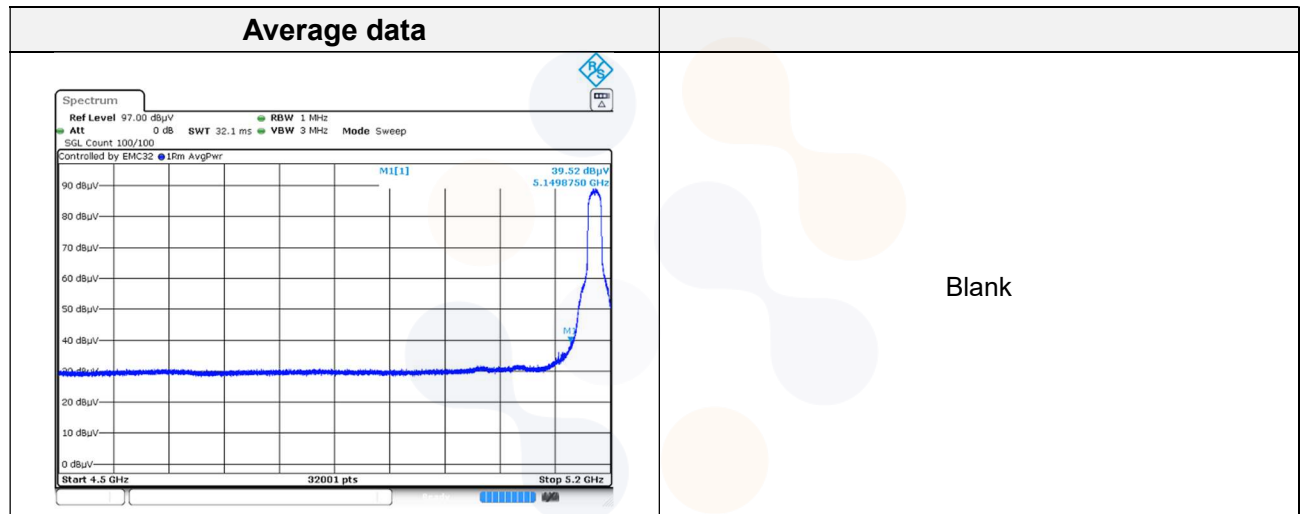


## Test results (Above 1 000 MHz)

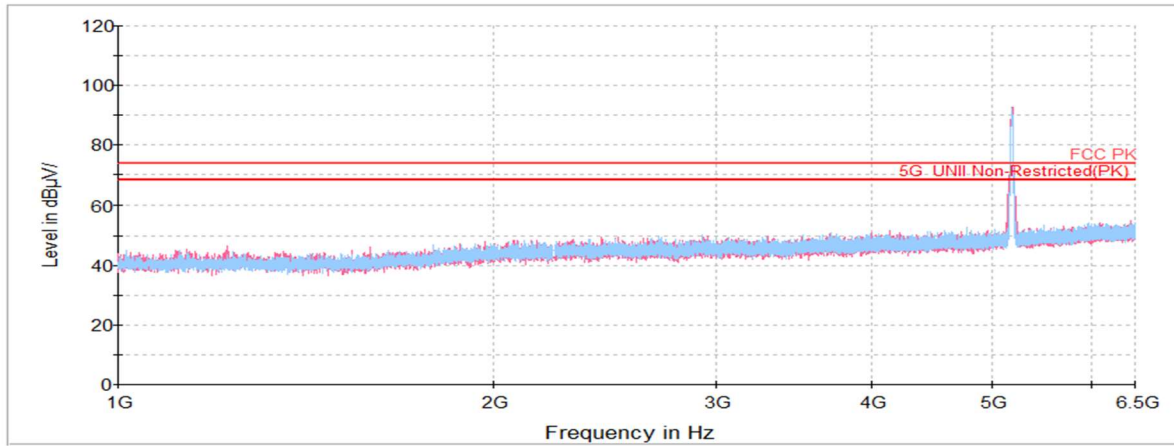
### 802.11a UNII 1

#### Lowest Channel (5 180 MHz)

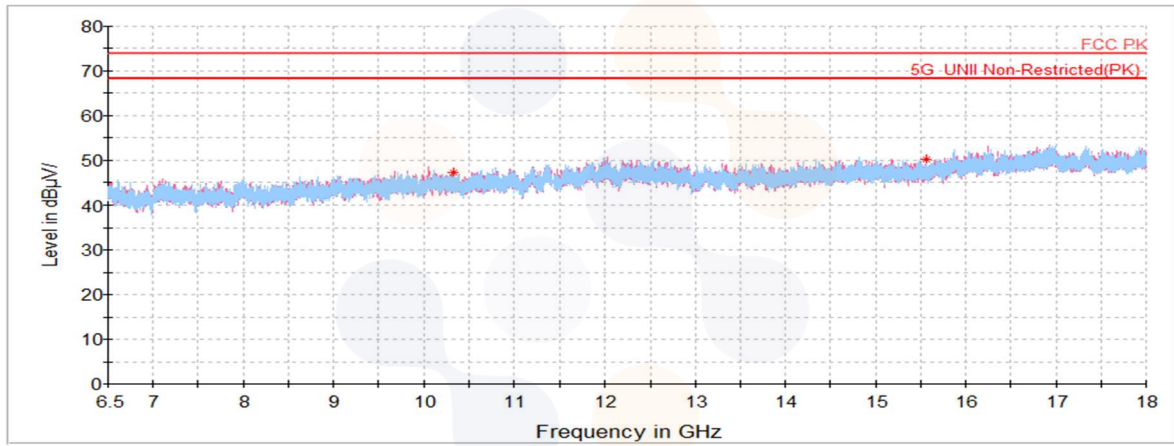
| Frequency               | Pol.  | Reading  | Antenna Factor | Amp. + Cable | DCF  | Result     | Limit      | Margin |
|-------------------------|-------|----------|----------------|--------------|------|------------|------------|--------|
| (MHz)                   | (V/H) | (dB(μV)) | (dB)           | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>        |       |          |                |              |      |            |            |        |
| 5 149.88 <sup>1)</sup>  | V     | 47.74    | 33.61          | -23.99       | -    | 57.36      | 74.00      | 16.64  |
| 10 330.22               | H     | 58.07    | 37.10          | -48.00       | -    | 47.17      | 68.20      | 21.03  |
| 15 560.56 <sup>1)</sup> | H     | 57.77    | 39.60          | -47.29       | -    | 50.08      | 74.00      | 23.92  |
| <b>Average Data</b>     |       |          |                |              |      |            |            |        |
| 5 149.88 <sup>1)</sup>  | V     | 39.52    | 33.61          | -23.99       | 0.22 | 49.36      | 54.00      | 4.64   |



**Horizontal/Vertical for 1 GHz ~ 6.5 GHz**



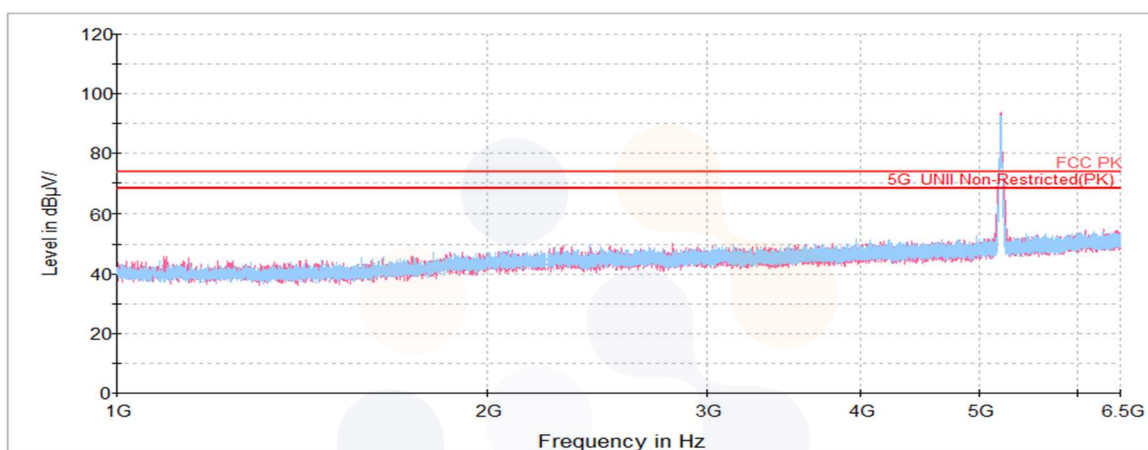
**Horizontal/Vertical for 6.5 GHz ~ 18 GHz**



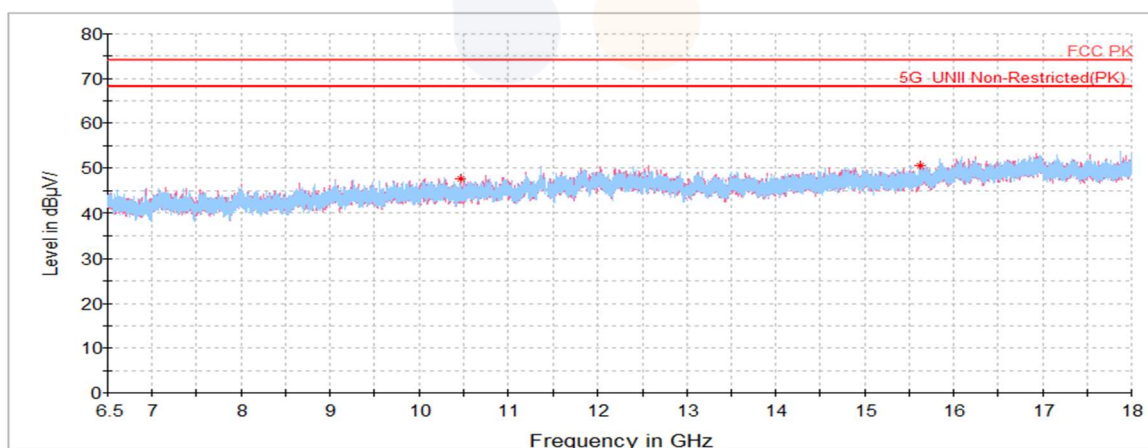
### Middle Channel (5 200 MHz)

| Frequency                                                      | Pol.  | Reading  | Antenna Factor | Amp. + Cable | DCF  | Result     | Limit      | Margin |
|----------------------------------------------------------------|-------|----------|----------------|--------------|------|------------|------------|--------|
| (MHz)                                                          | (V/H) | (dB(μV)) | (dB)           | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>                                               |       |          |                |              |      |            |            |        |
| 10 472.17                                                      | V     | 58.31    | 37.18          | -47.88       | -    | 47.61      | 68.20      | 20.59  |
| 15 623.09 <sup>1)</sup>                                        | H     | 58.01    | 39.60          | -47.17       | -    | 50.44      | 74.00      | 23.56  |
| <b>Average Data</b>                                            |       |          |                |              |      |            |            |        |
| No spurious emissions were detected within 20 dB of the limit. |       |          |                |              |      |            |            |        |

### Horizontal/Vertical for 1 GHz ~ 6.5 GHz

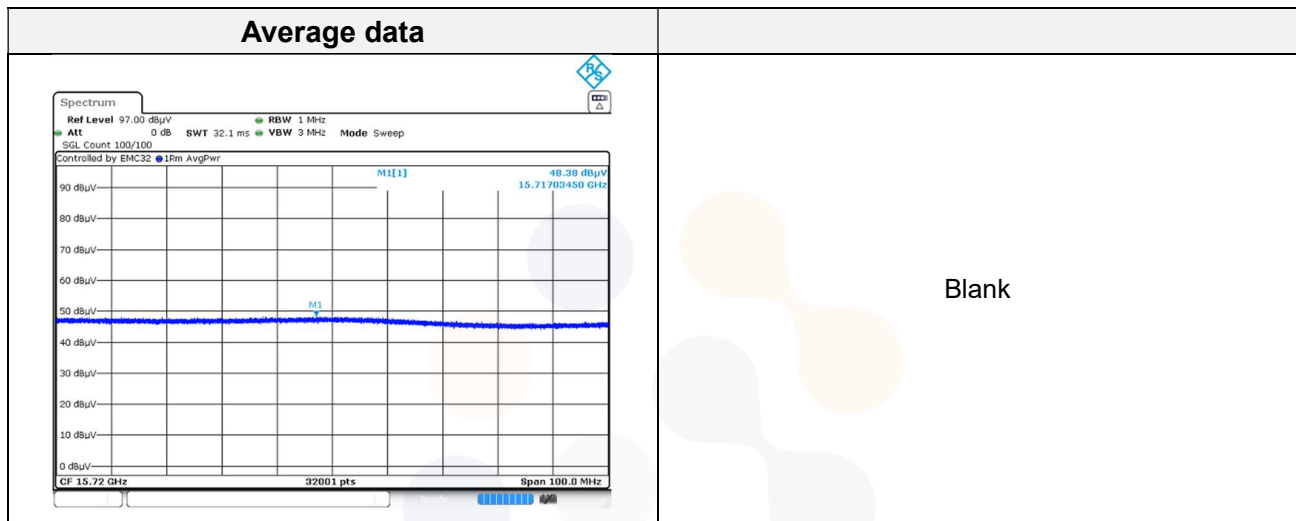


### Horizontal/Vertical for 6.5 GHz ~ 18 GHz

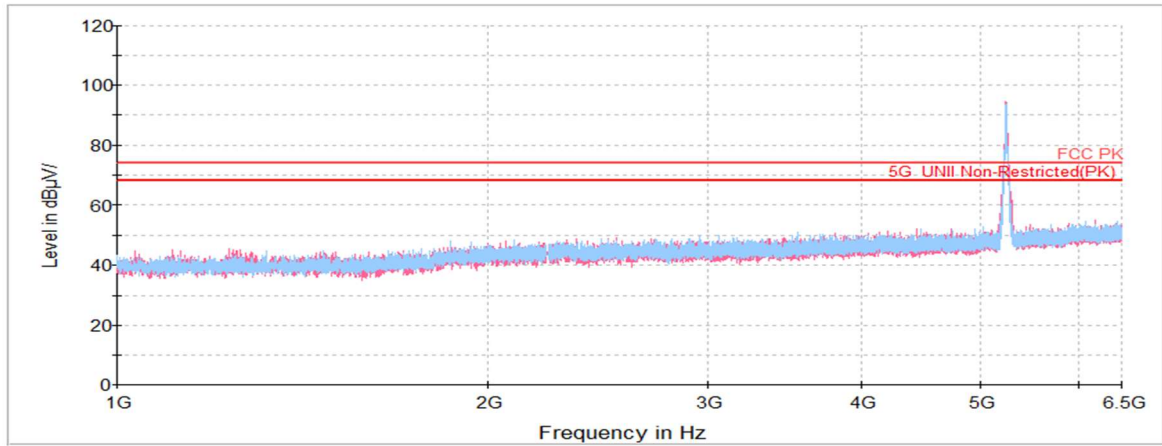


### Highest Channel (5 240 MHz)

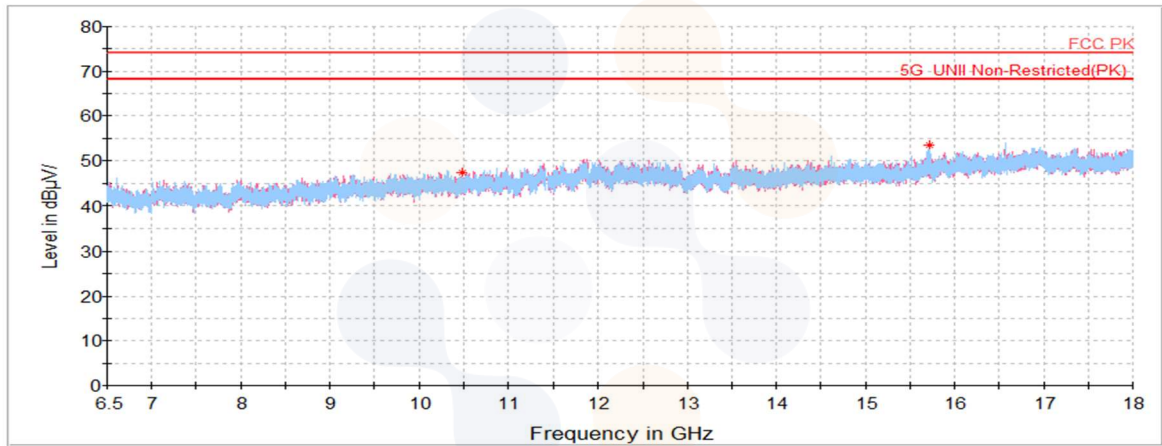
| Frequency               | Pol.  | Reading  | Antenna Factor | Amp. + Cable | DCF  | Result     | Limit      | Margin |
|-------------------------|-------|----------|----------------|--------------|------|------------|------------|--------|
| (MHz)                   | (V/H) | (dB(μV)) | (dB)           | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>        |       |          |                |              |      |            |            |        |
| 10 481.88               | V     | 57.98    | 37.19          | -47.87       | -    | 47.30      | 68.20      | 20.90  |
| 15 717.03 <sup>1)</sup> | H     | 60.81    | 39.60          | -46.98       | -    | 53.43      | 74.00      | 20.57  |
| <b>Average Data</b>     |       |          |                |              |      |            |            |        |
| 15 717.03 <sup>1)</sup> | H     | 48.38    | 39.60          | -46.98       | 0.22 | 41.22      | 54.00      | 12.78  |



**Horizontal/Vertical for 1 GHz ~ 6.5 GHz**

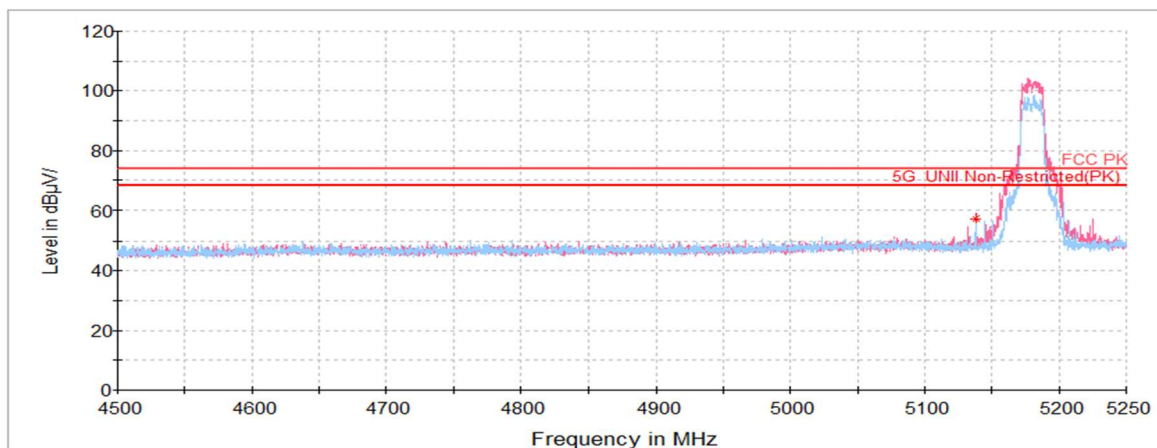


**Horizontal/Vertical for 6.5 GHz ~ 18 GHz**



**Test results (Above 18 GHz) – Worst case: 802.11a\_UNII 1\_5 180 MHz**

**Horizontal/Vertical for 18 GHz ~ 40 GHz**



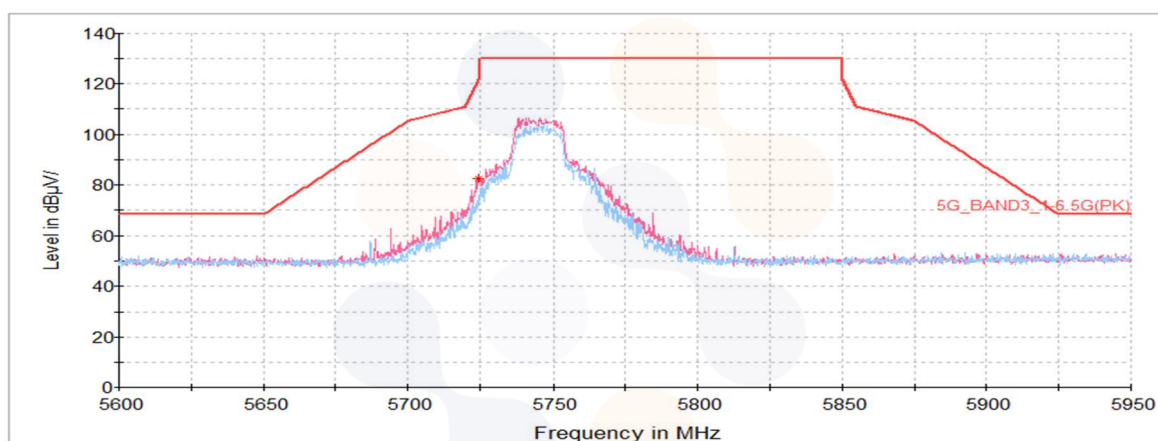
**Note:** The Worst case was based on the lowest margin condition considering Harmonic and Spurious Emission.

## 802.11a UNII 3

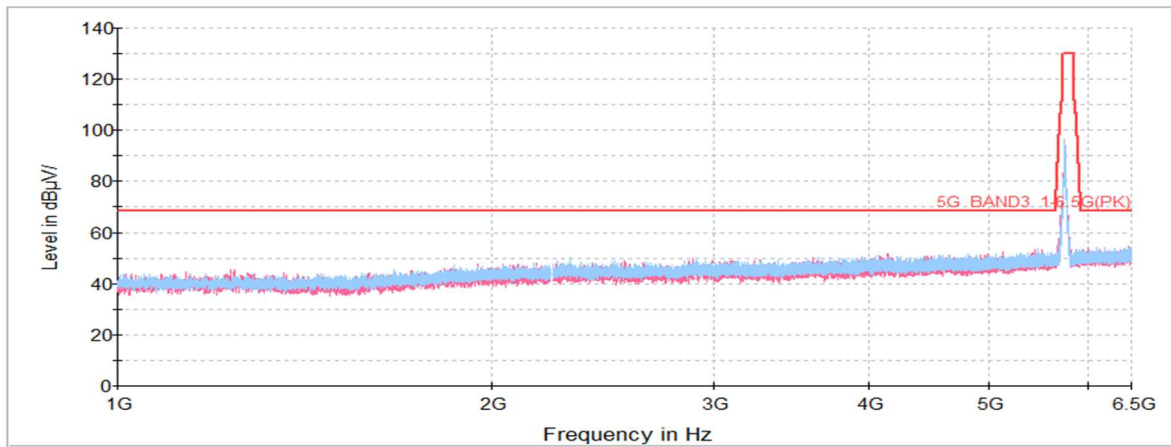
### Lowest Channel (5 745 MHz)

| Frequency                                                      | Pol.  | Reading         | Antenna Factor | Amp. + Cable | DCF  | Result            | Limit             | Margin |
|----------------------------------------------------------------|-------|-----------------|----------------|--------------|------|-------------------|-------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu V$ )) | (dB)           | (dB)         | (dB) | (dB( $\mu V/m$ )) | (dB( $\mu V/m$ )) | (dB)   |
| <b>Peak data</b>                                               |       |                 |                |              |      |                   |                   |        |
| 5 724.50                                                       | V     | 71.52           | 34.37          | -23.30       | -    | 82.59             | 121.06            | 38.47  |
| 11 390.73 <sup>1)</sup>                                        | V     | 59.18           | 37.91          | -47.60       | -    | 49.49             | 74.00             | 24.51  |
| 17 230.22                                                      | H     | 56.92           | 41.05          | -45.16       | -    | 52.81             | 68.20             | 15.39  |
| <b>Average Data</b>                                            |       |                 |                |              |      |                   |                   |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                 |                |              |      |                   |                   |        |

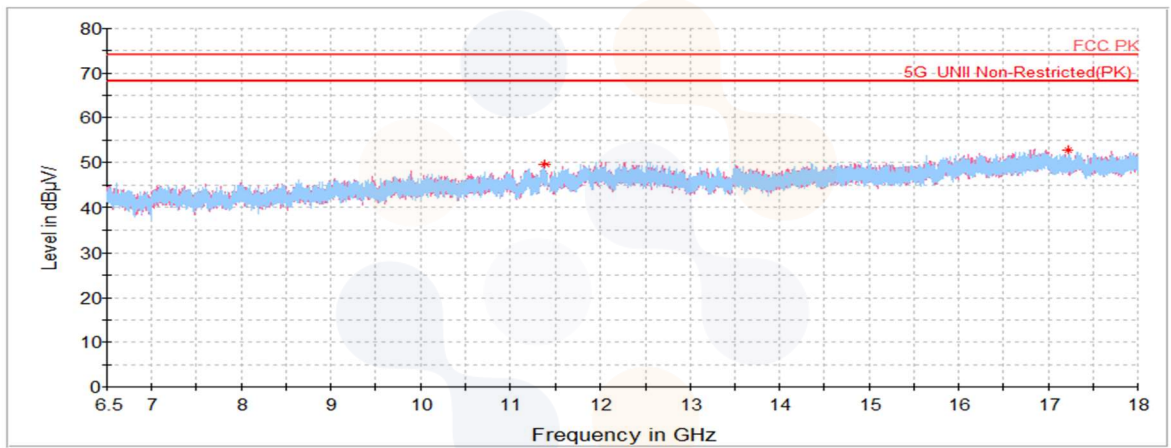
### Horizontal/Vertical for Band-edge



**Horizontal/Vertical for 1 GHz ~ 6.5 GHz**



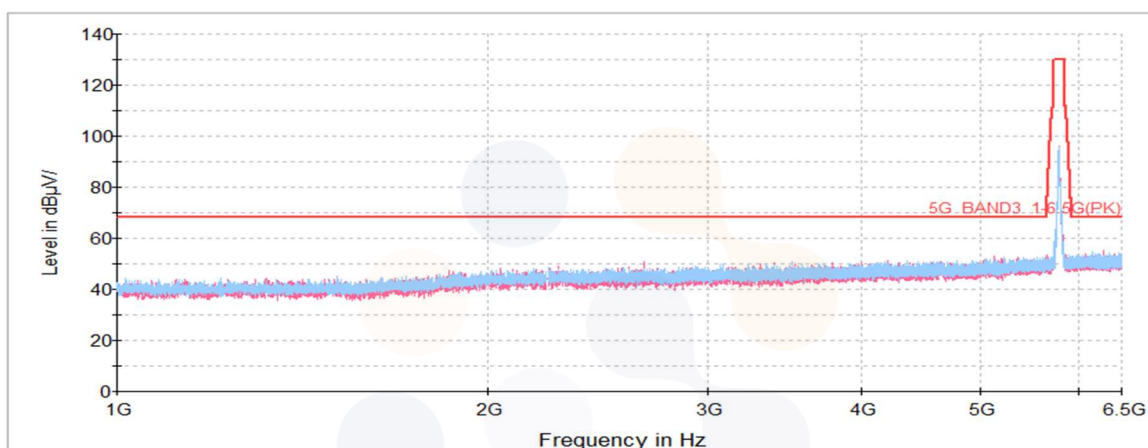
**Horizontal/Vertical for 6.5 GHz ~ 18 GHz**



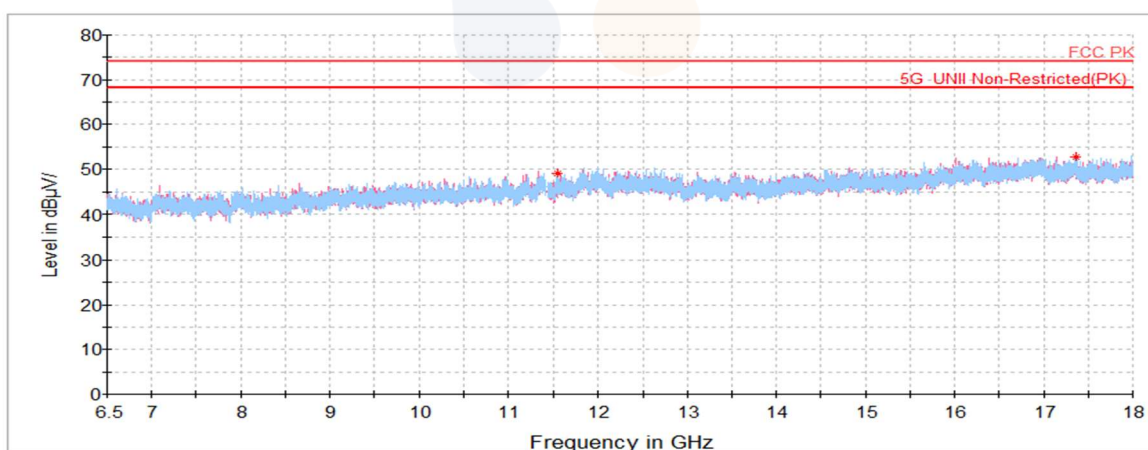
### Middle Channel (5 785 MHz)

| Frequency                                                      | Pol.  | Reading  | Antenna Factor | Amp. + Cable | DCF  | Result     | Limit      | Margin |
|----------------------------------------------------------------|-------|----------|----------------|--------------|------|------------|------------|--------|
| (MHz)                                                          | (V/H) | (dB(μV)) | (dB)           | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>                                               |       |          |                |              |      |            |            |        |
| 11 544.55 <sup>1)</sup>                                        | V     | 58.48    | 38.04          | -47.46       | -    | 49.06      | 74.00      | 24.94  |
| 17 365.70                                                      | V     | 57.18    | 41.07          | -45.42       | -    | 52.83      | 68.20      | 15.37  |
| <b>Average Data</b>                                            |       |          |                |              |      |            |            |        |
| No spurious emissions were detected within 20 dB of the limit. |       |          |                |              |      |            |            |        |

### Horizontal/Vertical for 1 GHz ~ 6.5 GHz



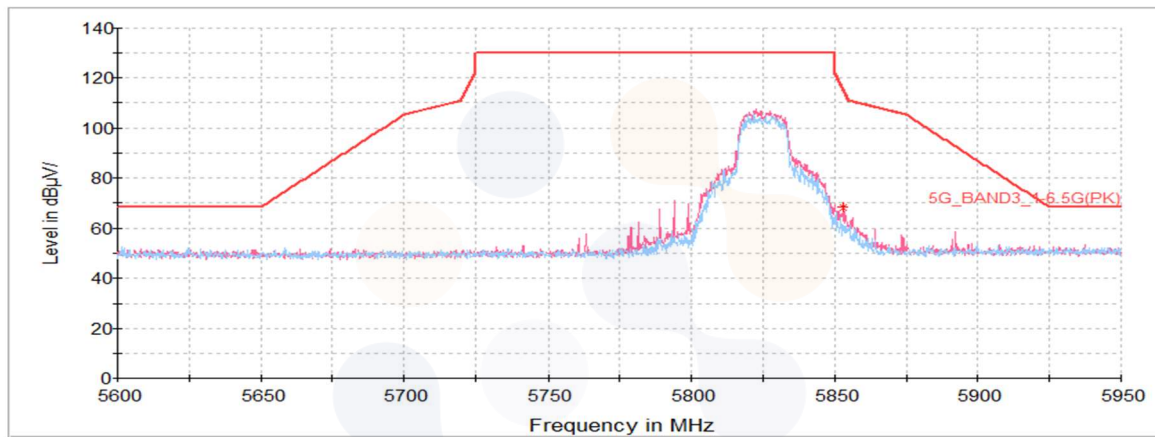
### Horizontal/Vertical for 6.5 GHz ~ 18 GHz



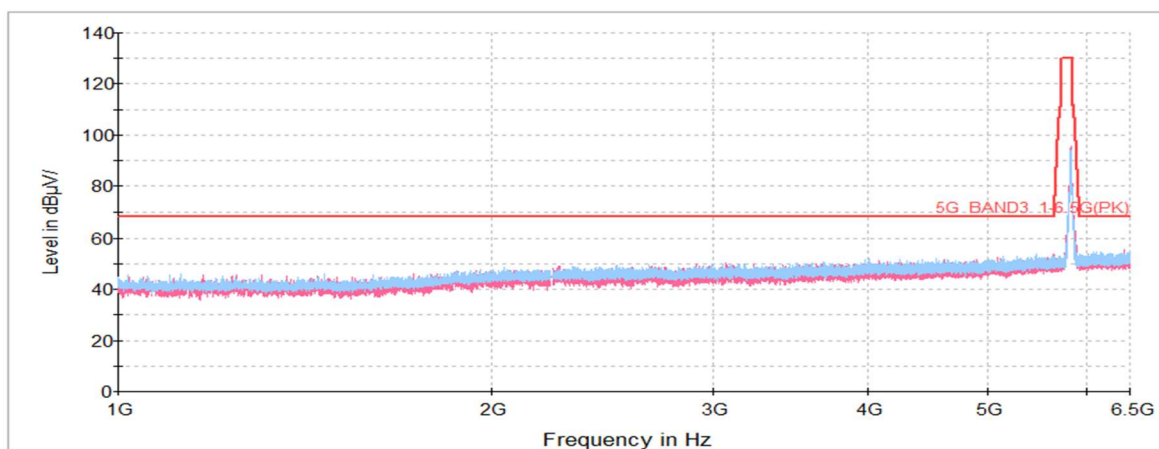
### Highest Channel (5 825 MHz)

| Frequency                                                      | Pol.  | Reading  | Antenna Factor | Amp. + Cable | DCF  | Result     | Limit      | Margin |
|----------------------------------------------------------------|-------|----------|----------------|--------------|------|------------|------------|--------|
| (MHz)                                                          | (V/H) | (dB(μV)) | (dB)           | (dB)         | (dB) | (dB(μV/m)) | (dB(μV/m)) | (dB)   |
| <b>Peak data</b>                                               |       |          |                |              |      |            |            |        |
| 5 853.06                                                       | V     | 56.26    | 34.52          | -22.72       | -    | 68.06      | 115.22     | 47.16  |
| 11 613.19 <sup>1)</sup>                                        | V     | 58.26    | 38.11          | -47.47       | -    | 48.90      | 74.00      | 25.10  |
| 17 536.77                                                      | H     | 57.04    | 40.68          | -45.63       | -    | 52.09      | 68.20      | 16.11  |
| <b>Average Data</b>                                            |       |          |                |              |      |            |            |        |
| No spurious emissions were detected within 20 dB of the limit. |       |          |                |              |      |            |            |        |

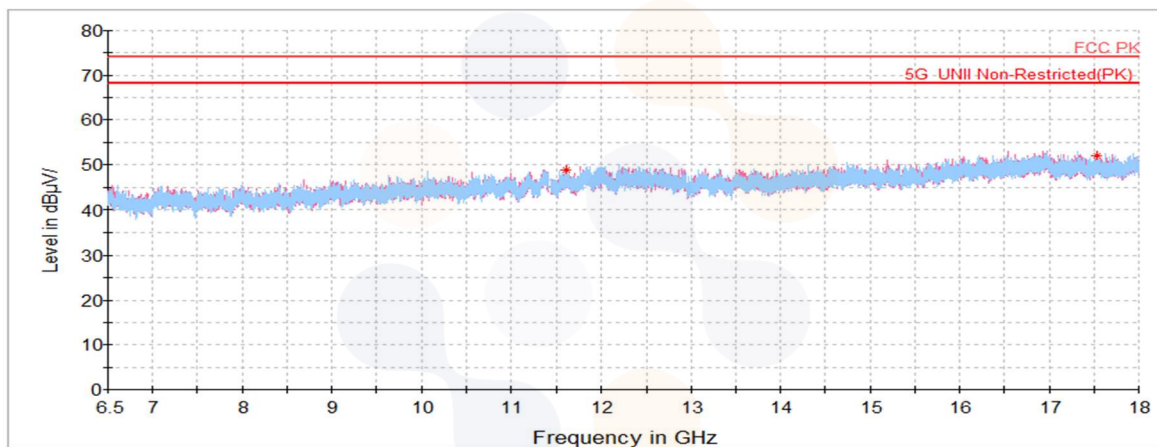
### Horizontal/Vertical for Band-edge



**Horizontal/Vertical for 1 GHz ~ 6.5 GHz**

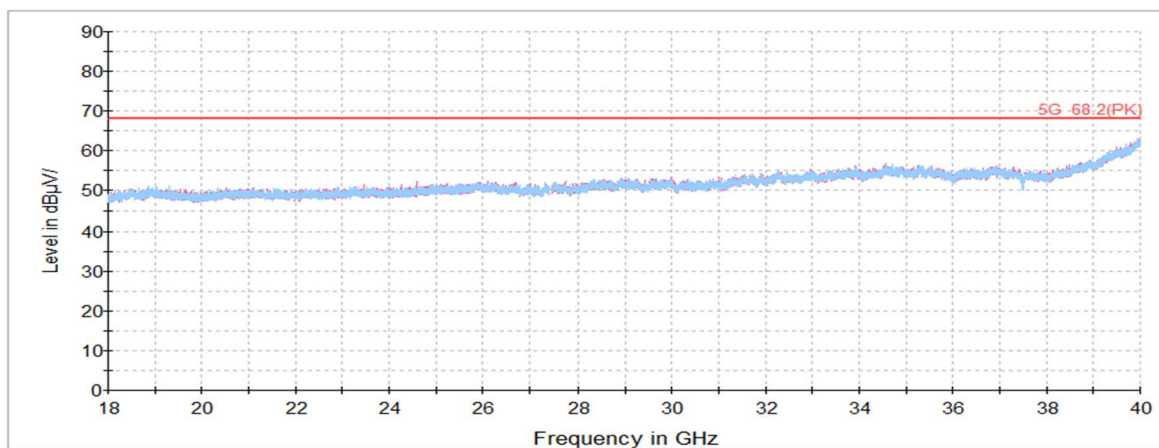


**Horizontal/Vertical for 6.5 GHz ~ 18 GHz**



**Test results (Above 18 GHz) – Worst case: 802.11a\_UNII 3\_5 785 MHz**

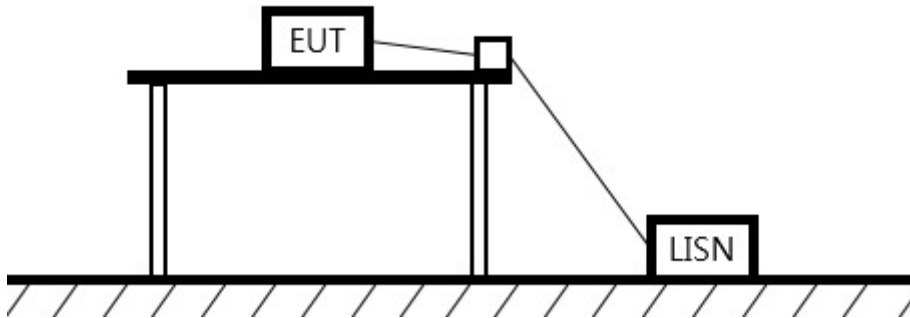
**Horizontal/Vertical for 18 GHz ~ 40 GHz**



**Note:** The Worst case was based on the lowest margin condition considering Harmonic and Spurious Emission.

### 7.3. AC Conducted emission

#### Test setup



#### Limit

According to 15.207(a), for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50μH/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequencies ranges.

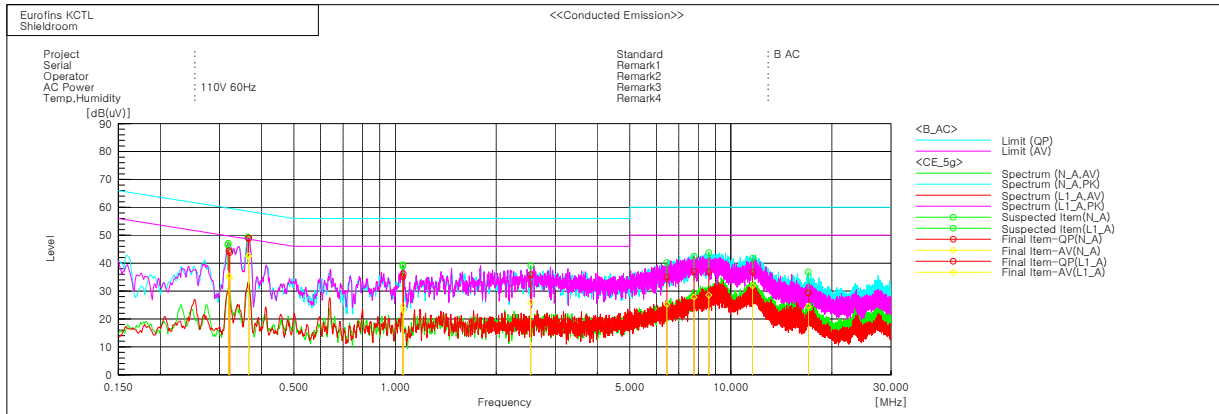
| Frequency of Emission (MHz) | Conducted limit (dBμV/m) |          |
|-----------------------------|--------------------------|----------|
|                             | Quasi-peak               | Average  |
| 0.15 – 0.50                 | 66 - 56*                 | 56 - 46* |
| 0.50 – 5.00                 | 56                       | 46       |
| 5.00 – 30.0                 | 60                       | 50       |

#### Measurement procedure

1. The EUT was placed on a wooden table of size, 1 m by 1.5 m, raised 80 cm in which is located 40 cm away from the vertical wall and 1.5m away from the side wall of the shielded room.
2. Each current-carrying conductor of the EUT power cord was individually connected through a 50Ω/50μH LISN, which is an input transducer to a spectrum analyzer or an EMI/Field Intensity Meter, to the input power source.
3. Exploratory measurements were made to identify the frequency of the emission that had the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable position, and with a typical system equipment configuration and arrangement. Based on the exploratory tests of the EUT, the one EUT cable configuration and arrangement and mode of operation that had produced the emission with the highest amplitude relative to the limit was selected for the final measurement.
4. The final test on all current-carrying conductors of all of the power cords to the equipment that comprises the EUT (but not the cords associated with other non-EUT equipment is the system) was then performed over the frequency range of 0.15 MHz to 30 MHz.
5. The measurements were made with the detector set to peak amplitude within a bandwidth of 10 kHz or to quasi-peak and average within a bandwidth of 9 kHz. The EUT was in transmitting mode during the measurements.

## Test results

**Worst case: 802.11a\_UNII 1\_ 5 240 MHz**



### Final Result

| --- N_A Phase --- |           |            |             |      |           |            |          |          |           |            |
|-------------------|-----------|------------|-------------|------|-----------|------------|----------|----------|-----------|------------|
| No.               | Frequency | Reading QP | Reading CAV | c.f  | Result QP | Result CAV | Limit QP | Limit AV | Margin QP | Margin CAV |
|                   | [MHz]     | [dB(uV)]   | [dB(uV)]    | [dB] | [dB(uV)]  | [dB(uV)]   | [dB(uV)] | [dB(uV)] | [dB]      | [dB]       |
| 1                 | 0.32182   | 34.0       | 24.9        | 9.8  | 43.8      | 34.7       | 59.7     | 49.7     | 15.9      | 15.0       |
| 2                 | 0.3665    | 38.9       | 32.6        | 9.9  | 48.8      | 42.5       | 58.6     | 48.6     | 9.8       | 6.1        |
| 3                 | 1.05526   | 25.4       | 14.8        | 9.8  | 35.2      | 24.6       | 56.0     | 46.0     | 20.8      | 21.4       |
| 4                 | 2.53481   | 26.1       | 16.1        | 9.8  | 35.9      | 25.9       | 56.0     | 46.0     | 20.1      | 20.1       |
| 5                 | 8.60106   | 26.7       | 18.3        | 10.2 | 36.9      | 28.5       | 60.0     | 50.0     | 23.1      | 21.5       |
| 6                 | 16.99985  | 18.8       | 13.9        | 10.6 | 29.4      | 24.5       | 60.0     | 50.0     | 30.6      | 25.5       |

| --- L1_A Phase --- |           |            |             |      |           |            |          |          |           |            |
|--------------------|-----------|------------|-------------|------|-----------|------------|----------|----------|-----------|------------|
| No.                | Frequency | Reading QP | Reading CAV | c.f  | Result QP | Result CAV | Limit QP | Limit AV | Margin QP | Margin CAV |
|                    | [MHz]     | [dB(uV)]   | [dB(uV)]    | [dB] | [dB(uV)]  | [dB(uV)]   | [dB(uV)] | [dB(uV)] | [dB]      | [dB]       |
| 1                  | 0.32013   | 34.6       | 25.6        | 9.8  | 44.4      | 35.4       | 59.7     | 49.7     | 15.3      | 14.3       |
| 2                  | 0.36627   | 39.1       | 32.7        | 9.9  | 49.0      | 42.6       | 58.6     | 48.6     | 9.6       | 6.0        |
| 3                  | 1.05836   | 26.4       | 13.2        | 9.8  | 36.2      | 23.0       | 56.0     | 46.0     | 19.8      | 23.0       |
| 4                  | 6.44991   | 24.9       | 15.3        | 10.0 | 34.9      | 25.3       | 60.0     | 50.0     | 25.1      | 24.7       |
| 5                  | 7.77585   | 26.9       | 17.7        | 10.1 | 37.0      | 27.8       | 60.0     | 50.0     | 23.0      | 22.2       |
| 6                  | 11.61448  | 26.4       | 21.5        | 10.4 | 36.8      | 31.9       | 60.0     | 50.0     | 23.2      | 18.1       |

## 8. Measurement equipment

| Equipment Name        | Manufacturer      | Model No.                   | Serial No.             | Next Cal. Date |
|-----------------------|-------------------|-----------------------------|------------------------|----------------|
| Antenna Mast          | Innco Systems     | MA4640-XP-ET                | -                      | -              |
| Controller            | Innco Systems     | CO3000                      | 1175/45850319/P        | -              |
| Spectrum Analyzer     | R&S               | FSV40                       | 100989                 | 23.10.14       |
| Horn antenna          | ETS.lindgren      | 3117                        | 251528                 | 24.02.02       |
| Horn antenna          | ETS.lindgren      | 3116                        | 86632                  | 24.01.25       |
| AMPLIFIER             | B&Z Technologies  | BZRT-00504000-481055-382525 | 26299-27735            | 24.07.04       |
| AMPLIFIER             | B&Z Technologies  | BZR-0050400-551028-252525   | 27736                  | 24.07.04       |
| Attenuator            | API Inmet         | 40AH2W-10                   | 12                     | 24.05.03       |
| High pass Filter      | WT                | WT-A1698-HS                 | WT160411001            | 24.04.25       |
| High pass Filter      | WT                | WT-A1699-HS                 | WT160411002            | 24.04.25       |
| High pass Filter      | Qotana            | DBHF058004000A              | 20070100016            | 24.07.04       |
| Signal Generator      | R&S               | SMB100A                     | 176206                 | 24.01.19       |
| TWO-LINE V - NETWORK  | R&S               | ENV216                      | 101358                 | 23.09.29       |
| EMI TEST RECEIVER     | R&S               | ESCI3                       | 100001                 | 23.08.18       |
| Controller            | INNCO SYSTEMS     | CO3000                      | 1441/54370322/P        | -              |
| Antenna Mast          | INNCO SYSTEMS     | MA4640-XP-ET                | -                      | -              |
| Turn Device           | INNCO SYSTEMS     | DS1200-S-1t                 | -                      | -              |
| Spectrum Analyzer     | R&S               | FSVA40                      | 101575                 | 24.06.19       |
| PSA Spectrum Analyzer | Agilent           | E4440A                      | MY46186407             | 24.03.22       |
| Amplifier             | SONOMA INSTRUMENT | 310N                        | 421821                 | 23.12.14       |
| Bilog Antenna         | Teseq GmbH        | CBL 6112D                   | 63756                  | 24.11.17       |
| Loop Antenna          | R&S               | HFH2-Z2                     | 100355                 | 24.08.10       |
| DC Power Supply       | Powercom          | DCP-50100A                  | 20220610-02            | 24.02.02       |
| Attenuator            | API Inmet         | 40AH2W-10                   | 11                     | 24.05.03       |
| Power Sensor          | R&S               | NRP-Z81                     | 1137.9009.02-106223-bB | 24.04.25       |

**End of test report**