



# TEST REPORT

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                          |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--|
| <b>KCTL Inc.</b><br>65, Sinwon-ro, Yeongtong-gu,<br>Suwon-si, Gyeonggi-do, 16677, Korea<br>TEL: 82-31-285-0894 FAX: 82-505-299-8311<br><a href="http://www.kctl.co.kr">www.kctl.co.kr</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Report No.:<br><b>KR19-SRF0078-B</b><br>Page (1) of (30) |  |
| <b>1. Client</b><br><div style="margin-left: 20px;">       ◦ Name : UWICOM<br/>       ◦ Address : Industry University Cooperation Foundation, 703, 154-42,<br/>                         GwangKyosan-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16227,<br/>                         Korea<br/>       ◦ Date of Receipt : 2019-04-17     </div><br><b>2. Use of Report</b> : -                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          |  |
| <b>3. Name of Product and Model</b> : Smart Voice Sender Receiver / SVS-R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                          |  |
| <b>4. Manufacturer and Country of Origin</b> : UWICOM / Korea                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          |  |
| <b>5. FCC ID</b> : 2AS7E-SVS-R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |  |
| <b>6. Date of Test</b> : 2019-05-13 to 2019-05-17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                          |  |
| <b>7. Test Standards</b> : FCC Part 15 Subpart C, 15.247                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                          |  |
| <b>8. Test Results</b> : Refer to the test result in the test report                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                          |  |
| <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="border: 1px solid black; padding: 10px; width: 45%;"> <p>Affirmation</p> <p>Tested by</p> <p>Name : Seonjun Yun (Signature)</p> </div> <div style="border: 1px solid black; padding: 10px; width: 45%;"> <p>Technical Manager</p> <p>Name : Jaehyong Lee (Signature)</p> </div> </div> <div style="text-align: right; margin-top: 20px;">       2019-08-23     </div> <div style="text-align: center; margin-top: 20px;"> <h2 style="margin: 0;">KCTL Inc.</h2> </div> <p style="margin-top: 20px;">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 KCTL Inc.</p> |                                                          |  |

#### Report revision history

| Date       | Revision             | Page No |
|------------|----------------------|---------|
| 2019-06-14 | Initial report       | -       |
| 2019-07-16 | Updated output power | 8 ~ 9   |
| 2019-08-23 | Updated              | 9       |
|            |                      |         |
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|            |                      |         |

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## 1. General information

Client : UWICOM  
 Address : Industry University Cooperation Foundation, 703, 154-42, GwangKyosan-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16227 Korea  
 Manufacturer : UWICOM  
 Address : Industry University Cooperation Foundation, 703, 154-42, GwangKyosan-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16227 Korea  
 Laboratory : KCTL Inc.  
 Address : 65, Sinwon-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do, 16677, Korea  
 Accreditations : FCC Site Designation No: KR0040, FCC Site Registration No: 687132  
 VCCI Registration No. : R-3327, G-198, C-3706, T-1849  
 Industry Canada Registration No. : 8035A  
 KOLAS No.: KT231

## 2. Device information

Equipment under test : Smart Voice Sender Receiver  
 Model : SVS-R  
 Derivative Model : HA1000  
 Frequency range : 2 402 MHz ~ 2 480 MHz\_Bluetooth(BDR/EDR)  
 Modulation technique : GFSK,  $\pi/4$ DQPSK, 8DPSK\_Bluetooth(BDR/EDR)  
 Number of channels : 79 ch  
 Power source : DC 5 V  
 Antenna specification : PCB Antenna  
 Software version : SVS\_Rx\_Ver2.00  
 Hardware version : SVS\_R\_V05  
 Test device serial No. : N/A  
 Operation temperature : 23 °C  
 Approved Module : A8TBM64S1  
 FCC ID :

### 2.1. Accessory information

| Equipment      | Manufacturer                             | Model      | Serial No. | Power source              |
|----------------|------------------------------------------|------------|------------|---------------------------|
| Earphones      | ONETECHplus                              | UW-02      | -          | 5.0 V d.c., 1.5 A         |
| Li-ion Battery | HUIZHOU<br>KAIYESHENG<br>ENERGY CO., LTD | KYS 521753 | -          | 3.7 V, 450mAh,<br>1.665Wh |

### 2.2. Information about derivative model

The basic and derivative model are electrically identical.  
 The derivative model has a microphone.

### 2.3. Frequency/channel operations

This device contains the following capabilities:

Bluetooth(BDR, EDR)

| Ch. | Frequency (MHz) |
|-----|-----------------|
| 00  | 2 402           |
| .   | .               |
| 39  | 2 441           |
| .   | .               |
| 78  | 2 480           |

Table 2.3.1. Bluetooth(BDR/EDR) mode

15.247 Requirements for Bluetooth transmitter:

- This Bluetooth module has been tested by a Bluetooth Qualification Lab, and we confirm the following:
  - 1) This system is hopping pseudo-randomly.
  - 2) Each frequency is used equally on the average by each transmitter.
  - 3) The receiver input bandwidths that match the hopping channel bandwidths of their corresponding transmitters
  - 4) The receiver shifts frequencies in synchronization with the transmitted signals.
- 15.247(g): The system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this Section 15.247 should the transmitter be presented with a continuous data (or information) stream.
- 15.247(h): The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

### 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 PCB Antenna(internal antenna) on board.

#### 4. Summary of tests

| FCC Part section(s)                   | Parameter                     | Test results           |
|---------------------------------------|-------------------------------|------------------------|
| 15.247(b)(1), (4)                     | Maximum peak output power     | Pass                   |
| 15.247(a)(1)                          | Carrier frequency separation  | NT(Note <sup>1</sup> ) |
| 15.247(a)(1)                          | 20dB channel bandwidth        | NT(Note <sup>1</sup> ) |
| 15.247(a)(iii)<br>15.247(b)(1)        | Number of hopping channel     | NT(Note <sup>1</sup> ) |
| 15.247(a) (iii)                       | Time of occupancy(dwell time) | NT(Note <sup>1</sup> ) |
| 15.205(a),<br>15.209(a)<br>15.247(d), | Spurious emission             | Pass                   |
|                                       | Band-edge, restricted band    | Pass                   |
| 15.207(a)                             | Conducted Emissions           | Pass                   |

**Notes:** (N/T: Not Tested, N/A: Not Applicable)

- Test was performed by modular transmitter (Model Name: BM64SPKabcC1 (a,b,c= 0~9, A~Z), FCC ID: A8TBM64S1, Test Report No. 50041195 001 issued on 17, May, 2016 by TUV Rheinland Taiwan Ltd.
- All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 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.
- 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
- The test procedure(s) in this report were performed in accordance as following.
  - ◆ ANSI C63.10-2013
  - ◆ KDB 558074 D01 v05r02

## 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 indicate 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.

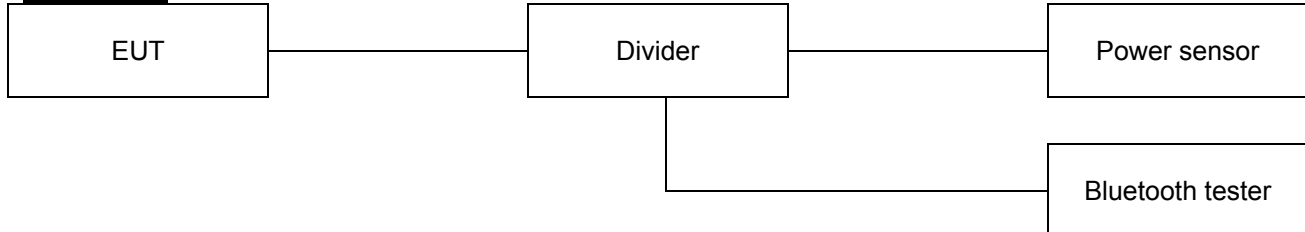
| Parameter                   | Expanded uncertainty |         |
|-----------------------------|----------------------|---------|
| Radiated spurious emissions | 9 kHz ~ 30 MHz:      | 2.28 dB |
|                             | 30 MHz ~ 300 MHz     | 4.98 dB |
|                             | 300 MHz ~ 1 000 MHz  | 5.14 dB |
|                             | 1 GHz ~ 6 GHz        | 6.70 dB |
|                             | Above 6 GHz          | 6.60 dB |

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## 6 Test results

### 6.1. Maximum peak output power

#### Test setup



#### Limit

According to §15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2 400-2 483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

According to §15.247(b)(1), for frequency hopping systems operating in the 2 400-2 483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5 725-5 850 MHz band: 1 watt. For all other frequency hopping systems in the 2 400-2 483.5 MHz band: 0.125 watts.

According to §15.247(b)(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

#### Test procedure

ANSI C63.10-2013 - Section 7.8.5

#### Test settings

The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:

Use the following spectrum analyzer settings:

- 1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 2) RBW > 20 dB bandwidth of the emission being measured.
- 3) VBW ≥ RBW.
- 4) Sweep: Auto.
- 5) Detector function: Peak.
- 6) Trace: Max hold.
- 7) Allow trace to stabilize.

#### Notes:

A peak responding power sensor is used, where the power sensor system video bandwidth is greater than the occupied bandwidth of the EUT.

### Test results

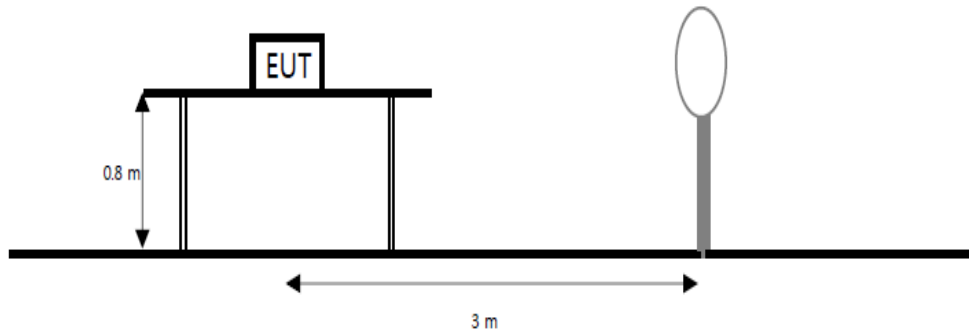
| Frequency(MHz) | Modulation    | Measured output power(dBm) |         | Limit(dBm) |
|----------------|---------------|----------------------------|---------|------------|
|                |               | Peak                       | Average |            |
| 2 402          | GFSK          | 16.11                      | 14.95   | 20.97      |
| 2 441          |               | 15.51                      | 14.35   |            |
| 2 480          |               | 15.01                      | 13.85   |            |
| 2 402          | $\pi/4$ DQPSK | 14.07                      | 12.91   | 20.97      |
| 2 441          |               | 13.17                      | 12.01   |            |
| 2 480          |               | 12.66                      | 11.50   |            |
| 2 402          | 8DPSK         | 14.13                      | 12.97   | 20.97      |
| 2 441          |               | 13.33                      | 12.17   |            |
| 2 480          |               | 12.66                      | 11.50   |            |

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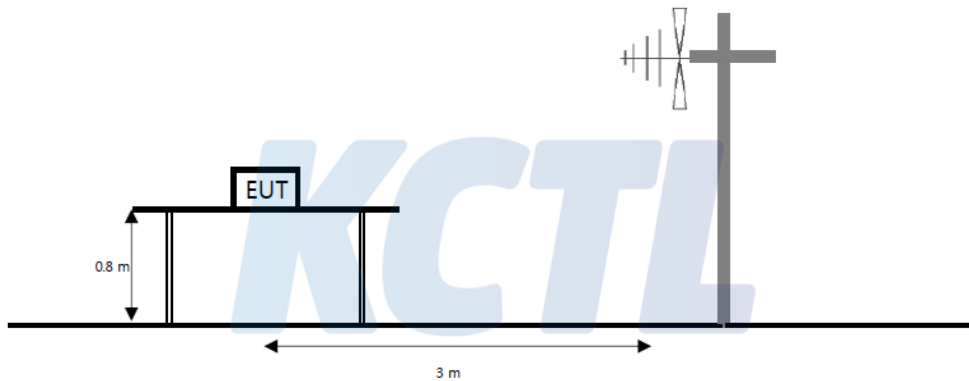
## 6.2. Radiated spurious emissions & band edge

### Test setup

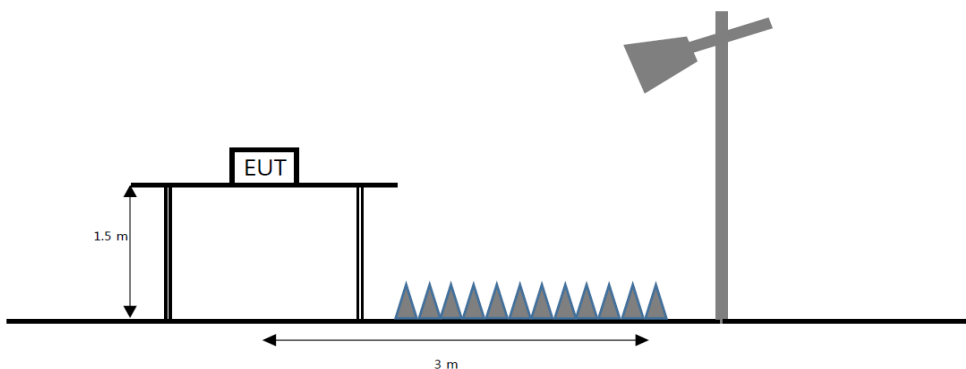
The diagram below shows the test setup that is utilized to make the measurements for emission from 9 kHz to 30 MHz Emissions



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 ( $\mu\text{V/m}$ ) | 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

**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**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1 MHz
3. VBW = 1/T  $\geq$  1 Hz
4. Averaging type was set to RMS to ensure that video filtering was applied in the power domain
5. Detector = peak
6. Sweep time = auto
7. Trace mode = max hold
8. Trace was allowed to run for at least 50 times(1/duty cycle) traces

**Notes:**

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1 GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1 kHz ( $\geq 1/T$ ) for Average detection (AV) at frequency above 1 GHz. (where T = pulse width)
2.  $f < 30$  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

3. Factors(dB) = Antenna factor(dB/m) + Cable loss(dB) + or Amp. gain(dB) + or  $F_d$ (dB)
4. The worst-case emissions are reported however emissions whose levels were not within 20 dB of respective limits were not reported.
5. Average test would be performed if the peak result were greater than the average limit.
6. <sup>1)</sup> means restricted band.
7. According to part 15.31(f)(2), an extrapolation factor of 40 dB/decade is applied because measured distance of radiated emission is 3 m.
8. 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."

**Duty cycle correction factor calculation:**

According to 7.5 Procedure for determining the average value of pulsed emissions

**Duty Cycle Correction Factor Calculation**

- Worst case : AFH mode
- Channel hop rate = 800 hops/second
- Hopping rate for DH5 mode = 800 hops/second / 5 (6 slots for DH5) = 133.33 hops/second
- Time per channel hop =  $1 / 133.33 \text{ hops/second} = 7.50 \text{ ms}$
- Time to cycle through all channels =  $7.50 \times 20 \text{ channels(AFH mode)} = 150 \text{ ms}$
- Number of times transmitter hits on one channel =  $100 \text{ ms} / \text{Time to cycle through all channels (ms)}$   
 $= 100 \text{ ms} / 150 \text{ ms} = 1 \text{ time}$
- Worst case Dwell time =  $7.5 \text{ ms}$
- Duty Cycle Correction Factor =  $20\log(7.5 \text{ ms}/100 \text{ ms}) = -22.5 \text{ dB}$

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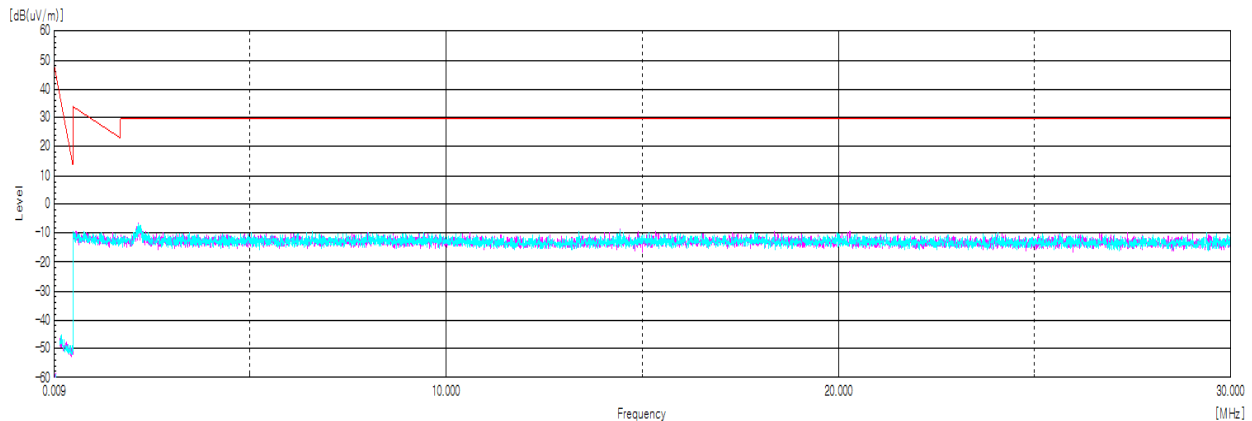
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Suwon-si, Gyeonggi-do, 16677, Korea  
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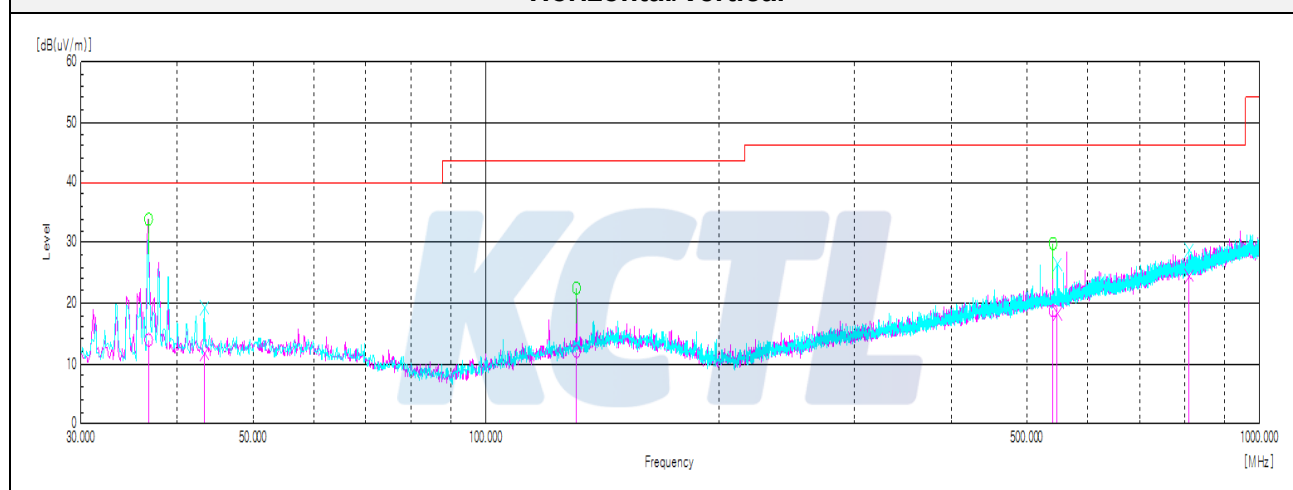
**KCTL****Test results (Below 30 MHz) – Worst case: GFSK Low frequency**

| Frequency                                                      | Pol.  | Reading  | Cable Loss | Amp Gain | Antenna Factor | DCCF | 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. |       |          |            |          |                |      |            |            |        |

**Horizontal/Vertical****KCTL**

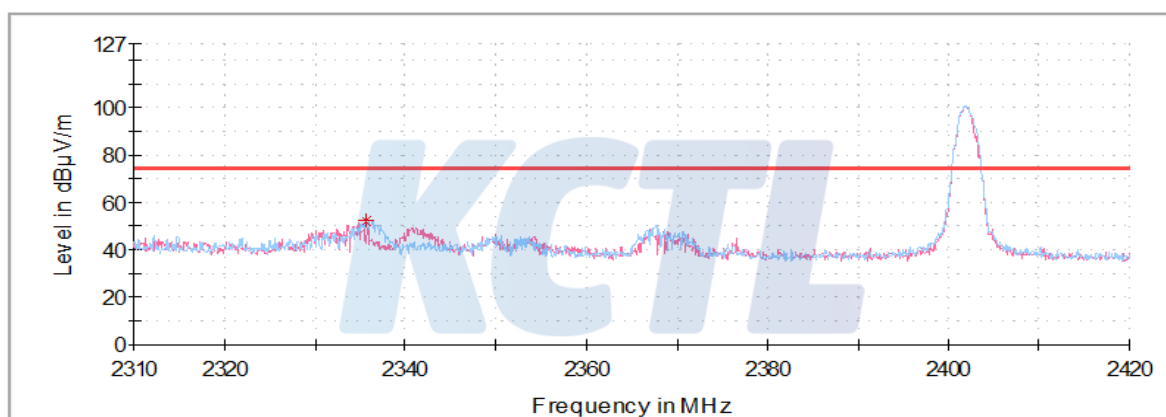
**Test results (Below 1 000 MHz) – Worst case: GFSK Low frequency**

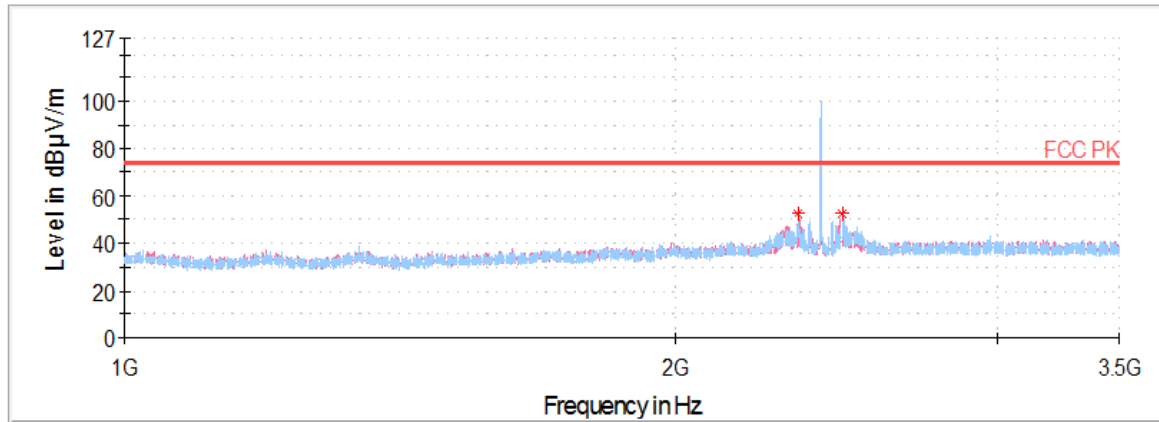
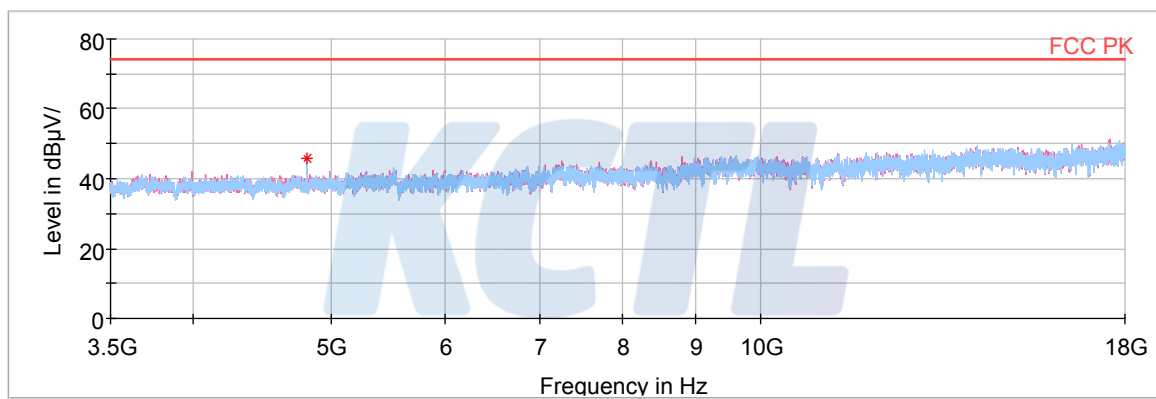
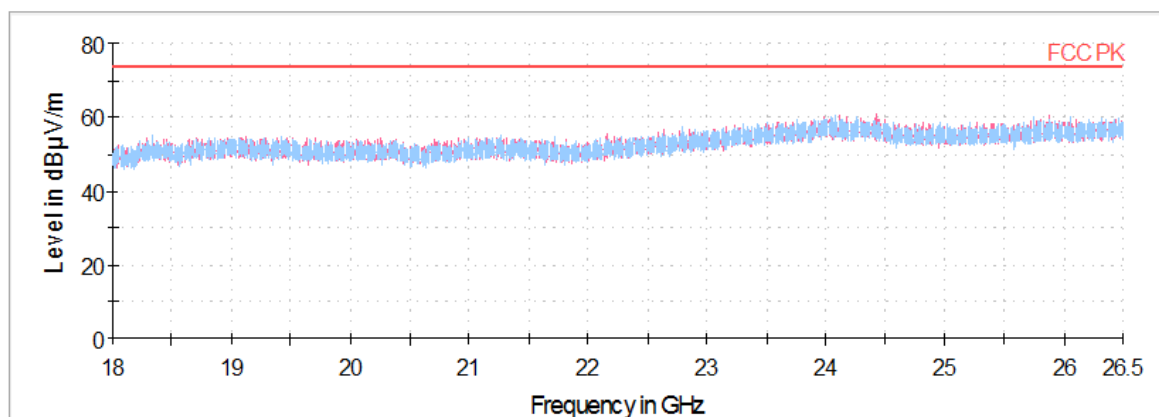
| Frequency       | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | Result           | Limit            | Margin |
|-----------------|-------|----------------|-------------|--------------|------|------------------|------------------|--------|
| (MHz)           | (V/H) | (dB( $\mu$ V)) | (dB)        | (dB)         | (dB) | (dB( $\mu$ V/m)) | (dB( $\mu$ V/m)) | (dB)   |
| Quasi peak data |       |                |             |              |      |                  |                  |        |
| 36.67           | H     | 27.10          | 17.73       | -30.86       | -    | 13.97            | 40.00            | 26.03  |
| 43.34           | V     | 24.20          | 18.40       | -30.77       | -    | 11.83            | 40.00            | 28.17  |
| 131.12          | H     | 23.50          | 18.01       | -29.65       | -    | 11.86            | 43.50            | 31.64  |
| 541.19          | H     | 21.30          | 24.22       | -26.78       | -    | 18.74            | 46.00            | 27.26  |
| 548.10          | V     | 20.70          | 24.36       | -26.76       | -    | 18.30            | 46.00            | 27.70  |
| 810.37          | V     | 21.40          | 28.50       | -25.26       | -    | 24.64            | 46.00            | 21.36  |

**Horizontal/Vertical**

**Test results (Above 1 000 MHz)****GFSK****Low Channel**

| Frequency                                                      | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | 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>                                               |       |                |             |              |      |                  |                  |        |
| 2 335.55 <sup>1)</sup>                                         | H     | 79.88          | 31.97       | -59.56       | -    | 52.29            | 74.00            | 21.71  |
| 4 803.64 <sup>1)</sup>                                         | H     | 68.48          | 33.78       | -56.47       | -    | 45.79            | 74.00            | 28.21  |
| <b>Average Data</b>                                            |       |                |             |              |      |                  |                  |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                |             |              |      |                  |                  |        |

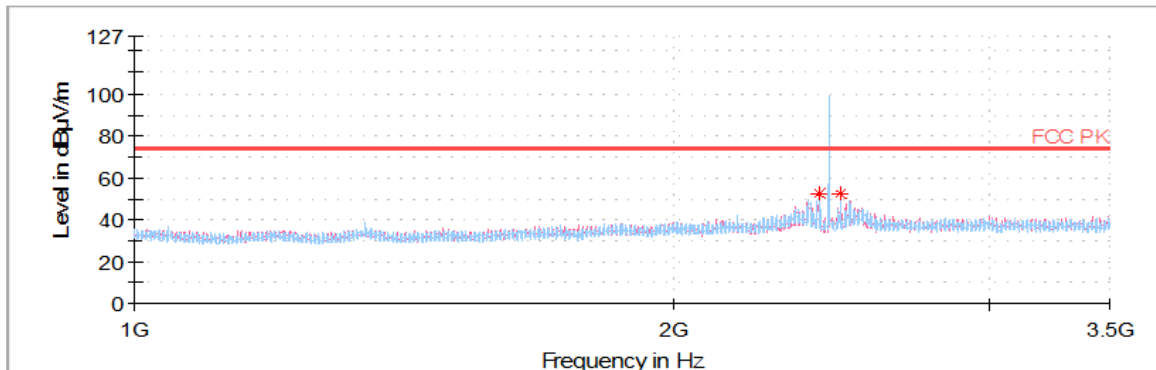
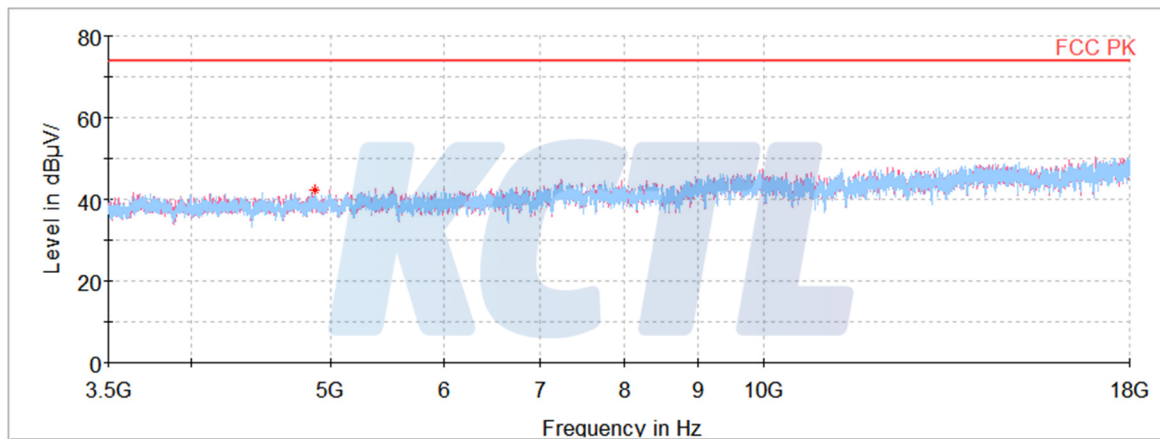
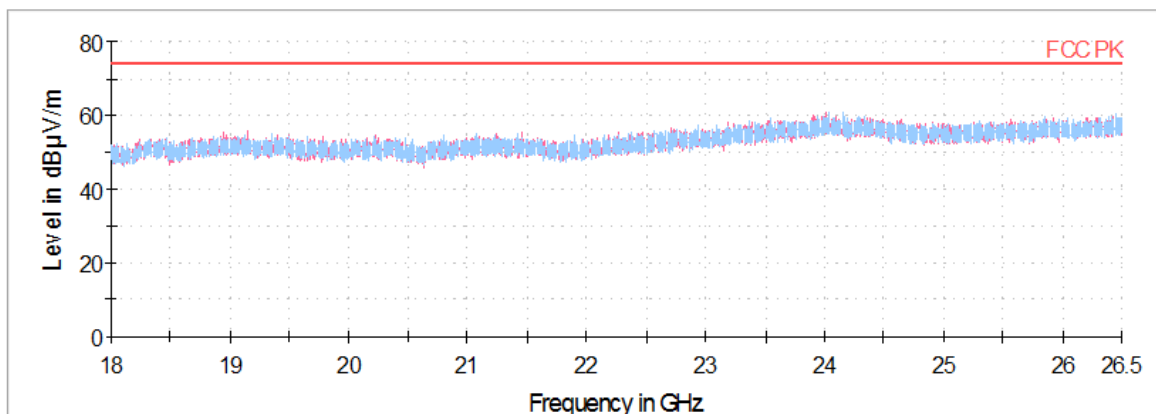
**Horizontal/Vertical for Band-edge**

**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

### Middle Channel

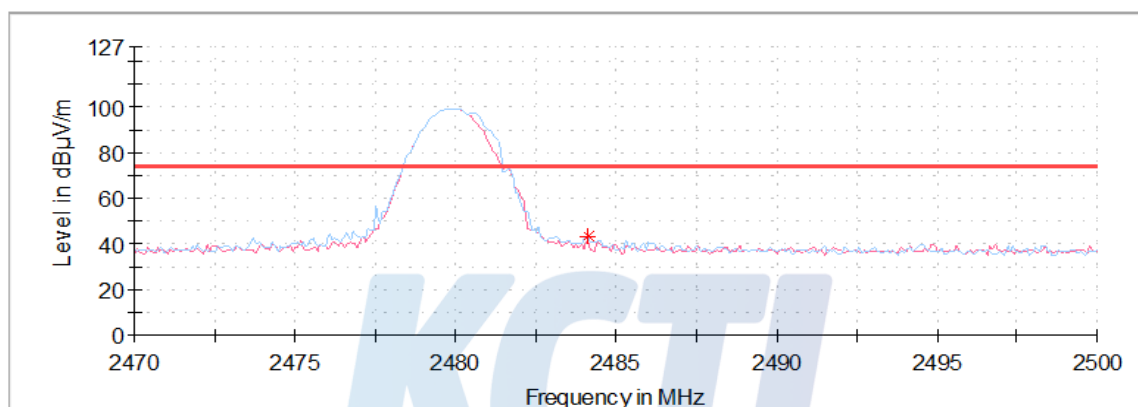
| Frequency                                                      | Pol.  | Reading         | Ant. Factor | Amp. + Cable | DCCF | Result            | Limit             | Margin |
|----------------------------------------------------------------|-------|-----------------|-------------|--------------|------|-------------------|-------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu V$ )) | (dB)        | (dB)         | (dB) | (dB( $\mu V/m$ )) | (dB( $\mu V/m$ )) | (dB)   |
| <b>Peak data</b>                                               |       |                 |             |              |      |                   |                   |        |
| 4 881.58 <sup>1)</sup>                                         | H     | 64.89           | 33.83       | -56.66       | -    | 42.06             | 74.00             | 31.94  |
| <b>Average Data</b>                                            |       |                 |             |              |      |                   |                   |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                 |             |              |      |                   |                   |        |

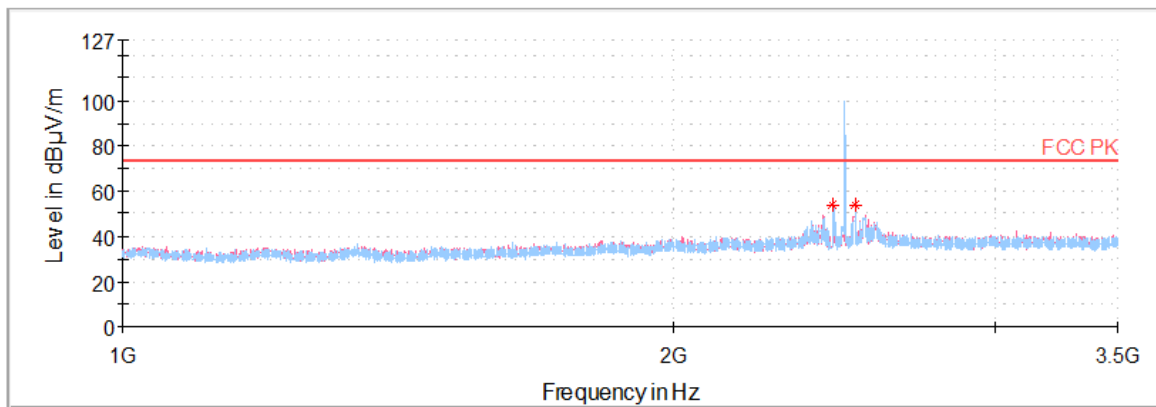
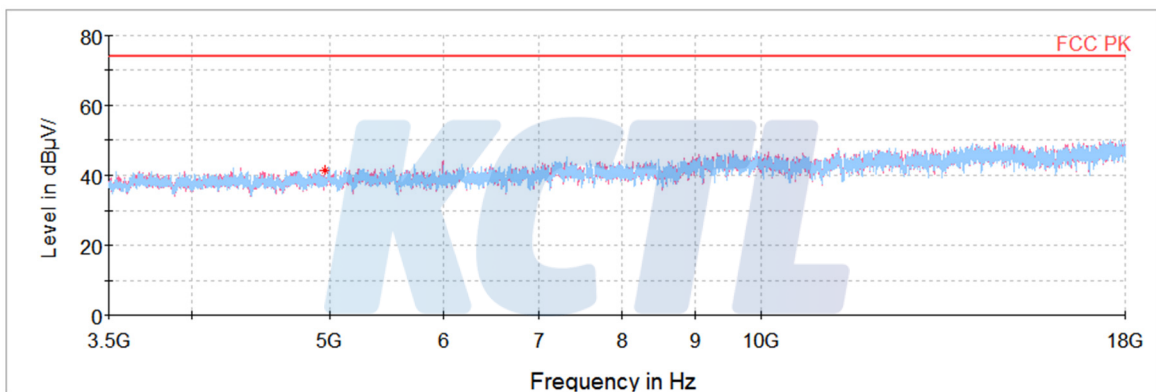
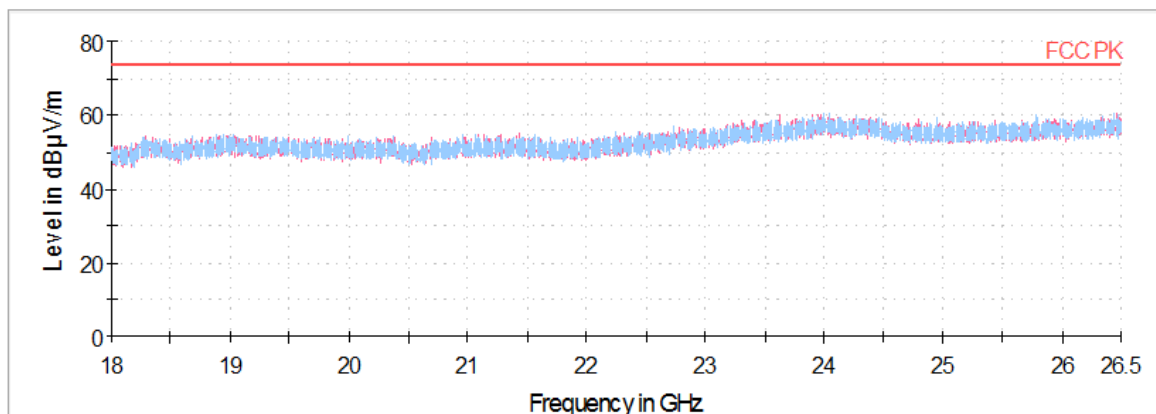


**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

**High Channel**

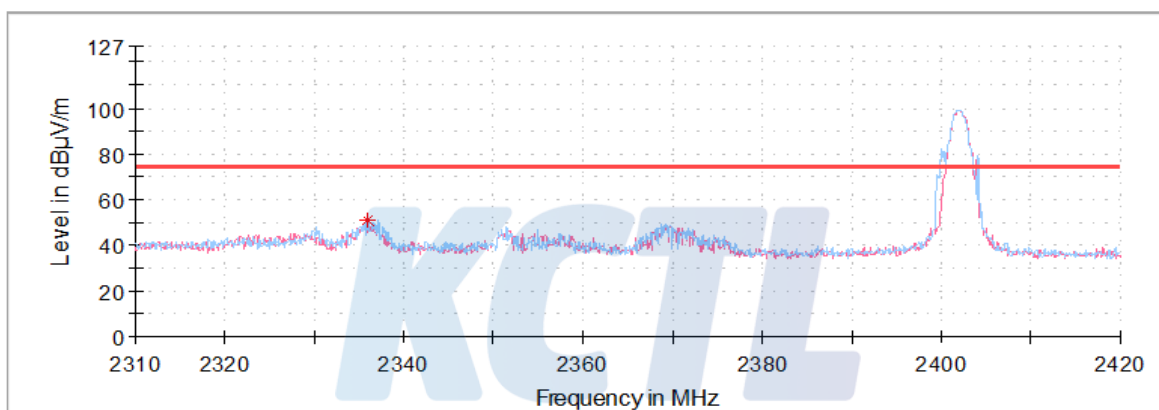
| Frequency                                                      | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | Result           | Limit            | Margin |
|----------------------------------------------------------------|-------|----------------|-------------|--------------|------|------------------|------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu$ V)) | (dB)        | (dB)         | (dB) | (dB( $\mu$ V/m)) | (dB( $\mu$ V/m)) | (dB)   |
| <b>Peak data</b>                                               |       |                |             |              |      |                  |                  |        |
| 2 484.14 <sup>1)</sup>                                         | H     | 70.11          | 32.09       | -59.17       | -    | 43.03            | 74.00            | 30.97  |
| 4 959.97 <sup>1)</sup>                                         | V     | 63.58          | 33.88       | -56.27       | -    | 41.19            | 74.00            | 32.81  |
| <b>Average Data</b>                                            |       |                |             |              |      |                  |                  |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                |             |              |      |                  |                  |        |

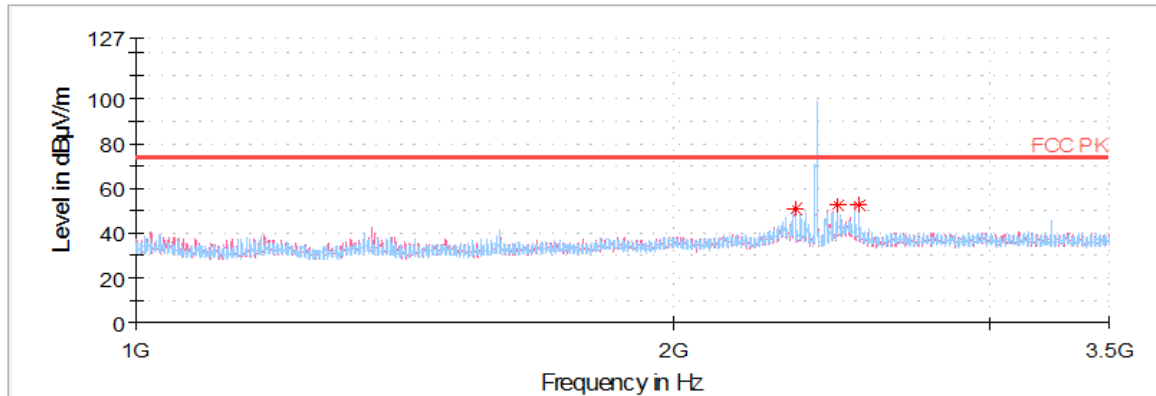
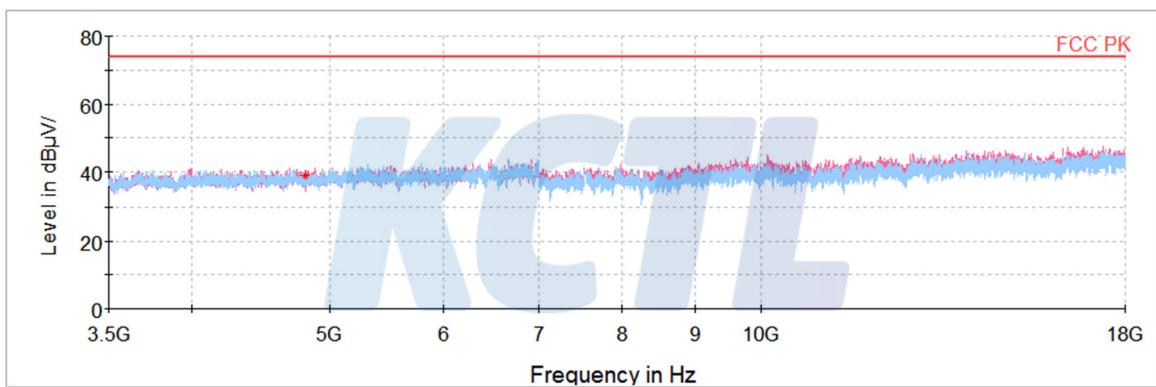
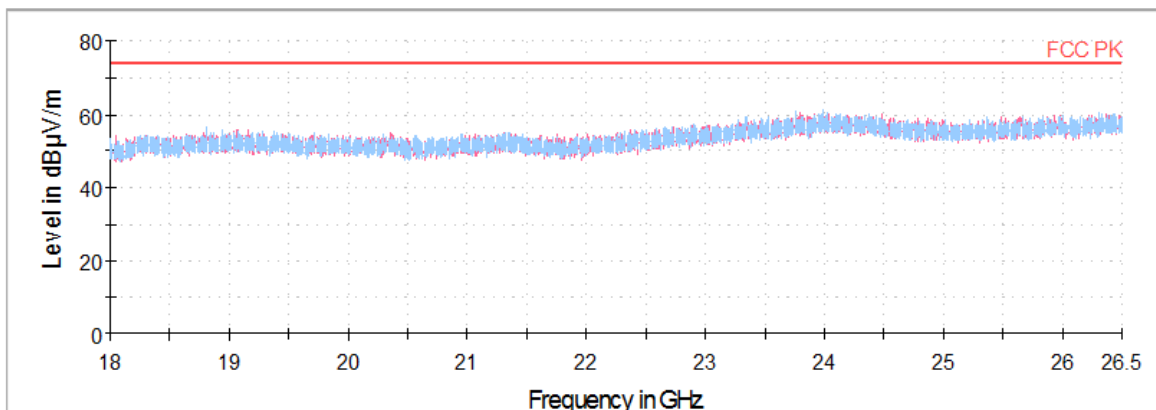
**Horizontal/Vertical for Band-edge**

**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

**8DPSK****Low Channel**

| Frequency                                                      | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | 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>                                               |       |                |             |              |      |                  |                  |        |
| 2 335.94 <sup>1)</sup>                                         | V     | 77.96          | 31.97       | -59.56       | -    | 50.37            | 74.00            | 23.63  |
| 4 804.09 <sup>1)</sup>                                         | V     | 61.58          | 33.78       | -56.47       | -    | 38.89            | 74.00            | 35.11  |
| <b>Average Data</b>                                            |       |                |             |              |      |                  |                  |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                |             |              |      |                  |                  |        |

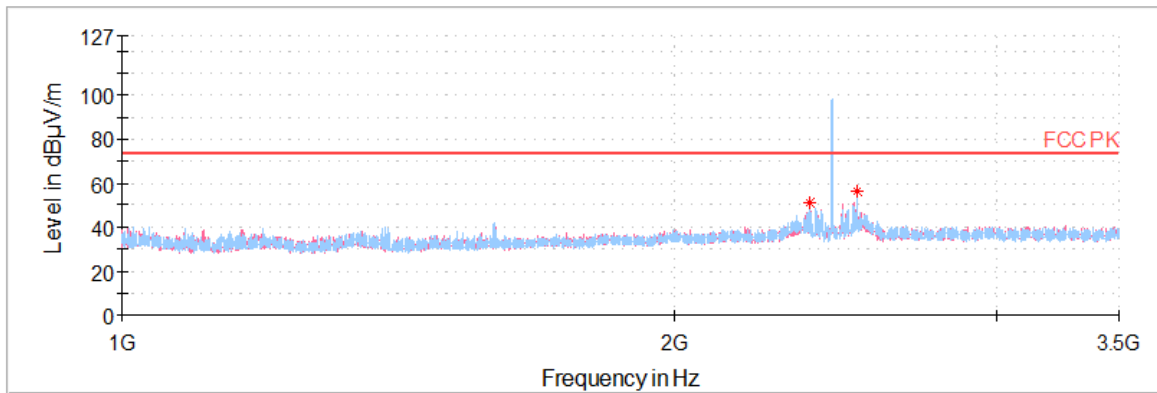
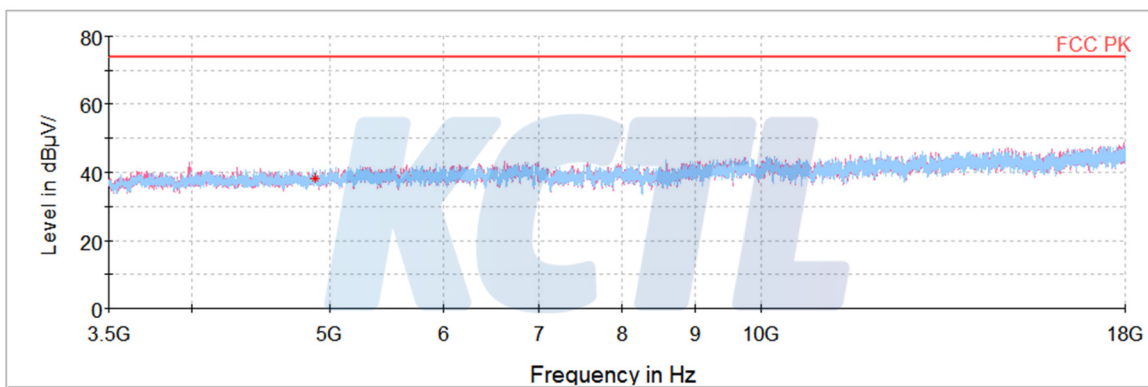
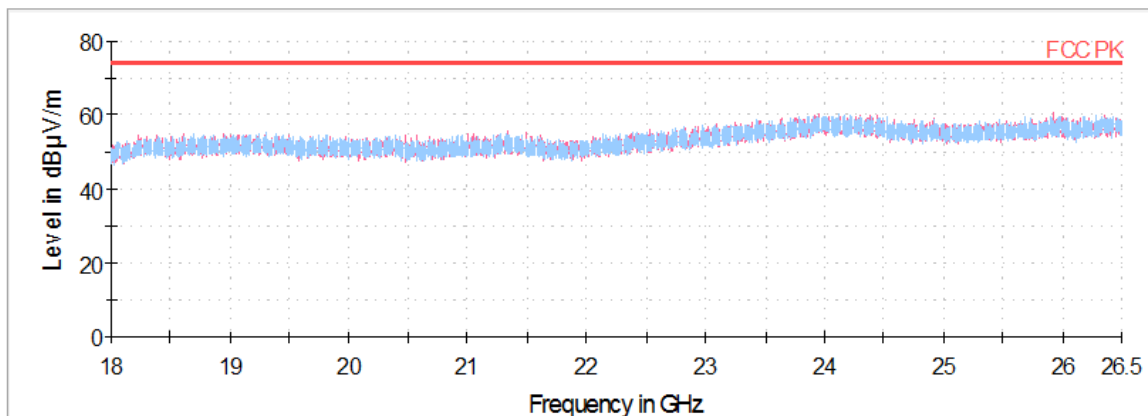
**Horizontal/Vertical for Band-edge**

**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

### Middle Channel

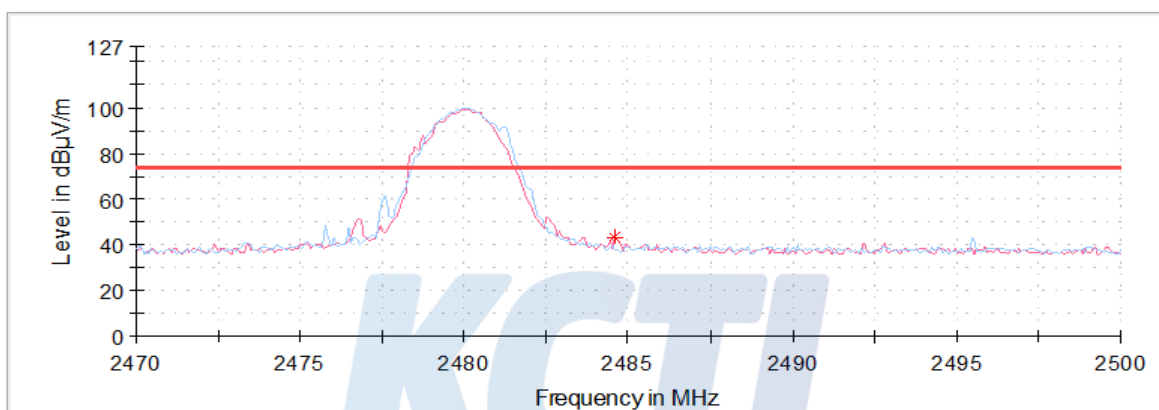
| Frequency                                                      | Pol.  | Reading         | Ant. Factor | Amp. + Cable | DCCF | Result            | Limit             | Margin |
|----------------------------------------------------------------|-------|-----------------|-------------|--------------|------|-------------------|-------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu V$ )) | (dB)        | (dB)         | (dB) | (dB( $\mu V/m$ )) | (dB( $\mu V/m$ )) | (dB)   |
| <b>Peak data</b>                                               |       |                 |             |              |      |                   |                   |        |
| 2 515.38                                                       | H     | 83.54           | 32.12       | -59.10       | -    | 56.56             | 74.00             | 17.44  |
| <b>Average Data</b>                                            |       |                 |             |              |      |                   |                   |        |
| No spurious emissions were detected within 20 dB of the limit. |       |                 |             |              |      |                   |                   |        |

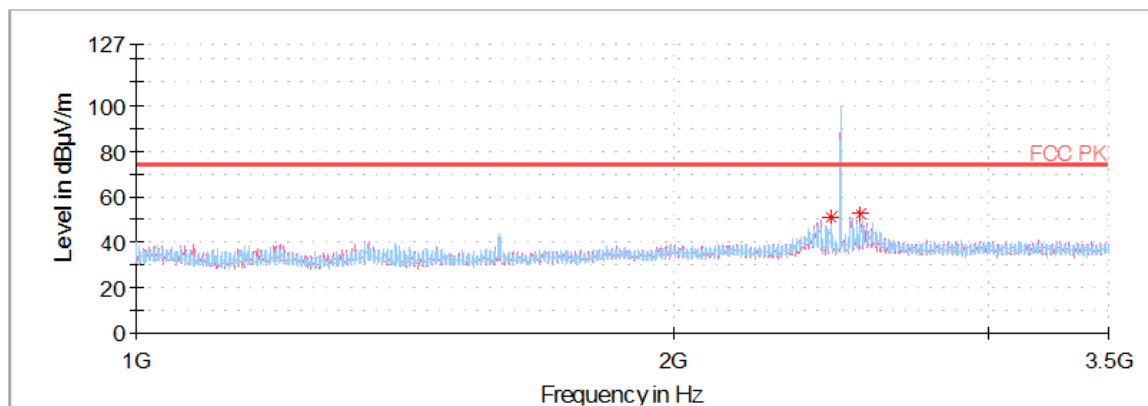
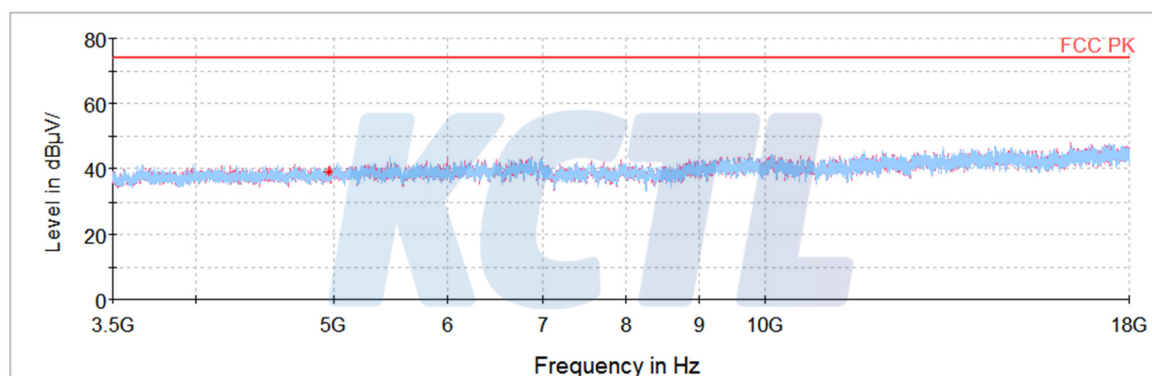
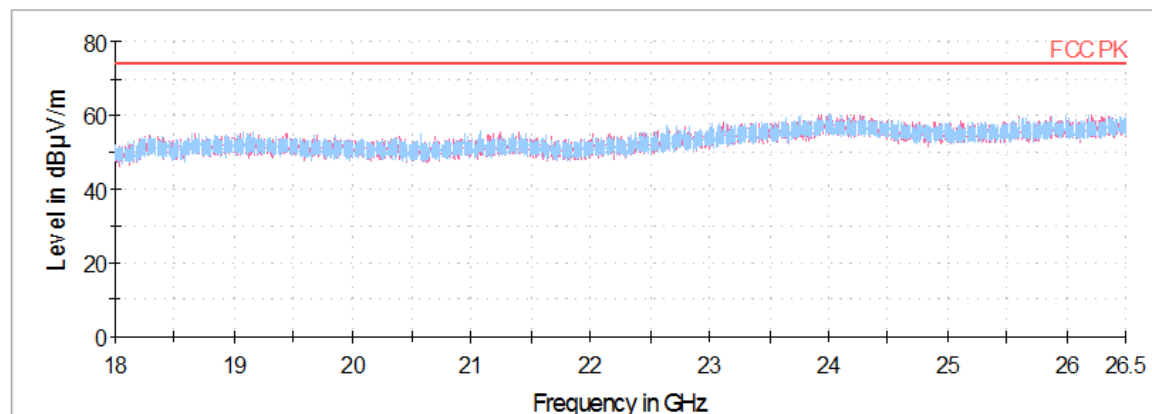


**Horizontal/Vertical for 1 GHz ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

**High Channel**

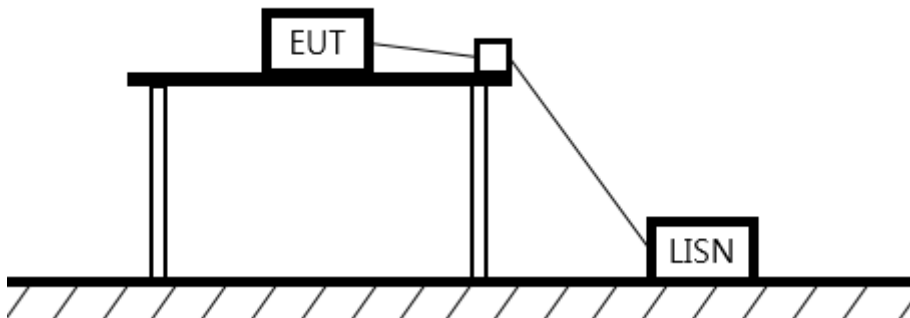
| Frequency                                                      | Pol.  | Reading        | Ant. Factor | Amp. + Cable | DCCF | Result           | Limit            | Margin |
|----------------------------------------------------------------|-------|----------------|-------------|--------------|------|------------------|------------------|--------|
| (MHz)                                                          | (V/H) | (dB( $\mu$ V)) | (dB)        | (dB)         | (dB) | (dB( $\mu$ V/m)) | (dB( $\mu$ V/m)) | (dB)   |
| <b>Peak data</b>                                               |       |                |             |              |      |                  |                  |        |
| 2 484.61 <sup>1)</sup>                                         | V     | 69.84          | 32.09       | -59.16       | -    | 42.77            | 74.00            | 31.23  |
| 4 960.42 <sup>1)</sup>                                         | V     | 61.11          | 33.88       | -56.27       | -    | 38.72            | 74.00            | 35.28  |
| <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 ~ 3.5 GHz****Horizontal/Vertical for 3.5 GHz ~ 18 GHz****Horizontal/Vertical for 18 GHz ~ 26.5 GHz**

### 6.3. AC Conducted emission

#### Test setup



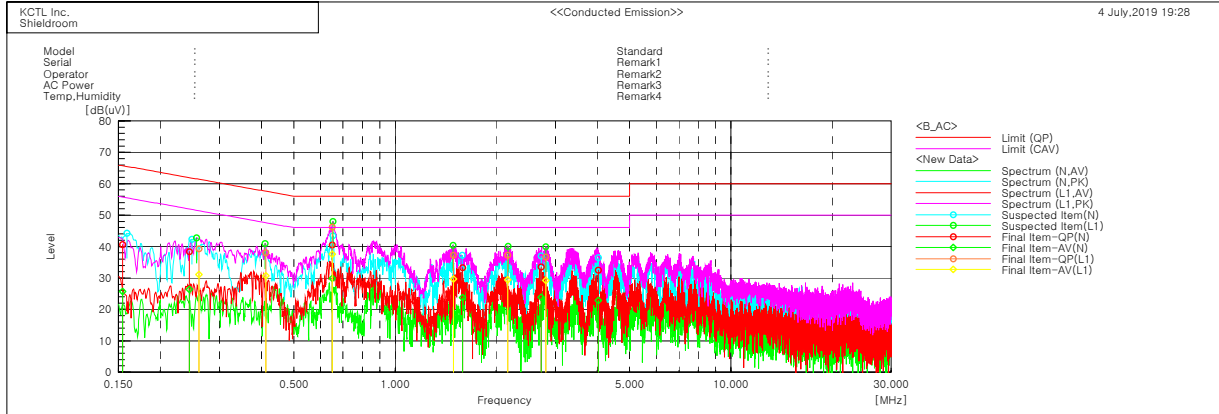
#### Limit

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 50 $\mu$ H/50 ohm line impedance stabilization network (LISN). Compliance with the provision of this paragraph shall be 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 (dB $\mu$ V/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 50 $\Omega$ /50 $\mu$ H 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 in 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**

## Final Result

## --- N Phase ---

| No. | Frequency [MHz] | Reading QP [dB(μV)] | Reading CAV [dB(μV)] | c.f [dB] | Result QP [dB(μV)] | Result CAV [dB(μV)] | Limit QP [dB(μV)] | Limit AV [dB(μV)] | Margin QP [dB] | Margin CAV [dB] |
|-----|-----------------|---------------------|----------------------|----------|--------------------|---------------------|-------------------|-------------------|----------------|-----------------|
| 1   | 0.1546          | 30.9                | 15.9                 | 9.8      | 40.7               | 25.7                | 65.7              | 55.7              | 25.0           | 30.0            |
| 2   | 0.24396         | 28.8                | 16.8                 | 9.6      | 38.4               | 26.4                | 62.0              | 52.0              | 23.6           | 25.6            |
| 3   | 0.65051         | 30.7                | 20.1                 | 9.8      | 40.5               | 29.9                | 56.0              | 46.0              | 15.5           | 16.1            |
| 4   | 1.58751         | 23.6                | 14.0                 | 9.7      | 33.3               | 23.7                | 56.0              | 46.0              | 22.7           | 22.3            |
| 5   | 2.71988         | 23.8                | 14.1                 | 9.7      | 33.5               | 23.8                | 56.0              | 46.0              | 22.5           | 22.2            |
| 6   | 4.03224         | 22.8                | 13.2                 | 9.7      | 32.5               | 22.9                | 56.0              | 46.0              | 23.5           | 23.1            |

## --- L1 Phase ---

| No. | Frequency [MHz] | Reading QP [dB(μV)] | Reading CAV [dB(μV)] | c.f [dB] | Result QP [dB(μV)] | Result CAV [dB(μV)] | Limit QP [dB(μV)] | Limit AV [dB(μV)] | Margin QP [dB] | Margin CAV [dB] |
|-----|-----------------|---------------------|----------------------|----------|--------------------|---------------------|-------------------|-------------------|----------------|-----------------|
| 1   | 0.26082         | 29.5                | 21.4                 | 9.7      | 39.2               | 31.1                | 61.4              | 51.4              | 22.2           | 20.3            |
| 2   | 0.41199         | 28.1                | 20.8                 | 9.9      | 38.0               | 30.7                | 57.6              | 47.6              | 19.6           | 16.9            |
| 3   | 0.64986         | 36.3                | 27.7                 | 9.9      | 46.2               | 37.6                | 56.0              | 46.0              | 9.8            | 8.4             |
| 4   | 1.49033         | 27.4                | 19.8                 | 9.8      | 37.2               | 29.6                | 56.0              | 46.0              | 18.8           | 16.4            |
| 5   | 2.16722         | 27.4                | 19.7                 | 9.8      | 37.2               | 29.5                | 56.0              | 46.0              | 18.8           | 16.5            |
| 6   | 2.8101          | 26.8                | 19.4                 | 9.8      | 36.6               | 29.2                | 56.0              | 46.0              | 19.4           | 16.8            |

## 7. Measurement equipment

| Equipment Name              | Manufacturer                | Model No.                                     | Serial No.  | Next Cal. Date |
|-----------------------------|-----------------------------|-----------------------------------------------|-------------|----------------|
| Spectrum Analyzer           | R & S                       | FSV30                                         | 100806      | 19.08.01       |
| Spectrum Analyzer           | R & S                       | FSV40                                         | 100989      | 20.01.04       |
| Wideband Power Sensor       | R & S                       | NRP-Z81                                       | 102398      | 20.01.25       |
| Power Divider               | Aeroflex/<br>Weinschel, Inc | 1580-1                                        | RM986       | 20.01.08       |
| Bluetooth Tester            | TESCOM                      | TC-3000B                                      | 3000B640056 | 20.01.25       |
| ATTENUATOR                  | R & S                       | DNF<br>Dämpfungsglied<br>10 dB in<br>N-50 Ohm | 31212       | 20.05.13       |
| EMI TEST RECEIVER           | R & S                       | ESCI                                          | 100732      | 19.08.23       |
| Bi-Log Antenna              | SCHWARZBECK                 | VULB 9168                                     | 583         | 20.05.04       |
| Amplifier                   | SONOMA<br>INSTRUMENT        | 310N                                          | 284608      | 19.08.23       |
| COAXIAL FIXED<br>ATTENUATOR | Agilent                     | 8491B-003                                     | 2708A18758  | 20.05.04       |
| Horn antenna                | ETS.lindgren                | 3116                                          | 00086635    | 20.05.09       |
| Horn antenna                | ETS.lindgren                | 3117                                          | 161225      | 20.05.22       |
| AMPLIFIER                   | L-3 Narda-MITEQ             | AMF-7D-01001800<br>-22-10P                    | 2031196     | 20.02.21       |
| AMPLIFIER                   | L-3 Narda-MITEQ             | JS44-18004000-33<br>-8P                       | 2000997     | 19.08.02       |
| LOOP Antenna                | R & S                       | HFH2-Z2                                       | 100355      | 20.08.24       |
| Antenna Mast                | Innco Systems               | MA4640-XP-ET                                  | -           | -              |
| Turn Table                  | Innco Systems               | DT2000                                        | 79          | -              |
| Antenna Mast                | Innco Systems               | MA4000-EP                                     | 303         | -              |
| Turn Table                  | Innco Systems               | DT2000                                        | 79          | -              |
| TWO-LINE V -<br>NETWORK     | R&S                         | ENV216                                        | 101584      | 20.04.05       |
| EMI TEST RECEIVER           | R & S                       | ESCI                                          | 101408      | 19.08.23       |
| Highpass Filter             | WT                          | WT-A1698-HS                                   | WT160411001 | 20.05.14       |
| Vector Signal<br>Generator  | R & S                       | SMBV100A                                      | 257566      | 20.01.04       |
| Signal Generator            | R & S                       | SMR40                                         | 100007      | 20.05.13       |
| Cable Assembly              | RadiAll                     | 2301761768000PJ                               | 1724.659    | -              |
| Cable Assembly              | gigalane                    | RG-400                                        | -           | -              |
| Cable Assembly              | HUER+SUHNER                 | SUCOFLEX 104                                  | MY4342/4    | -              |

**End of test report**