

# TEST REPORT

## Part 15 Subpart E 15.407

**Equipment under test** RF Module

**Model name** PG11

**FCC ID** 2AWVMPG11

**Applicant** PIXXGEN Corporation

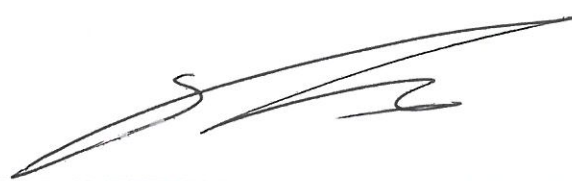

**Manufacturer** PIXXGEN Corporation

**Date of test(s)** 2020.07.27 ~ 2020.09.04

**Date of issue** 2020.09.07

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### Revision history

| Revision | Date of issue | Test report No. | Description |
|----------|---------------|-----------------|-------------|
| -        | 2020.09.07    | KES-RF1-20T0138 | Initial     |

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## 1. General information

Applicant: PIXXGEN Corporation  
Applicant address: 5F, SMART BAY, 123, Beolmal-ro, Dongan-gu, Anyang-si,  
Gyeonggi-do, Republic of Korea  
Test site: KES Co., Ltd.  
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Test Facility: FCC Accreditation Designation No.: KR0100, Registration No.: 444148  
FCC rule part(s): 15.407  
FCC ID: 2AWVMPG11  
Test device serial No.: ☒ Production ☐ Pre-production ☐ Engineering

### 1.1. EUT description

Equipment under test: RF Module  
Frequency range: 2 412 MHz ~ 2 462 MHz (11n-HT20)  
**UNII-1 5 180 MHz ~ 5 240 MHz (11ac-VHT20)**  
Model: PG11  
Modulation technique: WIFI : OFDM  
2 412 MHz ~ 2 462 MHz (11n-HT20) : 11 ch  
Number of channels: **5 180 MHz ~ 5 240 MHz (11ac-VHT20) : 4ch**  
PG11  
Antenna specification: 2.4 GHz Antenna type : Dipole antenna, Peak gain : 3.67 dBi  
5 GHz Antenna type : : Dipole antenna, Peak gain(UNII-1) : 5.62 dBi  
Power source: DC 5.0 V  
H/W version: v1.0  
S/W version: v1.0

### 1.2. Test configuration

The **PIXXGEN Corporation // PG11// FCC ID: 2AWVMPG11** was tested per the guidance of KDB 789033 D02 v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

### 1.3. Device modifications

N/A

#### 1.4. Frequency/channel operations

##### UNII-1

| Ch. | Frequency (MHz) |
|-----|-----------------|
| 36  | 5 180           |
| 44  | 5 220           |
| 48  | 5 240           |

**Table 1.7-1. 802.11ac\_VHT20 mode**

#### 1.5. Maximum average output power

Refer to the average output power.

##### Note.

1. Radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.
2. Worst-case data rates as provided by the client were:  
UNII-1 ac\_VHT 20 : **MCS8**

#### 1.6. Accessory information

| Equipment | Manufacturer | Model | Serial No. | Power source |
|-----------|--------------|-------|------------|--------------|
| -         | -            | -     | -          | -            |

#### 1.7. Antenna information

| Mode            | SISO      |           | MIMO          |
|-----------------|-----------|-----------|---------------|
|                 | Antenna 0 | Antenna 1 | Antenna 0 + 1 |
| 802.11ac(VHT20) | ✓         | ✓         | ✓             |

✓ = Support; ✕ = Not support

Antenna Model : WiFi Antenna (Dipole antenna)

| Ant0 Gain (dBi) | Ant1 Gain (dBi) | Note               |
|-----------------|-----------------|--------------------|
| 3.67            | 3.67            | 2 412 to 2 462 MHz |
| 5.62            | 5.62            | 5 180 to 5 240 MHz |

Antenna Model : Xls-857 (PCB antenna)

| Ant0 Gain (dBi) | Ant1 Gain (dBi) | Note               |
|-----------------|-----------------|--------------------|
| 2.27            | 2.27            | 2 412 to 2 462 MHz |
| 1.86            | 1.86            | 5 180 to 5 240 MHz |

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## 1.8. Measurement results explanation example

For all conducted test items :

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator 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.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 1.78 + 10 = 11.78 \text{ (dB)}\end{aligned}$$

## 1.9. Measurement Uncertainty

| Test Item   |            | Uncertainty |
|---|------------|-------------|
| Uncertainty for Conduction emission test  |            | 2.46 dB     |
| Uncertainty for Radiation emission test<br>(include Fundamental emission)   | Below 1GHz | 4.40 dB     |
|   | Above 1GHz | 5.94 dB     |
| Note. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. |            |             |

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## 2. Summary of tests

| Reference      | Parameter  | Test results |
|----------------|--|--------------|
| 15.407(a)      | 26 dB bandwidth & 99 % Occupied Bandwidth                                      | Pass         |
| 15.407(a)      | Maximum conducted output power   | Pass         |
| 15.407(a)      | Power spectral density   | Pass         |
| 15.407(g)      | Frequency stability  | Pass         |
| 15.205, 15.209 | Radiated restricted band and emission  | Pass         |
| 15.407(d)      | General field strength limit<br>(Restricted bands and radiated emission limit) | Pass         |
| 15.207         | AC power line conducted emissions  | Pass         |

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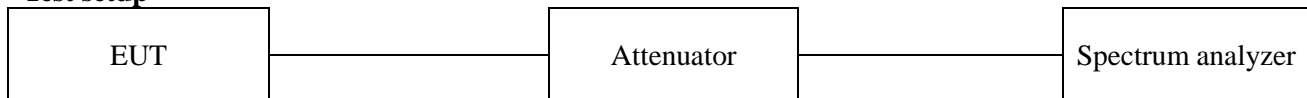
### 3. Test results

#### 3.1. 26 dB bandwidth & 99% Occupied Bandwidth

##### Test procedure

KDB 789033 D02 v02r01– Section C.1

##### Test setup



##### Section C.1

1. Set RBW = approximately 1% of the emission bandwidth.
2. Set the VBW > RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.

##### Limit

N/A

##### 99 % bandwidth

KDB 789033 D02 v02r01– Section D

1. Set span = 1.5 times to 5.0 times the OBW.
2. Set RBW = 1% to 5% of the OBW
3. Set the VBW > 3 x RBW.
4. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak bandwidth function of the instrument (if available).
5. Use the 99% power bandwidth function of the instrument (if available).
6. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.



**Test results**  
**Antenna port 0**

| Band   | Frequency(MHz) | Mode         | 26 dB bandwidth(MHz) | 99% Bandwidth(MHz) |
|--------|----------------|--------------|----------------------|--------------------|
| UNII-1 | 5 180          | ac_<br>VHT20 | 20.28                | 17.72              |
|        | 5 220          |              | 20.61                | 17.72              |
|        | 5 240          |              | 19.55                | 17.72              |

**Antenna port 1**

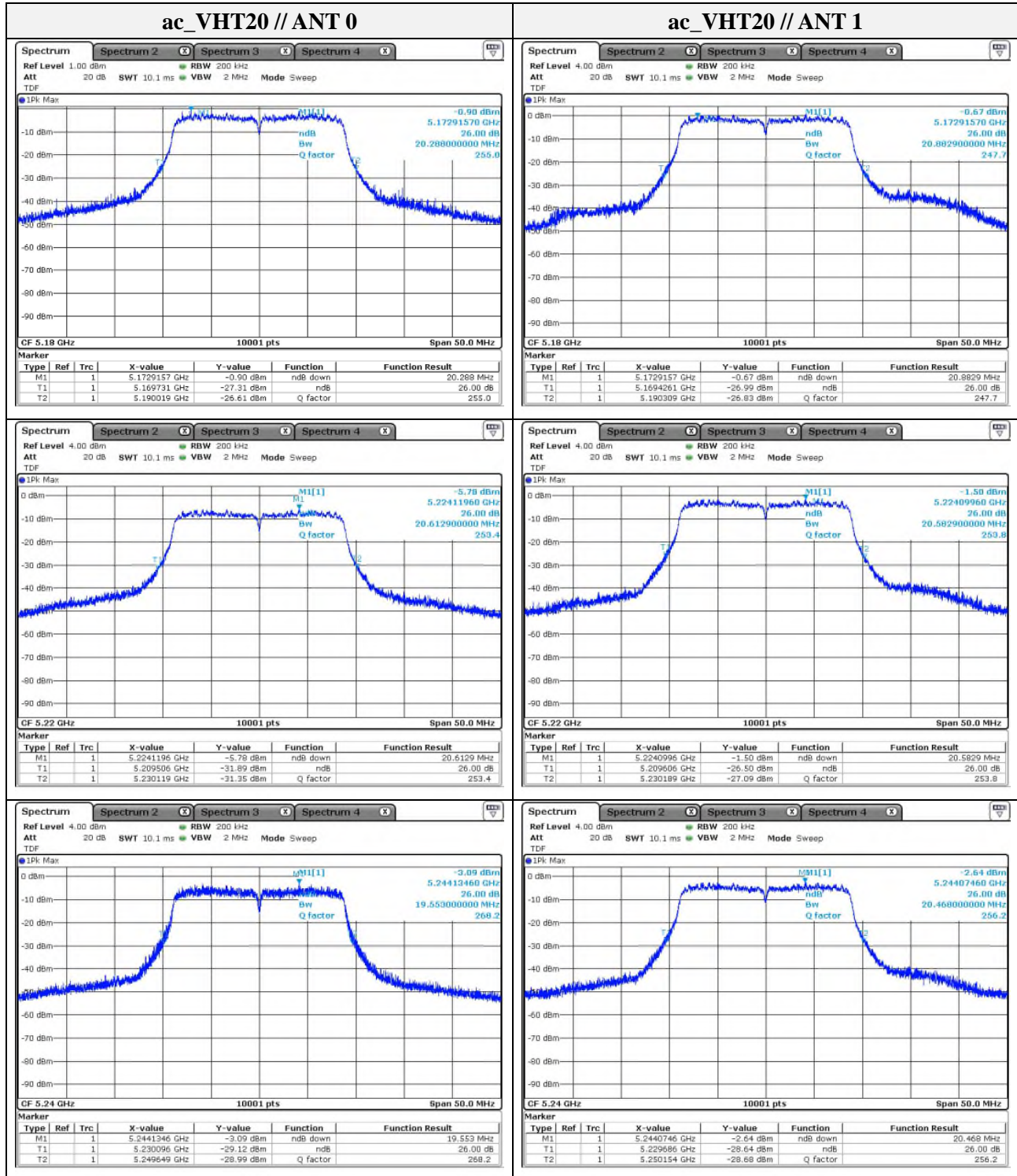
| Band   | Frequency(MHz) | Mode         | 26 dB bandwidth(MHz) | 99% Bandwidth(MHz) |
|--------|----------------|--------------|----------------------|--------------------|
| UNII-1 | 5 180          | ac_<br>VHT20 | 20.88                | 17.76              |
|        | 5 220          |              | 20.58                | 17.75              |
|        | 5 240          |              | 20.45                | 17.75              |

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## 26 dB bandwidth Test plots

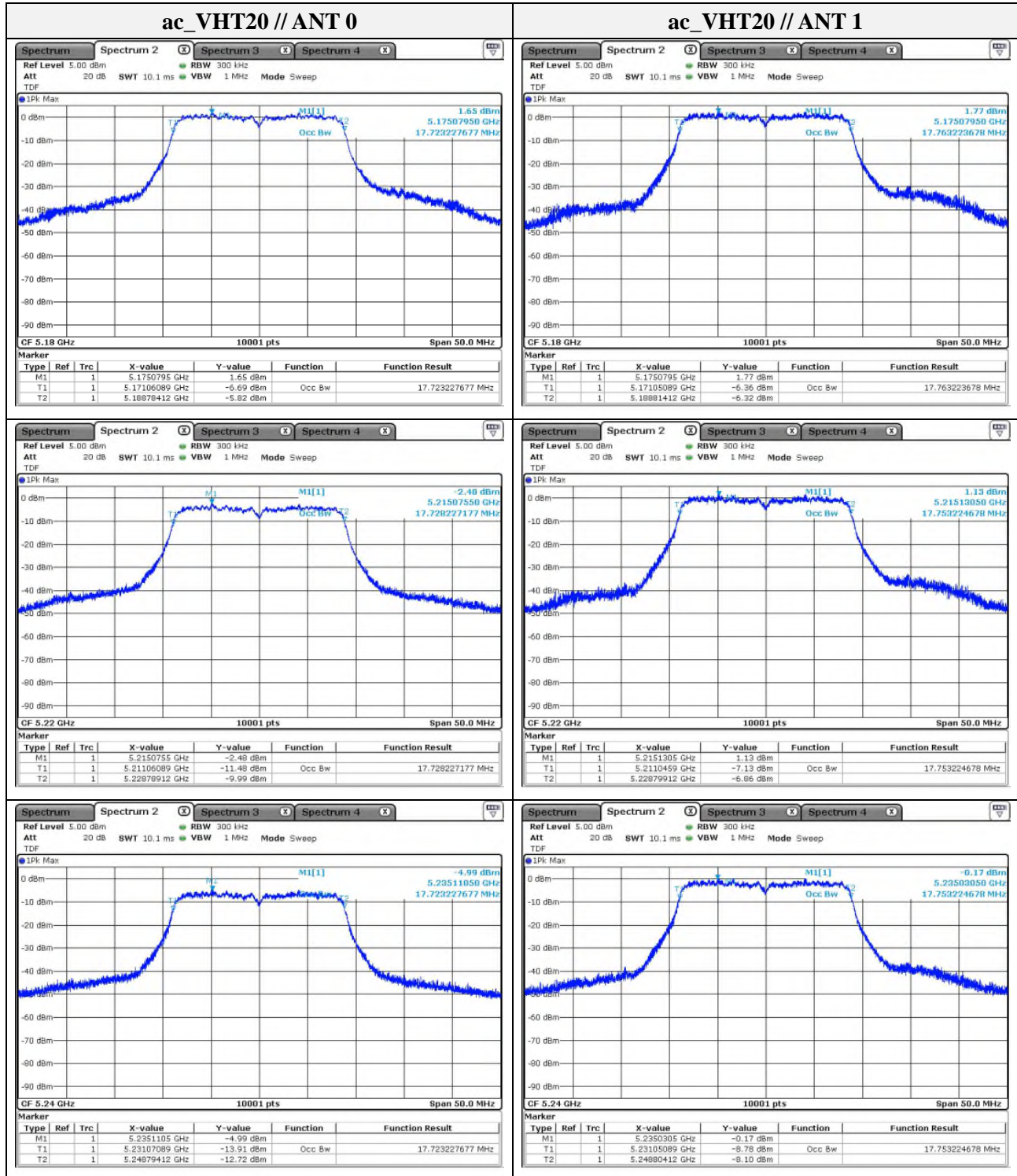


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## 99% Occupied Bandwidth Test plots



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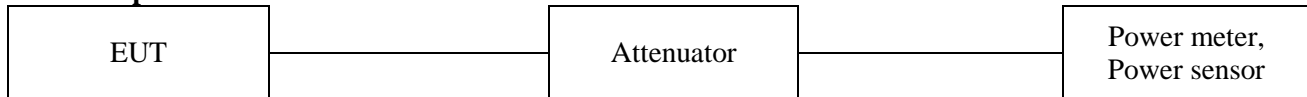
### 3.3. Maximum conducted output power

#### Test procedure

KDB 789033 D02 v02r01– Section E.3.a) or b)

Used test method is Section E.3.b)

#### Test setup



#### 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 section II.B.
- 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 %).
- v. In case of band crossing channels 138, 142 and 144, the measurement is complied with section E.2.d of KDB 644545\_D03 v01

#### Section E.3.b)

##### **Method PM-G (Measurement using a gated RF average power meter):**

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since the measurement is made only during the ON time of the transmitter, no duty cycle correction factor is required.

**Limit**

| Band    | EUT Category |                                   | Limit                      |
|---------|--------------|-----------------------------------|----------------------------|
| UNII-1  |              | Outdoor access point              | 1 W (30 dBm)               |
|         |              | Indoor access point               |                            |
|         |              | Fixed point-to-point access point |                            |
|         | ✓            | Mobile and portable client device | 250 mW(24 dBm)             |
| UNII-2A |              |                                   | 250 mW or 11 dBm + 10logB* |
| UNII-2C |              |                                   | 250 mW or 11 dBm + 10logB* |
| UNII-3  |              |                                   | 1 W (30 dBm)               |

**Note.**

1. FCC Limit B is the 26 dB emission bandwidth.

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### Test results

| Band   | mode         | Frequency<br>(MHz) | Detector<br>mode | Output power(dBm) |      |                  | Limit (dBm) |
|--------|--------------|--------------------|------------------|-------------------|------|------------------|-------------|
|        |              |                    |                  | ANT0              | ANT1 | SUM <sup>1</sup> |             |
| UNII-1 | ac_<br>VHT20 | 5 180              | AV               | 5.10              | 6.11 | 8.65             | 24.00       |
|        |              | 5 220              | AV               | 4.97              | 6.19 | 8.63             |             |
|        |              | 5 240              | AV               | 4.89              | 5.63 | 8.29             |             |

### Note.

- Sum =  $10\log(10^{Ant0/10} + 10^{Ant1/10} \dots 10^{Ant N/10})$

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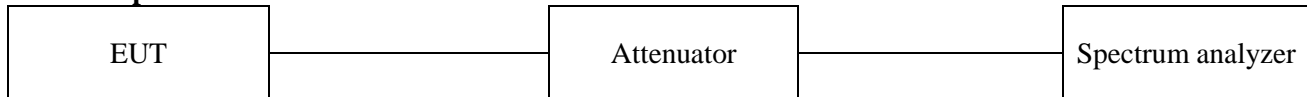


### 3.4. Maximum Power spectral density

#### Test procedure

KDB 789033 D02 v02r01 – Section F

#### Test setup



#### Section F

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, “Compute power...” (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)
2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.
3. Make the following adjustments to the peak value of the spectrum, if applicable:
  - a) If Method SA-2 or SA-2 Alternative was used, add  $10 \log(1/x)$ , where  $x$  is the duty cycle, to the peak of the spectrum.
  - b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.
4. The result is the Maximum PSD over 1 MHz reference bandwidth.
5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
  - a) Set  $RBW \geq 1/T$ , where  $T$  is defined in section II.B.1.a)
  - b) Set  $VBW \geq 3 \text{ RBW}$ .
  - c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add  $10 \log(500 \text{ kHz}/RBW)$  to the measured result, whereas  $RBW (< 500 \text{ kHz})$  is the reduced resolution bandwidth of the spectrum analyzer set during measurement.
  - d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add  $10 \log(1 \text{ MHz}/RBW)$  to the measured result, whereas  $RBW (< 1 \text{ MHz})$  is the reduced resolution bandwidth of spectrum analyzer set during measurement.
  - e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

#### Note.

As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

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**Limit**

| Band    | EUT Category |                                   | Limit          |
|---------|--------------|-----------------------------------|----------------|
| UNII-1  |              | Outdoor access point              | 17 dBm/MHz     |
|         |              | Indoor access point               |                |
|         |              | Fixed point-to-point access point |                |
|         | ✓            | Mobile and portable client device | 11 dBm/MHz     |
| UNII-2A |              |                                   | 11 dBm/MHz     |
| UNII-2C |              |                                   | 11 dBm/MHz     |
| UNII-3  |              |                                   | 30 dBm/500 kHz |

**Note.**

1. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceed 6 dBi.

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## Test results

### Antenna port 0

| Band   | Frequency<br>(MHz) | Mode         | PSD<br>(dBm/MHz) | RBWF<br>Note1 | DCF<br>Note2 | Sum<br>Note3 | Limit(dBm/MHz) |
|--------|--------------------|--------------|------------------|---------------|--------------|--------------|----------------|
|        |                    |              |                  |               |              |              | FCC            |
| UNII-1 | 5 180              | ac_<br>VHT20 | -4.89            | -             | 0            | -4.89        | 11.00          |
|        | 5 220              |              | -5.21            |               |              | -5.21        |                |
|        | 5 240              |              | -4.39            |               |              | -4.39        |                |

### Antenna port 1

| Band   | Frequency<br>(MHz) | Mode         | PSD<br>(dBm/MHz) | RBWF<br>Note1 | DCF<br>Note2 | Sum<br>Note3 | Limit(dBm/MHz) |
|--------|--------------------|--------------|------------------|---------------|--------------|--------------|----------------|
|        |                    |              |                  |               |              |              | FCC            |
| UNII-1 | 5 180              | ac_<br>VHT20 | -3.07            | -             | 0            | -3.07        | 11.00          |
|        | 5 220              |              | -0.93            |               |              | -0.93        |                |
|        | 5 240              |              | -1.06            |               |              | -1.06        |                |

### Note.

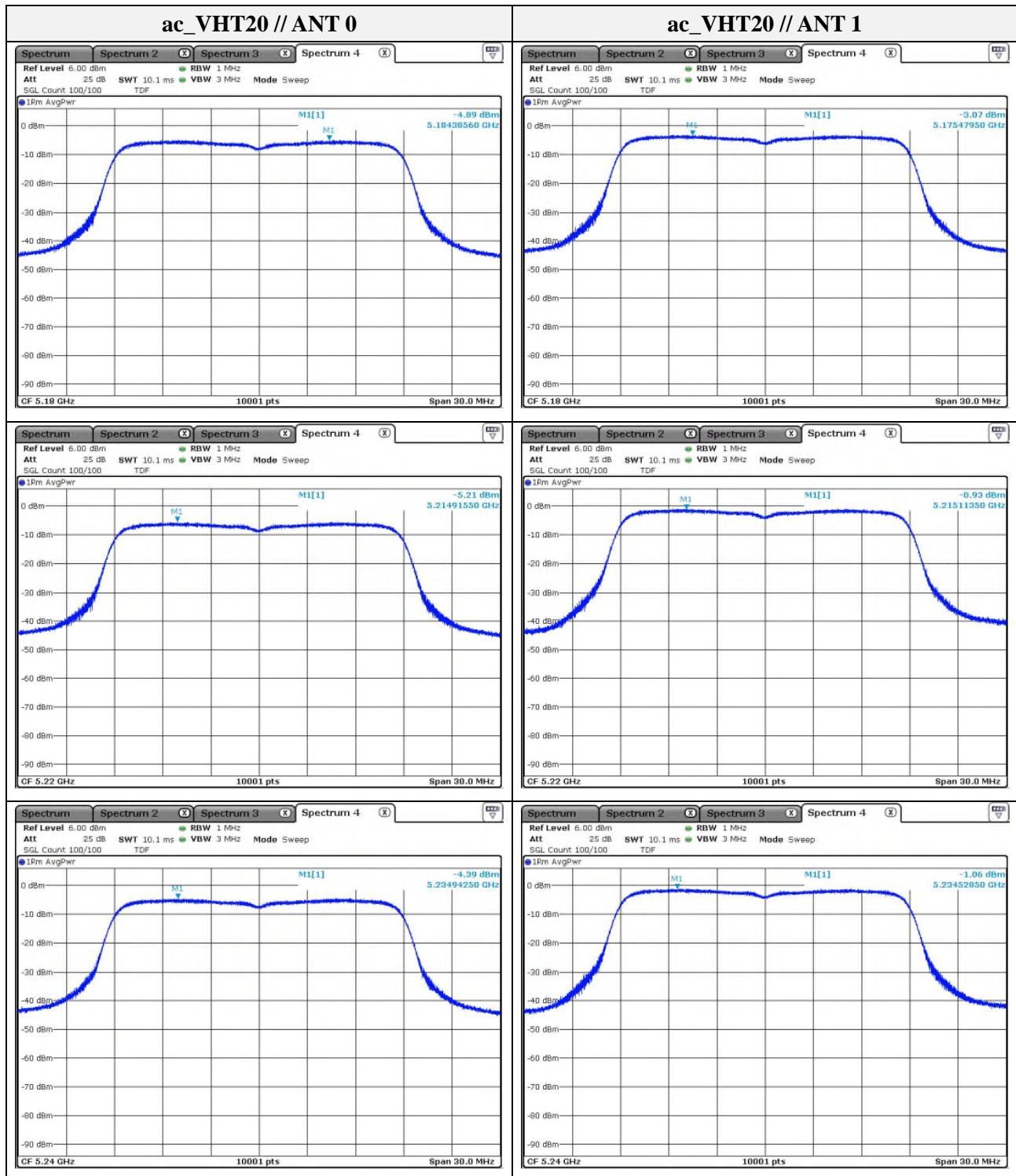
- UNII-1 =  $10\log(1 \text{ MHz}/1 \text{ MHz})$
- Refer to the page 51 on this report.
- $\text{Sum(dBm)} = \text{PSD(dBm)} + \text{RBWF} + \text{Duty correction factor (dB)}$

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## Test plots



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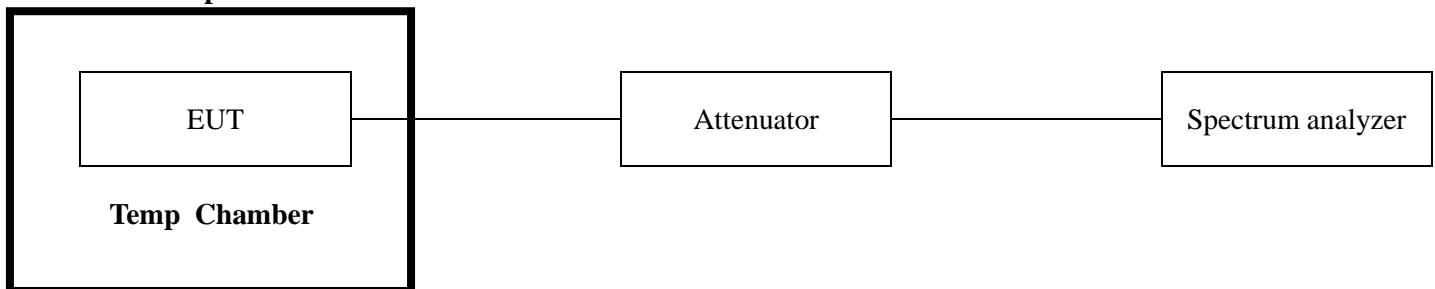
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### 3.5. Frequency Stability

#### Test procedure

ANSI C63.10-2013, clause 6.8.1

#### Test setup



1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
7. While maintaining a constant temperature inside the environmental chamber, turn the EUT on and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized. Four measurements in total are made.

#### Limit

N/A



### Test results

#### Antenna port 0

Mode: ac\_VHT20

Operating frequency: 5 180 MHz

| Test voltage (%) | Test voltage (V) | Temperature (°C) | Maintaining time | Measure frequency (MHz) | Frequency deviation (Hz) | Deviation (%) |
|------------------|------------------|------------------|------------------|-------------------------|--------------------------|---------------|
| 100 %            | DC 5.00          | -40              | Startup          | 5179.937670             | -62330                   | -0.001203     |
|                  |                  |                  | 2 minutes        | 5179.939895             | -60105                   | -0.001160     |
|                  |                  |                  | 5 minutes        | 5179.941576             | -58424                   | -0.001128     |
|                  |                  |                  | 10 minutes       | 5179.942976             | -57024                   | -0.001101     |
| 100 %            |                  | -30              | Startup          | 5179.962144             | -37856                   | -0.000731     |
|                  |                  |                  | 2 minutes        | 5179.962257             | -37743                   | -0.000729     |
|                  |                  |                  | 5 minutes        | 5179.962326             | -37674                   | -0.000727     |
|                  |                  |                  | 10 minutes       | 5179.962332             | -37668                   | -0.000727     |
| 100 %            |                  | -20              | Startup          | 5179.970307             | -29693                   | -0.000573     |
|                  |                  |                  | 2 minutes        | 5179.970188             | -29812                   | -0.000576     |
|                  |                  |                  | 5 minutes        | 5179.970107             | -29893                   | -0.000577     |
|                  |                  |                  | 10 minutes       | 5179.969994             | -30006                   | -0.000579     |
| 100 %            |                  | -10              | Startup          | 5179.972307             | -27693                   | -0.000535     |
|                  |                  |                  | 2 minutes        | 5179.972569             | -27431                   | -0.000530     |
|                  |                  |                  | 5 minutes        | 5179.972544             | -27456                   | -0.000530     |
|                  |                  |                  | 10 minutes       | 5179.972532             | -27468                   | -0.000530     |
| 100 %            |                  | 0                | Startup          | 5179.971132             | -28868                   | -0.000557     |
|                  |                  |                  | 2 minutes        | 5179.971150             | -28850                   | -0.000557     |
|                  |                  |                  | 5 minutes        | 5179.971088             | -28912                   | -0.000558     |
|                  |                  |                  | 10 minutes       | 5179.971075             | -28925                   | -0.000558     |
| 100 %            |                  | 10               | Startup          | 5179.980652             | -19348                   | -0.000374     |
|                  |                  |                  | 2 minutes        | 5179.983750             | -16250                   | -0.000314     |
|                  |                  |                  | 5 minutes        | 5179.986914             | -13086                   | -0.000253     |
|                  |                  |                  | 10 minutes       | 5179.986250             | -13750                   | -0.000265     |
| 100 %            |                  | 20               | Startup          | 5179.985069             | -14931                   | -0.000288     |
|                  |                  |                  | 2 minutes        | 5179.984250             | -15750                   | -0.000304     |
|                  |                  |                  | 5 minutes        | 5179.983117             | -16883                   | -0.000326     |
|                  |                  |                  | 10 minutes       | 5179.983245             | -16755                   | -0.000323     |
| 100 %            |                  | 23               | Startup          | 5179.942513             | -57487                   | -0.001110     |
|                  |                  |                  | 2 minutes        | 5179.942599             | -57401                   | -0.001108     |
|                  |                  |                  | 5 minutes        | 5179.942623             | -57377                   | -0.001108     |
|                  |                  |                  | 10 minutes       | 5179.942611             | -57389                   | -0.001108     |
| 100 %            |                  | 30               | Startup          | 5179.941580             | -58420                   | -0.00113      |
|                  |                  |                  | 2 minutes        | 5179.941564             | -58436                   | -0.00113      |
|                  |                  |                  | 5 minutes        | 5179.941517             | -58483                   | -0.00113      |
|                  |                  |                  | 10 minutes       | 5179.941439             | -58561                   | -0.00113      |
| 100 %            |                  | 40               | Startup          | 5179.951798             | -48202                   | -0.00093      |
|                  |                  |                  | 2 minutes        | 5179.952017             | -47983                   | -0.00093      |
|                  |                  |                  | 5 minutes        | 5179.951892             | -48108                   | -0.00093      |
|                  |                  |                  | 10 minutes       | 5179.951767             | -48233                   | -0.00093      |
| 100 %            |                  | 50               | Startup          | 5179.976204             | -23796                   | -0.00046      |
|                  |                  |                  | 2 minutes        | 5179.979954             | -20046                   | -0.00039      |
|                  |                  |                  | 5 minutes        | 5179.971688             | -28312                   | -0.00055      |
|                  |                  |                  | 10 minutes       | 5179.982626             | -17374                   | -0.00034      |
| 100 %            |                  | 60               | Startup          | 5180.031015             | 31015                    | 0.000599      |
|                  |                  |                  | 2 minutes        | 5180.032749             | 32749                    | 0.000632      |
|                  |                  |                  | 5 minutes        | 5180.033265             | 33265                    | 0.000642      |
|                  |                  |                  | 10 minutes       | 5180.036452             | 36452                    | 0.000704      |

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| Test voltage (%) | Test voltage (V) | Temperature (°C) | Maintaining time | Measure frequency (MHz) | Frequency deviation (Hz) | Deviation (%) |
|------------------|------------------|------------------|------------------|-------------------------|--------------------------|---------------|
| 100 %            | DC 5.00          | 70               | Startup          | 5180.039511             | 39511                    | 0.000763      |
|                  |                  |                  | 2 minutes        | 5180.044417             | 44417                    | 0.000857      |
|                  |                  |                  | 5 minutes        | 5180.047911             | 47911                    | 0.000925      |
|                  |                  |                  | 10 minutes       | 5180.050135             | 50135                    | 0.000968      |
| 100 %            |                  | 80               | Startup          | 5180.087435             | 87435                    | 0.001688      |
|                  |                  |                  | 2 minutes        | 5180.104231             | 104231                   | 0.002012      |
|                  |                  |                  | 5 minutes        | 5180.109590             | 109590                   | 0.002116      |
|                  |                  |                  | 10 minutes       | 5180.115356             | 115356                   | 0.002227      |
| 100 %            |                  | 85               | Startup          | 5180.129246             | 129246                   | 0.002495      |
|                  |                  |                  | 2 minutes        | 5180.142886             | 142886                   | 0.002758      |
|                  |                  |                  | 5 minutes        | 5180.149277             | 149277                   | 0.002882      |
|                  |                  |                  | 10 minutes       | 5180.154339             | 154339                   | 0.002980      |
| 85 %             | DC 4.25          | 23               | Startup          | 5179.942899             | -57101                   | -0.001102     |
|                  |                  |                  | 2 minutes        | 5179.942915             | -57085                   | -0.001102     |
|                  |                  |                  | 5 minutes        | 5179.942730             | -57270                   | -0.001106     |
|                  |                  |                  | 10 minutes       | 5179.942244             | -57756                   | -0.001115     |
| 115 %            | DC 5.75          | 23               | Startup          | 5179.942366             | -57634                   | -0.001113     |
|                  |                  |                  | 2 minutes        | 5179.942409             | -57591                   | -0.001112     |
|                  |                  |                  | 5 minutes        | 5179.942170             | -57830                   | -0.001116     |
|                  |                  |                  | 10 minutes       | 5179.942275             | -57725                   | -0.001114     |

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## Test results

### Antenna port 1

Mode: ac\_VHT20  
Operating frequency: 5 180 MHz

| Test voltage (%) | Test voltage (V) | Temperature (°C) | Maintaining time | Measure frequency (MHz) | Frequency deviation (Hz) | Deviation (%) |
|------------------|------------------|------------------|------------------|-------------------------|--------------------------|---------------|
| 100 %            | DC 5.00          | -40              | Startup          | 5179937430              | -62570                   | -0.001208     |
|                  |                  |                  | 2 minutes        | 5179938254              | -61746                   | -0.001192     |
|                  |                  |                  | 5 minutes        | 5179940053              | -59947                   | -0.001157     |
|                  |                  |                  | 10 minutes       | 5179939390              | -60610                   | -0.001170     |
| 100 %            |                  | -30              | Startup          | 5179962544              | -37456                   | -0.000723     |
|                  |                  |                  | 2 minutes        | 5179962399              | -37601                   | -0.000726     |
|                  |                  |                  | 5 minutes        | 5179962679              | -37321                   | -0.000720     |
|                  |                  |                  | 10 minutes       | 5179962989              | -37011                   | -0.000714     |
| 100 %            |                  | -20              | Startup          | 5179971034              | -28966                   | -0.000559     |
|                  |                  |                  | 2 minutes        | 5179971052              | -28948                   | -0.000559     |
|                  |                  |                  | 5 minutes        | 5179971124              | -28876                   | -0.000557     |
|                  |                  |                  | 10 minutes       | 5179971265              | -28735                   | -0.000555     |
| 100 %            |                  | -10              | Startup          | 5179972445              | -27555                   | -0.000532     |
|                  |                  |                  | 2 minutes        | 5179972569              | -27431                   | -0.000530     |
|                  |                  |                  | 5 minutes        | 5179972815              | -27185                   | -0.000525     |
|                  |                  |                  | 10 minutes       | 5179972993              | -27007                   | -0.000521     |
| 100 %            |                  | 0                | Startup          | 5179971263              | -28737                   | -0.000555     |
|                  |                  |                  | 2 minutes        | 5179971466              | -28534                   | -0.000551     |
|                  |                  |                  | 5 minutes        | 5179971600              | -28400                   | -0.000548     |
|                  |                  |                  | 10 minutes       | 5179971642              | -28358                   | -0.000547     |
| 100 %            |                  | 10               | Startup          | 5179980525              | -19475                   | -0.000376     |
|                  |                  |                  | 2 minutes        | 5179983642              | -16358                   | -0.000316     |
|                  |                  |                  | 5 minutes        | 5179985461              | -14539                   | -0.000281     |
|                  |                  |                  | 10 minutes       | 5179986690              | -13310                   | -0.000257     |
| 100 %            |                  | 20               | Startup          | 5179985444              | -14556                   | -0.000281     |
|                  |                  |                  | 2 minutes        | 5179985613              | -14387                   | -0.000278     |
|                  |                  |                  | 5 minutes        | 5179984179              | -15821                   | -0.000305     |
|                  |                  |                  | 10 minutes       | 5179983962              | -16038                   | -0.000310     |
| 100 %            |                  | 23               | Startup          | 5179942114              | -57886                   | -0.001117     |
|                  |                  |                  | 2 minutes        | 5179942256              | -57744                   | -0.001115     |
|                  |                  |                  | 5 minutes        | 5179942366              | -57634                   | -0.001113     |
|                  |                  |                  | 10 minutes       | 5179942778              | -57222                   | -0.001105     |
| 100 %            |                  | 30               | Startup          | 5179941449              | -58551                   | -0.001130     |
|                  |                  |                  | 2 minutes        | 5179941479              | -58521                   | -0.001130     |
|                  |                  |                  | 5 minutes        | 5179941490              | -58510                   | -0.001130     |
|                  |                  |                  | 10 minutes       | 5179941603              | -58397                   | -0.001127     |
| 100 %            |                  | 40               | Startup          | 5179952133              | -47867                   | -0.000924     |
|                  |                  |                  | 2 minutes        | 5179952265              | -47735                   | -0.000922     |
|                  |                  |                  | 5 minutes        | 5179952989              | -47011                   | -0.000908     |
|                  |                  |                  | 10 minutes       | 5179953124              | -46876                   | -0.000905     |
| 100 %            |                  | 50               | Startup          | 5179978453              | -21547                   | -0.000416     |
|                  |                  |                  | 2 minutes        | 5179978026              | -21974                   | -0.000424     |
|                  |                  |                  | 5 minutes        | 5179978606              | -21394                   | -0.000413     |
|                  |                  |                  | 10 minutes       | 5179978143              | -21857                   | -0.000422     |
| 100 %            |                  | 60               | Startup          | 5180032282              | 32282                    | 0.000623      |
|                  |                  |                  | 2 minutes        | 5180032346              | 32346                    | 0.000624      |
|                  |                  |                  | 5 minutes        | 5180033267              | 33267                    | 0.000642      |
|                  |                  |                  | 10 minutes       | 5180034370              | 34370                    | 0.000664      |

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| Test voltage (%) | Test voltage (V) | Temperature (°C) | Maintaining time | Measure frequency (MHz) | Frequency deviation (Hz) | Deviation (%) |
|------------------|------------------|------------------|------------------|-------------------------|--------------------------|---------------|
| 100 %            | DC 5.00          | 70               | Startup          | 5180046159              | 46159                    | 0.000891      |
|                  |                  |                  | 2 minutes        | 5180048196              | 48196                    | 0.000930      |
|                  |                  |                  | 5 minutes        | 5180047908              | 47908                    | 0.000925      |
|                  |                  |                  | 10 minutes       | 5180049891              | 49891                    | 0.000963      |
| 100 %            |                  | 80               | Startup          | 5180093612              | 93612                    | 0.001807      |
|                  |                  |                  | 2 minutes        | 5180098663              | 98663                    | 0.001905      |
|                  |                  |                  | 5 minutes        | 5180101425              | 101425                   | 0.001958      |
|                  |                  |                  | 10 minutes       | 5180108463              | 108463                   | 0.002094      |
| 100 %            |                  | 85               | Startup          | 5180122536              | 122536                   | 0.002366      |
|                  |                  |                  | 2 minutes        | 5180137468              | 137468                   | 0.002654      |
|                  |                  |                  | 5 minutes        | 5180140105              | 140105                   | 0.002705      |
|                  |                  |                  | 10 minutes       | 5180142690              | 142690                   | 0.002755      |
| 85 %             | DC 4.25          | 23               | Startup          | 5179942134              | -57866                   | -0.001117     |
|                  |                  |                  | 2 minutes        | 5179942288              | -57712                   | -0.001114     |
|                  |                  |                  | 5 minutes        | 5179942416              | -57584                   | -0.001112     |
|                  |                  |                  | 10 minutes       | 5179942624              | -57376                   | -0.001108     |
| 115 %            | DC 5.75          | 23               | Startup          | 5179942318              | -57682                   | -0.001114     |
|                  |                  |                  | 2 minutes        | 5179942503              | -57497                   | -0.001110     |
|                  |                  |                  | 5 minutes        | 5179942669              | -57331                   | -0.001107     |
|                  |                  |                  | 10 minutes       | 5179942801              | -57199                   | -0.001104     |

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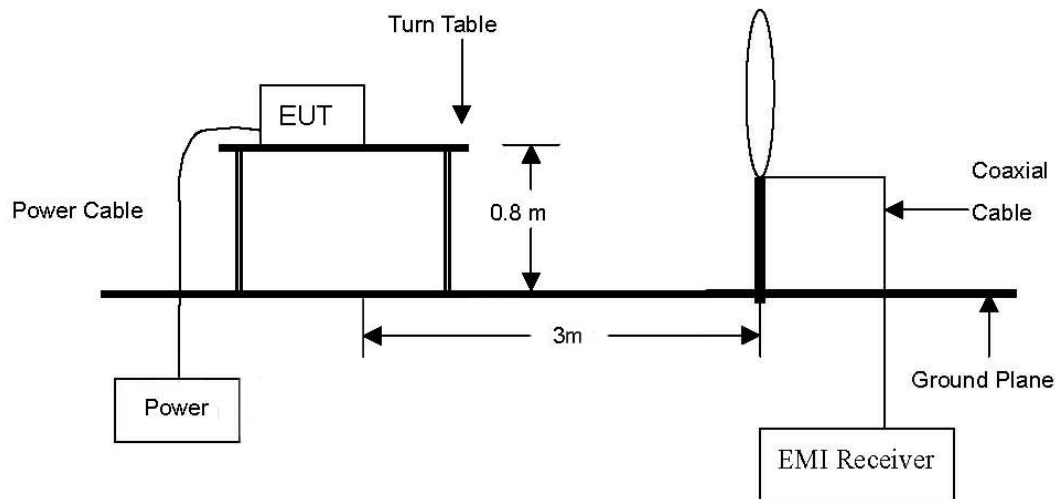
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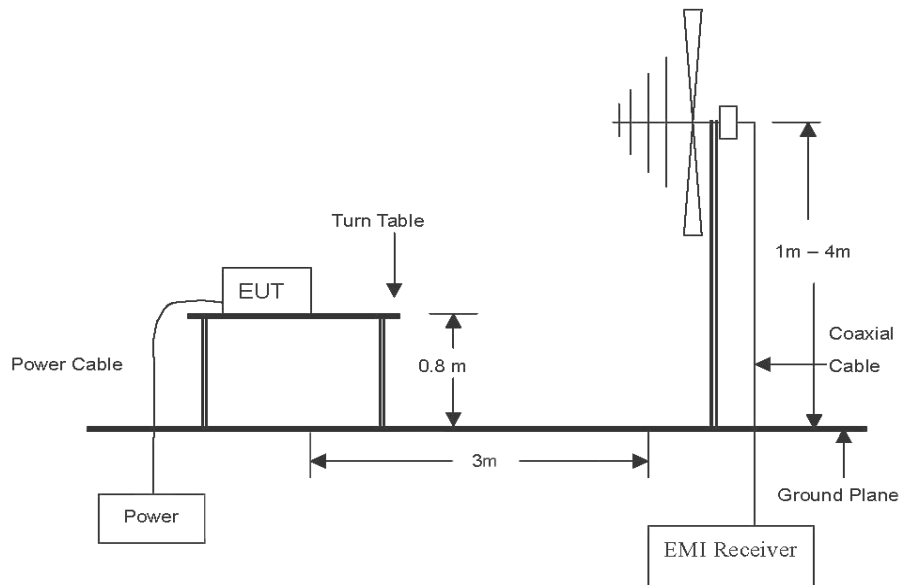
### 3.6. Radiated restricted band and emissions

#### 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.



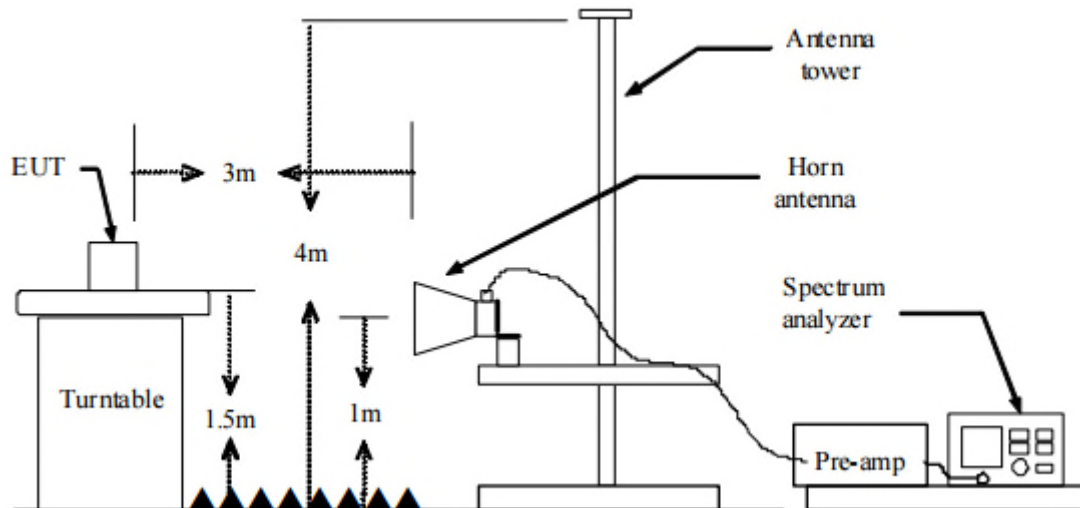
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The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz emissions, whichever is lower.



#### Test procedure below 30 MHz

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Then antenna is a loop antenna is fixed at one meter above the ground to determine the maximum value of the field strength. Both parallel and perpendicular of the antenna are set to make the measurement.
3. We have done x, y, z planes in EUT and horizontal and vertical polarization and Parallel to the ground plane in detecting antenna.
4. For each suspected emission, the EUT was arranged to its worst case and then the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to average or quasi peak detect function and Specified Bandwidth with Maximum hold mode.

#### Test procedure above 30 MHz

1. Spectrum analyzer settings for  $f < 1$  GHz:
  - ① Span = wide enough to fully capture the emission being measured
  - ② RBW = 120 kHz
  - ③ VBW  $\geq$  RBW
  - ④ Detector = quasi peak
  - ⑤ Sweep time = auto
  - ⑥ Trace = max hold
2. Spectrum analyzer settings for  $f \geq 1$  GHz: Peak
  - ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
  - ② RBW = 1 MHz
  - ③ VBW = 3 MHz ( $\geq 3 \times$  RBW)
  - ④ Detector = peak
  - ⑤ Sweep time = auto
  - ⑥ Trace = max hold
  - ⑦ Trace was allowed to stabilize

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3. Spectrum analyzer settings for  $f \geq 1$  GHz: Average

- ① Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
- ② RBW = 1 MHz
- ③ VBW  $\geq 3 \times$  RBW
- ④ Detector = RMS, if span/(# of points in sweep)  $\leq$  (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.
- ⑤ 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 in order to use linear voltage averaging. Log or dB averaging shall not be used.
- ⑥ Sweep = auto
- ⑦ Trace = max hold
- ⑧ Perform a trace average of at least 100 traces.
- ⑨ A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:
  - 1) If power averaging (RMS) mode was used in step ⑤, then the applicable correction factor is  $10 \log(1/x)$ , where  $x$  is the duty cycle.
  - 2) If linear voltage averaging mode was used in step ⑤, then the applicable correction factor is  $20 \log(1/x)$ , where  $x$  is the duty cycle.
  - 3) If a specific emission is demonstrated to be continuous ( $\geq 98$  percent duty cycle) rather than turning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

**Note.**

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. CF(Correction factors(dB)) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or  $F_d$ (dB)
4. Field strength(dB $\mu$ V/m) = Level(dB $\mu$ V) + CF (dB) + or DCF(dB)
5. Margin(dB) = Limit(dB $\mu$ V/m) - Field strength(dB $\mu$ V/m)
6. Emissions below 18 GHz were measured at a 3 meter test distance while emissions above 18 GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. 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**.
8. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
9. 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.

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### Limit

According to 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values :

| Frequency (MHz) | Distance (Meters) | Radiated ( $\mu\text{V/m}$ ) |
|-----------------|-------------------|------------------------------|
| 0.009 ~ 0.490   | 300               | 2400/F(kHz)                  |
| 0.490 ~ 1.705   | 30                | 24000/F(kHz)                 |
| 1.705 ~ 30.0    | 30                | 30                           |
| 30 ~ 88         | 3                 | 100**                        |
| 88 ~ 216        | 3                 | 150**                        |
| 216 ~ 960       | 3                 | 200**                        |
| Above 960       | 3                 | 500                          |

\*\*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., Sections 15.231 and 15.241.

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According to 15.407(b), (b) Undesirable emission limits: Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) For transmitters operating in the 5.15–5.25 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.
- (2) For transmitters operating in the 5.25–5.35 GHz band: All emissions outside of the 5.15–5.35 GHz band shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.
- (3) For transmitters operating in the 5.47–5.725 GHz band: All emissions outside of the 5.47–5.725 GHz band shall not exceed an e.i.r.p. of  $-27$  dBm/MHz.
- (4) For transmitters operating in the 5.725–5.85 GHz band:
  - i) All emissions shall be limited to a level of  $-27$  dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.
  - ii) Devices certified before March 2, 2017 with antenna gain greater than 10 dBi may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease by March 2, 2018. Devices certified before March 2, 2018 with antenna gain of 10 dBi or less may demonstrate compliance with the emission limits in §15.247(d), but manufacturing, marketing and importing of devices certified under this alternative must cease before March 2, 2020.
- (5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
- (6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in § 15.207.
- (7) The provisions of §15.205 apply to intentional radiators operating under this section.
- (8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

### Duty cycle

Regarding to KDB 789033 D02 v02r01, B)2)b), the maximum duty cycles of all modes were investigated and set the spectrum analyzer as below.

Set  $RBW \geq OBW$  if possible; otherwise, set RBW to the largest available value. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are  $> 50/T$ , where T is defined in II.B.1.a), and the number of sweep points across duration T exceeds 100.

For the band 5.15-5.25 GHz

| Test mode      | T <sub>on</sub> time<br>(ms) | Period<br>(ms) | Duty cycle<br>(Linear) | Duty cycle<br>(%) | Duty cycle correction<br>factor<br>(dB) |
|----------------|------------------------------|----------------|------------------------|-------------------|---|
| 802.11ac_VHT20 | 1                            | 1              | 1                      | 100               | 0                                       |

### Note:

Duty cycle (Linear) = T<sub>on</sub> time/Period

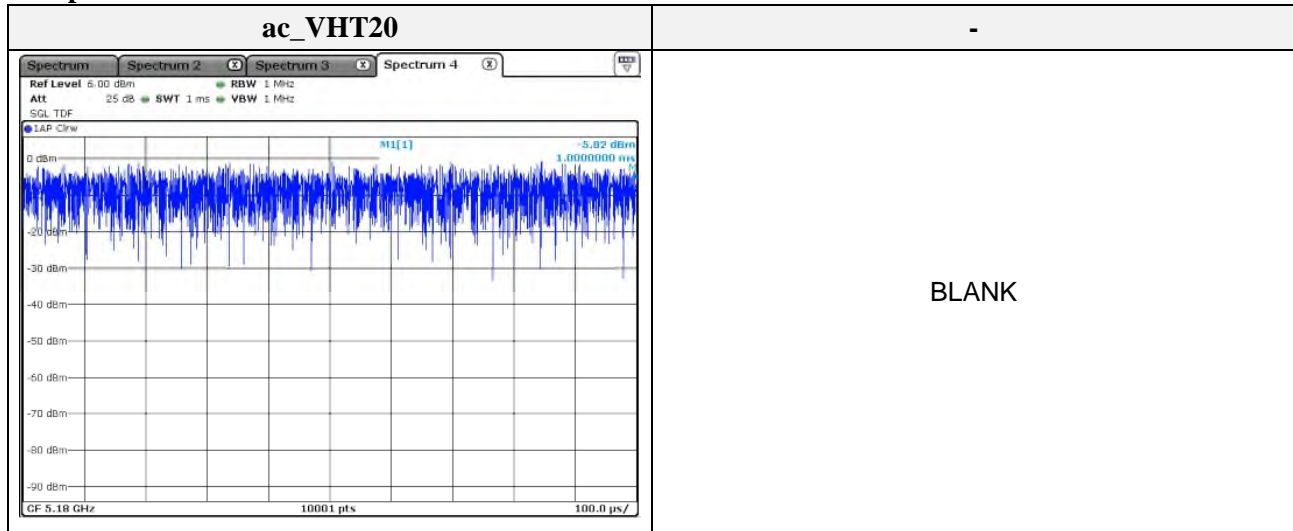
DCF(Duty cycle correction factor (dB)) =  $10\log(1/\text{duty cycle})$

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## Test plots



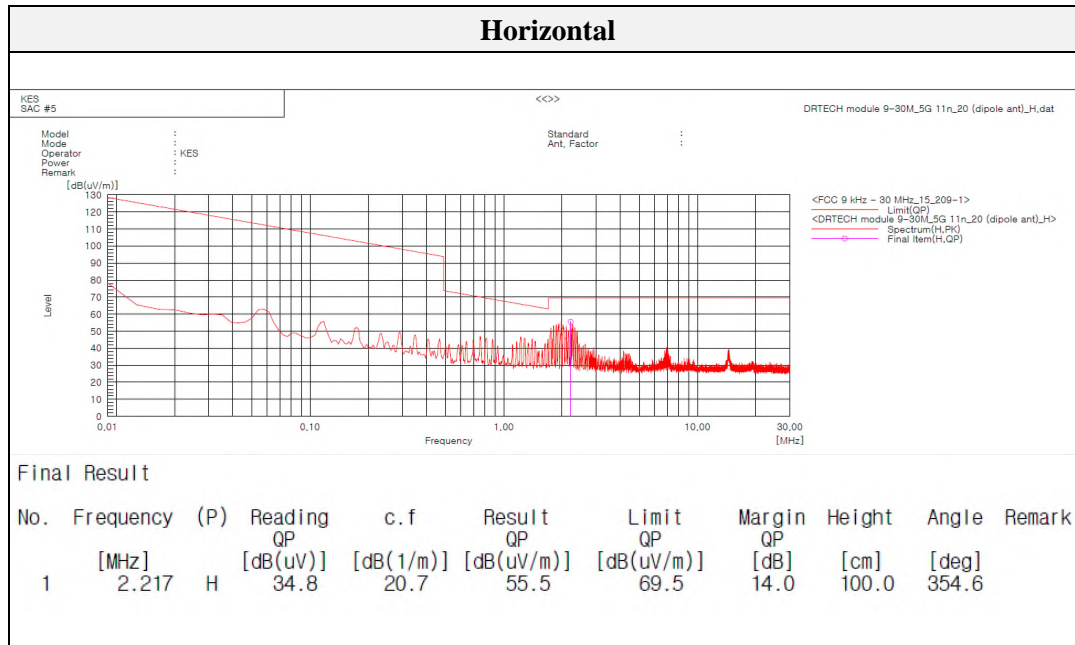
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### Test results (Below 30 MHz) – Worst case

Mode: ac\_VHT20  
 Distance of measurement: 3 meter  
 Channel: 36 (Worst case)  
 ANT #1 Dipole Antenna



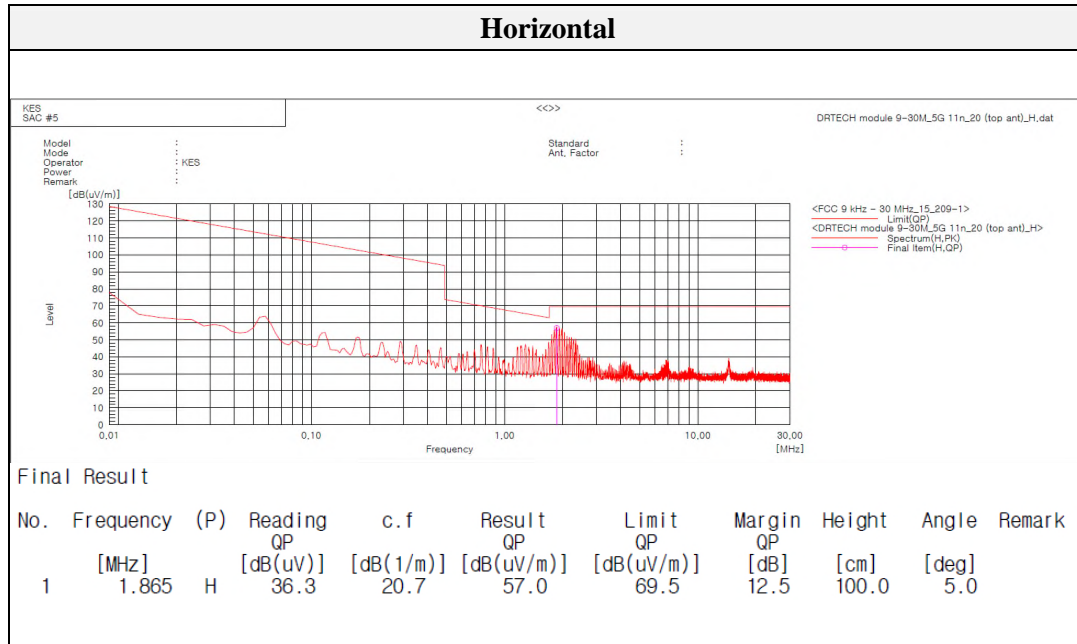
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Mode: ac\_VHT20  
Distance of measurement: 3 meter  
Channel: 36 (Worst case)  
ANT #2: PCB Antenna



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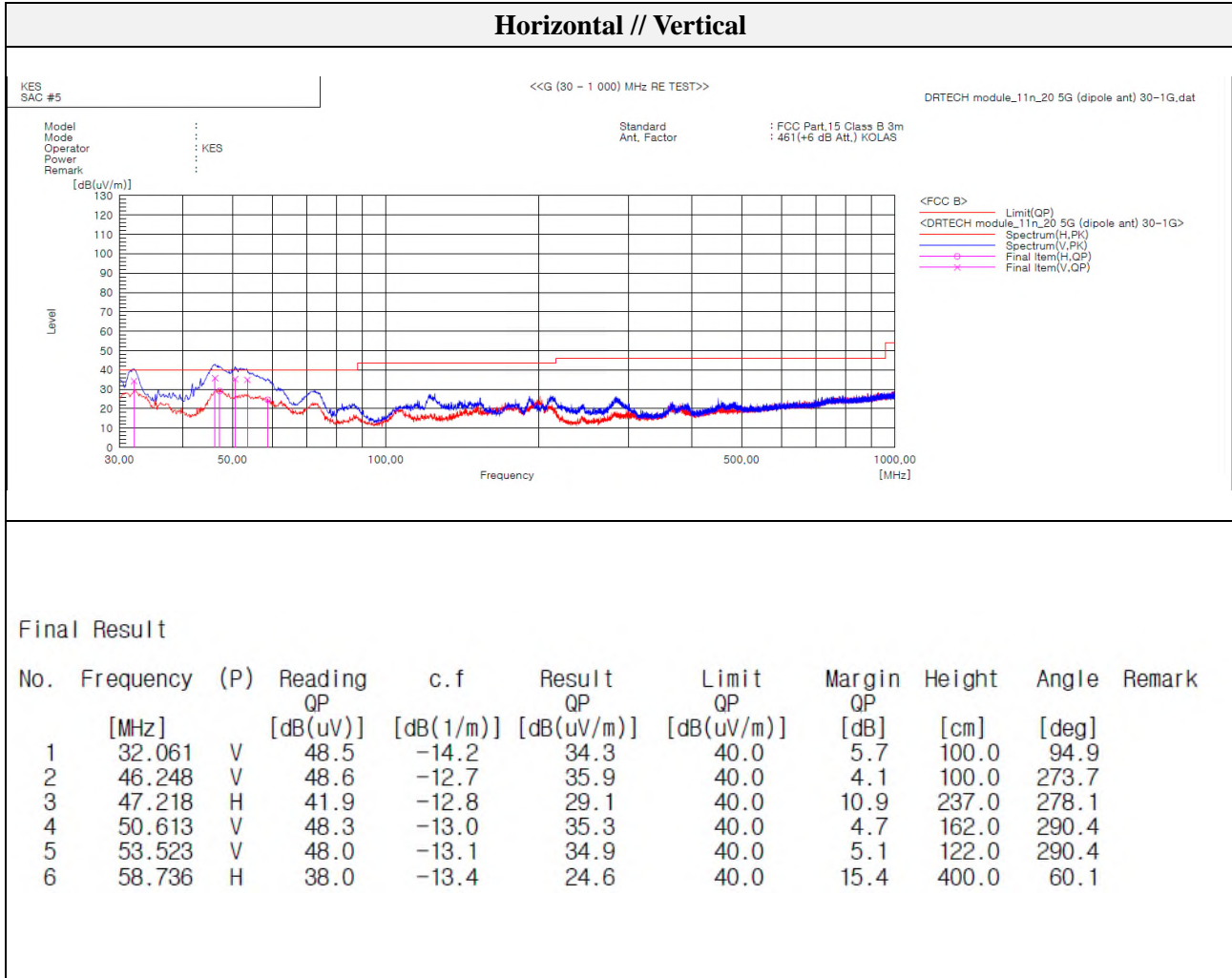
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### Test results (Below 1 000 MHz) – Worst case

Mode: ac\_VHT20  
Distance of measurement: 3 meter  
Channel: 36 (Worst case)  
ANT #1 Dipole Antenna



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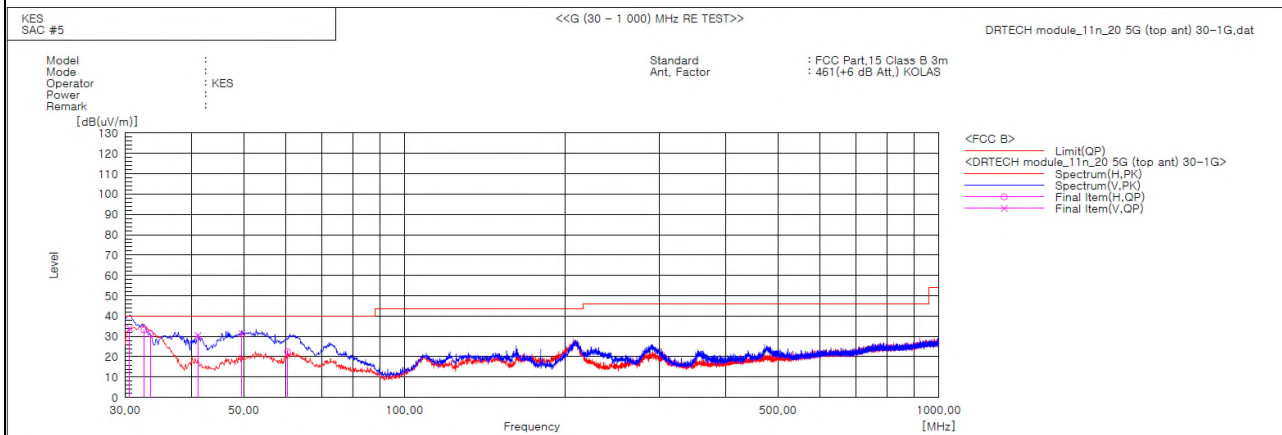
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Mode: ac\_VHT20  
Distance of measurement: 3 meter  
Channel: 36 (Worst case)  
ANT #2 PCB Antenna

### Horizontal // Vertical



### Final Result

| No. | Frequency [MHz] | (P) | Reading QP [dB(uV)] | c.f [dB(1/m)] | Result QP [dB(uV/m)] | Limit QP [dB(uV/m)] | Margin QP [dB] | Height [cm] | Angle [deg] | Remark |
|-----|-----------------|-----|---------------------|---------------|----------------------|---------------------|----------------|-------------|-------------|--------|
| 1   | 30.606          | V   | 48.2                | -14.3         | 33.9                 | 40.0                | 6.1            | 100.0       | 162.7       |        |
| 2   | 32.546          | H   | 47.3                | -14.1         | 33.2                 | 40.0                | 6.8            | 377.0       | 217.3       |        |
| 3   | 33.516          | H   | 45.3                | -14.0         | 31.3                 | 40.0                | 8.7            | 400.0       | 139.2       |        |
| 4   | 41.034          | V   | 43.6                | -13.2         | 30.4                 | 40.0                | 9.6            | 100.0       | 289.2       |        |
| 5   | 49.643          | V   | 44.3                | -12.9         | 31.4                 | 40.0                | 8.6            | 125.0       | 284.7       |        |
| 6   | 60.434          | H   | 35.9                | -13.5         | 22.4                 | 40.0                | 17.6           | 400.0       | 55.8        |        |

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### Test results (Above 1 000 MHz)

Mode: UNII-1(ac\_VHT20)

Distance of measurement: 3 meter

Channel: 36

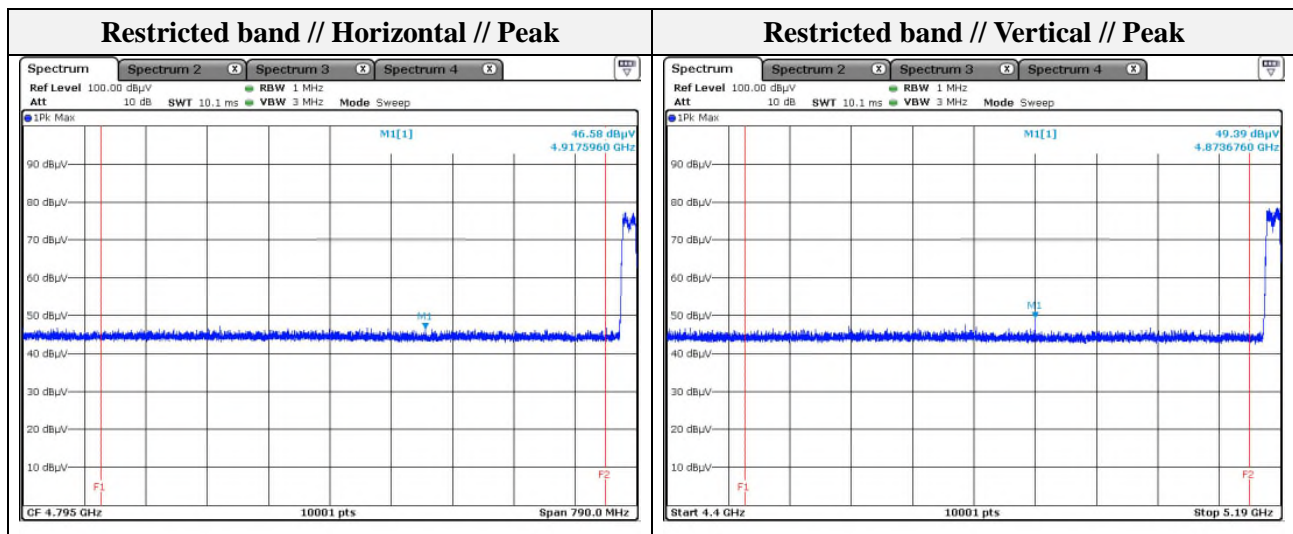
ANT #1 Dipole Antenna

#### - Spurious

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 1020.75         | 49.35        | Peak        | H               | -11.31  | -        | 38.04                   | 74.00          | 35.96       |
| 1176.73         | 50.24        | Peak        | V               | -11.26  | -        | 38.98                   | 74.00          | 35.02       |

#### - Band edge

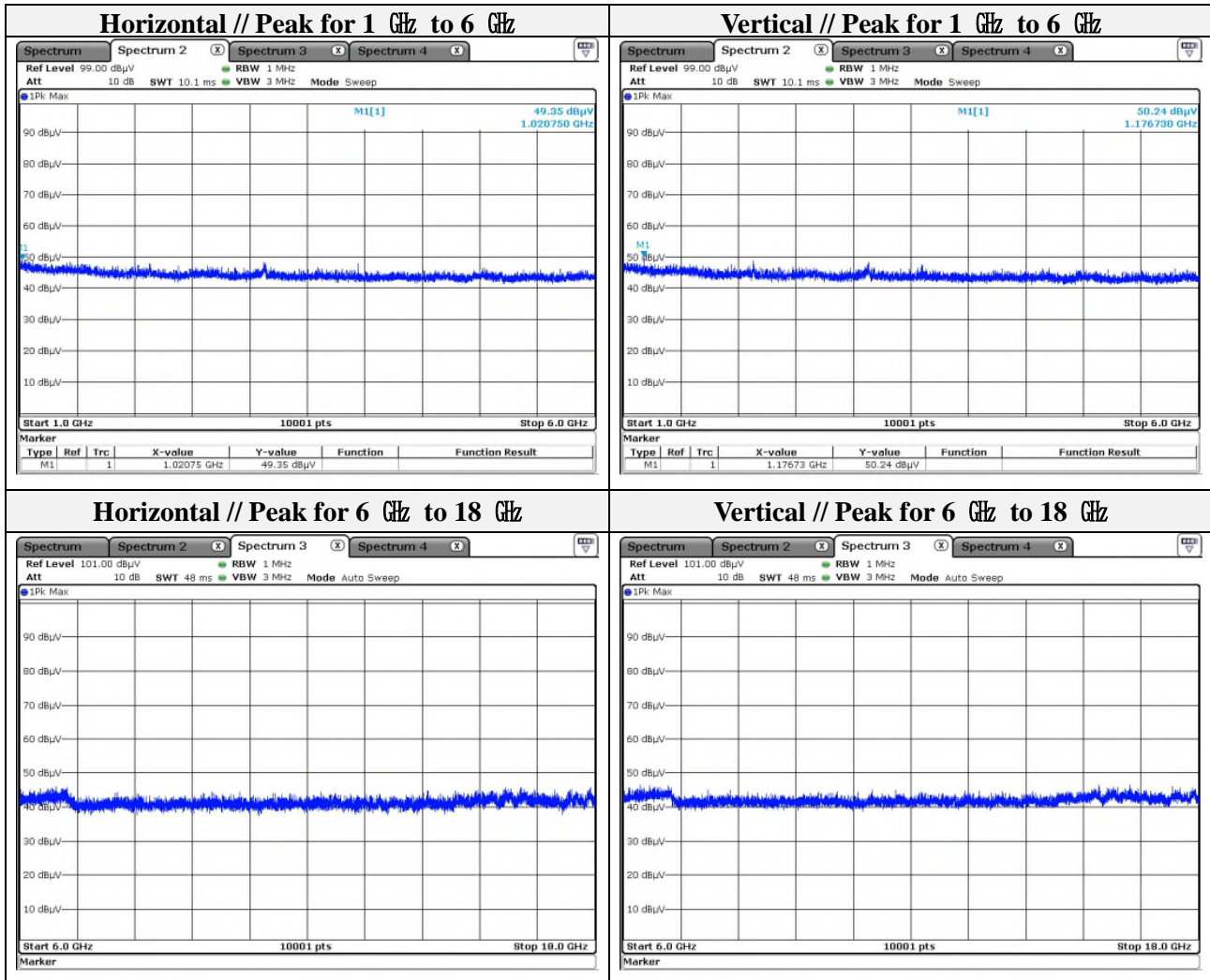
| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 4917.60         | 46.58        | Peak        | H               | 4.31    | -        | 50.89                   | 74.00          | 23.11       |
| 4873.68         | 49.39        | Peak        | V               | 3.98    | -        | 53.37                   | 74.00          | 20.63       |



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Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

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Mode: UNII-1(ac\_VHT20)

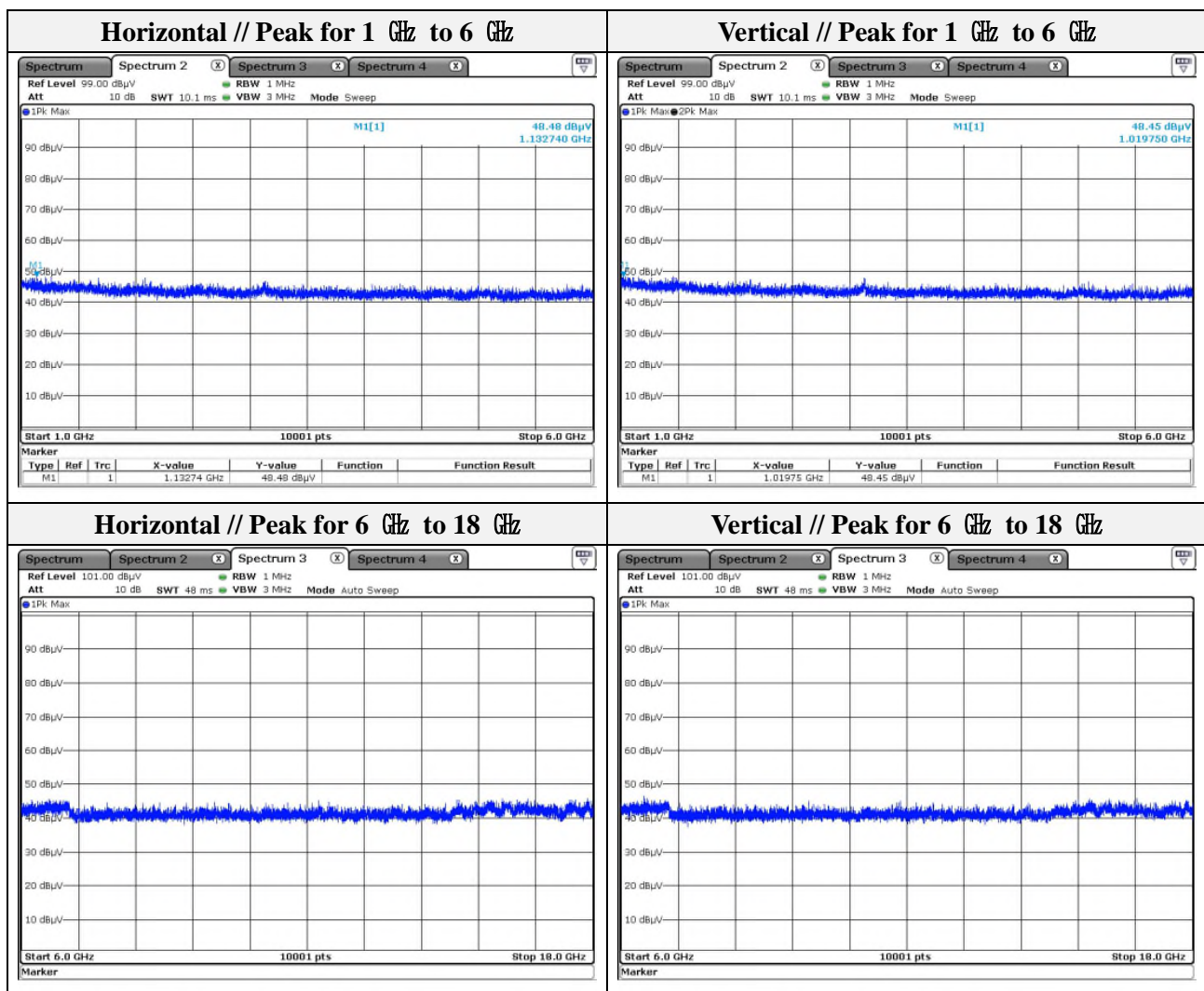
Distance of measurement: 3 meter

Channel: 44

ANT #1 Dipole Antenna

- Spurious

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 1132.74         | 48.48        | Peak        | H               | -11.28  | -        | 37.20                   | 74.00          | 36.80       |
| 1019.75         | 48.45        | Peak        | V               | -11.32  | -        | 37.13                   | 74.00          | 36.87       |



Note.

1. No spurious emission were detected above 6 GHz.

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Mode: UNII-1(ac\_VHT20)

Distance of measurement: 3 meter

Channel: 48

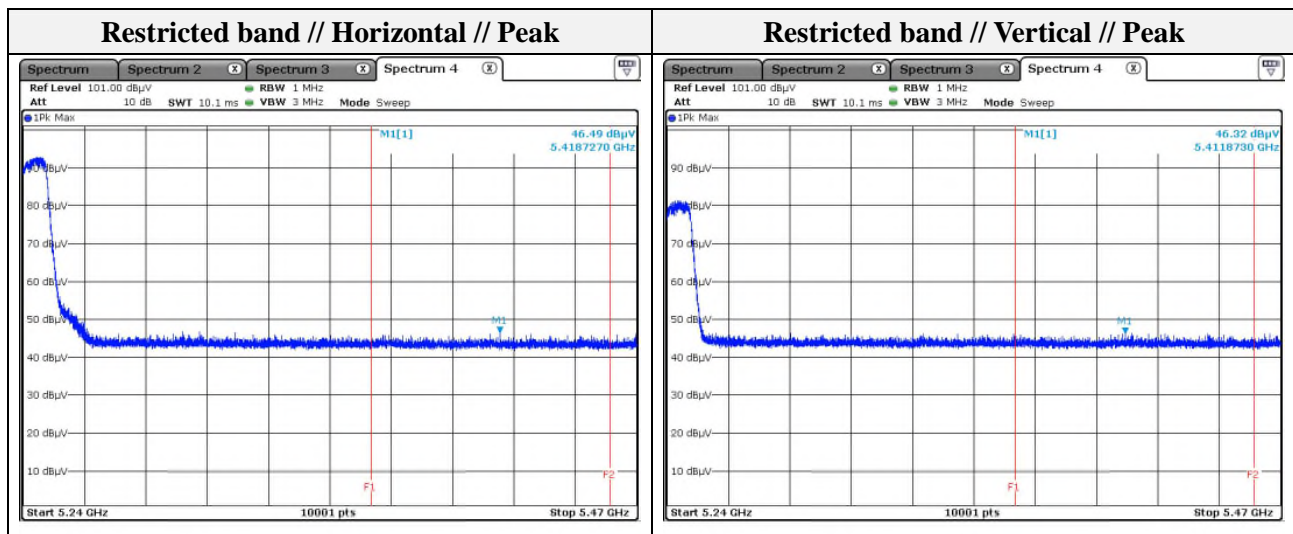
ANT #1 Dipole Antenna

- Spurious

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 1054.24         | 48.10        | Peak        | H               | -11.30  | -        | 36.80                   | 74.00          | 37.20       |
| 1134.24         | 49.38        | Peak        | V               | -11.27  | -        | 38.11                   | 74.00          | 35.89       |

- Band edge

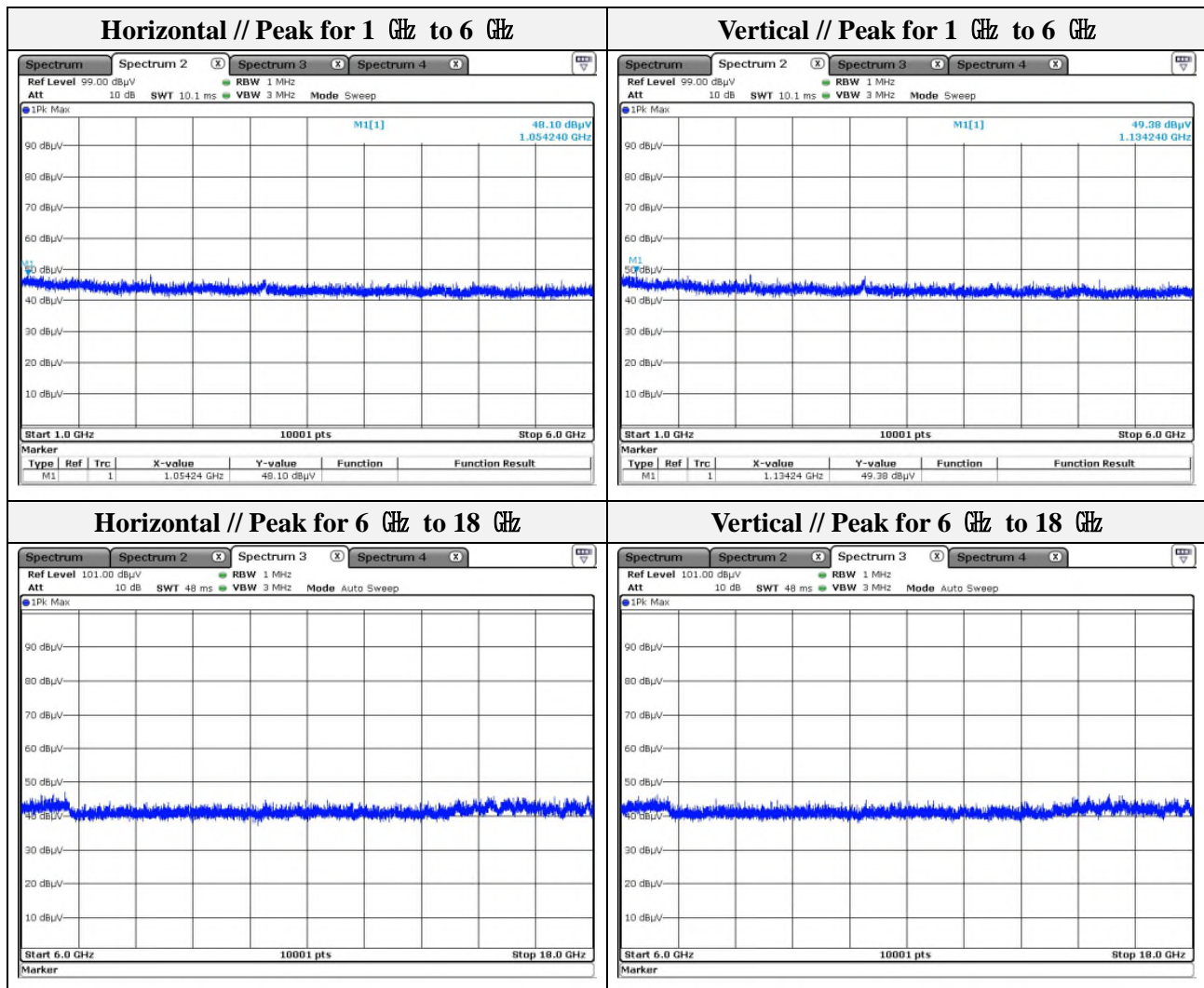
| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 5418.73         | 46.49        | Peak        | H               | 2.88    | -        | 49.37                   | 74.00          | 24.63       |
| 5411.87         | 46.32        | Peak        | V               | 2.91    | -        | 49.23                   | 74.00          | 24.77       |



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Note.

1. No spurious emission were detected above 6 GHz.

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Mode: UNII-1(ac\_VHT20)

Distance of measurement: 3 meter

Channel: 36

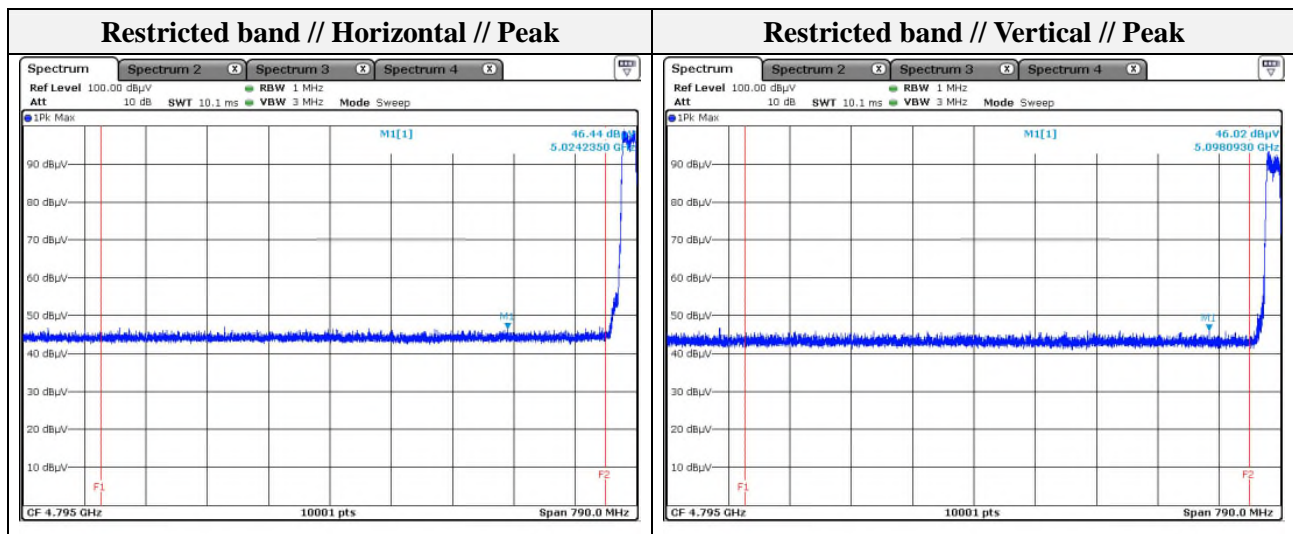
ANT #2 PCB Antenna

- Spurious

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 1049.75         | 48.89        | Peak        | H               | -11.30  | -        | 37.59                   | 74.00          | 36.41       |
| 1133.24         | 48.00        | Peak        | V               | -11.28  |          | 36.72                   | 74.00          | 37.28       |

- Band edge

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 5024.24         | 46.44        | Peak        | H               | 4.80    | -        | 51.24                   | 74.00          | 22.76       |
| 5098.09         | 46.02        | Peak        | V               | 4.35    | -        | 50.37                   | 74.00          | 23.63       |

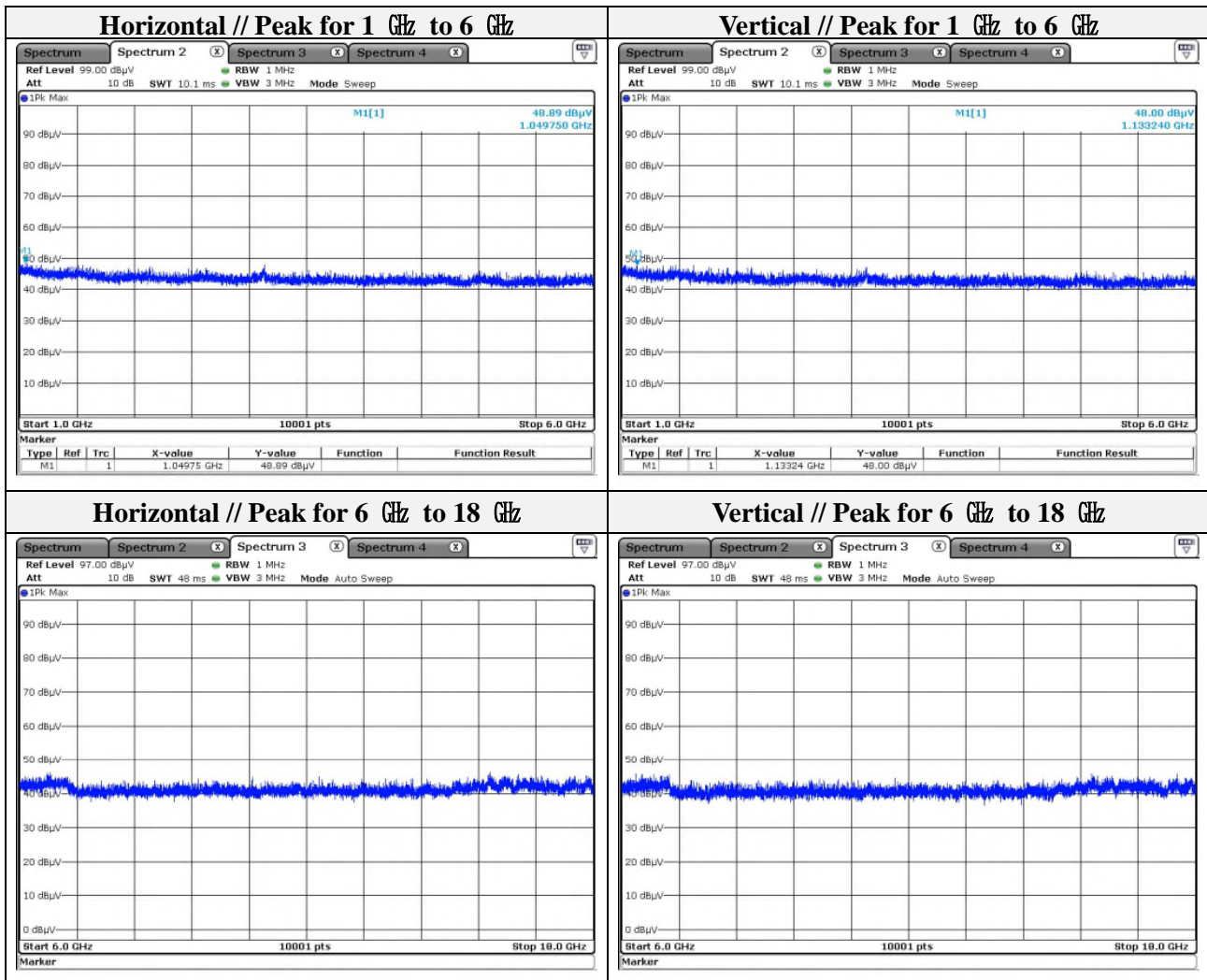


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Note.

1. No spurious emission were detected above 6 GHz.
2. Average test would be performed if the peak result were greater than the average limit.

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Mode: UNII-1(ac\_VHT20)

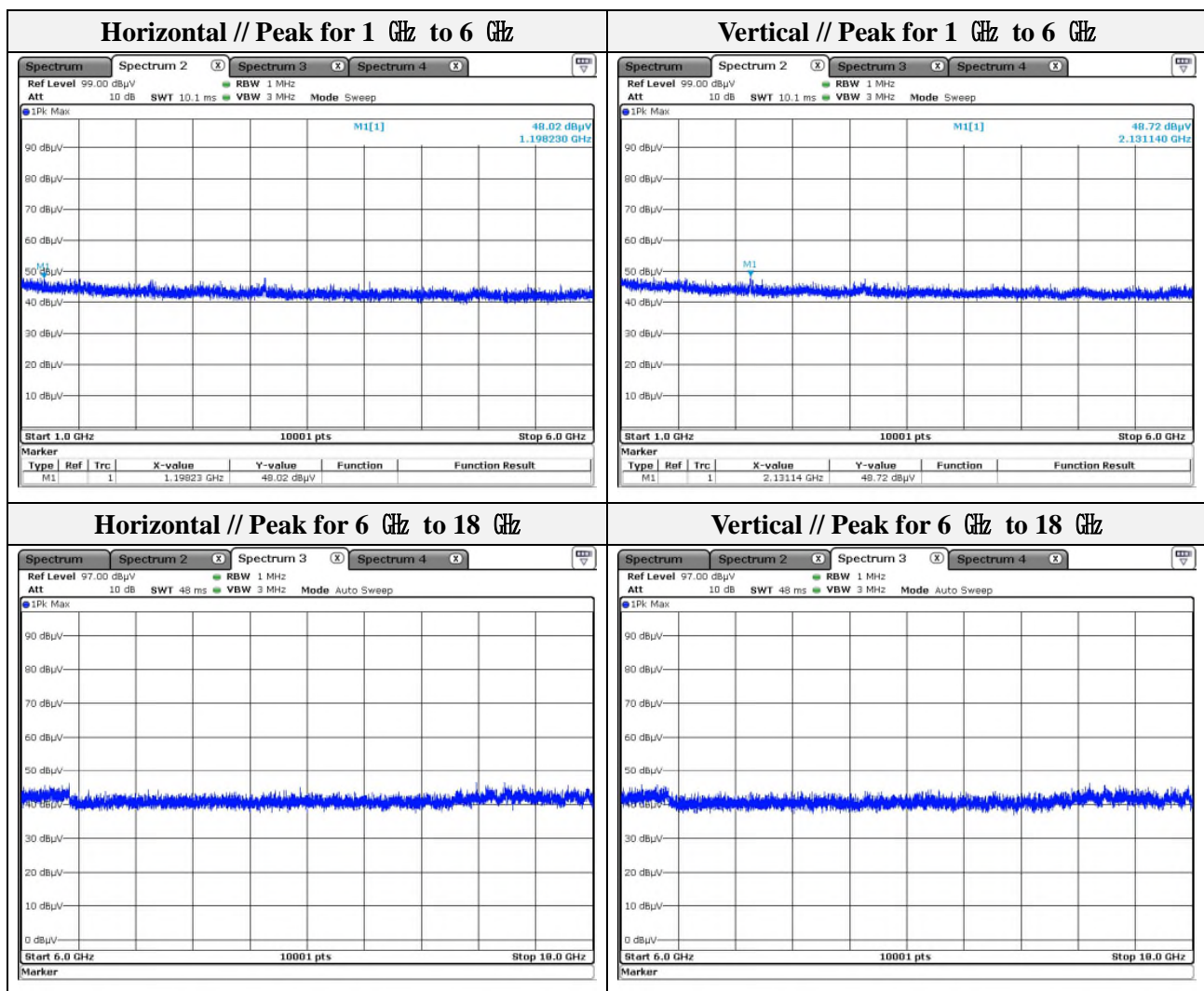
Distance of measurement: 3 meter

Channel: 44

ANT #2 PCB Antenna

- Spurious

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 1198.23         | 48.02        | Peak        | H               | -11.25  | -        | 36.77                   | 74.00          | 37.23       |
| 2131.14         | 48.72        | Peak        | V               | -5.97   | -        | 42.75                   | 68.20          | 25.45       |



Note.

1. No spurious emission were detected above 6 GHz.

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Mode: UNII-1(ac\_VHT20)

Distance of measurement: 3 meter

Channel: 48

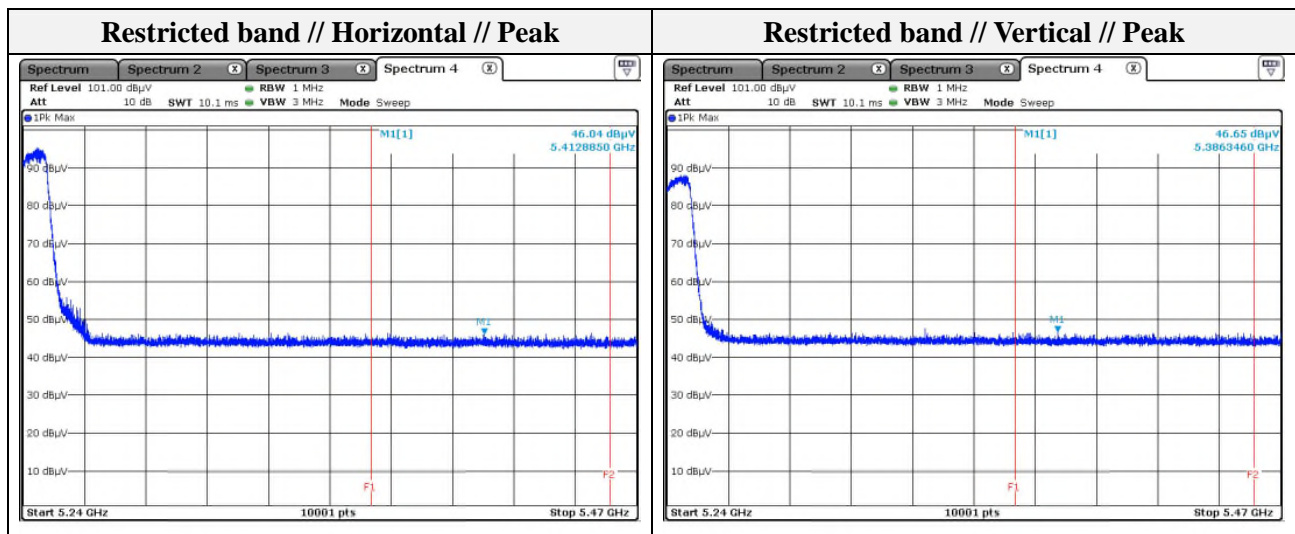
ANT #2 PCB Antenna

#### - Spurious

| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 1006.75         | 48.23        | Peak        | H               | -11.32  | -        | 36.91                   | 74.00          | 37.09       |
| 2126.14         | 48.48        | Peak        | V               | -5.94   | -        | 42.54                   | 68.20          | 25.66       |

#### - Band edge

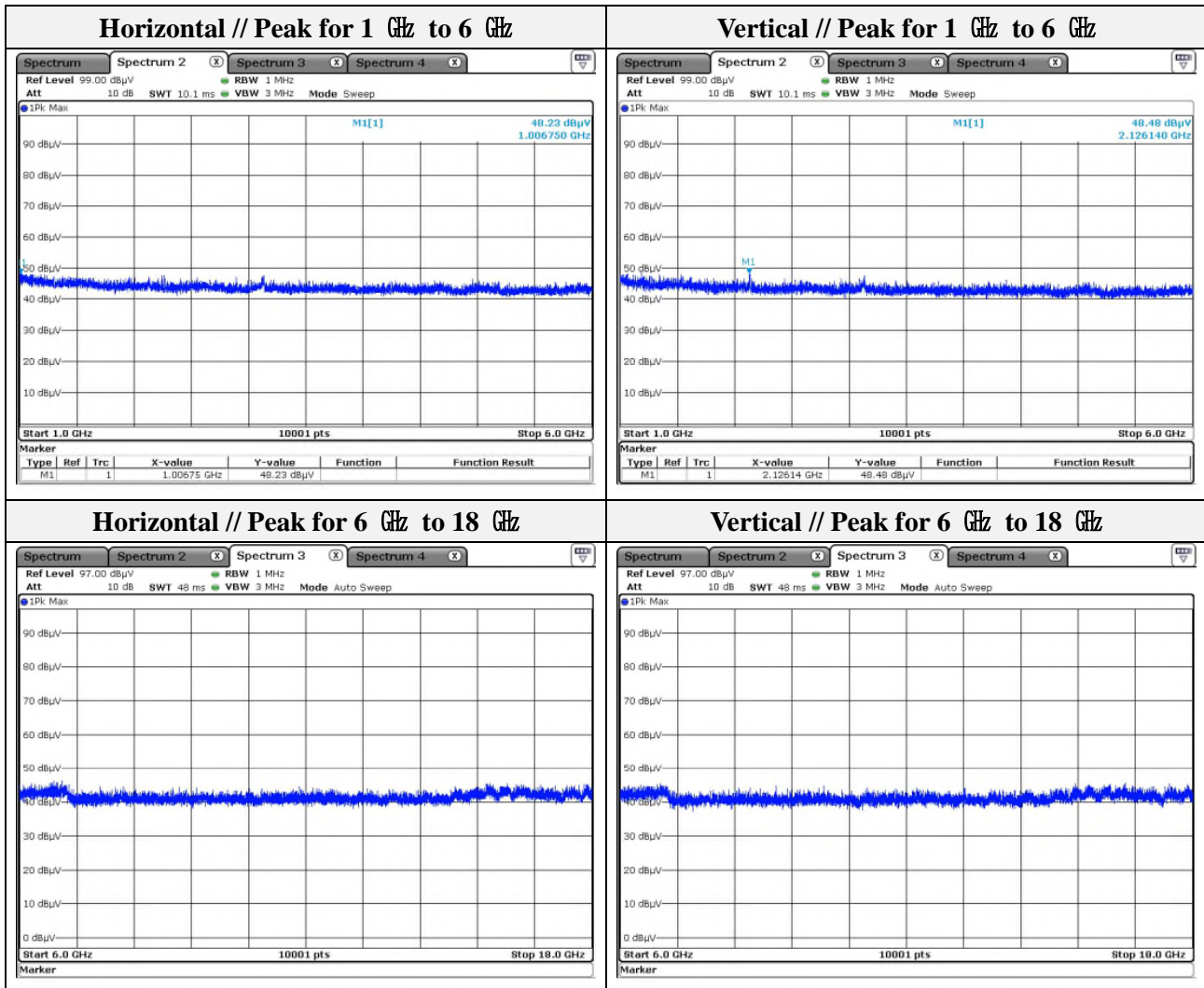
| Frequency (MHz) | Level (dBμV) | Detect mode | Ant. Pol. (H/V) | CF (dB) | DCF (dB) | Field strength (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|--------------|-------------|-----------------|---------|----------|-------------------------|----------------|-------------|
| 5412.90         | 46.04        | Peak        | H               | 2.91    | -        | 48.95                   | 74.00          | 25.05       |
| 5386.35         | 46.65        | Peak        | V               | 3.01    | -        | 49.66                   | 74.00          | 24.34       |



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Note.

1. No spurious emission were detected above 6 GHz.

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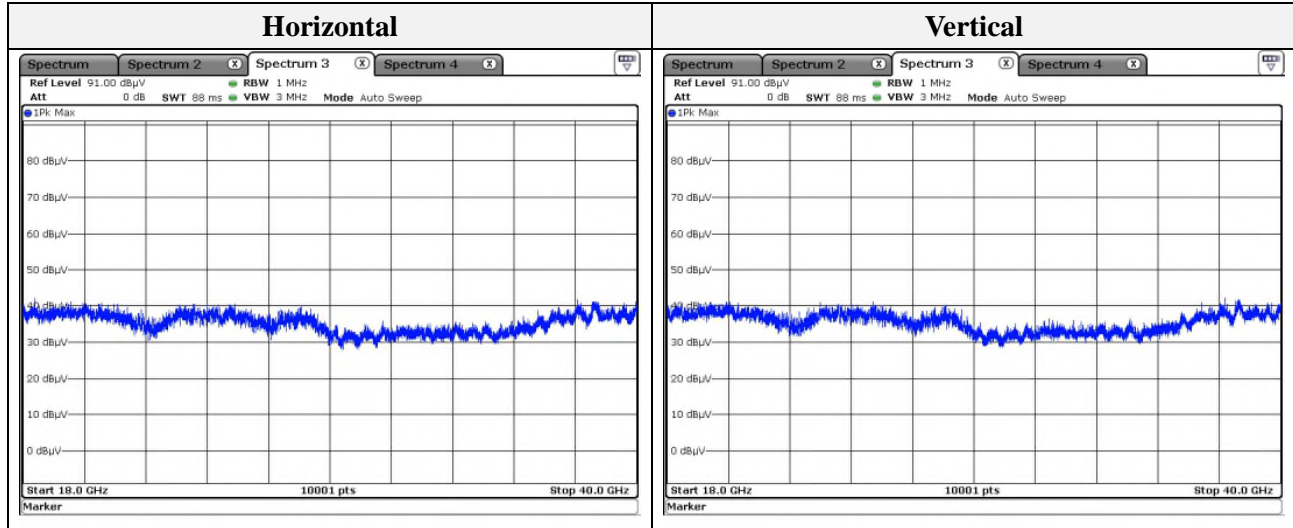
### Test results (18 GHz to 40 GHz) – Worst case

Mode: UNII-1(ac\_VHT20)

Distance of measurement: 3 meter

Channel: 36

ANT #1 Dipole Antenna



Note.

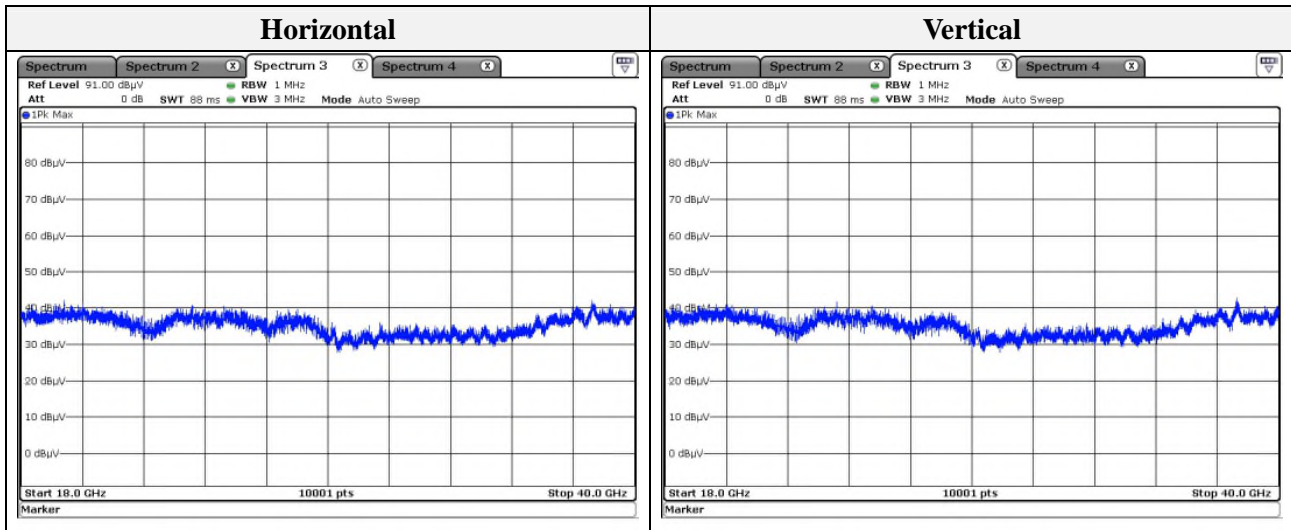
1. No spurious emission were detected above 18 GHz.

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Mode: UNII-1(ac\_VHT20)  
 Distance of measurement: 3 meter  
 Channel: 36  
 ANT #2: PCB Antenna



Note.

1. No spurious emission were detected above 18 GHz.

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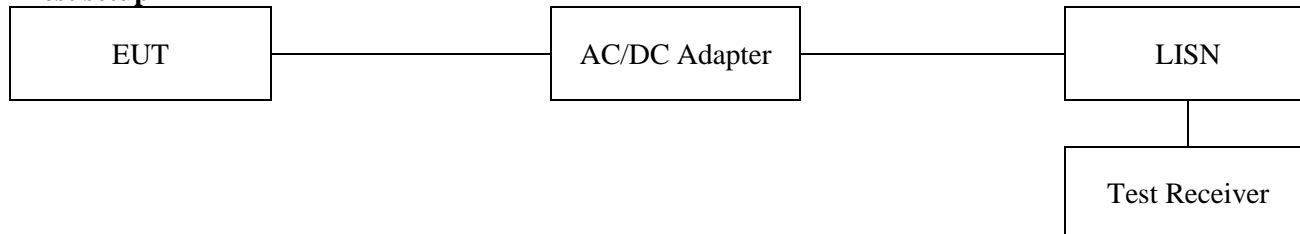
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### 3.7 AC conducted emissions

#### 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 50uH/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       |

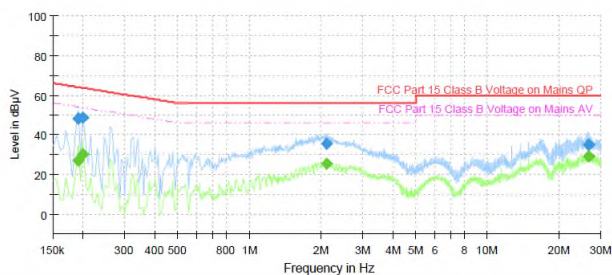
#### Note:

1. All AC line conducted spurious emission are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and the appropriate frequencies. All data rates and modes were investigated for conducted spurious emission. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.
2. Both Cable loss and LISN factor are included in measurement level(QP Level or AV Level).

## Test results

Mode: UNII-1(ac\_VHT20)  
Distance of measurement: 3 meter  
Channel: 36 (Worst case)  
ANT #2: PCB Antenna(Worst case)

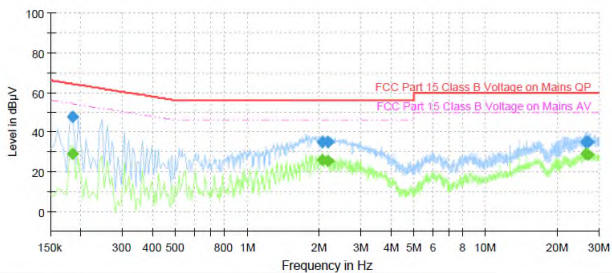
### Hot Line



#### Final Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.190000        | ---              | 26.91           | 54.04        | 27.13       | 1000.0          | 9.000           | L1   | 9.6        |
| 0.190000        | 48.43            | ---             | 64.04        | 15.61       | 1000.0          | 9.000           | L1   | 9.6        |
| 0.200000        | ---              | 30.31           | 53.61        | 23.30       | 1000.0          | 9.000           | L1   | 9.6        |
| 0.200000        | 48.88            | ---             | 63.61        | 14.73       | 1000.0          | 9.000           | L1   | 9.6        |
| 2.120000        | ---              | 25.45           | 46.00        | 20.55       | 1000.0          | 9.000           | L1   | 10.2       |
| 2.120000        | 35.36            | ---             | 56.00        | 20.64       | 1000.0          | 9.000           | L1   | 10.2       |
| 26.495000       | ---              | 29.02           | 50.00        | 20.98       | 1000.0          | 9.000           | L1   | 10.1       |
| 26.495000       | 34.93            | ---             | 60.00        | 25.07       | 1000.0          | 9.000           | L1   | 10.1       |
| 26.705000       | ---              | 29.31           | 50.00        | 20.69       | 1000.0          | 9.000           | L1   | 10.1       |
| 26.705000       | 34.96            | ---             | 60.00        | 25.04       | 1000.0          | 9.000           | L1   | 10.1       |

### Neutral Line



#### Final Result

| Frequency (MHz) | QuasiPeak (dBµV) | CAverage (dBµV) | Limit (dBµV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.185000        | ---              | 29.26           | 54.26        | 25.00       | 1000.0          | 9.000           | L1   | 9.6        |
| 0.185000        | 47.88            | ---             | 64.26        | 16.38       | 1000.0          | 9.000           | L1   | 9.6        |
| 2.065000        | ---              | 25.79           | 46.00        | 20.21       | 1000.0          | 9.000           | L1   | 10.2       |
| 2.065000        | 35.14            | ---             | 56.00        | 20.86       | 1000.0          | 9.000           | L1   | 10.2       |
| 2.180000        | ---              | 25.36           | 46.00        | 20.64       | 1000.0          | 9.000           | L1   | 10.2       |
| 2.180000        | 34.70            | ---             | 56.00        | 21.30       | 1000.0          | 9.000           | L1   | 10.2       |
| 26.390000       | ---              | 28.92           | 50.00        | 21.08       | 1000.0          | 9.000           | L1   | 10.1       |
| 26.390000       | 34.74            | ---             | 60.00        | 25.26       | 1000.0          | 9.000           | L1   | 10.1       |
| 26.975000       | ---              | 28.85           | 50.00        | 21.15       | 1000.0          | 9.000           | L1   | 10.1       |
| 26.975000       | 34.78            | ---             | 60.00        | 25.22       | 1000.0          | 9.000           | L1   | 10.1       |

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### Appendix A. Measurement equipment

| Equipment                           | Manufacturer  | Model             | Serial No. | Calibration interval | Calibration due. |
|-------------------------------------|---------------|-------------------|------------|----------------------|------------------|
| EMI TEST RECEIVER                   | ESU26         | Rohde & Schwarz   | 100552     | 1 year               | 2021.04.01       |
| SPECTRUM ANALYZER                   | R&S           | FSV40             | 101725     | 1 year               | 2021.06.22       |
| 8360B Series Swept Signal Generator | HP            | 83630B            | 3844A00786 | 1 year               | 2021.01.15       |
| SIGNAL GENERATOR                    | KEYSIGHT      | N5182B            | MY59100115 | 1 year               | 2021.05.12       |
| Power Meter                         | Anritsu       | ML2495A           | 1438001    | 1 year               | 2021.05.12       |
| Pulse Power Sensor                  | Anritsu       | MA2411B           | 1339205    | 1 year               | 2021.05.12       |
| DC POWER SUPPLY                     | SORENSEN      | DCS40-75E         | 1408A02745 | 1 year               | 2021.01.15       |
| ATTENUATOR                          | Mini-Circuits | BW-S10-2W263+     | 1          | 1 year               | 2021.01.17       |
| Loop Antenna                        | Schwarzbeck   | FMZB1513          | 225        | 2 years              | 2021.02.15       |
| BILOG ANTENNA                       | VULB 9168     | SCHWARZBECK       | 9168-461   | 2 years              | 2022.05.26       |
| HORN ANTENNA                        | A.H.          | SAS-571           | 414        | 1 years              | 2021.01.31       |
| BAND REJECT FILTER                  | MICRO-TRONICS | BRM50702          | G272       | 1 year               | 2021.01.15       |
| BAND REJECT FILTER                  | MICRO-TRONICS | BRM50716          | G199       | 1 year               | 2021.01.15       |
| AMPLIFIER                           | 310N          | SONOMA INSTRUMENT | 401123     | 1 year               | 2021.06.08       |
| PREAMPLIFIER                        | 8449B         | AGILENT           | 8008A01640 | 1 year               | 2021.04.01       |
| ATTENUATOR                          | F04-C1206-01  | SRT               | 20022403   | 1 year               | 2021.05.06       |
| EMI Test Receiver                   | R&S           | ESR3              | 101783     | 1 year               | 2021.01.20       |
| EMI Test Receiver                   | R&S           | ESU26             | 100552     | 1 year               | 2021.04.01       |
| Pulse Limiter                       | R&S           | ESH3-Z2           | 101915     | 1 year               | 2021.01.02       |
| LISN                                | R&S           | ENV216            | 101787     | 1 year               | 2021.01.02       |

### Peripheral devices

| Device            | Manufacturer         | Model No. | Serial No.    |
|-------------------|----------------------|-----------|---------------|
| Notebook computer | LG Electronics Inc., | 15UD590   | 904QCSF564006 |

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